

Learner Name : Matthew Thomas.

Course : HNC Process Operations Engineering, Year 2.

Module Code : PCPO4007. 

Module Name : Process Engineering Practice. 

Assignment : Operation of Processes. 

Contents Page

Section		Page
Introduction.		3
Part 1 :	Analysis of an item of Process Equipment at The First Milk Cheese Company Ltd.	4
Contents Page.		5
Introduction.		6
Report Demonstrating Knowledge and Understanding of the Operation of an item of Process Equipment within The First Milk Cheese Company Ltd.		7
Bibliography and References.		11
Part 2 :	Analysis of the Industrial Processes within The First Milk Cheese Company Ltd.	12
Contents Page.		13
Introduction.		14
Report Demonstrating Knowledge and Understanding of the Industrial Processes within The First Milk Cheese Company Ltd.		15
Bibliography and References.		18
Word Count		19

Introduction.

Two Pieces of Work shall be completed within this Assignment. Each section is divided within this Assignment and has its own Contents and Introduction.

The two sections are :

- Report Demonstrating Knowledge and Understanding of the Operation of an item of Process Equipment within The First Milk Cheese Company Ltd.
- Report Demonstrating Knowledge and Understanding of the Industrial Processes within The First Milk Cheese Company Ltd.

The first section will be an explanation of the Operation of a Process Item within The First Milk Cheese Company Ltd. The report will discuss the principles of the technology and its operation. It will also touch on the Hazards associated with the plant and how systems are created to reduce or remove the risk.

The second section is a brief summery of the whole process line within The First Milk Cheese Company Ltd discussing the main plant and the processes happening within them.

Learner Name : Matthew Thomas.

Course : HNC Process Operations Engineering, Year 2.

Module Code : PCPO4007.

Module Name : Process Engineering Practice.

Assignment : Operation of Processes.

Part 1 : Report Demonstrating Knowledge and Understanding of the Operation of an item of Process Equipment within The First Milk Cheese Company Ltd.

Contents Page

Section		Page
Part 1 :	Analysis of an item of Process Equipment at The First Milk Cheese Company Ltd.	4
	Contents Page.	5
	Introduction.	6
	Report Demonstrating Knowledge and Understanding of the Operation of an item of Process Equipment within The First Milk Cheese Company Ltd.	7
	Bibliography and References.	11

Introduction

The focus of this report will be to show the operational details of an items of process equipment within The First Milk Cheese Company Ltd. The item in question will be the Separator Units. As well as the operation of these units, the technology behind the units will be discussed and also an overview of the safety systems.

Task 1 : Report Demonstrating Knowledge and Understanding of the Operation of an item of Process Equipment within The First Milk Cheese Company Ltd.

Within "The First Milk Cheese Company Ltd, Haverfordwest Creamery" there is a single production line that takes raw unpasteurised milk and turns it into 20kg blocks of cheese, but there are also two by-product lines that come off this main line. One of these turns the fats into cream, the second turns whey into whey concentrate. Filtering out two different liquids can be an extremely difficult task, and at different points during the production processes it is necessary to remove excessive fats, whey and water. This is done by the use of Separator Units. The liquid is pumped into each unit which consists of a spinning bowl liner within a lidded bowl. The liner is spinning at speeds up to 4850rpm. This spinning causes the liquid molecules to separate due to the differences in their densities. There is a stack of stainless-steel discs within each unit and these stacks are specially designed for a specific filtering task. After filtering the separated liquids exit the unit at the top and continue either for further processing or are dumped to drain. On the main production line and the by-product line there are a total of 5 Separator units.



Image 1 : Separation Unit at The First Milk Cheese Company Ltd

First there is the Milk Clarifier which takes the raw milk and removes excess cream and fats off the milk. This allows for the raw milk going through the production line to be more standard and similar in quality. This means that less changing needs to be done to production recipes for the differences in milk quality. Changes in milk quality and differences in the fat and cream levels within it can lead to huge differences in the standard of the cheese coming out at the end of the production line. As such, having this plant in place allows for a much smoother production.

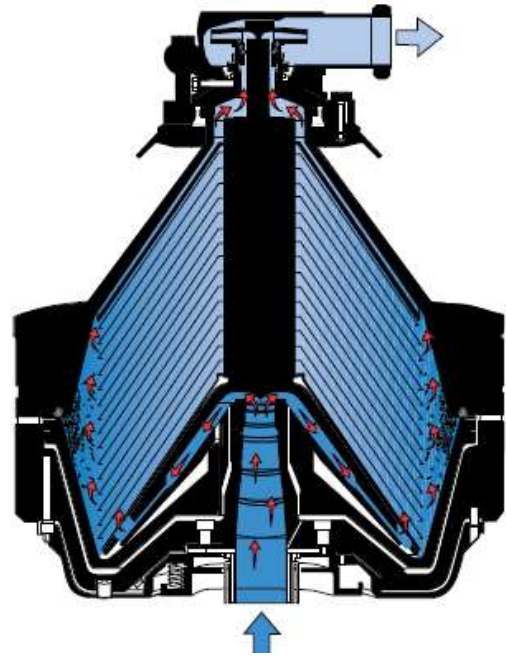


Image 2 : Diagram of a Clarification Unit

The second unit is the Milk Separator. This unit is only used when producing low fat cheese. The unit not only standardises the milk the same as the milk clarifier unit, but it also removes additional fat from the raw milk before its use in the production line.

