EIN12 – Electrical Installer Theory Examination Marking Schedule

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

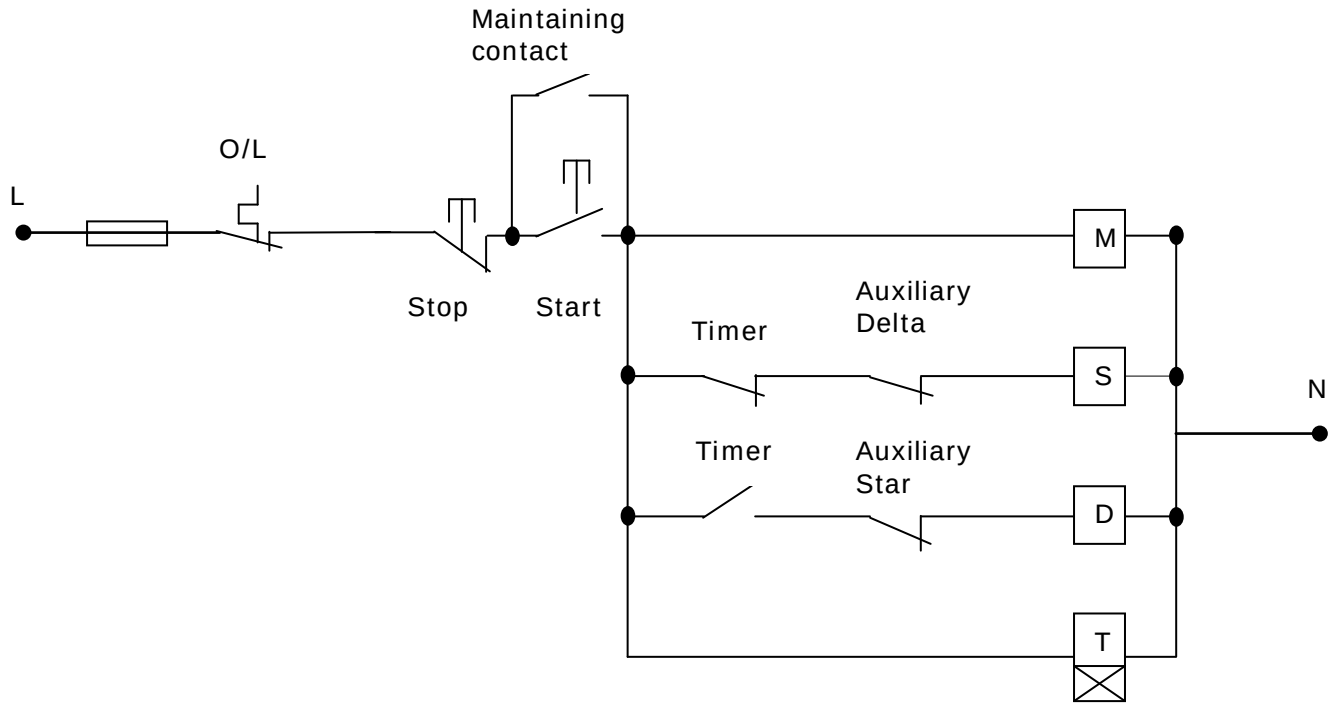
2. This schedule sets out the accepted answers to the examination questions. A marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate's own words.

Question 1	*Reference Marks*	*Marking notes*
(a) Any ONE of: ● Earth leakage current in the circuit. ● Earth leakage current in the appliance.	(2 marks)	
(b) ● To ensure the star operates before the delta contactor ● To prevent the star and delta contactors closing simultaneously	(1 mark) (1 mark)	
(c) (i) To ensure the protective device is rated to safely open under maximum short-circuit current conditions. (ii) An HRC fuse.	(1 mark) (1 mark)	
(d) To ensure the capacitor is discharged when the electricity supply ceases	(2 marks)	
(e) Any ONE of: ● By reversing the connections to the start winding ● By reversing the connections to the run winding	(2 marks)	
(f) (i) 30 mA. (ii) 10 mA	(1 mark) (1 mark)	
(g) Any TWO of: ● The protective devices may self-destruct ● A flash-over could occur in the switchboard ● Tracking could occur across the protective device	(2 marks)	

