Analysis Distribution System of Bangladesh Rural Electrification Board (BREB)

A Project and Thesis submitted in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering

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CERTIFICATION

This is to certify that this project and thesis entitled "**Analysis Of Distribution System Of Bangladesh Rural Electrification Board (BREB)"** is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on 20 February 2022.

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DECLARATION

The project and thesis entitled **" Analysis Of Distribution System Of Bangladesh Rural Electrification Board (BREB)"** submitted by **Md. Borhan Uddin**, ID No: 172-33-4117 and **Md. Al-Emran**, ID No: 172-33-4036 Session: Summer-2017 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering**.

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Dedicated to

Our Respectable Parents

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List of Abbreviations

- BREB- Bangladesh Rural Electrification Board
- PGCB- Power Grid Company of Bangladesh Ltd.
- AC- Alternating Current
- DC- Direct Current
- HVDC- High Voltage Direct Current
- KV- Kilo-Volt
- Hz- Hertz
- LA- Lightning Arrester
- CT- Current Transformer
- PT- Potential Transformer
- CVT- Capacitor Voltage Transformer
- CB- Circuit Breaker
- KWh- Kilo-Watt-Hour
- SF6- Sulfur Hexafluoride
- MVA- Mega Volt Ampere
- HT- High Tension Side of Transformer
- LT- Low Tension Side of Transformer

ACKNOWLEDGEMENT

First of all, I would like to express our sincere gratitude to Almighty Allah for his kindness, for which we successfully completed my internship work within the stipulated time and I apologize to him for any of our kind of mistakes. I would like to express my respect and admiration to my internship Supervisor Assistant Professor **Nusrat Chowdhury,** Assistant Professor, Department of Electrical and Electronic Engineering, Daffodil International University for his encouragement and for allowing me to be involved with my internship. I have completed my internship as per his instructions. I would like to express my sincere gratitude to **Md. Dara Abdus Satter**, Associate Head, Department of Electrical and Electronic Engineering, Daffodil International University, and **Tasmia Baten Dina**, Sr. Lecturer, department of Electrical and Electronic Engineering, Daffodil International University for their invaluable instructions, continuous guidance, constructive criticisms and thoughtful advice during pursuing this internship and preparation of this report.

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ABSTRACT

BREB (Bangladesh Rural Electrification Board), as a semi-government organization, with a specific objective to foster rural electrification, has over the years progressed well to expend areas electrified in the country aimed at fulfilling Government 1972 Constitutional provision.

Electricity supply systems owned and operated by PBS consist of 33 kilovolt (KV) lines, 33/11 KV substations, 11 KV lines, distribution transformers, low voltage lines, and low voltage service lines to customers.

Every sub-station is controlled by some experienced manpower, including one in charge,2/3 engineers, 4/5 technical staffs. All kinds of maintenance work of the substation done by them in addition, sub-station operation work done by the engineers. Every year annual maintenance work is done in every sub-station in according to the official schedule. This thesis report is prepared in according to the operation and maintenance procedure of 33/11KV Sub-Station, including emergency maintenance work.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Electricity is a force that drives the whole world. We can't things of a moment without electricity. Civilization without electricity we have to go back a thousand years. We depend on electricity at every step of modern life. This electrical energy comes to us in three steps, these are:

- Generation.
- Transmission.
- Distribution.

The main task is to understand the working environment and to prepare Internship report by which a graduate can show the ability in the field of engineering efficiently. For an engineer, internship is an important as his theoretical studies. I have done my internship at BREB. I was able to get learning about the company and how it works according to different demands by going to various substations at BREB. So, the basic ideas about BREB. Were covered in this internship book. The board objectives of this study are basically, this research are mainly every equipment of transmission substation.

1.2 Specified Objective

In order to pursue broader objectives, we need to find the following objectives, Followings these:

1. Study on Substation.
2. Study about drawing on substation.
3. To find out the current and potential market position of BREB.
4. To find out distinctive supply and services provided by BREB.

5. Instrollation and Maintenance on substation.

6. Test and check the equipments of Substation.
7. Identifying different types of instrument for operating this Substation.
8. Solving problem of substation.

1.3 Bangladesh Rural Electrification Board

Bangladesh Rural Electrification Board (BREB) was hired to manage the transmission system, Power Grid Company of Bangladesh Limited (PGCB), was formed in the process of restructuring the power sector of Bangladesh. In order to achieve commercial goals including increasing efficiency, establishing accountability and dynamism in fulfilling its objectives. Bangladesh Rural Electrification Board, commonly known as BREB, REB, PBS is a government organization BREB is responsible for rural electrification board, BREB is the largest power distribution in Bangladesh. BREB has brought all the 461 upazillas on grid under 100% electrification. Major general Moin Uddin is the present chairman of the board. Bangladesh rural electrification board was established in 1977.

1.4 History of BREB

Rural Electrification Board was established in 1977. It implements electrification of rural areas in Bangladesh and builds electrics lines and sub-stations. It counterpart Bangladesh power development board manages electric distribution in urban areas. Palli bidyut samities in a subsidiary or the board and acts as a consumer cooperative. The board has expanded rural electric connections rapidly. It has taken some market shares of solar energy.

1.5 Vision

The country's economy is improving by delivering electricity through relevant transmission, and important media.

1.6 Mission

Efficient and effective management of national power grid for reliable and quality transmission of electricity throughout the country, which is conducive to the development of the country.

1.7 Methodology

The research in this journal has been done with the help of various sources. During the preparation the paper was abused by the authorized persons of Rajendrapur 132/33 KV Gird Sub-Station. Data for the entire duration of the session were accurately selected. All though there were several sources, only a few of them are mentioned here, which are notable. The facts of this report have been collected from the following sources, which have been accepted:

1. Rural electricity Construction Insolation and Maintenance Department.
2. Member Service Department.
3. General Service Department.
4. Engineering Department.
5. Some facts collected from online collections, Journals and Brochures, which play a positive role. Are expending the scope of our knowledge and broaden our horizons.

1.8 Thesis outline

This thesis is organized as follows:

Chapter 1: Introduction

Chapter 2: Substation

Chapter 3: Rajendrapur 132/33 KV grid substation. Chapter 4: Earthing

Chapter 5: Protection System of Substation

Chapter 6: Conclusions

CHAPTER 2
SUBSTATION

2.1 Introduction

A substation is an important part of electrical generation, transmission, and distribution systems. Converts substation voltage from high to low, or the reverse, or perform any of various other important functions. The energy between the generation station and the consumer can be transmitted through different sub-station at different voltages. Firstly, electrical energy creates a power station. The power of the generation first comes through the substation or step-up substation. The step-up substation voltages move step by step and grid substation and gird substations come down step by step and through distribution substation. A substation may include a transformers to change its lining between high transmission voltages and lower distribution voltages.

Fig. 2.1 Rajendrapur 132/33 KV grid substation

2.2 Elements of Electrical Substation

The substation uses a variety of components. A substation has switching, protection, control equipment and transformers. Material protection in a substation is the first condition. All components are used for substation. We can choose a substation whether the substation is perfect or not based on the protection factor. We will give important device control equipment to the substation. We can control all the substation by controlling all the equipment. And we can use energy according to our needs. One of the substations main station transformer. We can compare transformer according to our ideas. There are usually two types of transformers. One is the step-up transformer and one is the step-down transformer.

