

- N.B.: (1) Question No. 1 is compulsory.
 (2) Answer any **three** out of remaining
 (3) **Assume data** if necessary and justify the same.

1. (a) Explain soft starters 5
 (b) Explain any one type of battery 5
 (c) Explain difference between conventional choke and electronic choke 5
 (d) Explain APFC 5

2. (a) Explain Benchmarking and its types 10
 (b) Discuss different types of distribution systems and their criterion 10

3. (a) The distribution transformer caters to the loads, the details of which are as follows 10

Type of load	Kw	η	pf	Lf	Df
(i) Machine shop	600	0.8	0.85	0.8	0.8
(ii) Paint shop	200	0.7	0.8	0.7	0.8
(iii) Auxiliary plant	300	0.8	0.7	0.8	0.7
(iv) Misc. Load	200	0.7	0.7	0.7	0.5

 (a) Calculate the rating of transformer
 (b) Draw SLD indicating different type of metering, protections etc.
 (b) Define energy audit. Explain its types in details. 10

4. (a) Explain energy efficient lighting controls in detail 10
 (b) Explain fuel and energy substitution 10

5. (a) Explain step by step approach in load management. 10
 (b) A sewing factory is to illuminated at 500lux. The hall measures 30m x 20m x 5m. Calculate number of fixtures required and also draw lightning layout. Different design consideration made. 10

6. (a) Explain EMS in details 10
 (b) A 20 HP, 400V, 3 phase, 0.85 efficiency, 0.86 pf lag, 1440rpm, delta connected motor is to be supplied from a MCC by a cable of length 50m. The grouping factor is 0.86. Ambient temperature is 45°C. Fault level at that point is 20kA. Select the size of cable. State assumptions. 10

Type of cable	Value of k(cu)	Value of k(Al)
PVC cable $< 300 \text{ mm}^2$	115	76
PVC cable $> 300 \text{ mm}^2$	103	68
XLPE cable $< 300 \text{ mm}^2$	114	92

TABLE 10
CURRENT RATINGS (ac) FOR TWO, THREE & FOUR CORE
650/1100 Vacs, Armoured or un-Armoured Aluminium Conductor
Cables as per IS : 3961 (PART II)-1967.

Nominal Area of Conductor mm ²	LAID DIRECT			IN AIR		
	IN THE GROUND	IN DUCTS	Core Core	3 3½ & 4 Core Core	3 3½ & 4 Core Core	Core Core
2 Core	18	16	16	14	16	13
2.5	25	21	21	16	21	18
4	32	28	27	23	27	23
6	40	35	34	30	35	30
10	55	46	45	39	47	40
16	70	60	58	50	59	51
25	90	76	76	63	78	70
35	110	92	92	77	99	86
50	135	110	115	95	125	105
70	160	135	140	115	150	130
95	190	165	170	140	185	155
120	210	185	190	155	210	180
150	240	210	210	175	240	205
185	275	235	240	200	275	240
240	320	275	275	235	325	280
300	355	305	305	280	365	315
400	385	335	345	290	420	375

TABLE 11

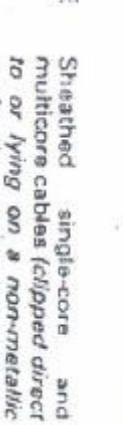
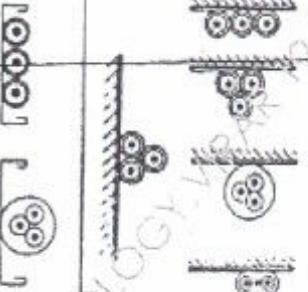
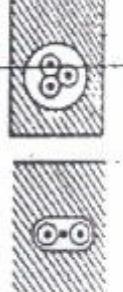
(IEE-Table 9 A)

Recommended methods of installation for cables and conductors	
Type	Description
1 'ENCLOSED'	
A	Single-core cables (<i>enclosed in conduit</i>).
B	Single-core cables (<i>enclosed in trunking</i>).
C	Single-core cables (<i>enclosed in underground conduit, or ducts, or cable ducting</i>).
D	Two or more single-core cables (<i>contained in separate bores of a multicore conduit and intended to be solidly embedded in concrete or plaster or generally incorporated in the building structure (may be used as a prefabricated wiring system)</i>).

