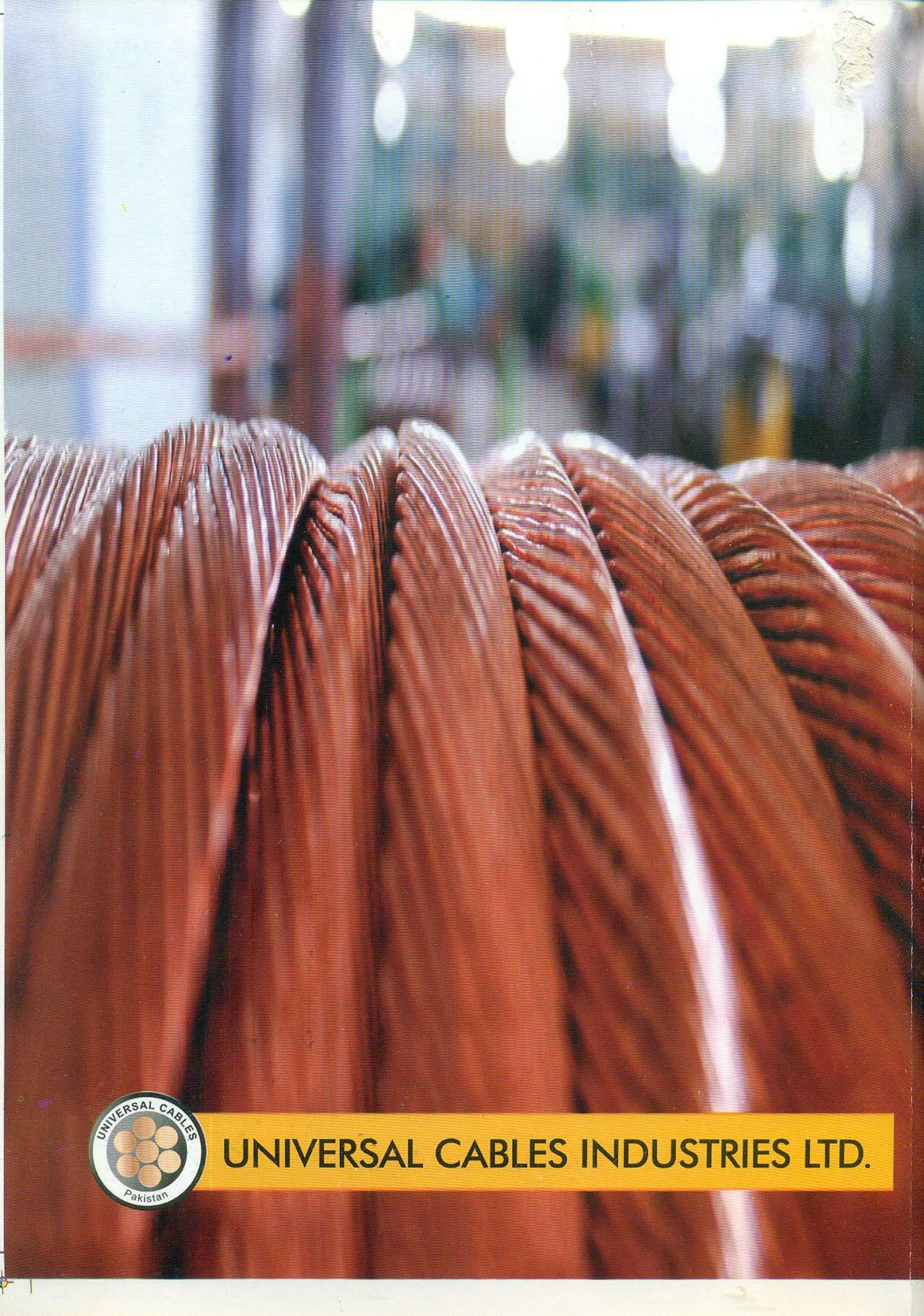
UNIVERSAL CABLES

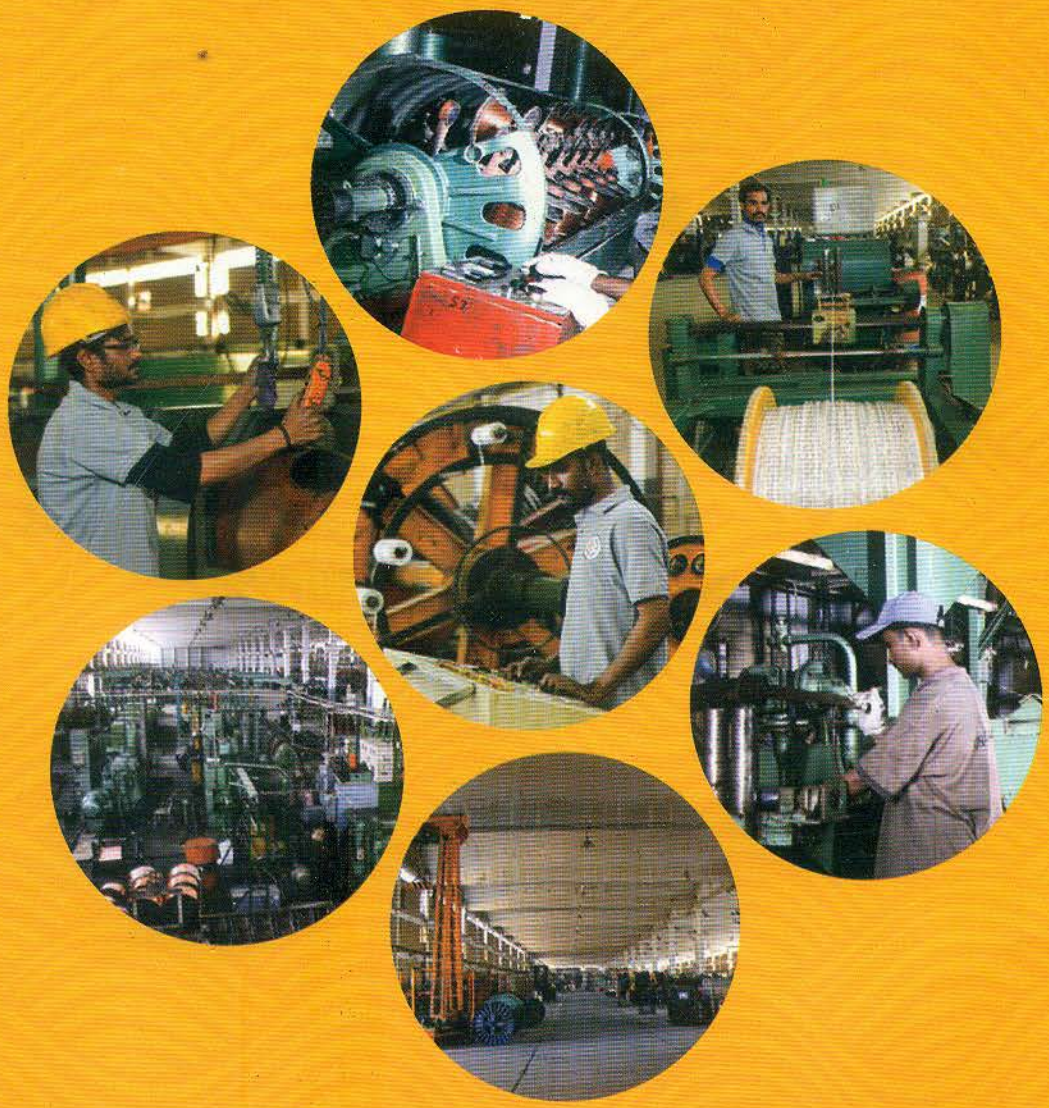
LOW VOLTAGE GENERAL
WIRES AND POWER CABLES

www.ucil.com.pk


UNIVERSAL CABLES
Pakistan
UNIVERSAL CABLES INDUSTRIES LTD.

About us

The effort of setting up a small yet strong setup in 1978 was the birth of a shining star in the Cable Industry. Initiated as a manufacturer of PVC insulated wires, cables and flexible cords, Universal Cables Industries Ltd. made its mark in its field of expertise. With a diverse product range, foresighted vision and advance technology, Universal Cables Industries Ltd. proudly crossed its benchmark of Quality and Customer satisfaction after it became ISO9001:2008 certified.



UNIVERSAL CABLES INDUSTRIES LTD.

PVC CABLES

PVC Insulated, Non-armoured Cable for Voltages up to & including 450/750 V, for Electric Power, Lighting & Internal Wiring, to BS 6004.

Power Cables,Non-armoured & Armoured, 600/1000 V & 1900/3300 V, to BS 6346

Incorporating IEE 16 Edition /BS 7671:2001 along with amendment No.1 (AMD 13628) which comes into effect on 1 February, 2002

UNIVERSAL CABLES INDUSTRIES LTD.

S.No.	CONTENTS (a)	PAGE No.
	Section - I **General**	
01	About Ourselves	01
02	Objectives & Quality policy	02
03	Establishment	03
	Section II **PVC Insulated & PVC Sheathed Wires & Cables 450/750 V & 300/500 V to BS 6004:2000**	
04	Excellent Features	04
05	General Construction	05
06	Operating and Installation Engineering Data	06
07	Conductor Information, Copper & Aluminium Conductors to IEC 228 & 6360 (Reference Table-1)	07
08	PVC insulated. Non-Sheathed General Purpose Cable, 450/750 V, Single-CoreReference Table-2 (Rigid Copper Conductor) & Reference Table-3 (Flexible Copper Conductor)	08-09
09	PVC Insulated, Non Sheathed Cable for Internal Wiring, 300/500 V Single Core Twisted Twin (Reference Table-4)	10
10	PVC Insulated, PVC Sheathed, Light Cable 300/500 V, Circular Twin, 3-Core, 4-Core and 5-Core. (Reference Table - 5)	11-12
11	PVC Insulated, PVC Sheathed Cable, 300/500 V, Single Core, Flat Twin, and 3-Core, (Reference Table - 6)	13
12	PVC Insulated, PVC Sheathed Cable, with circuit protective conductor, 300/500 V, Single Core, Flat Twin, & 3-Core, .(Reference Table 7)	14
13	Oil Resisting PVC Sheathed, Screened Cables, 300/500 V, having between 2 and 60 Cores (Reference Table —8)	15-16
14	14 Electrical Test (Routine tests) 1. Core Stage Testing 2. Integrity Tests on completed Cables	17-17
	Note: Current Carrying Capacity and Voltage Drop, single core unarmoured and multicore non-armoured cables (copper conductors) (Reference Tables 3,4,7,8 & 8a Pages 37,38,41 & 42respectively-Section III)	
	Section III **PVC Insulated, PVC Sheath, Un-Armoured and Armoured Power Cables, 600/1000 V & 1900/3300 V to BS 6346**	
15	General Specification	18
16	Index for Dimensions, Weights and Electrical Characteristics	19
17	Dimensions and Weights Copper Cables,including Auxiliary Cables (Reference Table1-8)	20-23
18	Dimensions and Weights Aluminium Cables (Reference Table 9-14)	24-26

SECTION I

Section-I

Introduction

UNIVERSAL CABLE INDUSTRIES LTD. Established in the year 1978 as small PVC insulated wires, cables and flexible cords manufacturing company. We planned the expansion of our operations facilities, and diversification of product range with a foresighted vision, a pioneering spirit, innovative approach, and the expertise of a highly motivated workforce. Today, we are proud to have a professional team, excellent infrastructure facilities and sales network together synergized for the ultimate objectives of customer satisfaction, quality and safety.

Today, **UCIL** is one of the prime suppliers to the power, automotive, telecommunications, construction and Special Project sectors. It is in the tune with the freedom spirit of Pakistan for economic growth, liberalization and globalization.

UCIL is committed to supplying only the highest quality products along with continuous support for customer's needs and requirements. Our success can be attributed to the consistent production of a superior quality product. In addition to the emphasis on quality, we are continuously devoting significant resources to acquire a unique state of the art operational facilities as well as providing dependable and reliable products and services to the custome

UCIL is one of the leading companies in producing cables that are tailor made to customer specifications. Here, every customer customer is considered like an appreciating asset and our services remain always with the customer before and after sales.

Here, the customers are assured of Quality, Reliability and complete customer satisfaction.

At **UCIL** as business entity, all our employees, by their thinking and actions will make sure to exercise optimum utilization of resources, highest quality and best services in the industry. At all times, we will go for an extra mile to help our customers thrive, very much believing that our success depends on theirs.

This catalogue illustrates the construction, dimension, and provides electrical data regarding our range of product based on BSS and IECspecifications.We also manufacture cables to other international cable standard such as a ASTM,JIS,VDE etc, and also cater to the specific needs to suit special requirements of our customers. At present we also manufacture a complete range of low voltage electric supply cables, overhead conductors,telecommunication cables, aluminium rod and copper rod and different types of specialty wires and cables. We strongly believe in continuous quality improvement and diversification of our product range and services in quest to meet the ever increasing needs of our valued customers.

We are always ready to provide detailed information about our products, services and related technical know-how and we can assure our best attention to meet the expectations and requirements of our valued patrons. Your patronage and advice would always be a source of encouragement and inspiration and will be most cordially welcomed.

OBJECTIVE:-

The management has full commitment and involvement to entire Management System to ensure the fullest implementation of our Quality Policy and thus maintain a standard that meets the customer's satisfaction and fulfills social and economic objectives of the country.

QUALITY POLICY:-

An effective and practicable quality policy has been drawn up comprising following features:

- The customer is foremost in our system.
- Quality is not only considered for verification and validation but also built in our manufacturing processes and services.
- Quality is considered as teamwork approach and everyone has a responsibility towards quality.
- Our suppliers are our partners in achieving quality in our products.
- The customer-supplier concept is also applied in internal processes.
- Corrective and preventive actions are used as a tool for continuous improvement.
- Fair and professional engagement with customers is our hallmark.

Since we continuously aim at meeting the quality as expected by our customers, we always strive to apply good industrial & commercial practices and our processes are geared up to ensure our customers' fullest satisfaction.

Here, in **UNIVERSAL**, we are much conscious of harmful effects of industrial waste and pollutants and determined to take all possible measures to protect the environment by meeting the laid down requirements of national and international organizations.

Product Range:

Energy Cables and Conductors Communication, Automobile, Specialty Wires & Cables, Copper Braids, Aluminium Rod & Copper Rod

Establishment:

Head Office / Marketing & Sales Department

61/C, Jami Commercial Street No.7 Phase - VII,D.H.A.,
Karachi -Pakistan.
Phone # 021-35382392/5 - 35804571-75, **111-786-825**
Fax # 021- 35382391- 35804576
E-Mail: sales@ucil.com.pk
URL : http://www.ucil.com.pk

Factory Building:

Plot No. A-25 North Western Industrial Zone,
Bin Qasim, Karachi.
Phone # 021-34750454-58, Fax # 021-34750462

Regional Sales Office Lahore :

Office # 222, 2nd Floor, Siddiq Trade Center,
72 main Boulebard, Gulberg III, Lahore.
Phone: (042) 35787640-41 Fax: (042) 35787610
E-Mail: lahore@ucil.com.pk

NOTES

NOTES

SECTION II

SECTION II

PVC insulated and PVC sheathed wires & cables
450/750 V and 300/500V to BS 6004:2000

Excellent Features:-

- Good moisture resistant.
- Oil & chemical resistant (consult the manufacturer, in specific cases).
- Bright colour circuit identification.
- Generally flame retardant (the flame extinguishes when the source of fire is removed).
- Easy handling because of flexibility and easy striping.
- Good physical properties.
- Superior electrical performance, voltage withstand and insulation resistance performance meeting the specified levels (for insulation grades).

Polyvinyle Chloride Compounds (PVC)

For more useful information for different types of PVC compounds as insulation and sheathing material for electrical cables,please refer to page 61 & 62.

Type of PVC for Insulation and Sheath to BS 7655

Insulation TI 1 General purpose Sheath type : TM 1 Hard,TM 5 (oil resistant) and TM1 : Type 6 General purpose

To meet specific environmental requirements and installation conditions, the other types of PVC compounds can be used as per customer's requirement.

Product Families

1. PVC insulated non- sheathed, general purpose cable-rigid &Flexible Copper Conductor (single core),450/750 V.

1a. PVC insulated non- sheathed cable for internal wiring,300/500 V.single core and twisted twin.

PVC insulated,PVC sheathed, circular twin core,three core, four core, and five core Cables 300/500 V (Light duty cables);

3. PVC insulated,PVC sheathed Cable, 300/500 V, single core, flat twin and 3-core.

3a. PVC insulated, PVC sheathed single core, flat twin and 3-core cables with circuit protective conductor, 300/500 V.

4. Oil resisting PVC sheathed,screened cables, 300/500 V, having between 2 and 60 cores.

Applicability: For Electric power supply & lighting in domestic, industrial and public, commercial buildings, farmhouse, workshop, and internal wiring.

Compatibility: The problems such as over-spacing and difficulty in threading through conduits, using with terminations and other fittings are taken care by exercising strict dimensional control in our products.

Availability: Our products are readily available from all our authorized dealers and electrical goods sales depots etc.

Compliant to: IEE applicable Regulations (**16th Edition / BS 7671:2001**), BS 6004:2000. BS 6360:1991 and BS 7655 1997

Note: We can also manufacture to other equivalent international standards, such as PS-714, IEC 502. VDE 0271, etc.

General Construction

1. PVC insulated, non-sheathed general purpose cable, 450/750 V. single core.
PVC insulated wires for conduit.
Conductor (Rigid or Flexible as applicable)
Plain annealed copper solid, copper stranded or copper flexible conductor complying with BS 6360
Insulation
PVC to comply with BS 7655
A single Layer of extruded PVC with circuit identification colours Green / yellow, blue or other colours.
Reference Table-2 & 3

1a. PVC insulated, non-sheathed cable for internal wiring, 300/500 v, single core and twisted twin.
Conductor
Plain annealed copper solid, copper stranded or flexible conductor complying with BS 6360
Insulation
A single Layer of extruded PVC with circuit identification colours Green / yellow, blue or other colours
Reference Table-4

2. PVC insulated, PVC sheathed. light cable, 300/500 V. circular twin, three-core, four-core & five-core.
Conductor
Plain annealed copper single solid or stranded in accordance with BS 6360
Insulation
An extruded layer of PVC complying with BS 7655
Circuit Identification:
The specific core identification colours are indicated in the appropriate construction table.
Sheath
An extruded layer of PVC complying with BS 7655
Colour of sheath :(as indicated in the construction table)
Reference Table-5

3. PVC/PVC single core, flat twin and 3 core cables, 300/500 V. and with circuit protective conductor.
Conductor
Plain annealed copper single solid or stranded in accordance with BS 6360
Insulation
PVC complying with BS 7655 with circuit identification colours as indicated in construction table.
Sheath An extended layer of PVC complying with BS-7655
Colour of sheath: as indicated in construction table.
Reference Table-6 & 7 (with circuit protective conductor)

4. Oil resisting PVC/PVC. screened cables, 300/500 V. having between 2 & 60 cores.
Conductor
Plain annealed flexible copper conductor in accordance with BS 6360
Insulation
An extruded layer of PVC complying with BS 7655 with circuit identification, white numerals on black core, except green/yellow core (in assemblies having three or more cores).
Sheath
PVC Type TM5 (Oil resisting to BS 7655)
Reference Table-8
Note: 1. Cable Marking: UNIVERSAL or as per order
2. Conductor-Class-I copper solid, Class-2 copper stranded and Class-5 copper flexible as indicated in Table-I page-7.

Operating and Installation Engineering Data
PVC insulated cables to BS 6004: 2000

Operating Temperatures:

To ensure normal expected service life of the PVC insulated wires and cables, these products shall not be exposed to more than the maximum allowed operating temperature of 70° C. However, PVC compound will withstand occasional fault current overloads of short duration without any harmful effects.

