

# **Leather processing**

## **Level-II**

**Based on December 2021, Curriculum Version 1**



**Module Title: - Beam house and Tanning operations**

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## ACRONYM

*ETP -----effluent treatment plant*

*OHS -----occupational health standard*

*PPE -----personal protective equipment*

*RPM-----revolution per minute*

## INTRODUCTION TO THE MODULE

Nowadays, the beam house is used to encompass all the processes conducted in the tannery leading to the tanning step. The purpose of the beam house is to prepare the pelt for tanning. Another way of putting that would be to say the beam house is for purifying the pelt or ‘opening up’ the pelt structure. Opening up is a generic term that has two components: The removal of non-collagenous skin components: the hyaluronic acid and other glycosaminoglycan’s, the non-structural proteins, the fats. This is not done to completion, so the processes in a tannery must be geared to the degree of removing these materials, required to produce the desired properties of the final leather. Splitting the fiber structure at the level of the fibril bundles, to separate them. These effects are the result of the complex reactions under the conditions in the beam house and the degree to which they happen depends on the precise conditions adopted throughout these preparative process steps. This module covers the beam house and tanning operations with their mechanical operation.

**This module covers the units:**

### MODULE CONTENTS:

- Instructions and operational requirement
- Undertake Process Operations
- Undertake Mechanical Operations

### Learning Objective of the Module

- Apply Instructions and operational requirement
- Perform Process Operations
- Carry out Mechanical Operations

### Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

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## UNIT ONE: INSTRUCTIONS AND OPERATIONAL REQUIREMENTS

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Process vessels and machines facility
- Process vessel and mechanical operations instructions and procedures
- Process vessel and machine settings and preparations

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Understand required facilities for process vessel and machines
- know the work instructions and procedures
- Determine process vessel
- Determine machine setting

## 1.1 Required facilities for process vessels and machines

Facility is a building, piece of equipment or services provided for a particular purpose. The tannery location must carefully consider the infrastructures and facilities which is critical for successful operations. Of particular importance is the problem of TDS (salinity), and no tannery should be planned without the ability to discharge its (pre-treated) effluents into municipal sewage. The required facilities one tannery to consider is described as follows:

- Outside residential area, preferably within industrial zone
- Sufficient supply of water of appropriate quality
- Stable and reliable power supply
- Proximity of tannery sanitary sewage network and wastewater works and solid waste utilization and disposal facilities
- Easy access for employees and trolley/forklift

## 1.2 Work instructions and procedures for process and mechanical operations

In drum or vessel process there are chemicals which have a specific function for each operation (soaking, unhairing, liming, deliming, bating, degreasing pickling and tanning) the operator should take great care in doing of such chemical preparation. He/she should identify hazardous chemicals and should practice OHS concept. Measure chemicals correctly by using weight balance or volumetric measurement. Now the chemicals are ready to add to the drum/vessel by adjusting the necessary adjustments as per the ‘process recipe’.

### 1.2.1 Work instructions

This in turn calls for functional operator responsibilities to plan, produce, maintain and innovate day-to-day work and the same are listed below:

- Choose the proper process method for the type of final leathers to be produced.
- Improve the efficiency of operations by suitable choice of chemicals and maintaining correct temperature and float.
- Carry out these operations to ensure lot to lot uniformity and monitor the same.
- Ensure optimum results based on the resources available to you. When any problem arises investigate and find out the causes for the same and suggest remedial measures.

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- In case of process modifications, analyze the entire system of drum operations and arrive at a suitable work system and implement the same.
- Coordinate with the drum yard supervisors, develop and improve their skill. Thus ensuring delivery of properly to the next department.
- Plan the allocation of work accordingly bearing in mind the capacity of the drums and the product range envisaged.
- Evaluate the work performances and correct whenever they go wrong to keep the production schedule as envisaged.
- As the workers are handling chemicals like acids, salts and enzymes, ensure and follow safety precautions to prevent health hazards.
- Carryout work without spoiling health. As an operator, maintain proper records about working performance and productivity, which will help you to achieve quality leathers ultimately.
- Freely communicate and discuss with other supervisors in your department as well as other departments, the problems arising during production and arrive at suitable remedies for the same.

### 1.2.2 Procedure of Operation of process vessel and machinery

It is the work responsibility of the drum worker in beam house and tanning sections to perform drum work operations productively and efficiently, as otherwise uptake of tanning chemicals will be affected which in turn affect the final quality of leather. In this connection, we list the work procedures under pre tanning and tanning processes/operations so as to facilitate you to implement them correctly.

- weigh the prepared hide/skin
- wash the preserved hide/skin before the main soaking process
- Add the skin/hide in the drum and required quantity of water and required chemicals and proceed the main soaking
- Check the completion of soaking by folding the skins/hides flesh side out, and feeling for uniform softness flexibility.

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- Add the hide /skin in the drum and add required quantity of water and required chemicals according to the given recipe and make the liming process
- Check the completion of the liming and proceed the mechanical operation (fleshing)
- Weigh the fleshed stock,
- Wash the stock in the drum
- Take the required quantity of chemicals
- Add the pelt in the drum and add required quantity of water for washing, to remove surface lime before deliming
- Drain the wash liquor
- Add required quantity of water at 35o C and required chemicals for deliming
- Check the completion of deliming using phenolphthalein indicator
- If deliming is not complete continue drumming until the completion of deliming
- Add the required quantity of bate to the deliming bath and maintain the temperature and run the drum further for the completion of bating.
- Carry out the tests for bating.
- Take the pelts for machine, hand or drum scudding with the addition of required chemicals and water.
- Wash after the completion of scudding in the drum.
- Take suitable float in the drum, add the required quantity of salt and drum the pelt for 15 minutes in case of skins and 20 minutes in case of hides.
- Take the required quantity of chemicals for pickling, dilute the acid and cool to less than 35o C before use.
- Start and complete the process of pickling by addition of acid
- Check the completion of pickling by checking the pH through and through across the cross-section.
- If pH of the pickle liquor is lower than the desired pH and through and through pH is not achieved, run the drum for further time to attain equilibrium pH
- If pH of the pickle liquor is higher than the desired pH, add further, small quantity of acid diluted with water to adjust the pelts to desired pH - 2.8
- After equilibrium pH, start chrome tanning process with the required quantity of chemicals

- Check the penetration of chromium by cutting the sample from thickest region (neck/butt) of the hide/skin. At least check penetration in four different pieces
- If through and through penetration of chromium is not achieved run the drum for further time and confirm the penetration of chromium
- After the penetration of chromium, add water and masking agents for good distribution of chromium and continue with basification process
- Check basification by checking the pH through and through across the cross-section. If pH is not achieved run the drum further or add carefully small quantity of required chemical to achieve basification pH-3.8-4.0.
- After basification pH, continue drumming for 2hrs and finally add fungicide to prevent any fungal attack followed by which, washing was carried out.

### 1.3 Process vessel and machine settings and preparations

#### Paddle

- Have a gentle Mechanical Action ideal for soaking & liming
- Use high water to hide ratio & during discharge of goods or float is not problem
- Used to process wool on skins



*Figure 1-1 Paddle*

#### Drum

The drum is a big hollow cylinder that is mounted and supported above the horizontal level and rotates around its horizontal axis. The purpose of a leather processing drum is to facilitate the penetration of chemical substances in to the hide/skin that can modify the characteristics of the dermic structure



*Figure 1-2 drum*

Based on the type of mechanical work that the drum is required to perform on the hides, certain diameter/length ratios have been standardized according to the particular operation to be carried out Three of these general D/L ratios are; - Less than 1 (0.9-.77), for liming drums - Equal to 1, for tanning drums - Greater than 1 (1.1-1.2), for dyeing drums.

