भारतीय मानक
Indian Standard

IS 3961 (Part 6) : 2016

केबलों के लिए अनुशंसित करेंट रेटिंग

भाग 6 क्रासलिंकंड पोलीइथायल उष्मारोधित पी वी सी आवरित केबलें

Recommended Current Ratings for Cables

Part 6 Crosslinked Polyethylene Insulated PVC Sheathed Cables

ICS 29.080.20

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February 2016 **Price Group 7**

Power Cables Sectional Committee, ETD 09

FOREWORD

This Indian Standard (Part 6) was adopted by the Bureau of Indian Standards, after the draft finalized by the Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

This standard has been drawn up to provide to the users general guidance for loading of cables. The over-loading of cables will reduce the life expectancy of cable and at the same time under-loading it shall mean uneconomic utilization of its capacity.

The current ratings have been calculated using the methods set out in IEC 60287. The conductor temperature limit of 90°C for the calculation of current ratings has been taken from the IS 7098 (Part 1) : 1988 ‘Crosslinked polyethylene insulated PVC sheathed cables: Part 1 For working voltage upto and including 1 100 V’.

The permissible current ratings have been specified for three commonly adopted conditions of installations, namely, laid direct in ground, laid in ducts, and for cables in air. Attention is drawn to the fact that a limitation on the temperature of the cables might be needed, if the cables are to be installed in situations where people might come into direct contact with cables.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*). The number of significant places retained in the rounded value should be the same as that of the specified value in this standard.

Indian Standard

RECOMMENDED CURRENT RATINGS FOR CABLES

PART 6 CROSSLINKED POLYETHYLENE INSULATED PVC SHEATHED CABLES

1 SCOPE

This standard (Part 6) covers recommended current ratings for cross-linked polyethylene insulated PVC sheathed cables covered by IS 7098 (Part 1) either laid in ground, in ducts or in air.

2 REFERENCES

The standard given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
7098 (Part 1) : 1988	Crosslinked polyethylene insulated PVC sheathed cables: Part 1 For working voltage up to and including 1 100 V

3 BASIC ASSUMPTIONS

The current ratings given in Tables 1 to 29 are on the following assumptions:

a) Maximum conductor temperature : 90°C
b) Thermal resistivity of soil : 1.5 K.m/W
c) Ground temperature : 30°C
d) Ambient air temperature : 40°C
e) Depth of laying (measured to the cable axis or centre of the trefoil group) : 750 mm

4 METHODS OF INSTALLATION

The current ratings given in this standard are for methods of installation as given in the following table:

Type of Cable	*Type of Installation*	*Method of Installation*
(1)	(2)	(3)
Single-core	a) Laid direct in the ground	1) Three cables in trefoil groups touching
		2) Two cables laid flat touching.
	b) In ducts	1) Three cables in trefoil ducts touching.
		2) Two cables laid flat ducts touching
	c) In air	1) Three cables in trefoil groups touching
		2) Two cables flat touching
Multi-core	—	Installed singly

5 CABLES IN BURIED TROUGHS FILLED WITH SAND

Where cables are installed in sand-filled troughs, either completely buried or with cover flush with the ground surface, there is danger that the sand will dry out and remain dry for long periods. The cable external thermal resistance may then be very high and the cable may reach undesirably high temperatures. It is advisable to adopt the current ratings for cables buried direct using a value of 2.5 K.m/W for the thermal resistivity of the sand filling unless a specially selected filling has been used for which the dry resistivity is known.

6 CABLES IN UNVENTILATED FORMED TRENCHES/TUNNELS

When cables are installed in unventilated formed trenches or tunnels, it is advisable to adopt the current ratings for cables laid in ducts.

7 SIZES OF THE DUCTS

The current ratings specified in the tables apply to cables laid in earthenware ducts with a thermal resistivity of 1.2 Km/W. The ratings are based on the assumption that the ducts are air filled. If the ducts have been filled with a material such as bentonite, then it is usual to adopt the current ratings for cables buried direct.

The combinations of duct and cable dimensions assumed are shown below:

Overall Cable Diameter	*Inside Duct Diameter*	*Outside Duct Diameter*
mm	mm	mm
(1)	(2)	(3)
Up to and including 65	100	130
Above 65 and up to and including 90	125	160
Above 90 and up to and including 115	150	190

8 CABLES IN AIR

Single core cables are assumed to be spaced at least 0.5 times the cable diameter from any vertical surface and installed on brackets or ladder racks. Multi-core cables installed in air spaced at least 0.3 times the cable diameter from any vertical surface.

9 RATING FACTORS

The current ratings given in the respective tables apply to continuous loading of cables at a rated frequency of 50 Hz under the specific conditions of installation mentioned in **2.1** and **3.1**. For the various rating factors which may have to be used under different conditions, reference shall be made to appropriate Tables from 7 to 29.

When a number of circuits are installed in close proximity the current rating should be reduced by the appropriate factor from Tables 18 to 29.

These factors should also be applied to groups of parallel cables forming the same circuit. In such cases, attention should also be given to the arrangement of the cables to ensure that the load current is shared equally between the parallel cables.

