BABU BANARASI DAS UNIVERSITY

LUCKNOW

Report on Industrial Training at

BIHAR STATE POWER TRANSMISSION CO. (220/132 KV HAJIPUR GSS)

2018-2019

Submitted by :- Akanksha Sinha

Roll No. :- 1150433002

Submitted to :-
Mr. Sankalp Paliwal

Under guidance of :-
Er. Priyanka
Er. Shweta Rani

ACKNOWLEDGEMENT

I am very thankful to Mr. Ratnesh Kumar, Executive Engineer, Power Transmission Corporation of Bihar State Limited who gave me an opportunity to undergo training at 220/132KV Substation, Bihar State Power Transmission Co. Ltd.

I am also thankful to Er. Shweta Rani, Sub Division Officer, 220/132 KV Substation, BSPTCL who organized the training in a systematic manner and guided me through the whole training programme.

I would also like to thank all officer/officials who guided and helped me at each and every step in the training programme.

Akanksha Sinha

Roll no.: 1150433002

4th year,

Electrical

Engineering

CERTIFICATE

This is to certify that Miss Akanksha Sinha, student of 4th year, Electrical Engineering, Bachelor of Technology, from BABU BANARASI DAS UNIVERSITY, LUCKNOW has undergone summer training at 220/132KV Substation, Bihar State Power Transmission Co. Ltd. from 11th June 2018 to 10th July, 2018 under the overall guidance of Mr. Ratnesh Kumar, S.D.O., Hajipur, Bihar.

Mr. Akanksha Sinha has successfully completed his training and submitted the training project report. During the period of training she was found sincere, punctual and regular. Her conduct and behaviour was very good.

Mr. M.K.Verma

E.S.E(Training)

220/132 KV Substation

BSPTCL

Hajipur, Bihar

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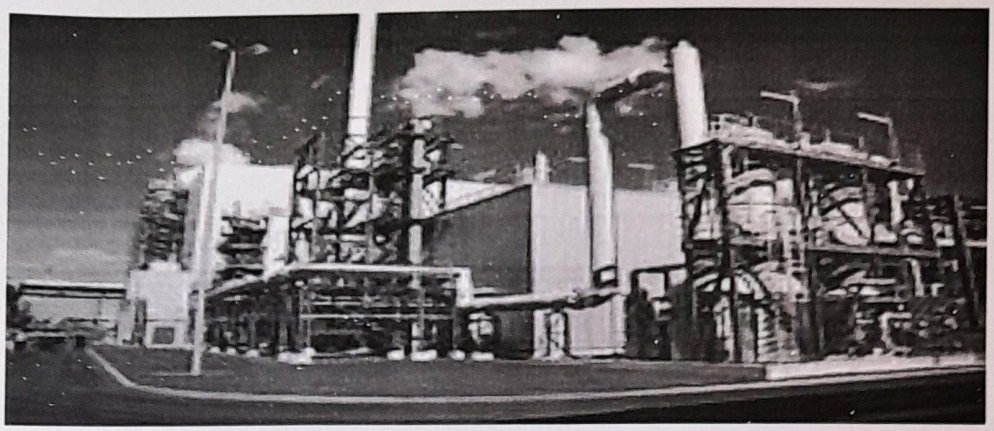
INTRODUCTION



The power plant produces three phase ac power,which enters a substation through transmission lines. A substation is an amportant part of electrical generation ,transmission and distribution system.By varying the voltage levels or frequency or any other aspects, the required electrical quantity can be altered in substations to provide quality power to the consumers. Between the generating station and consumers, electric power may flow through various substations at different voltage levels.

TYPES OF SUBSTATION

1. ON THE BASIS OF SERVICE RENDERED
   a) Transformer substation
   b) Switching substation
   c) Power factor correction substation
   d) Frequency changer substation
   e) Converting substation
2. ON THE BASIS OF DESIGN
   a) Indoor substation
   b)outdoor substation
   c)pole mounted substation
   d)underground substation
3. EQUIPMENTS AT A SUBSTATION
   a)Power transformer
   b)instrument transformer
   c)busbar
   d)circuit breaker
   e)isolator
   f)lightning arrester
   g)relay

HAJIPUR GSS

Hajipur grid substation is a type of transformer substation and outdoor grid substation. Here, transformers are used to step down the voltage level fron 220kv to 132kv .

