SOUTH BIHAR POWER DISTRIBUTION COMPANY LIMITED
OFFICE OF THE ELECTRICAL EXECUTIVE ENGINEER,
ELECTRIC SUPPLY DIVISION, DANAPUR
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CERTIFICATE

This is to certify that *Sri Rahul Kumar*, B.Tech. (EEE), Roll No.194001, *NSIT, Bihta* has successfully completed his/her In-plant Training at *Electric Supply Sub- division, Danapur under Electric Supply Division, Danapur from* 06.07.2022 to 05.08.2022. During the period of training his/her behaviour and conduct was very good.

(Anil Kumar)
Electrical Executive Engineer
Electric Supply Division
Danapur

Electrical Executive Engineer
Electric Supply Division
Danapur

Netaji Subhas Institute Of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"SUMMER TRAINING REPORT"

Undertaken by

SOUTH BIHAR POWER DISTRIBUTION COMPANY LIMITED, DANAPUR

IN THE MONTH OF JULY-AUGUST 2022

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL& ELECTRONICS ENGINEERING

Submitted by:

RAHUL KUMAR (194001)

Submitted to:

Department of Electrical &Electronics Engineering

NSIT, Bihta

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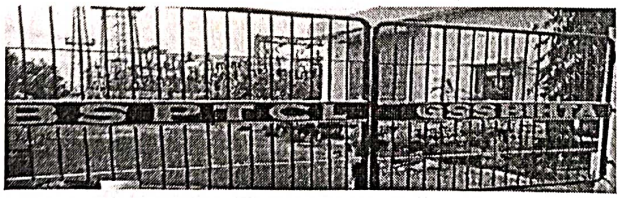
INTRODUCTION

- I was being trained at the 132/33 KV BIHTA grid under the Patna West Division.
- An electric substation is a subsidiary of an electricity generation, transmission and distribution system where voltages are transformed high to low or reverse using transformers.
- Electric power may flow through several substations between generation plant and consumer and may change in voltage in several steps.
- The 132/33 KV Bihta grid consist of transformers (4*50 MVA) of which are step down transformer and two Substation transformer rating of 315 KVA.
- They all step down 132 KV power to 33 KV, one substation transformer step down 33 KV to 440 V at grid.
- Here are the incoming sources of power are:-

a) Two circuit 132 KV, Coming from KHAGAUL GSS.

b) Two circuit 132 KV, Coming from BIHTA (NEW) GSS.

- The outgoing 33 KV power is further stepped down to 11 KV which is transmitted to the nearby areas of Bihta from the substation.
- There are all together 8 outgoing feeders and 2 GIS feeder.
- There are two battery room of 2.2*110 Volt and 2.2*24 Volt batteries are available.



Generation of Electricity:

Generator –

- The Electrical Generators are devices that convert kinetic energy into electrical energy. It is the most commonly used method for generation of electricity around the world.
- The generators contain turbines that rotate using kinetic energy of any other source such as water in dam, steam, wind etc. Upon rotation of the turbine, the magnetic field & conductors interacts with each other & generates electricity.
- The generators can be designed to generate alternating current (AC) or direct current (DC) depending on its design & requirement. We mostly use AC generators in our power plants due to its easier voltage conversion & transmission benefits.
- This method is used in huge power generation plants that supply electricity to the whole cities in ranges of Megawatts of power. **Electrochemistry –**
- Electrochemistry deals with relation between chemicals & electricity. In such method, the chemical energy inside chemicals is converted into electrical energy. The chemical reaction release electrons which can flow out through a metal electrode.
- Metal electrodes are place inside a chemical called electrolyte. The chemicals react with the electrodes & exchange electrons that flow out through the electrodes into the electrical circuit thus generating electricity. This process can be reversed to store the same electrical charge inside the chemical.
- Such method of electricity generation is used in batteries. Batteries can be of two types i.e. primary battery and

secondary battery. The primary batteries are not rechargeable & it can't be used once it's fully discharged. It is also known as disposable batteries.

Photovoltaic Effect –

- The conversion of light energy into electrical energy is called photovoltaic effect. In this process, the material generates electricity when it is exposed to light. A solar panel works on the same phenomenon using the sun as the source of light energy & converts it into electricity.
- The solar panels contain small photovoltaic cells. Each photovoltaic cell is made of semiconductor material. The photon (light particle) hits & knocks off electrons from it that flows out through the circuit. These electrons flow in a single direction which is why solar panels generate DC electricity.
- The DC supply can be easily converted into AC using Power inverter. We use multiple solar panels in remotes areas to generate electricity. It is also used as secondary power source in day-light for houses & businesses.

Transmission Lines

Transmission lines are the conductors that serve as a path for transmitting electrical waves through them. These basically form a connection between transmitter and receiver in order to permit signal transmission. Transmission lines in microwave engineering are known as distributed parameter networks. As their voltage and current shows variation over its entire length. It enables the transfer of electrical signals by a pair of conducting wires that are separated from each other by a dielectric medium which is usually air.

Transmission lines are majorly classified into three categories:

Open-wire transmission line: These are the conductors having 2 lines (wires) that are separated by dielectric medium whose, one end connected to the source and other to the destination. These are low cost and simplest form of transmission line. But, their installation cost is somewhat higher as well as its maintenance sometimes becomes difficult due to the change in atmospheric conditions.

Coaxial cable lines: These lines are formed when a conducting wire is coaxially inserted inside another hollow conductor. These are termed as coaxial as the 2 conductors share the same axis. These are widely used in applications where high voltage levels are needed.

Waveguides: This category of the transmission line is used for signal transmission at microwave frequencies. These are basically hollow conducting tubes as they somewhat resemble like coaxial cable line but do not have centre conductor as present in coaxial cables.

Applications: For the transmission of a signal having a highfrequency range over short as well as long distance, transmission lines are used. At the same time, this reduces the loss of power during transmission.

POWER TRANSFORMER

This is the most common type of transformer which converts high voltage to low voltage. It has power rating ranging from miliwatt to megawatt. If a load is connected to the secondary, current will flow in the secondary winding, and electrical energy will be transferred from the primary circuit through the transformer to the load. In an ideal transformer, the induced voltage in the secondary winding (Vs) is in proportional to the primary voltage (Vp) and is given by the ratio of the number of turns in the secondary (Ns) to the number of turns in the primary (Np) as follows:

$$Vs/Vp = Ns/Np$$

By appropriate selection of the ratio of turns, a transformer thus enables an alternating current (AC) voltage to be "stepped up" by making Ns or "stepped down" by making Ns less than Np. The winding are coils wound around a ferromagnetic core, air-core transformers being a notable exception.

- The main components of power transformer are: a)

Main tank.

b) Diverter tank containing on load tap changer.

c) Conservator tank.

d) Bushing and bushing studs for insulation.

e) Breather.

f) Winding temperature indicator which denotes the winding
temperature and oil temperature indicator.

g) Cooler units, fan and pumps for maintaining the temperature
of the transformer.

h) Buccholz relay located between main tank and conservator tank .

i) RS 1000 relay located between diverter tank and conservator
tank .

J) Magnetic oil level gauge.

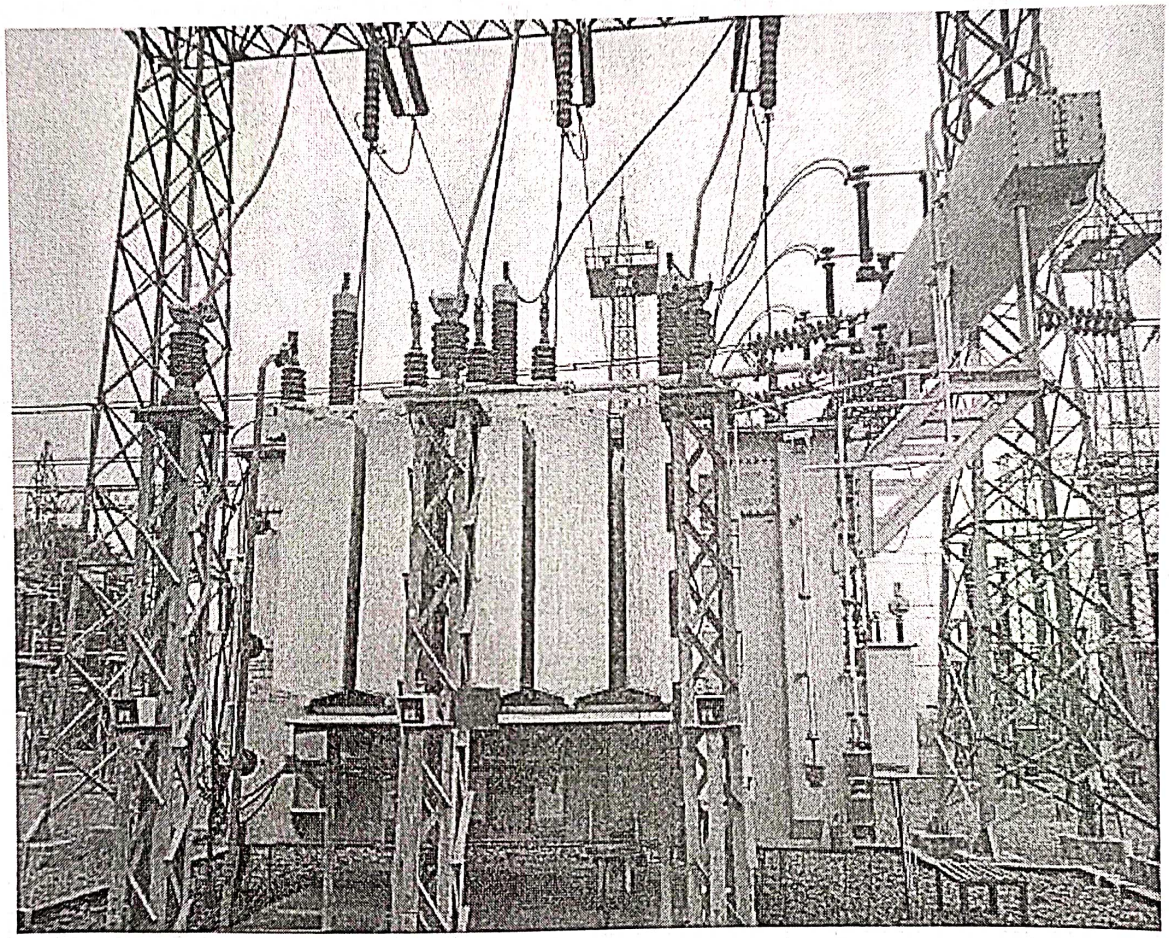


Fig:-POWER TRANSFORMER

PROTECTION EQUIPMENT

▪ LIGHTNING ARRESTER :-

A lightning arrester is a device used on electrical power systems and telecommunications systems to protect the insulation and conductors of the system from the damaging effects of lightning. The typical lightning arrester has a high voltage terminal and a ground terminal. When a lightning surge (or switching surge, which is very similar) travels along the power line to the arrester, the current from the surge is diverted through the arrestor, in most cases to earth.

Lightning arresters built for power substation use are impressive devices, consisting of a porcelain tube several feet long and several inches in diameter, typically filled with disks of zinc oxide. A safety port on the side of the device vents the occasional internal explosion without shattering the porcelain cylinder.

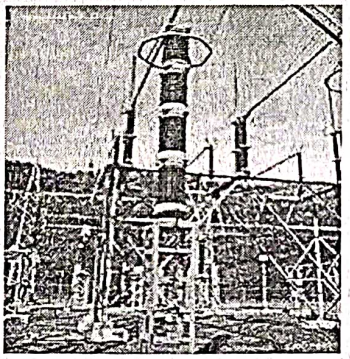


Fig:-**LIGHTNING ARRESTER**

▪ WAVE TRAP:-

Wave trap is used to create a high impedance to the carrier wave highfrequency communication entering into unwanted destinations, typically substations. Carrier wave communication uses up to 150kHz to 800kHz frequency to send all the communication. This highfrequency damages the power system components which are designed to operate 50 or 60 Hz. Wave traps are also called line traps.

- Line traps are connected in series with the power lines and thus their coils are rated to carry the full line current.

- The impedance of a line trap is very low at the power frequency and will not cause any significant voltage drop.

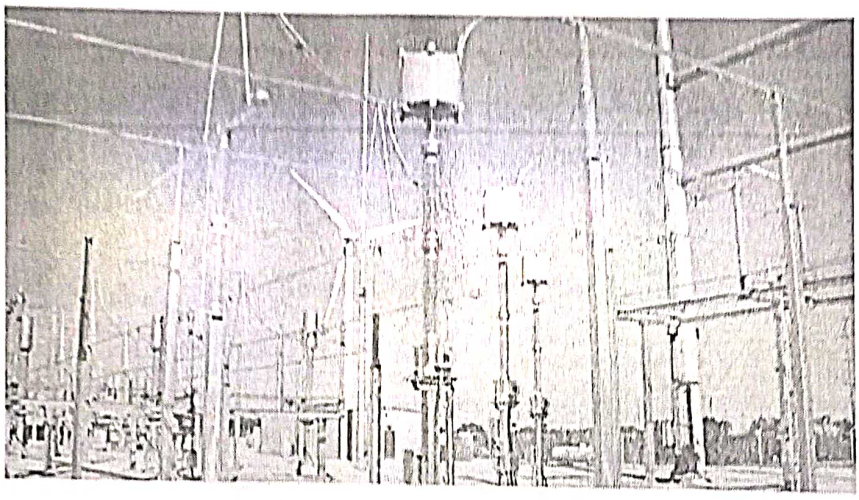


Fig:- **WAVE TRAP**

- **CAPACITOR VOLTAGE TRANSFORMER:-**

  Capacitor Voltage transformer is a switchgear device used to convert high transmission class voltage into easily measurable values, which are used for metering, protection, and control of high voltage systems.

Additionally, a CVT is used as coupling capacitors for coupling high-frequency power line carrier signals to the transmission line.

In an electrical power substation, Capacitor Voltage Transformer in combination with Wave Trap is placed at the sending and receiving ends of the substation. At the receiving end, they are found just after the lightning arrester and before the line isolator.

Applications :

- Voltage Measuring: They accurately transform transmission voltages down to useable levels for revenue metering, protection and control purposes.

- Insulation: They guarantee the insulation between the HV network and LV circuits ensuring safety condition to control room operators.

- HF Transmissions: They can be used for Power Line Carrier (PLC) coupling.

- Transient Recovery Voltage: When installing in close proximity to HV/EHV Circuit Breakers, CVT's own High Capacitance enhance C/B short line fault.

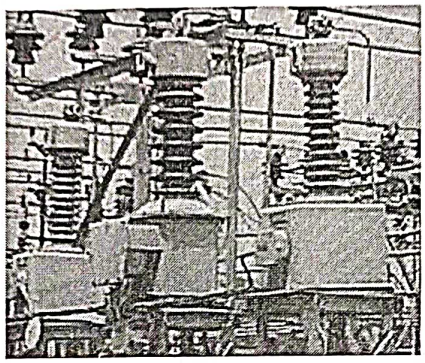


Fig:- **CAPACITOR VOLTAGE TRANSFORMER**

- **CURRENT TRANSFORMER :-**

These are the instrument transformer. The secondary winding of the C.T is connected to the instruments placed on the panel boards. The secondary winding is also connected to various relays for their operation. The major functions of a current transformer are metering of power to track energy use, monitoring of current flow through an energy grid, controlling of state or a circuit in a ground fault circuit interrupter and protection of instruments and appliances.

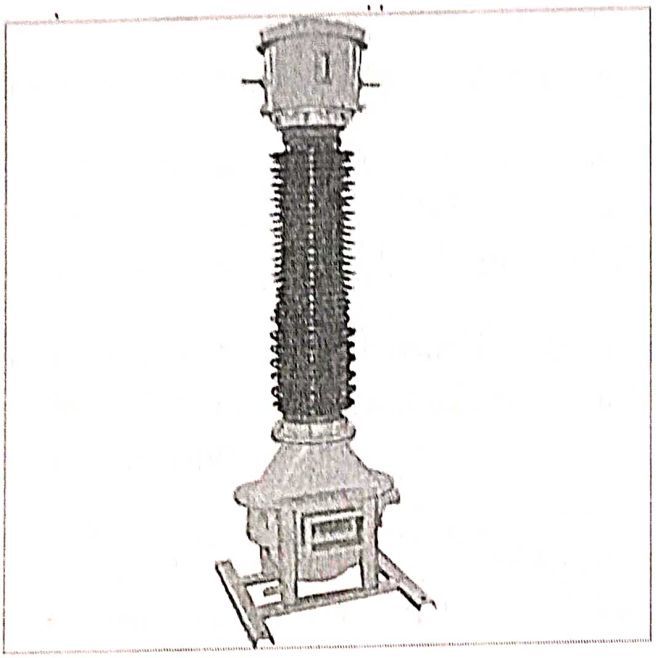


Fig:- **CURRENT TRANSFORMER**

- **CIRCUIT BREAKER:**

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

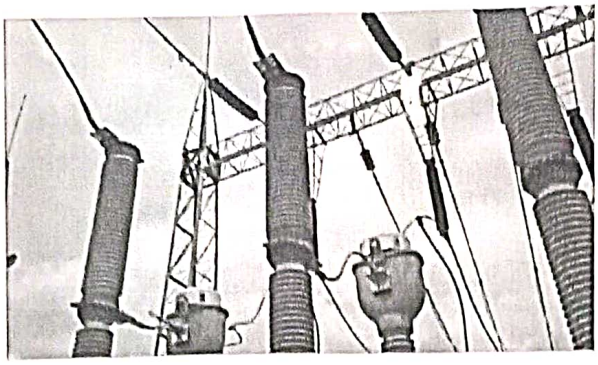


Fig:- **CIRCUIT BREAKER**

❖ CLASSIFICATION OF CIRCUIT BREAKER:-

- The circuit breaker can be classified on the basis of rated voltages. Circuit breaker below rated voltage 1000V are called low voltage circuit breaker and above 1000V called voltage circuit breakers.

- The type of the circuit breaker is usually identified according to medium arc extinction. The classification of the circuit breakers on the medium arc extinction as follows:

a. Air break breaker. Miniature circuit breaker.

b. Oil circuit breaker (tank type or bulk oil).

c. Minimum oil circuit breaker.

d. Air blast circuit breaker.

e. Sulphur hexafluoride circuit breaker.(single pressure double pressure).

f. Vacuum circuit breaker.

VACUUM CIRCUIT BREAKER: - In vacuum circuit breaker the fixed and moving contacts are housed inside a permanently sealed vacuum interrupter. The arc is quenched as the contacts are separated in high vacuum.

Fig:- **VACUUM CIRCUIT BREAKER**

Operating principle Of Circuit breaker: A circuit breaker is a device which Makes or breaks a circuit either manually or by remote contact under normal (full load) conditions.

Breaks a circuit manually or by remote control under abnormal conditions. Breaks a circuit automatically under abnormal conditions i.e. fault conditions.

Thus circuit breaker is just a switch, which can be operated under normal and abnormal conditions both manually and automatically.

To perform the above operation a circuit breaker essentially consists of fixed and moving contacts, called electrodes. When fault occur on the power system, the trip coil of the circuit breaker is energized, which pulls apart the moving contacts from the fixed contacts, thus opens the circuit. When the moving contacts are separated from the fixed contacts, an arc is struck between them.

▪ ISOLATORS:

One of the cardinal measures for ensuring full safety in carrying out work on piece of equipment in electrical installation is to disconnect reliably the unit or section on which the work is to be performed from all other live parts of the installation. To guard against mistake it is necessary that an apparatus, which make visible break in the circuit, should do this. Such an apparatus is the isolator.

TYPES OF ISOLATOR:-

1. Tandem Isolator
2. Line Isolator
3. Main Bus Isolator

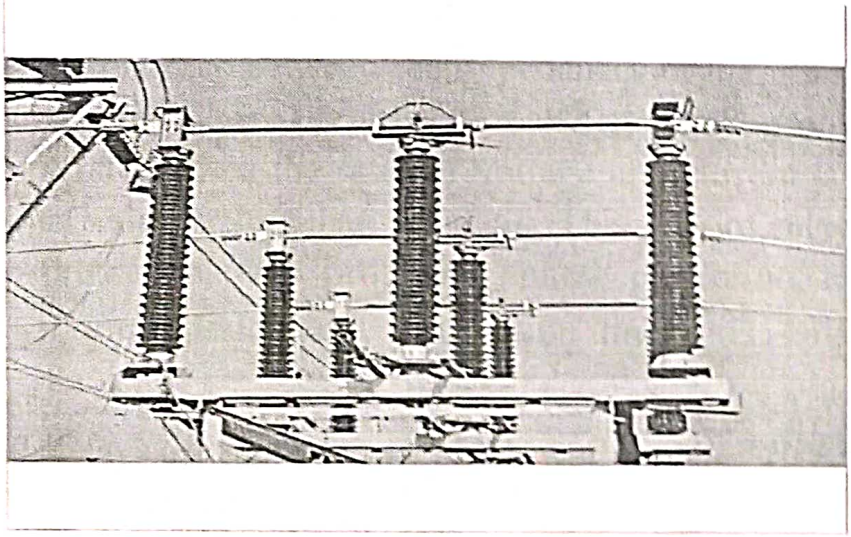


Fig:- **ISOLATORS**

RELAY PANEL:-

The relay panel consists of various types of relay whose function is being controlled in the control room. It is located at the back of the control room.

RELAYS

Relay is a device that detects the fault mostly in the high voltage circuit and Initiates the operation of the circuit breaker to isolate the defective section from the rest of the circuit.

Whenever fault occurs on the power system, the relay detects that fault and closes the trip coil circuit. This results in the opening of the circuit breaker, which disconnects the faulty circuit. Thus the relay ensures the safety of the circuit equipment from damage, which the fault may cause.

- **Distance relay**:-

The distance relay is also referred to as the impedance relay or distance protection element or voltage-controlled device. It's working mainly depends on the distance between the impedances of the points where the fault occurs and where the relay is installed (feeding point). The relay gets operated when the ratio of voltage and current is set to a predetermined value or less than the relay. This type of relay is used for backup protection, fault protection, phase protection, and main protection of transmission and distribution lines. **Differential relay**:-

Differential Relays are those relays which work on the 'difference' of the controlling (or actuating) signals. Differential Relays operate when the phasor difference of two or more similar electrical quantities exceeds a predetermined value. A current differential relay operates based on the result of comparison between the magnitude and phase difference of the currents entering in and leaving out of the system to be protected.

Under normal operating condition, the currents entering and leaving are equal in magnitude and phase so the relay is inoperative. But if a fault takes place in the system, these currents are no longer equal in magnitude and phase. Hence the relay coil is energized under fault

condition due to the difference quantity of the current. Thus, the relay operates and opens the circuit breaker so as to trip the circuit.

- **Backup relay:-**

Back-up protection is the name given to a protection which backs the primary protection whenever the primary protection failed to operate during fault condition. The back-up protection by definition is slower than the primary protection system. The design of the back-up protection needs to be coordinated with the design of the primary protection and essentially it is the second line of defense after the primary protection system. Here the backup protection and primary protection do not have anything common. Generally, the backup protection is located in different location. From the cost effect and economy point of view the backup protection will be implemented to protect the system against short circuit.

- **Overvoltage relay:-**
  Relay that serves primarily the same purpose as an over current relay except that it is connected in the line by a potential transformer which measures the voltage across the line. When an overvoltage exists the relay operates and opens the circuit breaker.
- **Relay valve:-**
  Protective relay valve are devices that are connected to instrument transformers to receive input signals and to circuit breakers to issue control commands for opening or closing. In some instances, the relays are also connected to the communication channels to exchange information with other relays.

DC SYSTEM

BATTERY BANK:-

The battery bank consists of a total of 110 batteries connected in series each of emf 2.2 Volt and 24 batteries of 2.2 Volt. The specific gravity of liquid inside the battery is 1250 kg per cubic meter. For the regular functioning of batteries they need to be charged regularly.
This is done by two methods

1. BOOST CHARGING:- It is partial charge of storage of battery usually at a high rate for a short period. Mainly used for new batteries.
2. FLOAT CHARGING:- It means charging a battery at a similar rate as to its self discharging i.e. gradually loosing charge in running batteries. Care must be taken that charge rate should not be greater than discharge rate otherwise overcharging and possible damage or leakage rate otherwise overcharging and possible damage or leakage may occur.

Fig:- **BATTERY BANK**

CONTROL ROOM

The control room is the most important section of the Bihta grid. All faults can be detected and all transformers can be controlled from the control room. The control room consists of:

A) Relay and control panels

B) D.C. battery charger panel

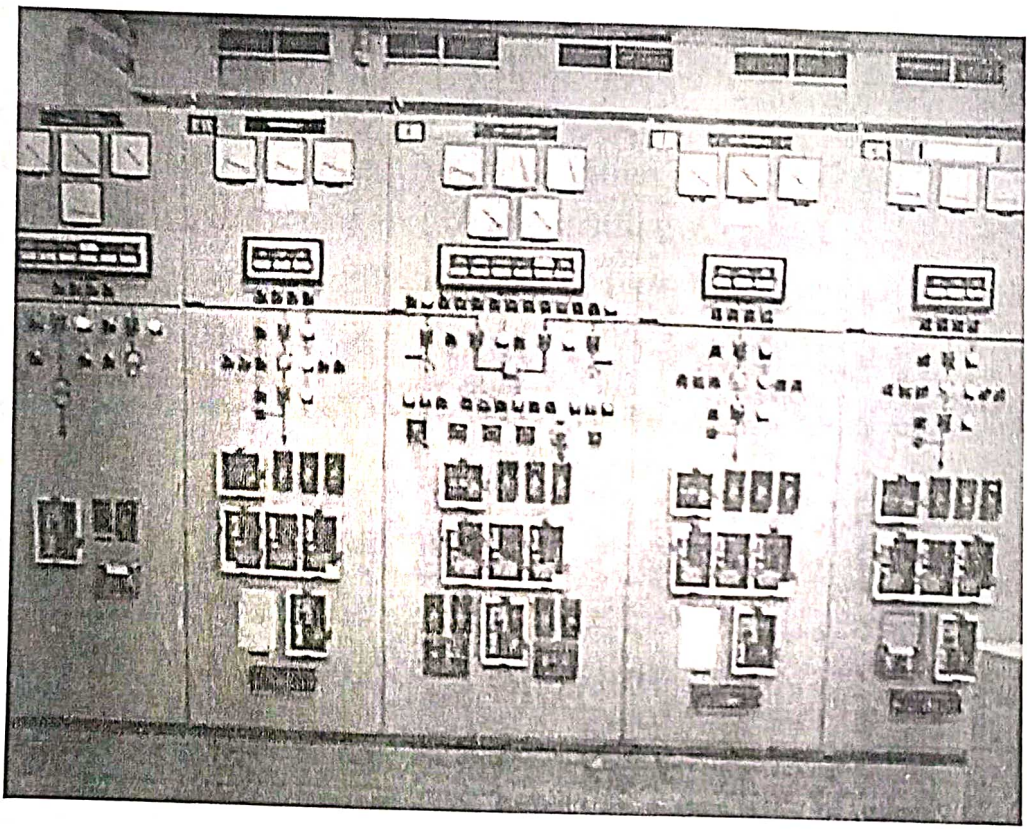


Fig:- **CONTROL ROOM**

GIS(GAS INSULATED SUB STATION)

- Gas-insulated substations (GIS) have been used in power systems over the last three decades because of their high reliability, easy maintenance, small ground space requirement, etc.
- Gas Insulated Substation (GIS) also called SF6 Gas Insulated Metal clad Switchgear is preferred for 12kV, 36kV, 72.5kV, 145 kV, 245 kV, 420 kV, and above voltages.
- In a GIS substation, the various equipment like Circuit Breakers, Bus bars, Isolators, Load break switches, Current transformers, Voltage transformers, Earthing switches, etc. are housed in separate metal-enclosed modules filled with SF6 gas. The SF6 gas provides the phase to ground insulation.
- GIS can save up to 90% of space compared with air insulated substation. It is particularly suitable for indoor and outdoor applications.

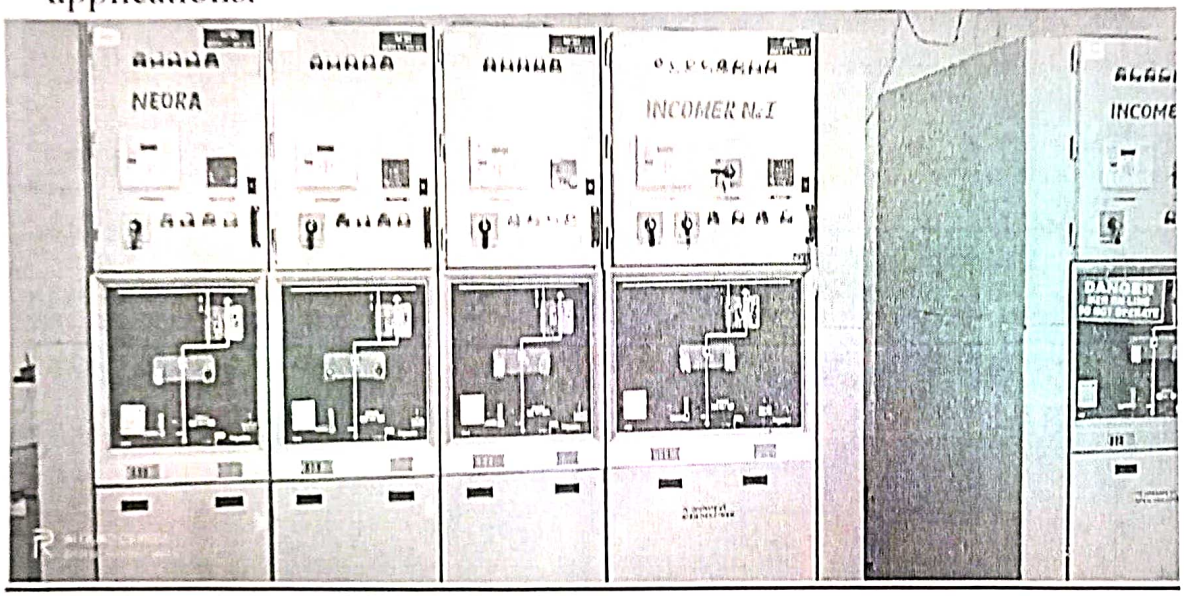
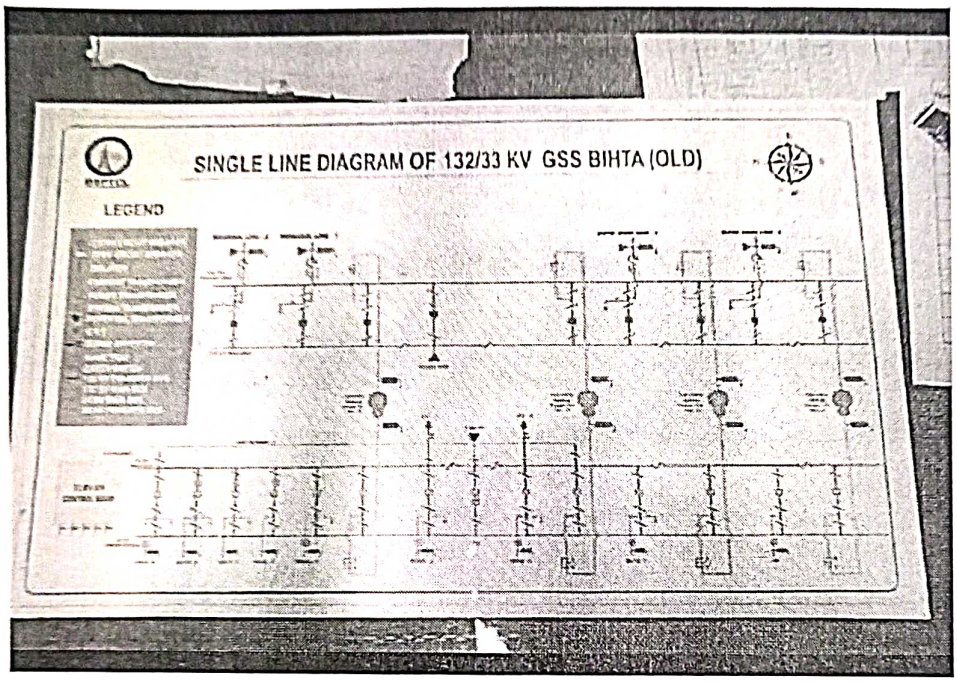


Fig:- GIS (GAS INSULATED SUB STATION)

SINGLE LINE DIAGRAM (SLD)

A Single Line Diagram (SLD) of an Electrical System is the Line Diagram of the concerned Electrical System which includes all the required ELECTRICAL EQUIPMENT connection sequence wise from the point of entrance of Power up to the end of the scope of the mentioned work.



CONCLUSION:

By doing summer training at the 132/33 KV Bihta Grid I came to know about the different types of equipments being used like isolators, circuit breakers, relays. I was exposed to different types of equipments and I also come to know about how the operating units are maintained and functioned. I also came to know about how the functions equipments kept in the switchyard are brought in the control room and operated from there was also taught about how the equipments were controlled if there was a fault in any of the circuits.

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CERTIFICATE

This is to certify that ABHISHEK KUMAR YADAV Branch.....E.E.E.....Registration no./Roll No..20110103008..... college.....NSIT Bihta, PATNA.....has successfully completed his/her in-Plant Training at 220/132/33 KV GSS.....under transmission Division Patna West), from..03../.02../2023 to ..02..../.03../2023 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was.....Good.

Place: Patna

Issue Date:..20/03/2023.....

EEE/TD/ Patna
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Electrical Executive Engineer
Transmission Division Patna (West)

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University,Patna (Bihar)

"INTERNSHIP PROGRAM"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED,

THE MONTH OF FEBRUARY 2023

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELCTRONICS ENGINEERING

Under the guidance of

Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:
ABHISHEK KUMAR YADAV
(2040012)

Submitted to:
Department of Electrical & Electronics Engineering
NSIT Bihta, Patna


Certificate of Completion
techgyan
CERTIFICATE
OF COMPLETION
Abhishek Singh
is presented with this certificate on successful completion of
WEB DESIGN WITH HTML/CSS
Under the guidelines and norms of the program structure
Conducted during the month of February & March 2023.
Sonam Sherwal
Coordinator
Techgyan Technologies
Drashti Abhilekh Sheth
Founder
Techgyan Technologies

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY,

BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta knowledge University Patna (Bihar)

REPORT

BASED ON THE TRAINING DONE AT **ABHYUDAY, IIT BOMBAY** IN THE MONTH OF JUNE-AUG 2022 IN **WEB DEVELOPMENT.**

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLGY

With specialization in

Electrical & Electronics Engineering

Submitted by:

ABHISHEK SINGH (194016)

B.tech (EEE)

4th year/7th semester

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

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CHAPTER 1

INTRODUCTION

1.1 Introduction

As a full-time student at NSIT, I was provided an opportunity to undertake an internship at TECHGYAN. The degree towards I am currently studying is a Bachelor of Engineering in Electronics and Communication. The course at Techgyan was quite challenging for me for a few reasons: Firstly, the programming languages and development tools I was using were new for me, hence I had to quickly integrate not only with my new living environment but also academically. This was very beneficial for me as at the end I could compare what I've learnt with what I already knew and find a connection between the two.

This report is a description of my 8 weeks internship carried out as a compulsory component of the course at Techgyan. In the following chapter details of tools and technology used and an overview is given. Afterwards, I explain my project work and give specific technical details about my work. Finally, a conclusion is drawn from the experience.

1.2 Objective

The objective of the web design is to handle the entire design of a website. The software keeps track of all the information about the entire website. The system contains database where all the information will be stored safely.

1.2.1 To gain skills and knowledge

This internship provided us essential skills and knowledge one requires in the field of web designing. The crucial tools used, helped us in gaining knowledge about programming languages.

1.2.2 To get field work experience

By taking this training we enhanced our knowledge in Web designing and got insight in how the websites are designed using HTML and CSS.

1.2.3 To enhance our communication skills

By interacting with my trainee, I got to learn a lot. It helped me to enhance my communicative skills and represent my work with confidence. It boosted my confidence to design more webpages and create some great designs just for fun.

1.2.4 To link theory with practice

First, we learned the theory aspect and then we put that into practice. By doing the practical work, our concept got clearer and it was easy to code into HTML once we got familiar with it. By putting our theoretical knowledge into practical, coding became more fun.

1.2.5 To build a network

By learning how to code in HTML and CSS it is easy to build and design our own websites with all the changes we want. We also got to know about how websites are designed initially and the logic behind that.

1.3 Tools and Technology

Various tools and technology are used of web development.

Some of them are listed below:

1. HTML5

-HTML stands for Hyper Text Mark-up Language. It is used to design web pages using mark-up language. HTML is the combination of Hypertext and Mark-up language. Hypertext defines the link between the web pages. Markup language is used to define the text document within tag which defines the structure of web pages. HTML5 is the fifth and current version of HTML. It has improved the mark-up available for documents and has introduced application programming interfaces (API) and Document Object Model (DOM).

Below example illustrate the HTML5 content:

```
<!DOCTYPE html>
<html>
<head>
<title>Page Title</title>
</head>
<body> <h1>This is a Heading</h1> <p> This is a paragraph. </p> </body>
</html>
```

Output of the above program:

This is a Heading

This is a paragraph.

2. CSS3

Cascading Style Sheets, fondly referred to as CSS, is a simply designed language intended to simplify the process of making web pages presentable. CSS allows you to apply styles to web pages. More importantly, CSS enables you to do this independent of the HTML that makes up each web page.

There are three types of CSS which are given below:

- Inline CSS
- Internal or Embedded CSS
- External CSS

Below example illustrate the CSS3 content:

```
<!DOCTYPE html> <html> <head> <title> HTML 5 Demo</title> <style> .intern { font-size:40px; font-weight:bold; color:green; } body { text-align:center; } </style> </head> <body> <div class = "intern">Hello World!</div> <aside> <div>This is Aditya</div> </aside> </body> </html>
```

Output of the above program:

Hello World!

This is Aditya

3. JavaScript

JavaScript is a lightweight, cross-platform and interpreted scripting language. It is well-known for the development of web pages; many non-browser environments also use it. JavaScript can be used for Client-side developments as well as Server-side developments.

Features of JavaScript:

- According to a recent survey conducted by Stack Overflow, JavaScript is the most popular language on earth. With advances in browser technology and JavaScript having moved into the server with Node.js and other frameworks, JavaScript is capable of so much more.
- Functions in JS are objects. They may have properties and methods just like another object. They can be passed as arguments in other functions.
- Can handle date and time.
- Performs Form Validation although the forms are created using HTML.
- No compiler needed.

4. Sublime text

Artfully run by a one-man development team, the secret to sublime's success lies in the program's vast array of keyboard shortcuts -such as the ability to perform simultaneous editing (making the same interactive changes to multiple selected

areas) as well as quick navigation to files, symbols, and lines. And when you're spending 8+ hours with your editor each day, those precious few seconds saved for each process really do add up.

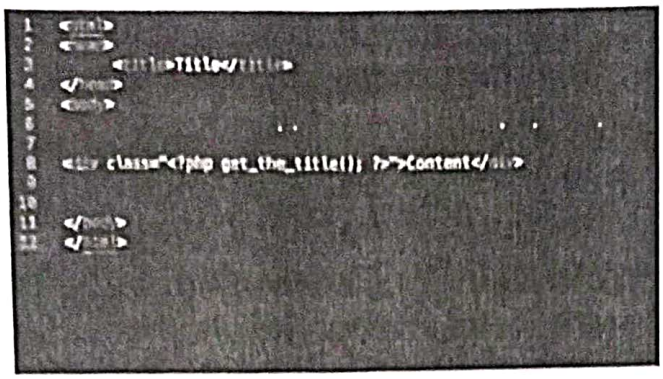

Fig.1.3.1 Sublime Text Editor

5. JQuery

(<https://careerfoundry.com/en/tutorials/web-development-for-beginners/an-introduction-to-javascript/>)JavaScript has long been considered an essential front-(<https://careerfoundry.com/en/tutorials/web-development-for-beginners/an-introduction-to-javascript/>)end language by developers, although it's not without its problems: riddled with browser inconsistencies, its somewhat complicated and unapproachable syntax meant that functionality often suffered.

That was until 2006, when jQuery – a fast, small, cross-platform (<https://en.wikipedia.org/wiki/JavaScript_library>)JavaScript library aimed at simplifying the front-end process – appeared on the scene. By abstracting a lot of the functionality usually left for developers to solve on their own, jQuery allowed greater scope for creating animations, adding plug-ins, or even just navigating documents.

Fig 1.3.2 JQuery

Chapter 2

Training work undertaken

2.1 Training Attended

According to University, the VII Semester of B.Tech ECE must involve an internship program. The students require at least 8 weeks of internship program for attaining a successful career in the related fields. There are more attendant and requirement is need to build a project. We know that, we can mix all languages like C++, C, HTML, PHP, JavaScript and more. The web server combines the results of the interpreted and executed HTML code, which maybe any type of data, including images, with the generated web page. The training that I attended In Techgyan included:

- HTML
- CSS
- BRACKETS

2.2 Roles and responsibility

As an intern my responsibilities at Techgyan, was to cover all aspects of creating web application to become a web developer. For this required core knowledge about designing tools like HTML, CSS, JavaScript, etc. The main responsibility was to ensure that the web application designed must appeal to the desired target audience and, as a result, catches their attention and also include a working knowledge of different web browsers. While learning about web development I also gained knowledge about front end designing. During my internship period I mostly worked on "Brackets" which is undoubtedly the best HTML & CSS Editor as well as other mini projects too.

2.3 Front-end & Back-end developer

Front-end Developer generally works at client side dealing with the web page design, graphics that is accessible to the user.

Back-end Developer is a person who is responsible for the back-end development that interacts with the server. This type of web developer specializes in the languages like PHP, Ruby, ASP.Net, Java and Perl.

Chapter 3

Project Work Discussion

3.1 Discussion

During entire training session we discussed about how to analysis the project and how to work on it as per the requirement. The projects done during the internship are based on the tags of programming language HTML & CSS. Here, I have also used JavaScript too.

3.2 Learning Outcome

3.2.1 HTML

- Basic Concept (WWW & HTTP, client server communication)
- Basic HTML (tags, element, attributes, paragraphs, headings, line breaks, lists, table, color codes, font, text linking, email, images, background, comments, media, charset)
- HTML Forms (input, text fields, password, checkbox, combo-box, radio box, text areas, files, buttons)
- HTML5 features

3.2.2 CSS

- Basic CSS (selector, internal, external, inline, class, id, background, font, text, padding, margin, border, list CSS, hovering and elements)
- Advance CSS (border-radius, opacity, cursor, layers, position, display, float, gradient and multiple-column)
- Concept of Menu (single menu, drop-down menu)
- Template design using CSS div.

3.2.3 Brackets

Brackets is an open-source code editor which is best suited for Website Designers and Front-end Web Developers.
It is one of the best free tools for Front End Web Development. It is lightweight, fast and easy to work with.

Important Features of Brackets:

- *Live Preview* – This feature helps you to see the output of your HTML or CSS code instantly on the browser as soon as you do the changes.
- *Extensions and Themes* – Lots of Extensions and Themes are available to customize the look, feel and ease of doing coding.
- *Quick Edit tool* – This is the best feature of this tool using which you can quickly edit the CSS and JavaScript files from your document.
- *Clean Interface* – As it is lightweight and user friendly, it has a beautiful clear interface.
- *Frequent updates & Maintainability* – As it is maintained by Adobe community, it has frequent updates and maintenance.
- *Cross Platform* – This tool works on Windows, Mac and most of the Linux distributions.

3.3 Result

Following are the screenshots of the result of the project done during the internship period.

Home page

CHAPTER 4

CONCLUSION AND FUTURE SCOPE

4.1 Conclusion

In conclusion, I can say that this internship was a great experience. Thanks to this project, I acquired deeper knowledge concerning my technical skills, but I also personally benefited. Currently HTML is a common part of web applications, and it is one of the most popular language for web designing used by professionals worldwide. If we surf internet, we can see millions of websites designed with HTML and CSS. I learned to live in a different environment from the one I am used to. Indeed, I grew more independent in work and also in everyday life. I realized that I could do more things than I thought, like learning new things by myself.

There are huge opportunities available for the students who want to work in this field. Many private and public organizations hire web designer for their online work and website development. With the rapid advent of online industry, the demand of web development professionals is increasing, and this has created a huge job opportunity for the aspirants in the upcoming days.

Also, an experienced person in this field can also work as a freelancer; there are many online companies which provide online projects to the individuals.

4.2 Future Scope

If someone has no experience in this field, finding work can be a real challenge. A successful internship can help an individual turn an experience into a career opportunity. So as a successful internship some future scopes are:

- To work in IT company.
- Can work as a Software Engineer.
- Can work as a Web Designer.
- Can work as a Web Developer.

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OFFICE OF THE ELECTRICAL EXECUTIVE ENGINEER,
ELECTRIC SUPPLY DIVISION, DANAPUR
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CERTIFICATE

This is to certify that *Sri Alok KumarDas*, B.Tech. (EEE), Roll No.194012, *NSIT, Bihta* has successfully completed his/her In-plant Training at *Electric Supply Sub-division, Danapur under Electric Supply Division, Danapur from* 06.07.2022 to 05.08.2022. During the period of training his/her behaviour and conduct was very good.

(Anil Kumar)
Electrical Executive Engineer
Electric Supply Division, Danapur

Electrical Executive Engineer
Electric Supply Division
Danapur

REPORT ON IN-PLANT TRAINING
AT ELECTRIC SUPPLY SUB-DIVISION, DANAPUR

Submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY
(ELECTRICAL & ELECTRONICS ENGINEERING) TO

ARYABHATTA KNOWLEDGE UNIVERSITY

Submitted by

Alok Kumar Das **194012** **19110103011**

Under the supervision of

Mr. ANIL KUMAR

Eectrical executive engineer
ELECTRIC SUPPLY DIVISION,DANAPUR

techgyan

CERTIFICATE
OF COMPLETION

Alok Kumar Das

is presented with this certificate on successful completion of

WEB DESIGN WITH HTML/CSS

Under the guidelines and norms of the program structure

Conducted during the month of February & March 2023.

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
Techgyan Technologies

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY,

BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta knowledge University Patna (Bihar)

REPORT

BASED ON THE TRAINING DONE AT **ABHYUDAY, IIT BOMBAY** IN THE MONTH OF JUNE-AUG 2022 IN **WEB DEVELOPMENT.**

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLGY

With specialization in

Electrical & Electronics Engineering

Submitted by:

ALOKKUMAR DAS (194012)

B.tech (EEE)

4th year/7th semester

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

नेशनल फर्टिलाइजर्स लिमिटेड

(भारत सरकार का उपक्रम)

National Fertilizers Limited

(A Government of India Undertaking)

सिबियां रोड, बठिण्डा, पंजाब - 151003

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संदर्भ संख्या : एन.एफ.बी./मा.सं.वि./ दिनांक : 27-01-2023

TO WHOMESOEVER IT MAY CONCERN

श्री अमृत कुमार सौरव, छात्र B.Tech (EEE) IV Year के अनुक्रमांक संख्या 184009 नेताजी सुभाष इंस्टिट्यूट ऑफ़ टेक्नोलॉजी, बिहटा पटना जिन्होंने एन.एफ.एल. बठिंडा में 28 दिन का व्यवसायिक प्रशिक्षण दिनांक 30-12-2022 से 27-01-2023 तक एन.एफ.एल. बठिंडा में प्राप्त किया है| प्रशिक्षण सफलतापूर्वक समाप्त होने की दशा में श्री अमृत कुमार सौरव को दिनांक 27-01-2023 से भारमुक्त किया जाता है |

Mr. Amrit Kumar Saurav student of B.Tech (EEE) IV Year Roll No. 184009 of Netaji Subhash Institute of Technology, Bihta Patna was engaged as Vocational Trainee for a period of 28 Days effective from 30-12-2022 to 27-01-2023. On successful completion of his training he is relieved on 27-01-2023.

(वैशाली तायडे)

उप. प्रबंधक (मानव संसाधन विकास)

प्रति:

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नेताजी सुभाष इंस्टिट्यूट ऑफ़ टेक्नोलॉजी, बिहटा पटना

PROJECT REPORT VOCATIONAL TRAINING AT

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ACKNOWLEDGEMENT

I am highly indebted to all faculty members of **NFL** for providing me an opportunity to have practical exposure at **NFL,Bhatinda (PUNJAB)** through I could learn how to work in a professional environment.

I express my sincere thanks to

HARBHAJAN SINGH
I.P. GUPTA

For giving me an opportunity to take part in such a valuable vocational training in his department and for their continuous assistance, guidance and valuable suggestions.

I wish my deep sense of gratitude and thanks to the staffs at the **NFL**.Their affectionate guidance has enabled to complete this training successfully.

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INDEX

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1.	UREA(PLANT)	02-11
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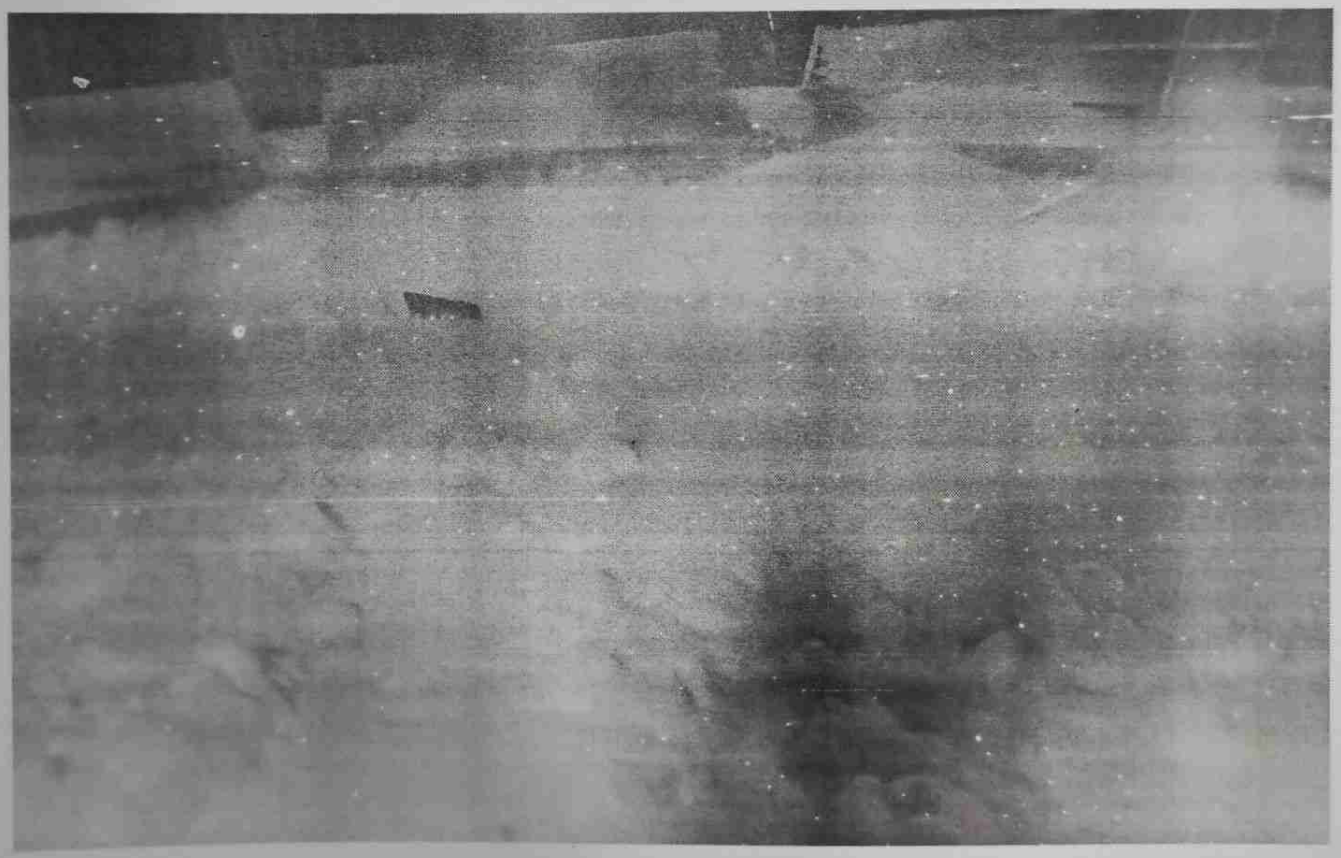
UREA

INTRODUCTION :

Urea plant is designed to produce 1550 TPD urea based on MITSUI TOATSU TOTAL RECYCLE C IMPROVED PROCESS. Ammonia and CO2, the raw material for manufacturing urea are received from Ammonia Plant and are compressed to a pressure of 250 kg/cm2 and is fed to the reactor operating at a pressure of 230 kg/cm2 and 200 deg.C.

The reactants are partially converted into urea and the solution at the exit of reactor contains about 30% urea. The unconverted ammonia and CO2 are recovered in three stages and recycled back to Reactor.



The solution at the end of 3rd stage contains about 70% urea solution and fed to the Crystallizer where solution is concentrated under vacuum and urea is crystallized. Urea crystals are separated in the centrifuges and conveyed to the top of Prilling Tower through the pneumatic duct.

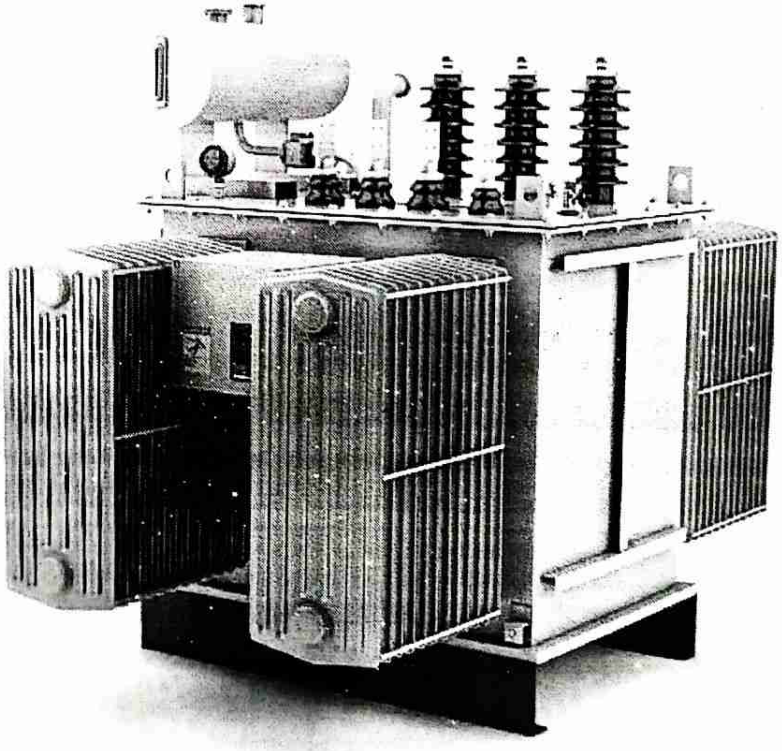
The crystals are melted by indirect heating with steam & molten urea is sprayed through Acoustic Granulators in Prilling Tower where it is cooled by air during its fall and further cooled on the fluidized bed at the bottom of Prilling Tower. Urea from Urea plant is conveyed through a set of conveyors to Bagging Plant for storage/dispatch.

TRANSFORMER

INTRODUCTION:

It is a static machine which increases or decreases the AC voltage without changing the frequency of the supply. It is a device that:

- Transfer electric power from one circuit to another.
- It accomplishes this by electromagnetic induction.
- In this the two electric circuit are in mutual inductive influence of each other.



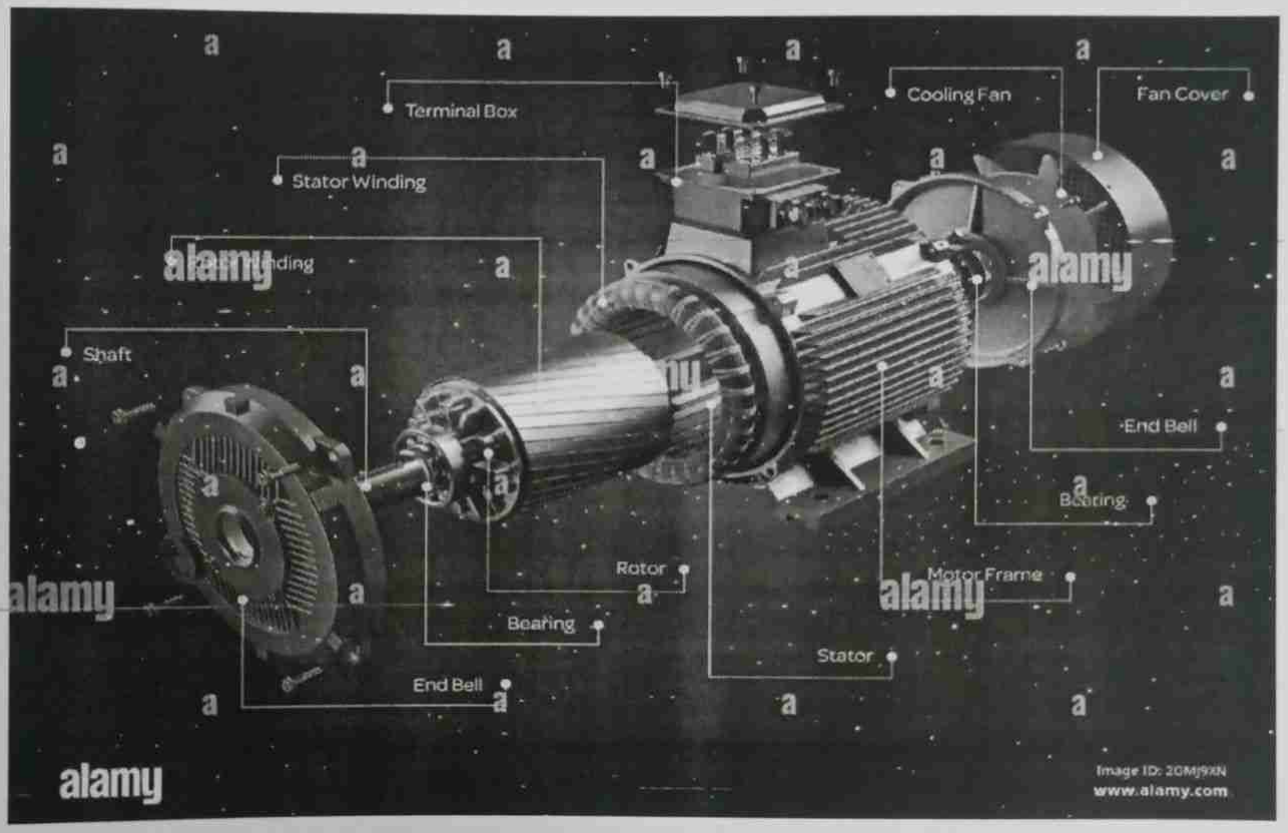
WORKING PRINCIPLE:

It works on FARADAY'S LAW OF ELECTROMAGNETIC INDUCTION (self or mutual induction depending on the type of transformer)

INDUCTION MOTOR

Definition:

An induction motor or asynchronous motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding. An induction motor can therefore be made without electrical connections to the rotor.



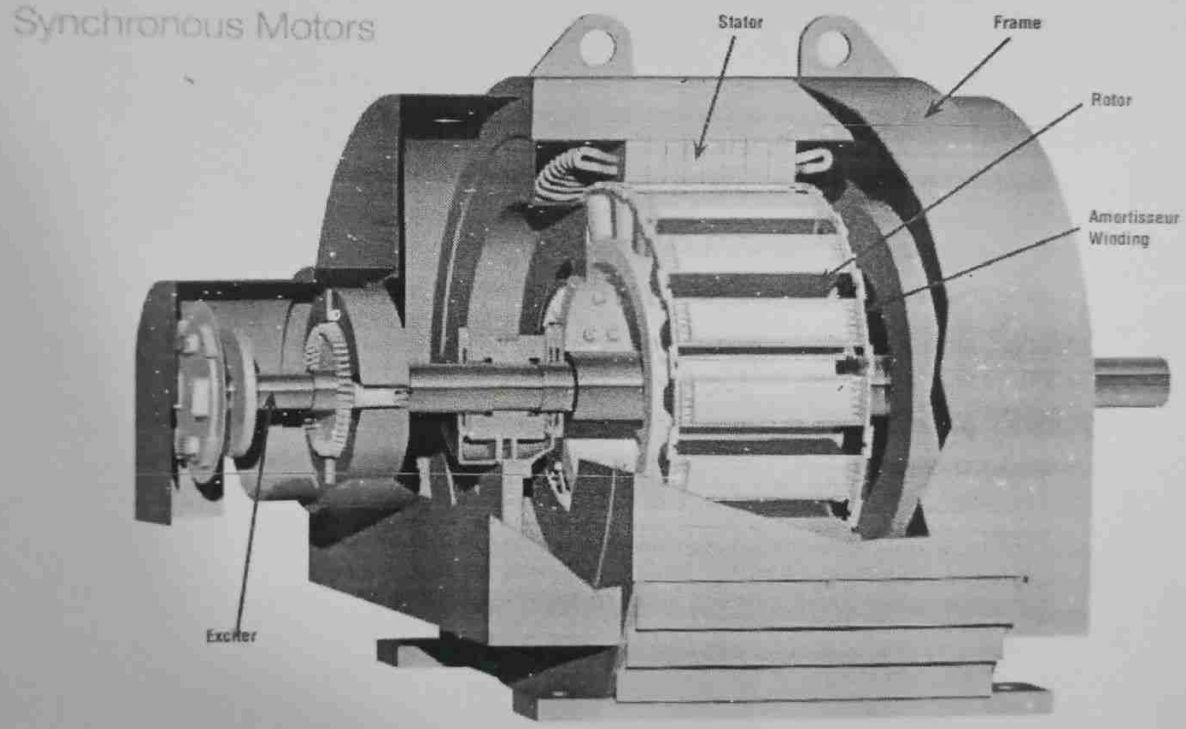
Working :

The electromagnetic induction is the phenomenon in which the electromotive force induces across the electrical conductor when it is placed in a rotating magnetic field. When the three phase supply is given to the stator, the rotating magnetic field produced on it.

SYNCHRONOUS MOTOR

Definition:

The motor which runs at synchronous speed is known as the synchronous motor. The synchronous speed is the constant speed at which the motor generates the electromotive force. The synchronous motor is used for converting the electrical energy into mechanical energy.



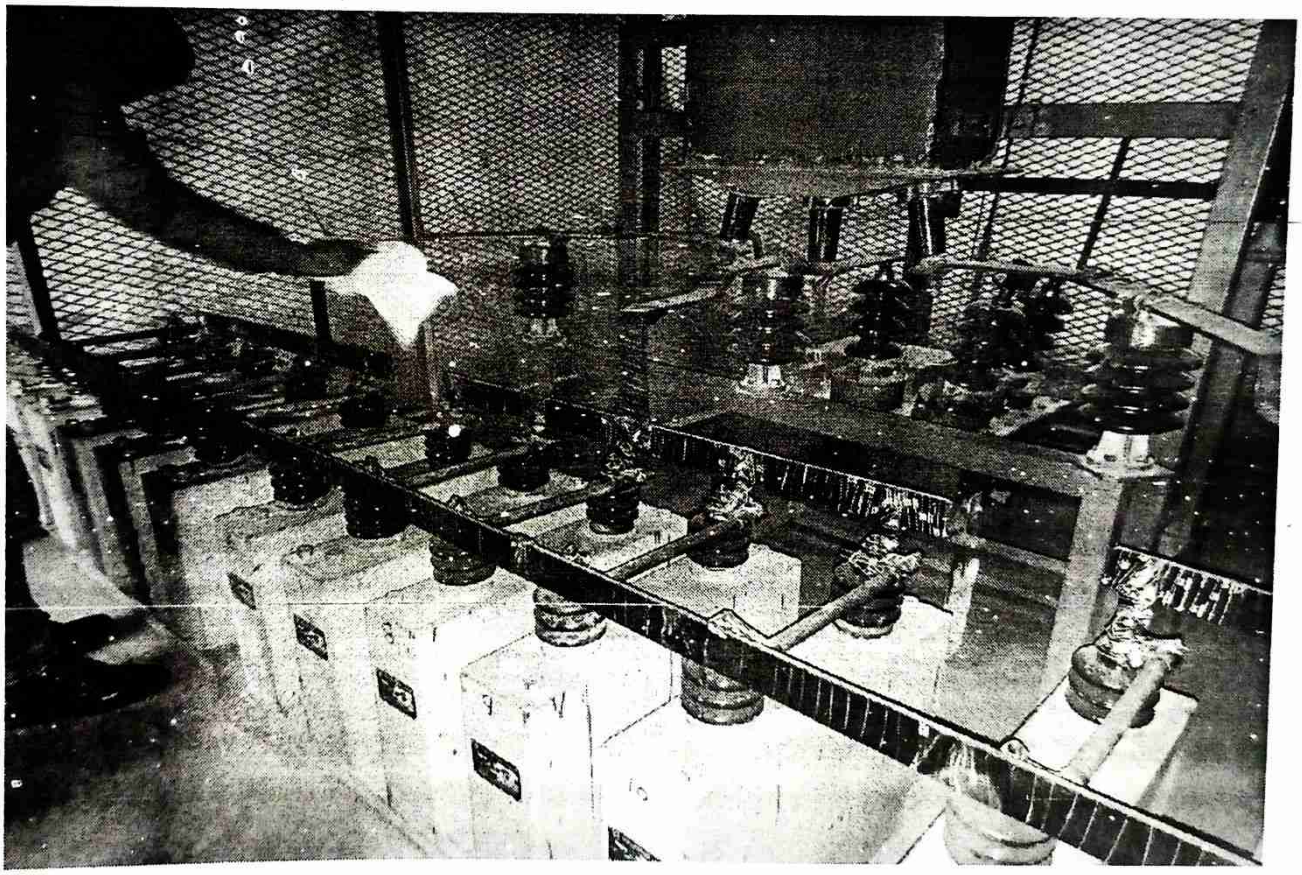
Working:

When the three-phase supply is given to the stator, the rotating magnetic field developed between the stator and rotor gap. The field having moving polarities is known as the rotating magnetic field. The rotating magnetic field develops only in the

CAPACITOR BANK

Definition:

As the name implies, a capacitor bank is merely a grouping of several capacitors of the same rating. Capacitor banks may be connected in series or parallel, depending upon the desired As with an individual capacitor, banks of capacitors are used to store electrical energy and condition the flow of that energy. Increasing the number of capacitors in a bank will increase the capacity of energy that can be stored on a single device.



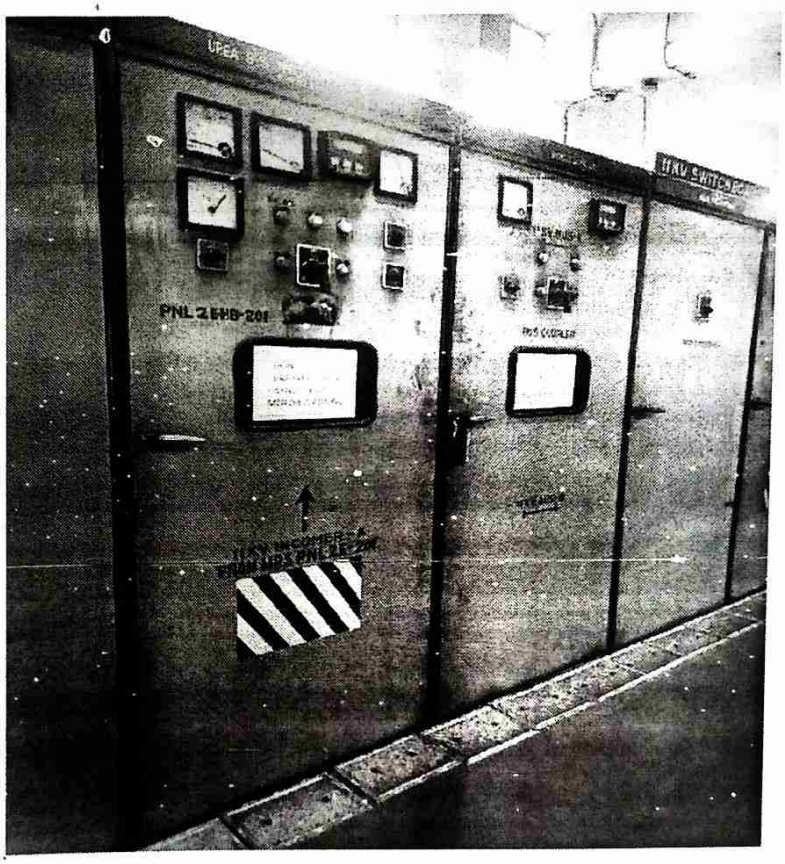
Working:

In the past, capacitor banks were relegated to isolated, low-tech, high- fenced public power stations. Today, capacitor bank applications have scaled down to nano-sized MEMS devices and outward to ocean-based wind-farm substations. Regardless of their usage, capacitor banks perform the same functions of storing and smoothing out electrical energy. This article will examine the basics of capacitor banks and their usage in a wide range of modern applications.

