MOI UNIVERSITY

BACHELOR OF SCIENCE IN ELECTRICAL AND TELECOMMUNICATIONS ENGINEERING

DEPARTMENT: ELECTRICAL AND TELECOMMUNICATION

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SUBMITTED TO: DR. KIPRONO L. LETTING

SIGNATURE:

ACKNOWLEDGEMENT

I would like to first of all thank the Almighty God for the gift of life and health that enabled me to attend the attachment to its completion. Secondly I would like to thank Diageo PLC for allowing me to be a part of their team, it was an honor. I would also like to thank the Moi University fraternity ,thus far we have come you have been a constant presence. I would like to thank my parents for the continued support throughout the attachment period, you efforts will never go unnoticed.

ABSTRACT

As a requirement for the fulfillment of my Bachelors in Engineering ,it is of necessity that I be part of team in a industry, in this case East African Breweries Limited PLC a subsidiary of Diageo PLC .I was attached to the Spirits Department (United Distillers and Vintners) where I worked under the Asset Care Team. The company produces a variety of product in the Fast Moving Consumer Goods(FCMG) sector. The main product being beer and spirits. The following report is an account of my stay there.

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1. INTRODUCTION

1.1VISION

To be the most celebrated business in every market in Eastern Africa

1.2MISSION

To create the best performing, most trusted and respected consumer products company in Africa

1.3PURPOSE

Celebrating life every day, everywhere

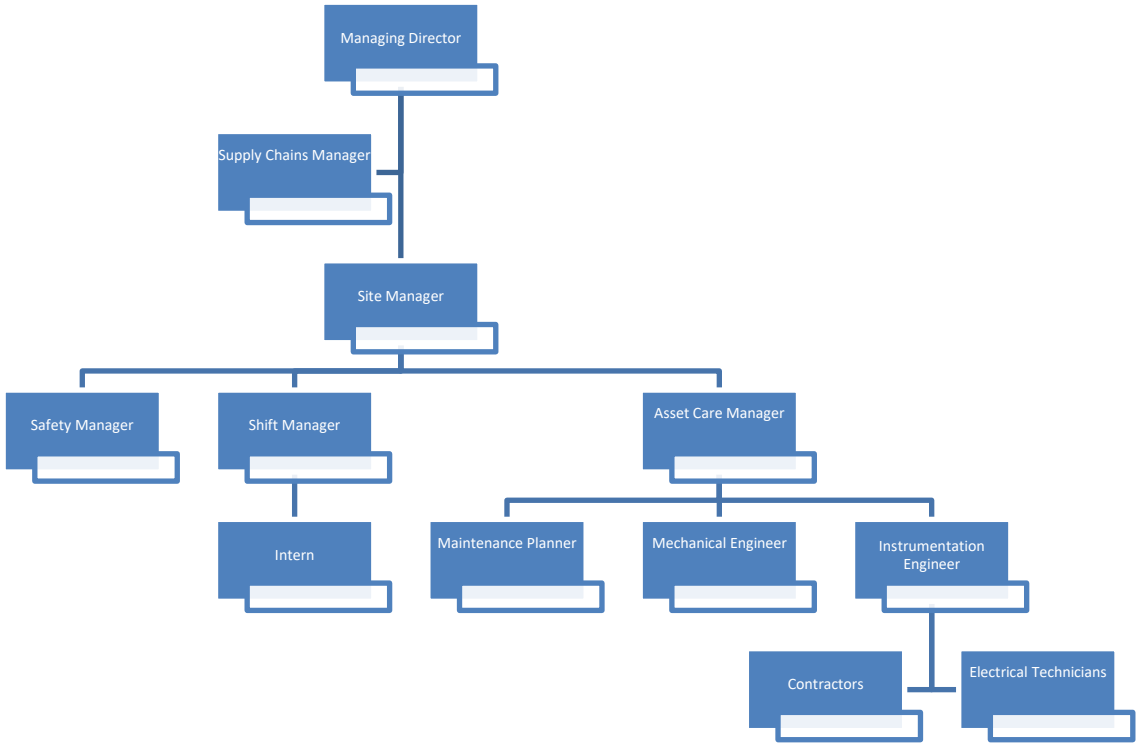


Fig 1

1.4 Working Schedule

The company employs about 1000 employees on a Permanent Contract basis and numerous contractors for most tasks.

The is General Shift (work for 8:00am to 5:00pm) and Shift (work from 7:00am to 7:00pm)

1.5 Raw Materials and Products

The company is in the Fast Moving Consumer Goods Sector of manufacturing mainly manufacturing beer and spirits for both the local market and foreign markets. I was in the spirits manufacturing department and the main product produced was spirits. The brands are ,Chrome,Richot,V&A,Bond 7,Kenya Cane,Smirnoff,Johnie Walker,Tanqueray and Gilbeys

The raw material is neutral ethanol, assorted flavors, sugar and hops. The neutral spirits is diluted to safe levels by adding water ,then flavors, sugar and hops are added and agitated. The product is then bottled and packed ready for consumption.