In HAJIPUR GSS three transformers each of capacity 100MVA are installed . these all transformers are auto transformers and are connected in parallel.

Incoming line voltage: 220kv

Outgoing line voltage:132kv

Hajipur grid substation receives power from kafen, muzaffarpur.

TWO TYPES OF INSULAING SYSTEMS ARE INSTALLED AT HAJIPUR GSS:

a)AIS-air insulated system

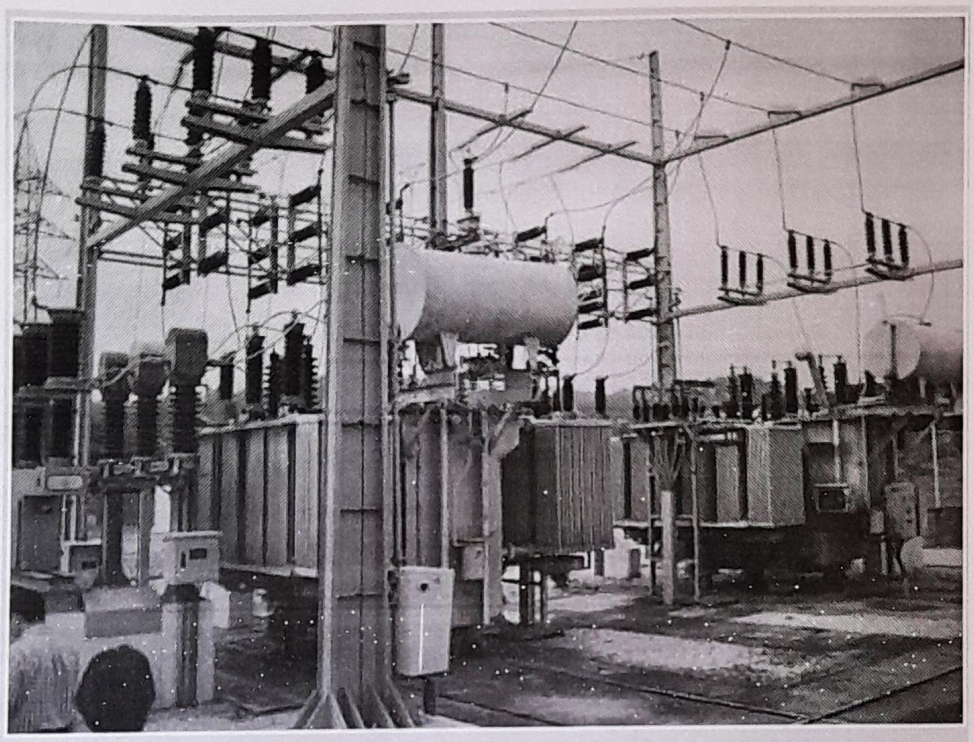
b)GIS-gas insulated system

Air insulated system(AIS):

The AIS uses air as the primary dielectric from phase to phase, and phase to ground insulation. They have been in use for years before the introduction of GIS.

Actually, most substations across all regions are AIS. They are in extensive use in areas where space, weather conditions, seismic occurrences, and environmental concerns are not an issue such as rural areas, and favourable offsite terrain.

The indoor AIS version is only used in highly polluted areas, and saline conditions, as the air quality is compromised.



Advantages

1. The primary choice for areas with extensive space
2. With quality design, the system is viable due to the low construction costs and cost of switchgear
3. Less construction time, thereby more suited for expedited installations
4. Easy maintenance as all the equipment is within view. It is easy to notice and attend to faults.

