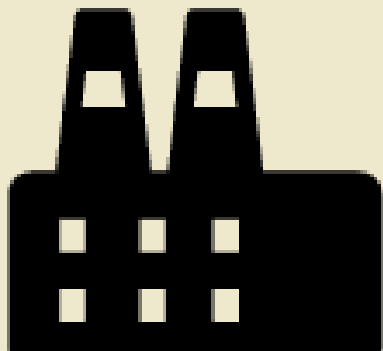
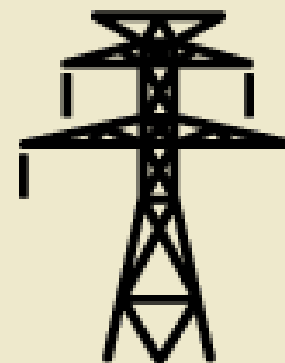


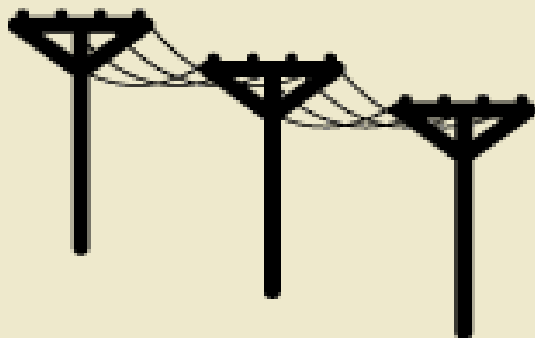
BUILDING SERVICES II



Generation of Electricity

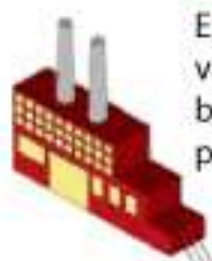


Transmission



Distribution



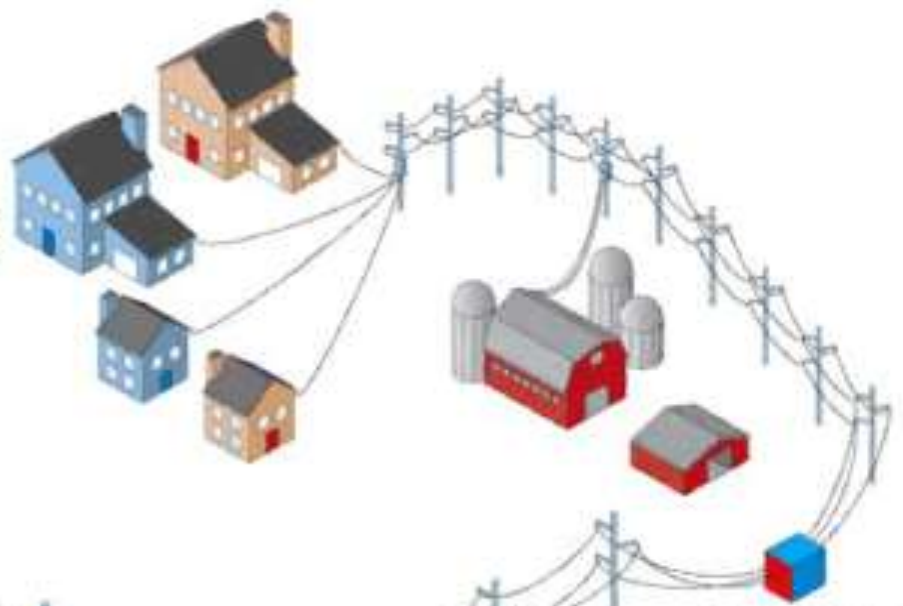


GENERATION

Electricity is generated at various kinds of power plants by utilities and independent power producers.

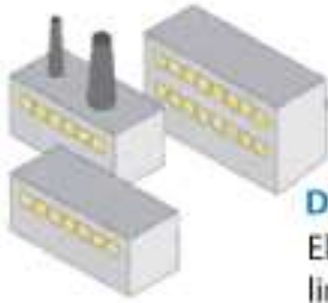
TRANSMISSION

Electric transmission is the vital link between power production and power usage. Transmission lines carry electricity at high voltages over long distances from power plants to communities.



SUBSTATION

SUBSTATION

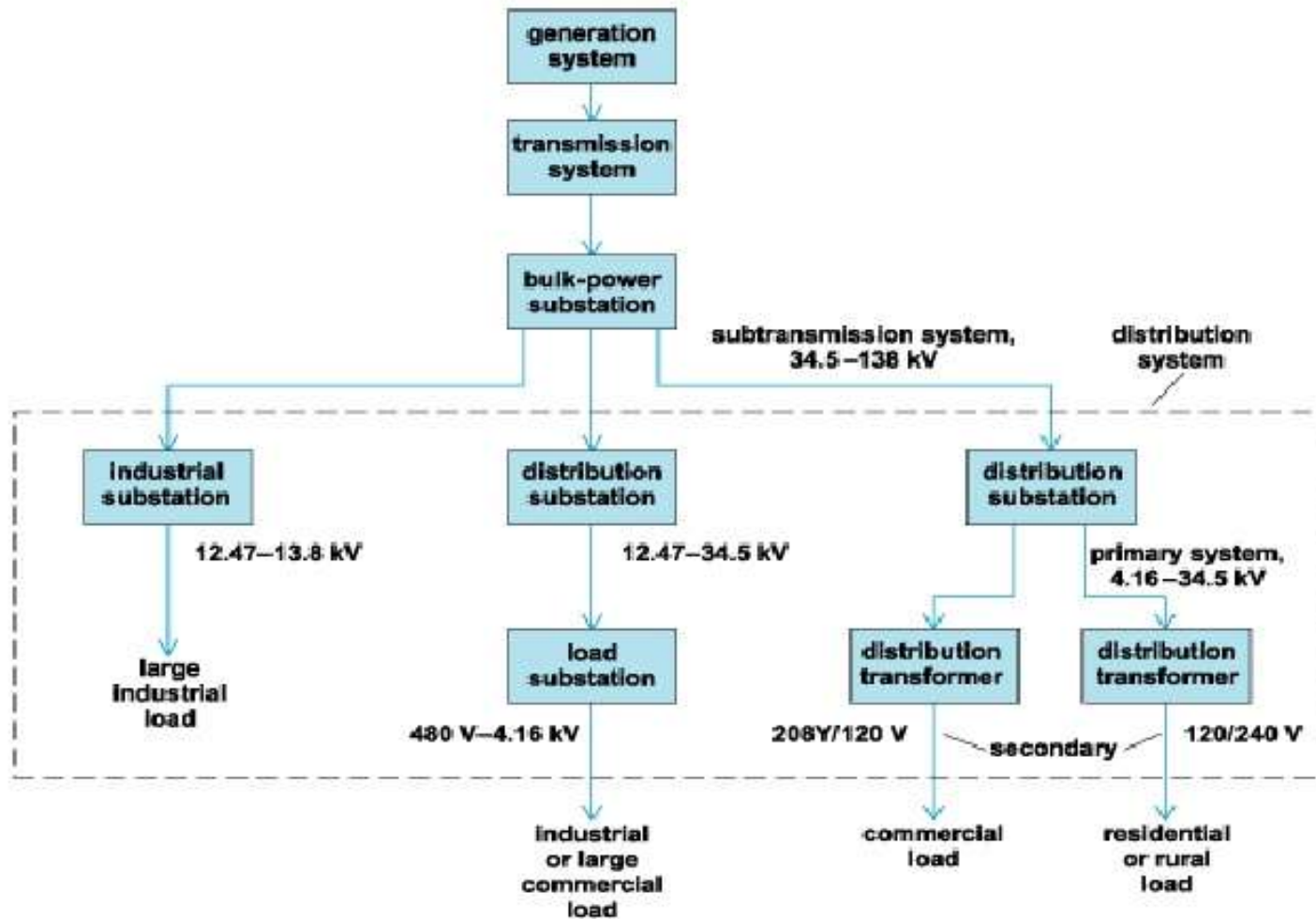


DISTRIBUTION

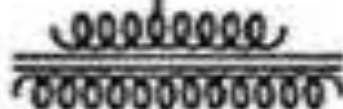
Electricity from transmission lines is reduced to lower voltages at substations, and distribution companies then bring the power to your home and workplace.



Distribution system layout



Generating station 11kV



Step up transformer
11 kV / 220 kV

Primary transmission
(High voltage)

Receiving station



Step down transformer
220 kV / 33 kV

Secondary transmission

Feeder

Substation



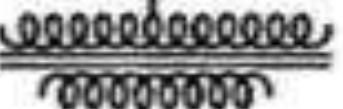
Step down transformer
33 kV / 6.6 kV

Primary distribution

Feeder

To large bulk loads like
factories, industries

Distribution
substation



Distribution transformer
6.6 kV / 400 V or 230 V

Secondary distribution

Distributors



To consumers

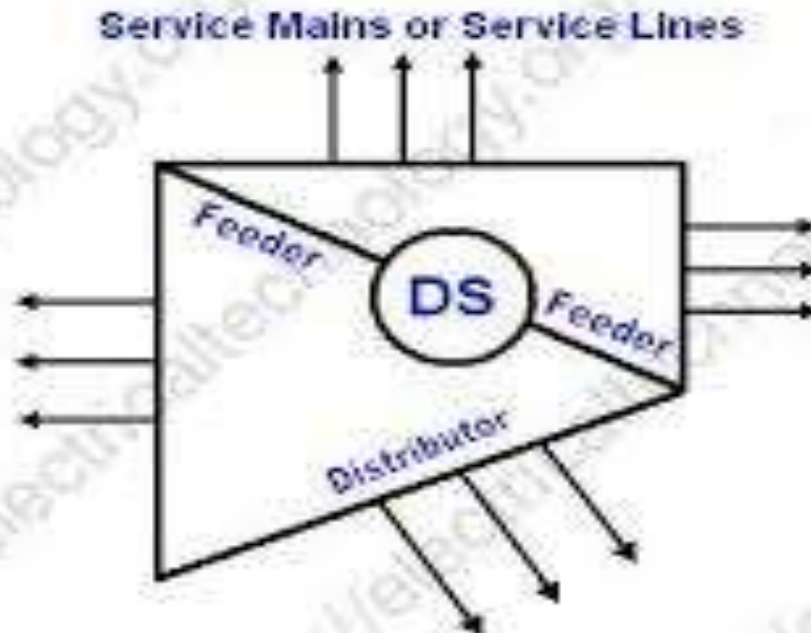
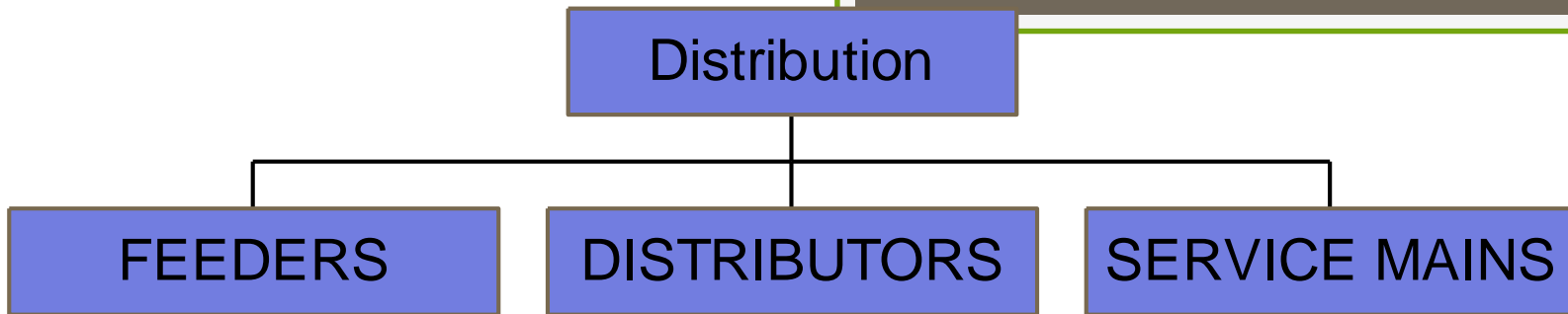
Service mains

