KYAMBOGO UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

BACHELOR OF ENGINEERING IN INDUSTRIAL ENGINEERING AND MANAGEMENT

INDUSTRIAL TRAINING AT ALFIL MILLERS (U) LIMITED

BY

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DECLARATION

I hereby declare that this project report contains my original work from my own efforts and knowledge in the guidance of my supervisor and it has never been submitted to Kyambogo University or any other higher institutions of learning for any award.

Student **Date**

………………………. ………………………

MUTESASILA JOHN MARK.

APPROVAL

This is to certify that Mutesasila John Mark had a period of three months of industrial training at Alfil Millers in the production department. This is a true record of the work he was able to do under my supervision.

External supervisor: Mill Manager

Mr. Wooka Ashiraff DATE

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LIST OF ABBREVIATIONS

AML……………….Alfil Millers Limited

B…………………...Break Roll

C…………………...Reduction Roll

R…………………...Scratch Roll

UNBS……………...Uganda National Bureau of Standards

OEE……………….Overall Equipment Effectiveness

MH………………..Materials Handling

DL………………..Damaged Loads Ratio

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CHAPTER ONE: MILLING PROCESS

1.0 Milling

Essentially this is the separation of bran and germ from the endosperm and the reduction of the endosperm into uniform particle size (flour). This is done by the sequence of breaking, grinding and separating operations. But before we start the milling process let us look briefly on the equipments and machines used when milling. These machines are categorized as those involved in direct milling and the auxiliary machines (material handling). Direct milling machines these carry out the real conversion of wheat grains into wheat flour and its by-products. They are described in the table 1 below.

Table 1 showing direct milling machines

Equipment	Illustration	Description
Roll mills		The roll mills do the real conversion of wheat grains into flour but this is a gradual process. These rolls are classified as break-rolls, scratch-rolls and the reduction-rolls each with a designated role. The roll-mills have a pair of rollers which rotate at different speeds (a ratio of 2:1 for breake-rolls and 1:1.25 for both scratch and reduction rolls) and in opposite direction. Each roll is fluted except for reduction rolls and size of flutes depends on the stage of break i.e. first break-rolls (B1 and B2) will have flutes larger than (B3 and B4). The scratch rolls have fairly flutes to scratch the endosperm from the semolina. Break-rolls are set with a clearance of 0.9mm while both scratch and reduction rolls have a clearance of 0.18mm. This clearance in both cases

		can be adjusted manually on the volume fed on the roll.
Flake disrupters/ detachers		These are used on the lower passages of a long reduction system to break-up the flakes of compressed flour before they reach the sifter. The detachers are mainly connected to receive fine semolina from reduction rolls C1, C2 and C3.
Sifter		The broken particles of wheat are introduced into huge, rotating, box-like sifters where they are shaken through a series of bolting cloths or screens to segregate the larger from the smaller particles Up to 6 different sizes of particles may come from a single sifter, including some flour with each sifting. Larger particles are shaken off from the top, or "scalped," leaving the finer flour to sift to the bottom and sent to the weighing scale. These fractions are sent to other roll passages and particles of endosperm are graded by size.
Bran finishers		In bran finishers, the bolting cloth rotating at high speed separates and grades coarser fractions by size and controlled flow of air sucks any particle other than bran through the high speed rotating screen. The bran is taken to the bran bin while the other material is taken back to the sifter.

Micro dozer		This is used in the fortification of wheat flour. The equipment dozes micro food nutrients in the required amount into wheat flour.
Weighing scales		This weighs the quantity of wheat flour extracted from the grain. It enables the miller to monitor the rate of extraction.

Source field data, 2017

The auxiliary machines (material handling machines) also support the smooth running of wheat flour production by transferring in-process, finished and by-products material from one point to another point in the mill. These include pneumatic transmission system and dust fans that use both positive and negative pressure to move materials from point to point, screw conveyors and bucket conveyors that mechanically move materials during processing. Supporting equipment is the compressor, this supplies compressed air mainly to the roll-mills and other pneumatic equipments in the mill such as slide gates, weighing scales, cleaning points and packaging units.