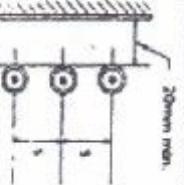
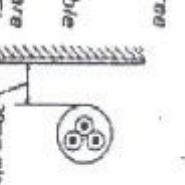
CONDITIONS OF INSTALLATION
 Maximum Conductor Temperature 70 °C
 Ambient Air Temperature 40 °C
 Ground Temperature 30 °C
 Depth of Laying for Cables in Ground 75 Cm.
 Thermal Resistivity of soil 150 Cm./Watt.
 Method of Installation Singly

TABLE 11 (Continued.)

II 'OPEN AND CLIPPED DIRECT'

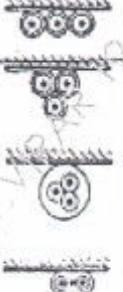
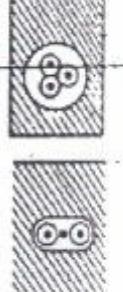
E	Sheathed single-core and multicore cables (clipped direct to or lying on a non-magnetic surface).	
F	Sheathed single-core and multicore cables (in a cable tray, bunched and unenclosed).	
G	Sheathed cables (embedded direct in plaster other than special thermally insulating plasters).	
H	Sheathed single-core and multicore cables (suspended from or incorporating a catenary wire).	

III 'DEFINED CONDITIONS'

J	Sheathed single core cables (in free air). Example : Vertical surface of a wall or open cable trench.	
K	Sheathed twin and multicore cables (in free air). Example : 1. Vertical surface of a wall or open cable trench. 2. Cables spaced by a lesser distance are assumed to be 'clipped direct' (see Method E).	

IV ENCLOSED TRENCHES

TABLE 11 (Continued.)

L	Single and multicore cables (enclosed trench 450mm wide by 300mm deep (minimum dimensions) including 100mm cover). Example : Two single-core cables with surfaces separated by a distance equal to one diameter; or three single-core cables in trefoil and touching throughout. Multicore cables or groups of single-core cables separated by a minimum distance of 50mm.	 
M	Single and multicore cables (enclosed trench 450mm wide by 600mm deep (minimum dimensions) including 100mm cover). Example : Single-core cables arranged in flat groups of two or three on the vertical trench wall with surfaces separated by a distance equal to one diameter with a minimum separation of 50mm between groups. Multicore cables installed singly separated by a minimum* distance of 75mm. All cables spaced at least 25mm from the trench wall.	 

N	Single and multicore cables in enclosed trench 1600mm wide by 750mm deep (minimum dimensions) including 100mm cover). Example : Single-core cables arranged in groups of two or three in flat formation with the surfaces separated by a distance equal to one diameter or in trefoil formation with cables touching. Groups separated by a minimum* distance of 50mm either horizontally or vertically. Multicore cables installed singly separated by a minimum* distance of 75mm either horizontally or vertically. All cables spaced at least 25mm from the trench wall.	 
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- * Larger spacings to be used where practicable.

Data for Illumination Design problems

K	Coefficient of Utilization Chart								
	Rc=0.7			Rc=0.5			Rc=0.3		
	Rw=0.5	Rw=0.3	Rw=0.1	Rw=0.5	Rw=0.3	Rw=0.1	Rw=0.5	Rw=0.3	Rw=0.1
0	0	0	0	0	0	0	0	0	0
0.6	0.43	0.39	0.36	0.42	0.38	0.36	0.41	0.38	0.36
0.8	0.45	0.41	0.38	0.44	0.40	0.38	0.43	0.40	0.38
1.00	0.51	0.47	0.44	0.55	0.47	0.44	0.49	0.46	0.40
1.25	0.55	0.51	0.49	0.53	0.50	0.48	0.52	0.50	0.48
1.50	0.57	0.54	0.52	0.56	0.53	0.51	0.54	0.52	0.50
2.00	0.61	0.58	0.56	0.59	0.57	0.55	0.57	0.56	0.54
2.50	0.63	0.61	0.59	0.61	0.59	0.57	0.59	0.58	0.56
3.00	0.65	0.63	0.61	0.63	0.61	0.59	0.61	0.59	0.58
4.00	0.67	0.65	0.63	0.64	0.63	0.62	0.62	0.61	0.59
5.00	0.68	0.67	0.65	0.65	0.64	0.63	0.63	0.62	0.61

Lamp Data			
Sr.No	Type of Lamp	Wattage	Lumen Output
1	GLS	25	230
		40	415
		60	710
		100	1340
		200	3000
2	Tungsten Halogen	50 (Miniature Dichroic)	900
		300	5100
		500	9000
		1000	22000
3	Fluorescent (T8/ T5)	18 (Halo phosphate)	1015
		36(Halo phosphate)	2450
		18 (82/85/85)	1300
		36(82/84/86)	3250
		28(T5)	2800
4	CFL	9	600
		11	760
		13	920
		18	1200

[Turn Over

TABLE 12
IEE-Table 2C

Correction factors for cables installed in enclosed trenches
(Installation methods L, M and N of Table 11)

The correction factors tabulated below relate to cross-sections of cables illustrated in items L, M, and N of Table 11 and are applicable to current-carrying capacities and volt drops for installation methods J and K of Table 11.

