N.S.

B.E. Electrical VIII CBGS
DMAES

25-11-16

Q.P. Code : 719903

(3 Hours) **[Total Marks : 86**

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 single line diagram. **5**
   (b) Write short note on : Elements of monitoring and targeting. **5**
   (c) What is meant by co-ordination and discrimination in the context of protection system design? **5**
   (d) Explain difference between temporary and permanent power supply? **5**

2. (a) What are the various types of distribution systems used in practice and their selection criteria. **10**
   (b) Explain BMS in details. **10**

3. (a) Explain Energy Efficient motors. **10**
   (b) Explain need of energy audit and its types. **10**

4. (a) Explain important provisions of EC act 2001. **10**
   (b) What are the various factors affecting the selection of material and area of conductor of a cable with the help of suitable examples? Also discuss the selection of type of cable insulating material used for particular applications. **10**

5. (a) Explain UPS. What are the types of UPS? Comment on the suitability of each of them with suitable examples. **10**
   (b) Explain Benchmarking and its types. **10**

6. (a) What is the need for power factor improvement? What are the different means of power factor correction? What are the calculations involved for sizing capacitors for PF improvements. **10**

TURN OVER

(b) The details of electrical load connected to plant is given below : 10

Load	Load in KW	Power factor	Efficiency	Diversity factor	Load factor
1	800	0.7	0.75	0.8	0.8
2	600	0.85	0.8	0.6	0.85
3	300	0.95	0.9	0.7	0.7
4	400	0.75	0.8	0.5	0.6

Based on above data :

(i) Calculate KVA rating of transformer required for the loads.

(ii) Suggest KVAR required for the load and calculate compensating KVAR required.

Data for Illumination Design problems

Coefficient of Utilization Chart

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

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 (82/84/86)	1300
		36(82/84/86)	3250
		28(T5)	2800
4	CFL	9	600
		11	760
		13	920
		18	1200

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

Correction factors tabulated below relate to disposisons of cables illustrated in items L, M, and N of Table 11 and are applicable to current-carrying cables and volt drops for installation methods J and K of Table 11

	Correction factors									
	Type L of Table 11				Type M of Table 11			Type N of Table 11		
Nominal cross sectional area of conductor (sq mm)	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-or4-core cables	Eight Single-core cables, of 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	Twenty four Single-core cables sixteen twin cables or twelve 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	0.81	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	0.67	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	0.75	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 12

IEE-Table 9D1

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

	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")					
Conductor cross sectional area	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)				Trefoil (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: Single-phase a.c.	Volt drop per ampere per metre: d.c.	Volt drop per ampere per metre: Three phase	Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
mm²	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	28	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	4.7	51	3.7	68	4.7	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.								
50	145	0.97 0.91	125	0.84	175	0.93 0.91	160	0.82	195	0.95	0.91	0.85	170	0.80
70	185	0.71 0.63	160	0.62	220	0.65 0.63	200	0.59	240	0.68	0.63	0.62	210	0.59
95	230	0.56 0.45	195	0.48	270	0.48 0.45	240	0.45	300	0.52	0.45	0.49	260	0.42
20	260	0.48 0.36	220	0.42	310	0.40 0.36	280	0.38	350	0.44	0.36	0.43	300	0.34
50	-	- -	-	-	355	0.34 0.29	320	0.34	410	0.39	0.29	0.39	350	0.29
85	-	- -	-	-	405	0.29 0.24	365	0.30	470	0.35	0.24	0.36	400	0.25
40	-	- -	-	-	480	0.24 0.18	430	0.27	560	0.36	0.18	0.38	480	0.22
00	-	- -	-	-	560	0.22 0.14	500	0.25	660	0.33	0.14	0.35	570	0.19
90	-	- -	-	-	600	0.20 0.12	610	0.24	800	0.30	0.12	0.33	680	0.17
00	-	- -	-	-	800	0.18 0.086	710	0.23	910	0.28	0.086	0.31	770	0.16
30	-	- -	-	-	910	0.17 0.068	820	0.22	1040	0.26	0.068	0.30	880	0.15

