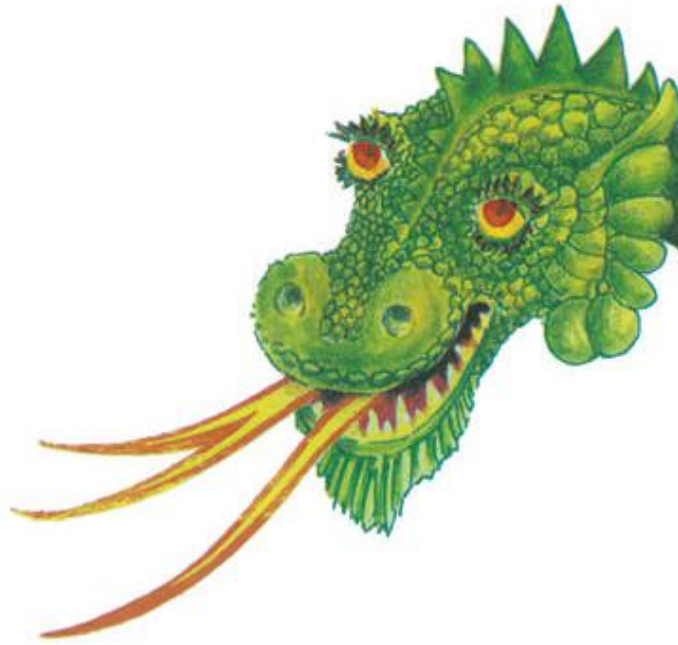


PVC POWER CABLES ARMoured & UNARMoured



OVER
35
YEARS OF SUCCESS

PIONEER BY NAME.
PIONEER BY DEED.



Some Cables Love To Devour Power **You** Pay For

Electricity flows through the copper strands inside the cables used for wiring. If the copper is not conductor grade, the cables will have less conductivity and greater resistance. Which means that much of the power flowing in from the mains to user outlets will be wasted. But it will be billed.

Some cables may initially cost less due to low grade material used. Low conductivity and high resistance of these cables increases risk of damage and current leakage and also contributes to increased power bills.

Use Pioneer Cables, manufactured by a company committed to excellence in product quality. Pioneer Cables are produced on a most modern plant using **prime conductor grade 99.9% pure copper**. Every single meter is subjected to stringent quality control and conforms to international standards. This is the reason why professionals prefer Pioneer Cables.

Ask for Pioneer Cables by name.

Make The Professionals Choice - Your Choice



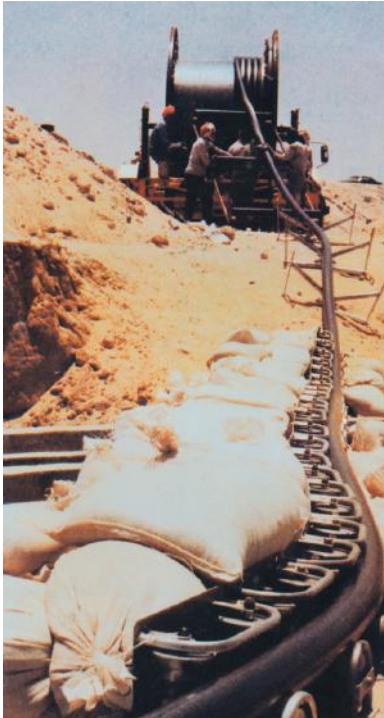
HEAD/SALES OFFICE KARACHI: 1001, Unitowers, I.I. Chundrigar Road, P.O. Box No. 6643, Karachi-74000 (Pakistan).

Phone: +92-21-32416511-14. Sales: +92-21-32410553, 32417786. Fax: +92-21-32475078. ☎+92335 (PIONEER) 7466337

E-mail: enquiry@pioneer cables.com, raza@pioneer cables.com, hasnain@pioneer cables.com Website: www.pioneer cables.com



Leaders in Cable Technology Paving the way for future generations



Installation of Power Cables



- ✓ Conforming to International Standards
- ✓ High Conductivity 99.9% Pure Copper
- ✓ Economical



High Conductivity 99.9% Pure Copper Rod.
99.5% Minimum Purity Aluminium Rod.
Made by Bawany Metals Ltd.



Transmission Line Conductors

HEAD/SALES OFFICE KARACHI:1001, Unitowers, I.I. Chundrigar Road, P.O. Box No. 6643, Karachi-74000 (Pakistan).

Phone: +92-21-32416511-14. Sales: +92-21-32410553, 32417786. Fax: +92-21-32475078.  +92335 (PIONEER) 7466337

E-mail: enquiry@pioneercables.com, raza@pioneercables.com, hasnain@pioneercables.com Website: www.pioneercables.com

Quality Assurance at its most powerful



The **only**
Pakistani
manufacturer to
be awarded
ISO 9001-2008
Certification for
the manufacture
of upto
33 kV High
Voltage Cables

**Buy genuine.
Buy direct.**

In line with our Total Customer Satisfaction, Pioneer Cables is the **first** cable manufacturer to have our cable successfully Type Tested at the prestigious HV & SC Testing Laboratory, NTDC Rawat.

Pioneer Cables: Leaders in cable technology, Paving the way for future generations



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Phone: +92-21-32416511-14. Sales: +92-21-32410553, 32417786. Fax: +92-21-32475078. ☎ +92335 (PIONEER) 7466337
E-mail: enquiry@pioneer cables.com, raza@pioneer cables.com, hasnain@pioneer cables.com Website: www.pioneer cables.com

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A Brief Profile

Pioneer Cables, established in 1980, is an ISO 9001:2008 certified company engaged in the manufacturing of H.T. /L.T. Power Cables, Conductors & General Wiring Cables according to international standards.



Pioneer Cables is the flag ship company of Bawany Group, a well-known and trusted name in Pakistan with a rich history of success and good business ethics that goes back 100+ years. Our sister concern, Bawany Metals Limited is the FIRST in Pakistan to manufacture 99.9% Copper Rods conforming to ASTM B-49. It also produces 99.5% Aluminium Rods conforming to ASTM B-233.

Our manufacturing facilities are based at Hub Chowki, Balochistan about 30 KM from Karachi and

occupy 52,600 sq. meters of prime manufacturing space with associated management and design offices, laboratories, quality control and other departments.

Pioneer Cables is committed to the production of the best product quality utilizing cutting edge European technology in production processes, material applications and logistics procedures. We have the capability to provide a versatile product range to serve individual home consumers as well as the construction, electric utilities, distribution and industrial sectors.

The Company is managed by qualified professionals specializing in different fields. Most of the heads of technical and manufacturing departments have been trained at the plant of AEI Cables Ltd, Gravesend, U.K. Improvements in facilities and upgrading of equipment is a continuing process at our plant.

The scope of this catalogue is to provide an in depth view of the technical information of our PVC Power Cables, Armoured & Unarmoured - single, twin, three & four core cables with Stranded Copper and Aluminium Conductors.

We are the Pioneers



We are
Registered with
almost all
government,
semi-government
Organizations in
Pakistan i.e.
WAPDA,
K-Electric
(formerly KESC),
MES, FWO, POF,
PAEC, NDC,
DHA, OGDC
Multinational
Companies like
Nestle, Unilever,
Siemens etc. &
Prestigious
Industrial Groups,
Housing Schemes
and Commercial
Plazas.

Pioneer by name.
Pioneer by deed.

With over 30 years of cable manufacturing Pioneer Cables has the honour to be the **1st:**

Unit in Pakistan to bring the technology of manufacturing XLPE 15 kV grade cables with the technical collaboration of AEI-UK in 1980.

To produce Jelly Filled Telephone Cables up to 1200 pairs by sister concern Pakistan Telephone Cable in 1983.

To have Copper / Aluminium Rod manufacturing industry by sister concern Bawany Metals Limited in 1983.

Pakistani manufacturer having the privilege of cable testing in **KEMA Laboratories, Holland in 1984.**

Cable manufacturer to have cables successfully type tested at the prestigious HV & SC Testing Laboratories, NTDC Rawat.

Manufacturer to produce Triple Extruded H.T XLPE 15 kV cables as per IEC-60502-2 and KESC specifications-123 (the latest in cable technology) in 2008.

To use 100% prime quality Copper / Aluminium Rods (made by our sister concern Bawany Metals Limited) and genuine imported insulating material.

Cable manufacturer with in-house testing facilities in the most modern laboratory in Pakistan for all its products handling various types of tests.

...And the **ONLY** Pakistani manufacturer to be awarded ISO 9001:2008 Certification for making up to 33 kV grade cables (the highest electrical rating manufacturing and testing facility in Pakistan).

Foreword

To help conserve the country's foreign exchange resources and keeping in view such innovation and future requirements arising out of technological development in the field of Power Cables, the Pioneer Cables Limited was established at Hub Chowki in the District of Lasbella, Balochistan in Technical Collaboration with AEI of U.K. (a subsidiary of GEC) to manufacture all sorts of Power Cables including cross linked polyethylene insulated Low Tension/High Tension Cables for the first time in Pakistan in order to meet the demand and to power the progress of the country.

Pioneer Cables Limited manufactures low and medium voltage PVC insulated armoured & unarmoured Power Cables, besides, XLPE low and medium voltage cables alongside the XLPE HV Cables.

The Cable Plant is the most modern and automated and is fully equipped with adequate testing facilities. It is managed by skilled, highly qualified and experienced personnel trained abroad.

MANAGEMENT OF COMPANY

The Company is managed by professional Managers in different fields. Almost all heads of technical/manufacturing departments have been trained in AEI Cables Ltd., plant at Gravesend U.K.

Quality Policy

The Quality Policy of PCL is to produce and supply cables and conductors according to international standards, adhering strictly to specifications to suit customer's requirement.

In order to achieve the objective, the company ensures that suitable plant / machinery and testing facilities are provided and that it is manned by proper trained and qualified staff who can effectively provide quality production.

It is our policy that quality control checks take place at all stages of production right from the start i.e. the selection and receipt of raw material to the finish i.e. completion of Cables / Conductors and its final testing, in order to ensure that it conforms to international standards in respect to quality.

According to the Quality Policy of PCL, if a cable / conductor is found deviating from standards at any stage of production it is not allowed to move further unless remedial action is taken as suggested by the Quality Control Department and if that is not possible it is scrapped altogether.

We firmly believe in producing quality product using the best of materials available and the right production technique so that it is comparable in quality with cables / conductors of international repute and satisfies our customers now and in future and are not prepared to compromise on this point under any circumstances.

We stand by "PRACTICE WHAT YOU PREACH"

AEI AEI Cables Limited
Gravesend Kent DA11 9AF
CABLES

Telephone - Gravesend (STD 0474) 64466
International + 44 474 64466

Telex - 25829
Telegrams - Assoclect Gravesend

Your ref

Our ref

Tel ext.

To whom it may concern

Dear Sirs,

This letter serves to confirm that an agreement was drawn up between Associated Electrical Industries Ltd. whose registered office is 1 Stanhope Gate, London W1A IEH, England, and Pioneer Cable Company Ltd. of Uni Tower Building, I.I. Chundrigar Road, Karachi, Pakistan, on the 26th day of November 1980 whereby AEI, who had developed certain technological expertise in the manufacture and know-how of production of elastomeric type power cables in the range up to 35000 volts, would provide technical collaboration with Pioneer Cable Company for the latter to develop cables in the same range. Additionally, AEI has agreed to make available particular insulating materials to enable Pioneer Cables to manufacture cross-linked polyethylene cables in the range quoted above. Within the terms of the agreement, AEI will afford instruction to Pioneer Cables engineers at its Gravesend Factory and that at any reasonable time an AEI engineer, on request, will be available to visit Pioneer Cables factory site to provide immediate assistance.


The duration of technical collaboration agreement is ten years from November 26, 1980. Provisions, however, are made whereby in the event of default either party may terminate the agreement at six months notice.

Yours faithfully



R. H. Simpson
Manager - Group Services

6



PEPCO

HIGH VOLTAGE AND SHORT CIRCUIT LABORATORY, PEPCO, RAWAT, ISLAMABAD

NO. HV/SC/TESTING/2019/368-08

Form No. HV/SC/TESTING/2019/368-08

Date: 20.12.2019


TEST REPORT

TYPE TESTING OF 15 KV XLPE POWER CABLE

1.	Client	MNS Pioneer Cables Ltd., Karachi	
2.	Specimen identification		
	• Type	500/12CV XLPE/VCVWAFVC-8.7/15 KV	
	• Make	MST Pioneer Cables Ltd., Karachi	
	• Rating	15 KV	
	• Serial No.	Production	
	• Purchaser	MSE ESCO, Islamabad	
	• Purchase order/date	GOE/ESC/ESC/1403/2019/030/23/0011 dated 24.11.2019	
	• Supplied by other manufacturer	N/A	
	• Requested by other manufacturer	N/A	
3.	Referent test standard/s	P-25-2010 & IEC 60502-2	
4.	Test performed on	Dated: 08-30-2019	
5.	Test outcomes	Results in Table 1 below	

Table 1. Various tests performed and the results.

S. #	Tests performed	Result	Remarks
1	Winding test - partial discharge test at 15 KV	0.4 PC	Within specified limit
2	tan δ measurement as a function of temperature at 2 KV	18 x 10 ⁻⁴	Within specified limit
3	Thermal treating cycle - partial discharge test at 15 KV	0.4 PC	Within specified limit
4	Lightning impulse voltage withstand test at 95 KV	Withstood	Qualified
5	Power frequency voltage test at 30.5 KV (18 min)	Withstood	Qualified
6	Power frequency voltage test at 35.4 KV (30 min)	Withstood	Qualified




Tested/authorized by:

1. Engr. Muhammad Arif Raza Director High Voltage Division, Rawat Lab

Tested/authorized by:

1. Engr. Mazhar Ali Khan Deputy Manager (D & S) NTDC, Lahore

2. Engr. Mohammed Ahsan Hameed Technical Manager MSE Pioneer Cables Ltd., Karachi



General Manager
HV & SC Lab PEPCO
Rawat, Islamabad

Printed/Stamp/Signature/Date/Place/Name

HIGH VOLTAGE AND SHORT CIRCUIT TESTING LABORATORY, WAPDA RAWALT

ISLAMABAD

No. 107/01/HYVOC/LAB

Date: 26/06/2012

REPORT OF TEST RESULTS OF SINGLE CORE 400 KV POWER CABLES MANUFACTURED BY TATTA, KANPUR, INDIA. BREATHING APPARATUS OF 400 KV POWER CABLES LTD.

PURCHASE SPECIFICATIONS INFORMATION AND OTHER RELEVANT DATA

Manufacturer	K.E.C Ltd., Kanpur
Manufacturer's	Self Protection, Insulation, Screen
Test Specimen	Self Protection, Insulation, Screen
Rated Voltage	115 kV
Test and test	As per IS: 11343-1983
Date of test	May 27, 2003 (As per IS: 11343-1983)
Internal Identification	100 - 300 - 1000

OUTCOME OF TESTS - GIVEN BY TATTA - BELMIL

Table 1. Various tests performed and the results

Sl.No.	Test Performed	Result
1	Insulation test - Partial discharge test	Not performed
2	Ins. tests assessment at a function of voltage	Not performed
3	Ins. tests assessment at a function of temperature	Not performed
4	Heating cycle - Partial discharge test	Not performed
5	Impulse voltage withstand test at 115 kV	Not performed
6	Power frequency voltage withstand test (50 Hz) at 115 kV	Not performed
7	Thermal cycle voltage test at 115 kV	Not performed

TEST PERFORMED BY

Engr. M. Aslam Khan	Director (Director, High Voltage Division)
Engr. Sadiq Jinn	Deputy Director, High Voltage Division
Engr. Akbar Khan	Assistant Director, High Voltage Division
Engr. Kullabhattar Hussain	Assistant Director, High Voltage Division

TEST WITNESSED BY

Engr. Akbar Qadir Noon	E.E. Identification, K.E.C. Ltd.
Engr. Saad Zahoor Akbar	E.E. (C.E.M) K.E.C. Ltd.
Engr. M. Aslam Khan	Assistant Director, Quality Control Lab.

