

INPLANT TRAINING UNDER TSECL (132KV GRID SUB-STATION SUB DIVISION)

Submitted in partial fulfillment of the requirements for the completion of

PROFESSIONAL TRAINING

By

Aditi Bhowmik (Reg. No. 41140005)



**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

SCHOOL OF ELECTRICAL AND ELECTRONICS

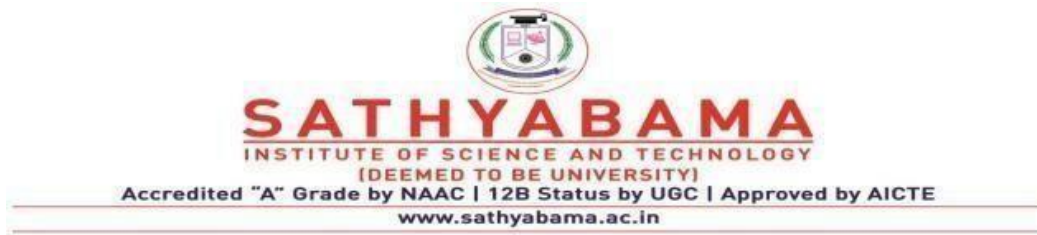
SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with grade “A++” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI – 600119

OCTOBER 2023



**DEPARTMENT OF ELECTRICAL AND
ELECTRONICS ENGINEERING**

BONAFIDE CERTIFICATE

This is to certify that this Internship Report submitted for EPICS is the bonafide work of ADITI BHOWMIK (41140005) who carried out the Internship during the period May 2023 to June 2023.

INTERNAL GUIDE

Dr. C. Bhuvaneswari, M.E., (Ph.D.)

HEAD OF THE DEPARTMENT

Dr. S. Radhika, M.E., (Ph.D.)

Submitted for Professional Training held on 03 October 2023

Internal Examiner

External Examiner

DECLARATION

I, **ADITI BHOWMIK (41140005)**, hereby declare that the Professional Training Report-I entitled “**INPLANT TRAINING UNDER TSECL (132KV GRID SUB-STATION SUB DIVISION)**”, done by me under the guidance of **Dr. C. Bhuvaneswari, M.E., (Ph.D.)**, is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in ELECTRICAL AND ELECTRONICS ENGINEERING.

DATE:

PLACE:

A handwritten signature in black ink, appearing to read 'Aditi Bhowmik', written over a horizontal line.

SIGNATURE OF THE CANDIDATE

ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

We convey our thanks to **Dr. N. M. Nandhitha**, Dean, School of Electrical and Electronics and **Dr. S. Radhika, M.E., (Ph.D.)**, Head of the Department, Dept. of Electrical and Electronics Engineering for providing us necessary support and details at the right time during the progressive reviews.

We would like to express our sincere and deep sense of gratitude to our Project Guide **Dr. C. Bhuvaneswari, M.E., (Ph.D.)** for her valuable guidance, suggestions and constant encouragement paved way for the successful completion of our project work.

We wish to express our thanks to all Teaching and Non-teaching staff members of the **Department of Electrical and Electronics Engineering** who were helpful in many ways for the completion of the project.

ABSTRACT

This Paper presents designing of 132/11 kV substation. For healthy operation of the system, the system should be balanced. The single line diagram is used for the substation to understand it's electrical system. The electrical equipment are represented by the symbols in a one-line diagram. The single line diagram is required so that we can understand the electrical system of the substation. The designing of single line diagram is necessary as it displays the right power distribution route from entering power source to each downstream load including the rating of each electrical apparatus. The single line diagram is a diagram in which the single line represents the three-phase power system. For maintaining and controlling, the power supply Substation apparatus are required. Reliability of the system is also dependent on Substation equipment sizing. By calculating the equipment sizing, we are able to find the rating of the equipment used in the substation. By doing equipment sizing the reliability of the system also, increases. The sizing of equipment is done so that the rating of equipment used in the substation can be selected. For different rating like 132kv, 11kv, the sizing of equipment like Lightning arrester, Wave trap, CVT, Current transformer, Isolator, Circuit breaker, Transformer etc. have been calculated.

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO.
1	INTRODUCTION ABOUT TSECL	10
	1.1 BRIEF HISTORY OF TSECL	
	1.2 MISSION, VISION AND GOAL OF TSECL	
2	OVERVIEW OF SUB-STATION	12
	2.1 SUB-STATION TRANSFORMER CAPACITY	
	2.2 INCOMING AND OUTGOING FEEDERS	
	2.3 TRANSFORMER	
	2.4 INSTRUMENT TRANSFORMER	
	2.5 BUSBAR	
	2.6 INSULATOR AND ISOLATOR	
	2.7 CIRCUIT BREAKER	
	2.8 MISCELLANEOUS EQUIPMENTS	
3	SPECIFICATION AND RATING	34
	3.1 SPECIFICATION OF POWER TRANSFORMER	
	3.2 SPECIFICATION OF CURRENT TRANSFORMER	
	3.3 SPECIFICATION OF VOLTAGE TRANSFORMER	
	3.4 SPECIFICATION OF CIRCUIT BREAKER	
4	POWER MAP	37
	4.1. POWER MAP OF TRIPURA	
	4.2. SINGLE LINE DIAGRAM	

5	PRECAUTION AND CONCLUSION	40
	5.1. SAFETY PRECAUTION	
	5.2. CONCLUSION	
	5.3. INTERNSHIP	
	COMPLETION CERTIFICATE	
	REFERENCE	43

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
5.1	INTERNSHIP COMPLETION CERTIFICATE	40



Fig: 132KV Grid Sub-Station Sub Division, 79 Tilla, Agartala, Tripura

CHAPTER 1

INTRODUCTION ABOUT TSECL

1.1. BRIEF HISTORY OF TSECL

Tripura is a land logged state surrounded by Bangladesh and Assam by four sides, sharing its international boundary with Bangladesh. Despite of the fact that it lacks industrial development somehow it's blessed in the sector of power generation thus contributing its share in overcoming the power crisis in India. Though due to its economical reasons, the power scenario here is not so much developed and thus suffers continuity in service and production but the resources stored below the soil of this state promises a bright future in the upcoming days. Agartala being the capital of the state, holds the region of maximum consumption of power has increased by a considerable amount over the past few decades & still on rise.

Tripura State Electricity Corporation Limited is a State Government company, incorporated on 09 Jun, 2004. It's a public unlisted company and is classified as company limited by shares'.

Company's authorized capital stands at Rs 100000 and has 66.57539% paid-up capital which is Rs 66575.39. Tripura State Electricity Corporation Limited is majorly in Electricity, Gas & Water companies business from last 19 years and currently, company operations are active. The last reported AGM (Annual General Meeting) of Tripura State Electricity Corporation Limited, per our records, was held on 27 September, 2022. Tripura State Electricity Corporation Limited has three directors - Sarvjit Singh Dogra, Nabanita Roy, and others.

