INTERNSHIP REPORT

ON

INDUSTRIAL MANUFACTURING MANAGEMENT AND MAINTENANCE SYSTEM

(Based on Butterfly Manufacturing Company Ltd, Mymensingh)

A thesis submitted in partial fulfillment of the requirement for the Award of Degree of Bachelor of Science in Electrical and Electronic Engineering

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November 8, 2020

To.
The Chief Operating Officer (COO)
Butterfly Manufacturing Company Limited.
City Centre Level-15, 103 Motijheel Commercial Area,
Dhaka-1000

Subject: Regarding Field Study Purpose.

Dear Sir,
Please Note that the following two (02) students of Electrical and Electronics Engineering Department of Daffodil International University are willing to do field study at your organization(**Butterfly Manufacturing Company Limited).**The duration of the field study will be at least two (02) months being effective from **November 15, 2020.**

Therefore, you are requested to permit them to avail the opportunity on several convenient dates.

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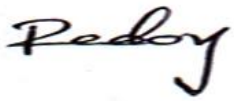
Letter of Approval

This is to certify that this thesis report entitled **"Study of Industrial Manufacturing Management and Maintenance System"** is done by **Redoy** and **Abdul Alim** under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfilment of the requirements for the degree of **Bachelor of science in Electrical and Electronic Engineering**. The presentation of the work was held on **15 January 2021.**

Signature of the candidate



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DEDICATION

Dedicated to

Our Respectable Parents

&

Honorable Teachers

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LIST OF ABBREVIATION

BMCL	Butterfly Manufacturing Company Ltd
CKD	Complete Knock Down
SKD	Semi Knock Down
5S	Short, Straighten, Shine, Standard, Sustain
3R	Right place, Right quantity, Right materials
QA	Quality Assurance
QC	Quality Control
IQC	Incoming Quality Control
LQC	Line Quality Control
OQC	Outgoing Quality Control
HIPS	High Impact Polystyrene Sheet
VFD	Variable Frequency Driver
PCM	Pre-coated Material
PVC	Polyvinyl chloride
ACR	Automatic Circuit Recloser
MCB	Miniature Circuit Breaker
ACB	Air Circuit Breaker
MDB	Main Distribution Board
ABS	Automatic Break switch
VCB	Vacuum Circuit Breaker
OCB	Oil Circuit Breaker
SF6	Sulphur Hexafluoride Circuit Breaker
CT	Current Transformer
PT	Potential Transformer
BREB	Bangladesh Rural Electrification Board

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First of all, we would like to express our cordial gratefulness to almighty Allah for his kindness, for which we successfully completed our internship within time and we also apologize to his for our any kind of mistakes. We would like to express our boundless honor and respect to our internship Supervisor Professor **Dr. M. Shamsul Alam**, Professor & Dean, Department of Electrical and Electronic Engineering, Daffodil International University for his encouragement and for giving us permission to involve with our internship. we have done our internship according to his direction. We would like to express our heartiest gratitude to **Md. Dara Abdus Satter**, Associate Head, Department of Electrical and Electronic Engineering, Daffodil International University, and **Md. Junaed Al-Hossain**, Lecturer, department of Electrical and Electronic Engineering, Daffodil International University for their invaluable instructions, continuous guidance, constructive criticisms and thoughtful advice during pursuing this internship and preparation of this report. We would also be giving special thanks to COO, Head of factory Operations and employees of **Butterfly Manufacturing Company Ltd** for their enthusiastic support and co-operation with us. And Special thanks are extended to the author's fellow classmates of the Department of Electrical and Electronic Engineering, Daffodil International University for their helping hand, continuous support and cooperation during my internship. Finally, the authors are proudly acknowledging the great sacrifices, good wishes, moral support, fruitful advice, inspirations and encouragements from their family members, teachers and friends which help the authors to finish the internship successfully.

ABSTRACT

Butterfly Manufacturing Company Ltd is a reputed electronics company in Bangladesh. They are having state of the art plant machinery, accessories for manufacturing different types of components and assembling of the Refrigerators & Air Conditioners. BMCL has two Sub-station. One is 4 MVA and another one is 8 MVA sub-station. As an Electrical and Electronics Engineering (EEE) student we can learnt both main source of power and its distribution system as well as manufacturing & maintenance management from this company. We did our internship in Butterfly Manufacturing Company Ltd from 15th November to 15th January (2 months). This internship report based on ‘’Industrial Manufacturing Management and Maintenance System of BMCL’’.

As an engineer we need to have some ideas about operations management of BMCL which will help us to make this report worthy. We spent our full internship with four departments. Materials department, Production department, Quality department and Maintenance department. We worked in materials, production and quality department for 1 month. And another 1 month we worked only in maintenance department. As an EEE student we have to stretch importance in maintenance department because this is our main objective. First one month we learnt about company rules and regulation, how to materials brought for production and where it’s stock, how to produce products, what kind of machine need to produce which products, how to check quality of products, how a product suitable for a customer and finally how to packaging outgoing all products from this company. Next one month we worked in maintenance department. We learnt here utility maintenance and floor maintenance of this company. During the utility maintenance we learnt about sub-station, sub-station equipment, transformer, generator, air dryer, compressor and main distribution panel. During the floor maintenance how to machine worked, automation system, hydraulic system, pneumatic system, how to control motor in Conveyor line and last which machine need PLC. This is all we learnt from our internship in Butterfly Manufacturing Company Ltd which will surely help us to visualize the effectiveness in our practical life.

Chapter 1
INTRODUCTION

1.1 Introduction

'Butterfly' is the most prominent name in the country's electronics scene. Since inception in **1987**, the Group has been playing a pivotal role in shaping up the industry with a portfolio of trusted brands and an ever-growing distribution network. This combination enables Butterfly to reach out for customers from all walks to meet their needs of electronic goods. Butterfly owns the exclusive distribution rights to market LG products in Bangladesh since **1995**. With the long-standing partnership, Butterfly has become synonymous to LG in Bangladesh. Other world-class brands like Hisense and Eco+ were added in its portfolio in **2013**.

Today, Butterfly offers industry's largest number of multi-product consumer durables through its retails, in **18** categories. This includes TVs, Refrigerators, Air Conditioners, Washing Machines, Microwave ovens and many more home appliances.

1.2 Mission & Vision

Butterfly Committed to provide latest state-of-art consumer electronics, home appliances and energy products to all consumers, their families, businesses and institutions at an affordable pricing through nationwide distribution network effectively coupled with faster and efficient service network.

