POWER POINT PRESENTATION
ON
Electrical Distribution Systems

IV B. Tech I semester (JNTUH-R15)

Prepared

By

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UNIT - I

INRODUCTION &GENERAL CONCEPTS

Hello viewers ,in this lecture we shall learn about the distribution system. So that dc as well as ac distribution system also we shall discuss about The components of a pole mounted substation and components fitted on lattice steel tower for transmission of a HT line. some insulators will also be discussed…..

The Transmission system can be divided into two parts:----

Primary Transmission

Secondary Transmission

The Distribution system can be divided into two parts:----

Primary Distribution

Secondary Distribution

A distributor is set to the legal requirement that power must be supplied at a voltage within ± 6% of the declared voltage., whereas a transmission system is not subject to any such restriction . Its voltage can vary as much as 10% to 15% due to variation in loads. any restriction in transmission system is technical and not legal. The transmission system of an area is called GRID.

The different grids are inter connected through the lines to form a regional grid and the different regional grids are further interconnected to form a national grid. Each grid operates independently. However power can be transmitted from one grid to another. The maximum generation voltage in advanced countries is 33 kV while that in India is 11 kV. The amount of power that has to be transmitted through transmission lines is

The amount of power that has to be transmitted through transmission lines is very large and if this power is transmitted at 11kV the line current and power loss will be large. There fore the voltage is stepped to a higher level by using step-up transformers located in sub-stations.

Also volume of conductor used in transmission lines depends upon the voltage and current.

The three phase transmission and distribution system may consist of

Overhead lines

Underground cables

The main advantage of underground system are that it is less prone to electric hazards like rain , wind & lightning. and that it does not interfere with other amenities.

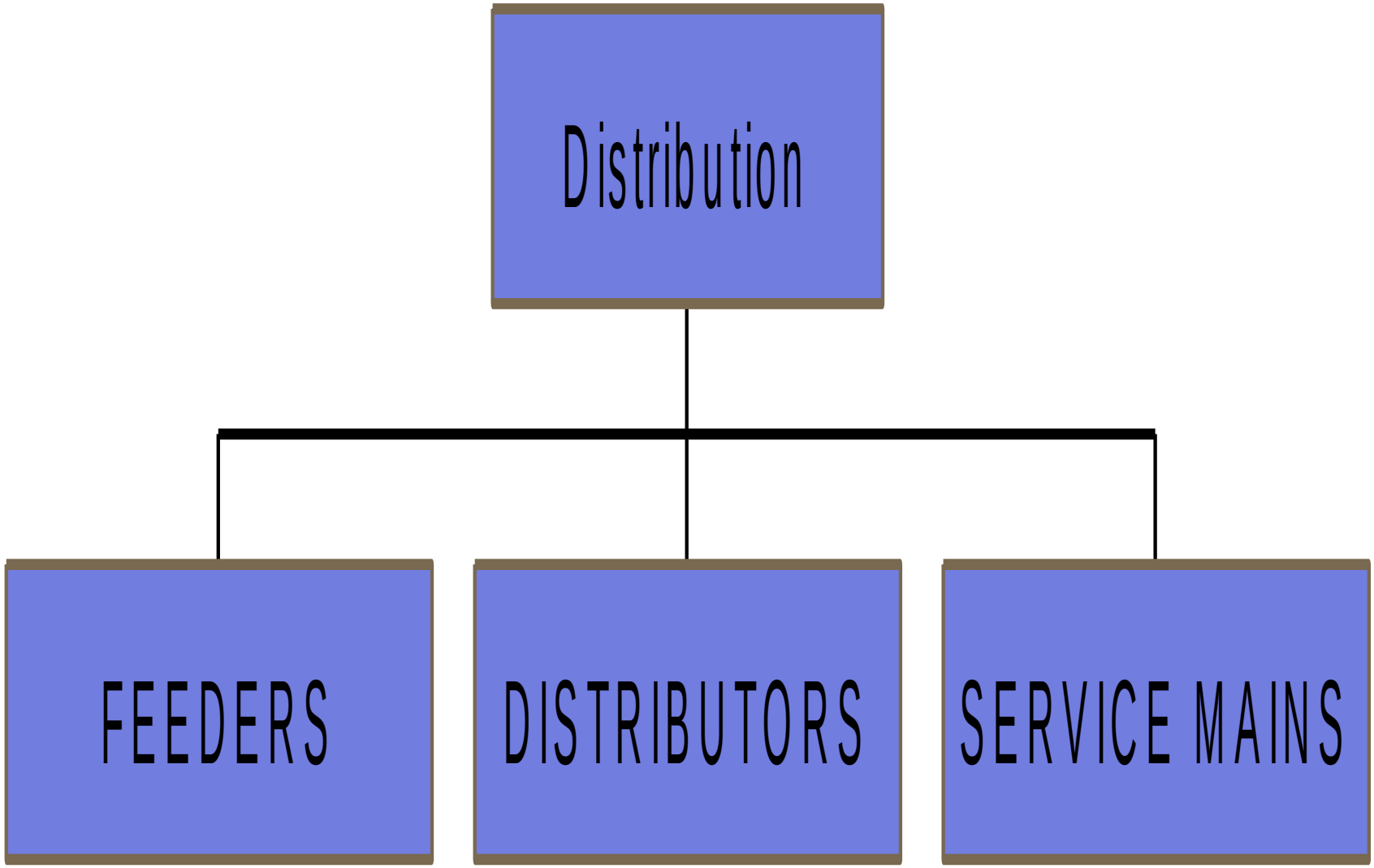
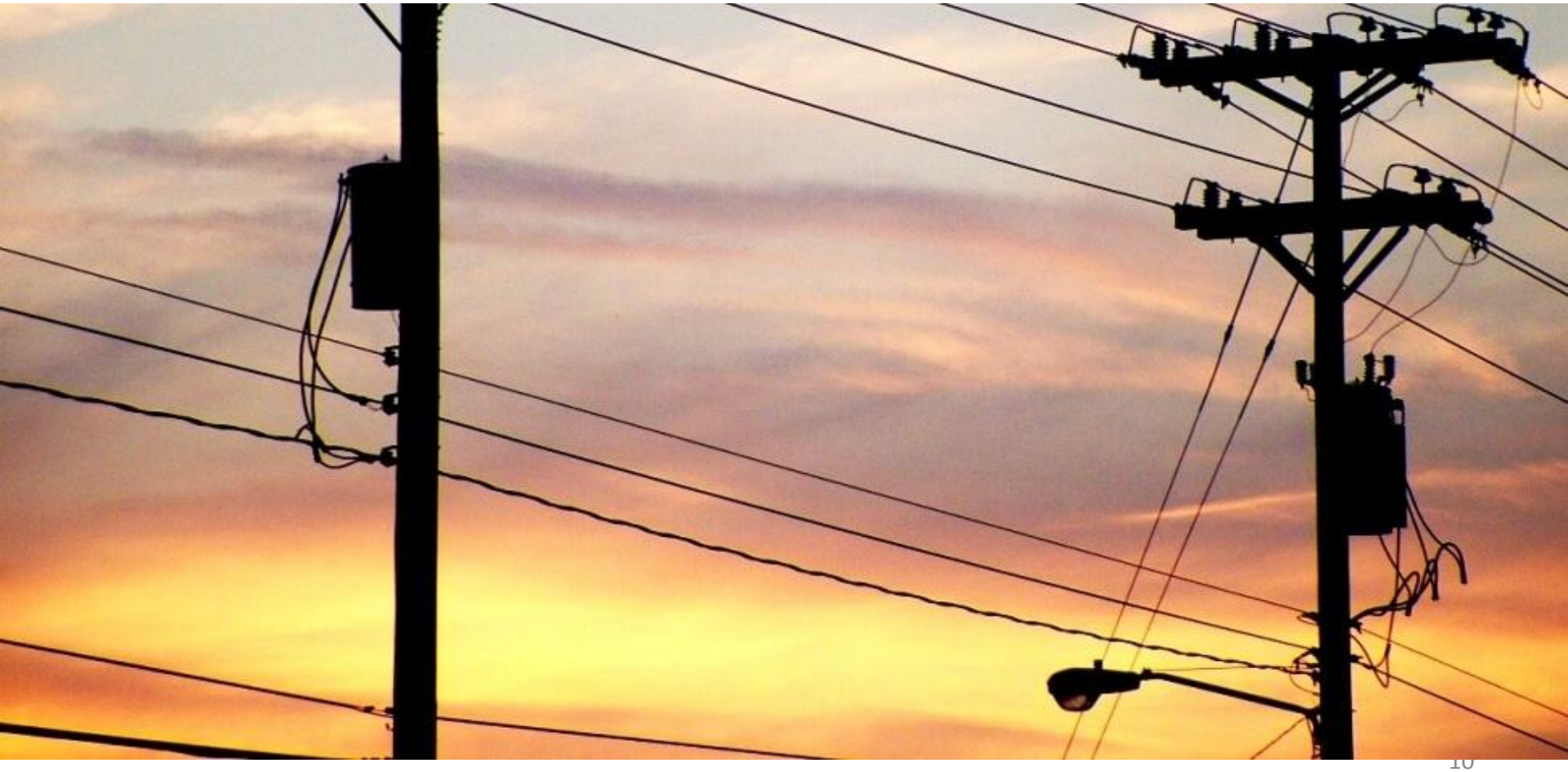


