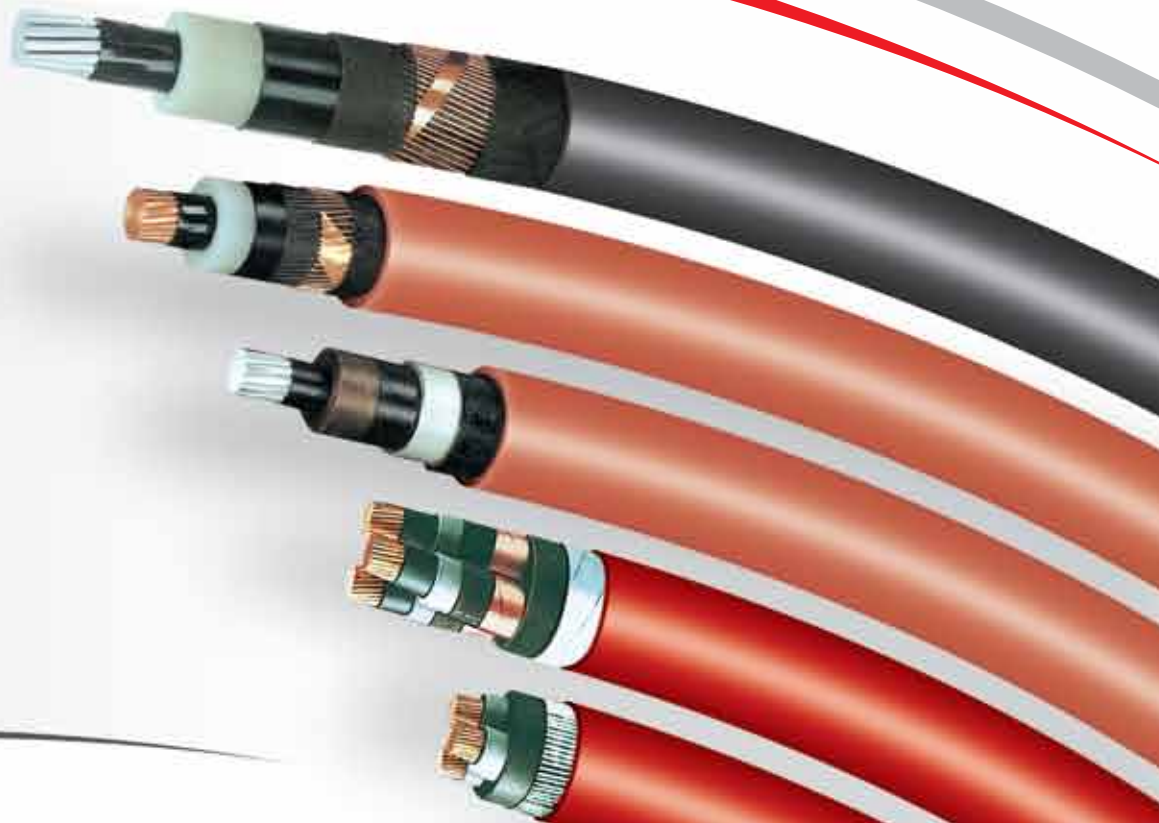


Liban^{saL} Cables

MEDIUM VOLTAGE CABLES

Up to and including 36 KV



Quality • Reliability • Innovation

ISO 9001

BUREAU VERITAS
Certification



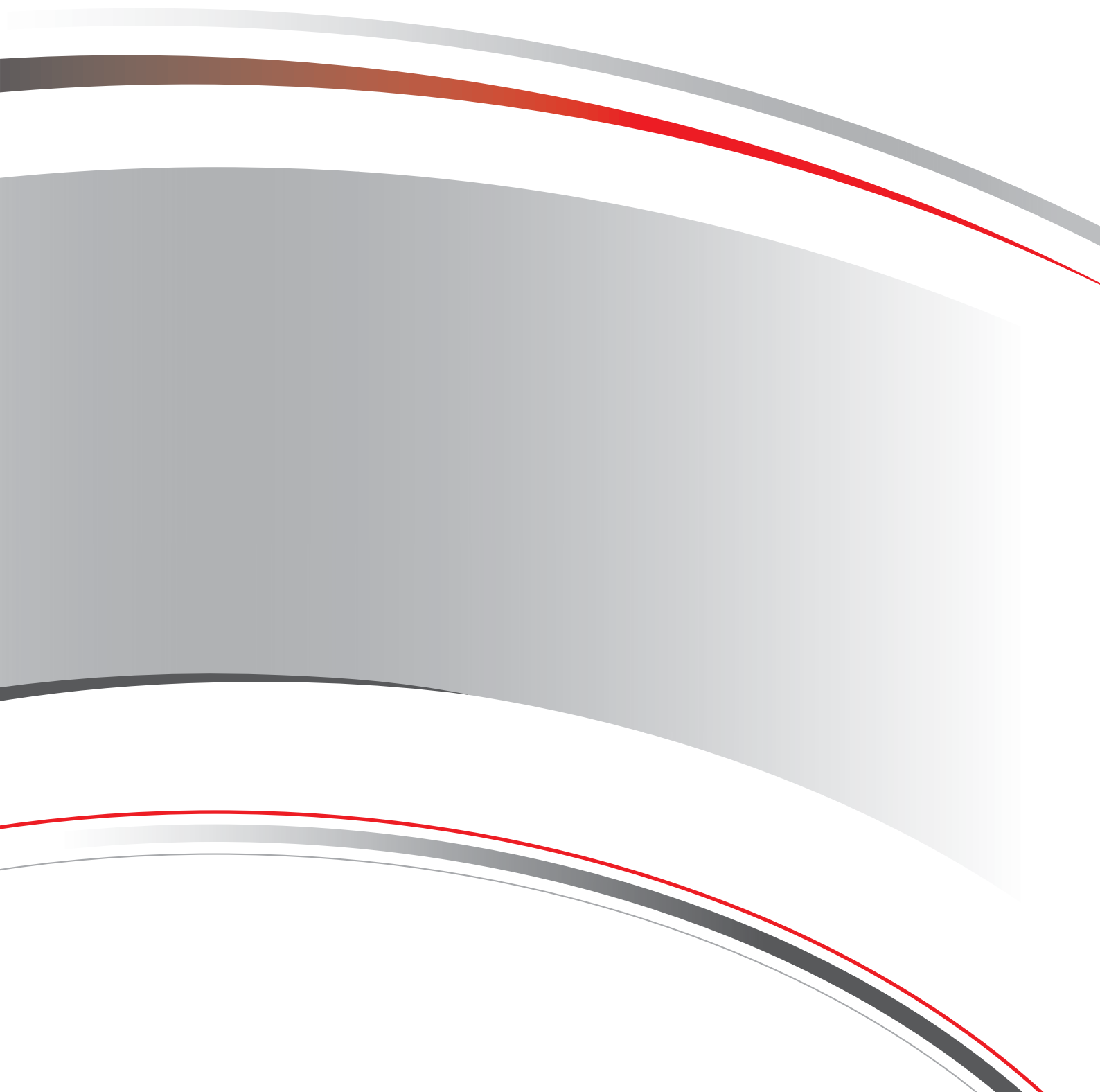
ISO 14001

BUREAU VERITAS
Certification



MEDIUM VOLTAGE CABLES

Up to and including 36 KV



- OUR VALUES

Share Together Our Values

Think Customer/Value People/Commit To Excellence/Take Action/Be Responsible/Work Globally



6 values
to share together

6 Values to share together:

Think Customer

WE PUT OUR CUSTOMERS, AT THE CENTER OF OUR FOCUS, listening relentlessly to them, seeking to understand them fully, anticipating their changing needs and executing flawlessly to deliver superior products, services and value.

Value People

We RECOGNIZE PEOPLE AS THE SOURCE OF OUR SUCCESS. We are reliable, open, honest, trustworthy and respectful to our colleagues and their diversity. We commit to Liban Cables Values. We expect fair treatment, progression and opportunities to develop our competencies.

Commit To Excellence

WE ACHIEVE EXCELLENCE IN OUR PRODUCTS, process and services through shared knowledge, personal development, continuous improvement, safety and best-in-class execution.

Take Action

WE BUILD TOGETHER A DYNAMIC CULTURE that encourages pro-activity, flexibility and innovation in the achievement of our strategic objectives. We anticipate and drive change.

Be Responsible

WE DEMONSTRATE INTEGRITY by taking ownership for what is expected of us and full responsibility for our actions. We conduct business in a safe and ethical manner, respecting the environment and supporting the communities in which we operate.

Work Globally

WE RECOGNIZE THE PRIMACY OF THE GROUP. We work together transversally, collaborating within and across organizational borders. We encourage openness, transparency, and the sharing of information and knowledge

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- NOTICE

As this catalogue is not intended to cover all of LIBAN CABLES SAL possibilities in special cables manufacturing, the hereafter listing of the types of cables is not restrictive but only indicative of the main and most current types we manufacture.

On the other hand, our specification sheets are inspired mainly from International Electrotechnical Commission Specification (IEC) only in order to conform with the sustained trend, noticed both regionally and worldwide, towards these same IEC supposed to inspire any further standardization approaches.

Whereas, in fact some special cables may require special conception, fully within the capabilities of LIBAN CABLES SAL, ISO 9001 certified, precisely because in position to conceive and tailor to your special needs.

That is why, while consulting this brochure, it is important to take into account that any combination or change of the constructional details mentioned in this catalogue remain feasible, on the basis of special conception and development, matching any special or different specifications.

Finally, and within our policy of constant improvement, we reserve the right to alter any part of the information contained in this publication without incurring any obligation. In all cases this brochure being only indicative, and unless expressly agreed upon, it cannot be considered by any mean as contractual document.

The Sheer magnitude and variety of cables used today... Requires a cable manufacturer with vision... Along with extensive production & service capability...

Having more than **45** years of experience, Liban Cables provides complete expertise in cables and cabling systems, starting with systems' original conception and design of products as well as solutions up to manufacturing a complete range of high quality cables. Liban Cables facilities operate under ISO:9001 and ISO:14001 High Standards.

Vision

Providing our clients with the best possible services and products since their satisfaction is our utmost priority.

Mission

Quality, Reliability and Innovation are the bases of our strategy.

CSR

Our Corporate Social Responsibility, Standards and Values are the key Factors that makes us committed to eliminate all risks affecting environment as well as our employees' safety.

Liban Cables offers:

- Wide choice of building and industrial cables
- Complete range of LV/MV/HV cables
- Different types and sizes of infrastructure cables (up to 220 KV)

Liban Cables, enhances both living and workplace. This variety of cables requires a cables manufacturer with an exceptional experience.

Liban Cables was founded in 1967 by a group of Lebanese industrialists backed up by the technical assistance of two international leading firms:

- Les Cables de Lyon - France (Became Alcatel afterwards & Nexans in 2000)
- Phelps Dodge - USA

Staffed with qualified engineers and highly skilled technicians, our plant is located in Nahr Ibrahim at 45 KM North of Beirut, where cables are designed and manufactured according to all international specifications: IEC, VDE, UTE, BS and others on customer request.

2 • QUALITY ASSURANCE

To satisfy our customers expectations for Quality, Safety, Reliability and Service; Liban Cables is committed to provide products and services of the highest possible Standards.

Raw material are continuously and repetitively tested from trial orders till the last batch received afterwards.

In addition to the final tests carried out on finished products, work in process, is already tested within two simultaneous procedures:

- A built-in quality control system is carried out by the production itself at any step of work in process.
- A parallel and contradictory procedure is also carried out on the same stages and products by independent inspectors reporting to the quality control service.