PANEL ROOM

Definition:

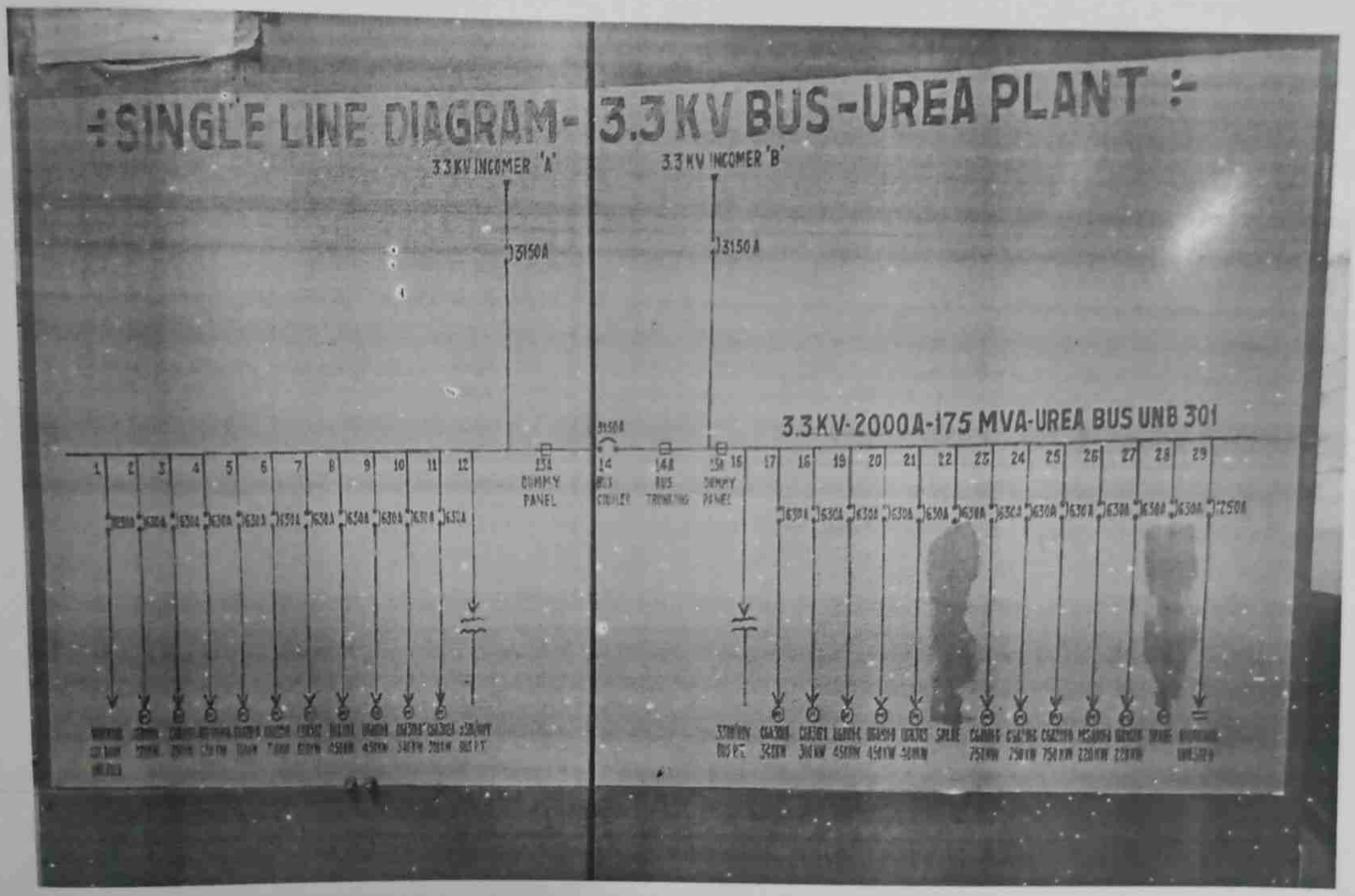
Switchgear is a broad term that describes a wide variety of switching devices that all fulfill a common need: controlling, protecting, and isolating power systems. This definition can be extended to include devices to regulate and meter a power system, circuit breakers, and similar technology.



Working:

Electrical switchgear refers to a collection of circuit protection devices (circuit breakers, fuses or switches) mounted in a common, metal enclosure. The circuit protection devices distribute power to various sections of a facility and the electrical loads within those sections.

Urea BLOCK DIAGRAM



AMMONIA

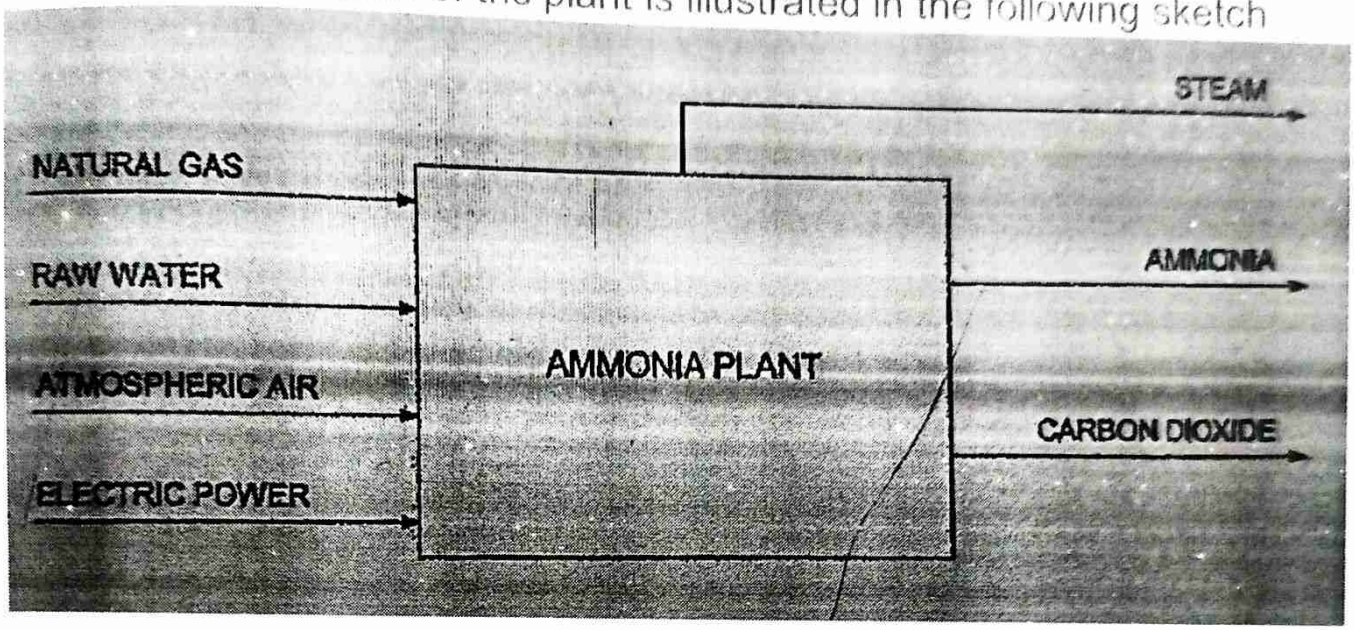
Introduction:

The document describes the process for two identical plants of National Fertilizers Limited (NFL) The name plate capacity of each plant is 900 MTPD of ammonia. The plants are based on steam reforming of natural gas and will be located at Panipat and Bathinda, in India.

This document contains information on chemical reactions, catalysts and an overview of the process in each of the main sections:

- Desulphurization
- Reforming
- CO Conversion CO, Removal
- Methanation and compression
- Drying
- Compression
- Ammonia synthesis and refrigeration
- Process condensate stripping

The main function of the plant is illustrated in the following sketch



Ammonia plant:

In the plant, ammonia is produced from synthesis gas containing hydrogen and nitrogen in the ra- tio of approximately 3:1. Besides these components, the synthesis gas contains inert gases such as argon and methane

To a limited extent. The source of H2 is demineralised water and the hydrocarbons in the natural gas. The source of

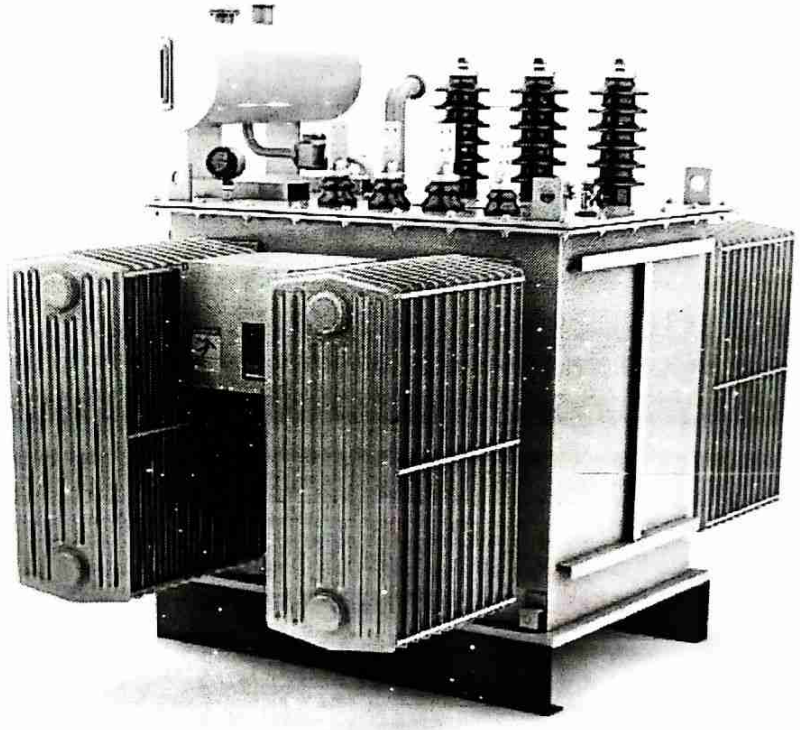
N, is the atmospheric air. The source of CO_2 is the hydrocarbons in the natural gas feed.

TRANSFORMER

INTRODUCTION:

It is a static machine which increases or decreases the AC voltage without changing the frequency of the supply. It is a device that:

- Transfer electric power from one circuit to another.
- It accomplishes this by electromagnetic induction.
- In this the two electric circuit are in mutual inductive influence of each other.



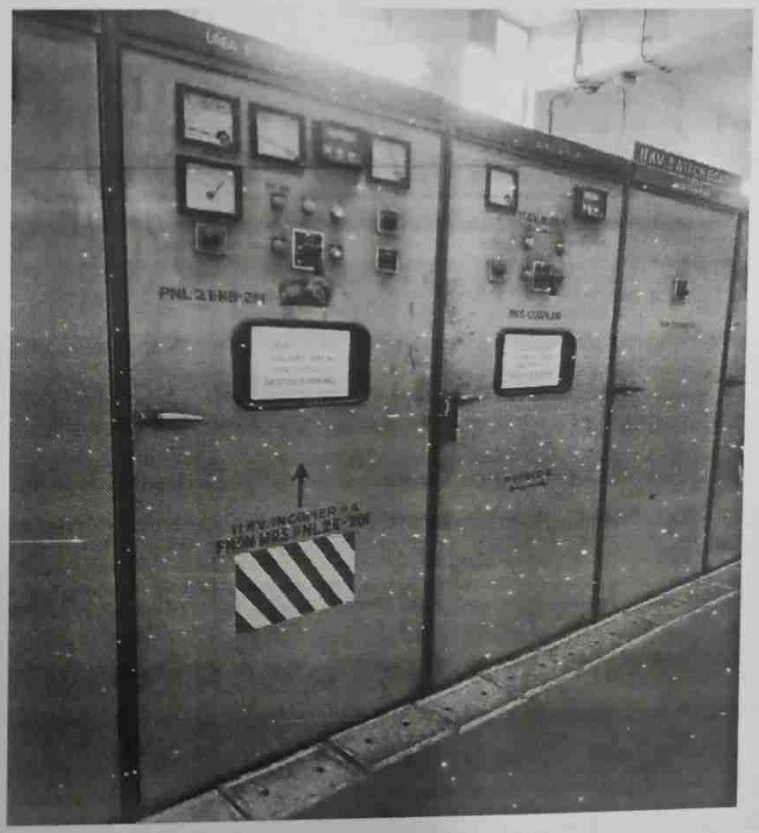
WORKING PRINCIPLE:

It works on FARADAY'S LAW OF ELECTROMAGNETIC INDUCTION (self or mutual induction depending on the type of transformer)

PANEL ROOM

Definition:

Switchgear is a broad term that describes a wide variety of switching devices that all fulfill a common need: controlling, protecting, and isolating power systems. This definition can be extended to include devices to regulate and meter a power system, circuit breakers, and similar technology.

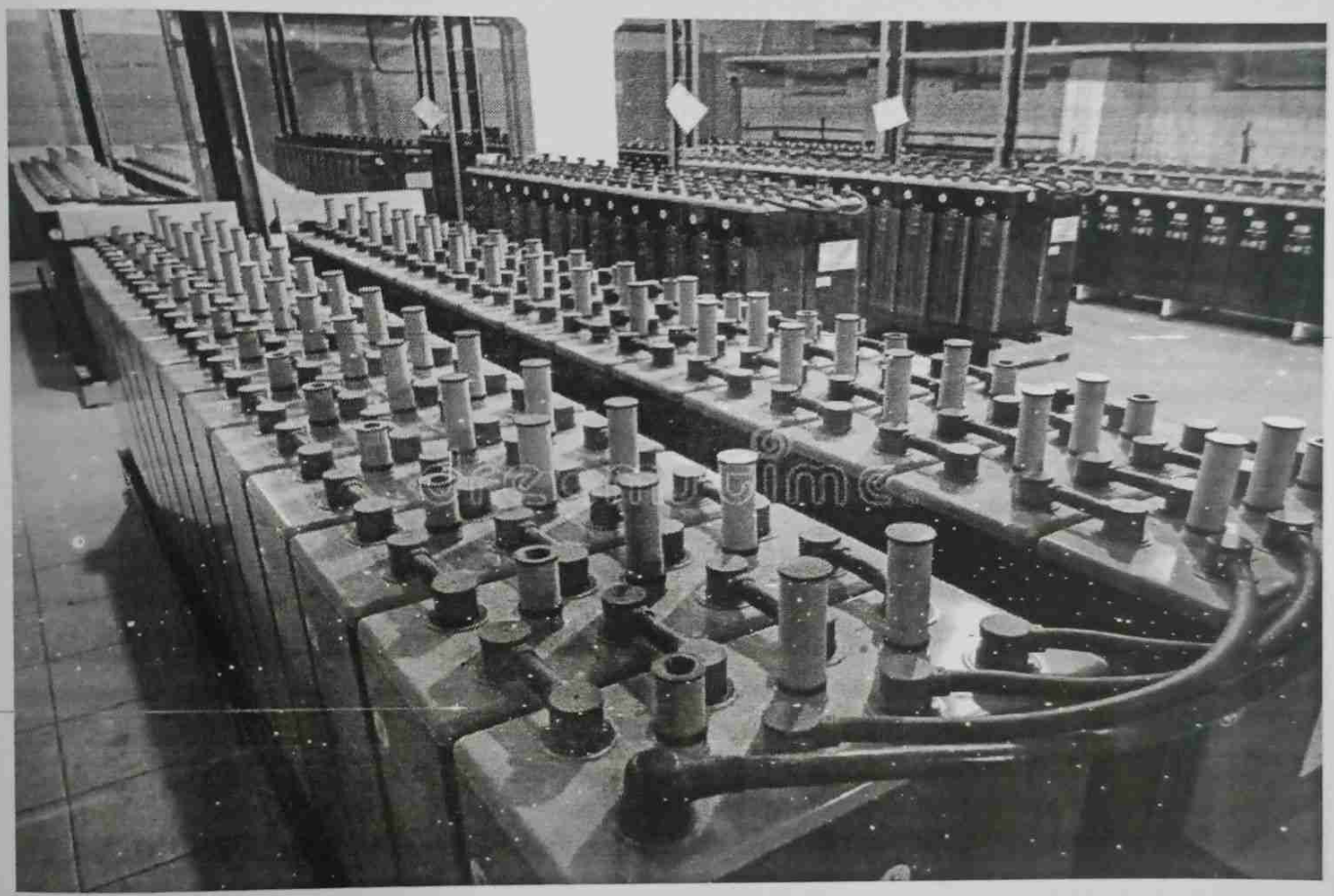


Working:

Electrical switchgear refers to a collection of circuit protection devices (circuit breakers, fuses or switches) mounted in a common, metal enclosure. The circuit protection devices distribute power to various sections of a facility and the electrical loads within those sections.

BATTERY ROOM

Battery rooms are provided for backup and uninterruptible power supplies (UPS) for process control functions. They are usually provided at or near the facility control room or electrical switchgear facilities.



Feb 1st, 2023

TO WHOM IT MAY CONCERN,

This is to certify that Mr **Anand raj bharti**, S/O Mr Bhim Sen giri, an Electronic and Electrical student from Netaji Subhas Institute of Technology **(NSIT) Patna**, has completed **Intern – Software Development.** The duration of the internship was from **14th December 2022 to 13th Jan 2023.**

His role was to familiarize himself with all the processes at the organization. He spent a significant amount of time in each department and learnt in-depth what the flow of work is like. Mr. **Anand raj bharti** is a diligent individual and particularly inquisitive. He helped in developing FastAPI for the product he was assigned to.

We hope his time spent at **Swiftstatsai.com** was fruitful. We wish him all the success in his future.

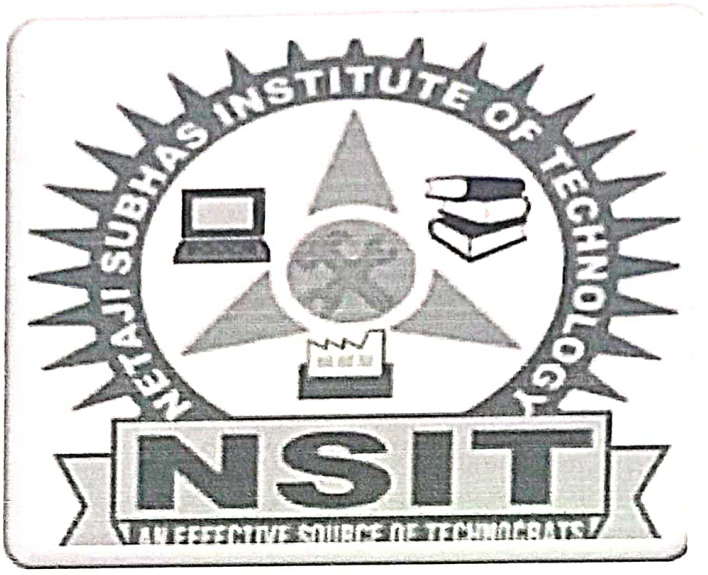
Congratulations!

Regards,

Swiftstatsai.com

Netaji Subhas Institute Of Technology, Bihta, Patna.

Approved by AICTE, New Delhi, Affiliated to Aryabhatta Knowledge University,
Patna (Bihar)



"Internship Report"

Submitted by:
Anand Raj Bharti
214005

Bihar State Power Transmission Company Limited

Registered Office :- 4th Floor
Vidyut Bhawan, Patna-21
CIN No. U74110BR2012SGC018889, Website- www.bsptcl.in

Electrical Executive Engineer
Transmission Division (WEST), Barrack No. 6,
Rajbanshi Nagar, Patna-23
Email : eectdpatnawest@gmail.com

CERTIFICATE

This is to certify that ASHISH RAJ Branch E.E.E. Registration no./Roll No. 20110103006 college NSIT Bihta, Patna has successfully completed his/her in-Plant Training at 220/132/33 KV GSS under transmission Division Patna West), from 03./.02./2023 to 02./03./2023 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was Good.

Place: Patna

Issue Date: 20./03./2023

EEE/TD/ Patna
L No. 414 Date 20/03/2023

Electrical Executive Engineer
Transmission Division Patna (West)

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University,Patna (Bihar)

"INTERNSHIP PROGRAM"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED,

THE MONTH OF FEBRUARY 2023

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELCTRONICS ENGINEERING

Under the guidance of

Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:
ASHISH RAJ (204010)

Submitted to:
Department of Electrical & Electronics Engineering
NSIT Bihta, Patna

INTRODUCTION

Bihar State Power Transmission Company Limited, a subsidiary company of Bihar State Power (Holding) Company Limited, is a wholly owned corporate entity incorporated under the Companies Act 1956 on 1st Nov, 2012 after, restructuring oferstwhile Bihar State Electricity Board.

Presently the company is carrying on intra-state transmission and wheeling of electricity under license issued by the Bihar Electricity Regulatory Commission.The company is also discharging the functions of State Load Dispatch Center (SLDC).

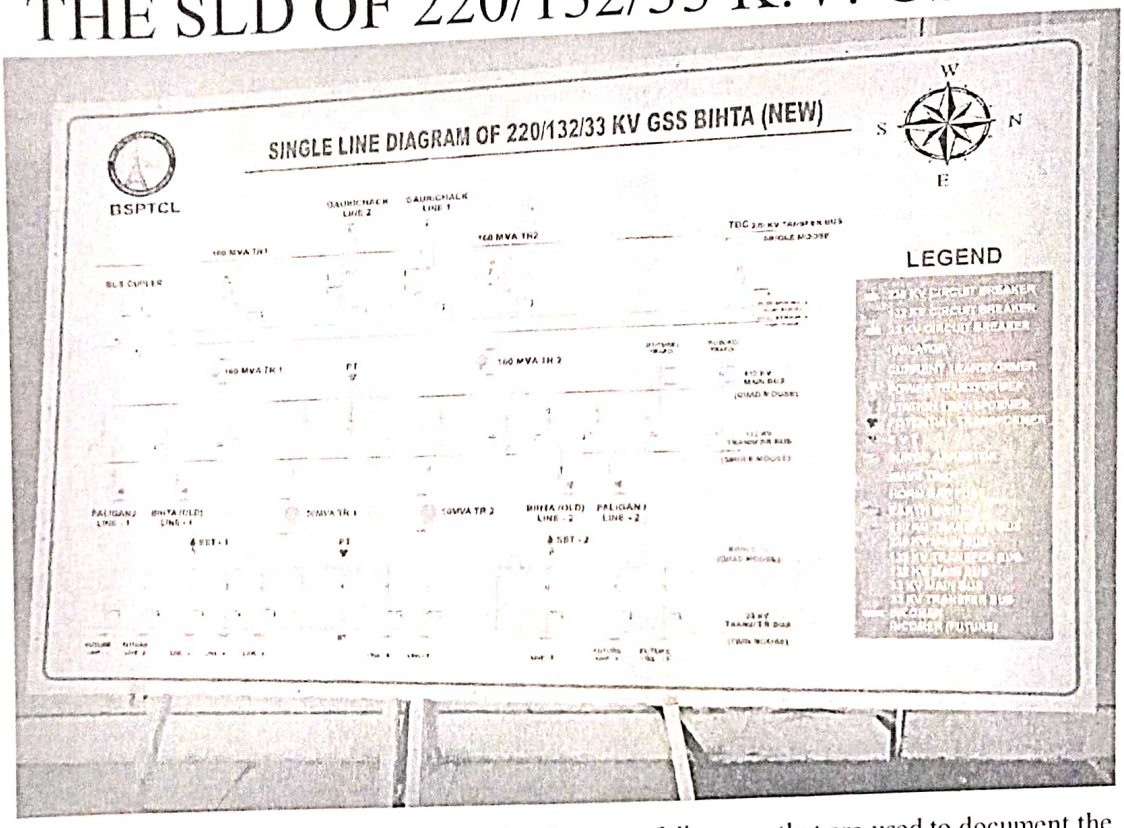
BSPTCL operates a transmission network of 8531.382 km of 132kV lines, 2491.584km of 220 kV lines and 75 km of 400kV line as well as 122 no. of EHV sub-stationswith 10280 MVA transformation capacities. The company is operating through its two transmission zones i.e., Patna & Muzaffarpur, seven transmission circles and seventeen transmission divisions.

BSPTCL has also undertaken various projects of augmentation, renovation and modernization of existing Grids and Transmission Lines. To ensure stable and uninterrupted power supply to the people of state, company has taken up projectsfor connecting its GSS to multiple sources of power and making them N-I compliant.

All the GSSs and Transmission Lines are on GIS map. The State Load Dispatchcenter has the latest technology of real time data control and communication.

"BSPTCL: The Life Line of Bihar" is committed to the goal of Quality Power toall.

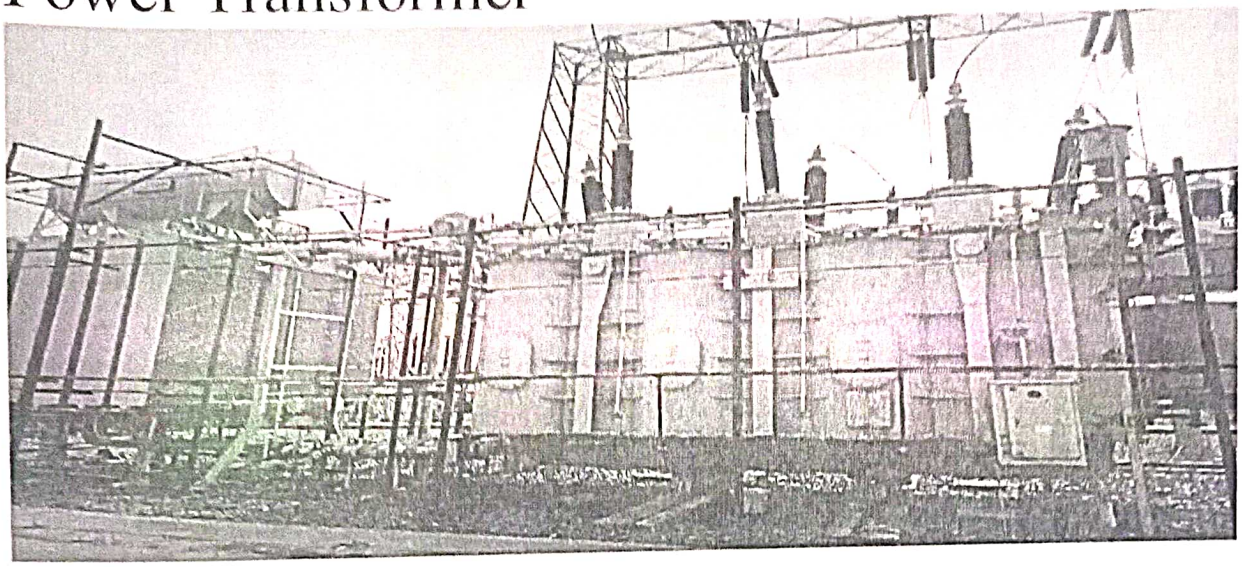
THE SLD OF 220/132/33 K.V. GSS



The single line diagram SLD is the most basic of the set of diagrams that are used to document the electrical functionality of the substation. Its emphasis is oncommunicating the functions of the power equipment and the associated protection and control system. Details about correction and physical location arenot as important unless they serve the purpose of communicating function.

The SLD of220/132/33 KV GSS consists of incoming source equipments feedersetc. The connections are shown via a single line and thus replacing the number of conductors with just a line. Legend is provided in the bottom right corner with necessary names and details of the symbols used. i.e, CT, etc

Power Transformer



220/132 KV , 160 MVA transformer

Power transformer are just general transformer but with High power rating.

The main purpose of these power transformer in the 220/132/33 KV GSS Bihta (New) is to step down the voltages from 220KV voltages to 132KV & 33KV, voltages by the use of four different transformers installled in the substation.

These transformers are generally insulated upon lengths of rails fixed on concrete slabs having foundation 1 to 1 and ½ meter deep. These transformers are provided with the tap changer.

Technical specification

SL. No.	Items	Specification
1.	Type of power	3-phase core type, auto interconnecting transformer suitable for outdoor installation and suitable for bi-directional flow of power
2.	Type of mounting	On wheels, mounted on rails
3.	Frequency	50 Hz (± 3%)
4.	Nominal voltage ratio (HV/IV/LV)	220/132/33 KV
5.	No. of phases	3
6.	No. of winding	Auto inter-connecting transformer with tertiary
7.	Type of cooling	ONAN/ONAF/OFAF
8.	MVA rating	160 MVA
9.	Method of connection	HV-Star IV- Star LV - Delta
10.	Vector group	YNa0d11
11.	System earthing	Effectively earthed
12.	Tap changing type	OLTC

Marshalling Box of 160 MVA transformer

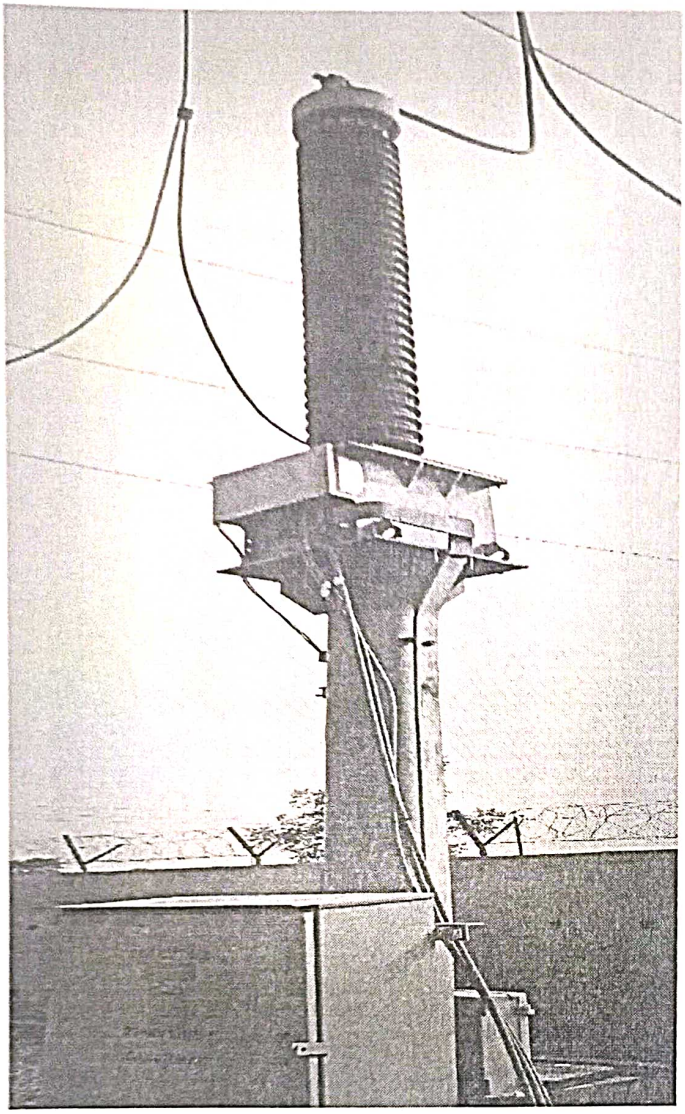
This marshalling box is the master control pane
For protection device. This panel comes with a
See-through glass door to allow easy visibility
Of the instruments and their readings. The pane
Is situated next to the transformer.
It contains OTI or oil temperature indicator,
WTI or winding temperature indicator, heater
Switch, pump control switch, fan cooler control
MCB and conductor.
It also contains motor starters for fans (in case of
a forced air cool transformer.

132/33 K.V, 50 MVA Transformer

Technical specification of 50 MVA Transformer

SL. No.	Items	Specification
1.	Type of power	3-phase core type, auto interconnecting transformer suitable for outdoor installation and suitable for bi-directional flow of power
2.	Type of mounting	On wheels, mounted on rails
3.	Frequency	50 Hz (± 3%)
4.	Nominal voltage ratio (HV/LV)	132/33 KV
5.	No. of phases	3
6.	No. of winding	Auto inter-connecting transformer
7.	Type of cooling MVA rating corresponding to cooling system	ONAN/OFAF
8.	MVA rating	50 MVA
9.	Method of connection	HV-Star LV - Star
10.	Vector group	YNyno
11.	System earthing	Effectively earthed
12.	Tap changing type	OLTC (HV side)

Potential transformer



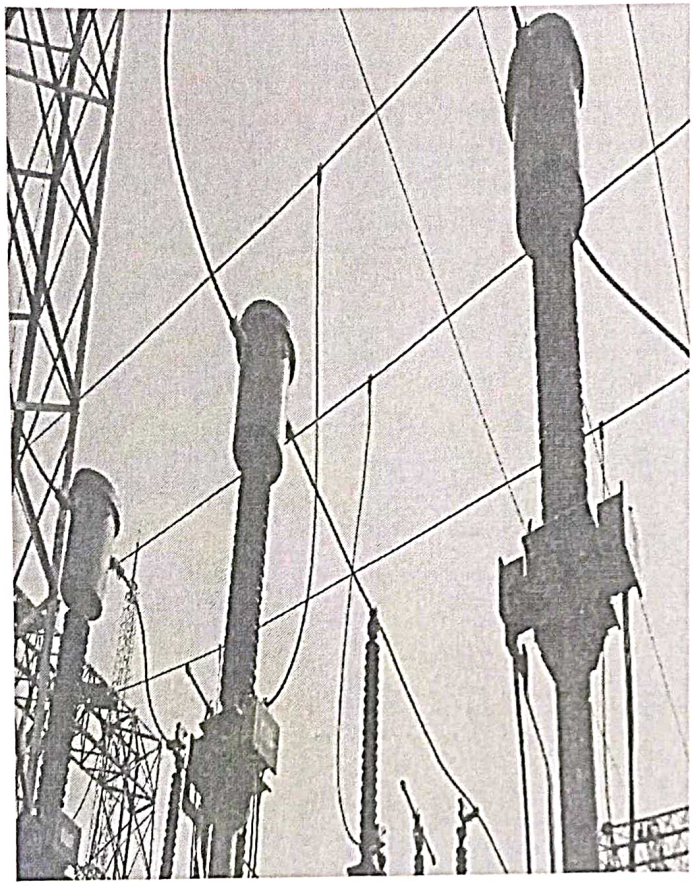
Potential transformers (PT), are aparallel-connected type of instrument transformer. They are designed to present a negligible load to the supply being measuredand have an accurate voltage ratioand phase relationship to enable accurate secondary connected metering.

CVTs in combination with wavetraps are used for filtering high-frequency communication signals from power frequency.

This forms a carrier communication network throughout the transmission network. Capacitor type VT isused for voltages 66 kV and above.

Current transformer

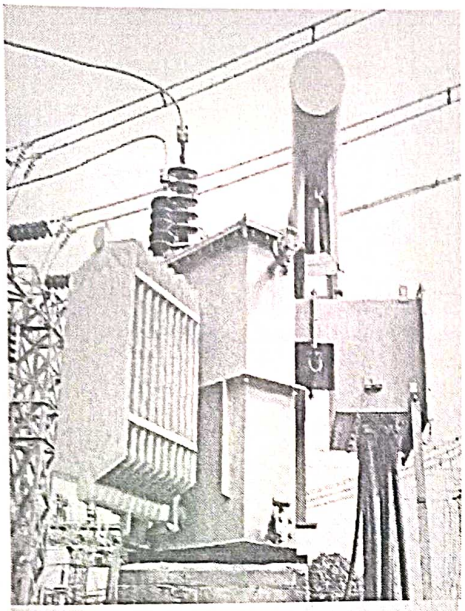
A current transformer (CT) is a type of transformer that is used to measure

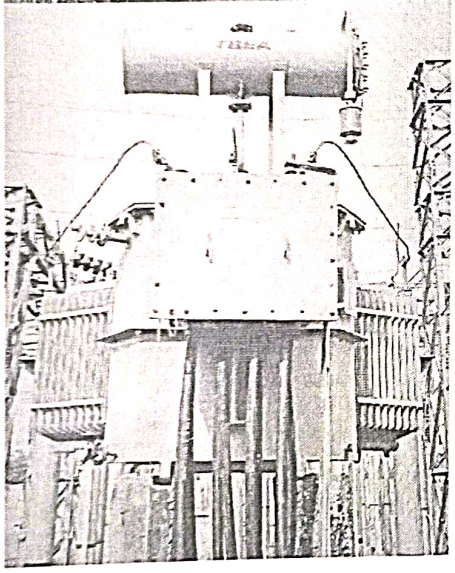


AC current. It produces an alternating current (AC) in its secondary which is proportional to the AC currentin its primary. Current transformers, along with voltage or potential transformers are Instrument transformer.

Current transformers are designed to provide a scale down replica of the current in the HV line and isolate the measuring instruments, meters, relays,etc., from the high voltage power circuit.

Station transformer

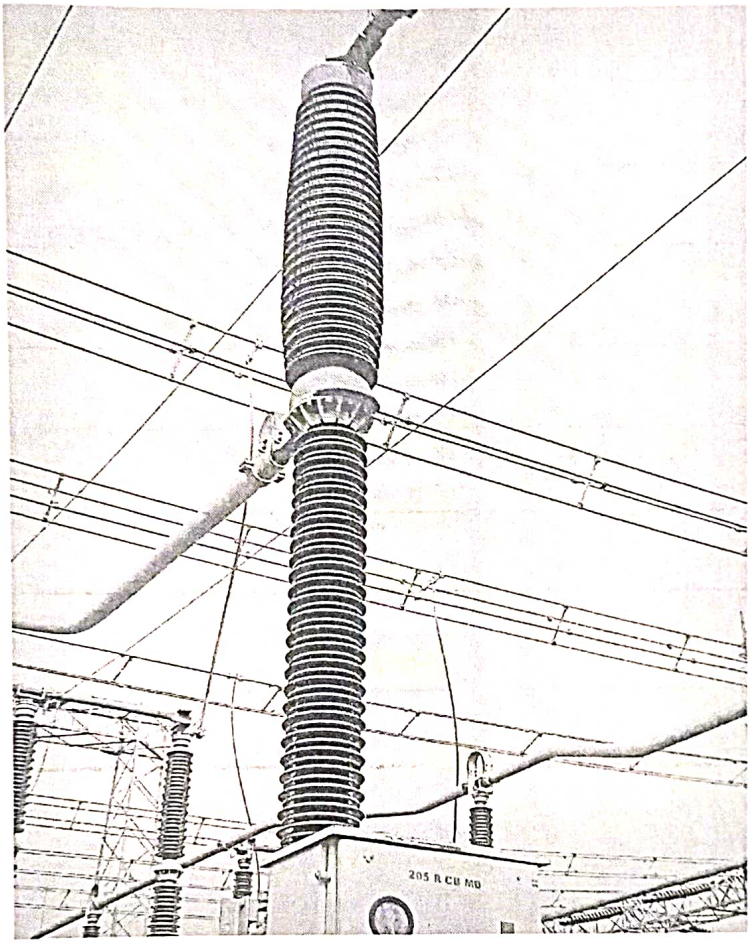




The Station Transformers are employed to supply auxiliary loads to thepower plant for starting the plant when generating unit is not in operation. There transformers are connectedto the switchyard bus. LV side of the stationtransformer is connected to the auxiliary buses. Station transformers are provided with On Load Tap changer with ONAN/ONAF cooling. In 220/132/33 KV GSS Bihta (new), there are two station transformers installed, both on 33KV side

with rating of 33 KV/440V. Stepping down 33kv to 440 volts and supplying the

Circuit breaker



ACDB and thus charging the bus coupler for further distribution and utilization A circuit breaker is an electrical safety device designed to protect an electrical circuit from damage caused by an overcurrent or short circuit. Its basic function is to interrupt current flow to protect equipment and to prevent the risk of fire. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

done without any danger.

Isolator

The isolator is a mechanical switch which isolates a part of the circuit from the system as when required. Electrical isolators separate a part of the system from rest for safe maintenance works. So, the definition of isolator can be rewritten as an isolator is a manually operated mechanical switch which separates a part of the electrical power. Isolators are used to open a circuit under no load. Its main purpose is to isolate one portion of the circuit from the other and is not intended to be opened while current is flowing in the line. Isolators are generally used on both ends of the breaker so that repair or replacement of circuit breaker can be

There are different types of isolators available depending upon system

Depending upon the position in the power system, the isolators can be categorized as

2. Line side isolator – the isolator is situated at line side of any feeder

3. Transfer bus side isolator – the isolator is directly connected with transfer bus.

requirement such as

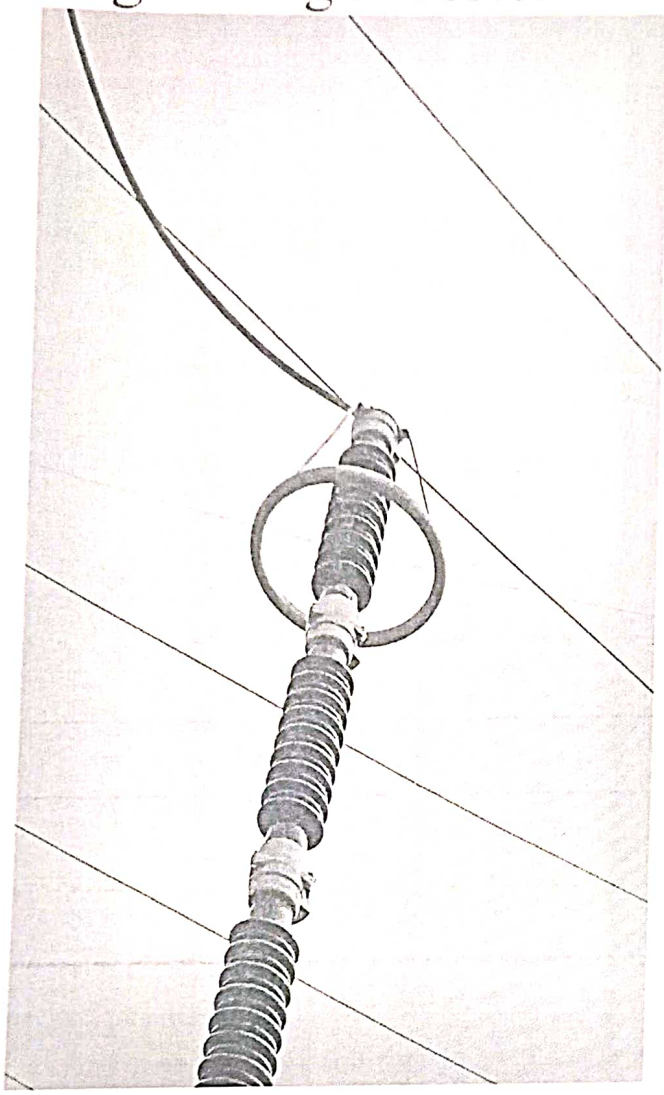
1.Double Break Isolator

2.Single Break Isolator

3.Pantograph type Isolator.

1. Bus side isolator – the isolator is directly connected with main bus

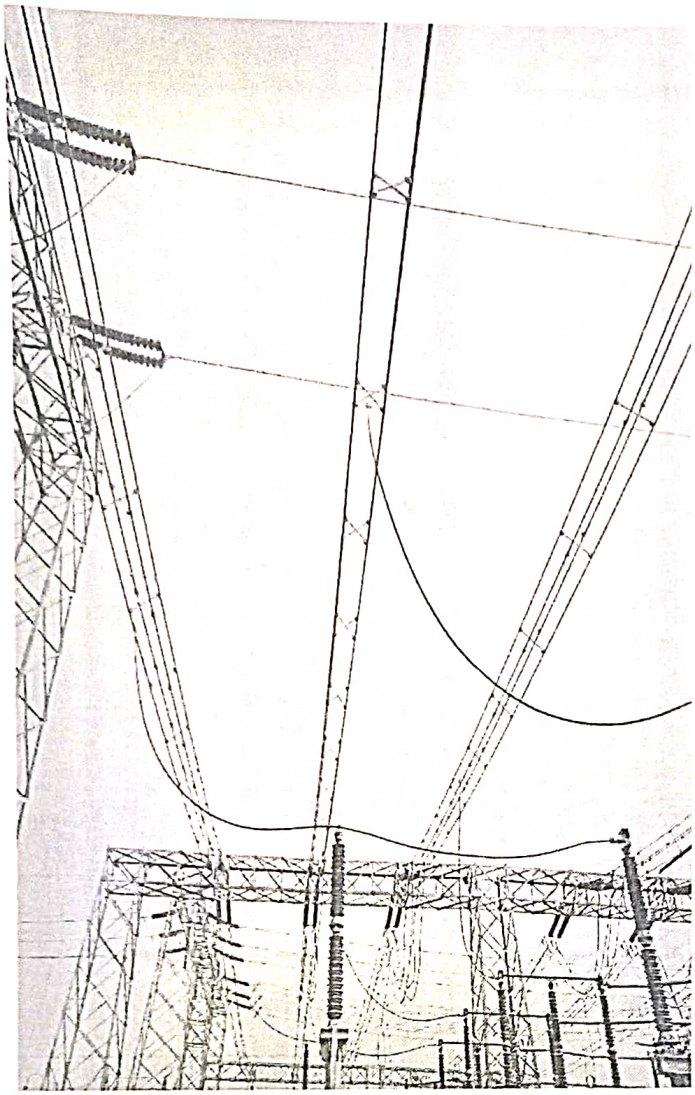
Lightening Arrester



A lightning arrester (alternative spelling lightning arrestor) (also called lightning Isolator) is a device used on electric power transmission and telecommunication systems to protect the insulation and conductors of the system from the damaging effects of lightning. The typical lightning arrester has a highvoltage terminal and a ground terminal. When a lightning surge (or switching surge, which is very similar) travels along the power line to the arrester, the current from the surge is diverted through the arrester, in most cases to earth.

Bus Bar System

An electrical bus bar is defined as a conductor or a group of conductors used for collecting electric power from the incoming feeders and distributes them to the outgoing feeders. In other words, it is a type of electrical junction in which all the incoming and outgoing electrical current meets. Thus, the electrical bus bar collects the electric power at one location.

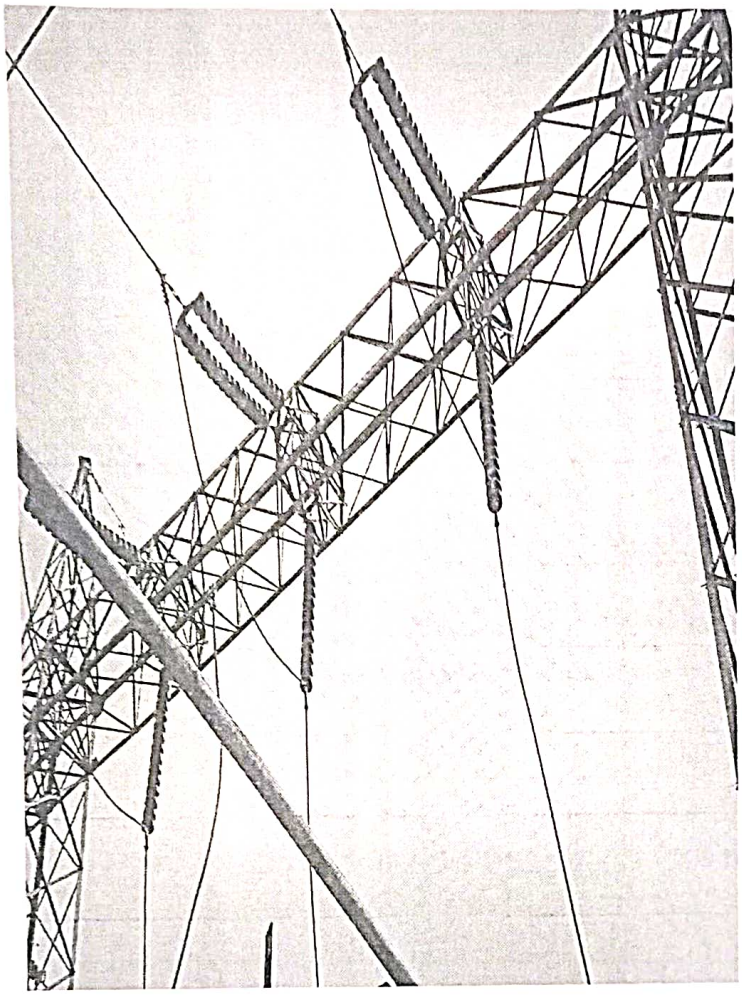


The bus bar system consists the isolator and the circuit breaker. On the occurrence of a fault, the circuit breaker is tripped off and the faulty section of the busbar is easily disconnected from the circuit.

The electrical bus bar is available in rectangular, cross-sectional, round and many other shapes. The rectangular bus bar is mostly used in the power system. The copper and aluminium are used for the manufacturing of the electrical bus bar.

Insulator

An electrical insulator is a material in which electric current does not flow freely.

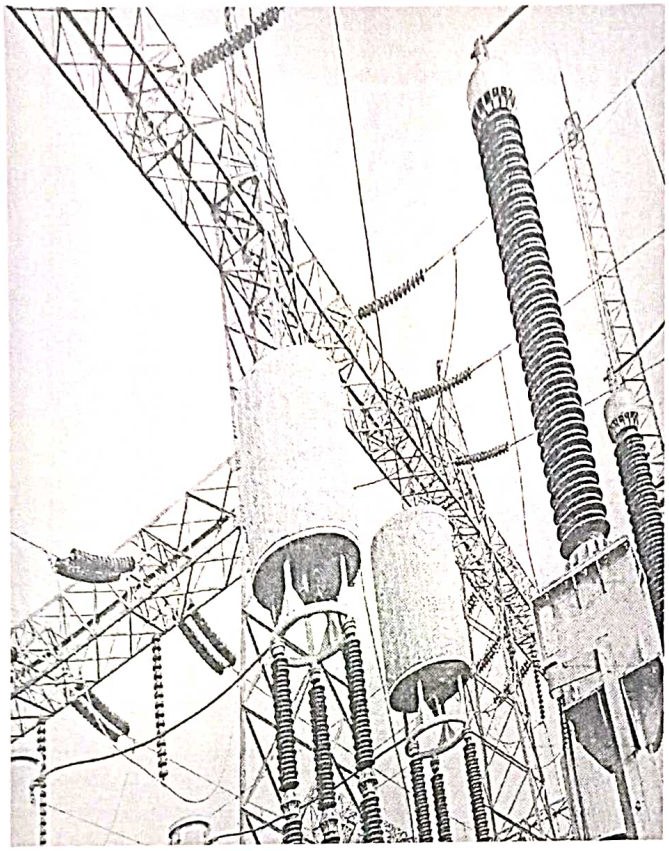


The atoms of the insulator have tightly bound electrons which cannot readily move. Other materials—semiconductors and conductors—conduct electric current more easily. The property that distinguishes an insulator is its resistivity; insulators have higher resistivity than semiconductors or conductors. The most common examples are nonmetals.

Insulators are used in electrical equipment to support and separate electrical conductors without allowing current through themselves. An insulating material used in bulk to wrap electrical cables or other equipment is called insulation. The term insulator is also used more specifically to refer to insulating supports used to attach electric power distribution or transmission lines to utility poles and transmission towers. They support the weight of the suspended wires without allowing the current to flow through the tower to ground

Wave trap

Wave trap, also called Line Trap or high-frequency stopper, is a maintenance-free parallel resonant circuit, mounted inline on high-voltage (HV) AC transmission

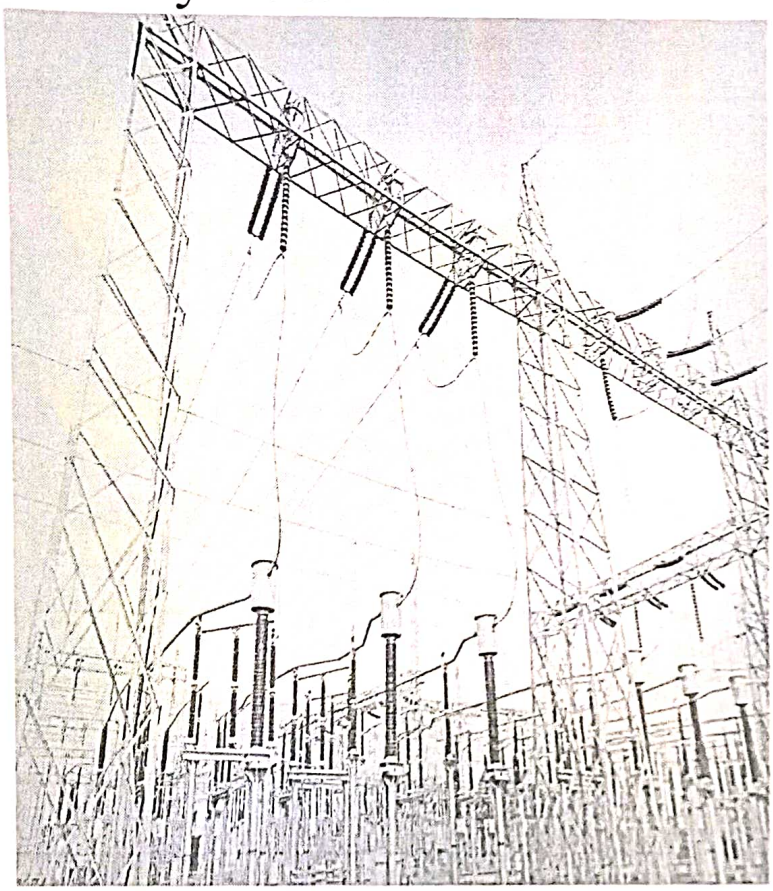


power lines to prevent the transmission of high frequency (40 kHz to 1000 kHz) carrier signals of power line communication to unwanted destinations. Line traps are cylinder-like structures connected in series with HV transmission lines. A line trap is also called a wave trap

Wine trap acts as a barrier or filter to prevent signal losses. The inductive reactance of the line trap presents a high reactance to high-frequency signals but a low reactance to mains frequency. This prevents carrier signals from being dissipated in the substation or in

a tap line or branch of the main transmission path and grounds in the case of anything happening outside of the carrier transmission path. The line trap is also used to attenuate the shunting effects of high-voltage lines.

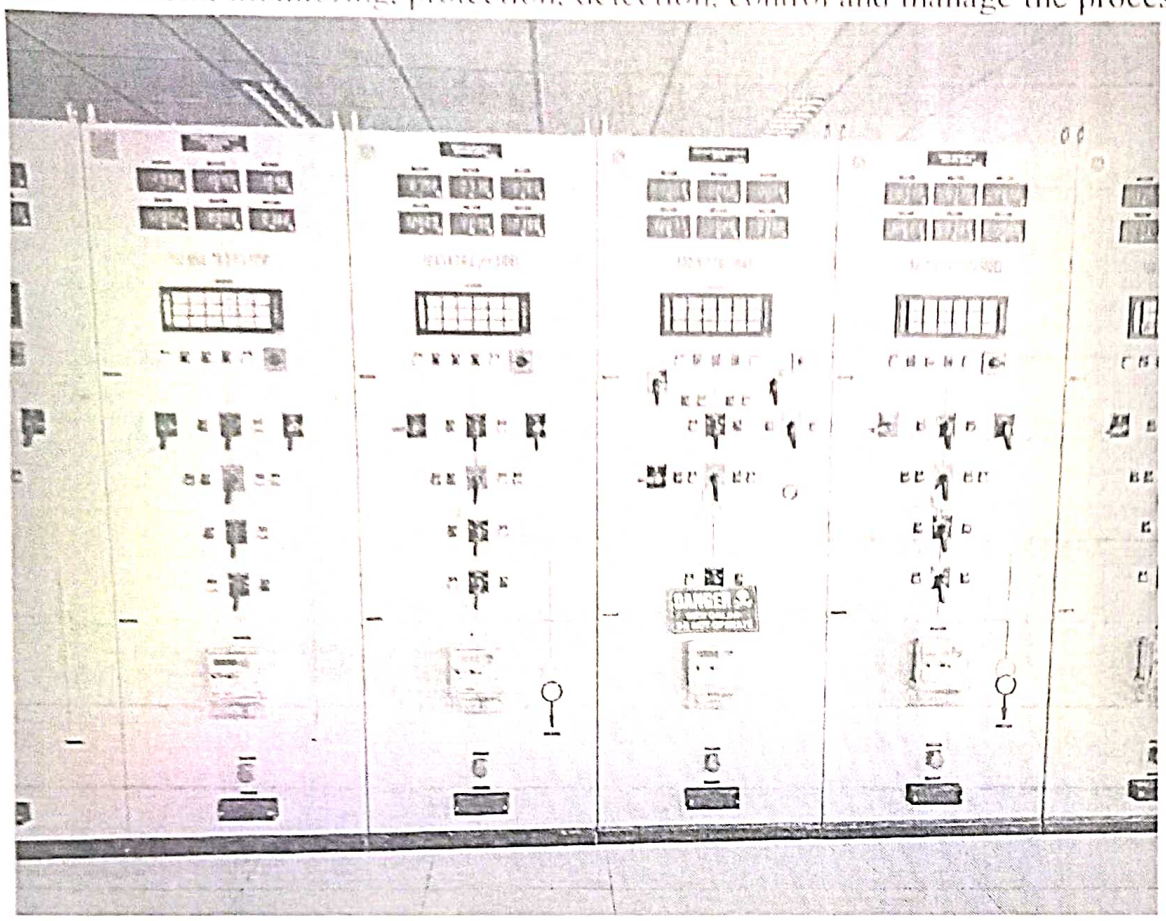
Gantry Tower



Gantry structures are mainly used for guiding the power conductor from last tower near substation to the electrical equipments in a substation. This structure consists of a number of columns and beams, which depend on number of circuits of the line. Gantries are also used for line crossing.

Control panel

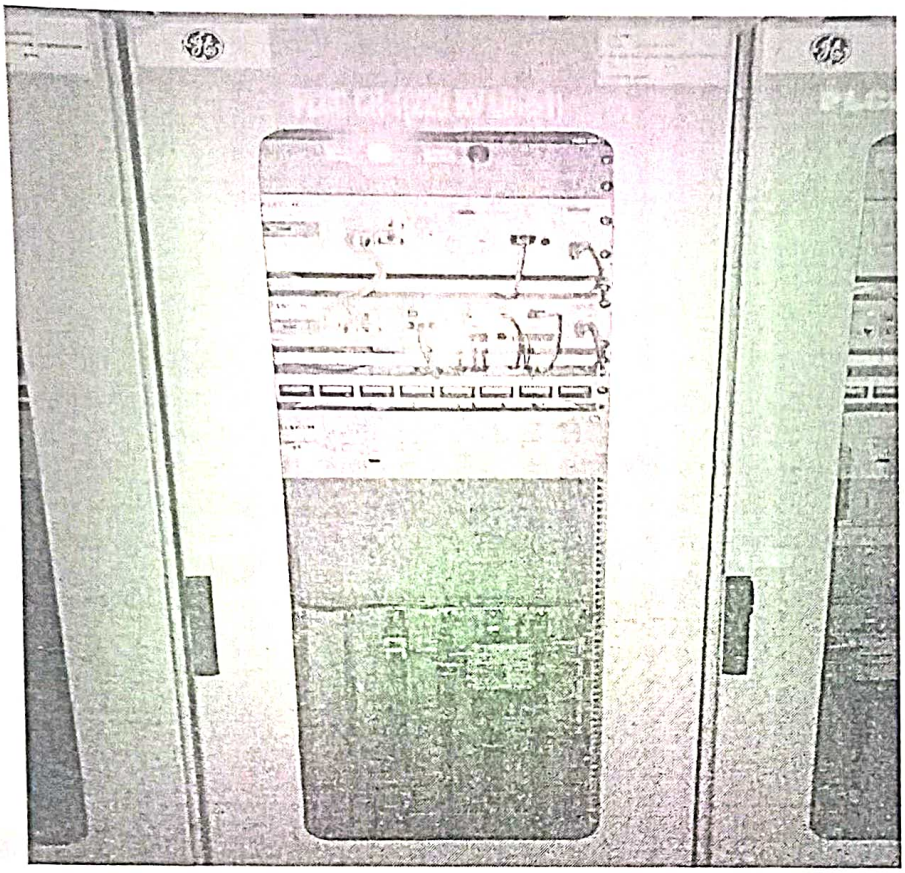
Control panel is used to accommodate instruments for the purpose of measurement, monitoring, protection, detection, control and manage the processes.



The panels are located in a control room as well as a field termed as a local control panel (LCP) for operational convenience.

PLCC (Power Line Carrier Communication)

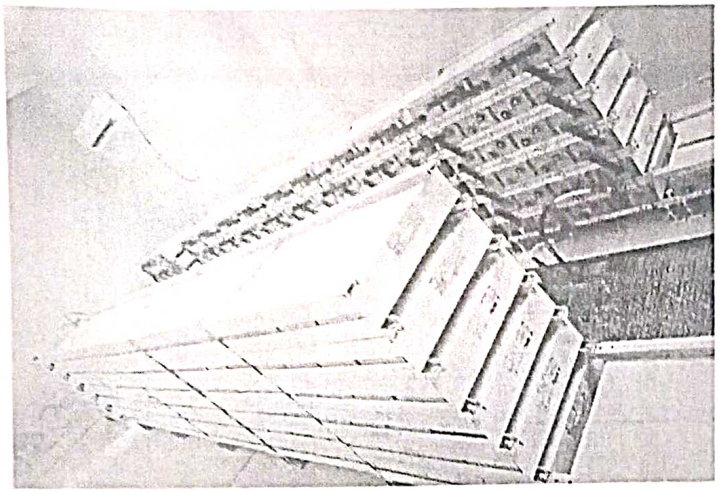
Power-line carrier communication (PLCC) is mainly used for telecommunication, tele-protection and tele-monitoring between electrical substations through power lines at high voltages, such as 110 kV, 220 kV, 400 kV. The modulation generally used in these system is amplitude modulation.

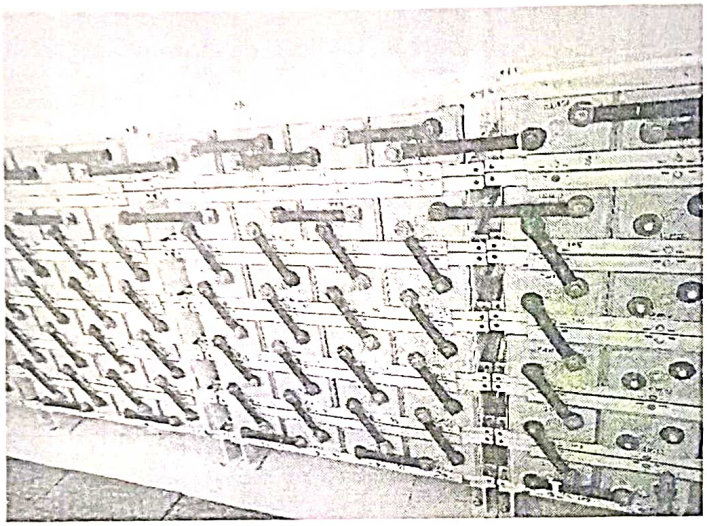


Power Line Carrier Communication (PLCC) is used for the purpose of protection of line and communication between the two stations. Two different PLCC channels are used for the protection of a single line. This is the reason; you will notice that wave traps are normally installed in R and B phase of transmission line.

Battery room

A battery room is a room that houses batteries for backup or uninterruptible power systems. The rooms are found in telecommunication central offices, and provide standby power for computing equipment in datacenters. Batteries provide direct current (DC) electricity, which may be used directly by some types of equipment, or which may be converted to alternating current (AC) by uninterruptible power supply (UPS) equipment. The batteries may provide power for minutes, hours or days, depending on each system's design, although they are most commonly activated during brief electric utility outages lasting only seconds.

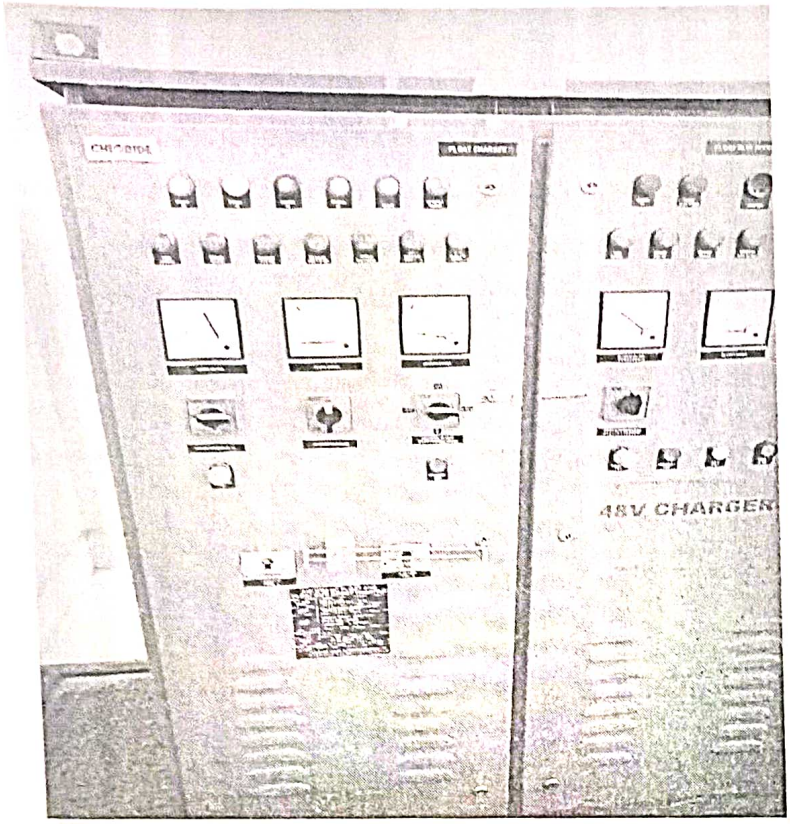


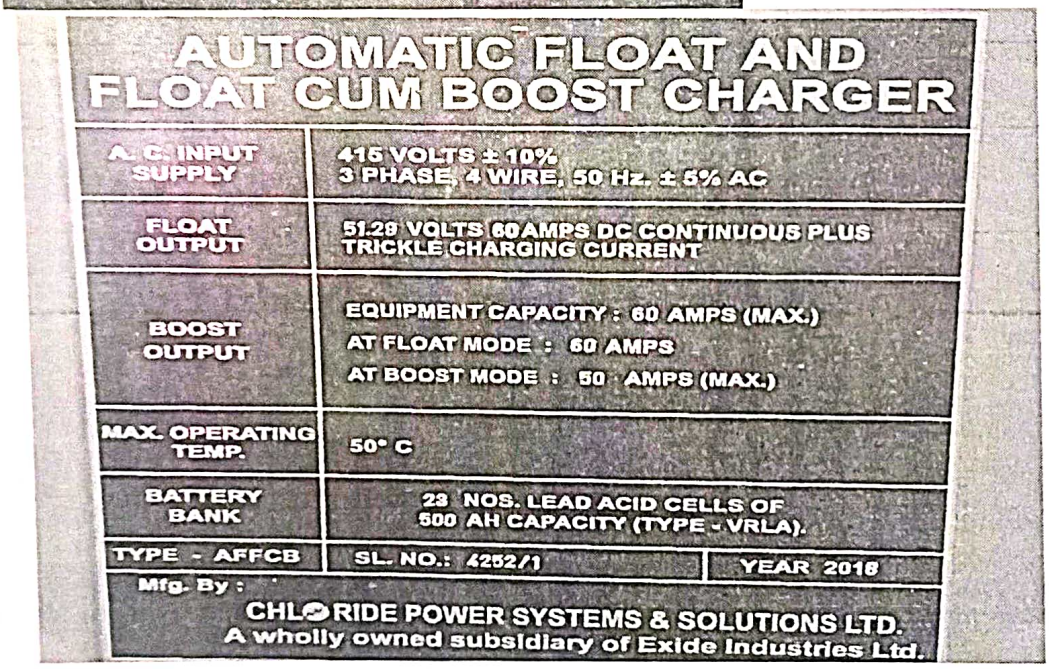


Charger

Given snapshot is of the charging panel residing in the switch gear room, facilitating the charging of 250v battery pack

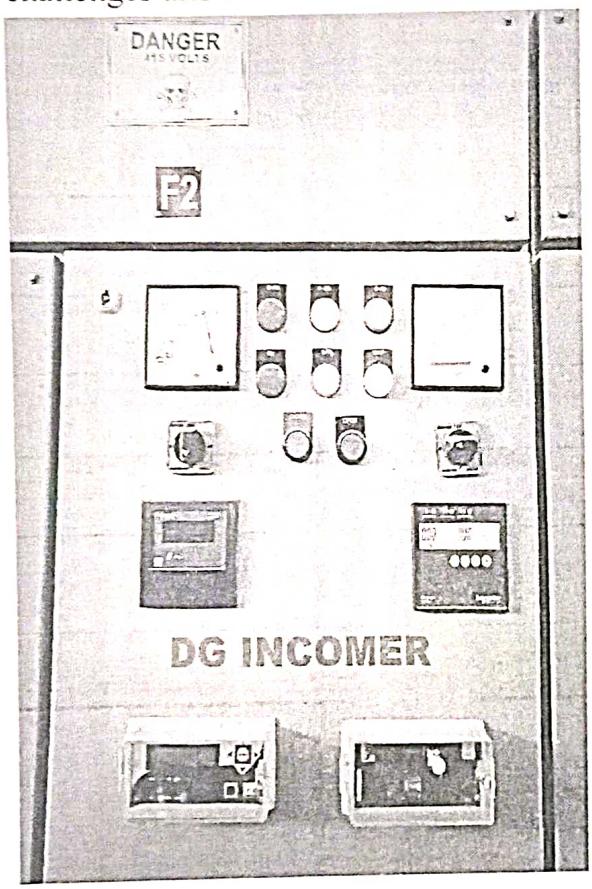
The charger receives power from ACDB and keeps the battery pack charged for backup





Diesel generator

Diesel generators are a vital part of a power grid, they help prevent large-scale power loss. While maintaining prime power generation sources is vital, it is also reassuring to know that diesel generators are there are a reliable back-up option if required. Many businesses and services also have their own backup generators, and those not connected to the main power grid will also utilize diesel generations as their main source of power. Diesel generators keep things up and running when challenges arise.



