

FIELD STUDY ABOUT HEAVY FUEL OIL BASED POWER PLANT ELECTRICITY GENERATION PROCESS

A Paper submitted to the
Department of Electrical and Electronics Engineering
In partial fulfillment of the requirement for the Degree of Bachelor of Science in Electrical
and Electronics Engineering

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Certification

This is to certify that this project and thesis entitled “**Field Study About Heavy fuel Oil Based Electricity Generation Process**” 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 January, 2020

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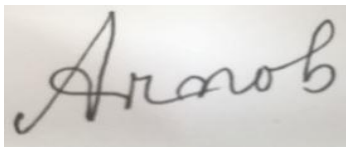
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Declaration

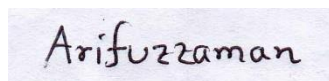
The project and thesis entitled “**Field Study About Heavy fuel Oil Based Electricity Generation Process**” submitted by **Mohammad Ataur Rahman**, ID No: 163-33-3578, **Md. Arifuzzaman**, ID No:163-33-3590 Session: Fall 2019 has been accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering** on January, 2020

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Dedicated to

Almighty Allah

And

Our parents

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ABSTRACT

We got an opportunity to complete our field study at Summit Narayananj Power Unit 2 Limited Our internship started on 6 October 2019 and ended on 5 December 2019. We got practical knowledge about power plants and observed the operating system of power plants. There we also got the knowledge of power distribution and maintenance of that plant. Protection and controlling of the equipment of the power station are a very important and complicated task. With the help of the plant engineers, we observed the control room and protective equipment such as: relays, circuit breakers, rectifier, battery house etc. very closely, understood the functions, and controlling system of that equipment. In addition, we gathered practical experience about different major components of power station such as diesel engine, alternator operation and control unit and maintenance procedures of the plants. We gathered practical knowledge about different types of equipment used in the substation of the plant such as power transformers, bus bar, and substation protection system.

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CHAPTER 1

INTRODUCTION

1.1 FIELD STUDY

We went summit power plant to gather practical knowledge. We must know about the sources of energy .In this unit we discuss the concepts of various power plants, their advantages and disadvantages. HFO are used as fuel in this power plant. We also discuss power generation, switchyard and protection system of 52MW Narayaganj summit power plant. This electricity produced from this power station is provided to the national power grid. As partial fulfillments of behavior of science in electrical and electronics engineering program, we have done practicum report. Study on power generation, switchyard and protection system of 52 MW HFO power plant. Basic on this three months practical experience. We have done this report and clearly described here.

1.2 PROBLEM STATEMENT

I have encountered some problems during my field study. The problems are given below:

- Practical participation in different works of summit power plant would give us more experience but practical participation was not allowed for field study student.
- I face some problem in understanding the mechanical arrangement of power plant components.
- Sometimes I could not collect my required information or sub information due to the administration's privacy policy.
- In that short period, I want to keep a good knowledge of HFO power plant. However, during my field, study period a diesel engine was under maintenance and my advisor sent me to different sections of summit power plant.

1.3 OBJECTIVES

- i. To investigate :
 - a. The main purpose of the field is to merge my academic knowledge with practical knowledge of power station.
 - b. In my field study, I have focused on generation system transmission process and maintenance of summit power plant.
 - c. The main objectives are to extrovert my theoretical knowledge to the practical field with adequate conceptualization and understanding the performance of parameters in case of power generation, operation, maintenance and troubleshooting of engine, radiator, control panel, transformer, switchyards etc.
 - d. Study on diesel generator, transformer, switchyard, maintenance of electrical machine (LV &MV) and equipment.
 - e. Identify the different types of problems, which arise for generation and substation.
 - f. Troubleshooting and isolate the problems occurred in power generation and substation.
 - g. Suggest problem solution of the identified problem.
- ii. To study :
 - a. I choose a power plant for this industrial training for a close an observation of a power plant and application of my academic knowledge in practical field.
 - b. I am taking a program to meet my academic equation practical need.
 - c. I have deeply known and seen about the distribution subdivision.
 - d. How the substation tool is managed, it is an idea.
 - e. In my main target was to get a complete overview of summit power plant.

1.4 SCOPE

This report will cover the types of machinery used in 52 MW HFO power plant the operating and controlling of these machines, transformer, power factor improvement ,troubleshooting, switchyards and protection system, what equipment is placed in which zone, how the equipment has been synthesized etc. the scope will be limited to only this type of power generation and transmission .

1.5 RESEARCH METHODOLOGY

Both primary and secondary data are being collected for the purpose of this report. The report is concentrated on 52 MW summit power plant.

- Primary data: primary data is collected from the books about power plants, the user manual to the engineers, technicians of the company, and official documents of the company and plant operation manuals. Author of the report is directly working in the O and M unit of summit power plant Ltd. In addition, has extensive expertise in the O and M activities, so it was easier for him to observe the system closely and collect necessary information to prepare the report.

- Secondary data: secondary data has been collected from the online resources and journals brochures.

1.6 FIELD STUDY REPORT OUTLINE:

In this chapter one, we have discuss about my field study introduction, problem statement, scopes research methodology, and objective and summit power plant. In chapter two, we discuss about generation & transmission theory. In chapter three, we discuss about generation of electricity. In chapter four transmission of electricity. In chapter five we discuss about our improved knowledge about power station, conclusion, limitation of the work and the future scopes of the work that we have faced during our field study, we have mention some limitation the work for the graduating student.

1.7 ABOUT SUMMIT POWER PLANT

Summit is a multinational company. Which incorporated in Singapore. Summit power plants plays important role in our power sector. Summit power plant was combined in Bangladesh on March 30, 1997. Currently summit add in the national grid about 1941 MW with 20 power plant. It contributes 9% capacity of total power generated in Bangladesh. It helps to develop our power sector. In past time Bangladesh facing a lot of load shedding due to its over demand compared to generation. As a private company in Bangladesh, it gives contribution to prevent load shedding and other power demands. Summits mission and vision is add more power to national grid and they are working to provide electricity in rural areas. As a part of electricity generation, Narayanganj power plant contributes a little.

- SPI Company: Summit Narayanganj Power Unit II Limited
- Project Name: Summit Narayanganj Power Plant - Unit II
- Type: Reciprocating Engine
- Technology: Wärtsilä
- Fuel: HFO
- Installed Capacity: 62 MW

