PIONEER CABLE®

trust in every meter

MORE THAN 100% CONDUCTIVITY

IS 694 IS 1554(1) IS 7098(1)

Approved By Bureau of Indian Standard

NS: 344

Introduction

Pioneer Electrocables (P) Ltd. started its commercial production in the year 1988 at Biratnagar (Nepal) and has steadily and impressively grown to become a leading producer of all type of Wires & Cable.

Due to our quality and competitive pricing PIONEER CABLE has become the first choice of most electricians, architects and engineers.

The factory is well equipped to manufacture & test products in conformity with National & International standards or to any special requirement of customer. Our team of engineers & consultants ensure that all cables are made to the highest of quality and for almost two decades we have an outstanding record of trouble free services.

Various technical information of our product have been included in the catalogue to assist in selection of suitable product. On enquiry our technical personnel will be pleased to provide all kinds of technical assistance and other services as required. Our motto is to delight our customers with best of our quality & services.

Since our company complies with ISO 9001 standard it becomes imperative to ensure the best quality products to our valued customers within the country and in global market.

We are continuously working towards making our customers delighted with our service & product quality.

Achievement

- First manufacturer to manufacture multicore cables up to 500 sq.mm. and single core upto 1000 sq.mm.
- First cable company in Nepal to achieve quality certificate of ISO 9002 now upgraded to 9001.
- First manufacturer of XLPE Insulated Power Cables.
- First manufacturer of Aerial Bundled Conductor Cables.

Prime Raw Materials

Copper : Cables are made from high conductivity, electrolytic grade annealed Copper having purity>99.90% and conforming to the IS 8130/BS 6360 Standards.

Aluminium : Electrically pure Aluminium wires of EC grades is used according to the application confirming to the IS 8130/BS 6360 standards.

PVC : Specially formulated PVC compound is imported from world's most reputed company in Europe, USA and Asia and meets/exceeds the requirement of IS 5831/BS 6746 standards.

XLPE : Silane grade XLPE compound with high dielectric strength and UV resistance is imported from renowned suppliers like Borouge & LG Chemicals.

Steel : Armouring strip and wire confirming to IS:3975 is sourced from reputed Indian manufacturers with ISI mark.

OUR OTHER PRODUCTS

1. **Multistrand House Wiring Cable:** These cable are used in domestic single phase wiring. It is made of fine wires as per IS 694 & NS 342. The wires are twisted to give more strength to prevent from wire breakage & hence heating.

2. **Concentric Cable:** it is used from Pole to Meter a service drop cable for the end user for use on a 400/230V uniground system.

3. **Single & Multicore Cable:** These cables are used in 3 phase application to power machine tools, appliances, control panels, machinery and these cables are made as per IS 8130, IS 694.

4. **Power & Control Cables:** These cables are used in industrial application for supplying low voltage power to machines and are made as per IS 8130, IS 1554 (1) IS 7098 (1).

5. **Telecom Cable:**
   a) Pair Cables upto 300 pair with/without tinned copper conductor , with/without armouring, with/without messenger.
   b) Self supporting Drop Wire with 40% conductivity Copper coated steel wire as per BS 4087 to meet the requirements of Nepal Telecom.
   c) 2 Pair Self supporting Distribution Wire (SD Wire)
   d) House wire and Jumper Wire

6. **Submersible 3 core Flat Cables** with flexible copper conductor as per IS 694 with specially formulated abrasion resistant PVC impervious to water, oil etc.

7. **Auto Cable & Battery Cable** as per BS 6862 and IS 2465 with heat resistant PVC Insulation as approved by automative industry.

8. **Aerial Bundled Cable Conductor** as per BS 7870 (5) and IS 142555 with XLPE insulation to meet the standards of Nepal Electricity Authority and various Indian Electricity Boards.

9. **Overhead Transmission Conductors** like ACSR, AAC, AAC, AAAC conductors upto 500 sq.mm. as per BS 215/IS 398/NS 259 are available. We are regular supplier to transmission conductors to Nepal Electricity Authority (NEA).

10. **Instrumentation Cable** as per IS: 1554, IS:3975, IS:5831 with braided/taped screening, drain wire, and cable construction so as to give maximum flexibility to the customers.

TESTS & QUALITY CONTROL

Raw Materials Control

All raw materials undergo rigorous testing for their suitability in the manufacturing process. PIONEER has laid down its own specifications for these raw materials after years of experience in line with the requirements of national & international standards and no compromise is allowed. A highly qualified and experienced group of technicians ensure that no substandard material is used in the manufacturing of Pioneer Cables.

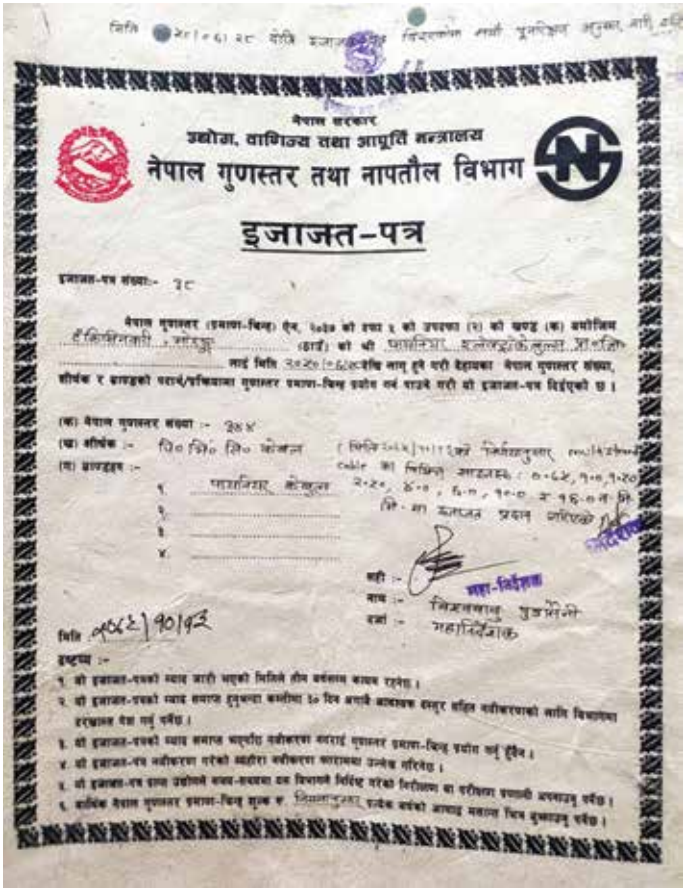
Process Control

A team of trained Quality Control Engineers are engaged in checking process variables in every manufacturing step. Any deviation from standard process specification is immediately brought to the notice of Shop floor Supervisors and corrective actions is taken without any delay. Following chart explains the salient features of the process inspection carried out in our works:

Process	Checks
Stranding	a. Surface of conductor, number of wires, wire dia, lay ratio and dimensions of conductor. b. Conductor Resistance.
Insulation (XPLE/PVC)	a. Surface, thickness and concentricity of insulation and dimensions of insulated conductor. b. Spark testing.
Laying-up	a. Direction of lay sequence of cores, lay length, circularity of cable and dia over laid up cores. b. Thickness of PVC tapes, thickness of inner sheath.
Extruded/ PVC Inner Sheath	Surface, thickness of inner sheath and diameter over inner sheath.
Armouring	Number and dimensions of armour wires, direction of lay, uniformity and diameter over armouring.
Outer Sheath	a. Thickness and concentricity of outer sheath and OD of cable. b. Embossing/Printing of company's name and voltage grade of cable.
Final Testing	Each and every drum of cable is tested as per scheme of testing and inspection as specified in Bureau of Indian Standard relevant standards.

Picture of Plant/Lab

NEPAL STANDARD FOR MULTISTRAND (NS 344)



नेपाल सरकार
उद्योग, वाणिज्य तथा आपूर्ति मन्त्रालय
नेपाल गुणस्तर तथा नापतौल विभाग

इजाजत-पत्र

इजाजत-पत्र संख्याः- ३८

(क) नेपाल गुणस्तर संख्या :- २४४

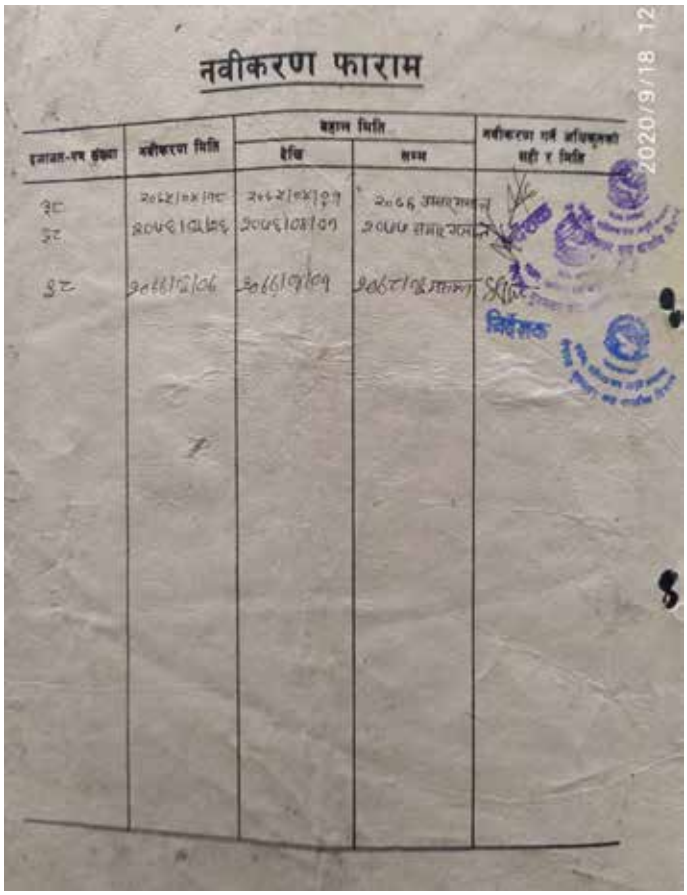
(ख) सीमांक :- पि० पि० लि० केबलस

(ग) ब्रान्डहरु :-
१. पाथानिया केबलस
२.
३.
४.

मिति :- ०७८।१०।१८

इष्टव्य :-
१. यो इजाजत-पत्रको म्याद जारी भएको मितिले तीन वर्षसम्म कायम रहनेछ ।
२. यो इजाजत-पत्रको म्याद समाप्त हुनुभन्दा कम्तीमा ३० दिन अगावै आवश्यक शुल्क सहित नवीकरणको लागि निवेदन दर्साउनु पर्नेछ ।
३. यो इजाजत-पत्रको म्याद समाप्त भइसकि नवीकरण गराई गुणस्तर चिह्नको प्रयोग गर्नु हुँदैन ।
४. यो इजाजत-पत्र नवीकरण गरेको खण्डमा नवीकरण गराएको उल्लेख गरिनेछ ।
५. यो इजाजत-पत्र प्राप्त उद्योगले कायम-कायमका सबै विभागले निर्दिष्ट गरेको निरीक्षण वा परीक्षण फ्रणाली अपनाउनु पर्नेछ ।
६. वार्षिक नेपाल गुणस्तर चिह्न-चिन्ह शुल्क रु. [illegible] रुपैया कार्यको आगाडि मात्रामा दिन बुझाउनु पर्नेछ ।

महा-निर्देशक
निजलचन्द्र पुजमैनी
महानिर्देशक



नवीकरण फाराम

इजाजत-पत्र संख्या	नवीकरण मिति	बहाल मिति		नवीकरण गर्ने अधिकृतको सही र मिति
		देखि	सम्म	
३८	२०८२।०४।१८	२०८२।०४।१९	२०८६ आषाढ मसान्त	
३८	२०८६।०८।२६	२०८६।०८।२७	२०९० साल मसान्त	
३८	२०९१।०२।०६	२०९१।०२।०७	२०९२ साल मसान्त	

INDIAN STANDARD CERTIFICATE FOR MULTISTRAND (IS 694)

IS 694

BUREAU OF INDIAN STANDARDS
मानक चिन्ह लगाने की अनुज्ञप्ति (लाइसेंस)
Licence for the use of STANDARD MARK

अनुज्ञप्ति (लाइसेंस) सं. सीएम/एल - 4011025
LICENCE NO. CM/L- 4011025

1. [illegible]

M/s Pioneer Electro Cables Pvt. Ltd.,	Authorised Indian Representative:
Tanki Sinawari, Nimuwa	Shri O.P. Sharma
VDC - 6	N-6, Rear Floor
District Morang	Green Park Main
Nepal	New Delhi - 110016

(hereinafter called "the licensee") this licence to use the Standard Mark set out in the first column of the First Schedule hereto, upon or in respect of the article/process set out in the second column of the said Schedule which is manufactured in accordance with/conforms to the related Indian standard(s) referred to in the third column of the said Schedule as from time to time amended or revised.

2. [illegible]

2. This licence carries the rights and obligations stipulated in the Regulations made under the above mentioned Act. In pursuance of his obligations, the licensee shall pay in due manner and time the scheduled Marking Fee set out in the Second Schedule hereto and maintain to the satisfaction of the BUREAU the Scheme of Testing and Inspection a copy of which is attached hereto.

3. [illegible] 03 अप्रैल 2008 से 02 अप्रैल 2009 तक विधिमान्य रहेगी और विधिवत् से विहित रूप से इसका नवीकरण हो सकेगा ।

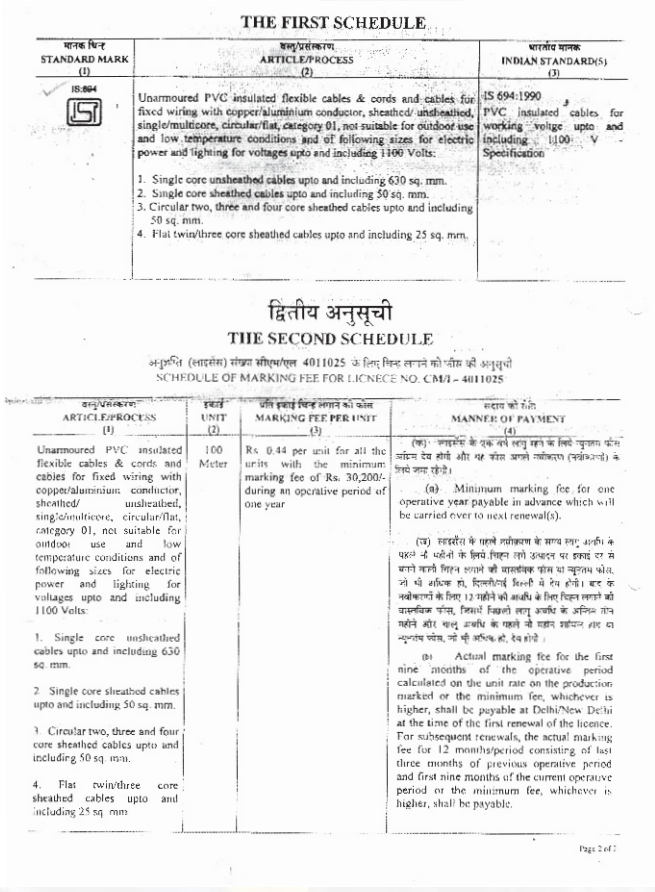
3. This licence shall be valid from Third April Two Thousand and Eight to Second April Two thousand and Nine and may be renewed as prescribed in the Regulations

आज दो हजार आठ के अप्रैल मास के तीसरे दिन हस्ताक्षरित तथा मुद्रांकित ।

Signed, Sealed and Dated this Third day of April Two Thousand and Eight

for BUREAU OF INDIAN STANDARDS

Addl Dy. Director General



THE FIRST SCHEDULE

मानक चिन्ह STANDARD MARK (1)	वस्तु/प्रसंस्करण ARTICLE/PROCESS (2)	भारतीय मानक INDIAN STANDARD(S) (3)
IS:694	Unarmoured PVC insulated flexible cables & cords and cables for fixed wiring with copper/aluminium conductor, sheathed/ unsheathed, single/multicore, circular/flat, category 01, not suitable for outdoor use and low temperature conditions and of following sizes for electric power and lighting for voltages upto and including 1100 Volts: 1. Single core unsheathed cables upto and including 630 sq. mm. 2. Single core sheathed cables upto and including 50 sq. mm. 3. Circular two, three and four core sheathed cables upto and including 50 sq. mm. 4. Flat twin/three core sheathed cables upto and including 25 sq. mm.	IS 694:1990 PVC insulated cables for working voltage upto and including 1100 V - Specification

द्वितीय अनुसूची

THE SECOND SCHEDULE

अनुज्ञप्ति (लाइसेंस) संख्या सीएम/एल 4011025 के लिए चिन्ह लगाने की फीस की अनुसूची
SCHEDULE OF MARKING FEE FOR LICENCE NO. CM/L - 4011025

वस्तु/प्रसंस्करण ARTICLE/PROCESS (1)	इकाई UNIT (2)	प्रति इकाई चिन्ह लगाने की फीस MARKING FEE PER UNIT (3)	संदाय की रीति MANNER OF PAYMENT (4)
Unarmoured PVC insulated flexible cables & cords and cables for fixed wiring with copper/aluminium conductor, sheathed/ unsheathed, single/multicore, circular/flat, category 01, not suitable for outdoor use and low temperature conditions and of following sizes for electric power and lighting for voltages upto and including 1100 Volts: 1. Single core unsheathed cables upto and including 630 sq. mm. 2. Single core sheathed cables upto and including 50 sq. mm. 3. Circular two, three and four core sheathed cables upto and including 50 sq. mm. 4. Flat twin/three core sheathed cables upto and including 25 sq. mm	100 Meter	Rs. 0.44 per unit for all the units with the minimum marking fee of Rs. 30,200/- during an operative period of one year	(क) लाइसेंस के एक वर्ष चालू रहने के लिए न्यूनतम फीस अग्रिम देय होगी और यह फीस अगले नवीकरण (नवीकरणों) के लिये जमा रहेगी। (a) Minimum marking fee for one operative year payable in advance which will be carried over to next renewal(s). (ख) लाइसेंस के पहले नवीकरण के समय चालू अवधि के पहले नौ महीनों के लिये चिह्नन लगे उत्पादन पर इकाई दर से बनने वाली चिह्नन लगाने की वास्तविक फीस या न्यूनतम फीस, जो भी अधिक हो, दिल्ली/नई दिल्ली में देय होगी। बाद के नवीकरणों के लिए 12 महीने की अवधि के लिए चिह्नन लगाने की वास्तविक फीस, जिसमें पिछली चालू अवधि के अन्तिम तीन महीने और चालू अवधि के पहले नौ महीने शामिल होंगे या न्यूनतम फीस, जो भी अधिक हो, देय होगी। (b) Actual marking fee for the first nine months of the operative period calculated on the unit rate on the production marked or the minimum fee, whichever is higher, shall be payable at Delhi/New Delhi at the time of the first renewal of the licence. For subsequent renewals, the actual marking fee for 12 months/period consisting of last three months of previous operative period and first nine months of the current operative period or the minimum fee, whichever is higher, shall be payable.

