



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

ELECTRICIANS REGULATIONS EXAMINATION

26 November 2016

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.

It is recommended that the reference source for your answers be included in the space provided if a question can be answered from the Act, Regulations, Standard or Code of Practice. However, just stating a reference only will earn no marks.

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

Warning – You could get 0 marks for any question, or part of a question, if you show anything hazardous or dangerous in your answer.

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

- Electricity (Safety) Regulations 2010 reprint dated 1 August 2014 **or** the Electricity (Safety) Regulations reprint dated 4 April 2016.
- AS/NZS 3000:2007 (incorporating amendments 1 and 2)

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 an **RCD installed for the protection of property** is deemed to be **electrically unsafe**.

(2 marks)

Ref:

- (b) Refer to the Electricity (Safety) Regulations 2010 and state the permitted minimum and maximum voltage at the point of supply for a standard low voltage, single-phase installation.

(2 marks)

Minimum voltage _____
Maximum voltage _____

Ref:

- (c) Refer to the Electricity (Safety) Regulations 2010 and state **ONE offence** relating to **certificates of compliance** that is liable to a level 2 penalty.

(2 marks)

Ref:

(turn over)

Question 1 continued

- (d) A caravan (connectable installation) is required to have a current warrant of electrical fitness.

Refer to the Electricity (Safety) Regulations 2010 and state **ONE** situation where a person must ensure that a caravan has a current warrant of electrical fitness.

(2 marks)

Ref:

- (e) Refer to AS/NZS 3000 and state the **TWO touch voltage** limits that, if exceeded, a protective device must automatically disconnect the supply.
(2 marks)

Ref:

- (f) Refer to AS/NZS 3000 and state **ONE** consideration that must be taken into account when **connecting aluminium conductors**.
(2 marks)

Ref:

(turn over)

Question 1 continued

- (g) AS/NZS 3000 sets requirements where there are **socket outlets of different systems**.

Refer to AS/NZS 3000 and state **ONE** requirement for a socket outlet supplied at ELV where an ELV electrical installation and an electrical installation of greater than ELV are in the same premises.

(2 marks)

Ref:

- (h) A **step-up transformer** is used in a commercial installation to supply a neon sign that operates at a voltage **higher** than the voltage at the point of supply.

Refer to AS/NZS 3000 and state the requirement for this arrangement.

(2 marks)

Ref:

(turn over)

Question 1 continued

- (i) Refer to AS/NZS 3000 and state **ONE** situation where conductive fittings and fixtures of a swimming pool are required to be **equipotentially bonded**.

(2 marks)

Ref:

- (j) Refer to AS/NZS 3000 and state the **specific** inspections required to be carried out on the **protective devices** installed on **switchboards**.

(2 marks)

Ref:

(turn over)

Question 2

Selection and installation of wiring systems must be carried out so that the systems are safe and do not cause detrimental effects on other systems.

- (a) Refer to AS/NZS 3000 and state **ONE** situation where **colour identification by sleeving or other means** can be used. (2 marks)

Ref:

- (b) AS/NZS 3000 details **exceptions and special applications** regarding the use of colour identification of conductors.

Refer to AS/NZS 3000 and state the requirement where the screen of a multicore cable is used as a protective earthing conductor.

(2 marks)

Ref:

(turn over)

Question 2 continued

(c) Segregation of different voltage levels.

- (i) Refer to AS/NZS 3000 and state **ONE** method of ensuring segregation between extra-low voltage cables and low voltage cables.

(2 marks)

Ref:

- (ii) State **ONE** reason why the method stated in (c)(i) is used.

(2 marks)

- (d) Refer to AS/NZS 3000 and state **ONE** requirement for rigid PVC conduit that is installed in direct sunlight.

