UTM

UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF MECHANICAL ENGINEERING
FACULTY OF ENGINEERING

INDUSTRIAL TRAINING REPORT

By

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2021

BACHELOR OF MECHANICAL ENGINEERING AERONAUTICS

TRAINING PLACE : EVERGREEN PRODUCTS FACTORY (BD) LTD

TRAINING PERIOD : 12 WEEKS (11TH JULY to 07th OCTOBER)

SUPERVISORS : MAJOR QUAZI FERDAUS-UL-ALAM
DR MD. NIZAM BIN DAHALAN

November 2021

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This industrial training report is submitted in partial fulfilment of the
requirements for the award of the degree of
Bachelor of Mechanical Engineering (Aeronautics)

School of Mechanical Engineering
Faculty of Engineering
Universiti Teknologi Malaysia

November 2021

STUDENT DECLARATION

"I declare that this report entitled "*INDUSTRIAL TRAINING REPORT*" is the result of my own work experience except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : Maryam.....

Name : MARYAM MUSNAD

Date : 4 NOVEMBER 2021

ACKNOWLEDGEMENT

I would like to express my gratitude to multiple people for their assistance and guidance during the industrial training period from 11th July to 7th October, 2021. I have been able to complete my internship successfully due to their guidance and support all through, especially when I was having difficulties.

Firstly, I wish to express my sincere appreciation to my faculty supervisor, Dr Md. Nizam Bin Dahalan, for his guidance, critics and support during my training period.

Secondly, I am thankful to my company supervisor, Major Quazi Ferdaus-Ul-Alam (Retd.) (General Manager of Department of Human Resource and Administration) who has been generously advising and guiding me since the first day of undertaking hands-on training at Evergreen Products Factory (BD) Ltd. He was willing to share his own experience and knowledge and oversaw that I was always learning under appropriate mentors. He has also given up his time to mentor me through my daily work tasks, from the start of the internship until the end of the program.

Finally, I would like to express my gratitude to my parents and family members who supported me in spirit and provided me with sufficient finances whenever required during the internship. Their prayers, wise counsel and kind words have always motivated me to keep going.

ABSTRACT

An internship can provide professional job experience in a secure and structured atmosphere while also providing guidance from professionals. Internships undertaken as part of the requirement of the Bachelor's degree from Universiti Teknologi Malaysia assist students in developing professional skills such as leadership, communication, critical thinking, organisational and technical knowledge that may be valuable in the future. This report contains the details of the 12 weeks long industrial training held at Evergreen Products Factory (BD) Ltd., Uttara EPZ Nilphamari, Bangladesh. I was assigned as an internship trainee in the mechanical engineering sector under the company supervisor, Major Quazi Ferdaus-Ul-Alam (Retd.) and my faculty supervisor Dr Md. Nizam Bin Dahalan. The purpose of selecting Evergreen Products Factory (BD) Ltd. is based on the reason that it is one of the biggest exporters of wig in Bangladesh. The industrial training encompassed various tasks related to mechanical engineering, where I acquired skills and expertise, that I aspire to use in order to achieve desired career goals and contribute to their and my country's development as well.

ABSTRAK

Latihan Industri boleh memberikan pengalaman kerja profesional dalam suasana yang selamat dan tersusun di samping memberikan bimbingan daripada profesional. Latihan amali yang dijalankan sebagai sebahagian daripada keperluan ijazah Sarjana Muda dari Universiti Teknologi Malaysia membantu pelajar dalam membangunkan kemahiran profesional seperti kepimpinan, komunikasi, pemikiran kritis, pengetahuan organisasi dan teknikal yang mungkin bernilai pada masa hadapan. Laporan ini mengandungi butiran latihan industri selama 12 minggu yang diadakan di Evergreen Products Factory (BD) Ltd., Uttara EPZ Nilphamari, Bangladesh. Saya telah ditugaskan sebagai pelatih amali dalam sektor kejuruteraan mekanikal di bawah penyelia syarikat, Mejar Quazi Ferdaus-Ul-Alam (Bersara) dan penyelia fakulti saya Dr Md. Nizam Bin Dahalan. Tujuan memilih Evergreen Products Factory (BD) Ltd. adalah berdasarkan sebab ia merupakan salah satu pengeksport rambut palsu terbesar di Bangladesh. Latihan industri merangkumi pelbagai tugas yang berkaitan dengan kejuruteraan mekanikal, di mana saya memperoleh kemahiran dan kepakaran, yang saya ingin gunakan untuk mencapai matlamat kerjaya yang diingini dan menyumbang kepada pembangunan mereka dan negara saya juga.

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INTRODUCTION

1.1 Introduction to Industrial Training

All undergraduate students from the School of Mechanical Engineering participate in industrial training for 12 weeks, which exposes them to real-world job situations in a variety of industries. Students are placed in industries that are most relevant to their field of study. It is an experiential learning method that requires students to learn the process and apply what they have learned in class in a real-world environment. The knowledge gained during practical training can be applied later in final year classes as well as to prepare students for employment interviews.

1.2 Objectives of Industrial Training

Industrial Training's objectives are to improve students' knowledge and abilities in preparation for a career in their chosen field, as well as to generate graduates who are professional, ethical, skillful, creative, and competent.

The objectives are:

i. to expose students to the environment and working conditions in their respective fields
ii. to gain working experiences in the organization/industry related field of study
iii. to apply the knowledge of the Industrial Training, which was followed at university

iv. to train students to interact and communicate effectively at all levels in the workplace
v. to train students to prepare technical reports related to the Industrial Training that was conducted
vi. to instill a sense of togetherness or teamwork
vii. to create awareness of their profession's ethical ideals

1.3 Scope of Industrial Training

Students must pass different parts of training to work in the company/organization, including:

i. observing operations/ factories/ firms
ii. carrying out operations using machinery and equipment
iii. working on installation and fabrication
iv. quality inspection and control
v. working on instrumentation and process control
vi. project design
vii. machinery and equipment maintenance and repair
viii. new equipment installation and testing
ix. administration and management
x. consultation

The extent and content of the training program, on the other hand, are determined by the sorts of companies and organizations engaged. The curriculum that only requires students to do production work would be deemed insufficient and would not be approved by the faculty.

Thus, the companies/organizations have been requested to provide appropriate training to students who would work as an engineer/industrial designer after completion of their studies.

1.4 Summary of Industrial Training

I attended my Industrial Training at Evergreen Products Factory (BD) Ltd. located at EPZ Uttara, Nilphamari, Bangladesh. It commenced on 11th July and ended on 07th October 2021. The primary purpose of the 12 weeks of industrial training is to expose students to working in the industrial sector in real-world conditions. Furthermore, students have the chance to apply theoretical knowledge to hands-on practical and design work, particularly in the fields of mechanical engineering. Furthermore, essential soft skills such as communication, teamwork, networking, and leadership may be developed in a professional setting. Overall, it provides as a platform for a person to unveil themselves to a learning environment in the organization.

CHAPTER 2

COMPANY BACKGROUND

2.1 Company Profile

Figure 2.1.1 The Evergreen Group Logo

Figure 2.1.2 Company Profile

Figure 2.1.3 History and Development

Evergreen Products Group, founded in 1962, is a renowned global manufacturer of hair products. With in-depth experience in the industry and a reputation for excellent products and a comprehensive range of products, the Evergreen Group has established distinct competitive advantages in the worldwide hair goods market since its inception. The Evergreen Group, headquartered in Hong Kong, has three manufacturing sites in China and two production centres in Bangladesh. The Evergreen Group employs about 15,000 people worldwide and has operations in Bangladesh, Hong Kong, China, Japan, and the United States. With the advancement of fashion awareness and the growing popularity of Halloween celebrations and COSPLAY culture, the global hair items industry is likely to continue its upward trajectory. The Evergreen Group creates, manufactures, and distributes a diverse variety of hair items comprised of synthetic fibres and human hair, such as wigs, hairpieces, braids, and high-end human hair extensions. With a presence in key markets such as the United States, the United Kingdom, China, Japan, and South Africa, the Evergreen Group offers a diverse product range aimed at various ethnic groups and the Halloween market, capturing numerous markets and fashion trends.

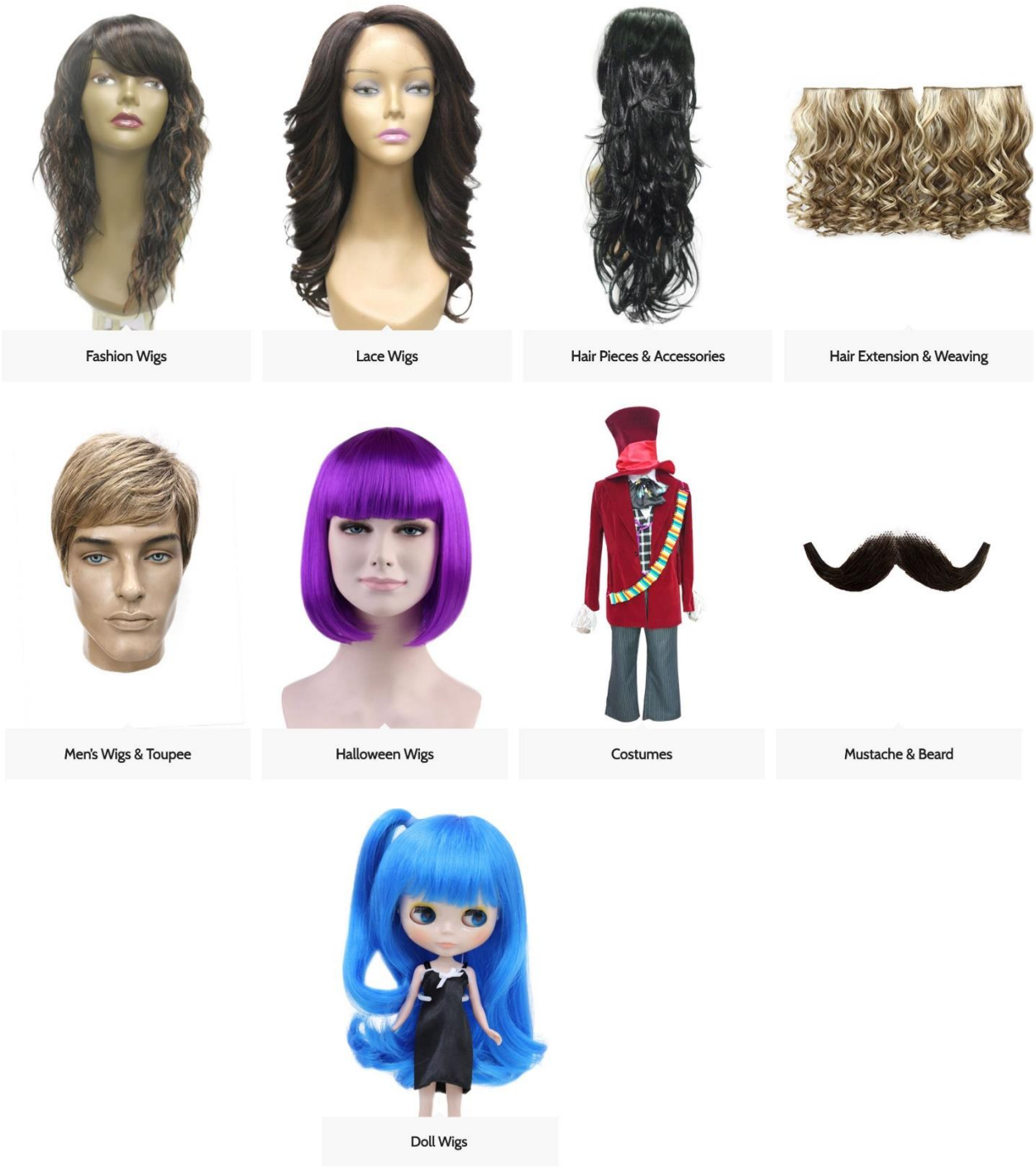

Figure 2.1.4 Evergreen Products Factory Production

Furthermore, with an approximately 4.0% market share of the global synthetic hair goods manufacturer revenue in 2016 and a solid foundation built over years of operation in Bangladesh and through implementing flexible development strategies, Evergreen's business has continued to grow and achieved outstanding results during the years. Although the COVID-19 pandemic has completely changed the lifestyle of people, and trends such as shopping online will not be reversible. The Group will continue to grow the E-commerce team, aiming to expand its customer base, achieve a more balanced and healthy market layout, and enhance its risk resistance. Besides, the Group has continuously made all efforts to reduce costs and overheads to make further improvement in the profitability soonest possible and preserve working capital for any future opportunities.

In the coming years, the Group will continue to enhance the e-commerce operation capability and develop new e-commerce platforms to explore the African American and Caucasian markets and be enabled with the technology of virtual reality (VR) for selling digital wigs in games. They have engaged Shadow Factory Limited, a leading VR/AR production company.