AMBIENT TEMPERATURE

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

IEE-Table 9D2

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
mm²	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	16	24	20	28	17	24	-	-	-	-
2.5	24	17	21	15	28	17	24	15	-	-	-	-
4	32	11	28	9.2	36	11	32	9.2	-	-	-	-
6	40	7.1	36	6.0	46	7.1	40	6.0	-	-	-	-
10	54	4.2	49	3.6	64	4.2	54	3.6	-	-	-	-
16	70	2.7	62	2.3	85	2.7	71	2.3	-	-	-	-
25	79	1.8	70	1.6	106	1.8	90	1.5	114	1.8	95	1.6
35	98	1.3	86	1.1	132	1.3	115	1.1	109	1.3	122	1.1
50	-	-	-	-	163	0.92	140	0.81	172	0.92	148	0.81
70	-	-	-	-	207	0.65 0.64	175	0.57	218	0.65 0.64	186	0.57
95	-	-	-	-	251	0.48 0.46	215	0.42	265	0.48 0.46	227	0.42
120	-	-	-	-	290	0.40 0.36	251	0.34	306	0.40 0.36	265	0.34
150	-	-	-	-	330	0.32 0.25	297	0.29	348	0.32 0.25	302	0.29
185	-	-	-	-	380	0.29 0.23	336	0.24	400	0.29 0.23	346	0.24
240	-	-	-	-	450	0.25 0.18	392	0.20	474	0.25 0.18	413	0.20
300	-	-	-	-	520	0.23 0.14	450	0.18	548	0.23 0.14	474	0.18
400	-	-	-	-	600	0.22 0.11	520	0.17	632	0.22 0.11	546	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE

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 15

IEE-Table 9D3

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
mm²	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	6.0	50	7.3	42	6.3
10	66	4.4	56	3.8	69	4.4	58	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 0.64	180	0.57	220	0.65 0.64	190	0.57
95	257	0.48 0.46	219	0.42	270	0.48 0.46	230	0.42
120	295	0.40 0.36	257	0.34	310	0.40 0.36	270	0.34
150	337	0.32 0.25	295	0.29	355	0.32 0.25	310	0.29
185	390	0.29 0.23	333	0.24	410	0.29 0.23	350	0.24
240	461	0.25 0.18	389	0.20	485	0.25 0.18	420	0.20
300	523	0.23 0.14	451	0.18	550	0.23 0.14	475	0.18
400	589	0.22 0.11	523	0.17	620	0.22 0.11	550	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE

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

IEE-Table 9C

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	Correction factors: Type L of Table 11 — Two Single-core cables, or one 3- or 4-core cables	Type L of Table 11 — Three single-core cables, or two twin cables	Type L of Table 11 — Four single-core cables, or two 3- or 4-core cables	Type L of Table 11 — Six single-core cables, four twin cables, or three 3- or 4-core cables	Type M of Table 11 — Six Single-core cables, four twin cables, or three 3-or4-core cables	Type M of Table 11 — Eight Single-core cables, of four 3- or 4-core cables	Type M of Table 11 — Twelve Single-core cables, eight twin cables or six 3- or 4-core cables	Type N of Table 11 — Twelve Single-core cables, eight twin cables or six 3- or 4-core cables	Type N of Table 11 — Eighteen Single-core cables twelve twin cables, or nine 3- or 4-core cables	Type N of Table 11 — 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
mm²										
4	0.83	0.90	0.87	0.82	0.86	0.83	0.76	0.81	0.74	0.69
6	0.92	0.89	0.86	0.81	0.85	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	0.70	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	0.68	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	0.79	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 9D1

