UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF INDUSTRIAL TECHNOLOGY

FINAL EXAMINATION

JANUARY 2016 SEMESTER

COURSE CODE	:	JFB 10303
COURSE TITLE	:	ELECTRICAL SYSTEM DESIGN AND INSTALLATION
PROGRAMME LEVEL	:	BACHELOR
DATE	:	24 MAY 2016
TIME	:	2.30 PM – 5.30 PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consists of ONE (1) section.
4. This question paper consists of FIVE (5) questions.
5. Answer FOUR (4) questions only.
6. Please write your answers on the answer booklet provided.
7. Table and formula are enclosed as reference.
8. Please answer all questions in English only.

Total: 100 Marks

INSTRUCTION: Answer FOUR (4) Question Only

Please use the answer booklet provided.

Question 1

(a) The *"magnitude of the current to be carried by a circuit in normal service"* Ib determine by two methods, describe both methods.

(7 marks)

(b)

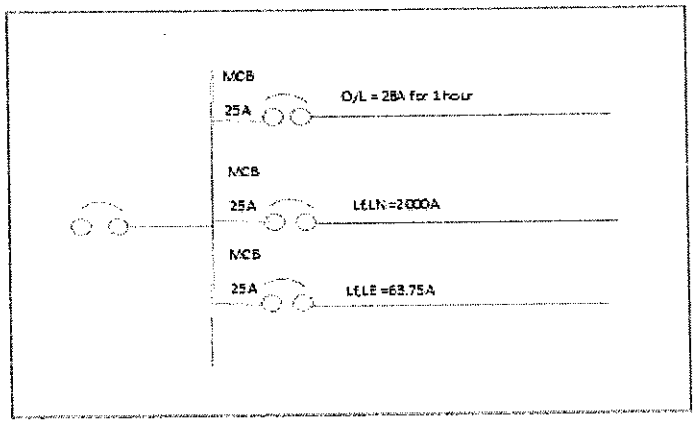


Figure 1: Connection of the System

A distribution board has a RCCB at 63A with a residual IN=0.03A and the three final circuit, each protection by a type of C MCB rated 25A as shown in Figure 1. Analyze the operating time of RCCB and MCB under each of the following condition:

(i) A constant overload of 28A for 1hour in this circuit.

(5 marks)

(ii) A sustained short circuit current of 2000A from live to neutral in the second circuit.

(5 marks)

(c) Based on Question (1b) calculate a high impedance sustained short circuit current of 63.75A from live to earth in the third circuit.

(8 marks)

Question 2

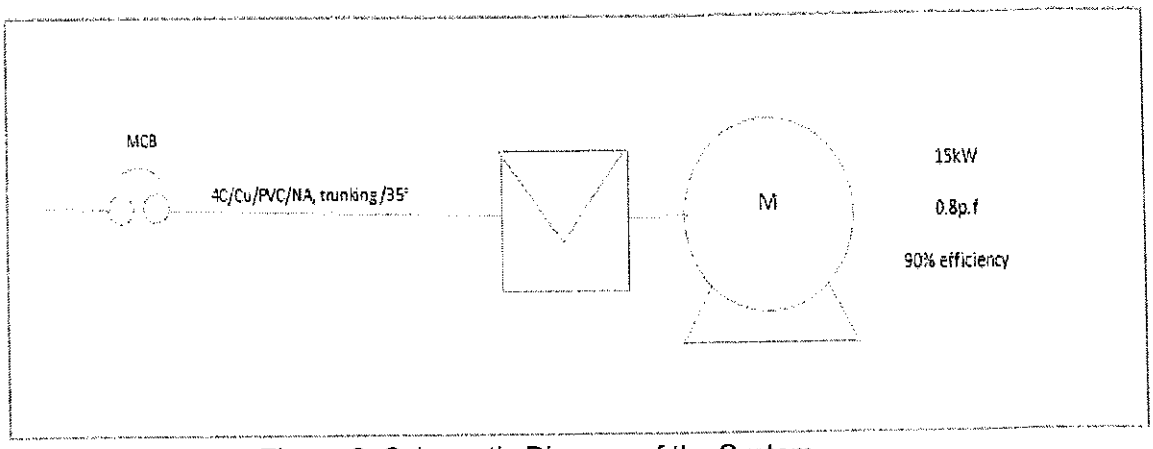


Figure 2: Schematic Diagram of the System

(a) Multi-core, PVC insulated cable connected to 3 phase motor rated at 400V, 15kW, 0.8PF and 90% efficiency. This motor is subjected to frequent start-stop and operating at the ambient temperature at 35° as shown in Figure 2.

i. Find the minimum tabulated current are under consideration of IEE Regulation BS60989 with start and stop current rating.

(7 marks)

ii. Evaluate the size of the conductor are accurate with the current rating for cable in Table 4D2A IEE Regulation.

(5 marks)