Page 2 of 2

ISO CERTIFICATE

Certificate of Registration

This certificate has been awarded to

Pioneer Electrocables Pvt. Ltd.

Ward No.# 6, Nimuwa, Tankisinuwari, Morang District, Nepal

In recognition of the organization's Quality Management System which complies with

ISO 9001:2015

The scope of activities covered by this certificate is defined below

Please refer to the Appendix

Certificate Number:	Date of Issue: (Original)	Date of Issue:
73810/A/000/UK/En	04 March 2016	08 March 2016
Issue No:	Expiry Date:	
3	03 March 2022	

Issued by: On behalf of the Scheme Manager

TEST REPORT

CENTRAL POWER RESEARCH INSTITUTE

CPRI

TEST REPORT

Test Report Number	**CPRIRTLCL20177173**	**Dated: 09.02.2018**
Name and Address of the Customer	**M/s. Pioneer Electro cables P. Ltd.** P.O. Box No.116, Bhrikuti Chowk, Biratnagar-6 Nepal	
	CRF dated 19.01.2018	
Name and Address of the Manufacturer	**M/s. Pioneer Electro cables P. Ltd.** P.O. Box No.116, Bhrikuti Chowk, Biratnagar-6 , Nepal	
Particulars of Sample tested	**600/1000V, 4C x 95 sq.mm AB Cable**	
	Conductor	Aluminium
	Size	95 sq.mm
	Insulation	XLPE
	No. of cores	Four
	The cable was embossed as "Pioneer Cable 1100 V LV ABC 2018 Jan XLPE 4C X 95 Sq. mm NEA C. No. ICB/DCSD – 072/073 – 10"	
Condition of sample on receipt	Nil	
Type	Aerial Bunched 4 core aluminium (ABC cable)	
Designation	Nil	
Serial Number	Nil	
Number of Samples tested	One only	
Date(s) of test(s)	23.01.2018 to 09.02.2018	
CPRI Sample Code Number	**CPRIRTLCL20175180**	
Particulars of tests conducted	Conductor Resistance Test, Tensile Strength and Elongation test (before and after aging), Shrinkage test, Hot Set Test, Insulation Resistance Test, Breaking load of conductor, High Voltage Test.	
Test in accordance with Standard/ Specification	General procedure followed as per IEC-60502- Part 1 : 2004 with amendment 1 : 2009 and as per customer request	
Sampling Plan	Not applicable	
Customer's requirement	Nil	
Deviation, if any	Breaking load test on conductor as per IS 14255	
Name of the witnessing persons Customer's representative Other than Customer's representative	 Nil Nil	
Test subcontracted with address of the laboratory	None	
Document constituting this report (in words)		
Number of sheets	Five	
Number of oscillograms	Nil	
Number of graphs	Nil	
Number of photos	One	
Number of test circuit diagrams	Nil	
Number of drawings	Nil	

(Dr. Neha Adhikari)
Test Engineer

(S.Bhattacharya)
Head of Division
Approved By

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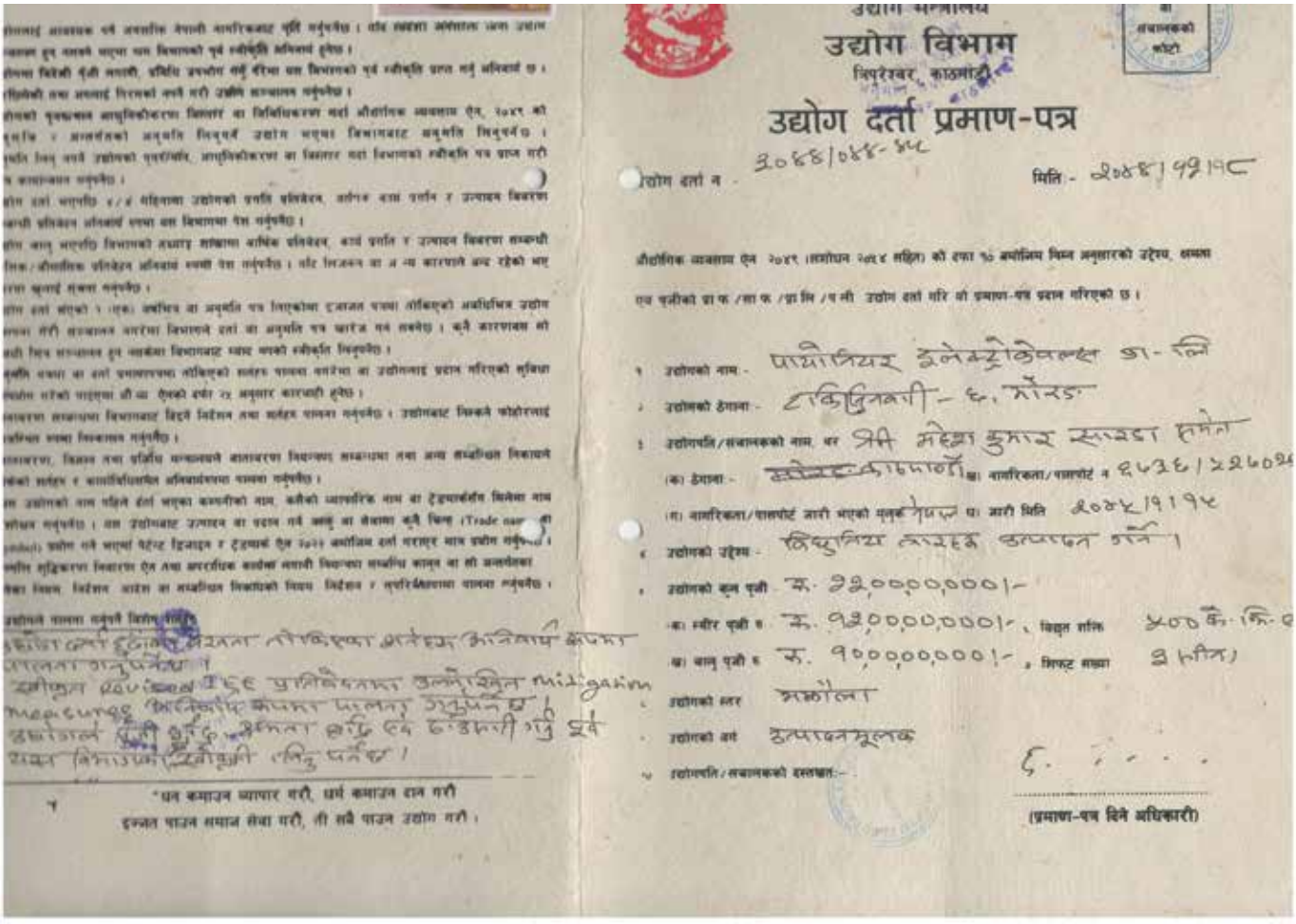


उद्योग विभाग
जिपरेश्वर, काठमाडौं

उद्योग दर्ता प्रमाण-पत्र

उद्योग दर्ता नं. २०६८/०६६-६८ मिति - २०६८/१२/१८

औद्योगिक व्यवसाय ऐन २०४९ (संशोधन २०५४ सहित) को दफा ५ बमोजिम निम्न अनुसारको उद्देश्य, क्षमता एवं पूंजीको आ.क /सा.क /आ.नि /प.नी उद्योग दर्ता गरि यो प्रमाण-पत्र प्रदान गरिएको छ ।

१. उद्योगको नाम - पायोनियर इलेक्ट्रोकेबल्स प्रा.लि
२. उद्योगको ठेगाना - टंकिसिनवारी - ६, मोरङ
३. उद्योगपति/संचालकको नाम, थर श्री महेश कुमार सरडा लगेत
(क) ठेगाना - [illegible] (ख) नागरिकता/पासपोर्ट नं ४६३६/२२६०२
(ग) नागरिकता/पासपोर्ट जारी भएको मुलुक/क्षेत्र (घ) जारी मिति २०२५/१/१५
४. उद्योगको उद्देश्य - विद्युतिय सरसहरु उत्पादन गर्ने ।
५. उद्योगको कूल पूंजी रु. २२,००,००,०००/-
(क) स्थीर पूंजी रु. १३,००,००,०००/- , विद्युत शक्ति ४०० के.भि.ए
(ख) चालू पूंजी रु. ९,००,००,०००/- , शिफ्ट संख्या ३ (तीन)
६. उद्योगको स्तर मझौला
७. उद्योगको वर्ग उत्पादनमूलक
८. उद्योगपति/संचालकको दस्तखत:-

(प्रमाण-पत्र दिने अधिकारी)

"घर कमाउन व्यापार गरौ, धर्म कमाउन दान गरौ
इज्जत पाउन समाज सेवा गरौ, तौ सबै पाउन उद्योग गरौ ।

श्री ५ को सरकार
अर्थ मन्त्रालय
आन्तरिक राजश्व विभाग

स्थायी लेखा नम्बर (PAN) दर्ता प्रमाण पत्र

आन्तरिक राजश्व कार्यालय: विराटनगर
पान: ३०००३६०३५
मिति: ०३ ०८ २०५४
मू.अ.क. दर्ता मिति: ०५ ०८ २०५४
दिन महिना साल

करदाताको नाम: पायोनियर इलेक्ट्रोकेबल्स प्रा.लि.
करदाताको प्रकार: प्राइभेट लिमिटेड
ठेगाना: घर नं. , वडा नं. ६, नेपुवा
टंकिसिनुवारी गाविस
मोरंग
व्यवसाय कारोबारहरु: ताम्रवा केबुल, तार, तारजन्य वस्तुहरुको कारोबार गर्ने,

करदाताको दस्तखत

कर अधिकृतको दस्तखत

यो प्रमाण पत्र देखिने गरी आफ्नो स्थान / मुख्य कार्यालयमा राख्नु पर्ने छ ।

Government of Nepal
Ministry of Finance
Department of Customs

EXIM Code Certificate

EXIM Code : 3000360350100NP

Business Reg. No. and Place : 3044 Kathmandu

PAN : 300036035

Person with above mentioned details has been granted this EXIM Code Certificate on B.S.2074 year 02 month 20 day.

Trade Name	:	PIONEER ELECTROCABLES (P) LTD
Address	:	Morang, Tankisinwari-6, Nemuwa, 226
Phone No.	:	021530935
Website	:	
Proprietor's Name	:	Nanda Kishor Sharda
Address	:	Main Road, Biratnagar 13, Morang, Nepal
Phone No.	:	9852021879
Email	:	pwp@sardaonline.com

Note : This certificate can be electronically received and renewed. For renewal of the certificate one should apply through this process before the beginning of every fiscal year.

Verified By : ARJUNNEUPANE

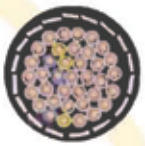
Date : Sun Jun 04 15:46:35 NPT 2017

TYPICAL EXAMPLES OF DESIGN & CONSTRUCTION AS PER IS 1554 (1)

Power Cable Steel Strip, Armoured	As per IS	Control Cable Steel Strip, Armoured
Conductor: EC Grade Aluminium	8130	**Conductor:** High Conductivity, Electrolytic Grade Copper
Insulation: PVC type A or C	5831	**Insulation:** PVC type A or C
Inner Sheath: PVC type ST 1 OR ST2	5831	**Inner Sheath:** PVC type ST 1 OR ST2
Armour: Galvanised Steel strip	3975	**Armour:** Galvanised Steel Strip
Outer Sheath: PVC type ST1 or ST 2	5831	**Outer Sheath:** PVC type ST1 or ST 2

Classification of PVC Compound

Type	Application	Max Conductor Temperature
A	Insulation	70°C
C	Insulation	85°C
ST1	Sheath	70°C
ST2	Sheath	90°C



Core Identification

For Power Cables and Control Cables up to 5 cores, the cores are identified by different colours as per IS 1554:

Single core : Red, Black, Yellow or Blue
2 core : Red and Black
3 core : Red, Yellow and Black
3½ core : Red, Yellow, Blue and reduced neutral core in Black
4 core : Red Yellow, Blue and Black
5 core : Red Yellow, Blue, Black and Grey

Where the numbers of cores exceed 5, two adjacent cores are blue for reference and yellow for direction in each layer. The remaining cores in each layer are grey.

On specific request we can also provide core numbering for Control cables.

Product Code

As per IS 1554 / Part - I / 1988, the product is coded by alphabets :

Aluminium Conductor (No abbreviations are used for copper.)	A
PVC insulation	Y
Steel round wire armour	W
Steel strip armour	F
Steel double round wire armour	WW
Steel double strip armour	FF
PVC outer sheath	Y
Al wire armour	AW

This product code is stenciled on the surface of the drum flange.

Note : Conductor constructions classified as :

r_e : single strand
r_m : multi-stranded circular
s_m : sector shaped

Note : The entire range of Power and Control cables can be supplied with Flame Retardant Low Smoke (FRLS) sheathing. These cables are also manufactured as per International Standards viz. BS 6346, IEC 502 etc.

TABLE 1: PROPERTIES OF COPPER AND ALUMINIUM

Properties	Copper Annealed	Copper Hard drawn	Aluminium Hard drawn	Aluminium ¾ Hard
Conductivity (%)	100	97	61	61
Density at 20°C (gm/cc)	8.89	8.89	2.703	2.703
Coeff. Of Linear Exp. (/°C x 10^{-6})	17	17	23	23
Melting point (°C)	1083	1083	659	659
Specific heat (Cal/gm)	0.092	0.092	0.23	0.23
Thermal conductivity at 0-100°C (cal/cm/sec/°C)	0.92	0.92	0.54	0.54
Resistivity at 20°C (micro ohm-cm)	1.724	1.771	2.845	2.845
Temp. coeff. of Resistance at 20°C (/°C)	0.00393	0.00381	0.004	0.004
Ultimate Tensile Stress (Kg/mm^2) (Approx)	25.3	42.2	14.8-19	11.5-15.5
Young's modulus, (Kg/mm^2)	12600	-	7000	7000

TABLE 2: COMPARISON BETWEEN COPPER AND ALUMIMIUM CONDUCTOR

Particulars	Copper	Aluminium
For Equal Resistance		
1. Area ratio for round conductor	1	1.61
2. Diameter ratio for round conductor	1	1.27
3. Weight Ratio	1	0.48
For Equal Current & Temp. Rise		
1. Area ratio for round conductor	1	1.39
2. Diameter ratio for round conductor	1	1.18
3. Weight Ratio	1	0.42
For Equal Diameter		
1. Resistance ratio	1	1.61
2. Current carrying capacity	1	0.78

TABLE 3: RESISTANCE OF CONDUCTORS AS PER IS 8130

Area	Maximum resistance of Conductor at 20°C		
mm^2	Copper Conductor		Aluminium (ohm/km)
	Plain Wires (ohm/km)	Tinned Wires (ohm/km)	
1.0	18.1	18.2	-
1.5	12.1	12.2	18.1
2.5	7.41	7.56	12.1
4.0	4.61	4.70	7.41
6.0	3.08	3.11	4.61
10.0	1.83	1.84	3.08
16.0	1.15	1.16	1.91
25.0	0727	0.734	1.20
35.0	0.524	0.529	0.868
50.0	0.387	0.391	0.641
70.0	0.268	0.270	0.443
95.0	0.193	0.195	0.320
120.0	0.153	0.154	0.253
150.0	0.124	0.126	0.206
185.0	0.0991	0.100	0.164
240.0	0.0754	0.0762	0.125
300.0	0.0601	0.0607	0.100
400.0	0.0470	0.0475	0.0778
500.0	0.0366	0.0369	0.0605
630.0	0.0283	0.0286	0.0469
800.0	0.0221	0.0224	0.0367
1000.0	0.0176	0.0177	0.0291

TABLE 4: RESISTANCE CORRECTION FACTOR AT DIFFERENT TEMPERATURES

Temperature °C	Temperature Correction Factor	
	Copper	Aluminium
5	0.9411	0.9396
10	0.9607	0.9597
15	0.9804	0.9798
20	1.0000	1.0000
25	1.0197	1.0202
30	1.0392	1.0403
35	1.0589	1.0604
40	1.0786	1.0806
45	1.0982	1.1008
50	1.1179	1.1209
55	1.1375	1.1410
60	1.1572	1.1612
65	1.1768	1.1814
70	1.1965	1.2015
75	1.2161	1.2216
80	1.2358	1.2418
85	1.2555	1.2620

ENGINEERING INFORMATION & USEFUL 3-PHASE FORMULAE

1. Phase current in 3-Phase Star Connection = Line Current

2. Phase current in 3-Phase Delta Connection = Line Current/1.732

3. $KW = KVA \times Power\,factor = \dfrac{H.P. \times 746}{1000 \times efficiency} = \dfrac{Line\ amps \times Line\ volts \times 1.732 \times p.f.}{1000}$

4. $KVA = \dfrac{KW}{p.f} = \dfrac{H.P \times 746}{1000 \times efficiency \times p.f} = \dfrac{Line\,amps \times Line\,volts \times 1.732}{1000}$

5. Current $Line\ in$ 3 phase AC $= \dfrac{KW \times 1000}{Line volts \times 1.732 p.f} = \dfrac{KVA \times 1000}{Line volts \times 1.732} = \dfrac{H.P \times 746}{Line volts \times 1.732 \times efficiency \times p.f}$

6. Current in $Single\ Phase\ AC = \dfrac{H.P \times 746}{Line\,volts \times p.f \times efficiency}$.

7. $H.P = \dfrac{KW \times 1000 \times efficiency}{746} = \dfrac{VA \times 1000 \times efficiency \times p.f}{746} = \dfrac{Line amps \times Line volts \times 1.732 \times efficiency \times p.f}{746}$

8. Voltage Drop:
   a. Voltage Drop in 3-Phase AC Circuit, per km = 1.732 × Line Amps × Resistance of 1 Core at t°C
   b. Voltage Drop in DC or 1-Phase AC Circuit, per km = 2 × Line Amps × Resistance of 1 Core at t°C

Note: (1) Formula 8(a) & 8(b) strictly apply when the load power factor is unity. Where the load power factor is not unity the formulae may be used with reasonable accuracy for conductor size upto 70 mm^2.
(2) Safely permissible Voltage Drop should be in single phase = 2.5% of 230V and in 3-phase = 2.5% of 400V.