End users and/or third part inspection authorities are also constantly commissioning the finished products and assessing the strict conformity to ordered specifications.

Quality Management System:

Liban Cables has a Quality Control System implemented at the factory on all manufacturing stages and on our Final Product Stages. Developing innovation, achieving quality, meeting deadlines & providing services are our key priorities to satisfy our customers.

We make sure to increase **production efficiency** and **speed delivery**, while assuring the highest levels of **quality, safety, security** and **reliability**. All our facilities operate under the highest ISO:9001 Standards and we are fully committed to continuously improve the effectiveness of the Quality Management System, On-Time Delivery and Cost Effectiveness.

Quality is not another goal; It is at the core of our performance.

3 • ENVIRONMENT POLICY

Liban Cables is stepping up its efforts to reduce its impact on the environment via an environmental management system that is currently in operation at all of its sites.

Strict environmental management:

Liban Cables **environmental and safety policy** include a thorough **assessment of industrial risks** associated with the company's products and manufacturing processes, a **continuous improvement program** and employee **training courses on environmental best practices**.

The **Company Environmental Manual** outlines the objectives, procedures and tools available to each site. A **dedicated Intranet site** is available allowing employees to access all of the Company environment-related data and share best practices, which are organized by subject matter. In addition, all our facilities operate under the highest **ISO:14001** Standards.

The safety of our employees and visitors is our priority. We conduct business in a safe and ethical manner, respecting the environment and supporting the communities in which we operate.

Liban Cables is committed to the protection of the environment at locations where design, manufacturing, storage and delivery of electrical and communication cables are performed.

4 • RECOMMENDED ORDERING PARAMETERS

For prompt quotation / supplies please make sure your inquiries and your orders are securing the following data:

- 1 - International or Special Standard. (Alternatively, the precise usage of the cable.)
- 2 - Rated voltage.
- 3 - Copper or Aluminum conductors.
- 4 - Size of each conductor.
- 5 - Insulation material: XLPE or others.
- 6 - Number and identification of conductors.
- 7 - Other requirements.
- 8 - Packing.
- 9 - Required delivery time.
- 10 - Required validity.

5 • GENERALITIES

• 5.1 - CHOICE OF VOLTAGE

The rated voltage is specified as U_0 / U where:

U_0 is the rated voltage between conductor and screen or outer metallic protection.

U is the rated voltage between any two conductors.

In three phase systems U_0 is $U / \sqrt{3}$

The voltage of the cable must be chosen according to the maximum voltage U_m in normal working conditions, which must not exceed the rated voltage by more than 20%.

The following table gives the maximum permissible operating voltage relative to each rated voltage (U_0 / U).

Rated voltage U_0/U (Kv)	Max. voltage U_m (KV)
1.8 / 3	3.6
3.6 / 6	7.2
6 / 10	12
8.7 / 15	17.5
12 / 20	24
18 / 30	36

• 5.2 - DETERMINATION OF THE CROSS SECTIONAL AREA

The determination of the cross sectional area depends on the:

- Current carrying capacities in continuous loading,
- Permissible short-circuit current,
- Conditions of installation (temperature, spacing, ...).

• 5.3 - CURRENT CARRYING CAPACITIES

The heat produced by the cable under the set conditions must be able to dissipate to the ambient environment at any point of the cable installation; therefore the loading of the cable must be limited accordingly. The current carrying capacities shown in the electrical characteristics tables are calculated according to the internationally adopted method of the IEC publication 60287 for a maximum core temperature of 90° C, at the following installation conditions:

◦ 5.3.1. BURIED CABLES

The stated values are for cables or ducts placed in the ground at a depth of 800 mm of average thermal resistivity of 100°C.cm/w and spaced so that the temperature rise in each duct has no effect on the other ducts (space being greater than 1 meter), for a soil temperature of 20°C.

Where the thermal resistivity is different (not 100° C.cm/w) the current rating should be multiplied by the correction factors shown in the following table.

Correction factor for different soil thermal resistivity

<i>Nature of the soil</i>	<i>Soil thermal resistivity °C.cm/w</i>	<i>Correction factor</i>
Very wet soil	40	1.25
	50	1.21
	70	1.13
Normal soil	85	1.05
	100	1.00
Dry soil	120	0.94
	150	0.86
Very dry soil	200	0.76
	250	0.70
	300	0.65

Where the temperature of the soil is different (not 20°C) the current rating should be multiplied by the following correction factors.

Correction factor for different soil temperature

<i>Soil temperature (°C)</i>	<i>Carrying core temperature (°C)</i>								
	65	70	75	80	85	90	95	100	105
0	1.20	1.18	1.17	1.15	1.14	1.13	1.13	1.12	1.11
5	1.15	1.14	1.13	1.12	1.11	1.10	1.10	1.09	1.08
10	1.11	1.10	1.09	1.08	1.07	1.07	1.06	1.06	1.06
15	1.05	1.05	1.04	1.04	1.04	1.04	1.03	1.03	1.03
20	1	1	1	1	1	1	1	1	1
25	0.94	0.95	0.95	0.96	0.96	0.96	0.97	0.97	0.97
30	0.88	0.89	0.90	0.91	0.92	0.93	0.93	0.94	0.94
35	0.82	0.84	0.85	0.87	0.88	0.89	0.89	0.90	0.91
40	0.75	0.77	0.80	0.82	0.83	0.85	0.86	0.87	0.87
45	0.67	0.71	0.74	0.76	0.78	0.80	0.82	0.83	0.84
50	0.58	0.63	0.67	0.71	0.73	0.76	0.77	0.79	0.80

When several cables or ducts are laid underground with less than one meter spacing the current rating values should be multiplied by the following correction factors:

Correction factor of proximity effect for underground cables

<i>Single or multicore cables</i>					
<i>Number of circuits</i>	<i>Touching cables</i>	<i>One diameter spaced cables a = D</i>	<i>a = 0.25m</i>	<i>a = 0.5m</i>	<i>a = 1.0m</i>
2	0.76	0.79	0.84	0.88	0.92
3	0.64	0.67	0.74	0.79	0.85
4	0.57	0.61	0.69	0.75	0.82
5	0.52	0.56	0.65	0.71	0.80
6	0.49	0.53	0.60	0.69	0.78

D = overall outer sheath diameter a = Space between cables

◦ 5.3.2. CABLES LAID "IN AIR":

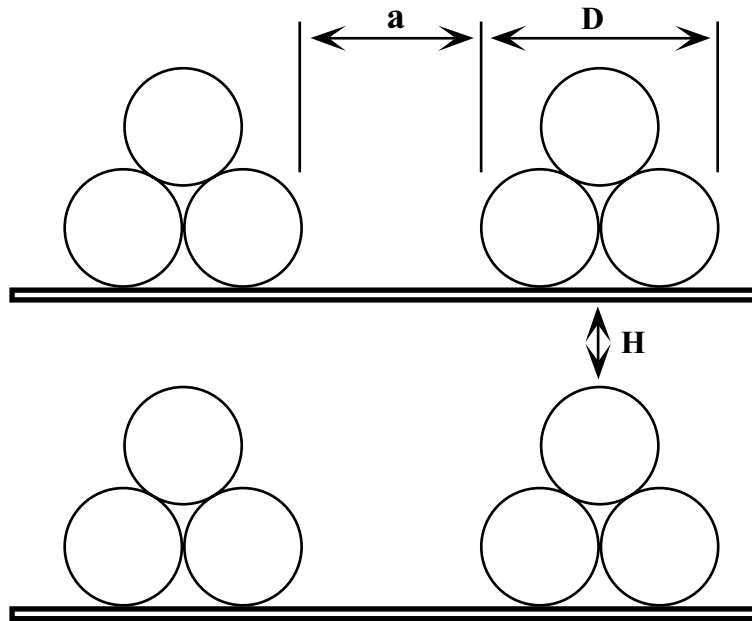
The stated values are for cables or ducts laid "in air" with an ambient temperature of 30°C and out of direct sunlight, spaced so that the temperature rise of individual cables has no influence on others. The spacing between adjacent cables is at least twice the cable or duct diameter.

When the ambient temperature is different (not 30°C) the current rating values should be multiplied by the following correction factors:

Correction factor for different ambient temperature

<i>Ambient temperature (°C)</i>	<i>Carrying core temperature (°C)</i>								
	65	70	75	80	85	90	95	100	105
0	1.36	1.32	1.29	1.26	1.24	1.22	1.21	1.20	1.18
5	1.31	1.27	1.25	1.22	1.21	1.19	1.18	1.16	1.15
10	1.25	1.22	1.20	1.18	1.17	1.15	1.14	1.13	1.13
15	1.20	1.17	1.15	1.14	1.13	1.12	1.11	1.10	1.10
20	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.07	1.06
25	1.07	1.06	1.05	1.05	1.04	1.04	1.04	1.04	1.03
30	1	1	1	1	1	1	1	1	1
35	0.93	0.94	0.94	0.95	0.95	0.96	0.96	0.96	0.97
40	0.85	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.93
45	0.76	0.79	0.82	0.84	0.85	0.87	0.88	0.89	0.89
50	0.65	0.71	0.75	0.77	0.80	0.82	0.83	0.85	0.86
55	0.53	0.61	0.67	0.71	0.74	0.76	0.78	0.80	0.82
60	0.38	0.50	0.58	0.63	0.67	0.71	0.73	0.76	0.77
65		0.35	0.47	0.55	0.60	0.65	0.68	0.71	0.73
70			0.33	0.45	0.52	0.58	0.62	0.65	0.68
75				0.32	0.43	0.50	0.55	0.60	0.63
80					0.30	0.41	0.48	0.53	0.58
85						0.29	0.39	0.46	0.52
90							0.28	0.38	0.45
95								0.27	0.37
100									0.26

When several cables or ducts are grouped, the current ratings values should be corrected as follows:



SINGLE CORE CABLES

Method of laying	Number of layers	Number of ducts			
		1	2	3	
Touching	1	0.97	0.89	0.87	3 cables in horizontal layer
	2	0.94	0.85	0.81	
	3	0.93	0.84	0.79	
One diameter spaced cables $a = D$	1	1.0	0.98	0.96	3 cables in triangular formation
	2	0.97	0.93	0.89	
	3	0.96	0.92	0.86	

MULTICORE CABLES

Method of laying	Number of layers	Number of ducts				
		1	2	3	4	6
Touching	1	1.0	0.88	0.82	0.78	0.76
	2	1.0	0.87	0.80	0.76	0.73
	3	1.0	0.86	0.79	0.75	0.71
One diameter spaced cables $a = D$	1	1.0	1.0	0.98	0.95	0.91
	2	1.0	0.98	0.86	0.92	0.87
	3	1.0	0.98	0.95	0.91	0.85

Note: the space H between layers must not be less than 30cm

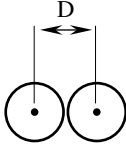
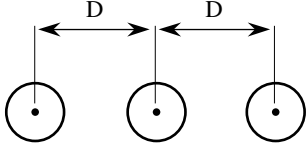
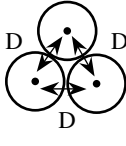
• 5.4 - INDUCTANCE

The Inductance L depends on the geometrical characteristics of the cable as well as the disposition of conductors

for unarmoured cables: $L = 0.05 + 0.46 \text{ Log}_{10} \frac{D_m}{r}$ (mH / Km)

where: r = Conductor Radius

D = Distance between Conductors

Single phase system	Three phase system flat formation	Three phase system trefoil formation
		
D _m = D	D _m = 1,26 D	D _m = D

For armoured Cables increase the inductance of about 10%

• 5.5 - CAPACITANCE

$$C = \frac{2.3}{18 L_n \frac{D}{d}}$$

d = Diameter of conductor (including the eventual semi-conductive layer)

D = Diameter of insulated Conductor

• 5.6 - CONDUCTORS SHORT - CIRCUIT CURRENT:

Current densities given in the table below are in (A/mm²), for a maximum conductor temperature of 250°C at the end of the short - circuit.

