DECLARATION OF THE STUDENTS

We Tariku Teka, Deme Abera, Riyad Abu and Girma Bekele are fifth year electrical and computer engineering students at Jimma University Institute of Technology hereby declare that this internship report have been submitted to Jimma Institute of Technology in partial fulfillment of the requirement of Engineering internship program in faculty of electrical and computer engineering, we clarify that this report is our original work and any work that is not ours has been duly cited and acknowledged in the reference.

As mentor of those students during their internship session we approve that we visit their work in the company of Asella Malt Factory and they work their practice as scheduled by the university and written report is the result of their own work and compiled according to the internship guideline provided by the school as far as my knowledge is concerned.

Name of advisor: Mr. Henok Ayele

Advisor signature: _____

Date: _____

As a supervisor of those students at my company I approve that in the past consecutive four months they stayed in our company I manage and organize their work and they have been excellent at performing work tasks and attend on time. They have also been developed their team work skills, communication skills and work ethics. To the best of my knowledge and as per their declaration all things included in this document are regarding their practice session and no plagiarism is takes place. I assure that all the written words are mine with my signature as follows.

Supervisor name: Mr. Dagnachow Tufa

Signature: _____

Date: _____

ACKNOWLEDGEMENT

First of all, we are forever grateful to Almighty God for helping us throughout the making of this report and project who blessed us with the opportunity to study at such knowing Institute and guided us through all the difficulties we encountered during the course of the four months of internship.

We express our sincere and deepest gratitude to Jimma university, Institute of Technology, school of electrical and computer engineering for giving this chance to enhance our practical knowledge besides to theoretical.

We extend our appreciation and great thanks goes to our advisor Mr. Henok Ayele for his encouragement, valuable advice, critical comment and expert guidance from the beginning to the end in which without his support and interest this project report would not have been the same as presented here. At the time we stayed in Asella Malt Factory we come across many different people and found a lot of experiences, so we would like to express our deepest thanks to Mr. Melaku Teka, Mr.Leul Tilahun and Mr. Biniyam Nigatu those who are motor winder senior electricians in Asella malt factory, Mr. Daniel Wedacho junior Electrician Forman in Asella malt factory, Mr.Dagnachow Tufa head of technician in Asella malt factory. Mr.Mesfin Abebe Senior Electrician at Asella malt factory and for all the Electrical Workshop Department members of Asella malt factory and all who responded to our questionnaires and interviews, without any hesitation in a great deal in our practical study. We wish all them even more success in their life.

Finally, we can't remain without expressing our heartfelt gratitude to our parents who made devotion and the endless effort to our studies and prayed for our success during our Industrial Internship work session which helps us for our successful educational life. We say again thank you

EXECUTIVE SUMMARY

This paper was formally written document that explains what we have done, learned and experiences we have gained in the four months we stayed in the company during the internship session. In this report we try to explain in detail almost all things related to our internship experience starting from the time we join into Asella malt factory up to the final day we leave the company including all the action between this times. For sake of simplicity and easily understood for the reader, it was divide into different chapters.

Chapter one, focus on describing the company's history, the service that the company gives to the society, the organizational structure and the product of the Asella malt factory. In chapter two, explain about the overall internship experience that includes: how we get into the company, the section that we have worked in which describe the electrical workshop section, workflow and the works implemented in this work shop such as motor repairing, maintenance and rewinding, controlling and identifying trouble shooting that causes three phases and single phase induction motor damage. Chapter three deals about the benefits that we have gained from the internship program in regarding of the practical and theoretical knowledge. It also describes the benefits gain in leadership, entrepreneurship and the communication skills. Chapter four state about the problems identified and solution proposed to the problem. The last chapter focus on conclusion and recommendation for the company.

CHAPTER ONE

BACKGROUND

1.1 Brief History of Asella Malt Factory

Asella Malt Factory was established on the main road of Addis Ababa to Asella near Kulumsa Agricultural Research Center with 9.3 million birr capital on 14.7 hectares of land in September 1/1984G.C. Location of Asella malt factory is 167km southern of Addis Ababa and 8km from Asella town in Kulumsa village. It was founded on the eve of the founding of workers party of Ethiopia and the tenth anniversary of the Ethiopia revolution. The factory was established with the aim of producing and providing malt for the existing breweries in the Country .The Factory was established in the region of potential malt barley producing zones namely: Arsi, Western Arsi, and Bale zones. The initial capacity of the factory was 100,000 quintal per annum whereas the demand of the breweries during this time was also nearest to the capacity.

In 1983 E.C.(1991 G.C.) due to change of government of the country the barley producer of Asella malt factory became highly decreased their production and the agricultural governance to change their face to other grain like wheat which is give profit. Due to this reason the factory is suffering from shortage of barley. Then the factory to take measurement to decrease this problem to create relationship with the farmer which produce barley in the zone and to give selected crops of barley for farmer , for producer to give training and extension service and for barley to give equal reasonable value(price) like other grain. Due to this reason the factory gradually decreases shortage of barley year to year. In other word in the past time the number of the country of brewery factory is very small but today due to expansion of new private brewery factory the malt production necessity is increase in higher stage in our country.

After down fall of the Dergi regime in 1991G.C (1983 E.C) and the followed free market policy, establishment of new breweries and expansion of the existing breweries create a rising demand for malt products. In response to this growing demand, the factory went through its first expansion to increase its annual production from 100,000 quintal per year to 150,000 quintal per year in December 1995 G.C. This production capacity can cover approximately 35-40 percent of the breweries' demand at that time whereas the remaining 60-65 percent of malt requirement had been fulfilled by import which exhausting the country's foreign currency reserves. With the aim of satisfying domestic demand of malt, the factory had been implemented its second and third expansion project during 2010-2012G.C. to increase its production capacity from 150,000 quintals to 360,000 quintals per annum and begin its production capacity of the factory by about 140% than before. In 2000E.C.(2008G.C.) the top management of Asella malt factory is committed to increase capacity of malt production implementing the second expansion project by 44,308,651 of Ethiopian birr in 2002E.C.(2010G.C). Then the factory is increasing their capacity of production from 150,000 quintal/year to 220,000quintal/year. In the 2003E.C (2011G.C) in the summer time the company implementing the third expansion project to increase capacity of production to 360,000 quintal/year. Time of finishing of this expansion project is 2004 E.C (2012G.C) and starting to work production. Even though the production capacity of the factory has been increased to this extent, it can cover only 55% of domestic breweries malt and demand because of continues expansion of domestic breweries' capacity. Asella malt factory is continuous to increase capacity production like this and creating awareness to raw barley suppliers to produce and supply the necessary quantity and quality products. Also raw barley during purchased to establish management policy of quality and to produce quality of malt which is full requirement of brewery factory of the country.

Additionally, to support any investigator (scientific study) of barley production by budget, for barley producer farmer to give extension service, to participate in protection of natural resource, to participate in school expansion, to help orphan children which is lost their family by HIV AIDS, participate in road expansion, and to participate in any development bazaar and sports to support and appreciate for sustainable development of the country. Asella malt factory to achieve their aims in 2003E.C (2011G.C) budget of year for implementation of new foster development

for achievement of this goal starting work by one top manager, by four administration, by five legal service to work together and under this organization 43 professional, 48 secondary professional, 83 worker have learned secondary elementary stage of education finished, 49 worker which have been learned 1-8 grade to start work by constant worker and by daily employee. Generally, Asella malt factory to create work opportunity for around 230 employees (citizen). From this employee 126 is constant worker. Now days, the Factory needs more than 600,000 quintals of raw malt barley per annum to produce 360,000 quintals of malt in the year. The factory could not get that amount of quality malt barley in local market to utilize its annual capacity. Thus, to minimize the shortage of malt barley in the local market, the factory has been under taking different types of measure in collaboration with different stoke holders. Even though the factory has been trying to technical support for producers since 2007, the factory is still facing shortage of malt barley both in quality and quantity.

1.2 It's Main Products and Services

Delivering quality goods and services can be a major target of any company to stay in competitive market. In response to the factory has been conducting different types of reform such as, Total Quality Management (TQM), Integrated Performance Measure System (IPMS), Kaizen, Business Process Reengineering (BPR) and Management Information System to improve its system. The implementation of these systems enabled the factory to improve its productivity and quality of its product. At the end of 2004, the factory has 54 professionals, 82 semi-professionals and 115 non-professional employees. Out of these workers and employees of whom approximately a quarter are women. This factory produces the malt from barley which is the major raw material for beer production. Other materials such as wheat, rye, sorghum or millet can also be used to produce malt. Of all the possible raw materials, barley has produced to be the most suitable malt for beer production.

1.3 The Main Customers of the Company

Asella Malt Factory has supplying barley malt to domestic brewery factory in high quality and quantity. The factory is trying to profit the country economic development by producing malt which is imported to the country which it saves foreign currency.

The main customers of Asella malt factory are brewery factories. Among them:

- St. Georges (BGI)
- Harar brewery factory
- Raya brewery factory
- Bedale brewery factory
- Meta brewery factory

The factory plans three year strategic plan by applying in action and participate on it. By this plan the factories vision, mission and selected strategic targets are organized.

1.4 Vision

- Producing universally standardized quality malt production and transfer the country's foreign market supply.
- To fulfill quality policy of the World.
- To supply inside the country, outside the country and become famous malt factory.

1.5 mission

- To produce malt and increase supply quality to give support for investigator (researcher) of barley for achievement of the goal.
- By using modern technology to fulfill quality policy of the World to produce quality malt.
- To become famous malt producer in the World to save economy of country which is purchased malt from foreign country and to take responsibility development of the country.

1.6 Value of the Company

- Quality, Accountability, justices and Loyalty are the assets of the company.
- Quality service and assuring remarks are the measures of success.
- Focus on developmental activities that participates all society.
- Follow best management method to use assets.
- Work together and the success or the failure will be ours.
- Following professional ethics is our quality.
- Giving more priority for customers and satisfying their needs.
- Concern for the quality of malt.

- Sustaining profitability and productivity

1.7 Strategies

Asella Malt Factory designed three year strategic plan. Based on this plan the factory tries to increase current production capacity in quality and improve the quality. By the time the factory is supplying excess product to the market and improving it selling activity. The main issues the factories success profit at the moment is strategic plan and minimizing production cost. Asella Malt Factory has done many successful events from those activities some are the following. The factory sees itself first and foremost as part of local community. It believes that the health and wellbeing of the community and health of the factory are linked together as the company's profitability is depend on the wellbeing of its work force and barley producer farmers. The factory believes it has the responsibility to support community led initiatives. Among its many community based programs some are the construction, equipment of schools, construction of coble stone roads in Asella town, rural gravel road, provision of ambulance to support Red Cross service in the vicinity, reforestation program and so on. In the case of the factories ICT service the factory is working with 85 computers and organized into 2 servers with LAN networking for internal information flow.

In addition to this internet service for the company about 24 hours a day with great fiber optics with 5 megabyte per second speed. This allows controlling the current malt barley domestic and foreign business issues.