Fig.Classification Of Distribution Systems

UNIT - II
DISTRIBUTION FEEDERS &SUBSTATIONS



FEEDERS

- These are the cables supplying power in bulk to a selected number of points called feeding points The feeders run along streets overhead (or underground, in some cases) and power the distribution transformers at or near the customer premises.

DISTRIBUTORS

- Distributors are used for current Tapping for the various consumers these cables are generally having the main street for there route .

SERVICE MAIN

- Service mains are the small cables teed of off from the distributors and taken into the premises of the various consumers these are low tension cables.

EFFECT OF SUPPLY VOLTAGE ON THE SIZE OF DISTRIBUTOR

The allowable current density for given type of cable laid is not constant but decreases somewhat as the cable size increases. If voltage of the system is increased N folds then for a given power delivered The current is reduced to 1/Nth.

Size of cable is reduced to 1/Nth.

BALANCERS

The generators supplying a three-wire feeder are all connected in parallel across the outers, and it is therefore necessary to fix the potential of the middle wire midway between that of the outers, otherwise voltages will not be equal, unless the currents taken from the outers are equal.

POLE-MOUNTED SUBSTATION

The substation consisting of a transformer and other apparatus installed on the pole structure is known as

pole mounted substation

As the name implies such substation are installed on H-pole structure many times

COMPONENTS OF 11kV/ 400V POLE MOUNTED SUB-STATION

It is an out-door type substation and is erected on a pole structure. this erected pole is also called H-pole structure

The various components of such a sub-station numbered as under:-

1)---R.C.C. Pole Structure
2)--Platform for transformer
3)--Transformer
4)--Pin-Type insulator
5)-Jumpers
6)--Strain insulator
7)--Fuses
8)--Gang Operating switch
9)--P.G. Clamps

10)-Earthing
11)--Caution Plates
12)--Stay wire
13)-Anchor road
14)-Stay insulators
15)-Anti-climbing devices
16)-G.I. Pipe and bends
17)-V.I.R. Cable
18)-T.P.I.C. Switch