Fig 1.1: Butterfly Manufacturing Company (Admin Building)

1.3 Factory Location and Area Information

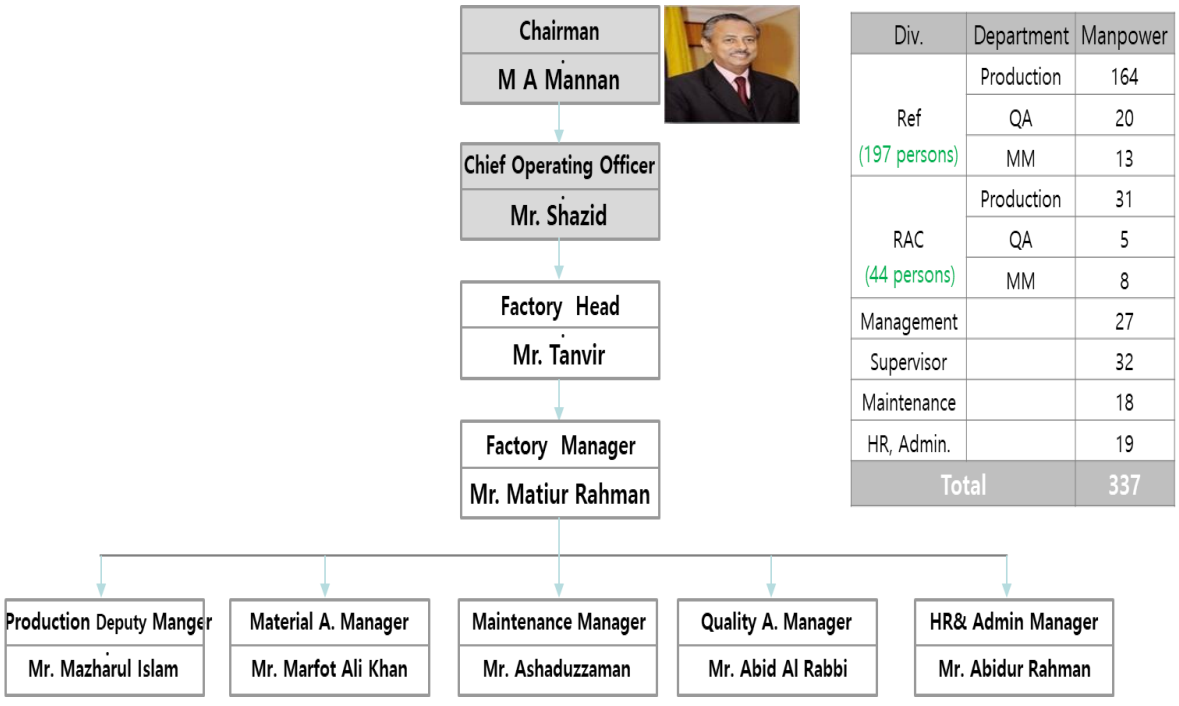
Location: Kathali, Bhaluka, Mymensingh
Distance:

- From Dhaka : 85 Km
- From CTG Sea Port : 330 Km
- From DAC Airport : 68 Km

- REF Factory shed : 109,923 Sq. feet
- AC Factory shed : 32,788 Sq. feet
- New W/H shed :30,245 Sq. feet
- TV Factory :115,048 Sq. feet
- Total Area :(1145+1162) =2307 decimal

- LG CKD REF/AC Factory shed :534,058 Sq. feet
- Total Area :1485 decimal

1.4 REF/RAC Organization Chart



Div.	Department	Manpower
Ref (197 persons)	Production	164
	QA	20
	MM	13
RAC (44 persons)	Production	31
	QA	5
	MM	8
Management		27
Supervisor		32
Maintenance		18
HR, Admin.		19
Total		337

Fig 1.2: Factory Shed: Refrigerator Unit

1.5 Specified Objective

In order to obtain the broad objective, we have to find out of the following objectives. These are follows:

- Concerning about basic rules and regulation in company
- Study about how a refrigerator produces
- Study about total 5S & 3R
- To know how all machinery worked and maintenance
- Study about Sub-station and all its equipment

- Study about 33/11KV and 11KV/440V Transformers
- Study about Diesel type Generator
- Maintenance of Sub-station

1.6 Methodology

The research of this paper has been done by the help of different sources. The paper was checked by the authorized persons of Butterfly manufacturing company. When we worked with different department, we submitted a report to the specific department head. The information of this report has been collected from the following sources-

- Materials Department
- Production Department
- Quality Department
- Maintenance Department

Some information collected from the online resources, Journals and Brochures.

1.7 Thesis Outline

This thesis is sequence organized as follows-

Chapter 1: Introduction

Chapter 2: Materials Department

Chapter 3: Production Management System

Chapter 4: Quality Management System

Chapter 5: Maintenance Management System

Chapter 6: Conclusion & Recommendation

Chapter 2
MATERIALS DEPARTMENT

2.1 Introduction

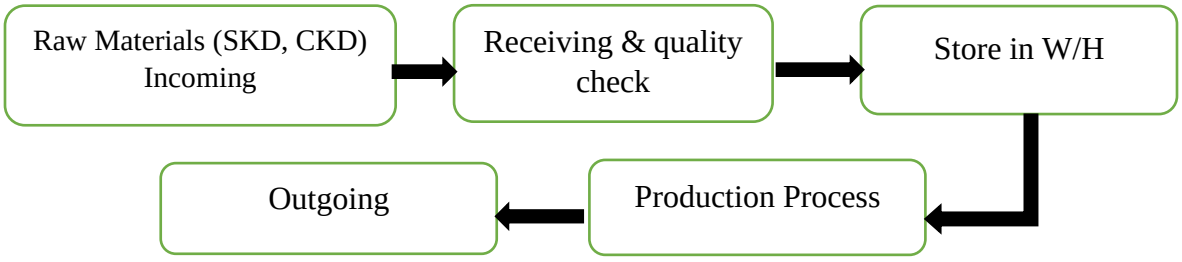
Materials Department is the planning, directing, controlling and coordinating those activities which are concerned with materials and inventory requirements, from the point of their inception to their introduction into the manufacturing process. Material department is an important function of an organization covering various aspects of input process, i.e., it deals with raw materials, consumables, accessories, procurement of machines and other equipment's necessary for the production process and spare parts for the maintenance of the factory.

2.2 Material Department (BMCL)

Like all factories Butterfly manufacturing company ltd have one materials department. This department collect materials and store in warehouse. When any kinds of materials need for production, they would supply it quickly.

Fig 2.1 Warehouse (BMCL)

2.3 Work Function



Chapter 3
PRODUCTION MANAGEMENT SYSTEM

3.1 Introduction

The Production Management System (PMS) allows users to control all aspects of batch production processing in a centralized and decentralized environment. A production department is a group of functions within a business that is responsible for the manufacture of goods. This can include just a few specialized functions with all other work outsourced, or a fully functioning department that converts raw materials, assembles components into finished goods, and packages them.

The production department can be the largest organization within a business. It may employee mechanics, machine setup specialists, maintenance personnel, and machine operators, quality check member and many workers. There are different types of plant machinery, accessories, equipment, tools, utilities are being used in BMCL factory for production purpose.

In production management system has many machineries. In bellow all machines working procedure has given step by step.

3.2 Cold Roller Forming (CRF) Machine/ Side Plate

Cold roller forming machine is used for making a side plate of a refrigerator. Roller farming machine runs by hydraulic system. This machine system is PLC controlled & run automatic.

Input- Pre-coated material

Output- Side plate

Fig 3.1: Cold Roller Forming (CRF) Machine

Working Procedure:

1. Sheet loading or sucker
2. Punching
3. Rolling
4. L-z shape bending
5. U shape bending
6. Robot controlling and unloading

3.3 Thermoforming Machine/Body Liner

Thermoforming machine is used for making body liner of a refrigerator. This is PLC driven automatic machine (COMI) runs through electro mechanical & pneumatic vacuum system.

