ELECTRICAL WORKERS REGISTRATION BOARD

Safety • Competency

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

ELECTRICAL WORKERS REGISTRATION BOARD

ELECTRICIAN'S REGULATIONS EXAMINATION

054

25 June 2005

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 on the basis of correctness.

Do not use correcting fluid or correcting tape.

Non-programmable calculators may be used.

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 may need to use the following documents in this examination:

- The Electricity Act 1992 and amendments.
- The Electricity Regulations 1997 and the Electricity Amendment Regulations 1999, Electricity Amendment Regulations 2002 and the Electricity Amendment Regulations 2003; or

  The Electricity Regulations Compilation 2003 and the Electricity Amendment Regulations 2003; or

  The Integrated Electricity Regulations 1997 and the Electricity Amendment Regulations 2003.
- AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, 3 and A); AS/NZS 3001:2001; NZS 3019 (Int):2002 or NZS 3019:2004; AS/NZS 3760:2001 or; AS/NZS 3760:2003.
- ECP 34, and ECP 54.

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM

(turn over)

SECTION 1

Answer all questions in this section. Each is worth 2 marks.

Question 1

Refer to the Electricity Act and list the **TWO** categories or types of accidents that require notification.

(2 marks)

(1) _____

_____

_____

(2) _____

_____

_____

Ref: ……

Question 2

Refer to the Electricity Act and state **TWO** limitations the Board may set to the work that may be undertaken by a registered person.

(2 marks)

(1) _____

_____

(2) _____

_____

Ref: ……

(turn over)

Question 3

Refer to the Electricity Regulations and state what is meant by each of the following terms.

(a) Isolated

(1 mark)

_____

_____

_____

(b) Mains

(1 mark)

_____

_____

_____

Ref: ……

Question 4

A low voltage domestic installation that has been disconnected for 6 months or more must be tested for safety prior to being reconnected to the supply. Refer to the Electricity Regulations and state who is permitted to carry out the testing.

(2 marks)

_____

_____

_____

Ref: ……

(turn over)

Question 5

Refer to the Electricity Regulations and list **FOUR** types of electrical installations that require safety checks.

(1) _____

(2) _____

(3) _____

(4) _____

Ref: ……

Question 6

Refer to Electricity Regulations and in respect to electrical security fences in electrical installations, state the Standard that is permitted to be used as a means of compliance with the Regulations.

(2 marks)

_____

Ref: ……

Question 7

The Electricity Regulations require that a handheld appliance must be double insulated and be supplied with electricity from a residual current device (RCD) when it is used in certain situations. Refer to the Electricity Regulations and state **ONE** of those situations.

_____

_____

Ref: ……

Question 8

Refer to the Electricity Regulations and state the requirements for protective fittings used to supply electricity at standard low voltage to connectable installations.

_____

_____

Ref: ……

(turn over)

Question 9

Refer to AS/NZS 3000 and state the **TWO** types of cable that may be buried direct without requiring the additional mechanical protection of a category B system.

(2 marks)

(1) _____

(2) _____

Ref: ……

Question 10

Refer to AS/NZS 3000 and state **TWO** types of earthing conductor that are not required to be insulated.

(1) _____

(2) _____

Ref: ……

Question 11

Refer to AS/NZS 3000 and state the reason why care must be taken when testing the insulation resistance of surge protection devices and electronic equipment.

_____

_____

Ref: ……

(turn over)

Question 12

Refer to AS/NZS 3000 and state:

(a) The minimum acceptable value for an insulation resistance test of a 4 core neutral screened cable operating at 400 volts.

(1 mark)

_____

Ref: ……

(b) The specified test voltage when carrying out an insulation resistance test of a 4 core neutral screened cable operating at 400 volts.

(1 mark)

_____

Ref: ……

Question 13

Refer to AS/NZS 3000 and state **TWO** requirements for the segregation of fire and smoke control wiring installed in the same enclosure as other wiring.

(1) _____

_____

_____

(2) _____

_____

_____

Ref: ……

(turn over)

Question 14

An automatically controlled fire pump motor supplies a sprinkler system. Refer to AS/NZS 3000 and state **TWO** requirements for the isolating switch controlling the motor.