Fig. 2.2 Elements of Rajendrapur 132/33 KV grid substation

2.3 Classification of substation

A substation is a means of transferring power from the generation end to the consumer end. It includes various types of equipment's like Generator, transformer, power cables, which helps in electrical transmission. Generation, Transmission and Distribution is the main function of the substation.

A substation that generates energy is called a generating substation. Similarly, the transmission substation transmits energy, and the distribution substation distribute

to the load. A generating substation produces energy and through the transmission substation, substation transmits the transmission substation power to the transmission substation, eventually the distribution substation distributes the electricity to the customers. The subclasses classifications of electrical substations is explained below.

2.3.1 Classification of Substation by Nature of Duty

Classification of Substation by Nature of Duty are explained below:

1. **Step-up Substation**: A power plant produces low voltage like 6.6, 11 or 33kv. However, step-up substation is done through step-up voltage and transmission line. This type of substation is built near the power station.

Fig. 2.3 Rajendrapur 132 KV Gas Insulated Substation

2. **Grid Substation:** The output of the step-up substation will be the input of the grid substation, which is a special media. The grid substation lowered the value of step-up voltages. The step-down voltages of the grid substation are

132, 66 or 33 KV. It worked after step-down the grid substation through the power to distribution substation. Which will gate the positive side of the substation.

Fig. 2.4 Rajendrapur 132/33 KV grid substation

3. **Step-down or Distribution Substation:** Step-down or Distribution Substation is setup near the load center where donations are made in the initial distribution is step-down for all sub transmission. The reservoir substation voltage is step-down and the power is delivered to the customer through the service. Substation step-down the voltages and distribute the power to consumer through the service line.

Fig. 2.5 Distribution Substation

2.3.2 Classification of Substation by Service Rendered

Classification of Substation by Service Rendered are explained bellow:

1. **Transformer substation:** Transformer substation transformers are used as instruments to convert from one voltage lining to another voltage lining.

2. **Switching Substation**: The voltage is used to switch to the power line without disturbing. Such substation is installed in the transition line.

3. **Converting Substation:** Substation conversion in DC power it can convert from this type of shaping frequency to high frequency.

2.3.3 : Classification of Substation by Operating Voltage

Classification of Substation by Operating Voltage are explained bellow:

1. **High Voltage Substation:** The operating voltage of the substation at high voltage exists between 11 KV and 66 KV.

2. **Extra-High Voltage Substation:** Additional high voltage substations typically have operating voltages between 132 kV and 400 KV.

3. **Ultra-High Voltage**: Operating voltage is very-high voltage are above at 400 KV.

2.3.4 : Classifications of Substation by Importance

Classifications of Substation by Importance are explained bellow:

1. **Grid Substation:** The gird substation is used to transferring the mass power from one mass point to another point. If an error occurs in the substation, it is exaggerated in the entire supply chain.

2. **Town Substation:** The town service station is used to bring down the voltage at 33kv to 11kv to further distribution the city.

2.3.5 : Classification of Substation by Design

Classification of Substations by Design are explained bellow:

1. **Indoor Substation:** In the indoor substation, the device is installed in the substation building. This type of substation is usually used for the voltage up to 11 KV when it is polluted by nearby air, dust. Grass, etc. It can be raised to 33kv or 66kv.
2. **Outdoor Substation:** Outdoor substation is divided into two types:

i. Pole Mounted Substation.

ii. Foundation Mounted Substation.

i. **Pole Mounted Substation:** The pole mounted substation is steep for power distributions in the area. A single stout pole or H-pole and 4-pole structures with relevant platforms are working for 25 KVA and 125 KVA, capacity transformers.

ii. **Foundation Mounted Substation:** The foundation mounted substation is used to mounting the transformers with using having capacity 33 KV volt or above 33 KV.

2.4 Types of equipment's in a substation

- Lightening arresters.

- Wave trap.
- Power transformer.
- Current transformer (CT).
- Potential transformer (PT).
- Line isolator with earthling switch.
- Circuit breaker.
- Bus isolator.
- 3 phase reactors.
- Capacitor voltage transformer (CVT).
- Power transformer.
- Capacitor bank.
- Insulator.
- Power cables, Control cables.
- Control and protection panel.
- DC battery and charging equipment.

2.5 Summary

Substation is a key part of electrical generation, transmission, and distribution systems. There are basically 3 types of substations: step-up substation, grid substation and step-down or distribution substation. Step-up substations convert voltage from low to high, Grid substations convert voltage from high to low and Step-down or Distribution substations convert voltage from high to low. Different types of classification are done through the work of the substation. Among them, a substation uses a lot of equipment. All equipment is used to maintain the safety, control, of the substation. This chapter deals with the basic substation layout, the classification of substation, modular design, the equipment's are uses in substation.

CHAPTER 3
RAJENDRAPUR 132/33 KV GRID SUBSTATION

3.1 Introduction

Some of the features of the assembly of apparatus used to change some characteristics (Ac to Dc, Voltage, Frequency, Power Factor etc.) are called electrical Sub-Station. A sub-station mainly has switching equipment's, protection, transformer and control equipment's. This is followed by substation described by the voltage class, their application in electrical systems, structural styling and most of the connection instructions using components. For example, transmission substation, gird substation, switching substation, outdoor substation, and converting substation etc.

3.2 About Rajendrapur 132/33 KV grid substation

At Rajendrapur grid-substation, there are incoming sources from kodda 150 MW power plant. Initially 132KV incoming sources from kodda 150 MW power plant are connected with Rajendrapur 132/33 KV Grid via O/H line. It is shown that incoming lines are connected with 132Kv bus bar by LA, PT, wave trap, earth switch, CT, CB, isolator. 132KV bus coupler is used for coupling 132KV bus bar 1 & bus bar 2. Then Grid transformers are connected with 132KV bus by isolator, CB, CT, LA and 33KV bus by CT, PT, CB, earth switch. In this substation three 132/33KV power transformers are used. The capacity of each transformer is 50/75 MVA. 33kv bus coupler is also used for coupling 33KV bus bar 1 & bus bar 2. At last, eleven outgoing lines are connected with 33KV bus bar by earth switch, CB, CT.

Fig. 3.1 Rajendrapur 132/33 KV grid substation

3.2.1 List of equipment and apparatus used in outdoor side

- 132 KV Bus Bar and Bus Coupler.
- 132 KV Vacuum Circuit Breaker.
- 132 KV SF6 Circuit Breaker.
- 132 KV Current Transformer (CT).
- 132 KV Potential Transformer (PT).
- 132 KV Capacitive Voltage Transformer (CVT).
- 132 KV Lightning Arrester (LA).
- 132 KV Isolator.
- Line Isolator with Earthing Switch.
- Capacitor Bank.
- 3 Phase Reactor.
- 20 MVA 132/33 KV Transformer.
- 12.5 MVA 132/33 KV Transformer.

3.2.2 List of equipment and apparatus used in indoor side

- Battery.

- Battery Charging Panel.
- 132 KV Control Relay and Meter Panel.
- 132 KV Protective Relay.
- LT Panel.
- 132 KV Circuit Breaker.
- 132 KV Bus Bar.
- 132 KV VCB.

