EAST WEST UNIVERSITY

INTERNSHIP REPORT

ON

POWER GENERATION, TRANSMISSION AND PROTECTION SYSTEM EQUIPMENTS OF SIDDHIRGANJ EGCB POWER PLANT

By

Khondoker Fazle Rabbi SID: 2009 – 1 – 80 – 020

Tauhid Anwar Bhuiyan SID: 2009 – 1 – 80 – 030

Humam Jahanzeb Momen SID: 2009 – 1 – 80 – 035

Submitted to the
Department of Electrical and Electronic Engineering,
Faculty of Sciences and Engineering
East West University

in partial fulfillment of the requirements for the degree of
Bachelor of Science in Electrical and Electronic Engineering
(B.Sc. in EEE)

[Spring, 2013]

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Approved By

Intern Advisor	Department Chairperson
Mariam B. Salim	Dr. Mohammad Mojammel Al Hakim

Approval Certificate

ELECTRICITY GENERATION COMPANY OF BANGLADESH LIMITED

(An Enterprise of Bangladesh Power Development Board)

Siddhirganj 2x120 MW Peaking Power Plant Project, Siddhirganj, Narayanganj

Tel: 880-2-7692013, Fax: 880-2-7691280, E-mail: pd2x120@egcb.com.bd

Office of the General Manager

Ref No.: 322/DGM (Op)/2x120MW /EGCB/2012. Date: 15.9.2012

CERTIFICATE

This is to certify that **Humam Jahanzeb Momen** son of Abdul Momen Chowdhury, **Student ID.2009-1-80-035**; Department of Electrical & Electoronic Engineering, East West University have successfully completed Industrial Training (105 hours) at **Siddhirgong 2x120MW Peaking Power Plant** of Electricity Generation Company Of Bangladesh Ltd from **12.08.2012 to 08.09.2012.** During his training period he was familiarized with operation and maintenance of GE Frame 9E Gas Turbine, Gas Booster Compressor, Instrument Air Compressor, Water Treatment plant, Switch-Gear, Transformer, Sub-station, etc.

We wish him all success in life.

(Md. Atiar Rahman)
Deputy General Manager (Operation)
Siddhirgong 2x120MW Peaking Power Plant,
Electricity Generation Company of Bangladesh Ltd.,
Siddhirgong, Narayangong.

Approval Certificate

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Office of the General Manager

Ref No.: 321/DGM (Op)/2x120MW /EGCB/2012. Date: 15.9.2012

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This is to certify that **Khondoker Fazle Rabbi** son of Khondoker Abul Monsur, **Student ID.2009-1-80-020**; Department of Electrical & Electoronic Engineering, East West University have successfully completed Industrial Training (105 hours) at **Siddhirgong 2x120MW Peaking Power Plant** of Electricity Generation Company Of Bangladesh Ltd from **12.08.2012 to 08.09.2012.** During his training period he was familiarized with operation and maintenance of GE Frame 9E Gas Turbine, Gas Booster Compressor, Instrument Air Compressor, Water Treatment plant, Switch-Gear, Transformer, Sub-station, etc.

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Deputy General Manager (Operation)
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Office of the
General Manager

Ref No.: 325/DGM (Op)/2x120MW /EGCB/2012. Date: 15.9.2012

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(Md. Atiar Rahman)
Deputy General Manager (Operation)
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Siddhirgong, Narayangong.

Acknowledgement

First and foremost, we want to convey our heartfelt gratitude to Almighty Allah for His help in complete our internship successfully. We also want to thank the management of Siddhirganj EGCB Power Station for providing us with the opportunity to accomplish our industrial training. We would like to especially thank Engr. Atiar Rahman, Managing Director (Operations) of Siddhirganj EGCB Power Station for giving us the permission to complete our internship work at the power plant. We would also like to thank Ms. Mariam B Salim, our supervising advisor for her constant support and many suggestions, but also for her patience in those times when we faced several problems.

We want to thank all those people who helped to complete our internship report successfully. In this process our special thanks goes to Engr. Md. Saiful Islam (Manager - Electrical) who coordinated our internship program and helped us get acquainted with the other engineers. We are very grateful to Engr. Nandhipan Das (Assistant Manager - Technical), Engr. Nadir Chowdhury (Assistant Manager - Operations), Engr. Siddiqur Rahman (Assistant Manager - Operation), Engr. A.K.M Zillur Rahman (Assistant Manager - I&C), Engr. Kazi M.H. Kabir (Manager - Environment & Safety), Engr. Ashis Kumar Biswas (Assistant Manager - Technical) and Engr. Md. Yamin Ali (Assistant Manager - Technical) for mentoring us.

We would also like to mention the name of Dr. Anisul Haque, former Chairperson and Professor of the Department of Electrical & Electronic Engineering, and Dr. Khairul Alam, former Chairperson and Associate Professor of the Department of Electrical & Electronic Engineering, and Dr. Mohammad Mojammel Al Hakim, Chairperson and Associate Professor of the Department of Electrical & Electronic Engineering for being so kind during the period of our internship. We are also grateful to all our teachers for their cooperation and encouragement throughout our whole academic life at East West University.

Executive Summary

We did our internship at Siddhirganj EGCB Power Plant, located on the bank of the river Shitalakha, within the Siddhirganj Power Station premises at Siddhirganj, Narayanganj from 12th of August to the 8th of September. This internship report is the result of those 15 days.
The EGCB Siddhirganj Power Station is a newly commissioned power generating plant. It has two generating units, both gas fired, with a peaking capacity of 240MW. Our duration of stay was divided into four sections: generation, instrumentation and control (I & C), mechanical, and electrical. In all of these sections, we were demonstrated how these systems work and what protective measures are taken for them. During our internship, we learned about how electricity is generated, operation of the plant, major equipments like generators, transformers, and switchgear equipments required for distribution of electricity and protection of the plant. We got to learn the importance of protection and switch gear system for the plant and how they work. In the end, our whole internship was the combination of our theoretical and practical knowledge. Protection and controlling of the equipments of the power station is a very important and complicated task. With the help of the plant engineers, we observed the control room operations, and protective equipments such as relays, circuit breakers, lightning arrestors, current transformers, potential transformers, etc. very closely and understood the functions and controlling system of those equipments. All the required information and knowledge was provided to us in a clear way by our mentors at the plant.

Training Schedule

The following table contains our training schedule at EGCB Siddhirganj Power Station. Our internship started on 12th of August 2012 and ended on 8th of September 2012.

Date	Division	Time	Instructor
12-08-2012	Electrical	9am to 4pm	Engr. Nandhipan Das Asst. Manager (Technical)
14-08-2012 25-08-2012 26-08-2012	Control Unit	9am to 4pm	Engr. Nadir Chowdhury Asst. Manager (Operation) Engr. Siddiqur Rahman Asst. Manager (Operation)
27-08-2012	Operation	9am to 4pm	Engr. A.K.M Zillur Rahman Asst. Manager (I&C)
28-08-2012	Fire Safety Training	9am to 4pm	Engr. K.M.H Kabir Manager (Environment & Safety)
29-08-2012 30-08-2012 01-09-2012	Electrical	9am to 4pm	Engr. Nandhipan Das Asst. Manager (Technical) Engr. Ashis Kumar Biswas Asst. Manager (Technical)
02-09-2012 03-09-2012	Mechanical	9am to 4pm	Engr. Yamin Ali Asst. Manager (Technical)

04-09-2012 05-09-2012	Electrical	9am to 4pm	Engr. Nandhipan Das Asst. Manager (Technical) Engr. Ashis Kumar Biswas Asst. Manager (Technical)
06-09-2012	Electrical	9am to 4pm	Engr. Saiful Islam Manager (Electrical)
08-09-2012	Mechanical	9am to 4pm	Engr. Yamin Ali Asst. Manager (Technical)

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Chapter 1 Introduction

The power generation sector is one of the most important sectors of our country. All the other sectors are directly or indirectly dependent on it. As a result industrial and overall economic growth is dependent on the power generation sector. But our power generation sector has been marred by many problems. The biggest problem is the inadequate generation of electricity. Day by day the demand for electricity in our country is increasing but the generation of power is not increasing at the same rate. Previously the sole responsibility of generation, transmission and distribution of electricity lied on the shoulders of Bangladesh Power Development Board (BPDB). But over the years, by making the BPDB a mother company, the government of Bangladesh has created several separate publicly owned entities under the BPDB for generation, transmission and distribution of electricity, thus relieving BPDB of the responsibilities of generation, transmission and distribution of electricity. Electricity Generation Company of Bangladesh (EGCB) is one such publicly owned entity for generating electricity [1].

It was a great opportunity to complete our internship at the EGCB Power Plant located inside the Siddhirganj Power Station premises. It is one of the most advanced power plants in the country. This plant has been adding electricity to the national grid since 2010. During our internship, we closely observed the generation, operation, switching station, and instrumentation and control sections of the plant. This chapter gives the overall idea about EGCB as a company, including the background, present capabilities, and future plan.

1.1 Company Profile

The Electricity Generation Company of Bangladesh (EGCB) Ltd is an enterprise of the Bangladesh Power Development Board (BPDB). It came into existence on the 16th of February, 2004. It was previously known as the Meghnaghat Power Company (MPC) Ltd. EGCB plans to become a leading electricity generation company across the country. The company's major share is held by BPDB [1].

1.2 Background of the 2×120 MW Peaking Power Plant

1.2.1 Construction of the Plant

The construction of the EGCB 2×120 MW Peaking Power Plant was completed on the bank of the river Shitalakha within the Siddhirganj Power Station premises. It was funded by the Asian Development Bank. Bharat Heavy Electricals Limited (BHEL) was the equipment procuring contractor (EPC) for this project. The first generating unit was put on test run on the 20th of November 2009 and it was inaugurated by the Honorable Prime Minister Sheikh Hasina on the 14th of February 2010. The second generating unit was put on test run on the 26th of May 2010. The second generating unit was taken over from the EPC contractor on the 14th of October 2010. Combined generation and distribution from both units was effective from the 5th of February 2012 [1].

1.2.2 Gas Availability and Usage

The gas to the power plant is supplied by Titas. Unfortunately, due to the presence of Adamjee Export Processing Zone (AEPZ) nearby, the plant does not receive the required gas pressure for optimum operation. The AEPZ houses many export oriented industries which require gas supplied by Titas for manufacturing. As a result the EGCB Power Plant operates below its capacity most of the time. Sometimes the gas pressure becomes too low for operation. Therefore, during those times there is no generation of electricity at the plant [1].

1.3 Future Projects of EGCB

EGCB has undertaken two new projects to add to its portfolio. Construction of both projects is now underway. One is the 335 MW Combined Cycle Power Plant near the Siddhirganj Power Station premises and the other is the Haripur 360 MW Combined Cycle Power Plant at Haripur. Both projects were approved by the Government of Bangladesh under its grand plan of achieving zero load-shedding by 2015. The construction of the EGCB 335 MW Combined Cycle Power Plant is to be completed by 2014-2015 whereas the Haripur 360 MW Combined Cycle Power Plant is expected to be completed by July 2013 [1].

1.4 Objective of the Internship

The main goal of this internship was to gather practical knowledge and experience about power station. In this internship report, we have focused on the generation process, protection strategy and maintenance of individual sections, and the control unit of EGCB Siddhirganj

Power Plant which we saw during our internship period. We have tried to give a complete overview of our experience at EGCB in this report.

1.5 Scope and Methodology

This report focuses on the total process of power generation, including water resource management, boiler management, generator, open cycle power plant and switching station. This report also mentions the protection and maintenance of generator, boiler, and turbine. The instrumentation and control section have also been discussed here. During our internship period, our mentors showed us various equipments and sections of the power station. This entire report was written based on what we learned in relative courses, our experience at the EGCB Power Plant, lectures and documents provided by the EGCB mentors, and relative books.

Chapter 2 Mechanical Components

2.1 Introduction

The mechanical components of the power plant were shown to us by Engr. Yamin Ali, Asst. Manager (Technical) at the power plant. This chapter includes information we learned about the mechanical components used in EGCB Power Plant, the modes of operation and the exhaust system.

