ABSTRACT

The report gives an overview of 220kv power substation. It includes electricity transmission and distribution processes at UPPTCL, Muradnagar substation. Its substation, an assembly of apparatus which is installed to control transmission and distribution of electric power, its two main divisions are outdoor and indoor substation. Different equipment's used in substations, Bus- bar, surge arrestor. Isolator, Earth switches, Current Transformers etc. Transformer which is being used here is core and shell type transformer for stepping up and down purposes. Different Instruments transformers, voltage. Current and CV transformers are also being us-ed. Finally the CVT rating which gives a total output overview.

Dedicated to Our Beloved Parents Who Sacrificed Their Present For Our Future

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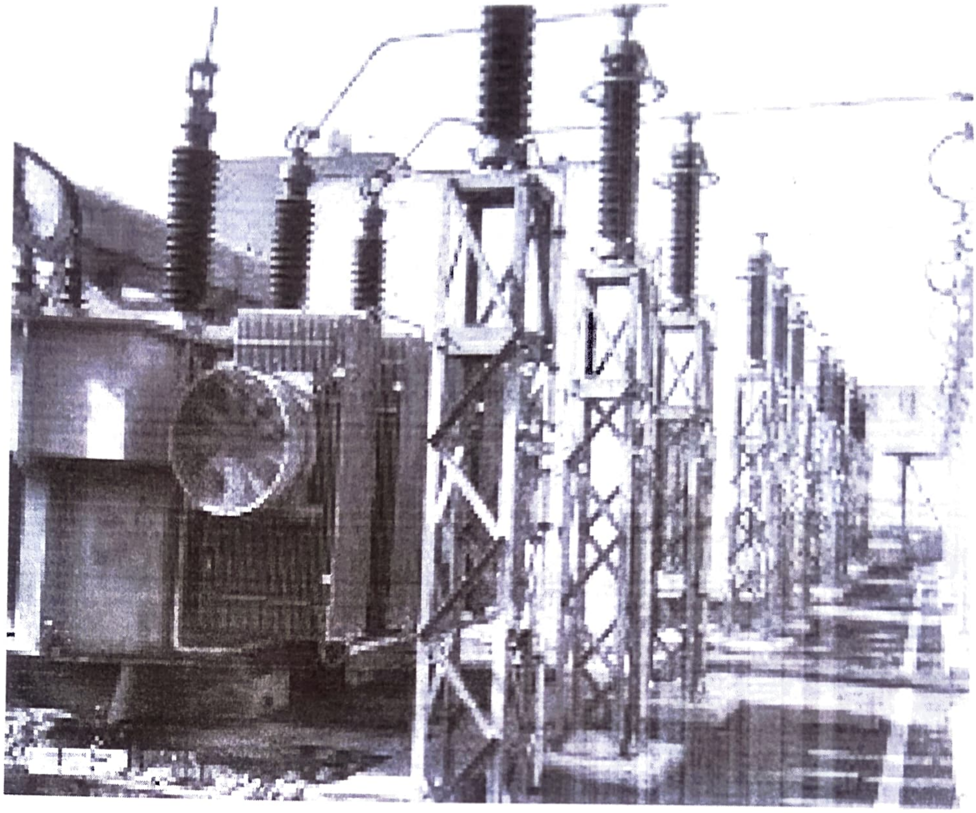

1. INTRODUCTION

UP Power Transmission Corporation Limited, incorporated under the Companies Act 1956, was incorporated in 2006 with the main objective to acquire, establish, construct, take over, erect, lay, operate, run, manage, hire, lease, buy, sell, maintain, enlarge, alter, renovate, modernize, work and use electrical transmission lines and/or network through extra high voltage, high voltage and associated sub-stations, cables, wires, connected with transmission ancillary services, telecommunication and telemetering equipment in the State of Uttar Pradesh, India and elsewhere.

1.1 ABOUT 220/132KV SUBSTATION MURADNAGAR, GHAZIABAD.

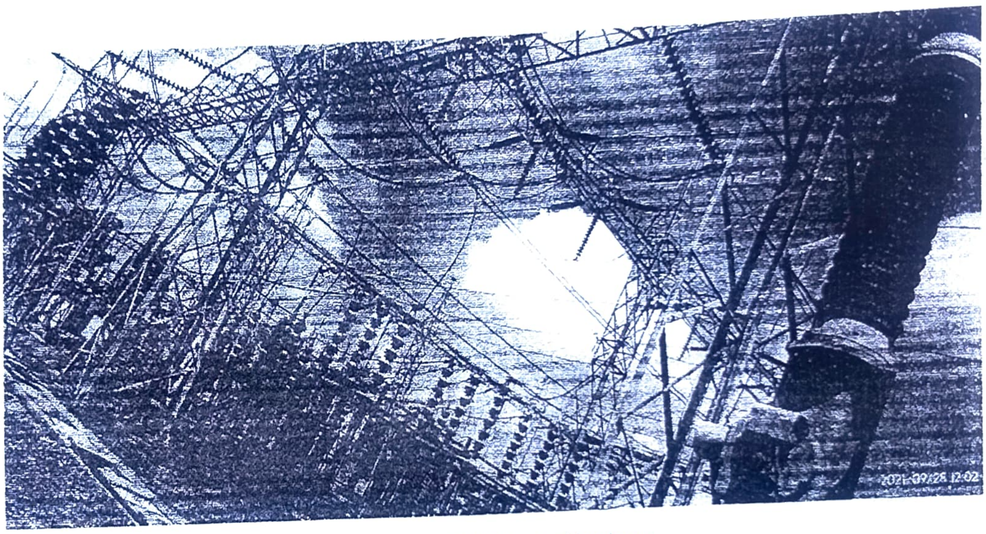

Figure 1.1 220/132KV Substation Muradnagar

The main bus 220KV is connected to grid located at MURADNAGAR, GHAZIABAD (UP). Now the transmission line first parallel connected with lightning arrester to diverge surge. Followed by CVT connected parallel CVT measures voltage and steeps down at 110V AC for control panel, at the location a wave trap is connected to carrier communication at higher frequencies. A current transformer. is connected in series with line which measure current and step down current at ratio 800:1 for control panel.

Details of Incoming & Outgoing Lines At

220KV Substation Muradnagar, Ghaziabad

In Muradnagar 220KV substation there are five incoming lines of 220KV are as follows:-

a. 220KV Sikandrabad CKT.
b. 220KV Dadri CKT.
c. 220KV Loni CKT.
d. 400KV CKT NO. 1
e. 400KV CKT NO.2

Outgoing Line of 132KV are as follows:-

a. 132KV Lalkuan CKT.
b. 132KV Morta CKT.
c. 132KV Railway
d. 132KV DPH
e. 132KV Dasna
f. 132KV Faridnagar
g. 132KV Modi steel line
h. 132KV Niwari Road CKT.

Two 132KV Lines are Stepping Down in 33KV for further distributing are as follows:-

a. 33KV S/S Asalatnagar
b. 33KV S/S Kakra
c. 33KV O.F.M-I
d. 33KV Old S/S
e. 33KV Rawli
f. 33KV Noorpur
g. 33KV O.F.M-II
h. 33KV Goel Ispat

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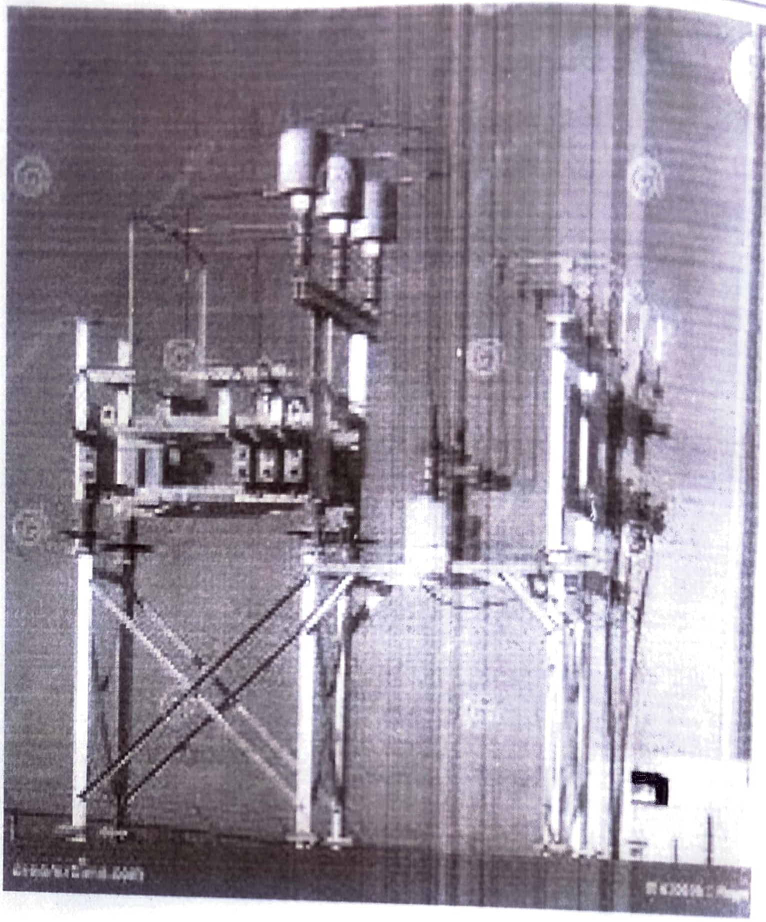

2. TRANSFORMERS:

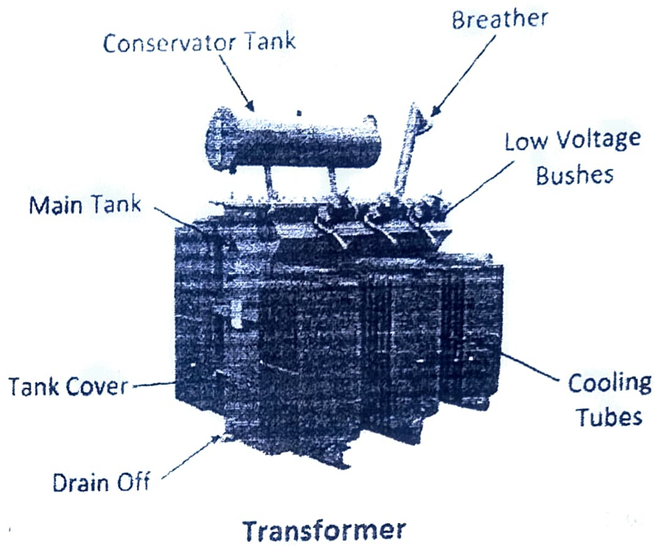

Figure: 2.1 Transformer.