The process of milling is described briefly in the table 6 below.

Table 2 showing milling process

Activity	**Procedure**
1st break (B1)	Dampened wheat is passed through B1 scale to measure the quantity of wheat grain that is coming in for milling; from this point the wheat enters B1 for the first break.

	The break-release is then transferred to the sifter were different grain sizes are sifted and released back to different sections of the mill i.e. those that fit to the second and third break, scratch rolls and reductions are taken there respectively.
Second, third, fourth and fifth break (B2, B3, B4 and B5)	Break releases from first break known as middlings are further broken down by the proceeding break rolls
Scratch rolls	Scratch rolls have fair flutes to scratch the remaining endosperm form the coarse semolina. The fair semolina is then transferred to the proceeding reduction rolls for further grinding.
Reduction rolls	These are smooth rolls that grind semolina gradually into fine flour. There are six rolls on the line i.e. (C1, C2, C3, C4, C5 and C6). The process continues until fine flour is obtained. By-products such as bran and pollard are given off at the last stage of the process.
Fortification	Micro food nutrients are added into fine flour before being stored in the flour silo.
Quality test	Fine flour is tested for moisture content and micro food nutrients
Packaging	The final process is packaging. The packaging medium depends on the purpose of flour being produced and company's packaging policy i.e. home baking flour is packaged in paper bags of 2kg each and rapped 12 bundles are rapped to form a carton. At the same time barkers flour is packed in polythene sacks of 25kg and 50kg then stored in the warehouse.

Source field data, 2017

1.1.0 Grades of wheat flour

From observation, these rollers release different grades of final flour basing on flour color i.e. from white to brownish. During grinding, as more bran is grinded into flour, it becomes inseparable and tarnishes gradually the white flour into brownish.

- ✓ High grade flour (white in colour), this is produced by break rolls (B1, B2, B3) and reduction rolls (C1, C2, C3, C4). This is because at these stages small content of bran has been grinded with the endosperm.

- ✓ Middle grade flour (white colour starts to fade), this is produced by break roll (B4) and reduction roll (C5) with scratch roll (R1). This result at these stages the content of bran being grinded with the endosperm increases.

- ✓ Low grade flour (brownish), this is produced by break-rolls (B5) and reduction rolls (C5). At these stages, the content of bran being grinded with the endosperm has increased.

AML produces straight run flour. This is one produced where all the above grades of flour are combined together.

1.2 Fortification of wheat flour

Fortification is the practice of adding essential vitamins and minerals (e.g. iron, vitamin A, folic acid) to staple foods to improve their nutritional content. It is a safe, effective way to improve public health that has been used around the world since the 1920s. Commonly fortified foods include staple products such as wheat flour, maize flour sugar and rice. (Dayakar Rao, 2014)

When vitamins and minerals are added to wheat, sorghum, maize & rice flour, commonly eaten foods become more nutritious. Consequently consumers improve their health without changing food habits. The extra nutrition by (fortifying wheat flour) helps people become smarter, stronger & healthier like, improved health, increased productivity and economic progress. (Maberly, 2006)

Micronutrient deficiencies, especially of vitamin A, iron, iodine, and zinc, are widely prevalent in both developing as well as some developed countries. However, iron deficiency is a major public health problem in developing countries, it affects up to 50% of infants, children, and women of child- bearing age in poorer populations of Asia, Africa and Latin America. (Tripati B, 2012) Table 3 below explains briefly the procedure for adding fortification by AML.