9. *Short Circuit Rating*, $I_{sh} = \dfrac{KA}{\sqrt{t}}$

Where,

I_{sh} = Short circuit current in kilo amps during the time t.

K = Constant for G.P. PVC insulated cables for Aluminium K=0.076 & for Copper K= 0.115, For H.R. PVC insulated cables for Aluminium K=0.069 & for Copper K=0.104, For XLPE insulated cable for Aluminium K=0.094 & Copper K=0.1448.

A = Cross sectional area of conductor in sq.mm.

t = Duration of short circuit in second.

TABLE 5: STANDARD WIRE GUAGE

SWG	mm	SWG	mm	SWG	mm	SWG	mm	SWG	mm
11	2.9464	19	1.0160	27	0.4160	35	0.2134	43	0.0914
12	2.6416	20	0.9144	28	0.3759	36	0.1930	44	0.0813
13	2.3368	21	0.8128	29	0.3454	37	0.1727	45	0.0711
14	2.0320	22	0.7112	30	0.3150	38	0.1524	46	0.0610
15	1.8288	23	0.6096	31	0.2946	39	0.1321	47	0.0508
16	1.6256	24	0.5588	32	0.2743	40	0.1219	48	0.0406
17	1.4224	25	0.5080	33	0.2540	41	0.1118	49	0.0306
18	1.2192	26	0.4572	34	0.2337	42	0.1016	50	0.0254

GENERAL NOTES ON CURRENT CARRYING CAPACITY OF CABLES

Following main factors affects the current carrying capacity of a cable:

1. Conductor Material

Basically the conductor material decides the current carrying capacity. Therefore, the current carrying capacities of copper cables are different from the current carrying capacities of Aluminium cables with the same conditions.

2. Conductor Cross Sectional Area

Conductor Cross Sectional Area decides the capacity of the rate of electrons flow through the conductor. Therefore, the current carrying capacity increases when the cross section area of the conductor increases.

3. Insulation Material

Insulation Material decides the conductor operating temperature limits and therefore the current carrying capacity varies according to the insulation material.

Conductor Material	Insulation Material	Conductor Operating Temperature Limit/°C
Copper / Aluminium	70°C General purpose PVC	70°C
	80°C Heat resistant PVC	85°C
	90°C Thermosetting (XLPE)	90°C

4. Number of Cores in the Cable

Each current carrying core contributes heat to warm up the cable and therefore, the current carrying capacity reduces as the number of phase conductors in the same multicore cable is increased.

5. Method of Installation of Cables for one Circuit

The method of installation of cables in one circuit decides the current carrying capacity of the conductor since, the heat emission depends on the method of installation. e.g. Current carrying capacity of a cable inside a non-metallic conduit or trunking is less than when the same cable is in the open air.

6. Ambient Temperature (Surrounding Temperature of air or soil)

If the surrounding temperature is higher than the standard Ambient Temperature (40°C for air & 30°C for ground/soil), then the current carrying capacity should be corrected by the relevant correction factors. Because, when the surrounding temperature increases the rate of heat emission of the cable becomes slow.

7. Grouping of Cables sets in different circuits

When numbers of cables in different circuits are grouped together, each set of cables contributes heat for total temperature rise. Therefore, the current carrying capacity should be corrected using the grouping correction factors accordingly.

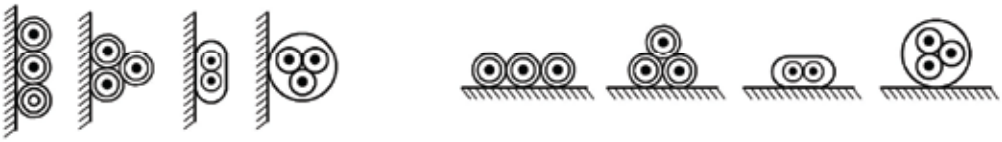
8. Bonding of Armour of Single Core Armoured Cables

If single core armoured cables are bonded at both ends, then it results in circulating current. In such case, the cable must be derated to 70% as circulating current generates heat.

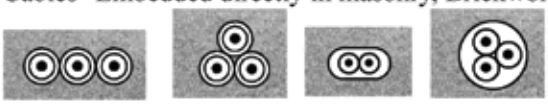
Installation Methods of single-core and multi-core cables In Domestic and Industrial and Industria wiring

Method 1

(I) Sheathed Cables "Clipped Direct" to or "Laying on a non-metallic surface"

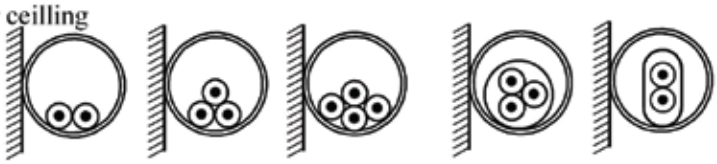


(II) Sheathe Cables "Embedded directly in masonry, Brickwork, concrete, plaster"

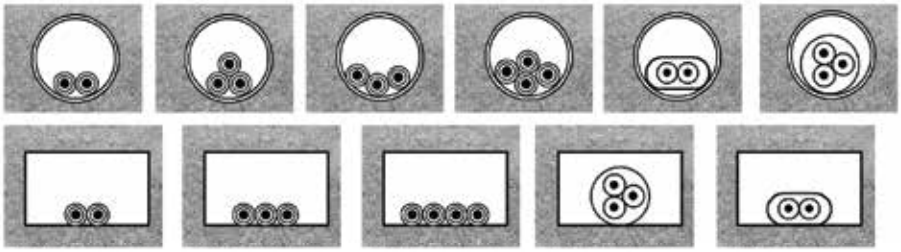


Method 2

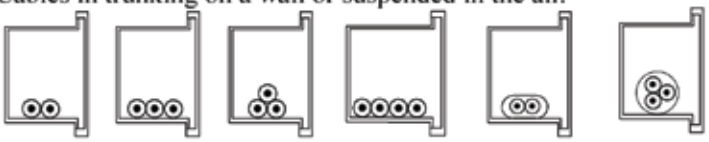
(I). Single core non-sheathed Cables in metallic or non-metallic conduit on a wall or ceilling



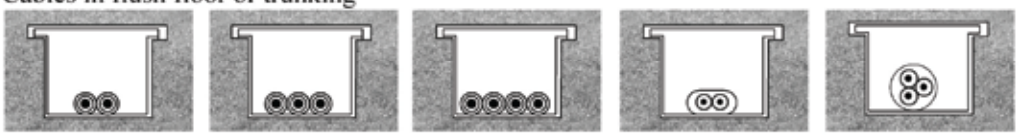
(II). Sheathed Cables in ducts or voids formed by the building structure (Duct perimeter is grater than 5x cable overall diameter or sum of cable diameters)



(III). Cables in trunking on a wall or suspended in the air.



(IV). Cables in flush floor or trunking

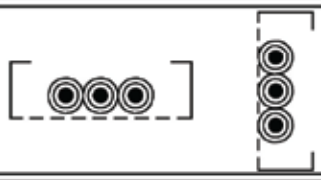


Method 3

Enclosed in Conduit in thermally insulating wall

Method 4

Sheathed Cables on a perforated cable tray
(Tray with holes occupy at least 30%of surface area)



Method 5

Cables Suspended free air

Note: All 3 Phase Single Core Cables must be laid in RYB Pattern in Trefoil or Flat Formation.

Installation Thumb Rule

Basic factors to be considered for cable installation:

- Proper selection of the cable as per given design.
- Identification of the starting point of the cable before unrolling form the drum.
- Arrangement of the axial movement of the drum before unrolling.
- Complete arrangement of cable laying path (cable trench/cable duct/cable tray etc.) including all accessories and materials.
- Actual measurement of cable length to be installed, with the addition of 10% as spare and termination length.
- Calculation of bending radius of the cables if bending is encountered in the cable route. Wherever possible bending radius 12 times the overall diameter of the cable should be maintained but in any case it should not be less than 8 times. At very low temperatures, PVC Compound becomes stiff and brittle so cable should not be bent to very small radius or struck hard.
- Marking and cutting of cable length using appropriate cutting tools.
- Meggering of the cut length of cable to ensure the continuity and insulation value.
- Laying/pulling the cable without any mechanical shears and injuries.
- Arrangement of the cut length for all metallic components including metal armour at both ends of the cable.
- Proper and skillful splicing of the cable at both ends.
- Corresponding size cable sockets are mandatory for all cables above 6 mm^2.
- Cable socket must be fixed with suitable crimping tools.
- All incoming and outgoing terminating points of cable in panels must be weather or vermin proof.
- All cable inside panels & DBs must be tightened in proper way.
- Cable route marking arrangement is mandatory in all underground installations.
- After installation, a D.C. voltage test is to be carried. Each core should be tested at 4 kV against others and the armour, the latters connected to earth. The voltage should be increased gradually to full value and maintained continuously for 15 minutes. No Breakdown of insulation should occur during test.

CONTINUOUS CURRENT RATINGS

The current ratings given are based on the following conditions of laying: -

Maximum Conductor Temperature	: 70°C for G.P.PVC Insulated cables. 85°C for H.R.PVC Insulated cables. 90°C for XLPE Insulated cables.
Ground temperature	: 30°C
Ambient air temperature	: 40°C
Thermal resistivity of soil for PVC/ XLPE	: 150(cm°C)/w
Depth of laying (for cable laid direct in ground and ducts)	: 750mm
Type of Installation	
Twin, Three and Multi-core cable	: Laid single
Single core cable	: 3 cables in close trefoil formation

Rating Factors

In actual practice the condition of installation may be different than those given above. Therefore to determine the continuous current rating under the actual operating conditions, the tabulated current rating should be multiplied by the appropriate rating factors given in table 5 - 13.

Note: For cables with heat resistant (Type C) insulation the continuous current ratings are increased as follows:

1) In ducts and ground by 14 percent.
2) In air by 20 percent.

TABLE 6: RATING FACTORS FOR GROUPING OF SINGLE CORE CABLES LAID DIRECT IN GROUND IN HORIZONTAL FORMATION.
(3 Cables in Trefoil Touching in RYB Formation)

Number of Circuit in group	SPACING				
	Touching	15cm	30cm	45cm	60cm
2	0.76	0.81	0.86	0.88	0.89
3	0.66	0.71	0.77	0.81	0.83
4	0.61	0.64	0.72	0.77	0.80
5	0.56	0.60	0.68	0.73	0.76
6	0.53	0.56	0.66	0.72	0.76
7	0.51	0.55	0.64	0.69	0.74
8	0.48	0.53	0.63	0.68	0.74
9	0.46	0.52	0.62	0.67	0.73
10	0.45	0.51	0.60	0.66	0.73
11	0.44	0.50	0.59	0.66	0.72
12	0.43	0.49	0.59	0.65	0.72

TABLE 7 : RATING FACTORS FOR VARIATION IN GROUND TEMPERATURE FOR CABLE LAID DIRECT IN GROUND AND DUCT.

Ground temperature (°C)	15	20	25	30	35	40	45	50
Rating factor	1.17	1.12	1.06	1.00	0.94	0.87	0.79	0.71

TABLE 8: RATING FACTORS FOR MULTI CORE CABLE LAID ON RACKS IN AIR.
(With Cable Touching)

No. of racks	Number of cable per rack				
	1	2	3	6	9
1	1.00	0.84	0.80	0.75	0.73
2	1.00	0.80	0.76	0.71	0.69
3	1.00	0.78	0.74	0.70	0.68
6	1.00	0.76	0.72	0.68	0.66

TABLE 9: RATING FACTORS FOR VARIATION IN AMBIENT AIR TEMPERATURE

Air temperature (°C)	20	25	30	35	40	45	50
Rating factor for PVC	1.32	1.25	1.16	1.09	1.00	0.90	0.81
Rating factor for XLPE	-	-	-	-	1.00	0.95	0.90

TABLE 10:RATING FACTORS FOR VARIATION IN DEPTH OF LAYING IN GROUND.
(Single Core)

Depth of laying (mm) / Size	Upto 750	900	1050	1200	1500	1800 & above
Up to 25mm^2	1.00	0.99	0.98	0.97	0.96	0.95
Above 25mm^2 & up to 300mm^2	1.00	0.98	0.97	0.96	0.94	0.93
Above 300mm^2	1.00	0.97	0.96	0.95	0.92	0.91

TABLE 11: RATING FACTORS FOR VARIATION IN DEPTH OF LAYING.
(Twin and Multicore Cables Laid In Single Way Ducts)

Depth of laying (mm)	Upto 750	900	1050	1200	1500	1800	2700	3600	4500	5400 or more
Rating factor	1.00	0.99	0.98	0.97	0.96	0.95	0.92	0.91	0.90	0.89

TABLE 12: RATING FACTORS FOR GROUPING OF TWIN AND MULTICORE CABLES LAID DIRECT IN GROUND.

Nos. of cables in group	Spacing when laid in horizontal formation					Spacing when laid in trefoil				
	Touching	15cm	30cm	45cm	60cm	Touching	15cm	30cm	45cm	60cm
2	0.79	0.82	0.87	0.90	0.91	0.81	0.84	0.88	0.90	0.91
3	0.69	0.75	0.79	0.83	0.86	0.69	0.73	0.79	0.82	0.85
4	0.62	0.69	0.75	0.79	0.82	0.60	0.67	0.73	0.76	0.78
5	0.58	0.65	0.72	0.76	0.80	0.55	0.61	0.67	0.71	0.73
6	0.54	0.61	0.69	0.75	0.78	0.51	0.57	0.63	0.67	0.69
7	0.52	0.59	0.68	0.73	0.77	0.48	0.54	0.59	0.63	0.64
8	0.50	0.57	0.66	0.72	0.75	0.45	0.51	0.57	0.59	0.61
9	0.47	0.55	0.64	0.71	0.74	0.44	0.48	0.54	0.56	0.58
10	0.46	0.54	0.63	0.70	0.74	0.42	0.46	0.51	0.54	0.56
11	0.45	0.53	0.63	0.69	0.73	0.41	0.45	0.50	0.53	0.55
12	0.44	0.52	0.62	0.68	0.73	0.40	0.45	0.49	0.52	0.54

TABLE 13: RATING FACTORS FOR VARIATION IN THERMAL RESISTIVITY OF SOIL.
(Twin and multicore cables)

Nominal area of Conductor (mm^2)	Thermal resistivity of soil in (cm°C)/w (Cable laid direct in ground)				Thermal resistivity of soil in (cm°C)/w (Cable laid in single way duct)			
	100	120	150	200	100	120	150	200
1.5	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
2.5	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
4	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
6	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
10	1.10	1.06	1.00	0.92	1.05	1.03	1.00	0.95
16	1.12	1.06	1.00	0.91	1.06	1.03	1.00	0.95
25	1.14	1.08	1.00	0.91	1.07	1.04	1.00	0.95
35	1.15	1.08	1.00	0.91	1.08	1.04	1.00	0.94
50	1.15	1.08	1.00	0.91	1.08	1.04	1.00	0.94
70	1.15	1.08	1.00	0.90	1.08	1.04	1.00	0.94
95	1.15	1.08	1.00	0.90	1.08	1.04	1.00	0.94
120	1.17	1.09	1.00	0.90	1.09	1.05	1.00	0.94
150	1.17	1.09	1.00	0.90	1.09	1.05	1.00	0.93
185	1.18	1.09	1.00	0.89	1.10	1.05	1.00	0.93
240	1.18	1.09	1.00	0.89	1.10	1.05	1.00	0.92
300	1.18	1.09	1.00	0.89	1.10	1.05	1.00	0.92
400	1.19	1.10	1.00	0.89	1.11	1.06	1.00	0.92
500	1.19	1.10	1.00	0.89	1.11	1.06	1.00	0.92
630	1.19	1.10	1.00	0.89	1.11	1.06	1.00	0.92

TABLE 14: RATING FACTORS FOR GROUPING OF TWIN AND MULTICORE CABLES LAID IN DUCTS OR PIPES.

