

GEMSCAB®

CABLES

THE RIGHT CONNECTION



IS-1054
Part-1(1050)

I N T R O D U C T I O N

GEMSCAB Cables are being manufactured by the people who have been associated with the cable industry for over 50 years and understand the requirements of their valued customers.

The company took up the manufacture of Poly Vinyl Chloride insulated power cables, control cables, industrial wiring cables, flexible cables, mining cables, and instrumentation paired cables etc. in the year 1987.

After playing an excellent role in the manufacture of L.T. PVC cables the company has been successful in developing Fire Retardant Low Smoke (F.R.L.S.) Heat Resistant PVC cables suitable for 85°C & 105°C continuous operation and other customer built cables through its well equipped Research and Development facilities & experienced team.

The factory is equipped with the most modern production, and testing facilities to make the best cables capable of satisfying the requirements of quality.

Properties and Advantages of GEMSCAB CABLES

1. GEMSCAB cables are excellent moisture resistant, and high dielectric strength even if the cables are immersed in water.
2. GEMSCAB cables have high short circuit - safety & overload capacity.
3. GEMSCAB cables have high mechanical strength, suitable for laying on slopes and vertical shafts.
5. GEMSCAB cables are high resistant to most of chemicals, acids, bases and oils.
6. GEMSCAB cables are flame retardant.
7. GEMSCAB cables have a smooth outer surface resulting in a neat appearance when installed.
8. GEMSCAB cables have a long working life.

General Construction

Conductor

The conductors of power cables are normally made from electrical purity aluminium and for control cables high conductivity annealed copper. All conductors conform to IS:8130-1984.

Aluminium conductors upto 10 mm² are solid circular in cross section and above 10 mm² the conductors are stranded. In case of single core cables the conductors are circular, for two core cables they are D shape above 10 mm² and for 3 core and 4 core cables the conductors are sector shaped above 10 mm². Stranded conductors are also given below 16 mm² if required for any specific application field.

Insulation

The conductors are insulated with the high quality PVC compound conforming to IS:5831-1984. Special compounds are continuously developed to meet customers requirements.

Manufacturing Programme

Cable Type	Normal Manufacturing Range
Power Cables 1.1 K.V.	Single core upto 1000 mm ² Multi core upto 400 mm ²
Power Cables 3.3 K.V. to 33 K.V.	Single core upto 1000 mm ² 3 core upto 300 mm ²
Control Cables 1.1 K.V.	Upto 61 cores 1.5 mm ² and 2.5 mm ²
Mining Cables 1.1 K.V. & 3.3 K.V.	Multi core upto 120 mm ²
Instrumentation Cables	Upto 50 pairs
Flexible Wires and Cables	As per special requirements

Core Identification

Colour Scheme

Core are identified by colour of PVC insulation given as under:

- 1 Core - Red, Black, Yellow or Blue.
- 2 Core - Red and Black.
- 3 Core - Red, Yellow and Blue.
- 4 Core - Red, Yellow, Blue and Black.
(For 3½ Core - Reduced neutral core is Black)
- 5 Core - Red, Yellow, Blue, Black and Grey.
- 6 Core and above - Two adjacent cores (counting & direction) in each layer, Blue and Yellow, remaining cores Grey.

Core numbering and different colours are also given for control & paired cables.

Laying up of cores

In twin, three and multicore cables the cores are laid up together with a suitable lay, the outer most layer is laid up in right hand and successive layers with opposite lay. The interstices are filled with non-hygroscopic material.

Inner Sheath (Common Covering)

For all cables having two or more cores, a common covering is applied over the laid up cores either by extrusion of PVC compound or wrapping of plastic or proofed tapes.

Single core cables do not have inner sheath.

Armouring

Armouring is applied over the inner sheath. Where the calculated diameter below armouring does not exceed 13 mm, the armour consists of galvanized round steel wires, above the size; normally the armour is of galvanized flat steel strips.

Armouring of GEMSCAB Mining cables consists of galvanized round steel wires / strips, but a few tinned copper wires / strips are also provided to meet the conductance requirements of armouring.

Outer Sheath

The tough outer sheath is applied by extrusion. It is applied:

1. Over insulation in case of single core unarmoured cables.
2. Over inner sheath in case of multi core unarmoured cables.
3. Over armouring case of armoured cables.

The colour of outer sheath is normally black for best resistance. However, other colour can also be given as required by any customer.

The manufacturers trade name GEMSCAB alongwith voltage grade are embossed on the outer sheath and in case of L.T. cables the word ELECTRIC and in case of mining cables, the word MINING is added in the embossing script.

Properties of PVC (Electrical & Physical)

Dielectric constant	- 5 to 8
Dielectric strength	- 30 KV / mm (Min.)
Volume Resistivity at 27°C	- 10 ¹³ to 10 ¹⁴ ohm-cm
Specific gravity	- 1.3 to 1.5
Tensile strength at break	- 12.5 N / mm ² (Min.)
Elongation at break	- 150% (Min.)
Continuous operating Temperature for cables	- 70°C for normal PVC - 85°C for HR PVC
Max. overload temperature	- for normal PVC 95°C - for HR PVC 105°C
Max. short circuit temperature	- 160°C

Cable Code

The following codes are used for designation of cables:

- A - Aluminium conductor (when type designation doesn't contain 'A' in the beginning then cable is with copper conductor.)
- Y - At first or second place in type designation, it stands for PVC insulation.
- W - Steel round wire armour.
- F - Steel strip armour.
- WW - Steel double round wire armour.
- FF - Steel double flat strip armour.
- Y - When last in type designation it stands for PVC outer Sheath.
- CE - Individual core screening.

Conductor Types

- re - Circular, solid conductor.
- rm - Circular stranded conductor.
- rm / v - Circular stranded compacted conductor.
- sm - Sector, shaped, stranded conductor.

GEMSCAB Quality Control System

1. Test at Raw Material Stage

GEMSCAB PVC insulated cables are manufactured from quality raw materials, which are tested in our laboratory strictly according to our works requirements. For PVC insulated cables, the raw materials and tests generally conducted are as under:

(i) Aluminium / Copper wire

Conductor resistance, wire diameter, tensile strength, annealing and wrapping test.

(ii) PVC Compound

Density, tensile strength, elongation at break, volume resistivity and shrinkage test.

(iii) Steel strip / Wire

Dimensions, tensile strength, elongation at break, torsion, resistivity and zinc coating test.

2. Production Shop Preventive Test i.e. Process Inspection

The process control tests are carried out at every stage of manufacture for checking the adequate manufacturing process, and taking necessary steps to remove any defects.

The following are the process inspections carried out by us for PVC cables.

