

EIN09 – Electrical Installer Theory Examination Marking Schedule

Notes:1. (1 mark) means that the preceding statement/answer earns 1 mark.

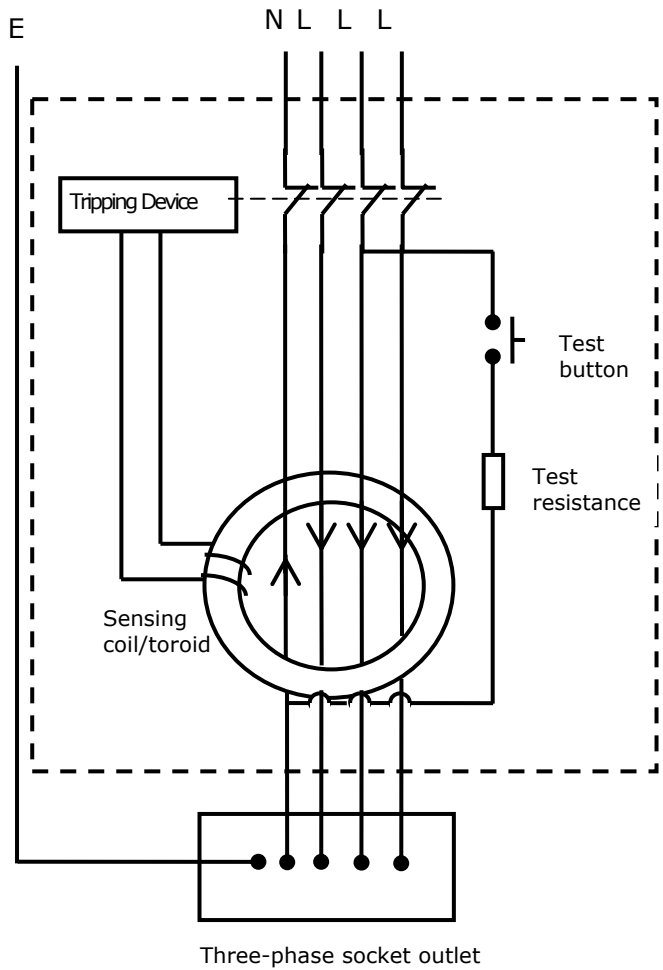
2. This schedule sets out the accepted answers to the examination questions. A marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.

Question 1	<i>Reference Marks</i>	<i>Marking notes</i>
(a) Any TWO of: <ul style="list-style-type: none"> • Reduce system losses • Reduce voltage drop • Prevent premature failure of highest loaded phase • Minimise neutral current 	(2 marks)	
(b) (i) Insulation resistance test. 1 MΩ or 10,000Ω minimum	(½ mark) (½ mark)	
(ii) Earth leakage test 5 mA maximum	(½ mark) (½ mark)	
(c) (i) No effect.	(1 mark)	
(ii) The power dissipated will drop 10%	(1 mark)	
(d) Any TWO of: <ul style="list-style-type: none"> • Capacitor-start, capacitor-run • Shaded pole • Split phase (or resistance start) • Permanently split 	(2 marks)	A universal motor is not an induction motor
(e) • A strong magnetic field is created in the coil	(1 mark)	
• The field attracts a trip mechanism that operates and opens the breaker.	(1 mark)	
(f) • Load of the motor	(1 mark)	
• Length of the final subcircuit cable	(1 mark)	

Question 2	Reference Marks	Marking notes
(a) (i) Where there is a possibility of personal danger through the supply being restored. (ii) <ul style="list-style-type: none"> • Ensure the correct isolating switch is tagged. • Fasten the tag securely. • Ensure the required details are entered on the tag • Lock the isolator (iii) Where equipment is faulty or damaged and using that equipment would cause damage or injury.	(1 mark) (3 marks) (1 mark)	
(b) <ul style="list-style-type: none"> • <u>Isolated</u> The motor has been disconnected from the electricity supply and precautions taken to prevent reconnection • <u>Switched off</u> Electricity ceases to be supplied to the motor 	(1 mark) (1 mark) (1 mark)	
(c) <ul style="list-style-type: none"> • The test instrument is checked to be operating correctly on a known live source. • The equipment is tested to confirm (or otherwise) the absence of voltage. • The test instrument is again checked on a known live source to ensure is still operates correctly. 	(½ mark) (½ mark) (½ mark)	
(d) Any ONE of: <ul style="list-style-type: none"> • Test between each phase and earth. • Test between each phase and neutral 	(½ mark)	

