

IEC



ITECO

Wire & Cable

EHV Power Cable Systems

Power Cables

Cable Accessories

Quality Assurance Systems

Cable Monitoring & Maintenance Systems

Cable Installation & System Design

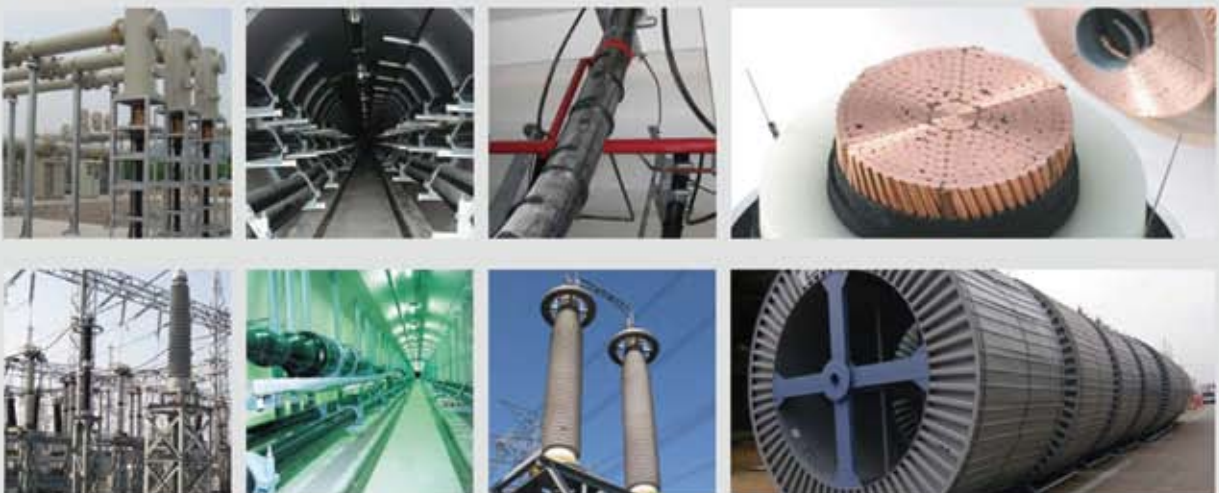
ITECO

ITECO LTD



ITECO EHV Cable System

Up to 330kv XLPE Cable & Accessories



Total Solution for Underground
Transmission System

Total Solution Provider for Electric Power Cable

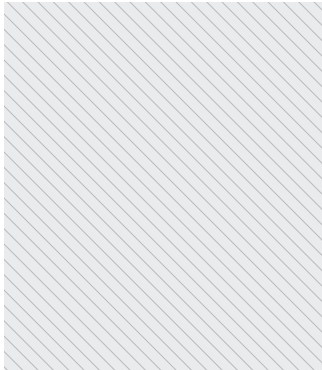


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Power Cables

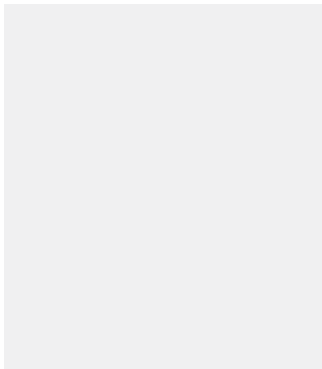
The diagrams below illustrate typical XLPE insulated cable designs which consist of AL/CU conductor, XLPE insulation, metallic sheath/wire shield and PVC/PE outer sheath.

* Refer to the following pages for technical specifications of each cable design.

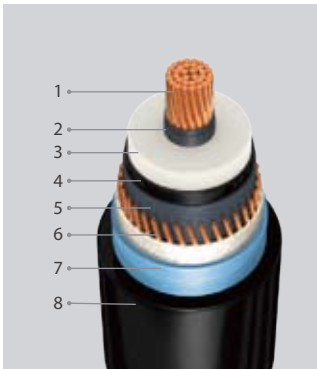


1. Single core XLPE cable with corrugated aluminum sheath

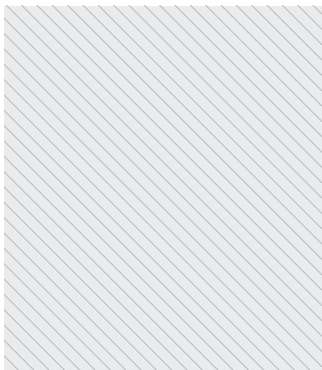
1. Conductor (Cu or Al)
2. Conductor Screen
3. XLPE Insulation
4. Insulation Screen
5. Semi-conducting Tape
6. Corrugated Aluminum
7. PE or PVC Outer Sheath



2. Single core XLPE cable with copper wire shield



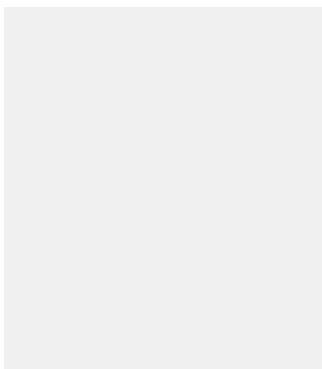
1. Conductor (Cu or Al)
2. Conductor Screen
3. XLPE Insulation
4. Insulation Screen
5. Semi-conducting Tape
6. Copper Wire Screen
7. Al or Cu Laminated Tape
8. PE or PVC Outer Sheath



3. Single core XLPE cable with lead sheath



1. Conductor (Cu or Al)
2. Conductor Screen
3. XLPE Insulation
4. Insulation Screen
5. Semi-conducting Tape
6. Lead Alloy Sheath
7. PE or PVC Outer Sheath



4. Single core XLPE cable with corrugated copper sheath

1. Conductor (Cu or Al)
2. Conductor Screen
3. XLPE Insulation
4. Insulation Screen
5. Semi-conducting Tape
6. Corrugated Copper Sheath
7. PE or PVC Outer Sheath



77kV Single Core Cable

Design and Construction of XLPE Cable

Aluminum Sheath Type

Construction : Copper Conductor / XLPE Insulation / Aluminum Sheath / PVC (or PE) Outer Sheath



