INTERNSHIP REPORT
ON
MANUFACTURING PROCESS OF LEAD ACID BATTERY
OF
RAHIMAFROOZ BATTERIES LTD. (RBL)

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

In partial fulfillment of the requirements for the degree of
Bachelor of Science in Electrical and Electronic Engineering
(B.Sc. in EEE)
Spring 2013

Approved By

_____	_____
Academic Advisor	Department Chairperson
Tahseen Kamal	Dr. Mohammad Mojammel Al Hakim

CERTIFICATE

RAHIMAFROOZ

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December 11, 2012

Ref: HR/NKM/INDST/2012/12

Nahid Hassan Khan
Advisor, Students' Welfare &
Head, Career Counselling Center (CCC)
East West University.

Sub: Industrial Attachment

Dear Sir/Madam,

With reference to your letter dated November 6, 2012 we would like to inform you that management has decided to accept 2(two) of the EEE students for 15 days industrial attachment program in RBL. The program is scheduled to start on December 23, 2012 till January 7, 2013 including Friday. Please note the students will receive an amount of Tk-/ 1000 as remuneration for their 15 days attachment.

The students will be executing their program in pairs in accordance with the dates and location given below. Please be informed, the information/documents received/collected for this industrial attachment program from Rahimafrooz should be kept confidential and used for academic purpose only.

Sl no	Name	ID	Degree/ Major
1	Farhana Akhter Zannat	2009-3-60-008	Electronics /EEE
2	Farzana Hossain	2008-2-86-030	Telecom /EEE

A copy of their industrial attachment report should be submitted to the respective Supervisor/s (nominated by the factory management) before academic submission. The industrial attachment is effective from the date of their joining. If you have any queries, please feel free to contact with the undersigned person.

Thank you,

(Shahina Yasmin)
Manager HR Services & Administration
Rahimafrooz Storage Power Division

cc. HRQ, RPN, HS, JAM

AUTHORIZATION LETTER

We declare that we are the sole authors of this internship report. We authorize East West University to lend this internship report to other institutions or individuals for the purpose of industrial attachment. We further authorize East West University to reproduce this internship report by photocopy or other means, in total or in part, at the request of other institutions or individuals for the purpose of industrial attachment.

_____ _____

Farzana Hossin Farhana Akther Zannat

ACKNOWLEDGEMENT

At the very outset, we wish to convey our heartfelt gratitude to almighty Allah for His help to complete the internship successfully. We also thank the management of Rahimafrooz Batteries Ltd. for providing us with such opportunity to accomplish our industrial training in Rahimafrooz Batteries Ltd. (RBL). We would specially like to thank Engr. S. M. Shamsul Farhan of RBL who helped us to approve our internship application.

We want to thank all who helped to complete our internship successfully. In this process our special thanks go to Engr. Subir Kumar Das (Engineering and Technical department), Engr Shah Muntasir Mamun (Assebly department) and Engr. Saifuddin Mahamood (Plate Preparation department) who coordinated our internship program and helped us to get acquainted with other engineers. They helped us to learn the scheduled topic which was present in our internship training schedule. We also want to thank each and every employee of RBL for their continual support.

We would also like to mention the name of Dr. Mohammad Mojammel Al Hakim, Chairperson and Associate Professor of the Department of Electrical and Electronic Engineering, East West University (EWU) for his support and encouragement throughout the period of our internship.

We would like to give our gratitude to our honorable supervisor Ms. Tahseen Kamal, Senior Lecturer, Department of Electrical and Electronic Engineering, East West University (EWU) for giving her valuable time for us to complete this report successfully.

We also want to thank our parents and all of our friends for their moral support and their helpful discussion during this work.

EXECUTIVE SUMMARY

We completed our internship at Rahimafrooz Batteries Ltd. (RBL) located at West Panisail, Zirani Bazar, Gazipur, Dhaka from 23rd December, 2012 to 8th January, 2013 (including Friday) and this internship report is the result of those 15 days attachment with the Rahimafrooz Batteries Ltd. (RBL). During our internship period we gathered practical experiences on topics related to lead acid battery production, different mechanical equipment which we have theoretically learned in Electrical Machine and Renewable Energy courses. In this report we have focused on the manufacturing process of lead acid battery which is manufactured in Rahimafrooz Batteries Ltd. (RBL).

Rahimafrooz Batteries Ltd. (RBL) manufactures around 200 types of automotive and customized industrial batteries. With the help of the factory engineers we observed the production floor of different sections, different machines such as grid casting machine, lead oxide mill, pasting machine etc. and understood the manufacturing process of the lead acid battery.

We acquired knowledge about various types of batteries, charging and discharging process of lead acid battery, manufacturing process of lead acid battery and were introduced with different machines such as plastic molding machine, curing oven, Positive Dry Oven (PDO), Inert Gas Oven (IGO) etc.

TRAINING SCHEDULE

We completed our internship at Rahimafrooz Batteries Ltd. (RBL) from 23rd December, 2012 to 8th January, 2013 (including Friday). Each day we worked from 8 AM to 4 PM. Table 1 represents the training schedule of RBL.

Table 1: Internship Training Schedule at RBL.

Day	**Topic**	**Trainer**
Sunday 23.12.2012	Overview of the Factory.	Engr. Md. Abdur Raquib Head of Supply Chain
Monday 24.12.2012	Overview of Smelting Section.	Engr. Md. Rafiqul Haque Production Officer
Wednesday 26.12.2012	Overview of Engineering and Technical Section.	Engr. Subir Kumar Das Manager, Engineering and Technical
Thursday 27.12.2012	Overview of Plastic Molding Section.	Engr. Abu Nasar M. Abdullah Senior Executive
Friday-Tuesday 28.12.2012- 01.01.2013	Overview of Plate Preparation Section.	Engr. Saifuddin Mahamood Senior Executive
Thursday-Saturday 02.01.2013- 04.01.2013	Overview of Assembly Section.	Engr. Shah Muntasir Mamun Executive, Production
Sunday 05.01.2013	Overview of Quality Assurance Department.	Engr. S. M. Shamsul Farhan Manager, Quality Assurance
Tuesday-Wednesday 07.01.2013- 08.01.2013	Overview of Maintenance Section.	Engr. Golam Quddus Manager, Maintenance

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Chapter 1 : INTRODUCTION

Rahimafrooz Batteries Ltd. is the largest lead acid battery manufacturer in Bangladesh. We got the opportunity for doing internship at Rahimafrooz Company under Rahimafrooz Batteries Limited (RBL) in spring semester of 2013. We started our internship on 23rd of December, 2012 and completed on 8th of January, 2013 including Fridays. In Rahimafrooz Batteries Limited, we have gathered the practical experience about the manufacturing process of different types of batteries and battery manufacturing mechanisms. Before this internship we had only theoretical knowledge about the manufacturing process of lead acid battery but during internship at Rahimafrooz Battery Limited, we had the opportunity to get practical experience about the manufacturing process of lead acid battery and also got the chance to observe the industrial environment.

1.1 Objective of Internship

The objective of this internship was to acquire practical knowledge and hand on experience in electrical and power section. According to the guideline which was provided by the EEE department of East West University, the internship can be viewed as a two part project. Firstly, we spent fifteen days at RBL to learn practically about the manufacturing process of different types of batteries, equipment of battery, battery manufacturing machines, mechanisms. Secondly, after completion of this training program, we have prepared a report which represents our experiences regarding the function of manufacturing battery, power generating equipment, battery production and protection of RBL.

1.2 Scope

This report is based on the internship program where we have reviewed the basic manufacturing process of different types of batteries of RBL. It also contains uses of various mechanical and electrical equipment which are used to manufacture battery, generate and distribute power. It also contains other relevant information about RBL which we have gathered during the internship program.

1.3 Methodology

This report is prepared on the basis of knowledge that we gained during our internship period. Some data are gathered by using company website and online sources. Major source of information is the engineers of RBL. We have also collected some production related information from the workers of RBL.

1.4 Report Organization

We have described our experiences of internship in this report. We have discussed about the manufacturing process of battery and the activities of all production sections of RBL. In chapter 1 we have described the objective, scope and methodology of our internship. The historical backgrounds of RBL, mission, vision and plant capacity are described in chapter 2. In chapter 3 we have discussed the procedure of hard lead and lead alloy preparation in smelting section. The basic properties of battery, the purposes of grid design and the chemical reactions of battery are described in chapter 4. In chapter 5 the process of manufacturing plastic container, cover and the uses of some parts of plastic molding machine are discussed. The process of preparing pasted plates, the process of charging and parting pasted plates in plate preparation are described in chapter 6. In chapter 7 the steps of assembling battery in assembly section are discussed. Quality assurance department tests the different materials of battery and finished battery which are described in chapter 8. In chapter 9 the activities of maintenance section such as maintenance and calibration of machines, process of filtering natural air and oxygen filtering are discussed. Safety precautions and the rules of maintaining battery are described in chapter 10. In chapter 11 we have discussed the summary of our internship.

Chapter 2 : COMPANY PROFILE

Rahimafrooz Batteries Limited (RBL) started its journey in the year of 1980 as Lucas Service Limited. It is situated at West Panisail, Zirani Bazar, Gazipur. RBL is one of the largest lead acid battery manufacturers in Bangladesh.

2.1 Mission and Vision

Every company has its own mission and vision. RBL is trying to grow the battery market by influencing and actively developing selected target markets. The goal of the RBL is to maintain leading position in battery industry and it will be done by enhancing their value through guaranteed performance, high efficiency, and unique operational flexibility. The mission of the company is to make different factories for industrial batteries, motorcycle batteries, automotive batteries, and appliance batteries and also to make their industrial network stronger to get the leading position of all over the world.

2.2 History

The Rahimafrooz started its journey in early fifties when Late Mr. A. C. Abdur Rahim founded a small trading company [1]. Today this group has seven operating companies, three other business ventures, and a non-profit social enterprise. Around 200 different types of automotive and customized industrial batteries are manufactured in RBL [1]. Rahimafrooz company achieved both International Organization for Standardization 9001 (ISO 9001) and International Organization for Standardization 14001 (ISO 14001) standards. Moreover to ensure occupational health and safety of the employees, company is now implementing Occupational Health and Safety Management System 18001 (OHSAS 18001) standard. Figure 2.1 shows the entrance of RBL.

Figure 2.1: Entrance of RBL [2].

2.3 Plant Capacity

Rahimafrooz has many manufacturing plants. RBL produces different types of batteries to meet the local and international market. Its capacity in automotive battery is 660,000 (N50) units per annum [1]. All the products are manufactured by following strict quality and environmental standards. Their main product ranges are as follows.

- Appliance battery,
- Deep cycle - Flat plate battery,
- Instant Power Supply (IPS) and Uninterruptible Power Supply (UPS) batteries,
- Automotive battery,
- Industrial batteries and
- Motorcycle Battery.

Figure 2.2: Trademarks of all batteries [1].

The manufacturing plants of the company produce a range of products - automotive, motorcycle, appliance batteries, industrial (stationary, deep cycle, traction) batteries, IPS and UPS batteries and rectifiers. Lucas and Spark are the leading names in the local automotive battery market while VOLTA, OPTUS and DELTA are gaining equity as international brands which are shown in Figure 2.2.

2.4 Management System

At RBL two management systems are maintained. One is Quality Management System (QMS) and another is Integrated Management System (IMS).

2.4.1 QMS and IMS

QMS means Quality Management System which maintains ISO standard. In Figure 2.3, we can see the steps of QMS.

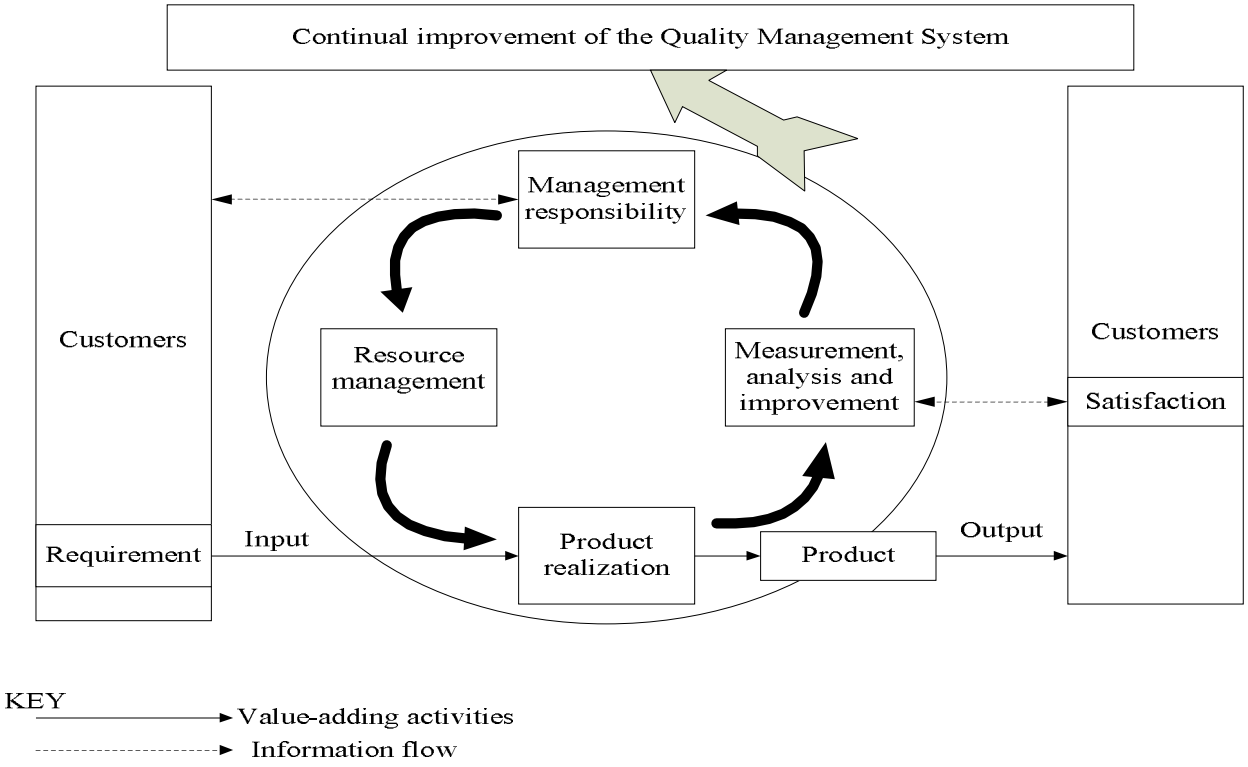


Figure 2.3: Flow diagram of Quality Management System (QMS).