Dr. Muhammad Akhtar
General Manager


NATIONAL TRANSMISSION & DISPATCH COMPANY LIMITED

TEL: 051-586610
051-586559
05774-048265
05774-048286
TELEFAX 05774-048285

OFFICE OF THE
GENERAL MANAGER
HV & SC TESTING LAB,
WARDA, RAWAT,
ISLAMABAD.

No. 1773/HV/SC/Lab./A-76
Dated: July 13, 2003

Mr. Rashid Zahedi Hoseney
Chief Executive
Pioneer Cables Ltd.
Karachi.

Subject: **HEATING /LOADING CYCLE SYSTEM**

Dear Sir:

We are grateful to MS Pioneer Cables Ltd., Karachi for gifting the Heating / Loading Cycle System to HV&SC Lab, Rawat.

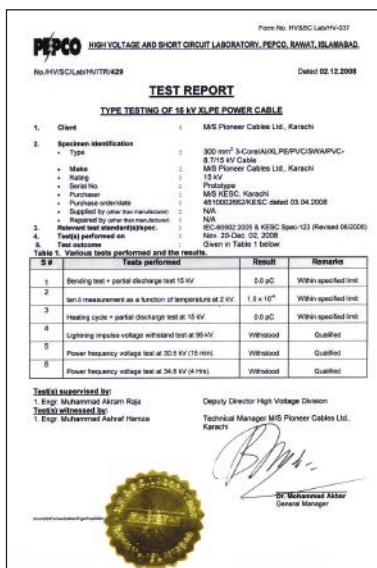
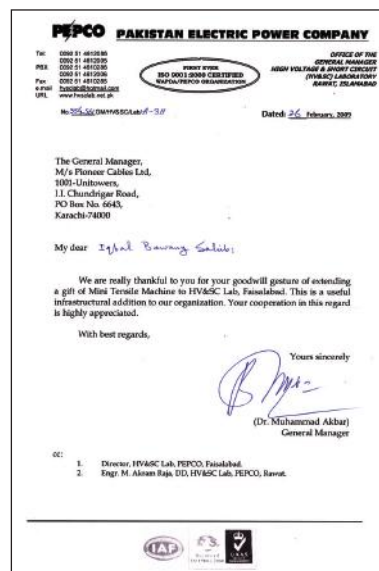
Mr. Zahoor-ud-Din and Mr. Shahid Nadeem have duly commissioned the equipment on their visit to the Laboratory during 11-13 July, 2003.

We look forward to have excellent professional relationship with MS Pioneer Cables Ltd. Karachi for mutual benefits of our two organizations.

Thank you and best regards.

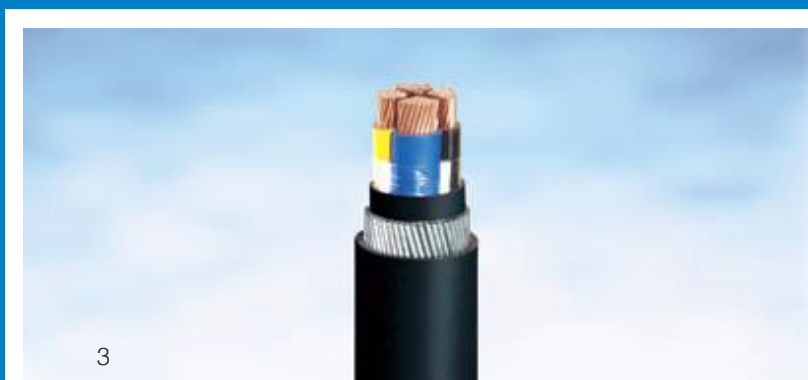

Dr. Muhammad Akbar
General Manager





Product Range

Pioneer Cable provides a versatile product range for individual home consumers, construction, electric utilities distribution and industrial sectors.



1. High Tension XLPE Power Cables
2. Low Tension XLPE Power Cables
3. Low Tension Power Cables
4. PVC Insulated Cables
5. PVC Insulated General Wiring
6. Quadruplex Cables



7



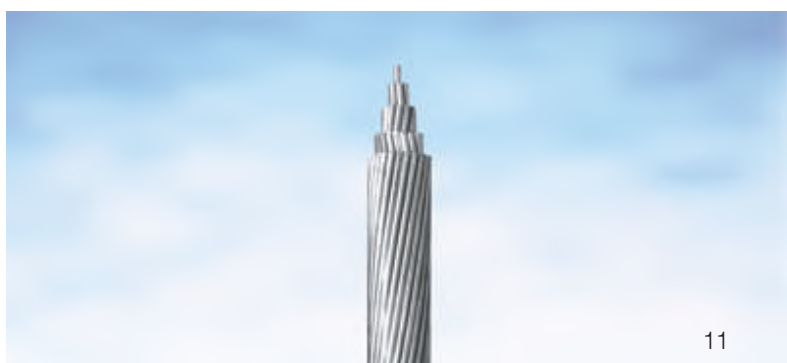
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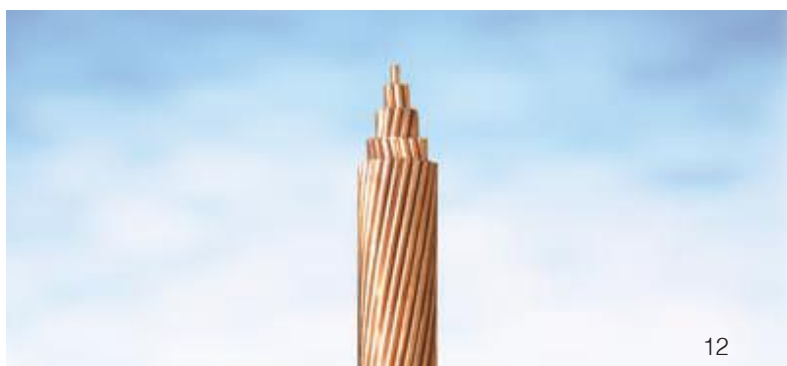
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10



11



12

- 7. Control Cables
- 8. Flexible Cables
- 9. Air Field Lighting Cables
- 10. Automobile Cables
- 11. Overhead Conductors AAC & ACSR
- 12. Bare Copper Conductors & Specialised Cables - All Types

PVC Insulated Cables

600 / 1000V FOUR-CORE with

Shaped Stranded Copper Conductors

Single Wire Armoured, PVC Sheathed

PVC Insulated Power Cables

Polyvinyl chloride has certain advantages over other materials as a cable insulant as well as having a better appearance. PVC is tough and light, which together with its inherent flexibility enables PVC, insulated cables to be bend through a smaller radius. PVC is impervious to moisture, and therefore cables insulated with this material are free from one of the major causes of break-downs. Jointing and terminating is also easier.



The Armored and Unarmoured PVC Power cables included in this publication are strictly manufactured to BS 6346 and generally conform to

international standard IEC-60502-1.

The multicore cables to BS 6346 are armoured with galvanized steel wires for mechanical protection and to provide an adequate fault-current path PVC is impervious to most chemicals and is fire resistant. However, as a thermoplastic material, PVC will soften at sufficiently high temperatures and thus cannot withstand sustained overload conditions. In addition, the dielectric properties of PVC are such that it is not recommended at present for voltages of more than 11 kV.

SPECIFICATIONS

Cables are manufactured to Specification BS 6346 which applies to PVC insulated armoured cables up to and including 3.3 kV. However, Pioneer Cables Limited, can and do, supply cables to all other national standards and to customers' special specifications.

CONDUCTORS

These are either plain annealed copper or aluminium complying with BS 6360 Conductors of single-core cables are circular and those of multi-core cables are generally shaped. Reduced neutral conductors and special-purpose conductors are generally circular.

INSULATION

This consists of extruded PVC complying with BS 7655 the grade of PVC compound used for insulation is chosen to give good flexibility, resistance to ageing and ability to



withstand deformation at high temperatures. It is normally recommended that PVC insulated or sheathed cables are installed at temperatures above 0 °C, but special grades of PVC are available that can be handled at lower temperatures, and others which are suitable for operation at higher temperatures. Such compounds are more expensive and would only be chosen for a specific purpose.

FILLERS / BINDER

Polypropylene or PVC as fillers and polypropylene tape as a binder is used.



BEDDING

For single & multi-core PVC insulated cables the bedding normally consists of extruded PVC.

ARMOURING

For single-core types a non-magnetic armour of hard drawn aluminium wires is provided for a.c. operation. Single wire armour is provided on multi-core cables with Galvanized Steel.

SHEATHING

The outer sheath is an extruded layer of black PVC to BS 7655.

CORE IDENTIFICATION

Cables to BS 6346, unless otherwise stated, have their cores identified by colours in the following way:

Number of cores	Core Colours
1	Red, black or any other color
2	Red, black
3	Red, Yellow, Blue
4	Red, Yellow, Blue, Black
5	Red, Yellow, Blue, Black, Green/Yellow

MINIMUM INSTALLATION RADIUS

During installation, PVC cables should not be bent to a smaller radius than eight times their overall diameter.

DIMENSIONS AND WEIGHTS OF PVC CABLE

The dimensions of the cables in the tables on pages 13-19 comply with BS 6346. The weights in the tables are calculated to the nearest 10 Kg and are therefore approximate.

SUSTAINED CURRENT RATINGS OF PVC INSULATED CABLES

Current ratings (a.c.) of PVC insulated cables are given on subsequent



pages. Values are given for the three customary methods of installation: laid direct in the ground, laid in underground ducts or installed in air.

Cables will only be continuously operated at their tabulated rating if the minimum current at which circuit protection is signed to operate does not exceed 1.5 times (in the case of cables in air or in ducts) or 1.3 times (in the case of cables laid direct in the ground) the values given in the tables. If this condition is not met, see section-5 of ERA publication 69-0030 on page No. 33 of this catalogue.

STANDARD CONDITIONS

The following conditions have been used to calculate the current ratings given in the tables.

Thermal resistivity of soil (g) = 1.2 km/w

Standard ground temperature = 15°C

Ambient air temperature = 30°C

Maximum conductor temperature = 70°C



Depth of burial, from ground surface to centre of cable, to centre of duct or to centre of trefoil group of cables or ducts:

600/1000 volt cables = 0.5m

1.9/3.3 kV cables = 0.8m

VARIATIONS IN STANDARD CONDITIONS

If there are any variations in the standard conditions, reference should be made to ERA publication 69-0030 (part-3).

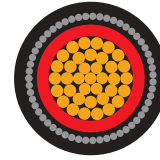
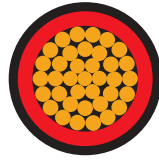


For cables installed in and around buildings reference should be made to the IEE publication 'Regulation for the Electrical Equipment of Buildings', current edition.

PVC Insulated Cables

Stranded Copper Conductors

600 / 1000V SINGLE-CORE

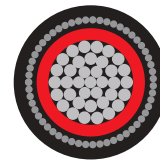
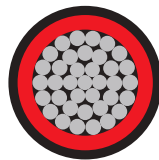


	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
*Single Core	50	1.4	15.1	60	1.25	19.1	101
	70	1.4	16.9	81	1.25	21.1	128
	95	1.6	19.4	110	1.25	23.4	162
	120	1.6	21.0	135	1.6	26.3	210
	150	1.8	23.2	165	1.6	28.3	246
	185	2.0	25.8	206	1.6	30.8	294
	240	2.2	29.0	267	1.6	34.1	366
	300	2.4	32.1	332	1.6	37.0	439
	400	2.6	35.8	419	2.0	42.0	572
	500	2.8	39.6	523	2.0	45.6	689
	630	2.8	43.8	663	2.0	49.7	844
	800	2.8	48.3	833	2.5	55.8	1088
	1000	3.0	53.7	1044	2.5	61.0	1322

PVC Insulated Cables

Stranded Aluminium Conductors

600 / 1000V SINGLE-CORE

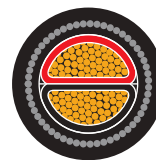
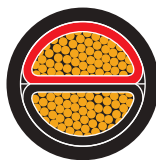


	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
*Single Core	50	1.4	15.1	28	1.25	19.1	66
	70	1.4	16.9	36	1.25	21.1	79
	95	1.6	19.4	48	1.25	23.4	95
	120	1.6	21.0	57	1.6	26.3	125
	150	1.8	23.2	69	1.6	28.3	143
	185	2.0	25.8	86	1.6	30.8	166
	240	2.2	29.0	109	1.6	34.1	198
	300	2.4	32.1	134	1.6	37.0	230
	400	2.6	35.8	167	2.0	42.0	303
	500	2.8	39.6	206	2.0	45.6	355
	630	2.8	43.8	244	2.0	49.7	404
	800	2.8	48.3	294	2.5	55.8	515
	1000	3.0	53.7	375	2.5	61.0	624

*Circular or compacted circular stranded conductors.

PVC Insulated Cables

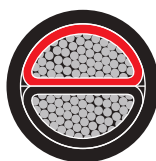
Stranded Copper Conductors 600 / 1000V TWIN-CORE



	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
Twin Core	• 16	1.0	15.6	47	1.25	18.9	84
	* 25	1.2	18.4	69	1.6	23.0	128
	35	1.2	20.1	95	1.6	24.9	161
	50	1.4	22.8	126	1.6	27.8	201
	70	1.4	25.5	170	1.6	30.4	252
	95	1.6	29.3	231	2.0	35.5	352
	120	1.6	31.8	288	2.0	38.0	420
	150	1.8	35.1	352	2.0	41.3	496
	185	2.0	39.1	439	2.5	46.4	639
	240	2.2	43.9	576	2.5	51.2	802
	300	2.4	48.7	716	2.5	58.4	971
	400	2.6	54.2	904	2.5	61.9	1187

PVC Insulated Cables

Stranded Aluminium Conductors 600 / 1000V TWIN-CORE



	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
Twin Core	• 16	1.0	15.6	23	1.25	18.9	65
	* 25	1.2	18.4	38	1.6	23.0	98
	35	1.2	20.1	53	1.6	24.9	119
	50	1.4	22.8	69	1.6	27.8	144
	70	1.4	25.5	87	1.6	30.4	170
	95	1.6	29.3	116	2.0	35.5	238
	120	1.6	31.8	137	2.0	38.0	271.0
	150	1.8	35.1	166.4	2.0	41.3	310.4
	185	2.0	39.1	206.2	2.5	46.4	406.2
	240	2.2	43.9	270.0	2.5	51.2	496.0
	300	2.4	48.7	332.0	2.5	56.4	587.0
	400	2.6	54.2	413.0	2.5	61.9	694.0

• Circular compacted conductor

* Shaped Conductors for 25 mm² and above in multicore cables.