Nominal Area [mm ²]	Conductor Shape	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	Thickness of Sheath [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
200	C.C	1.0	13.0	1.5	1.6	3.5	69.0	5.2
250	C.C	1.0	13.0	1.5	1.6	3.5	72.0	6.6
325	C.C	1.0	13.0	1.5	1.7	3.5	75.0	7.5
400	C.C	1.0	13.0	1.5	1.8	3.5	78.0	8.5
500	C.C	1.0	13.0	1.5	1.8	3.5	81.0	9.6
600	C.C	1.0	13.0	1.5	1.9	3.5	84.0	10.9
800	SEG	2.0	13.0	1.5	2.0	3.5	92.0	14.0
1000	SEG	2.0	13.0	1.5	2.1	3.5	97.0	16.4
1200	SEG	2.0	13.0	1.5	2.2	3.5	102.0	18.7
1400	SEG	2.0	13.0	1.5	2.2	3.5	106.0	21.0
1600	SEG	2.0	13.0	1.5	2.3	3.5	110.0	23.3
1800	SEG	2.0	13.0	1.5	2.3	3.5	112.0	25.2
2000	SEG	2.0	13.0	1.5	2.4	3.5	116.0	27.7

* C.C : Circular Compacted, SEG : Segmental Compacted

Copper Wire Shield Type

Construction : Copper Conductor / XLPE Insulation / Copper Wire Shield / PVC (or PE) Outer Sheath



Nominal Area [mm ²]	Conductor Shape	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	No. of Wire [mm]	Dia. of Wire [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
200	C.C	1.0	13.0	1.5	40	1.2	3.5	60.0	4.8
250	C.C	1.0	13.0	1.5	40	1.2	3.5	62.0	5.3
325	C.C	1.0	13.0	1.5	40	1.2	3.5	64.0	6.2
400	C.C	1.0	13.0	1.5	40	1.2	4.0	67.0	7.2
500	C.C	1.0	13.0	1.5	40	1.2	4.0	70.0	8.3
600	C.C	1.0	13.0	1.5	40	1.2	4.0	73.0	9.4
800	SEG	2.0	13.0	1.5	40	1.2	4.5	81.0	12.1
1000	SEG	2.0	13.0	1.5	40	1.2	4.5	86.0	14.2
1200	SEG	2.0	13.0	1.5	40	1.2	4.5	90.0	16.3
1400	SEG	2.0	13.0	1.5	40	1.2	4.5	94.0	18.4
1600	SEG	2.0	13.0	1.5	40	1.2	4.5	97.0	20.4
1800	SEG	2.0	13.0	1.5	40	1.2	4.5	100.0	22.4
2000	SEG	2.0	13.0	1.5	40	1.2	4.5	103.0	24.4

* C.C : Circular Compacted, SEG : Segmental Compacted

110kV Single Core Cable

Design and Construction of XLPE Cable

Aluminum Sheath Type



Construction : Copper Conductor / XLPE Insulation / Aluminum Sheath / PVC (or PE) Outer Sheath

Conductor		Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	Thickness of Sheath [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
Nominal Area [mm ²]	Shape							
400	C.C	1.5	15.0	1.2	1.8	4.0	83	9.3
500	C.C	1.5	15.0	1.2	1.9	4.0	86	10.8
630	C.C	1.5	15.0	1.2	2.0	4.0	92	12.7
800	SEG	2.0	15.0	1.2	2.1	4.0	97	15.4
1000	SEG	2.0	15.0	1.2	2.2	4.0	102	17.9
1200	SEG	2.0	15.0	1.2	2.3	4.0	108	20.2
2000	SEG	2.0	15.0	1.2	2.5	4.0	122	29.6

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity(40kA/1sec)

Copper Wire Shield & Lead Sheath Type



Construction : Copper Conductor / XLPE Insulation / Copper Wire Shield / Lead Sheath / PVC (or PE) Outer Sheath

Conductor		Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	No. of Wire [mm]	Dia. of Wire [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
Nominal Area [mm ²]	Shape								
400	C.C	1.5	15.0	1.2	Ø2.0x67ea	2.5	4.0	81	15.5
500	C.C	1.5	15.0	1.2	Ø2.0x70ea	2.6	4.0	84	17.4
630	C.C	1.5	15.0	1.2	Ø1.9x67ea	2.7	4.0	88	19.3
800	SEG	2.0	15.0	1.2	Ø1.8x70ea	2.9	4.0	94	22.8
1000	SEG	2.0	15.0	1.2	Ø1.8x65ea	3.0	4.0	98	25.6
1200	SEG	2.0	15.0	1.2	Ø1.7x67ea	3.1	4.0	102	28.1
2000	SEG	2.0	15.0	1.2	Ø1.4x70ea	3.5	4.0	115	39.1

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity(40kA/1sec)

132kV Single Core Cable

Design and Construction of XLPE Cable

Aluminum Sheath Type



Construction : Copper Conductor / XLPE Insulation / Aluminum Sheath / PVC (or PE) Outer Sheath

Nominal Area [mm ²]	Shape	Conductor	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	Thickness of Sheath [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
		400	C.C	1.5	16	1.2	1.9	4.0	88
500	C.C	1.5	16	1.2	2.0	4.0	92	11.2	
630	C.C	1.5	16	1.2	2.1	4.0	96	13.1	
800	SEG	2.0	16	1.2	2.2	4.0	102	15.7	
1000	SEG	2.0	16	1.2	2.3	4.0	109	18.4	
1200	SEG	2.0	16	1.2	2.3	4.0	113	20.4	
2000	SEG	2.0	16	1.2	2.6	4.0	126	29.9	

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity(40kA/1sec)

Copper Wire Shield & Lead Sheath Type



Construction : Copper Conductor / XLPE Insulation / Copper Wire Shield / Lead Sheath / PVC (or PE) Outer Sheath

Nominal Area [mm ²]	Shape	Conductor	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	No. of Wire [mm]	Dia. of Wire [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
		400	C.C	1.5	16	1.2	Ø2.0x67ea	2.5	4.0	82
500	C.C	1.5	16	1.2	Ø1.9x70ea	2.6	4.0	85	17.2	
630	C.C	1.5	16	1.2	Ø1.9x67ea	2.7	4.0	89	19.4	
800	SEG	2.0	16	1.2	Ø1.8x67ea	2.9	4.0	95	22.6	
1000	SEG	2.0	16	1.2	Ø1.7x70ea	3.0	4.0	99	25.4	
1200	SEG	2.0	16	1.2	Ø1.7x65ea	3.1	4.0	103	27.9	
2000	SEG	2.0	16	1.2	Ø1.4x65ea	3.5	4.0	116	38.8	

