Company Background

Belayab cable manufacturing private limited company is established in 2008 by two companies and four individual share holders with Company Asset of Birr 243,600,000 to manufacture low voltage, Copper Wire & Cable , all aluminum Conductor and all aluminum alloys, and aluminum Conductor steel reinforced electrical conductors, overhead transmission line and data cables This time all the necessary Machinery, equipment and raw material purchased and production started.

Belayab cable manufacturing PLC offers one of the most complete lines of power cables, control cables and data cables from copper and aluminum cabling system solutions with over hundreds of different cabling system products. And we will have a comprehensive stock of cables and cabling products through its national and international network of resellers and distributors. Our superior products provide leading edge within every cable series and for every application. Among the national and international standards with which our cables could comply are: Ethiopian standards,

BS - British Standard, DIN standards and IEC Standards. And we will respect for its high standards of quality, excellent service level, competitive pricing, and a unique and innovative spirit. With our latest technology result equipment and machineries, we are both inspired and well-positioned to meet the changing needs of our customers. We have the resources to diversify and to enhance our product lines and services. We understand the need for change and with our accurate planning. We are ready for the future and the promise of new marketing opportunities.

Our Vision

To be Best Choice in manufacturing Industries Aluminum and copper electrical cables in East Africa.

Our Vision

Producing copper(Cu),all aluminum alloy conductor (AAAC), and aluminum steel reinforced(ACSR) insulated and bar conductor using genuine input, Up to Date Production Technologies and Qualified Man Power to Satisfy Customer Requirements.

Company Background

1. Commitment and innovativeness we shall demonstrate the highest level of commitment, team work,loyality innovativeness and integrity among our em ployees and we shall empower them for their continuous development.
2. Partnership with international organizations We shall promote local and international committed partnership and strong networking.
3. Contributing for friendly environment.

Production Process

Our product is produced based on IEC, DIN and ENBS standards for copper and aluminum wire and cables. The production process is performed based on the production procedure and product quality assurance procedure prepared in accordance with quality management system.

Production Quality Assurance

We have experienced quality assurance engineers and our product quality is assured by checking using our latest technology result laboratory devices and equipments. Besides this we are working with Ethiopian conformity assessment enterprise for assuring product quality.

Quality Management System

We are working with ISO QAR to implement quality management system (ISO 9001:2008) in our organization. We already prepared documents and started to implement it.

1.1. Abbreviation of Important terms

- AC: Alternating current
- ASTM: American Society for Testing and Materials
- DC: Direct current
- IEC: International electric commission

1.2. Comparison of Characteristics of Copper and Aluminum

Material	Copper	Aluminum	Aluminum alloy	Galvanized steel
Specific gravity g/cm3	8.89	2.703	2.70	7.8
Tensile strength MPA a) Hard drawn	367	160	-	1320-1700
b (annealed	248	100	295	
Volume resistivity at 20°C .m	1.724 x Id ‘	2.826 x 10-x	3.253 x 10’*	-
Temperature coefficient of resistance per °C	0.00393	0.00403	0.00360	0.0054
Coefficient of linear expansion per °C	17 x 10 ‘6	23 x 10 ‘6	23 x 10 ■6	1 1.5
Specific heat KJ/kg/K	0.394	0.904	0.904	-
Melting point °C’	1083	658	658	-
conductivity	97	61	53	9

1.3. Insulating Materials Types Per IEC 60502-1

• PVC/A: PVC primary insulating material for low voltage electrical cable; working temperature 70 °C

• PVC/B: PVC primary insulating material for low voltage electrical cable: working temperature 80 °C

• PVC/C: PVC insulating material for low voltage electrical cable. Working temperature 90 °C.

• ST1: PVC sheathing material for medium and high voltage electrical cable; working temperature 80 °C.

• ST2: PVC sheathing material for medium and high voltage electrical cable; working temperature 90 °C.

• ST2: PVC sheathing material for medium and high voltage electrical cable; working temperature 90 °C.

• ST3: polyethylene outer jacket material for medium and high voltage electrical cable; working

tempera-ture 80 °C.

• ST7: Polyethylene outer jacket material for medium and high voltage electrical cable; working tempera-ture 90 °C.

• ST8: halogen free PVC insulation for special requirement cables; working temperature 90 °C

♦ XLPE: (cross linked polyethylene) inner insulating material for medium and high voltage electrical cable, Working temperature 90 °C.

* SE1; (EPR) Ethylene propylene rubber inner insulating material for medium and high voltage electrical cable, Working temperature 85 °C.

1.4. Comparison of Characteristics of Insulation Materials

1.4.1. Maximum insulating material operating temperature, Short circuit current and other physical properties

Insulating material	PVC	PVC	XLPE	EPR
1. Maximum conductor operating temperature °c	Cross sectional area<300mm2 70/80	Cross sectional area >3 00mm2 70/80	90	90
2. Short circuit current in maximum duration of 5 second.	160	140	250	250
3. Tensile strength minimum N/mm	12.5	12.5	12.5	4.2
4. Volume resistivity at max. conductor tempera¬ture nominal operating , p in ohm centime- ter(Q.cm)	10^{10}	10^{10}	10^{12}	10^{12}
5.Insulation resistance constant at maximum conductor temperature nominal opera¬tion. (Mflkm)	0.037	0.037	3.67	3.67
6.Elongation at break minimum,%	150	150	200	200

1.4.2.Product feature of PVC insulated cable.

• Non hygroscopic , un affected by moisture

• Non-migration of compound permitting vertical installation

• Complete resistance to electrolytic and chemical corrosion.

• Tough and resilient sheathing with excellent fire resistance

• Good aging characteristics' not affected by vibration.

1.4.3. Product feature of XLPE insulated cable

• Higher current and short current rating.

• Longer service life

• It is less sensitive to the setting of network protection.

• Low dielectric loss

• Excellent mechanical resistance against external stress.

• Excellent crack resistance due to cross linking of thermosetting effect.

• Resistance to acids bases than thermoplastic cables.

Note: for further technical information see annex attached.

1.5. Standards Related to Product

1.5.1 IEC Standards

• IEC 60228: Conductors of insulated cables

• IEC: 60060-1: High voltage test Techniques

• IEC 60227-2.: Polyvinyl chloride insulated cables of rated voltage up to and including450/750 V -

• IEC 60227-3: Polyvinyl chloride insulated cables of rated voltage up to and including450/750 V - Part 3: Non-sheathed cables for fixed wiring

• IEC 60227-4: Polyvinyl chloride insulated cables of rated voltage up to and including450/750 V: Part 4: Sheathed cables for fixed wiring

• IEC 60227-5: Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 5: Flexible cables (cords)

• IEC 60502-1: Power cables with extruded insulation and their accessories for rated voltages up to includ¬ing 0.6/1(1.2) k volt.

• IEC60502-2: Power cables with extruded insulation and their accessories for rated voltages up to includ¬ing 30/36K volt

• IEC 60173: Colors of the cores of flexible cables and cords

• IEC 60811: Common test methods for insulating and sheathing materials of electric cable.

• IEC 62440: Electric cables - Guide to use for cables with a rated voltage not exceeding 450/750V

• IEC 10104: Aluminum conductors

1.5.2 BS EN Standards

• BSEN 50363 Insulation type for wire and cable.

• BSEN 6004: British specific requirements for the construction, dimensions, mechanical and electrical Properties of non armored polyvinyl chloride (PVC) insulated for the operation at voltage up to

and in¬cluding 450/750 volt.

• BSEN 7655: specification for insulating material for wire and cables.

• BSEN 50182: Round concentric Conductors for overhead lines.

• BSEN 60811: Common test methods for insulating and sheathing materials of electric cable.

1.6 Insulating Wire & Cable Selecting Factors

There are important factors when selecting a suitable cable construction which is required to transport electrical energy from the power station to the consumer, from substation to main distributing line, from distributing line to users and within users machinery, equipment or anything that need power source.

• Maximum operating voltage

• Insulation type and level

• Frequency

• Rated voltage

• Magnitude and duration of possible load

• Voltage drop

• Line length

• Mode of installation, either underground ,in water or in air

• Chemical and physical properties of soil

• Max. and min. ambient air temperature and soil temperature

• Specification and requirements to be met

1.7. Color Scheme

The colors green and yellow, when not in combination, shall not be used for any multi core cable .The preferred color scheme for flexible cables and single-core cables is:

• single core cable: no need of color scheme

• two core cable: no need of color scheme

• Three core cable: Either green or yellow, Blue, brown or brown, black, grey

• Four core cable:Either green or yellow. Brown, black. Grey or blue, brown, black, grey.

• Five core cables:Either green or yellow, blue. Brown, black, grey or blue, brown, black, Grey, black.

1.8. Rated Voltage of Cable

It is denoted by Uo/U(Um) as per IEC 60502.

Where:

Uo: is the rated power frequency voltage between conductor and earth or metallic screen for Which

the cable is designed;

U: is the rated power frequency voltage between conductors for which the cable is designed;

Urn: is the maximum value of the “highest system voltage” for which the equipment may be used (see IEC 60038).

Rated voltage designation	Value											
Uo/U^kV	0.3/0.5	0.45/0.75	0.6/1	1.8/3.	3.6/6	6/10	8.7/15	12/20	18/30	38/66	76/132	172/220
Um	NA	NA	1.2	3.6	7.2	12	17.5	24	36	72.5	145	245

1.9. Product Code

: It is designated below as:

Conductor	Primary insula	Type of conductor	Inner sheath/tape	screening	Armor	Outer sheath /jacket	Rated voltage	No of core	Cross sectional
Cu	PVC or XLPE	S/R or F	PVC	Cu or A1	SWA or STA	PVC or HDPE	00	00	00
C	P or X	S/R or F	PI/PP	CT or AT	W or T	P.I or PE	00	00	00

For description of each see table (a-d) below:

d) Armor type, and screening conductor type

Armor type	*code*	*Screening type*	*code*
Galvanized steel wire armor(SWA)	*W*	*Copper tape screen*	*CT*
Galvanized steel tape armor (STA)	*T*	*Aluminum tape screen*	*AT*
Lead armor	*L*	*Galvanized steel tape(STA)*	*ST*
Lead alloy armor	*LI*		

1.10. Product Delivery Packing Type & Size

Product type	size	Packing type	delivery Remark size in meter
Single core solid insulated wire Two-five core solid cable	0.5-6 mm2 2xl.5-5x2.5mm2 3x6-5x6 mm2	coiled roll coiled roll wooden	100 100 1000
Single core Stranded or flexible cable	1.5-10 mm2	coiled roll	100
single core stranded or flexible cable	16-400 mm2 500-630 mm2	wooden wooden drum	1000 500
Two core stranded or flexible cable	2x1.5-2x6 mm2 2x6-2xl50mm2 2x180-2x400	coiled roll wooden drum wooden	100 1000 500
Three core stranded cable or flexible cable	3xl.5-3x4 mm2	coiled roll	100

	3x6-3x120	wooden	1000
	3xl50-3x240mm2	wooden drum	500
	3x300-3x400mm2	wooden drum	250
Four core stranded or flexible cable	4xl.5-4x2mm2	coiled roll	100
	4x4-4x95 mm2	wooden drum	1000
	4xl20-4x240mm2	wooden drum	500
	4x300-4x400mm2	wooden drum	100
Five core stranded or flexible cable	2xl.5-5x2.5 mm2	coiled roll	100
	5x4-5x70 mm2	wooden drum	1000
	5x70-5x185	wooden drum	500
	5x240-5x300	wooden drum	250

2. Product Types

The main inputs for products are conductor's semiconducting materials and insulators. Main Conductors used are copper or aluminum. Main insulating materials are PYC and XLPE.

2.1. Low Voltage Cables

Construction

• Conductor: Plain Annealed Copper

• Insulation : PVC type A compound per IEC60502-lor PVC typeTll per BSEN50363

• Operating temperature 70 °C

• Sheath ST1 ; operating temperature 70 °C per IEC 60227.

• Color : for insulation:

One core: Black Two cores: Red.

Black Three cores: Red Yellow, Blue

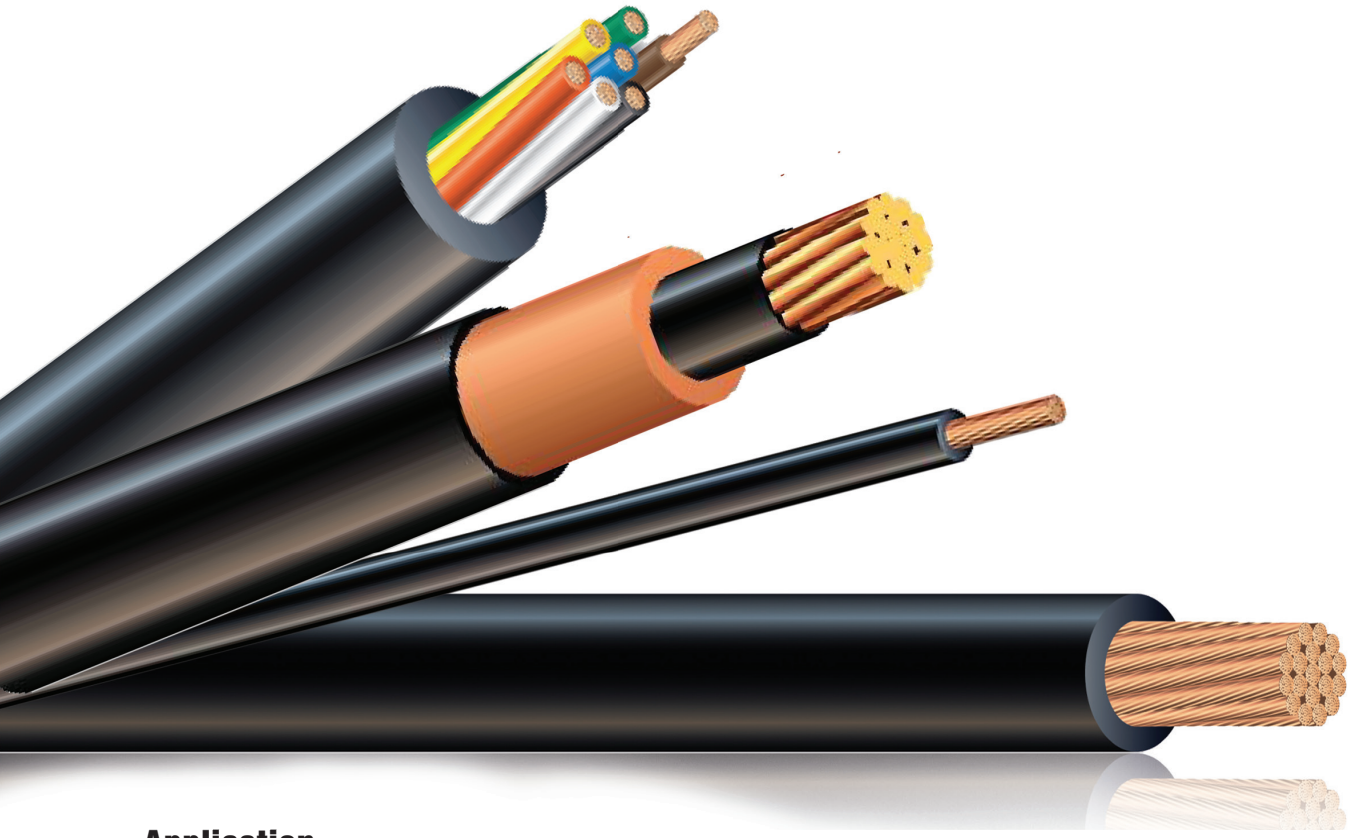
Four core: Red. Yellow, blue, black

Color for Sheath: grey for single core

Black for two or more core

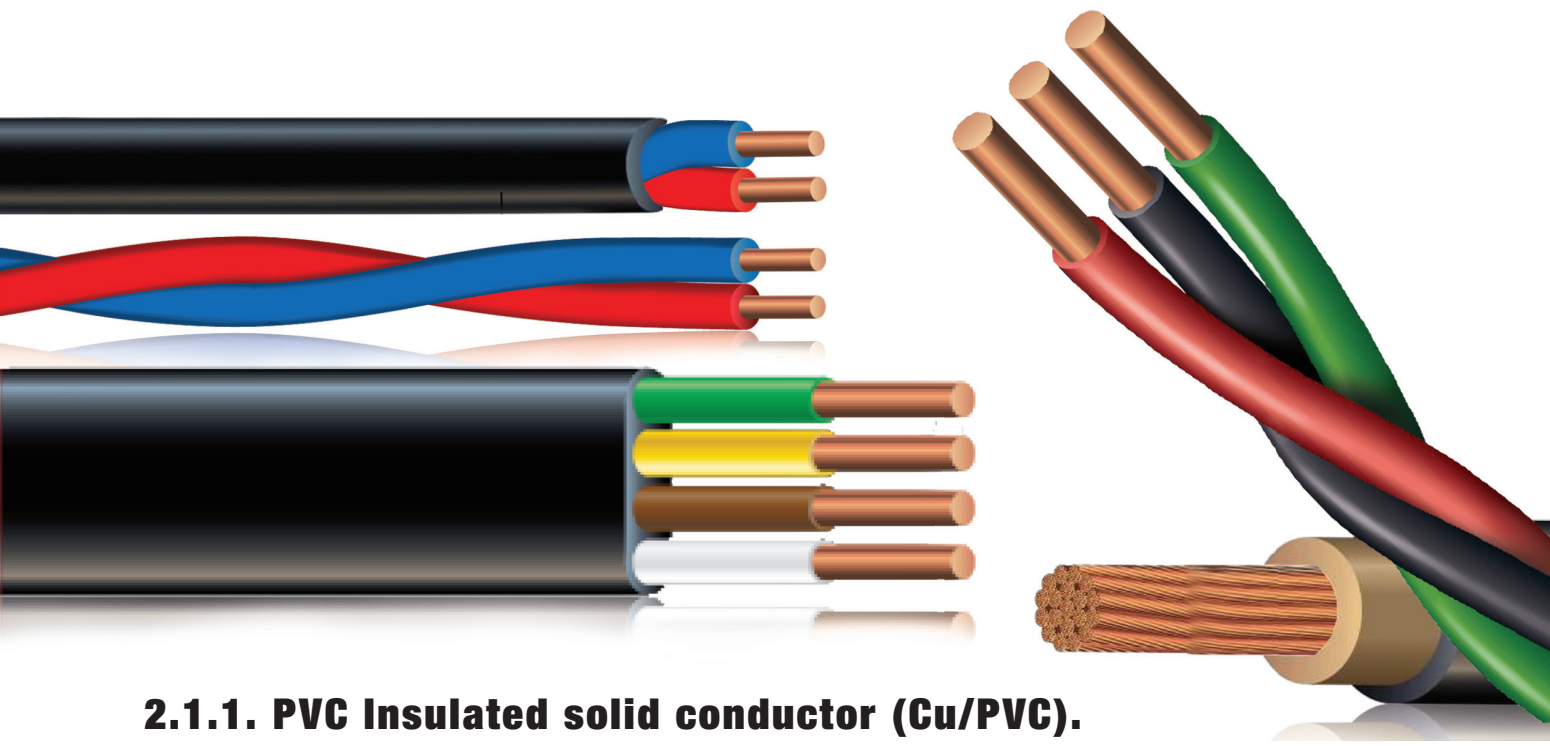
• Rated voltage: up to and including Uo/U : 450/750k V

• Conductor Stranding: Class Isolid circular conductors Per IEC 608228.IEC60227 :l-4



Application

• For installations in dry indoor places as fixed wiring laid in conduits or steel support brackets in the connection &distribution construction purposes.