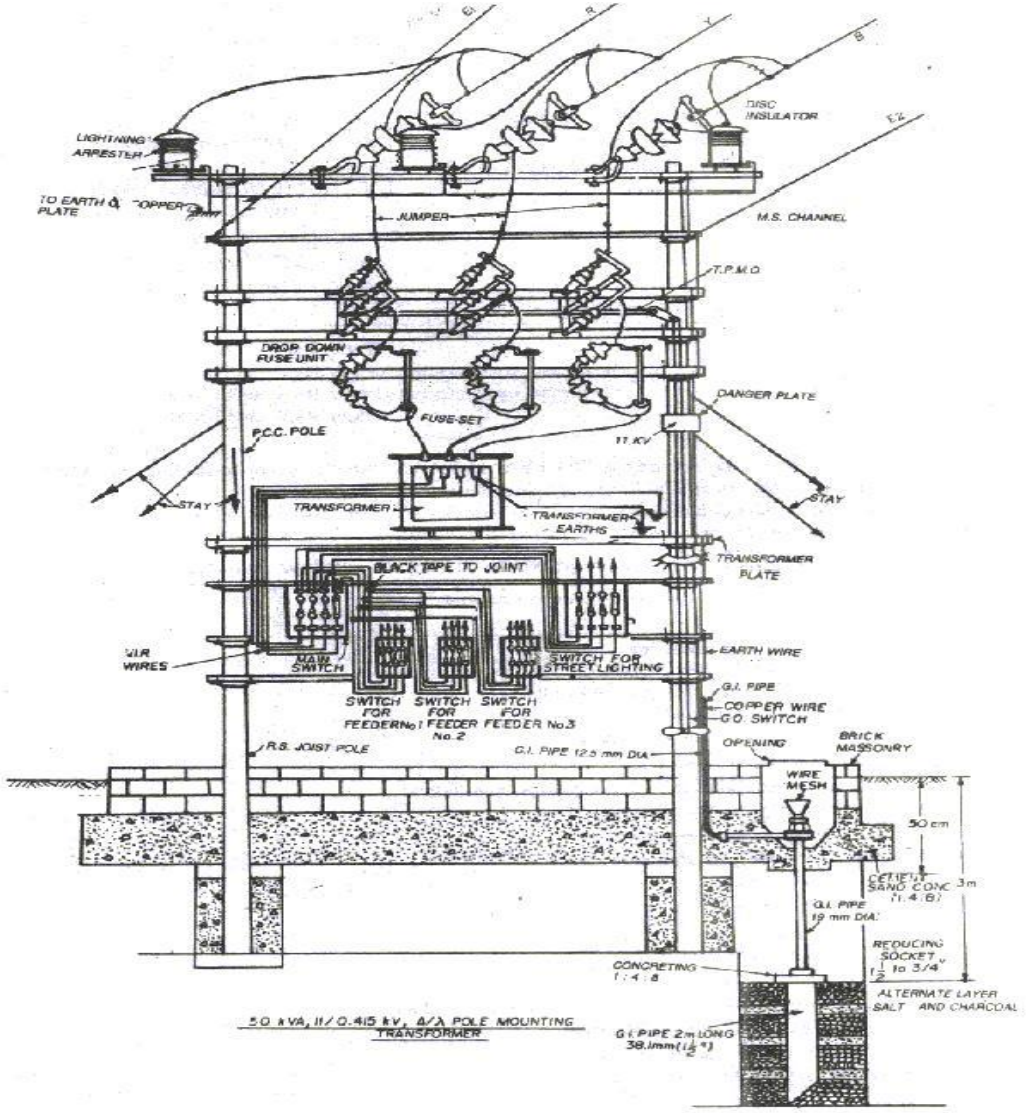


Fig. Pole Mounting

ESTIMATING OF 11KV/440V POLE MOUNTED OUTDOOR SUBSTATION

M.S.channel for cross arm	**10cm x 5 cm x 1.5mt long**	**1no**
H.T. 11 kV disc insulators with fittings	**11kv grade, porcelain body, glazed**	**3nos**
H.T. 11 kV pin insulators with fittings	**11kv grade, porcelain body, glazed**	**3nos**
Stay sets complete	**Stay clamp ,stay insulator, stay bow, egg insulator**	**2 sets**

Fig. Outdoor Transformer

UNIT - III
Distribution System Analysis: Voltage drop and power-loss calculations

Earth wire clamp.	**M.S flat with nut & bolt**	**1no**
Binding wire	**Aluminum wire**	**500 gm**
Total Conductor	**ACSR gopher 6/1/2.36 mm diameter: length 50 x 3=150mts sag allowed1% = 1.5mt**	**150+ 1.5 = 151.5 mts**
Galvanized steel wires	**8 SWG ,galvanized steel**	**50.5 mt or 6 kg**
R.S joist poles	**R.S joist, 175 mm x 100 mm x 10 mts long**	**2nos**

substation plate	**100 mm x 50 mm x 6mm long**	**1no**
dropper angle iron	**75mm x 75mm x 8mm x 2mts long long**	**1no**

Stay sets complete

a) Stay clamp **40x6 mm,M.S flat with nut & bolt.** **2nos**

b) Stay insulator **H.T grade, , porcelain body, glazed** **2nos**

Disc insulator	**11kv grade, porcelain body, glazed**	**3nos**
Pin insulators with pins	**11kv grade, porcelain body, glazed**	**3nos**
Danger board with clamp	**Written in local, national, English language**	**1no**
Jump wire for jumpering	**ACSR gopher 6/1/2.36mm dia**	**1kg**

T.P.M.O switch	**Iron clad Switch with handle**	**1no**
Painting for poles and other attachments		**2 ltr**
Fuse set	**415v,60amp,copper or tinned alloy**	**1set(3 Nos)**
Transformer	**50 KVA 11/0.4 kV**	**1no**
Cross channel for transformer	**75x40x6cm M.S channel, 0.7mtr long**	**1no**
Earthing complete		**25kg**
		25kg
a) salt **b) charcoal** **c) Earthing set**	**Complete Earthing set**	**1set**

1) Transformer	50 KVA 11/0.4 kV	1
2) Cross channel for transformer	75x40x6cm M.S channel, 0.7mtr long	1
Main switch	TPICN (Triple Pole ironclad and Neutral) main switch with 3 fuses & with one neutral link, 100 amp, and built in HRC fuse unit.	1no
Earthing for transformer	Complete earthing	1
Feeder	3 phase, 4 wire, 50 cycles, 400/440 volts	3 Nos
Transportation & labour charge		As required
Lightning arrester	11 kV grade ,glazed	3 Nos

Dimensions of Danger Plate

Two sizes of Danger Notice Plates as follows are recommended:

For display at 415 V installations – 200x150mm---

For display at 11 KV (or higher voltages) installations – 250x200mm

The corners of the plate shall be rounded off.

The location of fixing holes is provisional and can be modified to suit the requirements of the purchaser.

Lettering of Danger Plate

All letterings shall be centrally spaced. The dimensions of the letters, figures and their respective position shall be as shown in figs on next slide

The size of letters in the words in each language and spacing between them shall be so chosen that these are uniformly written in the space earmarked for them.