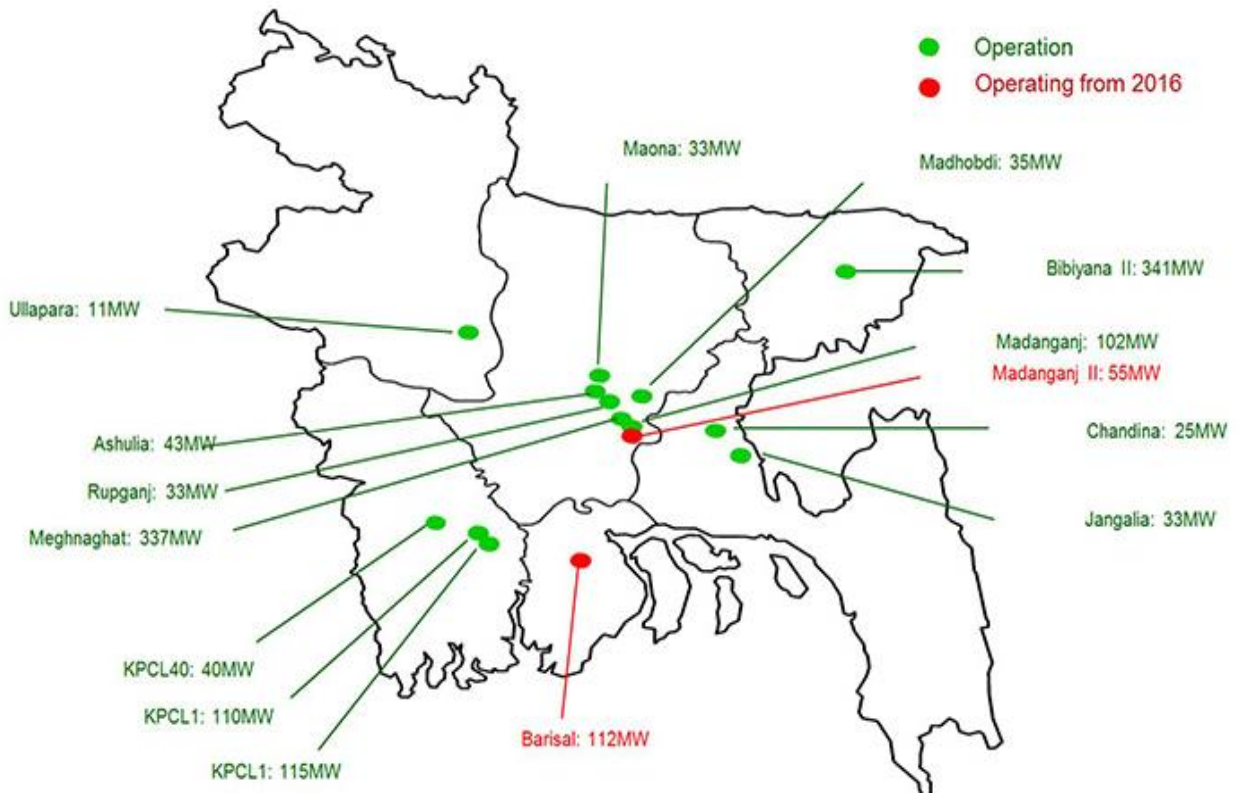


Figure 1.1: Summit power in Bangladesh [6]



Figure 1.2: Summit power Narayanganj



Figure 1.3: Overview of Narayanganj power plant



Figure 1.4: Fuel Tank



Figure 1.5: Narayananj substation



Figure 1.6: Exhaust pipe

CHAPTER 2

GENERATION & TRANSMISSION OF SUMMIT

2.1 GENERATION METHOD OF SUMMIT

In Summit Narayangonj power plant, they use heavy fuel oil based engine to produce electricity. Engine means a machine with moving parts that converts power into motion. For electricity generation they use two main component: a) Diesel Engine b) Alternator. In this power plant, they use reciprocating type diesel engine (Wartsilla -18V46DG, 12V46DG). It is a four-stroke engine. With four stroke, it complete one cycle or rotation. It gives a mechanical output around (17MW, 12MW).The engine is coupled with an alternator. The alternator has the rating (22MVA,11KV,50Hz).When engine rotates the alternator rotor also rotates , when engine reach its maximum rpm (500 rpm) a residual magnetism or magnetic flux creates in the rotor , this flux is cut by stator and a voltage produces there. This voltage go to a automatic voltage regulator (AVR), This give a excitation current to the stator and a stator voltage produce, this voltage go to the rotor, this happens until 11KV voltage generates. After reaching at this voltage, the voltage go to the medium voltage system (11KV). In medium voltage, system there is a switchgear room. In this room, it has circuit breaker (SF₆), neutral ground resistor (NGR), isolator, for measurement and protection current transformer, potential transformer, medium voltage bus bar (11KV). From medium voltage bus bar (11KV) the voltage go to the higher voltage system, in this higher voltage system it has a 132 KV bus bar and 132 KV substation. In this substation have two isolator for protection, lighting arrester, current transformer and potential transformer for measurement and power transformer (40/50 MVA) for transmission. There is a low voltage system (400V). In this system, it has air circuit breaker, 400V bus bar, diesel generator. This system is use for auxiliary system. A battery system is also use for auxiliary power. After transmission the load go to the grid system which is connect to the power development board of Bangladesh (BPDB)

2.2 TRANSMISSION PROCESSES OF SUMMIT

When electricity is produced in a power plant, it needs to be transmitted. In Summit Narayanganj power plant, they use a substation to transmit the power. The substation is 132KV rated. After generating the power, it comes to the substation system for transmission. In this substation, they use some equipment for supply the power. Here they use power transformer, current transformer, potential transformer, isolator, lightning arrester, bus bar. When generated power comes to the transformer it step up the voltage for transmission, Then its go through the current transformer and potential transformer for measurement , Then isolator part in the same line passes the power to the bus-bar, From bus-bar the power go to the transmission line. In this process the power plant, supply the power to the consumer.

2.3 SUBSTATION OF SUMMIT

In Summit power after generation from engine and alternator, they use 132 KV substation this is a high voltage. Here it has power transformer, current and potential transformer, isolator, circuit breaker, lightning arrester, bus bar. Which helps the work of transmission. It transmits the power to the Power Development Board of Bangladesh. PDB do the distribution work.



