CIRCUIT BREAKER
SWITCHING AND PROTECTING VARIOUS PARTS OF A POWER SYSTEM

Presented By: Abhimanyu Kumar
Zeeshan Qureshi
Branch: Electrical and Electronics Engg.
THAKRAL COLLEGE OF TECHNOLOGY, BHOPAL
Introduction

- A circuit breaker is a piece of equipment which can:
  - make or break a circuit either manually or by remote control under normal conditions.
  - break a circuit automatically under fault conditions.
Need of Circuit Breaker

- A circuit breaker, irrespective of its position in a grid has two tasks:
  - It is responsible for the daily switching of lines during normal operation.
  - For disconnection of the power supply in case of overload or short circuit.
- several GVA of power can be tamed by a circuit breaker within fraction of a second.
Operation

- Consists of fixed and moving contacts called electrodes.
- Under normal conditions, these contacts remain closed & will not open until and unless the system becomes faulty.
- When faults occurs in any part of the system, the trip coils of the circuit breaker get energized and the moving contacts are pulled apart by some mechanism, thus opening the circuit.
Electrical Arc

- Forms from ionized gases (plasma) between the high voltage opened contacts.
- Temperature can exceed 50,000 °C.
- Pressure up to 100MPa
- Contained with in volume of less than a liter.
Methods of Arc Extinction:

- **HIGH RESISTANCE METHOD** in which arc resistance is made to increase with time so that current is reduced to a value insufficient to maintain the arc. Consequently, current is interrupted or the arc is extinguished.
Methods of Arc Extinction:

- **LOW RESISTANCE METHOD** in which arc resistance is kept low until current is zero where the arc extinguishes naturally and is prevented from restriking in spite of the rising voltage across the contact. It is used exclusively in AC circuits.
Classification of Circuit Breakers

The medium used for arc extinction is usually oil, air, SF₆ or vacuum. Accordingly, circuit breaker may be classified into:

- **OIL CIRCUIT BREAKER** which employ some insulating oil for arc extinguishing
- **AIR-BLAST CIRCUIT BREAKER** in which high pressure air-blast ids used for extinguishing the arc
- **SULPHUR BREAKERS** in which SF6 is used for arc extinction
- **VACUUM CIRCUIT BREAKER** in which vacuum is used for arc extinction
OIL CIRCUIT BREAKER
Operation

- Transformer oil used as arc quenching medium
- It insulates between phases and the ground, and it provides the medium for the extinguishing of the arc.
- When electric arc is drawn under oil, the arc vaporizes the oil and creates a large bubble that surrounds the arc.
Operation

- The gas inside the bubble is around 80% hydrogen, which impairs ionization.
- The decomposition of oil requires energy that comes from the heat generated by the arc.
- The oil surrounding the bubble conducts the heat away from the arc and thus also contributes to deionization of the arc.
Operation of a Basic Circuit Breaker:
Advantages:

- It absorbs the arc energy to decomposes the oil into gases which have excellent cooling properties.
- It acts as an insulator and permits smaller clearance between live conductors and earth components.
- The surrounding oil presents cooling surface enclose proximity to the arc.
Disadvantages:

- Oil is inflammable and there is a risk of a fire.
- It may form an explosive mixture with air.
- The arcing products remain in the oil and its quantity deteriorates with successive operation.
Types of Oil Circuit Breaker

- **BULK OIL CIRCUIT BREAKER** in which large quantity of oil is required. The oil serves as an arc extinguishing agent and provides insulation between conductors.

Subtypes of Bulk Oil Circuit Breakers:
- Plain Oil Circuit Breakers
- Arc Control Oil Circuit Breakers
Types of Oil Circuit Breaker

- LOW OIL CIRCUIT BREAKER which use minimum amount of oil. Oil serves the purpose of only arc extinction.
THE END...

...THANK YOU!!!