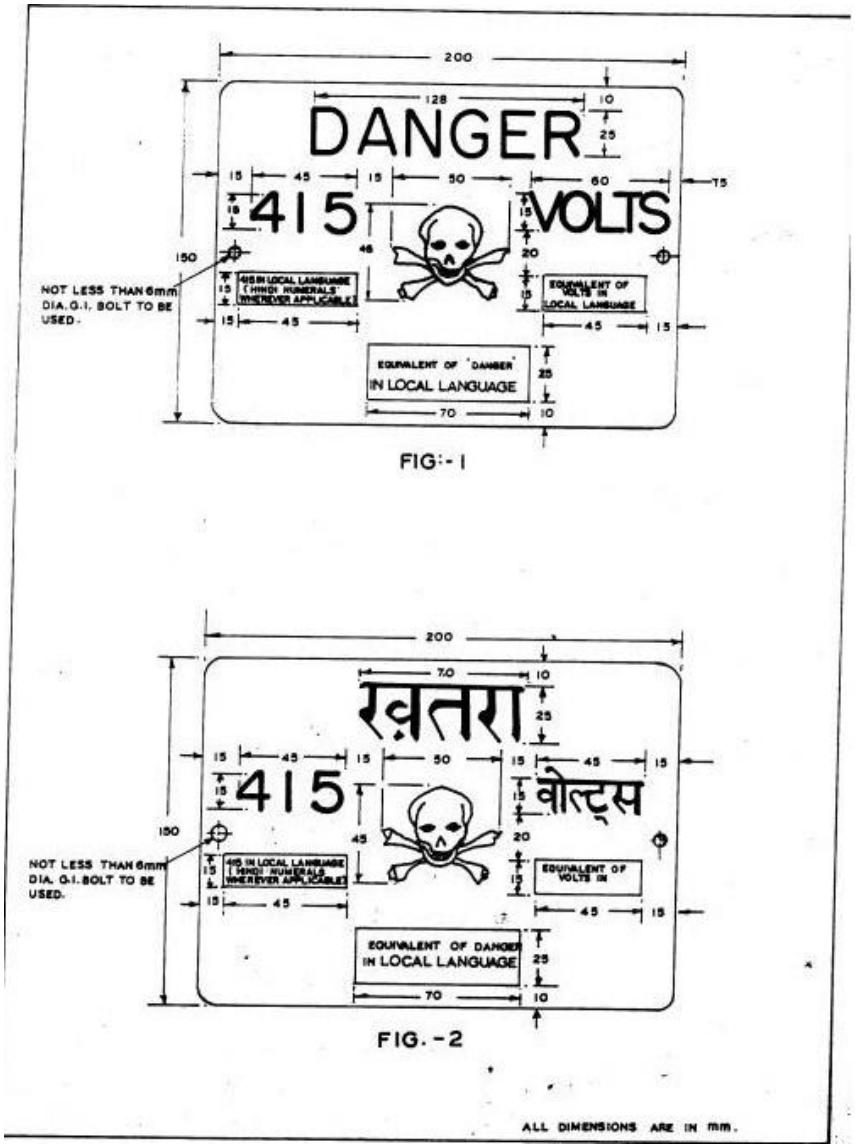


Fig. Safety Precautions

UNIT - IV
Protective devices & co-ordination:

Languages of Danger Plate

Under Rule No. 35 of Indian Electricity Rules, 1956, the owner of every medium, high and extra high voltage installation is required to affix permanently in a conspicuous position a danger notice in Hindi or English and, in addition, in the local language, with the sign of skull and bones.

The type and size of lettering to be done in Hindi is indicated in the specimen danger notice plates shown in Fig. 2 and those in English are shown in Figs.

Now let us discuss about the components Regarding the lattice steel tower for distribution the ac voltage. The main supporting unit of overhead transmission line is transmission tower. Transmission towers have to carry the heavy transmission conductor at a sufficient safe height from ground. In addition to that all towers have to sustain all kinds of natural calamities

•So transmission tower designing is an important engineering job where all three basic engineering concepts, civil, mechanical and electrical engineering concepts are equally applicable.

• Main parts of a transmission tower A power transmission tower consists of the following parts,

- 1) Peak of transmission tower
2) Cross Arm of transmission tower
3) Boom of transmission tower
4) Cage of transmission tower
5) Transmission Tower Body
6) Leg of transmission tower
7) Stub/Anchor Bolt and Base plate assembly of transmission tower