2. SPIRITS MANUFACTURING AND PACKAGING PROCESS

2.1PROCESS FLOW

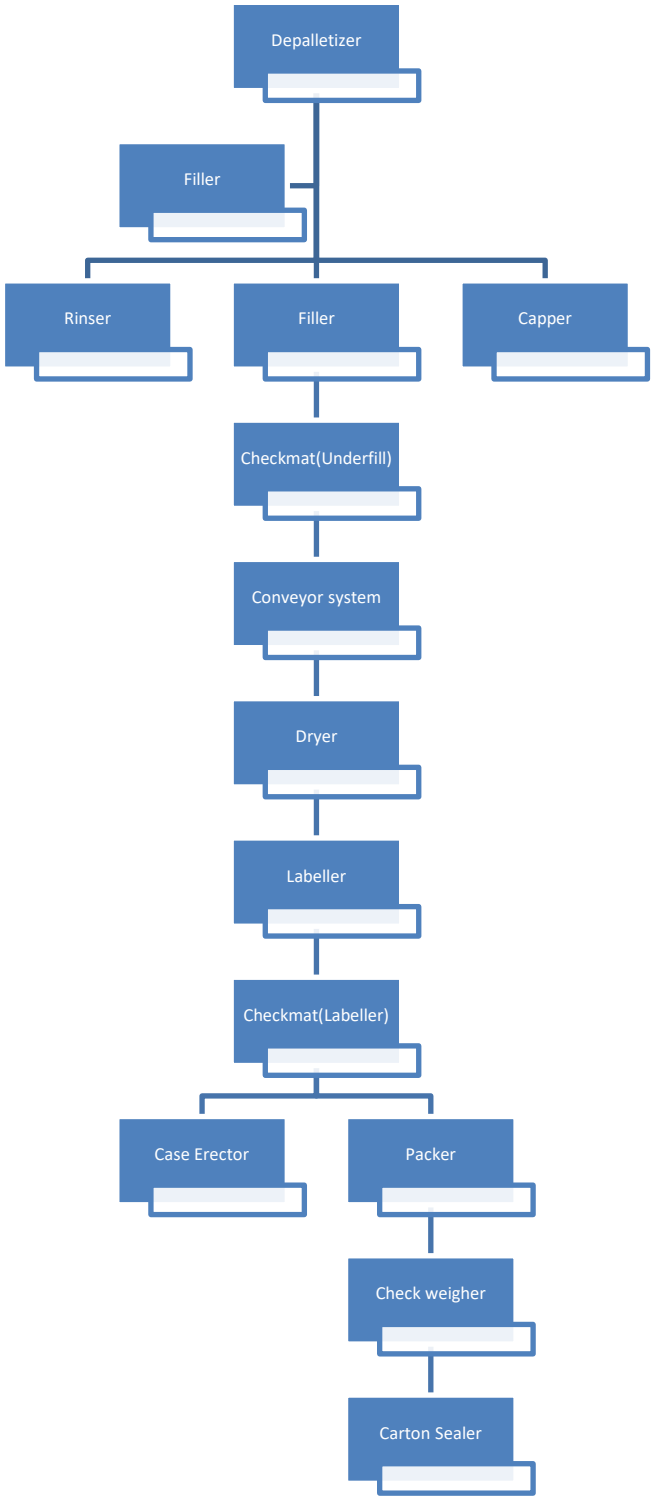

Depalletizer
Filler
Rinser
Filler
Capper
Checkmat(Underfill)
Conveyor system
Dryer
Labeller
Checkmat(Labeller)
Case Erector
Packer
Check weigher
Carton Sealer

Fig 2

2.2.Filler

Its is made of three machines in a single block :that is the rinser ,the capper and the filler itself.

2.2.1 Rinser

The rinser is used to rinse the bottle before the bottle is filled with the product.The rinser consists of a pneumatic cylinder,water supply and micro switch.The bottle presence sensor detects the presence of the bottele from the depalletizer and the pneumatic cylinder is activated that lowers the arm turning on the microswitch which allows the water to pass through.The water will shoot up the container for ¼ of the rotation cycle before it is turned off by an outer arm.The bottles are picked up from the rinser infeed star by the gripper and inverted by the cam.The deadplate is responsible for opening the gripper to accept the bottles.The inverted bottles then proceed to the water valves where water is shot up to rinse the bottles.The gripper is closed by a spring under tension.