Company is registered in Shillong Registrar Office. The Corporate Identification Number (CIN) of Tripura State Electricity Corporation Limited is U40101TR2004SGC007434. Tripura State Electricity Corporation Limited registered address is BIDYUT BHAVAN, BANAMALIPUR, TRIPURA WEST, DIST AGARTALA TR, 799003.

1.2. MISSION, VISION AND GOAL OF TSECL

The present day electrical power system is ac. i.e. electric power is generated, transmitted, and distributed in the form of Alternating Current. 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 place 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 (Say 220KV to 132KV) for transmission of electric Power. Similarly near the consumer's localities, the voltage may have to be stepped down to utilization level. Suitable apparatus called sub-station again accomplishes this job.

Keeping the power shortage of the State in mind, the govt. has put up many grid substations and state load dispatch centers, and one of them is at 79 TILLA, Agartala. The peak load of this substation is 70 MW for 132/33 KV transformer and 10 MW for 132/11KV transformer in 2017. During Durga Puja hours, the peak load reaches up to 238 MW. The allowed power for the state of Tripura by the Ministry of Power is 120MW but due to increased consumption in the recent years the mark reaches up To 129 MW, thus providing a deviation of 9 MW. Substation being an important part of power system, its main function is to contact & control the transmission lines, sub-transmission feeders, generating circuits & transformer. To provide maximum flexibility, continuity safety and control with minimal capital investment accompanied but satisfaction of the system requirements is its main objective. The grid substation at 79 TILLA, receives power from the gas thermal power plants located at RUKHIA (Govt. of Tripura), Ramchandra Nagar (NEEPCO) in Tripura. Intake of power happens from over 132 KV double circuit line and that from Ramchandra Nagar over double circuit lines.

CHAPTER 2

OVERVIEW OF THE SUBSTATION

2.1. SUB-STATION TRANSFORMER CAPCITY

The grid substation having capacity of six transformers:

1. 132/33kv (20/25 MVA)
2. 132/11kv (15/20 MVA)
(step down two transformers 33/11kv (7.5 MVA))
3. 132/33kv (15 MVA)
4. 132/33kv (15 MVA)
5. 132/33kv (20/25 MVA)
6. 132/33kv (25 MVA)

2.2. INCOMING AND OUTGOING FEEDERS

In a substation, there is a bus which is fed power through one or more incoming lines via transformer at local /remote end. These sources of power to the bus are called incomers. If the source is form another bus via interconnecting lines then it is called interconnector. This power is fed to the bus is taken out to respective loads through lines normally referred as outgoing feeders or simply feeders. So basically the incomer supplies power to the substation bus and feeders (outgoing feeder) takes out that power from the bus to respective loads. 132kv Grid Substation 79 Tilla, receives power through four incoming 132kv feeder which are connected with generating station. Both incoming and outgoing feeder depends upon the availability and demand for power since the feeder is connected with NORTH EASTERN REGIONAL GRID outside, Tripura.

DETAILS OF INCOMING FEEDER:

The substation receives power from total 8 nos. of 132KV lines coming from different substation:

1. Rokhiya -1 and 2 (through double circuit line)
2. Ramchandranagar-1 and 2 (through double circuit line)
3. Surjoymaninagar -1 and 2 (through double circuit line)
4. B/nagar
5. Dhalabil

DETAILS OF OUTGOING FEEDER:

33KV outgoing feeder delivers power to 33/11KV substation located at:

1. Rampur Feeder
2. Pragati Feeder

3. MES Feeder
4. Budhjungnagar Feeder
5. Durjaynagar Feeder
6. College Tilla Feeder
7. Capital Complex I Feeder
8. Banamalipur Feeder
9. Capital complex II Feeder
10. Mohanpur Feeder
11. Spare Feeder

11KV outgoing feeder feed power to 11/0.4 substation at:

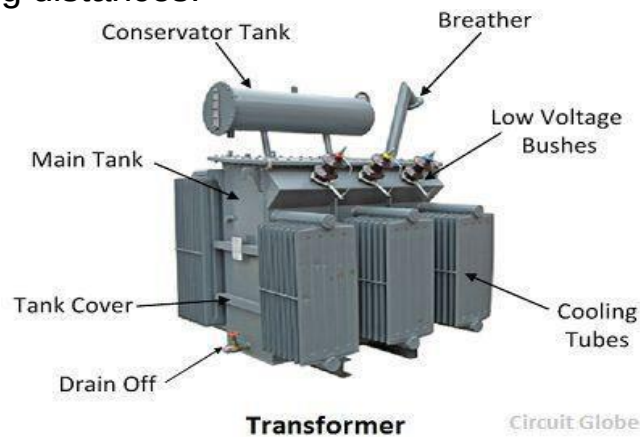
1. GB Feeder
2. AGMC Feeder
3. Secretariat Feeder
4. ILS Hospital Feeder
5. Sarkarpara Feeder
6. G.B Feeder
7. Kalikapur Feeder
8. I.T.I Feeder
9. G.B Special Feeder
10. Lichu Bagan Feeder



Fig: Feeder

2.3. TRANSFORMER

Transformer is a device that transfers electric energy from one alternating current circuit to one or more other circuits, either increasing (stepping up) or reducing (stepping down) the voltage. Transformers are employed for widely varying purposes; e.g., to reduce the voltage of conventional power circuits to operate low-voltage devices, such as doorbells and toy electric trains, and to raise the voltage from electric generators so that electric power can be transmitted over long distances.



Transformers through electromagnetic induction; i.e., as the magnetic lines of force (flux lines) build up and collapse with the changes in current passing through the primary coil, current is induced in another coil, called the secondary. The secondary voltage is calculated by multiplying the primary voltage by the ratio of the number of turns in the secondary coil to the number of turns in the primary coil, a quantity called the turn ratio.



Fig: Transformer

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

USE OF TRANSFORMER:

Generation of electrical power in low voltage level is very much cost effective. Theoretically, this low voltage level power can be transmitted to the receiving end. This low voltage power if transmitted results in greater line current which indeed causes more line losses.

TYPES OF TRANSFORMER:

A. Step Up Transformer and Step-Down Transformer:

Step up transformers converts the low voltage (LV) and high current from the primary side of the transformer to the high voltage (HV) and low current value on the secondary side of the transformer.

Step down transformers converts the high voltage (HV) and low current from the primary side of the transformer to the low voltage (LV) and high current value on the secondary side of the transformer

B. Three Phase Transformer and Single-Phase Transformer:

A three phase transformer is generally used in three phase power system as it is more cost effective than single phase transformers. But when size matters, it is preferable to use bank of three single phase transformer vs a three phase transformer, as it is easier to transport than one single three phase transformer unit.

BASIC PARTS OF TRANSFORMER:

1. LAMINATED CORE:

The core acts as a support to the winding in the transformer. It also provides a low reluctance path to the flow of magnetic flux. It is made of laminated soft iron core in order to reduce eddy current loss and Hysteresis loss. The composition of a transformer core depends on factors such as voltage, current, and frequency.

