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A

REPORT ON

INDUSTRIAL ATTACHMENT AT KATHMANDU MILK SUPPLY SCHEME

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AN INDUSRIAL ATTACHMENT REPORT

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We perceive this opportunity as big milestone in our career development. We will strive to use gained skills and knowledge in the best possible way.

Thank you all.

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CHAPTER ONE: INTRODUCTION

1.1 Background

Dairy Development Corporation (DDC) was established in 2026 B.S. (1969) under the corporation Act 2021 B.S. (1964). Prior to the establishment of DDC, a separate Dairy Development Board was constituted to carry out the task of dairy development in Nepal in wider scale. In 2010/11 B.S. the Central Dairy Plant was established in Lainchaur. By then collection, processing and marketing activities were made organized. The corporation is governed by the board of directors appointed by Government of Nepal (GoN). Different countries like USA, Denmark, Newlands, Switzerland, and Netherlands and organizations like World Food Program (WFP) and United States Agency for International Development (USAID) are providing economic as well as technical support.

Dairy Development Corporation has been acting as a bridging agent between milk producers and consumers. Annually, it collects over 60 million liters of milk from more than 75 thousand milk producers through 970 milk cooperatives spread out in twenty-nine districts. It has played an important role in economic development of the nation and uplifting status of rural farmers and every other employee thus assisting poverty alleviation.

1.1.1 Objectives of DDC

1. To provide qualitative milk product within reasonable price range.
2. To develop a well-established marketing system providing hygienic pasteurized milk and related products.
3. To guarantee all time availability through organized milk collection system.
4. Develop organized milk collection system to meet increasing demand for pasteurized milk and milk products.
5. Develop an organized marketing system for milk and milk products in urban areas.

1.1.2 Projects under DDC:

1. Kathmandu Milk Supply Scheme (KMSS)
2. Biratnagar Milk Supply Scheme (BMSS)
3. Milk Product Supply Scheme (MPSS)
4. Hetauda Milk Supply Scheme (HMSS)
5. Lumbini Milk Supply Scheme (LMSS)

6. Janakpur Milk Supply Scheme (JMSS)
7. Nepalgunj Milk Supply Scheme (NMSS)
8. Dhangadi Milk Supply Scheme (DMSS)

1.1.3 Collection Networks of DDC

The collection network under different Milk Supply Schemes is presented below. Chilling Centers (CC), established under the Milk Supply Schemes, is in operation across the country for chilling.

The milk collected from the Milk Producers Cooperative Society (MPCC)s:

Table 1 Projects Under DDC

Schemes	MPCCs	CCs	District Covered
KMSS	281	30	7
BMSS	126	11	4
LMSS	167	8	3
HMSS	63	6	4
NMSS	40	3	4
MPSS	49	14	8
JMSS	25	7	6
DMSS	24	4	2
Total	791	63	34

1.1.4 Chilling Centers of DDC

Under the supervision of KMSS there are numbers of chilling centers located at various parts of country in order to facilitate the collection of milk. Milk collected by cooperatives of different places is maintained at required temperature in chilling centers which is then transported to KMSS with the help of trucks for further treatment. Given below is the table that shows the capacity of different chilling centers:

Table 2 Milk Chilling Center under KMSS

Milk Chilling Centre under KMSS						
Scheme	Name of Chilling Centre	District	No.of chilling centre	Cooperative of milk production	Chilling Capacity	Average daily collection of milk
K.M.S.S	Banepa	Kavrepalanchowk	1	15	10000	6000
	Panauti	Kavrepalanchowk	1	11	10000	3000
	Panchkhal	Kavrepalanchowk	1	31	6000	9000
	Sipaghat	Kavrepalanchowk	1	11	10000	2000
	Charaudi	Dhading	1	9	3000	500
	Mahadev Besi	Dhading	1	17	3000	3000
	Balefi	Sindhupalanchowk	1	14	3000	6000
	Tika Bhairab	Lalitpur	1	5	10000	3000
	Bhaktapur	Bhaktapur	1	17	4000	4000
	Sankhu	Kathmandu	1	30	6000	4000
	Ranitar	Kavre	1	11	6000	5000
	Bharatpur	Chitwan	1	9	6000	1500
	Chanauli	Chitwan	1	26	6000	6500
	Jyamire	Chitwan	1	8	10000	4000
	Tinpipale	Kathmandu	1	4	1000	400
	Maghauli	Chitwan	1	5	3000	1500
	Sardhanagar	Chitwan	1	3	2000	1000
	Sangachowok	Sindhupalanchowk	1	13	2000	1500
	Baunepati	Sindhupalanchowk	1	18	3000	3000
	Total	7 Districts	22	281	109000	72400

Source: DDC annual report 2069

1.2 Objectives

1.2.1 Main Objectives

- To receive on the job knowledge and skills during the one-month internship.

1.2.2 Specific Objectives

- To purpose the effective plant layout and design the new conveyor system

- To analyze real life engineering problems and compare the experience with theoretical knowledge.
- To understand how materials flow inside the factory and the layouts used in the factory for efficient production and use of floor space.
- To understand the organization structure and management techniques used.

1.3 Limitations

- The time of the industrial attachment was not enough to understand all the aspects of the industry properly.
- Festivals disturbed the continuity of the internship.

CHAPTER TWO: MANAGEMENT SYSTEM

2.1. ORGANIZATIONAL STRUCTURE

The organizational structure of Kathmandu Milk Supply Scheme, DDC is line structure. It is the simplest and oldest form of organizational structure. The line of authority flows vertically from top most executive to the lowest subordinate throughout the organization. Where, managers have direct authority over their respective subordinates through the chain of command. Authority flows directly from top to bottom through various managerial positions. This is the reason for calling this organization as scalar organization which means scalar chain of command is a part and parcel of this type of administrative organization. In this type of organization, the line of command flows on an even basis without any gaps in communication and co-ordination taking place.

2.2. FORM OF OWNERSHIP

Dairy Development Corporation is established under corporation Act 2021 BS. DDC is a fully Government owned corporation. The corporation is governed by the board of **6** directors appointed by Government of Nepal (GoN).

Figure 1: Organization structure

2.3 FACTORY BUILDING

KMSS has single storey buildings. A single storey building normally consists of the ground floor only. It enables greater flexibility in layout and efficient supervision. It helps in effective utilization of floor space with cheaper and efficient material handling. There is less building vibration and transmission of noise and mainly suitable for heavy plants.

2.4 MATERIAL HANDLING EQUIPMENTS

Material handling equipment is mechanical equipment used for the movement, storage, control and protection of materials, goods and products throughout the process of manufacturing, distribution, consumption and disposal. The different types of handling equipment used in KMSS can be classified into two major categories:

- Lifting and lowering devices
    1. Pumps
    2. Inclined conveyor
- Transporting devices
    1. Horizontal conveyor
    2. Wheel barrow
    3. Hand truck
    4. Pipelines

2.5 Plant Layout

The layout used in DDC is process layout. It is also called functional or job lot layout. In a process layout all similar machines are grouped together. So, there are different sections such as butter section, filling section, testing section, etc.