IMS means Integrated Management System which maintains Environmental Management System (EMS) and OHSAS standard. In Figure 2.4, we can see the steps of IMS.

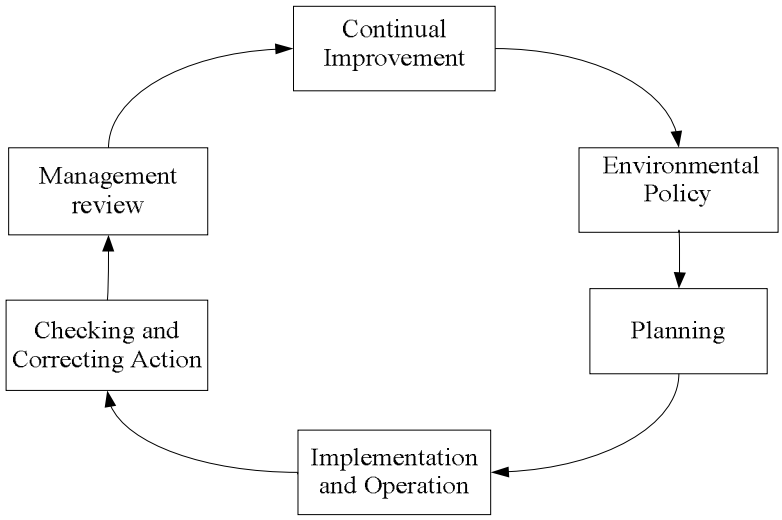


Figure 2.4: Flow diagram of Integrated Management System (IMS).

2.4.2 Planning and Coordination

Yearly productions or business planning and coordination are done in this section. In Figure 2.5, we can see the monthly flow chart of planning and coordination system.

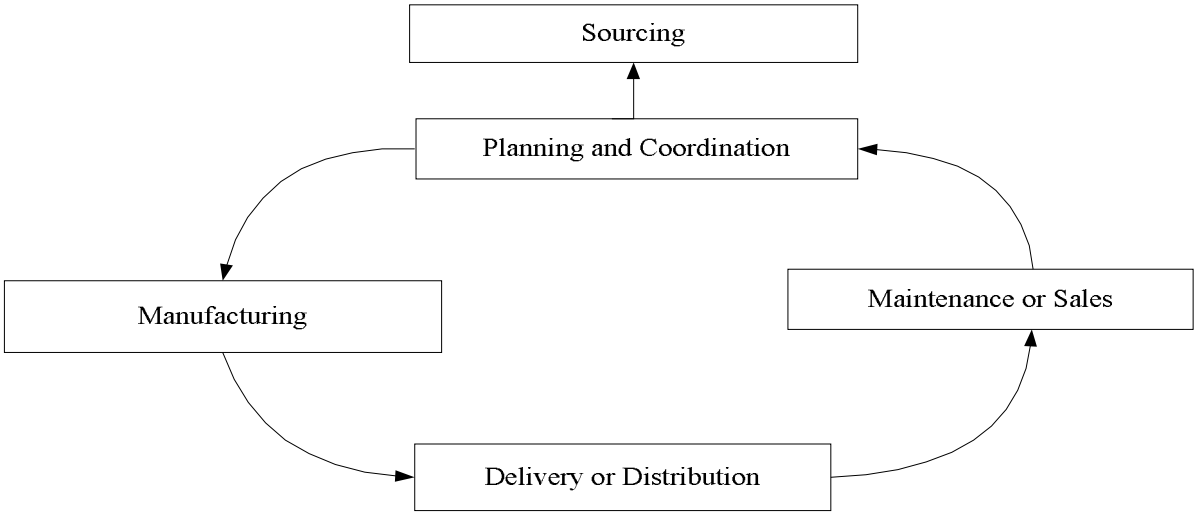


Figure 2.5: Flow chart of Planning and Coordination System.

2.4.3 Warehouse and Logistics

Every company has a warehouse and logistics. RBL also has a particular warehouse and logistics room. All sorts of raw materials for manufacturing batteries are stored and received in this section. The finished products and exportable products are stored here. All sorts of deliverable products are also stored in this section.

2.4.4 Supply Chain

Head of supply chain maintains all the working process of the RBL. The development of a company depends on supply chain planning. The head plans the yearly target and at the end of the year he or she takes the decision how the company will run and how the company will get profit. All the members of this company always follow the company rules and regulation which is provided by the head of supply chain.

Chapter 3 : SMELTING SECTION

Smelting section is a part of Rahimafrooz Storage Power Division (RSPD). RSPD has a Lead Management department (LM) which controls and manages the product requirements of local lead and imported lead. In Lead Management department (LM), there are three sections, Lead Recycle Battery (LRB), Use Battery Collection (UBC), and Battery Breaking Center (BBC) where LRB section recycles the lead batteries, UBC section collects old used batteries, and BBC section breaks the old batteries. In smelting section, the lead is collected from LM department, then it recycles the collected lead bar to get the hard lead. The required lead alloy is prepared by the hard lead. In this section, there is a dust collector section to reduce the environment pollution.

3.1 Procedure of Hard Lead and Lead Alloy Preparation

Hard lead and lead alloy is prepared in smelting section. In this section the capacity to produce the hard lead is 250 metric ton and the lead alloy is 500 metric ton. Raw materials are old lead, recycling dross, primary dross, unused plate, scrap plate and the chemical component are charcoal, soda ash (Na_2CO_3), iron chips, flour spar (CaF_2). Both raw materials and chemical compounds are put into rotary furnace by charging machine which is shown in Figure 3.1. These materials are melted at 1200˚C temperature in rotary furnace by gas burner for two hour. Then the primary dross (lead wastage) part is stored as a layer in upper part and melted lead is stored in the lower part of the rotary furnace. Then manually melted lead are taken out from the rotary furnace through the unload mouth by the help of ladle and reserved in different pots. In hard lead there have 99.5% lead and 0.5% have different materials in different percentages.

(a) (b)

Figure 3.1: Hard Lead Preparing Machines. (a) Charging Machine. (b) Rotary Furnace [2].

In Figure 3.2, we can see the lead alloying furnace A and unloaded lead alloy. There are four alloying furnaces such as furnace A, furnace B, furnace C, furnace D which are used for

preparing lead alloy and working principle is almost same in four alloying furnaces. These four alloying furnaces do not work at same time.

Figure 3.2: Lead Alloying Furnace A and Unloaded Lead Alloy [2].

Above 1081 kg hard lead is put into the alloying furnace A or D at 450˚C temperature to get required antimony or lead alloy. When the product is perfect according to the Optical Emission Spectrophotometer (OES) test, the melted alloy is unloaded and it takes eight hours. Then the final lead alloy is prepared where pure lead is 99.97% and it is preserved. Figure 3.3 shows the steps of hard lead and lead alloy preparation.

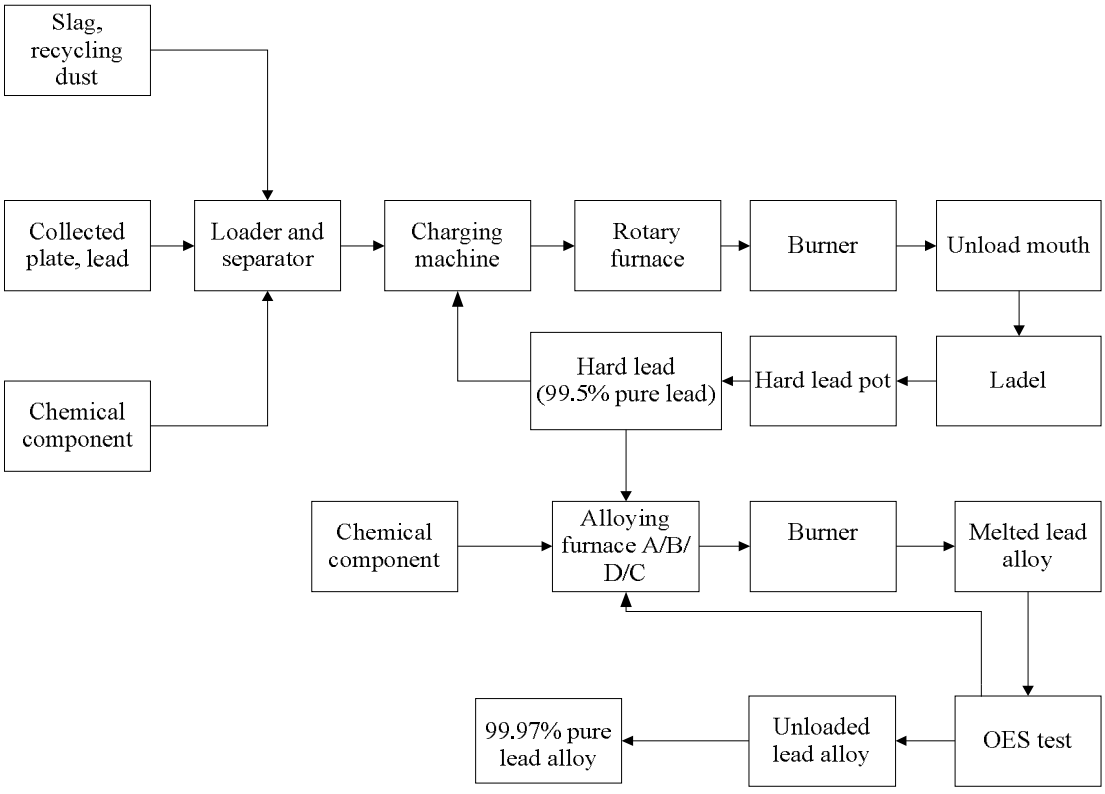


Figure 3.3: Flow chart of Hard Lead and Lead Alloy Preparation.

3.2 Impurities Testing and Removing

Quality Assurance department tests the product impurity and gives a required product data sheet to the Smelting section. Then the smelting section removes the product impurity by four alloying furnaces. According to data sheet, to get required lead alloy the tested hard lead, lead alloy and the essential chemical compounds are put again in the alloying furnace. Ammonium chloride (NH_4Cl) is mixed with the lead alloy in alloying furnace at 340˚C temperature to reduce nickel (Ni), tin (Sn) and iron (Fe). At 550˚C temperature, caustic soda and sodium nitride is mixed to reduce antimony, bismuth, arsenic and at 330˚ C temperature, sulphar is mixed to reduce copper (Cu).

3.3 Dust Collector Section

Now a days lead acid batteries are very popular and the demand is also increasing day by day. But lead and acid both are harmful for environment and human. To reduce the pollution and to save the human, RBL has a dust collector section in smelting section, where the dust is collected by the dust collector and fume is gathered in fumigation bag house which are shown respectively in Figure 3.4(a) and Figure 3.4(b).

(a) (b)

Figure 3.4: Dust and Fume Collector. (a) Dust Collector. (b) Fumigation Bag House [2].

At first all dusts are stored in dust collector through blower. Large size solid dust is stored in dust collector, then the medium size solid dust is stored in cooling tower by cyclone which are shown in Figure 3.5 and small size dust is stored in bag house-1.The bag house-1 and bag house-2 suck the dust, then fresh air blows out through air chimney. All fume dusts are filtered by the fumigation bag and fresh air blows out through air chimney. All solid dusts are put in the wet scrubber tank by the motor, then water flows over the dust and weighted materials are stored under the tank. Then the collected solid dusts are reused in smelting section.

(a) (b) (c)

Figure 3.5: Dust Filters. (a) Cyclone. (b) Cooling Tower. (c) Bag House-1 [2].

We can see the step by step process of dust collection in the smelting section in Figure 3.6.