(i) Conductor stranding

- a) Dimensions
- b) Surface and shape of conductor
- c) Lay and direction of lay
- d) D.C. resistance
- e) No. of wires in each conductor

(ii) Insulation

- a) Dimension of cores
- b) Thickness of insulation
- c) Surface
- d) Spark test, shrinkage test and I.R. test

(iii) Laying up

- a) Sequence of cores
- b) Direction of laying up and lay
- c) Circularity of cable
- d) Diameter over laid up cores
- e) Application of filler in the interstices

(iv) Inner Sheath

- a) Surface
- b) Concentricity

- c) Thickness
- d) Diameter over inner sheath

(v) Armouring

- a) Lay and direction of lay of armouring wire / strips
- b) No. of wires / strips
- c) Uniformity of application
- d) Diameter over armouring
- e) Dimension of wires / strips

(vi) Outer Sheath

- a) Thickness
- b) Concentricity
- c) Diameter over sheath
- d) Surface
- e) Embossing with requisite information on outer sheath

3. Finished Cable Test

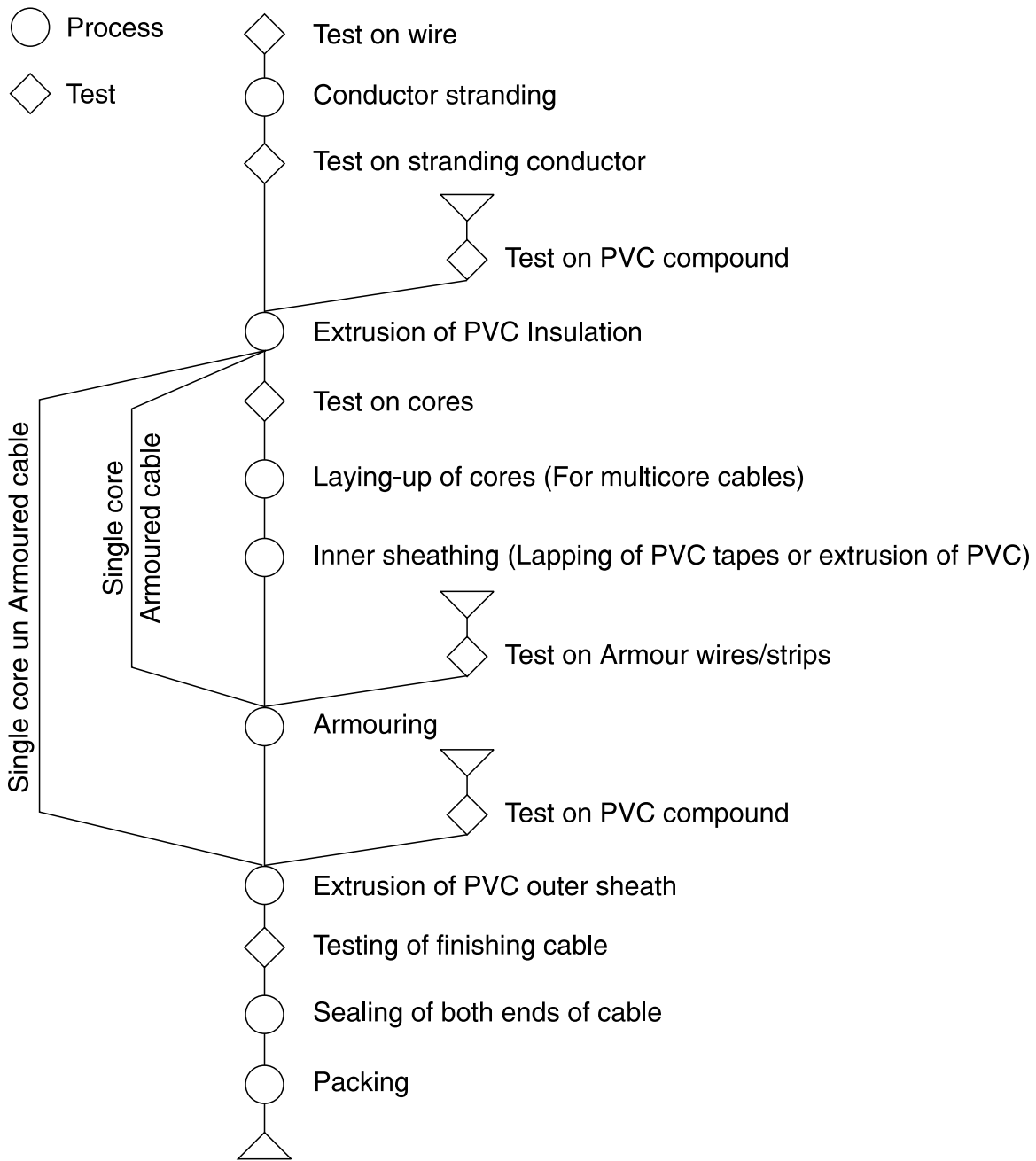
We have a well equipped arconditioned laboratory with state of the ultravoilet Rediation Testing, accelerated water absorption testing & dielectric strength retention testing instruments. All routine, acceptance and type tests are conducted as per relevant specifications and testing schemes i.e. IS:1554 (Part-I) - 1998 amended upto date, and IS:694 - 1990 with latest amendments.

FRLS Cables

GEMSCAB FRLS PVC CABLES are the result of keeping pace with the latest trends in technological innovations in the field. The specially formulated compounds meet the stringent requirements of international specifications. GEMSCAB FRLS-Cables range covers various specific requirements of any customer - be it oxygen index or corrosive gas generation or light absorbance. A typical GEMSCAB FRLS PVC sheathed cable shall give following results.

1. Oxygen Index - 29% min.
2. Temperature Index - 250° C min.
3. Smoke Density Rating - 60% max.
4. Acid Gas Emission - 20% max.
5. Flammability Test as per:
 - i) IEC - 332 - I
 - ii) IEC - 332 - III
 - iii) IEEE - 383
 - iv) SS - 424 - 1475

FLOW CHART FOR MANUFACTURING PROCESSES & QUALITY CONTROL CHECKS FOR CABLES TO IS:1554 (PART-1)



CONTINUOUS CURRENT RATINGS

The current ratings given are based on the normal conditions of installation of installation described below:

Maximum conductor Temperature

For PVC - 70° C

For HR PVC - 85° C

Ambient Air Temperature - 40° C

Ground Temperature - 30° C

Depth of laying - 75 cm (1.1 K.V.)

(for cables laid direct in ground) - 90 cm (3.3 K.V.)

Thermal Resistivity of Soil - 150° C cm / watt

Thermal Resistivity of PVC - 650° C cm / watt

Type of Installation

- Twin and multi core Cable laid singly
- 3 single core cables laid in trefoil touching formation
- In case of control cables all cores are assumed to be carrying full load current.
- For other conditions, the corresponding rating, factors are to be applied.