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity(40kA/1sec)

154kV Single Core Cable

Design and Construction of XLPE Cable

Aluminum Sheath Type



Construction : Copper Conductor / XLPE Insulation / Aluminum Sheath / PVC (or PE) Outer Sheath

Nominal Area [mm ²]	Conductor Shape	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	Thickness of Sheath [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
600	C.C	1.5	17	1.3	2.9	4.5	103	15.0
1200	SEG	2.0	17	1.3	2.5	4.5	115	21.8
2000	SEG	2.0	17	1.3	2.6	4.5	127	31.2
2500	SEG	2.0	17	1.3	2.8	4.5	135	36.2

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity(50kA/1.7sec)

Copper Wire Shield & Lead Sheath Type



Construction : Copper Conductor / XLPE Insulation / Copper Wire Shield / Lead Sheath / PVC (or PE) Outer Sheath

Nominal Area [mm ²]	Conductor Shape	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	No. of Wire [mm]	Dia. of Wire [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
600	C.C	1.5	17	1.3	Ø2.6x70ea	2.9	4.5	95	22.7
1200	SEG	2.0	17	1.3	Ø2.5x65ea	3.3	4.5	109	31.7
2000	SEG	2.0	17	1.3	Ø2.3x68ea	3.6	4.5	122	42.7
2500	SEG	2.0	17	1.3	Ø2.2x66ea	3.8	4.5	129	48.5

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity(40kA/1sec)

230kV Single Core Cable

Design and Construction of XLPE Cable

Aluminum Sheath Type



Construction : Copper Conductor / XLPE Insulation / Aluminum Sheath / PVC (or PE) Outer Sheath

Nominal Area [mm ²]	Shape	Conductor	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	Thickness of Sheath [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
		600	C.C	1.5	23	1.3	2.4	5.0	117
1200	SEG	2.0	23	1.3	2.6	5.0	132	24.2	
2000	SEG	2.0	23	1.3	2.9	5.0	146	34.1	
2500	SEG	2.0	23	1.3	3.0	5.0	153	39.1	

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity (63kA/1sec)

Copper Wire Shield & Lead Sheath Type



Construction : Copper Conductor / XLPE Insulation / Copper Wire Shield / Lead Sheath / PVC (or PE) Outer Sheath

Nominal Area [mm ²]	Shape	Conductor	Approx. Thickness of Conductor Shield [mm]	Thickness of Insulation [mm]	Approx. Thickness of Insulation Shield [mm]	No. of Wire [mm]	Dia. of Wire [mm]	Thickness of Jacket [mm]	Overall Dia. [mm]	Approx. Weight (kg / m)
		600	C.C	1.5	23	1.3	Ø2.3x66ea	3.2	5.0	108
1200	SEG	2.0	23	1.3	Ø2.2x68ea	3.6	5.0	121	35.0	
2000	SEG	2.0	23	1.3	Ø2.0x65ea	4.0	5.0	134	46.7	
2500	SEG	2.0	23	1.3	Ø1.9x65ea	4.1	5.0	141	52.4	

* C.C : Circular Compacted, SEG : Segmental Compacted

* Fault Current Capacity(63kA/1sec)

Continuous Current Ratings and Correction Factors

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

Laying conditions

The technical data which appears in the preceding pages is calculated based on the following laying conditions:

- 1) Ground temperature: 30(°C)
- 2) Ambient temperature: 40(°C)
- 3) Soil thermal resistivity: 1.2K.m/W
- 4) Depth: 1.5m
- 5) Installation formation: Trefoil formation
- 6) Max. conductor temperature: 90(°C)
- 7) Frequency: 50Hz
- 8) Load factor: 100%
- 9) Sheath ground: Cross bonding

Correction factors for various laying conditions

The technical data which appears in the preceding pages may be multiplied by the applicable correction factors in the table below if the laying conditions of the jobsite differ from those which appear above

Ambient temperature (°C)	25	30	35	40	45	50	55
Correction factor	1.16	1.11	1.06	1.00	0.94	0.88	0.82
Ground temperature (°C)	20	25	30	35	40	45	50
Correction factor	1.08	1.04	1.00	0.96	0.91	0.87	0.82
Thermal resistivity of soil (K.m/W)	0.8	1.0	1.2	1.5	2.0	2.5	3.0
Correction factor	1.16	1.07	1.00	0.92	0.82	0.74	0.69
Depth of laying (m)	0.5	0.8	1.0	1.2	1.5	2.0	2.5
Correction factor	1.10	1.16	1.07	1.00	0.92	0.82	0.74

Other Cables

* Technical data for the cables below is available upon request.



Smooth welded metal sheath type



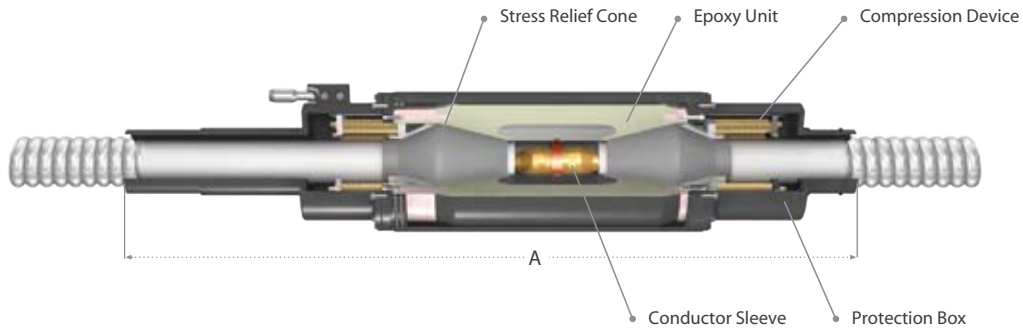
Wire shield + Lead alloy + Aluminum armour type