Temperature of conductor before overload T (°C)	Current density (A/mm ²)									
	Conductor metal									
	Copper					Aluminum				
	overload time in secs									
	0.1	0.5	1	2	5	0.1	0.5	1	2	5
20	556	249	176	124	78	366	164	116	82	51
30	537	241	170	120	76	354	159	112	79	50
70	464	207	147	103	65	325	145	103	72	46
90	439	196	139	98	62	287	128	91	64	40

For an overload duration (t) different than those figured in the above table, the correspondant current density is given by the following formula:

Current density for a duration (t) = $\frac{\text{Current density for 1 sec}}{\sqrt{t}}$

• 5.7 - SCREEN SHORT-CIRCUIT CURRENT

Following short-circuit current in Ampere, are approximative, calculated for copper tape screen of 0.1mm thickness applied helically with about 10% overlapping.

Nominal Conductor cross section	0.5 second			1 second			2 seconds		
	Specified Voltage, KV								
in mm ²	8.7/15(17.5)	12/20(24)	18/30(36)	8.7/15(17.5)	12/20(24)	18/30(36)	8.7/15(17.5)	12/20(24)	18/30(36)
16	1500	1800		1150	1350		900	1050	
25	1550	1800		1200	1350		920	1050	
35	1650	1800		1250	1350		970	1050	
50	1750	2000	2550	1300	1500	1950	1000	1200	1500
70	1950	2150	2600	1500	1650	2000	1150	1300	1550
95	2100	2300	2950	1600	1750	2250	1250	1350	1800
120	2250	2400	3050	1700	1850	2350	1350	1450	1850
150	2350	2550	3200	1800	1950	2400	1400	1500	1920
185	2550	2900	3500	1950	2250	2700	1500	1800	2150
240	2950	3150	3750	2250	2450	2900	1800	1950	2300
300	3150	3500	3950	2450	2750	3050	1900	2200	2450

• 5.8 - MINIMUM BENDING RADIUS

Listed values represent the permanent bending radius the cables withstand in fixed installation and on dispatching reels. Other constraints may impose greater bending radius.

	Cable on drum	Cable during installation	Installed Cable
Armoured single core	8 D	16 D	8 D
Unarmoured single core	10 D	20 D	10 D
Armoured multi core	7D	14 D	7 D
Unarmoured multi core	8 D	16 D	8 D

D = Overall diameter in mm

6 • OUR TYPE AND CODE DESIGNATION

The type designation is a combination of abbreviations indicating the type, voltage and the main constructional elements of the cable as follows:

- The first symbol is the letter M for Medium voltage cables
- The second symbol is a number (n) from 1 to 6 indicating the voltage as follows:

1	for	1.8/3	(3.6)	kV
2	for	3.6/6	(7.2)	kV
3	for	6/10	(12)	kV
4	for	8.7/15	(17.5)	kV
5	for	12/20	(24)	kV
6	for	18/30	(36)	kV

- The third symbol is a letter indicating the type of metal of the conductor as follows:

N	for	Copper conductor
A	for	Aluminum conductor

- The fourth symbol is a number indicating the type of the insulation screen as follows:

2	Semi-conductor bonded + copper tape
3	Semi-conductor strippable + copper tape
4	Semi-conductor bonded + copper wires
5	Semi-conductor strippable + copper wires
6	Semi-conductor bonded collective copper wires
7	Semi-conductor bonded + aluminum tape
8	Semi-conductor bonded + lead
9	Grooved semi-conductor

Note: For cables up to and including 3.6 kV where the insulation screen is not required, this number does not exist.

- The fifth, sixth and seventh abbreviations are eventual letters indicating the following:

L	For lead sheath global protection
B	For steel tape armouring
G	For galvanized steel tape armouring
R	For galvanized round steel wire armouring
F	For flat steel wire armouring
A	For aluminum tape armouring
W	For round aluminum wire armouring

Examples: **M3A2B:** Medium voltage cable, 6/10 (12) kV, aluminum conductor, XLPE insulation, bonded semi-conductor plus copper tape insulation screen, steel tape armour.

M5N3LR: Medium voltage cable, 12/20(24) kV, copper conductor, XLPE insulation, strippable semi-conductor plus copper tape insulation screen, lead sheath, galvanized round steel wire armour.

7 • SINGLE CORE AND THREE CORE MEDIUM VOLTAGE CABLES

According to international standard IEC 60502 - 1

7.1 • 1.8/3 (3.6) KV CABLES XLPE INSULATED, PVC OR PE SHEATHED

◦ 1. SCOPE

This specification covers single core cables and three core armoured or unarmoured cables, rated at 1.8/3 (3.6) KV conforming to IEC 60502-1 Specifications.

◦ 2. CONSTRUCTION

2.1 *Conductor*

Plain, annealed electrolytic copper or Aluminum conductors, circular stranded, conforming to the applicable requirements of IEC 60228.

2.2 *Insulation*

XLPE thermosetting material conforming to the applicable requirements of IEC 60502-1 (flame retardant XLPE for specific applications).

2.3 *Assembly*

Insulated conductors are laid up, filled where necessary with non hygroscopic material, and covered with an extruded thickness of thermoplastic material, or binding tape.

2.4 *Armour*

Two layers of steel tape, (non magnetic tape for 1 core cables) conforming to the applicable requirements of IEC 60502-1 recommendations.

Flat or round wires armouring can be provided upon specific customer requirements.

2.5 *Sheath*

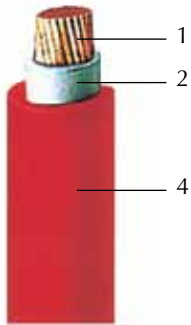
PVC or PE (halogen free or fire retardant compound on special request) thermoplastic material, conforming to the applicable requirements of IE 60502-1.

◦ 3. TESTS

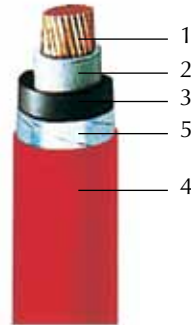
All tests required by the IEC 60502-1 either on raw material or on finished products.

SINGLE CORE CABLES

1.8 / 3 (3.6) KV



- M1N
- M1A



- M1NA
- M1AA



- M1NW
- M1AW

1. Stranded copper or aluminum conductor

2. XLPE Insulation

3. Bedding

4. PVC Sheath

5. Double aluminum tape armour

6. Round aluminum wire armour

THREE CORE CABLES

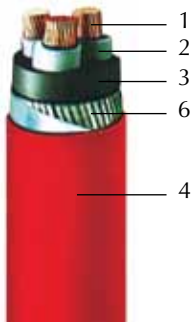
1.8 / 3 (3.6) KV



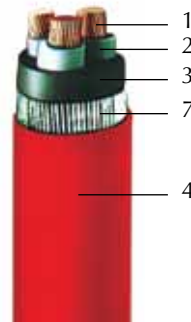
- M1N
- M1A



- M1NB
- M1AB



- M1NFG
- M1AFG



- M1NR
- M1AR

1. Stranded copper or aluminum conductor
2. XLPE Insulation
3. Bedding
4. PVC Sheath

5. Double steel tape armour
6. Galvanized flat steel strip armour with flat steel tape applied in helical form
7. Galvanized round steel wire armour

Note: Different constructions remain possible on special request.

1.8/3 (3.6) KV - SINGLE CORE, XLPE INSULATED, PVC SHEATHED

UNARMoured CABLES

Type M1N, M1A - Conforming to IEC 60502-1

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
10	2.0	-	1.4	3.82	7.82	11	90	190	28	130	1000
16	2.0	-	1.4	4.83	8.83	12	142	255	43	160	1000
25	2.0	-	1.4	6.02	10.02	13	224	355	68	200	1000
35	2.0	-	1.4	7.15	11.15	15	311	455	95	240	500
50	2.0	-	1.4	8.3	12.3	16	421	580	128	290	500
70	2.0	-	1.5	10.0	14.0	18	608	800	185	375	500
95	2.0	-	1.5	11.8	15.8	19	843	1060	256	475	500
120	2.0	-	1.6	13.3	17.3	21	1065	1320	324	570	500
150	2.0	-	1.6	14.8	18.8	23	1307	1580	398	665	500
185	2.0	-	1.7	16.55	20.55	25	1640	1950	499	805	500
240	2.0	-	1.8	18.73	22.73	27	2098	2450	638	990	500
300	2.0	-	1.8	21.3	25.3	29	2646	3040	804	1200	500
400	2.0	-	1.9	24.1	28.1	33	3460	3910	1051	1500	500
500	2.2	-	2.0	27.3	31.7	36	4361	4910	1325	1870	500
630	2.4	-	2.2	31.0	35.8	41	5631	6300	1710	2370	500
800	2.6	-	2.3	37.1	42.3	47	7203	8050	2188	3020	500
1000	2.8	-	2.4	41.6	47.2	53	9080	10050	2758	3740	500

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Current carrying capacity **					
			Underground Cable		Cables in air		Cables in duct	
	Copper	Alu	Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	Amp	Amp	Amp	Amp	Amp	Amp
10	1.83	3.08	90	75	95	75	80	70
16	1.15	1.91	120	95	125	95	105	85
25	0.727	1.20	160	125	165	125	140	105
35	0.524	0.868	195	150	200	150	165	125
50	0.387	0.641	230	180	235	185	200	155
70	0.268	0.443	285	220	295	230	250	195
95	0.193	0.320	340	260	360	280	305	240
120	0.153	0.253	385	300	420	325	350	275
150	0.124	0.206	430	335	475	370	395	310
185	0.0991	0.164	485	380	550	425	465	365
240	0.0754	0.125	560	440	650	510	550	430
300	0.0601	0.100	630	500	740	580	635	495
400	0.0470	0.0778	720	570	860	680	740	580
500	0.0366	0.0605	800	640	990	790	855	670
630	0.0283	0.0469	910	740	1140	920	1000	780
800	0.0221	0.0367	1000	830	1300	1070	1165	910
1000	0.0176	0.0291	1085	920	1450	1220	1340	1090

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

1.8/3 (3.6) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED

UNARMoured CABLES

Type M1N, M1A - Conforming to IEC 60502-1

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
10	2.0	-	1.8	3.82	7.82	22	270	585	82	400	500
16	2.0	-	1.8	4.83	8.83	24	429	795	130	500	500
25	2.0	-	1.8	6.02	10.02	26	679	1110	206	635	500
35	2.0	-	1.8	7.15	11.15	29	941	1420	286	760	500
50	2.0	-	1.9	8.3	12.3	31	1274	1830	387	940	500
70	2.0	-	2.0	10.0	14.0	35	1841	2500	559	1220	500
95	2.0	-	2.2	11.8	15.8	40	2552	3360	776	1580	500
120	2.0	-	2.3	13.3	17.3	43	3227	4130	980	1880	250
150	2.0	-	2.4	14.8	18.8	46	3960	4990	1204	2230	250
185	2.0	-	2.5	16.55	20.55	50	4969	6150	1510	2680	250
240	2.0	-	2.7	18.73	22.73	56	6357	7750	1931	3320	250
300	2.0	-	2.8	21.3	25.3	61	8017	9630	2435	4050	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Current carrying capacity **					
			Underground Cable		Cables in air		Cables in duct	
	Copper	Alu	Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	Amp	Amp	Amp	Amp	Amp	Amp
10	1.83	3.08	90	75	90	70	75	65
16	1.15	1.91	120	95	120	90	100	80
25	0.727	1.20	155	120	155	115	130	100
35	0.524	0.868	190	150	190	145	160	125
50	0.387	0.641	225	175	225	175	190	145
70	0.268	0.443	275	215	280	215	235	185
95	0.193	0.320	330	255	340	260	285	225
120	0.153	0.253	370	290	385	300	325	255
150	0.124	0.206	420	325	445	345	375	295
185	0.0991	0.164	470	365	510	395	430	335
240	0.0754	0.125	540	425	590	465	505	395
300	0.0601	0.100	620	485	675	530	580	450

