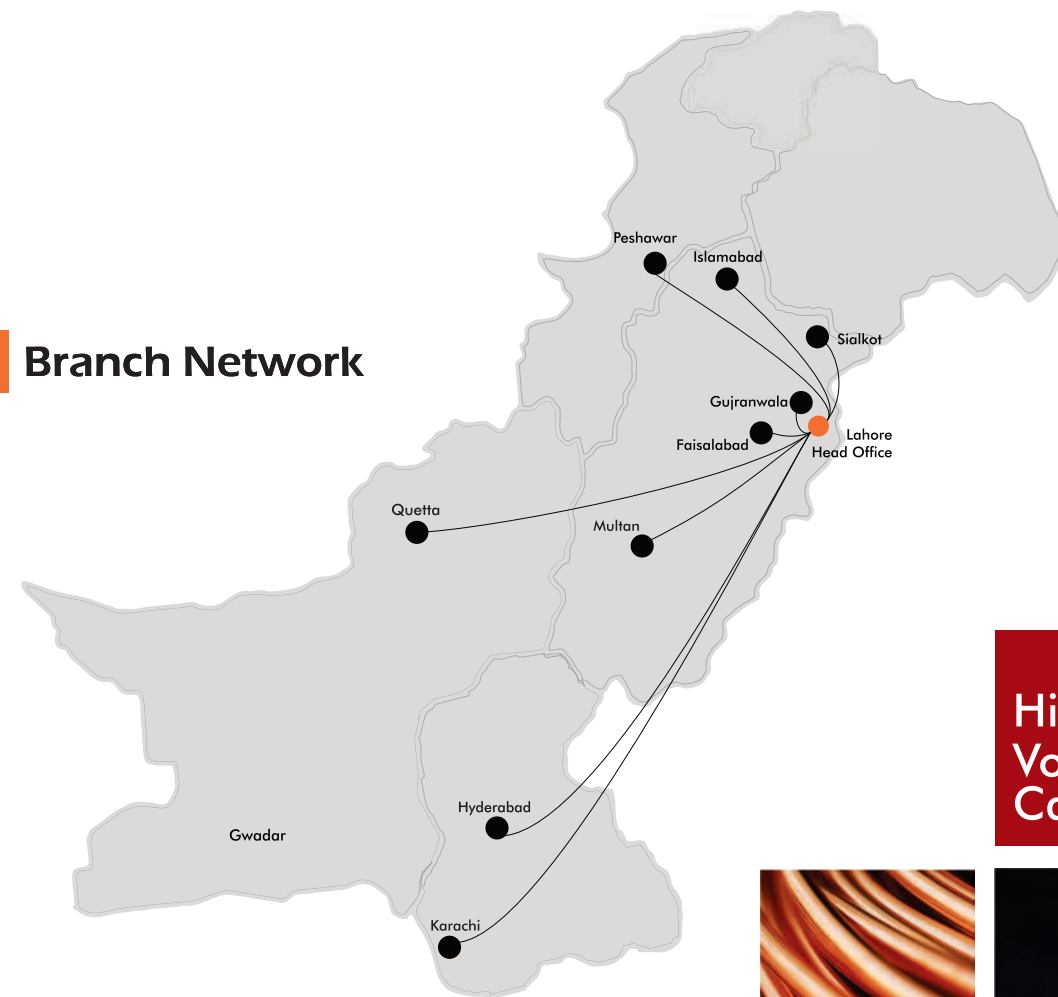
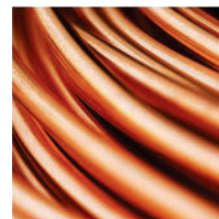


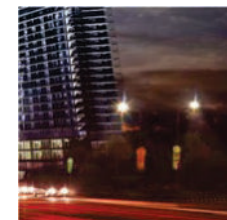
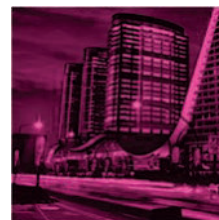
Branch Network



High
Voltage
Cables



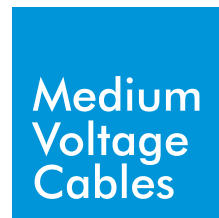
Conductors



Low
Voltage
Cables



Medium
Voltage
Cables

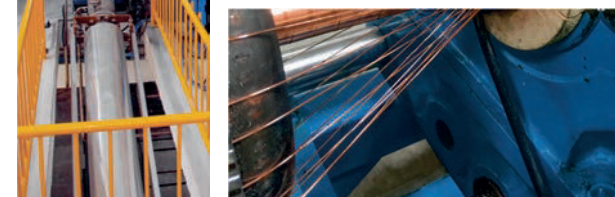


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PRODUCT CATALOG



CABLES

Medium Voltage Cables
High Voltage Cables
Conductors





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Vision

Empower communities for sustainable development.



About Us

Mission

To be the market leader by delivering excellence through innovation, and capacity building of all stakeholders.

Fast Cables is a leading manufacturer of electrical cables and conductors in Pakistan. Our emphasis on quality has made Fast Cables one of the most reliable brands in the cable industry of Pakistan and the choice of leading electrical consultants, engineers and architects in the country.

Our manufacturing plants in Lahore are equipped with state of the art technology along with excellent quality assurance system. In addition to our current product portfolio, we also manufacture electrical cables and conductors to cater to the specific needs of our valued customers. We serve the cable needs of customers from diverse sectors including building and infrastructure, oil and gas, telecommunication and textile.

We have a team of highly talented individuals working for the development of a lasting relationship built upon trust and long term commitment. We invite you to experience Fast Cables' services first hand and look forward to working with you.

Core Values

The values of a company are critical to its success. We at Fast Cables not only want to proclaim our core values but also want to live by them everyday.

Quality

We are dedicated to the delivery of quality products.

Customer Focus

We are committed to meeting the needs of our customers.

Respect for People

We recognize that people are the cornerstone of Fast Cables' success.

Performance with Integrity

We demand of ourselves and others the highest ethical standards and strive for continuous improvement in our performance.

Innovation

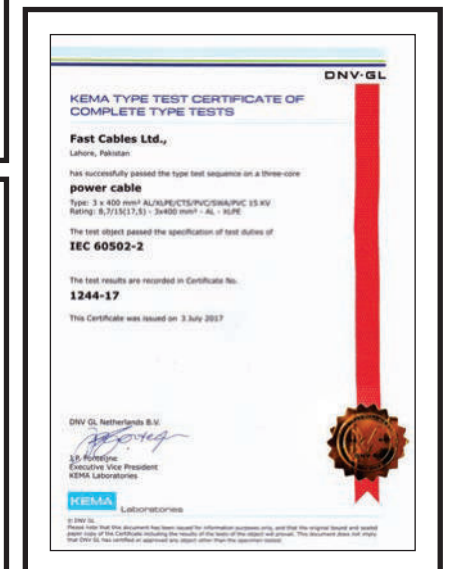
We recognize that innovation is the key to improving and sustaining Fast Cables' growth and profitability.

Team Work

We understand that to be a successful company, we must work together as a team.



Certifications



MV Gold Certification from KEMA Labs, The Netherlands

LV Gold Certification from KEMA Labs, The Netherlands

Customer Relations

We aim to build long term relationships with our customers through provision of quality products and excellent services.



Our business development and sales teams work closely with customers to understand their product requirements and assist them in selection of the requisite product. By sharing the latest technological developments and best practices in the industry, we enable our customers to obtain best value for their investment. We endeavor to increase customer's knowledge and understanding about electrical cables through our website and product catalog.

A Comprehensive 'Frequently Asked Questions' section on our website helps customers to find answers about common queries at their own convenience. In addition, our dedicated Customer Relations team focuses on resolving any issue a customer may face at any stage after purchase of product.

Quality

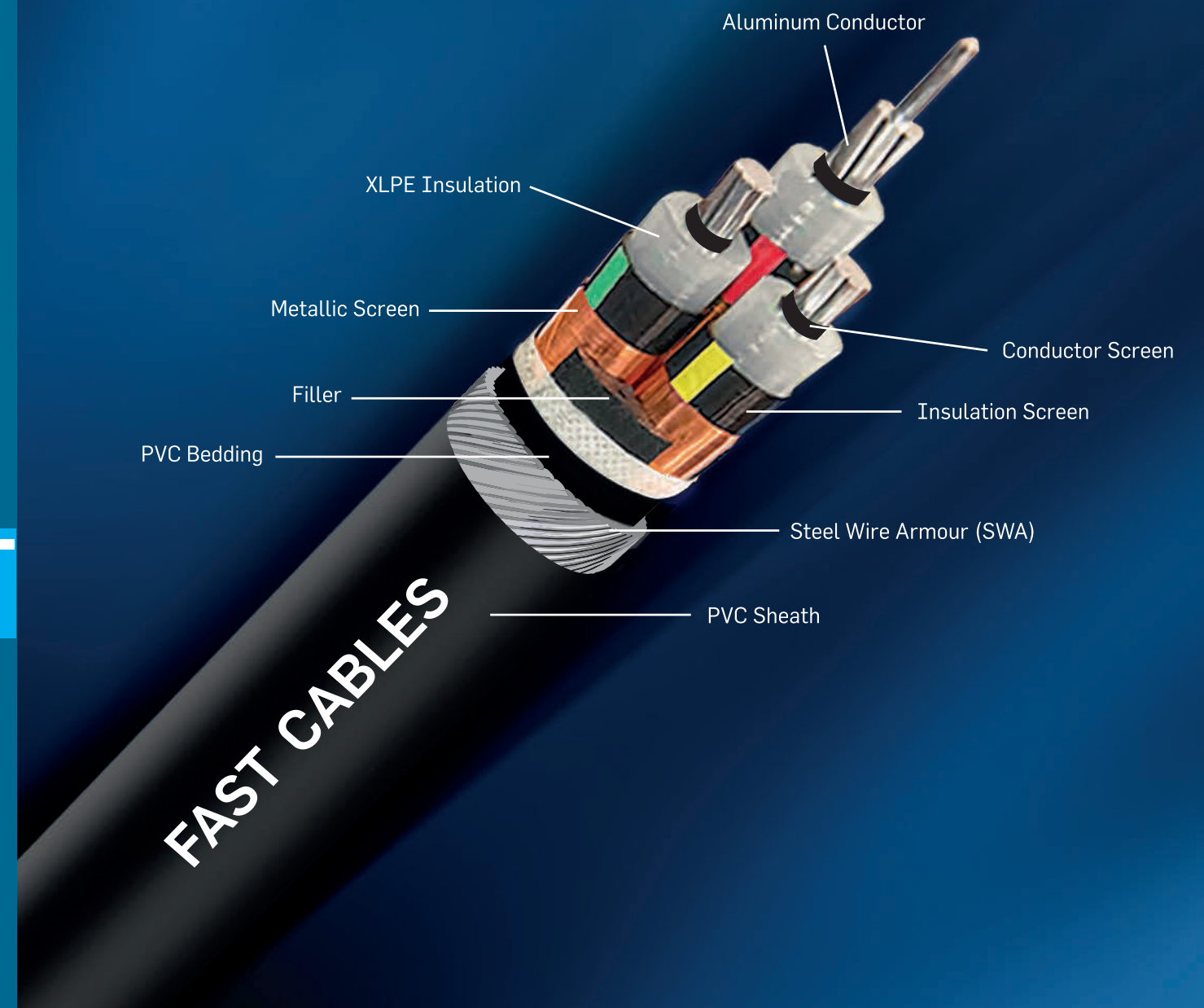
Quality

We deliver products designed and manufactured to the highest international standards. The quality of our cables is ensured by stringent monitoring at every phase of production, from the procurement of raw materials to in-process testing and 100% testing of the finished products before delivery. This allows us to ensure that all cables manufactured at our plants are fully compliant with the national and international standards.

Our manufacturing plants are equipped with the latest laboratory testing facilities and employ highly experienced technical staff. The laboratory equipment goes through periodic third party inspection and calibration by regulatory bodies. We offer our customers free 'testing and inspection before delivery' facility at our testing laboratory. Such a facility allows them to comply with their internal SOP's without incurring any additional cost.