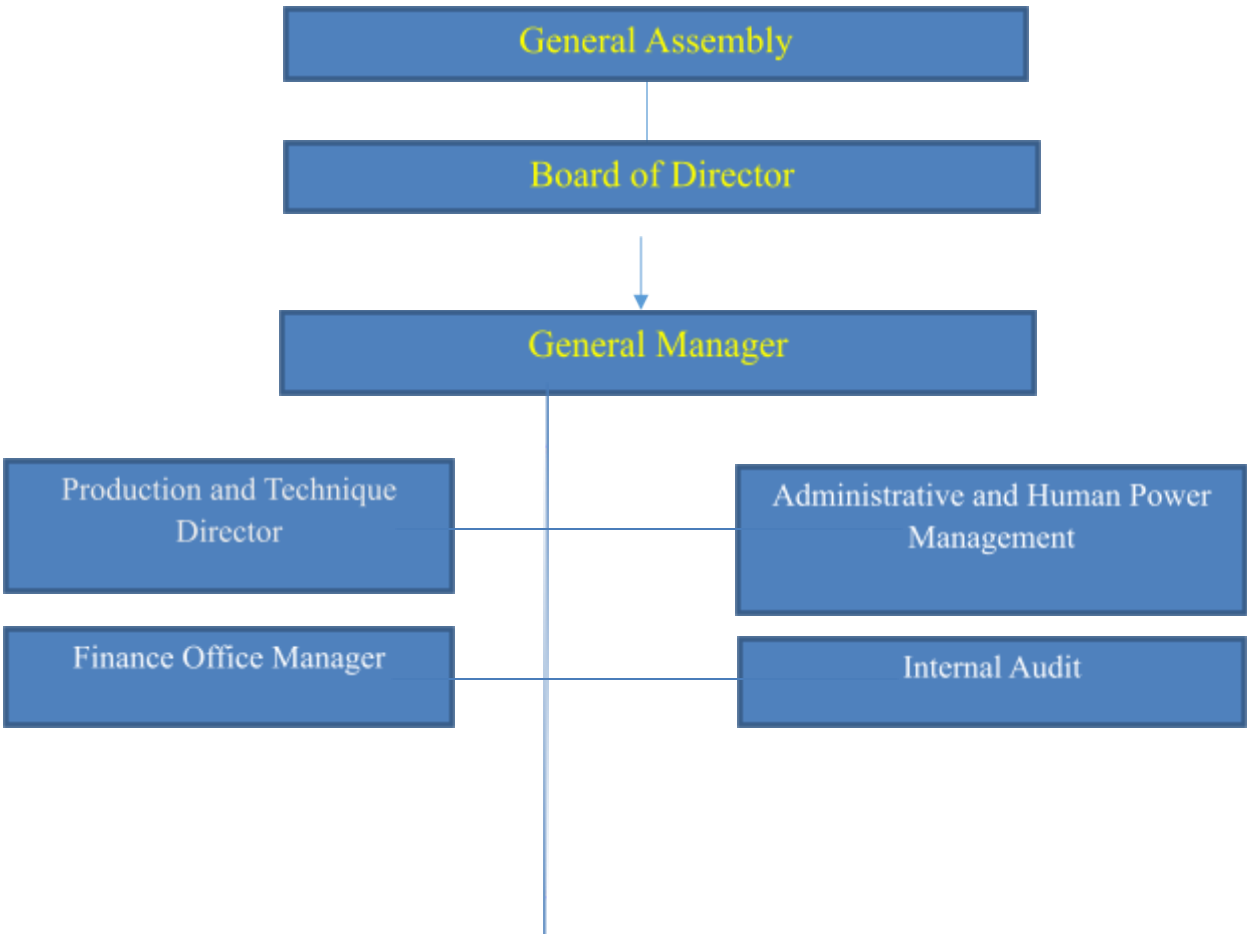
1.8 Objectives of Asella Malt Factory

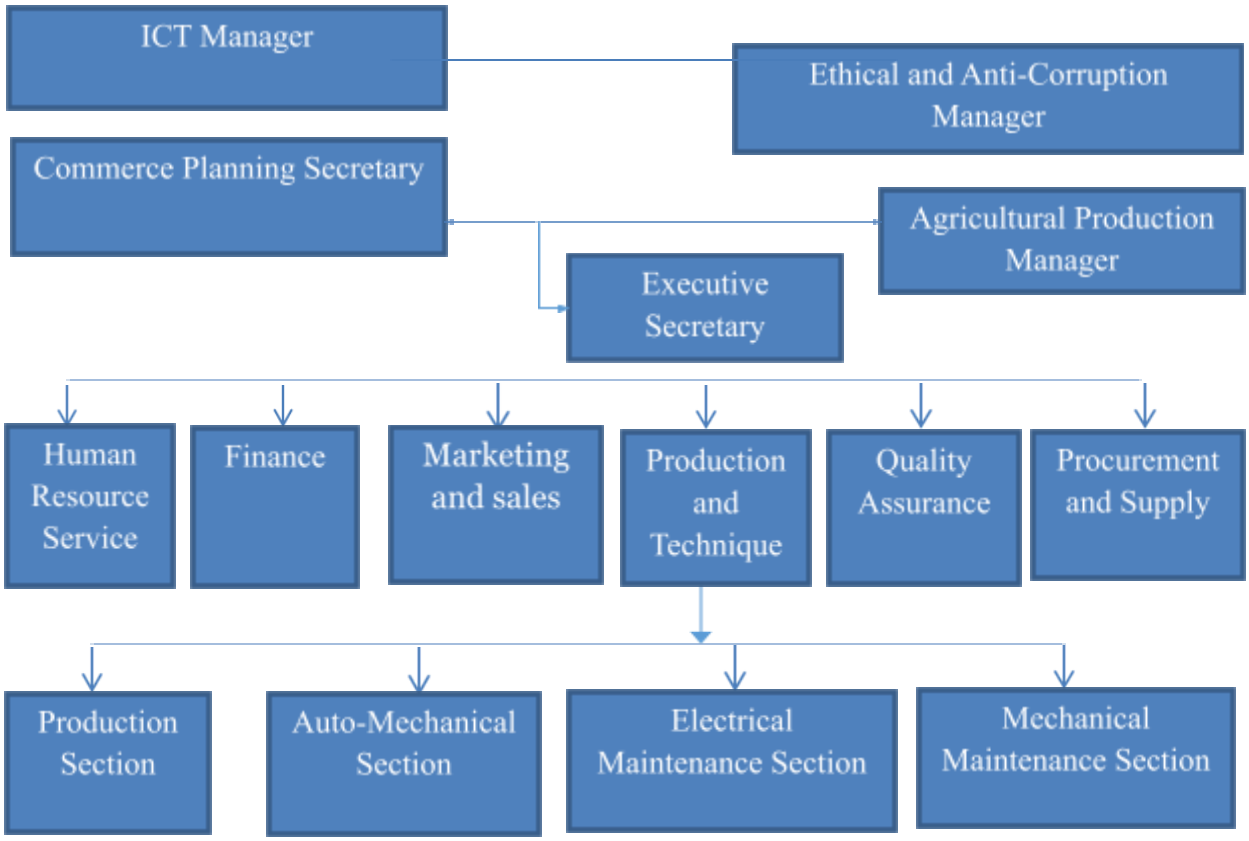
The quality policy of Asella malt factor directed towards the following objectives:

- It is committed to produce and supply quality malt.
- The top management is committed to establish, implement and maintain quality management system and continuously improve its effectiveness
- Ensuring continuous qualitative and quantitative improvement of the malt production.
- Creating awareness to raw barley suppliers to produce and supply the necessary quantity and quality products.
- Create and maintain a safe healthy working environment that will foster team.

1.9 The Overall Organizational Structure and Work flow

Each employee has their own code number during starting work and each employee registered their code number and that number has connection with manager in computerized system. That machine is called thumb machine. Each employee has to press the machine tamp before starting his/her work and follows the same fashion after work. The company produced malt all 24Hr per day. Some employee to start work from one hours up to nine hours (1-9Hr), two hours up to ten hours (2-10Hr), nine hours up to three hours evening (9AM-3PMHr), from ten hours up to four hours evening (10AM-4PM), from three hours evening up to one hours morning (3PM-1AM) and from four hours evening up to two hours morning. Each employee write report on what he/she did on that day at the end of the work.





CHAPTER TWO

OVERALL INTERNSHIP EXPERIENCE

2.1 How We Get Into the Company

The university industry linkage and transfer program is planned to create a good interactions between universities and industries. This provides engineering students to have the capability of solving practical problems the faced. Taking this in consideration Jimma University, Institute of Technology has given a great attention to this program in helping students, starting from searching companies by giving essential document and schedules. Based on this the letter is given to us from Jimma Institute of Technology, faculty of electrical and computer engineering in summer vacation season to select the company suitable for us. After we discuss with each other

we decided to enter AMF. At the time we allowed we went to Asella malt factory, as soon as we get into the company, the security guard allow us to enter after showing him our identification card and the letter written for us from Jimma institute of technology we hold and got to Ato Megersa, the one who accept the previous letter from us who, is director of the general service. He gave us permission to do in the company and send us to Ato Dagnachow Tufa. Then after we get the permission from the company's technician supervisor, Ato Dagnachow Tufa who told us safety, rule and regulation of the company and allowed us to get services from Ato Mesfin Abebe who is the supervisor of project officer. The senior planner Ato Daniel Wedacho told us to care about our work experience and to attend in all staff in which we were going to work. He advised us things that make us well experienced person in the factory in our internship moment. Since it is our beginning of the internship, he told us to start practice and what we should have to work with them. On the next day, we joined electrical technician workers Ato Melaku Teka, Ato Leul Tilahun, Ato Biniyam Nigatu and Ato Hailu Tasaw who showed us materials that we use in workshop. Then, they invited us to visit the factory that are different plants, panels, operation, and production process. After we visit the factory, it was such a good day through which we got good experience in our profession and the whole factory processing. After we get the necessary information from company workers we start our practice for the next consecutive days cooperatively with other students who came from different universities. Our staff has also supported us in preparing communication materials, applying our knowledge and experience through continuous follow up during the exhibition.

2.2 The Section That We Have Been Working In

We have been working in the technique department planning office. This department is under production and technique administration. It is organized basically for the production of brewery malt and producing attainable brewery quality to the customer. In addition asking inquiries planning production plan, organizing labor force, materials and resource and controlling production flow, show operational techniques for workers, testing and controlling inlet sold malting barley, equipment and machineries used in the factory. Technique department has sub sections under it. These are electrician, mechanical and auto-mechanical sections. The main participants on this department are Planners, Forman, Electricians, Mechanical and

Auto-mechanical operators in addition machine operators are included as technique department staffs.

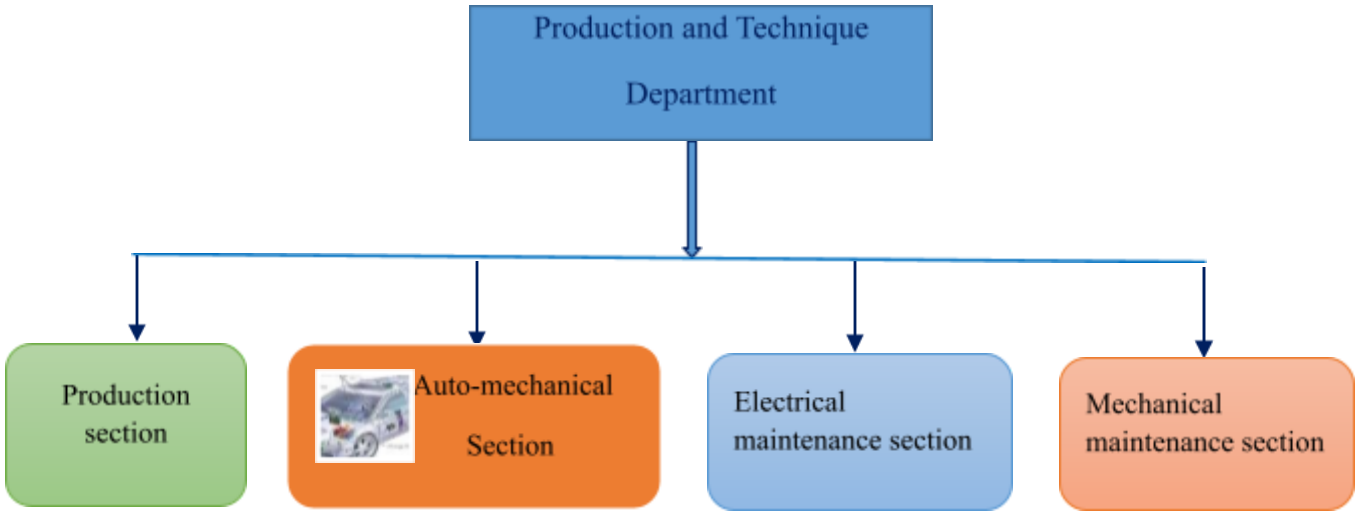


Fig 2.1 production and technique section work flow

2.3 Work Flow in the Section

The main task given to technique department is to insure the perfect operation of the factory by controlling and correcting failures and break down. The maintenance may vary based on failure. The technique department is actually working in protection of failure of existing machineries in their perfect operation. The protection is done using daily inspection by staff members of sub sections.

2.3.1 Maintenance

Maintenance is an act of maintaining equipment and machineries of the plant so as to maximize availability and reliability extends useful life and ensures operational readiness to obtain maximum possible return on investment. Maintenances are mainly divided in to two parts. These are:

I. Planned maintenance

II. Unplanned maintenance

2.3.1.1 Planned Maintenance

Planned maintenance is a type of preventive maintenance that is properly organized and carried out at predetermined interval or other prescribed criteria and intended to reduce the possibility of equipment condition falling below the required level of acceptability. In this planned maintenance variety action takes place. These are like over hauling, small repair, inspection, medium repair, lubricant. In this action work orders and life history cards are operational.

Over hauling: is well-organized maintenance type that is carried out at predetermined interval to check and maintain each and every part of the machine

Small maintenance: is carried out at predetermined interval and used to check and maintain damaged parts

Inspection: is a type of preventive maintenance used to carry out to see the operating parts and to maintain if there is malfunctioning parts

Medium repair: is also carried out at predetermined interval but it takes lesser time than over hauling repair

Lubricants: are oil and grease that are applied to the machineries. These machines are checked seasonally

Work orders are a document that gives information about investigation work activities of the maintenance. The 96 second work orders are asked from operators and workers. They report the failure occurred to technique department. The technique division head gives an instruction to planers to check and reason out the problem occurred. Planers get the instruction and check and give reasoning about the occurred failure or break down. After the problem approved, then it is documented on the break down logo. This instruction then send to the sub section Forman's, electrical, mechanical or auto mechanical Forman's. Then the Forman assign technician and maintain the break down.