2.2 Organizational Structure

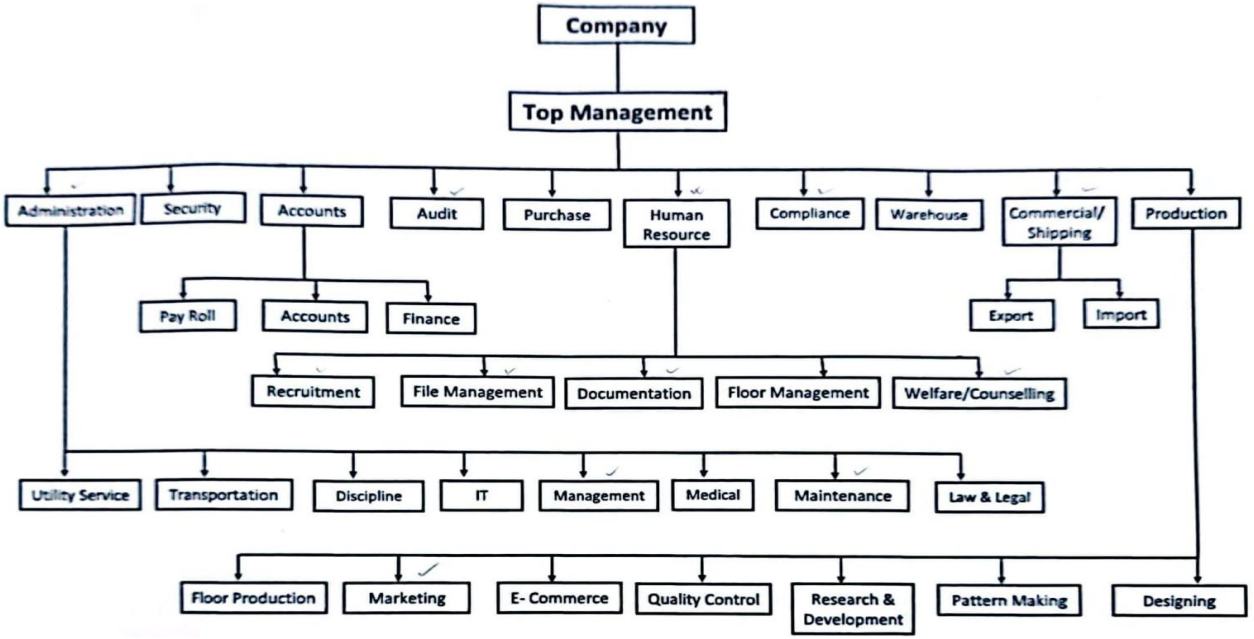

Figure 2.2.1 Organisation Chart

2.3 Industrial Training

In Evergreen Products Factory (BD) Ltd., the first three weeks, I was involved in learning about generator operations, maintenance, repair, and service. In week 5, I gained knowledge about Water Treatment Plant operation and maintenance. In the next few weeks, I participated in coal and diesel boiler operations, maintenance, the annual descaling process and testing steam quality and control. From weeks 8 to 9 I trained in external and internal electric substation maintenance and service. In my 10^{th} week, I gained knowledge about wig production and packaging equipment and machineries and worked in heating room operations and maintenance. In the last 2 weeks, I worked in the compressor room operation and maintenance, as well as the electrical wiring and service in new factory extension, their operation and maintenance overview. I was involved in designing electrical substations and load calculations of the factory extension. Furthermore, I was able to work with the administration, management, and human resources department in learning about recruitment and acquisition of machineries and operators.

2.4 Flowchart of Industrial Training

Following is a Gantt Chart to illustrate the workflow, as prepared during the internship,

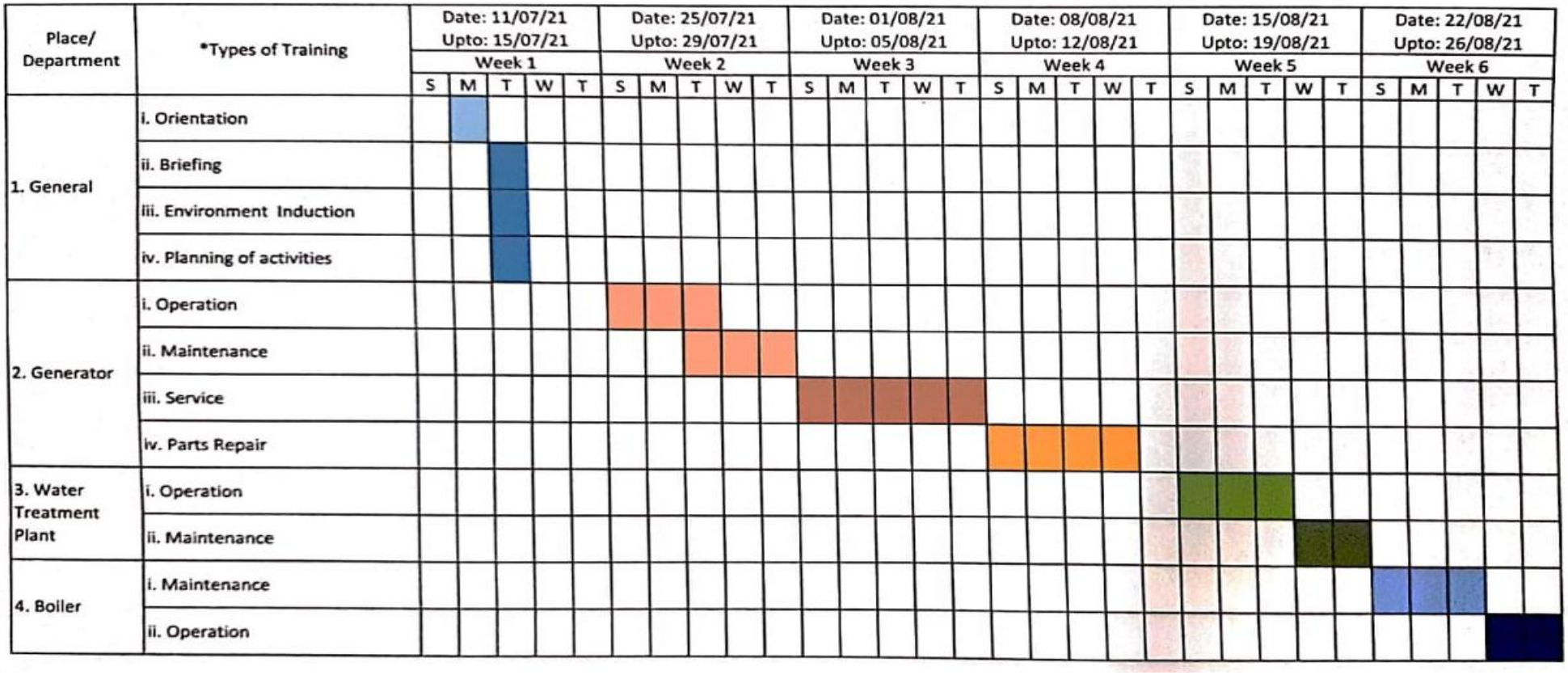

Figure 2.4.1 Gantt Chart of weeks 1 to 6

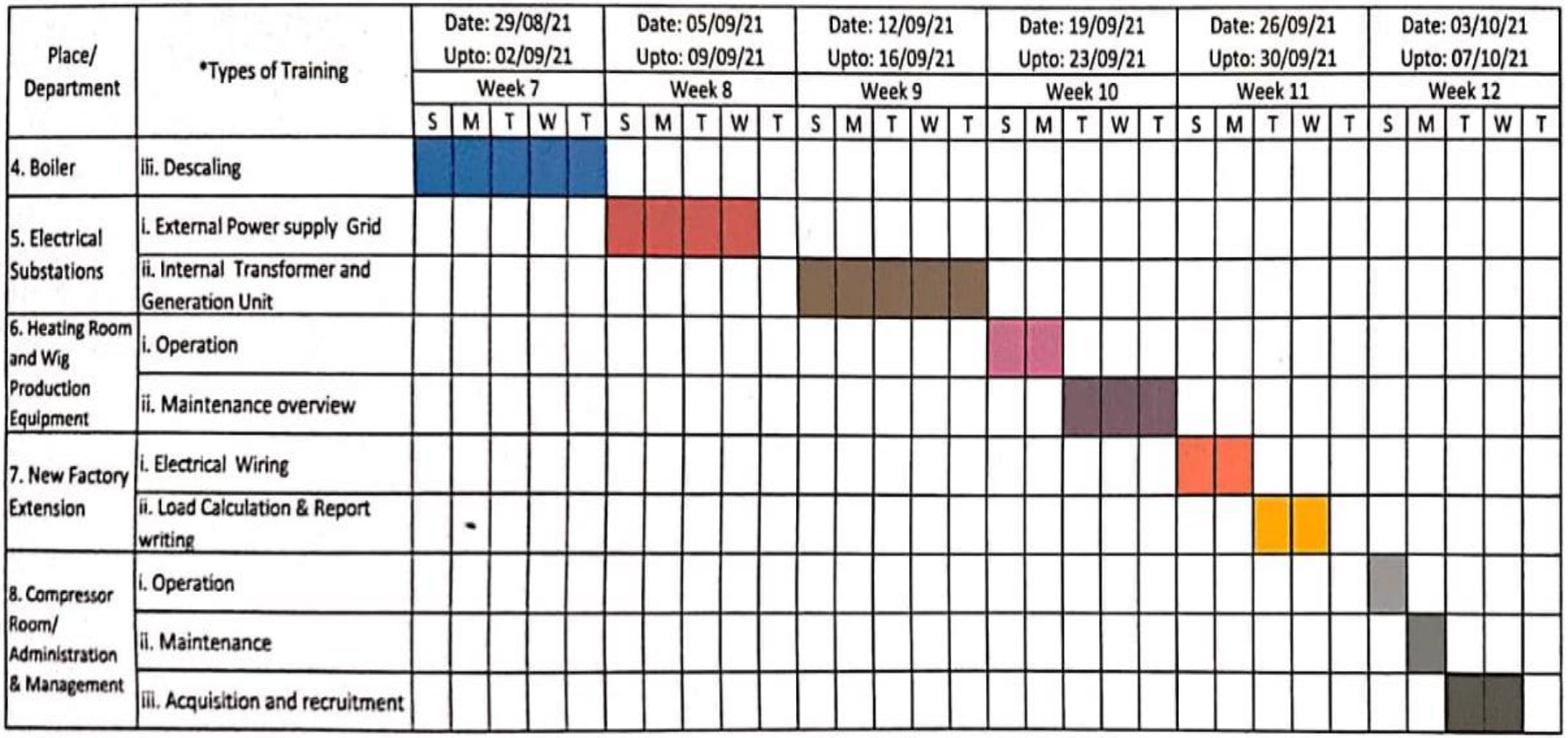

Figure 2.4.2 Gantt Chart of weeks 6 to 12

CHAPTER 3

COMPREHENSIVE TRAINING INFORMATION

3.1 Training Overview

My Industrial Training lasted for 12 weeks, starting from 11th July up to 07th October. Throughout this internship period, I was involved mostly in the operations as well as maintenance and repair of major mechanical engineering components in the factory including the generators, electric substation, boilers, etc. The people in charge of those sectors have always guided me and given me tasks to complete on my own, by virtue of which, I have learned a lot and gained confidence in workplace scenarios.

During the 12 weeks long internship, my work was divided into a few major mechanical engineering sectors, all of which required me to gain in depth knowledge prior to working in them. The sectors I worked in are summarised below:

- Internship Briefing and Training (Human Resource)
- Safety, Health, and Environment Induction (HR)
- Generator – operation, maintenance, repair
- Water Treatment Plant – operation and maintenance
- Coal and Diesel Boiler – operation, maintenance, annual descaling
- Electric Substation (External)
- Electric Substation (Internal)
- Wig Production Machineries and Heating Rooms
- Factory Extension (New)
- Compressor Room
- Administration and Management

3.1.1 Experience Gained

During the internship period, I gained a lot of valuable experience and knowledge, working in the mechanical sectors of one of the largest wig production centres in the region, the experience of which was different than what I have learnt in UTM.

Firstly, I was able gain exposure while acquiring in-depth knowledge of working conditions and environment in the mechanical engineering field i.e., problem solving, design, experimentation, and manufacturing.

Secondly, I was able to have a hands-on experience as I implemented mechanical engineering knowledge that I gained in class to real-life scenarios, i.e., thermodynamics of fuel combustion, calculating and maintaining boiler efficiency, steam mass flow, fluid dynamics, etc.

Thirdly, I gained insight on the technical management and operation as well as acquisition of machineries and operators, which gave me valuable industry experience.

Finally, I was able to improve on communication and team working skills as I was required to interact with several employees on a daily basis by virtue of my work in the collaborative work environment. I developed an increased understanding of the ethics and social responsibilities as a mechanical engineer. I was able to learn and implement environmentally sustainable engineering and production practices.