2.2 Mechanical components

The mechanical components are the main features for the generation of electricity. There are various types of components used in power generation. The mechanical components that we were taught about, and in some cases were shown, are given below:

1. Compressor,
2. Combustion System,
3. Turbine,
4. Generator,
5. Gas Booster Compressor,
6. Plant Air and Instrument Air,
7. Water Treatment Plant.

2.2.1 Compressors

The compressor is used to compress the natural air. The compressed air is used in the combustion chamber to ignite the gas. The compressor section consists of compressor rotor and compressor stator. There are 17 stages of compressor blades consisting of inlet and outlet guide valves. In the compressor, air is compressed in stages by a series of alternate rotating (rotor) and stationary (stator) blades. Compressed air is extracted from the compressor for turbine cooling, for bearing sealing, and for compressor pulsation control during startup and shutdown [4].

2.2.1.1 Compressor Blade

The compressor rotor blades are airfoil shaped and are designed to compress air efficiently at high blade tip velocities. The forged blades are attached to their wheels by axial dovetail connections. The dovetail is accurately machined to maintain each blade in the desired location on the wheel. Stages 1 through 8 out of 17 stages of rotor blades are mounted by axial dovetails into blade ring segments [4]. During operation of the gas turbine, air is extracted from various stages of the axial flow compressor to:

1. Cool the turbine parts subject to high operating temperatures.
2. Seal the turbine bearings.
3. Provide an operating air supply for air-operated valves.
4. Fuel nozzle atomizing air (if applicable).

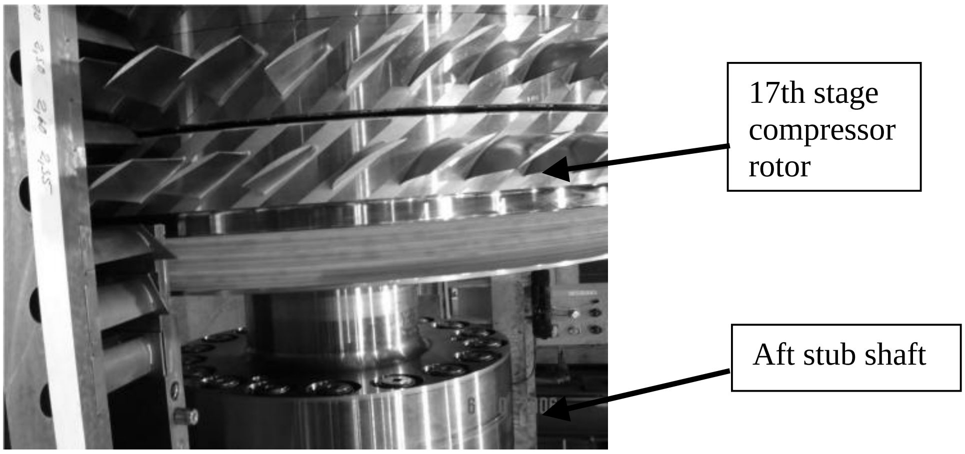

Figure 2.1: Compressor Rotor [3]

2.2.2 Combustion System

The combustion system consists of combustion chamber, spark plugs, ultraviolet flame detector, crossfire tubes, fuel nozzle, etc. When the fuel burns, a huge amount of heat is produced. This is used to drive the turbine. Fuel is supplied to each combustion chamber through a nozzle which is designed to disperse and mix the fuel with the proper amount of combustion air within the liner.

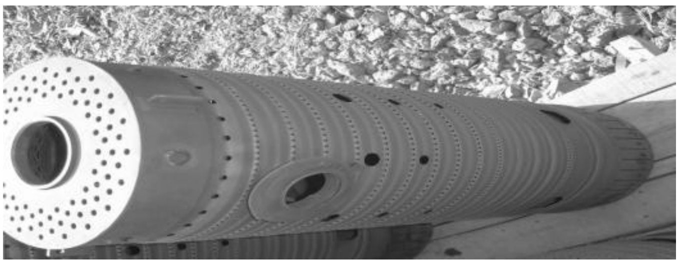

Figure 2.2: Combustion Liner [4]

2.2.2.1 Combustion Chamber

We have seen 14 combustion chambers and each of the combustion chambers are connected internally. Air discharged from the compressor flows to the combustion chamber through nozzles and enters into the combustion chamber reaction zone through the liner cap holes. The additional air is mixed with the combustion gases and enters into the reaction zone. The 14 chambers are identical with the exception of those fitted with spark plugs or flame detectors [4].

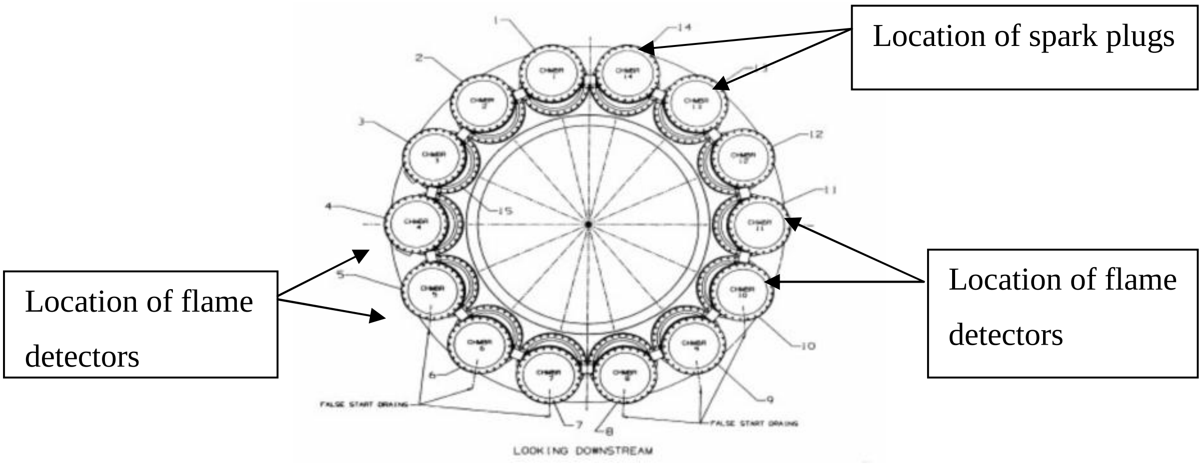

Figure 2.3: Combustion Chamber [3]

2.2.2.2 Spark Plugs

The combustion is initiated by means of discharge from two high voltage electrode spark plugs. Spark plugs are present at combustion chamber number 13 and 14. At the time of ignition, one or both sparks of these plugs ignite a chamber. The remaining chambers are ignited by crossfire through the tubes that interconnect the reaction zones of the remaining chambers. As rotor speeds up and air flow increases, the spark plugs and the high voltage electrodes are withdrawn from the combustion chamber [4].

2.2.2.3 Ultraviolet Flame Detectors

It is necessary to know the absence or presence of flame inside the combustion system and to send the signal to the control room. There are four flame detectors in four different combustion chambers of the EGCB power plant. These chambers are chamber number 4,5,10 and 11. The control system continuously monitors the presence or absence of flame. The “failure to fire” or “loss of flame” is indicated on the control panel [4].

2.2.2.4 Crossfire Tubes

The 14 combustion chambers are interconnected by means of crossfire tubes. These crossfire tubes propagate the flame from one combustion chamber to other [4].

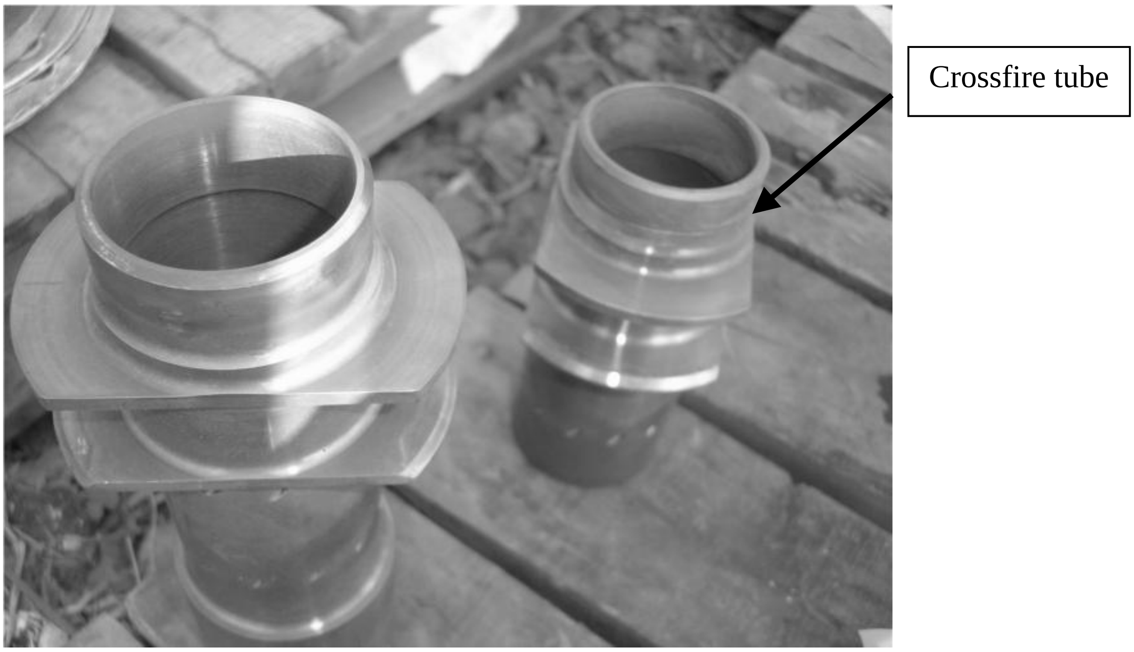

Figure 2.4: Crossfire Tubes [3]

2.2.2.5 Fuel Nozzle

The combustion chamber also consists of fuel nozzle. Gaseous fuel is entered directly into each combustion chamber through metering holes located at the inner edge of the chamber. Both gas and oil fuel may be burned simultaneously in a dual-fuel turbine configuration where the percentage of each fuel is determined by the operator within the control system limits [4].

2.2.3 Turbine

The turbine has three sections. These are turbine rotor, stator and buckets. Here the energy from the high pressurized gas which is produced by the compressor and the combustion section is converted into mechanical energy [4]. We did not see the turbine rotor and stator. The parts which we have learnt from our mentor are discussed below.

2.2.3.1 Turbine Buckets

There are three stages in turbine buckets. The turbine buckets increase in size from the first stage to the third stage. At every stage of energy conversion a high pressure is reduced, So that a large annular area is required to accommodate the gas flow. The hot gases extracted from the first stage nozzles first fall into the first stage rotating buckets of the turbine rotor. Buckets are placed in a manner that they can be set out easily for maintenance [4].

2.2.3.2 Nozzles

There are three stages of nozzles in the turbine stator section. These nozzles direct the high velocity flow of expanded hot combustion gas against the turbine bucket which causes the rotor to rotate. As these nozzles operate in the hot combustion gas flow, they are subjected to thermal stresses in addition to gas pressure loadings.

2.2.3.3 Exhaust Frame

The exhaust frame assembly consists of exhaust frame and diffuser. The exhaust frame is connected by bolts with the turbine shell. The frame consists of two cylinders, one inner cylinder and one outer cylinder. They are interconnected by bolts. The inner gas path surfaces of the two cylinders are attached to the inner and outer diffusers. The diffusers spread the heat across the surface or area. The exhaust diffuser is located between the outer and inner cylinders. Gases exhausted from the third turbine stage enter the diffuser where the velocity is reduced by diffusion and pressure is recovered. The exhaust frame is cooled by a portion of cooling air supplied by off-base motor driven blowers then enters the turbine shell after cooling the outer frame and the radial support struts [4].

2.2.3.4 Bearings

The PG 9171E gas turbine contains three main journal bearings used to support the rotor. Rotor to stator axial position is controlled by thrust bearing. This bearing assembles are located in three bearing house: one at inlet casing, one in the compressor discharge and one in the exhaust frame. These main bearings are pressure lubricated by oil supplied from the main lubricating oil system. The oil flows through branch lines to an inlet in each bearing housing [4].