Current Ratings and Associated Voltage Drop:

The recommended current ratings of IEE Wiring Regulations (Sixteenth Edition)/BS 767 1:2001. for Electrical Installations) are tabulated on pages 37, 38, 41 & 42 Reference Tables 3,4,7.8 & 8a (un-armoured/copper conductor). However, in case of specific conditions: the advice can be obtained from our technical department.

Wires and Cables Dimension:

In **UNIVERSAL,** strict dimensional control is exercised to ensure that the dimensions do not exceed the nominal ones as indicated in this publication in the relevant tables, which are in line with in BS 6004 and PS-714, inclusive of allowable maximum tolerances.

Installation Criteria:

The wires and cables as presented in Section - II of this catalogue shall be installed in accordance with applicable regulations of IEE publication.

Conductor Information

Copper & Aluminium Conductors, Construction & Configuration alongwith Maximum d.c. Resistance in compliant to IEC 228 & BS-6360

Table - 1

Nominal cross-sectional Area	Circular conductors no. / diameter of wires	Shaped/compacted stranded conductors minimum no. of wires		Maximum d.c. resistance at 20° C ohm/km		Flexible conductors	
						No./ diameter of wires	Max.d.c. resistance at 20° C
(mm^2)	mm	CU	AL	CU	AL	CU	Ohm/km
0.50	1/0.80	-	-	36.0	-	16/0.20	39.0
0.50	7/0.31	-	-	36.0	-		
0.75	1/0.97	-	-	24.5	-	24/0.20	26.0
0.75	7/0.37	-	-	24.5	-		
1	1/1.13	-	-	18.1	-	32/0.20	19.5
1	7/0.44	-	-	18.1	-		
1.5	1/1.38	-	-	12.1	-	30/0.25	13.3
1.5	7/0.53	-	-	12.1	-		
2.5	1/1.77	-	-	7.41	-	50/0.25	7.98
2.5	7/0.67	-	-	7.41	-		
4	7/0.85	-	-	4.61	7.41	56/0.30	4.95
6	7/1.04	-	-	3.08	4.61	84/0.30	3.30
10	7/1.35	-	-	1.83	3.08	80/0.40	1.91
16	7/1.70	6	6	1.15	1.91	126/0.40	1.21
25	7/2.14	6	6	0.727	1.20	196/0.40	0.780
35	7/2.52	6	6	0.524	0.868	276/0.40	0.554
50	19/1.78	6	6	0.387	0.641	396/0.40	0.386
70	19/2.14	12	12	0.268	0.443	360/0.50	0.272
95	19/2.52	15	15	0.193	0.320	475/0.50	0.206
120	37/2.03	18	15	0.153	0.253	608/0.50	0.161
150	37/2.25	18	15	0.124	0.206	756/0.50	0.129
185	37/2.52	30	30	0.0991	0.164	925/0.50	0.106
240	61/2.25	34	30	0.0754	0.125	1221/0.50	0.0801
300	61/2.52	34	30	0.0601	0.100	1525/0.50	0.0641
400	61/2.85	53	53	0.0470	0.0778	2013/0.50	0.0486
500	61/3.20	53	53	0.0366	0.0605	1769/0.60	0.0384
630	127/2.52	53	53	0.0283	0.0469	2257/0.60	0.0287
800	127/2.85	-	-	0.0221	0.0367	-	-
1000	127/3.20	-	-	0.0176	0.0291	-	-

NOTE: For nominal sectional area 4mm² to 10mm² conductor can also be supplied as solid Class 1

PVC insulated non-sheathed general purpose cable, 450/750 V, single core

SPECIFICATION:

a) Rigid copper conductor.

Note 1: The cables may be suitable for voltages up to 1000 V a.c. or up to 750 V to earth d.c.

Construction:

Conductor -Class 1 copper, solid, or class 2 copper , stranded, as indicated below.

Insulation -PVC type TI 1.

Colours for core identification:

Green/Yellow, blue or other colours.

Table - 2

Nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Mean overall diameter		Minimum insulation resistance at 70°C
			Lower limit	Upper limit	
mm^2		mm	mm	mm	MΩkm
1.5	1	0.7	2.6	3.2	0.011
1.5	2	0.7	2.7	3.3	0.010
2.5	1	0.8	3.2	3.9	0.010
2.5	2	0.8	3.3	4.0	0.0099
4	1	0.8	3.6	4.4	0.0087
4	2	0.8	3.8	4.6	0.0082
6	1	0.8	4.1	5.0	0.0074
6	2	0.8	4.3	5.2	0.0070
10	1	1.0	5.3	6.4	0.0072
10	2	1.0	5.6	6.7	0.0067
16	2	1.0	6.4	7.8	0.0056
25	2	1.2	8.1	9.7	0.0053
35	2	1.2	9.0	10.9	0.0046
50	2	1.4	10.6	12.8	0.0046
70	2	1.4	12.1	14.6	0.0040
95	2	1.6	14.1	17.1	0.0039
120	2	1.6	15.6	18.8	0.0035
150	2	1.8	17.3	20.9	0.0035
185	2	2.0	19.3	23.3	0.0035
240	2	2.2	22.0	26.6	0.0034
300	2	2.4	24.5	29.6	0.0033
400	2	2.6	27.5	33.2	0.0031
500	2	2.8	30.5	36.9	0.0030
630	2	2.8	34.0	41.1	0.0027

PVC insulated non-sheathed general purpose cable, 450/750 V, single core

SPECIFICATION:

b) Flexible copper conductor.

Note 1: The cables may be suitable for voltages up to 1000 V a.c. or up to 750 V to earth d.c.

Construction:

Conductor -Class 5 copper, flexible.

Insulation -PVC type TI 1.

Colours for core identification:

Green/Yellow, blue or other colours.

Table - 3

Nominal cross-sectional area of conductor	Radial thickness of insulation	Mean overall diameter		Minimum insulation resistance at 70°C
		Lower limit	Upper limit	
(mm^2)	mm	mm	mm	MΩkm
1.5	0.7	2.8	3.4	0.010
2.5	0.8	3.4	4.1	0.0095
4	0.8	3.9	4.8	0.0078
6	0.8	4.4	5.3	0.0068
10	1.0	5.7	6.8	0.0065
16	1.0	6.7	8.1	0.0053
25	1.2	8.4	10.2	0.0050.
35	1.2	9.7	11.7	0.0043
50	1.4	11.5	13.9	0.0042
70	1.4	13.2	16.0	0.0036
95	1.6	15.1	18.2	0.0036
120	1.6	16.7	20.2	0.0032
150	1.8	18.6	22.5	0.0032
185	2.0	20.6	24.9	0.0032
240	2.2	23.5	28.4	0.0031

PVC insulated non-sheathed general purpose cable 450/750 V, single- core

Construction:

Conductor - Class 1 copper, solid, or class 2 copper, stranded or class 5 copper, flexible.
Insulation - PVC type T I 1.
Sheath - PVC type 6.

Colours for core identification:
Green/Yellow, blue or other colours.

Table - 4

Nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Mean overall diameter		Minimum insulation resistance at 70°C
			Lower limit	Upper limit	
(mm^2)	mm	mm	mm	mm	MΩkm
0.50	1	0.6	1.9	2.3	0.014
0.75	1	0.6	2.1	2.1	0.013
1	1	0.6	2.2	2.2	0.011
0.50	2	0.6	2.0	2.0	0.014
0.75	2	0.6	2.2	2.2	0.012
1	2	0.6	2.3	2.3	0.011
0.50	5	0.6	2.1	2.1	0.013
0.75	5	0.6	2.2	2.2	0.011
1	5	0.6	2.4	2.4	0.010

PVC insulated PVC sheathed, light cable, 300/500V, circular twin, 3-core, 4-core and 5-core

Construction:

Conductor - Class 1 Copper, solid, or class 2 copper , stranded, as indicated below.
Insulation - PVC type TM 1.
Sheath - -PVC type TM 1.

The cores shall be twisted together. A center filler may be used.
The twisted cores shall be covered by an extruded inner covering. It shall be possible to separate the cores easily.
The sheath shall fit closely but not adhere to the inner covering.

Colours for core identification:

Twin : red and black
Three core : red, yellow and blue
Four core : red, yellow, blue and black
Five core : red, yellow, blue, black and green/yellow

Colour of Sheath: Grey or black as per customer's order.

Table - 5

Number & nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Thickness of inner covering	Radial thickness of sheath	Mean overall diameter		Minimum insulation resistance at 70°C
					Lower limit	Upper limit	
mm^2		mm	mm	mm	mm	mm	MΩkm
2 x 1.5	1	0.7	0.4	1.2	8.4	10.0	0.011
	2	0.7	0.4	1.2	8.4	10.5	0.011
2 x 2.5	1	0.8	0.4	1.2	9.6	11.5	0.010
	2	0.8	0.4	1.2	9.6	12.0	0.009
2 x 4	1	0.8	0.4	1.2	10.5	12.5	0.0085
	2	0.8	0.4	1.2	10.5	13.0	0.0077
2 x 6	1	0.8	0.4	1.2	11.5	13.5	0.0070
	2	0.8	0.4	1.2	11.5	14.0	0.0065
2 x 10	1	1.0	0.6	1.4	14.5	16.5	0.0070
	2	1.0	0.6	1.4	15.0	17.5	0.0065
2 x 16	2	1.0	0.6	1.4	16.5	20.0	0.0052
2 x 25	2	1.2	0.8	1.4	20.5	24.0	0.0050
2 x 35	2	1.2	1.0	1.6	23.0	27.5	0.0044
3 x 1.5	1	0.7	0.4	1.2	8.8	10.5	0.011
	2	0.7	0.4	1.2	8.8	11.0	0.010
3 x 2.5	1	0.8	0.4	1.2	10.0	12.0	0.010
	2	0.8	0.4	1.2	10.0	12.5	0.009

PVC insulated PVC sheathed, light cable, 300/500V, circular twin, 3-core, 4-core and 5-core

Table - 5 (Cont.)

Number & nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Thickness of inner covering	Radial thickness of sheath	Mean overall diameter		Minimum insulation resistance at 70°C
					Lower limit	Upper limit	
mm^2		mm	mm	mm	mm	mm	MΩkm
3 x 4	1	0.8	0.4	1.2	11.0	13.0	0.0085
	2	0.8	0.4	1.2	11.0	13.5	0.0077
3 x 6	1	0.8	0.4	1.4	12.5	14.5	0.0070
	2	0.8	0.4	1.4	12.5	15.5	0.0065
3 x 10	1	1.0	0.6	1.4	15.5	17.5	0.0070
	2	1.0	0.6	1.4	15.5	19.0	0.0065
3 x 16	2	1.0	0.8	1.4	18.0	21.5	0.0052
3 x 25	2	1.2	0.8	1.6	22.0	26.0	0.0050
3 x 35	2	1.2	1.0	1.6	24.5	29.0	0.0044
4 x 1.5	1	0.7	0.4	1.2	9.6	11.5	0.011
	2	0.7	0.4	1.2	9.6	12.0	0.010
4 x 2.5	1	0.8	0.4	1.2	11.0	13.0	0.010
	2	0.8	0.4	1.2	11.0	13.5	0.009
4 x 4	1	0.8	0.4	1.4	12.0	14.5	0.0085
	2	0.8	0.4	1.4	12.5	15.0	0.0077
4 x 6	1	0.8	0.6	1.4	14.0	16.0	0.0070
	2	0.8	0.6	1.4	14.0	17.0	0.0065
4 x 10	1	1.0	0.6	1.4	16.5	19.0	0.0070
	2	1.0	0.6	1.4	17.0	20.5	0.0065
4 x 16	2	1.0	0.8	1.4	20.0	23.5	0.0052
4 x 25	2	1.2	1.0	1.6	24.5	28.5	0.0050
4 x 35	2	1.2	1.0	1.6	27.0	32.0	0.0044
5 x 1.5	1	0.7	0.4	1.2	10.0	12.0	0.011
	2	0.7	0.4	1.2	10.0	12.5	0.010
5 x 2.5	1	0.8	0.4	1.2	11.5	14.0	0.010
	2	0.8	0.4	1.2	12.0	14.5	0.009
5 x 4	1	0.8	0.6	1.4	13.5	16.0	0.0085
	2	0.8	0.6	1.4	14.0	17.0	0.0077
5 x 6	1	0.8	0.6	1.4	15.0	17.5	0.0070
	2	0.8	0.6	1.4	15.5	18.5	0.0065
5 x 10	1	1.0	0.6	1.4	18.0	21.0	0.0070
	2	1.0	0.6	1.4	18.5	22.0	0.0065
5 x 16	2	1.0	0.8	1.6	22.0	26.0	0.0052
5 x 25	2	1.2	1.0	1.6	27.0	31.5	0.0050
5 x 35	2	1.2	1.2	1.6	30.0	35.0	0.0044

PVC insulated PVC sheathed, 300/500V, single core, flat twin and 3-core

Construction:

Conductor - Class 1plain Copper, solid, or class 2 plain copper , stranded, as indicated below.
Insulation - PVC type T I 1.
Sheath - -PVC type 6.

In twin and 3- core cables, the cores shall be laid parallel.
The sheath shall fit closely but not adhere to the inner covering.

Colours for core identification:

Single core : red and black
Twin core : red and black or for 2 x 1 and 1.5 cables red and red.

Colour of Sheath:

Single core : black, brown, grey, red or white.
Flat twin and 3-core grey or white or as per customer's requirement.

Table - 6

Number & nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Radial thickness of sheath	Mean overall diameter		Minimum insulation resistance at 70°C
				Lower limit	Upper limit	
mm^2		mm	mm	mm	mm	MΩkm
1x1.0	1	0.6	0.8	3.8	4.5	0.011
1x1.5	1	0.7	0.8	4.2	4.9	0.011
1x2.5	1	0.8	0.8	4.8	5.8	0.010
1x4	2	0.8	0.9	5.4	6.8	0.0077
1x6	2	0.8	0.9	6.0	7.4	0.0065
1x10	2	1.0	0.9	7.2	8.8	0.0065
1x16	2	1.0	1.0	8.4	10.5	0.0052
1x25	2	1.2	1.1	10.0	12.5	0.0050
1x35	2	1.2	1.1	11.0	13.5	0.0044
2x1.0	1	0.6	0.9	4.0 x 6.2	4.7 x 7.4	0.011
2x1.5	1	0.7	0.9	4.4 x 7.0	5.4 x 8.4	0.011
2x2.5	1	0.8	1.0	5.2 x 8.4	6.2 x 9.8	0.010
2x4	2	0.8	1.0	5.6 x 9.6	7.2 x 11.5	0.0077
2x6	2	0.8	1.1	6.4 x 10.5	8.0 x 13.0	0.0065
2x10	2	1.0	1.2	7.8 x 13.0	9.6 x 16.0	0.0065
2x16	2	1.0	1.3	9.0 x 15.5	11.0 x 18.5	0.0052
3x1.0	1	0.6	0.9	4.0 x 8.4	4.7 x 9.8	0.011
3x1.5	1	0.7	0.9	4.4 x 9.8	5.4 x 11.5	0.011
3x2.5	1	0.8	1.0	5.2 x11.5	6.2 x 13.5	0.010
3x4	2	0.8	1.1	5.8 x 13.5	7.4 x 16.5	0.0077
3x6	2	0.8	1.1	6.4 x 15.0	8.0 x 18.0	0.0065
3x10	2	1.0	1.2	7.8 x 19.0	9.6 x 22.5	0.0065
3x16	2	1.0	1.3	9.0 x 22.0	11.0 x 26.5	0.0052

PVC insulated PVC sheathed cable with circuit protective conductor, 300/500V, single -core, flat twin and 3-core

Construction:

Conductor - Class 1 plain copper, solid, or class 2 plain copper , stranded, as indicated below.
Insulation - PVC type TM 1.
Sheath - PVC type TM 1.

The core or cores shall be laid parallel with the uninsulated circuit protective conductor.
The sheath shall fit closely but not adhere to thecore(s).

Position of circuit protective conductor.
Twin - centrally placed between cores in same plane.
3 - core - centrally placed between yellow and blue cores in same plane.

Colours for core identification:
Single core : red and black
Twin : red and black or for 2 x 1 and 2 x 1.5 cables,red and red
Three core : red, yellow, blue and black
Five core : red, yellow (center core) and blue

Colour of Sheath:
Single core - black, brown, grey, red or white.
Flat twin & 3- core grey or white

Table - 7

Number & nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Radial thickness of sheath	Mean overall diameter		Circuit protective conductor, nominal cross-sectional area of conductor	Minimum insulation resistance at 70°C
				Lower limit	Upper limit		
mm^2		mm	mm	mm	mm	mm	MΩkm
1 x 1.0	1	0.6	0.9	4.0 x 5.1	5.2 x 6.4	1.0	0.011
1 x 1.5	1	0.7	0.9	4.4 x 5.4	5.8 x 7.0	1.0	0.011
2 x 1.0	1	0.6	0.9	4.0 x 7.2	4.7 X 8.6	1.0	0.011
2 x 1.5	1	0.7	0.9	4.4 x 8.2	5.4 x 9.6	1.0	0.011
2 x 2.5	1	0.8	1.0	5.2 x 9.8	6.2 x 11.5	1.5	0.010
2 x 4	2	0.8	1.0	5.6 x 10.5	7.2 x 13.0	1.5	0.0077
2 x 6	2	0.8	1.1	6.4 x 12.5	8.0 x 15.0	2.5	0.0065
2.10	2	1.0	1.2	7.8 x 15.5	9.6 x 19.0	4	0.0065
2 x 16	2	1.0	1.3	9.0 x 18.0	11.0 x 22.5	6	0.0052
3 x 1.0	1	0.6	0.9	4 x 9.6	4.7 x 11.0	1.0	0.011
3 x 1.5	1	0.7	0.9	4.4 x 10.5	5.4 x 12.5	1.0	0.011
3 x 2.5	1	0.8	1.0	5.2 x 12.5	6.2 x 14.5	1.0	0.010
3 x 4	2	0.8	1.0	5.8 x 14.5	7.4 x 18.0	1.5	0.0077
3 x 6	2	0.8	1.1	6.4 x 16.5	8.0 x 20.0	2.5	0.0065
3 x 10	2	1.0	1.2	7.8 x 21.0	9.6 x 25.5	4	0.0065
3 x 16	2	1.0	1.3	9.0 x 24.5	11.0 x 29.5	6	0.0052

Oil resisting PVC sheathed screened cables, 300/500V, having between 2 and 60 cores

Construction:

Conductor	-	Class 5 Copper
Insulation	-	PVC type TI 2
Inner sheath	-	PVC type TM 2
Braided Screen	-	Plain or tinned copper wires.
Sheath	-	PVC type TM 5.

The cores shall be twisted together, if necessary, in several concentric layers.
A center core is not permitted but a center filter of suitable material may be applied..
Assemblies with three or more cores shall have one core coloured green / yellow.
Around each layer a tape may be applied which may cover the cores fully or partly. The tape shall not adhere to the cores.
For two core cables, the space between the cores shall be filled either by separate fillers or by the sheath filling the interstices.