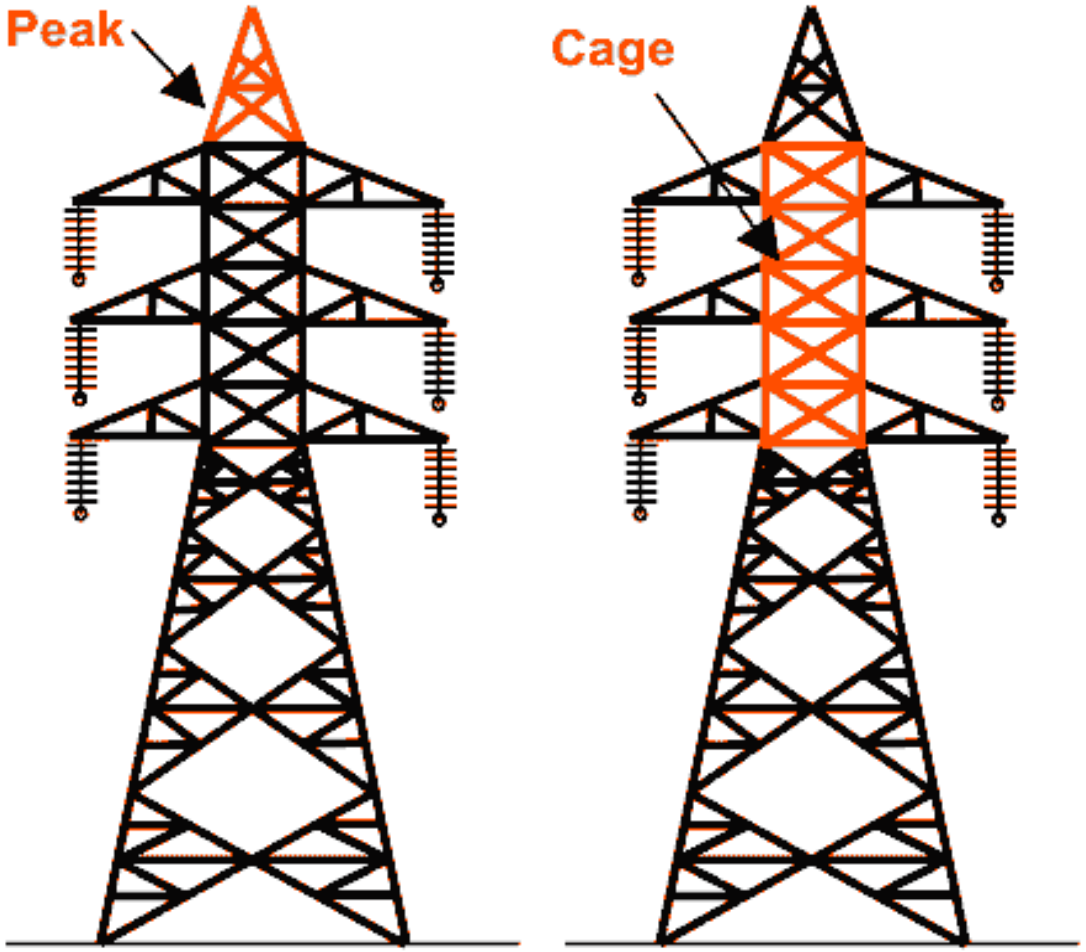
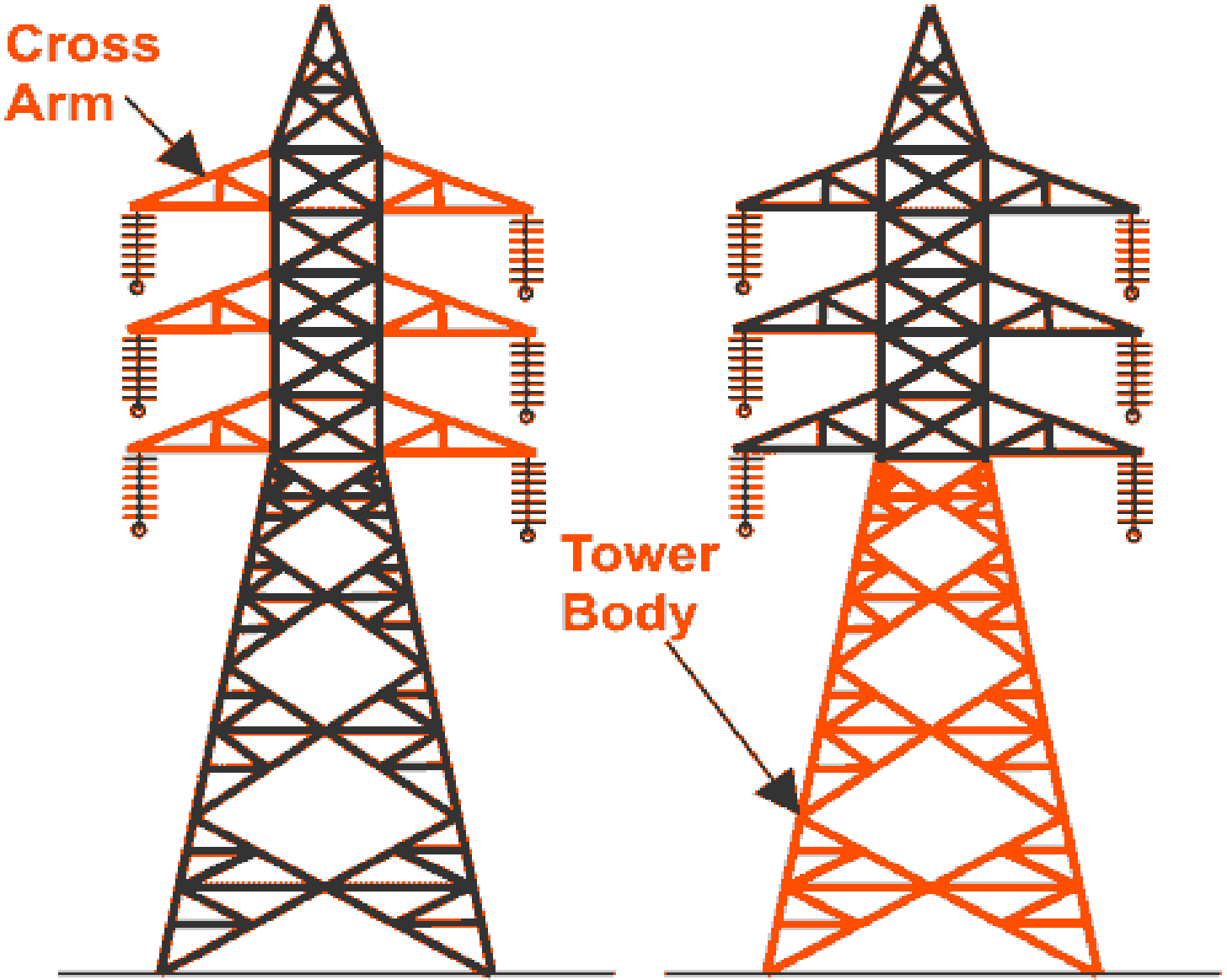


Fig.Lattice steel tower

- **Peak of transmission tower**
- The portion above the top cross arm is called peak of transmission tower. Generally earth shield wire connected to the tip of this peak.
- **Cross Arm of transmission tower**
- Cross arms of transmission tower hold the transmission conductor. The dimension of cross arm depends on the level of transmission voltage, configuration and minimum forming angle for stress distribution.

- **Cage of transmission tower**
- The portion between tower body and peak is known as cage of transmission tower. This portion of the tower holds the cross arms.
- **Transmission tower body**
- The portion from bottom cross arms up to the ground level is called transmission tower body. This portion of the tower plays a vital role for maintaining required ground clearance of the bottom conductor of the transmission line.


Cross
Arm
Tower
Body

The “Stockbridge” type vibration damper is commonly used to control vibration of overhead conductors and OPGW. The vibration damper has a length of steel messenger cable. Two metallic weights are attached to the ends of the messenger cable. The centre clamp, which is attached to the messenger cable, is used to install the vibration damper onto the overhead conductor.