Number of ducts in group	Spacing when laid in horizontal formation				Spacing when laid in trefoil		
	Touching	30cm	45cm	60cm	Touching	30cm	45cm
2	0.88	0.90	0.92	0.93	-	-	-
3	0.81	0.84	0.87	0.89	-	-	-
4	0.77	0.80	0.84	0.87	0.76	0.79	0.81
5	0.73	0.78	0.82	0.85	-	-	-
6	0.71	0.76	0.81	0.84	0.67	0.71	0.74
7	0.69	0.74	0.80	0.83	-	-	-
8	0.67	0.72	0.79	0.82	-	-	-
9	0.65	0.71	0.78	0.81	0.58	0.61	0.63
10	0.65	0.71	0.78	0.81	-	-	-
11	0.64	0.70	0.77	0.81	-	-	-
12	0.63	0.70	0.77	0.81	0.54	0.57	0.60

TABLE 15: SINGLE CORE PVC INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR (AS- IS:1554(1))

Area	Cond. Min. No. of wires		Thickness Insulation		Inner Thick-ness	Dimension of Amour Wire/Strip	Outer Thickness		Approx. O.D.		Approx. Net Wt.Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at 70°C		Approx capacitance/phase		Current Rating						Short Circuit rating for 1 sec.	
			Arm	Un-Arm			Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm						Arm	Un- Arm	In Ground		In Duct		In air			
mm²	No.		mm	mm	mm	mm	mm		mm		Kg/km				Ohm/km		Ohm/km		µf/km		Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	cu	Al/Cu	Al/Cu	Al/Cu	Al	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
4	1.0	1.0	1.3	1.0	NA	1.4	1.24	1.8	10.7	8.3	139	165	82	103	7.41	4.61	8.9	5.52	-	0.57	31	39	30	38	27	35	0.304	0.46
6	1.0	1.0	1.3	1.0	NA	1.4	1.24	1.8	11.6	9.2	168	205	102	139	4.61	3.08	5.54	3.69	-	0.67	39	49	37	48	35	44	0.456	0.69
10	1.0	7.0	1.3	1.0	NA	1.4	1.24	1.8	12.5	10.1	198	260	124	186	3.08	1.83	3.70	2.19	0.67	0.83	51	65	51	64	47	60	0.760	1.15
16	7.0	7.0	1.3	1.0	NA	1.4	1.24	1.8	13.2	10.8	225	322	149	246	1.91	1.15	2.30	1.38	0.8	0.97	66	85	65	83	64	82	1.220	1.84
25	7.0	7.0	1.5	1.2	NA	1.4	1.24	1.8	14.8	12.4	292	443	200	351	1.20	0.727	1.44	0.87	0.83	1.0	86	110	84	110	84	110	1.900	2.88
35	7.0	7.0	1.5	1.2	NA	1.4	1.24	1.8	15.8	13.4	340	556	239	455	0.868	0.524	1.04	0.627	0.95	1.15	100	130	100	125	105	130	2.66	4.03
50	7.0	7.0	1.7	1.4	NA	1.4	1.24	1.8	17.6	15.2	421	706	305	590	0.641	0.387	0.77	0.463	0.95	1.26	120	155	115	150	130	165	3.8	5.75
70	19	19	1.7	1.4	NA	1.4	1.4	1.8	19.6	16.8	529	959	385	815	0.443	0.268	0.532	0.321	1.12	1.32	140	190	135	175	155	205	5.32	8.05
95	19	19	1.9	1.6	NA	4 x 1.0	1.4	1.8	20.9	18.9	637	1217	497	1077	0.32	0.193	0.385	0.231	1.17	1.36	175	220	155	200	190	245	7.22	10.9
120	19	19	1.9	1.6	NA	4 x 1.0	1.4	2.0	22.4	20.8	738	1467	606	1335	0.253	0.153	0.305	0.184	1.28	1.49	195	250	170	220	220	280	9.12	13.8
150	19	19	2.1	1.8	NA	4 x 1.0	1.4	2.0	24.3	22.7	877	1799	724	1646	0.206	0.124	0.249	0.149	1.32	1.52	220	280	190	245	250	320	11.4	17.3
185	37	37	2.3	2.0	NA	4 x 1.0	1.4	2.0	26.4	24.8	1038	2166	876	2004	0.164	0.0991	0.199	0.120	1.3	1.47	240	305	210	260	290	370	14.1	21.3
240	37	37	2.5	2.2	NA	4 x 1.0	1.4	2.0	29.1	27.4	1292	2713	1093	2514	0.125	0.0754	0.152	0.0912	1.37	1.54	270	345	225	285	335	425	18.2	27.6
300	37	37	2.7	2.4	NA	4 x 1.0	1.56	2.0	32.1	30.0	1560	3381	1322	3143	0.100	0.0601	0.123	0.0739	1.4	1.60	295	375	245	310	380	475	22.8	34.5
400	61	61	3	2.6	NA	4 x 1.0	1.56	2.2	36	34.2	1935	4388	1686	4139	0.0778	0.0470	0.0975	0.0592	1.5	1.70	325	400	275	335	435	550	30.4	46.0
500	61	61	3.4	3.0	NA	4 x 1.0	1.56	2.2	39.6	37.8	2390	5444	2109	5163	0.0665	0.0366	0.0767	0.0468	1.46	1.63	345	425	295	355	480	590	38.0	57.7
630	61	61	3.9	3.4	NA	4 x 1.0	1.72	2.4	44.7	42.7	3052	6857	2696	6501	0.0469	0.0233	0.0614	0.0379	1.45	1.64	390	470	320	375	550	660	47.9	72.5
800	91	91	3.9	3.4	NA	4 x 1.0	1.88	2.4	49.4	47.1	3699	8352	3287	7940	0.0367	0.0221	0.0510	0.0314	1.65	1.87	440	530	345	405	600	725	60.8	92.0
1000	91	91	3.9	3.4	NA	4 x 1.0	2.04	2.6	53.7	51.5	4466	10521	4010	10065	0.0291	0.0176	0.0420	0.0271	1.76	2.05	490	590	370	435	720	870	76.0	115.0

TABLE 16: 2 CORE PVC INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR (AS-IS:1554(1))

Area	Cond.Min. No. of wires		Insulation Thick-ness	Inner Thick-ness	Dimension of Armour Wire Strip	Outer Thickness		Approx O.D.		Approx. Net Wt.Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at operating temp. 70°C		Approx capacitance/phase		Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-arm	Arm	Un-arm	Arm		Un-arm						Arm	Un-arm	In ground		In Duct		In air			
mm²	No.		mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/ km		Amps		Amps		Amps		KA(rms)	
Al/Cu	Al	Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
2.5	1.0	1.0	0.9	0.3	1.4	1.24	1.8	14.8	13.0	436	477	199	230	12.1	7.41	14.5	8.87	0.13	0.13	25	32	21	27	21	27	0.19	0.288
4	1.0	1.0	1.0	0.3	1.4	1.24	1.8	16.1	14.3	502	554	242	294	7.41	4.61	8.9	5.52	0.14	0.14	32	41	27	35	27	35	0.304	0.46
6	1.0	1.0	1.0	0.3	1.4	1.24	1.8	18.1	16.3	633	707	316	390	4.61	3.08	5.54	3.69	0.16	0.16	40	50	34	44	35	45	0.456	0.69
10	1.0	7.0	1.0	0.3	1.4	1.24	1.8	19.5	17.7	734	858	384	508	3.08	1.83	3.70	2.19	0.18	0.18	55	70	45	58	47	60	0.760	1.15
16	7.0	7.0	1.0	0.3	4 x 0.8	1.4	1.8	17.5	16.4	533	729	325	521	1.91	1.15	2.30	1.38	0.19	0.19	70	90	58	75	59	78	1.22	1.84
25	7.0	7.0	1.2	0.3	4 x 0.8	1.4	2.0	20.1	19.4	687	991	453	757	1.20	0.727	1.44	0.87	0.22	0.22	90	115	76	97	78	105	1.90	2.88
35	7.0	7.0	1.2	0.3	4 x 0.8	1.4	2.0	21.5	20.8	796	1226	538	972	0.868	0.524	1.04	0.627	0.24	0.24	110	140	92	120	99	125	2.66	4.03
50	7.0	7.0	1.4	0.3	4 x 0.8	1.4	2.0	24.1	23.4	976	1549	676	1249	0.641	0.387	0.77	0.463	0.24	0.24	135	165	115	145	125	155	3.80	5.75
70	19	19	1.4	0.3	4 x 0.8	1.56	2.0	26.7	25.6	1207	2072	842	1707	0.443	0.268	0.532	0.321	0.26	0.26	160	205	140	180	150	195	5.32	8.05
95	19	19	1.6	0.4	4 x 0.8	1.56	2.2	30.1	29.4	1501	2668	1122	2289	0.32	0.193	0.384	0.231	0.26	0.26	190	240	170	215	185	230	7.22	10.09
120	19	19	1.6	0.4	4 x 0.8	1.56	2.2	32.1	31.4	1743	3209	1309	2775	0.253	0.153	0.304	0.184	0.28	0.28	210	275	190	235	210	265	9.12	13.8
150	19	19	1.8	0.4	4 x 0.8	1.72	2.4	34.7	34	2053	3906	1577	3430	0.206	0.124	0.248	0.149	0.28	0.28	240	310	210	270	240	305	11.4	17.3
185	37	37	2.0	0.5	4 x 0.8	1.88	2.4	38	37	2461	4744	1914	4197	0.164	0.0991	0.198	0.120	0.28	0.28	275	350	240	300	275	350	14.1	21.3
240	37	37	2.2	0.5	4 x 0.8	2.04	2.6	43	42	3034	5891	2425	5282	0.125	0.0754	0.152	0.0912	0.28	0.28	320	405	275	345	325	410	18.2	27.6
300	37	37	2.4	0.6	4 x 0.8	2.20	2.8	46.5	45.6	3636	7297	2964	6625	0.100	0.0601	0.122	0.0739	0.29	0.29	355	430	305	385	365	465	22.8	34.5
400	61	61	2.6	0.7	4 x 0.8	2.36	3.2	52.3	51.8	4495	9461	3782	8748	0.0778	0.0470	0.096	0.0592	0.29	0.29	385	490	345	425	420	530	30.4	46.0
500	61	61	3.0	0.7	4 x 0.8	2.84	3.4	58.7	57.6	5419	9558	4732	8871	0.0605	0.0366	0.076	0.0468	0.29	0.29	415	520	365	460	455	575	38.0	57.5
630	61	61	3.4	0.7	4 x 0.8	2.84	3.8	64.8	64.4	6875	12247	6012	11384	0.0469	0.0283	0.061	0.0379	0.29	0.29	460	565	405	510	520	655	47.9	72.5

TABLE 17: 3 CORE PVC INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR. (AS-IS:1554(1))

Area	Cond. Min. No. of wires		Insulation Thickness	Inner Thick-ness	Dimension of Armour Wire Strip	Outers Thickness		Approx. O.D.		Approx. Net Wt.Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at operating temp.70°C		Approx capacitance/phase		Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm						Arm	Un-arm	In ground		In Duct		In air			
mm²	No.		mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/ km		Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
2.5	1.0	1.0	0.9	0.3	1.4	1.24	1.8	15.5	13.7	469	521	220	272	12.1	7.41	14.5	8.87	0.355	0.355	21	27	18	24	18	24	0.19	0.288
4	1.0	1.0	1.0	0.3	1.4	1.24	1.8	16.8	15.0	555	663	272	380	7.41	4.61	8.9	5.52	0.395	0.395	28	36	23	30	23	30	0.304	0.46
6	1.0	1.0	1.0	0.3	1.4	1.24	1.8	19	17.2	694	806	354	466	4.61	3.08	5.54	3.69	0.435	0.435	35	45	30	38	30	38	0.456	0.69
10	1.0	7.0	1.0	0.3	1.4	1.24	1.8	21.0	18.9	827	1014	435	622	3.08	1.83	3.70	2.19	0.495	0.495	46	60	39	50	40	52	0.760	1.15
16	7.0	7.0	1.0	0.3	4 x 0.8	1.4	1.8	20.2	19.1	679	972	432	725	1.91	1.15	2.30	1.38	0.56	0.56	60	77	50	64	51	66	1.22	1.84
25	7.0	7.0	1.2	0.3	4 x 0.8	1.4	2.0	22.5	21.5	868	1324	597	1053	1.20	0.727	1.44	0.87	0.62	0.62	76	99	63	81	70	90	1.90	2.88
35	7.0	7.0	1.2	0.3	4 x 0.8	1.4	2.0	24.2	23.5	1009	1661	719	1371	0.868	0.524	1.04	0.627	0.66	0.66	92	120	77	99	86	110	2.66	4.03
50	7.0	7.0	1.4	0.3	4 x 0.8	1.56	2.0	27.6	26.5	1292	2151	914	1773	0.641	0.387	0.77	0.463	0.7	0.7	110	145	95	125	105	135	3.80	5.75
70	19	19	1.4	0.4	4 x 0.8	1.56	2.2	30.9	30.0	1593	2889	1200	2496	0.443	0.268	0.532	0.321	0.73	0.73	135	175	115	150	130	165	5.32	8.05
95	19	19	1.6	0.4	4 x 0.8	1.56	2.2	34.1	33.2	1974	3723	1542	3291	0.32	0.193	0.385	0.231	0.76	0.76	165	210	140	175	155	200	7.22	10.09
120	19	19	1.6	0.4	4 x 0.8	1.72	2.2	37.3	36.2	2352	2750	1821	4019	0.253	0.153	0.305	0.184	0.78	0.78	185	240	155	195	180	230	9.12	13.8
150	19	19	1.8	0.5	4 x 0.8	1.88	2.4	41.0	40.0	2791	5571	2229	5009	0.206	0.124	0.249	0.149	0.795	0.795	210	270	175	225	205	265	11.4	17.3
185	37	37	2.0	0.5	4 x 0.8	1.88	2.6	44.9	44.3	3306	6732	2740	6166	0.164	0.0991	0.198	0.120	0.81	0.81	235	300	200	255	240	305	14.1	21.3
240	37	37	2.2	0.6	4 x 0.8	2.20	2.8	50.7	49.8	4193	8477	3496	7780	0.125	0.0754	0.152	0.0912	0.82	0.82	275	345	235	295	280	355	18.2	27.6
300	37	37	2.4	0.6	4 x 0.8	2.36	3.0	56.0	55.1	5025	10516	4268	9759	0.100	0.0601	0.123	0.0739	0.825	0.825	305	385	260	335	315	400	22.8	34.5
400	61	61	2.6	0.7	4 x 0.8	2.52	3.4	62.7	62.0	6255	13652	5429	12826	0.0778	0.0470	0.0975	0.0592	0.83	0.83	335	425	290	360	375	455	30.4	46.0
500	61	61	3.0	0.7	4 x 0.8	2.84	3.6	70.1	69.3	7774	17048	6827	16101	0.0605	0.0366	0.0767	0.0468	1.1	1.1	355	440	315	390	405	500	38.0	57.5

TABLE 18: 3.5 CORE PVC INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR.(AS-IS:1554 (1))

Area	Cond.Min. No. of wires		Insulation Thickness	Inner Thick-ness	Dimension of Armour Wire Strip	Outer Thickness		Approx O.D.		Approx. Net Wt.Of Cable				Max. D.C. resistance at 20°C		Approx A.C. resistance at operating temp 70°C		Approx capacitance/Phase		Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm						Arm	Un-arm	In ground		In Duct		In air			
mm²	No.		mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/ km		Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	7	7.0	1.2/1.0	0.3	4 x 0.8	1.4	2.0	24	23.4	983	1536	692	1245	1.2	0.727	1.44	0.873	0.86	0.86	76	99	63	81	70	90	1.90	2.88
35	7	7.0	1.2/1.0	0.3	4 x 0.8	1.4	2.0	26.1	25.4	1150	1900	818	1568	0.868	0.525	1.04	0.629	0.98	0.98	92	120	77	99	86	110	2.66	4.03
50	7	7.0	1.4/1.2	0.3	4 x 0.8	1.56	2.0	29.4	28.3	1451	2463	1051	2063	0.641	0.387	0.77	0.465	1	1	110	145	95	125	105	135	3.80	5.75
70	19	19	1.4/1.2	0.4	4 x 0.8	1.56	2.2	33	32	1784	3298	1372	2886	0.443	0.268	0.532	0.322	1.16	1.16	135	175	115	150	130	165	5.32	8.05
95	19	19	1.6/1.4	0.4	4 x 0.8	1.56	2.2	37	36	2273	4313	1782	3817	0.320	0.193	0.385	0.233	1.18	1.18	163	210	140	175	155	200	7.22	10.09
120	19	19	1.6/1.4	0.5	4 x 0.8	1.72	2.4	40.5	40	2720	5350	2187	4817	0.253	0.153	0.305	0.185	1.31	1.31	185	240	155	195	180	230	9.12	13.8
150	19	19	1.8/1.4	0.5	4 x 0.8	1.88	2.4	44.3	43.3	3175	6387	2549	5761	0.206	0.124	0.249	0.15	1.28	1.28	210	270	175	225	205	265	11.4	17.3
185	37	37	2.0/1.6	0.5	4 x 0.8	2.04	2.6	48.9	47.9	3855	7869	3166	7180	0.164	0.0991	0.198	0.121	1.3	1.3	235	300	200	255	240	305	14.1	21.3
240	37	37	2.2/1.6	0.6	4 x 0.8	2.20	3.0	55	55	4845	9862	4069	9086	0.125	0.0754	0.152	0.094	1.34	1.34	275	345	235	295	280	355	18.2	27.6
300	37	37	2.4/1.8	0.6	4 x 0.8	2.36	3.2	60.6	60.1	5743	12160	4952	11369	0.100	0.0601	0.123	0.075	1.37	1.37	305	385	260	335	315	400	22.8	34.5
400	61	61	2.6/2.0	0.7	4 x 0.8	2.68	3.4	69.1	68.2	7042	15635	6242	14834	0.0778	0.0470	0.0975	0.061	1.43	1.43	335	425	290	360	375	455	30.4	46.0
500	61	61	3.0/2.2	0.7	4 x 0.8	2.84	3.8	76.9	76.4	8920	19633	7968	18681	0.0605	0.0366	0.0767	0.049	1.41	1.41	355	440	315	390	405	500	38.0	57.50

TABLE 19: 4 CORE PVC INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR. (AS-IS:1554(1))