The table 3 below shows the procedure of fortification

Type of wheat flour	**Procedure**
Home baking flour	10.5kg of home baking flour is mixed with 3.5kg of a premix vitamins and minerals. The two ingredients are mixed thoroughly well and taken to the micro dozer.
Baker's flour	With baker's flour, 10.5kg of the same flour is mixed with 3.5kg of vitamins and minerals and 6 kg of improver. The improver enhances the baking properties of the flour. Then the mixture is taken to the micro dozer.
	Using a micro dozer, specified amount of these nutrients are added to the flour. The micro dozer adds a dosage at a rate of 55gm per minute. If the mill produces approximately 3000kg of fine flour per hour, this means that 3.3kg of these nutrients are used per 3000kg of fine flour. The standard rate is 72gm per minute (according to UNBS) but the company uses 55gm per minute to economize.

Source field data, 2017

1.3 Quality control at the mill

Quality control at the mill is done by examining the percentage of moisture in the wheat grains entering B1 and also the finished flour. The second quality check is to see whether the micro nutrients added in the flour are evenly distributed. The procedure is described in table 4 below.

Table 4 showing quality control procedure

Quality test	Sample	Description
Moisture content	Dampened wheat grains at B1	Wheat grains entering B1 are tested for moisture to check conformity within the specified range usually between (14% and 15.3%). This means that the grain will lose some moisture during milling and the final flour moisture will fall within the required range usually from 13% to 14%. Grains are first crashed using the auxiliary moisture testing equipment, and then tested using the moisture meter below. If the moisture content is below the pre-scribed range, then increase of the tempering time is required and the reverse is true.
	Wheat flour	The final flour is also tested for moisture content using a moisture meter. The percentage range should be within 13% to 14%. Any value below or above this range indicates that there is a fault in dampening process.
Iron test	Barker’s flour	A sample of barkers flour is prepared on a wooden spatula, little droplets of a water solution comprised of 30% hydrogen peroxide is sprinkled on the flour surface after which drops of acidified potassium cyanide is added. The sample is left for not less than 5minutes and dark brown spots will start to appear on the surface of the flour. These spots should be evenly distributed on the surface by direct observation. If the spots do not appear, it means the ingredients are missing, and if these spots are more spaced from one another it subjectively indicates little ingredients were added and if the spots are so close it indicates that the quantity of

		ingredients was more.
Color	Wheat flour	This is done by the miller through direct observation. Since the company produces straight run flour, the final flour is not expected to be white or brownish but partially white. The decision depends on the senior miller.

Source field data, 2017

CHAPTER TWO: MILL PERFORMANCE

2.0 Mill performance

Mill performance is the term used to describe how well a mill is running. Ideally, the plant should operate at optimum milling performance. This occurs when it is producing the maximum amount of flour of correct specification in the most efficient and profitable way. It covers all aspects of the milling process, from wheat buying to delivery of the final product. Mill performance is the combination of all these factors, it is inefficient and unprofitable to concentrate on one factor at the expense of the other as briefly described in table 9 below.

Table 5 showing mill factors for optimum performance

Factor	**Description**
Screen room	What proportion of the grains must be removed to prevent the extraction rate and flour colour from being adversely affected.
Atmospheric condition	How do changes in temperature and humidity affect the ease with which the wheat is milled?
Mill	Is the wheat milled as economically as possible? Is the mill output high enough? Does the flour meet its specification? Is the flour produced at suitable moisture content?
Maintenance	Are the productions machines cleaned and maintained regularly so that they can work at the maximum efficiency without any down time or reduced production capacity?
Extraction	Is the extraction rate as high as possible while maintaining the specified flour colour.
Gristing	Will the grist produce flour of the necessary quality from the cheapest available wheat?

During milling at AML, the following records are kept on a daily and weekly basis. They are compared with mill standards and the company targets. It was interesting to note that company keeps update of the extracted output and the input from the day the mill started operating. This is done by the computer that monitors the mill performance every time during production.

- Capacity per 24 hours of wheat at 1st break
- Output per hour of final flour produced
- Extraction against clean wheat to 1st break
- Extraction against dirty wheat
- Moisture content of flour (corrected to 14%)
- Protein content (quantity and quality) and colour grade of flour

2.1 Mill extraction

Mill extraction can be defined as the percentage of flour obtained from a given quantity of wheat. The miler must obtain a satisfactory extraction from grist. If the extraction rate falls, the production cost of flour will rise because the price of flour is higher than the price of wheat feed. A small percentage fall in extraction say 1% could well involve a cost to the miller depending on the prices of wheat, flour and wheat feed.

