ER 90

Candidate Code No.	
For Board Use Only	
Result	Result
Date	Date
Int	Int

ELECTRICIANS REGULATIONS EXAMINATION

25 November 2017

QUESTION AND ANSWER BOOKLET

Time Allowed: Three hours

INSTRUCTIONS – READ CAREFULLY

You have 10 minutes to read this paper but do not start writing until you are told to do so by the supervisor.

Write your Candidate Code Number in the box provided above. Your name must NOT appear anywhere in this paper.

Answer all questions.

The pass mark for this examination is 60 marks.

Use a pen for written answers. **Do not** use pencils or red pens.

Drawing instruments and pencils may be used when diagrams are required. Marks are allocated based on correctness.

Do not use correcting fluid or correcting tape.

If a question can be answered from the Act, Regulations, Standard or Code of Practice it is recommended that the relevant clause or regulation number be stated in the reference space provided.

For calculation questions, all workings, including formulae, must be shown to gain full marks.

You will need to use the following documents in this examination:

- Electricity (Safety) Regulations 2010 reprint dated 4 April 2016.
- AS/NZS 3000:2007 (incorporating amendments 1 and 2)
- AS/NZS 3760:2010

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM

(turn over)

Question 1

(a) Refer to the Electricity (Safety) Regulations 2010 and state **ONE** situation where a fitting or electrical appliance is **deemed to be electrically safe** and it **does not** have a current tag issued in accordance with AS/NZS 3760.

(2 marks)

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Ref: .....

(b) Refer to the Electricity (Safety) Regulations 2010 and state **TWO** types of low voltage electrical installations that **must** comply with Part 2 of AS/NZS 3000.

(2 marks)

(1) _____

_____

_____

(2) _____

_____

_____

Ref: .....

(turn over)

Question 1 continued

(c) A low voltage electrical installation has been disconnected from the electricity supply for 1 year. No high risk or general risk prescribed electrical work has been done in that time.

Refer to the Electricity (Safety) Regulations 2010 and state **TWO** conditions for issuing a certificate in accordance with AS/NZ 3019.

(2 marks)

(1) _____

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(2) _____

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Ref: ……

(d) Use the Electricity (Safety) Regulations 2010 to answer the following:

(i) A warrant of electrical fitness for a caravan must be issued in accordance with which Standard.

(1 mark)

_____

Ref: ……

(ii) A warrant of electrical fitness for a pleasure vessel must be issued in accordance with which Standard.

(1 mark)

_____

Ref: ……

(turn over)

Question 1 continued

(e) Refer to AS/NZS 3000 and state the purpose of identifying a **common neutral** in a switchboard.

(2 marks)

_____

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Ref: .....

(f) AS/NZS 3000 details requirements for the **segregation of different voltage levels**.

Refer to AS/NZS 3000 and state the requirement for a **multi-core cable** incorporating low voltage and extra-low voltage conductors.

(2 marks)

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_____

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_____

Ref: .....

(turn over)

Question 1 continued

(g) Motors must be control by **devices for starting and stopping**.

Refer to AS/NZS 3000 and state **TWO** requirements for devices used for **stopping** a motor.

(2 marks)

(1) _____

_____

_____

_____

(2) _____

_____

_____

_____

Ref: ……

(h) Refer to AS/NZS 3000 and state the reason why equipotential bonding is carried out in an electrical installation.

(2 marks)

_____

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_____

Ref: ……

(turn over)

Question 1 continued

(i) (i) A 230V, 2.5 mm^2 twin and earth TPS socket outlet final subcircuit has a combined phase and earth conductor resistance of 1.02 Ω.

Refer to AS/NZS 3000 and state the type and rating of the MCB for this final subcircuit.

(1 mark)

_____

Ref: .....

(ii) A 230V, 2.5 mm^2 twin and earth TPS socket outlet final subcircuit has an earth fault loop impedance test result of 1.84 Ω.

Refer to AS/NZS 3000 and state the maximum current rating of the HRC fuse protecting the final subcircuit, if the maximum operating time of the fuse is 0.4s.