Table 1 Current Ratings (a.c.) for Two Single-Core Cables with XLPE Insulation and Rated Voltage 1 100 V

(*Clause* 3.1)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Copper	Aluminium	Copper	Aluminium	Copper	Aluminium
	mm²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	32	26	27	22	28	22
ii)	2.5	42	32	36	28	37	28
iii)	4	54	43	46	36	48	38
iv)	6	67	55	57	47	61	50
v)	10	90	69	76	58	83	64
vi)	16	115	89	97	75	108	84
vii)	25	148	115	124	96	144	112
viii)	35	177	137	148	115	176	137
ix)	50	208	161	174	135	212	165
x)	70	255	198	213	165	269	209
xi)	95	312	243	256	199	340	264
xii)	120	355	276	291	226	396	308
xiii)	150	396	308	324	252	450	350
xiv)	185	447	349	365	285	519	406
xv)	240	515	404	420	329	613	480
xvi)	300	576	454	469	369	700	551
xvii)	400	651	518	528	421	813	647
xviii)	500	727	588	589	476	930	751
xix)	630	806	663	651	536	1056	868
xx)	800	877	740	707	596	1179	992
xxi)	1000	935	812	751	652	1288	1117

Table 2 Current Ratings (a.c.) for Three Single-Core Cables with XLPE Insulation and Rated Voltage 1 100 V

(*Clause* 3.1)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Copper	Aluminium	Copper	Aluminium	Copper	Aluminium
	mm²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	28	23	26	21	24	19
ii)	2.5	36	28	33	26	31	24
iii)	4	47	37	43	34	41	33
iv)	6	58	47	53	43	52	43
v)	10	77	59	70	54	71	55
vi)	16	98	76	89	69	94	72
vii)	25	126	98	114	89	126	98
viii)	35	150	116	136	106	154	119
ix)	50	177	137	160	124	187	145
x)	70	216	168	195	151	238	185
xi)	95	260	202	233	181	303	235
xii)	120	295	230	264	206	354	276
xiii)	150	329	256	294	229	403	314
xiv)	185	371	290	330	258	468	366
xv)	240	427	335	379	298	553	434
xvi)	300	477	376	422	333	634	500
xvii)	400	537	429	473	378	737	589
xviii)	500	598	485	525	426	844	685
xix)	630	661	546	578	477	961	793
xx)	800	721	608	626	528	1077	907
xxi)	1000	772	665	668	575	1188	1022

Table 3 Current Ratings (a.c.) for Two-Core Cables with XLPE Insulation and Rated Voltage 1 100 V

(*Clause* 3.1)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Copper	Aluminium	Copper	Aluminium	Copper	Aluminium
	mm²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	31	26	27	22	27	22
ii)	2.5	41	32	35	27	36	28
iii)	4	54	42	45	36	48	38
iv)	6	67	55	56	46	61	50
v)	10	89	68	75	57	83	64
vi)	16	115	89	96	74	108	83
vii)	25	147	114	122	95	140	109
viii)	35	176	136	146	113	172	133
ix)	50	208	161	173	134	208	162
x)	70	253	197	211	164	262	204
xi)	95	302	235	252	196	322	251
xii)	120	340	266	284	222	368	287
xiii)	150	379	296	317	248	419	328
xiv)	185	425	335	357	281	482	379
xv)	240	486	385	409	324	566	448
xvi)	300	541	432	456	364	644	513
xvii)	400	602	487	508	412	734	593
xviii)	500	665	548	562	463	831	683
xix)	630	728	612	616	518	936	784

Table 4 Current Ratings (a.c.) for Three, Four and Five-Core Cables with XLPE Insulation and Rated Voltage 1 100 V

(*Clause* 3.1)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Copper	Aluminium	Copper	Aluminium	Copper	Aluminium
	mm²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	26	22	22	18	23	19
ii)	2.5	34	27	29	23	30	24
iii)	4	45	35	38	30	41	32
iv)	6	56	46	47	38	52	42
v)	10	74	57	62	48	70	54
vi)	16	95	74	79	61	89	69
vii)	25	122	95	102	79	119	93
viii)	35	146	114	122	94	147	114
ix)	50	173	134	144	112	179	138
x)	70	212	164	177	137	226	175
xi)	95	254	197	212	164	279	216
xii)	120	287	223	240	187	320	249
xiii)	150	321	249	269	209	365	284
xiv)	185	362	282	304	238	422	329
xv)	240	418	327	352	276	500	392
xvi)	300	469	369	396	312	574	452
xvii)	400	528	420	447	356	662	526
xviii)	500	593	478	511	412	760	612
xix)	630	661	542	571	468	870	712

Table 5 Current Ratings (d.c.) for Two Single-Core Cables with XLPE Insulation and Rated Voltage 1 100 V

(*Clause* 3.1)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Copper	Aluminium	Copper	Aluminium	Copper	Aluminium
	mm²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	32	26	27	22	28	22
ii)	2.5	42	32	36	28	37	28
iii)	4	54	43	46	36	48	38
iv)	6	67	55	57	47	61	50
v)	10	90	69	76	58	83	64
vi)	16	115	89	97	75	108	84
vii)	25	148	115	124	96	144	112
viii)	35	177	137	148	115	176	137
ix)	50	208	161	174	135	212	165
x)	70	255	198	213	165	269	209
xi)	95	314	243	258	200	342	265
xii)	120	358	278	293	227	399	310
xiii)	150	401	310	328	254	455	352
xiv)	185	455	352	371	288	528	409
xv)	240	528	409	431	334	628	487
xvi)	300	598	463	487	377	726	561
xvii)	400	687	533	558	433	857	664
xviii)	500	790	613	640	497	1 008	782
xix)	630	911	705	736	570	1 189	921
xx)	800	1 046	809	843	652	1 398	1 082
xxi)	1 000	1 190	923	956	741	1 629	1 264

