ESTB 2014

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

ELECTRICAL WORKERS REGISTRATION BOARD

ELECTRICAL SERVICE TECHNICIAN "B" EXAMINATION

24 June 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 1997, and state what is meant by the term "earthed".

(2 marks)

_____

_____

Ref: ……

(b) Name **TWO** types of fire extinguishers suitable for use on fires on or near live electrical equipment.

(2 marks)

(1) _____

(2) _____

(c) 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: ……

(d) 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 _____

(turn over)

Question 1 continued

(e) A polarity test should be carried out on a Class I electrical appliance after a replacement flexible cord has been fitted. The appliance is controlled by a single-pole switch. What **TWO** important points will this polarity test confirm?

(2 marks)

(1) _____

_____

(2) _____

_____

(f) Explain how the power rating of an electrical jug element can be determined from the voltage and the element resistance.

(2 marks)

_____

_____

_____

_____

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

(2 marks)

(1) _____

_____

(2) _____

_____

(turn over)

Question 1 continued

(h) (i) What is the main difference between an MEN switchboard and a distribution switchboard?

(1 mark)

_____

_____

_____

(ii) What type of switchboard is the first switchboard (closest to the point of supply) in an MEN electrical installation?

(1 mark)

_____

_____

(i) An electric heater is rated at 2 kW and 230V. Calculate the current drawn.

(2 marks)

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

(2 marks)

(1) _____

_____

(2) _____

_____

(turn over)

Question 2

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

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

(1 mark)

_____

Ref: .....

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

(1 mark)

_____

Ref: .....

(b) An applicant for a practising licence – who has previously held a licence – must have attended a course of instruction. Refer to the Electricity Regulation and state:

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

(1 mark)

_____

Ref: .....

(ii) **FOUR** of the subjects that must be covered in a course of instruction:

(4 marks)

(1) _____

(2) _____

(3) _____

(4) _____

Ref: .....

(turn over)

Question 2 continued

(c) The Electricity Act lists **SEVEN** classes of person who may do, or assist in doing prescribed electrical work. Trainees are one class of person. Refer the Electricity Act and list **THREE** other of classes of person.

(3 marks)

(1) _____

(2) _____

(3) _____

Ref: .....

(turn over)

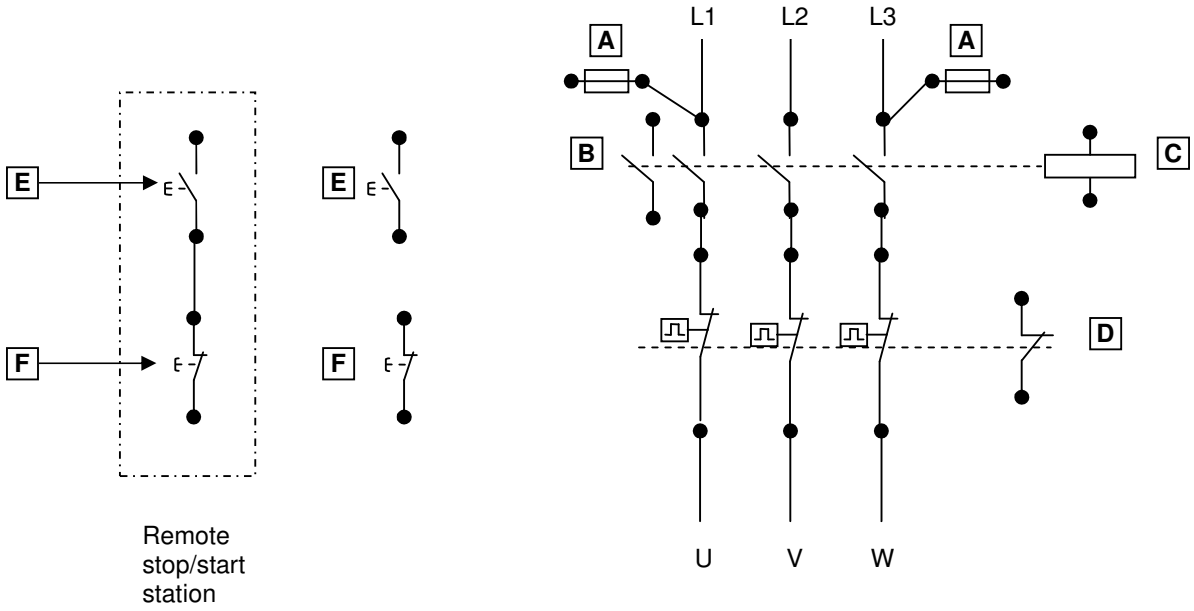
Question 3

(a) The figure below represents the components of a direct-on-line (DOL) starter with a 400V control circuit and a remote stop/start station:

- L1, L2, and L3 represent the three-phases connected to the main contacts.
- U, V and W represent the three conductors from the thermal overloads to the motor
- A are the control circuit fuses
- B is the hold-in contact
- C is the 400V coil
- D is the maintaining contact
- E are the start buttons
- F are the stop buttons

Draw the conductors on the figure to complete a working 400V control circuit

(9 marks)



(b) List **ONE** reason for using reduced voltage starters with squirrel-cage induction motors when a DOL starter may accelerate the load up to speed more quickly.