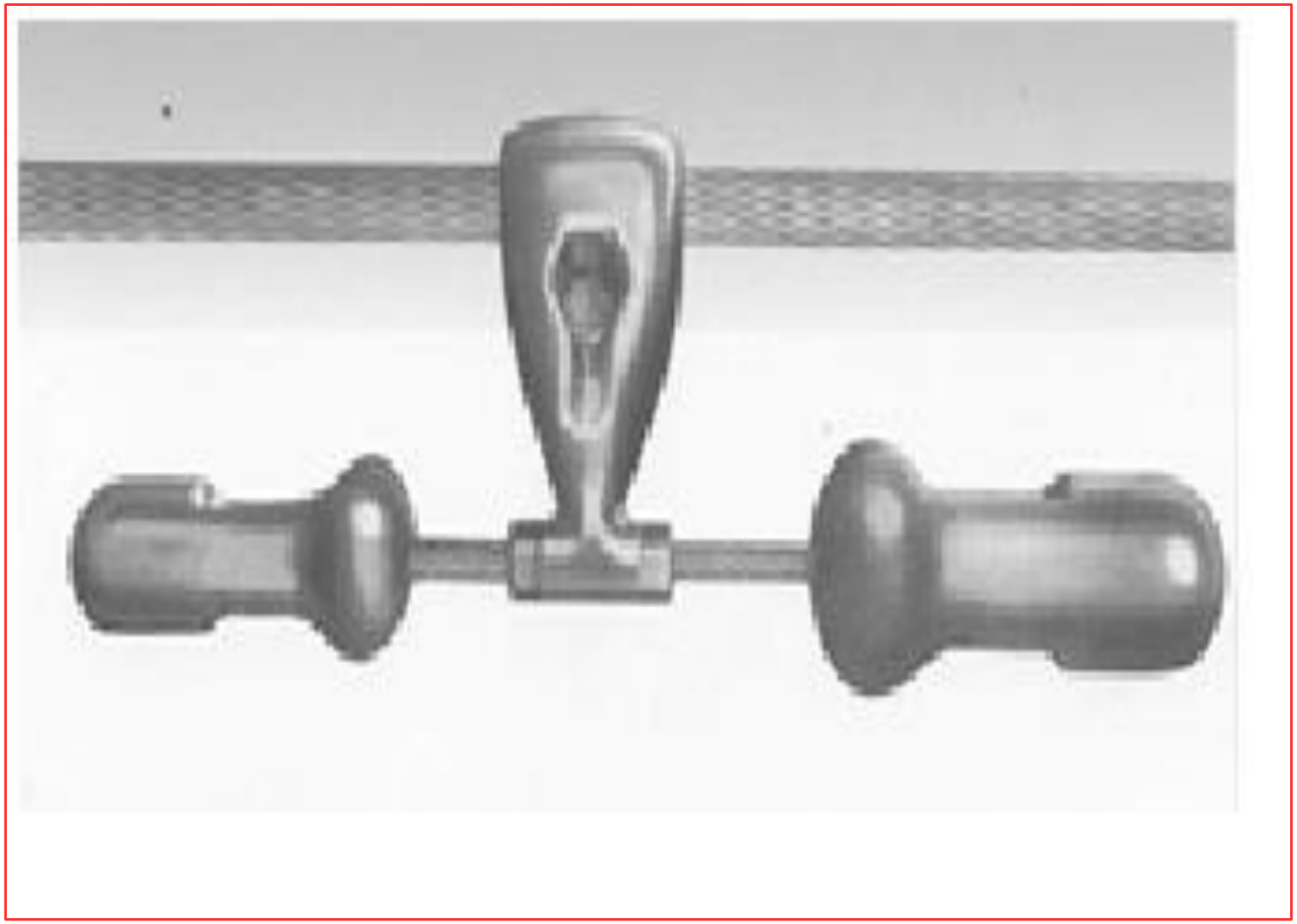


Fig.Stockbridge

Ring Distributor

A ring distributor is a distributor which is arranged to form a closed circuit and which is fed atone or more than one points. For the purpose of calculating voltage distribution, it can be looked uponas consisting of a series of open distributors fed at both ends. By using a ring distributor fed properly, great economy in copper can be

affected. If the ring distributor is fed at one point then, for the purposes of calculation, it is equivalent to a straight distributor fed at both ends with equal voltages There are 3 type of power distribution namely loop,network and radial.Radial distribution is the type of power distribution where the power is delivered from the main branch to sub-branches then it split out from the sub-branches again. it is the cheapest but least reliable network configuration.

Ring main system In this system, various power stations or sub-stations are interconnected alternate routes, thus forming a closed ring. In case of damage to any section of the ring, that section may be disconnected for repairs and power will be supplied from both ends of the ring. A radial system has a single simultaneous path of power .

The distribution systems are typically radial because networked systems are more expensive.

UNIT - V
Voltage Control & Power Factor Improvement

ADVANTAGES OF OUT-DOOR SUBSTATIONS

- Fault location is easier.
- Extension of the installation is easier.
- Less time is required foe their erection.
- The cost of civil engine4ering work is less.
- Practically no danger of a fault which appears at one point being carried over to another point.

Now let us discuss some insulators used In distribution systems

Pin type insulators

Post type insulators

Disc type insulators

D-Shakle type insulators

Egg type insulators

Reel insulators .....etc

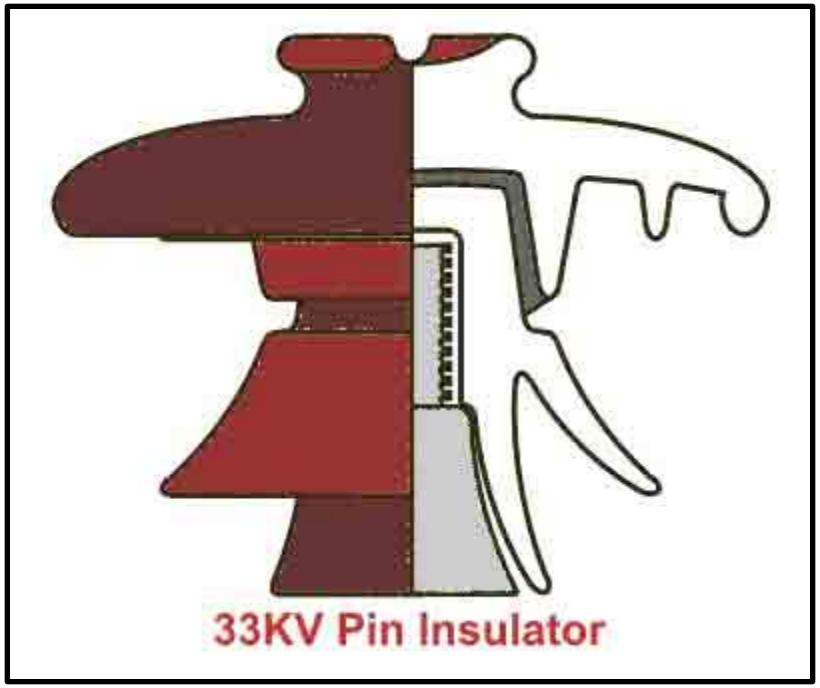


Fig. Pin Insulator

Pin Insulator is earliest developed **overhead insulator**, but still popularly used in power network up to 33KV system. Pin type insulator can be one part, two parts or three parts type, depending upon application voltage. In 11KV system we generally use one part type insulator where whole pin insulator is one piece of properly shaped porcelain or glass. As the leakage path of insulator is through its surface

In higher voltage like 33KV and 66KV manufacturing of one part porcelain pin insulator becomes difficult. Because in higher voltage, the thickness of the insulator become more and a quite thick single piece porcelain insulator can not manufactured practically. In this case we use multiple part pin insulator, where a number of properly designed porcelain shells are fixed together by Portland cement to form one complete insulator unit. For 33KV tow parts and for 66KV three parts pin insulator are generally used.