Question 3	Reference Marks	Marking notes
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(a)



- Correctly connected phases, neutral and earth.
- Correctly connected test button and resistance
- Correctly connected sensing coil/toroid
- Correctly connected tripping circuit
- Correctly connected sock
- Working circuit

(1½ marks)

(½ mark)

(½ mark)

(½ mark)

(½ mark)

(1½ marks)

No marks can be awarded for part (a), if there are any of the following hazards:

- A short circuit
- No test resistance.
- The socket outlet is not earthed
- The test button circuit is connected to the supply side of the tripping device

(b) It is the current imbalance required to trip the RCD

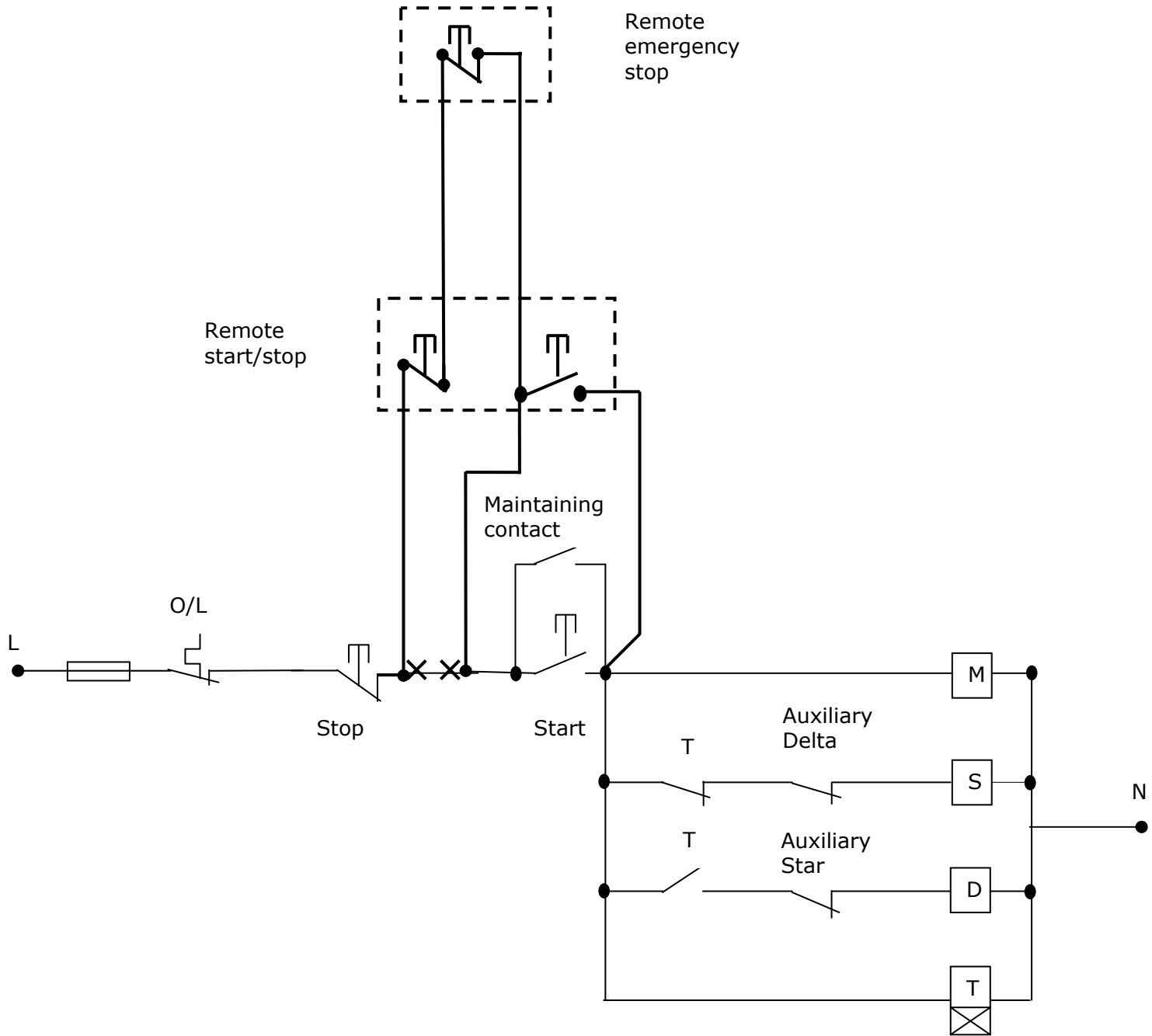
(1 mark)

