



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

ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION

28 June 2008

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 will need to use some of 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) or AS/NZS 3000:2007; 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) Which type of protective device is specifically designed to operate when it detects a sustained overload in a motor control circuit?
(2 marks)

- (b) When replacing an HRC fuse which has blown, the replacement must have four electrical characteristics that must be checked for similarity with the original fuse. Two of those characteristics are "current rating" and "voltage rating", state the other **TWO** characteristics.
(2 marks)

(1) _____

(2) _____

- (c) Refer to the Electricity Regulations and state

- (i) What is meant by the term "standard low voltage" when applied to a multi phase MEN system.
(1 mark)

- (ii) What is meant by the term "low voltage" when applied to a multi phase MEN system.
(1 mark)

Ref:

(turn over)

Question 1 continued

- (d) One method of identifying a double insulated appliance is by the words "double insulated" on the appliance name plate. State **TWO** other methods that are used to identify a double insulated appliance.

(2 marks)

(1) _____

(2) _____

- (e) (i) You have interchanged two of the supply phase connections to a motor, so the motor direction can be reversed. What type of motor are you reversing?

(1 mark)

- (ii) You have interchanged the connection to one winding of a motor that consists of two windings, so the motor direction can be reversed. What type of motor are you reversing?

(1 mark)

- (f) 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** requirements when the appliance is fixed-wired.

(2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 1 continued

(g) A switch controls two heating elements of the same resistance of an electric blanket. The switch has three positions – “low”, “medium” and “high”. The blanket is faulty because it draws current only in the “high” and “medium” positions, but not in the “low” position.

(i) What situation would cause such a fault?

(1 mark)

(ii) Would the faulty blanket draw more current or less current or the same current in the “high” position as in the “medium” position? State a reason for your answer.

(1 mark)

(h) 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)

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

(1 mark)

Ref:

(turn over)

Question 1 continued

- (i) A fuse has blown on a switchboard circuit supplying a single phase plug-in appliance. The appliance has been disconnected and taken away to be tested for faults.

When the fuse is replaced and the main switch is turned on, the fuse blows again. What is the probable cause of the fault and what action should be taken to rectify it?

(2 marks)

- (j) A Class II electrical appliance is supplied by a two-core flexible cord and is operating at full load. State the main effect the resistance of the conductors has on the operation of the flexible cord.

(2 marks)

(turn over)

Question 2

- (a) Fuses and RCDS are found on switchboards. What is the main purpose of a RCD found on a switchboard?
(2 marks)

- (b) What is meant by the term **current rating** of a fuse?
(2 marks)

- (c) State the **TWO** main reasons why HRC motor-rated fuse links are used provide backup protection under short circuit conditions for the thermal overloads in a DOL starter supplying a three-phase electric motor.
(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

- (d) State **TWO** reasons why it is important to correctly thread the fuse wire from terminal to terminal through the tortuous path in the fuse carrier, when reloading a rewirable fuse.

(2 marks)

(1) _____

(2) _____

- (e) (i) A fuse on a switchboard protects a final sub-circuit. State the reason why the fuse "blows" before the circuit has reached full-load current. There is no fault on the circuit.

(1 mark)

- (ii) A fuse on a switchboard protects a final sub-circuit. State the reason why the circuit has been damaged under fault conditions.

(1 mark)

(turn over)

Question 3

- (a) When selecting a flexible cord for fitting to a single phase electrical appliance it is necessary to consider its length and cross-sectional area.

List **FOUR** other physical factors that may need to be considered in selecting the cord.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

- (b) A three-phase delta-connected motor is controlled by a DOL (direct-on-line) starter. It is connected to the electricity supply by means of a three-core, neutral-screen flexible cord. Refer to AS/NZS 3000 and state the requirements regarding the colours of the cord conductors when the cord is terminated in the motor terminal block.

(2 marks)

Ref:

(turn over)

Question 3 continued

(c) You have to fit a new three-pin plug to a three-core PVC sheathed flexible cord supplying a Class I electrical appliance. You have fitted the cord to the plug:

(i) State the visual inspections you would make before fitting the cover to the plug.

(2½ marks)

(1) _____

(2) _____

(3) _____

(4) _____

(5) _____

(ii) State the visual inspection you would make after fitting the cover to the plug.

(½ mark)

(d) All flexible cords are given a "current rating". What does "current rating" mean when applied to flexible cords?

(1 mark)

(turn over)

Question 4

- (a) You are replacing a faulty ammeter on refrigeration plant control panel. Describe what would happen if you connected the ammeter in parallel with the electricity supply.

(3 marks)

- (b) You are using a voltmeter to measure the voltage on an electrical appliance. Describe what would happen if you connected the voltmeter in series with that appliance.

(3 marks)

(turn over)

Question 5

In a sawmill office, the fuse protecting a circuit consisting of two plug sockets supplying various 230V plug-in electrical appliances has blown.

You have been requested to locate and repair the fault. At the site:

- You find that a 20A HRC with a fusing factor of 1.5 protects the circuit.
- You find that the fuse is correctly rated for the circuit and is not faulty.
- You test the circuit and it is found to be working correctly.

There are **TWO** possible causes of this fault, one of which requires the use of a test instrument to locate the fault.

(a) The first possible cause of the fault does not require the use of a test instrument to locate the fault.

(i) State the type of fault that has occurred.

(1 mark)

(ii) State the action you would take to establish the cause of the fault.

(2 marks)

(iii) State the action taken to fix the fault.

(1 mark)

(turn over)

Question 5 continued

(b) The second possible cause of the fault requires the use of a test instrument to locate the fault.

(i) State the type of fault that has occurred.