(2 marks)

(1) _____

_____

(2) _____

_____

Ref: ……

Question 15

Refer to AS/NZS 3000 and state the maximum earth fault loop impedance for a circuit protected by a Type D, 20 amps MCB (in order that a 0.4 second disconnection time will be achieved in the event of a fault in a 230 volt circuit).

(2 marks)

_____

Ref: ……

Question 16

Refer to AS/NZS 3001 and state the requirement for the control of a permanently connected appliance in relocatable premises (a connectable installation).

(2 marks)

_____

_____

Ref: ……

(turn over)

Question 17

Refer to AS/NZS 3760 and state:

(a) The maximum resistance between exposed metal parts of Class I equipment and earth.

(1 mark)

_____

Ref: ……..

(b) The minimum insulation resistance between live supply conductors and external metal parts in Class II equipment.

(1 mark)

_____

Ref: ……

(turn over)

Section 2

Answer **ALL** questions in this section. Each question is worth 6 marks.

Question 18

During renovations on a low voltage electrical installation, the following work is carried out:

- The overhead service main wires are replaced with a neutral screen cable (same size conductors) to assist with future tree trimming.
- A new mains entry box is installed in a new location.
- New internal mains are installed (same size of the existing mains) and connected to the mains entry box.
- The old 30 amp metal-clad main switch on the switchboard is replaced with a new plastic 60 amp version.
- Several old rewireable fuses are replaced with an appropriate circuit breakers.
- The bare copper main earth lead is replaced and upgraded in size.
- New neutral and earth bars are installed.
- Lights and power points have been installed in 2 new bedrooms.
- A light and permanently connected heated towel railed have been installed in a new bathroom.

Refer to the Electricity Regulations and answer the following:

(a) Which of the above work is required to be certified on a Certificate of Compliance?

(4 marks)

_____

_____

_____

_____

_____

_____

_____

_____

Ref: ……

(turn over)

Question 18 continued

(b) Which of the above work is required to be tested in accordance with section 6 of AS/NZS 3000?

(1 mark)

_____

_____

Ref: ……

(c) Which of the above work is required to be inspected by a registered electrical inspector?

(1 mark)

_____

Ref: ……

(turn over)

Question 19

Refer to AS/NZS 3000 and answer the following:

(a) State **TWO** types of equipment which are required to be equipotentially bonded in a pool area.

(2 marks)

(1) _____

_____

_____

(2) _____

_____

_____

Ref: ……

(b) What are the earthing requirements for an underwater luminaire in a pool?

(1 mark)

_____

_____

Ref: ……

(c) State the minimum degree of protection required for electrical equipment installed in Zone 0, Zone 1 and Zone 2 of a pool.

(3 marks)

Zone 0 _____

Zone 1 _____

Zone 2 _____

Ref: ……

(turn over)

Question 20

(a) Refer to AS/NZS 3000 and state:

(i) **TWO** types of electrical installations in which some final subcircuits are required to be protected by an RCD.

(1 mark)

(1) _____

(2) _____

Ref: ……

(ii) The **TWO** types of final subcircuits which are required to be protected by an RCD.

(1 mark)

(1) _____

(2) _____

Ref: ……

(b) Briefly explain how a Residual Current Device (RCD) disconnects the supply from an electrical appliance when an earth fault occurs.

(4 marks)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Ref: ……

(turn over)

Question 21

Refer to AS/NZS 3001 and answer the following.

(a) Define what is meant by the term “site”.

(1 mark)

_____

_____

_____

_____

Ref: ……

(b) List the **THREE** permissible current ratings for single-phase socket outlets that are provided for connecting the supply to a caravan in a New Zealand caravan park.

(3 marks)

(1) _____

(2) _____

(3) _____

Ref: ……

(c) State the requirement for socket outlets located on the exterior of a vehicle or relocatable installation.

(1 mark)

_____

_____

Ref: ……

(turn over)

Question 21 continued

(d) State the **TWO** requirements for extra-low voltage socket outlets installed in a caravan.