### **Necessary settings and preparations for drum**

Before doing the process vessel operations check and set the following things about drum or vessel.

- Check if any braking device is applied to the drum or in safe condition before loading.
- Check whether the gear box is in correct mode and the gears are aligned and matching properly.
- Ensure level of gear oil in the gear box. Also check the gear lubrication.
- Ensure the belt/chain guards are properly fixed and the safety device (optional) is functioning correctly.
- Ensure the water supply and the dosing vats are in proper condition.
- Switch on the electric mains.
- Set the program in the display panel/timers/temperature controller etc.
- After completion of the above steps, raw hides/skins shall be put by using either a forklift or manually as per the instructions provided.
- Start the drum or vessel and follow the process/recipe.
- Stop the drum or vessel when process is completed.

- Empty the drum and wash/rinse as applicable.
- Switch off the mains when not in use.

### **Safety Precautions before Operation of drum**

- Check if any braking device is applied on.
- Check whether the gear box is correct and the gears are aligned and matching properly.
- Ensure level of gear oil in the gear box. Also check the gear lubrication.
- Ensure the belt/chain guards are properly fixed and the safety device (optional) is functioning correctly.
- Ensure the water supply and the dosing vats are in proper condition.
- Switch on the electric mains.
- Set the program in the display panel/ timers/temperature controller etc.
- Feed as per instructions/recipe and use the drum accordingly.
- Empty the drum after process and wash it.
- Switch off the mains when not in use

### **Necessary setups of drum operation**

- Main switch
- Starting the drum
- Speed adjustment
- Stop-start program
- Timer- for operation
- Jog-to opens the drum (to adjust up or down to load or unload).
- Emergency switch
- Adjust by key- to run o/n
- Safety door

## Self-check 1

Part one: - Give Short answer for the following question (each question have 2 points)

1. What is the required facility for operating beam house operation?
2. What is the necessary setting for process vessel?
3. Necessary setups of drum operation?
4. What are the Safety Precautions before Operation of dram?
5. Why paddle is more usable for soaking of dry salted hide and skin

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

## Operation sheet 1.1

**Title:** - Drum or vessel operation in accordance with standard operating instructions

**Instruction:** - by using operation instruction, you have to operate processes vessel in a given 10 minute

**Objective:** - able to develop the skill of the trainee by drum or vessel operation in accordance with standard operating instructions

**Tools and equipment that needed for the operations:** - Drum

Before doing the process vessel operations check and set the following things about process vessel.

**Precautions:**-try to operate more than one times

### Procedure

Step 1:- Check if any braking device is applied to the drum or in safe condition before loading.

Step 2:- Check whether the gear box is in correct mode and the gears are aligned and matching properly.

Step 3:- Ensure level of gear oil in the gear box. Also check the gear lubrication.

Step 4:- Ensure the belt/chain guards are properly fixed and the safety device (optional) is functioning correctly.

Step 5:- Ensure the water supply and the dosing vats are in proper condition.

Step 6:- Switch on the electric mains.

Step 7:- Set the program in the display panel/timers/temperature controller etc.

Step 8:- After completion of the above steps, raw hides/skins shall be put by using either a forklift or manually as per the instructions provided.

Step 9:- Start the drum or vessel and follow the process/recipe.

Step 10:- Stop the drum or vessel when process is completed.

Step 11:- Empty the drum and wash/rinse as applicable.

Step 12:- Switch off the mains when not in use

**Quality Criteria:** the operation will head in different speed

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## Lap test 1

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks. The project is expected from each student to do it.

Tasks-1: operate drum based on the procedure

You are given three (1) hours to complete the abovementioned

Request your teacher for evaluation and feedback of your work



## 2 UNIT TWO: - UNDERTAKE PROCESS OPERATIONS

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Status of skin/hide or pelt for processing
- operate beam house and tanning process vessels
- process controlling parameters
- Beam house and tanning process liquid waste

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Check states of skin and hide
- Know the operation of process vessels
- Determine process control parameter
- Handle beam house and tanning operation

## 2.1 Checking status of skin/hide or pelt for processing

### 2.1.1 Characteristics of drum

With reference to thermal isolation, polypropylene is slightly more efficient than wood and much more efficient than stainless steel. The movement of the drum with the help of pegs and shelves to overcome inertia will generate an increasingly high centrifugal effect on the leather mass causing it to fall from its higher part

#### 2.1.1.1 Loads capacity

- Load capacity of drum or vessel based on the volume and size of vessel.
- Load capacity is more when volume of drum is more.
- However, approximately 40% of the total volume of drum is taken only as load capacity of the drum, which is inclusive of raw material and water to be used for processing.

#### 2.1.1.2 Number of batches

- Before calculating the number of batches, the targeted/intended production based on the orders secured in sq.ft shall be taken into consideration
- Then the number of drums/vessels based on its size/capacity, quantity and quality of raw stock required including the weight, processing methodologies adopted for the intended article/product, drum running hours for each unit process and available working hours.
- Processing lead time is nothing but the approximate time required to start and finish one full cycle of process (For Eg., Soaking to Tanning in this case).
- Process lead time varies for each stages of process like pretanning, tanning and post tanning operations besides the process recipes adopted by the individual tanneries for articles

#### 2.1.1.3 Weight

Quantity of hides and skins are measuring by its weight. Most processing recipes are based on the weight of the hide and skin i.e., expressed in gram or kilogram or ton. Following are the weight designations used in tanning operations

#### 2.1.1.4 Chemicals

- In tanning operations, the required quantity of chemicals offered in weight terms.

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- Few chemicals are offered in volume terms. The chemicals to be offered are based on percentages based on weight of the raw material / starting material (such as wet-salted, fleshed pelt, and pickled pelt, etc). Percentages based on skin or pelt weight are easily calculated. The following equation is used for calculating the weight of chemicals based on skin weight.
- For example, 8% of lime on 2 ton of wet salted skin would be,
- Weight of the lime in kg =  $8 \times 2000 = 160$  kg

#### 2.1.1.5 Volume

- In all the operations of tanning process involve a quantity of water to be added.
- The amount of chemical used may be important relative to the weight of skin, but may also depend on the amount of water.
- E.g., 300% of water on 2 ton of wet salted skin would be
- Volume of the water in liter =  $300 \times 2000 = 6000$

#### 2.1.1.6 Counts

In leather processing, lot size of the batch is measuring by indicating the number of hides and skins, which is taken for this particular batch.

#### 2.1.2 Loading of hide/skin

After completing all tasks that have been learnt in the previous information sheets which include selecting, weighing, classification of raw hides or skins, and preparing the hide and skin the next step/work is loading of the prepared hides or skins into drum or vessel. Before doing so, check and set the following things about drum or vessel.

