LS Cable
Leading Solution

LS EHV Cable System

66~500kV XLPE Cable & Accessories


Energy Cables & Systems
LS Cable-setting the standards
in power solution business
Industrial Materials
Realizing a convenient future
with cutting-edge materials
Telecommunications
Providing cutting-edge,
innovative technologies for a
ubiquitous network
Integrated Modules
& Cable Systems
Providing the best customized
cable solutions for
all environments

Total Solution Provider for Electric Power and Telecommunication Industries

LS Cable, the longtime de facto holding company of LS Group, officially transformed into a holding company in July of 2008. The company's operations now encompass a total solution for electric power and telecommunication industries.

The latest change in corporate structure comes as the company is accelerating efforts to improve management efficiency in rapidly expanding markets. The move also results from efforts to effect a more responsible and transparent management structure. Management is now prepared to take more aggressive action to enhance our businesses and to identify new growth engines. The holding company will take the lead in fostering new growth engines and in identifying lucrative investment opportunities, while the company's other business units will focus on improving management and on making operations more efficient. With the continued support of the holding company, LS Cable will spearhead efforts to strengthen our business expertise, corporate competitiveness and management.

Toward the Global Leading Cable Company

In August of 2008 LS Cable acquired Superior Essex, North America's largest cable company, making LS Cable the third-largest player in the global cable industry. Superior Essex's flagship line of magnet wires and telecommunication cables further strengthened LS Cable's product lineup, which had focused on power cables, fiber optic cables and industrial materials. Superior Essex's extensive North America and European production and distribution networks will help LS Cable cement a presence in the region and bring the company one step closer to becoming a full-fledged global enterprise.

Superior Essex

Superior Essex Inc., a FORTUNE 1,000 company, is one of the largest wire and cable manufacturers in the world. The company manufactures and supplies a broad portfolio of wire and cable products for the communications, energy, automotive, industrial, and commercial & residential end-markets. It is a leading manufacturer of magnet wire, fabricated insulation products, and copper and fiber optic communications wire and cable. It is also a leading distributor of magnet wire, insulation and related products.

Our Philosophy

At LS Cable, we understand our responsibility and our potential in leading society to remarkable improvements in varied facets of human life and society. For the past many decades we successfully took the challenge of providing our clients with solutions and support systems to service their globe-spanning businesses. We recognize the significance of our contributing customer-oriented services for the betterment of the society and its operations.

We believe that our responsibility should not end in mere execution of our customers' project, but should extend towards contributing our knowledge and expertise in returning value to their company and to the society within which they live. Our vision is to provide world class services and products to our clients with a sense of responsibility and accountability towards them, their employees and ultimately the society

We are determined to shoulder our responsibility of serving the society by protecting the environment. We bear the vision of alleviating the ill-effects on the ecosystem and human life using more advanced technology. We are persistently in the process of putting our philosophy in action.

LS EHV Cable System

66~500kV XLPE Cable & Accessories




Total Solution for Underground Transmission System

LS Cable is one of the world's leading manufacturers of extra high voltage cable and accessories and also one of a few total solution providers of underground transmission system. We are prominently capable and facilitated in researching, designing, developing, and manufacturing products and solutions with a heritage of decades as a cable manufacturer and ceaseless invest on quality control.
We provide power system from 66kV ~ 500kV such as XLPE cables, terminations, joints and other related products as some parts of our total solution maximizing the competitive advantage in 230kV and higher voltage system. Especially, the certificate for the satisfactory completion of Type Test and Pre-qualification Test by KEMA lasted for 365 days in 400kV XLPE cable and accessories and shows the quality of full range of our products and system.




Commitment to Our Customers

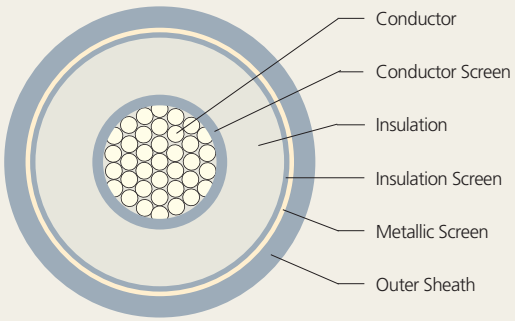
As an extra high voltage cable and accessories manufacturer and a division of LS Cable, we never stop researching, designing, developing, and manufacturing products with the higher level of quality to address the ever-changing demands in everyday life as well as in the industry.
Our quality control meets the most delicate requirements of international standards and the high level of quality is recognized both by local and international clients. Our commitment to develop and deliver solutions to address our customers' needs and challenges keep our technology on the cutting edge and our know-how in the field more valuable, which our customers highly appreciate.
We are looking forward to working with you.

Contents

1.00 Design & Construction of XLPE Cable

Structure of XLPE Cable

The XLPE Cable has the construction of a conductor (copper or aluminum) insulated with the cross-linked polyethylene and then shielded with metallic screen (corrugated and seamless aluminum or wire shield), to be covered by PVC or polyethylene for anti-corrosion.



Conductor

The conductor consists of annealed copper or hard aluminum stranded wires and classified into three (3) major types of concentric, compacted circular and segmental compacted circular.

The concentric is the wires wounded up concentrically, the compacted circular conductor consists of segments wounded up and then compacted. Normally the segmental compacted circular conductor has four (4) segments and is applied for the cross-section over than 800mm^2, to prevent the increase of A.C. resistance caused by skin effect. When the conductor's cross-section is less than 630mm^2, the compacted circular is applied generally.

Conductor Screen

The conductor screen consists of an extruded semi-conducting polyethylene to minimize electrical stresses due to the stranded configuration of the conductor. The semi-conducting material used for conductor screen has no deleterious effect on the conductor. Semi-conducting tape is sometimes applied as a separator.

Insulation

The insulation material is extruded cross-linked polyethylene. The conductor screen, the insulation and the insulation screen mentioned to the following clause are extruded simultaneously in one process to ensure that the screen and insulation are intimately bonded together and free from all possibilities of voids between layers.

The extrusion process is carried out under strictly controlled atmospheric conditions.

The thickness of the insulation layer is the maximum value figured out from the design of the impulse voltage and A.C. voltage.

The conventional cross-linking process by saturated steam has frequently caused deterioration of the electrical characteristics of the insulation as treeing phenomena arose when put to use for long time. But the new process by N_2 gas has enabled to protect the electrical characteristics from being deteriorated and to lessen the thickness of the insulation and accordingly the cable's outer diameter itself.

Insulation Screen

The insulation screen is provided over the insulation by extruding the semi-conducting compound concentrically and circularly to minimize the possibility of ionization on the outer surface of the dielectric.

Metallic Screen

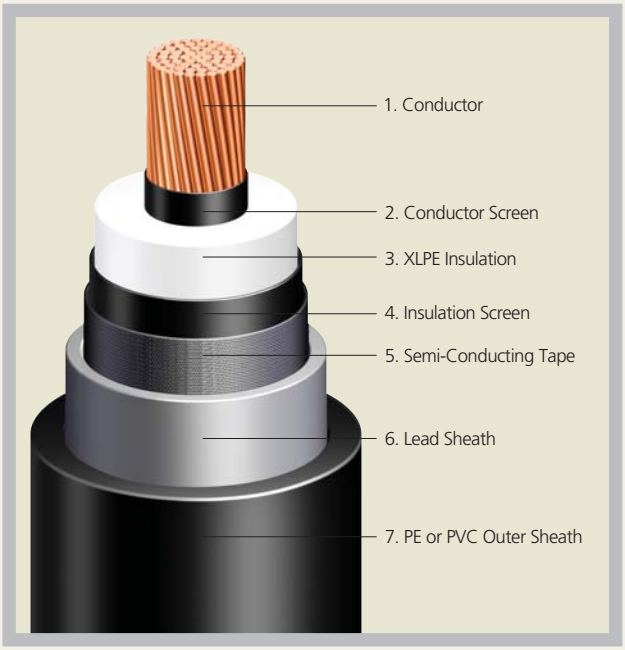
The metallic screen consists of the wire shield, the corrugated aluminum sheath or the lead sheath. The corrugated aluminum sheath and the lead sheath is also adopted where the surface of duct is poor and where moisture is high.

Outer Sheath

To protect the metallic sheath from electrical or chemical corrosion, it is covered by PE or PVC.

Corrugated Aluminum Sheath Cable

Lead Sheath Cable



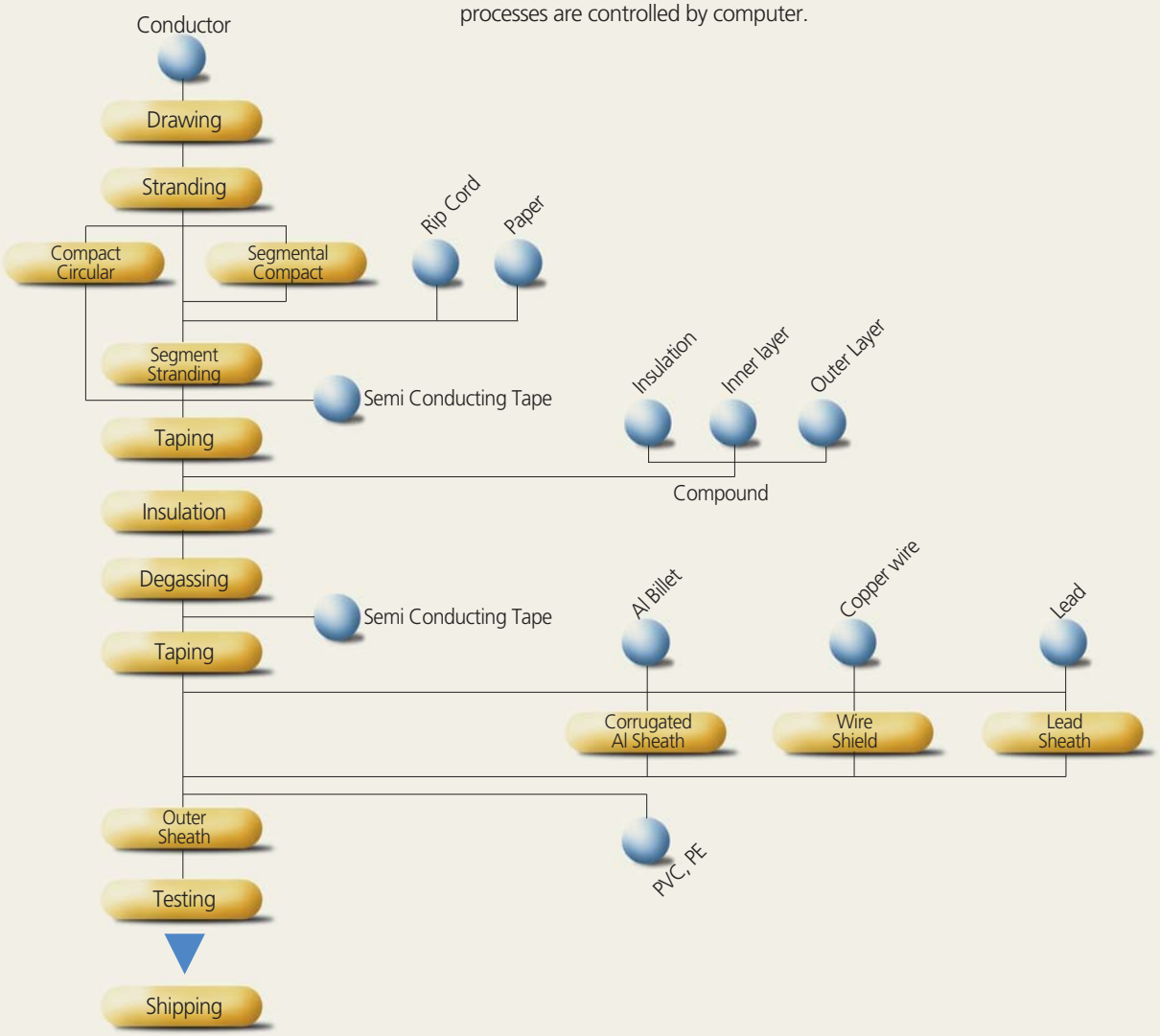
Wire Shield Cable

Copper Laminated Cable

2.00 Manufacturing Process & VCV Line

The system adopted for insulation of the XLPE Cable is VCV and N_2 gas is used for cross linking, and the line is extruded in a vertical type. The outstanding characteristics of the XLPE Cable manufactured in application of this system are :

1. The insulation has no eccentricity.
2. The cross-linking by use of N_2 gas guarantees excellent electrical characteristics of the insulation.
3. The simultaneous extrusion of the inner and outer semi-conducting layers and the insulation prevents treeing and other irregularities.
4. Uniformity of quality is maintained of all products as the manufacturing processes are controlled by computer.



Extrusion

The conductor screen, the insulation and the insulation screen are simultaneously extruded with the compounds supplied from the clean room.

Cross-Linking and Cooling

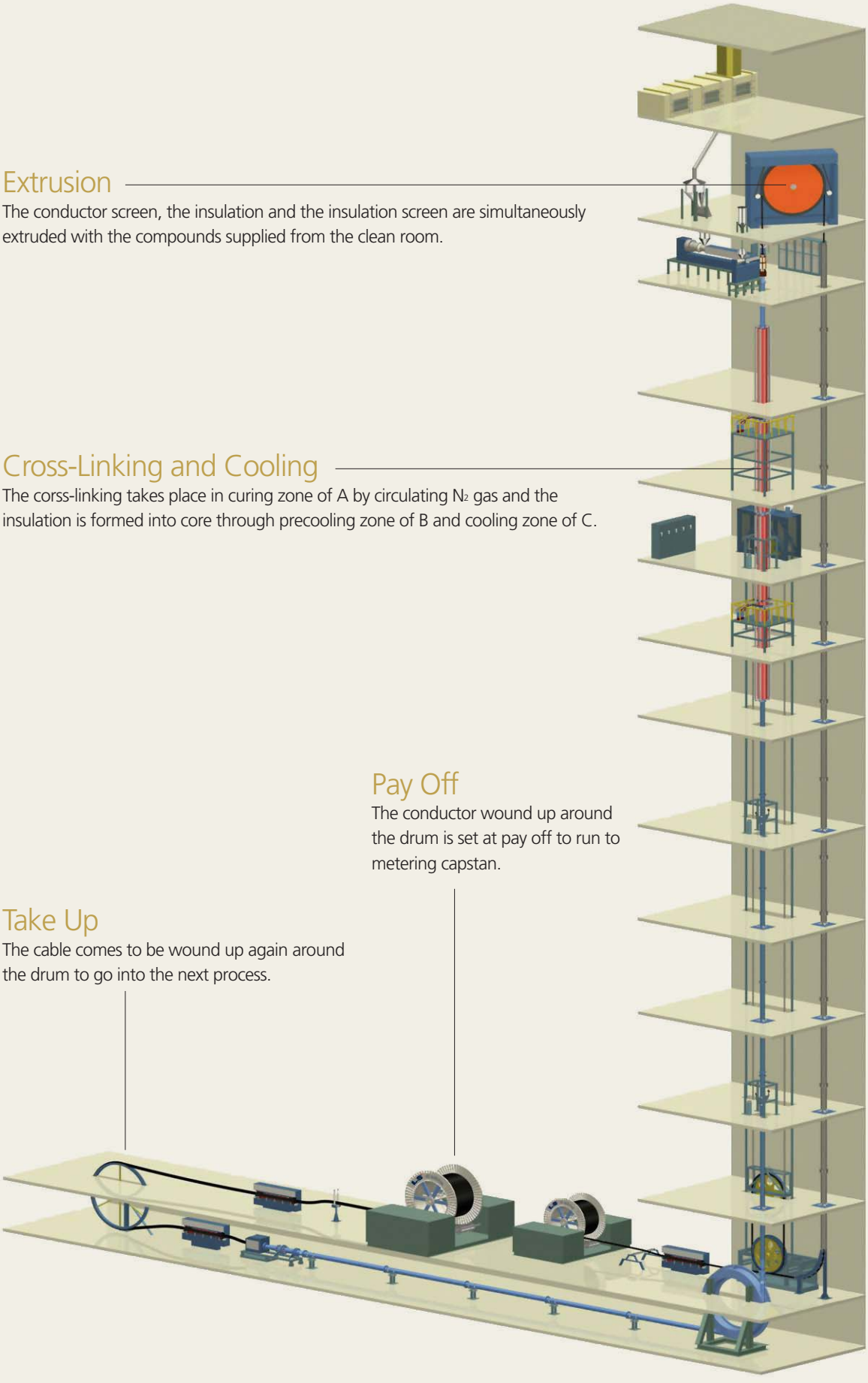
The corss-linking takes place in curing zone of A by circulating N_2 gas and the insulation is formed into core through precooling zone of B and cooling zone of C.

