



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

ELECTRICAL WORKERS REGISTRATION BOARD
ELECTRICAL SERVICE TECHNICIAN “B” EXAMINATION
16 September 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) Refer to the Electricity Regulations, and state what is meant by the term “electrically safe”?

(2 marks)

Ref:

- (b) The flexible cord has been replaced on a single phase 230V Class II, plug-in electrical appliance. State the colour coding which applies to the cord conductors.

(2 marks)

- (i) Phase _____
- (ii) Neutral _____

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

(2 marks)

Ref:

(turn over)

Question 1 continued

- (d) Refer to the Electricity Regulations and state what is meant by the term “standard low voltage” when applied to a single phase MEN system

(2 marks)

Ref:

- (e) Refer to AS/NZS 3000 and explain what is meant by a “Damp Situation”.

(2 marks)

Ref:

- (f) When replacing an HRC fuse which has blown, the replacement must have characteristics the same as the original. State **TWO** electrical characteristics to be checked for similarity.

(2 marks)

(1) _____

(2) _____

- (g) The capacitor in a single-phase capacitor-start motor is open-circuited. What effect will this have on the operation of the motor?

(2 marks)

(turn over)

Question 1 continued

- (h) 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) _____

(2) _____

Ref:

- (i) (i) State the formula for determining the power rating of an electrical appliance when the resistance and rated voltage of an electrical appliance is known.

(1 mark)

- (ii) If an electrical appliance is supplied at a constant voltage, what will decrease if the resistance of the appliance increases?

(1 mark)

- (j) List **FOUR** items of personal protective equipment (PPE) an electrical service technician should have when carrying out servicing work.

(2 marks)

(1) _____

(2) _____

(3) _____

(4) _____

(turn over)

Question 2

- (a) When fitting a new flexible cord to a Class I, single phase electrical appliance it is necessary select an appropriate cord. List **THREE** factors that should be considered in selecting the cord.

(3 marks)

(1) _____

(2) _____

(3) _____

- (b) A three phase motor is connected to the electricity supply by means of a four core flexible cord in which each conductor is identified by means of colour. There is no screen in the flexible cord. Refer to AS/NZS 3000 and state the requirements and alternative requirements that apply to the use of the colours?

(3 marks)

Ref:

(turn over)

Question 2 continued

- (c) (i) Explain why the voltage at the load end of a flexible cord extension set supplying current to an electrical appliance is less than that at the supply end of the cord?
(1 mark)

- (ii) State **TWO** ways in which the effect in (c)(i) above can be reduced.
(2 marks)

(1) _____

(2) _____

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

(turn over)

Question 3

(a) Explain how each of the following relays in a three-phase motor starter would provide protection to a three-phase motor.

(i) Overload relay

(1 mark)

(ii) Phase failure relay

(1 mark)

(iii) Phase reversal relay

(2 marks)

(turn over)

Question 3 continued

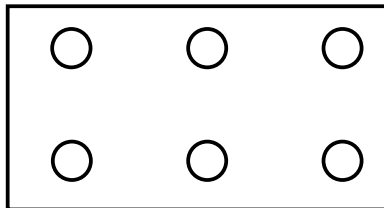
(b) The figure in (ii) below represents the terminal block on an old three-phase induction motor you are required to connect to a direct-on-line (DOL) starter. There are no markings on the terminal block to indicate which pair of terminals are the ends of a winding.

(i) Describe the procedure you would carry out to identify the winding terminal of the motor. Include in your description the type of instrument you would use. (2 marks)

(ii) Mark on the terminal block the winding connections and:

- Draw the conductors that run between the load side of the starter and the terminal block.
- Draw the terminal block connections so the motor can be started direct-on-line (DOL) in a Delta configuration.