Post Insulator--

Post insulator is more or less similar to Pin insulator but former is suitable for higher voltage application. **Post insulator** has higher numbers of petticoats and has greater height. This type of insulator can be mounted on supporting structure horizontally as well as vertically. The insulator is made of one piece of porcelain but has fixing clamp arrangement are in both top and bottom end.

Fig.Pin Insulator

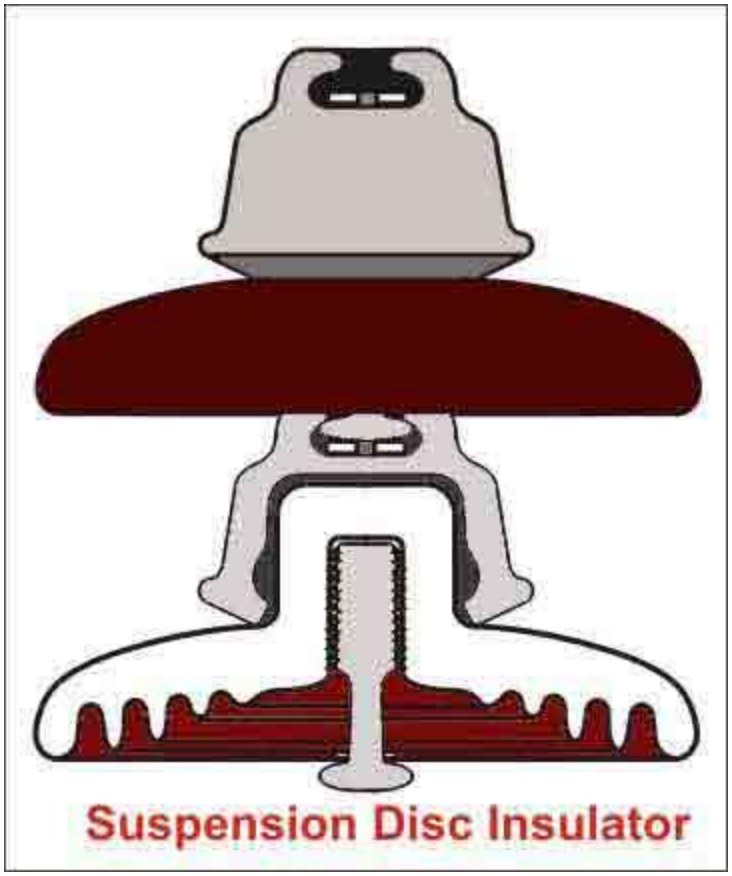


Fig. Suspension Insulator

In higher voltage, beyond 33KV, it becomes uneconomical to use pin insulator because size, weight of the insulator become more. Handling and replacing bigger size single unit insulator are quite difficult task. For overcoming these difficulties, **suspension insulator** was developed.

In **suspension insulator** numbers of insulators are connected in series to form a string and the line conductor is carried by the bottom most insulator. Each insulator of a suspension string is called disc insulator because of their disc like shape.

