



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

ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION

20 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 Act, and define a "supervisor of electrical work" as applied to an Electrical Service Technician.

(2 marks)

Ref

- (b) 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)

Ref

- (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

(c) An applicant for a practising licence – who has previously held a licence – must have attended a refresher course. Refer to the Electricity Regulation and state **TWO** of the subjects that must be covered in refresher course: (2 marks)

(1) _____

(2) _____

Ref:

(d) Refer to the Electricity Regulations, and briefly state the essential requirements of the term "electrically safe". (2 marks)

Ref

(e) A single-phase, split phase motor hums and fails to rotate on the bench when the supply is connected, yet it attains full load speed when the rotor is assisted by hand spinning. State the **TWO** likely causes of this fault? (2 marks)

(1) _____

(2) _____

(turn over)

Question 1 continued

(f) State the **TWO** circumstances in which 230V single phase metal clad electrical appliances must not be deliberately connected to earth. (2 marks)

(1) _____

(2) _____

(g) Refer to AS/NZS 3000 and explain what is meant by a **Damp Situation**. (2 marks)

(h) 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 1 continued

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

(2 marks)

6kA _____

16A _____

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

(2 marks)

(turn over)

Question 2

(a) 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

(b) A three-phase 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) A three-phase motor is controlled by a direct-on-line starter with a 400V control circuit. What would be the effect on the motor if the hold-in contact was jammed in the open position? (2 marks)

(turn over)

Question 3

Read the entire question before attempting to answer it.

Another electrical service technician has disconnected and repaired a single-phase, 230V industrial printing press in a print shop. You are required to:

- Reconnect the press by connecting the flexible cord to the single phase fixed wiring at a terminal box mounted on an adjacent pillar, and
- Recommission the printing press.

There are no danger tags attached to the isolator controlling the terminal box.

(a) Before you commence work

Describe the procedure you would take to ensure your own safety before recommissioning the printing press.

(2 marks)

(b) Before you connect the printing press to the terminal box

Describe the tests, using instruments, you would carry out to ensure the printing press is safe to reconnect to the electricity supply. Include the type of instrument used and maximum or minimum test results.

(6 marks)

Note: There is additional space over the page to complete your answer.

(turn over)

Question 3 continued

(c) After you have connected the printing press to the terminal box

Describe **TWO** main safety checks you would make before putting the press back in service.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 4

- (a) An electric motor that is supplied from a circuit protected by MCBs is required to be isolated. Two precautions must be taken to secure the isolation as the motor isolator is not located adjacent to the motor. State **TWO** types of precautions that can be taken.

(2 marks)

(1) _____

(2) _____

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

(2 marks)

(1) _____

(2) _____

- (c) State **TWO** circumstances where an isolating switch would carry two safety danger tags.

(2 marks)

(1) _____

(2) _____

(turn over)

Question 4 continued

- (d) A three-phase fixed wired electrical machine is protected by MCBs. It has been proven to be isolated at the isolating switch using the prove-test-prove method. Describe **FOUR** methods of ensuring the continued isolation of the machine.

(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) (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 the motor in (a)(i) above

(1 mark)

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

(1 mark)

(turn over)

Question 6 continued

- (c) (i) Sketch and label 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

(1 mark)

- (d) A single-phase capacitor start motor is being tested on a test bench prior to being put into service. When the supply is connected it hums but fails to rotate. It reaches full load speed when the rotor is assisted by hand spinning. State the **THREE** possible causes for this fault.

Note: The voltage level is normal

(3 marks)

(1) _____

(2) _____

(3) _____

(turn over)

Question 7

- (a) 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:

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

(2 marks)

Ref:

(turn over)

Question 7 continued

- (b) 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:

- (c) You have been requested to replace a faulty motor and control switch for a swimming pool pump. Due to age, neither the motor or control switch have any visible markings on them.

- The motor is in Zone 1 of the swimming pool.
- The control switch is in Zone 2 of the swimming pool.

Refer to AS/NZS 3000 and state:

- (i) The minimum IP rating requirement for the replacement pump motor. (1 mark)

- (ii) The minimum IP rating requirement for the replacement control switch. (1 mark)

Ref:

(turn over)

Question 8

- (a) The New Zealand Multiple Earth Neutral system of single/three phase standard low voltage distribution requires the use of four conductors. List the standard nominal voltages that exist between each of the four conductors, and between each conductor and earth.

(2 marks)

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

(2 marks)

Ref:

(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 final subcircuits. State **TWO** situations where a final subcircuit cable that supplies a three-phase load would not require a neutral conductor.

(4 marks)

(1) _____

(2) _____

- (d) (i) What is the frequency of the New Zealand low voltage a.c. supply.
(1 mark)

- (ii) If the usual operating voltage of a low voltage domestic electrical installation is 230 V, what is the peak voltage?

(1 mark)

(turn over)

Question 9 continued

- (b) Refer to AS/NZS 3760 and state the insulation resistance permitted between the live supply conductors and earthed exposed metal parts of a Class I portable isolating transformer. State a reference to support your answer.

(1 mark)

Ref:

- (c) A polarity test should be carried out on a plug-in 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?

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

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		