(4 marks)



(turn over)

Question 4

A three-phase, fixed-wired lathe is driven by a three-phase electric motor and is supplied by PVC cables enclosed in a flexible steel conduit. The PVC cables are connected to an isolating switch adjacent to the motor. The lathe 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 locate and fix the problem. You have:

- Safety tagged the circuit and confirmed by the prove-test-prove test that the supply is isolated.
- Disconnected the PVC cables from the isolating switch
- Established that the MCB is not faulty and is correctly rated for the circuit it protects.

(a) You carried out a protective earthing conductor (earth continuity) test.

(i) State the type of instrument you used.

(1 mark)

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

(1 mark)

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

(1 mark)

(b) You carried out an insulation resistance test.

(i) State the type of instrument you used and test voltage applied.

(1 mark)

(turn over)

Question 4 continued

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

(1 mark)

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

(1 mark)

(c) Describe the sequence of actions you should take to recommission the lathe after you have located the fault and completed repairs.

(4 marks)

(turn over)

Question 5 continued

(b) Why does the cylinder operate on one element with two fuses blown? Give a reason for your answer.

(2 marks)

(c) (i) Describe the test you would carry out to determine the location of the faults.

(½ mark)

(ii) Describe where you would carry out the tests.

(1½ marks)

(iii) Describe the likely cause for each of the faults.

(1 mark)

(turn over)

Question 6

- (a) Circuit breakers are available in a number of different operational types. Describe the operating principle of the following types of circuit breakers, and state how each is caused to trip when an overload occurs.

(i) Thermal type.

(2 marks)

(ii) Magnetic type.

(2 marks)

(iii) A combined thermal/magnetic type.

(3 marks)

(turn over)

Question 6 continued

- (b) State **ONE** reason explaining how HRC motor-rated fuse links provide backup protection for the thermal overloads in a DOL starter supplying a three-phase electric motor in the event of a short-circuit.

(1 mark)

- (c) State **TWO** reasons why it is important to 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) _____

(turn over)

Question 7

- (a) An electric motor, protected by MCBs, is required to be isolated and it is proposed to secure the isolation by the use of danger tags. However, as the motor isolator is not located adjacent to the motor, at least one additional precaution must be taken to secure the isolation. State **TWO** types of additional precautions that can be taken.

(2 marks)

(1) _____

(2) _____

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

(1 mark)

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

(3 marks)

(turn over)

Question 7 continued

(d) Refer to the Electricity Regulations and state:

(i) What is meant by the term **personal protective equipment**? (2 marks)

Ref:

(ii) **TWO** practical steps an employee must take when carrying out work requiring personal protective equipment. (2 marks)

(1) _____

(2) _____

Ref:

(turn over)

Question 8

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

(1) _____

(2) _____

- (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) _____

- (c) Under what circumstance would a three phase load operate satisfactorily on an MEN supply without a neutral conductor? (1 mark)

(turn over)

Question 8 continued

- (d) 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.

(2 marks)

- (e) State **ONE** situation where 230V single-phase metal-clad electrical appliances must not be deliberately connected to earth.

(1 mark)

(turn over)

Question 9

(a) Refer to the Electricity Regulations and answer the following:

- (i) No person shall assist to carry out prescribed electrical work for the first time unless that person has satisfactorily completed safety tuition in **FOUR** specific subjects. What are those subjects?

(2 marks)

(1) _____

(2) _____

(3) _____

(4) _____

Ref:

- (ii) At what intervals must a person complete the tuition in the subjects in (a)(i).

(1 mark)

Ref:

- (iii) Name the organisation that approved the form for an application for a practising licence.

(1 mark)

Ref:

- (iv) State the circumstances under which the holder of practising licence must carry that licence.

(1 mark)

Ref:

(turn over)

Question 9 continued

- (v) State **ONE** item that must be specified on an application for a practising licence. (1 mark)

Ref:

- (b) The Electricity Act lists **SEVEN** classes of persons who may do, or assist in doing prescribed electrical work. Registered electrical service technicians, are one class of person. Refer the Electricity Act and list **FOUR** other of classes of person. (4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

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		
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7		
8		
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TOTAL		