2. WINDINGS:

There are two types of winding:

Primary winding- These are the winding to which the input voltage is applied.

Secondary winding- These are the winding to which the output voltage is applied.

3. INSULATING MATERIALS:

Insulating paper and cardboard are used in transformers to isolate primary and secondary winding from each other and from the transformer core.

4. TRANSFORMER OIL:

Transformer oil or insulating oil is an oil that is stable at high temperatures and has excellent electrical properties. It is used in oil filled transformer.

The tank is filled with transformer oil; & sealed. It is a mineral oil obtained by refining crude petroleum. It serves the following purposes:

- A.** Provides additional insulation
- B.** Carries away the heat generated in the core & oils

Good transformer oil should have:

- A. High dielectric strength.
- B. Low viscosity to provide good heat transformation.
- C. High flash/fire point
- D. Free from inorganic acid, alkali & corrosive sulphur
- E. Free from sludging under normal operating condition.

It is Important to check the oil in regular intervals.

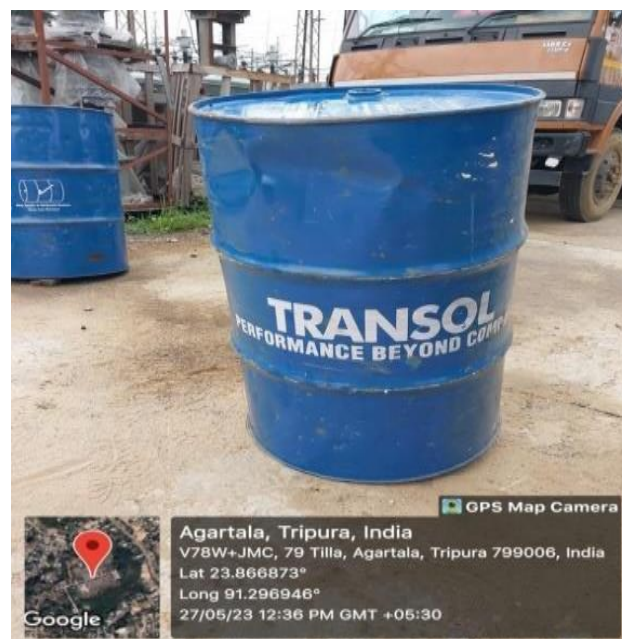


Fig: Transformer Oil

5. TAP CHANGER:

The output voltage of transformers varies according to their input voltage and the load. During loaded conditions, the voltage on the output terminal decreases, whereas during off-load conditions, the output voltage increases. In order to balance the voltage variations, tap changers are used.

6. CONSERVATOR:

The conservator conserves the transformer oil. It is an airtight, metallic cylindrical drum that is fitted above the transformer. The conservator tank is vented to the atmosphere at the top, and the normal oil level is approximately in the middle of the conservator to allow the oil to expand and contract as the temperature varies. The conservator is connected to the main tank inside the transformer, which is completely filled with transformer oil through a pipeline.

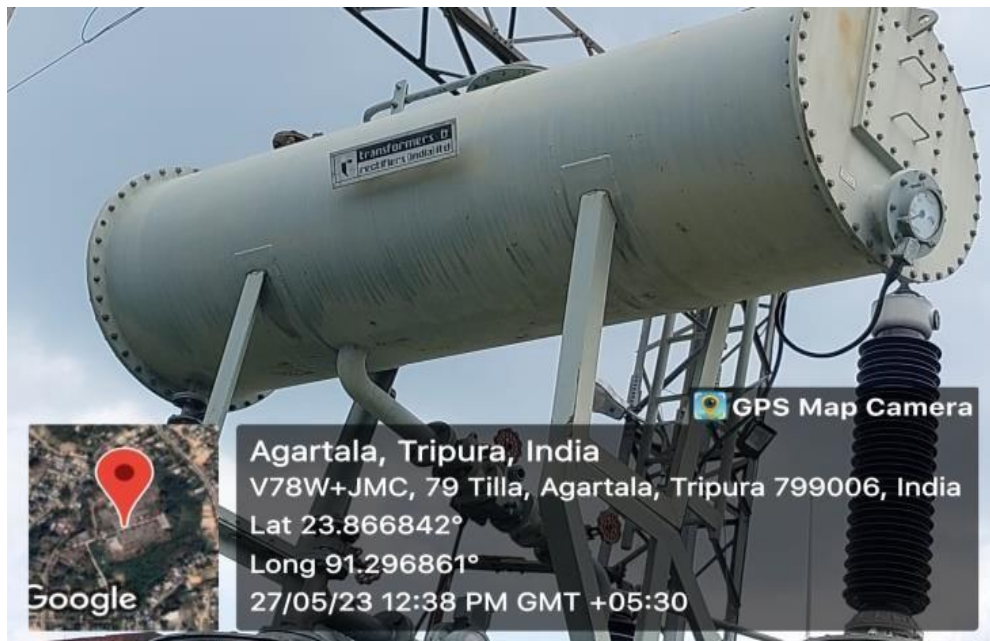


Fig: Conservator

7. BREATHER:

The breather controls the moisture level in the transformer. Moisture can arise when temperature variations cause expansion and contraction of the insulating oil, which then causes the pressure to change inside the conservator. Pressure changes are balanced by a flow of atmospheric air in and out of the conservator, which is how moisture can enter the system.

When the temperature changes, expansion of contacts & there is a displacement of air. When the transformer cools the oil level goes down 7 air is drawn in. The oil should not be allowed to come in contact with the atmospheric air as it may take moisture which may spoil its insulating properties. Air may cause acidity or slugging of oil, so, the air coming in is passed through an apparatus called breather for extracting moisture. The breather consists of a small vessel, which contains a drying agent like Silica gel crystal.



Fig: Breather

8. BUCHHOLZ RELAY:

The Buchholz Relay is a protective device container housed over the connecting pipe from the main tank to the conservator tank. It is used to sense the faults occurring inside the transformer. It is a simple relay that is operated by the gases emitted during the decomposition of transformer oil during internal faults. It helps in sensing and protecting the transformer from internal faults.

It is a gas actuated relay installed in oil immersed transformers for protection against all kinds of faults. Any fault produces heat & forces the evolution of gas. It mainly consists of two float switches placed in the connecting pipe between the main tank & conservator. Buchholz relay is completely filled up with oil & the conservator tank is about half full. When the fault occurs, it produces gas & collects in the container so the oil level gradually falls & closing the alarm circuit. If no attention is paid to it, the gas collection will be more & closes another circuit which will cut out the transformer from the line.



Fig: Buchholz Relay

9. EXPLOSION VENT:

The explosion vent is used to expel boiling oil in the transformer during heavy internal faults in order to avoid the explosion of the transformer. During heavy faults, the oil rushes out of the vent. The level of the explosion vent is normally maintained above the level of the conservatory tank.

