

- 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	$\eta$	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 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 mm <sup>2</sup>	115	76
PVC cable > 300mm <sup>2</sup>	103	68
XLPE cable < 300mm <sup>2</sup>	114	92

**TABLE 11**  
(IEE-Table 9 A)

**Recommended methods of installation for cables and conductors**

Type	Description	Example
<b>I 'ENCLOSED'</b>		
A	Single-core and multicore cables (enclosed in conduit).	
B	Single-core and multicore cables (enclosed in cable trunking).	
C	Single-core and multicore cables (enclosed in underground conduit, or ducts, or cable ducting).	
D	Two or more single-core cables [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).]	

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

Nominal Area of Conductor mm <sup>2</sup>	LAID DIRECT					
	IN THE GROUND		IN DUCTS		IN AIR	
	2 Core	3, 3½ & 4 Core	2 Core	3, 3½ & 4 Core	2 Core	3, 3½ & 4 Core
1.5	18	16	16	14	16	13
2.5	25	21	21	18	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

**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 Cmt.
Thermal Resistivity of soil	150 Cm/Watt.
Method of Installation	Singly



TABLE 11 (Continued)

II OPEN AND CLIPPED DIRECT

<p>E Sheathed single-core and multicore cables (clipped direct to or lying on a non-metallic surface).</p>	
<p>F Sheathed single-core and multicore cables (in a cable tray, bunched and unenclosed).</p>	
<p>G Sheathed cables (embedded direct in plaster other than special thermally insulating plasters).</p>	
<p>H Sheathed single-core and multicore cables (suspended from or incorporating a catenary wire).</p>	
<p>III DEFINED CONDITIONS</p>	
<p>J Sheathed single core cables (in free air). Example : Vertical surface of a wall or open cable trench.</p>	
<p>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 EI).</p>	

TABLE 11 (Continued.)

IV ENCLOSED TRENCHES

<p>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.</p>	
<p>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.</p>	
<p>N Single and multicore cables in enclosed trench (600mm wide by 760mm 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. * Larger spacings to be used where practicable.</p>	

## Data for Illumination Design problems

K.	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

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 (82/84/85)	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 90

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

The correction factors tabulated below relate to dispositions 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(s)	Correction factors									
	Type L of Table 11				Type M of Table 11			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, or four 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	Twentyfour Single-core cables, sixteen twin cables, or twelve 3- or 4-core cables
1	2	3	4	5	6	7	8	9	10	11
mm <sup>2</sup>										
4	0.83	0.90	0.87	0.82	0.85	0.83	0.75	0.81	0.74	0.69
6	0.92	0.89	0.86	0.81	0.86	0.82	0.75	0.80	0.73	0.68
10	0.91	0.88	0.85	0.80	0.85	0.80	0.74	0.78	0.72	0.66
16	0.91	0.87	0.84	0.78	0.83	0.78	0.71	0.76	0.70	0.64
25	0.90	0.86	0.82	0.76	0.81	0.76	0.69	0.74	0.67	0.62
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	0.68	0.61	0.66	0.58	0.53
150	0.84	0.78	0.74	0.67	0.72	0.67	0.59	0.64	0.57	0.51
185	0.83	0.77	0.73	0.65	0.70	0.65	0.58	0.63	0.55	0.49
240	0.82	0.76	0.71	0.63	0.69	0.63	0.56	0.61	0.53	0.48
300	0.81	0.74	0.69	0.62	0.68	0.62	0.54	0.59	0.52	0.46
400	0.80	0.73	0.67	0.59	0.66	0.60	0.52	0.57	0.50	0.44
500	0.78	0.72	0.66	0.58	0.64	0.58	0.51	0.56	0.48	0.43
630	0.77	0.71	0.65	0.56	0.63	0.57	0.49	0.54	0.47	0.41

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 (Clipped 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)			Trench (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	14	15
mm <sup>2</sup>	A	mV	A	mV	A	mV	A	mV	A	mV	mV	mV	A	mV
1.0	14	42	12	37	17	42	16	37	.	.	.	.	.	.
1.5	17	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	6.3	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	.	.	.	.	.	.
50	145	0.97	125	0.84	175	0.93	160	0.82	195	0.95	0.91	0.85	170	0.80
70	185	0.71	160	0.62	220	0.65	200	0.59	240	0.68	0.63	0.62	210	0.59
95	230	0.56	195	0.48	270	0.48	240	0.45	300	0.52	0.45	0.49	260	0.42
120	260	0.48	220	0.42	310	0.40	280	0.38	350	0.44	0.38	0.43	300	0.34
150	.	.	.	.	355	0.34	320	0.34	410	0.39	0.29	0.39	350	0.29
185	.	.	.	.	405	0.29	365	0.30	470	0.35	0.24	0.36	400	0.25
240	.	.	.	.	480	0.24	430	0.27	560	0.36	0.18	0.38	480	0.22
300	.	.	.	.	560	0.22	500	0.25	660	0.33	0.14	0.35	570	0.19
400	.	.	.	.	660	0.20	610	0.24	800	0.30	0.12	0.33	680	0.17
500	.	.	.	.	800	0.18	710	0.23	910	0.28	0.088	0.31	770	0.16
630	.	.	.	.	910	0.17	820	0.22	1040	0.26	0.068	0.30	880	0.15