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α : Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

1.8/3 (3.6) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED

DOUBLE STEEL TAPE ARMoured CABLES

Type M1NB, M1AB - Conforming to IEC 60502-1

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
10	2.0	1.0	1.8	3.82	7.82	24	270	825	82	635	500
16	2.0	1.0	1.8	4.83	8.83	27	429	1060	130	760	500
25	2.0	1.0	1.9	6.02	10.02	29	679	1410	206	940	500
35	2.0	1.1	1.9	7.15	11.15	32	941	1770	286	1110	500
50	2.0	1.1	2.0	8.3	12.3	35	1274	2200	387	1320	500
70	2.0	1.2	2.2	10.0	14.0	40	1841	3310	559	2030	500
95	2.0	1.3	2.3	11.8	15.8	44	2552	4260	776	2480	500
120	2.0	1.3	2.4	13.3	17.3	48	3227	5100	980	2860	250
150	2.0	1.4	2.5	14.8	18.8	52	3960	6050	1204	3310	250
185	2.0	1.5	2.7	16.55	20.55	56	4969	7350	1510	3910	250
240	2.0	1.6	2.8	18.73	22.73	61	6357	9100	1931	4660	250
300	2.0	1.6	3.0	21.3	25.3	67	8017	11150	2435	5550	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Current carrying capacity **					
			Underground Cable		Cables in air		Cables in duct	
	Copper	Alu	Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	Amp	Amp	Amp	Amp	Amp	Amp
10	1.83	3.08	90	75	90	70	75	65
16	1.15	1.91	120	95	120	90	100	80
25	0.727	1.20	155	120	155	115	130	100
35	0.524	0.868	190	150	190	145	160	125
50	0.387	0.641	225	175	225	175	190	145
70	0.268	0.443	275	215	280	215	235	185
95	0.193	0.320	330	255	340	260	285	225
120	0.153	0.253	370	290	385	300	325	255
150	0.124	0.206	420	325	445	345	375	295
185	0.0991	0.164	470	365	510	395	430	335
240	0.0754	0.125	540	425	590	465	505	395
300	0.0601	0.100	620	485	675	530	580	450

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

7.2 • XLPE INSULATED, SCREENED, PVC OR PE SHEATHED CABLES FOR VOLTAGES UP TO AND INCLUDING 36 KV

◦ 1. SCOPE

This specification covers single core cables and three core cables, armoured or unarmoured with or without lead sheath, rated at voltages up to and including 36 KV conforming to IEC 60502-2.

◦ 2. CONSTRUCTION

2.1 Conductor

Plain, annealed electrolytic copper or Aluminum conductors, circular stranded conforming to the applicable requirements of IEC 60228.

2.2 Conductor Screening

Semi-conducting layer or lapped, completely covering the conductors, conforming to the applicable to the requirements of IEC 60502-2 recommendations.

2.3 Insulation

XLPE thermosetting material conforming to the applicable requirements of IEC 60502-2.

2.4 Insulation Screening

Semi conducting layer extruded (bonded or strippable) or lapped, completely covering the insulated conductors, and a copper or aluminum tape or wire completely covering the semi-conducting layer, conforming to the applicable requirements of IEC 60502-2 recommendations.

2.5 Assembly

Insulated and screened conductors are laid up, filled where necessary with non hygroscopic material and covered with an extruded thickness of thermoplastic material, or binding tape.

2.6 Lead Sheath (for special use)

Extruded lead alloy sheath, conforming to the applicable requirement of IEC 60502-2 recommendations.

2.7 Armour

Two layers of steel tape (non magnetic tape for 1 core cables), conforming to the applicable requirements of IEC 60502-2 recommendation.

Flat or round wires armouring can be provided upon specific customer requirements.

2.8 Sheath

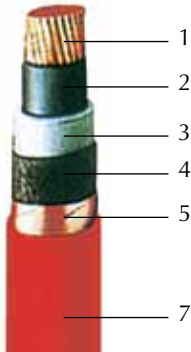
PVC or PE (halogen free or fire retardant compound on special request) thermoplastic material conforming to the applicable requirements of IEC 60502-2.

◦ 3. TESTS

All tests required by the IEC 60502-2, either on raw materials or on finished products.

SINGLE CORE CABLES

From 6 to 36 KV



- M2N - M2A
- M3N - M3A
- M4N - M4A
- M5N - M5A
- M6N - M6A



- M2NA - M2AA
- M3NA - M3AA
- M4NA - M4AA
- M5NA - M5AA
- M6NA - M6AA



- M2NW - M2AW
- M3NW - M3AW
- M4NW - M4AW
- M5NW - M5AW
- M6NW - M6AW



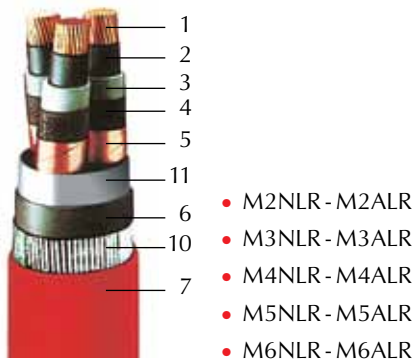
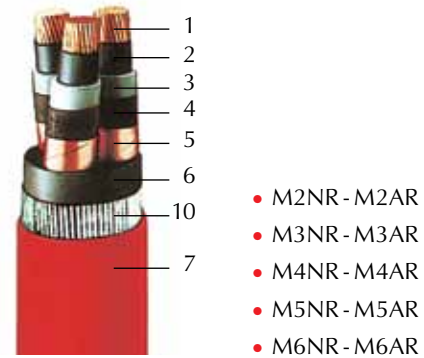
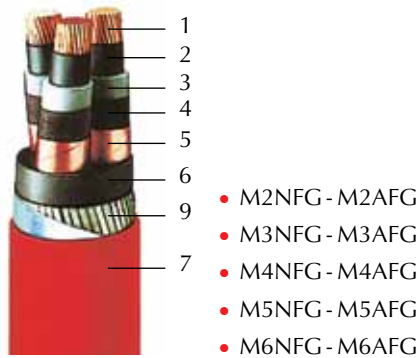
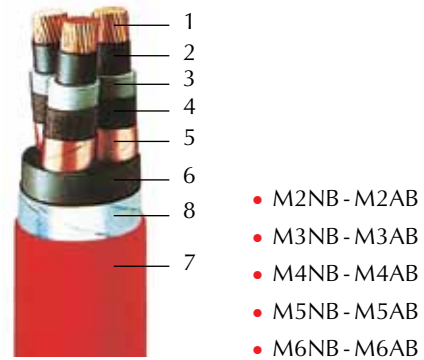
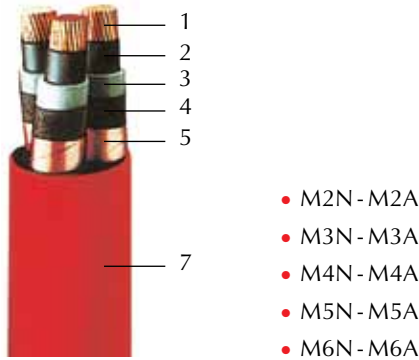
- M2NLW - M2ALW
- M3NLW - M3ALW
- M4NLW - M4ALW
- M5NLW - M5ALW
- M6NLW - M6ALW

1. Stranded copper or aluminum conductor
2. Conductor screen
3. XLPE Insulation
4. Insulation screen
5. Copper or aluminum tape or wires screen

6. Bedding
7. PVC sheath
8. Double aluminum tape armour
9. Round aluminum wire armour
10. Lead sheath / screen

THREE CORE CABLES

From 6 to 36 KV



1. Stranded copper or aluminum conductor
2. Conductor screen
3. XLPE insulation
4. Insulation screen
5. Copper or aluminum tape or wires screen
6. Bedding
7. PVC sheath
8. Double steel tape armour
9. Galvanized flat steel strips armour with flat steel tape applied in helical form
10. Galvanized round steel wire armour
11. Lead sheath

Notes : 1 - Different constructions remain possible on special request.

2 - Lead sheathed cables are also available.

3.6/6 (7.2) KV - SINGLE CORE, XLPE INSULATED, PVC SHEATHED

SCREENED, UNARMoured CABLES

Type M2N, M2A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
10	2.5	-	1.4	3.82	9.82	15	90	310	28	245	500
16	2.5	-	1.4	4.83	10.83	16	142	385	43	285	500
25	2.5	-	1.5	6.02	12.02	17	224	500	68	350	500
35	2.5	-	1.5	7.15	13.15	19	311	610	95	400	500
50	2.5	-	1.6	8.3	14.3	20	421	755	128	465	500
70	2.5	-	1.6	10.0	16.0	22	608	985	185	560	500
95	2.5	-	1.7	11.8	17.8	24	843	1270	256	685	500
120	2.5	-	1.7	13.3	19.3	25	1065	1530	324	790	500
150	2.5	-	1.8	14.8	20.8	27	1307	1820	398	910	500
185	2.5	-	1.8	16.55	22.55	29	1640	2200	499	1050	500
240	2.6	-	1.9	18.73	24.93	31	2098	2740	638	1280	500
300	2.8	-	2.0	21.3	27.9	35	2646	3420	804	1570	500
400	3.0	-	2.1	24.1	31.3	37	3460	4280	1051	1870	500
500	3.2	-	2.2	27.3	34.9	41	4361	5300	1325	2280	500
630	3.2	-	2.3	31.0	39.0	45	5631	6700	1710	2780	500
800	3.2	-	2.5	37.1	45.0	51	7203	8500	2188	3480	500
1000	3.2	-	2.6	41.6	49.6	56	3080	10550	2758	4200	500

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance		Nominal capacity	Current carrying capacity **					
	Copper	Alu	Trefoil formation	Flat formation		Underground Cable		Cables in air		Cables in duct	
						Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
10	1.83	3.08	0.462	0.646	0.169	90	75	95	75	80	70
16	1.15	1.91	0.428	0.612	0.195	120	95	125	95	105	85
25	0.727	1.20	0.396	0.580	0.225	160	125	165	125	140	105
35	0.524	0.868	0.384	0.568	0.254	195	150	200	150	165	125
50	0.387	0.641	0.364	0.549	0.283	230	180	235	185	200	155
70	0.268	0.443	0.346	0.531	0.325	285	220	295	230	250	195
95	0.193	0.320	0.330	0.515	0.370	340	260	360	280	305	240
120	0.153	0.253	0.315	0.499	0.407	385	300	420	325	350	275
150	0.124	0.206	0.308	0.493	0.444	430	335	475	370	395	310
185	0.0991	0.164	0.301	0.485	0.487	485	380	550	425	465	365
240	0.0754	0.125	0.289	0.474	0.523	560	440	650	510	550	430
300	0.0601	0.100	0.288	0.472	0.548	630	500	740	580	635	495
400	0.0470	0.0778	0.274	0.459	0.598	720	570	860	680	740	580
500	0.0366	0.0605	0.270	0.454	0.631	800	640	990	790	855	670
630	0.0283	0.0469	0.263	0.448	0.711	910	740	1140	920	1000	780
800	0.0221	0.0367	0.252	0.437	0.832	1000	830	1300	1070	1165	910
1000	0.0176	0.0291	0.248	0.433	0.923	1090	920	1450	1220	1340	1090