(1 mark)

_____

Ref: .....

(j) Refer to AS/NZS 3760 and state the main reason why the resistance of the protective earthing conductor of a 230V, Class I electrical appliance must be 1Ω or less.

(2 marks)

_____

_____

_____

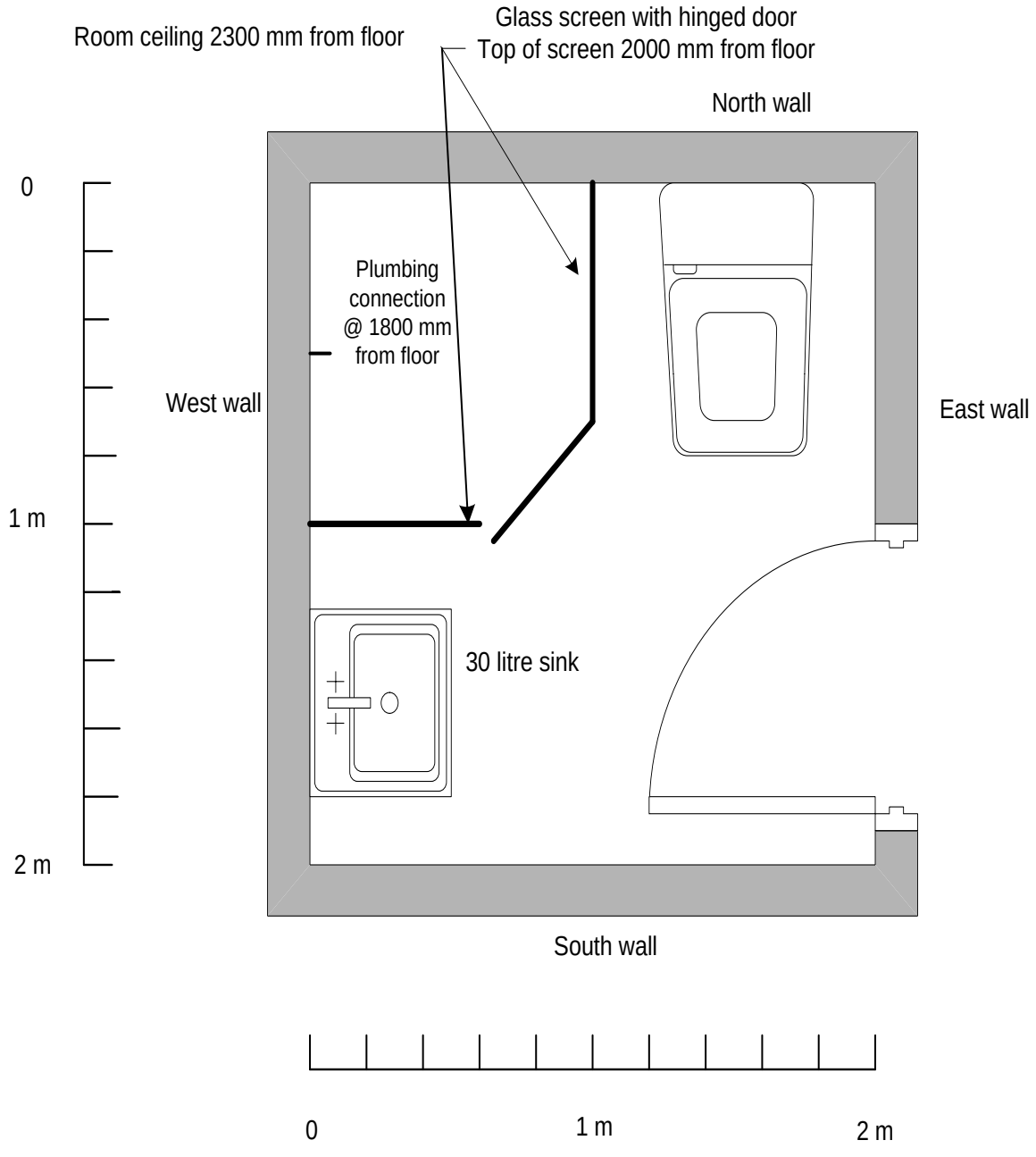
Ref: .....

