# G063A SECTION 6 WORKSHEETS

**Electrical Fault Protection**

1. What effects can it have on an electrical circuit if the maximum safe working current is exceeded?
   **It can result in damage to the cable and/or associated parts of the installation.**

2. List three of the general requirements for the protection of electrical wiring.

   **a. Small overloads of short duration should not cause the protection to operate.**

   **b. The protection must operate, even on a small overload, and if the overload Persists long enough to cause overheating of the circuit conductors.**

   **c. The protection must open the circuit before damage caused by fault currents can occur.**

   **d. Protection must be 'discriminative' in that only the faulty circuit is isolated and other circuits remain operative and unaffected.**

3. Which clause in AS/NZS 3000 specified the requirements for coordination between conductors and protective devices?

   **AS/NZS 2.5.3.1 P.g 97**

4. What two factors govern the value of current which can flow in a circuit if a 'short circuit' or 'bolted fault' occurs?

   **Impedance of the circuit and available short circuit energy**

5. If a distribution transformer had an impedance of 5%, what value of short circuit current would flow if the primary current was 100 amps.

- **2000A**

6. Calculate the rated full load current of a 350 kVA, 415/240 volt three phase distribution transformers with an impedance of 5%.

$$I_{FL} = \frac{350 \times 1000}{\sqrt{3} \times 415} = 486.92A$$

7. Calculate the prospective short circuit current of a 500 kVA, 415/240 volt three phase distribution transformers that has an impedance of 5%.

$$I_{FL(FULL\ LOAD\ O/P\ I)} = \frac{500 \times 1000}{\sqrt{3} \times 415} = 695.62A \qquad I_{SC} = \frac{695.62}{0.05} = 13912.05A$$

8. The network operator advises that the prospective short circuit current at the point of supply to a particular 415 volt three phase installation is 10 000 amps. What is the supply impedance per phase?

$$\frac{240}{10000} = 0.024 \text{ ohms}$$

9. Calculate the prospective fault current (fault level) per phase at the 3 phase 415 volt main switchboard if the impedance of the consumers mains is 0.028 ohms and the specified impedance at the point of supply is 0.02 ohms.

$$I_{fault} = \frac{240}{0.028 + 0.02} = 5000A$$

10. When providing protection against indirect contact in a 240 volt installation, what is the maximum permissible disconnection time for final sub circuits that supply 10 amp socket outlets?

**0.4S**

11. When providing protection against indirect contact in a 240 volt installation, what is the maximum permissible disconnection time for a final sub circuit supplying a fixed-wired air conditioning unit?

**5S**

12. A 240 volt final sub circuit supplies 10 amp socket outlets and is protected by a 16 amp Type C circuit breaker. Calculate the maximum internal fault-loop impedance of the final sub circuit if the supply is unavailable.

**1.28 Ω**

13. List the internal and external parts of an MEN system which comprise the 'fault-loop' according to AS/NZS 3000. State the Clause number.

**AS/NZS 3000 Clause B4.4, P.G 447 & 5.7.3 P.G313**

14. Determine the prospective short circuit fault current per phase at the main switchboard of an installation if the network operator gives the three phase distribution transformer details as 415 V, 500 kVA, with an impedance of 4.9%. The impedance of the 16 mm2 copper consumers mains is 0.4 ohms.

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|---|---|---|---|
| **Full Load Current** | **$I_{FL}$** | **= 500 x 1000 / 1.732 x 415** | **= 695.623A** |
| **Prospective Fault Current** | **$I_{SC}$** | **695.623A / 0.049 = 14196.39 A** | |
| **Supply Impedance per Phase** | **$Z_{PHASE}$** | **= 240 / 14196.39 A = 0.01690 Ω** | |
| **Fault Current per phase** | **$I_F$ =** | **= 240/0.01690 Ω (Supply Mains)+ 0.4 Ω(Cables)**<br>**= 240/0.0.41688**<br>**= 575.669A** | |