



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

ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION

27 September 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) Refer to the Electricity Regulations and state the meaning of the following terms:

(i) Isolated.

(1 mark)

Ref:

(ii) Live.

(1 mark)

Ref:

(b) Refer to the Electricity Regulations and state:

(i) The circumstances under which the holder of practising licence must carry that licence.

(1 mark)

(ii) The period before the date of applying for a licence in which an applicant must have attended a refresher course.

(1 mark)

Ref:

(turn over)

Question 1 continued

- (c) A trainee may assist in prescribed electrical work subject to supervision. Refer to the Electricity Regulations and state **ONE** category of person who can provide this supervision.

(2 marks)

Ref:

- (d) 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:

- (e) (i) Describe how the direction of rotation can be reversed for a 230V, single phase capacitor-start induction motor.

(1 mark)

- (ii) Describe how the direction of rotation can be reversed for a 230V, single phase universal (series) motor.

(1 mark)

(turn over)

Question 1 continued

(f) 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)

- (g) Electrical equipment designed for use in damp situations has an **IP rating** – an International Protection rating or Ingress protection rating. An **IP rating** consists of the initials IP followed by two numbers.

Refer to AS1939; AS 60529 or AS/NZS 3000 and state what is meant by the term "IP rating".

(2 marks)

Ref:

- (h) (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)

(turn over)

Question 1 continued

- (i) When replacing an HRC fuse which has blown, the replacement must have four electrical characteristics the same 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) _____

- (j) Which **TWO** of the following factors will affect the voltage drop in a two core flexible cord?

(2 marks)

- Insulation resistance
- Resistance
- Fusing factor
- Cross-sectional area

(1) _____

(2) _____

(turn over)

Question 2

- (a) A three-phase induction motor is controlled by a DOL starter
- (i) Draw and label a diagram of a 230V control circuit for a three-phase DOL motor starter. The diagram is to include the following components.

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

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

(4 marks)

(turn over)

Question 2 continued

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

- (1) The thermal overload has operated. What has the thermal overload detected that would cause it to operate
(1 mark)

- (2) The HRC fuses have operated. What have the HRC fuses detected that would cause them to operate?
(1 mark)

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

Note: The wood planer is not jammed.

(2 marks)

(1) _____

(2) _____

- (c) A three phase induction motor on a test bench motor hums on starting but fails to rotate. List the **TWO** possible causes for this fault.

Note: 1. The supply voltage is normal
2. There is no load on the motor
3. There are no mechanical defects in the motor

(2 marks)

(1) _____

(2) _____

(turn over)

Question 4

A three-phase fixed-wired electrical appliance is required to be repaired.

- (a) You are going to prove that the appliance is isolated using the prove-test-prove method. What does the prove-test-prove method of testing establish?

(2 marks)

(1) _____

(2) _____

- (b) The appliance is supplied via a flexible cable from a lockable isolating switch. The circuit supplying the appliance is protected by HRC fuses.

You have proved that the appliance is isolated using the prove-test-prove method.

Describe **FOUR** methods, any one of which will ensure the continued isolation of the electrical appliance.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 4 continued

- (c) You have proved that the appliance is isolated and have ensured the continued isolation of the appliance.

The fixed-wired appliance is supplied via a flexible cable from the lockable isolating switch. You have disconnected the flexible cord from the appliance (that is, the flexible cord is still connected to the isolating switch).

State **FOUR** precautions which you would take to ensure the safety of persons and property after you have disconnected the appliance.

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 5

- (a) You are replacing a faulty ammeter on refrigeration plant control panel and have accidentally connected the ammeter in parallel with the electricity supply.

Describe the **main safety issues** that arise when this situation occurs.

(2 marks)

- (b) You are using a voltmeter to measure the voltage on an electrical appliance and have accidentally connected the voltmeter in series with that appliance.

Describe the **main safety issues** that arise when this situation occurs.

(2 marks)

(turn over)

Question 5 continued

- (c) You are connecting test instruments to measure voltage and current values of a live 230V electrical appliance. When doing this work it is important to observe set procedures to ensure personal safety. Briefly describe the **FOUR** important electrical precautions relating to the test instruments that which 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.
- (4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

- (d) State **FOUR** electrical tests using test instruments that you would carry out to ensure that a Class I electrical appliance is electrically safe.

