Introduction to Electrical Disconnectors

An Online Continuing Education Course for Engineers

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Contents

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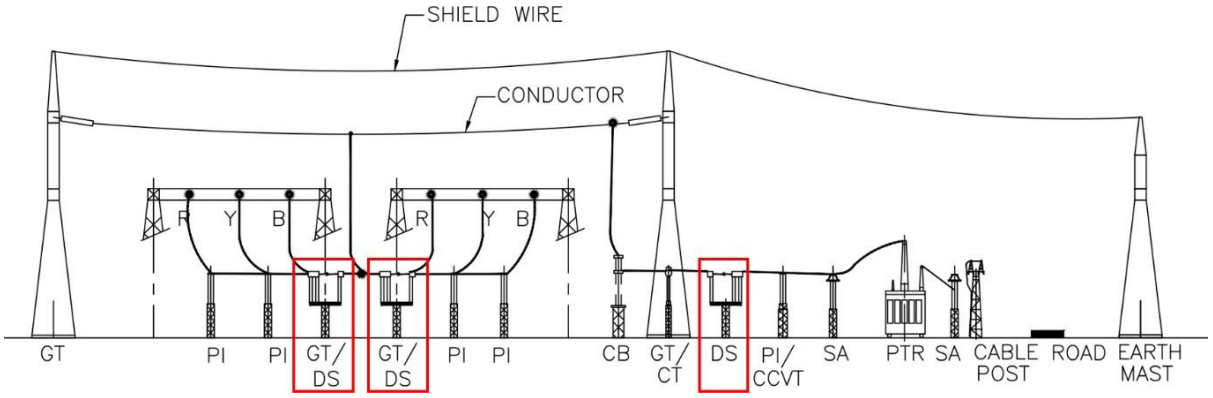
INTRODUCTION

A **disconnector** (**disconnecting switch**) is a **switching device** used to provide safe **isolation** by de-energizing parts of an electrical network, e.g., an overhead line, transformer, bus bar, etc. By virtue of their isolating function, disconnectors are sometimes also called **isolators**. The primary function of a disconnector is to serve as a **visual indicator** of whether an electrical connection is **open** or **closed**; this lets network operators know if the circuit/equipment is either **energized or de-energized**. Operators must confirm the energized state of the circuit/equipment in order that they can safely perform inspections, maintenance, and repairs without unnecessary risk.

Disconnector Switch (Courtesy of SDCEM)

Moreover, **earthing switches** are employed in conjunction with disconnectors to earth the de-energized parts of the system by providing an effective bonding/connection to the ground.

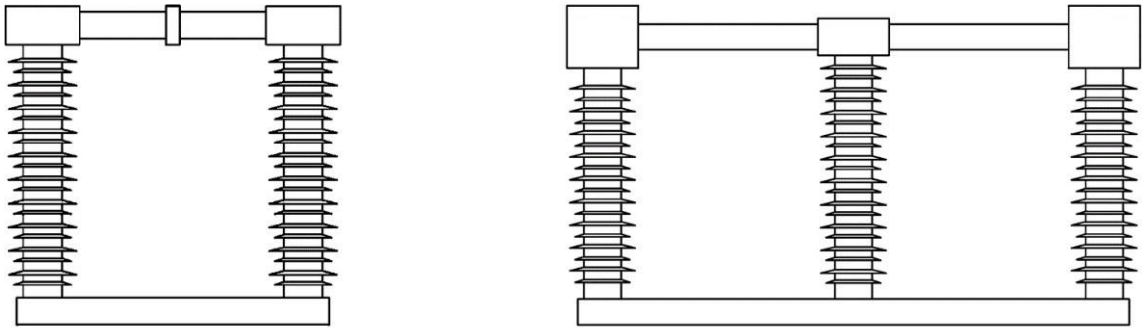
Disconnecting switches have been used to provide safe **working isolation** in power systems since the early 1900s. At that time, safety codes required relevant disconnectors to be opened so that a '**visible break**' was provided; the break was then **blocked** to prevent unauthorized closing. In addition to safe electrical isolation, **protective grounding** was also made mandatory, leading to the development of **earthing switches**.