(2 marks)

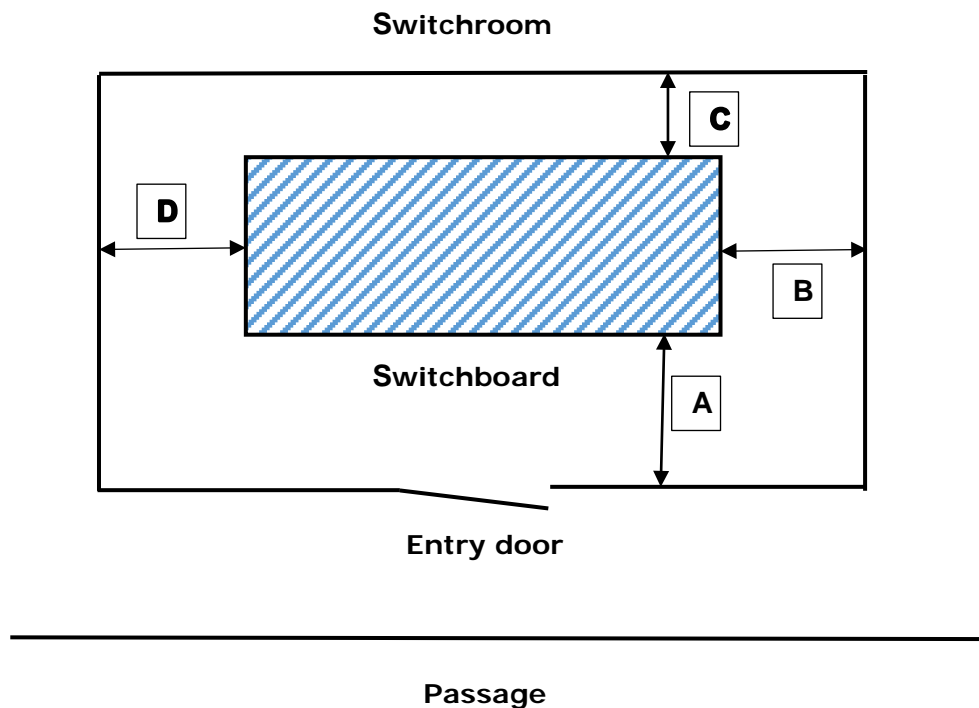
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Question 3

Introduction

This figure is a plan of a MEN main switchboard to be installed in a switchroom located in the middle of a shopping mall that is under construction. Your task is to ensure the dimensions of the switchroom meet the requirements of AS/NZS3000.



The installation conditions are:

- The switchboard is 2.7 metres long and 1.5 metres wide and is rated at 600 A.
- The switchboard is in the centre of the room so access can be gained to all sides.
- There are two 900 mm wide switchboard doors facing the entry door.
- Entry to the room is through a single door located in a passage.

Use the information in the introduction of this question to answer parts 3(a), 3(b) and 3(c).

(turn over)

Question 3 continued

- (a) To determine the size of the switchroom the dimensions A, B, C and D need to be calculated.

Each dimension must include the unimpeded space from the switchboard required by AS/NZS 3000 **plus 1 metre**.

- (i) Refer to AS/NZS 3000 and calculate the dimension for A. (1½ marks)

Ref:

- (ii) Refer to AS/NZS 3000 and calculate the dimension for B. (1½ marks)

Ref:

- (iii) Refer to AS/NZS 3000 and calculate the dimension for C. (1½ marks)

Ref:

- (iv) Refer to AS/NZS 3000 and the dimension for D. (1½ marks)

Ref:

(turn over)

Question 3 continued

(b) (i) Use the dimensions for A, C and the width of the switchboard to calculate the **width** of the **switchroom**.

(1½ marks)

(ii) Use the dimensions for B, D and the length of the switchboard to calculate the **length** of the **switchroom**.

(1½ marks)

(c) Refer to AS/NZS 3000 and state the minimum permitted dimensions of the entry door to the switchroom.

(1 mark)

Ref:

(turn over)

Question 4

Clause 1.5 of AS/NZS 3000 states:

Persons and livestock shall be protected against dangers that may arise from contact with parts of the electrical installation which are live in normal service (direct contact).