2.1.1. PVC Insulated solid conductor (Cu/PVC).

Rated voltage, up to and including, U/UO 300/500 Application: for internal wiring

1. Solid copper conductor
2. PVC primay insulation

Product code	Cross Sectional Area in mm2	Diameter of Conductor in mm	Thickness of Insulation in mm	Approximate iverall diametert	Total weight in kg/lOOm	Max. Conductor DC Resistance at 20°ClnXl/km
CPS-0000-03-01-05	0.5	1.35	0.6	2.0	0.52	36.7
CPS-0000-03-01-07	0.75	1.75	0.6	2.2	0.74	24.8
CPS-0000-03-01-10	1.0	2.24	0.6	2.3	1.00	18.2

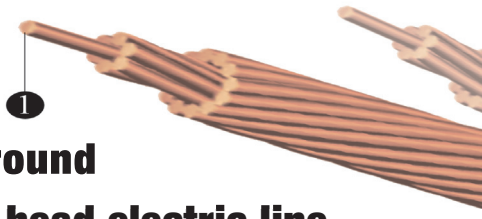
2.1.2. PVC Insulated solid conductor (CU/PVC) non bedding Rated

voltage up to and including, U/UO 450/750

Application: For fixed installations in dry or humid places as well as in the open air

Product code	Cross Sectional Area in mm2	Diameter of Conductor in mm	Thickness of Insulation in mm	Approximate over all diameter	Total weight in kg/100m	Max. Conductor DC Resistance at 20°Cin Q/km	Min Insulation Resistance at 70°Cin /2*km
Single core							
CPS-0000-03-01-11	1.5	1.35	0.7	2.8	1.42	12.10	0.0110
CPS-0000-03-01-13	2.5	1.75	0.8	3.4	2.41	7.41	0.0100
CPS-0000-03-01-16	4	2.24	0.8	3.8	4.00	4.61	0.0085
CPS-0000-03-01-20	6	2.75	0.8	4.4	6.07	3.08	0.0070
CPS-0000-03-01-21	10	3.57	1.0	5.6	10.24	1.83	0.0070
Two core							
CPS-000PJ-03-02-13	2.5		1.2	6.6	7.9	7.41	0.0110
CPS-000PJ-03-02-16	4		1.2	7.2	11.4	4.61	0.0100
CPS-000PJ-03-02-20	6		1.2	7.9	16.0	3.08	0.0085
CPS-000PJ-03-02-21	10		1.4	9.8	26.2	1.83	0.0070
Three core							
CPS-000PJ-03-03-13	2.5		1.2	7.5	10.8	7.41	0.0110
CPS-000PJ-03-03-16	4		1.2	8.3	16.1	4.61	0.0100
CPS-000PJ-03-03-20	6		1.2	9.0	22.8	3.08	0.0085
CPS-000PJ-03-03-21	10		1.4	11.3	37.6	1.83	0.0070
Four core							
CPS-000PJ-03-04-13	2.5		1.2	14	20.5	7.41	0.0110
CPS-000PJ-03-04-16	4		11	16.0	24	4.61	0.0100
CPS-000PJ-03-04-20	6		1.2	17.8	30.5	3.08	0.0085

2.2 Class 2 Bare Copper Wires.



1. Bare copper (Cu) as per IEC60502.

Assembly: A number of wires stranded to form round conductor Application: For grounding (earth) Over head electric line

Product code	Nominal Cross Sectional Area in mm2	Number ol Strands	Nominal Diameter Diameter of Stranded)f Copper ir Copper in mm mm		Approximate Weight in kg/lOOm	Max. Conductor DC Resistance at 20°C in/2/km
C0R-0000-04-01-11	1.5	7	0.53	1.7	1.3	12.100
C0R-0000-04-01-13	2.5	7	0.67	2.2	2.1	7.410
C0R-0000-04-01-16	4	7	0.85	2.6	3.4	4.610
C0R-0000-04-01-20	6	7	1.04	3.4	5.2	3.080
C0R-0000-04-01-21	10	7	1.35	4.3	8.7	1.830
C0R-0000-04-01-22	16	7	1.70	5.4	13.8	1.150
C0R-0000-04-01-23	25	7	2.14	6.4	21.9	0.727
C0R-0000-04-01-24	35	7	2.52	7.6	30.3	0.524
C0R-0000-04-01-25	50	19	1.78	9.0	43.4	0.387
C0R-0000-04-01-26	70	19	2.14	10.5	61.0	0.268
C0R-0000-04-01-27	95	19	2.52	11.8	82.3	0.193
C0R-0000-04-01-28	120	37	2.03	13.1	104.0	0.153
C0R-0000-04-01-29	150	37	2.25	14.7	127.8	0.124
C0R-0000-04-01-30	185	37	2.52	16.8	160.3	0.0991
C0R-0000-04-01-31	240	61	2.25	18.8	210.6	0.0754
C0R-0000-04-01-32	300	61	2.52	21.3	264.2	0.0601
C0R-0000-04-01-33	400	61	2.85	24.1	337.9	0.047
CP0-0000-04-01-34	500	61	3.20	27.3	434.0	0.0366
C0R-0000-04-01-35	630	127	2.52	29.6	555.0	0.0283

2.2.1 PVC Insulated Class-2 Stranded Conductors.

Construction

- Conductor: Plain Annealed Copper
- Conductor Stranding: Class 2 stranded circular or compacted conductors per IEC60228&.60502-1
- Assembly :A number wires twisted to form round conductor
- Insulation : PVC/C per IEC 60227-3 or PVC typeTl 1 per

BSEN50363 Technical data

- Rated voltage: Uo/U : 0.6/l.(1.2)kV
- Power frequency test voltage 3.5 kV for 5 minutes
- Maximum admissible temperature of conductor at normal operation 70 °C
- Maximum admissible temperature of conductor at short circuit for 5 seconds

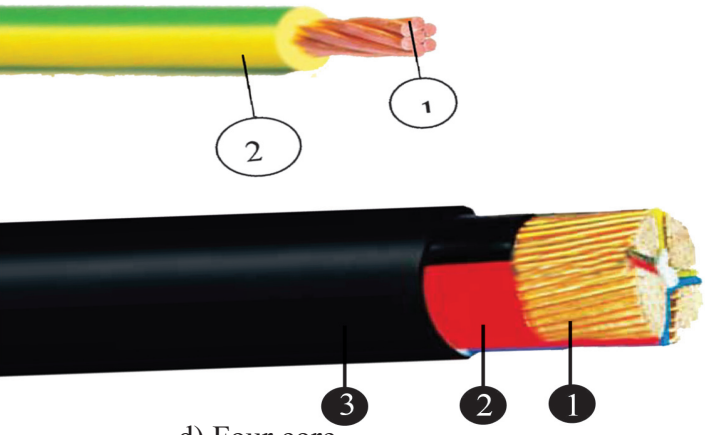
■ 160 °C for sizes < 300 mm2

■ 140 °C for sizes > 300 mm2

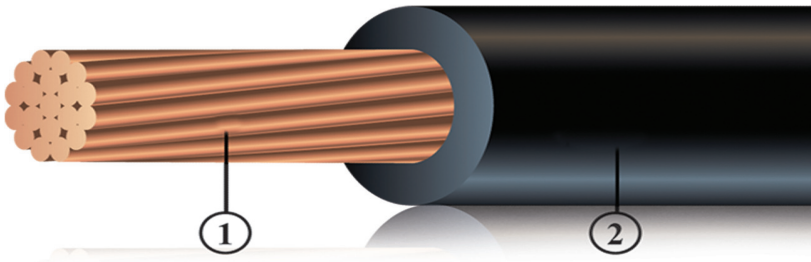
Color: for insulation

- One core: Black .Four core: Red. Yellow, blue, black
- Two cores: Red. Black . Color for Sheath :grey for single core
- Three cores: Red, Yellow . Black for two or more core

Application: For fixed installations in dry or humid places as well as in the open air.



d) Four core



1. Stranded copper
2. PVC primary insulation
3. PVC outer sheath (Jacket)

2.2.1.1 PVC Insulated Single Core Class-2 (Stranded) Copper Cnductors(Cu/PVC)

Product type	Nominal Cross Sectional Area in mm2	lumber Nominal of Diameter Strands of Copper in single strand mm						
CPR-0000-04-01-11	1.5	7	0.53	0.8	3.2	2.3	12.10	0.0100
CPR-0000-04-01-13	2.5	7	0.67	0.8	3.9	3.5	7.410	0.0090
CPR-0000-04-01-16	4	7	0.85	1.0	4.4	5.2	4.610	0.0077
CPR-0000-04-01-20	6	7	1.04	1.0	5.0	7.3	3.080	0.0065
CPR-0000-04-01-21	10	7	1.35	1.0	6.4	12.2	1.830	0.0065
CPR-0000-04-01-22	16	7	1.70	1.0	7.4	18.4	1.150	0.0050
CPR-0000-04-01-23	25	7	2.14	1.2	9.2	28.9	0.727	0.0050
CPR-0000-04-01-24	35	7	2.52	1.2	10.4	39.0	0.524	0.0043
CPR-0000-04-01-25	50	19	1.78	1.4	12.3	55.7	0.387	0.0043
CPR-0000-04-01-26	70	19	2.14	1.4	14.0	76.5	0.268	0.0035
CPR-0000-04-01-27	95	19	2.52	1.6	16.2	103.0	0.193	0.0035
CPR-0000-04-01-28	120	37	2.03	1.6	17.7	128.5	0.153	0.0032
CPR-0000-04-01-29	150	37	2.25	1.8	19.7	158.1	0.124	0.0032
CPR-0000-04-01-30	185	37	2.52	2.0	22.0	198.2	0.0991	0.0032
CPR-0000-04-01-31	240	61	2.25	2.2	25.0	259.4	0.0754	0.0032
CPR-0000-04-01-32	300	61	2.52	2.4	27.9	324.5	0.0601	0.0030
CPR-0000-04-01-33	400	61	2.85	2.6	31.3	413.4	0.047	0.0028
CPR-0000-04-01-34	500	61	3.20	2.8	35.1	528.6	0.0366	0.0028
CPR-0000-04-01-35	630	127	2.52	2.8	38.8	669.1	0.0283	0.0025

2.2.2. Two-Five cores PVC insulated & PVC sheathed class 2(standed) copper conductors (Cu/PVC/PVC)

Product code	Nominal Cross Sectional Area in mm2	Approximate Approximate overall di- weight in ameter mm kg/lOOm		Max. Conductor DC tesistance at 20°C in!2/km at	Min Insulation Resistance 70°C in 12*km
Two core					
CPR-000PJ-04-02-11	1.5	10.2	11.6	12.100	0.0100
CPR-000PJ-04-02-13	2.5	11.2	14.3	7.410	0.0090
CPR-000PJ-04-02-16	4	12.2	18.6	4.610	0.0077
CPR-000PJ-04-02-20	6	15.3	24.0	3.080	0.0065
CPR-000PJ-04-02-21	10	17.2	38.3	1.830	0.0065
CPR-000PJ-04-02-22	16	20.4	53.2	1.150	0.0050
CPR-000PJ-04-02-23	25	23.1	78.4	0.727	0.0050
CPR-000PJ-04-02-24	35	28.8	104.7	0.524	0.0043
Three core					
CPR-000PJ-04-03-11	1.5	10.4	13.2	12.100	0.0100
CPR-000PJ-04-03-13	2.5	11.4	17.9	7.410	0.0090
CPR-000PJ-04-03-16	4	12.4	23.8	4.610	0.0077
CPR-000PJ-04-03-20	6	15.4	31.3	3.080	0.0065
CPR-000PJ-04-03-21	10	17.3	50.6	1.830	0.0065
CPR-000PJ-04-03-22	16	20.5	71.7	1.150	0.0050
CPR-000PJ-04-03-23	25	23.1	107.4	0.727	0.0050
CPR-000PJ-04-03-24	35	28.8	143.9	0.524	0.0043
Four core					
CPR-000PJ-04-04-11	1.5	11.5	15.6	12.100	0.0100
CPR-000PJ-04-04-13	2.5	12.6	21.4	7.410	0.0090
CPR-000PJ-04-04-16	4	13.8	29.0	4.610	0.0077
Four core with one reduced neutral conductor					
CPR-000PJ-04-04-20	6	17.2	38.5	3.080	0.0065
CPR-000PJ-04-04-21	10	19.4	62.5	1.830	0.0065
CPR-000PJ-04-04-22	16	23.1	89.7	1.150	0.0050
CPR-000PJ-04-04-23	25	26.0	135.2	0.727	0.0050
CPR-000PJ-04-04-24	35	32.2	181.9	0.524	0.0043
CPR-000PJ-04-04-25	50	36.2	269.4	0.387	0.0043
CPR-000PJ-04-04-26	70	41.3	364.3	0.268	0.0035
CPR-000PJ-04-04-27	95	44.4	484.5	0.193	0.0035
CPR-000PJ-04-04-28	120	49.6	594.1	0.153	0.0032
CPR-000PJ-04-04-29	150	55.0	734.1	0.124	0.0032
CPR-000PJ-04-04-30	185	61.7	913.4	0.0991	0.0032
CPR-000PJ-04-04-31	240	67.6	1183.4	0.0754	0.0032
CPR-000PJ-04-04-32	300	76.5	1461.4	0.0601	0.0030

CPR-000PJ-04-04-(23+22)	25	22.6	130.2	0.727	0.0050
CPR-000PJ-04-04-(24+22)	35	28.3	166.0	0.524	0.0043
CPR-000PJ-04-04-(25+23)	50	31.8	260.3	0.387	0.0043
CPR-000PJ-04-04-(26+23)	70	36.1	372.5	0.268	0.0035
CPR-000PJ-04-04-(27+24)	95	38.8	480.4	0.193	0.0035
CPR-000PJ-04-04-(28+26)	120	43.3	576.9	0.153	0.0032
CPR-000PJ-04-04-(29+26)	150	47.9	725.7	0.124	0.0032
CPR-000PJ-04-04-(30+27)	185	53.7	897.6	0.0991	0.0032
CPR-000PJ-04-04-(31+27)	240	58.6	1147.5	0.0754	0.0032
CPR-000PJ-04-04-(32+28)	300	64.4	1391.1	0.0601	0.0030
CPR-000PJ-04-04-(33+29)	400	67.3	1720.2	0.047	0.0028
		Five core			
CPR-000PJ-04-05-21	10	23.6	77.5	1.830	0.0065
CPR-000PJ-04-05-22	16	26.8	112.0	1.150	0.0050
CPR-000PJ-04-05-23	25	32.9	170.3	0.727	0.0050
CPR-000PJ-04-05-24	35	37.8	228.9	0.524	0.0043
CPR-000PJ-04-05-25	50	42.3	336.7	0.387	0.0043
CPR-000PJ-04-05-26	70	46.4	457.2	0.268	0.0035
CPR-000PJ-04-05-27	95	52.1	607.7	0.193	0.0035
CPR-000PJ-04-05-28	120	58.1	747.7	0.153	0.0032
CPR-000PJ-04-05-29	150	65.0	923.9	0.124	0.0032
CPR-000PJ-04-05-30	185	71.0	1151.1	0.0991	0.0032
CPR-000PJ-04-05-31	240	78.8	1492.5	0.0754	0.0032
CPR-000PJ-04-05-32	300	84.2	1845.8	0.0601	0.0030

Note: Each data has manufacturing tolerance 6%

2.3. PVC Insulated Class-2 PP filled & PVC sheated conductor.

Construction

- Conductor: Plain Annealed Copper
- Conductor Stranding: Class 2 stranded circular or compacted conductors per IEC60228&60502-1.
- Assembly :A number wires twisted to form round conductor
- Insulation : PVC Compound Type ST1 per IEC60502-lor PVC typeTllper

BSEN50363 Technical Data

- Rated voltage: Uo/U : 0.6/1 .Ok V. Power frequency test voltage 3.5 kV for 5 minute
- Maximum admissible temperature of conductor at normal operation 70 °C
- Maximum admissible temperature of conductor at short circuit for 5 seconds

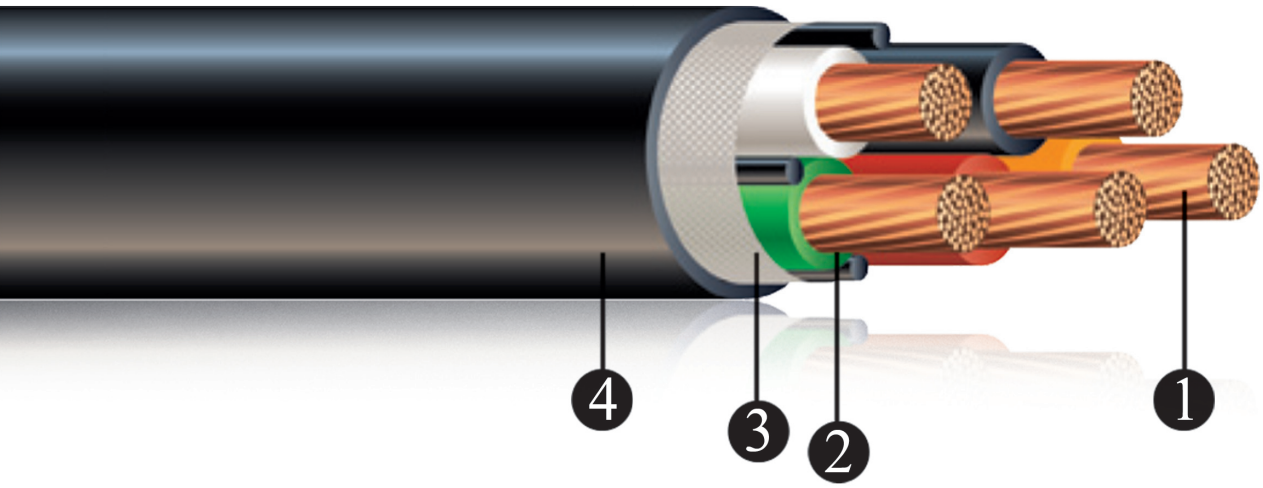
■ 140 °C for sizes < 300 mm2 . 160 °C for sizes > 300 mm2

Color: for insulation

- One core: Black .Four core: Red. Yellow, blue, black
- Two cores: Red. Black . Color for Sheath :grey for single core

• Three cores: Red, Yellow . Black for two or more core

Application: For indoor and outdoor installation in dump and wet area for the distribution of power in power stations and industrial areas which is not exposed to mechanical damage.