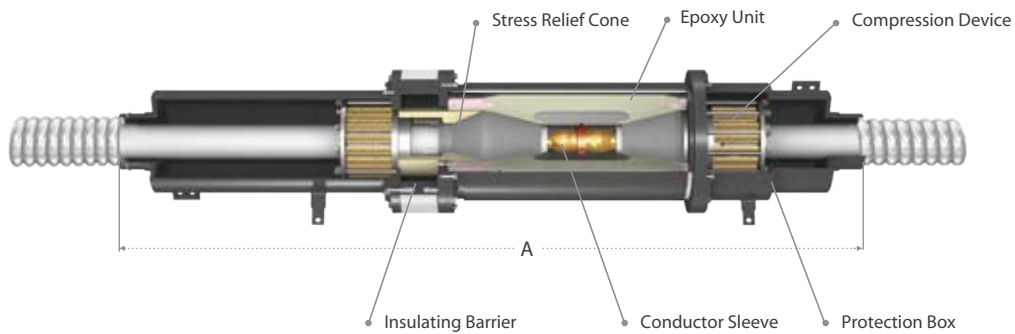
FOC embedded type (for DTS or DRS)

Pre Fabricated Joints

TECH DATA FOR CABLE ACCESSORIES



Normal Joint (NJ)



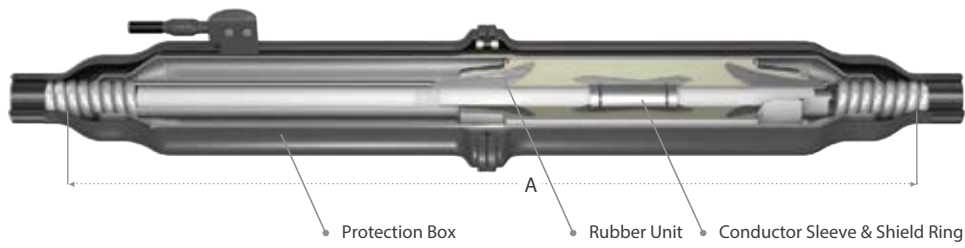
Insulation Joint (IJ)

Ratings & Dimensions

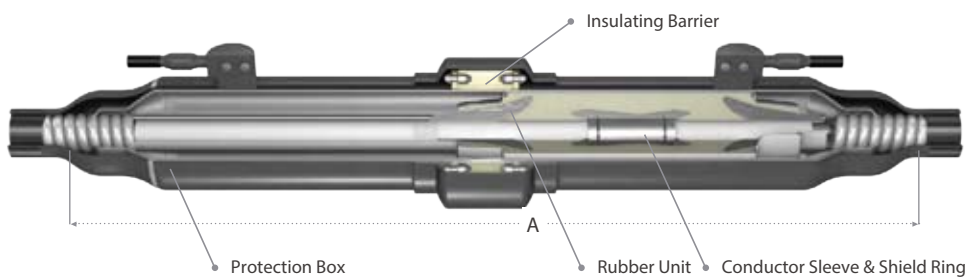
Rated voltage [kV]	Conductor Size [mm ²]	Approx. Dimensions [mm]			
		Normal Joint		Insulation Joint	
		Length (A)	Approx. Max Outer Dia. ϕ	Length (A)	Approx. Max Outer Dia. ϕ
60~69kV	240~2500	1700	260	1700	270
110~138kV		2000	280	2000	310
150~161kV		2000	310	2000	330
220~230kV		2200	340	2200	360
330~345kV		2200	370	2200	380
380~400kV		2200	390	2200	400

Pre Molded Joints (PMJ)

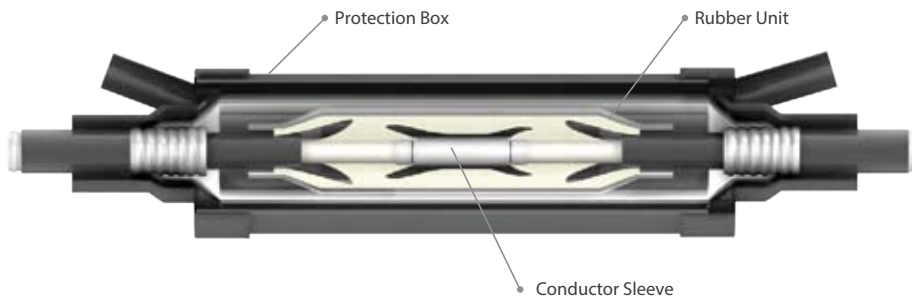
TECH DATA FOR CABLE ACCESSORIES



Normal Joint (NJ)



Insulation Joint (IJ)



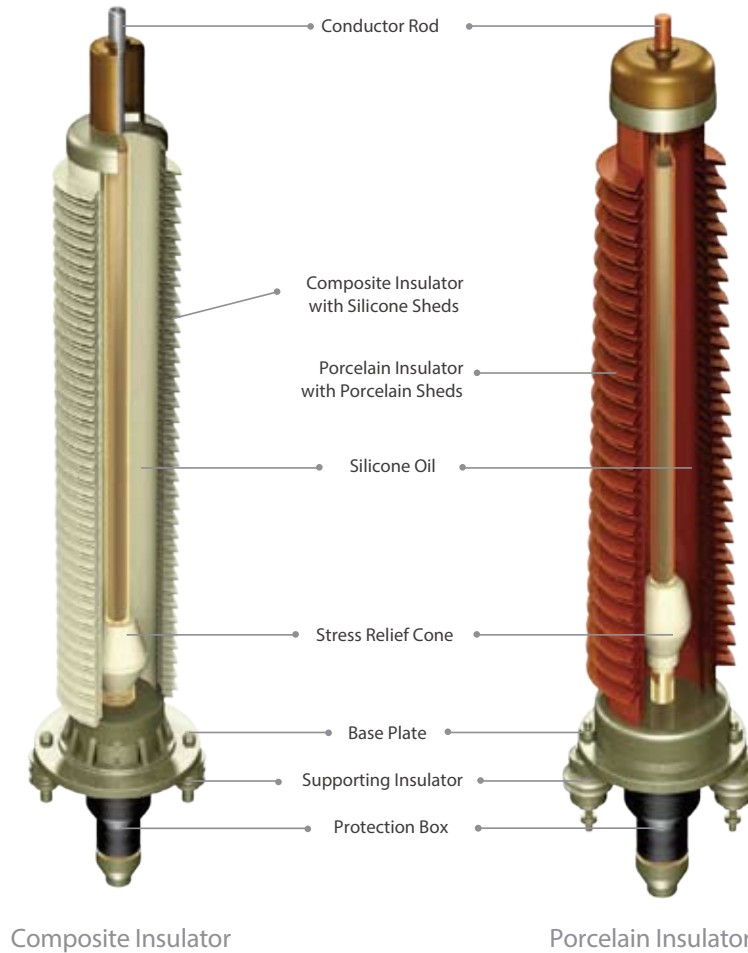
PE Protection Box Type (Plastic Housing)