Transformer is a static machine, which transforms the potential of alternating current at t same frequency. It means the transformer transforms the low voltage into high voltage & high voltage to low voltage at same frequency. It works on the principle of static induction principle.

When the energy is transformed into a higher voltage, the transformer is called step up transformer but in case of other is known step down transformer.

For Stepping down 220KV Muradnagar Substation, Ghaziabad uses following Transformers:-

a. 220/132KV, 220MVA Transformer BHEL Make.
b. 220/132KV, 220MVA Transformer EMCO Make.
c. 220/132KV, 160 MVA Transformer CGL Make.
d. 132/33KV, 63MVA Transformers TA Make.
e. 132/33KV, 63MVA Transformers BBI Make.
f. Two 220KVA Transformer 33/0.4KV are using for substation supply purpose.

2.1 TYPES OF TRANSFORMER:

2.1.1 Power transformer

2.1.2 Instrument transformer

2.1.3 Auto transformer

2.1.4. On the basic of working

2.1.5 On the basic of structure

2.1.1 POWER TRANSFORMER

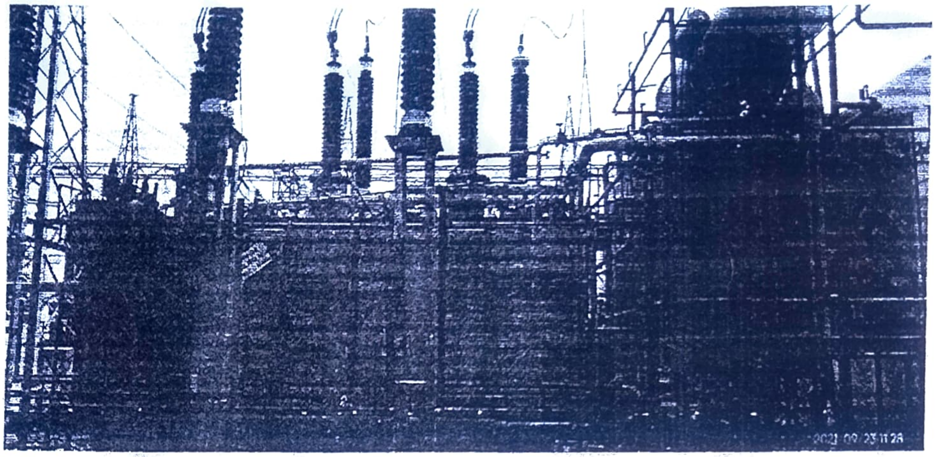

Figure 2.2 Power Transformer

Types of power transformer:

2.1.1.3 Single phase transformer

21.12 Three phase transformer

2.1.2 Instrument Transformer

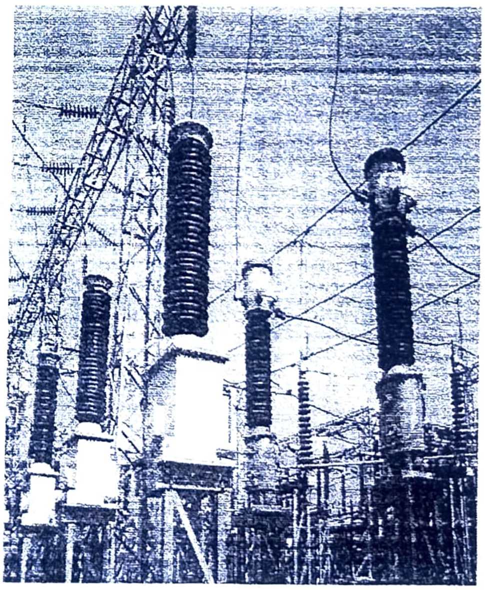

Figure. 2.2 Instrument Transformer

a) Current transformer
b) b) Potential transformer

2.1.3 AUTO TRANSFORMER

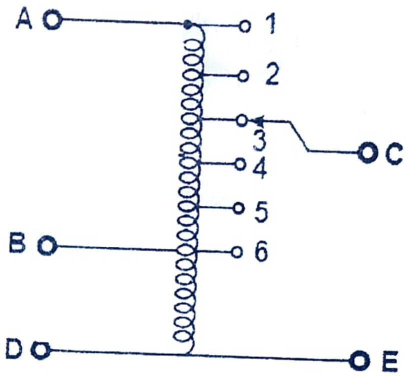

Fig. 2.4 Auto Transformer

a) Single phase transformer

b) Three phase transformer

2.1.4 ON THE BASIC OF WORKING

2.1.4.1 Step down: Convert high voltage into low voltage.

2.1.4.2 Step up: Convert low voltage into high voltage.

2.1.5 ON THE BASIC OF STRUCTURE

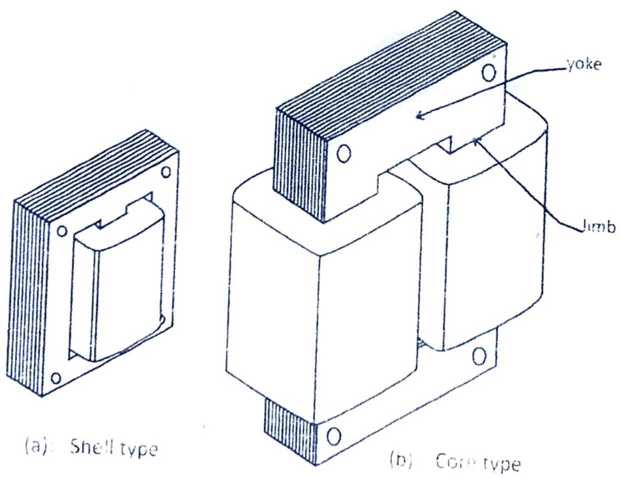

Figure 2.6 Shell type

Figure 2.6 Shell type

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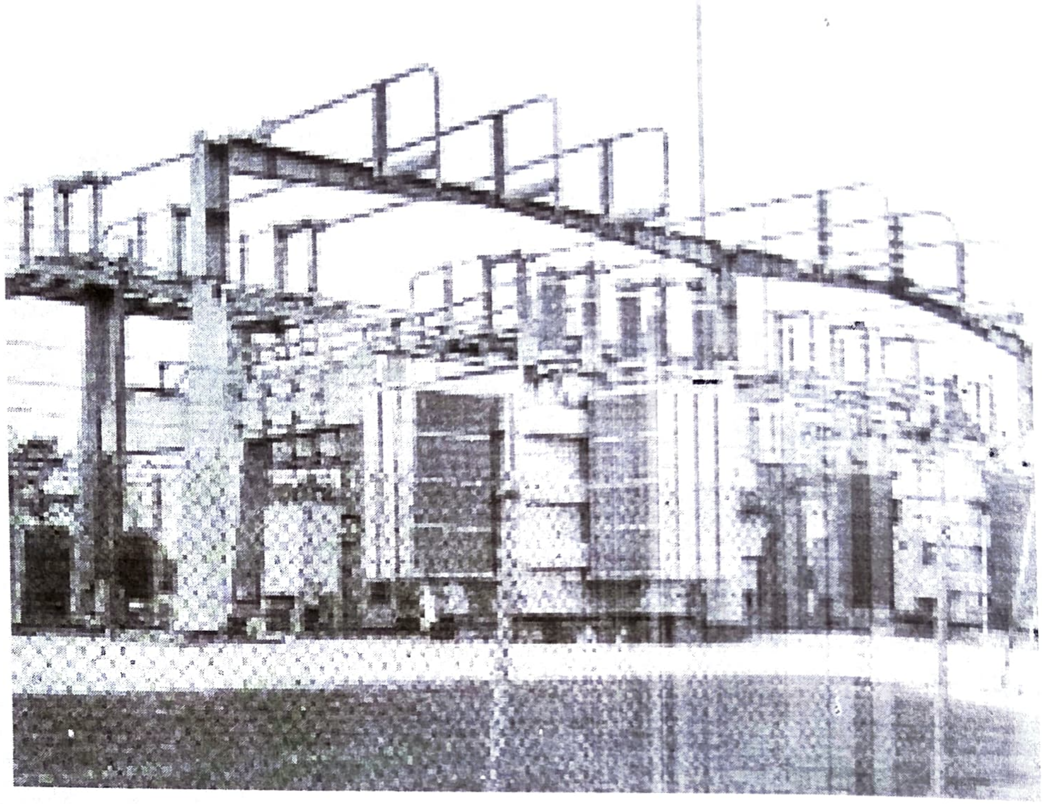

3. SPECIFICATION OF C.T. USED IN 220/132 KV SUB-STATION, MURADNAGAR GHAZIABAD

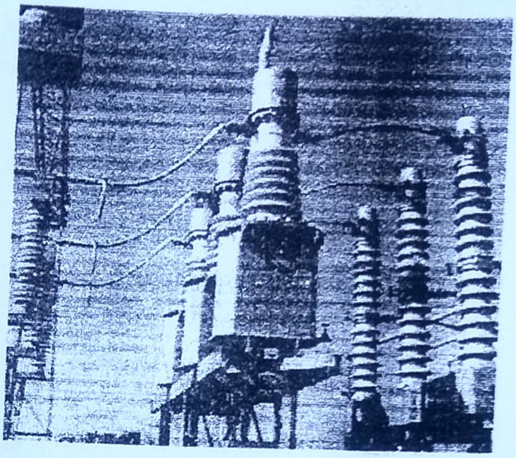

Figure 3.1 Current Transformer

3.1 Standard: IS-2785

3.2 Highest System Voltage: 145 KV

3.3 Frequency: SOHz

3.4°C.T. Current 25 KA / Sec.