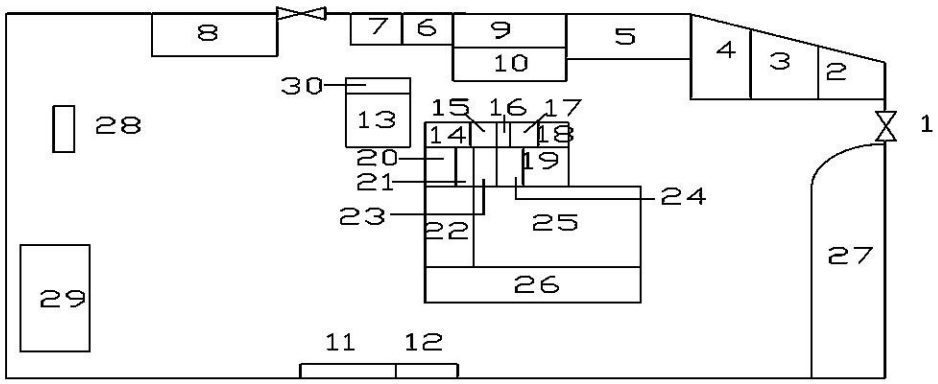


Figure 2 Plant layout of DDC

(Source: DDC annual report 2069)

S.N.	Description	S.N.	Description	S.N.	Description
1	Main Gate	11	Deep Freeze	21	Butter Production Room
2	Guard House	12	Bike Stand	22	Milk Cold Storage
3	Clinic	13	Ghee Section	23	Butter Cold Storage
4	Changing Room and Toilet	14	Boiler Room	24	Butter Packing
5	Bike stand	15	Power Control Room	25	Milk Production
6	Oil Storage Tank	16	Total Store Room	26	Administration
7	Guard House	17	Compressor Room	27	Garden
8	Canteen	18	Workshop	28	Auto Workshop
9	Water Treatment Plant	19	Engineering and Maintenance	29	Fresh Milk Unit
10	Evaporator	20	Butter Cold Storage Room	30	Generator Section

CHAPTER THREE: PRODUCTION PROCESS

3.1 PRODUCTS

In Kathmandu Milk Supply Scheme (KMSS), Balaju branch there are four variety of products produced:

- Pasteurized Milk
- Butter
- Ghee
- Curd
- Flavored milk

3.2 MILK (STANDARD MILK)

3.2.1 Definition

Standard milk's fat and/or Solid Not Fat (SNF) content have been adjusted to a certain pre-determined level. Standardization is done by partly skimming the milk with a cream separator or by mixing with fresh or reconstituted skim milk in proper proportions. The milk can however, be used for making other products by varying the proportions of fat and SNF content.

Under the national standards, the standardized milk for liquid consumption should contain a 3% fat and 8% SNF.

3.2.2 Raw material and Other Ingredients

The basic raw material for standard milk production is freshly drawn, unadulterated, and good quality cow or buffalo milk. Other materials that need to be used are: Skim milk powder (SMP), cream and clean contaminant free water.

3.2.3 Packing Materials and Type of Container

Milk is filled in the 3 layered plastic pouches made up of films of Low-density polyethylene (LDPE) and Linear low-density polyethylene (LLDPE). The roll of plastic film is placed, filled and sealed in various filling machines. A pouch of filled milk weighs around 516gm. The sachets are packed in polythene crates (20 sachets per crate).

3.2.4 Production capacity

Plant Capacity: 15000 litres per hour (75,000 litres per shift)

Maximum production per day: 1,50,000 litres (approx.)

Milk holding capacity: 1,50,000 litres(approx.)

3.2.5 Actual Production

Milk production is not stopped for a single day leading nearly constant output throughout the year. But the production of standard milk is less than the full capacity of the plant. The average daily production of standard milk is 80,000 litres(approx.).
Number of workers in production section: 105(approx.)

3.2.6 Number of Shifts and Working Hours

Milk production and filling is carried out in two shifts (8am to 2pm and 2pm to 8pm) while milk dispatching is only carried out form 10pm to 5am.During the flush seasons, when milk collection is very high, the production can run in 3 shifts as well.

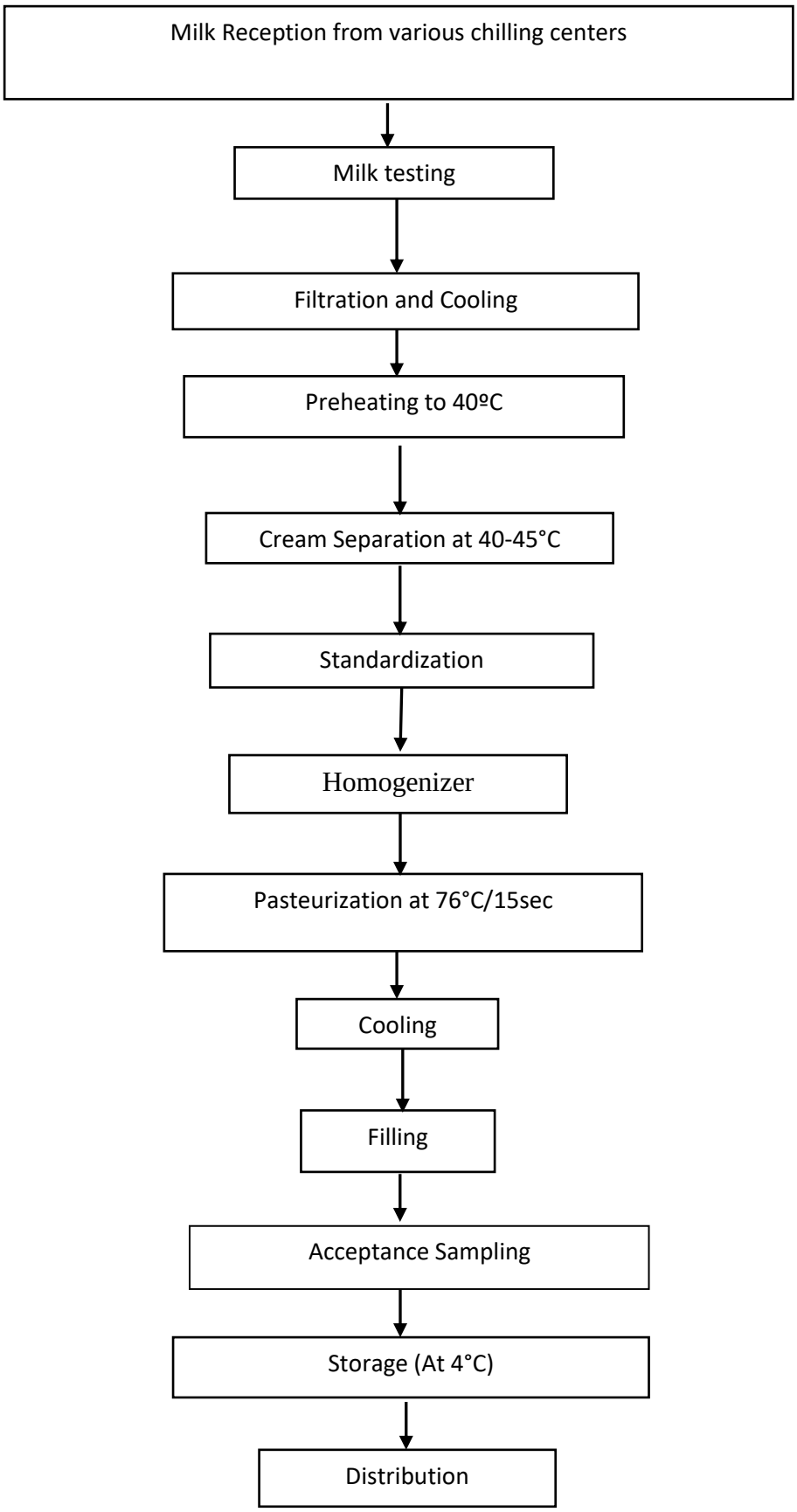
3.2.7 Chilling and Storage of Milk

For the storage of milk chilling process is very necessary because in normal temperature the growth rates of pathogens are very fast. Hence to prevent the breading of pathogens, low temperature must be maintained which is done with plate chiller in the line and stored in insulated tank. Storage tank is chilled by passing chilled water through the jacket.