PVC Insulated Cables

Stranded Copper Conductors

600 / 1000V THREE-CORE

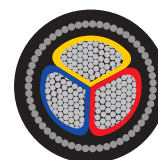
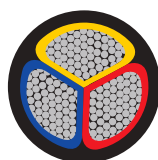


	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
Three Core	• 16	1.0	17.2	67	1.25	20.6	108
	* 25	1.2	20.4	100	1.6	25.0	167
	35	1.2	22.4	130	1.6	27.3	205
	50	1.4	25.5	172	1.6	30.5	258
	70	1.4	28.7	236	2.0	35.0	359
	95	1.6	33.3	333	2.0	39.3	471
	120	1.6	36.3	410	2.0	47.2	559
	150	1.8	40.0	502	2.5	47.5	711
	185	2.0	44.6	626	2.5	51.9	854
	240	2.2	50.1	815	2.5	57.8	1079
	300	2.4	55.6	1014	2.5	63.2	1304
	400	2.6	62.2	1286	2.5	69.6	1602

PVC Insulated Cables

Stranded Aluminium Conductors

600 / 1000V THREE-CORE



	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
Three Core	• 16	1.0	17.2	38	1.25	20.6	79
	* 25	1.2	20.4	54	1.6	25.0	121
	35	1.2	22.4	66	1.6	27.3	142
	50	1.4	25.5	90	1.6	30.5	176
	70	1.4	28.7	112	2.0	35.0	236
	95	1.6	33.3	160	2.0	39.3	299
	120	1.6	36.3	182	2.0	42.2	342
	150	1.8	40.0	235	2.5	47.5	446
	185	2.0	44.6	290	2.5	51.9	520
	240	2.2	50.1	344	2.5	57.8	640
	300	2.4	55.6	460	2.5	63.2	752

• Circular compacted conductor

* Shaped Conductors for 25 mm² and above in multicore cables.

PVC Insulated Cables

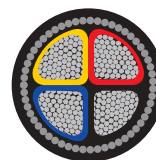
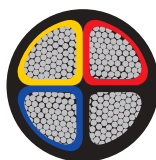
Stranded Copper Conductors 600 / 1000V FOUR-CORE



	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
Four Core	• 16	1.0	19.3	86	1.6	23.9	149
	* 25	1.2	22.9	129	1.6	27.8	205
	35	1.2	25.4	169	1.6	30.5	253
	50	1.4	29.2	225	2.0	35.4	348
	70	1.4	33.0	310	2.0	39.2	447
	95	1.6	38.3	436	12.0	44.3	590
	120	1.6	41.5	538	2.5	49.3	754
	150	1.8	46.3	663	2.5	53.6	897
	185	2.0	51.3	825	2.5	59.0	1089
	240	2.2	58.0	1073	2.5	65.7	1369
	300	2.4	64.6	1338	2.5	72.0	1661
	400	2.6	72.0	1693	3.15	81.3	2148

PVC Insulated Cables

Stranded Aluminium Conductors 600 / 1000V FOUR-CORE

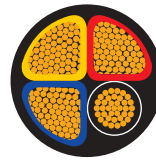


	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
Four Core	• 16	1.0	19.3	48	1.6	59	111
	* 25	1.2	22.9	64	1.6	27.8	144
	35	1.2	25.4	84	1.6	30.5	169
	50	1.4	29.2	113	2.0	35.4	240
	70	1.4	33.0	145	2.0	39.2	283
	95	1.6	38.3	206	2.0	44.3	361
	120	1.6	41.8	248	2.5	49.3	465
	150	1.8	46.3	306	2.5	53.6	542
	185	2.0	51.3	378	2.5	59.0	644
	240	2.2	58.0	485	2.5	65.7	783
	300	2.4	64.6	599	2.5	72.0	924

• Circular compacted conductor

* Shaped Conductors for 25 mm² and above in multicore cables.

PVC Insulated Cables
Stranded Copper Conductors
600 / 1000V FOUR-CORE
with reduced neutral conductor



	Nominal Area of Conductor	Nominal Area of Neutral Conductor	Thickness of Insulation	Unarmoured		Armoured		
				Approximate Diameter	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
Four Core with Reduced Neutral Conductor	* 25	16	1.2	22.9	126	1.6	27.8	202
	35	16	1.2	24.7	159	1.6	29.5	243
	50	25	1.4	28.3	212	1.6	33.1	305
	70	35	1.4	32.0	289	2.0	38.0	422
	95	50	1.6	37.5	392	2.0	43.7	546
	120	70	1.6	41.4	489	2.5	49.0	699
	150	70	1.8	44.7	5190	2.5	52.0	818
	185	95	2.0	49.0	740	2.5	57.2	991
	240	120	2.2	56.0	959	2.5	63.7	1247
	300	150	2.4	62.2	1191	2.5	69.8	1508
	400	185	2.6	69.6	1507	3.15	78.6	1947

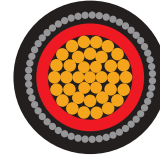
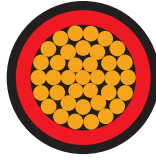
* Shaped Conductors for 25 mm² and above in multicore cables.



PVC Insulated Cables

Stranded Copper Conductors

1.9 / 3.3 kV SINGLE-CORE

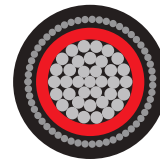
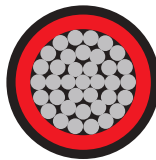


	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
*Single Core	50	2.2	16.8	66	1.25	21.0	113
	70	2.2	18.8	89	1.25	22.8	140
	95	2.2	20.7	116	1.6	26.0	190
	120	2.2	22.6	143	1.6	27.6	222
	150	2.2	24.1	171	1.6	29.4	255
	185	2.2	26.1	209	1.6	31.3	299
	240	2.2	29.0	267	1.6	34.1	366
	300	2.4	32.1	332	1.6	37.0	439
	400	2.6	35.8	419	2.0	42.0	572
	500	2.8	39.6	523	2.0	45.6	689
	630	2.8	43.8	663	2.0	49.7	844
	800	2.8	48.3	833	2.5	55.8	1088
	1000	3.0	53.7	1044	2.5	61.0	1322

PVC Insulated Cables

Stranded Aluminium Conductors

1.9 / 3.3 kV SINGLE-CORE



	Nominal Area of Conductor	Thickness of Insulation	Unarmoured		Armoured		
			Approximate Diameter Overall	Approximate Cable Weight	Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	kg/100m	mm	mm	kg/100m
*Single Core	50	2.2	16.8	34	1.25	21.0	77
	70	2.2	18.8	44	1.25	22.8	90
	95	2.2	20.7	54	1.6	26.0	122
	120	2.2	22.6	63	1.6	27.6	136
	150	2.2	24.1	74	1.6	29.4	151
	185	2.2	26.2	63	1.6	31.3	170
	240	2.2	29.0	109	1.6	34.1	198
	300	2.4	32.1	134	1.6	37.0	230
	400	2.6	35.8	167	2.0	42.0	303
	500	2.8	39.6	206	2.0	45.6	355
	630	2.8	43.8	244	2.0	49.7	404
	800	2.8	48.3	294	2.5	55.8	515
	1000	3.0	53.7	375	2.5	61.0	624

*Circular or compacted circular stranded conductors.

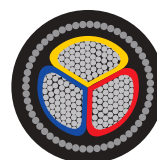


PVC Insulated Cables

Stranded Copper Conductors

1.9 / 3.3 kV THREE-CORE

	Nominal Area of Conductor	Thickness of Insulation	Armoured		
			Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	mm	kg/100m
Three Core	• 16	2.2	1.6	27.6	175
	* 25	2.2	1.6	29.9	215
	35	2.2	1.6	32.1	257
	50	2.2	2.0	35.6	333
	70	2.2	2.0	38.9	414
	95	2.2	2.0	42.3	511
	120	2.2	2.5	46.6	645
	150	2.2	2.5	49.4	743
	185	2.2	2.5	52.8	873
	240	2.2	2.5	57.8	1083
	300	2.4	2.5	63.2	1309
	400	2.6	2.5	69.6	1609



PVC Insulated Cables

Stranded Aluminium Conductors

1.9 / 3.3 kV THREE-CORE

	Nominal Area of Conductor	Thickness of Insulation	Armoured		
			Armour Wire Diameter	Approximate Cable Diameter Overall	Approximate Cable Weight
	mm ²	mm	mm	mm	kg/100m
Three Core	• 16	2.2	1.6	27.6	134
	* 25	2.2	1.6	29.9	154
	35	2.2	1.6	32.1	177
	50	2.2	2.0	35.6	224
	70	2.2	2.0	38.9	265
	95	2.2	2.0	42.3	309
	120	2.2	2.5	46.6	390
	150	2.2	2.5	49.4	434
	185	2.2	2.5	52.8	490
	240	2.2	2.5	57.8	586
	300	2.4	2.5	63.2	688

• Circular compacted conductor

* Shaped Conductors for 25 mm² and above in multicore cables.

PVC Insulated Cables

Sustained Current Ratings and Voltage Drop of Un-Armoured & Armoured PVC Power Cables

ERA technology is an independent contract research and development organization and the cable group is part of ERA technology limited. The group has particular experience in thermal rating of cables in various environment. Current ratings given on subsequent pages are the research work of ERA by an internationally agreed procedures for deriving rating for cables under many diverse condition of installation and operation.

We acknowledge with thanks the use of ERA publication and IEE regulation for compiling current ratings and voltage drop.

The current ratings (ac) of PVC insulated cables given on subsequent pages are given for the three customary methods of installation (1) laid direct in the ground, (2) laid under ground ducts (3) installed in air for cables having close excess current protection i.e cables will only be continuously operated at their tabulated rating if the minimum current at which circuit protection is designed to operate does not exceed 1.5 times (in case of cables in Air or ducts) or 1.3 times (in case of cables laid direct in the ground) the values given in the table. If this condition is not met see section five of ERA Publication 69-0030 on Page No. 33 of this catalogue.

EFFECT OF GROUPING OF CABLES

For groups of circuits the single circuit ratings apply provided that

- 1) The horizontal clearance between circuits is not less than twice the over all diameter of an individual cable.
- 2) The vertical clearance between circuits is not less than 4 times the diameter of an individual cable.
- 3) If the number of circuits exceed 3, they are in a horizontal plane.

Circuits mounted on racks of cleats etc where there is free circulation of air around circuits. For conditions other than this, the rating should be adjusted by suitable factor given on Page No. 34-43 (taken from ERA Publication 69-0030 part-III) of this catalogue.

MANNER OF INSTALLING CABLES

Current rating are given for specific installation practice mentioned in each table and under defined conditions of IEE regulation

STANDARD CONDITIONS

The following conditions have been used to calculate the current ratings given in the tables.

Thermal Resistivity of Soil	= 1.2 km/w
Standard Ground Temperature	= 15°C
Ambient Air Temperature	= 30°C
Max Conductor Temperature	= 70°C

Depth of burial from ground surface to center of cable, to centre of duct or to center of trefoil group of cables or ducts.

600/1000 Volts Cables = 0.5 m

1.9/3.3 kV Cables = 0.8 m

VARIATION IN STANDARD CONDITIONS:

If there are any variation in standard conditions, reference should be made to rating factors given on Page No. 44-48 of this catalogue (taken from ERA Publication 69-0030 part-III).

NOTE

FOR CABLES INSTALLED IN AND AROUND BUILDING REFERENCES SHOULD BE MADE TO THE IEE PUBLICATION REGULATION FOR THE ELECTRICAL EQUIPMENT OF BUILDING.

VOLTAGE DROP

According to IEE regulation. The size of every bare conductor or cable conductor shall be such that the drop in voltage from the origin of installation to any point in that installation should not exceed 2.5% of the normal voltage when the conductors are carrying the full load current, but disregarding starting conditions.

Values of voltage drop are tabulated for a current of one ampere for a metre run i.e. for a distance of 1m along the route taken by the cables, and represent the result of the voltage drops in all the circuit conductors. For any given run the values need to be multiplied by the length of the run in metres and by the current the

cables are to carry, in amperes. For three-phase circuits the values tabulated relate to the line voltage and balanced load conditions have been assumed, where the actual current to be carried, i.e. the design values of current for the circuit, is significantly less than the tabulated current-carrying capacity, the total voltage drop obtained by the above method is only approximate because the conductor temperature and hence its resistance will be less than those applicable at the tabulated current. Thus for a more accurate assessment, due allowance should be made for the change in conductor resistance with operating temperature.

The tabulated values of voltage drop to the worst conditions, namely, where the phase angle of the cable circuit is equal to that of the load, for cables up to and including 120mm Sq they apply with sufficient accuracy where the power factor of the load lies between 0.6 lagging and unity and, for larger cables, where the power factor of the load is not worse than .8 lagging. In all other cases the value may be unduly conservative and more exact calculation necessary.

If VD is the voltage Drop then

$$VD = \frac{mv \times I \times L}{1000}$$

where

I = Current in amperes

L = route length in meters

mv = approx. volt drop/amp/meter

Conductor Resistance Data

Resistance of copper and aluminium conductors for single & multi-core cables to BS-6360 is given below.

Nominal Area of Conductor mm ²	Maximum resistance at 20°C	
	Copper	Aluminium
0.5	36.0	√
0.75	24.5	√
1	18.1	√
1.5	12.1	√
2.5	7.41	√
4	4.61	7.41
6	3.08	4.61
10	1.83	3.08
16	1.15	1.91
25	0.727	1.20
35	0.524	0.868
50	0.387	0.641
70	0.268	0.443
95	0.193	0.320
120	0.153	0.253
150	0.124	0.206
185	0.0991	0.164
240	0.0754	0.125
300	0.0601	0.100
400	0.0470	0.0778
500	0.0366	0.0605
630	0.0283	0.0469
800	0.0221	0.0367
1000	0.0176	0.0291

Temperature Correction Factors

Temperature correction factor k_t for conductor resistance to correct the measured resistance at $t^{\circ}\text{C}$ to 20°C is given below.

