

Sub - StationsSub - Station!:-

The assembly of apparatus used to change some characteristic (i.e. voltage, a.c to d.c, frequency, P.S. etc) of electric supply is called a Sub-Station.

Location of Substation!:-

- 1) It should be located at proper site. As far as possible, it should be located at the centre of gravity of load.
- 2) It should provide safe and reliable arrangement. For safety consideration must be given to the maintenance of regulation clearances, facilities for carrying out repairs and maintenance abnormal occurrences such as possibility of explosion of fire etc. For reliability consideration must be given for good design and construction.
- 3) It should be easily operated and maintained.
- 4) It should involve minimum capital cost.

Classification of Substations!:-

Two most important ways of classifying them.

- 1) According to service requirement
- 2) According to constructional features.

According to Service requirement:-

A Substation may be called upon to change voltage level or improve power factor or convert a.c power into d.c power etc. According to the service requirement Substations may be classified into

1) Transformer Substation:-

Those Substations which change the voltage level of electric supply are called transformer Substations, these are receive power at some voltage and deliver it at some other voltage. obviously transformer will be the main component in such Substations. most of the Substations are of this type.

2) Switching Substations:-

These Substations do not change the voltage level i.e. incoming and outgoing lines have same voltage. However they simply perform the switching operations of power lines.

3) Power-factor correction Substations:-

These Substations which improve the power factor of the system are called power factor correction Substations. Such Substations are located at the receiving end of transmission lines. these are generally use synchronous condensers as the powerfactor improvement equipment.

4) Frequency changer Substations:-

②

Those Substations which change the supply frequency are known as frequency changer Sub-stations. Such a frequency change may be required for industrial utilisation.

5) Converting Sub-stations:-

Those Sub-stations which change a.c power into D.C Power are called converting Sub-stations. These Sub-stations receive a.c Power and convert it into d.c Power with suitable apparatus to supply for such purposes as traction, electro plating, electric welding etc..

6) Industrial Substations:-

Those which supply power to individual industrial concerns are known as industrial Substations.

→ According to constructional features:-

A Substation has many components (i.e. circuit breaker, switches, buses, instruments etc-) which must be housed properly to ensure continuous and reliable service.

So according to constructional features the Substations are classified into

1) Indoor Sub-stations:-

For voltage upto 11kV, the equipment of the Sub-station is installed indoor. because of economic.

considerations. However when the atmosphere is contaminated with impurities, these substations can be erected for voltages upto 66kV.

2) outdoor Sub-stations:-

For voltages beyond 66kV, equipment is invariably installed outdoor, it is because for such voltages, the clearances b/w conductors and space required for switches, circuit breakers and other equipment becomes so great that it is not economical to install the equipment indoor.

3) under ground Substations:-

In thickly populated areas, the space available for equipment and building is limited and the cost of land is high. Under such situations, the sub-station is erected underground.

4) Pole-mounted Sub-stations:-

This is an outdoor sub-station with equipment installed overhead on H-pole or 4-pole structure. It is the cheapest form of sub-station for voltage not exceeding 11kV. (or 33kV in some cases). Electric power is almost distributed in location through such substations.

Comparison b/w Indoor and outdoor Sub-stations:-

(3)

Particular	outdoor	Indoor.
1) Space required.	more	less
2) Time required for creation	less	more
3) Future extension	easy	difficult
4) Fault location	easier	difficult
5) Capital cost	low	high
6) Operation	difficult	easier

Transformer Sub-stations:-

The majority of the sub-stations in the power system are concerned with the changing of voltage level of electric supply. These are known as transformer sub-stations because transformer is the main component of sub-station.

Transformer sub-stations are classified into

- 1) Step-up sub-station
- 2) Primary grid sub-station
- 3) Secondary sub-station
- 4) Distribution sub-station.

1) Step-up Substation:-

The generation voltage (11kV in this case) is stepped up to high voltage (220kV) to affect economy

In transmission of electric power, the substations which accomplish this job are called step-up substations. These are generally located in the power houses and are of outdoor type.