(turn over)

Question 2

Introduction

This figure is a bathroom in a low voltage electrical installation.



Use the information in the introduction to this question and AS/NZS 3000: Section 6 to answer parts 2(a), 2(b) and 2(c).

(turn over)

Question 2 continued

(a) A **230V** light is to be installed on the ceiling in the centre of the room.

(i) On the figure in the introduction, draw the location of the light switch.
(1 mark)

(ii) State the Zone in which the light switch is located.
(1 mark)

_____

Ref: .....

(iii) State the degree of protection (IP rating) for the light switch.
(1 mark)

_____

Ref: .....

(b) A **230V** heated towel rail and permanent connection unit is to be installed in the bathroom.

(i) On the figure in the introduction, draw the location of the heated towel rail and permanent connection unit.
(1 mark)

(ii) State the Zone in which the heated towel rail and the permanent connection unit are located.
(1 mark)

_____

Ref: .....

(iii) State the degree of protection (IP rating) for the heated towel rail and the permanent unit connection.
(1 mark)

_____

Ref: .....

(turn over)

Question 2 continued

(c) A **230V** socket outlet is to be installed near the hand-basin (sink).

The socket outlet **must not** be in a cupboard.

(i) On the figure in the introduction, draw the location of the socket outlet.

(1 mark)

(ii) State the Zone in which the socket outlet is located.

(1 mark)

_____

Ref: .....

(iii) State the degree of protection (IP rating) for the socket outlet.

(1 mark)

_____

Ref: .....

(iv) State the minimum height from the floor the socket outlet can be installed.

(1 mark)

_____

Ref: .....

(turn over)

Question 3

Refer to AS/NZS 3000 and calculate the maximum demand in amps of a single-phase 230V **boarding house** with the following loads:

Number	Equipment
50	8W LED lights
10	75W fluorescent lights
4 metres	Lighting track
5	10A double socket outlets
20	10A single socket outlets
1	8 kW gas/electric cooker
1	6kW air conditioner
2	4 kW space heaters

Use the table on the following page for your calculations.

(10 marks)

Ref: .....

(turn over)

Question 3 continued

Equipment	Load Group	Calculation	Load (A)
50 8W LED lights			
10 75W fluorescent lights			
4 metres Lighting track			
5 10A double socket outlets			
20 10A single socket outlets			
1 8 kW gas/electric cooker			
1 6kW air conditioner			
2 4 kW space heaters			
Total			

Ref: ……..

(turn over)

Question 4

Introduction

The wiring in a **new** three-phase, low voltage, electrical installation in a commercial development has been completed.

The wiring complies with Part 2 of AS/NZS 3000.

Use the information in the introduction to this question and the Electricity (Safety) Regulations 2010: Part 5 to answer parts 4(a), 4(b) and 4(c).

(a) (i) Which certificate is required to be issued for the high-risk and general prescribed electrical work when the work is completed.

(1 mark)

_____

Ref: .....

(ii) Who is required to issue the certificate stated in (a)(i)?

(1 mark)

_____

_____

_____

Ref: .....

(iii) When can the general prescribed electrical work be treated as being completed?

(1 mark)

_____

_____

Ref: .....

(turn over)

Question 4 continued

(iv) When can the high-risk prescribed electrical work be treated as being completed?

(2 marks)

_____

_____

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Ref: .....

(b) (i) Which certificate must be issued once the electrical installation is completed?

(1 mark)

_____

_____

Ref: .....

(ii) State what the person issuing the certificate stated in (b)(i) is certifying on the certificate.

(1 mark)

_____

_____

Ref: .....

(iii) State when the work covered by the certificate stated in (b)(i) is considered to be completed.

(1 mark)

_____

_____

(turn over)

Question 4 continued

(iv) To whom must the certificate stated in (b)(i) be given?

(1 mark)

_____

_____

_____

Ref: .....

(c) State the Standard and section of that Standard that details the testing and inspection requirements for prescribed electrical work carried out on the electrical installation.