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	0.22



TABLE 14  
IEE-Table 502  
Current-carrying capacities and associated voltage drops for twin and multicore 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 <sup>2</sup>	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	20	9.2	36	11	32	9.2	.	.	.	.
6	40	7.1	26	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	100	1.8	90	1.6	114	1.8	95	1.6
35	92	1.3	86	1.1	135	1.3	115	1.1	139	1.3	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	186	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	255	0.34
150	.	.	.	.	330	0.32	287	0.29	348	0.32	302	0.29
185	.	.	.	.	380	0.29	330	0.24	402	0.29	348	0.24
240	.	.	.	.	450	0.25	392	0.20	474	0.25	413	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 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 503  
Current-carrying capacities and associated voltage drops for twin and multicore 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 <sup>2</sup>	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	.	.	42	6.3
6	48	7.4	41	6.3	50	7.3	56	3.8
10	66	4.3	56	3.8	69	4.3	77	2.3
16	86	2.7	73	2.3	90	2.7	102	1.6
25	115	1.8	97	1.6	121	1.8	125	1.1
35	142	1.3	119	1.1	149	1.3	155	0.81
50	168	0.92	147	0.81	180	0.92	190	0.57
70	209	0.65	180	0.57	220	0.65	230	0.42
95	257	0.48	219	0.42	270	0.48	270	0.34
120	295	0.40	257	0.34	310	0.40	310	0.29
150	337	0.32	295	0.29	355	0.32	350	0.24
185	390	0.29	333	0.24	410	0.29	420	0.20
240	451	0.25	399	0.20	485	0.25	475	0.18
300	523	0.23	451	0.18	550	0.23	550	0.17
400	589	0.22	523	0.17	620	0.22	620	0.17

CORRECTION FACTORS

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 14  
IEE-Table 502  
Current-carrying capacities and associated voltage drops for twin and multicore 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 <sup>2</sup>	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	28	17	24	15	.	.	.	.
4	32	11	29	9.2	36	11	32	9.2	.	.	.	FLAT
6	40	7.1	36	6.4	46	7.1	40	6.4	.	.	.	CP
10	53	4.3	49	3.7	64	4.3	53	3.7	.	.	.	OK
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	1.8	95	1.6
35	98	1.3	88	1.1	132	1.3	115	1.1	139	1.3	122	1.1
50	.	.	.	.	163	0.92	140	0.91	172	0.92	148	0.81
70	.	.	.	.	207	0.65	175	0.57	218	0.65	186	0.57
95	.	.	.	.	251	0.48	215	0.42	285	0.48	227	0.42
120	.	.	.	.	290	0.40	251	0.34	305	0.40	265	0.34
150	.	.	.	.	330	0.32	287	0.29	348	0.32	302	0.29
185	.	.	.	.	380	0.29	330	0.24	400	0.29	348	0.24
240	.	.	.	.	450	0.25	392	0.20	474	0.25	413	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

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 15  
IEE-Table 503  
Current-carrying capacities and associated voltage drops for twin and multicore 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 <sup>2</sup>	A	mV	A	mV	A	mV	A	mV
1.5	20	29	18	25	.	.	.	.
2.5	29	18	24	18	.	.	.	.
4	37	12	31	9.8	.	.	.	.
6	48	7.4	41	6.3	50	7.3	42	6.3
10	66	4.3	56	3.8	69	4.3	58	3.8
16	86	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
70	208	a.c. 0.65, d.c. 0.64	180	0.57	220	a.c. 0.65, d.c. 0.64	180	0.57
95	257	0.48	218	0.42	270	0.48	230	0.42
120	295	0.40	257	0.34	310	0.40	270	0.34
150	337	0.32	295	0.29	355	0.32	310	0.29
185	390	0.29	333	0.24	410	0.29	350	0.24
240	451	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 94z  
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-continuity conductor, or two single-core cables bunched) 3	Three-phase a.c. (one three, four, or five core cable) 4	d.c. 5	Single-phase a.c. 6	Three-phase a.c. 7
mm <sup>2</sup>	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	4.6	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	0.25	0.32	0.27
240	0.51	465	405	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		0.08	0.19	

CORRECTION FACTOR FOR AMBIENT TEMPERATURE

85°C rubber-insulated cables		35°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C		
Ambient temperature	Correction factor	0.93	0.86	0.80	0.72	0.53	0.54	0.44	0.31		
150°C rubber-insulated cables		35°C	100°C	105°C	110°C	115°C	120°C	125°C	130°C	135°C	140°C
Ambient temperature	Correction factor	1.0	0.94	0.88	0.82	0.77	0.71	0.64	0.56	0.48	0.39

Note: BS 6007 does not include 150°C rubber-insulated cables above 16mm<sup>2</sup> nominal cross-sectional area

TABLE 19  
IEE-Table 94j  
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 14	
mm <sup>2</sup>	A	mV	A	mV	A	mV	A	mV	A	mV	A	mV	mV
1.0	23	42	20	31	19	42	16	36	16	36	11	42	36
1.5	29	28	25	24	24	28	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									
150	440	0.28	385	0.24									1-ph. 3-ph. a.c. or a.c. d.c.