Method one-Dirty wheat extraction

Dirty wheat extraction is the percentage of flour obtained from dirty wheat bought i.e. the weight of the wheat including dirt and impurities compared with the weight of finished saleable flour. Millers use this method to determine the overall performance of their mills. This method is unsuitable for day to day control as the relevant figures can only be calculated over a longer period (such as weeks or months).

Method two-Clean wheat extraction to 1st break

This simple calculation compares the weight of clean, dampened wheat of 1st break with the weight of finished saleable flour. Clean wheat extraction are used to monitor mill performance on a daily basis. The information needed to make the calculation is usually available from the mill weighers or control computers. At AML, this is the method used since it gives relevant and accurate daily measurements and allow daily mill monitoring.

Method three-Total products extraction

This method can also be used to monitor mill performance on a regular basis. The individual weights of all mill products are added together (i.e. bran, wheat feed, germ and flour) to give a total production figure. This figure is compared with the weight of the flour produced. The information required should be available from the mill weighers.

Take look at the example in the table below

	Particulars	Tonnage
1	Dirty wheat used	100
2	Total flour produced	79.0
3	Screenings separated	1.5
4	Moisture added	2.5
5	Wheat feed produced	18
6	Bran	3.0
7	Germ produced	0.5

From the table above;

- $Dirty\ wheat\ extraction = \frac{79}{100} \times 100 = 79\%$
- $Clean\ wheat\ extraction = \frac{79}{(100-1.5)+(2.5)} \times 100 = 78.22\%$
- $Total\ product\ extraction = \frac{79}{79+18+3+0.5} \times 100 = 78.61\%$

N.B; At AML, all the extraction is monitored by the computer which gets the information from the weighers that are strategically positioned in the mill.

Factors affecting extraction rate

- Wheat variety

Some wheat gives better extraction than others. The miller must calculate whether it is more economical to mill high grade wheat or accept a slightly lower extraction rate from inferior but cheaper varieties.

- Specific weight

As a rule, higher specific weights give greater flour extraction. This relationship is fairly constant for a given grade and variety of wheat although it will vary for other varieties and grades. There also other factors responsible for extraction loss.

To increase the extraction rate, especially at AML, the plant ensures an efficient screen room (i.e. the number and type of machines will determine how thoroughly the wheat will be cleaned), the number of breaks in the system (i.e. the plant was designed with 5 breaks to increase extraction) and the use of bran finishers (i.e. bran finishers or dusters set especially after the 3rd and subsequent breaks help to increase the extraction rate).

2.2 Mill balancing

A mill is said to be balanced if all the parameters determined at the design, planning and installation stages are maintained. In order to achieve optimum efficiency of all machines operations, all sections of the mill should receive the correct amount of stock of the right quality and particle size. A deviation in one section of the mill can affect the performance of the following sections by upsetting the balance of feed to the machine next inline.

- Feed to the mill must be at correct moisture and condition and should not contain impurities; feed to first break should be kept at a constant rate.
- Break and scratch rolls must be kept in good operational condition and feed should be distributed evenly. Roll brushes (where used) should be checked for efficient operation.
- Reduction rolls must be checked at regular intervals for correct grind and even distribution of feed over the length of the roll. Roll cleaning devices must operate efficiently. Feed should be distributed evenly along the length of the feed gate.
- Dressing sifter covers must be checked regularly to ensure that they are in good condition. Cleaning pads should be in good order and replaced necessary. Covers must be checked for wear and tension and replaced as necessary.
- Dust collector sleeves must be kept clean and in good working order to give efficient dust extraction.

2.2.0 Factors that can affect mill performance

1) Wheat, below is a brief description of how the choice of wheat can affect mill performance.