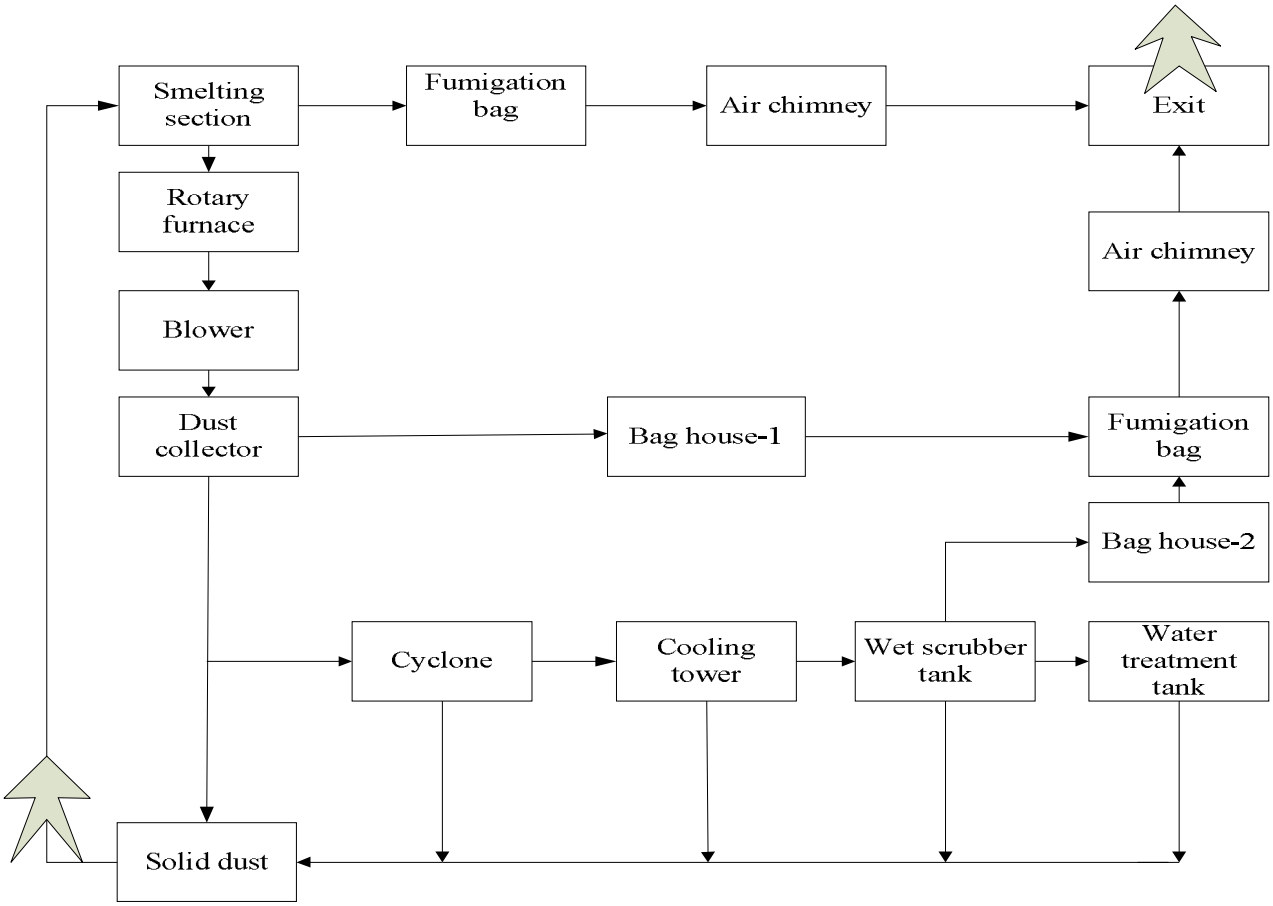


Figure 3.6: Flow chart of Dust Collector Section.

Chapter 4 : ENGINEERING AND TECHNICAL SECTION

The main purpose of Engineering and Technical section is to develop, improve, analyze and design the cell of battery. New technology cannot apply without permission or approval of this section in RBL. This section mainly works on design development, new technology, new innovation, new thought product, market product analysis, machine specifications of production floor, process parameters, production ingredients, running parameters etc.

4.1 Battery Properties

Basically battery is of two types, primary and secondary. Primary battery has dry cell which is not rechargeable and secondary battery is rechargeable. RBL mainly manufactures rechargeable secondary batteries which are prepared by lead and sulfuric acid. (95- 98)% leads are found from the old unusable lead acid batteries by recycling. These batteries are easy to maintain, less expensive than others and have low self discharge rates. But these batteries are bulky and heavy.

4.1.1 Basic parts of Lead acid Batteries

Lead acid battery is the most popular battery all over the world because of its recyclability, flexibility and casting efficiency. Here, some basic parts of lead acid batteries are described.

4.1.1.1 Antimony

Antimony is a poisonous chemical compound but it is very essential element to make lead acid batteries. Without antimony, lead cannot be formed as solid. Grid is an important part of lead acid batteries. 3.2% antimony lead are used to prepare grid and also used in small parts section where bush pin, inter, middle and angle post are manufactured.

4.1.1.2 Cell

A typical lead acid battery is organized into cells. Generally a lead acid battery has six cells and each cell normally produces 2.1 V. Each cell contains multiple positive and negative plates with electrolyte.

4.1.1.3 Plates

Two types of plates are used in battery cells. Positive plates are made of antimony covered with active layer of lead di oxide (PbO_2). Negative plates are made of lead covered with active layer of sponge lead (Pb).

4.1.1.4 Separators

In a cell, plates are separated by thin insulators. Insulators allow the electrolyte to pass freely between the plates and it separates the negative and positive plate from touching each other to remove short circuit.

4.1.1.5 Electrolyte

The electrolyte is a mixture of sulfuric acid (H_2SO_4) and water (H_2O). The electrolyte creates chemical bond with active materials of the grid to generate electrical pressure which produce the voltage.

4.1.1.6 Battery Case

The battery case holds and protects all of the internal components and also contains the electrolyte. A container should be sealed and should have the capacity to remove electrolyte leakage.

4.1.1.7 Vent Cap

Vent cap releases hydrogen gas when the battery charges. Some vent caps are attached with battery and some are not attached with battery.

4.1.2 Battery Function

The basic functions of a battery are starting, running and turning off engine. Battery provides energy to operate lights and accessories and to start the engine. It also services as voltage stabilizer to protect voltage sensitive circuits and particularly digital circuits. It is the main source of electrical energy in vehicles. Battery powers some major electrical systems which are:

- Starting,
- Ignition,
- Charging,
- Lighting and
- Accessories.

4.2 Basic Purpose of Grid Design

Engineering and technical section designs the grid based on material property, electrical conductivity. Then they plot the battery model using MATLAB and then test it electrically. Grid mesh is designed based on hold active material, conduct current, casting ability and strength.

4.2.1 Hold Active Material

Hold active material means the grid should have the capacity to hold the pasting materials. Otherwise the charging and discharging process should not occur properly and the battery could not store the energy.

4.2.2 Conduct Current

Grids work as a conductor in a cell. To get good conductivity, mesh density is kept high in lug side because wires are always connected with grid lug and current enters and outs through the grid. So, radial mesh is more preferable for grid design. It also depends on grid thickness and active materials. If the thickness of grid is thin and grid has less active material then rectangular mesh design is more preferable than radial mesh design.

4.2.3 Casting Ability

Melted lead is poured on the mold of grid casting machine. It should be flown uniformly toward the top to bottom path with same rate. There should have enough places for deposition otherwise it makes a cold joint. This joint will be opened at first in its service life and current flow will be stopped. Paths are created to think all about these and entire these things depend on casting ability of a grid mesh.

4.2.4 Strength

Strength is an important part of grid designing. There are two types of strengths, cycling strength and operational life strength. A grid that has both types of strengths is considered proper for designing battery.

4.2.4.1 Cycling Strength

Cycling strength means the grid can perform repeatedly in the same cycle. Charging and discharging happen in a cycle in service life. As a part of this, heat is produced and the grid is expanded. When the grid is cooled down, it is contracted. For this reason if this grid does not have enough strength then the interconnection of the grid will be damaged. This will cause shorter service life.

4.2.4.2 Operational Life Strength

In operational life, the grid should have the paste holding ability otherwise when the active material are pasted on the grid, it will not hold the active materials and it could be bent when it

put on the pasting machine. This strength is called operational life strength. It should have the hanging capacity otherwise it cannot stay in skid. The grid should have the strength to align properly otherwise it could not assemble in a cell properly.

4.3 Charging and Discharging Properties of a Battery

The function of lead acid battery is fully based on simple chemical reaction. When two dissimilar metals are immersed in an acid solution, the electric energy converts into chemical energy and produced a voltage. Lead acid batteries are charged and discharged based on this simple reaction.

4.3.1 Fully charged

During fully charged position of the battery, positive plates are covered with lead dioxide (PbO_2) and negatives plates are covered with spongy lead (Pb). Electrolyte contains water (H_2O) and sulfuric acid (H_2SO_4).

4.3.2 Discharging

During discharged position of the battery, current flows in the cell from the negative to the positive plates. Electrolyte separates into hydrogen (H_2) and sulfate (SO_4) and the free sulfate combines with the lead (both lead dioxide and spongy lead) and becomes lead sulfate ($PbSO_4$). At last the free hydrogen and oxygen combine to form more water for diluting the electrolyte.

4.3.3 Fully Discharged

During fully discharged position of the battery, both plates are fully sulfated and electrolyte is almost diluted to the water.

4.3.4 Charging

During charged position of the battery, the chemical reaction is reversed that took place during discharging. Sulfate (SO_4) leaves the positive and negative plates and combines with hydrogen (H_2) to become sulfuric acid (H_2SO_4). Hydrogen bubbles form at the negative plates and oxygen (O_2) appears at the positive plates. Free oxygen (O_2) combines with lead (Pb) at the positive plate to become lead dioxide (PbO_2).

4.4 Emf Calculation

The lead acid battery is one of the most common batteries which is used in automobiles. A 12 V automotive battery consists of six cells which are connected in series. If six cells individually

produce 2.1 V then the total volt for series connection is 6 * 2.1 = 12.6 V a battery can produce. The cathode of each cell consists of lead dioxide (PbO_2) and the anode of each cell is consisted by lead. Both electrodes are submerged into sulfuric acid. Figure 4.1 represents the chemical reaction of electrodes during the discharging period.

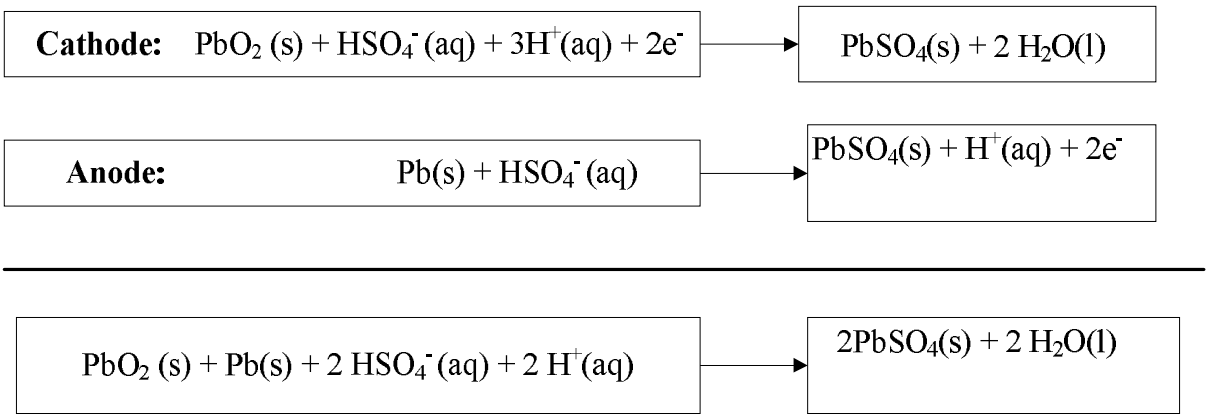


Figure 4.1: Chemical reactions of electrodes in lead acid battery.

The standard cell potential can be obtained from the standard reduction potentials is

$E^{\circ}_{cell} = E^{\circ}_{red}$ (cathode) - E°_{red} (Anode)

= (+ 1.685 V) - (- 0.356V)

= + 2.041 V.

4.5 Natural Death of Battery

Natural death of a battery depends on positive plates of a battery. Batteries are charged in the formation. During the charging time, active layer of lead dioxide (PbO_2) is made in the positive plates and an active layer of sponge lead (Pb) is made in negative plates. The positive plate is highly corrosive, so all surface active materials of positive plates form lead dioxide (PbO_2). After a certain time, the positive plates are totally corroded. It is called the natural death of batteries.

Chapter 5 : PLASTIC SECTION

Plastic materials of different types of batteries are manufactured in Plastic Section. According to customer demand many types of containers and covers are prepared in this section. Labeling and printing on the containers are also managed in this section according to batteries type and customer demand. Some plastic instruments like polypropylene, colorful pigment are imported from foreign countries. Plastic are two types, thermostat plastic and thermosetting plastic. Thermostat plastics are recyclable, so, battery container, cover and vent plug are prepared by thermostat plastic. Electrical equipment are prepared by unrecyclable thermosetting plastic.