After maintenance finished, data recorded on the machines life history card. It is a card used to record any change or events of each machines life. The technique division head has the responsibility to maintain the following records:

- Maintenance states report
- Weekly machineries inspection results

- Machineries life history record card
- Machineries daily maintenance report
- Machineries monthly work order maintenance result
- Machineries daily over hauling maintenance result
- Mechanical work done, Electrical work, automotive work registration log book

2.4 The Work Task We Executed

Since we joined in the technique department planning division of the factory, we were participating in the planning works. After we understood the work flow, the planners showed us the work done under this division. In addition to improve our practical and operational knowledge, we were working with technicians like electricians and mechanics. For instance, in electrical work shop we have been participating on different maintenance machineries and winding motors. In the planned working areas, we were involving as a member of technical division and involved in works like:

- Writing work orders
- Distributing work orders
- Identify machinery to be inspected
- Receiving reports of the work done
- Calculating maintenance cost and spare cost
- Recording maintenance cost and spare part used on life time history card of the machine and preparing maintenance report
- Distributing maintenance report to responsible division that is to the head of technique department

In the company we have been working with the Planners, Forman, Electricians, operators and other sub-division technician's work in the department like:

- Helping electricians and participating while identifying break down.
- Inspecting machineries every beginning of the weekend.

- Participating on the yearly maintenance and repairing the machineries and equipment when breakdown and failure is occurred.

- Motor windings.
- Installing 36w lamps in different plants and repair those that broken.
- Applying Kaizen application principles in practice with workers.

Since safety is beginning in the company, while we were working with technicians we understood to apply working principles that workers should have to follow. For instance, preparing oneself to the work mentally, wearing the appropriate safety and protective clothes.

2.5 Procedures We Followed in the Company

In the factory, we understood the machineries operation and components with Inspections and windings of motor, maintaining different machineries and installing lamps in plants. While we were participating in motor winding, we have been following the procedure to wind a motor. These are:

- Identifying types motor
- Operation and purpose of motor winding
- Selecting and preparing tools for motor winding
- Materials required for the winding

After preparing the above things we moved to the winding. The whole winding procedure will be discussed below.

2.5.1 Motor Type Identification

In the factory the two mainly available types of rotor construction is normally used for three phase induction motor with highest speed of 3000rev/min and lowest 1400rev/min. These are:

a) Squirrel-cage rotor: Motors employing this type of rotor are known as squirrel-cage induction motors. Without the rotor core, the rotor bars and end-rings look like the cage of a squirrel, hence the name squirrel cage induction motor. Squirrel-cage rotor induction motor has the following characteristics.

- Almost 90% of motors in AMF are squirrel-cage induction motors type, because this type ‘rotor' has the simplest and most rugged construction and is almost indestructible.
- The rotor consists of a cylindrical laminated core with parallel slots for carrying the rotor conductors which, it should be noted clearly, are not wires but consist of heavy bars of copper, aluminum or alloys.

- One bar is placed in each slot; rather the bars are inserted from the end when semi-closed slots are used.
- The rotor bars are brazed or electrically welded or bolted to two heavy and stout short circuiting end-rings.
- The rotor bars are permanently short-circuited on themselves, hence it is not possible to add any external resistance in series with the rotor circuit for starting purposes.

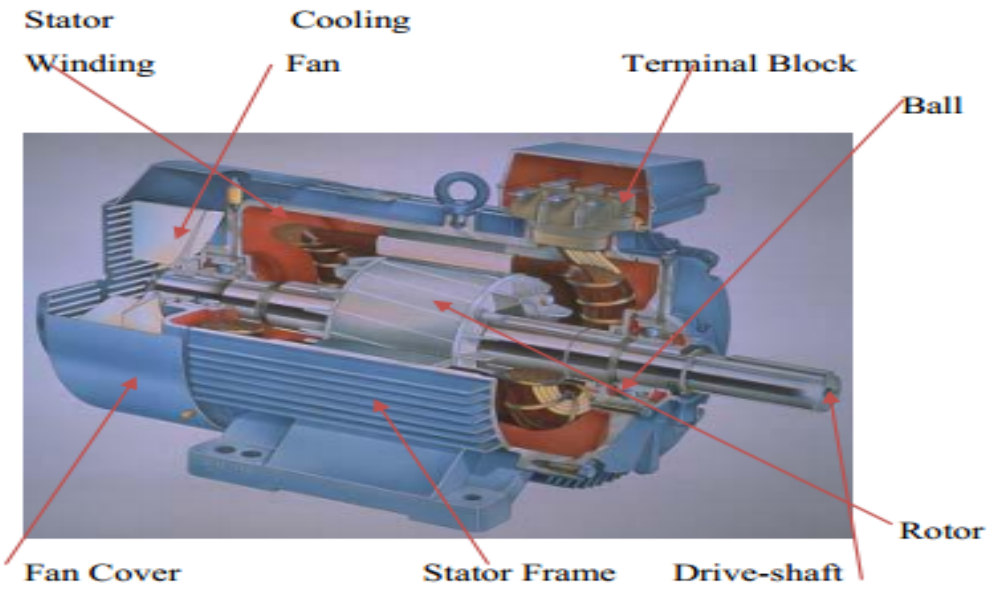


Fig 2.2 Complete Structure of 3-Phase Squirrel Cage Induction Motor

b) Phase-wound or wound rotor: Motors employing this type of rotor are variously known as phase-wound motors or wound motors. This type of rotor is provided with 3-phase, double-layer, distributed winding consisting of coils as used in alternators. The rotor is wound for as many poles as the number of stator poles and is always wound 3-phase even when the stator is wound two phase. The three phase are starred internally. The other three winding terminals are brought out and connected to three insulated slip-rings mounted on the shaft with brushes resting on them. These three brushes are further externally connected to a 3-phase star-connected rheostat. This makes possible the introduction of additional resistance in the rotor circuit during the starting period

- For increasing the final torque
- For decreasing starting current and
- For changing its speed-torque characteristic.

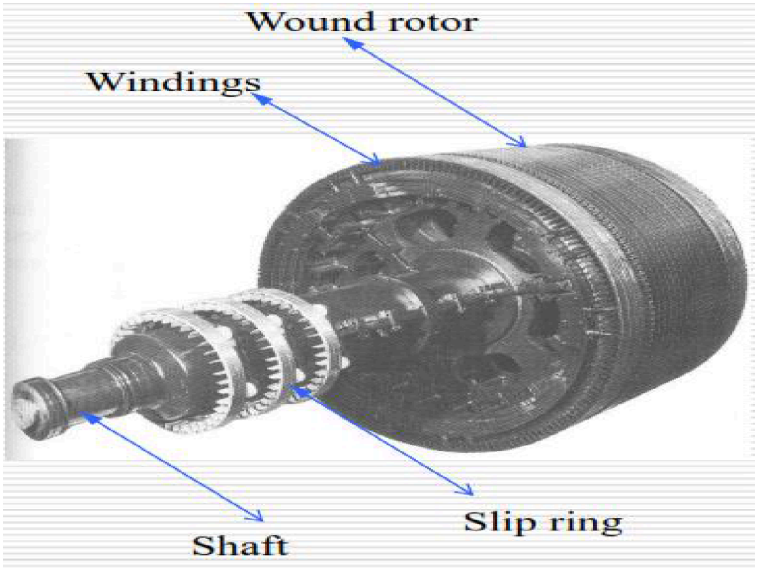


Fig 2.3 wound rotor 3-Phase Induction Motor

2.5.2 Operation and Purpose of Motor Winding

In AMF Company the motor has the following purposes.

- For pulling elevators
- For pumping water
- For rotating chain, belt and slash conveyor
- For rotating turning machines
- For pumping oxygen and engine for furnace

2.5.3 Tools Used for Motor Winding

There are different types of materials and equipment's are used for motor winding purpose. Among them:

- Hammer with plastic lips
- Combination pliers
- Side cutter and scissor
- Pressing wooden or soft object

- Ruler and caliper
- Micro meter
- Soldering (iron)
- Knife, sand paper or Henry paper
- Chisel for cutting
- Volt cutter

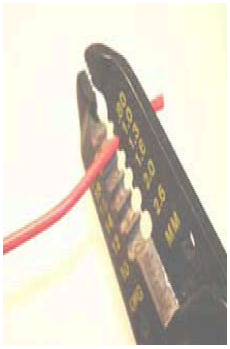
Screw drivers 	Wire striper 	Side cutter 	Coil tamper 
insulation guillotine 	Wire cutting scissor 	Plastic hammer 	Curved insulation scissor 

Fig 2.4 Electrical workshop tools

Materials used for the motor winding are discussed below.

- Wire with required size of diameter (copper wire)
- Motor stator
- Insulating paper
- Insulation paint (varnish)

- Winding machine
- Terminal plaster
- Cotton tape or yarn
- Lead and flux
- Insulating tube

Steps for motor winding used

1) First check the existing motor using multi meter

2) Read data from name plate and take appropriate data

3) Placing the motor on the work bench

4) Looking at the winding mode visually

5) Taking data from existing stator include, the following information should be recorded:

a) Name plate data
b) Terminal Connection
c) Number of turns per coil
d) Wire size
e) Wires in multiple (group)
f) Coil Pitch
g) Coil extension
h) Number of groups
i) Number of poles
j) Number of coils per group
k) Number of slots and
l) Winding arrangement

In addition to the above:

(i). Jumper connection

(ii). Phase connection

(iii). Thickness of wire

- Draw wiring diagram as appropriate using obtained data from existing motor
- Cutting out existing motor winding from connection side
- Removing wire from stator slot
- Cleaning the stator
- Extracting the smith
- Preparing materials for winding on place
- Slot insulation (ground insulation)
- Wedge insulation

- Setting coil based on coil pitch
- Using the data taken and making coil wind
- Insert the finished format of it on the slot according to drawing
- Connecting wire loads to connection terminal (soldering)
- Test using multi meter
- If testing is successful then insert phase insulation
- Yard tying the coil
- Testing magnetic field
- Varnishing and draying
- Reassembling then testing for final action of use

The name plate data of a motor is important to understand the operation and other important data's. some of the terms listed on the name plate are: manufacturers, rated voltage, full load amperes, rated frequency, number of phases, insulation class, full load RPM, temperature rise, time rating, code letter, design, serial number, motor efficiency, frame, service factor and power rate.

2.5.4 Armature Windings

The Armature winding of a machine is defined as an arrangement of conductors design to produce EMFs by relative motion in a magnetic field. It is usually conductors covers with single cotton cover, double cover cotton or enameled and cotton covered. Electrical machines employ groups of conductors distributed in slots over the periphery of the armature. The groups of conductors are connected in various types of series-parallel combination to form Armature winding. The conductors connected in series so as to increase the voltage rating. They are connected in parallel to increase the current rating.

2.5.5 Types of Induction Motor Windings

There are two basic physical types of windings:

a) Single layer winding and

b) Double layer winding

a) Single layer winding

In this type of winding arrangement, one coil side of a coil occupies the whole of the slot. This type of winding is not used for machine having commutator. These windings allow the use of semi-closed and opened types of slots. The most three common types of single layer windings are:

- ❖ Concentric windings (Unequal coil span)
- ❖ Mush windings (equal coil span)
- ❖ Chain windings (equal coil span)

Concentric Winding: Three-phase concentric winding consists of coil groups laid in the slots so that all the coils of each group are concentric. That is, the coil with the smallest slot pitch is surrounding by the coil with the next larger slot pitch and so on to make up a coil group. Each coil consists of several turns and the cross-over from one coil to the next is indicated by a short slanted line (jumper). In order to construct the diagram for a winding, the following date must be known.

i) The number of slots in the stator (S)
ii) The number of phases (m)
iii) The number of parallel circuits in the windings (a)
iv) The number of poles (P)
v) The pitch of the winding (Ys)

The coil pitch of the winding is determined by the formula:

$$YS = \frac{S}{P} \qquad (2.1)$$

The coil pitch is the distance between two sides of a coil expressed as the difference between the numbers of the slots in which the sides lie. The concentric winding of 36 slots of induction motor is given in the figure below.

Fig.2.5 Concentric Winding of three phase induction motor

Mush Winding: This winding is very commonly used for small induction motors having circular conductors. This is a single layer winding where all the coils have same span (unlike the concentric winding where coils have different spans). Each coil is wound on a former, making one coil side shorter than the other. The winding is put on the core by dropping the conductors, one by one into previously insulated slots. The short coil sides are placed first and then the long coil sides. The long and short coil sides occupy alternate slots. It will also observed that the ends of coil situated in adjacent slots cross each other i.e. proceed to left and right alternatively. Coil-sides of mush winding arrangement inside the slots. The following should be kept in mind while designing a mush winding:

- The coils have a constant span.
- There is only one coil side per slot and therefore the number of coil sides is equal to number of slots.
- There is only one coil group per phase per pole pair and therefore, the maximum number of parallel paths per phase is equal to pole pair.
- The coil span should be odd. For instance, for a 4 pole 36 slot machine, coil span should be 36/4=9 that is acceptable value while for a 4 pole 24 slot machine, the coil span should

not be 24/4=6; it should be either 5 or 7 slots. This is because a coil consists of a long and a short coil side. The long and short coil sides are placed in alternate slots and hence one coil will be in an even numbered slot and the other in odd number slot giving a coil span which is an odd integer.