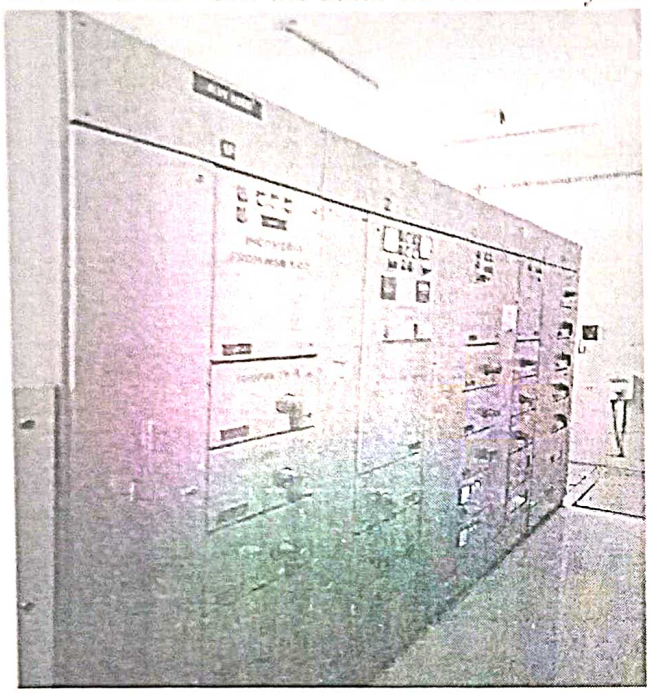
Switchgear

Switchgear/switchboards and motor control rooms are the combination of electrical disconnect switches, fuses, or circuit breakers used to control, protect, and isolate electrical equipment. Switchgears are used both to de-energize equipment to allow work to be performed and to clear faults downstream. This type of equipment is

directly linked to the reliability of the electricity supply and allows high currents and power levels to be safely controlled by automatic equipment. Switchgear equipment in substations is located on both the high and low-voltage sides of large power transformers and may be housed in a separate building.

Alternating Current Distribution Board (ACDB)

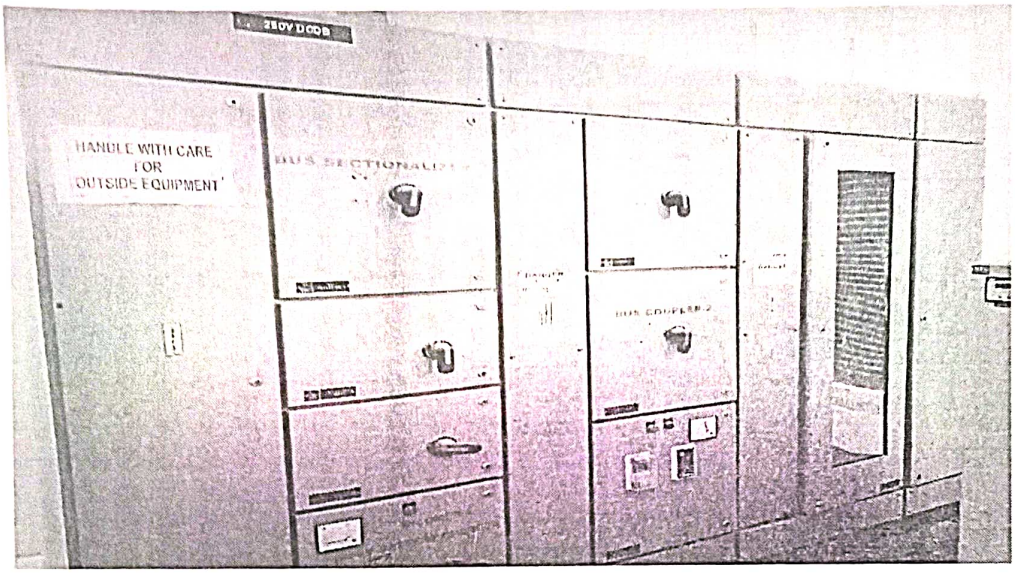
The ACDB (Alternative Current Distribution Box) is a small solar device that is installed between the solar inverter and your home load. An ACDB includes necessary surge protection devices (SPD), AC fuse, and MCB to protect the appliances from any type of electrical damage or high voltages.

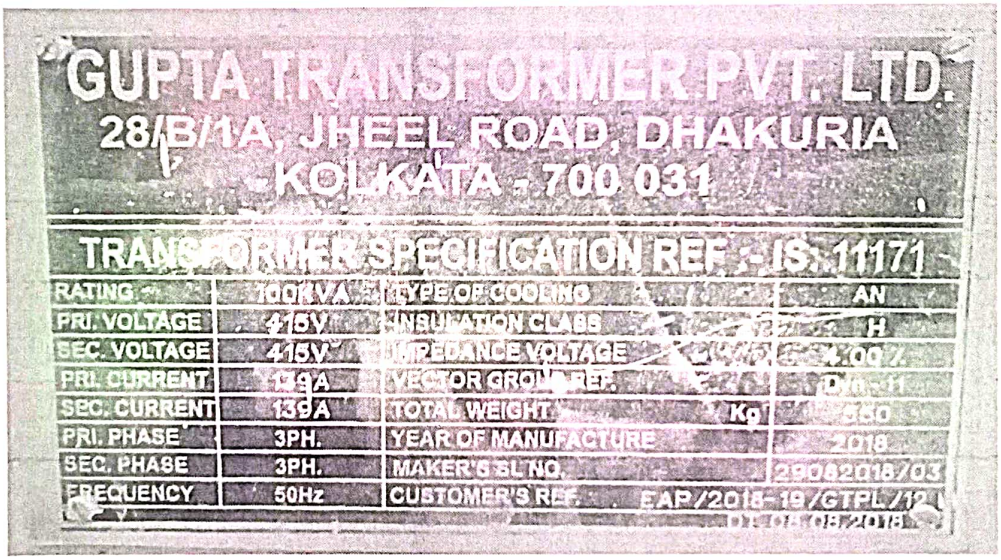


The ACDB receives AC power from solar inverter and directs it to AC loads / LT Panel. ACDB is an important part of SPV system as it provides extra protection to the system in case of failures on load side.

Direct Current Distribution Board (DCDB):

A distribution board (also known as panel board or breaker panel) is a component of an electricity supply system which divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit. The solar power generated is fed to the DCDB.





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 and distribution of electricity is done. We too came to know about the various parts of the substation systems.

We think that our training was beneficially and we think that the 220 / 132 / 33 KV GSS Bihta(new) is an excellent training center for inquisitive emerging electrical

techgyan

CERTIFICATE
OF COMPLETION

Gaurav Kumar

is presented with this certificate on successful completion of

WEB DESIGN WITH HTML/CSS

Under the guidelines and norms of the program structure

Conducted during the month of February & March 2023.

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
Techgyan Technologies

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY,

BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta knowledge University Patna (Bihar)

REPORT

BASED ON THE TRAINING DONE AT **ABHYUDAY, IIT BOMBAY** IN THE MONTH OF JUNE-AUG 2022 IN **WEB DEVELOPMENT.**

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLGY

With specialization in

Electrical & Electronics Engineering

Submitted by:

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B.tech (EEE)

4th year/7th semester

Submitted to:

Department of Electrical & Electronics Engineering

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CERTIFICATE

This is to certify that *Sri Gaurav Kumar*, B.Tech. (EEE), Roll No.194009, *NSIT, Bihta* has successfully completed his/her In-plant Training at *Electric Supply Sub-division, Danapur under Electric Supply Division, Danapur from* 06.07.2022 to 05.08.2022. During the period of training his/her behaviour and conduct was very good.

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REPORT ON IN-PLANT TRAINING
AT ELECTRIC SUPPLY SUB-DIVISION, DANAPUR

Submitted in partial fulfillment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY
(ELECTRICAL & ELECTRONICS ENGINEERING) TO

आर्यभट्ट ज्ञान विश्वविद्यालय
ARYABHATTA KNOWLEDGE UNIVERSITY

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1. INTRODUCTION

The creation of **Uttar Pradesh Power Corporation Ltd. (UPPCL)** on **January 14, 2000** is the result of power sector reforms and restructuring in UP (India) which is the focal point of the Power Sector, responsible for planning and managing the sector through its **transmission, distribution** and **supply of electricity.**

UPPCL will be professionally managed utility supplying reliable and cost efficient electricity to every citizen of the state through highly motivated employees and state of art

technologies, providing an economic return to our owners and maintaining leadership in the country.

We shall achieve this being a dynamic, forward looking, reliable, safe and trustworthy organization, sensitive to our customers interests, profitable and sustainable in the long run, providing uninterrupted supply of quality power, with transparency and integrity in operation

1.1 ABOUT 33/11KV SUBSTATION INDIRANAGAR

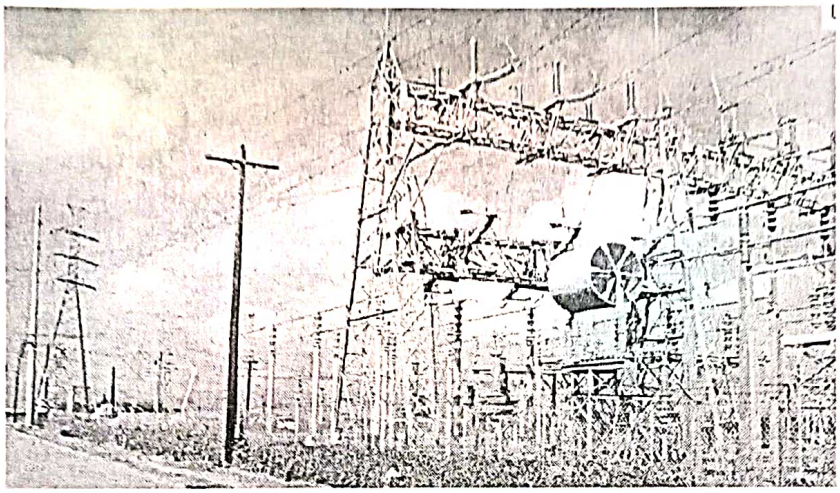


Figure 1.1 33/11KV Substation Indiranagar

The main bus 33KV is connected to grid located at **Sector-25, INDIRANAGAR, LUCKNOW.** 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. A.C. 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.

Switchgear equipment is provided, which is the combination of a circuit breaker having an isolator at each end. A transformer is connected to main bus though a bus coupler. The main bus has total capability of 160 MVA for 33 KV, which is subdivided into two transformer capacity of 80 MVA (40MVA+40MVA) parallel connected for 33KV and other two transformer capacity of 80KV (40KV+40KV) are parallel connected for substation.

At both ends of transformer lightning arrester current transformer and switchgear equipment provided. Transformer step downs voltage from **220KV to 33KV**. The main bus is provided with switchgear equipment & a current transformer. This gives way to six feeders transmitting power to **INDRA NAGAR.** The main bus is connected to jack bus or transfer bus through a bus coupler & 11KV is provided with switchgear equipment. This gives way to feeders transmitting power to **Sector-25, Bhoot Nath, Munshi Pulia, Ring Road and Sarvoday Nagar.**

A step down transformer of 11KV/440V is connected to control panel to provide supply to the equipments of the substation. Capacitor bank is connected to main bus of 11KV. It is provided to improve power factor & voltage profile.

2. TRANSFORMERS

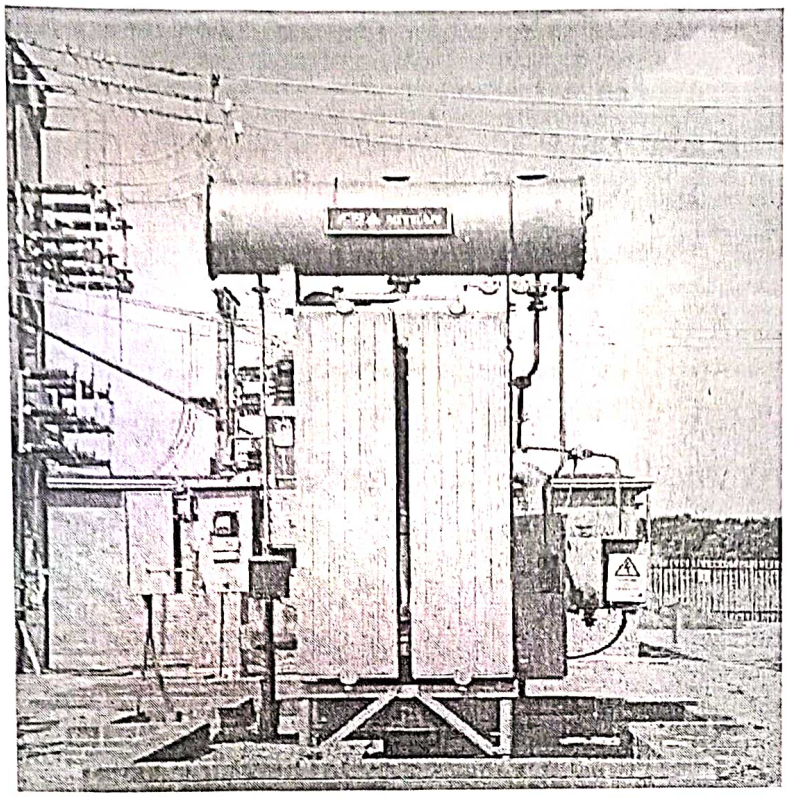


Figure: 2.1 Transformer

Transformer is a static machine, which transforms the potential of alternating current at 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 as step down transformer.

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 basis of working

2.1.5 On the basis of structure

2.1.1 POWER TRANSFORMER:

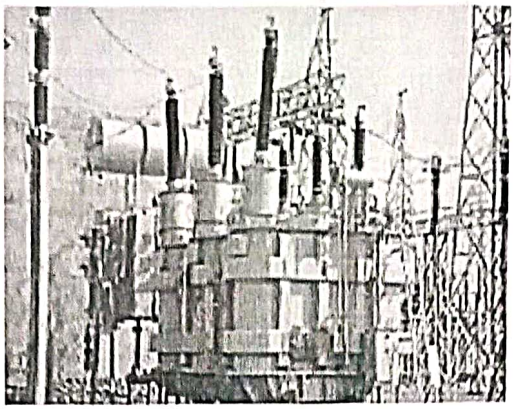


Figure 2.2 Power Transformers

Types of power transformer:

2.1.1.1 Single phase transformer

2.1.1.2 Three phase transformer

2.1.2 INSTRUMENT TRANSFORMER:

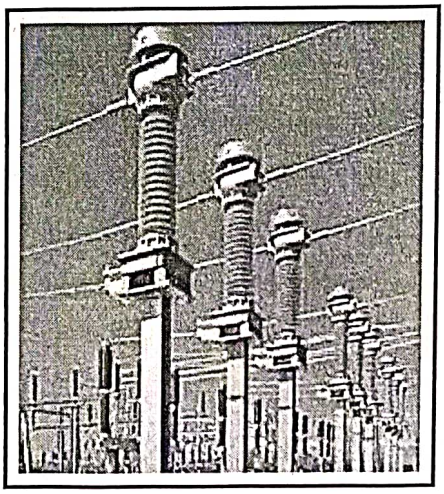


Fig: 2.3 Instrument Transformers

a) Current transformer

b) Potential transformer

2.1.3 AUTO TRANSFORMER:

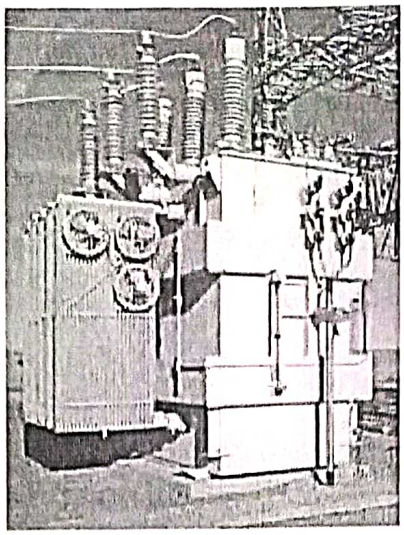


Fig 2.4 Auto Transformer

a) Single phase transformer

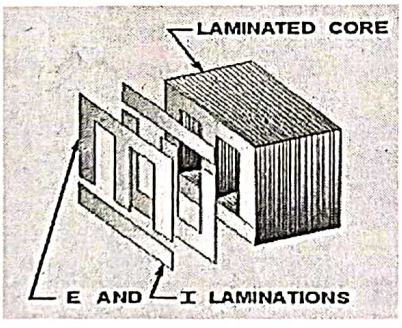
b) Three phase transformer

2.1.4 ON THE BASIS OF WORKING

2.1.4.1 Step down: Converts high voltage into low voltage.

2.1.4.2 Step up: Converts low voltage into high voltage.

2.1.5 ON THE BASIS OF STRUCTURE



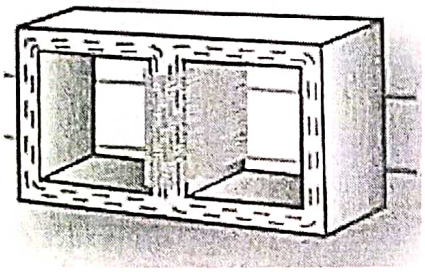


Figure 2.5 core type **Figure 2.6 Shell type**

3. SPECIFICATION OF C.T. USED IN 33/11 KV SUB STATION, INDIRANAGAR,LUCKNOW

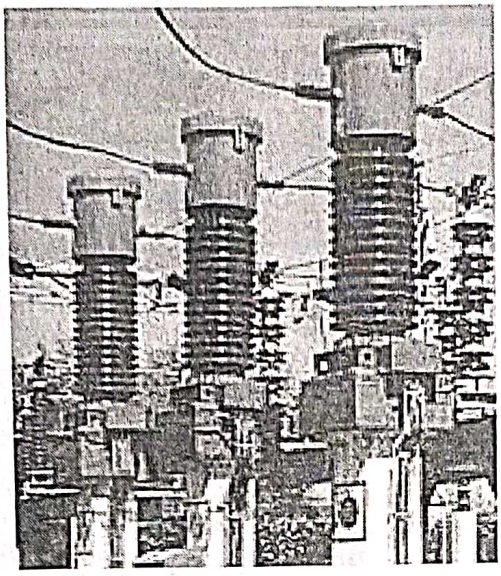


Figure 3.1 Current transformer

3.1 Standard: IS-2785 3.2 Highest System Voltage: 145 KV 3.3 Frequency: 50Hz

3.4 C.T. Current: 25 KA/1Sec.

3.5 Rated primary current: 800 Ampere

4. SUBSTATIONS

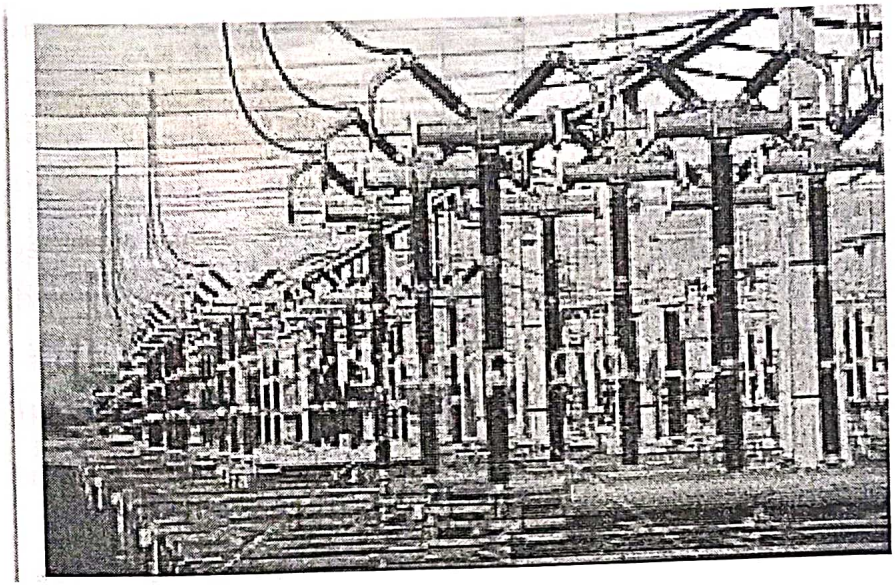


Figure 4.1 View of substation

The present day electrical power system is A.C.i.e. electrical power is generated, transmitted & distributed in the form of the alternating current. The electric power is produced at power plant stations which are located at favorable places generally quite away from the consumers. It is 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 (11 KV or 33 KV) at the power station is set up to high voltage (say 220 KV or 132 KV) for transmission of electric power. The assembly of apparatus (e.g. 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 is again accomplished by suitable apparatus called substation.

The assembly of apparatus to change some characteristic of electric power supply is called substation.

The two most ways to classify substation are:-

4.1 TYPES OF SUBSTATION

4.1.1 According to the service requirement:

4.1.1.1 Transformer substation

4.1.1.2 Switch substation

4.1.1.3 Power factor correction substation

4.1.1.4 Frequency change substation

4.1.1.5 Converting substation

4.1.1.6 Industrial substation

4.1.2 According to the constructional features:

4.1.2.1 Indoor substation

4.1.2.3 Outdoor substation

4.1.2.4 Underground substation

4.1.2.5 Pole mounted substation

4.1.1.1 TRANSFORMER SUBSTATION

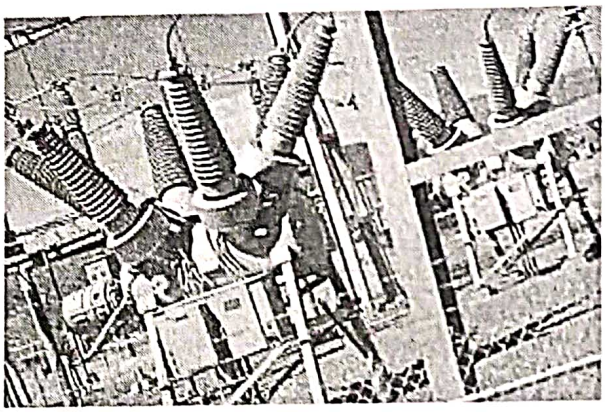


Figure 4.2 Transformer substation

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

4.1.1.1.1 STEP UP SUBSTATION

The generation voltage is steeped up to high voltage to affect 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 11KV for secondary transmission. The primary grid substation is generally of outdoor type.

4.1.1.1.3 SECONDARY SUBSTATIONS

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

4.1.1.1.3 DISTRIBUTION SUBSTATION

These substations are located near the consumer's localities and step down to 400V, 3-phase, 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:

4.2.1 Each circuit is protected by its own circuit breaker and hence plant outage does not necessarily result in loss of supply.

4.2.2 A fault on the feeder or transformer circuit breaker causes loss of the transformer and feeder circuit, one of which may be restored after isolating the faulty circuit breaker.

4.2.3 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.

4.2.4 Maintenance of a feeder or transformer circuit breaker involves loss of the circuit.

4.2.5 Introduction of bypass isolators between bus bar and circuit isolator allows circuit breaker maintenance facilities without loss of that 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 personnel. The earthing system also guarantees equipotent bonding such that there are no dangerous potential gradients developed in the substation.
In designing the substation, three voltage have to be considered these are:

4.3.1.1 Touch Voltage:

This is the difference in potential between the surface potential and the potential 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 of 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 fault levels. A grid layout with particular conductors is then analyzed 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 purposes. 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

4.3.3.4 Conductors:

Bare copper conductor is usually used for the substation earthing grid. The copper bars themselves usually have a cross-sectional area of 95 square millimeters, 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.

4.3.3.4 Connections:

Connections to the grid and other earthing joints should not be soldered because the heat generated during fault conditions could cause a soldered joint to fail. Joints are usually bolted.

4.3.3.5 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 practices are possible and are used by different utilities. These are:

4.3.4.1 Extend the substation earth grid 0.5m-1.5m beyond the fence perimeter. The fence is then bonded to the grid at regular intervals.

4.3.4.2 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 CONDUCTORS USED IN SUBSTATION DESIGN:

An ideal conductor should fulfills the following requirements:

4.4.1 Should be capable of carrying the specified load currents and short time currents.

4.4.2 Should be able to withstand forces on it due to its situation. These forces comprise self weight, and weight of other conductors and equipment, short circuit forces and atmospheric forces such as wind and ice loading.

4.4.3 Should be corona free at rated voltage.

4.4.4 Should have the minimum number of joints.

4.4.5 Should need the minimum number of supporting insulators.

4.4.6 Should be economical.

The most suitable material for the conductor system is copper or aluminums. Steel may be used but has limitations 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 Conductors, Stranded Conductors, and Tubular Conductors

4.5 Overhead Line Terminations

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

4.5.1 Tensioning conductors to substation structures or buildings

4.5.2 Tensioning conductors to ground winches.

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

VOLTAGE LEVEL	MINIMUM GROUND CLEARANCE
less than 11kV	6.1m
11kV - 20kV	6.4m
20kV - 30kV	6.7m
greater than 30kV	7.0m

Table 1 Clearance in accordance with voltage value

5. CHRONOLOGICAL TRAINING DIARY

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

5.1 POWER LINE CARRIER COMMUNICATION

Introduction:

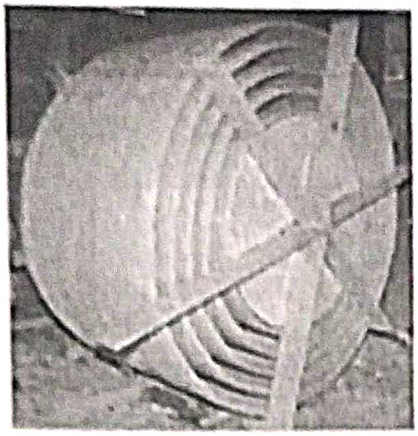


Figure 5.1: PLCC (POWER LINE CARRIER COMMUNICATION)

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.

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

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.

5.1.1 APPLICATIONS:

The PLCC can be used for the following facilities:

5.1.1.1 Telephony

5.1.1.2 Teleprotection

5.1.1.3 Remote control or indication

5.1.1.4 Telemetry

5.1.1.5 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 500 KHz. The modulated HF carrier fed into the power line conductor at the sending end and filtered out again at the 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 equipments have therefore to be employed which will permit the injection of high frequency carrier signal without undue loss and with absolute protection of communication equipments 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 S/S. Wave trap offers negligible impedance to HF carrier. Wave trap stands electromechanically and thermally for short circuit current in the event of fault on the line.

On the basis of blocking frequency bank, the wave trap can be following type:

5.2.1.1 ALL WAVE 5.2.1.2 SINGAL FREQUENCY 5.2.1.3 DOUBLE FREQUENCY 5.2.1.4 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 end 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 i.e. one end is connected to the bottom of the coupling capacitor and other end is earthed. This is provided to protect the coupling filter against line surges. An air gap is provided, where voltage of the 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 coupling 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 it isolates the connection of equipment from the power line. Secondly it serves to match characteristic impedance of the power line to that of the H.F. cable to connection equipments.

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. cable is so as to match with 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:

5.2.5.1.1 Phase to ground coupling

5.2.5.1.2 Phase to phase coupling

5.2.5.1.3 Internal coupling

5.2.5.2 COUPLING LOSSES:

5.2.5.2.1 Composite loss

5.2.5.2.2 Tapping loss

5.2.5.2.3 H.F. cable loss

5.2.5.2.4 Additional loss

6. BUSBARS

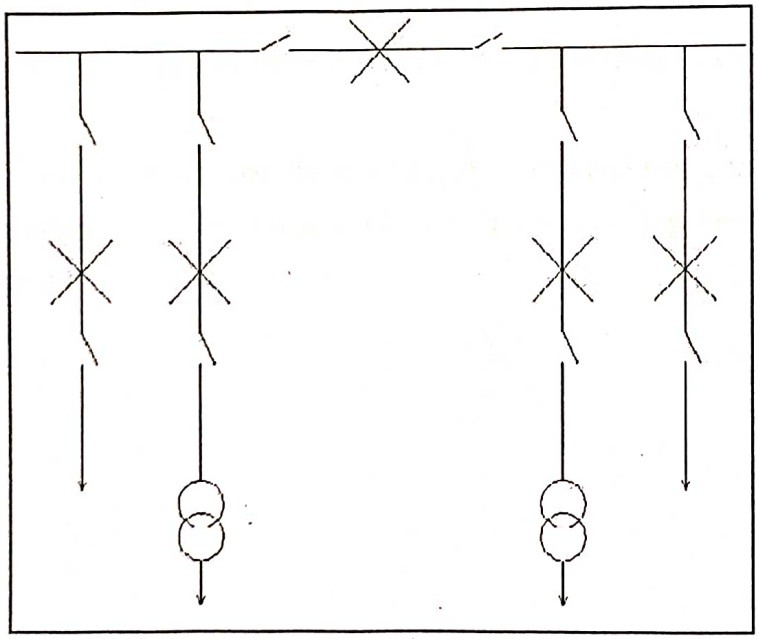


Figure 6.1 Typical representation of bus bars

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 are the important bus bars arrangements used at substations:

6.1 Single bus bar system

6.2 Single bus bar system with section alisation.

6.3 Duplicate bus bar system

In large stations it is important that break downs and maintenance should interfere 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 consist of the circuit breaker and isolator.

In substations, it is often desired to disconnect a part of the system for 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.

While opening a circuit, the circuit breaker is opened first then isolator while closing a 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 circuit breaker from live parts for the purpose of maintenance.

A transfer isolator is used to transfer main supply from main bus to transfer bus by using bus 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 conductors (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 (e.g. pin type, suspension type, post insulator etc.) and their use in substation will depend upon the service requirement. For example, post insulator is used for bus bars. A post insulator consists of a porcelain body, cast iron cap and flanged cast iron base. The hole in the cap is threaded so that bus bars can be directly bolted to the cap.

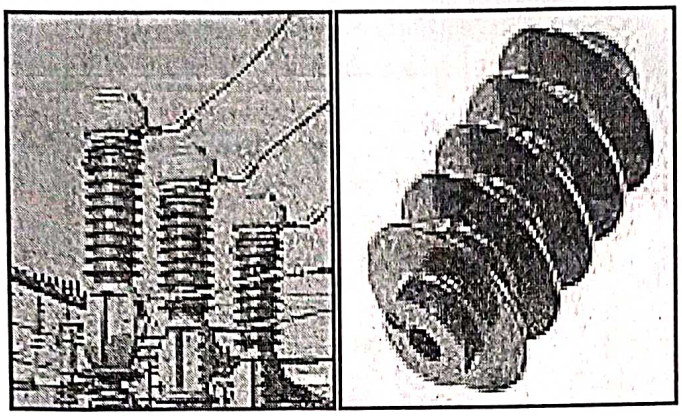


Figure 7.1 Insulators used in substations

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

The arrangements of switching along with switches cannot 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 a circuit either manually or automatically under all condition as no load, full load and short circuit condition.

A circuit breaker essentially consists of fixed and moving contacts. These contacts can be opened manually or by remote control whenever desired. When a fault occurs on any part 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 arcs are not only delays 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.

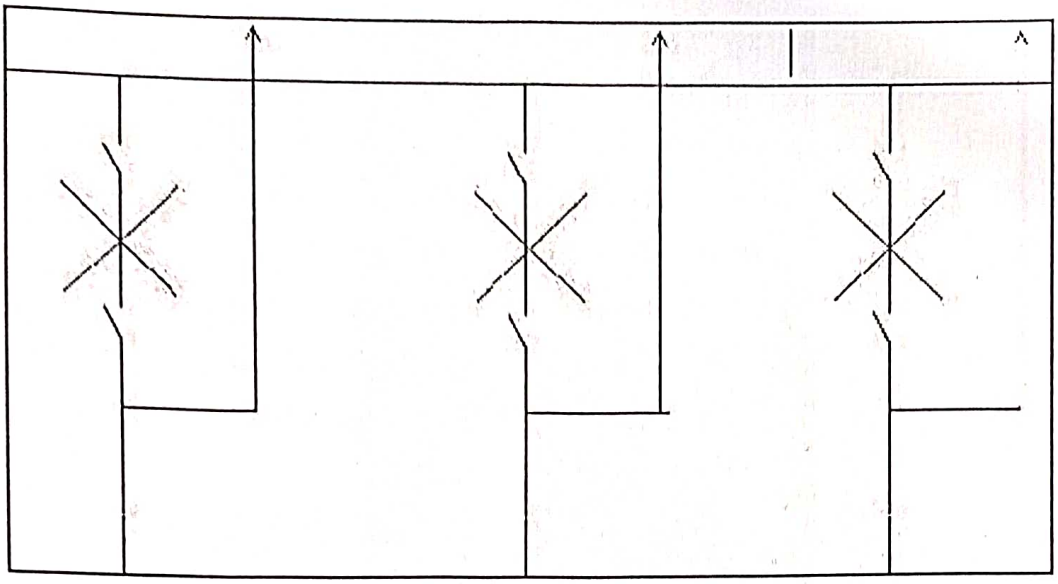


Figure 7.2 Circuit breaker arrangements

7.1. Circuit breakers

They can be classified into:

7.1.1 Oil circuit breaker **7.1.2 Air-blast circuit breaker** **7.1.3 Sulphar hexafluoride circuit breaker (SF_6)** **7.1.4 Vacuum circuit breakers**

Note: SF_6 and Vacuum circuit breaker are being used in 33KV distribution substation.

7.2 Oil Circuit Breaker

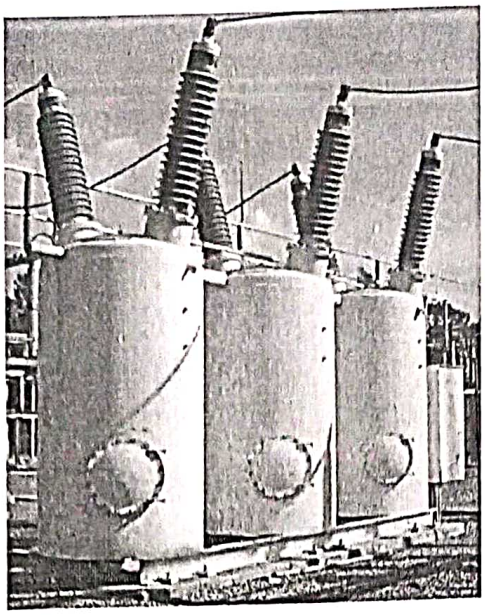


Figure 7.3 Oil circuit breaker

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 restrike of the arc.

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

7.3 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 maintain high air pressure in the air receiver. The air blast circuit breakers are especially suitable for railways and arc furnaces, where the breaker operates repeatedly. Air blast circuit breakers is used for interconnected lines and important lines where rapid operation is desired.

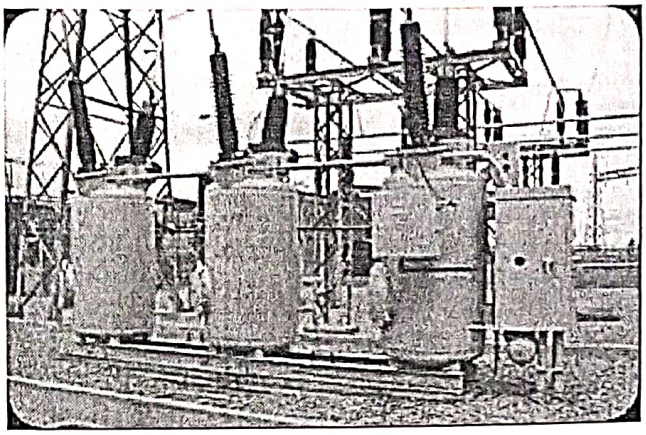


Figure 7.4 Air blast circuit breaker

High pressure air at a pressure between 20 to 30 kg/ cm2 stored in the air reservoir. Air is taken from the compressed air system. Three hollow insulator columns are mounted on the reservoir with valves at their basis. The double arc extinguished chambers are mounted on the top of the hollow insulator chambers. The current carrying parts connect the three arc extinction chambers to each other in series and the pole to the neighboring equipment. Since there exists a very high voltage between the conductor and the air reservoir, the entire arc extinction chambers assembly is mounted on insulators.

7.4 SF_6 CIRCUIT BREAKER:

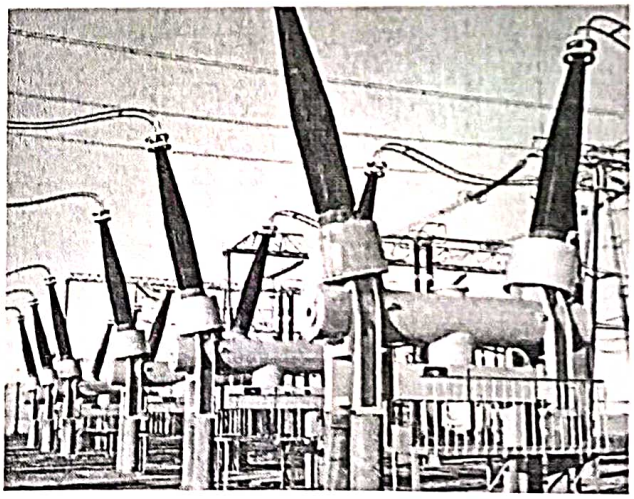


Figure 7.5 SF_6 Circuit breaker

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

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

7.5 Vacuum Circuit Breaker

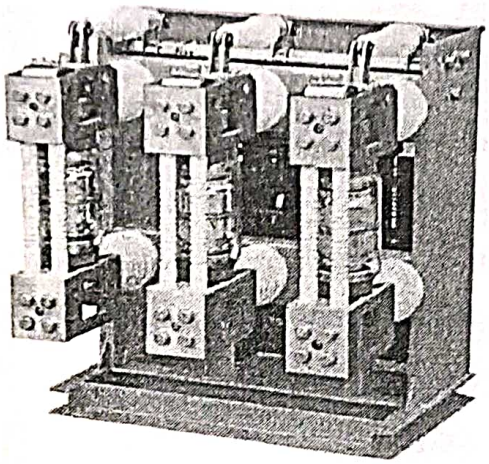


Figure 7.6 Vacuum circuit breaker

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

7.2.1 Rating of 132 KV SF_6 circuit breaker:

7.2.1.1 Breaking current: 50A

7.2.1.2 Making capacity: 80KA

7.2.1.3 Total break time < 60msec

7.2.1.4 Rated short circuit breaking current:

7.2.1.4.1 Symmetrical: 31.5 KA

7.2.1.4.2 Asymmetrical: 36.86 KA

7.2.1.5 Rated duration of short circuit current: 3sec

7.2.1.6 Rated nominal current: 1250 A

7.2.1.7 Rated voltage: 145 KV

7.2.1.8 Rated SF_6 gas pressure: 6 KG

techgyan

Certificate of Completion

CERTIFICATE
OF COMPLETION

Himanshu Kumar

is presented with this certificate on successful completion of

WEB DESIGN WITH HTML/CSS

under the guidelines and norms of the program structure conducted during the month of July & August 2022.

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
Techgyan Technologies

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta knowledge University Patna (Bihar)

REPORT

BASED ON THE TRAINING DONE AT **ABHYUDAY, IIT BOMBAY** IN THE MONTH OF JUNE-AUG 2022 IN **WEB DEVELOPMENT.**

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLGY

With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by:

HIMANSHU KUMAR (194010)

B.tech (EEE)

4th year/7th semester

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

Bihar State Power Transmission Company Limited

Registered Office :- 4th Floor
Vidyut Bhawan, Patna-21
CIN No. U74110BR2012SGC018889, Website- www.bsptcl.in

Electrical Executive Engineer
Transmission Division (WEST), Barrack No. 6,
Rajbanshi Nagar, Patna-23
Email : eeetdpatnawest@gmail.com

CERTIFICATE

This is to certify that KANIKA KUMARI Branch E.C.E Registration no./Roll No 19110103008 college NSIT, Bihta, Patna has successfully completed his/her In-Plant Training at 220/132/33 KV GSS Bihta (New) under transmission Division Patna West), from 13/05/2022 to 12/06/2022 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was V. Good

Place: Patna
Issue Date: 24/06/2022

EEE/TD/ Patna
L No. 393 Date 24/06/2022

Electrical Executive Engineer
Transmission Division Patna (West)

Netaji Subhas Institute of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"SUMMER TRAINING REPORT"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, BIHTA IN THE MONTH OF MAY-JUNE 2022

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELCTRONICS ENGINEERING

Under the guidance of

- Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))
- Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:

KANIKA KUMARI (194013)

Submitted to:

Department of Electrical & Electronics Engineering
NSIT Bihta, Patna

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INTRODUCTION

Bihar State Power Transmission Company Limited, a subsidiary company of Bihar State Power (Holding) Company Limited, is a wholly owned corporate entity incorporated under the Companies Act 1956 on 1st Nov, 2012 after, restructuring of erstwhile Bihar State Electricity Board.

Presently the company is carrying on intra-state transmission and wheeling of electricity under license issued by the Bihar Electricity Regulatory Commission. The company is also discharging the functions of State Load Dispatch Center (SLDC).

BSPTCL operates a transmission network of 8531.382 km of 132kV lines, 2491.584 km of 220 kV lines and 75 km of 400kV line as well as 122 no. of EHV sub-stations with 10280 MVA transformation capacities. The company is operating through its two transmission zones i.e., Patna & Muzaffarpur, seven transmission circles and seventeen transmission divisions.

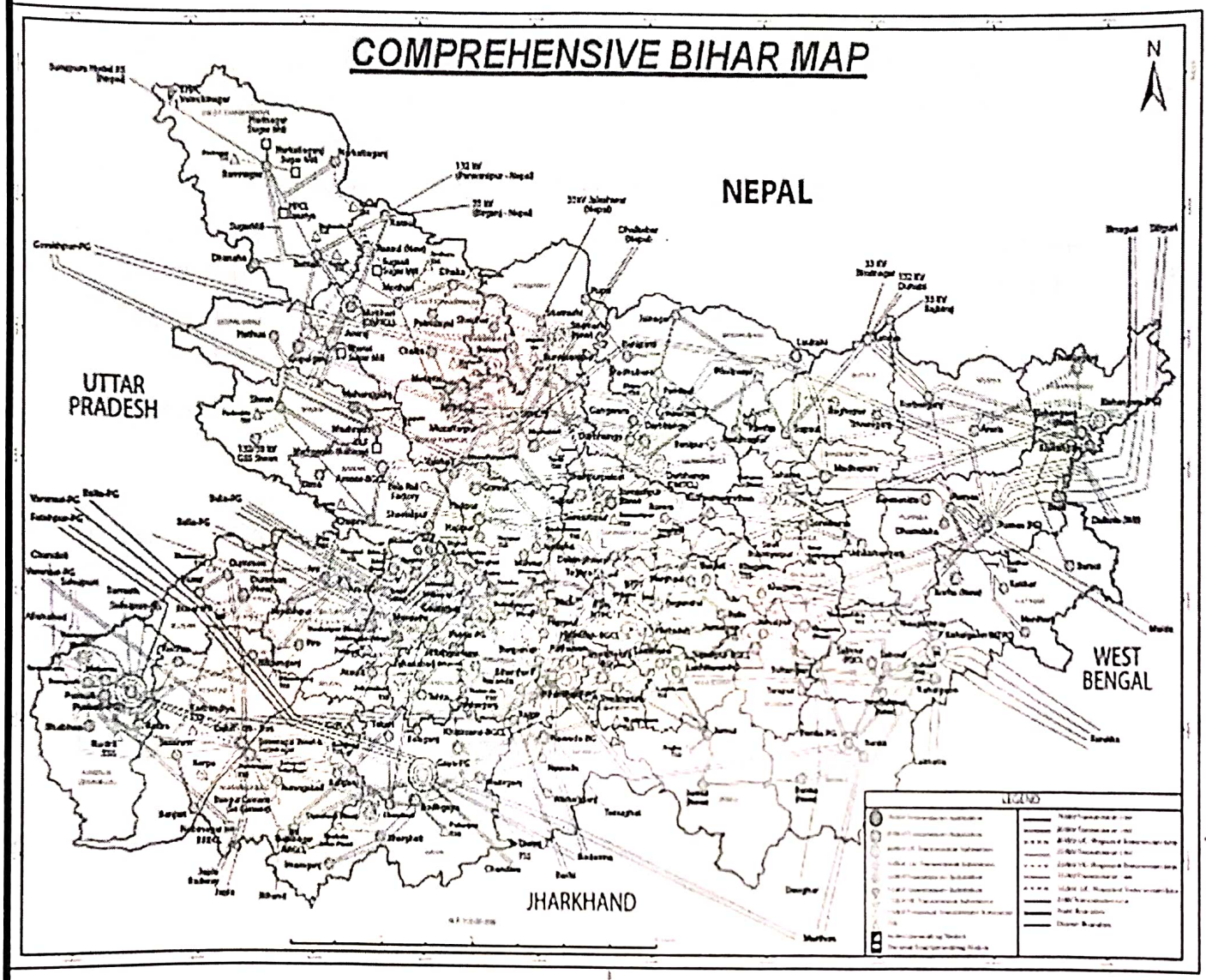
In order to increase the evacuation capacity, BSPTCL is implementing large number of sub-station and transmission line projects. BSPTCL is also working towards installation of Gas Insulated Sub-Substation, Sub-Station Automation System and High-Capacity Conductors in transmission lines.

BSPTCL has also undertaken various projects of augmentation, renovation and modernization of existing Grids and Transmission Lines. To ensure stable and uninterrupted power supply to the people of state, company has taken up projects for connecting its GSS to multiple sources of power and making them N-I compliant.

All the GSSs and Transmission Lines are on GIS map. The State Load Dispatch center has the latest technology of real time data control and communication.

"BSPTCL: The Life Line of Bihar" is committed to the goal of Quality Power to all.

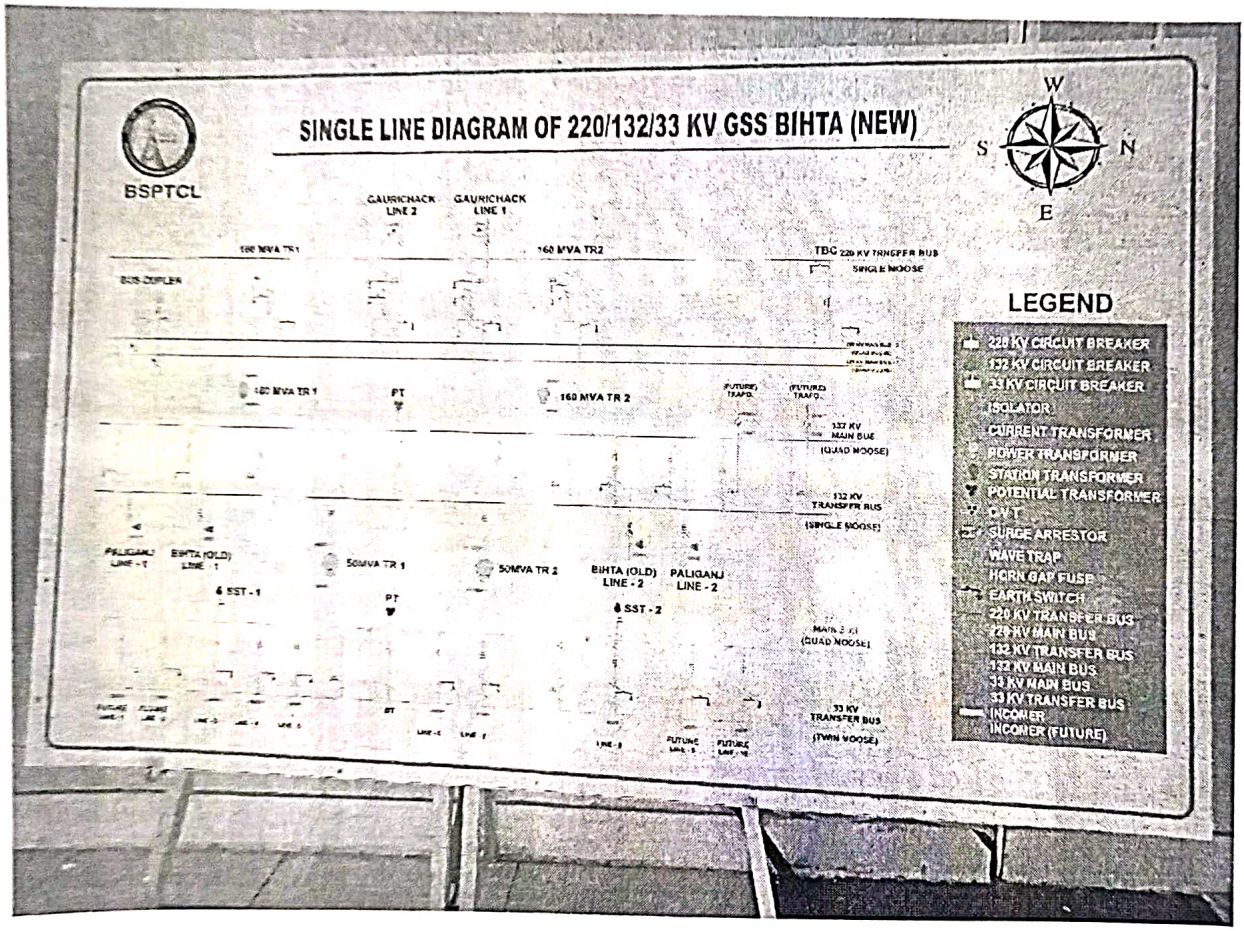
GUIDE MAP OF BSPTCL



THE SLD OF 220/132/33 K.V. GSS

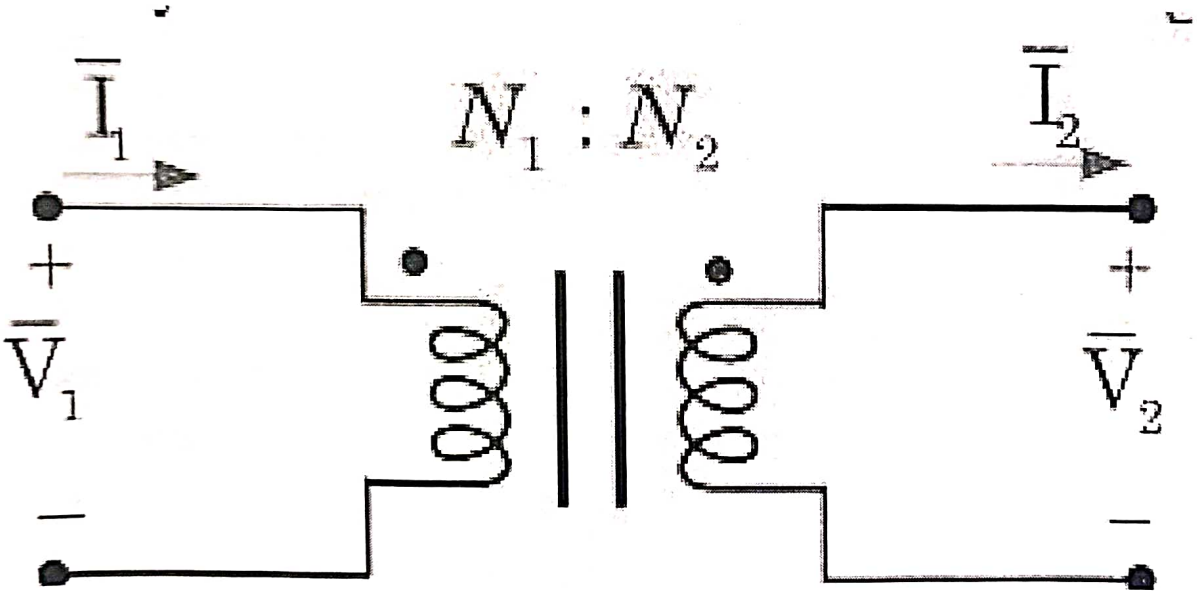
The single line diagram SLD is the most basic of the set of diagrams that are used to document the electrical functionality of the substation. Its emphasis is on communicating the functions of the power equipment and the associated protection and control system. Details about correction and physical location are not as important unless they serve the purpose of communicating function.

The SLD of 220/132/33 KV GSS consists of incoming source equipments feeders etc. The connections are shown via a single line and thus replacing the number of conductors with just a line. Legend is provided in the bottom right corner with necessary names and details of the symbols used. i.e, CT, CVT, LA, CB etc.



Transformers

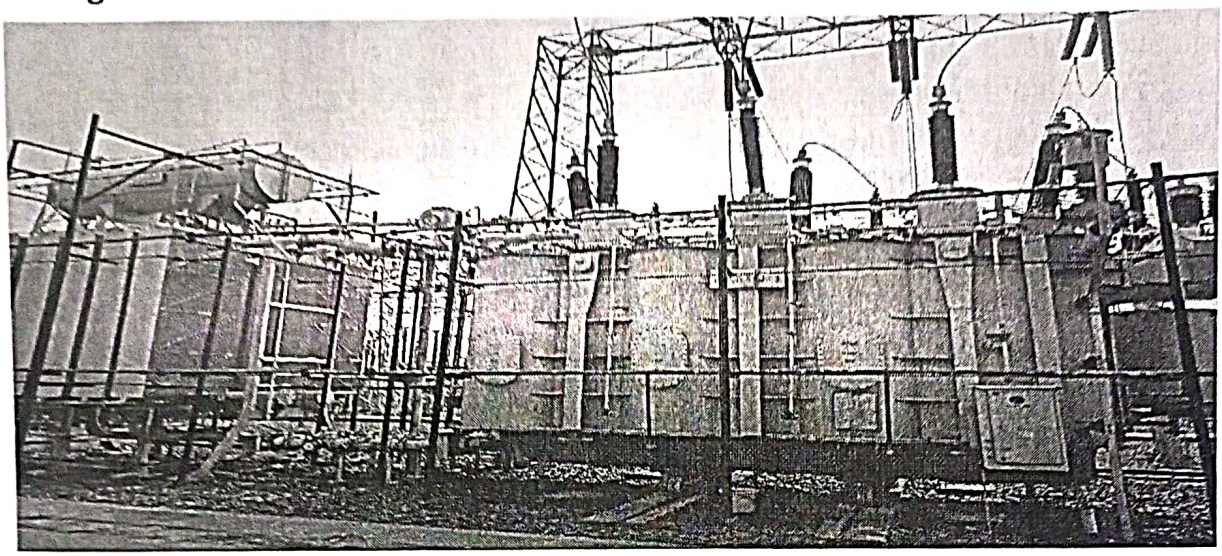
A transformer is a passive component that transfers electrical energy from one electrical circuit to another circuit, or multiple circuits. A varying current in any coil of the transformer produces a varying magnetic flux in the transformer's core, which induces a varying electromotive force across any other coils wound around the same core. Electrical energy can be transferred between separate coils without a metallic (conductive) connection between the two circuits. Faraday's law of induction, discovered in 1831, describes the induced voltage effect in any coil due to a changing magnetic flux encircled by the coil.



Ideal transformer

Power Transformer

Power transformer are just general transformer but with **High power rating**



220/132 KV , 160 MVA transformer

The main purpose of these power transformer in the **220/132/33 KV GSS Bihta (New)** is to step down the voltages from 220KV voltages to 132KV & 33KV, voltages by the use of four different transformers installled in the substation.

These transformers are generally insulated upon lengths of rails fixed on concrete slabs having foundation 1 to 1 and ½ meter deep. These transformers are provided with the tap changer.

Technical specification

SL. No.	Items	Specification
1.	Type of power	3-phase core type, auto interconnecting transformer suitable for outdoor installation and suitable for bi-directional flow of power
2.	Type of mounting	On wheels, mounted on rails
3.	Frequency	50 Hz (± 3%)
4.	Nominal voltage ratio (HV/IV/LV)	220/132/33 KV
5.	No. of phases	3
6.	No. of winding	Auto inter-connecting transformer with tertiary
7.	Type of cooling	ONAN/ONAF/OFAF
8.	MVA rating	160 MVA
9.	Method of connection	HV-Star IV- Star LV - Delta
10.	Vector group	YNa0d11
11.	System earthing	Effectively earthed
12.	Tap changing type	OLTC

In the 220/132/33 KV GSS Bihta (New), there are 2 identical transformers of the same specification, in parallel to each other, stepping down 220 KV to 132 KV voltage level. Parallel operation of the transformer is done by the transformers to step down 220 KV.

Marshalling Box of 160 MVA transformer

The Marshalling box is the master control panel for protection devices. This panel comes with a see-through glass door to allow easy visibility of the instruments and their readings. The panel is situated next to the transformer.

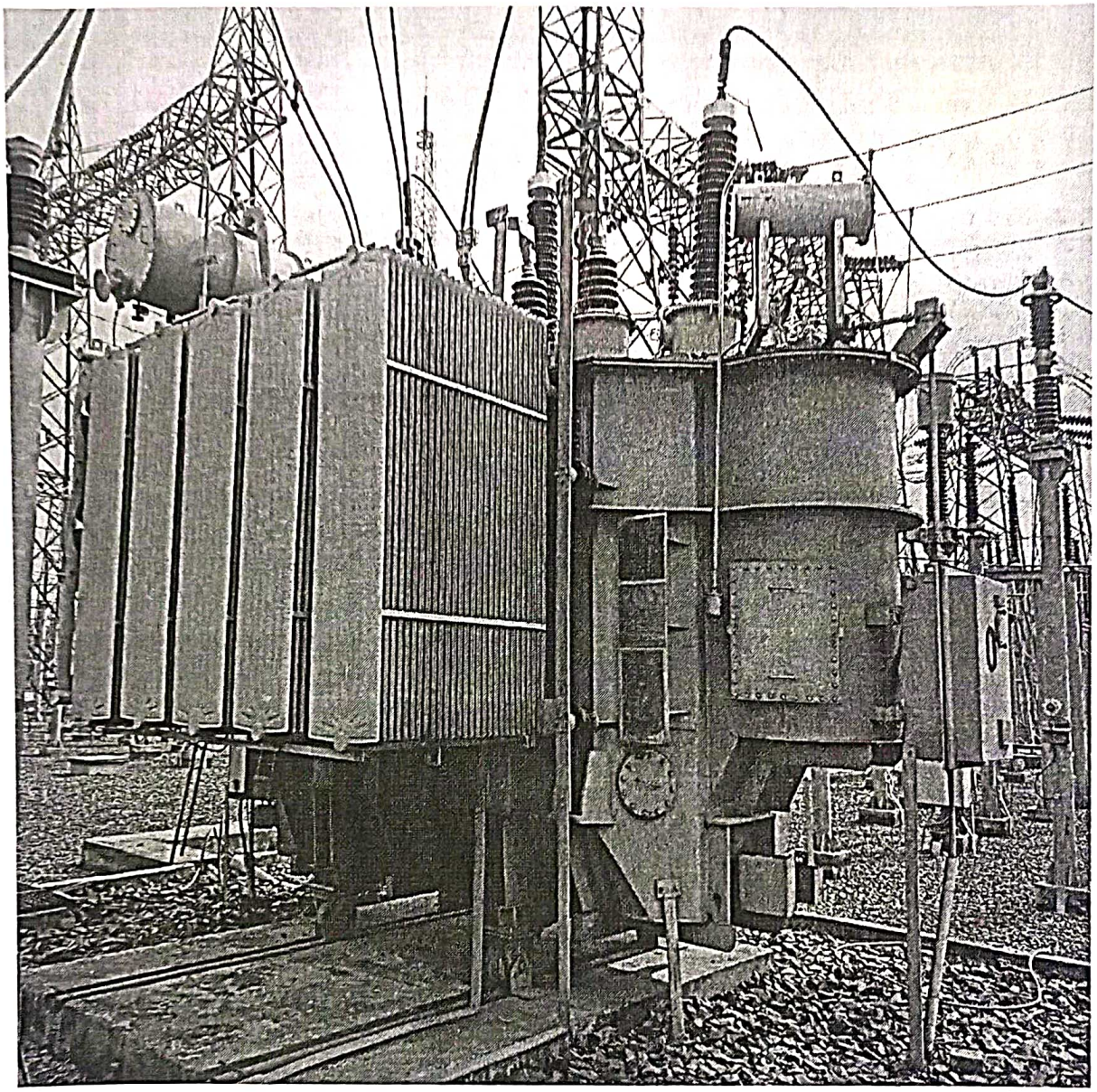
It contains OTI or oil temperature indicator, WTI or winding temperature indicator, heater switch, pump control switch, fan cooler control, MCB and contractors.

It also contains motor starters for fans (in case of a forced air cool transformer ONAF).

On can easily identify these kiosks beside

Name plate of the oil pump used in 160 MVA transformer.

132/33 K.V, 50 MVA Transformer



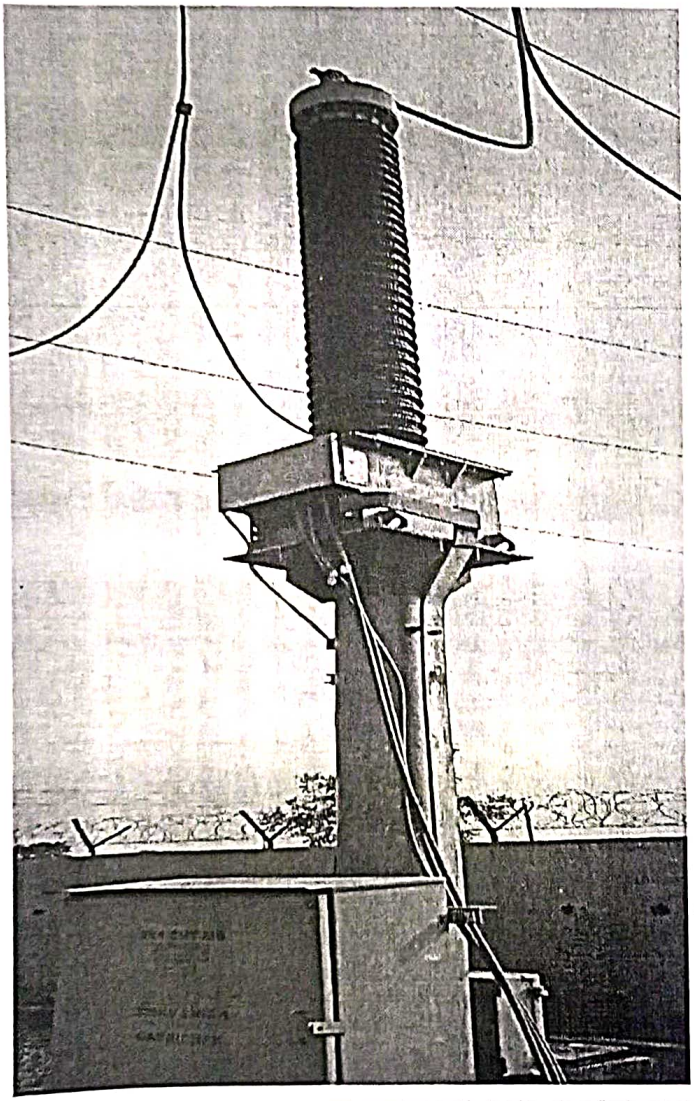
Technical specification of 50 MVA Transformer

SL. No.	Items	Specification
1.	Type of power	3-phase core type, auto interconnecting transformer suitable for outdoor installation and suitable for bi-directional flow of power
2.	Type of mounting	On wheels, mounted on rails
3.	Frequency	50 Hz (± 3%)
4.	Nominal voltage ratio (HV/LV)	132/33 KV
5.	No. of phases	3
6.	No. of winding	Auto inter-connecting transformer
7.	Type of cooling MVA rating corresponding to cooling system	ONAN/OFAF
8.	MVA rating	50 MVA
9.	Method of connection	HV-Star LV - Star
10.	Vector group	YNyno
11.	System earthing	Effectively earthed
12.	Tap changing type	OLTC (HV side)

Instrument transformers

Instrument transformers are high accuracy class electrical devices used to isolate or transform voltage or current levels. The most common usage of instrument transformers is to operate instruments or metering from high voltage or high current circuits, safely isolating secondary control circuitry from the high voltages or currents. The primary winding of the transformer is connected to the high voltage or high current circuit, and the meter or relay is connected to the secondary circuit.

Potential transformer

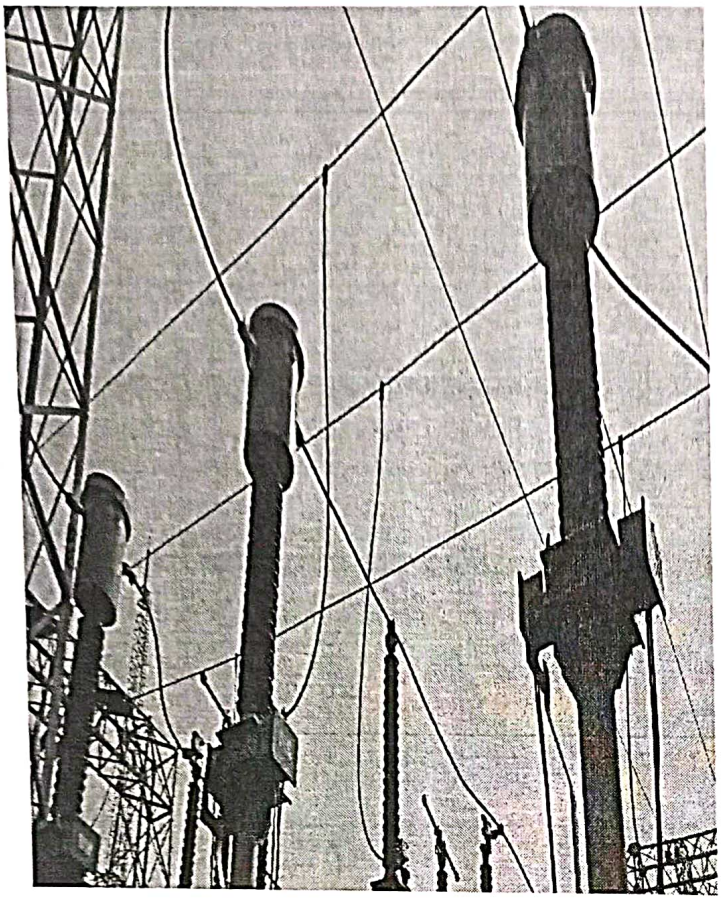


Potential transformers (PT), are a parallel-connected type of instrument transformer. They are designed to present a negligible load to the supply being measured and have an accurate voltage ratio and phase relationship to enable accurate secondary connected metering.

CVTs in combination with wave traps are used for filtering high-frequency communication signals from power frequency. This forms a carrier communication network throughout the transmission network. Capacitor type VT is used for voltages 66 kV and above.