Contents To Be Covered:

- Definition
- Classification Of Distribution System
- Distribution System Losses

Distribution System

- “The part of power system which distributes electrical power for local use is known as **DISTRIBUTION SYSTEM.**”
- This system is the electrical system between the substation fed by the transmission system and consumer meter.
- Distribution line generally consist of
 - Feeders
 - Distributers
 - Service mains



Elements of a Distribution System

01,02,03,04,05,06,12604

Feeder

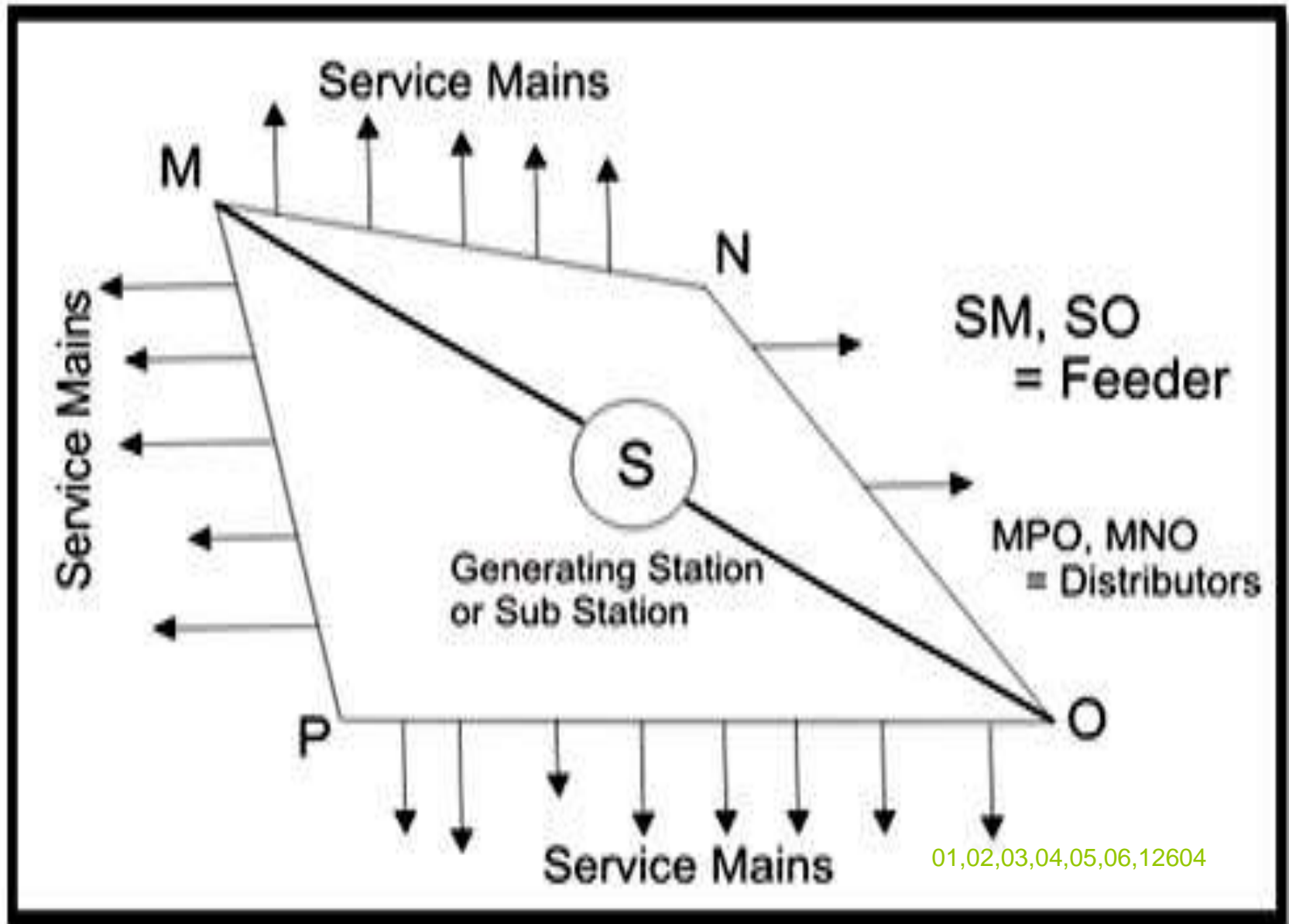
- A Feeder is conductor which connects the substation to the area where power is to be distributed .
- Feeder are used to feed the electrical power from the generating station to the substation
- No tapings are taken from the feeder
- So the current in it remains the same throughout
- Main consideration in the design of feeder is the Current carrying capacity.