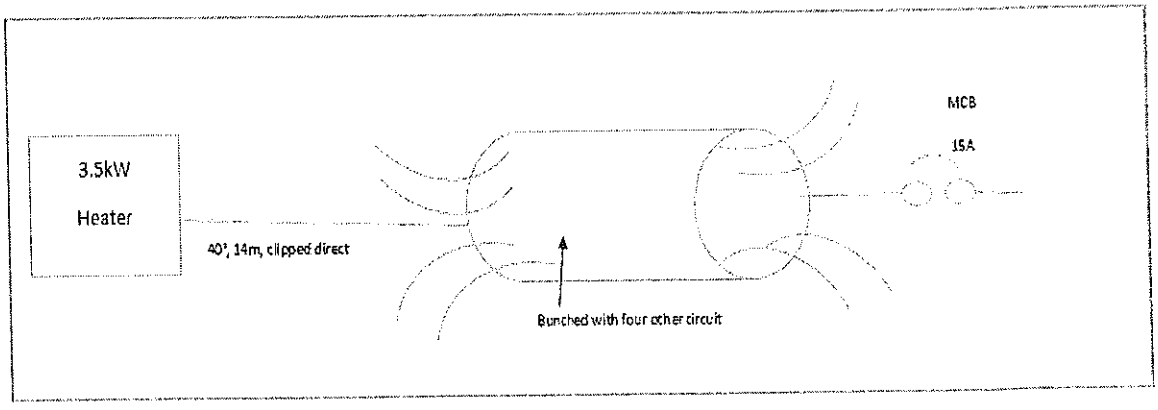


Figure 3: Diagram of the Circuit

(b) A heater rated at 230V, 3.5kW is to be installed using twin-with-earth PVC insulated and sheated cable clip direct in a roof space which has an ambient temperature of 40°C. The circuit is protected by 15A MCB. The cable is bunched with four other twin earth cable for a short distance as shown in Figure 3.

(i) Calculate the minimum tabulated current rating of the circuit

(5 marks)

(ii) Evaluate the size of the conductor.

(8 marks)

Question 3

A factory plan to install 1 unit a synchronous motor (3 phase). The motor is required to design a complete circuit in order to control a forward reverse movement with complete installation.

(a) Find the delta connection base on circuit diagram for this motor.

(8 marks)

(b) Analyze a power circuit for this connection of circuit to the 3phase power supply.

(8 marks)

(c) Evaluate a control circuit (schematic diagram) without stop push button.

(15 marks)

Question 4

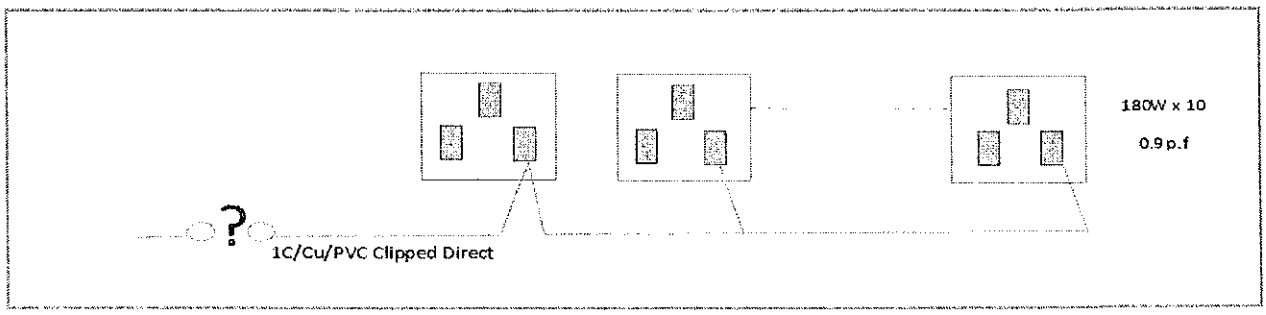


Figure 4: Connection of Power Outlet

Figure 4 shows the circuit that feeding a group of ten 230V socket outlet. The length of the cable from the protective device to the group of the socket outlet is 17m. The circuit is the single core, copper conductor, PVC insulated cable, clipped direct on nonmetallic surface. The expected average connected load of each socket outlet is 180W at 0.9 power factor. The earthing system is TN-S with measured value Ze of 0.3Ω and CPC 2.5mm is used. The installation will through an

area where the temperature may reach 35°C. By neglecting the thermal insulation correction factor, and assuming that short circuit current is 1.5kA and k = 115. Full load current in this circuit is 5000A.

(a) Find the design current (Ib) of installation.

(2 marks)

(b) Find the appropriate size of Miniature Circuit Braker (MCB) to be used by selecting type B.

(2 marks)

(c) Calculate the minimum tabulated current (It,min) and evaluate appropriate conductor size.

(7 marks)

(d) Calculate voltage drop of the installation satisfying the requirement 1.5% and create a suitable size of cable based on current rating.

(10 marks)

(e) Find the clearance time of fault current protection and the appropriate size of conductor as per common practice in 17th Edition IEE Wiring Regulation (BS 7671:2008).

(4 marks)

Question 5

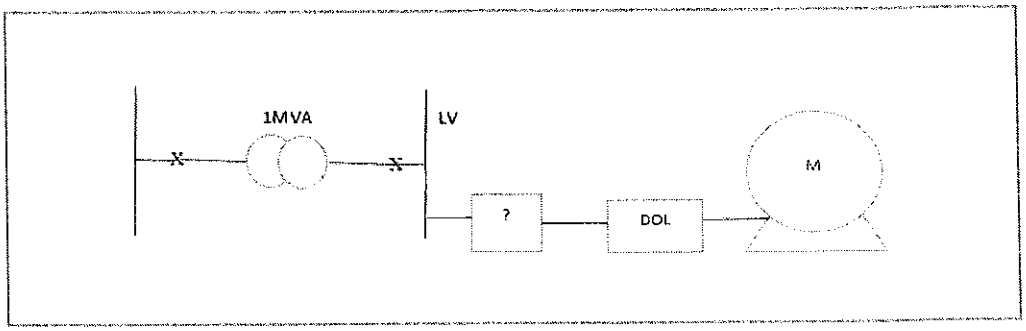


Figure 5: Diagram of Motor Installation

(a) Find the type of protective device and the requirement breaking capacity for the circuit supply to a 3 phase motor which rated at 20kW, 95% efficiency and 0.85 power factor as shown in Figure 5. This motor has a DOL starter. The main switchboard is fed by a 1-MVA, 22kV/400V transformer which the circuit current is 28.86kA. Find the current rating of the circuit breaker for an ambient temperature 20°C and 40°C respectively.