Pay Off

The conductor wound up around the drum is set at pay off to run to metering capstan.

Take Up

The cable comes to be wound up again around the drum to go into the next process.



3.00 Cable Construction & Continuous Current Ratings

The continuous current capacity is calculated in accordance with IEC 60287.

Laying Conditions

1) Ground Temperature : 25℃
2) Depth of Laying : 1.5m
3) Soil Thermal Resistivity : 1.0℃m/W
4) Ambient Temperature : 40℃
5) Max. Conductor Temperature : 90℃
6) Cable Formation : Flat (S=2D)
   S : Distance between cables / D : Cable diameter
7) Frequency : 50Hz
8) Load factor : 100%

Maximum Permissible Conductor Temperature

Normal Operation	Emergency Operation	Short Circuit
90℃	105℃	250℃

1) Normal Operation
   Normal operation is meant to be maintained through out a given period of time everyday or continuously, without affecting the operation.

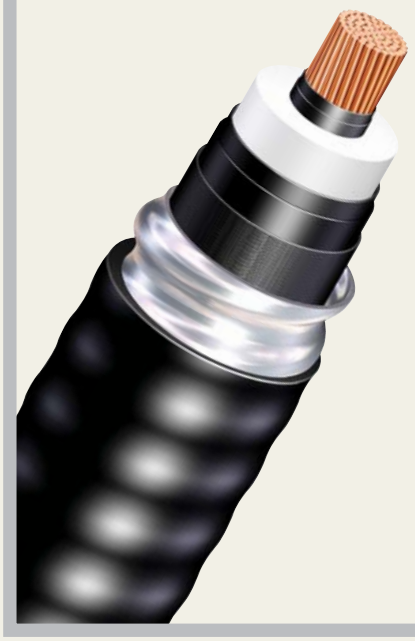
2) Emergency Load
   Emergency load is meant to be maintained for a short time under the condition of system breakdown or under the state of excessively loaded operation, without causing a defect.

3) Short Circuit
   Short circuit is meant to cause no defect of the cable when an irregular current, flows for short time due to shorting or earthing.

4.00 XLPE Insulated Cables

4.01 36/66 (72.5) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	524	491	598	671
300	592	556	682	770
400	671	631	781	888
500	762	714	894	1025
630	878	808	1023	1187
800	965	928	1150	1355
1000	1119	1075	1361	1615
1200	1198	1146	1460	1745
1600	1352	1357	1654	2030
2000	1468	1475	1800	2273

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.0	11.0	1.0	1.6	3.5	69	5.5	0.0754	0.20
300		20.4	1.0	11.0	1.0	1.6	3.5	72	6.3	0.0601	0.21
400		23.2	1.0	11.0	1.0	1.7	3.5	75	7.2	0.0470	0.23
500		26.3	1.0	11.0	1.0	1.8	4.0	79	8.6	0.0366	0.25
630		30.2	1.0	11.0	1.0	1.8	4.0	83	10.1	0.0283	0.28
800		34.0	1.0	11.0	1.0	1.9	4.0	87	12.0	0.0221	0.30
1000	Segment Stranded (Miliken)	38.7	1.0	11.0	1.0	2.0	4.0	92	14.4	0.0176	0.33
1200		41.8	1.0	11.0	1.0	2.1	4.5	98	16.7	0.0151	0.36
1600		48.1	1.0	11.0	1.0	2.2	4.5	105	20.9	0.0113	0.40
2000		54.3	1.0	11.0	1.0	2.4	4.5	112	25.4	0.0090	0.44

4.02 36/66 (72.5) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	535	525	621	706
300	606	567	710	810
400	691	646	822	942
500	787	733	951	1098
630	898	833	1096	1274
800	1008	958	1243	1462
1000	1184	1121	1505	1759
1200	1282	1208	1648	1938
1600	1469	1434	1906	2282
2000	1626	1585	2130	2597

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Lead Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.0	11.0	1.0	2.1	3.5	62	8.1	0.0754	0.20
300		20.4	1.0	11.0	1.0	2.2	3.5	64	9.1	0.0601	0.21
400		23.2	1.0	11.0	1.0	2.3	3.5	67	10.5	0.0470	0.23
500		26.3	1.0	11.0	1.0	2.4	4.0	72	12.5	0.0366	0.25
630		30.2	1.0	11.0	1.0	2.4	4.0	76	14.2	0.0283	0.28
800		34.0	1.0	11.0	1.0	2.6	4.0	80	16.9	0.0221	0.30
1000	Segment Stranded (Miliken)	38.7	1.0	11.0	1.0	2.7	4.0	85	19.9	0.0176	0.33
1200		41.8	1.0	11.0	1.0	2.8	4.5	91	23.0	0.0151	0.36
1600		48.1	1.0	11.0	1.0	3.0	4.5	97	28.0	0.0113	0.40
2000		54.3	1.0	11.0	1.0	3.2	4.5	104	33.4	0.0090	0.44

4.03 36/66 (72.5) kV with Copper Wire Shield

Copper Wire Shield

Construction

- Copper Conductor
- XLPE Insulation
- Copper Wire Shield
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

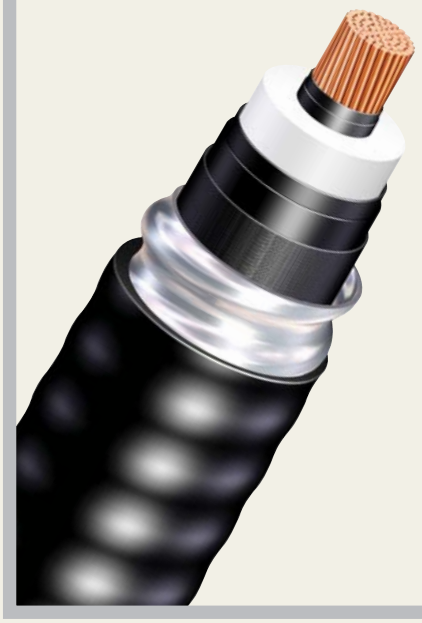
Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	530	483	606	692
300	599	544	693	795`
400	683	616	802	925
500	780	729	929	1075
630	886	828	1066	1247
800	997	929	1210	1432
1000	1173	1087	1473	1728
1200	1270	1173	1611	1894
1600	1465	1375	1883	2245
2000	1627	1530	2111	2556

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Diameter & Number of Copper Wires	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm x No.	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.0	11.0	1.0	1.2 x 40	3.5	58	4.4	0.0754	0.20
300		20.4	1.0	11.0	1.0	1.2 x 40	3.5	60	5.1	0.0601	0.21
400		23.2	1.0	11.0	1.0	1.2 x 40	3.5	63	5.9	0.0470	0.23
500		26.3	1.0	11.0	1.0	1.2 x 40	4.0	66	7.2	0.0366	0.25
630		30.2	1.0	11.0	1.0	1.2 x 40	4.0	71	8.6	0.0283	0.28
800		34.0	1.0	11.0	1.0	1.2 x 40	4.0	75	10.4	0.0221	0.30
1000	Segment Stranded (Miliken)	38.7	1.0	11.0	1.0	1.2 x 40	4.0	80	12.7	0.0176	0.33
1200		41.8	1.0	11.0	1.0	1.2 x 40	4.5	85	14.7	0.0151	0.36
1600		48.1	1.0	11.0	1.0	1.2 x 40	4.5	91	18.7	0.0113	0.40
2000		54.3	1.0	11.0	1.0	1.2 x 40	4.5	97	22.7	0.0090	0.44

4.04 64/110 (123) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	520	491	592	657
300	587	550	677	755
400	667	639	775	873
500	758	725	889	1006
630	860	821	1020	1169
800	961	915	1147	1333
1000	1109	1057	1346	1581
1200	1187	1180	1451	1717
1600	1338	1332	1635	1995
2000	1458	1447	1787	2236
2500	1538	1526	1885	2358

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.2	14.0	1.0	1.7	3.5	76	6.3	0.0754	0.17
300		20.4	1.2	14.0	1.0	1.8	3.5	78	7.0	0.0601	0.18
400		23.2	1.2	14.0	1.0	1.8	3.5	81	8.0	0.0470	0.20
500		26.3	1.2	14.0	1.0	1.9	4.0	86	9.3	0.0366	0.21
630		30.2	1.2	14.0	1.0	2.0	4.0	90	11.0	0.0283	0.23
800		34.0	1.2	14.0	1.0	2.0	4.0	94	12.9	0.0221	0.25
1000	Segment Stranded (Miliken)	38.7	1.2	14.0	1.0	2.1	4.0	99	15.4	0.0176	0.28
1200		41.8	1.2	14.0	1.0	2.2	4.5	104	17.7	0.0151	0.30
1600		48.1	1.2	14.0	1.0	2.4	4.5	111	22.1	0.0113	0.33
2000		54.3	1.2	14.0	1.0	2.5	4.5	118	26.5	0.0090	0.36
2500		63.0	1.2	14.0	1.0	2.6	4.5	128	33.0	0.0072	0.40

4.05 64/110 (123) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	533	498	617	692
300	602	563	705	794
400	687	654	816	923
500	782	744	939	1068
630	891	846	1083	1243
800	1001	949	1229	1425
1000	1176	1108	1486	1718
1200	1269	1235	1612	1871
1600	1455	1415	1870	2206
2000	1609	1562	2087	2505
2500	1695	1647	2201	2642

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Lead Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.2	14.0	1.0	2.3	3.5	68	9.6	0.0754	0.17
300		20.4	1.2	14.0	1.0	2.4	3.5	71	10.9	0.0601	0.18
400		23.2	1.2	14.0	1.0	2.5	3.5	74	12.3	0.0470	0.20
500		26.3	1.2	14.0	1.0	2.5	4.0	78	13.8	0.0366	0.21
630		30.2	1.2	14.0	1.0	2.6	4.0	82	16.0	0.0283	0.23
800		34.0	1.2	14.0	1.0	2.7	4.0	86	18.5	0.0221	0.25
1000	Segment Stranded (Miliken)	38.7	1.2	14.0	1.0	2.9	4.0	92	21.9	0.0176	0.28
1200		41.8	1.2	14.0	1.0	3.0	4.5	97	24.7	0.0151	0.30
1600		48.1	1.2	14.0	1.0	3.2	4.5	103	30.1	0.0113	0.33
2000		54.3	1.2	14.0	1.0	3.4	4.5	110	35.7	0.0090	0.36
2500		63.0	1.2	14.0	1.0	3.6	4.5	118	42.0	0.0072	0.40

4.06 64/110 (123) kV with Copper Wire Shield

Copper Wire Shield

Construction

- Copper Conductor
- XLPE Insulation
- Copper Wire Shield
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

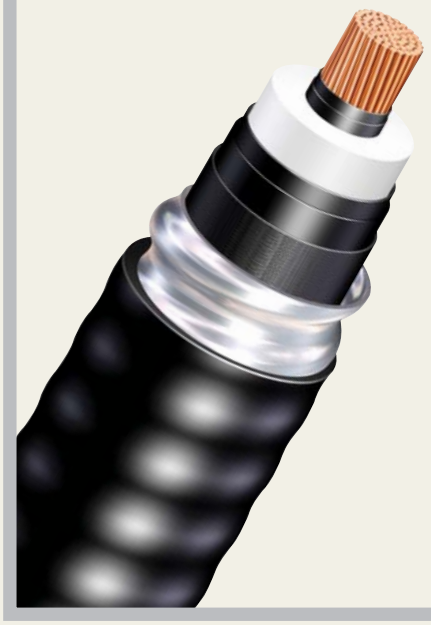
Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	528	495	605	682
300	597	559	692	783
400	681	650	800	909
500	775	739	922	1053
630	884	841	1065	1226
800	994	945	1208	1406
1000	1169	1106	1465	1695
1200	1264	1231	1595	1849
1600	1456	1415	1860	2185
2000	1618	1570	2089	2487
2500	1706	1656	2203	2623

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Diameter & Number of Copper Wires	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm x No.	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.2	14.0	1.0	1.2 x 40	3.5	64	5.0	0.0754	0.17
300		20.4	1.2	14.0	1.0	1.2 x 40	3.5	66	5.7	0.0601	0.18
400		23.2	1.2	14.0	1.0	1.2 x 40	3.5	69	6.6	0.0470	0.20
500		26.3	1.2	14.0	1.0	1.2 x 40	4.0	73	7.9	0.0366	0.21
630		30.2	1.2	14.0	1.0	1.2 x 40	4.0	77	9.4	0.0283	0.23
800		34.0	1.2	14.0	1.0	1.2 x 40	4.0	81	11.2	0.0221	0.25
1000	Segment Stranded (Miliken)	38.7	1.2	14.0	1.0	1.2 x 40	4.0	86	13.6	0.0176	0.28
1200		41.8	1.2	14.0	1.0	1.2 x 40	4.5	91	15.6	0.0151	0.30
1600		48.1	1.2	14.0	1.0	1.2 x 40	4.5	97	19.6	0.0113	0.33
2000		54.3	1.2	14.0	1.0	1.2 x 40	4.5	103	23.7	0.0090	0.36
2500		63.0	1.2	14.0	1.0	1.2 x 40	4.5	111	29.0	0.0072	0.40

4.07 76/132 (145) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	519	486	589	649
300	585	547	671	742
400	665	635	770	858
500	755	716	883	992
630	856	814	1011	1151
800	956	942	1137	1313
1000	1103	1093	1333	1555
1200	1185	1170	1439	1695
1600	1333	1324	1627	1972
2000	1452	1435	1777	2211
2500	1530	1512	1872	2330

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.5	16.0	1.3	1.8	4.5	83	7.1	0.0754	0.16
300		20.4	1.5	16.0	1.3	1.8	4.5	86	7.9	0.0601	0.17
400		23.2	1.5	16.0	1.3	1.9	4.5	89	8.9	0.0470	0.18
500		26.3	1.5	16.0	1.3	2.0	4.5	92	10.2	0.0366	0.20
630		30.2	1.5	16.0	1.3	2.1	4.5	97	11.9	0.0283	0.21
800		34.0	1.5	16.0	1.3	2.2	4.5	101	14.0	0.0221	0.23
1000	Segment Stranded (Miliken)	38.7	1.5	16.0	1.3	2.2	4.5	106	16.6	0.0176	0.25
1200		41.8	1.5	16.0	1.3	2.3	4.5	110	18.6	0.0151	0.27
1600		48.1	1.5	16.0	1.3	2.4	4.5	116	22.9	0.0113	0.30
2000		54.3	1.5	16.0	1.3	2.6	4.5	124	27.4	0.0090	0.32
2500		63.0	1.5	16.0	1.3	2.8	4.5	131	34.3	0.0072	0.36

4.08 76/132 (145) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	530	495	612	679
300	600	559	702	781
400	684	636	808	904
500	780	727	934	1050
630	889	840	1077	1222
800	997	941	1222	1400
1000	1170	1100	1469	1681
1200	1264	1226	1599	1842
1600	1449	1404	1853	2168
2000	1600	1548	2064	2460
2500	1686	1631	2175	2592

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Lead Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.5	16.0	1.3	2.4	4.5	76	11.2	0.0754	0.16
300		20.4	1.5	16.0	1.3	2.5	4.5	78	12.3	0.0601	0.17
400		23.2	1.5	16.0	1.3	2.6	4.5	81	13.8	0.0470	0.18
500		26.3	1.5	16.0	1.3	2.7	4.5	85	15.6	0.0366	0.20
630		30.2	1.5	16.0	1.3	2.7	4.5	88	17.5	0.0283	0.21
800		34.0	1.5	16.0	1.3	2.9	4.5	93	20.4	0.0221	0.23
1000	Segment Stranded (Miliken)	38.7	1.5	16.0	1.3	3.0	4.5	98	23.6	0.0176	0.25
1200		41.8	1.5	16.0	1.3	3.1	4.5	102	26.5	0.0151	0.27
1600		48.1	1.5	16.0	1.3	3.3	4.5	108	31.7	0.0113	0.30
2000		54.3	1.5	16.0	1.3	3.5	4.5	115	37.7	0.0090	0.32
2500		63.0	1.5	16.0	1.3	3.7	4.5	123	44.3	0.0072	0.36