Temperature $t^{\circ}\text{C}$	Correction Factor k_t
5	1.064
6	1.059
7	1.055
8	1.050
9	1.046
10	1.042
11	1.037
12	1.033
13	1.029
14	1.025
15	1.020
16	1.016
17	1.012
18	1.008
19	1.004
20	1.000
21	0.996
22	0.992
23	0.988
24	0.984
25	0.980
26	0.977
27	0.973
28	0.969
29	0.965
30	0.962
31	0.958
32	0.954
33	0.951
34	0.947
35	0.943

The value of correction factor k_t are based on a resistance temperature coefficient of 0.004 per $^{\circ}\text{C}$ at 20°C

Sustained Current Rating (AMP) (50HZ)

Condition: Installed in air

Single, Twin, Three & Four core cable with stranded copper conductor

PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 600/1000 Volt grade

Nominal Area Conductor	Single Core *				Twin		Three & Four Cores	
	2 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced °		Trefoil Touching					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm ²	amp	mV	amp	mV	amp	mV	amp	mV
1.5	-	-	-	-	22	29	19	25
2.5	-	-	-	-	31	18	26	16
4	-	-	-	-	41	12	35	9.6
6	-	-	-	-	52	7.4	45	6.3
10	-	-	-	-	72	4.3	66	2.3
16	-	-	-	-	96	2.7	81	1.60
25	-	-	-	-	128	1.8	109	1.10
35	-	-	-	-	156	1.30	133	0.81
50	230	0.96	181	0.81	188	0.92	161	0.57
70	285	0.69	229	0.57	236	0.65	204	0.42
95	348	0.54	280	0.42	293	0.48	251	0.34
120	401	0.46	326	0.34	338	0.40	291	0.29
150	452	0.41	372	0.29	385	0.32	330	0.24
185	510	0.36	426	0.24	444	0.29	380	0.20
240	590	0.36	500	0.22	524	0.25	451	0.18
300	670	0.33	572	0.20	597	0.23	514	0.17
400	740	0.31	642	0.19	685	0.22	589	-
500	810	0.29	721	0.18	-	-	-	-
630	890	0.27	810	0.18	-	-	-	-
800	940	0.24	872	0.16	-	-	-	-
1000	1010	0.23	949	0.16	-	-	-	-

* Aluminium wire armoured

° Distance between cable center Up to and including 185mm 2 - twice overall diameter of cable 240mm 2 and above - 90mm

Unarmoured

Nominal Area Conductor	Single Core						Twin		Three & Four Cores	
	2 Cables		3 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced °		Trefoil Touching		Laid Flat Spaced					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm²	amp	mV	amp	mV	amp	mV	amp	mV	amp	mV
16	-	-	-	-	-	-	91	2.8	78	2.5
25	-	-	-	-	-	-	122	1.8	103	1.5
35	-	-	-	-	-	-	150	1.34	127	1.1
50	222	0.96	172	0.80	222	0.84	182	0.95	156	0.85
70	280	0.67	220	0.58	280	0.60	230	0.67	197	0.57
95	344	0.52	272	0.42	345	0.48	284	0.50	243	0.44
120	400	0.45	318	0.34	401	0.41	330	0.41	284	0.36
150	460	0.40	365	0.29	458	0.36	378	0.35	324	0.30
185	530	0.36	423	0.25	530	0.33	436	0.30	374	0.26
240	630	0.36	505	0.22	630	0.33	518	0.25	445	0.22
300	730	0.33	508	0.19	728	0.32	598	0.21	512	0.19
400	850	0.30	680	0.17	850	0.29	695	0.20	593	0.18
500	988	0.28	780	0.16	989	0.27	-	-	-	-
630	1154	0.26	900	0.15	1150	0.26	-	-	-	-
800	1328	0.25	1018	0.15	1325	0.25	-	-	-	-
1000	1490	0.22	1135	0.15	1495	0.22	-	-	-	-

° Distance between cable centres Up to and including 185mm 2 - twice overall diameter of cable 240mm 2 and above - 90mm

Sustained Current Rating (AMP) (50HZ)

Condition: Laid Direct in ground

Single, Twin, Three & Four core cable with stranded copper conductor

PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 600/1000 Volt grade

Nominal Area Conductor	Single Core *				Twin		Three & Four Cores	
	2 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced °		Trefoil Touching					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm²	amp	mV	amp	mV	amp	mV	amp	mV
1.5	-	-	-	-	32	29	27	25
2.5	-	-	-	-	41	18	35	16
4	-	-	-	-	55	12	47	9.6
6	-	-	-	-	69	7.4	59	6.3
10	-	-	-	-	92	4.3	78	3.8
16	-	-	-	-	119	2.7	109	2.5
25	-	-	-	-	158	1.8	132	1.6
35	-	-	-	-	190	1.3	159	1.14
50	238	0.92	203	0.81	225	0.92	188	0.81
70	292	0.65	248	0.57	277	0.65	233	0.57
95	349	0.48	297	0.42	332	0.48	279	0.42
120	396	0.40	337	0.34	377	0.40	317	0.34
150	443	0.32	376	0.29	422	0.32	355	0.29
185	497	0.30	423	0.24	478	0.29	401	0.24
240	571	0.25	485	0.20	551	0.25	462	0.20
300	640	0.23	542	0.18	616	0.23	517	0.18
400	708	0.22	600	0.17	693	0.22	580	0.17
500	780	0.21	660	0.17	-	-	-	-
630	856	0.19	721	0.17	-	-	-	-
800	895	0.19	756	0.16	-	-	-	-
1000	939	0.18	797	0.16	-	-	-	-

* Aluminium wire armoured

° Adjacent cable surfaces separated by one cable diameter

Unarmoured

Nominal Area Conductor	Single Core									Twin		Three & Four Cores	
	2 Cables		Spaced *		3 Cables					Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Touching				Trefoil or Laid Flat Touching			Laid Flat Spaced					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter					
									Trefoil Flat				
mm ²	amp	mV	amp	mV	amp	mV	mV	amp	mV	amp	mV	amp	mV
16	-	-	-	-	-	-	-	-	-	120	2.7	101	2.35
25	-	-	-	-	-	-	-	-	-	158	1.6	132	1.5
35	-	-	-	-	-	-	-	-	-	190	1.35	159	1.15
50	234	0.92	242	0.96	202	0.81	0.83	211	0.84	225	0.95	186	0.82
70	292	0.66	305	0.70	247	0.60	0.60	257	0.63	277	0.69	233	0.58
95	347	0.48	360	0.54	294	0.42	0.46	310	0.48	332	0.47	279	0.43
120	397	0.40	412	0.46	332	0.35	0.37	360	0.43	377	0.41	317	0.35
150	444	0.34	457	0.42	369	0.29	0.34	397	0.38	422	0.34	355	0.29
185	505	0.28	522	0.37	427	0.24	0.31	455	0.35	478	0.27	401	0.26
240	582	0.24	610	0.33	495	0.22	0.28	530	0.32	551	0.25	462	0.21
300	665	0.22	685	0.31	555	0.19	0.25	600	0.29	610	0.21	517	0.17
400	755	0.19	785	0.28	635	0.17	0.24	690	0.27	693	0.19	580	0.17
500	845	0.18	890	0.28	710	0.17	0.24	770	0.27	-	-	-	-
630	954	0.17	1020	0.27	790	0.16	0.22	890	0.26	-	-	-	-
800	1050	0.17	1130	0.26	870	0.15	0.2-1	990	0.25	-	-	-	-
1000	1160	0.16	1280	0.26	950	0.15	0.20	1109	0.24	-	-	-	-

* Adjacent cable surfaces separated by one cable diameter

Sustained Current Rating (AMP) (50HZ)

Condition: Run in single way ducts

Single, Twin, Three & Four core cable with stranded copper conductor

PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 600/1000 Volt grade

Nominal Area Conductor	Single Core *				Twin		Three & Four Cores	
	2 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Duct Touching		Trefoil Touching					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm ²	amp	mV	amp	mV	amp	mV	amp	mV
1.5	-	-	-	-	26	27	23	24
2.5	-	-	-	-	34	16	29	15
4	-	-	-	-	45	12	38	9.7
6	-	-	-	-	57	7.5	48	6.5
10	-	-	-	-	76	2.8	64	3.8
16	-	-	-	-	98	1.7	93	2.5
25	-	-	-	-	129	1.3	107	1.5
35	-	-	-	-	154	0.95	129	1.1
50	216	1.0	199	0.88	183	0.66	153	0.83
70	262	0.75	241	0.66	225	0.49	190	0.57
95	308	0.63	282	0.55	275	0.41	228	0.43
120	341	0.55	311	0.47	300	0.35	260	0.35
150	375	0.46	342	0.43	346	0.28	292	0.28
185	414	0.40	375	0.38	393	0.23	339	0.24
240	463	0.38	419	0.35	455	0.22	382	0.22
300	509	0.36	459	0.32	510	0.18	428	0.18
400	545	0.35	489	0.30	574	-	490	0.17
500	585	0.33	523	0.27	-	-	-	-
630	632	0.31	563	0.25	-	-	-	-
800	662	0.27	587	0.24	-	-	-	-
1000	703	0.27	621	0.22	-	-	-	-

* Aluminium wire armoured

Unarmoured

Nominal Area Conductor	Single Core *					Twin		Three & Four Cores	
	2 Cables		3 Cables			Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Duct Touching		Trefoil Touching / Flat						
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter					
mm ²	amp	mV	amp	mV	mV	amp	mV	amp	mV
16	-	-	-	-	-	98	2.8	83	2.5
25	-	-	-	-	-	129	1.7	107	1.4
35	-	-	-	-	-	155	1.3	129	1.12
50	222	1.0	210	0.88	0.91	185	0.94	153	0.83
70	275	0.77	255	0.66	0.68	225	0.67	190	0.56
95	330	0.63	305	0.55	0.55	271	0.48	228	0.42
120	375	0.54	345	0.46	0.47	301	0.40	260	0.34
150	418	0.49	390	0.42	0.44	340	0.34	292	0.29
185	472	0.45	440	0.39	0.41	393	0.27	331	0.24
240	565	0.39	510	0.35	0.36	455	0.23	382	0.20
300	625	0.36	565	0.32	0.34	510	0.20	428	0.18
400	712	0.34	642	0.30	0.33	574	0.19	490	0.16
500	805	0.32	728	0.27	0.30	-	-	-	-
630	975	0.30	824	0.25	0.28	-	-	-	-
800	1040	0.27	930	0.24	0.27	-	-	-	-
1000	1155	0.27	1120	0.23	0.27	-	-	-	-

Sustained Current Rating (AMP) (50HZ)

Condition: Direct in ground / in single way ducts / in air

Single, Twin, Three & Four core cable with stranded copper conductor

PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 1900/3300 Volt grade

Nominal Area Conductor	Direct in Ground		In Single Way Ducts		In Air	
	Single Core *	Three Core	Single Core *	Three Core	Single Core *	Three Core
	3 Cables		3 Cables		3 Cables	
	Trefoil Touching		Ducts Touching in Trefoil		Trefoil Touching	
mm ²	amp	amp	amp	amp	amp	amp
16	-	97	-	82	-	90
25	-	125	-	105	-	118
35	-	151	-	126	-	143
50	193	178	169	150	195	173
70	236	219	228	184	244	217
95	282	264	265	221	302	266
120	319	299	284	252	348	308
150	357	336	324	282	395	351
185	401	379	357	319	453	403
240	459	436	397	388	532	474
300	513	488	434	412	607	540
400	566	548	462	471	690	620
500	621	-	493	-	776	-
630	678	-	530	-	869	-
800	708	-	551	-	937	-
1000	744	-	563	-	1010	-

* Aluminium wire armoured

Unarmoured

Nominal Area Conductor	Direct in Ground		In Single Way Ducts	In Air	
	3 Single Core Cables		3 Single Core Cables	3 Single Core Cables	
	Trefoil or Laid Flat	Laid Flat	Trefoil or Laid Flat	Trefoil	Laid Flat
	Touching	Spaced *	Ducts Touching	Touching	Spaced *
mm ²	amp	amp	amp	amp	amp
50	193	199	189	195	195
70	236	242	228	244	240
95	282	285	265	302	310
120	320	320	294	348	360
150	357	354	324	395	405
185	401	393	367	453	462
240	459	441	397	532	595
300	513	483	434	607	685
400	566	513	462	690	790
500	621	546	493	776	900
630	678	582	530	880	1050
800	708	599	551	1000	1190
1000	744	626	583	1150	1310

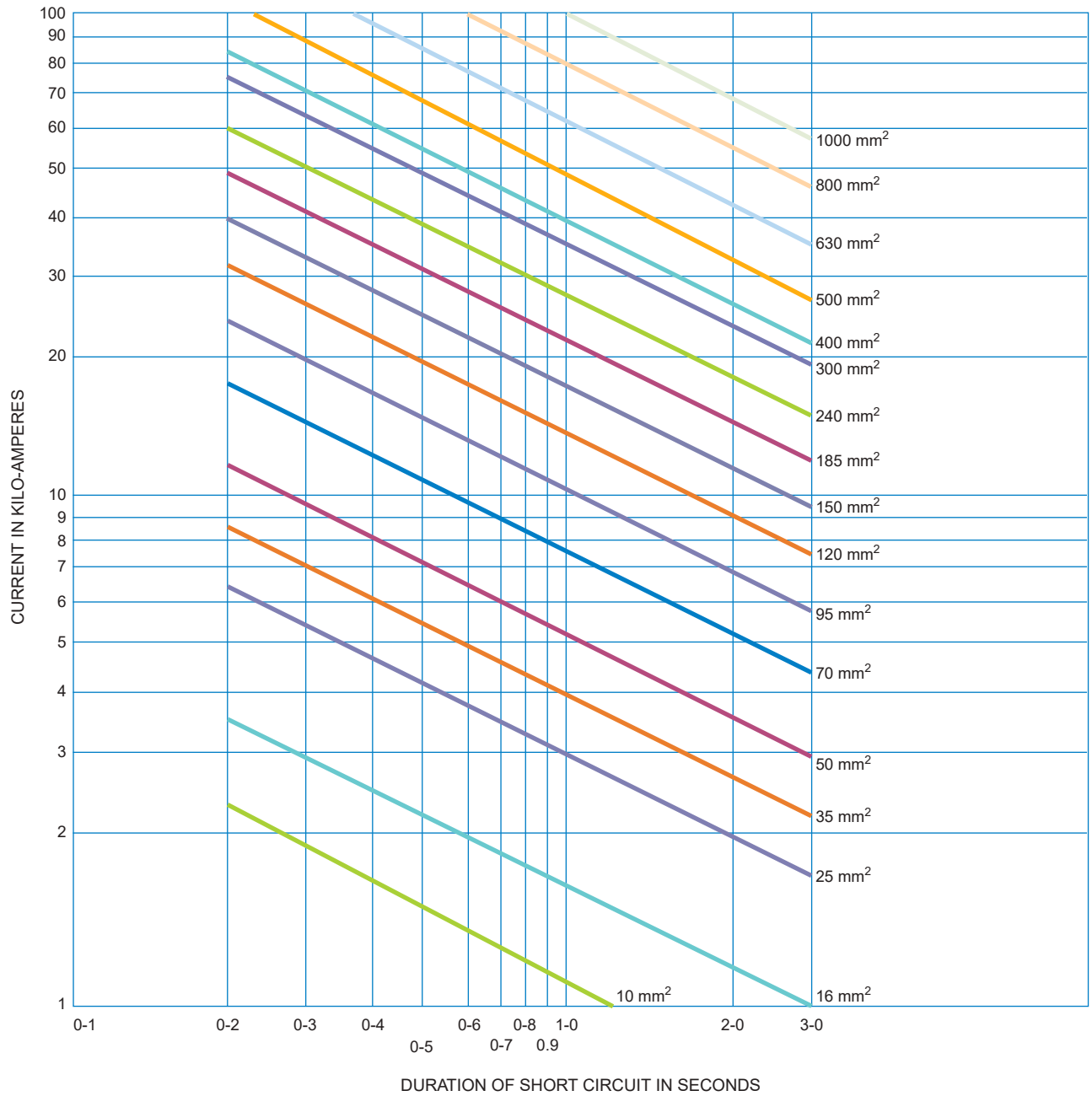
* Adjacent cable surfaces separated by one cable diameter 0 Distance between cable centres up to and including 185 mm twice overall diameter of cable 240 mm² and above - 90 mm

2 -

Short Circuit Rating Chart

Stranded Copper Conductors

Short Circuit Ratings



BASIS: Cable fully loaded at start of short circuit. Conductor temperature at end of short circuit: 130°C

Sustained Current Rating (AMP) (50HZ)

Condition: Installed in air

Single, Twin, Three & Four core cable with stranded Aluminium conductor

PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 600/1000 Volt grade

Nominal Area Conductor	Single Core *				Twin		Three & Four Cores	
	2 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced °		Trefoil Touching					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm ²	amp	mV	amp	mV	amp	mV	amp	mV
16	-	-	-	-	72	4.5	61	3.9
25	-	-	-	-	92	2.9	80	2.6
35	-	-	-	-	112	2.11	98	1.8
50	172	1.45	144	1.32	136	1.5	120	1.3
70	212	1.1	176	0.92	173	1.1	151	0.94
95	253	0.81	212	0.67	213	0.8	188	0.68
120	288	0.68	241	0.54	-	-	218	0.54
150	322	0.57	270	0.46	-	-	248	0.45
185	360	0.49	306	0.39	-	-	287	0.38
240	414	0.45	354	0.31	-	-	344	0.30
300	463	0.39	398	0.26	-	-	395	0.26
380	504	0.36	446	0.24	-	-	-	-
480	555	0.33	500	0.22	-	-	-	-
600	601	0.30	550	0.18	-	-	-	-
740	651	0.27	609	0.18	-	-	-	-
960	680	0.24	658	0.17	-	-	-	-
1200	720	0.22	709	0.16	-	-	-	-