(8Marks)

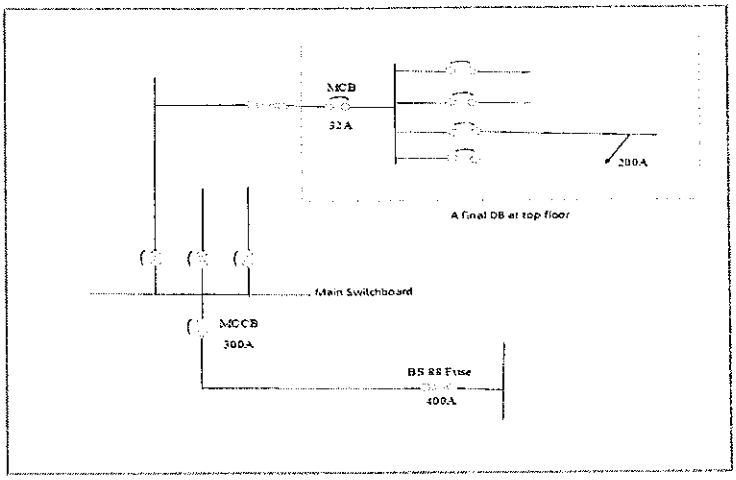


Figure 6: Schematic Diagram

(b) The low voltage supply to high risk block is shown in Figure 6. A short circuit occur inside the final distribution board at the top floor. The fault current is 200A. Calculate the operating time of the incoming protective device at the final DB under the following assumption:

(i) A type B MCB rated at 32A.

(3 marks)

(ii) A type 3 MCB rated at 32A.

(3 marks)

(iii) A RCCB rated at 40A with In= 0.03A

(4 marks)

(c) Base on question (5b) evaluate the operating time of MCCB rated at 300A at the main switchboard of the block.

(7 marks)

END OF EXAMINATION PAPER

Appendix 1: Table 4D1B

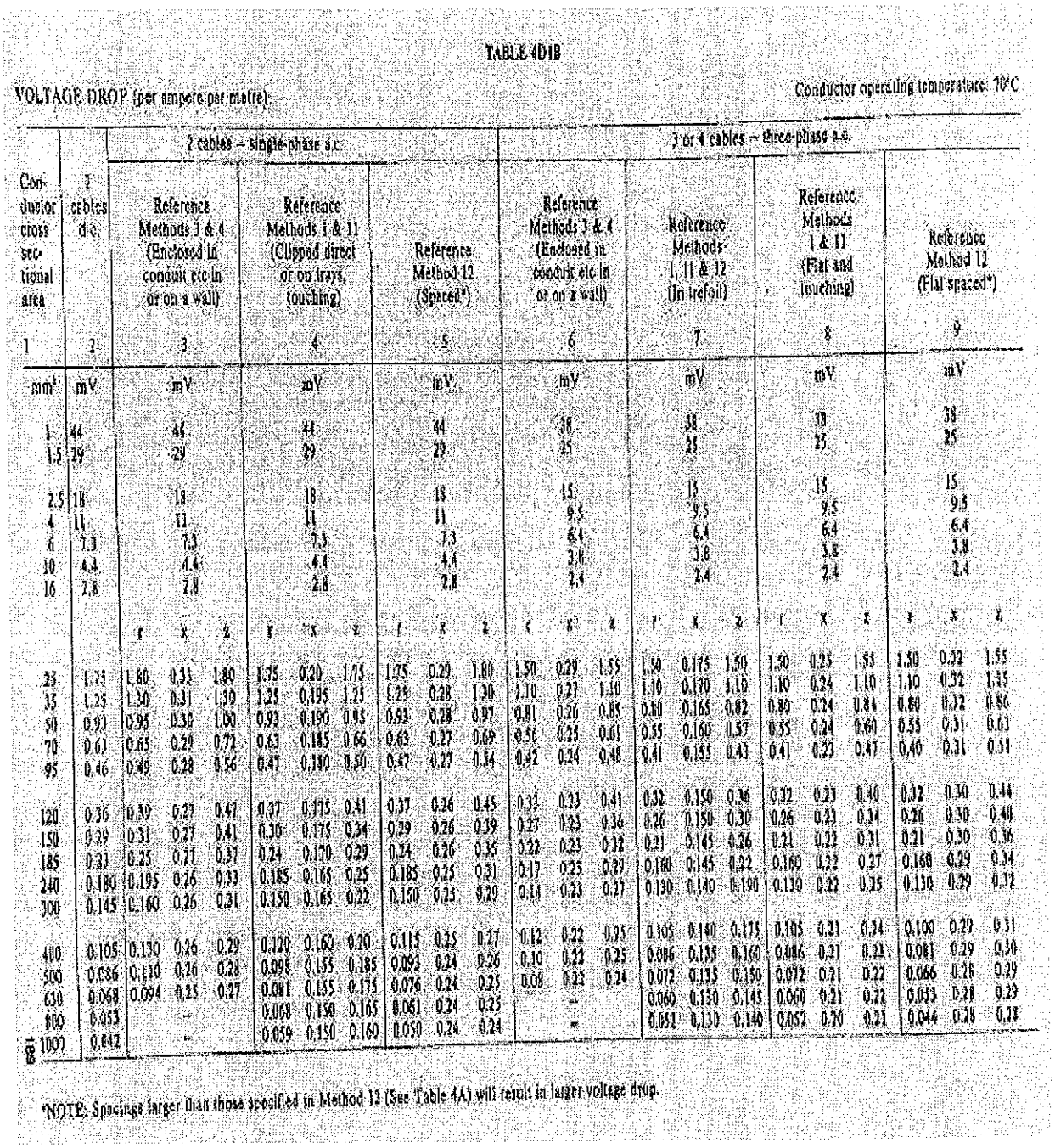


TABLE 4D1B

VOLTAGE DROP (per ampere per metre)