Where 1.Stranded copper 2. PVC insulation 3. PP Filler 4. PVC outer Sheath

2.3.1 Two-Five core PVC insulated,PP filled & PVC sheathed stranded copper conductor(Cu/PVC/PP/Pvc)

Product code

		Two core			
CPR-PP00PJ-04-02-11	1.5	10.4	12.4	12.100	0.0100
CPR-PP00PJ-04-02-13	2.5	11.8	16.9	7.410	0.0090
CPR-PP00PJ-04-02-16	4	12.6	21.9	4.610	0.0077
CPR-PP00PJ-04-02-20	6	14.9	28.1	3.080	0.0065
CPR-PP00PJ-04-02-21	10	16.4	46.4	1.830	0.0065
CPR-PP00PJ-04-02-22	16	19.6	63.6	1.150	0.0050
CPR-PP00PJ-04-02-23	25	22.4	97.2	0.727	0.0050
CPR-PP00PJ-04-02-24	35	27.4	128.4	0.524	0.0043
		Three core			
CPR-PP00PJ-04-03-11	1.5	11.5	15.0	12.100	0.0100
CPR-PP00PJ-04-03-13	2.5	12.4	20.5	7.410	0.0090
CPR-PP00PJ-04-03-16	4	13.4	26.9	4.610	0.0077
CPR-PP00PJ-04-03-20	6	17.1	34.9	3.080	0.0065
CPR-PP00PJ-04-03-21	10	18.9	55.6	1.830	0.0065
CPR-PP00PJ-04-03-22	16	22.7	77.8	1.150	0.0050
CPR-PP00PJ-04-03-23	25	25.8	117.0	0.727	0.0050
CPR-PP00PJ-04-03-24	35	31.5	153.5	0.524	0.0043
		Four core			
CPR-PP00PJ-04-04-11	1.5	12.7	18.6	12.100	0.0100
CPR-PP00PJ-04-04-13	2.5	13.7	25.8	7.410	0.0090
CPR-PP00PJ-04-04-16	4	14.7	34.3	4.610	0.0077

CPR-PP00PJ-04-04-20	6	18.2	44.9	3.080	0.0065
CPR-PP00PJ-04-04-21	10	20.0	72.1	1.830	0.0065
CPR-PP00PJ-04-04-22	16	23.7	101.6	1.150	0.0050
CPR-PP00PJ-04-04-23	25	26.2	154.0	0.727	0.0050
CPR-PP00PJ-04-04-24	35	32.5	202.6	0.524	0.0043
CPR-PP00PJ-04-04-25	50	35.9	296.2	0.387	0.0043
CPR-PP00PJ-04-04-26	70	40.8	394.9	0.268	0.0035
CPR-PP00PJ-04-04-27	95	43.6	524.9	0.193	0.0035
CPR-PP00PJ-04-04-28	120	48.5	640.8	0.153	0.0032
CPR-PP00PJ-04-04-29	150	53.6	788.8	0.124	0.0032
CPR-PP00PJ-04-04-30	185	60.0	981.8	0.0991	0.0032
CPR-PP00PJ-04-04-31	240	65.5	1270.8	0.0754	0.0032
CPR-PP00PJ-04-04-32	300	78.2	1573.3	0.0601	0.0030

Four core with one reduced neutral

CPR-PP00PJ-04-04-(23+22)	25	25.1	117.5	0.727	0.0050
CPR-PP00PJ-04-04-[24+22)	35	31.0	154.8	0.524	0.0043
CPR-PP00PJ-04-04-[25+23)	50	35.0	226.1	0.387	0.0043
CPR-PP00PJ-04-04-[26+23)	70	38.7	303.8	0.268	0.0035
CPR-PP00PJ-04-04-(27+24)	95	42.0	398.3	0.193	0.0035
CPR-PP00PJ-04-04-[28+25)	120	46.8	494.3	0.153	0.0032
CPR-PP00PJ-04-04-(29+25)	150	52.2	588.1	0.124	0.0032
CPR-PP00PJ-04-04-[30+26)	185	57.9	732.1	0.0991	0.0032
CPR-PP00PJ-04-04-[31+27)	240	62.7	935.4	0.0754	0.0032
CPR-PP00PJ-04-04-[32+28)	300	69.0	1144.1	0.0601	0.0030
CPR-PP00PJ-04-04-[33+29)	400	78.6	1429.6	0.047	0.0028

Five core

CPR-PP00PJ-04-05-21	10	26.5	88.4	1.830	0.0065
CPR-PP00PJ-04-05-22	16	29.6	125.2	1.150	0.0050
CPR-PP00PJ-04-05-23	25	36.9	190.4	0.727	0.0050
CPR-PP00PJ-04-05-24	35	40.9	250.6	0.524	0.0043
CPR-PP00PJ-04-05-25	50	46.9	365.2	0.387	0.0043
CPR-PP00PJ-04-05-26	70	50.4	487.2	0.268	0.0035
CPR-PP00PJ-04-05-27	95	56.1	649.1	0.193	0.0035
CPR-PP00PJ-04-05-28	120	62.0	793.6	0.153	0.0032
CPR-PP00PJ-04-05-29	150	69.5	976.9	0.124	0.0032
CPR-PP00PJ-04-05-30	185	76.1	1216.8	0.0991	0.0032
CPR-PP00PJ-04-05-31	240	83.9	1576.3	0.0754	0.0032
CPR-PP00PJ-04-05-32	300	88.8	1953.5	0.0601	0.0030

2.4. PVC insulared,PVC bedding, steel Tape armored stranded conductor.

Construction

Conductor: Plain annealed stranded circular copper conductor, as per Class 2 of 1EC 60228.

• Insulation: An extruded layer of polyvinyl chloride (PVC) insulation rated 90 °C at normal operation

to 1EC 60502-1.

• Bedding: An extruded layer of Polyvinyl chloride (PVC)

• Armor: double layer of galvanized steel tape.

• Outer sheath: An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST2 to IEC 60502-1.

Technical Data

• Rated voltage/Uo;0.6/1.0(1.2)kV

• Power frequency test voltage 3.5 kV for 5 minutes

• Maximum admissible temperature of conductor at normal operation 70 °C

• Maximum admissible temperature of conductor at short circuit for 5 seconds

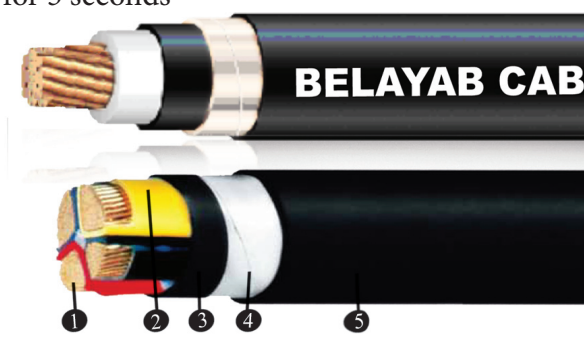
▪ 160 °C for sizes <300 mm2

▪ 140°Cfor sizes > 300 mm2

Color: for insulation

• One core: Black .Four core: Red. Yellow, blue, black

• Two cores: Red. Black . Color for Sheath :grey for single core



2.4.1. Two-four core PVC Insulated, PVC bedding, Steel tape armored & PVC sheathed standed conduc tors(Cu/PVC/STA/PVC)

Product code	Nominal Cross Sectional Area in mm2	Steel tape Armored thickness mm	Approximate >verall diameter mm	Approximat e weight in
		Two core		
CPR-PI0TPJ-04-02-11	4	0.2	14.4	40.0
CPR-PI0TPJ-04-02-13	6	0.2	17.0	58.3
CPR-PI0TPJ-04-02-16	10	02	18.5	75.5
CPR-PI0TPJ-04-02-20	16	0.2	22.7	130.0
CPR-PI0TPJ-04-02-21	25	0.5	24.9	159.6
CPR-PIOTPJ-04-02-22	35	0.5	29.9	219.2
		Three core		
CPR-PIOTPJ-04-03-11	4	0.2	17.9	49.4
CPR-PIOTPJ-04-03-13	6	02	21.5	60.9

CPR-PIOTPJ-04-03-16	10	0.2	23.3	91.8
CPR-PI0TpJ-04-03-20	16	0.2	28.6	138.1
CPR-PIOTPJ-04-03-21	25	0.5	31.1	193.5
CPR-PIOTPJ-04-03-22	35	0.5	37.3	247.9
		Four core		
CPR-PIOTPJ-04-04-16	4	0.2	18.9	55.8
CPR-PIOTPJ-04-04-20	6	0.2	23.0	67.3
CPR-PIOTPJ-04-04-21	10	0.2	25.3	99.1
CPR-PIOTPJ-04-04-22	16	02	31.3	147.6
CPR-PIOTPJ-04-04-23	25	0.5	34.3	
CPR-PIOTPJ-04-04-24	35	0.5	41.2	254.6
CPR-PIOTPJ-04-04-25	50	0.5	45.3	274.6
CPR-PIOTPJ-04-04-26	70	0.5	51.2	398.2
CPR-PIOTPJ-04-04-27	95	0.5	56.1	521.3
CPR-PIOTPJ-04-04-28	120	0.8	62.0	635.6
CPR-PIOTPJ-04-04-29	150	0.8	68.2	766.1
CPR-PIOTPJ-04-04-30	185	0.8	75.8	945.7
CPR-PIOTPJ-04-04-31	240	0.8	82.5	1281.1
CPR-PIOTPJ-04-04-32	300	0.8	88.6	1468.6
		four core with one reduced neutral		
CPR-PIOTPJ-04-04-(23+22)	25	0.5	28.3	177.6
CPR-PIOTPJ-04-04-(24+22)	35	0.5	34.9	187.6
CPR-PIOTPJ-04-04-(25+23]	50	0.5	41.5	248.5
CPR-PIOTPJ-04-04-(26+23)	70	0.5	45.3	318.5
CPR-PIOTPJ-04-04-(27+24)	95	0.5	50.7	463.6
CPR-PIOTPJ-04-04-(28+25)	120	0.8	55.4	555.1
CPR-PIOTPJ-04-04-(29+25)	150	0.8	60.9	678.3
CPR-PIOTPJ-04-04-(30+26)	185	0.8	66.6	835.7
CPR-PIOTPJ-04-04-(31+27)	240	0.8	73.6	1062.3
CPR-PIOTPJ-04-04-(32+28)	300	0.8	79.7	1298.0
CPR-PIOTPJ-04-04-(33+29)	400	0.8	86.9	1663.1

2.5. PVC insulated,PVC bedding,steel wire armored stranded conductor

Conductor: Plain annealed stranded circular copper conductor, as per Class 2 of IEC 60228.

• Insulation: An extruded layer of polyvinyl chloride (PVC) insulation rated 90 °C at normal operation to IEC 60502-1.

• Bedding: An extruded layer of Polyvinyl chloride (PVC).

• Armor: galvanized steel wire.

• Outer sheath: An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST2 to

IEC 60502-1.

• Power frequency test voltage 3.5 kV for 5 minutes

• Maximum admissible temperature of conductor at normal operation 70 °C

• Maximum admissible temperature of conductor at short circuit for 5 seconds

■ 160 °C for sizes <300 mm2

■ 140 °C for sizes >300 mm2

Color: for insulation

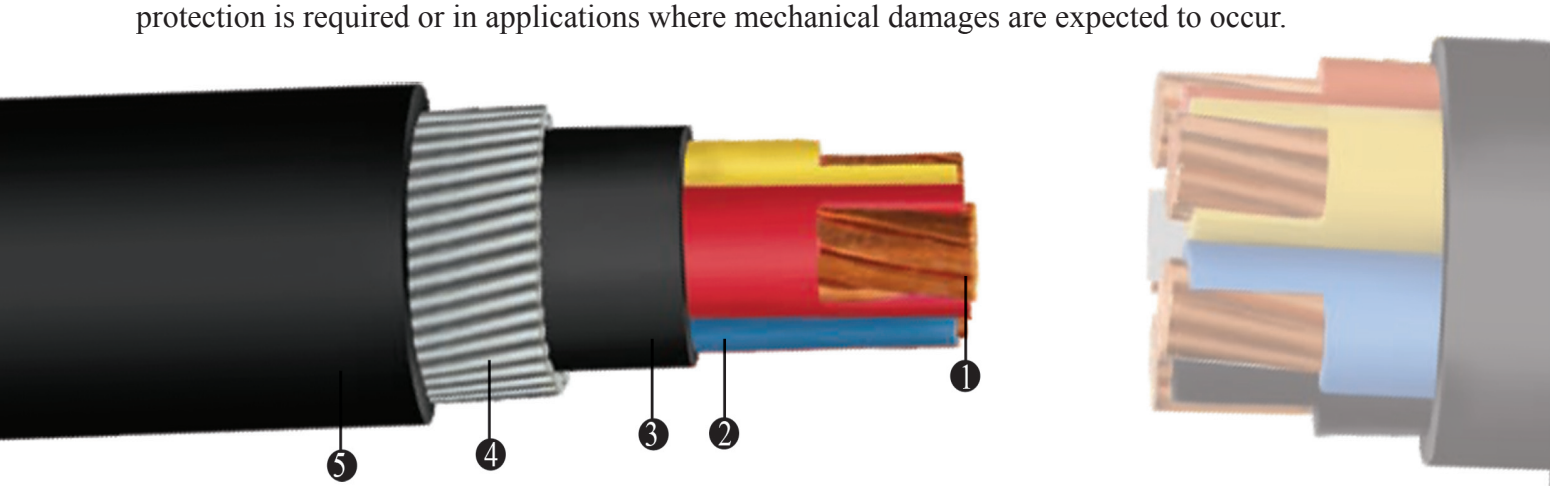
• One core: Black .Four core: Red. Yellow, blue, black

• Two cores: Red. Black . Color for Sheath :grey for single core

• Three cores: Red, Yellow .Black for two or more core

Application: For outdoor installations in power stations, industrial plants and switchgears if mechanical

protection is required or in applications where mechanical damages are expected to occur.



1.Stranded copper conductor. 2. PVC primary insulation. 3. PVC inner sheath. 4. Galvanized steel armor .5. PVC outer sheath (Jacket)

2.5.1 Two-four cores PVC insulated,PVC bedding,steel wire armored stranded conducto(CU/PVC/SWA/PVC)

Product code	Nominal Cross sectional Area	Armor wire diameter mm	Approximate over-all diameter mm	Approximate weight in kg/lOOm
		Two core		
CPR-PICTWP-04-02-16	4	0.8	17.3	67.1
CPR-PICTWP-04-02-20	6	0.8	18.1	78.8
CPR-PICTWP-04-02-21	10	0.8	19.6	96.9
CPR-PIOWPJ-04-02-22	16	0.8	22.5	107.9
CPR-PIOWPJ-04-02-23	25	0.9	24.6	148.1
CPR-PIOWPJ-04-02-24	35	0.9	30.6	207.2

Three core				
CPR-PIOWPJ-04-03-16	4	0.8	18.0	75.3
CPR-PICTWJ-04-03-20	6	0.8	19.0	85.3
CPR-PIOWPJ-04-03-21	10	0.8	22.5	101.4
CPR-PIOWPJ-04-03-22	16	0.8	24.4	122.5
CPR-PIOWPJ-04-03-23	25	0.9	28.3	178.2
CPR-PIOWPJ-04-03-24	35	0.9	30.9	216.7
Four core				
CPR-PIOWPJ-04-04-16	4	0.8	18.7	87.4
CPR-PIOWPJ-04-04-20	6	0.8	21.3	94.1
CPR-PIOWPJ-04-04-21	10	0.8	24.1	119.6
CPR-PIOWPJ-04-04-22	16	0.8	26.3	152.4
CPR-PIOWPJ-04-04-23	25	0.9	31.0	215.6
CPR-PIOWPJ-04-04-24	35	0.9	34.0	269.7
CPR-PIOWPJ-04-04-25	50	1.25	41.9	401.2
CPR-PIOWPJ-04-04-26	70	1.25	46.0	508.7
CPR-PIOWPJ-04-04-27	95	1.25	48.9	659.8
CPR-PIOWPJ-04-04-28	120	1.6	56.1	800.3
CPR-PIOWPJ-04-04-29	150	1.6	62.0	965.4
CPR-PIOWPJ-04-04-30	185	1.6	68.2	1170.4
CPR-PIOWPJ-04-04-31	240	1.6	75.8	1470.4
CPR-PIOWPJ-04-04-32	300	1.6	82.5	1784.4
Four core with one reduced neutral conductor				
CPR-PIOWPJ-04-04-23+22)	25	0.9	27.8	175.5
CPR-PIOWPJ-04-04-(24+22)	35	0.9	31.9	236.1
CPR-PIOWPJ-04-04-(25+23)	50	1.25	35.6	358.6
CPR-PIOWPJ-04-04-(26+23)	70	1.25	42.1	431.4
CPR-PIOWPJ-04-04-[27+24]	95	1.25	46.0	553.8
CPR-PIOWPJ-04-04-(28+25)	120	1.6	51.4	744.3
CPR-PIOWPJ-04-04-(29+25)	150	1.6	55.4	855.7
CPR-PIOWPJ-04-04-[30+26)	185	1.6	60.9	1030.2
CPR-PIOWPJ-04-04-(31+27]	240	1.6	66.6	1288.0
CPR-PIOWPJ-04-04-(32+28)	300	1.6	73.6	1563.1
CPR-PIOWPJ-04-04-(33+29)	400	1.6	79.7	1928.0

2.6. PVC insulated flexible cable

Construction

• Conductor : Plain Annealed Copper

• Conductor assembly: A number of wires twisted to form round conductor .Class 5 Bunched circular or compacted conductors per ICE 60228 , 60227-5 &BS EN6004

Technical Data

• Nominal voltage, U/Uo;300/500 volt

• Power frequency test voltage 3.5 kV for 5 minutes

• Maximum admissible temperature of conductor at normal operation 70 °C.

• Maximum admissible temperature of conductor at short circuit for 5 seconds.