Figure 2.1: 132KV Substation

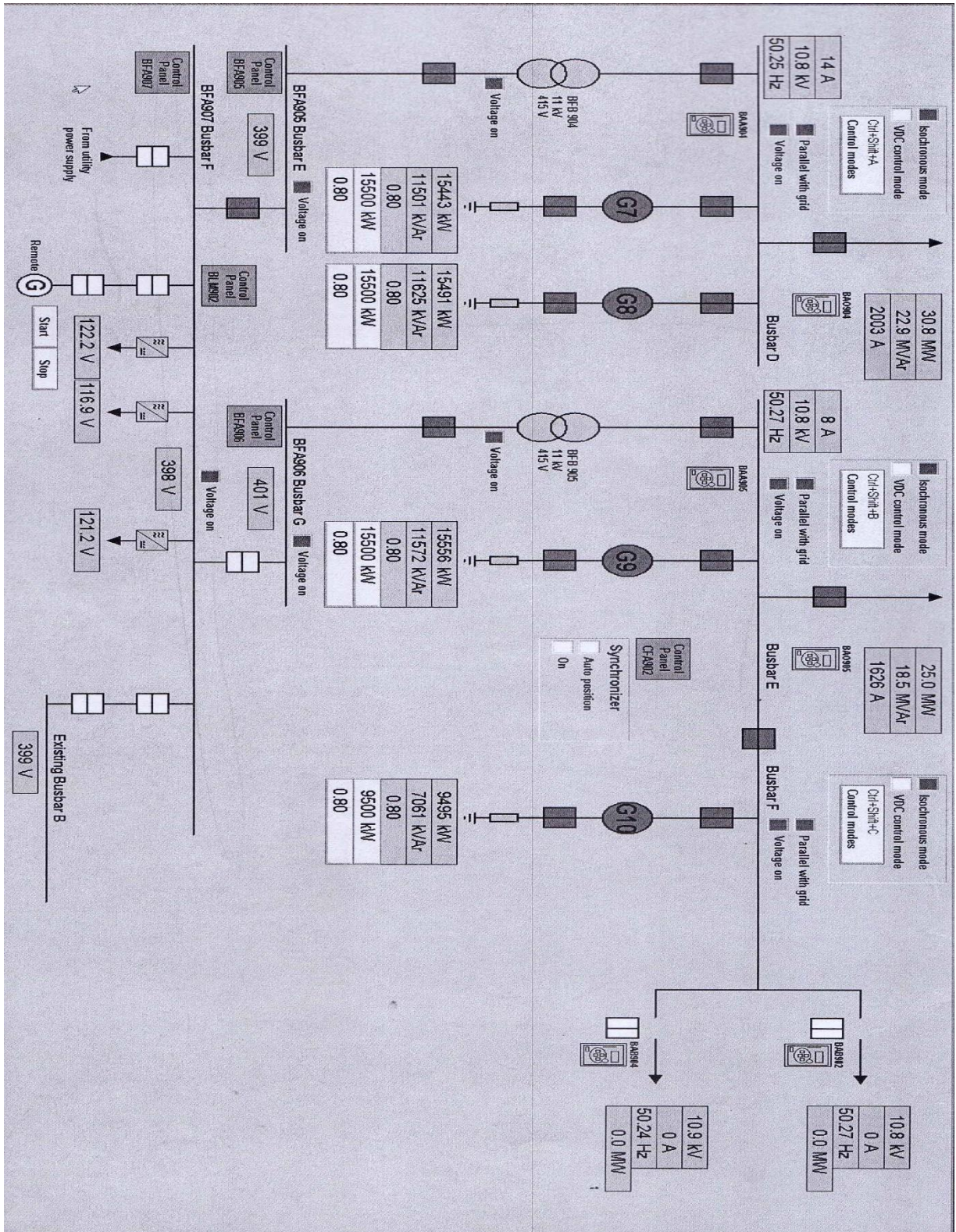


Figure 2.2: Medium and low voltage system

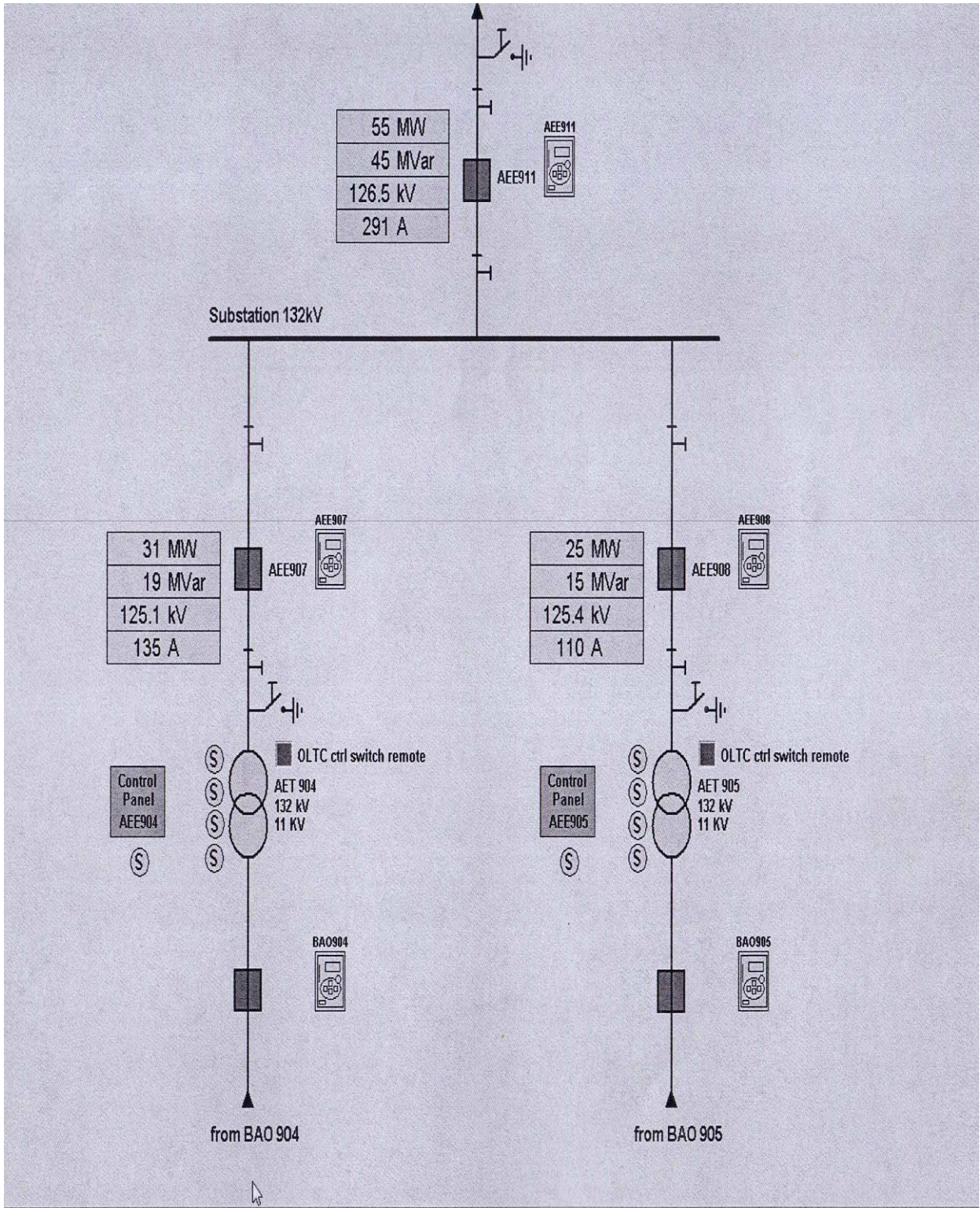


Figure 2.3: High voltage system

CHAPTER 3

GENERATION EQUIPMENT

3.1 DIESEL ENGINE

3.1.1. Diesel Engine:

The diesel engine is an internal combustion engine that uses the heat of compression to initiate Ignition and burn the fuel that has been injected into the combustion chamber. Diesel engines are manufactured in two-stroke and four-stroke versions. They were originally used as a more efficient replacement for stationary steam engines.

3.1.2 Diesel Engine Working Principle:

- A reciprocating engine, in the cylinders of which an introduced Charge of air is compressed sufficiently to ensure spontaneous ignition and combustion of an atomized stream of fuel injected into the said charge of compressed air.
- Engine, which works on the Diesel principle or Diesel cycle.

3.1.3 Four stroke cycle:

- **Intake stroke:**

Intake valve opens while the fresh air inserts by the help of turbocharger from the atmosphere in certain pressure. Then piston moves from upper position to lower position in the cylinder.

- **Compression stroke:** When intake valves closes and the piston moves upper position. After that, the air is compressed and heated. After the compression stroke fuel injects and after a short delay the fuel ignites impulsively

- **Combustion stroke:**

The hot gases made by the combustion of the fuel further increase the pressure in the cylinder, forcing the piston down.

- **Exhaust stroke:**

Exhaust valve opens when the piston is again near its last position, so that as the piston once more moves to its peak position, most of the burned gases are forced out of the cylinder.

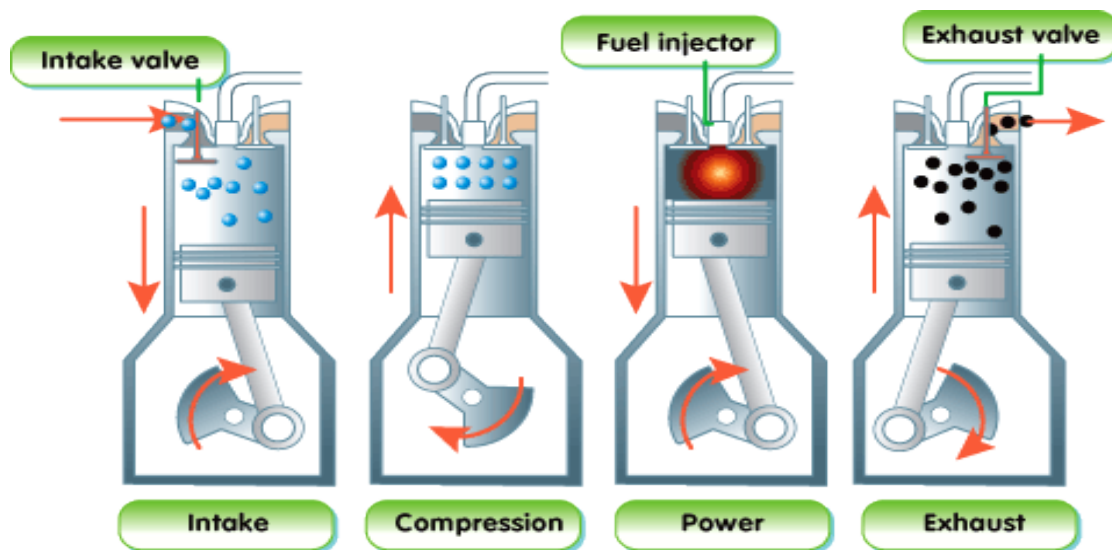


Figure 3.1: Four Stroke cycle [7]

3.2 DIESEL ENGINE OF SUMMIT

Engine is a mechanism, which can convert thermal energy to mechanical energy .ex: diesel engine, petrol engine, gas engine. There are two types of diesel engine: a) two stroke b) four stroke. In Summit power plant they use a four stroke reciprocating diesel engine (Wartsilla - 18V46DG, 12V46DG) . This is engine complete its on cycle or rotation in four stroke. Four stroke: a) Intake b) Compression c) Combustion d) Exhaust. This cycle repeats until engine turn off. To run this it has system to main as like, Fuel system, lubricating oil system, cooling water system, Start air system, Instrument air system, Charge air system, Exhaust air system, Heat recovery system, Battery system.

Table : 1

Engine	
Engine type	3*W18V46, 1*W12V46
Number of cylinder (W18V46)	18
Number of cylinder (W12V46)	12
Cylinder bore	460 mm
Stroke	580 mm
Speed	500 rpm
Rated output (W18V46)	17550 kwm
Rated output (W12V46)	11700 kwm
Main voltage	400V
Secondary voltage	24V DC
Frequency	50 HZ
Oil sump	Wet
Engine firing order	A1-B8-A7-B6-A4-B3-A2-B9-A8-B5-A6- B1 -A3-B7-A9-B4-A5-B2
Rotation direction	Clockwise

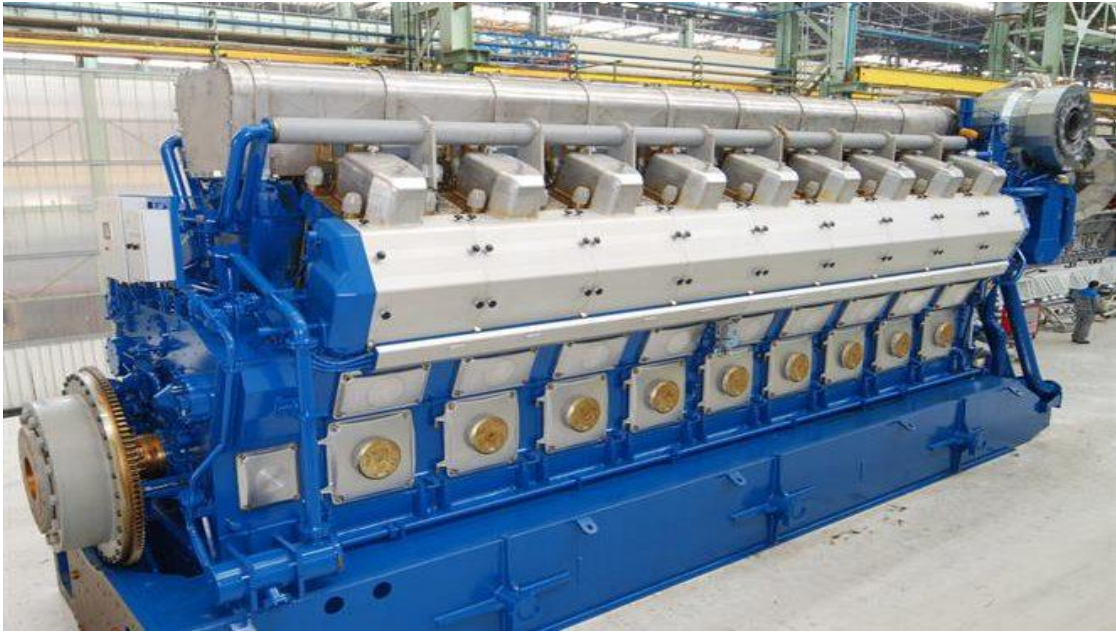


Figure 3.2: Diesel Engine

3.3 ALTERNATOR

An alternator is an electric device that produce alternating voltage. Alternator has mainly two parts armature and field. In that part of alternator static magnetic field induced, that is called magnetic field. Moreover, in armature, installed conductor cuts the magnetic field and therefore alternating voltage is induced. In case of large alternators armature is stationary, by rotation of field the armature conductor field cuts the flux, and therefor ac voltage generates. Rotating field of alternator is called is called rotor and the stationary part is called armature. Voltage is supplied in electrical load through static stator. For producing more voltage in stator field is need to be more powerful. Therefore, static magnetic field is induced by use of dc supply in field. Dc supply is given by using a dc generator. In practical field, 3-phase alternator is used. For small alternators field is stationary while armature rotates. The help of slip ring and carbon brush in terms of rotating armature transmits voltage.

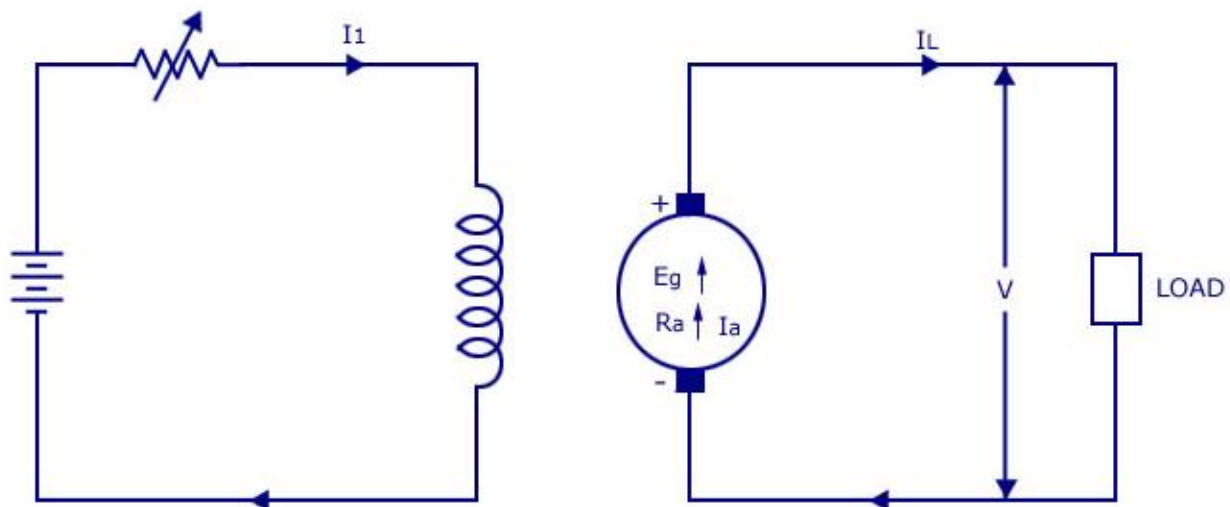


Figure 3.3: Alternator basic circuit [8]

A three-phase generator field and armature are shown in the above. In field, supply is given by use of shunt generator. Generally shaft of rotor and shunt generator are coupling. Whenever the shaft is rotate by help of prime mover shunt generators voltage is passed in alternator's field. . Therefor the field creates a stationary magnetic field and at the same time, the field

rotates. Therefore, the armature conductor cut the flux and voltage is produced. This the principle of alternator.

3.4 ALTERNATOR OF SUMMIT

In summit power plant, they use synchronous generator rated (22 KVA, 50 HZ). This generator is coupled with engine, when engine rotates the alternator rotor also rotates. For residual magnetism, a voltage developed in the rotor. A magnetic flux also created in the rotor field. This flux is cut by stator field. From stator, the voltage goes to the automatic voltage regulator (AVR) after pass through a potential transformer. The AVR is rated 11KV/165V. Until the alternator produces the rated voltage the AVR give a excited current to the alternator. For proper ac, excitation rectifiers are used inside the alternator. For generator protection, some protections are used such as a) Overvoltage protection b) Overcurrent protection c) Over / under frequency protection d) Reverse power protection e) Loss of excitation protection f) Differential (current) protection g) Earth fault protection. Current transformer also used internally protection

Table: 2

Generator (W18V46-Engine)	
Generator Output	21345 KVA
Generator Power Factor	0.80
Generator Voltage	11KV
Generator Current	1120 A
Generator Frequency	50 Hz

Table : 3

Generator (W12V46- Engine)	
Generator output	14230KVA
Generator power factor	0.80
Generator voltage	11KV
Generator current	747A
Generator frequency	50Hz



Figure 3.4: Alternator

3.4 ALTERNATOR EXCITATION SYSTEM

In the field of alternator for creating static magnetic field dc supply is given at the field of alternator. Alternator excitation is called when dc supply is given at alternator field. There several voltage is use for excitation. Like 115V, 125V, 230V, 250V. However, in terms of rotating alternator the excitation voltage is 415V and 600V. Since large field of alternator produced voltage in armature, therefore the field is separately excited. But in term of small alternators excitation is produced by self-exciter. So as an exciter of alternator dc shunt generator is used. Which coupled the shaft with a gear or belt of generator.

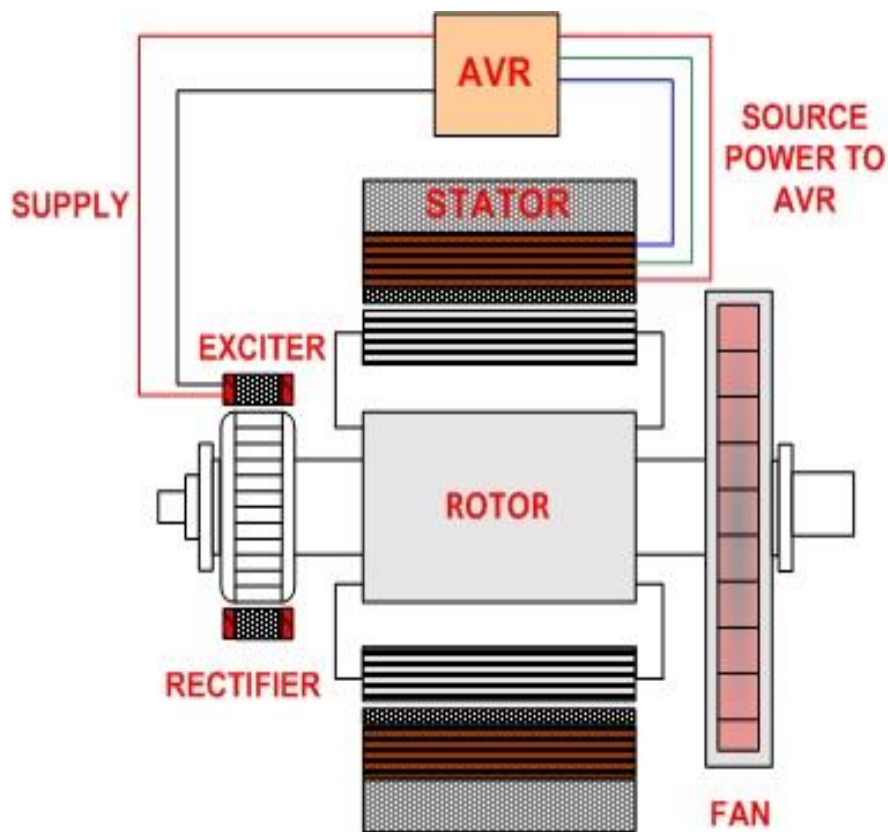


Figure:-3.5 Alternator Excitation [9]

CHAPTER 4

TRANSMISSION EQUIPMENTS

4.1 TRANSFORMER

Transformer is an electrostatic device, which transfer energy from one circuit to another circuit at constant frequency by use of electromagnetic induction. However, the voltage is altered, that means voltage can be increased or decreased according to the demand. It works on the basic principle of faraday's law "the magnitude of voltage is directly proportional to the rate of change of flux."

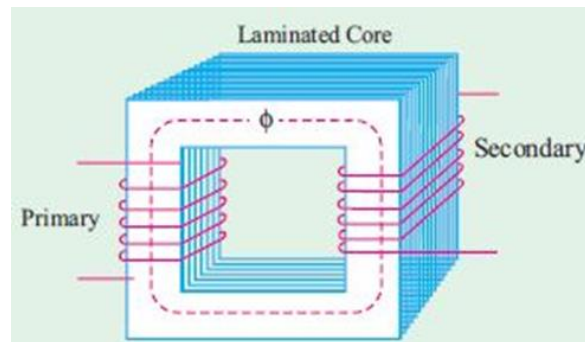


Figure 4.1: Basic transformer diagram [10]

4.1.1 Principle of transformer

Transformer generally consists of two coils wound around a iron core. When an ac voltage is applied in the primary coil, a magnetic field is produced around itself. The strength of the magnetic flux depends on the current flow. Current flow is proportional to the magnetic flux. When we applied ac voltage to the primary circuit. A current is start to pass from primary to secondary the magnetic field also passed through the core. When they pass the winding of the secondary, a voltage is induced in the secondary coil. Faraday's law can determine the voltage. This is the basic principle of transformer.

4.1.2 Necessity of Transformers

Most of power plant voltage is generated at 11kv or 15kv. Think of economical purpose we need to step up the voltage like 132,220kV through long distances. Hence, the transformer is used in power plant. Then for safety, purpose the voltage is need be stepped down. Then we need a stepped down transformer to step down the voltage to feed the consumer.

Step up transformer: when primary winding is smaller than the secondary then that is called step up transformer. In step up transformer, the secondary voltage is increases as compared to primary.

Step down transformer: When primary winding is bigger than secondary then it is called step down transformer. In this step down transformer. Voltage is decrease from primary to secondary.

4.1.3 Advantage of using a transformer:

The most benefit of using a transformer is its efficiency. Transformer efficiency is about to 90-95%. Any other device cannot give this type of efficiency. Reason of this efficiency is it has no moving parts in it. Therefore, no friction has happened in the device. It has less capital cost and less maintenance cost. The most advantage of transformer is easy to increase voltage and easy to decreased voltage.

4.1 POWER TRANSFORMER OF SUMMIT

Transformer is an electrostatic device which transform power. In Summit power plant, they use a power transformer. It is installed in high voltage system. From generation to medium voltage room the power come to this transformer .It helps to transform the generating voltage for transmission. It is rated at 40/50 MVA. It's a step up transformer which set up the 11KV voltage to 132KV. For body protection some current transformer is used, a horn gap lightning arrester is used from surge voltage. It has other protection also over and under voltage and current, differential protection, oil temperature protection, Buchholz relay protection, earth fault protection, oil temperature protection, winding protection, pressure relief device protection. It has natural and oil natural cooling system.

Table: - 4

Main Transformer		
Rated KVA	40/50 MVA	35/45 MVA
Type of Cooling	ONAN/ONAF	ONAN/ONAF
Rated KV	11/132KV	11/132KV
Rated Line Current	2100/175 AMP	1837/153 AMP
Vector Group	YNd1	YNd1
Frequency	50 HZ	50 HZ



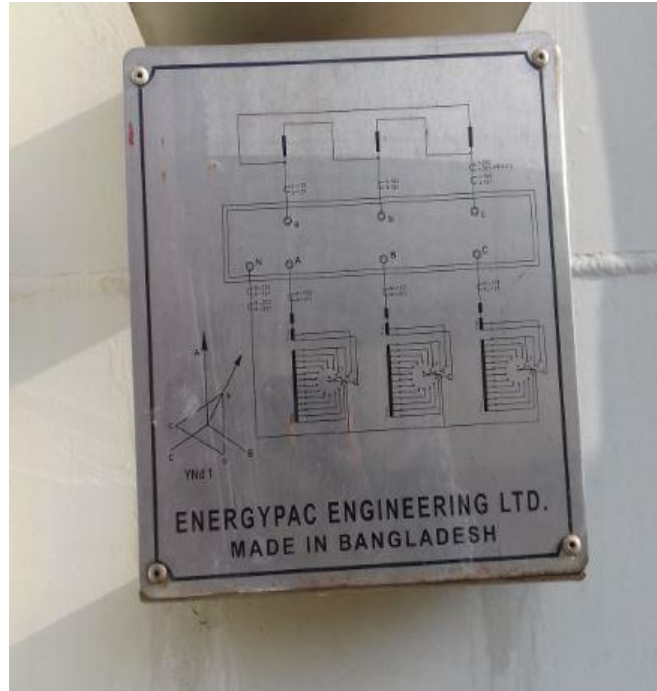


Figure 4.2: Transformer nameplate



Figure 4.3: (11/132) KV Power Transformer

4.4 CURRENT TRANSFORMER OF SUMMIT

Current transformer used for measure high current using low measurement instrument. In high power transmission, line current is also in high amount. In this case measuring the current by ammeter or multi-meter is tough. Because ammeter or multi-meter is made for measurement of small value if ammeter or multi-meter is created for, measure this type of high current that could be very costly so for economical consideration current transformer is used.

4.4.1 Function of current transformer:

Current transformer function is almost like power transformer. Like power, transformer current transformer has primary and secondary winding too. When ac supply is given at primary winding electromagnetic field is induced which secondary collect from it therefore mutual induction induced in primary and secondary and current is start flowing through secondary.

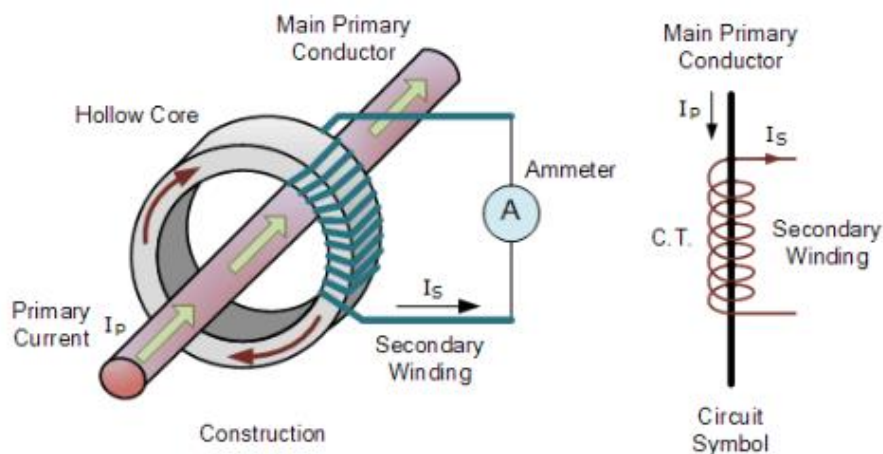


Figure 4.4: Basic construction of current transformer [11]

Current transformer is used for the measurement of the alternating current by taking samples of the higher current of the system. These reduced samples are in accurate proportions with the actual high currents of the system. These also have two secondaries. These are used for

installation and maintenance of the current relays in substation for protection purpose, which are normally, have low-current ratings for their operation. Some factors are need to be concern current transformer ratio, burden, protection class, accuracy, insulation class.

Table:- 5

Function	Protection relay CT	Measuring CT
Phase	3-Phase	3-Phase
Transformation Ratio	1250/1 A	1250/1 A
Burden	20 VA	15VA
Accuracy	5P (Protection)	0.5M (Measurement)
Accuracy limiting factor	10	0

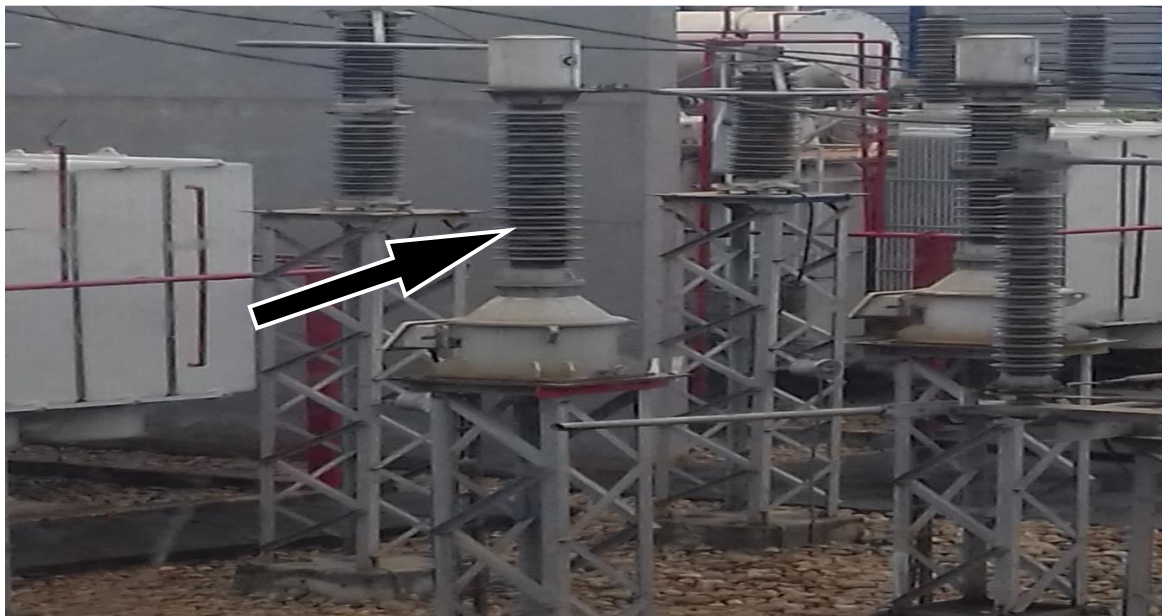


Figure 4.5: Current Transformer

4.5 POTENTIAL TRANSFORMER OF SUMMIT

Potential transformer : potential transformer is also known as voltage transformer. With help of this transformer High voltage is reduced to low range. It is the method of measuring high voltage using low range instrument.

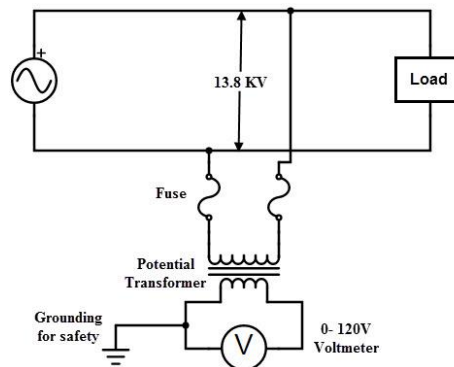


Figure 4.6: Circuit diagram of PT [12]

From above picture, it can be realize primary side is high voltage side and secondary is low voltage side. From according to the picture it is clear that it is a stepped down transformer. In secondary winding voltmeter is connected which measure the value.

In general, PT secondaries voltage is designed at 110 V. Since PT's voltmeter have high impedance so there will be a little current flow. For this characteristics PT act as a two winding transformer. Thus secondary of PT has small load PT's rating is small. For safety consideration grounding is taken from one side.

➤ Application of PT

- Electric metering system
- Electric protection system
- Use in grid with synchronizing generator
- Impedance protection

Potential transformer is quite similar to the current transformer, but it is used for takings samples of high voltages of a system for providing low voltage to the relays of protection system and also to the low rating meters for voltage measurement. From this low voltage measurement , the actual system high voltage can be calculated without measuring high

voltages directly to avoid the cost of the measurement system. Some factors are need to be concern potential transformer ratio, burden, protection class, accuracy, insulation class.

Table:-6

Function	Protection relay PT	Measuring PT
Transformation ratio	3-Phase	
Burden	11KV/ $\sqrt{3}$, 110/ $\sqrt{3}$	11KV/ $\sqrt{3}$, 110/ $\sqrt{3}$
Accuracy	50VA	50VA
Phase	6P(Protection)	0.5(Measurement)
Accuracy limiting factor	0	0

