

PRESENTATION ON SUBSTATIONS ELECTRICAL POWER GENERATIONS



SUBSTATION

- **SUBSTATION** - A station in the power transmission system at which electric power is transformed to a conveniently used form. The station may consist of transformers, switches, circuit breakers and other auxiliary equipment. Its main function is to receive energy transmitted at high voltage from the generating station, by either step-up or step-down the voltage to a value appropriate for local use and provide facilities for switching. Substations have some additional functions.



Typical Components of a Power Plant Substation (Switchyard)

• **CONNECT**

• **CONNECT & DIS-CONNECT**

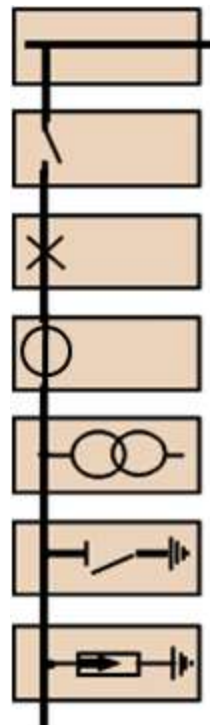
• **CONNECT, DIS-CONNECT & DETECT**

• **DETECT & TRANSFORM**

• **DETECT & TRANSFORM**

• **PROTECT & SAFETY**

• **PROTECT**



• **A - Busbar**

• **B - Disconnecter**

• **C - Circuit Breaker**

• **D - Current Transformer**

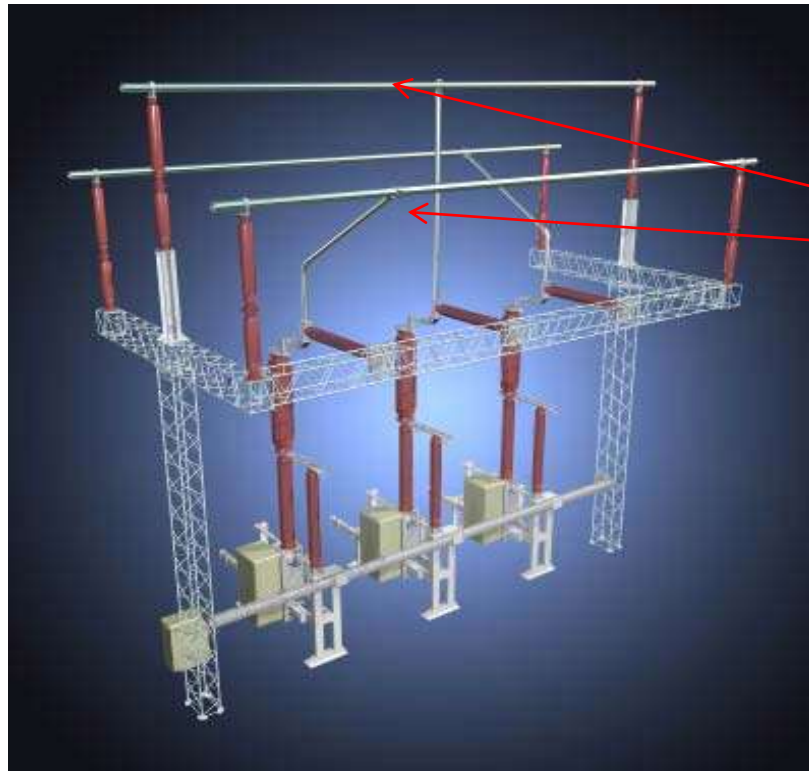
• **E - Voltage Transformer**

• **F - Earthing Switch**

• **G - Surge Arrestor**

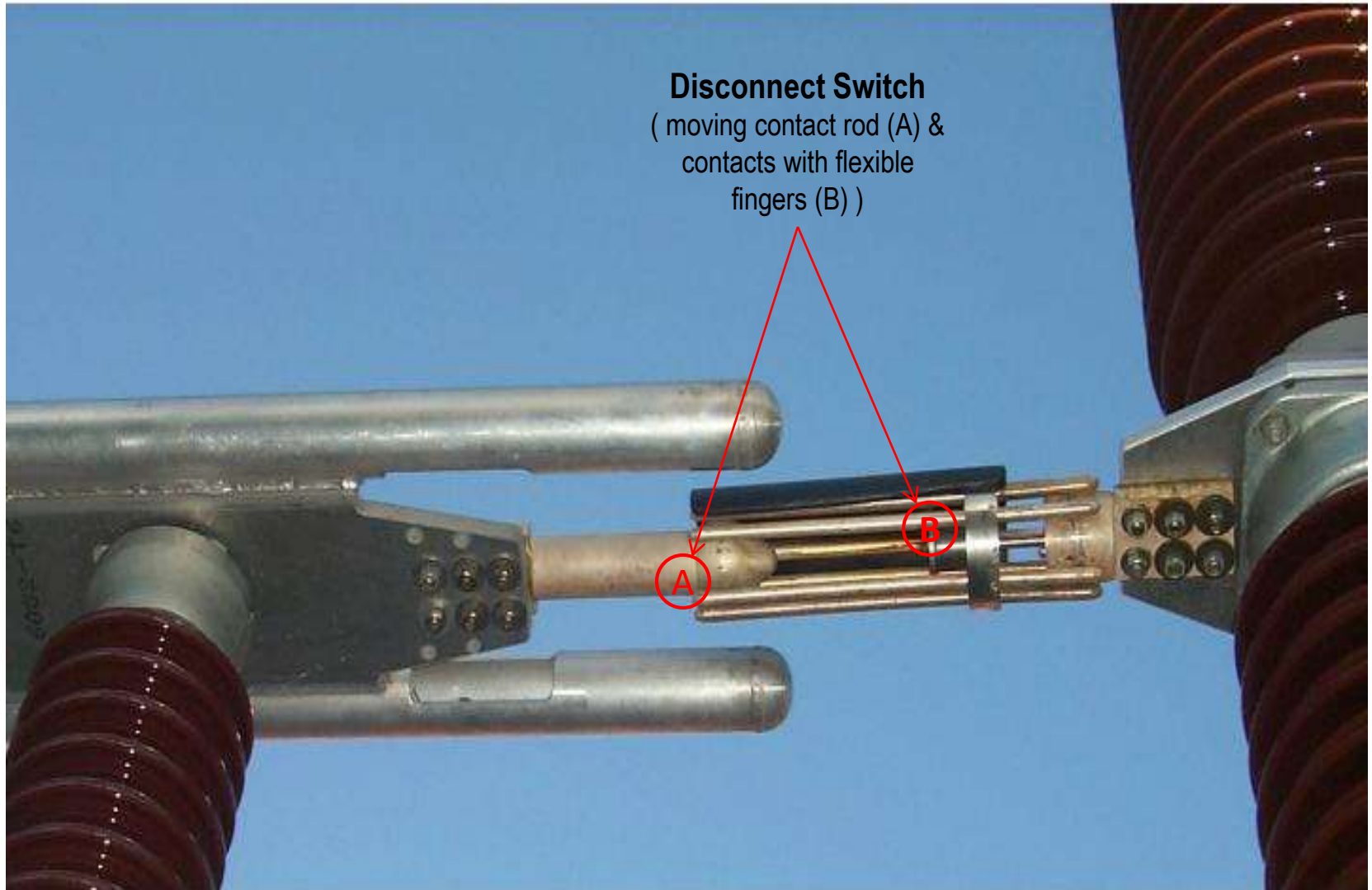
A. BUSBAR

- **BUSBAR** (or *bus*, for short) – is a term we use for a main bar or conductor carrying an electric current to which many connection may be made.