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CHAPTER 4

TRAINING INFORMATION

4.1 Training Objective

The industrial training aims to enable students to apply and integrate their theoretical knowledge and practical experiences in class into real-world projects in the workplace. Aside from that, this internship the purpose of this internship program is to expose students to the actual working environment in the realm of engineering. Furthermore, this curriculum will prepare students by polishing their soft skills such as leadership, teamwork, communication to become highly adaptive to their circumstances. Proper management of time is important in this program and it can improve for students since actual job includes a variety of activities that must be completed by the personnels in a short period of time. Altogether it serves as a placeforstudents tohone their skills and unveil themselves to real life workingconditions, even under pressure

4.2 Implementation of Project-related Training

4.2.1 Internship Briefing and Training

The internship briefing and training session conducted during the first week by the Human Resources Department entailed familiarizing with the people in charge, understanding the organizational structure, developing intentional learning objectives goals that are structured into the experience and supervised by a professional with relevant and related background in the mechanical engineering field. I was briefed on my responsibilities and training structures as well as the duration spent learning in each sector according to the schedule and dates that coincided with the important yearly maintenance e.g., boilers' descaling, etc.

4.2.2 Safety, Health, and Environment Induction

The Safety, Health and Environment induction was also conducted in the first week under the Human Resources Department. A Safety, Health, and Environment (SHE) specialist's responsibilities include developing and directing systems for the creation and implementation of safety and health measures for workers and visitors alike. Moreover, adherence to all safety and health rules governing the operation of plant, machinery, and equipment, as well as other workplace activities, is required. It also comprises aiding in the monitoring of accident investigations and investigations into dangerous working conditions, as well as teaching management and workers on safety and health practices and regulations. This training was delivered by a safety, health, and environment official, who explained the standard operating procedures (SOPs) for what to do and what not to do when working in the plant, warehouse, and workshop areas, such as donning a safety vest, ear protection when working at the generator plant, wearing heat protectant gloves when working in the boiler section, rubber gloves in the Water Treatment Plant, etc.

4.2.3 Generator

Figure 4.2.3.1 Cummins Generator KTAA19-G6/G7 Parts Disassembled

Industrial generators are extremely large units, designed for exclusive use in a commercial setting, e.g., power plants for factories. In Bangladesh, load shedding is a common occurrence which can hinder the large-scale production process in the wig factory, as most production and packaging equipment e.g., dying and bleaching, rolling, drying, hydraulic press, etc. run-on electricity. Which is why, all large-scale production factories employ generator power plants as backup for outages, to keep the production process running smoothly.

A generator is a device that facilitates the transfer of electrical charges. It employs mechanical energy to push electrical charges through the wire and, eventually, to whatever resource need power. The number of generator units of different wattages used depend on the type of load requirement of the factory as well as operating hours.

Industrial generators consist of seven core internal parts. These are:

a) Engine – in charge of input mechanical energy, running on various fuel types e.g., propane, diesel, etc. which is the main differentiator between different generator types.

b) Alternator – in charge of output electricity. To generate power, the alternator's magnetic components work in tandem with the rotor and plastic casing. It is mostly caused by movement between the magnetic and electrical fields.

c) Fuel System – The fuel system effectively turns the inclusion of fuel into the basic operation of the industrial generator. The fuel is processed through a sophisticated system that includes a fuel pump (which dislodges build-up) and a ventilation line. The fuel injector keeps the flow maintenained at the generator's end.

d) Voltage regulator – in charge of supplying specified amount of voltage. The armature is the most important aspect of this part. It generates a higher voltage across a stator, which is made up of thick coils of electrical conductors.

e) Cooling and Exhaust – A cooling tower supports a large-scale generator. The mechanism extracts heat from the engine and disperses it in the surrounding environment. Therefore, industrial generators require a minimum of 5 feet of unobstructed space in all directions. The exhaust, which is connected to the engine via connecting tubes, eliminates poisons and toxic compounds

produced by the generator. The tubing is frequently routed outside, away from doors and enclosed places.

f) Lubrication – The lubricating system is critical because it keeps oil in a basin and is powered by a small pump. The pump literally sprays oil onto the generator's various moving elements, reducing glitches and roughness in the many moving components.

g) Battery – A flash voltage is provided by both the battery and the following battery charging station. This unique function serves as an indicator of how much of the battery is being depleted.

Generator Installation and Parts Assembly

The Cummins Generator model EG160-560N comes with the Main Stator, Main Rotor, Exciting System, Automatic Voltage Regulator (AVR)

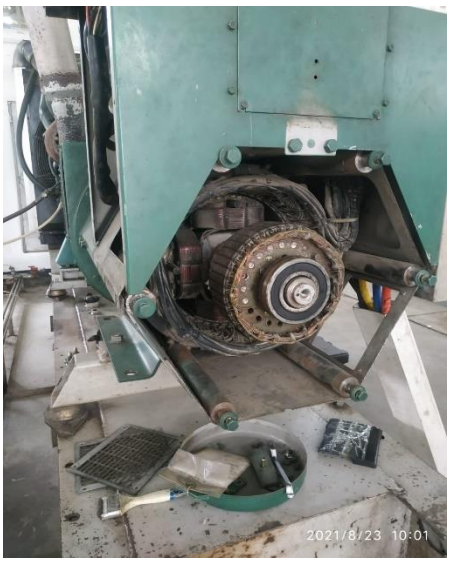


Figure 4.2.3.2 Generator Parts Repair and Assembly

Installation of single-bearing generator:

Steps consisted of checking of the engine housing and the SAE flywheel and adapter dimensions. Dismantled the flange cover, positioned the generator in-line with the engine and then aligned the generator flange with the engine housing. Then aligned generator coupling to engine flywheel, to make sure everything is vertically in-line with each other, any discrepancies could be adjusted by adding several shims to the

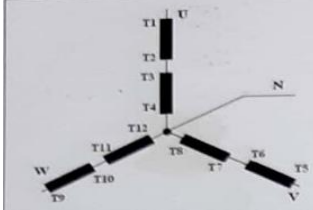
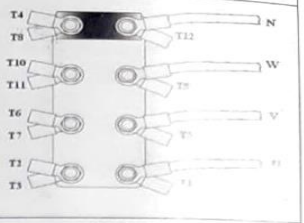
base frame. The coupling disc was then bolted to the flywheel housing using the recommended no. of bolts and size, i.e., grade 8.8 and above bolt grade whereas grade 8.8 fasteners, heavy series lockwashers and hardened washers were used to mount the generator with the prime engine and generator on base-frame. Then no-contact between rotor and stator assembly is ensured by turning the rotor and later the flange cover was installed to complete the installation process.

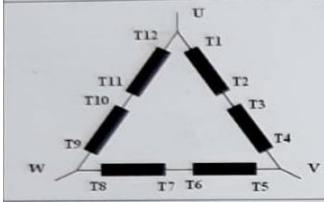
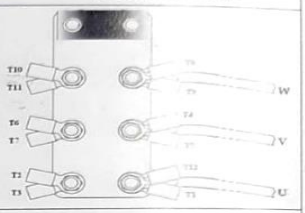
The following de-rating table is considered since generator operated under the following conditions.

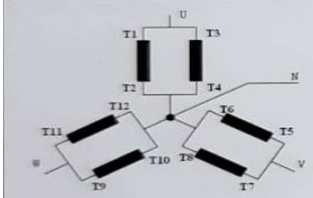
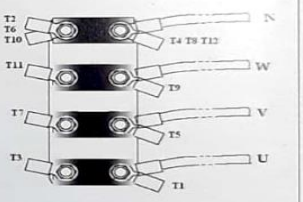
Altitude (m.s.l)	Revised coefficient	Temperature (°C)	Revised coefficient
1,500	0.96	45	0.96
2,000	0.93	50	0.93
2,500	0.90	55	0.90
3,000	0.87	60	0.88
3,500	0.85		
4,000	0.82		

Table 4.2.3.1 De-Rating coefficients for different ambient conditions

The following electrical connections are used for appropriate voltage output as required

EG225～315N STAR CONNECTION	VOLTAGE		TERMINAL BOARD
	L-L	L-N	
	50 Hz: 380～440	50 Hz: 219～254	
	60 Hz: 380～480	60 Hz: 219～277	

EG225～315N DELTA CONNECTION	VOLTAGE		TERMINAL BOARD
	L-L	L-N	
	50 Hz: 219～254		
	60 Hz: 219～277		

EG225～315N PARALLEL STAR CONNECTION	VOLTAGE		TERMINAL BOARD
	L-L	L-N	
	50 Hz: 190～220	50 Hz: 110～127	
	60 Hz: 190～240	60 Hz: 110～138	

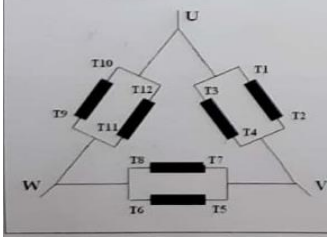
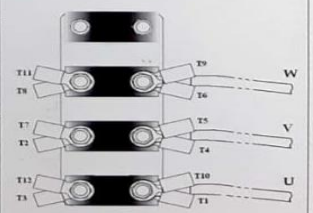
EG225～315N PARALLEL DELTA CONNECTION	VOLTAGE		TERMINAL BOARD
	L-L	L-N	
	50 Hz: 110～127		
	60 Hz: 110～138		

Table 4.2.3.2 Electrical Connections of EG160-560N

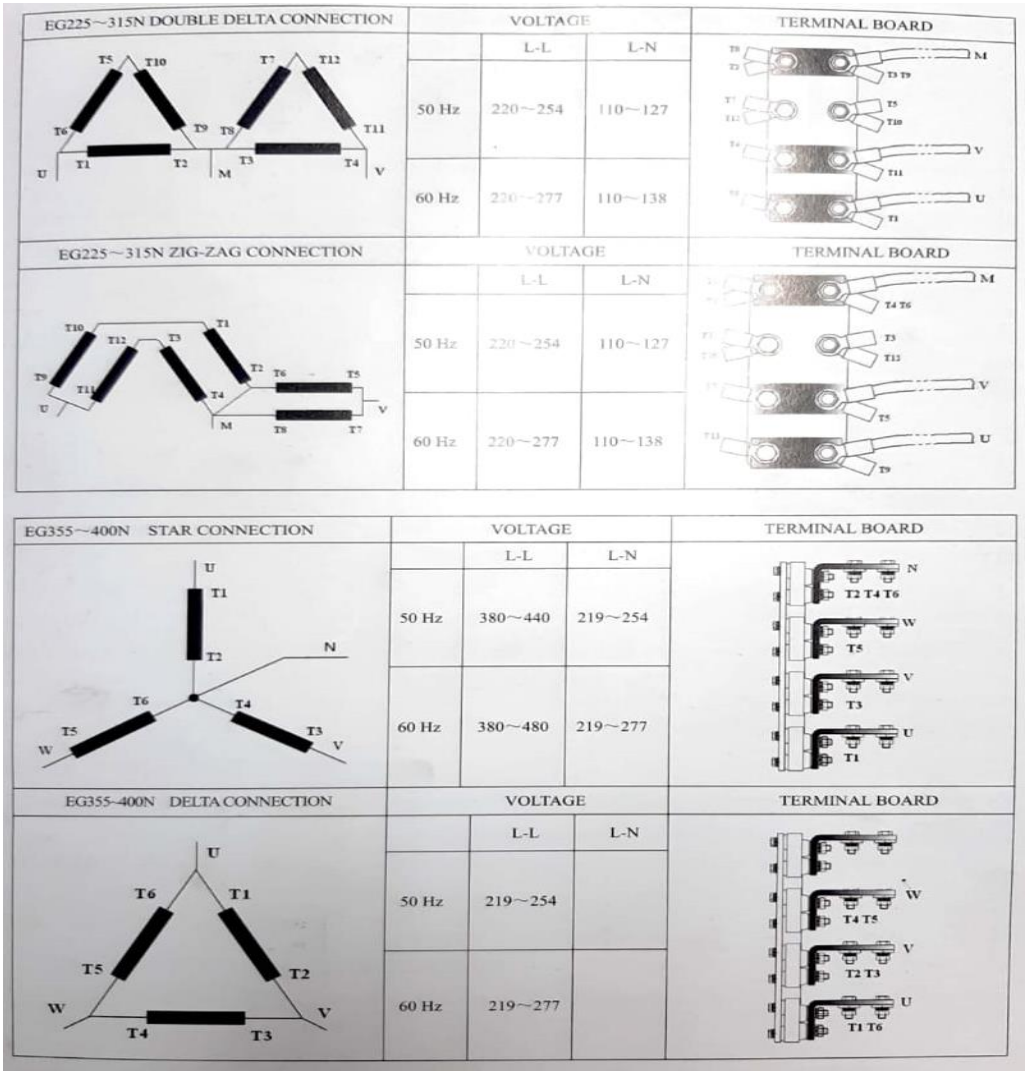


Table 4.2.3.3 Electrical Connections of EG160-560N (contd.)