Current transformer

A current transformer (CT) is a type of transformer that is used to measure

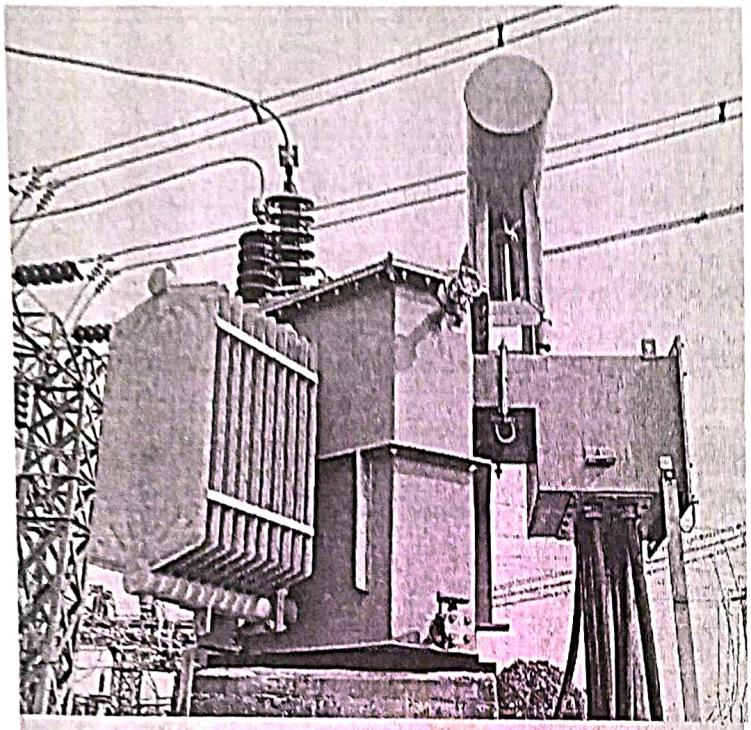


AC current. It produces an alternating current (AC) in its secondary which is proportional to the AC current in its primary. Current transformers, along with voltage or potential transformers are Instrument transformer.

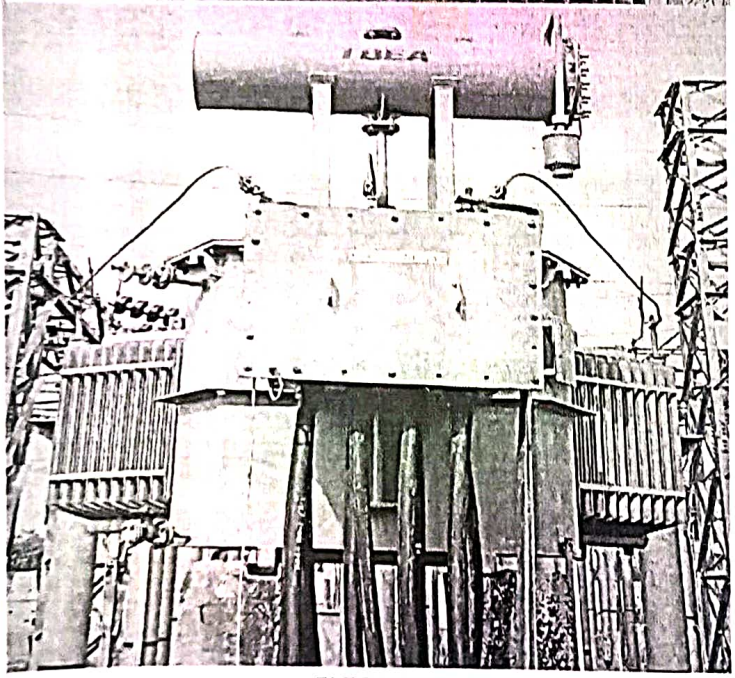
Current transformers are designed to provide a scaled-down replica of the current in the HV line and isolate the measuring instruments, meters, relays, etc., from the high voltage power circuit.

Station transformer

The Station Transformers are employed to supply auxiliary loads to the power plant for starting the plant when generating unit is not in operation.

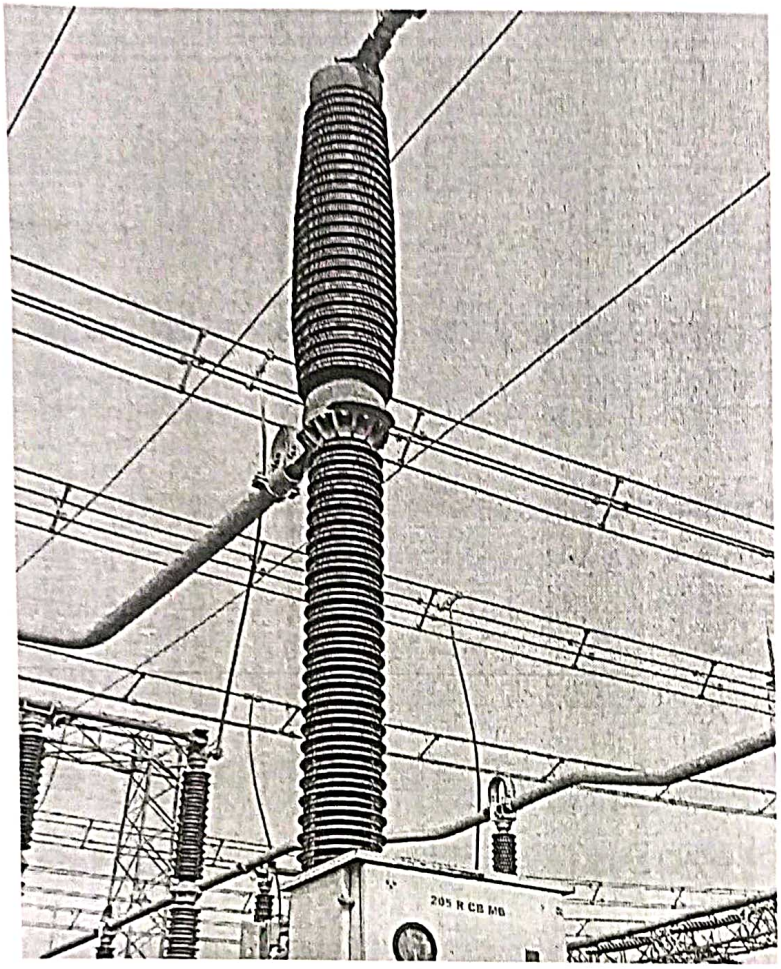


There transformers are connected to the switchyard bus. LV side of the station transformer is connected to the auxiliary buses. Station transformers are provided with On Load Tapchanger with ONAN/ONAF cooling.



In 220/132/33 KV GSS Bihta(new), there are two station transformers installed, both on 33KV side with rating of 33 KV/440V. Stepping down 33kv to 440 volts and supplying the ACDB and thus charging the bus coupler for further distribution and utilization

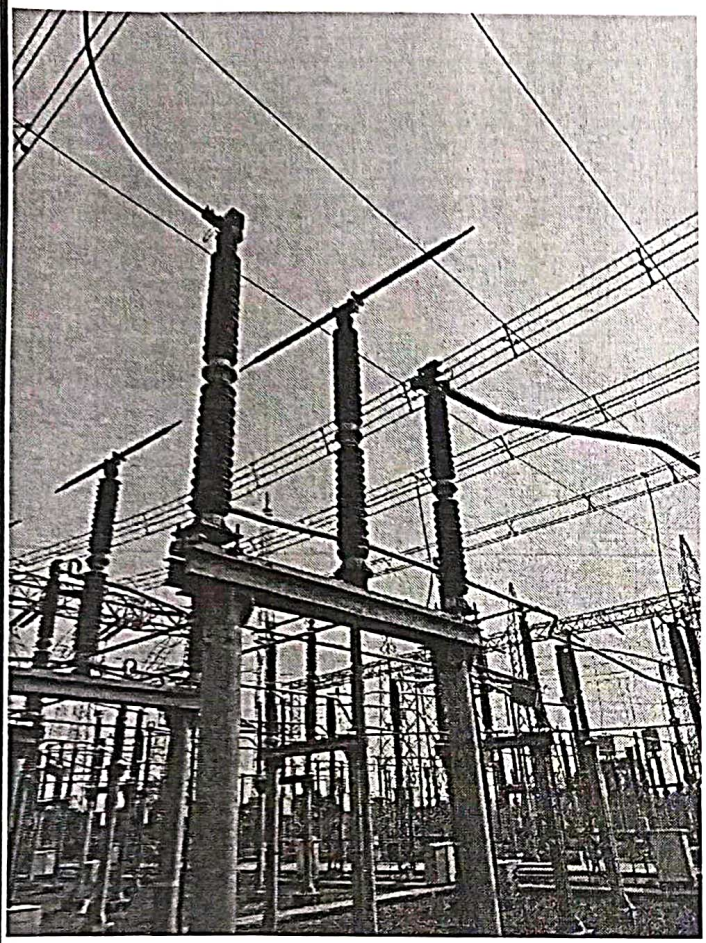
Circuit breaker



A circuit breaker is an electrical safety device designed to protect an electrical circuit from damage caused by an overcurrent or short circuit. Its basic function is to interrupt current flow to protect equipment and to prevent the risk of fire. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation.

Isolator

The isolator is a mechanical switch which isolates a part of the circuit from the system as when required. Electrical isolators separate a part of the system from rest for safe maintenance works. So, the definition of isolator can be rewritten as an isolator is a manually operated mechanical switch which separates a part of the electrical power. Isolators are used to open a circuit under no load. Its main purpose is to isolate one portion of the circuit from the other and is not intended to be opened while current is flowing in the line. Isolators are generally used on both ends of the breaker so that repair or replacement of circuit breaker can be done without any danger.



There are different types of isolators available depending upon system requirement such as

1.Double Break Isolator

2.Single Break Isolator

3.Pantograph type Isolator.

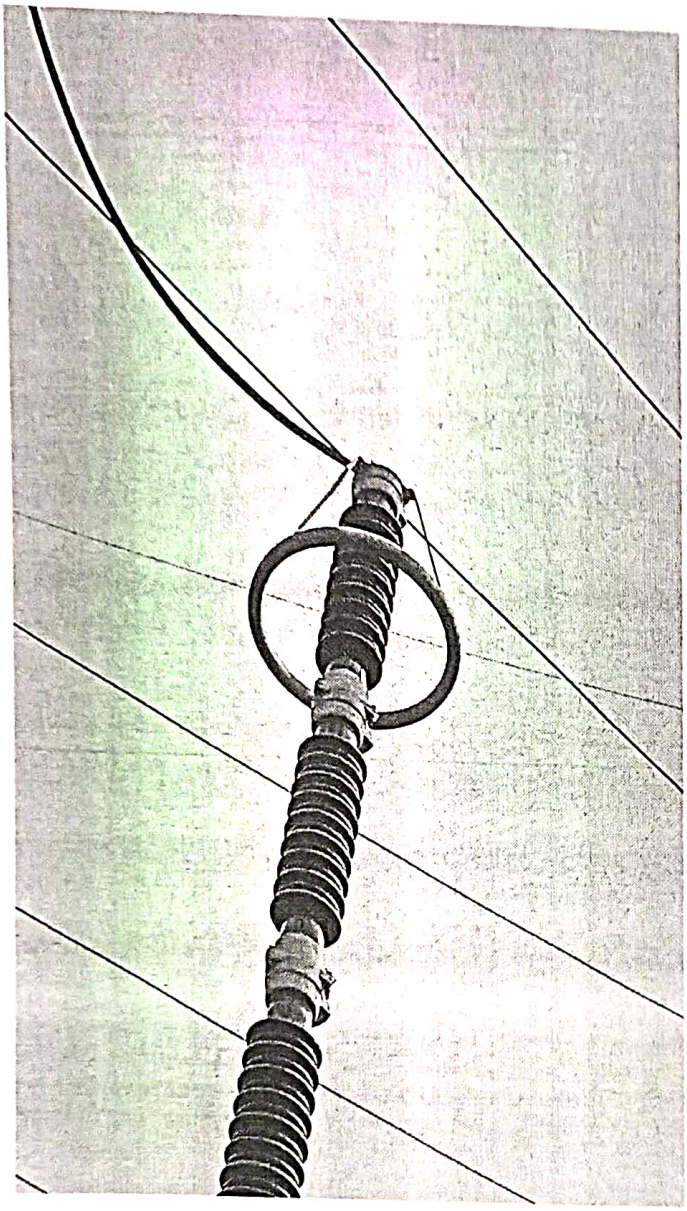
Depending upon the position in the power system, the isolators can be categorized as

1. Bus side isolator – the isolator is directly connected with main bus

2. Line side isolator – the isolator is situated at line side of any feeder

3. Transfer bus side isolator – the isolator is directly connected with transfer bus.

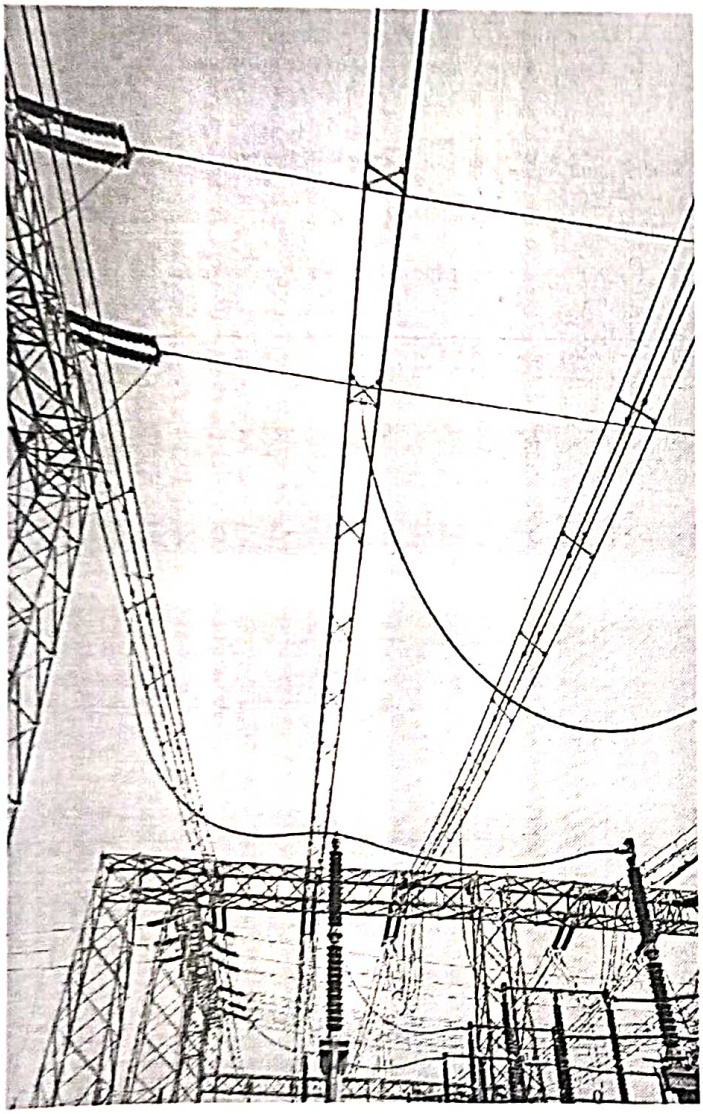
Lightening Arrester



A lightning arrester (alternative spelling lightning arrestor) (also called lightning Isolator) is a device used on electric power transmission and telecommunication systems to protect the insulation and conductors of the system from the damaging effects of lightning. The typical lightning arrester has a high-voltage terminal and a ground terminal. When a lightning surge (or switching surge, which is very similar) travels along the power line to the arrester, the current from the surge is diverted through the arrester, in most cases to earth.

Bus Bar System

An electrical bus bar is defined as a conductor or a group of conductors used for collecting electric power from the incoming feeders and distributes them to the outgoing feeders. In other words, it is a type of electrical junction in which all the incoming and outgoing electrical current meets. Thus, the electrical bus bar collects the electric power at one location.

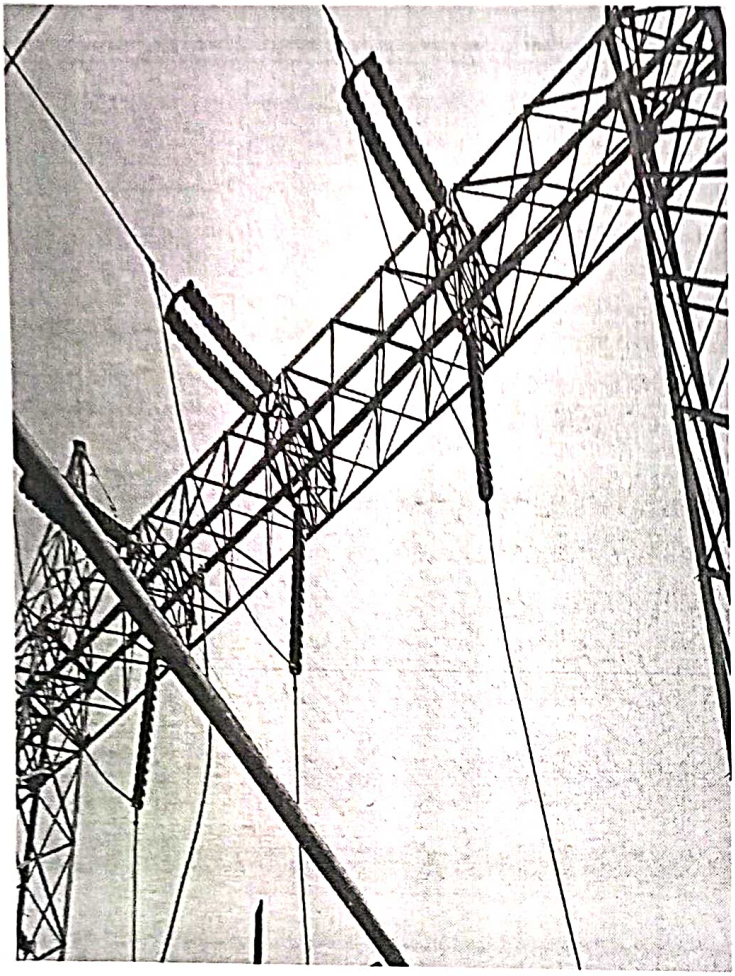


The bus bar system consists the isolator and the circuit breaker. On the occurrence of a fault, the circuit breaker is tripped off and the faulty section of the busbar is easily disconnected from the circuit.

The electrical bus bar is available in rectangular, cross-sectional, round and many other shapes. The rectangular bus bar is mostly used in the power system. The copper and aluminium are used for the manufacturing of the electrical bus bar.

Insulator

An electrical insulator is a material in which electric current does not flow freely.

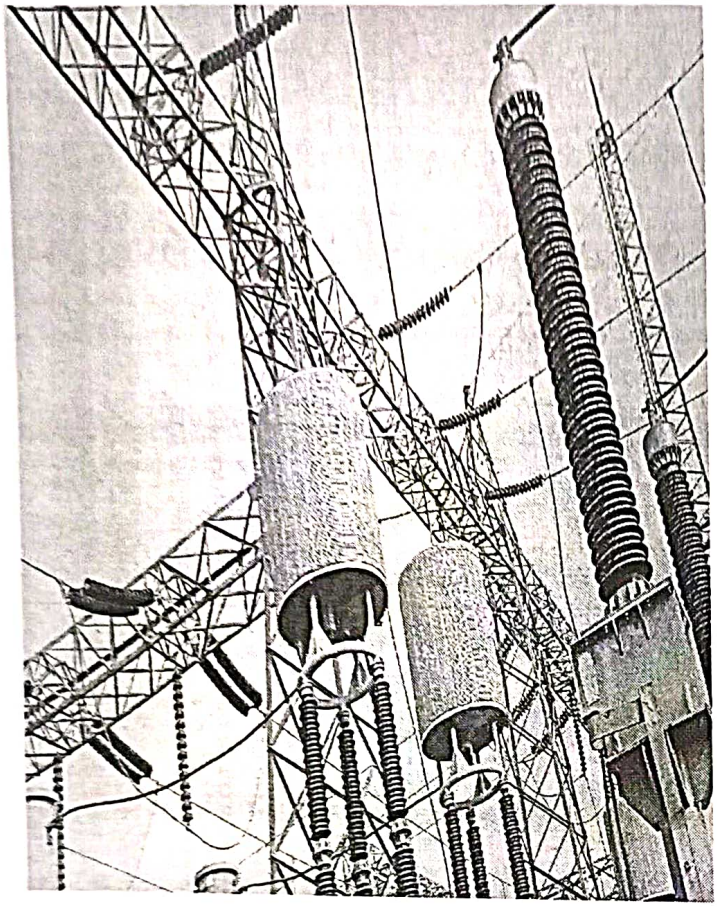


The atoms of the insulator have tightly bound electrons which cannot readily move. Other materials—semiconductors and conductors—conduct electric current more easily. The property that distinguishes an insulator is its resistivity; insulators have higher resistivity than semiconductors or conductors. The most common examples are non-metals.

Insulators are used in electrical equipment to support and separate electrical conductors without allowing current through themselves. An insulating material used in bulk to wrap electrical cables or other equipment is called insulation. The term insulator is also used more specifically to refer to insulating supports used to attach electric power distribution or transmission lines to utility poles and transmission towers. They support the weight of the suspended wires without allowing the current to flow through the tower to ground

Wave trap

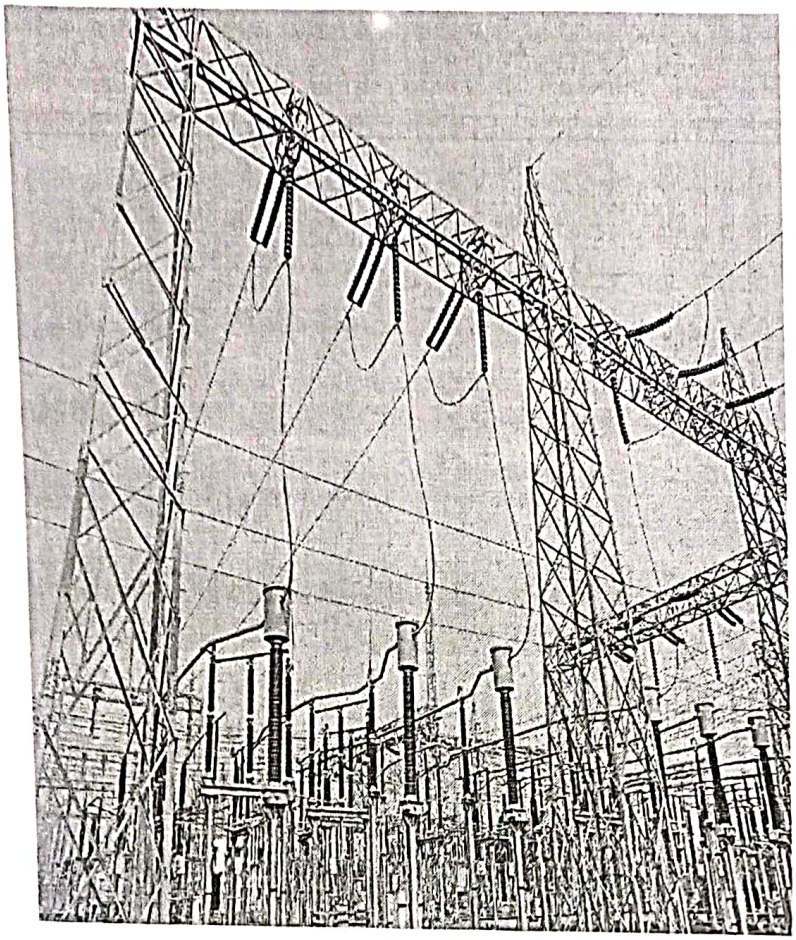
Wave trap, also called Line Trap or high-frequency stopper, is a maintenance-free parallel resonant circuit, mounted inline on high-voltage (HV) AC transmission



power lines to prevent the transmission of high frequency (40 kHz to 1000 kHz) carrier signals of power line communication to unwanted destinations. Line traps are cylinder-like structures connected in series with HV transmission lines. A line trap is also called a wave trap

Wine trap acts as a barrier or filter to prevent signal losses. The inductive reactance of the line trap presents a high reactance to high-frequency signals but a low reactance to mains frequency. This prevents carrier signals from being dissipated in the substation or in a tap line or branch of the main transmission path and grounds in the case of anything happening outside of the carrier transmission path. The line trap is also used to attenuate the shunting effects of high-voltage lines.

Gantry Tower

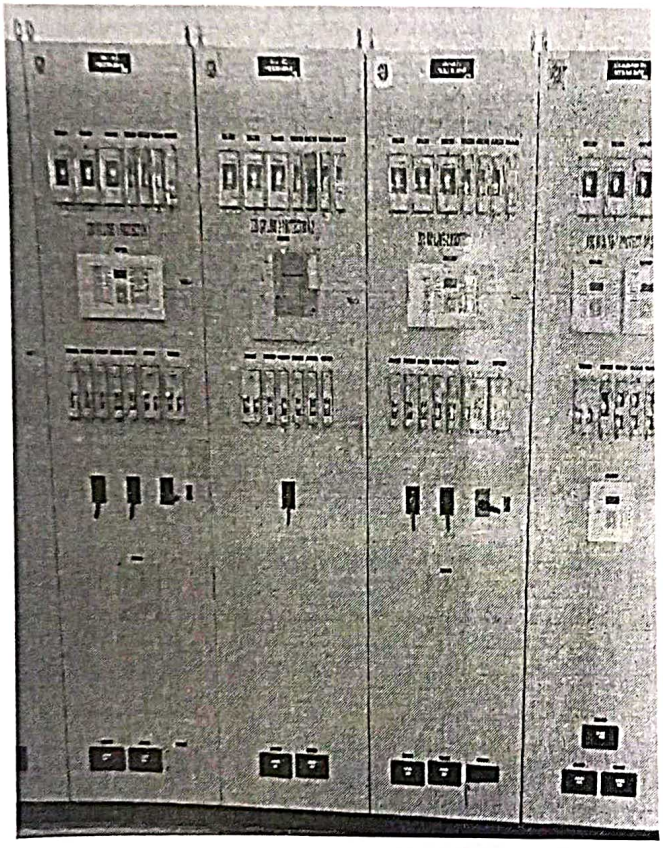


Gantry structures are mainly used for guiding the power conductor from last tower near substation to the electrical equipments in a substation. This structure consists of a number of columns and beams, which depend on number of circuits of the line. Gantries are also used for line crossing.

Control room of GSS

The control room where the operator can view the alarms, breaker states, measures of power elements (transformers, generators, loads, etc.). Depending on all the information that the operator receives, he will operate the incomings, the tie breakers, the outputs for the loads or simply will physically check the elements that are generating an alarm before a major fault occurs. If want more information about this topic I recomend that you find the applications of SCADA (supervision, control and data aquisition) systems.

Relays

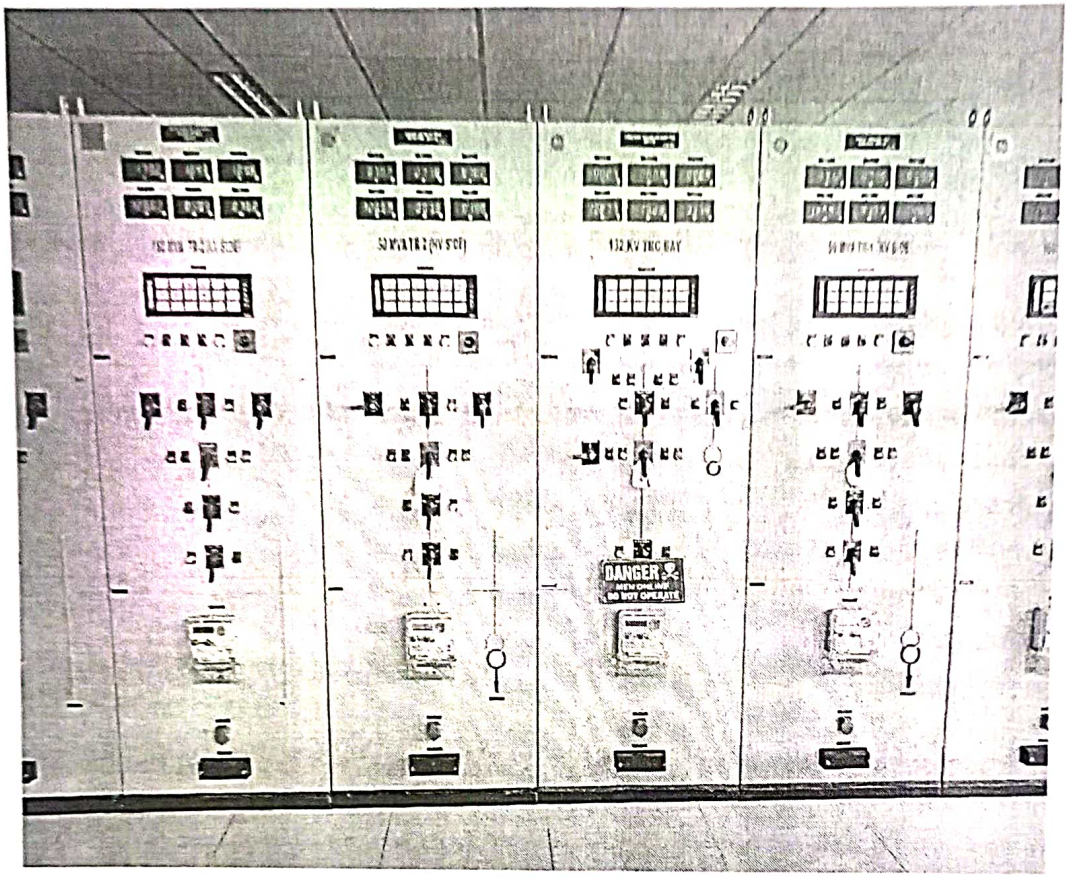


A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

Control panel

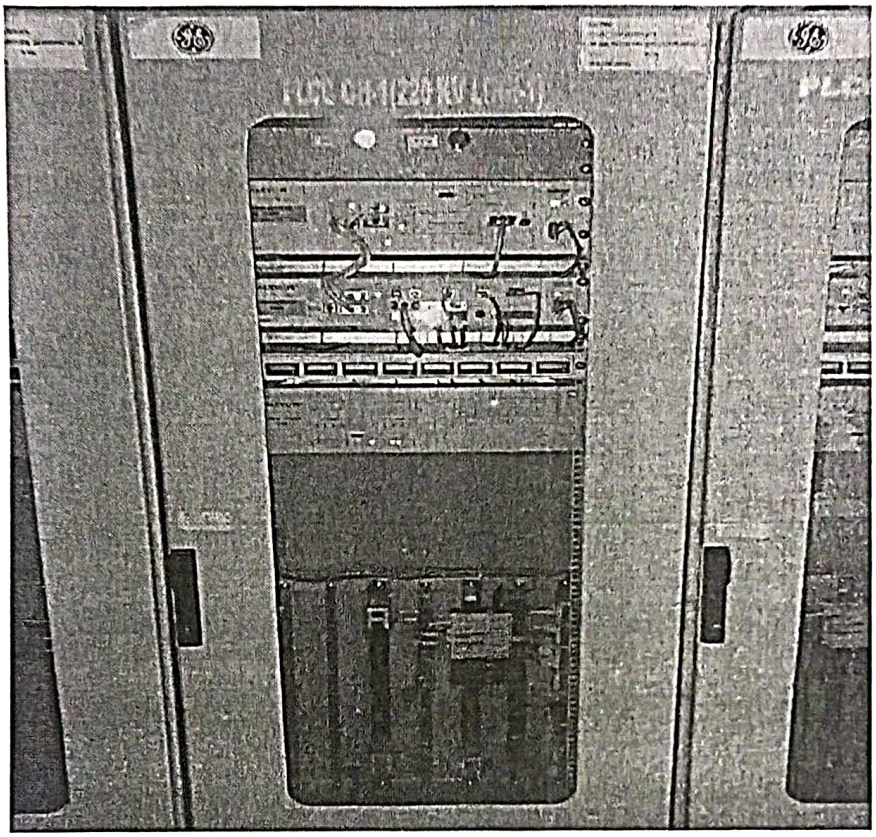
Control panel is used to accommodate instruments for the purpose of measurement, monitoring, protection, detection, control and manage the processes.



The panels are located in a control room as well as a field termed as a local control panel (LCP) for operational convenience.

PLCC (Power Line Carrier Communication)

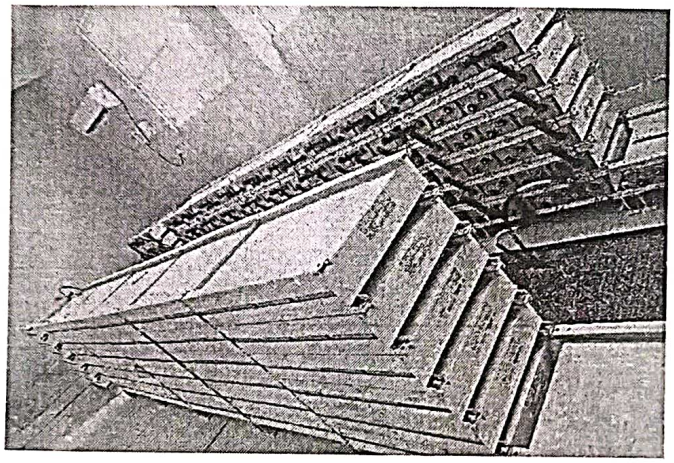
Power-line carrier communication (PLCC) is mainly used for telecommunication, tele-protection and tele-monitoring between electrical substations through power lines at high voltages, such as 110 kV, 220 kV, 400 kV. The modulation generally used in these system is amplitude modulation.

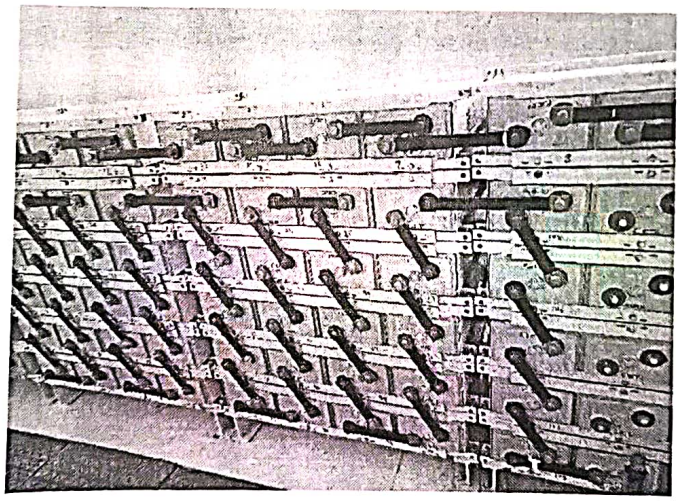


Power Line Carrier Communication (PLCC) is used for the purpose of protection of line and communication between the two stations. Two different PLCC channels are used for the protection of a single line. This is the reason; you will notice that wave traps are normally installed in R and B phase of transmission line.

Battery room

A battery room is a room that houses batteries for backup or uninterruptible power systems. The rooms are found in telecommunication central offices, and provide standby power for computing equipment in datacenters. Batteries provide direct current (DC) electricity, which may be used directly by some types of equipment, or which may be converted to alternating current (AC) by uninterruptible power supply (UPS) equipment. The batteries may provide power for minutes, hours or days, depending on each system's design, although they are most commonly activated during brief electric utility outages lasting only seconds.

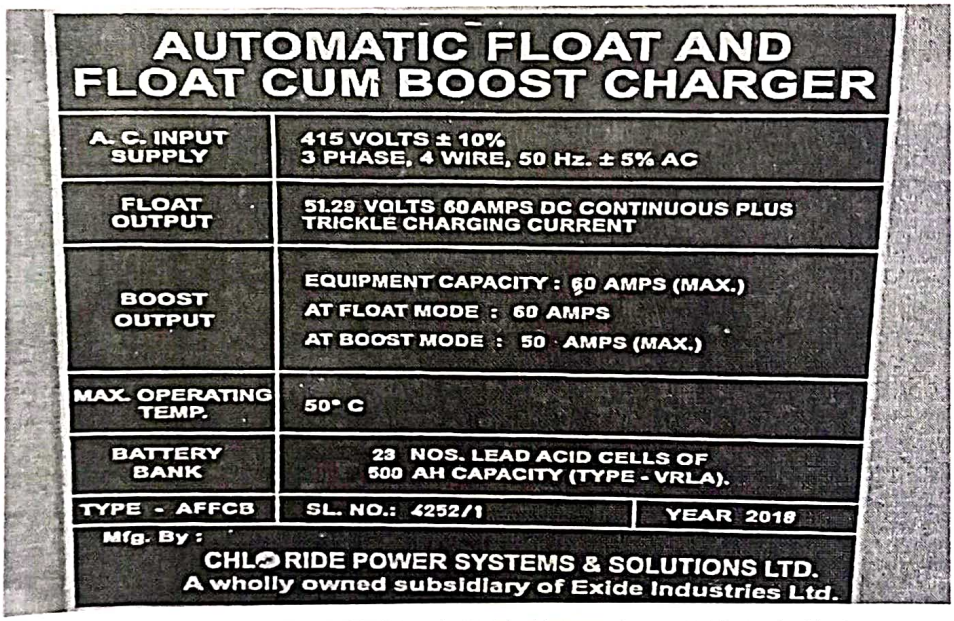




Charger

Given snapshot is of the charging panel residing in the switch gear room, facilitating the charging of 250v battery pack

The charger receives power from ACDB and keeps the battery pack charged for backup



Diesel generator

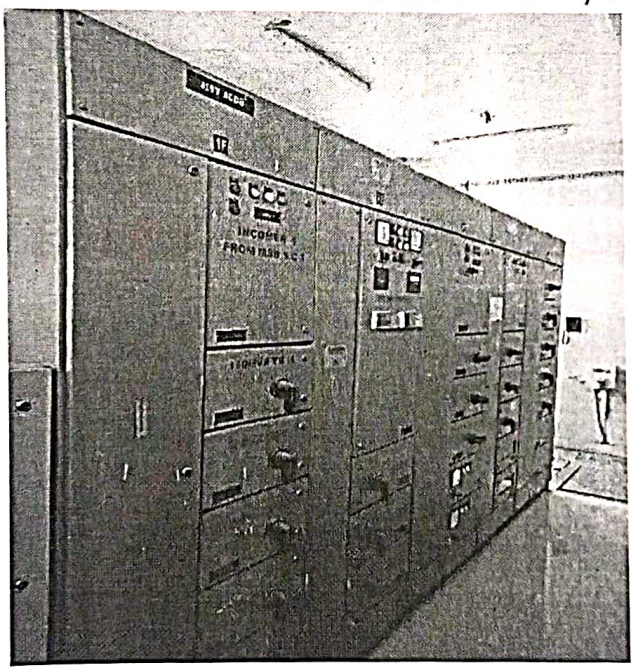
Diesel generators are a vital part of a power grid, they help prevent large-scale power loss. While maintaining prime power generation sources is vital, it is also reassuring to know that diesel generators are there are a reliable back-up option if required. Many businesses and services also have their own backup generators, and those not connected to the main power grid will also utilize diesel generations as their main source of power. Diesel generators keep things up and running when challenges arise.

Switchgear

Switchgear/switchboards and motor control rooms are the combination of electrical disconnect switches, fuses, or circuit breakers used to control, protect, and isolate electrical equipment. Switchgears are used both to de-energize equipment to allow work to be performed and to clear faults downstream. This type of equipment is directly linked to the reliability of the electricity supply and allows high currents and power levels to be safely controlled by automatic equipment. Switchgear equipment in substations is located on both the high and low-voltage sides of large power transformers and may be housed in a separate building.

Alternating Current Distribution Board (ACDB)

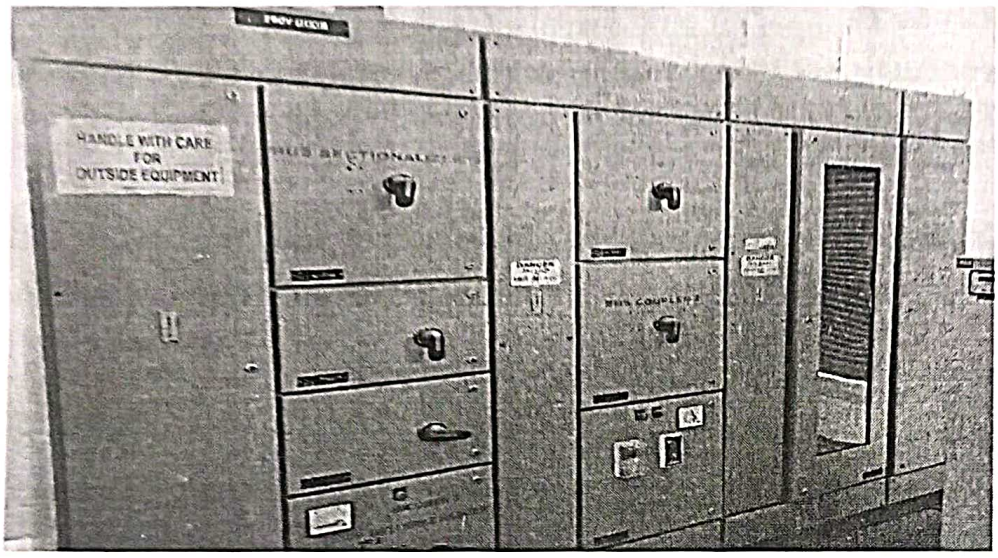
The ACDB (Alternative Current Distribution Box) is a small solar device that is installed between the solar inverter and your home load. An ACDB includes necessary surge protection devices (SPD), AC fuse, and MCB to protect the appliances from any type of electrical damage or high voltages.



The ACDB receives AC power from solar inverter and directs it to AC loads / LT Panel. ACDB is an important part of SPV system as it provides extra protection to the system in case of failures on load side.

Direct Current Distribution Board (DCDB):

A distribution board (also known as panel board or breaker panel) is a component of an electricity supply system which divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit. The solar power generated is fed to the DCDB.



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 and distribution of electricity is done. We too came to know about the various parts of the substation systems.

We think that our training was beneficially and we think that the 220 / 132 / 33 KV GSS Bihta(new) is an excellent training center for inquisitive emerging electrical engineers to learn about the transmission and distribution of high voltage electricity and all other protective devices.

In the training session we came to know about the fundamentals of power system which may be quite useful for our future.

Bihar State Power Transmission Company Limited

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Saurabh Kumar,
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Letter No...193(A)

CERTIFICATE

Date: 01/04/2023

This is to certify that KHUSHI Branch B.Tech (E.E.E) Registration no./Roll No. 204001 college Netaji Subhas Institute of Technology, Bihta has successfully completed his/her in-Plant Training at 132/33 KV GSS DIGHA under transmission Division Patna (Central) from 17/02/2023 to 02/03/2023 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was VERY GOOD

Place: Patna

विद्युत कार्यपालक अभियंता
संचरण प्रमंडल, पटना (मध्य)

(Saurabh Kumar)
Electrical Executive Engineer
Transmission Division Patna (Central)

IN PLANT TRAINING REPORT

132/33 KV GSS DIGHA (Identification of apparatus, their use & specification)

AT

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, PATNA

Submitted

In The Partial Fulfilment of Bachelor of Technology Department

Of

ELECTRICAL AND ELECTRONICS ENGINEERING

NETAJI SUBHAS INSTITUTE OF TECNOLOGY

SUBMITTED BY

NAME: - KHUSHI

COURSE: - B. TECH

ROLL NO: - 204001

REG NO: - 20110103002

Bihar State Power Transmission Company Limited

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CERTIFICATE

This is to certify that ANUP KUMAR Branch E.E.E Registration no./Roll No. 20110103004 college NSIT Bihta Patna has successfully completed his/her in-Plant Training at 220/132/33 KV GSS under transmission Division Patna West), from 03./02./2023 to 02./03./2023 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was Good.

Place: Patna

Issue Date: 20/03/2023

EEE/TD/ Patna
L No. 413 Date. 20/03/2023

Electrical Executive Engineer
Transmission Division Patna (West)

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University,Patna (Bihar)

"INTERNSHIP PROGRAM"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED,

THE MONTH OF FEBRUARY 2023

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELCTRONICS ENGINEERING

Under the guidance of

Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:
ANUP KUMAR (204006)

Submitted to:
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Bihar State Power Transmission Company Limited

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CERTIFICATE

This is to certify that .....UDIT RAJ.....Branch.....E.E.E.....Registration no./Roll No....20110103003..... college.....NSIT Bihta, Patna.....has successfully completed his/her in-Plant Training at 220/132/33 KV GSS.....under transmission Division Patna West), from..03.../.02./2023 ...02.../.03./2023in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was.....Good.....

Place: Patna

Issue Date:..20/03/2023

EEE/TD/ Patna
L No.411..... Date.20/03/2023

Electrical Executive Engineer
Transmission Division Patna (West)

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA, PATNA

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Under the guidance of

Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:
UDIT RAJ (204012)

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

Bihar State Power Transmission Company Limited

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Letter No. 203

CERTIFICATE

Date: 05.04.2023

This is to certify that PRIYA KUMARI Branch B.TECH (EEE) Registration no./Roll No. 204008 college Netaji Subhas Institute of Technology, Bihta DIGHA has successfully completed his/her in-Plant Training at 132/33 KV GSS..... under transmission Division Patna (Central) from 08/02/2023 to 02/03/2023 In Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was VERY GOOD

Place: Patna

(Saurabh Kumar)
Electrical Executive Engineer
Transmission Division Patna (Central)

IN PLANT TRAINING REPORT

132/33 KV GSS DIGHA (Identification of apparatus, their use & specification)

AT

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, PATNA

Submitted

In The Partial Fulfilment of Bachelor of Technology Department

Of

ELECTRICAL AND ELECTRONICS ENGINEERING

NETAJI SUBHAS INSTITUTE OF TECNOLOGY

SUBMITTED BY

NAME: - PRIYA KUMARI

COURSE: - B. TECH

ROLL NO: - 204008

REG NO: - 20110103009

Bihar State Power Transmission Company Limited

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Letter No. 193(B)

CERTIFICATE

Date: 01/04/2023

This is to certify that Tara Kant Mani Branch B.Tech (E.E.E) Registration no./Roll No. 204009 college Netaji Subhas Institute of Technology, Bihta has successfully completed his/her in-Plant Training at 132/33 KV GSS DIGHA under transmission Division Patna (Central) from 17/02/2023 to 02/03/2023 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was VERY GOOD

Place: Patna

विद्युत कार्यपालक अभियंता
संचरण प्रमंडल, पटना (मध्य)

(Saurabh Kumar)
Electrical Executive Engineer
Transmission Division Patna (Central)

IN PLANT TRAINING REPORT

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BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, PATNA

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Of

ELECTRICAL AND ELECTRONICS ENGINEERING

NETAJI SUBHAS INSTITUTE OF TECNOLOGY

SUBMITTED BY

NAME: - KHUSHI

COURSE: - B. TECH

ROLL NO: - 204001

REG NO: - 20110103002

CONTENTS

- BSPHCL
- BSPTCL
- INTRODUCTION TO GSS DIGHA
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- SINGLE LINE DIAGRAM
- TRANSMISSION LINES
- CONDUCTORS
- SUBSTATION
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- BUSBAR
- CAPACITOR VOLTAGE TRANSFORMER (CVT)
- SURGE ARRESTOR OR LIGHTNING ARRESTOR
- ISOLATORS
- CIRCUIT BREAKERS
- INSTRUMENT TRANSFORMERS
- CONTROL PANELS AND RELAYS
- WAVE TRAP
- OTHER IMPORTANT EQUIPMENTS
  - BATTERY BANK
  - SUBSTATION TRANSFORMER
  - ACDB and DCDB ROOM
- ELECTRICAL SAFETY AND EARTHING

INTRODUCTION TO GSS DIGHA

Digha Grid Substation is located just after the railway colony at Danapur main road, Birla Colony, Patna, Bihar, 800011. It remains operational 24*7. It receives supply of 132KV through overhead and underground cable from two supply lines from Khagaul. With the help of three 80 MVA transformers the voltages of 132KV step down to 33 KV and then it is supplied to 13 different feeders in which 8 indoor feeders and 5 outdoor feeders.

The five outdoor feeders of 33KV are :-

1. DIGHA 1
2. DIGHA 2
3. RAJAPUR
4. EXCISE COLONY
5. PATLIPUTRA

And the 8 indoor 33KV feeders are :-

1. NEW BOARD COLONY
2. RBI
3. LEAD ASIAN
4. GIS DIGHA 1
5. GIS DIGHA 2
6. EXCISE-2
7. RELIANCE JIO
8. DIGHA 3

In this grid there is a transformer, control and relay panel, battery room and GIS room. Here we can see switch yard containing transformer, lightning arrester, CT, CVT breaker, end termination, etc. 33KV switch yard contains sub isolator, circuit station transformer with all other equipment. The main machine that is used here is transformer of 80 MVA to step down the 132 KV to 33 KV and all the mentioned machine and instruments which are used in the yard have main purpose of measurement of power and protection of equipment including transformer.

GIS SUBSTATION

Gas-Insulated Substations(GIS) are high voltage substations that contain major conducting structures within a sealed environment. GIS uses the gas sulfur hexafluoride (SF6) for insulation. The atmospheric air insulation used in a conventional, Air-insulated Substation (AIS) requires meters of air insulation to do what SF6 can do in centimeters.

GIS can therefore be smaller than AIS by up to a factor of 10. A GIS is mostly used where space is expensive or not available. In a GIS the active parts are protected from the deterioration from exposure to atmospheric air, moisture, contamination, etc.

As a result, GIS is more reliable and requires less maintenance than AIS.

Advantages of GIS over AIS:

Primary hardware for primary equipment, **GIS is more expensive than AIS**. However, the price of auxiliary equipment such as support, conductors, land, installation, control, protection and monitoring can lead to a cost difference between the two systems being small.

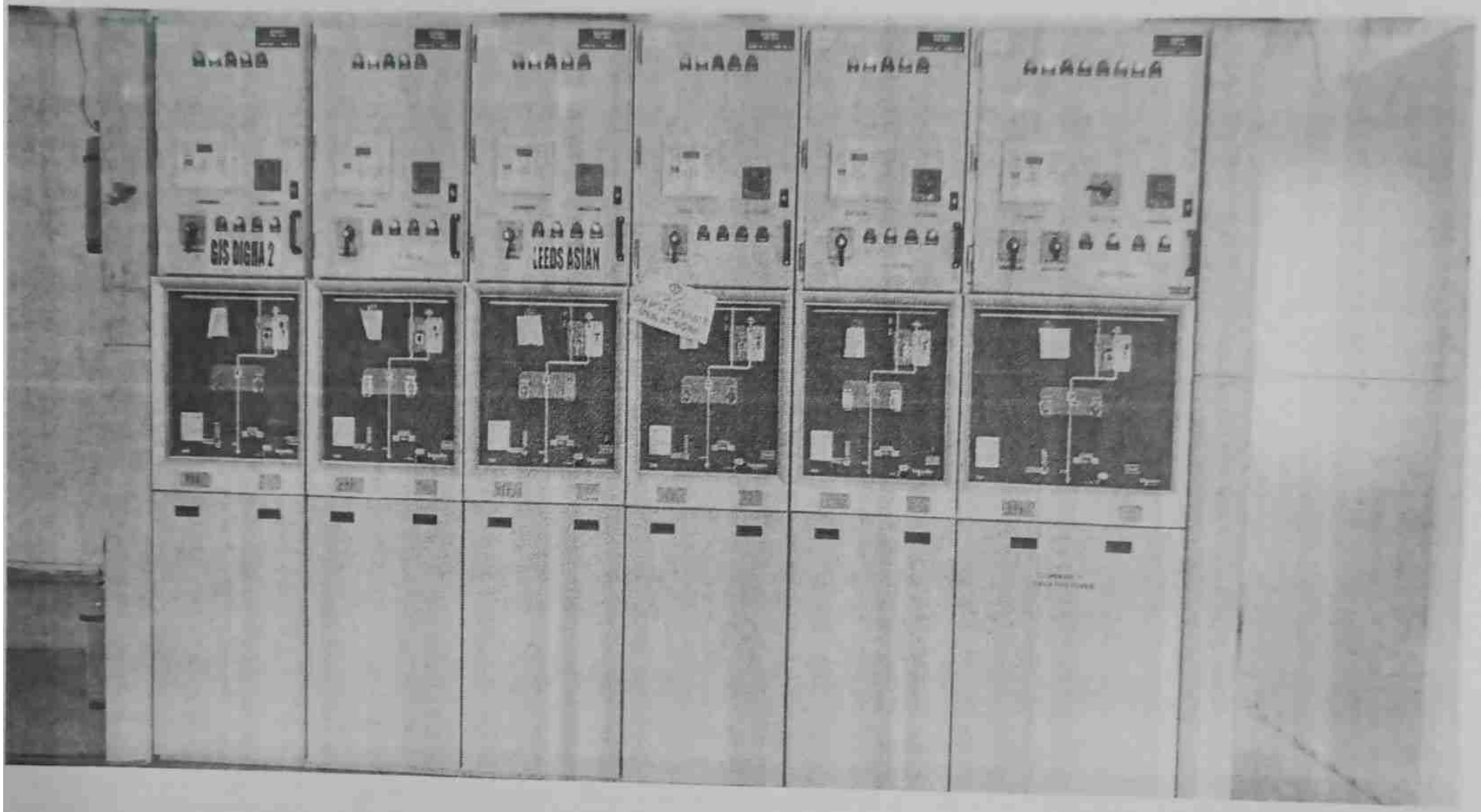
The failure rate of circuit breaker and disconnecting switch in GIS is **one-fourth of that of AIS and one tenth in case of busbar**, thus the maintenance cost of GIS is less than that of AIS over the lifetime.

The maintenance cost of GIS and AIS shall be **equivalent**. The cost for training in GIS is higher than in AIS.

Since the failure rate of GIS is lower, **the outage cost of AIS shall be greater**.

The cost of decommissioning and disposal after use should be capitalized. The value of future expense must be taken into account.

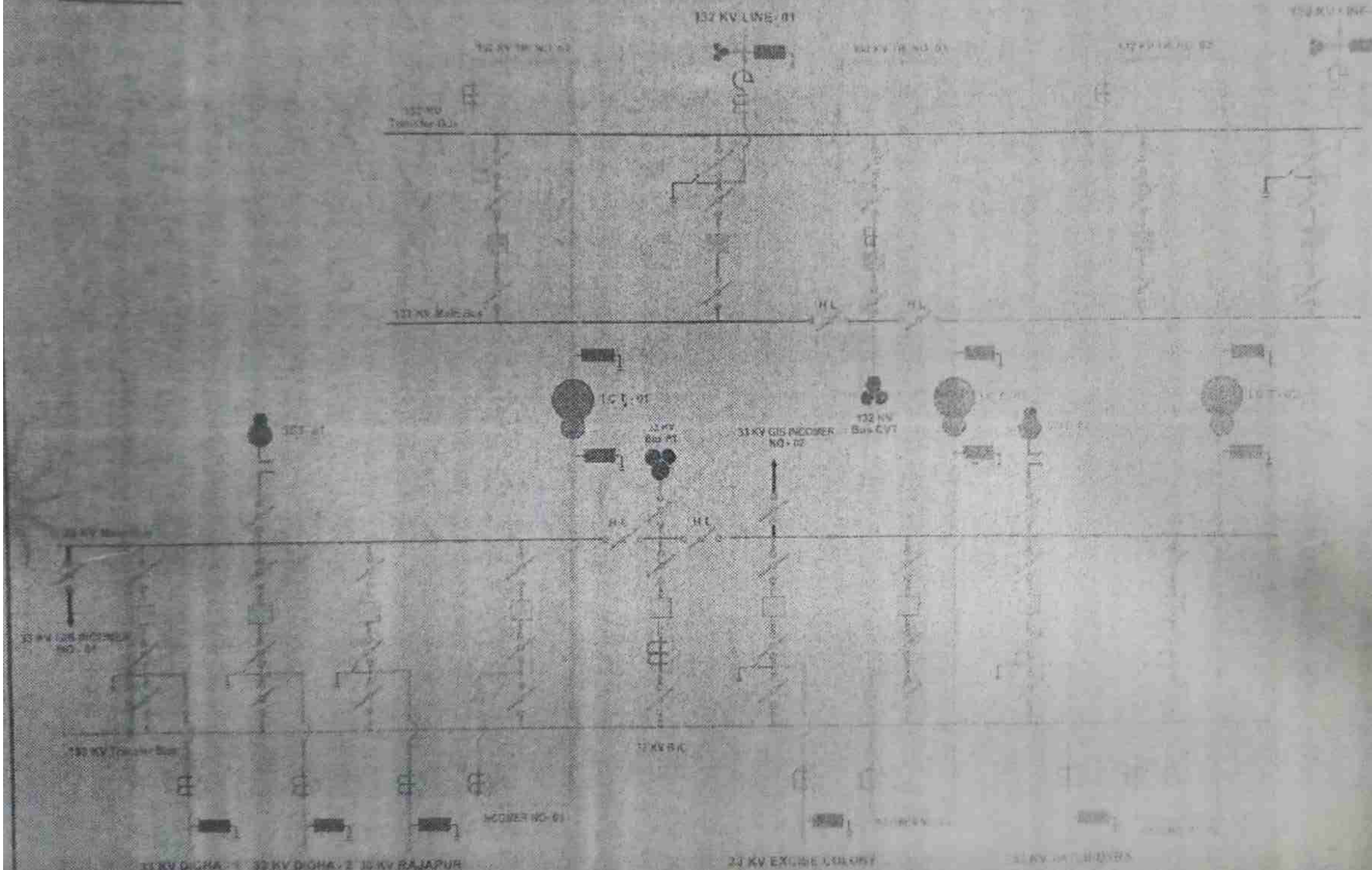
The general conclusion about the LCC advantages of AIS versus GIS **cannot be easily reached**. Hence it can only be determined in specific project. An example below illustrates the LCC comparison. In this example, GIS and AIS use H-configuration with three circuit breakers.



GIS SUBSTATION GSS DIGHA

BSPTCL

SINGLE LINE DIAGRAM OF 132/33 KV GSS DIGHA



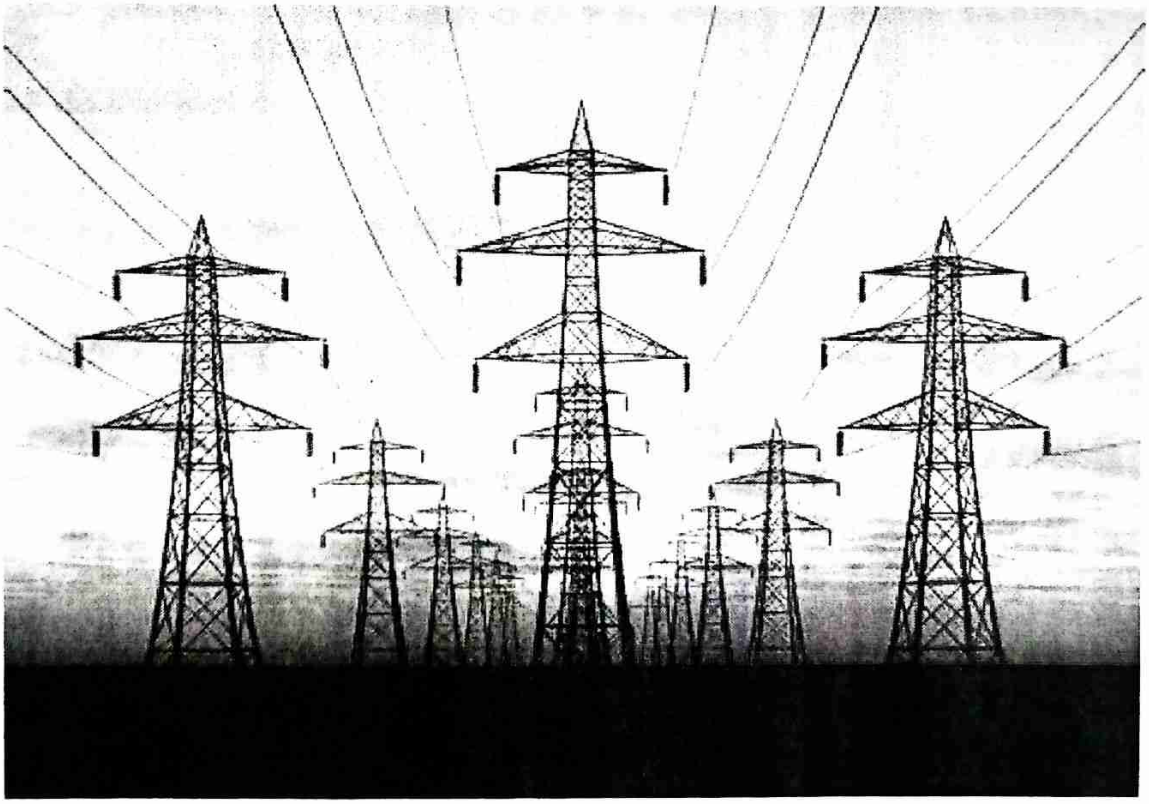
LEGEND

- 132 KV CIRCUIT BREAKER
- 33 KV CIRCUIT BREAKER
- ISOLATOR
- CURRENT TRANSFORMER
- POWER TRANSFORMER
- STATION TRANSFORMER
- POTENTIAL TRANSFORMER
- C.V.T
- 132 KV SURGE ARRESTOR
- 33 KV SURGE ARRESTOR
- WAVE TRAP
- HORN GAP FUSE
- EARTH SWITCH
- OPERATIONAL METER
- ART METER
- 132 KV TRANSFER BUS
- 33 KV MAIN BUS
- 33 KV TRANSFER BUS
- 132 KV LINE
- 33 KV LINE
- 33 KV GIS INCOMER

TRANSMISSION LINES

Transmission line is the long conductor with special design (bundled) to carry bulk amount of generated power at very high voltage from one station to another as per variation of the voltage level. A power transmission line might be connected to a source of energy at both ends- an unusual situation in other fields of transmission.

The transmission line is made up of a conductor having a uniform cross sectional area along the line. Air act as an insulating or dielectric medium between the conductors. The losses are taken care to be kept minimum. Several towers of specific heights are built to join the wires overhead.



Transmission of electricity

CLASSIFICATION OF TRANSMISSION LINES

In transmission line determination of voltage drop, transmission efficiency, line loss etc. are important things to design. These values are affected by line parameter R, L and C of the transmission line. Length wise transmission lines are three types.

1. Short transmission line
2. Medium transmission line
3. Long transmission line

Short transmission line :-

- A short transmission line is classified as a transmission line with:
- A length less than 80km (50 miles)
- Voltage level less than 69 kV
- Capacitance effect is negligible
- Only resistance and inductance are taken in calculation capacitance is neglected.

Medium transmission line :-

- A medium transmission line is classified as a transmission line with:
- A length more than 80 km (50 miles) but less than 250 km (150 miles)
- Operational voltage level is from 69 kV to approx 133 kV
- Capacitance effect is present
- Distributed capacitance form is used for calculation purpose.

Long transmission line :-

- A long transmission line is classified as a transmission line with:
- A length more than 250 km (150 miles)
- Voltage level is above 133 kV
- Line constants are considered as distributed over the length of the line.

CONDUCTORS

A conductor is one of the most important components of overhead lines. Conductor is a physical medium to carry electrical energy from one place to other. Selecting a proper type of conductor for overhead lines is as important as selecting economic conductor size and economic transmission voltage.

A good conductor should have the following properties :

- High electrical conductivity
- Lower weight per unit volume
- High tensile strength in order to withstand mechanical stresses
- Relatively lower cost without compromising much of other properties

Conductor materials :-

The most important and much suitable material for conductor of transmission line is copper as it having high conductivity and high tensile strength. More ever it is having good ductility. The only limitation is its cost. The most extensively used material in transmission line is Aluminum. Aluminum is having sufficient conductivity. More ever it is light in weight. Which results in low conductor weight and less sag. The only limitation is its low tensile strength. To overcome this limitation steel core is used for increasing the tensile strength of aluminum conductor such as in ACSR (Aluminum conductor steel reinforced) conductor.

ACSR conductor is very much popular for high voltage overhead transmission lines.

Aluminium conductor steel-reinforced cable (**ACSR**) is a type of high-capacity, high-strength stranded conductor typically used in overhead power lines. The outer strands are high-purity aluminium, chosen for its good conductivity, low weight, low cost, resistance to corrosion and decent mechanical stress resistance. The central strand is steel for additional strength to help support the weight of the conductor. Steel is of higher strength than aluminium which allows for increased mechanical tension to be applied on the conductor.

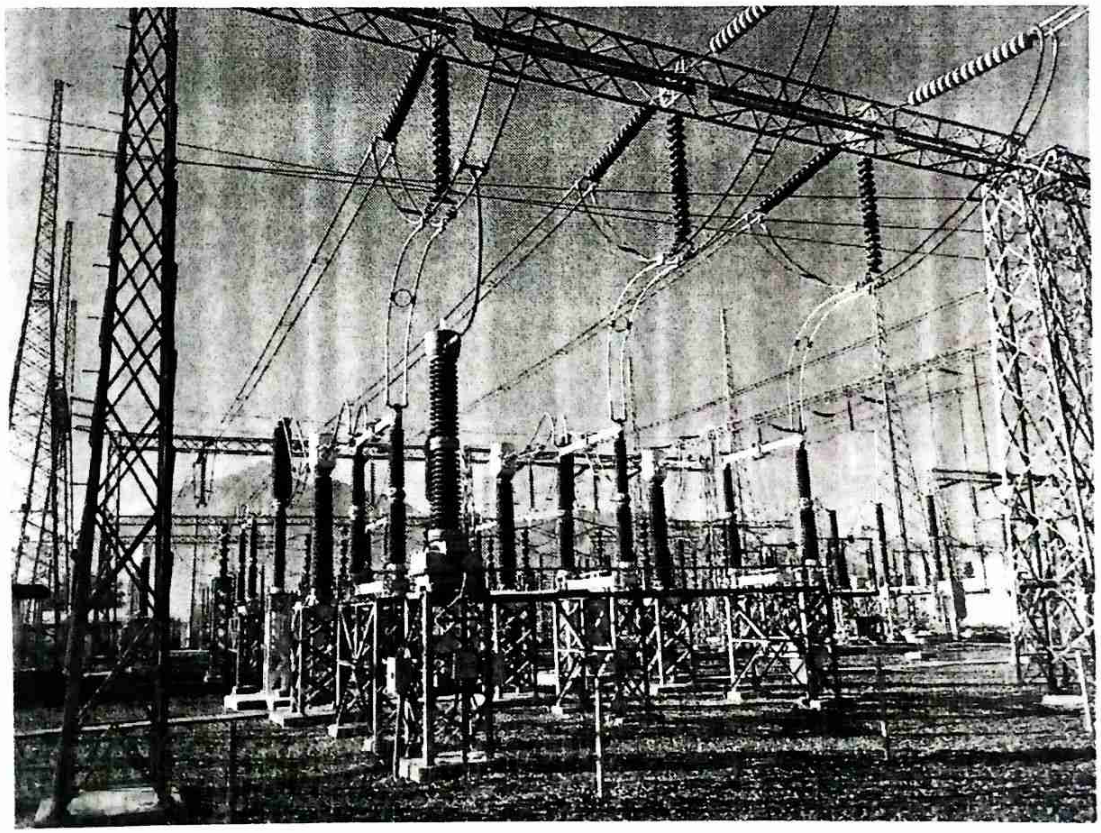
SUBSTATION

At present, the demand for electrical power is growing rapidly, and this can be fulfilled by the power generating substations. There are different types of power generating substations like thermal, atomic, and hydro-electric. Based on the availability of different resources, substations are building at different locations, but these locations may not be closer to load centers. The actual power utilization can be done by the load center. So it is essential to transmit the power from the substation to load center locations. So, high and long transmission networks are required for this function.

Power is generated fairly in the level of low voltage level; however, it is inexpensive to supply the power at a high-voltage level. For preserving high and low voltage levels a number of switching as well as transformation stations have to be produced among the generating place & customer ends. Generally, these two stations are named as electrical substations. There are **different types of substations.**

What is a Substation?

A substation is an electrical system with high-voltage capacity and can be used to control the apparatus, generators, electrical circuits, etc. The Substations are mainly used to convert AC (alternating current) to DC (direct current). Some types of substations are tiny in size with an inbuilt transformer as well as related switches. Other types of substations are very huge with different types of transformers, equipment, circuit breakers, and switches.



Types of Sub Stations :-

The different types of substations mainly include Step-up Type Substation, Step-down Transformer, Distribution, Underground Distribution, Switchyard, Customer Substation, and System Station.