Input- High impact polystyrene sheet (HIPS)

Output- Body liner

Fig 3.2: Thermoforming Machine/Body Liner

Working Procedure:

1. Sheet loading by Pneumatic sucker
2. Electro mechanical transportation system of Sheet.
3. Pre-heating
4. Heating (700 degree)
5. Vacuum forming
6. Output body liner

3.4 Thermoforming Machine/ Door Liner

Thermoforming machine is used for making door liner of a refrigerator. This system runs by vacuum system. This system is automatic and manual.

Input- High impact polystyrene sheet

Output- Door liner

Working Procedure:

1. Heating temperature (400-460) degree °C
2. Mould temperature (55-75) °C
3. Air Pressure 3-4 bar
4. Vacuum pressure 0.06-0.07 mPa
5. Body liner forming
6. Cutting & holing

Fig 3.3: Thermoforming Machine/ Door Liner

3.5 Freezing Evaporator Bending Section

There is a machine called evaporator bending which is used for bending evaporator in body liner. This section runs with mechanical system. Here manually bending evaporator with mechanical appliances.

Fig 3.4: Freezing Evaporator Bending

3.6 Door Assembly Point

There is a section called door assembly point. This section is only used for making door. In this section placing the door lock. Then also placing the light cable. All procedure for making a door is done here.

3.7 Roller forming machine/ Door plate

Roller forming machine is used for making a door plate of a refrigerator. Roller farming machine runs by hydraulic system. This machine system is automatic.

Fig 3.5: Roller forming machine/ Door plate

3.8 Door Foaming Machine

Here are the full details about door foaming machine-

- Machine name: Poly urethane foaming plant.
- Input: Door liner and Door plate.
- Output: Door with foaming.
- Chemical: ISO, POLO, C5
- Chemical ratio: ISO: POLO: C5
  50: 40: 5
- There are 7 moulds. That means there are 07 set of doors foaming at a time.
- Each mould complete foaming within 350 seconds.
- Then placing gasket in the door and quality check.
- If there is any problem then it goes to Repairing zone.

- Door/frame press machine used for making glass door.
- This company produce 12 types Door.
    - Eco+ - 7 types
    - Homa VCM - 3 types
    - Chest - 2 types

Fig 3.6: Door Foaming Machine

3.8.1 Door foaming chemical measurement

MODEL	Door chemical Weight(gm)	
ECO-225	Up door	970±20
	Down door	900±20
ECO-195	Up door	700±20
	Down door	950±20
ECO-235	Up door	855±20
	Down door	1130±20
HISENSE-218	Up door	845±20
	Down door	960±20
ECO-218(glass)	Up door	970±20
	Down door	1120±20
ECO-252(glass)	Up door	970±20
	Down door	780±20

ECO-202	Up door	970±20
	Down door	780±20
ECO-252	Up door	970±20
	Down door	1025±20
ECO-218	Up door	855±20
	Down door	950±20
HISENSE-225	Up door	970±20
	Down door	890±20
HISENSE-235	Up door	845±20
	Down door	1090±20
ECO-235(glass)	Up door	875±20
	Down door	1130±20

3.9 Gasket Section

In this section refrigerator gasket are made in this section.

- Input: Polyvinyl chloride (PVC resin).
- Magnet (Strip)
- Output: Gasket.

Gasket Section Equipment:

1. Crushing machine (recycle).
2. PVC mixer.
3. Blower.
4. Dryer.
5. Cutting machine.

Fig 3.7: Gasket Machine

3.10 ABS & HIPS Sheet section

Machine name: Co-extruding machine.

Input: Polystyrene, Styron & Masterbatch

Chemical Ratio: 63.5: 2.5: 4

There also use 30% recycle.

Output: High impact polystyrene sheet.

Fig 3.8: Co- Extruder machine

3.10.1 Working Procedure

1. First all materials brought in hopper by using vacuum pump (3KW)
2. Then all materials dry with 80-degree temperature by dryer.
3. Next it goes to barrel for melting. There are 11 dryers. 7 are 370W and 4 are 60W.
4. Then it goes to cylinder. There are 22 heaters. Temperature 210-225 degree.
5. After that it is filtering with mash filter.
6. There are three rollers it helps to flat the sheet. It's temperature sequence 70, 60 and 55 degree.
7. Then it is cooling with cold conveyor and cutting two side with cutting blade.
8. Next there gives electric shock with edge trim.
9. Finally, it cutting with actual measurement and output with manipulator conveyor.

Body HIPS Measurement

Model	Measurement(mm) (Thickness*Width*Length)
202F	4.2*710*1640
202R	3.7*680*1660
225R	4.0*690*1900
252R	3.7*690*1100
195F	3.6*710*1630
235R	3.6*690*1620
235F	3.6*710*990
DF2-350(260L)	4.0*780*1790
DF2-400(290L)	4.0*780*1910
DF2-470(320L)	4.0*780*2025

Table 3.1: Body HIPS Measurement

Door HIPS Measurement

Model	Measurement(mm) (Thickness*Width*Length)
202F	1.5*685*1530
202R	1.5*685*1605
225R	1.5*685*1835
252R	1.5*685*1070
195R	1.5*680*1560
195F	1.0*680*1570
235R	1.5*680*1785
235F	1.0*680*1785

CD-260	**1.25*730*1680**
CD-290	**1.25*730*1820**
CD-320	**1.25*730*1940**

Table 3.2: Door HIPS Measurement

3.11 Pre-assembly line (Chest freeze)

Here is the working procedure of pre-assembly line for chest freeze. They are separate in two part:

3.11.1 Outer part

1. First attach all side-plate of chest freeze.
2. Then each corner joint support.
3. Next use bottom pad for cover the bottom of chest freeze.
4. Then attach condenser inside the side-plate.
5. Last taping the condenser with side-plate properly.

3.11.2 Inner part

1. Inner bending machine makes aluminum sheet for inner part.
2. Then joint the aluminum sheet with soft hammer.
3. There is an equipment made by wood which help for shape aluminum sheet for inner side.
4. Then bending the evaporator with aluminum sheet and taping properly.
5. Next cleaning the evaporator with vacuum and attach a condenser to suction pipe.

Fig 3.9: Pre-assembly line chest freeze

Now attach the outer part and inner part. then join the top cover for closing the top side of chest freeze. Then quality checker checks its quality. If there no problem then it is taken for body foaming otherwise it takes to repair zone if there is any problem.

3.12 Pre-assembly line (Refrigerator)

Here is the working procedure of pre-assembly line for refrigerator. Here's the procedure step by step-

1. First the gasket is fitted with liner for attach screw.
2. Then attach an evaporator with plate and thermostat wire with liner.
3. There also attach a temperature catheter for detecting body temperature.
4. Then there joints a door switch with switch box and inner connecting wire.
5. Next attach the F liner(freezer) and R liner(refrigerator). It fitted with mid-level and lower-level beam part.
6. Then complete hot pipe settings and attach the full body liner with side plate.
7. There also a brazing point where is joining two tubes with compressor, and leakage check and repair if required.
8. Then there attaches compressor box, suction pipe and drain pipe.
9. Next fitted the back cover with side plate and protect with HIPS sheet against damage.
10. Then its quality check, adjust all body and also taping the body where needed. Then it is taken for body foaming.