10. COOLING TUBES:

Cooling tubes are used to cool the transformer oil. The transformer oil is circulated through the cooling tubes. The circulation of the oil may either be natural or forced.

11. TEMPERATURE INDICATOR:

These are generally precision instruments. A temperature indicator of power transformer is specially designed to protect transformer in addition to its temperature indication and cooling control features.

There are two temperature indicators on the transformer tank one for oil temperature measurement & another for core temperature measurement. In 31.5MVA transformers, when oil temperature reaches 65 degree C, cooling fans start automatically but when the oil temperature rises at 75 degree C or winding temperature rises at 85 degree C, the alarm circuit will be closed. Further increase in oil or winding temperature the circuit will trip automatically. Cooling fans are placed beside the radiator tube, which are used for oil cooling. Generally the cooling fans start automatically but when needed, it can be started manually.

2.4. INSTRUMENT TRANSFORMER

Instrument Transformers are used in AC system for measurement of electrical quantities i.e. voltage, current, power, energy, power factor, frequency. It is also used with protective relays for protection of power system. Basic function of Instrument transformers is to step down the AC System voltage and current. The voltage and current level power system is very high. It is very difficult and costly to design the measuring instruments. Generally, measuring instruments are designed for 5 A and 110V.

Types of Instrument Transformers Instrument transformers are of two types:

A. Current Transformer (C.T.):

Current transformer is used to step down the current of power system to a lower level to make it feasible to be measured by small rating Ammeter.

A current transformer is essentially a step-down transformer. It steps-down the current in a known ratio, the primary of this transformer consist of one or more turn of thick wire connected in series with the line. The secondary consist of thick wire connected in series with line having large number of turn of fine wire and provides for measuring instrument, and relay a current, which is a constant fraction of the current in the line. Current transformers are basically used to take the readings of the currents entering the substation. This transformer steps down the current from 800 amp 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 of current
- d. Protection current circuits when current are passed through protective relays.



Fig: Current Transformer (CT)

B. Potential Transformer (P.T.):

Potential transformer is used to step down the voltage of power system to a lower level to make it feasible to be measured by small rating voltmeter i.e., (110-120) V voltmeter.

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

These are used for

- a. Measurement of voltage
- b. Provide secondary voltage for protection purposes and measurements.



Fig- Potential Transformer (PT)

CAPACITOR VOLTAGE TRANSFORMER

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



Fig: Capacitor Voltage Transformer

2.5. BUSBAR

In electric power distribution, a bus bar (also bus bar) is a metallic strip or bar, typically housed inside switchgear, panel boards, and bus way enclosures for local high current power distribution. They are also used to connect high voltage equipment at electrical switchyards, and low voltage equipment in battery banks. They are generally uninsulated, and have sufficient stiffness to be supported in air by insulated pillars. These features allow sufficient cooling of the conductors, and the ability to tap in at various points without creating a new joint.

When a no. of lines operating at the same voltage has to be directly connected electrically, bus-bar is used. It is made up of copper or aluminium bars (generally of rectangular X-Section) and operates at constant voltage. The bus is a line in which the incoming feeders come into and get into the instruments for further step up or step down. The first bus is used for putting the incoming feeders in LA single line. There may be double line in the bus so that if any fault occurs in the one, the other can still have the current and the supply will not stop. The two lines in the bus are separated by a little distance by a Conductor having a connector between them. This is so that one can work at a time and the other works only if the first is having any fault.



Fig: Bus Bar

2.6. INSULATOR AND ISOLATOR

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 insulator serves two purposes. They support the conductor (or bus bar) and confine the current to the conductor. The most commonly used material for the manufacture of insulators is porcelain. There are several types of insulator (i.e. pin type, suspension type etc.) and their use in Sub-Station will depend upon the service requirement. Post insulators are used for the bus bars. A post insulator consists of a porcelain body, cast iron cap and flanged cast iron base. The whole cap is threaded so that bus bars can be directly bolted to the cap. When the line is subjected to a greater tension, strain insulators are used. When tension in line is exceedingly high, two or more strings are used in parallel.



Fig: Insulator

An isolator is a device used for isolating a circuit or equipment from a source of power. An isolator is a mechanical switching device that, in the open position, allows for isolation of the input and output of a device.

In Sub-Station, it is often desired to disconnect a part of the system for general maintenance and repairs. This is accomplished by an isolating switch or isolator. An isolator is essentially a knife Switch and is design to often open a circuit under no load, in other words, isolator Switches are operate only when the line is which they are connected carry no load. For example, consider that the isolator are connected on both side of a cut breaker, if the isolators are to be opened, the C.B. must be opened first. If an isolator is opened carelessly, when carrying high current the resulting arc easily causes flashover to earth. This may batter the supporting insulators & may even cause a fatal accident to the operator, particularly in the high voltage circuit.

The operating principle is manual plus one of the following:

- A. Electrical Motor Mechanism
- B. Pneumatic Mechanism

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



Fig: Isolator

2.6. 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.

These circuit breaker breaks for a fault which can damage other instrument in the station. It is so designed that it can be operated manually (or by remote control) under normal conditions and automatically under fault condition. A circuit breaker consists of fixed & moving contacts, which are touching each other under normal condition i.e. when breaker is closed. Whenever a fault occurs trip coil gets energized, the moving contacts are pulled by some mechanism & therefore the circuit is opened or circuit breaks. When circuit breaks an arc is stack between contacts, the production of arc not only interrupts the current but generates enormous amount of heat which may cause damage to the system or the breaker itself. Therefore the main problem in a circuit breaker is to extinguish the arc within the shortest possible time so that the heat generated by it may not reach a dangerous value.

At 79 Tilla sub station, there are two circuit breakers:

A. SF6 CIRCUIT BREAKER

Circuit breakers are used for protection against fault current in electrical systems. They abruptly break the circuit and safely quench the arc. The circuit-breaking part is easy as it is just the separation of contact but the arc that generates afterward which prevents the circuit from breaking and causes damage needs to be quenched as fast as possible. The arc strength depends on many variables such as voltage, the gap between the contacts, temperature, pressure, etc. The arc can be quenched using various techniques and mediums. The SF6 circuit breaker is one of the many types of circuit breakers that use the SF6 gas as the arc quenching medium to safely break the high voltage circuit.



Fig: SF6 Circuit Breaker

B. VACUUM CIRCUIT BREAKER

A vacuum circuit breaker is such kind of circuit breaker where the arc quenching takes place in vacuum. The technology is suitable for mainly medium voltage application. For higher voltage technology has been developed but not commercially viable. The operation of opening vacuum and closing of current carrying contacts and associated arc interruption take place in a vacuum chamber in the breaker which is called vacuum interrupter.