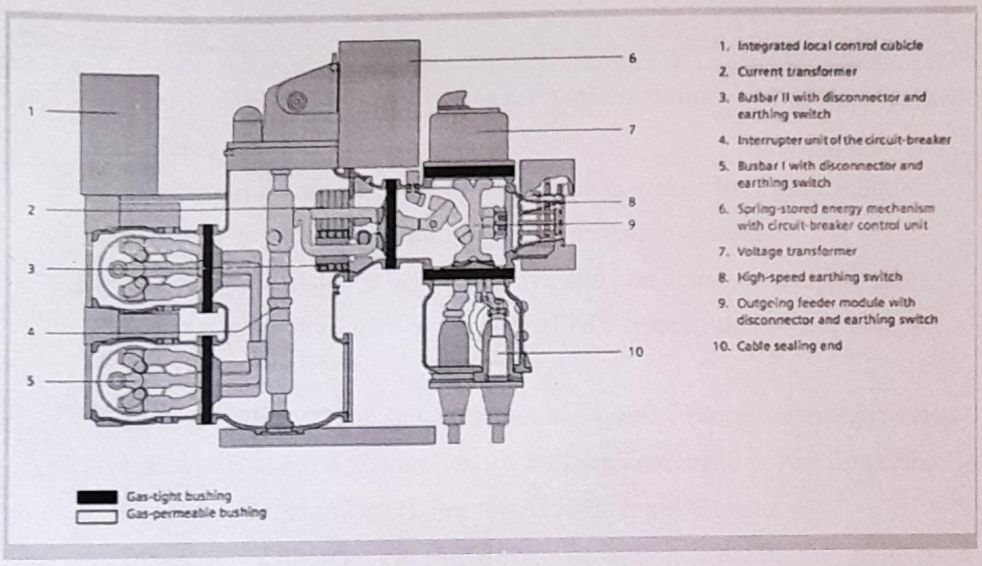
Disadvantages

1. More space is required compared to GIS
2. Vulnerable to faults since the equipment are exposed to the external elements such as human intrusion ,pollution, deposition of saline particles, lightning strikes and extreme weather condition.
3. More maintenance requirements, thus leading to high costs
4. The poor dielectric properties of air, as well as secondary factors such as humidity, pollutants, moisture means that more space is required for efficiency.

Gas insulated system(GIS):

Simply put, in the GIS system, all the live components are enclosed in a grounded metal enclosure, then the whole system housed in a chamber fuli of gas. Gas insulated substations (GIS) primarily use sulphur hexafluoride gas as the primary insulator. SF_6 is non-toxic, maintains atomic and molecular properties even at high voltages, high cooling properties, and superior arc quenching properties.

In addition, is safe. SF_6 has superior dielectric properties compared to other gases; thereby provide favourable insulation for the phase to phase and phase to ground moderation. In the substation setup, the gas is contained in a grounded metal enclosure containing the conductors, current and voltage transformers, circuit breaker interrupters, switches, and lightning arrestors.



1. Integrated local control cubicle
2. Current transformer
3. Busbar II with disconnector and earthing switch
4. Interrupter unit of the circuit-breaker
5. Busbar I with disconnector and earthing switch
6. Spring-stored energy mechanism with circuit-breaker control unit
7. Voltage transformer
8. High-speed earthing switch
9. Outgoing feeder module with disconnector and earthing switch
10. Cable sealing end

Working Principle

A point of note is that the GIS contain the same compartments and components as the normal (AIS) setups. The only difference is the insulation medium, and of course the size. The live components and parts are insulated in metal enclosures filled with SF6 gas at moderate pressure. Each compartment housing the live part is gas tight, with respect to each other. This ensures that the gas does not pass to the neighbouring modules, as well as ensure that gas monitoring is simpler and independent. 'O' rings are installed at the equipment and enclosure flanges to provide the gas tightness.

Another important installation is a gas monitoring system. This includes an integrated alarm system, automatic tripping, and lockout in case of low pressure due to leakage.

Advantages of GIS

1.The earthed metal enclosure makes for a safe working environment for the attending personnel

2.Compartmentalized enclosure of the live parts makes for a very reliable system due to reduced disruption of the insulation system.

3.By reducing the distance between active and non active switchgear parts, less space is required than in the normal AIS system: this comes in handy in

densely populated areas and unfavourable terrain (minimum requirements for an AIS is about 47,000m2, while GIS with the same power properties will require approx 523m2). For the AIS, the highest element approximately 28m, whereas for GIS you have 11m at the highest point for a 400kV substation.