Area	Cond. Min. No. of wires		Insulation Thickness	Inner Thick-ness	Dimension of Armour Wire Strip	Outer Thickness		Approx. O.D.		Approx. Net Wt. Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at operating temp. 70°C		Approx capacitance/phase		Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm						Arm	Un-arm	In ground		In Duct		In air			
mm²	No.		mm	mm	mm	mm	mm	Mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/ km		Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
2.5	1	1	0.9	0.3	1.4	1.24	1.8	16.5	14.7	552	614	253	335	12.1	7.41	14.5	8.87	0.355	0.355	21	27	18	24	18	24	0.19	0.288
4	1	1	1.0	0.3	1.4	1.24	1.8	17.6	15.7	638	735	320	417	7.41	4.61	8.9	5.52	0.395	0.395	28	36	23	30	23	30	0.3	0.46
6	1	1	1.0	0.3	1.4	1.24	1.8	18	17.1	792	941	419	568	4.61	3.08	5.54	3.69	0.435	0.435	35	45	30	38	30	39	0.46	0.69
10	1	7	1.0	0.3	4 x 0.8	1.4	1.8	21.7	20.5	824	1058	517	767	3.08	1.83	3.70	2.19	0.495	0.495	46	60	39	50	40	52	0.76	1.15
16	7	7	1.0	0.3	4 x 0.8	1.4	2.0	22.1	21.4	822	1214	555	947	1.91	1.15	2.30	1.38	0.56	0.56	60	77	50	64	51	66	1.22	1.84
25	7	7	1.2	0.3	4 x 0.8	1.4	2.0	25.3	25	1060	1668	748	1356	1.20	0.727	1.44	0.87	0.62	0.62	76	99	63	81	70	90	1.90	2.88
35	7	7	1.2	0.3	4 x 0.8	1.4	2.0	27.6	26.9	1261	2129	907	1775	0.868	0.524	1.04	0.627	0.66	0.66	92	120	77	99	86	110	2.66	4.03
50	7	7	1.4	0.4	4 x 0.8	1.56	2.2	33.0	31	1593	2740	1215	2362	0.641	0.387	0.77	0.463	0.7	0.7	110	145	95	125	105	135	3.80	5.75
70	19	19	1.4	0.4	4 x 0.8	1.56	2.2	35.1	34.4	1910	3711	1530	3259	0.443	0.268	0.532	0.321	1.16	1.16	135	175	115	150	130	165	5.32	8.05
95	19	19	1.6	0.4	4 x 0.8	1.72	2.4	39.4	38.7	2527	4859	2012	4344	0.32	0.193	0.384	0.231	1.18	1.18	165	210	140	175	155	200	7.22	10.9
120	19	19	1.6	0.5	4 x 0.8	1.88	2.4	43.1	42.1	3004	5935	2400	5331	0.253	0.153	0.304	0.184	1.31	1.31	185	240	155	195	180	230	9.12	13.8
150	19	19	1.8	0.5	4 x 0.8	1.88	2.6	47	46.4	3538	7245	2913	6620	0.206	0.124	0.248	0.149	1.28	1.28	210	270	175	225	205	265	11.4	17.3
185	37	37	2.0	0.6	4 x 0.8	2.04	2.8	52.1	51.5	4289	8856	3609	8175	0.164	0.0991	0.198	0.120	1.3	1.3	235	300	200	255	240	305	14.1	21.3
240	37	37	2.2	0.6	4 x 0.8	2.36	3.0	59	58.1	5394	11107	4573	10286	0.125	0.0754	0.152	0.0912	1.34	1.34	275	345	235	295	280	355	18.2	27.6
300	37	37	2.4	0.7	4 x 0.8	2.52	3.4	65.8	65.7	6553	13927	5755	13129	0.100	0.0601	0.122	0.0739	1.37	1.37	305	385	260	335	315	400	22.8	34.5
400	61	61	2.6	0.7	4 x 0.8	2.68	3.6	73.3	73.1	8080	18011	7205	17136	0.0778	0.0470	0.096	0.0592	1.43	1.43	335	425	290	360	375	455	30.4	46.0
500	61	61	3.0	0.7	4 x 0.8	3.0	4.0	83.1	83	10117	22483	9150	21516	0.0605	0.0366	0.076	0.0468	1.41	1.41	370	440	320	390	540	500	37.9	57.5

Why you should use Pioneer Power & Control Cables?

1. Specialization of cables for more than 20 years.
2. One of the largest plants for manufacture of cables in Nepal.
3. One of the largest exporters of cables from Nepal.
4. Product performance guaranteed for five years.
5. Better compacted and conductive conductors resulting in low power losses and this saves electricity.
6. Better insulation properties due to high dielectric value from imported PVC compound which are also imprevious to moisture/oil.
7. Pioneer cables have high mechanical strength and are suitable to lay on slopes and vertical surface.
8. Pioneer cables are suitable for easy jointing and termination.
9. Zero failure rate which results in high saving at customers end.
10. Widest available range and competitive pricing.
11. 100% on time delivery.

TABLE 20: PVC INSULATED ARMOURED & UNARMOURED CONTROL CABLE WITH COPPER CONDUCTOR. (AS-IS:1554(1))

No.of Cores x Area	Cond. Min. No. of wires	Insulation Thickness	Thickness of inner sheath	Dimension of Armour Wire Strip	Outer Thickness		Approx O.D.		Approx. Net Wt.Of Cable		Max. D.C. resistance at 20°C	Approx. A.C. resistance at operating temp. 70°C	Approx capacitance per phase	Current Rating			Short Circuit rating for 1 sec.
					Arm	Un-Arm	Arm	Un-arm	Arm	Un-arm				in ground	In Duct	In air	
No. x mm²	No.	mm	mm	mm	mm	mm	mm	mm	Kg/km	Kg/km	Ohm/km	Ohm/km	µf/ km	Amps	Amps	Amps	KA (rms)
2x1.5	1.0	0.8	0.3	1.4	1.24	1.8	13.6	11.7	411	183	12.1	14.5	0.1	23	20	20	0.173
3x1.5	1.0	0.8	0.3	1.4	1.24	1.8	14.1	12.3	450	212	12.1	14.5	0.1	21	17	17	0.173
4x1.5	1.0	0.8	0.3	1.4	1.24	1.8	14.9	13.1	508	247	12.1	14.5	0.1	21	17	17	0.173
5x1.5	1.0	0.8	0.3	1.4	1.24	1.8	16.1	14.3	542	278	12.1	14.5	0.1	21	17	17	0.173
6x1.5	1.0	0.8	0.3	1.4	1.24	1.8	17.1	15.3	607	322	12.1	14.5	0.1	15	13	13	0.173
7x1.5	1.0	0.8	0.3	1.4	1.24	1.8	17.1	15.3	621	332	12.1	14.5	0.1	14	13	13	0.173
10x1.5	1.0	0.8	0.3	1.4	1.40	1.8	20.8	18.6	838	456	12.1	14.5	0.1	13	11	11	0.173
12x1.5	1.0	0.8	0.3	4 x 0.8	1.24	1.8	19.8	19.2	723	501	12.1	14.5	0.1	12	10	10	0.173
14x1.5	1.0	0.8	0.3	4 x 0.8	1.40	1.8	21.0	20.0	822	558	12.1	14.5	0.1	11	10	10	0.173
16x1.5	1.0	0.8	0.3	4 x 0.8	1.40	1.8	22.0	21.0	912	626	12.1	14.5	0.1	11	9	9	0.173
19x1.5	1.0	0.8	0.3	4 x 0.8	1.40	2.0	23.2	22.4	987	724	12.1	14.5	0.1	10	9	9	0.173
24x1.5	1.0	0.8	0.3	4 x 0.8	1.40	2.0	26.4	25.8	1225	900	12.1	14.5	0.1	9	8	8	0.173
27x1.5	1.0	0.8	0.3	4 x 0.8	1.40	2.0	26.9	26.2	1291	968	12.1	14.5	0.1	9	8	8	0.173
30x1.5	1.0	0.8	0.3	4 x 0.8	1.40	2.0	27.8	27.2	1396	1051	12.1	14.5	0.1	9	7	7	0.173
37x1.5	1.0	0.8	0.3	4 x 0.8	1.40	2.0	29.7	29.1	1608	1243	12.1	14.5	0.1	8	7	7	0.173
44x1.5	1.0	0.8	0.3	4 x 0.8	1.56	2.0	33.4	32.3	1925	1468	12.1	14.5	0.1	7	6	6	0.173
52x1.5	1.0	0.8	0.4	4 x 0.8	1.56	2.0	35.0	34.0	2173	1698	12.1	14.5	0.1	7	6	6	0.173
61x1.5	1.0	0.8	0.4	4 x 0.8	1.56	2.2	36.9	36.3	2445	1959	12.1	14.5	0.1	6	6	6	0.173
2x2.5	1.0	0.9	0.3	1.4	1.24	1.8	15.0	12.8	477	230	7.41	8.87	0.1	32	27	27	0.288
3x2.5	1.0	0.9	0.3	1.4	1.24	1.8	15.5	13.7	521	282	7.41	8.87	0.1	27	24	24	0.288
4x2.5	1.0	0.9	0.3	1.4	1.24	1.8	16.5	14.7	614	335	7.41	8.87	0.1	27	24	24	0.288
5x2.5	1.0	0.9	0.3	1.4	1.24	1.8	18.0	16.0	674	366	7.41	8.87	0.1	27	24	24	0.288
6x2.5	1.0	0.9	0.3	1.4	1.24	1.8	19.0	17.0	757	426	7.41	8.87	0.1	21	18	18	0.288
7x2.5	1.0	0.9	0.3	1.4	1.24	1.8	19.0	17.0	776	451	7.41	8.87	0.1	20	17	17	0.288
10x2.5	1.0	0.9	0.3	4 x 0.8	1.40	1.8	23.8	21.1	908	622	7.41	8.87	0.1	18	15	15	0.288
12x2.5	1.0	0.9	0.3	4 x 0.8	1.40	2	22.8	20.3	972	708	7.41	8.87	0.1	17	14	14	0.288
14x2.5	1.0	0.9	0.3	4 x 0.8	1.40	2	23.9	23.2	1079	795	7.41	8.87	0.1	16	13	13	0.288
16x2.5	1.0	0.9	0.3	4 x 0.8	1.40	2	25.0	24.4	1197	892	7.41	8.87	0.1	15	12	12	0.288
19x2.5	1.0	0.9	0.3	4 x 0.8	1.40	2	26.3	25.7	1336	1010	7.41	8.87	0.1	14	12	12	0.288
24x2.5	1.0	0.9	0.3	4 x 0.8	1.40	2	30.3	29.7	1651	1264	7.41	8.87	0.1	13	11	11	0.288
27x2.5	1.0	0.9	0.3	4 x 0.8	1.40	2	30.9	30.3	1750	1366	7.41	8.87	0.1	12	10	10	0.288
30x2.5	1.0	0.9	0.3	4 x 0.8	1.56	2	32.3	31.3	1923	1487	7.41	8.87	0.1	12	10	10	0.288
37x2.5	1.0	0.9	0.4	4 x 0.8	1.56	2.2	34.9	34.2	2269	1826	7.41	8.87	0.1	11	9	9	0.288
44x2.5	1.0	0.9	0.4	4 x 0.8	1.56	2.2	38.9	38.2	2662	2140	7.41	8.87	0.1	10	9	9	0.288
52x2.5	1.0	0.9	0.4	4 x 0.8	1.56	2.2	40.3	39.9	2985	2474	7.41	8.87	0.1	10	8	8	0.288
61x2.5	1.0	0.9	0.4	4 x 0.8	1.56	2.2	42.5	41.9	3385	2821	7.41	8.87	0.1	9	8	8	0.288

Note: We also provide control cable with stranded conductor for 1.5mm^2 7/0.53mm and 2.5mm^2 7/0.67mm size of wire is used.

Introduction

XLPE is an abbreviation of Cross Linked Polyethylene. This has been recognized worldwide as an excellent dielectric for wires and cables. Polyethylene, which is a thermoplastic material, is converted into a thermosetting material by a process similar to vulcanization of rubber. By cross-linking, the liner chain structure of Polyethylene is changed into 3D network structure. By this change, Polyethylene, which has outstanding dielectric properties, is made resistant to extremes of temperature. The high resistance to heat deformation and ageing in hot air provides an important advantage in cable ratings and is of special significance at locations where the ambient temperature is high. These, along with better resistance to environment stress cracking and low dielectric constant make XLPE cables suitable for all voltage application.

Advantage of XLPE cables over PVC cable are as under:

1. Excellent Electrical & Physical Properties

High resistance to thermal deformation and the ageing property of XLPE cables provides higher continuous and short circuit current capacity ensuring higher degree or reliability over wide range of temperature variations as compared to PVC cables.

Permissible maximum conductor temperature

	XLPE Cable	PVC Cable
Continuous	90°C	70°C
Short Circuit	250°C	160°C

2. Higher current carrying capacity

XLPE cable can be used, even one size lower PVC cable for the similar application. Due to higher operating temperature 90°C in case of XLPE than PVC 70°C, current carrying capacity of XLPE cables of the same size is approximately 30% higher than that of PVC.

3. Lower Permitivity

Permitivity of XLPE insulation is 2.3, which is less than that of PVC. Therefore, XLPE cables has lesser charging current then PVC cables.

4. Lower Dielectric Loss

Dielectric loss of XLPE cable is much less and almost constant at all operating temperatures, compared to other types of cables.

5. System Protection

Due to lower Permitivity of XLPE cables, charging current are considerably lower than that of PVC cables, which permits coarse setting of Network Protection System.

6. Emergency Overloading

In case of emergency overloading of cables, XLPE can be overloaded for higher current and for longer duration.

Emergency Overloading

Max.Permissible Temp	Duration of Overloading	
	XLPE	PVC
XLPE 130°C **PVC 120°C**	Total duration for 100 hours per annum. Operations at the emergency overload temperature of 130°C shall not exceed 100 hours in any 12 consecutive months, not more than 500 hours during the life time of cables.	Total duration for 4 hours in life time.

7. Heat Resistant

With cross-linked molecules structure, XLPE cables are excellently ozone resistant and provide outstanding stability as well as resistant to heat.

8. Mechanical Resistance

Due to thermosetting process XLPE cable has high mechanical properties as compared to PVC cables.

9. Environmental & Surrounding Protection

Excellent mechanical features of XLPE improves the protection against external effects. Resistant to acids & alkalies is excellent.

10. Rating Features

XLPE cables carry more current than PVC cables at higher temperatures. Comparative rating factors are given below:

TABLE-21: RATING FACTOR VARIATION IN AMBIENT AIR TEMPERATURE

Insulating Materials	Continuous Operating Temperature	Temperature			
		40°C	45°C	50°C	55°C
PVC	70°C	1.00	0.90	0.80	0.69
HR-PVC	85°C	1.00	0.94	0.87	0.82
XLPE	90°C	1.00	0.95	0.90	0.84

11. Light Weight

Due to lower specific gravity, XLPE (0.90) cables are comparatively lighter in weight than PVC (1.35-1.55) cables, therefore there is easy in handling of cables.

12. Cost Saving

Due to lesser diameter and less weight of XLPE cables laying cost and system supporting accessories cost i.e. cables trays/support is comparatively lower than PVC cables.

TABLE-22: COMAPARISON OF A.C CURRENT RATING BETWEEN XLPE & PVC ALUMINIUM CONDUCTOR CABLES

Normal Cross Section area of Conductor (mm^2)	3 Single Core Cables				Multi Core Cables			
	In ground (Amps)		In air (Amps)		In ground (Amps)		In air (Amps)	
	XLPE	PVC	XLPE	PVC	XLPE	PVC	XLPE	PVC
25	99	86	115	84	95	76	99	70
35	117	100	140	105	116	92	117	86
50	138	120	170	130	140	110	140	105
70	168	140	210	155	170	135	176	130
95	204	175	255	190	200	165	221	155
120	230	195	300	220	225	185	258	180
150	265	220	342	250	255	210	294	205
185	295	240	385	290	285	235	339	240
240	340	270	450	335	325	275	402	280
300	390	295	519	380	370	305	461	315
400	450	325	605	435	435	335	542	375

TABLE-23: SINGLE CORE XLPE INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR. (AS-IS: 7098(1))