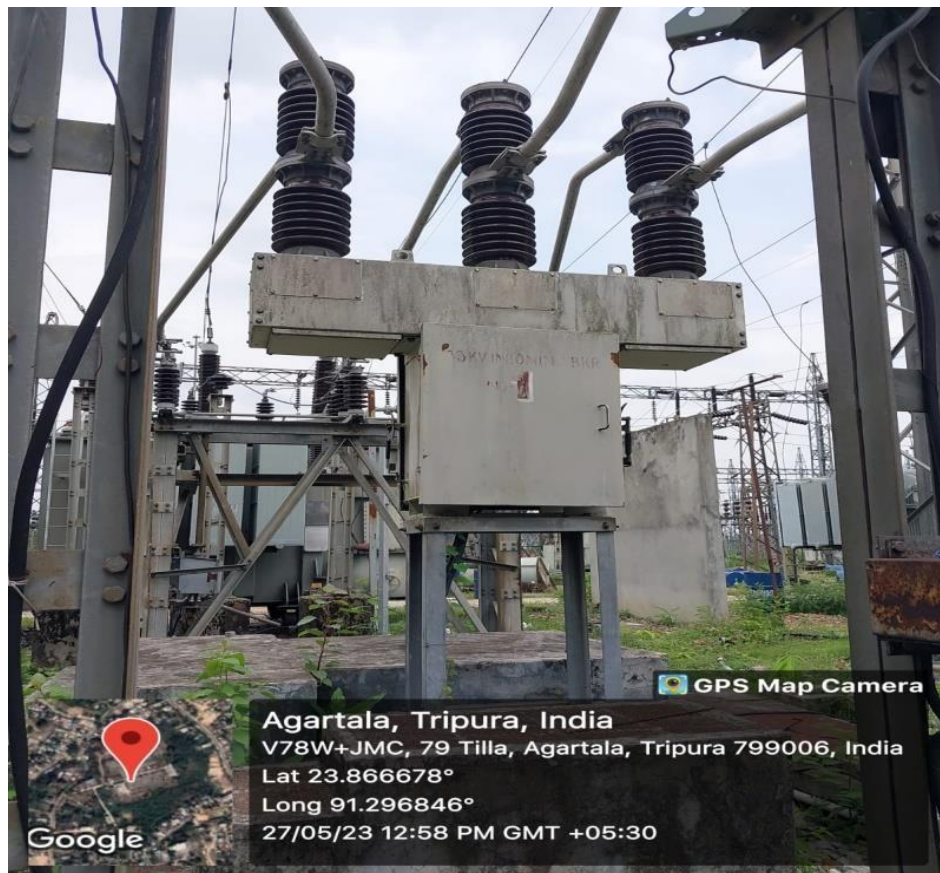


Fig: Vacuum Circuit Breaker

2.7. MISCELLANEOUS EQUIPMENTS

A. DC SOURCE:

A battery room in a substation is where number of batteries are connected in series for giving auxiliary use in substation, In 132kv substation, 110v, 400AH lead acid battery fulfill the requirement of de power to different installations. There are 55cells each of 2v. They are particularly important for switches tripping circuits.



Fig: 110V Battery Bank



Fig: D.C. Distribution Box



Fig- Charger

C. LIGHTNING ARRESTER:

A lightning arrester (alternative spelling lightning arrestor) (also called lightning isolator) a device power is on electric used 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 of the cases to earth.



Fig: Lightning Arrester

D. WAVE TRAP:

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



Fig: Wave Trap

E. RELAY:

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.

It is a device that detects the fault and initiates the operation of the C.B. to isolate the defective element from the rest of the system. The relay detects the abnormal condition in the electrical circuit by constantly measuring the electrical quantities, which are different under normal and fault condition. The electrical quantities which may change under fault condition are voltage, current, frequency and phase angle. After detecting the fault, the relay operates to close the trip circuit of C.B. There are two principle reasons for this. Firstly, if the fault is not cleared quickly, it may cause unnecessary interruption of service to the customer. Secondly, rapid disconnection of faulty apparatus limits the amount of damage to it & prevents the effects from speeding into the system. A protective relay is a device that detects the fault & initiates the operation of circuit breaker to isolate the defective element from the rest of the system. Most of the relays operate on the principle of electromagnetic attraction or electromagnetic induction. The following important types of relays are generally used in electrical distribution & transmission line.



Fig: Relay

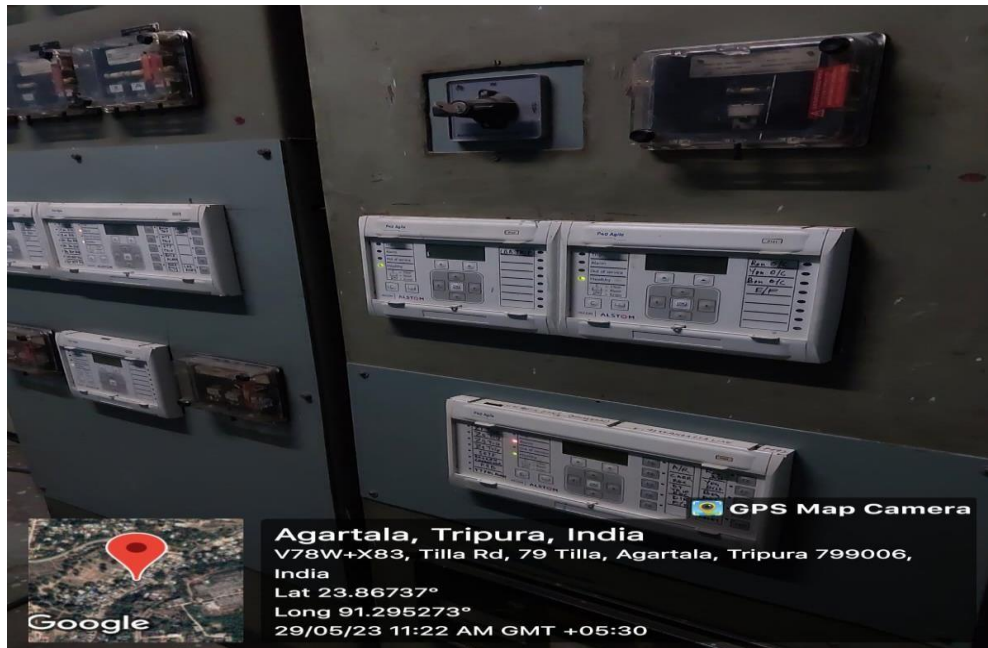


Fig: Relay

Other equipments of 132KV Grid Sub-Station Sub Division:



Fig: Trivectometer

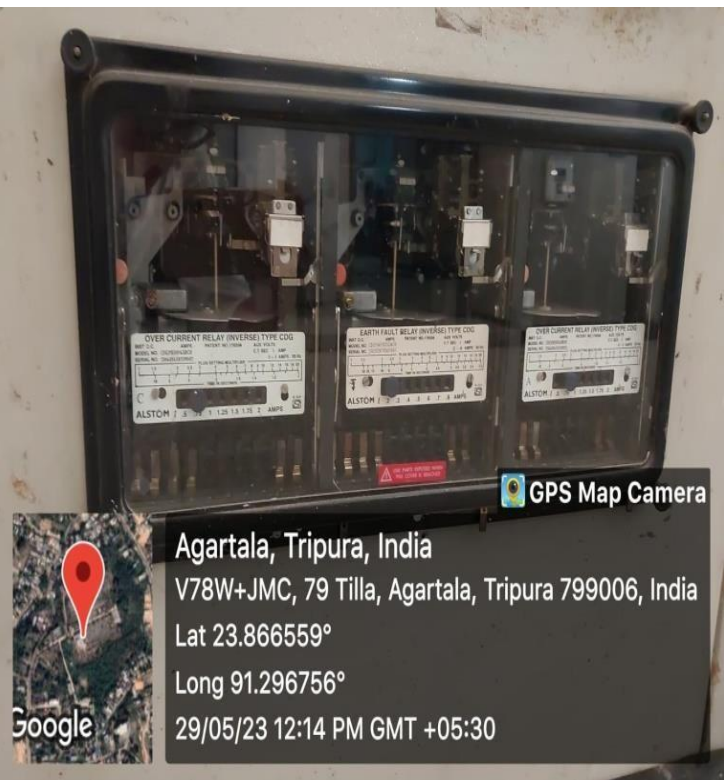


Fig: Electromagnetic Relay

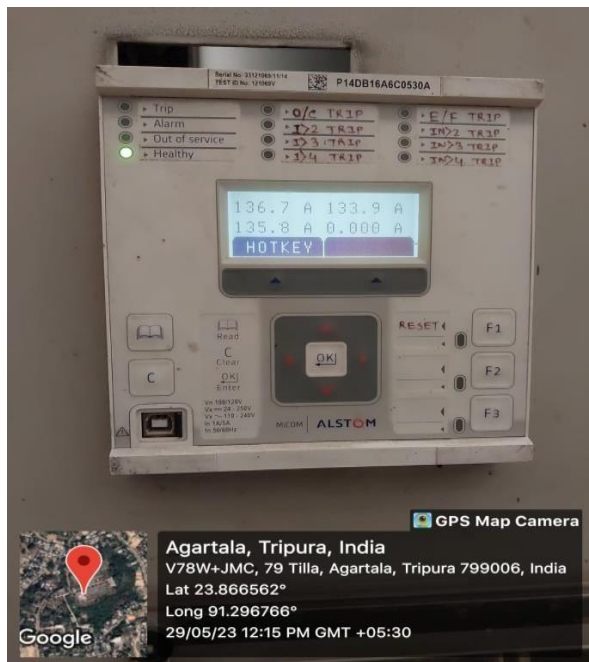


Fig: Numerical Relay



Fig: Tripping switch



Fig: Tripping Relay

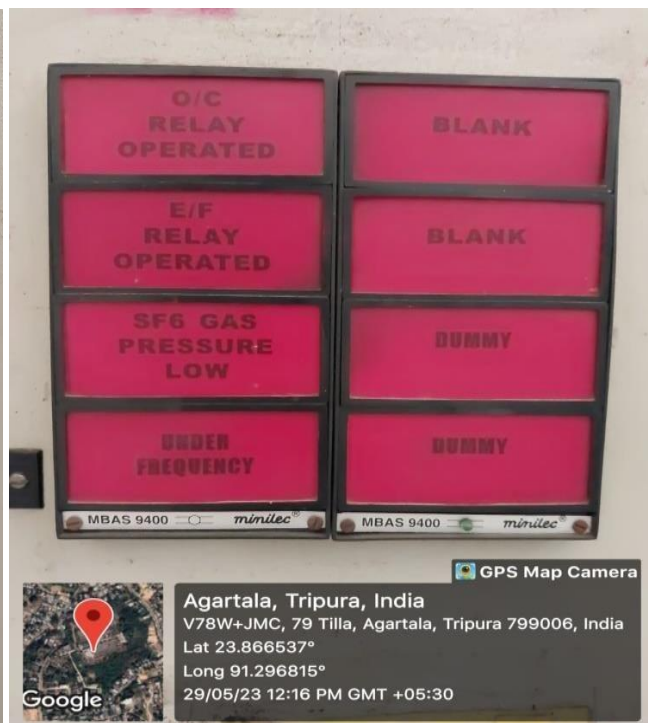


Fig: Fault Indication Device

CHAPTER 3

SPECIFICATION AND RATING

3.1. SPECIFICATION OF POWER TRANSFORMER

There are 6 power transformers at 132KV Grid Sub-Station Sub Division and theyare detailed below:

1	132/33KV	25MVA
2	132/11KV	15MVA
3	132/33KV	15MVA
4	132/33KV	15MVA
5	132/33KV	25MVA
6	132/33KV	20MVA
7	132/33KV	25MVA

RATINGS OF THE 15MVA TRANSFORMER:

TYPE OF COOLING		ON-AN	ON-AF
RATED POWER		12.5	15.0
RATED VOLTAGE(KV)	HV	13.2	15.0
	LV	11.0	15.0
RATED LINE CURRENT(A)	HV	54.7	65.6
	LV	656.1	787.3

Type of Winding: Double wound

Frequency: 50 Hz

Vector Group: Dyn 11

Volume of Oil: 15000 LITRES

RATINGS OF THE 7.5MVA TRANSFORMER:

1	33KV	7.5MVA
2	33KV	7.5MVA

3.2. SPECIFICATION OF CURRENT TRANSFORMER

Specification of Current Transformer at 132KV Grid Sub-Station Sub Division, 79 Tilla, Agartala:

System voltage-145KV

Normal System voltage- 132KV

Rated Primary current- 300KV

Rated dynamic current- 78.5A

Frequency- 50HZ

Ratios- (1) 300/1 (2) 150/1 (3) 75/1

3.3. SPECIFICATION OF CURRENT TRANSFORMER

Line voltage=132 KV

VA/Phase=750

Phase=1

Class=B

Frequency=50 Hz*

Neutrally Earthed Voltage:

Primary-73200V

Secondary-63.5V

3.4. SPECIFICATION OF CIRCUIT BREAKER

A. SPECIFICATION OF SF6 CIRCUIT BREAKER

Type=120-SFM-32B (3 Pole) STD.

Rated Voltage=145 kV

Rated Frequency=50 Hz

Rated Normal Current=1600 Amps

Rated Making Current=80 k Amps

Rated Short Circuit Breaking Current=31.5 k Amps

Rated Short Time Current=31.5 k Amps for 3 Sec

Rated Lightning Impulse Withstand Voltage=650 KVP

First Pole to Clear Factor=1.5

Rated Gas Pressure=6 kg/cm sq-gm at 20 degree C tem
Gas Weight=7.5 kg
Total Weight=1450 kg
Rated Coil Voltage Closing=220 v (d.c) Tripping=230 v (d.c)
Motor Voltage=230 v (a.c)
Auxiliary Voltage=1 phase 230 v (a.c)
Rated Closing Time<130 m Sec
Rated Operating Time<130 m Sec
Maker=M/S CG I

This breaker is used at 132 kV Grid Sub-Station Sub Division, 79 Tilla, Agartala for Transformer-3 protection.