MEDIUM VOLTAGE CABLES



MEDIUM VOLTAGE CABLES

MEDIUM VOLTAGE CABLES

SINGLE CORE CABLE

Unarmoured, XLPE

Standard IEC 60502-2

■ Cu or Al - XLPE - Cu - PVC or PE 10

■ Cu or Al - XLPE - Cu - PO 15

Flame retardant, Halogen free

■ Cu or Al - XLPE - Cu - PE 17

Total Watertight

Armoured, XLPE

Standard IEC 60502-2

■ Cu or Al - XLPE - Cu - ATA or AWA - PVC or PE 19

THREE CORE CABLE

Unarmoured, XLPE

Standard IEC 60502-2

■ Cu or Al - XLPE - Cu - PVC or PE 24

Armoured, XLPE

Standard IEC 60502-2

■ Cu or Al - XLPE - Cu - STA or SWA - PVC or PE 29

THREE CORE BUNDLE CABLE

XLPE, Without Messenger

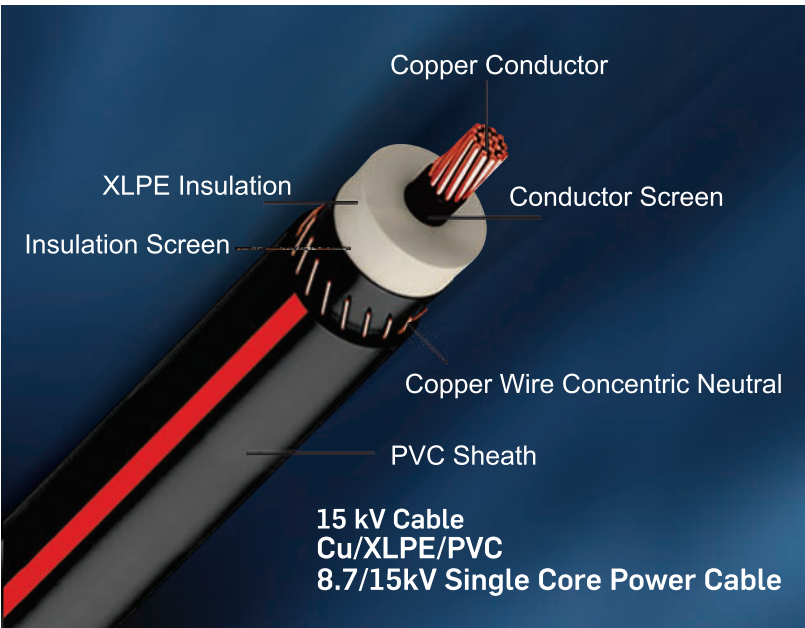
Standard IEC 60502-2

■ Cu or Al - XLPE - Cu - PVC or PE 34

XLPE, With Messenger

Standard IEC 60502-2

■ Al - XLPE - Cu - PVC or PE 36



MEDIUM VOLTAGE CABLES

Cu or Al - XLPE - Cu - PVC or PE
Single Core Cable
Unarmoured - XLPE Insulation - IEC 60502-2

APPLICATION

Cable for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages up to 18/30kV. Suitable for fixed installations, indoor or outdoor, in open air on cable trays, or underground in ducts or directly buried.

CABLE DESIGNATION

A: Cu / XLPE / Cu Tape screen / PVC or PE

B: Cu / XLPE / Cu Wire screen / PVC or PE

C: Al / XLPE / Cu Tape screen / PVC or PE

D: Al / XLPE / Cu Wire screen / PVC or PE

CONSTRUCTION CHARACTERISTICS

Conductor

Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation

Semi-conductive screen over the conductor, XLPE (cross-linked polyethylene) insulation and semi conductive screen over the insulation (strippable)¹, applied by simultaneous extrusion in just one operation.

Metallic Screen

Copper wire screen – annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix.

Poly Propylene tape is applied over the screen.

Or **Copper tape screen** – a copper tape, helically applied with overlap.

Oversheath

Extruded PVC or PE.



GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228 • IEC 60502-2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV • 6/10 (12) kV • 8.7/15 (17.5) kV • 12/20 (24) kV • 18/30 (36) kV
Standard cross-section of wire screen (mm²)	16 • 25 • 35
Test voltage	3.5 x U ₀
Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	25 x d
Minimum bending radius – after installation (mm)	20 x d
Maximum pulling force over conductor (N)	Copper – 50 x S • Aluminium – 30 x S
Flame retardant (for PVC oversheath)	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant (for PVC oversheath. upon agreement)	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2.5 cm)
S – conductor cross-section (mm) • d – cable outer diameter (mm)	

ELECTRICAL AND DIMENSIONAL CHARACTERISTICS

Copper conductor constructions

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					In air (A)	Buried (A)					
Copper conductor												
3.6/6	7.2	25	13.8	20.0	655	157	144	3.6	2.0	0.7270	0.41	0.27
		35	14.8	21.0	770	190	171	5.0	2.9	0.5240	0.39	0.30
		50	16.0	22.5	905	229	202	7.1	4.1	0.3870	0.37	0.33
		70	17.6	24.0	1120	286	246	10.0	5.8	0.2680	0.35	0.38
		95	19.4	26.0	1400	350	293	13.6	7.8	0.1930	0.33	0.43
		120	20.8	28.0	1675	406	332	17.2	9.9	0.1530	0.32	0.48
		150	22.3	29.0	1930	461	372	21.4	12.3	0.1240	0.31	0.51
		185	23.8	30.5	2305	526	418	26.5	15.3	0.0991	0.30	0.54
		240	26.6	33.5	2885	630	483	34.3	19.8	0.0754	0.29	0.60
		300	28.6	37.0	3555	731	541	42.9	24.8	0.0601	0.28	0.63
		400	32.6	40.5	4505	851	608	57.2	33.0	0.0470	0.28	0.66
		500	36.0	44.0	5480	956	675	71.5	41.2	0.0366	0.27	0.69
		630	40.0	47.5	7110	1095	753	90.1	52.0	0.0283	0.27	0.76
6/10	12	25	15.6	22.0	730	170	155	3.6	2.0	0.7270	0.47	0.23
		35	16.6	23.0	835	205	180	5.0	2.9	0.5240	0.44	0.25
		50	17.8	24.5	985	245	215	7.1	4.1	0.3870	0.42	0.28
		70	19.4	26.0	1210	310	260	10.0	5.8	0.2680	0.39	0.31
		95	21.2	28.0	1500	375	315	13.6	7.8	0.1930	0.38	0.35
		120	22.6	30.0	1760	435	355	17.2	9.9	0.1530	0.36	0.38
		150	24.1	31.0	2040	495	395	21.4	12.3	0.1240	0.35	0.41

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					In air (A)	Buried (A)					
Copper conductor												
6/10	12	185	25.8	32.5	2405	570	450	26.5	15.3	0.0991	0.34	0.45
		240	28.2	35.5	2990	670	520	34.3	19.8	0.0754	0.33	0.50
		300	30.4	38.0	3640	770	580	42.9	24.8	0.0601	0.32	0.54
		400	33.4	41.5	4580	890	650	57.2	33.0	0.0470	0.31	0.60
		500	36.4	44.5	5530	1020	740	71.5	41.2	0.0366	0.30	0.66
		630	40.5	48.0	7140	1190	830	90.1	52.0	0.0283	0.26	0.78
8.7/15	17.5	25	17.8	24.5	820	170	155	3.6	2.0	0.7270	0.47	0.18
		35	18.8	25.5	930	205	180	5.0	2.9	0.5240	0.44	0.20
		50	20.0	26.5	1075	245	215	7.1	4.1	0.3870	0.42	0.22
		70	21.6	28.5	1320	310	260	10.0	5.8	0.2680	0.39	0.25
		95	23.4	30.5	1595	375	315	13.6	7.8	0.1930	0.38	0.27
		120	24.8	32.0	1880	435	355	17.2	9.9	0.1530	0.36	0.30
		150	26.3	33.5	2145	495	395	21.4	12.3	0.1240	0.35	0.32
		185	28.0	35.0	2535	570	450	26.5	15.3	0.0991	0.34	0.34
		240	30.4	37.5	3130	670	520	34.3	19.8	0.0754	0.33	0.38
		300	32.6	40.5	3775	770	580	42.9	24.8	0.0601	0.32	0.42
		400	35.6	43.5	4720	890	650	57.2	33.0	0.0470	0.31	0.43
		500	38.6	47.0	5685	1020	740	71.5	41.2	0.0366	0.30	0.47
		630	42.6	50.5	7315	1190	830	90.1	52.0	0.0283	0.28	0.52
12/20	24	35	21.2	27.5	1025	198	183	5.0	2.9	0.5240	0.46	0.16
		50	22.4	29.0	1170	238	216	7.1	4.1	0.3870	0.44	0.18
		70	24.0	31.0	1425	296	263	10.0	5.8	0.2680	0.42	0.20
		95	25.8	32.5	1705	361	314	13.6	7.8	0.1930	0.41	0.21
		120	27.2	34.5	2000	417	355	17.2	9.9	0.1530	0.40	0.23
		150	28.7	35.5	2270	473	398	21.4	12.3	0.1240	0.39	0.25
		185	30.4	37.0	2660	543	448	26.5	15.3	0.0991	0.37	0.27
		240	32.8	39.5	3250	641	517	34.3	19.8	0.0754	0.36	0.30
		300	35.0	42.5	3920	735	581	42.7	24.8	0.0601	0.35	0.33
		400	38.0	45.5	4880	845	658	57.2	33.0	0.0470	0.33	0.37
		500	41.0	49.0	5855	956	740	71.5	41.2	0.0366	0.32	0.40
		630	45.0	52.5	7510	1095	829	90.1	52.0	0.0283	0.31	0.45
18/30	36	50	27.8	34.5	1630	248	232	7.1	4.1	0.3870	0.48	0.14
		70	29.4	36.0	1900	307	284	10.0	5.8	0.2680	0.46	0.16
		95	31.2	38.0	2250	373	339	13.6	7.8	0.1930	0.44	0.17
		120	32.6	39.5	2540	429	385	17.2	9.9	0.1530	0.43	0.18
		150	34.1	41.0	2970	484	430	21.4	12.3	0.1240	0.41	0.19
		185	35.8	42.0	3410	552	484	26.5	15.3	0.0991	0.40	0.21
		240	38.2	45.0	4040	649	559	34.3	19.8	0.0754	0.38	0.23
		300	40.4	48.0	4730	737	627	42.9	24.8	0.0601	0.37	0.25
		400	43.4	51.0	5740	861	701	57.2	33.0	0.0470	0.36	0.27
		500	46.4	54.5	6850	993	786	71.5	41.2	0.0366	0.35	0.30
		630	50.4	58.0	8350	1139	875	90.1	52.0	0.0283	0.33	0.33

ALUMINIUM CONDUCTOR CONSTRUCTIONS

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U	Um					In air	Buried					
(kV)	(kV)	(mm ²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(kA)	(Ω/km)	(mH/km)	(µF/km)
Aluminium conductor												
3.6/6	7.2	25	13.8	20.0	505	121	111	2.3	1.3	1.2000	0.41	0.27
		35	14.8	21.0	560	147	132	3.2	1.9	0.8680	0.39	0.30
		50	16.0	22.0	615	176	156	4.7	2.7	0.6410	0.37	0.33
		70	17.6	24.0	705	221	191	6.5	3.8	0.4430	0.35	0.38
		95	19.4	25.5	830	270	227	8.9	5.1	0.3200	0.33	0.42
		120	20.8	27.5	950	315	260	11.2	6.5	0.2530	0.32	0.47
		150	22.3	29.0	1055	357	290	14.1	8.1	0.2060	0.31	0.51
		185	23.8	30.5	1205	411	326	17.4	10	0.1640	0.30	0.55
		240	26.6	33.5	1425	489	378	22.5	13	0.1250	0.29	0.60
		300	28.6	37.0	1695	571	426	28.1	16.3	0.1000	0.28	0.63
		400	32.6	40.0	2055	670	484	37.6	21.8	0.0778	0.28	0.66
		500	36.0	43.5	2450	782	544	47.0	27.2	0.0605	0.27	0.69
		630	40.0	49.0	3040	925	617	59.2	34.3	0.0469	0.26	0.79
6/10	12	25	15.6	22.0	575	130	115	2.3	1.3	1.2000	0.47	0.23
		35	16.6	23.0	630	155	140	3.2	1.8	0.8680	0.44	0.25
		50	17.8	24.5	700	185	165	4.7	2.7	0.6410	0.42	0.28
		70	19.4	26.0	795	235	200	6.5	3.8	0.4430	0.39	0.31
		95	21.2	28.0	925	285	240	8.9	5.1	0.3200	0.38	0.33
		120	22.6	29.5	1040	330	275	11.2	6.5	0.2530	0.36	0.38
		150	24.1	31.0	1165	375	305	14.1	8.1	0.2060	0.35	0.41
		185	25.8	32.5	1305	430	345	17.4	10	0.1640	0.34	0.45
		240	28.2	35.0	1525	510	400	22.5	13	0.1250	0.33	0.50
		300	30.4	38.0	1785	585	450	28.1	16.3	0.1000	0.32	0.54
		400	33.4	41.0	2125	710	520	37.6	21.8	0.0778	0.31	0.60
		500	36.4	44.5	2500	810	590	47.0	27.2	0.0605	0.30	0.66
		630	40.5	49.0	3070	960	670	59.2	34.3	0.0469	0.28	0.78
8.7/15	17.5	25	17.8	24.5	665	130	115	2.3	1.3	1.2000	0.47	0.18
		35	18.8	25.5	720	155	140	3.2	1.9	0.8680	0.44	0.20
		50	20.0	26.5	785	185	165	4.7	2.7	0.6410	0.42	0.22
		70	21.6	28.5	900	235	200	6.5	3.8	0.4430	0.39	0.25
		95	23.4	30.0	1020	285	240	8.9	5.1	0.3200	0.38	0.27
		120	24.8	32.0	1160	330	275	11.2	6.5	0.2530	0.36	0.30
		150	26.3	33.5	1270	375	305	14.1	8.1	0.2060	0.35	0.32
		185	28.0	35.0	1435	430	345	17.4	10	0.1640	0.34	0.34
		240	30.4	37.5	1665	510	400	22.5	13	0.1250	0.33	0.36
		300	32.6	40.5	1815	585	450	28.1	16.3	0.1000	0.32	0.42
		400	35.6	43.5	2270	710	520	37.6	21.8	0.0778	0.31	0.43
		500	38.6	46.5	2655	810	590	47.0	27.2	0.0605	0.30	0.47
		630	42.6	51.5	3240	960	670	59.2	34.3	0.0469	0.28	0.52