Nominal Cross Sectional area of conductor cable, mm²	Type L of Table 11					Correction factors			Type N of Table 11		
	Two Single-core cables, or one 3- or 4-core cables		Three single-core cables, or two twin cables		Four single-core cables, or two 3- or 4-core cables	Six single-core cables, four twin cables, or three 3- or 4-core cables	Six Single-core cables, four twin cables, or three 3- or 4-core cables	Eight Single-core cables, six 3- or 4-core cables	Twelve Single-core cables, eight twin cables or six 3- or 4-core cables	Twelve Single-core cables, eight twin cables or six 3- or 4-core cables	Eighteen Single-core cables, twelve twin cables, or nine 3- or 4-core cables
	1	2	3	4	5	6	7	8	9	10	11
mm²											
4	0.83	0.90	0.87	0.82	0.86	0.83	0.76	0.81	0.74	0.69	
6	0.82	0.89	0.86	0.81	0.86	0.82	0.75	0.80	0.73	0.68	
10	0.91	0.88	0.85	0.80	0.85	0.80	0.74	0.78	0.72	0.65	
15	0.91	0.87	0.84	0.78	0.83	0.78	0.71	0.76	0.70	0.64	
25	0.90	0.86	0.82	0.76	0.81	0.76	0.69	0.74	0.67	0.62	
35	0.89	0.85	0.81	0.75	0.80	0.74	0.68	0.72	0.66	0.60	
50	0.88	0.84	0.79	0.74	0.78	0.73	0.66	0.71	0.64	0.59	
70	0.87	0.82	0.78	0.72	0.77	0.72	0.64	0.70	0.62	0.57	
95	0.86	0.81	0.76	0.70	0.75	0.70	0.63	0.68	0.60	0.55	
120	0.85	0.80	0.75	0.69	0.73	0.66	0.61	0.66	0.58	0.53	
150	0.84	0.78	0.74	0.67	0.72	0.67	0.59	0.64	0.57	0.51	
185	0.83	0.77	0.73	0.65	0.70	0.65	0.58	0.63	0.55	0.49	
240	0.82	0.76	0.71	0.63	0.69	0.63	0.56	0.61	0.53	0.43	
300	0.81	0.74	0.69	0.62	0.64	0.62	0.54	0.59	0.52	0.46	
400	0.80	0.73	0.67	0.59	0.66	0.60	0.52	0.57	0.50	0.44	
500	0.78	0.72	0.66	0.58	0.64	0.58	0.51	0.56	0.48	0.43	
630	0.77	0.71	0.65	0.56	0.63	0.57	0.49	0.54	0.47	0.41	

TABLE 13
IEE-Table 901
Current-carrying capacities and associated voltage drops for single-core p.v.c. insulated cables, non-armoured, with or without sheath (copper conductors)