Table 2.1: List of Some Bearings

Housing	Class	Type
1	Journal	Elliptical
1	Loaded Thrust	Self -Aligned
1	Unloaded Thrust	Tilting-Pod
2	Journal	Elliptical
3	Journal	Elliptical

2.2.4 Generator

A generator is an electrical device which converts mechanical energy into electrical energy. The generator consists of the following components:

1. Stator,
2. Frame,
3. Stator core,
4. Stator winding,
5. Stator end covers,
6. Rotor,
7. Rotor windings,
8. Rotor retaining rings,
9. Field connections,
10. Bearings,
11. Foundation frame,
12. Air filters,
13. Enclosure,
14. Generator Auxiliary Compartment, etc.

In a synchronous generator, a dc current is applied to the rotor winding, which produces a rotor magnetic field. The rotor of the generator is then turned by a prime mover, producing a rotating magnetic field within the machine. This rotating magnetic field induces a three phase set of voltages within the stator windings of the generator. At EGCB 2×120 MW Peaking Power Plant, brushless exciters are used to supply the dc field current to the machine. A brushless exciter is a small ac generator with its field circuit mounted on the stator and its armature circuit mounted on the rotor shaft. The three phase output of the exciter generator is rectified to direct current by a three phase rectifier circuit also mounted on the shaft of the generator, and is then fed into the main dc field circuit. By controlling the small dc field of the exciter generator, it is possible to adjust the field current on the main machine without slip rings and brushes. At the EGCB 2×120 MW Peaking Power Plant, the dc field is controlled by an Automatic Voltage Regulator (AVR). Thyristors are used for this purpose. At a certain firing angle the thyristors are fired. The firing angle is determined by considering certain parameters [4].

The ratings of the generator used in EGCB are given below:

Table 2.2: Ratings of Generator used in EGCB Power Plant

Manufactured by	Jhansi, BHEL India
KVA	13750
KW	108600
PF(lag)	0.80
Frequency	50 HZ
RPM	3000
Phase	3(AC)
Stator voltage	11000V
Stator current	7125A
Rotor voltage	370V
Rotor current	817A

2.2.5 Gas Booster Compressor

Gas booster compressor (GBC) is an important part of the EGCB 2×120 MW Peaking Power Plant. It is used to boost up the speed of the gas. The gas supplied from Titas is not fully pressurized enough for combustion. There are a lot of pneumatic valves in this plant. Some get air from bottom and some get air from top. The ones which get air from the top are called air to open and the ones which get air from the bottom are called air to close. Gas Booster Compressor (GBC) compressor has six stages. It is a centrifugal compressor. It has a suction line and a discharge line. The discharge gas has high temperature and pressure. Discharge temperature is 135°C and pressure is 25 kg. Gas cooler is used to reduce the temperature of the gas. When the turbine is not started, the discharge gas is again fed into the suction line through an anti-surge valve. Anti-surge valve is used to reduce the pressure of the feeder gas [5].

2.2.6 Plant Air and Instrument Air

An air compressor is used to produce instrument air, plant air, and nitrogen. Carbon molecular fid (CMF) is used to absorb the carbon related material. Oxygen is also absorbed by CMF. Instrument air is used in different types of pneumatic valve and in journal bearing. Lube (lubricating) oil is used for the operation of journal bearing. As it is a mechanical contact, it cannot be 100% leakage free. So the lube oil can leak out from the bearing. To stop the leaking, instrument air is used as a filling to pressurize the lube oil. This filling is used only at GBC. Since lube oil and instrument air can react with each other, nitrogen is used as a barrier to hinder the reaction. Nitrogen is also used inside different pipes when the operation at the plant remains turned off for a long time. This is used to stop the corrosion of the pipe [5].

2.2.7 Water Treatment Plant

Water treatment plant is necessary to make it useful for the plant. Here water is used for cooling. Mineralized water is not directly used in the plant. It is full of different minerals, anions and cations. If the mineralized water is used, it will react with metal, which is not desired. At the water treatment plant, the water from the river Shitalakhya is treated. First the anions and cations are removed and then make the water is de-mineralized by reverse osmosis process. Reverse osmosis is a process that various industry uses to clean water. Different types of motor and pumps are used in this process. The driving force of the reverse osmosis process is applied pressure [5].

2.3 Modes of Operation

The combustors of EGCB Power Plant control the emission of nitrogen oxide. To maintain this, the combustor operates at three different modes [5]. These modes are

1. Primary,
2. Lean lean, and
3. Premix steady state.

The combustion chamber has two regions, primary and secondary. There are also primary and secondary nozzle from which the fuel enters into the combustors. To operate at the above three modes, the fuel and flame position changes inside the combustors [4]. A brief explanation of these modes is given below:

Primary: In this mode, fuel is present only at the primary nozzle and flame is present in the primary stage only. This mode of operation is used to ignite, accelerate, and operate the machine over low to mid-loads, up to a pre-selected combustion reference temperature [5].

Lean lean: In this mode, fuel is present in both the primary and secondary nozzles. Flame is present in both the primary and secondary stage. This mode of operation is used for intermediate loads between two pre-selected combustion reference temperatures [5].

Premix steady state: In this mode, fuel is present in both primary and secondary nozzles. Flame is present in the secondary stage only. This mode of operation is achieved at and near the combustion reference temperature design point. Optimum emissions are generated in premix mode.

The flow of fuel to the combustors for different modes of operation is controlled by 1 speed/stop ratio valve (SRV) and three gas controlling valves (GCV) [5].

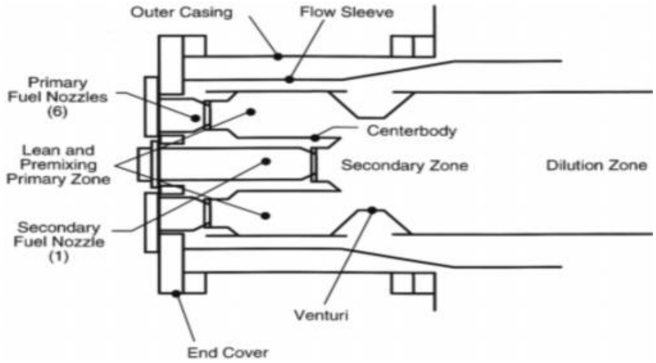

Figure 2.5: Dry Low NOx Combustor [3]

2.4 Exhaust System

Exhaust systems are necessary to guide the exhaust fuel gases of gas turbine into the atmosphere. The use of exhaust systems behind the gas turbine is mandatory as the exhaust fuel gases contain temperatures between 400 - 650°C. Gas turbine exhaust systems must perform three functions: reduce noise to the atmosphere, vent hot gases away from personnel, minimize backpressure to gas turbines [4].

Chapter 3 Power Plant Electrical Components

3.1 Introduction

In this part of our industrial training, Engr. Nandhipan Das and Engr. Ashis Kumar, both Assistant Managers at the power plant were our mentors. There are many electrical components in the EGCB power plant. Among the most important electrical components are:

- Transformers,
- Bus bar, and
- Circuit breakers.

Transformers are used to step up or step down the voltages for transmission of power. Circuit breakers are used to provide different types of protection for the different equipments at the power station. The use of transformers, circuit breakers, bus bars and their operating mechanism are discussed in this chapter.

3.2 Transformer

A transformer is an electrical device that takes electricity at one voltage and changes it into electricity of a different voltage. This occurs by inductive coupling which is related to the magnetic flux changing in the primary winding of the transformer. This results in changing magnetic flux in the secondary winding that induces a varying voltage secondary winding. At this point a load is connected in the secondary winding that causes current flow in the secondary winding and thus transformation of electricity [9].

An ideal transformer has two windings, primary and secondary. Primary winding voltage is denoted as (V_p) and secondary winding induced voltage (V_s). The ratio of the primary winding voltage to secondary winding induced voltage is equal to the ratio of number of turns in the primary winding (N_p) to number of turns in the secondary winding (N_s). At EGCB power plant, we saw both power and instrument transformers. There was a switchyard for each unit where the instrument transformers were present. We have discussed about them below.

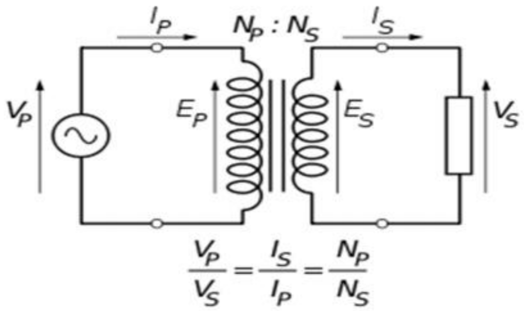

Figure 3.1: Ideal Transformer as a Circuit Element [10]

3.2.1 Power Transformer

Power transformers are used to step-up or step-down voltages for distribution. At EGCB power plant there are six power transformers, three for each unit. There are two 11/132 KV, two 11/6.6KV, two 6.6/0.4KV power transformers. An 11/132 KV transformer means that the input into the transformer is 11 KV and the transformer provides an output of 132 kV. Hence it is a step-up transformer and is basically used to supply the generated electricity (at 11 KV) to the substation (at 132 KV). The other transformers are step-down transformers and are used to get the desired voltage level for different equipments used in the plant. This means that at the plant there are different equipments that require either 6.6 KV or 0.4 KV to operate. These step-down transformers provide the 6.6 KV or 0.4 KV voltage levels to the bus bars.

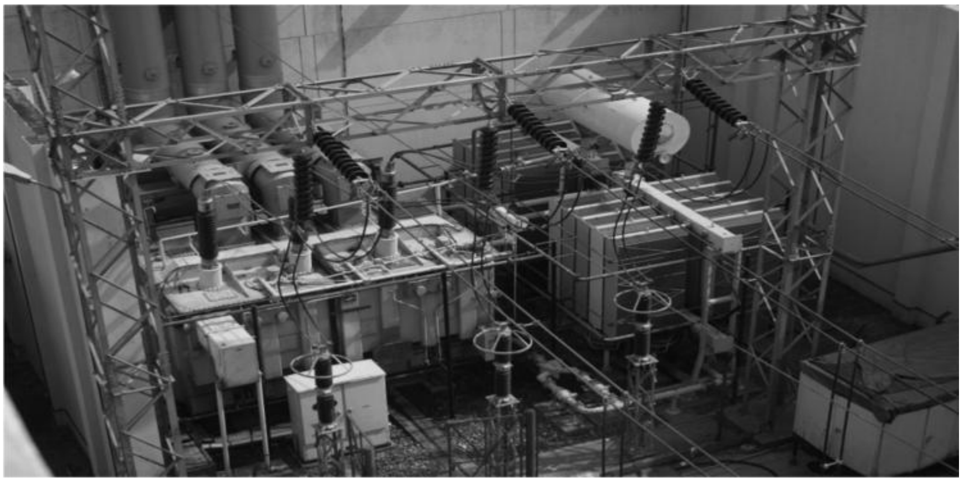

Figure 3.2: One of the 11/132 KV power transformer used in EGCB Power Plant [2]

The salient features of the power transformer used at the EGCB power plant are given below:

Table 3.1: Salient features of the Power Transformer at the EGCB power plant

Manufactured By	Jhansi, BHEL India, 170 MVA
Voltage	11/132 KV (step up)
Type of Cooling	Oil Forced Air Forced (OFAF)
Line Current	LV Side:8922.68 Amperes
	HV Side:743.55 Amperes

3.2.2 Instrument Transformer

Instrument transformers are used for accurate and reliable current and voltage measurements for secondary equipments such as meters, protection relays and other devices measurements which provide safe and efficient operation of transmission networks. Instrument transformers include:

- Current Transformer (CT), and
- Potential Transformer (PT).

The functions of CT and PT are discussed below.

3.2.2.1 Current Transformer (CT)

A current transformer is used in high voltage circuits where it is not possible to measure current directly. CT steps down high current to very low current that can be handled easily and thus can be read. Its secondary is connected to an ammeter of very small capacity (usually 5 A) but its scale is calibrated according to actual values. A current transformer is selected according to the ratio of maximum load current and required current. For EGCB power plant, the CT ratio is 800/1 for 132 KV line current.