Table 6 Current Ratings (d.c.) for Two-Core Cables with XLPE Insulation and Rated Voltage 1 100 V

(*Clause* 3.1)

Sl No.	Nominal Area of Conductor	Buried Direct in the Ground		In Single-Way Ducts		In Air	
		Copper	Aluminium	Copper	Aluminium	Copper	Aluminium
	mm²	A	A	A	A	A	A
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	31	26	27	22	27	22
ii)	2.5	41	32	35	27	36	28
iii)	4	54	42	45	36	48	38
iv)	6	67	55	56	46	61	50
v)	10	89	68	75	57	83	64
vi)	16	115	89	96	74	108	84
vii)	25	147	114	122	95	141	109
viii)	35	176	137	146	113	172	133
ix)	50	209	162	174	134	209	162
x)	70	256	198	213	165	265	205
xi)	95	306	237	255	198	326	253
xii)	120	347	269	290	225	375	290
xiii)	150	389	301	326	252	430	332
xiv)	185	441	342	370	287	498	386
xv)	240	513	397	432	334	595	461
xvi)	300	581	449	490	379	689	533
xvii)	400	666	516	563	436	807	626
xviii)	500	764	593	647	502	948	735
xix)	630	883	684	749	580	1 123	870

Table 7 Rating Factors for Variation in Ambient Air Temperature for Cables in Free Air

(*Clauses* 3.1 *and* 9.1)

Maximum Conductor Temperature	Ambient Air Temperature °C							
°C	25	30	35	40	45	50	55	60
90	1.14	1.10	1.05	1.00	0.95	0.89	0.84	0.77

Table 8 Rating Factors for Variation in Ground Temperature for Direct Buried Cables

(*Clauses* 3.1 *and* 9.1)

Maximum Conductor Temperature	Ground Temperature °C							
°C	15	20	25	30	35	40	45	50
90	1.12	1.08	1.04	1.00	0.96	0.91	0.87	0.82

Table 9 Rating Factors for Variation in Ground Temperature for Cables in Ducts

(*Clauses* 3.1 *and* 9.1)

Maximum Conductor Temperature	Ground Temperature °C							
°C	15	20	25	30	35	40	45	50
90	1.12	1.08	1.04	1.00	0.96	0.91	0.87	0.82

Table 10 Rating Factors for Depths of Lying for Direct Buried Cables

(*Clauses* 3.1 *and* 9.1)

Sl No.	Depth of Laying mm	Up to 25 mm²		Above 25 mm² and Up to 300 mm²		Above 300 mm²	
		Single-Core	Multi-Core	Single-Core	Multi-Core	Single-Core	Multi-Core
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	750	1.00	1.00	1.00	1.00	1.00	1.00
ii)	900	0.98	0.98	0.98	0.98	0.98	0.98
iii)	1 050	0.97	0.98	0.96	0.97	0.96	0.96
iv)	1 200	0.96	0.97	0.95	0.95	0.94	0.95
v)	1 500	0.94	0.95	0.93	0.93	0.92	0.93
vi)	1 800	0.93	0.93	0.91	0.92	0.90	0.91
vii)	2 000	0.92	0.93	0.90	0.91	0.89	0.90
viii)	2 500	0.90	0.92	0.89	0.89	0.87	0.88
ix)	3 000	0.90	0.90	0.87	0.88	0.86	0.87

Table 11 Rating Factors for Depths of Laying for Cables in Ducts

(*Clauses* 3.1 *and* 9.1)

Sl No.	Depth of Laying mm	Up to 25 mm²		Above 25 mm² and Up to 300 mm²		Above 300 mm²	
		Single-Core	Multi-Core	Single-Core	Multi-Core	Single-Core	Multi-Core
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	750	1.00	1.00	1.00	1.00	1.00	1.00
ii)	900	0.98	0.98	0.98	0.99	0.98	0.98
iii)	1 050	0.97	0.98	0.96	0.97	0.96	0.97
iv)	1 200	0.96	0.97	0.95	0.97	0.94	0.96
v)	1 500	0.94	0.96	0.93	0.95	0.92	0.94
vi)	1 800	0.93	0.95	0.91	0.94	0.90	0.93
vii)	2 000	0.92	0.94	0.90	0.93	0.89	0.92
viii)	2 500	0.90	0.93	0.88	0.92	0.87	0.91
ix)	3 000	0.89	0.92	0.87	0.91	0.86	0.90

Table 12 Rating Factors for Variations in Soil Thermal Resistivity for Two Single-Core Cables Laid Direct in Ground

(*Clauses* 3.1 *and* 9.1)