* Aluminium wire armoured °Distance between cable centrals: up to and including 185mm ² - twice overall diameter of cable 240mm ² and above - 90mm

Unarmoured

Nominal Area Conductor	Single Core						Twin		Three & Four Cores	
	2 Cables		3 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced *		Trefoil Touching		Laid Flat Spaced *					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm ²	amp	mV	amp	mV	amp	mV	amp	mV	amp	mV
16	-	-	-	-	-	-	69	4.5	52	3.9
25	-	-	-	-	-	-	90	2.8	78	2.5
35	-	-	-	-	-	-	109	2.1	95	1.8
50	165	1.6	128	1.3	164	1.3	134	1.5	116	1.3
70	170	1.12	163	0.9	208	0.95	170	1.12	148	0.94
95	255	0.80	202	0.68	255	0.72	208	0.80	183	0.69
120	298	0.66	236	0.54	297	0.60	-	-	212	0.54
150	340	0.56	270	0.45	340	0.52	-	-	243	0.45
185	392	0.46	314	0.38	392	0.45	-	-	281	0.38
240	468	0.43	376	0.30	468	0.43	-	-	335	0.29
300	540	0.38	436	0.25	540	0.38	-	-	387	0.26
380	627	0.36	509	0.23	627	0.38	-	-	-	-
460	727	0.32	591	0.20	727	0.30	-	-	-	-
600	830	0.29	673	0.18	830	0.28	-	-	-	-
740	960	0.28	775	0.17	959	0.27	-	-	-	-
960	1134	0.26	909	0.16	1131	0.24	-	-	-	-
1200	1295	0.18	1030	0.16	1292	0.24	-	-	-	-

* Distance between cable centres Up to and including 185 mm ² twice over all diameter of cable 240 mm ² and above - 90mm

Sustained Current Rating (AMP) (50HZ)

Condition: Laid Direct in ground

Single, Twin, Three & Four core cable with stranded Aluminium conductor

PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 600/1000 Volt grade

Nominal Area Conductor	Single Core *				Twin		Three & Four Cores	
	2 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced °		Trefoil Touching					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm²	amp	mV	amp	mV	amp	mV	amp	mV
16	-	-	-	-	85	4.5	72	3.9
25	-	-	-	-	110	2.95	94	2.5
35	-	-	-	-	133	2.12	112	1.8
50	180	1.5	154	1.3	157	1.5	134	1.3
70	221	1.1	188	0.93	196	1.1	165	0.92
95	265	0.79	226	0.68	235	1.81	200	0.67
120	302	0.64	257	0.55	-	-	228	0.64
150	338	0.53	288	0.46	-	-	255	0.44
185	382	0.44	326	0.38	-	-	290	0.36
240	442	0.36	377	0.32	-	-	338	0.28
300	498	0.31	424	0.27	-	-	382	0.24
380	558	0.27	475	0.24	-	-	-	-
480	626	0.25	532	0.20	-	-	-	-
600	681	0.23	586	0.20	-	-	-	-
740	764	0.22	648	0.18	-	-	-	-
960	829	0.20	701	0.17	-	-	-	-
1200	895	0.19	755	0.17	-	-	-	-

* Aluminium wire armoured

Unarmoured

Nominal Area Conductor	Single Core									Twin		Three & Four Cores	
	2 Cables		Spaced *		3 Cables					Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Touching				Trefoil or Laid Flat Touching		Laid Flat Spaced *						
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter		Current Rating	Approximate Volt Drop Per Ampere Per Meter				
						Trefoil Flat							
mm ²	amp	mV	amp	mV	amp	mV	mV	amp	mV	amp	mV	amp	mV
16	-	-	-	-	-	-	-	-	-	91	4.5	77	3.9
25	-	-	-	-	-	-	-	-	-	118	2.9	100	2.5
35	-	-	-	-	-	-	-	-	-	142	2.1	120	1.8
50	184	1.5	184	1.5	154	1.30	1.3	160	1.3	168	1.5	143	1.30
70	226	1.1	228	1.1	188	0.92	1.92	197	0.93	200	1.12	176	0.93
95	270	0.78	272	0.80	226	0.68	0.70	235	0.69	250	0.80	213	0.69
120	307	0.62	312	0.66	257	0.54	0.55	267	0.56	-	-	272	0.56
150	343	0.52	347	0.56	288	0.45	0.46	298	0.48	-	-	310	0.48
185	384	0.53	400	0.47	326	0.38	0.38	345	0.40	-	-	360	0.40
240	441	0.34	465	0.40	377	0.30	0.32	395	0.34	-	-	410	0.34
300	500	0.29	475	0.35	424	0.25	0.28	440	0.30	-	-	-	0.30
380	580	0.24	525	0.33	475	0.22	0.25	500	0.28	-	-	-	-
480	680	0.24	*595	0.30	545	0.20	0.22	570	0.26	-	-	-	-
600	730	0.20	*655	0.29	615	0.17	0.20	640	0.24	-	-	-	-
740	830	0.20	*760	0.27	690	0.16	0.19	750	0.24	-	-	-	-
960	955	0.18	965	0.26	790	0.15	0.18	860	0.23	-	-	-	-
1200	1055	0.17	1110	0.26	870	0.15	0.17	970	0.22	-	-	-	-

* Adjacent cable surfaces separated by one cable diameter

Sustained Current Rating (AMP) (50HZ)

Condition: Run in single way ducts

Single, Twin, Three & Four core cable with stranded Aluminium conductor

PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 600/1000 Volt grade

Nominal Area Conductor	Single Core *				Twin		Three & Four Cores	
	2 Cables		3 Cables		Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced °		Trefoil Touching					
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter				
mm ²	amp	mV	amp	mV	amp	mV	amp	mV
16	-	-	-	-	75	4.5	62	3.9
25	-	-	-	-	96	2.8	81	2.5
35	-	-	-	-	115	2.1	97	1.8
50	166	1.6	154	1.45	137	1.5	116	1.3
70	204	1.1	188	0.98	170	1.1	144	0.93
95	241	0.79	222	0.76	204	0.77	174	0.69
120	274	0.72	252	0.63	-	-	199	0.56
150	306	0.65	280	0.56	-	-	223	0.48
185	335	0.56	306	0.48	-	-	254	0.40
240	381	0.47	347	0.42	-	-	298	0.34
300	423	0.43	384	0.37	-	-	338	0.30
380	455	0.39	411	0.34	-	-	-	-
480	498	0.38	449	0.32	-	-	-	-
600	538	0.34	483	0.29	-	-	-	-
740	584	0.32	523	0.28	-	-	-	-
960	619	0.29	550	0.26	-	-	-	-
1200	664	0.28	588	0.25	-	-	-	-

* Aluminium wire armoured

Unarmoured

Nominal Area Conductor	Single Core					Twin		Three & Four Cores	
	2 Cables		3 Cables			Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter
	Spaced °		Trefoil Touching / Flat						
	Current Rating	Approximate Volt Drop Per Ampere Per Meter	Current Rating	Approximate Volt Drop Per Ampere Per Meter					
mm²	amp	mV	amp	mV	mV	amp	mV	amp	mV
16	-	-	-	-	-	75	4.5	65	3.9
25	-	-	-	-	-	96	2.8	84	2.5
35	-	-	-	-	-	117	2.1	98	1.8
50	166	1.6	160	1.4	1.4	137	1.5	120	1.3
70	204	1.1	192	1.01	1.02	167	1.1	145	0.93
95	246	0.87	230	0.76	0.76	205	0.77	174	0.69
120	382	0.73	264	0.64	0.64	-	-	198	0.56
150	320	0.63	292	0.56	0.56	-	-	225	0.48
165	360	0.55	330	0.48	0.49	-	-	255	0.40
240	418	0.49	382	0.42	0.43	-	-	295	0.34
300	474	0.43	434	0.38	0.39	-	-	335	0.30
380	535	0.39	484	0.35	0.36	-	-	-	-
480	610	0.36	555	0.34	0.34	-	-	-	-
600	685	0.34	614	0.32	0.32	-	-	-	-
740	774	0.32	698	0.30	0.30	-	-	-	-
960	885	0.29	794	0.28	0.28	-	-	-	-
1200	995	0.28	888	0.25	0.26	-	-	-	-

Sustained Current Rating (AMP) (50HZ)

Condition: Direct in ground / in single way ducts / in air
 Single, Twin, Three & Four core cable with stranded Aluminium conductor
 PVC insulated / PVC Bedded

Single Wire Armoured

PVC Oversheathed Cables 1900/3300 Volt grade

Nominal Area Conductor	Direct in Ground		In Single Way Ducts		In Air	
	Single Core	Three Core	Single Core *	Three Core	Single Core *	Three Core
	3 Cables		3 Cables		3 Cables	
	Trefoil Touching		Ducts Touching in Trefoil		Trefoil Touching	
mm ²	amp	amp	amp	amp	amp	amp
16	-	74	-	62	-	64
25	-	95	-	80	-	84
35	-	114	-	96	-	102
50	147	136	146	114	135	122
70	180	168	177	141	170	154
95	215	201	212	169	208	189
120	244	230	239	193	240	220
150	273	257	266	217	273	250
185	309	292	290	246	317	287
240	357	338	329	285	376	340
300	402	381	363	322	431	388
380	450	-	389	-	496	-
480	503	-	424	-	568	-
600	583	-	456	-	637	-
740	610	-	492	-	720	-
960	658	-	517	-	802	-
1200	707	-	552	-	884	-

* Aluminium wire armoured

Unarmoured

Nominal Area Conductor	Direct in Ground		In Single Way Ducts	In Air	
	3 Single Core Cables		3 Single core cables	3 Single Core Cables	
	Trefoil or Laid Flat	Laid Flat	Trefoil or Laid Flat	Trefoil	Laid Flat
	Touching	Spaced *	Ducts Touching	Touching	Spaced ^o
mm ²	amp	amp	amp	amp	amp
50	148	135	148	135	145
70	185	190	180	172	180
95	220	230	220	210	220
120	250	255	245	245	260
150	275	285	275	275	295
185	312	330	315	320	345
240	365	380	365	380	440
300	410	425	410	435	510
380	465	485	465	505	580
490	520	550	520	585	620
600	525	615	585	655	755
740	648	700	650	760	826
960	740	810	755	890	1010
1200	815	900	840	1010	1140

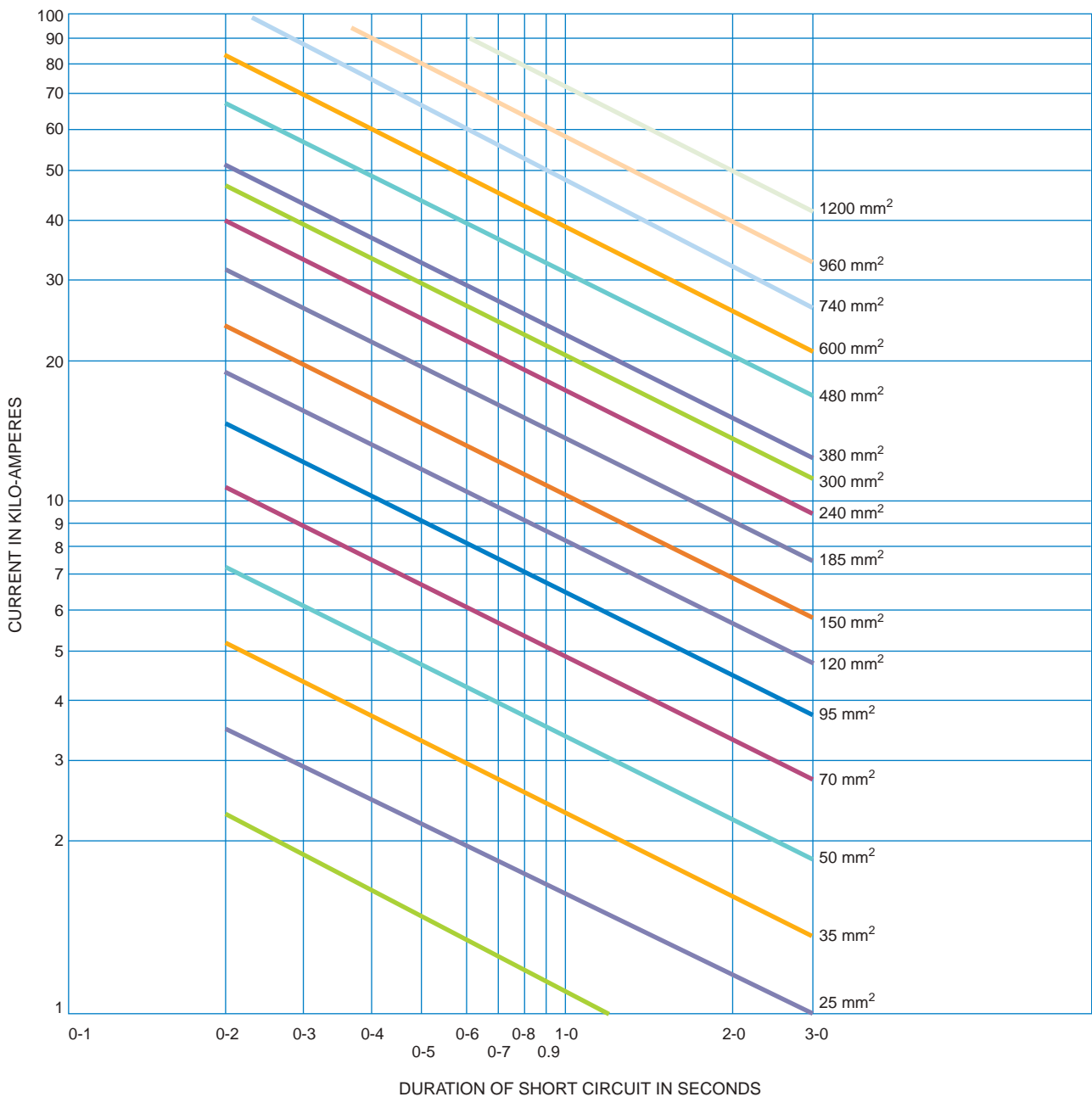
* Adjacent cable surfaces separated by one cable diameter

^o Distance between cable centres Up to and including 185 mm 2 - twice overall diameter of cable 240 mm 2 and above - 90 mm

Short Circuit Rating Chart

Stranded Aluminium Conductors

Short Circuit Ratings



BASIS: Cable fully loaded at start of short circuit. Conductor temperature at end of short circuit: 130°C

SECTION 5

Current Rating and Circuit Protection

Cables insulated with PVC, which is a thermoplastic material, may sustain serious damage when subjected, even for relatively short periods, to temperatures higher than that permissible for continuous operation.

The full current rating of PVC insulated cables corresponds to a Continuous operating conductor temperature of 70°C , the maximum permissible for this type of cable. Accordingly, it is essential that such cables shall be operated at full rating as given in the tables only if suitably protected against excess currents arising from abnormal conditions. It is shown in ERA Report 5074 that, if the duration of such excess currents does not exceed four hours, protection is considered to be adequate if the minimum current at which it is designed to operate does not exceed 1.45 times the tabulated ratings where cables are laid in air or in ducts and not more than 1.3 times the tabulated ratings where the cables are laid direct in the ground.

