

MATTHEW WILLIAMS
22 May 2020

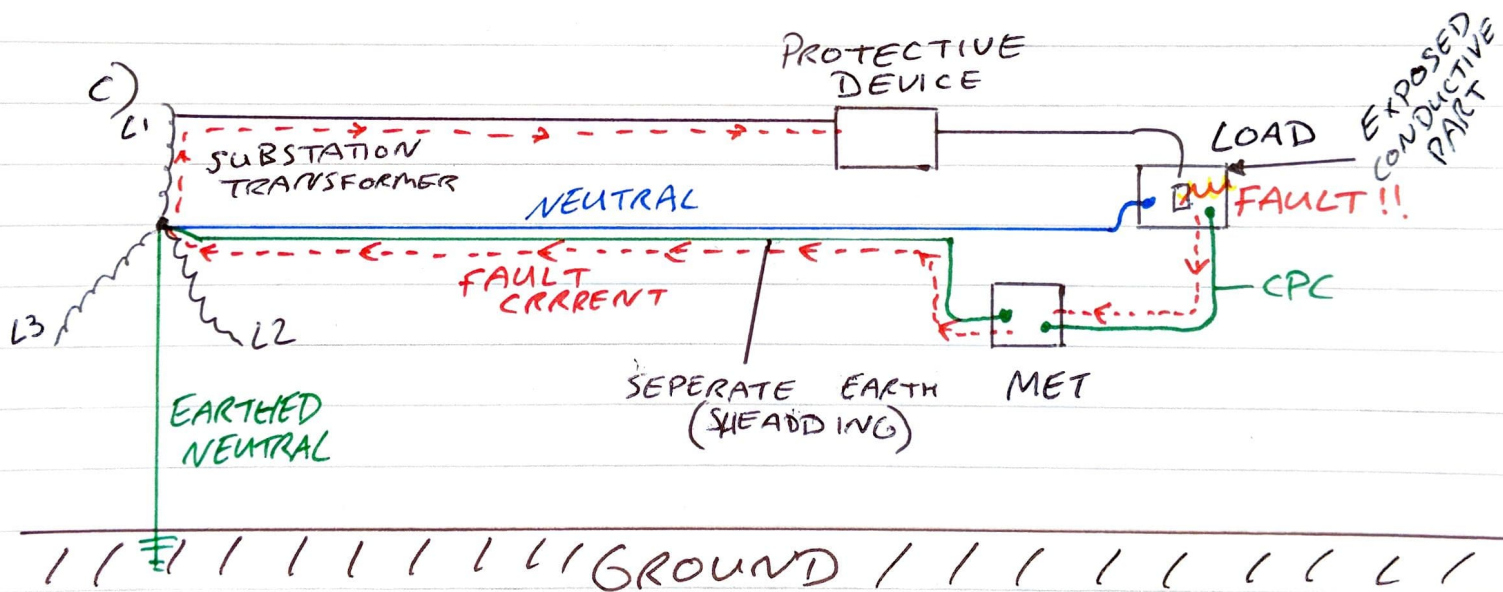
WIL18847411

M4X00920
HE ELECTRICAL DESIGN 9.30

Q1 a) Exposed Conductive parts can be touched and under normal conditions are not live, but may become live under fault conditions.
ie. Electrical + Metal + require connecting to earth.

- Metallic case of light fitting
- Steel conduit + trunking

b) Additional electrodes are needed in-core the Neutral circuit becomes an open circuit.



- d) i) • Fault path resistance is the same + doesn't depend on environmental circumstances
ii) • Lower touch voltages under fault conditions.

$$Q2. a) R_1 + R_2 = \frac{(R_1 + R_2) \times \text{multiplier} \times \text{length}}{1000}$$

$$R_1 + R_2 = \frac{10.49 \times 1.20 \times 23}{1000}$$

$$R_1 + R_2 = 0.29 \Omega$$

$$Z_s = \frac{R_1 + R_2}{+ Z_e} = \frac{0.29 \Omega}{0.32 \Omega} = 0.61 \Omega$$

$$I_f (PFC) = \frac{V}{Z_s} = \frac{230V}{0.61 \Omega} = \underline{\underline{377 \text{ Amps}}}$$

$$b) \text{ Disconnection time} = 0.1 \text{ seconds}$$

Q3 a) $I_b = 37 \text{ Amps}$

$I_n = 40 \text{ Amps}$

$$I_z = \frac{I_n}{C_a \times C_g \times C_i \times C_f \times C_c} = \frac{40}{0.94 \times 0.7 \times 1 \times 1 \times 1}$$

$I_z = 61 \text{ Amps}$

Live conductor minimum size = 16 mm^2

$$R_1 + R_2 = \frac{(R_1 + R_2) \times \text{multiplier} \times \text{length}}{1000}$$

$$R_1 + R_2 = \frac{2.30 \times 1.20 \times 27}{1000} = 0.07 \Omega$$

$$\begin{array}{rcl} Z_s = R_1 + R_2 & = & 0.07 \Omega \\ + \quad Z_e & & 0.60 \Omega \\ \hline Z_s & = & 0.67 \Omega \end{array}$$

$$I_f(\text{PFC}) = \frac{V}{Z_s} = \frac{230 \text{ V}}{0.67 \Omega} = 343.28 \text{ amps}$$