Sl No.	Nominal Area of Conductor	Values of Soil Thermal Resistivity K.m/W					
	mm²	**1.0**	**1.2**	**1.5**	**2.0**	**2.5**	**3.0**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	1.16	1.09	1.00	0.91	0.81	0.75
ii)	2.5	1.16	1.09	1.00	0.89	0.81	0.75
iii)	4	1.17	1.09	1.00	0.89	0.81	0.75
iv)	6	1.17	1.09	1.00	0.89	0.81	0.75
v)	10	1.17	1.09	1.00	0.89	0.80	0.74
vi)	16	1.17	1.09	1.00	0.89	0.80	0.74
vii)	25	1.18	1.09	1.00	0.89	0.80	0.74
viii)	35	1.18	1.10	1.00	0.88	0.80	0.73
ix)	50	1.19	1.10	1.00	0.88	0.80	0.73
x)	70	1.19	1.10	1.00	0.88	0.80	0.73
xi)	95	1.19	1.10	1.00	0.88	0.79	0.73
xii)	120	1.19	1.10	1.00	0.88	0.79	0.73
xiii)	150	1.19	1.10	1.00	0.88	0.79	0.73
xiv)	185	1.19	1.10	1.00	0.88	0.79	0.72
xv)	240	1.20	1.10	1.00	0.88	0.79	0.72
xvi)	300	1.20	1.10	1.00	0.88	0.79	0.72

Table 12 — (*Concluded*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
xvii)	400	1.20	1.10	1.00	0.88	0.79	0.72
xviii)	500	1.20	1.11	1.00	0.87	0.79	0.72
xix)	630	1.20	1.11	1.00	0.87	0.79	0.72
xx)	800	1.20	1.11	1.00	0.87	0.79	0.72
xxi)	1 000	1.20	1.11	1.00	0.87	0.79	0.72

Table 13 Rating Factors for Variations in Soil Thermal Resistivity for Two Single-Core Cables Laid in Buried Duct

(*Clauses* 3.1 *and* 9.1)

Sl No.	**Nominal Area of Conductor** mm²	**Values of Soil Thermal Resistivity** K.m/W					
		1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	1.16	1.09	1.00	0.91	0.81	0.75
ii)	2.5	1.16	1.09	1.00	0.89	0.81	0.75
iii)	4	1.17	1.09	1.00	0.89	0.81	0.75
iv)	6	1.17	1.09	1.00	0.89	0.81	0.75
v)	10	1.17	1.09	1.00	0.89	0.80	0.74
vi)	16	1.17	1.09	1.00	0.89	0.80	0.74
vii)	25	1.18	1.09	1.00	0.89	0.80	0.74
viii)	35	1.18	1.10	1.00	0.88	0.80	0.73
ix)	50	1.19	1.10	1.00	0.88	0.80	0.73
x)	70	1.19	1.10	1.00	0.88	0.80	0.73
xi)	95	1.19	1.10	1.00	0.88	0.79	0.73
xii)	120	1.19	1.10	1.00	0.88	0.79	0.73
xiii)	150	1.19	1.10	1.00	0.88	0.79	0.73
xiv)	185	1.19	1.10	1.00	0.88	0.79	0.72
xv)	240	1.20	1.10	1.00	0.88	0.79	0.72
xvi)	300	1.20	1.10	1.00	0.88	0.79	0.72
xvii)	400	1.20	1.10	1.00	0.88	0.79	0.72
xviii)	500	1.20	1.11	1.00	0.87	0.79	0.72
xix)	630	1.20	1.11	1.00	0.87	0.79	0.72
xx)	800	1.20	1.11	1.00	0.87	0.79	0.72
xxi)	1 000	1.20	1.11	1.00	0.87	0.79	0.72

Table 14 Rating Factors for Variations in Soil Thermal Resistivity for Three Single-Core Cables Laid Direct in Ground

(*Clauses* 3.1 *and* 9.1)

Sl No.	**Nominal Area of Conductor** mm²	**Values of Soil Thermal Resistivity** K.m/W					
		1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	1.14	1.07	1.00	0.89	0.80	0.75
ii)	2.5	1.17	1.08	1.00	0.89	0.80	0.75
iii)	4	1.17	1.09	1.00	0.88	0.79	0.73
iv)	6	1.17	1.09	1.00	0.88	0.79	0.73
v)	10	1.18	1.09	1.00	0.88	0.79	0.73
vi)	16	1.18	1.10	1.00	0.88	0.79	0.72
vii)	25	1.19	1.10	1.00	0.88	0.79	0.72
viii)	35	1.19	1.10	1.00	0.88	0.79	0.72
ix)	50	1.19	1.10	1.00	0.88	0.79	0.72
x)	70	1.20	1.11	1.00	0.88	0.79	0.72

Table 14 — (*Concluded*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
xi)	95	1.20	1.11	1.00	0.87	0.79	0.72
xii)	120	1.20	1.11	1.00	0.87	0.79	0.72
xiii)	150	1.20	1.11	1.00	0.87	0.79	0.72
xiv)	185	1.20	1.11	1.00	0.87	0.78	0.72
xv)	240	1.20	1.11	1.00	0.87	0.78	0.72
xvi)	300	1.20	1.11	1.00	0.87	0.78	0.72
xvii)	400	1.20	1.11	1.00	0.87	0.78	0.72
xviii)	500	1.21	1.11	1.00	0.87	0.78	0.72
xix)	630	1.21	1.11	1.00	0.87	0.78	0.72
xx)	800	1.21	1.11	1.00	0.87	0.78	0.72
xxi)	1 000	1.21	1.11	1.00	0.87	0.78	0.72

Table 15 Rating Factors for Variations in Soil Thermal Resistivity for Three Single-Core Cables Laid in Buried Duct

(*Clauses* 3.1 *and* 9.1)