Chain Winding: In all aspects, this winding is similar to that of mush winding except that both coil sides of a coil have equal length and diamond shape.

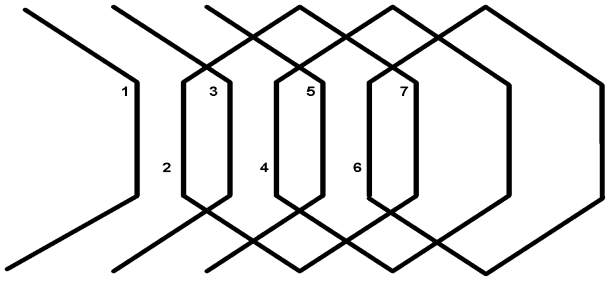


Fig 2.6 Arrangements of chain winding

b) Double layer winding

The double layer winding have identical coils with one coil side of each coil lying in top half of the slot and the other coil side in bottom half of another slot exactly or approximately one pole pitch. Double layer windings differ from single layer winding mainly on the following main points:

- Each slot is occupied by the side of two coils and each coil is arranged to form two layer round stator.
- One layer of the windings lies in the bottom half of the slots and the other in the top half of slots.
- Unlike the concentric winding, double layer winding consists of identical coils in which all of the same shape and pitch.
- In a double layer winding, the coil pitch is the distance between the top and the bottom sides of the coil expressed by the number of slots spanned or by the coil sides or by the number of slots occupied by each coil side.

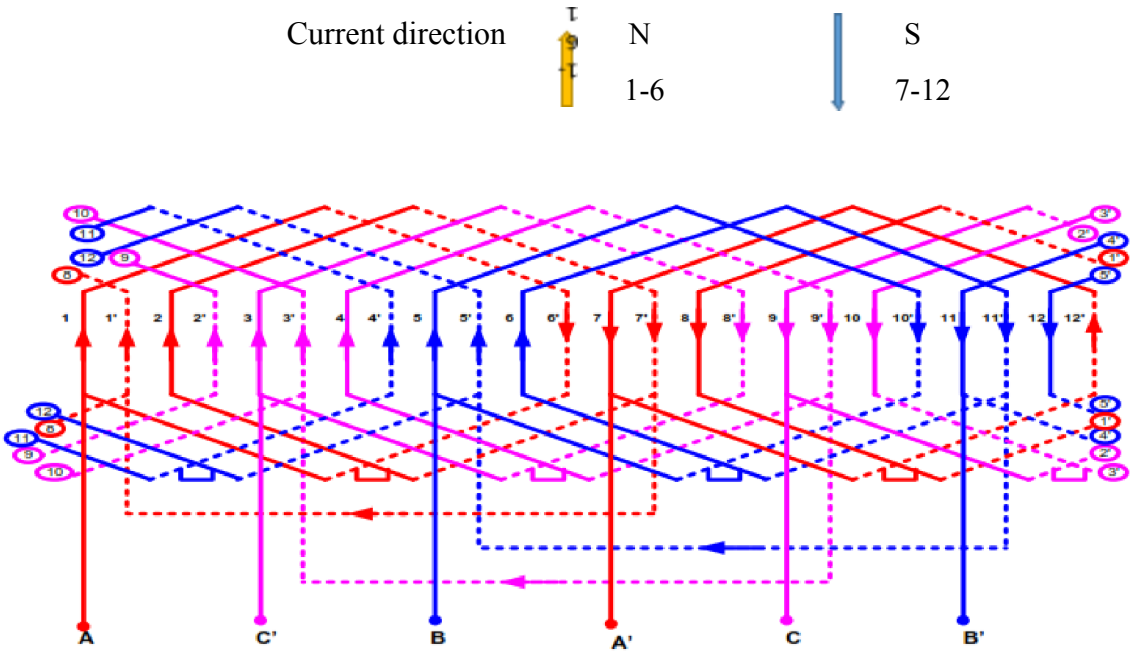


Fig 2.6 Winding Layout

2.5.6 Some Winding Terminologies

Some of the commonly used terms associated with windings are as follows:

Conductor: The active length of a wire or strip in the slot.

Turn: A turn consists of two conductors separated from each other by a pole pitch or nearly so, and connected in series.

Coil: A coil may consist of a single turn or may consist of many turns, placed in almost similar magnetic position, connected in series.

Pole pitch: Is the average distance between two adjacent poles. It also may be defined as the periphery of the armature divided by the number of the poles in generator.

Winding pitch: Is the distance round the armature periphery between two successive conductors directly connected together.

Commutator Pitch: Is the distance measured in commutator segments between the segments to which the two ends of the coil are connected.

Back pitch: Is the distance measured in terms of armature conductors which a coil advances on the back of armature.

Front pitch: Is the number of the armature conductors or elements separated by a coil on the commutator end.

Resultant pitch: Is the distance between the beginning of one coil and the beginning the next coil to which it is connected.

Test the winding: The three phase motor should be given tests for the following defects after rewinding: grounds, opens, shorts, and reverses.

Grounds: To locate the ground, connect one test lead to the frame of the motor and one test lead to the leads of the motor. If the lamp lights, a winding is grounded. To ensure a thorough test, move the test lead to each lead of a motor.

Open circuits: Causes due to a break in a coil or a loose connection at the splices or jumpers. To locate the opens, connect one test lead to the starting of the motor lead and one test lead to the ends of that motor lead. If the lamp isn't lights, a winding is opened. To ensure a thorough test, move the test lead to each lead of a motor.

Shorts: A short is a path of very low resistance caused by two wires making electrical contact. Shorts can occur when the coil wire is scratched during insertion or care less handling. To locate the ground, connect one test lead to the starting or ending of one lead of the motor and one test lead to the starting or ending of the other leads of the motor.

Reverses: Occur when a coil, group, or phase is improperly connected.

2.5.6 Common Types of Motor Troubleshooting

(i) If a three phase motor fail to start

(ii) If a three phase motor dose not run properly

(iii) If the motor run slowly

(iv) If the motor become excessively hot due to overload

2.6 How Good We Performed Our Work

In frankly speaking, the factory appreciated us very well due to we attend the work on time and while we were performing our tasks. Even at the time of Planners went out to visit other factories and when they were not available, we were fully covering their work on time. The head of technical department told us that he amazed with our attitude for the work and task that given to

us. This shows we were so good while performing our task in the factory on our industrial internship practice. Furthermore, we were participating in all staffs that the technicians involved and in practical activities such as motors winding, maintaining break down, controlling and installing lamps with electricians and operators. When our supervisor Ato Mesfin Abebe comes to visit our activity, He told us that we are so good and happy in our impression to the work.

2.7 Challenges We Have Been Faced In the Company

As it is most usual one challenges during the course of doing something, at the beginning we faced some challenges on technical activities. However it is not so much difficult for us since we have the tendency to know about electrical parts and done some activities with work shop lab in our university. The challenges that we have been encountered while we were performing our daily tasks in the company are:

- There are no enough access of internet (Wi-Fi) to dig out more information.
- We are unable to get the chance to visit the power house which contains the electric materials like transformer, stand by generator and bus bar.
- We have no more knowledge about plc.
- Most of the materials and equipment's are carried by man power to move from place to place. Which need more energy.
- We haven't got the safety clothes and other materials
- We haven't got access of computer to dig out some information necessary for us
- We enter into the company at 7:30 AM and we leave at 3:00 PM, in case of this many time we haven't get the chance to eat our breakfast
- Some technicians have lack of knowledge about the place they work, so they cannot give us full information about the machineries and their purposes.
- The other challenge we faced while we were winding motors is that the company uses outdated motor winding system, such as manual coil wiring and others.

2.8 Measure We Have Taken to Overcome the Challenges

The basic thing on facing the challenge is that how much we are ready and able to propose solution and we have under taken solution into practice and overcome the challenge we faced. The measure we have taken to overcome the challenge we faced are listed as follows.

- We bought safety clothes and other materials by ourselves
- By asking one person from electrians repeatly we have been able to see the power house.
- During the movement of machineries and materials we carried with other student who came from different universities and technique.
- We rewind the motors that are out service and the company reused them for its work
- We ask different technicians to tell us full information we want to know.

2.9 Malt Production

what is malt?

It is a cereal, usually barley, which has germinated for a certain period of time and then dried. Some brewers and malt esters define malt simply as “a package of enzymes and food substances”. The grains are made to germinate by soaking in water, and are then halted from germinating further by drying with hot air. Malting grains develops the enzymes required to modify the grain's starches into sugars.

Fig 2.7 Malt

2.9.1 Process Description of Malt Production at Asella Malt Factory

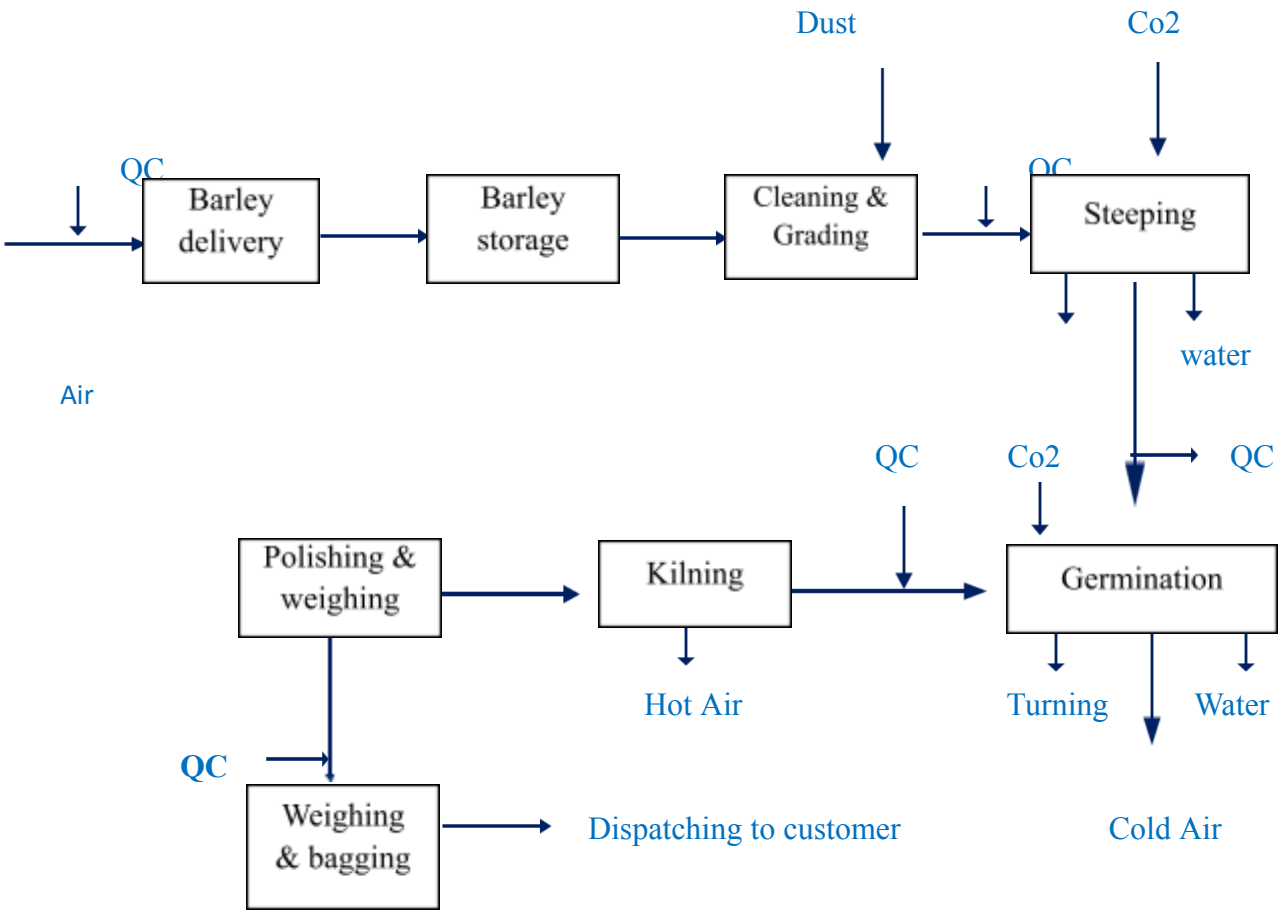


Fig 2.8 Process Description of Malt Production

The production process is performed at different plants in the company, starting from raw barley cleaning and grading to the final kilning malt and De culming. The major process activities includes:

- ❖ Cleaning and grading
- ❖ Steeping
- ❖ Germinating

- Kilning
- De culming
- Silo

Each production activity is described briefly as follows.