Figure 3.3: Current Transformer at the EGCB power plant [2]

3.2.2.2 Potential Transformer (PT)

Potential transformers have a large number of primary turns and a small number of secondary turns and may be either single phase or three phase units. For EGCB the PT ratio is 1200/1 for 132 KV line. This means that the PT converts the 132 KV voltage into 110 V voltage, measures the voltage with a meter and applies a user programmed multiplier (1200) to this number (110 V) to calculate the original voltage. The output seen by the user is after the multiplication.

Figure 3.4: Potential Transformer at the EGCB power plant [2]

3.2.3 AC and DC Auxiliary System

Auxiliary system is used to power up the power plant equipment's and provide backup when AC power supply fails. There are two types of auxiliary system in EGCB. They are:

1. AC auxiliary system, and
2. DC auxiliary system.

3.2.3.1 AC Auxiliary System

AC auxiliary system is used to operate the internal equipment's within the power plant. There are two types of AC auxiliary system in EGCB. They are:

i. Unit auxiliary system, and
ii. Station auxiliary system.

3.2.3.1.1 Unit Auxiliary System

In order to start the AC generator present in the power plant, the auxiliaries of this unit need to be started. Power required to start these auxiliary drives is derived from a step down transformer connected to the high voltage (HV) bus and this transformer is called unit auxiliary transformer. The HV side transformer voltage corresponds to the voltage of the generating unit (11 KV) and the low voltage (LV) side voltage is stepped down to 6.6 KV.

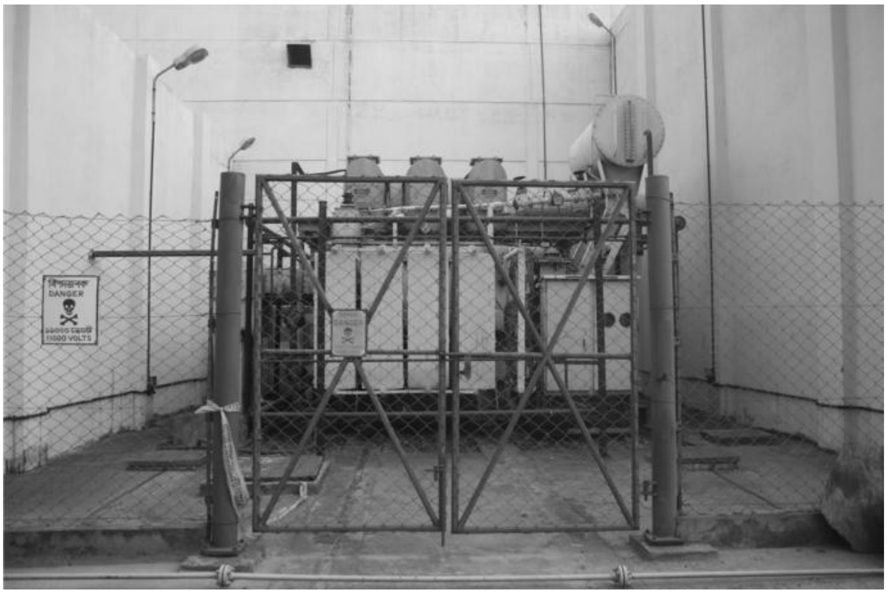

Figure 3.5: Unit Auxiliary Transformer [2]

The salient features of the Unit Auxiliary Transformer at the EGCB power plant are given below:

Table 3.2: Salient features of the Unit Auxiliary Transformer at the EGCB power plant

Manufactured By	Jhansi, BHEL India, 12.5 MVA
Voltage	11/6.6 KV (step down)
Type of Cooling	Oil Natural Air Forced (ONAF)
Line Current	LV Side: 1045.92 Amperes
	HV Side: 656.08 Amperes

3.2.3.1.2 Station Auxiliary System

The station auxiliary transformer is used to step down voltage from 6.6 KV to 440 V. The rating for this transformer corresponds to the rating of the auxiliary load it should be bearing. The HV side transformer voltage corresponds to the voltage of the unit auxiliary transformer (6.6 KV) and the LV side voltage is stepped down to 0.44 KV.

Figure 3.6: Station Auxiliary Transformer used at the EGCB Power Plant [2]

The salient features of the Station Auxiliary Transformer at the EGCB power plant are given below:

Table 3.3: Salient features of the Station Auxiliary Transformer at the EGCB power plant

Manufactured By	Jhansi, BHEL India, 2.5 MVA
Voltage	6.6/0.440 KV (step down)
Type of Cooling	Oil Natural Air Natural (ONAN)
Line Current	LV Side: 3436.6 Amperes
	HV Side: 218.6 Amperes

3.2.3.2 DC Auxiliary System

DC auxiliary power systems are used to maintain or manage systems during loss of power in the main line. In general, a DC auxiliary power system comprises of a battery and charger, both of which are connected to the DC distribution bus. The capacity, voltage and autonomy (region) of the auxiliary system varies depending on its operating purpose. At EGCB the batteries are of Nickel Cadmium (Ni-Cd) and the equipments that need DC supply is:

- All Field Instruments (24 V DC),
- Circuit breakers module control power supply (110 V DC),
- GT emergency drive panel (125V DC),
- Mark VI Control System for GT (125 V DC), and
- All GT solenoids (125 V DC).

Figure 3.7: The DC Auxiliary System storage facility at the EGCB Power Plant [2]

Figure 3.8: Ni-Cd Battery used for the DC Auxiliary System at the EGCB Power Plant [2]

3.3 Circuit Breaker

A circuit breaker (CB) is an automatic switch that stops the flow of electric current in a suddenly overloaded or otherwise abnormally stressed electric circuit. During abnormal conditions, when excessive current develops, a circuit breaker opens to protect equipment and surroundings from possible damage due to excess current. A CB does not need to be replaced like a fuse after each operation. It can be reset either manually or automatically to its normal operating condition [11].

There are different types of circuit breakers in EGCB. They are:

- Air Blast Circuit Breaker (ABCB),
- Air Break Circuit Breaker (ACB),
- SF_6Circuit Breaker,
- Vacuum Circuit Breaker (VCB),
- Miniature Circuit Breaker (MCB), and
- Molded Case Circuit Breaker (MCCB).

3.3.1 Air Circuit Breaker

The Air Circuit Breaker (ACB) creates an arc voltage in excess of the supply voltage. An Arc is an electric discharge between two electrodes. Arc voltage is defined as the minimum voltage required in maintaining the arc. In EGCB there are two types of ACB:

1. Air Blast Circuit Breaker (ABCB): Low voltage circuit breaker used for the protection of the 230 V line in EGCB.
2. Air Break Circuit Breaker (ACB): Low voltage circuit breaker used for the protection of the 400 V line in EGCB.

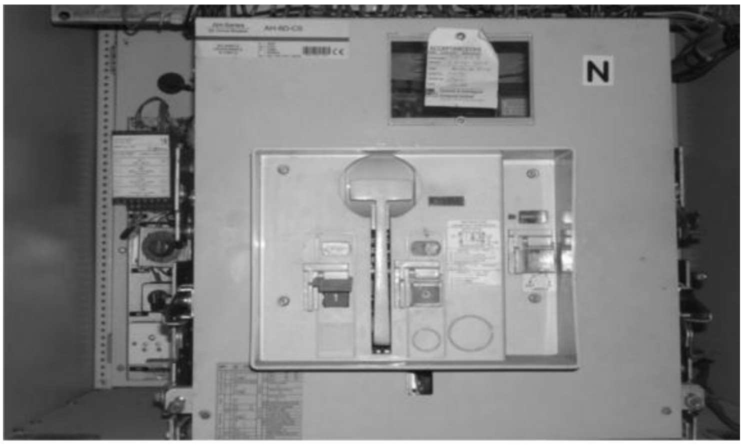

Figure 3.9: Air Circuit Breaker used at the EGCB Power Plant [2]

3.3.2 SF_6 (Sulphur Hexafluoride) Circuit Breaker

It is the circuit breaker in which the current carrying contacts are operated by Sulphur Hexafluoride or SF_6 gas. It is used in high voltage protection. At EGCB, the SF_6 breaker is used in protection of 11 KV line. Due to its high dielectric strength and high cooling effect, SF_6 gas is approximately 100 times more effective as an arc quenching media than air. Due to this unique property of SF_6 gas, this circuit breaker is used in complete range of medium voltage and high voltage electrical power system.

Figure 3.10: SF_6 Circuit Breaker used at the EGCB Power Plant [2]

The specifications of the SF_6 circuit breaker used at the EGCB power plant are given below:

Table 3.4: Specifications of SF_6 circuit breaker used at the EGCB Power Plant

Model	HECS-100M
Serial Number	HA3058-10
Rated Frequency	50Hz
Rated Operating SF_6 Density	40.7 kg/m^3
Rated Control Voltage for Closing and Trapping Coils	125VDC
Rated Voltage for Pump Motor Drive	125VDC
Closing and Trapping Current	3A
Current of the Pump Motor Drive	6A

3.3.3 Vacuum Circuit Breaker

Vacuum Circuit Breaker (VCB) is an electrical circuit breaker in which the contacts that perform switching and interrupting functions are enclosed in a vacuum. The VCB has very reliable current interruption technology and it requires minimum maintenance compared to other circuit breaker technologies. We saw indoor type VCB at EGCB power plant.

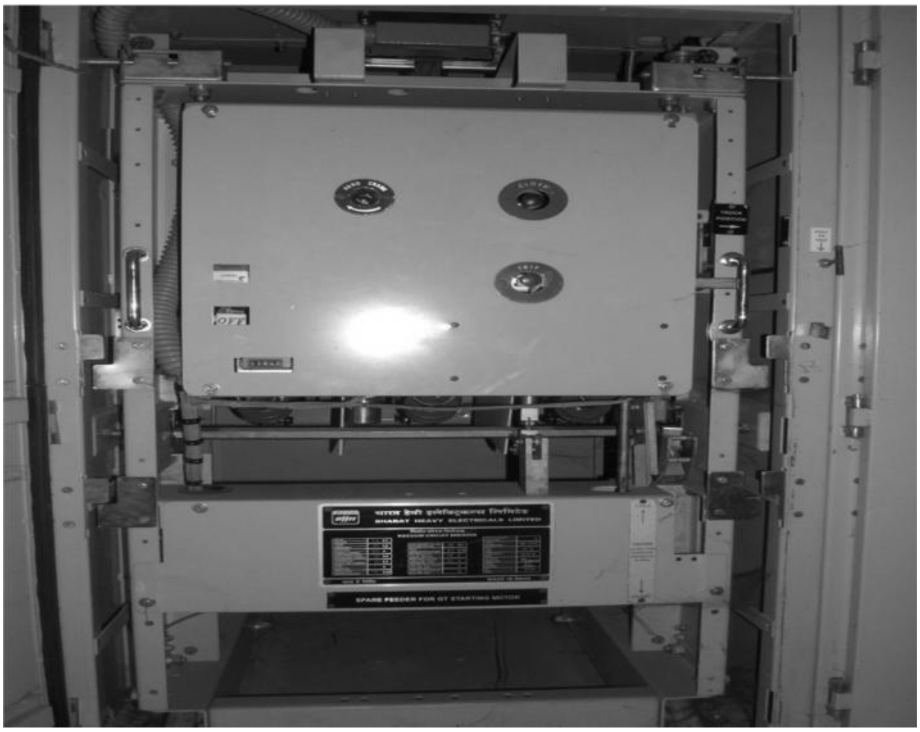

Figure 3.11: Vacuum Circuit Breaker used at the EGCB Power Plant [2]

The specifications of the Vacuum Circuit Breaker used at the EGCB power plant are given below:

Table 3.5: Specifications of Vacuum Circuit Breaker used at the EGCB Power Plant

Manufactures name and Collaborator	M/S BHEEL, BHOPAL
Type Designator	VM 12 (820 mm)
Number of Poles	3
Class	Indoor
Rated Voltage	3.6/7.2/12 KV
Rated Frequency	50Hz
Rated Normal Current	630/800/1250/1600/2000/2500/3150 A
Changing Motor	230VAC/220VDC
Auxiliary Supply for Closing Trapping Coil	24/30/110/220 V DC