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α : Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

**3.6/6 (7.2) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, UNARMoured CABLES**

Type M2N, M2A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
10	2.5	-	1.9	3.82	9.82	30	270	1000	82	815	500
16	2.5	-	2.0	4.83	10.83	32	429	1250	130	945	500
25	2.5	-	2.1	6.02	12.02	35	679	1620	206	1140	500
35	2.5	-	2.1	7.15	13.15	38	941	1970	286	1310	500
50	2.5	-	2.2	8.3	14.3	40	1274	2420	387	1530	500
70	2.5	-	2.3	10.0	16.0	44	1841	3180	559	1900	500
95	2.5	-	2.5	11.8	17.8	48	2552	4090	776	2310	500
120	2.5	-	2.6	13.3	19.3	52	3227	4940	980	2690	250
150	2.5	-	2.7	14.8	20.8	55	3960	5850	1204	3080	250
185	2.5	-	2.8	16.55	22.55	59	4969	7050	1510	3570	250
240	2.6	-	3.0	18.73	24.93	65	6357	8750	1931	4340	250
300	2.8	-	3.2	21.3	27.9	73	8017	10950	2435	5400	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
10	1.83	3.08	0.408	0.169	90	75	90	70	75	65
16	1.15	1.91	0.378	0.195	120	95	120	90	100	80
25	0.727	1.20	0.352	0.225	155	120	155	115	130	100
35	0.524	0.868	0.334	0.254	190	150	190	145	160	125
50	0.387	0.641	0.319	0.283	225	175	225	175	190	145
70	0.268	0.443	0.302	0.325	275	215	280	215	235	185
95	0.193	0.320	0.288	0.370	330	255	340	260	285	225
120	0.153	0.253	0.279	0.407	370	290	385	300	325	255
150	0.124	0.206	0.272	0.444	420	325	445	345	375	295
185	0.0991	0.164	0.265	0.487	470	365	510	395	430	335
240	0.0754	0.125	0.258	0.523	540	425	590	465	505	395
300	0.0601	0.100	0.256	0.548	620	485	675	530	580	450

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

**3.6/6 (7.2) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, DOUBLE STEEL TAPE ARMoured CABLES**

Type M2NB, M2AB - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
10	2.5	1.1	2.0	3.82	9.82	33	270	1360	82	1180	500
16	2.5	1.2	2.1	4.83	10.83	37	429	1970	130	1670	500
25	2.5	1.2	2.2	6.02	12.02	40	679	2410	206	1930	500
35	2.5	1.2	2.3	7.15	13.15	43	941	2830	286	2170	500
50	2.5	1.3	2.4	8.3	14.3	45	1274	3360	387	2470	500
70	2.5	1.4	2.5	10.0	16.0	49	1841	4240	559	2960	500
95	2.5	1.4	2.6	11.8	17.8	54	2552	5200	776	3440	500
120	2.5	1.5	2.8	13.3	19.3	57	3227	6200	980	3950	250
150	2.5	1.6	2.9	14.8	20.8	61	3960	7200	1204	4460	250
185	2.5	1.6	3.0	16.55	22.55	65	4969	8500	1510	5050	250
240	2.6	1.7	3.2	18.73	24.93	71	6357	10400	1931	6000	250
300	2.8	1.8	3.4	21.3	27.9	79	8017	12800	2435	7250	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
10	1.83	3.08	0.449	0.169	90	75	90	70	75	65
16	1.15	1.91	0.416	0.195	120	95	120	90	100	80
25	0.727	1.20	0.387	0.225	155	120	155	115	130	100
35	0.524	0.868	0.367	0.254	190	150	190	145	160	125
50	0.387	0.641	0.351	0.283	225	175	225	175	190	145
70	0.268	0.443	0.332	0.325	275	215	280	215	235	185
95	0.193	0.320	0.317	0.370	330	255	340	260	285	225
120	0.153	0.253	0.307	0.407	370	290	385	300	325	255
150	0.124	0.206	0.299	0.444	420	325	445	345	375	295
185	0.0991	0.164	0.291	0.487	470	365	510	395	430	335
240	0.0754	0.125	0.284	0.523	540	425	590	465	505	395
300	0.0601	0.100	0.282	0.548	620	485	675	530	580	450

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

6/10 (12) KV - SINGLE CORE, XLPE INSULATED, PVC SHEATHED

SCREENED, UNARMoured CABLES

Type M3N, M3A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
16	3.4	-	1.5	4.83	12.63	18	142	450	43	350	500
25	3.4	-	1.5	6.02	13.82	19	224	565	68	410	500
35	3.4	-	1.6	7.15	14.95	21	311	685	95	470	500
50	3.4	-	1.6	8.3	16.1	22	421	825	128	535	500
70	3.4	-	1.7	10.0	17.8	24	608	1070	185	645	500
95	3.4	-	1.7	11.8	19.6	25	843	1350	256	765	500
120	3.4	-	1.8	13.3	21.1	27	1065	1630	324	885	500
150	3.4	-	1.8	14.8	22.6	29	1307	1910	398	1000	500
185	3.4	-	1.9	16.55	24.35	31	1640	2310	499	1170	500
240	3.4	-	2	18.73	26.53	33	2098	2870	638	1400	500
300	3.4	-	2	21.3	29.1	36	2646	3490	804	1650	500
400	3.4	-	2.2	24.1	32.1	38	3460	4350	1051	1940	500
500	3.4	-	2.2	27.3	35.3	41	4361	5350	1325	2310	500
630	3.4	-	2.4	31.0	39.4	46	5631	6750	1710	2830	500
800	3.4	-	2.5	37.1	45.4	52	7203	8550	2188	3510	500
1000	3.4	-	2.6	41.6	50.0	57	9080	10550	2758	4240	500

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance		Nominal capacity	Current carrying capacity **					
	Copper	Alu	Trefoil formation	Flat formation		Underground Cable		Cables in air		Cables in duct	
						Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
16	1.15	1.91	0.451	0.636	0.158	120	95	130	85	105	80
25	0.727	1.20	0.418	0.603	0.181	160	120	170	115	135	100
35	0.524	0.868	0.404	0.588	0.202	195	150	200	150	165	125
50	0.387	0.641	0.383	0.568	0.224	230	180	235	185	200	155
70	0.268	0.443	0.363	0.548	0.256	285	220	295	230	250	195
95	0.193	0.320	0.338	0.523	0.289	340	260	360	280	305	240
120	0.153	0.253	0.330	0.515	0.317	385	300	420	325	350	275
150	0.124	0.206	0.323	0.508	0.345	430	335	475	370	395	310
185	0.0991	0.164	0.314	0.498	0.377	485	380	550	425	465	365
240	0.0754	0.125	0.302	0.486	0.417	560	440	650	510	550	430
300	0.0601	0.100	0.293	0.478	0.464	630	500	740	580	635	495
400	0.0470	0.0778	0.279	0.464	0.536	720	570	860	680	740	580
500	0.0366	0.0605	0.270	0.454	0.597	800	640	990	790	855	670
630	0.0283	0.0469	0.267	0.452	0.673	910	740	1140	920	1000	780
800	0.0221	0.0367	0.256	0.441	0.787	1000	830	1300	1070	1165	910
1000	0.0176	0.0291	0.251	0.436	0.873	1095	920	1455	1220	1340	1090

* At different operating T(°C): $R = R_{20°C} \{ 1 + \alpha(T°C - 20) \}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

**6/10 (12) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, UNARMoured CABLES**

Type M3N, M3A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
16	3.4	-	2.1	4.83	12.63	36	429	1470	130	1170	500
25	3.4	-	2.2	6.02	13.82	39	679	1850	206	1380	500
35	3.4	-	2.3	7.15	14.95	42	941	2240	286	1580	500
50	3.4	-	2.4	8.3	16.1	45	1274	2700	387	1810	500
70	3.4	-	2.5	10.0	17.8	48	1841	3470	559	2190	500
95	3.4	-	2.6	11.8	19.6	53	2552	4400	776	2620	250
120	3.4	-	2.7	13.3	21.1	56	3227	5250	980	3000	250
150	3.4	-	2.8	14.8	22.6	59	3960	6150	1204	3420	250
185	3.4	-	2.9	16.55	24.35	63	4969	7400	1510	3930	250
240	3.4	-	3.1	18.73	26.53	69	6357	9200	1931	4790	250
300	3.4	-	3.3	21.3	29.1	75	8017	11250	2435	5700	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
16	1.15	1.91	0.405	0.158	120	95	120	90	100	80
25	0.727	1.20	0.377	0.181	155	125	155	120	130	100
35	0.524	0.868	0.357	0.202	190	150	190	145	160	125
50	0.387	0.641	0.340	0.224	225	175	225	175	190	145
70	0.268	0.443	0.321	0.256	275	215	280	215	235	185
95	0.193	0.320	0.306	0.289	330	255	340	260	285	225
120	0.153	0.253	0.296	0.317	370	290	385	300	325	255
150	0.124	0.206	0.287	0.345	420	325	445	345	375	295
185	0.0991	0.164	0.279	0.377	470	365	510	395	430	335
240	0.0754	0.125	0.273	0.417	540	425	590	465	505	395
300	0.0601	0.100	0.264	0.464	610	485	680	535	590	460

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

**6/10 (12) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, DOUBLE STEEL TAPE ARMoured CABLES**

Type M3NB, M3AB - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
16	3.4	1.2	2.3	4.83	12.63	41	429	2310	130	2010	500
25	3.4	1.3	2.3	6.02	13.82	44	679	2750	206	2280	500
35	3.4	1.3	2.4	7.15	14.95	47	941	3190	286	2540	500
50	3.4	1.4	2.5	8.3	16.1	50	1274	3740	387	2860	500
70	3.4	1.5	2.7	10.0	17.8	54	1841	4650	559	3360	500
95	3.4	1.5	2.8	11.8	19.6	58	2552	5650	776	3890	250
120	3.4	1.6	2.9	13.3	21.1	62	3227	6650	980	4390	250
150	3.4	1.6	3.0	14.8	22.6	65	3960	7650	1204	4890	250
185	3.4	1.7	3.1	16.55	24.35	69	4969	9000	1510	5550	250
240	3.4	1.8	3.3	18.73	26.53	75	6357	11000	1931	6600	250
300	3.4	1.9	3.5	21.3	29.1	82	8017	13250	2435	7650	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
16	1.15	1.91	0.445	0.158	120	95	120	90	100	80
25	0.727	1.20	0.415	0.181	155	125	155	120	130	100
35	0.524	0.868	0.392	0.202	190	150	190	145	160	125
50	0.387	0.641	0.374	0.224	225	175	225	175	190	145
70	0.268	0.443	0.353	0.256	275	215	280	215	235	185
95	0.193	0.320	0.336	0.289	330	255	340	260	285	225
120	0.153	0.253	0.325	0.317	370	290	385	300	325	255
150	0.124	0.206	0.316	0.345	420	325	445	345	375	295
185	0.0991	0.164	0.307	0.377	470	365	510	395	430	335
240	0.0754	0.125	0.300	0.417	540	425	590	465	505	395
300	0.0601	0.100	0.291	0.464	610	485	680	535	590	460