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U	Um					In air	Buried					
(kV)	(kV)	(mm ²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(kA)	(Ω/km)	(mH/km)	(µF/km)
Aluminium conductor												
12/20	24	35	21.2	27.5	815	159	142	3.2	1.9	0.8680	0.44	0.17
		50	22.4	28.5	880	190	167	4.7	2.7	0.6410	0.42	0.18
		70	24.0	30.5	1005	235	204	6.5	3.8	0.4430	0.40	0.21
		95	25.8	32.5	1130	287	244	8.9	5.1	0.3200	0.38	0.23
		120	27.2	34.0	1275	330	277	11.2	6.5	0.2530	0.36	0.25
		150	28.7	35.5	1395	375	309	14.1	8.1	0.2060	0.35	0.27
		185	30.4	37.0	1565	428	350	17.4	10	0.1640	0.34	0.29
		240	32.8	39.5	1785	505	405	22.5	13.0	0.1250	0.33	0.32
		300	35.0	42.5	2065	578	455	28.1	16.3	0.1000	0.32	0.35
		400	38.0	45.5	2425	674	520	37.6	21.8	0.0778	0.30	0.39
		500	41.0	48.5	2825	778	592	47.0	27.2	0.0605	0.30	0.43
		630	45.0	53.5	3425	896	672	59.2	34.3	0.0469	0.28	0.49
18/30	36	50	27.8	34.0	1330	200	165	4.7	2.7	0.6410	0.46	0.14
		70	29.4	36.0	1470	250	205	6.5	3.8	0.4430	0.43	0.16
		95	31.2	37.5	1650	305	245	8.9	5.1	0.3200	0.41	0.17
		120	32.6	39.5	1786	350	275	11.2	6.5	0.2530	0.39	0.19
		150	34.1	41.0	2040	395	310	14.1	8.1	0.2060	0.38	0.20
		185	35.8	42.5	2250	455	350	17.4	10	0.1640	0.37	0.21
		240	38.2	45.0	2510	540	410	22.5	13	0.1250	0.36	0.24
		300	40.4	48.0	2810	584	465	28.1	16.3	0.1000	0.34	0.26
		400	43.4	51.0	3290	681	531	37.6	21.8	0.0778	0.33	0.29
		500	46.4	54.0	3750	792	605	47.0	27.2	0.0605	0.32	0.31
		630	50.4	59.0	4360	933	684	59.2	34.3	0.0469	0.30	0.35

Other compositions are available, contact info@fast-cables.com for information.

Current carrying capacity calculated considering the following conditions:

Maximum conductor temperature = 90°C

Cables in air: Ambient temperature = 30°C

Cables directly buried: Ground temperature = 15°C • Depth of laying = 0.5 m • Thermal resistivity of soil = 1.5 K.m/W

APPLICATION

Cable for power distribution and power supply stations, halogen free and flame retardant used in Utility and Industrial applications, for rated voltages up to 18/30kV.
Applicable for installations where it is necessary to guarantee improved fire behaviour. Suitable for fixed installations, indoor or outdoor, in open air on cable trays, or underground in ducts or directly buried.
Special oversheath compound guarantees low water absorption properties and improved mechanical performance (tear resistance, tensile strength and elongation at break) compared to LSHF standard materials.

CABLE DESIGNATION

Cu / XLPE / Cu Tape screen / PO
Al / XLPE / Cu Tape screen / PO
Cu / XLPE / Cu Wire screen / PO
Al / XLPE / Cu Wire screen / PO

CONSTRUCTION CHARACTERISTICS

Conductor

Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation

Semi-conductive screen over the conductor, XLPE (cross-linked polyethylene) insulation and semi conductive screen over the insulation (strippable¹), applied by simultaneous extrusion in just one operation.

Metallic Screen

Copper wire screen – annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix.
Poly Propylene tape is applied over the screen.
Or Copper tape screen – a copper tape, helically applied with overlap.

Oversheath

Polyolefin type DMZ2 according to HD 620 S2 – LSHF – Low Smoke Halogen Free thermoplastic compound. Flame retardant.

GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228
	IEC 60502-2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV · 6/10 (12) kV · 8.7/15 (17.5) kV · 12/20 (24) kV · 18/30 (36) kV
Standard cross-section of wire screen (mm²)	16 · 25 · 35
Test voltage	3.5 x U ₀
Conductor maximum operating temperature	90°C

Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	25 x d
Minimum bending radius – after installation (mm)	20 x d
Maximum pulling force over conductor (N)	Copper – 50 x S Aluminium – 30 x S
Flame retardant	IEC 60332-1-2 · EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
S – conductor cross-section (mm²) d – cable outer diameter (mm)	

ELECTRICAL AND DIMENSIONAL CHARACTERISTICS

Dimensional and electrical characteristics can be consulted in the corresponding table (whether copper or aluminium conductors) of single core XLPE unarmoured cables. (Refer pages 11, 12, 13 & 14)



APPLICATION

Cable for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages up to 18/30kV. Suitable for fixed installations, indoor or outdoor, in open air on cable trays, or underground in ducts or directly buried.

CABLE DESIGNATION

Cu / XLPE / Cu Tape Screen / PE
Al / XLPE / Cu Tape Screen / PE

CONSTRUCTION CHARACTERISTICS

Conductor
Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation
Semi-conductive screen over the conductor, XLPE (cross-linked polyethylene) insulation and semi-conductive screen over the insulation (strippable¹), applied by simultaneous extrusion in just one operation.

Metallic Screen
Copper tape, longitudinally applied over insulation. Cross-section area of tape in accordance with short circuit current.

Oversheath
Extruded PE

GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228
	IEC 60502-2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV • 6/10 (12) kV • 8.7/15 (17.5) kV • 12/20 (24) kV • 18/30 (36) kV
Test voltage	3.5 x U ₀
Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	25 x d
Minimum bending radius – after installation (mm)	20 x d
Maximum pulling force over conductor (N)	Copper – 50 x S
	Aluminium – 30 x S

S – conductor cross-section (mm²)
d – cable outer diameter (mm)
Several compositions are available. contact info@fast-cables.com for information.

APPLICATION

Cable for power distribution and power supply stations used in Utility and Industrial applications. for rated voltages up to 18/30kV. Suitable for fixed installations. indoor or outdoor, in open air on cable trays, or underground in ducts or directly buried. Cable is both longitudinally and radially watertight and therefore best suitable for wet conditions.

CABLE DESIGNATION

Cu / XLPE / Cu Wire screen / Cu tape / PE
Al / XLPE / Cu Wire screen / Cu tape / PE

CONSTRUCTION CHARACTERISTICS

Conductor
Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation
Semi-conductive screen over the conductor, XLPE (cross-linked polyethylene) insulation and semi conductive screen over the insulation (strippable¹), applied by simultaneous extrusion in just one operation.

Metallic Screen
Annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix.

Over Sheath:
Extruded PE oversheath, type ST7.

GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228
	IEC 60502-2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV • 6/10 (12) kV • 8.7/15 (17.5) kV • 12/20 (24) kV • 18/30 (36) kV
Standard cross-section of wire screen (mm ²)	16 • 25 • 35
Test voltage	3.5 x U ₀
Conductor maximum operating temperature	90°C



APPLICATION

Cable for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages up to 18/30kV. Suitable for fixed installations, directly buried. Good mechanical protection.

CABLE DESIGNATION

- A: Cu / XLPE / Cu Wire screen / Aluminium Tape armour / PVC or PE
- B: Cu / XLPE / Cu Tape screen / Aluminium Tape armour / PVC or PE
- C: Al / XLPE / Cu Wire screen / Aluminium Wire armour / PVC or PE
- D: Al / XLPE / Cu Tape screen / Aluminium Wire armour / PVC or PE
- E: Al / XLPE / Cu Tape screen / Aluminium Tape armour / PVC or PE
- F: Al / XLPE / Cu Wire screen / Aluminium Tape armour / PVC or PE
- G: Cu / XLPE / Cu Tape screen / Aluminium Wire armour / PVC or PE
- H: Cu / XLPE / Cu Wire screen / Aluminium Wire armour / PVC or PE

CONSTRUCTION CHARACTERISTICS

Conductor

Plain annealed Copper or Aluminium, circular, stranded, class 2 as per IEC 60228.

Insulation

Semi-conductive screen over the conductor, XLPE (cross-linked polyethylene) insulation and semi conductive screen over the insulation (strippable¹), applied by simultaneous extrusion in just one operation

Metallic Screen

Copper wire screen – annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix.

A wrapping Poly Propylene tape is applied over the screen.

Or Copper tape screen – a copper tape, helically applied with overlap.

Inner Sheath

Extruded PVC.

Armour

Two aluminium tapes helically applied.

Or Aluminium wires, helically applied, tightened with Poly Propylene tapes.

Oversheath

Extruded PVC, or PE.



GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228 · IEC 60502-2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV · 6/10 (12) kV · 8.7/15 (17.5) kV · 12/20 (24) kV · 18/30 (36) kV
Standard cross-section of wire screen (mm²)	16 · 25 · 35
Test voltage	3.5 x U ₀
Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	20 x d
Minimum bending radius – after installation (mm)	15 x d
Maximum pulling force over conductor (N)	Copper – 50 x S · Aluminium – 30 x S
Flame retardant (for PVC oversheath)	IEC 60332-1-2 · EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm)
Fire retardant (for PVC oversheath. upon agreement)	IEC 60332-3-24 · EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2.5 cm)

S – conductor cross-section (mm²) · d – cable outer diameter (mm)

ELECTRICAL AND DIMENSIONAL CHARACTERISTICS

Copper conductor constructions

Cu / XLPE / Cu Wire screen / Aluminium Tape armour or AWA / PVC

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					In air (A)	Buried (A)					
Copper conductor												
3.6/6	7.2	25	13.8	25	890	157	144	3.6	2.0	0.7270	0.41	0.27
		35	14.8	26	1010	190	171	5.0	2.9	0.5240	0.39	0.30
		50	16.0	27	1180	229	202	7.1	4.1	0.3870	0.37	0.33
		70	17.6	29	1460	286	246	10.0	5.8	0.2680	0.35	0.38
		95	19.4	31	1780	350	293	13.6	7.8	0.1930	0.33	0.43
		120	20.8	33	2140	406	332	17.2	9.9	0.1530	0.32	0.48
		150	22.3	35	2500	461	372	21.4	12.3	0.1240	0.31	0.51
		185	23.8	37	2920	526	418	26.5	15.3	0.0991	0.30	0.54
		240	26.6	39	3580	630	483	34.3	19.8	0.0754	0.29	0.60
		300	28.6	42	4310	731	542	42.9	24.8	0.0601	0.28	0.63
		400	32.6	47	5440	851	608	57.2	33.0	0.0470	0.28	0.66
		500	36.0	51	6600	956	675	71.5	41.2	0.0366	0.27	0.69
		630	40.0	55	8170	1095	753	90.1	52.0	0.0283	0.27	0.76

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)	(mm ²)	(mm)	(mm)	(kg/km)	In air (A)	Buried (A)	(kA)	(kA)	(Ω/km)	(mH/km)	(μF/km)
Copper conductor												
6/10	12	25	15.6	27	1020	170	155	3.6	2.0	0.7270	0.47	0.23
		35	16.6	28	1120	205	180	5.0	2.9	0.5240	0.44	0.25
		50	17.8	30	1310	245	215	7.1	4.1	0.3870	0.42	0.28
		70	19.4	31	1580	310	260	10.0	5.8	0.2680	0.39	0.31
		95	21.2	34	2000	375	315	13.6	7.8	0.1930	0.38	0.35
		120	22.6	36	2310	435	355	17.2	9.9	0.1530	0.36	0.38
		150	24.1	38	2640	495	395	21.4	12.3	0.1240	0.35	0.41
		185	25.8	39	3080	570	450	26.5	15.3	0.0991	0.34	0.45
		240	28.2	42	3740	670	520	34.3	19.8	0.0754	0.33	0.50
		300	30.4	44	4440	770	580	42.9	24.8	0.0601	0.32	0.54
		400	33.4	48	5520	890	650	57.2	33.0	0.0470	0.31	0.60
		500	36.4	52	6670	1020	740	71.5	41.2	0.0366	0.30	0.66
		630	40.5	56	8220	1190	830	90.1	52.0	0.0283	0.26	0.78
8.7/15	17.5	25	17.8	30	1130	170	155	3.6	2.0	0.7270	0.47	0.18
		35	18.8	31	1220	205	180	5.0	2.9	0.5240	0.44	0.20
		50	20.0	33	1410	245	215	7.1	4.1	0.3870	0.42	0.22
		70	21.6	35	1770	310	260	10.0	5.8	0.2680	0.39	0.25
		95	23.4	37	2120	375	315	13.6	7.8	0.1930	0.38	0.27
		120	24.8	39	2440	435	355	17.2	9.9	0.1530	0.36	0.30
		150	26.3	40	2780	495	395	21.4	12.3	0.1240	0.35	0.32
		185	28.0	42	3220	570	450	26.5	15.3	0.0991	0.34	0.34
		240	30.4	45	3900	670	520	34.3	19.8	0.0754	0.33	0.38
		300	32.6	48	4760	770	580	42.9	24.8	0.0601	0.32	0.42
		400	35.6	51	5710	890	650	57.2	33.0	0.0470	0.31	0.43
		500	38.6	55	6880	1020	740	71.5	41.2	0.0366	0.30	0.47
		630	42.6	59	8460	1190	830	90.1	52.0	0.0283	0.28	0.52
12/20	24	35	21.2	34	1440	198	183	5.0	2.9	0.5240	0.46	0.16
		50	22.4	36	1640	238	216	7.1	4.1	0.3870	0.44	0.18
		70	24.0	37	1920	296	263	10.0	5.8	0.2680	0.42	0.20
		95	25.8	40	2290	361	314	13.6	7.8	0.1930	0.41	0.21
		120	27.2	41	2620	417	355	17.2	9.9	0.1530	0.40	0.23
		150	28.7	43	2960	473	398	21.4	12.3	0.1240	0.39	0.25
		185	30.4	45	3420	543	448	26.5	15.3	0.0991	0.37	0.27
		240	32.8	48	4250	641	517	34.3	19.8	0.0754	0.36	0.30
		300	35.0	51	4990	735	581	42.9	24.8	0.0601	0.35	0.33
		400	38.0	54	5980	845	658	57.2	33.0	0.0470	0.33	0.37
		500	41.0	57	7120	956	740	71.5	41.2	0.0366	0.32	0.40
		630	45.0	61	8720	1095	829	90.1	52.0	0.0283	0.31	0.45
18/30	36	50	27.8	43	2180	248	232	7.1	4.1	0.3870	0.48	0.14
		70	29.4	45	2510	307	284	10.0	5.8	0.2680	0.46	0.16
		95	31.2	47	2900	373	339	13.6	7.8	0.1930	0.44	0.17