A) Cleaning and Grading

The production process of malt starts from cleaning and grading of received barley into different sizes of 2.6 mm, 2.4mm and 2.2mm grain. Grading into different sizes is principally performed to germinate similar sizes of grain in the same batch to have an even germination during the process. barley storage barley delivery cleaning and steeping grading polishing and weighing kilning germination weighing and bagging germinating grains of similar size in the same batch will all depend on the available quantity of grain having kernels with a size above 2.5 mm and /or below 2.5mm but above 2.2mm. If the incoming grain does not contain adequate quantity of the required size kernels, the storage of such identical size grain will unnecessarily occupy the silos for a longer period, until the required quantity is collected from the bulk delivery. Thus the type of barley with respect to its kernel size has an impact on the germination process**.**

Fig 2.9 Barley cleaning and grading machine of Asella Malt Factory

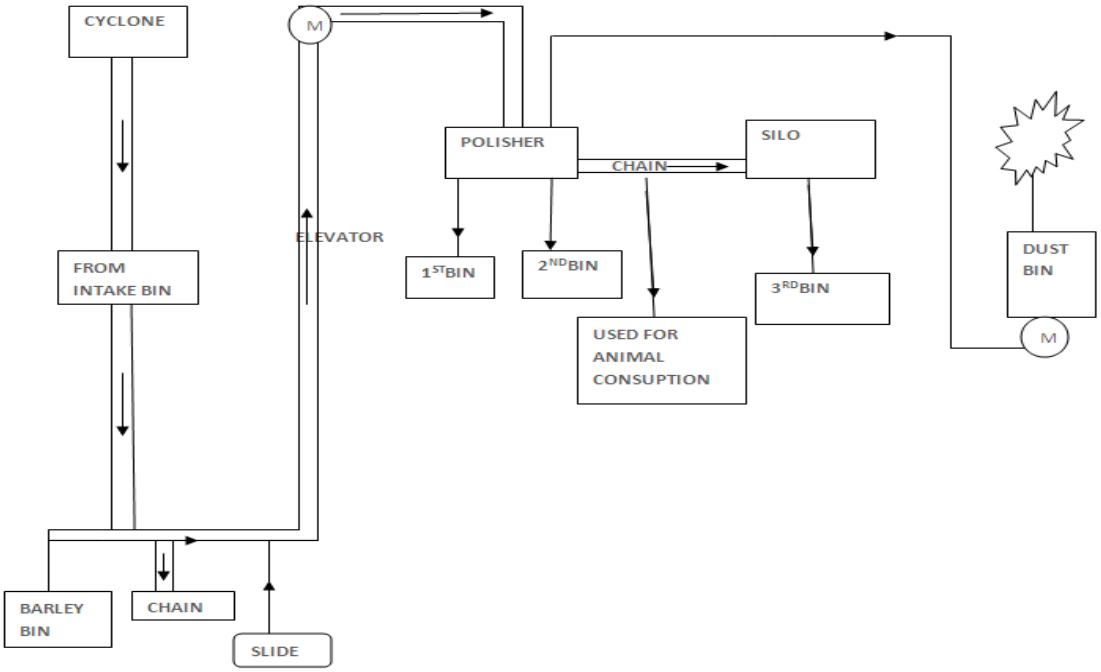


Fig 2.10 Cleaning and Grading diagram

B) Steeping

During the steeping process, the cleaned barley ready for malting is washed and steeped to raise the moisture content in the barley so that the enzymes are activated to enhance germination process. The process is as follows; from silo barley received by small reversible chain conveyor and then given to steeping elevators, steeping balance, steep chain conveyor and steeping tank. Grains that float and do not germinate due to their size are skimmed in this process. The process usually takes 12-18 hours. The required moisture that could facilitate germination is achieved within the period. Water pumps are the main operational devices in which it allows the water and moisture rise up through the barley. At the end of steeping the grain will contain 38-40% moisture.

Fig 2.11 Steeping Process

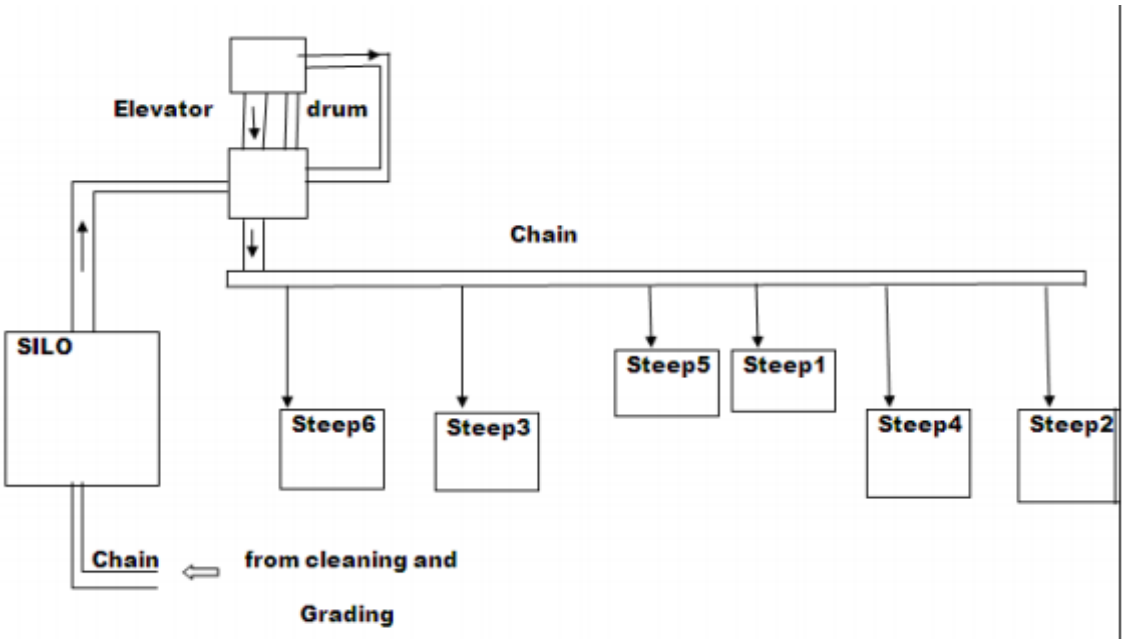


Fig 2.12 Steeping diagram

C) Germination

The steeped barley is pumped over to the germination boxes, and then germinates in which the starch in the barley changes to fermentable sugar. The process takes 4½ -6 days, depending on

the quality of the barley. Small size grains usually germinate faster than large size grains. During the process, the temperature and the moisture are controlled to the desired conditions. The malt has been observed not to have any difficulty in such processes. In this germination box there are about 14 motors are present around the germinating box. Largest motor on the machine which is the one travel the warm turner forward and reverse in chain or gear system. The screw turner moves fast for the case of turning of the barley and slow for the case of turn. The speed of the motor can be controlled by the frequency convertor.

Fig 2.13 Germination Process of Asella Malt Factory

D) Kilning

Kilning is in which the germination of the grain terminates by drying the germinated barley (green malt) is the final production process in malting. In this process, the moisture in the green malt is reduced from (44-46) % to (3-4.5) % with the kilning period of 25 hours. Enzyme activities terminate and the malt will have the flavor, taste, and aroma and color in the process. The process is as follows. The green malt is carried out by green malt loading chain conveyor with valves from germinating box to kilning house. First, by using loading and unloading machine the malt is poured over the sieve. Then the steam is coming from the boiler with pipes

and given to heat exchanger with heating system and valves and next given to malt by using high power radial fan. It is the final process in malt production. There are two kilning house.

(i) Old kiln

(ii) New kiln

The old kiln box is leveled by man power and dispatch by the heavy shovel. While the new one have its own leveling system and by means of motor and controlled by PLC (programing language control).

Fig 2.14 Kilning Box

2.9.2 Malting Processes

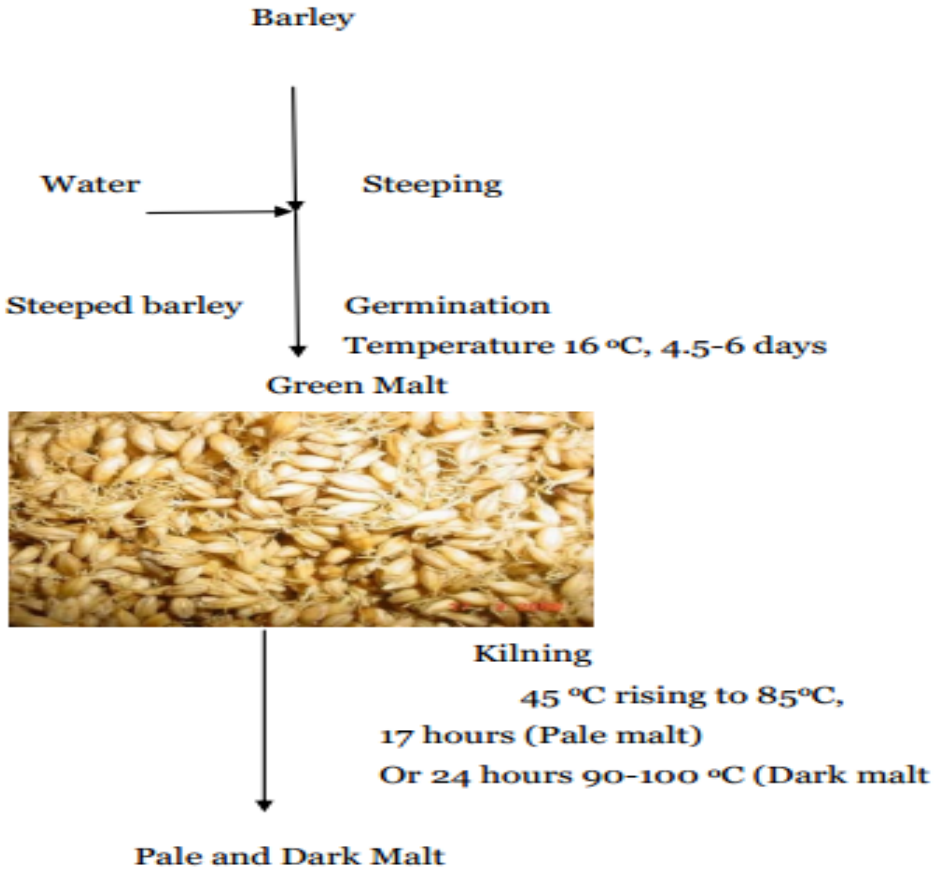


Fig 2.15 Simplified flow diagram of malting process

E) De culming

The roots and shoots grown during germination are removed in this process. The removal of the roots helps the malt not to absorb moisture during storage. Thus in the process of De culming, the roots are polished and then separated from the malt by blowing air into the polished malt by pneumatic sifter. Finally after going through all the above processes, the malt will be kept in the silos for at least 2 months before delivery to the breweries, so that the enzymes activated during germination settle down.

Fig 2.16 Malt polishing machine of Asella Malt Factory

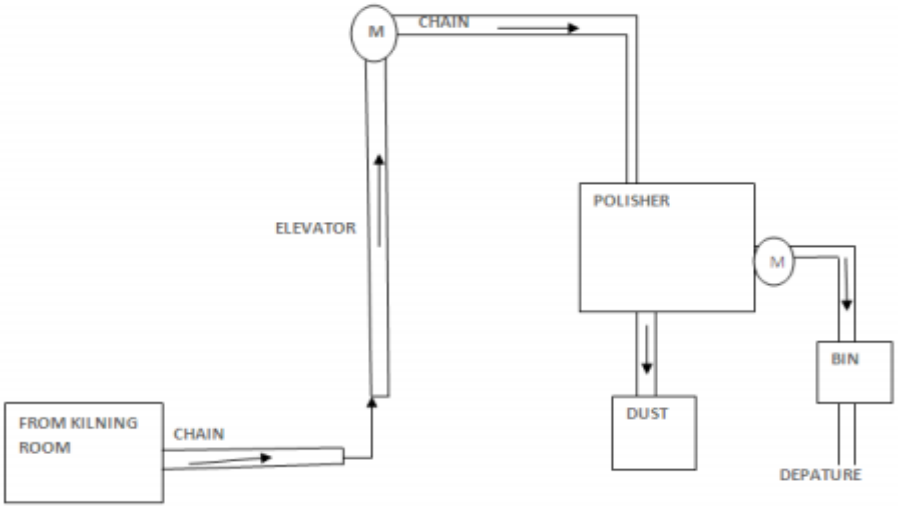


Fig 2.17 De Culming Process diagram

F) Silo

The silo is the barley and malt storage materials. The company at this moment has 36 silos. Before expansion the silos of company is 24 silos. In the company after expansion there are

different malt and barley silos. From 36 silos, 4 silos are used to storage of malt and other 32 silos are used for barley storage. The silos of company are grouped into two; Odd silo and Even silo.

The barley is given to odd silo by using long reversible chain conveyor and even silo by dispatch elevator.