(1 mark)

_____

Ref: .....

(turn over)

Question 5

Use AS/NZS 3000: Section 2 to answer parts 5(a), 5(b), 5(c), 5(d) and 5(e).

(a) State **ONE** **general** requirement for the selection and installation of **switchgear and controlgear**.

(2 marks)

_____

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Ref: .....

(b) Section 2 details the **operating characteristics of equipment**.

State **ONE** operating characteristic of electrical equipment in relation to **current**.

(2 marks)

_____

_____

_____

_____

_____

_____

Ref: .....

(turn over)

Question 5 continued

(c) State **TWO** types of fittings that are suitable for protection against both **overload and short circuit currents**.

(2 marks)

(1) _____

_____

(2) _____

_____

Ref: .....

(d) State **TWO** types of protective devices (fittings) that can be used for **automatic disconnection of the supply**.

(2 marks)

(1) _____

_____

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_____

(2) _____

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Ref: .....

(turn over)

Question 5 continued

(e) State **ONE** situation where live parts may be exposed on a switchboard in a non-domestic electrical installation.

(2 marks)

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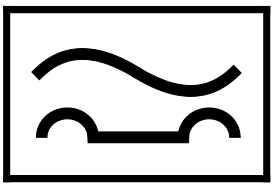
Ref: .....

(turn over)

Question 6

Use AS/NZS 3000: Section 2 to answer parts 6(a), 6(b), 6(c), 6(d), 6(e) and 6(f).

(a) This figure depicts a symbol found on an RCD.



(i) State the type of RCD identified by this symbol.

(1 mark)

_____

Ref: ……

(ii) Describe the operating characteristics of an RCD identified by this symbol.

(2 marks)

_____

_____

_____

_____

_____

_____

Ref: ……

(turn over)

Question 6 continued

(b) State **ONE** method of determining the load current rating of a RCD.

(1 mark)

_____

_____

_____

_____

Ref: .....

(c) A switchboard in an **existing** domestic electrical installation has no RCD protection on the final subcircuits.

State the requirement for RCD protection if the switchboard in the installation is replaced.

(2 marks)

_____

_____

_____

Ref: .....

(d) Three 10A MCBs protecting lighting final subcircuits are to be installed on a switchboard in a domestic electrical installation.

State the **minimum** number of RCCBs that must be installed.

(1 mark)

_____

Ref: .....

(turn over)

Question 6 continued

(e) Seven 20A MCBs protecting socket outlet final subcircuits are to be installed on a switchboard in a domestic electrical installation.

State the **minimum** number of RCCBs that must be installed.

(1 mark)

_____

Ref: .....

(f) Alterations and additions are being carried out in a domestic electrical installation.

State **TWO** circumstances where RCD protection is not required to be installed.

(2 marks)

(1) _____

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(2) _____

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Ref: .....

(turn over)

Question 7

Use of Class II equipment and limiting the fault current that can pass through a body are two methods of **fault protection (indirect contact)** in an electrical installation.

(a) Refer to AS/NZS 3000 and state the **TWO** other methods of **fault protection (indirect contact)** in an electrical installation

(2 marks)

(1) _____

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(2) _____

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_____

Ref: .....

(b) For each of the methods stated in (a), explain how the method achieves the safety outcome required.

(4 marks)

(1) _____

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(2) _____

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(turn over)

Question 7 continued

(c) For each of the methods stated in (a), refer to AS/NZS 3000 and explain the testing used to ensure that the method is operating correctly to provide the required protection.

(4 marks)

(1) _____

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(2) _____

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Ref: .....

(turn over)

Question 8

Use AS/NZS 3000: Section 5 to answer parts 8(a) and 8(b).

(a) (i) State how the **impedance** of **conductive sheaths, armours and screens of cables** is determined.

(2 marks)

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_____

_____

_____

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_____

Ref: .....

(ii) State the **ONE** requirement for exposed conductive parts that are connected to earth via **connecting devices** such as a plug and socket outlet arrangement.

(2 marks)

_____

_____

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_____

_____

Ref: .....