4.09 76/132 (145) kV with Copper Wire Shield

Copper Wire Shield

Construction

- Copper Conductor
- XLPE Insulation
- Copper Wire Shield
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

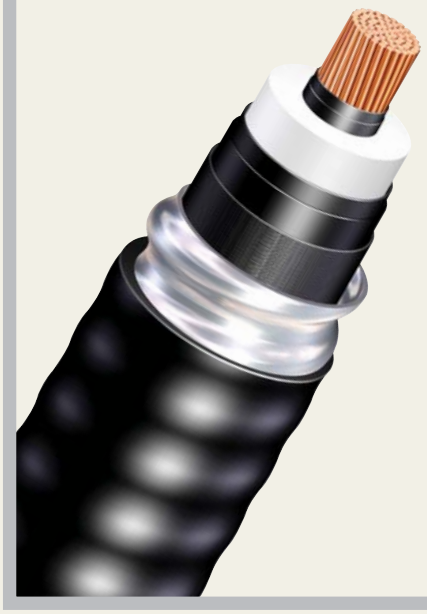
Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
240	525	492	601	673
300	593	555	688	774
400	675	632	792	896
500	767	716	908	1033
630	872	811	1045	1200
800	979	932	1182	1374
1000	1145	1087	1420	1649
1200	1233	1212	1539	1801
1600	1414	1388	1784	2125
2000	1569	1532	2003	2418
2500	1653	1614	2111	2548

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Diameter & Number of Copper Wires	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm x No.	mm	mm	kg / m	Ω / km	μF / km
240	Compact Round Stranded	18.1	1.5	16.0	1.3	1.5 x 80	4.5	70	6.5	0.0754	0.16
300		20.4	1.5	16.0	1.3	1.5 x 80	4.5	72	7.1	0.0601	0.17
400		23.2	1.5	16.0	1.3	1.5 x 80	4.5	75	8.1	0.0470	0.18
500		26.3	1.5	16.0	1.3	1.5 x 80	4.5	80	9.5	0.0366	0.20
630		30.2	1.5	16.0	1.3	1.5 x 80	4.5	84	11.0	0.0283	0.21
800		34.0	1.5	16.0	1.3	1.5 x 80	4.5	88	12.9	0.0221	0.23
1000	Segment Stranded (Miliken)	38.7	1.5	16.0	1.3	1.5 x 80	4.5	93	15.3	0.0176	0.25
1200		41.8	1.5	16.0	1.3	1.5 x 80	4.5	96	17.1	0.0151	0.27
1600		48.1	1.5	16.0	1.3	1.5 x 80	4.5	102	21.2	0.0113	0.30
2000		54.3	1.5	16.0	1.3	1.5 x 80	4.5	110	25.8	0.0090	0.32
2500		63.0	1.5	16.0	1.3	1.5 x 80	4.5	118	31.4	0.0072	0.36

4.10 87/161 (170) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
300	584	558	669	740
400	664	634	768	855
500	754	718	879	988
630	853	811	1009	1146
800	953	938	1134	1307
1000	1100	1087	1328	1548
1200	1179	1163	1429	1684
1600	1331	1311	1627	1967
2000	1447	1485	1774	2199
2500	1523	1563	1868	2315

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20℃	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
300	Compact Round Stranded	20.4	1.5	17	1.3	1.9	4.5	87	8.4	0.0601	0.16
400		23.2	1.5	17	1.3	1.9	4.5	91	9.4	0.0470	0.18
500		26.3	1.5	17	1.3	2.0	4.5	94	10.7	0.0366	0.19
630		30.2	1.5	17	1.3	2.1	4.5	98	12.3	0.0283	0.21
800		34.0	1.5	17	1.3	2.2	4.5	102	14.4	0.0221	0.22
1000	Segment Stranded (Miliken)	38.7	1.5	17	1.3	2.3	4.5	108	17.0	0.0176	0.24
1200		41.8	1.5	17	1.3	2.3	4.5	111	19.0	0.0151	0.26
1600		48.1	1.5	17	1.3	2.5	4.5	119	23.5	0.0113	0.28
2000		54.3	1.5	17	1.3	2.6	4.5	125	28.0	0.0090	0.31
2500		63.0	1.5	17	1.3	2.8	4.5	134	34.5	0.0072	0.34

4.11 87/161 (170) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
300	598	557	698	775
400	682	648	805	898
500	777	736	928	1042
630	886	836	1073	1214
800	996	939	1218	1391
1000	1168	1131	1464	1670
1200	1259	1221	1589	1825
1600	1445	1398	1845	2152
2000	1597	1541	2060	2445
2500	1681	1622	2169	2574

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Lead Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
300	Compact Round Stranded	20.4	1.5	17	1.3	2.5	4.5	80	12.5	0.0601	0.16
400		23.2	1.5	17	1.3	2.6	4.5	83	14.0	0.0470	0.18
500		26.3	1.5	17	1.3	2.7	4.5	86	15.7	0.0366	0.19
630		30.2	1.5	17	1.3	2.8	4.5	90	18.0	0.0283	0.21
800		34.0	1.5	17	1.3	2.9	4.5	94	20.5	0.0221	0.22
1000	Segment Stranded (Miliken)	38.7	1.5	17	1.3	3.0	4.5	100	23.8	0.0176	0.24
1200		41.8	1.5	17	1.3	3.2	4.5	103	26.7	0.0151	0.26
1600		48.1	1.5	17	1.3	3.4	4.5	110	32.2	0.0113	0.28
2000		54.3	1.5	17	1.3	3.6	4.5	116	37.9	0.0090	0.31
2500		63.0	1.5	17	1.3	3.7	4.5	124	44.9	0.0072	0.34

4.12 87/161 (170) kV with Copper Wire Shield

Copper Wire Shield

Construction

- Copper Conductor
- XLPE Insulation
- Copper Wire Shield
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

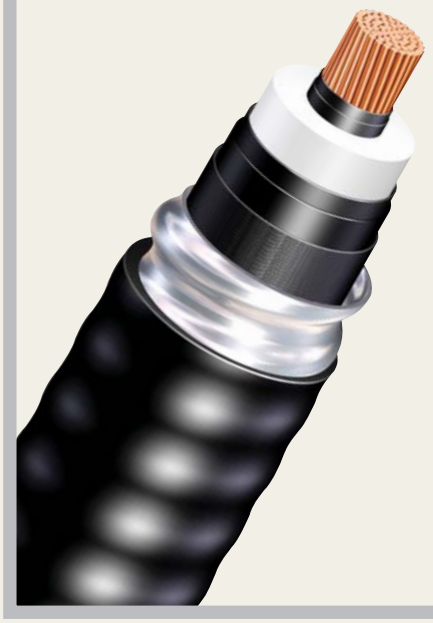
Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
300	591	553	684	765
400	673	629	789	887
500	766	713	907	1027
630	871	829	1043	1193
800	977	928	1181	1367
1000	1143	1081	1415	1639
1200	1232	1208	1535	1790
1600	1404	1382	1765	2100
2000	1554	1523	1973	2384
2500	1636	1603	2077	2510

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Diameter & Number of Copper Wires	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm x No.	mm	mm	kg / m	Ω / km	μF / km
300	Compact Round Stranded	20.4	1.5	17	1.3	1.5 x 80	4.5	72	6.3	0.0601	0.21
400		23.2	1.5	17	1.3	1.5 x 80	4.5	75	7.2	0.0470	0.23
500		26.3	1.5	17	1.3	1.5 x 80	4.5	79	8.6	0.0366	0.25
630		30.2	1.5	17	1.3	1.5 x 80	4.5	83	10.1	0.0283	0.28
800		34.0	1.5	17	1.3	1.5 x 80	4.5	87	12.0	0.0221	0.30
1000	Segment Stranded (Miliken)	38.7	1.5	17	1.3	1.5 x 80	4.5	92	14.4	0.0176	0.33
1200		41.8	1.5	17	1.3	1.5 x 80	4.5	98	16.7	0.0151	0.36
1600		48.1	1.5	17	1.3	1.5 x 80	4.5	105	20.9	0.0113	0.40
2000		54.3	1.5	17	1.3	1.5 x 80	4.5	112	25.4	0.0090	0.44
2500		63.0	1.5	17	1.3	1.5 x 80	4.5	118	31.1	0.0072	0.34

4.13 127/230 (245) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
400	657	641	757	836
500	745	725	866	962
630	843	822	989	1111
800	943	916	1116	1268
1000	1090	1057	1310	1505
1200	1165	1131	1403	1631
1600	1316	1322	1596	1902
2000	1438	1440	1758	2143
2500	1512	1514	1849	2254

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
400	Compact Round Stranded	23.2	1.5	23.0	1.3	2.2	4.5	104	11.0	0.0470	0.14
500		26.3	1.5	23.0	1.3	2.3	4.5	108	12.1	0.0366	0.15
630		30.2	1.5	23.0	1.3	2.4	4.5	112	14.2	0.0283	0.17
800		34.0	1.5	23.0	1.3	2.4	4.5	116	15.8	0.0221	0.18
1000	Segment Stranded (Miliken)	34.0	1.5	23.0	1.3	2.4	4.5	116	15.8	0.0221	0.18
1200		41.8	1.5	23.0	1.3	2.6	5.0	126	21.5	0.0151	0.21
1600		48.1	1.5	23.0	1.3	2.7	5.0	133	26.0	0.0113	0.23
2000		54.3	1.5	23.0	1.3	2.8	5.0	139	30.7	0.0090	0.24
2500		63.0	1.5	23.0	1.3	3.0	5.0	148	37.8	0.0072	0.27

4.14 127/230 (245) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
400	676	638	793	871
500	770	745	914	1010
630	876	847	1054	1173
800	986	950	1196	1343
1000	1153	1108	1429	1606
1200	1243	1194	1552	1757
1600	1424	1401	1797	2068
2000	1571	1545	2004	2342
2500	1652	1625	2108	2463

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Lead Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
400	Compact Round Stranded	23.2	1.5	23.0	1.3	3.2	4.5	96	17.9	0.0470	0.14
500		26.3	1.5	23.0	1.3	3.3	4.5	100	19.7	0.0366	0.15
630		30.2	1.5	23.0	1.3	3.4	4.5	104	22.1	0.0283	0.17
800		34.0	1.5	23.0	1.3	3.5	4.5	108	24.8	0.0221	0.18
1000	Segment Stranded (Miliken)	38.7	1.5	23.0	1.3	3.6	5.0	114	28.8	0.0176	0.20
1200		41.8	1.5	23.0	1.3	3.9	5.0	118	32.3	0.0151	0.21
1600		48.1	1.5	23.0	1.3	4.1	5.0	124	38.2	0.0113	0.23
2000		54.3	1.5	23.0	1.3	4.2	5.0	130	43.8	0.0090	0.24
2500		63.0	1.5	23.0	1.3	4.4	5.0	148	52.5	0.0072	0.27

4.15 127/230 (245) kV with Copper Wire Shield

Copper Wire Shield

Construction

- Copper Conductor
- XLPE Insulation
- Copper Wire Shield
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

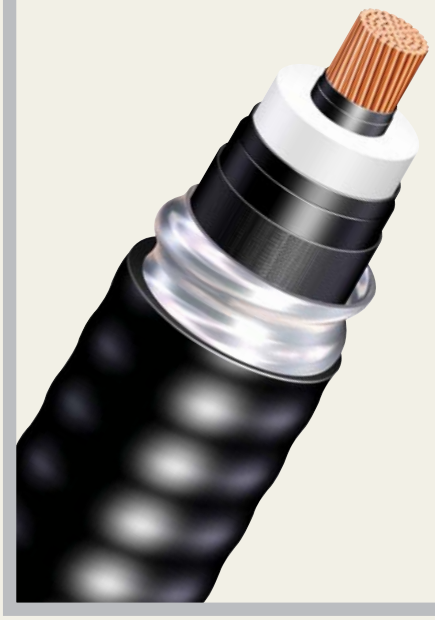
Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
400	668	634	779	863
500	759	719	895	998
630	864	842	1031	1159
800	970	944	1167	1326
1000	1131	1100	1390	1583
1200	1221	1185	1512	1733
1600	1397	1354	1750	2040
2000	1543	1489	1950	2309
2500	1623	1566	2051	2429

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Diameter & Number of Copper Wires	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm x No.	mm	mm	kg / m	Ω / km	μF / km
400	Compact Round Stranded	23.2	1.5	23.0	1.3	1.5 x 80	4.5	91	10.0	0.0470	0.14
500		26.3	1.5	23.0	1.3	1.5 x 80	4.5	94	11.2	0.0366	0.15
630		30.2	1.5	23.0	1.3	1.5 x 80	4.5	98	12.8	0.0283	0.17
800		34.0	1.5	23.0	1.3	1.5 x 80	4.5	102	14.8	0.0221	0.18
1000	Segment Stranded (Miliken)	38.7	1.5	23.0	1.3	1.5 x 80	5.0	107	17.2	0.0176	0.20
1200		41.8	1.5	23.0	1.3	1.5 x 80	5.0	110	19.2	0.0151	0.21
1600		48.1	1.5	23.0	1.3	1.5 x 80	5.0	116	23.3	0.0113	0.23
2000		54.3	1.5	23.0	1.3	1.5 x 80	5.0	123	27.6	0.0090	0.24
2500		63.0	1.5	23.0	1.3	1.5 x 80	5.0	132	33.9	0.0072	0.27

4.16 190/345 (362) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
630	832	822	976	1092
800	928	917	1095	1239
1000	1072	1060	1284	1467
1200	1149	1136	1383	1595
1600	1299	1325	1577	1859
2000	1419	1446	1726	2089
2500	1491	1519	1814	2195

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
630	Compact Round Stranded	30.2	1.5	27.0	1.3	2.5	6	124	16.5	0.0283	0.15
800		34.0	1.5	27.0	1.3	2.6	6	128	18.7	0.0221	0.16
1000	Segment Stranded (Miliken)	38.7	1.5	27.0	1.3	2.7	6	134	21.6	0.0176	0.18
1200		41.8	1.5	27.0	1.3	2.8	6	137	23.8	0.0151	0.19
1600		48.1	1.5	27.0	1.3	2.9	6	144	28.4	0.0113	0.20
2000		54.3	1.5	27.0	1.3	3.0	6	150	33.1	0.0090	0.22
2500		63.0	1.5	27.0	1.3	3.2	6	160	40.5	0.0072	0.24

4.17 190/345 (362) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

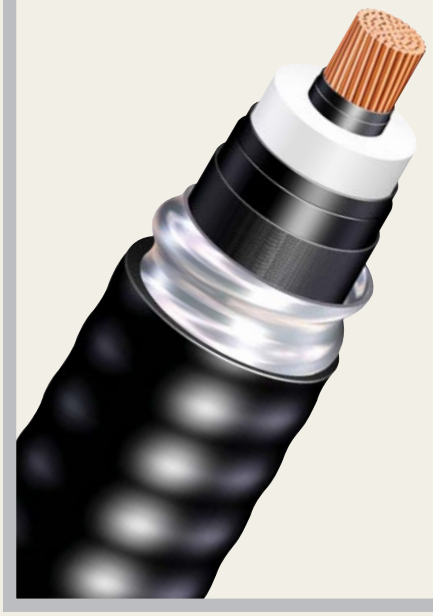
Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
630	862	828	1032	1141
800	970	936	1173	1305
1000	1133	1107	1399	1561
1200	1222	1193	1520	1706
1600	1400	1364	1764	2009
2000	1541	1540	1961	2270
2500	1619	1618	2061	2385

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Lead Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
630	Compact Round Stranded	30.2	1.5	27.0	1.3	3.4	6.0	113	23.5	0.0283	0.15
800		34.0	1.5	27.0	1.3	3.5	6.0	118	27.3	0.0221	0.16
1000	Segment Stranded (Miliken)	38.7	1.5	27.0	1.3	3.6	6.0	123	30.7	0.0176	0.18
1200		41.8	1.5	27.0	1.3	3.8	6.0	127	33.8	0.0151	0.19
1600		48.1	1.5	27.0	1.3	4.0	6.0	133	40.3	0.0113	0.20
2000		54.3	1.5	27.0	1.3	4.2	6.0	140	46.7	0.0090	0.22
2500		63.0	1.5	27.0	1.3	4.4	6.0	148	55.3	0.0072	0.24