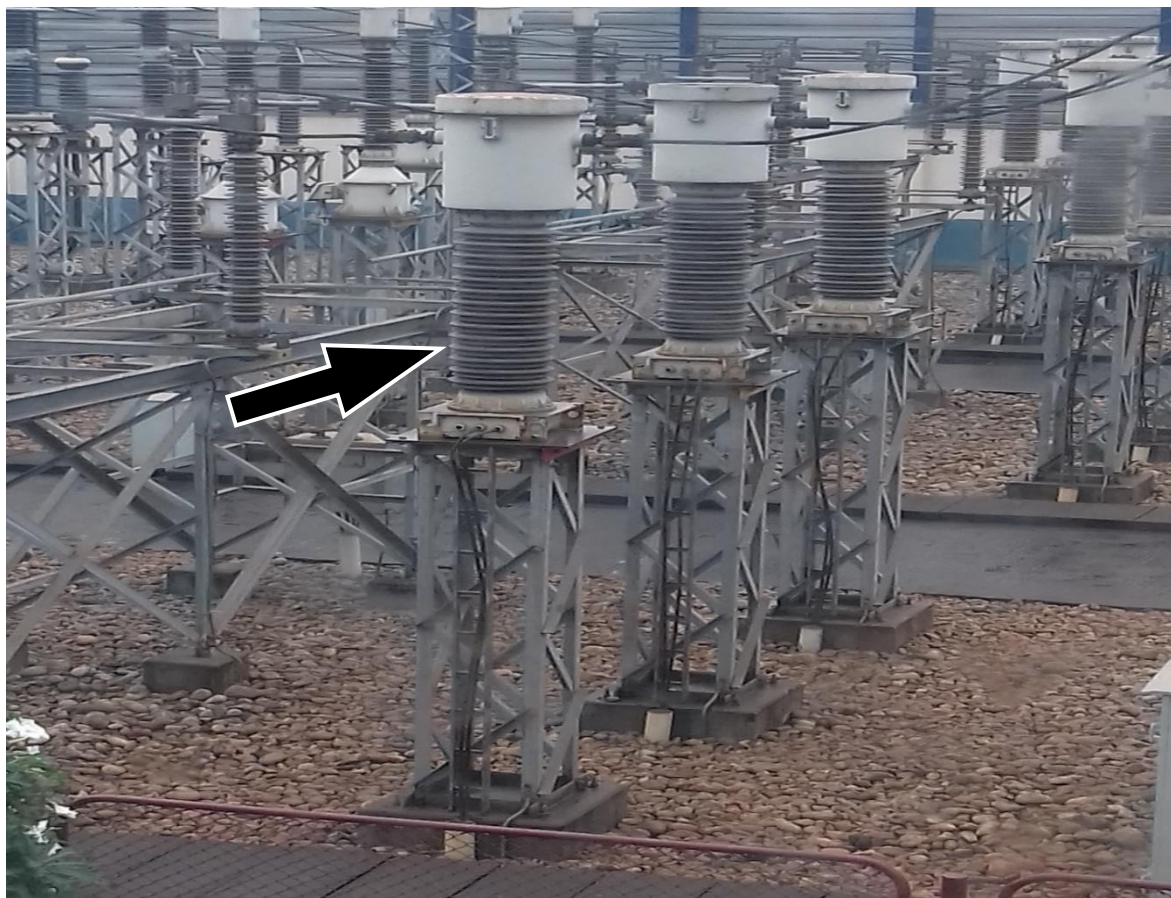


Figure 4.7:- Potential Transformer

4.6 CIRCUIT BREAKER

A circuit breaker is automatically automated device that is designed to protect and control the circuit in abnormal condition. It is isolated the whole circuit when fault is detected. But it does not reconnect the circuit automatically. For connecting the circuit various steps needs to be taken. In normal condition circuit breaker can be used as a switch for on and off.

4.6.1 Working principle

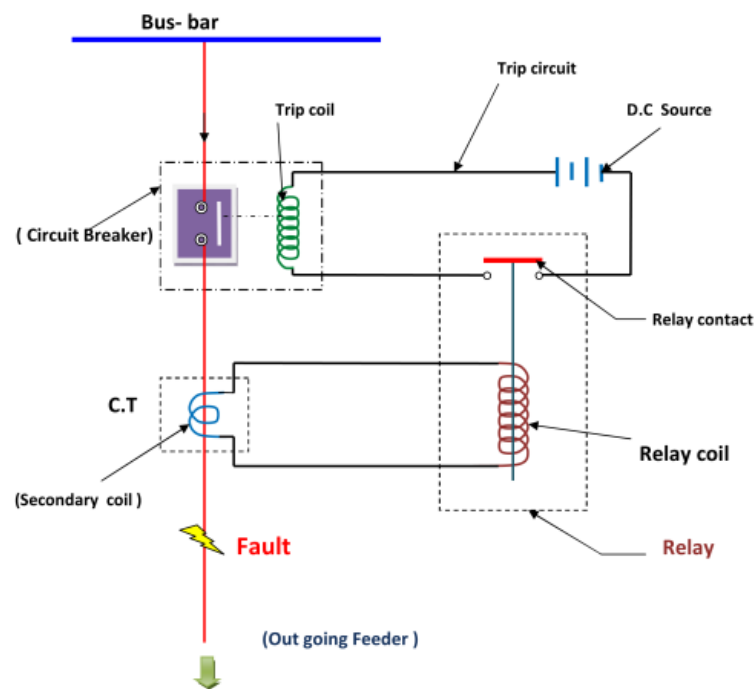


Figure 4.8: Basic diagram of circuit breaker [13]

Circuit breaker has two contacts. One is fixed contact another is moving contact. In normal condition such a current flow through the conductor that is not enough to energized the coil of relay. As a result the trip coil does not energized therefore moving contact is connected to fixed contact. That means moving contact and fixed contact do not get disconnected in normal condition. Whenever a fault or short circuit occur in the line exceeding current flows through the line through circuit breaker as a result the relay get energized and relay coil is attracted to

raw metal hence relay contact closed. Consequently trip circuit get completed and the trip coil is energized and the circuit breaks. Note to be pointed the relay sense the fault and supply the signal to the circuit breaker and circuit breaker trips the circuit. Tripping circuit is consist of circuit breaker's trip coil relay contact, and supply source.

4.6.2 Classification of circuit breaker

- Oil circuit breaker
- Air blast circuit breaker
- Sulphur hexafluoride circuit breakers
- Vacuum circuit breaker

When breaking a circuit under fault condition one thing happened in between the two contacts. When breaking a circuit moving contact is separated from fixed contact. And an electric spark is created when a short circuit is occurred too much high current flows through conductor. Therefore heat increases and air is get ionized and vaporized. The vaporized and ionized air act as a conductor. An arc is then created between the two contacts. That is not good for circuit interruption the more arc exists in the circuit the more time will take to break the circuit. Therefore it may damage the system.

4.7 CIRCUIT BREAKER OF SUMMIT

For the protection purposes of substation and its equipment from the over voltage or over current due to short circuit current or any other fault circuit breaker is used. It disconnects the faulty section from the healthy part. It is done by manually or automatically. When fault is removed from the system the main circuit can turn on again .Circuit breaker is used on different criteria and usages. In summit power plant they use SF₆ (Sulphur Hexafluoride) circuit breaker. For its powerful ark extinguishing properties. It is rated voltage 11KV, rated current 3250 A.

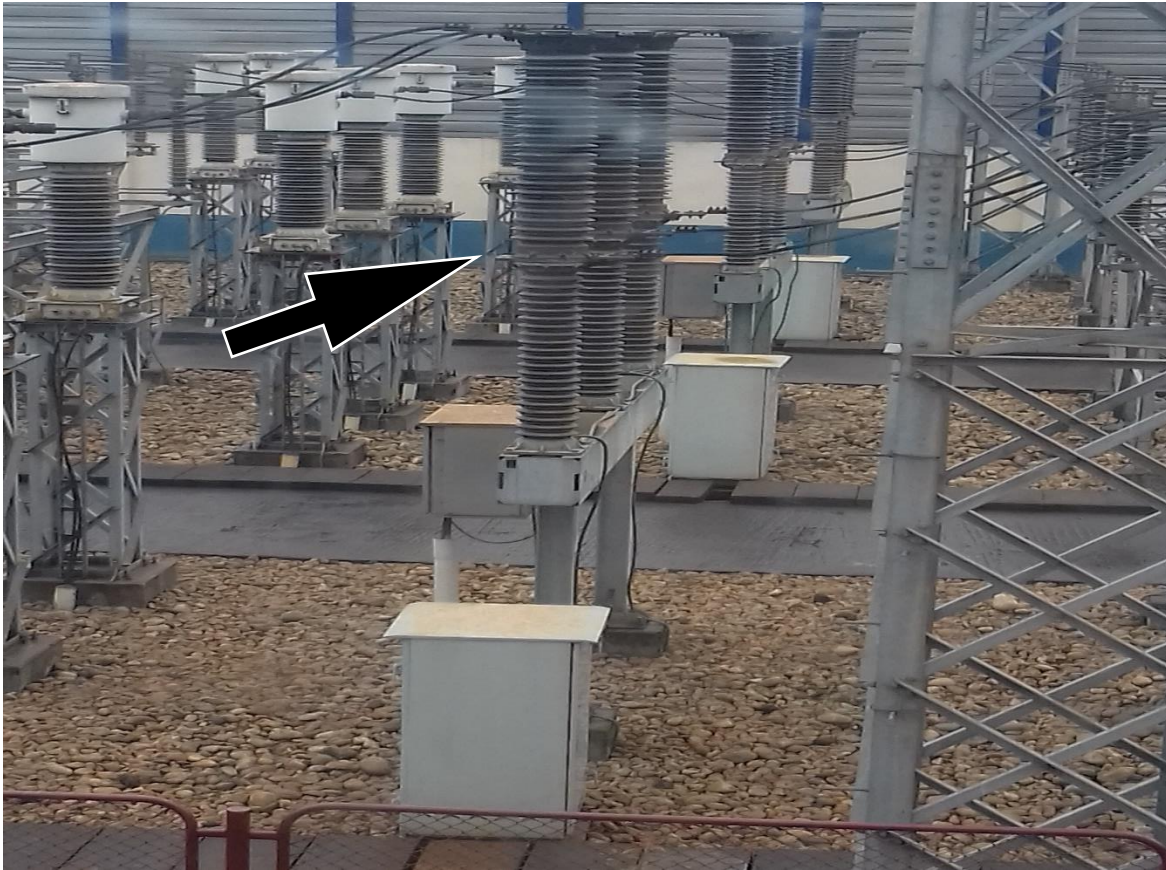


Figure 4.9:- SF₆ Circuit Breaker

4.8 RELAY

Relay is an automatic protective device, which can sense any kind of fault, sends signal to circuit breaker, and protect the whole system.