RATING FACTORS

In actual practice the conditions of installations may be different than normal conditions. Therefore, to determine the continuous current rating for the actual operating conditions, the tabulated ratings should be multiplied by the appropriate rating factors given in Table 1 to 11.

Table - 1

Rating factors for grouping of single core cables laid direct in Ground in horizontal formation (three cables in trefoil treading)

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

Table - 2

Rating factors for variation in Ground Temperature for cables laid direct in Ground and Duct

Temperature °C	15	20	25	30	35	40	45	50
Rating factor for PVC	1.17	1.12	1.06	1.00	0.94	0.87	0.79	0.71
for HR PVC	1.12	1.08	1.04	1.00	0.95	0.90	0.84	0.77

RATING FACTORS

Table - 3

Rating factors for multi core cable laid on racks in Air (with cable touching)

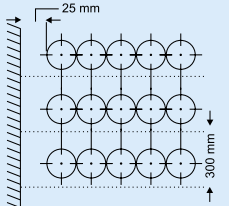
Arrangement	Number of Racks	Number of cables per Rack				
		1	2	3	6	9
	1	1.00	0.84	0.80	0.75	0.73
	2	1.00	0.80	0.76	0.71	0.69
	3	1.00	0.78	0.74	0.70	0.68
	6	1.00	0.76	0.72	0.68	0.66

Table - 4

Rating factors for variation in ambient Air Temperature

Temperature (°C)	20	25	30	35	40	45	50
Rating factor for PVC	1.32	1.25	1.16	1.09	1.00	0.90	0.81
for HR PVC	1.22	1.15	1.10	1.05	1.00	0.94	0.88

Table - 5

Rating factors for variation in depth of laying in Ground

Depth of laying (mm)	750	900	1050	1200	1500	1800 and above
Upto 25 Sq. mm.	1.00	0.99	0.98	0.97	0.96	0.95
Above 25 Sq. mm. and upto 300 Sq. mm.	1.00	0.98	0.97	0.96	0.94	0.93
Above 300 Sq. mm.	1.00	0.97	0.96	0.95	0.92	0.91

Table - 6

Rating factors for Grouping of Twin and multicore cables laid direct in Ground

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

RATING FACTORS

Table - 7

Rating factors for variation in depth of laying (Twin and multi core cables laid in single way ducts)

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

Table - 8

Rating factors for variation in Thermal resistivity of Soil (Twin and multi core cables)

Nominal area of conductor (Sq. mm)	Thermal Resistivity of Soil in °C - cm / watt (Cable laid direct in the Ground)				Thermal Resistivity of Soil in °C - cm / watt (Cable laid in single way duct)			
	100	120	150	200	100	120	150	200
1.5	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
2.5	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
4	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
6	1.10	1.05	1.00	0.92	1.05	1.03	1.00	0.96
10	1.10	1.06	1.00	0.92	1.05	1.03	1.00	0.95
16	1.12	1.06	1.00	0.91	1.06	1.03	1.00	0.95
25	1.14	1.08	1.00	0.91	1.07	1.04	1.00	0.95
35	1.15	1.08	1.00	0.91	1.08	1.04	1.00	0.94
50	1.15	1.08	1.00	0.91	1.08	1.04	1.00	0.94
70	1.15	1.08	1.00	0.90	1.08	1.04	1.00	0.94
95	1.15	1.08	1.00	0.90	1.08	1.04	1.00	0.94
120	1.17	1.09	1.00	0.90	1.09	1.05	1.00	0.94
150	1.17	1.09	1.00	0.90	1.09	1.05	1.00	0.93
185	1.18	1.09	1.00	0.89	1.10	1.05	1.00	0.93
240	1.18	1.09	1.00	0.89	1.10	1.05	1.00	0.92
300	1.18	1.09	1.00	0.89	1.10	1.05	1.00	0.92
400	1.19	1.10	1.00	0.89	1.11	1.06	1.00	0.92

Table - 9

Rating factors for Grouping of twin and multi core cables laid in ducts or pipes

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

RATING FACTORS

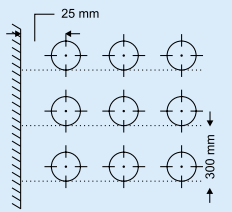
Table - 10

Rating factors for variation in Thermal resistivity of Soil (3 Single core cables)

Nominal area of conductor (Sq. mm)	Thermal Resistivity of Soil in °C - cm / watt (Cable laid direct in the Ground in Trefoil touching)				Thermal Resistivity of Soil in °C - cm / watt (Cable laid in Trefoil duct)			
	100	120	150	200	100	120	150	200
1.5	1.18	1.09	1.00	0.90	1.10	1.05	1.00	0.94
2.5	1.18	1.09	1.00	0.90	1.10	1.05	1.00	0.94
4	1.18	1.09	1.00	0.90	1.10	1.05	1.00	0.94
6	1.18	1.09	1.00	0.90	1.10	1.05	1.00	0.94
10	1.18	1.09	1.00	0.89	1.10	1.05	1.00	0.93
16	1.19	1.09	1.00	0.89	1.10	1.05	1.00	0.92
25	1.19	1.09	1.00	0.88	1.10	1.05	1.00	0.92
35	1.20	1.09	1.00	0.88	1.10	1.06	1.00	0.92
50	1.20	1.09	1.00	0.88	1.11	1.06	1.00	0.92
70	1.21	1.10	1.00	0.88	1.12	1.06	1.00	0.91
95	1.22	1.10	1.00	0.88	1.13	1.06	1.00	0.91
120	1.22	1.10	1.00	0.88	1.13	1.06	1.00	0.91
150	1.22	1.10	1.00	0.88	1.14	1.07	1.00	0.91
185	1.22	1.10	1.00	0.88	1.15	1.08	1.00	0.91
240	1.22	1.10	1.00	0.88	1.15	1.08	1.00	0.91
300	1.22	1.10	1.00	0.88	1.15	1.08	1.00	0.90
400	1.24	1.11	1.00	0.88	1.16	1.08	1.00	0.90
500	1.24	1.11	1.00	0.88	1.16	1.08	1.00	0.90
630	1.24	1.11	1.00	0.88	1.17	1.09	1.00	0.90
800	1.24	1.11	1.00	0.88	1.17	1.09	1.00	0.90
1000	1.24	1.11	1.00	0.88	1.17	1.09	1.00	0.90

Table - 11

Rating factors for multi core cable laid on racks in Air (with spacing between cables equal to diameter of the cable)

Arrangement	Number of Racks	Number of cables per Rack				
		1	2	3	6	9
	1	1.00	0.98	0.96	0.93	0.92
	2	1.00	0.95	0.93	0.90	0.89
	3	1.00	0.94	0.92	0.89	0.88
	6	1.00	0.93	0.90	0.87	0.86

BENDING RADIUS

The following minimum bending radius should be observed for 'GEMSCAB CABLES' in order that the cables, specially insulation, may not get damaged in installation.