4. SUBSTATIONS:

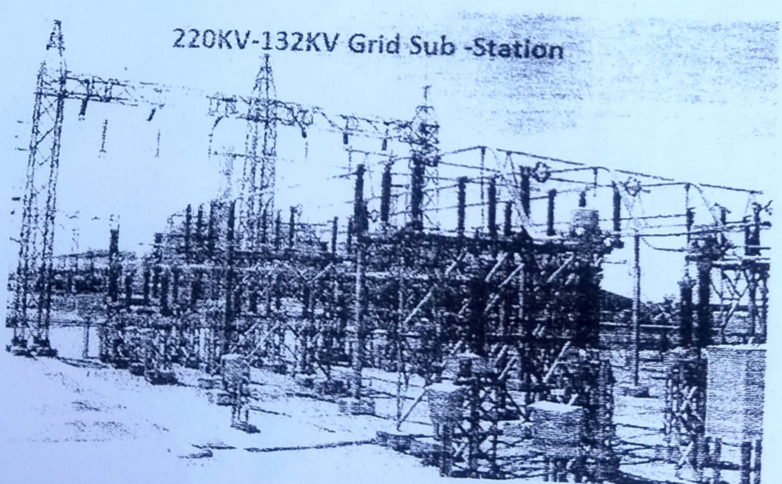

Figure 4.1 View of Substation

The present day electrical power system is A.C. Le, electrical power is generated, transmitted & distributed in the form of the alternating current. The electric power is produced at power plant

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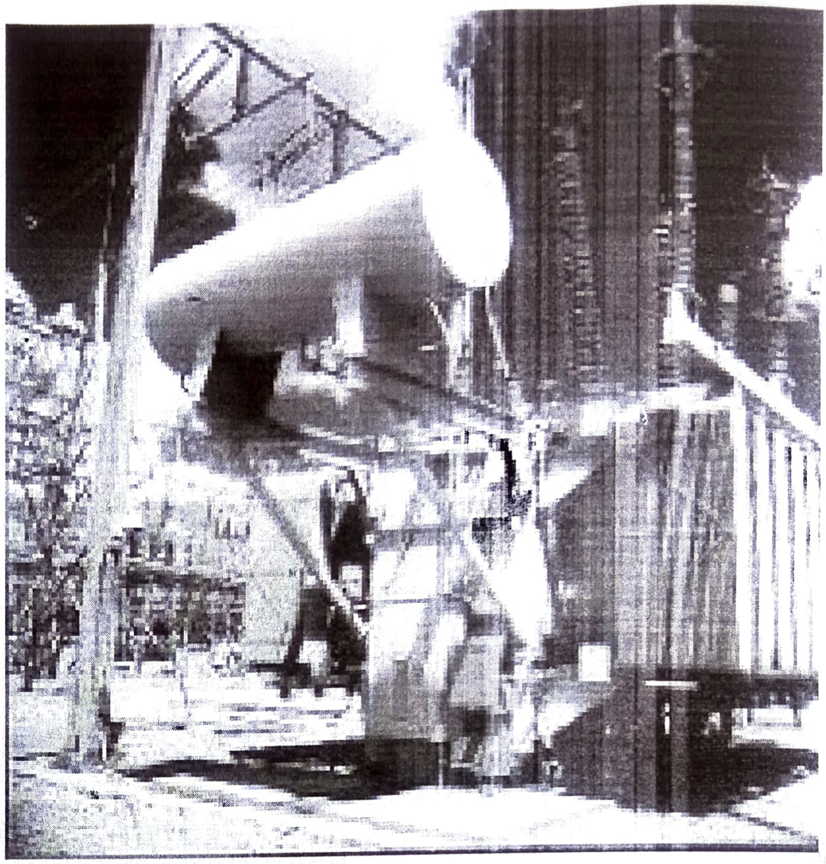

stations which are located at favourable places generally quite away from the consumers. It delivered to the consumers through a large network of transmission 7 distribution.

At many places in the power system, it may be desirable and necessary to change some characteristics e g. voltage, AC TO DC, frequency, power factor etc. of electric supply, This accomplished by suitable apparatus called substation. For example, generation voltage (11KV or 33KV) at the power station is set up to high voltage (say 220KV or 132KV) for transmission of electric power. The assembly of apparatus (eg transformer etc.) used for this purpose in the substation Similarly near the consumer's localities, the voltage may have to be step down to utilization level. This job as again accomplished by suitable apparatus called substation. The assembly of apparatus to change some characteristic of electric power supply is called substation.

The most ways to clarify substation.

4.1 TYPE OF SUBSTATION

4.1.1 According to the service requirement

- 4.1.1.1 Transformer substation
- 4.1.1.2 Switch substation
- 4.1.1.4 Power factor correction substation
- 4.1.1.5 Frequency change substation
- 4.1.1.6 Converting substation
- 4.1.1.7 Industrial substation

4.1.2 According to the constructional features:

- 4.1.2.1 indoor substation
- 4.1.2.2 Outdoor substation
- 4.1.2.3 Underground substation
- 4.1.2.4 Pole mounted substation

4.1.1.1 TRANSFORMER SUBSTATION:

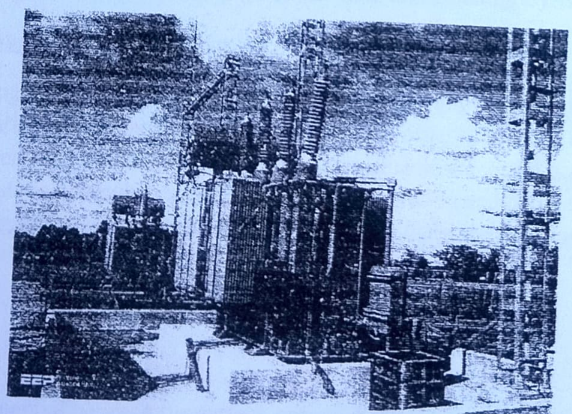

Figure 4.2 Transformer substation

They are known as transformer substations as because transformer is the main component employed to change the voltage level, depending upon the purposed saved transformer substations may be classified into:

4.1.1.1.1 STEP UP SUBSTATION

The generation voltage is steeped up to high voltage to airt economy in transmission of electric power. These are generally located in the power houses and are of outdoor type.

4.1.1.1.2 PRIMARY GRID SUBSTATION

Here electric power is received by primary substation which reduces the voltage level to substation for secondary transmission The primary grid substation generally of outdoor type.

4.1.1.1.3 SECCONDARY SUBSTATIONS

At a secondary substation, the voltage is further steeped down to 11V. The 114V lines runs along the important road of the city the secondary substation are of outdoor type.

4.1.1.1.4 DISTRIBUTION SUBSTATION

These substations are located heat the consumer's localities and step down to 400V, 3-phate, 4 wire for supplying to the consumers. The voltage between any two phases is 400V & between any phase and neutral it is 230V.

4.2 SUBSTATION CHARACTERISTICS

1. Each circuit is protected by its own circuit breaker and hence plant outage does not necessarily result in loss of supply.
2. A fault on the fender or transformer circuit breaker causes loss of the transformer and feeder circuit, one of which may be rest ordered after isolating the faulty circuit breaker.
3. A fault on the bus section circuit breaker causes complete shutdown of the substation. All circuits may be restored after isolating the faulty circuit breaker.
4. Maintenance of a feeder or transformer circuit breaker involves loss the circuit.
5. Introduction of bypass isolators between bus bar and circuit isolator allows circuit breaker maintenance facilities without loss of the circuit.

4.3. STEPS IN DESIGNING SUBSTATION:

The First Step in designing a Substation is to design an earthing and Bonding System.

4.3.1 Earthing and Bonding:

The function of an earthing and bonding system is to provide an earthing system connection to which transformer neutrals or earthing impedances may be connected in order to pass the maximum fault current. The earthing system also ensures that no thermal or mechanical damage occurs on the equipment within the substation, thereby resulting in safety to operation and maintenance personal. The earthing system also guarantees equipotent bonding such that there are no dangerous potential gradients development in the substation.

In designing the substation, three voltages have to be considered these are:

4.3.1.1 Tough Voltage:

This is the difference in potential between the surface potential and the at earthed equipment whilst a man is standing and touching the earthed structure.

4.3.1.2 Step Voltage:

This is the potential difference developed when a man bridges a distance of 1m with his feet while not touching any other earthed equipment.

4.3.1.3 Mesh Voltage:

This is the maximum touch voltage that is developed in the mesh the earthing grid.

4.3.2 Substation earthing calculation Methodology:

Calculations for earth impedances touch and step potentials are based on site measurements of ground resistivity and system faults levels. A grid layout with particular conductor is then analysed to determine the effective substation earthing resistance, from which the earthing voltage is calculated.

In practice, it is normal to take the highest fault level for substation earth grid calculation: purpose. Additionally, it is necessary to ensure a sufficient margin such that expansion of the system is catered for.

To determine the earth resistivity, probe tests are carried out on the site. These tests are best performed in dry weather such that conservative resistivity readings are obtained.

4.3.3 Earthing Materials:

4.3.3.1 Conductors:

Bare copper conductor is usually used for the substation earthing grid. The copper themselves usually have a cross-sectional area of 35 square millimetres, and they are laid at a shallow depth of 0.25-0.5m, in 3-7m squares, in addition to the buried potential earth grid, a separate above ground earthing ring is usually provided, to which all metallic substation plant is bonded

4.3.3.2 Connection:

Connection to the grid and other earthing joints should not be soldered because the heat generated during fault conditions could cause a soldered joints are usually bolted. And in this case, the face, of the joints should be tinned.

4.3.3.3 Earthing Rods:

The earthing grid must be supplemented by earthing rods to assist in the dissipation of earth fault currents and further reduce the overall substation earthing resistance. These rods are usually made of solid copper, or copper clad steel.

4.3.4 Switchyard Fence Earthing:

The switchyard fence earthing is possible and is used by different utilities

These are:

1. Extend the substation earth grid 0.5m-0.5m beyond the fence perimeter. The fence is then bonded to the grid at regular intervals.
2. Place the fence beyond the perimeter of the switchyard earthing grid and bond the fence to its own earthing rod system. This earthing rod system is not coupled to the main substation earthing grid.

4.4 CONDUTOR USED IN SUBSTATION DESIGN:

An ideal conductor should fulfil the following equipment:

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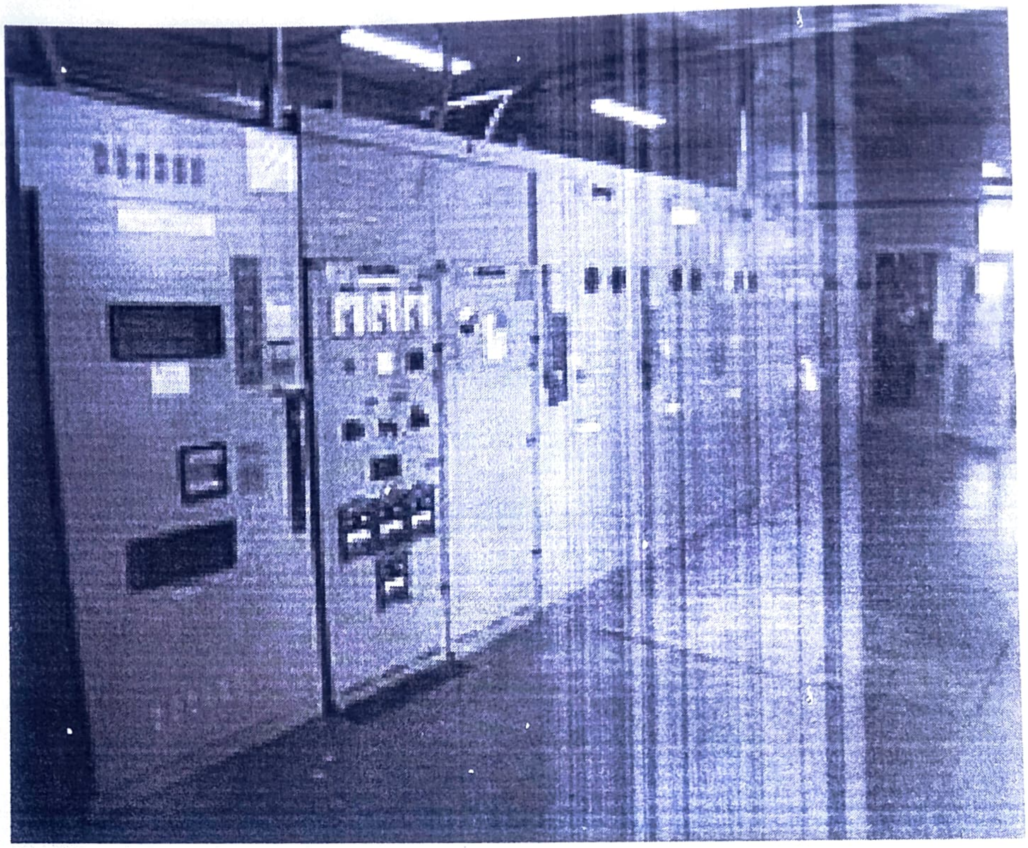

1. Should be capable of carrying the specified load currents and short time currents.
2. Should be able to withstand forces on it due to its situation. These forces comprise self weight, and weight of the conductors and equipments, short circuit forces atmospheric forces such as wind and ice loading.
3. Should be free at corona voltage.
4. Should have minimum number of joints.
5. Should need the minimum number of supporting insulators.
6. Should be economical.

The most suitable material for the conductor system is copper or aluminium. Steel may be used but has limitation of poor conductivity and high susceptibility to corrosion.

In an effort to make the conductor ideal, three different types have been utilized, and these include: Flat surfaced Conductor Stranded conductor, and Tubular Conductor.

4.5 Overhead Line Terminations

Two methods are used to terminate overhead line at a substation.

1. Tensioning conductor to substation structures or buildings.
2. Tensioning conductor to ground winches

The choice is influenced by height of the towers and the proximity to the substation. The following clearance should be observed:

VOLTAGE LEVEL	MINIMUM GROUND CLEARANCE
Less than 66KV	6.1m
66KV	6.4m
110KV-165KV	6.7m
Greater than 165KV	7.0m

Table 1 Clearance in accordance with voltage value

5. CHRONOLOGICAL TRAINING DAY

(Based on study & observation at different Departments and sections)

5.1 POWER LINE CARREIER COMMUNICATION

Introduction:

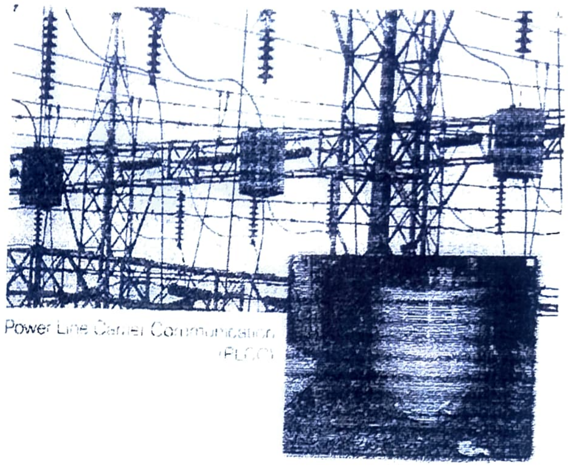

Figure 5.1: PLCC (POWER LINE CARRIER COMMMUNICATION)

Reliable & fast communication as necessary for sale efficient & economical power supply. To reduce the power failure in extent & time, to maintain the interconnected grid system in optimum working condition: to coordinate the operation of various generating unit communication network in indispensable for state electricity board.

In state electricity boards, the generating & distribution stations are generally located at a far distance from cities Where P&T communication provide through long overhead lines in neither reliable nor quick.

As we have very reliable physical paths available via the power lines, which are interconnected.

Hence power line cartier communication is found be most economical and reliable for electricity boards.

5.1.1 Applications:

The PLCC can be used for the following facilities:

1. Telephony
2. Teleportation
3. Remote control or indication,
4. Telemetry
5. Teleprinting

5.2 PRINCIPLE OF PLCC:

The principle of PLCC is the simple one:

All type of information is modulated on carried wave at frequency 50Hz to 500KHz. The modulated HF carried fed into the power line conductor at the sending end filtered out again at respective stations. Long earlier system double side band amplitude modulation was more common but the present amplitude modulated system.

Since high voltage power lines are designed to carry large quantities of energy on the high voltage and the communication system at low voltage, they cannot be directly connected to high voltage lines Suitably designed coupling equipment have therefore to be employed which will permit the injection of high frequency carrier signal without undue loss and with absolute protection of communication equipment or operating personal from high voltage hazard Therefore, the coupling equipment essentially comprises the following

5.2.1 Wave trap or line trap

Wave trap is connected in series with power line between the point of connection of coupling capacitor and 5/5. Wave trap offers negligible impedance to HF carrier. Wave trap stands electromechanically and thermally for short circuit current in the event of the fault on the line. On the basis of blocking frequency bank, the wave trap can be following type:

1. ALL WAVE
2. SINGAL FREQUENCY
3. DOUBLE FREQUENCY
4. BROAD BAND

5.2.2 Coupling capacitor:

The modulated carrier is let into power line through coupling capacitor specially designed to with stand line voltage under all weather condition. The upper end of the coupling capacitor is connected directly to the line and the lower and is connected to the ground through a carrier frequency chock coil or drain coil. Thus coupling capacitor forms the link between the PLCC equipment and power line. The coupling capacitor used in UPSEB is 2200pf capacitance.

The coupling capacitor are designed for outdoor use and hence to withstand normal atmospheric phenomenon such as temperature & humidity changes, rain, snow, anticipated wind load, nominal wire tension etc. at full rated voltage. In some case capacitive voltage transformers (CVT) used as a source of line voltage for metering and protection as also used coupling capacitor for PLCC.

5.2.3 Protective Device of coarse voltage Arrester

This is connected across the primary of the coupling filter Le one end is connected to the bottom of the coupling capacitor and other end is earthed. This is protects the coupling filter against line surges An air gap is provided where voltage of order of 1.8 to 2KV as observed across due to lighting etc. on line.

5.2.4 Coupling of Filter:

The coupling filter is inserted between the low voltage terminal of the capacitor and the carrier frequency connection of the carrier terminal Some time an earth switch is also provided with this unit This unit mainly performs two functions: firstly isolates the connection of equipment from the power line Secondly it serves to match characteristic impedance of the power line that of the HF cable to connection equipment.

5.2.5 H.F. Cable

H.F. Cable normally used to connect the coupling filter to another coupling terminal The cable is insulated to withstand the test voltage of 4KV. The impedance of this H.F. Cables so to match the output of the PLCC terminal and secondary impedance of coupling filter.

5.2.5.1 TYPES OF COUPLING

The following three types of coupling are being used in UPSEB depending on the requirement:

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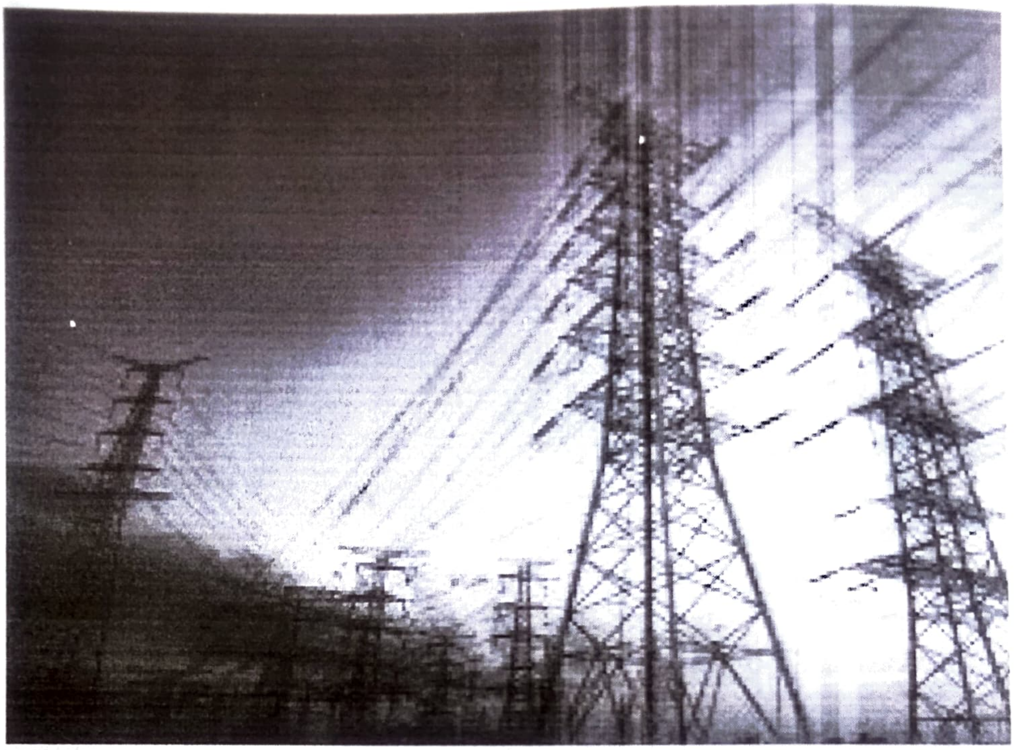

1. Phase to ground coupling
2. Phase to phase coupling
3. Internal coupling

5.2.5.2 COUPLING LOSSES

1. Compo loss
2. Tapping loss
3. HF Cable loss
4. Additional loss

6. BUS BARS:

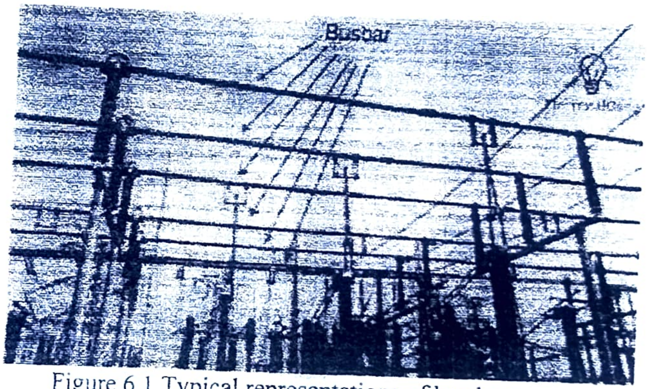

Figure 6.1 Typical representations of bus bars

When numbers of generators or feeders operating at the same voltage have to be directly connected electrically, bus bar is used as the common electrical component, Bus bars are made up of copper rods.

Operate at constant voltage. The following important bus bars arrangements used at substations:

1. Single bus bar system
2. Single bus bar system with alisation.
3. Duplicate bus bar system

In large stations it is important that break down and maintenance should interface as little as possible with continuity of supply to achieve this. duplicate bus bar system is used. Such a system consists of two bus bars, a main bus bar and a spare bus bar with the help of bus coupler, which consists of the circuits breaker and isolator.

In substations. it is often designed to disconnect a part of the general maintenance and repairs.

An isolating switch or isolator accomplishes this, isolator operates under no load condition. It does not have any specified current breaking capacity or current making capacity. In some cases isolators are used to breaking charging currents or transmission lines.

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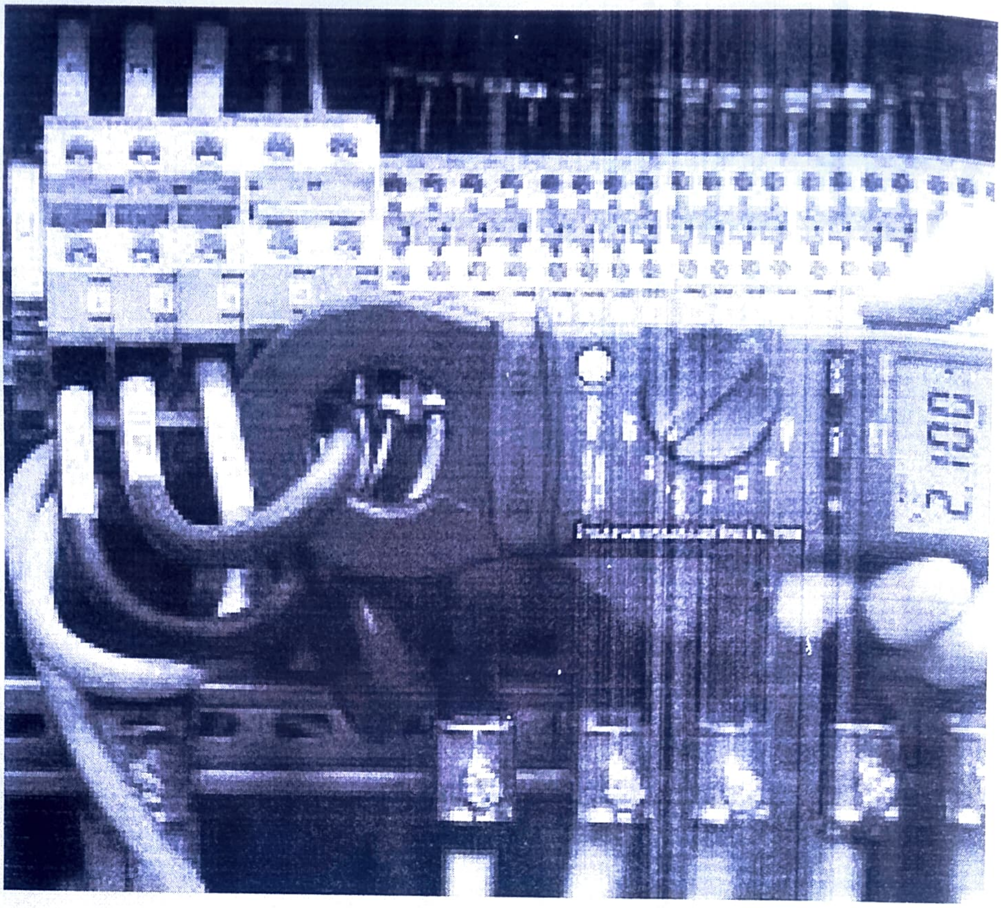

While opening a circuit, the circuit breaker is opened first then isolator while closing the circuit the isolator is closed first, then circuit breakers. isolators are necessary on supply side of circuit breakers, in order to ensure isolation of the breaker from live parts for the purpose of maintenance.

A transfer isolator is used to transfer main supply from bus to transfer bus by using coupler (combination of a circuit breaker with two isolators), if repairing or maintenance of any section is required.

7. INSULATORS:

The insulator serves two purposes. They support the conductor (bus bar) and confine the current to the conductors. The most common used material for the manufacture of insulator is porcelain. There are several types of insulators (eg. pin type, suspension type, post insulator, strain insulator etc.) and there used in substation will depend upon the service requirement. For example, post insulator is used for bus bars. A post insulator consists of porcelain body, cast iron cap and flanged cast iron base. The hole in the cap is threaded so that bus bar cab be directly bolted to the cap.

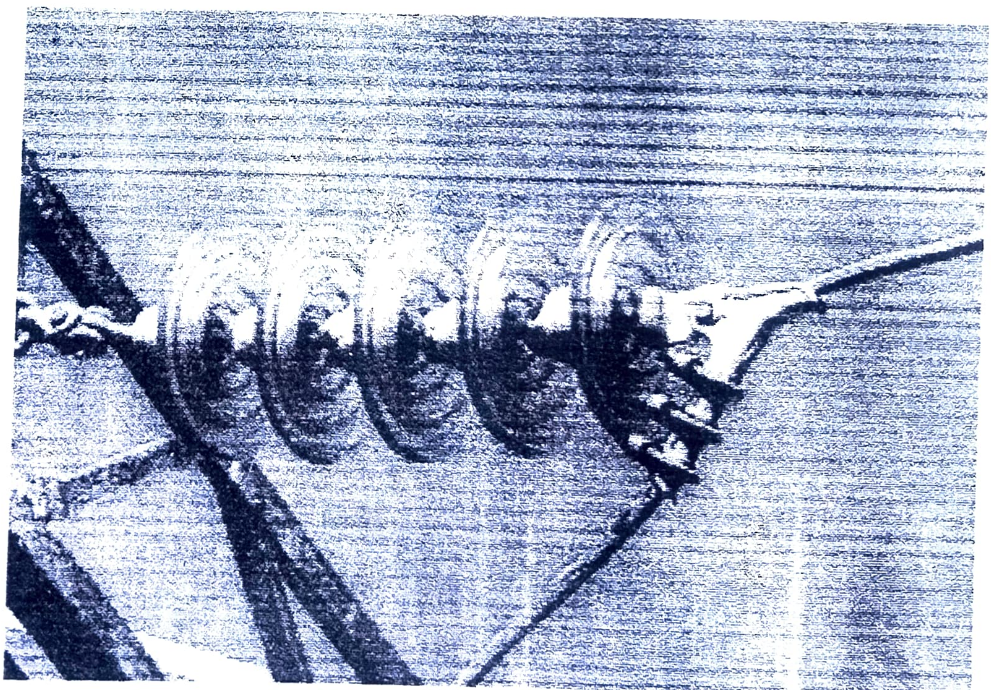

Figure 7: Insulator used in substation

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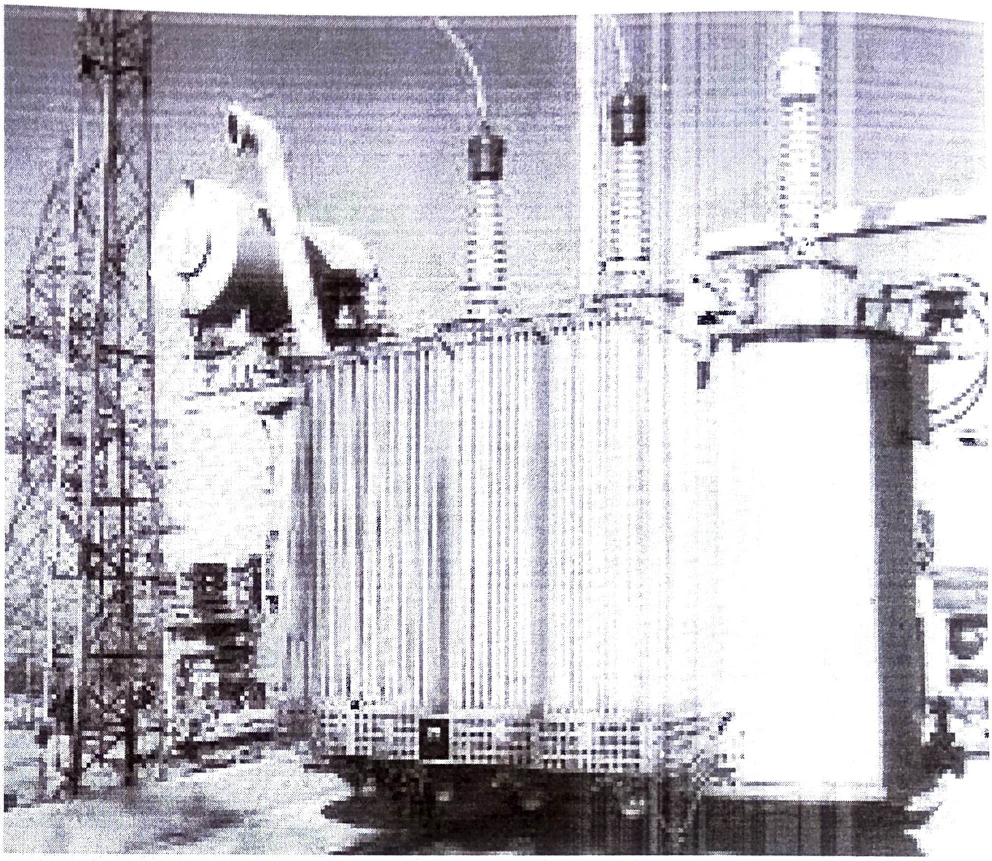


With the advantage of the power system, the lines and other equipment operate at very high voltage and carrying high current. साध्यम्

The arrangements of switching along with switches cannot be serve the desired function of switchgear in such high capacity circuits This necessitates employing a more dependable means of control such as is obtain by the use of the circuit breakers. A circuit breaker can make or break circuit either manually or automatically under all condition as no load, full load and short circuit condition.

8.CIRCUIT BREAKER:

They can be classified Into:

1. Oil circuit breaker
2. Air blast circuit breaker
3. Sulphur hexafluoride circuit breaker (SF_6)
4. Vacuum circuit breakers

NOTE: SF_6, and Vacuum circuit breaker are being used in 132KV distribution system.

A circuit breaker essentially consists of fixed and moving contacts. These contacts cab be opened manually or by remote control whenever desired. When a fault occurs on any of the system, the trip coils of breaker get energized and the moving contacts are pulled apart by some mechanism. thus opening the circuit.

When contacts of a circuit breaker are separated, an arc is struck: the current is thus able to continue. The production of are not only delay the current interruption, but is also generates the heat. Therefore, the main problem is to distinguish the arc within the shortest possible time so that it may not reach a dangerous value. The general way of classification is on the basis of the medium used for arc extinction.

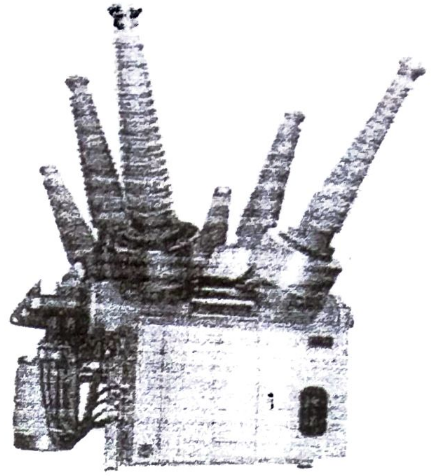


Figure 8.1 Circuit breaker

8.1 OIL CIRCUIT BREAKER

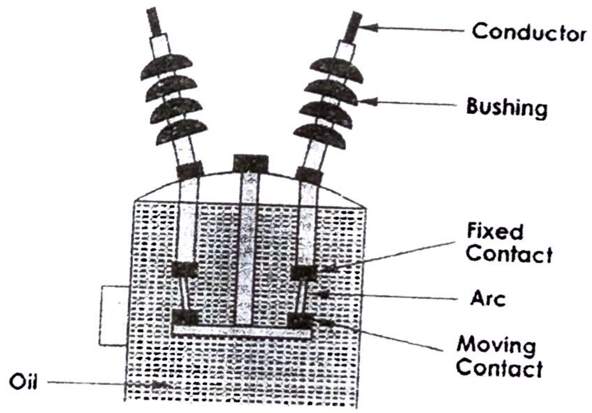


Figure 8.1.1 Oil circuit breaker

A high-voltage circuit breaker in which the arc is drawn in oil to dissipate the heat and extinguish the arc: the intense heat of the arc decomposes the oil, generating a gas whose high pressure produces a flow of fresh fluid through the arc that furnishes the necessary insulation to prevent a restrict of the arc

The arc is then extinguished, both because of its elongation of contacts and because of intensive cooling by the gases and oil vapour.

8.2 AIR BLAST CIRCUIT BREAKER

Fast operations, suitability for repeated operation, auto reclosure, unit type multi break constructions, simple assembly, modest maintenance are some of the main features of air blast circuit breakers. A compressors plant necessary to maintains high air pressure in the air receiver. The air blast circuit breakers are especially suitable for railways and arc furnaces, where the breakers operates repeatedly. Air blast circuit breaker is used for interconnected lines and important lines where rapid operation is desired.

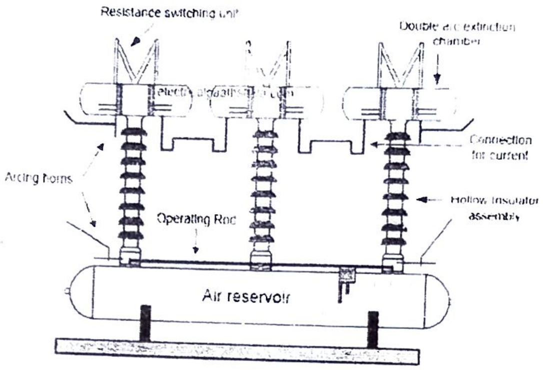


Figure 8.1.2 Air blast circuit breaker

High pressure air at a pressure between 20 to 30 kg/cm stored in the air reserve is taken from the compressed air system. Three insulator columns are mounted on the top reservoir with valves at their basis. The art extinguished chambers are mounted on the top of the follow insulator chambers The current carrying parts connect the three are extinction to each other ie series and the role to the neighbouring equipment. Since there reds a very high voltage between the conductor and the air reservoir. the entire arc extinction chambers assembly is mounted on insulators.

8.3 SF_6 CIRCUIT BREAKER

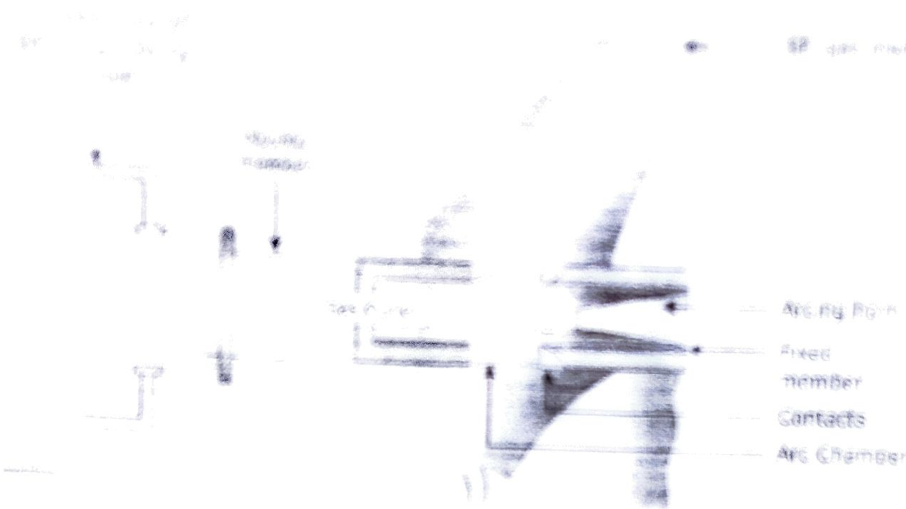


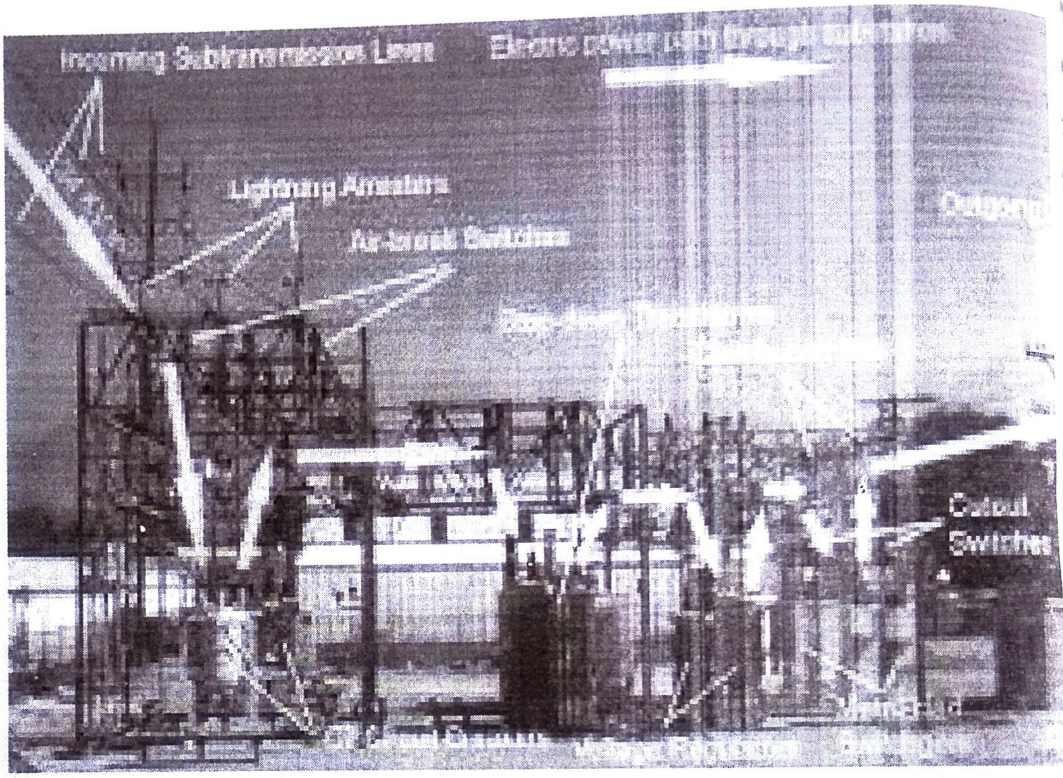
Figure 8.1.3 SF_6 CIRCUIT BREAKER

In such circuit breaker sulphur hexafluoride (SF_6) gas is used as the as quenching medium. The SF_6 is an electromegative gas and has a strong tendency to absorb free electrons The SF_6 circuit breakers have been found to a very effective for high power and high voltage service SF_6 circuit breakers have been developed for voltage 115KV to 230KV, power rating 10MVA.

It consists of fixed and moving contacts. It has chamber, SF_6 gas. When the contacts are opened, the mechanism permits a high pressure SF_6 gas from reservoir to flow toward the arc interruption chamber. The moving contact permits the SF_6 to let through these holes.

8.4 VACUUM CIRCUIT BREAKER:

CHAPTER-9



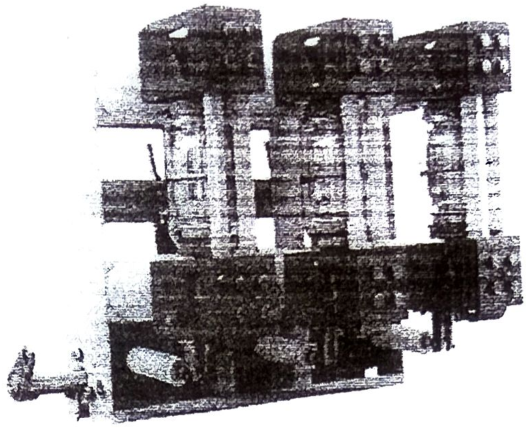


Figure 8.1.4 Vacuum circuit breaker

Vacuum circuit breakers are circuit breakers which are used to protect medium and high voltage circuit from dangerous situation. Like other type of circuit breaker, vacuum circuit breaker literally break the circuit so that energy cannot continue flowing through it, thereby preventing fire, power surges, and other problem which may emerge. These devices have been utilized since the 1920s, and several companies have introduces refinements to make them even safer and more effective.

8.4.1 Rating of 132 KV SF, circuit breaker:

1. Breaking current: 50A

2. Making capacity: 80 KA

3. Total break time< 60msec

4. Rated short circuit breaking current

4.1 Symmetrical: 31.5 KA

4.2 Asymmetrical 36.86KA

5. Rated duration of short circuit current: 3 sec

6. Rated nominal current: 1250

7. Rated voltage: 145 KV

8. Rated SF, gas pressure: 6 KG/CC

9. METERING AND INDICATION EQUIPMENT

9.1 RELAY:

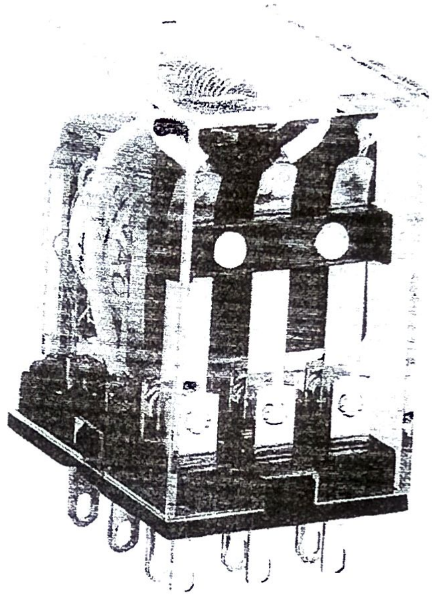


Figure 9.1 Relay

In a power system it is inevitable that immediately or later some failure does occur somewhere in the system. When a failure occurs on any part of the system, it must be quickly detected and disconnected from the system. Rapid disconnection of faulted apparatus limits the amount of damage to it and prevents the effects of fault from spreading into the system. For high voltage circuits relays are employed to serve the desired function of automatic protective gear. The relays defect the fault and supply the information to the circuit breaker.

The electrical quantities which may change under fault condition are voltage, frequency, current and phase angle. When a short circuit occurs at any point on the transmission line the current flowing in the line increases to the enormous value. This result in a heavy current flow through the relay coil. causing the relay to operate by closing its contacts. This in turn closes the trip circuit of the breaker making the circuit breaker open and Isolating the faulty section from the rest of the system in this way. the relay ensures the safety of the circuit equipment from the damage and normal working of the healthy portion of the system. Basically relay work on the following two main operating principles

9.1.1 Electromagnetic attraction relay

9.1.2 Electromagnetic Induction relay

9.2 Relays used in control panel of the substation:

9.2.1 DIFFERENTIAL RELAY

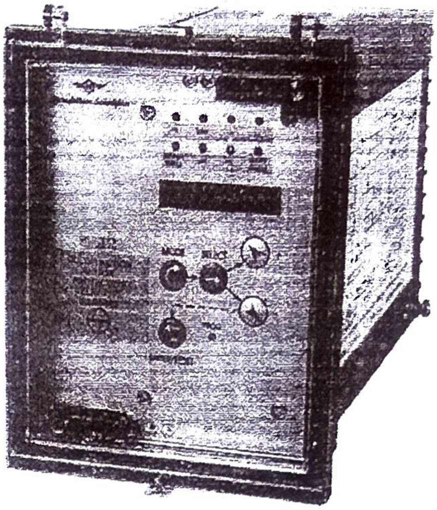


Figure 9.2 Differential Relay

A differential relay is one that operates when vector difference of the two or more electrical quantities exceeds a predetermined value. If this differential quantity is equal or greater than the pickup value. the relay will operate and open the circuit breaker to isolate the faulty section.

9.2.2 OVER CURRENT RELAY:

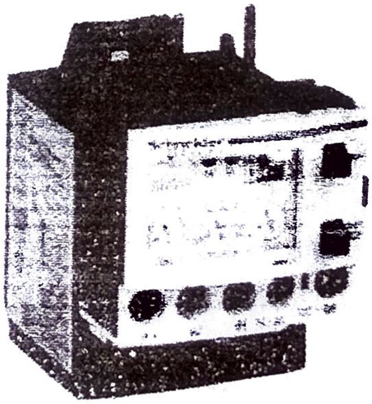


Figure 9.3 Overload Relay

This type of relay works when current in the circuit exceeds the predetermined value. The actuating source is the current in the circuit supplied to the relay from a current transformer. These relay are used on A.C. circuit only and can operate for fault flow in the either direction. This relay operates when phase to phase fault occurs.

9.2.3 DIRECTIONAL RELAY:

This relay operates during earth faults. If one phase touch the earth due to any fault. A direction power relay is so designed that it obtains its operating torque by the interaction of magnetic field derived from both voltage and current source of the circuit it protects. The direction of torque depends upon the current related to voltage.

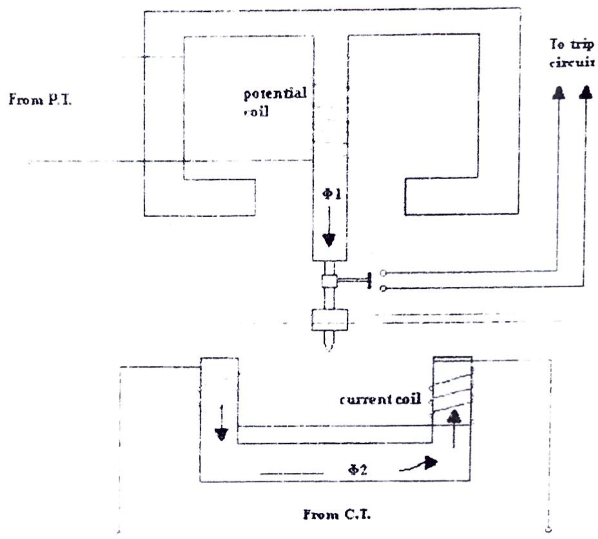


Figure 9.5 Directional relay

9.2.4 TRIPPING RELAY

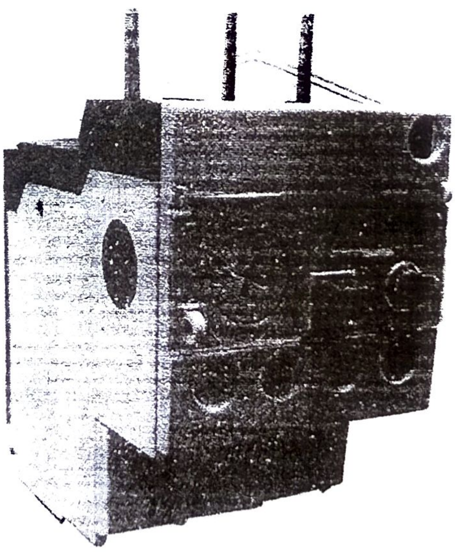
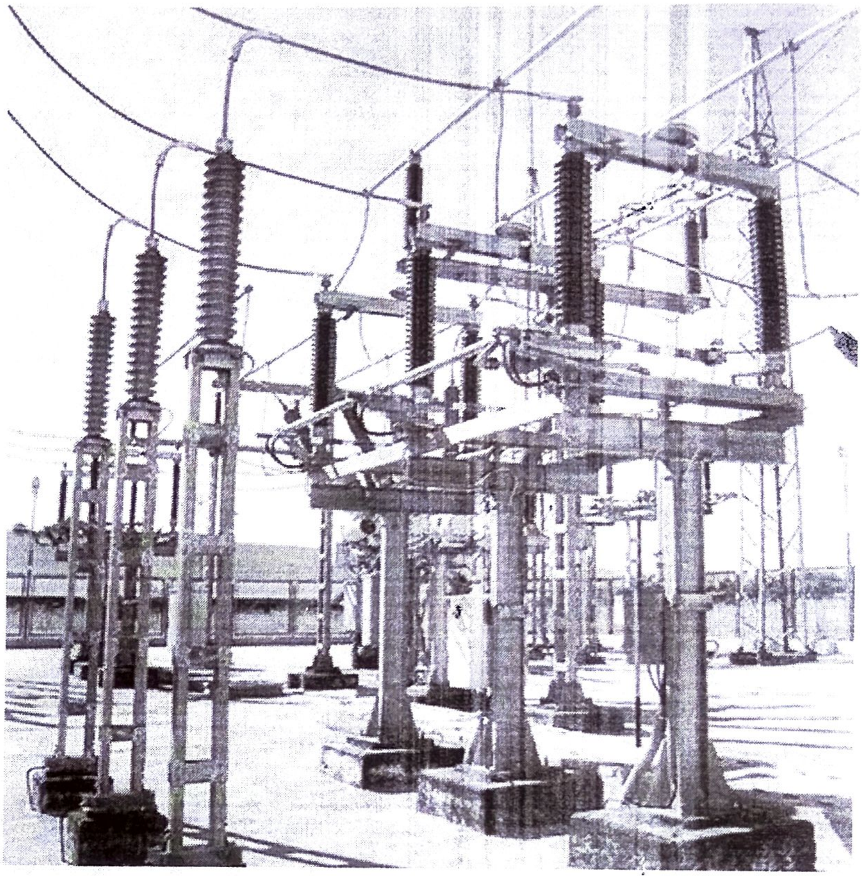


Figure 9.5 Tripping Relay

This type of relay is in the conjunction with main relay. When main relay sense any fault in the system, it immediately operates the trip relay to disconnect the faulty section from the section.

9.2.5 AUXILIARY RELAY

CHAPTER-10



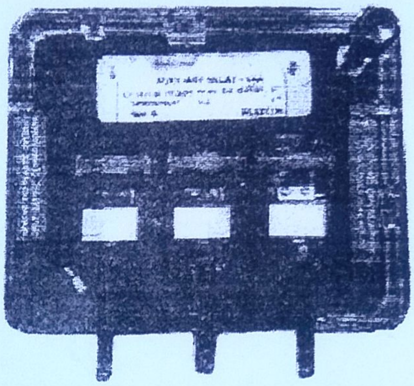


Figure 9.6 Auxiliary Relay

An auxiliary relay is used to indicate the fault by glowing bulb alert the employee.

10. MISCELLANOUS EQUIPMENT:

10.1 CAPACITOR BANK

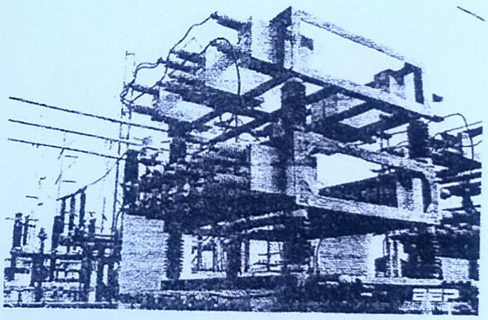


Figure 10.1 Capacitor Bank

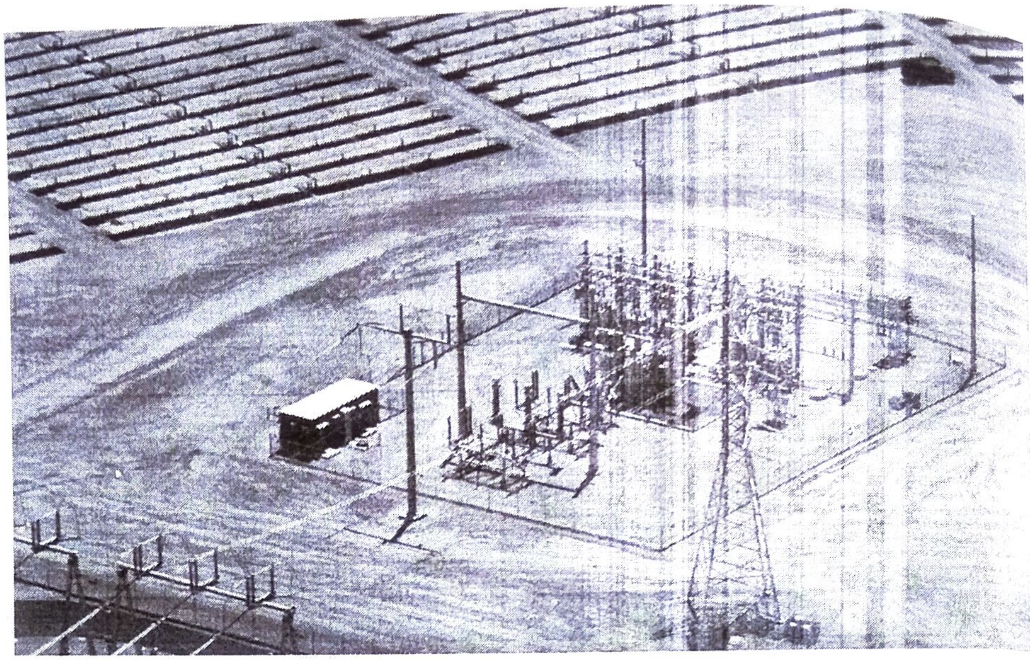
The load on the power system is varying being high during morning and evening which increases the magnetization current. This result in the decreased factor. The low power factor is mainly due to the fact most of the power loads are inductive and therefore take lagging currents. The low power factor is highly undesirable as it causes increases in current, resulting in additional losses. So in order to ensure most favourable conditions for a supply system from engineering and economical stand point it is important to have power factor as close to unity as possible. In order to improve power factor cum device taking leading power should be connected in parallel with the load. One of the such device can be capacitor bank. The capacitor draws a leading current and partially and completely neutralized the tagging reactive component of load current.

Capacitor bank accomplishes the following operations:

1. Supply reactive power
2. Increases terminal voltage
3. Improve power factor

10.2 FUSE:

CHAPTER-11



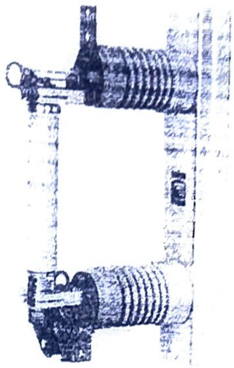


Figure 10.2 Substation fuse

A fuse is a short piece of wire or thin strip which melts when excessive current through it for sufficient time. It is inserted in series with the circuit under normal operating conditions: the fuse elements are at a nature below its melting point. Therefore it carries the normal load current overheating. It is worthwhile to note that a fuse performs both detection and interruption and functions.

10.3 BUS COUPLER:

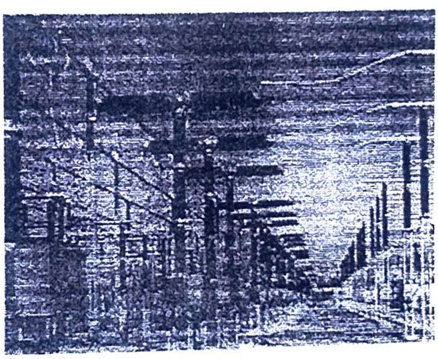


Figure 10.3 Bus coupler

The bus coupler consists of circuit breaker and isolator. Each generator and feeder may be connected to either main or spar bas bar with the help of bus coupler. Repairing, maintenance and testing of feeder circuit or other section can be done by putting on spar and bus bar, thus keeping the main bus bar undisturbed.

Bus coupler is a device which is used to switch from one bus to other without any interruption in power supply and without creating hazardous arcs. It is achieved with the help of circuit breaker and isolators.

11. PROTECTION OF SUBSTATION:

11.1 Transformer protection:

Transformers are totally enclosed static devices and generally oil immersed. Therefore chances of fault occurring on them are very easy rare, however the consequences of even a rare fault may be very serious unless the transformer is quickly disconnected from the system. This provides adequate automatic protection for transformers against possible faults

11.2 Conservator and Breather:

When the oil expands or contacts by the change in the temperature, the oil level goes either up or down in main tank. A conservator is used to maintain the oil level up to predetermine value in the transformer main tank by placing it above the level of the top of the tank.

Breather is connected to conservator tank for the purpose of extracting moisture as it spoils the insulating properties of the oil. During the contraction and expansion of oil and air is drawn in or out through breather silica gel crystals impregnated with cobalt chloride. Silica gel is checked and dried and replaced when necessary.

11.3 Marshalling box:

It has two meter which indicate the temperature of oil and winding of main tank if the temperature of oil and winding exceeds than specified value, relay operates to sound an alarm. If there is further increase in temperature then relay completes the trip circuit to open the circuit breaker controlling the transformer.

11.4 Transformer Cooling:

When the transformer is in operation heat is generated due to iron losses the removal of heat is called cooling. There are several types of cooling methods, they are as follows:

11.4.1 Air Natural Cooling:

In a dry type of self cooled transformer, the natural circulation of surrounding air is used for its cooling. This type of cooling is satisfactory for low voltage small transformers.

11.4.2 Air Blast Cooling:

It is similar to that of dry type self cooled transformer with to addition that continuous blast of filtered cool air is forced through the core and winding for better cooling. A fan produces the blast.

11.4.3 Oil Natural Cooling:

Medium and large rating have their winding and core immersed in oil, which act both as a cooling medium and an insulating medium. The heat produced in the cores and winding is passed to the oil becomes lighter and rises to the top and place is taken by cool oil from the bottom of the cooling tank.

11.4.4 Oil Blast Cooling:

In this type of cooling, forced air is directed over cooling element of transformer immersed in oil.

11.4.5 Forced Oil and Forced Air Flow (OFB) Cooling:

Oil is circulated from the top of the transformer tank to a cooling tank to a cooling plant Oil is then returned to the bottom of the tank.

11.4.6 Forced Oil and Water (OWF) Cooling:

In this type of cooling oil flow with water cooling of the oil in external water heat exchanger takes place. The water is circulated in cooling tubes in the heat exchanger.

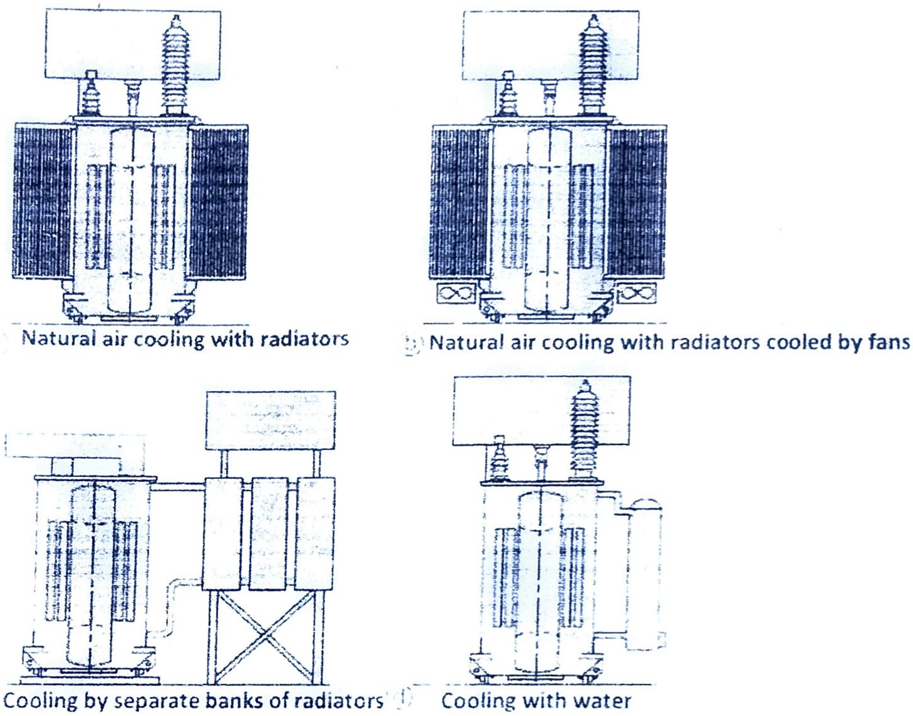


Figure 11.4 Transformer Cooling

12. CONCLUSION

Now from this report we can conclude that electricity plays an important role in our life. We are made aware of how the transmission of electricity is done. We too came to know about the various parts of the substation system.

The **Uttar Pradesh Power Transmission Corporation Limited** has got radio communication in microwave range in order to transmit and receive data with various substations in Uttar Pradesh to get reliable transmission & distribution of electricity.

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