Fig odd and even silo of Asella malt factory

2.10 Automatic Standby Generator

The factory has a supply of 15KVA supply from EEPCO. The automatic emergency generators have been built to meet the emergency power needs of the residential and light commercial customer. Startup automatically if the utility power is interrupted and the out themselves off when utility service is returned. Automatic standby generator has two switch; emergency switch which is used or operate for generator and normal switch which is operate for main power distribution. The standby emergency generator is used when the power failure occurred and it has capacity up to 1600KVA power supply to the factory. AMF has three transformers in the transformer house. Two old transformers are coupled synchronously in parallel each having 800KW. The new transformer feed power to the extension of the factory. It has 1250KW capacity, the out let of transformer connected to the ATS (automatic transfer switch) which is connected to the emergency generator and load. From main power distribution it is connected

like an automatic generator to bus bar of distribution panel. When main power distribution cut-off or normal switch is off automatic standby generator immediately become on or emergency switch is on which means normal switch off means emergency switch on and vice versa. To do a useful work percentage of the electricity being used is important called power factor. This power factor relay is used as a capacitor bank used to store power. For industrial process using electrical motor (to drive pumps, fans, and conveyor) introducing in efficiencies in to the electricity supply network by drawing additional current which is inductive reactive power. This inductive reactive current produces no useful power. They increase the load on the supplier's switch and distribution network and on the consumer switch gear and cabling. The inefficiency is expressed a ratio of useful to total power is what we call it power factor. Typically uncorrected power factor for Asella malt factories' 0.914 inductive. This means that a 1 MVA transformer can only supply 914 KW or the consumer only draws (Asella Malt Factory) 91.4 useful amps from 100Amps supply from EEPCO. Inductor motor with power applied and no load on its shaft should draw almost small production power since no output work is being accomplished until a load is applied. The current with no load associated with this motor reading is almost entirely reactive power. In calculations we use as it is ratio of active (useful actual) power to the apparent power expressed in VA.

$$PF= \frac{ACTIVE\ POWER}{APPARENT\ POWER} = \frac{W}{VA} = COS\Phi \qquad (2.2)$$

2.11 Distribution Panel

A distribution boards (panels) is an assemblage of parts, including one or more fuses or circuit breakers, arranged for the distribution of electrical energy to final circuits or to other sub distribution boards. It consists of a case inside which is a frame holding a number of fuse (circuit breaker) carriers. Behind the frame, or sometimes alongside or above it, is a bus bar to which the incoming sub main is connected. From the bus bar there is connection provided to one side of each fuse way (circuit breaker). Each final sub circuit is then connected by the installer to the outgoing terminal of the fuse ways. A second bus bar is provided to which the incoming neutral

and the neutral of the outgoing circuits are connected. The plus standard distribution boards usually have 4, 6, 8, 12, 18 or 24 fuse ways. Both single phase and three phases are available. It is not necessary to utilize all the available fuse ways on board and in fact it is very desirable to leave several spare ways on each board for future extensions. Bus bars and used to provide power supply to distribution board, breaking circuits, fuses and axillaries. The breaking circuits and substation axillaries include providing power supply to emergency lighting, air conditioning, various socket outlets, battery chargers, and all other control and monitoring equipment.

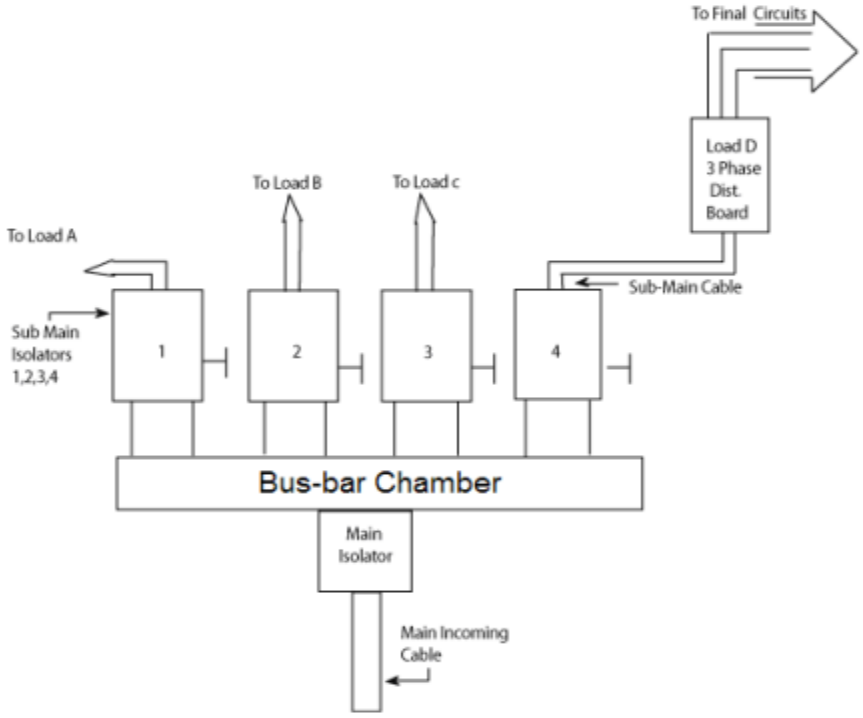


Fig 2.18 Bus bar description

2.12 Auxiliary Plants

2.12.1 Water Treatment

First impure water coming from outside of the factory through the channel and then, in the factory aluminum sulfate (500L water for 50kg aluminum sulfate), sodium carbonate(500L water for 50kg of sodium carbonate) and chlorine (160L water for 50kg of chlorine liquid) is added to each dosing tank. Then mixed by using mixer and given to the water by using dosing pump. Next filtered water is stored to the tanker. There are three water treatment tankers. Within water treatment process there is gauge and meter, clear water pump with level sensor and back wash

pump with level sensor to control the water purity. At the end water is distributed to germinating, steeping and other parts of the plants.

2.12.2 Cooling Plant

It is used for germinating box to control the temperature of the house. First ammonia in the form of gas and liquid is added to ammonia tanker with expander and pipe line. Second ammonia is sucked by compressor and compressed; next ammonia is discharged to condenser and expansion valve. Then given to the germinating room through the pipe and the six fans. In the house there are three ammonia compressors with motor of 90KW capacity, sensor, gauge etc.

2.12.3 Boiler

It is a closed vessel in which water or other fluid is heated. The heated or vaporized fluid exits the boiler for use in kilning house. The pressure vessel in boiler is made of copper. Because of its formality and higher thermal conductivity. In Asella malt factor there are two types of boiler. These are:

I. Furnace (fire) boiler

II. Electric boiler

2.12.3.1 Furnace Boiler

In fire tube (furnace) boiler Water is partially fills boiler barrel with a small volume left above accommodate the steam (steam pace). The heat source is inside a furnace or fire box that has to be kept permanently surrounded by water in order to maintain the temperature of heating surface just below boiling point. The source of heat for boiler is combustion of heavy oil. The furnace can be situated at one end of a fire tube which lengthens of the path of hot gases that augmenting the heating surface which can be further increased by making the gases reverse direction through a bundle of multiple tubes. Alternatively the gases may be taken along the sides and then beneath the boiler through flues. Steam production tons/Hr. working pressure 1.22Mpa, feed water temperature 60-100 C^0 and feed water PH 7.5-9.5.

2.12.3.2 Electric Boiler

Electric boiler is the most dominant boiler in asella malt factor which found only there among in our country's factory. It's supplied 33KV from EEPCO to produce 7000KW that consumed by the boiler. The heat source is inside tube that has to be kept permanently surrounded by water in

order to maintain the temperature of heating surface just below boiling point. The source of heat for boiler is 33 high resistance cable that sucked into tube. It is the mostly used in the factory due to the reduction of cost fuel, no noise and more exhaust of carbon dioxide except electric power is off which furnace boiler on.

CHAPTER THREE

OVERALL BENEFITS WE GAINED FROM INTERNSHIP

3.1 Improving Practical Skill

Internship program is very essential in terms of improving our practical skill, since we were engaging in different types of practical work, we were simple improved our practical knowledge. The skills and sound grasp knowledge's nurtured by studying electrical engineering practically enable us to solute many state of affairs like.

- Ability to analyze and interpret motor winding and install light
- Critical thinking and the ability to understand maintenance, repair, controller and different work activities.
- Inter personal communication, persuasiveness and the ability to work as a team
- It increases our confident to do alone

3.2 Improving or Upgrading Theoretical Knowledge

Even though, we were learnt a lot of things in the class theoretically, it is obvious that practical activity further increases our understanding towards the point of issue. Therefore internship program is not only used to improve our practical skill, but also used to impose our theoretical knowledge by correlating the practical skill with theoretical knowledge. The appropriate measures we undertake to improve our theoretical knowledge's are:

- To know power and controlling system in detail
- To know the details of electrical machine parts one by one: distribution panel, standby generator, boiler, compressor, generator, condenser, grain cooler, fans, pump and etc.
- To correlate the theoretical knowledge with the real work
- Knowing motor maintenance method
- Soon after we start our work, by we have done our best to have appropriate knowledge of automatic standby generator for emergency purpose

3.3 Improving Interpersonal Communication Skill

Team working is a priceless while performing tasks that make the factory profitable. Being in AMF has been good opportunity to develop our interpersonal communication skill. Doing activities alone in the factory is a difficult task. Therefore, by good communication among the different sections in the factory, we grasped wide knowledge. Communication and the sub agents learning help individuals specially engineers move from novices to experts and allow them to train new professional knowledge and abilities. In the factory, while we were working with any technician and asking open ended questions and listening effectively to the answers, we have got a lot of knowledge. Good interpersonal communication is the life blood of the engineering profession. Good communication has the following advantage.

- Analyze and perfect performance of targeted maintenance and inspection
- Improving efficiency of the factory from some defect due to inter personal communication
- To handle information, the more we communicate with the different section in the factory, the better we handle the information
- To persuade peoples the more we communicate the more we know, the better we persuade the people
- To improve relationship with others, if our day to day communication increases our relationship among the different sections also improved a delay.

3.3.1Improving Team Playing Skill

Even if tasks are done individually by the respective person at different section of the company, there are times at which different individuals come together to work for common goals of the

company for increasing productivity. The most important point in team playing skill is just reach an agreement from different points on the work to be done. For instance in the case of applying kaizen working principle all the factories worker were participating to insure the targeted goal in addition, the technique division head, senior planners, Forman's and technicians discusses on issues that led them to the team working. Thus achieving good team playing skill is essential for.

- It reduces errors from happening and to develop friend ship between the workers
- Grasping a good knowledge and help to share ideas
- It develops Communication skill
- Increasing understanding of the task
- Effective completion of tasks
- For time saving and increasing productivity

3.3.2 Improving Leader Ship Skill

Leadership is the process of influencing other to work towards the achievement of objectives or goals. It is one of the functions of management which like Planning, organizing, setting, leading, staffing and controlling. This internship program guides us to be an ethical leader that means ethical leadership provides the momentum, guidance and motivation among members, significant traits for effective leadership in our working area. In addition to this the internship program allow us what a good leader satisfied or fulfill like a change agent innovative skill and entrepreneur for himself . If activities not made us required he/she arrange and perform tasks rather than insult his staff members. Therefore this is a good collaboration between the leader and colleague. The company or the agency is also successful or fruit full. Generally what we understand for the past four months Internship program is that anyone who is willing to make the effort can become a good leader.

3.4 Understanding about Work Ethics and Related Issues

Work ethics are generally accepted guidelines for right and wrong behaviors in work place. As workers made to specialize in different fields specific codes of conduct were expected from each worker. In today's complex world, ethical conduct of workers is very important for developing healthy working environment and increasing productivity. For employee that works in Asella malt factory it must to obey rule and regulation to confirm work ethics and to be self-discipline.

While we were in the factory most workers told us what misbehavior cause workers to disappear from their working area.

The following principles allow good work ethics in working area

a) **Punctuality**: This means arriving at work on time
b) **Honesty**: Honesty at work means spending working hours and resources totally on work
c) **Willingness to learn**: This means understanding the way things are done at your work place and trying to do it better
d) **Initiative**: Being prepared to see what needs doing and to do the work without always being asked or told to do it
e) **Loyalty**: Do what best for the growth of the organization
f) **Maximizing productivity**: This is the ability to do high quality work faster and efficiently

The following are ethics we get:

- We observed that group work was better than individual work
- We learnt that no need of playing during work
- Saving money and time was must within the work ethics
- We observed safety was first for work
- How we are being punctual for a future
- Being responsibility for a future

3.5 Entrepreneurship Skill

Entrepreneur a person who sees a good opportunity for a new business and works hard to make it grow entrepreneur are very important for the growth of economy. While we were in the factories, we have got wide knowledge in the entrepreneurship skill that we should have to find our self as an engineer and creative person by analyzing work opportunities and employee. The major characteristics of entrepreneurship that we have seen in the factory include the following.

Self-confident multi- skilled: To be an entrepreneur engineer for the future we should have to be confident to take positive or negative consequence. Therefore, the past four moth intern ship programs leads us to a multi skilled engineer this skill creates confident in face of difficulties and discouraging circumstances.