1. Check if any braking device is applied to the drum or in safe condition before loading.
2. Check whether the gear box is in correct mode and the gears are aligned and matching properly.
3. Ensure level of gear oil in the gear box. Also check the gear lubrication.
4. Ensure the belt/chain guards are properly fixed and the safety device (optional) is functioning correctly.
5. Ensure the water supply and the dosing vats are in proper condition.

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6. Switch on the electric mains.

7. Set the program in the display panel/timers/temperature controller etc.

After completion of the above steps, raw hides/skins shall be put by using either a forklift or manually as per the instructions provided. Start the drum or vessel and follow the process/recipe. Stop the drum or vessel when process is completed.

- Empty the drum and wash/rinse as applicable.
- Switch off the mains when not in use.



*Figure 2-1 loading of hide/skin*

### 2.1.3 Procedures in making ready hides/skins for processing

- Segregate the skins and hides based on sizes hide
  - ✓ The outer covering of the larger animal is called as Hide. Example: Cow and Buff Skin
  - ✓ The outer covering of the smaller chemicals are called as skin. Example: Sheep and Goat
  - ✓ Make ready based on origin of the raw material
- The origin of raw material plays an important role in deciding the process. The origin based upon its own breeding, rearing and climatic conditions play a major role on the quality of raw material and hence without knowing the origin if the recipe is ensured it will be chaos at the end. For example within Ethiopian skins once has to clearly know whether it is a highland sheep skins or Wanke sheep skins or Adal sheep skins before ensuring the process.

- Visual inspection of the presence of any foreign material inside and outside of the hides and skins before loading.
- Take the weight of hides or skins to be taken for processing.

## 2.2 Operating beam house and tanning process vessels

### 2.2.1 Soaking

Means the immersion of hides and skins in water containing bactericide and soaking aids (enhance soaking operation)

#### 2.2.1.1 Purpose

- To rehydrate the raw hides and skins
- To remove animal dung, blood and preserving salt
- To remove non-structural proteins

#### 2.2.1.2 How to check the completion of soaking

- Restoration of the natural swollen condition of the hides/skins
- Good pliability in all sections of the hides/skins
- Complete removal of dirt, blood and dung

### 2.2.2 Liming

Here, soaked hides and skins are treated with dehairing agent (sodium sulfide/sodium sulphhydrate) and lime powder

**Chemicals used:** sodium sulfide/sodium sulphhydrate, Lime powder and liming auxiliary (to facilitate liming operation)

#### 2.2.2.1 Purpose

- To remove hair and non-structural proteins
- To open up the fibers and ease the penetration of chemicals in the subsequent operation

#### 2.2.2.2 Unhearing methods

##### A. Hair saving

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Used to recover the wool. Reduces the BOD and the solid waste. This is done by painting the skins using a solution containing sodium sulphide/sodium sulphhydrate and lime powder.

### Paint solution preparation

Approximately 300-400ml of paint solution is prepared for one piece of skin.

- Take 150g/l of sodium sulphhydrate
- 50g/l of sodium sulphide and
- 260g/l of lime powder
- Check the  $^0\text{Be}$  of the solution (14-15 $^0\text{Be}$ )
- Next day add lime powder until the  $^0\text{Be}$  of the solution is 26  $^0\text{Be}$
- Mix very well and apply on the flesh side of properly drained skins
- Pile flesh to flesh for 3-4hours and remove the hair mechanically (by hand or machine)

### B. burning

The soaked skins are placed in to a drum containing sodium sulphide/sodium sulphhydrate, lime powder and liming auxiliary. This method saves time but affects the environment negatively by loading the ETP

### 2.2.3 Deliming

As its name indicates this operation is aimed at removing the lime from the pelt and reduce the pH of the pelt and make ready for pickling

**Chemicals used:** Ammonium sulfate/ ammonium chloride and sodium metabisulphite

**Purpose:** to remove the lime in the limed pelt and to adjust the pH for bating operation

#### 2.2.3.1 Methods of deliming

**A) Dry deliming** (use 20-30% water and add the deliming agents)

**B) Conventional deliming method** (use 100-150% water and add the deliming agents)

#### 2.2.3.2 Deliming formulation

- Wash the fleshed limed pelt
- Add 100-150% water@cold
- Add 1.5-2% ammonium sulphate/ammonium chloride

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- Add 0.5% sodium meta bisulphate-----run drum for 45minutes or 1hr
- Check pH (8.5-9)

### 2.2.3.3 How to check the completion of deliming

Cut a cross-section and use drops of phenolphthalein. If the color is light pink or color less, deliming is complete.

### 2.2.4 Bating

**Chemicals used:** Alkaline bates (Example Basozyme CH, Basozyme s-20 from BASF)

**Purpose:** To open up the structure of collagen fibers and to remove the hair root/ scud/ short hair. The longer the bating process the softer and less wrinkled is the leather.

The concentration of bating enzyme and duration varies depending on the desired effect on the final leather and the type of input raw material used.

#### 2.2.4.1 Completion of bating

- A) **Thumb test:** the impression remains for some time on the surface. This is done for cow hides
- B) **Air permeability test:** air permeates through the porous hair roots. This is done for sheep and goat products

### 2.2.5 Degreasing

- Here the natural fat is removed from the pelt matrix. This enhances the penetration of chemicals in the subsequent operations
- Degreaser concentration varies depending on the raw material used.

**For example:**

0.5% Boron DN for goat skins

1-1.5% Boron DN for sheep skins

**Commonly used degreasers:** Eusapon OC and Eusapon-OE from BASF

### 2.2.6 Pickling

In this operation, the delimed pelt are treated with acid solutions of formic acid and sulfuric acid to a pH values of 2.8-3.0

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### 2.2.6.1 Purpose

- To prepare the pelt for tanning
- To preserve the pelt for longer periods up to 6months
- To open up the structure of collagen fiber and make softer leather such as glove leather

**Attention:** Take care of acid swelling. Because this could occur when the acid mixture is added to a liquor containing low salt concentration ( $<6^0\text{Be}$ ).

### 2.2.6.2 Pickling operation (% based on pelt weight)

Add 80% water@cold

Add 8-10%common salt .....run drum for 10minutes

Check  $0\text{Be}$  (6-7)

Add 0.5% formic Acid.....15'

Add 0.8% Sulphuric Acid.....2\*10'+30', Check pH (2.8-3.0 for chrome tanning) and 4.5 for vegetable tanning

### 2.2.7 Tanning

- Tanning is an irreversible stabilization of the hides and skins which are prone to putrefaction.
- Here, the pickled pelts are treated with the salts of chromium, aluminium , zinc and Zirconium. In addition, the pickled pelts are treated with vegetable extracts such as mimosa and quebracho. To avoid surface tannage, we usually add sodium formate before the addition of chromium

**Purpose:** To increase the resistance of the leather against hot water (thermal resistance), chemical (chemical resistance) and bacterial degradation.

#### 2.2.7.1 Commonly used chemicals

- Basic chromium sulphate (33% basicity, greenish color)
- Self-basified chrome (45% basicity, pale color): contains magnesium oxide, no need to add additional basifying agents, run for at least 6hrs

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### 2.2.7.2 Basification

Treatment of the wet blue leather with alkalis such as sodium formate and sodium bicarbonate. This helps us to fix the chrome in to the collagen fibers. Here the basicity of the chrome tannage reaches 50-60%.

#### Attention

Add the basifying agents portion by portion to avoid sudden pH changes or precipitation. It is advisable to add masking agents such as sodium formate to avoid this problem.