(1 mark)

_____

_____

(turn over)

Question 4

(a) Fuses, MCBs and RCDS are found on switchboards.

(i) What is the main purpose of a fuse or an MCB found on a switchboard?

(2 marks)

_____

_____

(ii) What is the main purpose of a RCD found on a switchboard?

(2 marks)

_____

_____

(b) Circuit breakers are available in a number of different operational types. Describe the operating principle of a combined thermal/magnetic type MCB.

(3 marks)

_____

_____

_____

_____

_____

_____

_____

_____

(c) What is meant by the term **current rating** of a fuse?

(2 marks)

_____

_____

_____

_____

(turn over)

Question 4 continued

(d) What would be the overall effect on a three-phase sub-circuit when one fuse operates and the circuit is protected by a phase failure relay?

(1 mark)

_____

_____

_____

_____

(turn over)

Question 5

Electrical equipment designed for use in damp situations has an IP rating. An **IP rating** consists of the initials IP followed by two numbers.

(a) Refer to AS/NZS 3000 and answer the following:

(i) What do the letters "IP" stand for?

(2 marks)

_____

_____

Ref: ……

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

(2 marks)

_____

_____

Ref: ……

(iii) What does the second number after the letters indicates.

(2 marks)

_____

_____

Ref: ……

(b) Refer to AS 1939 and describe the level of protection offered by fittings rated at **IP65**.

(2 marks)

6 _____

_____

_____

5 _____

_____

_____

Ref: ……

(turn over)

Question 5 continued

(c) You have been requested to replace a 230V heated towel rail and adjacent permanent connection unit in a domestic bathroom. The towel rail and switch are in Zone 2 but neither have markings on them.

The replacement towel rail and adjacent control switch can be installed in Zone 2, but both must have the required degree of protection. Refer to AS/NZS 3000 and state the minimum permitted IP rating of the heated towel rail and permanent connection unit.

(2 marks)

_____

Ref: ……

(turn over)

Question 6

(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.

(4 marks)

_____

_____

_____

_____

_____

_____

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

(2 marks)

(1) _____

_____

(2) _____

_____

(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)

_____

_____

_____

_____

_____

_____

(turn over)

Question 6 continued

(d) Refer to AS/NZS 3000 and state the requirement for a switch that controls more than one active conductor of a circuit in an a.c. system.

(2 marks)

_____

_____

_____

_____

Ref: ……..

(turn over)

Question 7

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 and trips again.

- The MCB is not faulty.
- The MCB is correctly rated for the circuit it protects.

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 an insulation resistance test.

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

(1 mark)

_____

(ii) Briefly describe how you carried out this test. Include any desired test result

(3 marks)

_____

_____

_____

_____

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_____

(iii) State the reason why the MCB tripped if an unsatisfactory insulation resistance test result was obtained.

(2 marks)

_____

_____

_____

_____

_____

_____

_____

(turn over)

Question 7 continued

(b) (i) Describe the test you would carry out to confirm the integrity of the protective earthing conductor. Identify the type of instrument used and any minimum or maximum test values that are applicable.

(2 marks)

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_____

_____

_____

_____

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_____

(ii) Describe how the test described in (b)(i) contributes to the safety of the motor.

(2 marks)

_____

_____

_____

_____

_____

_____

_____

(turn over)

Question 8

State **TWO** likely causes for each of the following reported faults?

(a) A three-phase induction motor hums noisily but fails to rotate when started.

(2 marks)

(1) _____

_____

(2) _____

_____

(b) A lightly loaded three-phase induction motor runs noisily and then starts to overheat.

(2 marks)

(1) _____

_____

(2) _____

_____

(c) A direct-on-line (DOL) motor starter makes an excessive humming noise whenever the contactor is engaged.

(2 marks)

(1) _____

_____

(2) _____

_____

(d) When a start button is pushed on a direct-on-line (DOL) starter the contactor closes, but as soon as the start button is released again the contactor drops out of the circuit.

(2 marks)

(1) _____

_____

(2) _____

_____

(turn over)

Question 8 continued

(e) A three-phase induction motor overheats while running, but the current in all three phases is the same as the nameplate rating.

(2 marks)

(1) _____

_____

(2) _____

_____

(turn over)

Question 9

(a) You are using an ammeter to measure the current drawn by an electrical appliance. Describe what would happen if you connected the ammeter in parallel with that appliance.

(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 9 continued

(c) When connecting test instruments to measure voltage and current values of 230V electrical appliances it is important to observe set procedures to ensure personal safety. Briefly describe **FOUR** important precautions which will promote personal safety.

(4 marks)

(1) _____

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(2) _____

_____

_____

(3) _____

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_____

(4) _____

_____

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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		
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7		
8		
9		
TOTAL		