# INTERNSHIP REPORT
# ON
## OPRATION & MAINTENANCE OF ONE MVA SUB-STATION
## &
## GENERATORS

**An Internship Report submitted in partial fulfillment of the requirements for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering**

**By**
**Md: Sazzad Hossain Talukder**
**172-33-521**

**Supervised by**
**Abdullah-Al-Islam**
**Lecturer**
**Department of EEE**


**DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**
**FACULTY OF ENGINEERING**
**DAFFODIL INTERNATIONAL UNIVERSITY**

**31 January 2021**

# Certification

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**Signature of the candidate**

_____

**Md: Sazzad Hossain Talukder**
ID #: 172-33-521

Countersigned

_____

Abdullah-Al-Islam

Lecturer

Department of Electrical and Electronic Engineering

Faculty of Science and Engineering

Daffodil International University

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**Dedicated to**

# Our Parents

# Surma Garments Ltd.

## CERTIFICATE

This is to certify that Md. Sazzad Hossain Talukder son of Md. Shahidur Rahman, Student ID.172-33-521; Department of Electrical & Electronic Engineering, Daffodil International University has successfully completed Industrial Training at Surma Garments Ltd. from 06.06.2020 to 31.08.2020. During his training period he was familiarized with operation and maintenance of Gas & Diesel Generator, Air-Compressor, Water Treatment plant, Switch- Gear, Transformer, Sub-station, and ETP.

We wish him all success in life.

Md. Ismail Hossen

Maintenance Manager
Surma Garments Ltd.
Savar, Dhaka-1340

**Head Office:**
BGMEA Complex - 8th Floor (Level-9)
23/1 Panthapath Link Road., Karwan Bazar, Dhaka-1215, Bangladesh.
Tel: +880-2-8140237,8140238,8140239
Fax: +880-2-8140240

**Factory:**
Aicha Noadda, Rajashon Road,
Savar, Dhaka-1340,Bangladesh.
Tel: 7745-653, 7747-159, 7747-511, 7742-527
Fax: 880-2-7747-159

| Date | Division | Time | Instructor |
|---|---|---|---|
| 06-06-2020<br>08-06-2020 | Operation | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 11-06-2020 | Electrical | 9 am to 4 pm | Engr. Ismail Hossen<br>Maintenance-Manager |
| 18-06-2020<br>22-06-2020 | Mechanical | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 24-06-2020<br>28-06-2020 | Electrical | 9 am to 4 pm | Engr. Ismail Hossen<br>Maintenance-Manager |
| 01-07-2020<br>04-07-2020 | Utility | 9 am to 4 pm | Engr. Ismail Hossen<br>Maintenance-Manager |
| 07-07-2020 | Electrical | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 11-07-2020<br>14-07-2020 | Mechanical | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 16-07-2020 | Utility | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 19-07-2020<br>21-07-2020<br>23-07-2020<br>27-07-2020 | Electrical | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 27-07-2020<br>09-08-2020 | Fire Fighting | 9 am to 4 pm | MD.Barek Hossain<br>Fire Safety officer |
| 17-08-2020 | Electrical | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 19-08-2020 | Electrical | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |
| 27-07-2020<br>09-08-2020 | Mechanical | 9 am to 4 pm | Engr. Atikul Islam<br>Maintenance-in charge |

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# List of Abbreviations

| | |
|---|---|
| LT | Low Tension |
| AC | Alternating Current |
| DC | Direct Current |
| PT | Potential Transformer |
| CT | Current Transformer |
| KVA | Kilo Volt Ampere |
| KW | Kilo Watt |
| MVA | Mega Volt Ampere |

# ACKNOWLEDGEMENT

We would like to start our acknowledgement by conveying our heartfelt gratitude towards Almighty Allah. Then we would like to thank my supervising advisor **Abdullah-Al-Islam** for his constant support, cooperation and generosity. We would also like to thank Professor **Dr. Md. Shahid Ullah,** Head of the Department of EEE for being helpful during the time of my internship. I would like to thank Surma Garments Ltd. for giving us the opportunity to work in the field of Maintenance Department. Big thanks to its engineers whose guidance and training came handy in obtaining the perfect knowledge and experience about how to Maintenance & operation in Industries and it will definitely be useful in our future. On the submission of my intern report on Maintenance & Operation of one MVA sub-station, generator & it`s troubleshooting. We would like to extend our gratitude and sincere thanks to Engr. Ismail Hosen (Maintenance, Manager) and Engr. Md. Atikul Islam (Maintenance-in- charge) for being a source of guidance and inspiration during this period. Their wonderful style of mentoring has surely made our training period a great learning experience.

We express our sincere thanks to all the members of Surma Garments Ltd. for their friendly and helpful attitude. And last but not the least, our cordial thanks to our parents whose continuous support was a genuine source of motivation behind making this report a fruitful one.

# ABSTRACT

Industrial training is important phase of student life. A Well planned properly executed and evaluated industrial training helps a lot in developing a professional attitude. It develops an awareness of industrial approach to problem solving, based on a broad under-standing of process and mode of operation of organization. During a period of three month training at Surma Garments Ltd., most of the theoretical knowledge that has been gained during the course of studies is put to test. In Surma Garments Ltd. there are two units each of which has capacity of Sub-station (1 MVA). I worked on the Sub-Station, Generator (Diesel & Gas), Air-Compressor, boiler and ETP. Here I worked as a team and was involved in generator section, transformer section, gas generator, substation. In all of these sections, I was demonstrated how these systems work and what protective measures are taken for them. The on duty engineer showed us how each of the unit works (as a whole). I got to learn the importance of protection and switch gear system for the plant and how do they work. At the end, the whole internship was a proper combination of our theoretical and practical knowledge which will help and guide us to deal real life problems in power sector & Industrial maintenance.

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

As a part of completion of our under graduation, I have to do an internship in any company of electrical field. Therefore, I had the opportunity to do that internship in Surma Garments Ltd. I worked in Industries as intern during the semester break of summer 2020 as per University rules. The detail work of what I did there is entirely and thoroughly described in this report.

### 1.2 Objective of the Internship

The objective and purpose of my internship is to access the academic knowledge in practical use and to know the industrial power system and machine controlling system.

**Objective keys of the study are:**

01. Power Generation and distribution in industry
02. Power Factor Improvement Plant(PFI)
03. LT Panel
04. MDB,DB,SDB (Distribution wiring)
05. Motor
06. Motor controlling
07. Inverter(VFD)
08. Industrial wiring
09. Lighting Protection System (LPS) Etc.

### 1.3 Scope

In Factory, as an intern I had opportunity to visit and gather practical knowledge on Gas & Diesel Generator, Air- compressor, Water treatment plant (WTP), Switch gear, Sub-station of the plant. This was a great scope for me to relate all my theoretical knowledge with practical knowledge and to realize how to maintenance work in Industries.

### 1.4 Methodology

We have designed our report mainly in five major parts. They are Generation, Protection and Switchgear, Testing & Maintenance, Substation, Control & Backup System. And thereafter, these sections are subdivided into subsections as all these sections need multiple things to be described in order to get a whole idea about the operation and maintenance of the Industries.

# CHAPTER 2

## 2.1 Company Profile

SURMA GARMENTS LTD. (SAVAR GROUP)

With 100 knitting machines & a technical collaboration with Daewoo Corporation of South Korea, Suram Garments Ltd., the flagship company of Suram Garments - Group of companies was established in 1983 with the manufacturing facility at a place called Savar, 28 km west of the capital city of Dhaka.
An export oriented, modern, vertically integrated composite knit garment unit, socks & underwear industry.
There are three main divisions with Suram Garments (Group):
**1. Supasox Ltd.** is our **Socks Division.**
**2. Surma Garments Ltd.** is our **Knits Garments Division.**
**3. Surma Garments Ltd.** is also our **Underwear Division.**

**SURMA POWER**

As the first export oriented socks factory in Bangladesh, it was not easy for us in the beginning. In 1983 while Ready-made garments factories were being set up in numbers every day, we were the lone investor & promoter in the hosiery-socks sector (we still remain so). We therefore had to develop our skill & experience in-house, & grew as a family.

