

- (c) Any ONE of:
- Interchange any two of the supply phase connections.
 - Change four connections on the motor terminal block
- (2 marks)
- (d) (i) A practising licence
- (1 mark)
- (ii) 30 June each year
Or
1 July
- (1 mark)
- (e) (i) • Reverse the connections to the field windings
Or.
• Reverse the connections to the armature windings.
- (1 mark)
- (ii) • Reverse the connections to the start winding
Or
• Reverse the connections to the run winding.
- (1 mark)
- (f) • Safe working practices appropriate to the work being undertaken.
• Basic first aid
- ER 26(2)
(2 marks)
- (g) Any TWO of:
- Environmental conditions
 - Correct current rating or cross-sectional area
 - Mechanical strength
 - Correct voltage rating
 - Temperature rating
 - Must have a PEC or is a three-core flex
 - Colour of cores
 - Length of flexible cord
 - Type of sheath or insulation
- (2 marks)
- (h) = $230 - (230 \times 5\%)$
- (1 mark)
- = 218.5 V
- (1 mark)
ER53(3)(b)

(i) Any TWO of:

- The appliance is fixed wired and connected through a continuous flexible cord to a supply of electricity from a source isolated from earth with a voltage between conductors not exceeding 250 volts:

ER 77(3)(a)

- The appliance is supplied with electricity from a safety extra-low voltage source:

ER 77(3)(b)

- The appliance is double-insulated and is supplied with electricity through a residual current device.

ER 77(3)(c)

(2 marks)

(j) Any TWO of:

- If in normal use, or in the event of abnormal operation, it functions unsafely so as to cause danger to persons, property, or animals; or
- If it has inadequate protection against direct contact or indirect contact; or
- If its unearthed conductive parts are separated from live parts only by basic insulation.
- If the voltage at which the appliances operates is not adequately marked on the appliance; or
- If it is used for a use other than its normal use, and is not provided, or used in conjunction, with suitable safeguards; or
- If it is constructed that it is not safe under both normal and abnormal conditions of use.

ER76A)

(2 marks)

Question 2

(a) Any TWO of:

- Loss of one phase
- Imbalance in the winding resistance (damaged winding)
- Mechanical damage in the motor (rotor or bearings)
- Load has jammed the machine
- Increase in load that the motor is driving.

(2 marks)

(b) (i) Any TWO of:

- Removal of ventilation fan or fan cowling.
- Blocked ventilation ports
- Additional of covers that block ventilation ports

(2 marks)

(ii) The maintaining circuit is open-circuited.

(2 marks)

(iii) Any TWO of:

- Mechanical overload
- Loss of one line or circuit
- Seized motor
- Open circuited rotor
- Bearing fault (poling)
- Open circuited stator winding

(2 marks)

(c) Any ONE of:

- Less mechanical strain put on motor shaft and bearings.
- Reduced starting current and voltage drop

(2 marks)

Question 3

- (a) (i) • To ensure that the test meter/instrument - is operating correctly.
• To ensure that the circuit has been isolated before it is worked on. (2 marks)
- (ii) • First - prove the meter is operating correctly on a known live circuit. (1 mark)
• Then - test that the circuit is isolated. (1 mark)
• Then - prove again that the meter is still operating correctly on a known live circuit. (1 mark)
- (b) With isolation, deliberate steps are taken to ensure the supply cannot be inadvertently turned back on. (1 mark)
- (c) Any FOUR of:
- Withdrawal of fuses supplying the current plus attaching safety warning tag
 - Locking open of appliance or circuit isolating switch plus attaching safety warning tag
 - Opening and locking open of supply circuit breaker, plus attaching safety warning tag
 - Removal of appliance plug from socket, plus attaching safety warning tag to appliance
 - Access permit or "hold card" system.
- (4 marks)

Question 4

(a) (i) To protect the fixed wiring against sustained overloads and short circuits. (2 marks)

(ii) Any ONE of:

- To provide personal protection to the user of an appliance that is connected to the circuit controlled by the RCD.
- To provide protection against earth leakage in the circuit. (2 marks)

(b) (i) A sustained overload:

- causes a bi-metal in the MCB to heat up and bend, (1 mark)
- operating a trip mechanism (1 mark)

(ii) A short circuit

- causes a strong magnetic field in an armature circuit in the MCB (1 mark)
- which attracts a trip mechanism (1 mark)

(c) The maximum current that a fuse-link will safely carry continuously.

