

Licensed Electrical Inspector Theory (LEIT) Assessment

Sample Paper Marking Guide January 2021

Questions 1-16: Standards, Regulations and the Act

Q.1

Answer: No, the ESR system shall not be installed in hazardous areas (2 marks)
Reference document: AS/NZS 3000:2018 (1 mark)
Clause number: 3.16(d) (2 marks)

Q.2

Answer: Identified by marking of its location on the switchboard at which the circuits supply the pool or spa originate, or other permanent location. (2 marks)
Reference document: AS/NZS 3000:2018 (1 mark)
Clause number: 5.6.2.6.3(b) (2 marks)

Q.3

Answer: all live conductors (2 marks)
Reference document: AS/NZS 4777.1:2016 (1 mark)
Clause number: 3.4.5 (a) (2 marks)

Q.4

Answer: 120 minutes (an answer of 2 hours also acceptable) (2 marks)
Reference document: AS/NZS 3000:2018 (1 mark)
Clause number: H1.3 Table H1 (2 marks)

Q.5

Answer: IP23. (2 marks)
Reference document: AS/NZS 3012:2019 (1 mark)
Clause number: 2.3.2.1(b) (2 marks)

Q.6

Answer: Each socket outlet on a service pillar shall be identified by suitable indelible means to indicate the site that it is intended to supply. (2 marks)
Reference document: AS/NZS 3001:2008 (1 mark)
Clause number: 2.2.7.3 (2 marks)

Q.7

Answer: When conduit or other wiring enclosure is used, the wiring enclosure shall be labelled 'SOLAR' on the exterior surface of the enclosure at an interval not exceeding 2m. If fixed to a surface, the identification shall be visible after mounting. (2 marks)

Reference document: AS/NZS 5033:2014 (1 mark)

Clause number: 5.3.1 (2 marks)

Q.8

Answer: At the origin of every circuit and at each point where a reduction occurs in the current-carrying capacity of the conductors. (2 marks)

Reference document: AS/NZS3000:2018 (1 mark)

Clause number: 2.5.1.3 (2 marks)

Q.9

Answer: No (2 marks)

Reference document: AS/NZS 3004.1:2014 (1 mark)

Clause number: 1.6.4(b) (2 marks)

Q.10

Answer: exhaust gases, smoke or fumes (2 marks)

Reference document: AS/NZS 3010:2017 (1 mark)

Clause number: 2.2 (2 marks)

Q.11

Answer: 3000 (2 marks)

Reference document: Electricity Safety (General) Regulations 2019 (1 mark)

Clause number 303(2)(b) (2 marks)

Q.12

Answer: Shall be legibly and indelibly marked with a set of numbers or letters or both which uniquely distinguish the switchboard from others on the site (2 marks)

Reference document: AS/NZS 3002:2008 (1 mark)

Clause number: 2.5.3 (2 marks)

Q.13

Answer: connected to the electricity supply (2 marks)

Reference document: Electricity Safety Act 1998 (1 mark)

Clause number: 45 (1) (2 marks)

Q.14

Answer: A residual current device or an isolating transformer (2 marks)

Reference document: AS/NZS 4836:2011 (1 mark)

Clause number: 3.4 (2 marks)

Q.15

Answer: AS 1670.4 (2 marks)

Reference document: AS/NZS 3000:2018 (1 mark)

Clause number: 7.2.8.1 (2 marks)

Q.16

Answer: In an area where an authorized person will be aware of the signal. (2 marks)

Reference document: AS/NZS 5139:2019 (1 mark)

Clause number: 5.3.8 (2 marks)

Q.17(a) Voltage Drop

Mains Heaviest loaded phase: Red phase 550A
T41 $V_c = 0.467\text{V/A.m}$ (1 mark)

$$I = 550/2 = 275\text{A}$$

$$V_D = (15 \times 275 \times 0.467/1000 = 1.93\text{V}$$

$$\text{Single phase voltage drop } 1.93/\sqrt{3} = 1.11\text{V} \quad (1 \text{ mark})$$

Submains Heaviest loaded phase: blue phase 63A
T41 $V_c = 2.43\text{mV/A.m}$ (1 mark)

$$V_D = (45 \times 63 \times 2.43)/1000 = 6.89\text{V}$$

$$\text{Single phase voltage drop } 6.89/\sqrt{3} = 3.98\text{V} \quad (1 \text{ mark})$$

FSC T42 $V_c = 15.6 \times 1.155 = 18.02\text{mV/A.m}$ (1 mark)

$$I = 20/2 = 10\text{A} \quad (\text{From AS/NZS3000:2018 clause 3.6.2.exception 1; it is not necessary to quote this clause but must use correct current value based on this clause}).$$

$$V_D = 35 \times 10 \times 18.02 = 6.31\text{V} \quad (1 \text{ mark})$$

$$\text{Total volts lost (single phase)} = 1.11 + 3.98 + 6.31 = 11.4\text{V}$$

$$\text{Voltage at the terminals } 230 - 11.4 = 218.6\text{V} \quad (1 \text{ mark})$$

The installation complies. (1 mark)

Q.17(b) Voltage Drop

$$(I_O/I_R)^2 = (\Theta_O - \Theta_A) / (\Theta_R - \Theta_A) \quad (\text{This formula may be located in AS/NZS3008.1.1 Clause 4.4})$$