Sl No.	**Nominal Area of Conductor**	**Values of Soil Thermal Resistivity** K.m/W					
	mm²	1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	1.08	1.04	1.00	0.92	0.88	0.84
ii)	2.5	1.08	1.05	1.00	0.93	0.88	0.84
iii)	4	1.08	1.05	1.00	0.93	0.87	0.83
iv)	6	1.09	1.06	1.00	0.93	0.87	0.83
v)	10	1.10	1.06	1.00	0.93	0.87	0.82
vi)	16	1.10	1.06	1.00	0.93	0.87	0.82
vii)	25	1.10	1.06	1.00	0.93	0.87	0.82
viii)	35	1.10	1.06	1.00	0.93	0.86	0.81
ix)	50	1.11	1.06	1.00	0.92	0.86	0.81
x)	70	1.11	1.06	1.00	0.92	0.86	0.80
xi)	95	1.12	1.06	1.00	0.92	0.85	0.80
xii)	120	1.12	1.06	1.00	0.91	0.85	0.79
xiii)	150	1.12	1.07	1.00	0.91	0.85	0.79
xiv)	185	1.12	1.07	1.00	0.91	0.84	0.79
xv)	240	1.12	1.07	1.00	0.91	0.84	0.78
xvi)	300	1.13	1.07	1.00	0.91	0.84	0.78
xvii)	400	1.13	1.07	1.00	0.91	0.84	0.78
xviii)	500	1.13	1.07	1.00	0.90	0.83	0.78
xix)	630	1.13	1.07	1.00	0.90	0.83	0.77
xx)	800	1.14	1.08	1.00	0.90	0.83	0.77
xxi)	1 000	1.14	1.08	1.00	0.90	0.82	0.77

Table 16 Rating Factors for Variations in Soil Thermal Resistivity for Multi-Core Cables Laid Direct in Ground

(*Clauses* 3.1 *and* 9.1)

Sl No.	**Nominal Area of Conductor**	**Values of Soil Thermal Resistivity** K.m/W					
	mm²	1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	1.14	1.08	1.00	0.90	0.83	0.77
ii)	2.5	1.15	1.08	1.00	0.90	0.82	0.76
iii)	4	1.15	1.08	1.00	0.89	0.82	0.76

Table 16 — (*Concluded*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
iv)	6	1.16	1.09	1.00	0.89	0.81	0.75
v)	10	1.16	1.09	1.00	0.89	0.81	0.75
vi)	16	1.17	1.09	1.00	0.89	0.80	0.74
vii)	25	1.17	1.09	1.00	0.89	0.80	0.74
viii)	35	1.18	1.10	1.00	0.88	0.80	0.74
ix)	50	1.18	1.10	1.00	0.88	0.80	0.74
x)	70	1.18	1.10	1.00	0.88	0.80	0.74
xi)	95	1.18	1.10	1.00	0.88	0.80	0.73
xii)	120	1.18	1.10	1.00	0.88	0.80	0.73
xiii)	150	1.18	1.10	1.00	0.88	0.80	0.73
xiv)	185	1.18	1.10	1.00	0.88	0.80	0.73
xv)	240	1.19	1.10	1.00	0.88	0.80	0.73
xvi)	300	1.19	1.10	1.00	0.88	0.80	0.73
xvii)	400	1.19	1.10	1.00	0.88	0.80	0.73
xviii)	500	1.19	1.10	1.00	0.88	0.80	0.73
xix)	630	1.19	1.10	1.00	0.88	0.80	0.73

Table 17 Rating Factors for Variations in Soil Thermal Resistivity for Multi-Core Cables Laid in Buried Duct

(*Clauses* 3.1 *and* 9.1)

Sl No.	**Nominal Area of Conductor** mm²	**Values of Soil Thermal Resistivity** K.m/W					
		1.0	1.2	1.5	2.0	2.5	3.0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1.5	1.05	1.03	1.00	0.96	0.92	0.88
ii)	2.5	1.05	1.03	1.00	0.95	0.91	0.88
iii)	4	1.06	1.03	1.00	0.95	0.91	0.87
iv)	6	1.06	1.03	1.00	0.95	0.91	0.87
v)	10	1.06	1.04	1.00	0.95	0.90	0.86
vi)	16	1.06	1.04	1.00	0.95	0.90	0.86
vii)	25	1.07	1.04	1.00	0.95	0.90	0.86
viii)	35	1.07	1.04	1.00	0.94	0.90	0.85
ix)	50	1.07	1.04	1.00	0.94	0.89	0.85
x)	70	1.07	1.04	1.00	0.94	0.89	0.84
xi)	95	1.08	1.04	1.00	0.94	0.88	0.84
xii)	120	1.08	1.05	1.00	0.94	0.88	0.84
xiii)	150	1.08	1.05	1.00	0.93	0.88	0.83
xiv)	185	1.08	1.05	1.00	0.93	0.88	0.83
xv)	240	1.09	1.05	1.00	0.93	0.87	0.83
xvi)	300	1.09	1.05	1.00	0.93	0.87	0.82
xvii)	400	1.09	1.05	1.00	0.93	0.87	0.82
xviii)	500	1.09	1.05	1.00	0.93	0.87	0.82
xix)	630	1.10	1.06	1.00	0.92	0.86	0.81

Table 18 Group Rating Factors for Circuits of Two Single-Core Cables Laid Direct in the Ground, Horizontal Formation