The bottles are released at the rinser discharge star ,they then proceed to the intermediate star, the to the filler in feed star then on to the filler in feed star.

2.2.2 Filler

The filler is a gravity feed type of filler. The filling valves are fed bottles from the filler in feed star from which they sit on the shoe of the lifting elements. As the lifting element rises as it leaves the cam it raise the bottle and press upon a valve seat where the liquid fills the container. It is released by the same mechanism but in reverse at the capper in feed star.

2.2.3Capper

The capper is used for capping filled product containers

2.3.Labeller

The main task of the machine is to add labeller to the finished products.

2.3.1 Labeller parts

Transport conveyor
The containers are made available to the machine with the transport conveyor. The incoming containers reach the container table via the container lock, infeed worm and infeed starwheel, and return from the discharge starwheel to the transport conveyor.
Infeed control
The infeed control checks whether there are any gaps in the container flow. If a gap is identified due to a transverse container,the machine stops. The fault can be rectified by using the selection switch or by completely switching off the infeed control.
Container detection sensor (label switch)
This sensor is located above the infeed worm or above the infeed starwheel. It detects the incoming containers and controls the label trolley accordingly.

Container lock

A bottle stop or a infeed worm that can be disengaged controls the container infeed into the machine. The container lock is controlled by the automatic performance control.

Infeed worm

It separates the containers at a required distance and transfers them to the infeed starwheel.

Infeed starwheel, curved guide

The infeed starwheel and the curved guide bring the containers between the servo-driven container pads of the container table and the centring bells of the machine head, where they are held in place firmly. The centring bells are pressed onto the containers by one of the control cams in
the machine head.

Guide blade

The guide blade is adjusted to the relevant infeed starwheel and is required for transferring the containers from the infeed worm to the infeed starwheel.

Container table with servo-driven container pads

It transports the containers through the treatment section (labelling, brushing-on, label monitoring). The containers are rotated by the servo-driven container pads to each position required for labelling and brushing on.

Rolling-on sponge/brushing-on plate

Rolls the labels onto the container, especially the label ends.

Brushing-on station

If the label is on the container it is smoothed down and the edges brushed on.

The brushes must be adjusted in such a way that each side reaches around the container at the same time and is perpendicular to the container shape. For each container type, the associated brush set must be installed in the machine.

Label guide

The label must be blown onto the middle of the gripper sponge in order to keep it stable for the transfer. In addition the label guide prevents the labels from rolling up. The function of the label guide is also to make it easier to pull the label from the gluing pallet and to place it cleanly on the gripper cylinder, which supports the transfer onto the container.

Gripper sponge

It has the task of pressing the label onto the container. At the same time, the labels are blown onto the containers using compressed air (blast air nozzles between the gripper sponges and anvil strip) from the anvil strip. The gripper blast air also has another task. If adhesive residue is found on the anvil strip, it must be ensured that the label nevertheless reaches the container and is not drawn back into the pallet carousel thereby causing a fault.

Discharge starwheel

The discharge starwheel transfers the containers from the container table and returns them to the transport conveyor.

Labelling process

The label control element ensures that the adhesive pallets only remove labels if containers feed into
the machine.

Gluing unit with cold glue (*)

The applicator unit transfers labels to the containers to be labelled by means of the gripper.

Labelling unit
The core of each labelling machine is the labelling unit with oscillating pallets.
This is made up of:

- adhesive roller, adhesive strip and adhesive
- pallet carousel and gluing pallets
- label trolley and label container
- gripper cylinder the labels on the container

Adhesive pump
The adhesive pump conveys the adhesive via the feed tube directly to the adhesive roller. The integrated heating unit heats up the adhesive to the predefined processing temperature. An integrated thermostat keeps the set temperature constant.
If there is a fault on the thermostat, the micro thermal cutoff interrupts the power supply and prevents the device from overheating.
A warning message is produced in the event of a malfunction. When switching off the compressed air supply, the electro-pneumatic pressure switch immediately interrupts the power supply. The application of adhesive to the adhesive roller is set manually depending on the number of containers
Adhesive roller and adhesive strip
A gap is inserted between the adhesive roller and adhesive strip, which determines the adhesive film thickness on the adhesive roller. The film thickness can be set exactly using the 2 adjustment screws

Tamper-evident seal
The tamper-evident seal is transferred to the container with the body or rear label. The tamper-evident
seal is pressed onto the container and seal contour by the controlled presser within the container table.
The excess strip is rolled over the seal in the discharge starwheel.
Date stamping
As an option, a date may be stamped onto the containers.For this purpose, a pressure head is assembled at the transport conveyor or near to the container table for the ink labelling, for example.