Ratings & Dimensions

Rated voltage [kV]	Conductor Size [mm ²]	Approx. Dimensions [mm]			
		Normal Joint		Insulation Joint	
		Length (A)	Approx. Max Outer Dia. ϕ	Length (A)	Approx. Max Outer Dia. ϕ
60~69kV	240~2500	1600	260	1600	260
110~138kV		1800	280	1800	280
150~161kV		2000	310	2000	310
220~230kV		2000	340	2000	340
330~345kV		2200	420	2200	420
380~500kV		2200	420	2200	420

Outdoor Sealing Ends

TECH DATA FOR CABLE ACCESSORIES

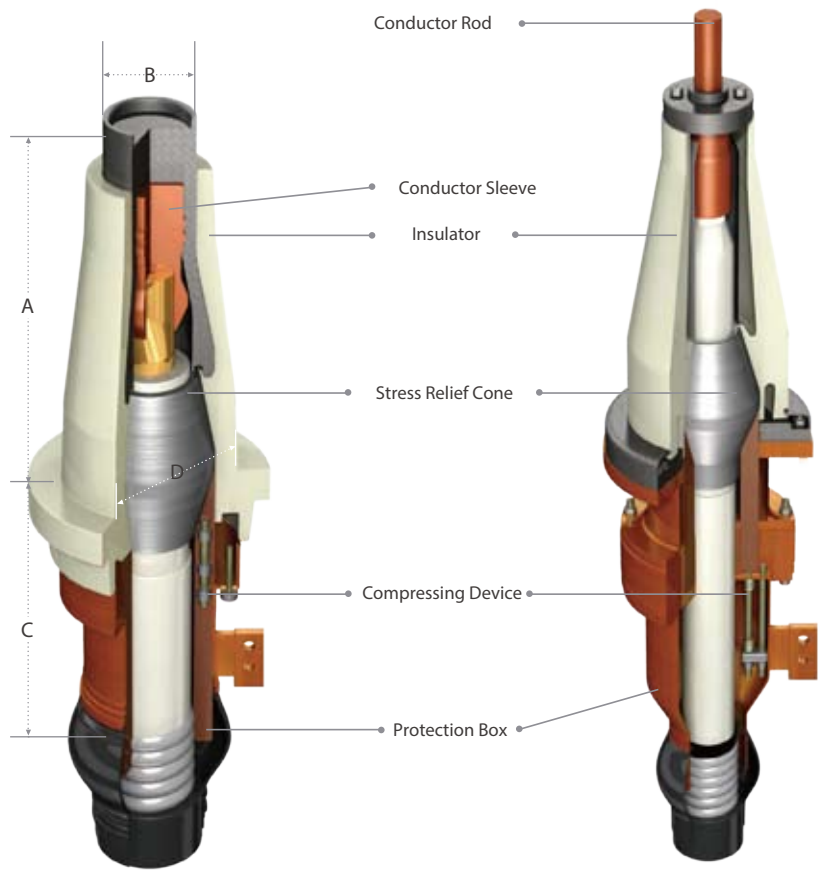


Ratings & Dimensions

Rated voltage (Um)	60~69kV	110~115kV	132~138kV	150~161kV	220~230kV	330~345kV	380~500kV
Maximum voltage	72.5kV	123kV	145kV	170kV	245kV	362kV	420kV
BIL	325kV	550kV	650kV	750kV	1050kV	1175kV	1425kV
Approx. Height	1000mm	1500mm	2200mm	2400mm	2900mm	5000mm	5000mm
Approx. weight (Porcelain)	100kg	200kg	300kg	350kg	450kg	2000kg	2000kg
Approx. weight (Composite)	18kg	30kg	40kg	51kg	95kg	194kg	315kg

Pollution Levels of Selected Insulators (Based on IEC60815)

Pollution level	I - Light	II - Medium	III - Heavy	IV - Very Heavy
Minimum nominal specific creepage distance	16 mm/kV	20 mm/kV	25 mm/kV	31 mm/kV



Plug-in type (IEC Type)

Compressing Leading Conductor Type (Non-IEC Type)

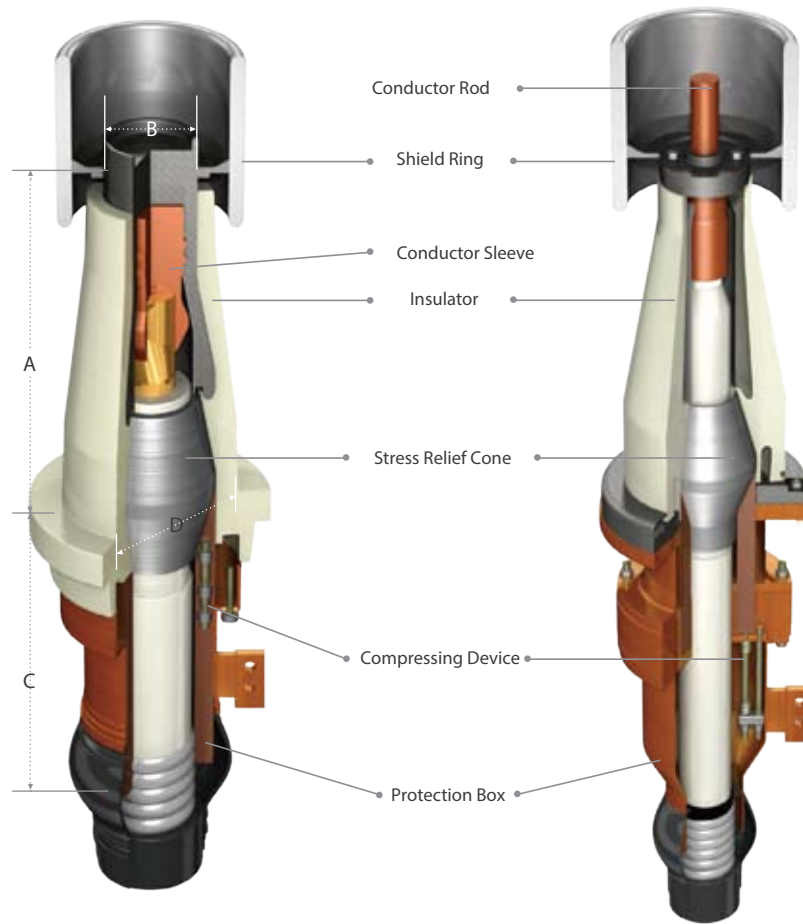
Ratings & Dimensions

Rated voltage (Um)	60~69kV	110~161kV	220~230kV	330~500kV
Maximum voltage	72.5kV	123~170kV	245kV	362~420kV
BIL	325kV	550~750kV	1050kV	1175~1425kV
A (mm)	310	470	620	960
B (ø, mm)	110	110	200	250
Approx. C (mm)	300	350	400	400
D (ø, mm)	196	250	375	500