Colour identification:
Except for the green/yellow core, if any all cores shall be identified by number in accordance with BS EN 50334 using black as the base and white for the inscription

Table - 8

Number & nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Thickness of inner covering	Radial thickness of sheath	Mean overall diameter		Minimum insulation resistance at 70°C
					Lower limit	Upper limit	
mm^2		mm	mm	mm	mm	mm	MΩkm
2 x 0.5	0.6	0.7	0.16	0.9	7.7	9.6	0.013
2 x 0.75	0.6	0.7	0.16	0.9	8.0	10.0	0.011
2 x 1	0.6	0.7	0.16	0.9	8.2	10.3	0.010
2 x 1.5	0.7	0.7	0.16	1.0	9.3	11.6	0.010
2 x 2.5	0.8	0.7	0.16	1.1	10.7	13.3	0.009
3 x 0.5	0.6	0.7	0.16	0.9	8.0	10.0	0.013
3 x 0.75	0.6	0.7	0.16	0.9	8.3	10.4	0.011
3 x 1	0.6	0.7	0.16	1.0	8.8	11.0	0.010
3 x 1.5	0.7	0.7	0.16	1.0	9.7	12.1	0.010
3 x 2.5	0.8	0.7	0.16	1.1	11.3	14.0	0.009
4 x 0.5	0.6	0.7	0.16	0.9	8.5	10.7	0.013
4 x 0.75	0.6	0.7	0.16	1.0	9.1	11.3	0.011
4 x 1	0.6	0.7	0.16	1.0	9.4	11.7	0.010
4 x 1.5	0.7	0.7	0.16	1.1	10.7	13.2	0.010
4 x 2.5	0.8	0.8	0.16	1.2	12.6	15.5	0.009
5 x 0.5	0.6	0.7	0.16	1.0	9.3	11.6	0.013
5 x 0.75	0.6	0.7	0.16	1.0	9.7	12.1	0.011
5 x 1	0.6	0.7	0.16	1.1	10.3	12.8	0.010
5 x 1.5	0.7	0.8	0.16	1.2	11.8	14.7	0.010
5 x 2.5	0.8	0.8	0.21	1.3	13.9	17.2	0.009

Oil resisting PVC sheathed screened cables, 300/500V, having between 2 and 60 cores (continued)

Table - 8 (Cont.)

Number & nominal cross-sectional area of conductor	Class of conductor	Radial thickness of insulation	Thickness of inner covering	Radial thickness of sheath	Mean overall diameter		Minimum insulation resistance at 70°C
					Lower limit	Upper limit	
mm²		mm	mm	mm	mm	mm	MΩkm
6 x 0.5	0.6	0.7	0.16	1.0	9.9	12.4	0.013
6 x 0.75	0.6	0.7	0.16	1.1	10.5	13.1	0.011
6 x 1	0.6	0.7	0.16	1.1	11.0	13.6	0.010
6 x 1.5	0.7	0.8	0.16	1.2	12.7	15.7	0.010
6 x 2.5	0.8	0.8	0.21	1.4	15.2	18.7	0.009
7x 0.5	0.6	0.7	0.16	1.1	10.8	13.5	0.013
7x 0.75	0.6	0.7	0.16	1.2	11.5	14.3	0.011
7 x 1	0.6	0.8	0.16	1.2	12.2	15.1	0.010
7 x 1.5	0.7	0.8	0.21	1.3	14.1	17.4	0.010
7 x 2.5	0.8	0.8	0.21	1.5	16.5	20.3	0.009
12 x 0.5	0.6	0.8	0.21	1.3	13.3	16.5	0.013
12x 0.75	0.6	0.8	0.21	1.3	13.9	17.2	0.011
12 x 1	0.6	0.8	0.21	1.4	14.7	18.1	0.010
12 x 1.5	0.7	0.8	0.21	1.5	16.7	20.5	0.010
12 x 2.5	0.8	0.9	0.21	1.7	19.9	24.4	0.009
18 x 0.5	0.6	0.8	0.21	1.3	15.1	18.6	0.013
18 x 0.75	0.6	0.8	0.21	1.5	16.2	19.9	0.011
18 x 1	0.6	0.8	0.21	1.5	16.9	20.8	0.010
18 x 1.5	0.7	0.8	0.21	1.7	19.6	24.1	0.010
18 x 2.5	0.8	0.9	0.21	2.0	23.3	28.5	0.009
27 x 0.5	0.6	0.8	0.21	1.6	18.0	22.1	0.013
27 x 0.75	0.6	0.9	0.21	1.7	19.3	23.7	0.011
27 x 1	0.6	0.9	0.21	1.7	20.2	24.7	0.010
27 x 1.5	0.7	0.9	0.21	2.0	23.4	28.6	0.010
27 x 2.5	0.8	1.0	0.26	2.3	28.2	34.5	0.009
36 x 0.5	0.6	0.9	0.21	1.7	20.1	24.7	0.013
36 x 0.75	0.6	0.9	0.21	1.8	21.3	26.2	0.011
36 x 1	0.6	0.9	0.21	1.9	22.5	27.6	0.010
36 x 1.5	0.7	1.0	0.26	2.2	26.6	32.5	0.010
36 x 2.5	0.8	1.1	0.26	2.4	31.5	38.5	0.009
48 x 0.5	0.6	0.9	0.26	1.9	23.1	28.3	0.013
48 x 0.75	0.6	1.0	0.26	2.1	24.9	30.4	0.011
48 x 1	0.6	1.0	0.26	2.1	26.1	31.9	0.010
48 x 1.5	0.7	1.1	0.26	2.4	30.4	37.0	0.010
48 x 2.5	0.8	1.2	0.31	2.4	35.9	43.7	0.009
60 x 0.5	0.6	1.0	0.26	2.1	25.5	31.1	0.013
60x 0.75	0.6	1.0	0.26	2.3	27.0	32.9	0.011
60 x 1	0.6	1.0	0.26	2.3	28.5	34.7	0.010
60 x 1.5	0.7	1.1	0.26	2.4	32.7	39.9	0.010
60 x 2.5	0.8	1.2	0.31	2.4	38.8	47.2	0.009

Electrical Test (Routine Tests)

(1) Core Stage Testing

All cores should be subjected either to the spark test or to the voltage and insulation resistance tests.

(1.1) Spark Test (Reference: STD BS 5099)

Tabulated radial thickness of insulation (mm)		Test voltage (kV)	
Above	Up to and including	a.c.(r.m.s)	d.c.
----	1.0	6	9
1.0	1.5	10	15
1.5	2.0	15	23
2.0	2.5	20	30
2.5	----	25	38

(1.2) Voltage Test

Tabulated radial thickness og insulation (mm)		Test voltage (kV)
Above	Up to and including	a.c.(r.m.s)
----	0.7	1.5
0.7	1.0	2.0
1.0	----	2.5

(1.3) Insulation Resistance Test

The insulation resistance of the length of cable in MΩkm should not be less than the minimum value specified in tables.

(1) Integrity Tests on Completed Cable

(2.1) Conductor Resistance Test

The D.C. resistance of each conductor is measured on the cable factory length which shall comply with the values as given in the Table - 1 on page-7 after correction to 20° C by applying correction factors as indicated in Table-B on Page-58

(2.2) Voltage Test (Twin and Multi-core cables)

(2.3) Insulation Resistance Test

Immediately after the completion of the voltage test described in (2.2),the insulation resistance test is carried out.


UNIVERSAL CABLES
Pakistan

NOTES

NOTES

SECTION III

Section III
General Specification
PVC insulated, PVC sheated,non-armoured and armoured,power cables,600/1000 V and 1900/3300 V to BS 6346

1 .Rated Voltage

600/1000 V
(Eo/E; Eo Volts between conductor and earth, E volts between conductors)

2. Conductors
The conductors shall be plain annealed copper conductor or aluminium, complying with BS 6360 and lEO 228. The conductors may be circular solid, circular stranded, circular compacted or shaped stranded as indicated in construction tables.

3. Insulation
The insulation shall be PVC compound complying with requirements of BS. 765.5 The grade of PVC compound is selected to give the required insulation resistance, flexibility, resistant to ageing and ability to withstand the 1eformation at high temperature.

4. Identification Of Cores*

The cores of cables shall be identified by colourof PVC compound or number printed on the surface of insulation.

-Single-core Red or Black
-Twin Red and Black
-Three-core Red, Yellow and Blue
-Four-core Red, Yellow, Blue and Black
-Five-core Red, Yellow, Blue, Black and Green/Yellow.

The PVC compound may be containing colour pigments or its skin will be of the required colour

*For detail refer to Regulation No 514 -06-0 1 lEE 16 Edition lBS 7671:2001

5. Laying Up
The cores of cables shall be laid up with right hand direction of lay. Where necessary, non-hydroscopic fillers may be applied.

6. Bedding (Armoured Cables)
The bedding of armoured cable shall be black PVC compound.

7. Armour
Wire armour shall consist of single layer of galvanized steel wires meeting the requirements as specified in Annex G (BS 6346:1997) and coating shall comply with BS.443. Where single-core cables are armoured and are used on a.c. circuits, the armour shall consist of non-magnetic material, such as aluminium.

8. Oversheath
The over sheath shall be black PVC compound complying with the requirements for TM1 material specified in BS 7655 section 4.1.

9. Marking
Theexternal surface of the oversheath all be embossed as described hereunder:

a)Electrical Cable ELECTRIC CABLE
b)Voltage Designation 600/1000V
3300V
c)British Standard Number BS.6346
d)Manufacturer's Identification XYZ
e)Number of cores,type and nominal area of conductor. .....

10.Minimum internal radii of bends in cables for fixed wiring.
regulation no.522-08-03 IEE 16 edition/BS7671:2001.The radius of every bend in wiring system shall be such that conductors and cables shall not suffer damage.

Type of insulation	Finish	Overall diameter(D)+	Factor applied to o'all diameter(D)+ of cable to get min.radius
Rubber or p.v.c. (circular, or circular stranded copper or aluminium conductors)	Non-armoured	Non exceeding 10 mm Exceeding 10mm but not exceeding 25mm Exceeding 25 mm	3(2)* 4(3)* 6
	armoured	Any	6
P.V.C (solid aluminium or shaped copper conductors)	armoured or Non-armoured	Any	8

+ For flat cables the factor is to be applied to the major axis
* The figure in brackers relates to single- core circular conductors of stranded construction installed in conduit, ducting or trunking.

11. Electrical Tests on Finished Cables
The following cable integrity tests are carried out on 100% factory lengths in accordance with the applicable cable standard.
(1) Voltage withstand test.
(2) Minimum insulation resistance test

Index for Dimensions, Weights and Electrical Characteristics

Dimensions and Weights:

For various core configuration and conductor material.

Copper-- Page: 20-23 Ref: Table Nos: 1,2, & 8

Aluminium-- Page: 24-26 Ref: Table Nos: 9,10,11,12,13 &14

Basis for Tabulated Current-Carrying Capacity, Voltage Drop, Determination of Size of Cable, and Minimum Voltage Drop In Consumers' Installations

Page: 27 - 34

Correction Factors:

For various cable configuration (grouping), installation conditions and ambient temperatures.

Page/Table: 3511, 36/2 & 2a

Tabulated Values-Current-Carrying Capacity (ampere Voltage Drop mV/A/m -

Ambient 30° C and conductor operating temperature 70° C for various cable configuration and Conductor material - Copper/Aluminiurn

Page/Table: 37/3, 38/4, 39/5, 40/6, 41/7, 42/8 & 8a, 43/9 & 44/10 (Copper Conductor)
Page/Table: 45/11, 46/12, 47/13, 48/14,49/15, 50/16, 5 1/17 & 52/18 (Aluminium Conductor)

Short Circuit Ratings

Armour fault currents to earth (for fault duration of 1 second) wire armour.
- Copper conductor cables page 53 (Reference Table-19)
- Guide for short circuit current—Copper conductor page-54 Figure-A(Graph).
- Aluminium conductor cables page 55 (Reference Table-20)
- Guide for short circuit current-Aluminium conductor page-56 Figure-B(Graph).

Comparison between imperial conductor sizes & nearest standard metric sizes,
Page: 57 Ref: Table-A
Temperature Correction Factors Page: 58 Ref: Table-B

Dimensions and Weights
Stranded Copper Conductors 600/1000 V
Non - armoured and Armoured,PVC Oversheathed Cables

Single Core **Table-1**

Nominal cross-sectional area of conductor	Thickness of insulation	Non - armoured		Armour wire diameter	Armoured	
		Approximate overall diameter	Approximate cable weight		Approximate overall diameter	Approximate cable weight
(mm^2)	mm	mm	kg/km	mm	mm	kg/km
50*	1.4	15.1	600	1.25	19.1	780
70*	1.4	16.9	810	1.25	21.1	1030
95*	1.6	19.4	1110	1.25	23.4	1330
120*	1.6	21.0	1350	1.60	26.3	1680
150*	1.8	23.2	1650	1.60	28.3	2000
185*	2.0	25.8	2060	1.60	30.8	2430
240*	2.2	29.0	2670	1.60	34.1	3090
300*	2.4	32.1	3320	1.60	37.0	3770
400*	2.6	35.8	4190	2.00	42.0	4830
500*	2.8	39.6	5230	2.00	45.6	5920
630*	2.8	43.8	6630	2.00	49.7	7420
800*	2.8	48.3	8330	2.50	55.8	9500
1000*	3.0	53.7	10440	2.50	61.0	11760

Two Core **Table-2**

1.5*	0.6	---	---	0.90	12.3	280
2.5*	0.7	---	---	0.90	13.6	350
4*	0.8	---	---	0.90	15.1	460
6*	0.8	---	---	0.90	16.5	550
10*	1.0	---	---	1.25	20.1	880
16*	1.0	18.5	540	1.25	21.9	990
25**	1.2	18.4	690	1.60	23.0	1280
35**	1.2	20.1	950	1.60	24.8	1610
50**	1.4	22.8	1260	1.60	27.8	2010
70**	1.4	25.5	1700	1.60	30.4	2520
95**	1.6	29.3	2310	2.00	35.5	3520
120**	1.6	31.8	2880	2.00	38.0	4200
150**	1.8	35.1	3520	2.00	41.3	4960
185**	2.0	39.1	4390	2.50	46.4	6390
240**	2.2	43.9	5760	2.50	51.2	8020
300**	2.4	48.7	7160	2.50	56.4	9710
400**	2.6	54.2	9040	2.50	61.9	11850

* Circular or compacted circular stranded conductors.
** Shaped stranded conductors.

Dimensions and Weights
Stranded Copper Conductors 600/1000 V
Non - armoured and Armoured,PVC Oversheathed Cables

Three Core **Table-3**

Nominal cross-sectional area of conductor	Thickness of insulation	Non - armoured		Armour wire diameter	Armoured	
		Approximate overall diameter	Approximate cable weight		Approximate overall diameter	Approximate cable weight
(mm^2)	mm	mm	kg/km	mm	mm	kg/km
1.5*	0.6	---	---	0.9	12.8	310
2.5*	0.7	---	---	0.9	14.1	390
4*	0.8	---	---	0.9	15.8	520
6*	0.8	---	---	1.25	18.0	730
10*	1.0	---	---	1.25	21.2	1010
16*	1.0	19.7	730	1.25	23.1	1210
25**	1.2	20.4	1000	1.60	25.0	1670
35**	1.2	22.4	1300	1.60	27.1	2050
50**	1.4	25.5	1720	1.60	30.5	2580
70**	1.4	28.7	2360	2.00	35.0	3590
95**	1.6	33.6	3330	2.00	39.3	4710
120**	1.6	36.3	4100	2.00	42.2	5590
150**	1.8	40.0	5020	2.50	47.5	7110
185**	2.0	44.6	6260	2.50	51.9	8240
240**	2.2	50.1	8150	2.50	57.8	10790
300**	2.4	55.6	10140	2.50	63.2	13040
400**	2.6	62.2	12860	2.50	69.6	16020

Four Core **Table-4**

1.5*	0.6	---	---	0.90	13.5	340
2.5*	0.7	---	---	0.90	15.0	430
4*	0.8	---	---	1.25	17.8	670
6*	0.8	---	---	1.25	19.2	800
10*	1.0	---	---	1.25	22.8	1110
16*	1.0	21.6	870	1.60	26.3	1490
25**	1.2	22.9	1330	1.60	27.8	2080
35**	1.2	25.4	1730	1.60	30.7	2570
50**	1.4	29.2	2320	2.00	35.4	3500
70**	1.4	33.0	3200	2.00	39.2	4470
95**	1.6	38.3	4380	2.00	44.3	5890
120**	1.6	41.8	5440	2.50	49.3	7510
150**	1.8	46.3	6680	2.50	53.6	8930
185**	2.0	51.3	8320	2.50	59.0	10800
240**	2.2	58.0	10870	2.50	65.7	13720
300**	2.4	64.6	13560	2.50	72.0	16670
400**	2.6	72.0	17150	3.15	81.3	21570

* Circular or compacted circular stranded conductors.

** Shaped stranded conductors.

Dimensions and Weights
Stranded Copper Conductors 600/1000 V
Non - armoured and Armoured,PVC Oversheathed Cables
Four Core with Reduced Neutral Conductor

Table-5

Nominal cross-sectional area of conductor		Thickness of insulation	Non - armoured		Armour wire diameter	Armoured	
			Approximate overall diameter	Approximate cable weight		Approximate overall diameter	Approximate cable weight
(mm^2)	mm	mm	mm	kg/km	mm	mm	kg/km
25**	16	1.2	22.9	1260	1.60	27.8	2020
35**	16	1.2	24.7	1590	1.60	29.5	2430
50**	25	1.4	28.3	2120	1.60	33.1	3050
70**	35	1.4	32.0	2890	2.00	38.0	4220
95**	50	1.6	37.5	3920	2.00	43.7	5460
120**	70	1.6	41.4	4890	2.50	49.0	6990
150**	70	1.8	44.7	5900	2.50	52.0	8180
185**	95	2.0	49.9	7400	2.50	57.2	9910
240**	120	2.2	56.0	9590	2.50	63.7	12470
300**	150	2.4	62.2	11910	2.50	69.8	15080
300**	185	2.4	64.2	12190	2.50	71.8	15360
400**	185	2.6	69.6	15470	3.15	78.6	19470

** Shaped stranded conductors

Dimensions and Weights
600/1000 V Armoured and Auxiliary Cables with
Stranded Copper Conductors

Table-6

Number of cores	Nominal cross-sectional area of conductor	Thickness of insulation	Armour wire diameter	Approximate overall diameter	Approximate cable weight
7	1.5	0.60	0.90	15.2	252
12			1.25	19.4	390
19			1.25	22.2	570
27			1.60	26.7	780
37			1.60	29.2	1020
48			1.60	32.9	1300
7	2.5	0.70	1.25	18.0	330
12			1.25	22.4	540
19			1.60	26.6	780
27			1.60	30.7	1100
37			1.60	34.0	1410
48			2.00	39.5	1810
7	4	0.80	1.25	20.5	480
12			1.60	26.8	780
19			1.60	30.5	1170
27			2.00	37.1	1650
37			2.00	40.8	2320
48			2.00	46.0	3020

* Circular stranded copper conductors (class-2)

Dimensions and Weights
Stranded Copper Conductors 1900/3300 V
Armoured PVC Oversheathed Cables

Single Core

Table-7

Nominal cross-sectional area of conductor	Thickness of insulation	Armour wire diameter	Approximate overall diameter	Approximate cable weight
(mm^2)	mm	mm	mm	kg/km
50	2.2	1.25	21.0	870
70	2.2	1.25	22.8	1110
95	2.2	1.60	26.0	1490
120	2.2	1.60	27.6	1770
150	2.2	1.60	29.4	2070
185	2.2	1.60	31.3	2470
240	2.2	1.60	34.1	3090
300	2.4	1.60	37.0	3770
400	2.6	2.00	42.0	4830
500	2.8	2.00	45.6	5920
630	2.8	2.00	49.7	7420
800	2.8	2.00	55.8	9500
1000	3.0	2.50	61.0	11760

Three Core

Table-8

16*	2.2	1.60	30.3	1800
25**	2.2	1.60	33.1	2250
35**	2.2	1.60	32.1	2570
50**	2.2	2.00	35.6	3330
70**	2.2	2.00	38.9	4140
95**	2.2	2.00	42.3	5110
120**	2.2	2.50	46.6	6450
150**	2.2	2.50	49.4	7430
185**	2.2	2.50	52.8	8730
240**	2.2	2.50	57.8	10830
300**	2.4	2.50	63.2	13090
400**	2.6	2.50	69.6	16090

* Aluminium wire armour.
* Circular or compacted circular stranded conductor (class-2).
** Shaped stranded conductor (class-2)

Dimensions and Weights
Stranded Copper Conductors 600/1000 V
Non - armoured and Armoured,PVC Oversheathed Cables