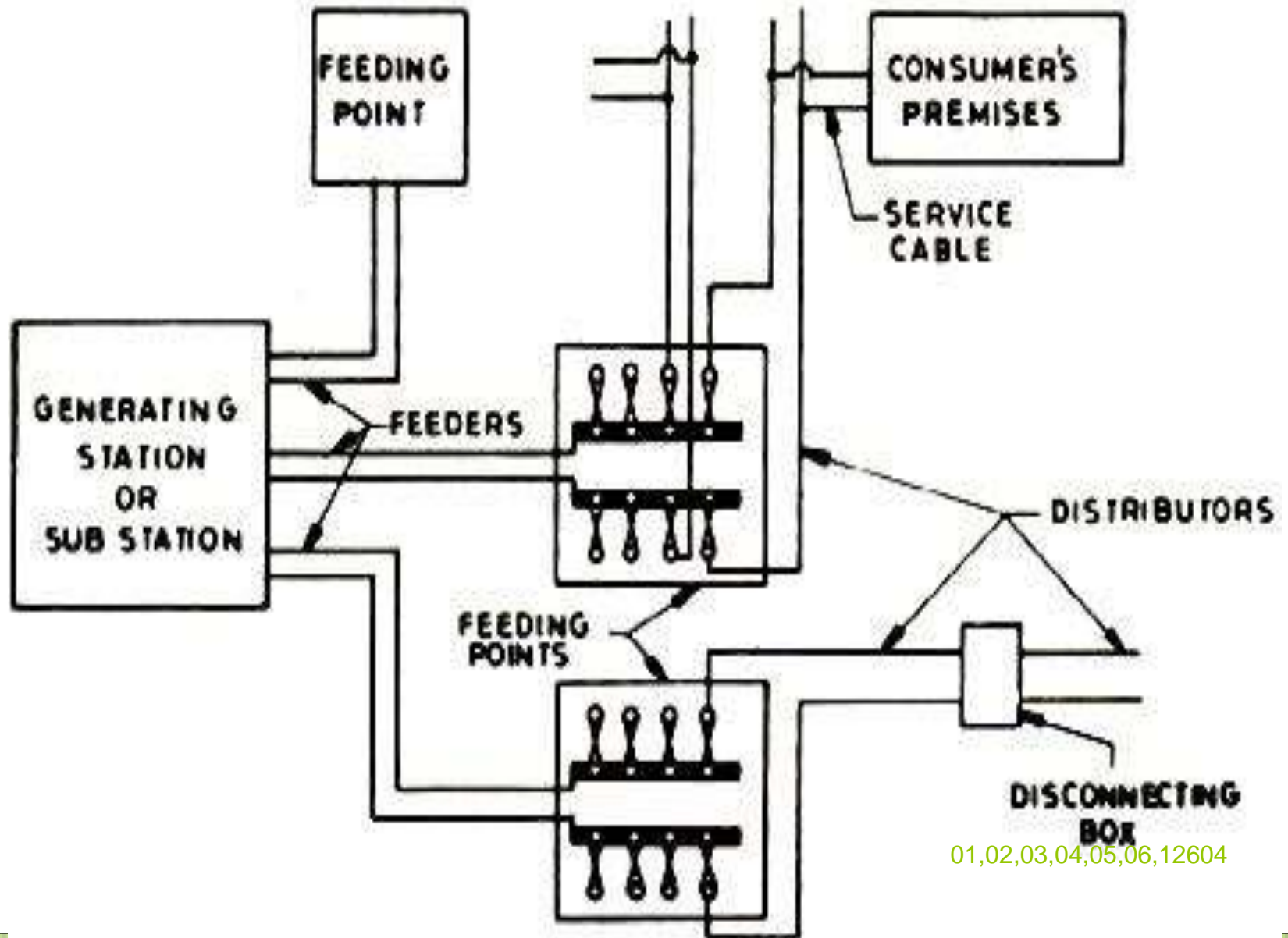
Distributor

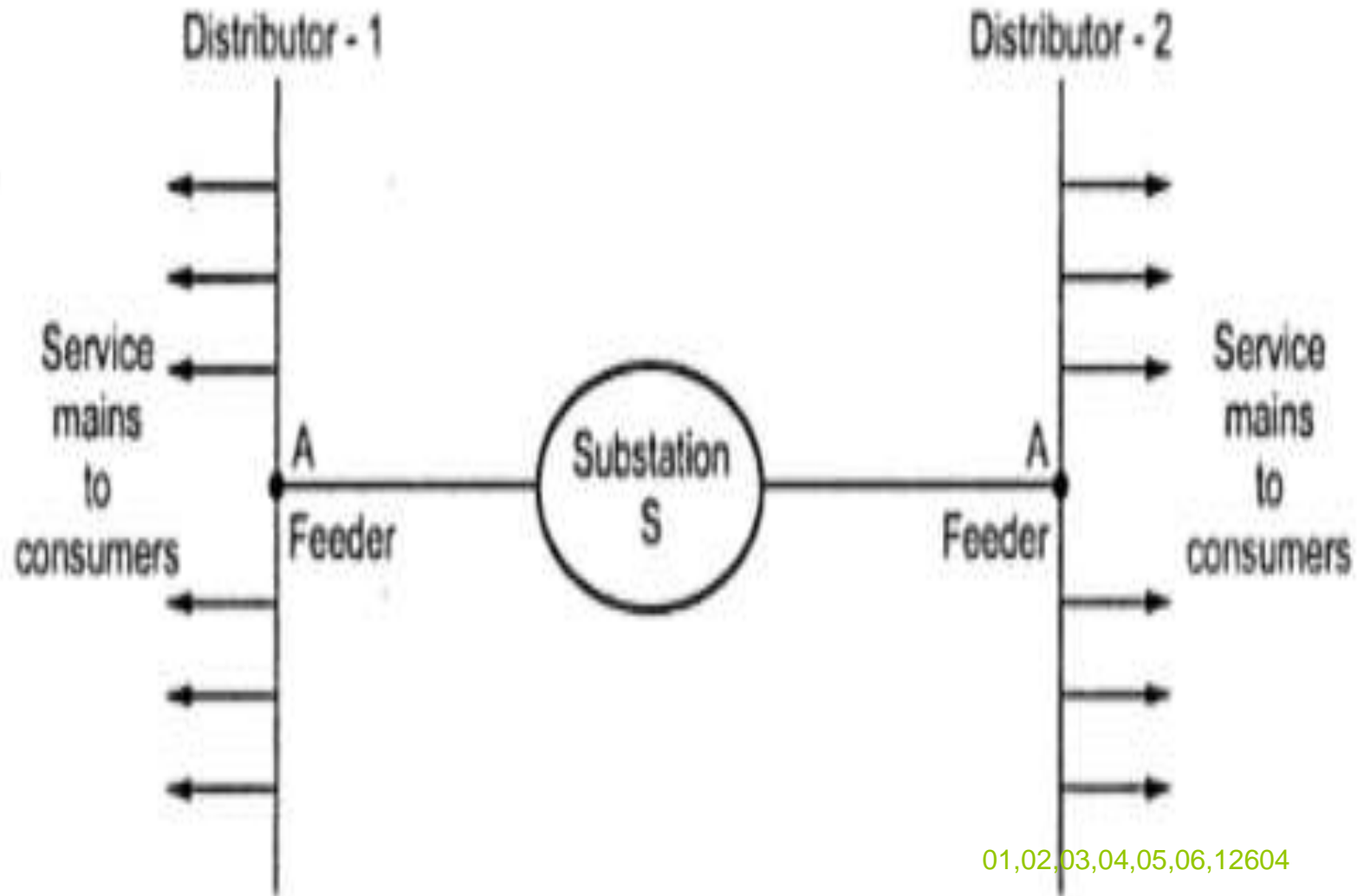
- A distributor is a conductor from which tapings are taken from pole mounted transformer to the consumer
- The current through a distributor is not constant because tapings are taken at various places along its length
- Voltage drop is main consideration
- Limit of variation is 6% of rated at consumer

Service mains

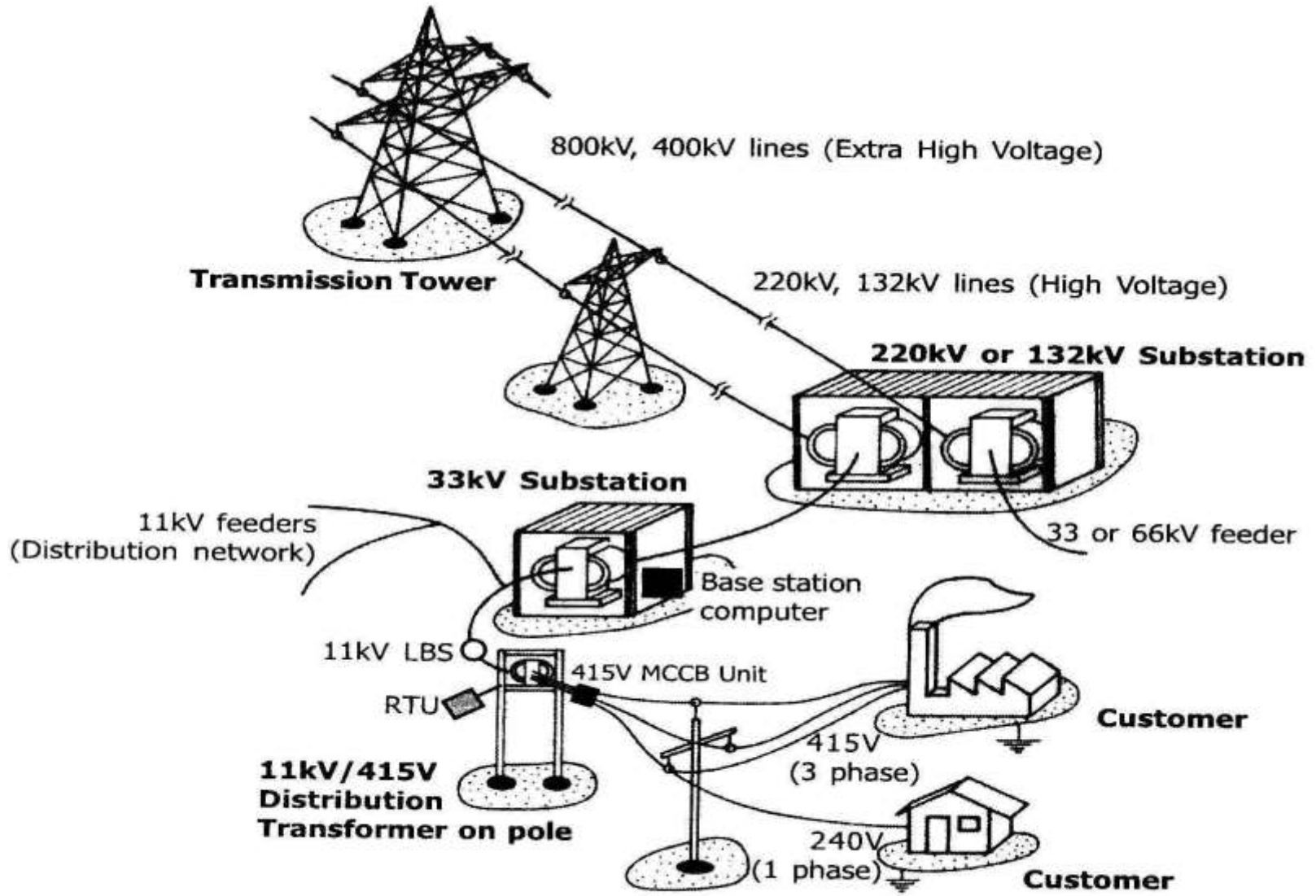
- A service mains is a generally a small cable which connects the distributor to the consumer 's meter.
- The connecting links between the distributor and the consumer terminals.

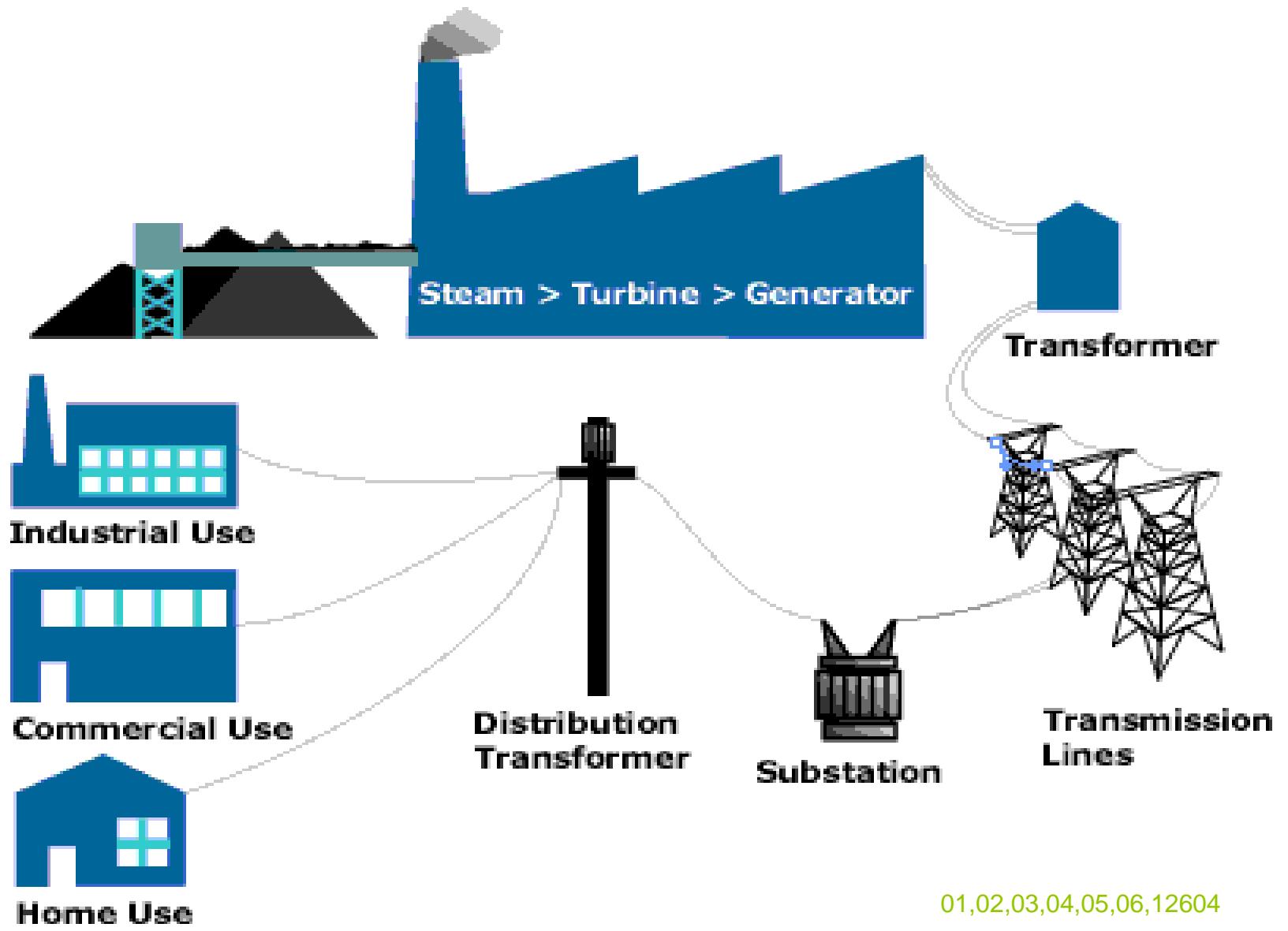






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Introduction:

- Distribution system is a part of power system, existing between distribution substations and consumers.