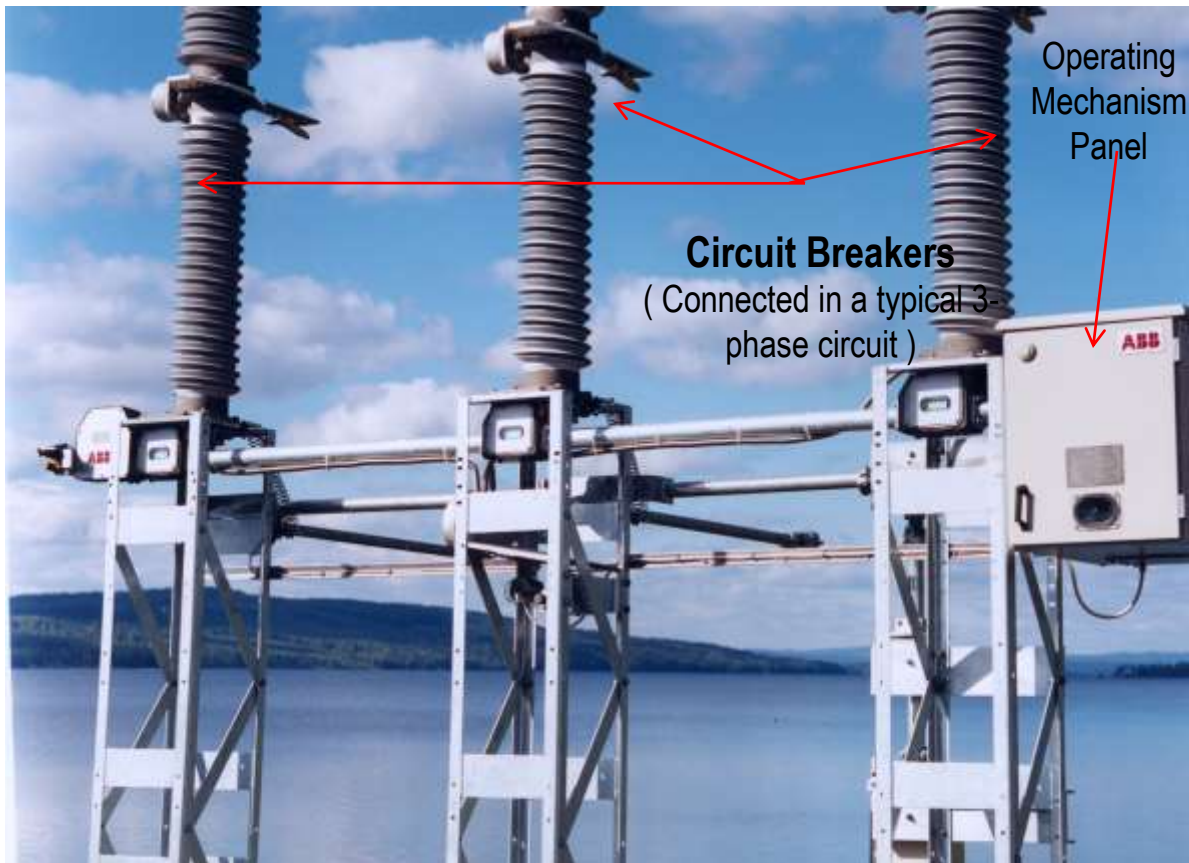
Busbars
(long heavy
tube type)

DISCONNECTS



CIRCUIT BREAKER

- **CIRCUIT BREAKER** – is used to interrupt circuits while current is flowing through them.



