Ducab دوكاب

دوكاب باوربلاس كابلات الطاقة ذات الجهد المتوسط لصناعة الفط والغاز والبتروكيماويات

Ducab POWERPLUS MEDIUM VOLTAGE CABLES FOR OIL, GAS AND PETROCHEMICAL INDUSTRIES

حلول متقدمة للكابلات من خلال التقنية والابداع

Advanced Cable Solutions Through Technology and Innovation

BICC

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"THE DTI QA REGISTER - PRODUCTS AND SERVICES LIST"

Only those companies whose quality system is assessed and certified by U.K. accredited certification bodies appear in the above publication.

دوکاب باوربلاس

INTRODUCTION

Ducab - Dubai Cable Company (Private) Ltd., is the leading manufacturer of electric cables in the Middle East. Established in 1979, the company is owned by the Governments of Dubai and Abu Dhabi.

Ducab is based in Jebel Ali, Dubai but to meet the continuing demand and keep pace with the steady growth of the region Ducab, in 2005 opened a second factory in Abu Dhabi. This state of the art facility doubles the production capacity enabling Ducab to better service its customers.

Ducab produces **Ducab Powerplus** medium voltage cables up to 33 kV. The Ducab product range also covers low voltage power cables, control and auxiliary cables, wiring cables, instrumentation cables as well as lead sheathed cables for the oil, gas and petrochemical industry, and **Ducab Smokemaster** Low Smoke and Fume cables for projects where safety is paramount. Fire resistant cables are also available under the brand name **Ducab Smokemaster.**

Ducab's aim is to produce electric cables of the highest quality and provide customer service that is unequalled in the Gulf region. Quality and customer service are two of the main obsessions of Ducab. Access to the leading edge technology in processing, manufacturing, engineering and in materials, gives Ducab the ability to maintain the highest standards of quality.

This brochure contains technical information covering the **Ducab Powerplus** range of XLPE insulated medium voltage lead sheathed cables rated up to U0/U = 18/30kV i.e., equivalent to 33kV rating of the British Standards. The applicable standards are IEC 60502-2 and EEMUA133.

The cables are designed to facilitate land-based activities in the oil, gas, petroleum and chemical industries where cables may be at risk through unavoidable installation in ground prone to waterlogging, or in areas where they may come into contact with corrosive liquids and vapours. Contaminants such as petroleum-based substances are capable of permeating cable sheaths and passing along and between armour wires, thus the inevitable degradation of insulating materials may not be limited to the proximity of penetration.

To counter the hazard, cables are constructed with an impermeable lead alloy sheath around the core assembly. The lead sheath dimensions are guided by EEMUA Publication No. 133, which is the Specification for Underground Armoured Cables Protected Against Solvent Penetration and Corrosive Attack. The purpose of this specification is to establish the degree and manner of protection to be applied over the insulated core assembly of almost any cable such that it is graded suitable for use by the industries concerned in those installation locations with the potential contamination hazards.

Quality

Where Quality is a Way of Life

The definition of quality in Ducab goes far beyond the conformance of product to specified requirements. Ducab is committed to providing the customer with total quality excellence of product and service that fully meets expectations and is superior in value to that which can be obtained elsewhere.

Since its inception, Ducab has an unrivaled reputation for quality in the region. The company's Quality Management System was certified to ISO 9001 in 1995 and upgraded in 2002 to the new, more stringent ISO 9001 : 2000 standard by BASEC, a reputed UKAS accredited certification body specialising in the cable industry. Ducab was the first cable company in the Middle East to achieve this distinction.

In 1997, Ducab became the first manufacturing company in the Middle East to obtain the ISO 14001 environmental certification, and was certified by BASEC.

Ducab is also the only cable manufacturer in the Middle East to obtain product type approval of a range of low voltage cables to British Standards by BASEC (The British Approvals Service for Cables). This approval is only awarded to manufacturers who meet the requirements of BS EN ISO 9000 Quality Management Standard and certified by BASEC.

Quality Assurance

Ducab's quality management system is certified for conformance to ISO 9001 standard by BASEC.

Ducab's medium voltage cables have been accepted as world class following the type testing and certification of several products by the KEMA High Voltage Laboratory in the Netherlands. Type testing included the requirements of the IEC 60502-2 standard and some of the stringent provisions of BS 6622 standard. 11kV and 33kV cables tested by KEMA consistently exhibited discharge-free characteristics. These cables also withstood Basic Impulse Levels of 95kV and 195kV respectively as against 75kV and 175kV specified in IEC 60502-2.

Ducab's high voltage test facility includes modern, highly sensitive partial discharge test equipment, situated in a fully screened room. For materials and in-process cable tests, well-equipped laboratories, manned by experienced and trained personnel are available. A separate cable fire test facility exists for IEC 60332 Pt. 3, smoke density and other tests.

Ducab's excellence in quality was recognised when the company was awarded the Dubai Quality Award, in the very first year of its inception, in 1994, and by Ducab winning the award again in 1998 and 2004.

دوکاب باوربلاس

Cable Selection

It is essential that any design of a cable system selected for a particular project or a distribution system is suitable for its intended use. Choice needs to be based on a range of factors including installation specifications, local regulations and the required performance characteristics, some of which are shown below:

- normal current load
- maximum fault current and its duration under fault conditions
- voltage grade
- subsoil conditions for underground installations e.g., presence of water, soil temperature and thermal resistivity, possible attack of rodents, termites etc.
- cable fire performance requirements
- compatibility with an existing distribution system

In the tables in the next section, cable constructions and performance features correspond to IEC 60502-2 Standard and Ducab's in-house quality norms.

Cable Design and Construction

Conductors

The conductors of all Ducab's HV and MV cables, both copper and aluminium, with the exception of very large sizes of 800sq mm and above, are all HCC + ™ design.

These are highly compacted and concentric conductors and offer the following advantages:

* Smaller overall size

* Smoother conductor/conducting screen interface

Conductors of 800 sq mm and above, are plain stranded and wrapped with penetration resistant semi-conductive tape prior to passage through the triple extrusion line.

All conductors comply with the requirements of IEC 60228, Class 2.

Conductor Screen

This is a layer of crosslinkable semi-conducting compound extruded directly over the conductor during the XLPE insulation extrusion.

Cable Selection

Insulation

All Ducab's MV and HV cables feature DFI ™ XLPE insulation which is virtually discharge free, ensuring a long and trouble-free service life.

The insulation is extruded and dry cured to meet the requirements of the standards and/or customer specification. A high degree of concentricity is assured through the use of x-ray monitoring device during extrusion. The XLPE insulation is capable of operating continuously at 90˚C.

Insulation Screen

This is a layer of cross-linkable semi-conducting compound extruded directly over the insulation at the same time when the conductor screen and XLPE insulation are extruded. This semi-conducting screen is cold strippable but fully bonded screens may be provided, if specified.

Metallic Screen

The metallic screen can be a helically applied copper tape or a number of copper wires applied with a lay or a combination of tape and wires applied over the semi-conducting screen. The metallic screen provides the earth fault current path and it is of a cross section designed as per customer's specification.

In case of three core cables, phase identification tapes (red/yellow/blue) are generally longitudinally applied under the metallic screen.

Laying up

In the case of three core cables, the three cores identified as red, yellow and blue are laid up together with polypropylene string fillers at the interstices between the three cores. A binder e.g., polyester tape is wrapped round the assembly to form a compact circular cable during this process.