3.4 Bus Bar

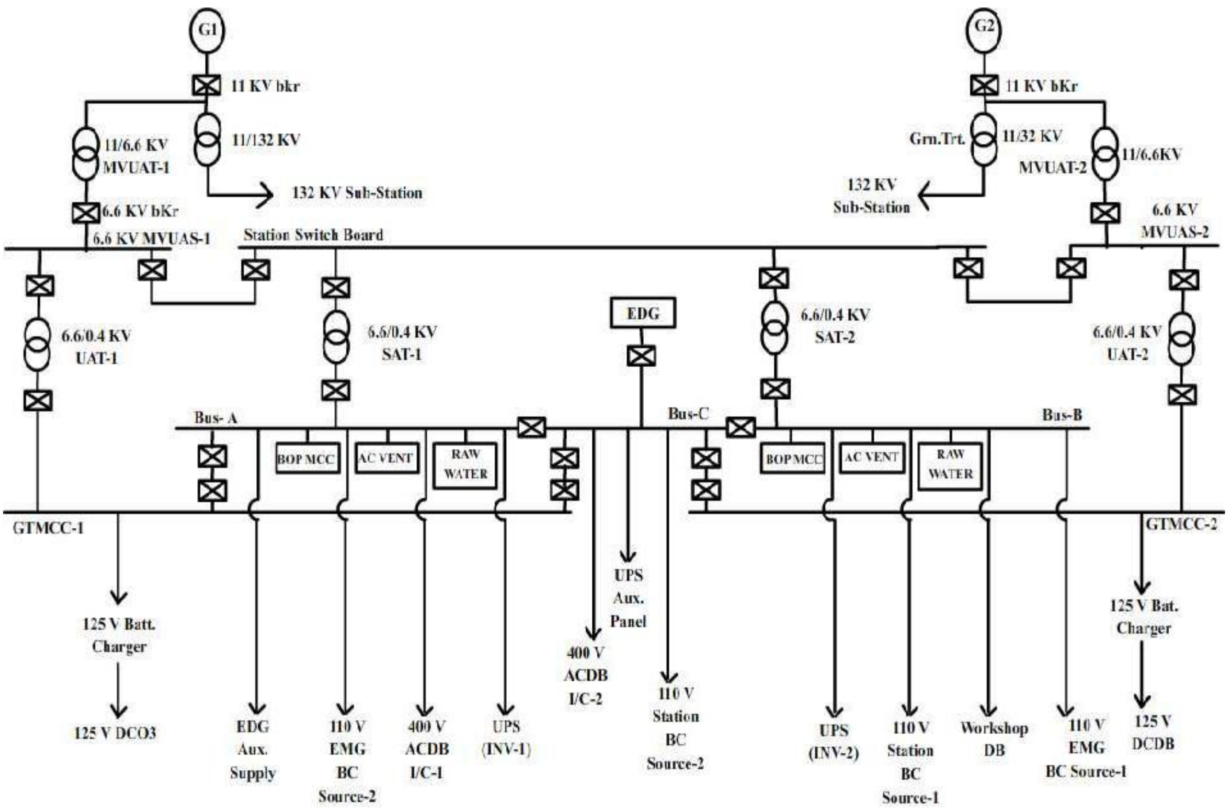

Figure 3.12: Single Line Diagram of 2x120 MW Power Plant at EGCB showing Double Bus Bars [3]

Bus bars are very important in an electrical substation. In electrical power distribution, a bus bar is a strip or bar of metal (copper, brass or aluminum) that conducts electricity within a switchboard, distribution board, substation, battery bank or other electrical apparatus. The bars may be exposed or enclosed. There are individual bus bars in EGCB for 11/6.6 KV and 6.6/0.44 KV. In EGCB, we have seen double bus bar and reserved bus bar diagram. The bus bar starts from the two generators G1 and G2. There are different bus bars for 11/6.6 KV and 6.6/0.44 KV. There is reserved bus bar also. The main purpose of using double bus bar arrangement is to increase the flexibility of system so in case of power failure the reserved bus bar can be used.

Chapter 4 Testing and Cooling System

4.1 Introduction

The testing and cooling system of the power plant were shown to us by Engr. Ashis Kumar Biswas, Asst. Manager (Technical) at the power plant. This chapter includes the testing and cooling system used in EGCB 2×120 MW Peaking Power Plant. Transformer oil testing was done during our internship period. Two different types of cooling system are present in EGCB which was shown and described by our mentor.

4.2 Oil Test

The insulation oil of potential transformer and current transformers fulfills the purpose of insulating as well as cooling. Thus, the dielectric quality of transformer oil is a matter of secure operation of a transformer. Since transformer oil deteriorates in its isolation and cooling behavior due to ageing and pollution by dust particles or humidity, the transformer oil must be subject to oil tests on a regular basis. Transformer oil testing sequences and procedures are defined by various international standards.

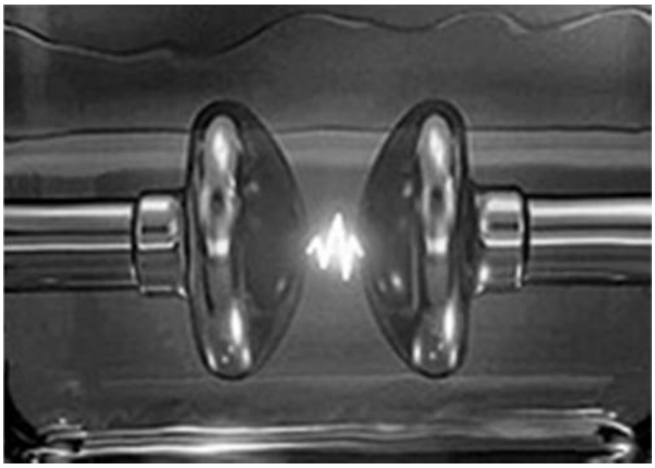

Figure 4.1: Voltage Breakdown during Transformer Oil Testing [2]

Periodic execution of transformer oil testing is very important for energy supplying companies, as potential damage to the transformer insulation can be avoided by well timed substitution of the transformer oil.

4.2.1 Transformer Oil Testing Procedure

To assess the insulating property of dielectric transformer oil, a sample of the transformer oil is taken and its breakdown voltage is measured. There are several steps in measuring the dielectric strength of the transformer oil. The steps are given below:

1. First the oil is filled in a vessel of the testing device. There are two electrodes inside the vessel. The distance between the electrodes is 2.5 mm and they are surrounded by the dielectric oil.
2. A test voltage is applied to the electrodes and is continuously increased up to the breakdown voltage.
3. After a certain voltage level, the dielectric strength of the oil breaks down and an electric arc occurs between the two electrodes.
4. When the arc forms, the test voltage automatically gets withdrawn immediately. This immediate withdrawal should be maintained to keep the additional pollution as low as possible.
5. The transformer oil testing device measures and reports the root mean square value of the breakdown voltage.
6. After the first test of transformer oil, the insulation oil is stirred automatically and the test sequence is performed repeatedly.
7. By taking the mean of all the resulting voltage, we get breakdown voltage.

The lower the resulting breakdown voltage, the poorer is the quality of the transformer oil.

4.2 Cooling System

There are two types of cooling system is present in the EGCB 2×120 MW Peaking Power Plant.

1. Air cooling system,
2. Water cooling system.

4.2.1. Air Cooling

The cooling and sealing air system provides the necessary air flow from the gas turbine compressor to other parts of the gas turbine rotor and stator to prevent excessive temperature build up in these parts during normal operation. Air from three centrifugal type blowers (1 is 88TK-1 type & 2 are 88TK-2 type) is used to cool the turbine exhaust frame. These two motor fans are part of a cooling system. They are situated on a base near the lower part of the gas turbine exhaust system duct. Cooling functions provided by the system are as follows:

1. Cooling of internal turbine parts subjected to high temperature, and
2. Cooling of the turbine outer shell and exhaust frame.

4.2.2. Water Cooling

The cooling water system is a pressurized, closed system, designed to accommodate the heat dissipation requirements of the turbine, the lubrication system, the atomizing air system, the turbine support legs, and the flame detectors. The cooling water system circulates water as a cooling medium to maintain the lubricating oil at acceptable lubrication system temperature levels and to cool several turbine components. Water cooling covers a significant part of the cooling system. Where there is lube (lubricating) oil, the cooling system is water cooling. Every bearing and the pipe of lube oil is water cooled. The pipe of lube oil goes through the water pipe. Thus water absorbs the heat of the lube oil and the water becomes hot. The hot water is then carried out and cooled by air. The air is supplied by six large electric fans at every water stock. These fans are driven by ac and dc motor. The dc motor is for redundant operation. If any fault or accident occurs and the ac motor stops working, then the dc motor is used.

Chapter 5 Protection

5.1 Introduction

The purpose of a protection system is to disconnect the faulty parts of the power system in conjunction with the circuit breakers. This is necessary in order to:

- protect the primary equipment’s against unnecessary damage,
- save people in the vicinity of the electrical plant from injuries, and
- enable continued service in the undamaged parts of the network.

Mr. Nandhipan Das gave us a lecture about the importance of Relays in the power plant, specially the Buchholz relay. He also taught and showed us different protection systems. Mr. Saiful Islam also showed us different protection systems. We also received one day training on fire safety by Kazi M H Kabir, a specialist from EGCB head office.

5.2 Generator Protection

The core of an electrical power system is the generator. The conversion of the fundamental energy into its electrical equivalent requires a prime mover to develop mechanical power as an intermediate stage. The nature of this machine depends upon the source of energy and in turn this has some bearing on the design of the generator. Gas is the main fuel in the EGCB power plant. Some important generator protections used at EGCB are,

- Over-Current Protection,
- Over-Voltage Protection,
- Frequency Protection,
- Frequency Relay,
- Rotor Earth Fault Protection, and
- Under Excitation (Loss of field) Protection.

5.2.1 Over-Current Protection

If a short circuit occurs, the circuit impedance is reduced to a low value and therefore a fault is accompanied by a large current. Over-current relays sense fault currents and also over-load currents.

5.2.2 Over-Voltage Protection

Over-voltage protection serves to protect the electrical machine and connected electrical plant components from the effects of inadmissible voltage increase. Over voltage can be caused by incorrect manual operation of the excitation system, faulty operation of the automatic voltage regulator, (full) load shedding of a generator, separation of the generator from the system etc.

5.2.3 Frequency Protection

The frequency protection function detects abnormally high and low frequencies of the generator. If the frequency lies outside the admissible range, appropriate actions are initiated, such as separating the generator from the system. An increase in system frequency occurs when large load-share is removed from the system and a decrease in system frequency occurs when the system experiences an increase in real power demand.

5.2.4 Frequency Relay

The frequency of induced electromotive force (EMF) of synchronous generators is maintained constant by constant speed. A frequency relay works at a predetermined value of frequency. It may be an over-frequency relay, an under-frequency relay, or a combination of both. Frequency relays are used in generator protection and for load-frequency control.

5.2.5 Rotor Earth Fault Protection

Rotor earth fault protection is used to detect earth faults in the excitation circuit of synchronous machines. An earth fault in the rotor winding does not cause immediate damage. However, if a second earth fault occurs it constitutes a winding short-circuit of the excitation circuit. The resulting magnetic imbalances can cause extreme mechanical forces which may destroy the machine.

5.2.6 Under Excitation (Loss of field) Protection

The under excitation protection protects a synchronous machine from asynchronous operation in the event of faulty excitation or regulation and from local overheating of the rotor. Furthermore, it avoids endangering network stability by under excitation of large synchronous machines.