2) Primary Grid Substation:-

From the step-up substation, electric power at 220kV is transmitted by 3-phase, 3-wire overhead system to the outskirts of the city. Here electric power is received by the primary grid substation which reduces the voltage level to 66kV for secondary transmission. The primary grid substation is generally outdoor type.

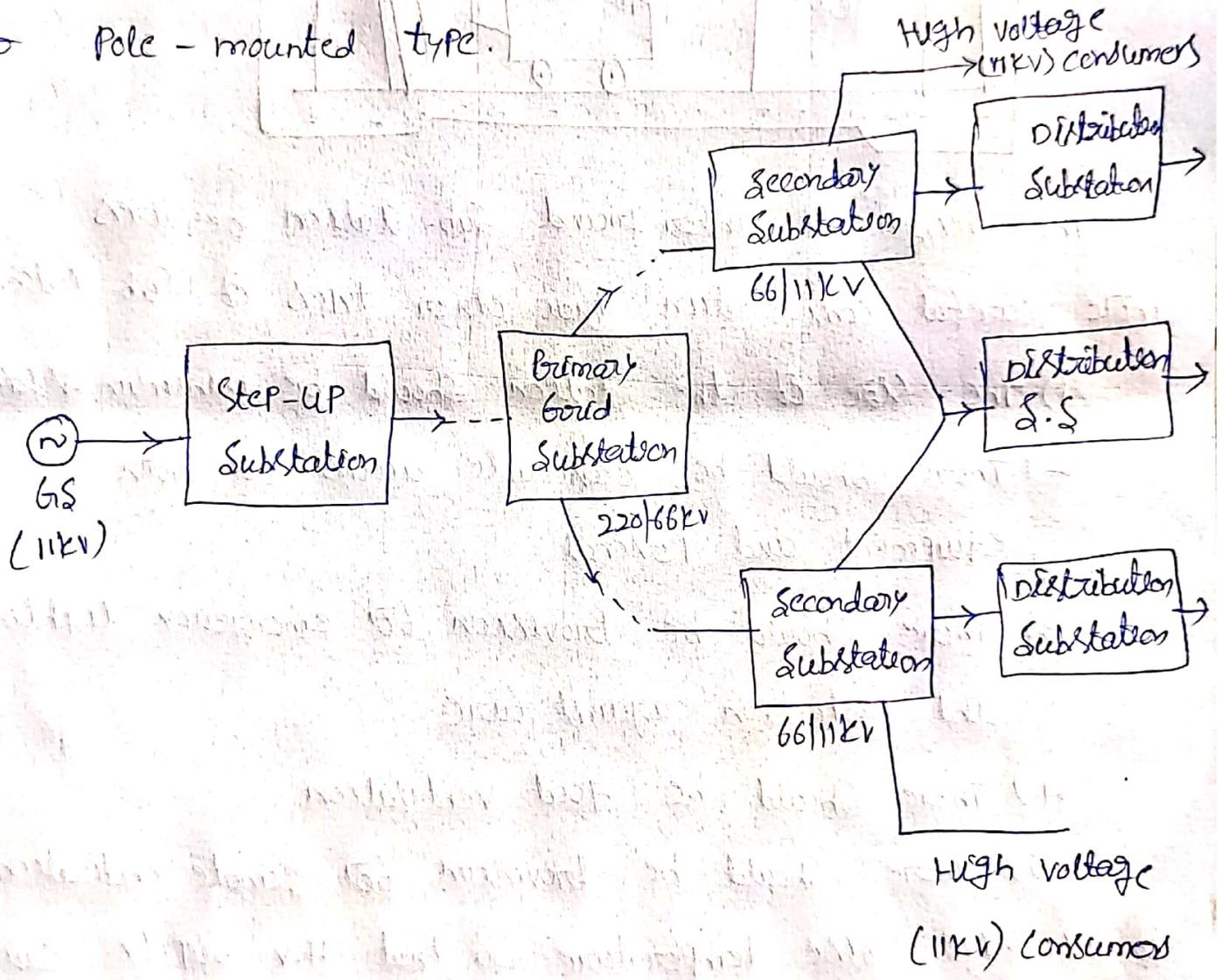
3) Secondary Substations:-

From the primary grid substation, electric power is transmitted at 66kV by 3-phase, 3-wire system to various secondary substations located at the strategic points in the city. At a secondary substation the voltage is further stepped down to 11kV. The 11kV lines run along the important road sides of the city. It may be noted that big consumers are generally supplied power at 11kV for further handling with their own substations.