Single core GEMSCAB Cables	-	$15 \times D$
Multi core GEMSCAB Cables 1.1 K.V.	-	$12 \times D$
Multi core GEMSCAB Cables 3.3 K.V.	-	$15 \times D$

where D is the overall diameter of cable.

RECOMMENDED PULLING FORCE

a) When conductor pulled by pulling eye:

(i) Aluminium conductor cable (Newton)	-	$30 \times$ Total conductor area in Sq. mm.
(ii) Copper conductor cable (Newton)	-	$50 \times$ Total conductor area in Sq. mm.

b) When cable pulled with stocking:

(i) Unarmoured cables 1.1 K.V. (Newton)	-	$5 \times D^2$
(ii) Armoured cables 1.1 K.V. (Newton)	-	$9 \times D^2$

where D is overall diameter of cable.

SHORT CIRCUIT MVA CAPACITY

Short circuit MVA Capacity of cables may be worked out with the following formula:

$$\text{MVA Capacity} = 3 \times E \times I_k$$

where : E - Phase to phase voltage in K.V.

I_k - Short circuit current in K.A.

HR PVC

Using HR PVC, cables can be operated at 85 °C continuous conductor temperature. Hence with same conductor size 16-18% more current can be drawn.

DIMENSIONS & WEIGHTS
1.1 KV Single Core PVC insulated & sheathed unarmoured & armoured cable with Aluminium Conductor conforming to IS:1554 / Part 1 / 1988

Nominal area of conductor	UNARMoured				ARMoured					
	Nominal thickness of insulation (Nominal)	Thickness of outer sheath (Nominal)	Overall dia of cable (Approx)	Weight of cable (Approx)	Thickness of insulation (Nominal)	Diameter of round wire (Nominal)	Dimension of flat strip (Nominal)	Thickness of outer sheath (Minimum)	Overall dia of cable (Approx)	Weight of cable (Approx)
Sq mm	mm	mm	mm	(Kg / Km)	mm	mm	mm	mm	mm	(Kg / Km)
4	1.0	1.80	8.5	78	-	-	-	-	-	-
6	1.0	1.80	9.0	88	-	-	-	-	-	-
10	1.0	1.80	10.0	110	-	-	-	-	-	-
16	1.0	1.80	11.0	140	1.3	1.40	-	1.24	14.0	240
25	1.2	1.80	13.0	195	1.5	1.40	-	1.24	15.0	300
35	1.2	1.80	14.0	240	1.5	1.40	-	1.24	16.0	350
50	1.4	1.80	16.0	305	1.7	1.40	-	1.24	18.0	410
70	1.4	1.80	17.0	390	1.7	1.40	-	1.40	20.0	530
95	1.6	1.80	19.0	500	1.9	-	4.0 × 0.8	1.40	21.0	600
120	1.6	2.00	21.0	605	1.9	-	4.0 × 0.8	1.40	23.0	710
150	1.8	2.00	23.0	725	2.1	-	4.0 × 0.8	1.40	24.0	800
185	2.0	2.00	25.0	880	2.3	-	4.0 × 0.8	1.40	27.0	950
240	2.2	2.00	27.0	1100	2.5	-	4.0 × 0.8	1.40	29.5	1200
300	2.4	2.00	30.0	1325	2.7	-	4.0 × 0.8	1.56	32.0	1450
400	2.6	2.20	35.0	1680	3.0	-	4.0 × 0.8	1.56	36.0	1780
500	3.0	2.20	38.0	2100	3.4	-	4.0 × 0.8	1.56	40.0	2200
630	3.4	2.40	43.0	2690	3.9	-	4.0 × 0.8	1.72	45.0	2770
800	3.4	2.40	48.0	3285	3.9	-	4.0 × 0.8	1.88	49.0	3400
1000	3.4	2.60	52.0	4010	3.9	-	4.0 × 0.8	2.04	54.0	4100

DIMENSIONS & WEIGHTS

1.1 KV Two Core PVC insulated & sheathed unarmoured & armoured cable with Aluminium Conductor conforming to IS:1554 / Part 1 / 1988

Nominal area of conductor	Thickness of insulation (Nominal)	Thickness of inner sheath (Minimum)	UNARMOURED			ARMOURED				
			Thickness of outer sheath (Nominal)	Overall dia of cable (Approx)	Weight of cable (Approx)	Diameter of round wire (Nominal)	Dimension of flat strip (Nominal)	Thickness of outer sheath (Minimum)	Overall dia of cable (Approx)	Weight of cable (Approx)
Sq mm	mm	mm	mm	mm	(Kg / Km)	mm	mm	mm	mm	(Kg / Km)
4	1.0	0.3	1.80	14.0	205	1.40	-	1.24	16.5	480
6	1.0	0.3	1.80	15.0	235	1.40	-	1.24	18.0	540
10	1.0	0.3	1.80	17.0	310	1.40	-	1.24	19.0	635
16	1.0	0.3	1.80	17.0	290	-	4.0 × 0.8	1.40	18.0	495
25	1.2	0.3	2.00	19.0	405	-	4.0 × 0.8	1.40	20.0	650
35	1.2	0.3	2.00	21.0	485	-	4.0 × 0.8	1.40	22.0	750
50	1.4	0.3	2.00	24.0	620	-	4.0 × 0.8	1.40	25.0	925
70	1.4	0.3	2.00	26.0	785	-	4.0 × 0.8	1.56	27.0	1140
95	1.6	0.4	2.20	30.0	1050	-	4.0 × 0.8	1.56	30.0	1440
120	1.6	0.4	2.20	32.0	1225	-	4.0 × 0.8	1.56	32.0	1650
150	1.8	0.4	2.40	35.0	1500	-	4.0 × 0.8	1.72	36.0	1960
185	2.0	0.5	2.40	38.0	1875	-	4.0 × 0.8	1.88	38.0	2375
240	2.2	0.5	2.60	42.0	2380	-	4.0 × 0.8	2.04	43.0	2925
300	2.4	0.6	2.80	46.0	2925	-	4.0 × 0.8	2.20	48.0	3550
400	2.6	0.7	3.20	52.0	3730	-	4.0 × 0.8	2.36	53.0	4390

DIMENSIONS & WEIGHTS
1.1 KV Three Core PVC insulated & sheathed unarmoured & armoured cable with Aluminium Conductor conforming to IS:1554 / Part 1 / 1988