**SURMA EXCELLENCE**

Internationally accepted Quality Assurance Certificate of ISO 9000 was achieved by our factory maintaining impeccable quality standards in production & management. All our production processes are well documented to ensure optical output. Each process has quality controllers who report to quality assurance manager who maintains the quality parameters required by our customers & governed by our quality policy.

**SURMA - STEP BY STEP**

We learned from our customers. We acquired production skills from experts. We exchanged & shared information with other International knitters. We are profoundly committed to understanding the specific needs of our customers & duly matching them in terms of price, quality & delivery from the very beginning by identifying the right yarn combination producing the right product at the right price & to ex-stock delivery from our warehouse facilities in Europe and USA through our own offices. In short, socks manufacturing to us from the beginning was not just business by a way of life.
We have been working with leading retailers across UK, Europe, USA & Canada. Our market percentage of business with our customers is as follows:

## 2.2 SURMA IN THE 21st CENTURY

We are aware of the market needs of the 21st century. The challenge is to give the Best Quality at the most Competitive Prices. To help achieve this we have strict rules of Business with our raw material suppliers & likewise enforce stringent quality control supervision. Local & International Labor law is strictly adhered to which includes standard minimum wage, number of working hours to safe working conditions. Our factories have been certified by UNICEF & Bangladesh Garments Manufacturers Association as a Child Labor Free Factory. We are absolutely ready with our years of experience to take on the challenge of the 21st century. Try us out. Speak to us. A happy partnership will begin. Surma Garments Ltd**.** has been exporting all over the world for the last 29 years enjoying much success and appreciation from its various customers.

# CHAPTER 3

## DIESEL GENERATOR

### 3.1 Diesel Generator:

A diesel generator is the combination of a diesel engine with an electric generator to generate electrical energy.

### 3.2 Classification of internal combustion (I.C.) Engines

According to cycle of operation I.C. engines are two types:

(i) Two-stroke cycle engine.

(ii) Four-stroke cycle engine.

The relative advantages and disadvantages of these engines are as follows:

The working or power stroke is completed in two revolutions of the crank shaft in four stroke cycle engine whereas in two-stroke cycle engine the working stroke is completed in one revolution. Thus the power obtained from a two- stroke engine should be twice that of power obtained from four-stroke engine but due to charge loss and power needed to drive scavenge compressor the actual power obtained from a two-stroke engine is 50 to 60% more than four stroke engine. As one working stroke

(i) Is completed for every revolution of crankshaft the turning moment on crankshaft is more uniform in case of two stroke engine and, therefore, a lighter flywheel serves the purpose.

(ii) Two-stroke engine is lighter in weight and requires less space than a four-stroke engine of the same power. This makes it suitable for marine engines,

(iii) In two-stroke engine the power needed to overcome-frictional resistance during suction and exhaust stroke is saved.

(iv) In a two-stroke engine there is more noise and wear.

(v) The consumption of lubricating oil is greater in a two timid) engine due to large amount of heat generated.

(vi) Two-stroke engine is simple and its maintenance cost is low

(vii) Scavenging is better in four-stroke engine.

(vii) In two-stroke engine the exhaust port remains open for a very short time which results in incomplete scavenging and thus dilution of fresh change.

(viii) Construction of combustion chamber is better and simple in two-stroke engine

### 3.3 Four-stroke Diesel Engine

If our-stroke diesel engine the four operations are completed in two revolutions of crankshaft. The various operations are as follows:

#### A) Suction Stroke.

In this stroke inlet valve (I.V.) remains open [Fig 3.1] and exhaust valve (E.V.) remains closed. The descending piston draws in a fresh charge of air to fill the cylinder with it. The air taken in during suction stroke is nearly at atmospheric pressure. Line *a b* in the indicator diagram [Fig. 3.2] represents this stroke.

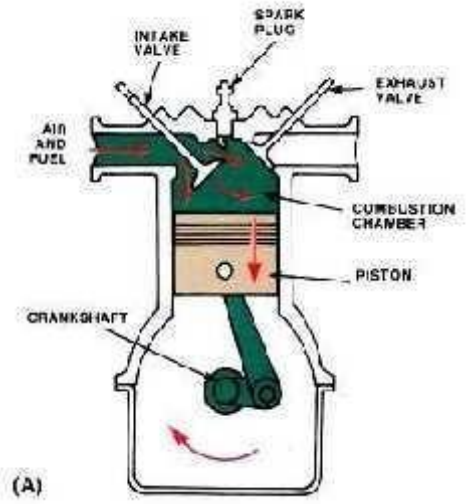


Fig: 3.1 Suction Stroke.

**B) Compression Stroke.**

In this stroke I.V. and E.V. remain closed. Piston moves up and the air sucked in during suction stroke is compressed to high pressure and temperature (nearly3.5kg/cm$^2$ and 600°C). This Stroke is represented by the line *be* in indicator diagram.

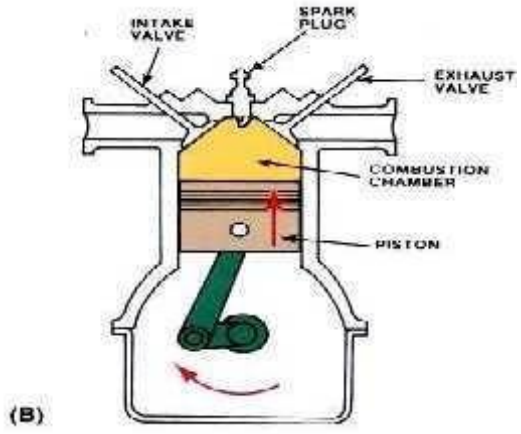


Fig: 3.2 Compression Stroke.

**C) Expansion Stroke:**

During the stroke [Fig. 3.3], I.V. and K.V. remain closed. Injection of fuel through the fuel valve starts Just before the beginning of this stroke. Due to compression the temperature of air inside the cylinder becomes high enough to ignite I ltr truffles soon as it is injected. The fuel is admitted in to the cylinder gradually in such a way that fuel bums at constant pressure. *Cd* represents the fuel burning operation. The ignited mixture nlnir and fuel expands and forces the piston downward Expansion stroke is represented by*de.*

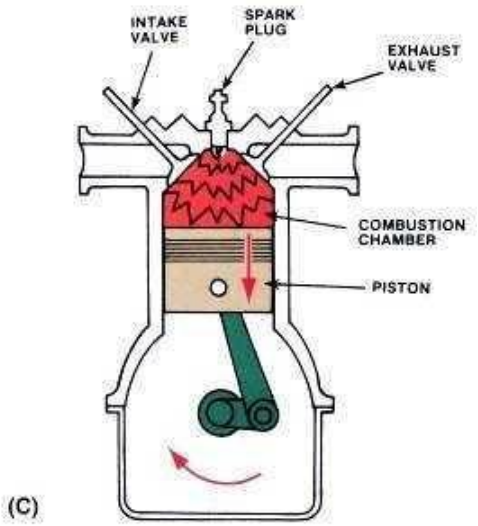

Fig: 3.3 Expansion Stroke.

D. **Exhaust Stroke:**

This stroke is represented by *ea*. In this stroke E.V. remains open, [Fig .D] and the rising piston forces the burnt gases out of cylinder. The exhaust of gases takes place at a pressure little above the atmospheric pressure because of restricted area of exhaust passages which do not allow the gases to move out of cylinder quickly. The figure shows the valve timing diagram for a four-stroke diesel engine. The approximate crank positions are shown when I.V, E.V, and fuel valves open and close. I.D.C. represents (inner dead center) and D.C. (outer dead center), I.V.O. represents (Inlet valve opens) and V.C. represent (Inlet valve closes). Similarly, E.V.O. means exhaust valve open and E.V.C. means exhaust valve closes F.V.O. represents fuel valve opens and F.V.C. represents fuel closes and F.V.O. represents fuel valve opens.