Single Core

Table-9

Nominal cross-sectional area of conductor	Thickness of insulation	Non - armoured		Armour wire diameter	Armoured	
		Approximate overall diameter	Approximate cable weight		Approximate overall diameter	Approximate cable weight
(mm^2)	mm	mm	kg/km	mm	mm	kg/km
50*	1.4	15.1	280	1.25	19.1	460
70*	1.4	16.9	360	1.25	21.1	570
95*	1.6	19.4	480	1.25	23.4	700
120*	1.6	21.0	570	1.60	26.3	890
150*	1.8	23.2	690	1.60	28.3	1030
185*	2.0	25.8	860	1.60	30.8	1220
240*	2.2	29.0	1090	1.60	34.1	1500
300*	2.4	32.1	1340	1.60	37.0	1770
400*	2.6	35.8	1670	2.00	42.0	2250
500*	2.8	39.6	2060	2.00	45.6	2700
630*	2.8	43.8	2440	2.00	49.7	3130
800*	2.8	48.3	2940	2.50	55.8	3890
1000*	3.0	53.7	3750	2.50	61.0	4790

Two Core

Table-10

16*	1.0	18.6	340	1.25	21.9	770
25**	1.2	18.4	380	1.60	23.0	940
35**	1.2	20.1	440	1.60	24.8	1110
50**	1.4	22.8	620	1.60	27.8	1330
70**	1.4	25.5	810	1.60	30.4	1580
95**	1.6	29.3	1080	2.00	35.5	2220

* Circular Stranded Conductor. (class 2)
** Shaped Stranded Conductors. (class 2)

Dimensions and Weights
Stranded Copper Conductors 600/1000 V
Non - armoured and Armoured,PVC Oversheathed Cables

Three Core

Table-11

Nominal cross-sectional area of conductor	Thickness of insulation	Non - armoured		Armour wire diameter	Armoured	
		Approximate overall diameter	Approximate cable weight		Approximate overall diameter	Approximate cable weight
(mm^2)	mm	mm	kg/km	mm	mm	kg/km
16*	1.0	19.7	420	1.25	23.1	860
25**	1.2	20.4	510	1.60	25.0	1160
35**	1.2	22.4	630	1.60	27.1	1340
50**	1.4	25.5	810	1.60	30.5	1630
70**	1.4	28.7	1060	2.00	35.0	2220
95**	1.6	33.6	1490	2.00	39.3	2800
120**	1.6	36.3	1780	2.00	42.2	3190
150**	1.8	40.0	2160	2.50	47.5	4140
185**	2.0	44.6	2690	2.50	51.9	4840
240**	2.2	50.1	3440	2.50	63.2	5900
300**	2.4	55.6	4250	2.50	69.6	6960

Four Core

Table-12

16*	1.0	21.6	500	1.60	26.3	1170
25**	1.2	22.9	650	1.60	27.8	1380
35**	1.2	25.4	780	1.60	30.7	1610
50**	1.4	29.2	1050	2.00	35.4	2240
70**	1.4	33.0	1380	2.00	39.2	2690
95**	1.6	38.3	1950	2.00	44.3	3420
120**	1.6	41.8	2320	2.50	49.3	4360
150**	1.8	46.3	2840	2.50	53.6	5050
185**	2.0	51.3	3520	2.50	59.0	6010
240**	2.2	58.0	4530	2.50	65.7	7310
300**	2.4	64.6	5620	2.50	72.0	8650

Note:-

* Circular or compacted Circular Stranded Conductor. (class 2)

** Shaped Stranded Conductors. (class 2)

Dimensions and Weights
Stranded Copper Conductors 600/1000 V
Non - armoured and Armoured,PVC Oversheathed Cables

Single Core

Table-13

Nominal cross-sectional area of conductor	Thickness of insulation	Armour wire diameter	Approximate overall diameter	Approximate cable weight
(mm^2)	mm	mm	mm	kg/km
50	2.2	1.25	21.0	550
70	2.2	1.25	22.8	650
95	2.2	1.60	26.0	850
120	2.2	1.60	27.6	970
150	2.2	1.60	29.4	1100
185	2.2	1.60	31.3	1250
240	2.2	1.60	34.1	1580
300	2.4	1.60	37.0	1770
400	2.6	2.00	42.0	2250
500	2.8	2.00	45.6	2700
630	2.8	2.00	49.7	3160
800	2.8	2.00	55.8	3890
1000	3.0	2.50	61.0	4790

Three Core

Table-14

16*	2.2	1.60	30.3	1470
25**	2.2	1.60	33.1	1680
35**	2.2	1.60	32.1	1820
50**	2.2	2.00	35.6	2320
70**	2.2	2.00	38.9	2720
95**	2.2	2.00	42.3	3190
120**	2.2	2.50	46.6	4010
150**	2.2	2.50	49.4	4450
185**	2.2	2.50	52.8	5030
240**	2.2	2.50	57.8	5950
300**	2.4	2.50	63.2	7000

Note:-
* Circular or compacted Circular Stranded Conductor. (class 2)
** Shaped Stranded Conductors. (class 2)

Current-Carrying Capacity and Voltage Drop

A.Basis for tabulated current carrying capacity:

The tabulated current carrying capacities relate to continuous loading and single circuit installation method as referred to in the tables and are based on the following criteria: Note: The details of installation methods are given in Appendix -A, page no.65-70

- For A.C. operating supply only to frequency 49 to 61 Hz.
- Ambient temperature of 30 C
- Conductor operating temperature of 70 C
- The current ratings for single core armoured cables are for the condition of armour bonded at both end to earth.

This to ensure "Full Thermal Current Ratings" for intended service life of the cables ,if cables are operated for any prolonged periods at higher than the indicated values of temperature that would result in earlier failure.

The selection of appropriate conductor size will also require to consider the following:

- Over current protection.
- Protection against thermal effects.
- Protection against electric shocks.
- Voltage Drop.
- Terminals' limiting temperature.

B. Correction factors for current-carrying capacity:

The current-carrying capacity of a cable for continuous service is affected by ambient temperature by grouping by partial or total enclosure in thermal insulating material and for a.c. by frequency This text provides correction factors in these respects as follows:

B1 Ambient temperature measurement

Table-2a(page 36) gives the correction factor to be applied to the tabulated current-carrying capacity depending upon the actual ambient temperature of the location in which the cable is to be installed.

In practice the ambient air temperatures may be determined by thermometers placed in free air as close as practicable to the position at which the cables are installed or are to be installed, subject to the proviso that the measurement are not to be influenced by the heat arising from the cables;thus if the measurements are made while the cables are loaded ,the thermometers should be placed about 0.5m or ten times the overall diameter of the cable,whichever is the lesser,from the cables,in the horizontal plane,or 150mm below the lowest of the cables. **Note:** The above referred to table does not take account of temperature increase if any, due to solar or other infra-red radiation. Where cables are subject to such radiation ,the current-carrying capacity may need to be specially calculated.

B2 Grouping

Tables 1&2 give the correction factors to be applied to the tabulated current-carrying capacity where cables or circuits are grouped.

B3 *Other frequencies*

In extreme cases, notably for large multicore cables,the reduction in current-carrying capacity of cables carrying, for example, balanced 400 Hz a.c compared with the current-carrying capacity at 50 Hz, may be as much 50%.For cables and flexible cords such as may be used to supply individual tools,the difference in the 50 Hz and the 400 Hz current-carrying capacities may be negligible.

B4 *Thermal insulation:*
In the appropriate tables of current - carrying capacities, provision is made for the installation of cables in thermally insulated wall or ceiling but in contact by thermally conductive surface on one side only, for a cable likely to be totally surrounded by thermally insulating material, the current-carrying capacity may, in the absence of more precise information, be taken as 0.5 times the value applicable to installation method 1 or 2 as appropriate.

C. Effective current carrying capacity:
The tabulated values relate to the maximum current that can be carried in the specified conditions without the conductors exceeding the permissible limit of steady state temperature for the type of insulation concerned.

The values of current tabulated represent the effective current-carrying capacity only where no correction factor is applicable.Otherwise the current-carrying capacity corresponds to the tabulated value multiplied by the appropriate factor or factors for ambient temperature,grouping and thermal insulation as applicable

Irrespective of the type of overcurrent protective device associated with the conductors concerned, the ambient temperature correction factors to be used when calculating current-carrying capacity (as opposed. to those used when selecting cable sizes) are those given in table-2a.

D. Relationship of current-carrying capacity to other circuit parameters:
The relevant symbols used in the Regulations are as follows:

I_z the current-carrying capacity of a cable for continuous service,under the particular installation conditions concerned .

I_t the value of current tabulated in this catalogue for the type of cable and installation method concerned for a single in an ambient temperature of 30 C.

I_b the design current of the circuit ie the curent intended to be carried by the circuit in normal service.

I_n the nominal current or current setting of the device protecting the circuit against overcurrent.

I_2 the operating current (ie the fusing current or tripping current for the conventional operating time) of the device protecting the circuit against overload.

C a correction factor to be applied where the installation conditions differ from those for whichvalues of current-carrying capacities are tabulated reference Tables 3 to 10(Copper conductor) and 11 to 18(Aluminium conductor) in this section of the catalogue.The
various correction factors are identified as follows.

- C_a for ambient temperature
- C_g for grouping,
- C_i for thermal insulation
- C_t for operating temperature of conductor.

In all circumstances Iz must be not less than Ib and In also must be not less than Ib. Where the overcurrent device is intended to afford protection against overload I2 must not exceed 1.45 Iz and In must not exceed Iz (seen item E below) .
Where the overcurrent device is intended to afford short circuit protection only In can be greater than Iz and I2 can be greater than 1.45 Iz.The protective device is then to be selected for compliance with Regulation 434-03-03.

E. Overload protection

Where overload protection is required the type of protection provided does not affect the current -carrying capacity of a cable for continuous service(Iz) but it may affect the choice of conductor size.The operating conditions of a cable are influenced not only by the limiting conductor temperature for continuous service but also by the conductor temperature which might be attained during the conventional operating time of the overload protection device in the event of an overload.
This means that the operating current of the protective device must not exceed 1.45 Iz. Where the protective device is a fuse to BS 88 or BS 1361 a circuit breaker to BS EN 60898 or BS EN 60947-2 or a residual current circuit-breaker with integral overcurrent protection to BS EN 61009-1 (RCBO), this requirement is satisfied by selecting a value of Iz not less than In.
In practice because of the standard steps in nominal rating of fuses and circuit-breakers it is often necessary to select a value of In exceeding Ib. In that case because it is also necessary for Iz in tern to be not less than the selected value of In the choice of conductor cross-sectional area may be dictated by the overload conditions and the current-carrying capacity (Iz) of the conductors will not always be fully used.
The size needed for conductor protected against overload by a BS-3036 semi-enclosed fuse can be obtained by the use of a correction factor ,1.45/2=0.725, which results in the same degree of protection as that afforded by other overload protective devices. This factor is to be applied to th the nominal rating of the fuse as a divisor , thus indicating the minimum value of It required of the conductor to be protected.In this case also the choice of conductor size is dictated by the overload conditions and current carrying capacity (Iz) of the conductors can not be fully used.

F. Determination of the size of cable to be used:

Having established the design current (Ib) of the circuit under consideration the appropriate procedure described in items E.1 to E.4 below will enable the designer to determine the size of the cable it will be necessary to use. As a preliminary step it is useful to identify the length of the cable run and the permissible voltage drop for the equipment being supplied as this may be an overriding consideration (see Regulation 525-01-01 page no.34 and item G of this section page32).
The following steps are required - Know the length of the cable run permissible voltage drop in mV when divided by Ib and by the cable length of run will give the value of voltage drop in mV/A/m which can be tolerated. A voltage drop not exceeding that value is identified in the appropriate table and the corresponding cross-sectional area of conductor needed on this account can be read off directly before any other calculations are made.
The conductor size necessary from consideration of the conditions of normal load and overload is then determined .Whilst all correction factors affecting Iz (that is the factors for ambient temperature ,grouping and thermal insulation) can if desired be applied to the values of It as multipliers giving the effective Iz for the installation conditions concerned this involves as process of trial and error until a cross-sectional area is reached which ensure that Iz is not less than Ib and not less than In of any protective device it is intended to select. In any event if if a correction factor for protection by a semi-enclosed fuse is necessary this has to be applied to In as a divisor . It is therefore more convenient to apply all the correction factors to In as divisors.

This method is used in items F.1 to F.3 and produces a value of current and that value (or the next larger value) can readily be located in the appropriate table of current carrying capacity and the corresponding cross sectional area of conductor can be identified directly. It should be noted that value of It appearing against the chosen cross-sectional area is not Iz It is not necessary to know Iz where the size of conductor is chosen by this method, but if it is desired to identify Iz the value is determined by the method indicated in item C above.

However this method can not be used for cables installed in enclosed trenches (installation methods 18, 19 and 20 of Appendix-A page 65-70) because correction factors given in Table-2 are related to conductor cross-sectional areas. For such cables it is therefore necessary to use the process of trial and error described in the third paragraph above selecting on a trial basis a particular size of cable from for instance ,voltage drop considerations.

F.1 *Where overload protection is afforded by fuse to BS-88 or BS-1361, or a circuit-breaker to BS-EN 60898 or BS 60947 -2 or a residual current circuit - breaker with integral overcurrent protection to BS EN 610091-1 (RCBO)*

F.1.1 For single circuits.
- DIVIDE the nominal current of the protective device (In) by any applicable correction factor for ambient temperature (Ca) given in table-2a.
- then fur ther DIVIDE by any applicable correction factor for thermal insulation (Ci).

The size of cable to be used is to be such that is tabulated current-carrying capacity (It) is not less than the value of nominal current of the protective device adjusted as above:

$$I_t \geq \frac{I_n}{C_a\, C_i} \qquad (1)$$

F.1.2 For groups

- DIVIDE the nominal current of the protective device (In) by the correction factor for grouping (Cg) given in Tables 1-2.

$$I_t \geq \frac{I_n}{C_g} \qquad (2)$$

Alternatively, it may be selected in accordance with the following formulae, provided, that the circuits of the group are not liable to simultaneous overload :

$$I_t \geq \frac{I_b}{C_g}\text{, and} \qquad (3)$$

$$I_t \geq \sqrt{I_n^2 + 0.48\, I_b^2 \left[\frac{I - C_g^2}{C_g^2}\right]} \qquad (4)$$

The size of cable to be used is to be such that its tabulated single current-carrying capacity (I_t) is not less then the value of I_t calculated in accordance with formula (2) above or where formulae (3) and (4) are used not less then the larger of the resulting two values of correction factors C_a and/or C_i are applicable they are to be applied as divisors to the value of It determined by the above formulae.

F2 Where the protective device is a semi-enclosed fuse to BS 3036.
F2 For single circuits .
-DIVIDE the nominal current of the fuse(In) by an applicable correction factor for ambient temperature (C_a) given in Table-2a.

-then further DIVIDE by any applicable correction factor for thermal insulation,(C_i).
-then further DIVIDE by 0.725.
The size of the cable to be used is to be such that its tabulated current-carrying capacity (I_t) is not less the value of nominal current of the fuse adjusted as above:

$$I_t \geq \frac{I_n}{0.725\ C_a\ C_i} \qquad (5)$$

F.2.2 For groups
-DIVIDE the nominal current of the fuse In by 0.725 and by the applicable correction factor for grouping (Cg) given in Tables 1-2:

$$I_t \geq \frac{I_n}{0.725\ C_g\ C} \qquad (6)$$

Alternatively, it may be selected by the following formulae, provided that the circuits of the groups are not liable to simultaneous overload:

$$I_t \geq \frac{I_b}{C_g}, \text{ and} \qquad (7)$$

$$I_t \geq \sqrt{1.9\ I_n\ {}_b^2 \left[\frac{I^{-2}Cg}{Cg^2}\right]} \qquad (8)$$

The size of cable to be used is to be such that its tabulated single-circuit current-carrying capacity(I_t) is not less than the value of It calculated in accordance with formula (6) above or where formulae (7) and (8) are used, not less then the larger of the resulting two values of It.
Where correction factors C_a and/ or C_i are applicable they are to be applied as divisors to the value of It determined by the above formulae.

F.3 *Where overload protection is not required*

Where Regulation 473-01-04 applies and the cable under consideration is not required to be protected against overload, the design current of the circuit (Ib) is to be divided by any applicable correction factors,and the size of the cable to be used is to be such that its tabulated current-carrying capacity(It) for the installation method concerned is not less than the value of Ib adjusted as above:

$$I_t \geq \frac{I_b}{C_a C_g C_i} \qquad (9)$$

F.4 *Variation of installation conditions along a cable route*

The procedures in items F.1 to F.3 above are based on the assumption that all the conditions necessitating the use of correction factors apply to the same part of the route of the conductors of the circuit.Where various factors apply to different part of the route ,each part may be treated separately,or alternatively only the factor or combination of factors appropriate to the most onerous conditions encountered along the route may be applied to the whole of the route.It is permissible to obtain more precise factors by calculation of the various conductor temperature rises that will occur along such a route, provided that appropriate limiting temperature of the conductor is nowhere exceeded (see Regulation 523-01).

G. Tables of voltage drop

In the tables, values of voltage drop are given for a current of one ampere for a meter run,ie for a distance of 1m along the route taken by the cables and represent the result of the voltage drops in all circuit conductors.The values of voltage drop assume that the conductors are at their maximum permitted normal operating temperatures.

The values in the tables, for a.c. operation apply only to frequencies in the range 49 to 61Hz and for single-core armoured cables the tabulated value apply where the armour is bonded to earth at both ends.The value of voltage drop for cables operating at higher frequencies may be substantially greater.

For a given run, to calculate the voltage drop (in mV) the tabulated value of voltage drop per ampere per meter for the cable concerned has to be multiplied by the length of the run in meters and by the current the cable is intended to carry namely the design current of the circuit (Ib) in amperes.For three-phase circuits the tabulated mV/A/m values relate to the line voltage and balanced conditions have been assumed.

For cables having conductors of 16mm or less cross-sectional area their inductances can be ignored and (mV/A/m)r values only are tabulated.For cables having conductors greater than 16mm, cross-sectional area the impedance values are given as (mV/A/m)z together with the resistive component (mV/A/m)r and the reactive component (mV/A/m)x.

The direct use of the tabulated (mV/A/m)r or (mV/A/m)z values as appropriate may lead to pessimistically high calculated values of voltage drop or in other words to unnecessarily low values of permitted circuit lengths.

For example, where the design current of circuit is significantly less than the effective current - carrying capacity of the cable chosen, the actual voltage drop would be less than the calculated value because the conductor temperature (and hence its resistance) will be less than that on which the tabulated m V/A/m had been based.

As regards power factor in a.c. circuits the use of the tabulated m V/A/m values, (for the larger cable sizes the tabulated (mV/A/m) values to calculate the voltage drop is strictly correct only when the phase angle of the cable equals that of the load. When the phase angle of the cable does not equal that of the load, the direct use of the tabulated mV/A/m or (mV/A/m)z values leads to a calculated value of voltage drop higher than the actual Value. In some cases it may be advantageous to take account of the load power factor when calculating voltage drop.

Where a more accurate assessment of voltage drop is desirable the following methods may be used.

G.1 *Correction for operating temperature*

For cables having conductors of cross-sectional area 16mm² or less the design value of mV/A/m is obtained by multiplying the tabulated value by a factor C_t, given by

$$C_t = \frac{230 + t_p - \left(C_a^2 C_g^2 - \frac{I_b^2}{I_t^2}\right)(t_p - 30)}{230 + t_p} \qquad (10)$$

Where t_p is the maximum permitted normal operating temperature (^{0}C)

This equation applies only where the over current protective device is other than a BS 3036 fuse and where the actual ambient temperature is equal to or greater than 30 ^{0}C

NOTE: For convenience, the above formula is based on the approximate resistance-temperature coefficient of 0.004 per ^{0}C at 20 ^{0}C for both copper and aluminium conductors.

For cables having conductors of cross-sectional area greater than 16 mm². only resistive component of the voltage drop is affected by the temperature and the factor C_t is therefore applied only to the tabulated value of (m/V/m) and the design value of (m/V/A/m) is given by the vector sum of C_t (m/V/A/m) and $(m/V/A/m)_x$

For very large conductor sizes where the resistive component of voltage drop is much less than the corresponding reactive part (i.e. when $x/r \geq 3$) this correction factor need not be considered.