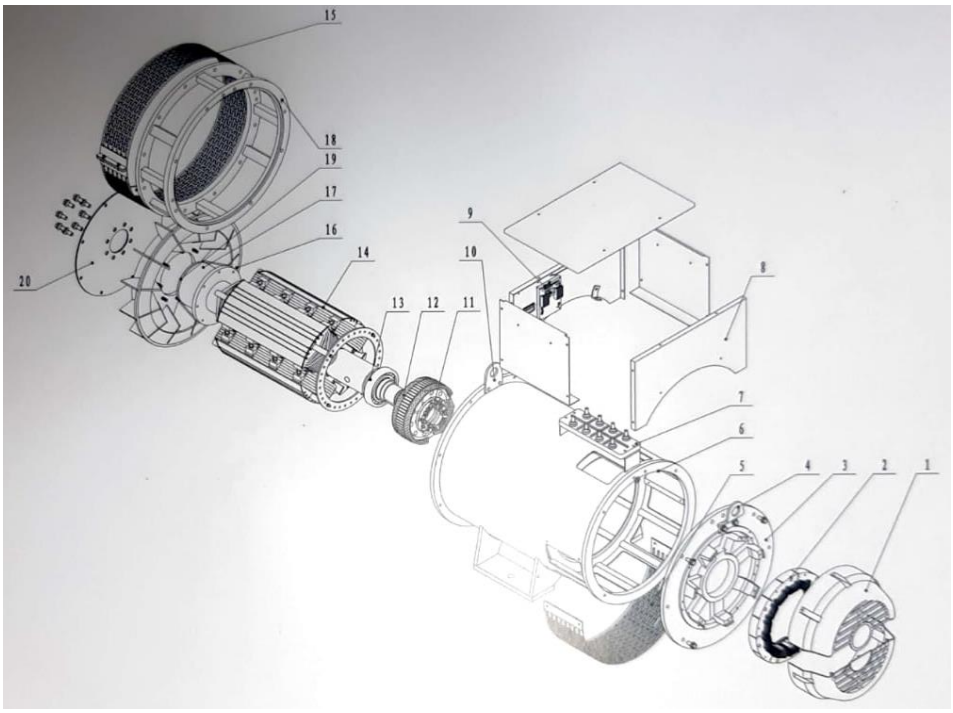


Figure 4.2.3.3 Single- Bearing Generator Assembly

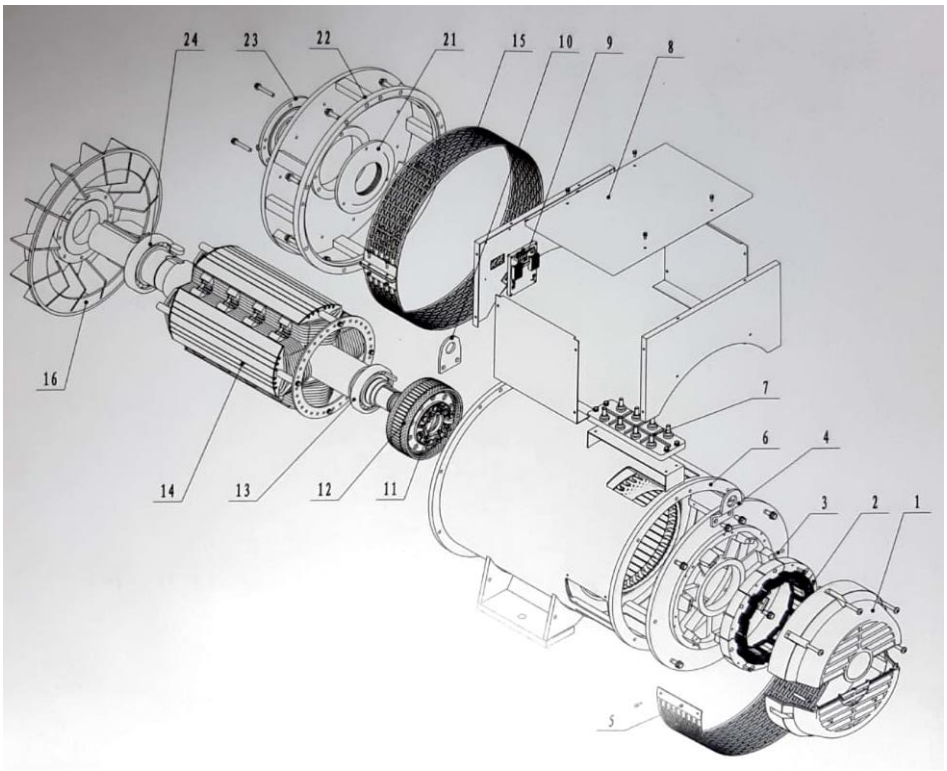
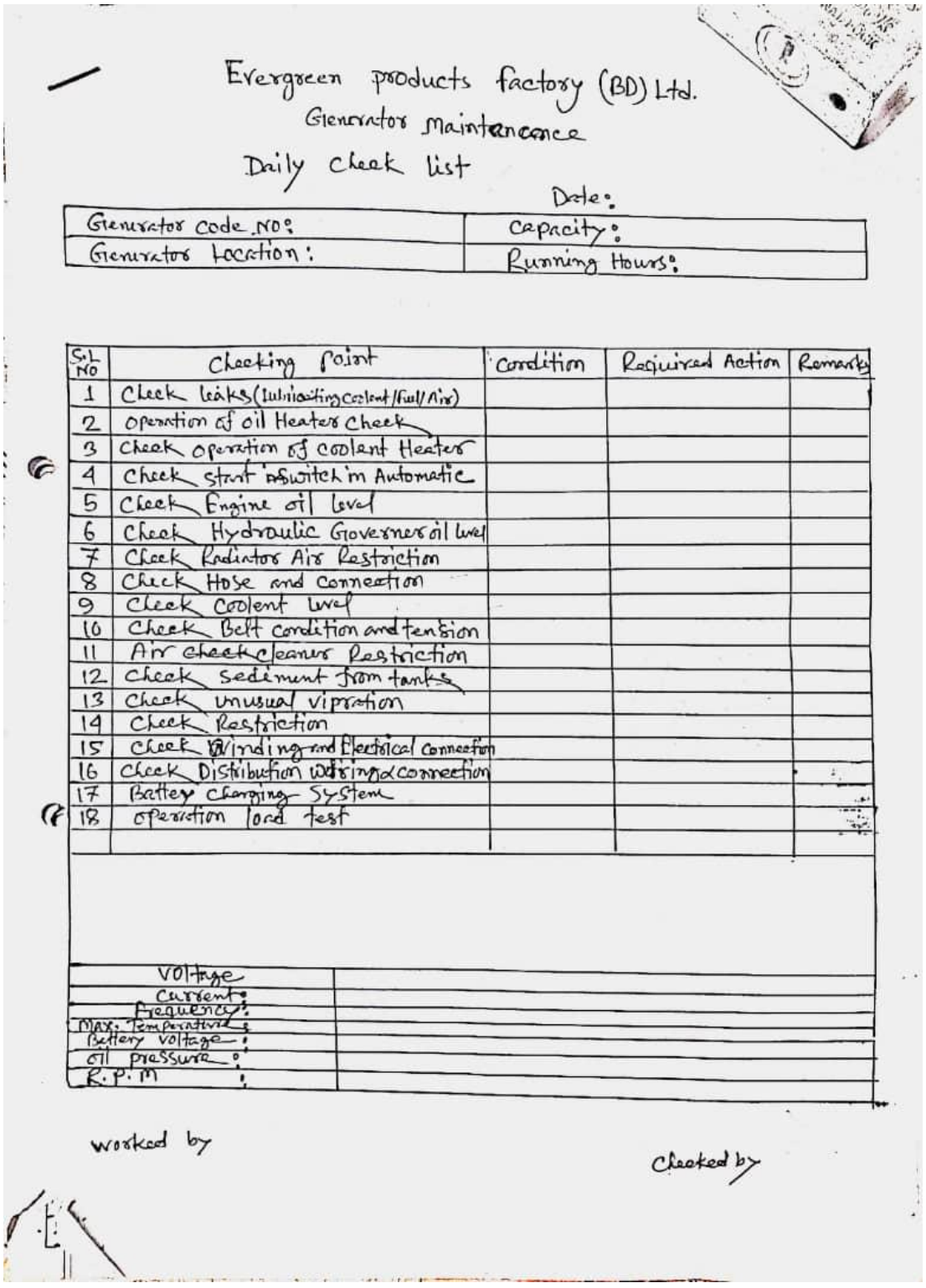


Figure 4.2.3.4 Double- Bearing Generator Assembly

Failures	Possible Causes	Solutions
No power supply	Wrong connection Rotating diodes damage AVR connection loose Short circuit on main cables Insufficient of residual voltage	Refer to connection manual Check in case of short circuit and repair or change diodes Disconnect and reconnect all wire again Check and repair Apply 12V battery to recharge
No load voltage below rated voltage	Fuse blown Wrong connections of exciter stator	Replace the fuse. If fuse blown again, check if the exciter stator is at short circuit state. Otherwise, replace the AVR Check connection again
No load voltage above rated voltage	AVR setting problem	Adjust the AVR potentiometer
Excitation current too high	Problem with diode	Check, repair or replace the diode assembly
Vibration	Generator to engine not in-line Rotor balancing problem after repair Bearing damage Engine problem	Check the alignment and rectify the problem Rebalancing required Check and change bearing immediately Check and service the engine
Bearing heating	Operation exceed bearing recommended running hours Insufficient of grease Generator to engine not in-line	Change bearing Change bearing grease Check the alignment and rectify the problem
Generator heating	Overload Power factor too low Rpm too low Airflow problem	Reduce to the raged load Adjust the load and adjust the ampere to the rated level Adjust the speed to the rated speed Check the fan assembly and ensure not obstruction
Voltage unstable	AVR problem	Check, adjust or change a new AVR

Table 4.2.3.4 Generator Troubleshooting



Evergreen products factory (BD) Ltd.

Generator Maintenance

Daily Check list

Date:

Generator code NO:	Capacity:
Generator Location:	Running Hours:

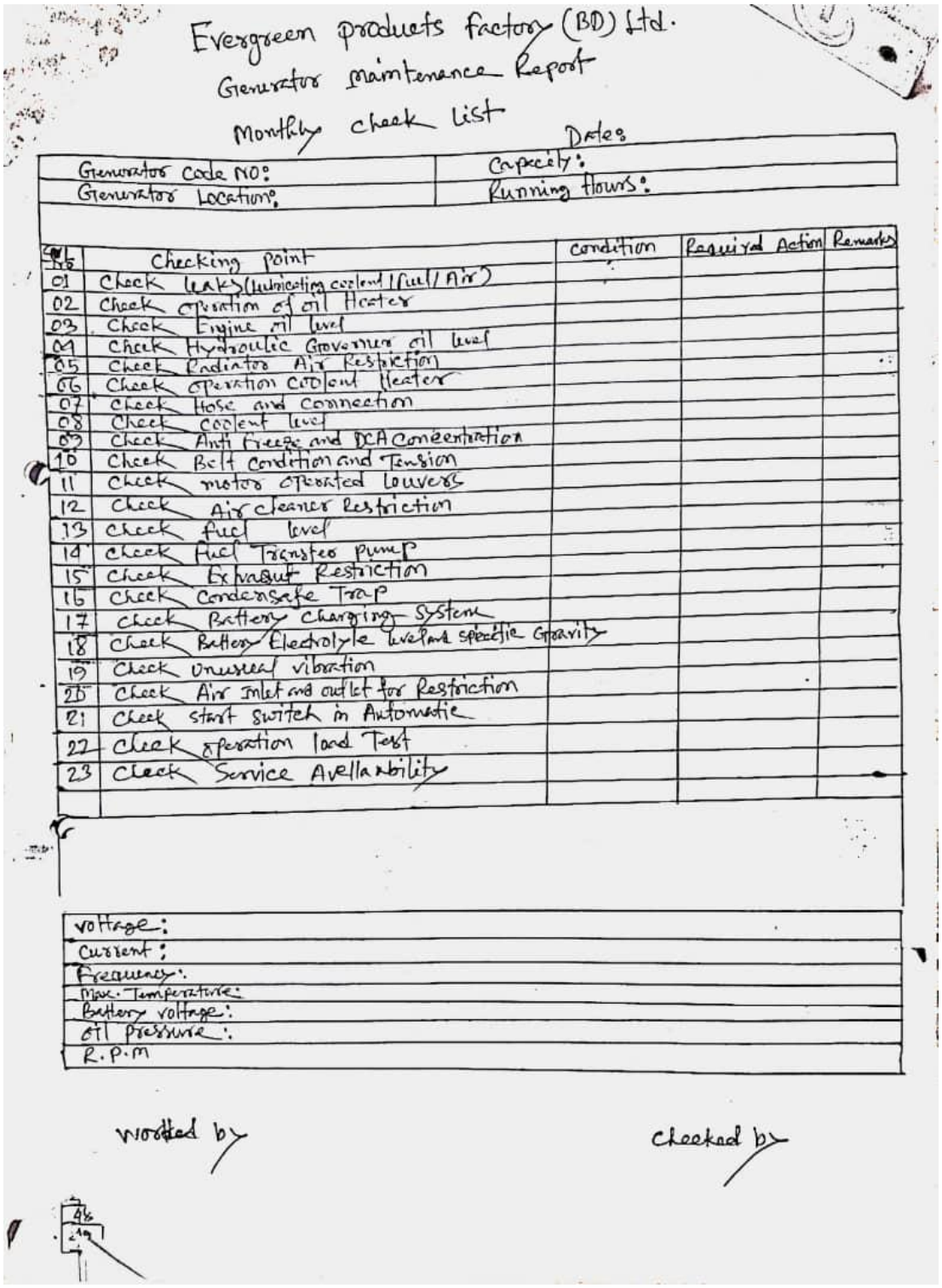
Sl NO	Checking point	Condition	Required Action	Remarks
1	Check leaks (lubricating coolant/fuel/Air)			
2	Operation of oil Heater Check			
3	Check operation of coolant Heater			
4	Check start switch in Automatic			
5	Check Engine oil level			
6	Check Hydraulic Governer oil level			
7	Check Radiator Air Restriction			
8	Check Hose and connection			
9	Check coolent level			
10	Check Belt condition and tension			
11	Air check cleaner Restriction			
12	Check sediment from tanks			
13	Check unusual vibration			
14	Check Restriction			
15	Check Winding and Electrical connection			
16	Check Distribution wiring & connection			
17	Battery charging System			
18	Operation load test			

Voltage	
Current:	
Frequency:	
MAX: Temperature:	
Battery voltage:	
Oil pressure:	
R.P.M:	

worked by

Checked by

Table 4.2.3.5 Generator Maintenance Daily Checklist



Evergreen products factory (BD) ltd.