- Moisture content, an increase in the moisture content of wheat will reduce the flour colour, reduce the extraction and increase the likelihood of sweating.

- Hardness, if a miller knows how hard the wheat is, then he can adjust the mill accordingly. For example, soft wheat needs a lighter grind and will produce more break flour at a lower throughput than hard wheat.

2) Screen room, if the screen room is inefficient or overloaded and allows screenings onto the mill, this will affect the mill performance.

3) Mill, the following should be taken into consideration if the mill is to work efficiently.
   - Rate of feed of wheat to 1st break, this must be carefully controlled to ensure optimum mill balance. If the feed rate is to be constant, there must be an accurate inflow measuring device on the 1st break and feed should be even and balanced on the 1st break roll and break releases must be maintained if the mill is to stay in balance.

4) Atmospheric factors such as humidity and temperature also affect the mill performance. Ideally, mills should be maintained between 60% to 65% humidity. This can be only achieved by installing air conditioning and recycling systems.

N.B. the effects of atmospheric condition are accentuated in elevator and conveyor mills where stocks are generally much warmer than in pneumatic mills. The large volume of air used for conveying in a pneumatic mill keeps the stocks cool and removes excess moisture. Since AML uses a pneumatic mill, it is not adversely affected by atmospheric factors.

5) Cleaning and maintenance of mill machinery is necessary for maintaining maximum mill efficiency. This must be done daily, weekly or monthly depending on the equipment.

2.3 Mill Maintenance

A plant is a place where an industrial or manufacturing process takes place. There is need to make sure that the plant is kept in good condition. Maintenance engineering encompasses the systematic study of the theory of the maintenance of systems and components as well as the management system needed for the correct application of the plant. Failure is one of the unfortunate facts of life. When man produces equipment or tools to increase his own productivity, he also has to deal with this unwanted side effect. And, although much effort is expanded to improve the reliability of machinery, the ever increasing sophistication and complexity of the modern technology and wonders give rise to maintenance being one of the fastest growing industries in the world.

To maintain is defined as 'cause to continue' (oxford dictionary) or "keep in an existing state' (Webster dictionary). This suggests that maintenance means preserving something. Productions assets or machinery are put into service because someone wants to do something. In other words, they expect them to fulfill a specific function or functions. So it follows that when we maintain an asset, the state we wish to preserve must be one in which it continues to do whatever its users want it to do.

The overall objective of mill maintenance is to increase availability (OEE), reliability, safety of equipment, operability and reduce the cost of maintenance and production losses especially with unplanned downtime due to abrupt breakdowns.

The importance of an effective maintenance program cannot be overlooked because it plays such an important role in the effectiveness of manufacturing. As in personal health care insurance, maintenance may be considered the health care of our manufacturing machines and equipment. It is required to;

- Effectively reduce waste and run an efficient, continuous manufacturing operation, business or service operation.
- The cost of regular maintenance is very small when it is compared to the cost of a major breakdown at which time there is no production.
- The need for a high return on investment- today there is an ever increasing pressure for higher productivity. This leads to more mechanization and an increase in the size of machines. To maintain this high level of productivity, maintenance must be predominant.
- To make sure machines and work environment are safe to work on thus reducing accidents and incidents.

At AML, various maintenance philosophies/ programmes are employed and these can be briefly described in the table 11 below.

Table 6 showing maintenance program at AML

Maintenance Program	**Definition**	**Application**
Preventive maintenance	This is carried out at predetermined intervals (daily, weekly or monthly) or according to prescribed criteria, to reduce the failure risk or performance degradation of equipment.	This is carried out on machine or electric motor bearings by greasing them accordingly with multi-purpose, high or low temperature grease or replacing them completely. Re-oiling of the compressor (monthly), changing of its air filter and empting of condensed water vapor in the air pressure tank (done hourly).
Break Down maintenance	This is only performed on components that are inexpensive to replace, where the failure does not cause collateral damage in the system or where the cost of maintenance is not greater than preventive maintenance.	This is done on electrical bulbs, power transmission belts, capacitor power banks, roller brushes, separator sieves and plan sifter sieves.
Condition based maintenance	This is based on equipment performance monitoring and maintenance is carried out when certain indicators give the signaling that the equipment is deteriorating and failure probability is increasing.	Mill rollers and feed rolls are subjected to this kind of maintenance program.
Other maintenance	This is done using pesticides to kill wheat	This can be done between 2 to 4 times a year. Fumigation is also used on wild grass around

programmes include fumigation	flies that feed on wheat grains and wheat flour.	the factory premises.