The next unit is the Whey Clarifier. This unit takes the whey that has drained off the cheese during the production and starts filtering out any impurities. These impurities are bits of cheese that have fallen through the drain off for the whey. Should they make their way into the whey processing line then they can cause blockages and contamination to the whey products. As such it is important to make sure that they are filtered out as soon as possible. This product is returned to the cheese production line for processing.

The final two units are a set of Duplex Whey Separators labelled as Whey Sep 1 and Whey Sep 2. These units which are only used one at a time, filter out some water from the Whey which concentrates the Whey up. They also filter out any impurities that may have got through the Whey Clarifier.

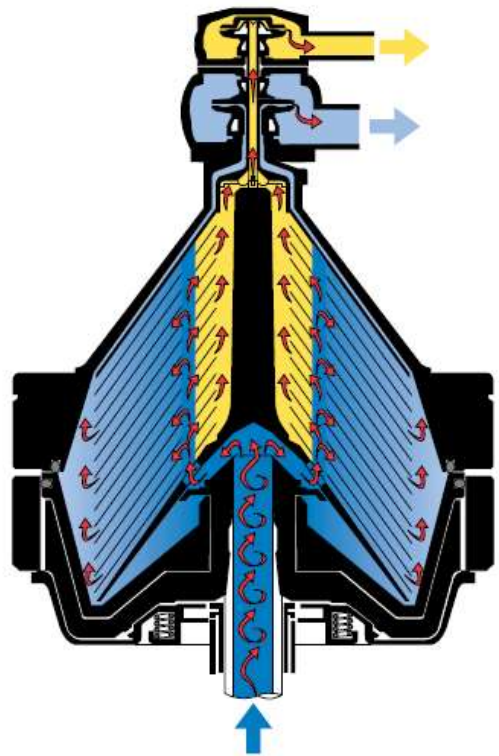


Image 3 : Diagram of a Separation Unit

Whilst all of these units are called Separator units, there are actually two different types of process units. The Milk Separator and both the Whey Separators are true Separation Units, whilst the Whey Clarifier and Milk Clarifier are Clarification units. Each type consists of a stainless-steel bowl with a cone shaped lid. There is a bowl liner which sits inside the bowl and spins when the unit is in use. Product is pumped into the bowls from the bottom and begins to spin as it enters the bowl liner. Above the liner are a stack of stainless-steel discs. These discs act as a filter for the product and only allow the desired product through. Any impurities, excesses or secondary products are filtered off and either dumped to drain or pumped for additional processing elsewhere. The desired product is collected at the top and pumped further along the production line.

The differences between the separation and clarification units are down to the set up of the stack of discs. The clarification discs are solid and set up to only allow fat to pass in between the discs whilst pushing the milk outwards and up to the top of the stack and out of the unit. However, the separation discs have an additional set of holes within them that allow the filtering of a second type of product. The discs are set so that two products can pass through the discs, but one will drop through the holes within the discs whilst the other will continue right through. Both are collected at the top and leave the unit. The setup of the discs can vary between each unit, so each separator can be set to allow different amounts of filtering to be completed.

The spinning of the bowl on each unit can cause vibrations that could, if not properly managed, result in the failure of that unit. The bowls can spin at speeds of up to 4850rpm, and if the liner or discs are not balanced or should there be any damage to the main drive shaft, then the units can vibrate. If the vibration is too high, then the unit could begin to fall apart. To prevent this each unit is fitted with vibration motions. There are a number of vibration alarms built into the SCADA that controls each unit. Upon starting each unit up, the vibration levels are automatically monitored by the SCADA. Should the vibration levels exceed the desired limits then the unit will not increase its speed further. An alarm is shown on the SCADA and the operator can choose to shut down the unit or hold and call for engineering assistance. This happens twice during start up. Once at 10% of standard rpm and once at 50%. Once above 50% the unit is monitored consistently by the SCADA. At this point there are two levels of vibration alarm on each unit. The first is a warning to the operators on their SCADA system, the second is an automatic shutdown of the plant. Each unit has a brake to give a steady slow down of the bowl. Slowing the bowl down too quick can cause damage to it, but not slowing the bowl down quick enough will not stop the vibration and could cause damage to the unit. It is therefore hugely important to ensure that the levels are set correctly for each plant. To help with the vibration levels, each unit is also secured to a specially prepared base that is concreted into the floor.

