



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

ELECTRICAL SERVICE TECHNICIAN "B" **EXAMINATION**

25 November 2006

QUESTION AND ANSWER BOOKLET

Time Allowed: Two 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. Show all working to TWO decimal places.

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 reprinted as at 19 August 2005.
- The Electricity Regulations 1997 reprinted as at 5 September 2005
- AS 60529 or AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1, 2, A and 3); 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)

Question 1

(a) An ohmmeter gives a reading of 24 ohms when used to measure the resistance of a plug-in heater designed for use on 230V/240V a.c. supply. If the heater draws 10 amps when plugged into a 240 V supply:

(i) Will the current increase or decrease when the heater is plugged into a 230 V supply?

(1 mark)

(ii) Will the power dissipated increase or decrease when the heater is plugged into a 230 V supply?

(1 mark)

(b) A small electric motor has a nameplate that reads:-

Voltage	230
Phases	1
Horsepower	0.75
Speed	1425 r.p.m.

Calculate the rated output power of the motor.

(2 marks)

(turn over)

Question 1 continued

(c) Explain how an overload relay in a three phase motor starter protects the motor.

(2 marks)

(d) State the main characteristic of a flexible cord that determines the maximum current the cord can carry safely without overheating.

. (2 marks)

(e) Refer to the Electricity Regulations and state is meant by the term "hazardous area".

(2 marks)

Ref:

(turn over)

Question 1 continued

- (f) Refer to AS/NZS 3000 and state what is meant by "Class II electrical equipment".

(2 marks)

Ref:

- (g) A single phase 230V electrical appliance is to be connected to fixed wiring. Refer to AS/NZS 3000 and state the requirement for the colour of the phase (active) conductor as applied to fixed wiring.

(2 marks)

Ref:

- (h) Explain how the **resistance** of an electrical jug element can be determined from the voltage and power rating printed on the nameplate.

(2 marks)

- (i) Explain how a phase reversal relay in a three phase motor starter protects the motor.

(2 marks)

(turn over)

Question 1 continued

(j) For the New Zealand MEN system state:

- (i) The nominal voltage that should exist between a neutral conductor and earth

(1 mark)

- (ii) The nominal voltage that should exist between any active conductor and the neutral conductor

(1 mark)

(turn over)

Question 2

- (a) Supply lines 1 and 3 have been reversed at the output terminals of a DOL starter supplying a 3-phase induction motor when the wiring was re-connected. What will happen when this induction motor is livened?

(1 mark)

- (b) Name **TWO** types of reduced voltage starters that would be suitable for starting a large three-phase induction motor.

(2 marks)

(1) _____

(2) _____

- (c) Draw and label a circuit diagram to show how the components listed below would be connected in a 230V control circuit of a three-phase DOL motor starter. Your diagram is to include the following components.

- a fuse
- stop button
- start button
- hold in contact (maintaining contact)
- thermal overload relay contact
- 230V coil

You do not need to show the main contacts or the motor

(4 marks)

(turn over)

Question 2 continued

- (d) Explain how the thermal overload relay in a 230V control circuit of a DOL starter protects the three-phase motor against a mechanical overload
(3 marks)

(turn over)

Question 3 continued

(b) Describe the test using a test instrument you would carry out to establish the fault in the motor. Include in your answer:

- The type of instrument used.
- The test voltage applied (if applicable)

(3 marks)

(c) State the likely cause of the fault.

(1 mark)

(turn over)

Question 4

(a) When selecting a replacement cartridge for a blown HRC fuse, it is necessary to consider its Utilisation category (fusing factor).

(i) What is meant by Utilisation category (fusing factor)? (2 marks)

(ii) How does the Utilisation category (fusing factor) influence the fuse operation? (2 marks)

(iii) Why is it important to ensure that the correct rupturing capacity is chosen when selecting a fuse link? (2 marks)

(turn over)

Question 4 continued

- (b) A circuit-breaker is used as back-up protection for a motor. The circuit breaker has the rating 80 kA, 16A. Briefly explain what each of these terms mean.

(2 marks)

80kA _____

16A _____

- (c) What is the main purpose of a fuse or an MCB found on a switchboard?