4.Low maintenance requirements due to expedient design and protection against external elements.

5.Under scheduled maintenance, SF6 neither ages nor depletes. There is no need to top up the gas throughout the equipment lifetime (approx 40years).

Quick assembly due to extensive pre-assembly

Disadvantages

1.High installation costs compared to AIS systems

2.Procurement and supply of SF6 gas can be a problems especially in rough terrain and off site locations. This further increases the costs

3.High level of maintenance is required. This requires highly skilled personnel

4.Internal faults tend to be very costly and severe when they occur. They

often lead to long outage periods. For example, the use of impure gas, as well as leakage due to 'O' ring failure, as well as presence of dust can lead to flashovers and explosions.

5. Though the gas is quite inert, flash problems can break it down into harmful by-products such as metal
6. fluoride powders. This poses a health hazard such as physical asphyxiation and other respiratory problems.

Applications

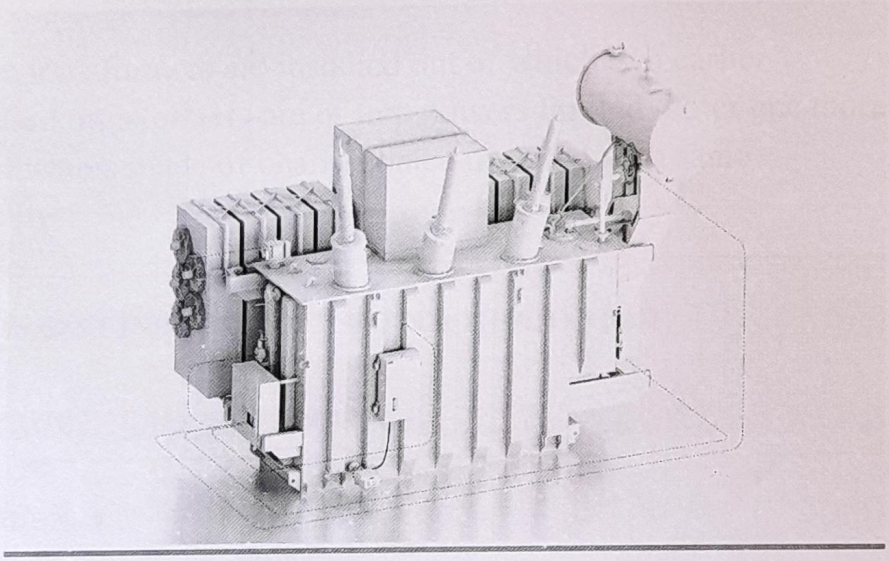
In a regular setup, the space between phases and ground to phase is normally very large. This is where the regular AIS come in handy. However, with the growing population, especially the large towns and cities, such large spaces are hard to come by. This is where the GIS is most applicable as the gas provides superior insulation properties compared to air.

Therefore, the substation unit can be contained in a smaller area without any risk of failure. The use of the SF6 thus reduces the space between the phases, and ground to phase. With the use of the gas, the size of the equipment, and consequently the whole substation can be reduced by about 10%, a significant area when you consider the size of substations serving large cities and towns.

Other areas of applications include:

1. Underground station: reduces the total area to be excavated, thus cutting on costs
2. Offshore-located substations
3. Substations situated in rough terrains such as mountain regions and valley
4. Highly populated area

POWER TRANSFORMER:



BASIC PRINCIPLES:

A transformers is an electrical device which transfers electrical energy between two more circuits through electromagnetic induction .a varying current in one coil of a transformer produces a varying magnetic field, which in turn induces a voltage in a second coil.

At **generating stations** transformers are used to step up voltage before transmitting electrical energy over long distances through wires. By transforming power to a higher voltage, transformers enable economical transmission of power.

SPECIFICATIONS OF TRANSFORMERS USED AT HAJIPUR GSS:

Three transformers are installed out of which two earlier installed transformers are of imp powers limited. Later one more transformers made of bharat bijalee installed with same capacity.