To also help with keeping the vibration levels low, each unit performs regular discharges of the bowl. This dumps all impurities that could build up within the bowl and slosh around. This discharge is different for each unit and needs to be set up based on the products and filtering being undertaken by each unit. If the units do not discharge, then when trying to start up a unit, there will be additional weight and an unbalance of the bowl liner which will in turn rub against the bowl and could cause a total failure of the machine. To help ensure the condition of the liner, it is replaced every 12 months with an inspection 6 months in between. This is done by a specialist contractor. Whilst site engineers are trained in the basic maintenance of each of these units, the knowledge needed to ensure a period of successful running means that external contractors are brought in to complete 6 monthly servicing on them.

Any health and safety issues.

Bibliography and References

Books

Tetra Pak Processing Systems (1995), Dairy Processing Handbook
Invensys APV, Dairy Technology

Websites

Tetra Pak, Dairy Processing Handbook, Viewed December 2020,
<<https://dairyprocessinghandbook.tetrapak.com/>>

Tetra Pak, Cheese Technology Guide, Viewed December 2020,
<<https://www.tetrapak.com/uk/about/cases-articles/cheese-technology-guide>>

Harvard Referencing.

Learner Name : Matthew Thomas.

Course : HNC Process Operations Engineering, Year 2.

Module Code : PCPO4007.

Module Name : Process Engineering Practice.

Assignment : Operation of Processes.

Part 2 : Report Demonstrating Knowledge and Understanding of the Industrial Processes within The
First Milk Cheese Company Ltd.

No
need to
have a separate
part

Contents Page

Section		Page
Part 2 :	Analysis of the Industrial Processes within The First Milk Cheese Company Ltd.	12
	Contents Page.	13
	Introduction.	14
	Report Demonstrating Knowledge and Understanding of the Industrial Processes within The First Milk Cheese Company Ltd.	15
	Bibliography and References.	18

Introduction

The focus of this report will be to give a brief overview of the main items of plant within ~~the~~ production line at The First Milk Cheese Company Ltd. Also covered will be the main processes ~~happening~~ with these items.

Task 2 : Report Demonstrating Knowledge and Understanding of the Industrial Processes within The First Milk Cheese Company Ltd.

Within “The First Milk Cheese Company Ltd, Haverfordwest Creamery” there is a single production line that takes raw unpasteurised milk and turns it into 20kg blocks of cheese, but there are also two by-product lines that come off this main line. One of these turns the fats into cream, the second turns whey into whey concentrate. The main production line will be the focus of this report. The raw milk undergoes drastic changes as it makes its way through the production line and comes out the other end as cheese.

Milk Intake : The raw milk is delivered to site and offloaded at the milk intake. Here the raw milk arrives and is pumped into one of five raw milk silos. The milk is kept here until called for by the production line. But whilst in the milk silos, the milk needs to be kept constantly in motion to prevent the fats from settling within the silo. This is done using an agitator on each silo. These keep the milk stirring until it called for.

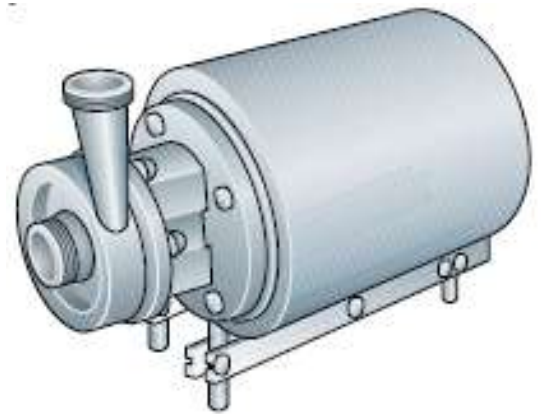


Image 4 : Centrifugal pump used in Milk Intake

Milk Pasteurisation Room : Once called for, the milk is pumped across from the raw milk silos into the milk pasteurisation room. The milk travels through one of two heat exchangers and is heated to a temperature in excess of 72.6°C. This is done to kill off any harmful bacteria within the product. A heat exchanger is a set of plates, usually made of stainless-steel, that are clamped together (usually into a stainless-steel frame). Raw milk and hot water will travel between alternative grooved plates allowing for the indirect transfer of heat from the hot water to the chilled raw milk. This heat transfer will bring the temperature of the raw milk up to the desired level before it exits at the other end of the plate pack and continues forward into VATs.