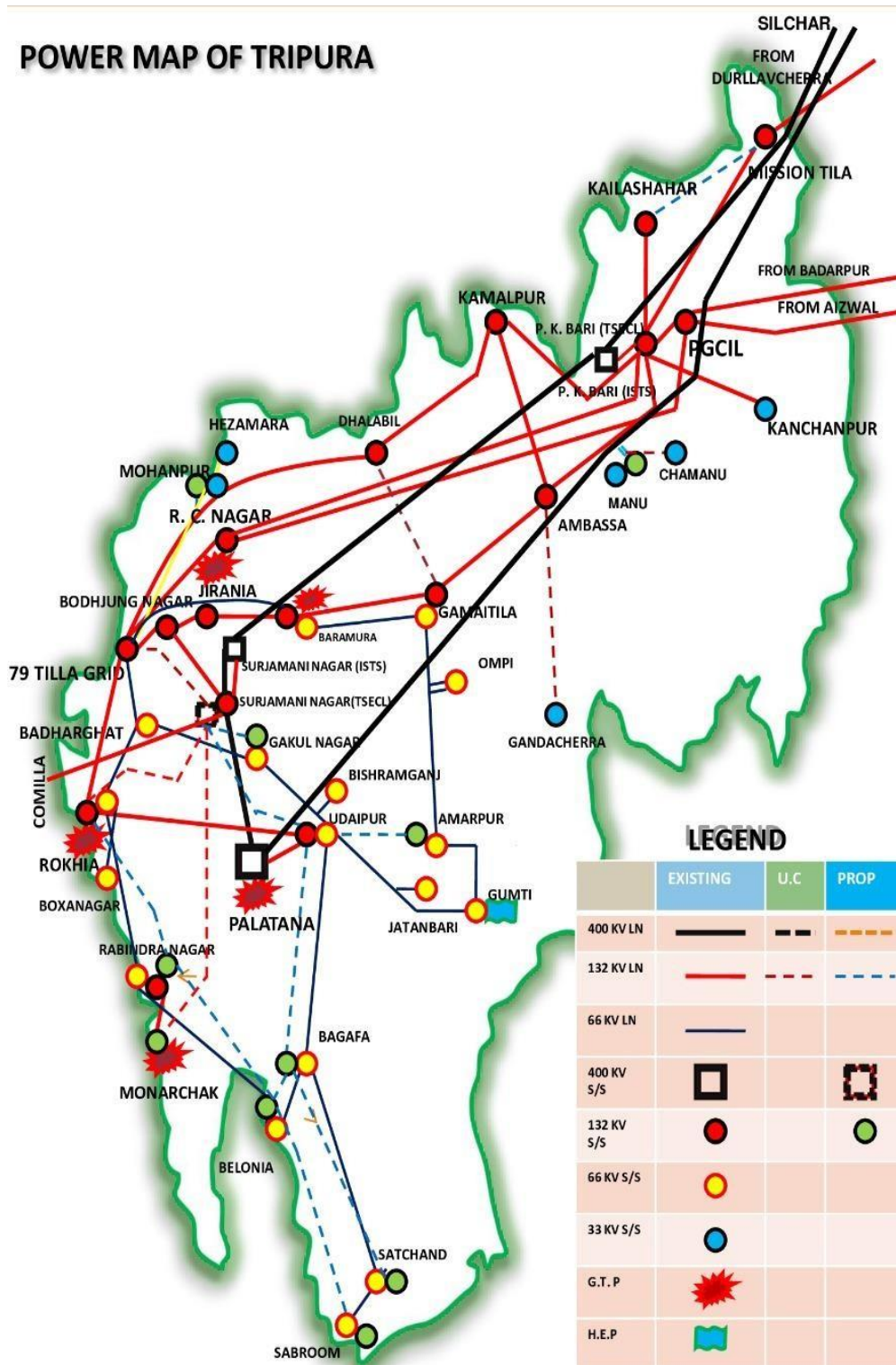
B. SPECIFICATION OF VACCUM CIRCUIT BREAKER

Type=ELFSF2-1 (r)
Rated Voltage=145 KV
Rated Frequency=50 Hz
Rated Normal current=3150 Amps at 40degree C
Rated Lightning Impulse Withstand Voltage=650 KVP
Rated Short Circuit Breaking Current=31.5 k Amps
Rated Short Time Withstand Current & Duration=31.3 k Amps for 3 sec
Line Charging Breaking Current=50 k Amps
First Pole to Clear Factor=1.5
Rated Gas Pressure SF6/20 degree C (abs) =7.0 bar
Closing & Opening Devices Supply Voltage=220 v (d.c)
Auxiliary Supply Voltage=One Phase, 240v ac &Three Phase, 415v ac
Air Pressure=22 bar
Total Mass=1750 kg (approx)
Closing Time $\leq$ 130 m sec Maker= M/S ABB
It is used for transformer-1 at 132 kV Grid Sub-Station Sub Division, 79 Tilla, Agartala.