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					In air (A)	Buried (A)					
Copper conductor												
18/30	36	120	32.6	49	3250	429	385	17.2	9.9	0.1530	0.43	0.18
		150	34.1	50	3640	484	430	21.4	12.3	0.1240	0.41	0.19
		185	35.8	52	4120	552	484	26.5	15.3	0.0991	0.40	0.21
		240	38.2	56	4990	649	559	34.3	19.8	0.0754	0.38	0.23
		300	40.4	58	5780	737	627	42.9	24.8	0.0601	0.37	0.25
		400	43.4	61	6780	861	701	57.2	33.0	0.0470	0.36	0.27
		500	46.4	65	8000	993	786	71.5	41.2	0.0366	0.35	0.30
		630	50.4	69	9690	1139	875	90.1	52.0	0.0283	0.33	0.33
Aluminium conductor constructions												
Al / XLPE / Cu Wire screen / Aluminium Wire armour / PVC												
Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					In air (A)	Buried (A)					
Aluminium conductor												
3.6/6	7.2	25	13.8	25	760	121	111	2.3	1.3	1.2000	0.41	0.27
		35	14.8	26	800	147	132	3.2	1.9	0.8680	0.39	0.30
		50	16.0	27	910	176	156	4.7	2.7	0.6410	0.37	0.33
		70	17.6	29	1020	221	191	6.5	3.8	0.4430	0.35	0.38
		95	19.4	31	1180	270	227	8.9	5.1	0.3200	0.33	0.42
		120	20.8	33	1400	315	260	11.2	6.5	0.2530	0.32	0.47
		150	22.3	35	1570	357	290	14.1	8.1	0.2060	0.31	0.51
		185	23.8	37	1740	411	326	17.4	10	0.1640	0.30	0.55
		240	26.6	39	2040	489	378	22.5	13	0.1250	0.29	0.60
		300	28.6	42	2400	571	426	28.1	16.3	0.1000	0.28	0.63
		400	32.6	47	2990	670	484	37.6	21.8	0.0778	0.28	0.66
		500	36.0	51	3510	782	544	47.0	27.2	0.0605	0.27	0.69
6/10	12	630	40.0	55	4170	925	617	59.2	34.3	0.0469	0.26	0.79
		25	15.6	27	860	130	115	2.3	1.3	1.2000	0.47	0.23
		35	16.6	28	900	155	140	3.2	1.9	0.8680	0.44	0.25
		50	17.8	30	1010	185	165	4.7	2.7	0.6410	0.42	0.28
		70	19.4	31	1150	235	200	6.5	3.8	0.4430	0.39	0.31
		95	21.2	34	1400	285	240	8.9	5.1	0.3200	0.38	0.33
		120	22.6	36	1550	330	275	11.2	6.5	0.2530	0.36	0.38
		150	24.1	38	1700	375	305	14.1	8.1	0.2060	0.35	0.41
		185	25.8	39	1910	430	345	17.4	10	0.1640	0.34	0.45
		240	28.2	42	2200	510	400	22.5	13	0.1250	0.33	0.50
		300	30.4	44	2510	585	450	28.1	16.3	0.1000	0.32	0.54
		400	33.4	48	3070	710	520	37.6	21.8	0.0778	0.31	0.60
		500	36.4	52	3570	810	590	47.0	27.2	0.0605	0.30	0.66
		630	40.5	56	4210	960	670	59.2	34.3	0.0469	0.28	0.78

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					In air (A)	Buried (A)					
Aluminium conductor												
8.7/15	17.5	25	17.8	30	960	130	115	2.3	1.3	1.2000	0.47	0.18
		35	18.8	31	1000	155	140	3.2	1.9	0.8680	0.44	0.20
		50	20.0	33	1110	185	165	4.7	2.7	0.6410	0.42	0.22
		70	21.6	35	1340	235	200	6.5	3.8	0.4430	0.39	0.25
		95	23.4	37	1520	285	240	8.9	5.1	0.3200	0.38	0.27
		120	24.8	39	1680	330	275	11.2	6.5	0.2530	0.36	0.30
		150	26.3	40	1850	375	305	14.1	8.1	0.2060	0.35	0.32
		185	28.0	42	2060	430	345	17.4	10	0.1640	0.34	0.34
		240	30.4	45	2370	510	400	22.5	13	0.1250	0.33	0.36
		300	32.6	48	2840	585	450	28.1	16.3	0.1000	0.32	0.42
		400	35.6	51	3260	710	520	37.6	21.8	0.0778	0.31	0.43
		500	38.6	55	3780	810	590	47.0	27.2	0.0605	0.30	0.47
630	42.6	59	4460	960	670	59.2	34.3	0.0469	0.28	0.52		
12/20	24	35	21.2	34	1220	159	142	3.2	1.9	0.8680	0.44	0.17
		50	22.4	36	1340	190	167	4.7	2.7	0.6410	0.42	0.18
		70	24.0	37	1490	235	204	6.5	3.8	0.4430	0.40	0.21
		95	25.8	40	1690	287	244	8.9	5.1	0.3200	0.38	0.23
		120	27.2	41	1870	330	277	11.2	6.5	0.2530	0.36	0.25
		150	28.7	43	2030	375	309	14.1	8.1	0.2060	0.35	0.27
		185	30.4	45	2260	428	350	17.4	10	0.1640	0.34	0.29
		240	32.8	48	2720	505	405	22.5	13	0.1250	0.33	0.32
		300	35.0	51	3070	578	455	28.1	16.3	0.1000	0.32	0.35
		400	38.0	54	3520	674	520	37.6	21.8	0.0778	0.30	0.39
		500	41.0	57	4030	778	592	47.0	27.2	0.0605	0.30	0.43
		630	45.0	61	4730	896	672	59.2	34.3	0.0469	0.28	0.49
18/30	36	50	27.8	43	1890	200	165	4.7	3.5	0.6410	0.46	0.14
		70	29.4	45	2080	250	205	6.5	3.8	0.4430	0.43	0.16
		95	31.2	47	2300	305	245	8.9	5.1	0.3200	0.41	0.17
		120	32.6	49	2500	350	275	11.2	6.5	0.2530	0.39	0.19
		150	34.1	50	2710	395	310	14.1	8.1	0.2060	0.38	0.20
		185	35.8	52	2960	455	350	17.4	10	0.1640	0.37	0.21
		240	38.2	56	3460	540	410	22.5	13	0.1250	0.36	0.24
		300	40.4	58	3860	584	465	28.1	16.3	0.1000	0.34	0.26
		400	43.4	61	4320	681	531	37.6	21.8	0.0778	0.33	0.29
		500	46.4	65	4900	792	605	47.0	27.2	0.0605	0.32	0.31
630	50.4	69	5690	933	684	59.2	34.3	0.0469	0.30	0.35		

Current carrying capacity calculated considering the following conditions:
Maximum conductor temperature = 90°C
Cables in air: Ambient temperature = 30°C
Cables directly buried: Ground temperature = 15°C • Depth of laying = 0.5 m • Thermal resistivity of soil = 1.5 K.m/W

APPLICATION

Cable for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages up to 18/30kV, Suitable for fixed installations, indoor or outdoor, in open air on cable trays, or underground in ducts or directly buried.

CABLE DESIGNATION

- A:** Cu / XLPE / Cu Tape screen / PVC or PE
B: Cu / XLPE / Cu Wire screen / PVC or PE
C: Al / XLPE / Cu Tape screen / PVC or PE
D: Al / XLPE / Cu Wire screen / PVC or PE

CONSTRUCTION CHARACTERISTICS

Conductor

Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation

Semi-conductive screen over the conductor, XLPE (cross-linked polyethylene) insulation and Semi-conductive screen over the insulation (strippable), applied by simultaneous extrusion in just one operation.

Metallic Screen over each conductor

Copper wire screen – annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix.

Or **Copper tape screen** – a copper tape, helically applied with overlap.

Screened conductors are stranded together with Cu Tape. A Poly Propylene tape is applied over this core.

Fillers

Extruded polymeric material.

Oversheath

Extruded PVC or PE.

Optionally, a Low Smoke Halogen Free thermoplastic compound can be used for cables with need for improved fire behaviour.

GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228
	IEC 60502-2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV • 6/10 (12) kV • 8.7/15 (17.5) kV •
	12/20 (24) kV • 18/30 (36) kV
Standard cross-section of wire screen (mm²)	16 • 25 • 35
Test voltage	3.5 x U ₀



Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	20 x d
Minimum bending radius – after installation (mm)	15 x d
Maximum pulling force over conductor (N)	Copper – 50 x S Aluminium – 30 x S
Flame retardant (for PVC oversheath)	IEC 60332-1-2 · EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm).
Fire retardant (for PVC oversheath. upon agreement)	IEC 60332-3-24 · EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2.5 cm)

S – conductor cross-section (mm²)
d – cable outer diameter (mm)

ELECTRICAL AND DIMENSIONAL CHARACTERISTICS

Copper conductor constructions

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U _o / U	Um					In air	Buried					
(kV)	(kV)	(mm ²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(kA)	(Ω/km)	(mH/km)	(µF/km)
Copper conductor												
3.6/6	7.2	25	13.8	39	1820	142	132	3.6	2.0	0.7270	0.38	0.27
		35	14.8	40	2140	170	157	5.0	2.9	0.5240	0.36	0.30
		50	16.0	43	2640	204	186	7.1	4.1	0.3870	0.34	0.33
		70	17.6	47	3430	253	227	10	5.8	0.2680	0.32	0.38
		95	19.4	52	4380	304	270	13.6	7.8	0.1930	0.30	0.43
		120	20.8	55	5270	351	307	17.2	9.9	0.1530	0.29	0.48
		150	22.3	58	6230	398	344	21.4	12.3	0.1240	0.28	0.51
		185	23.8	63	7580	455	388	26.5	15.3	0.0991	0.28	0.54
		240	26.6	68	9460	531	447	34.3	19.8	0.0754	0.27	0.60
		300	28.6	74	11600	606	504	42.9	24.8	0.0601	0.26	0.63
		400	32.6	79	14350	696	570	57.2	33.0	0.0470	0.26	0.66
6/10	12	25	15.6	44	2080	145	133	3.6	2.0	0.7270	0.41	0.23
		35	16.6	45	2440	175	167	5.0	2.9	0.5240	0.39	0.25
		50	17.8	48	2940	210	200	7.1	4.1	0.3870	0.37	0.28
		70	19.4	52	3730	260	245	10	5.8	0.2680	0.35	0.31
		95	21.2	56	4740	320	295	13.6	7.8	0.1930	0.33	0.35
		120	22.6	60	5660	365	335	17.2	9.9	0.1530	0.32	0.38
		150	24.1	63	6640	415	375	21.4	12.3	0.1240	0.31	0.41
		185	25.8	67	7980	470	420	26.5	15.3	0.0991	0.30	0.45
		240	28.2	72	9890	560	485	34.3	19.8	0.0754	0.29	0.50
		300	30.4	77	11940	630	540	42.9	24.8	0.0601	0.28	0.54
		400	33.4	82	14600	696	645	57.2	33.0	0.0470	0.26	0.59