Conductor operating temperature : 70°C

conductor cross sectional area	Installation methods A to C of Table 11 (Enclosed)				Installation methods E to H of Table 11 (Closed Direct)				Installation method J of Table 11 ("Defined conditions")			
	2 Cables, single-phase a.c. or d.c.		3 or 4 cables three-phase a.c.		2 Cables, single-phase a.c. or d.c.		3 or 4 cables three-phase a.c.		Flat or vertical (2 cables, single phase a.c. or d.c. or 3 or 4 cables three-phase)		Twin (3 cables three-phase)	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13
mm²	A	mV	A	mV	A	mV	A	mV	A	mV	mV	mV
1.0	42	12	37	17	42	16	37	-	-	-	-	-
1.5	28	14	24	21	28	20	24	-	-	-	-	-
2.5	24	17	21	15	30	17	26	15	-	-	-	-
4	32	11	29	9.2	40	11	36	9.2	-	-	-	-
6	41	7.1	37	6.2	50	7.1	45	6.2	-	-	-	-
10	55	4.2	51	3.7	68	4.2	61	3.7	-	-	-	-
16	74	2.7	66	2.3	90	2.7	81	2.3	-	-	-	-
25	97	1.7	87	1.5	118	1.7	106	1.5	-	-	-	-
35	119	1.3	106	1.1	145	1.3	130	1.1	-	-	-	-
	A.C.	A.C.	A.C.	A.C.	A.C.	A.C.	A.C.	A.C.	170	170	170	170
50	145	0.97	0.91	125	0.84	175	0.93	0.91	0.95	0.91	0.85	0.80
70	185	0.71	0.63	160	0.62	220	0.65	0.63	240	0.66	0.63	0.62
95	230	0.56	0.45	195	0.48	270	0.48	0.45	300	0.52	0.45	0.49
120	260	0.48	0.36	220	0.42	310	0.40	0.36	350	0.44	0.36	0.43
150	-	-	-	-	355	0.34	0.29	320	0.34	0.29	0.39	0.29
185	-	-	-	-	405	0.29	0.24	365	0.30	0.24	0.36	0.25
240	-	-	-	-	480	0.24	0.18	430	0.27	0.18	0.38	0.22
300	-	-	-	-	560	0.22	0.14	500	0.25	0.22	0.33	0.19
400	-	-	-	-	660	0.20	0.12	610	0.24	0.20	0.33	0.17
500	-	-	-	-	800	0.18	0.065	710	0.23	0.18	0.28	0.15
630	-	-	-	-	910	0.17	0.062	820	0.22	0.16	0.26	0.15

FOR AMBIENT TEMPERATURE
Ambient temperature
Correction factor

20°C 35°C 40°C 45°C 50°C 55°C 60°C 65°C
1.06 0.94 0.87 0.79 0.71 0.61 0.50 0.37

TABLE 14
IEE-Table 502
Current-carrying capacities and associated voltage drops for twin a. & three-core p.v.c.-insulated cables, non-armoured (copper conductors)

Conductor operating temperature : 70°C

Conductor cross-sectional area	Installation methods A to C of Fig. 1 (Enclosed)				Installation methods E to H of Fig. 1 (Clipped direct)				Installation method K of Fig. 1 (Defined conditions)			
	One twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13
mm ²	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV
1.0	14	42	12	37	16	42	13	37	-	-	-	-
1.5	18	28	18	24	20	28	17	24	-	-	-	-
2.5	24	17	21	15	28	17	24	15	-	-	-	-
4	32	11	29	9.2	36	11	32	9.2	-	-	-	-
6	40	7.1	36	6.2	46	7.1	40	6.2	-	-	-	-
10	53	4.2	49	3.7	64	4.2	54	3.7	-	-	-	-
16	70	2.7	62	2.3	85	2.7	71	2.3	-	-	-	-
25	79	1.8	70	1.6	108	1.8	90	1.6	114	1.5	95	1.5
35	98	1.3	86	1.1	125	1.3	115	1.1	139	1.1	122	1.1
50	-	-	-	-	163	0.92	140	0.81	172	0.92	148	0.81
70	-	-	-	-	207	0.65	176	0.57	218	0.65	164	0.57
95	-	-	-	-	251	0.48	215	0.42	265	0.48	227	0.42
120	-	-	-	-	290	0.40	251	0.34	306	0.40	265	0.34
150	-	-	-	-	330	0.32	287	0.29	348	0.32	302	0.29
185	-	-	-	-	380	0.29	323	0.24	403	0.29	348	0.24
240	-	-	-	-	450	0.25	392	0.20	474	0.25	388	0.20
300	-	-	-	-	520	0.23	450	0.18	548	0.23	474	0.18
400	-	-	-	-	600	0.22	520	0.17	632	0.22	548	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE
Ambient temperature
Correction factor25°C 35°C 40°C 45°C 50°C 55°C 60°C 65°C
1.06 0.94 0.87 0.79 0.71 0.61 0.50 0.35

TABLE 15
IEE-Table 503
Current-carrying capacities and associated voltage drops for twin and three-core armoured p.v.c.-insulated cables (copper conductors)