Area	Cond. Min. No. of wires		Insulation Thickness		Inner Thick-ness	Dimension of Arm Wire Strip	Outer Thickness		Approx O.D.		Approx. Net Wt.Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at 90°C		Approx capacitance/phase		Current Rating						Short Circuit rating for 1 sec.	
			Arm	Un-Arm			Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm						Arm	Un- Arm	In Ground		In Duct		In air			
mm ²	No.		mm	mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/km		Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	Cu	Al/Cu	Al/Cu	Al/Cu	Al	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu		Al	Cu	Al	Cu	Al	Cu	Al	Cu
1.5	-	1	1	0.7	NA	-	-	1.8	9.5	7.0	-	117	-	65	-	12.1	-	15.5	-	0.19	-	27	-	24	-	22	-	0.21
2.5	-	1	1	0.7	NA	-	-	1.8	10.0	7.5	-	134	-	78	-	7.41	-	9.5	-	0.24	-	36	-	32	-	29	-	0.36
4	1	1	1	0.7	NA	1.4	1.24	1.8	10.5	8.0	131	156	73	97	7.41	4.61	9.5	5.9	-	0.29	36	46	32	41	31	40	0.38	0.57
6	1	1	1	0.7	NA	1.4	1.24	1.8	11.0	8.5	152	189	87	124	4.61	3.08	5.9	3.94	-	0.34	44	57	40	51	39	51	0.57	0.86
10	1	7	1	0.7	NA	1.4	1.24	1.8	12.0	9.5	176	233	105	167	3.08	1.83	3.94	2.34	0.32	0.43	59	76	53	68	53	71	0.94	1.4
16	7	7	1	0.7	NA	1.4	1.24	1.8	12.5	10.5	209	300	134	225	1.91	1.15	2.44	1.47	0.38	0.51	76	97	68	87	73	95	1.5	2.3
25	7	7	1.2	0.9	NA	1.4	1.24	1.8	14.5	11.0	287	438	169	320	1.2000	0.7270	1.530	0.931	0.380	0.487	96	124	86	112	98	126	2.4	3.6
35	7	7	1.2	0.9	NA	1.4	1.24	1.8	15.5	11.5	331	547	203	419	0.8680	0.5240	1.110	0.671	0.423	0.545	114	148	103	133	121	152	3.3	5.0
50	7	7	1.3	1	NA	1.4	1.24	1.8	17.0	13.5	406	691	258	543	0.6410	0.3870	0.818	0.496	0.464	0.586	135	174	122	157	150	189	4.7	7.1
70	19	19	1.4	1.1	NA	1.4	1.24	1.8	19.5	15.5	523	953	341	771	0.4430	0.2680	0.565	0.344	0.518	0.643	166	213	149	192	187	240	6.6	10.0
95	19	19	1.4	1.1	NA	4 x 1.0	1.4	1.8	20.0	17.0	655	1147	429	1009	0.3200	0.1930	0.409	0.248	0.587	0.731	198	256	178	230	230	297	9.0	13.6
120	19	19	1.5	1.2	NA	4 x 1.0	1.4	1.8	22.0	19.0	767	1398	538	1267	0.2530	0.1530	0.323	0.197	0.616	0.755	225	289	203	260	268	346	11.3	17.1
150	19	19	1.7	1.4	NA	4 x 1.0	1.4	2.0	24.0	21.0	907	1706	652	1574	0.2060	0.1240	0.264	0.160	0.607	0.724	253	326	228	293	309	390	14.2	21.4
185	37	37	1.9	1.6	NA	4 x 1.0	1.4	2.0	26.0	23.0	1067	2071	786	1914	0.1640	0.0991	0.210	0.129	0.604	0.705	286	366	257	329	360	460	17.5	26.4
240	37	37	2	1.7	NA	4 x 1.0	1.4	2.0	29.0	26.0	1322	2575	989	2410	0.1250	0.0754	0.161	0.099	0.657	0.764	332	425	299	383	433	552	22.6	34.3
300	37	37	2.1	1.8	NA	4 x 1.0	1.56	2.0	31.0	28.0	1552	3213	1161	2982	0.1000	0.0601	0.129	0.080	0.689	0.794	376	479	338	431	501	640	28.3	42.9
400	61	61	2.4	2	NA	4 x 1.0	1.56	2.2	35.0	33.0	2015	4187	1517	3970	0.0778	0.0470	0.102	0.064	0.696	0.823	431	544	388	490	596	753	37.7	57.1
500	61	61	2.6	2.2	NA	4 x 1.0	1.56	2.2	38.0	36.0	2465	5187	1888	4942	0.0605	0.0366	0.0782	0.052	0.716	0.835	490	611	441	550	693	865	47.2	71.4
630	61	61	2.8	2.4	NA	4 x 1.0	1.72	2.2	43.0	40.0	2969	6481	2325	6130	0.0469	0.0283	0.0606	0.0368	0.745	0.859	557	684	501	616	814	1001	59.4	90.0
800	61	61	3.1	2.6	NA	4 x 1.0	1.72	2.4	48.0	44.0	3651	7967	2931	7584	0.0367	0.0221	0.047	0.0287	0.756	0.890	632	762	569	686	968	1176	75.5	114.3
1000	61	61	3.3	2.8	NA	4 x 1.0	1.88	2.6	53.0	49.0	4648	10112	3650	9705	0.0291	0.0176	0.038	0.0229	0.792	0.922	701	828	631	745	1102	1299	94.3	142.9

TABLE-24: 2 CORE XLPE INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR.(AS-IS:7098(1))

Area	Cond. Min. No. of Wires		Insulation Thickness	Inner Thickness	Dimension of Arm Wire Strip	Outer Thickness		Approx O.D.		Approx. Net Wt. Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at 90°C		Approx capacitance/ phase	Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm							In Ground		In Duct		In Air			
mm²	No.		mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/ km	Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
1.5	-	1	0.7	0.3	1.4	1.24	1.8	13.0	11.0	-	383	-	152	-	12.1	-	15.5	0.051	-	33	-	30	-	29	-	0.21
2.5	-	1	0.7	0.3	1.4	1.24	1.8	14.0	12.0	-	431	-	187	-	7.41	-	9.5	0.058	-	43	-	39	-	39	-	0.36
4	1	1	0.7	0.3	1.4	1.24	1.8	15.0	13.0	470	520	190	240	7.41	4.61	9.5	5.9	0.065	43	56	39	50	39	51	0.38	0.57
6	1	1	0.7	0.3	1.4	1.24	1.8	16.0	14.0	544	619	229	304	4.61	3.08	5.9	3.94	0.071	55	71	50	64	50	64	0.57	0.86
10	1	7	0.7	0.3	1.4	1.24	1.8	18.0	15.0	639	763	288	412	3.08	1.83	3.94	2.34	0.081	74	92	64	83	67	88	0.94	1.4
16	7	7	0.7	0.3	1.4	1.4	1.8	17.0	15.0	586	492	283	465	1.91	1.15	2.44	1.47	0.088	91	116	82	104	88	113	1.5	2.3
25	7	7	0.9	0.3	4x0.8	1.4	2.0	19.0	18.0	650	953	320	623	1.2000	0.7270	1.530	0.931	0.089	120	152	108	137	117	153	2.4	3.6
35	7	7	0.9	0.3	4x0.8	1.4	2.0	21.0	20.0	750	1184	390	824	0.8680	0.5240	1.110	0.671	0.096	143	180	129	162	145	186	3.3	5.0
50	7	7	1.0	0.3	4x0.8	1.4	2.0	24.0	22.0	890	1463	480	1053	0.6410	0.3870	0.818	0.496	0.098	167	218	150	196	176	226	4.7	7.1
70	19	19	1.1	0.3	4x0.8	1.4	2.0	27.0	26.0	1090	1954	630	1494	0.4430	0.2680	0.565	0.344	0.10	204	264	184	238	221	284	6.6	10.0
95	19	19	1.1	0.4	4x0.8	1.56	2.2	30.0	29.0	1360	2393	820	1853	0.3200	0.1930	0.409	0.248	0.11	245	314	221	283	271	348	9.0	13.0
120	19	19	1.2	0.4	4x0.8	1.56	2.2	33.0	32.0	1590	3055	990	2455	0.2530	0.1530	0.323	0.197	0.11	278	357	250	321	316	402	11.3	17.1
150	19	19	1.4	0.4	4x0.8	1.72	2.2	36.0	35.0	1900	3753	1190	3043	0.2060	0.1240	0.264	0.160	0.11	315	403	284	363	362	461	14.2	21.4
185	37	37	1.6	0.5	4x0.8	1.72	2.4	40.0	39.0	2280	4340	1490	3757	0.1640	0.0991	0.210	0.129	0.11	356	453	320	408	420	533	17.5	26.4
240	37	37	1.7	0.5	4x0.8	1.88	2.6	43.0	42.0	2530	5386	1900	4756	0.1250	0.0754	0.161	0.099	0.11	407	518	366	466	497	633	22.6	34.3
300	37	37	1.8	0.6	4x0.8	2.04	2.8	50.0	48.0	3330	6990	2330	5990	0.1000	0.0601	0.129	0.080	0.12	463	583	417	525	578	732	28.3	42.9
400	61	61	2.0	0.6	4x0.8	2.36	3.0	56.0	54.0	4100	9030	2940	7870	0.0778	0.0470	0.102	0.064	0.12	528	658	475	592	678	841	37.7	57.1
500	61	61	2.2	0.7	4x0.8	2.52	3.4	62.0	61.0	4950	11064	3680	3680	0.0605	0.0366	0.0782	0.052	0.12	592	730	533	657	786	967	47.2	71.4
630	61	61	2.4	0.7	4x0.8	2.68	3.6	69.0	68.0	6100	13748	4670	12318	0.0469	0.0283	0.6060	0.043	0.11	676	814	608	733	913	1103	59.4	90.0

TABLE-25: 3 CORE XLPE INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR. (AS- IS: 7098(1)

Area	Cond. in. No. of ires		Insulation Thickness	Inner Thickness	Dimension of Arm Wire Strip	Outer Thickness		Approx.O.D.		Approx. Net Wt. Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at 90°C		Approx capacitance/phase	Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm							In Ground		In Duct		In Air			
mm²	No.		mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/ km	Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
1.5	-	1	0.7	0.3	1.4	1.24	1.8	14	11	-	417	-	173	-	12.1	-	15.5	0.15	-	25	-	23	-	22	-	0.21
2.5	-	1	0.7	0.3	1.4	1.24	1.8	15	12	-	486	-	218	-	7.41	-	9.5	0.18	-	34	-	31	-	30	-	0.36
4	1	1	0.7	0.3	1.4	1.24	1.8	16	14	513	588	208	283	7.41	4.61	9.5	5.9	0.22	34	44	31	40	31	40	0.38	0.57
6	1	1	0.7	0.3	1.4	1.24	1.8	17	15	581	731	233	383	4.61	3.08	5.9	3.94	0.31	43	55	39	50	40	51	0.57	0.86
10	1	7	0.7	0.3	1.4	1.24	1.8	19	17	678	864	324	510	3.08	1.83	3.94	2.34	0.36	57	73	51	66	53	70	0.94	1.4
16	7	7	0.7	0.3	4x0.8	1.24	1.8	21	18	596	1109	360	653	1.91	1.15	2.44	1.47	0.41	73	97	66	87	70	90	1.5	2.3
25	7	7	0.9	0.3	4x0.8	1.40	2.0	22	20	790	1245	410	856	1.2000	0.7270	1.530	0.931	0.41	94	122	65	110	96	123	2.4	3.6
35	7	7	0.9	0.3	4x0.8	1.40	2.0	23	22	930	1581	510	1161	0.8680	0.5240	1.110	0.671	0.47	113	146	102	131	117	151	3.3	5.0
50	7	7	1.0	0.3	4x0.8	1.40	2.0	26	25	1090	1949	630	1489	0.6410	0.3870	0.818	0.496	0.50	133	172	120	155	142	183	4.7	7.1
70	19	19	1.1	0.4	4x0.8	1.56	2.2	30	29	1400	2696	870	2166	0.4430	0.2680	0.565	0.344	0.53	164	211	148	190	179	231	6.6	10.0
95	19	19	1.1	0.4	4x0.8	1.56	2.2	33	32	1720	3468	1120	2868	0.3200	0.1930	0.409	0.248	0.61	196	253	176	228	221	285	9.0	13.6
120	19	19	1.2	0.4	4x0.8	1.56	2.2	36	35	2030	4227	1360	3557	0.2530	0.1530	0.323	0.197	0.63	223	287	201	258	257	330	11.3	17.1
150	19	19	1.4	0.4	4x0.8	1.72	2.4	42	39	2430	5209	1680	4459	0.2060	0.1240	0.264	0.160	0.60	249	321	224	289	292	375	14.2	21.4
185	37	37	1.6	0.5	4x0.8	1.88	2.6	45	44	2930	6331	2090	5491	0.1640	0.0991	0.210	0.129	0.60	282	361	254	325	337	430	17.5	26.4
240	37	37	1.7	0.5	4x0.8	2.04	2.8	51	49	3650	7933	2690	6973	0.1250	0.0754	0.161	0.099	0.63	326	416	293	374	399	508	22.6	34.3
300	37	37	1.8	0.6	4x0.8	2.2	3.0	56	54	4360	9850	3290	8780	0.1000	0.0601	0.129	0.080	0.67	367	464	330	418	456	575	28.3	42.9
400	61	61	2.0	0.7	4x0.8	2.52	3.2	63	61	5440	12836	4160	11556	0.0778	0.0470	0.102	0.064	0.67	418	521	376	469	530	661	37.7	57.1
500	61	61	2.2	0.7	4x0.8	2.68	3.6	69	68	6590	15797	5200	14407	0.0605	0.0366	0.0782	0.052	0.69	470	582	423	524	612	753	47.2	71.4
630	61	61	2.4	0.7	4x0.8	2.84	3.8	77.5	76.0	8190	19662	6630	18102	0.0469	0.0283	0.0606	0.043	0.73	529	944	476	580	707	851	59.4	90.0

TABLE-26: 3.5 CORE XLPE INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR. (AS-IS: 7098(1))

Area	Cond. Min. No. of Wires		Insulation Thickness	Inner Thick-ness	Dimension of Arm Wire Strip	Outer Thickness		Approx. O.D.		Approx. Net Wt. Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at 90°C		Approx capacitance/phase	Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm							In Ground		In Duct		In Air			
mm²	No.		Mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/ km	Amps		Amps		Amps		KA (rms)	
Al/Cu	Al	Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al/Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu
25	7	7	0.9/0.7	0.3	4x0.8	1.4	2.0	23.0	22.0	890	1409	480	1033	1.2000	0.7270	1.538	0.931	0.41	94	122	85	110	96	123	2.4	3.6
35	7	7	0.9/0.7	0.3	4x0.8	1.4	2.0	25.0	24.0	1030	1765	580	1410	0.8680	0.5240	1.110	0.671	0.47	113	146	102	131	117	151	3.3	5.0
50	7	7	1.0/0.9	0.3	4x0.8	1.4	2.0	28.0	27.0	1460	2230	740	1848	0.6410	0.3870	0.818	0.496	0.50	133	172	120	155	142	183	4.7	7.1
70	19	19	1.1/0.9	0.3	4x0.8	1.56	2.2	33.0	32.0	1600	3112	1000	2629	0.4430	0.2680	0.565	0.344	0.53	164	211	148	190	179	231	6.6	10.0
95	19	19	1.1/1.0	0.4	4x0.8	1.56	2.2	36.0	35.0	1970	4018	1290	3416	0.3200	0.1930	0.409	0.248	0.61	196	253	176	228	221	285	9.0	13.6
120	19	19	1.2/1.1	0.4	4x0.8	1.72	2.2	40.0	39.0	2390	5035	1600	4338	0.2530	0.1530	0.323	0.197	0.63	223	287	201	258	257	330	11.3	17.1
150	19	19	1.4/1.1	0.4	4x0.8	1.72	2.4	45.0	43.0	2770	6022	1930	5362	0.2060	0.1240	0.264	0.160	0.6	249	321	224	289	292	375	14.2	21.4
185	37	37	1.6/1.1	0.5	4x0.8	1.88	2.6	50.0	48.0	3360	7425	2420	6664	0.1640	0.0991	0.210	0.129	0.6	282	361	254	325	337	430	17.5	26.4
240	37	37	1.7/1.2	0.5	4x0.8	2.04	2.8	56.0	55.0	4190	9268	3100	8448	0.1250	0.0754	0.161	0.099	0.63	326	416	293	374	399	508	22.6	34.3
300	37	37	1.8/1.4	0.6	4x0.8	2.2	3.0	61.0	60.0	4990	11237	3800	10347	0.1000	0.0601	0.129	0.080	0.67	367	464	330	418	456	575	28.3	42.9
400	61	61	2.0/1.6	0.7	4x0.8	2.52	3.4	69.0	68.0	6220	14929	4840	13938	0.0778	0.0470	0.102	0.064	0.67	418	521	376	469	530	661	37.7	57.1
500	61	61	2.2/1.7	0.7	4x0.8	2.68	3.6	76.0	75.0	7570	18518	6020	17415	0.0605	0.0366	0.0782	0.052	0.69	470	582	423	524	612	753	47.2	71.4
630	61	61	2.4/1.8	0.7	4x0.8	3.0	4.0	86.0	85.0	9450	23143	7710	21951	0.0469	0.0283	0.061	0.043	0.73	529	944	476	580	707	851	59.4	90.0

TABLE-27: 4 CORE XLPE INSULATED ARMOURED & UNARMOURED CABLE WITH ALUMINIUM/ COPPER CONDUCTOR. (AS-IS: 7098(1)