Question 1	*Reference Marks*	*Marking notes*
(h) Any TWO of: ● More efficient ● Less wear and tear on the motor. ● Easier to adjust for overcurrent and other parameters. ● Reduces mechanical shock to equipment ● Constant torque ● Wider range of settings for overcurrent and other parameters.	(2 marks)	
(i) (i) Any ONE of: ● To stress the insulation at a voltage above 325V a.c. (or peak a.c. voltage). ● To stress the insulation at a voltage of twice the r.m.s voltage of 250V.	(1 mark)	
(ii) To ensure capacitive or inductive reactance does not influence the test result.	(1 mark)	
(j) (i) One phase was still live.	(1 mark)	
(ii) Any ONE of: ● The electrical installer did not test between each phase and earth. ● The electrical installer did not test to a known earth reference.	(1 mark)	

Question 2	*Marks*	*Reference*	*Marking notes*

(a)

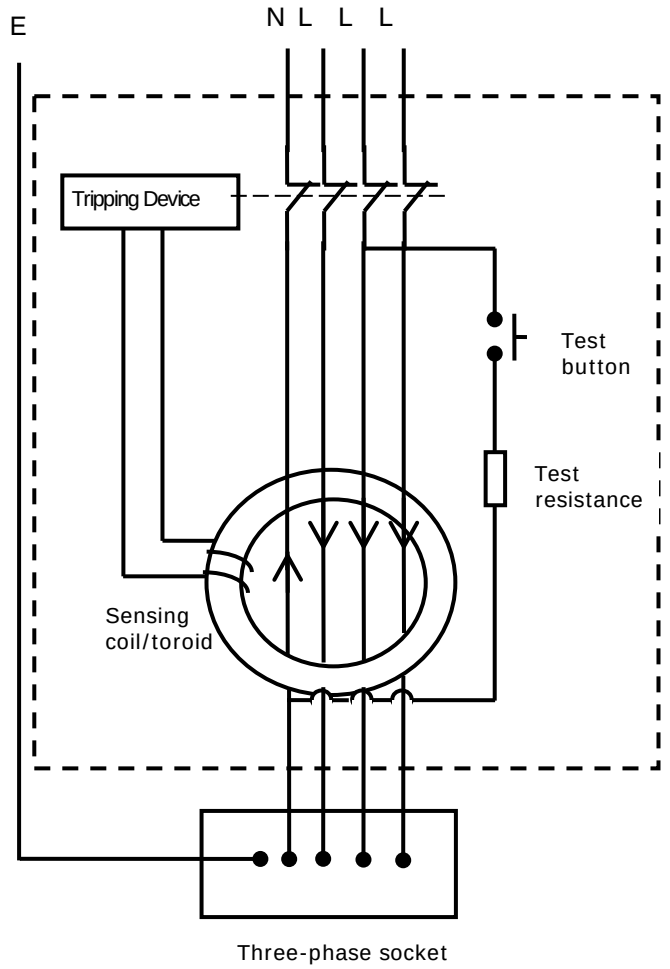


• Fuse protects entire circuit	(½ mark)		
• Overload protects entire circuit	(½ mark)		
• Correctly connected stop button	(½ mark)		
• Correctly connected start button and hold-in contacts	(½ mark)		
• Correctly connected timers	(½ mark)		
• Correctly connected delta auxiliary contact	(½ mark)		
• Correctly connected star auxiliary contact	(½ mark)		
• Correctly connected main contactor coil	(½ mark)		
• Correctly connected star contactor coil	(½ mark)		
• Correctly connected delta contactor coil	(½ mark)		
• Working circuit	(1 mark)		
(b) Any ONE of: • The motor ventilation is restricted in some manner. • The cooling fan has become detached from the motor shaft	(1 mark)		

(c)	• The thermistor changes resistance as the temperature in the motor winding rises • The change in resistance operates the thermistor monitoring relay which opens the motor control circuit.	(1 mark) (1 mark)		
(d)	Interchange two phases on the motor terminal block	(1 mark)		

