Overview of Fundamental Principles and Components of KET-35kV High-Voltage Switchgear

The 35KV high-voltage switchgear is a distribution, control and protection device used in the power system for the 35-kilovolt voltage level. Its core function is to connect and distribute high-voltage electrical energy and quickly cut off fault current in case of circuit failure, ensuring the safe and stable operation of the power grid.

Core Functions

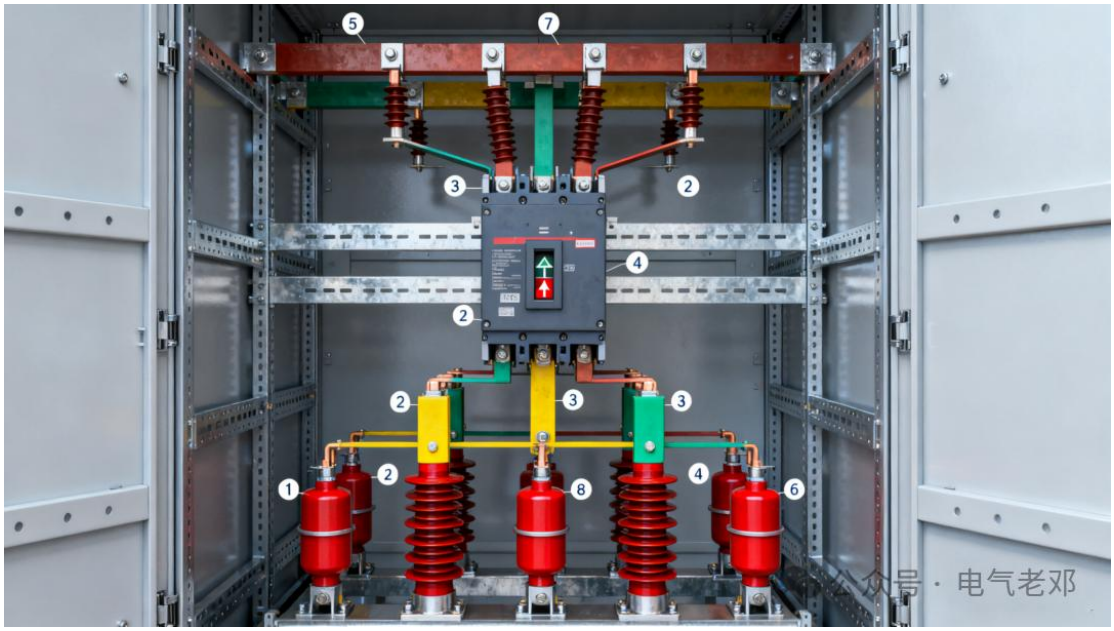
1. Power Distribution: Distribute the 35KV high-voltage electricity supplied by the upper-level substation to the lower-level transformers (such as reducing it to 10KV) or directly supply it to high-voltage electrical equipment (such as large motors).

2. Circuit Control: Through the switchgear inside the cabinet (such as circuit breakers), perform "closing to supply power" or "opening to cut off power" operations on the downstream circuits.

3. Fault Protection: When faults such as short circuits, overloads, or ground faults occur in the circuit, the protection device (such as relay protection) will trigger the switch to trip, cutting off the faulty circuit to prevent the fault from expanding.

4. Status Monitoring: Through instruments (such as voltmeters and ammeters) and sensors, display the voltage, current, power, and other parameters inside the cabinet in real time, facilitating the operation and maintenance personnel to grasp the operating status.

Decomposition diagram of the core components inside the high-voltage cabinet, marking the positions of key components such as circuit breakers, disconnectors, and transformers.



Main components

- Circuit breaker: The core switchgear, responsible for normal on-off operations and tripping during faults. Common types include SF_6 gas-insulated circuit breakers and vacuum circuit breakers.

- Isolating switch: Lacks arc-extinguishing capability and is only used for "isolating voltage during maintenance" (ensuring the maintenance area is de-energized), and cannot be operated under load.

- Transformer: Includes voltage transformers (reducing 35KV high voltage to 100V for use by meters and protection devices) and current transformers (reducing large currents to 5A or 1A, similarly used for monitoring and protection).

- Relay protection device: Receives signals from transformers, determines if the circuit is normal, and issues tripping commands during faults. It is the "brain" of the high-voltage cabinet.

- Busbar: Copper or aluminum bars used to connect various components and transmit 35KV high-voltage power. They are divided into main busbars (total incoming lines) and branch busbars (distributing to each circuit).

- Cabinet shell: Made of metal (such as cold-rolled steel plates), it provides protection against rain, dust, and electric shock, with a protection level typically no lower than IP3X (preventing solid foreign objects from entering).

Common types (classified by function)

1. Infeed cabinet: Also known as the receiving cabinet, it is the "first stop" for 35KV high-voltage electricity entering the distribution cabinet. It is mainly equipped with circuit breakers, disconnectors, and infeed current transformers, and is responsible for receiving power from the upper level.

2. Outfeed cabinet: Used to distribute 35KV electrical energy to lower-level equipment. Each outfeed corresponds to a load (such as a lower-level substation or high-voltage motor), and is equipped with circuit breakers, outfeed current transformers, and protection devices.

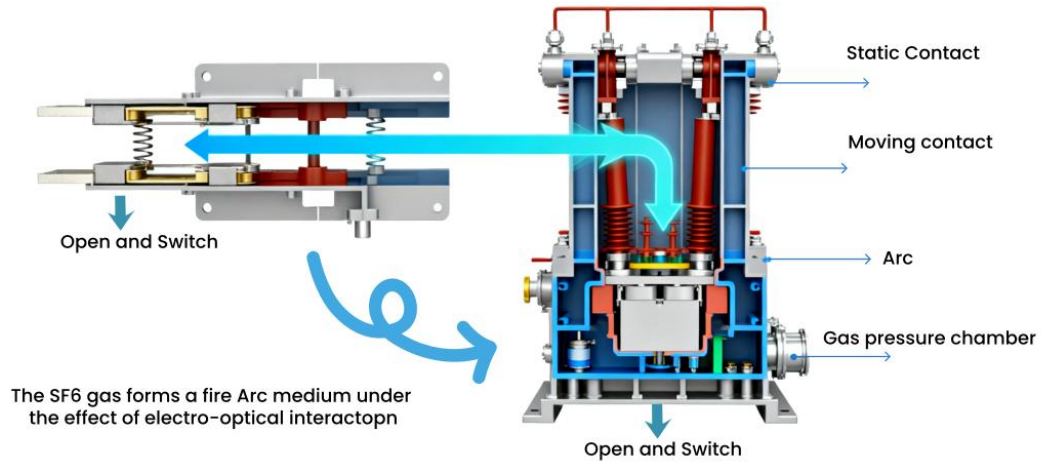
3. PT cabinet (voltage transformer cabinet): Specifically designed to install voltage transformers, it is used to monitor the 35KV bus voltage and simultaneously provide standard voltage signals (100V) for relay protection devices and instruments.

4. Isolation cabinet: Only equipped with disconnectors, it is used to achieve "physical isolation" between the infeed cabinet and the bus, or between bus sections, facilitating the disconnection of power to certain circuits during maintenance.

5. Bus tie cabinet: When the high-voltage cabinet system has two bus sections, the bus tie cabinet is used to connect the two bus sections. In the event of a fault in one bus section, the load can be switched to the other bus section through the bus tie switch, enhancing power supply reliability.

Schematic diagram of the arc extinguishing chamber of a circuit breaker, demonstrating the SF_6 gas insulation arc extinguishing process.

35KV SF6 Arc Interruption Acr Extinction 16:9



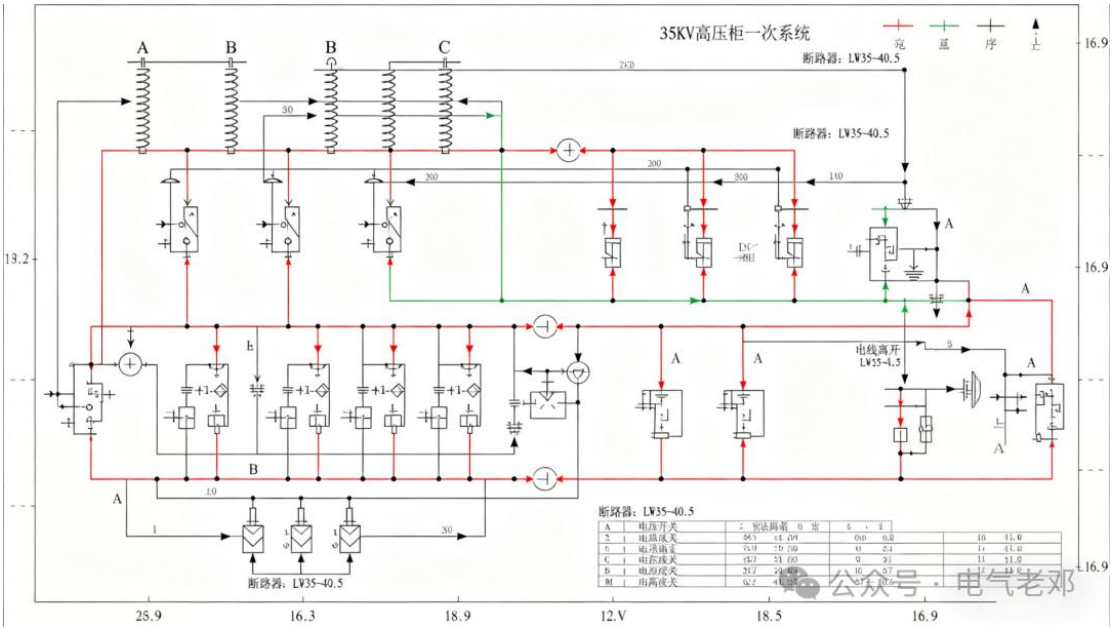
Basic Working Principle

1. Normal operation: The upper-level power supply is connected to the busbar through the isolating switch and circuit breaker in the incoming line cabinet. The busbar distributes the electrical energy to each outgoing line cabinet. After the circuit breaker in the outgoing line cabinet is closed, the electrical energy is transmitted to the lower-level equipment through the transformer and cable, and the voltage and current are displayed in real time by the instrument.

2. Fault protection: If a short circuit occurs in a certain outgoing line circuit, the current transformer in that circuit will detect a "sudden increase in current" and send a signal to the relay protection device. After the protection device determines it is a fault, it immediately issues a "trip command" to the circuit breaker in the outgoing line cabinet, which opens to cut off the faulty circuit and simultaneously sends an alarm signal.

3. Maintenance operation: When a certain outgoing line cabinet needs maintenance, first disconnect the circuit breaker in that cabinet, then disconnect the isolating switches on both sides, and hang the "grounding wire" to ensure that the maintenance area is de-energized before proceeding with the operation.

High-voltage cabinet primary system wiring diagram, showing the path of electrical energy from the incoming line to the outgoing line.



Key operation and maintenance points:

- Regular inspection: Check for any abnormal sounds or leaks in the cabinet (such as gas leakage in SF_6 circuit breakers), ensure normal display of instruments, and check for overheating at connection terminals (which can be detected with an infrared thermometer).

- Insulation testing: Regularly measure the insulation resistance of busbars and circuit breakers inside the cabinet (to prevent insulation aging and leakage), and SF_6 circuit breakers need to have their gas pressure and purity checked regularly.

- Operation procedures: Strictly follow the sequence of "close the isolating switch first, then the circuit breaker; open the circuit breaker first, then the isolating switch" to avoid pulling the isolating switch under load and causing arc accidents.

- Protection verification: Regularly verify the relay protection device to ensure accurate and rapid response in case of faults, and prevent protection failure or misoperation.

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