- (a) **Placing out of reach** is a permitted method for protection against direct contact.

Refer to AS/NZS 3000 and state **TWO** requirements for protection by **placing out of reach**.

(2 marks)

(1) _____

(2) _____

Ref:

- (b) **Barriers and placing out of reach** are two permitted methods for protection against direct contact.

Refer to AS/NZS 3000 and state the **TWO** other permitted methods for protection against direct contact.

(2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 4 continued

- (c) The use of **barriers** is a permitted method for protection against direct contact. Barriers must be constructed so they cannot be opened or removed by unauthorised persons.

Refer to AS/NZS 3000 and state **TWO** methods that can be used to prevent the opening or removal of a **barrier** by an unauthorised person.

(2 marks)

(1) _____

(2) _____

Ref:

- (d) A barrier is installed that has a rating of IP24.

- (i) Refer to AS/NZS 3000 and state the degree of protection provided by the **first number** of the IP 24 barrier.

(2 marks)

Ref:

- (ii) Refer to AS/NZS 3000 and state the degree of protection provided by the **second number** of the IP 24 barrier.

(2 marks)

Ref:

(turn over)

Question 5

Introduction

The final subcircuit electrical protection on a modular switchboard in a new domestic residence is:

- 1 32A MCB
- 8 20A MCBs
- 1 16A MCB
- 2 10A MCBs
- 3 40A RCCBs

The final subcircuit cables requiring connection to electrical protection are:

- 1 6 mm² twin and earth TPS cable supplying a free-standing oven socket outlet.
- 1 1.5 mm² twin and earth TPS cable supplying a permanently-connected storage water heater
- 1. 2.5 mm² twin and earth TPS **submain** cable supplying a garage distribution switchboard.
- 1. 2.5 mm² twin and earth TPS cable supplying a permanently-connected hair-dryer in a bathroom
- 5. 1.5 mm² twin and earth TPS cables supply lights
- 14 2.5 mm² twin and earth TPS cables supplying socket outlets

Use the information in the introduction to this question to answer parts 5(a), 5(b), 5(c) and 5(d).

- (a) Refer to AS/NZS 3000 and state the **arrangement** of **lighting** final circuits connected to RCDs in an electrical installation.

(2 marks)

Ref:

(turn over)

Question 5 continued

- (b) Refer to AS/NZS 3000 and state the **arrangement** of **socket outlet** final circuits connected to RCDs in a **residential** electrical installation. (2 marks)

Ref:

- (c) Refer to AS/NZS 3000 and state which final subcircuit cables **in the introduction are required** to be protected by an RCCB. (3 marks)

Ref:

- (d) How are the MCBs **in the introduction** distributed between the RCCBs that protect the final subcircuits stated in (c). (3 marks)

(turn over)

Question 6

The **selection and installation of appliances and accessories** must ensure the safe operation of an electrical installation.

- (a) Refer to AS/NZS 3000 and state the **THREE** functions **that are specifically required** for a switching device controlling a **motor**. (3 marks)

(1) _____

(2) _____

(3) _____

Ref:

- (b) Refer to AS/NZS 3000 and state **ONE** requirement relating to the **rating** of an isolating switch that is installed directly in a **motor supply circuit**. (2 mark)

Ref:

(turn over)

Question 6 continued

- (c) Refer to AS/NZS 3000 and state **ONE** situation where **protection against overtemperature** requirements **shall not** be installed for **motors**. (2 mark)

Ref:

- (d) Refer to AS/NZS 3000 and state **ONE operation** requirement for **over-temperature protective devices** for **motors**. (2 mark)

Ref:

- (e) Most motors require protection against overload. Refer to AS/NZS 3000 and state the **minimum** motor rating where protection against overload must be provided. (1 mark)

Ref:

(turn over)

Question 7

Introduction

The Electricity (Safety) Regulations 2010 requires that a **new low voltage electrical installation** is tested and inspected in accordance with AS/NZS 3000.

Use the information in the introduction to this question to answer parts 7(a), 7(b) and 7(c).