3.3 Brief description and rating of equipment's

3.3.1 Power Transformer

A power transformer is the main center of a substation. A substation is used to step up or lower the voltage of a power transformer. A transformer is an electric elastic static device that is used to convert power from one circuit to another circuit without changing the frequency. In the initial step-up substation voltage of the transformer and the gird substation are used for the voltage of the transformer used for google and the distribution substation transformer for the voltage. And distribution substations transformer used for step-down the voltage. There is no rotating or moving part, so transformer is an aesthetic device. The transformer operates only one ac supply. There are basically two types of a transformer-

1. Step-up transformer.
2. Step-down transformer.

1. **Step-up transformer:** Step-up transformers are mainly used for step-up the voltage. The input of step-up transformer is low voltage and high current output of the step-up transformer converts high voltage to low voltage current. Converts the transformer low voltage primary side to the high voltage secondary side of the transformer.

2. **Step-down transformer:** Step-down transformers used for step-down voltage. Input of step-down transformer is high voltage and low current and output of step-down voltage is low voltage and high current. The voltage output and the low voltage initial side are converted to the low voltage side of the transformer. The transformer converts high voltage primary side to the low

voltage secondary side of the transformer.

Fig. 3.2 Power transformer of Rajendrapur substation

Rating of Transformer

Table 3.1: Rating of Transformer

Type	Rating
Voltage rating	132/33 KV
Colling system	ONAF
Code name	TR-01
Country of origin	Germany
Current Ratio	100/5
Vector diagram	DYN11
Rated frequency	50 Hz
Rated power	20MVA

3.3.2 Lightning Arrester (LA)

A lighting arrester is a device that uses an electrical substation to help substations conductor and insulator from the harmful effects of light. The lightning transmits to the restore in a short time. It makes high-voltage which is very dangers for substation. Lightning arrester protects the substation is very important for the substation and the high voltage it is installed earth. And lightning arrester safe the substation from the dangers effect of the lightning. So, lightning arrester is very important for substation and it's installed high voltage side on substation.

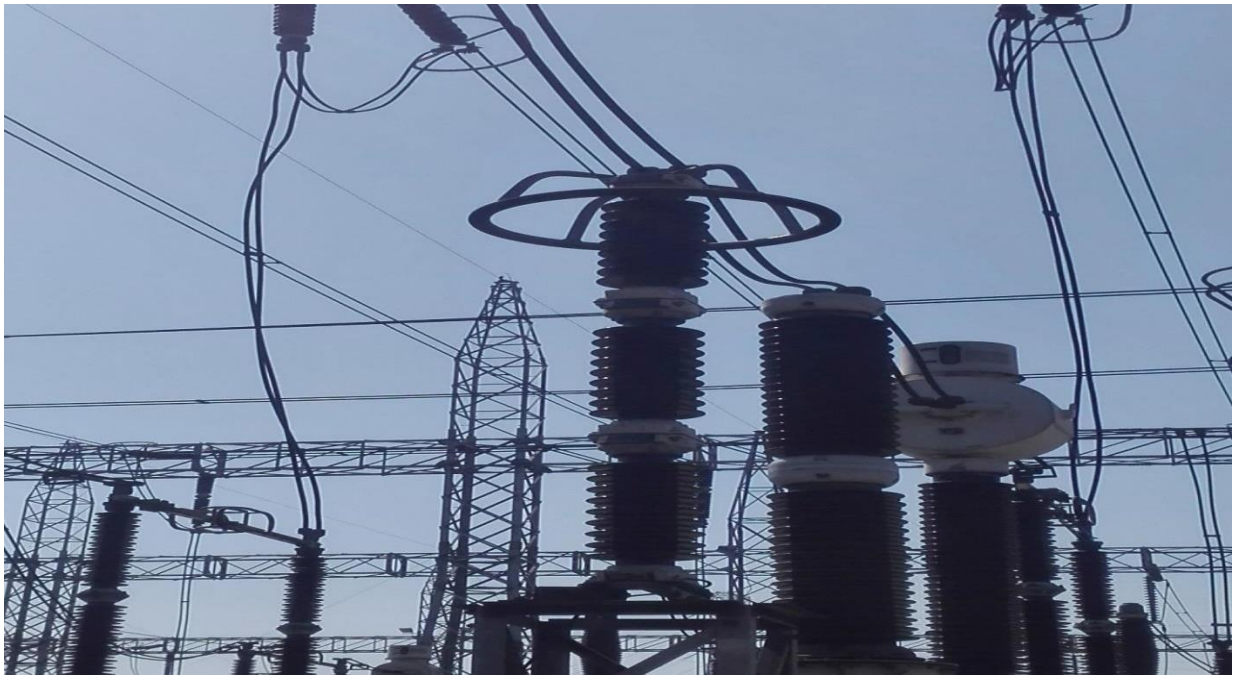

Fig. 3.3 Lightning Arrester (LA)

3.3.3 Current Transformer (CT)

Current transformer is a type of transformer used with measuring or protective devices where the gird source is used at a rate proportional to the primary current. It is playing a special role in measuring the current using a measuring device like ammeter. The transformation used for the current from a higher value within a proportionate current to a lower value. It measured the current by using the measuring device as like ammeter.

Type of Current Transformer (CT)

Based on the function performed by the current transformer it can be classify into two types:

1. Measuring current transformer.
2. Protective current transformer.

1. Measuring current transformer

The current transformer used in substation for the measuring of the current, energy and power. It measured the current, energy and power by using the measuring device such as ammeter. Measured current and power, and also current to check the amount of current flowing through the line, if the current flows at the required height, it gives a signal to relay and relay give signal to the circuit breaker of the system.

2. Protective current transformer

Protective devices current transformer used along with the protective equipment such as trip coil, relay etc. If the current flowing through the measuring current transformer is higher, it gives a signal to the protective current transformer and it gives a signal to circuit breaker and circuit breaker of the system.

Fig. 3.4 Current Transformer (CT)

Ratio of current transformer

Ratio of the current transformer where the secondary current under normal operation is partially proportional to the primary current. For the first core is 800-1600/1 would be like 800-1600A in a primary 1 A and secondary which will be effective would be 800-1600 turns of copper around the steel with winding wire between 800:1 to 1600:1 proportional ratio. The ratio for all the core is same as first core. The maximum system voltage is 245 KV and the normal system voltage is 132 KV. Rated S.T.C. is 40 KV for 1 second. Insolation level is 460/1050 KV. Rated frequency is 50 Hz.