(1 mark)

(ii) State the action you would take to establish the cause of the fault. Include in your answer:

- The type of test
- The type of test instrument used
- The test voltage
- The likely test result if a fault has occurred.

(4 marks)

(iii) State the action taken to fix the fault.

(1 mark)

(turn over)

Question 6

- (a) You are connecting two multi-function test instruments to measure voltage and current values of a live 230V electrical appliance. Briefly describe **THREE** important electrical precautions relating to the test instruments that will promote personal safety.

Note:

1. All the necessary safety equipment (overalls, rubber mats etc.) is available.
2. Set procedures are available.
3. All conductive items (e.g., rings) have been removed.

(3 marks)

(1) _____

(2) _____

(3) _____

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

(2 marks)

(1) _____

(2) _____

(turn over)

Question 6 continued

(c) An electrical service technician needs to replace an isolating switch. To check that the supply to the switch had been isolated, the person used the following procedure:

- Tested their voltmeter on an independent live source. This confirmed that the meter worked correctly.
- Then on the isolator measured between each of the phases and got a no-volt reading each time.
- Again, tested their voltmeter on an independent live source. This confirmed that the meter still worked correctly.

The person then proceeded to dismantle the isolator and received an electric shock. Explain why the person received the shock.

(2 marks)

(d) A fixed-wired appliance is controlled by an isolating switch and is supplied from a circuit protected by an MCB. The prove-test-prove method was used at the isolating switch to confirm that appliance has been isolated.

State **THREE** methods of ensuring the continued isolation of the appliance.

(3 marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 7

- (a) A Residual Current Device (RCD) - either a portable type or permanently connected type - is live even if no load is connected to the circuit in which it is installed.

State the **main** reason why the Residual Current Device (RCD) does not trip, even though it is live.

(1 mark)

- (b) Briefly explain how a Residual Current Device (RCD) detects an earth fault and disconnects the supply from a faulty Class I electrical appliance.

(4 marks)

- (c) Why should an RCD be operationally tested?

(1 mark)

(turn over)

Question 7 continued

(d) Refer to NZS 3019 and state:

- (i) The maximum time in which an RCD used for personal protection must operate at its rated residual current.

(1 mark)

Ref:

- (ii) The maximum time in which an RCD used for personal protection must operate at five times its rated residual current.

(1 mark)

Ref:

- (e) Briefly explain why a Portable Residual Current Device (PRCD) is "voltage dependent". That is, if the electricity supply to the device fails, the device trips.

(2 marks)

(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.

(i) State **ONE** reason why the protective earthing conductor is required.
(2 marks)

(ii) Explain why it is necessary to securely connect the protective earthing conductor
(1 mark)

(b) State **TWO** reasons why a neutral conductor is required in the cable supplying a three-phase electrical appliance which has heating loads that draw different values of current on each of the phases.

(4 marks)

(1) _____

(2) _____

(turn over)

Question 8 continued

- (c) In many installations, three-phase loads do not require nor have neutral conductors in the cables supplying three-phase subcircuits. Explain the circumstances under which a subcircuit cable that supplies a three-phase load would not require a neutral conductor.

(2 marks)

- (d) Refer to the Electricity Regulations and state what is meant by the term "MEN system".

(1 mark)

(turn over)

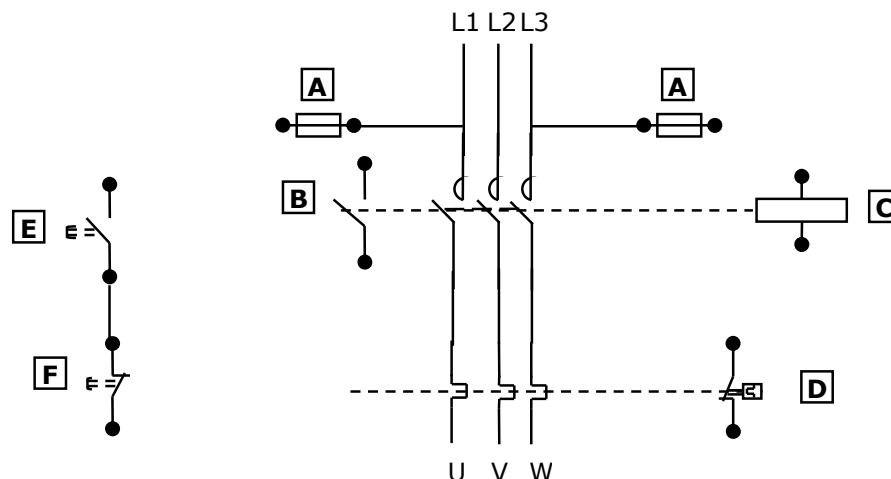
Question 9

(a) The figure below represents the components of a direct-on-line (DOL) starter with a 400V control circuit:

- L1, L2, and L3 represent the three-phases connected to the contactor/starter.
- U, V and W represent the three conductors from the thermal overloads to the motor
- A are fuses
- B is the hold-in (or maintaining) contact
- C is the 400V coil
- D is the overload auxiliary contact
- E is the start button
- F is the stop button

Complete a working 400V control circuit, by drawing the control circuit conductors on the figure.

(6 marks)



(turn over)

Question 9 continued

(b) A three-phase motor is controlled by a direct-on-line starter with a 400V control circuit.

- (i) What would be the effect on the motor if the stop button was jammed in the open position?

(1 mark)

- (ii) What would be the effect on the motor if the hold-in contact was jammed in the open position?

(2 marks)

- (iii) What would be the effect on the motor if the overload auxiliary contact was jammed in the open position?

(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

For Examiner's Use Only		
Questions Answered	Marks	
1		
2		
3		
4		
5		
6		
7		
8		
9		
TOTAL		