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"): 2 Cables, single-phase a.c., or d.c. — Current carrying capacity	Volt drop per ampere per metre	3 or 4 cables three-phase a.c. — Current carrying capacity	Volt drop per ampere per metre	Installation methods E to H of Table 11 ("Clipped direct"): 2 Cables, single-phase a.c., or d.c. — Current carrying capacity	Volt drop per ampere per metre	3 or 4 cables three-phase a.c. — Current carrying capacity	Volt drop per ampere per metre	Installation method J of Table 11 ("Defined conditions"): Flat or vertical (2 cables, single-phase a.c., or d.c. or 3 or 4 cables three-phase) — Current carrying capacity	Volt drop per ampere per metre: Single-phase a.c.	Single-phase d.c.	Three-phase	Trefoil (3 cables three-phase) — Current carrying capacity	Volt drop per ampere per metre
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
mm²	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	6.2	50	7.1	45	6.2	-	-	-	-	-	-
10	55	4.2	51	3.7	68	4.2	61	3.7	-	-	-	-	-	-
16	74	2.7	68	2.3	90	2.7	81	2.3	-	-	-	-	-	-
25	97	1.7	87	1.5	118	1.7	105	1.5	-	-	-	-	-	-
35	119	1.3	106	1.1	145	1.3	130	1.1	-	-	-	-	-	-
		a.c.	a.c.			a.c.	a.c.							
50	145	0.97	0.91	125	0.84	175	0.93	0.91	160	0.82	195	0.95	0.91	0.85	170	0.80
70	185	0.71	0.63	160	0.62	220	0.65	0.63	200	0.59	240	0.68	0.63	0.62	210	0.59
95	230	0.56	0.45	195	0.48	270	0.48	0.45	240	0.45	300	0.52	0.45	0.49	260	0.42
120	260	0.48	0.36	220	0.42	310	0.40	0.36	280	0.38	350	0.44	0.36	0.43	300	0.34
150	-	-	-	-	-	355	0.34	0.29	320	0.34	410	0.39	0.29	0.39	350	0.29
185	-	-	-	-	-	405	0.29	0.24	365	0.30	470	0.35	0.24	0.36	400	0.25
240	-	-	-	-	-	480	0.24	0.18	430	0.27	560	0.36	0.18	0.38	480	0.22
300	-	-	-	-	-	580	0.22	0.14	500	0.25	660	0.33	0.14	0.35	570	0.19
400	-	-	-	-	-	680	0.20	0.12	610	0.24	800	0.30	0.12	0.33	680	0.17
500	-	-	-	-	-	800	0.18	0.066	710	0.23	910	0.28	0.066	0.31	770	0.16
630	-	-	-	-	-	910	0.17	0.066	820	0.22	1040	0.26	0.066	0.30	880	0.15

CORRECTION FACTORS

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

IEE-Table 9D2

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
mm²	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	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	-	-	-	-
6	45	7.1	36	6.4	46	7.1	40	6.4	-	-	-	-
10	55	4.2	52	3.7	64	4.2	54	3.7	-	-	-	-
16	70	2.7	65	2.3	85	2.7	71	2.3	-	-	-	-
25	92	1.8	87	1.6	106	1.8	90	1.6	114	1.8	95	1.6
35	118	1.3	110	1.1	128	1.3	115	1.1	139	1.3	122	1.1
50	143	0.92	134	0.81	163	0.92	140	0.81	172	0.92	148	0.81
		a.c.	d.c.							a.c.	d.c.	
70	183	0.65	0.64	0.57	207	0.65	0.64	0.57	218	0.65	0.64	0.57
95	226	0.48	0.48	0.42	251	0.48	0.46	0.42	265	0.48	0.46	0.42
120	261	0.40	0.36	0.34	290	0.40	0.36	0.34	306	0.40	0.36	0.34
150	298	0.32	0.25	0.29	330	0.32	0.25	0.29	348	0.32	0.25	0.29
185	344	0.29	0.23	0.24	380	0.29	0.23	0.24	400	0.29	0.23	0.24
240	395	0.25	0.18	0.20	450	0.25	0.18	0.20	474	0.25	0.18	0.20
300	469	0.23	0.14	0.18	520	0.23	0.14	0.18	548	0.23	0.14	0.18
400	562	0.22	0.11	0.17	600	0.22	0.11	0.17	632	0.22	0.11	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE								
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 15

IEE-Table 9D3

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
mm²	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	7.3		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	163	0.92	147	0.81	180	0.92		155	0.81
		a.c.	d.c.			a.c.	d.c.		
70	209	0.65	0.64	0.57	220	0.65	0.64	190	0.57
95	257	0.48	0.48	0.42	270	0.48	0.48	230	0.42
120	295	0.40	0.36	0.34	310	0.40	0.36	270	0.34
150	337	0.32	0.25	0.29	355	0.32	0.25	310	0.29
185	390	0.29	0.23	0.24	410	0.29	0.23	350	0.24
240	481	0.25	0.18	0.20	485	0.25	0.18	420	0.20
300	523	0.23	0.14	0.18	550	0.23	0.14	475	0.18
400	589	0.22	0.11	0.17	620	0.22	0.11	550	0.17