Plasma treatment
Plasma system for the treatment of closures. For cleaning and pretreatment of metallic and non-metallic materials. The plasma jets directed at the material serve the generation and propagation of the plasma, cold Plasma is being generated.

Vacuum control
Content, completeness and emptiness can be found in all dimensions can be checked.
Camera Alignment Camera - coarse alignment
Image processing system for container alignment The bottles rotate in the labeller on a special LED lighting and a camera-equipped Casing over. The system determines the exact position of the glass seam, the embossing or the marker and transmits the result of the Machine control.

The servo driven plates then bring the of the transmitted result, the bottles are placed in the correct position around the label exactly at the desired.

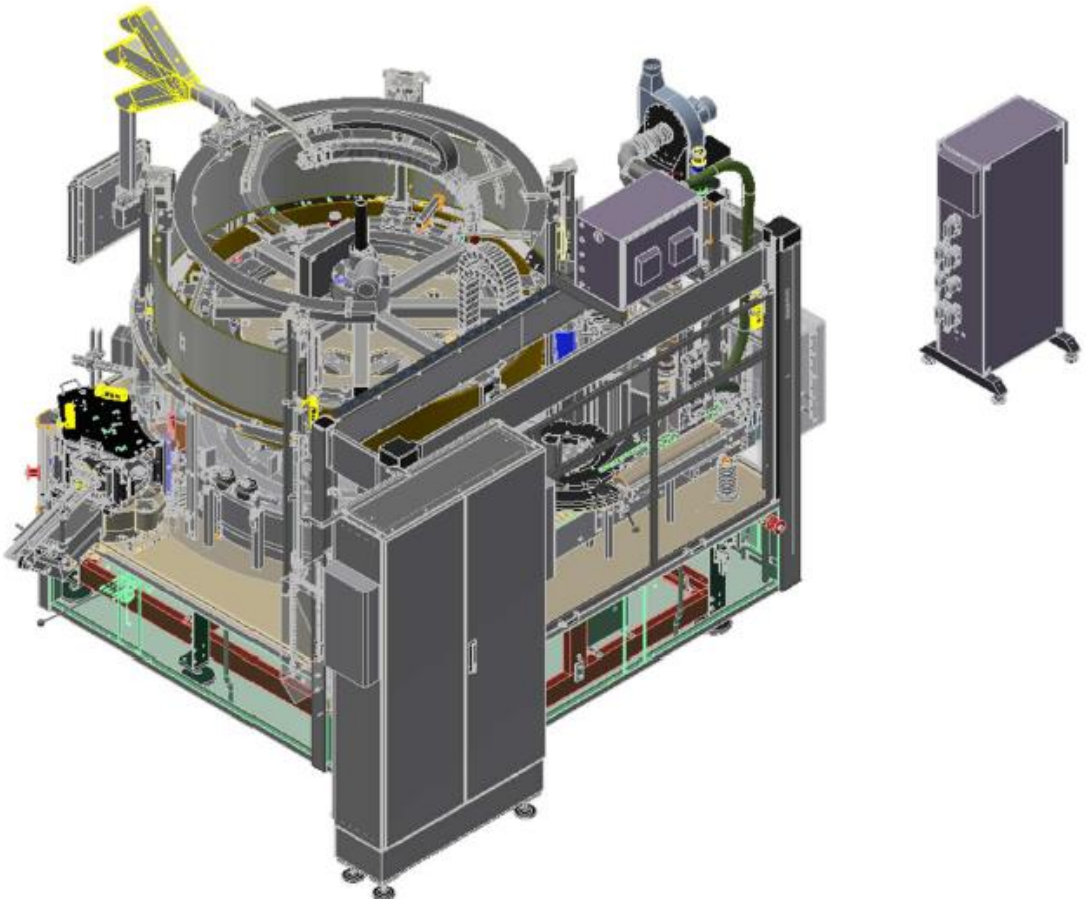
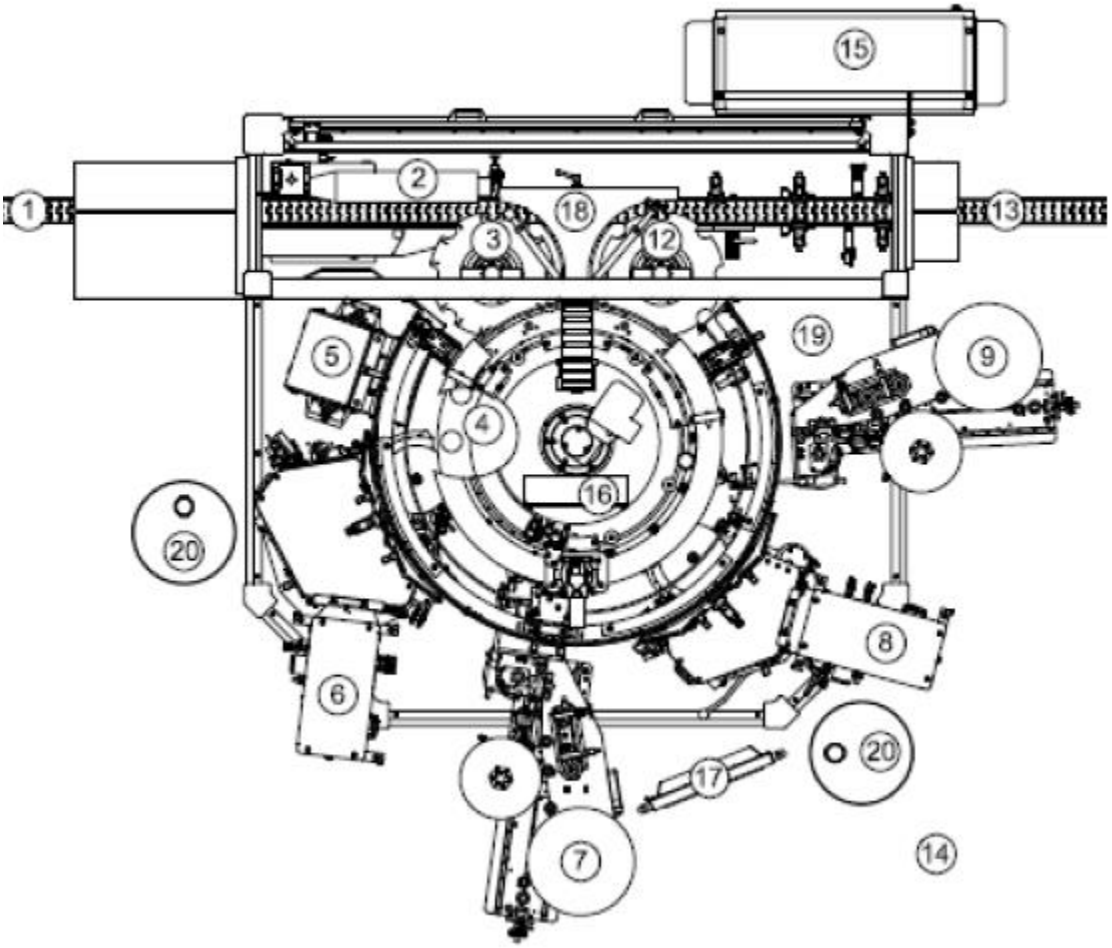