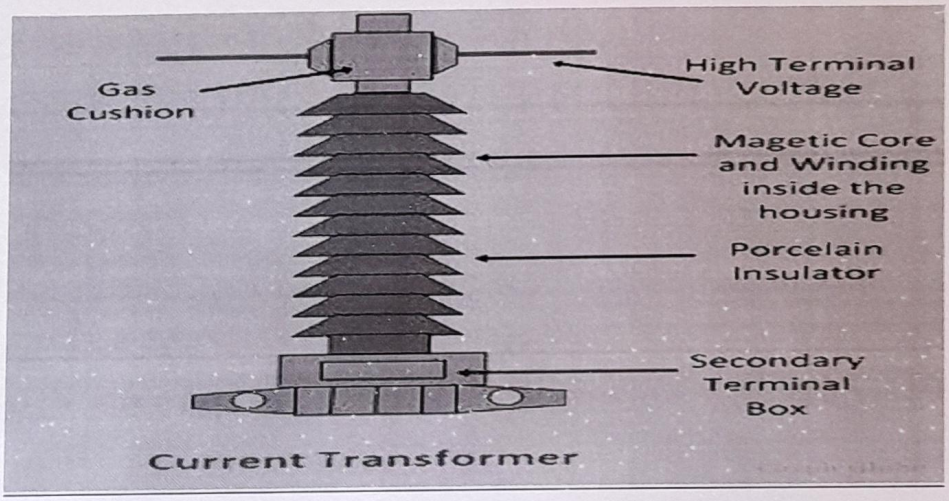
MAKE: EAST INDIA UDYOG LIMITED, GHAJIYABAD

KVA	**:630**
VOLTAGE	**:HV 33000KV**
	LV 433V
FREQUENCY	**:50HZ**
TOTAL WEIGHT	**:2850KG**
WEIGHT OF OIL	**:750KG**
VOLUME OF OIL	**:900LITRES**

CURRENT TRANSFORMERS

- A current transformer is a type of transformer that is used to measure ac current.
- It produces an alternating current in its secondary which is proportinal to ac current in its primary.

- Current transformers together with potential transformers which are desingned for measurement are known as instrument transfomers.



THE MAIN TASKS OF CURRENT TRANSFORMERS ARE:

1. To transforms current from a usually high value to a value easy to handle for relays and instruments.
2. To provide possibilities of standardizing the instruments to a few rated currents.
3. **When the current to be measured is too high to measure directly,** a current transformer can be used to provide an isolated lower current in its secondary which is proportinal to the the current in its primary circuit. The induced

secondary current is then suitable for measuring instruments or processing in electrical equipments.

SPECIFICATIONS OF CURRENT TRANSFORMERS USED AT HAJIPUR GSS:

MADE IN INDIA BY: SCT LIMITED

FREQUENCY	**:50HZ**
INSULATION LEVEL	**:460/1050KV**
OIL QUANTITY	**:250 LITRES**
CURRENT RATIO	**:1200-600-300/1A**

POTENTIAL TRANSFORMERS

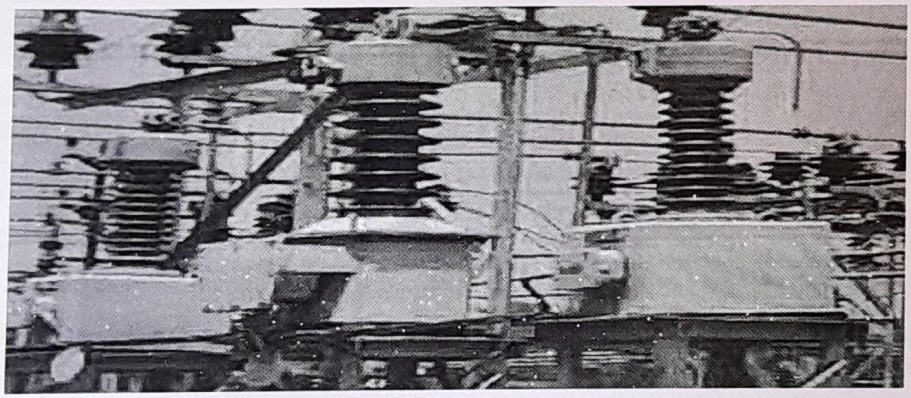
Potential transformer or **voltage transformer** gets used in electrical power system for stepping down the system voltage to a safe value which can be fed to low ratings meters and relays. Commercially available relays and meters used for protection and metering, are designed for low voltage. This is a simplest form of potential transformer definition.