Transposed for cable operating temperature $\Theta_O = (I_O/I_R)^2 \times (\Theta_R - \Theta_A) + \Theta_A$

$$\begin{aligned} \Theta_O &= (120/280)^2 \times (90-25) + 25 && (1 \text{ mark}) \\ &= 36.9^\circ\text{C} \end{aligned}$$

- (i) The cable operating temperature is 36.9°C (1 mark)
- (ii) The effect would be to lower the value of V_C . (1 mark)

Q.18 Prospective Fault Current

$$I_{(\text{fault current at transformer})} = \frac{750,000}{(400 \times \sqrt{3})} \times \frac{100}{6} = \mathbf{18,042A} \quad (2 \text{ marks})$$

$$Z_{(\text{transformer})} = 230 / 18042 = 0.01275\Omega \quad (1 \text{ mark})$$

$$Z_{(\text{mains})} \text{ AS/NZS3008.1.1:2017 Table 34 } R_c = 0.342 \Omega/\text{km} \quad (1 \text{ mark})$$

$$0.342 \times (15/1000) = 0.00513\Omega \quad (1 \text{ mark})$$

$$I_{(\text{MSB})} = 230 / (0.01275 + 0.00513) = \mathbf{12,863A} \quad (12,864 \text{ also accepted}) \quad (2 \text{ marks})$$

$$Z_{(\text{sub mains})} = \text{AS/NZS3008.1.1:2017 Table 34 } R_c = 0.884 \Omega/\text{km} \quad (1 \text{ mark})$$

$$0.884 \times (37/1000) = 0.03271\Omega \quad (1 \text{ mark})$$

$$I_{(\text{DB})} = 230 / (0.01275 + 0.00513 + 0.03271) = \mathbf{4,546A} \quad (2 \text{ marks})$$

Q.19 Circuit Breaker Selection

$$I_a = \frac{0.8U_o S_{ph} S_{pe}}{L_{max} p(S_{ph} + S_{pe})} \quad (\text{This formula may be located in AS/NZS3000 clause B5.2.2})$$

$$I_a = \frac{0.8 \times 230 \times 50 \times 16}{160 \times 22.5 \times 10^{-3} (50 + 16)} \quad (1 \text{ mark})$$

$$I_a = 619.5A \quad (2 \text{ marks})$$

Type B $I_a = 4 \times \text{rated current}$
 $= 4 \times 100 = 400A \quad (1 \text{ mark})$

Type C $I_a = 7.5 \times \text{rated current}$
 $= 7.5 \times 100 = 750A \quad (1 \text{ mark})$

Type D $I_a = 12.5 \times \text{rated current}$
 $= 12.5 \times 100 = 1,250A$

Therefore a Type B must be used. (1 mark)

Q.20 Clearing Time

$$t = \frac{K_e I_r}{I_f^{1.5}} \quad (\text{This formula may be located in AS/NZS3000 clause 2.5.5.3})$$

$$I_r = 1800A$$

$$I_f = 30\% \text{ of } 27kA = 0.3 \times 27,000 = 8100A \quad (1 \text{ mark})$$

$$t = \frac{250 \times 1800}{8100^{1.5}} \quad (1 \text{ mark})$$

$$t = 0.617 \text{ seconds} \quad (2 \text{ marks})$$

Q.21 Earth Size

$$S = \sqrt{(I^2 t / K^2)} \quad (\text{This formula may be located in AS/NZS3000 clause 5.3.3.1.3})$$

K is taken from Table 52 AS/NZS3008.1.1 with an initial temp of 25° (note: earth cables do not normally carry current therefore the initial temperature is always the ambient temperature of 25°C or 40°C for earthing conductors), and a final temp of 250° (from Table 53).

$$K = 179 \quad (2 \text{ marks: } 1 \text{ mark for Table no, } 1 \text{ mark for value})$$

$$S = \sqrt{(7000^2 \times 0.4 / 179^2)}$$

$$= 24.7 \text{mm}^2 \quad (2 \text{ marks})$$

Use 25mm² cable (1 mark)

Q.22 Circuit Breaker and Fuse Ratings

a) for a circuit breaker

$$I_B \leq I_N \leq I_Z$$

$$125 \leq I_N \leq 133$$

Any circuit breaker with a rating between 125 and 133 inclusive may be used, therefore may use 125A or 130A (2 marks)

b) for a HRC fuse

$$I_B \leq I_N \leq 0.9 I_Z$$

$$125 \leq I_N \leq 0.9 \times 133$$

$125 \leq I_N \leq 119.7$ not possible, therefore a HRC fuse cannot be used. (2 marks)

Q.23 Cable Selection

T14: $C_{23} = 251A$ (2 marks)

$\times 2 = 502A$ (1 mark)

T25(2) = 0.87 (1 mark)

Answer Part (a) = 436.7A (1 mark)

T29: Rating factor 1.07 applied (1 mark)

Answer Part (b) new current rating = 467.3A (1 mark)

Q.24 Discrimination

$$C_1 \geq 1.5 \times C_2$$

$$600 \geq 1.5 \times 400$$

Max permissible = 400A (2 marks)