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U _o / U	Um					In air	Buried					
(kV)	(kV)	(mm ²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(kA)	(Ω/km)	(mH/km)	(µF/km)
Copper conductor												
8.7/15	17.5	25	17.8	49.0	2410	161	152	3.6	2.0	0.7270	0.42	0.18
		35	18.8	51.5	2770	195	180	5.0	2.9	0.5240	0.39	0.20
		50	20.0	54.5	3300	230	215	7.1	4.1	0.3870	0.37	0.22
		70	21.6	58.0	4120	285	280	10	5.8	0.2680	0.35	0.25
		95	23.4	62.0	5160	338	298	13.6	7.8	0.1930	0.34	0.28
		120	24.8	66.0	6070	388	340	17.2	9.9	0.1530	0.32	0.30
		150	26.3	68.5	7120	449	390	21.4	12.3	0.1240	0.31	0.32
		185	28.0	71.5	8480	505	437	26.5	15.3	0.0991	0.30	0.34
		240	30.4	78.0	10390	580	490	34.3	19.8	0.0754	0.29	0.38
		300	32.6	84.0	12520	610	545	42.9	24.8	0.0601	0.28	0.42
12/20	24	400	35.6	90.5	15400	696	645	57.2	33.0	0.0470	0.27	0.46
		35	21.2	56.0	3130	172	170	5.0	2.9	0.5240	0.43	0.17
		50	22.4	59.0	3680	205	200	7.1	4.1	0.3870	0.41	0.19
		70	24.0	63.0	4550	253	245	10.0	5.8	0.2680	0.37	0.21
		95	25.8	67.0	5620	307	293	13.6	7.8	0.1930	0.36	0.23
		120	27.2	70.5	6550	352	333	17.2	9.9	0.1530	0.34	0.25
		150	28.7	73.5	7590	396	373	21.4	12.3	0.1240	0.33	0.27
		185	30.4	78.0	9020	469	421	26.5	15.3	0.0991	0.32	0.28
		240	32.8	82.5	10950	549	486	34.3	19.8	0.0754	0.31	0.32
		300	35.0	88.5	13130	625	547	42.9	24.8	0.0601	0.30	0.35
18/30	36	50	27.8	75	5200	225	205	7.1	4.1	0.3870	0.45	0.14
		70	29.4	79	6110	275	250	10.0	5.8	0.2680	0.41	0.16
		95	31.2	83	7290	330	300	13.6	7.8	0.1930	0.39	0.18
		120	32.6	86	8300	380	335	17.2	9.9	0.1530	0.38	0.19
		150	34.1	90	9420	425	375	21.4	12.3	0.1240	0.36	0.20
		185	35.8	94	10940	485	420	26.5	15.3	0.0991	0.35	0.21
		240	38.2	99	12970	570	485	34.3	19.8	0.0754	0.34	0.24
		300	40.4	104	15270	640	540	42.9	24.8	0.0601	0.32	0.25

Current carrying capacity calculated considering the following conditions:
Maximum conductor temperature = 90°C
Cables in air: Ambient temperature = 30°C
Cables directly buried: Ground temperature = 15°C • Depth of laying = 0.5 m • Thermal resistivity of soil = 1.5 K.m/W

ALUMINIUM CONDUCTOR CONSTRUCTIONS

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U	Um					In air	Buried					
(kV)	(kV)	(mm ²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(kA)	(Ω/km)	(mH/km)	(μF/km)
Aluminium conductor												
3.6/6	7.2	25	13.8	39	1340	110	103	2.4	1.3	1.2000	0.38	0.27
		35	14.8	40	1480	135	130	3.3	1.9	0.8680	0.36	0.30
		50	16.0	43	1720	160	155	4.7	2.7	0.6410	0.35	0.33
		70	17.6	47	2110	200	190	6.6	3.8	0.4430	0.32	0.38
		95	19.4	52	2550	240	225	9.0	5.1	0.3200	0.30	0.42
		120	20.8	55	2960	280	260	11.3	6.5	0.2530	0.29	0.47
		150	22.3	58	3400	315	290	14.2	8.1	0.2060	0.29	0.51
		185	23.8	63	3960	360	325	17.5	10.0	0.1640	0.28	0.55
		240	26.6	68	4780	425	340	22.7	13.0	0.1250	0.27	0.60
		300	28.6	74	5750	485	405	28.3	16.3	0.1000	0.26	0.63
		400	32.6	79	7050	545	451	37.8	21.8	0.0778	0.26	0.66
6/10	12	25	15.6	44	1600	110	111	2.4	1.3	1.2000	0.40	0.22
		35	16.6	45	1770	135	130	3.3	1.9	0.8680	0.39	0.24
		50	17.8	48	2030	160	155	4.7	2.7	0.6410	0.37	0.26
		70	19.4	52	2410	200	190	6.6	3.8	0.4430	0.34	0.30
		95	21.2	56	2910	240	225	9.0	5.1	0.3200	0.32	0.33
		120	22.6	60	3350	280	260	11.3	6.5	0.2530	0.31	0.37
		150	24.1	63	3810	315	290	14.2	8.1	0.2060	0.30	0.39
		185	25.8	67	4360	360	325	17.5	10.0	0.1640	0.29	0.43
		240	28.2	72	5210	425	370	22.7	13.0	0.1250	0.28	0.47
		300	30.4	77	6070	485	425	28.3	16.3	0.1000	0.27	0.53
		400	33.4	82	7300	562	487	37.8	21.8	0.0778	0.26	0.59
8.7/15	17.5	25	17.8	49.0	1920	110	110	2.4	1.3	1.2000	0.43	0.18
		35	18.8	51.5	2100	135	130	3.3	1.9	0.8680	0.41	0.19
		50	20.0	54.0	2400	160	155	4.7	2.7	0.6410	0.39	0.21
		70	21.6	58.0	2810	200	190	6.6	3.8	0.4430	0.36	0.24
		95	23.4	61.5	3330	240	225	9.0	5.1	0.3200	0.34	0.27
		120	24.8	65.5	3770	280	260	11.3	6.5	0.2530	0.33	0.29
		150	26.3	68.5	4290	315	290	14.2	8.1	0.2060	0.32	0.31
		185	28.0	72.0	4880	360	325	17.5	10.0	0.1640	0.31	0.34
		240	30.4	77.5	5710	425	370	22.7	13.0	0.1250	0.30	0.37
		300	32.6	84.0	6660	485	425	28.3	16.3	0.1000	0.29	0.42
		400	35.6	90.5	8100	562	487	37.8	21.8	0.0778	0.27	0.46

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U	Um					In air	Buried					
(kV)	(kV)	(mm ²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(kA)	(Ω/km)	(mH/km)	(μF/km)
Aluminium conductor												
12/20	24	35	21.2	56.0	2450	136	132	3.3	1.9	0.8680	0.43	0.17
		50	22.4	58.5	2760	162	156	4.7	2.7	0.6410	0.41	0.18
		70	24.0	62.5	3230	200	190	6.6	3.8	0.4430	0.38	0.21
		95	25.8	66.5	3790	242	227	9.0	5.1	0.3200	0.36	0.23
		120	27.2	70.5	4240	278	259	11.3	6.5	0.2530	0.34	0.25
		150	28.7	73.5	4750	313	289	14.2	8.1	0.2060	0.33	0.27
		185	30.4	78.0	5410	358	328	17.5	10.0	0.1640	0.32	0.29
		240	32.8	82.5	6270	422	379	22.7	13.0	0.1250	0.31	0.32
		300	35.0	88.5	7250	481	427	28.3	16.3	0.1000	0.30	0.35
18/30	36	50	27.8	75	4280	175	160	4.7	2.7	0.6410	0.45	0.16
		70	29.4	79	4800	215	195	6.6	3.8	0.4430	0.43	0.17
		95	31.2	83	5960	260	230	9.0	5.1	0.3200	0.41	0.19
		120	32.6	86	5990	295	265	11.3	6.5	0.2530	0.39	0.20
		150	34.1	90	6580	335	295	14.2	8.1	0.2060	0.38	0.22
		185	35.8	94	7320	380	330	17.5	10.0	0.1640	0.36	0.23
		240	38.2	99	8290	445	380	22.7	13.0	0.1250	0.35	0.25
		300	40.4	104	9390	480	444	28.3	16.3	0.1000	0.32	0.26

Current carrying capacity calculated considering the following conditions:
Maximum conductor temperature = 90°C
Cables in air: Ambient temperature = 30°C
Cables directly buried: Ground temperature = 15°C • Depth of laying = 0.5 m • Thermal resistivity of soil = 1.5 K.m/W

APPLICATION

Cable for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages up to 18/30kV. Suitable for fixed installations, directly buried. Good mechanical protection.

CABLE DESIGNATION

- A: Cu / XLPE / Cu Tape screen / Galv. Steel Wire armour / PVC or PE
- B: Cu / XLPE / Cu Wire screen / Galv. Steel Wire armour / PVC or PE
- C: Al / XLPE / Cu Tape screen / Galv. Steel Wire armour / PVC or PE
- D: Al / XLPE / Cu Wire screen / Galv. Steel Wire armour / PVC or PE
- E: Cu / XLPE / Cu Tape screen / Steel Tape armour / PVC or PE
- F: Cu / XLPE / Cu Wire screen / Steel Tape armour / PVC or PE
- G: Al / XLPE / Cu Tape screen / Steel Tape armour / PVC or PE
- H: Al / XLPE / Cu Wire screen / Steel Tape armour / PVC or PE

CONSTRUCTION CHARACTERISTICS

Conductor

Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation

Semi-conductive screen over the conductor, XLPE (cross-linked polyethylene) insulation and semi conductive screen over the insulation (strippable¹), applied by simultaneous extrusion in just one operation.

Metallic Screen

Copper wire screen – annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix. Poly Propylene tape is applied over the screen.
Or Copper tape screen – a copper tape, helically applied with overlap.

Fillers

Extruded polymeric material.

Inner Sheath

Extruded PVC or PE.

Armour

Steel double tape, helically applied.
Or Galvanized steel wires, helically applied.

Oversheath

Extruded PVC or PE.

Optionally, a Low Smoke Halogen Free thermoplastic compound can be used for cables with need for improved fire behaviour.



GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228 IEC 60502-2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV • 6/10 (12) kV • 8.7/15 (17.5) kV • 12/20 (24) kV • 18/30 (36) kV
Standard cross-section of wire screen (mm ²)	16 • 25 • 35
Test voltage	3.5 x U ₀
Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	15 x d
Minimum bending radius – after installation (mm)	12 x d
Maximum pulling force over conductor (N)	Copper – 50 x S Aluminium – 30 x S
Flame retardant (for PVC oversheath)	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm).
Fire retardant (for PVC oversheath. upon agreement)	IEC 60332-3-24 • EN 60332-3-24 (bunch of cables vertically mounted on a ladder, length of charred cable ≤ 2.5 cm)
S – conductor cross-section (mm ²) d – cable outer diameter (mm)	

ELECTRICAL AND DIMENSIONAL CHARACTERISTICS

Copper Conductor Constructions

Cu / XLPE / Cu Tape screen / Galv. Steel Wire armour / PVC

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					(mm ²)	(mm)					
Copper conductor												
3.6/6	7.2	25	13.8	48	3900	142	132	3.6	2.0	0.7270	0.38	0.27
		35	14.8	49	4300	170	157	5.0	2.9	0.5240	0.36	0.30
		50	16.0	52	4980	204	186	7.1	4.1	0.3870	0.34	0.33
		70	17.6	56	5940	253	227	10.0	5.8	0.2680	0.32	0.38
		95	19.4	60	7220	304	270	13.6	7.8	0.1930	0.30	0.43
		120	20.8	64	8300	351	307	17.2	9.9	0.1530	0.29	0.48
		150	22.3	68	9460	398	344	21.4	12.3	0.1240	0.28	0.51
		185	23.8	72	11072	455	388	26.5	15.3	0.0991	0.28	0.54
		240	26.6	79	14150	531	447	34.3	19.8	0.0754	0.27	0.60
		300	28.6	86	16790	606	504	42.9	24.8	0.0601	0.26	0.63
400	32.6	90	19840	696	570	57.2	33.0	0.0470	0.26	0.66		

MEDIUM VOLTAGE CABLES

Cu or Al - XLPE - Cu - STA or SWA - PVC or PE
Three Core Cable
Armoured - XLPE Insulation - IEC 60502-2

MEDIUM VOLTAGE CABLES

Cu or Al - XLPE - Cu - STA or SWA - PVC or PE
Three Core Cable
Armored - XLPE Insulation - IEC 60502-2

ELECTRICAL AND DIMENSIONAL CHARACTERISTICS

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity 		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance 	Capacitance
U ₀ / U (kV)	Um (kV)	(mm ²)	(mm)	(mm)	(kg/km)	In air (A)	Buried (A)	(kA)	(kA)	(Ω/km)	(mH/km)	(μF/km)
Copper conductor												
6/10	12	25	15.6	52	4320	145	133	3.6	2.0	0.7270	0.41	0.23
		35	16.6	54	4760	175	167	5.0	2.9	0.5240	0.39	0.25
		50	17.8	57	5410	210	200	7.1	4.1	0.3870	0.37	0.28
		70	19.4	61	6420	260	245	10.0	5.8	0.2680	0.35	0.31
		95	21.2	65	7680	320	295	13.6	7.8	0.1930	0.33	0.35
		120	22.6	69	8800	365	335	17.2	9.9	0.1530	0.32	0.38
		150	24.1	74	10720	415	375	21.4	12.3	0.1240	0.31	0.41
		185	25.8	78	12400	470	420	26.5	15.3	0.0991	0.30	0.45
		240	28.2	83	14610	560	485	34.3	19.8	0.0754	0.29	0.50
		300	30.4	89	17100	630	540	42.9	24.8	0.0601	0.28	0.54
8.7/15	17.5	400	33.4	92	20350	696	645	57.2	33.0	0.0470	0.26	0.59
		25	17.8	58	5150	161	152	3.6	2.0	0.7270	0.42	0.18
		35	18.8	60	5600	195	180	5.0	2.9	0.5240	0.39	0.20
		50	20.0	63	6330	230	215	7.1	4.1	0.3870	0.37	0.22
		70	21.6	67	7350	285	280	10.0	5.8	0.2680	0.35	0.25
		95	23.4	71	8670	338	298	13.6	7.8	0.1930	0.34	0.28
		120	24.8	76	10630	388	340	17.2	9.9	0.1530	0.32	0.30
		150	26.3	80	11890	449	390	21.4	12.3	0.1240	0.31	0.32
		185	28.0	84	13620	505	437	26.5	15.3	0.0991	0.30	0.34
		240	30.4	89	15900	580	490	34.3	19.8	0.0754	0.29	0.38
12/20	24	300	32.6	95	18470	610	545	42.9	24.8	0.0601	0.28	0.42
		400	35.6	103	20240	696	645	57.2	33.0	0.0470	0.27	0.46
		35	21.2	56.0	6260	172	170	5.0	2.9	0.5240	0.43	0.17
		50	22.4	59.0	6980	205	200	7.1	4.1	0.3870	0.41	0.19
		70	24.0	63.0	8100	253	245	10.0	5.8	0.2680	0.37	0.21
		95	25.8	67.0	10300	307	293	13.6	7.8	0.1930	0.36	0.23
		120	27.2	70.5	11500	352	333	17.2	9.9	0.1530	0.34	0.25
		150	28.7	73.5	12790	396	373	21.4	12.3	0.1240	0.33	0.27
		185	30.4	76.5	14500	469	421	26.5	15.3	0.0991	0.32	0.28
		240	32.8	82.5	16870	549	486	34.3	19.8	0.0754	0.31	0.32
18/30	36	300	35.0	88.5	19480	625	547	42.9	24.8	0.0601	0.30	0.35
		50	27.8	86	10410	225	205	7.5	4.1	0.3870	0.45	0.14
		70	29.4	90	11630	275	250	10.0	5.8	0.2680	0.41	0.16
		95	31.2	95	13210	330	300	13.6	7.8	0.1930	0.39	0.18
		120	32.6	98	14500	380	335	17.2	9.9	0.1530	0.38	0.19
		150	34.1	102	15880	425	375	21.5	12.3	0.1240	0.36	0.20
		185	35.8	106	17740	485	420	26.5	15.3	0.0991	0.35	0.21
		240	38.2	111	20180	570	485	34.3	19.8	0.0754	0.34	0.24
		300	40.4	117	22920	640	540	42.9	24.8	0.0601	0.32	0.25