* Dimension's based on IEC60859 and 62271-209

Oil Immersed Sealing Ends

TECH DATA FOR CABLE ACCESSORIES



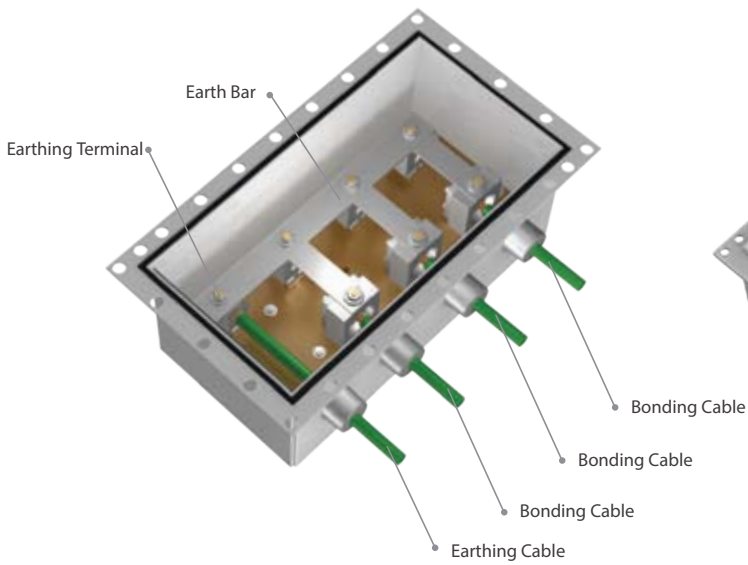
Plug-in type (IEC Type)

Compressing Leading Conductor Type (Non-IEC Type)

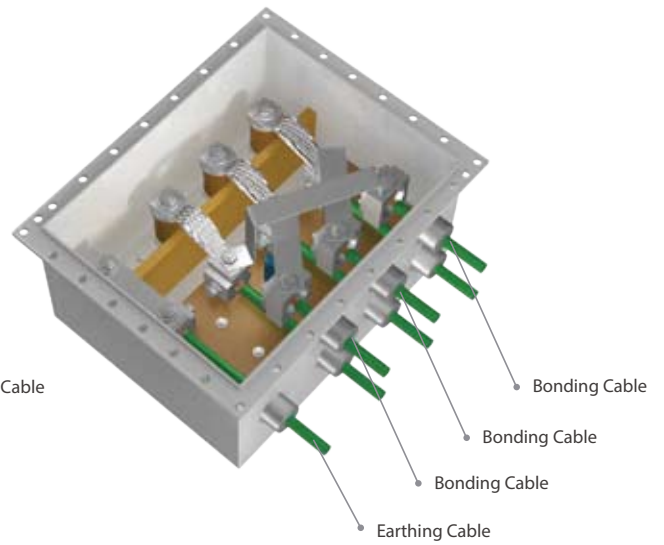
Ratings & Dimensions

Rated voltage (Um)	60~69kV	110~161kV	220~230kV	330~500kV
Maximum voltage	72.5kV	123~170kV	245kV	362~420kV
BIL	325kV	550~750kV	1050kV	1175~1425kV
A (mm)	310	470	620	960
B (ø, mm)	110	110	200	250
Approx. C (mm)	300	350	400	400
D (ø, mm)	196	250	375	500

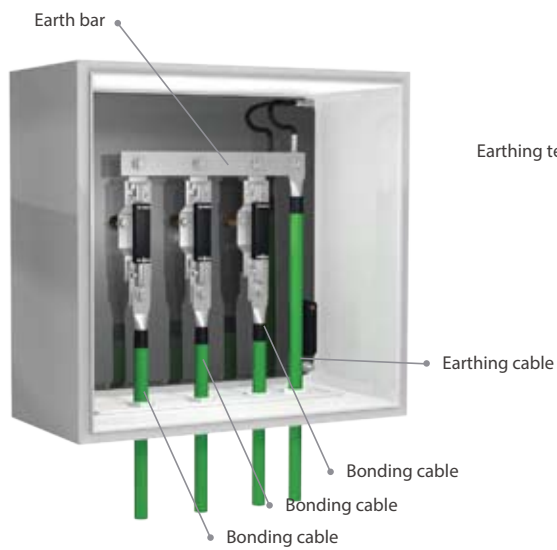
* Dimension's based on IEC60859 and 62271-209



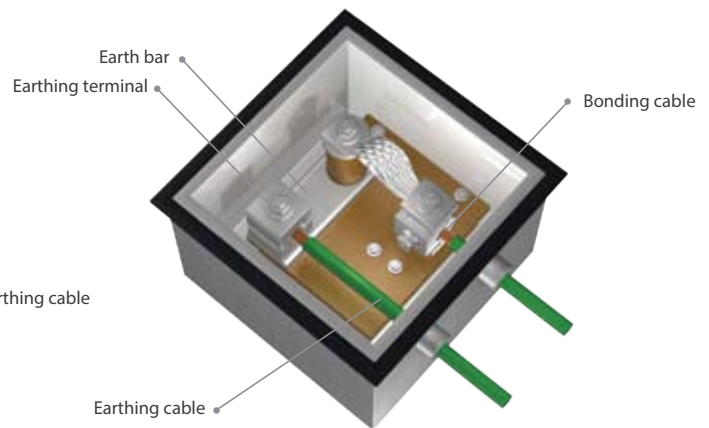
3-1 Way Link Box (Direct Buried Type)