(2 marks)

(1) _____

_____

(2) _____

_____

Ref: ……

(turn over)

Question 22

You have repaired a Class I plug-in electrical appliance. You have carried out a protective earthing (earth continuity) test and the result is 15Ω.

(a) Refer to AS/NZS 3760 and:

(i) State the maximum resistance value permissible for the protective earthing conductor of a Class I plug-in electrical appliance.

(1 mark)

_____

Ref: ……

(ii) State the reason why the resistance of the protective earthing conductor must be no greater than the value stated in (a)(i).

(2 marks)

_____

_____

_____

_____

_____

Ref: ……

(b) Briefly describe the corrective action or procedure you would take to ensure the resistance of the protective earthing conductor complies with AS/NZS 3760.

(3 marks)

_____

_____

_____

_____

_____

_____

(turn over)

Question 23

It is proposed to install a 4.0 mm^2 three-core and earth TPS cable to supply a three-phase commercial freezer from a switchboard under the following conditions.

- The cable will be unenclosed and partially surrounded by thermal insulation.
- The load is 26.5 amps per phase.
- The voltage at the switchboard is 400V.
- The distance between the switchboard and the freezer is 60 metres.
- The ambient temperature is 20^o C.
- The maximum permitted voltage drop is 4%.

Assume the conductor temperature to be 75^o C

Using this information and the tables below answer the following.

(a) Determine by calculation whether the cable meets the voltage drop requirements.

(3 marks)

_____

_____

_____

_____

_____

_____

_____

(b) Determine by calculation whether the cable meets the load requirements.

(3 marks)

_____

_____

_____

_____

_____

_____

_____

(turn over)

Question 23 continued

The following are extracts from AS/NZS 3008.1.2.

Table 12

CURRENT CARRYING CAPACITIES OF THREE-CORE AND FOUR-CORE O.6/1 kV INSULATED AND SHEATHED (INCLUDING NEUTRAL SCREENED) CABLES WITH OR WITHOUT EARTH CONDUCTOR, ARMOURED OR NON-ARMOURED CABLES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Current carrying capacity A															
Conductor size	**Unenclosed**				**Enclosed**								**Buried Direct**		**Underground non-metallic wiring enclosure**	
	Spaced		**Touching**		**Non-metallic wiring enclosures in air – round cable**		**Non-metallic wiring enclosures in air – flat cable**		**In non-metallic wiring enclosures or unenclosed partially surrounded by thermal insulation**		**Completely surrounded by thermal insulation**					
mm^2	**Cu**	**Al**	**Cu**	**Al**	**Cu**	**Al**	**Cu**	**Al**	**Cu**	**Al**	**Cu**	**Al**	**Cu**	**Al**	**Cu**	**Al**
1	15	--	14	--	11	9	14	10	11	8	7	-	21	-	17	-
1.5	18	-	17	-	15	11	17	13	14	11	9	-	26	-	21	-
2.5	26	-	25	-	21	16	23	17	19	15	13	-	37	-	29	-
4	35	-	33	-	27	21	30	23	25	19	17	-	48	-	37	-
6	46	-	42	-	35	27	39	30	33	25	22	-	61	-	47	-
10	52	-	58	-	48	38	52	40	44	34	29	-	81	-	63	-
16	82	64	78	60	64	49	68	52	59	46	39	30	106	83	81	64
25	111	86	104	81	90	68	95	72	82	64	52	40	138	107	106	83
35	137	106	125	99	105	80	105	80	96	74	64	49	165	127	127	100

Table 27(1)

RATING FACTORS FOR VARIATIONS IN AMBIENT TEMPERATURE FOR CABLES IN AIR OR HEATED CONCRETE SLABS AND FOR CABLES BURIED DIRECT IN THE GROUND OR IN UNDERGROUND WIRING ENCLOSURES – AIR AND CONCRETE SLAB TEMPERATURES

1	2	3	4	5	6	7	8	9	10	11
Conductor temperature ^0C	**Rating Factor**									
	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

(turn over)