Where the circuit protection is such that operation of a cable at full rating is not permissible under the foregoing provisions, the cable required for a given continuous load current shall be selected to have a rating as given in the tables which shall be not less than:


- (a) the given continuous load current,
- (b) 1. for cables in air or in ducts, 0.69 of the minimum current at which the excess current protection is designed to operate, or
2. for cables laid direct in the ground 0.77 of the minimum current at which excess current protection is designed to operate.



Groups,
Twin or Multi-Core
Laid Direct

Group Rating Factors

For Twin or Multi-Core Cables in Horizontal Formation
Laid Direct in the Ground

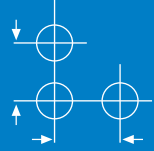


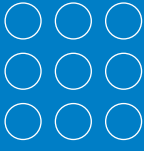
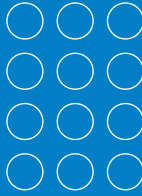
	Number of Cables In Group					
		Touching	0.15	0.3	0.45	0.6
600/1000 Volt Cables	2	0.81	0.87	0.91	0.93	0.95
	3	0.70	0.78	0.84	0.88	0.90
	4	0.63	0.74	0.81	0.86	0.89
	5	0.59	0.70	0.78	0.84	0.87
	6	0.55	0.46	0.77	0.83	0.87
	7	0.52	0.66	0.75	0.82	0.86
	8	0.50	0.64	0.75	0.81	0.86
	9	0.48	0.63	0.74	0.81	0.85
	10	0.47	0.62	0.73	DAD	0.85
	11	0.45	0.61	0.73	0.80	0.85
	12	0.44	0.60	0.72	0.80	0.84
1900/3300 Volt Cables	2	0.80	0.85	0.89	0.91	0.93
	3	0.68	0.76	0.81	0.84	0.87
	4	0.62	0.71	0.77	0.81	0.84
	5	0.57	0.66	0.73	0.78	0.82
	6	0.54	0.64	0.71	0.77	0.81
	7	0.51	0.61	0.69	0.75	0.79
	8	0.49	0.59	0.68	0.74	0.79
	9	0.47	0.58	0.67	0.73	0.78
	10	0.45	0.57	0.66	0.73	0.78
	11	0.44	0.55	0.65	0.72	0.77
	12	0.43	0.54	0.64	0.72	0.77

The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC - 60287.

**Groups,
Twin or Multi-Core
Laid Direct**

Group Rating Factors

For Twin or Multi-Core Cables in Tier Formation
Laid Direct in the Ground

	Spacing of Cables Meter	FORMATION OF CABLE *				
						
600/1000 Volt Cables	Touching	0.69	0.62	0.53	0.44	0.40
	0.15	0.77	0.71	0.62	0.53	0.48
	0.30	0.81	0.77	0.68	0.58	0.53
	0.45	0.83	0.80	0.72	0.62	0.56
	0.60	0.85	0.82	0.74	0.64	0.59
1900/3300 Volt Cables	Touching	0.68	0.61	0.52	0.43	0.38
	0.15	0.75	0.69	0.59	0.50	0.46
	0.30	0.79	0.74	0.65	0.55	0.50
	0.45	0.81	0.77	0.68	0.58	0.53
	0.60	0.83	0.79	0.71	0.61	0.56


The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

* The factors in the last column also apply when the larger dimension of the formation is horizontal.

Groups,
Twin or Single-Core
Laid Direct

Group Rating Factors

For Circuits of Three Single-Core Cables, Laid Flat Spaced
Horizontal Formation, Laid Direct in the Ground


	Number of Circuits	(600/1000 VOLT CABLES ONLY)			
					
		SPACING OF CIRCUITS - METER			
		1.15 *	0.30	0.45	0.60

2	0.83	0.88	0.91	0.93
3	0.72	0.79	0.84	0.87
4	0.67	0.76	0.81	0.85
5	0.63	0.72	0.79	0.83
6	0.61	0.71	0.77	0.82
7	0.59	0.69	0.76	0.81
8	0.57	0.68	0.76	0.81
9	0.56	0.67	0.75	0.80
10	0.55	0.67	0.74	0.80
11	0.54	0.66	0.74	0.80
12	0.53	0.65	0.74	0.80

* These spacings will not be possible for some of the larger diameter cables.

Group Rating Factors

For Circuits of Two Single-Core Cables, Laid Flat Touching
Horizontal Formation, Laid Direct in the Ground

	Number of Circuits	(600/1000 VOLT CABLES ONLY)				
						
		SPACING OF CIRCUITS - METER				
		Touching	0.15	0.30	0.45	0.60

2	0.79	0.84	0.89	0.91	0.93
3	0.68	0.74	0.80	0.85	0.88
4	0.62	0.69	0.77	0.82	0.86
5	0.57	0.65	0.74	0.80	0.84
6	0.54	0.63	0.72	0.79	0.83
7	0.52	0.60	0.71	0.78	0.83
8	0.50	0.59	0.70	0.77	0.82
9	0.48	0.57	0.69	0.76	0.82
10	0.47	0.56	0.68	0.76	0.81
11	0.46	0.56	0.67	0.75	0.81
12	0.45	0.55	0.67	0.75	0.81

The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

Groups, Twin or Single-Core Laid Direct

Group Rating Factors

For Twin or Multi-Core Cables in Horizontal Formation
Laid Direct in the Ground

	Spacing of Cables Meter	 SPACING OF CIRCUITS - METER			
		0.15 *	0.30 *	0.45	0.60
600/1000 Volt Cables	2	0.81	0.86	0.90	0.92
	3	0.70	0.77	0.82	0.86
	4	0.65	0.74	0.79	0.84
	5	0.61	0.70	0.77	0.82
	6	0.59	0.68	0.75	0.81
	7	0.56	0.67	0.74	0.80
	8	0.55	0.66	0.74	0.79
	9	0.54	0.65	0.73	0.79
	10	0.53	0.64	0.72	0.78
	11	0.52	0.64	0.72	0.78
	12	0.51	0.63	0.72	0.78
1900/3300 Volt Cables	2	0.80	0.84	0.87	0.89
	3	0.69	0.75	0.79	0.82
	4	0.63	0.70	0.75	0.79
	5	0.59	0.66	0.72	0.76
	6	0.56	0.64	0.70	0.74
	7	0.53	0.62	0.68	0.73
	8	0.52	0.60	0.67	0.72
	9	0.50	0.59	0.66	0.71
	10	0.49	0.58	0.65	0.71
	11	0.48	0.57	0.65	0.70
	12	0.47	0.57	0.64	0.70

The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

* These spacings will not be possible for some of the larger diameter cables.

Groups,
Twin or Single-Core
Laid Direct

Group Rating Factors

For Circuits of Three Single-Core Cables, in Tire - Touching or Laid Flat Touching
Horizontal Formation, Laid Direct

	Number of Cables in Group	 SPACING OF CIRCUITS - METER					
		Touching		0.15 *	0.30	0.45	0.60
		Trefoil	Laid Flat				
600/1000 Volt Cables	2	0.78	0.81	0.83	0.88	0.91	0.93
	3	0.66	0.70	0.73	0.79	0.84	0.87
	4	0.61	0.64	0.68	0.73	0.81	0.85
	5	0.56	0.60	0.64	0.73	0.79	0.83
	6	0.53	0.57	0.61	0.71	0.78	0.82
	7	0.50	0.54	0.59	0.69	0.76	0.82
	8	0.49	0.53	0.57	0.68	0.76	0.81
	9	0.47	0.51	0.56	0.67	0.75	0.81
	10	0.46	0.50	0.55	0.67	0.75	0.80
	11	0.44	0.49	0.54	0.66	0.74	0.80
	12	0.43	0.48	0.53	0.66	0.74	0.80
1900/3300 Volt Cables	2	0.78	0.80	0.82	0.86	0.89	0.91
	3	0.66	0.68	0.71	0.77	0.80	0.83
	4	0.59	0.62	0.65	0.72	0.77	0.80
	5	0.55	0.58	0.61	0.68	0.74	0.78
	6	0.52	0.55	0.58	0.66	0.72	0.76
	7	0.49	0.52	0.56	0.64	0.70	0.75
	8	0.47	0.50	0.54	0.63	0.69	0.74
	9	0.45	0.48	0.52	0.61	0.68	0.74
	10	0.44	0.47	0.51	0.61	0.68	0.73
	11	0.43	DAIS	0.50	0.60	0.67	0.73
	12	0.41	0.45	0.49	0.59	0.67	0.72

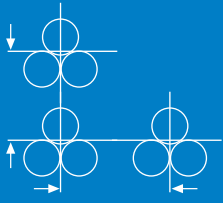
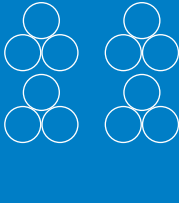
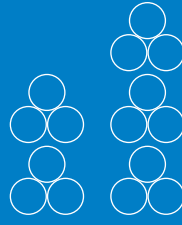
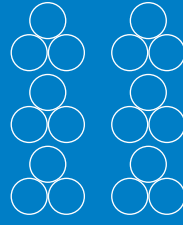
The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

* These spacings will not be possible for some of the larger diameter cables.

**Groups,
Twin or Single-Core
Laid Direct**

Group Rating Factors

For Circuits of Three Single-Core Cables in Trefoil Touching
Tier Formation, Laid Direct in the Ground

FORMATION OF CABLE CIRCUITS *					
	Spacing of Cable Circuits Meter	FORMATION OF CABLE CIRCUITS *			
					
600/1000 Volt Cables	Touching	0.66	0.59	0.53	0.49
	0.15	0.71	0.65	0.58	0.55
	0.30	0.76	0.71	0.63	0.60
	0.45	0.79	0.74	0.66	0.63
	0.60	0.80	0.77	0.68	0.65
1900/3300 Volt Cables	Touching	0.66	0.59	0.53	0.49
	0.15	0.70	0.64	0.57	0.54
	0.30	0.74	0.69	0.62	0.59
	0.45	0.77	0.72	0.65	0.62
	0.60	0.79	0.74	0.67	0.64


The figures given are averages over the appropriate range of conductors sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

* The factors in the last two columns also apply when the larger dimension of the formation is horizontal.

Groups,
Twin or Multi-Core
Single-Way Ducts

Group Rating Factors

For Twin or Multi-Core Cables in Single-Way Ducts
Horizontal Formation


	Number of Ducts in Group	 SPACING - METER			
		Touching	0.30	0.45	0.60
600/1000 Volt Cables	2	0.90	0.93	0.95	0.96
	3	0.83	0.88	0.91	0.93
	4	0.79	0.85	0.89	0.92
	5	0.75	0.83	0.88	0.91
	6	0.73	0.82	0.87	0.90
	7	0.71	0.81	0.86	0.89
	8	0.70	0.80	0.85	0.89
	9	0.68	0.79	0.85	0.89
	10	0.67	0.79	0.85	0.89
	11	0.66	0.78	0.84	0.88
	12	0.66	0.78	0.84	0.88
1900/3300 Volt Cables	2	0.88	0.91	0.93	0.94
	3	0.80	0.85	0.88	0.90
	4	0.76	0.81	0.85	0.88
	5	0.72	0.78	0.83	0.86
	6	0.69	0.76	0.81	0.85
	7	0.67	0.75	0.80	0.84
	8	0.65	0.74	0.79	0.83
	9	0.63	0.72	0.78	0.83
	10	0.62	0.72	0.78	0.82
	11	0.61	0.71	0.77	0.82
	12	0.60	0.70	0.77	0.81

The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

Groups,
Single-Core
Single-Way Ducts

Group Rating Factors

For Single-Core Cables in Trefoil Single-Way Ducts
Horizontal Formation

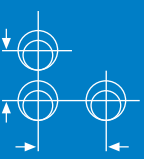


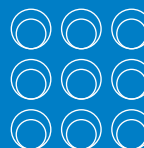
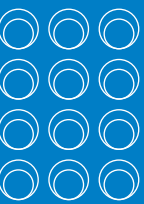
	Number of Circuits	 SPACING - METER		
		Touching	0.45	0.60
600/1000 Volt Cables	2	0.87	0.91	0.93
	3	0.78	0.84	0.87
	4	0.74	0.81	0.85
	5	0.70	0.79	0.83
	6	0.69	0.78	0.82
	7	0.67	0.76	0.82
	8	0.66	0.76	0.81
	9	0.65	0.75	0.81
	10	0.64	0.75	0.80
	11	0.63	0.74	0.80
	12	0.63	0.74	0.80
1900/3300 Volt Cables	2	0.85	0.88	0.90
	3	0.75	0.80	0.83
	4	0.70	0.77	0.80
	5	0.67	0.74	0.78
	6	0.64	0.72	0.76
	7	0.62	0.70	0.75
	8	0.61	0.69	0.74
	9	0.59	0.68	0.73
	10	0.58	0.67	0.73
	11	0.57	0.67	0.72
	12	0.57	0.66	0.72

The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

Groups,
Twin or Multi-Core
Single-Way Ducts

Group Rating Factors

For Twin or Multi-Core Cables in Single-Way Ducts
in Tier Formation

		FORMATION OF DUCTS *				
						
600/1000 Volt Cables	Spacing of Ducts Meter					
	Touching	0.82	0.77	0.63	0.59	0.54
	0.30	0.85	0.82	0.74	0.65	0.60
	0.45	0.87	0.84	0.77	0.68	0.63
1900/3300 Volt Cables	Touching	0.80	0.74	0.65	0.56	0.51
	0.30	0.83	0.79	0.70	0.61	0.56
	0.45	0.85	0.81	0.74	0.65	0.59

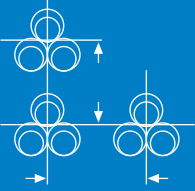
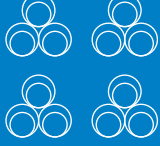
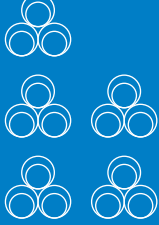
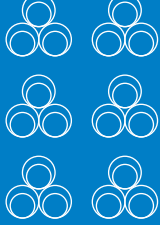
The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

* The factors in the last two columns also apply when the larger dimension of the formation is horizontal.

Groups,
Single-Core
Single-Way Ducts
Ambient Air Temperature

Group Rating Factors

For Twin or Multi-Core Cables in Single-Way Ducts
in Tier Formation

	FORMATION OF DUCTS *				
	Spacing of Ducts Meter				
600/1000 Volt Cables	Touching	0.75	0.69	0.62	0.59
	0.45	0.78	0.74	0.66	0.63
1900/3300 Volt Cables	Touching	0.73	0.67	0.61	0.57
	0.45	0.77	0.72	0.65	0.61

The figures given are averages over the appropriate range of conductor sizes and types of cable, and relate to the standard depth of laying. For particular cases the group rating factor may be calculated using the methods given in ERA Report Ref. F/T187 and IEC 60287.

* The factors in the last two columns also apply when the larger dimension of the formation is horizontal.

