SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE605 PROTECTION AND SWITCHGEAR

III YEAR /VI SEMESTER

Unit 5- CIRCUIT BREAKERS

Topic: Air Circuit Breaker

Air Circuit Breakers

Air circuit breakers are essential components in electrical power systems, providing reliable protection against overloads and short circuits.

Principle of Operation

Contacts

Metallic contacts that open to interrupt the flow of current.

Arc Chutes

Extinguish the electric arc generated when the contacts separate.

Operating Mechanism

Rapidly opens and closes the contacts to clear faults.

Key Components

Main Contacts

Carry normal load current and open to interrupt faults.

Arcing Contacts

Initiate arc formation and guide it into the arc chutes.

Operating Mechanism

Spring, pneumatic, or hydraulic powered to open/close rapidly.

Arc Interruption

1. **Contact Separation**

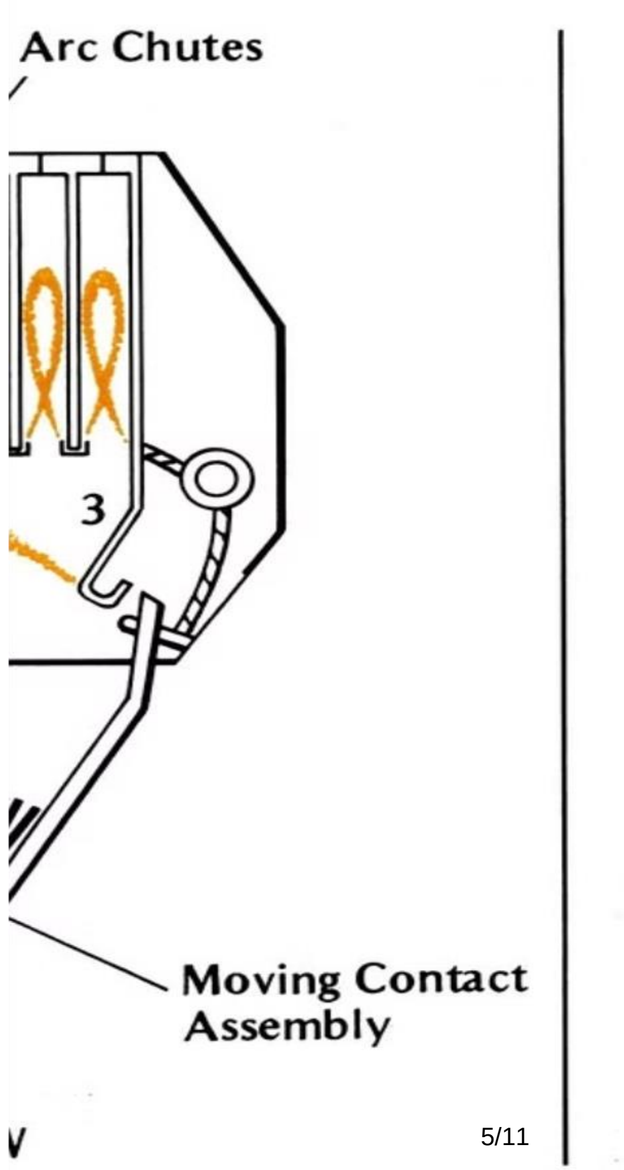
   Contacts part, creating an electric arc between them.

2. **Arc Elongation**

   Arc is drawn out and cooled by the arc chutes.

3. **Current Zero Crossing**

   Arc extinguishes as current reaches zero, interrupting the fault.



Ratings and Standards

1 Voltage Rating

Defines max voltage the breaker can safely interrupt.

2 Current Rating

Maximum continuous current the breaker can carry.

3 Interrupting Rating

Maximum fault current the breaker can safely interrupt.

4 Standards

IEC, ANSI, and IEEE standards define performance requirements.

Applications

Utility Substations

Protect high-voltage transmission and distribution equipment.

Industrial Facilities

Safeguard power distribution systems in factories.

Commercial Buildings

Provide overload and short circuit protection.

Maintenance and Testing

1

Inspection

Check for wear, damage, and proper lubrication.

2

Timing Tests

Verify breaker opens and closes within spec.

3

Dielectric Tests

Ensure insulation integrity and no internal faults.

Safety Considerations

Hazardous Voltages

Proper PPE and safe work practices required.

High Fault Currents

Can cause severe burns and explosive forces.

Arc Flash Hazards

Protective clothing needed to prevent injury.

Future Trends

Smart Grid Integration

Advanced sensors and controls for grid automation.

Vacuum Technology

Smaller size and reduced maintenance requirements.

Renewable Energy

Support increasing distributed generation and microgrids.

Assessment

What is the primary arc extinguishing medium used in an air circuit breaker?

a) Vacuum
b) Oil
c) SF6 gas
d) Air.

References

1. Sunil S Rao, “Switchgear, Protection and Power System (Theory, Practice & Solved Problems)”, Khanna Publishers, New Delhi, 2019.

2. Paithankar Y G, Bhide S R, “Fundamentals of Power System Protection”, Prentice Hall of India Pvt Ltd., New Delhi, 2nd Edition, 2014.

3. Badriram, Vishwakarma B.H, “Power System Protection and Switchgear”, New Age International Pvt Ltd Publishers, 2nd Edition 2017.

Thank You