Question 23 continued

Table 42

THREE-PHASE VOLTAGE DROP AT 50Hz OF MULTICORE CABLES WITH CIRCULAR COPPER CONDUCTORS

Conductor size mm^2	Three-phase voltage drop at 50 Hz, mV/A.m									
	Conductor temperature, ^0C									
	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	-

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

(turn over)

Question 24

Refer to AS/NZS 3000 and determine the maximum demand of a 230 volt domestic installation with the following loads:

- 32 lighting points
- 15 double socket outlets (10 A)
- 12 single socket outlets (10 A)
- 1 electric range (12 kW)
- 3000 watts of outdoor lighting
- 1 gas water heater with auxiliaries supplied from a 10A socket outlet

(6 marks)

Ref: ……

(turn over)

Question 25

Switchboards in an electrical installation shall —

- Be safe to use when properly assembled, installed and connected to supply; and
- Not cause a danger from electric shock, fire, high temperature or physical injury in the event of reasonably expected conditions of overload, abnormal operation, fault or external influences.

Refer to AS/NZS 3000 and answer the following:

(a) State the **TWO** types of switchboards that shall not be installed in the vicinity of an automatic fire sprinkler system.

(2 marks)

(1) _____

_____

(2) _____

_____

Ref: ……

(b) State **THREE** requirements for the neutral bar or link in a switchboard.

(3 marks)

(1) _____

_____

_____

(2) _____

_____

_____

(3) _____

_____

_____

Ref: ……

(turn over)

Question 25 continued

(c) A switchboard in an industrial electrical installation has exposed live parts. State the access requirements for this switchboard.

(1 mark)

_____

_____

_____

_____

_____

_____

Ref: ……

(turn over)

Question 26

A fixed-wired small printing press, driven by a three-phase electric motor is supplied by PVC cables enclosed in a flexible steel conduit. It has been operating safely for some months, but the operator has now reported the MCB protection occasionally tripping. When reset, the MCB functions for a short period.

You have been required to find the problem and have safety tagged the circuit and confirmed by testing, that the supply is isolated. You intend to carry out a protective earthing conductor (earth continuity) test and an insulation resistance test.

(a) Refer to ASNZS 3000 and state **ONE** reason why you will carry out an earthing conductor (earth continuity) test.

(2 marks)

_____

_____

_____

_____

Ref: ……

(b) Refer to ASNZS 3000 and state **ONE** reason why you will carry out an insulation resistance test

(2 marks)

_____

_____

_____

_____

Ref: ……

(turn over)

Question 26 continued

(c) Briefly describe how you will carry out the protective earthing (earth continuity) test. Include the minimum acceptable resistance value for the protective earthing conductor.

(2 marks)

_____

_____

_____

_____

_____

_____

(turn over)

Question 27

Refer to the Electricity Regulations and answer the following:

(a) List **TWO** conditions under which conductors or fittings can be replaced without the need for certification.

(2 marks)

(1) _____

_____

_____

(2) _____

_____

_____

Ref: ……

(b) State **FOUR** types of installation work which require inspection by a registered electrical inspector, prior to connection to a power supply.

(2 marks)

(1) _____

_____

(2) _____

_____

(3) _____

_____

(4) _____

_____

Ref: ……

(turn over)

Question 27 continued

(c) An electrician has installed a new fitting in an existing domestic residence. State **TWO** circumstances where the electrician can connect the fitting to the supply, without the work being inspected by an electrical inspector.

(1) _____

_____

_____

(2) _____

_____

_____

Ref: ……

(turn over)

Question 28

You have completed installing a new, three-phase, 230/400V food processing plant that includes a 4.5 kW water heating cylinder and two 4 kW ranges. The insulation resistance test result you obtained for the whole installation was 600,000Ω.

You have issued a Certificate of Compliance because the installation complies with the requirements of AS/NZS 3000.

Describe how you carried out the insulation resistance testing to verify compliance with section 6 of AS/NZS 3000. Include the instrument used and the test voltage.

(6 marks)

_____

_____

_____

_____

_____

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Ref: ……

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**	
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