FOR AMBIENT TEMPERATURE

CORRECTION FACTORS		25°C	35°C	40°C	50°C	60°C
Ambient temperature	Correction factor for cables exposed to touch	1.06	1.0	0.85	0.68	0.46
	Correction factor for cables having overall p.v.c. covering	1.16	1.1	0.94	0.75	0.51



TABLE 20  
IEE-Table 9K1  
Current-carrying capacities and associated voltage drops for single-core p.v.c.-insulated cables, non-armoured, with sheath (Aluminium conductors)

Conductor operating temperature : 70°C

Gross sectional area of conductor	Installation methods A to C of Table 11 (Enclosed)						Installation methods E to H of Table 11 (Clipped 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)			Trellis (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		
1	2	a.c. 3	d.c. 4	5	6	7	a.c. 8	d.c. 9	10	11	12	13	14	15	16	17
mm <sup>2</sup>	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mV	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	-	-	-	-	-	-
70	150	1.2	1.0	125	1.0	181	1.1	1.0	156	0.93	155	1.5	1.5	1.34	140	1.3
95	175	0.93	0.75	150	0.80	223	0.77	0.75	193	0.69	190	1.1	1.0	0.95	170	0.90
120	205	0.80	0.60	175	0.70	261	0.62	0.60	225	0.56	235	0.80	0.75	0.72	205	0.67
150	235	0.73	0.49	200	0.64	298	0.51	0.49	259	0.48	275	0.65	0.60	0.60	235	0.54
185	-	-	-	-	-	345	0.42	0.39	290	0.40	320	0.55	0.49	0.51	270	0.45
240	-	-	-	-	-	411	0.34	0.29	361	0.34	370	0.46	0.39	0.45	310	0.37
300	-	-	-	-	-	-	-	-	-	-	440	0.43	0.29	0.43	370	0.30
380	-	-	-	-	-	475	0.29	0.23	419	0.30	510	0.38	0.23	0.39	435	0.25
480	-	-	-	-	-	554	0.26	0.19	465	0.28	584	0.35	0.19	0.37	490	0.22
600	-	-	-	-	-	643	0.23	0.15	541	0.26	677	0.32	0.15	0.34	570	0.20
						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 9K2  
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

Conductor 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
1	2	3	4	5	6	7	8	9
mm <sup>2</sup>	A	mV	A	mV	A	mV	A	mV
16	62	4.5	53	3.9	65	4.5	55	3.9
25	82	2.9	70	2.5	96	2.9	74	2.5
35	102	2.1	86	1.8	107	2.1	91	1.8
50	120	1.5	106	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 22  
(IEE-Table 9A2)

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
a.c.		d.c.	a.c.				d.c.			
1	2	3	4	5	6	7	8	9	10	11
mm <sup>2</sup>	A	mV	mV	A	mV	A	mV	mV	A	mV
16	63	4.5	4.5	55	3.9	66	4.5	4.3	58	3.9
25	83	2.9	2.9	67	2.5	87	2.9	2.9	71	2.5
35	100	2.1	2.0	88	1.8	105	2.1	2.0	93	1.8
50	124	1.6	1.5	105	1.3	130	1.6	1.5	110	1.3
70	157	1.1	1.0	138	0.93	165	1.1	1.0	145	0.93
95	185	0.79	0.77	166	0.68	195	0.79	0.77	175	0.68
120	-	-	-	195	0.54	-	-	-	205	0.54
150	-	-	-	219	0.45	-	-	-	230	0.45
185	-	-	-	257	0.37	-	-	-	270	0.37
240	-	-	-	304	0.30	-	-	-	320	0.30
300	-	-	-	347	0.25	-	-	-	365	0.25

CORRECTION FACTORS

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

TABLE 23

(IEE-Table 9A3)

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 cables, 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
a.c.		d.c.	a.c.				d.c.			
1	2	3	4	5	6	7	8	9	10	11
mm <sup>2</sup>	A	mV	mV	A	mV	A	mV	mV	A	mV
16	63	4.5	4.5	55	3.9	66	4.5	4.3	58	3.9
25	83	2.9	2.9	67	2.5	87	2.9	2.9	71	2.5
35	100	2.1	2.0	88	1.8	105	2.1	2.0	93	1.8
50	124	1.6	1.5	105	1.3	130	1.6	1.5	110	1.3
70	157	1.1	1.0	138	0.93	165	1.1	1.0	145	0.93
95	185	0.79	0.77	166	0.68	195	0.79	0.77	175	0.68
120	-	-	-	195	0.54	-	-	-	205	0.54
150	-	-	-	219	0.45	-	-	-	230	0.45
185	-	-	-	257	0.37	-	-	-	270	0.37
240	-	-	-	304	0.30	-	-	-	320	0.30
300	-	-	-	347	0.25	-	-	-	365	0.25

CORRECTION FACTORS

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