Question 4	Reference Marks	Marking notes
(a) (i) <ul style="list-style-type: none"> • It shows that when the fault current rises • The time taken for a fuse to blow shortens (ii) <ul style="list-style-type: none"> • 25A fuse – 50A fault current - would operate in about 7 seconds. • 25A fuse - 150A fault current - would operate in about 0.07 seconds. (iii) 20×1.5 = 30A	(1 mark) (1 mark) (1 mark) (1 mark) (½ mark) (½ mark) (1 mark) (1 mark)	
(b) This is the maximum fault current the fuse can safely interrupt.	(1 mark)	
(c) This is the time it takes to interrupt the flow of current and extinguish the arc.	(1 mark)	
(d) This is the maximum current that the fuse is designed to carry continuously	(1 mark)	

Question 5	Marks	Reference	Marking notes
<p>(a) Sec. V_{PH} = $\frac{\text{Sec } V_L}{\sqrt{3}}$ = $\frac{415}{\sqrt{3}}$ = 239.6 volts</p> <p>Turns ratio = $\frac{11000}{239.6}$ = 45.9 to 1</p> <p>Sec I_L = 3.03×45.9 = 139.08A</p>	<p>(1/2 mark)</p> <p>(1/2 mark)</p> <p>(1 mark)</p> <p>(1/2 mark)</p> <p>(1/2 mark)</p> <p>(1/2 mark)</p> <p>(1 mark)</p>		
<p>(b) $3.03 \times \sqrt{3} = 5.25$</p> <p>VA = $\frac{\sqrt{3} \times PV_L \times PI_L}{1000}$ = $\frac{\sqrt{3} \times 11000 \times 5.25}{1000}$ = 100 kVA</p>	<p>(1/2 mark)</p> <p>(1/2 mark)</p> <p>(1/2 mark)</p> <p>(1 mark)</p>		
<p>(c) (i) kVA = $\frac{100 \times 100}{5}$ = 2000 kVA</p> <p>(ii) ISC = $\frac{2000}{415}$ = 4.82 kA</p>	<p>(1/2 mark)</p> <p>(1 mark)</p> <p>(1/2 mark)</p> <p>(1 mark)</p>		

Question 6	Reference Marks	Marking notes

(a)