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

8.7/15 (17.5) KV - SINGLE CORE, XLPE INSULATED, PVC SHEATHED

SCREENED, UNARMoured CABLES

Type M4N, M4A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
25	4.5	-	1.6	6.02	16.02	22	224	655	68	500	500
35	4.5	-	1.7	7.15	17.15	23	311	780	95	565	500
50	4.5	-	1.7	8.3	18.3	24	421	925	128	635	500
70	4.5	-	1.7	10.0	20.0	26	608	1170	185	745	500
95	4.5	-	1.8	11.8	21.8	28	843	1470	256	885	500
120	4.5	-	1.9	13.3	23.3	30	1065	1750	324	1010	500
150	4.5	-	1.9	14.8	24.8	31	1307	2040	398	1130	500
185	4.5	-	2.0	16.55	26.55	33	1640	2470	499	1330	500
240	4.5	-	2.0	18.73	28.73	36	2098	3000	638	1540	500
300	4.5	-	2.1	21.3	31.3	38	2646	3650	804	1810	500
400	4.5	-	2.2	24.1	34.3	40	3460	4500	1051	2090	500
500	4.5	-	2.3	27.3	37.5	44	4361	5550	1325	2490	500
630	4.5	-	2.4	31.0	41.6	48	5631	6950	1710	3010	500
800	4.5	-	2.6	37.1	47.6	54	7203	8750	2188	3740	500
1000	4.5	-	2.7	41.6	52.2	59	9080	10800	2758	4490	500

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance		Nominal capacity	Current carrying capacity **					
	Copper	Alu	Trefoil formation	Flat formation		Underground Cable		Cables in air		Cables in duct	
						Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
25	0.727	1.20	0.447	0.632	0.150	160	125	170	135	140	105
35	0.524	0.868	0.422	0.607	0.166	195	150	200	160	170	130
50	0.387	0.641	0.401	0.585	0.183	230	180	245	190	205	160
70	0.268	0.443	0.379	0.564	0.207	280	220	305	235	255	200
95	0.193	0.320	0.361	0.546	0.233	335	260	375	290	310	245
120	0.153	0.253	0.351	0.536	0.254	385	300	425	330	355	280
150	0.124	0.206	0.336	0.521	0.276	430	335	485	375	410	320
185	0.0991	0.164	0.326	0.511	0.300	490	380	560	430	465	365
240	0.0754	0.125	0.319	0.504	0.331	560	440	660	510	555	435
300	0.0601	0.100	0.304	0.489	0.367	640	500	750	590	640	500
400	0.0470	0.0778	0.290	0.474	0.420	720	570	870	680	740	580
500	0.0366	0.0605	0.284	0.468	0.466	810	640	1000	790	855	670
630	0.0283	0.0469	0.276	0.461	0.523	910	740	1150	930	1010	790
800	0.0221	0.0367	0.263	0.448	0.609	1005	830	1290	1060	1160	900
1000	0.0176	0.0291	0.258	0.443	0.674	1100	930	1460	1230	1340	1090

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

**8.7/15 (17.5) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, UNARMoured CABLES**

Type M4N, M4A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
25	4.5	-	2.4	6.02	16.02	44	679	2180	206	1720	500
35	4.5	-	2.4	7.15	17.15	47	941	2570	286	1920	500
50	4.5	-	2.5	8.3	18.3	50	1274	3060	387	2170	500
70	4.5	-	2.7	10.0	20.0	54	1841	3870	559	2590	250
95	4.5	-	2.8	11.8	21.8	58	2552	4840	776	3060	250
120	4.5	-	2.9	13.3	23.3	61	3227	5700	980	3470	250
150	4.5	-	3.0	14.8	24.8	65	3960	6650	1204	3900	250
185	4.5	-	3.1	16.55	26.55	69	4969	8000	1510	4540	250
240	4.5	-	3.3	18.73	28.73	75	6357	9800	1931	5350	250
300	4.5	-	3.4	21.3	31.3	80	8017	11800	2435	6200	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
25	0.727	1.20	0.404	0.150	155	115	160	120	135	100
35	0.524	0.868	0.381	0.166	190	145	195	150	165	125
50	0.387	0.641	0.364	0.183	225	175	230	175	195	150
70	0.268	0.443	0.343	0.207	270	210	280	220	235	185
95	0.193	0.320	0.326	0.233	330	255	345	265	285	225
120	0.153	0.253	0.314	0.254	370	290	395	305	330	260
150	0.124	0.206	0.304	0.276	415	320	450	345	375	295
185	0.0991	0.164	0.299	0.300	465	360	510	395	430	335
240	0.0754	0.125	0.287	0.331	540	420	600	470	510	400
300	0.0601	0.100	0.278	0.367	620	490	685	535	585	455

* At different operating T(°C): $R = R_{20°C} \{ 1 + \alpha(T°C - 20) \}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

**8.7/15 (17.5) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, DOUBLE STEEL TAPE ARMoured CABLES**

Type M4NB, M4AB - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
25	4.5	1.4	2.5	6.02	16.02	50	679	3220	206	2740	500
35	4.5	1.4	2.6	7.15	17.15	52	941	3690	286	3030	500
50	4.5	1.5	2.7	8.3	18.3	55	1274	4260	387	3370	250
70	4.5	1.5	2.8	10.0	20.0	59	1841	5150	559	3860	250
95	4.5	1.6	3.0	11.8	21.8	63	2552	6250	776	4490	250
120	4.5	1.7	3.1	13.3	23.3	67	3227	7250	980	5000	250
150	4.5	1.7	3.2	14.8	24.8	70	3960	8300	1204	5550	250
185	4.5	1.8	3.3	16.55	26.55	76	4969	9800	1510	6350	250
240	4.5	1.9	3.5	18.73	28.73	81	6357	11700	1931	7300	250
300	4.5	2.0	3.7	21.3	31.3	88	8017	14800	2435	9200	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
25	0.727	1.20	0.444	0.150	155	115	160	120	135	100
35	0.524	0.868	0.420	0.166	190	145	195	150	165	125
50	0.387	0.641	0.400	0.183	225	175	230	175	195	150
70	0.268	0.443	0.377	0.207	270	210	280	220	235	185
95	0.193	0.320	0.358	0.233	330	255	345	265	285	225
120	0.153	0.253	0.345	0.254	370	290	395	305	330	260
150	0.124	0.206	0.335	0.276	415	320	450	345	375	295
185	0.0991	0.164	0.329	0.300	465	360	510	395	430	335
240	0.0754	0.125	0.316	0.331	540	420	600	470	510	400
300	0.0601	0.100	0.306	0.367	620	490	685	535	585	455

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

12/20 (24) KV - SINGLE CORE, XLPE INSULATED, PVC SHEATHED

SCREENED, UNARMoured CABLES

Type M5N, M5A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
35	5.5	-	1.7	7.15	19.15	25	311	865	95	650	500
50	5.5	-	1.8	8.3	20.3	26	421	1030	128	735	500
70	5.5	-	1.8	10.0	22.0	28	608	1270	185	850	500
95	5.5	-	1.9	11.8	23.8	30	843	1590	256	1000	500
120	5.5	-	1.9	13.3	25.3	32	1065	1860	324	1120	500
150	5.5	-	2.0	14.8	26.8	34	1307	2190	398	1280	500
185	5.5	-	2.0	16.55	28.55	35	1640	2590	499	1450	500
240	5.5	-	2.1	18.73	30.73	38	2098	3140	638	1680	500
300	5.5	-	2.2	21.3	33.3	41	2646	3810	804	1960	500
400	5.5	-	2.3	24.1	36.5	43	3460	4680	1051	2270	500
500	5.5	-	2.4	27.3	39.7	46	4361	5700	1325	2680	500
630	5.5	-	2.5	31.0	44.4	51	5631	7200	1710	3280	500
800	5.5	-	2.6	37.1	50.4	57	7203	9050	2188	4010	500
1000	5.5	-	2.8	41.6	55.0	62	9080	11150	2758	4810	500

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance		Nominal capacity	Current carrying capacity **					
	Copper	Alu	Trefoil formation	Flat formation		Underground Cable		Cables in air		Cables in duct	
						Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
35	0.524	0.868	0.439	0.623	0.145	195	150	200	160	170	130
50	0.387	0.641	0.417	0.601	0.159	230	180	245	190	205	160
70	0.268	0.443	0.394	0.579	0.180	280	220	305	235	255	200
95	0.193	0.320	0.375	0.560	0.201	335	260	375	290	310	245
120	0.153	0.253	0.364	0.549	0.219	385	300	425	330	355	280
150	0.124	0.206	0.355	0.539	0.236	430	335	485	375	410	320
185	0.0991	0.164	0.338	0.522	0.257	490	380	560	430	465	365
240	0.0754	0.125	0.330	0.514	0.282	560	440	660	510	555	435
300	0.0601	0.100	0.319	0.504	0.312	640	500	750	590	640	500
400	0.0470	0.0778	0.304	0.489	0.356	720	570	870	680	740	580
500	0.0366	0.0605	0.293	0.477	0.394	810	640	1000	790	855	670
630	0.0283	0.0469	0.288	0.472	0.448	910	740	1150	930	1010	790
800	0.0221	0.0367	0.274	0.459	0.519	1010	830	1290	1060	1155	900
1000	0.0176	0.0291	0.268	0.453	0.572	1105	930	1460	1230	1340	1090

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

12/20 (24) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED

SCREENED, UNARMoured CABLES

Type M5N, M5A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
35	5.5	-	2.6	7.15	19.15	52	941	2900	286	2250	500
50	5.5	-	2.7	8.3	20.3	54	1274	3440	387	2550	250
70	5.5	-	2.8	10.0	22.0	58	1841	4250	559	2960	250
95	5.5	-	2.9	11.8	23.8	62	2552	5200	776	3440	250
120	5.5	-	3.0	13.3	25.3	66	3227	6100	980	3860	250
150	5.5	-	3.1	14.8	26.8	70	3960	7200	1204	4430	250
185	5.5	-	3.2	16.55	28.55	74	4969	8450	1510	4950	250
240	5.5	-	3.4	18.73	30.73	79	6357	10300	1931	5850	250
300	5.5	-	3.6	21.3	33.3	85	8017	12400	2435	6800	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
35	0.524	0.868	0.402	0.145	190	145	195	150	165	125
50	0.387	0.641	0.383	0.159	225	175	230	175	195	150
70	0.268	0.443	0.360	0.180	270	210	280	220	235	185
95	0.193	0.320	0.342	0.201	330	255	345	265	285	225
120	0.153	0.253	0.330	0.219	370	290	395	305	330	260
150	0.124	0.206	0.322	0.236	415	320	450	345	375	295
185	0.0991	0.164	0.311	0.257	465	360	510	395	430	335
240	0.0754	0.125	0.300	0.282	540	420	600	470	510	400
300	0.0601	0.100	0.290	0.312	620	490	685	535	585	455

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α : Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