In electrical system relay is used between current transformer and circuit breaker. Whenever any fault occurs relay automatically activated and energized the coil of tripping circuit. Then circuit breaker breaks the circuit and the whole system detain from damage. Though in electrical system relay has a less costly but its subsidize in electrical circuit is infinite. For improper maintenance small fault can be make a large disaster. Example if thermal overload protection has taken motor can be prevent the overloading. That is why proper protection is needed in power plant.

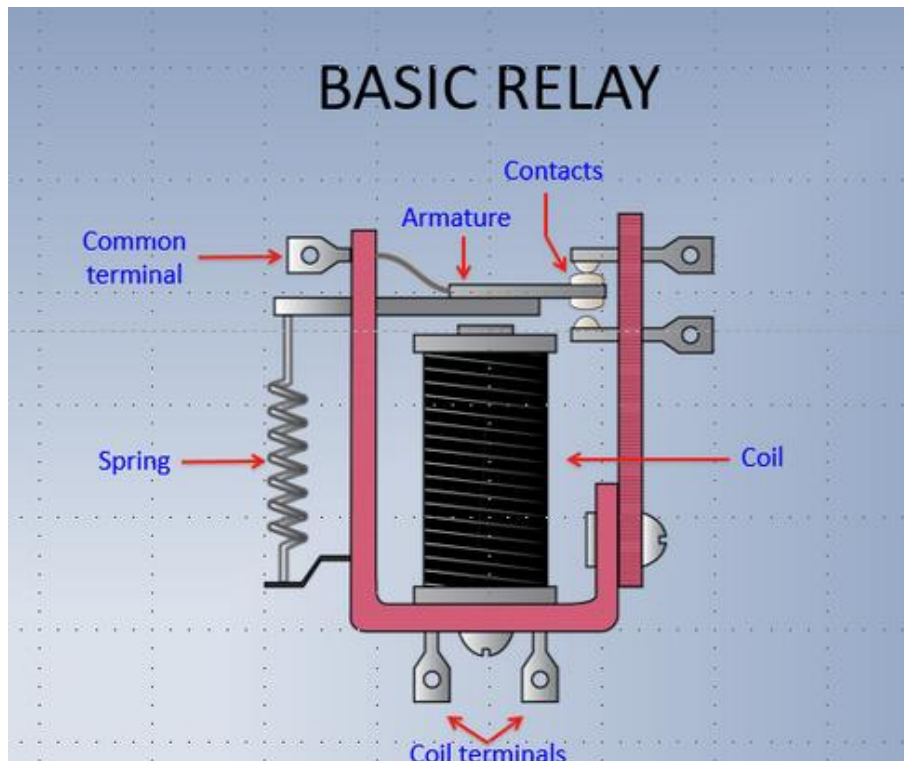


Figure 4.10: Basic Relay [14]

4.9 RELAY IN SUMMIT

A relay is a device that detects the fault and initiates the operation of the breaker to isolate the defective element from the rest of the system. In this power plant relay used in several places. As like control panel, medium voltage, low voltage, high voltage system and also used in sub-stations. In Summit they used several relay for every equipment protection. As like differential (current and voltage) relay, induction relay, thermal relay, high voltage relay, overcurrent and directional relay, frequency protection relay. If any fault occurs in any system relay sense the fault and send a signal to circuit breaker and the control panel.



Figure 4.11: Relay [15]

4.10 ISOLATOR IN SUMMIT

Isolator is one kind of switch. It disconnects circuits when it is needed. It is used when any kind of fault occurs, maintenance work is required, and safety for workers it is required. It mainly used in sub-station and high voltage devices; Isolator also used for isolate any line. In Summit, they operate isolator automatically and manually. For operate in manually they need to consider that first they need to open the circuit breaker then the isolators. Sometime they need to separate one portion from another circuit; they use isolator for that purpose.



Figure 4.12: Disconnecting Switch

4.11 LIGHTNING ARRESTER IN SUMMIT

In Summit, power plant lightning arrester is used in sub-station that protects the sub-station equipment and bus-bar lines. It is connected to all equipment of sub-station. In power transformer a horn-gap arrester is used for its protection. In rainy season, there is a lot of possibility for surge voltage, in sub-station there are a lot of current-carrying conductors; it helps to absorb the abnormal voltage and keep the equipment safe.



Figure 4.13:- Surge Absorber

4.12 BUS BAR

Bus bar sheet of copper or aluminum. Bus bar can be rectangular bar, swelled pipe or three sided shape. Bus bar receives from one or more circuit and distribute in other different circuit. Bus bar conducts in static voltage. Every bus bar is insulated and separated. In substation, the connection procedure between various equipment like circuit breaker, isolator etc. and bus bar is called bus-bar arrangement.

➤ **Bus-bar characteristics**

- Low resistance must be used
- Rate of change of resistance with time must not be changed.
- Increasing temperature must not affect the change of resistance.
- For proper insulation, bus bar must have specific gaps.

4.13 BUS-BAR USED IN SUMMIT

A bus bar is metallic strip or bar that conducts electricity within a switch board, distribution board, substation other electrical apparatus. A bus bar is a place where the input is connected by wire and output is taken from it. In summit power plant, we generate electricity by moving rotors of alternator than it goes to mv room where we can find a bus bar that is connected to various equipment. In summit power plant's substation bus bar, also alternator generates used electricity. Then for distribution purpose, we need to supply to grid via substation. In substation, bus bar is one of the important equipment.



Figure 4.14:- Bus-Bar

CHAPTER 5

CONCLUSION AND FUTURE SUGGESTIONS

5.1 CONCLUSION

It was a great opportunity for us to complete my field study in Summit Narayanganj Power Plant Unit 2. Summit power plant is playing an important role in producing power for the nation and thus contributing to the country's economy. The authorities of Summit Power Limited are very considerate about all kinds of safety and security of that power plant. There I spent two months and experienced many things during my field study program under a friendly environment which encouraged us to learn more things about the power plant and its system. At Summit power plant, I have also observed the working environment and their official activities. The power plant is a combination of mechanical and electrical engineering, so both mechanical and electrical engineers are working at Summit power plant. Within this short period, I tried my best to learn about HFO power plant electricity generation process. I have learned practical power plant about how to generate power, how to supply power in main grid, what was the purpose of transformer, how to improve power and so on. I am also explained the various ways of protecting electric machines against various electrical faults. This power plant is connected to the national grid of 55MW electricity produced and produced because of electricity. I tried to gain practical knowledge about some major equipment of all these power plants. I learned about the power generation, transmission and distribution system of power station. I hope that this experience will extend my knowledge effectively and provide us the best future in the field of power plant.

5.2 LIMITATION OF WORK

During the period of field study from my experience, it is clear to me that they don't have sufficient manpower especially in maintenance section. Sometimes Wartsila engine is suddenly tripped and takes 2 or 3 days. Temperature of the exhaust gas is very high that pollutes the environment and causes global warming. Since it is an oil, based plant oil leak is happen. During my internship, a good number of breakdowns have occurred in the plant. They do not have enough cleaner to keep the plant neat and clean. The time of replacement of any fault equipment is quite long.

5.3 FUTURE SCOPE OF THE WORK

The Summit power company limited is responsible for generation of electricity. They are using equipment Transformer, circuit breaker, relay, isolator, lightning arrester, current transformer, potential transformer, auxiliary transformer, fuses etc in sub-station. I have gather a clear knowledge about different equipment of distribution system and sub-station. The assistant engineer help us to know about various type of equipment work. From this study, I have gathered a clear knowledge about sub-station equipment. I would like to research the Thermal power plant, Gas turbine power plant, Biogas power plant in future and work on power Generation, Distribution and Transmission. In future, I will convey the promise of power generation and service, distribution, transmission and work in power plant in future, Insha-Allah. It will be helpful in my future life.

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