



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

ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION

29 September 2007

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.

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) A circuit-breaker on a switchboard supplies a motor circuit. The circuit breaker has the rating 6 kA, 16A. Briefly explain the meaning of both of these terms.

(2 marks)

- (b) Electrical equipment designed for use in damp situations has an IP rating. An **IP rating** consists of the initials IP followed by two numbers. Refer to AS/NZS 3000 or AS1939 - supplement 1 – 1990 or AS 60529 and answer the following:

- (i) What is an IP rating?

(1 mark)

Ref:

- (ii) What does the second number after the letters indicate?

(1 mark)

Ref:

(turn over)

Question 1 continued

- (c) Explain how the direction of rotation can be reversed for a three phase squirrel cage induction motor that is controlled by a star/delta starter?

(2 marks)

- (d) Registered electrical service technicians must hold a licence to work for payment and reward.

- (i) Name the type of licence that is required.

(1 mark)

- (ii) On what date does this licence expire?

(1 mark)

- (e) (i) Describe how the direction of rotation can be reversed in a Universal (series) motor.

(1 mark)

- (ii) Describe how the direction of rotation can be reversed in a single phase split-phase start motor.

(1 mark)

(turn over)

Question 1 continued

- (f) No person shall assist to carry out prescribed electrical work unless that person has satisfactorily completed safety tuition in four specific subjects within the previous 24 months. Testing and cardio-pulmonary resuscitation are two of those subjects. Refer to the Electricity Regulations and state the **TWO** other subjects.

(2 marks)

(1) _____

(2) _____

Ref:

- (g) State **TWO** criteria that should be observed when selecting a flexible cord for a Class I single phase electrical appliance?

(2 marks)

(1) _____

(2) _____

- (h) Refer to the Electricity Regulations and calculate the lowest acceptable voltage between the phase and neutral at the supply terminals of any standard low voltage fixed wired appliance if the voltage at the switchboard is 230 volts.

(2 marks)

Ref:

(turn over)

Question 1 continued

- (i) A handheld electrical appliance used by a person who is partially immersed in a conductive substance must be used in conjunction with an appropriate safeguard. Refer to the Electricity Regulations and state **TWO** such safeguards.

(2 marks)

(1) _____

Ref:

(2) _____

Ref:

- (j) Refer to the Electricity Regulations and list **TWO** situations where fittings or electrical appliances are deemed not to be electrically safe.

(2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 2

- (a) A three-phase motor controlled by a DOL starter drives a wood planer. The thermal overload in a motor starter has tripped due to a sustained overcurrent. State **TWO** conditions that could cause a sustained overcurrent.

(2 marks)

(1) _____

(2) _____

- (b) State **TWO** likely causes for each of the following reported faults.

Note: 1. The voltage level is normal.
2. The protection is correctly rated and is not faulty.

- (i) A three-phase induction motor overheats while running, but the current in all three phases is the same as the nameplate rating.

(2 marks)

(1) _____

(2) _____

- (ii) A three-phase induction motor, controlled by a direct-on-line (DOL) starter, has been operating normally and has been switched off. When restarted using the start button, the contactor closes, but as soon as the start button is released again the contactor drops out of the circuit.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

- (iii) When started, a three-phase induction motor hums noisily but fails to rotate.

(2 marks)

(1) _____

(2) _____

- (c) List **ONE** reason for using reduced voltage starters with squirrel-cage induction motors when a DOL starter may accelerate the load up to speed more quickly.

(2 marks)

(turn over)

Question 3

(a) (i) State **TWO** reasons why the prove test prove method of testing for isolation is used.

(2 marks)

(1) _____

(2) _____

(ii) Explain how the **prove test prove** procedure is carried out.

(3 marks)

(b) What is the essential safety difference between switching an electrical appliance off and isolating an electrical appliance?