### 2.2.7.3 Why do we use masking agents?

- ✓ To slows down the bonding of tanning agent and hence achieve complete penetration of tanning material
- ✓ To Prevent the flocculation of the tanning agent by alkalis
- ✓ Improves exhaustion of chrome bath

#### The products obtained

- Wet blue (from chrome tanning)- b/c the color imparted to the leather is blue
- Wet white (from aluminum and zinc tanning)- b/c the color imparted to the leather is white

**Purpose of ageing:** to enhance the cross linking of the tanning agent and collagen fibers

### 2.2.7.4 Checking the completion of proper tannage

#### Boil test method

- Take small cutting (of known size) from the wet blue
- Place the cutting in to hot water for 3minutes and check for size change
- If there is size reduction of the cutting piece, give time for basification

#### Shrinkage temperature test

- Take a piece of wet blue leather of known dimension
- Put inside a shrinkage tester mounted with a thermometer
- Record the reading in<sup>0</sup>C when the wet blue started to shrink
- Wet blue leather must meet a minimum of 95<sup>0</sup>C

### 2.2.8 Unload hides or skins

When the hides and skin are processed from the beginning we use the vessels or drums for different process like soaking, pickling and tanning. After the process is over the hide or skins must be discharged or unloaded from drum or vessels to the right place. You must check the following before Unloading

- Make sure the load is stable.
- Rack capacity.
- Top and side clearance of racks
- The forks are clear of the rack before lowering.

Remember the following when unloading

- Do not strike the rack with the forks or the load.
- The forks are clear before pulling out.
- Keep the mast vertical.
- Never reach through the mast for any reason.
- Never let anyone reach through the mast.

Safety that must be taken on loading and unloading hide/skin

- The unloading material should be known carefully.
- The safety material should be taken in to consideration.
- Care must be taken for the running water during unloading.
- The hide/skin should be unloaded completely.

#### 2.2.8.1 Appropriate placement of the unloaded hides or skins

After the process is over the hide/skin is going to be unloaded, the unloaded hide/skin must be kept in appropriate place which is free from contaminating material like waste water, chemicals, greases, and different trimming waste.

The unloaded material should be kept properly and transferred for the next process. Material used for placing the hide/skin after unloading

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Figure 2-2 unloading of hide/skin

## 2.3 Process controlling parameters

### 2.3.1 Parameters to be controlled during soaking

#### A. Temperature

- Low temperature ( $<15^{\circ}\text{C}$ ): slows down the soaking process and reduces the water absorption of the hides/skins
- High temperature ( $>28^{\circ}\text{C}$ ): high bacterial growth, hydrolytic degradation of skin/hide substance resulting in tinny leather quality

#### B. Time

- (18-20hrs, depending on the article produced)
- Short soaking time: hard, tiny texture of the leather
- Longer soaking time: Vein marks and Putrefaction

#### C. Rpm

- (usually 3)
- Higher rpm: The grain may be crack and it also lead to looseness of the grain in the case of dried hides or partly dried and salted hides

#### D. Float length

- ✓ Short floats: insufficient distribution of chemicals
- ✓ Longer floats: reduces the effect of the chemicals

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### 2.3.2 Parameters to be controlled during liming

#### A. Temperature

- It should not be  $>280^{\circ}\text{C}$ , higher temperatures reduces the solubility of lime.  
Temperature control is especially important for enzymatic liming

#### B. PH

- PH of liming liquor (12-13)

#### C. Time

- Rpm (usually 3)

#### D. Float length

- Depending on the final article leather

### 2.3.3 Control parameters during bating

#### A) Temperature

- The temperate should be  $(30-35^{\circ}\text{C})$

#### B) pH

- The PH must be (8-9) for enzyme activation

#### C) Time

- 45- 60 minutes to hors based on the article produced)

#### D) Float length

- Depending on the final article leather

#### E) Enzyme concentration

- 1-1.5% depending on the active matter of the enzyme employed

### 2.3.3.1 Controls during pickling

#### A) Salt concentration

- The concentration of salt is (8-10%)

#### B) Acids' concentration

- Depends on the objective of pickling and types of acid used in the process.

#### C) Float length

#### D) Duration time

- (1-3hrs) and 5-10 minutes using beta naphthalene sulphonic acid.

#### 2.3.4 Parameters to be controlled during tanning

- Concentration of chrome or vegetable tanning agents
- pH of tanning liquor
- Float length
- Time
- Concentration of sodium bicarbonate during basification

### 2.4 Handling beam house and tanning process liquid waste

Process effluent handling Effluents generated from beam house and tanning yard mainly:

- Sulfide discharge
- Chrome discharge

The waste of beam house and tanning yard mostly contain sulfide and chrome bearings. These wastes must be discharged properly since it have adverse effect. The working area must be cleaned regularly and free from any wastes to make the area suitable for working. The discharge lines should be regularly monitored for their proper working and should be well connected with the effluent treatment plant. The discharge and drainage channels shall be well cleaned and maintained to avoid choking and spilling over to the work place or process yard. Effluent segregation and screening Tannery effluents contain many types of pollutants, which are present in all forms from large solids through colloids to dissolved salts. The flow and composition of the effluent also varies considerably during the day and from the various stages of the beam house and and tanning process. Pre-treatment is especially important in the treatment of tannery wastewater to remove coarse solids and to equalize flow variations in order to protect and optimize the subsequent processes. Particles, which can be easily retained or separated by physical and/or mechanical means, are usually removed from the liquid effluent at the earliest possible stage. This prevents problems of blockage and damage on pumps, pipe work, liquid flow channels and other subsequent treatment equipment. The main components which should be considered for separation are:

- High and low salinity effluent

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- ✓ Sulphide and non-sulphide containing liquors
- Chrome and non-chrome containing liquors

## Self-check 2

Part one: chose the best Answer for the questions listed below. (Each question have 1 points)

1. Un haring is the operation
  - A. After liming
  - B. During liming
  - C. After soaking is completed
  - D. Before paint solution application
  - E. None of this
2. What are the chemicals that used in unharing
  - A. Lime
  - B. Sodium Sulphide
  - C. Sodium hydro sulphide
  - D. All of the above
  - E. None of this
3. Fleshing done after which unit operation in beam house?
  - A. Tanning
  - B. Soaking
  - C. Liming
  - D. Pickling
  - E. None of this

Part two: Give short answer for the following question (each question have 2 points)

1. Write at least three soaking completion methods?
2. List five parameters of soaking operations?
3. What will happen if the RPM of soaking drum becomes higher?
4. Explain the objective of liming?
5. What is the main objective of unhairing?
6. What should be the PH of the bath in deliming operation?
7. How to check the completion of deliming?
8. What is drenching?
9. How to check the completion of bating?

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10. List four objectives of pickling?
11. Write the effect of salt both on the chrome liquor and on the leather?
12. What is basification and its importance?
13. What we call it the product obtained from the chrome tanning?