Step-up Type Substation

This type of substation gets the power supply from a near producing facility. It uses a large power transformer for enhancing the voltage level for transmitting to the remote locations. In is substation, the power transmission can be done by using a transmission bus to transmission lines. This substation can also be a knock on the incoming power which is received by the generation plant. The received power can be used to supply power to the operation of apparatus in the plant. A substation includes circuit breakers for switch generation as well as transmission circuits in & out of service as required.

Customer Substation

This type of substation works as the major source of power supply for one specific business client. The business case, as well as the requirements of technical, highly depends on necessities of customers.

System Stations

This substation includes the huge amount of power transfer across the station and it is called as a system station. These stations only offer no power transformers while others do voltage exchange as well. Typically, these stations supply the end-points to the transmission lines creating from switchyards & supply the electrical energy for circuits that supply transformer stations. They are important to long-term consistency. These stations are strategic services as well as very costly to build as well as to maintain.

Distribution Type Substation

Distribution type substations are placed where the main voltage distributions are stepped-down to supply voltages to the consumers using a distribution network. The voltage of any two phases will be 400 volts, and the voltage between neutral and any phase will be 230volts.

Step-down Type Substation

This type of substation is placed at different points in an electrical network. They can connect different parts of the network and that are a source of sub-transmission or distribution lines. This type of substation can change the transmission voltage to a sub-transmission voltage (69kV). The converted voltage lines can provide a source for distribution substations. In some cases, power is tapped from the line of - transmission line to utilize in an industrial capacity along the way. Or else, the power will supply to a distribution substation.

Underground Distribution Substation

Installation of a substation in urban centers requires large space, but generally, they don't have a place to install the substation. To overcome this problem, installing the substation underground decreases requirement of space and the surface area can also be used for other constructions like buildings, shopping malls, etc. The main concept of the underground substation is to offer the best conventional substation by reducing the space occupied above land.

Switchyard

The switchyard is the mediator among the transmission as well as generation, and equal voltage can be maintained in the switchyard. The main purpose of this is to supply the generated energy from the power plant at the particular level of voltage to the nearby transmission line or power grid.

11kv Substation

The main purpose of the 11kv substation is to gather the energy which is transmitted at high- voltage from the producing station, then lessens the voltage to a suitable value for local distribution & provides amenities for switching. This substation includes isolator, lightning arrester, step-down transformer, CT metering, circuit breaker, and capacitor bank.

220 kV Substation

Here, the 220kVA substation is the power-capability utilized by the step-down transformer in the substation, and it illustrates the highest apparent power a step-down transformer can provide. The received voltage level of this substation will be 220kV.

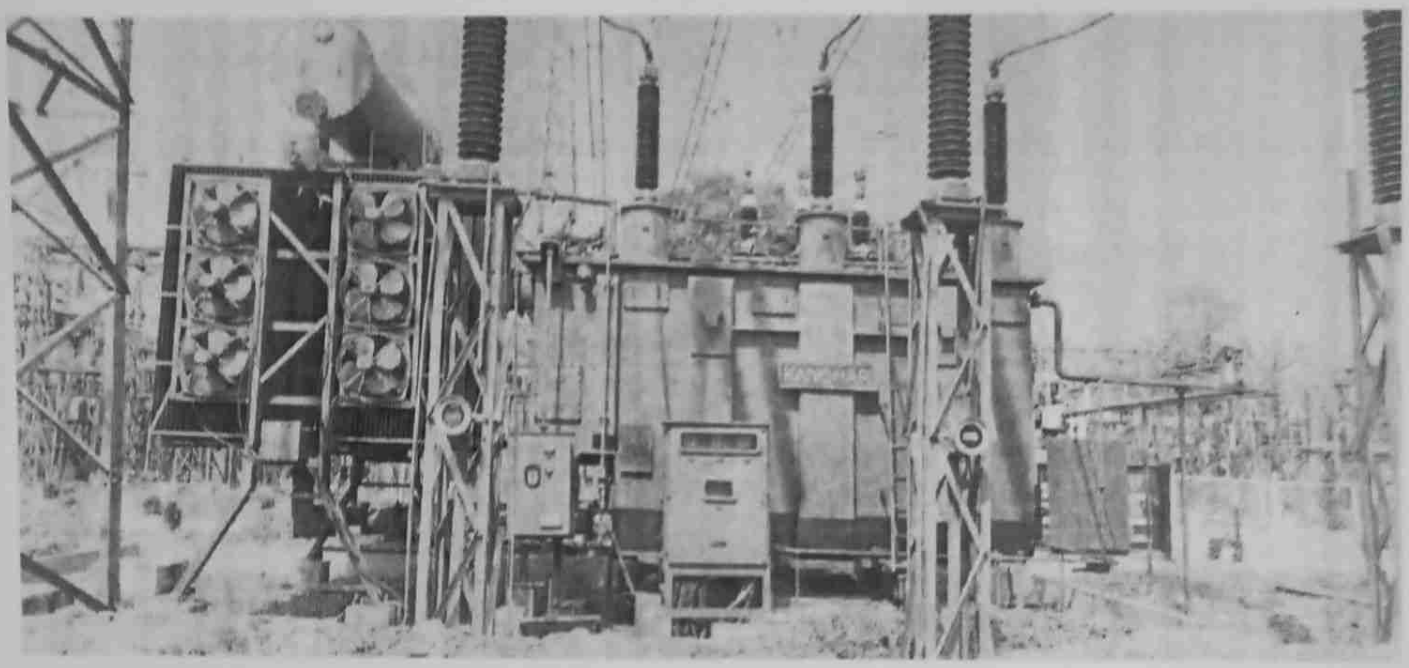
132 kV Substation

The 132kV is the rating of the step-down transformer, which has a 132kV primary voltage. Generally, these transformers are employed in transmission type substations where the voltage has to be stepped-down to additional distribution.

Similarly, some of the substations are classified based on the nature of duties, service rendered, operating voltage, by importance and design.

TRANSFORMERS

Transformer is a device which transfers electrical energy from source to load by changing voltage and current level without any change in frequency. The winding which receives energy from supply is called as primary winding and the winding which delivers energy to load is called as secondary winding.



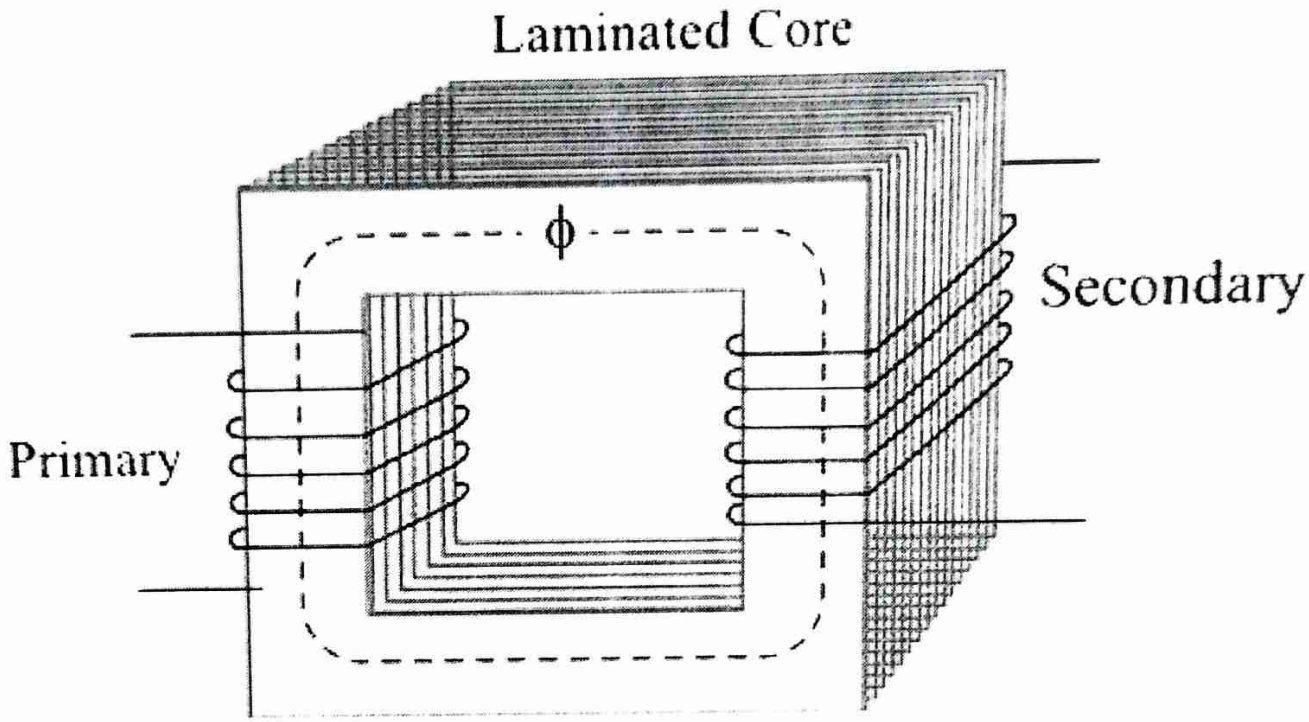
Power transformer of 80 MVA (GSS DIGHA)

The primary and secondary winding are coupled by means of magnetic field and it allows energy transfer in either direction i.e. high voltage to low voltage or low voltage to high voltage.

Primary and secondary winding of a transformer is not fixed but H.V. and L.V. side of transformer is always fixed, when source is on L.V. side and on H.V. side it is called step up transformer. And if source is on H.V. side and load on L.V. side it is called step down transformer.

Transformer is static device which means it has not any moving parts and hence it has highest efficiency.

Working principle of a transformer :-



The transformer works on the principle of Faraday's Laws of Electromagnetic Induction and mutual induction.

There are usually two coils- primary and secondary coils on the transformer core. The core laminations are joined in the form of strips. The two coils have high mutual inductance. When an alternating current pass through the primary coil it creates a varying magnetic flux. As per Faraday's Law of Electromagnetic Induction, this change in magnetic flux induces and emf (electromotive force) in the secondary coil which is linked to the core having a primary coil. This is mutual induction.

Overall, the transformer carries the below operations :

1. Transfer of electrical energy from one circuit to another
2. Transfer of electrical power through electromagnetic induction
3. Electric power transfer without any change in frequency
4. Two circuits are linked with mutual induction

Windings:-

Transformer winding includes different turns of copper coil bundles where every bundle is connected to form a winding. Each phase of the transformer contains two sets of windings. Primary winding and secondary winding are the two types. The main winding has a higher voltage than the secondary winding, which is known as the high voltage (HV) winding, while the other is known as the low voltage (LV) winding.

Insulation:-

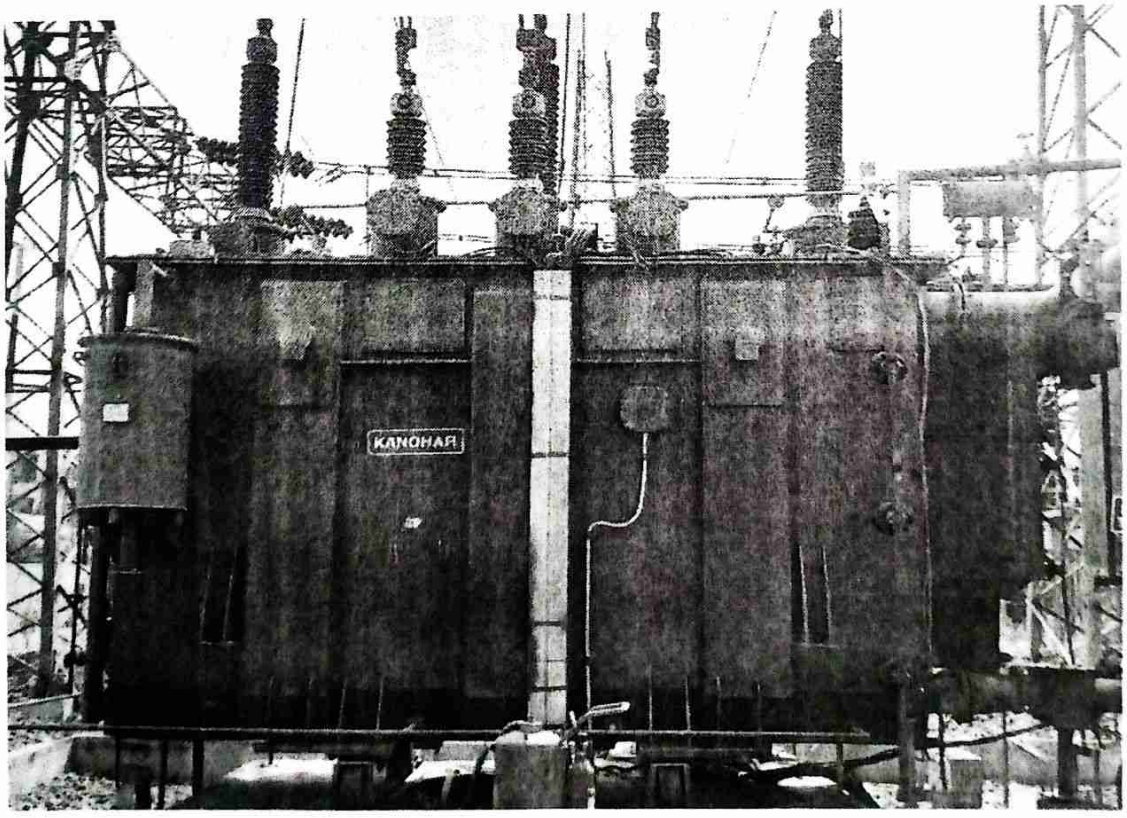
The most crucial aspect of transformers is proper insulation.

Transformers can be severely damaged by insulation failures. For its stability and endurance, proper insulation is essential. Transformers are insulated using synthetic materials, paper, cotton, insulating oil, and other materials.

Tank:-

The main tank of a transformer serves two purposes:

- The core and the windings are protected from the elements, such as rain and dust.
- It functions as an oil container as well as a support for all other transformer attachment.



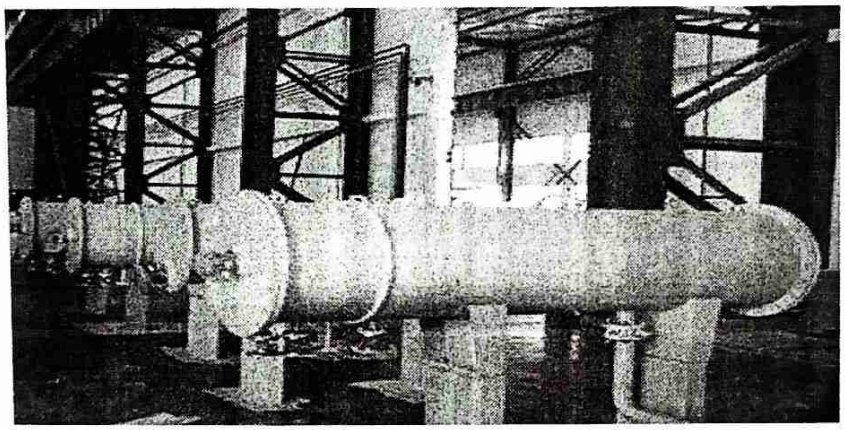
Transformer oil:-

The majority of the huge transformers are submerged in oil. The transformer oil adds insulation between the conductors, improves heat dissipation from the coils, and has fault detecting capabilities. Transformer oil is typically made of hydrocarbon mineral oil.

To sense those faults Buchholz relay is used in oil-immersed transformers rated over 500KVA. The color of the oil helps to measure the intensity of the fault.

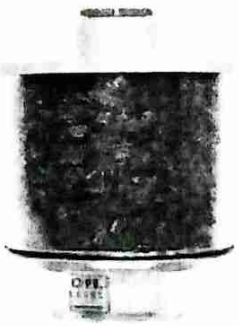
Oil conservators:-

The oil conservator is situated above the transformer's tank and bushings. Some transformer oil conservators contain a rubber bladder. When a transformer is loaded, the ambient temperature rises, causing the amount of oil inside the transformer to increase. The transformer's conservator tank has enough room for the increased transformer oil. It also serves as a reservoir for oil that is used to insulate buildings.



Breather:-

All oil-immersed transformers with a conservator tank include it. It aids in the protection of the oil against moisture. Silica gel plays the main role to protect transformer oil from moisture. It has great ability to absorb moisture from air.



Main and Transfer Bus Arrangement

This type of bus bar is designed by combining the auxiliary type and the main bus bar by using a bus coupler to connect the circuit breaker and isolated switches. In case of overloading, the load is transferred from one to another bus bar by using a bus coupler. In this case, the potentials of the two bus bars should be the same to transfer the load and the main bar should be opened and should be kept closer to transfer the load.

Double Bus Double Breaker Arrangement

In this type, two bus bars with two circuit breakers are used. So, that it doesn't require any special types of equipment like a switch and bus coupler.

Sectionalized Double Bus Bar Arrangement

In this type, an auxiliary type is also used along with the sectionalized main bus bar system. Any of the sections in the main type can be removed for repair and maintenance and can be connected to any of the auxiliary bus bars in the system. There is no need to sectionalize the auxiliary type because of its highest cost.

One and a Half Breaker Arrangement

This type of system uses 3 circuit breakers for 2 circuits. That means each circuit in this will use ½ circuit breaker. This type of arrangement is mainly employed in large stations like power handling circuits.

Ring Main Arrangement

This type of system is arranged in ring form by connecting the endpoint of the main bus bar in the system back to the starting point.

Mesh Arrangement

This type of bus bar is controlled by 4 circuit breakers, which are installed in the mesh. From the node point, the circuit is tapped. The mesh formed by the buses gets opened due to the occurrence of faults in any of the sections. It is mainly used in the substations where it requires a large no. of circuits. It also provides security against faults. There is a lack of facility in switching.

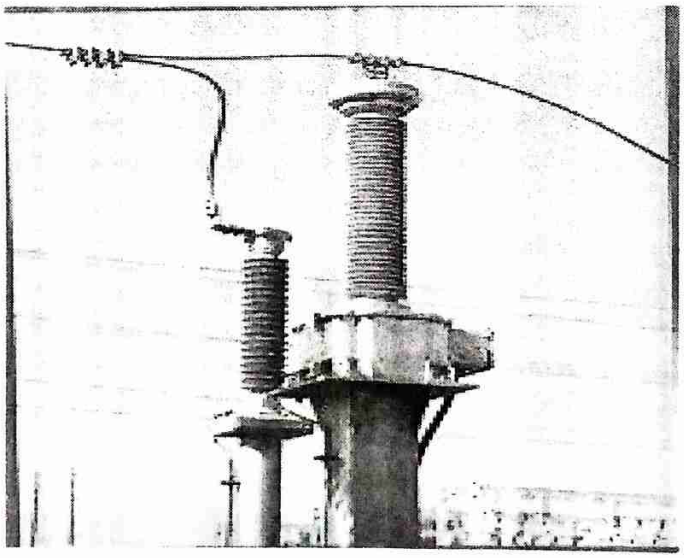
Capacitor Voltage Transformer (CVT)

CVT Capacitive Voltage Transformer is a step down transformer just like potential transformer which converts high voltage in to low voltage. Capacitor Voltage Transformers convert transmission class voltages to standardized low and easily measurable values, which are used for metering, protection and control of the high voltage system. Normally in high voltage system, the line voltage or current cannot be measured. Therefore, instrument transformer such as Potential transformer and current transformers are generally used. At that same time in EHV lines (Extra high voltage lines) the cost of a potential transformer is high because of its insulation. In order to reduce the cost of the insulation the capacitive voltage transformers are used instead of standard voltage transformer.

The Capacitive voltage transformer (CVT) is also called capacitive potential transformer. Capacitive voltage transformers (CVTs) are used on higher voltage levels, starting from 72.5 kV and upwards.

Capacitive voltage transformer (CVT) Working Principle:

CVT is working under principle of potential divider. It consists of two capacitors to form a potential divider, line reactor and a step down transformer. Here line reactor is used to compensate the capacitor's phase shift. The value of inductances is adjustable. The inductance compensates the voltage drops occurs in the transformer because of the reduction of the current from the potential divider. But, in actual practice, the compensation is not possible because of the inductance losses.



SURGE ARRESTOR OR LIGHTNING ARRESTOR

A surge arrester, as the name suggests, is a device that protects other electrical equipment by "arresting" or discharging surge currents brought about by external (e.g. lightning) or internal (switching events) forces. All appliances and electrical devices have a fixed voltage range. This is a band of operating voltages that indicates the range at which a particular device is designed to safely operate within. If the voltage received by a device is higher than its recommended voltage range, the device may malfunction, its internal components damaged, and even blow up in a worst-case scenario.

So, why would there be a high voltage transmission in the first place? It's important to note that voltage fluctuations happen all the time. These can be attributed to a variety of reasons like a corroded, loose connection in your house or building, wiring issues, poor power supply quality, interference, etcetera. Most of the time, these fluctuations do not exceed usual voltage ranges and are thus not a cause of worry. However, there might be instances wherein the voltage fluctuations can experience extreme dips and spikes brought about by lightning storms and switching overvoltage.

Surge arresters limit these overvoltage caused by lightning or switching surges (i.e. surges that occur when operating conditions in an electrical system are suddenly changed). They are not designed to protect against a direct lightning strike if ever one should occur.

But rather, they offer some degree of protection against electrical transients caused by lightning strikes when they occur within the general vicinity of the conductor. In this regard, surge arresters can also divert transients similar to those that come from lightning like those that come from a high voltage system's faulty switching.

Whatever it is that the overvoltage is coming from, a surge arrester works the same way. It either clamps the surge to minimize the voltage that passes through its power system, or it redirects it to the ground. Some surge arresters on the market today come equipped with a "surge counter" component, which is a module that allows the device to capture the occurrence of a discharge

ISOLATORS

An electrical isolator which is commonly known as an isolator or disconnector is a piece of equipment that is used in electric devices and power systems with the main function of effectively isolating two different parts of an instrument. By definition, isolation is the process of complete separation of various parts of an apparatus and this separation can either be physical or electrical, or both.

As already discussed the main purpose of an isolator is safety because if a fault occurs in one section of a circuit or power supply then an electrical isolator is used as a switch to keep apart that section from other sections of the system to perform repair work. In a similar scenario, isolators also ensure the safety of workers in regular maintenance and service of the power system. Isolators separate a certain circuit from the electricity mains and discharge any residual current, left in the circuit, to the ground.

Isolator Switch

These switches are generally used for the repair or replacement of a circuit breaker. It acts as a switch that disconnects the required part from the circuit where the repair has to be done. It does not have any current ratings as compared to CB as these are operated with current being made zero in the circuit. These switches cannot be opened unless CB is open and CB cannot be closed unless the isolator is closed.

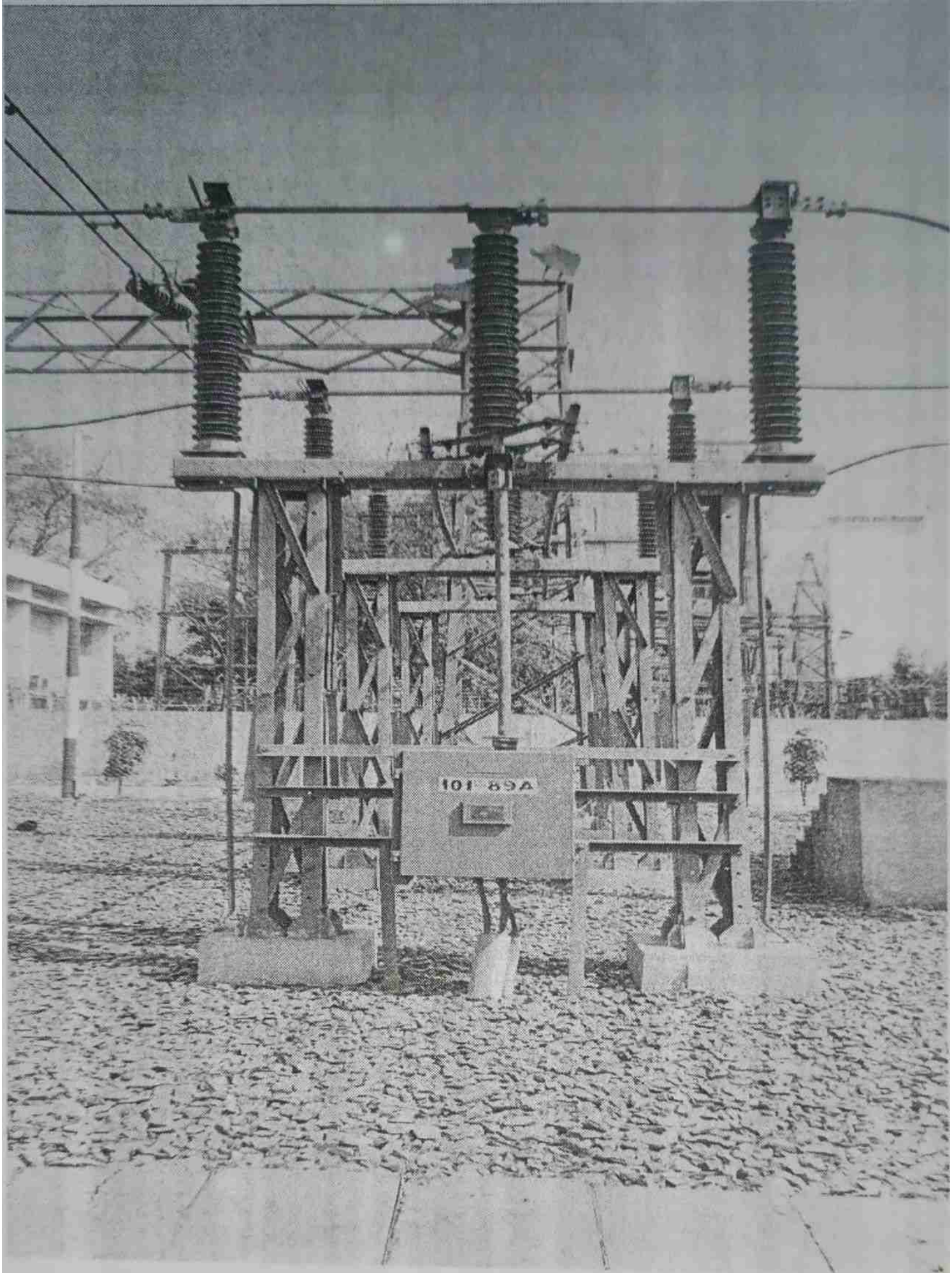
The working of an isolator is very simple and it can be operated in various ways such as fully automatic, semi-automatic, or manually operated. Isolators are sometimes used as switches that can be opened or closed based on the requirement. But many times, isolators are used permanently in a fixed position to keep isolation such as in electrical transmission lines, transformers, and grid stations.

Depending on their Position, isolators are classified as:

Bus Side Isolator: These are connected to the main buses in the substation. Whenever there is a need for repair or replacement of any bus, they are operated.

Lineside Isolator: These are connected between the line and any feeder. A feeder is a line that carries power from the Substation to the distribution system.

Transfer Bus Side Isolator: In an electrical system for reliability main or transfer bus is used. In case the main bus side isolator is unavailable due to some fault/maintenance transfer bus isolator is used. These are used in combination with a circuit breaker.



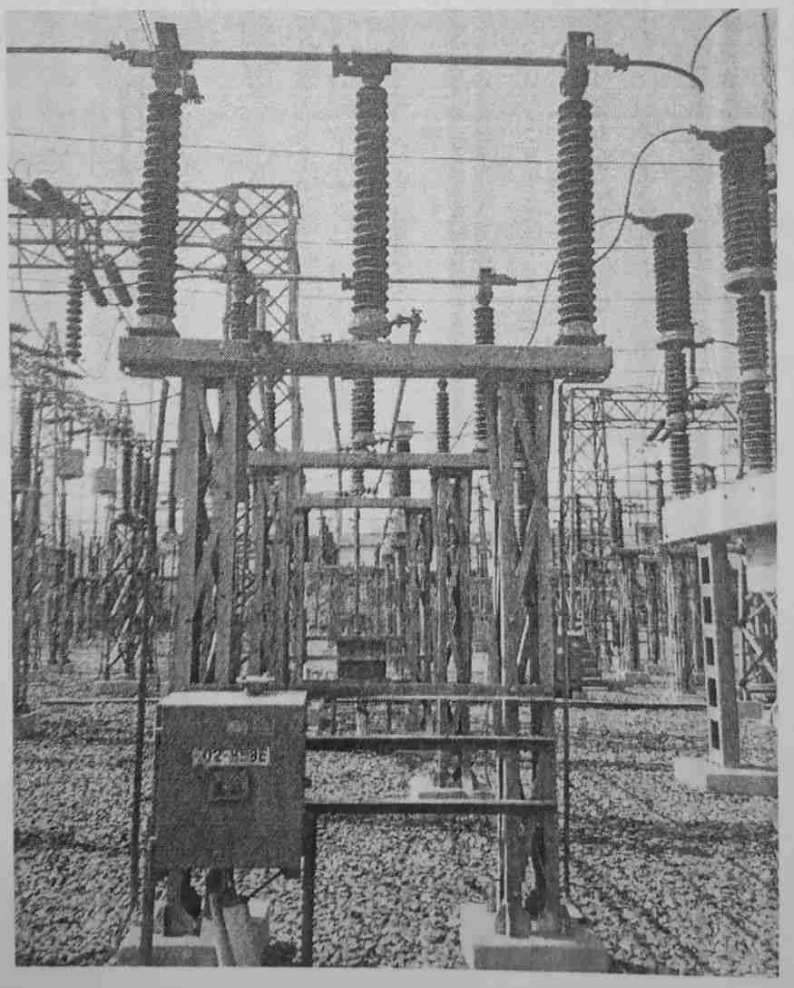
Isolator GSS DIGHA

CIRCUIT BREAKERS

An electrical circuit breaker is a switching device which can be operated manually and automatically for controlling and protecting an electrical power system. As the modern power system deals with huge currents, special attention should be given during designing of a circuit breaker to ensure it is able to safely interrupt the arc produced during the closing of a circuit breaker.

The circuit breaker mainly consists of fixed contacts and moving contacts. In normal "ON" condition of the circuit breaker, these two contacts are physically connected to each other due to applied mechanical pressure on the moving contacts. There is an arrangement stored potential energy in the operating mechanism of circuit breaker which is released if the switching signal is given to the breaker.

The potential energy can be stored in the circuit breaker by different ways like by deforming metal spring, by compressed air, or by hydraulic pressure. But whatever the source of potential energy, it must be released during operation. The release of potential energy makes the sliding of the moving contact in a speedy manner.



Circuit breaker (GSS DIGHA)

All circuit breaker have operating coils (tripping coils and close coil), whenever these coils are energized by switching pulse, and the plunger inside them displaced. This operating coil plunger is typically attached to the operating mechanism of circuit breaker, as a result the mechanically stored potential energy in the breaker mechanism is released in forms of kinetic energy, which makes the moving contact to move as these moving contacts mechanically attached through a gear lever arrangement with the operating mechanism.

After a cycle of operation of circuit breaker the total stored energy is released and hence the potential energy again stored in the operating mechanism of the circuit breaker using spring charging motor or air compressor or by any other means.

The circuit breaker has to carry large rated or fault power. Due to this large power, there is always dangerously high arcing between moving contacts and fixed contact during operation of the circuit breaker. Again as we discussed earlier the arc in circuit breaker can be quenching safely if the dielectric strength between the current carrying contacts of circuit breaker increases rapidly during every current zero crossing of the alternating current.

The dielectric strength of the media in between contacts can be increased in numbers of ways, like by compressing the ionized arcing media since compressing accelerates the deionization process of the media, by cooling the arcing media since cooling increase the resistance of arcing path or by replacing the ionized arcing media with fresh gasses. Hence some arc quenching processes should be involved in the operation of the circuit breaker.

Although circuit breakers perform their function independently and without supervision, there are also remote control circuit breakers which can be operated on demand at a distance.

Types of Circuit Breaker

According different criteria there are different types of circuit breaker. According to their arc quenching media the circuit breaker can be categorized as:

1. Oil circuit breaker.
2. Air circuit breaker.
3. SF_6 circuit breaker.
4. Vacuum circuit breaker.

INSTRUMENTS TRANSFORMER

A current transformer (CT) is used for measurement of electric currents. Current transformers, together with voltage transformers (VT) {potential transformers (PT)}, are known as instrument transformers. Main information on the state of the power system and the substation equipment is acquired by measuring various parameters. The measuring, monitoring, control and protection devices measure and use parameters such as current, voltage, power factor, frequency, active power, reactive power, direction of power flow, load balance and phase angles. These parameters are measured by using two types of analog sensors- CT and PT. These transducers provide the instantaneous values of currents and voltages. The remaining parameters are derived from these measurements.

Older substations have instruments that are operated by analog signals from the transducers. In modern substations, currents and voltages are acquired in the form of quantized samples using analog to digital converters. The samples are then processed by digital signal processors to estimate the desired parameters.

Instrument transformers are used for measuring voltage and current in electrical power systems, and for power system protection and control. Where a voltage or current is too large to be conveniently used by an instrument, it can be scaled down to a standardized low value, instrument transformers isolate measurement, protection and control circuitry from the high currents or voltages present on the circuits being measured or controlled.

Current transformer:-

A current transformer is essentially a step-down transformer which 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 wore 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. The CT is often treated as a "black box".

Current transformers are basically used to take readings of the currents entering the substation. This transformer steps down the current from 800 amps to 1 amp. 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

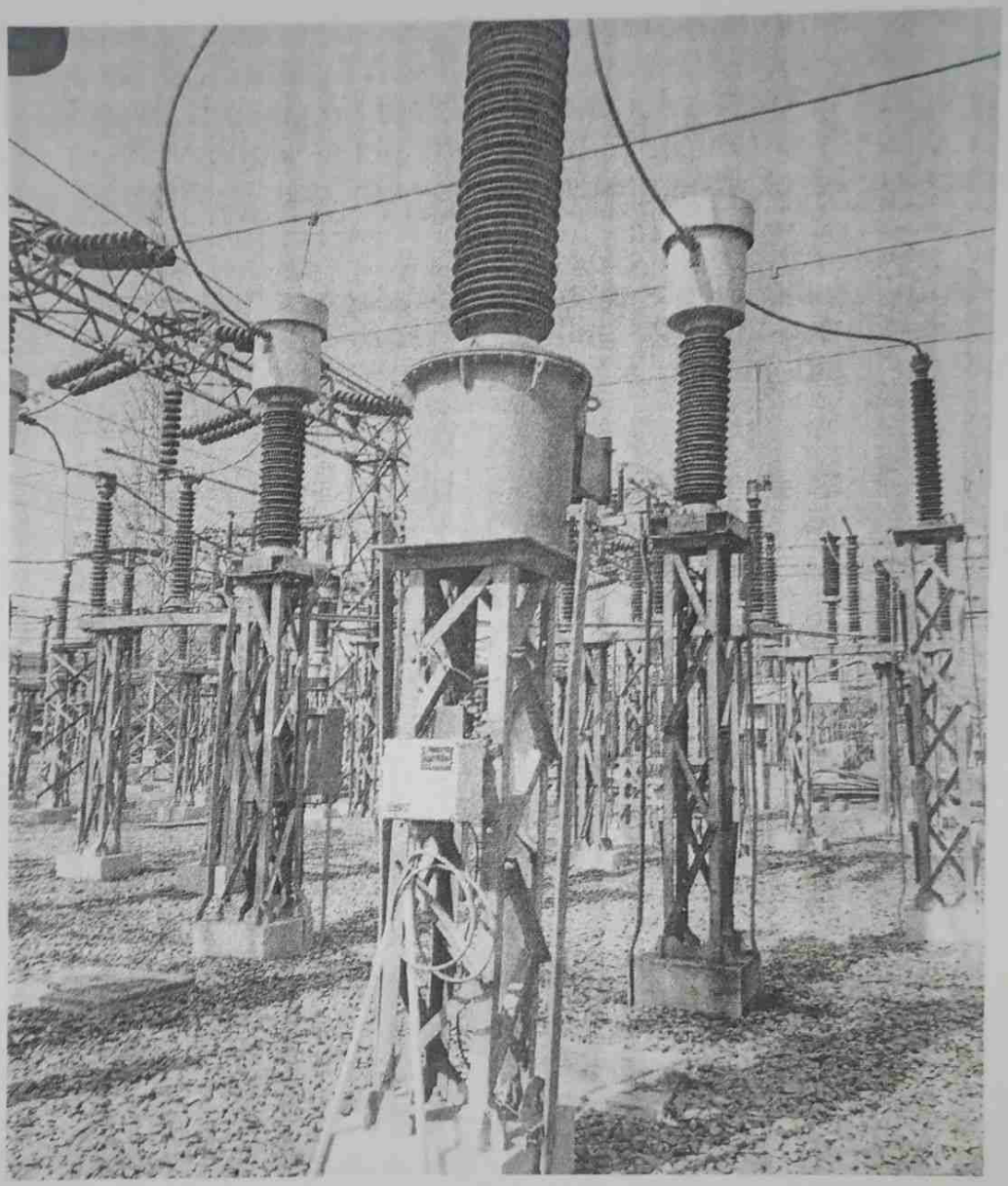
c) Measurement

A current transformer is a transformer designed to provide a current in its secondary coil proportional to the current flowing in its primary coil.

When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments. A current transformer also isolates the measuring instruments from what may be very high voltage in the monitored circuit. Current transformers a commonly used in metering and protective relays in the electrical power industry.

Current transformers are used extensively for measuring current and monitoring the operation of the power grid. Along with voltage leads, revenue-grade CTs drive the electrical utility's watt-hour meter on virtually every building with three-phase service and single phase services greater than 200 amps.

The CT is typically described by its current ratio from primary to secondary. often, multiple CTs are installed as a "stack" for various uses.



Current transformer (GSS DIGHA)

Voltage / potential transformer:-

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

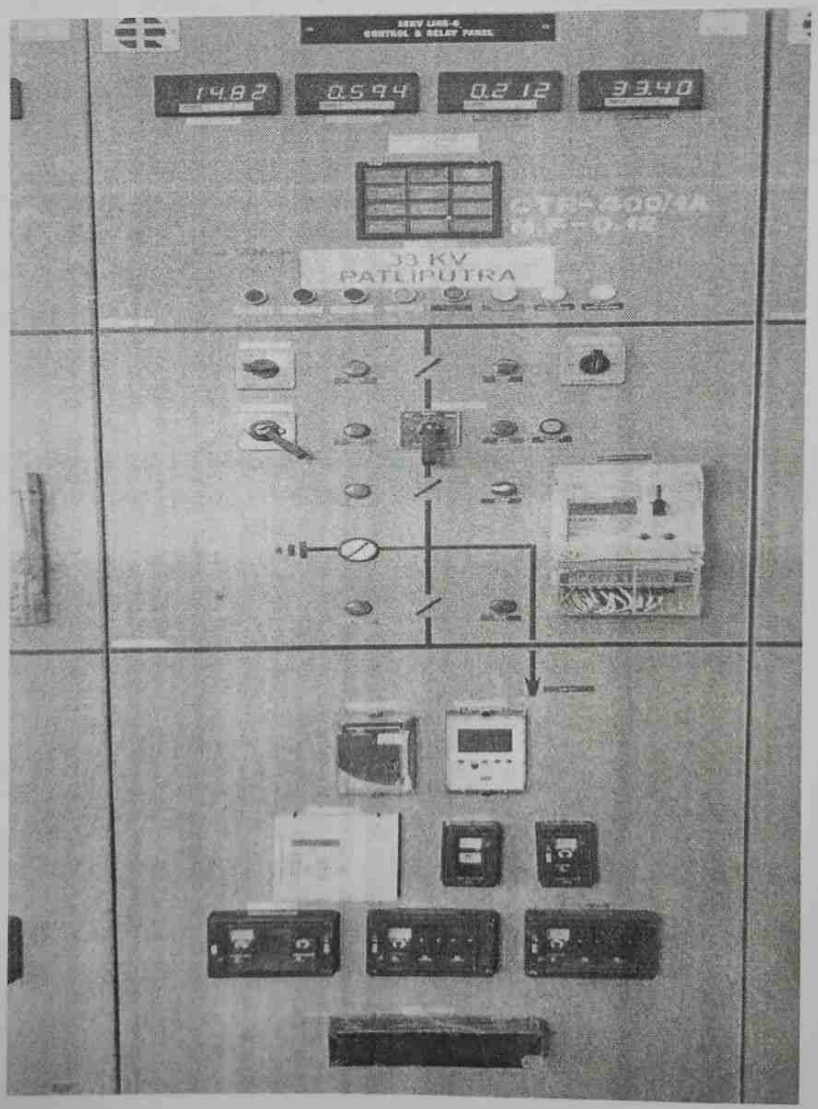
Voltage transformers also referred to as "potential transformers" (PTs), are designed to have an accurately known transformation ratio in both magnitude and phase, over a range of measuring circuit impedances. A PT is intended to present a negligible load to the supply being measured. The low secondary voltage allows protective relay equipment and measuring instruments to be operated at a lower voltage.

Both current and voltage transformers are designed to have predictable characteristics on overloads. Proper operation of over-current protective relays requires that the current transformers provide a predictable transformation ratio even during a short-circuit.

CONTROL PANELS AND RELAY

An electrical panel is nothing but a load control center. All the electrical actions such as power distribution, power transmission, power system protection are performed by using electrical panel only. The electrical scheme (wiring diagram) will be established using electrical panel & Electrical panels are the practical installation of electrical wiring diagram. It consists of trip circuit, closing circuits, busbars, cables, MCCBs, MCBs, MPCBs, NO & NCs, etc. Electrical panels are ensuring the safe power distribution to the load. Electrical panels are manufactured by rolled steel and well-shaped either rectangle or square. Electrical panel are classified different types as per application.

Control Panel consists of circuit control elements such as protecting relays, meters, alarm circuits, PLCs, SMPS, Small power source, etc. These panels will be placed near the maintenance operator's place or the operator will be monitored the control panel.



Control panel at GSS DIGHA

Electrical Relay is nothing but an electromechanical switch that is used to control an electrical/electronic circuit locally or remotely. But latest solid-state relays use electronics components such as the transistor, diode to control the circuit without physical contact.

Construction front, electromagnetic coil, contact, iron core and power source are the important parts of a relay. Here electromagnetic coil is made up of thin copper wire wound in magnetic material and it will be connected to a power source. An iron core will be kept inside or outside of the electromagnetic coil.

The power source will be controlled by the external circuit. It can be DC or AC. In generally relays are designed to operate both direct and alternating current up to 1.5V to 690V.

The contact will be connected with the external circuit. The contact made up of silver alloy to withstand the high current breaking. Also, it has the ability to withstand on high arcing temperature up to 3000°C.

According to our requirement, the selection of relay contact can be varied such as NO or NC. NO, and NC indicates the relay's default position. It means the relay should be either Normally Open or Normally closed condition. Mostly both the type of relays are used.

Relay Operating Principle:

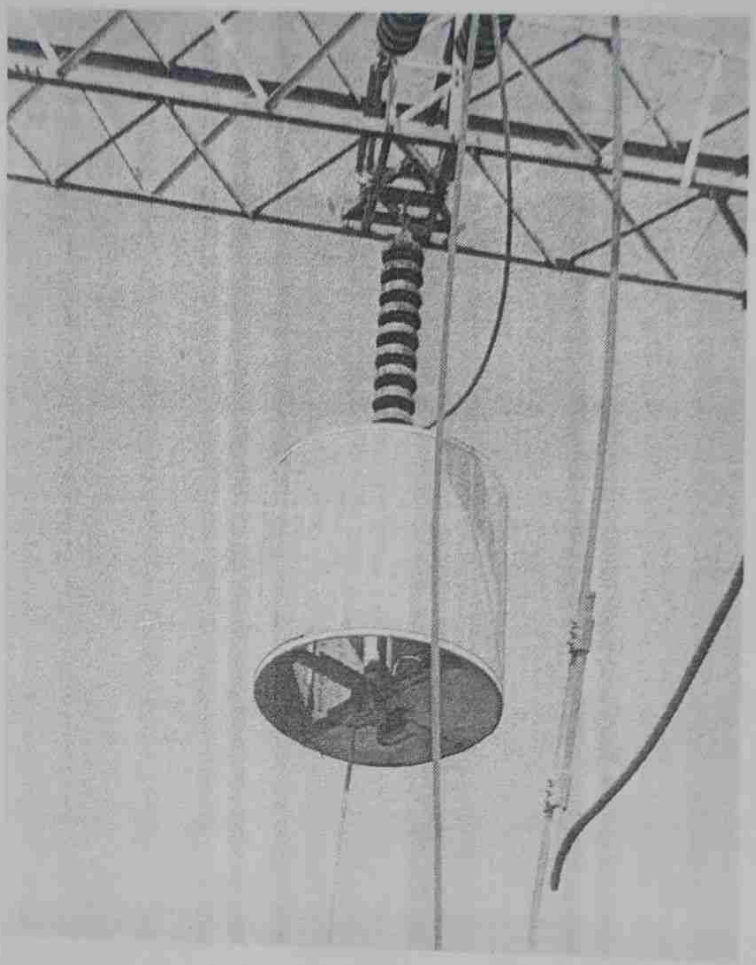
All electromagnetic relays are working based on Faraday's Electromagnetic Induction. For instance, if we close the external circuit contact, the current start flows from power source to coil.

Then the coil becomes electromagnet and which attracts the iron core placed inside the coil. Also, the iron core pulls the relay contact terminal A. Due to this, A and B will be connected.

Then the current starts flowing in the external control circuit. Finally, the Lamp blows.

WAVE TRAP

Wave trap is an instrument used for trapping the wave. The function of this wave trap is to trap the waves of unwanted frequencies. Its shape is like that of a drum. It is connected to the main incoming feeder so that it can trap the waves which may be dangerous to the instruments in the substation. Generally it is used to exclude unwanted frequency components, such as noise or other interference of a wave.



Wave trap (GSS DIGHA)

The wave trap is also called line trap. The inductive reactance of it presents a high reactance to high-frequency signals but a low reactance to mains frequency. They are connected in series with power line and thus their coils are rated to carry full line current. They are connected in two out of the three phases.

OTHER IMPORTANT EQUIPMENTS

➢ Battery bank:-

Since the DC system supplying specially relay protection, control, and interlocking circuits is of paramount importance to the substations reliable and safe operation, the energy supply has to be always available. The need for this reliable supply becomes even more important during disturbances and faults in the high or medium voltage primary circuits.

Battery bank (GSS DIGHA)

➢ Substation transformer (SST):-

A substation transformer is a type of transformer that provides power for substation which is used in charging batteries as well as other important operation at substation.

SST at GSS DIGHA

➢ ACDB and DCDB Room:-

Alternating Current Distribution Box (ACDB) and Direct Current Distribution Box (DCDB) are basically safety circuit boxes which controls the flow of electricity to battery room and different equipment panels of the substation. Mainly two boxes of each type are used one for regular use and other for backup during fault in first or while maintenance.

ELECTRICAL SAFETY AND EARTHING

The process of transferring the immediate discharge of the electrical energy directly to the earth by the help of the low resistance wire is known as the electrical earthing. The electrical earthing is done by connecting the non-current carrying part of the equipment or neutral of supply system to the ground.

Every building, equipment, power plant, substation facility included in electricity require earth grounding, either directly or through grounding system. The main objective of doing earthing in electrical network is safety.

But when the neutral for any system is not connected with the earth then it will be known as electrical system without earthing.

Mostly, the galvanized iron is used for the earthing. The earthing provides the simple path to the leakage current and fault current in the system. The short-circuit current of the equipment passes to the earth which is assumed to have zero potential. Thus, protects the system equipment and personnel working with these equipment from damage as well as shock current Earthing is not likely to reduce the total magnitude of over voltages produce by lightening or switching surges, it can however mitigate the possibilities of excessive voltage stress on the phase to ground insulation of particular phase.

The system earth resistance should be such that which any fault occurs against which earthing is designed to give protection, the protective gear will operate to make the faulty main or plant harmless. In most cases, such operation involves isolation of the faulty main or plant, for example by circuit breaker or fuses.

Types of Electrical Earthing

The electrical equipment mainly consists of two non-current carrying parts. These parts are neutral of the system or frame or support structure of the electrical equipment. From the earthing of these two non-current carrying parts of the electrical system, earthing can be classified into two types: Neutral Earthing, and Equipment Earthing.

Neutral Earthing

In neutral earthing, the neutral of the system is directly connected to earth with the help of some metallic conducting wire. The neutral earthing is also called the system earthing. Such type of earthing is mostly provided to the system which has star winding. For example, the neutral earthing is provided in the generator, transformer, motor etc.

Equipment Earthing

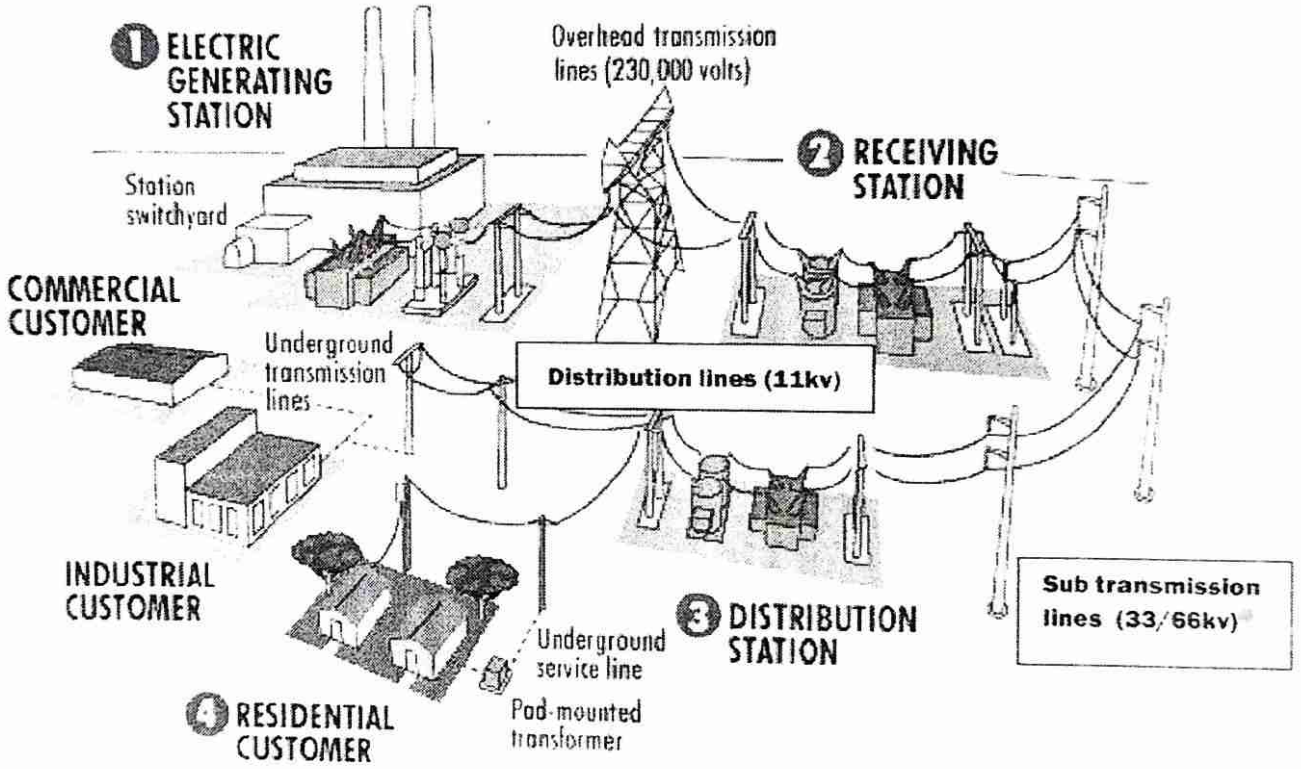
Such type of earthing is provided to the electrical equipment. The non-current carrying part of the equipment like their metallic frame is connected to the earth by the help of the conducting wire as shown in fig 3. If any fault occurs in the apparatus, the short-circuit current to pass the earth by the help of wire. Thus, protect the system from damage.

Importance or purpose of earthing

- To Protect the workers who regularly come in contact with electrical devices that might give them a shock.
- To keep the voltage of the device constant in the healthy phase in case of single of single phase to ground fault.
- A good grounding path which has a low impedance value ensure that faults in the electrical path are cleared quickly. If the faults stay within the system for a long time, they can pose a serious threat to the stability of the system.
- Many modern electronic devices generate a form of 'electrical noise' that can cause damage to the device and reduce its efficiency, unless the device is property grounded.
- Surge protection device function better with the of help of proper grounding.
- Malfunctioning electric devices often leak electricity, which has the potential to start a fire if not redirected safely.

Classification of Earthing System

A low voltage (LV) distribution system may be identified according to its earthing system. These are defined using the five letters T (direct connection to earth), N (neutral), C (combined), S (separate) and I (isolated from earth). The first letter denotes how the transformer neutral (supply source) is earthed while the second letter denotes how the metal work of an installation (frame) is earthed. The third and fourth letters indicate the functions of neutral and protective conductors respectively. The electrical power network is shown in fig below.



CONCLUSION

In conclusion to all the mentioned design aspects of the 132/33 KV substation there are several other factors that are needed to be considered. A grid substation is integral part of the electrical power system. Digha GSS is a vital grid of Patna as many VIP localities come under this GSS.

Transmission substation exist at various scales throughout a power system. In general, they represent an interface between different levels or sections of the power system, with the capability to switch or reconfigure the connections among various transmission and distribution lines.

As a trainee, it was a great experience learning under one of the finest and experienced engineers and operators. I got to learn a lot from them regarding the operation and maintenance of the grid. Learned about the way power is transmitted and distributed among various grids and distribution stations. I also got to learn the management skills from the substation manager. I had interactive sessions with the engineers and site operators working in the grid. This industrial visit helped me to acquaint with the industrial environment, it helped me to visualize my concepts that I had learnt in my theory classes. Overall, it was a very wonderful experience at Digha GSS.

Bihar State Power Transmission Company Limited

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Electrical Executive Engineer
Transmission Division (WEST), Barrack No. 6,
Rajbanshi Nagar, Patna-23
Email : eeetdpatnawest@gmail.com

CERTIFICATE

This is to certify that .....KUMARI AKANKSHA.....Branch....B. Tech [EEE].....Registration no./~~Roll No~~.....19110103006..... college...NSIT, AMHARA BIHTA.....has successfully completed his/her in-Plant Training at 220/132/33 KV GSS.....KHAGAUL.....under transmission Division Patna West), from...03../..09./2022to 30...../.09../2022in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was.√...GOOD.....

Place: Patna

Issue Date:...08|10|2022

EEE/TD/ Patna
L No.609..... Date.08|10|2022

Electrical Executive Engineer
Transmission Division Patna (West)

Netaji Subhas Institute of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"INTERNSHIP REPORT"

BASED ON THE INTERNSHIP DONE AT BSPTCL,PATNAIN THE MONTH OF SEPTEMBER 2022 IN in-Plant Training at 220/132/33 KV GSS KHAGAUL Under Transmission Division Patna(West).

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by

KUMARI AKANKSHA

(194006)

Submitted to

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

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    5) Wave Trapper
    6) Circuit Breaker
    7) Isolator
    8) Busbar
    9) Capacitor Bank
    10) Capacitive Voltage Transformer
    11) Bus Coupler
    12) Power Transformer
        - ❖ Parts of Transformer
        - ❖ Oil in Transformer
        - ❖ Protection of Transformer
    13) Relay Panel
    14) Control Panel
    15) Battery Room
    16) Sub-Station Transformer
    17) PLCC
    18) GIS
G. Types of protection in power system
    - ❖ Differential Protection
    - ❖ Distance Protection

Executive Summary

An electrical grid station is an interconnection point between two transmission ring circuits, often between two geographic regions. They might have a transformer, depending on the possibly different voltages, so that the voltage levels can be adjusted as needed. Grid station regulates and controls the power between interconnected transmission lines to increase the reliability of the power system. It receives power from the power station at extremely high voltage and then convert these voltages to some low levels and supplied electric power to the sub stations or to other grid stations at the same voltage level according to the requirements.

National grid system of India contains an interconnected group of transmission lines in a ring system. It covers most of the power stations of the country in this single ring and supplied electric power to the different areas of the country. Main function of the grid station is switching between the connected line stations and the load centres. The electric power is produced at the power station, which are located at favourable places, generally quite away from the consumers. It is delivered to the consumer through a large network of transmission and distribution. At many places in the line of power system, it may be desirable and necessary to change some characteristic (e.g. Voltage, AC to DC, frequency, p.f. etc.) of electric supply. This is accomplished by suitable apparatus called sub-station for example, generation voltage (11kv or 6.6kv) at the power station is stepped up to high voltage (Say220kv to 132kv) for the transmission of electric power. Similarly, near the consumer's localities, the voltage may have to be stepped down to utilization level. This job is again accomplished by the suitable apparatus called sub-station.

Functions of BSPTCL:

- To undertake transmission of electricity through intra-State transmission system
- To discharge all functions of planning and co-ordination relating to intra-state transmission system with :
  - Central Transmission Utility
  - State Governments
  - Generating companies
  - Regional Power Committees
  - Authority
  - Licensees
  - Any other person notified by the State Government in this behalf
- To ensure development of an efficient, co-ordinated and economical system of intra-State transmission lines for smooth flow of electricity from a generating station to the load centres

Achievements:

- Bihar State Power Transmission Company Limited, the State Transmission Utility (STU) formed after unbundling of the erstwhile Bihar State Electricity Board, is working under the aegis of Govt. of Bihar and a subsidiary company of Bihar State Power (Holding) Company Limited.
- Bihar State Power Transmission Company Limited is intensifying its network capabilities through continuous planning, timely execution, rigorous operation and maintenance of Intra-State Transmission System in coordination with the Central Transmission Utility (CTU) and various other bodies.
- 12th Five year plan (2012-17) schemes are in advance stage of completion by which the remarkable benchmark achieved by BSPTCL in the power transmission sector vis-à-vis contributing in Nation building are as follows:-
    - As on 31th July, 2017 BSPTCL is operating a transmission network comprising 122 Grid Sub-stations (2 Nos. of 220/132 kV GSS , 15 nos. of 220/132/33 kV GSS and 105 nos. of 132/33 kV GSS) having transformation capacity of 6490 MVA (at 220/132 kV) & 10280 MVA (at 132/33 kV) & 2585 CKM of 220 kV and 8510 CKM of 132 kV transmission lines to cater load demand of remotest area of the State and thus achieving the organization goal of Quality Power for All.
    - By the end of 13th Plan i.e. 2021-22, BSPTCL is likely to have 165 Grid Sub-stations with transformation capacity of 3000 MVA, 14510 MVA and 15290 MVA at 400/220 kV, 220/132 kV and 132/33 kV levels, respectively. Bihar Grid Company Limited (BGCL), a joint venture between Bihar State Power Holding Company Ltd (BSPHCL) and Power Grid Corporation of India Limited (PGCIL) is also contributing in achieving the goal.

KHAGAUL GRID SUBSTATION

Khagaul GSS is also known as 220/132/33 KV GSS which falls under PATNA WEST DIVISION of BSPTCL.

INCOMINGS : It receives power from six sources (220KV) :

1. Khagaul patna-1
2. Khagaul patna-2
3. Khagaul patna-3
4. Naubatpur circuit-1
5. Naubatpur circuit-2
6. Khagaul gaurichak

Power is delivered to 220 KV Main bus bar. 220 KV is stepped down using four power transformers of 200 MVA. GSS Khagaul is also connected to other sub stations where it supplies 132 KV.

1. DIGHA-I
2. DIGHA-II
3. DNR RAILWAY
4. BIHTA-I
5. BIHTA-II

Then 132 KV is stepped down to 33 KV using five transformers of 80 MVA. GSS Khagaul is also connected to other feeders to which it supplies 33KV GIS and AIS FEEDER.

Feeder(GIS) :

1. SHERPUR
2. ANAND BAZAR
3. ASHIYANA
4. RPS
5. FARIDPUR
6. RADIANT

Feeder(AIS) :

1. NEORA
2. KHAGAUL-I
3. KHAGAUL-II
4. ASHOPUR
5. KHAGAUL-V
6. DANAPUR-I
7. DANAPUR-II
8. KHAGAUL-III
9. KHAGAUL-IV
10. KHAGAUL-VI

These places are provided with 33 KV supply, where it is further stepped down to 11 KV and then sent to local distribution transformer which supply 415 KV to households.

TOTAL GRID CAPACITY : 200 MVA

TOTAL TRANSFORMER CAPACITY = (4x200)+(5x80) = 1200 MVA

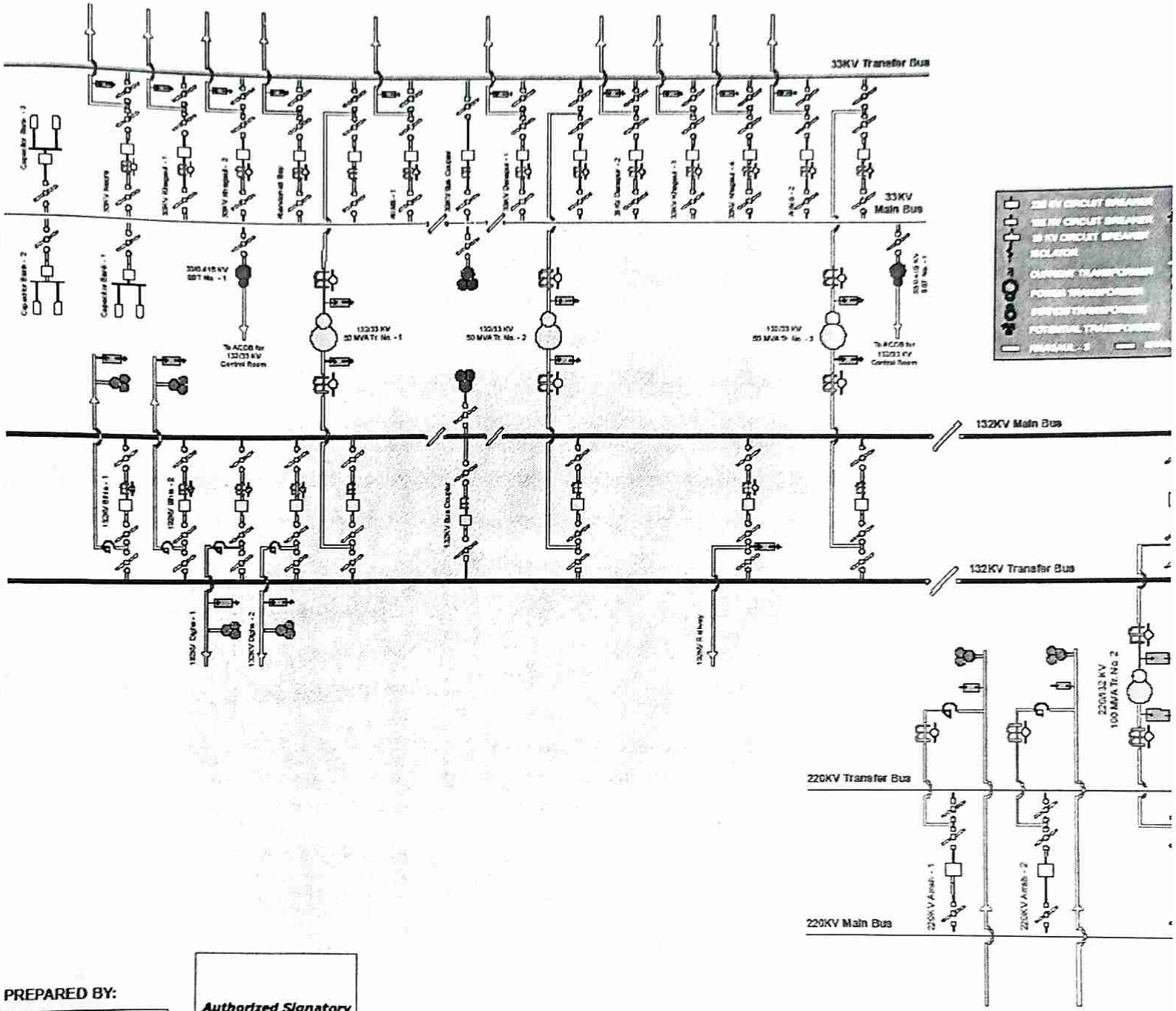
Advantages of the Grid System :

1. Any time electricity is available for the consumers at the lower cost.
2. Flow of electrical energy is continuous and sure.
3. It is possible to fulfil the emergency demand of power.
4. Better regulation of the voltages.
5. Improved power factor

Disadvantages of the Grid System:

1. Cost of the control system is increased and their maintenance is complicated.
2. Power system is affected from the environmental factors.
3. This system is unsafe during the war.
4. Extended system is going to complexity.
5. Due to the expensive equipment, additional load occurred on the consumers.

SINGLE LINE DIAGRAM OF 220/132/33 KV GSS KH



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Substation:

Electrical Substations are the interface between parts of the distribution grid and transmission systems. They step down the voltage in the transmission lines to one that is suitable for the distribution grid. They are also equipped with circuit breakers to protect the distribution systems, and can be used to control the flow of current in various directions. They also smooth and filter voltage fluctuations caused by, for example, an increased load.

Equipment used in a Sub-Station:

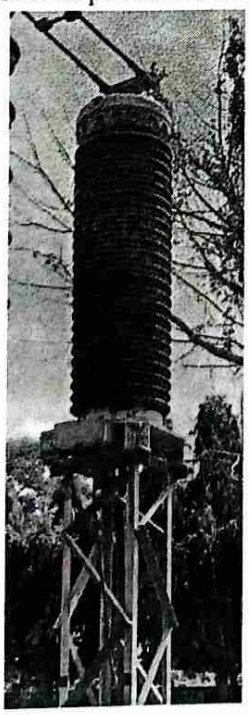
1. Instrument Transformer:

The main purpose of an instrument transformer is to decrease high current as well as voltages for a secure & realistic value. These values can be calculated with conventional devices. The range of voltage and current are 110 V, and 1 A (or) 5 A. This transformer is also used for triggering the protective relay (AC type) by providing the current as well as voltage. These transformers are classified into two types namely a voltage transformer.

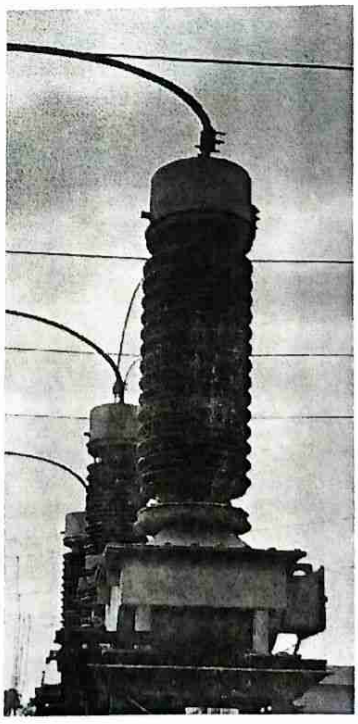
- Voltage Transformer
- Current Transformer

2. Voltage Transformer:

This transformer can be defined as it is an instrument transformer used for changing the voltage from a superior value to the minor value. It is used for measurement of voltage & also used as protective relay.



Potential Transformer(220/132KV)



Potential Transformer(132/33KV)

3. Current Transformer:

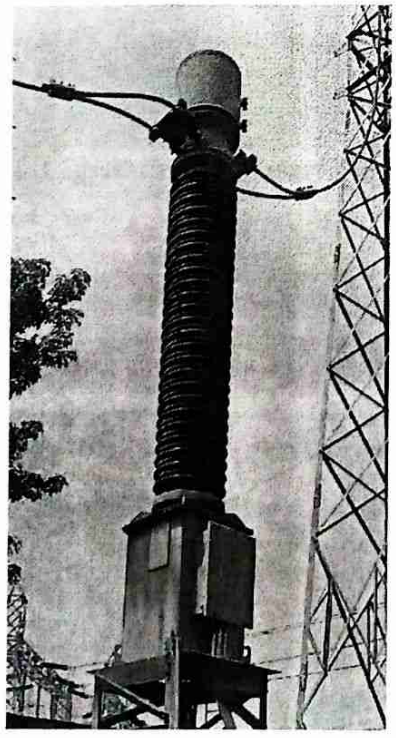
A current transformer is an electrical device, and the main function of this is to change the value of current from a superior value to the minor value. Typical examples of low voltage single ratio metering current transformers are either ring type or plastic moulded case. High-voltage current transformers are mounted on the porcelain bushings to insulate them from ground. Some CT configurations slip around the bushing of a high-voltage transformer or circuit breaker, which automatically centres the conductor inside the CT window.