Voltage Transformer or Potential Transformer Theory

A **voltage transformer theory** or **potential transformer theory** is just like a

theory of general purpose step down transformer. Primary of this transformer is connected across the phase and ground. Just like the transformer used for stepping down purpose, potential transformer i.e. PT has lower turns winding at its secondary.

The system voltage is applied across the terminals of primary winding of that transformer, and then proportionate secondary voltage appears across the secondary terminals of the PT.



The secondary voltage of the PT is generally 110 V. In an ideal potential transformer or voltage transformer, when rated burden gets connected across the secondary; the ratio of primary and secondary voltages of transformer is equal to the turns ratio and furthermore, the two terminal voltages are in precise phase opposite to each other. But in actual transformer, there must be an error in the voltage ratio as well as in the phase angle between primary and secondary voltages.

The errors in potential transformer or voltage transformer can be best explained by phasor diagram, and this is the main part of potential transformer theory.

SPECIFICATIONS OF POTENTIAL TRANSFORMERS USED AT HAJIPUR GSS:

FREQUENCY :50HZ

INSULATION LEVEL:460/1050KV

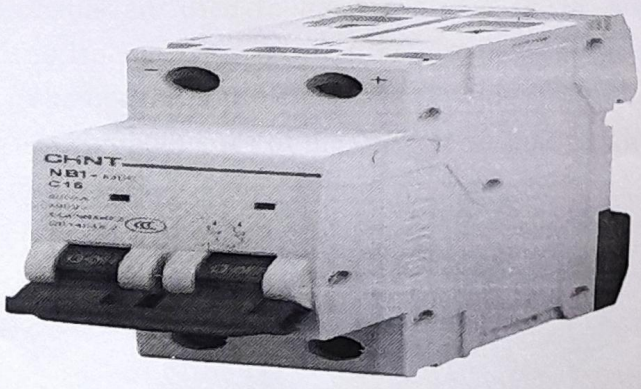
OIL QUANTITY :200 LITRES

TOTAL WEIGHT :850KGS

VOLTAGE RATIO :20000/110

CIRCUIT BREAKER

Electrical circuit breaker is a switching device which can be operated manually and automatically for controlling and protection of electrical power system respectively. As the modern power system deals with huge currents, the special attention should be given during designing of circuit breaker for safe interruption of arc produced during the operation of circuit breaker. This was the basic definition of circuit breaker.



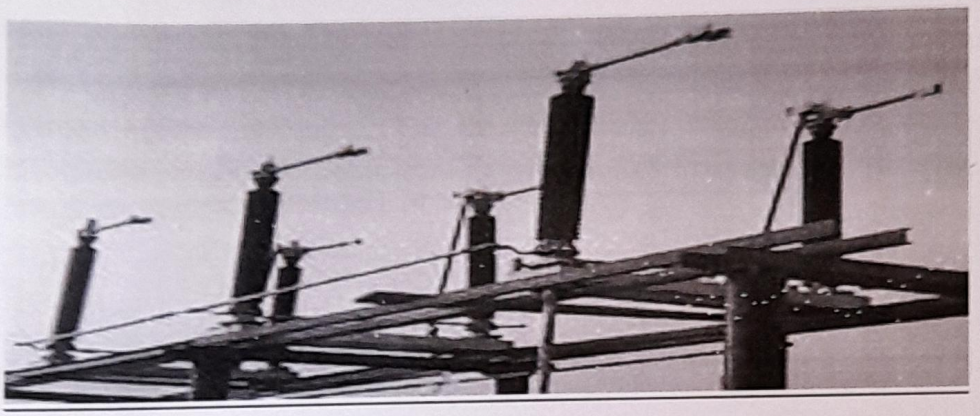
Types of Circuit Breaker

According different criteria there are different types of circuit breaker. According to their arc quenching media the circuit breaker can be divided as-

1. **Air circuit breaker.**
2. **SF_6 circuit breaker.**
3. **Vacuum circuit breaker**
4. OIL CIRCUIT BREAKER

ISOLATOR

DEFINITION of isolator can be rewritten as Isolator is a manually operated mechanical switch which separates a part of the electrical power. Isolators are used to open a circuit under no load. Its main purpose is to isolate one portion of the circuit from the other and is not intended to be opened while current is flowing in the line. Isolators are generally used on both ends of the breaker so that repair or replacement of circuit breaker can be done without any danger.