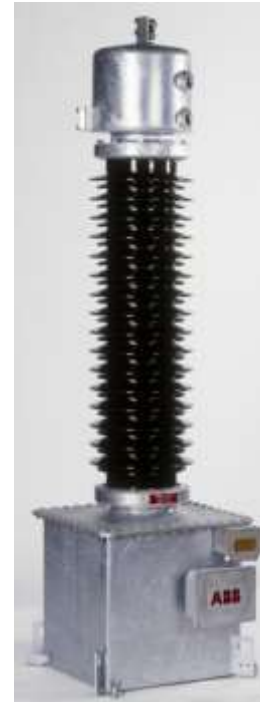
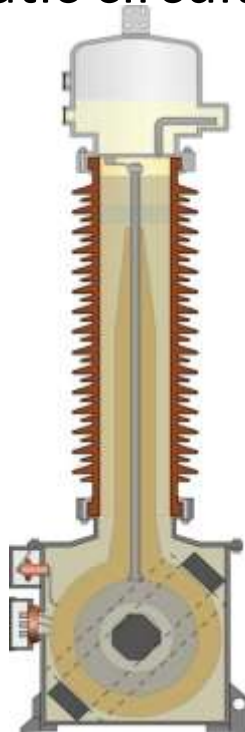
D. CURRENT TRANSFORMER

- **CURRENT TRANSFORMER** – Current transformer are used with ammeters, watt meters, power-factor meters, watt-hour meters, compensators, protective and regulating relays and the trip coil of circuit breakers.



E. VOLTAGE TRANSFORMER

- **VOLTAGE TRANSFORMER** – also known as potential transformer, are used with volt-meters, wattmeters, watt-hour meters, power-factor meters, frequency meters, synchrosopes and synchronizing apparatus, protective and regulating relays and the no-voltage and over-voltage trip coils of automatic circuit breakers.



F. EARTHING SWITCH

- **EARTHING SWITCH** – also known as ground disconnect, which used to connects the equipment to a grid of electrical conductors buried in the earth on the station property. It is intended to protect people working on the grounded equipment. It does this by completing a circuit path, thereby reducing the voltage difference between the equipment and its surroundings.

G. SURGE ARRESTOR

- **SURGE ARRESTOR** – are devices used to provide the necessary path to ground for such surges, yet prevent any power current from following the surge. An ideal arrester must therefore have the following properties:
 1. Ability to remove the surge energy from the line in a min. time.
 2. High resistive to flow of power current.
 3. A valve action automatically allowing surge to pass and then closing up so as not to permit power current to flow to ground.
 4. Always ready to perform.
 5. Performance such that no system disturbances are introduced by its operation.
 6. Economically feasible



CLASSIFICATION OF SUBSTATIONS

- CLASSIFICATION ON THE BASIS OF FUNCTION:

- (1)Transformer substation:In this type of substation,electrical power is received at one voltage and it is converted to the required voltage.
- (2)Industrial substation:power required for big industrial estates is received from this substation.
- (3)Switching substation:In such substation,voltage is not changed but switching operation of power line is carried out.
- (4)Frequency changer substation:in this type of substation,the power frequency is changed.For a.c traction,frequency is converted to 25Hz from 50Hz.