Generator maintenance Report

Monthly check list

Date:

Generator Code NO:	Capacity:
Generator Location:	Running Hours:

S/L No	Checking point	Condition	Required Action	Remarks
01	Check leaks (lubricating coolent / fuel / Air)			
02	Check operation of oil Heater			
03	Check Engine oil level			
04	Check Hydraulic Governer oil level			
05	Check Radiator Air Restriction			
06	Check operation coolent Heater			
07	Check Hose and connection			
08	Check coolent level			
09	Check Anti Freeze and DCA Concentration			
10	Check Belt condition and Tension			
11	Check motor operated louvers			
12	Check Air cleaner Restriction			
13	Check fuel level			
14	Check fuel Transfer pump			
15	Check Exhaust Restriction			
16	Check Condensate Trap			
17	Check Battery Charging System			
18	Check Battery Electrolyte level and specific Gravity			
19	Check Unusual vibration			
20	Check Air Inlet and outlet for Restriction			
21	Check start switch in Automatic			
22	Check operation load Test			
23	Check Service Availability			

voltage:
Current:
Frequency:
Max. Temperature:
Battery voltage:
Oil pressure:
R.P.M

worked by

Checked by

Table 4.2.3.6 Generator Maintenance Monthly Checklist

Evergreen products factory (BD) Ltd.

Generator maintenance Report

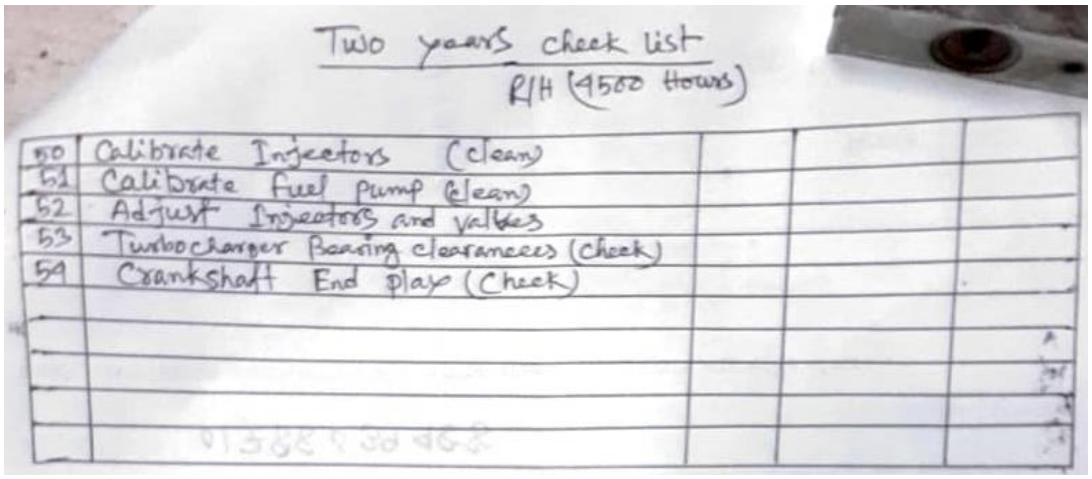
Six (06) month

Date:

Generator code NO:	capacity:
Generator Location:	Running Hours:

SL NO	Check Point	Condition	Required Action	Remarks
01.	Check lube oil (Fuel / Coolent / lubricating oil) or leaks			
02.	Check operation of oil Heater			
03	Check Engine oil level Heater			
04	Check Hydraulic Governer oil level			
05	Check full flow filter (change)			
06	Check By Pass filter (change)			
07	Check Engine oil (change)			
08	Check DCA water filter (change)			
09	fuel filter (")			
10	Check Hydraulic Governer oil (change)			
11	Check Radiator Air Restriction			
12	Check operation of coolant Heater (~~change~~) (clean)			
13	Check Hose and connection (~~change~~) (clean)			
14	Check coolant level (")			
15	Check Anti freeze and DCA concentration			
16	Check belt condition and Tension			
17	Check Heat Exchanger Zinc Anode plugs (~~clean~~)			
18	Check Moter operated louvers			
19	Check Air cleaner restriction			
20	Check piping and connections			
21	Check Crankcase Breather (clean) (~~clean~~) Clean			
22	Check Air cleaner Element			
23	Check fuel level (~~change~~) (clean)			
24	Check Governor Linkage (~~change~~) (clean)			
25	Check fuel line and connection (clean)			
26	Check fuel Transfer pump (clean)			
27	Check Sediment from Tank (Drain)			
28	Check Exhaust Restriction (clean)			
29	Check Condensate Trap			
30	Battery charging System (clean)			
31	Check Battery Electrolyte level and specific Gravity			
32	Check Safety Controls and Alarms			
33	Check unusual vibration			
34	Check Air Inlet and outlet for Restriction			
35	Check Generator			
36	Check Start switch in Automatic			
37	Check Power Distribution wiring and connection			
38	Check Power Circuit Breaker			
39	Check Transfer switch			
40	Check Operational load Test			
	Annual / Four yearly check list (1500 Hours)			
41	Check Fan Hub, Dive Pully and water pump			
42	Check Cooling System (clean)			
43	Check change Air cleaner Element (change)			
44	Exhaust manenifold and Turbo charger (Torque)			
45	Tighten Mounting Heardware (Check)			
46	Check Bearing (Grease)			
47	Check Instrumentation			
48	Generator load Bank Test (Perform)			
49	Service Tools Availability			

Table 4.2.3.7 Generator Maintenance Half Yearly Checklist



Two years check list

R/H (4500 Hours)

50	Calibrate Injectors (clean)			
51	Calibrate fuel pump (clean)			
52	Adjust Injectors and valves			
53	Turbocharger Bearing clearances (check)			
54	Crankshaft End play (Check)			

Table 1.2.3.8 Generator Maintenance 2 Years Checklist

4.2.4 Water Treatment Plant

Figure 4.2.4.1 Coagulation and Sedimentation Tanks of WTP

Figure 4.2.4.2 Industrial Water Treatment System

Figure 4.2.4.3 Filtration Tank

The source water for the water treatment plant is primarily derived from the wastewater left after production stages in the wig factory i.e., dyeing, bleaching, etc. via a series of pumps and pipelines, which transport this water to the treatment facility.

Effective treatment of the wastewater source helps to minimize disposal cost as well as ensuring discharge regulations are complied with, with minimal consequence on the environment and people. A series of pumps and pipelines transport this water to the treatment facility. After the completion of treatment stages, this water is used in the flush water for the restrooms

A few factors are taken into consideration before treatment stages begin, i.e., intake water characteristics, volume, target water quality, etc.

I was involved in water treatability testing where resulting lab reports were analyzed to help determine whether the raw water could be treated for the process and exactly how it could be treated, in compliance to the discharge requirements set by the WASA regulatory agency.

The stages of treating water are:

a) Screening and Straining

b) Addition of Chemicals
c) Coagulation and Flocculation
d) Sedimentation and Clarification
e) Filtration
f) Disinfection
g) Storage
h) Distribution

The process stages are fully automated and supervised via a control panel.

Figure 4.2.4.4 Control Panel

The control panel is set up for both local and remote operation, and it controls 16 motors. The operator can alter the Dissolved Oxygen set points using the 7-inch AB control panel, as well as monitor the motor run time hours and watch the system operation in real time. I participated in learning and developing one of the Programmable Logic Controllers for 2 tanks in the Water Treatment Plant. Moreover, I worked in the Process Laboratory and Process Instrumentation to monitor the input and output water quality parameters daily.

Process Automation using Programmable Logic Controllers (PLC)

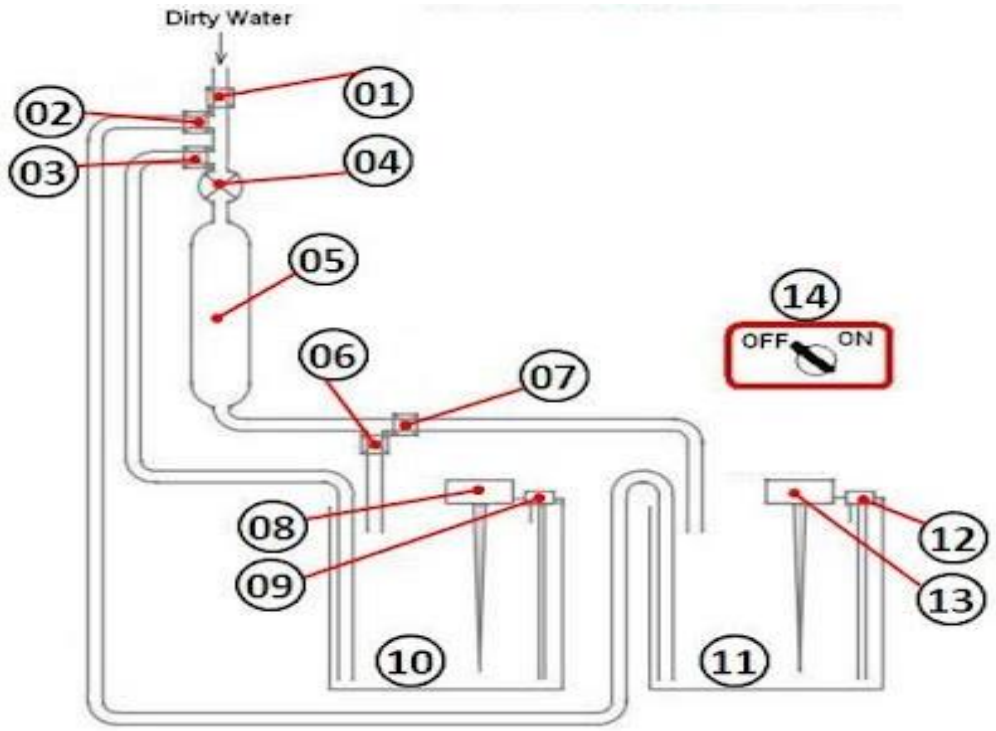


Figure 4.2.4.5 Details of PLC Process Automation

Identification information

1. Connect a valve to the source of dirty water.
2. Valve for obtaining water from Water Tank No. 2
3. Valve for obtaining water from the Water Tank 1
4. Pump for water
5. Water Purifier or Water Purification or any other
6. Water-to-Water Tank No. 1 Valve

7. Water-to-Water Tank No. 2 Valve

8. Water Tank 1 Clean Water Sensor, PH Water Sensor, or Other

9. Water Level Sensor, Level Gauge, or Other Device for Water Tank 1

10. 1st Water Tank

11. 2nd Water Tank

12. Water Level Sensor, Water Level Gauge, or Other Device for Water Tank 2

13. Water Tank 2 Clean Water Sensor, PH Water Sensor, or Others

14. Switch ON/OFF

Number of Input and Output PLC applied:

a) 9 input PLCs:

- 1 Unit Input for ON/OFF Switch (No.14).
- 1 Unit OK (Good) Input from Clean Water Sensor in Water Tank 1 (No.08).
- 1 Unit NG (No Good) Input from Clean Water Sensor in Water Tank 1 (No.08).
- 1 Unit OK (Good) Input from Clean Water Sensor in Water Tank 2 (No.13).
- 1 Unit Input for NG (No Good) from Water Tank 2 Clean Water Sensor (No.13).
- 1 Unit Input for FULL WATER from the Water Level Sensor in the Water Tank 1 (No.09).
- 1 Unit Input for EMPTY WATER from the Water Level Sensor in the Water Tank 1 (No.09).
- 1 Unit Input for FULL WATER from the Water Level Sensor in the Water Tank 2 (No.12).