Cross-bonding Link Box



3-1 Way Link Box (Wall Mounted Type)

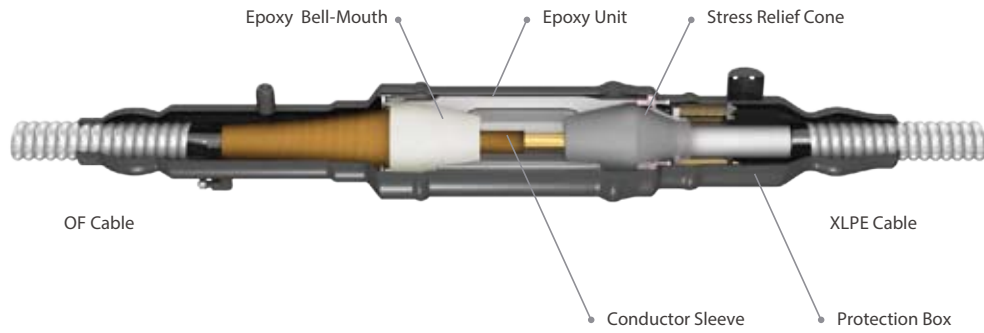


1-1 Way Link Box

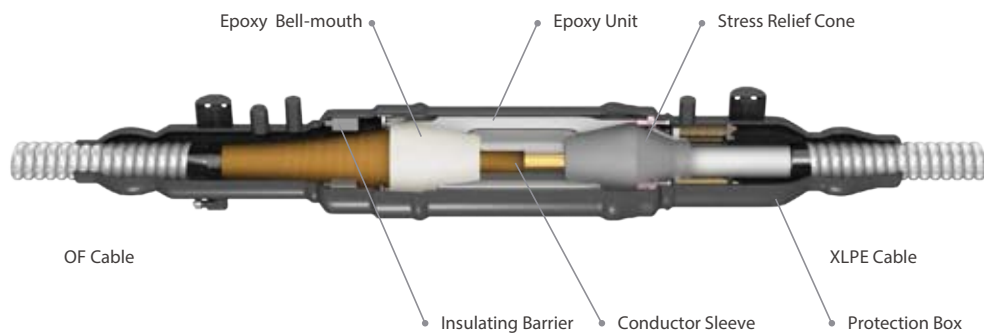
Others

TECH DATA FOR CABLE ACCESSORIES

Transition Joints (XLPE-OF Cable)



Normal Joint (TNJ)



Insulation Joint (TIJ)

Cold Shrinkable Joint



700kV - Wall Bushing (Polymer type)



Quality Assurance Systems

Testing Equipment



AC resonant testing equipment up to 900kV



AC resonant testing equipment up to 750kV



Impulse testing equipment up to 3600kV

List of Test Certificates

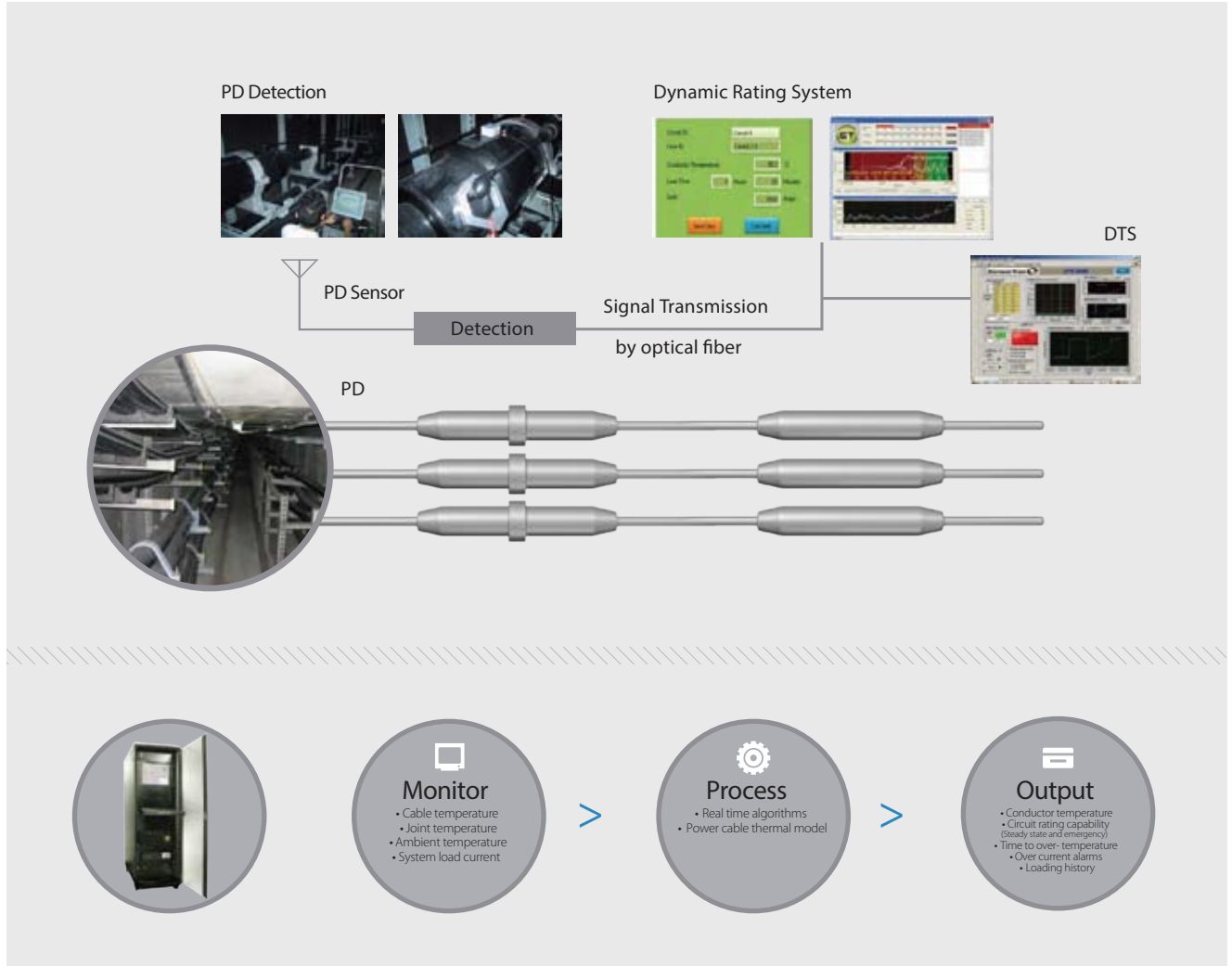
* Full list of test reports available upon request.