(turn over)

Question 8 continued

(b) State the requirement for the **earthing of electrical equipment supplied by flexible cord or flexible cable**.

(2 marks)

_____

_____

_____

_____

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Ref: .....

Use AS/NZS 3000: Section 6 to answer parts 8(c) and 8(d).

(c) State the **supplementary equipotential bonding** requirements for a swimming pool.

(2 marks)

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Ref: .....

(turn over)

Question 8 continued

(d) State **ONE** protective measure for preventing voltage gradients appearing in a swimming pool.

(2 marks)

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Ref: .....

(turn over)

Question 9

Introduction

A 230V, single-phase, 2-core and earth **aluminium** TPS cable is to be installed between a 400V, three-phase MEN switchboard and a 230V distribution switchboard.

- The cable route length is 30 metres.
  15 metres will be installed unenclosed (touching)
  15 metres will be buried direct.
- The maximum demand of the new load is 20 kW.
- The ambient **air** temperature is 30 ^{0}C.
- The ambient **soil** temperature is 15 ^{0}C.
- The maximum voltage drop permitted between the MEN switchboard and the distribution switchboard is 1.5%.
- The conductor temperature is assumed to be 75 ^{0}C

Use the information in the introduction to this question and from the tables on the following pages to answer parts 9(a), 9(b) and 9(c).

(a) Calculate the **minimum** size **aluminium** cable that will carry the load.
(3½ marks)

(turn over)

Question 9 continued

(b) Calculate the **minimum** size **aluminium** cable that meets the voltage drop requirements.

(5½ marks)

(c) State the **minimum** size **aluminium** cable that will meet the load and voltage drop requirements.

(1 mark)

_____

Question 9 continued

The following are extracts from AS/NZS 3008.1.2.

TABLE 10

CURRENT-CARRYING CAPACITIES

CABLE TYPE: **TWO-CORE SHEATHED**
Cable with or without earth core, armoured or unarmoured, including neutral screened cables

INSULATION TYPE **THERMOPLASTIC**

MAXIMUM CONDUCTOR TEMPERATURE **75^{0}C**

REFERENCE AMBIENT TEMPERATURE **30^{0}c IN AIR, 15^{0}C IN GROUND**

1	2	3	4	5	6	7	8	9	10	11	12	13
Conductor size	Current carrying capacity A											
	Unenclosed									Enclosed		
	Spaced			Touching			Exposed to sun			Wiring enclosure in air		
	Cu		Al	Cu		Al	Cu		Al	Cu		Al
mm^2	Solid/stranded	Flexible		Solid/stranded	Flexible		Solid/stranded	Flexible		Solid/stranded	Flexible	
1	17	18	-	16	17	-	13	14	-	15	15	-
1.5	22	23	-	21	21	-	16	16	-	18	19	-
2.5	31	30	-	30	29	-	23	22	-	26	26	-
4	42	40	-	39	38	-	31	30	-	34	33	-
6	52	51	-	50	48	-	39	36	-	44	43	-
10	73	72	-	68	67	-	52	51	-	59	58	-
16	97	95	75	91	89	71	68	67	54	78	78	59
25	129	125	100	122	119	95	90	88	71	103	99	80
35	158	156	123	149	146	115	111	107	86	128	124	99
50	194	195	150	181	184	141	132	133	103	152	153	117
70	245	245	190	229	230	178	165	165	128	194	193	150
95	302	293	234	283	275	219	200	194	155	233	226	180
120	350	347	272	328	325	255	230	227	179	275	269	213
150	400	397	310	374	372	291	259	257	202	309	304	239
185	459	450	358	430	422	335	294	287	229	357	348	278
240	544	536	425	508	500	398	342	335	268	415	420	325
300	624	612	489	583	572	457	386	377	303	483	473	380
400	719	725	570	671	676	532	438	438	348	549	570	437
500	816	830	656	762	773	611	489	491	393	640	643	514

(turn over)

Question 9 continued

TABLE 10 CONTINUED

CURRENT-CARRYING CAPACITIES

CABLE TYPE: **TWO-CORE SHEATHED**
Cable with or without earth core, armoured or unarmoured, including neutral screened cables

INSULATION TYPE **THERMOPLASTIC**

MAXIMUM CONDUCTOR TEMPERATURE **75^{0}C**

REFERENCE AMBIENT TEMPERATURE **30^{0}c IN AIR, 15^{0}C IN GROUND**

14	15	16	17	18	19	20	21	22	23	24	25	26	27
Conductor size	Current carrying capacity A												
	Thermal insulation								Buried direct		Underground wiring enclosure		
	Partially surrounded by thermal insulation, unenclosed		Partially surrounded by thermal insulation, in a wiring enclosure		Completely surrounded by thermal insulation, unenclosed		Completely surrounded by thermal insulation, in a wiring enclosure						
mm^2	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu		Al
											Solid / stranded	Flexible	
1	13	-	11	-	8	-	7	-	19	-	19	20	-
1.5	16	-	15	-	10	-	9	-	23	-	23	24	-
2.5	23	-	22	-	15	-	14	-	33	-	33	32	-
4	31	-	27	-	19	-	17	-	43	-	43	42	-
6	40	-	35	-	25	-	23	-	55	-	55	53	-
10	55	-	48	-	34	-	30	-	73	-	73	72	-
16	73	56	62	48	46	35	39	30	125	97	95	94	73
25	97	75	82	64	60	47	51	40	162	125	123	119	96
35	120	92	103	80	74	58	64	49	196	152	150	146	117
50	145	113	122	95	-	-	-	-	232	179	178	179	139
70	184	143	155	120	-	-	-	-	285	221	222	222	173
95	226	176	186	145	-	-	-	-	342	265	267	260	208
120	262	204	219	171	-	-	-	-	391	304	310	305	242
150	300	233	247	192	-	-	-	-	438	340	349	344	271
185	344	268	285	222	-	-	-	-	494	385	399	388	311
240	407	318	332	260	-	-	-	-	572	447	463	461	362
300	466	366	388	303	-	-	-	-	645	506	531	519	417
400	537	425	440	349	-	-	-	-	729	579	603	616	477
500	609	489	512	410	-	-	-	-	815	655	691	692	554

(turn over)

Question 9 continued

TABLE 13

CURRENT-CARRYING CAPACITIES

CABLE TYPE: **THREE-CORE AND FOUR-CORE**
Cable with or without earth core, armoured or unarmoured, including neutral screened cables

INSULATION TYPE **THERMOPLASTIC**

MAXIMUM CONDUCTOR TEMPERATURE **75^{0}C**

REFERENCE AMBIENT TEMPERATURE **30^{0}c IN AIR, 15^{0}C IN GROUND**

1	2	3	4	5	6	7	8	9	10	11	12	13
Conductor size	**Current carrying capacity A**											
	Unenclosed									**Enclosed**		
	Spaced			**Touching**			**Exposed to sun**			**Wiring enclosure in air**		
	Cu		**Al**	**Cu**		**Al**	**Cu**		**Al**	**Cu**		**Al**
mm²	**Solid / stranded**	**Flexible**		**Solid / stranded**	**Flexible**		**Solid / stranded**	**Flexible**		**Solid / stranded**	**Flexible**	
1	15	15	-	14	15	-	10	11	-	13	13	-
1.5	18	19	-	17	18	-	14	14	-	16	16	-
2.5	26	25	-	25	24	-	19	18	-	23	22	-
4	35	34	-	33	32	-	26	25	-	29	27	-
6	46	43	-	42	41	-	33	32	-	38	36	-
10	62	62	-	58	58	-	44	43	-	50	49	-
16	82	81	64	78	76	60	58	57	46	66	65	51
25	111	107	86	104	101	81	76	74	59	87	83	67
35	137	133	106	128	125	99	93	91	73	107	105	83
50	166	169	129	156	157	121	113	114	88	128	128	99
70	211	211	163	196	197	153	140	140	109	162	162	127
95	260	253	202	243	236	188	171	165	132	202	196	156
120	302	299	235	282	278	219	196	193	153	230	227	179
150	345	343	268	321	319	250	221	219	172	260	261	202
185	397	390	310	369	363	288	251	245	196	300	293	235
240	470	464	368	437	431	343	292	286	228	360	352	283
300	538	529	424	499	490	393	328	321	259	-	-	-
400	620	626	495	575	579	458	372	372	296	-	-	-
500	702	715	568	651	661	526	414	416	335	-	-	-

(turn over)

Question 9 continued

TABLE 13 CONTINUED

CURRENT-CARRYING CAPACITIES

CABLE TYPE: **THREE-CORE AND FOUR-CORE**
Cable with or without earth core, armoured or unarmoured, including neutral screened cables

INSULATION TYPE **THERMOPLASTIC**

MAXIMUM CONDUCTOR TEMPERATURE **75^{0}C**

REFERENCE AMBIENT TEMPERATURE **30^{0}c IN AIR, 15^{0}C IN GROUND**

14	15	16	17	18	19	20	21	22	23	24	25	26	27
Conductor size	Current carrying capacity A												
	Thermal insulation								Buried direct		Underground wiring enclosure		
	Partially surrounded by thermal insulation, unenclosed		Partially surrounded by thermal insulation, in a wiring enclosure		Completely surrounded by thermal insulation, unenclosed		Completely surrounded by thermal insulation, in a wiring enclosure						
mm^2	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu	Al	Cu		Al
											Solid / stranded	Flexible	
1	10	-	10	-	7	-	6	-	15	-	15	17	-
1.5	14	-	13	-	9	-	8	-	20	-	20	20	-
2.5	18	-	18	-	13-	-	11	-	28	-	28	26	-
4	26	-	23	-	17	-	15	-	36	-	36	35	-
6	34	-	30	-	22	-	18	-	46	-	46	44	-
10	47	-	40	-	29	-	25	-	61	-	61	59	-
16	62	48	54	41	39	30	33	26	106	83	80	78	62
25	83	65	68	54	52	40	43	33	138	107	103	100	80
35	103	79	86	66	64	49	54	41	165	129	125	123	98
50	124	97	101	79	-	-	-	-	196	152	150	151	116
70	157	122	130	100	-	-	-	-	241	187	187	186	145
95	194	150	162	125	-	-	-	-	289	224	229	221	177
120	226	176	185	144	-	-	-	-	330	256	261	255	202
150	258	200	207	162	-	-	-	-	370	287	293	292	228
185	295	231	241	188	-	-	-	-	417	326	334	326	261
240	350	274	288	226	-	-	-	-	482	378	395	386	309
300	-	-	-	-	-	-	-	-	542	427	444	433	350
400	-	-	-	-	-	-	-	-	613	488	515	514	411
500	-	-	-	-	-	-	-	-	682	551	574	575	464

(turn over)

Question 9 continued

Table 27(1)

VARIANCE: AIR AND CONCRETE SLAB AMBIENT TEMPERATURES

INSTALLATION CONDITIONS: CABLES IN AIR OR HEATED CONCRETE SLAB

1	2	3	4	5	6	7	8	9	10	11
Conductor temperature ^0C	Rating Factor									
	Air and concrete slab ambient temperature									
	15	20	25	30	35	40	45	50	55	60
150	1.07	1.05	1.03	1.00	0.98	0.96	0.94	0.91	0.89	0.87
110	1.08	1.06	1.03	1.00	0.97	0.93	0.90	0.87	0.83	0.79
90	1.15	1.09	1.05	1.00	0.95	0.91	0.85	0.80	0.74	0.66
80	1.17	1.12	1.06	1.00	0.95	0.89	0.82	0.75	0.68	0.59
75	1.18	1.12	1.06	1.00	0.94	0.88	0.80	0.72	0.63	0.53

Table 27(2)

VARIANCE: SOIL AMBIENT TEMPERATURES

INSTALLATION CONDITIONS: CABLES BURIED DIRECT IN GROUND OR IN UNDERGROUND WIRING ENCLOSURES

1	2	3	4	5	6	7	8
Conductor temperature ^0C	Rating Factor						
	Soil ambient temperature						
	10	15	20	25	30	35	40
110	1.02	1.00	0.97	0.94	0.92	0.89	0.86
90	1.04	1.00	0.96	0.93	0.91	0.87	0.83
80	1.04	1.00	0.95	0.92	0.88	0.83	0.78
75	1.04	1.00	0.95	0.91	0.86	0.81	0.75