- 1 EMPTY WATER input from Water Level Sensor in Water Tank 2 (No.12).

- Minimum 9 Input Unit

b) 6 output PLCs:

- 1 Unit Output for the Valve to the Dirty Water Source (No.01).

- 1 Unit Output Valve for Water Tank 2 (No.02).

- 1 Unit Output Valve for Water Tank 1 (No.03).

- 1 Water Pump Output Unit (No.04).

- 1 Unit Output Valve for the Water to Water Tank 1 (No.06).

- 1 Unit Output Valve for the Water to Water Tank 2 (No.07).

- The total number of PLC outputs must be at least six.

Sequence of PLC Programming for Water Treatment Plant Process Automation

A) 1st Step:

I. If Switch = ON Then Valve No.01 = ON And Pump No.04 = ON And Valve No.06 = ON.

II. If FULL WATER No.09 = ON Then Valve No.01 = OFF And Pump No.04 = OFF And Check Clean Water Sensor No.08.

III. If OK (Clean Water Sensor) No.08 = ON Then Finish Process.

IV. If NG (Clean Water Sensor) No.08 = ON Then Next Process to Step 2.

B) 2nd Step:

I. If NG (Clean Water Sensor) No.08 = ON And Switch = ON, then Valve No.01 = OFF And Valve No.03 = ON And Pump No.04 = ON And Valve No.06 = OFF And Valve No.07 = ON.

II. If FULL WATER No.12 = ON Or EMPTY WATER No.09 = ON, then Pump No.04 = OFF And Valve No.03 = OFF And Check Clean Water Sensor No.13.

III. If NG (Clean Water Sensor) No.13 = ON, then Valve No.01 = OFF And Valve No.02 = ON And Valve No.03 = OFF And Pump No.04 = ON And Valve No.06 = ON And Valve No.07 = OFF.

IV. If FULL WATER No.09 = ON Or EMPTY WATER No.13 = ON, then Pump No.04 = OFF And Valve No.02 = OFF And Check Clean Water Sensor No.08.

V. If OK (Clean Water Sensor) No.08 = ON, then Finish Process.

VI. If NG (Clean Water Sensor) No.08 = ON, then Next Process to Step 2.a.

VII. Continuous Process until Clean Water = OK.

C) 3rd Step:

I. If Switch = OFF, Then Stop Process Automation.

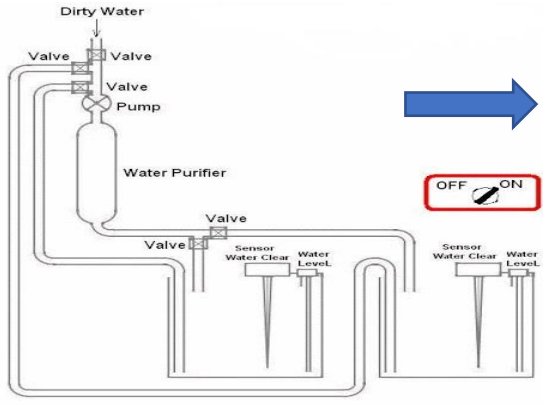


Figure 4.2.4.6 STEP 1A

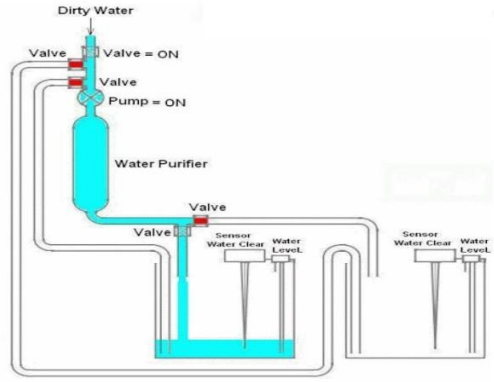


Figure 4.2.4.7 STEP 2A

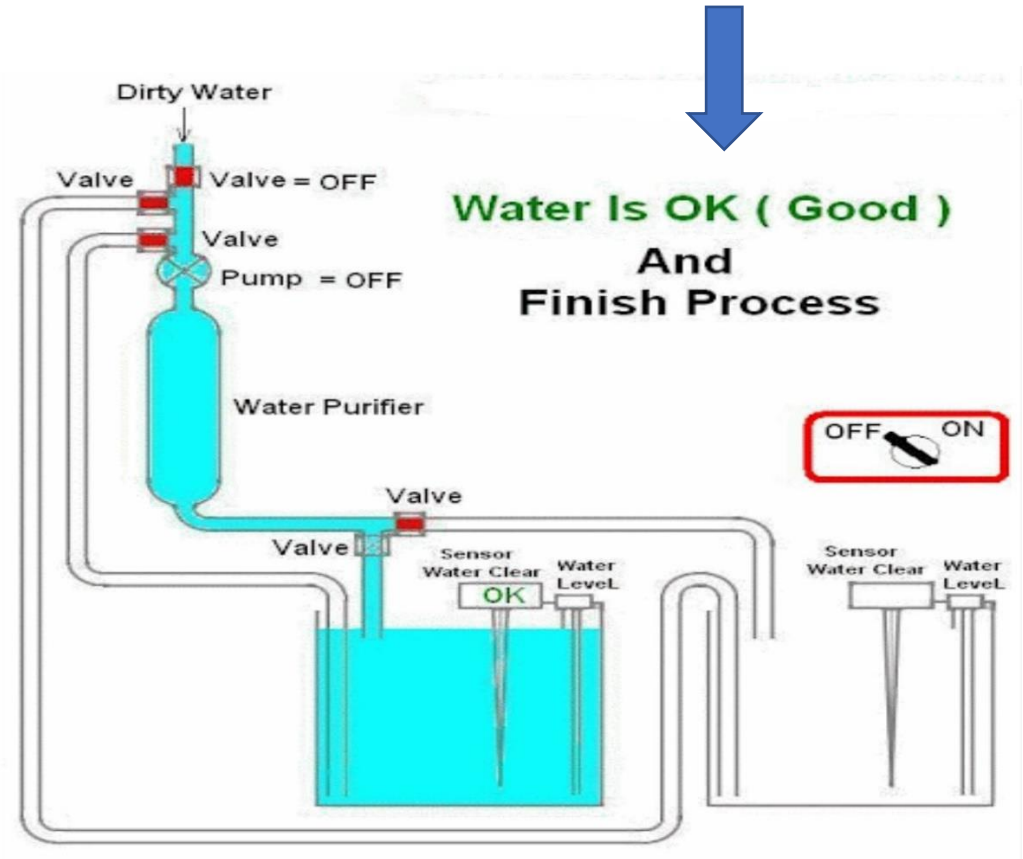


Figure 4.2.4.8 STEP 3A

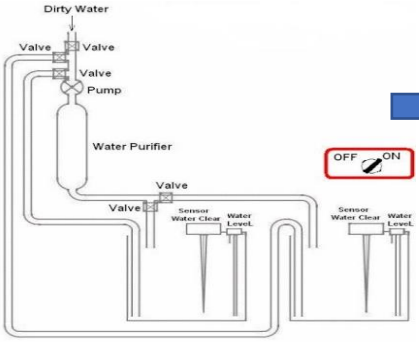


Figure 4.2.4.9 STEP 1

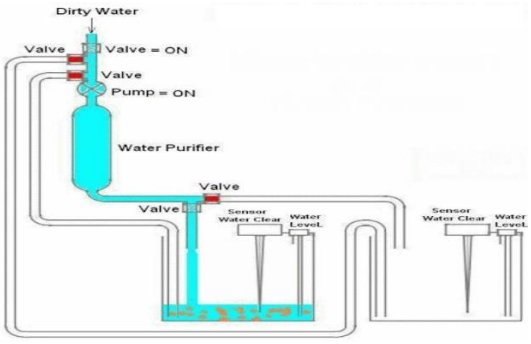


Figure 4.2.4.10 STEP 2

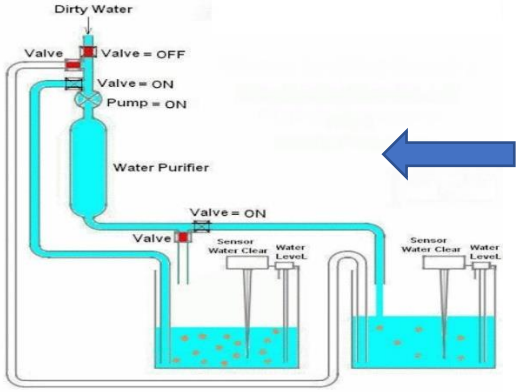


Figure 4.2.4.11 STEP 3

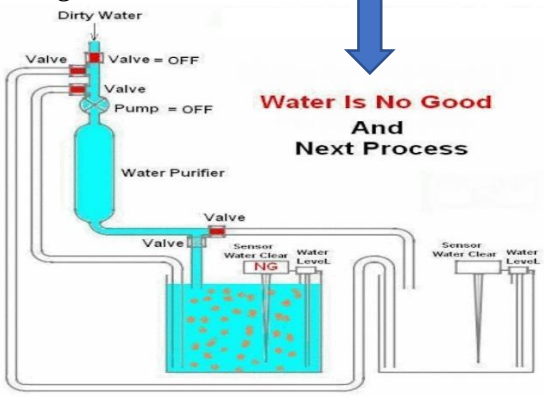


Figure 4.2.4.12 STEP 4

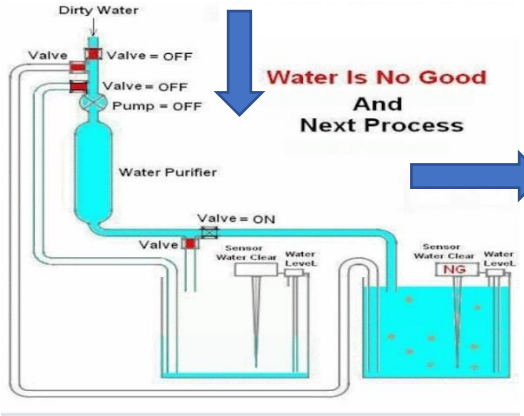


Figure 4.2.4.13 STEP 5

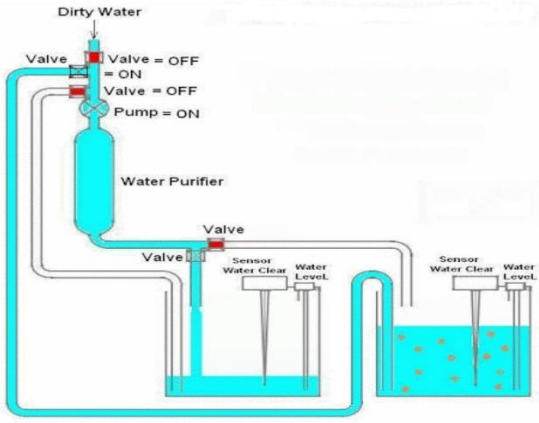


Figure 4.2.4.14 STEP 6

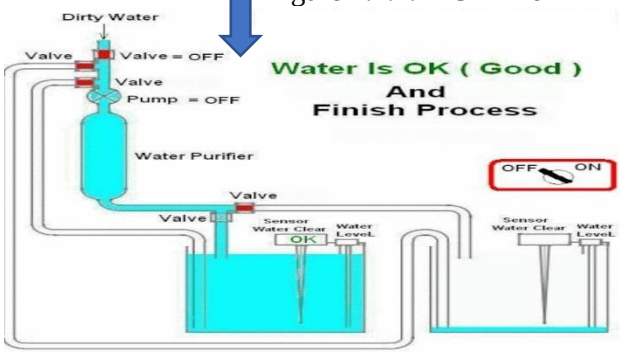


Figure 4.2.4.15 STEP 7

4.2.5 Coal Boiler and Diesel Boiler

Figure 4.2.5.1 Coal Boiler

Figure 4.2.5.2 Diesel Boiler

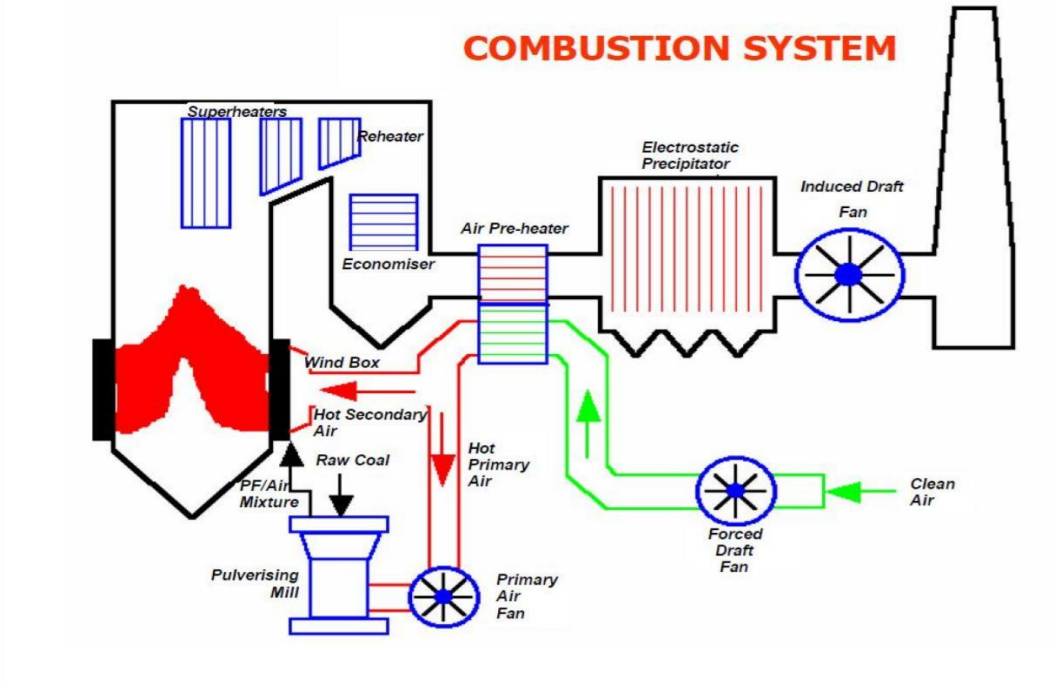


Figure 4.2.5.3 Combustion System of a Coal Boiler

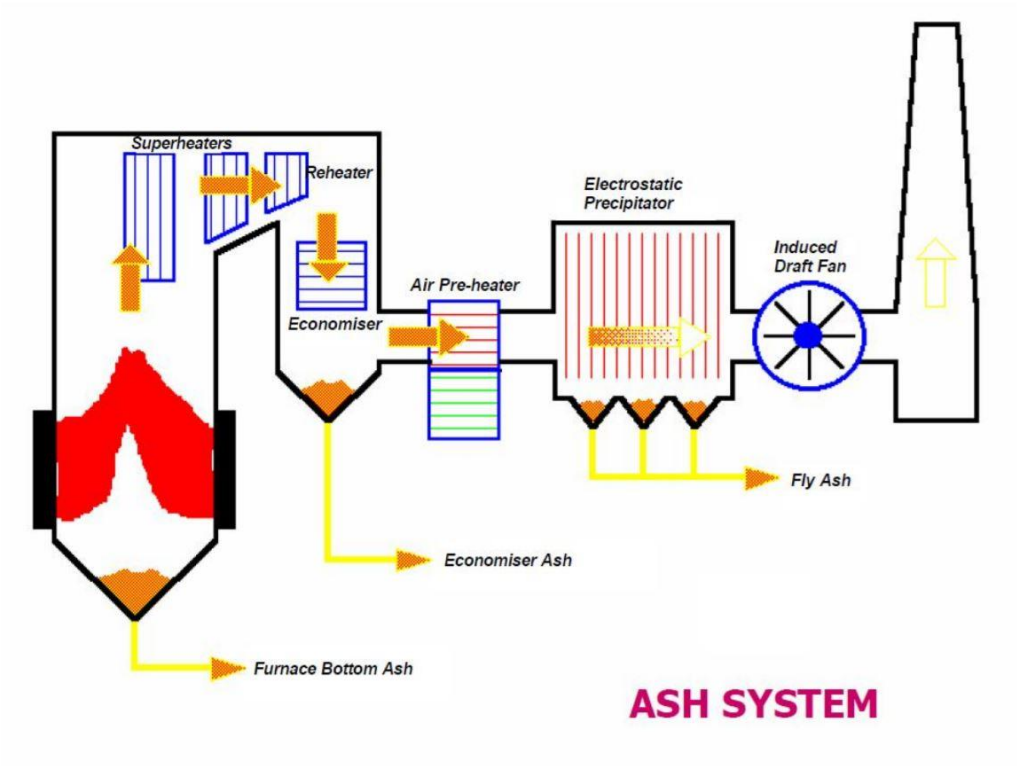


Figure 4.2.5.4 Ash System of a Coal Boiler

Boilers are closed vessels which convert water to steam by heating. In Evergreen Products Factory(BD) Ltd., there are two boilers, coal boiler (primary) and the secondary boiler runs on diesel. They are used for producing process steam, used in various wig production stages i.e., Dyeing, Bleaching, etc. Boilers must store a particular amount of water in order to generate and deliver steam safely at the specified temperature and pressure at the defined pace. For engineering economics calculations, the maximum heat produced by the furnace's fuel should be used. Boiler fittings consist of mountings required for their safe and proper functioning e.g., water level indicator, pressure gauge, safety valve, feed check valve, fusible plug. Typical boilers consist of several integral parts to run efficiently i.e., feed pump, superheater, economiser, air preheater.

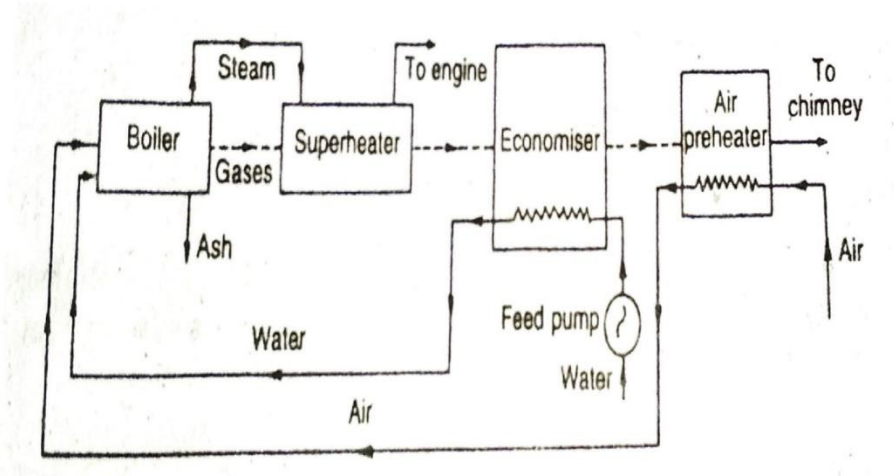


Figure 4.2.5.5 Schematic Diagram of a Boiler

I was involved in checking quality control and quality assurance practice of the boiler sector. Both the coal fired and diesel run boilers are internally fired. They are water tube boilers, where the water is circulated through numeroustubes while the hot gas pass around them. This system calls for a considerable amount of area to be installed. The advantages are that there is high pressure steam geenration, which is raised quickly with large capacity of water. Moreover, the hot gases flowing toward the direction of water flow, providing maximum amount of heat transfer. These are safe as one or two of the tubings being burst does not affect the boiler operation greatly.

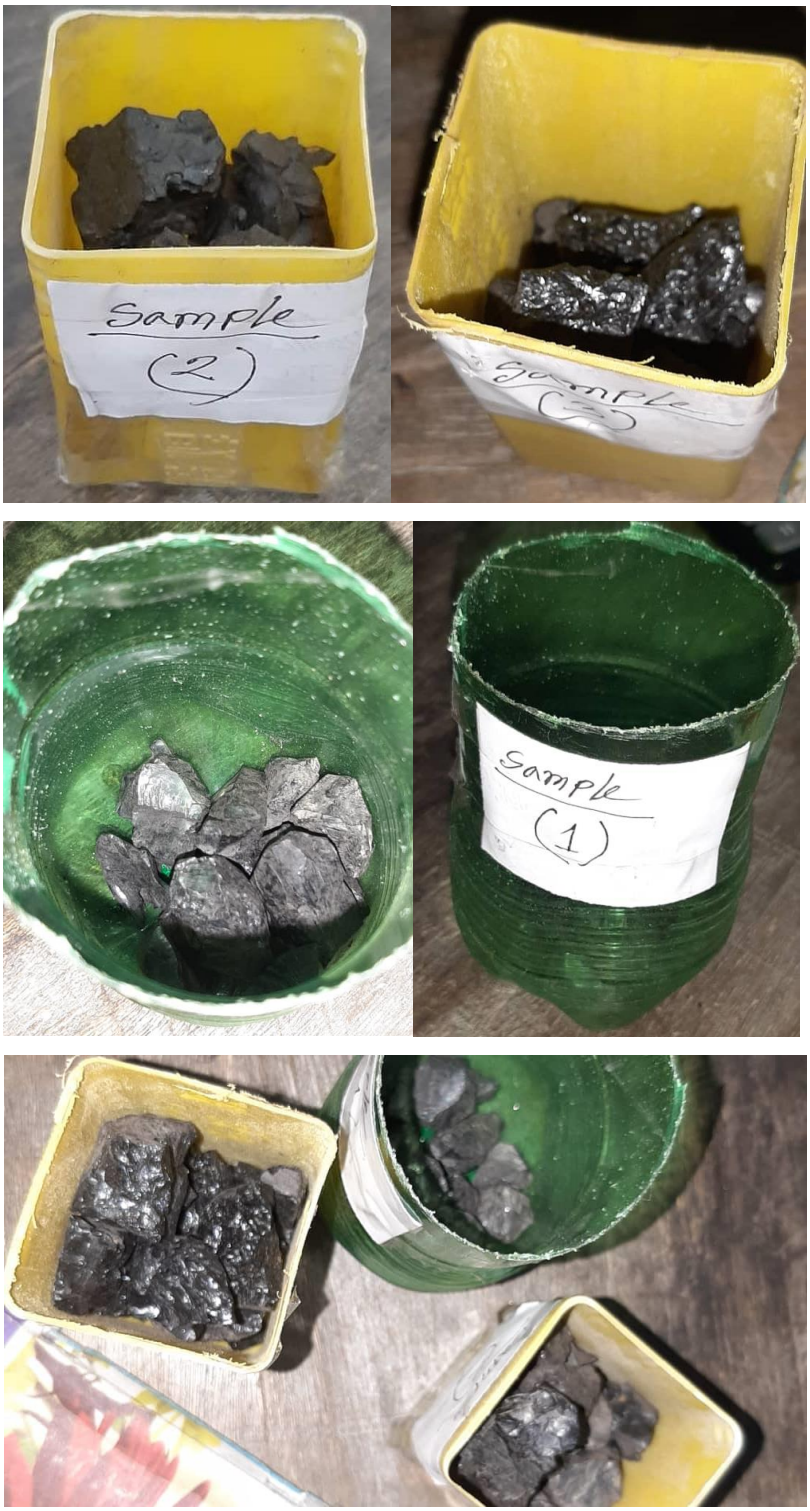


Figure 4.2.5.6 Coal Sampling

	Lab. Analysis	Bench Scale Tests	Pilot Scale Tests	Power Station Tests
Precision	←	—	—	→
Accurate Simulation	→	—	—	→
Cost	→	—	—	→
Sample Requirements	→	—	—	→
Initial Resource Assessment	✣			
Geological Mapping for Coal Quality	✣	✣		
Pre-Treatment & Washability Studies	✣	✣	✣	
Trial Pit	✣	✣	✣	✣
Commercial Mining & Preparation	✣	✣	✣	✣

Table 4.2.5 Scales of Coal Quality Evaluation Tests

I was involved in studying the effects of coal rank on a boiler, i.e. low rank coal compared to high rank coal,where low rank coals have lower heating value (HV) and ID Fan capacity limit. Furthermore, coal properties have significant influence on thermal efficiency of power plantsdue to various parameters i.e., carbon content of ash, moisture content of coal, heat in flue gas as well asexcess air or air heater leakage. The coal ignitability and fineness of coal grind significantly affects boiler turn down capability. Different testing methods were used to predict coal performance i.e., standard laboratoy analysis using Proximate, Ultimate, HGI, etc. and Bench & Pilot-Scale to simulate power plant process as well as full-scale trial burns. Furthermore, burnout efficiencies (a component of boiler efficicency) were calculated in order to obtain maximum fuel values as well as minimising carbon-in-ash.