Lead Sheath

The material of lead sheath is lead alloy grade PB021K of composition as given in BS EN12548 (erstwhile known as alloy E). The thickness of the lead sheath is in accordance with EEMUA (Publication no. 133). The lead sheath perform the mechanical function of acting as a barrier to entry of hydrocarbons. In addition, it can also be engaged to perform the electrical function of sharing the earth fault current with the armour.

Bedding Sheath

Black polyvinyl chloride (PVC) or Polyethylene (PE) Compound is extruded over the laid up 3 core cable or on the screened single core cables.

Armouring

This process is not applicable if an unarmoured cable is specified. If armour is required, then following variations are possible:

- **Single Core Cables:**

Aluminium armour wires applied all round the cable with a lay.

- **Three Core Cables:**

a) Galvanised Steel Wires applied all round the cable with a lay.

b) Galvanised Steel Tapes applied helically to provide coverage all round the cable.

Oversheath

This is an extruded layer of black PVC (Type ST2) or PE (Type ST 3 or ST7) as required by customer specification. The oversheath has an embossed legend in two or more lines appropriate for the cable.

Special Features

The cable as a whole or its specific cores or other design elements can vary in a number of ways to meet specific customer needs. The following are some examples, and by no means an exhaustive list of special features possible:

- Longitudinal and radial water blocking of conductors, cores or complete cable.
- Extra water-tree retardant XLPE insulation
- PVC oversheath with:
  - a) reduced flame propagation (RP) and low HCL (LHCL) emission properties
  - b) anti-termite properties
- **Ducab Smokemaster** Low Smoke and Fume construction using zero-halogen bedding and oversheath
- Oversheath of red colour with sulphide-resistant and/or UV resistant properties
- Graphite coated oversheath
- Embossed legend as per customer specification
- Metre length marking

Cable Data

ELECTRICAL CHARACTERISTICS - ARMOURED-CABLES

Table 1

3.6/6 (17.5) kV Single core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 And EEMUA 133 Spec.														
Nominal Area of Conductor	**mm²**	**50**	**70**	**95**	**120**	**150**	**185**	**240**	**300**	**400**	**500**	**630**	**800**	**1000**
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047	0.0366	0.0283	0.0221	0.0176
Approximate AC resistance of Conductor at 90°C	ohm/Km	0.494	0.342	0.247	0.196	0.159	0.128	0.0982	0.0791	0.0632	0.051	0.0417	0.038	0.029
Approximate Reactance at 50 Hertz	ohm/Km	0.13	0.13	0.12	0.11	0.11	0.11	0.11	0.1	0.1	0.1	0.1	0.09	0.09
Approximate Capacitance of Cable	µf/Km	0.34	0.38	0.43	0.47	0.51	0.56	0.61	0.63	0.65	0.69	0.73	0.79	0.85
Approx. Charging Current per phase at U_0 = 3.6 kV and f = 50Hz	mA/m	0.38	0.43	0.49	0.53	0.58	0.63	0.69	0.71	0.74	0.78	0.83	0.89	0.96
Sustained Current Ratings														
1. Laid Direct, Ground Temp. 30°C & g = 1.2°C m/W	A	196	240	285	320	365	405	463	500	562	613	656	699	742
Depth of laying = 0.8m, laid in Trefoil touching														
2. Drawn into Ducts, Ground Temp. 30°C & g = 1.2°C m/W	A	196	231	271	303	334	365	418	445	472	507	552	587	614
Depth of laying = 0.8m, laid singly														
3. Laid in Air in Trefoil touching, Ambient Temp. 35°C	A	230	285	345	396	451	506	598	681	77.	865	957	1049	1132
One Second Short Circuit Current Rating of Conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2	71.5	90.1	115	143

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

Table 2

3.6/6 (7.2) kV Three core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 And EEMUA 133 Spec.										
Nominal Area of Conductor	**mm²**	**50**	**70**	**95**	**120**	**150**	**185**	**240**	**300**	**400**
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.06	0.047
Approx. AC resistance of Conductor at 90°C	ohm/Km	0.494	0.342	0.247	0.196	0.159	0.128	0.0982	0.079	0.063
Approximate Reactance at 50 Hertz	ohm/Km	0.13	0.13	0.12	0.11	0.11	0.11	0.011	0.01	0.01
Approx. Capacitance of Cable	µf/Km	0.34	0.38	0.43	0.47	0/51	0.56	0.61	0.63	0.65
Approx. Charging Current per phase at U_0 = 3.6 kV And f = 50Hz	mA/m	0.38	0.43	0.49	0.53	0.58	0.63	0.69	0.71	0.74
Sustained Current Ratings										
1. Laid Direct, Ground Temp. 30°C & Thermal resistivity = 1.2°C m/W										
depth of laying = 0.8m, laid singly	A	187	227	267	303	338	383	436	481	534
2. Drawn into Ducts, Ground Temp. 30°C &										
g = 1.2°C m/W, depth of laying = 0.8m, laid singly	A	161	191	227	258	294	329	378	418	472
3. Laid in Air Ambient Temp. 35°C	A	203	248	304	345	396	451	524	598	681
One Second Short Circuit Current Rating of Conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

ELECTRICAL CHARACTERISTICS - ARMOURED-CABLES

Table 3

6/10 (12) kV Single core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 And EEMUA 133 Spec.														
Nominal Area of Conductor	**mm²**	**50**	**70**	**95**	**120**	**150**	**185**	**240**	**300**	**400**	**500**	**630**	**800**	**1000**
Maximum DC resistance of Conductor at 20° C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047	0.0366	0.0283	0.0221	0.0176
Approximate AC resistance of Conductor at 90° C	ohm/Km	0.493	0.342	0.246	0.196	0.16	0.127	0.098	0.079	0.063	0.05	0.041	0.039	0.029
Approximate Reactance at 50 Hertz	ohm/Km	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.10	0.09	0.09
Approximate Capacitance of Cable	µf/Km	0.25	0.29	0.35	0.38	0.41	0.47	0.51	0.54	0.58	0.66	0.74	0.78	0.80
Approx. Charging Current per phase at U_0 = 6 kV and f = 50Hz	mA/m	0.47	0.55	0.66	0.72	0.77	0.89	0.96	1.00	1.10	1.20	1.40	1.50	1.50
Sustained Current Ratings														
1. Laid Direct, Ground Temp. 30°C & g = 1.2° C m/W	A	196	240	285	320	365	405	463	501	562	613	656	699	742
Depth of laying = 0.8m, laid in Trefoil touching														
2. Drawn into Ducts, Ground Temp. 30°C & g = 1.2° C m/W	A	196	231	271	303	334	365	418	445	472	507	552	587	614
Depth of laying = 0.8m, laid singly														
3. Laid in Air in Trefoil touching, Ambient Temp. 35° C	A	230	285	345	396	451	506	598	681	773	856	957	1049	1132
One Second Short Circuit rating of conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2	71.5	90.1	115	143

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

Table 4

6/10 (12) kV Three core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 And EEMUA 133 Spec.										
Nominal Area of Conductor	**mm²**	**50**	**70**	**95**	**120**	**150**	**185**	**240**	**300**	**400**
Maximum DC resistance of Conductor at 20° C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047
Approximate AC resistance of Conductor at 90° C	ohm/Km	0.493	0.342	0.247	0.196	0.16	0.128	0.098	0.078	0.064
Approximate Reactance at 50 Hertz	ohm/Km	0.11	0.11	0.1	0.1	0.09	0.09	0.09	0.09	0.08
Approximate Capacitance of Cable	µf/Km	0.25	0.29	0.35	0.38	0.41	0.47	0.51	0.54	0.58
Approx. Charging Current per phase at U_0 = 6 kV and f = 50Hz	mA/m	0.47	0.55	0.66	0.72	0.77	0.89	0.96	1.0	1.1
Sustained Current Ratings										
1. Laid Direct, Ground Temp. 30° C &Thermal Resistivity = 1.2° C m/W	A	187	227	267	303	338	383	436	481	534
depth of laying = 0.8m, laid singly										
2. Drawn into Ducts, Ground Temp. 30°C & g = 1.2° C m/W	A	161	191	227	258	294	329	378	418	472
depth of laying = 0.8m, laid singly										
3. Laid in Air, Ambient Temp. 35° C	A	203	248	304	345	396	451	524	598	681
One Second Short Circuit Current Rating of conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

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ELECTRICAL CHARACTERISTICS - ARMOURED-CABLES

Table 5

8.7/15 (17.5) kV Single core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 & EEMUA 133 Spec.