Fig 3.10: Pre-assembly line Refrigerator

There is one more line called supporting line. Mid-level and lower-level beam part, compressor box and back cover are brought from that line.

3.13 Body Foaming

Machine Name: Poly urethane foaming plant.

Input: Body from pre-assembly

Output: Body with Foaming.

Chemical: ISO, POLO, C5

Ratio: 55:40:5 (100%)

Time: Chest Freeze 6-7minutes, refrigerator 8-9minutes.

Fig 3.11: Poly urethane foaming plant

3.14 Post-Assembly Line

This line is divided into two parts. First Cycle line, second is Assembly line. All the work related to compressor is done on cycle line. All other work is done on Assembly line.

3.14.1 Working Procedure

1. Complete body foaming First clear taping then fitted wheel.
2. Then fitted compressor base plate and power cable.
3. Next fitted compressor in compressor base plate.
4. After that cleaning grime in body.
5. Cleaning and quality check.

6. If there is a problem, it is sent to the repairing zone.
7. If there is no problem, it is sent to the next step.
8. Next step fitted thermostat and velos pipe.
9. Then attach discharge point to condenser and suction to Evaporator.
10. Grounding and covering with plastic box.
11. Door Hing and basket (chest freeze) Shelf part and glass shelf (Refrigerator).
12. Next fitted Evaporator inside the refrigerator.
13. In Brazing point welding all attach point.
14. Then joint door key.
15. Next first joint down door 2nd upper part.

Fig 3.12: Post-Assembly line

16. Then placing lower door part.
17. Next ground wire connects.
18. Relay overload cable connect.
19. Suction pipe rubber cup out and cleaning.
20. After that Flash with Nitrogen gas for Moisture remove.
21. Then Fitted ECO+ Logo and warranty logo.
22. Next Vacuum cleaning. It takes 2-3minutes for cleaning.
23. Then refrigerant gas charged.

Model	Weight
252	53gm
235	52gm
170	40gm
320	67gm
290	63gm
260	64gm
198	37gm
218	43gm
225	53gm
202	48gm
195	43gm
142	33gm

Table 3.3: Gas Measurement

24. Process tube and dryer welding with ultrasonic welding machine.
25. In low pressure leakage test station process tube and discharge tube leakage test with low voltage.
26. Then place water drain storage and attach foam.
27. In high pressure and safety performance test station Dryer capillary and suction tube leakage test with high voltage.
28. Then again, its quality test. If found any problem then it takes to the repair zone. Otherwise, it takes to the cooling test line.

3.15 Cooling Test

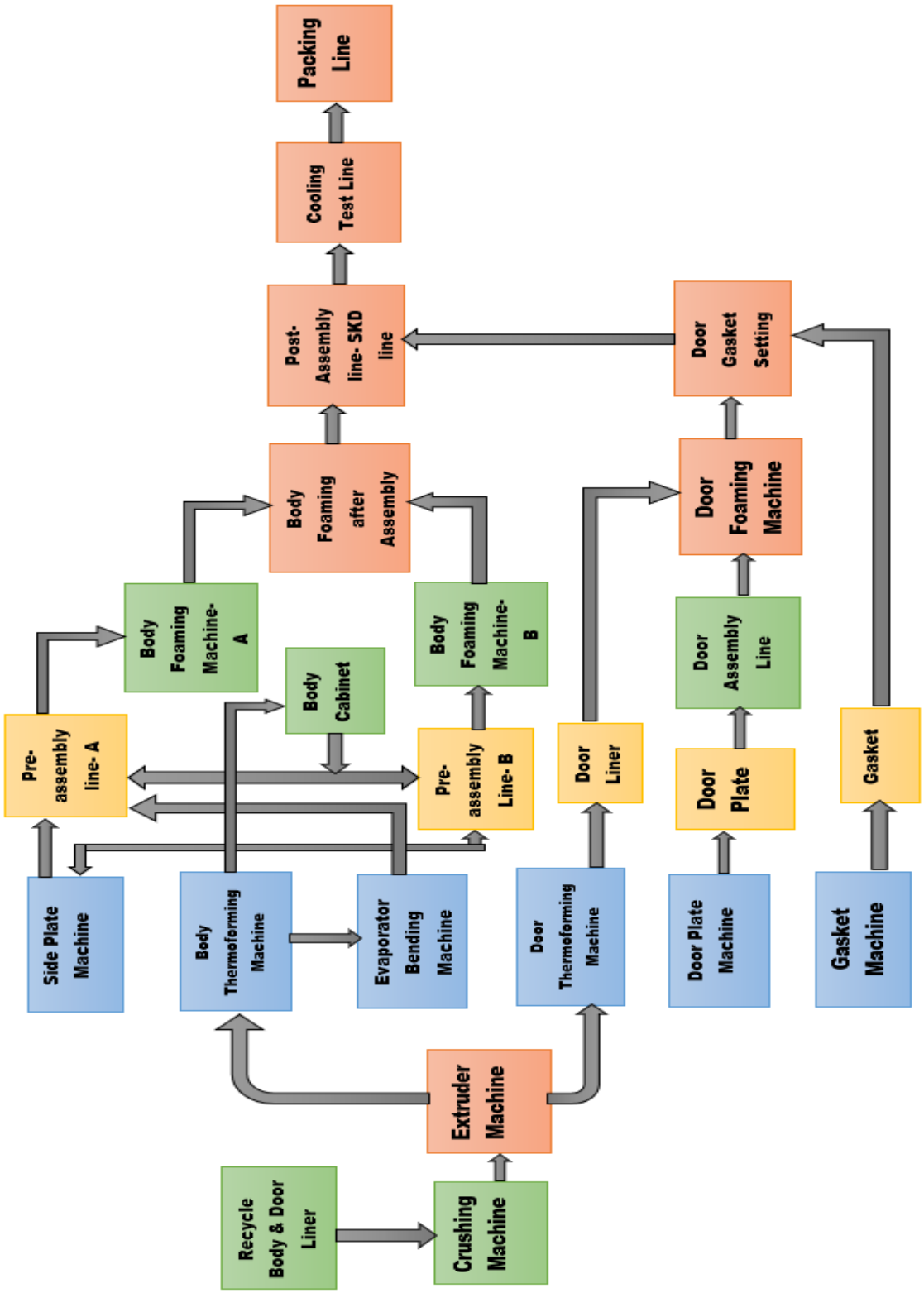
In this unit the cooling test is done with a thermocouple sensor. It takes about 2 hours for cooling test each freeze. The quality department handle this unit.

3.16 Packing Line

1. First All refrigerator drawers are being installed in drawer assembly point.
2. Then safety test all freezes in safety performance test station.
3. Next fitted a plastic cover in the compressor for safety.
4. Then it is cleaning with Isopropyl alcohol chemical solution for disinfectant.
5. In final inspection station investigation, all body part of a freeze. If there any problem then it takes to the repair zone. Otherwise, it is all ok and taken for packing.
6. First it covered with polythene and then carton.
7. next EPS (cock sheet) is used for safety inside the box and taping properly.
8. Then attach leveling and FG tag.
9. The serial number is stored on the computer by bar code scanner.
10. At last binding with packing machine.