Depth of Laying
Laid Direct
Ground Temperature

Rating Factors

For Depth of Laying for Cables Laid Direct in the Ground

Depth of Laying Metre	600 / 1000 VOLT CABLES			1900 / 3300 VOLT CABLES	
	Up To 50 mm ²	70 mm ² to 300 mm ²	Above 300 mm ²	Up To 300 mm ²	Above 300 mm ²
0.5	1.00	1.00	1.00	-	-
0.6	0.99	0.98	0.97	-	-
0.8	0.97	0.96	0.94	1.00	1.00
1.0	0.95	0.93	0.92	0.98	0.97
1.25	0.94	0.92	0.89	0.96	0.95
1.5	0.93	0.90	0.87	0.95	0.93
1.75	0.92	0.89	0.86	0.94	0.91
2.0	0.91	0.88	0.85	0.92	0.89
2.5	0.90	0.87	0.84	0.91	0.88
3.0 or more	0.89	0.85	0.82	0.90	0.86

Rating Factors

For Variation in Ground Temperature

For Cables Laid Direct in the Ground Temperature

Ground Temperature °C	10	15	20	25	30	35	40	45	50
Rating Factor (Maximum Conductor Temperature 70°C)	1.04	1.00	0.95	0.90	0.85	0.80	0.74	0.67	0.60

Thermal Resistivity of Soil Twin or Multi-Core Laid Direct

Rating Factors

For Variation in Thermal Resistivity of Soil
Twin or Multi-Core Cables Laid Direct in the Ground

Nominal Area of Conductor mm ²	VALUE OF g, Km / W									
	0.7	0.8	0.9	1.0	1.5	2.0	2.5	3.0	3.5	4.0
1.5/2.5	1.12	1.09	1.07	1.04	0.94	0.86	0.80	0.75	0.70	0.66
4	1.13	1.10	1.07	1.05	0.94	0.85	0.79	0.74	0.69	0.65
6	1.14	1.10	1.07	1.05	0.93	0.85	0.79	0.74	0.68	0.64
10	1.15	1.11	1.08	1.05	0.93	0.85	0.78	0.73	0.67	0.63
16	1.16	1.12	1.08	1.05	0.93	0.84	0.77	0.72	0.66	0.62
25	1.17	1.13	1.09	1.05	0.93	0.83	0.77	0.71	0.65	0.61
35	1.17	1.13	1.09	1.06	0.92	0.83	0.76	0.71	0.65	0.61
50	1.17	1.13	1.09	1.06	0.92	0.83	0.76	0.71	0.65	0.61
70	1.18	1.14	1.09	1.06	0.92	0.83	0.75	0.70	0.64	0.60
95	1.18	1.14	1.09	1.06	0.92	0.83	0.75	0.70	0.64	0.60
120	1.19	1.14	1.10	1.06	0.92	0.82	0.75-	0.69	0.64	0.60
150	1.19	1.14	1.10	1.06	0.92	0.82	0.75	0.69	0.63	0.59
185	1.19	1.14	1.10	1.06	0.92	0.82	0.74	0.69	0.63	0.59
240	1.20	1.15	1.10	1.07	0.92	0.81	0.74	0.69	0.63	0.59
300/400	1.20	1.15	1.10	1.07	0.92	0.81	0.74	0.69	0.63	0.59

Thermal Resistivity of Soil Two of Three Single-Core Laid Direct

Rating Factors

For Variation in Thermal Resistivity of Soil for
Two or Three Single-Core Cables Laid Direct in the Ground

Nominal Area of Conductor mm ²	VALUE OF g, Km / W									
	0.7	0.8	0.9	1.0	1.5	2.0	2.5	3.0	3.5	4.0
50	1.21	1.16	1.11	1.07	0.91	0.81	0.73	0.68	0.63	0.59
70	1.22	1.16	1.12	1.07	0.91	0.81	0.73	0.68	0.63	0.59
95	1.22	1.16	1.12	1.07	0.91	0.81	0.73	0.68	0.63	0.59
120	1.22	1.16	1.12	1.07	0.91	0.81	0.73	0.68	0.63	0.59
150	1.22	1.16	1.12	1.07	0.91	0.81	0.73	0.68	0.63	0.59
185	1.22	1.17	1.12	1.07	0.91	0.81	0.73	0.68	0.62	0.59
240	1.23	1.17	1.12	1.07	0.91	0.80	0.73	0.68	0.62	0.59
300	1.23	1.17	1.12	1.07	0.91	0.80	0.73	0.68	0.62	0.59
380/400	1.23	1.17	1.12	1.07	0.91	0.80	0.73	0.67	0.62	0.58
480/500	1.23	1.17	1.12	1.07	0.91	0.80	0.73	0.67	0.62	0.58
600/630	1.23	1.17	1.12	1.07	0.91	0.80	0.73	0.67	0.61	0.58
740/800	1.23	1.17	1.12	1.07	0.91	0.80	0.72	0.66	0.61	0.58
960/1000	1.24	1.18	1.12	1.07	0.91	0.80	0.72	0.66	0.61	0.58
1200	1.24	1.18	1.12	1.08	0.90	0.80	0.72	0.66	0.61	0.58

Depth of Laying
Single, Twin and Multi-Core
Single-Way Ducts
Ground Temperature

Rating Factors

For Depth of Laying Single, Twin or Multi-Core Cables
in Single-Way Ducts

Depth of Laying Metre	600 / 1000 VOLT CABLES		1900 / 3300 VOLT CABLES	
	Single-Core	Multi-Core	Single-Core	Multi-Core
0.50	1.00	1.00	-	-
0.60	0.98	0.99	-	-
0.80	0.95	0.98	1.00	1.00
1.00	0.93	0.96	0.98	0.99
1.25	0.91	0.95	0.95	0.97
1.50	0.89	0.94	0.94	0.96
1.75	0.88	0.94	0.92	0.96
2.00	0.87	0.93	0.91	0.95
2.50	0.84	0.92	0.89	0.94
3.0 or more	0.85	0.91	0.88	0.93

Rating Factors

For Variation in Ground Temperature for Cables Laid in Ducts

Ground Temperature, °C	10	15	20	25	30	35	40	45	50
---------------------------	----	----	----	----	----	----	----	----	----

Rating Factor

(Maximum Conductor
Temperature 70°C)

1.04	1.00	0.95	0.90	0.85	0.80	0.74	0.67	0.60
------	------	------	------	------	------	------	------	------

Rating Factors

For Variation in Ambient Air Temperature

Air Temperature, °C	25	30	35	40	45	50	55
------------------------	----	----	----	----	----	----	----

Rating Factor

(Maximum Conductor
Temperature 70°C)

1.06	1.00	0.94	0.87	0.79	0.71	0.61
------	------	------	------	------	------	------

Thermal Resistivity of Soil Twin and Multi-Core Single-Way Ducts

Rating Factors

For Variation in Thermal Resistivity of Soil
Twin or Multi-Core Cables Laid in Single-Way Ducts

Nominal Area of Conductor mm ²	VALUE OF g, Km / W									
	0.7	0.8	0.9	1.0	1.5	2.0	2.5	3.0	3.5	4.0
1.5/2.5	1.04	1.03	1.02	1.02	0.98	0.94	0.91	0.88	0.86	0.83
4	1.00	1.00	1.03	1.02	0.97	0.94	0.90	0.87	0.85	0.82
6	1.05	1.04	1.03	1.02	0.97	0.93	0.90	0.86	0.84	0.81
10	1.05	1.04	1.03	1.02	0.97	0.93	0.89	0.86	0.83	0.80
16	1.06	1.04	1.03	1.02	0.97	0.92	0.88	0.85	0.82	0.79
25	1.06	1.05	1.03	1.02	0.96	0.92	0.88	0.84	0.82	0.78
35	1.06	1.05	1.03	1.02	0.96	0.92	0.87	0.83	0.81	0.77
50	1.07	1.05	1.03	1.02	0.96	0.91	0.87	0.83	0.80	0.77
70	1.07	1.05	1.04	1.02	0.96	0.91	0.86	0.82	0.79	0.76
95	1.07	1.06	1.04	1.02	0.96	0.91	0.86	0.82	0.78	0.75
120	1.08	1.06	1.04	1.03	0.95	0.90	0.85	0.81	0.78	0.74
150	1.09	1.06	1.04	1.03	0.95	0.90	0.85	0.80	0.77	0.73
185	1.09	1.07	1.05	1.03	0.95	0.89	0.84	0.80	0.76	0.72
240	1.09	1.07	1.05	1.03	0.95	0.89	0.84	0.79	0.76	0.72
300/400	1.10	1.07	1.05	1.03	0.95	0.88	0.83	0.78	0.75	0.71

Thermal resistivity of soil Three Single-Core in Ducts

Rating Factors

For Variation in Thermal Resistivity of Soil Three Single-Core Cables in Ducts

Nominal Area of Conductor mm ²	VALUE OF g, Km / W									
	0.7	0.8	0.9	1.0	1.5	2.0	2.5	3.0	3.5	4.0
50	1.11	1.08	1.06	1.04	0.94	0.87	0.82	0.77	0.73	0.69
70	1.12	1.09	1.06	1.04	0.94	0.87	0.81	0.76	0.72	0.68
95	1.12	1.09	1.06	1.04	0.94	0.87	0.81	0.76	0.72	0.68
120	1.13	1.10	1.07	1.04	0.94	0.86	0.80	0.75	0.72	0.67
150	1.13	1.10	1.07	1.04	0.94	0.86	0.80	0.75	0.71	0.67
185	1.13	1.10	1.07	1.04	0.93	0.86	0.79	0.75	0.70	0.67
240	1.14	1.11	1.07	1.04	0.93	0.86	0.79	0.74	0.70	0.66
300	1.14	1.11	1.08	1.05	0.93	0.85	0.79	0.74	0.69	0.65
380/400	1.14	1.11	1.08	1.05	0.93	0.85	0.78	0.73	0.68	0.64
480/500	1.15	1.11	1.08	1.05	0.93	0.85	0.78	0.73	0.68	0.64
600/630	1.15	1.12	1.08	1.05	0.93	0.84	0.78	0.72	0.68	0.64
740/800	1.16	1.12	1.09	1.05	0.93	0.84	0.77	0.72	0.67	0.64
960/1000	1.16	1.13	1.09	1.05	0.92	0.84	0.77	0.71	0.67	0.63
1200	1.17	1.13	1.09	1.05	0.92	0.83	0.77	0.71	0.66	0.63

Thermal Resistivity of Soil
Twin and Multi-Core
Single-Way Ducts

Rating Factors

For Variation in Thermal Resistivity of Soil
Two Single-Core Cables in the Ducts

Nominal Area of Conductor mm ²	VALUE OF g, Km / W									
	0.7	0.8	0.9	1.0	1.5	2.0	2.5	3.0	3.5	4.0
50	1.08	1.06	1.04	1.03	0.96	0.90	0.85	0.81	0.77	0.74
70	1.08	1.06	1.05	1.03	0.96	0.90	0.84	0.81	0.76	0.73
95	1.08	1.07	1.05	1.03	0.95	0.89	0.84	0.81	0.75	0.72
120	1.09	1.07	1.05	1.03	0.95	0.89	0.83	0.79	0.75	0.71
150	1.09	1.07	1.05	1.03	0.95	0.88	0.83	0.79	0.74	0.71
185	1.09	1.07	1.05	1.03	0.95	0.88	0.83	0.78	0.74	0.70
240	1.10	1.08	1.05	1.04	0.95	0.88	0.82	0.78	0.73	0.70
300	1.10	1.08	1.06	1.04	0.95	0.87	0.82	0.77	0.72	0.69
380/400	1.11	1.08	1.06	1.04	0.94	0.87	0.82	0.77	0.72	0.68
480/500	1.12	1.08	1.06	1.04	0.94	0.87	0.81	0.76	0.71	0.68
600/630	1.12	1.09	1.06	1.04	0.94	0.87	0.81	0.76	0.71	0.67
740/800	1.13	1.10	1.07	1.04	0.94	0.86	0.80	0.75	0.71	0.67
960/1000	1.13	1.10	1.07	1.04	0.94	0.86	0.80	0.75	0.70	0.66
1200	1.13	1.10	1.07	1.05	0.94	0.86	0.80	0.75	0.70	0.66

Dimensions and Weights of Over Head Conductors

AAC ALL ALUMINIUM STRANDED CONDUCTORS							
Code Word	Nominal Size	Stranding & Wire Dia	Dia of Complete Conductor	Calculated Area of Complete Conductor	Ultimate Strength	D.C Resistance at 20°C	Weight
	mm ²	No/mm	mm	mm ²	kg	ohm/km	kg/km
Gant	25	7/2.21	6.63	26.85	469	1.0661	73.4
Ant	50	7/3.10	9.30	52.83	847	0.5419	144.4
Wasp	100	7/4.39	13.17	105.95	1633	0.2702	290.1
Arbutus	400	37/3.72	26.06	402.14	6304	0.0717	1108.7
Hawthorn	600	61/3.35	31.95	603.78	8966	0.0479	1668.1
Coreopsis	810.74	61/4.11	36.99	1075.06	13670	0.0356	2241.0

ACSR ALUMINIUM CONDUCTORS - STEEL REINFORCED									
Code Word	Aluminium Conductor	Steel Core	Diameter		Area of Aluminium	Area of Complete Conductor	Rated Ultimate Strength	D.C Resistance at 20°C	Weight
			Complete Conductor	Steel Core					
	No/mm	No/mm	mm	mm	mm ²	mm ²	kg	ohm/km	kg/km
Gopher	6/2.36	1/2.36	7.08	2.36	26.25	30.62	980	1.093	106
Rabbit	6/3.35	1/3.35	10.05	3.35	52.88	61.69	1875	0.543	214
Dog	6/4.72	7/1.57	14.15	4.71	104.98	118.53	3225	0.273	394
Merlin	18/3.47	1/3.47	17.36	3.47	170.5	179.7	3936	0.1691	544
Lynx	30/2.79	7/2.79	19.53	8.37	183.41	226.20	8192	0.158	842
Panther	30/3.0	7/3.0	21.00	9.0	212.1	261.5	9408	0.167	974
Osprey	18/4.465	1/4.465	22.33	4.465	281.9	297.5	6220	0.123	899
Cuckoo	24/4.62	7/3.08	27.72	9.24	402.33	454.48	12385	0.072	1519
Rail	45/3.70	7/2.47	29.61	7.41	483.84	517.38	11874	0.060	1599
Cardinal	54/3.38	7/3.38	30.42	10.14	484.50	547.30	15262	0.060	1832

Appendix A

PVC Insulated Cables

Recommendations for the Selection and Operation of Armoured Power Cables

A.1 TYPE OF FINISH

A.1.1 Bright wire armour

Bright wire armour without further covering should be used only for cables to be installed in air in non-corrosive atmospheres.

A.1.2 PVC oversheath

PVC oversheath provides protection against most corrosive and wet environments. In particularly onerous cases reference should be made to the cable manufacturer.

A.2 VOLTAGE RATINGS

The selection of standard cables of appropriate voltage designation for particular systems depends on the type of system and on the system earthing arrangements. For this purpose, systems have been divided into two categories:

CATEGORY 1

This category comprises those systems where one of the following applies:

- (1) The neutral point or mid-point connection is earthed in such a manner that, even under fault conditions, the maximum voltage that can occur between any conductor and earth does not exceed 0.8 E.
- (2) A device is installed which automatically and instantly cuts out any part of the system which becomes accidentally earthed.
- (3) (A.C. systems only). The neutral point is earthed through an arc suppression coil, with arrangements for isolation within an hour of the occurrence of a fault.

For systems in this category the rated voltage E_0 of the cable should be not less than the system voltage to neutral or mid-point, and the rated voltage E of the cable should be not less than the system voltage between lines.

CATEGORY 2

This category comprises one-wire (earth-return) systems, insulated two-wire systems, two-wire systems having one pole-earthed, insulated multiwire and polyphase systems and all other systems which do not fall into.