- It is further classified on the basis of voltage
 - Primary distribution system- **11 KV or 6.6 KV or 3.3 KV**
 - Secondary distribution system- **415 V or 230 V**

Classification Of Distribution System:

It can be classified under different considerations as;

1. Type Of Current:
 - a) AC Distribution System
 - b) DC Distribution System

2. Type Of Construction:
 - a) Overhead System
 - b) Underground System

3. Type Of Service:

- a) General Lighting & Power
- b) Industrial Power
- c) Railway
- d) Streetlight etc

4. Number Of Wires:

- a) Two Wire
- b) Three Wire
- c) Four Wire

5. Scheme Of Connection:

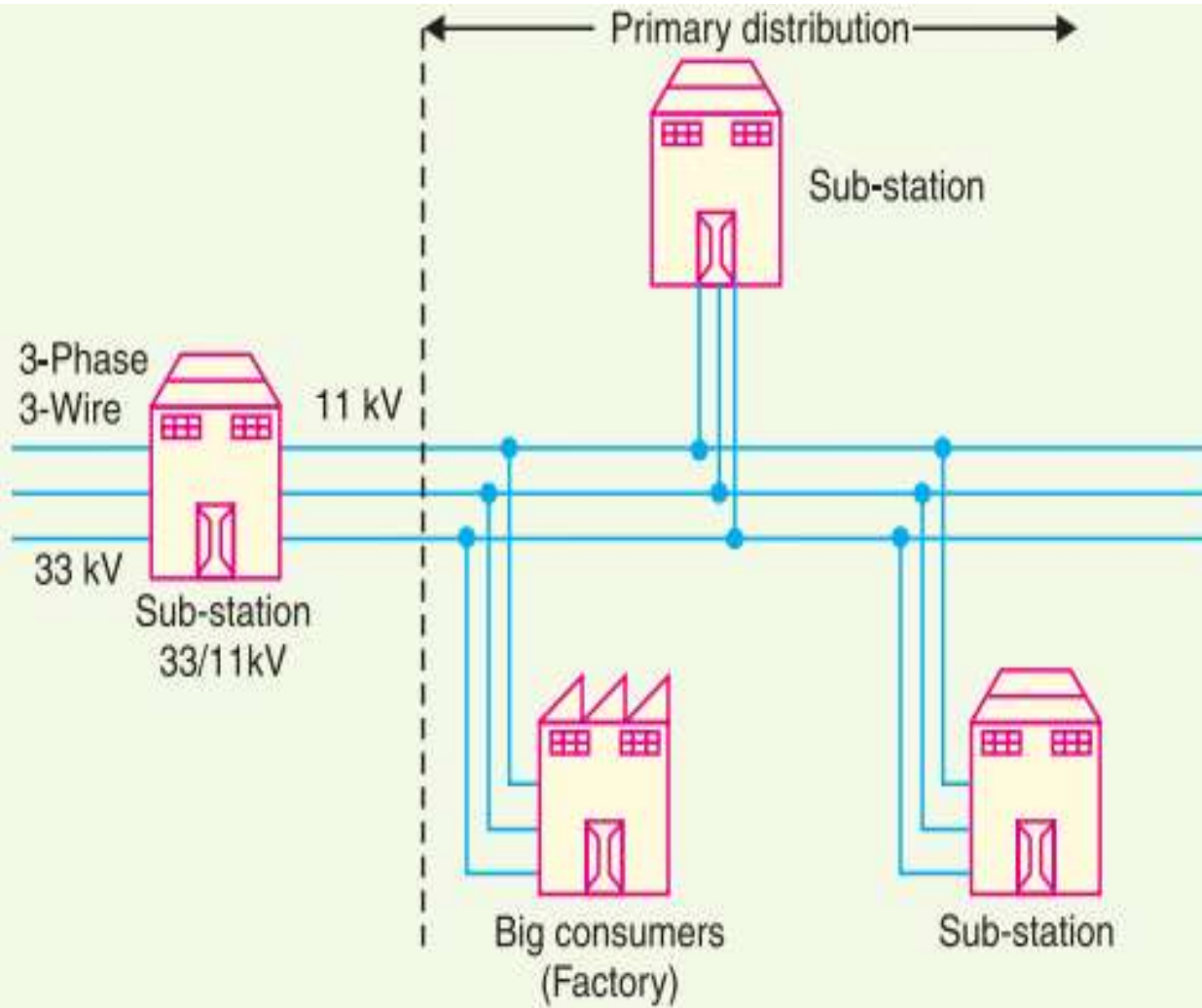
- a) Radial Distribution System
- b) Ring or Loop Distribution System
- c) Interconnected Distribution System

Ac distribution

- A.c. distribution system is the electrical system between the step-down substation fed by the transmission system and the consumers' meters. The a.c. distribution system is classified into
 - (*i*) primary distribution system and
 - (*ii*) secondary distribution system.

Primary distribution system

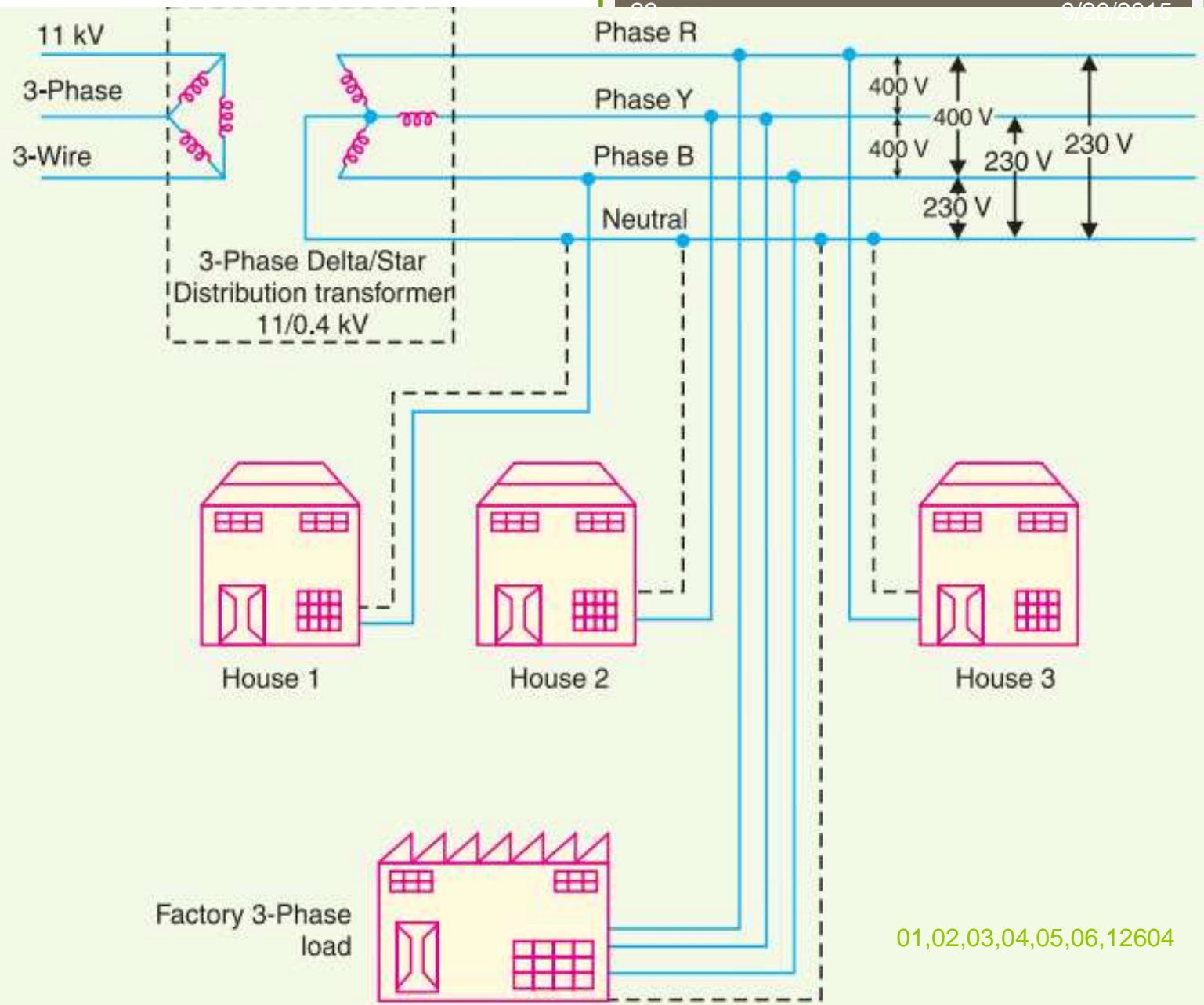
- voltages somewhat higher than general utilisation and handles large blocks of electrical energy than the average low-voltage consumer uses.
- Commonly used primary distribution voltage 11KV, 6.6 KV, 3.3 KV.
- Electric power from the generating station is transmitted at high voltage to the substation located in or near the city.
- At this substation, voltage is stepped down to 11 kV with the help of step-down transformer.
- Power is supplied to various substations for distribution or to big consumers at this voltage.
- This forms the high voltage distribution or primary distribution.

**Fig. 12.2**

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Secondary distribution system.

- It is that part of a.c. distribution system which includes the range of voltages at which the ultimate consumer utilizes the electrical energy delivered to him.
- The secondary distribution employs 400/230 V, 3-phase, 4-wire system.



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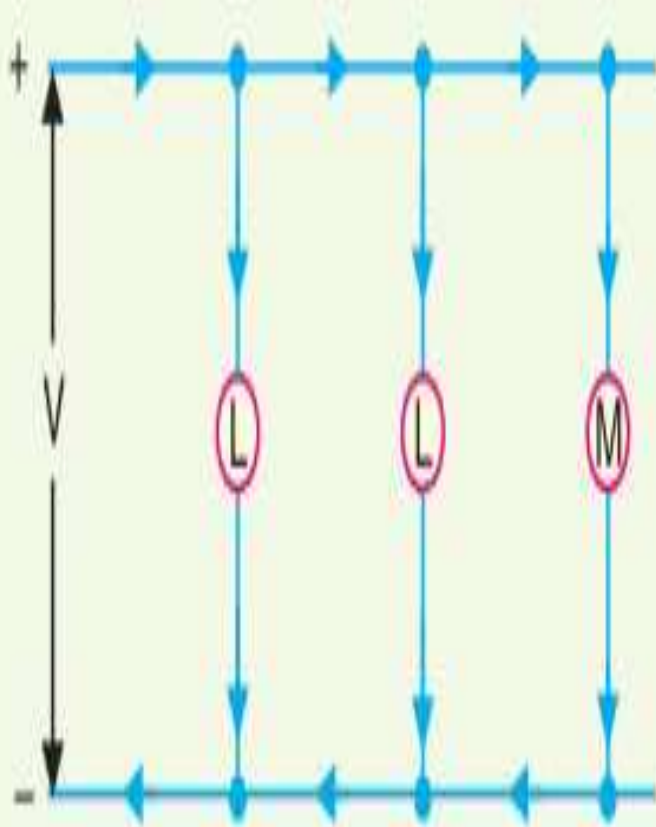
D.C. Distribution

- D.c. supply is required for the operation of variable speed machinery (*i.e.*, d.c. motors), for electro-chemical work and for congested areas where storage battery reserves are necessary.
- For this purpose, a.c. power is converted into d.c. power at the substation by using converting machinery *e.g.*, mercury arc rectifiers, and motor-generator sets. The d.c. supply from the substation may be obtained in the form of

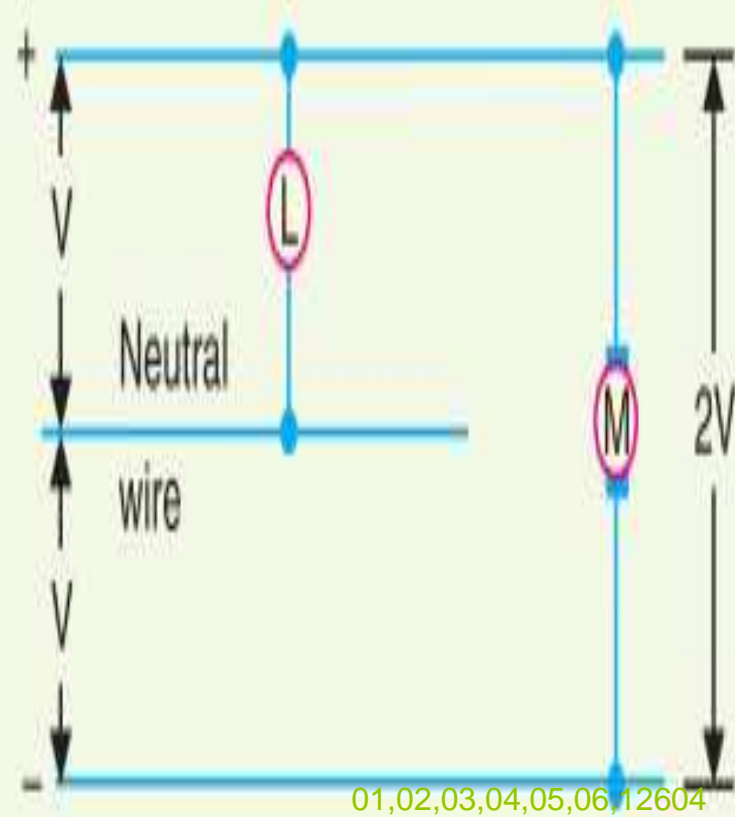
Type of DC distributor

- The dc supply from the substation may be obtained in form of
 - (i) 2-wire or
 - (ii) 3-wire for distribution.

2 wire



3 wire



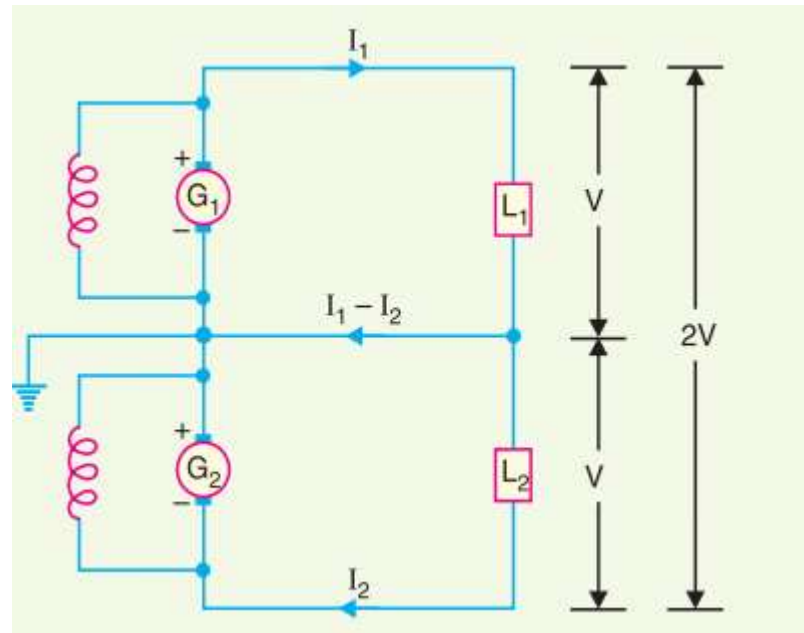
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- Two outer and a middle or neutral wire is earthed at the s/s.
- Voltage between the outer is twice the voltage between either outer and neutral wire.
- Advantage – available two voltage at the consumer terminal.
- Loads requiring high voltage connected across the outers.
- Lamps and heating circuits requiring less voltage are connected between either outer and neutral.

Method of obtaining 3 wire D.c system

- *Two generator method.*
- *3-wire D.c. generator.*
- *Balancer set*

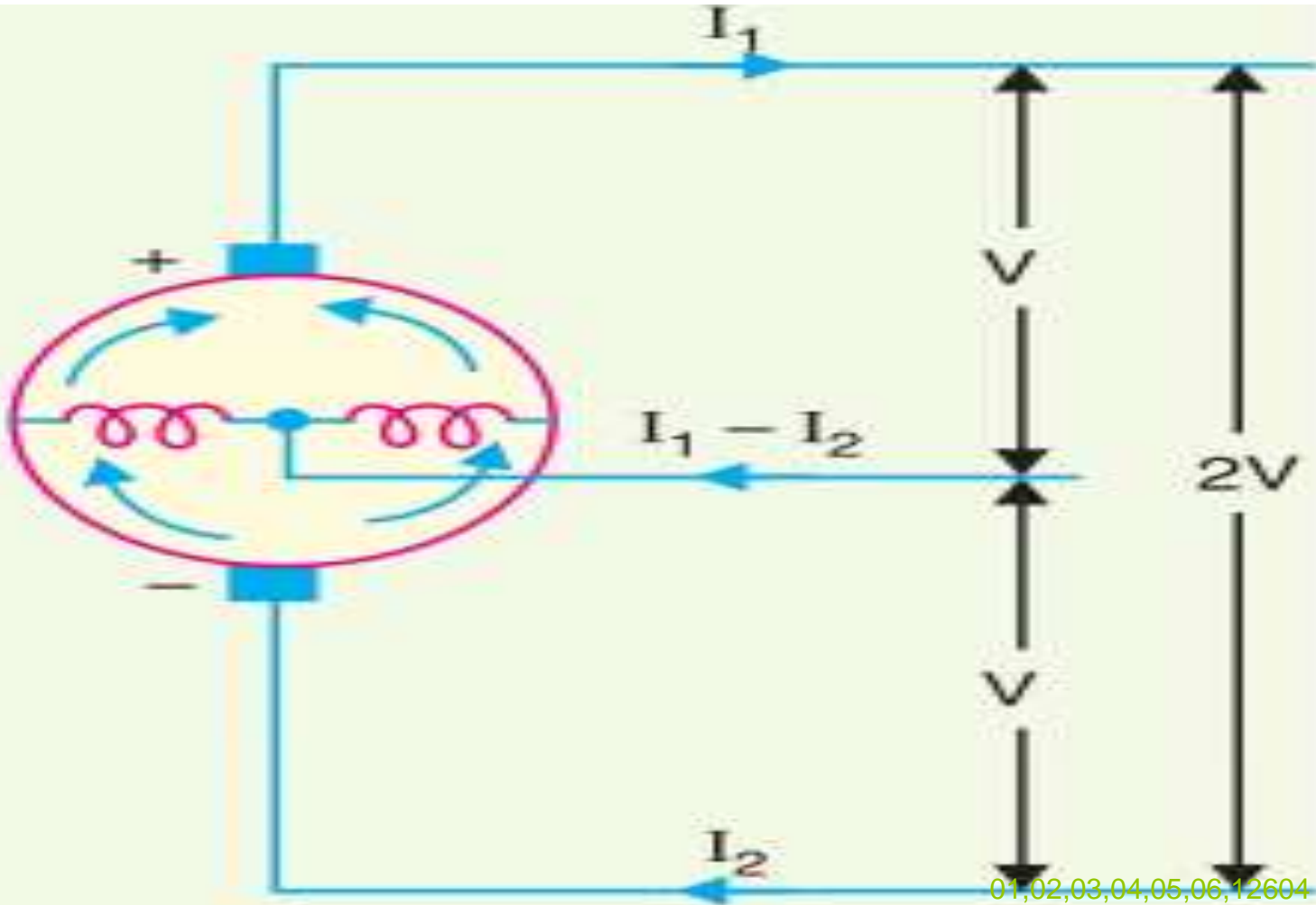
Two generator method



Two generator method

- D.c generator G1 and G2 are connected in series and the neutral is obtained from the common point btwn generator
- G1 supplies a I_1 , G2 supplies a I_2
- Difference of load current on both side ($I_1 - I_2$) flow through the neutral wire.
- Disad.:two separate generator are required.

3-wire D.c. generator.



3-wire D.c. generator.

- Consist of a standard 2 wire machine with one or two coils of high reactance and low resistance that connected to opposite points of the armature winding.
- Neutral wire is obtained from common point.

Connection schemes of distribution system

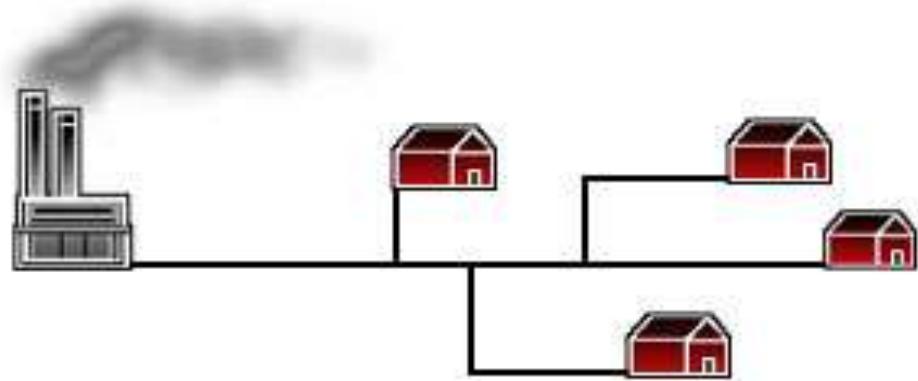
- Radial system
- Ring main system
- Interconnected system

Radial Distribution System:

- separate feeders radiate from a single substation and feed the distributors at one end only.
- Only one path is connected between each customer and substation.
- Electrical power flows along a single path.
- If interrupted, results in complete loss of power to the customer.

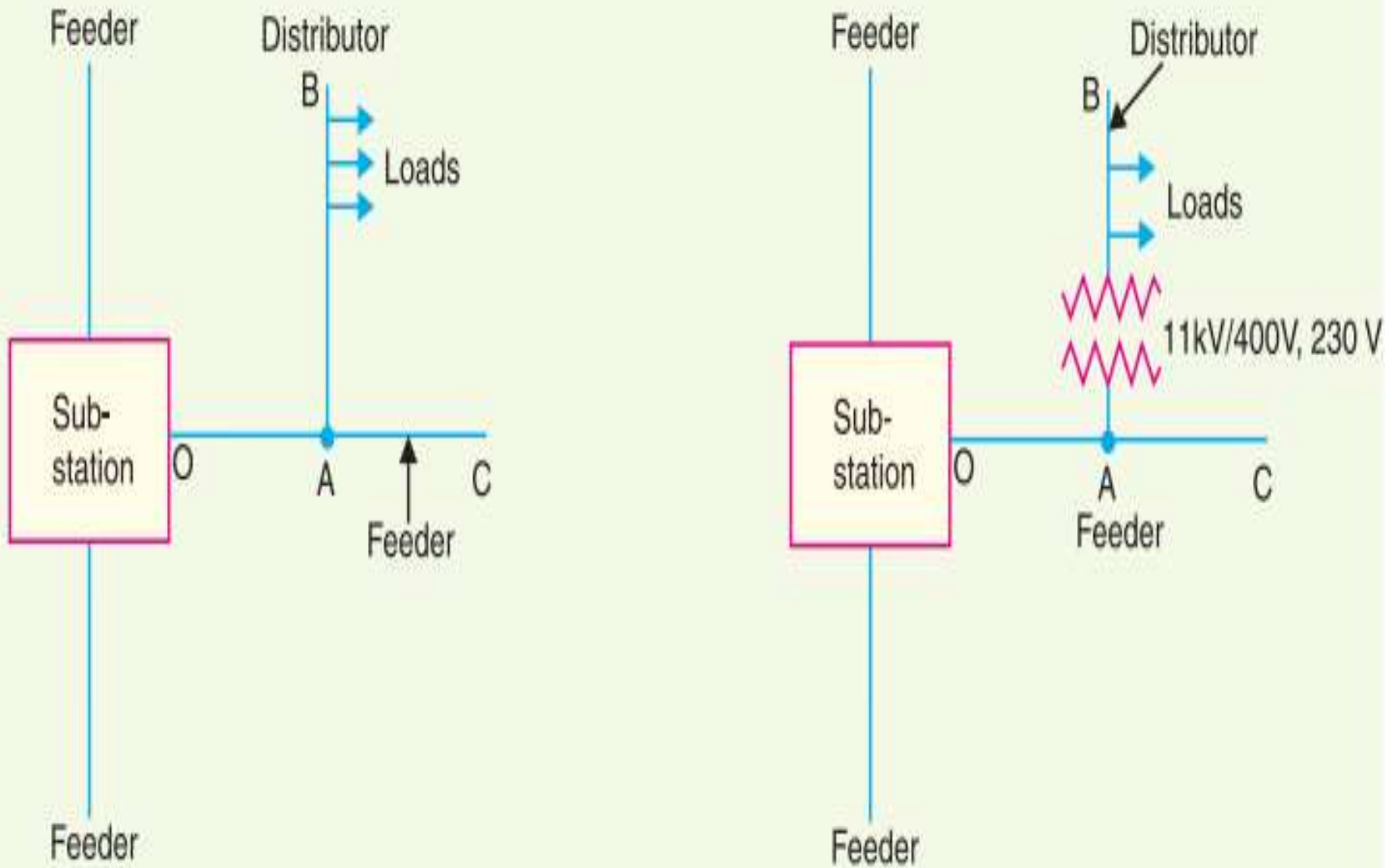
Advantages:

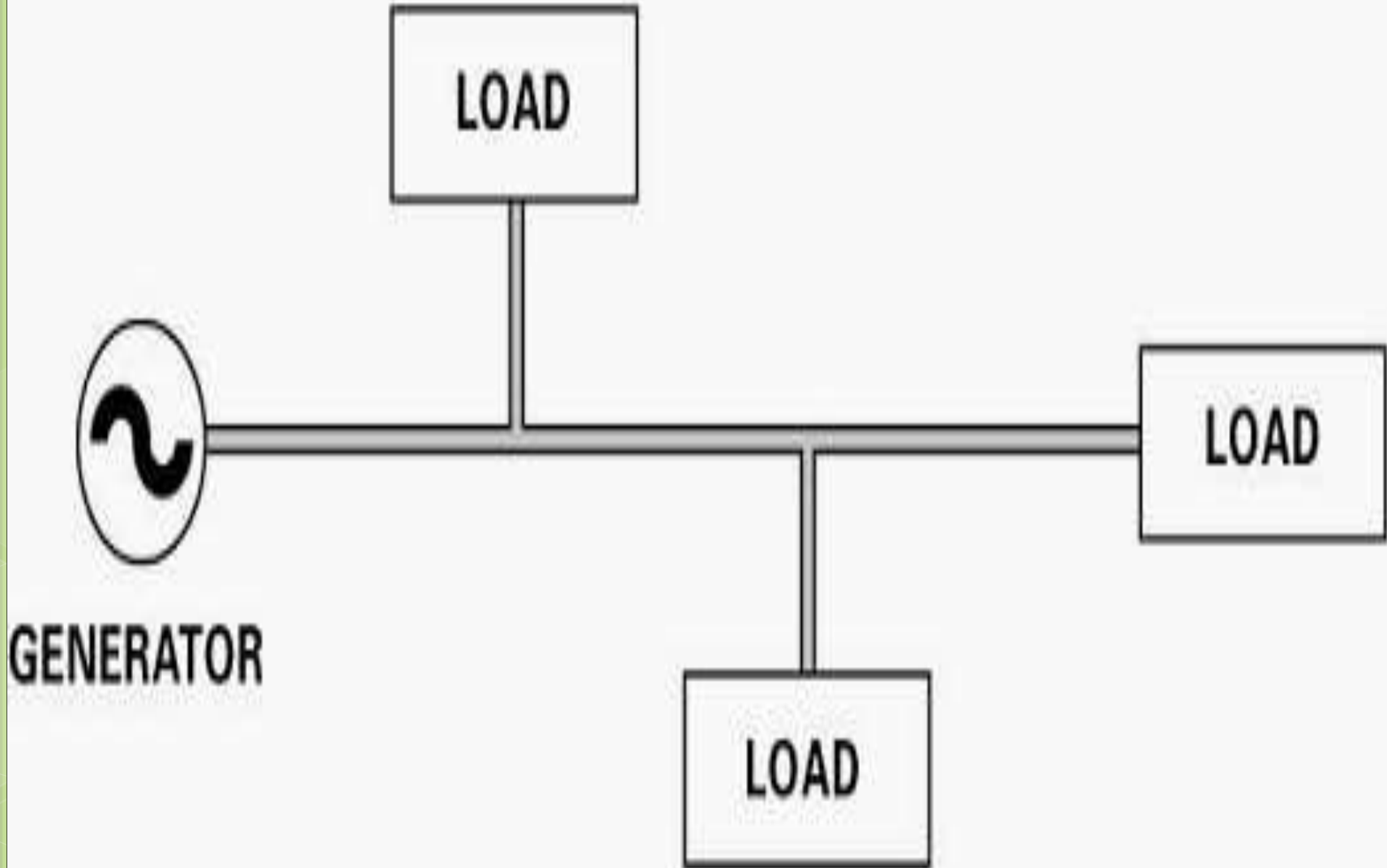
- Low cost .
- Simple planning.



Disadvantages :

- The radial system is employed only when power is generated at low voltage and the substation is located at the centre of the load.
- Distributor nearer to feeding end is heavily loaded.
- Consumers at far end of feeder would be subjected to serious voltage fluctuations.





Ring or Loop Distribution System:

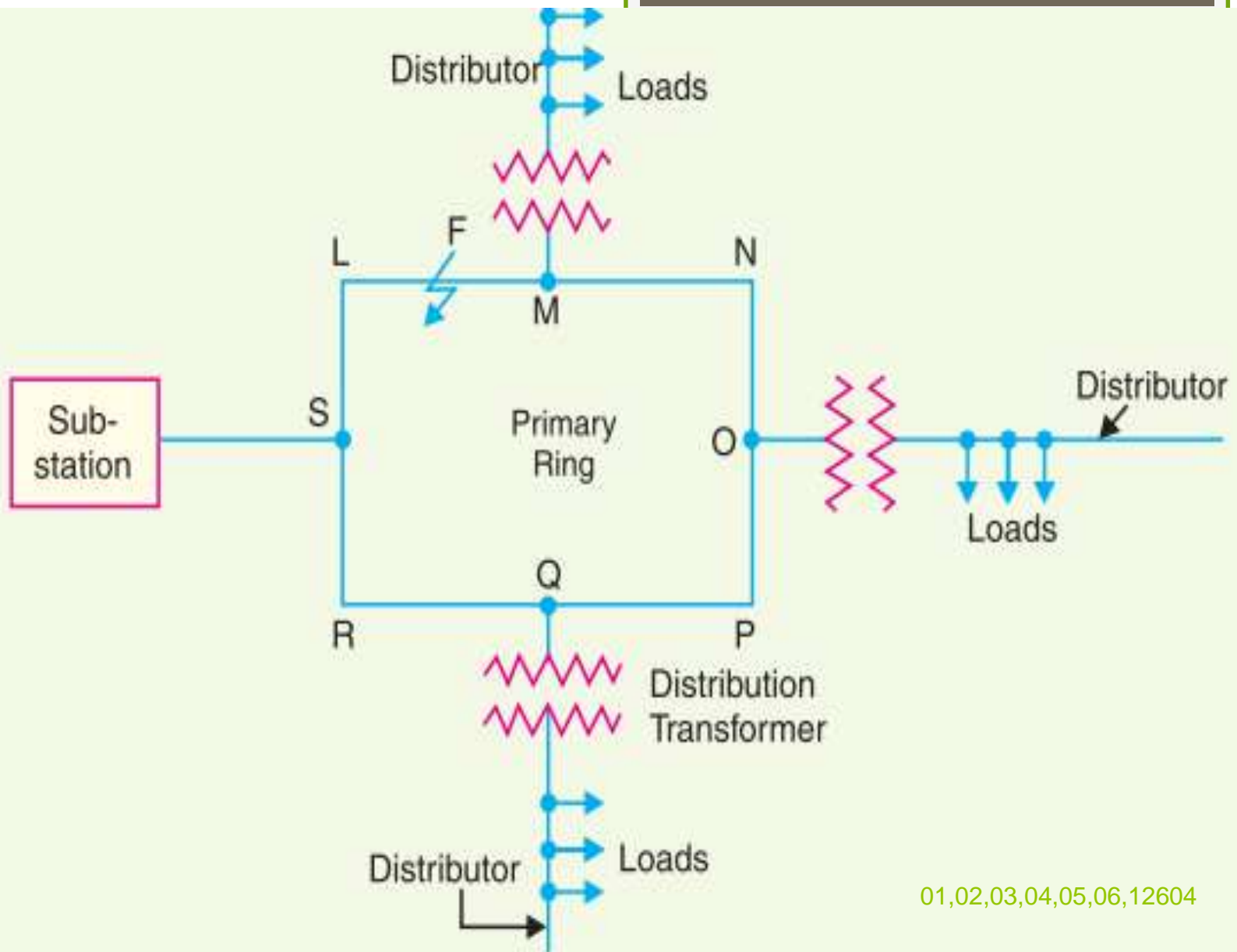
- It consists of two or more paths between power sources and the customer.
- The loop circuit starts from the substation bus-bars, makes a loop through the area to be served, and returns to the substation

Advantages:

- Less conductor material is required.
- Less voltage fluctuations.
- More reliable.

Disadvantages:

- It is difficult to design as compared to the design of radial system.



Interconnected Distribution System:

- It is supplied by a number of feeders.
- Radial primary feeders can be tapped off from the interconnecting tie feeders.
- They can also serve directly from the substation.

Advantages:

- Increases the reliability of supply
- Losses are less
- Quality of service is improved.

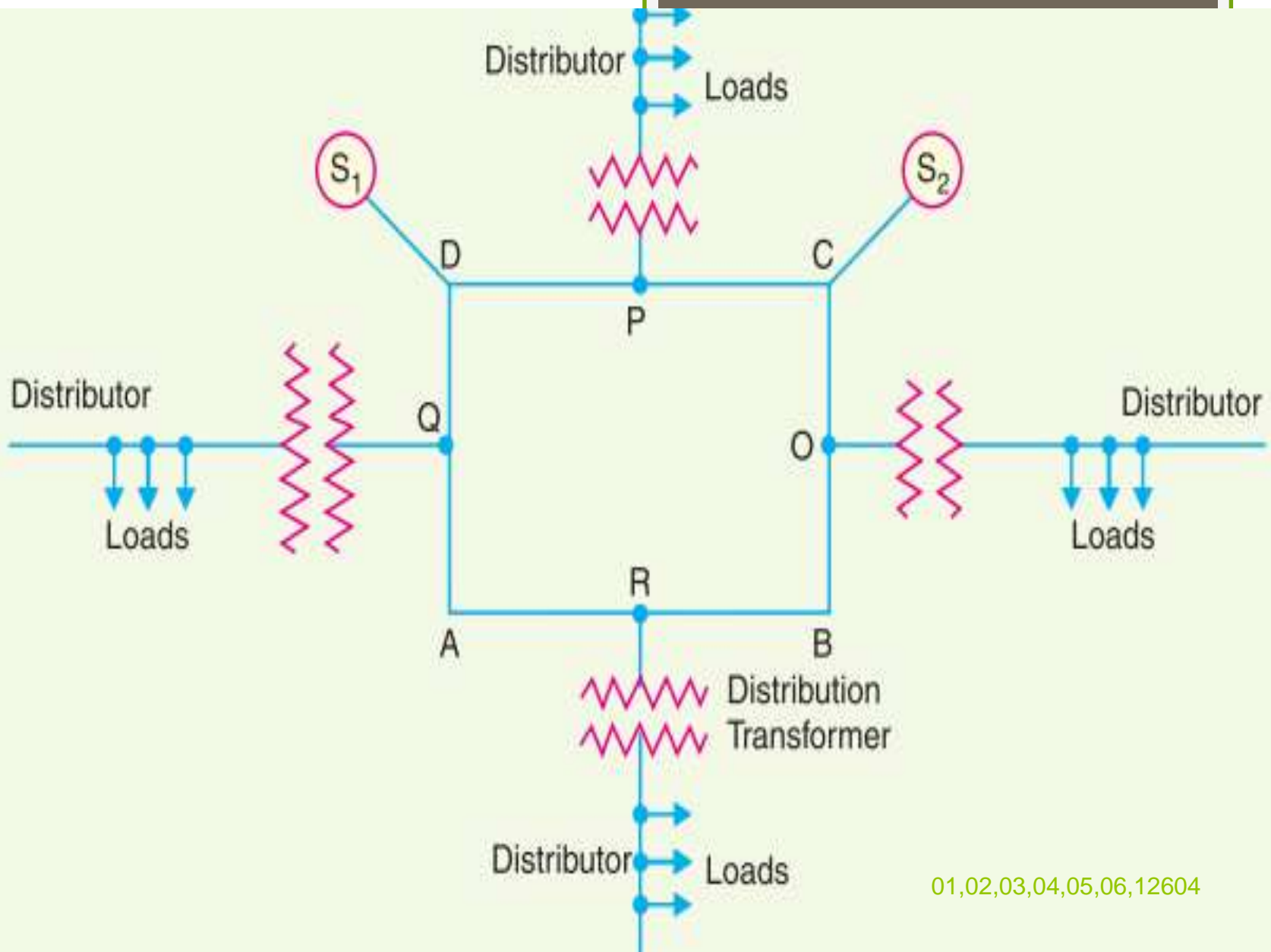
Disadvantages:

- Its initial cost is more.
- Difficult in planning, design and operation.

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Difficult in planning, design and operation.

Its initial cost is more.

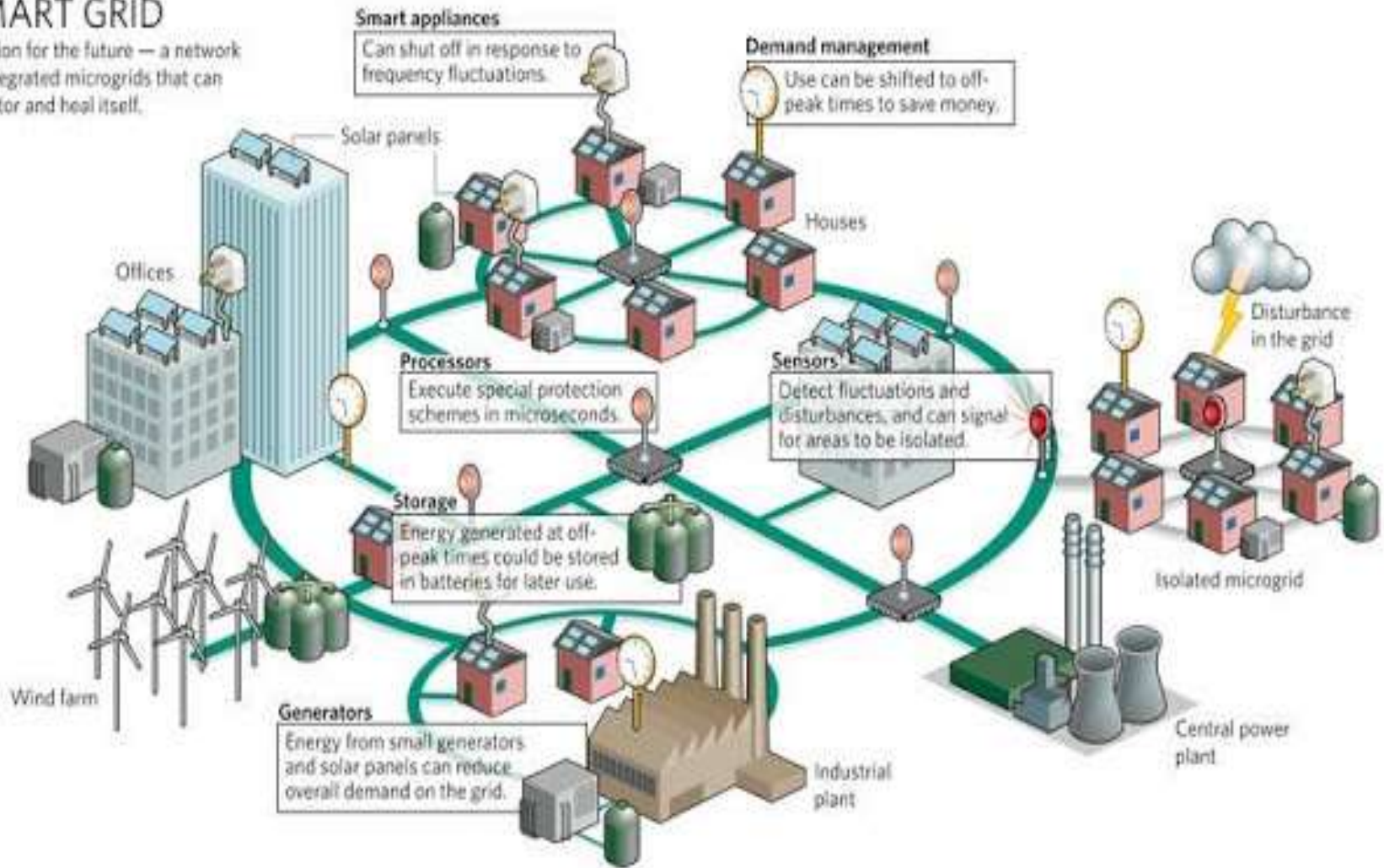




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SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.



D.C. Distribution

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- for electro-chemical work and for congested areas where storage battery reserves are necessary.
- For this purpose, a.c. power is converted into d.c. power at the substation by using converting machinery e.g., mercury arc rectifiers, rotary converters and motor-generator sets. The d.c. supply from the substation may be obtained in the form of

DC Distribution:

- Voltage drop along distributor is considered as a main factor while designing a distributor.
- It depends upon the nature of load and also on feeding, whether it is fed at one or both ends.

According to loading, a distributor can be classified as:

- i. Fed at one end.
- ii. Fed at both ends. a). With equal voltages.
b). With unequal voltages.
- iii. Fed at centre.
- iv. Ring mains.

DC Distribution Feed at one end

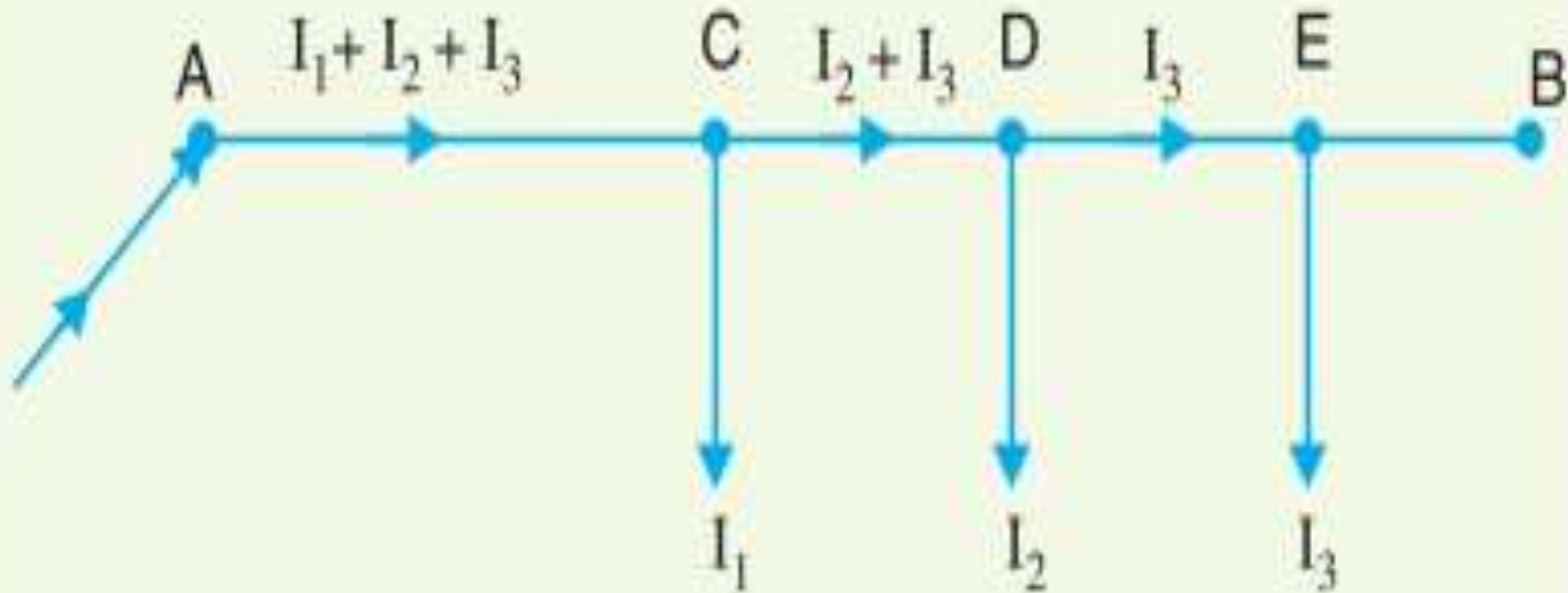
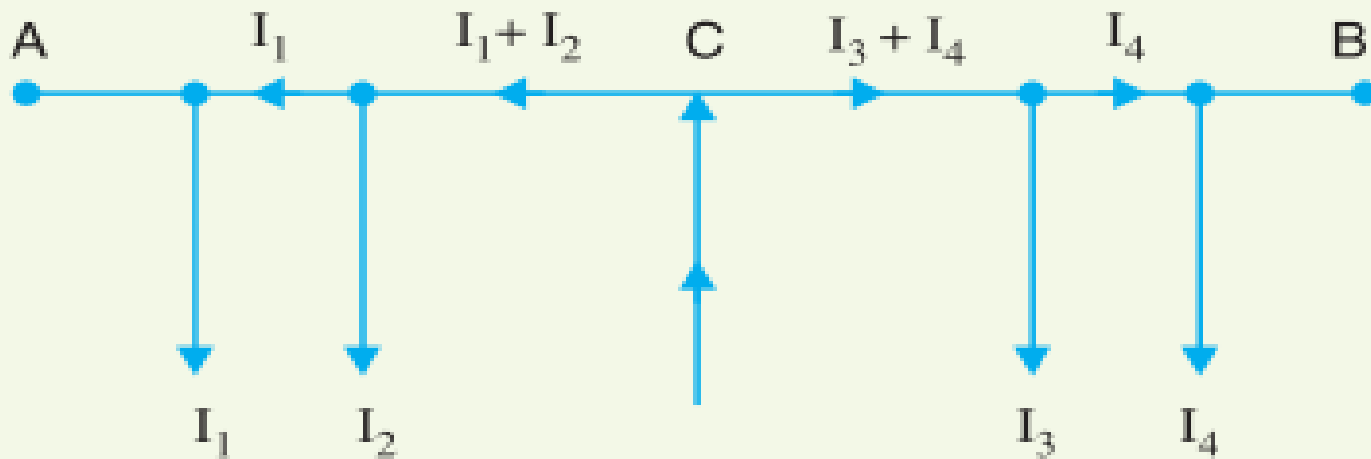


Fig. 13.1

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- **(a)** The current in the various sections of the distributor away from feeding point goes on decreasing. Thus current in section *AC* is more than the current in section *CD* and current in section *CD* is more than the current in section *DE*.
- **(b)** The voltage across the loads away from the feeding point goes on decreasing. Thus in Fig. 13.1, the minimum voltage occurs at the load point *E*.
- **(c)** In case a fault occurs on any section of the distributor, the whole distributor will have to be disconnected from the supply mains. Therefore, continuity of supply is interrupted

Distributor fed at center

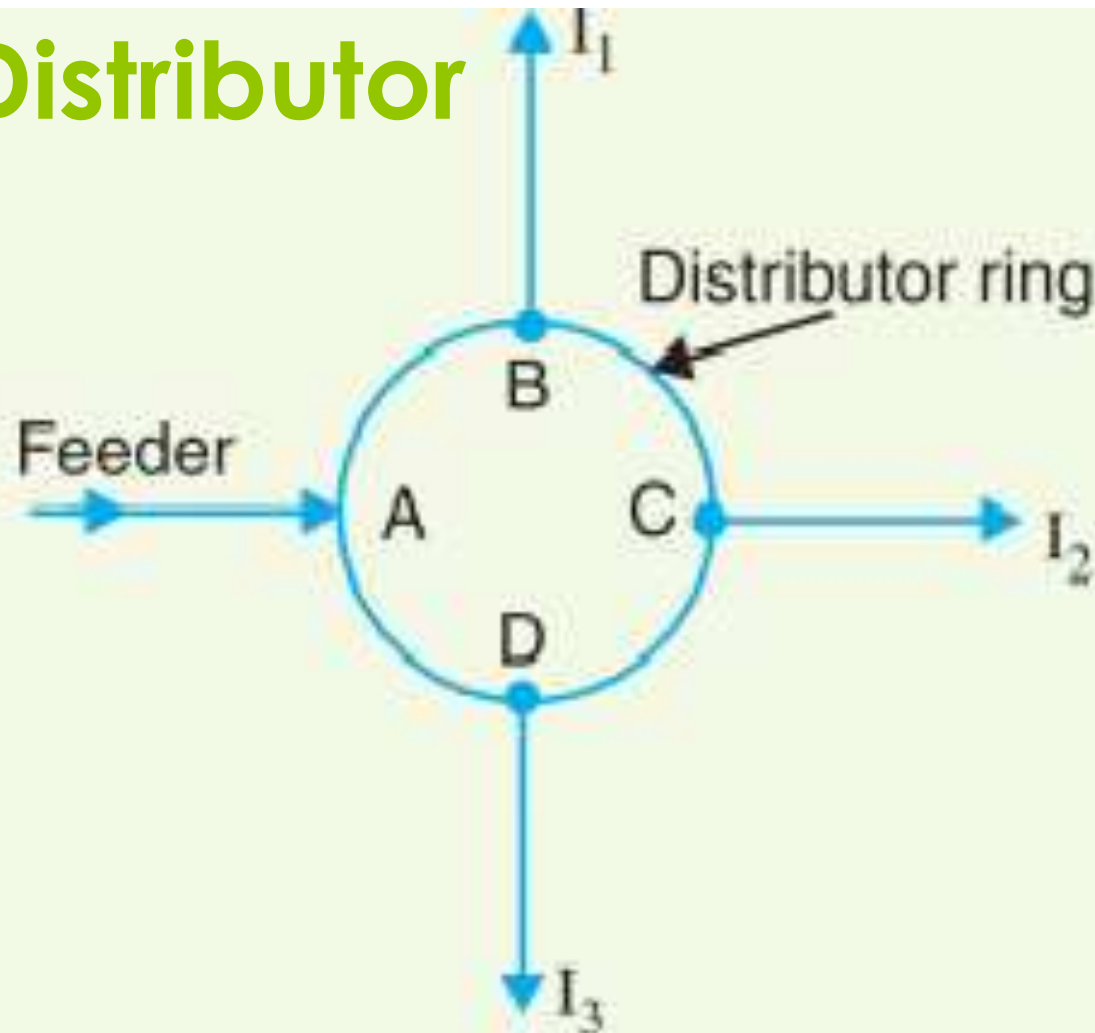


- In this type of feeding, the distributor is connected to the supply mains at both ends and loads are tapped off at different points along the length of the distributor.
- The voltage at the feeding points may or may not be equal. distributor $A B$ fed at the ends A and B and loads of I_1 , I_2 and I_3 tapped off at points C respectively.
- Here, the load voltage goes on decreasing as we move away from one feeding point say A , reaches minimum value and then again starts rising and reaches maximum value when we reach the other feeding point B .
- The minimum voltage occurs at some load point and is never fixed. It is shifted with the variation of load on different sections of the distributor.

Advantages

- (a) If a fault occurs on any feeding point of the distributor, the continuity of supply is maintained from the other feeding point.
- (b) In case of fault on any section of the distributor, the continuity of supply is maintained from the other feeding point.
- (C) The area of X-section required for a doubly fed distributor is much less than that of a singly fed distributor.

Ring Distributor



- In this type of feeding, the centre of the distributor is connected to the supply mains as shown in Fig.
- It is equivalent to two singly fed distributors, each distributor having a common feeding point and length equal to half of the total length

THANK YOU

13601,13602,13603,13604,13605,13606

01,02,03,04,05,06,12604