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE								
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 18
(IEE-Table 9H2
Current-carrying capacities and associated volt drops for 85°C or 150°C rubber-insulated flexible cables
Conductor operating temperature : 75°

Nominal cross sectional area of conductor	Maximum diameter of wires forming conductor	Current-carrying capacity: d.c. or single-phase a.c. (one twin cable, with or without earth continuity conductor, of two single-core cables bunched)	Current-carrying capacity: Three-phase a.c. (one three, four, or five core cable	Volts drop per ampere per metre: d.c.	Volts drop per ampere per metre: Single-phase a.c.	Volts drop per ampere per metre: Three-phase
1	2	3	4	5	6	7
mm²	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	4.8	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	306	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		0.08	0.19	-

CORRECTION FACTOR FOR AMBIENT TEMPERATURE

85°C rubber-insulated cables

Ambient temperature	35°C	40°C	45°C	50°C	55°C	60°C	65°C	70°C
Correction factor	0.93	0.86	0.80	0.72	0.63	0.54	0.44	0.31

150°C rubber-insulated cables

Ambient temperature	35°C to 95°C	100°C	105°C	110°C	115°C	120°C	125°C	130°C	135°C	140°
Correction factor	1.0	0.94	0.88	0.82	0.77	0.71	0.64	0.56	0.48	0.3

Note - BS 6007 does not include 150°C rubber-insulated cables above 185mm² nominal cross-sectional area

TABLE 19
IEE-Table 9J3
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 :

Nominal Cross sectional area of conductor	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 full loaded-	
	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	A	mV
1.0	20	42	20	36	19	42	16	36	16	36	11	42
1.5	29	28	26	24	24	28	20	24	20	24	14	28
2.5	39	17	34	14	32	17	26	14	27	14	19	17
4	50	10	44	9.0	41	10	34	9.0	35	9.0	24	10
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	330	0.44	290	0.38	-	-	-	-	-	-	-	1 ph. 3.
120	380	0.35	335	0.30	-	-	-	-	-	-	-	a.c., or
150	440	0.28	385	0.24	-	-	-	-	-	-	-	d.c.

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE

Ambient temperature	25°C	35°C	40°C	50°C	60°C
Correction factor for cables exposed to touch	1.06	1.0	0.85	0.66	0.46
Correction factor for cables having overall p.v.c. covering	1.16	1.1	0.94	0.75	0.51

TURN OVER

TABLE 21
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

Cross 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)				Trefoil (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
		a.c.	d.c.				a.c.	d.c.				1 ph	d.c.	3 ph		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
mm²	A	mV	mV	A	mV	A	mV	mV	A	mV	A	mV	mV	mV	A	mV
16	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	120	1.3	155	1.5	1.5	1.34	140	1.3
70	150	1.2	1.0	125	1.0	181	1.1	1.0	156	0.93	190	1.1	1.0	0.85	170	0.96
95	175	0.93	0.75	150	0.80	223	0.77	0.75	193	0.69	230	0.80	0.75	0.72	205	0.67
120	205	0.80	0.60	175	0.70	261	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
185	-	-	-	-	-	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	-	-	-	-	-	476	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	616	0.24	776	0.30	0.12	0.33	648	0.18

CORRECTION FACTORS

FOR AMBIENT TEMPERATURE	25°C	35°C	40°C	45°C	50°C	55°C	60°C	65°C
Ambient temperature								
Correction factor	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
mm²	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	86	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	-	-	298	0.29	-	-	311	0.29
300	-	-	340	0.25	-	-	358	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								
Correction factor	1.06	0.94	0.87	0.79	0.71	0.61	0.50	0.35

TABLE 22

(IEE–Table 9K2)

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 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
		a.c.	d.c.				a.c.	d.c.		
1	2	3	4	5	6	7	8	9	10	11
mm²	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								
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 9K3)

Current-carrying capacities and associated voltage drops for twin and multicore armoured p.v.c. insulated cables (Aluminium Conductors) BS 5348

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
mm²	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	106	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								
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