Increased problem solving and decision making abilities: which enable to make good decision and solve one owns problem

Innovative skills: A good skilled engineer can create a new mechanism in case of a difficult challenge is occur in the factory. Therefore, the past four moth internship program gave us wide hint how we innovate if we were subjected to a difficult challenges.

Results oriented: To make be successful requires the drive that only comes from setting goals and targets and getting pleasure from achieving them.

A risk taker: To succeed means taking measured risk as turn. the successful entrepreneur exhibits as incremental approach to risk talking at each stage exposing our self to only a limited measured amount of personal risk and moving from one stage to another as each decision is proved.

Total commitment: Hard work and energy are essential elements in the entrepreneur profile. Finally with this changing nature of work students must be enterprising and flexible and may need to become entrepreneurial.

CHAPTER FOUR

PROBLEM IDENTIFICATION AND PROPOSED SOLUTION

4.1 Problem Identifications

There are many problems in different section of the company which reduces the total production rate, efficiency, quality and safety of the workers. The major problems in the company are the following:

1) In machine tower plant there is necessity of lifting system but there is no lifting system in the machine tower which is the main problem of these plants. Which leads the following problems.

- ❖ It is not possible to solve emergency problem immediately
- ❖ It is difficult to pull up and pull down the heavy materials such as motors, compressors etc.
- ❖ Time loss

2) There are six old Germination box and one kill box placed in the company cascaded form. These seven boxes used by one a big shovel during the process of malt discharge or unloading the malt. The shovel moved from one germination box to other germination or kill box by help of human power. The problem is that in old system, the shovel move from one germination to the other at the time of discharging by the help of human power. So the system is dangerous and time consuming.

3) There is a stand by generator which stands to operate when ELPA power is disappeared. The ELPA power and stand by generator power is connected to automatic transfer system (ATS) which is a functional unit to energize the stand by generator immediately when ELPA power is turned OFF. But there is a five minute delay. The connection is found at the terminal part of output of three transformer of ELPA and directly connected to the stand by generator. The problem is that the power rating of two transformers is the same while one transformer is different. The power output of one transformer is not attached to a bus bar to which two transformer are connected that .This is the reason to avoid the circulation of current between the transformer .As a result an electrical technician should go to power house in order to close the electrical circuit of the one different rated output of transformer when ELPA power is disappeared and stand by generator is started to feed the machines connected to this transformer. This is a tire full work if ELPA power is frequently disappeared.

4) In the company there are 36 silos and 3 green coolers on working. The application of the green cooler is to cool the malt at the time of temperature increase or the air condition change in the silo. These green cooler are move from one silo to other silo by human power. The problem are time consuming, loss of human power, difficult to move due to heavy weight.

5) There is overloading of power because of the company have many expansion project which adds a lot of machines. But ELPA from the beginning still know supply a power rate of 15KVA.

6) The company uses water to transfer or pump over the barley from steeping to germination box which is more water consuming.

7) The silo in the company has no exact controller which shows the exact position and amount of the barley.

8) There is no phase sequence controller in the factory. When high load driving motors fail, just it maintain and return to its place so the workers has record the phase sequence and replace it but what we observe sometime they forget it and they try to know it simply connect the motor and start it. If motor rotate wrong direction the change again. This causes the damage of that expensive machine.

4.2 Solution to Problem

From the above identified problems we have tried to bring the solutions to problem in the company we have been shared ideas about the problems of the factory with our supervisor and mentor we agreed to do the project on authenticated problem and to submit one as a proposal and also comment on other problems.

PROJECT TITLE: AT89C51MICROCONTROLLER BASED LIFT CONTROL SYSTEM USING STEPPER MOTOR

4.3 Introduction

Lift is a transport device that is very common to us nowadays. We use it every day to move goods or peoples vertically in a high building such as shopping center, working office, hotel and many more places. It is a very useful device that moves things to the desired floor in the shortest time. In this project, AT89C51 microcontroller is used as the primary controller and it consist of various inputs and outputs circuits together with a lift model. The AT89C51 Microcontroller is used to coordinate the functions of various hardware circuitries. Service request Push button and sensors are used as input. One Stepper motor driver circuit, is used to move up-ward and down word, and seven-segment display are used as output. The lift model was constructed and simulated by proteus software. It can be counted as the output hardware of the system. The program code is written on Kiel compiler which used to convert this code into executable file or hex code.

4.4 Statement of problem

In AMF machine tower plant there is necessity of lifting system but there is no lifting system in the machine tower which is the main problem of these plants. This leads the following problem.

- ❖ It is not possible to solve emergency problem immediately

- It is difficult to take heavy motor at the top of the machine tower
- Unexpected healthy accident
- The damage of materials.
- Time loss

Because of the above mentioned problems design lift is an extreme rational solution for the company.

4.5 Objectives

4.5.1 General Objective

The main objective of this project is to design microcontroller based lift control system for five level elevator using a stepper motor.

4.5.2 Specific Objective

In accomplishment of the main objective, the following areas need to be properly understood.

- To design lift based on AT89C51 microcontroller
- To reduce the damage of materials and loss of energy in the company
- To design the program (software) for the overall system according to the real lift management algorithm.
- To study and understand the types, the operation principles and applications of elevators, stepper motors and the controllers.
- Integration, building and testing of a five level elevator control.

4.6 Scope of the Project

The scope of this project is focus on the design and simulation of microcontroller based lift system for five level floor using proteus software and the analysis of the operation principles and applications of elevators, stepper motors and the controllers in Asella malt factory.

4.7 Methodology of the project

Different methods and steps are carried out to reach the final result and the completion of this project. Some of them are.

- Information gathering
- Identifying types of material required for the project.
- Design of the system.

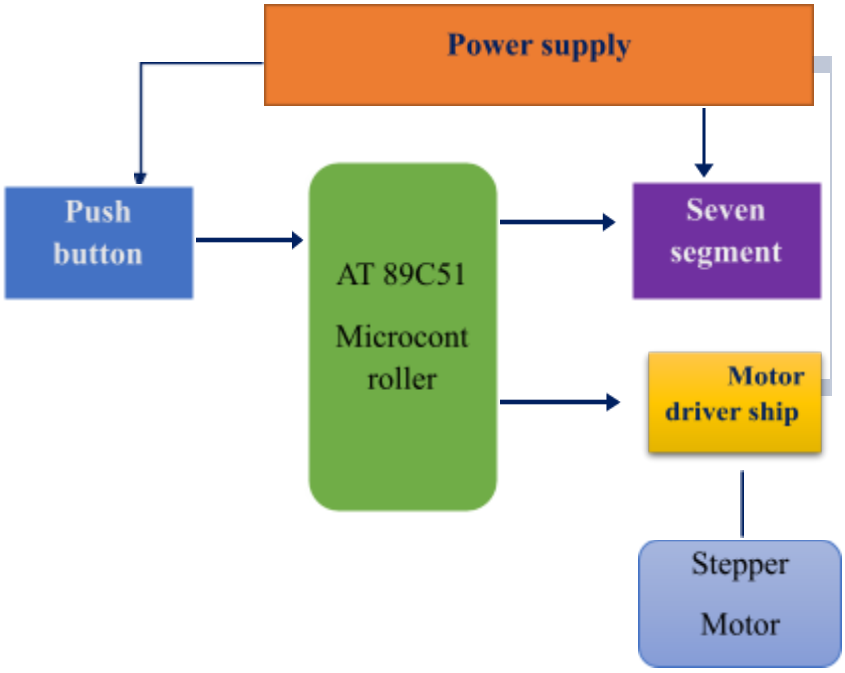


Fig 4.1 Block diagram of 89C51 microcontroller based lift control system

In this project, we will show five floors with 5 push button switches on each floor. Although we show the concept with five floors, it is still possible to show this concept on multiple floors. The lift carries the materials to each floor. Along with these five push button, we use separate push button switches for timed operation and priority for any floor. With the help of these switches, the lift automatically chooses a path when we press a push button; the lift automatically starts up and down immediately responds to user input with help of seven segment display.

4.8 Materials used for the project and it's Description

4.8.1 89C51 Microcontroller

This is the CPU of our project. Its maximum operating frequency is 33MHz and operating voltage is +5V DC. It receives the command signal from the Buttons and IR sensor through P0RT C. Microcontroller ATmega8 is connected to the motor driver IC (L293D) and then control Motor. The 89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured

using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel 89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

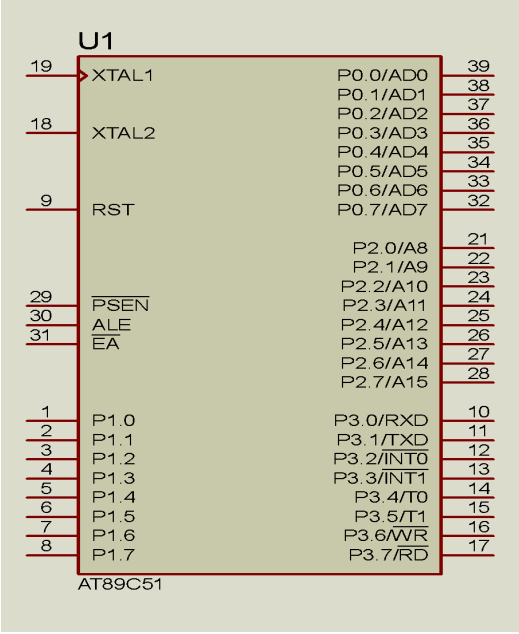


Fig 4.2 89C51 microcontroller

Pin Description

VCC: Supply voltage.

GND: Ground.

Port 0: Port 0 is an 8-bit open-drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high impedance inputs. Port 0 may also be configured to be the multiplexed low order address/data bus during accesses to external program and data memory. In this mode P0 has internal pull ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull ups are required during program verification.

Port 1: Port 1 is an 8-bit bi-directional I/O port with internal pull ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pull ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull ups. Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2: Port 2 is an 8-bit bi-directional I/O port with internal pull ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pull ups and can be used as inputs.

Port 3: Port 3 is an 8-bit bi-directional I/O port with internal pull ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pull ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull ups. Port 3 also serves the functions of various special features of the 89C51 as listed below:

Table: 4.1 Special features of the 89C51 Microcontroller

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{\text{INT0}}$ (external interrupt 0)
P3.3	$\overline{\text{INT1}}$ (external interrupt 1)
P3.4	T0 (timer 0 eternal input)
P3.5	T1 (timer 1 eternal input)
P3.6	$\overline{\text{WR}}$ external data memory write strobe
P3.7	$\overline{\text{RD}}$ external data memory read strobe

4.8.2 Stepper Motor

In mechanical movement the shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors

rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses are directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied. Stepper motor is an electromechanical device which converts electrical pulses into discrete. A stepper motor can be a good choice whenever controlled movement is required. It is used in the following applications.

- Where you need to control rotation angle, speed, position and synchronism.
- It has found their place in many different applications like printers, plotters, High end office equipment, hard disk drives, medical equipment, fax machines, automotive etc.

4.8.3 Seven Segment

Seven-segment displays first became widely used as a popular way of displaying numbers. Today they are used as displays in home appliances, cars, and various digital devices. The LDS-C303RI is commonly used in many designs, it includes seven LED bars aligned in a figure eight pattern as seen in Figure 4.3. It is capable of displaying the numbers 0-9 and the letters A-F by lighting the appropriate segments.

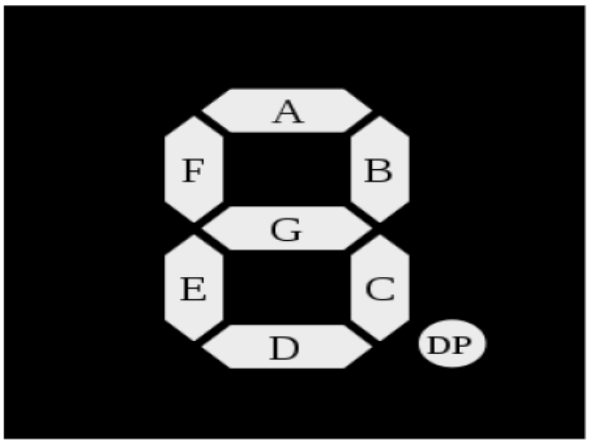


Fig 4.3 Seven segment displays

4.8.4 Push Button

A push-button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is

usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, though even many un-biased buttons (due to their physical nature) require a spring to return to their un-pushed state. Different people use different terms for the "pushing" of the button, such as press, depress, mash, and punch. Different types of push buttons are shown below in figure 4.4.

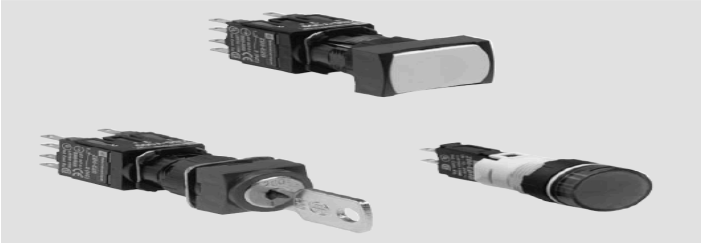


Fig 4.4 Push button

4.8.5 Electrical Tools Used In This Project

- Side cutter
- Pillar
- Tester
- Drilling machine
- Multi meter
- Screw drivers etc.

