UNIT 2 MILK RECEPTION AT THE DAIRY DOCK

Structure

2.0 OBJECTIVES

After studying this unit, we shall be able to:

- outline the layout of a dairy reception dock.
- state the operations involved at reception.
- undertake preliminary examination of raw milk
- do sampling of milk
- check cleaning and sanitization of cans and tankers
- list out equipments and devices used for reception.

2.1 INTRODUCTION

Milk may be delivered to the dairy plant either in cans or in tankers (road/rail). The place in the dairy plant, where milk first arrives and is received after grading for acceptance, is known as milk reception dock or platform or raw milk receiving dock (RMRD). Dairy reception dock is especially designed and equipped to facilitate rapid reception of milk and, cleaning and sterilization of used containers.

Since further processing of milk mainly depends upon its quality, the decision of accepting the milk, must be done quickly immediately after arrival and, thorough investigation. Milk reception should be so planned and the equipment so chosen that intake operations are expedited, particularly where large volumes of milk are received. Delay may lead to deterioration of milk awaiting dumping and, increase in labour and operating costs of the can washer. So, the deliveries of milk should follow a schedule and reception be completed within stipulated period of 2 to 3 hours to facilitate the following plant operation un-interrupted, especially in tropical countries.

2.2 LAYOUT OF RECEPTION DOCK AND EQUIPMENT

i. Important Considerations

Layout at the reception dock and equipment placement is done for obtaining the maximum efficiency at the minimum cost.

Health regulations: Local health authorities requirements must be met. It is absolutely necessary to consult the health authorities while the drawings are in preliminary form and to get formal written approval before construction is started.

Volume of milk: The reception platform should be large to accommodate necessary number of milk can lorries and road/rail tankers to be unloaded at a time. The seasonal variation in milk availability should also be taken into account.

Methods of delivery of milk: Whether milk is being delivered by individual producers, route hauler, tank truck, tank car, tanker or any combination of these, layout of platform and equipment should take care of. A good layout of conveyors at the reception dock contributes much to efficiency. To unload trucks without delay, the trucker should be able to discharge all of his cans at the intake point before moving to the next position to pick up his empties. To avoid the need of a man to take empties from the discharge conveyor, the combined capacity of the intake conveyor, the washer, and the discharge conveyor should be sufficient to hold all the cans from the largest route.

Floor space: Adequate space and equipment must be provided for proper inspection of milk and for handling cans containing rejected milk until they can be tagged and reloaded on the hauler's truck for return to the producers. Location of equipment either too close to each other or nearer to walls or ceiling should be avoided. Sufficient space be provided for conveying incoming and outgoing cans, weighing, sampling and dumping of milk. Emptied cans and lids should be properly washed and returned to the trucker

Location of driveways and vehicle yards: Streets, driveways and yards for the vehicles must be located suitably in relation to the receiving dock.

Elevation of dock: The level of the truck and receiving platform should be the same.

ii. Equipment and Devices at Reception Dock

The layout of equipment must provide the most economical use of available floor space. The equipment are so arranged as to obtain the maximum processing volume per man-hour. Provision for future revisions or expansion, which will involve a minimum change and expense, must also be made. These plans must comply with the building and health regulations of the particular area. The possible equipment and devices required on a dairy reception dock have been listed in Table 2.1.

Check Your Pogress 1

1. Enumerate the points to be considered in laying out milk reception dock.

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2. List the equipment and devices to be placed on a reception dock of a large dairy plant.

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Table 2.1:
Equipment & Devices at Milk Reception Dock of a Dairy Plant