Source field data, 2017

CHAPTER THREE: MATERIALS HANDLING

3.0 Back ground of materials handling

Material handling can be defined as: “art and science of conveying, elevating, positioning, transporting, packaging and storing of materials Starting from the time, the raw material enters the mill gate and goes out of the mill gate in the form of finished products; it is handled at all stages within mill boundaries such as within and between raw material stores, various section of production department, machine to machine and finished product. (A. P. Bahale, 2014)

Material handling involves the movement of materials, manually or mechanically in batches or one item at a time within the plant. The movement may be horizontal, vertical or the combination of these two. Material movement adds to the cost but not to the product value. The ideal mill would have an absolute minimum of materials handling and more use of mechanical material handling equipment. The increasing wages cost demand the most efficient use of labour. By saving in the material handling cost, the cost of production can be reduced considerably. (Charlotte, 2000)

In a typical mill, a material may be handled even 50 times or more before it changes to finished product. Material Handling (MH) accounts for 25% of all employees, 55% of all factory space, and 87% of production time. MH is estimated to represent between 15 and 70% of the total cost of a manufactured product. MH is one of the first places to look for cost reduction & quality improvement. It has been estimated that between 3 to 5% of all material handled becomes damaged (Nureddin, 2010).

AML was designed with an input capacity of 103 tons of wheat grains processed per 24 hours. With this input, the final flour output is always between 76% and 79% per 24 hours. With such enormous capacity output, the company needs an efficient material handling system in its warehouse to improve customer service by shortening delivery time (loading time), reduce material damage, and improve the quality of work for the employees and lower overall handling costs.

3.1 Material handling system/practices in the warehouse of AML

Finding from general observation revealed the following materials handling practices.

1. Unit loading concept is not used,

As a result small quantities of material are moved at a time that has led to increase in the frequency of movement due to excessive manual work and may contribute to increased handling cost. There is slow speed in loading and unloading and a corresponding increase of handling time and this may result into customer complaints in the near future due to frequent delays.

2. There is no work principle, material is moved manually over long distance as a result, the level of service (productivity) required of the material transfer operation is low e.g. workers manually carry heavy loads over a distance of 40 meters from the warehouse to the loading area (dock).
3. Ergonomic Principle. Human capabilities and limitations were not recognized and respected in the design of MH tasks and the ware house facility e.g. the step ladders on the warehouse add a discomfort to workers when carrying heavy loads.
4. Absence of tools to be used especially during manual handling yet there is need for them
5. No safety equipment especially overalls, reflectors and boots provided to workers
6. A lot of congestion in the ware house because of the many operations carried out in the warehouse.

3.2 Tools and equipment used for material handling in the warehouse of AML

This objective was to study the materials movement and flow in the dispatch warehouse. Here, reasonable precautions to protect the safety of the materials and workers within the warehouse.

1. Materials were always arranged to arrive on pallets, and also kept materials on pallets during storage.

2. Due to excessive manual labor used, there is no use of mechanical devices (e.g. lifts, hoists, conveyors, fork trucks) to assist in material transfer yet the work requires them urgently. E.g. loading a forty-foot (40ft) container with ten (8) men takes around three (3hrs) full hours. If 5 similar containers are to be loaded with similar load, how long will it take for these ten men or how many extra men will be needed to complete the job in a day? Or will the job be extended to the next day?