4.18 220/400 (420) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
630	825	812	967	1081
800	920	907	1090	1231
1000	1062	1046	1279	1458
1200	1139	1120	1372	1581
1600	1292	1304	1569	1842
2000	1410	1422	1711	2067
2500	1480	1493	1796	2170
3000	1570	1582	1904	2300

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
630	Compact Round Stranded	30.2	1.5	29.0	1.3	2.6	6	128	17.5	0.0283	0.14
800		34.0	1.5	29.0	1.3	2.7	6	132	19.6	0.0221	0.15
1000	Segment Stranded (Miliken)	38.7	1.5	29.0	1.3	2.8	6	138	22.5	0.0176	0.17
1200		41.8	1.5	29.0	1.3	2.8	6	141	24.6	0.0151	0.18
1600		48.1	1.5	29.0	1.3	3.0	6	150	29.9	0.0113	0.19
2000		54.3	1.5	29.0	1.3	3.1	6	157	34.7	0.0090	0.20
2500		63.0	1.5	29.0	1.3	3.3	6	167	42.0	0.0072	0.23
3000		69.0	1.5	29.0	1.3	3.3	6	174	46.7	0.0060	0.24

4.19 220/400 (420) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

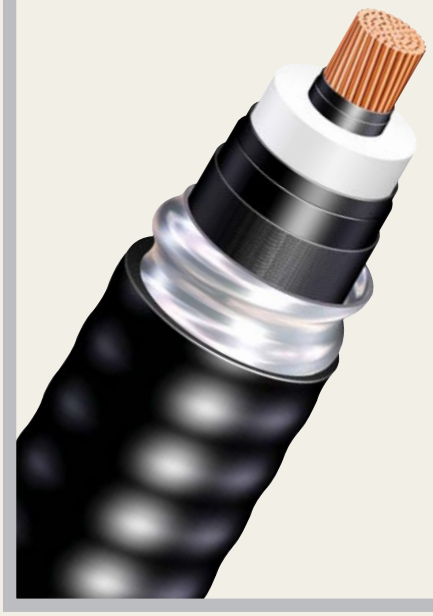
Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
630	856	819	1024	1131
800	960	925	1161	1291
1000	1122	1093	1385	1542
1200	1208	1178	1501	1683
1600	1380	1375	1734	1971
2000	1520	1513	1926	2231
2500	1596	1588	2022	2342
3000	1691	1683	2143	2483

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Lead Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
630	Compact Round Stranded	30.2	1.5	29.0	1.3	3.5	6.0	118	27.0	0.0283	0.14
800		34.0	1.5	29.0	1.3	3.6	6.0	122	28.6	0.0221	0.15
1000	Segment Stranded (Miliken)	38.7	1.5	29.0	1.3	3.8	6.0	127	33.5	0.0176	0.17
1200		41.8	1.5	29.0	1.3	3.9	6.0	131	36.0	0.0151	0.18
1600		48.1	1.5	29.0	1.3	4.2	6.0	140	43.1	0.0113	0.19
2000		54.3	1.5	29.0	1.3	4.4	6.0	146	50.0	0.0090	0.20
2500		63.0	1.5	29.0	1.3	4.5	6.0	153	57.0	0.0072	0.23
3000		69.0	1.5	29.0	1.3	3.3	6.0	174	64.1	0.0060	0.24

4.20 290/500 (550) kV with Aluminum Sheath

Aluminum Sheath



Construction

- Copper Conductor
- XLPE Insulation
- Aluminum Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm²)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
800	910	890	1080	1221
1000	1052	1036	1270	1447
1200	1128	1110	1361	1565
1600	1281	1284	1555	1825
2000	1400	1400	1700	2050
2500	1470	1470	1785	2150
3000	1560	1558	1895	2280

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm²		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
800	Compact Round Stranded	34.0	2.5	34.0	2.0	3.0	6	148	24.6	0.0221	0.14
1000	Segment Stranded (Miliken)	38.7	2.5	32.0	2.0	3.0	6	146	26.2	0.0176	0.16
1200		41.8	2.0	32.0	2.0	3.0	6	150	28.6	0.0151	0.16
1600		48.1	2.0	30.0	2.0	3.1	6	153	32.1	0.0113	0.19
2000		54.3	2.0	30.0	2.0	3.2	6	158	36.8	0.0090	0.20
2500		63.0	2.0	30.0	2.0	3.3	6	168	43.6	0.0072	0.23
3000		69.0	2.0	30.0	2.0	3.5	6	178	48.8	0.0060	0.24

4.21 290/500 (550) kV with Lead Sheath

Lead Sheath

Construction

- Copper Conductor
- XLPE Insulation
- Lead Sheath
- PE (or PVC) Outer Sheath

Continuous Current Ratings for Single Circuit (A)

Cross-Sectional Area (mm^2)	Direct Buried	Pipe Duct	In Air	
			Trefoil	Flat (S=2D)
800	950	915	1151	1280
1000	1110	1082	1375	1522
1200	1188	1167	1475	1658
1600	1360	1360	1710	1946
2000	1500	1495	1900	2206
2500	1575	1570	1995	2316
3000	1670	1665	2115	2455

Constructional Data (Nominal Values)

Conductor			Thickness of Conductor Screen Approx.	Thickness of Insulation	Thickness of Insulation Screen Approx.	Thickness of Aluminum Sheath	Thickness of Outer Sheath	Outer Diameter of Cable	Weight of Cable	Max. DC Conductor Resistance at 20°C	Capacitance
Cross-Sectional Area	Shape	Diameter									
mm^2		mm	mm	mm	mm	mm	mm	mm	kg / m	Ω / km	μF / km
800	Compact Round Stranded	34.0	2.5	34.0	2.0	4.3	6.0	136	37.5	0.0221	0.14
1000	Segment Stranded (Miliken)	38.7	2.5	32.0	2.0	4.3	6.0	134	38.7	0.0176	0.16
1200		41.8	2.0	32.0	2.0	4.4	6.0	137	41.6	0.0151	0.16
1600		48.1	2.0	30.0	2.0	4.5	6.0	140	46.0	0.0113	0.19
2000		54.3	2.0	30.0	2.0	4.5	6.0	147	51.7	0.0090	0.20
2500		63.0	2.0	30.0	2.0	4.9	6.0	154	60.0	0.0072	0.23
3000		69.0	2.0	30.0	2.0	5.1	6.0	162	68.1	0.0060	0.24

5.00 Correction Factors for Various Laying Conditions

To determine current capacity for the various laying conditions than those indicated on the every tables, multiply table values by the correction factors shown below.

Correction Factors for Various Ambient Air Temperature

Air Temperature (℃)	20℃	25℃	30℃	35℃	40℃	45℃	50℃
Rating Factor	1.2	1.16	1.10	1.05	1.0	0.94	0.88

Correction Factors for Various Ground Temperature

Air Temperature (℃)	15℃	20℃	25℃	30℃	35℃	40℃	45℃
Rating Factor	1.08	1.04	1.0	0.96	.091	0.87	0.83

Correction Factors for Various Thermal Resistivity of Ground

Thermal Resistivity of Soil (℃m/W)	0.7	1.0	1.2	1.5	2.0	2.5	3.0
Rating Factor	1.14	1.0	0.93	0.84	0.74	0.67	0.61

Correction Factors for Various Depth of Laying

Depth of Laying (m)	Rating Factor
0.50 ~ 0.70	1.09
0.71 ~ 0.90	1.05
0.91 ~ 1.10	1.03
1.11 ~ 1.30	1.01
1.31 ~ 1.50	1.00

6.00 Permissible Short Circuit Currents

The permissible short circuit current of a cable is determined by the maximum permissible conductor temperature and by the duration of the short circuit current. At high peak currents, the dynamic forces between the conductors must be taken into account.
The short circuit capacity of the conductor and metallic shield of a cable are related principally to their heat capacities and are limited by the maximum temperature permitted under short circuit XLPE power are as follow.
From the two graphs, the short circuit capacity of copper or aluminum conductors (based on a temperature rise from 90℃ to 250℃) can be determined.
Logarithmic interpolation between the curves will give estimated values for the various duration.
The curves may be used also to determine the amount of conducting material required to carry a known short circuit current for a given duration.

Copper Conductor

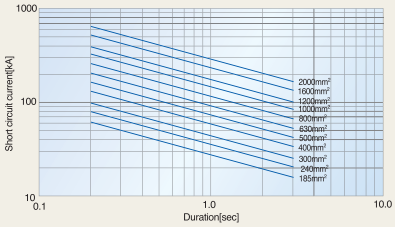
According to IEC 60949 curves based on formula

$$Is = \varepsilon \times 226 \frac{S}{\sqrt{t}} \sqrt{\ln \frac{\theta_f + 234.5}{\theta_i + 234.5}}$$

where,

- Is = Permissible Short Circuit Current (A)
- ε = Factor to allow for heat loss into the Adjacent Components
- S = Cross-Sectional Area of Conductor (mm^2)
- t = Duration of Short Circuit (s)
- θ_f = Final Temperature (250℃)
- θ_i = Initial Temperature (90℃)

Cu



Aluminum Conductor

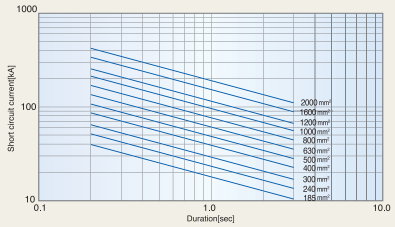
According to IEC 60949 curves based on formula

$$Is = \varepsilon \times 148 \frac{S}{\sqrt{t}} \sqrt{\ln \frac{\theta_f + 228}{\theta_i + 228}}$$

where,

- Is = Permissible Short Circuit Current (A)
- ε = Factor to allow for heat loss into the Adjacent Components
- S = Cross-Sectional Area of Conductor (mm2)
- t = Duration of Short Circuit (s)
- θ_f = Final Temperature (250℃)
- θ_i = Initial Temperature (90℃)

Al



7.00 Accessories for EHV Cable Systems

LS Cable has developed and manufactured a wide range of terminations and joints for Extra High Voltage(EHV) cable system since 1983. Prefabricated terminations and tape molded joints are installed for 154kV cable system in domestic market. A new advanced accessories, which is called prefabricated and premolded joints, were developed and supplied to many countries in the world. Cable systems from 132kV up to 400kV has been certified through the type test by many international independent institutes (KEMA, CESI, KERI).
Pre-qualification tests for 345kV and 400kV cable systems in accordance with latest IEC standard were carried out successfully by the KEMA and KERI.

7.01 Outdoor Terminations for 66kV~110kV

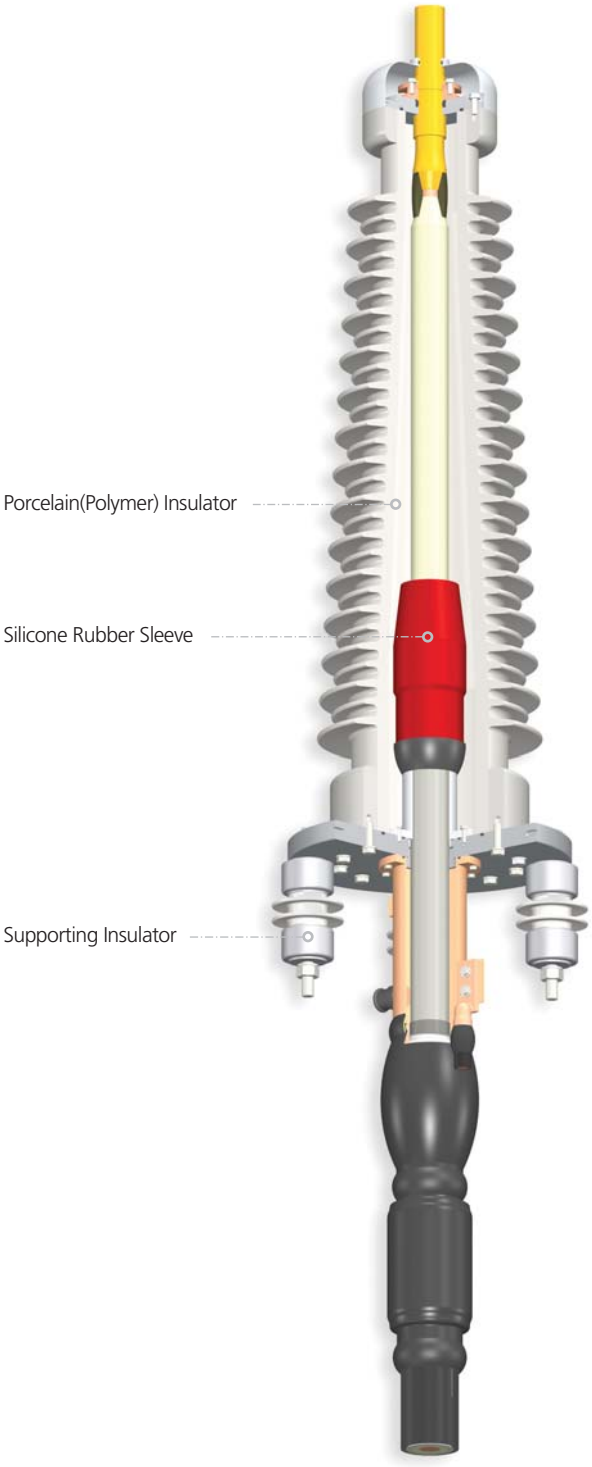


Figure 1

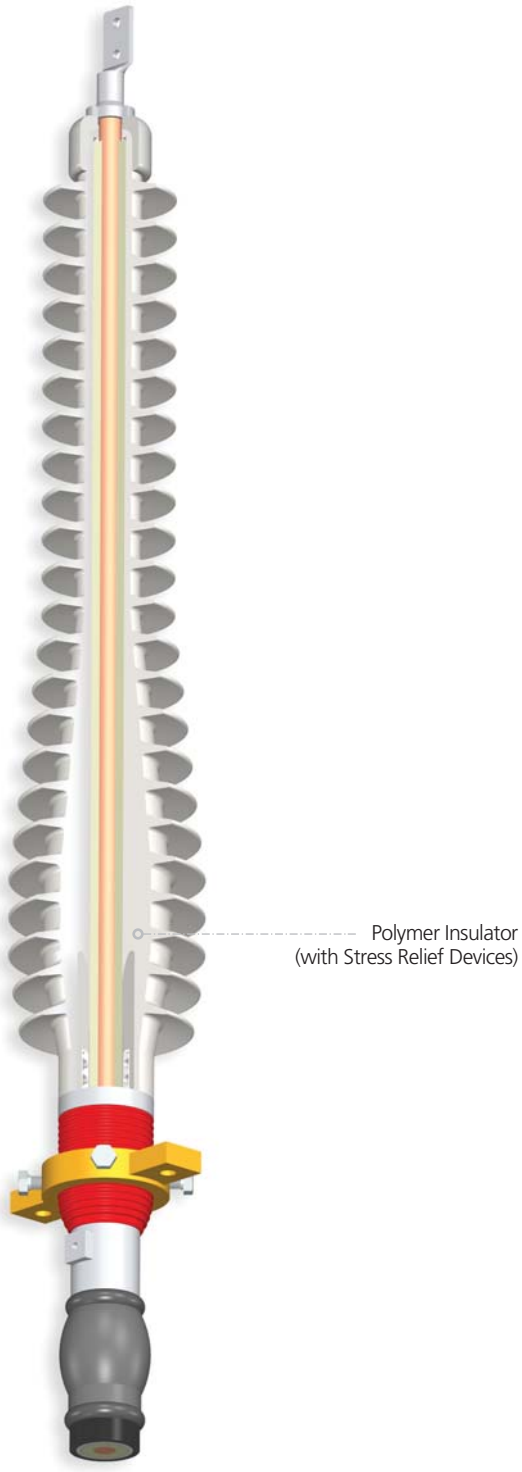


Figure 2

The outdoor terminations for 66~110kV are classified on two types. One is based on silicone rubber sleeve(so called Pre-moulded type, Figure1). The other is based on silicone rubber housing(so called dry type, Figure2). Pre-moulded silicone rubber sleeve is designed to fit with controlled interference over the cable insulation and is able to follow the cable's diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration. This uses elastic retention of silicone material itself. The termination is filled with an insulating compound up to a level where the electric field is substantially reduced. The termination base plate and the cable's metallic sheath are electrically insulated from the supporting structure by means of stand off insulators designed to withstand both mechanical and electrical stresses in services. Upon request of the customer, either porcelain or composite hollow insulator can be supplied. And the insulator can be supplied in brown or grey color. The maximum allowable cable conductor size is 3000mm^2(6000kcmil). The latter uses pre-moulded silicone housing with built in sleeve. They completely free from any Liquid insulating materials. The high electrical field area of the termination surface covered with skirts.

The housing is whole preformed and can be supplied in grey color. This has advantage like easier installation. The maximum allowable cable conductor size 3000mm^2(6000kcmil). The main insulation components are fully examined and tested in the factory.

Rating & Dimension(Based on pre-moulded type)

Max. Voltage	BIL	Max. Height	Max. Weight	Max. Creepage Distance
kV	kV	mm	kg	mm
72.5	325	1000	100	2500
123	550	1500	200	4300

Rating & Dimension(Based on Dry type)

Max. Voltage	BIL	Max. Height	Max. Weight	Max. Creepage Distance
kV	kV	mm	kg	mm
72.5	325	980	100	2500
123	550	1350	200	4300

Selection of insulators with respect to polluted conditions (Based on IEC60815)

Pollution	Ⅰ(Light)	Ⅱ(Medium)	Ⅲ(Heavy)	Ⅳ(Very Heavy)
Min. Norminal Specific Creepage Distance	16mm/kV	20mm/kV	25mm/kV	31mm/kV

7.02 Outdoor Terminations for 132kV~275kV

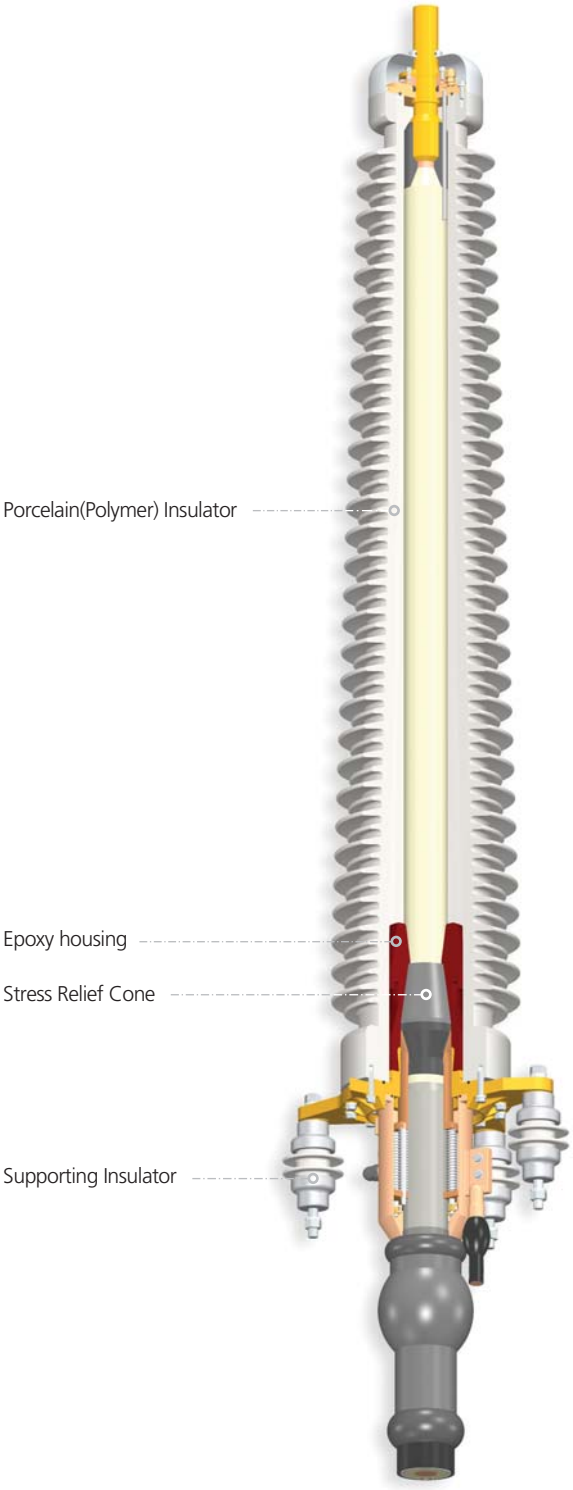


Figure 3

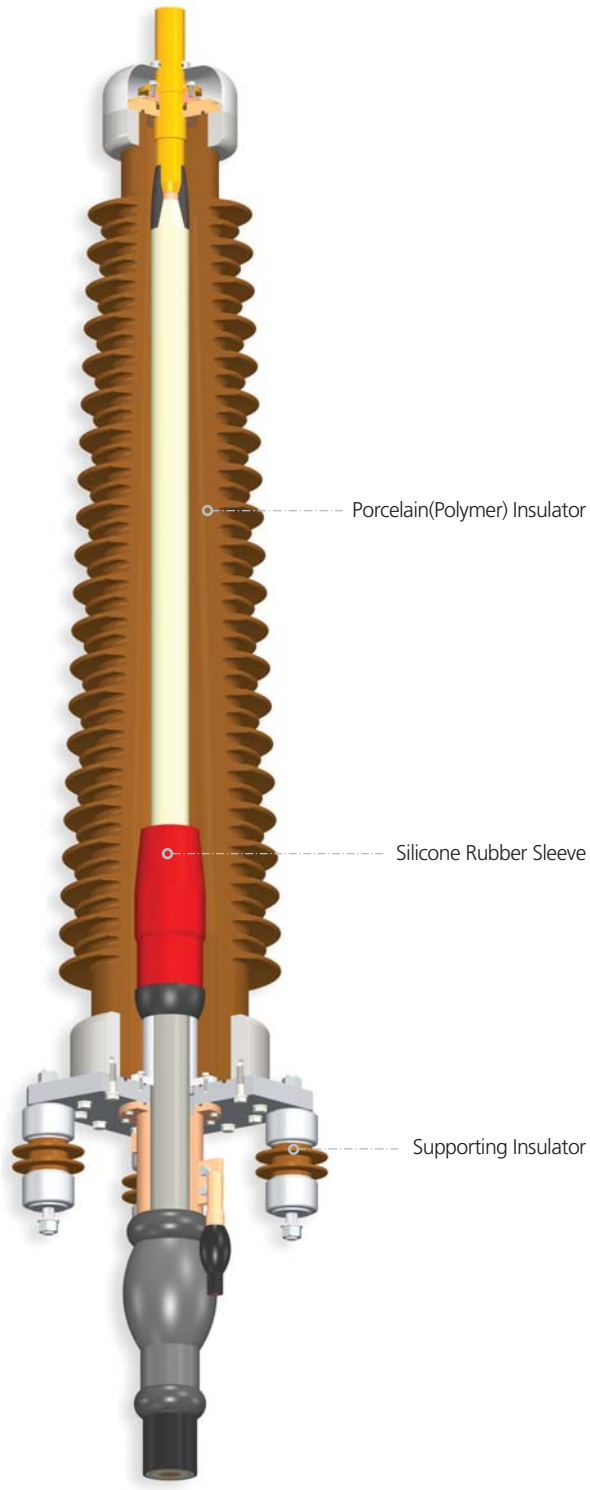


Figure 4

The outdoor termination for 132~275kV is classified into two types. One is based on the EPR-based rubber stress relief cone with an epoxy housing(so called pre-fabricated type, figure3). The other is based on the silicone rubber sleeve(so called pre-molded type, figure4).
The former uses mechanical devices to maintain the interface pressure. The latter uses elastic retention of silicone material itself. Pre-moulded silicone rubber sleeve is designed to fit with controlled interference over the cable insulation and is able to follow the cable's diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration.
The termination base plate and the cable's metallic sheath are electrically insulated from the supporting structure by means of stand off insulators designed to withstand both mechanical and electrical stresses in services. Upon request of the customer, either porcelain or composite hollow insulator can be supplied. And the insulator can be supplied in brown or grey colour. In addition upon request of the customer, arcing horn and shield ring can be supplied. The termination is filled with an insulating compound up to a level where the electric field is substantially reduced. The main insulation components are fully examined and tested in the factory. The maximum allowable cable conductor size is 3000mm^2(6000kcmil).

Rating & Dimension(Based on pre-moulded type)

Max. Voltage	BIL	Max. Height	Max. Weight	Max. Creepage Distance
kV	kV	mm	kg	mm
145	650	2410	700	5000
170	750	2410	800	6000
275	1050	3500	900	8400

Selection of insulators with respect to polluted conditions (Based on IEC60815)

Pollution	Ⅰ(Light)	Ⅱ(Medium)	Ⅲ(Heavy)	Ⅳ(Very Heavy)
Min. Norminal Specific Creepage Distance	16mm/kV	20mm/kV	25mm/kV	31mm/kV

7.03 Outdoor Terminations for 345kV~500kV

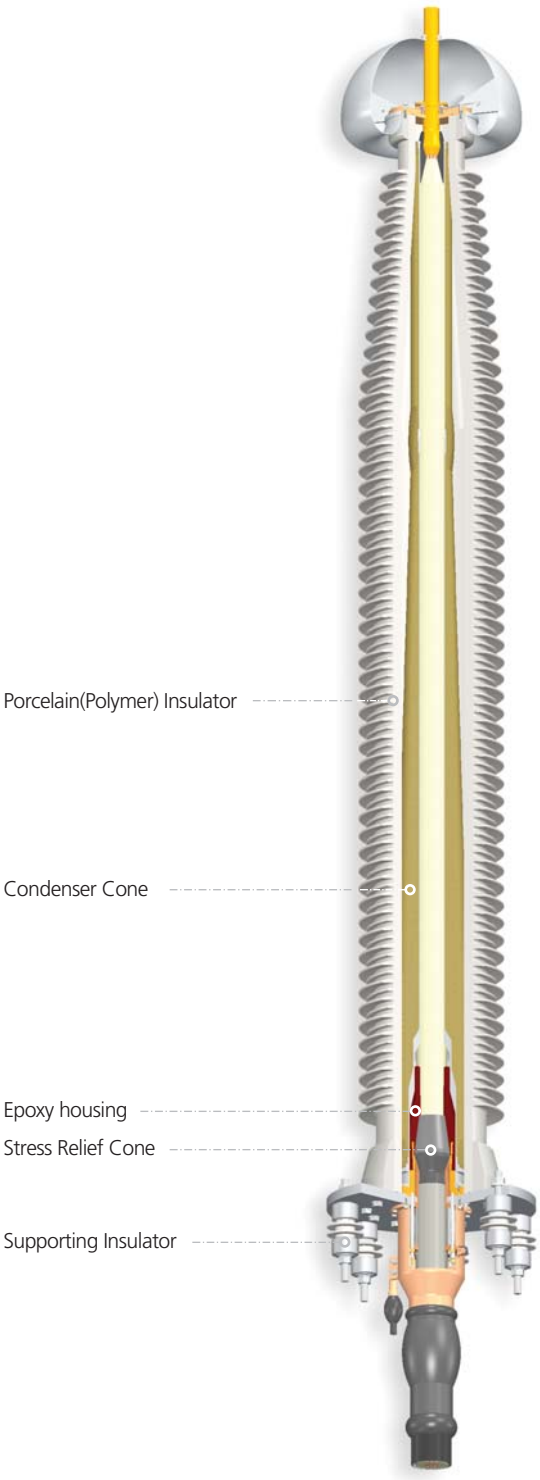


Figure 5

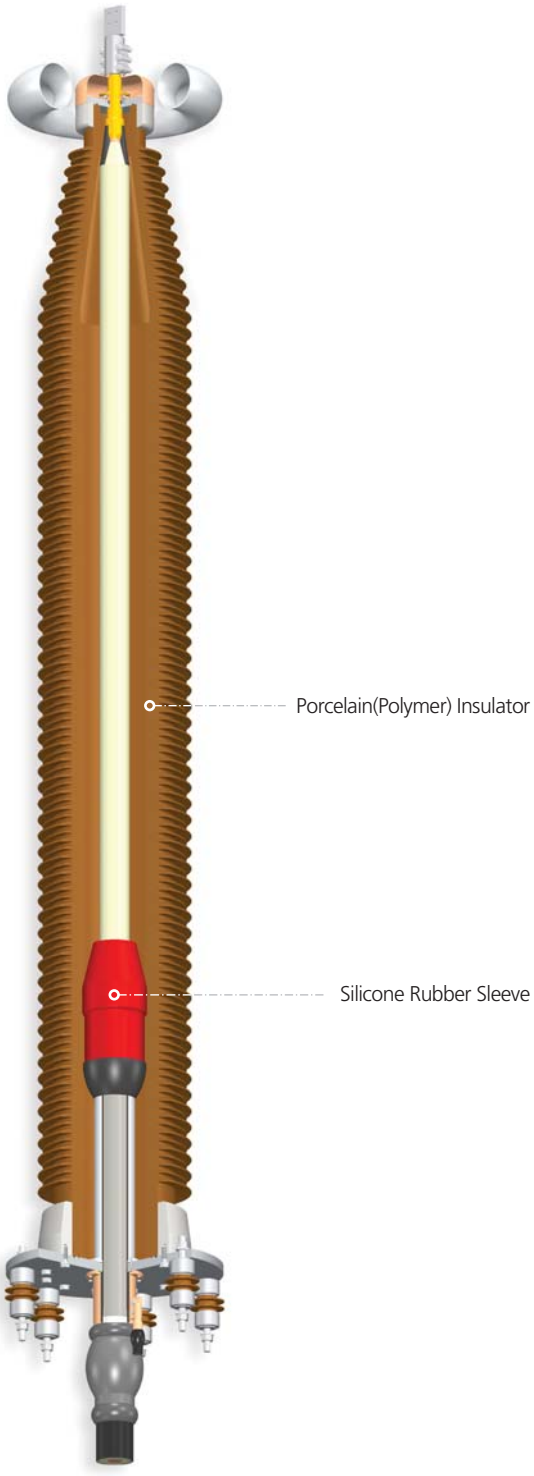


Figure 6

The outdoor termination for 345~500kV is classified into two types. One is based on the EPR-based stress relief cone with the epoxy housing and the oil-impregnated cylindrical capacitor cone is added to secure the uniform longitudinal voltage distribution all along the termination(so called condenser cone type, figure 5). The other is based on silicone rubber sleeve(so called pre-molded type, figure 6).
The former uses mechanical devices to maintain the interface pressure and the latter uses elastic retention of silicone material itself.
Pre-moulded silicone rubber sleeve is designed to fit with controlled interference over the cable insulation and is able to follow the cable's diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration.
The termination base plate and the cable's metallic sheath are electrically insulated from the supporting structure by means of stand off insulators designed to withstand both mechanical and electrical stresses in services. Upon request of the customer, either porcelain or composite hollow insulator can be supplied. And the insulator can be supplied in brown or grey colour. In addition upon request of the customer, arcing horn and shield ring can be supplied. The termination is filled with an insulating compound up to a level where the electric field is substantially reduced. The main insulation components are fully examined and tested in the factory. The maximum allowable cable conductor size is 3000mm^2(6000kcmil).