Disconnection time = 0.2 seconds

$$S = \frac{\sqrt{I^2 \times t}}{k} \quad S = \frac{\sqrt{(343.28)^2 (0.2)}}{115} = 1.33$$

CPC Conductor minimum size = 1.5 mm^2

Q4 a) $42\text{m} \times 19\text{m} = 798\text{m}^2$

$$N = \frac{E \times A}{f \times UF \times MF}$$

$$N = \frac{300 \times 798}{13,500 \times 0.8 \times 0.7} = 31.66$$

Number of Lights
required for hall = 32

b) $E = \frac{I}{d^2} = \frac{10000}{(6)^2} = \underline{\underline{277.77 \text{ lux}}}$

c) I would arrange the lights in a uniform pattern for an even spread of light.

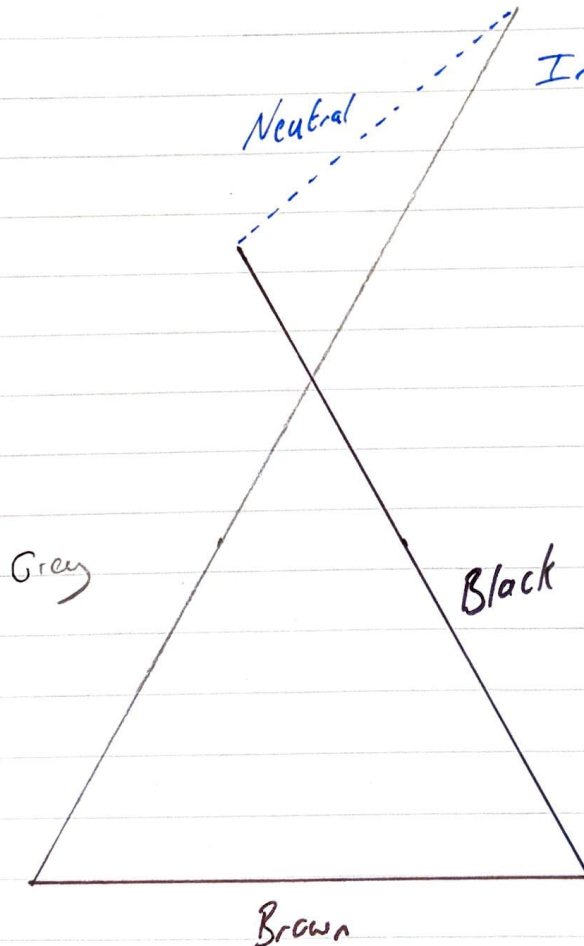
x	x	x	x	x	x	x
x	x	x	x	x	x	x
x	x	x	x	x	x	x
x	x	x	x	x	x	x
x	x	x	x	x	x	x

Q5 a) (A) 115 Amps Brown Phase $115 \div 15 = 7.66$
 (B) 145 Amps Black Phase $145 \div 15 = 9.66$
 (C) 200 Amps Grey Phase $200 \div 15 = 13.33$

$$\sqrt{A^2 + B^2 + C^2 - (AB) - (AC) - (BC)}$$

$$\sqrt{(115)^2 + (145)^2 + (200)^2 - (115 \times 145) - (115 \times 200) - (145 \times 200)}$$

$$= 74.66 \text{ Amps}$$



$$I_n = 4.9 \times 15 = 73.5 \text{ Amps}$$

b) IF a load is purely resistive then the voltage + current are then same, as in "in phase with each other" IF the load is partly reactive the current will lead or lag the voltage, that is "out of phase" with each other

c) All accessories must be labeled as to which phase they are fed from

Q6.

$$\begin{array}{rclcl} \text{a)} & 1.5 \text{ mm}^2 & \rightarrow & 8.6 & \times & 6 & = & 51.6 \\ & 2.5 \text{ mm}^2 & \rightarrow & 12.6 & \times & 9 & = & 113.4 \\ & 6 \text{ mm}^2 & \rightarrow & 21.2 & \times & 6 & = & 127.2 \\ & 10 \text{ mm}^2 & \rightarrow & 35.3 & \times & 3 & = & 105.9 \\ & & & & & & & \hline & & & & & & & 398.1 \end{array}$$

Closest factor = 738

Trunking size = 75 x 25

$$\text{b)} \quad 10 \text{ mm}^2 \rightarrow 35.3$$

$$= \frac{\text{factor for trunking}}{\text{factor for cable}} = \frac{738}{35.3}$$

$$= 20.90$$

Maximum number of 10 mm^2 cables that could be installed in 75×25 trunking

$$= \underline{\underline{20}} \times 10 \text{ mm}^2 \text{ cables}$$