**12/20 (24) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, DOUBLE STEEL TAPE ARMoured CABLES**

Type M5NB, M5AB - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
35	5.5	1.5	2.8	7.15	19.15	57	941	4150	286	3500	500
50	5.5	1.6	2.9	8.3	20.3	60	1274	4780	387	3890	250
70	5.5	1.6	3.0	10.0	22.0	64	1841	5700	559	4400	250
95	5.5	1.7	3.1	11.8	23.8	68	2552	6800	776	5000	250
120	5.5	1.8	3.2	13.3	25.3	72	3227	7900	980	5550	250
150	5.5	1.8	3.3	14.8	26.8	76	3960	9000	1204	6200	250
185	5.5	1.9	3.5	16.55	28.55	80	4969	10400	1510	6900	250
240	5.5	2.0	3.7	18.73	30.73	87	6357	13250	1931	8750	250
300	5.5	2.1	3.8	21.3	33.3	93	8017	15500	2435	9950	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
35	0.524	0.868	0.442	0.145	190	145	195	150	165	125
50	0.387	0.641	0.421	0.159	225	175	230	175	195	150
70	0.268	0.443	0.396	0.180	270	210	280	220	235	185
95	0.193	0.320	0.376	0.201	330	255	345	265	285	225
120	0.153	0.253	0.362	0.219	370	290	395	305	330	260
150	0.124	0.206	0.353	0.236	415	320	450	345	375	295
185	0.0991	0.164	0.342	0.257	465	360	510	395	430	335
240	0.0754	0.125	0.330	0.282	540	420	600	470	510	400
300	0.0601	0.100	0.345	0.312	620	490	685	535	585	455

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

18/30 (36) KV - SINGLE CORE, XLPE INSULATED, PVC SHEATHED

SCREENED, UNARMoured CABLES

Type M6N, M6A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
50	8.0	-	2.0	8.3	26.3	33	421	1390	128	1090	500
70	8.0	-	2.0	10.0	28.0	35	608	1660	185	1260	500
95	8.0	-	2.1	11.8	29.8	37	843	1990	256	1400	500
120	8.0	-	2.1	13.3	31.3	38	1065	2280	324	1540	500
150	8.0	-	2.2	14.8	32.8	40	1307	2610	398	1690	500
185	8.0	-	2.2	16.55	34.55	42	1640	3030	499	1890	500
240	8.0	-	2.3	18.73	36.73	44	2098	3610	638	2150	500
300	8.0	-	2.4	21.3	39.3	48	2646	4350	804	2510	500
400	8.0	-	2.5	24.1	42.1	49	3460	5150	1051	2760	500
500	8.0	-	2.6	27.3	45.3	52	4361	6250	1325	3210	500
630	8.0	-	2.7	31.0	49.4	56	5631	7700	1710	3790	500
800	8.0	-	2.8	37.1	55.4	62	7203	9600	2188	4580	500
1000	8.0	-	2.9	41.6	60.0	67	9080	11700	2758	5400	500

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance		Nominal capacity	Current carrying capacity **					
	Copper	Alu	Trefoil formation	Flat formation		Underground Cable		Cables in air		Cables in duct	
						Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
50	0.387	0.641	0.464	0.649	0.136	230	180	245	190	205	160
70	0.268	0.443	0.439	0.623	0.151	280	220	305	235	255	200
95	0.193	0.320	0.417	0.601	0.166	335	260	375	290	310	245
120	0.153	0.253	0.398	0.583	0.179	385	300	425	330	355	280
150	0.124	0.206	0.387	0.572	0.191	430	335	485	375	410	320
185	0.0991	0.164	0.375	0.559	0.205	490	380	560	430	465	365
240	0.0754	0.125	0.359	0.544	0.223	560	440	660	510	555	435
300	0.0601	0.100	0.351	0.535	0.244	640	500	750	590	640	500
400	0.0470	0.0778	0.330	0.515	0.267	720	570	870	680	740	580
500	0.0366	0.0605	0.317	0.502	0.293	810	640	1000	790	855	670
630	0.0283	0.0469	0.307	0.491	0.326	910	740	1150	930	1010	790
800	0.0221	0.0367	0.291	0.476	0.375	1015	830	1290	1060	1155	900
1000	0.0176	0.0291	0.284	0.468	0.411	1110	935	1465	1230	1340	1090

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

18/30 (36) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED

SCREENED, UNARMoured CABLES

Type M6N, M6A - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
50	8.0	-	3.1	8.3	26.3	69	1274	4730	387	3840	250
70	8.0	-	3.2	10.0	28.0	73	1841	5600	559	4320	250
95	8.0	-	3.3	11.8	29.8	77	2552	6700	776	4900	250
120	8.0	-	3.4	13.3	31.3	80	3227	7650	980	5400	250
150	8.0	-	3.5	14.8	32.8	84	3960	8750	1204	5950	250
185	8.0	-	3.6	16.55	34.55	88	4969	10150	1510	6300	250
240	8.0	-	3.8	18.73	36.73	93	6357	12050	1931	7600	250
300	8.0	-	4.0	21.3	39.3	100	8017	14400	2435	8850	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
50	0.387	0.641	0.435	0.136	225	175	230	175	195	150
70	0.268	0.443	0.409	0.151	270	210	280	220	235	185
95	0.193	0.320	0.388	0.166	330	255	345	265	285	225
120	0.153	0.253	0.373	0.179	370	290	395	305	330	260
150	0.124	0.206	0.361	0.191	415	320	450	345	375	295
185	0.0991	0.164	0.348	0.205	465	360	510	395	430	335
240	0.0754	0.125	0.335	0.223	540	420	600	470	510	400
300	0.0601	0.100	0.324	0.244	620	490	685	535	585	455

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

**18/30 (36) KV - THREE CORE, XLPE INSULATED, PVC SHEATHED
SCREENED, DOUBLE STEEL TAPE ARMoured CABLES**

Type M6NB, M6AB - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of			Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Inner Sheath	Outer Sheath	Conductor	Insulation	Overall	Copper cable		Aluminum cable		
							Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
50	8.0	1.8	3.3	8.3	26.3	75	1274	6500	387	5000	250
70	8.0	1.8	3.4	10.0	28.0	79	1841	7450	559	6200	250
95	8.0	1.9	3.5	11.8	29.8	83	2552	8650	776	6900	250
120	8.0	2.0	3.7	13.3	31.3	88	3227	10650	980	8400	250
150	8.0	2.0	3.8	14.8	32.8	92	3960	11800	1204	9050	250
185	8.0	2.1	3.9	16.55	34.55	96	4969	13400	1510	9950	200
240	8.0	2.2	4.1	18.73	36.73	101	6357	15550	1931	11100	200
300	8.0	2.3	4.2	21.3	39.3	108	8017	18200	2435	12650	200

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
50	0.387	0.641	0.479	0.136	225	175	230	175	195	150
70	0.268	0.443	0.450	0.151	270	210	280	220	235	185
95	0.193	0.320	0.427	0.166	330	255	345	265	285	225
120	0.153	0.253	0.411	0.179	370	290	395	305	330	260
150	0.124	0.206	0.397	0.191	415	320	450	345	375	295
185	0.0991	0.164	0.383	0.205	465	360	510	395	430	335
240	0.0754	0.125	0.368	0.223	540	420	600	470	510	400
300	0.0601	0.100	0.357	0.244	620	490	685	535	585	455

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

**6/10 (12) KV - THREE CORE, XLPE INSULATED, PVC OVER SHEATHED
COPPER SCREENED, LEAD SHEATHED, STEEL WIRES ARMoured CABLES**

Type M3N2LR, M3A2LR - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of				Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Lead Sheath	Inner Sheath	Outer Sheath	Conductor	of each Steel wire	Overall	Copper cable		Aluminum cable		
								3 Conductor	Cable	3 Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
16	3.4	1.7	1.3	2.5	4.67	2.5	47	409	5450	122	5160	500
25	3.4	1.7	1.4	2.6	5.87	2.5	50	649	6100	197	5650	500
35	3.4	1.8	1.4	2.7	6.91	2.5	52	897	6900	275	6280	500
50	3.4	1.9	1.5	2.8	8.13	2.5	55	1227	7850	374	7000	500
70	3.4	2.0	1.5	2.9	9.71	2.5	59	1773	9150	525	7900	500
95	3.4	2.1	1.6	3.0	11.35	2.5	63	2448	10700	743	9000	250
120	3.4	2.2	1.7	3.2	12.86	2.5	67	3106	12200	937	10050	250
150	3.4	2.3	1.7	3.3	14.17	3.15	72	3818	14450	1132	11800	250
185	3.4	2.4	1.8	3.5	15.85	3.15	76	4787	16500	1470	13200	250
240	3.4	2.5	1.9	3.6	18.20	3.15	82	6302	19400	1864	15000	250
300	3.4	2.6	2.0	3.8	20.60	3.15	88	7893	22600	2380	17100	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance	Nominal capacity	Current carrying capacity **					
	Copper	Alu			Underground Cable		Cables in air		Cables in duct	
					Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
16	1.15	1.91	0.445	0.158	120	95	120	90	100	80
25	0.727	1.20	0.415	0.181	155	125	155	120	130	100
35	0.524	0.868	0.392	0.202	190	150	190	145	160	125
50	0.387	0.641	0.374	0.224	225	175	225	175	190	145
70	0.268	0.443	0.353	0.256	275	215	280	215	235	185
95	0.193	0.320	0.336	0.289	330	255	340	260	285	225
120	0.153	0.253	0.325	0.317	370	290	385	300	325	255
150	0.124	0.206	0.316	0.345	420	325	445	345	375	295
185	0.0991	0.164	0.307	0.377	470	365	510	395	430	335
240	0.0754	0.125	0.300	0.417	540	425	590	465	505	395
300	0.0601	0.100	0.291	0.464	610	485	680	535	590	460

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

**6/10 (12) KV - SINGLE CORE, XLPE INSULATED, PVC OVER SHEATHED
LEAD SHEATHED, ALUMINIUM WIRES ARMoured CABLES**

Type M3N8LW - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section	Nominal Thickness of				Nominal Diameters			Approximate net weight				Length on drum
	Insulation	Lead Sheath	Inner Sheath	Outer Sheath	Conductor	of each Alum. wire	Overall	Copper cable		Aluminum cable		
								Conductor	Cable	Conductor	Cable	
mm ²	mm	mm	mm	mm	mm	mm	mm	Kg/Km	Kg/Km	Kg/Km	Kg/Km	m
16	3.4	1.2	1.0	1.8	4.67	1.7	26	135	1340	40.20	1250	500
25	3.4	1.3	1.0	1.8	5.87	1.7	27	214	1580	65.00	1430	500
35	3.4	1.3	1.0	1.9	6.91	1.7	28	296	1760	90.55	1560	500
50	3.4	1.3	1.0	1.9	8.13	1.7	29	405	1970	123.4	1690	500
70	3.4	1.4	1.0	2.0	9.71	1.7	31	585	2380	173.3	1970	500
95	3.4	1.4	1.1	2.1	11.35	2.0	35	808	2870	245.0	2310	500
120	3.4	1.5	1.1	2.1	12.86	2.0	36	1025	3320	309.0	2610	500
150	3.4	1.5	1.1	2.2	14.17	2.0	38	1260	3700	373.3	2820	500
185	3.4	1.6	1.2	2.2	15.85	2.0	40	1580	4300	485.0	3210	500
240	3.4	1.6	1.2	2.3	18.20	2.0	42	2080	5050	615.0	3590	500
300	3.4	1.7	1.3	2.4	20.60	2.5	47	2605	6150	785.3	4330	500
400	3.4	1.8	1.3	2.6	23.60	2.5	51	3380	7500	1010	5130	500
500	3.4	1.9	1.4	2.7	27.00	2.5	55	4300	9050	1298	6050	500
630	3.4	1.9	1.4	2.8	30.20	2.5	59	5500	10700	1669	6870	500
800	3.4	2.1	1.5	2.9	37.05	2.5	67	7160	13650	2188	8680	500
1000	3.4	2.2	1.6	3.1	41.60	2.5	72	9026	16350	2758	10100	250