All the above mentioned material are available in the store of the factory and no need of buy from the market.

4.9 Power and Control Circuit Diagram of the Project

4.10.1 Power Circuit

Power circuit carries power for electrical load. It often carries high voltages and consists of incoming main power, a motor starter and the motor. A power supply circuit will fundamentally requires the following device.

Circuit Breaker: Circuit breaker is protective device that opens a circuit up on sensing current overloads. It is an electromagnetic when the current exceeds as predetermined value. The Circuit

breaker is found in an electrical service panel and is an electrical device used to protect the electrical wiring from over loaded current condition when exposed to more electrical current that is designed to handle similar function to an electrical fuse which blows when over loaded. The advantage of Circuit breaker is that it can be reset after it has been tripped.

Forward and Reverse Contactor: Is configured in such a way as to run the motor to its normal forward rotation with L1 connected to U1, L2 to V1 and L3 to W1 whereas the configuration or the reverse contactor is wired in contrast to forward contactor, so as to provide reverse rotation of motor with L1 to V2, L2 toU1, L3 to W3.

Thermal over Load Relay: Is provides motor over load protections, which detect motor over current to shut down the control system of forward or reverse controller.

4.10.2 Control Circuit

Control circuit in its simplest form is the application and removal of power. This can also be expressed as turning a circuit on and off or opening and closing a circuit using control circuit device. Control circuits usually carry lower voltages than power circuits. If a circuit develops problems that could damage the equipment or endanger person, it should be possible to remove the power from that circuit.

Fig 4.5 power and control circuit

4.10 How the Designed System Work

In this project we developed the five floor level elevator system in AMF by using Atmega8 Microcontroller to minimize the travelling time and reduce energy loss by using switch we give command to the microcontroller and floor detect by IR sensor module. This is a simple model of lift or elevator based on AT89C51 microcontroller for five floors building. There is a lift which will be moved up and down among different floors with the help of a motor. Motors driver is brought to the desired position by sending appropriate signals to the coils. This circuit also has about 3 ° ~ 15.3 °, a stepper motor with a stepping angle is used. And our engine, our program by

assigning the value 10 to the variable speed tour and we make around 315 ° rotation 4.5.6 [3]. We used 6-pin stepper motor circuit with +12-volt supply at terminal two. We use the commonly used circuits to drive stepper motor ULN2003 all our Circuit. Thus applied to the logic "1", all the circuits output "0" as received and thereby driven motor. Our circuit has five buttons Pressing these buttons because our engine will return many times known to each floor, most recently printed value, then taking the difference between the value being printed, we calculate the speed of our engine and engine so it come to the desired floor. Most recently printed value by comparing the value printed at that moment, our engine down or up (right or left) are decided to return. There are five floors in the building, thus lift cabin has to moves between these floor, for floor detection and to generate the arrival of any floor, some sensor are used. The floor detection sensors are limit switches which could be proximity switches. The signals will be generated from within the lift cabin these could be push buttons and will be used to request the lift to go on desire floor. The lift cabin will have five push switches for this purpose, one for each floor. Seven segment led indication of lift system circuit design. The seven segment circuit is separate from main controller circuit of lift. The power supply of master controller circuit, and 5 floor indicator circuits (LED seven segment display) will be separate.

4.11 Budget of Material That Required For the Project

Table: 4.2 Cost of material required

Materials Required	Description of Material	Quantity	Cost of single material (ETB)	Total cost of materials (ETB)
Stepper Motor		1		
Seven Segment display		5		
Contactor				
Overload Relay				
Cable				
Limiting Switch				
Circuit Breaker				
Push Button		5		

Total Cost				

4.11 Result and Discussion

4.11.1 Simulation Result

We use two most known software for our simulation that compatible to the design component of microcontroller based lift control system. For the construction of the schematic diagram of the project we applied proteus and compiled our code by keil. Here the figure 4.6 shows the connection of the device in the proteus software.

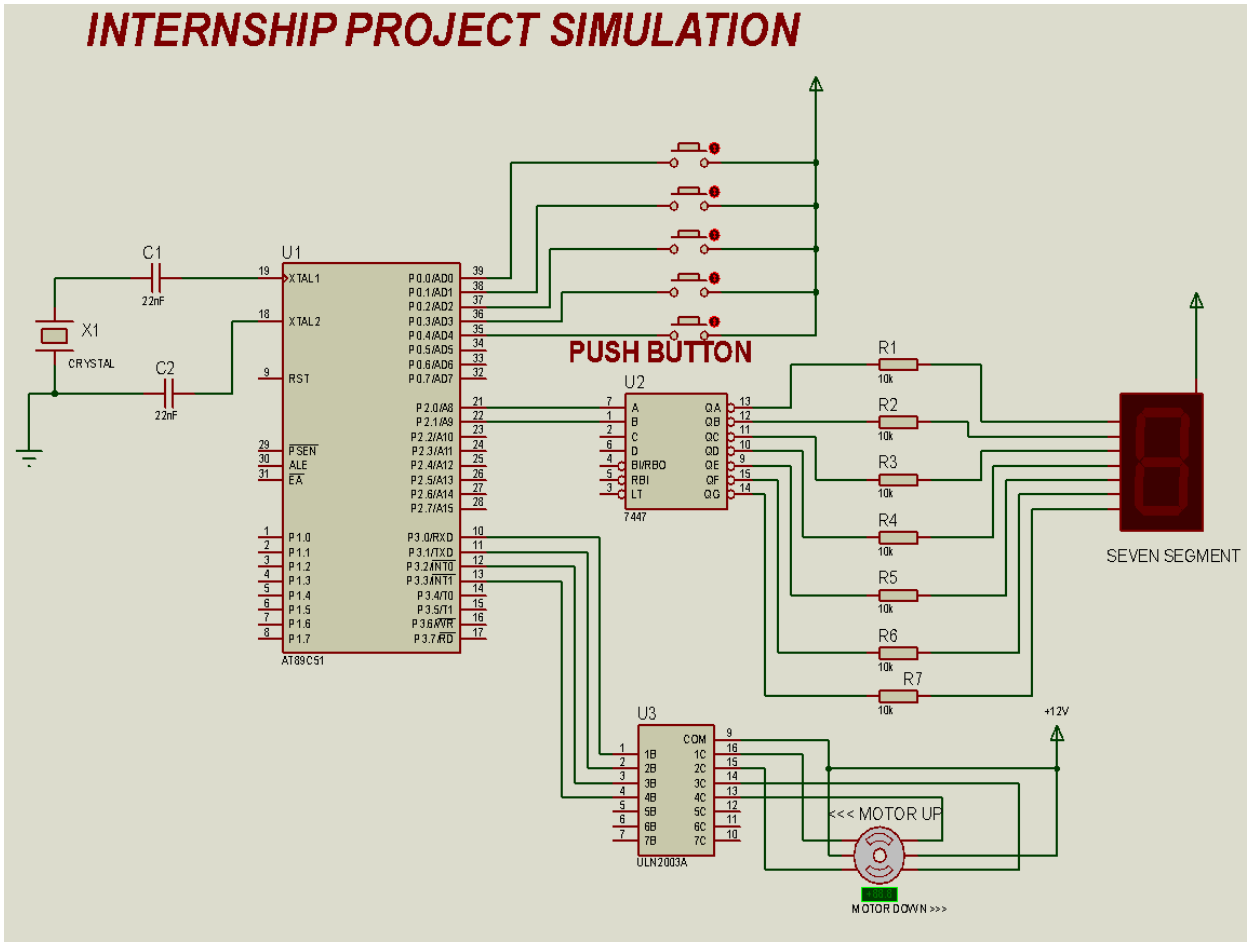


Fig 4.6 Overall simulated circuit diagram of lift control system

4.11.2 Discussion

As it seen from the above simulation result the status of lift was indicated with the help of seven segment display. One seven segment display is installed on each floor; which will tell the current location of the lift. The following display pattern is visible on seven segment displayed of microcontroller based lift control system simulation project:

If 0 is displayed lift or elevator is on floor # 0 which is ground floor.

If 1 is displayed lift or elevator is on fifth floor.

If 2 is displayed it means lift or elevator is on fourth floor.

If 3 is displayed it means lift or elevator is on third floor.

If 4 is displayed it means lift or elevator is on second floor.

Similarly, if 5 it means lift or elevator is on first floor.

4.12 Application of lift system on the Company's Problem

Earlier the company is used man power to carry the material and motor up and down in machine tower plant to reach on desired place which is great risk for the motor as well as for the operator. But this new designed system needs only one operator to move the motor up and down by pressing start and stop push button when the material is reach on the desired floor. Therefore, this new system should be used to save the energy of man power and decrease time down occurred in company.

Further, it reduces unexpected health accident and increasing the profitability and productivity of the company also it increases life time of motors.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In general the four months industrial internship program gives us a great knowledge about our working area very well. In addition to the practical activities that an electrical engineering should have to do when the student are participate in the external world. At the time four months we spent at Asella Malt Factory, we were work in technical department especially in electrical work shop and another field work of the company. In our duration we got many practical knowledge like motor winding, maintenance of different machineries, testing the machine and communicative skill, work management, punctuality etc. In addition it improves the inter-personal communication skill among other individual workers and employees on the hosting company. Under some circumstances newly graduated engineering students have got challenge when they employed on the companies due to lack of practical knowledge. But this industrial internship can resolve such kinds of thing by preparing students to the actual existing outside world. This internship program also increases student's self-confidence to take an action and taking responsibility on the task given to them. In our case we have been taking such disciplinary actions while we were performing planning activates and this internship program enables us to be hard worker and a successful engineer for the future because electrical engineering is not only theoretically but also practically a tire some job activity. Since our country is a collection of different nation nationalities this internship program allows us how we can familiarize our self with the different cultures and problem of living and working together. Finally, in our duration we try to understand many problems of the company which related to our field. As an electrical engineering students we have tried to solve the crucial problem like, lifting system and comment on the others.

5.2 Recommendation

AMF is one of the factory under the governmental control working for the countries development having the motto of "Bridging Agriculture and Industry". In this company there are different employees whom they are work different activities and tasks in different sections and shifts within 24 hours in order to achieve the factory goal. From the time we began the course of intern up to the time we leave the company we have been performing several tasks along with the technicians and other employees. In the company we observed different tasks and program that deserved to be changed and modified starting from the overall production of the product and services. Among such tasks that needs modification the common one we list as follows.

- Since most of the motors used in the company are outdated, the company ought to replace those motors with new motor.
- There is absence of lighting installed in the some parts of working area and around the factory. Since the working time of AMF is 24 hours the workers at night shift don't have comfortable to them because of poor lighting system existing in the factory.
- The company uses old version materials while maintaining the motors, what we recommend here is that it is better to use new coming materials to maintain motors.
- Most of company's workers have a long year of service and they are not productive manpower, the company should have to replace by youths those who are productive and informed with new technology.
- In order to have a proper working system, the weekly scheduled program should be provided from Jimma Institute of Technology for students before they go to the industry and the report should submit to company supervisor on what the practice weekly.

Finally, we recommend the company to take into practice what we have done as a solution in our project to prevent unexpected health problem and damage of materials.

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Appendix

Program in Atmel8 microcontroller for microcontroller based lift control system using stepper motor

```
//-------------------------------------------------------------------------------------------------------------
// Compiler Keil for AT89C51microcontroller
#include <stdio.h>
#include <REG51.H>
int x,y,z;
int c,b,a;
y=10;      // the engine rotatoin number
z=10;
b=5;
a=5;

expect(c)
{
int i,j;
if(c==0)
{
for(i=0;i<150;i++)
{
for(j=0;j<z;j++)
{
;
}
}
}
return;
}


// lift coming up existing
up(b)
{
```

```
int i,j;
for (i=1;i<=b;i++)
{

for (j=0;j<=10;j++)
{
P3=1;
expect(0);
P3=2;
expect(0);
P3=4;
expect(0);
P3=8;
expect(0);
}
P2=x+i;
}
x=x+b;
return;
}

// lift coming down
down(b)
{
int i,j;
for (i=1;i<=b;i++)
{
for (j=0;j<=y;j++)
{
P3=8;
expect(0);
P3=4;
expect(0);
P3=2;
expect(0);
P3=1;
expect(0);
}
P2=x-i;
}
x=x-b;
return;
}



control(a)
```

```
{
int s;
if(a>x)
{
s=a-x;
up(s);
}

if(a<x)
{
s=x-a;
down(s);
}
return;
}


main()
{
int x1;
x=0;
P2=x;
while(1)
{
if(P0==1)
{
x1=1;
control(1);
}

if(P0==2)
{
x1=2;
control(2);
}

if(P0==4)
{
x1=3;
control(3);
}

if(P0==8)
{
x1=4;
control(4);
}
```

```
if(P0==16)
{
x1=5;
control(5);
}
}
}
```

----------END OF PROGRAM----------