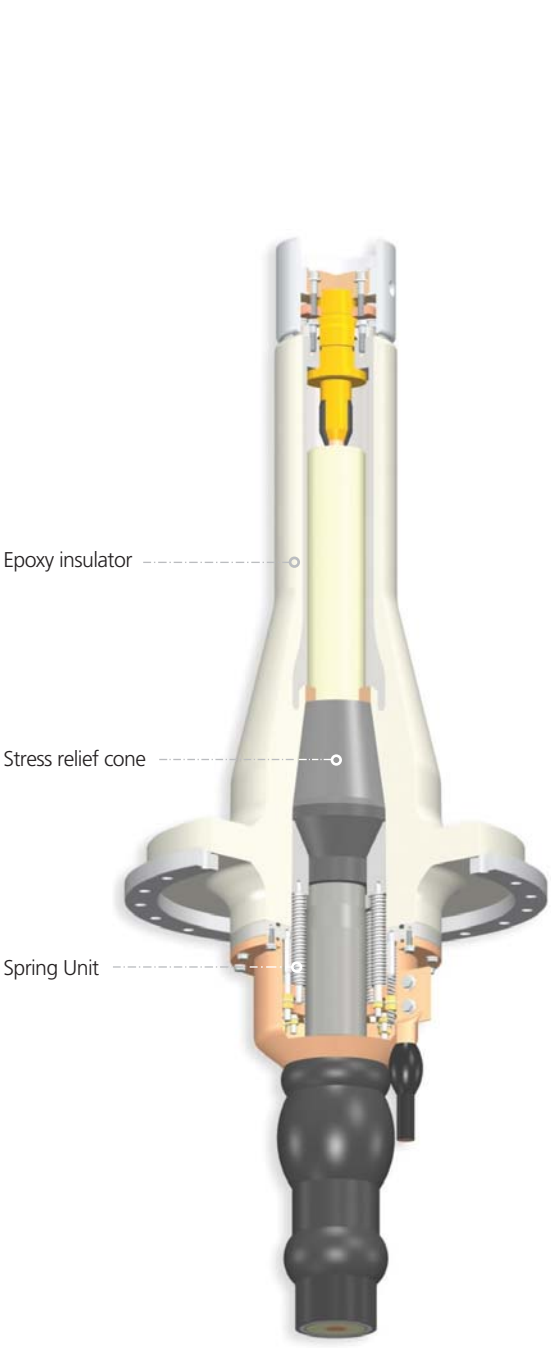
Rating & Dimension(Based on pre-moulded type)

Max. Voltage	BIL	Max. Height	Max. Weight	Max. Creepage Distance
kV	kV	mm	kg	mm
362	1175	4300	1700	13000
420	1425	4300	2000	14500
550	1550	5000	2500	20000

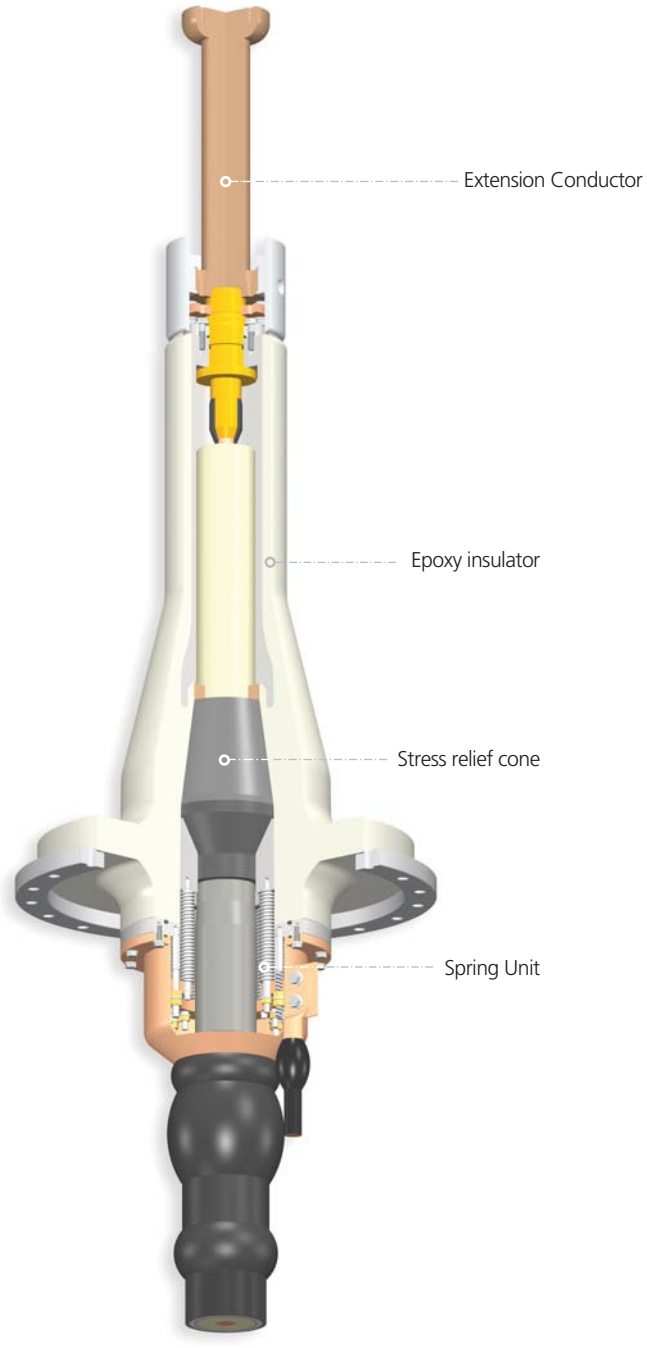
Selection of insulators with respect to polluted conditions (Based on IEC60815)

Pollution	Ⅰ(Light)	Ⅱ(Medium)	Ⅲ(Heavy)	Ⅳ(Very Heavy)
Min. Norminal Specific Creepage Distance	16mm/kV	20mm/kV	25mm/kV	31mm/kV

7.04 SF_6 Gas Insulated Terminations



For Dry Dimension



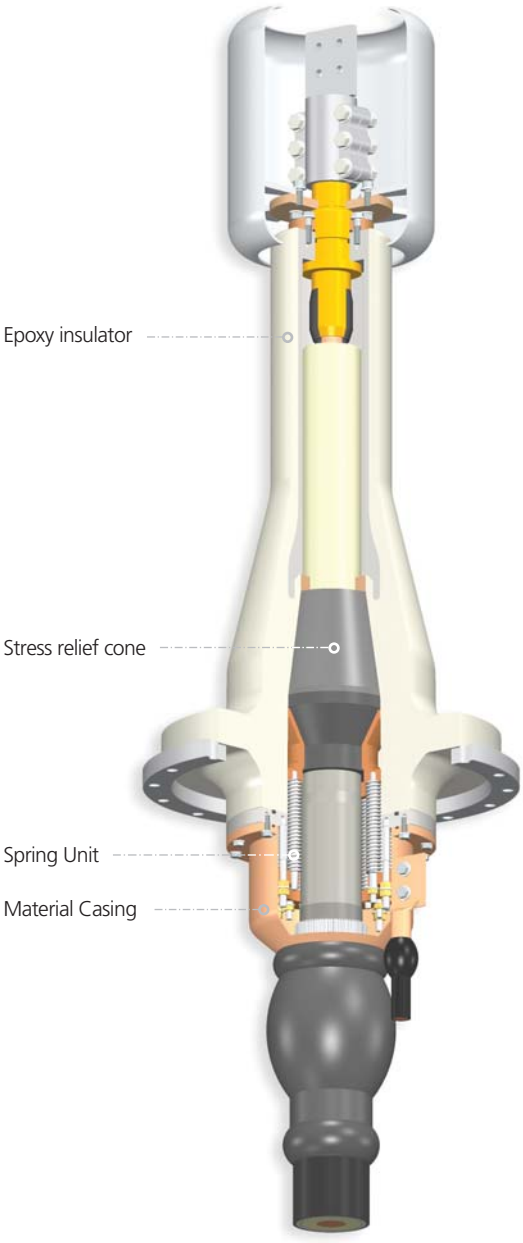
For Fluid Filled Dimension

The construction of SF6 gas insulated terminations is based on the EPR(Ethylene-Propylene Rubber) or LSR(Liquid Silicone Rubber) - based stress relief cone and the epoxy resin housing. They are mechanical devices to maintain the interface pressure. Stress relief cone and mechanical devices are designed to fit with controlled interference over the cable insulation and is able to follow the cable's diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration.
They also use epoxy insulating plate to isolate between cable sheath and GIS chamber. The SVLs(Sheath Voltage Limiter) can be installed to protect epoxy insulating plate from switching impulse. Upon request of the customer, we can supply three type of leading conductors. That is normal type, blind-ended type, plug-in type. Design and scope of delivery are fully complying with IEC60859 , IEC62271-209 and possibly adjusted to various needs of customers. The main insulation components are fully examined and tested in the factory. They are currently available at the voltage range up to 500kV and the maximum allowable cable conductor size is 3000mm^2(6000kcmil).

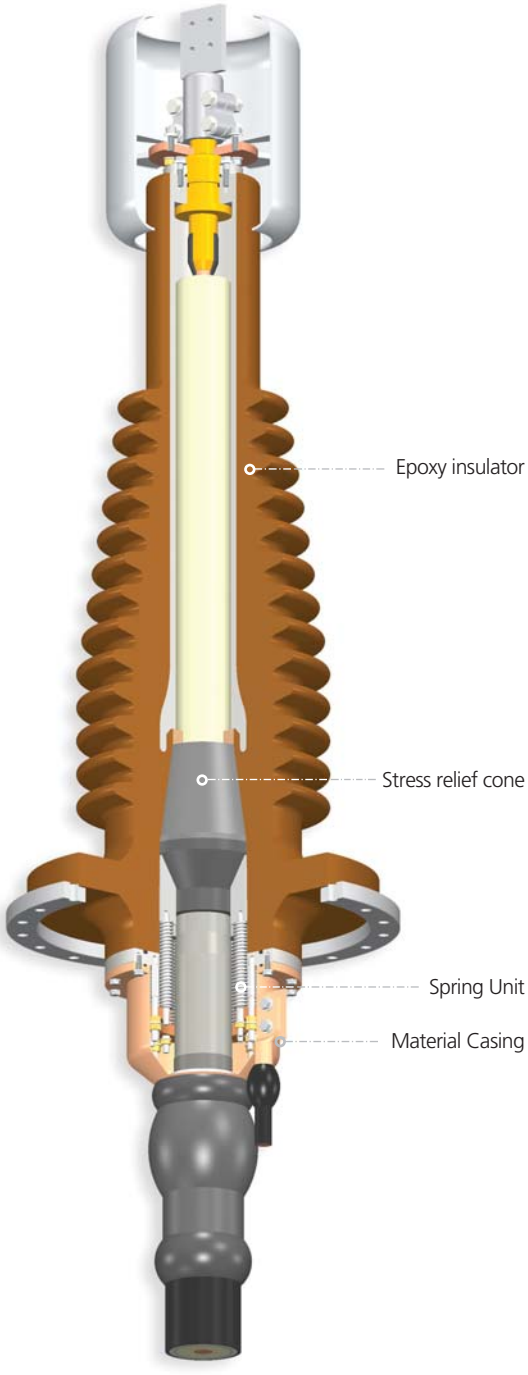
Rating & Dimension(Based on IEC 60859)

Max. Voltage	BIL	Max. Height	Dimension of base plate	Max. weight
kV	kV	mm	mm	kg
72.5	325	583	270	120
123	550	470	320	130
145	650	470	320	150
170	750	470	320	170
245	1050	620	582	280
420	1425	960	640	500
550	1550	960	640	600

7.05 Oil-Immersed Terminations



Below 220kV



Above 345kV

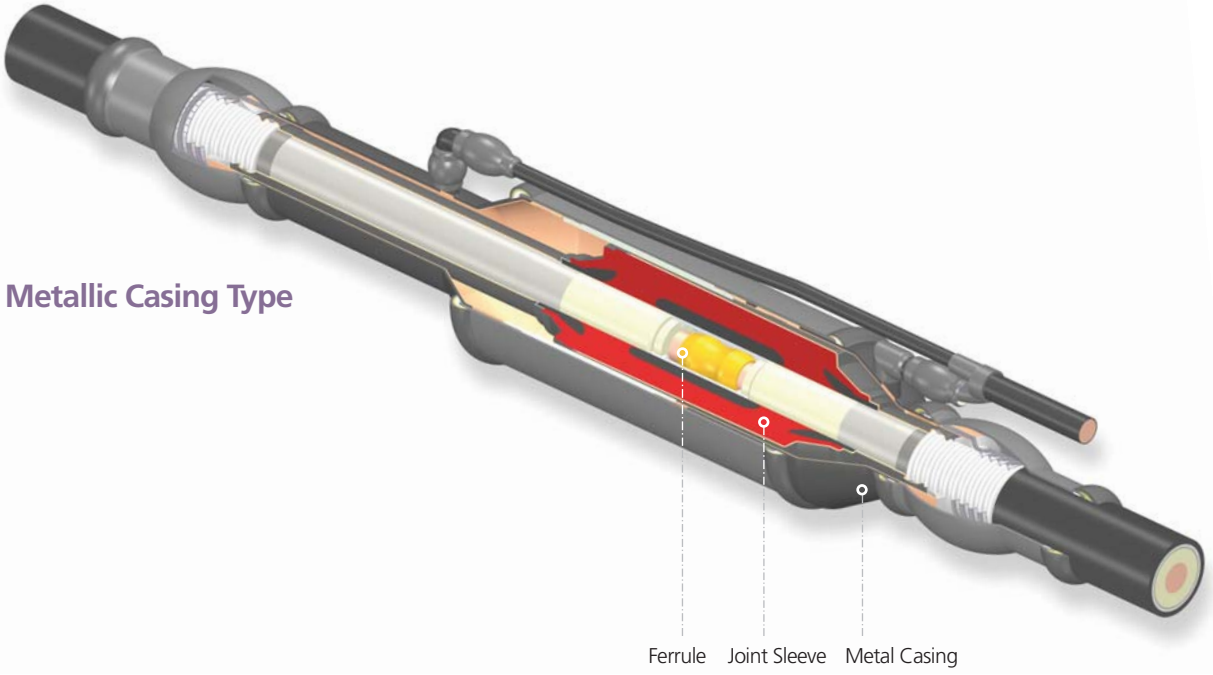
The construction of oil immersed terminations is based on the EPR(Ethylene-Propylene Rubber) or LSR(Liquid Silicone Rubber) - based stress relief cone and the epoxy housing. This is similar to gas insulated sealing end. But they use shield ring with insulating paper or epoxy insulated layer to prevent flashover in transformer. They are mechanical devices to maintain the interface pressure. Stress relief cone and mechanical devices are designed to fit with controlled interference over the cable insulation and is able to follow the cable's diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration. The main insulation components are fully examined and tested in the factory. Dimensions of base paste are complying with various needs of customers. They are currently available at the voltage range up to 500kV and the maximum allowable size is 3000mm²(6000kcmil).

Rating & Dimension

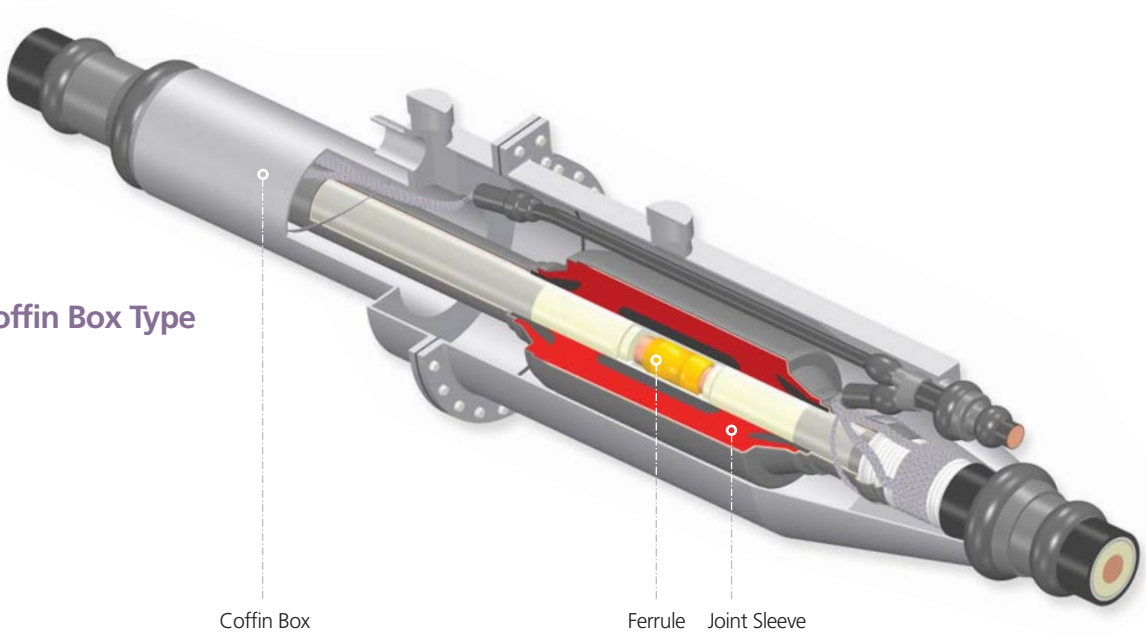
Max. Voltage	BIL	Max. Height	Dimension of base plate	Max. weight
kV	kV	mm	mm	kg
72.5	325	686	270	130
123	550	841	320	140
145	650	841	320	180
170	750	841	320	180
245	1050	1040	582	280
420	1425	1440	640	520
550	1550	1440	640	620