3.2.8 Heat Exchange Process

Almost all heat treatment of diary is done in Plate Heat Exchanger (PHE). The PHE consists of a pack of stainless-steel plate clamped in a frame. The frame may contain several separate packs known sections, in which different stages of treatment such as pre-heating, final heating, holding and cooling takes place. The plates in the pack are corrugated in a pattern designed for optimum heat transfer efficiency. The plate pack is compressed with great force in the frame. The liquid enters and leaves the channels by the holes in the corner of the plate, varying patterns open and through blind holes route the liquids passes from one channel to the next. Gaskets are used round the edges of the plates and the holes from the boundaries of the channels to prevent leakage. The heating or cooling medium is introduced at the other end of the section and passed in the same way through alternate inter plate channel.

3.2.9 Production Process



3.2.10 Pasteurization

Heating the milk at a particular temperature and then cooling it, in order to kill harmful bacteria is called pasteurization. High temperature and short time method are employed in DDC where milk is heated up to 72^{o}C for about 15 secs and then rapidly cooled to 4^{o}C. The heating process kills pathogens but some bacteria that remain alive rapidly grow in the presence of heat. This is the why rapid cooling is necessary.

3.2.11 Homogenization

Homogenization is a process where fat globules are subjected to mechanical treatment which breaks them down into smaller globules uniformly dispersed in the milk. As the milk is forced through a narrow orifice at high pressure and velocity, then by distribution of the broken fat globules uniformly throughout the fluid by means of process of explosion on release of pressure and cavitation.

3.2.12 Packing Process:

Packing process takes place in RMC Packaging Machine with the series of steps.

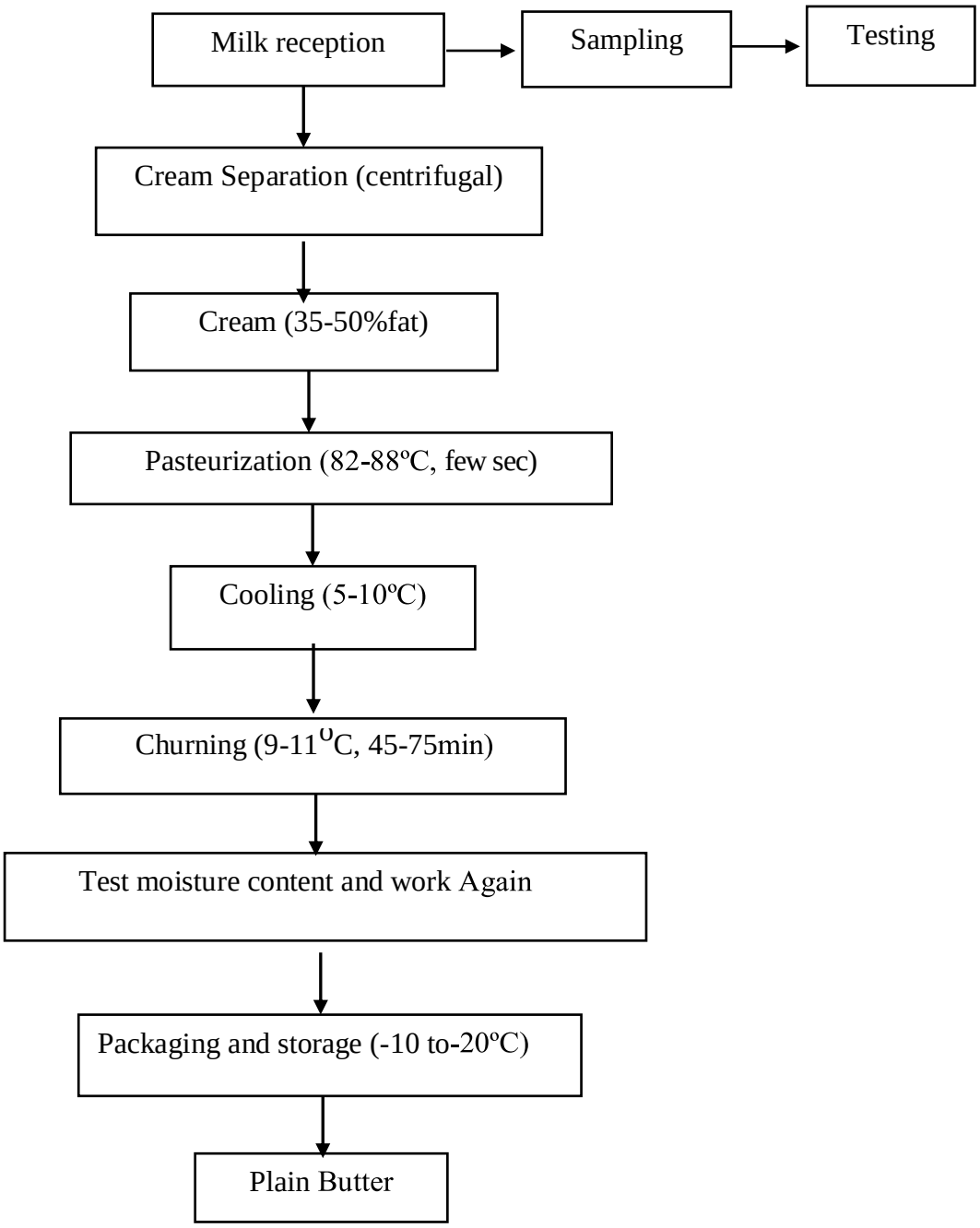
3.3 CREAM

Cream is continuously separated as a by-product from standardization of milk. This separated cream is the main raw material for the production of butter and ghee. Only when demanded, cream is standardized to 40% milk fat and packed. Otherwise it is pasteurized at 90-95^{o}C and stored in intermediate storage tank.

3.4 BUTTER

Butter is a product exclusively derived from milk fat. Apart from milk fat, it contains some non-fat milk solids, water and occasionally additives. In DDC, the capacity of butter churner is 3,000 liters per batch. The butter production is depended on the flush and lean seasons of milk supply. About 1,500 kg per day butter is produced during lean seasons, during flush seasons, up to 6,500 liters of cream is churned per day, which yields 3500 - 4000 kg butter. The actual production depends upon the cream separated and fat% in cream. The production of salted butter in the year 2069/70 was 740134 kg while sales was only 213867 kg.

3.4.1 Manufacturing Process of Butter



3.4.3 Production Details

Material Balance

1300 litres cream with 50 % fat gives 812.5 kg butter with 80% fat in a batch.

Packing Material and Type of Container

White unsalted butter is packed as 15 kg block in printed polythene sheets. Table

butter is packed in 250gm blocks in vegetable parchment paper (butter paper). 60 such blocks are packed in printed corrugated fibreboard boxes.