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers



## Operation sheet 2.1

**Title:** - Preparation to Load the Material into Drum

**Instruction:** - by using operation instruction, you have to operate load hides and skins in to processes vessel in a given 20 minute

**Objective:** - **able** to develop the skill of the trainee by performing the correct loading of hide and skin in to drum

**Tools and equipment that needed for the operations:** -

- Drum
- Dram opening steel bar
- Forklift

**Precautions:**-try to load drums by hand and forklift more than one times

### Procedure

Step 1: Identify the material to be loaded into the drum

Step 2: Ensure the identified lot is with tag/route card and process sheet and no deviation or damages. If any deviation found, report to the supervisor

Step 3: Identify the drum assigned

Step 4: Ensure the assigned drum is in working condition, clean, static and in OFF condition. If not so, report to the concerned official

Step 5: Decide the mode of loading; manual/forklift

Step 6: If manual, wear gloves and protective equipment's or OHS as described for the activity

Step 7: Load the material without affecting personal safety

Step 8: If through forklift, check the working condition of the assigned forklift

Step 9: Ensure the material is placed on the palette

Step10: Using the forklift load the material into the drum

Step 11: Try to avoid overloading the palette or forklift

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Step 12: Avoid hitting or causing injuries to the self and others while loading and transporting

Step 13: Report/consult the supervisor or section in charge if any problems encountered

**Quality Criteria:** accurately load processed hides and skins in to dram without any damage

## Operation sheet 2.2

**Title:** - produce tanned leather

**Instruction:** - by using operation instruction, you have to operate loaded hides and skins to produce tanned leather

**Objective:** - be able to develop the skill of the trainee by performing the correct beam house and tanning operation for hide and skin

**Tools and equipment that needed for the operations:** -

- Drum
- Chemicals
- Dram opening steel bar
- Forklift

**Precautions:**-try to produce different articles like sheep, goat, caw, with different preservation method more than one times

### Procedure

Steps to be followed to produce the tanned leather:

Step 1: Receive the hide/skin.

Step 2: Choose the appropriate process.

Step 3: confirm the availability of materials and quality of chemicals going to be used.

Step 5: Measure the chemicals.

Step 6: Choose the vessel type if needed.

Step 7: Perform the process using the working procedure listed in the information sheet or by using the tannery process sheet

Step 8: Check the quality parameters.

Step 9: Finish the operation.

Step 10: Ensure the effectiveness each operations.

**Quality Criteria:** accurately production of tanned leather for different article

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## Operation sheet 2.3

**Title:** - unload hides/skins, pelts and tanned leather in each operation

**Instruction:** - by using operation instruction, you have to operate to unload hides/skins, pelts and tanned leather in each process

**Objective:** - be able to develop the skill of the trainee by performing the correct unloading operation in beam house and tanning section

**Tools and equipment that needed for the operations:** -

- Drum
- Dram opening steel bar
- Forklift

**Precautions:**-try to unload drums more than one times

### Procedure

Step 1:- Ensure the surrounding is clean

Step 2:- Drum or process vessel should be in off condition

Step 3:- Drain the water first from the process vessel through lattice door

Step 4:- Make arrangements clearly to place the perforated wooden collection rack to collect the material

Step 5:- Then unload the material

Step 6:- Make sure the load is stable and rack capacity.

Step 7:- Keep the forklift or material shifting equipment ready

Step 8:- The pathways to move the unloaded material should be free of obstacles

**Quality Criteria:** accurately unload processed hides and skins in clean place without any damage

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## Lap test 2

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks. The project is expected from each student to do it.

Tasks-1: all prepared raw hides/skins to load or feed to the drum or vessel using loading machine or manually by hand

Task 2 Move to tannery and apply the above beam house and tanning operation working procedures.

Task3: - after the completion of each process unload the hides/skins, pelts and tanned for the next operation

You are given three (15 days) to complete the abovementioned

Request your teacher for evaluation and feedback of your work

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### 3 UNIT THREE: - UNDERTAKE MECHANICAL OPERATIONS

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Status of skin/hide or pelt for machine operation
- Beam house and tanning machines
- Process controlling parameters
- Beam house and tanning mechanical operations solid waste

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Determine the state of hide/skin for mechanical operation
- Know how to operate machines
- Determine process control parameters during machine operation
- Handle beam house and tanning solid waste

### 3.1 Status of skin/hide or pelt for machine operation

#### 3.1.1 Status pelt for fleshing

- The area must be cleaned from any waste, which may affect the fleshing process.
- Operator should check the availability of water.
- The operator must know that the pelt hide or skin have three times weighed after liming.

##### 3.1.1.1 Status pelt for lime splitting

- The areas must be clean. It should not be slippery and one should also make sure that the power and water is available.
- Ensure the condition of the material is suitable for splitting.
- The personal protection like (water proof and skid proof shoes, water proof apron, protective gloves) must be available because the pelt has slippery nature. The operator now needs to check the availability of all those items.
- The thickness that the hide will assume after it is tanned and dried.
- In tanneries where various types of products having various thicknesses are made, the programming of the work is simplified by standardizing the thicknesses obtained by splitting pelt hides.
- The three standard ranges are as follows:
  - Thin hides 2-2.2mm
  - Medium hides 2.8-3.0mm
  - Heavy hides 3.6-4.0mm
- To perform the operation there must be at least two operators for introducing to the splitting machine and two operators to receive the splitted pelt. There should be a proper material or drum to keep in water or lime liquor immediately after splitting so as to avoid the formation of lime blast.

### 3.2 Operating beam house and tanning machines

#### 3.2.1 Types of beam house machines

There are different types of machineries in beam house operation like Fleshing machine, lime Splitting machine.

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### 3.2.1.1 *Fleshing machine operation*

Fleshing machine is a machine which removes fat, flesh, and all other tissues still remaining on the hide or skin after liming.



*Figure 3-1 Fleshing machine*

#### **Preparation for the Fleshing Operation**

Preparation for the Materials:

- The area must be cleaned from any waste, which may affect the fleshing process.
- Operator should check the availability of water.
- The operator must know that the pelt hide or skin have three times weighed after liming

#### **Adjustments on the fleshing machine:**

- Adjust the pressure on the pneumatic feed roller (which holds the skin against fleshing cylinder, in order to avoid blades cutting the skin owing to uneven pressure)
- Clean the fleshing cylinder and feed roller with water, which is necessary.
- Great care must be taken in handling the sharpening stone or grinding stone.
- Properly lubricate all the moving parts periodically.
- Report any abnormality or problems to maintenance department immediately.
- Since the environment is corrosive, make sure machine is not bare and there is a paint-coat, at least red-oxide

#### **Quality parameter for fleshed pelt •**

- Entire area of the hide/skin must be free from loose flesh.

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- The pelt must be free from any cut marks, gouges mark etc. occurred due the transporter roller.
- The pelt must be free from any lubricating grease of the machine.
- In lime fleshing, the skin should be flat, cleaned and free from loosely held flesh.
- The stock is checked for cleaned flesh side. It should be free of any flesh cuts or holes.

### **Preparation for the Fleshing Machine**

- The operator should check before doing fleshing
- The conveyer speed adjustment
- Distance adjustment between knife cylinder and rubber support
- Grinder controls
- Opening and closing control
- Emergency control this all should be settled before starting the operation.
- Check that the machine if having any unwanted objects on it and it is cleaned properly.
- Check that the grinding stone is away from the cylinder.
- Check the belts are in good condition and the tension is right.
- Check that the electrical panel and pedal are dry and clean.
- Before Starting the main switch and blade cylinder, arrange proper safety devices like goggle, mask and hand gloves.
- If the machine is having hydraulic power pack, make sure there is sufficient oil in the tank.
- Check the gap between the feed roll and blade cylinder is correct.