(*Clauses* 3.1, 9.1 *and* 9.2)

Sl No.	**Number of Circuits**	**Spacing Between Group Centre** mm				
		Touching	150	300	450	600
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.80	0.85	0.90	0.92	0.95

Table 18 — (*Concluded*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
ii)	3	0.70	0.78	0.85	0.88	0.91
iii)	4	0.64	0.73	0.81	0.86	0.89
iv)	5	0.59	0.70	0.79	0.84	0.88
v)	6	0.55	0.67	0.77	0.83	0.87
vi)	7	0.53	0.65	0.76	0.82	0.86
vii)	8	0.51	0.64	0.75	0.82	0.86
viii)	9	0.49	0.63	0.74	0.81	0.85
ix)	10	0.48	0.63	0.74	0.81	0.85
x)	11	0.47	0.62	0.73	0.80	0.84
xi)	12	0.46	0.61	0.73	0.80	0.84

Table 19 Group Rating Factors for Circuits of Three Single-Core Cables Laid Direct in the Ground, Horizontal Formation

(*Clauses* 3.1, 9.1 *and* 9.2)

Sl No.	Number of Circuits	Spacing Between Group Centre mm				
		Touching	150	300	450	600
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.77	0.81	0.86	0.88	0.89
ii)	3	0.67	0.71	0.78	0.81	0.83
iii)	4	0.61	0.64	0.72	0.76	0.80
iv)	5	0.57	0.60	0.69	0.74	0.77
v)	6	0.53	0.57	0.66	0.72	0.75
vi)	7	0.51	0.55	0.64	0.70	0.74
vii)	8	0.49	0.53	0.63	0.69	0.73
viii)	9	0.47	0.52	0.62	0.68	0.73
ix)	10	0.45	0.51	0.61	0.67	0.72
x)	11	0.44	0.50	0.60	0.66	0.72
xi)	12	0.43	0.49	0.59	0.65	0.71

Table 20 Group Rating Factors for Circuits of Three Single-Core Cables in Single-Way Ducts

(*Clauses* 3.1, 9.1 *and* 9.2)

Sl No.	Number of Circuits	Spacing Between Group Centre mm				
		Touching	150	300	450	600
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.78	0.83	0.87	0.90	0.91
ii)	3	0.66	0.73	0.78	0.82	0.85
iii)	4	0.59	0.67	0.74	0.78	0.82
iv)	5	0.55	0.63	0.70	0.76	0.80
v)	6	0.51	0.61	0.68	0.74	0.78
vi)	7	0.48	0.58	0.66	0.73	0.77
vii)	8	0.46	0.57	0.65	0.72	0.76
viii)	9	0.44	0.55	0.64	0.71	0.76
ix)	10	0.43	0.54	0.63	0.70	—
x)	11	0.42	0.53	0.62	0.69	—
xi)	12	0.40	0.51	0.61	0.69	—

Table 21 Group Rating Factors for Multi-Core Cables Laid Direct in the Ground, in Tier Formation

(*Clauses* 3.1, 9.1 *and* 9.2)

Sl No.	Number of Cables	Number of Tiers	Spacing Between Group Centre mm				
			Touching	150	300	450	600
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	2	1	0.80	0.84	0.87	0.90	0.91
ii)	3	1	0.68	0.74	0.79	0.83	0.86
iii)	4	2	0.60	0.66	0.73	0.77	0.79
iv)	5	2	0.55	0.61	0.68	0.71	0.73
v)	6	2	0.51	0.57	0.63	0.67	0.69
vi)	7	3	0.48	0.54	0.59	0.63	0.64
vii)	8	3	0.46	0.51	0.56	0.60	0.61
viii)	9	3	0.44	0.48	0.53	0.57	0.58
ix)	10	4	0.42	0.47	0.52	0.55	0.56
x)	11	4	0.41	0.46	0.50	0.54	0.55
xi)	12	4	0.40	0.45	0.49	0.53	0.54

Table 22 Group Rating Factors for Multi-Core Cables Laid Direct in the Ground, in Horizontal Formation

(*Clauses* 3.1, 9.1 *and* 9.2)

Sl No.	Number of Circuits	Spacing Between Duct Group Centre mm				
		Touching	150	300	450	600
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.80	0.84	0.87	0.90	0.91
ii)	3	0.68	0.74	0.79	0.83	0.86
iii)	4	0.62	0.69	0.75	0.80	0.83
iv)	5	0.58	0.65	0.72	0.77	0.80
v)	6	0.55	0.62	0.69	0.75	0.78
vi)	7	0.52	0.59	0.67	0.73	0.77
vii)	8	0.50	0.57	0.66	0.72	0.75
viii)	9	0.48	0.55	0.65	0.71	0.75
ix)	10	0.46	0.54	0.64	0.70	0.74
x)	11	0.45	0.53	0.63	0.70	0.74
xi)	12	0.44	0.52	0.62	0.69	0.73

