



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 BREAKER

Topic: DC & AC Circuit Breaking



DC Circuit Breakers

Design

Rely on magnetic blowout coils to rapidly extinguish the arc.

Applications

Used in DC traction power, industrial DC drives, and solar/battery systems.

Challenges

Must handle high currents and voltages without welding contacts.



AC Circuit Breakers

Electromagnetic

Use powerful electromagnets to pull apart contacts and extinguish arcs.

Air-Blast

Forcefully blow compressed air through the arc to cool and interrupt it.

Vacuum

Interrupt the arc inside a sealed vacuum chamber for clean, compact design.



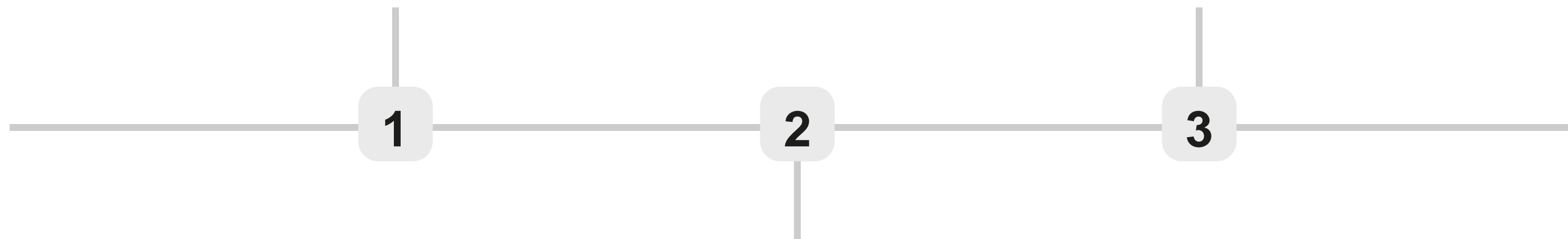
Circuit Breaker Ratings

Voltage

Rated for the maximum system voltage the breaker can withstand.

Interrupting Time

Measures how quickly the breaker can open and interrupt a fault.



Current

Rated for the maximum steady-state and fault currents it can safely interrupt.



Circuit Breaker Retrofits

1 Higher Ratings

Upgrade to handle increased load demand and short-circuit levels.

2 Improved Controls

Add microprocessor-based controls for more precise protection and monitoring.

3 Increased Safety

Reduce arc flash hazards with modern arc-resistant designs.



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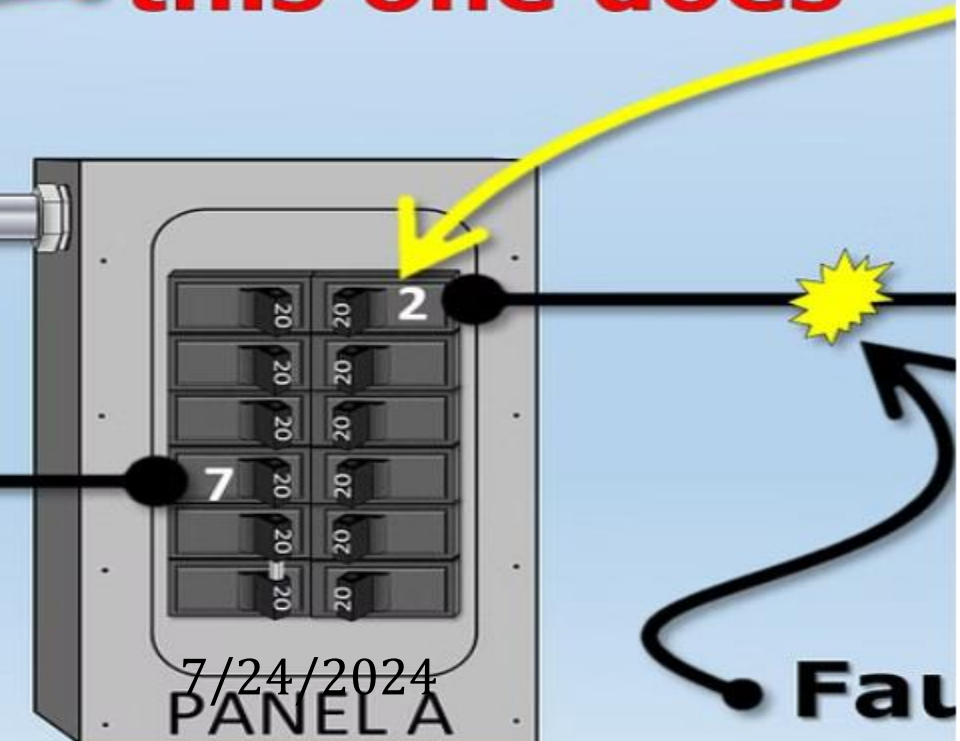
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Electrical License

This circuit breaker

needs to trip before

this one does



Coordination & Selectivity

Coordination

Ensure breakers operate in a logical, predictable sequence to isolate faults.

Selectivity

Minimize the number of customers affected by a fault by tripping the nearest breaker.

Relay Logic

Sophisticated protection relays monitor system conditions and control breaker operation.



Maintenance & Testing

Inspection

Visual checks for wear, tear, and proper mechanical operation.

1

Testing

Verify breaker can successfully interrupt a high-current, low-voltage test circuit.

3

Cleaning

Remove contaminants and ensure contacts are clean and free-moving.

2



Breaker Failure Protection



Instantaneous

Trips backup breaker within 150ms if primary fails.



Fault Detection

Monitors current transformers to sense a breaker failure event.



Alarm

Alerts operators to a breaker failure so it can be addressed.

Future Trends



1

Solid-State

Power electronics replacing mechanical contacts for faster, more reliable operation.

2

Digital Controls

Advanced microprocessors allowing predictive maintenance and self-diagnostics.

3

Green Designs

Alternative arc-extinguishing mediums to replace traditional oil or SF6 gases.



Safety Considerations

Arc Flash

Violent release of energy from a short-circuit arc, causing severe burns

Blast Pressure

Powerful force that can propel shrapnel and knock workers off their feet

Toxic Fumes

Vaporized metals and insulation can release dangerous gases when arcing occurs



Assessment



Which type of circuit breaker is typically used for DC circuits?

- a) AC circuit breaker
- b) Thermal circuit breaker
- c) Magnetic circuit breaker.
- d) Semiconductor circuit breaker





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