



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

ELECTRICAL WORKERS REGISTRATION BOARD

ELECTRICAL SERVICE TECHNICIAN “B” EXAMINATION

26 June 2004

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 the following documents in this examination:

The Electricity Act 1992 and amendments
 The Electricity Regulations 1997 and the 1999 and 2002 Amendments or
 The Electricity Regulations Compilation 2003
 AS 1939 supplement 1 – 1990; AS/NZS 3000:2000 (including amendments 1 and 2); NZS
 3019 (Int):2002; AS/NZS 3760:2001
 ECP 34 and ECP 54

PLEASE HAND THIS PAPER TO THE SUPERVISOR BEFORE LEAVING THE ROOM
 (turn over)

Question 1

- (a) An HRC fuse with a Utilisation category (fusing factor) of 1.5 has a rating of 20 amps. Calculate the fusing current of this fuse.

(2 marks)

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

(2 marks)

- (c) 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)

- (d) A three phase electric motor with conductors attached is to be tested before being connected to the fixed wiring.

(2 marks)

- (i) State the minimum acceptable value for the insulation resistance between the windings of a the motor _____
- (ii) State the maximum acceptable value for the resistance of the protective earthing conductor of the motor _____

(turn over)

Question 1 continued

- (e) Refer to AS/NZS 3000, and state what meant by the terms **Class I electrical equipment**?

(2 marks)

Ref

(turn over)

Question 2

- (a) Refer to the Electricity Regulations, and state what is meant by the term **hazardous area**?

(2 marks)

Ref

- (b) Refer to the Electricity Regulations, and state what is meant by the term **electrically safe**?

(2 marks)

Ref

- (c) Describe **TWO** different ways of safely ensuring the continued isolation of an electrical appliance.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 2 continued

- (d) Refer to AS/NZS 3000 and state **TWO** acceptable colours for the active (phase) conductor of a flexible cord.

(2 marks)

(1) _____

(2) _____

Ref

- (e) The isolating switch for a three-phase, **fixed wired appliance** has been turned off. When testing the appliance for confirmation of isolation, it is found that some terminals on the appliance are still live. State **TWO** different possible causes for this situation.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 4 continued

- (b) The three-phase motor has thermistors embedded in the windings to provide protection against overheating. The thermistors are connected to an electronic control circuit. What precautions need to be taken to ensure that no damage is done to this circuit when performing the insulation resistance test?

(2 marks)

(turn over)

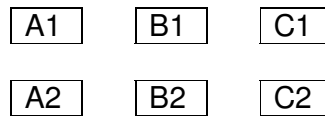
Question 5

A three-phase induction motor is operated by a star-delta starter. The starter is controlled by a 230 volt control circuit.

(a) The diagrams in (i) and (ii) below represent the terminal block for the motor. The three individual stator windings are connected internally between terminals: A1–A2, B1–B2, C1–C2.

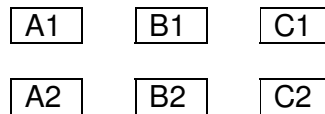
(i) On the terminal block show both the incoming supply lines and the six terminals wired to achieve a **star** connection.

(2 marks)



(ii) On the terminal block show both the incoming supply lines and the six terminals wired to achieve a **delta** connection.

(2 marks)



(turn over)

Question 5 continued

(b) Sketch a labelled schematic diagram to show how the components listed below would be connected on a '230V direct on line motor starter'. Your diagram is to include the following components.

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

(6 marks)

(turn over)

Question 6

A fixed-wired small printing press, 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.

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 (earth continuity) 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

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

(2 marks)

(ii) Describe how the direction of rotation can be reversed for the motor in (a)(i) above

(2 marks)

(b) Describe how the direction of rotation can be reversed for a Universal (series) motor

(2 marks)

(turn over)

Question 7 continued

- (c) (i) Sketch a circuit diagram of a single-phase split-phase resistance start motor.

(2 marks)

- (ii) Describe how the direction of rotation can be reversed for the motor in (c)(i) above

(2 marks)

(turn over)

Question 8

(a) With reference to AS/NZS3000, what is a damp situation?

(2 marks)

Ref:

(b) Electrical equipment designed for use in damp situations has an IP rating. What is an IP rating?

(2 marks)

Ref:

(turn over)

Question 8 continued

(c) An IP rating has the letters IP followed by two numbers.

(i) Explain what the first number indicates?

(2 marks)

(ii) Explain what the second number indicates?

(2 mark)

(d) Briefly state the protection afforded by a fitting that is labelled IP44.

(2 marks)

Ref:

(turn over)

Question 9

- (a) State **THREE** principal technical and safety reasons for earthing the neutral in the 400V/230VMEN system of supply.

(6 marks)

(1) _____

(2) _____

(3) _____

- (b) Explain the purpose of the neutral conductor in a three phase Multiple Earth Neutral (MEN) supply to a circuit which has a different load on each of the three phases.

(3 marks)

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

(1 mark)

(turn over)

Question 10

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.

(a) Thermal type.

(2 marks)

(b) Magnetic type.

(2 marks)

(turn over)

Question 10 continued

(c) A combined thermal/magnetic type.

(3 marks)

(d) A circuit-breaker is used as back-up protection fro a motor. The circuit breaker has the rating 6 kA, 16A. Briefly explain what each of these terms mean.

6kA _____

(2 marks)

16A _____

(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		
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TOTAL		