Fig 3

Assembly drawing



1 *Transport conveyor on the infeed side*
2 *Infeed worm*
3 *Infeed starwheel*
4 *Container table with servo rotary plate*
5 *Camera system*
6 *Cold adhesive labelling unit 1*
7 *PSL unit 1*
8 *Cold adhesive labelling unit 2*
9 *PSL unit 2*
12 *Discharge starwheel*
13 *Transport conveyor on the discharge side*
14 *Working area*
15 *Control cabinet (SS)*
16 *Terminal boxes (KL)*
17 *Commando boxes (KK)*
18 *Curved guide*
19 *Machine table*
20 *Adhesive pump (cold adhesive)*

Fig 4

2.4 Packer

The packer is used to package finished products into cartons. The machine consists of a transport conveyor to bring in the finished products, a carton erector for forming and bringing in finished cartons to the packer. The bottles arrive on the packer via table mat that consist of servo driven divider to separate the bottles in to for separate line at equal intervals .The bottle counter detects if the packer is full. This will signal the servo driven head to pick up the bottle from the conveyor side and place them on the carton side of the packer.

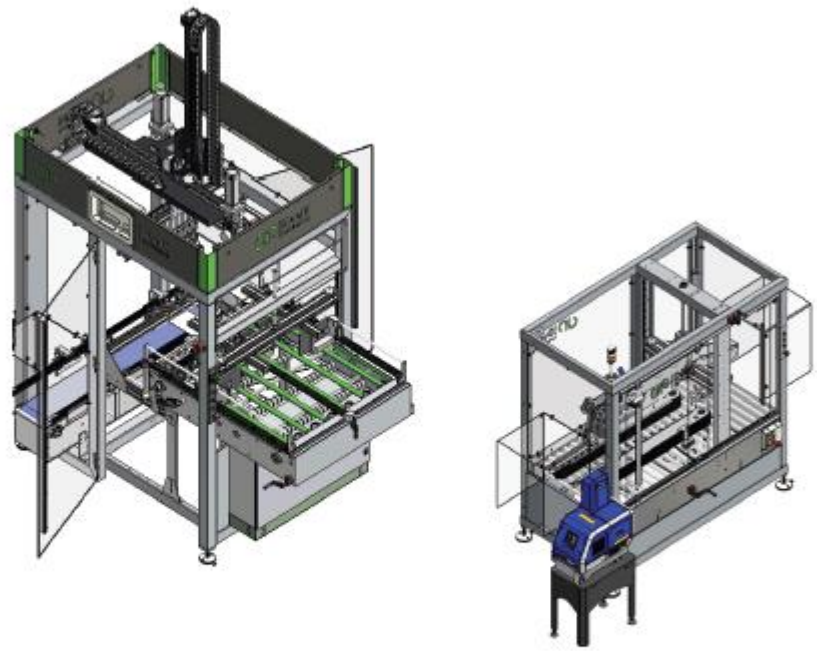


Fig 6 Carton forming and Packer machine

2.4 Dryer

It's a machine that is used before the labeller to dry the bottles before they proceed for labeling. This important because for the labels to stick on properly the container must be dry.It consists of a heating element and transport conveyor.

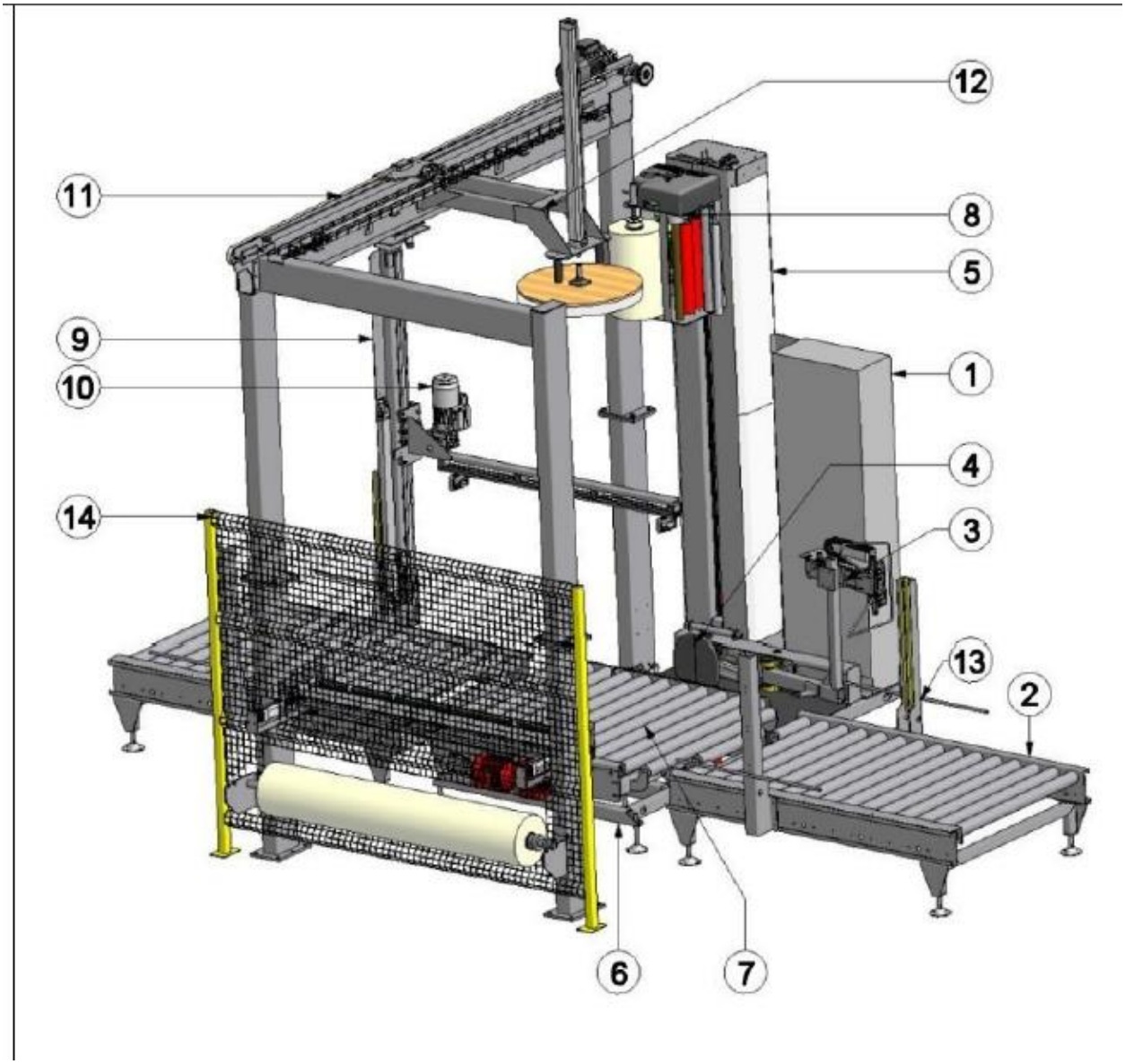
2.5 Checkmat

There are two checkmats on the line for different purposes. One is just before the filler and is used for checking the filled containers for overfills and underfills.Another one is after the labeller and is used to check if the labellers are correctly placed on the container, presence and absence of the labels before proceeding to the packer for packaging into boxes for wrapping.