7.06 Pre-Moulded Joint(PMJ)

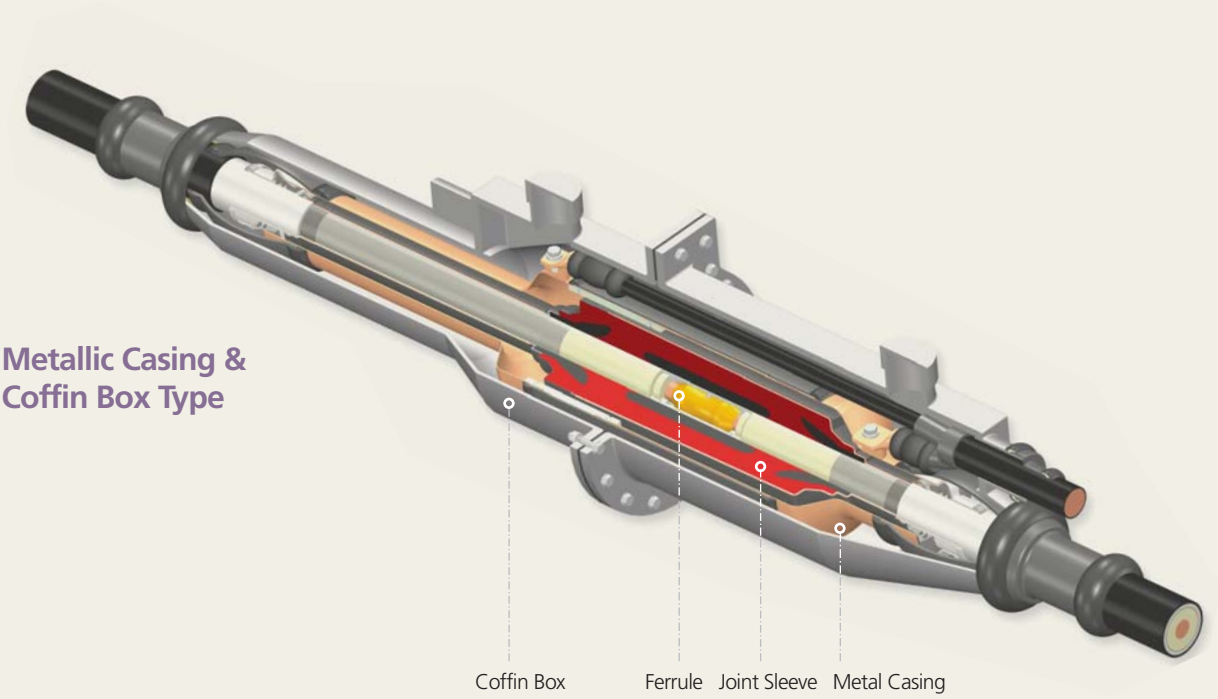
Metallic Casing Type



Coffin Box Type



Metallic Casing & Coffin Box Type

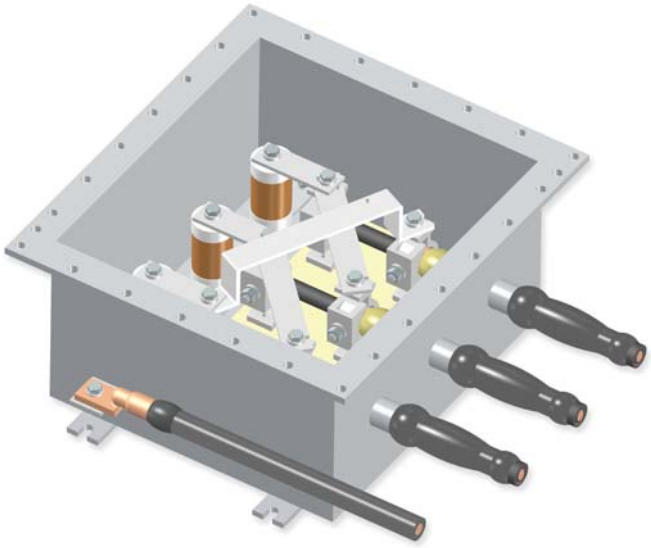


The single piece pre-moulded type rubber joint is based on silicone insulation embedded with two semi-conductive stress relief cones and one high voltage electrode. Without any mechanical devices, the interface pressure is safely maintained with elastic retention of material itself. Semi-conductive stress relief cones and electrode are designed to fit with controlled interference over the cable insulation and is able to follow the cable' s diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration. Upon request of the customer, outer casing is designed(metalic casing, coffin box, and metalic casing with coffin box). They use filling compound in outer casing. In case of sheath sectionalizing joint, we use insulating plate made of epoxy or FRP to disconnect between cable sheathes. The main insulation components and outer casing components are factory-made and fully tested before delivering to the site. The cost-efficient and simplified design along with easy and fast installation meets the various needs of customers. Installation tools can be provided if requested by customers. They are currently available at the voltage range up to 500kV and the maximum allowable conductor size is 3000mm^2(6000kcmil).

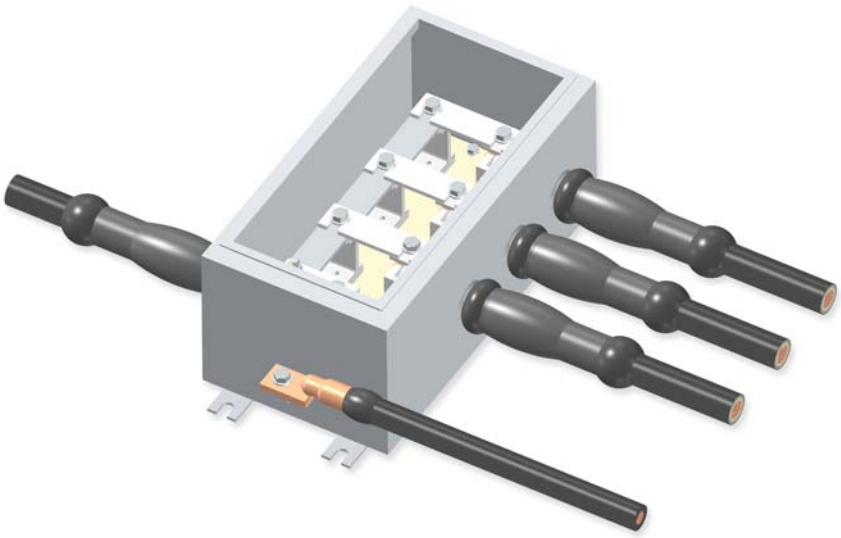
Rating & Dimension(Based on Coffin Box Type)

Max. Voltage	Max. Lenght	Max. Outer Dia.	Max. Weight
kV	mm	mm	mm
72.5	2000	500	90
123	2000	500	120
145~170	2000	500	150
245~300	2200	550	200
362~420	2600	700	300
550	2700	700	400

7.07 Link Box

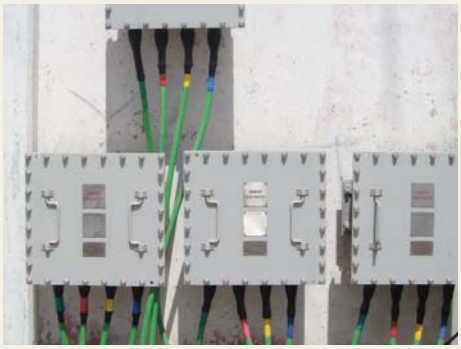


Buried Type : Link Box for cross bonding(3-1Way)



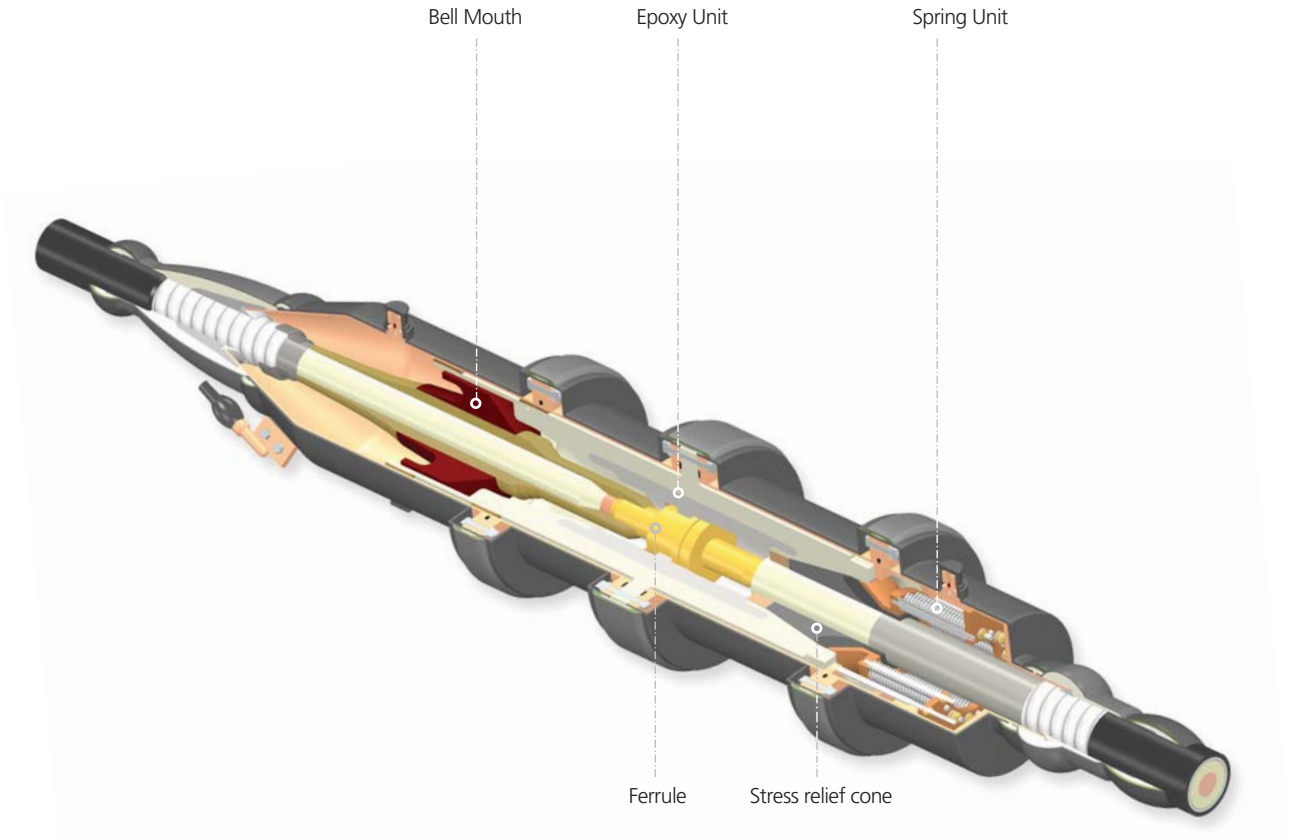
Gantry Mounted Type : Link Box for Earthing(3-1Way)

Link Boxes are used at the end of cable termination to gain easy access to the cable metallic sheath and to limit the transient over-voltage induced on the metallic sheath by the lighting, switching operations and fault currents. Cross bonding(C.B.) link boxes allow metallic sheath to be transposed at cable joints with surge voltage suppression and reduction of circulation currents. Sheath voltage limiters(SVLs) in link box are the gapless ZnO arresters, which have the insulation resistance above 100MΩ at test voltage so that the sheath insulation can be checked without disconnection SVLs.



Standard Product	Box Type	Approx. Size	Bonding Lead	Approx. Weight
		mm		kg
Link Box for Earthing(1-1Way)	Gantry Mounted / Buried	150X150 200X200	Single Core	15 30
Link Box for Earthing(3-1Way)	Gantry Mounted / Buried	300X500 350X600	Single Core	30 50
Link Box with SVLs(3-1Way)	Gantry Mounted / Buried	450X500 500X550	Single Core	40 70
Link Box for Cross-Bonding .(3-1Way)	Gantry Mounted / Buried	500X550 550X600	Concentric	50 80
Link Box for Bonding & Earthing (3-1Way)	Buried	700X500	Concentric	80
Link Box for Earthing with SVL (3-1way)	Buried	700X500	Concentric	50

7.08 Transition Joint



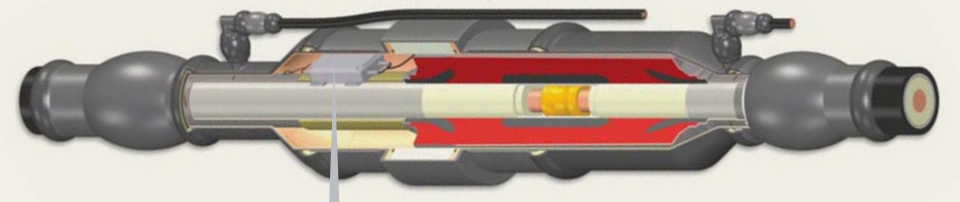
The transition joint connects between existing oil-filled cables and extruded dielectric cables. They comprise the stop joint with oil-impregnated paper insulation and epoxy bell mouth at side of oil-filled cables. They also comprise prefabricated type joint with stress relief cone based EPR(Ethylene-Propylene Rubber) and mechanical devices at side of extruded dielectric cables. They are designed to fit with controlled interference over the cable insulation and is able to follow the cable's diameter variations still guaranteeing under any service condition a sufficient positive pressure to control the electric field concentration. Each components fully examined and tested in the factory. They are currently available at the voltage range up to 300kV and the maximum allowable cable conductor size is 3000mm^2(6000kcmil).

Rating & Dimension

Max. Voltage	Max. Lenght	Max. Outer Dia.	Max. Weight
kV	mm	mm	mm
145	1800	290	220
170	1800	320	250
245	2000	360	300

7.09 Optical Cable & Joint

These type for power cable are very useful to measure distributed temperature. Especially optical cable located the sensing fiber to the cable core provides a better indication of conductor temperature. We can supply optical joint to connect optical fiber cable.



Optical Fiber Joint Box

Cable Embeded
Optical Cable

8.00 Monitoring & Diagnosis System

8.01 Real Time Thermal Monitoring-Underground Power Cable System

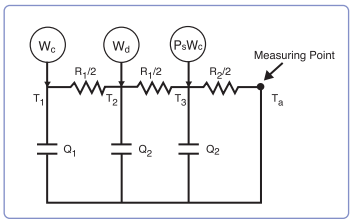
Real time thermal monitoring cooperated with DTS* system using optical fiber as the sensor provides high efficiency and reliability of power cable system.

Personal Computer

Dynamic Rating System (Power cable)

SCADA

Dynamic Rating System



Under Ground Cable Thermal Modeling

Thermal models and real-time temperature measurement can provide dynamic rating system. And this system allows qualification of actual cable capacity, cable conditions and environmental parameters critical to the stability and longevity of the cable system.

Temperature Monitoring

Right : Sensor fiber embedded cable (under the sheath)

Left : Sensor fiber attached cable

These types of power cable are very useful to measure distributed temperature. Especially, the right cable, located the sensing fiber closer to the cable core, provides a better indication of conductor temperature.

Dynamic Cable Rating Systems (R-TAS™)

Monitor	Process	Output
• Cable Temperature • Joint Temperature • Ambient Temperature • System Load Current	• IEC 60287 • Real Time Algorithms • Power Cable Thermal Model	• Conductor Temperature • Circuit Rating Capability (Steady State & Emergency) • Time to Over-Temperature • Over Current Alarms • Thermal/Loading History

*Distributed Temperature Sensor : Supplied by Sensa, UK. For more information, refer to www.sensa.org

8.02 On-Site PD Detection System

On-Site PD Detection based on high frequency PD measurement can be a highly effective method to increase the reliability of XLPE power cable system not only as after-laying test but also as on-site insulation diagnosis.