- Five conductors correctly connected.
- One conductor removed
- Working circuit

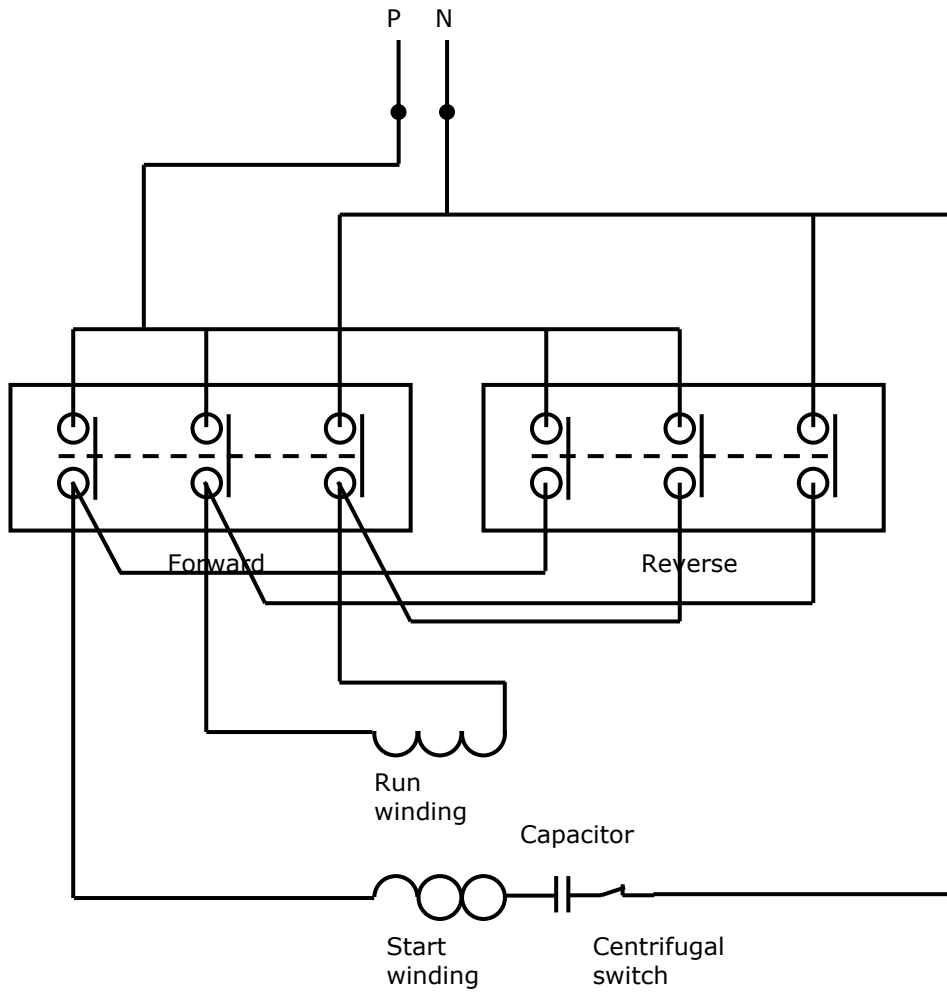
(2½ marks)
(½ mark)
(1 mark)