Figure 4.2.5.7 Scale of Water Tubing Section

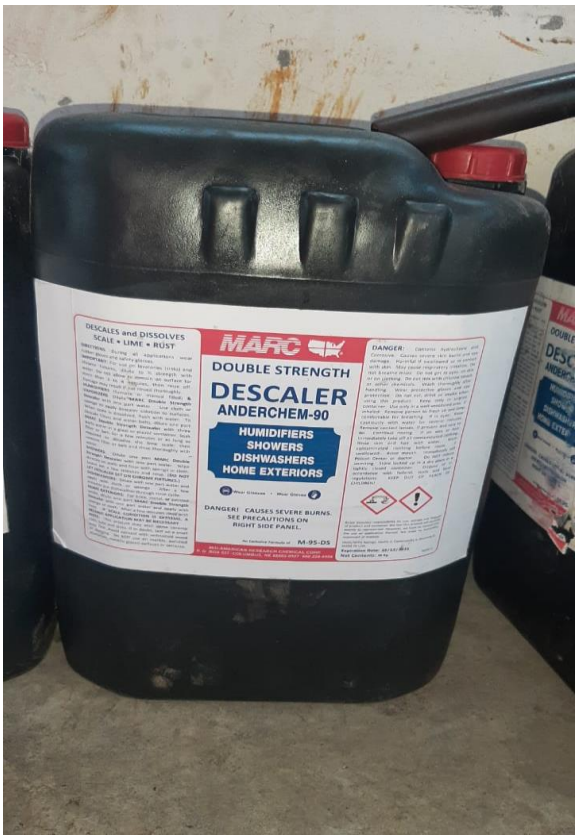


Fig 4.2.5.8 Chemical Descaler used

Due to hardness of the water in the boiler, salts combine to make scales. These salts entered the boiler as soluble solids through the water and were precipitated as the concentration level had risen due to evaporation. Scales are crystalline in nature and more difficult to remove and were composed of silica, aluminum, iron, magnesium, etc.. Carbonates, bicarbonates, and sulphates were the most common scale salts. Because these scales formed slowly, they formed in a thick pattern. Scales significantly decreased heat transfer. I participated in the chemical removal of these scales and the whole descaling process duration was 3 days. The scale thickness was about 5 mm as shown in Figure 4.2.5.7 .

One of the improvements I suggested is the development of a water quality testing lab in order to test the water hardness, alkalinity, dissolved oxygen content and salinity of water in the boiler monthly.

4.2.6 External and Internal Electrical Substations

Figure 4.2.6.1 Outdoor Electrical Substation and indoor unit

Evergreen Products Factory (BD) employs a distribution type substation where the main voltage of 11kV transmission line is stepped down to supply voltage of 440 V to supply to the factory and nearby area using a distribution network. The factory also consists of outdoor pole-mounted substations MV/LV type power transformer with a load break switch, set of three fuses, and surge arrestors, low voltage circuit breaker, earthing electrode at the pole base, etc. These are located at the back of the power generation units, allowing easy access to personnel and operators handling equipment.

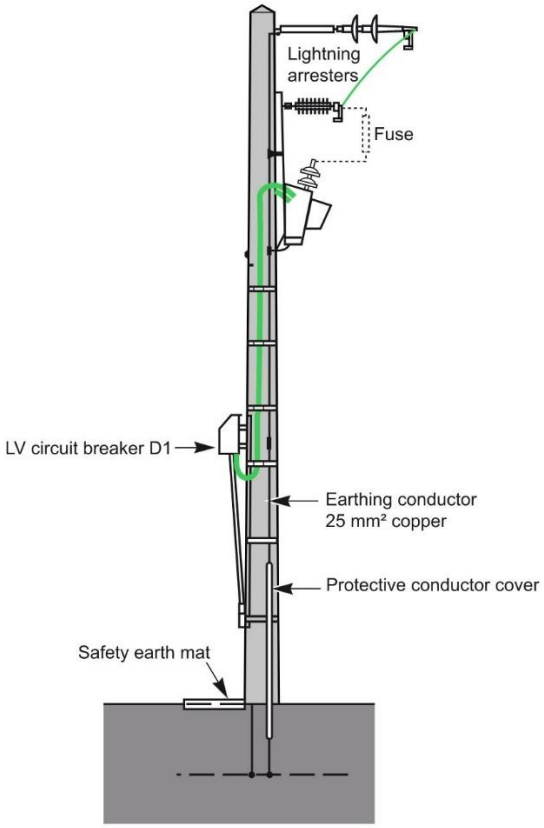


Figure 4.2.6.2 Pole Mounted Substation Components

I worked with Current Transformers (C.T) and Power Transformers (P.T) consisting of oil-type and air-type. I was also responsible for working in maintenance of daily load and coordinating load shedding with the main grid as per the regulations of Bangladesh Power Development Board (BPDB) and Bangladesh Rural Electrification Board (BREB). I was also involved in the servicing of contact switches and learnt about the mechanisms of Vacuum Circuit Breaker (VCB) and Air Circuit Breaker (ACB). I carried out analysis and calculated the power factor modulation in the indoor substations while following the regulations set by Bangladesh Power Development Board (BPDB) and Bangladesh Rural Electrification Board (BREB).

4.2.7 Heating Room and Wig Production Equipment

Figure 4.2.7.1 Heating Room Control System

One of the integral steps of the wig production stages is “Heating” to set the pigments on the hair strands permanently. This stage is carried out inside specially designed heating rooms. The bunches of hair strands are hung vertically on racks, which are mounted on rotating shelves that revolve periodically inside the heating room. Everyday, each heating room operates between 6 to 8 hours daily, depending on production output. I worked with the heating room control system and logic operator responsible for maintaining the temperature and humidity and rpm of the revolving tracks.

I also worked in regulating and analysing the effects of changing steam pressure and quality used in the hair dyeing and bleaching departments. Furthermore, I was involved in the operation and maintenance of the large centrifugal dryers used in the “Drying” process of bleached and/or dyed wigs. I tested the operations and quality inspection for new bleaching equipments.

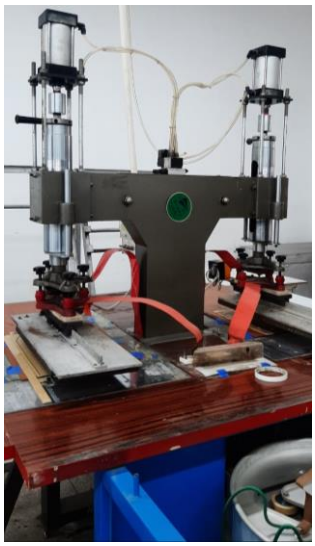


Figure 4.2.5.2 Hydraulic Press

Fig 4.2.7.3 Bleaching Department

The packaging process of wigs are carried out by the help of hydraulic baling press and clicker cutter machines (HG-B30T/48). Their motor power varied from7.5 to 10 HP. They consist of double-cylinders, four-columns, self-balancing connecting rods which maintain equal pressure of each position. When the upper board is pressed down and contacts the blade, it can cut slowly, ensuring that there is no size difference between the top and bottom materials. I was involved in operating as well as installation of new machines and testing process for quality control.

4.2.8 Administration and Management

Figure 4.2.8 Asset Verification

By virtue of working in the Administration and Management Department as well as the Human Resources Department during my last week of training, I gained knowledge on the technical management as well as acquisition of assets and recruitment of operators. One of the key steps before testing of new equipment is the process of asset verification. It is used to validate details regarding assets for the factory and machineries i.e., establishing asset's ownership, documentation, location, and condition. All commercial and public companies are required to perform an annual physical count of all fixed assets to verify actual assets in hand and value, as well as to certify the accuracy of essential financial records. Asset verification is a component of truth testing. As a result, my responsibility was to guarantee that the balance sheet elements were right.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Training Outcomes

I was able to understand the process flow of wig production after working as an intern in Evergreen Products Factory (BD) Ltd., which begins with the preparation of the raw material (human hair, animal hair, natural and synthetic fibers) for the wig and ends with the dispatching process. Moreover, I learned via various activities such as Generator Repair and Maintenance, Boiler Descaling and Maintenance, Water Treatment Plant Operation and Maintenance, Electric Substation Operation and Maintenance, Asset Structure, and Maintenance Strategy. The industrial training at the Evergreen Products factory provided me with knowledge and experience for applying my technical abilities in the plant and introduced me to a working atmosphere that was completely different from what I was used to at Universiti Teknologi Malaysia. I have also improved my communication skills by being able to communicate effectively in both written and spoken mediums. Furthermore, I was exposed to the responsibilities and working atmosphere of an engineer during my training, especially at Evergreen Products Factory (BD) Ltd. Additionally, I improved on interpersonal skills that are essential in work, particularly while working under duress. This ability comprises more than simply communication; it also includes time management, mood regulation, and the ability to work under stress. Enrolling in the engineering department enabled me to study and witness procedures and work flows not just in engineering, but also in production, quality control, inspection, testing and safety.

5.2 Problems and Recommendations

During the initial stages of my industrial training, I faced a few challenges due to extended pandemic conditions, where preventive precautions and country-wide lockdowns in both Malaysia and Bangladesh significantly reduced my capacity to participate in onsite industrial training programs in Malaysia in person. Moreover, in Bangladesh, some of the scope of training courses were limited i.e., ones relevant to the aeronautics side of mechanical engineering. However, I am thankful for the opportunity to intern at Evergreen Products Factory (BD) Ltd., where I was able to successfully end the industrial training and maintain a good communication with the organisation for future career possibilities.

Finally, my industrial training at Evergreen Products Factory (BD) Ltd taught me a lot about the challenges of becoming a mechanical engineer. I would like to express my heartfelt gratitude to everyone who was a part of this experience for assisting me in completing my fantastic industrial training. They consistently encouraged me to offer suggestions for development.

REFERENCES

Ademola Sonibare, J., Adetayo Adeniran, J., Sunday Fakinle, B., O. Latinwo, I., Adekilekun Jimoda, L., & Abel Olu-Arotiowa, O. (2014). Ambient noise from off-grid diesel engines electric power generators in an urban environment. *Management of Environmental Quality: An International Journal*, *25*(2), 186–199. https://doi.org/10.1108/meq-12-2012-0078

Boiler plant and auxiliaries. (1982). *The Efficient Use of Energy*, 200–248. https://doi.org/10.1016/b978-0-408-01250-8.50019-2

Bureska-Joleska, L. (2017). Influence of coal quality to the boiler efficiency and opportunity for its improvement. *Termotehnika*, *43*(1–4), 59–65. https://doi.org/10.5937/termoteh1704059b

Emergency supply equipment. (1992). *Electrical Systems and Equipment*, 748–798. https://doi.org/10.1016/b978-0-08-040514-8.50017-3

Goudarzi, A., Li, Y., & Xiang, J. (2021). Efficient energy management of renewable resources in microgrids. *Renewable Energy Microgeneration Systems*, 285–321. https://doi.org/10.1016/b978-0-12-821726-9.00013-8

Gupta, A. (2014). Human Hair "Waste" and Its Utilization: Gaps and Possibilities. *Journal of Waste Management*, *2014*, 1–17. https://doi.org/10.1155/2014/498018

Hiray, A., Chinchkar, O., Butte, P., & Pyla, M. V. (2017). PLC and SCADA Based Sewage Water Treatment Plant. *IJIREEICE*, *5*(5), 38–41. https://doi.org/10.17148/ijireeice.2017.5507

History and Development – Evergreen Products Group Limited | The Leading Manufacturer and Exporter of Wigs and Hair Pieces from China and Bangladesh | Wig Factory. (n.d.). [Press release]. https://www.epfhk.com/about-us/history-and-development/

Hoang, T. A., & Le, V. V. (2017). The Performance of A Diesel Engine Fueled With Diesel Oil, Biodiesel and Preheated Coconut Oil. *International Journal of Renewable Energy Development*, *6*(1), 1–7. https://doi.org/10.14710/ijred.6.1.1-7

R, V., Kumar, K., B, P., & R, R. (2016). DESIGN OF AIR PRE-HEATER FOR BLAST FURNACE GAS FIRED BOILER. *JOURNAL OF APPLIED PHYSICS AND ENGINEERING*, *1*(3), 53–59. https://doi.org/10.26524/jap17

Ruskai, M., & Lowery, A. (2010a). Choosing, Cutting, Coloring, and Perming the Hair. *Wig Making and Styling*, 165–174. https://doi.org/10.1016/b978-0-240-81320-2.00015-9

Ruskai, M., & Lowery, A. (2010b). Wig Styling Techniques. *Wig Making and Styling*, 129–150. https://doi.org/10.1016/b978-0-240-81320-2.00013-5

Ruskai, M., & Lowery, A. (2010c). Wig-Making Terms, Tools, and Techniques. *Wig Making and Styling*, 1–17. https://doi.org/10.1016/b978-0-240-81320-2.00005-6

Shayeghi, H., & Alilou, M. (2021). Distributed generation and microgrids. *Hybrid Renewable Energy Systems and Microgrids*, 73–102. https://doi.org/10.1016/b978-0-12-821724-5.00006-4

Taole, R., Falcon, R., & Bada, S. (2015). The impact of coal quality on the efficiency of a spreader stoker boiler. *Journal of the Southern African Institute of Mining and Metallurgy*, *115*(12), 1159–1165. https://doi.org/10.17159/2411-9717/2015/v115n12a3

Zhu, H., & Qiu, X. (2017). The Application of PLC in Sewage Treatment. *Journal of Water Resource and Protection*, *09*(07), 841–850. https://doi.org/10.4236/jwarp.2017.97056