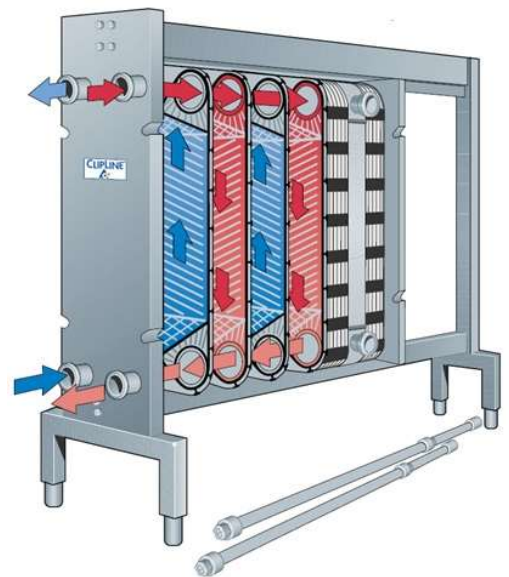


Image 5 : Milk Pasteurisation Heat Exchanger

Cheese VATs : Within each VAT, when 25,000ltrs of milk is pumped in the process to turn it into cheese begins. Enzymes are added to the milk that causes the milk molecules to begin sticking together. This in turn causes the milk to start becoming a solid product known as Curd. The VATs contain several stirrer blades that perform three tasks. Firstly, to stir the milk as it is entering the VAT, then mix the starter enzymes throughout the milk before finally being sharp enough to keep cutting up the solid curd that forms within the VAT after the enzymes have done their task. Once the cutting process has been completed the curd is pumped over to the Draining Conveyor.



Image 6 : Cheese VATs

Draining Conveyor : The small chips of curd enter the draining conveyor and fall onto a conveyor belt that is full of drainage holes. These holes allow the excess whey to drain off from the curd and off for further processing. There are numerous stirrers within the plant that keeps mixing up the curd, this helps to drain off additional whey from the curd. At the end of the draining conveyor the curd is blown up to the top of the cheddar tower.

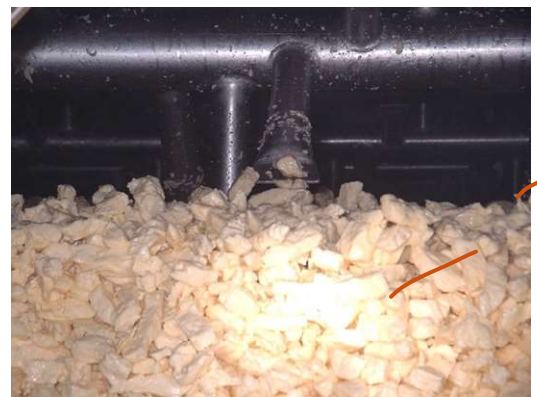


Image 7 : Chips of curd in the Draining Conveyor

Cheddar Tower : The small chips of curd are blown in at the top of an 8-metre-high stainless-steel cylinder known as the cheddar tower. The curd falls down the cylinder and collects at the bottom. The weight of all this collected curd forces it to begin to join. Once a set weight is reached, a blade cuts across the top of the curd. This prevents anymore curd from dropping on top of the collected curd. A trapdoor opens at the bottom, below the collected curd, and drops it onto the salting conveyor for further processing. Once the trapdoor is back in position, the blade will retract and let more curd collect.

Salting Conveyor : The salting conveyor mirrors in the draining conveyor in its setup and design, but it also includes an additional piece of plant, this is the salter. The curd is salted to stop the enzymes, that were added in the VATs, from continuing to develop in the curd that could cause spoilage. At the end of the salting conveyor the curd is then blown over to the blockformers.

Blockformers : The blockformers are a set of tall stainless-steel towers with a packing unit at the bottom. The curd enters the towers at the top and falls to the bottom where it is compacted by the weight of more curd falling on top of it. The tower forms the curd into the right shape and size to be cut into the 20kg blocks that are the finished product of the production line.

Once the cheese comes out of the blockformer units it moves onto the Packaging Plant where it is boxed up, chilled and palletised ready for sending off site for maturation until it is ready for consumption.

Conclusion!



Image 8 : Blockformer Unit

Bibliography and References

Books

Tetra Pak Processing Systems (1995), Dairy Processing Handbook
Invensys APV, Dairy Technology

Harvard
Referencing.

Websites

Tetra Pak, Dairy Processing Handbook, Viewed April 2021,
<<https://dairyprocessinghandbook.tetrapak.com/>>

Tetra Pak, Cheese Technology Guide, Viewed April 2021, <<https://www.tetrapak.com/uk/about/cases-articles/cheese-technology-guide>>

Cheese Science Toolkit, Viewed April 2021, <<https://www.cheesescience.org/>>

Word Count

Report 1 : 1,245

Report 2 : 801

Total : 2,046