Nominal area of conductor	Thickness of insulation (Nominal)	Thickness of inner sheath (Minimum)	UNARMOURED			ARMOURED				
			Thickness of outer sheath (Nominal)	Overall dia of cable (Approx)	Weight of cable (Approx)	Diameter of round wire (Nominal)	Dimension of flat strip (Nominal)	Thickness of outer sheath (Minimum)	Overall dia of cable (Approx)	Weight of cable (Approx)
Sq mm	mm	mm	mm	mm	(Kg / Km)	mm	mm	mm	mm	(Kg / Km)
4	1.0	0.3	1.80	14.5	225	1.40	-	1.24	17.0	530
6	1.0	0.3	1.80	18.0	285	1.40	-	1.24	18.0	600
10	1.0	0.3	1.80	19.0	355	1.40	-	1.40	20.0	725
16	1.0	0.3	1.80	19.0	375	-	4.0 × 0.8	1.40	19.5	615
25	1.2	0.3	2.00	22.0	520	-	4.0 × 0.8	1.40	23.0	820
35	1.2	0.3	2.00	24.0	635	-	4.0 × 0.8	1.40	24.0	980
50	1.4	0.3	2.00	27.0	830	-	4.0 × 0.8	1.56	28.0	1210
70	1.4	0.4	2.20	30.0	1090	-	4.0 × 0.8	1.56	31.0	1500
95	1.6	0.4	2.20	33.5	1415	-	4.0 × 0.8	1.56	34.0	1900
120	1.6	0.4	2.20	38.0	1695	-	4.0 × 0.8	1.72	38.0	2220
150	1.8	0.5	2.40	41.0	2080	-	4.0 × 0.8	1.88	42.0	2645
185	2.0	0.5	2.60	44.0	2575	-	4.0 × 0.8	1.88	46.0	3160
240	2.2	0.6	2.80	50.0	3280	-	4.0 × 0.8	2.20	51.0	4050
300	2.4	0.6	3.00	55.0	4020	-	4.0 × 0.8	2.36	55.0	4800
400	2.6	0.7	3.40	62.0	5125	-	4.0 × 0.8	2.52	63.0	6000

DIMENSIONS & WEIGHTS

1.1 KV Three and Half Core PVC insulated & sheathed unarmoured & armoured cable with Aluminium Conductor conforming to IS:1554 / Part 1 / 1988

Nominal area of conductor		Thickness of insulation (Nominal)		UNARMOURED				ARMOURED			
Main	Neutral	Main	Neutral	Thickness of inner sheath (Minimum)	Thickness of outer sheath (Nominal)	Overall dia of cable (Approx)	Weight of cable (Approx)	Diameter of flat strip (Nominal)	Thickness of outer sheath (Minimum)	Overall dia of cable (Approx)	Weight of cable (Approx)
Sq mm	Sq mm	mm	mm	mm	mm	mm	(Kg / Km)	mm	mm	mm	(Kg / Km)
25	16	1.2	1.0	0.3	2.00	24.0	610	4.0 × 0.8	1.40	24.0	935
35	16	1.2	1.0	0.3	2.00	25.0	735	4.0 × 0.8	1.40	26.0	1045
50	25	1.4	1.2	0.3	2.00	28.5	960	4.0 × 0.8	1.56	30.0	1365
70	35	1.4	1.2	0.4	2.20	32.0	1270	4.0 × 0.8	1.56	33.0	1690
95	50	1.6	1.4	0.4	2.20	36.0	1630	4.0 × 0.8	1.56	37.0	2140
120	70	1.6	1.4	0.5	2.40	40.0	2030	4.0 × 0.8	1.72	40.0	2575
150	70	1.8	1.4	0.5	2.40	43.0	2375	4.0 × 0.8	1.88	44.0	3040
185	95	2.0	1.6	0.5	2.60	47.0	2980	4.0 × 0.8	2.04	48.0	3690
240	120	2.2	1.6	0.6	3.00	54.0	3825	4.0 × 0.8	2.20	55.0	4650
300	150	2.4	1.8	0.6	3.20	60.0	4650	4.0 × 0.8	2.36	59.0	5630
400	185	2.6	2.0	0.7	3.40	66.0	5880	4.0 × 0.8	2.68	67.0	6960

DIMENSIONS & WEIGHTS
1.1 KV Four Core PVC insulated & sheathed unarmoured & armoured cable with Aluminium Conductor conforming to IS:1554 / Part 1 / 1988

Nominal area of conductor	Thickness of insulation (Nominal)	Thickness of inner sheath (Minimum)	UNARMOURED			ARMOURED				
			Thickness of outer sheath (Nominal)	Overall dia of cable (Approx)	Weight of cable (Approx)	Diameter of round wire (Nominal)	Dimension of flat strip (Nominal)	Thickness of outer sheath (Minimum)	Overall dia of cable (Approx)	Weight of cable (Approx)
Sq mm	mm	mm	mm	mm	(Kg / Km)	mm	mm	mm	mm	(Kg / Km)
4	1.0	0.3	1.80	15.5	275	1.40	-	1.24	18.0	580
6	1.0	0.3	1.80	16.5	330	1.40	-	1.24	19.5	680
10	1.0	0.3	1.80	18.5	420	-	4.0 × 0.8	1.40	20.0	690
16	1.0	0.3	2.00	20.0	475	-	4.0 × 0.8	1.40	21.0	760
25	1.2	0.3	2.00	24.0	680	-	4.0 × 0.8	1.40	25.0	1020
35	1.2	0.3	2.00	27.0	830	-	4.0 × 0.8	1.40	28.0	1210
50	1.4	0.4	2.20	31.0	1125	-	4.0 × 0.8	1.56	31.0	1540
70	1.4	0.4	2.20	34.0	1430	-	4.0 × 0.8	1.56	35.0	1910
95	1.6	0.4	2.40	39.0	1885	-	4.0 × 0.8	1.72	41.0	2400
120	1.6	0.5	2.40	43.0	2260	-	4.0 × 0.8	1.88	43.0	2870
150	1.8	0.5	2.60	46.0	2775	-	4.0 × 0.8	1.88	46.0	3400
185	2.0	0.6	2.80	51.0	3450	-	4.0 × 0.8	2.04	51.0	4130
240	2.2	0.6	3.00	56.0	4375	-	4.0 × 0.8	2.36	57.0	5190
300	2.4	0.7	3.40	66.0	5420	-	4.0 × 0.8	2.52	66.0	6250
400	2.6	0.7	3.60	74.0	6725	-	4.0 × 0.8	2.84	74.0	7740

DIMENSIONS & WEIGHTS

1.1 KV 1.5 Sq mm (Solid) Multicore PVC insulated & sheathed unarmoured & armoured Copper Control cables conforming to IS:1554 / Part 1 / 1988

Nominal of cores	Thickness of insulation (Nominal)	Thickness of inner sheath (Minimum)	UNARMoured			ARMoured				
			Thickness of outer sheath (Nominal)	Overall dia of cable (Approx)	Weight of cable (Approx)	Diameter of round wire (Nominal)	Dimension of flat strip (Nominal)	Thickness of outer sheath (Minimum)	Overall dia of cable (Approx)	Weight of cable (Approx)
(Nos.)	mm	mm	mm	mm	(Kg / Km)	mm	mm	mm	mm	(Kg / Km)
2	0.8	0.3	1.8	11.5	170	1.4	-	1.24	13.0	385
3	0.8	0.3	1.8	12.0	195	1.4	-	1.24	13.5	420
4	0.8	0.3	1.8	12.5	225	1.4	-	1.24	14.0	460
5	0.8	0.3	1.8	13.5	240	1.4	-	1.24	15.0	500
6	0.8	0.3	1.8	14.5	280	1.4	-	1.24	16.0	565
7	0.8	0.3	1.8	14.5	300	1.4	-	1.24	16.0	580
8	0.8	0.3	1.8	16.0	330	1.4	-	1.24	17.0	630
9	0.8	0.3	1.8	17.0	365	1.4	-	1.24	18.5	695
10	0.8	0.3	1.8	17.5	395	1.4	-	1.40	19.0	765
12	0.8	0.3	1.8	18.0	445	-	4.0 × 0.8	1.24	18.0	665
14	0.8	0.3	1.8	18.5	495	-	4.0 × 0.8	1.40	19.0	750
16	0.8	0.3	1.8	19.5	520	-	4.0 × 0.8	1.40	20.0	825
19	0.8	0.3	2.0	21.0	590	-	4.0 × 0.8	1.40	21.0	905
24	0.8	0.3	2.0	24.0	740	-	4.0 × 0.8	1.40	24.0	1105
27	0.8	0.3	2.0	24.5	800	-	4.0 × 0.8	1.40	24.5	1195
30	0.8	0.3	2.0	25.0	870	-	4.0 × 0.8	1.40	25.0	1260
37	0.8	0.3	2.0	27.0	1040	-	4.0 × 0.8	1.40	27.0	1460
44	0.8	0.3	2.0	30.0	1240	-	4.0 × 0.8	1.56	31.0	1750
52	0.8	0.4	2.2	31.5	1450	-	4.0 × 0.8	1.56	32.0	1975
61	0.8	0.4	2.2	33.0	1680	-	4.0 × 0.8	1.56	34.0	2215

DIMENSIONS & WEIGHTS
1.1 KV 2.5 Sq mm (Solid) Multicore PVC insulated & sheathed unarmoured & armoured Copper Control cables conforming to IS:1554 / Part 1 / 1988

Nominal of cores (Nos.)	Thickness of insulation (Nominal) mm	Thickness of inner sheath (Minimum) mm	UNARMOURED			ARMOURED				
			Thickness of outer sheath (Nominal) mm	Overall dia of cable (Approx) mm	Weight of cable (Approx) (Kg / Km)	Diameter of round wire (Nominal) mm	Dimension of flat strip (Nominal) mm	Thickness of outer sheath (Minimum) mm	Overall dia of cable (Approx) mm	Weight of cable (Approx) (Kg / Km)
2	0.9	0.3	1.8	12.5	215	1.4	-	1.24	15.0	455
3	0.9	0.3	1.8	13.0	250	1.4	-	1.24	15.0	505
4	0.9	0.3	1.8	14.0	290	1.4	-	1.24	15.5	575
5	0.9	0.3	1.8	15.0	320	1.4	-	1.24	16.5	620
6	0.9	0.3	1.8	16.0	375	1.4	-	1.24	17.5	705
7	0.9	0.3	1.8	16.0	400	1.4	-	1.24	17.5	720
8	0.9	0.3	1.8	17.5	450	1.4	-	1.40	19.5	840
9	0.9	0.3	1.8	19.0	505	-	4.0 × 0.8	1.40	19.5	800
10	0.9	0.3	1.8	20.0	510	-	4.0 × 0.8	1.40	20.0	825
12	0.9	0.3	2.0	21.0	585	-	4.0 × 0.8	1.40	21.0	900
14	0.9	0.3	2.0	21.5	660	-	4.0 × 0.8	1.40	21.5	1010
16	0.9	0.3	2.0	22.5	750	-	4.0 × 0.8	1.40	23.0	1075
19	0.9	0.3	2.0	24.0	850	-	4.0 × 0.8	1.40	24.0	1220
24	0.9	0.3	2.0	27.5	1060	-	4.0 × 0.8	1.40	27.5	1480
27	0.9	0.3	2.0	28.0	1160	-	4.0 × 0.8	1.40	28.0	1610
30	0.9	0.3	2.0	29.0	1260	-	4.0 × 0.8	1.56	29.0	1740
37	0.9	0.4	2.2	31.5	1560	-	4.0 × 0.8	1.56	32.0	2030
44	0.9	0.4	2.2	35.0	1860	-	4.0 × 0.8	1.56	36.0	2425
52	0.9	0.4	2.2	36.5	2150	-	4.0 × 0.8	1.56	37.0	2740
61	0.9	0.4	2.2	38.5	2470	-	4.0 × 0.8	1.56	40.0	3100

CURRENT RATINGS

Current ratings for PVC insulated Aluminium Conductor 1.1 KV grade cables

Nominal Area of conductor	Cables in Ground					Cables in Air				
	Single Core Cables			Two Core Cables	Three, Three and a half & Four Core Cables	Single Core Cables			Two Core Cables	Three, Three and a half & Four Core Cables
	Two Cables		Three Cables			Two Cables		Three Cables		
	AC	DC	AC	AC	AC	AC	DC	AC	AC	AC
Sq. mm	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)
4	36	36	31	32	28	32	32	27	27	23
6	44	44	39	40	35	41	41	35	35	30
10	59	59	51	55	46	56	56	47	47	40
16	75	75	66	70	60	72	72	64	59	51
25	97	97	86	90	76	99	99	84	78	70
35	120	120	100	110	92	120	120	105	99	86
50	145	145	120	135	110	150	155	130	125	105
70	170	175	140	160	135	185	190	155	150	130
95	205	210	175	190	165	215	225	190	185	155
120	230	240	195	210	185	240	260	220	210	180
150	265	270	220	240	210	270	300	250	240	205
185	300	305	240	275	235	305	345	290	275	240
240	335	355	270	320	275	350	405	335	325	280
300	370	400	295	355	305	395	470	380	365	315
400	410	460	325	385	335	455	560	435	420	375
500	435	510	345	415	370	490	630	480	455	425
630	485	600	390	460	405	560	750	550	520	480
800	530	705	440	-	-	640	900	640	-	-
1000	580	845	490	-	-	740	1090	720	-	-

CURRENT RATINGS
Current Ratings for HR PVC insulated Aluminium Conductor 1.1 KV grade cables

Nominal Area of conductor	Cables in Ground					Cables in Air				
	Single Core Cables			Two Core Cables	Three, Three and a half & Four Core Cables	Single Core Cables			Two Core Cables	Three, Three and a half & Four Core Cables
	Two Cables		Three Cables			Two Cables		Three Cables		
	AC	DC	AC	AC	AC	AC	DC	AC	AC	AC
Sq. mm	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)
4	38	38	34	41	32	33	33	30	36	29
6	48	48	42	53	40	42	42	38	45	37
10	65	65	56	69	53	57	57	51	63	50
16	84	84	72	89	70	78	78	70	84	67
25	110	110	92	115	90	104	104	95	113	90
35	133	133	110	138	110	127	127	118	140	109
50	156	156	133	161	128	154	154	141	172	131
70	188	188	161	198	156	195	195	181	213	168
95	230	230	193	239	188	245	245	227	268	204
120	262	262	220	271	216	286	286	263	309	240
150	289	289	248	303	239	327	327	300	354	272
185	331	331	280	345	271	382	381	350	409	318
240	386	386	326	395	312	454	463	418	490	377
300	432	437	368	450	354	527	536	481	563	431
400	496	506	418	515	404	627	636	563	663	500
500	561	570	469	579	450	727	745	654	763	572
630	634	662	542	653	515	845	881	763	900	672
800	717	754	607	-	-	981	1045	881	-	-
1000	791	864	671	-	-	1118	1218	1000	-	-

CURRENT RATINGS

Current ratings for PVC insulated Copper Conductor 1.1 KV grade cables

Nominal of cores (Nos.)	Nominal area of conductor 1.5 Sq mm		Nominal area of conductor 2.5 Sq mm	
	In ground (Amps)	In air (Amps)	In ground (Amps)	In air (Amps)
2	23	20	32	27
3	21	17	27	24
4	21	17	27	24
5	16	14	23	19
6	15	13	21	18
7	14	13	20	17
8	14	12	19	16
9	13	12	18	15
10	13	11	18	15
12	12	10	17	14
14	11	10	16	14
16	11	9	15	13
19	10	9	14	12
21	10	8	13	11
24	9	8	13	11
27	9	8	12	10
30	9	7	12	10
37	8	7	11	9
44	7	6	10	9
52	7	6	10	8
61	6	6	9	8

CURRENT RATINGS

Current ratings for PVC insulated Copper Conductor 1.1 KV grade cables

Nominal area of conductor	Cables in ground			Cables in air		
	Single core* cables	Two core cables	Three, three and half & four core cables	Single core cables	Two core cables	Three, Three and half & four core cables
(Nos.)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)
1.5	22	23	21	20	20	17
2.5	30	32	27	27	27	24
4	39	41	36	35	35	30
6	49	50	45	44	45	39
10	65	70	60	60	60	52
16	85	90	77	82	78	66
25	110	115	99	110	105	90
35	130	140	120	130	125	110
50	155	165	145	165	155	135
70	190	-	175	205	-	165
95	220	-	210	245	-	200
120	250	-	240	280	-	230
150	280	-	270	320	-	265
185	305	-	300	370	-	305
240	345	-	345	425	-	355
300	375	-	385	475	-	400
400	400	-	425	550	-	455
500	425	-	440	590	-	500
630	470	-	-	660	-	-
800	530	-	-	725	-	-
1000	590	-	-	870	-	-

*Three Single core cables laid in trefoil formation.

Note: The General construction of "GEMSCAB" cables with Copper conductors shall be same as that of "GEMSCAB" cables with Aluminium conductors except for the net weight of cable which shall be furnished on request.

CONDUCTOR RESISTANCE

Nominal area of conductor (Sq mm)	Aluminium		Plain Copper	
	Max. D.C. Resistance at 20 °C	Approx A.C. Resistance at operating Temp. 70 °C	Max. D.C. Resistance at 20 °C	Approx A.C. Resistance at operating Temp. 70 °C
	Ohm / km	Ohm / km	Ohm / km	Ohm / km
1.5	-	-	12.1	14.5
2.5	-	-	7.41	8.87
4	7.41	8.90	4.61	5.52
6	4.61	5.54	3.08	3.69
10	3.08	3.70	1.83	2.19
16	1.91	2.30	1.15	1.38
25	1.20	1.44	0.727	0.870
35	0.868	1.04	0.524	0.627
50	0.641	0.770	0.387	0.463
70	0.443	0.532	0.268	0.321
95	0.320	0.385	0.193	0.231
120	0.253	0.305	0.153	0.184
150	0.206	0.249	0.124	0.149
185	0.164	0.198	0.0991	0.120
240	0.125	0.152	0.0754	0.0912
300	0.100	0.123	0.0601	0.0739
400	0.0778	0.0975	0.0470	0.0592
500	0.0605	0.0767	0.0366	0.0468
630	0.0469	0.0614	0.0283	0.0379
800	0.0367	0.0501	0.0221	0.0314
1000	0.0291	0.0420	0.0176	0.0271

REACTANCE

Approximate Reactance at 50 Hz (Ohms / Km) 1.1 KV PVC and HR PVC Cables

Nominal area of conductor (Sq mm)	PVC and HR PVC cables		
	Single core		Multicore
	Unarmoured	Armoured*	
1.5	0.157	-	0.110
2.5	0.145	-	0.106
4	0.136	-	0.102
6	0.128	-	0.0962
10	0.118	-	0.0908
16	0.110	-	0.084
25	0.107	0.120	0.084
35	0.102	0.115	0.081
50	0.100	0.110	0.079
70	0.091	0.103	0.076
95	0.087	0.101	0.075
120	0.085	0.095	0.074
150	0.085	0.093	0.074
185	0.082	0.092	0.073
240	0.080	0.089	0.072
300	0.078	0.087	0.072
400	0.078	0.087	0.071
500	0.078	0.087	0.071
630	0.077	0.085	0.071
800	0.076	0.084	-
1000	0.073	0.082	-

*Wire armoured.