Conductor operating temperature: 70°C

Conductor cross-sectional area	2 cables d.c.	2 cables – single-phase a.c.								3 or 4 cables – three-phase a.c.								
		Reference Methods 3 & 4 (Enclosed in conduit etc in or on a wall)			Reference Methods 1 & 11 (Clipped direct or on trays, touching)			Reference Method 12 (Spaced*)			Reference Methods 3 & 4 (Enclosed in conduit etc in or on a wall)			Reference Methods 1, 11 & 12 (In trefoil)			Reference Methods 1 & 11 (Flat and touching)			Reference Method 12 (Flat spaced*)		
1	2	3			4			5			6			7			8			9		
mm²	mV	mV			mV			mV			mV			mV			mV			mV		
1	44	44			44			44			38			38			38			38		
1.5	29	29			29			29			25			25			25			25		
2.5	18	18			18			18			15			15			15			15		
4	11	11			11			11			9.5			9.5			9.5			9.5		
6	7.3	7.3			7.3			7.3			6.4			6.4			6.4			6.4		
10	4.4	4.4			4.4			4.4			3.8			3.8			3.8			3.8		
16	2.8	2.8			2.8			2.8			2.4			2.4			2.4			2.4		
		r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z	r	x	z
25	1.73	1.60	0.33	1.80	1.75	0.20	1.75	1.75	0.29	1.80	1.50	0.29	1.55	1.50	0.175	1.50	1.50	0.25	1.55	1.50	0.32	1.55
35	1.25	1.30	0.31	1.30	1.25	0.195	1.25	1.25	0.28	1.30	1.10	0.27	1.10	1.10	0.170	1.10	1.10	0.24	1.10	1.10	0.32	1.15
50	0.93	0.95	0.30	1.00	0.93	0.190	0.95	0.93	0.28	0.97	0.81	0.26	0.85	0.80	0.165	0.82	0.80	0.24	0.84	0.80	0.32	0.86
70	0.63	0.65	0.29	0.72	0.63	0.185	0.66	0.63	0.27	0.69	0.56	0.25	0.61	0.55	0.160	0.57	0.55	0.24	0.60	0.55	0.31	0.63
95	0.46	0.49	0.28	0.56	0.47	0.180	0.50	0.47	0.27	0.54	0.42	0.24	0.48	0.41	0.155	0.43	0.41	0.23	0.47	0.40	0.31	0.51
120	0.36	0.39	0.27	0.47	0.37	0.175	0.41	0.37	0.26	0.45	0.33	0.23	0.41	0.32	0.150	0.36	0.32	0.23	0.40	0.32	0.30	0.44
150	0.29	0.31	0.27	0.41	0.30	0.175	0.34	0.29	0.26	0.39	0.27	0.23	0.36	0.26	0.150	0.30	0.26	0.23	0.34	0.26	0.30	0.40
185	0.23	0.25	0.27	0.37	0.24	0.170	0.29	0.24	0.26	0.35	0.22	0.23	0.32	0.21	0.145	0.26	0.21	0.22	0.31	0.21	0.30	0.36
240	0.180	0.195	0.26	0.33	0.185	0.165	0.25	0.185	0.25	0.31	0.17	0.23	0.29	0.160	0.145	0.22	0.160	0.22	0.27	0.160	0.29	0.34
300	0.145	0.160	0.26	0.31	0.150	0.165	0.22	0.150	0.25	0.29	0.14	0.23	0.27	0.130	0.140	0.190	0.130	0.22	0.35	0.130	0.29	0.32
400	0.105	0.130	0.26	0.29	0.120	0.160	0.20	0.115	0.25	0.27	0.12	0.22	0.25	0.105	0.140	0.175	0.105	0.21	0.34	0.100	0.29	0.31
500	0.086	0.110	0.26	0.28	0.098	0.155	0.185	0.093	0.24	0.26	0.10	0.22	0.25	0.086	0.135	0.160	0.086	0.21	0.33	0.081	0.29	0.30
630	0.068	0.094	0.25	0.27	0.081	0.155	0.175	0.076	0.24	0.25	0.08	0.22	0.24	0.072	0.135	0.150	0.072	0.21	0.32	0.066	0.28	0.29
800	0.053		–		0.068	0.150	0.165	0.061	0.24	0.25		–		0.060	0.130	0.145	0.060	0.21	0.32	0.053	0.28	0.29
1000	0.042		–		0.059	0.150	0.160	0.050	0.24	0.24		–		0.052	0.130	0.140	0.052	0.20	0.31	0.044	0.28	0.28

*NOTE: Spacings larger than those specified in Method 12 (See Table 4A) will result in larger voltage drop.

Appendix 2: 4C1

TABLE 4C1

Correction factors for ambient temperature where protection is against short-circuit

NOTE: This table applies where the associated overcurrent protective device is intended to provide short circuit protection only. Except where the device is a semi enclosed fuse to BS 3036 the table also applies where the device is intended to provide overload protection.

Type of insulation	Operating temperature	Ambient temperature °C														
		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
Rubber (flexible cables only)	60°C	1.04	1.0	0.91	0.82	0.71	0.58	0.41	—	—	—	—	—	—	—	—
General purpose p.v.c.	70°C	1.03	1.0	0.94	0.87	0.79	0.71	0.61	0.50	0.35	—	—	—	—	—	—
Paper	80°C	1.02	1.0	0.95	0.89	0.84	0.77	0.71	0.63	0.55	0.45	0.32	—	—	—	—
Rubber	85°C	1.02	1.0	0.95	0.90	0.85	0.80	0.74	0.67	0.60	0.52	0.43	0.30	—	—	—
Heat resisting p.v.c.*	85°C	1.03	1.0	0.97	0.94	0.91	0.87	0.84	0.79	0.71	0.61	0.50	0.35	—	—	—
Thermosetting	90°C	1.02	1.0	0.96	0.91	0.87	0.82	0.76	0.71	0.65	0.58	0.50	0.41	0.29	—	—
Mineral	70°C sheath	1.03	1.0	0.93	0.85	0.77	0.67	0.57	0.45	0.31	—	—	—	—	—	—
	105°C sheath	1.02	1.0	0.96	0.92	0.88	0.84	0.80	0.75	0.70	0.65	0.60	0.54	0.47	0.40	0.32

NOTE: (i) Correction factors for flexible cords and for 85°C or 150°C rubber-insulated flexible cables are given in the relevant table of current-carrying capacity.
(ii) This table also applies when determining the current carrying capacity of a cable.
*These factors are applicable only to ratings in columns 2 to 5 of Table 4D1.