5.3 Transformer Protection

In a transformer, fault occurs due to insulation breakdown, aging of insulation, overheating due to over excitation, oil contamination and leakage or reduced cooling. Hence a reliable, secure and fast protection system for the transformer is essential to minimize the damage. In order to get an early warning and to minimize the damage in case of fault, it is necessary to equip the transformer with monitors and protective relays. Some important transformer protections used at EGCB are,

- Differential Protection
- Protective Relay
- Over-current Relay
- Distance Relay
- Buchholz Relay

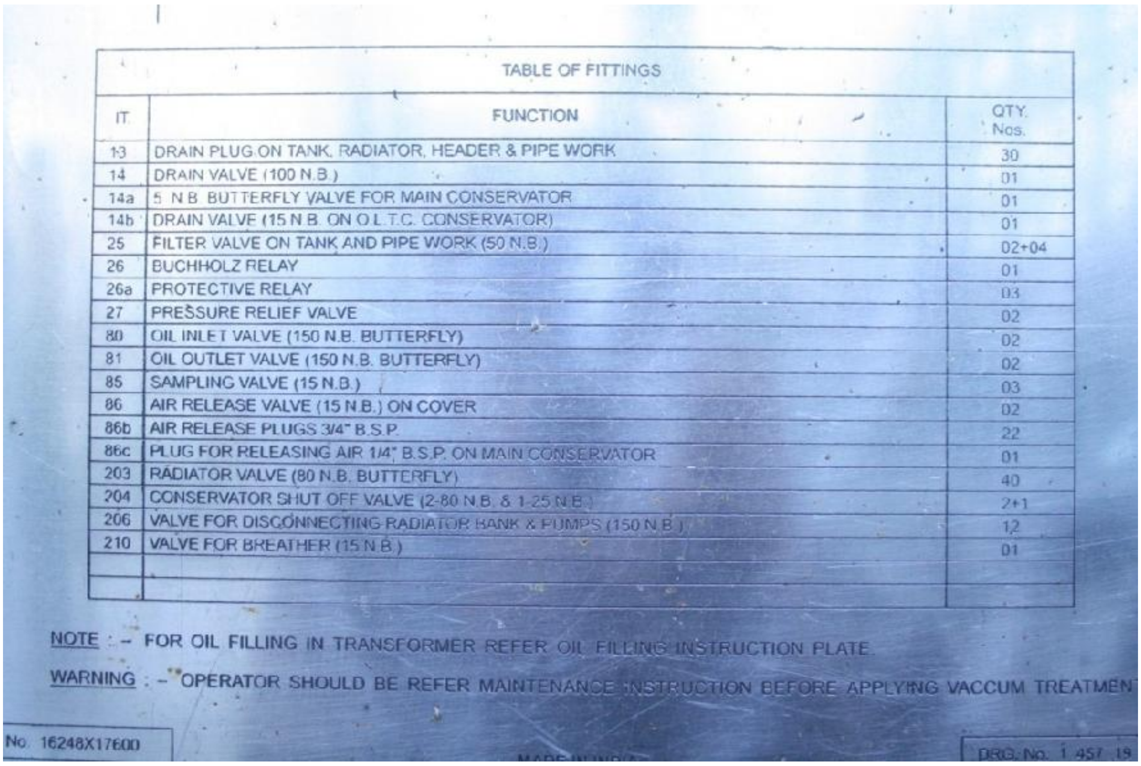

TABLE OF FITTINGS

IT.	FUNCTION	QTY. Nos.
13	DRAIN PLUG ON TANK, RADIATOR, HEADER & PIPE WORK	30
14	DRAIN VALVE (100 N.B.)	01
14a	5 N.B. BUTTERFLY VALVE FOR MAIN CONSERVATOR	01
14b	DRAIN VALVE (15 N.B. ON O.L.T.C. CONSERVATOR)	01
25	FILTER VALVE ON TANK AND PIPE WORK (50 N.B.)	02+04
26	BUCHHOLZ RELAY	01
26a	PROTECTIVE RELAY	03
27	PRESSURE RELIEF VALVE	02
80	OIL INLET VALVE (150 N.B. BUTTERFLY)	02
81	OIL OUTLET VALVE (150 N.B. BUTTERFLY)	02
85	SAMPLING VALVE (15 N.B.)	03
86	AIR RELEASE VALVE (15 N.B.) ON COVER	02
86b	AIR RELEASE PLUGS 3/4" B.S.P.	22
86c	PLUG FOR RELEASING AIR 1/4" B.S.P. ON MAIN CONSERVATOR	01
203	RADIATOR VALVE (80 N.B. BUTTERFLY)	40
204	CONSERVATOR SHUT OFF VALVE (2-80 N.B. & 1-25 N.B.)	2+1
206	VALVE FOR DISCONNECTING RADIATOR BANK & PUMPS (150 N.B.)	12
210	VALVE FOR BREATHER (15 N.B.)	01

NOTE :- FOR OIL FILLING IN TRANSFORMER REFER OIL FILLING INSTRUCTION PLATE.

WARNING :- "OPERATOR SHOULD BE REFER MAINTENANCE INSTRUCTION BEFORE APPLYING VACCUM TREATMEN

No. 16248X17600

DRG. No. 1 457 19

Figure 5.1: List of Fittings (showing different protections) from 11/132 KV Transformer used at the EGCB Power Plant [2]

5.3.1 Differential Protection

The differential relay compares between primary current and secondary current of power transformer. If there is any unbalance found, the relay will actuate and inter-trip both the primary and secondary circuit breaker of the transformer.

5.3.2 Protective Relay

The choice of protection depends upon several aspects such as type and rating of the protected equipment, its importance, location, probable abnormal conditions, cost etc. A fault is a defect in an electrical circuit due to which the flow of current is diverted from the intended path. The protective relaying senses the abnormal conditions in a part of the power system due to a fault and gives an alarm or isolates that part from the healthy system.

5.3.3 Over-current Relay

Over-current relaying is the simplest and cheapest, the most difficult to apply, and the quickest to need readjustment or even replacement as a system changes. If a short circuit occurs, the circuit impedance is reduced to a low value, and therefore a fault is accompanied by large current. Over current relays sense fault currents and also overload currents. It is generally used for phase and ground-fault protection [7].

5.3.4 Distance Relay

Distance relays are double actuating quantity relays with one coil energized by current. When over-current relay does not work properly, distance relay should be considered. During a fault on a transmission line, the fault current increases and the voltage at fault point reduces. If fault is nearer the relay, measured voltage is lesser. If fault is further from the relay, measured voltage is more. Hence assuming constant fault resistance, each value of V/I measured from relay location corresponds to distance between the relaying point and the fault along the line. Hence such protection is called distance protection [8].

5.3.5 Buchholz Relay

In the field of electric power distribution and transmission, a Buchholz relay is a safety device mounted on some oil-filled power transformers and reactors, equipped with an external overhead oil reservoir called a “conservator”. The Buchholz Relay is used as a protective device sensitive to the effects of dielectric failure inside the equipment. We saw Buchholz relay on the top of the 11/132 KV transformer.

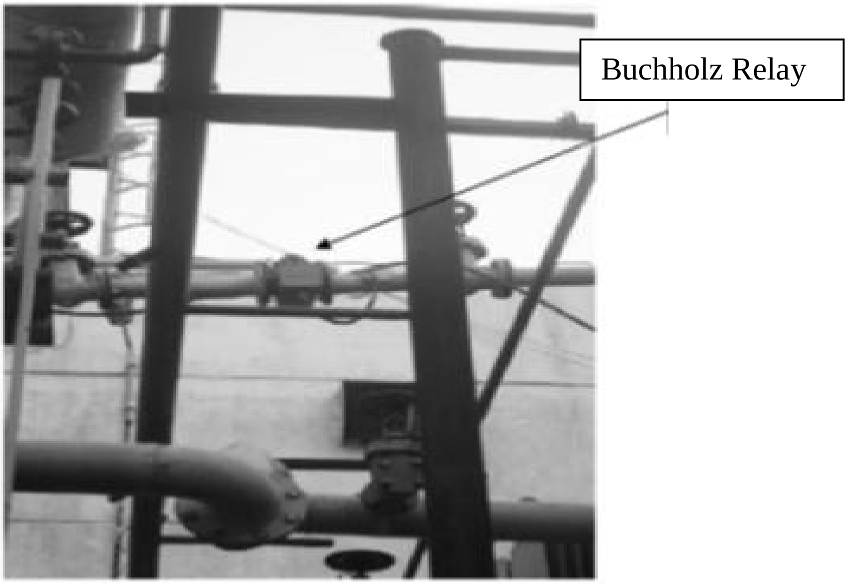

Figure 5.2: Buchholz Relay used at the EGCB Power Plant [2]

5.4 Lightning Arrester

A lightning arrester is a device used in electrical power 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 travels along the power line to the arrester, the current from the surge is diverted through the arrester, in most cases to earth. We saw lightning arrester near the 11/132 KV transformer (132 KV side).

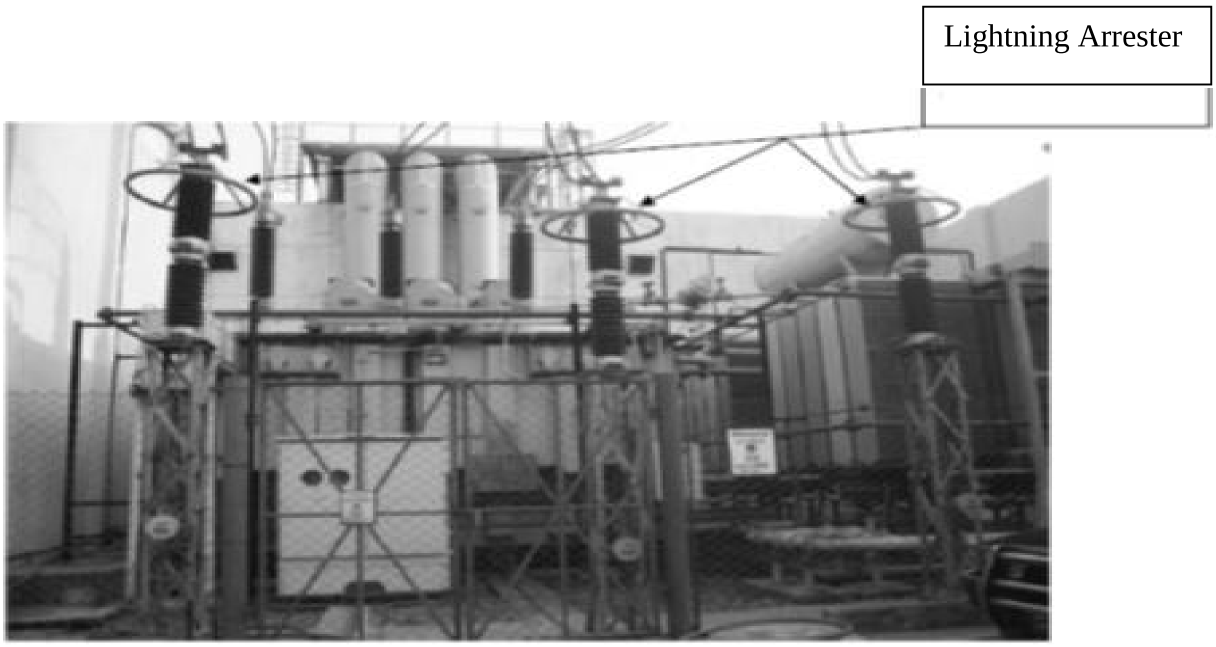

Figure 5.3: Lightning Arrester used at the EGCB Power Plant [2]

5.5 Isolator

Isolator is used to isolate the circuit permanently after a fault. The main difference between isolator and circuit breaker is that isolator is an off-load device, whereas circuit breaker is an on-load device. An off-load device is a switch where there is no current passing through it when it is switched. In an on-load device current passes through when it is switched. There are three isolators at 132 KV switch yard at EGCB, both of which are motor operated (can be control from the control room) and manual gear operated.