Question 3	*Reference Marks*	*Marking notes*
(a) ● The phase voltage does not rise above 230V under fault conditions. ● To maintain the potential difference between neutral and earth to (about) 0V	(1 mark) (1 mark)	
(b) Any TWO of: ● kVA rating of the transformer ● Transformer impedance. ● Circuit impedance from the transformer to the switchboard (length of cable run).	(2 marks)	
(c) Any ONE of: ● A touch voltage hazard between conductive parts and the mass of earth. ● Protective devices may not operate under fault conditions. ● Fire hazard at any high resistance joint in the main neutral. ● Over or under voltage could damage equipment – particularly on three phase installations.	(2 marks)	
(d) (i) ● The neutral would be switched ● The pump circuitry would be live when the isolating switch is in the "off" position. (ii) The RCCB will trip as the PEC would carry the return current.	(1 mark) (1 mark) (2 marks)	

Question 4	*Marks*	*Reference*	*Marking notes*
(a) The ELEVEN components are: ● The final subcircuit earth conductor ● The earth bar ● The MEN link ● The neutral bar ● The consumers main neutral ● The distribution neutral ● The distribution transformer winding ● The distribution active (phase) conductor ● The switchboard cables ● The protective device ● The final subcircuit active conductor ● All eleven correct	 (½ mark) (½ mark) (½ mark) (½ mark) (½ mark) (½ mark) (½ mark) (½ mark) (½ mark) (½ mark) (½ mark)		
(b) Any TWO of: ● Determine the prospective short circuit current at the switchboard ● Determine that the correct type and current rating of circuit protection ● Determine whether the circuit protection will operate within the specified time ● Determine if the main neutral is connected to the MEN system	(2 marks)		
(c) It is the path with the lowest impedance so that automatic disconnection of supply occurs quickly if an earth fault occurrs.	(1 mark)		
(d) Any ONE of: ● The fault loop impedance is lower ● Because the distribution transformer is close to the installation or on-site	(1 mark)		

Question 5	Marks	Reference	Marking notes
(a)  Three-phase socket ● Correctly connected phases, neutral and earth. ● Correctly connected test button and resistance ● Correctly connected sensing coil/toroid ● Correctly connected tripping circuit ● Correctly connected socket ● Working circuit	(2½ marks) (½ mark) (½ mark) (½ mark) (½ mark) (½ mark)		
(b) Any ONE of: ● It is the current imbalance required to trip the RCD ● It is the rated residual current of the device	(1 mark)		
(c) Residual Current-Operated Circuit Breaker with Overcurrent Protection	(1 mark)		

Question 5	*Marks*	*Reference*	*Marking notes*
(d) Socket Outlet Residual Current Device	(1 mark)		
(e) • No. • It does not operate on residual pulsating direct current.	(½ mark) (1½ marks)		

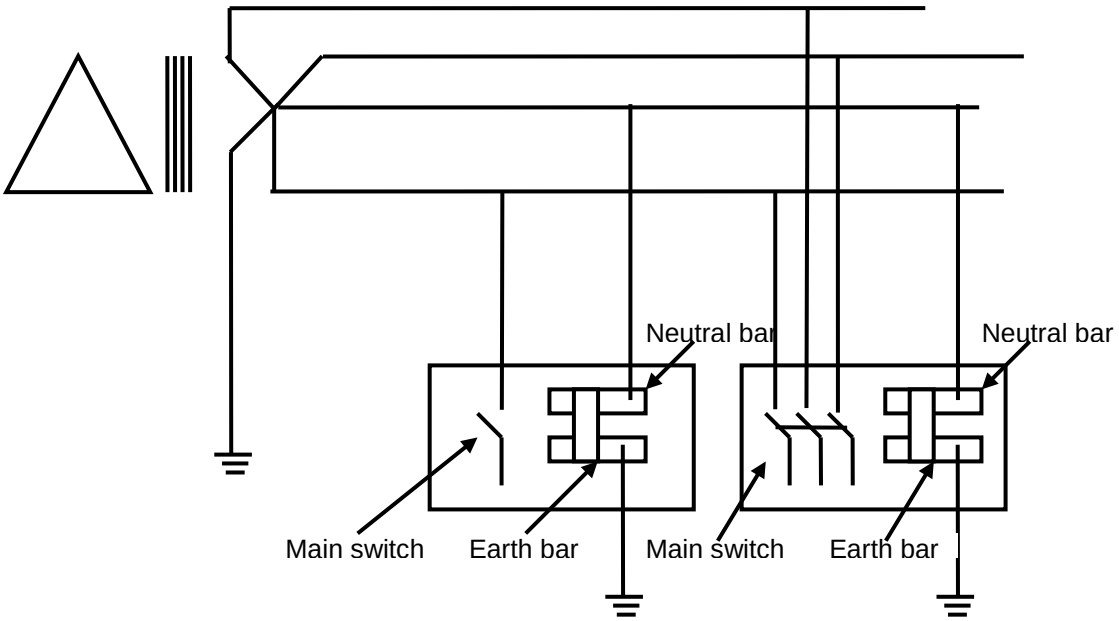
Question 6		*Reference Marks*	*Marking notes*
(a)	● AS/NZS 3000	(½ mark)	
	● Section 8	(½ mark)	
(b)	● Ohmmeter	(½ mark)	
	● Test between the end of the protective earthing conductor of the cable	(1 mark)	
	And the earth pin on the socket outlet.	(1 mark)	
	● The resistance of the PEC is consistent with the characteristics of the cable.	(½ mark)	Accept 1Ω as an alternative
(c)	● Insulation resistance tester	(½ mark)	
	● 500V d.c.		
	● Test between each phase conductor	(1 mark)	
	Test between each phase conductor and the earth conductor	(1 mark)	
	Test between each phase conductor and the neutral conductor	(1 mark)	
	● 1 MΩ minimum	(½ mark)	
(d)	● Ohmmeter	(½ mark)	
	● Each phase connected to the correct phase pin	(½ mark)	
	● Neutral connected to neutral pin	(½ mark)	
	● Earth connected to the earth pin	(½ mark)	