Electrical Characteristics

Nominal cross section	DC Resistance at 20°C*		Nominal inductance		Nominal capacity	Current carrying capacity **					
	Copper	Alu	Trefoil formation	Flat formation		Underground Cable		Cables in air		Cables in duct	
						Copper	Alu	Copper	Alu	Copper	Alu
mm ²	Ω/km	Ω/km	mH/Km	mH/Km	μF/km	Amp	Amp	Amp	Amp	Amp	Amp
16	1.15	1.91	0.547	0.595	0.158	120	95	130	85	105	80
25	0.727	1.20	0.51	0.559	0.181	160	120	170	115	135	100
35	0.524	0.868	0.486	0.534	0.202	195	150	200	150	165	125
50	0.387	0.641	0.461	0.509	0.224	230	180	235	185	200	155
70	0.268	0.443	0.438	0.486	0.256	285	220	295	230	250	195
95	0.193	0.320	0.426	0.474	0.289	340	260	360	280	305	240
120	0.153	0.253	0.41	0.458	0.317	385	300	420	325	350	275
150	0.124	0.206	0.398	0.447	0.345	430	335	475	370	395	310
185	0.0991	0.164	0.386	0.435	0.377	485	380	550	425	465	365
240	0.0754	0.125	0.371	0.419	0.417	560	440	650	510	550	430
300	0.0601	0.100	0.365	0.413	0.464	630	500	740	580	635	495
400	0.0470	0.0778	0.353	0.402	0.536	720	570	860	680	740	580
500	0.0366	0.0605	0.343	0.392	0.597	800	640	990	790	855	670
630	0.0283	0.0469	0.333	0.382	0.673	910	740	1140	920	1000	780
800	0.0221	0.0367	0.318	0.366	0.787	1000	830	1300	1070	1165	910
1000	0.0176	0.0291	0.309	0.358	0.873	1095	920	1455	1220	1340	1090

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α: Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

7.3 • 12/20 (24) KV THREE CORE XLPE INSULATED BUNDLED OVERHEAD CONDUCTORS (TORSADE)

OUR TYPES: M5A2T - M5A3T - M5A4T

◦ 1. SCOPE

This specification covers three core overhead insulated cables, rated 12/20 (24) KV generally conforming to IEC 60502-2.

◦ 2. CONSTRUCTION

2.1 *Conductor*

Aluminum, circular stranded and compacted conforming to IEC 60228 - Class 2.

2.2 *Conductor Screening*

Extruded thermosetting semi-conductor layer, conforming to IEC 60502-2.

2.3 *Insulation*

XLPE thermosetting material conforming to IEC 60502-2.

2.4 *Insulation Screening*

2.4.1 Semi conducting screen:

Extruded thermosetting semi-conducting layer, applied under a swellable semi-conducting tape for watertightness, upon specific customer requirements.

2.4.2 Metal screen:

Plain soft copper wire and/or copper tape applied helically, or aluminum tape applied longitudinally bonded to the outer PE sheath.

2.5 *Outer sheath*

Extruded black PE sheath, or PVC upon specific customer requirements, conforming to IEC 60502-2.

2.6 *Steel Messenger*

50 or 70mm² steel stranded wires, covered with black PE, or PVC upon specific customer requirements.

◦ 3. TESTS

All tests required by the IEC 60502-2, either on raw materials or on finished products.



12/20 (24) KV - THREE CORE, XLPE INSULATED
BUNDLED OVERHEAD CONDUCTORS (TORSADE)

Type M5A4T - Conforming to IEC 60502-2

Dimensional Characteristics

Nominal cross section mm ²	Nominal Thickness of		Nominal Diameters				Approximate net weight		Length on drum m
	Insulation mm	Outer Sheath mm	Conductor mm	Suspension Strand mm	Over Jacket mm	Over brunched Conductors mm	Conductor	Cable	
							Kg/Km	Kg/Km	
3x50/16	5.5	1.8	8.1	50	28	67	374	2820	500
3x70/16	5.5	1.9	10.3	50	30	72	541	3200	500
3x95/16	5.5	1.9	12.0	50	32	75	743	3550	500
3x120/16	5.5	2.0	13.0	50	33	78	954	3890	500
3x150/25	5.5	2.0	14.6	50	35	81	1124	4470	500
3x185/25	5.5	2.1	16.2	50	37	85	1460	4960	250
3x240/25	5.5	2.2	18.8	50	40	90	1863	5650	250

Electrical Characteristics

Nominal cross section mm ²	DC Resistance at 20°C*	Nominal inductance mH/Km	Nominal capacity µF/km	Current carrying capacity**
	Alu Ω/km			Cables in air Amp
50	0.641	0.436	0.175	176
70	0.443	0.405	0.204	220
95	0.320	0.385	0.227	269
120	0.253	0.376	0.240	310
150	0.206	0.363	0.260	352
185	0.164	0.352	0.281	405
240	0.125	0.337	0.314	480

* At different operating T(°C): $R = R_{20°C} \{1 + \alpha(T°C - 20)\}$

α : Temperature coefficient at 20°C = 0.00393 for copper & 0.00403 for aluminum

** Laying conditions: - Underground: Temperature of the soil 20°C - Thermal resistivity 100°C cm/w - In air: Ambient temperature 30°C

*** Greater sizes are also available

8 • TECHNICAL INFORMATION

• 8.1 - FORMULAE

Ohms law	$U = RI$	<p>U = Rated Voltage in V (volts) (between phase in three phase system).</p> <p>I = Current in A (Amperes).</p> <p>R = Resistance in (ohms).</p> <p>W = Energy in Ws (Watt second).</p> <p>t = Times in s (second).</p> <p>L = Length of cable in m (meter).</p> <p>x = Conductivity (56 for copper and 34 for Aluminum).</p> <p>S = Cross sectional area in mm².</p> <p>P = Power in W (Watt) or VA (Volt Ampere).</p> <p>Cosφ = Power factor.</p> <p>e = Efficiency.</p> <p>Δu = Voltage drop sending to receiving end of line in V (Volts).</p>
Joules law	$W = RI^2t$	
Resistance of a line (feed and return)	$R = \frac{2L}{x S}$	
DC Power	$P_{(w)} = U I$	
Single phase Power	$P_{(w)} = U I \cos \varphi$	
Three phase Power	$P_{(w)} = \sqrt{3} U I \cos \varphi$	
DC Current	$I = \frac{P_{(w)}}{U}$	
AC Single core current	$I = \frac{P_{(VA)}}{U} = \frac{P_{(w)}}{U \cos \varphi}$	
AC Three phase current	$I = \frac{P_{(VA)}}{U \sqrt{3}} = \frac{P_{(w)}}{U \sqrt{3} \cos \varphi}$	
Efficiency	$e = \frac{P \text{ output}}{P \text{ input}}$	

Voltage drop

Nature of the current	Volotage drop Δu (v)	Size mm ²
Single phase AC/DC systems	$\Delta u = \frac{2 L I}{x S}$	If current known $S = \frac{2 L I}{x \Delta u}$
	$\Delta u = \frac{2 L P_{(w)}}{x S U}$	If power known $S = \frac{2 L P_{(w)}}{x \Delta u U}$
Three phase system	$\Delta u = \frac{1.73 L I \cos \varphi}{x S}$	If current known $S = \frac{1.73 L I \cos \varphi}{x \Delta u}$
	$\Delta u = \frac{L P_{(w)}}{x S U}$	If power known $S = \frac{L P_{(w)}}{x \Delta u U}$

• 8.2 - CONVERSION FACTORS AND UNITS

Length: the SI unit for length is the m
1 m = 10² cm = 10³ mm = 10⁻³ Km
1 m = 39.37 in = 3.28 ft = 1.0936 Yd = 0.6214 x 10⁻³ miles
1 in = 0.0254 m = 0.0833 ft = 0.0277 Yd = 0.0158 x 10⁻³ miles
1 ft = 0.3048 m = 12 in = 0.333 Yd = 0.189 x 10⁻³ miles
1 Yd = 0.9144 m = 36 in = 3 ft = 0.568 x 10⁻³ miles
1 Yd = 0.9144 m = 36 in = 3 ft = 0.568 x 10⁻³ miles
1 mile = 1609 m = 63360 in = 5280 ft = 1760 Yd

m = meters, in = inches, ft = feet, Yd = Yards

Weight: The SI unit for weight is the Kg
1 Kg = 10³ g = 10⁻³ T (metric ton)
1 Kg = 2.20462 lb = 35.27 oz
1 oz = 28.349 x 10⁻³ Kg = 0.0625 lb

Kg = Kilograms, lb = pounds, oz = ounces

Volume: The SI unit for volume is the m³
1 m³ = 10 dm³ = 10⁶ cm³ = 10⁹ mm³
1 m³ = 1000 L = 35.315 ft³ = 219.97 l.gal = 264.17 U.S. gal
1 L = 0.001 m³ = 0.0353 ft³ = 0.21997 l.gal = 0.26417 U.S. gal
1 ft³ = 28.317 x 10⁻³ m³ = 28.317 L = 6.2288 l.gal = 7.479 U.S. gal
1 l.gal = 4.546 x 10⁻³ m³ = 4.546 L = 0.1605 ft³ = 1.2009 U.S. gal
1 U.S. gal = 3.7854 x 10⁻³ m³ = 3.785 L = 0.1366 ft³ = 0.8327 l. gal

L = liters, ft = feet, l.gal = Imperial gallon, U.S. gal = United States gallon

Force: The SI unit for force is the N
1 N = 0.10197 Kgf = 0.2248 Lbf
1 Kgf = 9.80665 N = 2.2046 Lbf
1 Lbf = 4.4482 N = 0.4536 Kgf

N = Newton, Kgf = Kilogram force, Lbf = Pound force

Power: The SI unit for power is the W
1 W = 0.102 Kgm/s = 1.359 x 10⁻³ HP = 3.412 BTU/h
1 Kgm/s = 9.81 W = 0.0133 Hp = 33.47 BTU/h
1 HP = 735.5 W = 75 Kgm/s = 2510 Btu/h
1 BTU/h = 0.2931 W = 0.0298 Kgm/s = 0.393 x 10⁻³ HP

w = watt, Kgm/s = Kilogram meter per second,
HP = metric Horse power, BTU/h = British thermal unit per hour

Pressure: The SI unit for pressure is the Pa = 1 N/m²
1 N/m² = 10⁻⁵ Kgf/cm² = 10⁻⁵ bar
1 Kgf/cm² = 10⁵ N/m² = 1 bar

Pa = Pascal, N/m² = Newton per square meter
Kgf/cm² = Kilogram force per square centimeter

Work: The SI unit for work is the J
1J = 1Ws (Wattsecond) = 1Nm (newton meter)
1J = 0.2778 x 10⁻⁶ Kwh = 0.239 x 10⁻³ Kcal
1Kwh = 3.6 x 10⁶ J = 859.8 Kcal
1Kcal = 4186.8 J = 1.163 x 10⁻³ Kwh

J = Joules, Kwh = Kilowatt hour, Kcal = Kilocalories

Temperature: The SI unit for Temperature is the Kelvin (K)
Temperature in °C = Temperature in °K - 273 = 5/9 (Temperature in °F - 32)
Temperature in °K = Temperature in °C + 273

°C = degree celcius, °K = degree Kelvin, °F = degree Fahrenheit

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