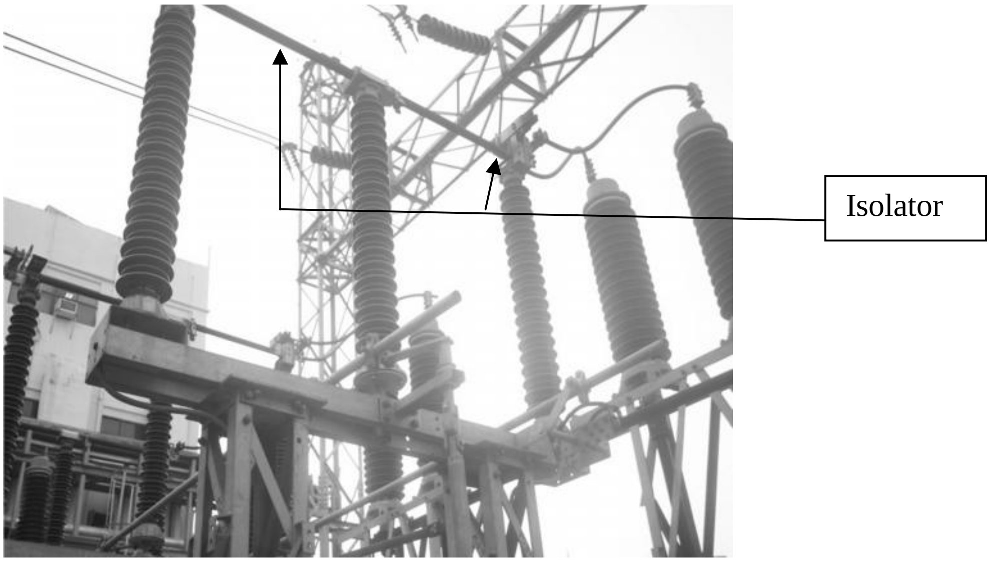

Figure 5.4: Isolators used at EGCB Power Plant [2]

5.6 Relay

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal with complete electrical isolation between control and controlled circuits or where several circuits must be controlled by one signal.

5.6.1 Electromagnetic Relay

An electromagnetic relay is a type of electrical switch controlled by an electromagnet. The electromagnetic relay is capable of controlling an output of higher power than the input, and it is often used as a buffer to isolate circuits of varying energy potentials as a result. The coil can be energized from a low power source such as a transistor while the contacts can switch high powers such as the mains supply [6].

5.7 Fire Safety Measures

We attended fire safety training by Kazi M H Kabir, a specialist from EGCB head office. There were a couple of cylinders having Carbon-Di-Oxide gas. This gas can be used through pipes in combustion chamber and other important areas. Gas containing capacity of each cylinder is 6000 Kg. It can be controlled by both automatic and manual process. We also saw them to change the cylinders.

Figure 5.5: CO_2 cylinders for fire safety at the EGCB power plant [2]

Chapter 6 Control Rooms

6.1 Introduction

In this part of our industrial training, Mr. Nadir Chowdhury and Mr. Siddiqur Rahman, both Assistant Managers in charge of different shifts of the control room were our mentors. We spent three days learning about the control rooms. The types of control rooms present at the EGCB Power Plant are:

- Central control room for the whole power plant,
- One secondary control room for each generating unit, and
- One switch gear control room for each generating unit.

6.2 Central Control Room

The central control room has Assistant Manager level operators. It is from where the entire power plant is controlled and supervised. The operator interface is referred to as the Human-Machine interface (HMI). The computers in the central control room have a Microsoft Windows operating system supporting client/server capability, a CIMPLICITY graphics display system, a control system toolbox for maintenance and a software interface [3]. The first thing that the operators do every day at the central control room is start the generating unit that is not running and turn off the unit that is running. Due to gas supply shortage, the power plant always uses only one unit every day. The job of the operators is to monitor the operations of the whole plant and observe the critical readings. Sometimes when the gas supply is below the gas pressure required, both units remain turned off. So there is no electricity generation at the plant during those times. The control room serves as two senses (eyes and ears) for the engineers. The system helping the operators at the central control room is called Distributed Control System (DCS) or more specifically Distributed Digital Control Monitoring and Information System (DDCMIS). DCS is mainly the combination of PID controllers. It is necessary to control the balance of plant (BOP). The software helping with the DCS operation is maxDNA by Metso Automation. The maxDNA distributed gas turbine control system is divided into two partitions – one for control functions and the other for protection functions. The control functions include control systems for automatic startup and speed control, synchronization, load control, frequency control and valve testing. The protection functions include control systems for monitoring critical turbine parameters, over-speed runbacks and tripping, load rejection anticipation and trips for low hydraulic oil pressure, lube oil pressure, vibration, exhaust, flame control and vacuum pressure. Although they are separate partitions, the system is integrated into the maxDNA distributed power plant automation system. It uses the same components and shares the same operator interface and communication network [3].

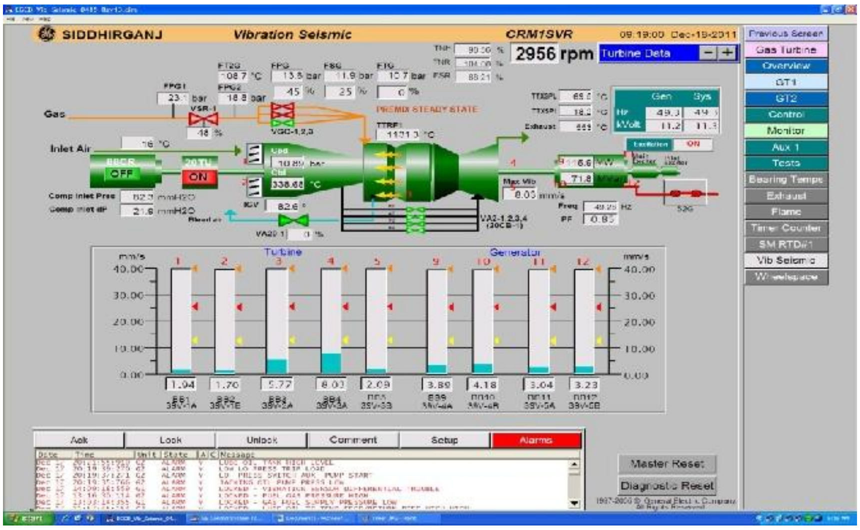

Figure 6.1: Screenshot of the Vibration Protection System interface at the Central Control Room [2]

6.3 Secondary Control Room

There are two secondary control rooms in the power plant, one for each generation unit. Both rooms have a single computer. These rooms contain different types of manually controlled monitoring panels like data concentrator panel, field suppressor panel, thyristor panel, automatic voltage regulator panel, generator transformer panel, gas turbine auxiliary panel, gas turbine control panel, generator relay panel, 2×120 MW generator control panel, 110/200 AH battery charger panel, 110V emergency lighting charger panel, 125V/150Amp dual FCBF panel. All these panels are there to help the engineers monitor and control different aspects of a generating unit while in operation and when in rest. These panels are required in worst case scenario when the computer and the software interface in it do not work. The software interface for the secondary control rooms is Speedtronic MARK VI control system. The Speedtronic Mark VI turbine control system is the current state of the art control software for GE turbines. It is designed as a complete integrated control, protection, and monitoring system for generator and mechanical drive applications of gas turbines and steam turbines [3]. This software is run on the computer present in the room.

The main functions of MARK VI Control System are:

- Speed control during startup

- Turbine load control during normal operation on the grid
- Protection against turbine over speed on loss of load
- Automatic generator synchronization
- HMI provides operator display and control for mark VI turbine controller
- HMI contains a number of product feature
- Dynamic graphics
- Alarm display
- Process variable trending
- Point control display (For maintenance)
- HMI access security

6.4 Switch Gear Control Room

Figure 6.2: One Side of the Manual Control Room at EGCB Power Plant [3]

The switch gear control room houses large cabinets in which there are different meters that read the measurements made by the relays, current transformers, potential transformers, circuit breakers, BUS monitors, etc. The cabinets are arranged in rows and are parallel to each other. The cabinets have meters that show the readings of all the equipments, except the turbine, in the panels on the cabinets. These readings are very important to know whether or not the equipments are functioning properly. This room acts as a backup monitoring room for the engineers. If for some reason the DCS in the central control room does not work, the engineers can monitor the workings of all the equipments, except the turbine, from this room.

Chapter 7 Conclusion

7.1 Our Achievements

Before the internship, we had learned many theories and working principles of power system and related equipments in relative academic courses. However from the internship we acquired practical knowledge about power system engineering and its equipments. We always tried to relate what we saw at the power plant to our academic courses. Our communication skills also improved through communicating with different mentors. Most importantly we have gathered practical experience on how electricity is generated. Therefore, we believe we made good achievements with our industrial training which will help us a lot in our future.

7.2 Problems Faced

There were some problems which we faced during the internship period. The problems are given below:

- During the course of our internship, due to low gas pressure, we were never able to observe full load of the power plant.
- We would have liked to learn more thoroughly about all the sections at the power plant but were unable to do so due to the short length of the internship period.
- We did not have any academic knowledge about the mechanical sections of a power plant.

7.3 Recommendations

Some recommendations are given below for future students who want to do their internship program in a better way:

- It is better to undertake the industrial training course after completion of all three courses on power. If not then at least two courses on power (especially power station and switch gear or power electronics) should be completed. This will enable the student to better understand the equipments and their working principles at a power plant.
- Theoretical knowledge should be obtained about power generation, protection systems and power equipments before going for internship. For this purpose, relative

books (like Switchgear Protection and Systems, Heat Engineering, Principles of Power System, etc.) are very useful.

- We believe that the duration of the industrial training course should be increased to at least one month. Fifteen days are not enough to fully understand everything about a power plant. Since this course is vital for students who want to major in power systems, understand the workings of a power plant in depth is very important for their future career.
- We believe that at least one related mechanical engineering course should be offered to better understand the mechanical sections of a power plant.

7.4 Discussion

In the EGCB Power Plant, electricity is generated through open cycle gas fired turbines. There is one switch gear and three control rooms in total to control the overall system of producing power. Various types of relays used for protective purposes are also controlled by these control rooms. We went inside the turbine compartment of one of the units. In the turbine compartment, we were told about the different parts of the turbine and how they work, and given an idea on how gas is supplied to the turbine. Gas is first burned, and the produced hot gas is used to rotate the turbine for generating power. Protective relays are also used and controlled using the switch gear room. Isolators are used for the distribution of power from the plant through the transmission lines. The authorities at the plant were very concerned about all kinds of safety. The friendly environment at the plant encouraged us to co-operate with them. We learned a lot and obtained practical knowledge from our internship at the EGCB Power Plant, which will help us in our professional life. Because of the friendly environment we enjoyed at the EGCB Power Plant, we can wholeheartedly recommend performing industrial training at the EGCB Power Plant.

Appendix

ABCB = Air Blast Circuit Breaker

ACB = Air Circuit Breaker

BHEL = Bharat Heavy Electrical Ltd.

BOP = Balance of plant

CB = Circuit Breaker

CT = Current Transformer

DCS = Distributed Control System

DDCMIS = Distributed Digital Control Monitoring and Information System

EGCB = Electricity Generation Company of Bangladesh

EMF = Electromotive force

GBC = Gas Booster Compressor

HMI = Human Machine Interface

HV = High Voltage

Hz = Hertz

KV = Kilo Volts

LV = Low Voltage

MCB = Miniature Circuit Breaker

OFAF = Oil Forced Air Forced

ONAF = Oil Natural Air Forced

ONAN = Oil Natural Air Natural

PT = Potential Transformer

SF_6CB = Sulphur Hexafluoride Circuit Breaker

VCB = Vacuum Circuit Breaker

MVA = Mega Volt Ampere

References

1. www.egcb.com.bd
2. Pictures taken at EGCB
3. Materials provided by the mentors at EGCB Power Plant
4. http://www.aafintl.com
5. Audio recording done at EGCB Power Plant
6. Sunil S. Rao, “Switchgear Protection and Power Systems”, 12^{th} Edition, Khanna Publishers, 2011-2012, pp. 500-501.
7. C. Russel Mason, “The Art and Science of Protective Relaying”, General Electronics, pp. 259.
8. C. Russel Mason, “The Art and Science of Protective Relaying”, General Electronics, pp. 295.
9. http://en.wikipedia.org/wiki/Transformer
10. http://en.wikipedia.org/wiki/File:Transformer_under_load.svg
11. http://en.wikipedia.org/wiki/Circuit_breaker

Daily Activity Report

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	12.08.12
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Nandipan Das

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

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Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activity was to get an overview of the electrical system of the power plant.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

It was my first day of internship. The mentor give me an overview of the power plant's electrical portion. He ~~has~~ showed us which one is the turbine, how a transformer looks like, PT, CT, lightning arrester and many other electrical equipments.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In my academic course I have read about the equipments but in practical I got the chance to see how those equipments really. looks like.