- (a) An **insulation resistance test** is to be carried out on the consumers' mains and submains of a **new low voltage electrical installation**. Describe how the insulation resistance testing is carried out that satisfies the requirements of AS/NZS 3000.

(2 marks)

Ref:

- (b) Refer to AS/NZS 3000 and state what is ensured by the testing of continuity of the earthing system of the **new low voltage installation**.

(2 marks)

Ref:

(turn over)

Question 7

- (c) (i) Refer to AS/NZS 3000 and state the recommended **sequence of tests** – using test instruments - to be carried out on the **new low voltage electrical installation**.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(6) _____

(7) _____

(8) _____

Ref:

(turn over)

Question 7

- (ii) The **new low voltage installation** failed the test stated in (c)(i)(3).

Refer to AS/NZS 3000 and state what action is required to be taken.

(2 marks)

Ref:

(turn over)

Question 8

AS/NZS 3000 details the safety outcomes required for an electrical installation, so that the installation is electrically safe under the Electricity (Safety) Regulations 2010.

AS/NZS 3000 details the methods of protection that can be used to provide **fault protection** in an electrical installation.

(a) Automatic disconnection of supply

- (i) Refer to AS/NZS 3000 and state **TWO** types of protective fittings used to achieve automatic disconnection of supply.

(2 marks)

(1) _____

(2) _____

Ref:

- (ii) Refer to AS/NZS 3000 and state **ONE** method of verifying whether an automatic disconnection of supply method is operating correctly.

(2 marks)

Ref:

(turn over)

Question 8 continued

(b) Use of Class II equipment or equivalent insulation

- (i) Refer to AS/NZS 3000 and state TWO means of achieving protection by Class II equipment or equivalent insulation.

(2 marks)

Ref:

- (ii) State **ONE** method of verifying whether the use of Class II equipment or equivalent insulation method of protection is operating correctly.

(2 marks)

Ref:

- (c) Refer to AS/NZS 3000 and state the type of system used to limit the fault current that can pass through a body to a value lower than the shock current.

(2 marks)

Ref:

(turn over)

Question 9

Introduction

A 230V, single-phase **aluminium** mains cable is to be installed between a point of supply and a workshop on a rural property.

The installation conditions are:

- The cable route length is 40 metres between the point of supply and the main switchboard.
30 metres of the cable will be buried direct, the remaining 10 metres will be installed through a building (touching).
- The load is 16 kW.
- The supply voltage is 230V.
- The maximum permitted voltage drop is 1.5%.
- The ambient **soil** temperature is 20° C.
- The ambient **air** temperature is 35° C.
- The maximum conductor temperature is 75° C.
- The power factor is 0.95 lagging.

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

- (a) Calculate, the **minimum** size **aluminium** cable that will satisfy the **load** requirements.

(4½ marks)

(turn over)

Question 9 continued

- (b) Calculate, the minimum size aluminium cable that will satisfy the voltage drop requirements.

(4½ marks)

- (c) State the minimum size aluminium cable that meets both the load and voltage drop requirements.

(1 mark)

(turn over)

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°C

REFERENCE AMBIENT TEMPERATURE: 30°C IN AIR, 15°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°C

REFERENCE AMBIENT TEMPERATURE: 30°C IN AIR, 15°C IN GROUND

14	15	16	17	18	19	20	21	22	23	24	25	26	27
Conduct or 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	
											Solid/stranded	Flexible	
1	13	-	11	-	8	-	7	-	19	-	19	20	-
1.5	61	-	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°C**

REFERENCE AMBIENT TEMPERATURE: **30°C IN AIR, 15°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	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°C**

REFERENCE AMBIENT TEMPERATURE **30°C IN AIR, 15°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	
											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 °C	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 °C	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 mm ²	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 mm ²	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

For Candidate's Use

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

For Examiner's Use Only

Questions Answered	Marks	
1		
2		
3		
4		
5		
6		
7		
8		
9		
TOTAL		