RATED VOLTAGE	COND. SIZE	TESTED ITEMS	TEST LAB	SPEC	ISSUED	REMARKS
400kV	2500mm ²	Cable, PMJ, O/T, G/T	KEMA	IEC 62067	2009	+PQ TEST
345kV	2500mm ²	Cable(FOC), PMJ, O/T, G/T, DTS	KERI	IEC 62067	2009	+PQ TEST
		Cable, O/T, G/T	KEMA	IEC 62067	2008	TYPE ONLY
	2000mm ²	Cable, PJ, O/T, G/T	KERI	IEC 62067	2001	+PQ TEST
220kV	2500mm ²	Cable, PMJ, O/T, G/T	KEMA	IEC 62067	2007	+PQ TEST
161kV	630mm ²	Cable, PJ, O/T, G/T	KEMA	IEC 60840	2002	
154kV	1200mm ²	Cable	KEMA	IEC 60840	1999	
	2000mm ²	Cable	KERI	IEC 60840	1998	
150kV	1600mm ²	Cable, O/T, G/T	CESI	IEC 60840	2005	
132kV	1200mm ²	Cable, PMJ, O/T, G/T, OIL/T	SGS	IEC 60840	2008	
	630mm ²	Cable, PMJ, O/T, G/T, OIL/T	SGS	IEC 60840	2007	
	300mm ²	Cable, O/T, G/T	SGS	IEC 60840	2004	
115kV	800mm ²	Cable	KEMA	IEC 60840	2002	
110kV	630mm ²	Cable, PMJ, O/T, G/T	IPH Berlin	IEC 60840	2009	
	800mm ²	Cable	SGS	AS1429.2.	2003	
66kV	1000mm ²	Cable, PMJ, O/T, G/T	SGS	IEC 60840	2007	
		Cable, PMJ, O/T, G/T	CESI	IEC 60840	2001	

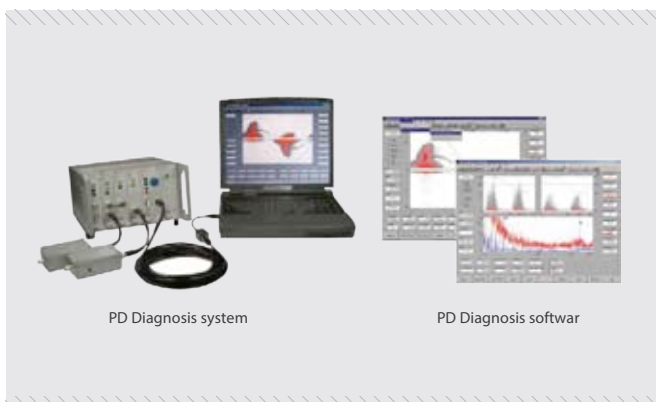
* PMJ : Pre-Molded Joint, **PJ : Pre-fabricated Joint, ***O/T : Outdoor Termination, ****G/T : GIS Termination, OIL/T : Transformer Termination

Cable Monitoring and Maintenance Systems

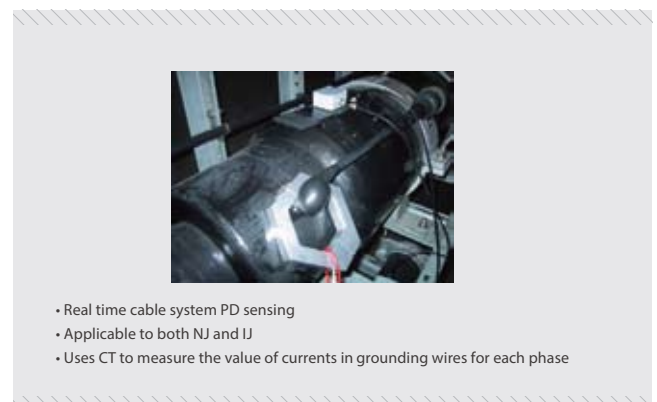
Schematic Drawing of Real-time PD sensing, DTS, and DRS



PD Diagnosis



(U)HF PD Sensing Tools



Cable Installation & System Design

1. Laying the Cable

	Direct Buried	In Underground Duct	In Air (Tunnel)
Advantage	<ul style="list-style-type: none"> - Low cost - Good heat dispersion 	<ul style="list-style-type: none"> - Convenient to expand or remove - Minimal exposure to external damage 	<ul style="list-style-type: none"> - Convenient for multi-line installations - Good heat dispersion
Disadvantage	<ul style="list-style-type: none"> - Inconvenient to maintain - Risk of external damage 	<ul style="list-style-type: none"> - High cost of installation - Expansion possibilities limited by permissible current 	<ul style="list-style-type: none"> - High cost

2. Maximum Cable Pulling Tension

Cable pulling tension is calculated using the following equation and must be within the conductor's allowable tensile strength.

From the pulling eye to the conductor

- Copper : 7kg/mm² of conductor
- Aluminum : 4kg/mm² of conductor

3. Minimum Bending Radius

Adhere to the minimum bending radius outlined below to avoid damaging the electrical and physical properties of cables during installation

*Minimum Bending Radius

	Wire screen type	Lead sheath type	Corrugated sheath type	Armored cable
Min. Bending Radius	20D	20D	18D	15D

D : Cable overall diameter [mm]

4. Maximum Sidewall Pressure

$$P = T / R$$

P : Maximum sidewall pressure [kg/m] T : Maximum pulling tension [kg] R : Minimum bending radius [m]

Cable Installation & System Design

5. Bonding Systems

*Typical Bonding Systems

	Solid Bonding System	Single Point Bonding System	Cross Bonding System
Characteristics	<ul style="list-style-type: none"> - Sheath induced voltage is zero - Low permissible current caused by circulating loss 	<ul style="list-style-type: none"> - Suitable for short routes generally without any joints 	<ul style="list-style-type: none"> - Suitable for long routes with two or more joints
Diagram			
Induced Voltage			

X : Distance / Y : Induced voltage

6. ITECO Cables after installation





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