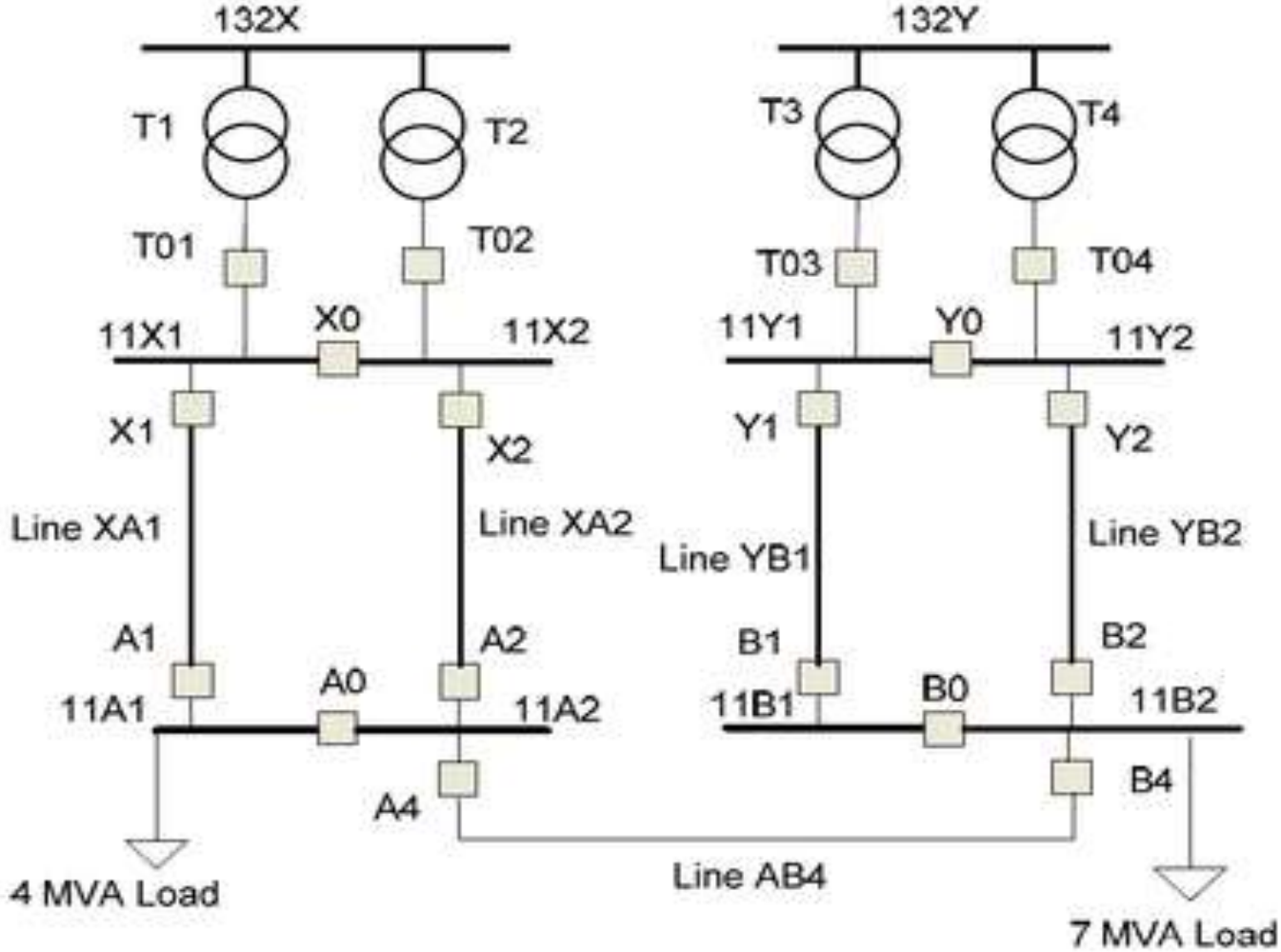
- Classification on the basis of method of control:

(1) Manual control substation: in such substation, the control of equipments is done manually.

(2) Automatic control substation: In such substation, control operation is done automatically. In this the control signal is obtained from the supervisory substation and the equipment is operated.

(3) Supervisory substation: such substation supervises the other substation and controls them according to the need. This includes operations like opening and closing of the circuit breakers and isolators, tap changing of transformers, etc.

132KV/11KV distribution substation:



66KV/11KV distribution substation:

- One 66KV line comes to the 66KV bus bars.
- From the same bus bars, outgoing line is taken which goes to the other substation.
- 66KV PT is connected to the 66KV bus bar through isolator.
- A 66 KV/33KV, star delta transformer is connected to the 66KV bus bars.
- Secondary winding is connected to 33KV tubular bus bars. Circuit breakers and isolators are connected on each side of transformer.
- Substation gets 440KV supply through 33KV/440KV station transformer connected to 33KV bus bars.

- 33KV feeders are taken out from 33KV bus bars through isolators and circuit breakers.
- Two transformers each of 66KV/11KV,10MVA are connected to 66KV strain bus bars through isolators and circuit breakers.
- 11KV is taken to the control room through underground cable.
- Number of 11KV feeders taken out from 11KV bus bars through isolators and circuit breakers.

References

- [Wikipedia.com](https://www.wikipedia.com)
- Atul prakashan book

THANK YOU