(2 marks)

(1) _____

(2) _____

(3) _____

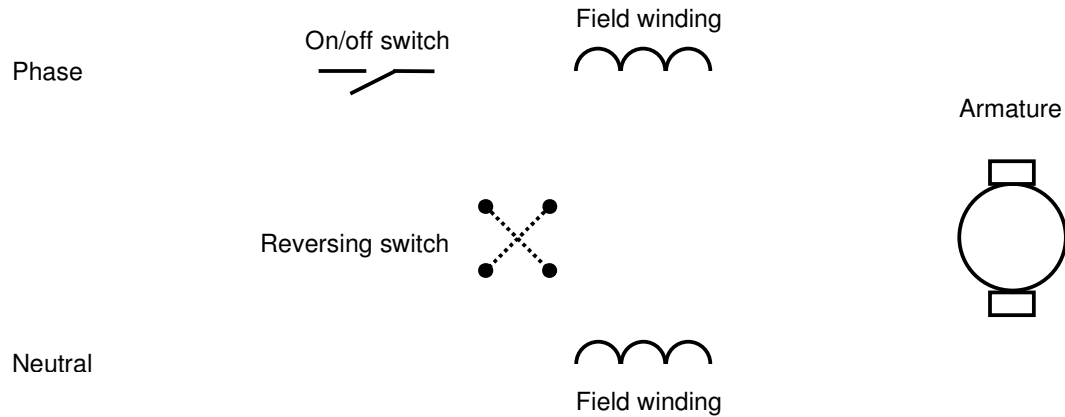
(4) _____

(turn over)

Question 6

- (a) The diagram below shows the components of a universal (series) motor in a floor polisher. Draw the conductors on the diagram to show how the on/off switch and the reversing switch are used to control the motor.

(5 marks)



- (b) State **TWO** reasons why universal motors are more suitable than single-phase induction motors for use in portable power tools.

(2 marks)

- (1) _____

- (2) _____

(turn over)

Question 6 continued

- (c) (i) Sketch and label a circuit diagram of a single-phase capacitor start motor.

(2 marks)

- (ii) Describe how the direction of rotation can be reversed for single-phase capacitor start motor.

(1 mark)

(turn over)

Question 7

- (a) Alterations have been carried out to a domestic bathroom and a new bath and shower have been installed. No changes have been made to the wiring or fittings in the bathroom.

You have been requested to replace a 230V heated towel rail and adjacent control switch with fittings of a more modern design. These were supplied by the customer.

The towel rail and switch are in Zone 2. Can these be fitted in Zone 2? State a reason for your answer and include the reference.

(2 marks)

Ref:

- (b) Electrical equipment designed for use in damp situations has an IP rating – an International Protection rating or Ingress protection rating. An IP rating consists of the initials IP followed by two numbers.

Refer to AS1939; AS 60529 or AS/NZS 3000 and answer the following:

- (i) What is an IP rating?

(2 marks)

Ref:

- (ii) Explain what the first number after the letters IP indicates.

(2 marks)

Ref:

(turn over)

Question 7 continued

(iii) Explain what the second number after the letters IP indicates. (2 marks)

Ref:

(c) Refer to AS1939, AS 60529 or AS/NZS 3000 and describe the level of protection offered by fittings rated at IP34. (2 marks)

3

4

Ref:

(turn over)

Question 8

(a) Sketch and label a simple circuit diagram showing three-phase, 4 wire, MEN distribution lines supplying:

- A single-phase consumer installation.
- A three-phase consumer installation.

You need to show for each installation, the main switch, neutral and earth bar connections, MEN link and earth electrode

You do not need to show metering, water heating control and fuses and subcircuit conductors.

(6 marks)

(turn over)

Question 8 continued

- (b) 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. State **ONE** reason why the protective earthing conductor is required.

(2 marks)

- (c) State **ONE** reason 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.

(2 marks)

(turn over)

Question 9

- (a) Refer to the Electricity Regulations and state the Standard to which a 230V, Class I, plug-in electric water heater must be tested following completion of repairs?

(1 mark)

Ref:

- (b) The 230V, Class I, plug-in electric water heater has an MIMS element. Refer to the Standard you have stated in (a) and complete the following table in relation to the tests required to be carried out using test instruments.

(6 marks)

Note: You must state whether the permitted test result is a minimum or maximum value.

Type of test	Type of instrument required	Permitted test result

Ref:

(turn over)

Question 9 continued

(c) Refer to the Standard you have stated in (a) above and describe **THREE** visual checks (inspections) that must be carried out on the 230V, Class I, plug-in electric water heater

(3 marks)

Note: The visual checks (inspections) must relate specifically to the 230V, Class I, plug-in electric water heater

(1) _____

(2) _____

(3) _____

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

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Questions Answered	Marks	
1		
2		
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TOTAL		