S.N.	Equipment/ Device	Description	Function
Receiving milk in cans			
1.	Conveyor	i) Power driven a) ball & socket type or b) slot & chain type ii) Gravity rollers- lubricated and non-lubricated	i) Permits inspection, grading, sampling of milk. ii) To carry milk cans from one end of platform to tipping point.
2.	Trolley	i) can or ii) platform	-do-
3.	Can tipping device	Floor mounted tubular and rubber padded cross bar	i) for resting can ii) tilting and un-loading milk to weigh bowl.
4.	Weigh scale/bowl/ tank/ weighing machine	Stainless steel bowl attached to circular dial weigh scale. May be fitted with automatic weigh recorder.	i) Permits straining, sampling, weighing, recording and dumping of milk.
5.	Dump tank	Stainless steel tank with a pump below weigh bowl.	To receive milk from weigh bowl.
6.	Drip saver/ drain rack	Tubular with rack arrangement	To drain off residual milk from just emptied cans.
7.	Can washer	i) rotary- 1 – 6 can/min, ii) straight through 3-16 can/min	To wash, clean & sterilize cans.
8.	Can washing trough	Semi circular manual cleaning with scrubbing brush.	To scrub & clean cans.
9.	Can scrubber	Two rotating nylon brushes, mechanically operated.	To scrub & clean cans.
10.	Can rinsing and steaming block	Pedal operated	For rinsing and sterilizing cans.
11.	Sanitary milk pump	Stainless steel, centrifugal type.	To pump milk from dump tank.
12.	Draining rack	Roller type conveyor or rod type rack	To drain & dry clean milk cans and lids
13.	Sanitizing assembly	Consists of can steaming block, pump spray & sanitizing solution tank.	To sanitize cans.
14.	Plunger	Manual stirrer made of stainless steel or aluminium	To stir milk in can or vat for grading sampling.
15.	Testing kit	Sampler, sample bottle, test tubes etc.	To accomplish platform tests.

16.	Pre-washer	Fits into the conveyor line	To wash the exterior of milk cans before dumping.
17.	Can cover loosener or opener	A mechanical cover loosener/opener placed in the conveyor line after pre-washer or immediately after unloading from vehicle.	To loosen or open the lid from the cans.
18.	Ventilation	A ventilator duct installed near ceiling	To remove fumes, air etc. from reception dock.
19.	Sanitary pump	Stainless steel centrifugal	To pump milk from tanker to storage tank.
20.	Compressed air arrangement	Connected to the top of the tanks	To empty the tanker under air pressure
21.	Sanitary piping	Stainless steel between tanker outlet and storage tank inlet	To convey milk from tankers to storage tank.
22.	Washing & sanitizing devices	CIP circuit or manual	To wash and sanitize tankers, pump and piping.
23.	Weighing arrangement	Weigh bridge, volumetric meter or dip stick	To weigh or measure the milk.
24.	Shed	Parking yard covered with shed	To park tankers under shed.

2.3 RECEPTION OF MILK

Reception includes following operations: Unloading, grading, conveying, sampling, testing, weighing or measuring and recording, dumping and pumping.

i. Unloading

Milk brought either in cans or in tankers is unloaded.

Milk cans: As soon as vehicle carrying milk in cans arrives at the reception dock, the cans are unloaded manually and generally placed on the conveyors. If the level of the truck surface is in line with the platform, the unloading of cans requires least effort.

Road/Rail tankers: Tanker, after grading and sampling, is connected with the pump and piping and milk is pumped through a flow meter where the volume of milk is automatically recorded.

ii. Conveying

Milk cans are placed on gravity roller or power chain conveyor. The lids are removed and each can is subjected to rapid sensory evaluation and some preliminary tests to decide the acceptance or rejection of the milk.

Conveyors: Conveying systems and related devices must be considered in connection with efficient materials handling to provide direct and continuous flow from a point of origin to the ultimate destination. The conveyor system should be simple, direct, flexible, and free from trouble spots. It should have proper elevation at all points, and easy to clean, lubricate and maintain. Sharp curves, sudden changes of elevation switching of various size packages and other tasks can be handled without difficulty.

Pipelines: In a milk plant, liquids are conveyed from point to point by means of pipes that are joined together and attached to equipment by sanitary pipe fittings. Special metals are needed for the construction of pipe fittings coming in contact

with dairy products in order to protect flavour and purity. Stainless steel sanitary pipe is now used throughout the industry. The size, length and joints of piping must be optimized in light of quantity of product to be pumped to desired destination in a given period of time.

iii. Examination of Raw Milk

Raw milk has to pass through rigorous examination which may include organoleptic, physical and chemical tests to assess the quality of intake milk rapidly, and decide for its acceptance or rejection. All these tests known as “platform tests” are performed on each can/tanker to assess the quality of the incoming milk before it is accepted and weighed. These tests must be easy to perform, give quick and reliable results and should not require complicated and elaborate equipment. The classification of milk on the basis of quality is usually referred to “grading of milk”. So grading of milk is done on the basis of platform tests which include organoleptic as well as preliminary tests.