5.1 Plastic Containers and Cover Types

At RBL different types of batteries are manufactured, so different containers and covers are needed which are shown in Figure 5.1. In motorcycle batteries, small size containers and small raised covers, in IPS batteries, medium size containers and medium raised or dome covers, in mini bus or truck batteries, large size containers and large covers are used. Here, the containers and covers of old batteries are collected and reused these to make new container and cover.

Figure 5.1: Containers of polypropylene and covers of colorful pigment [2].

5.1.1 Types of Containers

There are various types of plastic containers manufactured in plastic section. These are:

- NS40,
- N40,
- N50,
- N70,

- 6X15,
- 6XT15,
- N100,
- N120,
- N150,
- N200 and
- EV 120.

Here, NS40 is smallest type container and N200 is largest type container which are manufactured in this factory. Others necessary containers and smaller than NS40 or larger than N200 containers are not manufactured in this factory, those are imported from others countries.

Some containers are imported from other countries which are called DIN type containers. They are:

- DIN 44,
- DIN 88,
- DIN 45 and
- DIN 46.

5.1.2 Types of Covers

Mainly three types of covers are manufactured in this factory such as coin flash, dome and raised cover. Coin flash and dome cover are made for coin flash vent plug and raised cover is made for raised vent plug.

5.1.2.1 Coin Flash Cover

This cover is manufactured to set up the coin flash vent plug and it is used in exportable battery. Coin flash cover is better than raised cover and it is expensive than raised cover batteries.

5.1.2.2 Dome Cover

Dome cover looks like a coin flash cover but its height is small bit larger than coin flash cover. It is used in different types of car batteries. Coin flash vent plug is used in dome cover.

5.1.2.3 Raised Cover

This type of cover is manufactured to set up the raised vent plug, so this cover is called raised cover. This type of cover is used in local battery container like IPS, motorcycle battery etc.

5.2 Uses of Plastic Crusher and Mixture Machine

Old and unusable plastic covers, containers are broken by the different crusher machines. Containers are broken in the crusher machine-1 which is shown in Figure 5.2(a) and colorful covers are broken in the crusher machine-2 which is shown in Figure 5.2(b). White polypropylene and crushed plastic are mixed in the mixture machine which is shown in Figure 5.2(c). In this way unused plastics are reused to prepare new plastic container.

(a) (b) (c)

Figure 5.2: Plastic Crusher & Mixture Machines. (a) Crusher Machine-1. (b) Crusher Machine -2. (c) Mixture Machine [2].

5.3 Uses of Parts of Plastic Molding Machine

Using different mold inside the plastic molding machine, different plastic parts of battery is manufactured here.

5.3.1 Vacuum Suckers

Vacuum sucker sucks plastic raw materials and passes them in the hopper part of the plastic molding machine which is shown in Figure 5.3. One side of this vacuum sucker is connected with the hopper and another side is kept on the mixture drum.

Figure 5.3: Vacuum Sucker [2].

5.3.2 Hopper

Hopper is a receiver where all types of plastics are stored and melted for making plastic instrument for the battery. Plastics are sent here by vacuum suckers and auto loader machine. Sometimes manually plastics are kept here. Plastic are melted here by heat.

5.3.3 Auto Loader Machine

In plastic molding machine plastic raw materials are sent in the hopper by auto loader machine which is shown in Figure 5.4. There is a regulator which regulates the amount of raw material that is needed to fill up the hopper. When the hopper is filled up with the plastic raw material, the auto loader machine automatically shuts down. When the machine needs more raw materials, the auto loader machine automatically turns on and fills up the hopper according to the requirement.

Figure 5.4: Auto Loader Machine [2].

5.3.4 Cooler Machine

Cooler machine cools the molds and injection unit of the plastic molding machine and also helps to cool the container, cover and vent plug in the molding machine. Figure 5.5 shows a cooler machine which is connected with a water tank. This water tank is located outside the plastic section.

Figure 5.5: Cooler Machine [2].

5.4 Manufacturing Plastic Container and Cover

Plastic container is prepared by polypropylenes. Only 10% recycled polypropylenes (crushed plastic) are mixed with imported polypropylenes to prepare the plastic container. The container manufacturing machine is shown in Figure 5.6.

(a) (b)

Figure 5.6: Plastic Cover Molding Machine. (a) Inside of Machine. (b) Outside of Machine [2].

The mold of plastic cover manufacturing machine is different from the mold of container manufacturing machine. Polypropylenes are mixed with different amount of colorful pigment to manufacture different color plastic cover. Table 2 shows the amount of polypropylenes and pigment which are used to prepare the covers of different colors.

Table 2: Amount of polypropylenes and pigments for different colored covers.

Serial No.	Cover and Pigment Color	Amount of Polypropylenes (kg)	Amount of pigments (gm)
1	Red	25	600
2	Blue	25	800
3	Green	25	600
4	Yellow	25	400
5	Bottle Green	25	1000
6	Black	25	400

Only 25% recycled polypropylenes are mixed with imported colorful pigments to prepare the plastic container cover. The container manufacturing machine and the cover manufacturing machine mold are not same but the production processes are almost same. Figure 5.7 represents the flow process of manufacturing plastic containers and covers.

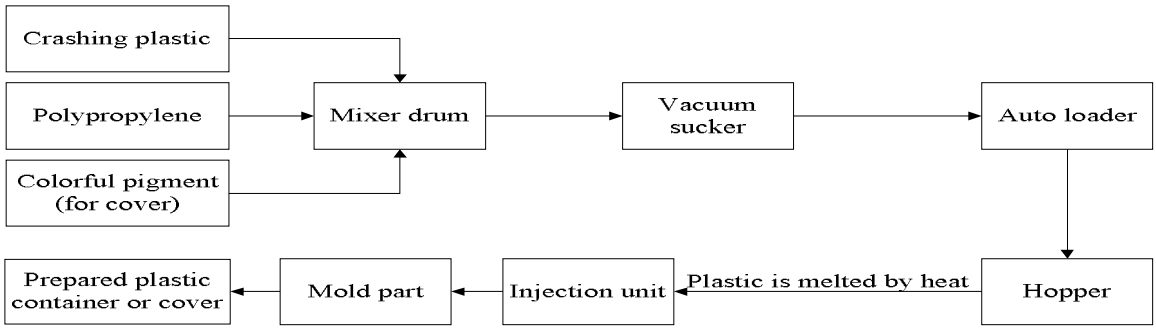


Figure 5.7: Process of Manufacturing Plastic Container and Cover.

5.5 Manufacturing Vent Plug and Bush Pin

Vent plugs are manufactured in small production machine. Different types of vent plugs and inside of vent plugs are shown in Figure 5.8.

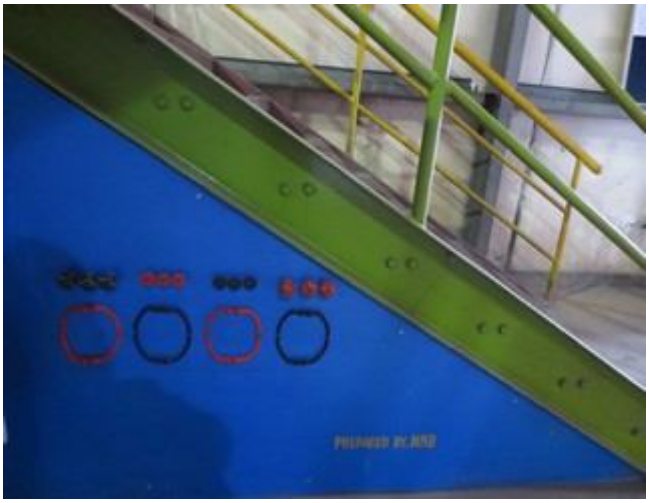


Figure 5.8: Different types of Vent Plugs [2].

There are two types of vent plugs. They are:

- Raised vent plug - It is used in local battery and it is easy to use than coin vent plug.
- Coin vent plug - It looks like a coin shape, so it is called coin vent plug. Coin vent plug is used in exported exclusive batteries. Coin vent plug is better than raise vent plug.

Bush pin is prepared in small part section. 3.2% antimony lead alloy is used to prepare bush pin. Lead are melted in lead pot and manually poured into the mold part of the terminal bush machine. Then the terminal bushes are prepared by the terminal bush machine which is shown in Figure 5.9.

Figure 5.9: Terminal Bush Machine [2].

5.6 Labeling and Printing

According to the battery type and customer demand, container labeling and printing are also managed in the plastic section. Normally, the labeling and printing of the container are done according to the battery type or battery name or company name. But some time customer order different labeling and printing. This type of order is also managed in this section. Figure 5.10 shows the labeling and printing of the batteries.

Figure 5.10: Labeling and Printing of Container [2].

Chapter 6 : PLATE PREPARATION SECTION

The plates of cells are prepared and managed in this section. Plate is the most important part of a battery. The plate preparation processes is most critical and creative process of RBL. This process needs many times. Plates are prepared in different steps which are briefly described in this section.

6.1 Grid casting

Different sizes and types of grids are prepared in grid casting machine. Different quantities of antimony lead are used to prepare the grid. Grid machine has different parts where lead alloy is melted first then it is poured in the mold part where grids are formed. Then it is sent to the cutter to cut the scrap part. Then the final grids come out from the machine by conveyer belt. The grid casting machine is shown in Figure 6.1.

Figure 6.1: Grid Casting Machine [2].

6.1.1 Parts of Grid Casting Machine

There are different parts of grid casting machine. The working process of some parts of the grid casting machine are explained here.

6.1.1.1 Lead Pot

Lead pot is used to melt the lead where certain temperature is needed to melt the lead. Here, (455-480)˚C temperature is needed which is generated by gas burner or electric heater. A lead pump is used to transfer the liquid lead to the ladle through feed line and dispense valve.

6.1.1.2 Feed Line

It is a cylindrical shaped supply line which is used to transfer the melted lead to the dispense valve. Here, 4000 watt, 3000 watt and 1500 watt electrical heaters are used to heat the feed line to keep the temperature at a desired level and to prevent the liquid lead from turning into solid.

6.1.1.3 Lead Dispense Valve

It is used to ensure the accurate distribution of melted lead from feed line to ladle.

6.1.1.4 Ladle Part

Ladle pours certain amount of melted lead to the mold. In ladle, there are a gas burner and a heater to maintain certain temperature which is monitored on a display board.

6.1.1.5 Mold Part

The main function of the mold is to form a solid grid from melted lead. This mold part has two parts, namely fixed part and movable part. Both parts have individually two heaters to maintain the even temperature in the mold. The movement of the mold is controlled by the limit switch, solenoid valve. There are some pins in fixed mold to detach the grid after preparing the grid.

6.1.1.6 Grid Transport

The formed grids are sent to the transfer rulers through transfer belt. Then the grid is transferred to the cutter to cut the unexpected part or scrap part. Then the scrap part is sent to the lead pot by conveyer belt and prepared grid is come out by another conveyer belt.

6.2 Lead Oxide Preparation

99.97% pure lead is used to manufacture lead oxide. Following steps are done for lead oxide preparation.

- In cylinder casting machine melted leads are formed in cylindrical shapes where diameter of the cylinder is 18 millimeter and length is 18 to 22 millimeter. Cylinder casting machine is shown in Figure 6.2(a).

(a)

(b)

Figure 6.2: Lead Oxide Preparation. (a) Cylinder Casting Machine. (b) Lead Oxide Mill [2].

- Small shape cylinders are stored in the silo through elevator bucket. These cylinders need 16 hours to get cooled. Silo is shown in Figure 6.2(b).

- Cylinders are formed as lead oxide powder (PbO) in ball mill which is shown in Figure 6.2(b).
- The lead oxide powder is filtered by cyclone filter and the produced powder is stored in the output bag where a weight sensor is connected which measures the weight of the lead oxide powder. Weight Sensor is shown in the bottom part of right side in Figure 6.2(b).
- When the bag is filled up with 50 kg PbO then the gear light is automatically turned off. Then the lead oxide is preserved in the shelf. Its shelf life is one month.

The flow diagram of lead oxide preparation is shown in Figure 6.3.

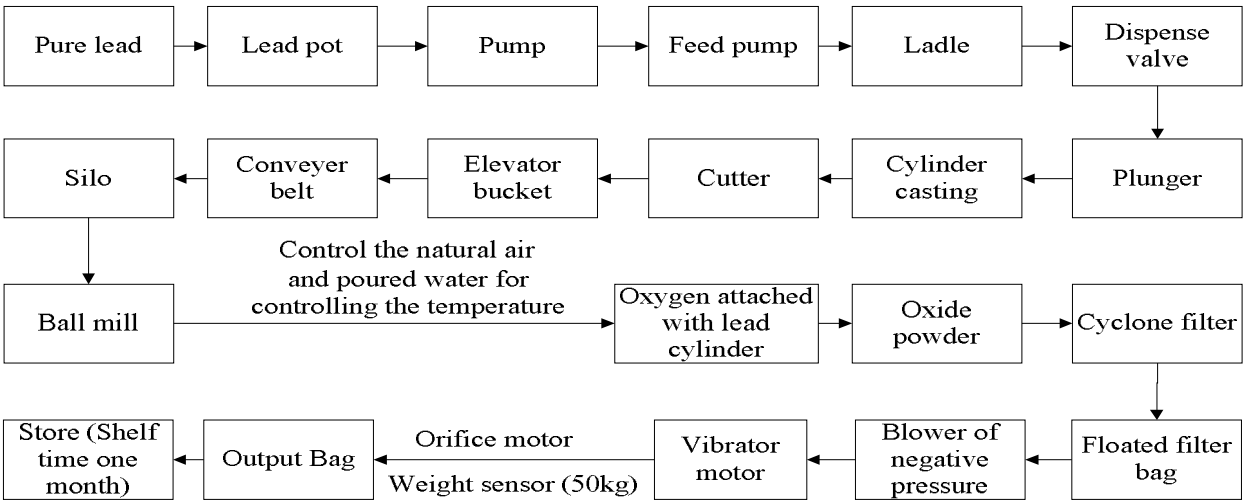


Figure 6.3: Block diagram of Lead Oxide Preparation.