Production Capacity (installed)

Capacity of butter churn: 3,000 litres; but only 1300 litres of cream is churned per batch to allow space for foam formation.

Actual Production

During flush seasons, up to 6500 litres of cream is churned per day, which yields 3500-4000 kg butter. The actual production depends upon the cream separated and fat % in cream.

No. of workers per shift

8

Number of shifts and Working Hours

2 shifts 1st shift 8 am to 2 pm

2nd shift 2 pm to 8 pm

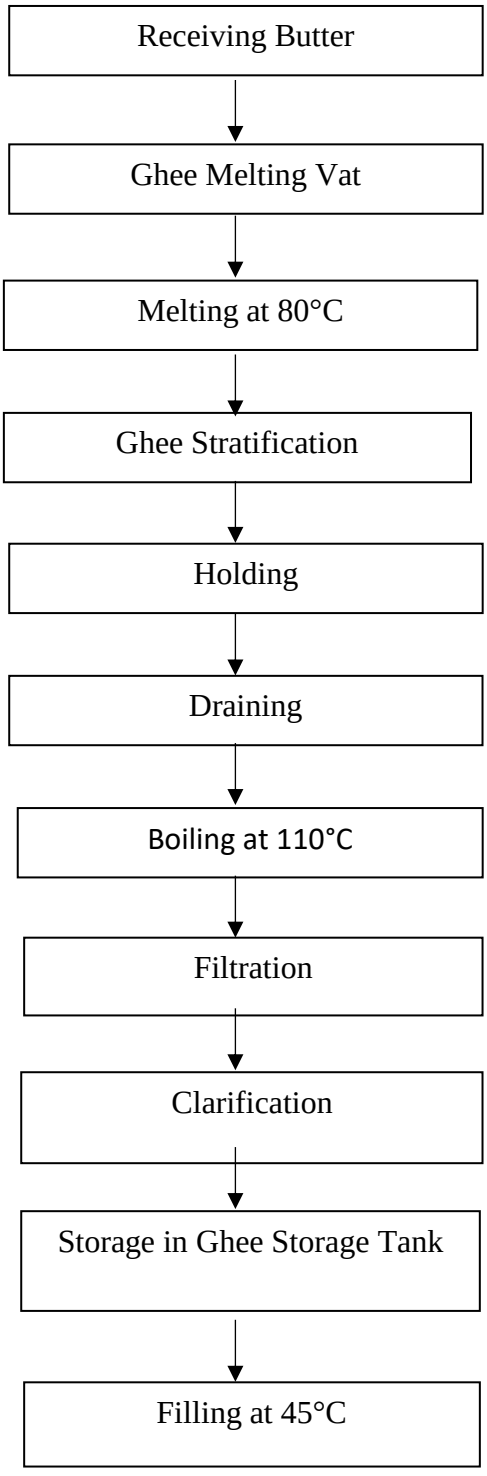
Peak and Lean Seasons

Depending on flush and lean seasons of milk supply, during the lean seasons, about 1500 kg butter is produced per day but during flush seasons it ranges from 3500-4000 kg per day.

3.5 GHEE

Ghee is an important product that KMSS produces as another by-product in the processing of milk. The main raw material for the production of ghee is butter. Ghee consist moisture of less than 0.5% and its fat percentage is 99.5%. Hence, ghee can be storage for years. But the acid content of ghee should be less than 3%.

GHEE PRODUCTION FLOW CHART

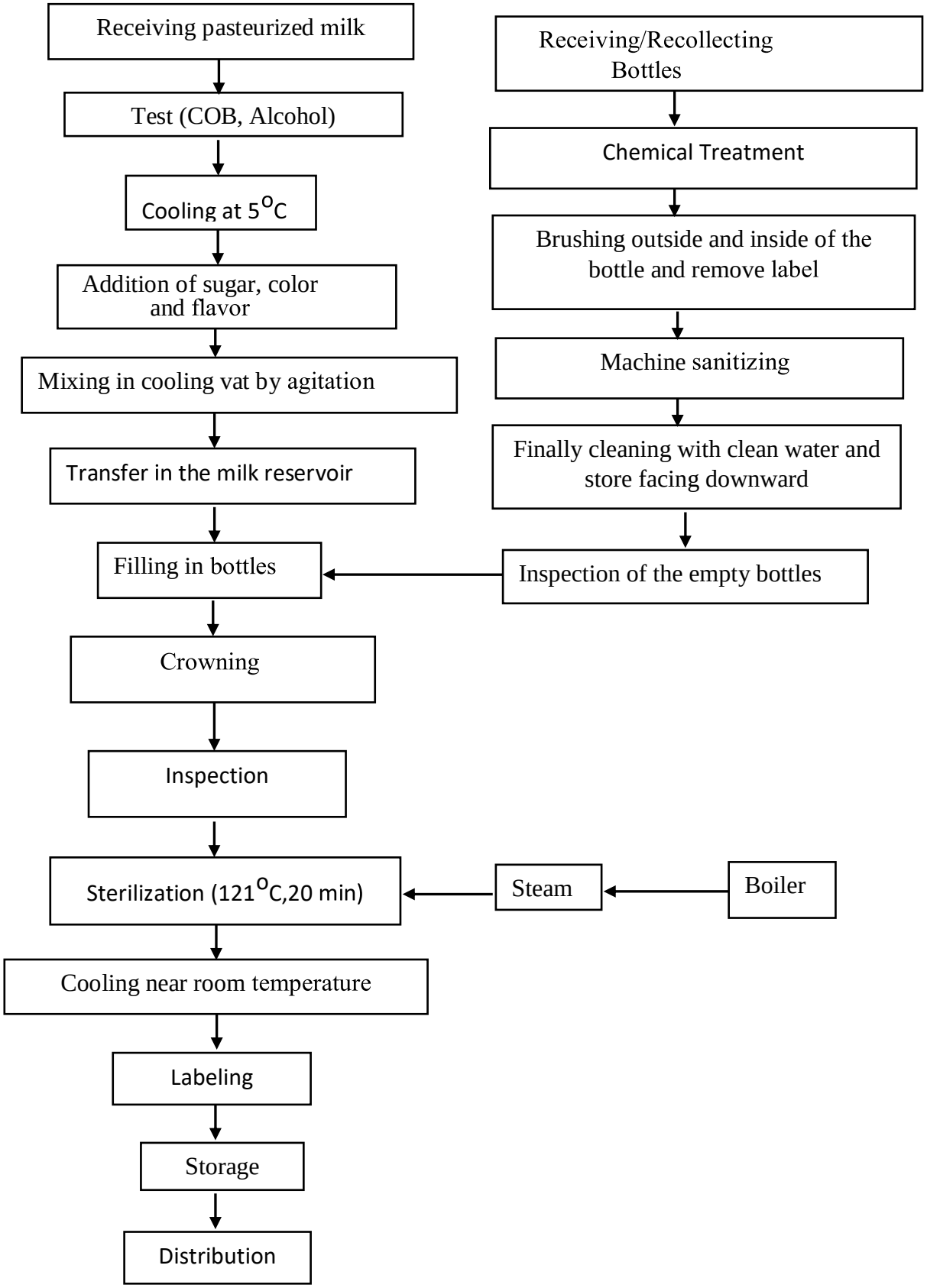


3.6 FRESH MILK

Fresh milk is the sterilized flavored milk produced by the addition of sugar, flavor and color to the pasteurized milk. KMSS produces fresh milk of 3 different flavors, viz. mango, kesar and cardamom. Fresh milk requires 9% of SNF and 3% of fat milk. 7kg sugar is added per 100L milk. Flavor is added at the rate of 100gm per 100L. The

milk should be of good quality for the production of flavored milk. The total production fresh milk in 2069/070 was 418539 liters while sales was 192557 liters. It has shelf life of three months.

Process Flow-Chart of Fresh Milk



CHAPTER FOUR: MAINTENANCE SECTION

4.1. Major Maintenance and Production Devices

4.1.1 Boiler:

Boiler is used for steam generation. It is a closed pressure vessel into which water can be feed and evaporated into steam continuously. This steam produced is then used in pasteurizers, heating tanks and vats. Thermal energy release by burning fuel is utilized in converting water to steam which is used for different purpose. In KMSS, fire tube boilers are used. In fire tube boiler, fire and hot gases passes through the tube surrounded by the water. The water is heated to the boiling point and the steam is collected for the distribution to the system.

Diesel Boiler

Specification

- Multi-fuel option – light oils/heavy oils/gases.
- High efficiency of about 88% to 95%
- High dryness fraction steam increases usable heat
- Comes with mono-block/ dual block / steam atomized burner with world renowned Technology from UNIGAS (ITALY)
- Additional option of oil pre-heater confirming to European safety standards
- Corrugated furnaces for boilers above 6 Tonnes per hour (TPH) capacity

Operating range:

Capacities: In the range of 1.0 TPH to 15 TPH

Pressure: In the range of 10.54 to 17.4 kg/cm^2

Firing fuels: Light Diesel Oil (LDO), Fuel Oil (FO), Low Sulphur Heavy Stock (LSHS) and natural gas

Efficiency: Overall efficiency of 88%

Flow Diagram

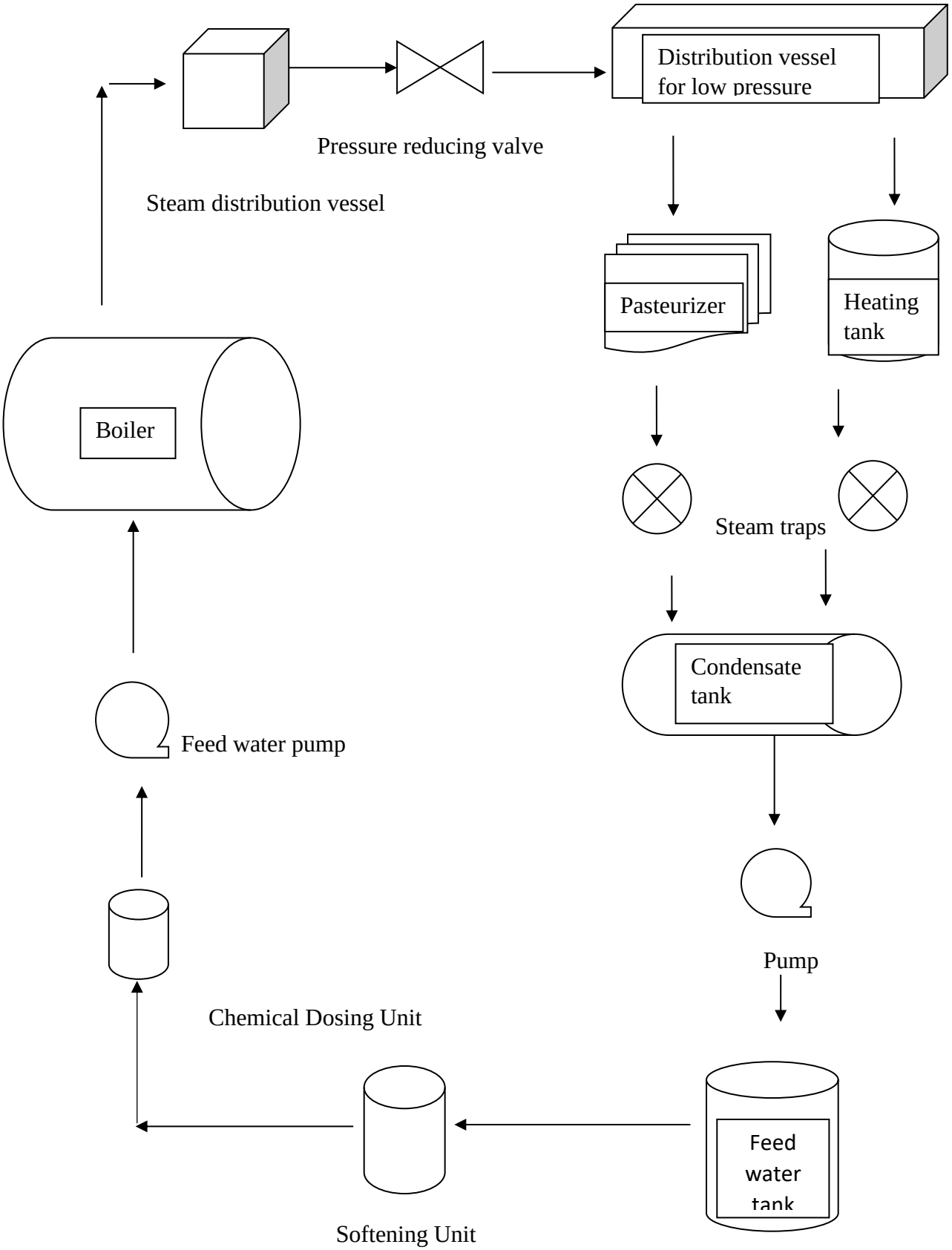


Figure 3: Flow Diagram of Steam Production and Distribution

Steam Production

Fuel such as diesel and furnace fuel are used for the generation of steam. When this fuel burns in presence of air heat energy is liberated and is utilized for heating purposes. The efficiency of the boiler is 88-95% and heat losses in the piping system are about 15%. Therefore, only 73-80% of the total thermal energy of fuel is utilized for the production.

4.1.2 COMPRESSOR

A six-cylinder piston reciprocating type compressor has been used in the company. The vapour at low temperature and pressure enters the compressor where it is compressed and its temperature and pressure increased subsequently. This vapour after leaving the compressor enters the condenser through the discharge line.

Specification

Make	: Sabroe,1977
Model	: TC No 18
Refrigerant	: R717 (Ammonia)
Motor	: 1460RPM, 18.5 kW
Capacity	: 19000 kCal/hr
Working pressure	: 18 bar

4.1.3 CLEANING IN PLACE (CIP) SYSTEM

CIP refers to that system of cleaning and sanitization which does not require the daily dismantling of the equipment. It saves time and also ensures that all equipment receives uniform treatment. It reduces the contamination through human error. CIP causes less damage to the equipment.

CIP of Plate Heat Exchanger

1. Hot water (60 degrees Celsius) flush until clean outlet comes out (approx. 10 minutes).
2. Rinse with alkali (75 degrees Celsius) with concentration of 1 to 2% for 20 minutes.
3. Flush with water till clean outlet of water (approx. 1 minutes)

4. Rinse with acid (60-65 degree Celsius) with concentration of 1% for 15 minutes.
5. Flush with water
6. Rinse with Hot water (70 degree Celsius)

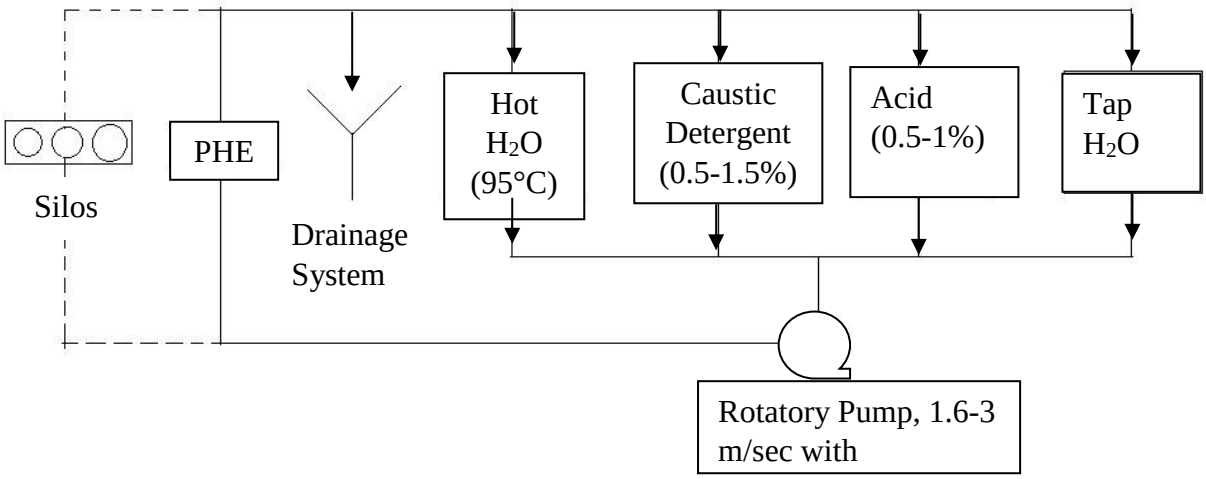


Figure 4: Centralized System of CIP

- One system at a time i.e. PHE only or raw milk tank only one at a time.
- Acid & caustic are changed after 10-12 days

If chlorination is used in plant, it shouldn't be circulated more than 1-2 mins.

4.1.4 MILK PRODUCTION EQUIPMENT

R.M.C Packaging Machine:

R.M.C Packaging Machine is the main filling machine used for filling milk, ghee, yoghurt in the plastic packets. These machines have the various assemblies that help the proper amount of injection at within certain time with very precise timing. The various assemblies embedded in the machine with their brief descriptions are given below:

Different Assemblies:

i. Film carrier assembly: A film roll of 25-30 kg is kept in between the rollers at the bottom. Guides prevent lateral movement of the film roll. End of the film roll is drawn through idler rollers and fed to the forming collar through dancing roller.

ii. Dancing assembly: It is provided just above horizontal assembly at the rear side to unwind the film from the roll for uninterrupted flow of the film. The dancing roller moves up and down on its pivot. This system is linked to the horizontal shaft.

iii. Forming assembly: It is present at the front side of the machine above the vertical assembly to form required width of pouch. A 'V' type forming collar is assembled together with injection tube to shape the film in the form of a tube. Two lateral sides of the film get folded and overlapped at the center which is then sealed by vertical sealer.

iv. Vertical seal assembly: It is provided at the front side below forming station to seal overlapped joint. Guide rod moves with the vertical press till the electrode holder touches the injection tube. Vertical press moves along with the horizontal press. So opening and closing time of these presses are almost same.

v. Injection assembly: It fills required pre-set quantity of product into the pouch from a float-controlled tank mounted on the top of the machine. Fill quantity and accuracy can be regulated during running. Milk flown through the injection end nozzle per minute is equal to the product of quantity packed per pouch and the number of pouches packed per minute. The flow rate depends upon the area of opening because velocity and time remains constant (pre-set).

vi. Horizontal seal assembly: It is provided at the front side below injection tube bottom end. Rear jaw moves to and fro with the motion of the cam provided on the main drive. Sealing time can be regulated but cooling time is pre-fixed. Main cam pushes a push rod which in turn presses the moving jaw against fixed jaw. Spring present on fixed jaw presses the electrode against the back up rubber keeping the pouch in between.

vii. Programmable Logic Controller (PLC): It is present to control sequence of operation and functions of the machine. It consists of display unit and input/output box. Variable parameters like sealing time and temperature can be controlled through display unit while the machine is in use. PLC units starts controlling the functions as per the program against the signal given by the limit switch LI. More reliable than PCB based system.

4.1.5 BUTTER PRODUCTION EQUIPMENT

Cream Separator

The machine works on the principle of centrifugal force. Milk is fed into rapidly rotating ball above the stationary axial inlet tube. The milk is accelerated to the rotational velocity of the ball in the distributor, and then ascends through the aligned distribution holes in the disc stack to reach the separation channel between the discs. The heavier solid particles settle particles settle outwards and are deposited in the sediment space, while cream settles inwards towards the axis of rotation and passes through the channels to the cream paring chamber. The skim milk leaves the disc stack at the outer edge and passes between the top and the bowl hood to its paring chamber.

Butter Churning Machine:

The cream with little fat content is rotated with the great rpm which in product gives butter and skimmed milk. The rpm can be regulated by the Variable Frequency Drive (V.F.D.) that regulates the speed of motor whose shaft is connected to the rotating axis of the machine. Hence, it physically agitates cream until fragile membrane of the milk fat ruptures.

4.1.6 GHEE PRODUCTION EQUIPMENT

Ghee Melting Vat: It is a cylindrical, vertical, triple walled container with conical dish at the bottom. The inner shell and the dish are made up of 4mm SS 304 sheet and the inner shell is pressed conical dish. The intermediate shell and dish jacket is fabricated with the 6 mm MS sheet and outer shell is made up of 2 mm MS sheet or 304 sheet. Adequate height is given for the outlet of the tank and the drain is provided at the bottom of the conical end.

4.1.7 WASHING EQUIPMENT

Crate Washer: Crate washer is used to clean crates of milk pouches. It has an arrangement of detergent and hot water. High pressure water jet is allowed to strike the crate moving on the chain conveyor.

CHAPTER FIVE: REFRIGERATION AND COOLING SYSTEM

5.1 REFRIGERATION SYSTEM

General Introduction: Refrigeration is essential for preserving the dairy products such as butter, cheese, and milk. KMSS uses a vapor compression refrigeration system. The refrigeration effect is based on the fact that it absorbed when a liquid is converted into vapor.

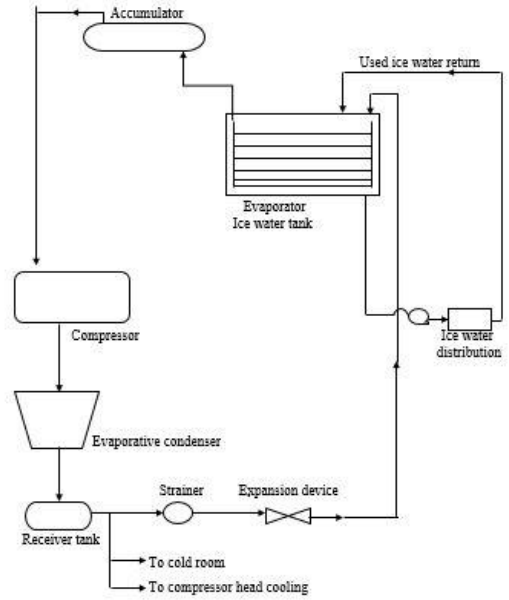


Figure9.2.: Refrigeration System for Ice-water-banks in KMSS

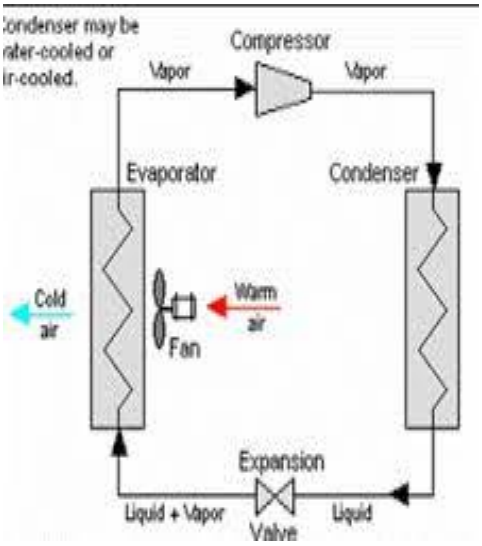


Figure 5: Refrigeration System

Components of Refrigeration System

Compressor

A six-cylinder piston type compressor has been used in the company. The vapour at low temperature and pressure enters the compressor where it is compressed and its temperature and pressure increased subsequently. This vapour after leaving the compressor enters the condenser through the discharge line.

Condenser

In the condenser heat is rejected from the hot ammonia vapor to the condensing medium that is cold water from the cooling tower. The spraying water removes heat of ammonia by direct heat exchanging and evaporative water, so the air blower is also provided in

condensing tower. The ammonia vapor is condensed into high pressure liquid and is collected in a receiver tank.

Ammonia receiver

It provides storage for condensed liquid so that a constant supply of liquid is available to the evaporator as required. From this tank it is passed through the liquid to the expansion valve.

Evaporator

Ammonia extracts heat from the water in the ice tank and vaporizes to low pressure vapor. The water in the ice tank subsequently cools.

Surge drum

It provides storage for lower pressure ammonia vapour from the evaporator tank.

5.2 COOLING SYSTEM:

The ammonia was generally used as the main coolant in the refrigeration cycle. The compressor mainly (in addition with other components) which gets heated up is cooled by the liquid cool ammonia which is pumped by the high-pressure pump into compressor. The ammonia after cooling the compressor gets self-heated up and is passed to the cooling tower where the ammonia is flowed through the ducts and the water was sprayed from the top with the help of pumps i.e. the water-cooled cooling system was used for re-cooling the ammonia.

CHAPTER SIX: DISCUSSION

During the internship period, we were expected to make the most effective utilization of our theoretical studies gained throughout the course of Mechanical Engineering. We were regularly assigned repair and maintenance jobs within our limits under the supervision of senior engineers. Along with the technical section, we were also given opportunity to study the management and organizational structure of KMSS.

Mostly, our area of the training included:

1. Repair and routine maintenance of conveyer belt in packet transfer unit.
2. Repair and routine maintenance of refrigeration unit (Compressor, Ice-bank, condenser, and expansion), different size and capacity motors and different pumps like milk pump, water circulation pump, etc.
3. Repair of ghee filling machine, milk filling machines, curd and ghee packaging machines, etc.
4. Preventive maintenance of the various machine parts including greasing oiling, tightening of the nuts and bolts.
5. Study of the processing plants in the dairy including raw and whole milk processing, packaging, pasteurization, ghee, butter, yoghurt and fresh milk storage.

MAJOR CONTRIBUTIONS MADE:

- **Compressor repair:**

  Compressor repair was always a major issue in repair and maintenance department. This was because the identification of problem wasn't something that could be done with ease.

  We helped to replace pressure cut out device in the compressor. We frequently added compressor fluid (R-22) because of leakage. These were not the permanent solution, so we helped replacing the compressor unit.

- **Crate washer repair:**

  The alignment of sprocket in the washer was not proper and the chain was long. We helped to align the sprocket and to reduce the chain length.

- **Design of proposed Plant layout and Conveyer:**

Packaging machines were placed in different section and conveyor was installed only in one section of packaging machines. Milk produced in one section were carried to the chilling room using human hand truck. So, we were asked to design the new layout and conveyor.

During the design we considered,

1 Heat flow

Conveyor was designed so that there was minimum heat flow from storage section. The conveyor is taken into the storage section through small portion away from the chiller.

2 Available space

Optimum use of space was made. The new layout and conveyor did not affect the smooth operation of plant.

3 Cost

The number of workers in the plant can be reduced with our design. The conveyor was also designed with minimum installation cost.

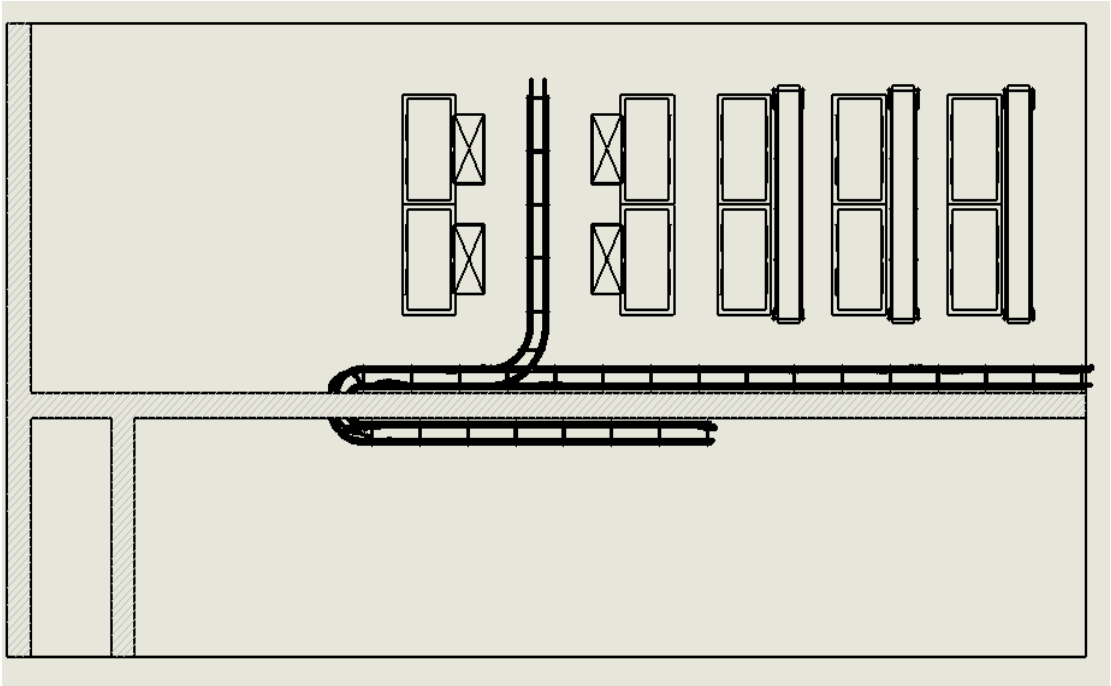


Figure 6: Designed Layout

Other Contributions and Learnings:

Leakage was a frequent occurrence in DDC as there was maximum liquid flow whether that be milk, cold water or steam. Hence, we got the chance to learn about cutting and fitting of gaskets and also, we have to resize the gaskets sometimes**.**

- The new bearings were placed in few old RMC filling machines.
- We were to deal with the various problems in RMC filling machine due to presence of various moving parts.
  - Breaking of the chains
  - Disintegration of Sprockets
  - Minor Current leakages
  - Horizontal and vertical seal failure

  Hence, we were continuously assigned to these jobs whenever needed. In this process, we learned to fix chains, tighten the nuts with proper wrenches and make proper alignment of sprockets and keys.

- Daily basis lubrication of the moving parts of the packaging machines were assigned to us as a part of the Preventive maintenance.
- Cleaning of evaporator was assigned to us as accumulation of dirt and frost in the evaporator caused the improper functioning.
- As a part of pump maintenance, we cleaned the impellers and learned to use the pipe-wrench and tool wrench**.**
- The guide in the conveyor was broken and there used to be accumulation of milk packets and improper flow. Thus, we welded the part and there was a smooth flow.
- The groove in the shaft of pump was deterioted due to the pressure and we took out the part and the part was sent to the workshop for maintenance.
- Repairing of a quick return mechanism in milk filling machine was done.
- We also gained the brief knowledge about the management aspects of the KMSS where we shortly learned about: Organizational Structure, Plant Layout, Human Resource and Financial Management.

CHAPTER SEVEN: CONCLUSION

DDC, a leading dairy industry of Nepal has been serving our country for more than 4 decades now and has been a real hope for the farmers to sell their milk at reasonable price and regarded as the most convincing brand for purchasing dairy products in the cities. The products of the DDC like milk, yoghurt, butter, cheese, flavoured milk, ice cream has somewhat been the part of daily Nepalese routine. With 150,000 litres of production per day, DDC is one of the biggest industries of our country employing a bunch of technical man powers.

It was really amazing to be a part of maintenance crew of this industry and to learn about the production mechanisms, the sequence of operations and systems to sustain and enhance them.

CHAPTER EIGHT: RECOMMENDATIONS

DDC with its countrywide users and suppliers has certainly the huge trust of the people and has got real challenge in maintaining its quality. With emerging private dairy industries as its competitors, DDC needs to reinforce the current strength and overcome the growing problems. During our training period, we found lots of faults and areas of improvement.

Enlisted below are some points which we think must be strengthened:

- The first and most noticeable thing we found was degrading sanitation and poor food safety. We found the disposal of the unused goods like plastics and the fresh-milk bottles pretty unmanaged. Any people can come to the plants without any safety globes or special dresses and so on.
- The filling section was observed to be congested. Enough open space must be provided to move about uninterrupted.
- The trend of breakdown maintenance is prevailed here resulting the massive time lag and endangering security of workers. Hence, the practice of preventive regular maintenance must be implemented for the efficient timely production and safety of the workers.
- Most of the major mechanical equipment there were installed in DDC during 1994 A.D. in collaboration with Danish Government Company are outdated. With 24 years gone now, this equipment must be replaced as they continuously seem to breakdown.
- Decreasing number of mechanical tools and equipment on a daily basis forcing the workers to use their personal tools. So, with the help of NG or some NGOs, they must be properly managed.
- The workshop inside the DDC must be properly maintained so that trend of giving the work of small mechanical modifications on the machine to some outer workshops can be removed.
- The designed layout is submitted and recommended. This recommended design lowers the number of workers and operating time.

GLOSSARY

Churner	Any machine used to agitate the content inside it by the means of rotation
CIP	Cleaning-in-Place
RMC Machine	The machine used to pack the milk, ghee, yoghurts in the plastic packets
Silo Tanks	The tanks used as reservoir for the raw milks and the pasteurized milks
SNF	Solid Not Fat, the content of solid in the milk
PHE	Plate Heat Exchanger
LDPE	Low Density Polyethylene
LLDPE	Linear Low-Density Polyethylene
COB	Clot on Boiling
EN	European safety Standard
TPH	Tonnes per hour
LDO	Light diesel oil
FO	Fuel oil
LSHS	Low density sulphur heavy stock

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ANNEXURE

1. Compressor

2. Packaging Machine

3. Churning Machine

4. Powder Funnel

5. Control Boards

6. Condenser

7. Piping System

8. Condenser

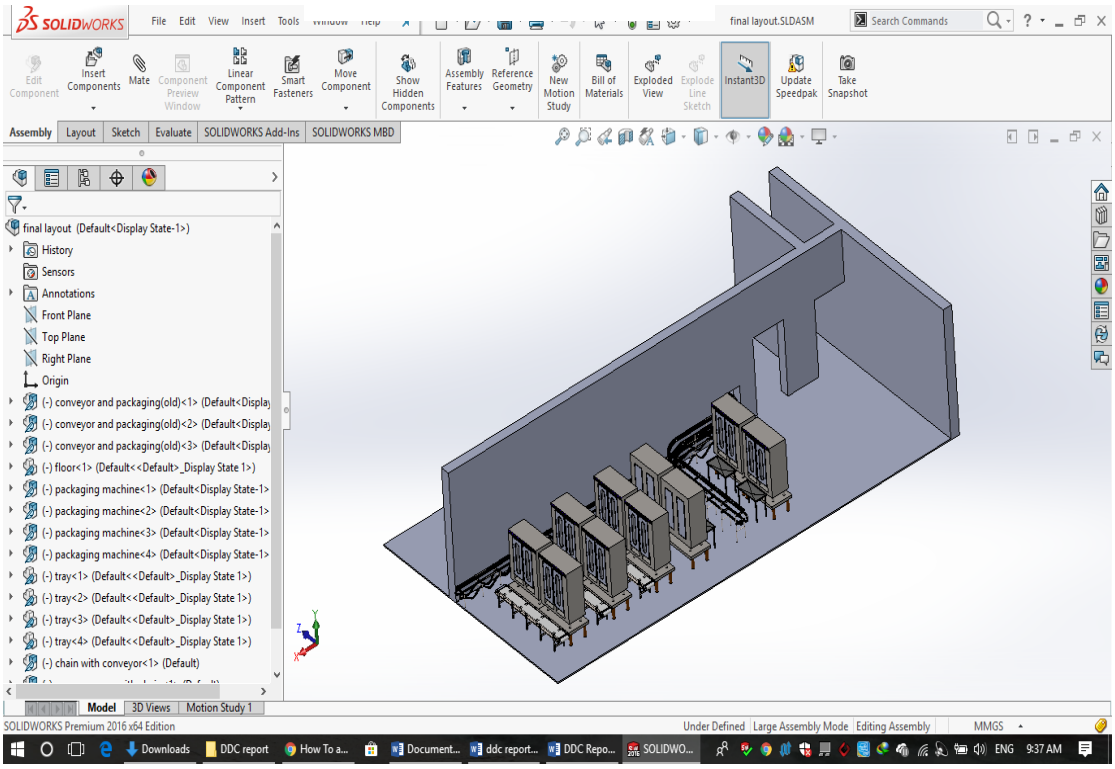
9. Drilling Machine

10. Power Cutting

11. Packaging Machine

12. Drilling

13. Butter Production



14. Proposed New
Assembly Line