Aluminium conductor constructions

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity 		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance 	Capacitance
U ₀ / U (kV)	Um (kV)	(mm ²)	(mm)	(mm)	(kg/km)	In air (A)	Buried (A)	(kA)	(kA)	(Ω/km)	(mH/km)	(μF/km)
Aluminium conductor												
3.6/6	7.2	25	13.8	48	3480	110	103	2.4	1.3	1.2000	0.38	0.27
		35	14.8	49	3680	135	130	3.3	1.9	0.8680	0.36	0.30
		50	16.0	52	4120	160	155	4.7	2.7	0.6410	0.35	0.33
		70	17.6	56	4680	200	190	6.6	3.8	0.4430	0.32	0.38
		95	19.4	60	5440	240	225	9.0	5.1	0.3200	0.30	0.42
		120	20.8	64	6050	280	260	11.3	6.5	0.2530	0.29	0.47
		150	22.3	68	6680	315	290	14.2	8.1	0.2060	0.29	0.51
		185	23.8	72	7540	360	325	17.5	10.0	0.1640	0.28	0.55
		240	26.6	79	9520	425	340	22.7	13.0	0.1250	0.27	0.60
		300	28.6	86	10980	485	405	28.3	16.3	0.1000	0.26	0.63
6/10	12	400	32.6	90	11740	545	451	37.8	21.8	0.0778	0.26	0.66
		25	15.6	52	3820	110	111	2.4	1.3	1.2000	0.40	0.22
		35	16.6	54	4080	135	130	3.3	1.9	0.8680	0.39	0.24
		50	17.8	57	4500	160	155	4.7	2.7	0.6410	0.37	0.26
		70	19.4	61	5110	200	190	6.6	3.8	0.4430	0.34	0.30
		95	21.2	65	5840	240	225	9.0	5.1	0.3200	0.32	0.33
		120	22.6	69	6500	280	260	11.3	6.5	0.2530	0.31	0.37
		150	24.1	74	7900	315	290	14.2	8.1	0.2060	0.30	0.39
		185	25.8	78	8800	360	325	17.5	10.0	0.1640	0.29	0.43
		240	28.2	83	9940	425	370	22.7	13.0	0.1250	0.28	0.47
8.7/15	17.5	300	30.4	89	11240	485	425	28.3	16.3	0.1000	0.27	0.53
		400	33.4	92	12930	562	487	37.8	21.8	0.0778	0.26	0.59
		25	17.8	58	4670	110	110	2.4	1.3	1.2000	0.43	0.18
		35	18.8	60	4930	135	130	3.3	1.9	0.8680	0.41	0.19
		50	20.0	63	5420	160	155	4.7	2.7	0.6410	0.39	0.21
		70	21.6	67	6030	200	190	6.6	3.8	0.4430	0.36	0.24
		95	23.4	71	6840	240	225	9.0	5.1	0.3200	0.34	0.27
		120	24.8	76	8320	280	260	11.3	6.5	0.2530	0.33	0.29
		150	26.3	80	9050	315	290	14.2	8.1	0.2060	0.32	0.31
		185	28.0	84	10000	360	325	17.5	10.0	0.1640	0.31	0.34
		240	30.4	89	11220	425	370	22.7	13.0	0.1250	0.30	0.37
		300	32.6	95	12590	485	425	28.3	16.3	0.1000	0.29	0.42
		400	35.6	103	13010	562	487	37.8	21.8	0.0778	0.27	0.46

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight B-PVC	Current carrying capacity		Cond. max. short-circuit current, t=1s	Max symmetrical short-circuit for 3 second	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U (kV)	Um (kV)					In air (A)	Buried (A)					
Aluminium conductor												
12/20	24	35	21.2	56.0	5630	136	132	3.3	1.9	0.8680	0.43	0.17
		50	22.4	58.5	6100	162	156	4.7	2.7	0.6410	0.41	0.18
		70	24.0	62.5	6830	200	190	6.6	3.8	0.4430	0.38	0.21
		95	25.8	66.5	8540	242	227	9.0	5.1	0.3200	0.36	0.23
		120	27.2	70.5	9270	278	259	11.3	6.5	0.2530	0.34	0.25
		150	28.7	73.5	10060	313	289	14.2	8.1	0.2060	0.33	0.27
		185	30.4	76.5	11070	358	328	17.5	10.0	0.1640	0.32	0.29
		240	32.8	82.5	12370	422	379	22.7	13.0	0.1250	0.31	0.32
		300	35.0	88.5	13830	481	427	28.3	16.3	0.1000	0.30	0.35
18/30	36	50	27.8	86	9490	175	160	4.7	2.7	0.6410	0.45	0.16
		70	29.4	90	10310	215	195	6.6	3.8	0.4430	0.43	0.17
		95	31.2	95	11380	260	230	9.0	5.1	0.3200	0.41	0.19
		120	32.6	98	12190	295	265	11.3	6.5	0.2530	0.39	0.20
		150	34.1	102	13040	335	295	14.2	8.1	0.2060	0.38	0.22
		185	35.8	106	14130	380	330	17.5	10.0	0.1640	0.36	0.23
		240	38.2	111	15500	445	380	22.7	13.0	0.1250	0.35	0.25
		300	40.4	117	17050	480	444	28.3	16.3	0.1000	0.32	0.26

*Only for steel tape armoured or SWA cables.
Current carrying capacity calculated considering the following conditions:
Maximum conductor temperature = 90°C
Cables in air: Ambient temperature = 30°C
Cables directly buried: Ground temperature = 15°C • Depth of laying = 0.5 m • Thermal resistivity of soil = 1.5 K.m/W

APPLICATION

Three single-core cables pre-assembled without messenger, for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages up to 18/30kV. Suitable for fixed installations, indoor or outdoor, in open air on cable trays, or underground in ducts or directly buried.

CABLE DESIGNATION

- Cu / XLPE / Cu Tape screen / PVC or PE
- Cu / XLPE / Cu Wire screen / PVC or PE
- Al / XLPE / Cu Tape screen / PVC or PE
- Al / XLPE / Cu Wire screen / PVC or PE

CONSTRUCTION CHARACTERISTICS

Conductor

Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation

Semi-conductive screen over the conductor. XLPE (cross-linked polyethylene) insulation and Semi-conductive screen over the insulation (strippable¹), applied by simultaneous extrusion in just one operation.

Metallic Screen

Copper wire screen – annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix.

Poly Propylene tape is applied over the screen.

Or Copper tape screen – a copper tape, helically applied with overlap.

Oversheath

Extruded PVC type ST2 or PE type ST7.



GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228 IEC 60502-2 • HD 620 S2
Rated voltage $U_0/ U(Um)$	3.6/6 (7.2) kV • 6/10 (12) kV • 8.7/15 (17.5) kV • 12/20 (24) kV • 18/30 (36) kV
Standard cross-section of wire screen (mm²)	16 • 25 • 35
Test voltage	3.5 x U_0
Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	12 x D
Minimum bending radius – after installation (mm)	9 x D
Maximum pulling force over conductor (N)	Copper – 50 x S Aluminium – 30 x S
Flame retardant (for PVC oversheath)	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm).

s – conductor cross-section (mm²)
d– diameter over the three cores approx. 2.16 x d
d-single core outer diameter (mm)

APPLICATION

Three single-core cables pre-assembled with steel messenger, for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages up to 18/30kV, Suitable for aerial installations.

CABLE DESIGNATION

Al / XLPE / Cu Tape screen / PVC or PE + Messenger
Al / XLPE / Cu Wire screen / PVC or PE + Messenger

CONSTRUCTION CHARACTERISTICS

Conductor

Aluminium conductor, circular, stranded, class 2 per IEC 60288.

Insulation

Semi-conductive screen over the conductor. XLPE (cross-linked polyethylene) insulation and Semi-conductive screen over the insulation (strippable), applied by simultaneous extrusion in just one operation.

Metallic Screen

Copper wire screen – annealed copper wires helically wound and an equalising copper tape applied in an open counter-helix. Cross-section area of screen according to client request.

A wrapping Poly Propylene tape is applied over the screen.

Or **Copper tape screen** – a copper tape. helically applied with overlap.

Oversheath

Extruded PVC type ST2, or PE type ST7.



GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228 IEC 60502-2 • HD 620 S2
Rated voltage U ₀ / U(Um)	3.6/6 (7.2) kV • 6/10 (12) kV • 8.7/15 (17.5) kV • 12/20 (24) kV • 18/30 (36) kV
Standard cross-section of wire screen (mm²)	16 • 25 • 35
Test voltage	3.5 x U ₀
Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C (t ≤ 5s)
Minimum bending radius – during installation (mm)	12 x D
Minimum bending radius – after installation (mm)	9 x D
Maximum pulling force over conductor (N)	Copper – 50 x S Aluminium – 30 x S
Flame retardant (for PVC oversheath)	IEC 60332-1-2 • EN 60332-1-2 (cable vertically mounted, length of charred cable ≤ 540 mm).

s – conductor cross-section (mm²)
d – diameter over the three cores aprox. 2.16 x d
d-single core cable outer diameter (mm)



HIGH VOLTAGE CABLES

HIGH VOLTAGE CABLES

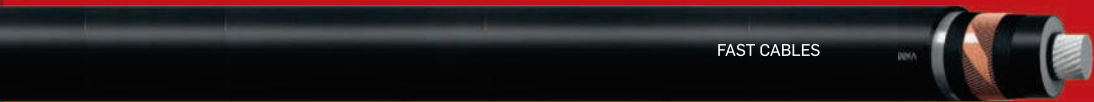
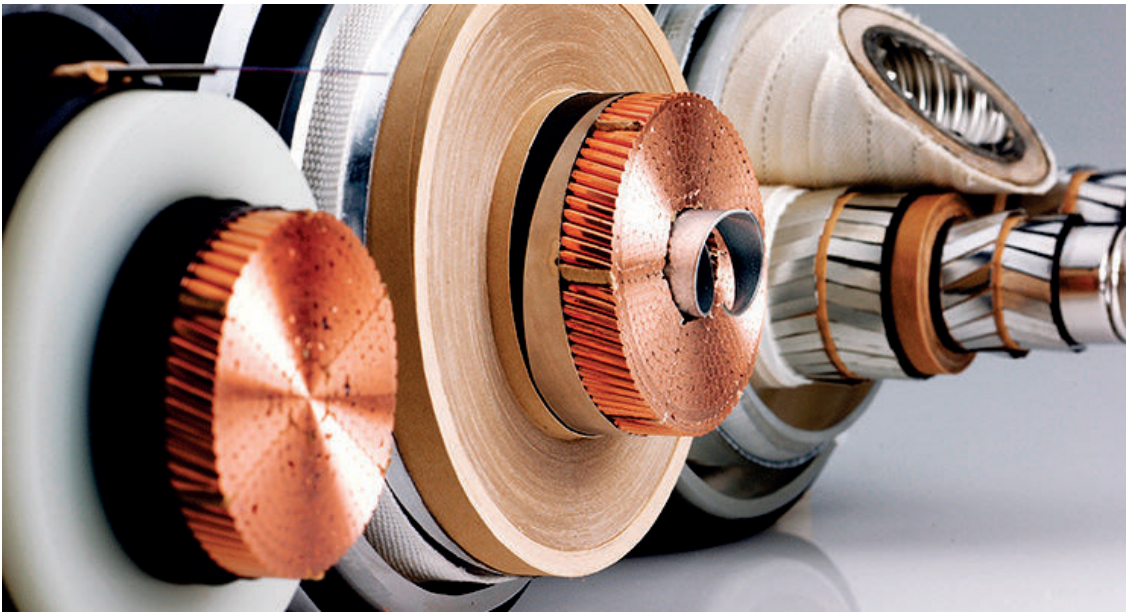
SINGLE CORE CABLE

Unarmoured - XLPE Insulation

Standard IEC-60840

■ Cu or Al - XLPE - Cu - Al - PE

40



HIGH VOLTAGE CABLES

Cu or Al - XLPE - Cu - Al - PE
Single Core Cable
Unarmoured - XLPE Insulation - IEC-60840

APPLICATION

Cable for power distribution and power supply stations used in Utility and Industrial applications, for rated voltages 26/45kV and 36/60kV. Suitable for fixed installations, underground in ducts or directly buried.