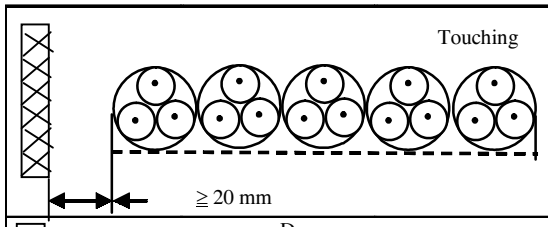
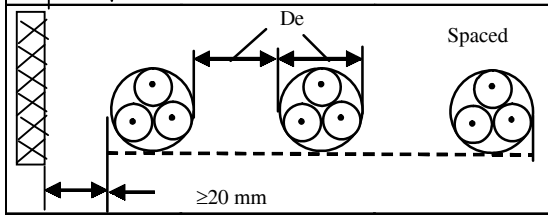
Table 23 Group Rating Factors for Three-Core Cables in Single Way Ducts in Horizontal Formation

(*Clauses* 3.1, 9.1 *and* 9.2)

Sl No.	Number of Cables	Spacing Between Cable Centres mm				
		Touching	150	300	450	600
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	2	0.85	0.87	0.90	0.92	0.94
ii)	3	0.75	0.79	0.83	0.86	0.88
iii)	4	0.69	0.74	0.79	0.83	0.86
iv)	5	0.65	0.70	0.76	0.80	0.84
v)	6	0.62	0.67	0.73	0.79	0.83
vi)	7	0.59	0.65	0.72	0.78	0.82
vii)	8	0.57	0.63	0.70	0.77	0.81
viii)	9	0.55	0.62	0.69	0.76	0.80
ix)	10	0.54	0.61	0.68	0.75	—
x)	11	0.52	0.60	0.68	0.75	—
xi)	12	0.51	0.59	0.67	0.74	—

Table 24 Group Rating Factors for Multi-Core Cables in Air on Perforated Trays

(*Clauses* 3.1, 9.1 *and* 9.2)

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	1	1.00	0.88	0.82	0.79	0.76	0.73
	2	1.00	0.87	0.80	0.77	0.73	0.68
	3	1.00	0.86	0.79	0.76	0.71	0.66
	1	1.00	1.00	0.98	0.95	0.91	—
	2	1.00	0.99	0.96	0.92	0.87	—
	3	1.00	0.98	0.95	0.91	0.85	—

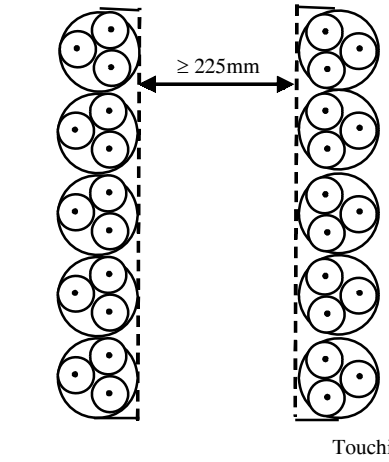
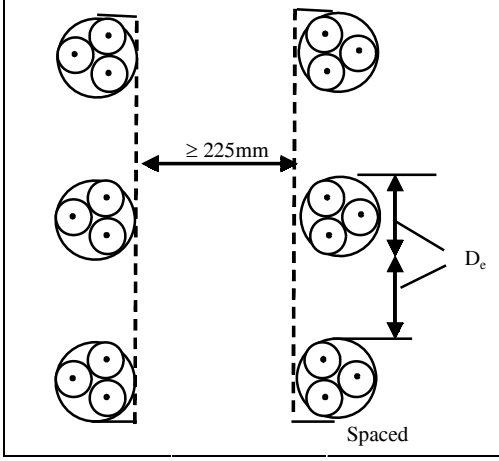
NOTES

1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing , the factors should be reduced.

Table 25 Group Rating Factors for Multi-Core Cables in Air on Vertical Perforated Trays

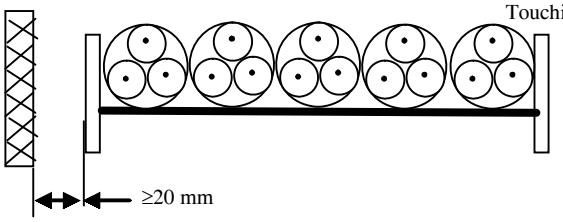
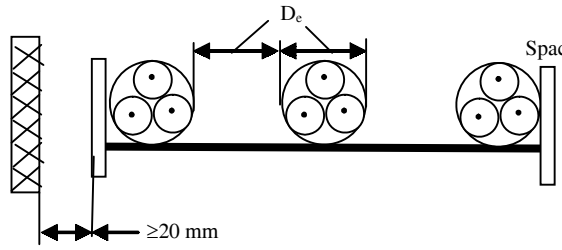
(*Clauses* 3.1, 9.1 *and* 9.2)

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
	1	1.00	0.88	0.82	0.78	0.73	0.72
	2	1.00	0.88	0.81	0.76	0.71	0.70
	1	1.00	0.91	0.89	0.88	0.87	—
	2	1.00	0.91	0.88	0.87	0.85	—

NOTE — Factors are given for horizontal spacing between trays of 225 mm with trays mounted back to back. For closer spacing the factors should be reduced.