### **Safety precaution to perform fleshing operation**

- Safety Precautions before Operation: Skin Fleshing Machine
  - ✓ Check that the machine is not having any unwanted objects on it and it is cleaned properly.
  - ✓ Check that the grinding stone is away from the cylinder.
  - ✓ Check the belts are in good condition and the tension is right.
  - ✓ Check that the electrical panel and pedal are dry and clean.

- ✓ Start the main switch and blade cylinder, use proper safety devices like goggle, mask and hand gloves.
- ✓ If the machine is having hydraulic power pack, make sure there is sufficient oil in the tank.
- ✓ Check the gap between the feed roll and blade cylinder is correct.
- ✓ Grind the blades once or twice by starting the blade roll and grinder-slide.
- ✓ Now use the machine for operation.
- ✓ After finishing the work, clean the machine and lubricate as per program.
- ✓ Report any abnormality or problems to maintenance department immediately.
- ✓ Since the environment is corrosive, make sure machine is not bare and there is a paint-coat, at least red-oxide.
- ✓ Thanks for keeping machine up to-date.
- Safety Precautions before Operation: Hide Fleshing Machine
  - ✓ Check that the machine is clean.
  - ✓ Check that all the guards and covers are fixed.
  - ✓ Check the hydraulic oil in the tank. If not up to the level, please top-up.
  - ✓ Check that the grinder slide is in correct position (grinder will not touch all of a sudden).
  - ✓ Open the cleaning water tap.
  - ✓ Make sure the feed roll and nip rolls are in correct position.
  - ✓ Switch on the main switch and hydraulic pump.
  - ✓ Now switch on the blade roll and grind it for few minutes.
  - ✓ Here the machine is ready for use.
  - ✓ After finishing the fleshing operation, clean the machine thoroughly with water.
  - ✓ Lubricate the machine
  - ✓ Few machines may have automatic lubrication plant.
  - ✓ Thank you for keeping machine in perfect working order.
  - ✓ Occasionally inspect the rubber bolster for wear and adjust the same if necessary..

### 3.2.1.2 *Splitting machine Operation*

As the name implies, it is used for splitting the hides and skins. This is one of the important and delicate machines. In this machine, hide or skin can be split into required thickness for direct use after liming. The objective of Lime splitting is to avoid wastage of chemicals while

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further processing. The main layer with grain splits and further processed separately to get the desired end product.



*Figure 3-2 Splitting machine*

Identification of Some Important Parts of a splitting Machine:

- Touch screen control panel
- Emergency stop
- Safety guard
- Band knife grinding Procedure:

### **Preparation for the Splitting Machine**

- Check that the machine is clean and free from foreign objects.
- Check that the hydraulic oil is sufficient in the tank.
- Check that the band knife, grinding wheels and jaw plates are in correct positions.
- Check that the grinder-dust extractor plant is properly functioning.
- Adjust the program/cambering- DE cambering if it is provided

### **Objective:**

The objective of Lime splitting is to avoid wastage of chemicals while further processing. The main layer with grain splits and further processed separately to get the desired end product.

### **Preparation for the Splitting Operation**

Preparation for the Materials:

- The areas must be clean.

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- It should not be slippery and one should also make sure that the power and water is available.
- Ensure the condition of the material is suitable for splitting.
- The personal protection like (water proof and skid proof shoes, water proof apron, protective gloves) must be available because the pelt has slippery nature. The operator now needs to check the availability of all those items.
- The thickness that the hide will assume after it is tanned and dried. In tanneries where various types of products having various thicknesses are made, the programming of the work is simplified by standardizing the thicknesses obtained by splitting pelt hides. The three standard ranges are as follows:
  - Thin hides 2-2.2mm
  - Medium hides 2.8-3.0mm
  - Heavy hides 3.6-4.0mm

To perform the operation there must be at least two operators for introducing to the splitting machine and two operators to receive the splitted pelt. There should be a proper material or drum to keep in water or lime liquor immediately after splitting so as to avoid the formation of lime blast.

### **Preparation for the Splitting Machine**

- Check that the machine is clean and free from foreign objects.
- Check that the hydraulic oil is sufficient in the tank.
- Check that the band knife, grinding wheels and jaw plates are in correct positions.
- Check that the grinder-dust extractor plant is properly functioning.
- Adjust the program/cambering- decambering if it is provided.

### **Quality parameter for lime splitting pelt**

- The pelt thickness should be as per the requirement.
- The pelt should be free of gouges, holes and formation of stairs.
- The pelt must be cleaned from any other unwanted waste.

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- The uniformity of splitting should be maintained through all the area of skin or hide.
- Grain structure should be more relaxed particularly in neck wrinkles.

### **Safety Precaution to Perform Splitting:**

- Check that the machine is clean and free from foreign objects.
- Check that the hydraulic oil is sufficient in the tank.
- Check that the band knife, grinding wheels and jaw plates are in correct positions.
- Check that the grinder-dust extractor plant is properly functioning.
- Switch on the mains, start the hydraulic pump and ensure the substance roller, cambering-decambering, table lifting and foot switches are working properly.
- Inspect the section (ring) rollers and rubber roller for trimmings/leachate.
- Make sure the covers and safety guards are properly fixed and emergency switches are functioning correctly.
- Start the band knife rotation, grinding wheels and ensure the bevel is correct do dressing of the grinding wheels with diamond dresser if necessary.
- Check whether the pushers are excessively stressed and the electronic eye is in right position.
- Start feeding rotation and check the correct thickness by splitting small bits. Adjust if necessary.
- Adjust the program/cambering decambering if it is provided.
- Now the machine is ready for use.
- Clean the machine after finishing the work and lift away the grinders.
- Do switch off the electric mains.

### **Other Important Work Steps**

Over and above what is described above, there may be other important work steps applicable for all the work processes from the above sections

### **Health safety while working**

- i) Wear hand gloves

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- ii) Wear gum boots
- iii) Wear apron.

### **Machine maintenance**

Follow daily machine maintenance schedule as given by Supervisor in terms of:

- i) General cleaning.
- ii) Lubrication
- iii) Adjusting of machine for proper operation

## **3.3 Process controlling parameters**

### **Fleshing Machine Operational parameters**

- Visual and functional checking of the existing devices.
- Functional checking of the safety switches.
- Functional checking of the interlocks.
- Verification of safety devices to stop the dangerous movement
- Check whether the machine creates any holes or scratch mark

### **Splitting Machine Operational parameters**

- Visual and functional checking of the existing devices.
- Measurement of the safety distance between the fixed barriers and the danger point.
- Functional checking of the safety switches.
- Functional checking of the interlocks.
- Measurement of the noise level.
- Verification of the following exhaust points to ensure that they meet the process requirement
  - ✓ Pressure
  - ✓ Flow rate
  - ✓ Direction

### 3.4 HANDLING BEAM HOUSE AND TANNING PROCESS SOLID WASTE

Waste(s) is a pejorative term for unwanted materials. In terms of tanning Industry after processing, which is not further more useful for that particular processing is known as waste. i.e Input = Waste + Useful output (intended end product for that particular process)

For example Raw Skin/Hide (with Hair/wool) + Chemical = Unhaired Skin/Hide + Waste (Wool/Hair + lime + H<sub>2</sub> S).