[signature] 12.08.2012	[signature]
Signature of the mentor with date	Signature of academic supervisor with date
Name: Nandhipan Das	Name: MARIAM B. SALIM
Designation: Asst. Manager (Technical)	Designation: LECTURER
Contact Phone #: 01717676873	

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Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	14.08.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Nadir Chowdhury

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to learn the software DCB (Distributed Control System), Mark VI and visit the switchgear control system room.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First I learned the software control and observed its responses on the ~~co~~ screen. A lecture was given on how the software works and the DCB. After that I visited the switchgear control system room and saw different types of motors and other electrical parts. A lecture was given by the mentor about how the machines works. It was a new experience for me.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I didn't learn anything about the software in my academic course but I ~~got~~ learned about the control system in my academic course. Practically I learned many times more ~~abo~~ of what I learned in my academic course.

14/8/12
Signature of the mentor with date
Name: Nadir Chowdhury
Designation: Asst. Manager
Contact Phone #: 01722-020360

Mariam B. Salim
Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

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Daily Activity Report

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Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	25.08.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Siddiqur Rahman

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

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Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable list multiple objectives)

The objective of the day's activity was to understand the single line diagram and it's practical use. Different parts of the diagram is briefly discussed and the software representation of the diagram is also seen.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First we have a brief about how the control system works. Then the key single line diagram of the power plant is drawn and discussed in details. Distribution Control System (DCS) and Mark - VI software is used to control the whole system. Each of the two 120 MW power generating unit has 4 transformers of rating 132 KV, 11 KV, 6.6 KV and 0.44 KV for different BUS lines.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In theoretical part I have learnt about the single line diagram and power transmission process in my class. Practically there are many similarities and plenty more to learn than what I have learnt in my class. A special mention is the use of software in the control system.

Siddiqur 25.8.12

Signature of the mentor with date
Name: Md. Siddiqur Rahman
Designation: Assistan Manager (Tech.)
Contact Phone #: 01717283380

Mariam Salim

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

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Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation company of Bangladesh (EGCB)
Name of the student:	Khondoker fazle Rabbi
ID:	2009-1-80-020

Date:	26.08.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Siddiqur Rahman

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable, list multiple objectives)

The day's objective was to understand the MARK VI control system.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

I learned differents functions of the MARK VI and our mentor allowed us to handle the software. He taught us different functions and the usage of the software. He also give us a brief idea on generator circuit breaker, local breaker backup and balance of plant.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I didn't learn anything about MARK VI in my academic course. It's completely new topic for me.

28/8/12

Signature of the mentor with date
Name: Md. Siddiqur Rahman
Designation: Assistant Manager (Tech.)
Contact Phone #: 01717283380

Mariam Salim

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

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Daily Activity Report

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Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	27.08.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	A.K.M Zillur Rahman

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The day's objective was to visit and understand three types of valves. Coupling, operating modes and protection was also covered in this day.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First I visited three types of valves. They are 1. IGV (Inlet Guide Valve), 2. SRV (Speed/stop ratio valve), 3. GCV (Gas control valve). The mentor gave us a brief discussion about the valves. After that he taught us about coupling techniques, generator operating modes and protection.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I didn't learn about these three valves and coupling techniques in my academic course but I learned about operating modes in my academic course.

[signature] 27/08/12

Signature of the mentor with date
Name: A.K.M. Zillar Rahman
Designation: Asst. Manager (IFC)
Contact Phone #: 01739664236

Mariam Salim

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

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Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	28.08.2012
Start time/End time	09.00 am - 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Kazi M. H. Kabir

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The day's objective was a training on fire fighting and safety procedures.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First there was a pre-training exam on fire fighting. It was a basic Knowledge ~~the~~ test about fire fighting. Then there was a long discussion on a given handout. After that there is a post training exam on the handout and discussion.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In my academic course I have learned about some basic fire fighting activities. In the practical activity I ~~got a~~ learned a large detailed and explained fire fighting and safety procedure.

27/8/12	Mariam Salim
Signature of the mentor with date	Signature of academic supervisor with date
Name: Kazi M. H. Karim	Name: MARIAM B. SALIM
Designation: Manager, Environment	Designation: LECTURER
Contact Phone #: 8124197- Ext- 110	

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Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	29.08.2012
Start time/End time	09.00 am - 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Ashis Kumar Biswas

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

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East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activity was to understand and view the gas conditioning skid.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

We visited the gas conditioning skid and our mentor showed us different parts of the gas unit. I saw condenser which is used for seporate the liquid from the gas. There were many other gas purification systems also. Different valves and meaning of different color pipes was cleared in the field. Gas boosting process and gas cooling process was also shown. ~~in the~~

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

My academic ~~to~~ knowledge about the gas system was very little. I learned plenty of new things about the gas turbine's gas system in the day's activity.

Biswas 29/08/12

Signature of the mentor with date
Name: Ashis Kumar Biswas
Designation: Asst. Manager (Tech.)
Contact Phone #: 01912598109

Mariam Salim

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
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Industrial Training
Daily Activity Report

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Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker fazle Rabbi
ID:	2009-1-80-020

Date:	30.08.2012
Start time/End time	09.00 am - 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Nandhipan Das

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

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East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The day's objective was to learn about transformers.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Today I learnt about transformers. The mentor showed us different types of transformers. How a transformer looks like from a near view, transformer cooling system, different transformer protections, transformer vector group was showed by the mentor. Step up, step down, transformer working mechanism was also cleared ~~in~~ by the mentor.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In my academic course I have learned about the transformer but in practical activity I have seen how a transformer really looks like, ~~and~~ how it works and different protection and additional systems of a transformer.

[signature] 30.08.2012

Signature of the mentor with date
Name: Nandhipan Das
Designation: Asst. Manager (Technical)
Contact Phone #: 01717676873

[signature] Mariam Salim

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	01.09.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Nandhipan Das

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable, list multiple objectives)

The objective of the day's activity was to learn the excitation system of the ~~transformer~~ generator. Single line diagram and different transformer protection was also cleared.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

I did an assignment on ~~transformer~~ generator excitation system. Later the mentor taught us about different generator excitation systems. He also give us a handout on single line power flow, a different protection system. Later he give a lecture on the handout. ~~and~~

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

Previously I have learned about excitation system in my academic course but in practical part I learned very detailed topics on transformers and generator excitation system.

[signature] 1.7.2012
Signature of the mentor with date
Name: Nandhipan Das
Designation: Asst. Manager (Tech.)
Contact Phone #: 01717676873

[signature] Mariam Salim
Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	2.09.2012
Start time/End time	09.00 am - 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Md. Yamin Ali

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the day's activities was to understand the mechanical portion of the power system. Gas turbine's mechanical part was cleared in the lecture.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

In the mechanical part I learned about different types of compressors, GBC, combustion technique, different generation modes, pumps, bearing, efficiency, temperature and detectors.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In my academic course I learned very little about the mechanical portion of the generator. While doing internship I learned very detailed and clear mechanical knowledge about of turbine generator.

09.12

Signature of the mentor with date
Name: Md. Yamin Ali
Designation: Asst. Manager (Tech.)
Contact Phone #: 01929301768

Mariam Salim

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	03.09.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Md. Yasin Ali

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

There are multiple objective for the day's activities.
1. Water filter and cooling system
2. Different pumps, tags
3. Different protections and ratios.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First I visited the water filter and cooling system. The whole process was clearly described by the mentor. Then I saw different pumps, their working purpose and pump protections. The meaning of different ~~pu~~ tags, as an example, 20 means solenoid valve is taught by the mentor. 3 types of turbine protection and 3 types of generator operating fuel ratios are cleared by the mentor.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I learned plenty of new things in the day's internship and my academic knowledge ~~is not~~ was very little in compare to what I learned there.

Signature of the mentor with date
Name: Md. Yamin Ali
Designation: Asst. Manager (Tech.)
Contact Phone #: 01929301768

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	04.09.2012
Start time/End time	09 am – 4 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Ashis Kumar Biswas

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
c. The report should not be a compilation of lectures notes taken during the internship, rather it should depict what the intern has learned on a particular day.
d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (if applicable. list multiple objectives)

The objective of the day's activity was
1. Visit the main transformer
2. Visit and understand the DCS

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First I saw 3 types of transfor operating conditions, reason for using transformer oil, Bucholz relay, pressure release valve and plenty of transformer protections. Then I saw the DCS (Distributed Control System) which is operated by metzo automation. DCS is used to control and monitor the power plant. Different DCS programe software was also shown by the mentor.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I learned about the transformer and control system in my academic course. Here in the power plant I learned these things very elaborately.

[signature] 4/9/12
Signature of the mentor with date
Name: Ashis Kumar Biswas
Designation: Asst. Manager (Tech.)
Contact Phone #: 01912598109

Mariam Salim
Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	05.09.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Nandhipan Das

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The day's objective was to visit the Thyristor, AVR control system, GRP-M and GRP-R panels.

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First I visit the control room where AVR is situated. I saw thyristors, generator relay panels. All the transformer and other power plant protections can be monitor and control from this room.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I did not study AVR and thyristor in my academic course. This is a completely new topic for me.

[signature] 5.9.2012
Signature of the mentor with date
Name: Nandhipan Das
Designation: Asst. Manager (Tech.)
Contact Phone #: 01717676873

[signature]
Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondoker Fazle Rabbi
ID:	2009-1-80-020

Date:	06.09.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Md. Saiful Islam

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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d. In case of any confusion, interns are strongly recommended to consult their respective academic supervisors.

Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of the days activities are to visit the
1. Switchgear room
2. Water treatment plant
3. Oil test for transformer

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

First our mentor showed us the switchgear room. There I saw different types of relays such as ~~generation~~ generator protection relay, transformer earth fault protection, different types of other protection and the AVR system. After that I saw the demineralized water treatment plant. After that our mentor showed us the transformer oil test machine.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

In my academic course I learned about different protection relays but demineralized water treatment plant and oil test machine is new for me.

[signature] 27/2/2

Signature of the mentor with date
Name: Md. Saiful Islam
Designation: Manager (Electrical)
Contact Phone #: 01730359532

Mariam Salim

Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER

Department of Electrical and Electronic Engineering
East West University
EEE 499
Industrial Training
Daily Activity Report

Separate Daily Activity Report should be completed by each intern for every day of work and should be signed by the mentor from the company and the academic advisor. Copy of all the reports should be attached to the final internship report.

Name of the company:	Electricity Generation Company of Bangladesh (EGCB)
Name of the student:	Khondokor Fazle Rabbi
ID:	2009-1-80-020

Date:	08.09.2012
Start time/End time	09.00 am – 04.00 pm
Location:	Siddhirganj, Narayanganj
Mentor:	Md. Yamin Ali

General Instructions:

a. It is the intern's duty to make sure that all his/her daily activity reports are appropriately signed by both the mentor and the academic supervisor.
b. The daily report should be a brief narration of the activities during the internship period in the eyes of the intern and should be completed and submitted by every intern irrespective of the number of partners s/he might have for the presentation and final report writing purpose.
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Department of Electrical and Electronic Engineering
East West University

Address the following points briefly (Use additional page if necessary)

1 What was the objective of the day's activities? (If applicable. list multiple objectives)

The objective of today's activities are to learn about
1. IAPA/N_2 Compressor
2. GBC

2. List the day's activities according to the order of objectives listed in 1. Mention the specifications of the equipments used/visited. Comment on how these activities fulfill your objectives.

Today I learn about IAPA/N_2 compressor. I saw different types of tanks such as Nitrogen air tank, Instrument air tank, pneumatic valve which is air operated and some other important valves and tanks. After that our mentor gave us an over view of the Gas Booster Compressor (GBC) and water purifying system.

3. Relate your practical activity with the theoretical knowledge you gained in the respective academic course.

I didn't learn about IAPA/N_2 compressor and GBC in my academic courses. It was completely new topic for me.

[signature] 08.09.12
Signature of the mentor with date
Name: Md. Yamin Ali
Designation: Asst. Manager (Tech.)
Contact Phone #: 01929301768

Mariam Salim
Signature of academic supervisor with date
Name: MARIAM B. SALIM
Designation: LECTURER