3.3 Impact of materials handling on the overall level of productivity of the warehouse

The way material is moved, protected, stored and controlled throughout the warehouse in one way or the other impacts either positively or negatively on the general level of service. In this particular case, the inefficient materials handling has resulted into the following;

1) Damage of finished goods especially during transfer of home baking flour to packaging area, this is backed up by the damage loads ratio which is high. The material damaged was recorded and compared with the extraction in a single day.

Damaged Loads Ratio (DL),

$$DL = \frac{2.7\ tonnes\ of\ damaged\ flour}{38\ tonnes\ of\ extracted\ flour} = 0.07 = 7\%$$

This figure may build up enormously if it’s on a daily basis and the company may incur additional costs on labor, electrical power due to re-processing and reduces the mill productivity.

Figure 1: showing damaged flour brought back to the mill

2) Dirty facilities, this is due to excessive material spillage on the floor during material transfer and packaging especially with home baking flour. There two grand reasons for

this; one- the sacks used to transfer home baking flour are worn out with alot of holes in them, secondly- the women who do packaging lack manual packaging skills and self discipline.

3) Dispatch delays, this may be attributed to a number of reasons at the plant ware house and include the following;
    - Material is not stored close to the dock and has to be moved long distances manually i.e. approximately 30 meters from the dock and increases material transfer time.
    - Depending entirely on manual labour for material handling in the warehouse seems to be inefficient i.e. loading 2000 cartons in a forty- feet container was recorded to take 3 full hours when using 10 men each carrying two cartons per turn. In a short run, this may seem satisfactory, but in the long run, the company may incur invisible losses due to inefficiently utilized time and labour.
    - Absence of mechanical devices (e.g. conveyors, fork lift trucks) and proper material handling practices such as unit loading concept to assist in material transfer yet the work requires them urgently. In short run, investing in such systems may be expensive but profitable in the long run.

N.B. such delays can lead to customer complaints and consequentially customer loss especially if the competitor gives a better service at the same cost.

4) Severity of injury, excessive and frequent manual handling of heavy loads by the workers pose a risk to their health especially if coupled with the poor design of the ware house facility. E.g. carrying heavy loads up an incline (e.g. ladder dock) poses an ergonomic risk such as back pains to the workers and this reduces their work rate and productivity. (so far there are no records of such injury recorded at the warehouse)

Figure 2: showing a ladder dock at the dispatch warehouse

N.B. provision of a fork lift and proper material handling practices such as unit load concepts can solve dispatch delays and injury risk consequentially improving work quality at the warehouse and minimize invisible losses.

CHAPTER FOUR: CONCLUSION AND RECOMMENDATIONS

4.0 Conclusion

Theoretical knowledge was practically applied by the end of these three months of industrial training. I also became more conversant with the tools, machinery and also learnt to be more social with other workers because the more social one could be with knowledgeable people, the more knowledge one can acquire. This is confirmed by the mini projects done with the guide of the technicians.

The current materials handling system used in the warehouse of AML entirely depend on manual labor and upon assessment, it was found through observation that there are many inefficiencies in the material handling system at the warehouse such as; Lack of equipment for material handling, Long transportation distances from material locations to loading area, material locations are not well organized, Lack of awareness in material handling staff, poor facility design etc.

4.1 Recommendations

I recommend the company to provide appropriate material handling equipment such as forklift trucks, material locations should be well planned to fit the material handling in an optimum way to minimize movements and use efficient material handling practices such as unit load concept where applicable and lastly modify the warehouse facility layout to create more space that fits the transportation devices better.

Create awareness in material handling staff especially in the packaging section and teach them better packaging techniques and replace worn out sacks that are used to transfer home baking flour to packaging areas in order to reduce material spillage and damage.

Provision of safety equipment such as overalls and safety boots to casual workers and eye goggles to those who clean inside the mill with pressurized air

4.2 Challenges

Two big challenges faced at AML;

- The company does not provide lunch for trainees
- Most people at the mill used Kiswahili which am not conversant with

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