Fig 3.13: Packing line

3.17 Production Management System Flow Diagram



Chapter 4
QUALITY MANAGEMENT SYSTEM

4.1 Introduction

A quality management system (QMS) is defined as a formalized system that documents processes, procedures, and responsibilities for achieving quality policies and objectives. A QMS helps coordinate and direct an organization's activities to meet customer and regulatory requirements and improve its effectiveness and efficiency on a continuous basis. Thus, quality can be defined as fitness for intended use or, in other words, how well the product performs its intended function. Butterfly manufacturing company ltd brought materials in two ways-

1. **Raw materials:** These materials come from Hisense company in China. CKD and SKD both are coming from there. There are 256 items in CKD and SKD only side by side refrigerator and its equipment.
2. **Local materials:** These materials come from local vendors/suppliers of Bangladesh like Padma plastic company ltd. e.g., Carton, EPS, PE bag etc. are come from there.

Quality assurance and quality control are two aspects of quality management. While some quality assurance and quality control activities are interrelated, the two are defined differently.

4.1.1 Quality Assurance

Quality assurance can be defined as "all the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality."

4.1.2 Quality Control

While quality assurance relates to how a process is performed or how a product is made, quality control is more the inspection aspect of quality management. An alternate definition is "the operational techniques and activities used to fulfill requirements for quality."

A quality management system (QMS) controls their quality in three method. They are-

1. Incoming Quality Control (IQC)
2. Line Quality Control (LQC)
3. Outgoing Quality Control (OQC)

4.2 Incoming Quality Control (IQC)

The factories, manufacturers have special IQC department to check the raw materials, components and parts from their suppliers, before admitting to the warehouse. The main function of the IQC department is started collecting all materials from suppliers to until delivered to assembly line. Here is the procedure of IQC department-

- When a lot arrived, first a picture is picked up while the door is locked.
- Then unlock the door. This is called unstrapping.
- Then a picture is taken again when opened one side of the door.
- After that the door is fully opened.
- Then a picture is taken again, and unloading start.

Fig 4.1: Unloading from the truck

- At the same time randomly open some boxes and check the parts are in good condition or not.
- Here are basically three things to check.
  i. Over
  ii. Short
  iii. Defect
- They also check the quality which are taken from the local vendors and self-made raw materials by various measuring instruments.

- At last, they check all parts and create a total inspection report. There includes parts number, parts image, quantity etc.

Fig 4.2: Warehouse BMCL

4.3 Measuring Instruments

This measuring instruments need to check their materials-

- vernier caliper
- measurement tape
- Push-pull gauge
- Torque wrench
- Micrometer etc.

4.4 Line quality control (LQC)

The line quality control (LQC) process incorporates inspection points across the production line. In short line quality control department check the quality of production processing system. Its benefit is waste of products prevention, reduction in unnecessary procedures, cost reduction etc. LQC department divide their procedure in Four steps. They are-

- Pre-Assembly inspection
- Kit inspection
- First inspection
- Final inspection

4.4.1 Pre-Assembly inspection

In this section the body of the fridge is being made before foaming. Pre- assembly line's worker complete their procedure step by step. When it complete or ready for foaming the LQC member check it before foaming.

- First there is machine called Inner bending machine which made inner part for chest freeze by aluminum sheet. The inner part is measurement by LQC department.
- In assembly point they check body before foaming- gap issue, wire check, foaming point check, top cover broken check, dent, crash, broken etc. all type of visual check. Then the body take for foaming.

Fig 4.3: Pre-Assembly Inspection Section

4.4.2 Kit Inspection

After completing the body foaming there is a quality check section called kit inspection. In this section check the body again after foaming and some procedure-

- First check there is any mold problem or not.
- Then again check dent, crash, somewhere broken or not, foaming check, deform, wire check etc.
- Next clean with IPE and attach a quality trace sheet.
- If there any problem in body then it includes in trace sheet.

Fig 4.4: Kit Inspection Section

4.4.3 First Inspection

The things that are done on the post-assembly line that checked in first inspection section. The procedure of first inspection-

- First check gas quantity of compressor. There is model wise measurement for gas input in compressor. So, they checked
  Whether it is entering in quantity.

- Next there is a station called low pressure leakage test station. There test the body with low voltage (85% voltage). Some leakage tests like evaporator, compressor discharge and process tube test with Inficon Ecotec E3000 machine.

Fig 4.5: First Inspection Section

- There is another station called high pressure leakage test and safety performance station. There test the body with high voltage (100%). Dryer, capillary tube, suction pipe leakage test with Inficon Ecotec E3000 machine. Safety test like grounding, insulation resistance etc. test with ANUO machine.
- Then again test dent, crash and broken etc. visual check. Also attach a hinge cover there. Then the body take for cooling test.

4.4.4 Cooling Test Line

In this section chest freeze and refregerator are taken for cooling test. There are 9 lines in cooloing test.1 line is for repair and 8 lines is for cooling test. There 36 body space for cooling test in one line but they kept 34 body. For cooling test they use thermocouple sensor. Generally they kept body for cooling test 120 miniuts. But there is some seperation test method in model wise. CAL test system sofware use for cooling test.

Fig 4.6: Cooling Line

Generally, these problems could be seen during cooling-

Again test, Power box problem, Non-stop compressor, No cooling, large power etc.

4.4.5 Final Inspection

Before body go for packing there is a quality cheking point called final inspection. There check-

- First they check trace sheet. Which problem in that sheet they check again.
- Then again check all visual problem.

- Then check all parts are matching or not with part number.
- Then they kept key in the drawer.
- At last collect all trace sheet. If the body has problem then it goes for repair if no problem then it taken for packing.

Fig 4.7: Final inspection section

4.5 Outgoing Quality Control (OQC)

The outgoing quality control (OQC) is the inspection of finished products prior to delivery to identify flaws in a manufacturing process. After finishing the packing of product outgoing quality control department randomly pick some body from the storage zone. Then they checked the body again. They maintain some method for checking. They are-

- General Inspection-
  [Visual Check]
- Ongoing reliability test (ORT)-
  [Safety check, Torque, Product liability]
- Details Appearance Inspection (DAI)-
  [Check box,EPS,Door appearance]
- Performance-
  I. Pull down test-[Compressor non-stop run after 8 hours]
  II. Cycle test- [Generally compressor run]
- Packing Inspection-
  [Packing vent, Bar code-shiping level, Carton hole, Word missing, PE bag hole]

Fig 4.8: Storage zone BMCL

4.6 Benefits of Quality Management Systems

Implementing a quality management system affects every aspect of an organization's performance. Benefits of a documented quality management system include:

- Meeting the customer’s requirements, which helps to instill confidence in the organization, in turn leading to more customers, more sales, and more repeat business
- Meeting the organization's requirements, which ensures compliance with regulations and provision of products and services in the most cost- and resource-efficient manner, creating room for expansion, growth, and profit.

These benefits offer additional advantages, including:

- Defining, improving, and controlling processes
- Reducing waste
- Preventing mistakes
- Lowering costs
- Facilitating and identifying training opportunities
- Engaging staff
- Setting organization-wide direction
- Communicating a readiness to produce consistent results

Chapter 5
MAINTENANCE MANAGEMENT SYSTEM

5.1 Introduction

Maintenance management is the process of maintaining a company's assets and resources. The purpose is to ensure that production proceeds efficiently and that resources are used effectively.

Maintenance management involves keeping track of assets and parts. The purpose is to ensure that production proceeds efficiently and the minimum number of resources are wasted. This is generally accomplished by a tailored combination of software, practices, and personnel that focus on achieving these goals.

5.2 Objectives of maintenance management

Almost any business process has objectives and maintenance management is no different. The five main objectives of maintenance management are:

- Budgeting
- Scheduling work
- Regulation compliance
- Optimizing work
- Improving safety

While there exist many different software programs that can assist with maintaining a healthy manufacturing process, the common objectives of all maintenance management programs are to analyze the production and seek the best practices within the specific field. Through thorough analyses and accurate reports, the goal is to control costs, schedule work properly and efficiently, and to ensure that the company complies with all rules and regulations while preventing failures and keeping breakdowns to a minimum.

In Butterfly manufacturing company, the maintenance department divided their management system into two parts. They are-

1. Utility maintenance
2. Floor maintenance

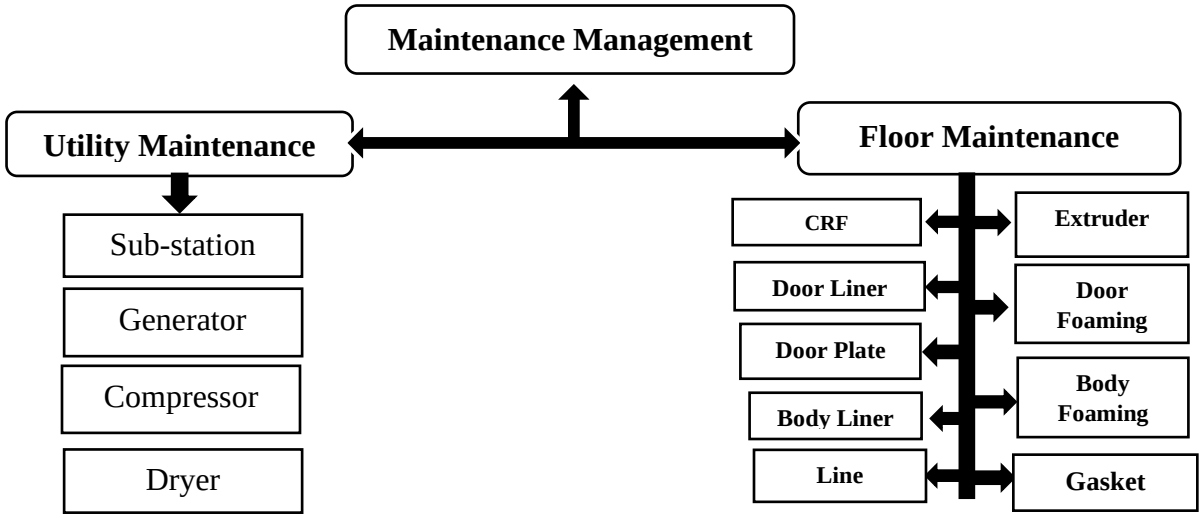


Table 5.2: Maintenance Management System

5.3 Maintenance Flow Chart

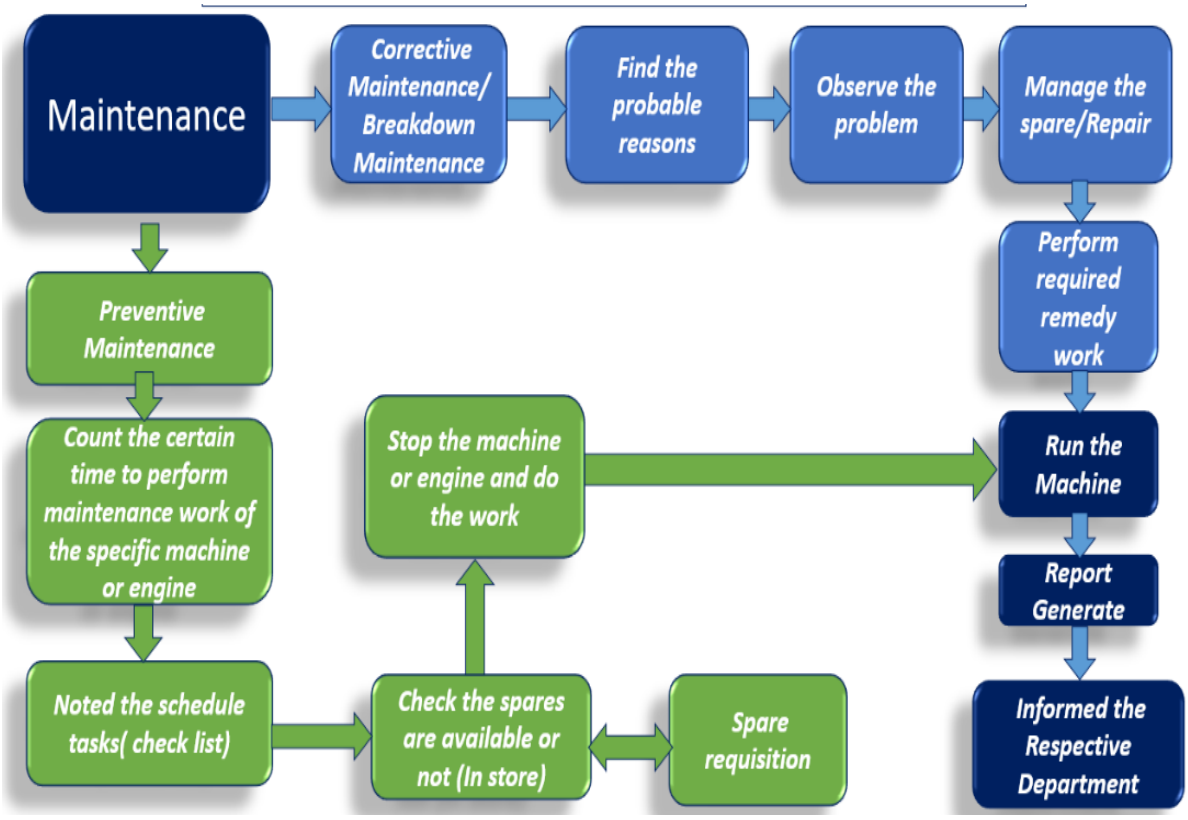


Table 5.3: Maintenance Flow Chart

5.4 Sub-Station

A substation is a part of an electrical generation, transmission, and distribution system. Substations transform voltage from high to low, or the reverse, or perform any of several other important functions. A substation is a high-voltage electric system facility. It is used to switch generators, equipment, and circuits or lines in and out of a system. It also is used to change AC voltages from one level to another, and/or change alternating current to direct current or direct current to alternating current.

Fig 5.1: Sub-Station of BMCL

5.5 Types of Sub-Station

Substation Types: Although, there are generally four types of substations there are substations that are a combination of two or more types.

1. Step-up Transmission Sub-station.
2. Step-down Transmission Sub-station.
3. Distribution Sub-station.
4. Underground Distribution Sub-station.