Nominal Area of Conductor	mm²	50	70	95	120	150	185	240	300	400	500	630	800	1000
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047	0.0366	0.0283	0.0221	0.0176
Approximate AC resistance of Conductor at 90°C	ohm/Km	0.494	0.342	0.247	0.196	0.159	0.127	0.098	0.078	0.063	0.05	0.041	0.039	0.029
Approximate Reactance at 50 Hertz	ohm/Km	0.14	0.14	0.13	0.12	0.12	0.12	0.11	0.11	0.11	0.1	0.1	0.09	0.09
Approximate Impedance at 50 Hertz	ohm/Km	0.51	0.36	0.27	0.2	0.19	0.16	0.14	0.13	0.11	0.11	0.11	0.09	0.09
Approximate Capacitance of Cable	µf/Km	0.22	0.25	0.28	0.31	0.33	0.36	0.41	0.44	0.49	0.54	0.59	0.68	0.72
Approx. Charging Current per phase at U_0 = 8.7 kV and f = 50Hz	mA/m	0.6	0.68	0.77	0.85	0.9	1.0	1.1	1.2	1.3	1.5	1.6	1.9	2.0
Sustained Current Ratings														
1. Laid Direct, Ground Temp. 30°C & g = 1.2°C m/W	A	196	240	285	320	365	405	463	516	579	632	676	721	765
Depth of laying = 0.8m, laid in Trefoil touching														
2. Drawn into Ducts, Ground Temp. 30°C & g = 1.2°C m/W	A	196	231	271	303	334	365	418	445	472	507	552	587	614
Depth of laying = 0.8m, laid singly														
3. Laid in Air in Trefoil touching, Ambient Temp. 35°C	A	230	285	345	396	451	506	598	681	773	856	957	1049	1132
One Second Short Circuit Rating of Conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2	71.5	90.1	115	143

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

Table 6

8.7/15 (17.5) kV Three core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 & EEMUA 133 Spec.

Nominal Area of Conductor	mm²	50	70	95	120	150	185	240	300	400
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047
Approx. AC resistance of Conductor at 90°C	ohm/Km	0.493	0.342	0.247	0.196	0.159	0.128	0.098	0.079	0.064
Approximate Reactance at 50 Hertz	ohm/Km	0.12	0.11	0.11	0.1	0.1	0.1	0.09	0.09	0.09
Approximate Impedance at 50 Hertz	ohm/Km	0.51	0.36	0.27	0.22	0.19	0.16	0.14	0.12	0.11
Approx. Capacitance of Cable	µf/Km	0.22	0.25	0.28	0.31	0.33	0.36	0.41	0.44	0.49
Approx. Charging Current per phase at U_0 = 8.7 kV and f = 50Hz	mA/m	0.6	0.68	0.77	0.85	0.9	1.0	1.1	1.2	1.3
Sustained Current Ratings										
1. Laid Direct, Ground Temp. 30°C & g = 1.2°C m/W	A	187	227	267	303	338	383	436	481	534
depth of laying = 0.8m, laid in singly										
2. Drawn into Ducts, Ground Temp. 30°C & g = 1.2°C m/W	A	161	191	227	258	294	329	378	418	472
depth of laying = 0.8m, laid in singly										
3. Laid in Air in Trefoil touching, Ambient Temp. 35°C	A	203	248	304	345	396	451	524	598	681
One Second Short Circuit Rating of Conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

ELECTRICAL CHARACTERISTICS - ARMOURED-CABLES

Table 7

12/20 (24) kV Single core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 & EEMUA 133 Spec.

Nominal Area of Conductor	mm²	50	70	95	120	150	185	240	300	400	500	630	800	1000
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047	0.0366	0.0283	0.0221	0.0176
Approximate AC resistance of Conductor at 90°C	ohm/Km	0.494	0.342	0.247	0.196	0.159	0.127	0.098	0.079	0.063	0.05	0.04	0.039	0.029
Approximate Reactance at 50 Hertz	ohm/Km	0.15	0.14	0.13	0.13	0.12	0.12	0.12	0.11	0.11	0.11	0.1	0.1	0.09
Approximate Impedance at 50 Hertz	ohm/Km	0.52	0.37	0.28	0.23	0.2	0.17	0.15	0.14	0.12	0.12	0.11	0.1	0.1
Approximate Capacitance of Cable	µf/Km	0.18	0.21	0.23	0.25	0.27	0.29	0.32	0.35	0.39	0.43	0.48	0.53	0.58
Approx. Charging Current per phase at U_0 = 12 kV and f = 50Hz	mA/m	0.68	0.79	0.87	0.94	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2
Sustained Current Ratings														
1. Laid Direct, Ground Temp. 30° C & g = 1.2° C m/W	A	196	240	285	320	365	401	454	507	570	623	676	721	765
Depth of laying = 0.8m, laid in Trefoil touching														
2. Drawn into Ducts, Ground Temp. 30° C & g = 1.2°C m/W	A	187	231	271	303	329	356	401	436	472	507	543	596	614
Depth of laying = 0.8m, laid singly														
3. Laid in Air in Trefoil touching, Ambient Temp. 35° C	A	239	294	350	405	451	515	598	672	764	865	966	1049	1132
One Second Short Circuit Rating of Conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2	71.5	90.5	115	143

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

Table 8

12/20 (24) kV Three core Copper conductors, XLPE Insulated, Lead sheathed Cables, To IEC 60502-2 & EEMUA 133 Spec.

Nominal Area of Conductor	mm²	50	70	95	120	150	185	240	300	400
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047
Approx. AC resistance of Conductor at 90°C	ohm/Km	0.493	0.342	0.247	0.196	0.159	0.127	0.098	0.079	0.064
Approximate Reactance at 50 Hertz	ohm/Km	0.12	0.12	0.11	0.11	0.1	0.1	0.1	0.09	0.09
Approximate Impedance at 50 Hertz	ohm/Km	0.51	0.36	0.27	0.22	0.19	0.16	0.14	0.12	0.11
Approx. Capacitance of Cable	µf/Km	0.18	0.21	0.23	0.25	0.27	0.29	0.32	0.35	0.35
Approx. Charging Current per phase at U_0 = 12 kV and f = 50Hz	mA/m	0.68	0.79	0.87	0.94	1.0	1.1	1.2	1.3	1.3
Sustained Current Ratings										
1. Laid Direct, Ground Temp. 30° C & g = 1.2° C m/W	A	187	227	263	298	334	374	427	472	530
depth of laying = 0.8m, laid singly										
2. Drawn into Ducts, Ground Temp. 30° C & g = 1.2°C m/W	A	165	200	231	267	298	338	383	427	461
depth of laying = 0.8m, laid singly										
3. Laid singly Air, Ambient Temp. 35° C	A	207	253	304	350	396	451	524	598	674
One Second Short Circuit Rating of Conductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90° C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250° C.