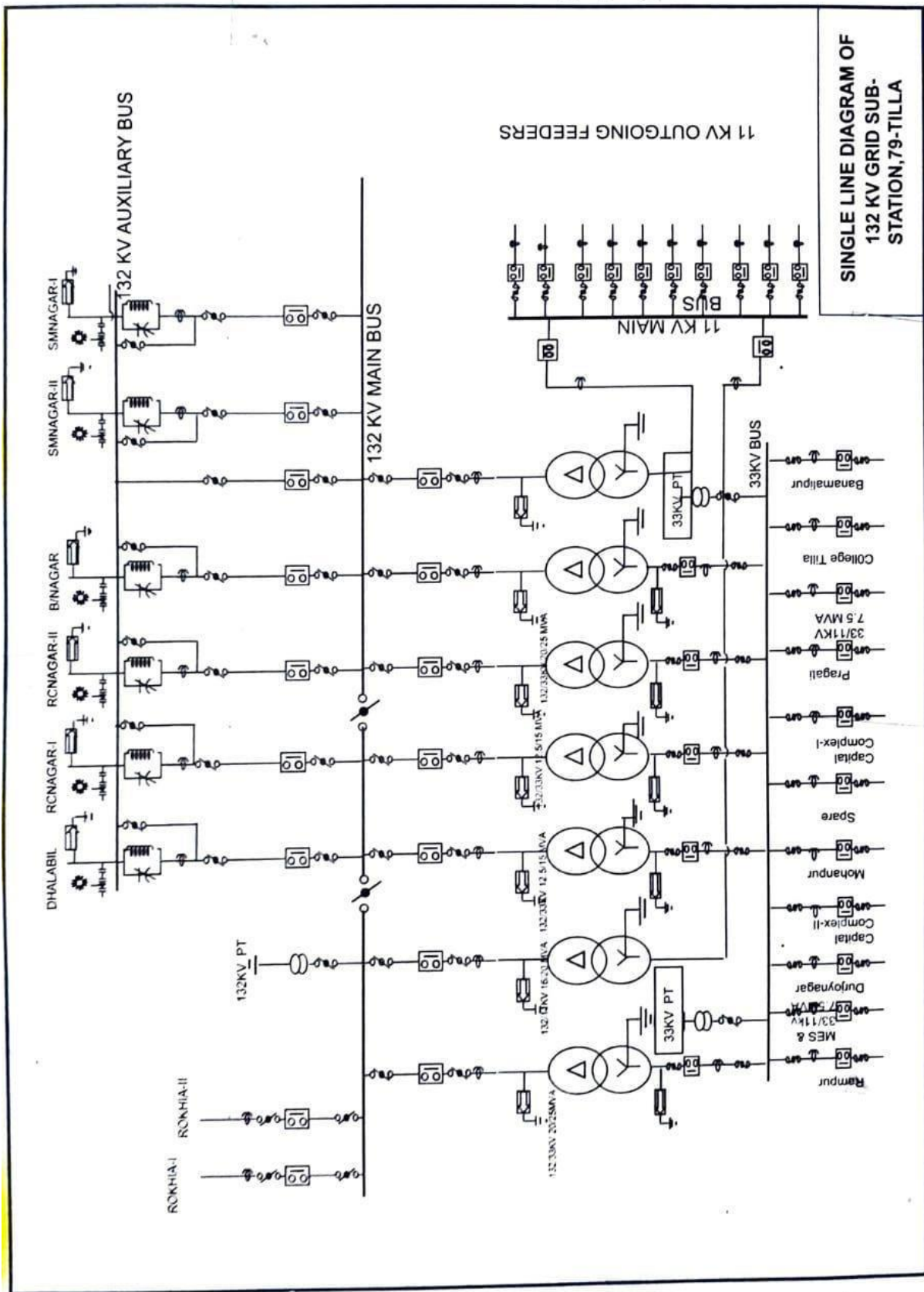
CHAPTER 4

POWER MAP

4.1. POWER MAP OF TRIPURA



4.2. SINGLE LINE DIAGRAM OF 132KV GRID SUB-STATION



CHAPTER 5

PRECAUTION AND CONCLUSION

5.1. SAFETY PRECAUTION

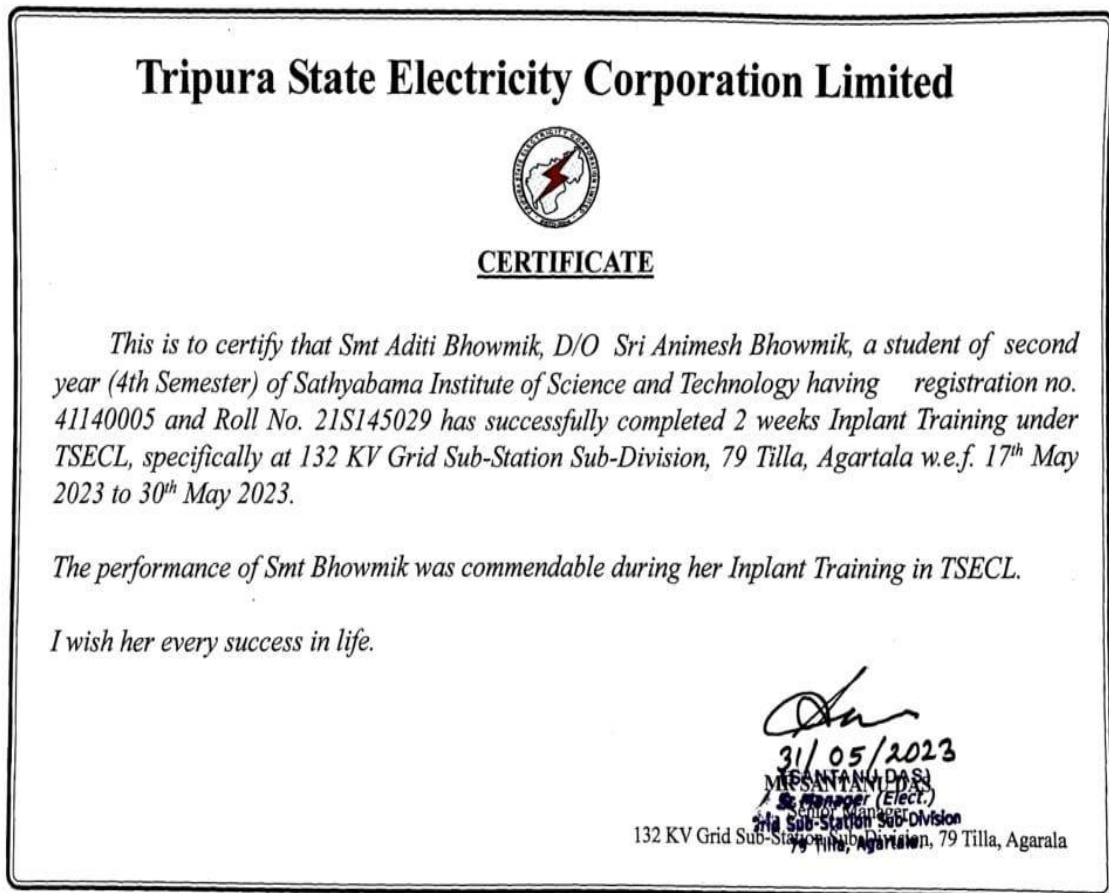
1. All personnel must wear the correct protective clothing.
2. All personnel must avoid contact with high voltage and transmission lines, which could result in serious burns.
3. Do not wear loose clothing, neckties, etc. near rotating machinery.
4. All personnel should develop safety awareness.
5. All personnel are to wear correct ear protection when working in the vicinity of the transmission lines, breakers, etc.
6. All personnel must wear closed shoes in the working sight.

5.2. CONCLUSION

This training report gives us an elaborate knowledge regarding the substation and also about the various equipments used in substations. It also provides us with knowledge of safety and the precautions we must make to run the process for a longer time.

This is a 14 days vocational training that gives us a practical view of the machines which we deal theoretically. A proper idea of the power grid and its distribution over the whole state and outside the state, proper illustration of the equipment's and their importance in the substation is attained by this vocational training.

5.3. INTERNSHIP COMPLETION CERTIFICATE:



REFERENCES:

1. <https://indiaei.in/detailed-information/35332755/3358003HWIHTR4HFAE96/tripura-state-electricity-corporation-limited/>
2. <https://www.tofler.in/tripura-state-electricity-corporation-limited/company/U40101TR2004SGC007434>
3. <https://www.scribd.com/document/359189847/Training-Report-on-132-33-kv-sub-station>
4. <https://m.timesofindia.com/topic/tripura-state-electricity-corporation-limited>