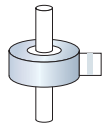
Characteristics of On-Site PD Detection System

- High sensitivity by tuning low noise frequency range
- System configuration without line-off
- Easy installation of PD sensor
- Pattern recognition by Φ-q-n analysis
- PD localization using PD attenuation property

Sensor Type

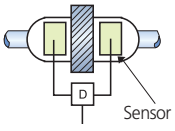
HFCT

- Installation on Ground Wire or Cross-Bonding Wire of Joint
- Measuring Frequency Range : More than 2MHz
  (Depends on the type of HFCT)



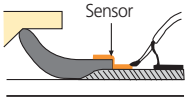
Outer Type Capacitive Sensor

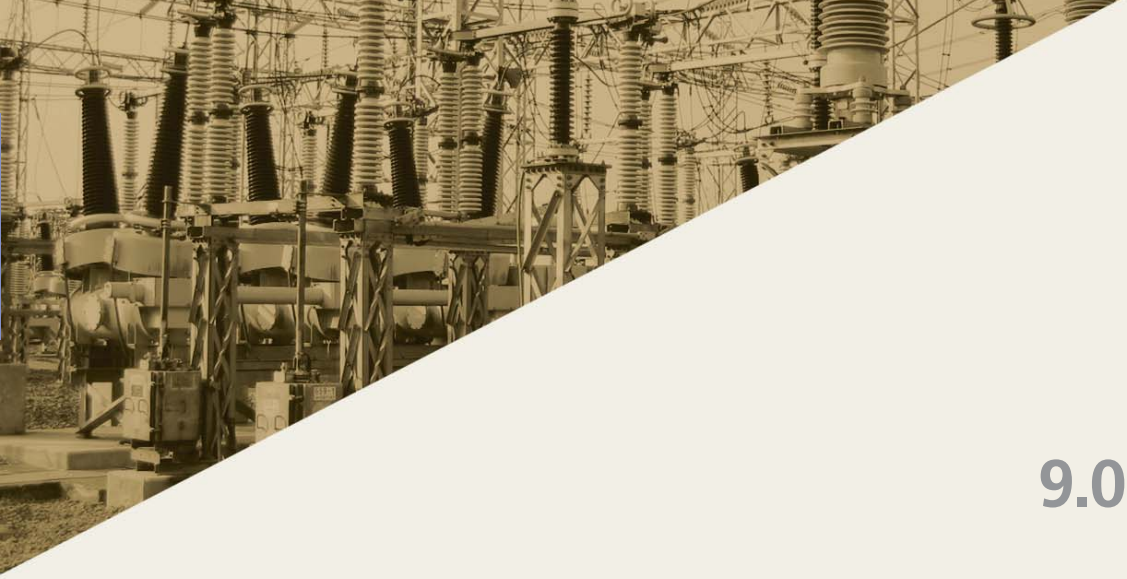
- Installation on Outer Sheath of Joint
  (Applicable only for Insulating Joint)
- Measuring Frequency Range : 1MHz ~ 50MHz



Inner Type Capacitive Sensor

- Installation on Semi-Conductive Layer in Joints
- Measuring Frequency Range : 2 ~ 20MHz





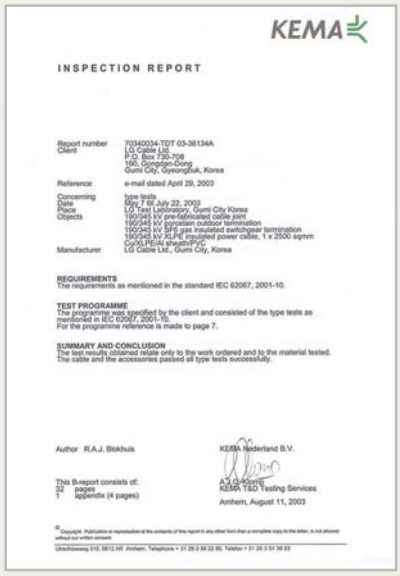
9.00 Appendix

9.01 Type Test/Pre-Qualification Test Certificates

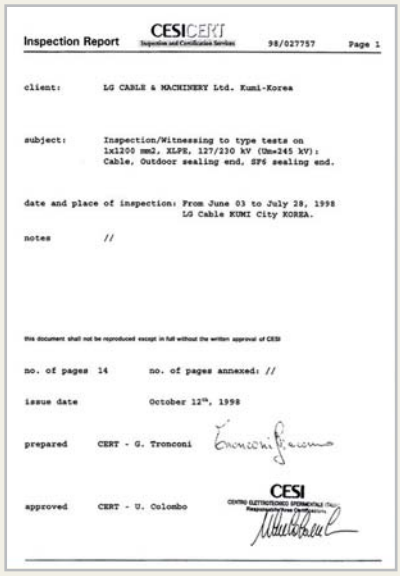

KEMA 02-1053

CERTIFICATE OF
COMPLETE TYPE TEST AND PRE-QUALIFICATION TEST

IEC 62067 (2001)


KEMA

INSPECTION REPORT


Inspection Report CESICERT 98/027757 Page 1

client: LG CABLE & MACHINERY Ltd. Kumi-Korea

subject: Inspection/Witnessing to type tests on 1x1200 mm2, XLPE, 127/230 kV (Um=245 kV): Cable, Outdoor sealing end, SF6 sealing end.

date and place of inspection: From June 03 to July 28, 1998 LG Cable KUMI City KOREA.

notes //

no. of pages 14 no. of pages annexed: //

issue date October 12th, 1998

prepared CERT - G. Tronconi

approved CERT - U. Colombo

CESI

The reliability of XLPE cable systems are fully verified by internationally accredited independent laboratories, KEMA (Netherlands), CESI (Italy), Kinetrics (Canada) and KERI (Korea).

Certificates for XLPE cable system over 230kV

Year	Voltage Grade	Spec.	Test Items	Certificate Issued by	Test
1999	400kV, 1200mm²	IEC62067	Cable, PJ, GIS & Outdoor Termination	KEMA	Type Test
2001	230kV, 1200mm²	IEC62067	Cable, PMJ, GIS & Outdoor Termination	KEMA	Type Test
	345kV, 2000mm²		Cable, PJ, GIS & Outdoor Termination	KERI(KEPCO)	Type Test
2002	345kV, 2000mm²	IEC62067	Cable, PJ, GIS & Outdoor Termination	KERI(KEPCO)	PQ
	400kV, 1200mm²		Cable, PJ, GIS & Outdoor Termination	KEMA	PQ
2003	345kV, 2500mm²	IEC62067	Cable, PJ, GIS & Outdoor Termination	KEMA	Type Test
2004	345kV, 2500mm²	IEC62067	Cable, GIS & Outdoor Termination	KEMA	PQ
	400kV, 2500mm²		Cable, PMJ, GIS & Outdoor Termination	KEMA	Type Test
2006	230kV 800SQ	IEC62067	Cable, GIS, Outdoor Termination	SGS	Type Test
	345kV 2500SQ		Cable, PMJ, Outdoor Termination	KEMA	Type Test
2007	345kV1500SQ	IEC62067	Cable, PMJ, Outdoor Termination	KEMA	Type Test
	380kV2500SQ		Cable, GIS, Outdoor Termination	KEMA	Type Test
2008	345kV2500SQ	IEC62067	Cable, GIS, PMJ, Outdoor Termination	KERI(KEPCO)	Type Test

9.02 ISO Certificates

UNDERWRITERS LABORATORIES INC.

ENVIRONMENTAL MANAGEMENT SYSTEM REGISTRATION

ISO 14001

LS Cable Ltd.

Gumi Plant
190 Gondan-Dong
Gumi- Si
Gyeongsangbuk-Do, 730-708
Korea

Indong Plant
643 Jinpyeong-Dong
Gumi-Si
Gyeongsangbuk-Do, 730-735
Korea

Underwriters Laboratories Inc.® (UL) issues this certificate to the Firm named above, after assessing the Firm's environmental management system and finding it in compliance with

ISO 14001:2004

ENVIRONMENTAL MANAGEMENT SYSTEM
KS A 14001:2004

for the following scope of registration

The environmental management system of LS Cable Ltd. associated with the design and manufacture of copper and optical fiber telecommunication cables, power cable, power cable accessories, aluminum extruded products, UC(Ultracapacitor) and rubber hoses and assemblies for automotive application and manufacture of magnet wires, communication cables (LAN), optical fibers, curtain walls, aluminum billet and rods, aluminum tubes and copper rods at Gumi and Indong Plants, Gumi-Si, Gyeongsangbuk-Do, Korea.

This environmental management system registration is included in UL's Directory of Registered Firms and applies to the operations of the address(es) shown above. By issuance of this certificate the firm represents that it will maintain its registration in accordance with the applicable requirements. This certificate is not transferable and remains the property of Underwriters Laboratories Inc.®.

File Number: A5120
Volume: 1
Original Certification Date: January 30, 1997
ISO 14001:2004 Issue Date: September 6, 2005
Revision Date: September 3, 2007
Recertification Date: January 30, 2008
Renewal Date: January 29, 2011

John H. Schmidt
Senior Vice President, Chief Development Officer

UL REGISTERED FIRM

UNDERWRITERS LABORATORIES INC.

CERTIFICATE OF REGISTRATION

ISO 9000

LS Cable Ltd.

Anyang Plant
555 Hogye-Dong
Dongan-Gu
Anyang-Si,
Gyeonggi-Do 431-831 Korea

Gumi Plant
190 Gongdan-Dong
Gumi-Si
Gyeongbuk 730-708 Korea

Underwriters Laboratories Inc.® (UL) issues this certificate to the Firm named above, after assessing the Firm's quality system and finding it in compliance with

ISO 9001:2000

EN ISO 9001:2000; BS EN ISO 9001:2000; ANSI/ASQ Q9001:2000; KS A 9001:2001

for the following scope of registration

3357 (US) : Drawing and Insulating of Nonferrous Wire
3643 (US) : Current-Carrying Wiring Devices
3069 (US) : Fabricated Rubber Products, Not Elsewhere Classified
3449 (US) : Miscellaneous Structural Metal Work
3351 (US) : Rolling, Drawing and Extruding of Copper
3081 (US) : Unsupported Plastics Film and Sheet
3613 (US) : Switchgear and Switchboard Apparatus

The design and manufacture of copper telecommunication cables, power cables, power cable accessories, control cables, nuclear power plant cables, rubber floorings, vibration absorbent rubbers, connectors for electronics equipment, overhead AL conductors, OPGW (optical fiber composite ground wires), anisotropic conductive films for display material, appliance wiring materials and busduct systems.
The design and development of micro coaxial cable assemblies.
The manufacture of magnet wires, bare conductors and copper rods.
The management of outsourced micro coaxial cable assemblies manufacture.

Further clarifications regarding the scope of this certificate and the applicability of ISO 9001:2000 requirements may be obtained by consulting the organization.

This quality system registration is included in UL's Directory of Registered Firms and applies to the provision of goods and/or services as specified in the scope of registration from the address(es) shown above. By issuance of this certificate the firm represents that it will maintain its registration in accordance with the applicable requirements. This certificate is not transferable and remains the property of Underwriters Laboratories Inc.®.

File Number: A1690 Volume: 1
Original Certification Date: July 16, 1993
ISO 9001:2000 Issue Date: November 25, 2001
Revision Date: July 24, 2007
Recertification Date: November 25, 2007
Renewal Date: November 24, 2010

John H. Schmidt
Senior Vice President, Chief Development Officer

ANAB

UL REGISTERED FIRM

UNDERWRITERS LABORATORIES INC.

CERTIFICATE OF REGISTRATION

ISO 9000

LS Cable Ltd.

190 Gongdan-Dong
Gumi-Si
Gyeongbuk 730-030 Korea

Underwriters Laboratories Inc.® (UL) issues this certificate to the Firm named above, after assessing the Firm's quality system and finding it in compliance with

ISO 9001:2000

EN ISO 9001:2000; BS EN ISO 9001:2000; ANSI/ASQ Q9001:2000

for the following scope of registration

1731 (US) : Electrical Work

The design and installation of electrical systems including underground EHV cables and overhead transmission lines.

Further clarifications regarding the scope of this certificate and the applicability of ISO 9001:2000 requirements may be obtained by consulting the organization.

This quality system registration is included in UL's Directory of Registered Firms and applies to the provision of goods and/or services as specified in the scope of registration from the address(es) shown above. By issuance of this certificate the firm represents that it will maintain its registration in accordance with the applicable requirements. This certificate is not transferable and remains the property of Underwriters Laboratories Inc.®.

File Number: A4993
Volume: 1
Original Certification Date: December 5, 1996
ISO 9001:2000 Issue Date: December 3, 2001
Revision Date: November 17, 2008
Renewal Date: December 4, 2011

John H. Schmidt
Senior Vice President, Chief Development Officer

UL REGISTERED FIRM

We do what it takes to earn quality certifications like ISO 14001, ISO 9001, and ISO/TS 16949 which sets standards for process control and manufacturing flow.

LS Cable

Korea's foremost cable maker in both product list and service range,
LS Cable has an integrated supply system from basic raw materials to
ultranhigh voltage cables, optical fiber cables, system engineering and installation works.
In non-cable sector as well, LS Cable flourishes as a top-rate supplier of information and
communication networks, connectors, lead frames, industrial rubber, and aluminum products.
Reputed for its outstanding technology and quality,
LS Cable is at the service of customers within and oytside Korea.
Armed with the world's leading technology in electric power and optic fiber,
it has been successful with four joint ventures in Malaysia and Vietnam.
It has thus demonstrated leadership in establishing a global
network in the domains of electric power, other energy and information.

Global Network

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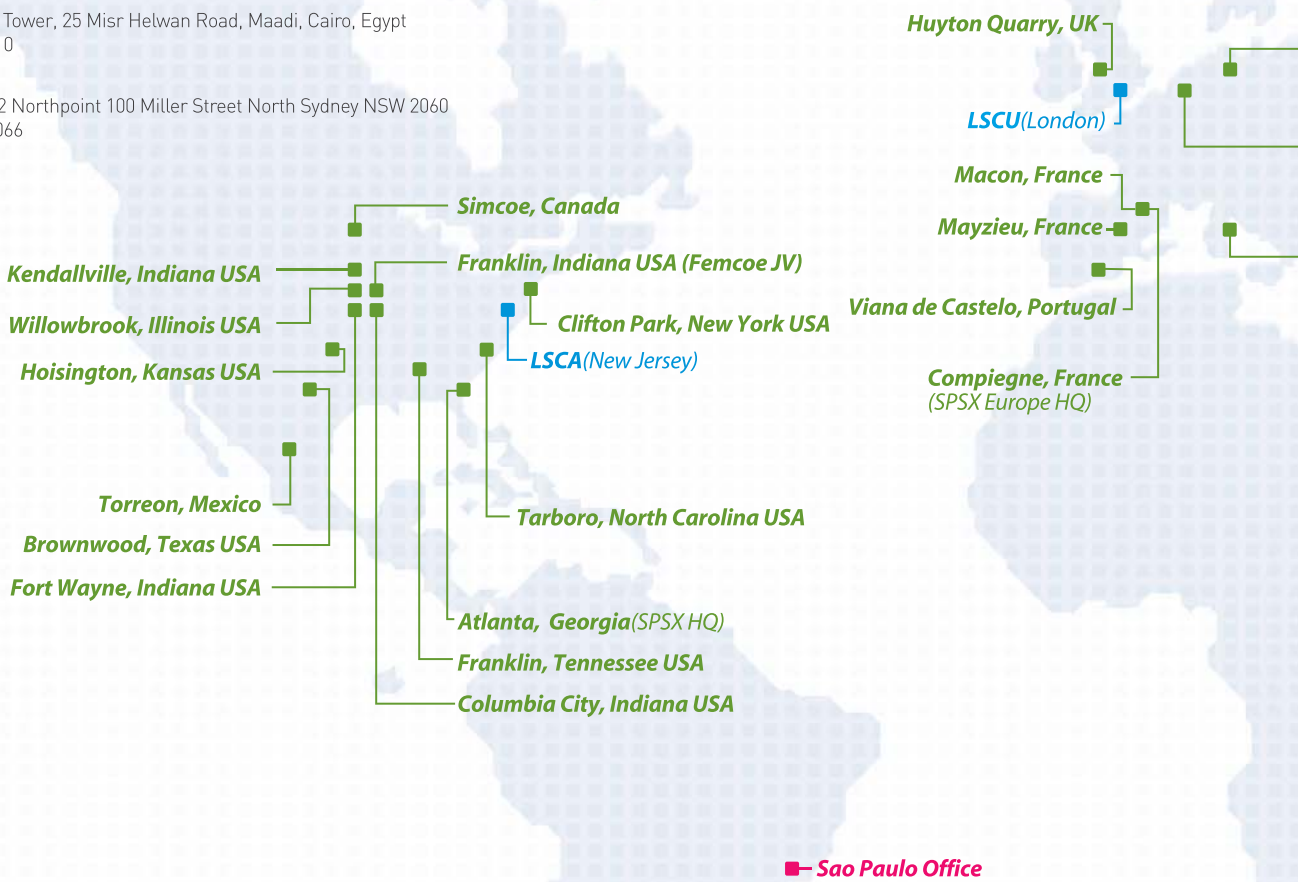

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