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ELECTRICAL CHARACTERISTICS - ARMOURED-CABLES

Table 9

18/30(36) kV Single core Copper conductors, XLPE Insulated, To IEC 60502-2 And EEMUA 133 Spec.														
Nominal Area of Conductor	**mm²**	**50**	**70**	**95**	**120**	**150**	**185**	**240**	**300**	**400**	**500**	**630**	**800**	**1000**
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047	0.0366	0.0283	0.0221	0.0176
Approximate AC resistance of Conductor at 90°C	ohm/Km	0.494	0.342	0.247	0.196	0.159	0.127	0.0982	0.0791	0.0632	0.051	0.0417	0.038	0.029
Approximate Reactance at 50 Hertz	ohm/Km	0.16	0.15	0.14	0.14	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.09	0.09
Approximate Capacitance of Cable	µf/Km	0.14	0.16	0.18	0.19	0.2	0.22	0.24	0.26	0.29	0.32	0.35	0.4	0.44
Approx. Charging Current per phase at U_0 = 18 kV and f = 50Hz	mA/m	0.8	0.9	1.0	1.1	1.1	1.2	1.4	1.5	1.6	1.8	2.0	2.3	2.5
Sustained Current Ratings														
1. Laid Direct, Ground Temp. 30°C & g = 1.2°C m/W	A	196	240	285	320	365	401	454	492	553	604	656	699	742
depth of laying = 0.8m, laid in Trefoil touching														
2. Drawn into Ducts, Ground Temp. 30°C & g = 1.2°C m/W	A	187	231	267	303	329	356	401	436	472	507	543	596	623
depth of laying = 0.8m, laid singly														
3. Laid in Air in Trefoil touching, Ambient Temp. 35°C	A	207	254	305	360	411	466	550	626	719	829	956	1092	1210
One second short circuit rating of ronductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2	71.5	90.1	115	143

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

Table 10

18/30(36) kV Three core Copper conductors, XLPE Insulated, To IEC 60502-2 And EEMUA 133 Spec.										
Nominal Area of Conductor	**mm²**	**50**	**70**	**95**	**120**	**150**	**185**	**240**	**300**	**400**
Maximum DC resistance of Conductor at 20°C	ohm/Km	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.047
Approximate AC resistance of Conductor at 90°C	ohm/Km	0.493	0.342	0.247	0.196	0.159	0.128	0.098	0.079	0.064
Approximate Reactance at 50 Hertz	ohm/Km	0.14	0.13	0.12	0.12	0.11	0.11	0.1	0.1	0.1
Approximate Capacitance of Cable	µf/Km	0.14	0.16	0.18	0.19	0.2	0.2	0.22	0.23	0.26
Approx. Charging Current per phase at U_0 = 18 kV and f = 50Hz	mA/m	0.8	0.9	1.0	1.1	1.1	1.1	1.2	1.3	1.5
Sustained Current Ratings										
1. Laid Direct in Ground Temp. 30°C & Thermal Resistivity = 1.2°C m/W	A	187	227	267	303	338	379	431	477	527
depth of laying = 0.8m, laid in Trefoil touching										
2. Drawn into Ducts, Ground Temp. 30°C & g = 1.2°C m/W	A	160	191	227	258	294	322	366	405	448
depth of laying = 0.8m, laid singly										
3. Laid in Air, Ambient Temp. 35°C	A	202	248	304	345	396	462	533	599	671
One second short circuit rating of ronductor	kA	7.15	10.1	13.6	17.2	21.5	26.5	34.4	42.9	57.2

FOR ALL CABLES THE MAXIMUM CONDUCTOR OPERATING TEMPERATURE IS 90°C AND LIMITIG CONDUCTOR TEMPERATURE AFTER SHORT CIRCUIT IS 250°C.

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Cable Data

XLPE INSULATED CABLE TO IEC 60502-2 & EEMUA 133
Uo/U(Um) = 3.6/6(7.2) OR 3.8/6.6(7.2) kV

Table 11

3600/6000V cable, stranded copper conductors, copper tape screen, lead sheath, PVC separation sheath, single wire armoured, PVC sheath					
	Nominal area of conductor	Approximate Diameter			
	mm2	Over lead mm	Under armour mm	Over armour mm	Overall mm
SINGLE CORE	50	18.9	20.9	24.1	27.0
	70	20.8	22.8	26.0	29.0
	95	22.3	24.3	27.5	30.7
	120	23.8	25.8	29.8	33.0
	150	25.5	27.5	31.5	34.9
	185	27.2	29.2	33.2	36.8
	240	29.8	31.8	35.8	39.6
	300	32.7	34.7	38.7	42.6
	400	36.2	38.2	43.2	47.3
	500	39.8	41.8	46.8	51.5
	630	43.9	46.1	51.1	55.8
	800	48.1	50.5	55.5	60.4
	1000	53.6	56.1	61.1	66.4
THREE CORE	50	38.9	40.9	45.7	50.0
	70	42.7	44.9	49.8	54.3
	95	46.2	48.4	53.3	58.2
	120	49.6	52.0	56.9	61.9
	150	53.0	55.6	60.5	65.7
	185	56.9	59.5	64.4	70.0
	240	62.3	64.9	71.0	77.0
	300	68.5	71.5	77.6	83.9
	400	76.0	79.2	85.3	92.2

Cable Data

XLPE INSULATED CABLE TO IEC 60502-2 & EEMUA 133
Uo/U(Um) = 6/10(12) OR 6.35/11(12) kV

Table 12

6000/10000V cable, stranded copper conductors, copper tape screen, lead sheath, PVC separation sheath, single wire armoured, PVC sheath					
	Nominal area of conductor	Approximate Diameter			
		Over lead	Under armour	Over armour	Overall
	mm^2	mm	mm	mm	mm
SINGLE CORE	50	20.9	22.9	26.1	29.1
	70	22.6	24.6	27.8	31.0
	95	24.3	26.3	30.3	33.7
	120	25.8	27.8	31.8	35.2
	150	27.3	29.3	33.3	36.9
	185	29.2	31.2	35.2	38.8
	240	31.6	33.6	37.6	41.4
	300	33.9	35.9	40.9	44.8
	400	37.0	39.0	44.0	48.1
	500	40.2	42.2	47.2	51.7
	630	44.3	46.5	51.5	56.2
	800	48.5	50.9	55.9	61.0
	1000	54.0	56.5	61.5	67.0
THREE CORE	50	43.6	46.2	51.1	55.5
	70	47.4	49.6	54.5	59.4
	95	50.9	53.3	58.2	63.2
	120	54.3	56.9	61.8	67.2
	150	57.8	60.4	66.7	72.3
	185	61.6	64.2	70.3	76.3
	240	66.8	69.6	75.7	81.8
	300	71.9	74.9	81.0	87.5
	400	78.5	81.9	88.0	95.1