(turn over)

Question 9 continued

Table 42

THREE-PHASE VOLTAGE DROP *(V_c)* at 50 Hz

CABLE TYPE: MULTICORE WITH CIRCULAR COPPER CONDUCTORS

Conductor size mm²	Three-phase voltage drop (V_c) at 50 Hz, mV/A.m									
	Conductor temperature, °C									
	45		60		75		90		110	
	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.
1	40.3	-	42.5	-	44.7	-	46.8	-	49.7	-
1.5	25.9	-	27.3	-	28.6	-	30.0	-	31.9	-
2.5	14.1	-	14.9	-	15.6	-	16.4	-	17.4	-
4	8.77	-	9.24	-	9.71	-	10.2	-	10.8	-
6	5.86	-	6.18	-	6.49	-	6.80	-	7.22	-
10	3.49	-	3.67	-	3.86	-	4.05	-	4.29	-
16	2.19	-	2.31	-	2.43	-	2.55	-	2.70	-
25	1.39	-	1.47	-	1.54	-	1.61	-	1.71	-
35	1.01	-	1.06	-	1.11	-	1.17	-	1.24	-
50	0.751	-	0.790	-	0.829	-	0.868	-	0.920	-
70	0.530	-	0.556	-	0.583	-	0.609	-	0.645	-
95	0.394	-	0.413	-	0.431	-	0.450	-	0.475	-
120	0.323	-	0.337	-	0.351	-	0.366	-	0.385	-
150	0.274	-	0.285	-	0.296	-	0.307	-	0.322	-
185	0.234	-	0.242	-	0.251	-	0.259	-	0.271	-
240	0.198	0.198	0.204	0.204	0.210	0.210	0.216	0.216	0.224	-
300	0.178	0.175	0.182	0.180	0.186	0.185	0.190	0.189	0.196	0.196
400	0.162	0.157	0.165	0.160	0.168	0.164	0.171	0.167	0.175	0.172
500	0.152	0.143	0.154	0.146	0.156	0.148	0.158	0.151	0.160	0.155

Note: To convert to single-phase values multiply the three-phase value by 1.155

Table 45
THREE-PHASE VOLTAGE DROP (V_c) at 50 Hz

CABLE TYPE: MULTICORE WITH CIRCULAR ALUMINIUM CONDUCTORS

Conductor size mm²	Three-phase voltage drop (V_c) at 50 Hz, mV/A.m									
	Conductor temperature, °C									
	45		60		75		90		110	
	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.	Max.	0.8 p.f.
16	3.64	-	3.84	-	4.04	-	4.11	-	4.24	-
25	2.29	-	2.42	-	2.54	-	2.59	-	2.67	-
35	1.66	-	1.75	-	1.84	-	1.87	-	1.93	-
50	1.23	-	1.30	-	1.36	-	1.39	-	1.43	-
70	0.856	-	0.902	-	0.948	-	0.966	-	0.993	-
95	0.626	-	0.659	-	0.691	-	0.706	-	0.723	-
120	0.501	-	0.527	-	0.552	-	0.565	-	0.577	-
150	0.416	-	0.436	-	0.457	-	0.468	-	0.476	-
185	0.341	-	0.357	-	0.373	-	-	-	0.388	-
240	0.274	-	0.285	-	0.297	-	-	-	0.307	-
300	0.233	-	0.242	-	0.251	-	-	-	0.258	-
400	0.200	0.200	0.206	0.206	0.212	-	-	-	0.216	-
500	0.178	0.176	0.182	0.181	0.186	0.185	-	-	0.189	0.189

Note: To convert to single-phase values multiply the three-phase value by 1.155

(turn over)

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In the box, write the number of **EXTRA** sheets you have used. Write **NIL** if you have not used any

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