Purpose: Milk received is further subjected to some sort of processing including heat processing for manufacturing products, and finally marketed to consumers. A good quality product cannot be made from bad quality raw ingredients. So, quality and composition of raw milk must be checked for freshness, hygiene and conformity to the legal standards. These can be accomplished by examination of raw milk through platform and other laboratory tests. Accordingly, the main purposes of examination of raw milk at reception dock are assessment of (i) freshness, (ii) hygienic quality, and (iii) composition.

Organoleptic tests: Organoleptic or sensory tests are performed with the help of five sensing organs, viz. eye, nose, tongue, ear and skin. The general appearnce, cleanliness, colour, taste and smell of milk are tested before emptying the transport containers.

Milk in can is evaluated while moving on the conveyor. Organoleptic tests are quick, cheap and with growing experience of the assessor, very reliable. Since practically no equipment is needed, the sensory test can be carried out anywhere and anytime. However, sensory tests are subjective and would depend on the assessor’s faculty of perception.

Smell or odour: Just after opening the lid of the container, sniffing will detect the smell/odour of the milk. Normal milk should not have any off-or unnatural smell in it. If the smell is slightly sour, the milk might have undergone microbial deterioration.

Appearance: After the odour test, milk in each can is observed for any floating extraneous matters, off-colour, or partially churned milk. Normal milk should be free from these. Presence of visible dirt, straw or manure indicates that milk has been handled in an unhygienic way. The colour of milk of cows and sheep should be slightly yellowish-white, that of buffaloes and goat absolutely white. If the colour is reddish, the milk may contain blood; if it is yellowish, it may contain pus, such milk may be secreted from infected udder (mastitis) and should not be accepted.

Taste: Taste of milk can be noted by taking a spoonful milk in the mouth and rotating inside with the help of tongue. When doubt exists concerning smell, the taste of the milk may help to determine sourness and if so, milk should be rejected. Adulteration of milk with salt, sugar, etc. can also be detected by taste and found positive must be rejected.

Temperature: With practice, the grader can judge the temperature of milk with a high degree of accuracy by touching the container. Abnormal to the weather or condition may indicate the prehistory of milk with respect to its cooling or heating, etc.

Preliminary tests: Preliminary tests as discussed below. These are simple and rapid physical-chemical tests which can be performed easily on the reception dock:

Clot-On-Boiling (C.O.B.): A small portion of milk is heated to boiling point in a test tube for checking whether it withstands heat treatment without clotting. If the milk clots on boiling it is sour or abnormal. This milk cannot be processed any more and hence it should be rejected.

Alcohol test: Milk with increased acidity or of abnormal salt balance or mastitis flocculates after addition of alcohol. This test is used to determine heat stability of milk. If no flocculation occurs after addition of alcohol, the milk is fresh or its acidity is only very slightly increased. If milk flocculates with alcohol, the milk is heat unstable and it should be rejected.

Titratable acidity (T.A.): The titratable acidity of milk is determined by titrating 10 ml of milk with N/9 NaOH solution to assess sourness in milk. The result is either expressed in degrees Dornic, i.e. ml of N/10 NaOH used being equal to 1 degree Dornic(Do) or in % lactic acid, whereby ml of N/10 NaOH used is equal to 0.01% w/v lactic acid. Milk testing more than 0.15% lactic acid should be rejected.

pH: The pH value can be measured with an electronic pH meter or with the help of different pH-indicators to assess the acidity of milk. Normal milk has pH ranging from 6.6 (in cow milk) to 6.8 (in buffalo milk). A higher pH (7.0 to 7.4) means milk from infected (mastitis) udders or it is neutralized by alkali. The major shortcoming of this method is its poor sensitivity since milk is extremely well buffered system, slight change in acidity or alkalinity cannot be detected.

Lactometer test: Lactometer is used for determination of specific gravity. However, test result obtained can be misleading due to variation in temperature and fat content in milk etc. This method is correct only when carried out at the correct temperature and combined with milkfat test.

Sediment test: The sediment test is used to check the visible foreign matter contained in the milk. Off the bottom sediment tester or barrel type sediment tester may be used. Test is carried out by allowing a measured quantity of milk (usually 500 ml) to pass through a fixed area of a filter disc and comparing the sediment left with the prepared standard (Table 2.2). Any hair flies, pieces of hay or straw or any large particles of dirt are not included in grading sediment. Presence of appreciable sediment indicates careless or insanitary dairy farm practice. However lack of sediment is not always indicative of ideal conditions, since visible sediment may be readily removed by straining at the dairy farm. It may have bacterial contamination.

Table 2.2 : Quality of Milk by Sediment Test

Amount of sediment in disc		Quality of milk
At collection center, mg/500ml milk	Dairy reception dock, mg/500ml milk	
0.0	0.0	Excellent
0.5	0.2	Good
2.0	0.5	Fair
5.0	1.0	Bad
7.0	2.0	Very bad

Alizarin-alcohol test: Incorporation of alizarin in alcohol helps to determine both heat stability and approximate percentage of acidity in milk. Milk showing poor heat stability is rejected. (Table 2.3).

Table 2.3: Quality of Milk by Alizarin-Alcohol Test

Colour	Approx. % Lactic acid	Heat stability
Lilac	Up to 0.14	Good (low acidity)
Pale red	0.14 to 0.17	Poor (sweet curdling)
Violet or purple (alkaline)	0.17	Poor (late lactation or mastitis)
Reddish brown to brown (acidic)	0.17 to 0.20	Very poor
Brownish yellow to yellow highly acidic	> 0.20	Very poor

iv. Tilting/Emptying of Milk Cans

Acceptable milk in cans are lifted manually from the conveyor, rested on floor mounted can tipping cross bar padded with rubber and tilted to drain the milk into weigh bowl. When the can tipping device is used, the operator must hold the can until the milk drains from it and then convey the emptied can by hand to the washer via drip saver. For quick, easy and high speed, a dump grid, suspended over the weigh tank, is used on which the can drains and is automatically moved to the can washer.

v. Weighing/Measuring and Recording of Milk

The milk in cans is dumped into the weigh tank/bowl, of single or double compartment, either manually or mechanically. The stainless steel weigh bowl of 250 or 500 Kg capacity is attached to a circular dial weigh scale and the portion towards the outlet valve overhangs with anti-splash stainless steel strainer. The outlet valve of weigh bowl is suited for manual or air actuated operation. The operator makes direct reading of the weight of the milk on the scale and records it separately for individual suppliers. Automatic printing of weight is also possible. The milk in tanker (road/rail) may be measured in volume by passing it through a flow-meter or in weight by using a weigh bridge where tare weight of the tanker is deducted from gross weight of it.

vi. Sampling of Milk

Samples may be drawn during reception of milk for chemical and microbiological analysis in the laboratory. Only representative sample, without any type of adulteration, dilution and contamination should be drawn using correct technique and appropriate device. While strict precautions regarding sterility of the stirrer, sampler, container, etc. are required for obtaining a microbiological sample and dryness and cleanliness of the above appliances should suffice for a chemical sample. Test cannot be accurate unless the test sample is truly representative of the product to be tested. Samples from milk containers may be drawn with the help of a suitable device. The characteristics of various devices have been listed in Table 2.4.

Table 2.4: Characteristics of Milk Sampling Devices

S.No.	Device	Principle	Advantages	Disadvantages
1.	Dipper	Secures 10-15 ml milk	i) Fairly fast and easy to work with ii) Quite accurate with well mixed milk sampling	Inaccurate when wide variations exist in milk lots quantitatively and qualitatively
2.	Tube or milk thief	Secures aliquot portion of milk in proportion to the depth of milk.	Most accurate	i) Cumbersome to use ii) Larger sample needed impractical for varying bottom container in shape and size.
3.	Automatic vacuum	Secures aliquot portion by vacuum automatically	i) Very fast in operation ii) Very accurate	Expensive
4.	Drip	Milk is collected in drops in the sample bottle	Helpful in Fat and SNF accounting of the total intake	Not useful for individual sampling

Sampling methods: Sample should be taken after thorough mixing of milk with the help of plunger or sampler (devices) or some other means.

i) **From a small handy batch:** Milk is properly mixed before taking sample.

ii) **From a large batch:** Milk in can or vat or small tank can be mixed by using a plunger manually. Minimum ten times from top to bottom plungering will ensure adequate mixing before drawing sample. Mechanical stirring can also be done wherever facilities available. Vigorous stirring is avoided as milk may get churned at temperatures between 26.5 and 29.5 ^{0}C.

iii) **From several containers of different size, shape and type:** If a large vat is available, milk of all the containers are mixed in vat and a sample is drawn.

iv) **From bulk units:** Nos. of cans filled from storage tank/bulk unit is not required to be sampled individually. The number of random cans to be sampled shall be as follows:

Total Number of cans	Number of cans to be selected
1	1
2-5	2
6-20	3
21-60	4
61-100	5
> 100	5+1 per 100 additional units or action there of

v) **From storage tanks/rail/road tankers:** Method of sampling is governed by storage/transport conditions. So, no rigid procedure of sampling can be prescribed. However, a recommended procedure described below may be followed.

Milk is thoroughly mixed by using either a sufficiently large plunger or a mechanical agitator or compressed air till a complete agreement is obtained between samples taken at the manhole and the outlet cock with respect to Fat and SNF. Plunger is inserted through manhole and, pushed forward and pulled back, downward and back, and backward and back in cyclic order repeatedly for not less than 15 minutes. Sampling is done through the stopcock in the tank door or from a valve in the discharge line from the tank as it is being emptied.

vii. Dumping of Milk

After weighing and recording, the milk can be discharged into the dump tank situated below through stainless steel chute between the weigh bowl and dump tank. Dump tank should be of sufficient capacity to avoid delay or overflow of milk, at least one and half times but not more than 3 times the capacity of the weigh bowl. An electronic milk level control may be installed in the dump tank to eliminate the possibility of loss of milk from overflow.

Check Your Progress 2

1. What are the steps involved in receiving milk on a reception dock of a dairy plant?

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2. What are the platform tests conducted on a dairy dock?

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3. How is milk sampled and name the devices used for sampling?

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2.4 LABORATORY TESTING OF MILK SAMPLES

For conducting some other tests to assess the freshness, hygiene and composition of milk, small laboratories and well trained technicians are needed. These tests are also needed to improve the quality of milk production and supply. Milk of initial good quality alone will give products of better quality. Moreover, the payment for milk is based on its constituents such as fat and solids-not-fat (SNF) contents. These tests are conducted in the laboratory.

i. Chemical Tests

Various chemical and physical tests conducted to assess the quality of milk received in a dairy include titratable acidity, fat content, total solids and solids-not-fat content, and tests for detection of adulterants.

Titratable Acidity: Acidity of milk is expressed in term of its lactic acid content. 10 to 50 ml of milk sample is titrated with N/9 or N/10 NaOH solution and phenolphthalein as indicator. Normal acidity of fresh milk varies between 0.10 to 0.16 % lactic acid. The titratable acidity (T.A.) as lactic acid per 100 ml of milk is calculated by using formulae as under:

% Lactic acid = 9 * V1 * N1 / V2
where, V1 = Volume of standard NaOH solution, ml
N1 = Normality of standard NaOH solution
V2 = Volume of milk sample taken, ml

Fat Test: Fat test of milk is done for making payment of the milk. Among several methods, one common method is the acidobutyrometric butterfat test or Gerber test. Fat globule membranes and proteins of the milk are hydrolyzed with concentrated sulphuric acid to break the emulsion and to set the fat free. The volume of fat from a given quantity of milk sample is measured in a specially designed glass recipient, known as butyrometer. The butyrometer reading gives the result directly in fat percentage. For accurate results, the reading has to be taken quickly to avoid cooling of the fat column.

Now, Milko-tester Minor or semi-automatic butterfat analyzer is used for determining the fat content in milk. This is based on the principle of scattering of light by milk fat globules. Light transmission through the milk-mix is measured photometrically and read directly as the fat percentage in milk samples on digital display. Accuracy of the result is approximately the same as for the Gerber fat test.

Determination of total solids (TS) and Solids-not-fat (SNF) content: A lactometer is used to measure the specific gravity of milk. Based on the lactometer reading of milk taken under standard conditions and knowing the fat percentage as determined by the Gerber method, it is possible to calculate TS and SNF by using the well known Richmond's formula which differs for the types of lactometer, viz. Quevenne, Zeal-and BIS-lactometer.

(i) Quevenne lactometer:

% TS = CLR/4 + 1.2 F + 0.14

% SNF= CLR/4+0.2 F + 0.14

(ii) Zeal lactometer

% TS = CLR/4 + 1.2 F + 0.50

% SNF= CLR/4+0.2 F + 0.50

(iii) BIS lactometer

% TS = CLR/4 + 1.2 F + 0.60

% SNF= CLR/4+0.2 F + 0.60

Where, CLR = corrected lactometer readings, obtained by applying the specific correction factor to the observed lactometer readings based on temperature of milk.

Determination of TS and SNF of milk can help to detect the adulteration of milk. TS and SNF also form the basis for the pricing of milk.

ii. Microbiological Tests

Microbiological tests provide information on the sanitary condition and keeping quality of milk. The tests are intended to be carried out on samples collected for microbiological analysis. Microbiological standards for cow milk have been presented in Table 2.5.

Table 2.5: Microbiological Standards for Cow Milk

Grade	MBR (hours)	One-hour Resazurin Test (Resazurin disc no.)	Total plate count of milk (cfu/ml)
Very good	>=5	—	Not more than 0.2 million
Good	2 to 4	> = 4	0.2 to 1 million
Fair	1 to 2	3.5 to 1	1 to 5 million
Poor	0.5	0.5 to 0	> 5 million

Methylene blue and Resazurin reduction tests measure the bio-chemical activity of microorganisms in milk. They get reduced, if added to milk, after a certain time and lose their colour. Quick reduction of a given quantity of dye means high microbiological activity and vice versa.

Half-hour methylene blue reduction (MBR) test: The length of time taken by milk to de-colourize methylene blue is a fairly good measure of its bacterial content. Ten ml milk in sterile test tube is well mixed with one ml methylene blue solution. Tube is closed with sterile rubber stopper and incubated in a water bath maintained at 37.5 $\pm$ 0.5ºC. Tube is inspected after 30 minutes and seen whether milk in the tube is de-colourized at least up to within 5 mm of the surface. Milk is graded as in Table 2.5.

Ten-Minute resazurin test: Since resazurin reduction occurs in two stages, the first from blue to pink, and the second from pink to colourless, the quality of milk can be assessed easily in shorter time. Procedure is the same as described in MBR test. At the end of 10 minutes $\pm$ 30 second of incubation, the tube is removed from the water bath and immediately the colour is matched with the resazurin disc in the comarator. The result shall be interpreted as follows:

Disc reading	**Keeping quality**
>= 4	satisfactory
3.5 to 1	doubtful
0.5 to 0	unsatisfactory

Direct Microscopic Count (DMC): The direct microscopic count method consists of examination of milk under a compound microscope. It enables the rapid estimation of the total bacterial population of a sample of milk and also reveals useful information for tracing the source of contamination in milk.

Counts per ml	**Quality of milk**
< 5,00,000	Good
5,00,001 to 4,000,000	Fair
4,000,001 to 20,000,000	Poor
> 20,000,000	Very poor

Check Your Progress 3

1. Name the physical, chemical and microbiological tests are performed in the laboratory to assess the quality of Raw milk.

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2.5 CLEANING AND SANITIZATION OF MILK CANS AND TANKERS

Cleaning is done to remove the residues of milk from the surface of the utensils, while sanitization is done to destroy all types of micro-organisms present on the surface of the utensils and equipments.

i. Types of Washers:

The types of washers include manual washing, mechanical washing and cleaning-in place.

(i) **Manual washing:** Small plants are not equipped with mechanical can washers and employ manual washing methods. Manual washing can be aided by installation of can washing trough, can scrubber, and can rinsing and steaming block. These tools will be helpful in reducing the manual brushing, rinsing and sanitizing the cans.

(ii) **Mechanical washer:** In mechanical washing, the can is usually passed over a succession of jets emitting water, cleaning solution, hot water, steam and air. Where the operation is big and manual washing is considered difficult and uneconomical, washing is done mechanically. Mechanical can washers are of two types:

a) **Rotary type:** One man is required to place the cans and lids in inverted position in the machine and remove them after washing and drying. The can and lid are moved through a rotating platform divided into sections. A series of tanks of solutions are located under the platform. Cans get continuous spray of various solutions both inside and outside through circulating pumps and solutions return to respective tanks. The rotary washer rotates at intervals.

b) **Straight through or tunnel type:** In this type, empty can and lid in inverted position enter into the tunnel at one end of the conveyor and come out at the other end after getting cleaned, rinsed, sterilized and dried in straight-up position. The main operations involved are: pre-rinsing with clean water, steam sterilization, detergent solution washing, hot water rinsing and hot air drying. All these operations are carried out in quick succession and the process is continuous.

(iii) **Cleaning-in-place:** The permanent line as well as equipment remain intact during the cleaning and sterilizing procedures. Milk tankers can be cleaned by this method. The modern dairies are equipped with CIP system of cleaning which is controlled by electronic device. The cleaning operations are programmed according to the need and the operations have to make necessary connection for the proper flow of liquids. The CIP system consists of essentially 3 tanks, namely cold water, hot water and detergent or lye tank, and an automatic electronically controlled panel. The route sequence selection may be manual, semi or fully automatic. The sequences are programmed operations controlled by card, tape or microprocessor.

ii. Sanitizing Systems

Cleaning is followed by sanitizing. Sanitizing is done chemically or by hot water or steam to kill pathogenic organisms and nearly all non-pathogenic organisms. Dairy equipment can be sanitized with application of one of the following methods:

- **Flushing:** All equipment and piping are assembled and flushed out with a hypochlorite solution.
- **Spraying and brushing of equipment.**
- **Fogging:** sanitizing solutions may also be applied by air pressure or atomizing solution in form of a mist or fog. The minimum chlorine strength should be 400 ppm and the strength at the discharge end around 100 ppm. To avoid corrosion, the chlorine should not stand in the tank longer than 30 minutes.
- **Submersion:** Small parts, pails and certain utensils may best be sanitized by submersion in a sanitizing solution.

Check Your Progress 4

1. Name the type of washers used to clean the cans.

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2.6 LET US SUM UP

As soon as milk arrives at the reception dock, it must be received after thorough checking of the quality for freshness and composition. The layout and design of the dock and equipment should facilitate the reception. Size, shape, capacity and inter-spacing of receiving devices must speed up to complete the reception within 2-3 hours. The conveyor should be long enough so that by the time can reaches to tilting device, the operator must be able to decide for acceptance or rejection of milk after performing the platform tests. Accepted milk must be weighed, recorded, sampled and dumped. Empty cans and tankers should be washed and sanitized and returned to the suppliers.

2.7 KEY WORDS

Acceptance	:	An experience or feature of experience characterized by a positive attitude.
Appearance	:	The visual properties of a food, including size, shape, colour and conformation.
Assessment	:	A judgement or an evaluation
Fittings	:	Device used for change in the direction of the lines or for making attachment to equipment or other lines.
Grading	:	Sorting of products according to size or quality.
Lactometer	:	An instrument for estimating the specific gravity.
Odour	:	Impression derived by smelling or sniffing.
Organoleptic	:	Of the intrinsic quality of food which has an effect on the senses.
Sensory	:	Pertaining to the action of the sense organs
Subjective	:	Pertaining to individual experience

2.8 SOME USEFUL BOOKS

Anantakrishnan, C.P. & Simha, N.N. (1987) Technology and Engineering of Dairy Plant Operations. Laxmi Publications, New Delhi.

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IS:1479 (Part-I)1960. Methods of test for Dairy Industry. Part I, Rapid Examination of milk. ISI, New Delhi.

Milk Industry Foundation, (1957). Manual for milk plant operators, Washington, USA.

Milk Industry Foundation, (1959). Laboratory Manual Washington, USA.

2.9 ANSWERS TO CHECK YOUR PROGRESS

Your answer should include the following points:

Check Your Progress 1

1) i. Purpose of layout of reception dock and equipment.

ii. Considerable points for layout: health regulations, handling quantity of milk, methods of delivering milk, type of equipment, availability of floor space, location of vehicle movement space, elevation of dock, etc.

2) i. As per Table 2.1

Check Your Progress 2

1) i. For receiving milk in cans steps are unloading, conveying, grading, tilting, weighing, recording, sampling, dumping and pumping.

ii. For handling empty cans: drip saving, washing, cleaning, sterilizing, drying and despatching.

iii. For receiving milk in tankers: weighing/measuring, measuring devices, pumping, cleaning and sterilizing.

2) i. Essentiality of platform tests;

ii. Performing platform tests: sensory, C.O.B., alcohol, alcohol-alizarin, acidity, pH, lactometer, sediment etc.

3) i. Purpose of sampling

ii. Sampling principles & precautions

iii. Sampling procedures

iv. Sampling devices

Check Your Progress 3

1) i. Requirement of a laboratory with regards, glass-wares and apparatus

ii. Performing tests: reduction tests, acidity, fat, S.N.F., DMC, adulteration etc.

Check Your progress 4

1) i. Washers: manual and mechanical.