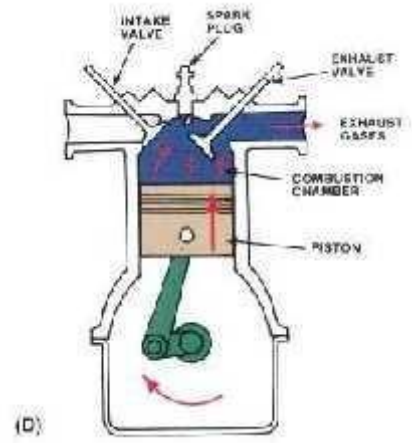


Fig: 3.4 Exhaust Stroke.

**3.4 DIESEL GENERATOR RATING & FEATURES:**

Table: 3.1 Rating of Diesel Generator:

| Max Energy | Manufactured By U.S.A |
|---|---|
| KVA | 440 |
| KW | 352 |
| PF(lag) | 0.8 |
| Frequency | 50 Hz |
| Phase | 3(AC) |
| RPM | 1500 |
| Rated Current | 634 |
| Insulation | NEMA CLASS H |

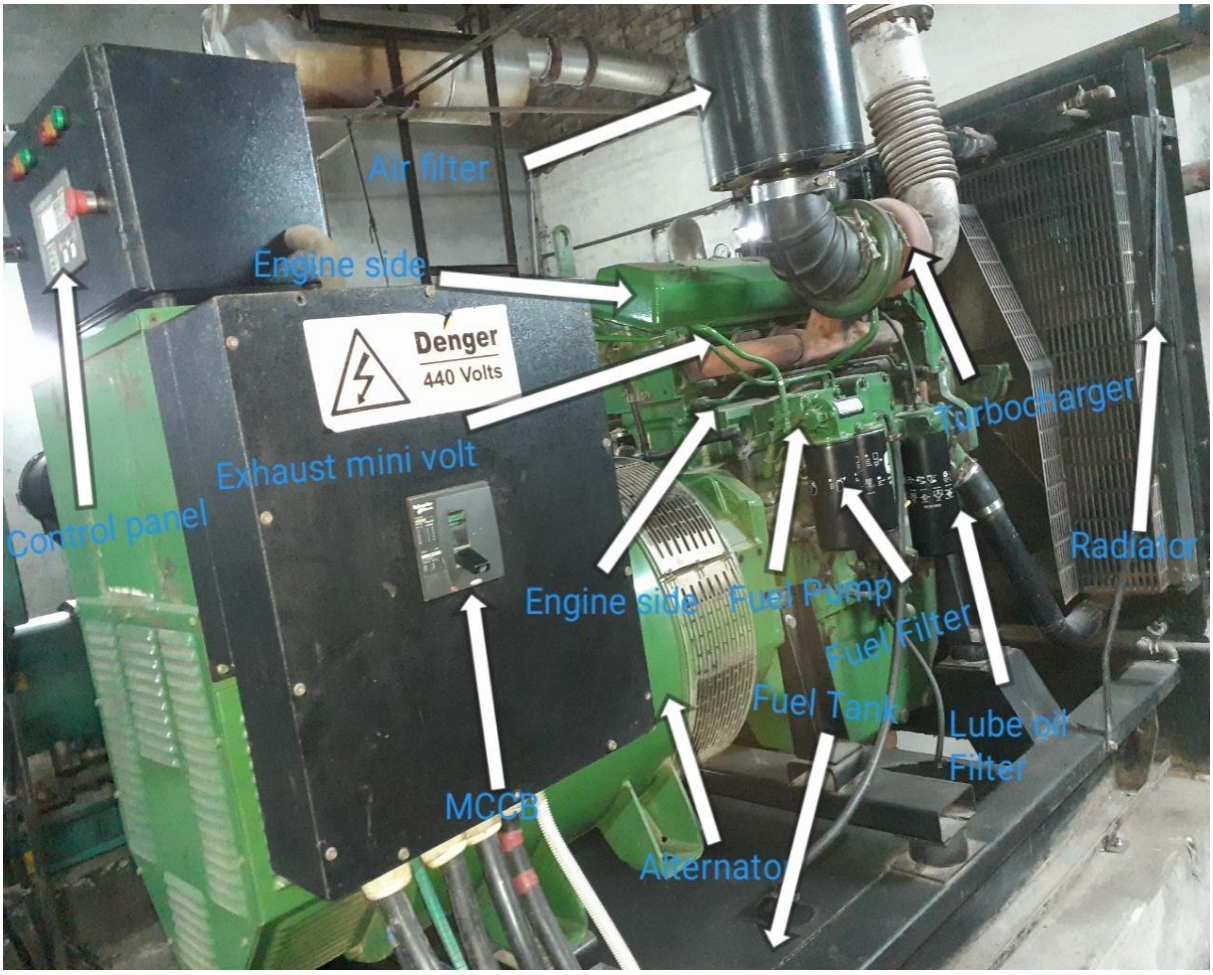


Fig: 3.5 Diesel Generators.

### 3.5 MAINTENANCE PROCEDURE:

Table: 3.2 Diesel Generator maintenance schedule:

| Activity | Regular Cleaning Interval | First 100 Hours | Change Interval |
|---|---|---|---|
| Lube oil | - | - | 300 hours |
| Lube oil filter | - | - | 300 hours |
| Fuel filter | - | - | 300 hours |
| Air filter | Clean | - | 300 hours |
| Taping | - | - | 1500-1800 hours |
| Radiator | - | clean | - |
| Battery | - | - | 1 years |
| Fuel tank | - | - | 2000-2500 hours |

### 3.6 Findings

1. There is no adequate ventilation.
2. The amount of dust in the air causes the radiator & air filter to jam.
3. Its operation manual.

### 3.7 Recommendation

1. Maintain adequate air circulation.
2. Arrange to reduce the amount of dust from the air.
3. Need to operation automatic.

# CHAPTER 4

## GAS GENERATOR

### 4.1 GAS GENERATOR

At first, gas comes from Titas Gas Company Ltd. Then the gas is passed through on, the gas is filtered with fine filter and filter separator. Next, the gas is sent to gas valve module. Afterwards, the gas is sent into combustion chamber. In combustion chamber the gas is mixed with air. Then firing is made. When the rotor speed goes 1500 rpm, then it is synchronized. As a result, we get 415 V generator output voltages.

### 4.2 GAS GENERATORRATING & FEATURES:

Table: 4.1 Rating of Diesel Generator:

| Cummins | Manufactured By United kingdom |
|---|---|
| KVA | 394 |
| KW | 315 |
| PF(lag) | 0.8 |
| Frequency | 50 Hz |
| Phase | 3(AC) |
| RPM | 1500 |
| Rated Current | 548 |


Fig: 4.1 Gas Generators left side.