6.3 Pasting

Pasting is a most important part of plate preparation. Active material for grid which is mainly creating reaction in a cell that is prepared in this section. Different types of active materials are prepared for different types of positive and negative plates. Positive paste is made for positive plate and negative past is made for negative plate. These active materials are pasting both side of the grid to prepare pasted plate.

6.3.1 Paste Mixing

Different chemical compounds are mixed together to prepare active materials for the battery cell. Active materials are different for different plates. Different quantities of compounds are mixed together to follow the different steps to prepare positive paste and negative paste.

6.3.1.1 Positive Paste

Quantities of chemical compounds of positive paste are as follows.

- Lead oxide (PbO): 600 kg.
- Sulfuric acid (H_2SO_4): 45±1 liters (Gravity of acid: 1.400, 30˚C).
- De mineralized water (DM water): 78±3 liters.
- Fiber flock: 360 gm.

6.3.1.2 Negative Paste

Quantities of chemical compound for negative paste are as follows.

- Lead oxide (PbO): 600 kg.
- Fiber flock: 360gm.
- DM water: 72-75 liters.
- Sulfuric acid (H_2SO_4): 42±1 liters (Gravity of acid: 1.400, 30˚C).
- Indulin C: 1200 gm.
- Carbon black: 1800 gm.
- Barium Sulfate: 2400 gm.

6.3.2 Pasting Process

At first pastes are manually poured in the hopper from mixture dram. On the other side, 50 bunches of grids are put in the belt roller which sends the grids into the cam roller or auto lifter. When the pasting machine is turned on, then the pastes are pasting on the grid by a roller and the pasting is finished in the finishing roller which is shown in Figure 6.4.

Figure 6.4: Pasting Machine [2].

Then the pasted plates are passed into the oven by conveyer chain. Then it is sent into the receiving chain by passing roller and the pasted plates are put in the skid. The skid has five layers and has a square shape tray in the bottom which is filled up by water. The five layers of skid are covered by the wet jute bag. These wet jute bags and water filled tray are used to keep the accurate moisture, otherwise these pasted plates will create reaction with air and will lose the moisture range. Then the skid is sent to the curing oven. The sequence block diagram of pasting process is shown in Figure 6.5.

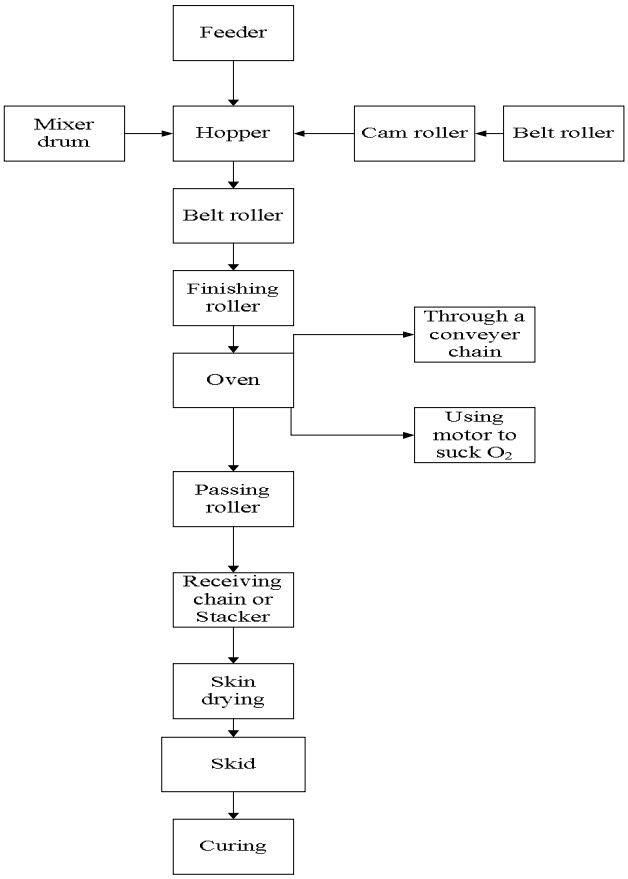
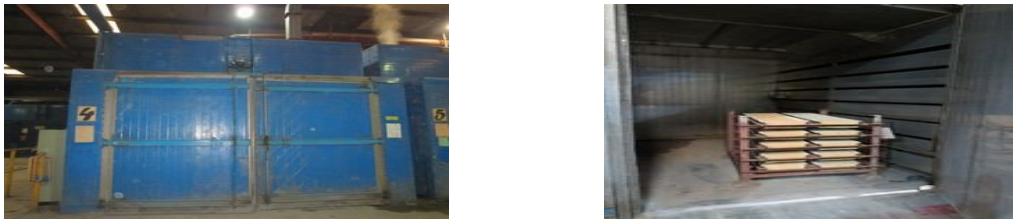


Figure 6.5: Sequence block diagram of pasting.

6.4 Curing and Conditioning

Grids are being dried with skin drying process to remove the moisture from the plate to keep it under certain value. At a time maximum 12 skids can stay in a curing chamber which is shown in Figure 6.6. 12 skids of grids are kept at (30-40)˚C for 16-22 hours to minimize the moisture. This process is called curing. In a curing chamber, first 8 hours are loading period, the following 4 hours are steaming period, then the following 12 hours are curing period and the later 12 hours are drying period. For a total of 36 hours the skids of grids are kept in the curing chamber. After curing, grids are kept at ambient temperature for 48 hours where moisture is maximum 1% and Free Lead Content (FLC) is maximum 5%. This process is called conditioning. The shelf life of each skid is one month.



(a) (b)

Figure 6.6: Curing Oven. (a) Outside of Curing Oven. (b) Inside of Curing Oven [2].

6.5 Formation

After curing and conditioning, formation process is done for charging both the positive and negative plates. Here, plates are dipped into the sulfuric acid mixer and the plates are charged using rectifier. This process continues up to 18-22 hours. De-Mineralized (DM) water is also managed in this section.

6.5.1 DM Water Plant

In the time of paste mixing and formation, mineral mixed water is created problem to form appropriate bond. For this reason, RBL made a DM plant to fulfill its own demand. Natural water is de-mineralized in DM plant which is shown in Figure 6.7. In this plant, mineral compound as like calcium, chloride, arsenic, nickel, iron, cyanide, nitride etc. are removed from water.

Figure 6.7: DM Water Plant [2].

6.5.2 Plate Charging

Plates are charged in a vat and all plates are aligned in this vat furnace. Following steps are done for plate charging.

- Positive plates and negative plates are put together in this circuit furnace which is shown in Figure 6.8(a).
- Plates are dipped into the sulfuric acid (gravity 1.05 - 1.06) mixed water.
- Plates are charged using rectifier. The lugs of positive plates are put in series connection with the positive cable of rectifier and the negative plates are put in series connection with negative cable of this rectifier.

(a)

(b)

Figure 6.8: Formation of Pasted Plates. (a) Charging Plates in Vat. (b) Scrubber [2].

- During the charging time, produced gas fumes are sent to the scrubber tank by through a blower which shown in Figure 6.8(b).

6.5.3 Washing and Drying

After charging positive plates are washed in a tank which is shown in Figure 6.9 and negative plates are dipped in to the sulfuric acid (gravity is 1.030) mixed water and washed it randomly. Then the positive plate sent to the Positive Dry Oven (PDO) and the negative plates are sent to the Inert Gas Oven (IGO) for drying.

Figure 6.9: Washing Tank for Positive Plates [2].

6.5.3.1 Positive Dry Oven (PDO)

When the formation is completed, then positive plates are sent to the washing tanks and water is flown on the plates in washing tank. The pH of this water should be above 4. Then the plates are kept in the PDO for eight hours at above 74.8˚C in order to reduce moisture which is shown in Figure 6.10. The moisture has to be maximum 0.3%.

Figure 6.10: Positive Dry Oven (PDO) [2].

6.5.3.2 Inert Gas Oven (IGO)

After formation the negative plates are taken to the washing tanks to make them free from acid. The tank contains water of pH above 6.5. They are kept in the IGO for 75 minutes at 76˚C. The cycle time of plate varies between 18 minutes to half an hour.

6.6 Plate Parting

After drying, each charged plate is parted into two parts by plate parting machine. When grids are pasted and charged, then the grid lug becomes oily and dusty. So, the lugs are also cleaned by wheel brush in this machine. Figure 6.11 shows the sequence block diagram of plate parting.

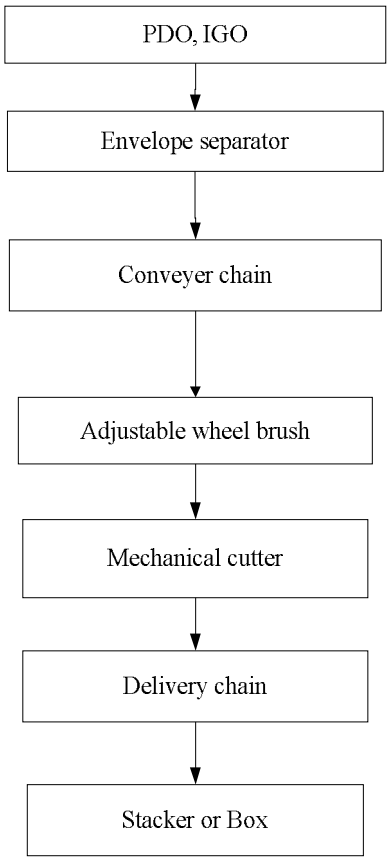


Figure 6.11: Sequence block diagram of plate parting.

Chapter 7 : ASSEMBLY SECTION

In the assembly section, finally the components of batteries are assembled. Assembly section uses the pasted plates to assemble the battery. After assembling, we can use the batteries after filling electrolyte. The raw materials of assembling batteries are plate, separator, cover, container, small parts and accessories.

7.1 Small Parts of Battery

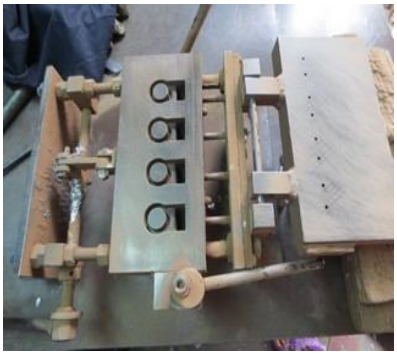
The small parts are casted in small parts casting section which is controlled by assembly section. In small parts casting section 3.2% antimony lead is used. There are four types of small parts like as ring post, main post, inter middle post, inter post, angle post and lead stick. Lead stick is shown in Figure 7.1(a). Here, the names of different types of posts are given.

7.1.1 Ring Post

Ring post is also called screw post. It is used in large size battery. Figure 7.1(b) shows the mold of ring post. The names of different types of ring posts are as follows.

- N100,
- N120,
- N150 and
- N200.

(a)



(b)

Figure 7.1: Lead Stick and Ring Post Preparing Mold. (a) Lead Pot with Lead Stick. (b) Ring Post Mold [2].

7.1.2 Main Post

Main posts are used in terminal bush burning in assembly section. The names of different types of main posts are:

- N70,

- N50,
- NS40,
- NS60,
- N100,
- N120,
- N200,
- DIN88 and
- DIN55.

7.1.3 Inter Middle Post

Inter middle posts and inter posts are used in group burning in assembly section. The names of different types of inter middle posts are:

- N120,
- N150 and
- N200.

7.1.4 Angle Post

Angle posts are also used in group burning. Names of different types of angle posts are:

- NS40 (Left and Right),
- N40 (Left and Right),
- NS60 (Left and Right) and
- N50 (Left and Right).

7.2 Process of Assembly Section

There are thirteen steps of assembling a battery. After completing this process, batteries are completely assembled. The steps of assembling battery are described here.

7.2.1 Envelope Cutting

There is a P-envelope machine in assembly section where the roll of Polyethylene (PE) separator is attached which is shown in Figure 7.2 and it cuts the PE separator in envelope size. One side of PE separator is rib side and another side is plane side. There are two types of separators, one is HN 1.2 (2 mm) and another is HN 1.2 (4 mm). After cutting, envelopes are sent to the separating portion.

Figure 7.2: PE Separator Cutting Machine [2].