Question 6

*Reference
Marks*

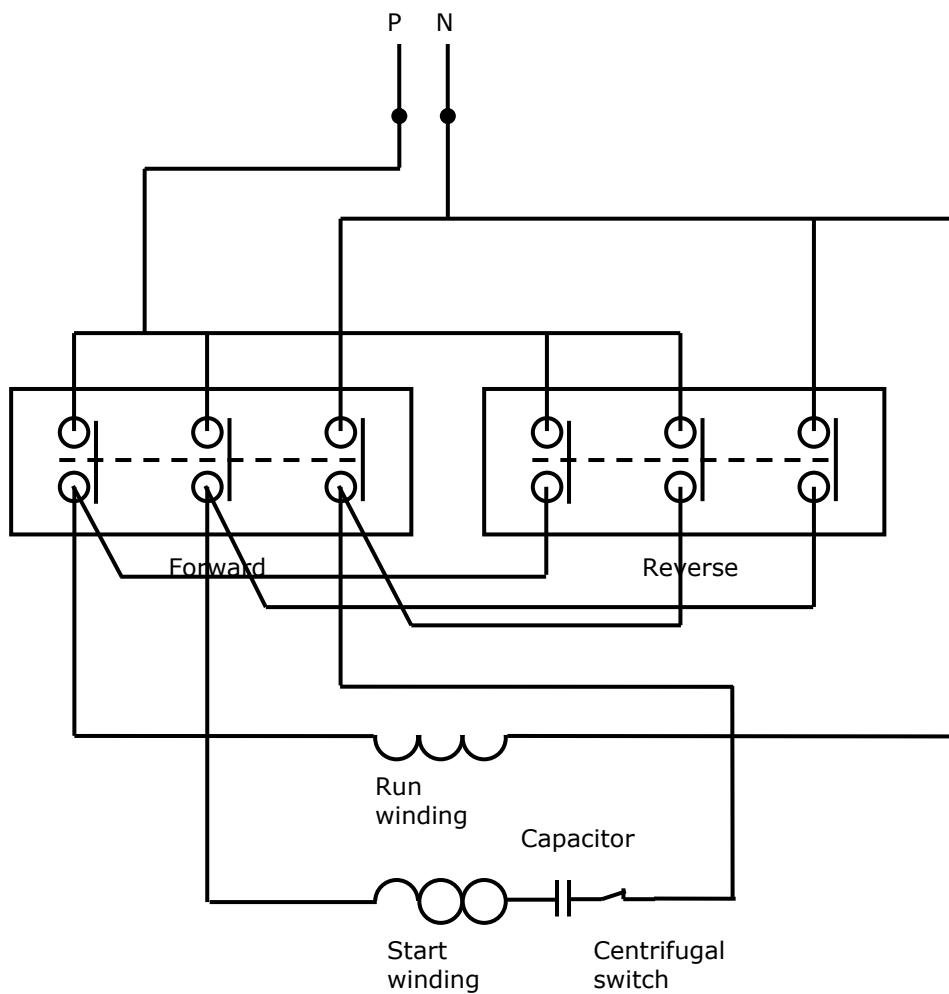
Marking notes

(b) Reversed run winding



Question 6	Reference Marks	Marking notes

Reversed start winding



- | | |
|---|-----------|
| <ul style="list-style-type: none"> • Start winding correct – forward and reverse | (2 marks) |
| <ul style="list-style-type: none"> • Run winding correct – forward and reverse | (2 marks) |
| <ul style="list-style-type: none"> • Complete working circuit | (2 marks) |

Question 7	Reference Marks	Marking notes
(a) $I_{ph} = \frac{P}{V_L \times \sqrt{3}}$ $= \frac{18000}{400 \times \sqrt{3}}$ $= 25.98A$	(1/2 mark) (1/2 mark) (1 mark)	
$I_{fault} = \frac{V}{R}$ $= \frac{230}{(6 + 0.25)}$ $= 36.8A$	(1/2 mark) (1 mark)	
$I_{total} = I_{fault} + I_{load} = 36.8 + 25.98$ $= 67.8A$	(1/2 mark) (1 mark)	
(b) The 40A fuses have a fusing factor (gG Utilisation Category) of 1.5 Fusing current = $1.5 \times 40 = 60A$. Because the fault current is 67.8A the fuse will not operate within 0.4s	(1 mark) (1 1/2 marks)	
(c) V_d across protective earthing conductor equals touch voltage $V_{dE} = I \times R$ $= 36.8 \times 0.25$ $= 9.25V$	(1/2 mark) (1/2 mark)	
No touch voltage hazard exists between the oven frame and earth	(1 1/2 marks)	

Question 8	Reference Marks	Marking notes
<p>(a) (i) The procedure has to include:</p> <ul style="list-style-type: none"> • Opening the isolator. • Taking a voltage test using the prove test prove method. • At the load side of the isolator or the supply side of the contactor to confirm isolation has occurred. • Locking open the isolator. • Attaching a danger tag to the isolator. <p>(ii) Protect the cables against mechanical damage.</p> <p>(iii) Any ONE of:</p> <ul style="list-style-type: none"> • Disconnect the cables at the load side of the isolator Attach an out-of-service tag to the isolator. • Disconnect the cables at the switchboard. Attach an out-of-service tag to the circuit fuses. 	<p>(½ mark)</p> <p>(1 mark)</p> <p>(1 mark)</p> <p>(½ mark)</p> <p>(½ mark)</p> <p>(1 mark)</p> <p>(1 mark)</p> <p>(1 mark)</p> <p>(1 mark)</p>	
<p>(b)</p> <ul style="list-style-type: none"> • Remove the out-of-service tag. • Take a voltage test using the prove test prove method. • At the load side of the isolator or the supply side of the contactor to confirm isolation still exists. • Lock open the isolator. • Attach a danger tag to the isolator. 	<p>(½ mark)</p> <p>(1 mark)</p> <p>(1 mark)</p> <p>(½ mark)</p> <p>(½ mark)</p>	

Question 9	Reference Marks	Marking notes
(a) (i) The fluorescent tube gives 100 flashes of light per second from the 50 Hz a.c. supply. (ii) This can make rotating machinery appear to be stationary or revolving very slowly in either direction. (iii) Any TWO of: <ul style="list-style-type: none"> • Install fittings with ballasts that produce a phase displacement between the tube currents. • Connect adjacent single tubes on different phases. • Mix incandescent lighting with the fluorescent lighting. 	(2 marks) (2 marks) (2 marks)	
(b) By fusing each fitting with a 1 amp fuse, compared to the 16A MCB protecting the circuit.	(2 marks)	
(c) <ul style="list-style-type: none"> • The wiring and components in the light fittings have a much lower current rating. • The wiring and components are not capable of withstanding high currents for extended periods 	(1 mark) (1 mark)	