Conductor operating temperature : 70°C

Conductor cross-sectional area	Installation method E, F and G of Table 11 ("Clipped direct")				Installation method K of Table 11 ("Defined conditions")			
	One twin cable single phase a.c. or d.c.		One three- or four-core cable three-phase		One twin cable single phase a.c. or d.c.		One three- or four-core cable three-phase	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9
mm ²	A	mV	A	mV	A	mV	A	mV
1.5	20	29	18	25	-	-	-	-
2.5	29	18	24	16	-	-	-	-
4	37	12	31	9.5	-	-	-	-
6	48	7.4	41	6.3	50	7.3	42	6.3
10	66	4.3	58	3.8	69	4.3	56	3.8
16	86	2.7	73	2.3	90	2.7	77	2.3
25	115	1.8	97	1.6	121	1.8	102	1.6
35	142	1.3	119	1.1	149	1.3	125	1.1
50	168	0.92	147	0.81	180	0.92	155	0.81
	a.c.	d.c.			a.c.	d.c.		
70	209	0.65	180	0.57	220	0.65	190	0.57
95	257	0.46	219	0.42	270	0.48	230	0.42
120	295	0.36	257	0.34	310	0.40	270	0.34
150	337	0.32	295	0.29	355	0.32	310	0.29
185	393	0.29	330	0.24	410	0.29	350	0.24
240	451	0.25	399	0.20	485	0.25	420	0.20
300	573	0.23	451	0.18	550	0.23	475	0.18
400	589	0.22	523	0.17	620	0.22	550	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE
Ambient temperature
Correction factor25°C 35°C 40°C 45°C 50°C 55°C 60°C 65°C
1.06 0.94 0.87 0.79 0.71 0.61 0.50 0.35

[Turn Over

TABLE 14
IEE-Table 902
Current-carrying capacities and associated voltage drops for twin and
multicore p.v.c.-insulated cables, non-armoured (copper conductors)

Conductor cross sectional area	Installation methods A to C of Fig. 1 ("Enclosed")				Installation methods E to H of Fig. 1 ("Clipped direct")				Installation method K of Fig. 1 ("Defined conditions")			
	One twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase		One Twin cable With or without protective conductor single-phase a.c. or d.c.		One three-core cable with or without protective conductor or one four-core cable, three phase	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13
mm ²	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV
1.0	14	42	12	37	15	42	13	37	-	-	-	-
1.5	18	28	16	24	20	28	17	24	-	-	-	-
2.5	24	17	21	15	23	17	24	15	-	-	-	-
4	32	11	29	9.2	36	11	32	9.2	-	-	-	-
6	48	7.1	36	6.2	46	7.1	48	6.2	-	-	-	-
10	63	4.2	49	3.7	64	4.2	63	3.7	-	-	-	-
15	70	2.7	62	2.3	85	2.7	71	2.3	-	-	-	-
25	79	1.8	70	1.8	108	1.8	80	1.6	114	1.8	95	1.6
35	98	1.3	86	1.1	132	1.3	115	1.1	139	1.3	122	1.1
50	-	-	-	-	163	0.92	140	0.81	172	0.92	146	0.81
70	-	-	-	-	207	0.65	176	0.57	218	0.65	186	0.57
95	-	-	-	-	231	0.48	215	0.42	245	0.48	227	0.42
120	-	-	-	-	290	0.40	0.38	251	0.34	305	0.40	0.36
150	-	-	-	-	330	0.32	0.25	287	0.29	348	0.32	0.25
185	-	-	-	-	380	0.29	0.23	330	0.24	400	0.29	0.23
240	-	-	-	-	450	0.25	0.18	392	0.20	474	0.25	0.18
300	-	-	-	-	520	0.23	0.14	450	0.15	548	0.23	0.14
400	-	-	-	-	600	0.22	0.11	520	0.17	632	0.22	0.11

FOR AMBIENT TEMPERATURE
Ambient Temperature Correction factor

25°C 35°C 40°C 45°C 50°C 55°C 60°C 65°C
1.06 0.94 0.87 0.79 0.71 0.61 0.50 0.35

TABLE 15
IEE-Table 903
Current-carrying capacities and associated voltage drops for twin and
multicore armoured p.v.c.-insulated cables (copper conductors).

Conductor cross sectional area	Installation method E, F and G of Table 11 ("Clipped direct")				Installation method K of Table 11 ("Defined conditions")			
	One twin cable single phase a.c. or d.c.		One three- or four-core cable three-phase		One twin cable single phase a.c. or d.c.		One three- or four-core cable three-phase	
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9
mm ²	A	mV	A	mV	A	mV	A	mV
1.5	20	29	18	25	-	-	-	-
2.5	29	18	24	16	-	-	-	-
4	37	12	31	9.6	-	-	-	-
6	48	7.4	41	6.3	50	7.1	42	6.3
10	65	4.5	56	3.8	69	4.3	58	3.8
16	95	2.7	73	2.3	90	2.7	77	2.3
25	118	1.8	97	1.6	121	1.8	102	1.6
35	142	1.3	119	1.1	149	1.3	125	1.1
50	168	0.92	147	0.81	180	0.92	155	0.81
	a.c.	d.c.						
70	208	0.65	180	0.57	220	0.65	180	0.57
95	257	0.48	219	0.42	270	0.48	230	0.42
120	285	0.40	257	0.34	310	0.40	270	0.34
150	337	0.32	285	0.29	355	0.32	310	0.29
185	353	0.29	333	0.24	410	0.29	350	0.24
240	431	0.25	399	0.20	485	0.25	420	0.20
300	523	0.23	451	0.18	550	0.23	475	0.18
400	589	0.22	523	0.17	620	0.22	550	0.17