In butterfly manufacturing company ltd have two sub-stations.

i. 33/11 KV Step-down Transmission Sub-station
ii. 11 KV/440 V Distribution Sub-station.

This sub-station capacity is 4 MVA. BMCL source of electricity from Bangladesh Rural Electrification Board (BREB). It is supplying electricity from 132/33 KV sub-station to BMCL power line.

5.6 Substation Equipment

The following equipment are installed in distribution substations:

- Distribution Transformer
- Circuit breaker
- Lightning Arrester
- Air Brake Switches (ABS) / Isolator
- Insulator
- Busbar
- Capacitor Bank
- Earthing
- Fencing
- Distribution panel board

There also used many types of circuit breaker and equipment-

- ACR
- MCB
- ACB
- MDB
- VCB
- OCB
- CT
- PT
- SF6

5.7 Sub-Station maintenance

These are the overall maintenance and repair service includes of a sub-station-

- overall electric power substation inspection
- thorough cleaning of each device
- troubleshooting of any equipment operation
- mechanical and electrical testing of all substation apparatus
- troubleshooting of any substation electrical system
- design modifications required for equipment replacement

- electrical wiring replacement
- testing of any substation relay for proper operation
- verification of protective device coordination
- complete relay system upgrades
- full testing and commissioning
- complete test reporting

5.8 Transformer

A transformer can be defined as a static device which helps in the transformation of electric power in one circuit to electric power of the same frequency in another circuit.

Transformers are most commonly used for increasing low AC voltages at high current (a step-up transformer) or decreasing high AC voltages at low current (a step-down transformer) in electric power applications.

Fig 5.2: 10 MVA Transformer

5.9 Working Principle

The basic principle on which the transformer works is Faraday's Law of Electromagnetic Induction or mutual induction between the two coils. The working of the transformer is explained below. The transformer consists of two separate windings placed over the laminated silicon steel core.

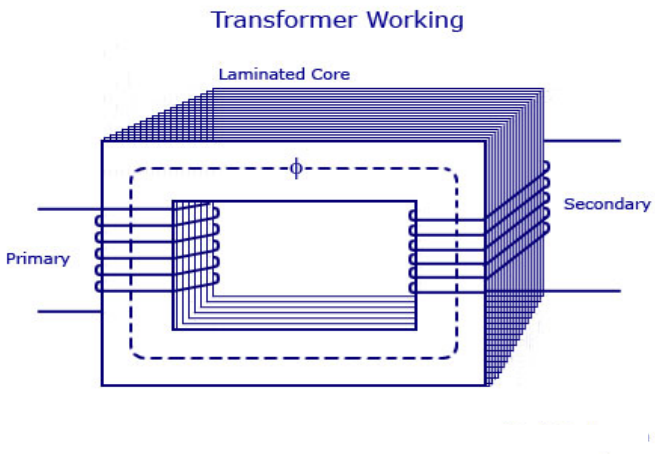


Fig 5.3: Transformer Working Principle

The winding to which AC supply is connected is called primary winding and to which load is connected is called secondary winding as shown in the figure below. It works on the alternating current only because an alternating flux is required for mutual induction between the two windings.

5.10 Types of Transformer

There are several types of transformer. They are-

- Step up and Stepdown Transformer.
- Power Transformer.
- Distribution Transformer.
- Instrument Transformer.
- Current Transformer.
- Potential Transformer.
- Single Phase Transformer.
- Three Phase Transformer.

In butterfly manufacturing company ltd have 3 step-down transformers. 33/11 KV (2) and 11 KV/440 V (1). Transformer capacity 4 MVA.

5.11 Transformer Maintenance

Content inspection	Inspection standards
Buchholz Relay	Check the oil level inside the buchholz relay, if oil level below the marked level alarm circuit must be close.
Transformer oil level and oil	Transformer oil level and oil condition should be check.
Transformer (HV/LV Bushing)	Transformer bushing in high voltage and low voltage side should be check.
Tape regulator	Transformer tape regulator should be check.
Lighting Arrester	Lightening arrester must be check lose or tit.
Terminal connector	Terminal connector need to check lose or tit, if lose must be tit it.
Conservator Tank	Need to check oil store into the conservator, if oil present then check oil leakage
Oil level indicator	Should be check oil level indicator active or inactive.
Earthing Terminal	Earthing terminal must be check lose or disconnect, if lose/disconnect must be connected.
Silica gel Breather	Silica gel need to check dirty or clean (blue or black), if black should be change.
Pressure relief valve	Pressure relief valve must be check.

5.12 Generator

In electricity generation, a generator is a device that converts motive power (mechanical energy) into electrical power for use in an external circuit. Electric generators work on the principle of electromagnetic induction. A conductor coil (a copper coil tightly wound onto a metal core) is rotated rapidly between the poles of a horseshoe type magnet.

Fig 5.4: Generator BMCL

A diesel type generator used in Butterfly manufacturing company. There are 4 diesel type generators in this company. Each generator produces electricity 1.6 Mw.

5.13 Types of Generator

There are 8 different types of generator. These are-

1. Gasoline Generator.
2. Standby Generators.
3. Diesel Generators.
4. Natural Gas Generators.
5. Portable generator.
6. Solar Generators.
7. Inverter generators.
8. Hydrogen Generators

5.14 Generator Maintenance

As a diesel type generator these 8 things is key to ensure that your electrical generator is safe. They are-

1. Diesel Generator Routine General Inspection
2. Lubrication Service
3. Cooling System
4. Fuel System
5. Testing Batteries
6. Routine Engine Exercise
7. Keep your Diesel Generator Clean
8. Exhaust system inspection

5.15 Air Compressor

A compressor is a mechanical device that increases the pressure of a gas by reducing its volume. An air compressor is a specific type of gas compressor. As gases are compressible, the compressor also reduces the volume of a gas. There are two compressors in butterfly manufacturing company. Each compressor power is 100 kw. Each compressor produces 8 bar pressure. Its capacity 19.5m^3/Min.

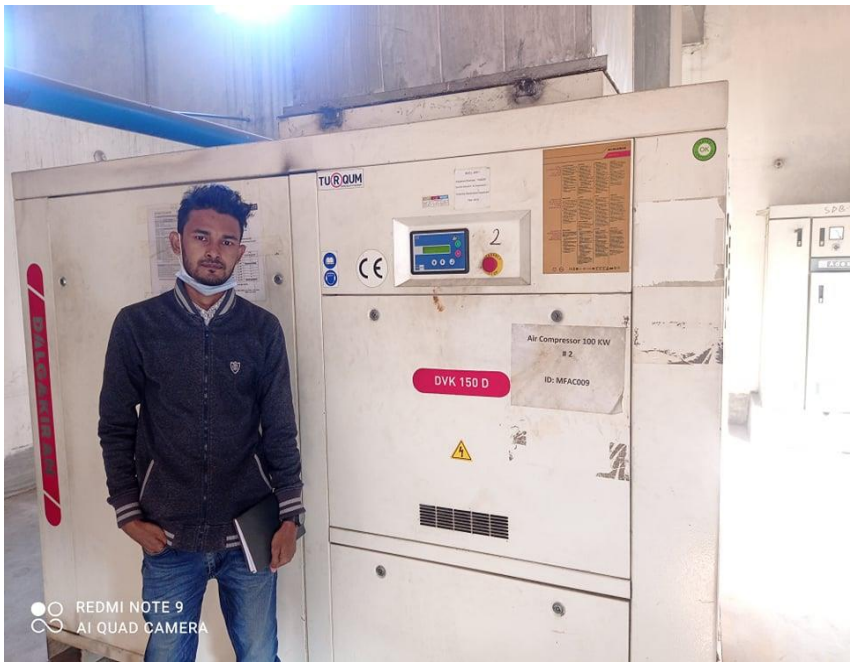


Fig 5.5: Air Compressor 100KW

5.16 Air Dryer

Compressed air dryers are special types of filter systems that are specifically designed to remove the water that is inherent in compressed air. The process of compressing air raises its temperature and concentrates atmospheric contaminants, primarily water vapor. There are 2 air dryers in Butterfly manufacturing company. Each dryer power is 6.2 kw. Its maximum pressure is 16 bar. It connects with 440 V/3 phase/50 Hz.