Appendix 3: Table 4C2

TABLE 4C2

Correction factors for ambient temperature where the overload protective device is a semi-enclosed fuse to BS3036.

Type of insulation	Operating temperature	Ambient temperature °C														
		25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
Rubber (flexible cables only)	60°C	1.04	1.0	0.96	0.91	0.87	0.79	0.56	—	—	—	—	—	—	—	—
General purpose p.v.c.	70°C	1.03	1.0	0.97	0.94	0.91	0.87	0.84	0.69	0.48	—	—	—	—	—	—
Paper	80°C	1.02	1.0	0.97	0.95	0.92	0.90	0.87	0.84	0.76	0.62	0.43	—	—	—	—
Rubber	85°C	1.02	1.0	0.97	0.95	0.93	0.91	0.88	0.86	0.83	0.71	0.58	0.41	—	—	—
Heat resisting p.v.c.*	85°C	1.03	1.0	0.97	0.94	0.91	0.87	0.84	0.80	0.76	0.72	0.68	0.49	—	—	—
Thermosetting	90°C	1.02	1.0	0.98	0.95	0.94	0.91	0.89	0.87	0.85	0.79	0.69	0.56	0.39	—	—
Mineral: Bare and exposed to touch or p.v.c. covered	70°C sheath	1.03	1.0	0.96	0.93	0.89	0.86	0.79	0.62	0.42	—	—	—	—	—	—
Bare and not exposed to touch	105°C sheath	1.02	1.0	0.98	0.96	0.93	0.91	0.89	0.86	0.84	0.82	0.79	0.77	0.64	0.55	0.43

NOTE: Correction factors for flexible cords and for 85°C or 150°C rubber-insulated flexible cables are given in the relevant table of current-carrying capacity.
* These factors are applicable only to ratings in columns 2 to 5 of Table 4D1.

Appendix 4: Table 4D1A

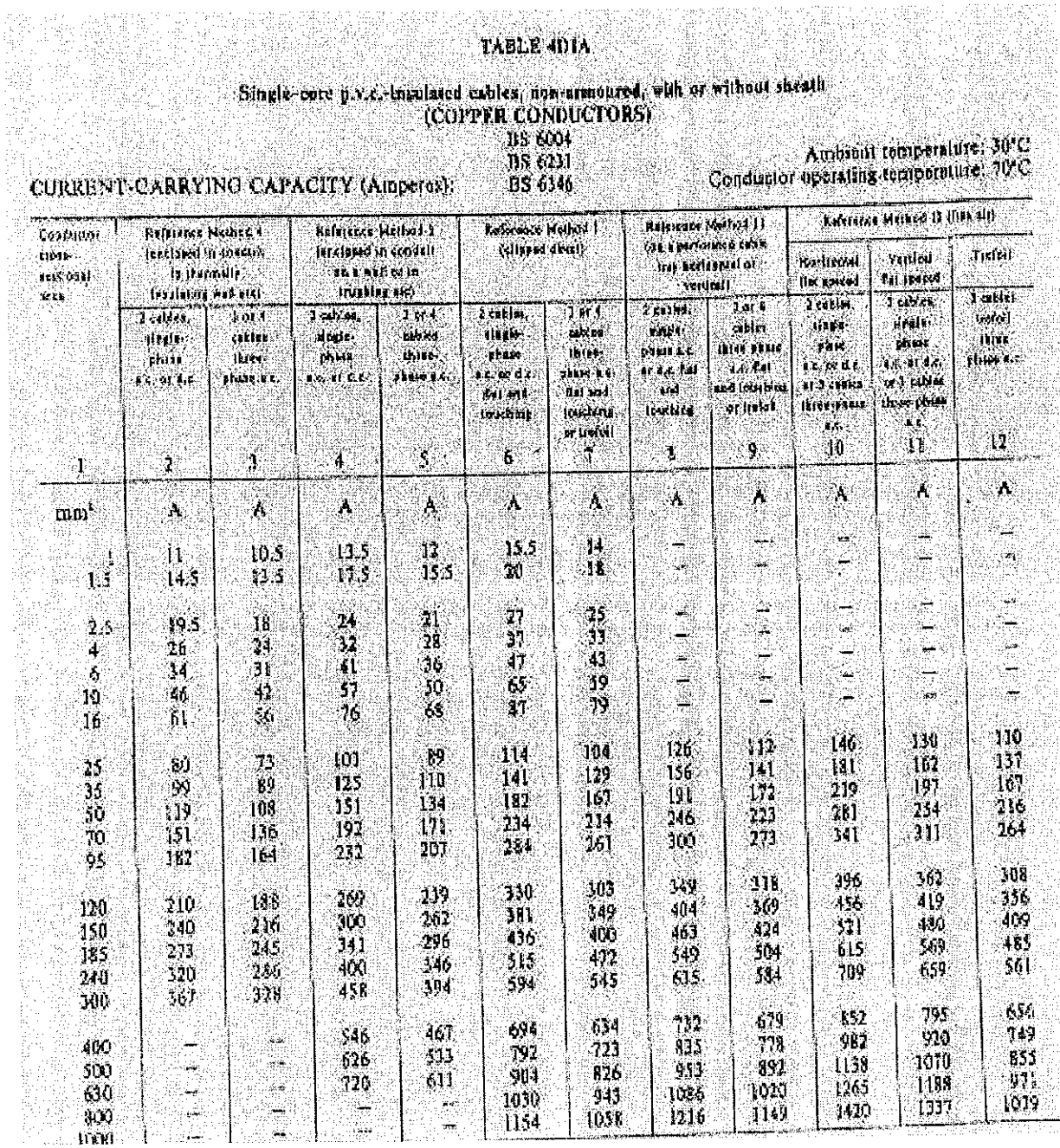


TABLE 4D1A

Single-core p.v.c.-insulated cables, non-armoured, with or without sheath
(COPPER CONDUCTORS)

BS 6004
BS 6231
CURRENT-CARRYING CAPACITY (Amperes): BS 6346

Ambient temperature: 30°C
Conductor operating temperature: 70°C

Conductor cross-sectional area	Reference Method 4 (enclosed in conduit in thermally insulating wall etc.)		Reference Method 3 (enclosed in conduit on a wall or in trunking etc.)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray horizontal or vertical)		Reference Method 13 (free air)		
									Horizontal (flat spaced)	Vertical (flat spaced)	Trefoil
	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.	2 cables, single-phase a.c. or d.c. (flat and touching)	3 or 4 cables three-phase a.c. (flat and touching or trefoil)	2 cables, single-phase a.c. or d.c. (flat and touching)	3 or 4 cables three-phase a.c. (flat and touching or trefoil)	2 cables, single-phase a.c. or d.c. or 3 cables three-phase a.c.	3 cables, single-phase a.c. or d.c. or 4 cables three-phase a.c.	3 cables (trefoil) three-phase a.c.
1	2	3	4	5	6	7	8	9	10	11	12
mm²	A	A	A	A	A	A	A	A	A	A	A
1	11	10.5	13.5	12	15.5	14	—	—	—	—	—
1.5	14.5	13.5	17.5	15.5	20	18	—	—	—	—	—
2.5	19.5	18	24	21	27	25	—	—	—	—	—
4	26	24	32	28	37	33	—	—	—	—	—
6	34	31	41	36	47	43	—	—	—	—	—
10	46	42	57	50	65	59	—	—	—	—	—
16	61	56	76	68	87	79	—	—	—	—	—
25	80	73	101	89	114	104	126	112	146	130	110
35	99	89	125	110	141	129	156	141	181	162	137
50	119	108	151	134	182	167	191	172	219	197	167
70	151	136	192	171	234	214	246	223	281	254	216
95	182	164	232	207	284	261	300	273	341	311	264
120	210	188	269	239	330	303	349	318	396	362	308
150	240	216	300	262	381	349	404	369	456	419	356
185	273	245	341	296	436	400	463	424	521	480	409
240	320	286	400	346	515	472	549	504	615	569	485
300	367	328	458	394	594	545	635	584	709	659	561
400	—	—	546	467	694	634	732	679	852	795	656
500	—	—	626	533	792	723	835	778	982	920	749
630	—	—	720	611	904	826	953	892	1138	1070	855
800	—	—	—	—	1030	943	1086	1020	1265	1188	971
1000	—	—	—	—	1154	1058	1216	1149	1420	1337	1079

Appendix 5: Table 4B1

TABLE 4B1

Correction factors for groups of more than one circuit of single-core cables, or more than one multicore cable (to be applied to the corresponding current-carrying capacity for a single circuit in Tables 4D1 to 4D4, 4E1 to 4E4, 4F1 and 4F2, 4J1, 4K1 to 4K4, 4L1 to 4L4)**

Reference method of installation (see Table 4A)		Correction factor (C_g) Number of circuits or multicore cables												
		2	3	4	5	6	7	8	9	10	12	14	16	18	20
Enclosed (Method 3 or 4) or bunched and clipped direct to a non-metallic surface (Method 1)		0.80	0.70	0.65	0.60	0.57	0.54	0.52	0.50	0.48	0.45	0.43	0.41	0.39	0.38
Single layer clipped to a non-metallic surface (Method 1)	Touching	0.85	0.79	0.75	0.73	0.72	0.72	0.71	0.70	–	–	–	–	–	–
	Spaced*	0.94	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Single layer multicore on a perforated metal cable tray, vertical or horizontal (Method 11)	Touching	0.86	0.81	0.77	0.75	0.74	0.73	0.73	0.72	0.71	0.70	–	–	–	–
	Spaced* #	0.91	0.89	0.88	0.87	0.87	–	–	–	–	–	–	–	–	–
Single layer single-core on a perforated metal cable tray, touching (Method 11)	Horizontal	0.90	0.85	–	–	–	–	–	–	–	–	–	–	–	–
	Vertical	0.85	–	–	–	–	–	–	–	–	–	–	–	–	–
Single layer multicore touching on ladder supports (Method 13)		0.86	0.82	0.80	0.79	0.78	0.78	0.78	0.77	–	–	–	–	–	–

* Spaced by a clearance between adjacent surfaces of at least one cable diameter (D_e). Where the horizontal clearance between adjacent cables exceeds $2D_e$, no correction factor need be applied.

Not applicable to Mineral Insulated Cables see Table 4B2.

** When cables having differing conductor operating temperatures are grouped together, the current rating shall be based upon the lowest operating temperature of any cable in the group.

Appendix 6: Table 4B2

TABLE 4B2

Correction factors for Mineral insulated Cables installed on Perforated Tray, (to be applied to the corresponding current carrying capacity for single circuits for reference method 11 in Table 4J1A)

Tray Orientation	Arrangement of cables	Number of Trays	Number of multicore cables or circuits					
			1	2	3	4	6	9
Horizontal	Multiconductor cables touching	1	1.0	0.90	0.80	0.80	0.75	0.75
Horizontal	Multiconductor cables spaced†	1	1.0	1.0	1.0	0.95	0.90	--
Vertical	Multiconductor cables touching	1	1.0	0.90	0.80	0.75	0.75	0.70
Vertical	Multiconductor cables spaced†	1	1.0	0.90	0.90	0.90	0.85	--
Horizontal	Single conductor cables trefoil separated††	1	1.0	1.0	0.95			
Vertical	Single conductor cables trefoil separated††	1	1.0	0.90	0.90			

† Separated by a clearance between adjacent surfaces of at least two cable diameters (2De).
†† Spaced by a clearance between adjacent surfaces of at least one cable diameter (De).

Notes to Tables 4B1 and 4B2

1. The factors in the table are applicable to groups of cables of one size. The value of current derived from application of the appropriate factors is the maximum current to be carried by any of the cables in the group.
2. If, due to known operating conditions, a cable is expected to carry not more than 30% of its grouped rating, it may be ignored for the purpose of obtaining the rating factor for the rest of the group.
   For example, a group of N loaded cables would normally require a group reduction factor of C_g applied to the tabulated it, however, if M cables in the group carry loads which are not greater than 0.3 C_g I, respectively the other cables can be sized by using the group rating factor corresponding to (N-M) cables.
3. Where cables having different conductor operating temperatures are grouped together, the current rating shall be based on the lowest of the operating temperature of any cable in the group.
4. Where the horizontal clearances between adjacent cables exceed 2De, no correction factor need be applied.

Appendix 7: Time Current Characteristic of MCB by BS 60898

Test	Type	Test Current	Initial Condition	Test Period	Result
1	B, C, D	1.13 I_N	Cold*	$t \geq 1$ h (for $I_N \leq 63$ A) $t \geq 2$ h (for $I_N > 63$ A)	No tripping
2	B, C, D	1.45 I_N	Right after Test 1	$t < 1$ h (for $I_N \leq 63$ A) $t < 2$ h (for $I_N > 63$ A)	Tripping
3	B, C, D	2.55 I_N	Cold *	1s < t < 60 s ($I_N \leq 32$ A) 1s < t < 120 s ($I_N > 32$ A)	Tripping
4	B C D	3 I_N 5 I_N 10 I_N	Cold *	$t \geq 0.1$ s (i.e. Instantaneous tripping does not occur)	No tripping
5	B C D	5 I_N 10 I_N 50 I_N	Cold *	$t < 0.1$ s (i.e. Instantaneous tripping occurs)	Tripping

* Cold means without previous loading and at 30^0C.

Maximum break time of RCCB

0.3s for residual current equal to $I_{\Delta N}$.

0.15s for residual current equal to $2\,I_{\Delta N}$.

0.04s for residual current equal to $5\,I_{\Delta N}$.

0.04s for residual current equal to 500A.

MCCB Standards (BS EN 60497)

Current rating : 10, 16, 20, 32, 40, 50, 63, 80, 100, 200, 300, 400, 630, 800, 1250A

Rated Breaking Capacity: 10, 20, 25, 35, 65, 85 kA (r.m.s)

Appendix 8: 4D2A

TABLE 4D2A

Multicore p.v.c.-insulated cables, non-armoured
(COPPER CONDUCTORS)

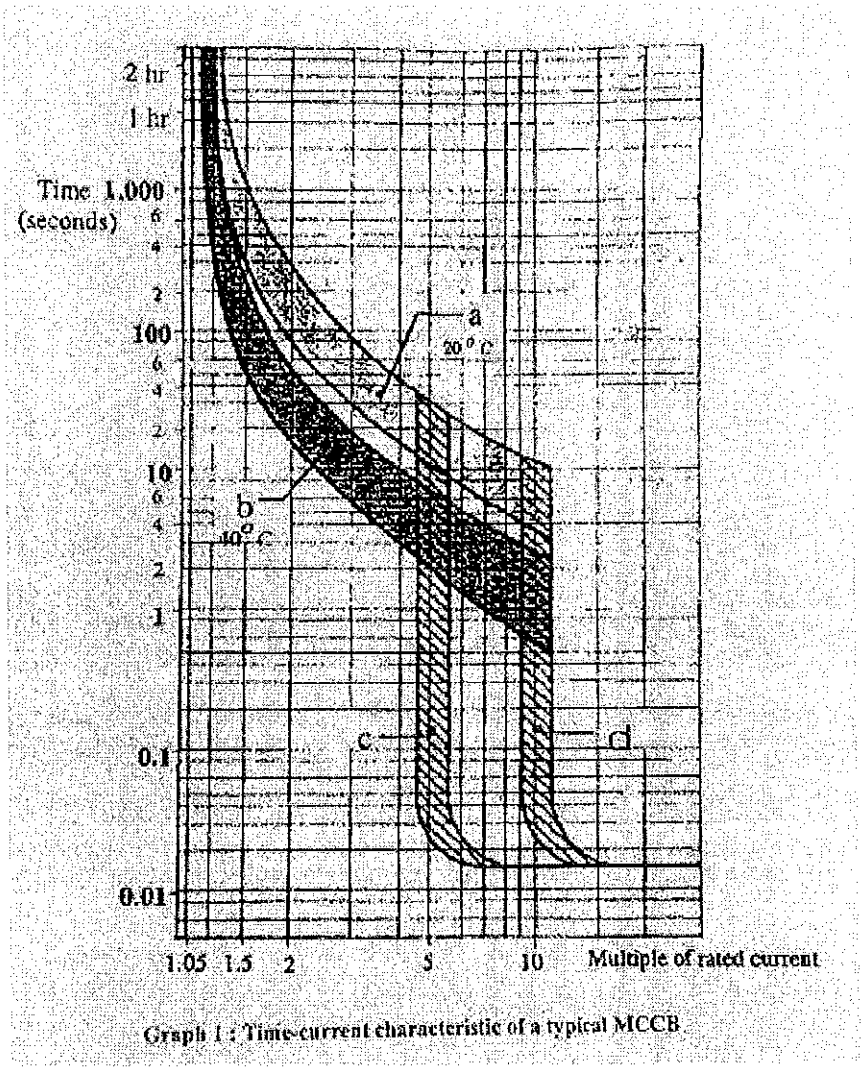
BS 6004
BS 6346

CURRENT-CARRYING CAPACITY (Amperes):