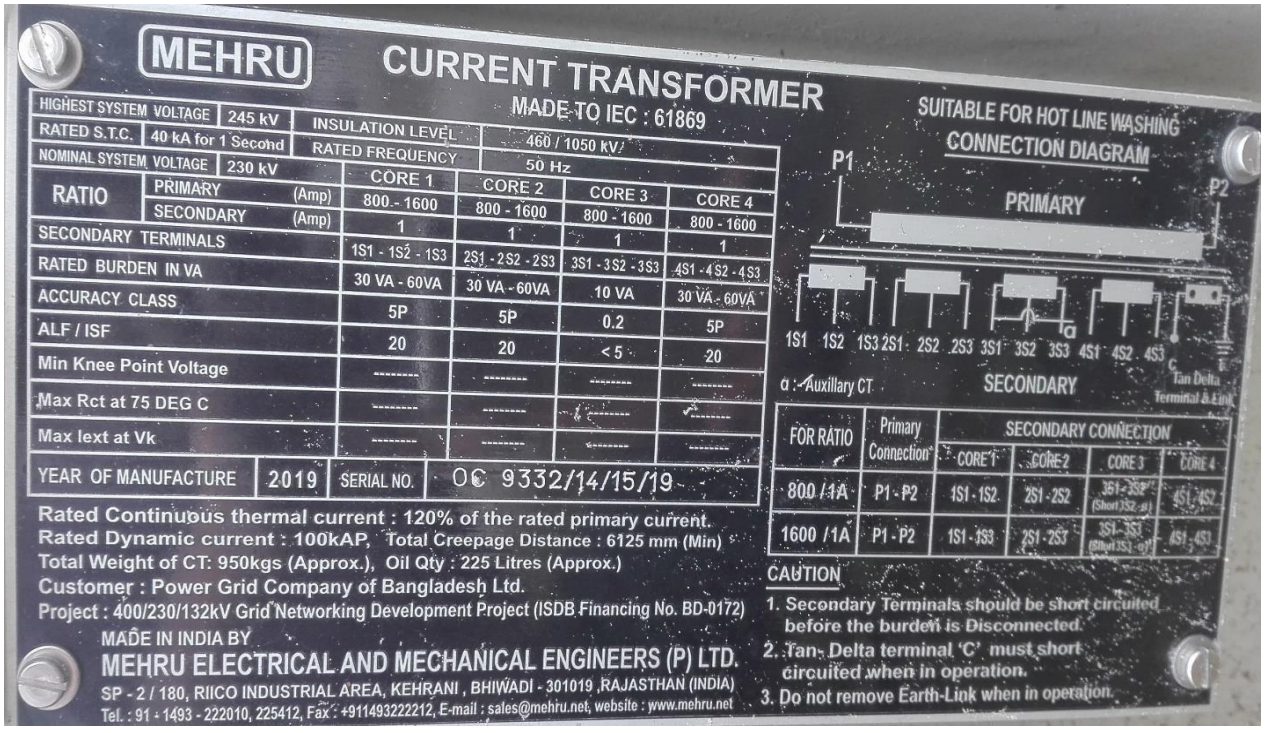

Fig. 3.5 Ratio of current transformer

3.3.4 Potential Transformer (PT)

The potential transformer can be defined as a device transformer used to convert from a higher quality to a lower quality. The transformer step-/down the voltage to a safe limit value which can be simply measured. Potential transformer lowers the voltage below a boundary that can be easily measured. The voltage by using measuring device as like a voltmeter, wattmeter and watt-hour meters etc.

Potential transformer used for voltage measurement. The potential transformer is known as voltage transformer and it is basically a step-down transformer with a very accurate turns ratio. The primary winding has a large number of turns and the secondary winding has a considerable small number of turns. The potential transformer used for measuring voltage, is a signal to the substation for the voltage is very high dangerous for the substation, and signals the circuit breaker of the relay system and then the circuit breaker is done. Then it gives a signal to relay and relay gives a signal to circuit breaker and then circuit breaker of the system. The insulation cost is also reduced by dividing the primary winding into the sections which reduced the insulation between the layers.

Fig. 3.6 Potential Transformer (PT)

Ratio of Potential Transformer

In ideal potential transformer, the primary and secondary voltage are accurately proportional to the primary voltage and are performed correctly in the case of phase opposite. However, due to the drop in primary and secondary voltage, it cannot be achieved in practice. However, the primary and secondary systems have been introduced.

Voltage Ratio Error: The voltage ratio error is pronounced relative to the measuring voltage and is given by the formula as shown below:

$$\text{Ratio Error} = \frac{\text{KtIs-Ip}}{\text{Ip}}$$

Table 3.2: Rating of Potential Transformer

Type	Potential Transformer (1,2)	Potential Transformer (3,4)
Voltage rating	132/33 KV	33/.33 KV
Code name	PT(HT)	PT(LT)

3.3.5 Relay

A Relay is an electromechanical device used to make or break an electrical connection. It can be controlled electricity as required by an electromagnet consisting of elastic moving mechanical parts. It is like a mechanical switch but we can control it with electrical power instead of turning it on or of manually. The relay input goes from the current to the CT and the voltage from the PT and the output goes to the trip signal to the circuit breaker. Every day the relay has a certain rating, if the range of the signal exceeds the rating of the relay, it will be activated and will start working.

There are several types of relays and each relay has its own application, a standard relay is made up of electromagnets which in general used as a switch. The relay is like a switch that electrically which control the circuits.

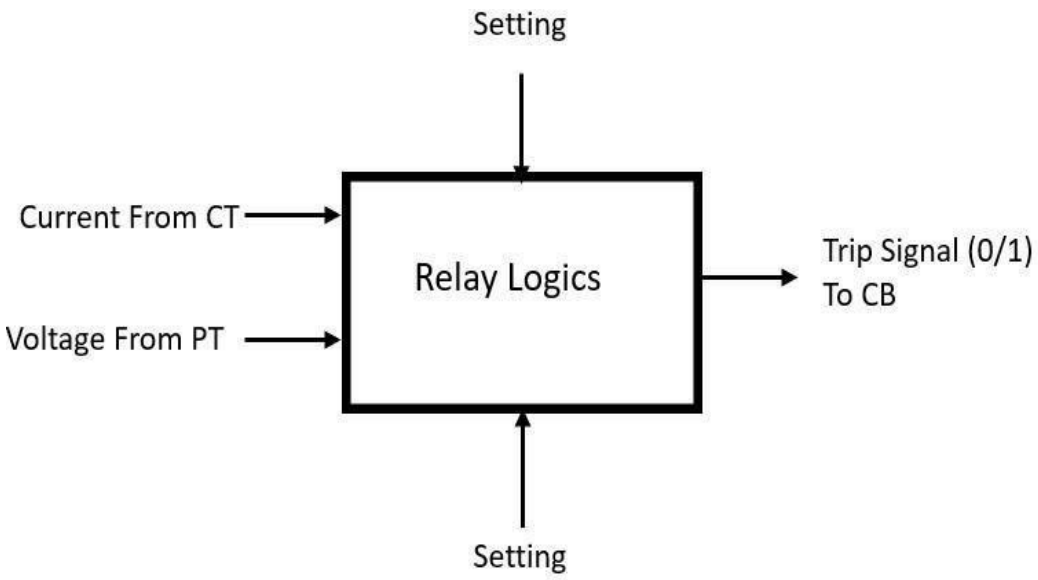

Fig. 3.7 conceptual diagram of relay

Working principal of relay

Relays are working with normally two conditions. These are:

1. Relay in normally close condition.
2. Relay in normally open condition.

1. Relay in normally close condition:

The relay usually cannot create a magnetic field when no in no voltage goes through the core in the close state and it does not act as a magnet and for this reason it cannot be interested in running fancy. Thus the armature is usually in the closed position at the initial connected position. And it usually works like a proximity switch when closed. As like a close switch in normally close condition.

2. Relay in normally open condition:

The relay is usually in the open state, when enough voltage come through to the core, it starts to create a magnetic field everywhere and it acts as like a magnet. And for this reason, the movable armature has been kept within its limits. It

becomes insolated with the magnetic field created by the core so the positions of the armature are changing. That's why, the movable armature is placed within its range, it gets involved to that magnetic field created by the core, therefore the position of the armature is being altered. Now, this relay is usually connected to the open pin. And it usually works like turning off the switch when off. As like a close switch in normally close condition.