7.2.2 Separating

Creating a group with PE separator envelope, positive and negative pasted plate, that process is called separating which is shown in Figure 7.3. This group is created according to coupling. In some batteries, positive plates remain in separator envelope.

Figure 7.3: Positive and Negative Separated Plates [2].

7.2.3 Group Burning

After separating, the flags of positive plates are joined and the negative plates are also joined by melting lead stick with the help of oxyacetylene gas torch which is shown in Figure 7.4. At the same time the main posts, inter middle posts and angle posts (left and right) are also joined by the melted lead. It is called group burning.

Figure 7.4: Group Burning with Lead Stick [2].

7.2.4 Indicating Positive Plate

After group burning only the positive plates are indicated by color. So, everyone can identify the positive and negative plates. Figure 7.5 represents the indicated positive plates.

Figure 7.5: Indicated Positive Plates [2].

7.2.5 Cell Insert

After indicating the positive plates, the joints of positive plates and the joints of negative plates are checked properly. Then the cells are inserted into the plastic container which is shown in Figure 7.6.

Figure 7.6: Inserted Cell [2].

7.2.6 Short and Polarity Test

In the plastic container, a group of positive plates remain beside a group of negative plates. Here, the arrangements of cells are checked properly and manually polarity is checked. Then two probes of short testing machine are used for short testing. One probe is held in positive side and another probe is held in negative side. If any how the positive and negative plates are shorted then the alarm will ring otherwise alarm will not ring.

7.2.7 Inter Cell Welding

In inter cell welding, here is done resistance spot welding by inter cell welding machine which is shown in Figure 7.7. There are hole punches in the partitions of plastic containers. At the time of inter cell welding two inter posts are set in the two sides of hole. The high current is passed through the inter cell welding tips. When the electrons flow through the tips, they get air resistance and then temperature is generated there. The inter cell welding tips hold the inter posts with pressure, so the lead is melted and an inter post is joined with other. Then after a few time it will be solid.

Figure 7.7: Inter Cell Welding Machine [2].

7.2.8 Shear Testing

In shear testing, the joint of inter cell welding are tested. Here, strong force is applied to the joint of inter cell welding. If the joint is weak, then the joint will be separated.

7.2.9 Automatic Heat Sealing

In the automatic heat sealing machine, the lower part of plastic cover and the upper part of plastic container are melted to attach with one another. This automatic heat sealing machine takes around two hours to set. Figure 7.8 shows the automatic heat sealing machine.

Figure 7.8: Automatic Heat Sealing Machine [2].

7.2.10 Pole Burning with Terminal Bush

There are two main posts or poles in the battery. For pole burning, a burning guard is kept on the ring post and ring post is kept on the terminal bush and then the pole is burnt by melting lead stick with the help of oxyacetylene gas torch which is shown in Figure 7.9. The positive and negative electrical connections are connected to these two poles of the battery.

Figure 7.9: Pole Burning with Terminal Post [2].

7.2.11 Leak Testing Machine

By leak testing machine, a positive air is fitted to the six cells of the battery and then pressure builds up for five to six seconds. If the pressure leaks or drops more than a certain level in a certain time, then the alarm will ring. If the battery is leaked, then air tight tested device is used. This leak testing process is also applied to the two adjacent cells, so that internal leakage of a battery can also be identified. If the battery has no leakage, then pass sticker is tagged on the battery container.

7.2.12 Aluminum Foiling and Numbering

For aluminum foiling and numbering on the container, two different machines are used which are shown in Figure 7.10. At first the aluminum foiling is done on the holes of pass sticker holder battery. Then a permanent numbering process is done on the cover of battery.

Figure 7.10: Aluminum Foiling and Numbering [2].

7.2.13 Shrink Wrapping and Packing

Shrink wrapping and packing is the last step of assembly section process. In the shrink wrapping and packing process, the battery is wrapped by a shrink paper and some batteries are kept in carton with vent plug and necessary accessories. At first battery is wrapped by shrink paper, and then it is passed through a conveyor belt into a covered high temperature zone. So, the shrink paper is tightly attached to the body of battery. Here, bar codes of the batteries are also scanned.

7.3 Per Hour Production Capacity

We have observed the per hour production capacity of NS60L battery excluding the leisure time of workers and the setup time of the machines. Table 3 represents the capacity of separating, group burning, inter cell welding, heat sealing, pole burning and packing within per hour, 6.5 hours, 7 hours and 8 hours.

Table 3: Production capacity of NS60L battery.

Section	Per Hour	6.5 Hours	7 Hours	8 Hours
Separating	40	260	280	320
Group Burning	40	260	280	320
Inter Cell Welding	160	1040	1120	1280
Heat Sealing	180	1170	1260	1440
Pole Burning	300	1950	2100	2400
Packing	192	1248	1344	1536

7.4 Air Treatment Plant

In Air Treatment Plant (ATP), full of lead dust air and fume are filtered. There are two types of blower. One is air blower and another is fume blower. There is also a filter bag house to collect the dust from air. Here, the functions of different parts of ATP are described.

7.4.1 Air Blower

The air blower sucks the lead dust mixed air from group burning section. Then the air passes to the filter bag house to filter the lead dust. Figure 7.11 shows the air blower, fume blower, filter bag house and dust filter.

Figure 7.11: Air blower, Fume blower, Filter Bag house and Dust Filter [2].

7.4.2 Fume Blower

The fume blower sucks the fume of polypropylene which is produced in heat sealing section. Then the fume blows out to the environment. The fume of propylene is not so harmful for environment so that there is no filter in fume blower.

7.4.3 Filter Bag House

In filter bag house, there are 144 filter bags which are hanging vertically in filter bag house. The doors of filter bag house are air tight. After sucking the air by air blower, air passes through the filter bags. Then the lead dust remains in dust collector of filter bags and lead dust free air passes to dust filter. For cleaning filter bags, after a certain time air is given to the upper side for 1-1.5 seconds.

7.4.4 Dust Filter

The dust filter also filters the air. Sometimes a few dust remains in that air which comes from filter bag house. Then dust filter filters that air again.

7.4.5 Air Blower with Chimney

After filtering the air completely, this air blower sucks the lead dust free air and blows out the air through chimney to the environment. If the lead dust remains in air, then after passing a certain level the lead dust cannot blow out with air through chimney to the environment. Figure 7.12 shows the chimney of ATP.

Figure 7.12: Chimney [2].

Chapter 8 : QUALITY ASSURANCE DEPARTMENT

Quality Assurance (QA) department is an independent department of RBL. This department is not included under supply chain. QA department of RBL reports to the General Manager (GM) of Research and Development (R and D) department in head office and also to the Chief Executive Officer (CEO) about the quality of product.

8.1 Functions of QA Department

The functions of QA department are as follows.

- Checking and controlling quality in every stage as –
  - Incoming material,
  - In process and
  - Finished product.
- Holding the product by raising NCPR, which products are failed to meet the standard,
- Passing the incoming material,
- Collecting the standard sample,
- Conducting different test of material or, product,
- Providing Batch Number of material or, product and
- Accepting and passing daily activity note.

8.2 Testing of Incoming Material and In Process Material

When incoming materials of battery come to the store of RBL after purchasing, then QA department brings a sample of that material and tests it according to the manual. If the result of test is perfect, then those materials can come to the production floor. QA department also tests the in-process materials of all sections with a sample base test.

8.2.1 Smelting Section

QA department tests the melted lead of the smelting section and identifies the quantity of pure lead and antimony lead. RBL follows OES test process to identify the quantity of lead.

8.2.1.1 OES Test

OES test means Optical Emission Spectrophotometer test. This test is conducted by OES machine which is controlled by computer. After taking the sample of melted lead, it is serviced by lead machine. Then after putting the sample into OES machine, a spark is created by electrode

to send the sample into inside the machine. OES machine identifies the different molecules of melted lead for their different wavelengths. Then we can see the report in computer. This test is done by taking two samples.

8.2.2 Plate Preparation Section

QA department tests different materials of plate preparation sections in different process.

8.2.2.1 Grid Test

QA department takes 5 pieces of grids as sample after every four hours (two times per shift) and tests some properties of grid. This department checks the weight of grid, identifies the crack of grid, checks the feather and identifies the missing part of grid etc. If the qualities of samples are good all the grids of these four hours will be passed otherwise, all the grids will be recycled.

8.2.2.2 Lead Oxide Test

QA department takes sample of lead oxide powder after every two hours. Then the apparent density, mesh size and quantity of Free Lead Content (FLC should be around 28%) are tested according to the procedure manual. For lead oxide, titration test is used.

8.2.2.3 Pasted Plate Test After Pasting

After every hour, 5 pieces of pasted plates are checked. If the qualities of pastes are good and pastes are attached properly with the grid, then the pasted plates will pass.

8.2.2.4 Pasted Plate Test After Curing

In curing chamber, the temperature of automotive plate is 60˚C and humidity of automotive plate is 80%. After completing 36 hours curing time, FLC and moisture of pasted plates are tested in a sample base. FLC can be maximum 3% and moisture should be less than 1%.

8.2.3 Formation Section

In formation section, the voltages of positive plate and negative plate are measured in the vat under electrolyte by cadmium test.

8.2.3.1 Cadmium Test

Cadmium test is done by a cadmium metal stick. At first the negative probe of voltmeter connects to the cadmium metal stick, and then the cadmium metal stick is kept in the electrolyte

of vat. Then when positive probe touches the positive plate, the voltage of positive plate is shown in voltmeter. Again when the positive probe touches the negative plate, the voltage of negative plate is shown in voltmeter. The voltage of positive plate should be around 2.4 V, the voltage of negative plate should be around 0.2 V and the voltage between positive and negative plate should be around 2 V.

8.2.3.2 Charged Plate Test After Washing and Drying

After washing the positive plate, percentage of lead die oxide in positive plate is tested. The range of lead die oxide in positive plate is around 87% - 95%. After drying the negative plates in Inert Gas Oven (IGO), percentage of lead oxide is tested. The range of lead oxide should be below 3%.

8.2.4 Assembly Section

QA department tests the small parts and also performs different tests in assembly section.

8.2.4.1 Destructive Test

The test of small parts is called destructive test. Here, a small part is kept in a gas burner for a few minutes and its inside is checked by breaking. If there is no empty space, the small part is perfect.

8.2.4.2 Short and Polarity test

In assembly section, QA department performs short and polarity test of a battery per hour. The arrangement of polarities of battery is manually checked and any short connection between positive and negative plate is also tested here.

8.2.4.3 Shear Test and Leak Test

In assembly section, QA department also performs shear test and leak test of a battery per hour. The joint of inter cell welding are tested by shear test. The internal leakage of each battery cell and the leakage of battery container can be identified by doing leak test.

8.3 Finished Battery Testing

QA department also tests finished battery in a sample base. For some faulty results of finished battery, finished products of this batch will not hold or reject but QA department will inform it to Engineering and Technical department. Here, different tests of finished battery are described.

8.3.1 Capacity Test

RBL follows Japanese International Standard (JIS) to manufacture battery. According to JIS, a battery has to meet up 95% capacity. If a battery supports 20 hours by discharging in 5A current, then it is called perfect design. This battery has to support minimum 19 hours.

8.3.2 RC Test

RC test means Reserved Capacity test. When the engine of a car is suddenly stopped, then the light or fan of a car will may be on for 40 minutes or 60 minutes which is identified by RC test.

8.3.3 Life Cycle Test

Life cycle test is done in life cycle machine. A battery is kept in the life cycle machine to identify its total time of life cycle. According to JIS, the life cycle of a battery is 2 years.

8.3.4 Self Discharge Test

Self discharge test is done to find out the duration of existing time of battery at unused condition. If a battery is kept in unused condition after filling the electrolyte into battery, then the battery will start to self discharge. So, the life cycle of battery decreases.

8.4 Non Confirmed Product Report (NCPR) Raising System

NCPR can rise in every stage of production process for incoming material and finished products. Figure 8.1 shows the processes of raising NCPR.

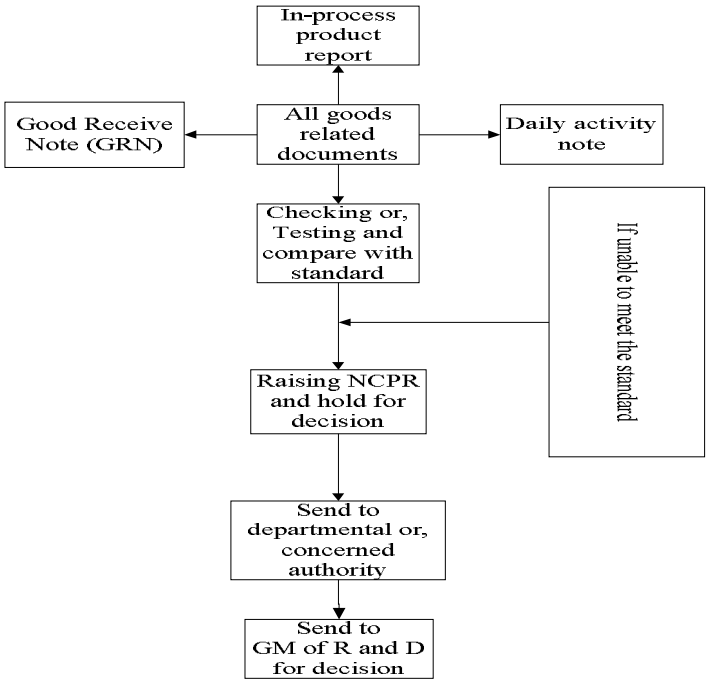


Figure 8.1: Non Confirmed Product Report (NCPR) Raising System.