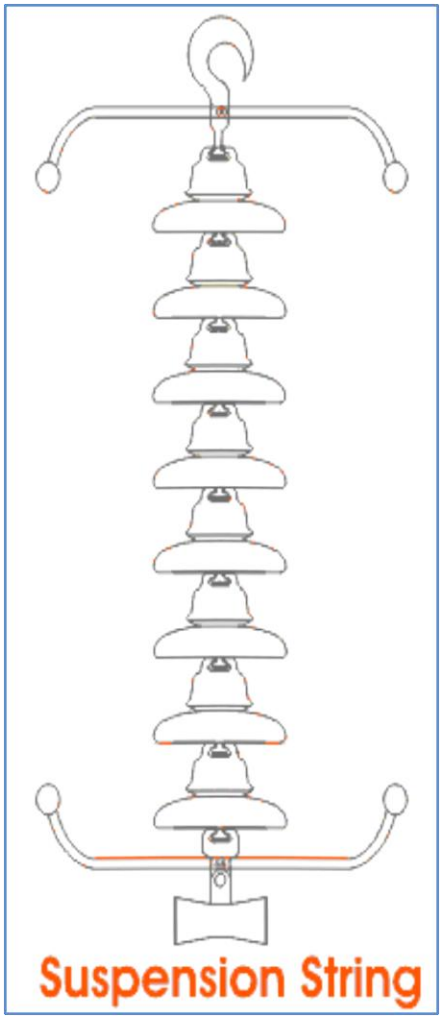


Fig. Suspension Insulator

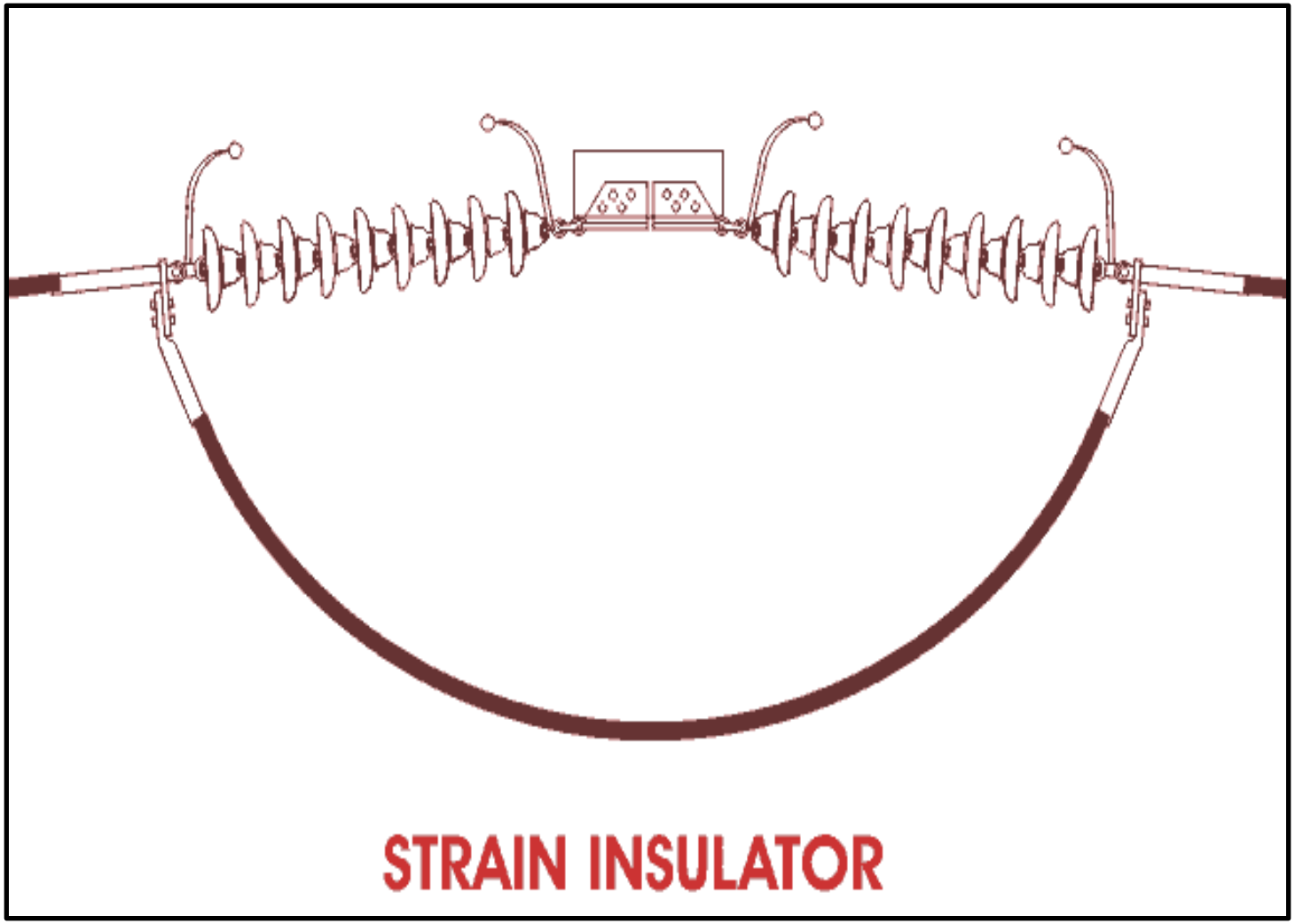
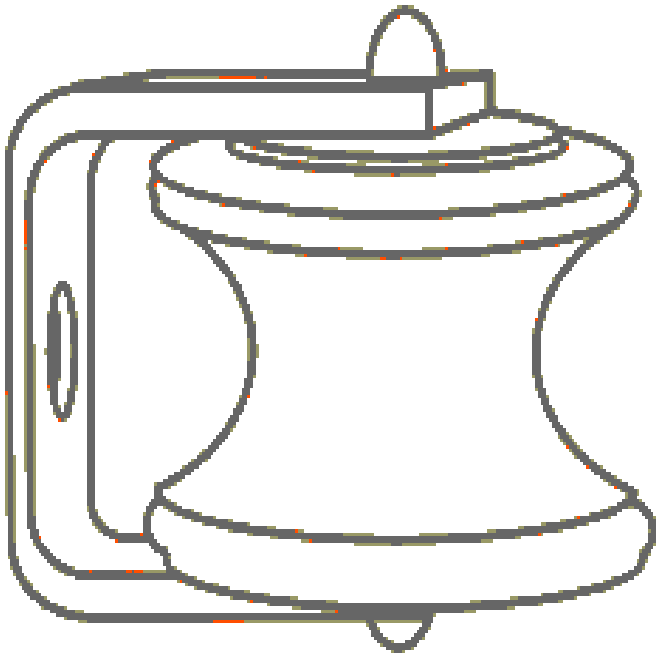


Fig. Strain Insulator

When suspension string is used to sustain extraordinary tensile load of conductor it is referred as **string insulator**. When there is a dead end or there is a sharp corner in transmission line, the line has to sustain a great tensile load of conductor or strain. A **strain insulator** must have considerable mechanical strength as well as the necessary electrical insulating properties.



Shackle or Spool Insulator

Fig. Shackle Insulator

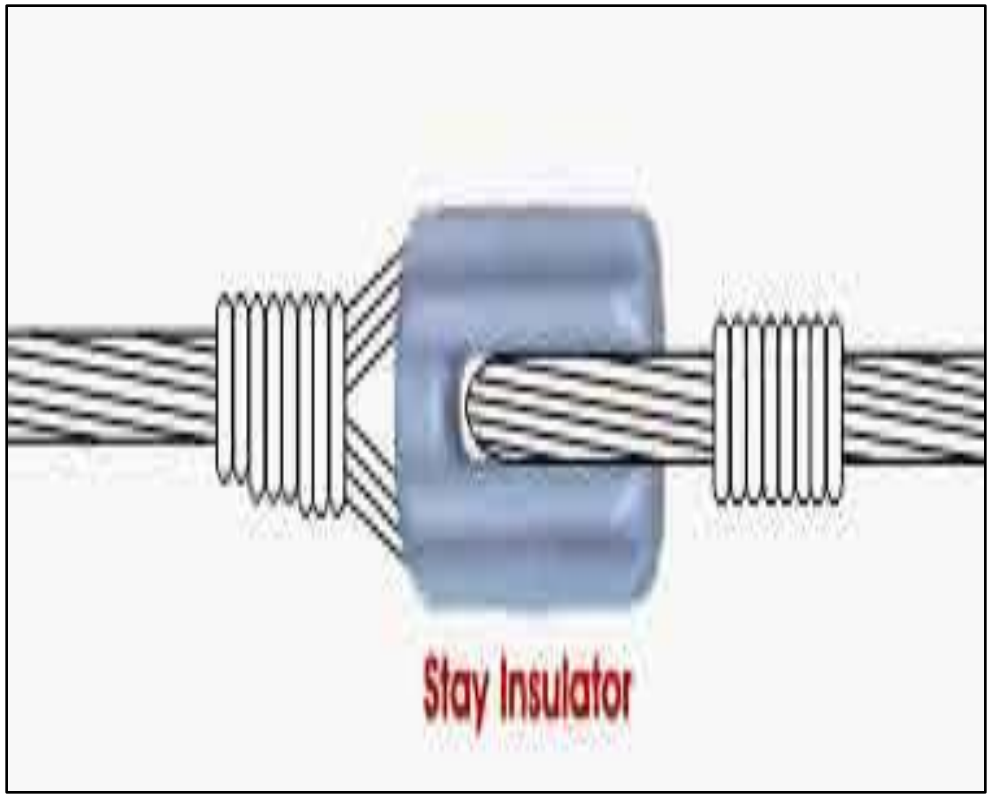


Fig. Stay Insulator

Fig. GlassInsulator

Fig. Suspension(Polymer) Insulator

THANK YOU