Different types of relay

There are different types of relay that work on different principal. These are:

1. **Electrothermal relay:**

When two separate materials are joined it is decorated form into a bimetallic. When this strip is encouraged it goes to rest. This thing is used in such a way that the curved nature can establish a connection with the contacts.

2. **Electromechanical relay:**

Communication are made with the help of a few mechanical parts and based on the properties of an electromagnet. This is an important issue.

3. **Solid State relay:**

The electro-thermal-+--+ and electro-mechanical relay are in place to use mechanical parts. It uses semiconductor devices, which speed of device switching is more quiet and faster. Its main advantages are longer than other relationships and fast switching operations are completed. its more life length and quicker switching operation compared to other relays.

4. **Hybrid relay:**

This is done by a combination of both electro-mechanical and solid-state relays. This is why it works like an electrical device or like solid-state relays.

Types of Relay Based on the polarity:

There are different types of relay that depend based on the polarity. These are:

1. **Polarized relay:**

Like electrified relay electrical relay, it exists in both permanent magnets and electric magnets, the mobility of the mobility from the mobility coil depends on the polarization of the input signals.

2. **Non-polarized relay:**

The non-polarized relay coil has no polarization and if the polarity of the input signal is changed, its operation will remain unchanged and uniform.

3.3.6 Circuit Breaker

A circuit breaker is a switching device that interrupts an irregularly shaped current. It is a mechanical device that carries a high level of sound. And the additions additionally perform the function of a switch. Circuit breaker are primarily designed to shut of electrical circuits. In the event of a fault in the system, actually give a signal to the circuit breaker and open the circuit breaker circuit and shut down the system. So, the systems tire to save an important thing from circuit breaker damage.

Working Principle of Circuit Breaker

Circuit breaker consist mainly of stationary and moving contacts. These contacts are touching each other and carrying the present under normal circumstances. When closed, the current sounding contacts, called the electrode, assigns a spring composition to each other.

The circuit breaker can be turned on or off for switching and maintenance of the system during normal operating conditions. The arms of the circuit breaker can be opened or closed for a switching and maintenance of the system. To open the circuit breaker, only one shortening needs to be applied to the trigger. Separates from and opens the circuit breaker. Circuit breakers are basically used to protect the system from information's. The trip coil of the breaker gets energized and the moving contacts are getting separately from each other by some mechanism and

open the circuit breaker. Circuit breaker is mainly used for protect the system from any faults.

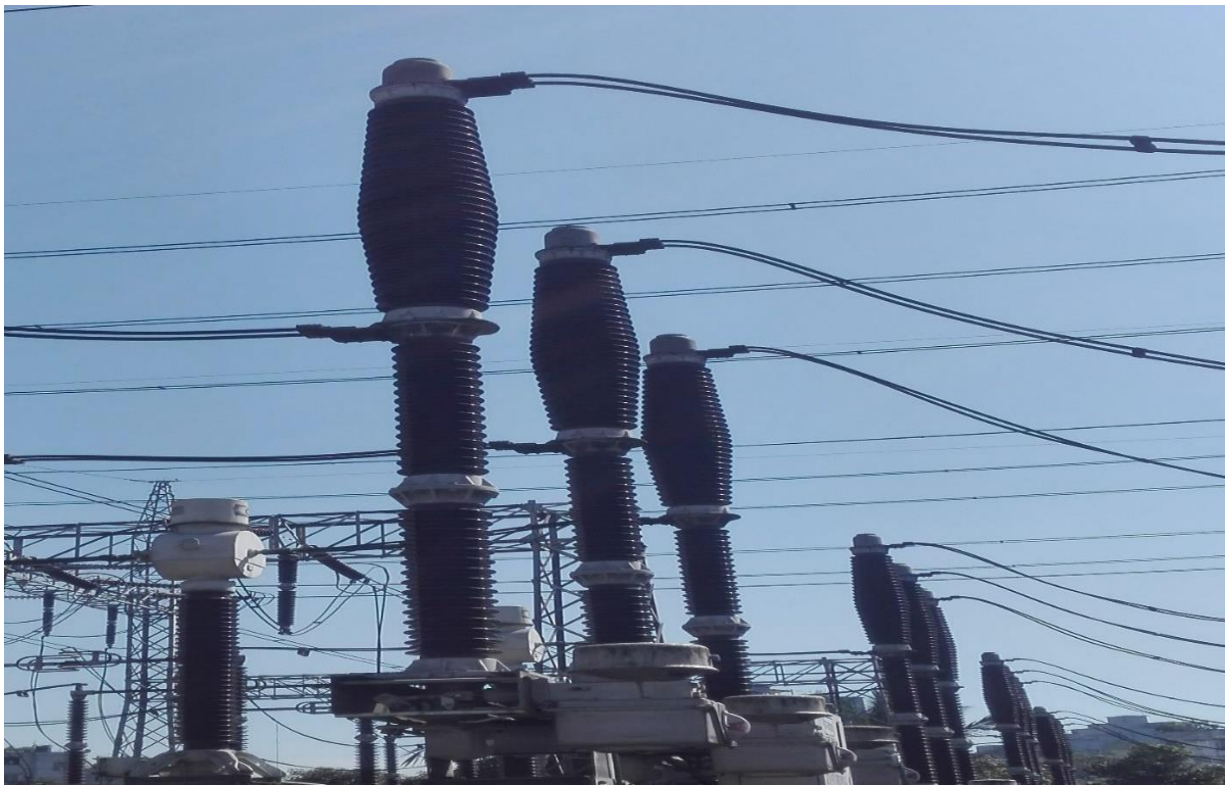

Fig.3.8 Circuit Breaker

Types of Circuit Breaker

The most general method of the classification of the circuit breaker is on the basis of the medium of arc extinction. Such types of circuit breakers are as follows bellow:

1. Oil Circuit Breaker.

i. Bulk Oil Circuit Breaker.

ii. Minimum Oil Circuit Breaker.

2. Minimum Circuit Breaker.
3. Air Blast Circuit Breaker.
4. Sulphur Hexafluoride Circuit Breaker (SF6).
5. Vacuum Circuit Breaker.

6. Air-Break Circuit Breaker.

One type of Circuit Breaker used in this substation. This are:

1. Sulphur Hexafluoride Circuit Breaker (SF6).

Table 3.3: Rating of SF6 circuit breaker on HT side

Type	SF6
Voltage rating	132 KV
Current rating	1250 A
Code name	OCB
Manufacturer	Siemens
Country of origin	Germany

1. **Sulphur Hexafluoride Circuit Breaker (SF6):** A circuit breaker where SF6 is used to extinguish gas is called SF6 circuit breaker. The SF6 (Sulphur hexafluoride) gas has remarkable dielectric, chemical and other physical properties that are characterized by its best pay off in other means of extinguishing oils such as oil. SF6 circuit breaker are basically divided into three types-

i. Non-puffer piston circuit breaker.
ii. Single- puffer piston circuit breaker.
iii. Double-puffer piston circuit breaker.

The circuit breaker which used air and oil as an insulating medium, their arc extinction force builds up was comparatively slow after the movement of contact separation. In the case of high voltage circuit breakers fast arc extinction properties are used which require less time for fast recovery, voltage builds up. SF6 circuit breakers have good possessions in this regard compared to oil or air circuit breakers. So, in high voltage up to 760 kV, SF6 circuit breakers is used.