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Cable Data

XLPE INSULATED CABLE TO IEC 60502-2 & EEMUA 133
Uo/U(Um) = 8.7/15(17.5) kV

Table 13

8700/15000V cable, stranded copper conductors, copper tape screen, lead sheath, PVC separartion sheath, single wire armoured, PVC sheath					
	Nominal area of conductor	Approximate Diameter			
		Over lead	Under armour	Over armour	Overall
	mm^2	mm	mm	mm	mm
SINGLE CORE	50	23.1	25.1	28.3	31.5
	70	25.0	27.0	31.0	34.4
	95	26.5	28.5	32.5	35.9
	120	28.2	30.2	34.2	37.8
	150	29.7	31.7	35.7	39.3
	185	31.6	33.6	37.6	41.4
	240	33.8	35.8	40.8	44.7
	300	36.3	38.3	43.3	47.4
	400	39.4	41.4	46.4	50.7
	500	42.5	44.7	49.7	54.2
	630	46.7	48.9	53.9	58.8
	800	50.9	53.3	58.3	63.3
	1000	56.4	58.9	63.9	69.3
THREE CORE	50	48.5	50.9	55.8	60.9
	70	52.6	55.2	60.1	65.3
	95	56.0	58.6	63.5	68.9
	120	59.5	62.1	68.2	74.0
	150	62.7	65.5	71.6	77.6
	185	66.8	69.6	75.7	81.8
	240	71.7	74.7	80.8	87.3
	300	77.0.	80.2	86.3	93.2
	400	83.5	86.9	93.0	100.5

Cable Data

XLPE INSULATED CABLE TO IEC 60502-2 & EEMUA 133
Uo/U(Um) = 12/20(24) OR 12.7/22(24) kV

Table 14

12000/20000V cable, stranded copper conductors, copper tape screen, lead sheath, PVC separation sheath, single wire armoured, PVC sheath					
	Nominal area of conductor	Approximate Diameter			
		Over lead	Under armour	Over armour	Overall
	mm^2	mm	mm	mm	mm
SINGLE CORE	50	25.3	27.3	31.3	34.7
	70	27.0	29.0	33.0	36.6
	95	28.7	30.7	34.7	38.3
	120	30.2	32.2	36.2	40.0
	150	31.9	33.9	37.9	41.7
	185	33.6	35.6	40.6	44.5
	240	36.0	38.0	43.0	47.1
	300	38.5	40.5	45.5	49.8
	400	41.4	43.4	48.5	52.9
	500	44.5	46.7	51.7	56.4
	630	48.9	51.3	56.3	61.3
	800	53.1	55.6	60.6	65.9
	1000	58.4	61.1	67.4	73.2
THREE CORE	50	53.2	55.8	60.7	65.9
	70	57.1	59.7	64.6	70.2
	95	60.5	63.1	69.2	75.0
	120	64.0	66.8	72.9	79.0
	150	67.4	70.2	76.3	82.6
	185	71.3	74.3	80.4	86.9
	240	76.2	79.4	85.5	92.4
	300	81.5	84.9	91.0	98.3
	400	87.9	91.6	97.7	105.3

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Cable Data

XLPE INSULATED CABLE TO IEC 60502-2 & EEMUA 133
Uo/U(Um) = 18/30(36) OR 19/33(36) kV

Table 15

18000/30000V cable, stranded copper conductors, copper tape screen, lead sheath, PVC separation sheath, single wire armoured, PVC sheath					
	Nominal area of conductor	Approximate Diameter			
		Over lead	Under armour	Over armour	Overall
	mm^2	mm	mm	mm	mm
SINGLE CORE	50	30.5	32.5	36.5	40.3
	70	32.4	34.4	38.4	42.2
	95	33.9	35.9	40.9	44.8
	120	35.6	37.6	42.6	46.7
	150	37.1	39.1	44.1	48.2
	185	39.0	41.0	46.0	50.3
	240	41.2	43.2	48.2	52.7
	300	43.6	45.8	50.8	55.5
	400	46.7	48.9	53.9	58.8
	500	49.9	52.3	57.3	62.3
	630	54.1	56.6	61.6	67.1
	800	58.3	61.0	67.3	73.1
	1000	63.8	66.6	72.9	79.1
THREE CORE	50	67.7	70.6	76.7	83.1
	70	71.7	74.7	80.8	87.3
	95	75.1	78.3	84.4	91.3
	120	78.8	82.1	88.2	95.3
	150	82.3	85.7	91.8	99.0
	185	86.1	89.6	95.7	103.2
	240	91.0	94.6	100.7	108.6
	300	96.2	100.0	106.1	114.3
	400	102.9	107.0	113.1	121.8

Technical Data

Current Ratings and Rating Factors

The current ratings of copper conductor cables stated in the tables in this catalogue are based on the IEC 60287 Publication, assuming continuous conductor operating temperature of 90˚C, for cables laid underground or in air, or drawn through ducts.

These ratings are applicable for conditions defined in the tables and derating factors need to be applied in case of variations in:

- Ambient temperature
- Ground temperature
- Depth of buried cable
- Thermal resistivity of soil
- Multiple circuits and their configuration

Appropriate tables for derating factors are provided in the latter part of this catalogue.

Short Circuit Ratings

The short circuit rating graph given in this catalogue assume final conductor temperature of 250˚C rising from 90˚C i.e., in a fully loaded condition. It is therefore necessary that accessories used with the cables are also capable of operation at these values of fault current and temperature.

The tables also indicate the specific short circuit fault current rating for a duration of one second for each cable size and type. When the fault duration (t) is different, then the appropriate rating may be obtained by multiplying the 1 second rating by the factor 1/t.

Short circuit forces should be taken into account when single core cables are installed touching each other. Cleating and strapping should be such that repulsive forces that occur under short circuit conditions are contained.

Installation

Cables described in this publication are suitable for laying direct in ground, in air or drawn through ducts. Special construction features are needed when sustained wet conditions prevail in the ground.

Cable pulling forces have to be limited according to the total conductor cross section area (A) in mm^2 and the maximum may be limited to A x 50 Newtons for copper and A x 30 Newtons for aluminium.

Cable bending radii are recommended as follows:

	Minimum Bending Radius	
	During installation	Controlled bending
Single core unarmoured	20D	15D
Single core armoured	15D	12D
Three core unarmoured	15D	12D
Three core armoured	12D	10D

D is overall cable diameter.

As intended in all international specifications; whenever possible larger installation radii shoul be used. Minimum values hold for areas of constraints such as close to joints or terminations etc.

Voltage Tests After Installation

The following test levels are recommended for cables immediately after installation.

Cable Voltage Designation	15 min. D.C. Voltage Test
kV	kV
3.6/6	15
6/10	25
8.7/15	37
12/20	50
18/30	76

Repeated voltage tests of an installation, particularly with cables in service for more than 5 years can be detrimental and hence not recommended. If unavoidable, 50% of above voltages may be applied for tests.

Rating Factors

Table 16

Cables laid direct in ground

Variation in Ground Temperature

Ground temperature° C	15	20	25	30	35	40	45
Cable Type	Rating factor						
All Cables	1.11	1.08	1.04	1.00	0.96	0.91	0.87

Table 17 RATING FACTORS FOR DEPTH OF LAYING (TO CENTRE OF CABLE OR TREFOIL GROUP OF CABLES)

Depth of laying m	3.6/6kV to 18/30kV cables	
	Up to 300mm²	Above 300mm²
0.50	-	-
0.60	-	-
0.80	1.00	1.00
1.00	0.98	0.97
1.25	0.96	0.95
1.50	0.95	0.94
1.75	0.94	0.92
2.00	0.92	0.90
2.50	0.91	0.89
3.00 or more	0.90	0.88

Table 18 RATING FACTORS FOR VARIATION IN THERMAL RESISTIVITY OF SOIL (AVERAGE VALUES)