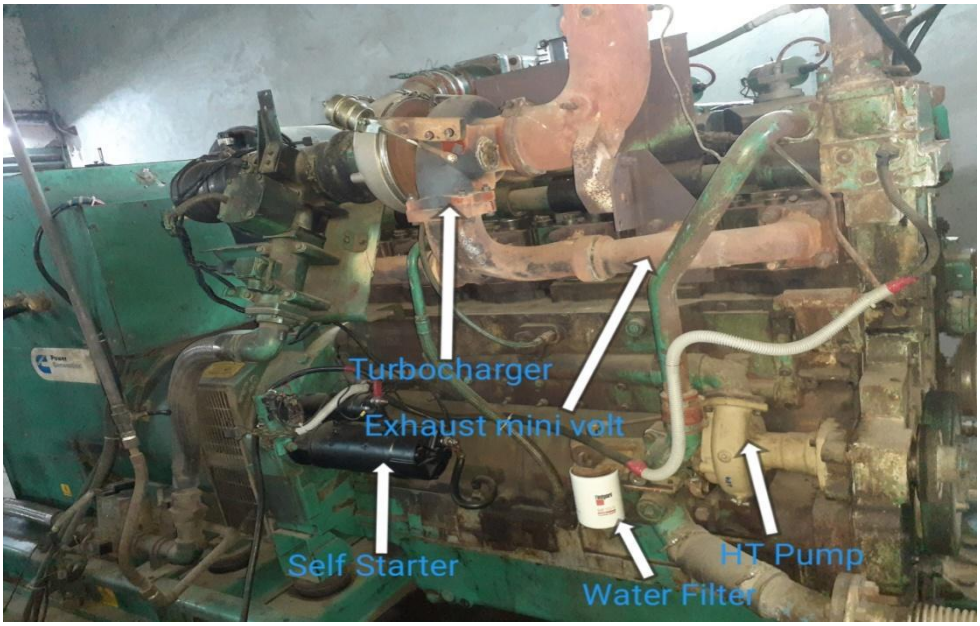


Fig: 4.2 Gas Generators right side.

**4.3 Gas Generator Main parts:**

- Gas Engine
- Alternator
- Voltage Regulator
- Lubrication System
- Battery Charger
- Control Panel
- Main Assembly Frame or Skid

**Alternator**

This is essentially the component that's responsible for generating power output. Here, we see the concept of electromagnetic induction come into play.

An alternator is made up of many complex components, but one of the most crucial aspects is the rotor. This is a shaft that rotates - driven by the mechanical energy supplied by the engine - with multiple permanent magnets fixed around it. In doing so, this creates a magnetic field.

This magnetic field created continuously rotates around another critical part of the alternator: the stator. Simply put, this is a variation of different electrical conductors that are tightly wound over an iron core. This is where things start to become slightly more scientific.

According to the principle of electromagnetic induction, if an electrical conductor remains stationary and a magnetic field moves around it, then an electrical current is induced.

In summary, the alternator takes mechanical energy created by the diesel engine, which drives the rotor to create a magnetic field that moves around the stator, which in turn generates an alternating current.

**Lubrication System**

This component attaches to the engine and pumps oil through it to ensure all the parts work smoothly and don't grind against one another. Without it, the engine will break down.

**Battery Charger**

All diesel engines need a tiny little electrical motor to help kick it into action. This small motor requires a battery, which needs to be charged. The battery charger keeps it nice and full of charge, either by an external source of the generator itself.

**Control Panel**

This is simply where the generator is controlled and operated. On an electric start (or auto start) generator you will find a whole host of controls here that allow you to do different things or check certain figures. This could include anything from the start button and a frequency switch, to an engine fuel indicator, coolant temperature indicator and much more.

**Main Assembly Frame**

Every generator needs to be contained somehow, and this is what the main assembly frame is. It houses the generator and is where all the different parts are built onto. It keeps everything together, and it can be an open design - or closed (canopied) for added protection and sound attenuation. Outdoor generators are typically housed in a protective frame that's weatherproof to prevent damages.

## 4.4 MAINTENANCE PROCEDURES:

Table: 4.2 Gas Generator maintenance schedule:

| Activity | Regular Cleaning Interval | First 100 Hours | Change Interval |
|---|---|---|---|
| Lube oil | - | - | 500 hours |
| Lube oil filter | - | - | 500 hours |
| Fuel filter | - | - | 1500-1800 hours |
| Air filter | Clean | - | 500 hours |
| Taping | - | - | 1500-1800 hours |
| Battery | - | - | 1 years |

## 4.5 Findings

1. Its operation manual

## 4.6 Recommendation

1. Need to operation automatic.

# CHAPTER 05

## Generator Cooling System

### 5.1 Generator Cooling System

Generator is heated up while running. Too much heat built in generator is not allowed. Excessive heat reduces the performance and its lifetime. In Surma there is cooling system installed with generator. In the following section, generator cooing system will be discussed.

### 5.2 Air cooling

In Surma, air cooling method is used to cool the generator. Air is passed through the generator to dissipate the heat. The air around the generator is hot. So passing cool air replaces the hot air around generator and eventually the temperature falls down.

### 5.3 Water cooling

Water fins are surrounded by the generator to absorb heat and then carrying the heat away. Water is being flown continuously by a motor and the heat is being dissipated away. At the Surma they use water cooling system to cool down the generator.

# CHAPTER 06

## SUB-STATION

**6.1 Sub-station definition**: The electrical substation is the part of a power system in which the voltage is transformed from high to low or low to high for transmission, distribution, switching and transformation. The power transformer, circuit breaker bus-bar, insulator, and lightning arrester are the main components of an electrical substation.

### 6.2 SUB-STATION FETURES:

**2* 500=1000 KVA**.

Its indoor sub-station.

Table: 6.1 Rating of Sub-station:

| | |
|---|---|
| KVA | 500 |
| KW | 400 |
| Primary Voltage | 11KV |
| Secondary Voltage | 400 V |
| Bus bar (100*12)mm | CCC (2400A) |
| PF(lag) | 0.8 |
| Switchgear Type | LBS |
| Frequency | 50 Hz |
| Phase | 3(AC) |
| Rated Current | 630A |
| PFI Panel | 300 KVA (Capacitor Bank Type) |


FIG: 6.1 Sub-station.

### 6.3 Main Parts of Sub Station

I will discuss the main parts of a substation used in Surma. Figure 6.1 shows the partial part of the substation at Surma where the Current Transformers (CT), Power Transformers (PT), Isolators, Insulators are connected and arranged. Below, different equipment of the substation is described from the collective perspective. At Surma I visited the substation; mainly substation is used for distribution of power. The equipment that is used in the substation of Surma is as follows.

- Power Transformer
- Instrument Transformer
- Current Transformer (CT)
- Potential Transformer (PT)
- Bus bar
- Transmission and Distribution
- Insulators
- Isolators
- Auxiliary Systems
- Switchgear