FOR AMBIENT TEMPERATURE
Ambient Temperature Correction factor

CORRECTION FACTORS

25°C 35°C 40°C 45°C 50°C 55°C 60°C 65°C
1.06 0.94 0.87 0.79 0.71 0.61 0.50 0.35

TABLE 18
IEE-Table 8H2
Current-carrying capacities and associated volt drops for 85°C or 150°C rubber-insulated flexible cables
Conductor operating temperature: 75°C

Nominal cross-sectional area of conductor 1	Maximum diameter of wires forming conductor 2	Current-carrying capacity		Volts drop per ampere per metre		
		d.c. or single-phase a.c. (one twin cable, with or without earth-contINUOUS conductor, or two single-core cables bunched)	Three-phase a.c. (one three, four, or five core cable)	d.c.	Single-phase a.c.	Three-phase a.c.
mm ²	mm	A	A	mV	mV	mV
4	0.31	40	34	13.0	13.0	11.5
6	0.31	51	44	7.9	7.9	7.2
10	0.41	70	60	4.5	4.6	4.2
16	0.41	93	81	2.9	2.9	2.6
25	0.41	120	105	1.9	1.9	1.7
35	0.41	145	125	1.3	1.3	1.2
50	0.41	185	160	0.93	0.95	0.85
70	0.51	225	195	0.65	0.68	0.61
95	0.51	270	235	0.49	0.53	0.47
120	0.51	305	270	0.38	0.43	0.38
150	0.51	355	305	0.31	0.36	0.31
185	0.51	405	350	0.26	0.32	0.27
240	0.51	465	406	0.20	0.27	0.22
300	0.51	530	470	0.16	0.24	0.19
400	0.51	630	-	0.12	0.21	-
500	0.61	720	-	0.10	0.20	-
630	0.61	830	-	0.09	0.19	-

CORRECTION FACTOR FOR AMBIENT TEMPERATURE

85°C rubber-insulated cables

Ambient temperature Correction factor

150°C rubber-insulated cables

Ambient temperature

35°C 40°C 45°C 50°C 55°C 60°C 65°C 70°C

0.93 0.86 0.80 0.72 0.63 0.54 0.44 0.31

35°C 100°C 105°C 110°C 115°C 120°C 125°C 130°C 135°C 140°C

10 0.94 0.88 0.82 0.77 0.71 0.64 0.56 0.48 0.39

Correction factor

Note : BS 6007 does not include 150°C rubber-insulated cables above 16mm² nominal cross-sectional area

TABLE 19

Current-carrying capacities and associated volt drops for heavy-duty mineral-insulated cables (copper conductors and sheath) (BS 6207, Part 1) exposed to touch or having an overall covering of p.v.c.
Sheath operating temperature: 70°C

Nominal cross-sectional area of conductor 1	Two single-core cables, single-phase a.c., or d.c.		Three or four single-core cables, three-phase a.c.		One twin cable single-phase a.c. or d.c.		One three-core cable, three-phase a.c.		One four-core cable, three-phase a.c.		One seven-core cable, all cores fully loaded		
	Current carrying capacity 2	Volt drop per ampere per metre 3	Current carrying capacity 4	Volt drop per ampere per metre 5	Current carrying capacity 6	Volt drop per ampere per metre 7	Current carrying capacity 8	Volt drop per ampere per metre 9	Current carrying capacity 10	Volt drop per ampere per metre 11	Current carrying capacity 12	Volt drop per ampere per metre 13	Volt drop per ampere per metre 14
mm ²	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV	mV
1.0	23	42	20	34	19	42	16	36	16	36	11	42	36
1.5	29	28	25	24	24	26	20	24	20	24	14	28	24
2.5	36	17	34	14	32	17	26	14	27	14	19	17	14
4	50	10	44	9.0	41	10	34	9.0	35	9.0	24	10	9.0
6	63	6.9	56	6.0	53	6.9	44	6.0	45	6.0	-	-	-
10	85	4.2	75	3.6	71	4.2	59	3.6	61	3.6	-	-	-
16	110	2.6	99	2.3	94	2.6	78	2.3	81	2.3	-	-	-
25	150	1.7	130	1.4	124	1.7	105	1.4	110	1.4	-	-	-
35	180	1.2	160	1.0	-	-	-	-	-	-	-	-	-
50	225	0.83	200	0.72	-	-	-	-	-	-	-	-	-
70	275	0.59	240	0.51	-	-	-	-	-	-	-	-	-
95	320	0.44	290	0.38	-	-	-	-	-	-	-	-	-
120	360	0.35	335	0.30	-	-	-	-	-	-	-	1.p.h. 3.ph.	-
150	440	0.28	385	0.24	-	-	-	-	-	-	-	-	d.c.