Area	Cond. Min. No. of wires		Insulation Thickness	Inner Thickness	Dimension of Arm Wire Strip	Outer Thickness		Approx. O.D.		Approx. Net Wt. Of Cable				Max. D.C. resistance at 20°C		Approx. A.C. resistance at 90°C		Approx capacitance/ phase	Current Rating						Short Circuit rating for 1 sec.	
						Arm	Un-Arm	Arm	Un-arm	Arm		Un-arm							In Ground		In Duct		In Air			
mm²	No.		mm	mm	mm	mm	mm	mm	mm	Kg/km		Kg/km		Ohm/km		Ohm/km		µf/km	Amps		Amps		Amps		KA(rms)	
Al/Cu	Al	cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al/Cu	Al	cu	Al	cu	Al	cu	Al	cu	Al/Cu	Al	cu	Al	cu	Al	cu	Al	Cu
1.5	-	1	0.7	0.3	1.4	1.24	1.8	15.0	12.0	–	458	-	203	-	12.1	-	15.5	0.15	-	25	-	23	-	22	-	0.21
2.5	-	1	0.7	0.3	1.4	1.24	1.8	16.0	13.0	-	549	-	259	-	7.41	-	9.5	0.18	-	34	-	31	-	30	-	0.36
4	1	1	0.7	0.3	1.4	1.24	1.8	17.0	15.0	596	700	242	346	7.41	4.61	9.5	5.9	0.22	34	44	31	40	31	40	0.38	0.57
6	1	1	0.7	0.3	1.4	1.24	1.8	18.0	16.0	664	814	289	439	4.61	3.08	5.9	3.94	0.31	43	55	39	50	40	51	0.57	0.86
10	1	7	0.7	0.3	1.4	1.4	1.8	20.0	18.0	785	1033	378	626	3.08	1.83	3.94	2.34	0.36	57	73	51	66	53	70	0.94	1.4
16	7	7	0.7	0.3	4x0.8	1.4	1.8	22.0	19.0	1284	1663	454	833	1.91	1.15	2.44	1.47	0.41	73	97	66	87	70	90	1.5	2.3
25	7	7	0.90	0.3	4x0.8	1.4	2.0	24.0	22.0	950	1532	520	1204	1.2000	0.7270	1.530	.931	0.41	94	122	85	110	96	123	2.4	3.6
35	7	7	0.90	0.3	4x0.8	1.4	2.0	26.0	25.0	1120	1982	650	1578	0.8680	0.5240	1.110	0.671	0.47	113	146	102	131	117	151	3.3	5.
50	7	7	1.00	0.3	4x0.8	1.56	2.0	29.0	28.0	1360	2507	810	2049	0.6410	0.3870	0.818	0.496	0.50	133	172	120	155	142	183	4.7	7.1
70	19	19	1.10	0.4	4x0.8	1.56	2.2	33.0	32.0	1730	3459	1110	2969	0.4430	0.2680	0.565	0.344	0.53	164	211	148	190	179	231	6.6	10.0
95	19	19	1.10	0.4	4x0.8	1.56	2.2	36.0	35.0	2130	4462	1430	3910	0.3200	0.1930	0.409	0.248	0.61	196	253	176	228	221	285	9.0	13.6
120	19	19	1.20	0.5	4x0.8	1.72	2.4	41.0	39.0	2580	5511	1790	4854	0.2530	0.1530	0.323	0.197	0.63	223	287	201	258	257	330	11.3	17.1
150	19	19	1.40	0.5	4x0.8	1.88	2.6	45.0	44.0	3080	6787	2210	6093	0.2060	0.1240	0.264	0.160	0.60	249	321	224	289	292	375	14.2	21.4
185	37	37	1.60	0.5	4x0.8	2.04	2.8	50.0	49.0	3730	8264	2750	7484	0.1640	0.0991	0.210	0.129	0.60	282	361	254	325	337	430	17.5	26.4
240	37	37	1.70	0.6	4x0.8	2.2	3	56.0	55.0	4660	10373	3530	9609	0.1250	0.0754	0.161	0.099	0.63	326	416	293	374	399	508	22.6	34.3
300	37	37	1.80	0.7	4x0.8	2.36	3.2	62.0	61.0	5590	12940	4330	12338	0.1000	0.0601	0.129	0.080	0.67	367	464	330	418	456	575	28.3	42.9
400	61	61	2.00	0.7	4x0.8	2.68	3.6	70.0	69.0	6950	16981	5510	15961	0.0778	0.0470	0.102	0.064	0.67	418	521	376	469	530	661	37.7	57.1
500	61	61	2.20	0.7	4x0.8	2.84	3.8	78.0	77.0	8430	20877	6830	19897	0.0605	0.0366	0.0782	0.052	0.69	470	582	423	524	612	753	47.2	71.4
630	61	61	2.40	0.7	4x0.8	3	4	87.0	87.0	10510	31428	8700	31102	0.0469	0.0283	0.0606	0.043	0.73	529	944	476	580	707	851	59.4	90.0

TABLE-28: XLPE INSULATED CONTROL CABLE WITH COPPER CONDUCTOR (AS-IS:7098 (1))

No. of cores X Area	Cond. Min. No. of wires	Insulation Thickness	Inner Thickness	Dimension of Arm Wire Strip	Outer Thickness		Approx. O.D.		Approx. Net Wt. Of Cable		Max. D.C. resistance at 20°C	Approx. A.C. resistance at 90°C	Approx capacitance/phase	Current Rating			Short Circuit rating for 1 sec.
					Arm	Un-Arm	Arm	Un-Arm	Arm	Un-Arm				In Ground	In Duct	In air	
Sq. mm	No.	mm.	mm	mm	mm	mm	mm	mm	Kg/km	Kg/km	Ohm/km	Ohm/km	µf/km	Amps	Amps	Amps	KA(rms)
2x1.5	1.0	0.8	0.3	1.4	1.24	1.8	14	12.0	411	183	12.1	14.5	0.1	23	20	20	0.173
3x1.5	1.0	0.8	0.3	1.4	1.24	1.8	14	12.0	450	212	12.1	14.5	0.1	21	17	17	0.173
4x1.5	1.0	0.8	0.3	1.4	1.24	1.8	15	13.0	508	247	12.1	14.5	0.1	21	17	17	0.173
5x1.5	1.0	0.8	0.3	1.4	1.24	1.8	16	14.0	542	278	12.1	14.5	0.1	21	17	17	0.173
6x1.5	1.0	0.8	0.3	1.4	1.24	1.8	17	15.0	607	322	12.1	14.5	0.1	15	13	13	0.173
7x1.5	1.0	0.8	0.3	1.4	1.24	1.8	17	16.0	621	322	12.1	14.5	0.1	14	13	13	0.173
10x1.5	1.0	0.8	0.3	1.4	1.40	1.8	21	19.0	838	456	12.1	14.5	0.1	13	11	11	0.173
12x1.5	1.0	0.8	0.3	4x0.8	1.24	1.8	20	19.0	723	501	12.1	14.5	0.1	12	10	10	0.173
14x1.5	1.0	0.8	0.3	4x0.8	1.40	1.8	21	20.0	822	558	12.1	14.5	0.1	11	10	10	0.173
16x1.5	1.0	0.8	0.3	4x0.8	1.40	1.8	22	21.0	912	626	12.1	14.5	0.1	11	9	9	0.173
19x1.5	1.0	0.8	0.3	4x0.8	1.40	2.0	23	23.0	987	724	12.1	14.5	0.1	10	9	9	0.173
24x1.5	1.0	0.8	0.3	4x0.8	1.40	2.0	26	26.0	1225	900	12.1	14.5	0.1	9	8	8	0.173
27x1.5	1.0	0.8	0.3	4x0.8	1.40	2.0	27	27.0	1291	968	12.1	14.5	0.1	9	8	8	0.173
30x1.5	1.0	0.8	0.3	4x0.8	1.40	2.0	28	28.0	1396	1051	12.1	14.5	0.1	9	7	7	0.173
37x1.5	1.0	0.8	0.3	4x0.8	1.40	2.0	30	29.0	1608	1243	12.1	14.5	0.1	8	7	7	0.173
44x1.5	1.0	0.8	0.3	4x0.8	1.56	2.0	34	33.0	1925	1468	12.1	14.5	0.1	7	6	6	0.173
52x1.5	1.0	0.8	0.4	4x0.8	1.56	2.0	35	34.0	2173	1698	12.1	14.5	0.1	7	6	6	0.173
61x1.5	1.0	0.8	0.4	4x0.8	1.56	2.2	37	37.0	2445	1959	12.1	14.5	0.1	5	6	6	0.173
2x2.5	1.0	0.9	0.3	1.4	1.24	1.8	15	13.0	477	230	7.41	8.87	0.1	32	27	27	2.88
3x2.5	1.0	0.9	0.3	1.4	1.24	1.8	16	14.0	521	282	7.41	8.87	0.1	27	24	24	2.88
4x2.5	1.0	0.9	0.3	1.4	1.24	1.8	17	15.0	614	335	7.41	8.87	0.1	27	24	24	2.88
5x2.5	1.0	0.9	0.3	1.4	1.24	1.8	18	16.0	674	366	7.41	8.87	0.1	27	24	24	2.88
6x2.5	1.0	0.9	0.3	1.4	1.24	1.8	19	17.0	757	426	7.41	8.87	0.1	21	18	18	2.88
7x2.5	1.0	0.9	0.3	1.4	1.24	1.8	19	17.0	776	451	7.41	8.87	0.1	20	17	17	2.88
10x2.5	1.0	0.9	0.3	4x0.8	1.40	1.8	20	21.0	908	622	7.41	8.87	0.1	18	15	15	2.88
12x2.5	1.0	0.9	0.3	4x0.8	1.40	2.0	23	20.0	972	708	7.41	8.87	0.1	17	14	14	2.88
14x2.5	1.0	0.9	0.3	4x0.8	1.40	2.0	24	23.0	1079	795	7.41	8.87	0.1	16	13	13	2.88
16x2.5	1.0	0.9	0.3	4x0.8	1.40	2.0	25	24.0	1197	892	7.41	8.87	0.1	15	12	12	2.88
19x2.5	1.0	0.9	0.3	4x0.8	1.40	2.0	27	26.0	1336	1010	7.41	8.87	0.1	14	12	12	2.88
24x2.5	1.0	0.9	0.3	4x0.8	1.40	2.0	30	30.0	1651	1264	7.41	8.87	0.1	13	11	11	2.88
27x2.5	1.0	0.9	0.3	4x0.8	1.40	2.0	31	30.0	1750	1366	7.41	8.87	0.1	12	10	10	2.88
30x2.5	1.0	0.9	0.3	4x0.8	1.56	2.0	33	31.0	1923	1487	7.41	8.87	0.1	12	10	10	2.88
37x2.5	1.0	0.9	0.4	4x0.8	1.56	2.2	35	34.0	2269	1826	7.41	8.87	0.1	11	9	9	2.88
44x2.5	1.0	0.9	0.4	4x0.8	1.56	2.2	39	38.0	2662	2140	7.41	8.87	0.1	10	9	9	2.88
52x2.5	1.0	0.9	0.4	4x0.8	1.56	2.2	41	40.0	2985	2474	7.41	8.87	0.1	10	8	8	2.88
61x2.5	1.0	0.9	0.4	4x0.8	1.56	2.2	43	42.0	3385	2821	7.41	8.87	0.1	9	8	8	2.88

TABLE-29: Single Core / Multicore Flexible Cables as per IS 694:1990

Area (sq. mm)			0.5	0.75	1.0	1.5	2.5	4.0	6.0	10.0	16.0	25.0	35.0	50.0
	No. & Size of Wire	No./mm	16/.2	24/.2	32/.2	30/.25 Or 48/.2	50/.25 Or 80/.2	56/.3	84/.03	80/.4 Or 140/.3	126/.4	196/.4	276/.4	396/.4
Conductor	Resistance (Max) @ 20°C	Ohms/km	39.0	26.0	19.5	13.3	7.98	4.95	3.30	1.91	1.21	0.780	0.554	0.386
	Current Rating	Amps	4	7	12	15	20	27	35	46	62	80	102	138
Insulation	Thickness (Nom.)	mm	0.6	0.6	0.6	0.6	0.7	0.8	0.8	1.0	1.0	1.2	1.2	1.4
Single Core Unsheathed	Overall Diameter (Approx)		2.20	2.45	2.60	2.90	3.55	4.30	5.20	6.70	7.80	9.70	10.90	13.20
Single Core Sheathed	Sheath Thickness (Nom.) Overall Diameter (Approx)	mm mm	0.90 4.00	0.9 4.25	0.9 4.50	0.9 4.80	1.0 5.45	1.0 6.30						
Twin Flat Sheathed	Overall Width (Approx) Overall Height (Approx)	mm mm	6.2 4.0	6.7 4.25										
2 Core	Sheath Thickness (Nom.) Overall Diameter (Approx)	mm mm	0.9 6.5	0.9 7.0	0.9 7.3	0.9 7.8	1.0 9.5	1.0 11.0						
3 Core	Sheath Thickness (Nom.) Overall Diameter (Approx)	mm mm	0.9 6.9	0.9 7.4	0.9 7.7	0.9 8.2	1.0 10.0	1.0 11.5						
4 Core	Sheath Thickness (Nom.) Overall Diameter (Approx)	mm mm	0.9 7.5	0.9 8.0	0.9 8.5	1.0 9.5	1.0 10.0	1.0 13.0						
5 Core	Sheath Thickness (Nom.) Overall Diameter (Approx)	mm mm	0.9 8.3	0.9 9.0	1.0 9.5	1.0 10.5	1.0 12.0	1.1 14.0						

TABLE-30: Single Core Flexible Cables Generally Conforming To IS 694:1990

Area (sq. mm)			70.0	95.0	120.0	150.0	185.0	240.0
	No. & Size of Wire	No./mm	360/.5	475/.5	608/.5	756/.5	925/.5	1221/.5
Conductor	Resistance (Max) @ 20°C	Ohms/km	0.272	0.206	0.161	0.129	0.106	0.0801
	Current DC/AC	Amps	214	260	305	355	415	500
Insulation	Thickness (Nom.)	mm	1.4	1.6	1.6	1.8	2.0	2.2
	O.D. (Approx)	mm	15.3	17.9	19.4	21.9	24.5	28.0

TABLE-31: Three & Four Flexible Cables Generally Conforming To IS 694:1990

Area (sq. mm)			6.0	10.0	16.0	25.0	35.0	50.0	70.0	95.0	120.0
	No. & Size of Wire	No./mm	84/.3	140/.3 Or 80/.4	226/.3 Or 126/.4	354/.3 Or 196/.4	495/.3 Or 276/.4	703/.3 Or 396/.4	360/.5	475/.5	608/.5
Conductor	Resistance (Max) @ 20°C	Ohms/km	3.30	1.91	1.21	0.780	0.554	0.386	0.272	0.206	0.161
	Current	Amps	31	42	57	72	91	120	165	200	225
Insulation	Thickness	mm	0.8	1.0	1.0	1.2	1.2	1.4	1.4	1.6	1.6
3 Core	Sheath Thickness (Nom.) Overall Diameter (Approx)	mm mm	1.3 14.0	1.4 18.0	1.4 21.0	1.5 25.5	1.6 29.0	2.0 33.0	2.2 38.5	2.4 45.0	2.5 49.0
4 Core	Sheath Thickness (Nom.) Overall Diameter (Approx)	mm mm	1.4 16.5	1.4 19.0	1.4 23.0	1.6 28.5	1.7 33.0	2.0 35.0	2.2 40.0	2.4 46.5	2.5 51.0

TABLE-32: Aluminium Conductor Steel Reinforced (ACSR) Conforming To BS 215 Part B

Conductor	Electrical Properties						Mechanical Properties							
Code Name	Equivalent Copper Area		Calculated equivalent Aluminium Area	Calculated resistance at 20°C d.c. ohms	Inductive reactance at 50 Hz and 50 Cm spacing (Ohms/Km)	Current Rating in still air	Srtranding & Wire Diameter (mm)		Overall Conductor diameter	Area of the conductor steel aluminum	Approximate Weight Kg/Km			Ultimate tensite strength
	(sq. mm)	(sq. inch)	(sq. mm)	per Km.		(Amp)	Aluminium No/dia	Steel No/dia	(mm)	(sq. mm)	Al	Steel	Total	(Kg.)
SQUIRREL	13	0.020	20.71	1.3740	0.355	76	6/2.11	1/2.11	6.33	24.43	53	27	80	771
GOPHER	16	0.025	25.91	1.0980	0.349	85	6/2.36	1/2.36	7.09	30.60	72	34	106	952
WEASEL	20	0.030	31.21	0.9116	0.345	95	6/2.59	1/2.59	7.77	37.00	87	41	128	1,136
FERRET	25	0.040	41.87	0.6795	0.339	115	6/3.00	1/3.00	9.00	49.60	116	55	171	1,503
RABBIT	30	0.050	52.21	0.5449	0.335	135	6/3.35	1/3.35	10.05	61.90	145	69	214	1860
MINK	40	0.060	62.32	0.4565	0.333	165	6/3.66	1/3.66	11.00	73.90	173	82	255	2207
BEAVER	45	0.070	74.07	0.3841	0.327	176	6/3.99	1/3.99	12.00	87.70	206	98	304	2613
RACOON	48	0.075	77.83	0.3656	0.329	180	6/4.09	1/4.09	12.30	92.10	215	103	318	2746
OTTER	50	0.080	82.85	0.3434	0.328	185	6/4.22	1/4.22	12.60	98.00	230	109	339	2923
CAT	55	0.090	94.21	0.3020	0.327	195	6/4.50	1/4.50	13.50	113.00	261	124	385	3324
DOG	65	0.100	103.6	0.2745	0.315	205	6/4.72	7/1.57	14.20	118.45	288	106	394	3299
LEOPARD	80	0.125	129.7	0.2193	0.282	275	6/5.28	7/1.76	15.85	150.45	360	133	493	4137
COYOTE	80	0.125	128.5	0.2214	0.268	260	26/2.54	7/1.90	16.86	157.60	365	156	521	4638
TIGER	80	0.125	128.1	0.2221	0.271	265	30/2.36	7/2.36	16.50	162.00	363	241	604	5758
WOLF	95	0.150	154.3	0.1844	0.266	305	30/2.59	7/2.59	18.10	195.00	436	291	727	6880
LYNX	110	0.175	179.0	0.1589	0.261	335	30/2.79	7/2.79	19.60	226.00	507	338	845	7950
PANTHER	130	0.200	207.0	0.1375	0.256	370	30/3.00	7/3.00	21.00	262.00	586	390	976	9127
LION	140	0.225	232.5	0.1223	0.252	405	30/3.18	7/3.18	22.30	295.00	659	438	1097	10210
BEAR	160	0.250	258.1	0.1102	0.250	430	30/3.35	7/3.35	22.90	326.00	734	485	1219	11310

The current ratings are based on the following operating conditions:

Ambient Temperature : 35°C maximum Conductor Temperature : 75°C

Intensity of solar rediation : 089W/sq. cm Surface Condition : Black (Weathered)

Multiplication factor to obtain inductive reactance for spacing other than 50 cm:

Spacing in cm	50	60	70	80	90	100	110
M.F.	1.0000	1.0114	1.0211	1.0295	1.0369	1.0435	1.0495

HOW TO SELECT LOW VOLTAGE CABLE

Following steps can be used to find the size of single-core or multi-core cables:

Step 1
Find out the current to be drawn through the cable (or protective device rating)

Example:
For 40 H.P., 3 Phase Motor, having efficiency 85%, P.f. 0.80 and line voltage 400V, the line current require is :

$$I_L = \frac{\text{H.P.} \times 746}{1.732 \times \text{Line Voltage} \times \text{efficiency} \times \text{p.f.}}$$ [See Page 4]

$$= \frac{40 \times 746}{1.732 \times 400e \times 0.85 \times 0.80.} = 63.338 \text{ A} \sim 64 \text{ A}$$

Step 2
Decide whether the installation is single phase AC/DC or 3-phase AC

e.g. 3-phase AC.

Step 3
Decide whether the installation is done with single-core or multi-core Cables and decide if the cable has to be armored (if placed in ground) or unarmored copper cables (if places in air).

Example:
Multi-core copper cables laid direct in ground i.e. armoured.

Step 4
If the conditions of laying are different from mentioned in *Page 7* then apply relevant correction factors from Table No. 6 – 14.

Example:

Parameters of Laying	Table No	Standard Condition	Actual Condition	Fact or
Ground Temperature (Armoured)	7	30°C	40°C	0.87
Air Temperature (Unarmoured)	9	40°C	NR*	-
Depth of laying in ground (Single Core)	10	750mm	NR*	-
Depth of laying in ground (twin & multiple core)	11	750mm	1.0	1.00

* Not required (NR) for this type of cable in laying; but may be required for other purpose.

Therefore corrected current, $I_1 = I_L/C_g$
$= 64/ 0.87 = 73.56$ A

Step 5
Decide whether the cable sets in different circuits will be grouped together. If such grouping is done select the relevant grouping correction factor from the give table for grouping correction factors and divide the resulting current in the Step 4 by that grouping correction factor refer Table 12.

$$I = I / C$$

Example:
If Two cable sets of two 3-phase circuits is to be grouped together, laid direct in ground, single layer and touching

$I_2 = 73.56/0.79$
$= 93.113$ A

Step 6

Go through the relevant Table No. 15-28 with current carrying capacities and find the nearest and higher current then the resulting current from the *Step 5.* And then get the relevant conductor cross-sectional area for that current.

Example

For the resulting current in the above step (93.113 A) by going through the cable with current carrying capacities of 3.5 core armoured copper PVC insulated cables

3.5 Core × 25mm^2 Copper armour cable can be taken for the purpose.

Step 7

Calculate the Voltage drop across the selected cable for the length of installation.

3-phase voltage drop per km = $1.732 \times I_L R$

Where,

I_L = Line current

R = A.C. Resistance of 1-core cable per km [From Table No. 15-28]

If the voltage drop is less than 2.5% of the nominal supply voltage (For single phase, nominal supply voltage is 230V and for 3-phase, nominal supply voltage is 400V) then the selected cable is suitable for the installation.

Otherwise, go to the next higher cross sectional area of the conductor and check whether the voltage drop is less than the permissible value and repeat until this condition is satisfied.

Example:

3.5 Core × 25mm^2 CU,AR Cable in PVC insulation with 50m in length the,

Voltage Drop in the cable per km = $1.732 \times 64 \times 0.873$ V = 96.770 V

Therefore, Voltage Drop for 50m length = $96.770 \times 50/ 1000$ = 4.838 V

Permissible Voltage Drop = $400 \times 2.5/100$ = 10 V

Voltage Drop in the cable < Permissible voltage Drop

There fore, the selected cable cross section is suitable for the purpose.

TABLE 33: IMPORATANT BUS BAR DATA

Size in mm	Cross Sectional Area in mm^2	COPPER BUS BAR									ALUMINUM BUS BAR								
		Weight (Approx) Kg/Meter	Continuous Current Carrying Capacity in Amps.								Weight (Approx) Kg/Meter	Continuous Current Carrying Capacity in Amps.							
			A.C No of Buses				D.C No of Buses					A.C No of Buses				D.C No of Buses			
			1	2	3	4	1	2	3	4		1	2	3	4	1	2	3	4
			I	II	III	II50II	I	II	III	IV		I	II	III	II50II	I	II	III	IIII
12x2	23.5	0.209	110	200	-	-	115	205	-	-	0.0633	80	140	-	-	80	145		-
15x2	29.5	0.262	140	200	-	-	145	245	-	-	0.0795	95	170	-	-	95	175	-	-
15x3	44.5	0.396	170	300	-	-	175	305	-	-	0.120	115	210	-	-	115	220	-	-
20x2	39.5	0.351	185	315	-	-	190	325	-	-	0.107	120	220	-	-	125	225	-	-
20x3	59.5	0.529	220	380	-	-	225	390	-	-	0.161	145	270	-	-	150	280	-	-
20x5	99.1	0.882	295	500	-	-	300	510	-	-	0.268	195	350	-	-	200	370	-	-
25x5	74.5	0.663	270	460	-	-	275	470	-	-	0.201	180	330	-	-	185	340	-	-
25x3	124.0	1.11	350	600	-	-	355	610	-	-	0.335	230	430	-	-	235	440	-	-
30x3	89.5	0.796	315	540	-	-	320	560	-	-	0.242	205	385	-	-	220	400	-	-
30x5	149.0	1.33	400	700	-	-	410	720	-	-	0.403	270	500	-	-	275	520	-	-
40x3	119.0	1.06	420	710	-	-	430	740	-	-	0.323	280	500	-	-	285	525	-	-
40x5	199.0	1.77	520	900	-	-	530	930	-	-	0.538	350	650	-	-	360	660	-	-
40x10	399.0	3.55	760	1350	1850	2500	770	1400	2000	-	1.08	515	975	1350	1800	540	1000	1420	-
50x5	249.0	2.22	630	1100	1650	2100	650	1150	1750	-	0.673	425	780	1120	1500	445	815	1220	-
50x10	499.0	4.44	920	1600	2250	3000	960	1700	2500	-	1.35	625	1150	1600	2160	655	1220	1730	-
60x5	299.0	2.66	760	1250	1760	2400	780	1300	1900	2500	0.808	500	900	1300	1730	530	960	1420	1850
60x10	599.0	5.33	1060	1900	2600	3500	1100	2000	2800	3600	1.62	730	1330	1900	2500	770	1430	2030	2600
80x5	399.0	3.55	970	1700	2300	3000	1000	1800	2500	3200	1.08	680	1170	1650	2230	700	1260	1850	2400
80x10	799.0	7.11	1380	2300	3100	4200	1450	2600	3700	4800	2.16	940	1700	2360	3150	985	1840	2640	3400
100x5	499.0	4.44	1200	2050	2850	3500	1250	2250	3150	4050	1.35	820	1440	2000	2600	855	1550	2220	2900
100x10	999.0	8.89	1700	2800	3650	5000	1800	3200	4500	5800	2.70	1150	2050	2800	3700	1200	2240	3200	4200
120x10	1200.0	10.7	2000	3100	4100	5700	2150	3700	5200	6700	3.24	1350	2400	3250	4300	1420	2700	3900	5100
160x10	1600.0	14.2	2500	3900	5300	7300	2800	4800	6900	9000	4.32	1750	3000	4150	5300	1850	3450	5000	6500
200x10	2000.0	17.8	3000	4750	6350	8800	3400	6000	8500	10000	5.40	2150	3650	4950	6400	2300	4300	6200	8100

TABLE 34: TINNED COPPER FUSE WIRE TABLE

S.W.G	Diameter in mm	Curr. Rating of fuse in Amp	Approximate fusing current
40	0.1219	1.5	3
39	0.1321	2.5	4
38	0.1524	3	5
37	0.1727	3.5	6
36	0.1930	4.5	7
35	0.2134	5	8
34	0.2337	5.5	9
33	0.2540	6	10
32	0.2743	7	11
31	0.2946	8	13
30	0.3150	8.5	13
29	0.3454	10	16
28	0.3759	12	18
27	0.4160	13	23
26	0.4572	14	28
25	0.5080	15	30
24	0.5588	17	33
23	0.6096	20	38
22	0.7112	24	48
21	0.8128	29	58
20	0.9440	34	70
19	1.0160	38	81
18	1.2192	45	106
17	1.4224	65	135
16	1.6256	73	166

Note :

(a) Approximate size of fuse elements composed of tinned copper wire for use in semi-enclosed fuses.

(b) The figures are an approximate guide only and the current at which the fuse will blow will depend upon the construction of the fuse holder in which the wire is used.

TABLE 35: RECOMMENDED CAPICITOR RATINGS

For direct connection to induction motors to improve power factor to 0.95 or better at all loads

KVAR rating at motor speed of					
otor H.P	000 rpm	1500 rpm	1000 rpm	750 rpm	500 rpm
2.5	1	1	1.5	2	2.5
5	2	2	2.5	3.5	4
7.5	2.5	3	3.5	4.5	5.5
10	3	4	4.5	5.5	6.5
15	4	5	6	7.5	9
20	5	6	7	9	12
25	6	7	9	10.5	14.5
30	7	8	10	12	17
40	9	10	13	15	21
50	11	12.5	16	18	25
60	13	14.5	18	20	28
70	15	16.5	20	22	31
80	17	19	22	24	34
90	19	21	24	26	37
100	21	23	26	28	40
110	23	25	28	30	43
120	25	27	30	32	46
130	27	29	32	34	49
140	29	31	34	36	52
145	30	32	35	37	54
150	31	33	36	38	55
155	32	34	37	39	56
160	33	35	38	40	57
165	34	36	39	41	59
170	35	37	40	42	60
175	36	38	41	43	61
180	37	39	42	44	62
200	40	42	45	47	67
250	45	50	55	60	70

TABLE 36: SIZE OF CAPACITORS IN KVAR REQUIRED FOR GIVEN DEGREE OF POWER FACTOR CORRECTION PER KW OF LOAD.

Initial power factor	Correction to				
	0.85	0.90	0.95	0.98	Unity
1	2	3	4	5	6
0.50	1.112	1.248	1.403	1.529	1.732
0.51	1.066	1.202	1.357	1.483	1.686
0.52	1.024	1.160	1.315	1.441	1.644
0.53	0.980	1.116	1.271	1.397	1.600
0.54	0.939	1.075	1.230	1.356	1.559
0.55	0.899	1.035	1.190	1.316	1.519
0.56	0860	0.996	1.151	1.277	1.480
0.57	0.822	0.958	1.113	1.239	1.442
0.58	0.785	0.921	1.076	1.202	1.405
0.59	0.748	0.884	1.039	1.165	1.368
0.60	0.714	0.849	1.005	1.131	1.334
0.61	0.679	0.815	0.970	1.096	1.299
0.62	0.645	0.781	0.936	1.062	1.265
0.63	0.613	0.749	0.904	1.030	1.233
0.64	0.580	0.716	0.871	0.997	1.200
0.65	0.549	0.685	0.840	0.966	1.169
0.66	0.518	0.654	0.809	0.935	1.138
0.67	0.488	0.624	0.779	0.905	1.108
0.68	0.459	0.595	0.750	0.876	1.079
0.69	0.429	0.565	0.720	0.840	1.049
0.70	0.400	0.536	0.691	0.811	1.020
0.71	0.372	0.508	0.663	0.783	0.992
0.72	0.343	0.479	0.634	0.754	0.963
0.73	0.316	0.452	0.607	0.727	0.936
0.74	0.289	0.425	0.580	0.700	0.909
0.75	0.262	0.398	0.553	0.673	0.882
0.76	0.235	0.371	0.526	0.652	0.855
0.77	0.209	0.345	0.500	0.620	0.829
0.78	0.183	0.319	0.473	0.594	0.803
0.79	0.156	0.292	0.447	0.567	0.776
0.80	0.130	0.266	0.421	0.541	0.750
0.81	0.104	0.240	0.395	0.515	0.724
0.82	0.078	0.214	0.369	0.489	0.698
0.83	0.052	0.188	0.343	0.463	0.672
0.84	0.026	0.162	0.317	0.437	0.645
0.85	-	0.136	0.291	0.417	0.620
0.86	-	0.109	0.264	0.390	0.593
0.87	-	0.083	0.238	0.364	0.567
0.88	-	0.054	0.209	0.335	0.538
0.89	-	0.028	0.183	0.309	0.512
0.90	-	-	0.155	0.281	0.484
0.91	-	-	0.124	0.250	0.453
0.92	-	-	0.097	0.223	0.426
0.93	-	-	0.066	0.192	0.395
0.94	-	-	0.034	0.160	0.363
0.95	-	-	-	0.126	0.329
0.96	-	-	-	0.089	0.292
0.97	-	-	-	0.047	0.250
0.98	-	-	-	-	0.203
0.99	-	-	-	-	0.143

Example: -

To find the capacitor rating required to correct a load of 97 KW. at 0.67 P.F. to 0.95 P.F.

Required KVAR per KW (from table) = 0.779

Total capacitor rating = 0.779 × 97 = 75.65 or 79 *KVAR*

TABLE 37: FULL LOAD CURRENT IN AMPERE FOR ELECTRIC MOTORS

H.P.	Single phase AC			Three phase AC			Direct current		
	115 vol.	230 vol.	400 vol.	230 vol.	400 vol.	440 vol.	110 vol.	220 vol.	440 vol.
1/8	3.0	1.5	0.86	0.70	0.40	0.36	1.8	0.9	0.45
¼	5.2	2.6	1.5	1.13	0.65	0.59	2.9		0.73
½	8.0	4.0	2.3	2.1	1.20	1.10	5.0	2.5	1.30
¾	11.2	5.6	3.2	2.8	1.6	1.44	7.5	3.7	1.90
1	14.0	7.0	4.0	3.5	2.0	1.8	9.6	4.8	2.40
1½	18.0	9.0	5.2	4.9	2.8	2.6	14.0	7.0	3.5
2	22.0	11.0	6.3	6.1	3.5	3.2	17.5	8.8	44
3	32.0	16.0	9.2	8.7	5.0	4.6	25.0	12.5	6.3
5	52.0	26.0	15.0	14.0	8.0	7.3	42.0	21.0	10.5
7½	76.0	38.0	22.0	20.0	11.5	10.5	63.0	32.0	15.3
10	100.0	50.0	29.0	26.0	15.4	13.8	84.0	42.0	21.0
15	144.0	72.0	41.0	38.0	22.0	20.0	121.0	61.0	30.0
20	180.0	90.0	52.0	50.0	29.0	27.0	160.0	80.0	40.0
25	220.0	110.0	63.0	63.0	36.0	32.0	195.0	97.0	49.0
30	260.0	130.0	75.0	73.0	42.0	38.0	234.0	117.0	58.0
40	-	-	-	98.0	56.0	51.0	310.0	155.0	78.0
50	-	-	-	122.0	70.0	64.0	376.0	188.0	94.0
60	-	-	-	146.0	84.0	76.0	450.0	225.0	113.0
75	-	-	-	180.0	104	95.0	550.0	275.0	138.0
100	-	-	-	240.0	138	124.0	-	370.0	185.0

Note : The values of current given assume a pure supply. If the D.C., source is delivered from rectifier equipment the resulting values taken may be somewhat higher. With thyristor drive variable speed units, values may be as much as 1.5 times.

TABLE 38: MAXIMUM CURRENT IN AMPERE FOR PURE RESISTIVE LOAD

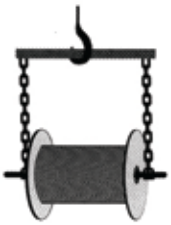
Power	1 Phase			3 Phase	
	110V	230V	380V	415V	440V
KW	amp	amp	amp	amp	amp
1	9.1	4.3	1.5	1.4	1.3
2	18.2	8.7	3.0	2.8	2.6
3	27.3	13.0	4.6	4.2	3.9
4	36.4	17.4	6.1	5.6	5.3
5	45.5	21.7	7.6	7.0	6.6
6	54.6	26.1	9.1	8.4	7.9
7	63.6	30.4	10.6	9.7	9.2
8	72.7	34.8	12.2	11.1	10.5
9	81.8	39.1	13.7	12.5	11.8
10	91.0	43.5	15.2	13.9	13.1
20	182	87.0	30.4	27.9	26.3
40	364	170	60.8	55.7	52.5
60	545	261	91.3	83.6	78.8
80	727	348	122	111	105
100	909	435	152	139	131

RECOMMENDATIONS FOR STORAGE & INSTALLATION OF CABLES

HANDLING & STORAGE

Handling at site: While unloading the cable drums certain precautions are to be taken for ensuring the safety of the cable.

WRONG



CORRECT

When using a lift or crane use a spreader bar longer than the overall drum width just above the drum flanges. Without a spreader bar this will lead to bending of drum flanges crushing & damaging the cable.

WRONG

CORRECT

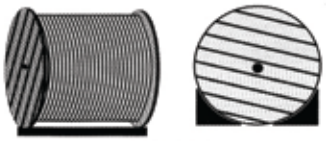
When unloading from the truck, inclined ramp should be used to lower the drum. Do not drop the drum directly from the truck, which may lead to damage of the drum & subsequently the cable.

While using forklift for handling or shifting the drum, the drum should be perpendicular to the forks, rather than parallel. Do not allow the forks to be in contact with the cable.

Storage:

Cable drums should be stored on plain ground without any hard stones projecting above the surface and dry place away from direct sunlight and rain. All cable drums should be stored with the battens intact, with sufficient space in between the drums. Ensure stoppers for every drum to avoid the drum movement after storage. Cable drums should not be stored one above the other.

WRONG



CORRECT

Installation and Laying:

While laying of cables special care to be taken. The cable end should be pulled with pulling eye only after mounting the drum on the Jacks. Do not keep the drum on its flange while pulling the cable. This will result in Bird Caging (Twists and deformation of cable) and armour swelling.

Roll the drum in only one direction as indicated by arrow marked on the drum.

WRONG

CORRECT

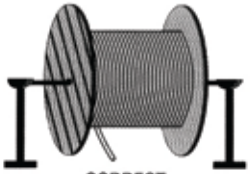
Minimum Bending Radius:

Cable Type	Single Core	Multi Core
HT Cable	20xD	15xD
LT Cable	15xD	12xD

Testing at site:

After the cable is installed before commissioning, it should be tested for DC High Voltage. The recommended voltage and duration will be as per IS:1255. Megger, continuity and cross continuity to be checked on each core before and after laying.

WRONG



CORRECT

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