(1 mark)

(turn over)

Question 3 continued

(c) Describe **FOUR** ways of safely isolating and ensuring the continued isolation of an electrical appliance.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 4

(a) Fuses, MCBs and RCDS are found on switchboards.

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

(2 marks)

(ii) What is the main purpose of an RCD found on a switchboard?

(2 marks)

(b) Circuit breakers are available in a number of different operational types. Describe the internal operation of a combined thermal/magnetic type MCB when:

(i) A sustained overload fault occurs

(2 marks)

(ii) A short-circuit fault occurs

(2 marks)

(turn over)

Question 4 continued

(c) What is meant by the term **current rating** of a fuse?

(1 mark)

(d) What would be the overall effect on a three-phase sub-circuit when one fuse operates and the circuit is protected by a phase failure relay?

(1 mark)

(turn over)

Question 6

- (a) When selecting a flexible cord for fitting to a single phase electrical appliance it is necessary to consider factors that will influence the use of the cord.

List **SIX** factors that may need to be considered in selecting the cord.
(6 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(6) _____

- (b) The flexible cord has been replaced on a single phase 230V Class I, plug-in electrical appliance. Refer to AS/NZS 3760 and state the colour coding which applies to the cord conductors.

(3 marks)

(turn over)

Question 6 continued

- (c) State **TWO** ways of identifying double insulated electrical appliances. (1 mark)

(1) _____

(2) _____

(turn over)

Question 7

- (a) Refer to the Electricity Regulations and state the Standard to which a plug-in Class I electrical appliance must be tested following completion of repairs? State the reference in your answer.

(1 mark)

Ref:

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

(1½ marks)

(1) _____

(2) _____

(3) _____

Ref:

- (ii) Of the **TWO** tests required to be carried out with instruments, state the test instrument required and the minimum or maximum test result that is acceptable.

(3 marks)

Ref:

(turn over)

Question 7 continued

- (c) 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 **FOUR** important points will this polarity test confirm?

(4½ marks)

(1) _____

(2) _____

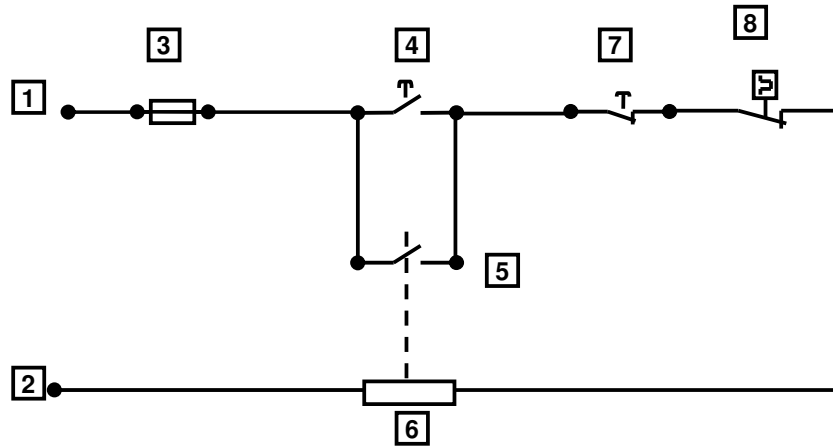
(3) _____

(4) _____

(turn over)

Question 8

- (a) The diagram below shows the low voltage control circuit of a three-phase DOL motor starter. The starter is supplied directly from the MEN system



- (i) Name the numbered parts of the circuit.

(4 marks)

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

- (ii) State the **TWO** typical operating voltages for the circuit

(1 mark)

(1) _____

(2) _____

(turn over)

Question 8 continued

(b) The motor is protected by a thermal overload and HRC fuses.

(i) Briefly explain how the thermal overload protects the motor. (2 marks)

(ii) Briefly explain how the HRC fuses protect the motor. (2 marks)

(c) 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)

(turn over)

Question 9 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)

For Candidate's Use

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		
4		
5		
6		
7		
8		
9		
TOTAL		