The accuracy of a CT is directly related to a number of factors including:

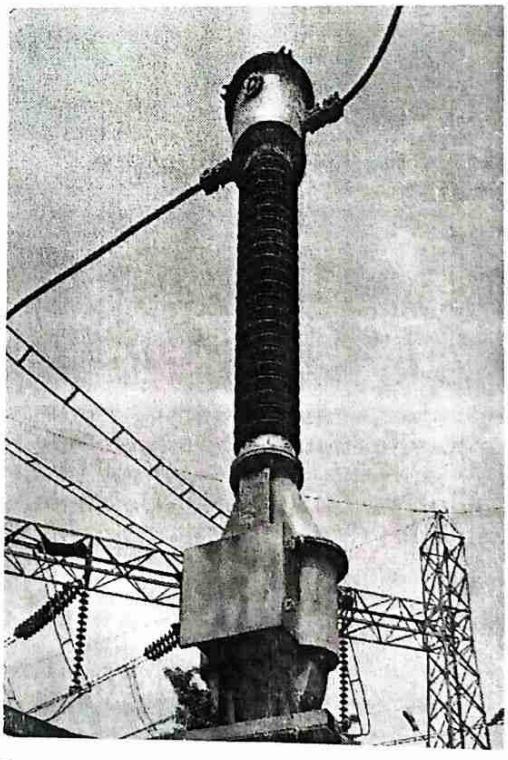
- Burden
- Burden class/Saturation class
- Rating Factor
- Load
- External Electromagnetic Fields
- Temperature
- Physical configuration
- The selected tap, For multi-ratio CT's

Functions of a Current Transformer:

- Metering of Power to track Energy Use
- Monitoring of Current Flow Through a circuit
- Relay of Power Through an Energy Grid
- Control of the State of a Circuit (Open or Closed) in a Ground Fault Circuit Interrupter
- Protection of Instruments and Appliances



Current Transformer(220/132KV)



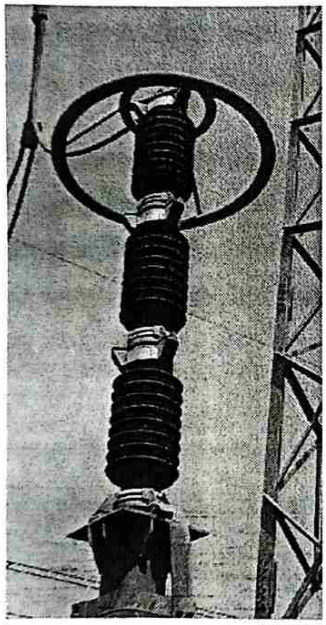
Current Transformer(132/33KV)

4. Lightning Arrester:

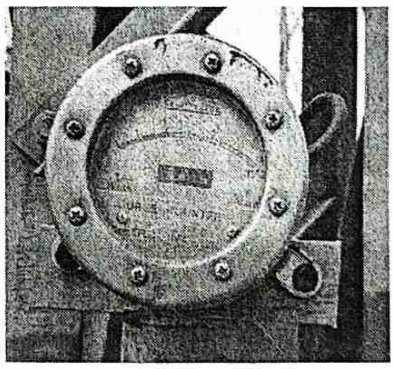
- It is a device used on electric power transmission systems to protect the insulation and conductors of the system from damaging effects of lightning.
- It activates under lightning strikes and diverts the lightning to the ground.
- It is connected in parallel with the apparatus that it safeguards meaning between line and earth.

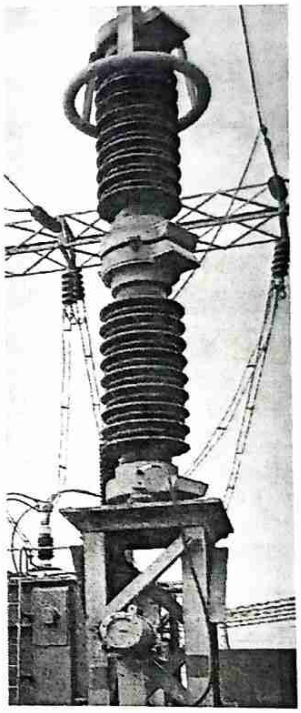
Types of Lightning Arresters :

- Rod Arrester
- Horn Gap Arrester
- Multi-gap Arrester
- Expulsion Type Lightning Arrester
- Valve Type Lightning Arrester



Lightning Arrester(220/132KV)





Lightning Arrester(132/33KV)

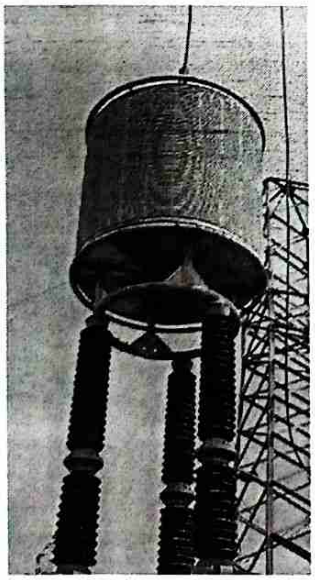
5. Wave Trapper :

The wave-trapper is located on incoming lines to trap the high-frequency signal. This signal (wave) comes from the remote station which interrupts the current and voltage signals. This component trips the high-frequency signal and redirects them to the telecom board. Sometimes, Transmission line is used for Power Line Carrier Communication (PLCC).

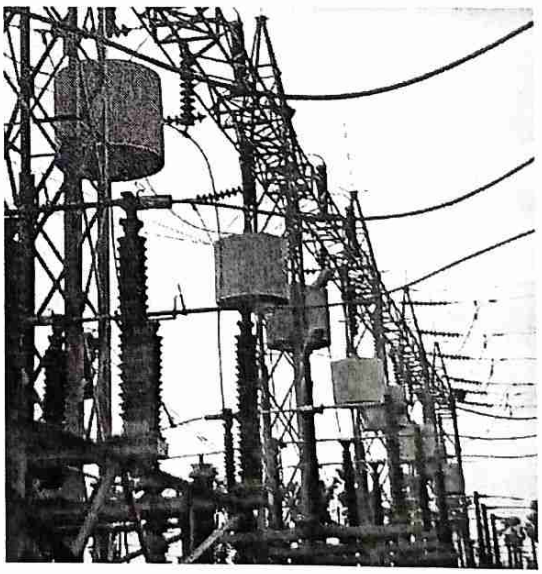
Design :

The trap consists of three major components: the main coil, the tuning device, and the protective device (also known as a surge arrester). The protective and tuning devices are mounted inside the main coil. A line trap may be covered with a bird barrier, in which case there are four components.

The main coil is the outer part of the line trap which is made from stranded aluminium cable. The reactor coil, depending on the device, can be made up of several aluminium wires, allowing equal distribution amongst the parallel wires. The stranded aluminium coil is wound in one layer. However, when the application of more than one layer is necessary, separation between layers is required to provide a cooling duct between them to avoid overheating. The cooling duct is created with spacer bars made out of epoxy resin and fiberglass. The coil carries rated continuous power frequency currents; therefore, this is the power inductor in this system. It provides a low impedance path for the electricity flow.



Wave Trap(220/132KV)



Wave Trap(132/33KV)

6. Circuit Breaker :

This is a type of electrical switch, used to open or close the circuit when an error arises in the system. It includes two moving parts that are usually closed. When an error happens in the system, then the relay transmits the signal to the circuit-breaker & therefore their parts are moved separately. Therefore, errors occur in the system turns into clear.

Types of Circuit breakers:

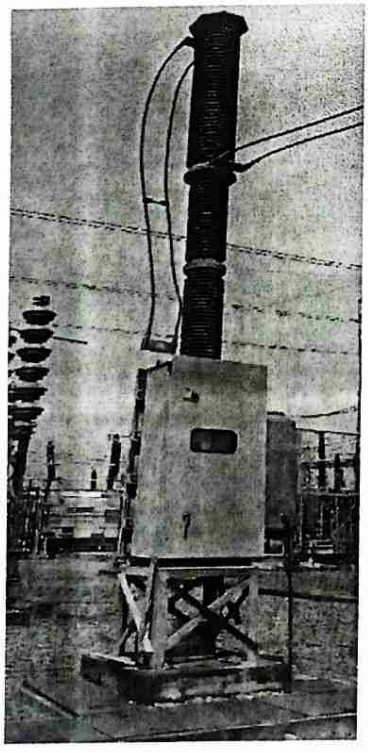
- Vacuum Circuit Breaker
- Magnetic Circuit Breaker
- Thermal Magnetic Circuit Breaker
- Carbon dioxide (CO_2) high-voltage Circuit Breaker
- Sulphur Hexafluoride (SF) high-voltage Circuit Breaker
- Disconnecting circuit breaker (DCB)

Several Characteristics Of SF6 Circuit Breakers That Explain Their Success:

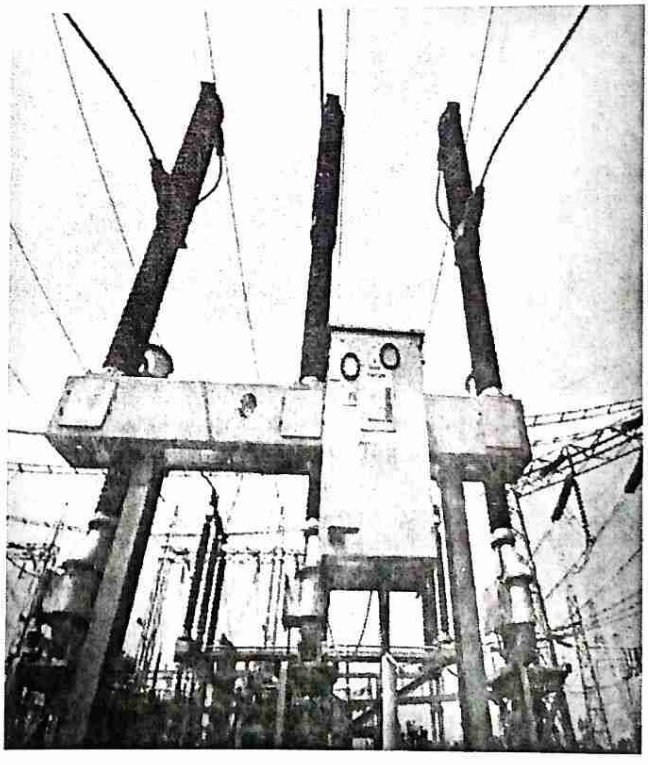
- Simplicity of the interrupting chamber which does not need an auxiliary breaking chamber.
- Autonomy provided by the puffer technique.
- The possibility to obtain the highest performance up to 63 kA, with a reduced number of interrupting chambers.
- Short break time of 2 to 2.5 cycles.

Force for breaking in Circuit Breaker:

- Spring Charging: it is done manually as well as locally
- Air Pressure Charging: Air is compressed from compressor tank



Circuit Breaker(220/132KV)



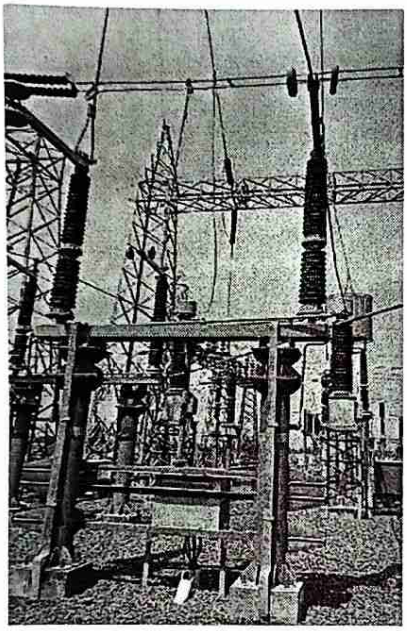
Circuit Breaker(132/33KV)

7. Isolator :

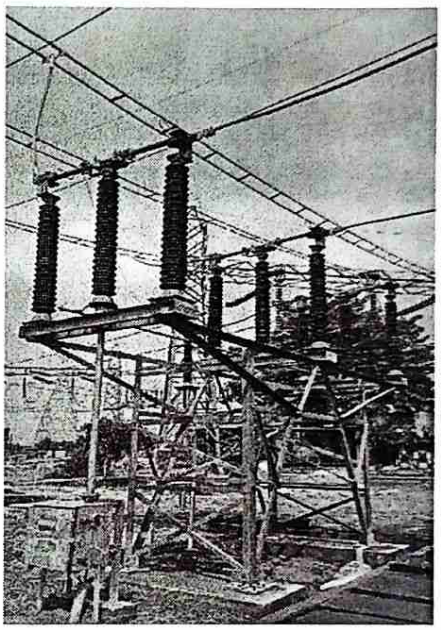
The isolator is one type of electrical switch used to isolate the circuit whenever the flow of current has been disrupted. These switches are named as disconnected switches, and it works under no-load condition. Isolators are not inbuilt by arc-quenching apparatus, and they don't have any particular current-making or circuit-breaking capacity. In some situations, it is used to break the current charging of the line of transmission.

Types of Isolators :

- Bus Isolator : the isolator is directly connected with main bus
- Line Isolator : the isolator is situated at line side of any feeder
- Transfer bus Isolator : the isolator is directly connected with transfer bus



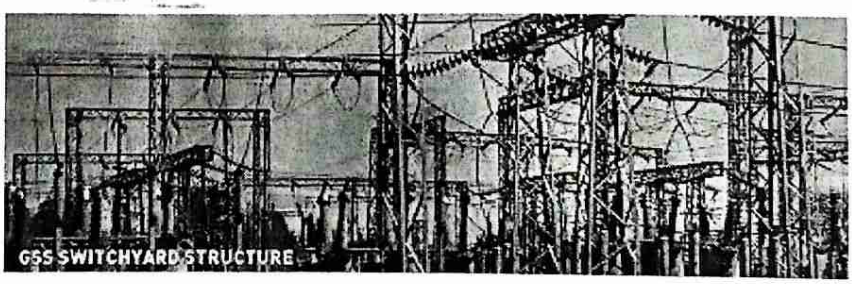
Isolator(220/132KV)



Isolator(132/33KV)

8. Switchyard :

The switchyard is the inter-connector among the transmission as well as generation, & equal voltage is maintained in this device. Switchyards are used to transmit the power which is generated from the substation at the preferred level of voltage to the near transmission line or power station.



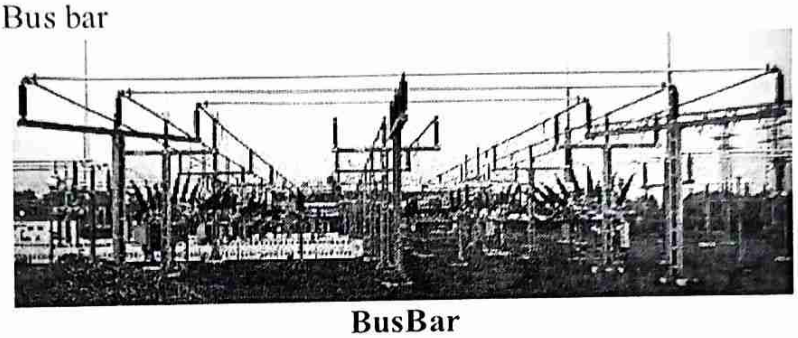
Switchyard

9. Bus bar :

The bus bar is a very important component in an electrical substation. It is a kind of current carrying conductor where many connections are made. In other terms, it can be defined as it is one type of electrical connection where the incoming current and outgoing current take place. They are generally made up of copper, brass and aluminium.

GSS Khagaul has three bus bars carrying different voltages.

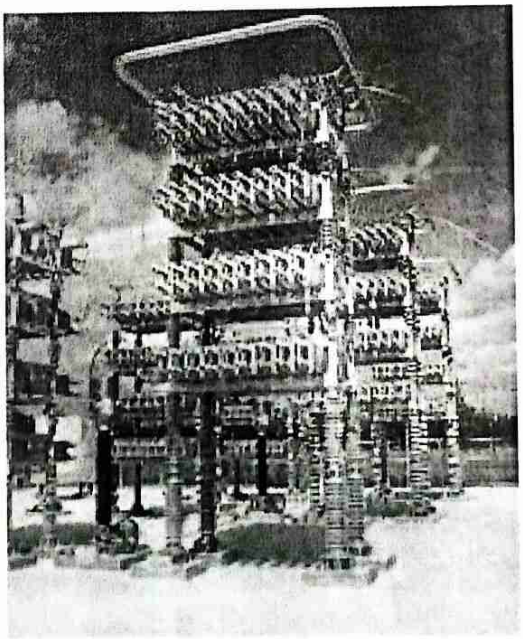
I. 200 KV Bus bar
II. 132 KV Bus bar
III. 33KV Bus bar



BusBar

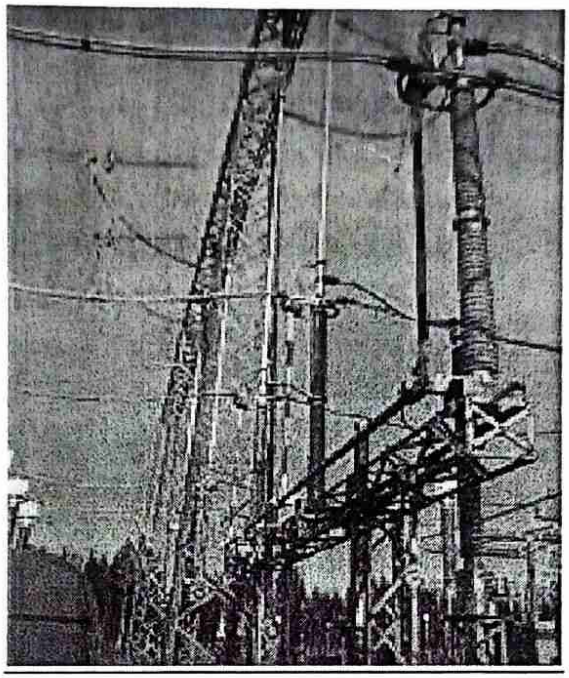
10. Capacitor Bank :

This device is inbuilt with capacitors that are connected either in series or else parallel (usually). The main function of this is to store the electrical energy in electrical charge form. This bank draws primary current which amplifies the PF (power factor) of the system. As a source, the capacitor bank works for reactive power, and the phase-difference among the current as well as the voltage will be decreased. They will enhance the capacity of ripple current of the power supply, and it removes the unnecessary characteristics within the system. The capacitor bank is an efficient method for preserving large electrical energy charges as well as conditioning the flow of energy as needed.



Capacitor Bank

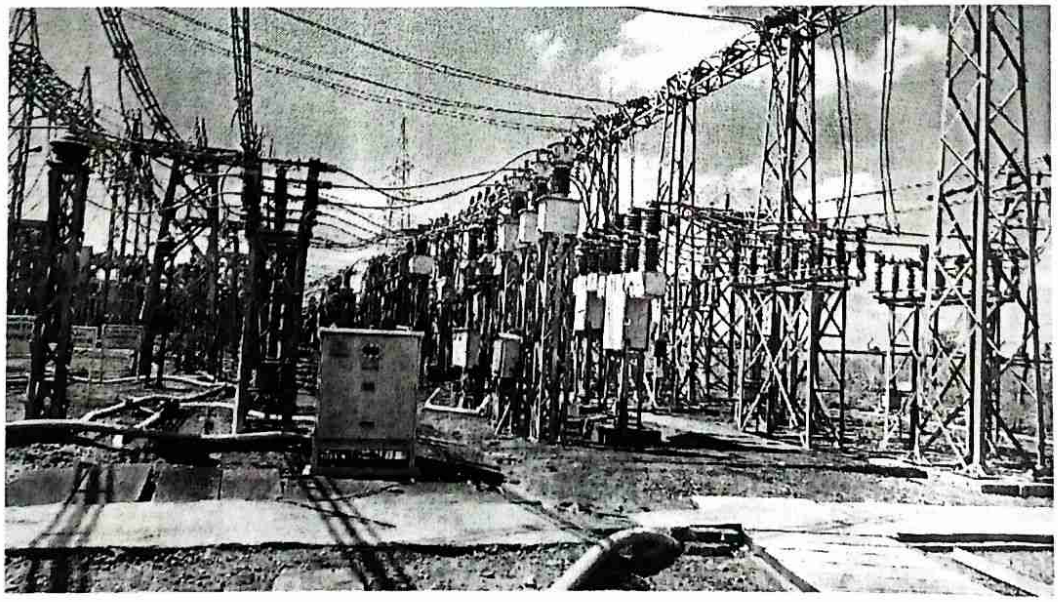
Earthing switches are typically applied in combination with a disconnecting switch but may also be freestanding. The switches are interlocked with the disconnecting switch, or a circuit breaker in the freestanding case, to prevent closing under voltage.



Earth Switch

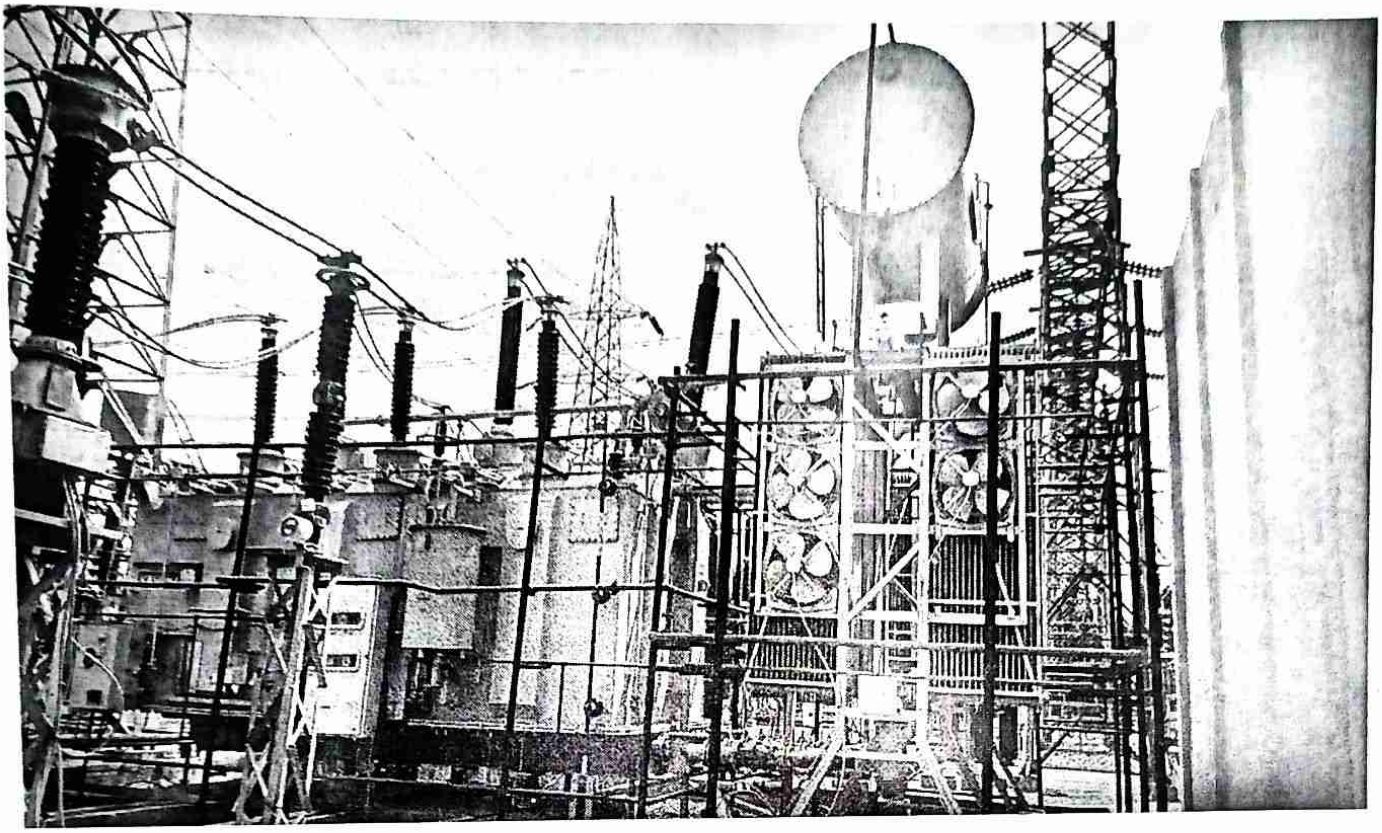
11. Bus Coupler :

Bus Coupler is a device which is used to couple one bus to the other without any interruption in power supply and without creating hazardous arcs. Bus coupler is a breaker used to couple two busbars in order to perform maintenance on other circuit breakers associated with that busbar. It is achieved with the help of a circuit breaker and isolators.

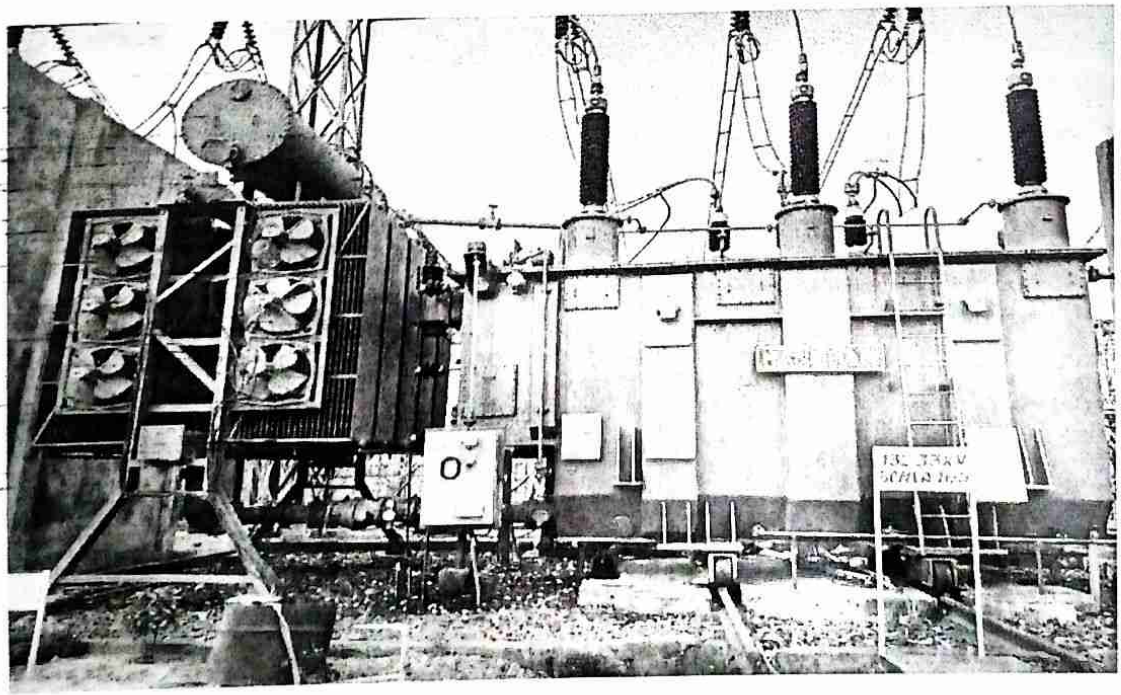


Bus Coupler

Transformer(200MVA)



Transmer(80MVA)



PARTS OF A TRANSFORMER :

Transformer facility the Delivery of power electric energy at minimum power loss. The basic part of a transformer are core, the primary winding and secondary winding. Apart from these, there are various other component such as insulation, transformer oil, cooling arrangements, protection Relays, enclosure etc. present in larger transformers.

a) **Core :** The core provide a low reluctance path for electromagnetic flux and supports the primary and secondary winding. It is made by stacking thin sheets of high-grade grain-oriented steel which are separated by thin insulating material. In order to minimize the hysteresis and eddy current, the carbon content of the core steel is maintained below 0.1%.

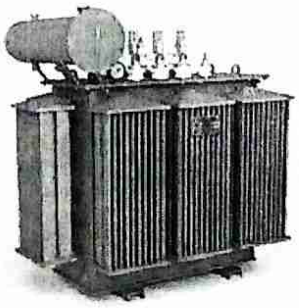
b) **Winding :** Transformer Carrie's two sets of winding per phase - primary winding and secondary winding. These winding consists of several turns of copper or aluminum conductor, insulated from each other and the transformer core. The type and arrangements of winding use for transformer depends upon the current rating, short circuit strength, temperature rise, impedance and surge voltages.

c) **Insulation :** Insulation is the most important part of transformer. Insulation failure can cause the most saver damage to transformers. Insulation is required between the winding and the core, between winding, between each term of the winding and between all current-carrying parts and the tank. The insulators should have high dielectric strength, good mechanical properties and high temperature withstand ability.

d) **Tank :** The main tank is a part of a transformer serves two purposes :

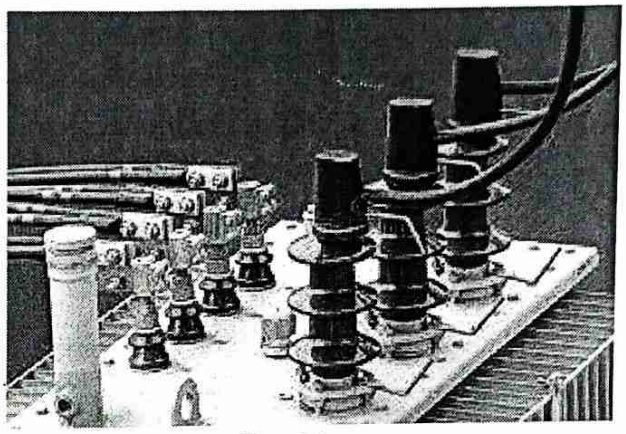
- ❖ Protects the core and the winding from the external environment.
- ❖ Serves as a container for oil and support for all other transformer accessories.

Tank bodies are made by fabricating rolled steel plates to container. They are provided with lifting hooks and cooling tube. In order to reduce weight and stray losses, aluminum sheets are also used instead of steel plates. However, aluminum tanks are costlier than steel ones.



Tank

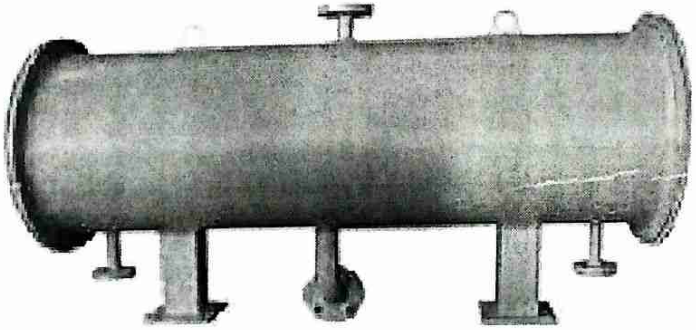
e) **Terminal and bushings :** For connecting incoming and outgoing cables, terminal are present in transformers. They are mounted upon the bushings and is connected to the ends of the windings.
Bushings are insulators that forms a barrier between the terminal and the tank. They are mounted over the transformer tank. They serve as a safe passage for the conductors connecting terminals to the winding. They are made from porcelain or epoxy resins.



Bushings

f) **Transformer oil :** In all oil-immersed transformers, transformer oil provides added insulation between the conducting parts, better heat dissipation, and fault detection features. Hydro-carbon mineral oil is used as transformer oil. It is composed of aromatic, paraffin, naphthalene, and olefins. Transformer oil has a flashpoint of 310 degree Celsius, a relative permeability of 2.7, and a density of 0.96 kg/cm.

g) **Oil conservators :** Oil conservators is moved on the top of the transformers and is located well above the tank and bushings. Normally a rubber bladder is present in some oil conservators. The transformer oil expand and contract with increase and decrease in temperature. The oil conservator provides adequate space for oil expansion. It is connected to the main tank through a pipe. A level indicates the oil level inside.

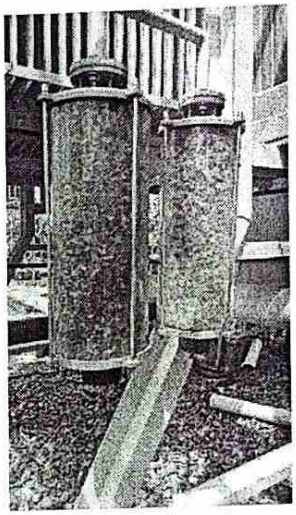


Oil conservators

h) **Tap changers :** Tap changers are used to adjust the secondary voltage of transformer. They are designed to change the turns ratio of the transformer as required. There are two types of tap changers:

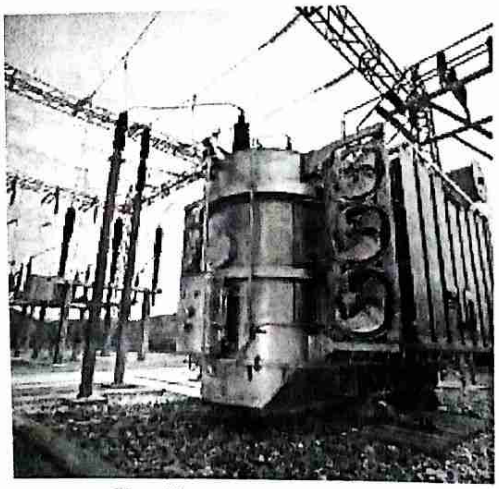
- On-load tap changers : On-load tap changers are capable of operating without interrupting the current flow to the load
- Off- load tap changers : Off-lode tap changers are designed to operate only when the transformer is not supplying any load

i) **Breather :** Breather is present in oil-immersed transformer that have a conservator tank. It is necessary to keep the oil-free from moisture. As the temperature variations cause the transformer oil to expand and contact, air flows in and out of the conservator tank. This air should be free from moisture. A breather attached to the end of air pipe such that the air enters and exits the conservator through it.



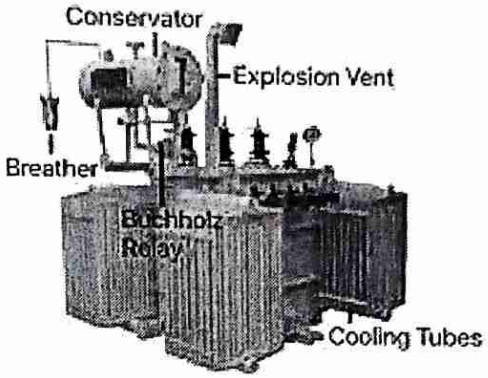
Breather

j) **Radiators and fans :** The power lost in the transformer is dissipated the form of heat. Dry transformer is mostly natural air cooled. But when it comes to oil immersed transformer, a variety of cooling method are followed. Depending on the KVA rating, power losses and level of cooling requirements, radiators and cooling fans are mounted on the transformer tank.



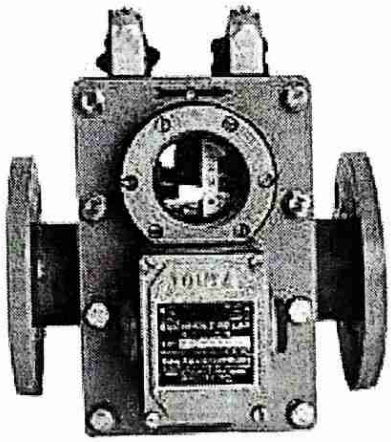
Radiators and fans

k) **Explosion vent :** An explosion vent acts as an emergency exit for oil and air gases inside a transformer. It is a metallic pipe with a diaphragm at one end, held slightly above the conservator tank. Faults occurring under oil elevates the pressure inside the tank to dangerous level. Under such circumstances, the diaphragm ruptures at a relatively low pressure to release the force from within the transformer to the atmosphere.



Explosion vent

l) **Buchholz relay :** Buchholz relay is one of the most important parts of oil immersed transformer rated over 500KVA. It is a oil and gas actuated relay which is used to sense faults occurring in the parts immersed in the oil. Short circuit occurring under the transformer oil generate enough heat to decompose the oil into hydrogen, carbon monoxide, methane etc.



Buchholz relay

Oil of Transformer :

- Transformer oil (also known as insulating oil) is a special type of oil which has excellent electrical insulating properties and is stable al high temperature.
- Transformer oil is used in only - filled electrical power transformers to insulate, stop arcing and corona discharge, and to dissipate the heat of the transformer.
- Transformer oil is used to preserve the transformer's core and winding - as these are fully immersed inside the oil.

techgyan

CERTIFICATE
OF COMPLETION

Kumari Akanksha

is presented with this certificate on successful completion of

WEB DESIGN WITH HTML/CSS

Under the guidelines and norms of the program structure

Conducted during the month of February & March 2023.

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
Techgyan Technologies

Netaji Subhas Institute of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"INTERNSHIP REPORT"

BASED ON THE ONLINE INTERNSHIP DONE IN THE MONTH OF FEBRUARY 2023 AT TECHGYAN TECHNOLOGIES In Web Design with HTML and CSS.

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by

KUMARI AKANKSHA

(194006)

Submitted to

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

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CHAPTER I

INTRODUCTION

In 2019 the Internet will be celebrated its 50th anniversary, and the World Wide Web had been in existence for over 25 years. The concepts of computer networks and hypertext on which these technologies rely are only a little older. And yet the speed of development of these technologies, the speed of uptake by companies, and the speed of acceptance by consumers is unlike anything mankind has witnessed. Although both the Internet and the Web are firmly rooted in academic, altruistic Endeavour, there is no doubt that the commercial interests are currently driving much of the technological development. This project aims for contributing to this Endeavour the basic ideas and technologies behind the Internet, and giving the opportunity to design and write Web pages using HTML5 and JavaScript.

1.1.Hypertext

Take a dictionary and observe how its content is linked together. How do you search for the meaning of a word? How can you find another word synonymous with that word? The dictionary is a paper example of a hypertext system. So are encyclopedias, product catalogues, user help books, technical documentation and many other kinds of books. Information is obtained by searching through some kind of index - the dictionary is arranged in alphabetical order, and each word is its own index. Readers are then pointed to the page of any other related information. They can read the information they are interested in without having to read the document sequentially from beginning to end. Hypertext systems allow for non-sequential or non-linear reading. This is the underlying idea of a hypertext system. The result is a multidimensional document that can be read by following different paths through it. In this section we will look into the application of hypertext in computer systems, mainly the World Wide Web hypertext system. The main use of hypertext is in information retrieval applications. The ease of linking different pieces (fragments) of information is the important aspect of hypertext information retrieval. The information can be of various media: it may be fragments of textual documents, structured data from databases, or list of terms and their definitions. Any of these, or a mixture thereof, can make up the contents of a hypertext document.

Therefore, in a hypertext system it is possible to:

- link with a term that represents aspects of the content of a document;
- connect two related documents;
- relate a term to a fragment containing its definition and use; and
- link two related terms.

Such a hypertext system can store a large collection of textual and multimedia documents. Such a hypertext system gives the end-user access to a large repository of knowledge for reading, browsing and retrieving. This is a "database" of sorts, and is the reason why such a hypertext system is called a digital library. The Web started as an extensively large digital library. As it has grown in

popularity, it has offered the possibility of interactive applications and commerce on the Internet, making it much more than a digital library.

1.2 Project Scope

The scope of library Website and Online Library Management System includes:

- Create distinct product users based on their roles and permissions.
- Authenticate users at their login.
- Provide the list of books the users can borrow.
- Facility to reserve books that are available.
- A status page for all users to view books reserved by them.
- Facility to cancel the reservation for a book made earlier.
- A status page for all users to view books borrowed by them, their individual due dates and their individual penalties if any.
- An interface to view and edit the own profile.
- Provide method for adjusting account settings such as passwords.
- Mechanism to reset the password in case user forgets it.
- Providing interface to add or delete books to staffs.

1.3. The Web as a Digital Library

The Web as a vast digital library is becoming what is known as a 'Global Information Structure'. It will have a profound effect on how we live, work and play. We shall now look into a few of the social implications of the Web as a digital library and a marketplace.

Different Literacy The hypermedia concept includes not only text and illustrations, but also music, animation, digital movies, video games and computer software. This diversity changes the form of literacy required when using the Web. The literacy needed when listening to music and watching a movie may be different from that used when reading a book. Less literacy may be required with innovative ways of using the digital library. For example, software that reads text aloud can assist people with visual handicaps.

Indeterminate Quality and Value Editors and publishers employing traditional methods of publishing have little to gain from this type of publishing. As digital works can be copied at low costs, stored in almost no space and transported instantly anywhere in the world, writers can be their own publishers. Therefore, the works published are of indeterminate quality and value. Web publishing may provide no evaluation of work published.

Specialist Audiences An article may perhaps interest a group of specialists in a particular field. With the Web, an average reader may browse through the article according to their degree of interest in the field. He or she may not want to be burdened with an additional flood of technicalities,

or perhaps would navigate further to extract more in-depth information to supplement a deeper interest in the field.

Copyright Issues and Ease of Purchasing The ease of copying digital works causes difficulties in protecting copyrights. It may be tempting to make illegal copies rather than finding the rightful owners and paying them a fee. On the other hand, the non-issue of distance and the 24-hour, 365-day activity on the Web means that much can be easily bought through on-line shops. Consumers may come from distant areas or different time zones. With the Web, this market place is open at all times and can serve a very large global region. New technology even allows computational agents to staff the market place rather than people. Therefore, businesses are not constrained by distance or time. v. Sense of Place Despite the irrelevance of distance, an electronic marketplace may be attractive as it goes to the consumers instead of them physically moving to the business environment. Its sense of place is created as an illusion for the benefit of the consumers.

CHAPTER II

WEB TERMINOLOGIES

2.1 Network Protocols

A network protocol is a standard way of regulating data transmission between computers. Just as diplomats adhere to protocols — rules of behavior — when in foreign lands, network communications do the same. They have to obey agreed rules if they are to communicate and 'get on with each other'. After many years of both public and private research and development, two network protocols are now dominant:

TCP (Transaction Control Protocol) and IP (Internet Protocol), together known as TCP/IP. These were actually unlikely protocols to be so widely accepted, as faster, standardized protocols had been agreed upon, but none had the same robustness and extensibility as TCP/IP.) Very often protocols were implemented without any formal acceptance and, because they worked most of the time, they became standards by default. Although TCP/IP is an accepted, de facto standard, work on Internet protocols continue in order to improve communication quality and support the continued growth of the Internet.

There is no dictating authority for the Internet. Without a controlling authority, interim proposals about protocol changes are made by groups of interested individuals and then opened up for discussion. Documents containing the various proposed standards are published as Requests For Comment documents (RFCs). You may see references to a specific RFC as the best description of a protocol!

2.2. Web Application (Webapp)

A web application (or webapp), unlike standalone application, runs over the Internet. Examples of webapps are google, amazon, ebay, facebook and the UCT website. A webapp is typically a 3-tier (or multi-tier) client-server database application run over the Internet and it comprises five components:

HTTP Server: E.g., Apache HTTP Server, Apache Tomcat Server, Microsoft Internet Information Server (IIS), nginx, Google Web Server (GWS), and others. You will learn how to install Apache HTTP and Tomcat web servers in the next chapter.

- HTTP Client (or Web Browser): E.g., Internet Explorer (MSIE), FireFox, Chrome, Safari, and others.

- Database: E.g., Open-source MySQL, MariaDB, Apache Derby, mSQL, SQLite, PostgreSQL, OpenOffice's Base; Commercial Oracle, IBM DB2, SAP SyBase, MS SQL Server, MS Access; and others. You will learn how to install MySQL in the next chapter.

• Client-Side Programs: could be written in HTML Form, JavaScript, VBScript, Flash, and others. You will learn how to writer client-side programs using HTML and JavaScript in this course.

• Server-Side Programs: could be written in Java Servlet/JSP, ASP, PHP, Perl, Python, CGI, and others.

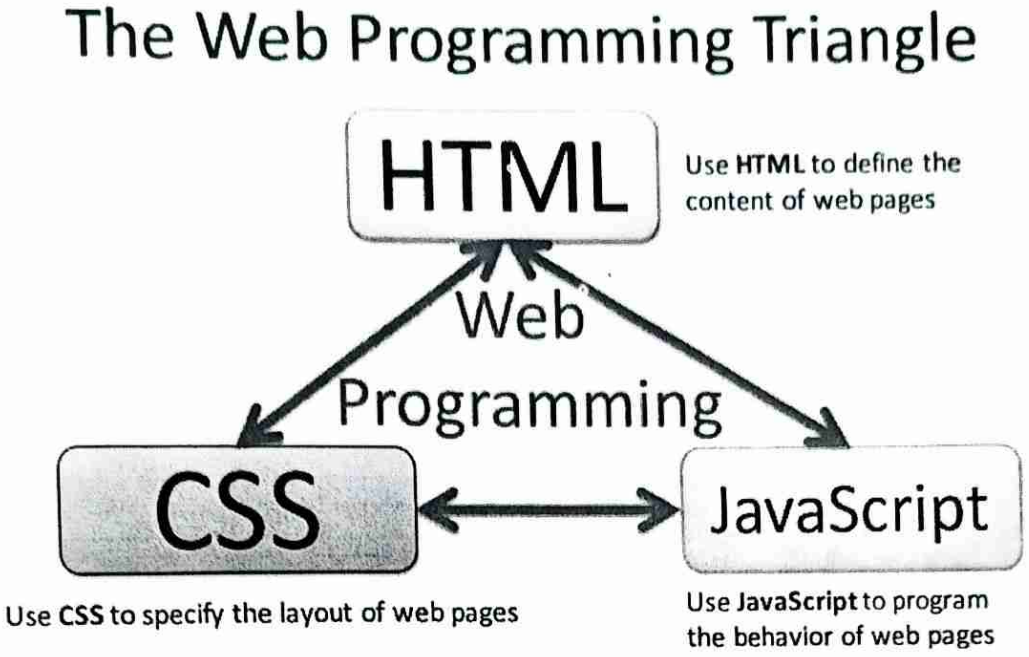
2.3. Uniform Resource Locator (URL)

An URL is needed to locate any resources on the Web. It is an address format that specifies how and where to find a document. The general format is as follows, where the various items in italics must be substituted with part of a real URL, or omitted altogether. http://machine_name:port/path/file_name.file_extension machine_name is either an IP address, for example 137.234.33.89, or a Fully Qualified Domain Name (also known as a DNS name, because Domain Name Servers map between Domain Names and IP addresses), for example, www.apple.com [http://www.apple.com].

In the machine name http is the protocol identifier, while www.apple.com is the resource name. port is the TCP port to connect to; this is an entry point to software on the server; an optional part of a URL. path is a relative file path from the server's document root; the server will start looking for a file in a specific directory and paths are relative to this file_name is the name of the file to be browsed, e.g. welcome file_extension is one of a number of suffixes which, by convention and operating system setup, indicate the type of data contained within the file, e.g. htm,html,txt.Forexample,intheURLbelow,http://www.apple.com/retail/business/jointventure/terms.html 'terms.html' is a file with the html extension.

2.4. Hyper Text Markup Language (HTML)

This language provides the format for specifying simple logical structure and links in a hypertext document. As a markup language, special formatting commands are placed in the text describing how the final version should appear. These formatted documents are interpreted by a Web browser which usesthe HTML code to format the page being displayed. Although most professionals use special authoring tools to write HTML documents and to manage sites, developers of e-commerce sites and applications need to know the nitty-gritty detail of HTML, and this is what you will study. HTML has had several versions over the years. "HTML 2.0" was the first standard HTML specification which was published in 1995. HTML 4.01 was a major version of HTML and it was published in late 1999. Though HTML 4.01 version is widely used but currently we are having HTML 5 version which is an extension to HTML 4.01, and this version was published in 2012 . This course will take you through website creation using HTML5.



2.5. Hypertext Transfer Protocol (HTTP)

HTTP is a network protocol used to retrieve documents from a variety of machines in a minimum amount of time. It was invented by Tim Berners-Lee to support a project in developing a distributed hypertext system. Distributed hypertext requires the retrieval of documents from many different machines. File Transfer Protocol (FTP), which predates the Web, would be too slow for this purpose as it is a connection-oriented protocol that requires a permanent connection to a server, thus requiring a connection-maintenance overhead when accessing different machines.

Therefore, to support browsing, HTTP has the following characteristics: connection-less; a connection is established only for the period of transfer, and the connection need not be maintained after thereafter;

• stateless; the server has no 'history' of client visits (although the implementation of cookies overcomes this);

• comprehensive addressing; diverse files on any HTTP server world-wide can be referenced via URLs;

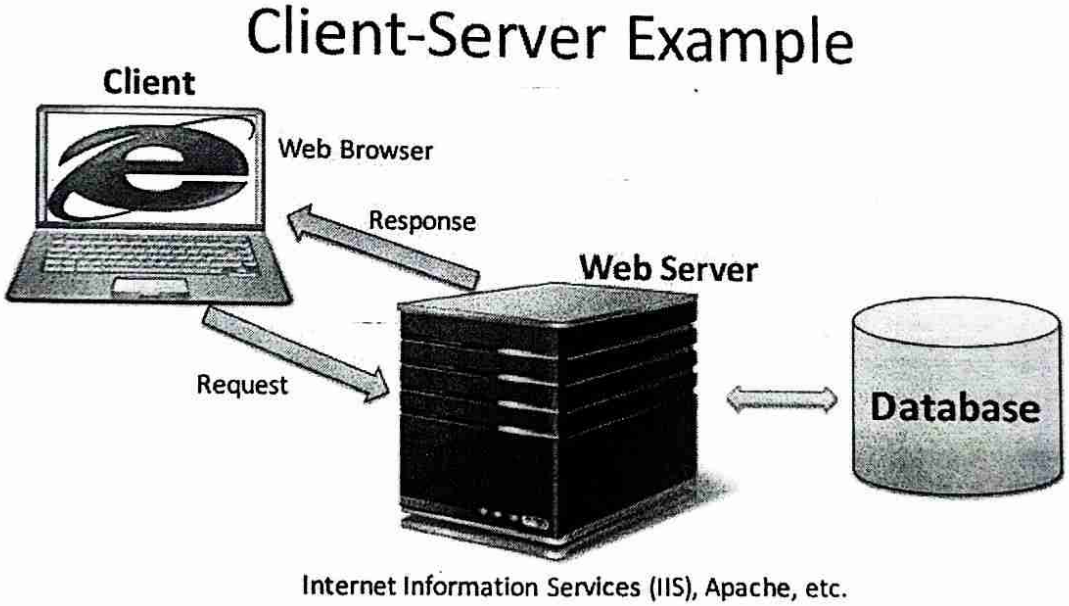
• diverse data; using extensible MIME-types (see later), HTTP servers can supply information of every possible data types; and

• rapid; allows request-response cycles of less than 100 milliseconds HTTP is not mandatory for distributed hypertext; there are other techniques and protocols that can be used to access or transfer information. However, like TCP/IP and HTML, HTTP is ubiquitous and so enables development in e-commerce.

2.6. Client-server Computing Model

A software partitioning paradigm in which a distributed system is split between one or more server tasks which accept requests, according to some protocol, from (distributed) client tasks, asking for information or action. There may be either one centralized server or several distributed ones. This model allows clients and servers to be placed independently on nodes in a network. Client-server computing is mainly about the client computer possessing its own computing power. In the days of mainframes, all the processing power took place on central computers.

The client 'terminals' were little more than a television that could send and receive characters. When microprocessors became available, it was possible to make the terminals more powerful so that they could handle some of the processing. Over time this has meant that mainframes have been replaced by smaller server machines and terminals have been replaced by more powerful client workstations. The client-server model provides a good division of processing power, since the server primarily provides information to the client, which is responsible for interpreting and displaying it. This means that servers do not have to be powerful machines, allowing more people to become service providers.



2.7. Functionality

In the context of the Web, users run client programs (i.e. Web browsers) which provide the following functionality:

- They allow the user to send a request for information to the server.
- They format the request so that the server can understand it.

• They format the response from the server in a way that the user can read it. Server programs carry out the following:

• They receive a request from a client and process the request.

• They respond by sending the requested information back to the client. In summary, the typical functionality of a client-server model is:

• A user, via a web browser (HTTP client), issues a URL request to an HTTP server to start a webapp.

• A client-side program (such as an HTML form) is loaded into client's browser.

• The user fills up the query criteria in the form.

• The client-side program sends the query parameters to a server-side program.

• The server-side program receives the query parameters, queries the database and returns the query result to the client.

• The client-side program displays the query result on the browser.

• The process repeats.

CHAPTER III

HTML BASICS

This language provides the format for specifying simple logical structure and links in a hypertext document. As a markup language, special formatting commands are placed in the text describing how the final version should appear. These formatted documents are interpreted by a Web browser which uses the HTML code to format the page being displayed. Although most professionals use special authoring tools to write HTML documents and to manage sites, developers of e-commerce sites and applications need to know the nitty-gritty detail of HTML, and this is what you will study. HTML has had several versions over the years. "HTML 2.0" was the first standard HTML specification which was published in 1995. HTML 4.01 was a major version of HTML and it was published in late 1999. Though HTML 4.01 version is widely used but currently we are having HTML 5 version which is an extension to HTML 4.01, and this version was published in 2012 . This course will take you through website creation using HTML5.

3.1. HTML Markup

HTML pages are created by tagging textual information with HTML markup. HTML markup consists of tags, which appear inside angled brackets < and > . An example of an HTML tag is , which causes text to appear in bold. only notes where text should begin to appear in bold, while the tag marks the end of the emboldening. Most HTML tags have a corresponding end tag, which is specified by the name of the tag preceded by the / character.

3.2. Nesting HTML Tags

Text may be both bold and italicized. This is done by using both the and tags. When doing so, it is important to remember not to overlap HTML tags Overlapping tags is a common mistake. Although Web browsers are usually smart enough to work out what is meant, it can lead to problems. Furthermore, for an HTML page to be considered valid HTML, it must contain no overlapping tags.

3.3. Creating HTML Text using Notepad++

This section covers the creation of an HTML page. You will need a Web browser and a text editor. Use HTML: Basics 3 any text editor you wish to, but the following Activity descriptions will use Notepad++. Notepad++ is a free Windows editor that also supports several programming languages. For example, you will notice that HTML keywords are highlighted in different colors.

1. Open your Web browser. This sections' goal is to create a Web document that can be opened with your browser.

2. Open Notepad++. It can be found by selecting Start, then All Programs, then Notepad++.

3. Type the following text into Notepad++: your name and the module number (CSC5003). Save this file as start.txt.

4. Now load start.txt into the browser by dragging start.txt onto your browser.

5. The browser should now display the text contained in start.txt. (If it does not, make sure that you have saved start.txt and that this is the file you are opening).

6. Once you have displayed start.txt, return to Notepad. Add the text "Internet Commerce", and save the file again.

7. Return to the Web browser and reload the document (by using either by using the Refresh or Reload toolbar buttons, or by selecting File/Open once again).

8. If you are able to see the new piece of text, you have successfully used Notepad to create your first Web page.

3.4. Processing Forms

Although forms could simply be used to display information, HTML provides them in order to supply a way for the user to interact with a Web server. The most widely used method to process the data submitted through a form is to send it to server-side software typically written in a scripting language, although any programming language can be used. The figure below outlines the kind of processing that takes place.

1. The user retrieves a document containing a form from a Web server.

2. The user reads the Web page and interacts with the form it contains.

3. Submitting the form sends the form data to the server for processing.

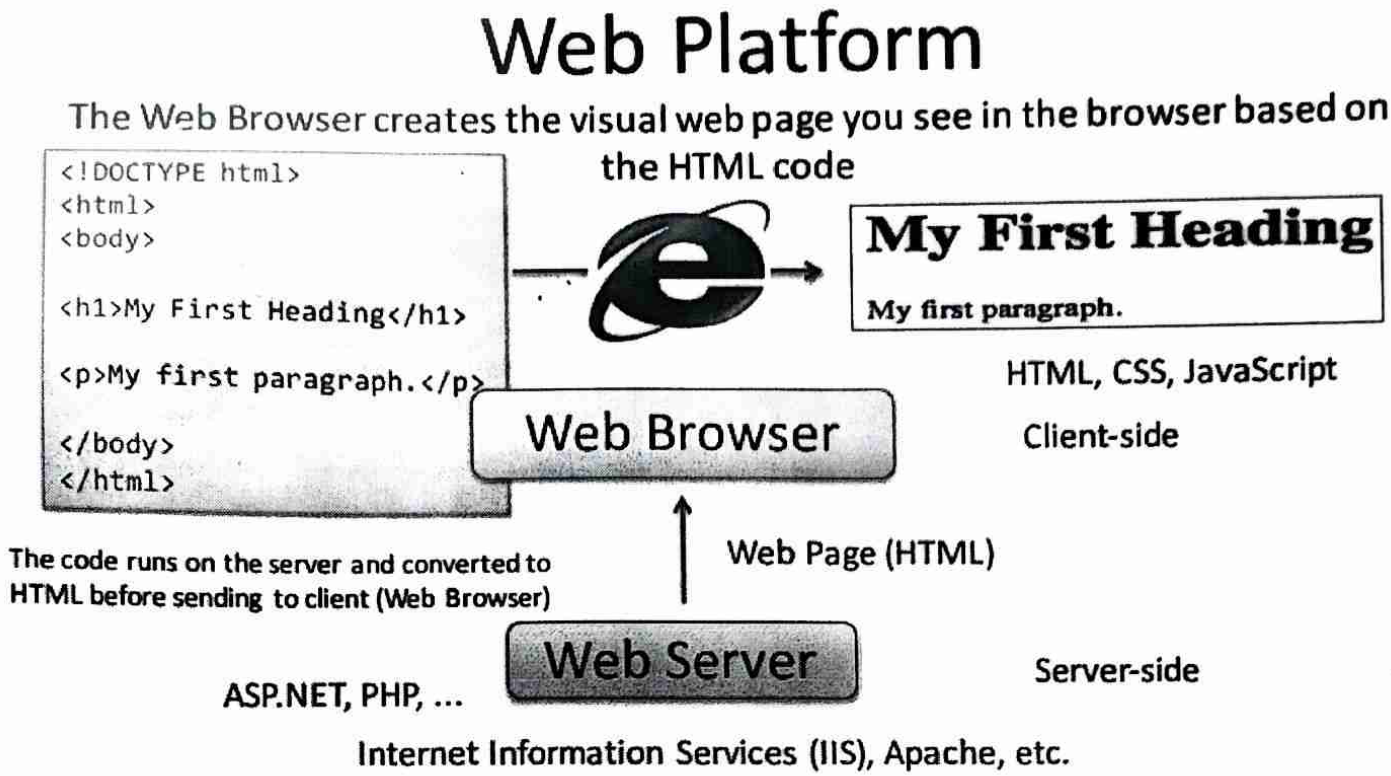
4. The Web server passes the data to a CGI programme.

5. The CGI software may use database information or store data in a server-side database.

HTML Forms

6. The CGI software may generate a new Web page for the server to return to the user.

7. The user reads the new Web document and may interact with it.



3.5. List of used HTML codes

- Basic HTML
- Formatting
- Forms and Input
- Frames
- Images
- Audio / Video
- Links
- Lists
- Tables
- Styles and Semantics
- Meta Info

3.6. Basic HTML Tags and Description

Tag	Description
<!DOCTYPE>	Defines the document type
<html>	Defines an HTML document
<head>	Defines information about the document
<title>	Defines a title for the document
<body>	Defines the document's body
<h1> to <h6>	Defines HTML headings
<p>	Defines a paragraph
 	Inserts a single line break
<hr>	Defines a thematic change in the content
<!--...-->	Defines a comment
<abbr>	Defines an abbreviation or an acronym
<address>	Defines contact information for the author/owner of a document/article
<b>	Defines bold text
<bdi>	Isolates a part of text that might be formatted in a different direction from other text outside it
<bdo>	Overrides the current text direction
<big>	Not supported in HTML5. Use CSS instead. Defines big text
<blockquote>	Defines a section that is quoted from another source
	Not supported in HTML5. Use CSS instead. Defines centered text
<cite>	Defines the title of a work
<code>	Defines a piece of computer code
<del>	Defines text that has been deleted from a document
<dfn>	Represents the defining instance of a term
	Defines emphasized text
<font>	Not supported in HTML5. Use CSS instead. Defines font, color, and size for text
<i>	Defines a part of text in an alternate voice or mood
<ins>	Defines a text that has been inserted into a document
<kbd>	Defines keyboard input
<mark>	Defines marked/highlighted text
<meter>	Defines a scalar measurement within a known range (a gauge)
<pre>	Defines preformatted text

<progress>	Represents the progress of a task
<q>	Defines a short quotation
<rp>	Defines what to show in browsers that do not support ruby annotations
<rt>	Defines an explanation/pronunciation of characters (for East Asian typography)
<ruby>	Defines a ruby annotation (for East Asian typography)
<s>	Defines text that is no longer correct
<samp>	Defines sample output from a computer program
<small>	Defines smaller text
<strike>	Not supported in HTML5. Use <del> or <s> instead. Defines strikethrough text
	Defines important text
<sub>	Defines subscripted text
<sup>	Defines superscripted text
<template>	Defines a template
<time>	Defines a date/time
<tt>	Not supported in HTML5. Use CSS instead. Defines teletype text
<u>	Defines text that should be stylistically different from normal text
<var>	Defines a variable
<wbr>	Defines a possible line-break
Forms and Input	
<form>	Defines an HTML form for user input
<input>	Defines an input control
<textarea>	Defines a multiline input control (text area)
<button>	Defines a clickable button
<select>	Defines a drop-down list
<optgroup>	Defines a group of related options in a drop-down list
<option>	Defines an option in a drop-down list
<label>	Defines a label for an <input> element
<fieldset>	Groups related elements in a form
<legend>	Defines a caption for a <fieldset> element
<datalist>	Specifies a list of pre-defined options for input controls
<output>	Defines the result of a calculation
Frames	
<frame>	Not supported in HTML5. Defines a window (a frame) in a frameset
<frameset>	Not supported in HTML5.

	Defines a set of frames
<noframes>	Not supported in HTML5. Defines an alternate content for users that do not support frames
<iframe>	Defines an inline frame
Images	
<img>	Defines an image
<map>	Defines a client-side image-map
<area>	Defines an area inside an image-map
<canvas>	Used to draw graphics, on the fly, via scripting (usually JavaScript)
<figcaption>	Defines a caption for a <figure> element
<figure>	Specifies self-contained content
<picture>	Defines a container for multiple image resources
<svg>	Defines a container for SVG graphics
Audio/Video	
<audio>	Defines sound content
<source>	Defines multiple media resources for media elements (<video>, <audio> and <picture>)
<track>	Defines text tracks for media elements (<video> and <audio>)
<video>	Defines a video or movie
Links	
<a>	Defines a hyperlink
<link>	Defines the relationship between a document and an external resource (most used to link to style sheets)
<nav>	Defines navigation links
Lists	
	Defines an unordered list
	Defines an ordered list
	Defines a list item
<dir>	Not supported in HTML5. Use instead. Defines a directory list
<dl>	Defines a description list
<dt>	Defines a term/name in a description list
<dd>	Defines a description of a term/name in a description list
<menu>	Defines a list/menu of commands
<menuitem>	Defines a command/menu item that the user can invoke from a popup menu
Styles and Semantic	
<style>	Defines style information for a document
	Defines a section in a document

Bihar State Power Transmission Company Limited

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CERTIFICATE

This is to certify that LAVANYA SINGH Branch E.E.E Registration no./Roll No. 19110103009 college NSIT, Bihta, Patna. has successfully completed his/her in-Plant Training at 220/132/33 KV GSS Bihta (New) under transmission Division Patna West), from 13/05/2022 to 12/06/2022 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was V. Good

Place: Patna

Issue Date: 24/06/2022

EEE/TD/ Patna
L No. 392 Date 24/06/2022

Electrical Executive Engineer
Transmission Division Patna (West)

Netaji Subhas Institute of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

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Undertaken by

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With specialization in

ELECTRICAL & ELCTRONICS ENGINEERING

Under the guidance of

- Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))
- Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:

LAVANYA SINGH (194014)

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

TRAINING CERTIFICATE

Certified That Mr. Rashid Mahboob Student of Degree in Electrical & Electronics Engineering 2nd Year Netaji Subhas Institute Of Technology, Amhara, Bihta, Patna – 801118, is imparted Knowledge about maintenance of Coaches in Coaching Depot/THE (Thawe), N.E. Railway during in plant training & visit from dated 01.12.2022 to date 31.12.2022

Date: 31.12.2022

31.12.2022

Signature

Senior Section Engineer (C&W)
North Eastern Railway
Thawe Junction

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Sri Santosh Kumar ,JEE/MRT– 2

Sri Deepak Kumar ,JEE/MRT - 1

Submitted by:

Surya kant (214008)

Submitted to:

. Department of Electrical and Electronics Engineering

SOUTH BIHAR POWER DISTRIBUTION COMPANY LTD.
PATNA (BIHAR)

OFFICE OF ELECTRICAL SUPERINTENDING ENGINEER
ELECTRIC SUPPLY CIRCLE, PATNA
'R' BLOCK ROAD NO.-1, PATNA-800001

Letter No. - 714

Date: 21-03-23

TO WHOM IT MAY CONCERN

This is to certify that Mr/Miss. Saurav Kumar, Roll No.214007 a student Netaji Subhas Institute of Technology, Bihta, Patna. has completed 'In Plant Training' at "M.R.T, PATNA" during the period from 12-01-2023 to 08-02-2023 in reference of Letter No.01 Date. 02-01-2023 of Sri Surender Kumar Gupta Dy. Secretary, South Bihar Power Distribution Company Ltd. Patna. His/her conduct during Training has been satisfactory and I wish for his/her success in future

Electrical Superintending Engineer Electric Supply Circle, Patna
SBPDCL

(Shankar Choudhary)
Electrical Superintending Engineer

18.03.23

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY , BIHTA , PATNA

Approved by AICTE, New Delhi; Affiliated to Bihar Engineering University Patna

Illuminating Lives

"INTERNSHIP PROGRAM"

Undertaken by

SOUTH BIHAR POWER DISTRIBUTION COMPANY LTD.

PATNA (BIHAR) IN THE MONTH OF JANUARY 2023

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

UNDER THE GUIDENCE OF

Sri Rupak Kumar ,EEE/MRT PATNA

Sri Prasant Rahul ,AEE/MRT– 1

Sri Santosh Kumar ,JEE/MRT– 2

Sri Deepak Kumar ,JEE/MRT - 1

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Submitted to:

Department of Electrical and Electronics Engineering

SOUTH BIHAR POWER DISTRIBUTION COMPANY LTD.
PATNA (BIHAR)

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ELECTRIC SUPPLY CIRCLE, PATNA
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SOUTH BIHAR POWER DISTRIBUTION COMPANY LTD.
PATNA (BIHAR)

OFFICE OF ELECTRICAL SUPERINTENDING ENGINEER
ELECTRIC SUPPLY CIRCLE, PATNA
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Letter No. - 712

Date: 21-03-23

TO WHOM IT MAY CONCERN

This is to certify that Mr/Miss. Sonu Kumar, Roll No.214004 a student Netaji Subhas Institute of Technology, Bihta, Patna. has completed 'In Plant Training' at "M.R.T, PATNA" during the period from 12-01-2023 to 08-02-2023 in reference of Letter No.01 Date. 02-01-2023 of Sri Surender Kumar Gupta Dy. Secretary, South Bihar Power Distribution Company Ltd. Patna. His/her conduct during Training has been satisfactory and I wish for his/her success in future

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18-03-23

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Submitted by:

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Submitted to:

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SOUTH BIHAR POWER DISTRIBUTION COMPANY LTD.
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Letter No. - 499

Date: 17-02-23

TO WHOM IT MAY CONCERN

This is to certify that Mr/Miss. Abhishek Rajan, Roll No.214003 a student Netaji Subhas Institute of Technology, Bihta, Patna. has completed 'In Plant Training' at "M.R.T, PATNA" during the period from 20-12-2022 to 16-01-2023 in reference of Letter No.343 Date. 15-12-2022 of Sri Surender Kumar Gupta Dy. Secretary, South Bihar Power Distribution Company Ltd. Patna. His/her conduct during Training has been satisfactory and I wish for his/her success in future.

Superintending Engineer Electric Supply Circle Patna
SBPDCL

(Shankar Choudhary)
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16.2.23

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Sri Prasant Rahul ,AEE/MRT– 1

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Submitted by:

ABHISHEK RAJAN (214003)

Submitted to:

Department of Electrical and Electronics Engineering

CONTENTS:

- Introduction about Energy Meter
- Types of Energy Meter
- Testing of Meter
- Tranformer and its uses
- Types of Transformer
- Part of Transformer
- Breakdown Voltage
- Oil testing of Transformer
- Relay and its Components
- Circuit Breaker

ABSTRACT

The purpose of this report is to define M.R.T system and their application in modern industry and to elucidate the security of the system, to analyze the fundamental vulnerabilities and to put forth recommendation for the implementation of security in these system.

M.R.T stands for meter relay testing . In M.R.T different types of meter are tested so that consumer pay exact amount of electrical energy consumed.

In M.R.T we have also studied about C.T. (current transformer) & P.T. (potential transformer) which are used to measure & control very high potential.

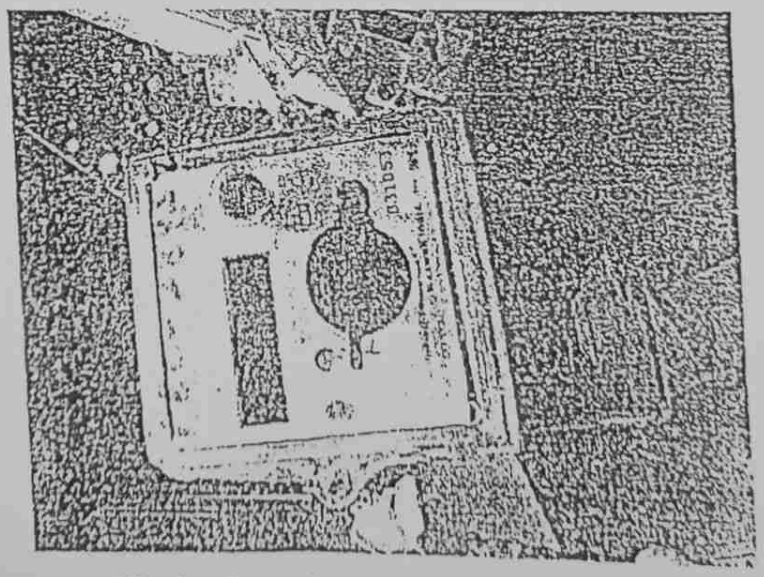
Under the aforesaid purpose we have also visited some more sites which are **Transformer repairing** work shop nearby sub-station & corresponding power grid in Patna for deep knowledge & good experience.

Energy meter - Electrically powered device.

Electricity meters are typically calibrated in billing units, the most common one being the kilowatt hour (*kWh*). Periodic reading of electric meters establishes billing cycles and energy used during a cycle.

In settings when energy savings during certain periods are desired, meters may measure demand, the maximum use of power in some interval. "Time of day" metering.

An electricity meter or energy meter is a device that measures the amount of electric energy consumed by a residence, business or allows electric rates to be changed during a day, to record usage during peak high-cost periods and off-peak, lower-cost, periods. Also, in some areas meters have relays for demand response shedding of loads during peak load period.



Single phase 2 wire L.T. energy meter

CHAPTER 1
INTRODUCTION

The energy meter is an electrical measuring device, which is used to record electrical energy consumed over a specified of time in terms of units.

Market Potential

Energy meters are required wherever power consumption needs to be measured like houses, factories, shops, offices, etc. The supplier of electricity raised the electricity bill on the basis of the reading shown by the meters. Electricity generation units sell the electricity to the electricity boards from where it is sold to the consumers. The data generated by the energy meter is the basis to raise the bill by power supplier. Because of massive rural and urban electrification plan of the government, there is a good demand for this product. It is available in single phase and three phase as per customer requirement. Though newly developed energy electronic energy meter is available in the market but in view of simple technology involved in manufacture of this product and replacement of spare parts, its present demand and future prospect is reasonably good.

A Case for Electronic Electricity Meter in India

The price of electricity is determined by several factors, including power generation, the necessary upkeep of our system and regulatory actions by the state and federal governments.

With present investment costs on generation alone above $1,000 per kW, investment on metering is small in comparison with total investment, but at lease for domestic consumers large in comparison with collections. Various electronic energy meters, indigenously manufactured, are or could be available in the Indian market.

CHAPTER 2
TYPES OF ENERGY METER

Modern day meters fall into two broad categories: Electromechanical and Electronic meters.

Electromechanical Meter: This was invented by Elihu Thomson in 1888. These kind of electric meters are operated by counting the number of revolutions of an aluminum disc which keeps on rotating at a speed proportional to the power supplied. The number of revolutions is thus proportional to the energy usage. It consumes a small amount of power, typically around two watts. There is a disc made up of a metal which is acted upon by two coils. The one of the two coils is attached in a way that it produces a magnetic flux proportional to the voltage and the other produces a magnetic flux in proportion to the current. The field of the voltage coil is delayed by ninety degrees using a lag coil. The eddy currents are produced in the disc and the effect is such that a force is exerted on the disc in proportion to the product of the instantaneous current and voltage. A permanent magnet exerts an opposing force proportional to the speed of rotation of the disc. The equilibrium between these two opposing forces results in the disc rotating at a speed proportional to the power being used.

Electronic Meter: The types of electric meter in modern times has changed and now we have solid state electric meters which display the power used on an LCD screen whereas there are some latest electrical meters which can be made to read automatically. A part from the amount of electricity used, the solid state electric meter type can also record other parameters of the load and supply such as maximum demand, power factor and reactive power used etc. The technology used in most of the solid state electric meter type is the use of a current transformer to measure the current. The main current-carrying conductors need to pass through the meter itself and so the meter can be located remotely from the main current-carrying conductors, which is a particular advantage in large power installations.

There are three types of meter:-

- Whole Type Meter
- LT CT Meter
- HT CT Meter

CHAPTER 3
WHOLE TYPE METER

It can be further categorized into two type

- Single-Phase Meter
- Three-Phase Meter

Single-Phase Meter:

Specifications:

Voltage reading	240V
Current	5-30Amp
Frequency	50 Hz
Impulse	1600 imp/kwh

Working: Modern electricity meters operate by continuously measuring the instantaneous voltage and current and finding their product to give instantaneous electric power which is then integrated against time to give energy used. With communication options and support software available for single phase meters, these can be easily incorporated into automated meter reading systems.

Salient features of one-phase meter are:

Instantaneous start

Low power consumption less the 1Wt. saving 30% over conventional meters.

Records correct energy with same accuracy under reverse current conditions.

LED indication for current reversal tampering and phase availability.

One need to have Power Company to make any adjustment to the meter otherwise self-tempering constitutes a fraud.

Single-phase meters are generally used for domestic purposes.

Three-Phase Meter: It stands for three-phase four-wire meter. It is generally used for industrial purposes. It has 8 (eight) point, 3 point for main supply (R, Y, B) 3 for load and 2 for neutral and earth.

Rating of meter

Volt rating: 3* (240) V
Frequency: 50 Hz
Current: 10-60 A
Impulse: 16000imp/ kwh

Working: Voltage and current measurement are electricity isolated for each phase, and transformers are used instead of shunts for current sensing. Current transformers are measure the current produced in current-carrying conductors. The electric meter working in case of watt-hour meters is being explained. It uses an aluminum disc acted upon by two coils. One coil is positioned in such a way to produce magnetic flux in proportion to the voltage on the disc, and the other coil produces magnetic flux proportional to current.

CHAPTER 4
CT METER

The meter measures the following parameters:

- Active energy
- Reactive energy (lag/lead)
- Apparent energy
- Fundamental active energy
- R phase I_{rms}
- Frequency
- Y phase I_{rms}
- B phase I_{rms}
- R-N V_{rms}
- Y-N V_{rms}
- B-N V_{rms}

Meter has inbuilt capability to perform self-diagnostic and display error if any for following:

- All display segments on meter display
- Real time clock status
- Non-volatile memory status
- Battery status

The meter continuously monitors and calculates the average demand in KW and KVA during the integration period set and maximum out of these shall be stored. MD is calculated on real time for a configuration period viz. ¼ hr, ½ hr, 1hr. At the end of each fixed integration period, average power for that period is calculated. If this value is greater than the already existing values during the month, then this is stored as MD.

CHAPTER 6
HT CT Meter

Salient feature of the meter are:

- True RMS measurement
- Several parameters displayed in a single meter
- Field programmable PT, CT ration
- Maximum demand control with 3 relays
- Prediction demand control function
- Suitable for all kind of balanced / unbalanced loads
- Low power consumption
- Suitable integration in SCADA application

Specification:

Voltage	P.T. Secondary voltage Rated voltage Range	110 volts Ph-Ph 63.5 volts Ph-N 3*63.5 V +15% to -30% of rated voltage
Current	Secondary current C.T C.T. ratio Rating Range	5,1 A 5/5, 1/1A 5,1 A 0.1% to 200% of base current
Temperature	Standard Temperature coefficient	27 degree Celsius 0.03%
Frequency	Rated Range	50 Hz -5% to +5% of rated frequency
Power factor	Range	Zero lag-unity-zero lead

CHAPTER 7
Testing of Meter

Testing of electricity meters with Interconnected current & voltage circuit

Testing of meters is an increasing need for meter manufacturers and meter operators. The meters that do not allow to open the links between the current and voltage measuring circuits (I-P links) for test or calibration purposes are increasingly in use. Chief reason is the lower manufacturing cost of single-phase meter using resistive shunts for current measurement. Provision of facility to isolate the voltage and current paths of these meters would result in significantly higher manufacturing cost. Another reason for using meters with noon-removable IP links is to prevent their misuse for fraud. Reason for testing meters with closed links might be reduction of additional work needed for manipulation with the links before and after testing i.e., increasing of testing capacity and reduction of cost at high volume testing sites as well.

During meter testing the source is normally used as a phantom load to provide test current flowing into current terminal is supplied independently from the test voltage. This configuration allows simultaneous of any number of meters limited only by mechanical and power capacity of the system. The separation of current and voltage circuit at each meter is achieved by opening the IP link in the terminal block. Disconnection avoids interaction of current and voltage circuits and thus introduction of large unpredictable measurement error.

If the meter under test has closed IP links, then the interconnection between voltage and current circuits should be eliminated beyond the meter. Principle is based on mutual isolation of individual voltage current source feeding each meter instead of isolating the voltage and current circuits of the meter. Generally it is possible to isolate the voltage source or the current source.

Voltage source isolation: In traditional approach, special voltage transformer having separated output voltage windings for each meter is used for isolation. In this case, the test rack must be equipped with multiple voltages using wiring network for individual connection of each meter to respective winding of the common transformer. (The transformer is known generally as a multi-secondary voltage isolation transformer or MSIVT). The number of secondary windings is at least equal to the number of meters under test, plus an additional one for reference meter connection. These transformers are specially manufactured and calibrated for this purpose and the windings are typically matched to within 0.1% as reported by some manufacturers of test systems. The additional error introduced by the transformer is unpredictable as it depends on the load impedance created by the tested meters, as the absolute accuracy of the MSIVT is not guaranteed.

Current source isolation : The required isolation can be achieved by using transformers in the current circuits with one current transformer per phase for each test position. In this way, each meter under test is supplied with isolated currents. These transformer advantageously have a current ratio of 1.1 and over the required current range should have amplitude and phase errors small enough as not to introduce significant additional errors. The classic test systems specify the accuracy degradation from 0.5% to 0.1%. Because of non-linearity in here in slandered transformers, the overall accuracy of the system significantly decreases at lower currents. As the current isolation transformers provide an additional load to the current amplifier, the power of the current source needs to be higher then for the system without current transformer.

Testing Meter Equipment

- Test bench consisting of Ampere meter, Wattmeter, Voltmeter, Frequency meter
- Standard kWh
- Meter variance including software for 1 phase / 3 phase
- Stop watch 0-60 min.
- H.V. crackdown tester 0.3 kV
- Shock tester
- Stray field tester

Testing of Single-Phase Meter

The isolation of each meter is realized either using individual isolated voltage source or individual isolated current source. In both cases, each installed meter must be equipped with individual source.

For testing the meters, all are laid upon the test bench. All meters are connected in series through wire with RSS. The connection of meter is such that the first meter of outgoing point is connected to next meter of incoming phase. At once 12 meters are tested at a time. The first meter is given the supply and the last meter is connected to the load. The initial readings of all meters are noted. Then the reading of meter increases. When reading of RSS reached 5 unit, the load supply is cut off. The difference between the final and initial reading for each meter is noted, when error is below 1, then meter is accurate.

CALCULATION: RSS – 3.03 kwh

S.No.	Meter No.	I / R (kwh)	F / R (kwh)	Difference	Error (%)
1	763932	3.8	6.8	3	-0.99

2	765042	3.9	6.9	3	-0.99
3	764095	3.7	6.7	3	-0.99
4	764093	3.7	6.7	3	-0.99
5	766780	3.7	6.7	3	-0.99
6	768151	3.7	6.6	3	-0.99
7	768146	3.7	6.7	3	-0.99
8	764125	3.6	6.6	3	-0.99
9	768156	4	7	3	-0.99
10	765014	3.9	6.9	3	-0.99
11	766789	0.5	3.5	3	-0.99
12	763937	3.8	6.8	3	-0.99

Testing of 3-Phase Meter

Multi-phase maters for direct connection are also manufactures with closed IP links. Due to the common neutral connection of three voltage circuits, it is not possible to simply utilize voltage transformers with separated secondary windings for isolation of individual meters.

There are three separated voltage sources U1,U2,U3 for each meter A and B via common neutral the three independent sources of each meter are interconnected via closed links, common neutral and current wires I1,I2,I3. This is the reason interaction between the voltage and current circuits due to non-equality voltage drops on the current wires due to impedance of the wires and contact resistance. The interconnection cause undefined balance currents destroying the measurement accuracy. The required isolation of three-phase meters with closed links can be achieved only using isolation current transformers in the current circuits fitted with separate current transformer for each test position.

Connection of Meter

1L - 1S

2L – 2S

3L – 3S

0L – 0S

In this meter three supply R,Y,B, are taken and potential, neutral are given to test bench. In this all meter connected in series. Then initial reading of all meter & RSS reading is noted, after note initial reading load is given, after a few minutes final reading are noted, when the difference of final and initial reading are same, meters are correct.

Calculation RSS: 9.050315

S.No.	Meter No.	I / R (kwh)	F / R (kwh)	Diff.	Error (%)
1	43770	0.2	9.3	9.1	0.50
2	43806	5.2	14.2	9	-0.50

3	43244	0.2	9.2	9	-0.55
4	43873	0.2	9.2	9	-0.55
5	43872	0.2	9.2	9	-0.55
6	43712	0.2	9.2	9	-0.55
7	43764	0.1	0.1	0 -	100

Testing of HT Meter

HT Meter is high tension meter which is used for measuring the high power consumption where the supply is 11kv or more.

Connection

Connection is made as per the circuit diagram. It has no such kind of similarity as the connection diagram of single phase or three phase series connection. In this type a single HT meter is tested isolated.

Testing

A 230 V supply is given to load due to lack of 11 Kv supply source. The supply is three phase reading is taken by computer. After getting final reading we get that meter is correct or not.

Testing of LT CT Meter

LTCT energy meter is low tension current transformer meter. It is used for measuring the power, where power consumption is more. It is generally used in Apartment, where power consumption is more.

Connection

Connection is made as per the circuit diagram. Three phase supply is given to load, after some time we get the final reading of meter. And from the final reading of meter we get % error. Which is useful for checking of meter.

Testing

A three phase supply is given to the meter and sensor is put on the impulse led. With the help of blinking of LED supply voltage, current and power factor sensor send the data to the COMPUTER, which further calculate the % error and give the result whether the meter is good or not.

CHAPTER 8
CONTROL PANEL

Electrical control panels are used in meter testing lab for testing the meter. They control the Current, Voltage, Power factor, Frequency.

Single-Phase reference standard

The Radian RD-20 single-phase electricity reference standard is one of the most versatile reference instruments. It has a typical accuracy of 0.01% for all measurement function across its entire operating range, with a maximum worst case accuracy of 0.04%. This worst case accuracy specification includes the variables of stability, power factor, traceability and test system errors. The RD-20 utilizes Radian's new diatonic measurement technology consisting of a Radian designed integrating analog to digital signal converter. Unlike off-the-shelf A/D Convertor used in other instrument, Radian's A/D Convertors is specifically designed for power and energy requirements.

Measurements: The RD-20 is a four quadrant single-phase, simultaneous measuring instrument that registers both forward and reverse energy flow and provides voltage, current, power, energy information. The Harmonic analysis option makes available the analysis of customer load through the 50^{th} harmonic order while the built – in-comparator option provides for automatic calculation of test results of the meters.

CHAPTER 9

Transformer

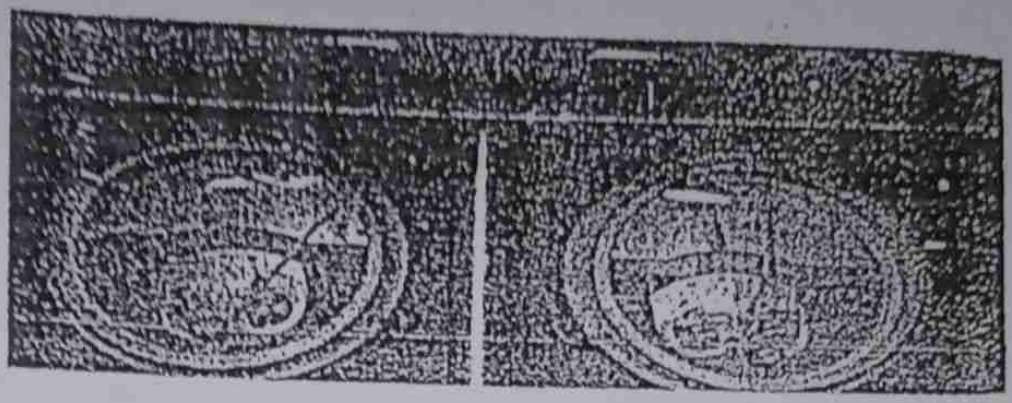
A transformer is a static electrical device that transfers energy by inductive coupling between its winding circuits. A varying current in the *primary* winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic flux through the *secondary* winding. This varying magnetic flux induces a varying electromotive force (emf) or voltage in the secondary winding.

Transformers range in size from thumbnail-sized used in microphones to units weighing hundreds of tons interconnecting the power grid. A wide range of transformer designs are used in electronic and electric power applications. Transformers are essential for the transmission, distribution Basic transformer parameters and construction.

Various Parts of Transformer :

The main parts of the transformer are as under :

- Oil tank
  This part of the transformer contains the assembly of the core and the winding which is immersed in insulation oil.
- Radiator
  This part is basically used for the cooling of the transformer by the means of natural air.
- Conservator
  It is used to provide adequate space for the expansion of oil when the transformer is loaded or when ambient temperature changes.
- Silica Gel Breather
  It sucks the moisture from from the air which is taken by the transformer,so that dry air is taken by the transformer.
- Air Breather
  This is used for the extraction of moisture from the transformer.
- Temperature Meter
  These are use dfor taking the readings of O.T.I-oil temperature indicator and W.T.I-winding temperature indicator



Drain Valve

This is use dfor the exaust of the insulation oil during the mainainence of the transformers.

- Tap-changer:
This is used for the tapping of the transformer at different level.These are of two types namely on load tap changers and off load t: p changers.

- Pressure Release Valve(P.R.V)

This is used for the tripping of transformers for safety purpose.

- Bucloz Relay
It is a very sensitive gas and oil operated instrument which safely detects the formation of gas or sudden pressure inside the oil of the transformer.
- Primary and Secondary windings
These are the two coils of the transformer and the number of turns depends upon the rating of thetransformer.

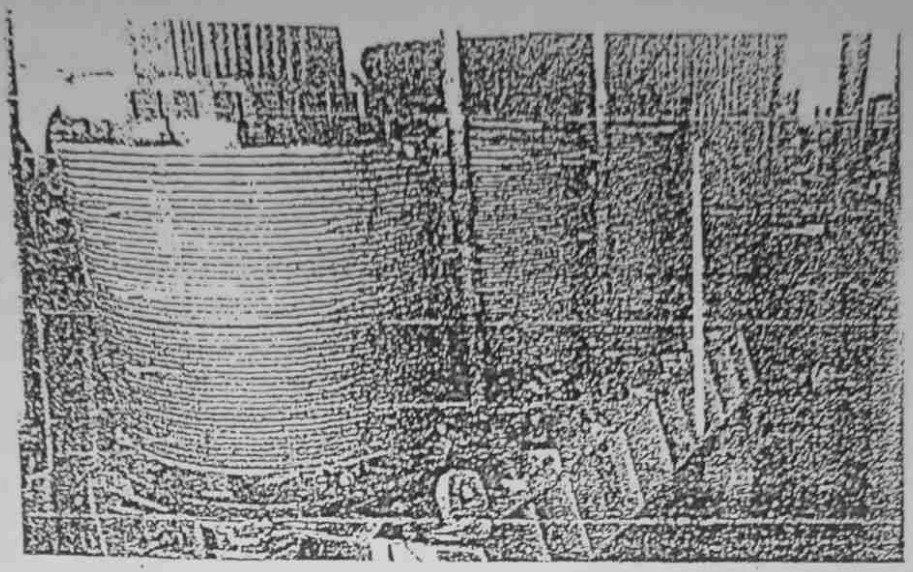


Fig: Primary and secondary winding in a transformer

Effect of frequency

Transformer universal emf equation

If the flux in the core is purely sinusoidal, the relationship for either winding between its rms voltage E_{rms} of the winding, and the supply frequency f, number of turns N, core cross-sectional area a in m^2 and peak magnetic flux density B_{peak} in Wb/m^2 or T (tesla) is given by the universal emf equation:

$$E_{\mathrm{rms}} = \frac{2\pi f N a B_{\mathrm{peak}}}{\sqrt{2}} = 4.44 f N a B_{peak}$$

If the flux does not contain even harmonics the following equation can be used for half-cycle average voltage E_{avg} of any wave shape:

$$E_{\mathrm{avg}} = 4 f N a B_{\mathrm{peak}}$$

The time-derivative term in Faraday's Law shows that the flux in the core is the integral with respect to time of the applied voltage. Hypothetically an ideal transformer would work with direct-current excitation, with the core flux increasing linearly with time. In practice, the flux rises to the point where magnetic saturation of the core occurs, causing a large increase in the

magnetizing current and overheating the transformer. All practical transformers must therefore operate with alternating (or pulsed direct) current.

The emf of a transformer at a given flux density increases with frequency. By operating at higher frequencies, transformers can be physically more compact because a given core is able to transfer more power without reaching saturation and fewer turns are needed to achieve the same impedance. However, properties such as core loss and conductor skin effect also increase with frequency. Aircraft and military equipment employ 400 Hz power supplies which reduce core and winding weight. Conversely, frequencies used for some railway electrification systems were much lower than normal utility frequencies (50 – 60 Hz) for historical reasons concerned mainly with the limitations of early electric traction motors. As such, the transformers used to step-down the high over-head line voltages were much heavier for the same power rating than those designed only for the higher frequencies.

Power transformer over-excitation condition caused by decreased frequency; flux (green), iron core's magnetic characteristics (red) and magnetizing current (blue).

Operation of a transformer at its designed voltage but at a higher frequency than intended will lead to reduced magnetizing current. At a lower frequency, the magnetizing current will increase. Operation of a transformer at other than its design frequency may require assessment of voltages, losses, and cooling to establish if safe operation is practical. For example, transformers may need to be equipped with 'volts per hertz' over-excitation relays to protect the transformer from overvoltage at higher than rated frequency.

One example of state-of-the-art design is traction transformers used for electric multiple unit and high speed train service operating across the, country border and using different electrical standards, such transformers' being restricted to be positioned below the passenger compartment. The power supply to, and converter equipment being supply by, such traction transformers have to accommodate different input frequencies and voltage (ranging from as high as 50 Hz down to 16.7 Hz and rated up to 25 kV) while being suitable for multiple AC asynchronous motor and DC converters & motors with varying harmonics mitigation filtering requirements.

Large power transformers are vulnerable to insulation failure due to transient voltages with high-frequency components, such as caused in switching or by lightning.

Energy losses

An ideal transformer would have no energy losses, and would be 100% efficient. In practical transformers, energy is dissipated in the windings, core, and surrounding structures. Larger transformers are generally more efficient, and those rated for electricity distribution usually perform better than 98%.

Experimental transformers using superconducting windings achieve efficiencies of 99.85%. The increase in efficiency can save considerable energy, and hence money, in a large heavily loaded transformer; the trade-off is in the additional initial and running cost of the superconducting design.

As transformer losses vary with load, it is often useful to express these losses in terms of no-load loss, full-load loss, half-load loss, and so on. Hysteresis and eddy current losses are constant at all loads and dominate overwhelmingly at no-load, variable winding joule losses dominating increasingly as load increases. The no-load loss can be significant, so that even an idle transformer constitutes a drain on the electrical supply and a running cost. Designing transformers for lower loss requires a larger core, good-quality silicon steel, or even amorphous steel for the core and thicker wire, increasing initial cost so that there is a trade-off between initial cost and running cost (also see energy efficient transformer).

Transformer losses arise from:

Winding joule losses

Current flowing through winding conductors causes joule heating. As frequency increases, skin effect and proximity effect causes winding resistance and, hence, losses to increase.

Hysteresis losses

Each time the magnetic field is reversed, a small amount of energy is lost due to hysteresis within the core. According to Steinmetz's formula, the heat energy due to hysteresis is given

Core losses

by

$W_h \approx \eta B_{max}^{1.6}$ and,

hysteresis loss is thus given by

$P_h \approx W_h f \approx \eta f B_{max}^{1.6}$ where, f is the frequency,

η is the hysteresis coefficient and β_{max} is the maximum flux density, the empirical exponent of which varies from about 1.4 to 1.8 but is often given as 1.6 for iron.

Eddy current losses

Ferromagnetic materials are also good conductors and a core made from such a material also constitutes a single short-circuited turn throughout its entire length. Eddy currents therefore circulate within the core in a plane normal to the flux and are responsible for resistive heating of the core material. The eddy current loss is a complex function of the square of supply frequency and inverse square of the material thickness. Eddy current losses can be reduced by making the core of a stack of plates electrically insulated from each other, rather than a solid block; all transformers operating at low frequencies use laminated or similar cores.

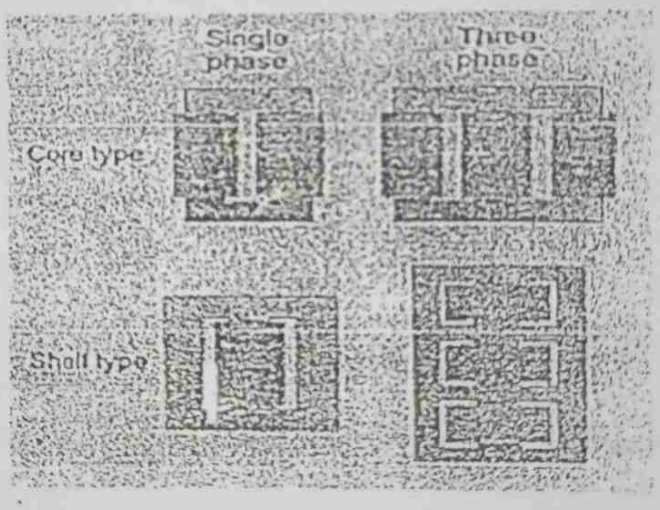
Magnetostriction related transformer hum

Magnetic flux in a ferromagnetic material, such as the core, causes it to physically expand and contract slightly with each cycle of the magnetic field, an effect known as magnetostriction, the frictional energy of which produces an audible noise known as mains hum or transformer hum. This transformer hum is especially objectionable in transformers supplied at power frequencies and in high-frequency fly back transformers associated with PAL system CRTs.

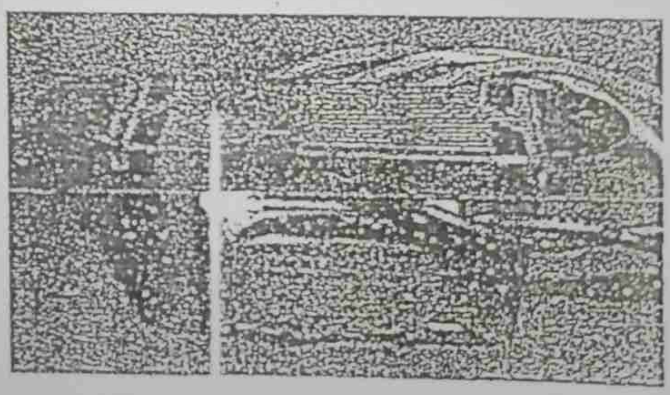
Stray losses

Leakage inductance is by itself largely lossless, since energy supplied to its magnetic fields is returned to the supply with the next half-cycle. However, any leakage flux that intercepts nearby conductive materials

Core form and shell form transformers



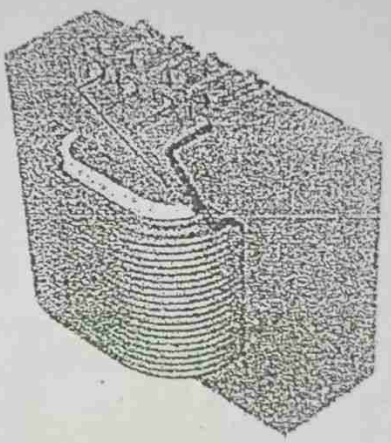
Laminated steel cores



Transformers for use at power or audio frequencies typically have cores made of high permeability silicon steel. The steel has a permeability many times that of free space and the core thus serves to greatly reduce the magnetizing current and confine the flux to a path which closely couples the windings. Early transformer developers soon realized that cores constructed from solid iron resulted in prohibitive eddy current losses, and their designs mitigated this effect with cores consisting of bundles of insulated iron wires. Later designs constructed the core by stacking layers of thin steel laminations, a principle that has remained in use. Each lamination is insulated from its neighbours by a thin non-conducting layer of insulation. The universal transformer equation indicates a minimum cross-sectional area for the core to avoid saturation.

The effect of laminations is to confine eddy currents to highly elliptical paths that enclose little flux, and so reduce their magnitude. Thinner laminations reduce losses, but are more laborious and expensive to construct. Thin laminations are generally used on high-frequency transformers, with some of very thin steel laminations able to operate up to 10 kHz

Windings



Windings are usually arranged concentrically to minimize flux leakage. The conducting material used for the wind ings depends upon the application, but in all cases the individual turns must be electrically insulated from each other to ensure that the current travels throughout every turn.[52] For small power and signal transformers, in which currents are low and the potential difference between adjacent turns is small, the coils are often wound from enamelled magnet wire, such as Formvar wire. Larger power transformers operating at high voltages may be wound with copper rectangular strip conductors insulated

by oil-impregnated paper and blocks of pressboard.

every 7°C to 10°C increase in operating temperature, this life expectancy halving rule holding more narrowly when the increase is between about 7°C to 8°C in the case of transformer winding cellulose insulation.

Small dry-type and liquid-immersed transformers are often self-cooled by natural convection and radiation heat dissipation. As power ratings increase, transformers are often cooled by forced-air cooling, forced-oil cooling, water cooling, or combinations of these. Large transformers are filled with transformer oil that both cools and insulates the windings. Transformer oil is a highly refined mineral oil that cools the windings and insulation by circulating within the transformer tank. The mineral oil and paper insulation system has been extensively studied and used for more than 100 years. It is estimated that 50% of power transformers will survive 50 years of use, that the average age of failure of power transformers is about 10 to 15 years, and that about 30% of power transformer failures are due to insulation and overloading failures. Prolonged operation at elevated temperature degrades insulating properties of winding insulation and dielectric coolant, which not only shortens transformer life but can ultimately lead to catastrophic transformer failure. With a great body of empirical study as a guide, transformer oil testing including dissolved gas analysis provides valuable maintenance information. This can translate in a need to monitor, model, forecast and manage oil and winding conductor insulation temperature conditions under varying, possibly difficult, power loading conditions.

Building regulations in many jurisdictions require indoor liquid-filled transformers to either use dielectric fluids that are less flammable than oil, or be installed in fire-resistant rooms. Air-cooled dry transformers can be more economical where they eliminate the cost of a fire-resistant transformer room

Insulation drying

Construction of oil-filled transformers requires that the insulation covering the windings be thoroughly dried of residual moisture before the oil is introduced. Drying is carried out at the factory, and may also be required as a field service. Drying may be done by circulating hot air around the core or by vapour-phase drying (VPD) where an evaporated solvent transfers heat by condensation on the coil and core.

For small transformers, resistance heating by injection of current into the windings is used. The heating can be controlled very well, and it is energy efficient. The method is called low-frequency heating (LFH) since the current is injected at a much lower frequency than the nominal of the power grid, which is normally 50 or 60 Hz. A lower frequency reduces the effect of the inductance in the transformer; so the voltage needed to induce the current can be reduced. The LFH drying method is also used for service of older transformers.

Bushings

Larger transformers are provided with high-voltage insulated bushings made of polymers or porcelain. A large bushing can be a complex structure since it must provide careful control of the electric field gradient without letting the transformer leak oil An auto transformer has a single

winding with two end terminals, and one or more terminals at intermediate tap points. The primary voltage is applied across two of the terminals, and the secondary voltage taken from two terminals, almost always having one terminal in common with the primary voltage. The primary and secondary circuits therefore have a number of windings turns in common. Since the volts-per-turn is the same in both windings, each develops a voltage in proportion to its number of turns. In an autotransformer part of the current flows directly from the input to the output, and only part is transferred inductively, allowing a smaller, lighter, cheaper core to be used as well as requiring only a single winding however, a transformer with separate windings isolates the primary from the secondary, which is safer when using mains voltages.

Auto transformers are often used to step up or down between voltages in the 110-117-120 volt range and voltages in the 220-230-240 volt range, e.g., to output either 110 or 120V (with taps) from 230V input, allowing equipment from a 100 or 120V region to be used in a 230V region.

Auto transformers are very simply one tapped winding, they offer no isolation between the primary and secondary windings ,therefore do not have the isolation properties of a Double wound transformer with safety isolating screen. Auto transformers are however popular in many sectors machine builders with additional protection within the circuit favour the auto transformer due to its size and cost advantages.

By effectively reducing the equivalent frame size you ultimately reduce the cost of the transformer, to calculate the equivalent frame size (VA) of an auto transformer our engineers have provided the following equation.

$$Equivalent\ frame\ size = \frac{\text{Highest voltage} - \text{Lowest voltage}}{\text{Highest voltage}} \text{ x VA}$$

Application

Transformers are used to increase voltage before transmitting electrical energy over long distances through wires. Wires have resistance which loses energy through joule heating at a rate corresponding to square of the current. By transforming power to a higher voltage transformers enable economical transmission of power and distribution. Consequently, transformers have shaped the electricity supply industry, permitting generation to be located remotely from points of demand. All but a tiny fraction of the world's electrical power has passed through a series of transformers by the time it reaches the consumer.

Transformers are also used extensively in electronic products to step-down the supply voltage to a level suitable for the low voltage circuits they contain. The transformer also electrically isolates the end user from contact with the supply voltage.

Signal and audio transformers are used to couple stages of amplifiers and to match devices such as microphones and record players to the input of amplifiers. Audio transformers allowed

CHAPTER 10

Megger- Getting down to earth

Nothing is quite so common or abundantly available throughout the world as the earth's soil. We are more apt to think of earth as something to be tilled for planting or to be excavated for a building foundation. Yet, it also has an electrical property -- conductivity (or low resistance) -- that is put to practical use every day in industrial plants and utilities. Broadly speaking, "earth resistance" is the resistance of soil to the passage of electric current. Actually, the earth is a relatively poor conductor of electricity compared to normal conductors like copper wire. But, if the area of a path for current is large enough, resistance can be quite low and the earth can be a good conductor. It is the earth's abundance and availability that make it an indispensible component of a properly functioning electrical system.

Earth resistance is measured in two ways for two important fields of use:

1. Determining effectiveness of "ground" grids and connections that are used with electrical systems to protect personnel and equipment.

2. Prospecting for good (low resistance) "ground" locations, or obtaining measured resistance values that can give specific information about what lies some distance below the earth's surface (such as depth to bed rock).

Measurements of earth resistivity are useful also for finding the best location and depth for low resistance electrodes. Such studies are made, for example, when a new electrical unit is being constructed; a generating station, substation, transmission tower, or telephone central office.

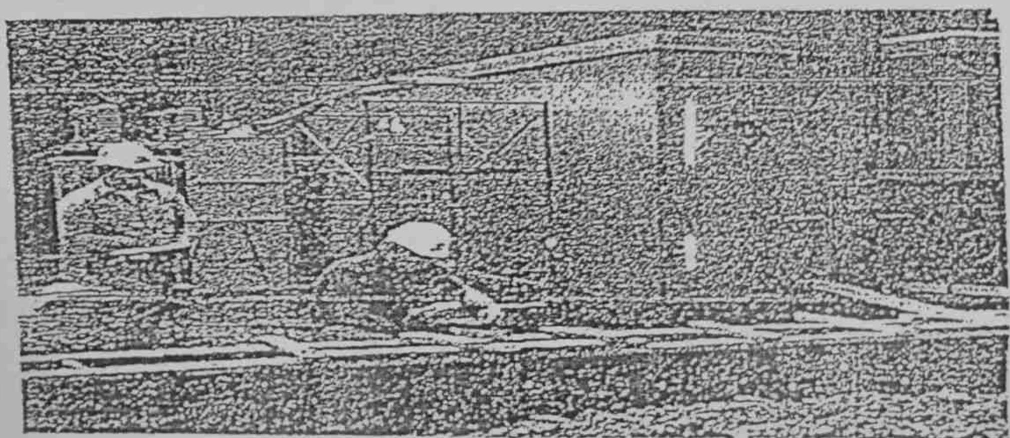
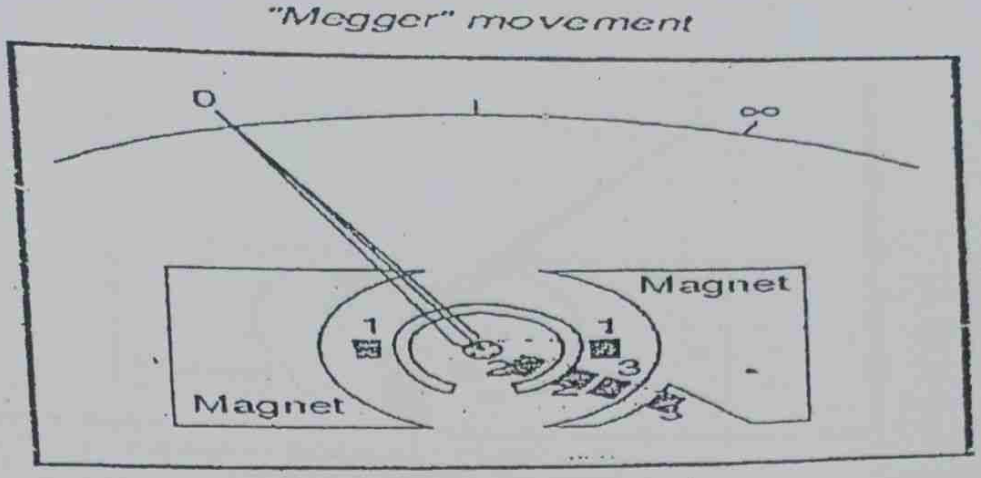
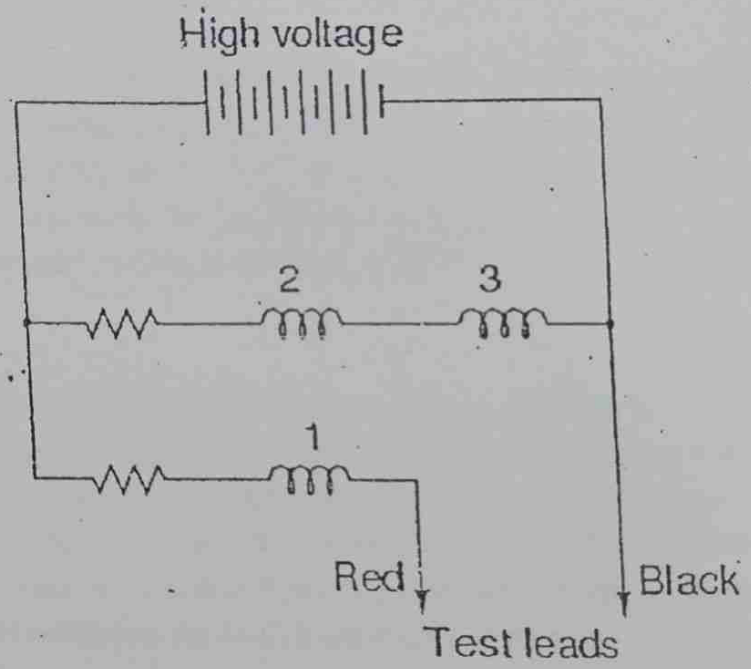


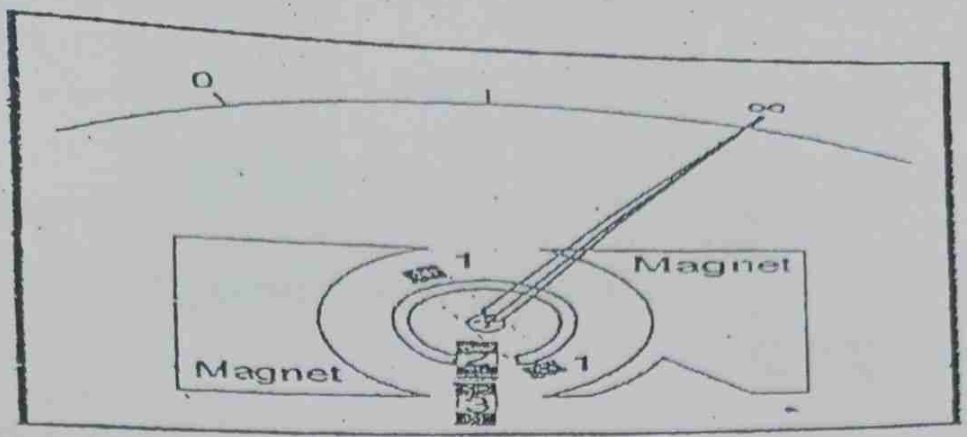
FIG: Checking the earth resistance of a ground system at a substation using a megger ground tester



The numbered, rectangular blocks in the above illustration are cross-sectional representations of wire coils. These three coils all move with the needle mechanism. There is no spring mechanism to return the needle to a set position. When the movement is unpowered, the needle will randomly "float." The coils are electrically connected like this:



With infinite resistance between the test leads (open circuit), there will be no current through coil 1, only through coils 2 and 3. When energized, these coils try to center themselves in the gap between the two magnet poles, driving the needle fully to the right of the scale where it points to "infinity."



Current through coils 2 and 3;
no current through coil 1

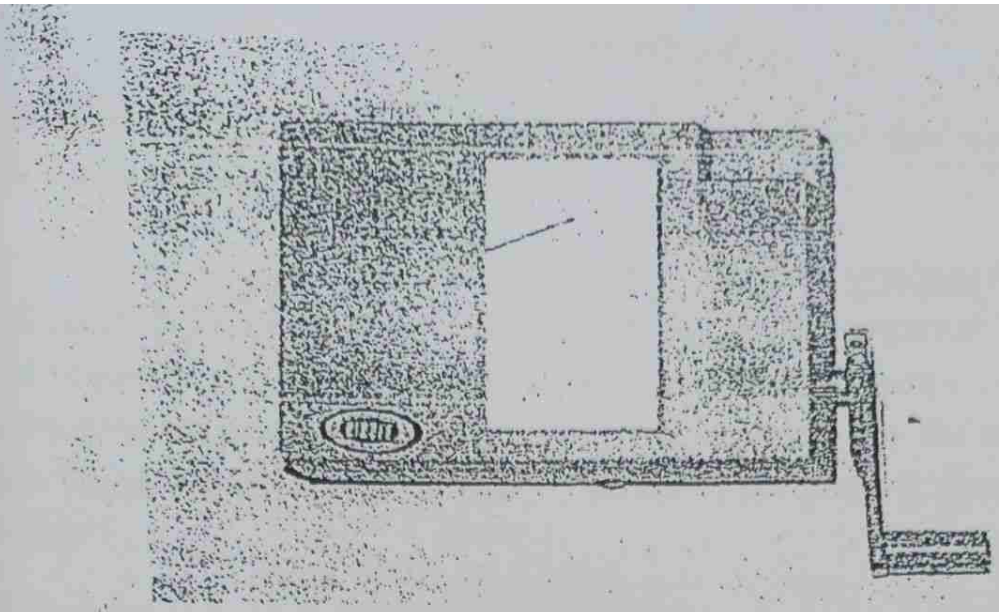
Any current through coil 1 (through a measured resistance connected between the test leads) tends to drive the needle to the left of scale, back to zero. The internal resistor values of the meter movement are calibrated so that when the test leads are shorted together, the needle deflects exactly to the 0 Ω position.

Because any variations in battery voltage will affect the torque generated by *both* sets of coils (coils 2 and 3, which drive the needle to the right, and coil 1, which drives the needle to the left), those variations will have no effect of the calibration of the movement. In other words, the accuracy of this ohmmeter movement is unaffected by battery voltage: a given amount of measured resistance will produce a certain needle deflection, no matter how much or little battery voltage is present.

The only effect that a variation in voltage will have on meter indication is the degree to which the measured resistance changes with applied voltage. So, if we were to use a megger to measure the resistance of a gas-discharge lamp, it would read very high resistance (needle to the far right of the scale) for low voltages and low resistance (needle moves to the left of the scale) for high voltages. This is precisely what we expect from a good high-voltage ohmmeter: to provide accurate indication of subject resistance under different circumstances.

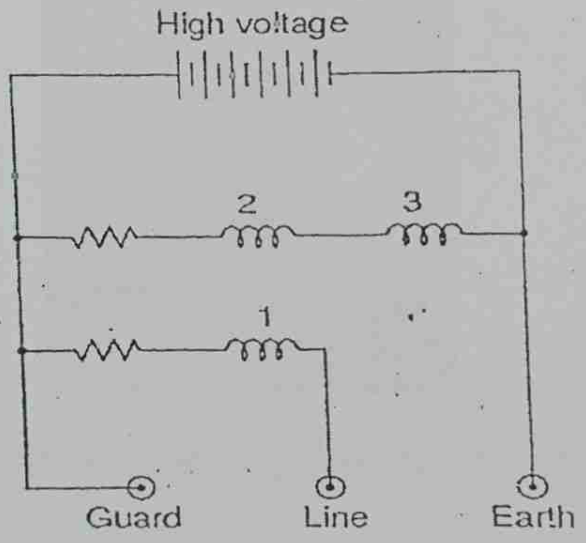
For maximum safety, most meggers are equipped with hand-crank generators for producing the high DC voltage (up to 1000 volts). If the operator of the meter receives a shock from the high voltage, the condition will be self-correcting, as he or she will naturally stop cranking the generator! Sometimes a "slip clutch" is used to stabilize generator speed under different cranking conditions, so as to provide a fairly stable voltage whether it is cranked fast or slow. Multiple voltage output levels from the generator are available by the setting of a selector switch.

A simple hand-crank megger is shown in this photograph:



Hand-crank megger

Real meggers are equipped with three connection terminals, labeled *Line*, *Earth*, and *Guard*. The schematic is quite similar to the simplified version shown earlier:



Resistance is measured between the Line and Earth terminals, where current will travel through coil 1. The "Guard" terminal is provided for special testing situations where one resistance must be isolated from another. Take for instance this scenario where the insulation resistance is to be tested in a two-wire cable:

Partial electrical breakdown of the air causes the "fresh air" smell of ozone during thunderstorms or around high-voltage equipment. Although air is normally an excellent insulator, when stressed by a sufficiently high voltage (an electric field strength of about 3×10^6 V/m), air can begin to break down, becoming partially conductive. If the voltage is sufficiently high, complete electrical breakdown of the air will culminate in an electrostatic discharge or Electric arc that bridges the entire gap. While the small sparks generated by static electricity may barely be audible, larger sparks are often accompanied by a loud snap or bang. Lightning is an example of an immense spark that can be many miles long. The colour of the spark depends upon the gases that make up the gaseous media.

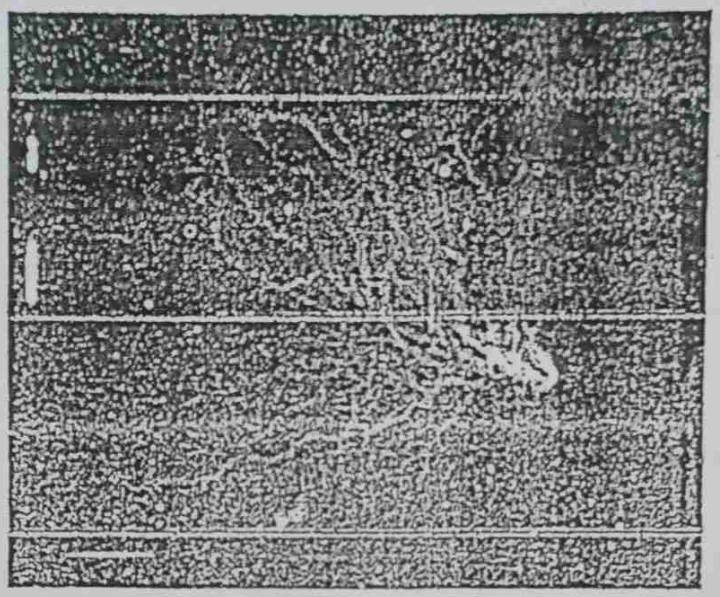


FIG: **Electric discharge showing the lightning-like plasma filaments from a Tesla coil.**

If a fuse or circuit breaker fails to interrupt the current through a spark in a power circuit, current may continue, forming a very hotelectric arc. The colour of an arc depends primarily upon the conductor materials (as they are vaporized and mix within the hot plasma in the arc). The free ions in and around the arc recombine to create new chemical compounds (ozone, carbon monoxide, nitrous oxideand other compounds). Ozone is most easily noticed due to its distinct odour.[2] Although sparks and arcs are usually undesirable, they can be useful in everyday applications such as spark plugs for gasoline engines, electrical welding of metals, or for metal melting in an electric arc furnace.

Voltage-current relation

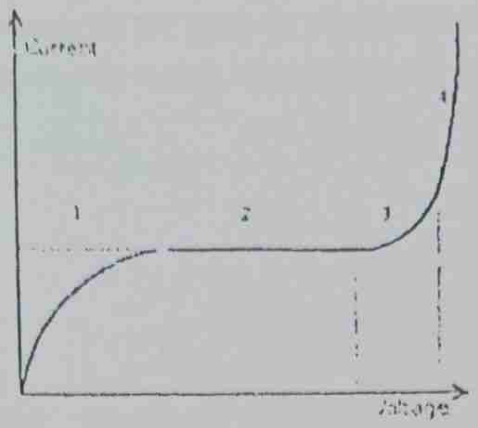


FIG: Voltage-current relation before breakdown

Before gas breakdown, there is a non-linear relation between voltage and current as shown in the figure. In region 1, there are free ions that can be accelerated by the field and induce a current. These will be saturated after a certain voltage and give a constant current, region 2. Region 3 and 4 are caused by ion avalanche as explained by the Townsend discharge mechanism

Corona breakdown

Partial breakdown of the air occurs as a corona discharge on high voltage conductors at points with the highest electrical stress. As thedielectric strength of the material surrounding the conductor determines the maximum strength of the electric field the surrounding material can tolerate before becoming conductive, conductors that consist of sharp points, or balls with small radii, are more prone to causing dielectric breakdown. Corona is sometimes seen as a bluish glow around high voltage wires and heard as a sizzling sound along high voltage power lines. Corona also generates radio frequency noise that can also be heard as "static" or buzzing on radio receivers. Corona can also occur naturally at high points (such as church spires, treetops, or ship masts) during thunderstorms as St. Elmo's Fire. Although corona discharge is usually undesirable, until recently it was essential in the operation of photocopiers (xerography) and laser printers. Many modern copiers and laser printers now charge the photoconductor drum with an electrically conductive roller, reducing undesirable indoor ozone pollution. Additionally,lightning rods use corona discharge to create conductive paths in the air that point towards the rod, deflecting potentially-damaging lightning away from buildings and other structures.

Corona discharge ozone generators have been used for more than 30 years in the water purification process. Ozone is a toxic gas, even more potent than chlorine. In a typical drinking water treatment plant, the ozone gas is dissolved into the filtered water to kill bacteria and viruses. Ozone also removes the bad odours and taste from the water. The main advantage of ozone is that the overdose (residual) decomposes to gaseous oxygen well before the water reaches the consumer. This is in contrast with chlorine which stays in the water and can be tasted by the consumer.

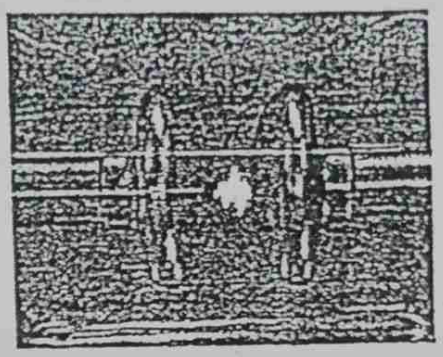
Corona discharges are also used to modify the surface properties of many polymers. An example is the corona treatment of plastic materials which allows paint or ink to adhere properly.

MATERIAL	DIELECTRIC STRENGTH(Kv/inch)
Vacuum	20
Air	20-75
Porcelain	40-200
Parrafin wax	200-300
Transformer oil	400
Bakelite	300-550
Rubber	450-700
Shellac	900
Paper	1250
Teflon	1500
Glass	2000-3000
Mica	5000

CHAPTER12
Oil testing of Transformer

The insulation oil of voltage- and current-transformers fulfill the purpose of insulating as well as cooling. Thus, the dielectric quality of transformer oil is a matter of secure operation of a transformer.

As transformer oil deteriorates through ageing and moisture ingress, transformer oil should, depending on economics, transformer duty and other factor, be tested periodically.



Voltage breakdown during oil test

Transformer oil testing sequences and procedures are defined by various international standards.

Power utility companies have a vested interest in periodic oil testing since transformers represent a large proportion of their total assets.

Through such testing, transformers' life can be substantially increased, thus delaying new investment of replacement transformer assets.

Transformer oil testing procedure

To assess the insulating property of dielectric transformer oil, a sample of the transformer oil is taken and its breakdown voltage is measured.

- The transformer oil is filled in the vessel of the testing device. Two standard-compliant test electrodes with a typical clearance of 2.5 mm are surrounded by the dielectric oil.
- A test voltage is applied to the electrodes and is continuously increased up to the breakdown voltage with a constant, standard-compliant slew rate.
- At a certain voltage level breakdown occures in an electric arc, leading to a collapse of the test voltage.
- An instant after ignition of the arc, the test voltage is switched off automatically by the testing device. Ultra fast switch off is highly desirable, as the carbonisation due to the electric arc must be limited to keep the additional poilution as low as possible.

- The transformer oil testing device measures and reports the root mean square value of the breakdown voltage.
- After the transformer oil test is completed, the insulation oil is stirred automatically and the test sequence is performed repeatedly.
- As a result the breakdown voltage is calculated as mean value of the individual measurements.

Conclusion: The lower the resulting breakdown voltage, the poorer the quality of the transformer oil!

The break down characteristics depends upon initial moisture content of transformer & oil. The electrical strength of oil depends upon the water content in transformer & temperature gradient. The electrical strength of oil is reduced if the water content is more than 2%.

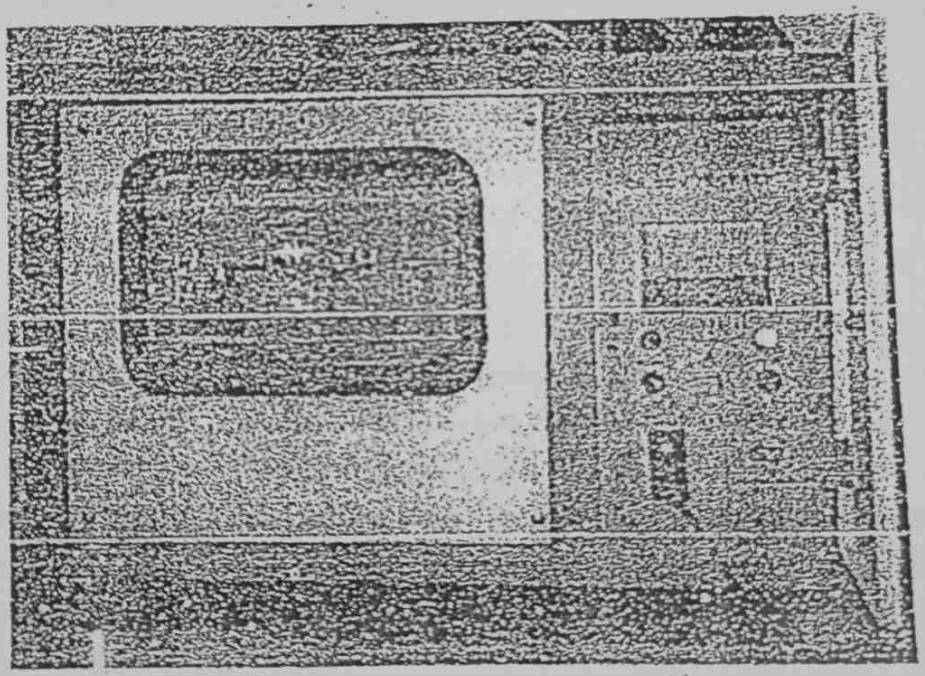
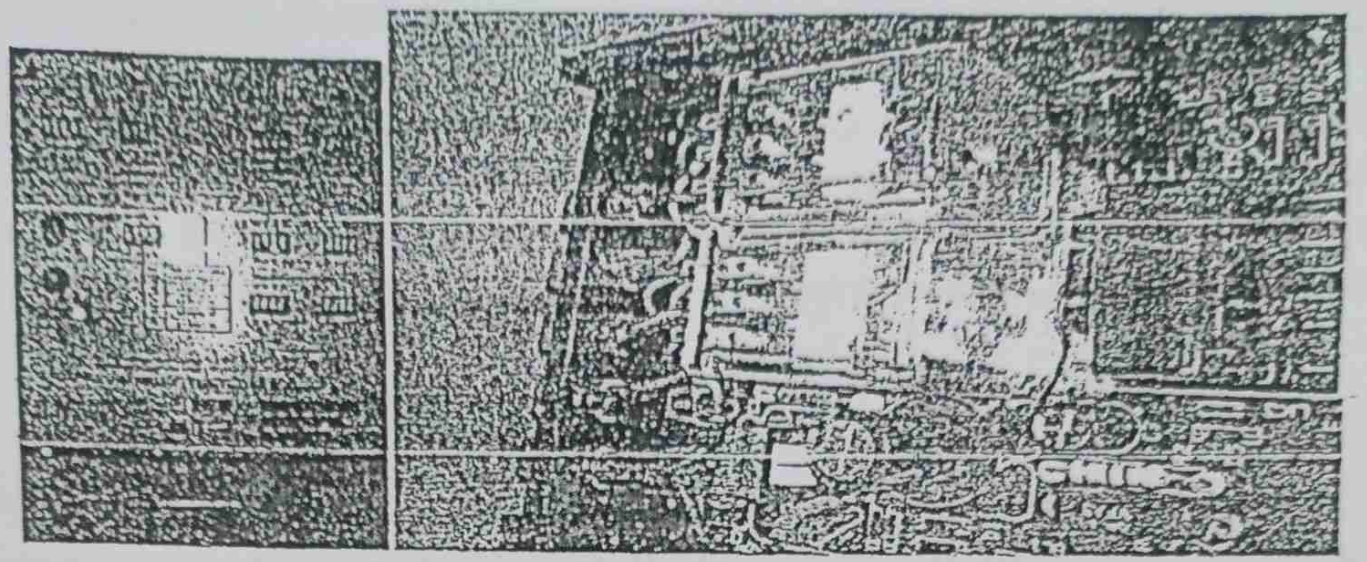


FIG: Oil insulation tester

CHAPTER13
Relay and its Component



A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

CHAPTER 14
Circuit Breaker

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and interrupt current flow. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation. Circuit breakers are made in varying sizes, from small devices that protect an individual household appliance up to large switchgear designed to protect high-voltage circuits feeding an entire city.

Operation

All circuit breakers have common features in their operation, although details vary substantially depending on the voltage class, current rating and type of the circuit breaker.

The circuit breaker must detect a fault condition; in low-voltage circuit breakers this is usually done within the breaker enclosure. Circuit breakers for large currents or high voltages are usually arranged with pilot devices to sense a fault current and to operate the trip opening mechanism. The trip solenoid that releases the latch is usually energized by a separate battery, although some high-voltage circuit breakers are self-contained with current transformers, protection relays, and an internal control power source.

Once a fault is detected, contacts within the circuit breaker must open to interrupt the circuit; some mechanically-stored energy (using something such as springs or compressed air) contained within the breaker is used to separate the contacts, although some of the energy required may be obtained from the fault current itself. Small circuit breakers may be manually operated, larger units have solenoids to trip the mechanism, and electric motors to restore energy to the springs.

The circuit breaker contacts must carry the load current without excessive heating, and must also withstand the heat of the arc produced when interrupting (opening) the circuit. Contacts are made of copper or copper alloys, silver alloys, and other highly conductive materials. Service life of the contacts is limited by the erosion of contact material due to arcing while interrupting the current. Miniature and molded case circuit breakers are usually discarded when the contacts have worn, but power circuit breakers and high-voltage circuit breakers have replaceable contacts.

When a current is interrupted, an arc is generated. This arc must be contained, cooled, and extinguished in a controlled way, so that the gap between the contacts can again withstand the voltage in the circuit. Different circuit breakers use vacuum, air, insulating gas, or oil as the medium the arc forms in. Different techniques are used to extinguish the arc including:

- Lengthening / deflection of the arc
- Intensive cooling (in jet chambers)

- Division into partial arcs
- Zero point quenching (Contacts open at the zero current time crossing of the AC waveform, effectively breaking no load current at the time of opening. The zero crossing occurs at twice the line frequency i.e. 100 times per second for 50 Hz and 120 times per second for 60 Hz AC)
- Connecting capacitors in parallel with contacts in DC circuits.

Finally, once the fault condition has been cleared, the contacts must again be closed to restore power to the interrupted circuit.

High-Voltage Circuit Breaker

Electrical power transmission networks are protected and controlled by high-voltage breakers. The definition of *high voltage* varies but in power transmission work is usually thought to be 72.5 kV or higher, according to a recent definition by the International Electrotechnical Commission (IEC). High-voltage breakers are nearly always solenoid-operated, with current sensing protective relays operated through current transformers. In substations the protective relay scheme can be complex, protecting equipment and buses from various types of overload or ground/earth fault.

High-voltage breakers are broadly classified by the medium used to extinguish the arc.

- Bulk oil
- Minimum oil
- Air blast
- Vacuum
- SF_6
- CO_2

Due to environmental and cost concerns over insulating oil spills, most new breakers use SF_6 gas to quench the arc.

Circuit breakers can be classified as *live tank*, where the enclosure that contains the breaking mechanism is at line potential, or *dead tank* with the enclosure at earth potential. High-voltage AC circuit breakers are routinely available with ratings up to 765 kV. 1200kV breakers were launched by Siemens in November 2011, followed by ABB in April the following year.

High-voltage circuit breakers used on transmission systems may be arranged to allow a single pole of a three-phase line to trip, instead of tripping all three poles; for some classes of faults this improves the system stability and availability.

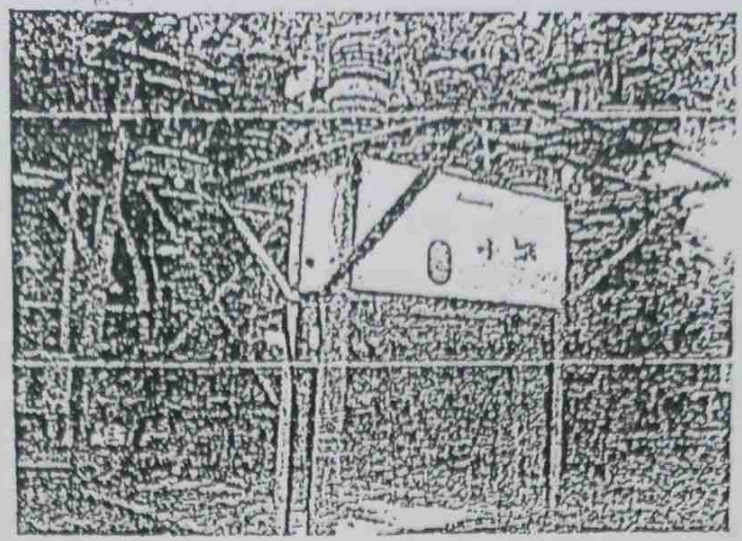
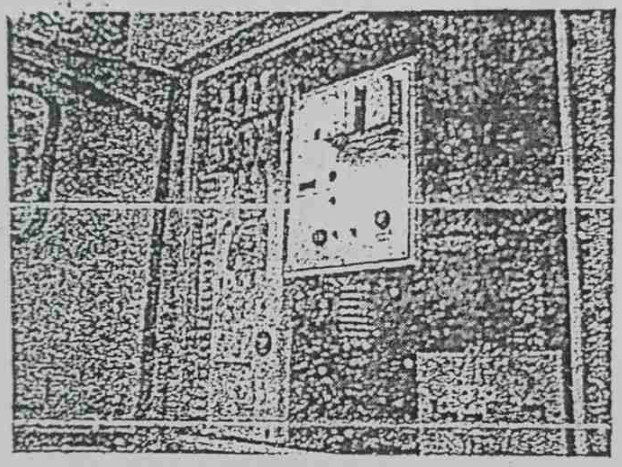


FIG: Circuit breaker at power sub station



Vacuum circuit Breaker

The VVPS 12/2150 outdoor vacuum circuit breakers are structure mounted easy – to – install Outdoor vacuum circuit breakers for use up to 12 kv systems. They are a porcelain Clad, three pole circuit breakers fitted with reliable and well proven vacuum interrupters. Adequate phase clearances and heights have been provided to meet the standard safety requirements. They are suitable for direct connection to overheads lines. This design incorporates a minimum number of moving parts and a simple assembly which ensure a long electrical and mechanical service life. It has all the advantages inherent to the use of vacuum interrupters like how drive and arc energy, lightweight, shock-proof performance and many more.

Key Features:

This all whether product comes with adequate clearances & sufficient creep age to suit highly polluted environment. Sturdy spring operating mechanism ensures high reliability & minimal maintenance. The breaker is type tested at renowned testing laboratories like CPRI – India.

The circuit breakers:

Each Phase of the three phase's circuit breakers is self contained in a porcelain bushing, which housed the vacuum Interrupter supported from top plate well guide. Insulating drive rod transmits motion from mechanism to moving contacts; the movement is 8 ± 0.5 mm or 6 ± 1 mm for 12 kv breakers. It has Interface mechanism, which also contains crank assembly, contact force, linkages for transmitting the rotary movement to linear movement of moving contact stems. A damper is provided to protect bellows of interrupters.

It has incoming and outgoing terminal connections at the top and bottom of the bushing.

All associated live parts within the vacuum Interrupter housing bushings are fully sealed to protect the Interrupter from adverse weather and polluted environment. The creep age of the Interrupter surface being fixing, the porcelain protection ensure that the circuit breaker operates in atmospheres of varying degrees of pollution from saline atmospheres, fuel, gases dust etc.

Operating mechanisms:

The mechanism is of conventional design and is very simple in operation and construction. Mechanism is designed for operation of very short stroke required in vacuum Interrupter and is normally charged by motor but as a standby manual charging facility is also provided for the operation in case of necessity.

When charged, the closing spring is held by a latch which can be closed either manually by close lever or by a solenoid to release closing spring and close the circuit breaker. Where motor charging is provided, the spring gets automatically charged immediately after a closing operation. The mechanism is retained in the "ON" position (circuit breaker closed) by an over toggle linkage. The breaker can be opened either manually by trip lever or by the springs, incorporated in the drive chamber assemblies which are compressed during the closing stroke.

Mechanism cabinet:

The mechanism cabinet comprises of sheet enclose, which conforms to IP55 Standard and is bolted directly with the circuit breaker supporting steelwork. The cabinet housed the main closing mechanism as well as auxiliary switch, incoming and outgoing control terminals, fuses for control circuits and anti condensation heater etc. A hinged door is provided for easy access to the above components. The closing mechanism includes the following indications (Mechanical):

- Breaker on/off
- Spring charged or discharged
- Operating counter

The cabinet is also equipped with following features (electrical), wherever required.

- Breaker control switch

- Local remote switch
- Indication lamps
- Push buttons etc.