4) Distributed Substations:-

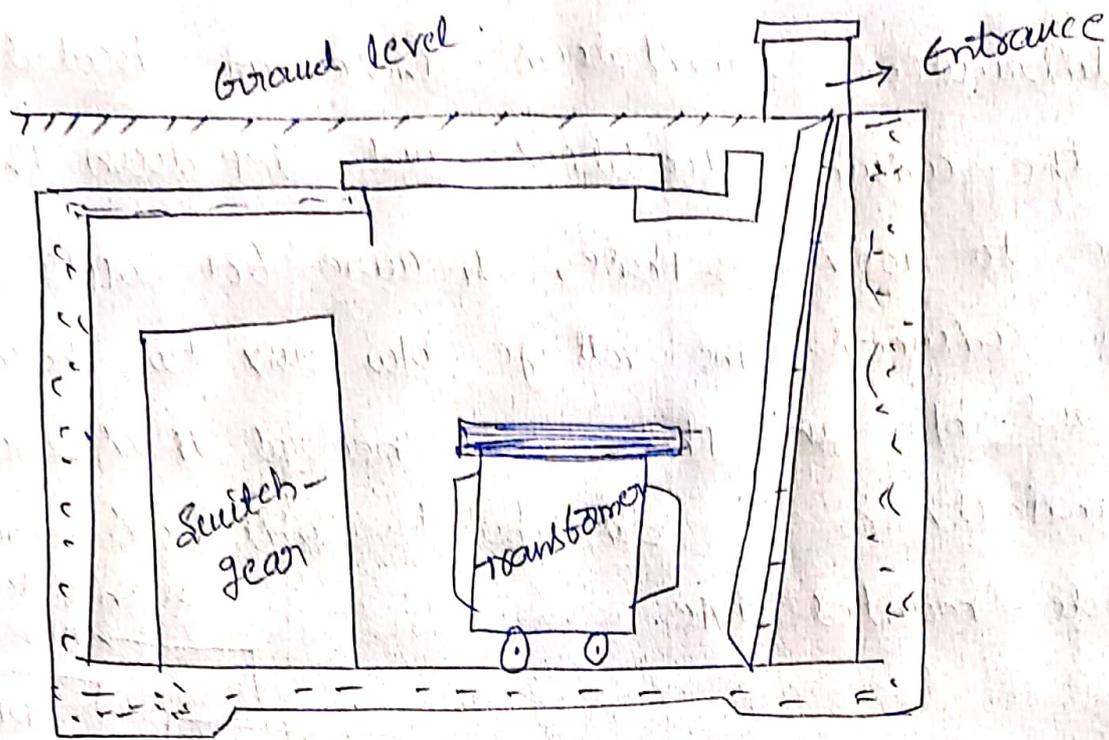
The electric power from 11kV lines is delivered

to distribution Sub-stations. these are located near the consumer localities and step down the voltage to 400V, 3-Phase, 4-wire 60 supplying to the consumers. The voltage b/w any two phases is 400V and b/w any phase and neutral it is 230V. The majority of the distributed Substations are of Pole-mounted type.



→ Under Ground Sub-Station:-

In thickly populated cities, there is scarcity of land as well as the prices of land are very high. this has led to the development of underground Substations.



The design of underground sub-station requires more careful consideration than other types of sub-stations

- 1) The size of the station should be minimum as possible
- 2) There should be reasonable access for both equipment and personal
- 3) There should be provision for emergency lighting and protection against fire
- 4) There should be good ventilation
- 5) There should be provision for remote indication of excessive rise temperature so that H.V supply can be disconnected
- 6) The transformers, switches and buses should be air cooled to avoid bringing oil into the premises.