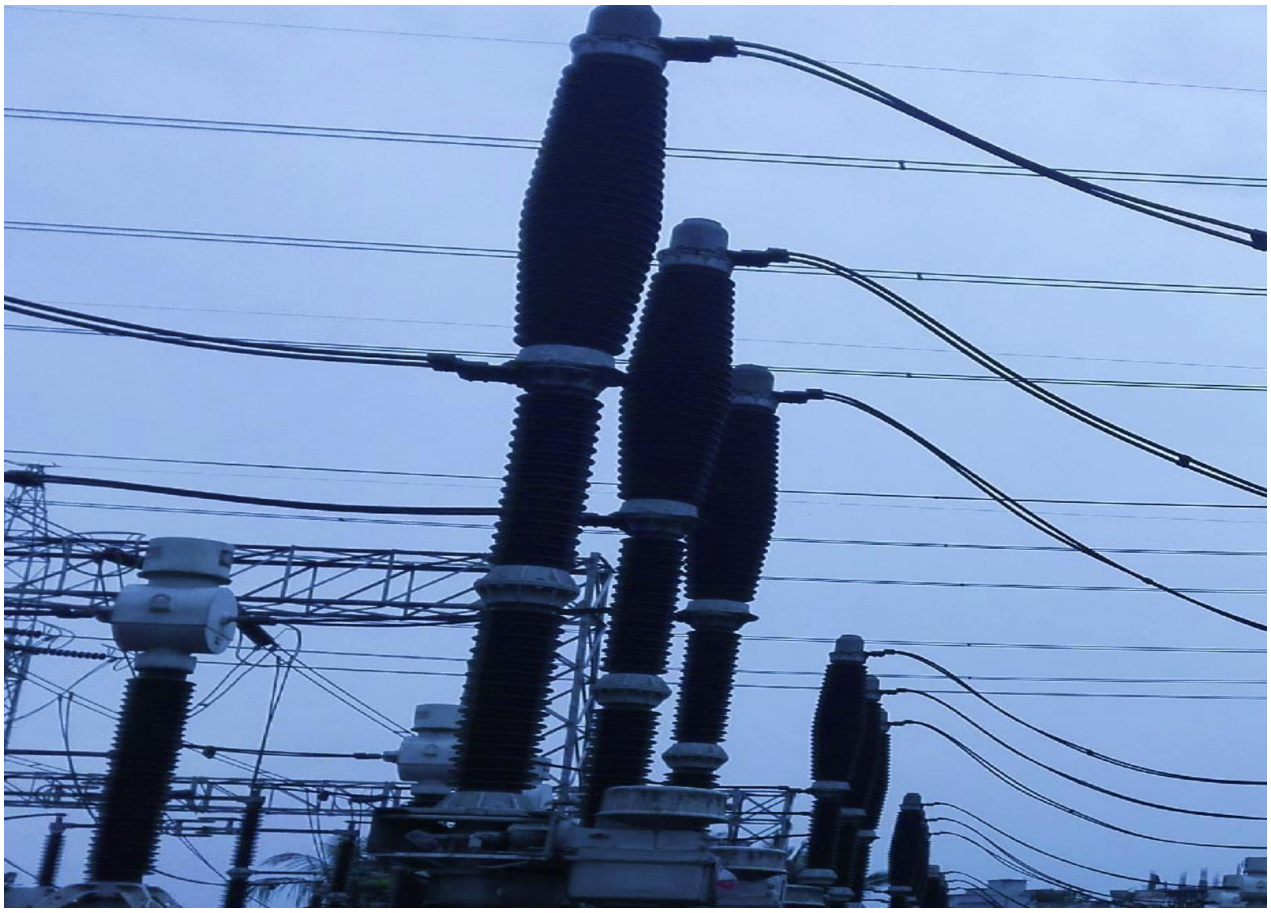

Fig.3.9 Sulphur Hexafluoride Circuit Breaker (SF6)

Table 3.4: Rating of SF6 circuit breaker on LT side

Type	SF6
Voltage rating	33 KV
Current rating	1250 A
Code name	VCB
Manufacturer	Siemens
Country of Origin	Germany

3.3.7 : Isolator

Isolator is a type of mechanical switch used to isolate a fraction of the electrical circuit when needed. Isolator switches is used to open a circuit. It is not fitted to open when it flows through a line. Normally, these are employed on circuit breaker both the ends so the circuit breaker repair can be done simply without any risk.

The station can be repaired without the use of different types of isolation depending on the condition of the system and as follows:

- Double Break Type Isolator.
- Single Break Type Isolator.
- Pantograph Type Isolator.

Fig. 3.10 Isolator

Rating of Isolator

Table 3.5: Rating of isolator

Type	Isolator
Rated Voltage	132 KV

Rated Current	2000 A
Rated Short time current / 3 Sec	40 KA
Rated Peak current	100 KA
Manufacturer	Siemens
Country of Origin	Germany

3.3.8 : Bus Bar

Electric bus bar is defined as a group of conductors or conductors used to collect electrical energy for incoming feeders and distribute them to outgoing feeders. It is only a fraction of the electrical energy. It carries electrical energy from one side to the other. In other words, it is a kind of electrical connection that fills all incoming and outgoing current. The bus bar system has isolator and circuit breaker. When any fault occurs in the bus bar the circuit breaker is tripped off and the faulty section of the bus bar is simply disconnected from the circuit.

The electric bus bar is available in cross-sectional, rectangular, circular and many more shapes. Originally copper and aluminum were used for the engineering of electric bus bars. Most bus bar use copper conductors, because copper conductor is less expensive from other conductors. So all equipment for conductors is very expensive and costly.

Fig. 3.11 Bus Bar

3.3.9 Bus Coupler

The bus coupler connects the two buses to a total of two power transfers between the two buses, but if there is a defect in the feeder of a bus and the bus supplying the fault of its complete feeder needs to be tripped. Then the connector operators and the erroneous system disconnect. Such a healthy yet can provide at least 50% load power. It the end of the brief general concept it would be that no bus coupler has NC during the healthy operation of the PS without suppling maximum power and in case of any fault do not arrange to disconnect the connected part of the bus couple and destroy the healthy part of the system and only one circuit breaker. However, the two buses are connected. The substation was used by the connectors for protection. The bus coupler also used for safety in the substation.

Fig. 3.12 Bus Coupler

3.4 Summary

The assembly of a machine used to change certain characteristics of an electrical supply (from Ac to Dc, Frequency, Voltage, Power Factor etc.) is called a substation. A substation includes cooperating switching equipment, protection, transformers and control equipment. A substation described by their voltage class, the method used to determine the style of the structure used in its application within the power system. The method used to convey most of the material. For example, switching substation, transmission substation, distribution substation, grid substation, indoor substation, outdoor substation, converting substation etc. All of equipment if an equipment error is added then all the subscription will be stopped. Substation is very important, because if one equipment is fault then all the substation will stop.

CHAPTER 4

EARTHING

4.1 Introduction

The process of transferring instantaneous discharge of electrical energy directly to the earth with the help of the low resistance wire is known as electrical earthling. This is the first and main condition for a substation. It is a very important part for the substation. The non-existent carrying part of the electrical earthing equipment or land supply is arranged through nature connections. It' has saved a substation in an unwanted state. When lightning strikes or any unforeseen situation occurs in a substation, in a very short period of time over voltage flows to the ground with the help of financial and save the substation. Very low earthing resistance 0.5 ohms is perfect for any station to prevent earthing. The lower the earthing resistance, the better the substation earthing.