CABLE DESIGNATION

Cu / XLPE / Cu Wire Screen / Al Tape / PE

Al / XLPE / Cu Wire Screen / Al Tape / PE:

CONSTRUCTION CHARACTERISTICS

Conductor

Plain annealed Copper or Aluminium, circular, stranded, class 2 per IEC 60228.

Insulation

Semi-conductive screen over the conductor. XLPE (cross-linked polyethylene) insulation and semi-conductive screen over the insulation (adhered), applied by simultaneous extrusion in just one operation.

Metallic Screen

Annealed copper wires, helically wound and an equalising copper tape applied in an open counter-helix. Cross-section area of screen according to client request.

Oversheath

Aluminium copolymer coated tape, longitudinally applied, bonded to the extruded PE oversheath, type ST7.

Upon agreement, an extruded semi-conductive thin layer may be applied on the surface of the oversheath, to facilitate the detection and location of defective points.

Watertightness option

(cbe) – Conductor and metallic screen longitudinally watertight. Conductor: Use of waterblocking yarns and/or tapes between wire layers; Metallic screen: Assured by application of semi-conductive waterblocking tapes under and over the screen.

L – Radial watertightness provided by the aluminium-coated tape.

GENERAL CHARACTERISTICS

Construction and test standards	IEC 60228 • IEC 60840
Rated voltage U_0 / $U(U_m)$	26/45 (52) kV – 36/60 (72.5) kV
Test voltage	$2.5 \times U_0$
Conductor maximum operating temperature	90°C
Maximum short-circuit temperature	250°C ($t \leq 5s$)



GENERAL CHARACTERISTICS

Minimum bending radius – during installation (mm)	30 x d
Minimum bending radius – after installation (mm)	15 x d
Maximum pulling force over conductor (N)	Copper – 50 x S Aluminium – 30 x S

d – cable outer diameter (mm) • S – conductor cross-section (mm²)

ELECTRICAL AND DIMENSIONAL CHARACTERISTICS

Copper conductor constructions

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight	Current carrying capacity		Cond. max. short-circuit current, t=1s	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U	Um					In air	Buried				
(kV)	(kV)	(mm²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(Ω/km)	(mH/km)	(µF/km)
36/60	72.5	185	43.5	60.0	4.980	526	407	26.5	0.0991	0.46	0.15
		400	51.6	68.0	7.250	795	578	57.2	0.0470	0.40	0.20
		630	60.6	77.0	9.970	1 015	710	90.1	0.0283	0.37	0.25

Aluminium conductor constructions

Voltage		Conductor cross-section	Diameter over insulation	Approx. outer diameter	Approx. weight	Current carrying capacity		Cond. max. short-circuit current, t=1s	Cond. DC resistance @ 20°C	Inductance	Capacitance
U ₀ / U	Um					In air	Buried				
(kV)	(kV)	(mm²)	(mm)	(mm)	(kg/km)	(A)	(A)	(kA)	(Ω/km)	(mH/km)	(µF/km)
36/60	72.5	185	43.5	60.0	3.900	415	322	17.5	0.164	0.46	0.15
		400	51.5	68.0	4.840	637	467	37.8	0.0778	0.40	0.20
		630	60.5	77.0	6.090	857	597	59.5	0.0469	0.37	0.25
		1 000	69.0	86.0	7.620	1 082	724	94.5	0.0291	0.34	0.29

Current carrying capacity calculated considering the following conditions:

- Maximum conductor temperature = 90°C
- Cables in air: Ambient temperature = 30°C
- Cables directly buried: Ground temperature = 20°C • Depth of laying = 1.3 m • Thermal resistivity of soil = 1.2K.m/W



WAPDA SPECIFICATION CONDUCTORS

- All Aluminium Conductor(AAC)
- All Aluminium Alloy Conductor (AAAC)
- Aluminium Conductor Steel Reinforced-BS(ACSR)
- Aluminium Conductor Steel Reinforced-US(ACSR)
- AAC Insulated Conductor
- ACSR Insulated Conductor
- Factors for AAC Conductor
- Factors for ACSR Conductor

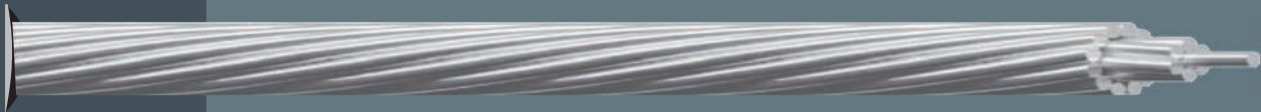


WAPDA SPECIFICATION OVERHEAD CONDUCTORS AAC P-63
All Aluminium Conductor (AAC) P-63

Code name	Nominal Size	Strands and wire diameter	Dia of complete conductor	Calculated area of complete conductor	Ultimate strength	Maximum D.C resistance at 20° C	Weight
	mm ²	No/mm	mm	mm ²	Kg	Ohms/km	Kg/km
Gant	25	7/2.21	6.63	26.85	469	1.0661	73.4
Ant	50	7/3.10	9.30	52.83	847	0.5419	144.4
Wasp	100	7/4.39	13.17	105.95	1633	0.2702	290.1
Arbutus	400	37/3.72	26.06	402.14	6304	0.0717	1108.7
Hawthorn	600	61/3.55	31.95	603.78	8966	0.0479	1668.1
Coreopsis	810	61/4.11	36.99	1075.06	13670	0.0356	2241.0

All Aluminium Alloy Conductor (AAAC) P-117-79

Code name	Stranding and wire diameter	Dia of complete conductor	Calculated area of complete conductor	Rated ultimate strength	(Max.) D.C. resistance at 20°C	Weight
	No/mm	mm	mm ²	kg	Ohms/km	Kg/km
Almond	7/2.34	7.02	30.10	903	1.094	82
Azoza	7/3.37	10.11	62.44	1873	0.527	171
Alliance	7/4.77	14.30	125.09	3753	0.263	342
Cairo	19/3.98	19.90	236.38	7091	0.1740	650
Greely	37/4.02	28.14	469.60	13835	0.071	1295



Aluminium Conductor Steel Reinforced(ACSR)P-50:88-BS

Code name	Aluminium Conductor	Steel core	Diameter		Cross Section Area		Rated ultimate Tensile strength	Maximum D.C. resistance at 20 °C	Weight
			Complete conductor	Steel core	Aluminium	Complete conductor			
	no/mm	no/mm	mm	mm	mm ²	mm ²	kg	Ohms/km	Kg/km
Gopher	6/2.36	1/2.36	7.08	2.36	26.25	30.62	980	1.093	106
Rabbit	6/2.35	1/3.35	10.05	3.35	52.88	61.69	1875	0.543	214
Dog	6/4.72	7/1.57	14.15	4.71	104.98	118.53	3225	0.273	394
Lynx	30/2.79	7/2.79	19.53	8.37	183.41	226.20	8192	0.158	842
Cuckoo	24/4.62	7/3.08	27.72	9.24	402.33	454.48	12385	0.072	1519
Rail	45/3.70	7/2.47	29.61	7.41	483.84	517.38	11874	0.060	1599
Cardinal	54/3.38	7/3.38	30.42	10.14	484.50	547.30	15262	0.060	1832

Aluminium Conductor Steel Reinforced(ACSR)DD-PDS-7/US

Code name	Aluminium Conductor	Steel core	Diameter		Cross Section Area		Rated ultimate Tensile strength	Maximum D.C. resistance at 20 °C	Weight
			Complete conductor	Steel core	Aluminium	Steel			
	no/mm	no/mm	mm	mm	mm ²	mm ²	kg	Ohms/km	Kg/km
Merlin	18/3.47	1/3.47	17.35	3.47	170.5	9.46	3936	0.1691	544
Panther	30/3.00	7/3.00	21.00	9.00	212.1	49.48	9407	0.1363	974
Osprey	18/4.465	1/4.465	22.35	4.465	281.9	15.66	6220	0.1022	898.8

PVC-Covered Conductors For Overhead Power Lines
AAC Insulated Conductors DD - PD 44 : 91

1	2	3	4	5	6	7	8
Code name	Nominal aluminium area	Stranding and wire diameter	Approximate over all diameter bare conductor	Resistance per km at 20 °C (max)	Approximate breaking load (min)	Approximate over all diameter covered conductor	Approximate mass per km of covered conductor
	mm ²	mm	mm	Ohms/ km	kg	mm	Kg
Gnat	25	7/2.21	06.63	1.0661	469	10.63	170
Ant	50	7/3.10	09.30	0.5419	847	13.70	285
Wasp	100	7/4.39	13.17	0.2702	1633	18.37	520

PVC Covered Aluminium Conductors
Steel Reinforced
ACSR Insulated Conductors DD - PD 67 : 95

1	2	3	4	5	6	7	8	9
Code name	Nominal aluminium area	Stranding and wire diameter		Approximate over all diameter bare conductor	Resistance per km at 20 °C (max)	Approximate breaking load (min)	Approximate over all diameter covered conductor	Approximate mass per km of covered conductor
		Aluminium	Steel					
	mm ²	mm	mm	mm	Ohms/ km	kg	mm	Kg
Gopher	25	6/2.36	1/2.36	7.08	1.0930	980	11.1	210
Rabbit	50	6/3.35	1/3.35	10.05	0.5426	1875	14.1	345
Dog	100	6/4.72	7/1.57	14.15	0.2733	3225	18.2	570
Lynx	175	30/2.79	7/2.79	19.53	0.1576	8192	23.6	1070
Panther	200	30/3.00	7/3.00	21.00	0.1363	9407	25.0	1220
Osprey	275	18/4.465	1/4.465	22.33	0.1022	6220	26.4	1160

Factors for AAC Conductors

Number of wires in conductor	Standing Constant	
	Weight	Resistance
7	7.091	0.14470
19	19.34	0.05357
37	37.74	0.02757
61	62.35	0.01676

Factors for ACSR Conductors

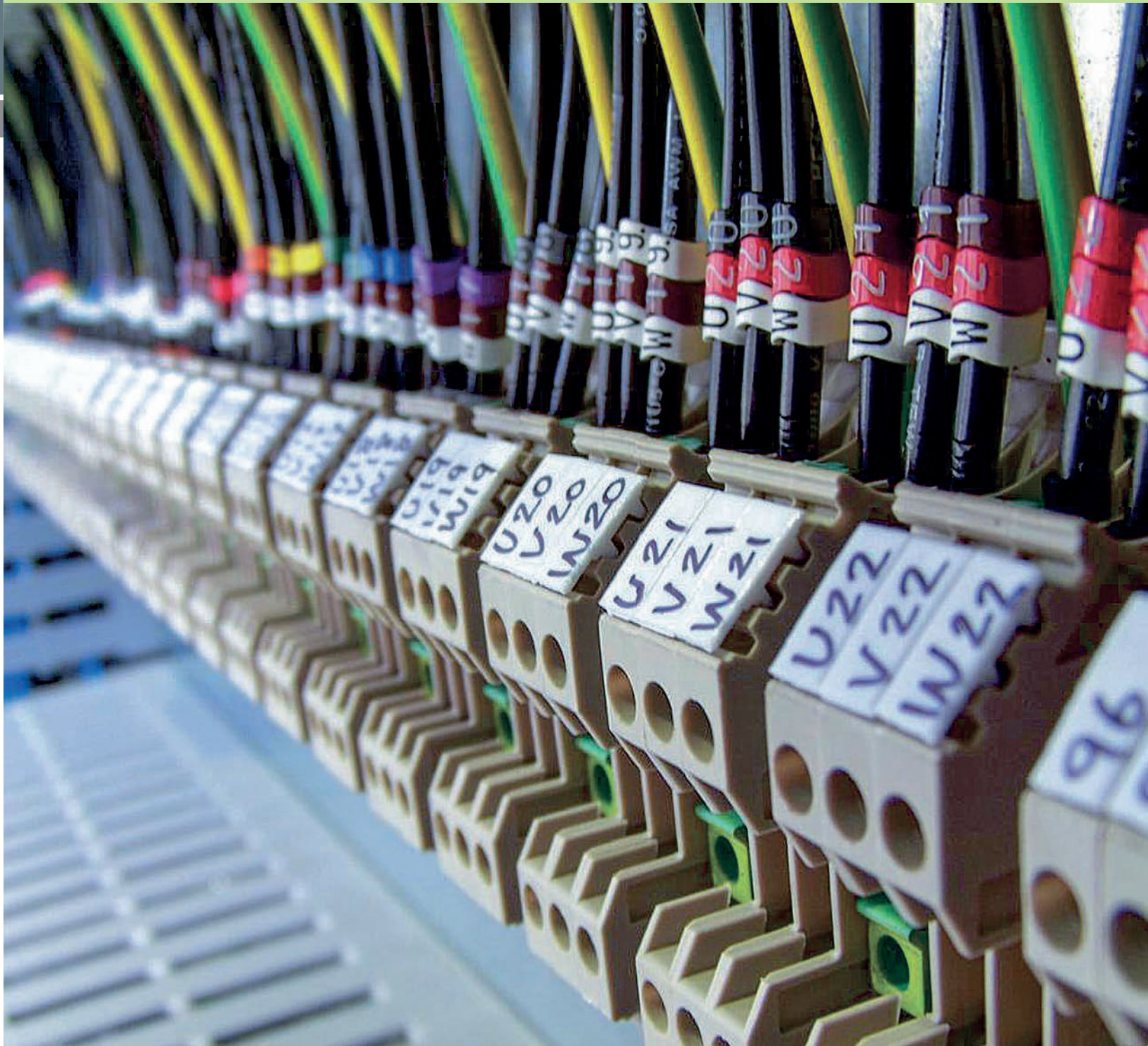
No. of wires in conductor		Weight		Electrical Resistance
Aluminium	Steel	Aluminium	Steel	
6	1	6.091	1.000	0.1692
6	7	6.091	7.032	0.1692
12	7	12.26	7.032	0.08514
18	1	18.34	1.000	0.05660
24	7	24.50	7.032	0.04253
26	7	26.56	7.032	0.03928
28	7	28.61	7.032	0.03649
30	7	30.67	7.032	0.03408
30	19	30.67	19.15	0.03408
32	19	32.66	19.15	0.03180
45	7	45.98	7.032	0.02271
54	7	55.23	7.032	0.01894
54	19	55.23	19.15	0.01894