#### A. BOD (Biological Oxygen Demand)

The BOD is the amount of oxygen required by micro-organisms to oxidize the organic material in the wastewater. The BOD-value is generally measured after a five day incubation period at 20°C. Officially this is expressed as BOD 5 at 20oC.

#### B. COD (Chemical Oxygen Demand)

The COD represents the oxygen consumption for chemical oxidation of organic material under strongly acid conditions.

#### C. Solid Waste

By-products that are not used in any way will be referred to as solid waste. They must be dumped Solid Waste:

- Toxic Compounds: These compounds require special attention, e.g. special dumping grounds.
- Organic Compounds: These compounds may require attention under certain conditions because of hygienic reasons or because during decomposition ill odor or leaching problems may arise.
- Non Degradable Compounds: these may be dumped at regular dumping grounds.

*Table 1 wastes produced on the beam house operation*

Unit Process/Operations	Waste
Unhairing	Hair and wool
Unhairing& Liming	Trimming

Fleshing Process	Flesh and fat
Lime Splitting	Split

### 3.4.1 Physical/Chemical/Biological Nature of the beam house waste

#### 3.4.1.1 Physical nature:

The physical nature of those waste are solid and semi-solid.

Solid Waste: These figures show that the solid waste produced per ton of raw hide is about 450-600 kg. Out of 1000 kg nearly 850kg solid waste is generated in leather processing. Only 150kg of the raw material is converted into leather. Among that the fleshing generated 50-60 % & hair 2% of the total weight of solid waste. The Solid waste can be hydrolyzed & can be used as a useful by product in many Ways. Keratin is difficult to hydrolyze & is highly resistance towards enzyme.

#### 3.4.1.2 Chemical nature:

When we see the chemical nature of the waste since the skin/hide or pelts are treated by the alkali like (soaking agent, unhairing agent i.e. Na<sub>2</sub>S/NaHS and Lime) we can say the chemical nature of the wastes viz., hair, fleshing, unusable lime splitting are more alkaline in nature.

H<sub>2</sub>S is another highly toxic gas and is liberated when Na<sub>2</sub>S is treated with acid, fortunately the composite effluent of tannery is always an alkaline in nature and therefore the possibility of liberation of this gas in the effluent is much less. But when the effluent is discharged into the receiving water this gas slowly liberates due to the lowering of pH value. So it is better to allow minimum possible amount of Sulphide to drain out with the tannery effluent.

The lime liquor generated from the fleshing wastes after the fleshing operation should be carefully segregated. These have adverse effect on environment (like water pollution, Air pollution etc.)

### 3.4.2 Environmental Impact of the Waste Material:

- In most developing countries, tannery effluents are discharged into Sewers or inland surface waters and/or brought onto the land with irrigation water.



- The high concentrations of salt and Hydrogen Sulphide in tannery wastewater affects the quality of water and may cause bad taste and odor.
- Suspended matter (lime, hair, fleshing, etc.) makes the surface water turbid and settles eventually on the bottom. Both processes create unfavorable Conditions for aquatic life.
- As a result of infiltration, the quality of the ground water is affected adversely also. Discharge of untreated tannery effluents into the sewer system causes deposition of calcium carbonate and choking of the sewer.

### 3.4.3 Beam house waste handling:

All pre-tanning processes generate a lot of waste.

- Different types of waste demand different types of collecting and handling.
- In order to handle the waste correctly the right kind of equipment is needed.
- Floor supervisor / Technical Supervisor will be able to assist in drawing up a waste handling plan for the entire event.
- This includes the making of adaptations for waste separation, delivering the right equipment, training personnel, emptying bins and containers, and transporting the Waste.
- Implementing a system of waste sorting will reduce the amount of waste you will need to dispose of, and therefore also cut waste disposal costs. In many places it has become more expensive to dispose of unsorted waste than sorted waste.

### 3.4.4 Disposal of beam house Waste:

Waste disposal is the act of taking items that no longer have value to be destroyed. "Disposal" :-The discharge, deposit, injection, dumping, spilling, or placing of any solid waste or hazardous waste (whether containerized or un containerized) on any land or water so that such solid waste or any constituent therefore may enter the environment, or may emit into the air, or may discharge into water bodies, including ground waters. After handling, it is necessary to dispose the waste properly, in a proper way and into a proper place. For example:

- The keratin (wool, hair etc.,) found from the Unhairing operation must be collected and treated well.

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- The hair, fleshing, hair roots, etc., if not disposed or used properly it also load tannery effluents with suspended solids. The hair and wool can be further used for the production of blanket, rugs etc.
- The resultant waste of Fleshing operation should be cleaned and the operator must take into consideration that the waste is highly slippery and should be disposed accordingly.
- The flesh collected can be dried and can be sold for glue manufacturing.
- The flesh also can be further processed for different use example soap, for fat liquor, pad etc.

### Self-check 3

Part one:-chose the best answer for the following questions (each question have 1 points)

1. Which of the following machine used to split hide?
  - A. Setting machine
  - B. Splitting machine
  - C. Shaving machine
  - D. All the above
  - E. None of this
2. One of the following is the objective of lime splitting
  - A. To avoid wastage of chemicals
  - B. To make the grain of hide flat
  - C. To remove wrinkle and fold
  - D. All of the above
  - E. None of this
3. Which is not a pre –tanning machines
  - A. Splitting machine
  - B. Fleshing machine
  - C. Unhairing machine
  - D. Shaving machine
  - E. None of this
4. Which of the following should be done before starting fleshing machine
  - A. The conveyer speed adjustment
  - B. Distance adjustment between knife cylinder and rubber support
  - C. Grinder controls
  - D. Opening and closing control
  - E. All of the above
5. What the three thickness standards for splitting
  - A. Thin hides 2-2.2mm
  - B. Medium hides 2.8-3.0mm

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- C. Heavy hides 3.6-4.0mm
- D. All are correct
- E. None of this

Part two: - Answer all the questions listed below. Examples may be necessary to aid some explanations/answers. (Each question have 2 points)

6. What are the quality parameters that need to be checked during fleshing?(3 points)
7. What are the quality parameters of the lime splitting pelt?(3points)
8. Write the operational parameter that should be controlled on fleshing machine.(3points)
9. Write the operational parameter that should be controlled on splitting machine.(3points)

Note: Satisfactory rating – above 60%      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

### Operation sheet 3.1

**Title:** - Operating Procedures of fleshing Machine

**Instruction:** - by using operation instruction, you have to operate to Operating fleshing Machine after liming

**Objective:** - be able to develop the skill of the trainee by performing the correct Operating Procedures of fleshing Machine beam house and tanning section

**Tools and equipment that needed for the operations:** -

- Fleshing machine
- Thickness gauge

**Precautions:-**try to operate fleshing machine for both hide and skin more than one times

Before Starting the Fleshing Operation please ensures that all the preparation (for both the machine & materials) is followed. If not it will affect the final product/desire result. If everything is ok then the fleshing can be started now.

#### Procedure:

Step 1:- Fleshing has to be done starting from the center and working out wards, Making one pass from the center toward the butt.

Step 2:- witch on the machine.

Step 3:- Grind the blades once or twice by starting the blade roll and grinder-slide.

Step 4:- Now use the machine for operation.