Fig. 4.1 Earthing of Rajendrapur 132/33 KV grid substation

4.2 Types of Electrical Earthing

Electrical earthing can be classified into two types:

1. Nutural earthing.
2. Equipment earthing.

1. **Neutral earthing**: In neutral earthing, the neutral galvanized of the system is connected directly to the earth by means of an iron wire. This is called system earthing and this type of earthing is supplied through most systems that have star windings.

2. **Equipment earthing**: Equipment tooling by conductors is connected to all equipment. And conductors of all equipment connected with a mass. A substation has two types of mass and a sub-mass. The sub-mass is combined with the main mass. If a fault occurs in the equipment, the current of the short circuit flows to the conductors wire in a very short time. So, it will be beneficial to protect the system from any problem. Main mass and sub mass both are conductor.

4.3 Importance of Earthing

Importance of earthing are explained bellow:

1. Earthing short circuit protects a substation from current.
2. Earthing provides an easy the way for short-circuit current to flow even after intermittent failure.
3. The earthing is main and first safety for a substation.
4. Provides protection from high voltage for earthing device and light discharge.
5. I a substation fails to discharge from current and excess voltage than the other subwoofer helps, it is a very reliable matter.

4.4 Drawing of Earthing in Rajendrapur 132/33 KV grid substation

Fig. 4.2 Drawing of Earthing at Rajendrapur 132/33 KV grid substation

Drawing is a more important issue for the substation. The drawing needs to be prepared first before starting a substation and then all the work be complete

following the drawing. All work is done without following the drawing but this can be a result of the system. All the work is done without follow drawing it may be any foult the system. Rajendrapur 132/33 KV grid substation above ancon. All of work is done in this substation by follow this drawing. All the work in this drawing is clearly symbolic. Easy to work for everyone. In this drawing there are two types of conductor mass, one main mass and the other sub-mass. All components are connected to the subwoofer and all subwoofers are connected to the main mass.

4.5 Joint of sub mass with main mass in Rajendrapur 132/33 KV grid substation

Fig. 4.3 Joint of sub mass with main mass in Rajendrapur 132/33 KV grid substation

In this substation has two types of conductor mass. These are:

1. Main mass.
2. Sub mass.

All materials are connected by sub-mass and all of sub-mass is connected by main mass. Each tool is connected twice to the subwoofer. If one subwoofer fails to pass higher current and high voltage, another will do the work.

4.6 Resistance of Earthing

Earthing resistance substation is a major problem. It is completely depended on the soil, environments and the water level of the substation. Different types of soil, environment and water level in different regions. Thus the different in resistance to earthing in different areas. The earthing performance of a substation is depending on the resistance of that substation. The less resistance, the better the earthing of the substation. The less standard resistance for a substation is 0.5 ohm. So, we should try to keep the resistance is above under 0.5 ohm. If the resistance is above 0.5 ohm and above, then we have to maintain the resistance using the support amount or other system.

Fig. 4.4 Joint of sub mass with main mass in Rajendrapur 132/33 KV grid substation

4.7 Summary

The earthing substation is the first part and it is more important part for the substation. The non-carrying part of the electrical earthing equipment is done by

connecting the ground to the supply system. This protects a substation from unwanted action. When electrostatic or an unwanted situation occurs it occurs in a substance that in a very short time goes to the ground with the help of over voltage earthing and saves the substation. Very low earthing resistance, 0.5 ohm is suitable for any station with earthing resistance. Because the lower the resistance, the faster it will go to the ground at high voltage. And the substation is safe from accidents. So, we have to maintain the resistance perfectly and try to keep it at 0.5 ohm.

CHAPTER 5
PROTECTION SYSTEM OF SUBSTATION

5.1 Introduction

Electrical system protection is a branch of electrical engineering communicates that contracts with the protection electrical power systems protection of electrical systems from connections to the rest of the network by connecting the connected parts to the electrical system. The purpose of the security system is simply to keep the power system intact by isolating the faulty components, where the network can be maintained as long as possible. Thus, the security systems must implement a very practical and positive approach to clear the system of errors. The devices used to protect electrical systems from creating errors are called protection devices.

Protection systems generally comprise five components:

- The current and voltage transformers aroused to understand the safety pitfalls and to make a trip or disconnect to bring down the appropriate voltage to deal with the high voltages and conductors of the electrical power system.
- Protective relays to sense the fault and start a trip or disconnection.
- Circuit breakers are used to open or close the system based on relay and auto closure commands.
- Battery is provided power in case of power disconnection in the system.

Communication channels are active for analyzing current and voltage at remote terminals of a line and for remote gripping of equipment.

5.2 Transmission system protection

1. Typical transmission network architectures.
2. Protection basics and requirement.
3. Brief review of protection philosophies and schemes:
   - Unit/non unit.
   - Differential/over current.
   - Sectionalizes.
   - Recloser.
   - Fuses.
4. Summary of operation and setting of transmission protection.
5. Practical consideration.

5.2.1 Fault on power system

- Large fault is identified by currents.
- The fault current level is usually dramatically dropped away from the source due to the obstruction of the line or transformer shorts.
- There is a large voltage drop around the point of the curves.

5.2.2 Various types of line fault

Table 5.1: Various types of line fault

No	Type of fault	Operation of relay
1	Phase to earth fault	Earth fault relay
2	Phase to phase fault	Related phase over current relays
3	Double phase to ground fault	Related phase over current relays and earth fault relays

5.2.3 Overcurrent protection of transmission system

Over-current protection is basically to operate only under fault condition and therefore, relay cables should not be installed in the current as a way to protect the system against overload. Nonetheless, the relay setting is often closed to take into account, both in the current situation.

An over-current protection relay is a device capable of acquiring intelligence on a signal that it normally forms a current or voltage transformer, and the incoming signal performs a specific operation in conditions outside a predefined range. Typically, the relay acts as a tripping of a circuit breaker to close/open the electrical circuit.

5.3 Types of over current relays

Concerning the relay operating characteristics, over current relay may be confidential into three major groups:

- Definite current relay.
- Definite Time relay.
- Inverse time relay.

5.3.1 Definite current relay

Definite handles the current relay properly when the current default value is reached. Performs at specified times when the current exceeds its selection value. Its operation criterion only current level is constant while operating. The setting is chosen in such a way that the relay, which is installed on the furthest material, creates us. It will work for a\ small current value and relay operating current and gradually moving towards the source at each substation. Through this, the relay furthest from the source first disconnects the load at the site adjacent to the fault. In this case, the security setting is based on the maximum error level condition, when the error will not be cleared in a higher way, it will reach the security settings value.

