G063A SECTION 4 WORKSHEET

Operation and Selection of Protective Devices

1. **What are the three main ratings applied to circuit breakers?**

   Fuses and circuit breakers have the following ratings:
   a. Maximum operating voltage
   b. Full load or continuous current rating
   c. Rupturing capacity.

2. **State two advantages of HRC fuses compared to rewirable fuses of the same current rating.**

   The main advantages of HRC fuses compared with semi enclosed fuses are:
   a. **Accurate Calibration**. The time/current characteristics are constant and predictable.
   b. **Rapid Rupture**. The largest rating HRC fuse made will interrupt a full capacity short circuit fault in less than half a cycle.

3. **What type of load requires a special slower-acting HRC fuse cartridge?**

   Special slower acting motor rated HRC fuses are used to accommodate high starting currents of motors.

4. **Which type of protective device operates fastest, a thermal type circuit breaker or a fault current limiter fuse?**

   Fault Current Limiters are especially fast acting HRC fuses operating at approximately five milliseconds and designed to clear short circuits and not overloads. This high speed operation reduces the large thermal and magnetic stresses caused by the very high short circuit current.

5. **What is meant by the term 'discrimination' in a circuit protection system?**

   Discrimination between two or more circuit interrupting devices in series is said to occur when, on the incidence of a short circuit or overcurrent, the fuse or other overload device nearest the fault operates before any other protective device even begins to clear the fault

6. **List the various methods used to quench arcs within circuit breakers. Give an application for each type.**

   De-ion Arc Quenching. De-ion is a trade name for an arc chute arranged to stretch and break up the arc that may occur on switching. The operation of the grid depends on the fact that the arc established between the contacts is a current carrying conductor surrounded by a magnetic field. The U-plates distort the circular field thereby pushing the arc into the plates which cut the arc into a number of small segments.

   Magnetic Blow Out. Most small and medium range circuit breakers on a.c. well as d.c. cause the contact or arc current to produce a magnetic field across the contacts. The polarity of this field is arranged so that the arc bends outwards and stretches until it is broken.

   Oil Quenching. In oil circuit breakers (OCB) the contacts are submerged in a non-conducting oil and the arc is quenched very quickly by the oil due to rapid cooling.

Air Blast Quenching. Very large air circuit breakers (ACB), as used by the supply authority mostly in the high tension switchgear, use a blast of air across the contact gap to stretch and quench the arc.

7. **If the maximum safe working current for wiring is exceeded and the protection is inadequate or does not operate, how will the wiring be affected?**

   It would overheat and burn out

8. **Explain the term inverse time characteristic as applied to fuses and circuit breakers.**

   The inverse time characteristic is when the tripping time of the CCT breaker is reduced substantially when higher than rated current is forced though the breaker.

9. **What limits the value of short circuit current when a short occurs in a final sub-circuit.**

   a) How fast the fuse acts
   b) Circuit Impedance

10. **What is the most common type of tripping mechanism in small air circuit breakers?**

    Thermal

11. **What is the common name given to the method of arc quenching which involves magnetic attraction and compartmentalisation of the arc?**

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12. **Which type of fuse will let through the most electrical energy before it interrupts the supply under short circuit conditions?**

    Semi-enclosed rewirable fuses

13. **A particular final sub circuit is protected by a 16 amp Type C circuit breaker. Use the tripping characteristics curve in this Section to determine how much time it would take for the circuit breaker to trip if the circuit current increased to 48 amps as a result of a circuit fault.**

    Approx 5 to 20 Secs

14. **A particular final sub circuit is protected by a 20 amp motor-rated HRC fuse link. Use the characteristic curves in this Section to determine how much time it would take for the fuse to interrupt the circuit if the current increased to 45 amps as a result of a circuit fault.** Approx 110 secs