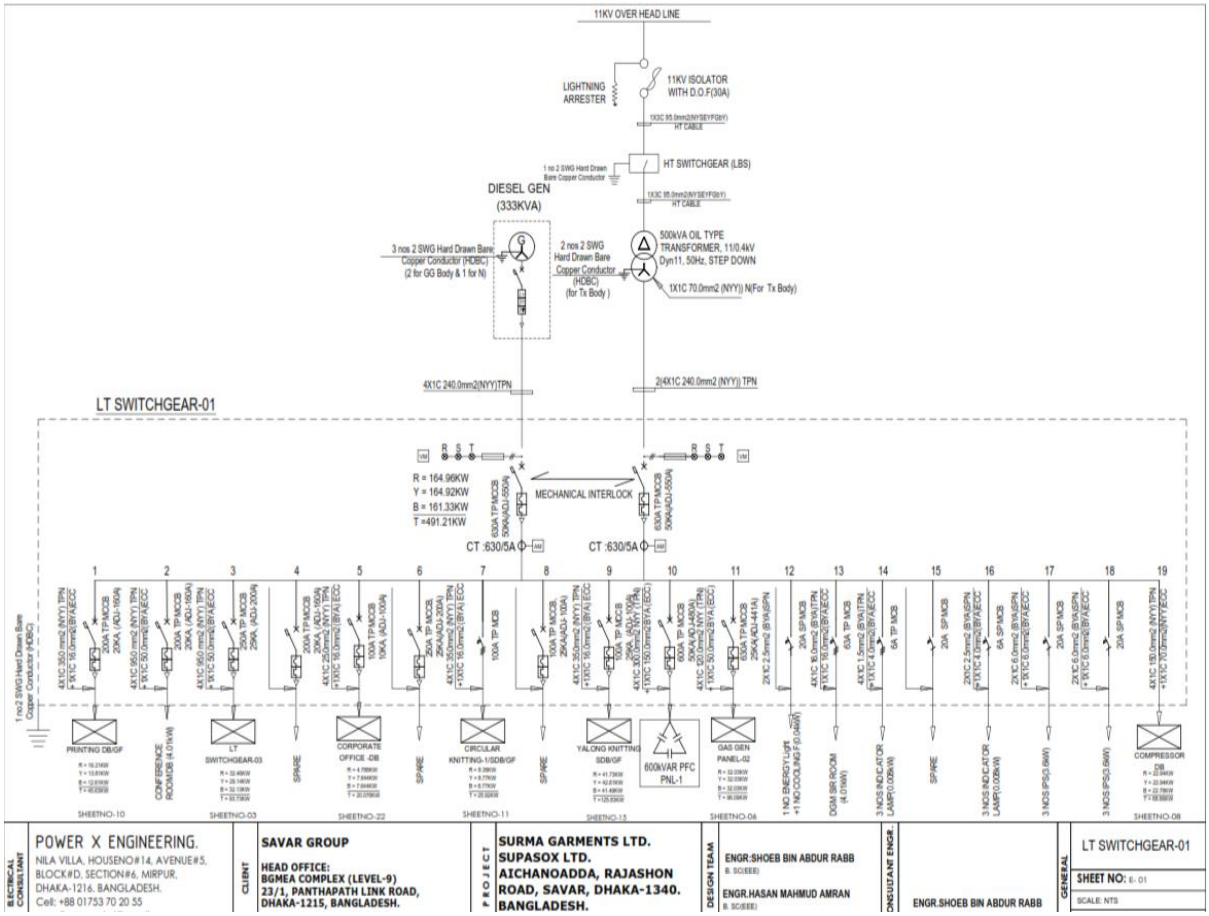


Fig: 6.2 SLD of Sub-Station.

### 6.4 Single Bus Configuration

As the name suggests, it consist of a single bus bar and all the incoming and outgoing lines are connected to it. At Surma, the reason why they have used Single Bus Configuration is due to the fact that it has low initial cost, less maintenance needed and simple operation. However, the disadvantage of single bus bar system is that if repair is to be done on the bus bar or a fault occurs on the bus, there is a complete interruption of the power supply.

### 6.5 Power Transformer

In Surma, I closely observed power transformers and they are generally installed for step up or step down the voltage. For long line transmission high voltage in needed. In Surma, there are total two power transformers. Figure 6.2 shows Transformer-1 of the substation which is used for stepping down the voltage from 11 KV to 415 V. This is a Δ-Y connected transformer.

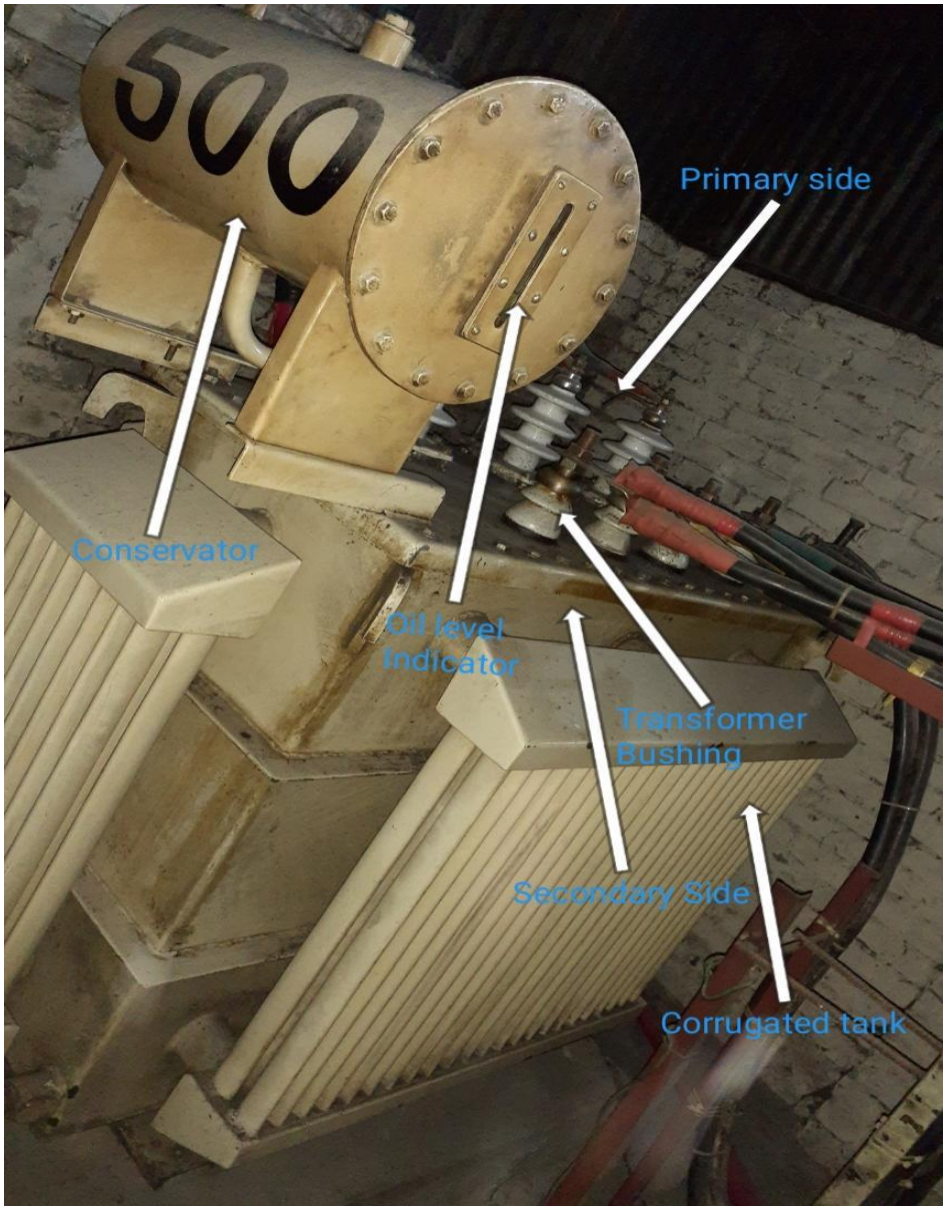


Fig: 6.3 Power Transformers.


Fig: 6.4 Instrument Transformers of Surma.

**6.6 Instrument Transformer**

During our internship i saw instrument transformers. There were two kinds of Instrument Transformers. They are Current Transformer and Potential Transformer. Instrument transformers are used for measuring and protection purposes. These transformers are discussed below.

**i) Current Transformers (CT)**

In Surma during our intern period, I saw several current transformers. Current transformers are mainly used for metering and protection. Usually we cannot use high current for metering purpose. So we need to step down the current to a convenient value. Normally in CT, primary side current is very high and secondary side is low. At Surma, the ratio is 500/5. Current Transformers are always connected in series with the 400 V line. These transformers are made in Bangladesh by AEG Figure 6.4shows the CT at Surma substation. Apparently CT looks like wide circular cylinder and it is connected in series with the distribution line i observe carefully.

**ii) Potential Transformers (PT)**

In Surma, I saw several potential transformers. These transformers are used for measuring and protection purpose. Usually protective relays need low voltage to operate. So we need to convert the high voltage to low voltage. In fact, potential transformer is a step down transformer. It indicates primary side voltage is high and secondary side voltage is low. PT is used in parallel with the line. The ratio is 6350/240 of 400 V line. Potential transformers used in Surma are made in Bangladesh. Figure 7.2 is the PT. It sometimes creates confusion about which one is PT in between CT and PT as both looks more or less same. But PT is connected in parallel with the transmission line. Some components are used in Surma which are given below.

### 6.6.1 Insulators

There are two types of insulators

- Pin type insulator
- Strain Insulator

### 6.6.2 Isolators

In substation we also saw the Isolators. It is the extra protection part of the system. It is often desired to disconnect a part of the system for general maintenance and repairs. It is accomplished by an isolator. Isolator does not have the arc extinction capacity. It operates under no load condition. It does not have any specified current breaking capacity or current making capacity. Isolator not even used for breaking load currents. While opening a circuit we have to open the circuit breaker first, and then we can open the isolator. While closing circuit, the isolator is closed first, then circuit breakers

## 6.7 Findings

1. Here Electrical Protection do not maintain properly.
2. Its operation manual.

## 6.8 Recommendation

1. Awareness needs to be raised.
2. Need to operation automatic.

# CHAPTER 07

## AIR COMMPRESSOR

### 7.1 Air Compressor definition:

An air compressor is a pneumatic device that converts power using an electric motor into potential energy stored in pressurized air. By one of several methods, an air compressor forces more and more air into a storage tank, increasing the pressure.

### 7.2 Classification

Compressors can be classified according to the pressure delivered:

1. Low-pressure air compressors (LPACs), which have a discharge pressure of 150 pounds per square inch (10 bar) or less
2. Medium-pressure compressors which have a discharge pressure of 151 to 1,000 pounds per square inch (10.4 to 68.9 bar)[
3. High-pressure air compressors (HPACs), which have a discharge pressure above 1,000 pounds per square inch (69 bar)

They can also be classified according to the design and principle of operation:

1. Single-stage reciprocating compressor
2. Two-stage reciprocating compressor
3. Compound compressor
4. Rotary-screw compressor
5. screw compressor
6. Turbo compressor
7. Centrifugal compressor

### 7.3 AIR COMPRESSOR FEATURES:

Table: 7.1 rating of air compressor:

| | |
|---|---|
| Manufactured By | India |
| Plant Capacity | 19.5 m/Min |
| Control System | PLC |
| Type | Screw |
| Stage | One |
| Oil Grade | ISO VG 68 |
| Working Pressure | 7 Bar |

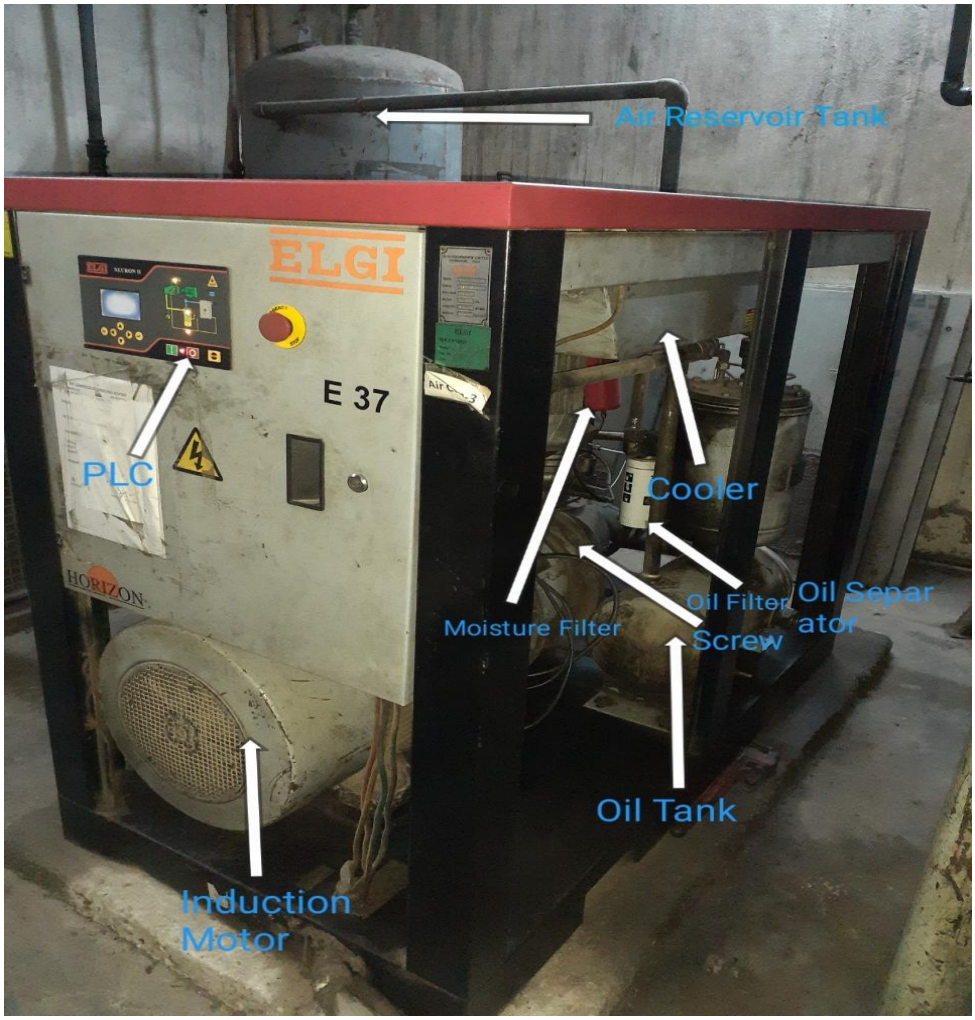


Fig: 7.1 Air-Compressors.

**7.4 Main parts & its detail:**

- **Rotors/Rollers**. There are few elements as critical as rotors. They're the centralized component to the compression process without which, these air compressors simply couldn't function or exist as they do. Rotors or rollers come in pairs and are built inside cylinders. When on, rotors rotate at high, smooth, sweeping speeds, creating the pipeline for suctioned air to move through, compress and then discharge out, ultra-pressurized.
- **Compression Cylinder**. These compressor models include mainline compression cylinders that house their all-important rollers. Collected air runs through a cylinder's chambers and into the interlocking, spinning rotors. The amount of cylinders contained in a unit determines how many "stages" that unit has, as well as the pressurization amount it can produce.
- **Air Filters**. The first of many essential layers of filters built within these type of compressors. The inlet air filter rests just inside the compressor's opening valve, catching dust, moisture and air particles that would be damaging to the inside of the machine. Other

air filters may be set within chamber components for additional cleaning and protective layers.

- **Oil Filters.** For oil-lubricating compressors, oil filters will be placed both within rotating chamber walls and near discharge valves to sift oil lubrication from compressed air properly. Liquid lubrication also provides the cooling needed for compression machines, which produce high heat contrary to what's safe for optimal air and machine capacities.
- **Bearings**. Bearings sit on both rotor ends and help rotors stay securely in place, rotating evenly and maintaining their loads balanced and in proper capacity. They are typically anti-friction and anti-corrosive, with several design modifications based on the size, scale and output expectations of the compressor unit, as well as whether it's oil-lubricating or oil-free.
- **Suction Valve**. The suction valve sits atop most compressing units and is responsible for raw, initial gas retrieval. At the cue of a unit's system stage control, the suction valves open to allow air to rush inside, where it will mix in and become trapped within the interlocked twin rotors.
- **Discharge Valve**. Likewise, discharge valves sit on the opposite end of the suction valve and cue the end of the compression cycle. They receive the now-pressurized air and release it into a holding or storage tank, or out a discharge pipe for immediate application.
- **Motor**. The compressor motor powers the rotations of the rollers on automatic and adjusted settings, which in turn powers the machine's entire compression capabilities.
- **System Control**. With their multi-control scheme settings, a system control display for operators is needed in order to read and gauge a unit's health and overall output. A system control will display and monitor the various components of a compressor, as well as its operating, idling or stop parameters. In high-capacity, automatic units working nearly 24/7, the gauge allows safe and procedural pressures to be monitored with or without human oversight.
- **Storage Tanks.** The storage tank receives the now-condensed air from the discharge valve, where it sits safely and maintains its pressure until use.
- **Separators**. In oil-injection compressors, separator tanks are employed as another line of defense against oil and gas mixtures that damage the purity of your final compressed gas stream.