Step 5:- Press the foot treadle (feed roller moves away from the grip rollers)

Step 6:- Place the limed pelt on the feed roller i.e. first half of the pelt exposed towards the fleshing cylinder.

Step 7:- Again press the foot treadle.

Step 8- feed roller moves towards the fleshing cylinder and removes the flesh. (Here, the drive is automatically engaged which rotates the grip roller)

Step 9:- The hides/skins are drawn away from the machine.

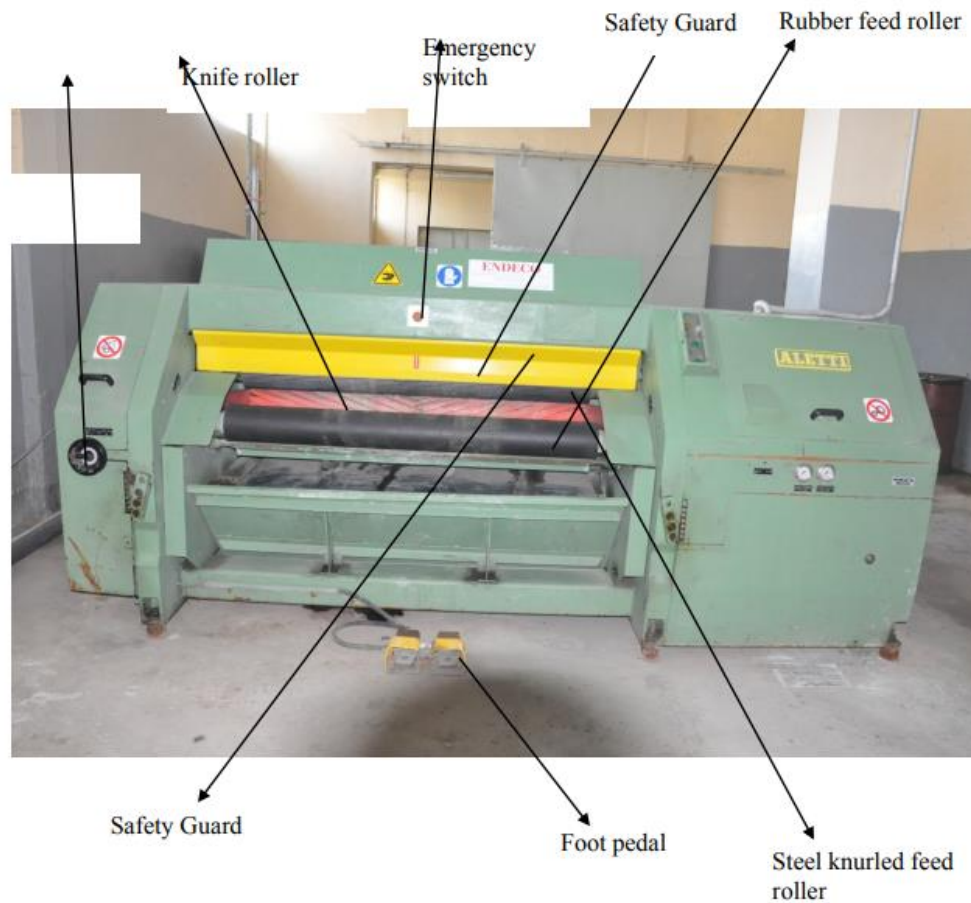
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Step 10:- Repeat the same procedure for the second half of the hides/skins also.

Step 11:- Hides/skins are placed on the 'horse' to pile up.

Step 12:- Switch off the machine

**Quality Criteria:** accurately operation by given thickness



## Operation sheet 3.2

**Title:** - Operating Procedures of lime splitting Machine

**Instruction:** - by using operation instruction, you have to operate to Operating splitting Machine after liming

**Objective:** - be able to develop the skill of the trainee by performing the correct Operating Procedures of splitting Machine beam house and tanning section

**Tools and equipment that needed for the operations:** -

- Splitting machine
- Thickness gauge

**Precautions:**-try to operate splitting machine for both hide and skin more than one times

### Procedure

Step 1:- Now the machine is ready to use.

Step 2:- Switch on the mains, start the hydraulic pump and ensure that the substance roller, cambering-decambering, table lifting and foot switches all are working properly.

Step 3:- Inspect the section (ring) rollers and rubber roller for trimming.

Step 4:- Make sure the covers and safety guards are properly fixed and emergency switches are functioning correctly

Step 5:- Start the band knife rotation, grinding wheels and ensure the bevel is correct.

Step 6:- Do the dressing of the grinding wheels with diamond dresser if necessary.

Step 7:- Check whether the pushers are excessively stressed and the electronic eye is in right position.

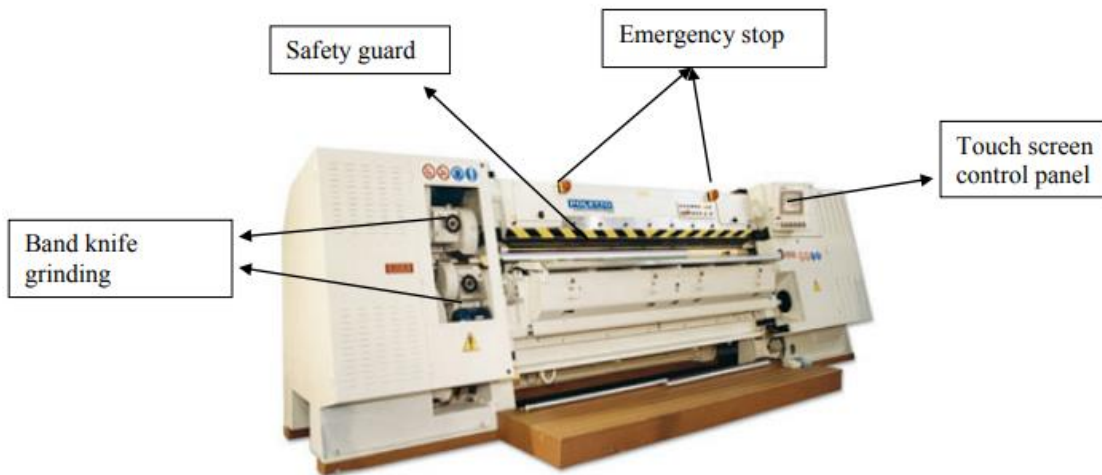
Step 8:- Start feeding rotation and check the correct thickness by splitting small bits. Adjust if necessary.

Step 9:- Clean the machine after finishing the work and lift away the grinders.

Step 10:- Do switch off the electric mains.

**Quality Criteria:** accurately operation by given thickness

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### Lap test 3

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks. The project is expected from each student to do it.

Tasks-1 operate fleshing machine to remove the flesh of different types of animal pelt

Task-2 operate splitting machine to split the grain and flesh side of different types of animal pelt

You are given three (3) hours to complete the abovementioned

Request your teacher for evaluation and feedback of your work



## REFERENCE

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- 3) Han, W., Zeng, Y., & Zhang, W. (2016). A Further Investigation on Collagen-Cr (III) Interaction at Molecular Level. *Journal of the American Leather Chemists Association*, 111(03), 101-106
- 4) *Leather Technicians Hand book* by, J.H. Sharphouse, BSc. Revised edition 1983
- 5) *Process vessel and machine operation manual*, Machine manufactu



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