Technical Particulars

Type	VVPS 12/ 1250
Rated voltage	12 kV
Rated current	800/ 1250A
1 min. power frequency voltage	28 kV rms
Lightening Impulse	75 kV rms
Rated short time withstand current	20/25 kA rms for 3 sec
Rated short circuit making current	50/ 62.5 kA peak
Rated operating duty cycle	O-O. 3sec- CO-3min-CO
*Mechanical	30,000 Operations
*At load current	20,000 - 30,000 Operations
*At full short circuit current	100 Operations
Symmetrical breaking capacity	20/25 kA

Bihar State Power Transmission Company Limited

Registered Office :- 4th Floor
Vidyut Bhawan, Patna-21
CIN No. U74110BR2012SGC018889, Website- www.bsptcl.in

Electrical Executive Engineer
Transmission Division (WEST), Barrack No. 6,
Rajbanshi Nagar, Patna-23
Email : eeetdpatnawest@gmail.com

CERTIFICATE

This is to certify that Nitish Kumar Branch B. Tech (EEE) Registration no./Roll No. 184017 college NSIT, Bihta, Patna has successfully completed his/her in-Plant Training at ~~220~~/132/33 KV GSS Bihta (old) under transmission Division Patna West), from 13/05/~~2022~~ to 12/06/~~2022~~ in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was V. Good.

Place: Patna

Issue Date: 16/06/2022

EEE/TD/ Patna
L No. 376 Date 16/06/22

Electrical Executive Engineer
Transmission Division Patna (West)

Netaji Subhas Institute Of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"SUMMER TRAINING REPORT"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, BIHTA
IN THE MONTH OF MAY-JUNE 2022

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL& ELECTRONICS ENGINEERING

Under the guidance of

Mr. Vikash Kumar (Assistant Engineer, 132/33kv Grid Sub-Station)

Mr. Shivesh Kumar (Junior Engineer, 132/33kv Grid Sub-Station)

Submitted by: - **NITISH KUMAR (184017)**

Submitted to: - **Department of Electrical &Electronics Engineering**

NSIT Bihta, Patna

Certificate of Completion

techgyan

CERTIFICATE
OF COMPLETION

Rahul Kumar

is presented with this certificate on successful completion of

WEB DESIGN WITH HTML/CSS

Under the guidelines and norms of the program structure

Conducted during the month of February & March 2023.

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
Techgyan Technologies

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY,

BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta knowledge University Patna (Bihar)

REPORT

REPORT

BASED ON THE TRAINING DONE AT **ABHYUDAY, IIT BOMBAY** IN THE MONTH OF JUNE-AUG 2022 IN **WEB DEVELOPMENT.**

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLGY

With specialization in

Bihar State Power Transmission Company Limited

Registered Office :- 4th Floor
Vidyut Bhawan, Patna-21
CIN No. U74110BR2012SGC018889, Website- www.bsptcl.in

Electrical Executive Engineer
Transmission Division (WEST), Barrack No. 6,
Rajbanshi Nagar, Patna-23
Email : eeetdpatnawest@gmail.com

CERTIFICATE

This is to certify that ...RAJA KUMAR.....Branch.....E.E.E.....Registration no./Roll No.2011010 3007..... college.....NSIT Bihta , Patna.....has successfully completed his/her in-Plant Training at 220/132/33 KV GSS.....under transmission Division Patna West), from..03.../02.../2023 to ....02.../03.../2023 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was.....Good.....

Place: Patna

Issue Date:..20/03/2023

EEE/TD/ Patna
L No. 111 ..... Date 20/03/2023

Electrical Executive Engineer
Transmission Division Patna (West)

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University,Patna (Bihar)

"INTERNSHIP PROGRAM"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED,

THE MONTH OF FEBRUARY 2023

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELCTRONICS ENGINEERING

Under the guidance of

Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:
RAJA KUMAR (204004)

Submitted to:
Department of Electrical & Electronics Engineering
NSIT Bihta, Patna

Certificate of Completion

techgyan

CERTIFICATE
OF COMPLETION

Satyam kumar sinha

is presented with this certificate on successful completion of

WEB DESIGN WITH HTML/CSS

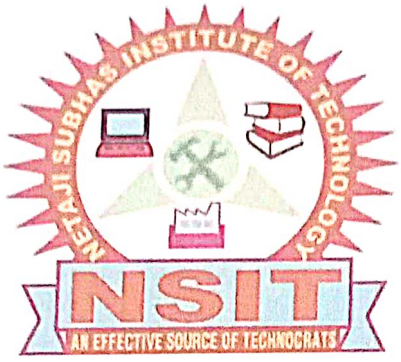
under the guidelines and norms of the program structure
conducted during the month of November & December 2022.

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
Techgyan Technologies

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY, BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta knowledge University Patna (Bihar)



REPORT

BASED ON THE TRAINING DONE AT **ABHYUDAY, IIT BOMBAY** IN THE MONTH OF NOV-DEC 2022 IN **WEB DEVELOPMENT.**

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLGY

With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by:

SATYAM KUMAR SINHA (184007)

B.tech (EEE)

4th year/7th semester

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

Bihar State Power Transmission Company Limited

Registered Office :- 4th Floor
Vidyut Bhawan, Patna-21
CIN No. U74110BR2012SGC018889, Website- www.bsptcl.in

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CERTIFICATE

This is to certify that SHIVAM KUMAR Branch E.E.E. Registration no./Roll No. 1911010 3004 college NSIT Bihta, Patna has successfully completed his/her in-Plant Training at 220/132/33 KV GSS under transmission Division Patna West), from 13/05/2022 to 12/06/2022 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was √. Good.

Place: Patna

Issue Date: 24/06/2022

EEE/TD/ Patna
L No. 325 Date 24/06/22

Electrical Executive Engineer
Transmission Division Patna (West)

Netaji Subhas Institute of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"SUMMER TRAINING REPORT"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, BIHTA IN THE MONTH OF MAY-JUNE 2022

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELCTRONICS ENGINEERING

Under the guidance of

- Raushan Kumar Bhargav (AEE, 220/132/33KV GSS BIHTA (NEW))
- Binita Prakash (AEE, 220/132/33KV GSS BIHTA (NEW))

Submitted by:

SHIVAM KUMAR (194008)

Submitted to:

Department of Electrical & Electronics Engineering
NSIT Bihta, Patna

INTERNSHALA TRAININGS

Certificate of Training

Sri Harsh Kumar

from Netaji Subhas Institute Of Technology has successfully completed an 8-week online training on **Android App Development**. The training consisted of Introduction to Android, World of Kotlin, Android Kick-Off, Higher Order Functionalities, and The Final Project modules.

In the final assessment, Sri Harsh scored 86% marks.

We wish Sri Harsh all the best for future endeavours.

Sarvesh Agarwal

FOUNDER & CEO, INTERNSHALA

Date of certification: 2023-02-28

Certificate no.: fo3krtmvi96

For certificate authentication, please visit https://trainings.internshala.com/verify_certificate

Netaji Subhas Institute Of Technology, Bihta, Patna.

Approved by AICTE, New Delhi, Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"INTERNSHIP REPORT"

On

Android application development

In partial fulfilment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted to:

Department of Electrical & Electronics Engineering

NSIT, Bihta, Patna

Submitted by:
Sri Harsh Kumar (184026)

Under the guidance of:
Dr. Jyotirmayee Dalei
(Head of Department)

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1. INTRODUCTION

TITLE OF THE PROJECT:

OBJECTIVE:

1. Provide an innovative and effective government management system..
2. Offer fast and efficient usability of the data collected through the app.
3. Dramatically reduce paper work and administrative work

2. TOOLS & PLATFORMS

- **JAVA**
  Java is a widely used programming language expressly designed for use in the distributed environment of the internet. Java can be used to create complete applications that may run on a single computer or be distributed among servers and clients in a network.

- **ANDROID STUDIO**
  Android Studio is the official integrated development environment (IDE) for Google's Android Operating System, built on JetBrains's IntelliJ IDEA software and designed specifically for Android Development. It is available for download on Windows, mac-OS and Linux based OS.

- **SQLITE DATABASE**
  SQLite is an in-process library that implements a self-contained, zero configuration, serverless, transactional SQL database engine. The source code for SQLite exists in the public domain and is free for both private and commercial purposes.

3. PRELIMINARIES

3.1 JAVA

Java is a widely used programming language expressly designed for use in the distributed environment of the internet. Java can be used to create complete applications that may run on a single computer or be distributed among servers and clients in a network. Java is the technology of choice for building applications using managed code that can execute on mobile devices.
Android applications are developed using the Java language. As of now, that's really your only option for native applications. Java is a very popular programming language developed by Sun Micro-systems (now owned by Oracle). Developed long after C and C++, Java incorporates many of the powerful features of those powerful languages while addressing some of their drawbacks. Still, programming languages are only as powerful as -their libraries. These libraries exist to help developers build applications.

Some of the Java's important core features are:

- It's easy to learn and understand.
- It's designed to be platform-independent and secure, using virtual machines.
- It's object-oriented.

Android relies heavily on these Java fundamentals. The Android SDK includes many standard Java libraries (data structure libraries, math libraries, graphics libraries, networking libraries and everything else you could want) as well as special Android libraries that will help you develop awesome Android applications.

3.2 ANDROID STUDIO

Android Studio is the official Integrated Development Environment (IDE) for Android app development, based on IntelliJ IDEA. On top of IntelliJ's powerful code editor and developer tools. Android Studio provides many excellent features that enhance productivity when building Android apps, such as a blended environment where one can develop for all Android devices, apply Changes to push code and resource changes to the running app without restarting the app, a flexible Gradle-based build system, a fast and feature-rich emulator, GitHub and Code template integration to assist you to develop common app features and import sample code, extensive testing tools and frameworks, C++ and NDK support, and many more.
Android Studio offers even more features that enhance your productivity when building Android application, such as:

- A flexible Gradle-based build system
- A fast and feature-rich emulator
- A unified environment where you can develop for all Android devices
- Instant Run to push changes to your running app without building a new APK
- Code templates and GitHub integration to help you build common app features and import sample code
- Extensive testing tools and frameworks
- Lint tools to catch performance, usability, version compatibility, and other problems
- C++ and NDK support
- Built-in support for Google Cloud Platform, making it easy to integrate Google Cloud Messaging and App Engine

3.2.1 ANDROID ARCHITECTURE

Android operating system is a stack of software components which is roughly divided into five sections and four main layers:

- **LINUX KERNEL** At the bottom of the layers is Linux - Linux 3.6 with approximately 115 patches. This provides a level of abstraction between the device hardware and it contains all the essential hardware drivers like camera, keypad, display etc. Also, the kernel handles all the things that Linux is really good at such as networking and a vast array of device drivers, which take the pain out of interfacing to peripheral hardware.
- **LIBRARIES** On top of Linux kernel there is a set of libraries including open-source Web browser engine WebKit, well known library libc, SQLite database which is a useful repository for storage and sharing of application data, libraries to play and record audio and video, SSL libraries responsible for Internet security etc.
- **ANDROID LIBRARIES** This category encompasses those Java-based libraries that are specific to Android development. Examples of libraries in this category include the application framework libraries in addition to those that facilitate user interface building, graphics drawing and database access. A summary of some key core Android libraries available to the Android developer is as follows –
  - **android.app:** Provides access to the application model and is the cornerstone of all Android applications.
  - **android.content:** Facilitates content access, publishing and messaging between applications and application components.
  - **android.database:** Used to access data published by content providers and includes SQLite database management classes.
  - **android.opengl:** A Java interface to the OpenGL ES 3D graphics rendering API.

- **android.os:** Provides applications with access to standard operating system services including messages, system services and inter-process communication.
- **android.text:** Used to render and manipulate text on a device display.
- **android.view:** The fundamental building blocks of application user interfaces.
- **android.widget:** A rich collection of pre-built user interface components such as buttons, labels, list views, layout managers, radio buttons etc.
- **android.webkit:** A set of classes intended to allow web-browsing capabilities to be built into applications.

- **ANDROID RUN-TIME** This is the third section of the architecture and available on the second layer from the bottom. This section provides a key component called Dalvik Virtual Machine which is a kind of Java Virtual Machine specially designed and optimized for Android. The Dalvik VM makes use of Linux core features like memory management and multi-threading, which is intrinsic in the Java language. The Dalvik VM enables every Android application to run in its own process, with its own instance of the Dalvik virtual machine. The Android run-time also provides a set of core libraries which enable Android application developers to write Android applications using standard Java programming language.

- **APPLICATION FRAMEWORK** The Application Framework layer provides many higher-level services to applications in the form of Java classes. Application developers are allowed to make use of these services in their applications. The Android framework includes the following key services.
  - **Activity Manager:** Controls all aspects of the application life cycle and activity stack.
  - **Content Providers:** Allows applications to publish and share data with other applications.
  - **Resource Manager:** Provides access to non-code embedded resources such as strings, colour settings and user interface layouts.
  - **Notifications Manager:** Allows applications to display alerts and notifications to the user.
  - **View System:** An extensible set of views used to create application user interfaces.

3.2.2 APPLICATION COMPONENTS

Application components are the essential building blocks of an Android application. These components are loosely coupled by the application manifest file AndroidManifest.xml that describes each component of the application and how they interact.

- **ACTIVITIES:** They dictate the UI and handle the user interaction to the smart phone screen. An activity represents a single screen with a user interface, in short Activity performs actions on the screen. For example, an email application might have one activity that shows a list of new emails, another activity to compose an email, and another activity for reading emails. If an application has more than one activity, then one of them should be marked as the activity that is presented when the application is launched.

- **SERVICES:** They handle background processing associated with an application. : A service is a component that runs in the background to perform long-running operations. For example, a service might play music in the background while the user is in a different application, or it might fetch data over the network without blocking user interaction with an activity.

- **BROADCAST RECEIVER:** They handle communication between Android OS and applications. Broadcast Receivers simply respond to broadcast messages from other applications or from the system. For example, applications can also initiate broadcasts to let other applications know that some data has been downloaded to the device and is available for them to use, so this is broadcast receiver who will intercept this communication and will initiate appropriate action.

- **CONTENT PROVIDER:** They handle data and database management issues. A content provider component supplies data from one application to others on request. Such requests are handled by the methods of the ContentResolver class. The data may be stored in the file system, the database or somewhere else entirely.

ADDITIONAL COMPONENTS

S.No	COMPONENTS & DESCRIPTION
1	**Fragments** Represents a portion of user interface in an Activity.
2	**Views** UI elements that are drawn on-screen including buttons, lists forms etc.
3	**Layouts** View hierarchies that control screen format and appearance of the views.
4	**Intents** Messages wiring components together.
5	**Resources** External elements, such as strings, constants and drawable pictures.
6	**Manifest** Configuration file for the application.

3.2.3 PROJECT STRUCTURE

Each project in Android Studio contains one or more modules with source code files and resource files. Types of modules include:

- Android app modules
- Library modules

All the build files are visible at the top level under Gradle Scripts and each app module contains the following folders:

- manifests: Contains the AndroidManifest.xml file.
- java: Contains the Java source code files, including JUnit test code.
- res: Contains all non-code resources, such as XML layouts, UI strings, and bitmap image.

The Android project structure on disk differs from this flattened representation. To see the actual file structure of the project, select Project from the Project drop down. We can also customize the view of the project files to focus on specific aspects of our app development. For example, selecting the Problems view of our project displays links to the source files containing any recognized coding and syntax errors, such as a missing XML element closing tag in a layout file

3.2.4 USER INTERFACE

- The toolbar lets you carry out a wide range of actions, including running your app and launching Android to.
- The navigation bar helps you navigate through your project and open files for editing. It provides a more compact view of the structure visible in the Project window.
- The tool windows give you access to specific tasks like project management, search, version control, and more. You can expand them and collapse them.
- The editor window is where you create and modify code. Depending on the current file type, the editor can change. For example, when viewing a layout file, the editor displays the Layout Editor.
- The tool window bar runs around the outside of the IDE window and contains the buttons that allow you to expand or collapse individual tool windows.
- The status bar displays the status of your project and the IDE itself, as well as any warnings or messages.

We can organize the main window to give our self more screen space by hiding or moving toolbar and tool windows. We can also use keyboard shortcuts to access most IDE features. At any time, you can search across your source code, databases, actions, elements of the user interface, and so on, by double-pressing the Shift key, or clicking the magnifying glass in the upper right-hand corner of the Android Studio window. This can be very useful if, for example, you are trying to locate a particular IDE action that you have forgotten how to trigger.

3.2.5 GRADLE BUILD SYSTEM

Android Studio uses Gradle as the foundation of the build system, with more Android-specific capabilities provided by the Android plugin for Gradle. This build system runs as an integrated tool from the Android Studio menu, and independently from the command line. You can use the features of the build system to do the following:

- Customize, configure, and extend the build process.
- Create multiple APKs for your app, with different features using the same project and modules.
- Reuse code and resources across source-sets.

By employing the flexibility of Gradle, you can achieve all of this without modifying your app's core source files. Android Studio build files are named build.gradle. They are plain text files that use Groovy syntax to configure the build with elements provided by the Android plugin for Gradle. Each project has one top-level build file for the entire project and separate module-level build files for each module. When you import an existing project, Android Studio automatically generates the necessary build files.

3.2.6 INLINE DEBUGGING

Use inline debugging to enhance your code walk-throughs in the debugger view with inline verification of references, expressions, and variable values. Inline debug information includes:

- Inline variable values
- Referring objects that reference a selected object
- Method returns values
- Lambda and operator expressions
- Tool-tip values

3.2.7 CODE INSPECTION

Whenever you compile your program, Android Studio automatically runs configured Lint and other IDE inspections to help you easily identify and correct problems with the structural quality of your code. The Lint tool checks your Android project source files for potential bugs and optimization improvements for correctness, security, performance, usability, accessibility, and internationalization. In addition to Lint checks, Android Studio also performs IntelliJ code inspections and validates annotations to streamline your coding workflow

3.3 SQLITE DATABASE

SQLite is a programming library which implements a relational database management system. The SQLite database concept is, in contrast to other client server systems, to be linked into the applications code, instead of providing a standalone daemon with which an application can communicate to request or write data. Because of the small size of the library itself, and the ease of use, it is especially interesting for embedded systems. SQLite supports a variety of SQL (Structured Query Language) commands with some exceptions and does not provide any access or user-management. That means, that everyone, who can access the database file, can access the data as well as write (change, delete, add) data, if he can write the database file. It therefore inherits the access permissions of the filesystem. SQLite implements the SQL-92 standard for SQL and uses an unusual system for SQL compatible database management systems. Types are assigned to individual values, adding flexibility to columns when bound to dynamic scripting languages. Full Unicode support in SQLite is optional. DB Browser for SQLite (DB4S) is a high quality, visual, open-source tool to create, design, and edit database files compatible with

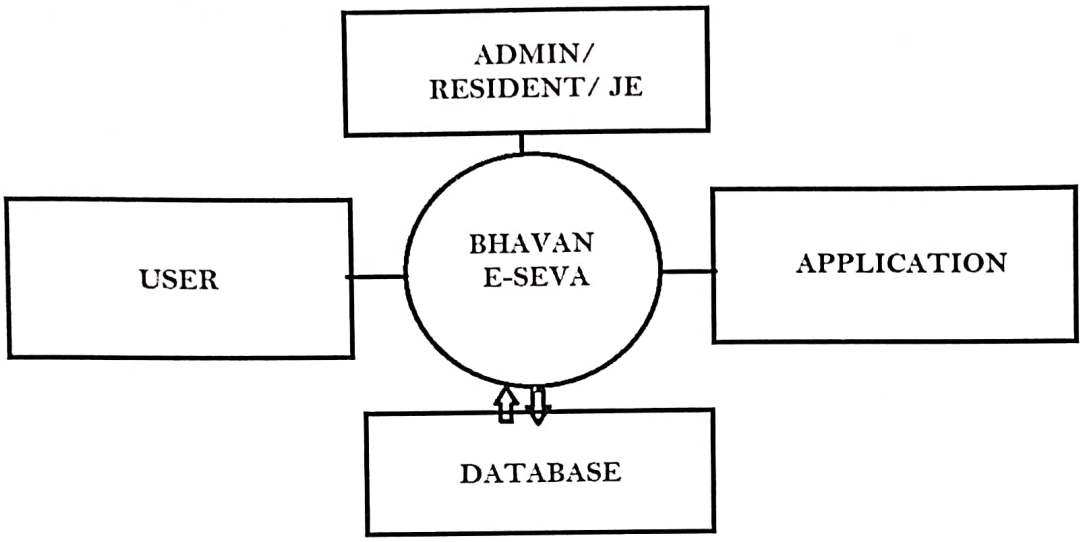
SQLite. DB4S is for users and developers who want to create, search, and edit databases. DB4S uses a familiar spreadsheet-like interface, and complicated SQL commands do not have to be learned. Controls and wizards are available for users to:

- Create and compact database files
- Create, define, modify and delete tables
- Create, define, and delete indexes
- Browse, edit, add, and delete records
- Search records
- Import and export records as text
- Import and export tables from/to CSV files
- Import and export databases from/to SQL dump files
- Issue SQL queries and inspect the results
- Examine a log of all SQL commands issued by the application
- Plot simple graphs based on table or query data

3.4 SHARED PREFERENCES

One of the most Interesting Data Storage options Android provides its users is Shared Preferences. Shared Preferences is the way in which one can store and retrieve small amounts of primitive data as key/value pairs to a file on the device storage such as String, int, float, Boolean that make up your preferences in an XML file inside the app on the device storage. Shared Preferences can be thought of as a dictionary or a key/value pair.

4. METHODOLOGY

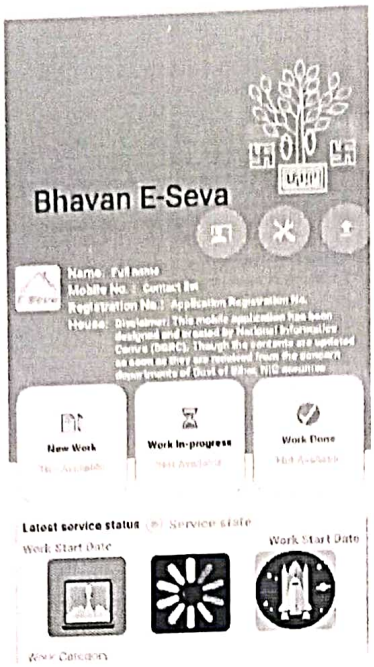


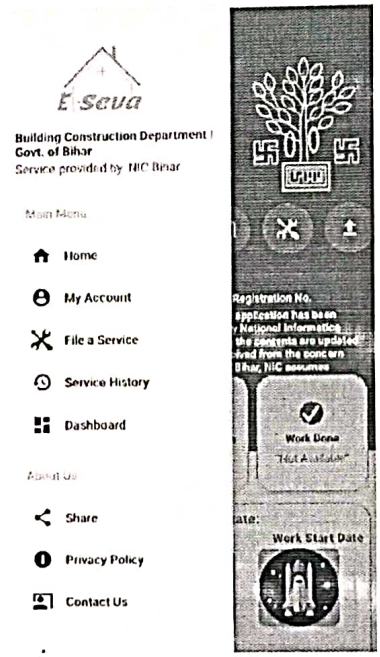
5. CODE DOCUMENTATION

LoginActivity.java

6. APP SCREENSHOTS

Loading


Bhavan E-Seva
New Work
Work In-progress
Work Done
Latest service status
Work Start Date
Work Start Date


E Seva
Building Construction Department ,
Govt. of Bihar
Service provided by NIC Bihar
Main Menu
Home
My Account
File a Service
Service History
Dashboard
About us
Share
Privacy Policy
Contact Us
Work Done
Work Start Date

Location

Current official residence Government offices/ Place

Service type:

Civil Electrical Special

Work Category List:

Work Category

Want to receive service call on:

Email:

Want to receive service call on:

Email:

Short description:

Global Issue

Number of employee impacted:

At least 1 people/family affected by it.

Capture image button *

Save

7. CONCLUSION

The Bhavan E-Seva is saving time and manpower as well as providing a transparency throughout the process. Work can be done further and simplified and integrate current system with online Database options or online server for global usages. The project has a great future for serving a greater number of candidates in an organized an efficient manner. The project Bhavan E-Seva system exhibits pre-possibilities for further development.

8. REFERENCES

- https://sqlitebrowser.org/
- https://www.javatpoint.com/android-tutorial
- https://en.wikipedia.org/wiki/Android_Studio
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- https://developer.android.com/training/data-storage/room
- https://www.tutorialspoint.com/android/android_sqlite_database.htm
- https://developer.android.com/training/data-storage/shared-preferences
- https://www.developer.com/mobile/java-mobile/java-mobileprogramming-for-android/

SwiftStats AI

Swiftstatsai.com
CIN No: U74999DL2012PTC243176

Feb 1st, 2023

TO WHOM IT MAY CONCERN,

This is to certify that Ms **Sohani Sharan**, D/O Shankar Kumar, an Electronics and Electrical student from Netaji Subhas Institute of Technology **(NSIT) Patna**, has completed **Intern – Software Development.** The duration of the internship was from **14th December 2022 to 13th Jan 2023**.

Her role was to familiarize herself with all the processes at the organization. She spent a significant amount of time in each department and learnt in-depth what the flow of work is like. Ms **Sohani Sharan** is a diligent individual and particularly inquisitive. She helped in developing FastAPI for the product she was assigned to.

We hope her time spent at **Swiftstatsai.com** was fruitful. We wish her all the success in her future.

Congratulations!

Regards,

Swiftstatsai.com

Netaji Subhas Institute Of Technology, Bihta, Patna.

Approved by AICTE, New Delhi, Affiliated to Aryabhatta Knowledge University,
Patna (Bihar)

"Internship Report"

Submitted by:
Anand Raj Bharti
214005

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Introduction

Linear regression is a statistical method used to model the relationship between two or more variables. It is a widely used technique in machine learning and data science for predicting a continuous output variable based on one or more input variables.

In linear regression, a linear relationship is assumed between the input variables and the output variable. The model tries to fit a straight line through the data to make predictions. The line is defined by the intercept and the slope of the line.

The basic form of linear regression is expressed as:

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta\square x\square + \varepsilon$

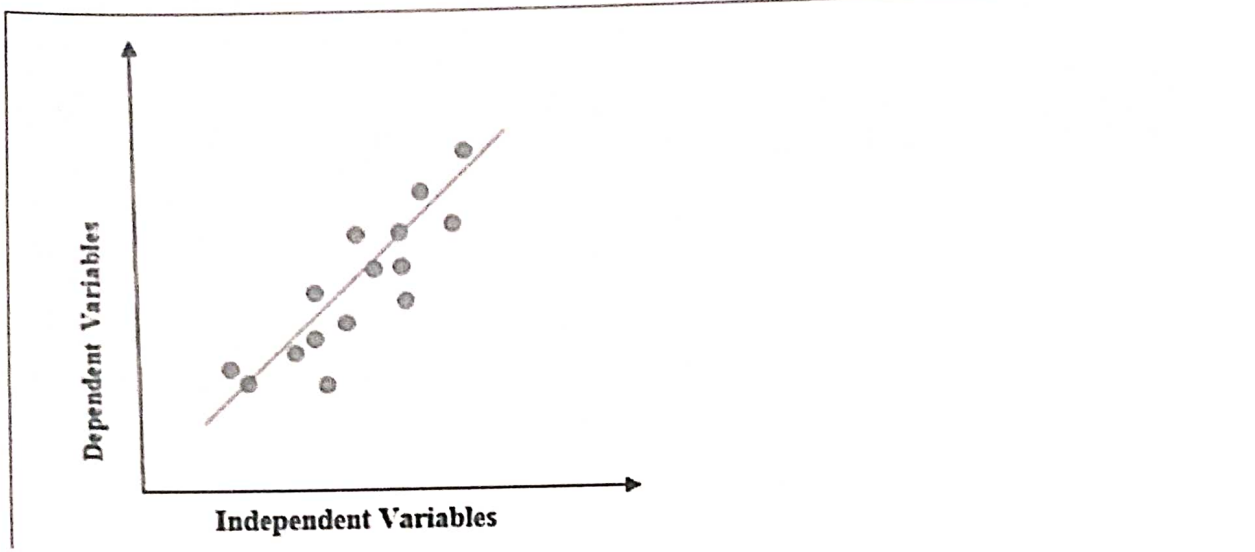
where:

- y is the output or response variable
- β_0 is the intercept
- $\beta_1, \beta_2, ..., \beta\square$ are the coefficients or weights of the input variables $x_1, x_2, ..., x\square$
- ε is the error or residual term that accounts for unexplained variability in the data

The goal of linear regression is to find the values of the coefficients that minimize the sum of the squared errors between the predicted values and the actual values in the training data.

Linear regression can be used for both simple linear regression (one input variable) and multiple linear regression (multiple input variables). It can also be extended to include more complex relationships between the input and output variables, such as polynomial regression or regression with interaction terms.

Drawing a line/Slope intercept



Types of linear Regression

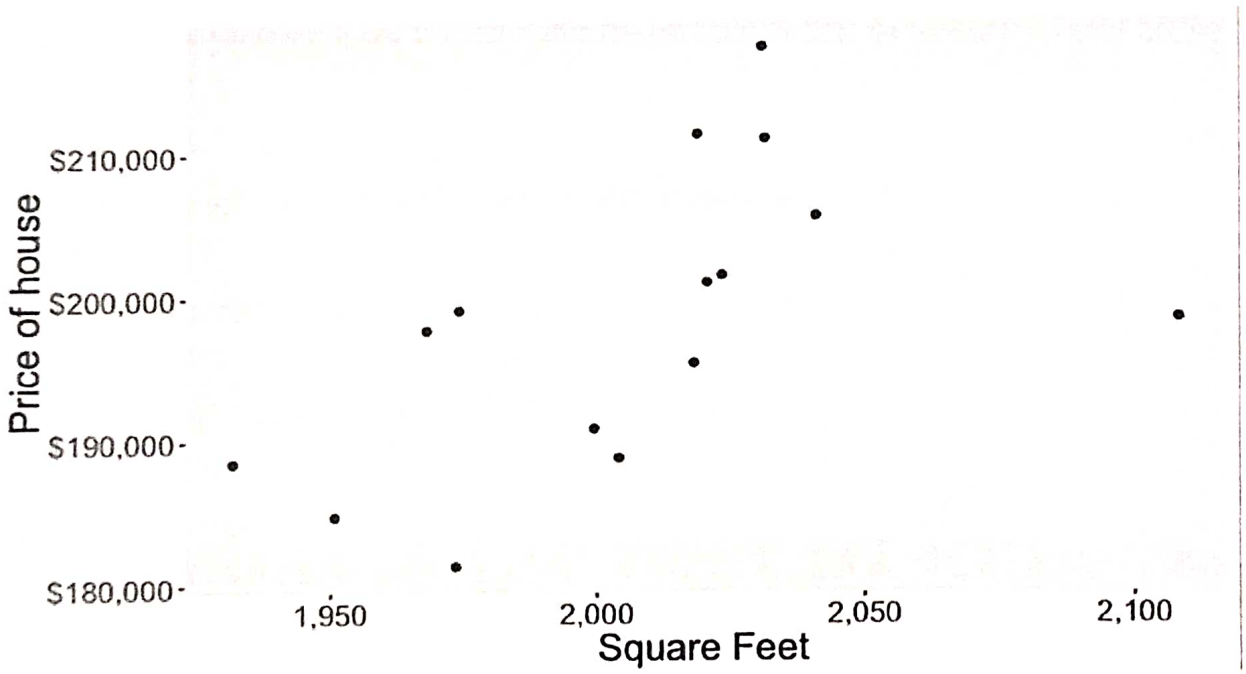
Linear regression is a statistical method used to model the relationship between two variables by fitting a linear equation to the observed data. There are several types of linear regression, including:

1. Simple Linear Regression: This is the most basic form of linear regression that involves two variables, one independent variable and one dependent variable. The goal is to find the best fitting straight line through the data that minimizes the sum of the squared residuals.
2. Multiple Linear Regression: This type of regression involves more than one independent variable and one dependent variable. The goal is to find the best fitting linear equation that explains the relationship between the dependent variable and multiple independent variables.

3. Polynomial Regression: This is a type of regression where the relationship between the independent variable and dependent variable is modeled as an nth degree polynomial. This type of regression is useful when the relationship between the variables is not linear.

Creating a linear regression

Linear regression is a quiet and the simplest statistical regression method used for predictive analysis in machine learning. Linear regression shows the linear relationship between the independent(predictor) variable i.e. X-axis and the dependent(output) variable i.e. Y-axis, called linear regression. If there is a single input variable X(independent variable), such linear regression is called simple linear regression.



The above graph presents the linear relationship between the output(y) variable and predictor(X) variables, which are price of houses vs square feet of those houses.

To calculate best-fit line linear regression uses a traditional slope-intercept form which is given below -

$$Yi = \beta 0 + \beta 1 Xi$$

where Yi = Dependent variable, $\beta 0$ = constant/Intercept, $\beta 1$ = Slope/Intercept, Xi = Independent variable.

This algorithm explains the linear relationship between the dependent(output) variable y and the independent(predictor) variable X using a straight line Y= B0 + B1 X.

But how the linear regression finds out which is the best fit line?

The goal of the linear regression algorithm is to get the best values for B0 and B1 to find the best fit line. The best fit line is a line that has the least error which means the error between predicted values and actual values should be minimum.

Random Error(Residuals)

In regression, the difference between the observed value of the dependent variable(yi) and the predicted value(predicted) is called the residuals.

$\varepsilon i =$ y predicted $-$ yi

where y predicted = B0 + B1 Xi

What is the best fit line?

In simple terms, the best fit line is a line that fits the given scatter plot in the best way. Mathematically, the best fit line is obtained by minimizing the Residual Sum of Squares(RSS).

Cost Function for Linear Regression

The cost function helps to work out the optimal values for B0 and B1, which provides the best fit line for the data points.

In Linear Regression, generally Mean Squared Error (MSE) cost function is used, which is the average of squared error that occurred between the y predicted and yi.

We calculate MSE using simple linear equation y=mx+b:

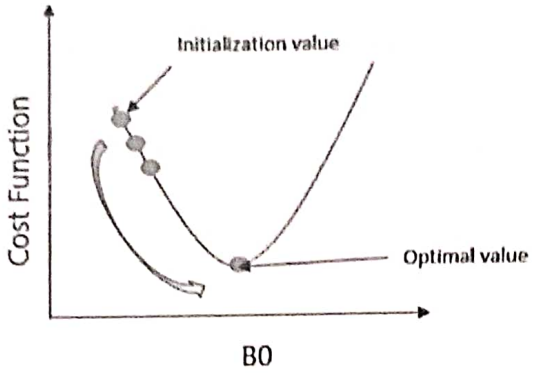
$$MSE = \frac{1}{N}\sum_{i=1}^{n}(y_i - (B1x_i + B0))^2$$

Using the MSE function, we'll update the values of B0 and B1 such that the MSE value settles at the minima. These parameters can be determined using the gradient descent method such that the value for the cost function is minimum.

Gradient Descent for Linear Regression

Gradient Descent is one of the optimization algorithms that optimize the cost function(objective function) to reach the optimal minimal solution. To find the optimum solution we need to reduce the cost function(MSE) for all data points. This is done by updating the values of B0 and B1 iteratively until we get an optimal solution.

A regression model optimizes the gradient descent algorithm to update the coefficients of the line by reducing the cost function by randomly selecting coefficient values and then iteratively updating the values to reach the minimum cost function.



Let's take an example to understand this. Imagine a U-shaped pit. And you are standing at the uppermost point in the pit, and your motive is to reach the bottom of the pit. Suppose there is a treasure at the bottom of the pit, and you can only take a discrete number of steps to reach the bottom. If you opted to take one step at a time, you would get to the bottom of the pit in the end but, this would take a longer time. If you decide to take larger steps each time, you may achieve the bottom sooner but, there's a probability that you could overshoot the bottom of the pit and not even near the bottom. In the gradient descent algorithm, the number of steps you're taking can be considered as the learning rate, and this decides how fast the algorithm converges to the minima.

Evaluation Metrics for Linear Regression

The strength of any linear regression model can be assessed using various evaluation metrics. These evaluation metrics usually provide a measure of how well the observed outputs are being generated by the model.

The most used metrics are-

- Coefficient of Determination or R-Squared (R2)
- Root Mean Squared Error (RSME) and Residual Standard Error (RSE)

Coefficient of Determination or R-Squared (R2)

R-Squared is a number that explains the amount of variation that is explained/captured by the developed model. It always ranges between 0 & 1 . Overall, the higher the value of R-squared, the better the model fits the data.

Mathematically it can be represented as,

$$R2 = 1 - (RSS/TSS)$$

Residual sum of Squares (RSS) is defined as the sum of squares of the residual for each data point in the plot/data. It is the measure of the difference between the expected and the actual observed output.

Root Mean Squared Error

The Root Mean Squared Error is the square root of the variance of the residuals. It specifies the absolute fit of the model to the data i.e. how close the observed data points are to the predicted values. Mathematically it can be represented as,

$$RMSE = \sqrt{\frac{RSS}{n}} = \sqrt{\sum_{i=1}^{n} \left(y_i^{Actual} - y_i^{Predicted}\right)^2 / n}$$

To make this estimate unbiased, one has to divide the sum of the squared residuals by the degrees of freedom rather than the total number of data points in the model. This term is then called the Residual Standard Error(RSE). Mathematically it can be represented as,

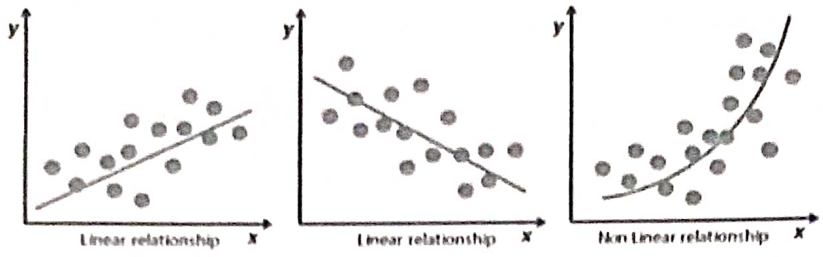
$$RSE = \sqrt{\frac{RSS}{df}} = \sqrt{\sum_{i=1}^{n} \left(y_i^{Actual} - y_i^{Predicted}\right)^2 / (n-2)}$$

R-squared is a better measure than RSME. Because the value of Root Mean Squared Error depends on the units of the variables (i.e. it is not a normalized measure), it can change with the change in the unit of the variables.

Assumptions of Linear Regression

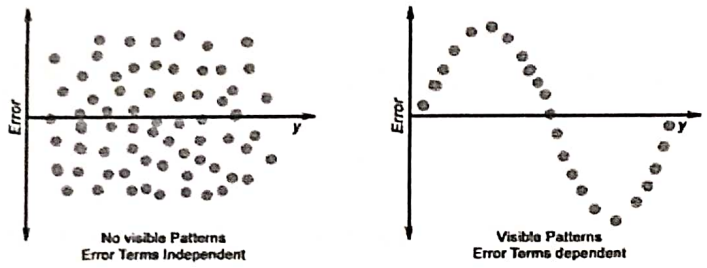
Regression is a parametric approach, which means that it makes assumptions about the data for the purpose of analysis. For successful regression analysis, it's essential to validate the following assumptions.

1. Linearity of residuals: There needs to be a linear relationship between the dependent variable and independent variable(s).



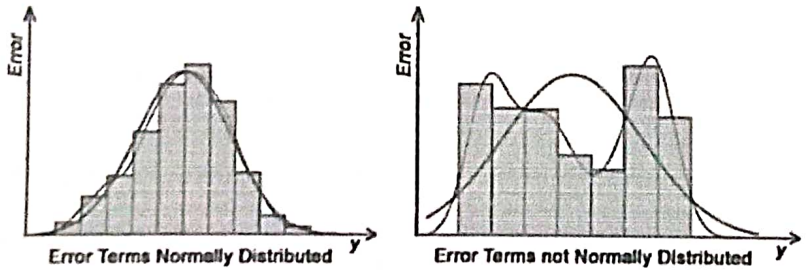
2. Independence of residuals: The error terms should not be dependent on one another (like in time-series data wherein the next value is dependent on the previous one). There should be no correlation between the residual terms. The absence of this phenomenon is known as Autocorrelation.

There should not be any visible patterns in the error terms.



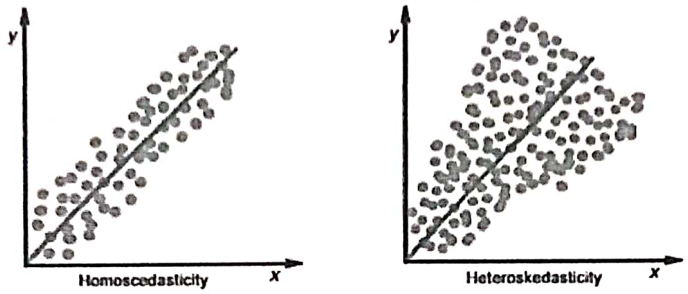
3. Normal distribution of residuals: The mean of residuals should follow a normal distribution with a mean equal to zero or close to zero. This is done in order to check whether the selected line is actually the line of best fit or not.

If the error terms are non-normally distributed, suggests that there are a few unusual data points that must be studied closely to make a better model.



4. The equal variance of residuals: The error terms must have constant variance. This phenomenon is known as Homoscedasticity.

The presence of non-constant variance in the error terms is referred to as Heteroscedasticity. Generally, non-constant variance arises in the presence of outliers or extreme leverage values.



Hypothesis in Linear Regression

Once you have fitted a straight line on the data, you need to ask, "Is this straight line a significant fit for the data?" Or "Is the beta coefficient explain the variance in the data plotted?" And here comes the idea of hypothesis testing on the beta coefficient.

The Null and Alternate hypotheses in this case are:

H0: $B1 = 0$

HA: $B1 \neq 0$

To test this hypothesis we use a t-test, test statistics for the beta coefficient is given by,

Assessing the model fit

Some other parameters to assess a model are:

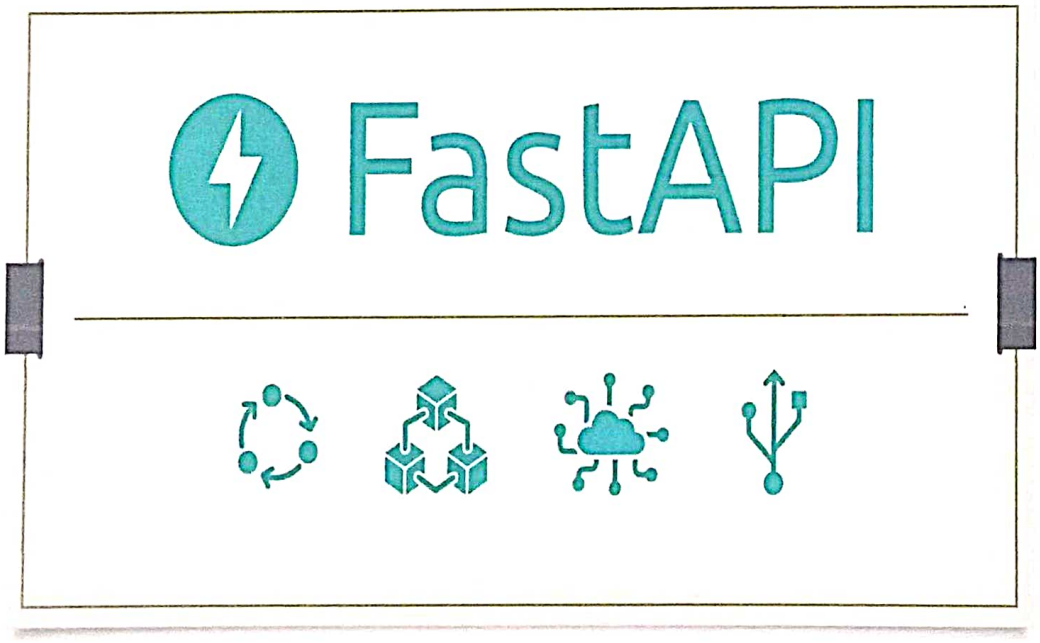
t statistic: It is used to determine the p-value and hence, helps in determining whether the coefficient is significant or not

F statistic: It is used to assess whether the overall model fit is significant or not. Generally, the higher the value of the F-statistic, the more significant a model turns out to be.

FastAPI: A High-Performance Web Framework for Python

Abstract

FastAPI is a modern, high-performance web framework for building APIs with Python. It is designed to be fast, easy to use, and provide automatic validation, serialization, and documentation features. This report explores the key features, advantages, and use cases of FastAPI, highlighting its role in simplifying API development while delivering top-notch performance.



Introduction

FastAPI is a modern, high-performance web framework for building APIs with Python. It was created to address the shortcomings of traditional Python web frameworks by leveraging the capabilities of Python 3.7+ and asynchronous programming. FastAPI is designed to be both easy to use and highly efficient, making it an excellent choice for developers who need to build APIs quickly and handle high loads.

Building Practical Applications using Python
and FastAPI series

Key features of FastAPI:

1. **Fast:** As the name suggests, FastAPI is incredibly fast. It achieves this by leveraging the power of Python's asynchronous programming capabilities and using high-performance data serialization, making it ideal for high-performance applications.
2. **Easy to Use:** FastAPI is built with a clean and intuitive syntax, inspired by Python's type hints. This means you can enjoy the

benefits of autocompletion and type checking, which results in more maintainable and less error-prone code.

3. **Type Annotations:** One of the standout features of FastAPI is its use of Python's type annotations. These annotations are not only used for documentation but also for data validation. This feature allows you to define clear and strict input and output data types for your API routes, which enhances API documentation and error handling.
4. **Automatic Documentation:** FastAPI automatically generates interactive API documentation through OpenAPI and JSON Schema. This documentation can be accessed via a web browser, making it easier for developers to understand and test API endpoints. Additionally, FastAPI also supports automatic generation of request payloads and response models based on the provided type annotations.
5. **Support for WebSockets:** FastAPI provides built-in support for handling WebSockets, enabling real-time bidirectional communication between clients and servers.
6. **Security:** FastAPI includes various security features out of the box, such as OAuth2 authentication, API key handling, and request rate limiting, making it easier to build secure APIs.
7. **Extensibility:** FastAPI is designed to be easily extendable, allowing you to integrate it with other Python libraries and frameworks as needed.

6. **Compatibility:** FastAPI works seamlessly with Python 3.7 and later versions, and it is fully compatible with the popular ASGI (Asynchronous Server Gateway Interface) servers, such as Uvicorn and Hypercorn.

Overall, FastAPI has gained significant popularity in the Python community due to its performance, ease of use, and robust features. Whether you're building small, simple APIs or large, complex applications, FastAPI provides an excellent framework to get the job done efficiently and effectively.

Bihar State Power Transmission Company Limited

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Place: Patna

Issue Date: 16/06/2022

EEE/TD/ Patna
L No. 372 Date 16/06/22

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Netaji Subhas Institute Of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"SUMMER TRAINING REPORT"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, BIHTA
IN THE MONTH OF MAY-JUNE 2022

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL& ELECTRONICS ENGINEERING

Under the guidance of

Mr. Vikash Kumar (Assistant Engineer, 132/33kv Grid Sub-Station)

Mr. Shivesh Kumar (Junior Engineer, 132/33kv Grid Sub-Station)

Submitted by:- **SUDHANSHU SHEKHAR (184004)**

Submitted to:- **Department of Electrical &Electronics Engineering**

NSIT Bihta, Patna

Bihar State Power Transmission Company Limited

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Place: Patna

Issue Date: 16/06/2022

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Mr. Shivesh Kumar (Junior Engineer, 132/33kv Grid Sub-Station)

Submitted by:

SURYANSH VERMA (194002)

Submitted to:

Department of Electrical &Electronics Engineering

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This is to certify that Himanshu Kumar Branch B. Tech (E.E.E) Registration no./Roll No. 194010 college NSIT, Bihta (Patna), has successfully completed his/her in-Plant Training at ~~220~~/132/33 KV GSS Bihta (old) under transmission Division Patna West), from 13/05/2022 to 12/05/2022 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was V. Good.

Place: Patna

Issue Date: 16/06/2022

EEE/TD/ Patna
L No. 375 Date 16.06.22

Electrical Executive Engineer
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Mr. Shivesh Kumar (Junior Engineer, 132/33kv Grid Sub-Station)

Submitted by:

HIMASHUKUMAR(194010)

Submitted to:

Department of Electrical &Electronics Engineering

NSIT Bihta, Patna

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INTRODUCTION

• I was being trained at the 132/33 KV BIHTA grid under the Patna West Division.

• An electric substation is a subsidiary of an electricity generation, transmission and distribution system where voltages are transformed high to low or reverse using transformers.

• Electric power may flow through several substations between generation plant and consumer and may change in voltage in several steps.

• The 132/33 KV Bihta grid consist of transformers (4*50 MVA) of which are step down transformer and two Substation transformer rating of 315 KVA.

• They all step down 132 KV power to 33 KV, one substation transformer step down 33 KV to 440 V at grid.

• Here are the incoming sources of power are:-

a) Two circuit 132 KV, Coming from KHAGAUL GSS.

b) Two circuit 132 KV, Coming from BIHTA (NEW) GSS.

• The outgoing 33 KV power is further stepped down to 11 KV which is transmitted to the nearby areas of Bihta from the substation.

• There are all together 8 outgoing feeders and 2 GIS feeder.

• There are two battery room of 2.2*110 Volt and 2.2*24 Volt batteries are available.

GSS BIHTA

Generation of Electricity:

Generator –

- The Electrical Generators are devices that convert kinetic energy into electrical energy. It is the most commonly used method for generation of electricity around the world.
- The generators contain turbines that rotate using kinetic energy of any other source such as water in dam, steam, wind etc. Upon rotation of the turbine, the magnetic field & conductors interacts with each other & generates electricity.
- The generators can be designed to generate alternating current (AC) or direct current (DC) depending on its design & requirement. We mostly use AC generators in our power plants due to its easier voltage conversion & transmission benefits.
- This method is used in huge power generation plants that supply electricity to the whole cities in ranges of Megawatts of power.

Electrochemistry –

- Electrochemistry deals with relation between chemicals & electricity. In such method, the chemical energy inside chemicals is converted into electrical energy. The chemical reaction release electrons which can flow out through a metal electrode.
- Metal electrodes are place inside a chemical called electrolyte. The chemicals react with the electrodes & exchange electrons that flow out through the electrodes into the electrical circuit thus generating electricity. This process can be reversed to store the same electrical charge inside the chemical.
- Such method of electricity generation is used in batteries. Batteries can be of two types i.e. primary battery and secondary battery. The primary batteries are not rechargeable & it can't be used once it's fully discharged. It is also known as disposable batteries.

Photovoltaic Effect

- The conversion of light energy into electrical energy is called photovoltaic effect. In this process, the material generates electricity when it is exposed to light. A solar panel works on the same phenomenon using the sun as the source of light energy & converts it into electricity.
- The solar panels contain small photovoltaic cells. Each photovoltaic cell is made of semiconductor material. The photon (light particle) hits & knocks off electrons from it that flows out through the circuit. These electrons flow in a single direction which is why solar panels generate DC electricity.
- The DC supply can be easily converted into AC using Power inverter. We use multiple solar panels in remotes areas to generate electricity. It is also used as secondary power source in day-light for houses & businesses.

Transmission Lines

Transmission lines are the conductors that serve as a path for transmitting electrical waves through them. These basically form a connection between transmitter and receiver in order to permit signal transmission. Transmission lines in microwave engineering are known as distributed parameter networks. As their voltage and current shows variation over its entire length. It enables the transfer of electrical signals by a pair of conducting wires that are separated from each other by a dielectric medium which is usually air.

Transmission lines are majorly classified into three categories:

Open-wire transmission line: These are the conductors having 2 lines (wires) that are separated by dielectric medium whose, one end connected to the source and other to the destination. These are low cost and simplest form of transmission line. But, their installation cost is somewhat higher as well as its maintenance sometimes becomes difficult due to the change in atmospheric conditions.

Coaxial cable lines: These lines are formed when a conducting wire is coaxially inserted inside another hollow conductor. These are termed as coaxial as the 2 conductors share the same axis. These are widely used in applications where high voltage levels are needed.

Waveguides: This category of the transmission line is used for signal transmission at microwave frequencies. These are basically hollow conducting tubes as they somewhat resemble like coaxial cable line but do not have centre conductor as present in coaxial cables.

Applications: For the transmission of a signal having a high-frequency range over short as well as long distance, transmission lines are used. At the same time, this reduces the loss of power during transmission.

POWER TRANSFORMER

This is the most common type of transformer which converts high voltage to low voltage. It has power rating ranging from miliwatt to megawatt. If a load is connected to the secondary, current will flow in the secondary winding, and electrical energy will be transferred from the primary circuit through the transformer to the load. In an ideal transformer, the induced voltage in the secondary winding (Vs) is in proportional to the primary voltage (Vp) and is given by the ratio of the number of turns in the secondary (Ns) to the number of turns in the primary (Np) as follows:

$$Vs/Vp = Ns/Np$$

By appropriate selection of the ratio of turns, a transformer thus enables an alternating current (AC) voltage to be "stepped up" by making Ns or "stepped down" by making Ns less than Np. The winding are coils wound around a ferromagnetic core, air-core transformers being a notable exception.

- The main components of power transformer are:

a) Main tank.

b) Diverter tank containing on load tap changer.

c) Conservator tank.

d) Bushing and bushing studs for insulation.

e) Breather.

f) Winding temperature indicator which denotes the winding temperature and oil temperature indicator.

g) Cooler units, fan and pumps for maintaining the temperature of the transformer.

h) Buccholz relay located between main tank and conservator tank .

i) RS 1000 relay located between diverter tank and conservator tank .

J) Magnetic oil level gauge.

Fig:-POWER TRANSFORMER

PROTECTION EQUIPMENT

- **LIGHTNING ARRESTER :-**

A lightning arrester is a device used on electrical power systems and telecommunications systems to protect the insulation and conductors of the system from the damaging effects of lightning. The typical lightning arrester has a high voltage terminal and a ground terminal. When a lightning surge (or switching surge, which is very similar) travels along the power line to the arrester, the current from the surge is diverted through the arrestor, in most cases to earth.

Lightning arresters built for power substation use are impressive devices, consisting of a porcelain tube several feet long and several inches in diameter, typically filled with disks of zinc oxide. A safety port on the side of the device vents the occasional internal explosion without shattering the porcelain cylinder.

Fig:-LIGHTNING ARRESTER

- **WAVE TRAP:-**

Wave trap is used to create a high impedance to the carrier wave high-frequency communication entering into unwanted destinations, typically substations. Carrier wave communication uses up to 150kHz to 800kHz frequency to send all the communication. This high-frequency damages the power system components which are designed to operate 50 or 60 Hz. Wave traps are also called line traps.

- Line traps are connected in series with the power lines and thus their coils are rated to carry the full line current.

- The impedance of a line trap is very low at the power frequency and will not cause any significant voltage drop.

Fig:- **WAVE TRAP**

- **CAPACITOR VOLTAGE TRANSFORMER:-**
  Capacitor Voltage transformer is a switchgear device used to convert high transmission class voltage into easily measurable values, which are used for metering, protection, and control of high voltage systems.

Additionally, a CVT is used as coupling capacitors for coupling high-frequency power line carrier signals to the transmission line.

In an electrical power substation, Capacitor Voltage Transformer in combination with Wave Trap is placed at the sending and receiving ends of the substation. At the receiving end, they are found just after the lightning arrester and before the line isolator.

Applications :

- Voltage Measuring: They accurately transform transmission voltages down to useable levels for revenue metering, protection and control purposes.

- **Insulation: They guarantee the insulation between the HV network** and LV circuits ensuring safety condition to control room operators.

- HF Transmissions: They can be used for Power Line Carrier (PLC) **coupling.**

- Transient Recovery Voltage: When installing in close proximity to HV/EHV Circuit Breakers, CVT's own High Capacitance enhance **C/B short line fault.**

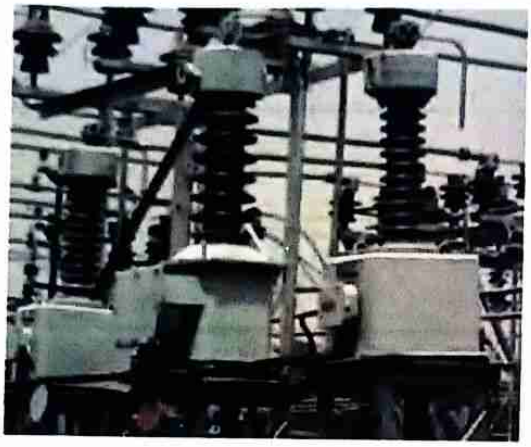

Fig:- **CAPACITOR VOLTAGE TRANSFORMER**

- **CURRENT TRANSFORMER :-**

These are the instrument transformer. The secondary winding of the **C.T is connected to the instruments placed on the panel boards.** The secondary winding is also connected to various relays for their operation. The major functions of a current transformer are metering **of power to track energy use, monitoring of current flow through an** energy grid, controlling of state or a circuit in a ground fault circuit interrupter and protection of instruments and appliances.

Fig:- **CURRENT TRANSFORMER**

- **CIRCUIT BREAKER:**

A circuit breaker is an automatically operated electrical switch designed to protect an electrical circuit from damage caused by overload or short circuit. Its basic function is to detect a fault condition and, by interrupting continuity, to immediately discontinue electrical flow. Unlike a fuse, which operates once and then must be replaced, a circuit breaker can be reset (either manually or automatically) to resume normal operation. Circuit breakers are made in varying sizes, from small devices that protect an individual household appliance up to large switchgear designed to protect high voltage circuits feeding an entire city.

Fig:- **VACUUM CIRCUIT BREAKER**

Operating principle Of Circuit breaker: A circuit breaker is a device which Makes or breaks a circuit either manually or by remote contact under normal (full load) conditions.

Breaks a circuit manually or by remote control under abnormal conditions. Breaks a circuit automatically under abnormal conditions i.e. fault conditions.

Thus circuit breaker is just a switch, which can be operated under normal and abnormal conditions both manually and automatically.

To perform the above operation a circuit breaker essentially consists of fixed and moving contacts, called electrodes. When fault occur on the power system, the trip coil of the circuit breaker is energized, which pulls apart the moving contacts from the fixed contacts, thus opens the circuit. When the moving contacts are separated from the fixed contacts, an arc is struck between them.

- **ISOLATORS:**

One of the cardinal measures for ensuring full safety in carrying out work on piece of equipment in electrical installation is to disconnect reliably the unit or section on which the work is to be performed from all other live parts of the installation. To guard against mistake it is necessary that an apparatus, which make visible break in the circuit, should do this. Such an apparatus is the isolator.

TYPES OF ISOLATOR:-

1. Tandem Isolator
2. Line Isolator
3. Main Bus Isolator

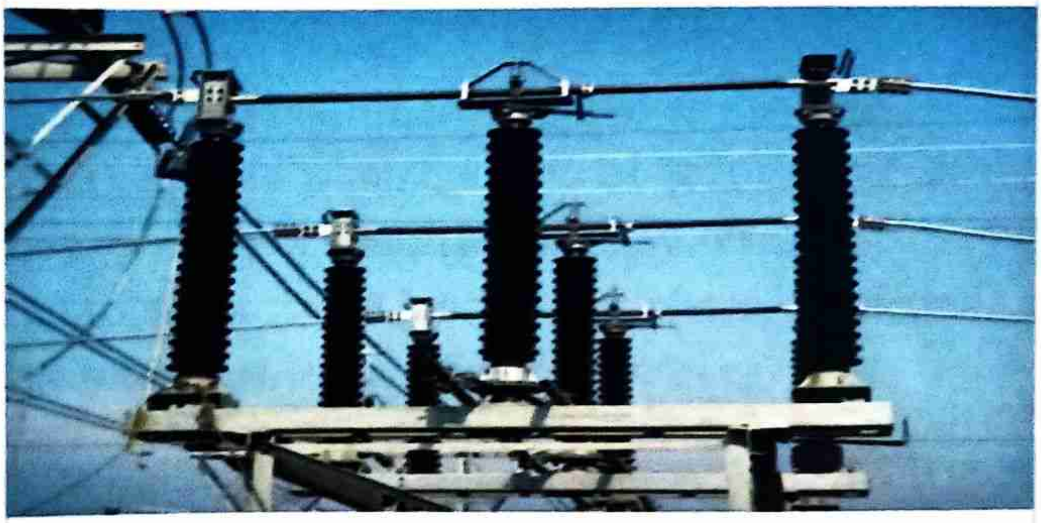

Fig:- ISOLATORS

RELAY PANEL:-

The relay panel consists of various types of relay whose function is being controlled in the control room. It is located at the back of the control room.

RELAYS

Relay is a device that detects the fault mostly in the high voltage circuit and Initiates the operation of the circuit breaker to isolate the defective section from the rest of the circuit.

Whenever fault occurs on the power system, the relay detects that fault and closes the trip coil circuit. This results in the opening of the circuit breaker, which disconnects the faulty circuit. Thus the relay ensures the safety of the circuit equipment from damage, which the fault may cause.

- **Distance relay:-**

The distance relay is also referred to as the impedance relay or distance protection element or voltage-controlled device. It's working mainly depends on the distance between the impedances of the points where the fault occurs and where the relay is installed (feeding point). The relay gets operated when the ratio of voltage and current is set to a predetermined value or less than the relay. This type of relay is used for backup protection, fault protection, phase protection, and main protection of transmission and distribution lines.

- **Differential relay:-**

Differential Relays are those relays which work on the 'difference' of the controlling (or actuating) signals. Differential Relays operate when the phasor difference of two or more similar electrical quantities exceeds a predetermined value. A current differential relay operates based on the result of comparison between the magnitude and phase difference of the currents entering in and leaving out of the system to be protected.

Under normal operating condition, the currents entering and leaving are equal in magnitude and phase so the relay is inoperative. But if a fault takes place in the system, these currents are no longer equal in

magnitude and phase. Hence the relay coil is energized under fault condition due to the difference quantity of the current. Thus, the relay operates and opens the circuit breaker so as to trip the circuit.

- **Backup relay:-**

Back-up protection is the name given to a protection which backs the primary protection whenever the primary protection failed to operate during fault condition. The back-up protection by definition is slower than the primary protection system. The design of the back-up protection needs to be coordinated with the design of the primary protection and essentially it is the second line of defense after the primary protection system. Here the backup protection and primary protection do not have anything common. Generally, the backup protection is located in different location. From the cost effect and economy point of view the backup protection will be implemented to protect the system against short circuit.

- **Overvoltage relay:-**
  Relay that serves primarily the same purpose as an over current relay except that it is connected in the line by a potential transformer which measures the voltage across the line. When an overvoltage exists the relay operates and opens the circuit breaker.
- **Relay valve:-**
  Protective relay valve are devices that are connected to instrument transformers to receive input signals and to circuit breakers to issue control commands for opening or closing. In some instances, the relays are also connected to the communication channels to exchange information with other relays.

DC SYSTEM

BATTERY BANK:-

The battery bank consists of a total of 110 batteries connected in series each of emf 2.2 Volt and 24 batteries of 2.2 Volt. The specific gravity of liquid inside the battery is 1250 kg per cubic meter. For the regular functioning of batteries they need to be charged regularly. This is done by two methods

1. BOOST CHARGING:- It is partial charge of storage of battery usually at a high rate for a short period. Mainly used for new batteries.
2. FLOAT CHARGING:- It means charging a battery at a similar rate as to its self discharging i.e. gradually loosing charge in running batteries. Care must be taken that charge rate should not be greater than discharge rate otherwise overcharging and possible damage or leakage rate otherwise overcharging and possible damage or leakage may occur.

Fig:- **BATTERY BANK**

CONTROL ROOM

The control room is the most important section of the Bihta grid. All faults can be detected and all transformers can be controlled from the control room. The control room consists of:

A) Relay and control panels

B) D.C. battery charger panel

Fig:- CONTROL ROOM

GIS(GAS INSULATED SUB STATION)

- Gas-insulated substations (GIS) have been used in power systems over the last three decades because of their high **reliability, easy maintenance, small ground space requirement,** etc.
- Gas Insulated Substation (GIS) also called SF6 Gas Insulated **Metal clad Switchgear is preferred for 12kV, 36kV, 72.5kV, 145** kV, 245 kV, 420 kV, and above voltages.
- In a GIS substation, the various equipment like Circuit Breakers, Bus bars, Isolators, Load break switches, Current transformers, Voltage transformers, Earthing switches, etc. are housed in separate metal-enclosed modules filled with SF6 gas. The SF6 gas provides the phase to ground insulation.
- **GIS can save up to 90% of space compared with air insulated** substation. It is particularly suitable for indoor and outdoor applications.

Fig:- GIS (GAS INSULATED SUB STATION)

SINGLE LINE DIAGRAM (SLD)

A Single Line Diagram (SLD) of an Electrical System is the Line Diagram of the concerned Electrical System which includes all the **required ELECTRICAL EQUIPMENT connection sequence wise** from the point of entrance of Power up to the end of the scope of the mentioned work.

CONCLUSION:

By doing summer training at the 132/33 KV Bihta Grid I came to know about the different types of equipments being used like isolators, circuit breakers, relays. I was exposed to different types of equipments and I also come to know about how the operating units are maintained and functioned. I also came to know about how the functions equipments kept in the switchyard are brought in the control room and operated from there was also taught about how the equipments were controlled if there was a fault in any of the circuits.

techgyan

CERTIFICATE
OF COMPLETION

Suryansh Verma

is presented with this certificate on successful completion of

WEB DESIGN WITH HTML/CSS

under the guidelines and norms of the program structure
conducted during the month of July & August 2022.

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
Techgyan Technologies

NETAJI SUBHAS INSTITUTE OF TECHNOLOGY,

BIHTA, PATNA

Approved by AICTE, New Delhi; Affiliated to Aryabhatta knowledge University Patna (Bihar)

REPORT

BASED ON THE TRAINING DONE AT **ABHYUDAY, IIT BOMBAY** IN THE MONTH OF JUNE-AUG 2022 IN **WEB DEVELOPMENT.**

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLGY

With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by:

Suryansh Verma (194002)

B.tech (EEE)

4th year/7th semester

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

techgyan

Abhyuday
IIT Bombay

CERTIFICATE
OF ACHIEVEMENT

THIS CERTIFICATE IS AWARDED TO

Md Tausif Mallick

in acknowledgement of participation in the

Web Development With HTML & CSS

Winter Camp successfully completed with **Techgyan Technologies**
in association with **Abhyuday, IIT Bombay** in the month of **December 2022.**

Certificate Number

TG-WC-1331

Winter Camp 2022

Sonam Sherwal
Coordinator
Techgyan Technologies

Drashti Abhilekh Sheth
Founder
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With specialization in

ELECTRICAL & ELECTRONICS ENGINEERING

Submitted by:

MD Tausif Mallick (194007)

B.tech (EEE)

4th year/7th semester

Submitted to:

Department of Electrical & Electronics Engineering

NSIT Bihta, Patna

Bihar State Power Transmission Company Limited

Registered Office :- 4th Floor
Vidyut Bhawan, Patna-21
CIN No. U74110BR2012SGC018889, Website- www.bsptcl.in

Electrical Executive Engineer
Transmission Division (WEST), Barrack No. 6,
Rajbanshi Nagar, Patna-23
Email : eeetdpatnawest@gmail.com

CERTIFICATE

This is to certify that Md. Tausif Mallick Branch B.Tech [E.E.E] Registration no./Roll No 194007 college NSIT, Bihta (patna) has successfully completed his/her in-Plant Training at ~~220~~/132/33 KV GSS Bihta (old) under transmission Division Patna West), from 13/05/2022 to 16/06/2022 in Bihar State Power Transmission Company Limited, Patna. During the period of training his/her behavior and conduct was V. Good

Place: Patna

Issue Date: 16/06/2022

EEE/TD/ Patna
L No. 373 Date 16.06.22

Electrical Executive Engineer
Transmission Division Patna (West)

Netaji Subhas Institute Of Technology, Bihta, Patna

Approved by AICTE, New Delhi; Affiliated to Aryabhatta Knowledge University, Patna (Bihar)

"SUMMER TRAINING REPORT"

Undertaken by

BIHAR STATE POWER TRANSMISSION COMPANY LIMITED, BIHTA
IN THE MONTH OF MAY-JUNE 2022

In partial fulfillment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

With specialization in

ELECTRICAL& ELECTRONICS ENGINEERING

Under the guidance of

Mr. Vikash Kumar (Assistant Engineer, 132/33kv Grid Sub-Station)

Mr. Shivesh Kumar (Junior Engineer, 132/33kv Grid Sub-Station)

Submitted by:

MD TAUSIF MALLICK(194007)

Submitted to:

Department of Electrical &Electronics Engineering

NSIT Bihta, Patna