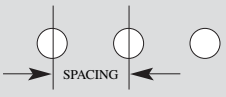
Size of cables mm²	Soil thermal resistivity in K.m./W						
	0.8	0.9	1.0	1.5	2.0	2.5	3.0
Single core							
50	1.15	1.11	1.07	0.91	0.81	0.73	0.68
70	1.16	1.12	1.07	0.91	0.81	0.73	0.68
95	1.16	1.12	1.07	0.91	0.81	0.73	0.68
120	1.16	1.12	1.07	0.91	0.81	0.73	0.68
150	1.17	1.12	1.07	0.91	0.81	0.73	0.68
185	1.17	1.12	1.07	0.91	0.81	0.73	0.68
240	1.17	1.12	1.07	0.91	0.80	0.73	0.68
300	1.18	1.12	1.07	0.91	0.80	0.73	0.68
400	1.18	1.12	1.07	0.91	0.80	0.73	0.67
500	1.18	1.12	1.07	0.91	0.80	0.73	0.67
630	1.18	1.12	1.07	0.91	0.80	0.73	0.67
800	1.18	1.12	1.07	0.91	0.80	0.72	0.66
1000	1.18	1.12	1.07	0.91	0.80	0.72	0.66
Multicore							
50	1.13	1.09	1.06	0.92	0.83	0.76	0.71
70	1.14	1.09	1.06	0.92	0.83	0.75	0.70
95	1.14	1.09	1.06	0.92	0.83	0.75	0.70
120	1.14	1.10	1.06	0.92	0.82	0.75	0.69
150	1.14	1.10	1.06	0.92	0.82	0.75	0.69
185	1.14	1.10	1.06	0.92	0.82	0.74	0.69
240	1.15	1.10	1.07	0.92	0.81	0.74	0.69
300	1.15	1.10	1.07	0.92	0.81	0.74	0.69
400	1.15	1.10	1.07	0.92	0.81	0.74	0.69

Group Rating Factors

Table 19 GROUP RATING FACTORS FOR CIRCUITS OF THREE SINGLE CORE CABLES IN TREFOIL AND LAID FLAT TOUCHING, HORIZONTAL FORMATION (AVERAGE VALUES)

							
	Number of Circuits	Spacing of Circuits					
		Touching +					
		Trefoil	Laid flat	0.15 m*	0.30 m	0.45 m	0.60 m
3.6/6 to 12/20kV cables	2	0.78	0.81	0.81	0.85	0.88	0.90
	3	0.66	0.68	0.71	0.76	0.80	0.83
	4	0.59	0.62	0.65	0.72	0.76	0.80
	5	0.55	0.58	0.61	0.68	0.73	0.77
	6	0.52	0.55	0.58	0.66	0.72	0.76
18/30kV cables	2	0.79	0.81	0.81	0.85	0.88	0.90
	3	0.67	0.70	0.71	0.76	0.80	0.83
	4	0.62	0.65	0.65	0.72	0.76	0.80
	5	0.57	0.60	0.60	0.68	0.73	0.77
	6	0.54	0.57	0.57	0.66	0.72	0.76

Table 20 GROUP RATING FACTORS FOR MULTICORE CABLES IN HORIZONTAL FORMATION

						
	Number of Cables in Group	Spacing				
		Touching	0.15 m	0.30 m	0.45 m	0.60 m
3.6/6 to 12/20kV cables	2	0.80	0.85	0.89	0.90	0.92
	3	0.68	0.75	0.80	0.84	0.86
	4	0.62	0.70	0.77	0.80	0.84
	5	0.57	0.66	0.73	0.78	0.81
	6	0.55	0.63	0.71	0.76	0.80
18/30kV cables	2	0.80	0.83	0.87	0.89	0.91
	3	0.70	0.73	0.78	0.82	0.85
	4	0.64	0.68	0.74	0.78	0.82
	5	0.59	0.63	0.70	0.75	0.79
	6	0.56	0.60	0.68	0.74	0.78

Cables installed in single way ducts:

The term 'ducts'applies to single earthenware, fibre or plastic pipes.

Table 21 VARIATION IN GROUND TEMPERATURE

Ground temperature° C	15	20	25	30	35	40	45
Cable Type	**Rating factor**						
All Cables	1.11	1.08	1.04	1.00	0.96	0.91	0.87

Table 22 RATING FACTORS FOR DEPTH OF LAYING (TO CENTRE OF CABLE OR TREFOIL GROUP OF CABLES)

Depth of laying	3.6/6kV to 18/30kV cables	
m	Up to 300mm²	Above 300mm²
0.50	-	-
0.60	-	-
0.80	1.00	1.00
1.00	0.98	0.99
1.25	0.95	0.97
1.50	0.93	0.96
1.75	0.92	0.95
2.00	0.90	0.94
2.50	0.89	0.93
3.00 or more	0.88	0.92

Table 23 RATING FACTORS FOR VARIATION IN THERMAL RESISTIVITY OF SOIL (AVERAGE VALUES)

Size of cables	Soil thermal resistivity in K.m./W						
mm²	0.8	0.9	1.0	1.5	2.0	2.5	3.0
Single core							
50	1.08	1.06	1.04	0.94	0.87	0.82	0.77
70	1.09	1.06	1.04	0.94	0.87	0.81	0.76
95	1.09	1.06	1.04	0.94	0.87	0.81	0.76
120	1.10	1.07	1.04	0.94	0.86	0.80	0.75
150	1.10	1.07	1.04	0.94	0.86	0.80	0.75
185	1.10	1.07	1.04	0.93	0.86	0.79	0.75
240	1.11	1.07	1.04	0.93	0.86	0.79	0.74
300	1.11	1.08	1.05	0.93	0.85	0.79	0.74
400	1.11	1.08	1.05	0.93	0.85	0.78	0.73
500	1.11	1.08	1.05	0.93	0.85	0.78	0.73
630	1.12	1.08	1.05	0.93	0.84	0.78	0.72
800	1.12	1.09	1.05	0.93	0.84	0.77	0.72
1000	1.13	1.09	1.05	0.92	0.84	0.77	0.71
Multicore							
50	1.05	1.03	1.02	0.96	0.91	0.87	0.83
70	1.05	1.04	1.02	0.96	0.91	0.86	0.82
95	1.06	1.04	1.02	0.96	0.91	0.86	0.82
120	1.06	1.04	1.03	0.95	0.90	0.85	0.81
150	1.06	1.04	1.03	0.95	0.90	0.85	0.80
185	1.07	1.05	1.03	0.95	0.89	0.84	0.80
240	1.07	1.05	1.03	0.95	0.89	0.84	0.79
300	1.07	1.05	1.03	0.95	0.88	0.83	0.78
400	1.07	1.05	1.03	0.95	0.88	0.83	0.78

Group Rating Factors

Table 24 GROUP RATING FACTORS FOR SINGLE CORE CABLES IN TREFOIL SINGLE WAY DUCTS, HORIZONTAL FORMATION (AVERAGE VALUES)

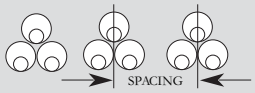
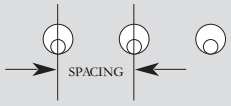
				
	Number of Circuits	Spacing		
		Touching	0.45 m	0.60 m
3.6/6 to 12/20 kV Cables	2 3 4 5 6	0.85 0.75 0.70 0.67 0.64	0.88 0.80 0.76 0.73 0.71	0.90 0.83 0.80 0.77 0.76
18/30kV Cables	2 3 4 5 6	0.85 0.76 0.71 0.67 0.65	0.88 0.80 0.76 0.73 0.71	0.90 0.83 0.80 0.77 0.76

Table 25 GROUP RATING FACTORS FOR MULTICORE CABLES IN SINGLE WAY DUCTS, HORIZONTAL FORMATION (AVERAGE VALUES)

					
	Number of Ducts in Ground	Spacing			
		Touching	0.30 m	0.45 m	0.60 m
3.6/6 to 12/20kV cables	2 3 4 5 6	0.88 0.80 0.75 0.71 0.69	0.91 0.84 0.81 0.77 0.75	0.93 0.87 0.84 0.82 0.80	0.94 0.89 0.87 0.85 0.84
18/30kV cables	2 3 4 5 6	0.87 0.78 0.73 0.69 0.67	0.89 0.82 0.78 0.75 0.73	0.92 0.85 0.82 0.79 0.78	0.93 0.87 0.85 0.83 0.82

Group Rating Factors

Cables installed in free air:

All the ratings for cables run in air are based upon the assumption that they are shielded from direct sunlight and without restriction of ventilation.