Ambient temperature: 30°C
Conductor operating temperature: 70°C

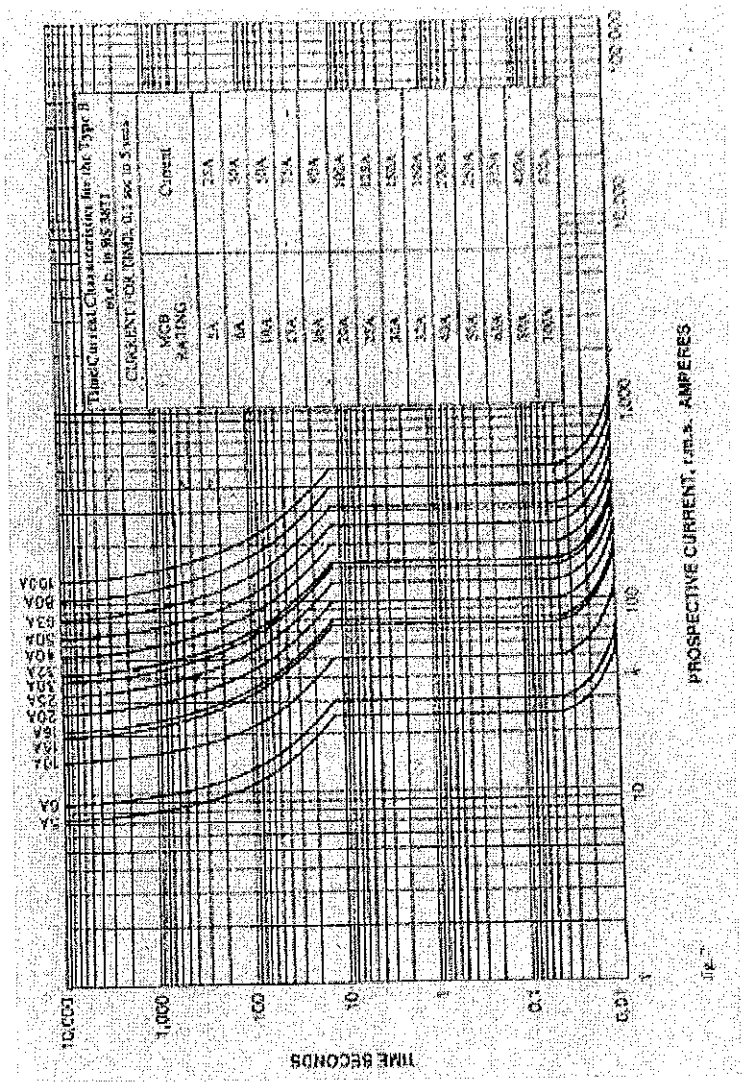
Conductor cross-sectional area	Reference Method 4 (enclosed in an insulated wall, etc)		Reference Method 3 (enclosed in conduit on a wall or ceiling, or in trunking)		Reference Method 1 (clipped direct)		Reference Method 11 (on a perforated cable tray), or Reference Method 13 (free air)	
	1 two-core cable* single-phase a.c. or d.c.	1 three-core cable* or 1 four-core cable, three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*, or 1 four-core cable, three-phase a.c.	1 two-core cable* single-phase a.c. or d.c.	1 three-core cable*, or 1 four-core cable, three-phase a.c.	1 two-core cable*, single-phase a.c. or d.c.	1 three-core cable*, or 1 four-core cable, three-phase a.c.
1	2	3	4	5	6	7	8	9
mm²	A	A	A	A	A	A	A	A
1	11	10	13	11.5	15	13.5	17	14.5
1.5	14	13	16.5	15	19.5	17.5	22	18.5
2.5	18.5	17.5	23	20	27	24	30	25
4	25	23	30	27	36	32	40	34
6	32	29	38	34	46	41	51	43
10	43	39	52	46	63	57	70	60
16	57	52	69	62	85	76	94	80
25	75	68	90	80	112	96	119	101
35	92	83	111	99	138	119	148	126
50	110	99	133	118	168	144	180	153
70	139	125	168	149	213	184	232	196
95	167	150	201	179	258	223	282	238
120	192	172	232	206	299	259	328	276
150	219	196	258	225	344	299	379	319
185	248	223	294	255	392	341	434	364
240	291	261	344	297	461	403	514	430
300	334	298	394	339	530	464	593	497
400	—	—	470	402	634	557	715	597

Appendix 9: Time Current Characteristic of a typical MCCB



Graph 1 : Time-current characteristic of a typical MCCB

Appendix 10: Graph Prospective Current r.m.s AMPERE



Appendix 10 : Table of Time Current Characteristic of MCB by BS 60898

Test	Type	Test Current	Initial Condition	Test Period	Result
1	B,C,D	1.13In	Cold	+≥1h(for In ≤ 63A) +≥2h(for In > 63A)	No Tripping
2	B,C,D	1.45In	Right after test 1	+≥1h(for In ≤ 63A) +≥2h(for In > 63A)	Tripping
3	B,C,D	2.25In	Cold	1s<+<60s (In≤32A) 1s<+<120s (In>32A)	Tripping
4	B C D	3 In 5In 10In	Cold	+≥0.1s (i.e instantaneous tripping does not occurs)	No Tripping
5	B C D	5In 10In 50In	Cold	+≥0.1s(i.e instantaneous tripping occurs)	Tripping