G.2 Correction for load power factor

For cables having conductors of cross-sectional area of 16mm² or less the design value mV/A/m is obtained approximately by multiplying the tabulated value by the power factor of the load, cos∅.

For cables having conductors of cross-sectional area greater than 16mm² the design value of mV/A/m is given approximately by:

$$\cos\varnothing(\text{tabulated (mV/A/m)}r) + \sin\varnothing(\text{tabulated (mV/A/m}x)$$

For single core cables in flat formation the tabulated values apply to the outer cable and may under estimate for the voltage drop between and outer cable and centre cable for cross-sectional area above 240mm and power factors greater than 0.8.

G .3 *Combined correction for both operating temperature and load power factor*

For items G.1 and G.2 above, where it is considered appropriate to correct the tabulated mV/A/m values for both operating temperature and load power factor, the design values of mV/A/m are given by:

for cables having conductors of 16mm² or less cross-sectional area

$C_t \cos\varnothing$(tabulated mV/A/m)

for cables having conductors of cross-sectional area greater than 16mm²

$C_t \cos\varnothing(\text{tabulated (mV/A/m)}_r) + \sin\varnothing(\text{tabulated (mV/A/m)}_x)$.

H. Methods of installation of cables:

The methods of installation which are referred to in Table 1-18. are described in Appendix-A. (Page 65-70), provides guidance for the selection of the appropriate cable size.

Tables 3-18 contain current ratings for specific cable constructions. The method of installation distinguished by bold type are reference methods for which the current-carrying capacities given in the above referred to tables have been determined For other methods in indication is given of the appropriate reference method having values of current-carrying capacity which can safely be applied.

As stated in Regulation 521-07-01 the use of other methods is not precluded, where specified by a suitably qualified electrical engineer; in that case the evaluation of current-carrying capacity may need to be based on experimental work.

VOLTAGE DROP IN CONSUMERS' INSTALLATION

Ref: IEE 16th Edition/BS-7671:2001

Regulation No. 525 -Voltage drop in consumers' installation

Ref: 525-01-Ol. Under normal service conditions the voltage at the terminals of any fixed current-using equipment shall be greater than the lower limit corresponding to the British Standard relevant to the equipment.
Where the fixed current-using equipment concerned is not the subject of a British Standard the voltage at the terminal shall be such as not to impair the safe functioning of that equipment.
525-01-02 The requirements of Regulation 525-01-01 are deemed to be satisfied for a supply given in accordance with the Electricity Supply Regulations 1988 as amended if the voltage drop between the origin of the installation (usually the supply terminals) and a socket-outlet or the terminals of the fixed current-using equipment does not exceed 4% of the nominal voltage of the supply.
A greater voltage drop may be accepted for a motor during starting periods and for other equipment with high inrush currents provided that it is verified that the voltage variations are within the limits specified in the relevant British Standards for the equipment or, in the absence of a British Standard, in accordance with the manufacturer's recommendations.

Correction factors for groups of more than one circuit of single - core cables or more than one multi-core cable (to be applied to the corresponding current-carrying capacity for single circuit in tables.)

†Page/Table : 36/2, 37/3, 38/4, 39/5, 40/6, 41/7, 42/8,8a, 43/9 &44/10(Copper Conductor).

†Page/Table: 45/11, 46/12, 47/13, 48/14, 49/15, 50/16, 51/17, & 52/18.(Aluminium Conductor)

Reference Method of installation Appendix A (page 65-70)		Correction factor (Cg) Number of circuit or multi core cables													
		2	3	4	5	6	7	8	9	10	12	14	16	18	20
Enclosed (Method 3 or 4) or bunched clipped director to an non-metallic surface (method 1)		0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.48	0.45	0.43	0.41	0.39	0.38
Single layer clipped to a non-metallic surface (Method 1)	Touching	0.85	0.79	0.75	0.73	0.72	0.72	0.71	0.70	---	---	---	---	---	---
	Speed*	0.94	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Single layer multi core on a perforated metallic cable tray, vertical or horizontal (Method 11)	Touching	0.86	0.81	0.77	0.75	0.74	0.73	0.73	0.72	0.71	0.70	---	---	---	---
	Speed*	0.91	0.89	0.88	0.87	0.87	---	---	---	---	---	---	---	---	---
Single layer single core on a perforated metallic cable tray, touching (Method 11)	Horizontal	0.90	0.85	---	---	---	---	---	---	---	---	---	---	---	---
	Vertical	0.85	---	---	---	---	---	---	---	---	---	---	---	---	---
Single layer multi core touching on ladder supports. (Method 13)		0.86	0.82	0.80	0.79	0.78	0.78	0.78	0.77	---	---	---	---	---	---

Spaced* means a clearance between adjacent surface of at last one cable diameter (De). Where the horizontal clearances between adjacent cables exceed 2De,no correction factor need be applied.

Notes:

1 The factors in the table are applicable to groups of cables of all one size. The value of current derived from application of the appropriate factors is the maximum continuous current by any of the cables in the group.

2 If due to known operating conditions a cable is expected to carry not more than 30% of its grouped rating it may be ignored for the purpose of obtaining the rating factor for the rest of the group.

3 When cables having different conductor operating temperatures are grouped the current rating shall be based on the lowest operating temperature of any cable in the group.

4 For installation methods, as referred to above and in the tables (Current carrying capacity) are in detailed in Appendix-A. (Page 65-70)

Correction factors for cables installed in enclosed trenches (Installation Methods 18, 19 & 20)

The correction factors tabulated below relate to the disposition of cables illustrated in items 18 to 20 and are applicable to the current-carrying capacities for installation methods 12 or 13 as given in the relevant tables.....)

CORRECTION FACTORS

Table 10

	Installation Method 18				Installation Method 19			Installation Method 20		
Conductor cross-sectional area	2 single-core cables, or 1 three core cable or four-core cables	3 single-core cables, or 2 two core cable	4 single-core cables, or 2 three core or four-core cables	6 single-core cables, 4 two-core cables or 3 three- or four-core cables	6 single-core cables, 4 two-core cables or 3 three- or four-core cables	8 single-core cables, or 4 three or four core cables	12 single-core cables, 8 two core cables, or 6 three- or four core cable	12 single-core cables, 8 two core cables, or 6 three- or four core cable	18 single-core cables, 12 two core cables, or 9 three- or four core cable	24 single-core cables, 16 two core cables, or 12 three- or four core cable
1	2	3	4	5	6	7	8	9	10	11
4	0.93	0.90	0.87	0.82	0.86	0.83	0.76	0.81	0.74	0.69
6	0.92	0.89	0.86	0.81	0.86	0.82	0.75	0.80	0.73	0.68
10	0.91	0.88	0.85	0.80	0.85	0.80	0.74	0.78	0.72	0.66
16	0.91	0.87	0.84	0.78	0.83	0.78	0.71	0.76	0.70	0.64
25	0.90	0.86	0.82	0.76	0.81	0.76	0.69	0.74	0.67	0.62
25	0.89	0.85	0.81	0.75	0.80	0.74	0.68	0.72	0.66	0.60
25	0.88	0.84	0.79	0.74	0.78	0.73	0.66	0.71	0.64	0.59
70	0.87	0.82	0.78	0.72	0.77	0.72	0.64	0.70	0.62	0.57
95	0.86	0.81	0.76	0.70	0.75	0.70	0.63	0.68	0.60	0.55
120	0.85	0.80	0.75	0.69	0.73	0.68	0.61	0.66	0.58	0.53
150	0.84	0.78	0.74	0.67	0.72	0.67	0.59	0.64	0.57	0.51
185	0.83	0.77	0.73	0.65	0.70	0.65	0.58	0.63	0.55	0.49
240	0.82	0.76	0.71	0.63	0.69	0.63	0.56	0.61	0.53	0.48
300	0.81	0.74	0.69	0.62	0.68	0.62	0.54	0.59	0.52	0.46
400	0.80	0.73	0.67	0.59	0.66	0.60	0.52	0.57	0.50	0.44
500	0.78	0.72	0.66	0.58	0.64	0.58	0.51	0.56	0.48	0.43
630	0.77	0.71	0.65	0.56	0.63	0.57	0.49	0.54	0.47	0.41

Correction Factors for Ambient Temperatures

Table 10A

Ambient Air Temperature C	25	30	35	40	45	50	55	60	65
Circuit Breaker IEC 947	1.03	1.00	0.94	0.87	0.79	0.71	0.61	0.50	0.35
BS 3036	1.03	1.0	0.97	0.94	0.91	0.87	0.84	0.69	0.48

The above correction factors for ambient temperatures are applicable to general purpose PVC (70° c).Ref: Table-10
*When cables having different conductor operating temperatures are grouped together the current rating shall be based on the lowest operating temperature of any cable in the group.

Note:

1. The factors in Table-10A are applicable to groups of cables all of one size. The value of current derived from application of the appropriate factors is the maximum current to be carried out by any of the cables in the group.

2. If, due to known operating conditions, a cable is expected to carry not more than 30% of its grouped rating, it may be ignored for the purpose of obtaining the rating factor for the rest of the group.

3. When the number of the cables used differs from those stated in the table, the derating factor for the next higher stated number of cables shall be used.

Single-core 70° C thermoplastic (Pvc) insulated cables, non-armoured, with or without sheath (Copper Conductors)

BS 6004 & BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table - 3

Conductor cross-sectional area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc.)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)		Reference Method 12(free air)		
									Horizontal flat spaced	Vertical flat spaced	Trefoil
	2 cables, single-phase a.c. or d.c.	3 or 4 cables, three-phase a.c.	2 cables, single-phase a.c. or d.c.	3 or 4 cables, three-phase a.c.	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching or trefoil	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching or trefoil	2 cables, single-phase a.c. or d.c. or 3 cables three- phase a.c.	2 cables, single-phase a.c. or d.c. or 3 cables three- phase a.c.	3 cables, trfoil, three-phase a.c.
1	2	3	4	5	6	7	8	9	10	11	12
(mm^2)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
1	11	10.5	13.5	12	15.5	15.5	—	—	—	—	—
1.5	14.5	13.5	17.5	15.5	20	20	—	—	—	—	—
2.5	20	18	24	21	27	27	—	—	—	—	—
4	26	24	32	28	37	37	—	—	—	—	—
6	34	31	41	36	47	47	—	—	—	—	—
10	46	42	57	50	65	65	—	—	—	—	—
16	61	56	76	68	87	87	—	—	—	—	—
25	80	73	101	89	114	114	126	112	146	130	110
35	99	89	125	110	141	141	156	141	181	162	137
50	119	108	151	134	182	182	191	172	219	197	161
70	151	136	192	171	234	234	246	223	281	254	216
95	182	164	232	207	284	284	300	273	341	311	264
120	210	188	269	239	330	330	349	318	396	362	308
150	240	216	300	262	381	381	404	369	456	419	356
185	273	245	341	296	436	436	463	424	521	480	409
240	320	286	400	346	515	515	549	504	615	569	485
300	367	328	458	394	594	594	635	584	709	659	561
400	—	—	546	467	694	694	732	679	852	795	656
500	—	—	626	533	792	792	835	778	982	920	749
630	—	—	720	611	904	904	953	892	1138	1070	855
800	—	—	—	—	1030	1030	1086	1020	1265	1188	971
1000	—	—	—	—	1154	1154	1216	1149	1420	1337	1079

Note:-

1. Where the conductor is to be protected by a semi-enclosed fuse to BS-3036.
2. The current carrying capacities in columns 2 to 5 are also applicable to flexible cables and to 90°C heat resisting thermoplastic (pvc) cables where the cables are used in fixed installation.
3. Associated voltage drop Reference Table-4.

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°C

Table - 4

2 cables, single-phase a.c.										3 or 4 cables, three-phase a.c.													
Conductor cross-sectional area	2 cables, d.c.	Reference Methods 3 & 4(enclosed in conduit etc in or on a wall)			Reference Methods 1 & 11(clipped direct or on trays, touching)			Reference Method 12(Spaced*)			Reference Methods 3 & 4(enclosed in conduit etc in or on a wall)			Reference Method 1, 11 & 12 (in trefoil)			Reference Methods 1 & 11 (flat &touching)			Reference Method 12 (flat spaced*)		
1	2	3			4			5			6			7			8			9		
(mm^2)	(mV/A/m)	(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)		
1	44	44			44			44			38			38			38			38		
1.5	29	29			29			29			25			25			25			25		
2.5	18	18			18			18			15			15			15			15		
4	11	11			11			11			9.5			9.5			9.5			9.5		
6	7.3	7.3			7.3			7.3			6.4			6.4			6.4			6.4		
10	4.4	4.4			4.4			4.4			3.8			3.8			3.8			3.8		
16	2.8	2.8			2.8			2.8			2.4			2.4			2.4			2.4		
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
25	1.75	1.80	0.33	1.80	1.75	0.200	1.75	1.75	0.29	1.80	1.75	0.29	1.80	1.50	0.175	1.50	1.50	0.25	1.55	1.50	0.32	1.55
35	1.25	1.30	0.31	1.30	1.25	0.195	1.25	1.25	0.28	1.30	1.25	0.28	1.30	1.10	0.170	1.10	1.10	0.24	1.10	1.10	0.32	1.15
50	0.93	0.95	0.30	1.00	0.93	0.190	0.95	0.93	0.28	0.97	0.93	0.28	0.85	0.80	0.165	0.82	0.80	0.24	0.84	0.80	0.32	0.86
70	0.63	0.65	0.29	0.72	0.63	0.185	0.66	0.63	0.27	0.69	0.56	0.25	0.61	0.55	0.160	0.57	0.55	0.24	0.60	0.55	0.31	0.63
95	0.46	0.49	0.28	0.56	0.47	0.180	0.50	0.47	0.27	0.54	0.42	0.24	0.48	0.41	0.155	0.43	0.41	0.23	0.47	0.40	0.31	0.51
120	0.36	0.39	0.27	0.47	0.37	0.175	0.41	0.37	0.26	0.45	0.33	0.23	0.41	0.32	0.150	0.36	0.32	0.23	0.40	0.32	0.30	0.44
150	0.29	0.31	0.27	0.41	0.30	0.175	0.34	0.29	0.26	0.39	0.27	0.23	0.36	0.26	0.150	0.30	0.26	0.23	0.34	0.26	0.30	0.40
185	0.23	0.25	0.27	0.37	0.24	0.170	0.29	0.24	0.26	0.35	0.22	0.23	0.32	0.21	0.145	0.26	0.21	0.22	0.31	0.21	0.30	0.36
240	0.180	0.195	0.26	0.72	0.185	0.165	0.25	1.185	0.25	0.31	0.17	0.23	0.29	0.16	0.145	0.22	0.16	0.22	0.27	0.160	0.29	0.34
300	0.145	0.160	0.26	0.56	0.150	0.165	0.22	1.150	0.25	0.29	0.14	0.23	0.27	0.13	0.140	0.190	0.13	0.22	0.25	0.130	0.29	0.32
400	0.105	0.130	0.26	0.47	0.120	0.160	0.30	1.115	0.25	0.27	0.12	0.22	0.25	0.105	0.140	0.175	0.105	0.21	0.24	0.100	0.29	0.31
500	0.086	0.110	0.26	0.41	0.098	0.155	0.185	0.093	0.24	0.26	0.10	0.22	0.25	0.086	0.135	0.160	0.086	0.21	0.23	0.081	0.29	0.30
630	0.068	0.094	0.25	0.37	0.081	0.155	0.175	0.076	0.24	0.25	0.08	0.22	0.24	0.072	0.135	0.150	0.072	0.21	0.22	0.066	0.28	0.29
800	0.053	—			0.068	0.150	0.165	0.061	0.24	0.25	—			0.060	0.130	0.145	0.060	0.21	0.22	0.053	0.28	0.29
1000	0.042	—			0.039	0.150	0.160	0.050	0.24	0.24	—			0.052	0.130	0.140	0.052	0.20	0.21	0.044	0.28	0.28

*spacings larger than those specified in Method-12 will result in larger voltage drop.

Single-core 70° C armoured thermoplastic (Pvc) insulated cables (non-magnetic armoured) (Copper Conductors) BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table 5

Conductor cross-sectional area	Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)		Reference Method 12(free air)						
					2 cables, single-phase a.c.		2 cables, d.c.		3 or 4 cables, three-phase a.c.		
	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching	Horizontal flat spaced	Vertical flat spaced	Horizontal spaced	Vertical spaced	Horizontal flat spaced	Vertical flat spaced	3 cables, trefoil
(mm^2)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
50	193	179	205	189	229	217	229	216	230	212	181
70	245	225	259	238	287	272	294	279	286	263	231
95	296	269	313	285	349	332	357	340	338	313	280
120	342	309	360	327	401	383	415	396	385	357	324
150	393	352	413	373	455	435	479	458	436	405	373
185	447	399	469	422	511	489	548	525	490	456	425
240	525	465	550	492	593	568	648	622	566	528	501
300	594	515	624	547	668	640	748	719	616	578	567
400	687	575	723	618	737	707	885	815	674	632	657
500	763	622	805	673	810	777	1035	997	721	676	731
630	843	669	891	728	893	856	1218	1174	771	723	809
800	919	710	976	777	943	905	1441	1390	824	772	886
1000	975	737	1041	808	1008	967	1685	1627	872	816	945

Notes:
1. Where the conductor is to be protectected by a semi-enclosed fuse to BS-3036.
2. Associated voltage drop Reference Table -6

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°

Table 6

Conductor cross-sectional area	2 cables, d.c.	2 cables, single-phase a.c.			3 or 4 cables, single-phase a.c.								
		Reference Method 1 & 11 (touching)			Reference Method 12 (spaced*)			Reference Method 1,11 & 12 (in trefoil touching)			Reference Method 1 & 11 (flat touching)			Reference Method 12 (flat spaced*)		
1	2	3			4			5			6			7		
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
50	0.93	0.93	0.22	0.95	0.92	0.30	0.97	0.80	0.190	0.82	0.79	0.26	0.84	0.79	0.34	0.86
70	0.63	0.64	0.21	0.68	0.66	0.29	0.72	0.56	0.180	0.58	0.57	0.25	0.62	0.59	0.32	0.68
95	0.46	0.48	0.20	0.52	0.51	0.28	0.58	0.42	0.175	0.45	0.44	0.25	0.50	0.47	0.31	0.57
120	0.36	0.39	0.195	0.43	0.42	0.25	0.50	0.33	0.170	0.37	0.36	0.24	0.43	0.40	0.30	0.50
150	0.29	0.31	0.190	0.37	0.34	0.27	0.44	0.27	0.165	0.32	0.30	0.24	0.38	0.34	0.30	0.45
185	0.23	0.26	0.190	0.32	0.29	0.27	0.39	0.22	0.160	0.27	0.25	0.23	0.34	0.29	0.29	0.41
240	0.180	0.20	0.180	0.27	0.23	0.26	0.35	0.175	0.160	0.23	0.20	0.23	0.30	0.24	0.28	0.37
300	0.145	0.160	0.180	0.24	0.190	0.26	0.32	0.140	0.155	0.21	0.165	0.22	0.28	0.20	0.28	0.34
400	0.105	0.140	0.175	0.22	0.180	0.24	0.30	0.120	0.130	0.195	0.160	0.21	0.26	0.21	0.25	0.32
500	0.086	0.120	0.170	0.21	0.165	0.23	0.29	0.105	0.145	0.180	0.145	0.20	0.25	0.190	0.24	0.30
630	0.068	0.105	0.165	0.195	0.150	0.22	0.27	0.091	0.145	0.170	0.135	0.195	0.23	0.175	0.220	0.28
800	0.053	0.095	0.160	0.185	0.145	0.21	0.25	0.082	0.140	0.160	0.125	0.180	0.22	0.170	0.195	0.26
1000	0.042	0.091	0.155	0.180	0.091	0.19	0.24	0.079	0.135	0.155	0.125	0.165	0.21	0.165	0.170	0.24

*Spacing larger those specified in method 12 will result in larger voltage drop.