OR

The pre-determined level of protection for the circuit (1 mark)

(d) The phase failure relay detects the loss of voltage and trips out the entire circuit. (1 mark)

Question 5

- Carry out the protective earthing conductor test first. (1 mark)
To ensure that the protective earthing conductor resistance is low (or 1 ohm or below) so no false insulation resistance test reading is obtained. (2 marks)
- Protective earthing conductor test
 - Use an instrument that can read values of less than 1 ohm (½ mark)
 - Test between the earth pin of the plug and the frame of the motor (1 mark)
 - The acceptable test result is 1 ohm - maximum. (1 mark)
- Insulation resistance test
 - Use an insulation resistance tester (½ mark)
 - A test voltage of 500v d.c. (1 mark)
 - Test between each winding and earth (1 mark)
 - Test between each winding (1 mark)
 - The acceptable test result is 1 MΩ, minimum (1 mark)

Question 6

(a) Any SIX of:

- Number of cores
- Colour Coding
- Mechanical strength if weight is to be supported?
- Sheath suitable for the environment
- Cord shape
- Length
- Voltage rating
- Current rating
- Cross-sectional area

(6 marks)

(b) (i) Brown

(1 mark)

(ii) Blue

(1 mark)

(iii) Green or Green/Yellow

(1 mark)

AS/NZS 3760: Appendix F

(c) Any TWO of:

- The words "double insulated"
- The symbol of a square within a square
- The words "Class II"

(1 mark)

Question 7

- (a) • AS: /NZN 3760
• Regulation 38 (1 mark)
- (b) (i) AS/NZN 3760: 2001 or AS/NZN 3760: 2003
- (1) Visual Inspection (½ mark)
Ref: Clause 2.3.2
 - (2) Insulation Resistance (½ mark)
Ref: Clause 2.3.3.2
 - (3) Protective earthing conductor continuity (½ mark)
Ref: Clause 2.3.3.1
- (ii) • Instrument Insulation resistance tester (½ mark)
Test result Minimum of 1 Megohm (1 mark)
Ref: Clause 2.3.3.2
- Instrument Meter that can accurately read values of less than 1 ohm (½ mark)
Test result Maximum of 1 ohm (1 mark)
Ref: Clause 2.3.3.1
- (c) • To ensure that the control switch is connected in the phase conductor. (1 mark)
- The phase pin on the plug is connected to the phase terminal in the appliance. (1 mark)
 - The neutral pin on the plug is connected to the neutral terminal in the appliance (1 mark)
 - The earth pin on the plug is connected to the frame of the appliance. (1½ marks)

Question 8

- (a) (i) 1. Phase or Positive
2. Neutral or Negative
3. Fuse
4. Start button
5. Hold-in contact
6. Coil
7. Stop button
8. Thermal overload

(4 marks)

- (ii) 230V or any other typical a.c. or d.c. voltage less than 230V

(1 mark)

- (b) (i) Thermal overloads

Any ONE of:

- To protect the motor against a small sustained overload or over current.
- To protect against the phase imbalance of single-phasing

(2 marks)

- (ii) HRC fuses

The HRC fuses operate fast under short circuit conditions.

(2 marks)

- (c) The motor's original direction of rotation will be reversed.

(1 mark)

Question 9

(a) The isolation method has to show:

- Identification of the correct fuses. (1 mark)
- Prove-test-prove to ensure circuit is isolated. (2 marks)
- No live terminals exposed (1 mark)
- Steps taken to prevent reconnection, that is, a danger tag applied or locking device used (2 marks)

Note: Nos 1 and 2 must occur first, No.s 3 and 4 can be in any order.

(b) The test method has to show:

- The use of an insulation resistance tester (½ mark)
- Applying a test voltage of 500V d.c. (½ mark)
- Testing between motor winding and earth (1 mark)
- Testing between each motor winding (1 mark)

Note: The use of a 1000V d.c. test between each motor winding is acceptable.

(c) Any ONE of:

- Short to earth on one or more motor windings.
- A short between two active conductors supplying the motor.
- Two motor windings have shorted to earth.
- Two active conductors supplying the motor have shorted to earth. (1 mark)