Question 7	*Marks*	*Reference*	*Marking notes*
(a) (i) ● It shows that the higher the fault current ● The shorter the time it takes the fuse to trip.	(1 mark) (1 mark)		
(ii) The gG fusing factor (utilisation category) is in the range between 1.25 and 1.6.	(1 mark)		
(iii) 20 x 1.6 = 32A	(½ mark) (½ mark)		The fusing current will be between 25A and 32A depending on the fusing factor stated in (a)(ii)
(iv) 95A	(1 mark)		
(b) Only the protective device nearest the fault operates	(1 mark)		
(c) To provide short-circuit protection for the final subcircuit and motor	(1 mark)		
(d) This is the maximum continuous current that the fuse is designed to carry.	(1 mark)		
(e) This is the maximum fault current the fuse can safely interrupt.	(1 mark)		
(f) Any ONE of: ● This is the time it takes to interrupt the flow of current and extinguish the arc. ● It is the sum of the pre-arc time and the arc time	(1 mark)		

Question 8	*Marks*	*Reference*	*Marking notes*
(a) Any ONE of: ● Rewireable fuses are not rated for more than 1 kA ● Rewireable fuses will not safely rupture under the stated fault conditions	(2 marks)		
(b) (i) ● A bi-metal strip heats up and distorts ● The distortion operates a trip mechanism that opens the breaker	(1 mark) (1 mark)		
(ii) ● A strong magnetic field is created in the coil ● The field attracts a trip mechanism that operates and opens the breaker.	(1 mark) (1 mark)		

Question 8	Marks	Reference	Marking notes

(c)



Single-phase consumer Three-phase consumer

• Star point earthed	(1 mark)	
• For each switchboard - an earthing conductor connected to the earth bar.	(1 mark)	
• For each switchboard - an MEN link between the neutral bar and earth bar.	(1 mark)	
• For each switchboard – a neutral conductor between the neutral bar and the distribution neutral.	(1 mark)	

Question 9	*Reference Marks*	*Marking notes*
(a) ● Carrying out a checking or testing procedure with or without test instruments ● To prove that the work is safe and completed correctly	(1 mark) (1 mark)	
(b) ● Prove that the meter is working on a known live source ● Test the circuit/equipment to verify that no voltage is present ● Again prove that the meter is working on a known live source to ensure it is working correctly	(1 mark) (1 mark) (1 mark)	
(c) ● An ohmmeter has an output voltage in the 1.5V to 9V range. ● This voltage is insufficient to stress the insulation and expose weaknesses	(1 mark) (1 mark)	
(d) Any THREE of: ● The instrument is suitable for the required tasks ● The instrument, clips, leads and probes are in good condition. ● The correct function is selected. ● The correct range is selected. ● The leads are correctly connected to the instrument ● The leads are correctly connected to the appliance.	(3 marks)	