Table 26 **Variation in Air Temperature**

Ambient temperature° C	25	30	35	40	45	50	55
Cable Type	**Rating factor**						
All Types	1.09	1.04	1.00	0.95	0.90	0.85	0.80

Effect of grouping cables: No reduction in rating is necessary where there is free circulation of air around the circuits provided that:

1. The horizontal clearance between circuits is not less than twice the overall diameter of an individual cable.
2. The vertical clearance between circuits is not less than four times the diameter of an individual cable.
3. If the number of circuits exceeds three, they are installed in a horizontal plane.

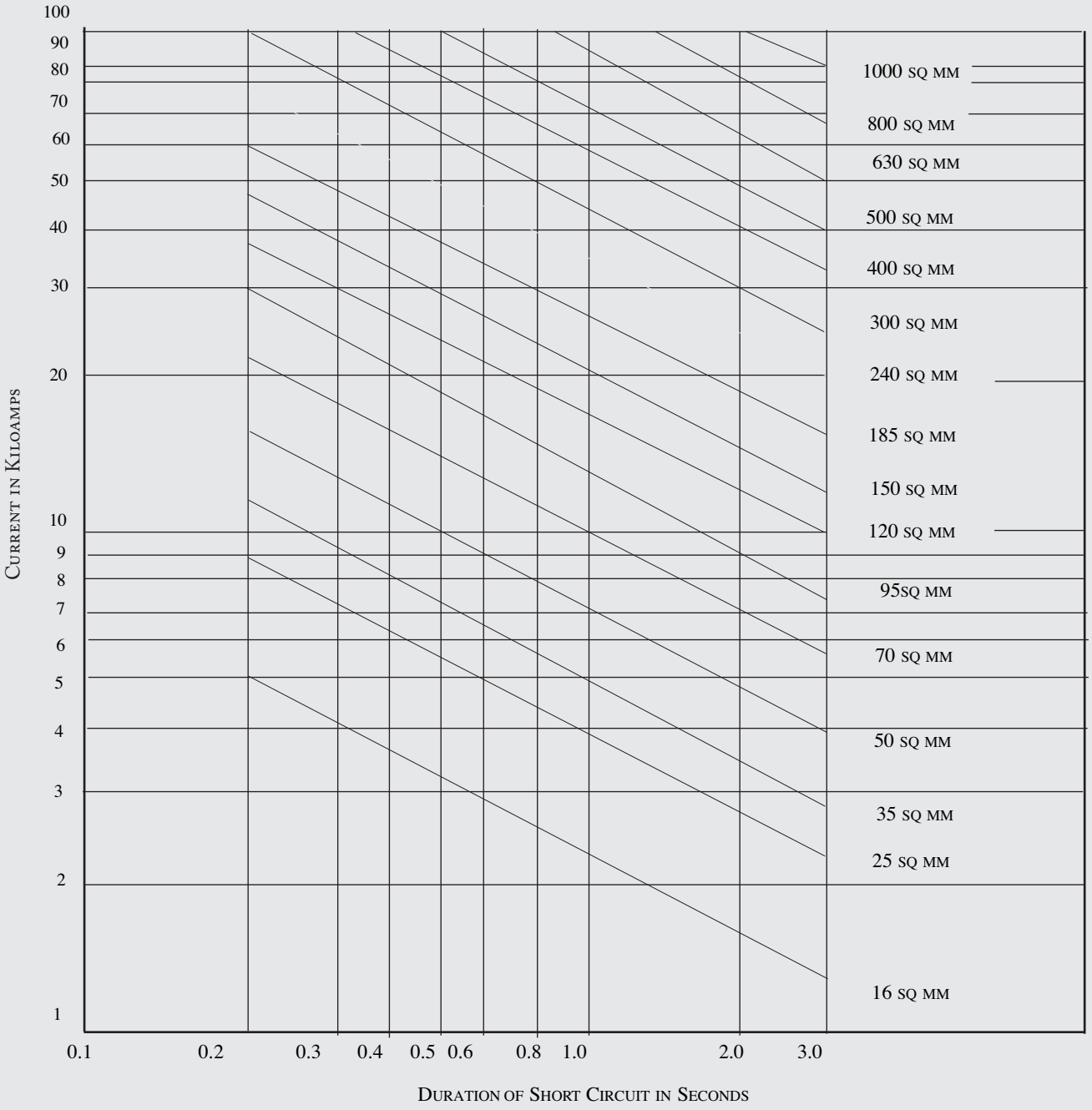
Copper Screen for single core unarmoured cables:

It is common practice to provide copper screen of minimum cross-sectional area (as indicated below) for single core unarmoured cables, unless specific earth fault requirements of the system govern the same. In the latter case, it is advisable to design the copper screen to carry the specified earth fault current.

Table 27

Conductor cross section mm^2	**Screen Area** mm^2
50 - 120	16
150 - 300	25
400 and above	35

Short Circuit Rating
Copper Conductor



Basis

1. Cable fully loaded at start of short circuit.

(Conductor temperature: 90˚C)

2. Conductor temperature at end of short circuit: 250˚C

Note:

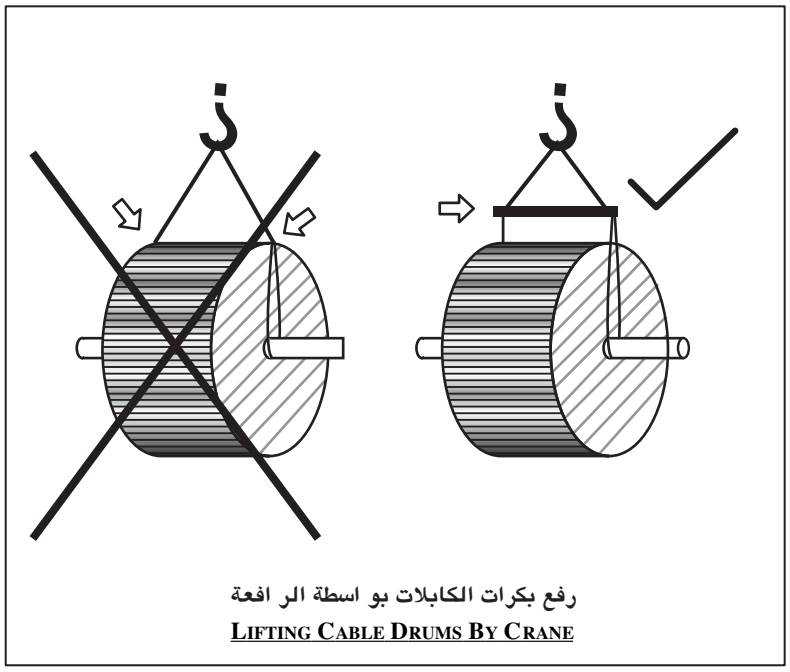
It should be ensured that the accessories associated with the cable are also capable of operation at these values of fault current and temperature.