FOR AMBIENT TEMPERATURE

Ambient temperature

Correction factor for cables exposed to touch

Correction factor for cables having overall p.v.c. covering

CORRECTION FACTORS

25°C 35°C 40°C 50°C 60°C

1.06 1.0 0.85 0.68 0.46

1.16 1.1 0.94 0.75 0.51

TABLE 20
IEE-Table 3K1
Current-carrying capacities and associated voltage drops for single-core p.v.c.-insulated cables,
non-armoured, with sheath (Aluminium conductors)

Cross sectional area of conductor	Installation methods A to C for Table 11 (Enclosed)					Installation methods E to H of Table 11 (Clipped direct)					Conductor operating temperature : 70°C						
	2 Cables, single- phase a.c. or d.c.		3 or 4 cables three-phase a.c.			2 Cables, single- phase a.c. or d.c.		3 or 4 cables three-phase a.c.			Flat or vertical (2 cables, single- phase a.c. or d.c. or 3 or 4 cables three-phase)		Twin (3 cables three-phase)				
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	T ph	d.c.	3 ph	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
mm ²	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV
18	60	4.5	4.5	52	3.9	72	4.5	4.5	65	3.9	-	-	-	-	-	-	-
25	78	2.9	2.8	67	2.5	94	2.8	2.8	85	2.5	-	-	-	-	-	-	-
35	96	2.1	2.0	83	1.8	115	2.1	2.0	105	1.8	-	-	-	-	-	-	-
50	120	1.6	1.5	100	1.4	140	1.5	1.5	123	1.3	155	1.5	1.5	1.34	160	1.3	-
70	150	1.2	1.0	125	1.0	181	1.1	1.0	156	0.93	190	1.1	1.0	0.95	170	0.96	-
95	175	0.93	0.75	150	0.80	223	0.77	0.75	183	0.69	235	0.80	0.75	0.72	205	0.67	-
120	205	0.80	0.60	175	0.70	251	0.62	0.60	225	0.56	275	0.65	0.60	0.60	235	0.54	-
150	235	0.73	0.49	200	0.64	298	0.51	0.49	259	0.48	320	0.55	0.49	0.51	270	0.45	-
165	-	-	-	-	-	345	0.42	0.39	290	0.40	370	0.46	0.39	0.45	310	0.37	-
240	-	-	-	-	-	411	0.34	0.29	361	0.34	440	0.43	0.29	0.43	370	0.30	-
300	-	-	-	-	-	475	0.29	0.23	419	0.30	510	0.38	0.23	0.39	435	0.25	-
380	-	-	-	-	-	554	0.26	0.19	465	0.28	584	0.35	0.19	0.37	490	0.22	-
480	-	-	-	-	-	643	0.23	0.15	541	0.26	677	0.32	0.15	0.34	570	0.20	-
600	-	-	-	-	-	737	0.21	0.12	618	0.24	776	0.30	0.12	0.33	648	0.18	-

FOR AMBIENT TEMPERATURE
Ambient temperature
Correction factor

CORRECTION FACTORS

25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35

TABLE 21
IEE-Table 3K2
Current-carrying capacities and associated voltage drops for twin and
multicore armoured p.v.c.-insulated cables; non-armoured (Aluminium conductors)