Multi-core 70° C thermoplastic (Pvc) insulated cables,non- armoured)
(Copper Conductors)

BS 6004 & BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table 7

Conductor cross-sectional area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc.)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)	
	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.
1	2	3	4	5	6	7	8	9
(mm²)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
1	11	10	13	11.5	15	13.5	17	14.5
1.5	14	13	16.5	15	19.5	17.5	22	18.5
2.5	18.5	17.5	23	20	27	24	30	25
4	25	23	30	27	36	32	40	34
6	32	29	38	34	46	41	51	43
10	43	39	52	46	63	57	70	60
16	57	52	69	62	85	76	94	80
25	75	68	90	80	112	96	119	101
35	92	83	111	99	138	119	148	126
50	110	99	133	118	168	144	180	153
70	139	125	168	149	213	184	232	196
95	167	150	201	179	258	223	282	238
120	192	172	232	206	299	259	328	276
150	219	196	258	225	344	299	379	319
185	248	223	294	255	392	341	434	364
240	291	261	344	297	461	403	514	430
300	334	298	394	339	530	464	593	497
400	---	---	470	402	634	557	715	597

* with or without a circuit protective conductor.
Note: Associated voltage drop Reference Table -8

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°

Table 8

Conductor cross-sectional area	Two - core cable, d.c.	Two - core cable, single-ohase a.c			Three, four or five -core cable, three-phase a.c		
1	2	3			4		
(mm²)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
1	44	44			38		
1.5	29	29			25		
2.5	18	18			15		
4	11	11			9.5		
6	703	703			6.4		
10	4.4	4.4			3.8		
16	2.8	2.8			2.4		
		r	x	z	r	x	z
25	1.75	1.750	0.170	1.750	1.500	0.145	1.500
35	1.25	1.250	0.165	1.250	1.100	0.145	1.100
50	0.93	0.930	0.165	0.940	0.800	0.140	0.810
70	0.63	0.630	0.160	0.650	0.550	0.140	0.570
95	0.46	0.470	0.155	0.500	0.410	0.135	0.430
120	0.36	0.380	0.155	0.410	0.330	0.135	0.350
150	0.29	0.300	0.155	0.340	0.260	0.130	0.290
185	0.23	0.250	0.150	0.290	0.210	0.130	0.250
240	0.180	0.190	0.150	0.240	0.165	0.130	0.210
300	0.145	0.155	0.145	0.210	0.135	0.130	0.185
400	0.105	0.115	0.145	0.185	0.100	0.125	0.160

70° C thermoplastic (Pvc) insulated AND sheathed flat cables with protective conductor (Copper Conductors)

BS 6004

CURRENT-CARRYING CAPACITIES (amperes) Ambient temperature: 30°C
Conductor operating temperature: 70° **Table 8a**

Conductor cross-sectional area	Installation Method 6* (Enclosed in conduit in an insulated wall)	Installation Method 15* (Insulated directly in an insulated wall)	Reference Method 1 (clipped direct)	Voltage drop (per ampere per meter)
	1 two - core cable, single-phase a.c. or d.c.			
1	2	3	4	5
(mm²)	(A)	(A)	(A)	(mV/A/m)
1	11.5	12	16	44
1.5	14.5	15	20	29
2.5	20	21	27	18
4	26	27	37	11
6	32	35	47	7.3
10	44	47	64	4.4
16	57	63	85	2.8

Notes: 1. Where the conductor is to be protectected by a semi-enclosed fuse to BS-3036.
2. * These methods are regarded as reference methods for the cable types specified by the table.
Table -8a corresponds to table 4D5A amdt. N0 1 (AMD 13628) to BS 7671:2001 This amendment comes into effect on 1st February 2002.

Single-core 70° C armoured thermoplastic (Pvc) insulated cables (Copper Conductors)

BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table 9

Conductor cross-sectional area	Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)	
	1 two - core cable, single-phase a.c. or d.c.	1 three or four - core cable three-phasea.c.	1 two - core cable, single-phase a.c. or d.c.	1 three or four - core cable three-phase a.c.
1	2	3	4	5
(mm²)	(A)	(A)	(A)	(A)
1.5	21	18	22	19
2.5	28	25	31	26
4.	38	33	41	35
6	49	42	53	45
10	67	58	72	62
16	89	77	97	83
25	118	102	128	110
35	145	125	157	135
50	175	151	190	163
70	222	192	241	207
95	269	231	291	251
120	310	267	136	290
150	356	306	386	332
185	405	348	439	378
240	476	409	516	445
300	547	469	592	510
400	621	540	683	590

Notes:
1. Where the conductor is to be protectected by a semi-enclosed fuse to BS-3036.
Associated voltage drop Reference Table -10

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°

Table 10

Conductor cross-sectional area	Two - core cable, d.c.	Two - core cable, single-phase a.c			Three, four or five -core cable, three-phase a.c		
1	2	3			4		
(mm²)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
		29			25		
1.5	29	18			15		
2.5	18						
		11			9.5		
4	11	703			6.4		
6	7.3	4.4			3.8		
10	4.4	2.8			2.4		
16	2.8						
		r	x	z	r	x	z
25	1.75						
35	1.25	1.750	0.170	1.750	1.500	0.145	1.500
		1.250	0.165	1.250	1.100	0.145	1.100
50	0.93						
70	0.63	0.930	0.165	0.940	0.800	0.140	0.810
95	0.46	0.630	0.160	0.650	0.550	0.140	0.570
		0.470	0.155	0.500	0.410	0.135	0.430
120	0.36						
150	0.29	0.380	0.155	0.410	0.330	0.135	0.350
185	0.23	0.300	0.155	0.340	0.260	0.130	0.290
		0.250	0.150	0.290	0.210	0.130	0.250
240	0.180						
300	0.145	0.190	0.150	0.240	0.165	0.130	0.210
400	0.105	0.155	0.145	0.210	0.135	0.130	0.185
		0.115	0.145	0.185	0.100	0.125	0.160

Single-core 70° C thermoplastic (Pvc) insulated cables, non-armoured, with or without sheath (Copper Conductors)

BS 6004 & BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table - 11

Conductor cross-sectional area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc.)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)		Reference Method 12(free air)		
									Horizontal flat spaced	Vertical flat spaced	Trefoil
	2 cables, single-phase a.c. or d.c.	3 or 4 cables, three-phase a.c.	2 cables, single-phase a.c. or d.c.	3 or 4 cables, three-phase a.c.	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching or trefoil	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching or trefoil	2 cables, single-phase a.c. or d.c. or 3 cables three- phase a.c.	2 cables, single-phase a.c. or d.c. or 3 cables three- phase a.c.	3 cables, trfoil, three-phase a.c.
1	2	3	4	5	6	7	8	9	10	11	12
(mm²)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
50	93	84	118	104	134	123	144	132	163	148	128
70	118	107	150	133	172	159	185	169	210	191	165
95	142	129	181	161	210	194	225	206	256	234	203
120	164	149	210	186	245	226	261	240	298	273	237
150	189	170	234	204	283	261	301	277	344	317	274
185	215	194	266	230	324	299	344	317	394	364	316
240	252	227	312	269	384	354	407	375	466	432	375
300	289	261	358	306	444	410	469	433	538	501	435
380	-	-	413	352	511	472	543	502	625	584	507
480	-	-	477	405	591	546	629	582	726	680	590
600	-	-	545	462	679	626	722	669	837	787	680
740	-	-	-	-	771	709	820	761	956	902	776
960	-	-	-	-	900	823	953	886	1125	1066	907
1200	-	-	-	-	1022	926	1073	999	1293	1299	1026

Notes:
1. Where the conductor is to be protectected by a semi-enclosed fuse to BS-3036.
Associated voltage drop Reference Table -12.

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°

Table - 12

2 cables,single-phase a.c.												3 or 4 cables,single-phase a.c.											
Conductor cross-sectional area	2 cables, d.c.	Reference Method 3 & 4 (enclosed in conduit or on a wall)			Reference Method 1 & 11 (touching)			Reference Method 12 (spaced*)			Reference Method 3 & 4 (enclosed in conduit or on a wall)			Reference Methods 1 & 11 &12 (in trefoil touching)			Reference Method 1 & 11 (flat touching)			Reference Method 12 (flat spaced*)		
1	2	3			4			5			6			7			8			9		
(mm²)	(mV/A/m)	(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)		
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
50	1.55	1.60	0.30	1.60	1.55	0.190	1.55	1.55	0.28	1.55	1.35	0.26	1.40	1.35	0.165	1.35	1.35	0.24	1.35	1.35	0.24	1.40
70	1.05	1.10	0.30	1.15	1.05	0.185	1.05	1.05	0.27	1.10	0.94	0.26	0.97	0.91	0.160	0.92	0.91	0.24	0.94	0.91	0.24	0.96
95	0.77	0.81	0.29	0.86	0.77	0.185	0.79	0.77	0.27	0.82	0.70	0.25	0.74	0.67	0.160	0.69	0.67	0.23	0.71	0.67	0.23	0.74
120	0.61	0.64	0.29	0.70	0.61	0.180	0.64	0.61	0.27	0.67	0.55	0.25	0.61	0.53	0.155	0.55	0.53	0.23	0.58	0.53	0.23	0.61
150	0.49	0.51	0.28	0.59	0.49	0.175	0.52	0.49	0.26	0.55	0.45	0.24	0.51	0.42	0.155	0.45	0.42	0.23	0.48	0.42	0.30	0.52
185	0.39	0.42	0.28	0.50	0.40	0.175	0.43	0.40	0.26	0.47	0.36	0.24	0.44	0.34	0.150	0.37	0.34	0.23	0.41	0.34	0.30	0.46
240	0.30	0.32	0.27	0.42	0.30	0.170	0.35	0.30	0.26	0.40	0.28	0.24	0.37	0.26	0.150	0.30	0.26	0.22	0.35	0.26	0.30	0.40
300	0.24	0.26	0.27	0.37	0.24	0.170	0.30	0.24	0.26	0.35	0.23	0.23	0.32	0.21	0.145	0.26	0.21	0.22	0.31	0.21	0.30	0.36
380	0.190	0.220	0.27	0.35	0.195	0.165	0.26	0.195	0.25	0.32	0.190	0.23	0.30	0.170	0.145	0.22	0.170	0.22	0.22	0.170	0.29	0.34
480	0.150	0.180	0.26	0.32	0.155	0.165	0.23	0.155	0.25	0.29	0.155	0.23	0.27	0.140	0.140	.0.195	0.140	0.22	.0.28	0.135	0.29	0.32
600	0.120	0.350	0.26	0.30	0.130	0.160	0.21	0.125	0.165	0.28	0.125	0.22	0.26	0.110	0.140	0.180	0.110	0.22	0.24	0.110	0.29	0.31
740	0.099	-	-	-	0.105	0.160	0.19	0.100	0.25	0.27	-	-	-	0.094	0.135	0.165	0.094	0.21	0.23	0.089	0.29	0.23
960	0.075	-	-	-	0.086	0.155	0.18	0.082	0.24	0.26	-	-	-	0.077	0.135	0.155	0.077	0.21	0.22	0.071	0.29	0.22
1200	0.060	-	-	-	0.074	0.155	0.17	0.068	0.24	0.25	-	-	-	0.066	0.135	0.150	0.066	0.21	0.22	0.059	0.29	0.22

Note: * Spacing larger than specified in method 1 will result in larger voltage drop.

Single-core 70° C armouredthermoplastic (Pvc) insulated cables (non-magnetic armour) (Copper Conductors)

BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table 13

Conductor cross-sectional area	Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)		Reference Method 12(free air)						
					2 cables, single-phase a.c.		2 cables, d.c. spaced		3 or 4 cables, three-phase a.c.		
	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching	2 cables, single-phase a.c. or d.c. flat & touching	3 or 4 cables, three-phase a.c. flat & touching	Horizontal flat spaced	Vertical flat spaced	Horizontal spaced	Vertical spaced	Horizontal flat spaced	Vertical flat spaced	3 cables, trefoil
1	2	3	4	5	6	7	8	9	10	11	12
(mm²)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
50	143	133	152	141	168	159	167	157	169	155	131
70	183	168	194	178	212	200	214	202	213	196	168
95	221	202	234	214	259	245	261	247	255	236	205
120	255	233	270	246	299	285	303	288	293	272	238
150	294	267	310	282	340	323	349	333	335	312	275
185	334	303	352	319	389	371	400	382	379	354	315
240	393	354	413	374	457	437	472	452	443	415	372
300	452	405	474	427	520	498	545	523	505	475	430
380	518	452	543	479	583	559	638	613	551	518	497
480	586	501	616	534	655	629	742	715	604	568	568
600	658	550	692	589	724	696	859	828	656	618	642
740	728	596	769	642	802	770	986	952	707	666	715
960	819	651	868	706	866	832	1171	1133	770	726	808
1200	893	692	952	756	938	902	1360	1317	822	774	880

Notes:
1. Where the conductor is to be protectected by a semi-enclosed fuse to BS-3036.
2. Associated voltage drop Reference Table -14

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°

Table14

Conductor cross-sectional area	2 cables, d.c.	2 cables,single-phase a.c.						3 or 4 cables,single-phase a.c.								
		Reference Method 1 & 11 (touching)			Reference Method 12 (spaced*)			Reference Method 1,11 & 12 (in trefoil touching)			Reference Method 1 & 11 (flat touching)			Reference Method 12 (flat spaced*)		
1	2	3			4			5			6			7		
(mm²)	(mV/A/m)	(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)			(mV/A/m)		
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
50	1.55	1.55	0.23	1.55	1.55	0.31	1.55	1.35	0.195	1.35	1.35	0.27	1.35	1.30	0.34	1.35
70	1.05	1.05	0.22	1.10	1.05	0.30	1.10	0.92	0.190	1.93	0.93	0.26	1.96	0.95	0.33	1.00
95	0.77	0.78	0.21	0.81	0.81	0.29	0.86	0.68	0.185	0.70	0.70	0.25	0.75	0.73	0.32	0.80
120	0.61	0.62	0.21	0.66	0.65	0.29	0.71	0.54	0.180	0.57	0.57	0.25	0.62	0.60	0.32	0.68
150	0.49	0.50	0.20	0.54	0.53	0.28	0.60	0.44	0.175	0.47	0.46	0.24	0.52	0.50	0.31	0.58
185	0.39	0.41	0.195	0.45	0.44	0.28	0.52	0.35	0.170	0.39	0.38	0.24	0.45	0.42	0.30	0.51
240	0.30	0.32	0.190	0.37	0.34	0.27	0.44	0.28	0.165	0.32	0.30	0.23	0.38	0.33	0.29	0.44
300	0.24	0.26	0.185	0.32	0.28	0.26	0.39	0.22	0.160	0.27	0.24	0.23	0.34	0.28	0.29	0.40
380	0.190	0.22	0.185	0.28	0.26	0.25	0.36	0.185	0.155	0.24	0.22	0.22	0.32	0.27	0.26	0.38
480	0.150	0.180	0.180	0.25	0.22	0.25	0.33	0.155	0.155	0.22	0.195	0.22	0.29	0.24	0.25	0.35
600	0.120	0.150	0.175	0.23	0.195	0.24	0.31	0.130	0.150	0.200	0.170	0.21	0.27	0.21	0.24	0.32
740	0.097	0.135	0.170	0.22	0.180	0.23	0.29	0.115	0.145	0.185	0.160	0.20	0.26	0.200	0.22	0.30
960	0.075	0.115	0.160	0.200	0.65	0.21	0.27	0.100	0.140	0.175	0.150	0.185	0.24	0.190	0.195	0.27
1200	0.060	0.110	0.155	0.190	0.160	0.180	0.24	0.094	0.140	0.170	0.145	0.160	0.22	0.185	0.165	0.25

Note: * Spacing larger than specified in method 1 will result in larger voltage drop.

Multi-core 70° C thermoplastic (Pvc) insulated cables,non- armoured)
(Aluminium Conductors)

BS 6004 & BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table 7

Conductor cross-sectional area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc.)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)	
	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*,or 1 four-core or 1 five-core cable three-phase a.c.
1	2	3	4	5	6	7	8	9
(mm^2)	(A)	(A)	(A)	(A)	(A)	(A)	(A)	(A)
16	44	41	54	48	66	59	73	61
25	58	53	71	62	83	73	89	78
35	71	65	86	77	103	90	111	96
50	86	78	104	92	125	110	135	117
70	108	98	131	116	160	140	173	150
95	130	118	157	139	195	170	210	183
120	-	135	-	160	-	197	-	212
150	-	155	-	184	-	227	-	245
185	-	176	-	210	-	259	-	280
240	-	207	-	248	-	305	-	330
300	-	237	-	285	-	351	-	381

Note: Associated voltage drop Reference Table -16

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°

Table 16

Conductor cross-sectional area	Two - core cable, d.c.	Two - core cable, single-phase a.c			Three or four cable, three-phase a.c		
1	2	3			4		
(mm^2)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
16	4.5	4.5			3.9		
		r	**x**	**z**	**r**	**x**	**z**
25	2.9	2.90	0.175	2.90	2.50	0.150	2.5
35	2.1	2.10	0.170	2.10	1.80	0.150	1.80
50	1.55	1.55	0.170	1.55	1.35	0.145	1.35
70	1.05	1.05	0.165	1.05	0.90	0.140	0.92
95	0.77	0.77	0.160	0.79	0.67	0.140	0.68
120	-	-	-	-	0.53	0.135	0.55
150	-	-	-	-	0.42	0.135	0.44
185	-	-	-	-	0.34	0.135	0.37
240	-	-	-	-	0.26	0.130	0.30
300	-	-	-	-	0.21	0.130	0.25

Multicore 70° C armoured thermoplastic (Pvc) insulated cables (Aluminium Conductors)

BS 6346

CURRENT-CARRYING CAPACITIES (amperes)

Ambient temperature: 30°C
Conductor operating temperature: 70°

Table17

Conductor cross-sectional area	Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated horizontal cable tray or reference method 13 (free air))	
	1 two-core cable, single-phase a.c. or d.c.	1 three or four core cable,three-phase a.c.	1 two-core cable, single-phase a.c. or d.c.	1 three or four core cable,three-phase a.c.
1	2	3	4	5
16	68	58	71	61
25	89	76	94	80
35	109	94	115	99
50	131	113	139	119
70	165	143	175	151
95	199	174	211	186
120	-	202	-	216
150	-	232	-	250
185	-	265	-	287
240	-	312	-	342
300	-	360	-	399

Notes:
1. Where the conductor is to be protectected by a semi-enclosed fuse to BS-3036.
2. Associated voltage drop Reference Table -18

Voltage Drop (per ampere per meter): Conductor operating temperature: 70°

Table 18

Conductor cross-sectional area	Two - core cable,d.c.	Two - core cable, single-ohase a.c			Three or four -core cable, three-phase a.c		
1	2	3			4		
(mm^2)	(mV/A/m)	(mV/A/m)			(mV/A/m)		
16	4.5	4.5			3.9		
		r	x	z	r	x	z
25	2.9	2.90	0.175	2.90	2.5	0.150	2.50
35	2.1	2.10	0.170	2.10	1.80	0.150	1.80
50	1.55	1.55	0.170	1.55	1.35	0.145	1.35
70	1.05	1.05	0.165	1.05	0.90	0.140	0.92
95	0.77	0.77	0.160	0.79	0.67	0.140	0.68
120	-	-	-	-	0.53	0.135	0.55
150	-	-	-	-	0.42	0.135	0.44
185	-	-	-	-	0.34	0.135	0.37
240	-	-	-	-	0.26	0.130	0.30
300	-	-	-	-	0.21	0.130	0.25

Short Circuit Ratings
Copper Conductor Cables
Armour Fault Currents to Earth
(for fault duration of 1 second)
Wire Armour