Types of Electrical Isolators

There are different types of isolators available depending upon system requirement such as

1. Double Break Isolator
2. Single Break Isolator
3. Pantograph type Isolator.

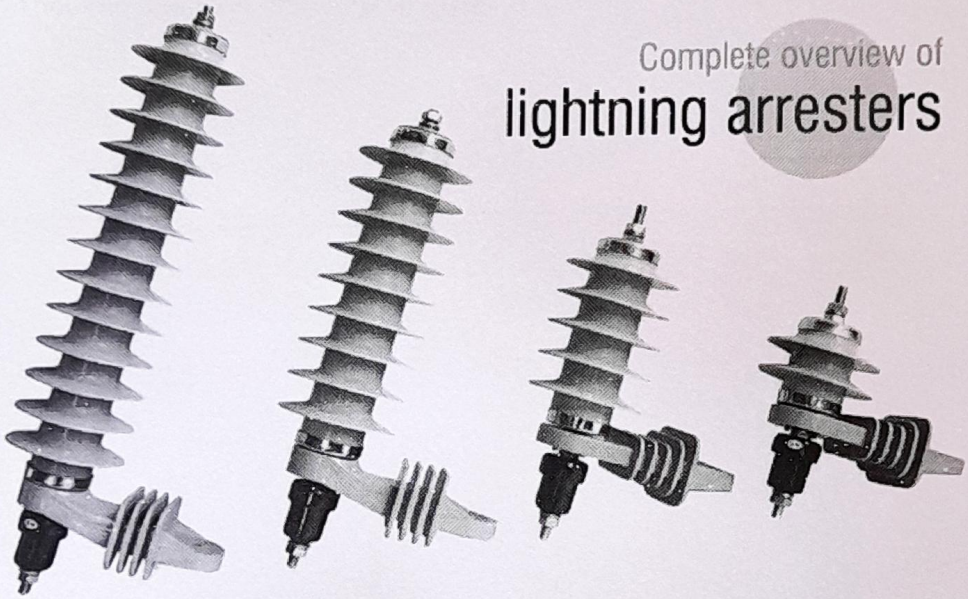
Depending upon the position in power system, the isolators can be categorized as

1. Bus side isolator – the isolator is directly connected with main bus
2. Line side isolator – the isolator is situated at line side of any feeder
3. Transfer bus side isolator – the isolator is directly connected with transfer bus.

Circuit breaker always trip the circuit but open contacts of breaker cannot be visible physically from outside of the breaker, and that is why it is recommended not to touch any electrical circuit just by switching

off the circuit breaker. So for better safety, there must be some arrangement so that one can see the open condition of the section of the circuit before touching it. The isolator is a mechanical switch which isolates a part of the circuit from the system as when required. Electrical isolators separate a part of the system from rest for safe maintenance works.

LIGHTNING ARRESTER



Lightning and Voltage Surge

Rod arrester

Lightning can create voltage surges in several of the following ways. Lightning can score a direct hit on your house. It can strike the overhead power line which enters your house, or a main power line that is blocks away from your home. Lightning can strike brancircuitry wiring in the walls of your house.

Lightning can strike an object near your home such as a tree or the ground itself and cause a surge. Voltage surges can be created by cloud to cloud lightning near your home. A highly charged cloud which passes over your home can also induce a voltage surge.

Voltage surges can also be caused by standard on and off switching activities of large electric motors or pieces of equipment. These surges can be created by a neighbor, or by a business or manufacturing facility some distance from your house. These surges are insidious and for the most part are silent.

They can occur with little or no warning.