Conductor operating temperature : 70°C

Conduc- tor cross sectional area	Installation method E to H of Table 11 (Clipped direct)					Installation method K of Table 11 (Defined conditions)				
	One twin cable, single phase a.c. or d.c.		One three - or four core cable, three-phase			One twin cable, single phase a.c. or d.c.		One three - or four core cable, three-phase		
	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11
mm ²	A	mV	A	mV	A	mV	A	mV	A	mV
16	82	4.5	53	3.9	65	4.5	55	3.9	-	-
25	82	2.9	70	2.5	86	2.9	74	2.5	-	-
35	102	2.1	86	1.8	107	2.1	91	1.8	-	-
50	120	1.5	105	1.3	125	1.5	110	1.3	-	-
70	150	1.1	133	0.93	158	1.1	139	0.93	-	-
95	185	0.79	163	0.68	195	0.79	172	0.68	-	-
120	-	-	190	0.54	-	-	200	0.54	-	-
150	-	-	217	0.45	-	-	227	0.45	-	-
185	-	-	247	0.37	-	-	260	0.37	-	-
240	-	-	296	0.29	-	-	311	0.29	-	-
300	-	-	340	0.25	-	-	358	0.25	-	-

FOR AMBIENT TEMPERATURE

Ambient temperature
Correction factor

CORRECTION FACTORS

25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35

TABLE 2c
(IEE-Table SK2)
Current-carrying capacities and associated voltage drops for twin and multicore p.v.c.-insulated cables,
non-armoured (aluminium conductors)

Conductor operating temperature: 70°C

Cross-sectional area of conductor	Installation methods E, F and G of Table II ('Clipped direct')						Installation method K of Table II ('Defined conditions')					
	One twin cable, single-phase a.c. or d.c.			One three-or four-core cable, three-phase			One twin cable, single-phase a.c. or d.c.			One three-or four-core cable, three-phase		
	Current carrying capacity	Volt drop per ampere per metre		Current carrying capacity	Volt drop per ampere per metre		Current carrying capacity	Volt drop per ampere per metre		Current carrying capacity	Volt drop per ampere per metre	
mm ²	A	mV		A	mV		A	mV		A	mV	
1	2	3	a.c.	4	5	b.c.	7	8	c.c.	10	11	d.c.
16	63	4.5		4.5	55		3.5	65		4.5	4.3	58
25	83	2.9		2.9	67		2.5	87		2.9	2.9	71
35	100	2.1		2.0	88		1.8	105		2.1	2.0	93
50	124	1.6		1.5	105		1.3	130		1.6	1.5	110
70	157	1.1		1.0	138		0.93	165		1.1	1.0	145
95	185	0.79		0.77	166		0.68	195		0.79	0.77	175
120	-	-		-	195		0.54	-		-	-	205
150	-	-		-	219		0.45	-		-	-	230
185	-	-		-	257		0.37	-		-	-	270
240	-	-		-	304		0.30	-		-	-	320
300	-	-		-	347		0.25	-		-	-	365

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE	25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
Ambient temperature	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35

TABLE 2d
(IEE-Table SK3)
Current-carrying capacities and associated voltage drops for twin and multicore armoured p.v.c. insulated cables
(Aluminium Conductors)
BS 1348

Conductor operating temperature: 70°C

Nominal cross-sectional area of conductor	Installation methods E, F and G of Table 9A ('Clipped direct')						Installation method K of Table 9A ('Defined conditions')					
	One twin cable, single-phase a.c. or d.c.			One three-or four-core cable, three-phase			One twin cable, single-phase a.c. or d.c.			One three-or four-core cable, three-phase		
	Current carrying capacity	Volt drop per ampere per metre		Current carrying capacity	Volt drop per ampere per metre		Current carrying capacity	Volt drop per ampere per metre		Current carrying capacity	Volt drop per ampere per metre	
mm ²	A	mV		A	mV		A	mV		A	mV	
1	2	3	a.c.	4	5	b.c.	7	8	c.c.	10	11	d.c.
16	63	4.5		4.5	55		3.9	66		4.5	4.3	58
25	83	2.9		2.9	67		2.5	87		2.9	2.9	71
35	100	2.1		2.0	88		1.8	105		2.1	2.0	93
50	124	1.6		1.5	105		1.3	130		1.6	1.5	110
70	157	1.1		1.0	138		0.93	165		1.1	1.0	145
95	185	0.79		0.77	166		0.68	195		0.79	0.77	175
120	-	-		-	195		0.54	-		-	-	205
150	-	-		-	219		0.45	-		-	-	230
185	-	-		-	257		0.37	-		-	-	270
240	-	-		-	304		0.30	-		-	-	320
300	-	-		-	347		0.25	-		-	-	365

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE	25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
Ambient temperature	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35