Table 19

Nominal area of conductor	Aluminium wire armour		Steel wire armour 600/1000 Volt				1900/3300 Volt three core
	600/1000 Volt single core	1900/3300 Volt single core	Two core	Three core	Four core (equal)	Five core (reduced neutral)	
mm²	amp	amp	amp	amp	amp	amp	amp
1.5	-	-	700	700	700	-	-
2.5	-	-	800	800	900	-	-
4	-	-	900	1000	1500	-	-
6	-	-	1000	1500	1700	-	-
10	-	-	1800	1900	2100	-	-
16	-	-	2000	2200	3200	-	3800
25	-	-	2700	2900	3400	3400	4200
35	-	-	2900	3300	3700	3600	4000
50	3100	3500	3300	3700	5400	4200	5400
70	3500	3900	3700	5300	6100	5900	6100
95	4000	5700	5400	6100	7000	6900	6600
120	5700	6200	5800	6600	9700	9500	9100
150	6400	6500	6400	9300	10800	10400	9700
185	7000	7000	8900	10200	11700	11400	10400
240	7800	7800	9900	11400	13200	12700	11400
300	8600	8600.	11000	12700	14700	14300	12700
400	12200	12200	12300	14000	20600	19900	14000
500	13400	13400	-	-	-	-	-
630	14600	14600	-	-	-	-	-
800	20600	20600	-	-	-	-	-
1000	22900	22900	-	-	-	-	-

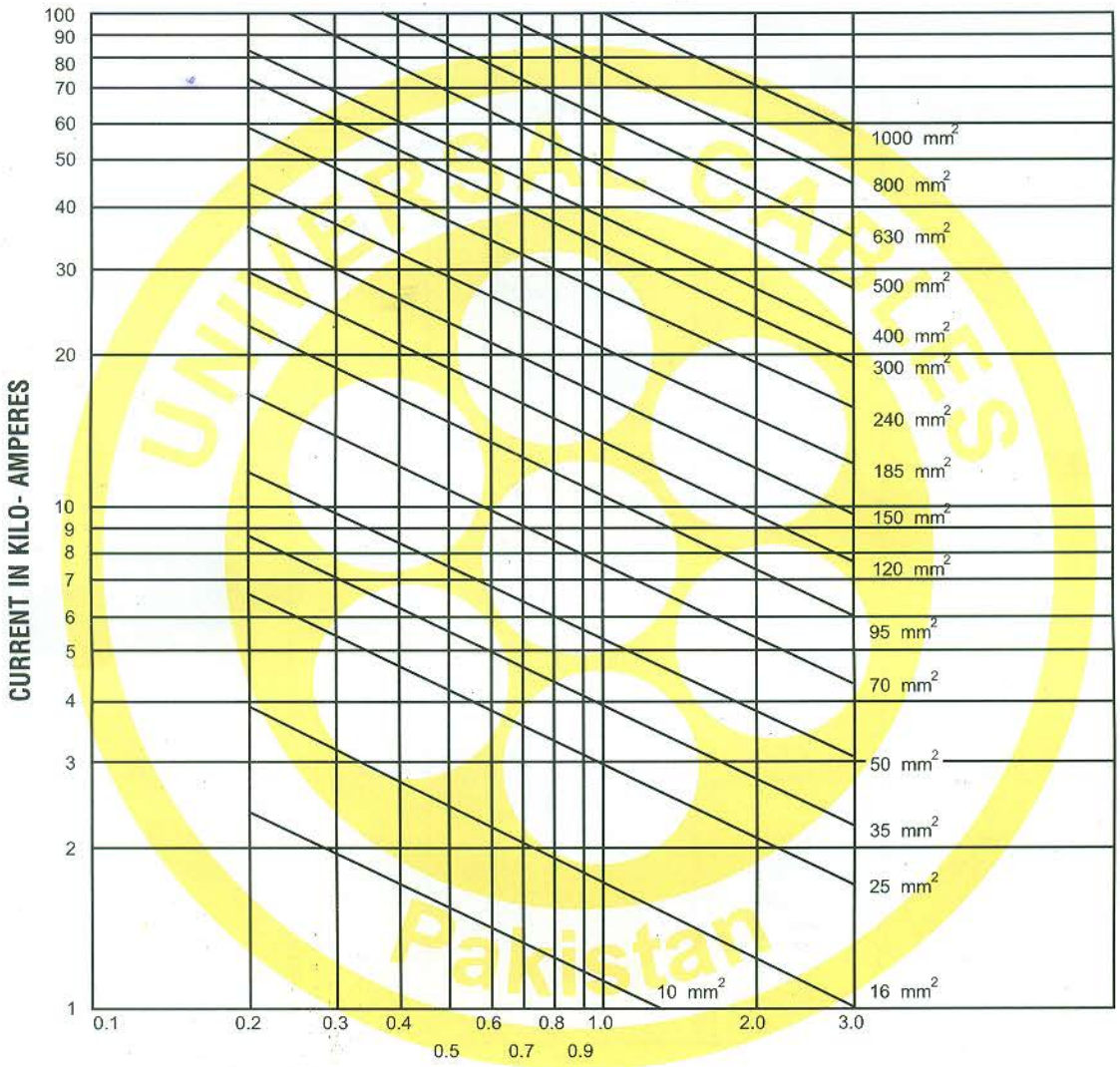
Note:

1. The above values are based on a fault duration of one second and an armour temperature rise from 60 C at commencement of fault to a final temperature of 160 C (Divide the tabulated value by the square root of the time in seconds for other then the indicated period).

2. The asymmetrical fault rating of the smaller sizes may be decided by the short circuit capability of the conductor rather than armour. It is therefore necessary to compare the two ratings.

Figure - A

Short Circuit Ratings
Stranded Copper Conductors



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

Short Circuit Ratings
Aluminium Conductor Cables
Armour fault currents to earth
(for fault duration of 1 second)
Wire Armour

Table 20

Nominal area of conductor	Aluminium wire armour		Steel wire armour 600/1000 Volt			1900/3300 Volt three core
	600/1000 Volt single core	1900/3300 Volt single core	Two core	Three core	Four core	
mm^2	amp	amp	amp	amp	amp	amp
16	---	---	1900	2000	2900	3600
25	---	---	2400	2700	3200	4000
35	---	----	2600	3100	3500	3800
50	2800	3200	4000	3500	5000	5100
70	3200	3600	4400	5000	5500	5700
95	3600	5200	4800	5700	6500	6200
120	5200	5600	---	6100	8900	8400
150	5700	5900	---	8400	9700	9100
185	6200	6400	---	9500	10800	9700
240	7000	7000	---	10600	12100	10600
300	7600	7600	---	11700	13400	11700
400	10900	10900	---	---	---	---
500	12200	12200	---	---	---	---
630	12900	12900	---	---	---	---
800	17800	17800	---	---	---	---
1000	20200	20200	---	---	---	---

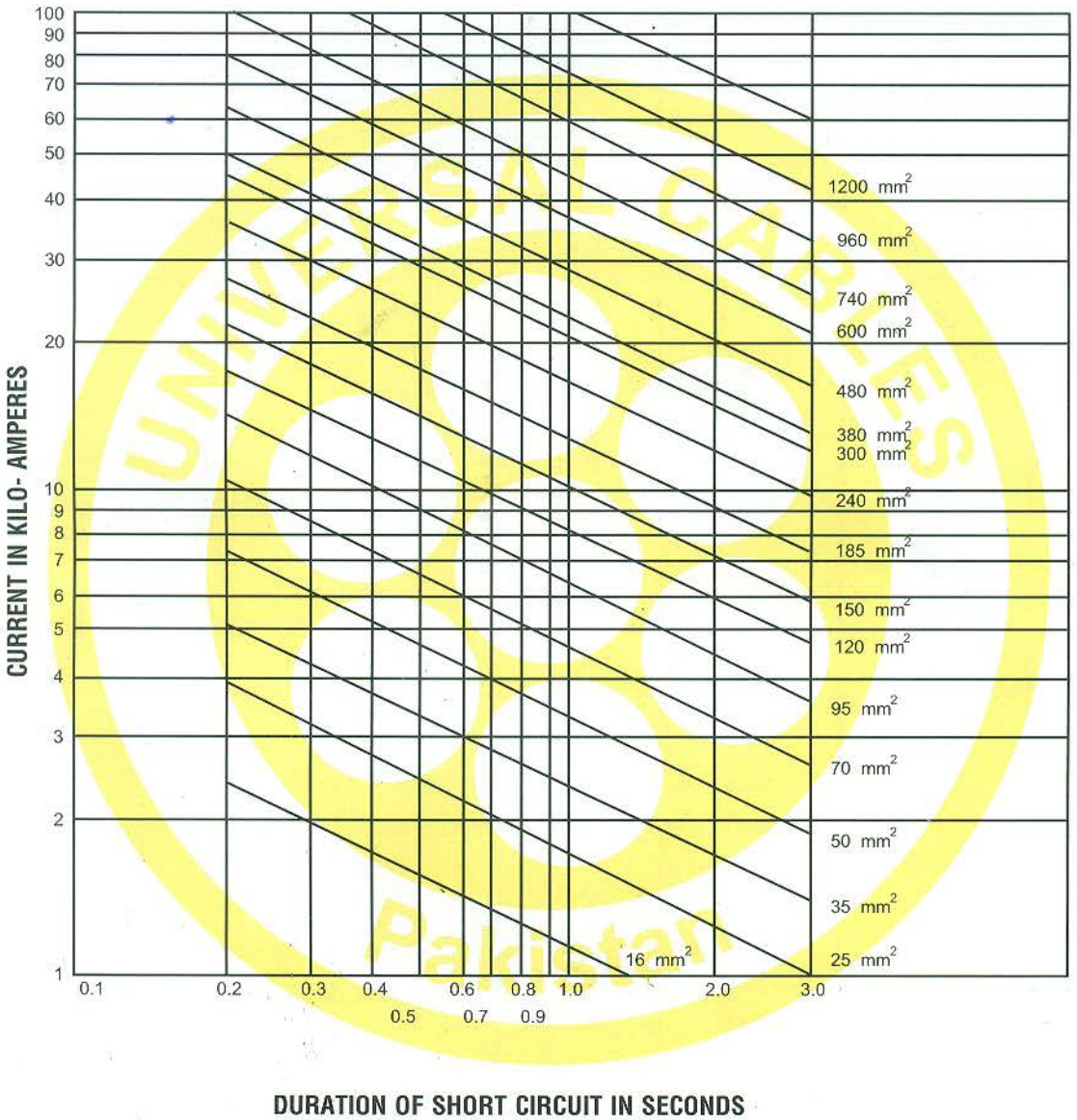
Note:

1. The above values are based on a fault duration of one second and an armour temperature rise from 60 C at commencement of fault to a final temperature of 160 C (Divide the tabulated value by the square root of the time in seconds forother then the indicated period).

2. The asymmetrical fault rating of the smaller sizes may be decided by the short circuit capability of the conductor rather than armour. It is therefore necessary to compare the two ratings.

Figure - B

Short Circuit Ratings
Stranded Aliuminium Conductors



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

Comparison between standard imperial and nearest standard metric sizes of conductors for electrical cables.

Table -A

Standard Imperial stranding /wire diameter inch	inch²	inch² converted to mm²	Nearest Metric Stranded Size to mm²	No. and nominal diameter of wires in circular conductor mm
3/.029"	0.0020	1.29	1.5	1/1.38
3/.036"	0.0030	1.94	1.5	7/0.53
7/.029"	0.0045	2.90	2.5	1/1.77
7/.036"	0.0070	4.52	4	7/0.85
7/.044"	0.010	6.45	6	7/1.04
7/.052"	0.0145	9.35	10	7/1.35
7/.064"	0.0225	14.52	16	7/1.70
19/.052"	0.04	25.81	25	7/2.14
19/.064"	0.06	38.71	35	7/2.52
19/.072"	0.075	48.39	50	19/1.78
19/.083"	0.10	64.52	70	19/2.14
37/.072"	0.15	96.77	95	19/2.52
37/.083"	0.20	129.0	120	37/2.03
37/.093"	0.25	161.3	150	37/2.25
37/.103"	0.30	193.6	185	37/2.52
61/.093"	0.40	258.1	240	61/2.25
61/.103"	0.50	322.6	300	61/2.52
91/.093"	0.60	387.1	400	61/2.85
91/.103"	0.75	483.9	500	61/3.20
127/.103"	1.0	645.2	630	127/2.52
127/.112"	1.25	806.4	800	127/2.85
127/.123"	1.50	967.7	1000	127/3.20

Temperature Correction Factors

Table -B

TEMPERATURE	TEMPERATURE CORRECTION MULTIPLICATION FACTORS	
° C	COPPER	ALUMINIUM
10	1.041	1.042
11	1.037	1.038
12	1.032	1.033
13	1.028	1.029
14	1.024	1.025
15	1.020	1.021
16	1.016	1.016
17	1.012	1.012
18	1.008	1.008
19	1.004	1.004
20	1.000	1.000
21	0.996	0.966
22	0.992	0.992
23	0.988	0.988
24	0.985	0.984
25	0.981	0.980
26	0.977	0.976
27	0.973	0.973
28	0.970	0.969
29	0.966	0.965
30	0.962	0.961
31	0.959	0.958
32	0.955	0.954
33	0.951	0.950
34	0.948	0.947
35	0.944	0.943
36	0.941	0.939
37	0.937	0.936
38	0.934	0.932
39	0.931	0.929
40	0.927	0.925

Formulae for Calculation of Rated Current for Electric Circuits.

Table -C

To calculate	Given	D.C.	A.C.Single Phase	A.C.Three Phase
Current (A)	kW	$A = \frac{1000 \times kW}{V}$	$A = \frac{1000 \times kW}{V}$	$A = \frac{1000 \times kW}{1.73 \times V \times p.f.}$
Current (A)	kVA	--	$A = \frac{1000 \times kVA}{V}$	$A = \frac{1000 \times kVA}{V}$
Current (A)	hp	$A = \frac{746 \times hp}{V \times eff:}$	$A = \frac{746 \times hp}{V \times eff: \times p.f.}$	$A = \frac{746 \times hp}{1.73 \times eff: \times p.f.}$
Power (kW)	VA	$kW = \frac{A \times V}{1000}$	$kW = \frac{A \times V \times p.f.}{1000}$	$kW = \frac{1.73 \times A \times V}{1000}$
Apparent Power (kVA)	VA	--	$kV = \frac{A \times V}{1000}$	$kVA = \frac{1.73 \times A \times V}{1000}$

p.f = Power factor of equioment or system under consideration.

eff = Efficiency of motor or machinery.

V = Line voltage


UNIVERSAL CABLES
Pakistan

NOTES

NOTES

SECTION IV

Section - IV

Characteristics of Conductor Materials

Table -1

Characteristics	Annealed Copper	Annealed Copper	Cadmium Copper	Hard drawn Aluminium	Aluminium Alloy	Galvanized Steel
Conductivity percent	100	97 (average)	79.2 (minimum)	61 (minimum)	53.5)	-
Volume resistivity at 20°C Ohm-mm²/m Micro ohm-inch³	0.017241* (standard) 0.67879	0.01771* (average) 0.67879	0.021769 (maximum) 0.85705	0.028264 (maximum) 1.1128	0.00322 (standard) 1.2677	- -
Mass resistivity at 20°C Ohm-gramme/m Ohm-pound/mile	0.15328 875.20	0.15741 89.83	0.19472 1111.90	0.076398 436.23	0.08694 496.42	- -
Resistance at 20°C Ohm-mm²/km Ohm-inch²/1000Y	17.241 0.024437	17.71 0.025096	21.769 0.30854	28.264 0.040059	32.20 0.045637	- -
Density at 20°C gramme /cm³	8.89	8.89	8.945	2.703	20703	7.78
Weight kg/mm²/km Ib/inch²/1000Y	8.89 11562	8.89 11562	9.945 11634	2.703 3516 0.0403	2.703 3516	7.84 10197
Temperature coefficient of resistance at 20°C/°C	0.00393	0.00381	0.0031		0.0036	-
Coefficient of linear expansion at 20°C per °C per°F	$17x10^{-6}$ 9.44x10	$17x10^{-6}$ 9.44x10	$17x10^{-6}$ 9.44x10	$23x10^{6}$ 12.78x10	$12.78x10^{-6}$ 23x10	$11.5x10^{-6}$ 6.4x10
Ultimate tensile stress (approximate) kg/mm² Ib/inch²	25.3 36000	42.2 60000	63.3 90000	16.5 23500	29 44000	136 194000
Modulus of elasticity (approximate) kg/mm² Ib/inch²	9 to10.5x10³ 13 to 15x10	12.66x10³ 18x10	12.66x10³ 18x10	6.96x10³ 9.9x10	7x10³ 9.9x10	20x10³ 28x10

* For calculation, this value has been extended to 0.017241379

Assumed average ultimate tensile strength:27 tons/inch²

For conductors covered cables, this is the assumed standard value -6

Salient Characteristic of Polyvinyl Chloride (PVC) Compounds Insulating Materials

Chart-A

MATERIAL	PVC TI 1	PVC TI 2	PVC TI 3	PVC TI 4	PVC TI 5	PVC Type 2
FORMULATED AS INSULATION	General Purpose	Flexible including transparent	Heat Resisting	Low Temperature	Low Temperature General purpose Flexible	Hard Grade
FORMULATED AS SHEATH						
CONDUCTOR Limiting temperature °C						
Max. Continuous operation	70	70	90	70	70	70
Max. Overload	120	120	120	120	100	120
Max. Short circuit	150	150	150	150	120	150
MATERIAL Limiting temperature °C						
Min. Flexing Duty	-15	-15	-15	-40	-30	-15
Min. For installation	0	+10	0	-30	-30	+10
RESISTANCE to Ozone						
Corona						
Weather						
Oil						
Water						
(2) Chemical						
(2) Solvents						
Abrasion						
Flame Retardance						
ELECTRICAL Insulation Resistance						
Voltage Breakdown						
a.c.losses						
British Standard -Part=#	7655-3.1	7655-3.1	7655-3.1	7655-3.1	7655-3.1	7655-3.2

=Very good = Good = Fair = Poor = Non Applicable

Salient Characteristic of Polyvinyl Chloride (PVC) Compounds Sheathing Materials

Chart-B

MATERIAL	PVC TM1	PVC TM2	PVC TM3	PVC TM4	PVC TM5	PVC Type 5	PVC Type 6	
FORMULATED AS INSULATION								
FORMULATED AS SHEATH								
CONDUCTOR Limiting temperature °C								
Max. Continuous operation	70	70	90	70	70	85	70	90
Max. Overload	120	120	120	120	120	120	120	120
Max. Short circuit	150	150	150	150	150	150	150	150
MATERIAL Limiting temperature °C								
Min. Flexing Duty	-15	-15	-15	-30	-15	-15	-15	-15
Min. For installation	0	+10	0	-10	+10	0	+10	0
RESISTANCE to Ozone								
Corona								
Weather								
Oil								
Water								
(2) Chemical								
(2) Solvents								
Abrasion								
Flame Retardance								
ELECTRICAL Insulation Resistance								
Voltage Breakdown								
a.c.losses								
British Standard -Part=#	7655-4.1	7655-4.1	7655-4.1	7655-4.1	7655-4.1	7655-4.2	7655-4.2	7655-4.2

=Very good = Good = Fair = Poor = Non Applicable

Instructions for Handling Cable Drums

Improper handling can damage the drums and thus resulting damage to the cable. Moreover when drums are moved without taking recommended instructions their structure also become lose and in sonic cases nails come out and pierce through the cable, which causes electrical break down. Therefore the following instructions should always be implemented.

1. Use the proper method as indicated when lifting the cable with crane **(Figure-1)**
2. Use the proper method as illustrated **(Figure-2)** when handling the reel with a forklift. Maintain a minimum 30 cm clearance from the reel flange as indicated in the figure.
3. Do not lay the reels on their sides (flat); use proper stops to prevent the reel from rolling **(Figure-3).**
4. Secure the reel on the truck adequately as indicated in **Figure-4A** and not as shown in Figure-4B before transportation.
5. While unloading, do not drop the reel on the ground, use forklift, and crane or ramp **(Figure-5)**
6. Do not roll the reels against the roll this way direction **(Figure-6)**

Storage

When drums of cable are required to be stored for the longer period then the following precautions should be taken: -

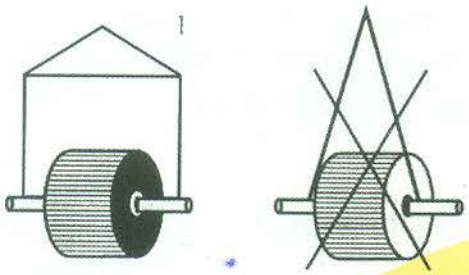
- The site of the storage of drums should be hard surfaced soils or a concrete surfaced in order to avoid sinking of drums, which may pose difficulty in moving drums and thus causing damage.
- The drums should be stored by leaving enough space between them and taking care that lagging is intact and barrels or bolts are tightened.
- The stacking of the drums should always be avoided.
- The cable end must be kept sealed to avoid the ingress of moisture.

Minimum temperature during installation

To avoid the risk of damage during handling, in the region of 0 °C or lower, it is desirable that the cable specified in this catalogue should be installed only when both the cable and the ambient temperatures are above 0 °C and have been so for the last 24 hours or special measures shall be taken to eliminate any such risks, by maintaining the cable above 0 °C.

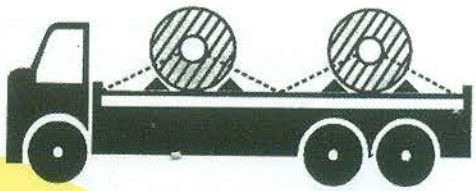
Proper Way of Handling Cable Drums

1



Correct Incorrect

4 A

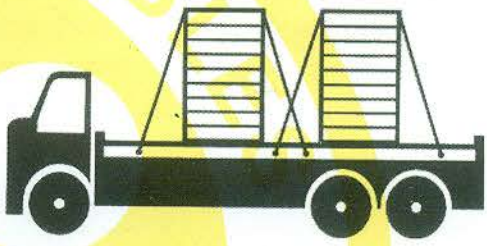


Correct

2

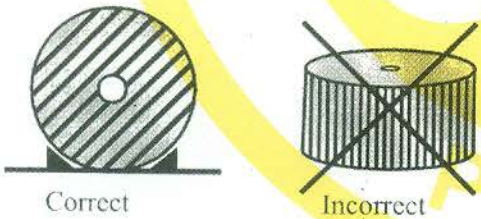
Correct Incorrect

4 B



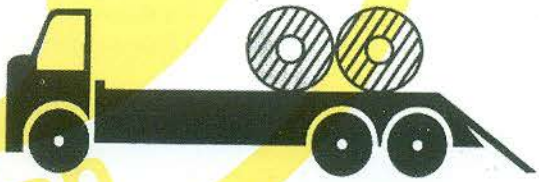
Incorrect

3



Correct Incorrect

5



Correct

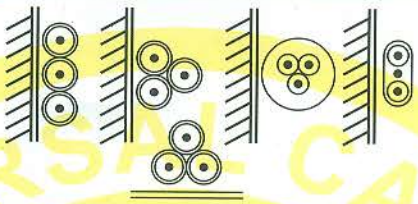
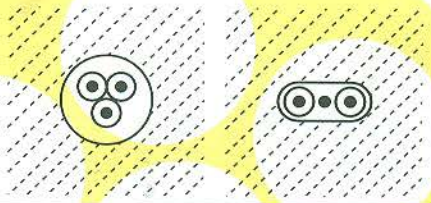
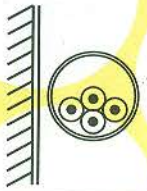
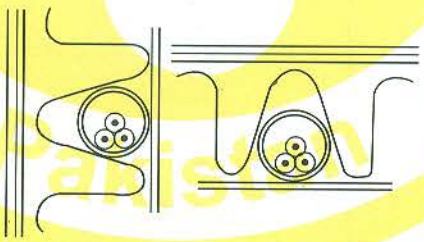
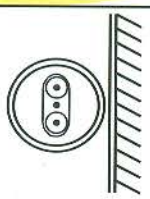
6

ROLL THIS WAY

Correct

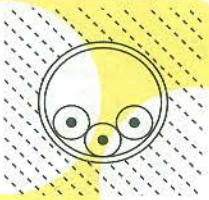
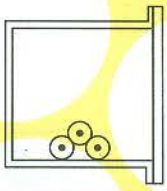
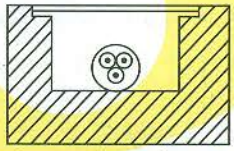
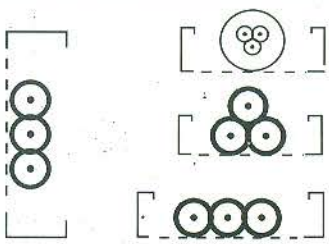
APPENDIX-A

Schedule of Installation Mathods of Cables (including Reference Method)

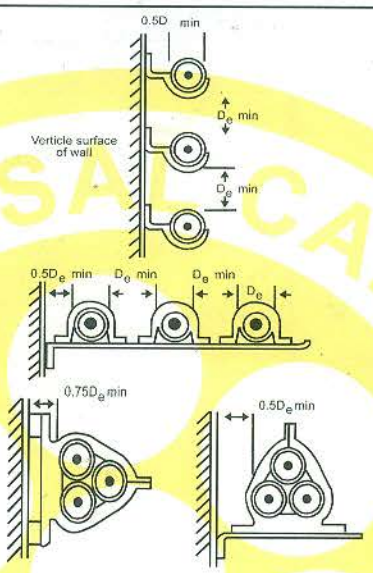
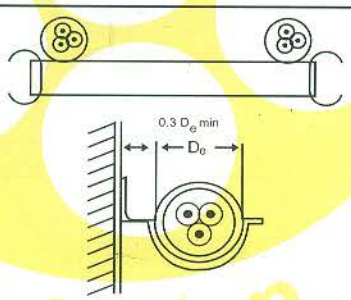
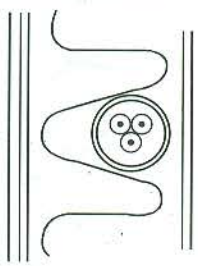
Number	Installation method Description	Examples	Appropriate Reference Method for determining current-carrying capacity
1	2	3	4
Open and clipped direct:			
1	Sheathed cables clipped direct to or lying on a non-metallic surface.		Method 1
Cables embedded direct in building materials:			
2	Sheathed cables embedded directly in masonry, brickwork, concrete, plaster or the like (other than thermally insulating materials)		Method 1
In conduit :			
3	Single-core non-sheathed cables in metallic or non-metallic conduit on a wall or ceiling		Method 3
4	Single-core non-sheathed cables in metallic or non-metallic conduit in a thermally insulating wall or above a thermally insulating ceiling, the conduit being, in a contact with a thermally conductive surface on one side.†		Method 4
5	Multicore cables having non-metallic sheath, in metallic or non-metallic conduit on a wall or ceiling.		Method 3

† The wall is assumed to consist an outer weatherproof skin, thermal insulation and or inner skin of plasterboard or wood-like material having a coefficient of heat transfer not less than 10 W/m2K. The conduit is fixed so as to be close to, but not necessarily touching, the inner skin. Heat from the cables is assumed to escape through the inner skin only.

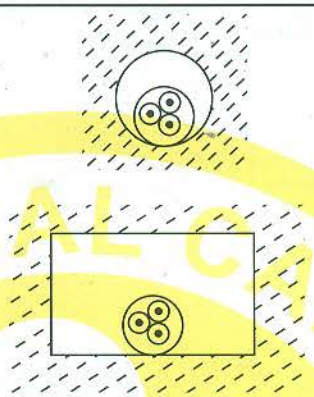
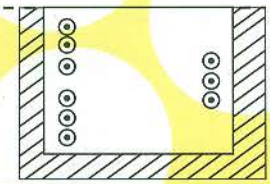
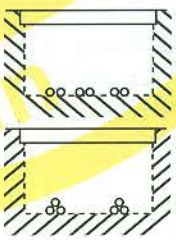
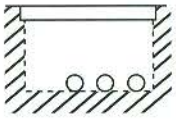
APPENDIX-A

Number	Installation method Description	Examples	Appropriate Reference Method for determining current-carrying capacity
1	2	3	4
6	Sheathed cables in conduit ina thermally insulating wall etc. (Otherwise as Ref. Method 4)		Method 4 or Method 6 for cable type covered by Table 8a (Page-42)
7	Cables in conduit embedded in masonry, brickwork, concrete, plaster or the like (other then thermally insulating materials).		Method 3
In trunking :			
8	Cables in trunking on a wall or suspended in the air.		Method 3
9	Cables flush floor in trunking.		Method 3
10	Single-core cables in skirting turnking.		Method 3
On trays:			
11	Sheathed cables on a perforated cable tray, bunched and unenclosed. A perforated cable tray is considered as a tray in which the holes occupy at least 30% or more of the surface area.		Method 11

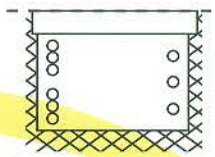
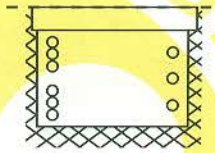
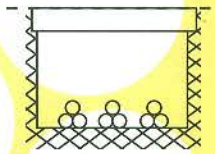
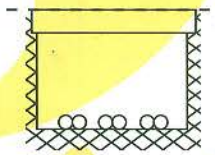
APPENDIX-A

Number	Installation method Description	Examples	Appropriate Reference Method for determining current-carrying capacity
1	2	3	4
In free air, on cleats, brackets or a ladder:			
12	Sheathed single-core cables in free air (any supporting metal work under the cables occupying less than 10% of the plan area): Two or three cables vertically one above the other, minimum distance between cable surfaces equal to the overall cable diameter (D_e): distance from the wall not less than 0.5 D_e. Two or three cables horizontally, with spacings as above. Three cables in trefoil, distance between wall and surface of nearest cables 0.75 D_e.		Method 12
13	Sheathed multi-core cables on ladder or brackets, separation greater than 2D_e, Sheathed multi-core cables in free air distance between wall and cable surface not less than 0.3D_e Any supporting metal work under the cables occupying, less then 10% of the plan area		Method 13
14	Cables suspended from or incorporating a catenary wire		Method 12 or 13 as appropriate
Cables in building voids:			
15	Sheathed cables installed directly in a thermally insulating wall or above a thermally insulating ceiling, the cable being in contact with a thermally conductive surface on one side (otherwise as Ref. Method 4)		Method 4 or Method 15 for cable type covered by Table 8a (Page-42)

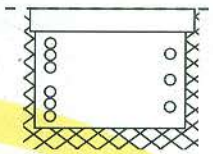
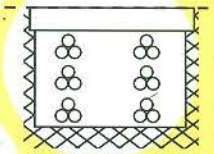
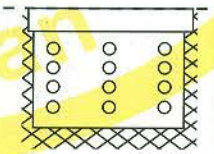
APPENDIX-A

Number	Installation method Description	Examples	Appropriate Reference Method for determining current-carrying capacity
1	2	3	4
16	Sheathed cables in ducts or voids formed by the building structure, other than thermally insulating materials.		Method 4 where the cable has a diameter D_e and the ducts has a diameter not greater than $5D_e$ or a perimeter not greater than $20D_e$ Method 3 where the ducts has either a doameter greater than $5D_e$ or a perimeter greater than $20D_e$ NOTE-1: where the perimeter is greater than $60D_e$, installation methods 18 to 20, as appropriate, should be used. NOTE-2: D_e is the overall cable diameter. For groups of cables D_e is the sum of the cable diameters.
Cables in trenches:			
17	Cables supported on the wall of an open or ventilated trench, with spacings as indicated for Ref. Method 12 or 13 as appropriate		Method 12 or 13, as appropriate
18	Cables in enclosed trench 450mm wide by 300 mm deep (minium)dimensions) including 100 mm cover.	Two to six Single-core Cables with surfaces separated by a minium of one cable diameter.  One or two groups or three single-core cables in trefoil formation. One or four 2-core cables or one to three 3 or 4 core cables with all cables separated by a minimum of 50mm. 	Method 18 Use rating factors in Table 2 (page-36)

APPENDIX-A

Number	Installation method Description	Examples	Appropriate Reference Method for determining current-carrying capacity
1	2	3	4
19	Cables in enclosed trench 450 mm wide by 600 mm deep (minimum dimensions) including 100 mm cover	Six to twelve single-core cables arranged in flat groups of two or three on the vertical tranch wall with cables separated by one cable diameter and a minimum of 50 mm between groups.  or  two to four groups of three single-core cables in trefoil formation with a minimum of 50 mm between trefoil formations  or  four to eight cables of 2-core or three to six cables of 3 or 4 cores with cables separated by a minimum 75 mm. All cables spaced at least 25 mm from the trench wall.	Method 19 Use rating factors in Table 2 (page-36)

APPENDIX-A

Number	Installation method Description	Examples	Appropriate Reference Method for determining current-carrying capacity
1	2	3	4
20	Cables in enclosed trench 600 mm wide by 760 mm deep (minimum dimensions) including 100 mm cover	Twelve to twenty four single-core cables arranged in either  flat formation of two or three cables in a group with cables separated by one cable diameter and each cable group separated by a minimum of 500 mm either horizontally or vertically or single-core cables in trefoil formation with each group or trefoil formation separated by a minimum of 50 mm either horizontally or vertically  or eight to sixteen 2-core cables or six to twelve cables of 3 or 4 cores with cables separated by a minimum of 75 mm either horizontally or vertically. All cables spaced at least 25 mm from trench wall. 	Method 20 Use rating factors in Table 2 (page-36)

* Larger spacing to be used where practical

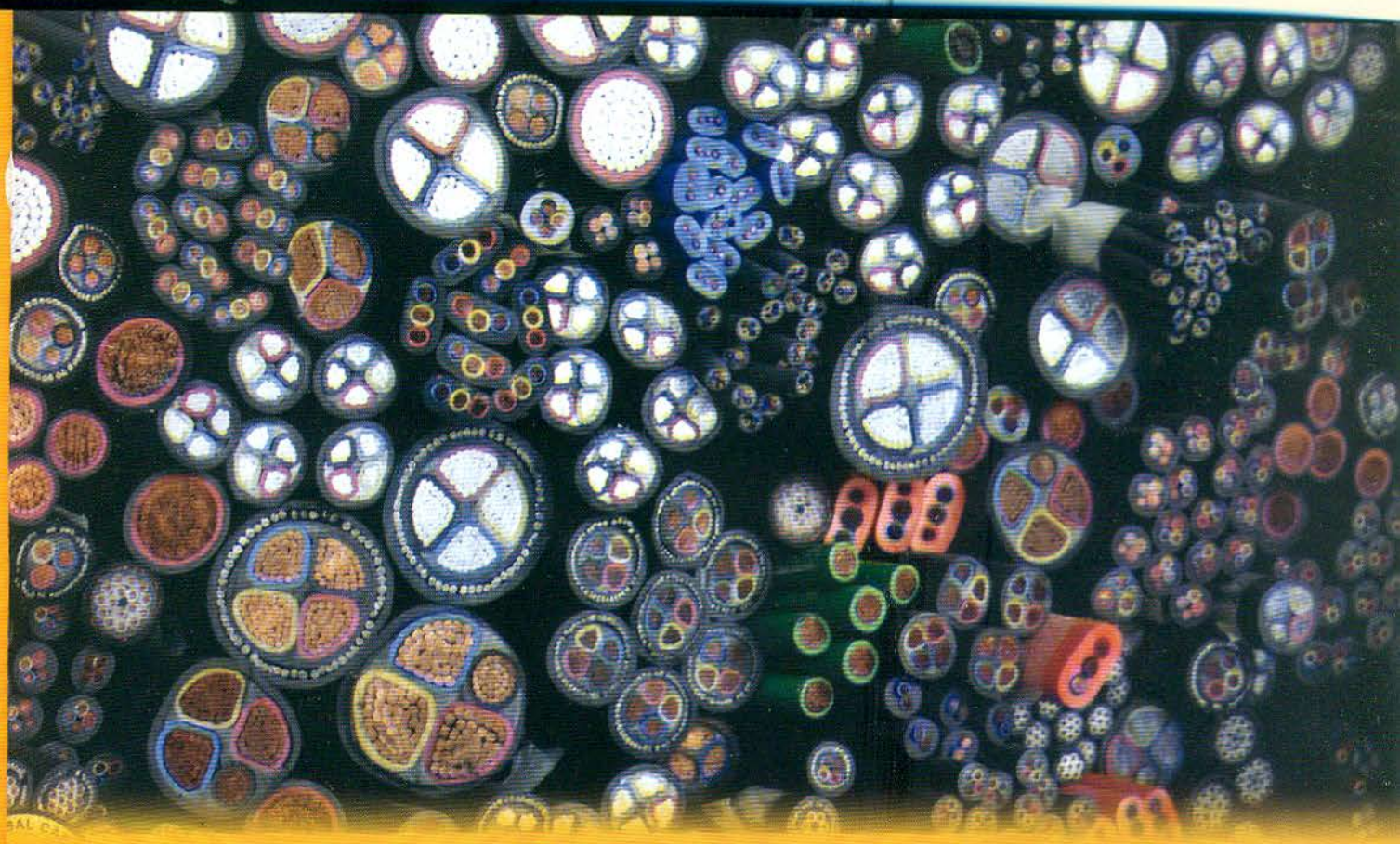
NOTES

Certificates & Memberships

ISO 9001:2008

Certification Under Process
ISO 14001:2015

UNIVERSAL CABLES INDUSTRIES LTD.



Range of Products

L.T POWER CABLES
- Armoured & Un-Armoured
- PVC & XLPE Insulated

CONDUCTORS (COPPER & ALUMINIUM)
- Hard & Soft Drawn Bare Copper Conductor
- As per WAPDA & K-Electric Specifications

FLEXIBLE CABLES
- Flexible L.T. Power & General Wiring Cables
- Flat Type (Submerssible Cables)

CONTROL CABLES
- Solid, Stranded & Flexible Conductors
- Armoured & Un-Armoured

GENERAL WIRING
- Solid, Stranded & Flexible Conductors
- Imperial Sizes

INSTRUMENTATION CABLES
- Armoured & Un-Armoured
- Collective Aluminium Foil Shielded
- Individual & Collective Aluminium Foil Shielded

COPPER BRAID SHIELDED CABLES
- Solid, Stranded & Flexible Conductors

COPPER TAPE SCREENING CABLES
- As per Wapda, BS & IEC Specifications

H.T CABLES (IMPORTED)
- As per K-Electric & IEC Specifications

COPPER ROD 8 MM AS PER ASTM B49

Aluminium ROD 9.5 MM AS PER ASTM 233/97

AERIAL BUNDLE CABLES

TELEPHONE CABLES

AUTOMOTIVE CABLES

FLAT BRAID CABLES

JUMPER WIRES

BINDING WIRES

LOW SMOKE ZERO HALOGEN CABLES
CUSTOMIZED CABLES
AS PER CUSTOMER SPECIFICATIONS.

UNIVERSAL CABLES Pakistan

UNIVERSAL CABLES INDUSTRIES LTD.

THE POWERLINE OF PAKISTAN

UNIVERSAL CABLES INDUSTRIES LTD.

Head Office:
61/C, Jami Commercial Street # 07,
Phase VII, D.H.A, Karachi, Pakistan.
Phone: 021-35382392-94, 021-35804571-75
Fax: 021-35382391, 021-35804576

Regional Sales Off. (Northern)
Office # 222, 2nd Floor,
Siddique Trade Centre,
Main Boulevard, Gulberg-III,
Lahore, Pakistan.
Phone: 042-35787640-41,
Fax: 042-35787610

Factory:
A-25, North Western Industrial Zone,
Bin Qasim, Karachi, Pakistan.

UAN: 021-111-786-825 sales @ucil.com.pk www.ucil.com.pk