CAPACITANCE

Approximate Capacitance (Micro Farads / Km) 1.1 KV PVC and HR PVC Cables

Nominal area of cross section (Sq mm)	PVC and HR PVC cables		
	Single core		Twin & Multicore Cables
	Unarmoured	Armoured	
1.5	0.47	-	0.20
2.5	0.52	-	0.22
4	0.58	-	0.24
6	0.68	-	0.28
10	0.83	-	0.34
16	1.01	-	0.40
25	1.05	0.87	0.42
35	1.22	1.00	0.48
50	1.22	1.03	0.49
70	1.43	1.21	0.56
95	1.47	1.27	0.58
120	1.62	1.42	0.63
150	1.62	1.42	0.63
185	1.62	1.44	0.64
240	1.72	1.53	0.67
300	1.74	1.56	0.68
400	1.81	1.59	0.70
500	1.76	1.57	0.70
630	1.77	1.57	0.70
800	1.98	1.75	-
1000	2.20	1.94	-

SHORT CIRCUIT RATINGS

Short circuit rating of 1.1 KV grade cables (Kilo Amps)

Nominal Area of conductor (Sq mm)	PVC Cables		HR PVC Cables	
	Copper	Aluminium	Copper	Aluminium
1.5	0.172	-	0.156	-
2.5	0.287	-	0.26	-
4	0.46	0.303	0.417	0.276
6	0.69	0.455	0.625	0.414
10	1.15	0.758	1.04	0.69
16	1.84	1.21	1.67	1.10
25	2.87	1.89	2.60	1.72
35	4.02	2.65	3.65	2.41
50	5.75	3.79	5.21	3.45
70	8.05	5.30	7.29	4.83
95	10.92	7.20	9.90	6.55
120	13.79	9.09	12.5	8.28
150	17.24	11.36	15.63	10.35
185	21.26	14.02	19.27	12.76
240	27.59	18.18	25.0	16.55
300	34.48	22.73	31.25	20.69
400	45.98	30.30	41.67	27.59
500	57.47	37.88	52.08	34.48
630	72.41	47.73	65.63	43.54
800	91.95	60.61	83.33	55.17
1000	114.94	75.76	104.17	68.97

1. Max. Conductor temperature before short circuit: for normal PVC 70 °C
for HR PVC 85 °C
2. Max. Conductor temperature during short circuit – 160 °C.
3. Max. duration of short circuit – 1 second.

Formula for calculating the short circuit rating for other duration.

$$I_{sh} : \frac{KA}{\sqrt{t}} \quad \text{Where } I_{sh} = \text{Short circuit current in KA}$$

K = Constant (10.076 for Aluminium & 0.094 for copper)

A = Area of cross section in Sq.mm.

t = Duration of short circuit in seconds

(The above formula is valid for "t" from 0.2 to 5 seconds)

FORMULA FOR CALCULATING VOLTAGE DROP IN A BALANCED 3 PHASE AC DISTRIBUTION SYSTEM 50 HZ

Voltage drop (rms) per KM per Phase (Volts)

$$= 3 \times K_T \times K_{AC} \times \begin{matrix} \times & [\text{Max. continuous current rating (Amps)}] \\ \times & [\text{D.C. Resistance per phase per KM (Ohms/Km)}] \end{matrix}$$

Where

$$K_T = 1 + a (T_c - T_o) ; \begin{matrix} a & = & 0.00393 & \text{for Copper} \\ & a & = & 0.004 & \text{for Aluminium} \\ & T_c & = & \text{Max. conductor temperature (}^\circ\text{C)} \\ & T_o & = & 20^\circ\text{C standard temperature.} \end{matrix}$$

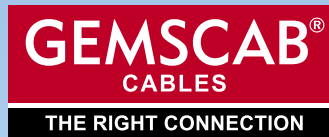
and K_{AC} - factor for converting DC resistance to AC resistance.

Approximate values of K_{AC} for 1100 V Cables are given below:

Nominal Conductor Area (mm ²)	Copper Conductor	Aluminium Conductor
1.5 to 95	1.000	1.000
120	1.010	1.003
150	1.015	1.005
185	1.022	1.008
240	1.038	1.014
300	1.062	1.020
400	1.100	1.038
500	1.150	1.060

RECOMMENDED “GEMSCAB” CABLE SIZES

For Motors with Start-Delta Starter								For Motors with DOL Starters				
3 Phase 415 V HP	415 V 50 Hz KW	Approx. full load current in Amps	Phase Current in Amps	Typical Cable size Aluminium		Typical Cable Size Copper		3 Phase 415 V, 50Hz HP	415 V, 50 Hz KW	Approx full load current in Amps	Typical Cable Size	
				Supply side	Motor side	Supply side	Motor side				Aluminium (sq mm)	Copper (Sq mm)
3	2.2	5	2.88	1.5 / 2.5	1.5 / 2.5	1.5 / 1.5	1.5 / 1.5	0.50	0.40	1.2	1.5 / 2.5	1.5
5	3.75	7.5	4.32	1.5 / 2.5	1.5 / 2.5	1.5 / 1.5	1.5 / 1.5	0.75	0.55	1.6	1.5 / 2.5	1.5
7.5	5.50	11	6.34	2.5 / 4	1.5 / 2.5	1.5 / 2.5	1.5 / 1.5	1.0	0.75	1.8	1.5 / 2.5	1.5
10	7.50	14	8.10	4	1.5 / 2.5	2.5	1.5 / 1.5	1.5	1.1	2.6	1.5 / 2.5	1.5
12.5	9.30	18	10.02	4	2.5	2.5	1.5	2.0	1.5	3.5	1.5 / 2.5	1.5
15	11.0	21	12.10	6	2.5	4	1.5	3.0	2.2	5	1.5 / 2.5	1.5
20	15.0	28	16.0	10	4	6	2.5	4.0	3.0	6.2	1.5 / 2.5	1.5
25	18.5	35	20.20	16	6	10	4	5.0	3.75	7.5	2.5	1.5
30	22.0	40	23.0	16	6	10	4	6.0	4.5	9	2.5	1.5
35	26.0	47	27.0	25	10	16	6	7.5	5.5	11	4	2.5
40	30.0	55	30.30	25	16	16	10	10	7.5	14	4	2.5
45	33.5	60	34.6	35	16	25	10	12.5	9.3	18	6	4
50	37.0	66	35.0	35	16	25	10	15	11	21	6	4
60	44.0	80	45.0	50	25	35	16	17.5	13	24	10	6
65	48.5	87	50	70	35	50	25	20	15	28	10	6
70	52	94	54	70	35	50	25	25	18.5	35	16	10
75	55	100	57.5	70	35	50	25	30	22	40	25	16
90	67.5	120	69	95	50	70	35	35	26	47	25	16
100	75.0	135	78	95	50	70	35	40	30	55	25	16
125	90	165	95	120	70	95	50	45	33.5	60	35	25
150	110	200	115	185	70	120	50	50	37	66	35	25
175	132	230	133	240	120	185	95	60	44	80	50	35
200	150	275	159	300 / 400	150	240 / 300	120	75	55	100	70	50
240	175	320	184.5	300 / 400	185	240 / 300	150	90	67.5	120	95	70
250	187.5	323	185	400	185	240 / 300	150	100	75	135	95	70
275	204	360	206	500	185	300 / 400	150	150	110	150	185	150
300	225	385	222	500	240	300 / 400	185	200	150	175	300 / 400	240 / 300
400	300	500	300	630	300 / 400	400 / 500	240 / 300	225	168	200	300 / 400	240 / 300



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