(2 marks)

(turn over)

Question 5

The Electricity Regulations require that when an electrical appliance has been repaired inspections and tests must be carried out in accordance with a specific Standard.

(a) Name that Standard

(1 mark)

(b) List the **THREE** inspections and tests that must be carried out in accordance with the Standard.

(3 marks)

(1) _____

Ref:

(2) _____

Ref:

(3) _____

Ref:

(c) State the **TWO** tests required to be carried out with instruments and state the minimum or maximum test result that applies.

(4 marks)

(i) Test _____

Instrument _____

Test result _____

(ii) Test _____

Instrument _____

Test result _____

Ref:

(turn over)

Question 5 continued

- (d) A polarity test should be carried out on a Class I electrical appliance after a replacement flexible cord has been fitted. The appliance is controlled by a single-pole switch. What important points will this polarity test confirm?
(2 marks)

(turn over)

Question 6

A fixed-wired planer, 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.
- Small electric shocks were received from the frame of the machine

You have been required to find the problem and have safety tagged the circuit and confirmed by testing, that the supply is isolated.

(a) You carried out a protective earthing conductor (PEC) test.

(i) State the type of instrument you used.

(1 mark)

(ii) Briefly describe how you carried out this test.

(2 marks)

(iii) Briefly describe how an unsatisfactory test result could make the printing press electrically unsafe.

(2 marks)

(turn over)

Question 6 continued

(b) You carried out an insulation resistance test.

(i) State the type of instrument you used.

(1 mark)

(ii) Briefly describe how you carried out this test.

(2 marks)

(iii) Briefly describe how an unsatisfactory test result could make the printing press electrically unsafe.

(2 marks)

(turn over)

Question 7

The circuit supplying a 230V a.c. single phase induction motor has both RCCB and MCB protection. The motor isolator has been replaced.

What would be the effect if:

- (a) The phase and neutral were accidentally interchanged at the supply side of the isolating switch.

(3 marks)

- (b) The neutral and earth were accidentally interchanged at the supply side of the isolating switch.

(1 mark)

- (c) The phase and earth were accidentally interchanged at the supply side of the isolating switch and the RCCB failed to operate.

(4 marks)

(turn over)

Question 7 continued

- (d) State **TWO** tests that would detect the interchange of the phase and earth conductors?

(2 marks)

(1) _____

(2) _____

(turn over)

Question 8

- (a) When connecting a three-phase motor to the electricity supply it is necessary to connect the three supply conductors to the motor windings. It is also necessary to **securely** connect the motor to earth by means of a protective earthing conductor.

Explain the **purpose** of the protective earthing conductor (PEC), and why it is necessary to take **care** in its termination.

- (i) Purpose (2 marks)

- (ii) Termination (2 marks)

- (b) List the **TWO** circumstances in which 230V single phase metal clad electrical appliances must not be deliberately connected to earth. (2 marks)

- (1) _____
- (2) _____

(turn over)

Question 8 continued

(c) State **TWO** reasons why the neutral in the MEN system is multiple-earthed.
(2 marks)

(1) _____

(2) _____

(d) Refer to the Electricity Regulations and list **TWO** situations where fittings or electrical appliances are considered not to comply with the Regulations.
(2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 9

- (a) According to the Electricity Act, every person shall on payment of the prescribed fee (if any), be entitled to be registered as an electrical service technician, if the person satisfies the Board that **FOUR** requirements have been met. State those **FOUR** these requirements.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

Ref:

- (b) The Electricity Act requires that a registered person who works for payment of reward must hold an additional type of licence.

(i) What is the name of the licence?

(1 mark)

Ref:

(ii) On what date in any year does the licence expire?

(1 mark)

Ref:

(turn over)

Question 9 continued

(iii) To whom must application be made for the licence?

(1 mark)

Ref:

(c) The Electricity Act lists **SEVEN** classes of person who may do, or assist in doing prescribed electrical work. List **THREE** of these classes.

(3 marks)

(1) _____

(2) _____

(3) _____

Ref:

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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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Questions Answered	Marks	
1		
2		
3		
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7		
8		
9		
TOTAL		