CATEGORY 1

For systems in this category both the rated voltages E_0 and E of the cable should be not less than the system voltage between lines.

Appendix B

PVC Insulated Cables

Recommendations for Installation of Armoured Power Cables

B.1 COMPLIANCE WITH REGULATIONS

The cables should be installed and used in association with other equipment in accordance with the current regulations for the Electrical Equipment of Buildings, published by the Institution of Electrical Engineers and/or the Electricity Supply Regulations, 1937, published by Her Majesty's Stationery Office: In countries outside Great Britain any applicable corresponding national regulations should be observed. In special environments, the appropriate regulations and codes of practice should be observed (e.g. for installations in potentially explosive atmosphere).

B.2 MINIMUM TEMPERATURE DURING INSTALLATION

Attention is drawn to the fact that as the temperature decreases, PVC compounds become increasingly stiff and brittle, with the result that if the cable is bent too quickly to too small a radius or is struck at temperatures in the region of 0 °C or - lower there is a risk of shattering the PVC components.

To avoid the risk of damage during handling, therefore, it is desirable that the cable specified in this standard should be installed only when both the cable and the ambient temperatures are above 0 °C and have been so for the previous 24 hours, or where special precautions have been taken to maintain the cable above this temperature.

B.3 MINIMUM INSTALLATION RADIUS

Non of the cables specified should be bent during installation to a radius smaller than that recommended below.

Finish	Overall Diameter D	Minimum Internal Radius of Bend
Circular copper conductor non-armoured	up to 10 mm	3D
	above 10 mm up to 25 mm	4D
	above 25 mm	6D
Circular copper conductor armoured	any	6D
Solid aluminium or shaped copper conductors, armoured or unarmoured	any	8D

B.4 PREVENTION OF MOISTURE INGRESS

Care should be exercised during installation to avoid any damage to cable coverings. This is important in Wet or other aggressive environments especially for cables which do not have extruded bedding. Unprotected open ends should not be exposed to moisture prior to final termination or jointing.

The possibility of damage to moisture seals during handling and installation of the cable should be borne in mind. Where such damage may have occurred the seals should be inspected and remade if necessary.

B.5 EARTHING BONDS AND CLAMPS

Owing to the absence of a metal sheath, all earth fault currents will return through the armour unless there is a parallel bonding connection to relieve the armour of some of the fault current. In either event, it is necessary to ensure that there is no discontinuity in the return circuit via the armour and no local spot of high resistance.

B.6 COMPOUND FILLING

Joints and sometimes terminations require filling with specified compounds to seal against wet or hazardous environments. When hot pouring compound is used, care should be taken that at the time of pouring, the temperature of the compound does not exceed 150°C.

Any joint included should be of suitable design to provide a protective seal to prevent moisture gaining access to the insulation and ferrules or to the armour connectors.

B.7 EARTHING OF ARMOUR

Provision should be made for earthing the armour to the main earth system at the supply end by means of a metallic bond of adequate conductance, the bonding connection being as short and straight as possible. It is also desirable to earth the armour at additional positions such as at joints.

Special precautions may be necessary to eliminate the risk of corrosion, especially corrosion due to the use of dissimilar metals.

B.8 TESTS AFTER INSTALLATION

A voltage test after installation is not an essential requirement of this British Standard, but if a test is made it should be carried out with direct current, the value of the voltage being that specified in a Table given below.

During the test the voltage should be increased gradually to the full value and maintained continuously for 15 min between conductors and between each conductor and armour. No breakdown should occur.

TABLE: TEST VOLTAGES AFTER INSTALLATION

Cable Voltage Designation	D.C. Test Voltage	
	Between Conductors	Between all Conductors and Armour
	V	V
600/1000	3500	3500
1900/3300	10000	7000

Conversion Tables

American Wire Gauge – Metric Comparison Chart

U.S. Standard (AWG)	Equivalent Cross-Section (mm ²)	Nearest Available Cross-Section (mm ²)
24	0.205	0.20
22	0.324	0.50
20	0.511	0.50 - 0.75
18	0.806	1.00
16	1.286	1.50
14	2.042	2.50
12	3.244	4.00
10	5.169	6.00
9	6.508	10.00
8	8.237	10.00
7	10.36	16.00
6	13.06	16.00
5	16.51	16.00 - 25.00
4	20.78	25.00
3	26.21	25.00 - 35.00
2	33.08	35.00
1	41.66	50.00
1/0	52.44	70.00
2/0	66.19	70.00
3/0	83.29	95.00
4/0	105.20	120.00
250 MCM	124.30	120.00 - 150.00
300	149.00	150.00
350	174.10	185.00
400	198.90	240.00
500	248.30	240.00 - 300.00
600	298.30	300.00
700	347.70	400.00
750	372.80	400.00
800	397.80	400.00
1000	496.60	500.00
1250	620.90	630.00
1500	745.60	800.00
2000	993.90	1000.00

Conversion Tables

Comparison Between Standard Imperial and the Nearest Standard Metric Sizes of Conductors for Electric Cables

(1) Standard Imperial Diameter Inch	(1) Standard / Wire Inch 2	(2) Column (1) Converted to mm ²	(3) Nearest Metric Standard Size mm ²
(3/.029)	.0020	(1.29)	1.5
(3/.036)	.003	(1.94)	1.5
(7/.029)	.0045	(2.90)	2.5
(7/.036)	0.007	(4.52)	4
(7/.044)	0.01	(6.52)	6
(7/.052)	0.0145	(9.35)	10
(7/.064)	0.0225	(14.52)	16
(19/.052)	0.04	(25.81)	25
(19/.064)	0.06	(38.71)	35
(19/.072)	.075	(48.39)	50
(19/.083)	0.10	(64.52)	70
(37/.072)	0.15	(96.77)	95
(37/.083)	0.2	(129.0)	120
(37/.093)	0.25	(161.3)	150
(37/.103)	0.3	(193.6)	185
(61/.093)	0.4	(268.1)	240
(61/.103)	0.5	(322.6)	300
(91/.093)	0.6	(387.0)	400
(91/.103)	0.75	(483.9)	500
(127/.103)	1.0	(645.2)	630
	1.25	(806.4)	800
	1.5	(967.7)	1000

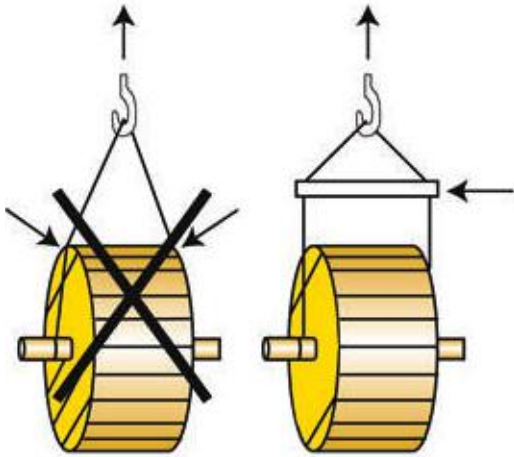
Note: Sizes (3/0.029", 3/0.036" 7/0.029") are manufactured by us in both imperial & Metric Sizes.



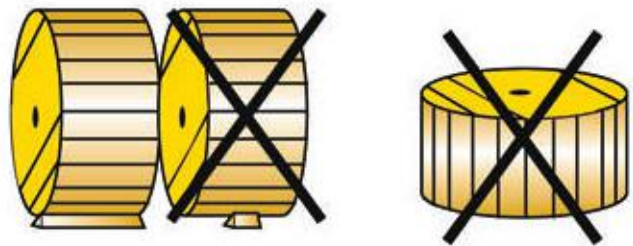
The Right Way of Handling Cable Drums

Incorrect handling of cable drums while lifting, loading / unloading and storing can be very hazardous. Cables are supplied on heavy wooden / steel drums and should be handled by trained persons according to International Regulations.

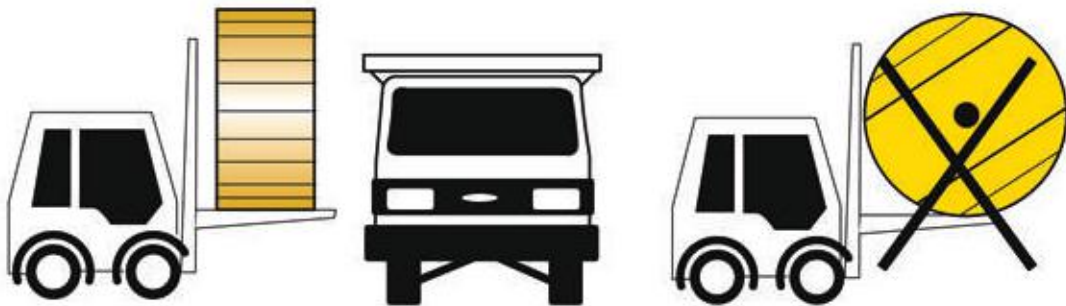
Follow these Instructions



Lifting cable drum using cranes



Drums should never be laid flat on their sides
Always use proper wedges to prevent drums rolling



Lifting cable drums correctly using fork lifts



Secure drums properly for transportation



The right way to roll the drums
Follow the direction shown by the arrow



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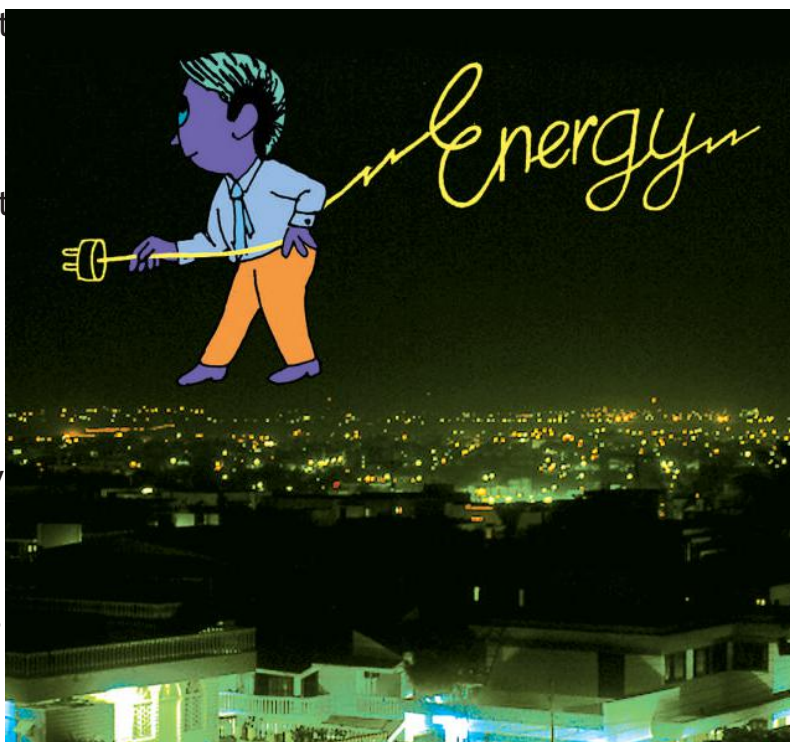
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Energy needs to be brought to you safely and efficiently without current leakages and risk of short circuits.

Energy needs to be brought to you economically without recurring re-wiring costs and risk of increased power bills.

PIONEER CABLES are energy efficient. A Company devoted to product quality using Prime Grade Raw Materials and 99.9% pure Copper Rod. Every meter of cable manufactured is subject to stringent quality control tests to conform to international standards.



SURVEY : Samples Test of 3/.029 CU/PVC Market Survey.

	Standard	ST Value	Pioneer Cables	Brand X	Brand XX
1	Conductivity	100.00%	102.56	97.51	37.10
2	Resistivity	17.241	16.8107	17.68107	46.470
3	Cond. Resistance	13.76 Ohms/KM	12.90	13.57	35.66
4	Elog. PVC	125%	225	350	190
5	T/s PVC	12.5 N/sqmm	14.16	16.98	11.68
6	Overall Dia	3.36 mm	3.50	3.50	3.65
7	Ins. Thick	0.889 mm	0.9-1.0	0.85-1.0	1.0-1.2
8	Lay Length	40 to 47.7	42.0 RH	103.0 R.H.	Straight
9	Dia of Strand	0.736 mm	0.74	0.72	0.71

COSTS : Brand xx/Brand x may cost less initially but increase Risk of damages and Current Leakages, causing continuous increased power bills and overload on our already scarce energy resources.

Make The Professionals Choice - Your Choice



HEAD/SALES OFFICE KARACHI:1001, Unitowers, I.I. Chundrigar Road, P.O. Box No. 6643, Karachi-74000 (Pakistan).

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30
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Introducing Triple Extruded XLPE Power Cables

By the Grace of Allah,
we celebrate our Silver Jubilee
with yet another milestone
achievement.

Being the first and only
Pakistani manufacturer to successfully
Test and produce

**Triple Extruded XLPE
Power Cables**
the latest in Cable Technology.

Type test approved by the
prestigious HV & SC testing
laboratory, PEPCO Rawat and
Faisalabad Campus.


300 mm sq 3 Core AL/XLPE/PVC /
SWA /PVC 8.7/15 kV Cables are
made under the latest IEC 60502
and KESC Spec-123.

Leaders in Cable Technology
Paving the way for future generations



□ THINER

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بعض کیبلز بڑے شوق سے بجلی ہڑپ کر جاتی ہیں - اور بل آپ کو ادا کرنا پڑتا ہے۔

بجلی تانبے کے ان باریک تاروں میں سفر کرتی ہے جو وائرنگ میں استعمال ہونے والے کیبلز کے اندر ہوتے ہیں۔ اگر استعمال شدہ تانبہ ضروری معیار کا (کنڈیکٹر گریڈ) نہیں ہے تو کیبلز میں بجلی کی روکرواں رکھنے کی استعداد کم ہوگی اور مزاحمت زیادہ۔ جس کا سیدھا سیدھا مطلب یہ ہے کہ مین لائن سے آنے والی بہت ساری بجلی استعمال کے پوائنٹس تک پہنچنے پہنچنے کیبلز کی مزاحمتی قوت کی نذر ہو جائے گی۔ مگر اس کا بل تو آئے گا۔

بعض کیبلز ہلکے میٹیریل کے استعمال کی بدولت بظاہر سستی معلوم ہوتی ہیں۔ ان کیبلز میں بجلی رواں رکھنے کی کم استعداد اور از حد زیادہ مزاحمتی قوت کرنٹ لیک ہونے کے خطرہ اور نقصان کے امکان میں اضافہ کرتے ہی ہیں۔ آپ کے بلوں میں بھی ہر ماہ اضافہ کرتے رہتے ہیں۔

پائیر کیبلز استعمال کیجئے جو ایک ایسی کمپنی کے تیار کردہ ہیں جو اپنی مصنوعات کے معیار کی ضامن ہے۔ پائیر کیبلز جدید ترین پلانٹ پر عمدہ ترین ۹۹.۹۹ فیصد خالص کنڈیکٹر گریڈ تانبے سے بنائے جاتے ہیں اور ہر میٹر کو انتہائی سخت کوالٹی کنٹرول کے مراحل سے گزارا جاتا ہے۔ پائیر کیبلز بین الاقوامی معیار پر پورے اترتے ہیں۔ اسی لئے ماہرین انہیں دوسرے کیبلز پر فوقیت دیتے ہیں۔

پائیر کیبلز نام لے کر طلب کریں۔ ماہرین کے انتخاب کو اپنائیں۔

PIONEER CABLES LTD
Leaders in Cable Technology

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