2.6 Carton wrapping

The machine is used to wrap the finished cartons after being placed into pallets for transport and to keep the moisture out.

Fig 6



BASE

It is a supporting structure which sustains the vertical column with the rotary idler at the centre. It is built of steel sheets and profiles to obtain a robust support for the parts involved in wrapping. The platform rotates by means of a roller fifth wheel

VERTICAL COLUMN

This part of the machine sustains the "prestretch carriage" and makes it ascend and descend vertically at the same time as the platform rotation movement. These two combined movements allow the film to wrap around the pallet to form a coil. A geared motor powers chain transmission to obtain the vertical movement. The "prestretch carriage" is attached to a bent-steel sheet slide with special wheels for sliding.

SPOOL CARRIAGE WITH MOTOR-DRIVEN PRE-STRECH

This structure supports the spool. The spool carriage with fixed motor-driven pre-stretch, run by an inverter, stretches the film before it comes into contact with the palletised load, by means of a

transmission device made of two various-speed rollers. This feature differs it from any other standard carriage.
During wrapping, an electrical-mechanical sensor interacts with the rotating movement of the outfeed roller, called the “tachometer roll”. It automatically controls the amount of film distributed so that there is a constant wrapping tension along the whole pallet perimeter with different shapes and sizes.
The percentage of extension (pre-stretch) is acquired by a gear torque mounted on the upper part of the pre-stretch carriage, below the protection sump. This percentage can change based on the mounted gear torques, the requirements of the customer and above all on the quality of the film used. The film can be wrapped at different tensions, always depending on the prestretch degree set by the installed gear torque. This operation is carried out by means of a potentiometer or from an operator panel.
The pre-stretched film can be simply rested on the pallet or tensioned to the its limit.

GRIPPER

One of the most important elements for the automatic running of the wrapping machine.
The gripper holds the edge of the stretchable film at the beginning and end of the cycle.

PROTECTION GRIDS (NOT PRESENT)

The protections grids are made up of a perimeter tubular frame containing metal mesh panels. They outline the **hazardous area** inside which the machine carries out all necessary operations for wrapping. Here is a walkable gate where the operator accesses the hazardous area for some manual operations, such as to change the stretchable film.

ELECTRO SENSITIVITY BARRIERS (PRESENT)

The pallet infeed and outfeed areas and/or the load and unload accesses, are protected by electro sensitivity safety barriers (electro sensitive protective equipment ESPE), compliant with Standard EN 415-6.

PNEUMATIC SYSTEM

The pneumatic system consists of a set of solenoid valves, pneumatic actuators and tanks which allow handling of different devices.

MAIN SWITCHBOARD

The main control switchboard, inside a cabinet, contains all of the electrical, electronic and pushbutton equipment for management of all the machine functions. Operation status and intervened alarm messages with operations to be carried out for restoration of the anomalies (auto diagnosis) are indicated on the operator interface display (touchscreen panel).
Also, all the parameters which intervene during wrapping (wrapping cycles, times, number of revs, welding time, welding temperature, etc.) can be set on the keyboard and the manual operations can be carried out.

2.5Check weigher

The finished and packed cartons are weighed to ensure as quality control mechanism to ensure all products are available and meet the required standards.