■ 160 °C for sizes < 300 mm2

■ 140 °C for sizes >300 mm2

Color: for insulation

• One core: Black . Fourcore: Red. Yellow, blue, black

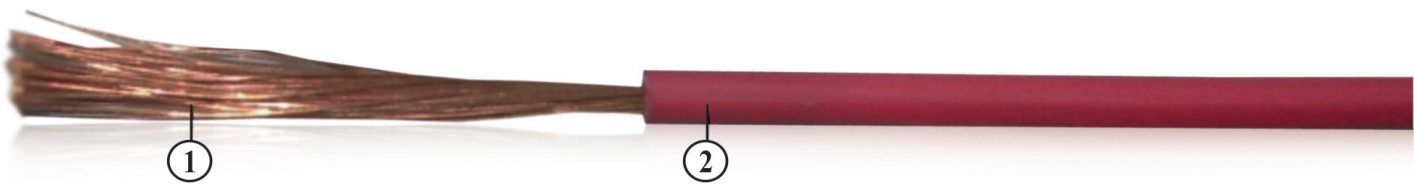
• Two cores: Red. Black . Color for Sheath: grey for single core .

• Three cores: Red, Yellow, Blue . Black for two or more core

Application: for indoor and outdoor installation, to connect instruments, for movable welding machine connection that required extra flexibility.

2.6.1. Single core PVC insulated flexible wire(Cu/PVC)

Rated voltage, U/Uo, 300/300 volt based on BS EN6004.



1. Annealed Cu bunched wire

2. PVC Primary insulation

3roduct code	NominalCross Sectional Area in mm2	:hickness ol Insulation mm	Approxi mate over ill diameter in mm	Approximate Max. Conduc-over all tor DC Re-i/Veightof in sistanceat kg/lOOm 20°C in.fi/km		Min Insula-tion Resist-ance at70°C infi*km
			Single core			
CPF-0000-03-01-05	0.5	0.6	2.2	0.8	39.0	0.013
CPF-0000-03-01-07	0.75	0.6	2.5	1.1	26.0	0.011
CPF-0000-03-01-10	1.0	0.7	2.6	1.5	19.5	0.010
			Two core			
CPF-0000-03-02-05	0.75	0.8	4.8	4.4	26.0	0.011
CPF-0000-03-02-07	1	0.8	5.0	5.5	19.5	0.010
CPF-000PJ-04-02-11	1.5	0.8	5.1	8.7	13.30	0.0100
CPF-000PJ-04-02-13	2.5	OOO	6.8	11.8	7.98	0.0090
CPF-000PJ-04-02-16	4	1.0	7.4	15.4	4.95	0.0077

2.6.2. Rated voltage,up to and including U/Uo;450/750 volt based on BS 6004

Construction

• Conductor : Plain Annealed Copper

• Conductor assembly: A number of wires twisted to form round conductor .Class 5 Bunched circular or compacted conductors per ICE 60228 , 60227-5 &BS EN6004

Technical Data

• Nominal voltage, up to and including U/Uo; 450/750 volt

• Power frequency test voltage 3.5 kV for 5 minutes

• Maximum admissible temperature of conductor at normal operation 70 °C.

• Maximum admissible temperature of conductor at short circuit for 5 seconds.

■ 160 °C for sizes < 300 mm2

■ 140 °C for sizes > 300 mm2

Color: for insulation

• One core: Black . Fourcore: Red.Yellow,blue,black

• Two cores: Red. Black .Color forSheath:grey for single core .

• Three cores: Red, Yellow, Blue . Black for two or more core

Application: for indoor and outdoor installation, to connect instruments, for movable welding machine

connection that required extra flexibility.

2.6.3. Single core PVC/PVC Insuleted flexible Cable,Circular sheathed(Cu/PVC/PVC)

Product code	Nominal Humber	Nominal Radial	Approxi-	Approxi-	Max. Con-	Min	Cross Sec- of Insulation tional Area	Resistance in mm2
CPF-0000-04-01-20	6	84	0.31	0.8	4.9	68	3.300	0.0060
CPF-0000-04-01-21	10	76	0.41	1.0	6.3	114	2.290	0.0056
CPF-0000-04-01-22	16	122	0.41	1.0	7.4	176	1.450	0.0046
CPF-0000-04-01-23	25	180	0.41	1.2	9.3	259	0.940	0.0044
CPF-0000-04-01-24	35	265	0.41	1.2	10.7	372	0.663	0.0038
CPF-0000-04-01-25	50	379	0.41	1.4	12.7	529	0.462	0.0037
CPF-0000-04-01-26	70	343	0.51	1.4	14.6	728	0.326	0.0032
CPF-0000-04-01-27	95	465	0.51	1.6	16.7	983	0.247	0.0032

2.6.4. Two-Four core PVC Insuleted Flexible Cable(Cu/PVC/PVC)

Product code	Nominal Cross Sectional Area in mm.	Ap proximate overall diameter mm	Approximate weight in kg/lOOm	Vlax. Conduc- Min tor DC Re-Insulation sistance at Resistance 20°Cin/2/km at 70°C ini2*km	
		Two core			
CPF-PI00PJ-04-02-20	6	8.1	22.45	3.300	0.0065
CPF-PI00PJ-04-02-21	10	9.8	34.52	1.910	0.0065
CPF-PI00PJ-04-02-22	16	10.4	47.89	1.210	0.0050
CPF-PI00PJ-04-02-23	25	11.7	67.10	0.780	0.0050
CPF-PI00PJ-04-02-24	35	13.1	92.81	0.554	0.0043
CPF-PI00PJ-04-02-25	50	14.2	139.33	0.386	0.0043
		Three core			
CPF-PI00PJ-04-03-11	1.5	8.4	11.55	13.300	0.0100
CPF-PI00PJ-04-03-13	2.5	8.8	16.02	7.98	0.0090
CPF-PI00PJ-04-03-16	4	9.2	21.39	4.950	0.0077
CPF-PI00PJ-04-03-20	6	11.2	28.30	3.300	0.0065
CPF-PI00PJ-04-03-21	10	12.0	43.65	1.910	0.0065
CPF-PI00PJ-04-03-22	16	13.6	62.65	1.210	0.0050
CPF-PI00PJ-04-03-23	25	15.2	88.37	0.780	0.0050
CPF-PI00PJ-04-03-24	35	19.6	124.91	0.554	0.0043
		Four core			
CPF-PI00PJ-04-04-11	1.5	9.3	14.14	13.300	0.0100
CPF-PI00PJ-04-04-13	2.5	9.7	19.91	7.98	0.0090
CPF-PI00PJ-04-04-16	4	10.2	26.91	4.950	0.0077
CPF-PI00PJ-04-04-20	6	12.5	35.95	3.300	0.0065
CPF-PI00PJ-04-04-21	10	13.4	55.62	1.910	0.0065
CPF-PI00PJ-04-04-22	16	15.1	80.57	1.210	0.0050
CPF-PI00PJ-04-04-23	25	16.9	114.29	0.780	0.0050
CPF-PI00PJ-04-04-24	35	21.8	161.91	0.554	0.0043
CPF-PI00PJ-04-04-25	50	23.9	240.45	0.386	0.0043
CPF-PI00PJ-04-04-26	70	26.9	324.42	0.272	0.0035
CPF-PI00PJ-04-04-27	95	28.2	432.97	0.206	0.0035

2.7. XLPE/PVC insulated stranded copper conductors

Construction

• Conductor : Plain Annealed Copper

• Insulation : XLPE Compound per IEC 60502-1

• Bedding :PVC type ST2 per IEC 60502-1 or BSEN50363 or pp filler

• Sheath: PVC type ST2 per IEC 60502 -1 or BSEN50363

Color: for insulation

One core: Black Thrcc cores: Red Ycllow- Blue

Two cores: Red. Black Follr core: Red' Yellow-blue-black

• Conductor assembly: A number of wires twisted to form round compacted conductors per IEC 60228 Single core Color for Sheath: grey for single core Black for two or more core conductor .Class 2 stranded circular o

TECHNICAL DATA

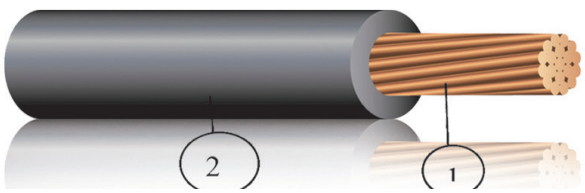
Nominal voltage Uo/U = 0.6/1 kV

• Power frequency test voltage 3.5 kV for 5 minutes

• Maximum admissible temperature of conductor at normal operation 90 °C.

• Maximum admissible temperature of conductor at short circuit 250 °C for 5 seconds. Application: For indoors use in cable trenches or ducts.

2.7.1. XLPE insulated stranded conductor(Cu/XLPE)



1. Annealed stranded copper conductor
2. XLPE primary insulation

CXR-0000-04-01-11	1.5	7	0.53	0.7	3.2	1.7	12.100
CXR-0000-04-01-13	2.5	7	0.67	0.7	3.9	2.5	7.410
CXR-0000-04-01-16	4	7	0.85	0.7	4.4	3.2	4.610
CXR-0000-04-01-20	6	7	1.04	0.7	5.0	4.1	3.080
CXR-0000-04-01-21	10	7	1.35	0.7	6.4	6.7	1.830
CXR-0000-04-01-22	16	7	1.70	0.7	7.4	9.1	1.150
CXR-0000-04-01-23	25	7	2.14	0.9	9.1	13.6	0.727
CXR-0000-04-01-24	35	7	2.52	0.9	10.3	17.5	0.524
CXR-0000-04-01-25	50	19	1.78	1.0	12.3	24.8	0.387
CXR-0000-04-01-26	70	19	2.17	1.1	13.6	30.6	0.268
CXR-0000-04-01-27	95	19	2.52	1.1	16.1	42.6	0.193
CXR-0000-04-01-28	120	37	2.03	1.2	17.6	50.7	0.153
CXR-0000-04-01-29	150	37	2.25	1.4	19.7	63.9	0.124
CXR-0000-04-01-30	185	37	2.52	1.6	21.9	78.9	0.0991
CXR-0000-04-01-31	240	61	2.25	1.8	25.0	103.2	0.0754
CXR-0000-04-01-32	300	61	2.52	1.8	27.7	126.4	0.0601

CXR-0000-04-01-33	400	61	2.85	2.0	31.6	164.6	0.047
CXR-0000-04-01-34	500	61	3.20	2.2	35.1	202.7	0.0366
CXR-0000-04-01-35	630	127	2.52	2.4	38.5	243.9	0.0283

2.7.2. Two-five core XLPE Insulated Stranded conductors (Cu/XLPE/PVC)

	Two core		
CXR-000PJ-04-02-11	1.5	8.7	10.0
CXR-000PJ-04-02-13	2.5	9.5	12.5
CXR-000PJ-04-02-16	4	10.3	16.4
CXR-000PJ-04-02-20	6	12.2	21.2
CXR-000PJ-04-02-21	10	13.7	32.4
CXR-000PJ-04-02-22	16	16.3	45.7
CXR-000PJ-04-02-23	25	18.5	68.4
CXR-000PJ-04-02-24	35	23.2	92.1
	Three core		
CXR-000PJ-04-03-11	1.5	10.0	12.7
CXR-000PJ-04-03-13	2.5	10.9	16.3
CXR-000PJ-04-03-16	4	11.9	21.8
CXR-000PJ-04-03-20	6	14.1	28.6
CXR-000PJ-04-03-21	10	15.9	44.0
CXR-000PJ-04-03-22	16	19.2	63.1
CXR-000PJ-04-03-23	25	21.7	95.5
CXR-000PJ-04-03-24	35	27.0	128.8
	Four core		
CXR-000PJ-04-04-11	1.5	11.0	14.5
CXR-000PJ-04-04-13	2.5	12.1	20.1
CXR-000PJ-04-04-16	4	13.2	27.2
CXR-000PJ-04-04-20	6	15.7	36.1
CXR-000PJ-04-04-21	10	17.8	55.9
CXR-000PJ-04-04-22	16	21.5	80.9
CXR-000PJ-04-04-23	25	24.4	123.2
CXR-000PJ-04-04-24	35	30.1	166.4
CXR-000PJ-04-04-25	50	34.6	245.8
CXR-000PJ-04-04-26	70	38.7	307.0
CXR-000PJ-04-04-27	95	42.3	402.3
CXR-000PJ-04-04-28	120	47.5	507.4
CXR-000PJ-04-04-29	150	52.9	608.6
CXR-000PJ-04-04-30	185	59.1	766.2
CXR-000PJ-04-04-31	240	64.5	1002.8
CXR-000PJ-04-04-32	300	70.3	1245.6

	Four core with one reduced neutral conductor		
CXR-OOOPJ-04-04-(23+22)	25	19.6	112.6
CXR-OOOPJ-04-04-(24+22)	35	24.8	143.5
CXR-OOOPJ-04-04-(25+23)	50	27.2	213.5
CXR-000PJ-04-04-(26+23)	70	30.6	288.8
CXR-OOOPJ-04-04-(27+24)	95	33.7	382.4
CXR-OOOPJ-04-04-(28+25)	120	37.1	479.6
CXR-OOOPJ-04-04-(29+25)	150	40.5	571.6
CXR-OOOPJ-04-04-(30+26)	185	44.3	715.1
CXR-OOOPJ-04-04-C31+27)	240	48.1	917.8
CXR-OOOPJ-04-04-(32+28)	300	54.5	1076.0
CXR-000PJ-04-04-(29+25)	150	40.5	571.6
CXR-000PJ-04-04-C30+26)	185	44.3	715.1
CXR-000PJ-04-04-[31+27]	240	48.1	917.8
CXR-000PJ-04-05-(32+28)	300	54.5	1076.0
	Five core		
CXR-000PJ-04-05-21	10	19.5	64.6
CXR-000PJ-04-05-22	16	23.6	94.9
CXR-000PJ-04-05-23	25	26.8	144.8
CXR-000PJ-04-05-24	35	32.9	197.1
CXR-000PJ-04-05-25	50	37.8	291.2
CXR-000PJ-04-05-26	70	42.3	400.8
CXR-000PJ-04-05-27	95	46.4	529.2
CXR-000PJ-04-05-28	120	52.1	656.6
CXR-000PJ-04-05-29	150	58.1	812.3
CXR-000PJ-04-05-30	185	65.0	1012.9
CXR-000PJ-04-05-31	240	71.0	1312.5
CXR-000PJ-04-05-32	300	83.2	1620.9

2.8. XLPE Insulted,PP filled & PVC sheathed conductor

2.8.1. Two-five core XLPE Insulated,PP,filled & PVC sheathed stranded conductor(Cu/XLPE/PP/PVC)

Product code	Slominal Cross Sectional Area in mm2	Approximate overall diame ter mm	Approximate weight in kg/lOOm
	Two core		
CXR-PP00PJ-04-02-11	1.5	9.5	10.8
CXR-PP00PJ-04-02-13	2.5	10.3	13.2
CXR-PP00PJ-04-02-16	4	11.1	16.9
CXR-PPOOPJ-04-02-20	6	13.4	21.8
CXR-PPOOPJ-04-02-21	10	14.8	33.2
CXR-PPOOPJ-04-02-22	16	17.9	48.6
CXR-PP00PJ-04-02-23	25	20.5	75.7
CXR-PP00PJ-04-02-24	35	25.1	88.2

Three core			
CXR-PP00PJ-04-03-11	1.5	11.0	14.0
CXR-PP00PJ-04-03-13	2.5	12.0	17.4
CXR-PP00PJ-04-03-16	4	13.0	22.6
CXR-PPOOPJ-04-03-20	6	15.7	29.2
CXR-PP00PJ-04-03-21	10	17.6	45.1
CXR-PP00PJ-04-03-22	16	21.3	64.4
CXR-PP00PJ-04-03-23	25	24.4	98.6
CXR-PP00PJ-04-03-24	35	29.7	132.4
Four core			
CXR-PP00PJ-04-04-11	1.5	12.1	16.3
CXR-PP00PJ-04-04-13	2.5	13.2	20.7
CXR-PP00PJ-04-04-16	4	14.3	27.6
CXR-PP00PJ-04-04-20	6	17.3	36.8
CXR-PP00PJ-04-04-21	10	19.4	58.6
CXR-PP00PJ-04-04-22	16	23.7	84.0
CXR-PP00PJ-04-04-23	25	27.1	129.7
CXR-PP00PJ-04-04-24	35	32.8	165.8
CXR-PP00PJ-04-04-25	50	37.3	248.6
CXR-PPOOPJ-04-04-26	70	41.9	331.6
CXR-PP00PJ-04-04-27	95	45.6	434.7
CXR-PP00PJ-04-04-28	120	50.8	535.9
CXR-PP00PJ-04-04-29	150	56.2	661.0
CXR-PP00PJ-04-04-30	185	62.4	820.7
CXR-PP00PJ-04-04-31	240	68.3	1058.8
CXR-PP00PJ-04-04-32	300	74.3	1302.4
Four core with one reduced neutral conductor			
CXR-PP00PJ-04-04-(23+22)	25	21.3	112.6
CXR-PP00PJ-04-04-(24+22)	35	26.6	150.7
CXR-PP00PJ-04-04-(25+23)	50	30.5	219.1
CXR-PP00PJ-04-04-(26+23)	70	34.0	300.6
CXR-PP00PJ-04-04-(27+24)	95	37.0	398.7
CXR-PP00PJ-04-04-(28+25)	120	41.6	501.0
CXR-PP00PJ-04-04-(29+25)	150	46.2	604.3
CXR-PP00PJ-04-04-(30+26)	185	51.5	759.6
CXR-PP00PJ-04-04-(31+27)	240	56.0	978.6
CXR-PP00PJ-04-04-(32+28)	300	61.8	1204.9
CXR-PP00PJ-04-04-(33+29)	400	68.4	1517.1
Five core			
CXR-PP00PJ-04-05-21	10	20.6	63.9
CXR-PP00PJ-04-05-22	16	24.7	91.8
CXR-PP00PJ-04-05-23	25	27.9	137.7
CXR-PP00PJ-04-05-24	35	34.5	185.9

CXR-PP00PJ-04-05-25	50	39.5	278.7
CXR-PP00PJ-04-05-26	70	44.0	379.9
CXR-PP00PJ-04-05-27	95	48.0	497.7
CXR-PP00PJ-04-05-28	120	53.7	613.7
CXR-PP00PJ-04-05-29	150	59.7	757.2
CXR-PP00PJ-04-05-30	185	66.6	940.4
CXR-PP00PJ-04-05-31	240	72.6	1212.9
CXR-PP00PJ-04-05-32	300	84.6	1491.7

2.9. TWo-four cores XLPE Insulated,PVC bedding,PVC sheathed Stranded & Galivanized steel tape armored copper conductor

Construction

• Conductor : Plain Annealed Copper

• Insulation: extruded XLPE Compound rated 90 °C at normal operation to IEC 60502-1.

• Bedding :extruded PVC type ST2 or lapped PVC tape

• Outer Sheath: PVC type ST2

• Armor: galvanized steel tape

Color: for insulation

Two cores: Red, Black

Three cores: Red, Yellow and Blue

Four core: Red. Yellow. Blue. Black

• Color for Sheath: grey for single core

Black for two or more core

• Conductor assembly: Class 2 stranded circular or compacted conductors per IEC 60228 and 60502-2.

• Two or more insulated wires twisted to form round conductor

TECHNICAL DATA

• Rated voltage: up to and including Uo/U : 0.6/1 .OK V

• Power frequency test voltage 3.5 kV for 5 minutes

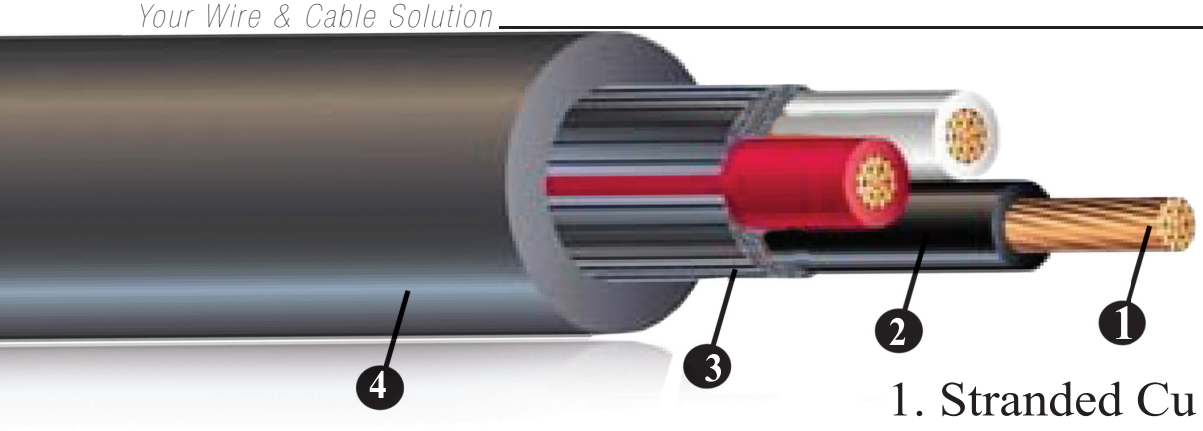
• Maximum admissible temperature of conductor at normal operation 90 °C.

• Maximum admissible temperature of conductor at short circuit 250 °C for 5 seconds.

Application: For outdoor installations in power stations, industrial plants and switchgears if mechanical pro tection is required or in applications where mechanical damages and high temperature are expected to occur.

2.9.2. TWo-four cores XLPE Insulated,PVC bedding & still tape armored standed conductrs(Cu/XLPE/PP/PVC)

Product code	Nominal Cross Sectional Area in mm2	Steel tape Armor thickness mm	Approximate overall diameter mm	Approximate veight in kg/ lOOrr
		Two core		
CXR-PI0TPJ-04-02-21	10	0.2	16.0	60.1
CXR-PI0TPJ-04-02-22	16	0.2	17.5	76.3
CXR-PI0TPJ-04-02-23	25	0.5	21.8	113.6
CXR-PI0TPJ-04-02-24	35	0.5	24.0	141.4
CXR-PI0TPJ-04-02-25	50	0.5	28.6	194.2
		Three core		
CXR-PI0TPJ-04-03-21	10	0.2	17.9	80.7
CXR-PI0TPJ-04-03-22	16	0.2	19.7	103.8
CXR-PI0TPJ-04-03-23	25	0.5	24.6	153.6
CXR-PI0TPJ-04-03-24	35	0.5	27.2	192.6
CXR-PI0TPJ-04-03-25	50	0.5	32.4	263.6
		Four core		
CXR-PI0TPJ-04-04-21	10	0.2	19.5	100.4
CXR-PI0TPJ-04-04-22	16	0.2	21.6	130.4
CXR-PI0TPJ-04-04-23	25	0.5	27.0	192.2
CXR-PI0TPJ-04-04-24	35	0.5	29.8	242.0
CXR-PI0TPJ-04-04-25	50	0.5	35.6	330.1
CXR-PI0TPJ-04-04-26	70	0.5	40.0	427.4
CXR-PI0TPJ-04-04-27	95	0.5	44.1	539.9
CXR-PI0TPJ-04-04-28	120	0.8	49.4	677.0
CXR-PI0TPJ-04-04-29	150	0.8	54.6	811.2
CXR-PI0TPJ-04-04-30	185	0.8	60.0	980.0
		Four core with one reduced neutral conductor		
CXR-PI0TPJ-04-04-(23+22)	25	0.5	29.8	167.6
CXR-PI0TPJ-04-04-(24+22)	35	0.5	32.6	180.4
CXR-PI0TPJ-04-04-(25+23)	50	0.5	40.0	300.0
CXR-PI0TPJ-04-04-(26+23)	70	0.5	44.4	386.4
CXR-PI0TPJ-04-04-(27+24)	95	0.5	48.3	487.5
CXR-PI0TPJ-04-04-(28+25)	120	0.8	53.7	591.1
CXR-PI0TPJ-04-04-(29+25)	150	0.8	58.8	715.4
CXR-PI0TPJ-04-04-(30+26)	185	0.8	63.9	866.3
CXR-PI0TPJ-04-04-(31+27)	240	0.8	69.9	1086.9
CXR-PI0TPJ-04-04-(32+28)	300	0.8	75.1	1312.6
CXR-PI0TPJ-04-04-(33+29)	400	0.8	84.0	1644.6



1. Stranded Cu
2.PVC Insulation
3.PP Filler
4.PVC Sheath

2.10 XLPE primary isulated,PVC sheathed,STW armored stranded copper conductor

• Conductor: Plain annealed stranded circular copper conductor, as per Class 2 of IEC 60228.

• Insulation: An extruded layer of cross linked polyethylene (XLPE) insulation rated 90 °C at normal operation per IEC 60502-1.

• Bedding: An extruded layer of Polyvinyl chloride (PVC).

• Armor: galvanized steel wire.

• Outer sheath: An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST2 to IEC 60502-1.

Color: for insulation

• Two cores: Red, Black .Color for Sheath: grey for single core

Three cores: Red, Yellow and Blue . Black for two or more core

• Four core: Red. Yellow. Blue. Black

• Conductor assembly: Class 2 stranded circular or compacted conductors per IEC 60228 and 60502-1.

• Two or more insulated wires twisted to form round conductor

TECHNICAL DATA

• Rated voltage: up to and including Uo/U : 0.6/1 .OK V

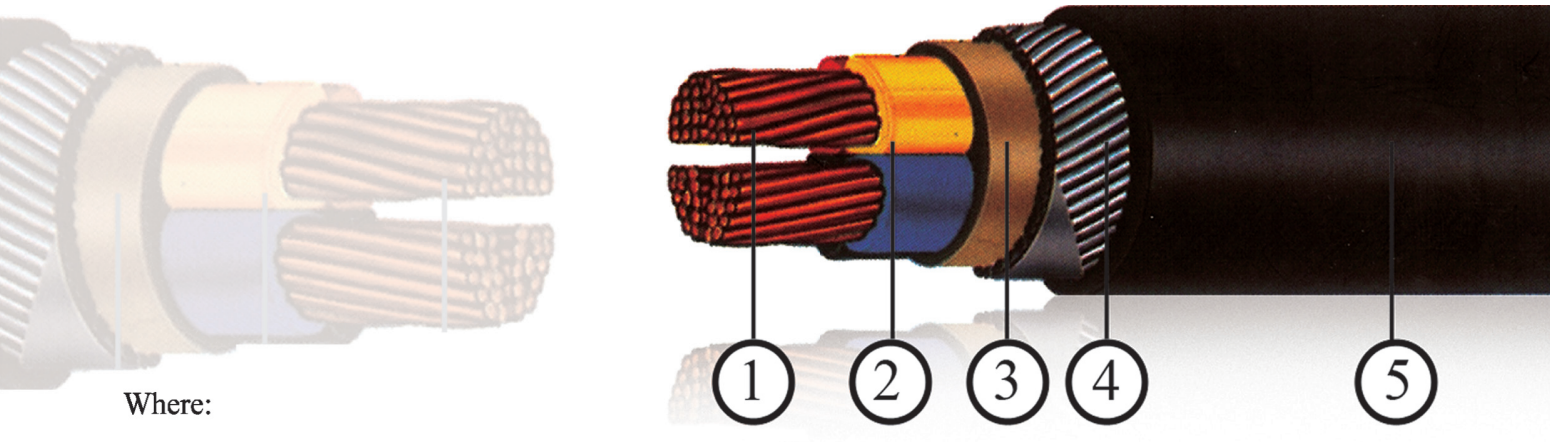
• Power frequency test voltage 3.5 kV for 5 minutes

• Maximum admissible temperature of conductor at normal operation 90 °C.

• Maximum admissible temperature of conductor at short circuit 250 °C for 5 seconds.

Application: For outdoor installations in power stations, industrial plants and switchgears if mechanical

protection is required or in applications where mechanical damages and high temperature are expected to



Where:

1. Stranded copper conductor 2. XLPE primary insulation 3.SWA armor 4.PVC Jacket(outer sheath

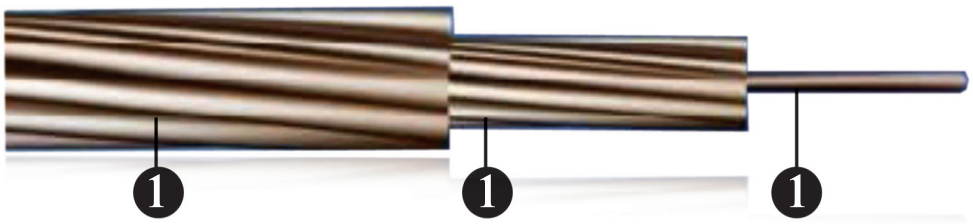
2.10.1. Two-four cores XLPE insulted,PVC bedding,steel wire armored stranded conducto(Cu/XLPE/PVC/SWA/PVC)

Product code	NominalCross Sec-:ional Area ir mm2	Armor wire diameter mm	Approximate jverall diameter mm	Approximate weight in kg/lOOm
		Two core		
CXR-PI0WPJ-04-02-21	10	0.8	17.1	73.7
CXR-PIOWPJ-04-02-22	16	0.8	18.6	91.4
CXR-PIOWPJ-04-02-23	25	0.9	21.5	122.5
CXR-PIOWPJ-04-02-24	35	0.9	23.7	151.2
CXR-PI0WPJ-04-02-25	50	1.25	29.3	220.7
		Three core		
CPR-PIOWPJ-04-03-21	10	0.8	19.0	96.7
CPR-PIOWPJ-04-03-22	16	0.8	20.8	121.8
CPR-PIOWPJ-04-03-23	25	0.9	24.3	164.8
CPR-PIOWPJ-04-03-24	35	0.9	26.9	204.9
CPR-PIOWPJ-04-03-25	50	1.25	33.1	296.0
		Four core		
CXR-PIOWPJ-04-04-21	10	0.8	20.6	118.2
CXR-PIOWPJ-04-04-22	16	0.8	22.7	150.4
CXR-PIOWPJ-04-04-23	25	0.9	26.7	204.7
CXR-PIOWPJ-04-04-24	35	0.9	29.6	255.8
CXR-PIOWPJ-04-04-25	50	1.25	36.2	366.4
CXR-PIOWPJ-04-04-26	70	1.25	40.7	468.7
CXR-PIOWPJ-04-04-27	95	1.25	44.8	585.6
CXR-PIOWPJ-04-04-28	120	1.6	49.4	726.6
CXR-PIOWPJ-04-04-29	150	1.6	54.6	866.0
CXR-PIOWPJ-04-04-30	185	1.6	60.0	1040.7
CXR-PIOWPJ-04-04-31	240	1.6	66.2	1303.2
CXR-PIOWPJ-04-04-32	300	1.6	72.1	1585.3

2.11.ALUMINUM CONDUCTOR.

2.11.1. All aluminum conductors(AAC)per IEC 60089

Construction: Aluminum conductors stranded successively to get required layers and standard conductor.



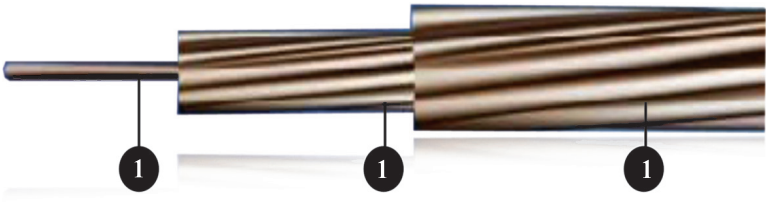
Where: 1 AAC

A0R-0000-04-01-22	16	7/1.70	5.1	4.33	43.3	290	1.802
A0R-0000-04-01-23	25	7/2.10	6.3	6.64	66.3	425	1.181
A0R-0000-04-01-24	35	7/2.50	7.5	9.41	94.0	590	0.8332
A0R-0000-04-01-25	50	7/3.0	9.0	13.5	135	810	0.5786
A0R-0000-04-01-26	70	19/1.80	9.0	13.3	133	862	0.5950
A0R-0000-04-01-27	95	19/2.10	10.5	18.1	181	1155	0.4371
A0R-0000-04-01-28	120	19/2.50	12.5	25.6	256	1599	0.3085
A0R-0000-04-01-29	150	19/2.80	14.0	32.2	322	1916	0.2459
A0R-0000-04-01-30	185	37/2.25	15.8	40.6	405	2581	0.1960
A0R-0000-04-01-31	240	37/2.50	17.5	50.1	500	3115	0.1587
A0R-0000-04-01-32	300	61/2.25	20.3	67.1	670	4030	0.1191
A0R-0000-04-01-33	400	61/2.50	22.5	82.8	827	4865	0.09651
A0R-0000-04-01-34	500	61/2.89	26.0	110.6	1.105	6208	0.0722
A0R-0000-04-01-35	625	61/3.23	29.1	138.2	1.381	7616	0.0578
A0R-0000-04-01-36	800	91/2.96	32.6	173.5	1.733	9716	0.0462:
A0R-0000-04-01-37	1000	91/3.35	36.9	222.2	2.220	12076	0.0361
A0R-0000-04-01-38	16000	91/3.74	41.1	277.0	2.767	14868	0.028997

2.11.2. All Aluminum alloy conductor(AAAC)

1. AAAC

It contains about 0.6% silicon and magnesium element.



It has the following benefits:

A) Strength: stronger than pure AAC about twice

B) Lighter than ACSR about 20% at equal diameter

C) It has a high atmospheric corrosion resistance which is suitable for coastal and industrial areas.

D) Has harder surface resistance than AAC which is important to reduce damage during installation

E) It contains non magnetic element which is not exhibit the magnetic core losses.

Construction: Aluminum conductors stranded successively to get required layers to get required standard

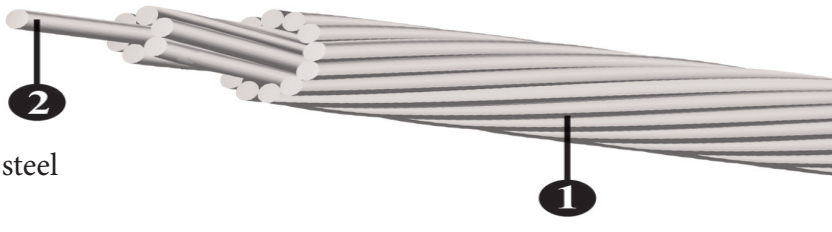
conductor.

Application: are applicable for aerial over head distribution lines that require high strength, corrosion resistance and harder surface than pure aluminum.

Product code	Nominal cross Sectional area mm2	No of wire / Approximate Wire Diameter _ overall diameter	Approximate weight Kg/lOOm		Breaking strength Kg	DC resistance at 20 ocohm/km
A10R-0000-04-01-22	16	7/1.70	5.1	4.33	453	2.091
A10R-0000-04-01-23	25	7/2.10	6.3	6.64	691	1.370
A10R-0000-04-01-24	35	7/2.50	7.5	9.41	979	0.9669
A10R-0000-04-01-25	50	7/3.0	9.0	13.5	1410	0.6714
A10R-0000-04-01-26	70	19/1.80	9.0	13.3	1377	0.6905
A10R-0000-04-01-27	95	19/2.10	10.5	18.1	1875	0.5073
A10R-0000-04-01-28	120	19/2.50	12.5	25.6	2657	0.3580
A10R-0000-04-01-29	150	19/2.80	14.0	32.2	3333	0.2854
A10R-0000-04-01-30	185	37/2.25	15.8	40.6	4191	0.2274
A10R-0000-04-01-31	240	37/2.50	17.5	50.1	5174	0.1842
A10R-0000-04-01-32	300	61/2.25	20.3	67.1	6909	0.1383
AlOR-0000-04-01-33	400	61/2.50	22.5	82.8	8530	0.1120
A10R-0000-04-01-34	500	61/2.89	26.0	110.6	11400	0.08380
AlOR-0000-04-01-35	625	61/3.23	29.1	138.2	14239	0.06709
A10R-0000-04-01-36	800	91/2.96	32.6	173.5	17840	0.05367
AlOR-0000-04-01-37	1000	91/3.35	36.9	222.2	22850	0.04190
A10R-0000-04-01-38	16000	91/3.74	41.1	277.0	28480	0.03362

2.11.3. Aluminum conductor's steel reinforced(ACSR)

Construction: ACSR is composite concentrically stranded conductor successively to get required layers to get required light weight and high tensile strength standard conductor. Application: widely used as high tension over head distribution lines.



1. Aluminum 2.galvanized steel

Nominal cross Sectional area mm2	Construction No of wire / wire diameter		Area mm2	Total cross Sectional area	overall diameter	Approximate total weight Kg/lOOm	Breaking strength Kg	DC resistance at 20°C ohm/km
	A1	steel	A1	steel				
16/2.5	6/1.80	1/1.80	15.3	2.5	17.8	5.4	6.15	593	1.8793
25/4	6/2.25	1/2.25	23.9	4.0	27.9	6.8	9.68	920	1.2028
35/6	6/2.70	1/2.70	34.4	5.7	40.1	8.1	14.02	1295	0.8353
44/32	14/2.0	7/2.4	44.0	31.7	75.7	11.2	17.23	4637	0.6573
50/8	6/3.20	1/3.2	48.3	8.0	56.3	9.6	19.62	1752	0.5946
50/30	12/2.33	7/2.33	51.2	29.8	81.0	11.7	37.77	4517	0.5644
70/12	26/1.89	7/1.44	69.9	11.4	81.3	11.7	28.39	2687	0.4130
95/15	26/2.15	7/1.67	94.4	15.3	109.7	13.6	38.28	3587	0.3058
95/55	12/3.20	7/3.20	96.5	56.3	152.8	16.0	71.23	8180	0.2992
105/75	14/3.10	19/2.25	105.7	75.5	181.2	17.5	89.08	10882	0.2736
120/20	26/2.44	7/1.90	121.6	19.8	141.4	15.5	49.37	4584	0.2374
120/70	12/3.6	7/3.60	122.1	71.3	193.4	18.0	90.05	10012	0.2364
125/30	30/2.33	7/2.33	127.9	29.8	157.7	16.1	59.09	5902	0.2259
150/25	26/2.70	7/2.10	148.9	24.2	173.1	17.1	60.48	5546	0.1939
170/40	30/2.70	7/2.70	171.8	40.2	211.9	18.9	79.35	7855	0.1682
185/30	26/3.00	7/2.33	183.8	29.8	213.6	19.0	74.56	6761	0.1571
210/35	26/3.20	7/2.49	209.1	34.1	243.2	20.3	85.1	7644	0.1380
210/50	30/3.00	7/3.0	212.1	49.5	261.6	21.0	98.08	9410	0.1363
230/30	24/3.50	7.233	230.9	29.8	260.7	21.0	87.67	7455	0.1249
240/40	26/3.45	7/2.68	243.1	39.5	282.6	21.9	98.67	8819	0.1188
265/35	24/374	7/2.49	263.7	34.1	297.8	22.4	100.18	8460	0.1094
300/50	26/3.86	7/3.00	304.3	49.5	353.8	24.5	123.56	10719	0.0949
305/40	54/2.68	7/2.68	304.6	39.5	344.1	24.1	115.96	10129	0.0949
340/30	48/3.00	7/2.33	339.3	29.8	369.1	25.0	117.96	9441	0.0851
380/50	54/3.00	7/3.00	381.7	49.5	431.2	27.0	145.28	12333	0.0757
385/35	48/3.20	7/2.49	386.0	34.1	420.1	26.7	134.38	10640	0.0748
435/55	54/3.20	7/3.20	434.3	56.3	490.6	28.8	165.27	13900	0.0666
450/40	48/3.45	7/2.68	487.7	39.5	488.2	28.7	156.08	12259	0.0644
490/65	54/3.40	7/3.40	490.3	63.6	553.9	30.6	186.56	15591	0.0590
495/35	45/3.74	7/2.49	494.4	34.1	528.5	29.9	163.56	12272	0.0584

2.11.4.Aluminum conductor steel reinforced(ACSR) per BS EN 50182

Code Name	Construction No of wire / wire diameter	Area mm2			Total cross Sectional area	overall diameter	total weight Kg/ lOOm	Breaking strength Kg	DC resistance at 20°C ohm/ km
MOLE	6/1/1.50	1.50	10.60	1.77	12.4	4.5	4.31	4780	27.062
SQUIRREL	6/1/2.1	1	2.11	20.98	3.50	24.5	6.33	8.52	8020	13.677
GOPHER	6/1/2.36	2.36	26.25	4.37	30.6	7.08	10.7	9610	10.933
WEASEL	6/1/2.59	2.59	31.61	5.27	36.9	7.77	12.9	11450	0.9077
FOX	6/1/2.79	2.79	36.68	6.11	42.8	8.37	14.9	13100	0.7822
FERRET	6/1/3.00	3.00	42.41	7.07	49.5	9.00	17.3	15200	0.6766
RABBIT	6/1/3.35	3.35	52.88	8.81	61.7	10.05	21.4	18500	0.5426
MINK	6/1/3.66	3.66	63.13	10.52	73.7	10.98	25.7	21900	0.4546
SKUNK	12/7/2.59	7.77	63.22	36.88	100.1	12.95	46.7	52900	0.4571
BEAVER	6/1/3.99	3.99	75.02	12.50	87.5	11.97	30.4	25900	0.3825
HORSE	12/7/2.79	8.37	73.36	42.80	116.2	13.95	54.1	60700	0.3939
RACCOON	6/1/4.09	4.09	78.83	13.14	92.0	12.27	32.0	27200	0.3640
OTTER	6/1/4.22	4.22	83.33	13.99	97.9	12.66	34.1	28900	0.3419
CAT	6/1/4.50	4.50	95.43	15.90	111.3	13.50	38.8	32800	0.3007
HARE	6/1/4.72	4.72	104.98	17.50	122.5	14.16	42.7	36000	0.2733
DOG	6/4.72	4.71	104.98	13.55	118.5	14.15	38.9	34700	0.2733
HYENA	7/1.57	5.79	105.95	20.48	126.4	14.57	45.3	41900	0.2697
LEOPARD	7/4.39	5.25	131.37	16.84	148.2	15.81	49.4	42200	0.2184
COYOTE	7/1.93	5.73	131.74	20.06	151.8	15.89	52.4	47300	0.3035
TIGER	6/5.28	4.72	131.23	30.62	161.9	16.52	60.6	58700	0.2202
WOLF	7/1.75	7.77	158.06	36.88	194.9	18.13	73.0	69200	0.1828
LYNX	26/2.54	8.37	183.41	42.80	226.2	19.53	84.6	79300	0.1576
PANTHER	7/1.91	9.00	212.06	49.48	261.5	21.00	97.0	90800	0.1363
LION	30/7/2.36	9.54	238.27	55.60	293.9	22.26	110.0	101000	0.1213
BEAR	30/7/2.59	10.05	264.42	61.33	326.1	23.45	122.0	112000	0.1093
GOAT	30/7/2.79	11.13	324.31	75.70	400.0	25.97	150.0	136000	0.0891
SHEEP	30/7/3.00	11.97	375.11	87.67	462.6	27.93	173.0	157000	0.0770
ANTELOPE	30/7/3.18	8.91	374.11	48.53	422.6	26.73	142.0	117000	0.0773
BISON	30/7/3.35	9.00	381.70	49.50	431.2	27.00	145.0	119000	0.0757
DEER	30/7/3.71	12.81	429.60	100.24	529.8	29.89	198.0	179000	0.0673
ZEBRA	30/7/3.99	9.54	428.88	55.60	484.5	28.62	163.0	133000	0.0674
ELK	54/7/2.97	13.50	477.13	111.33	588.5	31.50	220.0	199000	0.0606
CAMEL	54/7/3.00	10.05	475.96	61.70	537.7	30.15	181.0	147000	0.0607
MOOSE	30/7/4.27	10.59	528.49	68.51	597.0	31.77	200.0	162000	0.0547
DINOSAUR	54/7/3.18	11.80	661.73	83.11	744.8	35.50	249.3	202920	0.0437
BERSFORD	30/7/4.50	9.96	687.36	60.60	748.0	35.58	238.6	177650	0.0420

2.11.5. PVC insulation aluminium conductor (Al/PVC)

Construction

Conductor: Stranded circular aluminum conductor, as per Class 2 of IEC 60228.

Insulation: An extruded layer of Polyvinyl chloride (PVC) insulation rated 70 °C at normal operation to IEC 60502-1. ‘ ’

Outer sheath: An extruded layer of Polyvinyl chloride (PVC) sheathing compound type ST1 to TEC 605021. - - - . . .

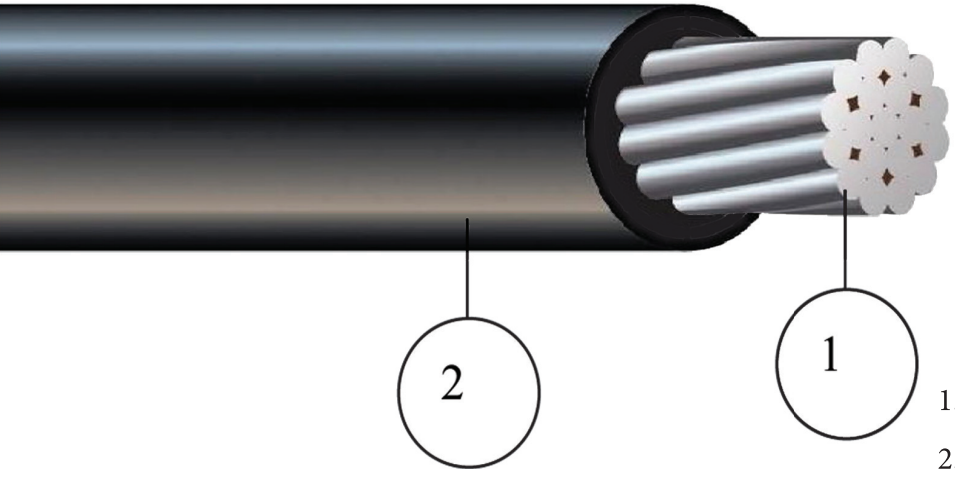
Color: for insulation

Two cores: Red, Black

Three cores: Red, Yellow and Blue

Four core: Red. Yellow. Blue. Black

- Color for Sheath: grey for single core Black for two or more core Technical Data
- Rated voltage; U/Uo: up to and including 0.6/1.1(1.2) KV.
- Power frequency test voltage 3.5 kV for 5 minutes
- Maximum admissible temperature of conductor at normal operation 70 °C .
- Maximum admissible temperature of conductor at short circuit 160 °C for 5 seconds.
  - 160 °C for sizes < 300 mm2
  - 140 °C for sizes >300 mm2



1. Stranded A1 conductor
2. PVC primary insulation.

2.11.5. PVC insulated single core aluminium conductor (Al/PVC)

Product code	Nominal Cross Sectional Area in mm2	Number of Strands	Radial thickness of Insulation mm	Approx- Approximate overall diameter mm	Max. Conimate Total Weight ductor DC in kg/lOOm	Resistance at 20°C in/2/km
APR-0000-04-01-22	16	7	1.0	9.1	6.7	1.802
APR-0000-04-01-23	25	7	1.2	10.3	10.2	1.181
APR-0000-04-01-24	35	7	1.2	12.3	13.5	0.8332
APR-0000-04-01-25	50	19	1.4	13.6	19.2	0.5786
APR-0000-04-01-26	70	19	1.4	16.1	24.3	0.5950
APR-0000-04-01-27	95	19	1.6	17.6	34.1	0.4371
APR-0000-04-01-28	120	19	1.6	19.7	41.4	0.3085
APR-0000-04-01-29	150	37	1.8	21.9	52.2	0.2459
APR-0000-04-01-30	185	37	2.0	25.0	64.4	0.1960
APR-0000-04-01-31	240	61	2.2	27.7	84.9	0.1587
APR-0000-04-01-32	300	61	2.4	31.6	104.3	0.1191
APR-0000-04-01-33	400	61	2.6	35.1	137.3	0.09650
APR-0000-04-01-34	500	61	2.8	38.5	170.0	0.07221
APR-0000-04-01-35	625	127	3.0	42.3	207.9	0.05781

2.11.5.2. PVC insulated two-four core aluminum conductors (Al/PVC)

Product code	Nominal Cross Sectional Area in mm2	Approximate overall diameter mm	Approximate Total Weight in kg/100m	Max. Conductor DC Resismm tance at 20°C in 12/km
APR-000PJ-04-02-21	10	13.9	27.5	3.08
APR-000PJ-04-02-22	16	15.4	32.1	1.802
APR-000PJ-04-02-23	25	17.9	43.5	1.181
APR-000PJ-04-02-24	35	20.2	55.9	0.8332
		Three core		
APR-000PJ-04-03-21	10	17.9	35.1	3.08
APR-000PJ-04-03-22	16	20.9	44.3	1.802
APR-000PJ-04-03-23	25	23.7	61.0	1.181
APR-000PJ-04-03-24	35	29.7	78.4	0.8332
		Four core		
APR-000PJ-04-04-21	10	20.0	38.4	3.08
APR-000PJ-04-04-22	16	23.5	49.2	1.802
APR-000PJ-04-04-23	25	26.5	69.0	1.181
APR-000PJ-04-04-24	35	33.2	88.8	0.8332
APR-000PJ-04-04-25	50	36.6	136.1	0.5786
APR-000PJ-04-04-26	70	42.3	166.9	0.5950
APR-000PJ-04-04-27	95	45.3	224.9	0.4371

APR-000PJ-04-04-28	120	51.0	261.0	0.3085
APR-000PJ-04-04-29	150	56.2	330.6	0.2459
APR-000PJ-04-04-30	185	63.3	402.5	0.1960
APR-000PJ-04-04-31	240	68.9	515.0	0.1587
APR-000PJ-04-04-32	300	76.9	614.1	0.1191
APR-000PJ-04-04-33	400	84.1	775.2	0.09650
APR-000PJ-04-04-34	500	91.0	933.7	0.07221
APR-000PJ-04-04-35	625	96.2	1104.5	0.05781

ANNEX TECHNICAL DATA

1.1.Technical information

1. Conductor resistance

Formula of DC resistance of conductor as per IEC 60228 at 20 °C is:

R=R2o[l+a (T-20)]

Where

R: Conductor DC resistance at T °C R20: Conductor DC resistance at 20 °C T: Operating temperature in a: Resistance temperature coefficient per °C = 0.00393 for Copper = 0.00403 for Aluminum

AC resistance of the conductor at its operating temperature can be calculated using the following formula is used:

RAC = RT(1 + Ys + Yp) =; (ohm/km)

Where:

Ys is skin factor effect Yp is a proximity effect

Ys and Yp depend on operation frequency and cable spacing.

RT: DC resistance at temperature T RAC: Alternating current resistance.

At power frequencies of 50-60 Hz the skin effect factor is small for conductors smaller than about 150 mm2

2. Inductance

The formula to calculate self and mutual inductance is:

LK + 0.21oge ^, (D /km)

Where:

L: Inductance in Q/km

K: Constant that depends on number of wires obtained from table, d: diameter of wire

S: axial spacing between cables in trefoil formation in mm

S: 1.26 x axial spacing between cables in flat cable formation in mm

3. Capacitance

The capacitance for cables with circular conductors (F/m) is given by the formula below and this may also be applied for oval conductors if the geometric mean diameter is used:

Where

C: capacitance (|if/km) C=sr

iStoge (5} * 10 -19

sr: Relative permittivity of insulation material D: Diameter over insulation excluding screen (mm) d: conductor diameter including screen (mm)

4. Dielectric loses in ac cable.

Dielectric loss in each phase is calculated using the formula:

Wd — wCUo 2 tana, (W/m)

Where: w — 2nf, (1/s) in which f is frequency (Hz) (s = second)

C: capacitance

Uo: Voltage between phase and earth

5. Insulation resistance

It can be calculated the formula below based on EN BS6040 as:

R = kloglO(^)

Where:

R: insulation resistance (M Q /km)

D: Diameter over insulation excluding screen; semi-conducting layer

(mm) d: conductor diameter including screen (mm)

K: constant depending on the insulation material (0.0367 for PYC, 3.67 for XLPE and ERP), MQ.km

6. Charging current

The charging current is the capacitive current which flows capacitance between the conductor and earth and for a multi core cable in which cores are not screened between conductors. The value can be calculated from the formula:

Ic = UoU/CKT6 (A/km)

Where:

Ic : Charging current A/km

U0: Voltage between phase and earth, V

C : Capacitance to neutral

UJ = 2nf

ffrequenc

7. Cable Ampacity

Cable ampacity or current carrying capacity is defined as the continuous maximum current the cable can

carry at its maximum operating temperature. In the technical information tables the following installation

conditions were assumed during the current calculation:

- Ambient air temperature :40°C
- Ground temperature :35°C
- Ground thermal resistivity: 120°C cm/watt
- Burial depth : 0.5meter
- All cable ampacities are based on IEC 60287

8. Cable short circuit capacity

The calculation of short circuit current for conductor and screen based on the following conditions required:

A- Short circuit starts from the maximum operating conductor / screen

temperature B- Maximum temperature during short circuit C- Maximum short

circuit current duration is 5 seconds.

If the short circuit current is required at duration not mentioned in 1 second, it is obtained by dividing

the short circuit current for 1 second by the square root of the required

Where: I sx.t: short circuit current in time t second (kA)

I s.c.t: short circuit current in one second

(KA) t:time(s)

9. Voltage drop

Voltage drop occurs when current flows in a cable conductor. It occurs between the ends of the conductor which is the product of the current and the impedance. If the voltage drop were excessive, it could result in the voltage at the equipment being supplied being too low for proper operation- The voltage drop is of more consequence at the low end of the voltage range of supply voltages than it is at higher voltages, and

generally it is not significant as a percentage of the supply voltage for cables rated above 1000V unless very long route lengths are involved. The following equations can be used to calculate the voltage drop:

A. Single phase circuit.

Vd = 2IL(Rcos 0 + Xsin0)

Three phase circuit Vd = V3 *

L(Rcos 0 -I- Xsin0)

Where:

Vd= voltage drop (V)

1= load current (A)

R=AC resistance (G/km)

L=lenth(km) Relation between cosp and sin0 as follows

UJ =2jrf cos(p 1.0 0.9 0.8 0.71 0.6 0.5

X= L* U7 10'6 sincp 0.0 0.44 0.6 0.71 0.8 0.87

10. Current carrying capacity

1= { A0-Wd[~+n(T2+T3+T4)

RTl+nR(l+Al)T2+nR(l+Al+A2)(T3+T4)1/2

But for d.c. cables some of the losses are not applicable and for up to 5 kV formula may be simplified to:

tR/Tl+nR'T2+nRf(T3+T4)J

Where:

A0 : Conductor temperature rise (K)

I: current flowing in one conductor (A)

R: alternating current resistance per unit length of the conductor at maximum operating temperature (Q/m)

Wd: dielectric loss per unit length for the insulation surrounding the conductor (W/m)

T1: thermal resistance per unit length between one conductor and the sheath (km/w)

T2: thermal resistance per unit length between one conductor and armor (km/w)

T3: thermal resistance per unit length of the external serving cable and surrounding medium (km/w) T4: thermal resistance per unit length between the cable surface and surrounding medium (km/w)

n: number of load-carrying conductors in the cable (conductors of equal size and carrying the same loa A1: ratio of losses in the metal sheath to total losses in all conductors in that cable.

A2: ratio of losses in the armoring to total losses in all conductors in that cable

R' =d.c. resistance per unit length of the conductor at maximum operating temperature (G/m)

11. Thermal resistance between one conductor and sheath (Tl)

The equations for various cable constructions are outlined below; IEC287 contains further informat

including data for the geometric factor G and an additional screening factor which is necessary screened cables A. Single core cable

Where:

pT : Thermal resistivity of insulation (K m/W) dc: diameter of conductor (mm) tl: thickness of insulation, conductor to sheath (mm) B. Multi belted cable

C. Multi screened cables

T1 ~ * Screening factor

Where: G is geometric factor from IEC287.

D. SL and SA type cables: these are treated as single core cables.

Thermal resistance between sheath and armor

Single and multi core cables

Where: t2 is thickness of bedding (mm), Ds is thickness of outer diameter (mm) Or

T2 = — G' 2n

Where: G' is geometrical factor from IEC 287

E. Thermal resistance of outer covering

Where:

t3 is thickness of outer covering while D'a is thickness of armor

F. External thermal resistance in air (T4)

Assuming protection from solar radiation ^

T4 = ----------

nDeh^AGs^l/A

Where: h is heat dissipation coefficient from IEC 287, De is external diameter of cable (mm)

210s : Excess of surface temperature above ambient (K)

G. External thermal resistance for buried cable.

T4 = ^loge[p + (p2 - 1) 1 / 2]

where pT : the thermal resistivity of the soil (K m/W) g :2L/De, L

= distance from ground surface to cable axis (mm)

De = external diameter of the cable (mm)

H. Thermal resistance cable in buried ducts

HI: Thermal resistance of air space (T'4)

For cable diameters of 25 to 100mm, _ U

T 4 " 1 + 0.1(F + Y0m)De Where: U,

Vand Y are constants for various types of ducts from IEC2 87.

0m: mean temperature of the airspace(°C)

De: External diameter of cable (mm)

H2.Thermal resistance of the duct (T")

„ pT /Do\

Where: Do: outside diameter of duct (mm),Dd inside diameter of duct(mm),and pT thermal resistivity of duct(km/w) from IEC 287

Singlecore		cables	0.8	0.9	1.0	1.5	2.0	2.5	3.0
Up	to	150	1.16	1.11	1.07	0.91	0.81	0.73	0.67
185	to	400	1.17	1.12	1.07	0.90	0.80	0.72	0.66
5000	to	1200	1.18	1.13	1.08	0.90	0.79	0.71	0.65

Multi core cable

Up	to	16	1.09	1.06	1.04	0.95	0.86	0.79	0.74
25	to	150	1.14	1.10	1.07	0.93	0.84	0.76	0.70
185	to	400	1.16	1.11	1.07	0.92	0.84	0.74	0.68

13. EFFECT OF INSTALLATION CONDITIONS ON RATINGS

There is rating differences between installation in air and in the ground, which is being associated with the

cable surface area. Some aspects that arising effect of installation condition are listed below.

13.1. Depth of Burial

The depth of lying is governed primarily by what is considered to be the most advisable to minimize effects of damage and generally increases with cable voltage. Values adopted in various countries have been given in table below. An equation covering the effect on rating has already been quoted and for most purposes the thermal resistance of the soil may be simplified to

pT: Soil thermal resistivity (K m/W)

De: cable external diameter (mm)

1: depth of burial to cable axis (mm)

In this formula variations of Pr may be extremely important but variations of laying depth have less effect.

13.2. Standard conditions

When groups of multi core power cables are installed in air it is necessary to have a sufficient air space for dissipation

of heat. No reduction in rating is necessary provided that:

a) The horizontal clearance between circuits is not less than twice the overall diameter of an individual cable.

b) the vertical clearance between circuits is not less than four times the diameter of an individual cable;

c) If the number of circuits exceeds three, they are installed in a horizontal plane.

13.3. Cables lay direct in ground standard conditions

a) Ground temperature 15°C

b) Soil thermal resistivity 1.2km/w

c) Adjacent circuits at least 1.8m distance

d) Depth of laying 0.5m for lkv cables, 0.8m for above l.Okv and up to 33kv cables.

14. Current carrying capacity rating factor

Table 6 Group rating factor for circuit of three single core cables in trefoil and laid flat touching horizontal formation

14. Current carrying capacity rating factor

Table 8 Group rating factor for circuit of three single core cables in trefoil and laid flat touching horizontal formation

Table10 five core cables with conductors PVC 90 °C insulated and PVC Sheathed copper conductor rated voltage, U/Uo 0.6/1 KV

Nominal Cross Sectional Area in mm2	Approximate current carrying capacity (Ampere)						Voltage drop(mv/Amp/m)	
	In ground			In air			PVC rated 90 °C	PVC rated 90 °C
	R Direct laid(flat)	Direct laid (trfoil)	In duct	H Direct laid(flat)	Direct laid (trefoil)	In pipe	Flat	Trefoil
1.5	17	17	13	14	13	10	22.6	22.5
2.5	23	22	17	19	16	13	13.9	13.8
4	30	30	22	26	22	18	8.7	8.6
6	38	36	28	33	29	23	5.8	5.7
10	50	49	37	45	39	31	3.5	3.4
16	65	63	48	60	51	40	2.3	2.2
25	84	81	63	79	68	53	1.5	1.4
35	103	99	76	99	85	65	1.1	1
50	122	116	92	121	104	79	0.83	0.82
70	151	144	114	154	133	99	0.61	0.6
95	183	174	139	193	166	122	0.47	0.45
120	208	197	158	225	193	140	0.39	0.38
150	235	223	179	259	223	160	0.34	0.33
185	266	251	203	300	258	183	0.29	0.28
240	312	292	237	361	308	216	0.25	0.24
300	353	328	267	417	355	245	0.22	0.21

Nominal Cross Sectional Area in mm2	Approximate current carrying capacity (Ampere)						Voltage drop(mv/Amp/m)
	In ground						
	Unarmored			Armored			
	Direct laid	Laid in direct	Direct laid	Direct laid	In duct Direct laid		PVC rated 90 #C Trefoil
1.5	24	19	20	19	14	17	22.60
2.5	30	25	28	24	19	23	13.80
4	40	32	39	32	24	32	8.60
6	50	40	50	40	30	42	5.80
10	65	55	66	52	41	55	3.50
16	85	65	88	68	49	73	2.00
25	110	85	116	88	64	97	1.40
35	130	105	143	104	79	119	1.10
50	160	131	162	128	98	135	0.80

Nominal Cross Sectional Area in mm2	Approximate current carrying capacity (Ampere)						Voltage drop(mv/Amp/m)
	In ground						
	Unarmored			Armored			
	Direct laid	Laid in direct	Direct laid	Direct laid	In duct Direct laid		PVC rated 90 #C Trefoil
1.5	21	18		16	14		22.60
2.5	27	23		22	19		13.80
4	36	30	36	29	24	29	8.60
6	45	37	45	37	31	37	5.80
10	60	50	60	50	41	51	3.50
16	78	65	78	66	54	66	2.00
25	100	83	100	87	70	88	1.40
35	125	101	124	106	84	109	1.10
50	149	121	147	130	102	133	0.80
70	183	148	180	163	126	167	0.58
95	219	178	215	201	154	204	0.44
120	249	203	245	233	177	235	0.37
150	280	229	273	268	202	268	0.32
185	315	259	306	308	230	305	0.27
240	364	301	349	364	269	355	0.23
300	409	339	387	417	306	401	0.20
400	465	386	428	485	352	454	0.18

1.5	31	30	22	27	22	19	22.90	22.80
2.5	40	39	29	36	29	24	14.10	14.00
4	52	50	38	47	38	32	8.80	8.70
6	65	63	47	60	49	40	5.90	5.80
10	87	83	63	82	66	54	3.60	3.50
16	112	107	82	109	88	70	2.30	2.20
25	144	137	105	145	116	92	1.50	1.40
35	172	165	127	178	143	112	1.10	1.00
50	204	195	151	218	175	134	0.84	0.83
70	251	238	187	277	222	168	0.61	0.60
95	301	286	225	344	274	205	0.47	0.46
120	345	327	258	409	326	237	0.39	0.38
150	385	363	290	461	367	269	0.34	0.33

185	436	410	430	534	425	308	0.29	0.28
240	507	474	382	638	505	361	0.25	0.24
300	573	532	434	740	583	411	0.22	0.21
400	645	600	489	865	676	469	0.19	0.18
500	744	673	550	1009	779	533	0.17	0.16
630	847	752	615	1184	900	603	0.16	0.15

Table 15 Single core cables with copper conductor, XLPE insulated and PVC Sheathed; rated voltage; U/Uo 0.6/1 kv

1.S	31	30	22	27	22	19	22.90	22.80
2.5	40	39	29	36	29	24	14.10	14.00
4	52	50	38	47	38	32	8.80	8.70
6	65	63	47	60	49	40	5.90	5.80
10	87	83	63	82	66	54	3.60	3.50
16	112	107	82	109	88	70	2.30	2.20
25	144	137	105	145	116	92	1.50	1.40
35	172	165	127	178	143	112	1.10	1.00
50	204	195	151	218	175	134	0.84	0.83
70	251	238	187	277	222	168	0.61	0.60
95	301	286	225	344	274	205	0.47	0.46
120	345	327	258	409	326	237	0.39	0.38
150	385	363	290	461	367	269	0.34	0.33
185	436	410	430	534	425	308	0.29	0.28
240	507	474	382	638	505	361	0.25	0.24

300	573	532	434	740	583	411	0.22	0.21
400	645	600	489	865	676	469	0.19	0.18
500	744	673	550	1009	779	533	0.17	0.16
630	847	752	615	1184	900	603	0.16	0.15

Table 16 Two core cable with copper conductor, XLPE 90°C insulated and PVC sheath rated voltage ;U/Uo 0.6/1.2 kV.

1.5	30	25	25	24	19	21	22.80
2.5	37	32	24	30	24	20	14.00
4	50	40	46	40	30	38	8.70
6	63	52	60	50	39	50	5.90
10	82	69	79	66	52	66	3.50
16	106	83	105	85	62	87	2.20
25	139	107	138	111	80	115	1.50

Table 17 Three and four core cable with copper conductor, XLPE insulated and PVC sheathed,rated voltage U/Uo; 0.6/1 kv.

1.5	27	22		22	18		22.80
2.5	35	29		29	24		14.00
4	45	37	46	38	31	39	8.70
6	56	46	57	48	39	50	5.90
10	76	62	76	67	52	67	3.50
16	98	80	98	88	68	89	2.20
25	128	104	128	118	90	120	1.50
35	157	125	158	142	107	149	1.10
50	187	149	188	175	129	182	0.81
70	229	183	229	220	161	229	0.58
95	276	220	274	272	196	280	0.44
120	313	251	310	316	226	322	0.37
150	350	283	346	363	258	368	0.31
185	395	321	387	418	295	420	0.27
240	458	372	444	496	346	491	0.23
300	516	420	494	571	394	557	0.20
400	584	478	549	665	454	635	0.18

Table 18. Minimum cable bending radius

Cable outer diameter (mm)	Cable rated voltage volt	Cable	radius * outer diameter
Single ore cables diameter	300/300,450/750,600/1000		
Up to 10	66	3	
10 to 25	66	4	
Over 25 mm	«	6	
Any armored cable	66	6	
Any cable with shaped conductors	66	8	
Without armor or screen	1900/3300 to 6350/11000	6	
Un armored 66 8			
Armored	66	12	

Table 19. Thermally permissible short-circuit currents of the screen, with a final temperature not exceeding 350 °C, in line withNEN 3620.

	0.5	0.4	0.3	0.2	0.1	1	2	3	4	5
10	2.52	2.81	3.25	3.98	5.63	1.78	1.26	1.03	0.89	0.80
16	4.03	4.50	5.20	6.37	9.01	2.85	2.01	1.64	1.42	1.27
25	6.29	7.04	8.12	9.95	14.07	4.45	3.15	2.57	2.23	1.99
35	8.81	9.85	11.37	13.93	19.70	6.23	4.41	3.60	3.12	2.79
50	12.59	14.07	16.25	19.90	28.14	8.90	6.29	5.14	4.45	3.98
70	18.88	21.11	24.37	29.85	42.22	13.35	9.44	7.71	6.68	5.97
95	23.91	26.74	30.87	37.81	53.47	16.91	11.96	9.76	8.46	7.56
120	30.21	33.77	39.00	47.76	67.55	21.36	15.10	12.33	10.68	9.55
150	37.76	42.22	48.75	59.70	84.43	26.70	18.88	15.42	13.35	11.94
185	46.57	52.07	60.12	73.63	104.13	32.93	23.29	19.01	16.47	14.73
240	60.42	67.55	78.00	95.52	135.09	42.72	30.21	24.66	21.36	19.10
300	75.52	84.43	97.49	119.41	168.87	53.40	37.76	30.83	26.70	23.88
400	100.69	112.58	129.99	159.21	225.15	71.20	50.35	41.11	35.60	31.84
500	125.87	140.72	162.49	199.01	281.44	89.00	62.93	51.38	44.50	39.80
630	158.59	177.31	204.74	250.75	354.62	112.14	79.29	64.74	56.07	50.15

The short circuit current indicated in table 17 has been calculated in line with NEN 3620 for cables with a copper earthling screen only which is allowed to reach a temperature of 350 9c. The temperature allowed for an aluminum foil screen is onlyl60 9C. Even so, the thermally permissible short-circuit currents for the screen of transversally and Longitudinally watertight cables are close to the values applying to copper wire screens. This is caused by the current distribution.

Table 20. Short circuit current

	0.5	0.4	0.3	0.2	0.1	1	2	3	4	5
16	2.13	3.62	4.18	5.12	7.24	1.50	1.06	0.87	0.75	0.67
25	3.32	5.65	6.53	7.99	11.31	2.35	1.66	1.36	1.18	1.05
35	4.65	7.91	9.14	11.19	15.83	3.29	2.33	1.90	1.65	1.47
50	6.65	11.31	13.05	15.99	22.61	4.70	3.32	2.71	2.35	2.10
70	9.97	16.96	19.58	23.98	33.92	7.05	4.99	4.07	3.53	3.15
95	12.63	21.48	24.80	30.38	42.96	8.93	6.31	5.16	4.47	3.99
120	15.95	27.13	31.33	38.37	54.26	11.28	7.98	6.51	5.64	5.04
150	19.94	33.92	39.16	47.96	67.83	14.10	9.97	8.14	7.05	6.31
185	24.59	41.83	48.30	59.16	83.66	17.39	12.30	10.04	8.70	7.78
240	31.90	54.26	62.66	76.74	108.53	22.56	15.95	13.03	11.28	10.09
300	39.88	67.83	78.32	95.93	135.66	28.20	19.94	16.28	14.10	12.61
400	53.17	90.44	104.43	127.90	180.88	37.60	26.59	21.71	18.80	16.82
500	66.47	113.05	130.54	159.88	226.10	47.00	33.23	27.14	23.50	21.02
630	83.75	142.44	164.48	201.45	284.89	59.22	41.87	34.19	29.61	26.48

ANNEX 2. Handling of products

Producing products is not enough to get the quality product for the intended wire and cable installation. There shall proper handling of products in the store, during delivery loading unloading and at the installation activities. Operators; production workers; labourers and installation technicians shall follow the instruction listed below.

1. Rolling reels with workers

a) Don't stack reels poorly

b) Don't use damaged or broken reel flanges or nailed reel.

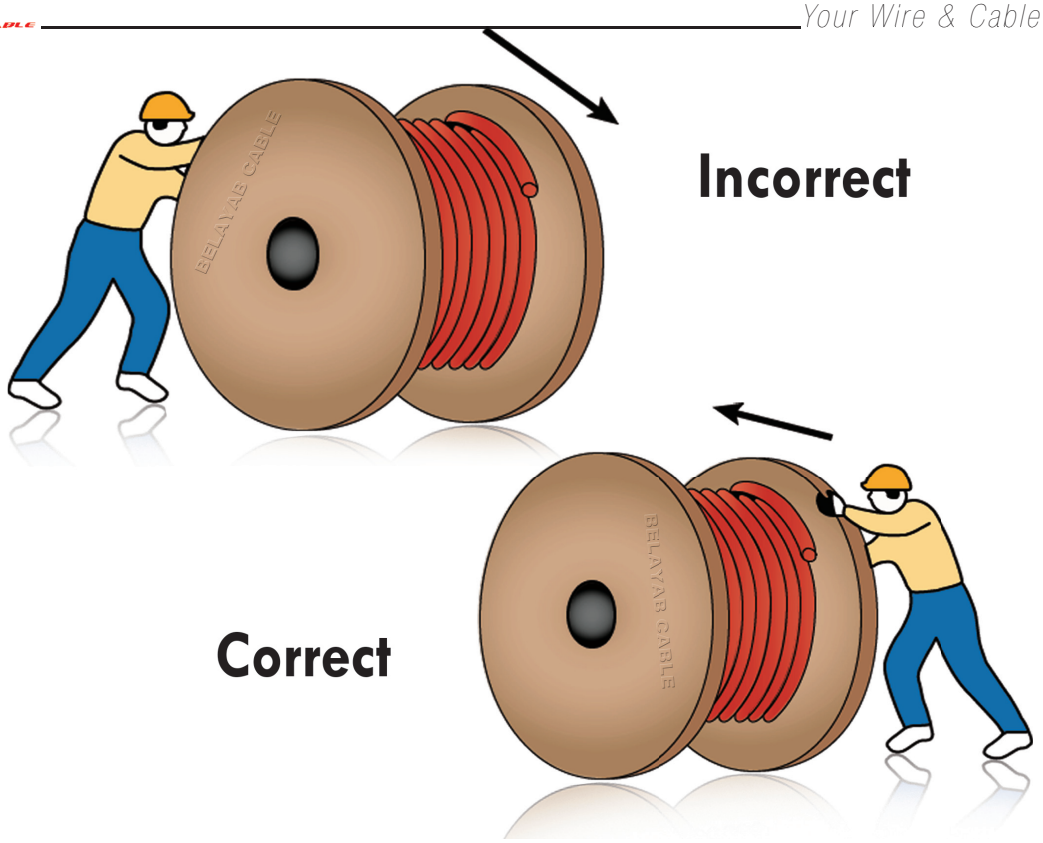
c) Tie ends of cable firmly.

d) Make sure the cable ends are secure before moving drums.

e) Roll reels only in the same direction it was turned when the cable was wound onto the reel.

f) If reels are moved by rolling, examine the route and clear the path of any debris such as rocks, wooden blocks, pipes, or other

equipment.



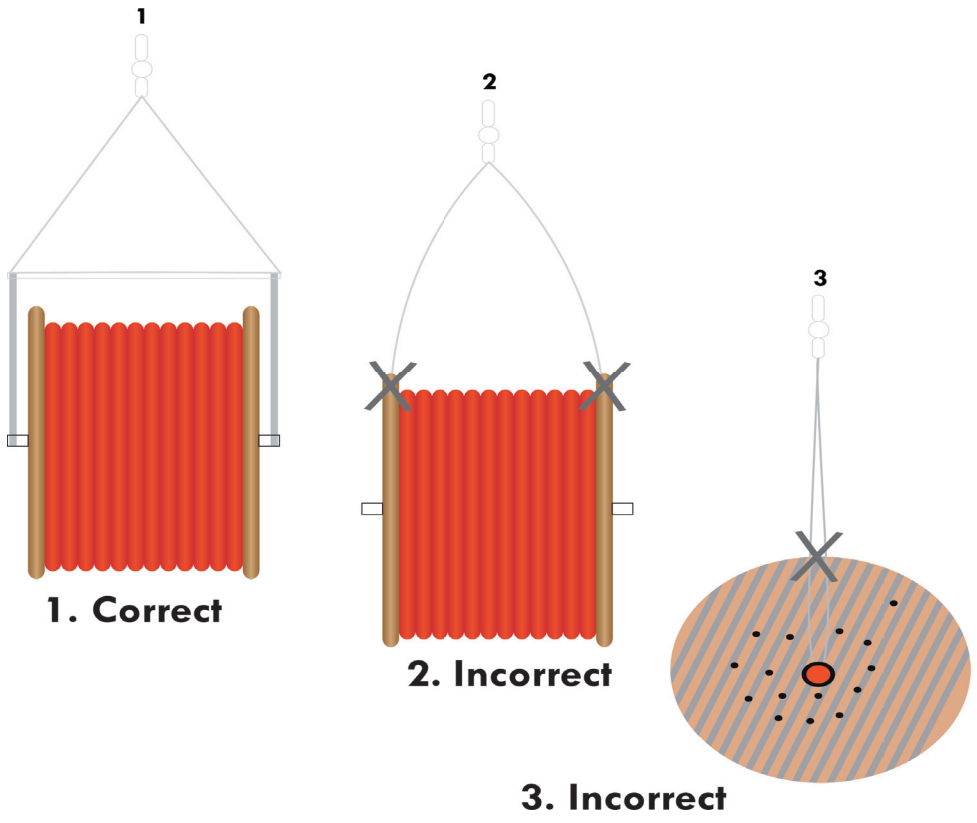
2. How to use for lifts to move reels

a) Use forks of the capacity that is not lift it

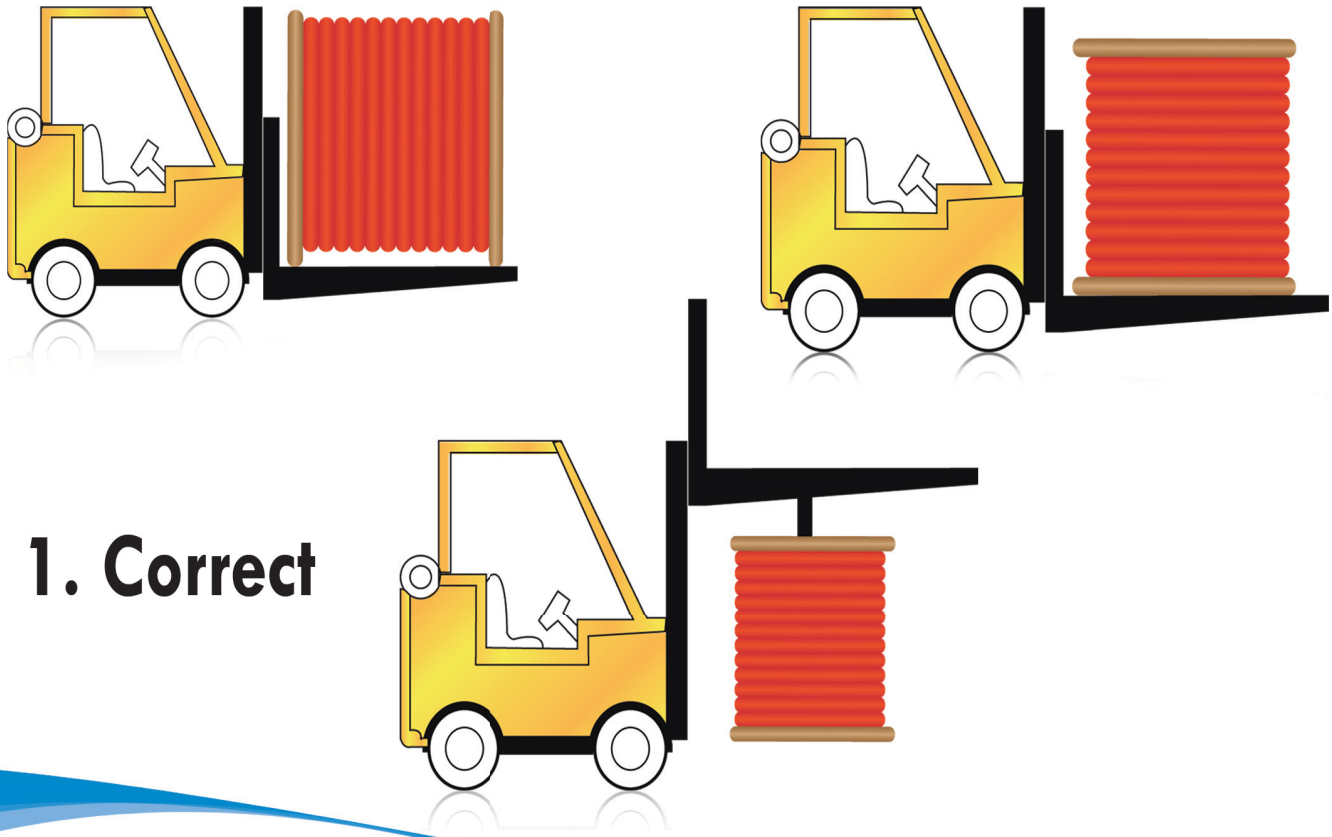
b) Only lift from the sides and only if the forks are of sufficient length to securely capture both flanges.

c) Don't lift reels with the forks between the reel flanges or let the forks contact the cable or the protective covering.

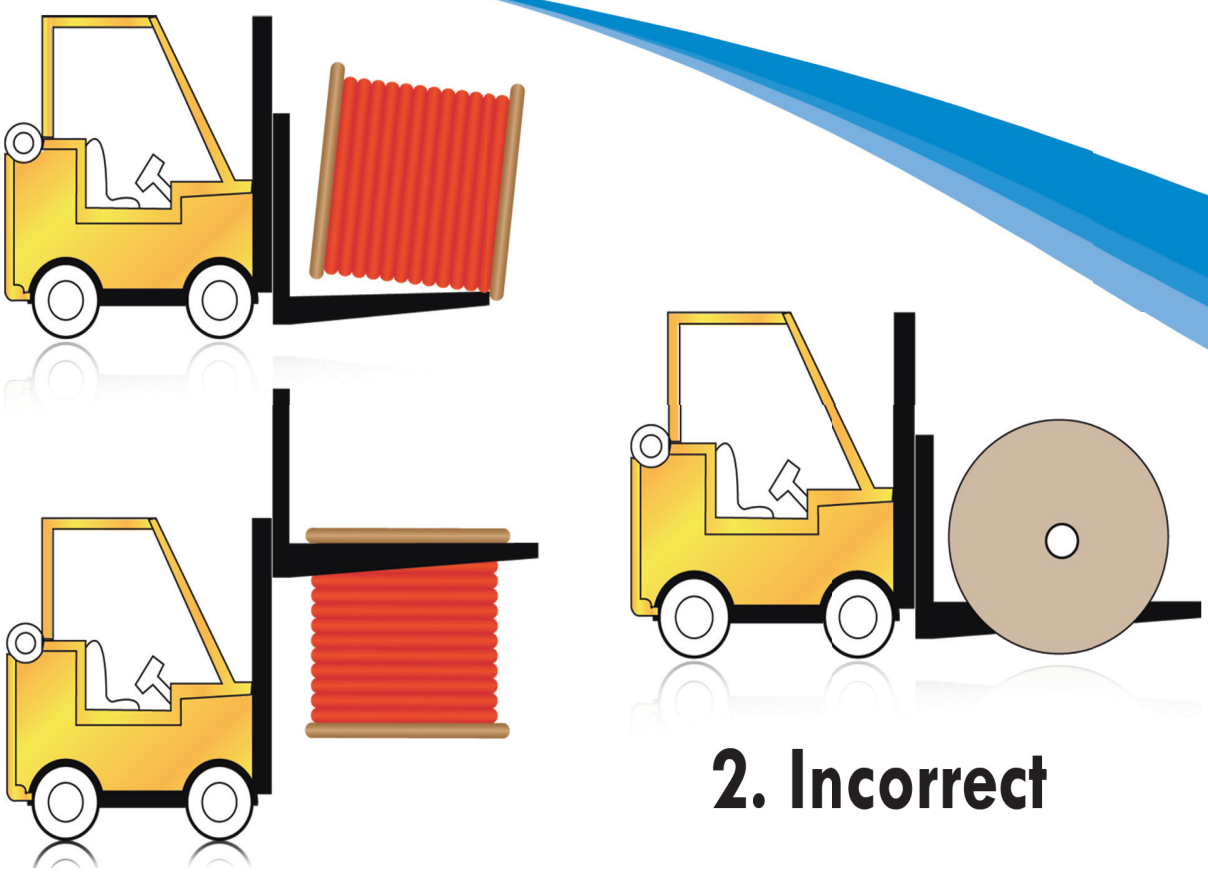
d) Use suitable holding device inserted in the arbor hole of the top flange.



e) Insert steel lifting bars of suitable length and size through the arbor hole in the center of the flange when there is requirement to use crane or other over head lift.



1. Correct



2. Incorrect

3. Storage of product in reels.

a) The area of store shall be accessible for using fork lift. Choose Stores reels in an orderly manner to allow easy access for moving and lifting

b) Reels should be stored indoors on a smooth, hard, and dry surface.

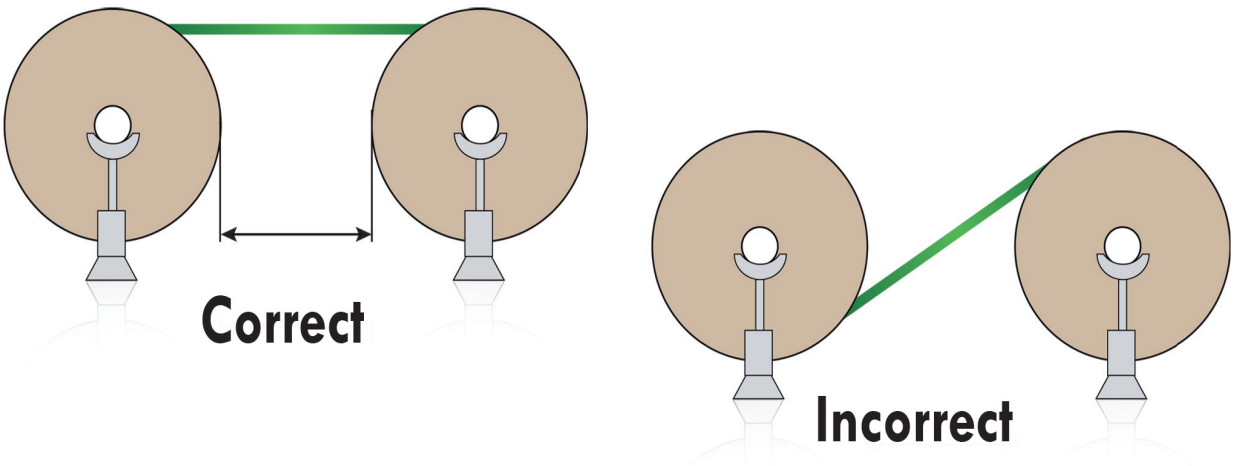
c) Chock reels from both sides.

d) Align reels flange to flange.

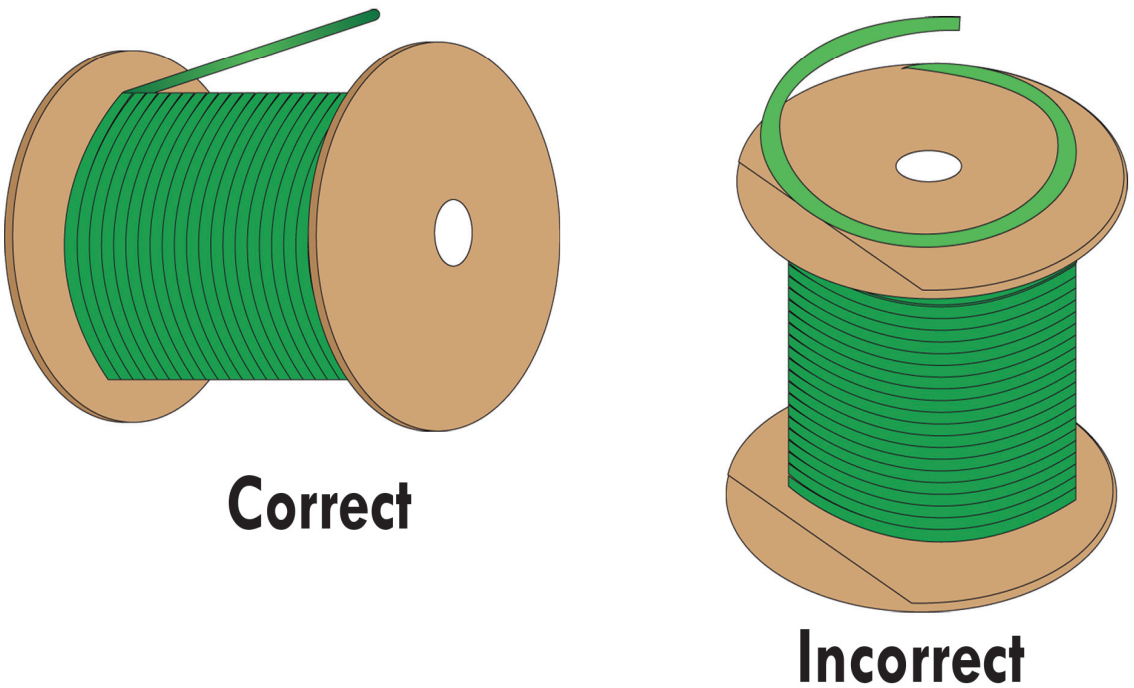
4. How to remove cables from reel

a) Unwound cable from bottom or from the top but if the cable is wound from reel to reel; position it from top to top of each reel as shown in the figure below.

b) Use suitable support for the reel at the rotating side.

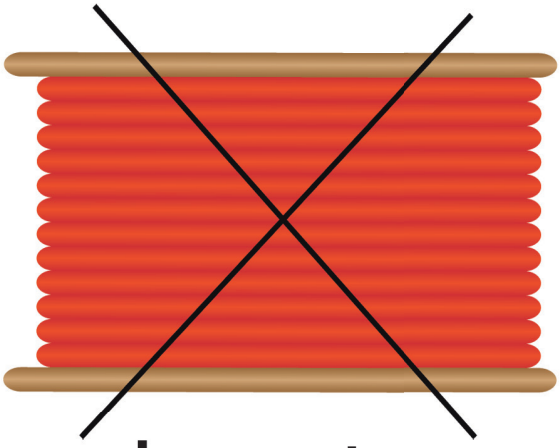


c) Don't pool the cable over the reel flange or the side of the coil as shown below.



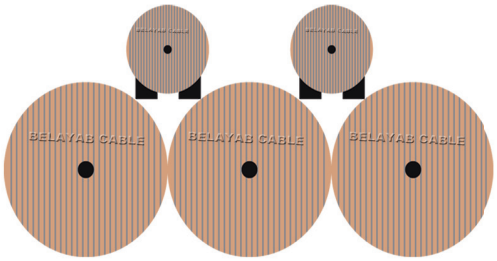
e) Put the reel its edge not on the flat position of reel as shown:

Correct

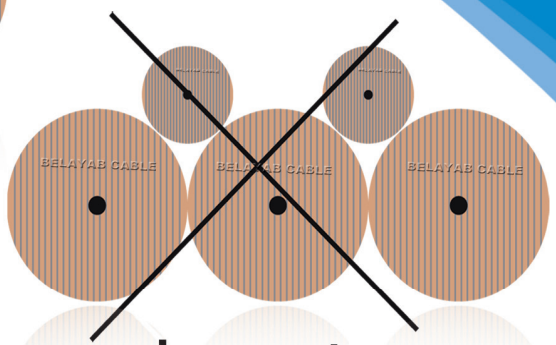


Incorrect

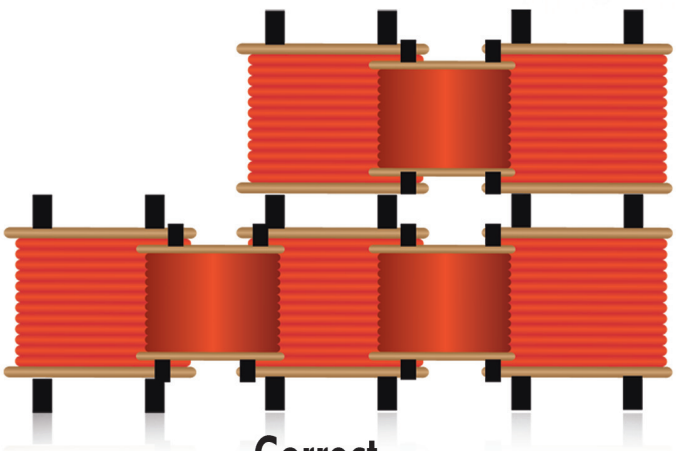
f) Avoid stacking of reels.



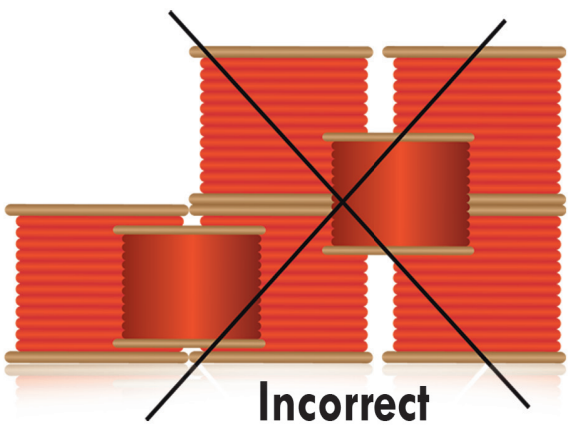
Correct



Incorrect



Correct



Incorrect

5. How keep reels from damage during installation.
   a) Use wheeling devices to unwound cable from reel in the field as shown below.
   b) Keep the direction of unwinding cable as shown below.
   c) Check the edge of reel not damage cable.

Proper loading method