Fig 5.6: Air dryer 6.2 KW

5.17 Power Distribution Panel Board

A distribution board (also known as panelboard, breaker panel, or electric panel) is a component of an electricity supply system that divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit in a common enclosure. In Butterfly manufacturing company, there are 10 power distribution boards. An electrician can control this board. There is many machine, generator, line and company's all building can control from this power distribution board. safety is the most importance when it comes to working with wires and cables at sub-station. Distribution boards must ensure the following:

- The fuse shouldn't allow overcurrent through the circuitry.
- It should have sufficient space for other wires, fixtures and cables, in addition to its being easy to install as long as it is not close to any water splashes.

- It shouldn't be susceptible to corrosion and should be kept away from fire, particularly in spaces where food is cooked. Follow foolproof ways to ensure that your wiring and cables are of the best quality.

Fig 5.7: Power Distribution Panel Board

5.18 Floor Maintenance System

In Butterfly manufacturing company ltd used many Electrical and Mechanical machine for produce refrigerators. These machines are-

- Side plate machine
- Thermo-forming machine (Door & Body)
- Door press machine
- Door foaming machine
- Gasket machine
- Punching machine
- Inner banding machine
- Body foaming machine

All these machines run on 3 systems. They are-

1. Pneumatic system
2. Hydraulic system
3. Automation system.

Some of these machines are manual and some are automatic. In automation system used PLC. Like siemens, Mitsubishi, Omron, Delta, LS. In this company generally used Siemens & Mitsubishi.

All these machines have many types of sensor. They are-

- Metal sensor
- Photo electric sensor
- Temperature Sensor
- Proximity Sensor.

There are also many types of conveyor belt in line. These are-

- Flat belt conveyor
- Timing belt conveyor
- Roller type conveyor
- Plate conveyor
- Free roller conveyor
- Manipulator Conveyor
- Cargo lift

All this conveyor connected with induction motor. These motor's speed control with VFD (Variable Frequency Driver). There also connect with PLC which drive the line.

5.19 Electric Motor

An electric motor is an electrical machine that converts electrical energy into mechanical energy. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

There are many types of motors. But BMCL used some specific types of motor in different machine and line. All these motors are connected with 3-phase star, delta or star-delta connection. These types of motor are –

- Induction motor
- Synchronous motor
- Servo motor

5.20 Benefits of Maintenance Management System

Effective maintenance management systems consist of four key elements: people, process, a software program, and behavior. The four ingredients, while observing common objectives, combine to improve a company's or facility's effectiveness and bottom line.

- Plan and schedule preventative maintenance
- Manage work orders efficiently.
- Manage spare parts inventory.
- Enhance productivity.
- Reduce downtime and repair costs.
- Increase safety.
- Keep a finger on the pulse of your organization.
- Ensure compliance with regulatory standards.
- Reduce overtime.
- Boosting Financial Performance

Chapter 6
Recommendation & Conclusion

6.1 Recommendation

Butterfly Manufacturing Company Ltd is a well-organized Electrical home appliance company in Bangladesh. During our Internship Program at BMCL we have noted our observations at different area of operations. Basing on that we have some recommendations for further improvement as follows:

- The Energy saving analytical report should be prepared in a monthly basis along with action plan to reduce the energy consumption cost furthermore.
- The exposed power cables should be covered by nonconductive duct to eliminate the electrical hazards.
- For personal safety of Electricians/Technicians there should use personal protective equipment (PPE) during work.
- The diesel fuel drums which kept at Generator room should be removed and an underground fuel tank to be constructed outside near the Generator room & distribute the fuel to Gen set through underground pipe line for safety.
- To maintain the desired ambient temperature of 3MW Electrical Substation at BMCL, there should install minimum two Exhaust Fan to exhaust the heat which generated from 4MVA Transformer.
- Incoming Quality Control of Raw Materials to be improved.
- Automation of material requirement planning and production requirement may be introduced.

6.2 Conclusion

We have spent some excellent days at Butterfly Manufacturing Company Ltd during our internship program. BMCL is one of the best practical ground for the Electrical and Electronic Engineers in our country. We must say the theories that we have learned at our University was practically observed by us at BMCL. Here we learnt about both Electrical and Electronics. We consider us very much lucky to have our internship program with a reputed electrical and electronics company like BMCL. It gave us an opportunity to implement our theoretical knowledge in practically. Our

achievements from BMCL are follows:

- Industrial training provided by BMCL has enriched my practical knowledge.
- It has enlarged our thinking capacity about practical operation of the different equipment.
- It has increased our confidence level for facing job interview in future.
- BMCL gave us a unique experience of observing the equipment of substation.
- The friendly environment in BMCL encouraged us to co-operate with each other. I have learned a lot and got practical knowledge during our internship at BMCL which will help us in future life.

References

- A Text Book of Electrical Technical Technology by B.L Theraja
- https://www.butterflygroupbd.com/about-us
- https://www.dpsi.com/blog/10-advantages-of-using-computerized-maintenance-management-software/
- https://bizfluent.com/list-6830657-benefits-maintenance-management-system.html
- https://finolex.com/different-types-of-electrical-distribution-boards/
- https://en.wikipedia.org/wiki/Electrical_substation
- https://www.toolshero.com/management/materials-management/#:~:text=Materials%20Management%20is%20a%20method,manufacturing%20process%20and%20final%20delivery.
- https://www.sbctc.edu/colleges-staff/it-support/legacy-applications/pms/
- https://asq.org/quality-resources/quality-management-system
- https://circuitglobe.com/working-principle-of-a-transformer.html#:~:text=The%20basic%20principle%20on%20which,induction%20between%20the%20two%20coils.&text=It%20works%20on%20the%20alternating,induction%20between%20the%20two%20windings.
- https://www.electrical4u.com/what-is-transformer-definition-working-principle-of-transformer/
- https://circuitglobe.com/types-of-transformer.html
- https://www.architecturelab.net/types-of-generators/
- https://en.wikipedia.org/wiki/Electric_motor#:~:text=An%20electric%20motor%20is%20an,applied%20on%20the%20motor's%20shaft.
- https://optiware.com/blog/the-importance-of-maintenance-management/