Table 26 Group Rating Factors for Multi-Core Cables in Air on Ladder Supports, Cleats, etc

(*Clauses* 3.1, 9.1 *and* 9.2)

	Number of Trays	Number of Cables					
		1	2	3	4	6	9
Touching  ≥20 mm	1	1.00	0.87	0.82	0.80	0.79	0.78
	2	1.00	0.86	0.80	0.78	0.76	0.73
	3	1.00	0.85	0.79	0.76	0.73	0.70
Spaced  ≥20 mm	1	1.00	1.00	1.00	1.00	1.00	—
	2	1.00	0.99	0.98	0.97	0.96	—
	3	1.00	0.98	0.97	0.96	0.93	—

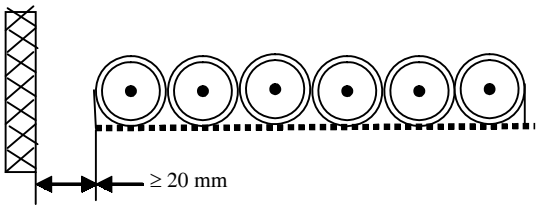
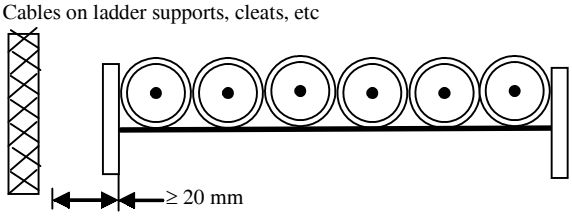
NOTES

1 Factors apply to single layer groups of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

Table 27 Group Rating Factors to be Applied for Circuits of Three Single-core Cables in Air Flat Touching

(*Clauses* 3.1, 9.1 *and* 9.2)

	Number of Trays	Number of Three-Phase Circuits		
		1	2	3
Cables on perforated trays  ≥ 20 mm	1	0.98	0.91	0.87
	2	0.96	0.87	0.81
	3	0.95	0.85	0.78
Cables on ladder supports, cleats, etc  ≥ 20 mm	1	1.00	0.97	0.96
	2	0.98	0.93	0.89
	3	0.97	0.90	0.86

NOTES

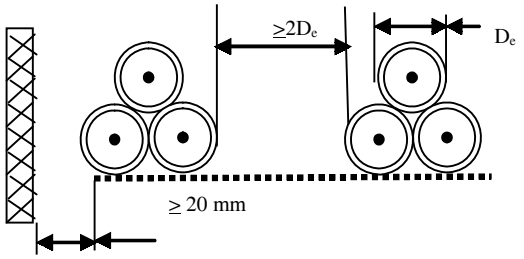
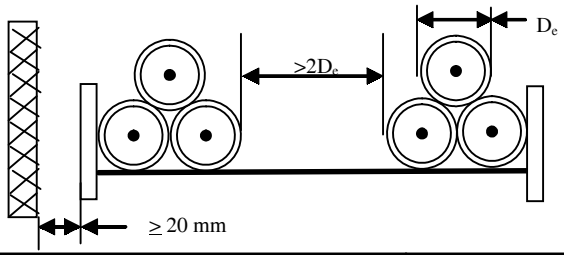
1 Factors are given for single layers of cables as shown above. Factors for cables installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

3 For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.

Table 28 Group Rating Factors to be Applied for Circuits of Three Single Core Cables in Air on Perforated Trays and Ladder Supports in Trefoil Formation

(*Clauses* 3.1, 9.1 *and* 9.2)

	Number of Trays	Number of Three-Phase Circuits		
		1	2	3
Cables on perforated trays 	1	1.00	0.98	0.96
	2	0.97	0.93	0.89
	3	0.96	0.92	0.86
Cables on ladder supports, cleats, etc 	1	1.00	1.00	1.00
	2	0.97	0.95	0.93
	3	0.96	0.94	0.90

NOTES

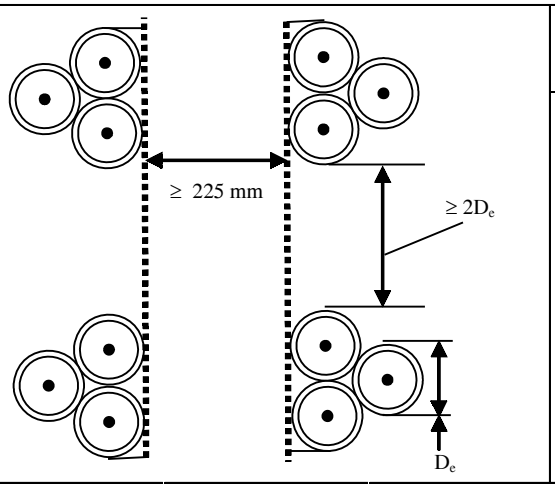
1 Factors are given for single layers of trefoil groups as shown above. Factors for trefoil groups installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

2 Factors are given for vertical spacing between trays of 300 mm and at least 20 mm between trays and wall. For closer spacing, the factors should be reduced.

3 For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.

Table 29 Group Rating Factors to be Applied for Circuits of Three Single Core Cables in Air on Vertical Perforated Trays in Trefoil Formation

(*Clauses* 3.1, 9.1 *and* 9.2)

	Number of Trays	Number of Three-Phase Circuits		
		1	2	3
	1	1.00	0.91	0.89
	2	1.00	0.90	0.86

NOTES

1 Factors are given for single layers of trefoil groups as shown above. Factors for trefoil groups installed in more than one layer touching each other will be significantly lower and must be determined by an appropriate method.

2 Factors are given for horizontal spacing between vertical trays of 225 mm with trays mounted back to back. For closer spacing the factors should be reduced.

3 For circuits having more than one cable in parallel per phase, each three phase set of conductors should be considered as a circuit for the purpose of this table.

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This Indian Standard has been developed from Doc No.: ET 09 (6502).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi