REPORT ON

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED

132/33 KV GRID SUBSTATION MOTIHARI, Bihar (845401)

An 4 week Summer Entrepreneurship (from 01/06/2025 to 28/06/2025)

Report Submitted For the Partial Fulfillment of

BACHELOR OF TECHNOLOGY

In Electrical Engineering
UNDR THE GUIDANCE OF

Er. NARAYAN KUMAR SINGH
AEE GSS MOTIHARI

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2022-2026

Preface to the Project Report

I have experienced Vocational Training in Bihar State Power Transmission Company Limited (BSPTCL) ,**132/33 KV Grid Substation, MOTIHARI** from **01 JUNE 2025** to **28 JUNE 2025.**

I am very thankful to all the officers who gave me warm reception & their precious time for me. We have an electric lab our collage where we have been trained in educational environment. However, through this training, I have learnt many more things in industrial environment, which will be helpful for my future. By that practical knowledge & their application, I am getting helpful to realize the theoretical knowledge. Therefore, I am very thankful to BSPTCL for allowing me to perform this sort of Vocational Training in their substation.

I will be glad if my training report gets approved.

ACKNOWLEDGEMENT

Summer training has an important role in exposing the real life situation in an industry. It was a great experience for me to work on training at **BIHAR STATE POWER TRANSMISSION COMPANY LIMITED** through which I could learn how to work in a professional challenging environment.

Now, I would like to thank the people who guided me and have been a constant source of inspiration throughout the tenure of my summer training.

I am sincerely grateful to **MR . NARAYAN KUMAR SINGH (ASSISTANT ENGINEER) at 132/33 KV GRID SUBSTATION, MOTIHARI** who rendered me his valuable assistance, constant encouragement and able guidance which ae this training actually possible. I wish my deep sense of gratitude to **MR. PRANAV KUMAR (JUNIOR ENGINEER)** whose affectionate guidance has enabled me to complete this training successfully. I also wish my deep sense of gratitude to **ABHISHEK KUMAR(HOD OF EE Department) & OM PRAKASH RAM (Subject Teacher) and other faculty members** whose guidance and encouragement made my training successful.


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1. About 132/33 KV Grid Substation MOTIHARI

- Type: - Outdoor grid substation.
- Incoming Line Voltage: - 132 kV
- Outgoing feeder Voltage: - 33 kV
- GSS MOTIHARI has following 132 kV incoming sources:
    - MOTIPUR
    - BETTIAH
    - DMTCL-1
    - DMTCL-2

❖ GSS MOTIHARI has following 132 KV outgoing feeders:

- RAILWAY TSS JIVDHARA
- MOTIPUR
- BETTIAH
- DHAKA-01
- DHAKA-02
- SUGAULI

❖ GSS MOTIHARI has following 33 kV Outgoing feeders:

- MOTIHARI
- CHHATAUNI
- BANJARIA
- CHAKIA
- KOTWA
- TURKAULIA
- BELISARAI
- MADHOPUR
- PIPRAKOTHI
- JAMLA
- I.O.C.L
- DHEKAHA
- CHOTA BARIYARPUR

2. **TRAINING OBJECTIVES: -**

The objective of this six - week industrial training is to :

- Gain practical knowledge of transmission and distribution system components and working.
- Learn the substation functioning in practical way.
- Learn operations of switch yards, power transformer, Circuit breaker, Isolators, instrument transformer, Wave trap, Lighting arrester, Bus Coupler and Marshalling box etc.
- To learn protection system of substation to familiarize with SCADA and power line communication system.

3. **ELECTRICAL SUBSTATION:-**

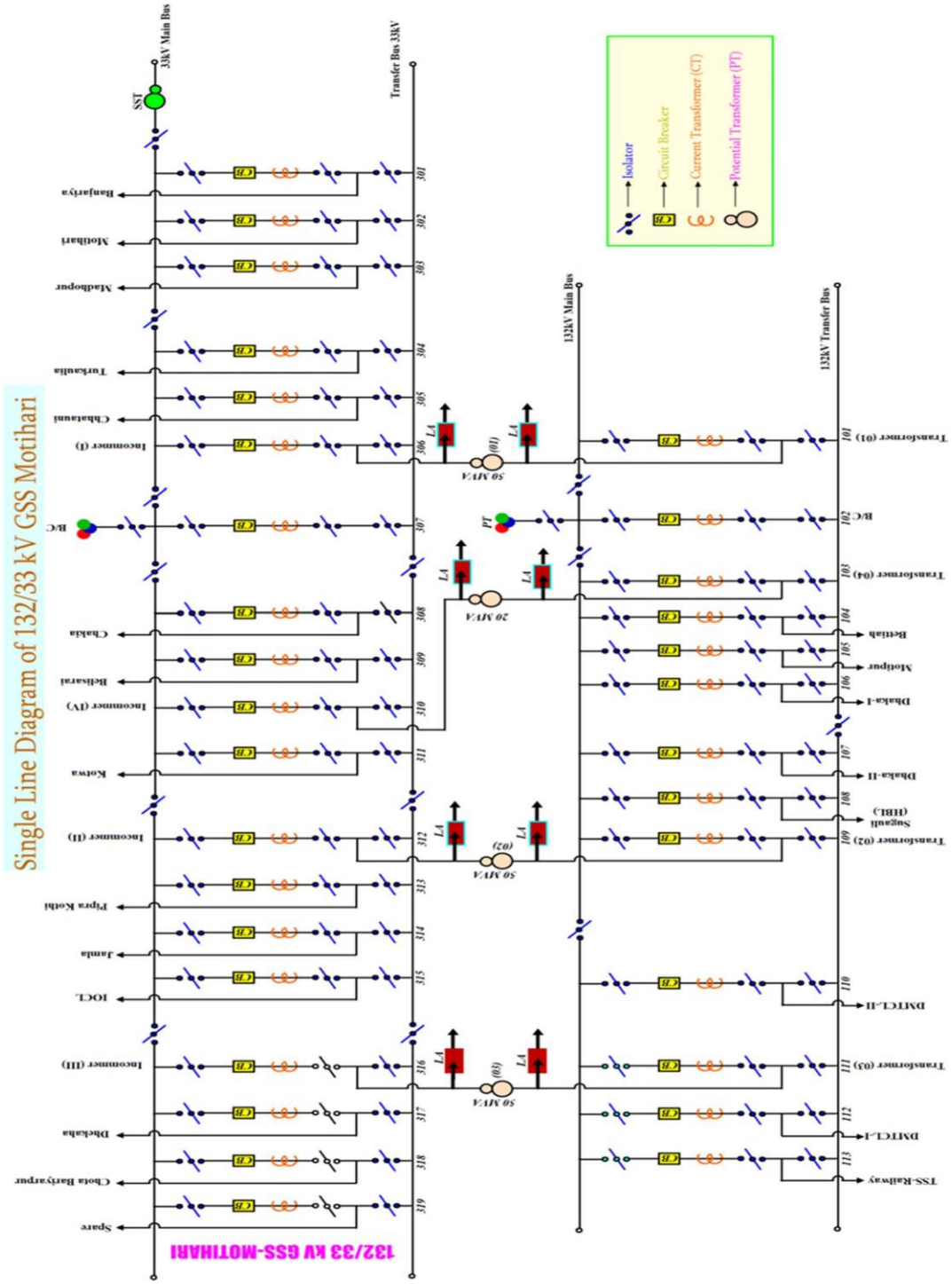
A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. Between the generating station and consumer.

Ex; GSS MOTIHARI, GSS MUZAFFARPUR

❖ Types of Substations:

- According to the service requirement:
  - ➢ Transformer substation
  - ➢ Switch substation
  - ➢ Power factor correction substation
  - ➢ Frequency change substation
  - ➢ Converting substation
  - ➢ Industrial substation
- According to the constructional features:
  - ➢ Indoor substation
  - ➢ Outdoor substation
  - ➢ Underground substation
  - ➢ Pole mounted substation

4. SINGLE LINE DIAGRAM:



5. EQUIPMENT USED IN THE SUBSTATION:

i. Power Transformer (Step Down Transformer)

A power transformer is a static machine used for transforming power from one circuit to another without changing the frequency. As there is no rotating or moving parts, a transformer is classified as a static device. Transformer operates on an AC supply. Transformers operate based on the principle of mutual induction.

In GSS MOTIHARI two types of Power Transformers are used:

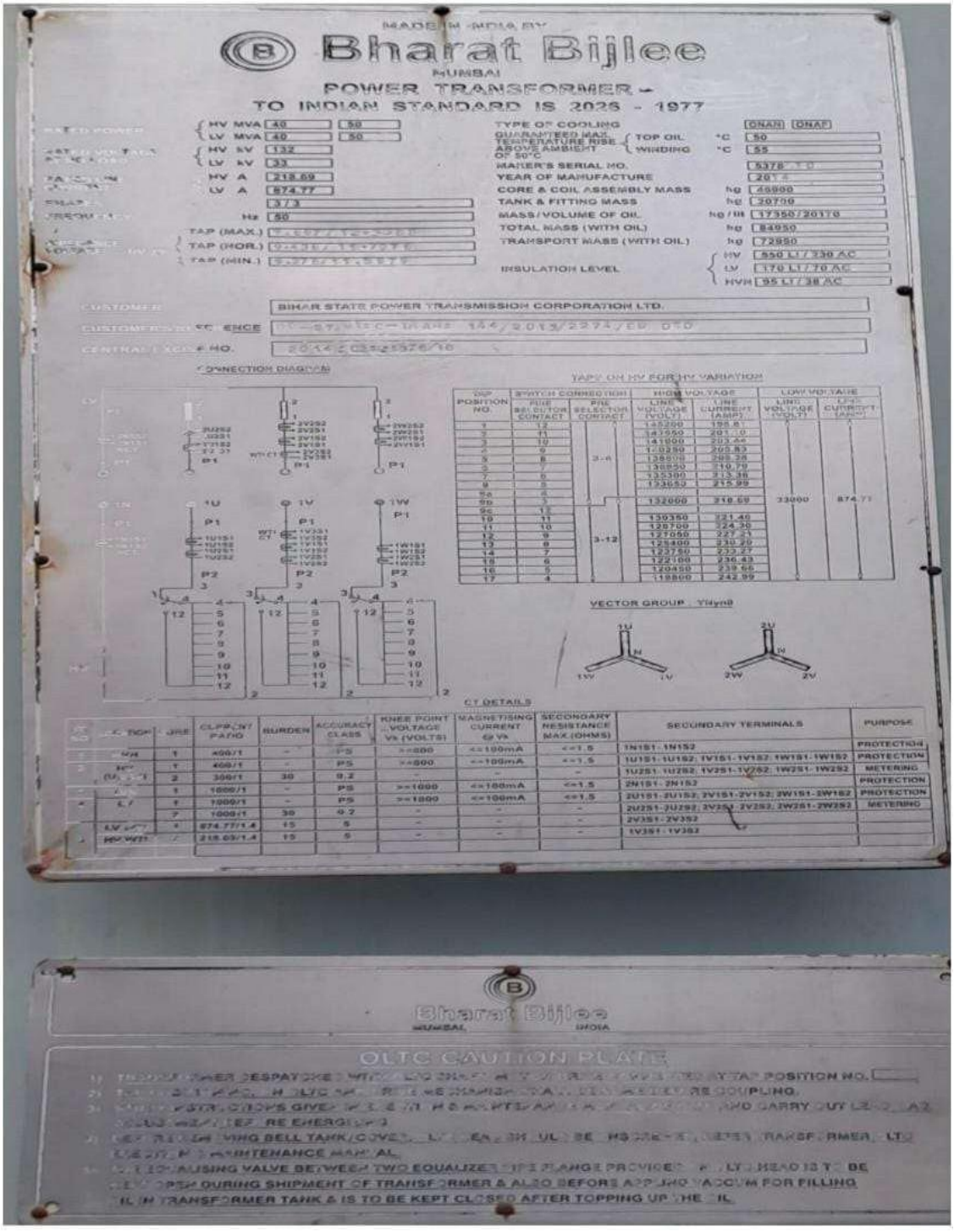
a) 50 MVA POWER T/F-3

b) 20 MVA POWER T/F-1

- It is a step-down transformer that step-down 132kv to 33kv and feed to different power substation located nearby
- One is in operation while other is at standby

ii. Name Plate of Transformer

Name Plate of Transformer:



iii. Bus-Bar

When a no. of lines operating at the same voltage have to be directly connected electrically, bus-bar are used, it is made up of copper or aluminium bars (generally of rectangular X-Section) and operate at constant voltage.

There may be double line in the bus so that if any fault occurs in the one, the other can still have the current and the supply will not stop. The two lines in the bus are separated by a little distance by a Conductor having a connector between them. This is so that one can work at a time and the other works only if the first is having any fault.

6. PROTECTING DEVICE:

Isolator:

In Sub-Station, it is often desired to disconnect a part of the system for general maintenance and repairs. This is accomplished by an isolating switch or isolator. An isolator is essentially a knife Switch and is design to often open a circuit under no load, in other words, isolator Switches are operated only when the line is which they are connected carry no load. This may batter the supporting insulators & may even cause a fatal accident to the operator, particularly in the high voltage circuit.

The operating principle is manual plus one of the following:-

a) Electrical Motor Mechanism

b) Pneumatic mechanism

Isolators cannot be opened unless the Circuit Breakers are opened. Circuit Breakers cannot be closed until isolators are closed.

In substations 3 types of isolators are used:

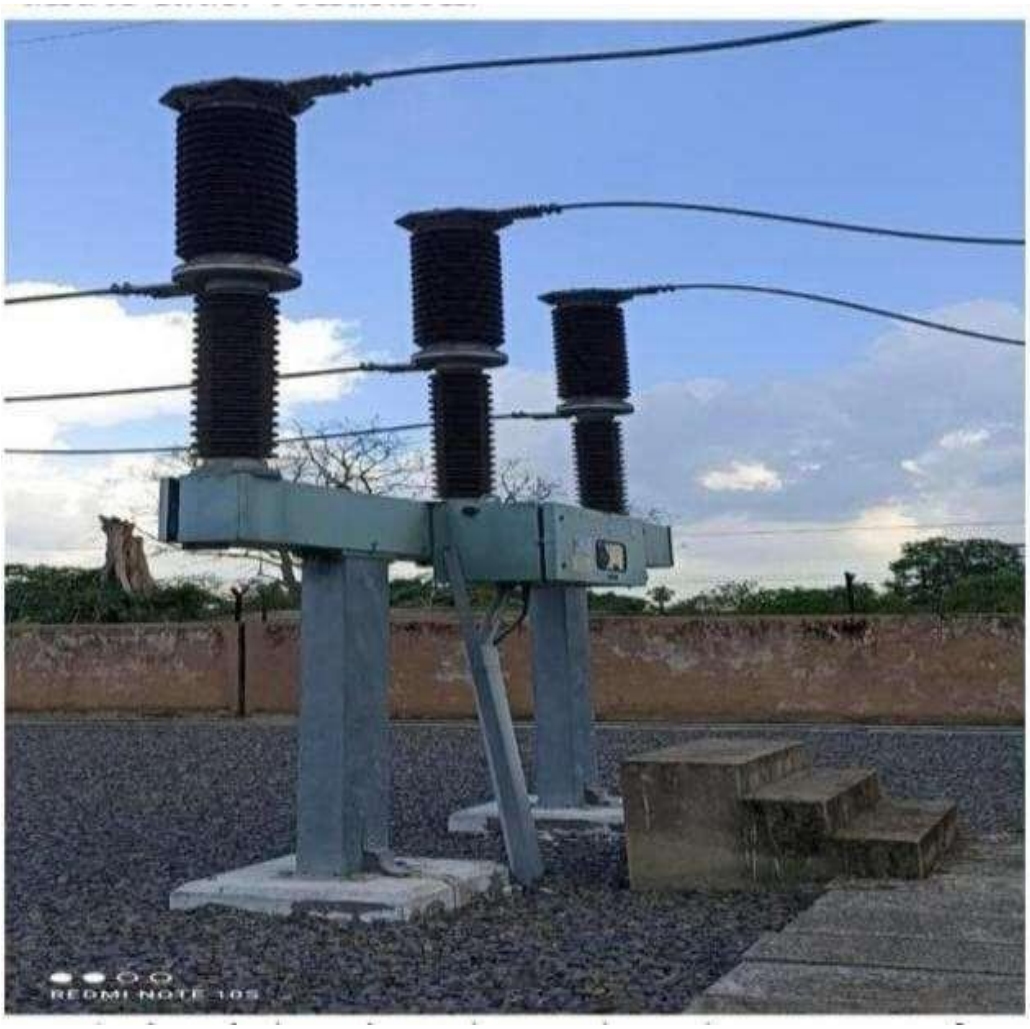
i. Tendam isolator

ii. Main bus isolator

iii. Main line isolator

Circuit breaker:

A circuit breaker is an equipment, which can open or close a circuit under normal as well as fault condition. These circuit breaker breaks for a fault which can damage other instrument in the station. It is so designed that it can be operated manually (or by remote control) under normal conditions and automatically under fault condition.



SF6 circuit breakers have the advantages of very much reduced electrical clearances, performance independent of ambient conditions, noise less operation, reduce moisture problem, minimum current chopping, small arcing time, no reduction in dielectric strength of SF6, low maintenance, reduced installation time & increased safety. Such as circuit breakers are used for rated voltages in the ranges of 3.6 to 760 kV.

Lightening Arrestors:

1. It is protective device which conducts the high voltage surges on the power system to ground.
2. Lighting arrester works on the principle of non-linear resistance under normal operation the lighting arrester is off the line.
3. Lighting arrester in-corporate zinc oxide (ZnO) element with superior linear voltage current non characteristics.

It is a device used in Electrical Power systems to protect the insulation of the system from the damaging effect of lightning. Metal Oxide arrestors (MOVs) have been used for power system protection the mid

Types of lightning arrestors:

a. Rod gap arrestor
b. Horn gap arrestor
c. Valve type arrestor
d. Expulsion type arrestor
e. Silicon Cathode arrestor
f. Metal oxide arrestor

Wave Trap:

Wave trap is an instrument using for tripping of the wave. The function of this trap is that it traps the unwanted waves. Its function is of trapping wave. Its shape is like a drum. It is connected to the main incoming feeder so that it can trap the waves which may be dangerous to the instruments here in the substation.

Low pass filter: when power frequency currents are passed to switch yard and high frequency signals are blocked. Line Isolator with E.B. – To isolate the line from Sub Station and earth, it under shut down.

Protective relay:

A protective relay is a device that detects the fault and initiates the operation of the C.B. is to isolate the defective element from the rest of the system". The relay detects the abnormal condition in the electrical circuit by constantly measuring the electrical quantities, which are different under normal and fault condition. The electrical quantities which may change under fault condition are voltage, current, frequency and phase angle. Having detect the fault, the relay operates to close the trip circuit of C.B. There are two principal reasons for this; Firstly, if the fault is not cleared quickly, it may cause unnecessary interruption of service to the customer. Secondly, rapid disconnection of faulty apparatus limits the amount of damage to it & a prevents the effects from speeding into the system.

Most of the relays operate on the principle of electromagnetic attraction or electromagnetic induction. The following important types of relays are generally used in electrical distribution & transmission line:

1. Induction Type Over Current Relay
2. Induction Type Over Voltage Relay
3. Distance Relay
4. Differential Relay
5. Earth Fault Relay / Directional Relay

7. INSTRUMENT TRANSFORMER:

The line in Sub-Station operates at high voltage and carry current of thousands of amperes. The measuring instrument and protective devices are designed for low voltage (generally 110V) and current (about 5A). Therefore, they will not work satisfactory if mounted directly on the power lines.

Types of instrument transformer:-

Current transformer:

A current transformer is essentially a step-down transformer. It steps-down the current in a known ratio, the primary of this transformer consists of one or more turn of thick wire connected in series with the line. The secondary consists of thick wire connected in series with line having large number of turns of fine wire and provides for measuring instrument, and relay a current, which is a constant fraction of the current in the line.

Current transformers are basically used to take the readings of the currents entering the substation. This transformer steps down the current from 800 amps to1amp. This is done because we have no instrument for measuring of such a large current.

The main use of this transformer is:

a. Distance protection

b. Backup protection

c. Measurements.

Voltage Transformer or Potential Transformer:

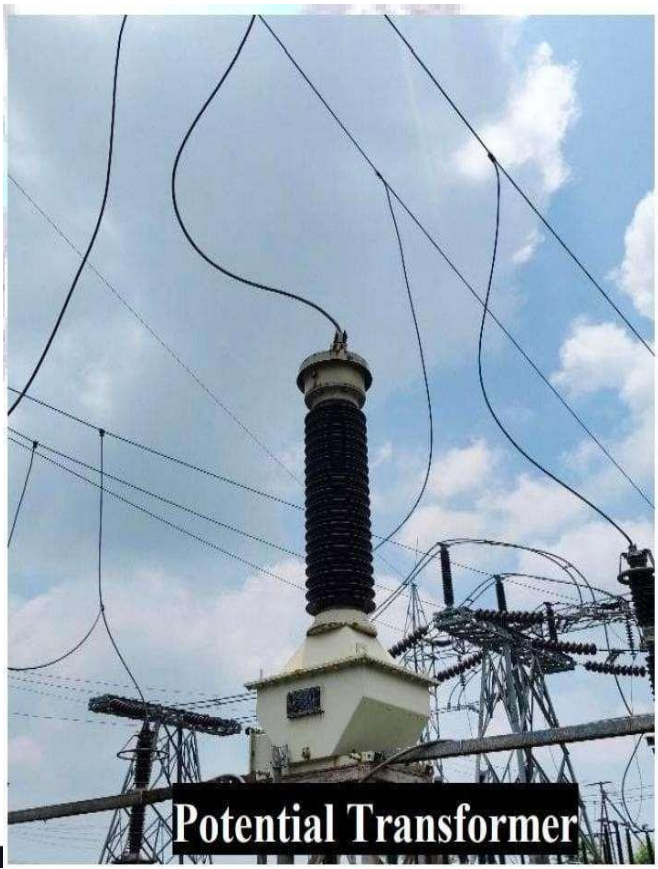
It is essentially a step–down transformer and step down the voltage in known ratio. The primary of these transformer consist of a large number of turns of fine wire connected across the line. The secondary winding consist of a few turns, provides for measuring instruments, and relay a voltage that is known fraction of the line voltage.

Capacitor voltage transformer:

The capacitive voltage transformer step-down the high voltage input signals and provide the low voltage signals which can easily measure through the measuring instrument. The Capacitive voltage transformer (CVT) is also called a capacitive potential transformer.

Difference between CVT and PT:

Pt is only use for measuring voltage & and for some safety purpose while cvt use for these all works as well as for communication purpose as cvt from L-C circuit with the help of wave trap.



8. COMMUNICATION SYSTEM:

Power Line Carrier Communication:

Reliable & fast communication is necessary for safe 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 is indispensable for state electricity board.

As we have available very reliable physical paths viz. the power lines, which interconnected, hence power line carrier communication is found to be most economical and reliable for electricity boards.

Applications:

The PLCC can be used for the following facilities:

i. Telephony

ii. Teleportation

iii. Remote control or indication

iv. Telemetry

Coupling capacitor:

The modulated carrier is let into power line through coupling capacitor specially designed to with stand line voltage under all-weather conditions. The upper end of the coupling capacitor is connected directly to the line and the lower end is connected to the ground through a carrier frequency chock coil or drain coil. Thus, coupling capacitor forms the link between the PLCC.

9. CONTROL PANNEL:

Control panel is most important equipment of the substation as it works as shield guard for all substation equipment's and electrical network. Moreover, these panels are useful to control the flow of electricity as per the Voltage class and detect the faults in transmission lines.

Designing and manufacturing of Control panel depend on the requirement of utilities and these can broadly be classified as follows:

- Line Protection
- Transformer Protection
- Bus Bar Protection
- Tie Breaker
- Bus Coupler
- Reactor

Annunciator:

This consists of:

a. Master trip relay operated

b. Trip circuit

c. Low oil level alarm

d. Over current relay operated

e. Winding temp alarm

f. Earth fault relay operated

g. Differential relay operated

h. Isolator connected indicator

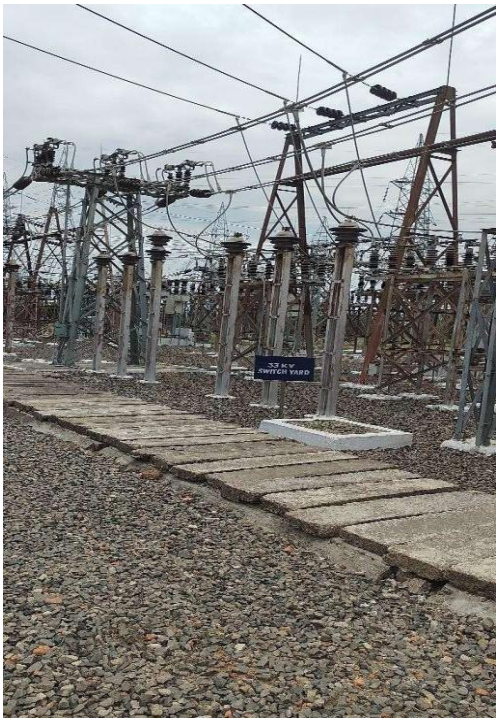
10. SCADA System:

In order to ensure the proper functioning of substations and related equipment such as line- mounted switches and capacitors, most utilities use SCADA (supervisory control and data acquisition) systems to automate monitoring and control.

The SCADA system consists of a master control station with one or more PC-based human machine interfaces (HMIs). The SCADA system may also contain other secondary control stations with HMIs, and large substations may also have local HMIs.

11. SWITCH YARD PANNEL:

In an electric power transmission grid system, switch yard reactors are installed at substations to help stabilize the power system.



12. DC SYSTEM FOR RELAY OPERATION:

We know all the controlling equipment link SCADA system and all relays are work on DC So we need to DC supply as well therefore we need a battery bank to store power.

13. <u>BATTERY BANK</u>:

It is nothing but combination of so many batteries.

14. BATTERY CHARGERS FOR BATTERY BANK:

15. SOLAR SYSTEM FOR EMERGENCY SUPPLY:

A solar cell panel, solar electric panel, photovoltaic module or solar panel is an assembly of photovoltaic cell mounted in a frame work for installation.

Solar panel use sun light as a source of energy to generate direct current electricity.

16. FIRE PROTECTION OF SUBSTATION:

The fire protection device should be kept in store yard for safety of equipment during storage. It can be useful in the time of danger. This includes fire extinguishers, constant supply of water etc.

Types of fire extinguishers used in substation:

CO2 Fire Extinguishers:

CO2 fire extinguishers contain pure carbon dioxide which is a clean extinguishant, leaving no residue. Suitable for class B flammable liquid fires (petrol, oil, solvents), and recommended for use on live Electrical equipment.

17. CONCLUSION:

➢ It was a great experience to me to work on this training. Now from this training I am aware of how the transmission of electricity is done. I learned about the various parts of the Substation as well as the grid and its interconnections. I learned how to work in a professional challenging environment and understand the real-life situation in the industry.

THANK YOU!