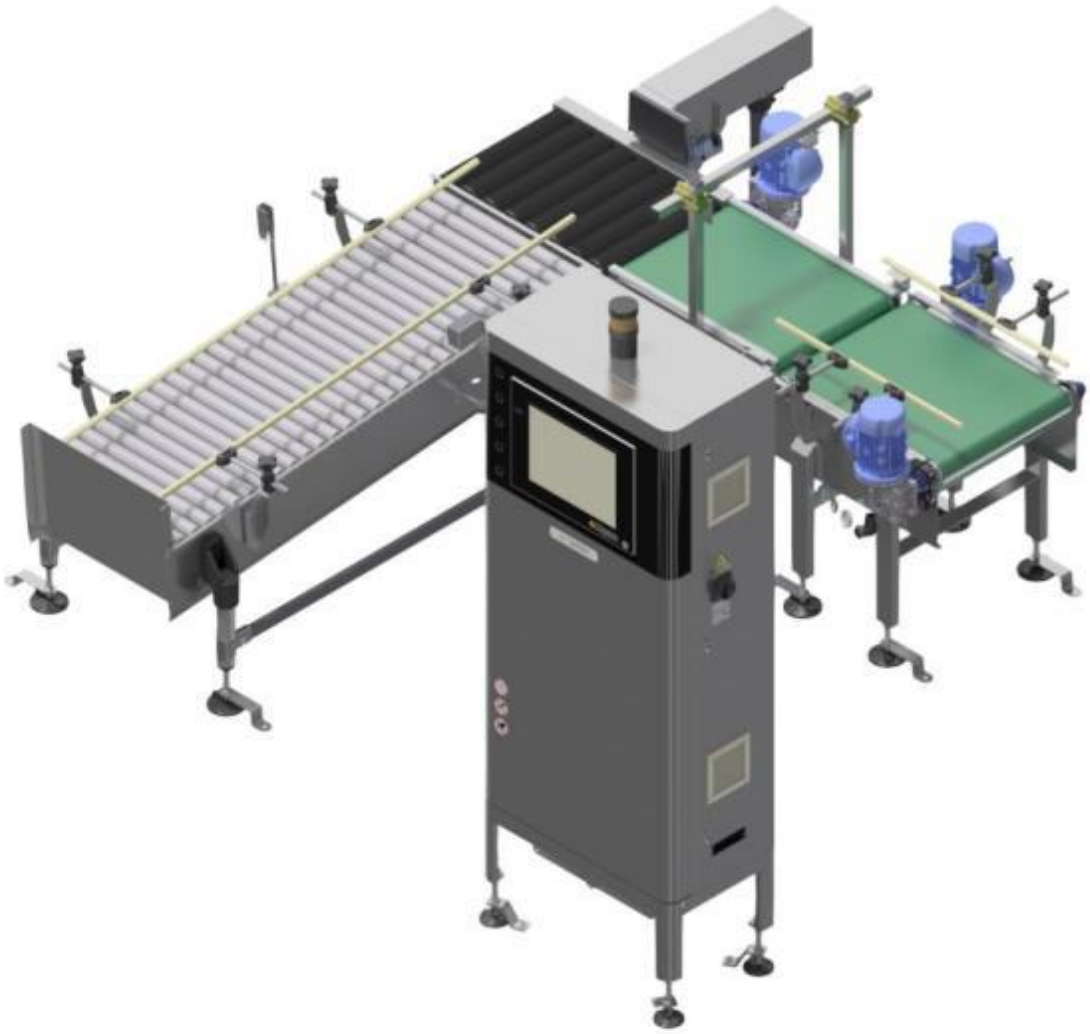


Fig 10

3. Engineering Problem 1

3.1Problem statement

I observed that maintenance at the plant was based on reactive maintenance rather than predictive maintenance. There was also an element of condition monitoring on a 3-month basis. I found this insufficient and therefore proposed the following solution.

3.2Literature review

The plant uses Danfoss and Schneider drives to control the speed of the conveyors and the speed of drives in pretty much all of the other drives. The drives have the ability to among other thing to monitor the current. The drives also have data logging capabilities that enable them to have them record the values of a certain preset parameter for certain interval of time. This data is a gold mine when condition of the particular machine is to be determined because the machine.

The data from the machine can be used to train a model that can be then used to classify the different kinds of faults that occur as the machine operates. The model can then be used to predict the occurrence of faults in future.

3.3 Problem solution

I proposed that we use the drives to collect the data on the operating currents of the machine. We then cleaned the data, removing 0 values that was inconsequential in the machine operation. The data was then analyzed to show trend of machine operation over the different brands in operation. The data showed a clear deterioration in the machine health with time

3.4 Challenges

While the data showed the machine health over time, it failed to indicate the distinguish the various types of problems. It was also limited to friction related problems. I proposed the use of vibration analysis for a more nuance approach to the problems

4. Engineering Problem 2

4.1 Literature review

The technicians at the plant do daily walkabouts to determine the general state of the machines and the operating state of the machines. This is done to get ahead of certain problems before they actually happen.

4.2 Problem statement

The was a lack of structure around the walkabouts hence were not as effective as they were supposed to be .

4.3 Solution

With the guidance of the Mechanical Engineer ,we developed a walkabout template and provided some structure and uniformity to the whole system. It also provided record systems for future reference.

5. Conclusions and recommendation

- I believe that the potential of the drives in the company are under-utilized and a lot more can be squeezed out of them to improve the efficiency of the machine and reduce down time. I recommend that to that end ,the drives capabilities should be re-examined.
- The position of machine learning and data mining in the plant should be seriously considered because it will improve the efficiency an decrease downtimes at the company.