Substation Disconnectors (Elevation View)

DISCONNECTORS

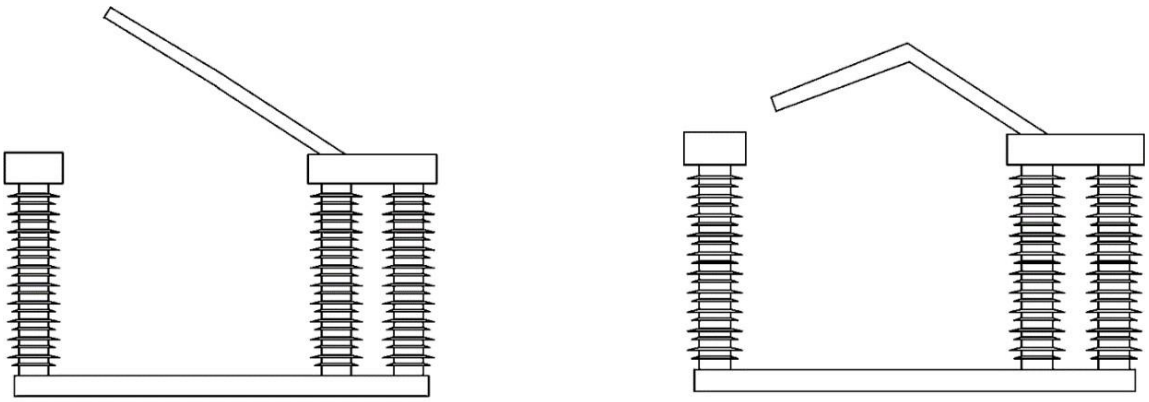
Different types of **air-break disconnectors** are used in substations: the center break, double break, vertical break, knee break, and **pantograph** types. The type of disconnector switch used depends on the substation layout, design, and spatial constraints.



Centre Break

Double Break

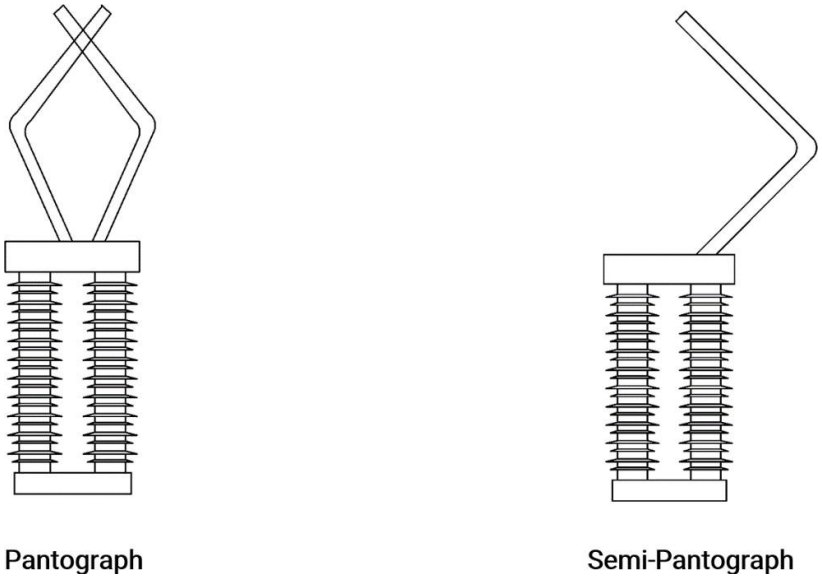
Centre and Double Break Disconnectors



Vertical Break

Knee Break

Vertical and Knee Break Disconnectors



Pantograph and Semi-Pantograph Disconnectors

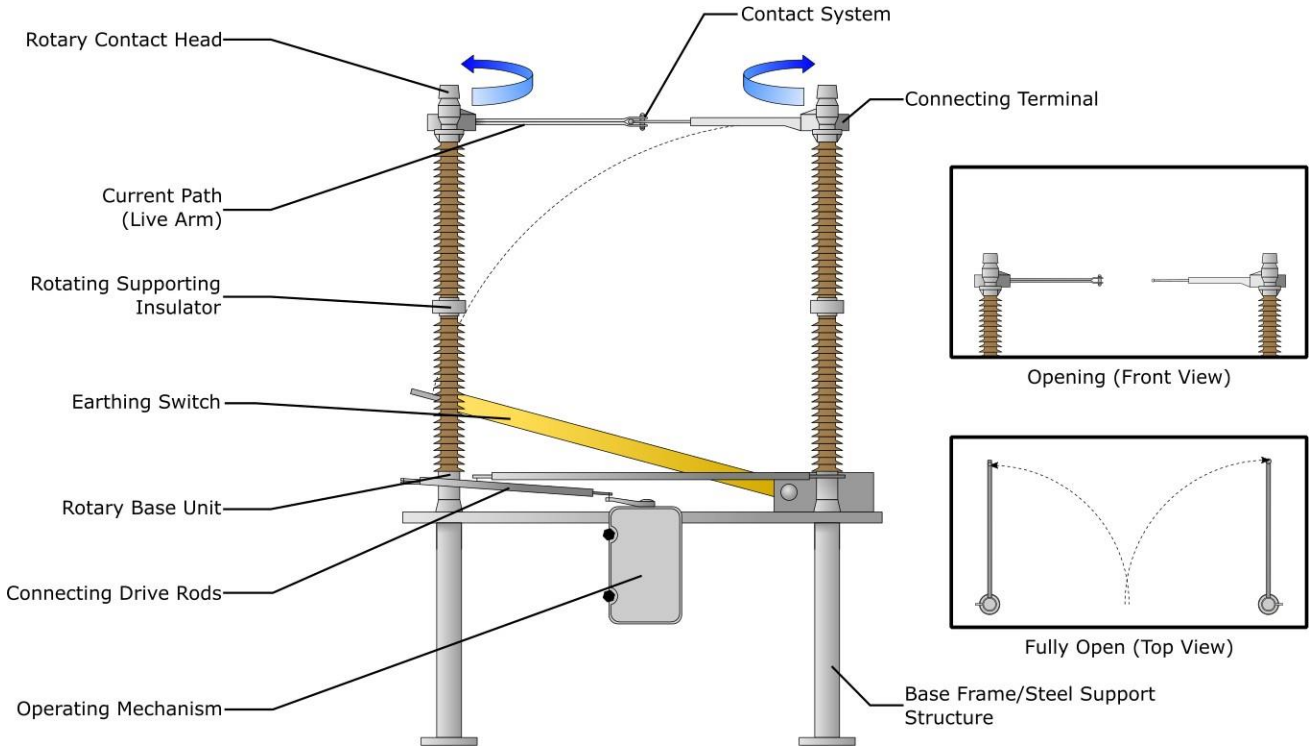
Parts and Construction

All disconnector types consist of the same basic components:

1. **Current/live part** – the part of the disconnector that carries electrical load.
2. **Contact system** – the point where the disconnector makes or breaks the electrical circuit.
3. **Supporting and rotating insulators** – insulators reduce leakage/creepage current and reduce the likelihood of flashover.
4. **Operating drive and connecting rods** – used to actuate (make/break) the disconnector (usually an electric motor is used).
5. **Base frame** – allows for the disconnector to be mounted or installed easily.

Centre Side Break Disconnector

The **center break disconnector** is the most widely used disconnector type in the industry. With this design, the live current path opens along the **horizontal plane** away from the center point where they connect (similar to how two doors installed next to each other open).

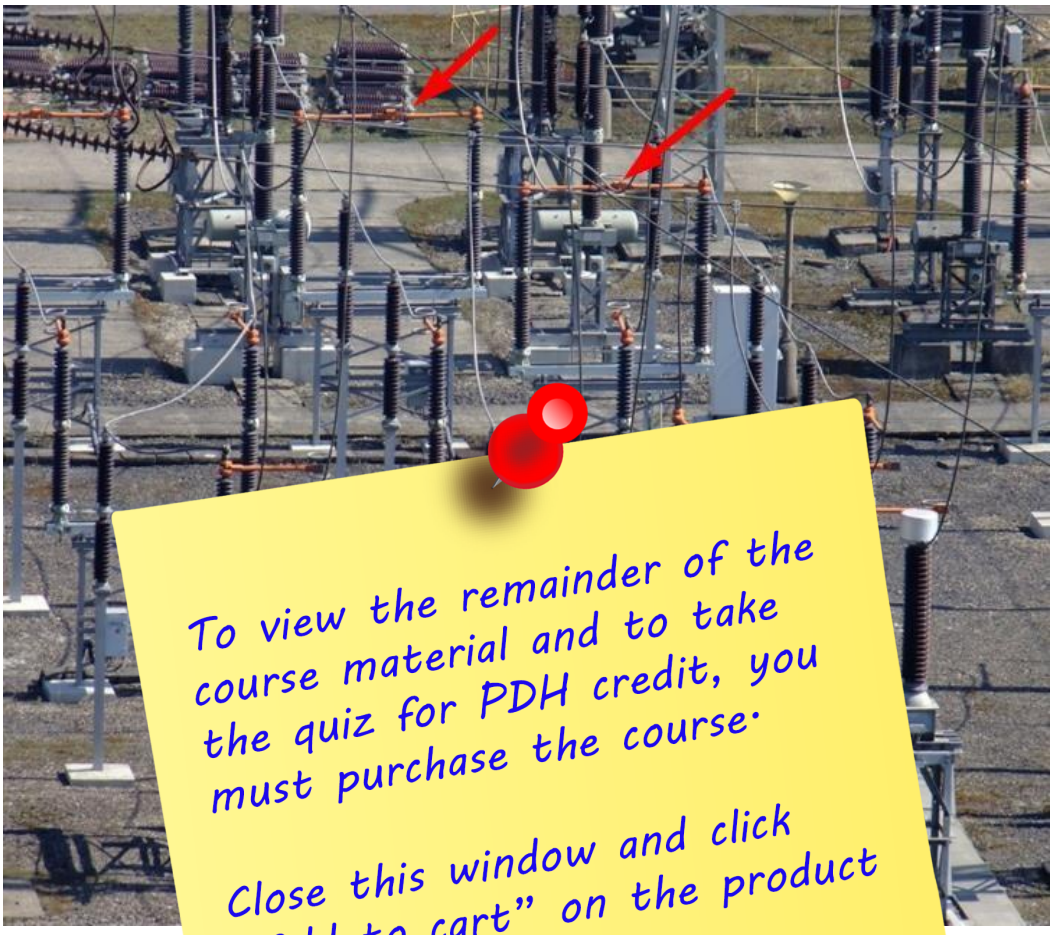


Centre Break Disconnector Components

The center brake design provides a low profile in the open and closed position, but it is wider compared to disconnectors that open along a **longitudinal** or **vertical** plane.

A center break disconnector's live arms are manufactured from drawn aluminum, and the contacts (pads) are manufactured from silver-plated **electrolytic copper**; this provides **good conductivity** and prevents **oxidation**. The contact system is bolted to the aluminum arms, usually as a **fist/block** (**male**) and **finger** (**female**) pair. Sometimes, the contact system contains **stainless steel springs**; these springs help maintain adequate contact pressure and minimize **contact resistance**.

Manual or **motorized actuators** transfer rotational power to a disconnector's **rotary base unit** (the entire base rotates) via a series of **gears** and **shafts**. A diagonal **rod** is used to **mechanically connect** a disconnector's two rotary base units together to ensure **simultaneous** operation of both columns. Each rotating base unit utilizes **high-quality ball bearings** and is designed for **high mechanical loads**. The **supporting insulators** mounted on top of the rotating base units transfer the rotational motion from the actuator to the **rotary contact head** at the top end of the disconnector.



Centr

Flexible copper leads tran e current-carrying arms at the rotary contact ontact head can form part of the current path in a tulip-type angement.

Double Side Break Disconnector

A further variation of the center break disconnecting switch is the double-side **break disconnector**. The double-side break disconnector has a lesser impact on the phase distance, as the current path opens horizontally through an angle of less than 90º (a center break disconnector opens to 90º). Therefore, double-side break disconnectors are predominantly used in substations where there is limited phase-phase lateral and vertical spatial availability.