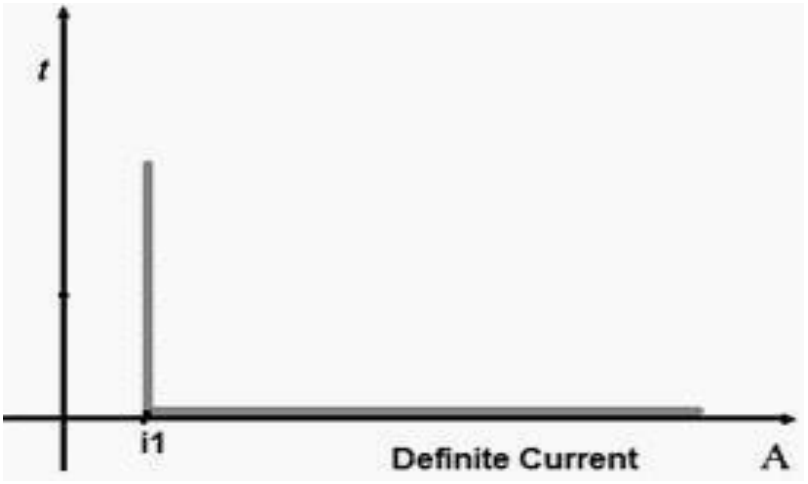

Fig. 5.1 Definite current relay

5.3.2 Definite Time relay

Such relay is made by applying an intentional time delay after receiving the current value so that a trip can be adjusted to the output topic at the exact time after the relay is picked up at a certain time. Therefore, it has a time setting adjustment and pickup adjustment. In electrical power system protection systems, sometime delay is used to operate certain relays. Definite time relays are people who work after a certain time.

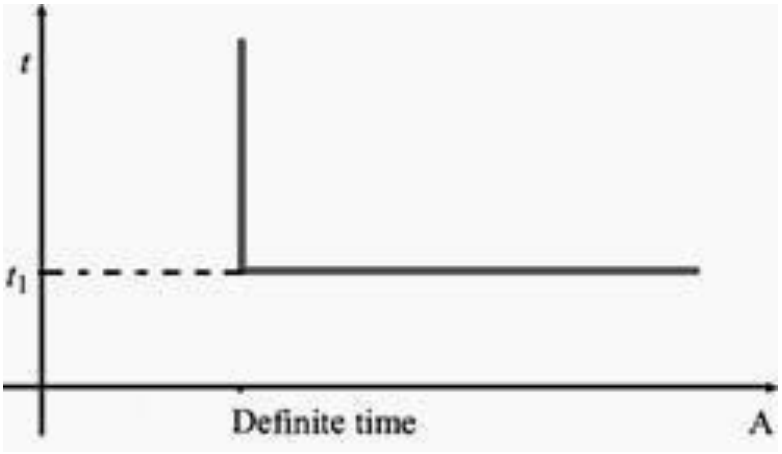

Fig. 5.2 Definite Time relay

5.3.3 Inverse time relay

Such operating time of relay is opposite to current. Thus, the current over-content of the height will handle faster than the following. The values are retrograde, very inverse and the final revers and the final revers type. The over-current relay can be

moved up (made slower) by adjusting the ‘operating time dial’. The minimum setting time is usually (fastest operating time) 0.5 and the slowest is 10.

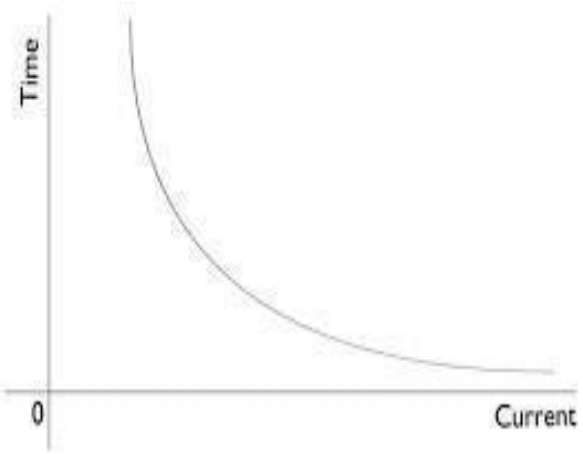

Fig. 5.3 Inverse time relay

5.3.4 Over current relay gives protection against

Over current include short circuit protection and short circuit can be:

- Phase faults.
- Earth faults.
- Winding faults.

5.3.5 Purpose of over current protection

The most important purposes of over current relay are:

- Detect abnormal conditions.
- Isolate faulty part of the system.
- Discrimination isolate only the fault section.
- Speed fast operation to minimized damage and danger.
- Dependability or reliability.
- Security or stability.
- Cost of protection or against cost of potential hazard.

5.3.6 Application of over current protection

Transformer protection:

- Used only when the cost of over current relay isn't justified.
- Extensively also at power transformer location for external fault back up protection.

Transmission protection:

Over current relays is very suitable for transmission system protection for the following:

- It is usually simple and inexpensive.
- So often the relay doesn't need to be indicative and so no PT is required.
- It is now possible to use separate sets of relays for two o/c relay for protection against interplanetary errors and a separate over current relay for ground fault.

Line protection

- In some transmission lines where the cost of the distance relay can't be adjusted.
- In most transmission lines the primary ground fault protection is used for the fault in the distance relay stage.
- Most lines with pilot relays for initial protection are used for ground backup protection.

Motor protection

- Used against over load and short circuit in stator winding of motor.
- Inverse time and instantaneous over current phase and ground.
- Over current relay used for motors above 1000 KW.

5.4 CT Ratio and Connection for Differential Relay

This simple thumb rule is that the current transformers of any star winding should be connected to the delta and the current transformers of any delta winding should be connected to the star. This is done to reject the zero chrome current for the relay circuit.

If connected to the CT star, the CT ratio for the delta to be connected will be 5A CT, the CT ratio will be 1A in general.

The earths curves are LLG and SLG faults. The presence of chrome separates the earths crutches.

5.5 Summary

The substation maintenance system is very important part of a substation. Because a substation is good or bad without a good protection which depends on their production. All substation a large number of protective device from one substation to protect them. There are many expensive devices in the substation, for example, if the transformer has some kind of fault occurs in the substation, they are harmful to that device and then it will stop the work of substation. For that many protection devices are used a substation as if any fault occurs then it can protect the system.

CHAPTER 6

CONCLUSION

6.1 Discussion

I have spent some remarkable days at Gazipur PBS-2 during my internship program. BREB is one of the best practical grounds for the Electrical and Electronic Engineers in our country. I must say the theories that I have learned at my University was practically observed by me at BREB.

I consider myself very much lucky to have my internship program with a reputed electricity distribution company like BREB. It gave me an opportunity to implement my theoretical knowledge in practically.

My achievements from BREB are follows:

- Industrial training provided by BREB has enriched my practical knowledge.
- It has enlarged my thinking capacity about practical operations of the different equipment.
- It has increased my confidence level for facing my job interview in the future.
- BREB gave me a unique experience of observing the equipment of substation.
- The friendly environment in Gazipur PBS-2 encouraged me to collaborate with each other. During the internship, I have learned a lot and gained practical knowledge during my internship at Gazipur PBS-2 which will help me in future life. I am forever grateful to Gazipur PBS-2.

6.2 Recommendation

BREB provides excellent internship opportunities, which is very helpful for gaining theoretical and practical knowledge. I think BREB should continue such

internship opportunities. It will be a great help for students who are about to finish their engineering course.

6.3 Future scope of the work

The outline of the previous trend will show more powerful relays with more processing power, more sophisticated running and will deliver better distribution protection presentation. Engineers can often go to first principal in power engineering and develop a better to M and C method of device citing more detailed features of maintenance and control equipment it will develop. Hover when conducting current and voltage measurements we reach the physical limit of what is possible as well as with dishonest returns. The speed protection function will be applied almost parallel to the fast-reactive ones under a certain speed, but al, in fact, the unit is often not the time. Condition, unit often, these algorithms will be engaged only for a limited period of time to boost the speed of operation when it's safe to do that. So reliable algorithms, however, are done based on the basic frequency elements in a classic way.

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