دوكاب باور بلاس

Cable Drum Handling

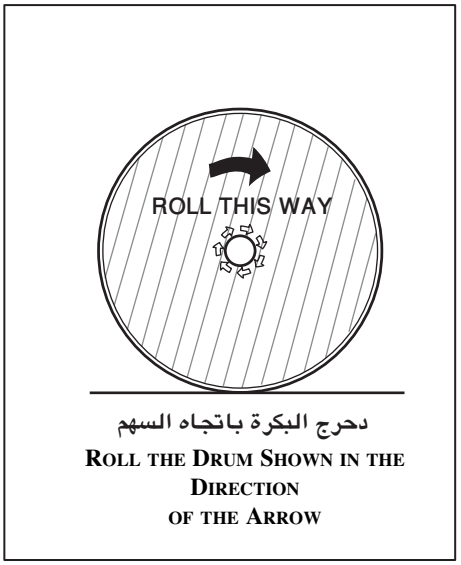
Ducab Medium Voltage cables should be installed by trained personnel in accordance with good engineering practices, recognised codes of practice, statutory local requirements, IEE wiring regulations and where relevant, in accordance with any specific instructions issued by the company. Cables are often supplied in heavy cable drums and handling these drums can constitute a safety hazard. In particular, dangers may arise during the removal of steel binding straps and during the removal of retaining battens and timbers which may expose projecting nails.

For detailed information, refer to Ducab's Drum Handling Instructions Catalogue.



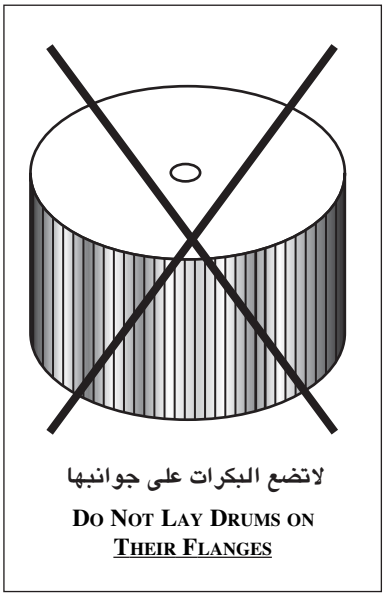
رفع بكرات الكابلات بو اسطة الر افعة

LIFTING CABLE DRUMS BY CRANE



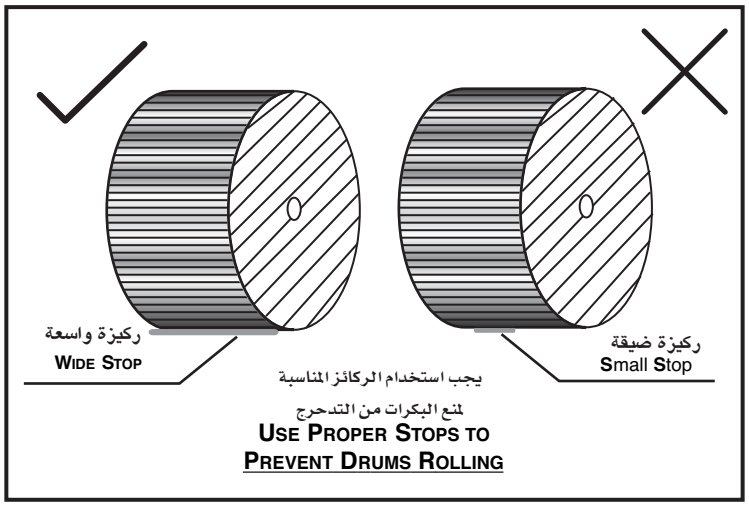
دحرج البكرة باتجاه السهم

ROLL THE DRUM SHOWN IN THE DIRECTION OF THE ARROW

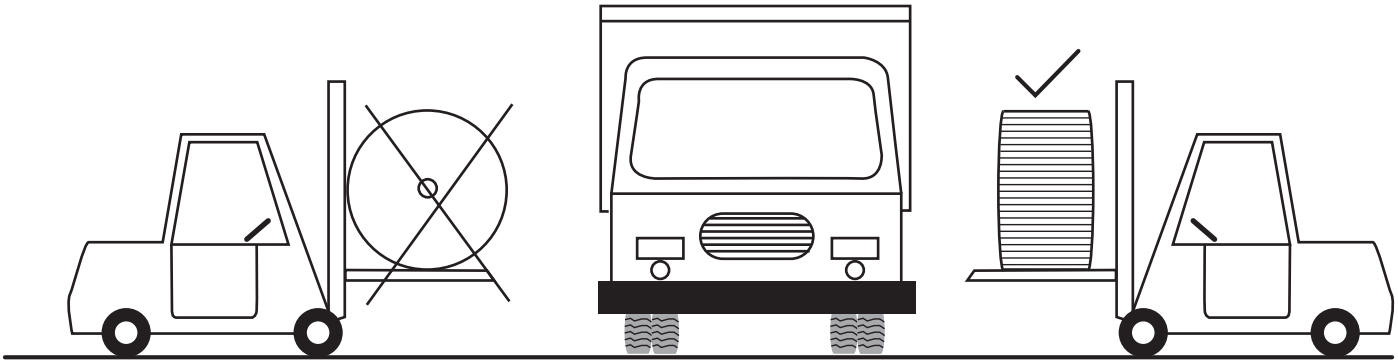


لاتضع البكرات على جوانبها

DO NOT LAY DRUMS ON THEIR FLANGES

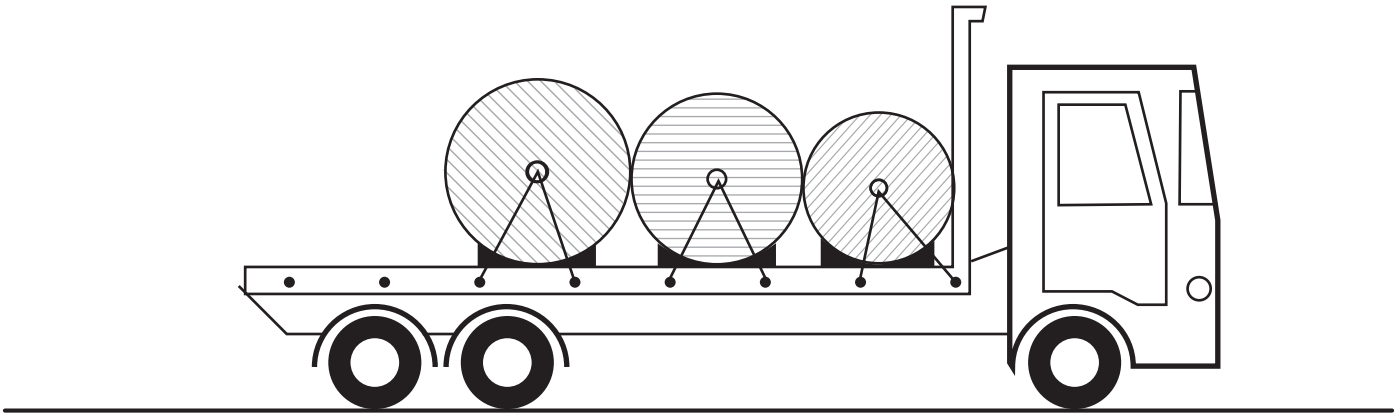


Cable Drum Handling



الطريقة السليمة لرفع البكرات على ظهر مركبة الرفع الشوكي

LIFT DRUMS ON FORK TRUCKS CORRECTLY



يجب تثبيت البكر ات بالطريقة الصحيحة قبل نقلها

SECURE DRUMS ADEQUATELY BEFORE TRANSPORTATION

Ducab دوكاب

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