Correction Factor for AAC,ACSR,AAAC Conductors	
Ambient Temperature (°C)	Correction factor (mutiplied)
55	0.91
50	1
45	1.08
40	1.15
35	1.22
30	1.29
25	1.35
20	1.41
15	1.47
10	1.52
5	1.58
0	1.63
-5	1.68

Note : Conductor Operating Temperature = 80° C Maximum

Correction Factor for AAC,ACSR,AAAC Conductors	
Ambient Temperature (°C)	Correction factor (mutiplied)
55	0.89
50	1
45	1.10
40	1.18
35	1.26
30	1.34
25	1.41
20	1.48
15	1.55
10	1.61
5	1.67
0	1.73
-5	1.79

Note : Conductor Operating Temperature = 75° C Maximum



PROPERTIES OF ELECTRICITY

Conductance

Electricity is a subject that is frequently explained in terms of opposites. The term that is exactly the opposite of resistance is conductance. Conductance is the ability of a material to pass electrons. The unit of conductance is the mho or ohm spelled backwards. Whereas the symbol used to represent resistance is the Greek letter omega (Ω), the symbol used to represent conductance is the Greek letter omega upside down ($\Uparrow$). The relationship that exists between resistance and conductance is reciprocal. A reciprocal of a number is obtained by dividing the number into one. In terms of resistance and conductance:

$$G = \frac{1}{R} \quad \text{or} \quad R = \frac{1}{G}$$

If the resistance of material is known, dividing its value into one will give its conductance. Similarly, if the conductance is known, dividing its value into one will give its resistance. The relative conductance of several conductors of the same length and cross section is given below with copper as a standard of 100 and the remaining metals arranged in order of descending conductance.

Silver.....	106
Copper.....	100
Copper hard drawn.....	97
Gold.....	78
Aluminium.....	61
Mild Steel.....	12
Lead.....	8

Resistivity (P) and Conductivity (Y)

The resistivity P of a material is its ability to oppose the passage of electric current. Thus, if a conductor has resistance (R) , length (L), and cross sectional area A, its resistivity is expressed as:

$$P = \frac{RA}{L}$$

Conductivity is the reciprocal of resistivity.
A substance that has a high resistivity will have a low conductivity, and vice versa.
Thus, if a conductor has conductance G, length L, and cross-sectional area A,

$$Y = \frac{GL}{A}$$

Inductance (L) and Capacitance (C)

Inductance is the property of an electric circuit that opposes any change in the current through the circuit. That is, if the current increases, a self-induced voltage opposes the change. If current decreases, a self-induced voltage tends to prolong the current flow. The unit for measuring inductance is the henry (H). A henry is the unit employed when the induced electromotive force of one volt is produced by the inducing current changing at the rate of one ampere per second.

Capacitance, on the other hand, is the property of an electric circuit that opposes any change in the circuit, That if applied voltage is increased, capacitance opposes the change and delays the voltage increase across the circuit. The unit of measuring capacitance is the farad (F).

Reactance (X)

If the current applied to the circuit is not dc, the opposition is referred to as inductive reactance X_L . If on the other hand, the opposition is to the applied alternating EMF or voltage, it is referred to as capacitive reactance X_C . Total Reactance X equals the sum of inductive and capacitive reactance, $X_L + X_C$.
Alternating current and voltage are in phase only in a circuit containing pure resistance. Current lags voltage by 90 degrees in a pure inductive circuit and leads voltage by 90 degrees in a pure capacitive circuit.

Impedance (Z)

Impedance is the total opposition to the flow of alternating current in a circuit that contains both resistance R and reactance X. It is expressed in ohms as:

$$Z = \sqrt{R^2 + X^2}$$

Ohm's law for alternating current is similar to Ohm's law for direct current, with the difference that impedance is substituted for resistance in the formula:

$$E = IZ$$

A single-phase circuit is energized by a single alternating voltage. Two phase circuits are a combination of two circuits energized by alternating voltages differing in phase by 90 degrees. Three-phase circuits are a combination of three circuits energized by alternating voltages differing in phase by 120 degrees.

Electromotive Force

- Symbol: E or V
- Units:
- 1 Volt (V) = 10^8 egs electromagnetic units [abvolts]
 - = 0.0033356 egs electrostatic unit [stat volt]
 - = 0.99958 international volt
- 1 kilovolt [kV] = 1000 volts
- 1 millivolt [mv] = 0.001 volt

Current

Symbol:I	
Units:	
1 ampere [amp]	=0.1 egs electromagnetic unit [abampere] =2.998 X 10 ⁹ egs electrostatic units [statamperes]
1 milliampere [mA]	= 1.0001 O international amperes
1 microampere [uA]	=0.001 ampere =0.001 milliampere = 10 ⁻⁶ ampere [one millionth of an ampere]

Frequency

Symbol: f	
Units:	
1 cycle per second [c]	
1 kilocycle per second [kc]	= 1000 cycles per second
1 megacycle per second [mc]	= 1000 kilocycles per second = 10 ⁶ cycles per second

The quantity 2πf which appears often in electrical formulas, is represented by the symbol w. The following are useful values of w.

f	w[=2πf]
25	157
50	314
60	377
1,000	6283
1,000,000	6.283 X 10 ⁶

Power Factor

Symbol=pf
The power factor of an alternating current is the cosine to the angle of phase difference between current and voltage. It can also be defined as the ratio of active power to apparent power in a circuit.

pf=cosØ=P/S

Approx. Voltage Drop Per Amp Per Meter for XLPE Insulated Cables Using CU Conductors

Armoured

Ambient Temperature: 30°C
Conductor Operating Temperature: 90°C

Nominal area of conductor	* Single core		Three core
	Two cables spaced	Three cable trefoil touching	Approximate volt drop per amp per meter
	Approximate volt drop per amp per meter	Approximate volt drop per amp per meter	
mm²	mV/A/m	mV/A/m	mV/A/m
25	0.85	0.74	0.83
35	0.64	0.56	0.62
50	0.5	0.44	0.48
70	0.37	0.32	0.36
95	0.3	0.26	0.28
120	0.25	0.22	0.24
150	0.22	0.19	0.21
185	0.19	0.17	0.18
240	0.16	0.14	0.15
300	0.15	0.13	0.13
400	0.13	0.11	0.12
500	0.12	0.10	-
630	0.11	0.10	-

Un-Armoured

Ambient Temperature: 30°C
Conductor Operating Temperature: 90°C

Nominal area of conductor	* Single core		Three core
	Two cables spaced	Three cable trefoil touching	Approximate volt drop per amp per meter
	Approximate volt drop per amp per meter	Approximate volt drop per amp per meter	
mm²	mV/A/m	mV/A/m	mV/A/m
25	0.85	0.74	0.82
35	0.64	0.56	0.61
50	0.49	0.43	0.47
70	0.37	0.32	0.35
95	0.29	0.25	0.27
120	0.25	0.22	0.22
150	0.21	0.18	0.19
185	0.19	0.17	0.17
240	0.16	0.14	0.14
300	0.14	0.12	0.12
400	0.13	0.11	
500	0.11	0.10	-
630	0.10	0.09	-

*spacings larger than one cable diameter will result in a larger voltage drop.

Approx. Voltage Drop Per Amp Per Meter for XLPE Insulated Cables Using Al Conductors

Armoured

Ambient Temperature: 30°C
Conductor Operating Temperature: 90°C

Nominal area of conductor	*Single core		Three core
	Two cables spaced	Three cable trefoil touching	Approximate volt drop per amp per meter
	Approximate volt drop per amp per meter	Approximate volt drop per amp per meter	
mm²	mV/A/m	mV/A/m	mV/A/m
25	1.34	1.17	1.32
35	1.00	0.87	0.98
50	0.76	0.66	0.74
70	0.55	0.48	0.54
95	0.43	0.38	0.41
120	0.35	0.31	0.34
150	0.30	0.26	0.29
185	0.26	0.23	0.24
240	0.21	0.18	0.20
300	0.19	0.17	0.17
400	0.16	0.14	-
500	0.14	0.12	-
630	0.13	0.11	-

Un-Armoured

Ambient Temperature: 30°C
Conductor Operating Temperature: 90°C

Nominal area of conductor	*Single core		Three core
	Two cables spaced	Three cable trefoil touching	Approximate volt drop per amp per meter
	Approximate volt drop per amp per meter	Approximate volt drop per amp per meter	
mm²	mV/A/m	mV/A/m	mV/A/m
25	1.34	1.17	1.31
35	1.00	0.87	0.97
50	0.76	0.66	0.73
70	0.55	0.48	0.53
95	0.42	0.37	0.40
120	0.35	0.31	0.33
150	0.30	0.26	0.28
185	0.25	0.22	0.23
240	0.21	0.18	0.19
300	0.18	0.16	0.16
400	0.16	0.14	-
500	0.14	0.12	-
630	0.12	0.10	-

*spacings larger than one cable diameter will result in a larger voltage drop.

Rating factors for ambient air temperatures other than 30°C to be applied to the current-carrying capacities for cables in free air, on tray & clipped directly

Ambient temperature (°C)	Insulation
	90°C Thermoset (XLPE)
10	1.15
15	1.12
20	1.08
25	1.04
30	1
35	0.96
40	0.91
45	0.87
50	0.82
55	0.76
60	0.71
65	0.65

Rating factors for ambient ground temperatures other than 20°C to be applied to the current-carrying capacities for cables burried direct in the ground or in an underground conduit system according to BS EN 50086-2-4

Ambient temperature (°C)	Insulation
	90°C Thermoset (XLPE)
10	1.07
15	1.04
20	1.00
25	0.96
30	0.93
35	0.89
40	0.85
45	0.8
50	0.76
55	0.71
60	0.65
65	0.60
70	0.53
75	0.46
80	0.38

Short Circuit Rating Copper Conductor

Characteristics	Annealed Copper	Hard drawn Copper	Cadmium Copper	Hard drawn Aluminium	Aluminium Alloy (in BS 3242)	Galvanized Steel
Conductivity percent	100 (average)	97 (minimum)	79.2 (minimum)	61 (minimum)	53.5	-
Volume resistivity at 20°C ohm-mm ² /m micro ohm/inch'	0.017241 (std.) 0.67879	0.01771 (avg.) 0.69712	0.021769 (max.) 0.85705	0.028264 (max.) 0.85705	0.0322 (std.) 1.2677	-
Mass resistivity at 20°C Ohm/gramme/m ohm-pound/mile	0.15328 875.2	0.15741 898.83	0.076398 436.23	0.076398 436.23	0.08694 496.42	-
Resistance at 20°C ohm-mm ² /km ohm-inch'/1000 yards	17.241 0.024437	17.71 0.025096	28.264 0.040059	28.264 0.040059	32.2 0.045637	-
Density at 20°C Grams/ cm	8.89	8.89	8.94	2.703	2.705	7.78
Weight Kg/mm/km Lb/inch'/1000 yards	8.89 11562	8.89 11562	2.703 3516	2.703 3516	2.705 3518	7.78 11562
Temperature coefficient of resistance at 20°C (68 F) per °C	0.00393	0.00381	0.00403	0.00403	0.0036	-
Coefficient of linear expansion at 20°C (68°F) per' F	17×10 ² 9.44 ×10 ²	17×10 ² 9.44×10 ²	23×10 ² 12.78×10 ²	23×10 ² 12.78×10 ²	12.78×10 ² 23×10 ²	11.510 64×10
Ultimate tensile stress (approximate kgf / mm ² lbf / inch ²	25.3 3600	42.2 60000	16.5 23500	16.5 23500	18.9 26900	136 195000
Modulus of elasticity kgf / mm ² lb / inch ²	9 to 10.5 × 10 ² 13 to 15 × 10 ²	12.66×10 ² 18×10 ²	6.96×10 ² 9.9×10 ²	6.96×10 ² 9.9×10 ²	7.0×10 ² 9.9×10 ²	20.0×10 ² 28×10