Chapter 9 : MAINTENANCE SECTION OF RBL

At RBL maintenance section maintains and solves all the problems of machines. Beside this, it also maintains the generator section and utility section (air distribution and oxygen generation). This department has six electrical and mechanical engineers and also 33 skilled, semi skilled technicians or helping hands.

9.1 Categories of Maintenance

The work of maintenance is done in three categories. They are discussed in the following sections.

9.1.1 Breakdown Maintenance

When a machine breaks down suddenly during the time of running operation, then a team of maintenance section maintains this type of break down problem, it is called breakdown maintenance. This type of break down can occur at any time in any machine.

9.1.2 Preventive Maintenance

Preventive maintenance is done to keep the machines in their ideal position. On the basis of the breakdown history of the last six months, maintenance section creates a check list on some topic which are also collected from break down history. Then the maintenance section makes a schedule in the beginning of the month to maintain or calibrate machines and this schedule is also sent to the planning department and to the user section of machines. This preventive maintenance is done in following categories.

- Weekly,
- Monthly,
- Quarterly,
- Half yearly and
- Yearly.

9.1.3 Conditional Maintenance

Conditional maintenance is done on the basis of duration which is given by equipment manufacturer. The time of this maintenance is given in an Enterprise Resource Planning (ERP) software, which is called System Applications and Products in Data Processing (SAP). But it is rarely used.

9.2 Types and Capacity of Generators

The total load of RBL is around 3 MW but the Rural Electrification Board (REB) supplies only 500 KVA or 400 kW. So, RBL needs generators to fill up their load demand. RBL has five generators of different capacities.

- One diesel generator - 1204 kW,
- One diesel generator - 904 kW,
- One rental diesel generator - 500 kW,
- One gas generator - 1000 kW and
- Another gas generator - 1000 kW.

9.3 Substation of REB

REB supplies only 400 kW power to RBL. It is not sufficient for them. Thus at RBL there is a small substation of REB. There is some equipment in the substation. The equipment are listed in the following sections. As they did not discuss about the equipment in details, we are only listing them along with photographs taken by us.

9.3.1 High tension panel

There is one high tension panel in substation for 11 kV voltages which is shown in Figure 9.1.

Figure 9.1: High Tension Panel [2].

9.3.2 Transformer

Figure 9.2 shows a step down transformer which is connected to high tension panel.

Figure 9.2: Step down Transformer [2].

9.3.3 Change Over Switch (COS)

There is a Change Over Switch (COS) which is used to manually change the source of power from REB to generator. Figure 9.3 shows the COS used at RBL.

Figure 9.3: Change Over Switch (COS) [2].

9.3.4 Molded Case Circuit Breaker (MCCB)

MCCB means Molded Case Circuit Breaker which is shown in Figure 9.4. By MCCB, current can be adjusted 160 A to 400 A. When the current rating is larger than 60 A, then MCCB is used. In the distribution board of home, we use Miniature Circuit Breaker (MCB).

Figure 9.4: MCCB [2].

9.3.5 Automatic Transfer Switch (ATS)

ATS is also one kind of Change Over Switch (COS) but ATS operates automatically. When the load is higher than the supply of REB, ATS changes its source automatically. In REB substation, ATS has two sources and one output which are shown in Figure 9.5.

Figure 9.5: ATS [2].

9.3.6 Capacitor bank

Figure 9.6 represents a capacitor bank in the substation of REB which is used to improve the power factor. Power factor is considered good when it is 0.9 but it can range from 0.75 to 0.9.

Figure 9.6: Capacitor Bank [2].

9.3.7 Low Tension Panel

There are four low tension panels in substation for 400 V voltages which are shown in Figure 9.7.

Figure 9.7: Low Tension Panel [2].

9.4 Load Distribution of RBL

The power generated in gas power plant is distributed among different units according to their required load. Table 4 represents the list of loads for different machines and units.

Table 4: Load Distribution.

Serial No.	Name of Machine	Rated Power
1	Grid Casting Machine	Wirtz 18.5 kW Yuasa 33 kW Diam 11 kW
2	Oxide Mill	80 kW
3	Paste Mixer	4.15 kW
4	Pasting	13 kW
5	Curing Chamber	4 kW
6	Formation (Per Circuit)	25 kW
7	Positive Dry Oven (PDO)	20.2 kW
8	Inert Gas Oven (IGO)	5.96 kW
9	Plate Parting	23.15 kW
10	Assembly	92.11 kW
11	Plastic Molding	50 kW
12	Maintenance	35.1 kW
13	Utility	31.4 kW
14	Oxygen Generator	30 kW
15	Compressor	49 kW
16	Water Pump	15 kW

9.5 Utility section

Utility section is also a part of maintenance section. In utility section, natural air is absorbed and also filtered, and then the air is delivered to the desired machine. In this section, oxygen gas is separated from air and delivered to the desired machine.

9.5.1 Process of Natural air Absorbing and Filtering

Natural air is absorbed and filtered to deliver the air to the desired machine. To absorb and filter the air, following two equipment are used.

9.5.1.1 Air Compressor

Air compressor sucks the air from the environment, and then it passes to the air preserver to reserve the air for certain time. Air compressor sucks 10 bar (1 bar = 14.5 pounds per square inch) air at a time. Figure 9.8 shows the air compressor.

Figure 9.8: Air Compressor [2].

9.5.1.2 Air Dryer

From air preserver, air comes to the air dryer to filter the air dust and remove the moisture. To remove the air dust and air moisture, two micron filters are used which are shown in Figure 9.9.

- Air dust filter - Holds the solid dust and passes the air.
- Air moisture dryer - Separates the moisture or water from air.

Figure 9.9: Two Air Dryer Micron Filter [2].

9.5.2 Oxygen Filtering

In utility section, oxygen is filtered from air. Air dryer passes air to another small air preserver to filter oxygen. There are two adsorbers to filter oxygen which are shown in Figure 9.10, where one is pre filter and another is sediment filter. There are some molecular sieves in adsorbers which pass only oxygen and holds other molecules like as nitrogen, carbon die oxide etc. Then filtered oxygen is reserved in another preserver and then oxygen is distributed to the desired section.

Figure 9.10: Pre and Sediment Filter with Oxygen Preserver [2].

9.6 Mold Preparation Section

In maintenance section, there are some mold preparatory machines. They are as follows.

- Battery Cutting Machine - Separates the plastic cover of battery from plastic container.
- Pillar Drill Machine - Drills metals.
- Lathe Machine - Gives cylindrical shape to any shaft.
- Milling Machine - Makes different types of molds of small parts.

Chapter 10 : SAFETY PRECAUTIONS AND MAINTENANCE OF BATTERY

At RBL they maintain some safety precautions inside the factory. These safety precautions are very important for handling battery. There are also some processes to maintain a battery properly which are supposed to be maintained by battery users.

10.1 Safety Precautions for Handling Battery

For handling or working with a lead acid battery, vehicle and manual of battery owner should be consulted for instruction and safety precautions. Lead acid battery contains hydrogen, oxygen gases that can be explosive and sulfuric acid that can cause severe burn injury. So, following precautions should be followed when handling or working with a lead acid battery.

- Safety glasses or goggles, mask and a face shield should be worn.
- Proper clothing to protect face, hands and body should be worn.
- Work area should be well ventilated.
- Never lean on battery while boosting, testing or charging.
- Cigarettes, flames or sparks could cause a battery to explode.
- Without proper instructions and training, the battery should not be charged.
- In the event of accident, the injured part should be flushed with water and a physician should be called immediately.

10.2 Maintenance of Battery

Regular Maintenance of battery will ensure long life. The battery maintenance instructions can be followed in this regard. These are simple and easy instructions to follow.

- The battery should be tested on a regular basis. Battery should be also tested before driving for any long trips or before or after car has been serviced.
- Regularly the battery container and terminals should be cleaned.
- Baking soda is applied to any corrosion and cover is rinsed.
- The electrolyte level of battery should be checked before charging. It should always be within the upper and lower limit mark.

Chapter 11 : CONCLUSION

We passed fifteen days at RBL during our internship program. We feel lucky to be able to complete our internship program at RBL which is a reputed battery manufacturing company. In four years we have gathered theoretical knowledge from our university and visiting RBL has given us opportunity to apply our those theoretical knowledge in future industry work. The authorities of RBL were very concerned about all kinds of safety. The friendly environment of RBL encouraged us to co-operate with industrial environment. We have learnt a lot and obtained practical knowledge from our internship at RBL.

11.1 Discussion

We can say that the knowledge we gathered practically is very important for us. Before this internship we had only theoretical knowledge about battery factory and different types of machines and equipment. We could relate our knowledge with the practical running equipment of the industry during the period of internship. At RBL we observed the full manufacturing process of batteries.

At RBL we saw the recycling process of lead and manufacturing process of lead alloy in the smelting section. Then we have come to know about the charging and discharging process and reactions of battery from the engineering and technical section. Then we saw the process of plastic container, cover and its associated plastic parts in the plastic molding section. Then we saw the different steps for preparing positive and negative plates such as grid casting, cylinder casting, lead oxide preparing, paste mixing, pasting, curing, charging plates at formation and plate parting. Then the assembly section uses parted plate to assemble battery. In assembly section, we saw different steps of assembling a battery such as cutting separator envelope, separating, group burning, positive plate indicating, cell inserting, polarity and short testing, inter cell welding, shear testing, automatic heat sealing, pole burning, leak testing, aluminum foiling, numbering, shrink wrapping and packing. We also saw the workings of quality assurance department and how it passes a good product. We saw the workings of maintenance department such as maintain and solving all the machines regularly, process of absorbing and filtering natural air, oxygen filtering and making different types of molds. RBL has an ATP plant to extract the harmful lead from air and fume to save the environment.

Internship at RBL gave us a great chance to relate our theoretical knowledge with practical field and get familiar with industrial environment and real life equipment. It was a great experience to

visit a battery manufacturing industry like RBL, where we got familiar not only with traditional equipment but also some advanced equipment. Internship at RBL will help us in our job sector to co-operate with industrial environment. Every student studying in Electrical and Electronic Engineering should visit this type of industry to get some practical experiences.

11.2 Problems

During internship program we faced some problems. Those are as follows:

- The time of the internship was too short. Because of this we could not learn all the sections in details.
- Before the internship we did not have any academic knowledge about the mechanical section of industry. Because of this we faced some problems in our internship.

11.3 Recommendations

There are some recommendations about internship which are given by us.

- The length of the internship duration should be increased. We think the duration should be scheduled for at least three months.
- Department authority should offer at least one mechanical related course to understand the mechanical parts of the industry.
- Everyone should know about the precautions of battery manufacturing industry.
- We need more theoretical knowledge about power equipment.

REFERENCES

[1] History details, Rahimafrooz Batteries Limited. [Online]. Available: http://www.rahimafrooz.com.

[2] Photos taken by the authors at RBL.

APPENDIX

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD.
Name of the student:	Farhana Akther Zannat.
ID:	2009-3-80-008

Date:	23-12-2012
Start time/End time	8:00 AM- 4:00 PM
Location:	West Panisail, Zirani Bazar, Gazipur, Dhaka
Mentor:	Md. Abdur Raquib

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of this day was to introduce with the RAHIMAFROOZ BATTERIES LTD. factory and understand the working process of this factory.

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

1. QMS & EHS – It introduced us with the continual improvement of the quality management system & integrated management system [EMS & OHSAS]
2. Planning & coordination – It introduced us with sourcing, yearly planning, Delivery system of the PBL.
3. Warehouse & Logistics – It introduced us with the receiving process of raw materials. It also introduced us with the finished product & delivery of the finished product.
4. Head of Supply chain – He introduced us with the working process of the PBL factory.

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

This was just an introductory part of our internship and it is related to MGT-321 course.

23/12/2012

Signature of the mentor with date
Name: Md. Abdur Raquib
Designation: Head of Supply chain
Contact Phone #: 01711605658

Md. Abdur Raquib
Head of Supply Chain
RAHIMAFROOZ BATTERIES LTD.

Tahseen Kamal 17-01-2013

Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD.
Name of the student:	Farhana Akther Zannat.
ID:	2009-3-80-008

Date:	24-12-2012
Start time/End time	8:00 AM - 4:00 PM
Location:	West Panisail, Zirani Bazar, Kazipur, Dhaka
Mentor:	Md. Rafiqul Haque

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of this day was to know about the working procedure of smelting section at RBL.

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

1. Recycling the Pb-Sb alloyed plate in the charging machine & Rotary Furnace.
2. Manufacturing process of lead alloy in the Lead Alloying Furnace and unloading the lead from alloying furnace and giving a shape of lead alloy.
3. Collecting process of dust from air with dust collector, cyclone, cooling tower, bag house & fumigating bag house.

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

We have known about the Pb-alloy in the EEE-308.