- **Gaskets & Seals**. Pressurizing systems only work when air-tight themselves. Gaskets and seals address this overall concern, ensuring a compressor is locked, sealed and leak-free at every nook and cranny, interior and exterior.

### 7.5 MAINTENANCE PROCEDURES:

Table: 7.2 Air compressor maintenance schedule:

| Activity | Regular Cleaning Interval | First 100 Hours | Change Interval |
|---|---|---|---|
| Oil | - | - | 2000 Hours |
| Oil filter | - | - | 1000 Hours |
| Air filter | Clean | - | 1500 Hours |
| Coolers | Clean | Clean | - |
| Separator Element | - | - | 4000 Hours |
| Moisture Separator | - | Clean | - |
| Electrical Connection Check | 500 Hours | - | - |
| Tank | 2000 Hours | - | - |
| Motor greasing periods | 4000 Hours | - | - |

### 7.6 Findings

1. There is no adequate ventilation.
2. The amount of dust in the air causes the cooler& air filter to jam.

### 7.7 Recommendation

1. Maintain adequate air circulation.
2. Arrange to reduce the amount of dust from the air.

# CHAPTER 08

## BOILER

### 8.1 Boiler Definition:

Boiler is a closed vessel in which water or other liquid is heated, steam or vapor is generated, steam is super-heated, or any combination thereof, under pressure or vacuum, for use external to itself, by the direct application of energy from the combustion of fuels, from electricity or nuclear energy.

### 8.2 BOILER RATING & FEATURES:

Table: 8.1 rating of boiler:

| Yuanda Boiler | Manufactured By China |
|---|---|
| KW | 5 KW |
| Capacity | 1 Ton |
| Type | Fire tube |
| PF(lag) | 0.8 |
| Control System | Semi-Automatic |
| Working Pressure | 6 Bar |


**Fig: 8.1 Boiler.**

### 8.3 Main parts of boilers

There are different parts that make up a boiler and though they've been around for a while now and modern boilers are more energy-efficient than the older ones, some of these parts are still the same. Learning different parts help you in repairing and the maintenance of your boiler. But what are these main parts?

**Combustion chamber or firebox**

The burner creates combustion in this chamber that heats the heat exchanger up to several hundred degrees. The fuel that is burned in this chamber varies. Kerosene, heating oil, and liquid propane are the most common fuel sources used in the combustion chamber of the

boilers. The firebox or the combustion chamber is usually made of cast iron to withstand the heat and the pressure of the process inside. The process increases the temperature inside the chamber up to several hundred degrees in a really short time so the used materials should be suitable for such a condition.

**Heat exchanger**

The combustion created in the firebox, creates a heat that's transferred by the heat exchanger to heat the fluid up in the tank. This heat exchanger carries the produced heat to the fluid without any direct contact with the water.

**Expansion tank**

Another item in the list of different parts of boilers is expansion tank; this small tank is responsible for protecting the boiler from excessive pressure and ensures its safety along the process.

**Burner**

One of the most important parts of boiler is the burner which is where the mixing of the air with the fuel source happens, resulting in the combustion which provides the necessary heat to heat up the fluid. They are responsible for initiating the combustion reaction in the system with the electronic signal of the thermostats to the burner. This signal informs the system when there's a need to produce heat. The burner uses the fuel pumped from an outside source with a filter mechanism. There's a nozzle designed on the burner to turn this fuel into the spray and ignites it initiate the combustion inside the firebox.

**Aqua stats**

Aqua stats are the components in the boiler responsible to send the right signal to the burner about when to stop or when to start the process. They know the right time based on the temperature of the fluid in the boiler.

**Backflow valve**

Backflow valve acts as a safety unit, allowing the flow of the fluid only in a single direction.

**Supply lines**

These parts of boiler are pipes that are responsible for delivering the heated stream of fluid to the distribution points in the boiler.

**Return lines**

Return lines are responsible for bringing the cooled fluid or the cooled steam (which changes its state back to its liquid form) back to the boiler to heat it up again.

**Circulator pump**

The last item on the list of different parts of boiler we want to introduce to you is the circulator pump. This part directs the hot water throughout the boiler to help it circulate to the different outlets in our homes, offices, or other places that the boiler is used. They are used in the boilers that use hot water for heating purposes.

### 8.4 Boiler Applications:

The Boilers have a very wide application in different industries such as

- Power Sector
- Textiles
- Plywood
- Food Processing Industry
- Sugar Plants
- Thermal Power Plants

# CHAPTER 09

# ETP

## 9.1 ETP FEATURE:

Table: 9.1 ETP feature:

| | |
|---|---|
| Plant Capacity | 2000LPD |
| Type | Chemical |
| Control System | Manual |
| Chemical Name | Polymer, PAC |
| Water Reusable | Yes |
| Water Quality Input | pH: 8-14, TDS: 1500-2500, Hardness:1000-1400, BOD:300-500, COD: 900-1100 |
| Water Quality Output | pH:7-8, TDS:400-500,Hardness: 400-600 BOD: <50, COD: <250 |


Fig: 9.1 ETP (Effluent Treatment Plant).

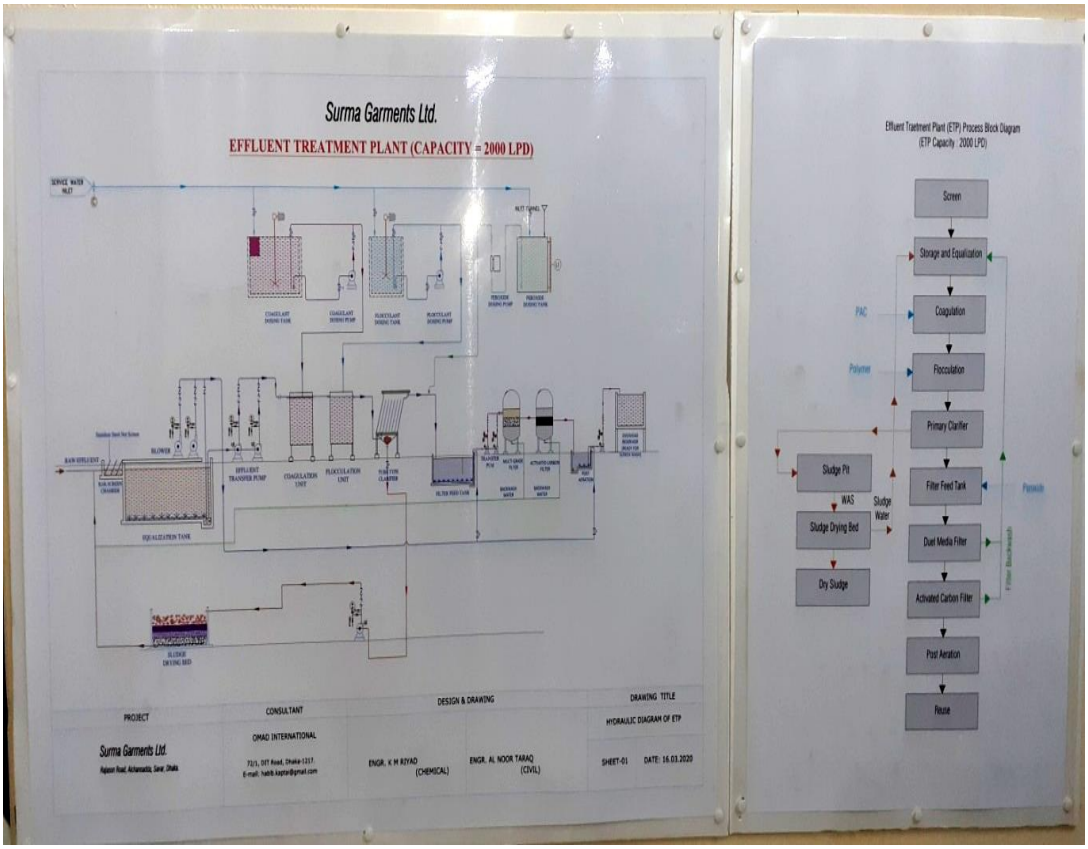


Fig: 9.2 ETP Flow Diagrams.

## 9.2 ETP filtration Step

### Primary filtration:

Waste liquor after pretreatment, dyeing, printing and finishing is subjected to primary filtration in which removal of gross solids, such as waste threads, fabric pieces, lint's etc. takes place.

### Cooling & Mixing:

After primary filtration, the liquor passes to cooling and mixing tank in which uniform mixing of effluents from various process takes place. A paddle mixer is provided for mixing. Cooling of the effluent may be done with the help of cooling tower.

### Neutralization:

The effluent is pumped to a tank in which it is neutralized by acid or alkali dozing. The tank has an automatic dosing controller which at automatically control the dose of acid or alkali to maintain the required ph.

### Coagulation:

Then the effluent is pumped to the coagulation tank. Chemical coagulation very effective for removal of color and suspended materials, aluminum, ferrous sulphates, ferric chloride, chlorinated copper etc. to increase the efficiency of coagulation, coagulation gain may be added for example polyacrylate.

**Setting & separation of sludge:**

Some of the soluble organic matter and light suspended solids will form a blanket of flocculent matter with the coagulants. The blanket is skimmed off to another tank and the remaining solution is moved to pressure filter.

**Pressure filter:**

For pressure filtration vacuum pumps may be used to force through the filter and suspended flocks are collected in the pressure fine filter.

**Discharging to drain:**

After filtration the purified water sent to reuse.

# CHAPTER 10

## FIREF DEPARTMENT

### 10.1 FIREFIGHTING FEATURES:

Table: 10.1 firefighting features:

| | |
|---|---|
| Water reserve capacity | 29941 Liter |
| Pump capacity (Electric & Diesel) | 2842 L/Min |
| Plant type | Automatic |
| Fire Extinguisher | ABC Powder, Co2& Foam |
| Sensor | Smoke Detection, Heat detection, Multi Detection |
| Control Panel Type | Addressable |
| Control Panel Operating Voltage | 24V Dc |

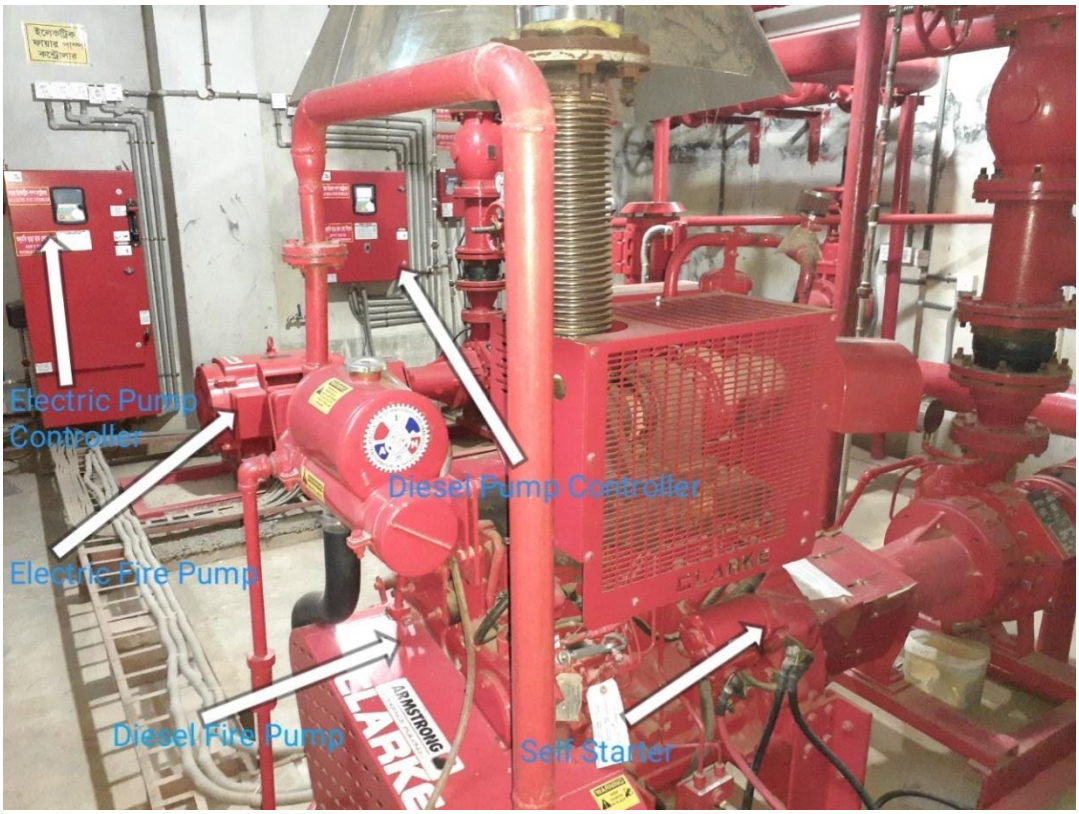


Fig: 10.1 Fire Pump Control Room.


Fig: 11.2 Fire Extinguishers.

**10.2 Firefighting Tools:**

1. Fire Extinguisher
2. Lock Cutter
3. Ladder
4. Water Nozzle
5. Exit Light
6. Fire Door
7. Axe
8. Fire Blanket
9. Rope
10. Call Point
11. Helmet
12. Torch light
13. Hand Gloves

**10.3 Fire Safety Measures:**

During our working period in Surma, I attained a whole day training session about Fire Fighting and Safety Procedure by a senior specialist MD.Barek Hossain on this field. In Surma, there is a Fire section where cylinders containing Carbon-Di-Oxide. The capacity of $CO_2$ in each cylinder at is 13kg/cylinder. They are programmed such that where ever any burning or combustion occurs internally in the system; $CO_2$ directly reaches there and handle the situation automatically. For that, there are sensors used everywhere in the system off course to find out any combustion.. Here also used BC Powder & Foam. Apart from that, routine workshop is hold for the workers and stuffs to keep them aware and cautious about dealing fire. This compartment branches out and expands to various sections of the plant where there is the need of fire safety. It is to mention that these cylinders are changed on routine basis as they need to be refilled

# CHAPTER 11

## CONCLUSION

### 11.1 Problems

In our internship program I faced some problems. Those are as follows:

• During our internship one generator unit was turned off for low gas pressure. This is why we could not observe full load of the power station.

• The time of the internship was too short for which we could not learn all the sections thoroughly.

• Before the internship I did not have any academic knowledge about the mechanical section of the power plant, for which we faced some problems in my internship.

### 11.2 Recommendations

• The length of the internship duration should be increased. I think the duration should be spare for at least four months.

• Students should complete power station related courses such as power station and switchgear before internship.

• University authority should offer at least one course related to mechanical engineering to understand the mechanical parts of the power station.

• Substation is a high voltage area. So everyone should be aware of the precautions of power station.

### 11.3 Conclusion

Industries are a very important and sensitive issue for any country for its industrial thus economic growth. If we want to keep growth, we should be skilled in Practical work. Hey, we can learn these from Industries. For this internship I got the opportunity to work as a member of a professional team which was involved in the I&C (Instrumentation and Control) section, electrical section, mechanical section and the maintenance section. The Maintenance work is one of the most complex processes among all these sections. I have gathered some practical experience in maintenance department. I also have gained practical knowledge in internship period; with the experience of this internship I can relate the practical understanding with the theoretical knowledge. In this internship I also have encountered some real life problems in electrical maintenance. I believe that, the practical experience that I have gathered in Surma will help us in our professional life.

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