Signature of the mentor with date
Name: MD. RAFIQUL HASSUE
Designation: PRODUCTION OFFICER
Contact Phone #: 01847-024699

Signature of academic supervisor with date
Name: Jahseen Kamal
Designation: Senior Lecturer

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD.
Name of the student:	Farhana Akther Fawzat
ID:	2009-3-80-008

Date:	26-12-2012
Start time/End time	8:00 AM - 4:00 PM
Location:	West Panisail, Zirani Bazar, Gazipur, Dhaka
Mentor:	Subir Kumar Das

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of this day was to know about development process of Engineering & Technical section of RBL.

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

1. Basic Purpose of Grid Size
2. Charging & discharging reaction of Lead acid battery.
3. Battery charging and discharging Properties.
4. Reason of gradually decreasing efficiency of Lead acid battery.

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

It is related to our CHE-101 & EEE-445 course

26/12/2012

Signature of the mentor with date
Name: SUBIR KUMAR DAS
Designation: Manager, Engineering & Technical
Contact Phone #: 01713-367547

Tahseen Kamal 1.7.2013

Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD.
Name of the student:	Farhana Akther Zannat
ID:	2009-3-80-008

Date:	17-12-2012
Start time/End time	8:00 AM - 4:00 PM
Location:	West Parisail, ZiraniBazar, Gazipur, Dhaka
Mentor:	Abu Nasar M. Abdullah

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of this day was to see the process of manufacturing plastic container of battery and its related tools.

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

1. Manufacturing vent plug & its inside using different mold in plastic molding machine
2. Manufacturing plastic container and labelling on it.
3. Using Poly propylene & different colors of pigment to manufacture plastic container.
4. Uses of Crashing & Mixture machine of plastic.

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

The basic concepts of the uses of this machine is related to EEE-301.

27/12/12
Signature of the mentor with date
Name: Abu Nasar M. Abdullah
Designation: Sr. Executive
Contact Phone #: 01713061809

Tahseen Kamal
17/12/2012
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD.
Name of the student:	Farhana Akther Zannat
ID:	2009-3-80-008

Date:	28-12-2012
Start time/End time	8:00 AM – 4:00 PM
Location:	west Panisail, Zirani Bazar, Cazipur, Dhaka
Mentor:	SAIFUDDIN MAHAMOOD

Gencral Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of this day was to see the Grid casting, cylinder casting process & Lead oxide production in the Plate preparation section.

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

1. Grid casting process in Grid casting machine using (1.7 – 2.5)% Antimonial lead as raw material.
2. Cylinder casting process in cylinder casting machine using 99.97% pure lead.
3. Manufacturing process of Lead oxide using casted cylinder in the Sovema / Paramount oxide mill.

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

It is related to our EEE-304 course.

29/12/12
Signature of the mentor with date
Name: SAIFUDDIN MAHMUD
Designation: SR. EXECUTIVE
Contact Phone #:

Tahseen Kamal 01.2013
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD.
Name of the student:	Farhana Akther Zannat
ID:	2009-3-80-008

Date:	29-12-2012
Start time/End time	8:00 AM - 4:00 PM
Location:	Head Parisail, Zirani Bazar, Gazipur, Dhaka
Mentor:	SAIFUDDIN MAHAMOOD

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of this day was to see the positive and negative paste making process by paste mixing machine in the plate preparation section.

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

1. Positive paste is prepared with PbO, DM water, H_2SO_4 of 1.4 Specific gravity, fiber block. DC and auto both types of positive paste is prepared here.

2. Negative paste is prepared with PbO, DM water, H_2SO_4 of 1.4 specific gravity, Carbon black, Vanesphere HT, Barsol, Indeline, Parabmid. Here, DC and auto both types of negative paste is also prepared.

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

It is related to our CHE-101 course.

27/12/12
Signature of the mentor with date
Name: SAIFUDDIN MAHAMOOD
Designation: SR. EXECUTIVE
Contact Phone #:

Tahseen Kamal 17.01.2013
Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

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

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

Name of the company:	RAHIM AFROOZ BATTERIES LTD.
Name of the student:	Farhana Akther Zannat
ID:	2009-3-80-008

Date:	30-12-2012
Start time/End time	8:00 AM - 4:00 PM
Location:	West Panisail, ZirabiBazar, Gazipur, Dhaka
Mentor:	SAIFUDDIN MAHAMOOD

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The objective of this day was to see the pasting, skin drying process and curing & drying process.

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

1. In the pasting machine, pastes are loaded, then the grids are pasted by the pasting machine, then the pasted plates are passed through the skin drying oven to decrease the humidity. Then the plates are arranged in a skid
2. Positive & negative pasting are done seperately.
3. Then the pasted plates are arranged in curing chamber in skid to reduce moisture & its limit is maximum 1%.

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

It is related to our EHE-101 course.

20/12/12

Signature of the mentor with date
Name: SAIFUDDIN MAHAMOOD
Designation: SR. EXECUTIVE
Contact Phone #:

Tahseen Kamal 17.01.2013

Signature of academic supervisor with date
Name: Tahseen Kamal
Designation: Senior Lecturer

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

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

Name of the company:	RAHIMAFROZ BATTERIES LTD.
Name of the student:	Farhana Akther Zannat
ID:	2009-3-80-008

Date:	31-12-2012
Start time/End time	8:00AM - 4:00PM
Location:	West Paniail, ZiraniBazar, Gazipur, Dhaka
Mentor:	SAIFUDDIN MAHAMOOD

General Instructions:

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

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

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

The objective of this day was to see the process formation of the pasted plates and washing of positive plate.

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

1. To charge the positive & negative plates in the VAT, H_2SO_4 of around 1.23 specific gravity is required. This charging process takes 20 hours.

2. After completing formation positive plates are washed in washing tank and negative plates are kept in a VAT under water.

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

It is related to EEE-445 course.

Signature of the mentor with date
Name: SAIFUDDIN MAHAMOOD
Designation: SR. EXECUTIVE
Contact Phone #:

Signature of academic supervisor with date
Name:
Designation:

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD
Name of the student:	Farzana Hossin
ID:	2008-2-86-030

Date:	01-01-2013
Start time/End time	8:00 AM - 4:00 PM
Location:	West panisail, Zirtoni Bazar, Gazipur, Dhaka
Mentor:	SAIFUDDIN MAHAMOOD

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The main objective of this day was to see the washing of negative plates, drying process of the negative plates in IGO, drying process of positive plates in PDO and parting process of plates.

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

1. After washing the positive plates, they are kept in positive drying oven to dry the (t) plate
2. Negative plates are also washed in washing tank then they are kept in Inert Gas oven to dry the negative plates.
3. After drying, plates are pasted by pasting machine. Every grids are parted in to two parts.

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

It is related to our EEE-413 course and EEE-445 course.

01/01/13
Signature of the mentor with date
Name: SAIFUDDIN MAHAMOOD
Designation: SR. EXECUTIVE
Contact Phone #:

15.1.13
Signature of academic supervisor with date
Name:
Designation:

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD
Name of the student:	Farzana Hossin
ID:	2008-2-86-030

Date:	2·1·2013
Start time/End time	8:00 AM - 4:00 PM
Location:	West panisail, Zirani Bazar, Gazipur, Dhaka
Mentor:	SHAH MUNTASIR MAMUN

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The main objective of this day was to see the manufacturing the small parts using different mold process of cutting and making the seperaton as an envelope form.

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

1. There are various types of small parts are manufactured. (a) Diffrunt types of PCM ring post (b) Angle post (c) Main post, (d) Inter middle post (e) Inter post.

2. Envelop sige seperaton is made by seperaton cutting machine. This seperaton is also called PE seperaton.

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

The basic conapts of the uses of this machine is related to EEE-301. course

02.01.2013
Signature of the mentor with date
Name: Shah Muntasir Mamun
Designation: Executive, Production
Contact Phone #: 01712112545

15.1.13
Signature of academic supervisor with date
Name:
Designation:

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD
Name of the student:	Farzana Hossin
ID:	2008-2-86-036

Date:	03.01.2013
Start time/End time	8:00 AM - 4:00 PM
Location:	West Panisail, Zirani Bazar, Gazipur, Dhaka
Mentor:	SHAH MUNTASIR MAMUN

General Instructions:

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

Department of Electrical and Electronic Engineering
East West University

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

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

The main objective of this day was to see the begining process of assembly section.

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

1. separating
2. Group Burning
3. Indicating positive plate.
4. Celling insert
5. Short & polarity test
6. Inter cell welding.

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

The basic concepts of the uses of this test is related to EEE-447 course.

03.01.2013

Signature of the mentor with date
Name: Shah Muntasir Mamun
Designation: Executive, production
Contact Phone #: 01712112545

15.1.13

Signature of academic supervisor with date
Name:
Designation:

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD
Name of the student:	Farzana Hossin
ID:	2008-2-86-030

Date:	04.01.2013
Start time/End time	8:00 AM - 4:00 PM
Location:	West Panisail, Zirtani Bazar, Gazipur, Dhaka
Mentor:	SHAH MUNTASIR MAMUN

General Instructions:

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

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

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

The main objective of this day was to see the rust part process of the assembly section of RBL.

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

1. shear testing.
2. Automatic Heat sealing.
3. pole Burning with terminal bush.
4. Leak testing machine.
5. Alumindum foiling & numbering
6. Raping & parking

To purify the air of assembly section. there in air treatment plant.
The machines of ATP are—
1. Air blower
2. Fume filter
3. Dust collection
4. Dust filter
5. Air blower through chimney

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

The basic conapts of the uses of this test is related to EEE-447. course.

04.01.2013
Signature of the mentor with date
Name: Shah Muntasir Mamun
Designation: Executive, Production
Contact Phone #: 01712112545

15.1.13
Signature of academic supervisor with date
Name:
Designation:

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD
Name of the student:	Farzana Hossin
ID:	2008-2-86-030

Date:	05.01.2013
Start time/End time	8:00 AM - 4:00 PM
Location:	West Panisail, Zinani Bazar, Bagipur, Dhaka
Mentor:	S.M. Shamsul Farhan

General Instructions:

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

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

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

The main objective of this day was to learn about the activity of Quality Assurance section of RBL.

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

⇒ QA department assures the quality of below things.
1. Incoming 2. Inprocen 3. Finished product
⇒ smelting section's test : OES test
⇒ small parts test : Destructive test.
⇒ Different types of tests have done for these product
1: capacity test 2. Re test 3. life cycle 4. self discharge 5. Retention test.

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

It is related to our EEE-447 course and EEE-445 course.

05/01/13
Signature of the mentor with date
Name: S. M. Shamsul Farhan
Designation: Manager, QA.
Contact Phone #: 01713064882

15.1.13
Signature of academic supervisor with date
Name:
Designation:

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD
Name of the student:	Fargana Hossin
ID:	2008-2-86-030

Date:	07.1.2013
Start time/End time	8:00 AM - 4:00 PM
Location:	West panisail, Zirani Bazar, Gazipur, Dhaka
Mentor:	Golam Quddus

General Instructions:

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Department of Electrical and Electronic Engineering
East West University

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

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

The main objective of this day was to see the genration section of the RBL.

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

→ There are two disele genrators of 1.2 MW and c. 904 MW
→ There are one rental disel genration of 508 KW.
→ There is another small diesel genraton of 400 KW.
→ There are two gas genratons of 1 MW.
→ There are two types of cooling tower. They are-
1. Radiaton base cooling tower
2. cooling tower.

Utility section: [For Air reserving]
1. Air compression
2. Air dryer with two micron filter
3. Air reserver

Oxygen filtering:
1. Two air filter which filtered oxygen.
2. Deliver oxygen to assembly and associated section

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

We have learnt about the genraton part in EEE-301 and EEE-304. also we learnt the application of genraton in EEE-447 course.

15.1.13

Signature of the mentor with date
Name: Golam Quddus
Designation: Manager, maintenance
Contact Phone #: 01713064805

15.1.13

Signature of academic supervisor with date
Name:
Designation:

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

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

Name of the company:	RAHIMAFROOZ BATTERIES LTD
Name of the student:	Farzana Hossin
ID:	2008-2-86-030

Date:	08.1.2013
Start time/End time	8:00 AM - 4:00 PM
Location:	West panisail, Zirani Bazar, Gazipur, Dhaka
Mentor:	Golam Guddus.

General Instructions:

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Department of Electrical and Electronic Engineering
East West University

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

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

The main objective of this day was to see the substation of REB and to see the process of keeping the every machine in ideal position.

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

In REB substation. There are -

① one high tension panel ② 4 low tension panel ③ capacitor bank ④ Transformer ⑤ change over switch ⑥ MCCB ⑦ ATS

To keep all machines in ideal position, every machine is checked weekly, monthly, half yearly on the basis of machine type.

Maintenance has 3 category - ① Breakdown maintenance ② preventive maintenance ③ conditional maintenance.

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

We have learnt about the machine part in EEE - 447, EEE-301 and EEE-304

Gias 01.13

Signature of the mentor with date
Name: Golam Quddus.
Designation: Manager, maintenance.
Contact Phone #: 01713 064805.

15.1.13

Signature of academic supervisor with date
Name:
Designation: