

# **Leather processing**

## **Level-II**

**Based on December 2021, Curriculum Version**



**Module Title: - Performing Finishing operation**

**Module code: \_IND LEP2 M06 1221**

**Nominal duration: 96 hour**

**Prepared by: Ministry of Labour and Skill**

August, 2022

Addis Ababa, Ethiopia

## Acknowledgment

Ministry of Labor and Skills wish to extend thanks and appreciation to the many representatives of TVET instructors and respective industry experts who donated their time and expertise to the development of this Teaching, Training and Learning Materials (TTLM).

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## Acronym

EL . Emulsion Lacquers

MSDS, Material safety data sheets

NDT, Non Destructive Tests

N.C/NC, Nitro cellulose

PVC, polyvinyl chlorides

SL , Solvent lacquers

VOC, Volatile Organic Compounds

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## Introduction to the Module

In leather processing field; the Finishing operation of in leather processing helps to improve the product quality, improving the aesthetic appeal and the sales value of the product. By the finishing process, the grain surface of the leather is coated with various substances and is then submitted to different mechanical operations, depending upon the purpose intended whereby the appearance of leather can be highly influenced to make it more useful, attractive and appealing to users..

This module is designed to meet the industry requirement under the **leather processing**, particularly for the unit of competency: **Performing Finishing operation**.

### Module contents:

- Prepare for finishing operations
- Operate machines to produce finished leathers
- Apply Chemical formation
- Monitor product quality

### Learning objective of the Module

- preparing for finishing operations
- To operate machines to produce finished leathers
- Applying formulated chemicals
- To monitor product quality

### 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 the unit and
5. Read the identified reference book for Examples and exercise

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## Unit one: Prepare for finishing operations

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

- Types of leather finishing methods
- Types of leather finishing chemicals, machine, equipment and tools
- Preparing finishing formulations for different types of leather products

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:

- Identify types of various finishing methods
- To ensure Availability of the required finishing chemicals, tools and equipment
- preparing Finishing formulations as per the required leather products

## 1.1 Types of leather finishing methods

### Introduction to finishing

The object of finishing is to give a treatment of coatings to the grain surface to protect it against dirt, staining, wetting, mechanical stresses like rubbing, scuffing, flexing etc., leveling or evening out the colour of the grain surface, hiding grain blemishes and upgrading its quality, improving the aesthetic appeal and the sales value of the product. By the finishing process, the grain surface of the leather is coated with various substances and is then submitted to different mechanical operations, depending upon the purpose intended whereby the appearance of leather can be highly influenced to make it more useful, attractive and appealing to users. Finishing may be employed to impart colors, a uniform shade, special patterns, a smooth or grained or printed/embossed surface, luster (Matt or glossy) as well as opaque (covered) or transparent (aniline/semi-aniline) appearance to the leather surface. Finishing operation is the most vital part of the processing of leather as the final product is judged by its appearance, evenness of colour and surface, feel, handle, break, gloss etc. Hence it is usually the finishers who have to face the complaints or blames, if anything goes wrong. They are also expected to correct whatever faults that have occurred during the earlier operations.

Finishing was once considered as an art and was kept a secret but today with the introduction and availability of a wide variety of leather finishing chemicals and mechanization, finishing is no longer that secret. However, in spite of the innumerable finishing auxiliaries available and marketed by the firms providing details like general composition and properties of the products, mode of application with formulation for different types of finishing of leather, finishing is still dependent upon the finisher's ability of judging and blending of different auxiliaries to make his own combination to give the best finishing effect. Also, he keeps in mind the high qualities required from finishing, like adhesion, flexibility, durability against weathering and aging, durability against dry and wet rubbing, resistant to peeling, cracking on flexing, light fastness, resistant to the various mechanical operations involved in finishing and permeability to water vapor and air thus ensuring the hygienic conditions.

These rigid requirements cannot be met by a finishing agent in a single coating. It is necessary to have various finishing agent with different properties applied in several coats. A normal finish essentially consists of 3 coats.

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## Type of finishing system

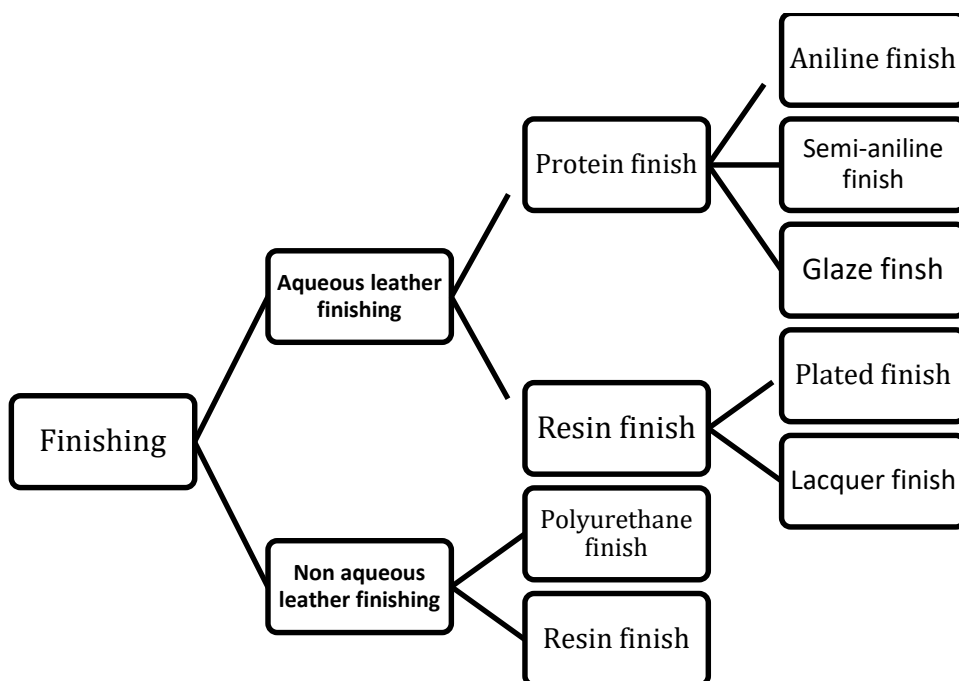


figure1. 1 type of finishing system

### Protein Finish (Aqueous)

Shoe uppers, lining leathers of goat, sheep, cattle any leathers of various types for leather goods which are protein finished and glazed still occupy an important position in the export demand of finished leathers. This type of finish uses binders mostly based on proteins. The film formed is not continuous, which facilitates the friction glazing at high temperature. The leathers will have a natural look and feel. The finish would also be resistant to cold weather.

### Aniline Finish

In the recent years, the practice of coating leathers with a heavy opaque, plastic like finish has been abandoned due to the simulation of the leather imitation materials by their manufactures. The leather manufactures and finished goods manufacturers are anxious to preserve the natural look and handle of leather and hence finishing with thin coats are done through which the grain pattern is more or less visible. Leathers that were formerly buffed and heavily filled with film forming materials like polymers and covered with opaque/covering pigments is slowly replaced and given an aniline look subsequently. Aniline finish is a transparent/translucent finish, which keeps the natural appearance so that the original grain pattern of leather surface is easily visible. This is a lighter finish without loading the surface of the good quality leathers. It will have good

fastness to light and bleeding. Most of the colour matching is competed in the wet finishing stage itself. Aniline finish is done only in full grain leathers to retain the natural grain clearly visible.

The term aniline leather through not clearly defined is not confined to any specific processing method e.g. drum dyed leather or to any specific type of leather (e.g). Shoe upper or bag leather to any specific finishing system (e.g). Glazed or resin finished. Aniline leather need not have full grain.

### **Semi-aniline or aniline look or mock-aniline finish**

These types finishing are more adopted for plated finished leather. The leathers are more or less heavily retanned and invariably the leathers are snuffed on the grain lightly or deeply depending upon the defects in the grain surface. After initial impregnation the grain surface may be coated with a good covering of opaque pigments to hide the defects. The finisher then uses his skill to give a slightly darker tone on the top using sprits soluble dyestuff transparent organic pigments/colored lacquer emulsions etc., so that they look like aniline leather. Effects like pull up, speckle effect, smoky effect can be produced. Even full grain leather which is not good for aniline finish can be finished like this. Sometimes even in full grain aniline small quantity of pigment is used to hide the defects. Brilliancy as increased by adding suitable dyestuffs and/or transparent pigments to opaque pigments. This finish is in between real aniline and pigment (opaque) finishing.

### **Glaze Finish**

In India glazed finish for shoe uppers, for aniline uppers and lining leathers are having International standard that still occupy an important position in the leather world. Initially for glazing casein pigments, polymeric substances and natural substances like shellac, linseed oil are used in these finishes for getting filling, glossy and smooth feel. Goat is mainly used for making glaze finish.

For glazed aniline leather can also be produced by plated (polymer) finish using polymer binders. Leather which are dyed wFigure 1. 1ith aniline dyestuffs may be sprayed with sprit soluble dyestuffs to even out the shade and then coated with a finish containing polymer binders, fillers wax emulsions, protein binders etc., to get the desired appearance and feel. They are then plated and top coated with lacquer emulsions or with protein binders and formaldehyde for forming a protective coat.

### **Resin Finish (Aqueous or Aqueous Cum Non Aqueous)**

This finish is primarily based on polymer emulsions and top coated with lacquer. This has a continuous film which is thermoplastic. The resin finished leathers can only be plated at pressure and temperature and not capable of being friction glazed. The film has more filling effect than protein finishes. Unlike protein finish, the film is internally plasticized and hence possesses intrinsic elasticity. The new easier form of film forming products like acrylates or vinyl or butylenes polymers or polyurethane or nitrocellulose are offered by the chemical industry. The new modern finishes have been accepted by the tanner as it is possible to upgrade the poor quality raw material by this finishes.

### **Lacquer Finish**

This finish is generally based on nitrocellulose or cellulose nitrate. Here both lacquers (solvent dilutable) and lacquer emulsions (water dilutable and solvent dilutable) are used. The film formed is firm, but may crack at low temperatures. Some of the lacquers with suitable plasticizers' can be friction glazed. The leathers finished with nitrocellulose lacquers have no fastness to light. Hence, for finishing of white leathers special lacquers or lacquer emulsions based on cellulose acetate-Butyrate are preferred to cellulose nitrate as the former are more stable to light and yet yield a flexible film.

### **Polyurethane finish (non- aqueous)**

Urethane finishes have come into extensive use in leather finishing in the current decade. Polyurethanes represent a class of versatile, high performing polymers. The reaction of poly isocyanates with polyols is the basis for polyurethane chemistry. The best known simple urethane is ethyl carbonate. The most widely used method for the synthesis of urethane is the reaction of diamide polyisocyanates with polyols (polyether or polyester polyols). The characteristics of the finish film depends on the nature of the polymer binder used and hence the nature of the polyurethane system with respect to these characteristics have been dealt here with some of the polyurethanes, they are highly compatible both in cationic and anionic systems. This finish is based on urethanes (both reactive and non-reactive polyurethane systems). This finish gives a film, which has exceptionally excellent abrasion resistance, balance of flexibility and toughness, high gloss, gloss retention, solvent resistance, covering, better handle, softness and levelness, brilliancy of the finish, dry and wet rub fastness, and better adhesion. At the same time, the finish has one disadvantage in that it makes the leather look like plastic.

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In polyurethane resins which are supplied in one component system the curing is affected by moisture from air. In using one pack system, it is always better to remember that the container once it is opened should be used quickly (within a day or two). Otherwise, the finish gets on changing in composition and becomes as solid. Two pack systems are better in this respect.

### **Opaque or Covering Finish**

Finish using covering pigments for hiding the grain defects and damages or for covering the very uneven drum dyeing. Here covering pigments are used along with polymer (resin) dispersions and other auxiliaries. Sometimes little dye solutions is also added to brighten the finish. Finally they are top coated with lacquer emulsions or lacquers. In addition there are a variety of finishing systems and finishes like metallic finishes, pearl finishes, two tone finishing, antique finishing, rub off/brush off finishing, burnish type finishing, transfer of gold, silver and other metallic foils, transfer of PVC films, polyurethane films etc., marbled and fancy finishing and so on. The list is really inexhaustible. Once the finisher has a basic understanding of the various materials and finishing agents that go into making of finish and also their properties compatibility, mode of application etc., he can juggle with an endless combination of finishes, formulation and produce results that can be highly individualistic.

### **Compact Finishes**

Now a day everything becomes sophisticated in the industry easy way of applying, handling and with less labor. The compact resin binder will be used as single binder for the finishing of garment leather, upper leather and upholstery leather. It give excellent wet/dry resistances and a soft and natural feel, good adhesion and long lasting film which remain unchanged even after dry drumming and staking. This can be used in the place of season coat but initially pre bottom or base coat should be given and normal topcoat.

## **1.2 Types of leather finishing chemicals, machine, equipment and tools**

### **1.2.1 Types finishing chemicals**

- Pigment paste
- Dye solution
- Binders/ Gloss giving agents Fillers
- Plasticizers
- Wax emulsions

- Fixing agents
- Preservatives

#### a) **Pigments Pastes**

In leather finishing dry pigment colours (inorganic or organic), which are not miscible with water are normally dispersed using dispersing agents or with other vehicles like casein, plasticizers, wetting agents, preservative etc. The dry pigments are ground and dispersed using equipment's like ball mill, cone mill, triple roll mill, unroll mill or similar equipment's. The vital properties required for leather pigment are; colour, strength of staining, hiding power, texture, absorption, fastness to light, fastness to heat and temperature and resistance in various media in which the pigment pastes are likely to come into contact (viz., alkali, acid, formaldehyde, solvent, etc.)

The quality of pigment paste depends upon the particle size and shape of original dry pigment colors and degree of dispersion besides the above-mentioned properties. Pigments are broadly divided into inorganic and organic. Inorganic pigments have better covering power than organic pigments. Pigment paste are marketed into two categories viz., pigment dispersed in finely divided form with dispersing agents and protective colloids containing no pronounced binders (casein free pigment pastes). The later type does not overload the grain surface and there is no encrustation of the pigment pastes which are known for their transparency and brilliancy are also marketed and these are both suitable for glazed and plated finishing. Though in general, organic pigments are known for their poor resistance to light, heat, temperature and alkali and give bronzy effect, selected pigments are used which are very handy in making aniline, semi aniline and special effects on opaque or covering finishes.

#### b) **Dyestuffs**

In protein finishes, only anionic dyestuffs can be used for brightening the aqueous finishes. Because of the opposite charge, basic dyes cannot be mixed with protein finishes as they may precipitate. As normal anionic dyestuffs contain additives, for finishing concentrated dyestuffs are marketed and used. Metal complex dyes with special molecular structure which are soluble in solvents like alcohol, diacetone alcohol, dimethy formamide, oxitol are used not only for colouring lacquers but also sometimes in protein finish.

#### c) **Binders/ Gloss Giving Agents**

##### **Casein**

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This is a protein derived from milk. It is obtained by acidifying warm skimmed milk and allowing the precipitated casein to settle down. Usually lactic acid is used for acidifying. It is then washed, filtered and finally dried and later ground to obtain desired fineness of 30, 60 or 100 mesh. For leather finishing 30 mesh is used. Amongst the protein binders, casein is the most important and widely used finishing auxiliary. For leather finishing, casein dispersions of 10 to 18% in strength are made, dispersing casein in water using alkalis like liquor ammonia or borax..

### **Linseed**

Acrylic resins are manufactured by reacting (polymerising) various quantities and ratios of acrylate, methylmethacrylate. Acrylic monomers can also be emulsified with other classes of monomers like acroitrile, vinyl chloride, styrene, vinyl acetate, butadiene to form copolymers. Such combinations are introduced for reducing the cost or for importing specific characteristics like soft binders. Soft binders give soft films which are soft and stretchy and are crackier. They are in general having cold crack resistance. These characteristics are dependent upon the monomers that are selected for polymerisation.

### **Properties of Acrylic Resins**

Acrylic resins are manufactured by reacting (polymerizing) various quantities and ratios of acrylic monomers. Each acrylic monomer will contribute to different properties. Different polymer combinations are possible resulting in products with different and specific characteristics. Acrylic emulsions are tiny insoluble resin particles uniformly dispersed in water. The acrylic emulsions used for leather are film forming (i.e.) on evaporation tiny resin particles flow together to form a durable uniform film. Acrylics can be emulsified with other resin monomer class to form co-polymers. Normally acrylic polymers have good light fastness. Some of the parameters, which influence the performance of the acrylic emulsion, are particle size, molecular weight, film formation, viscosity and reactivity.

Particle size of the acrylic emulsion ranges from 0.07 to 0.25 microns. Smaller sizes give good penetration or impregnation, bigger size gives good filling and covering with pigments also. Though the size of the acrylic is tiny they have high molecular weights.

### **Polymer emulsions for impregnation**

Emulsions of smaller aqueous medium, these penetrate the leather surface instead of surface deposition. The object of this impregnation is to deposit the resin between the grain layer and corium thus strengthening the zone so as to overcome the tendency of loose grain and pipe break.

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To regulate the penetration, solvents and penetrators/drivers are used along with impregnating resins. Sometimes lubricating agents like sulphated oils are also used in small quantities depending upon the softness required.

#### **d) Wax Emulsions**

Wax emulsions are one of the most important leather finishing materials. Popular waxes are carnauba wax, micro crystalline wax, montan wax, shellac wax, paraffin wax etc., and other modern synthetic waxes of different hardness. In leather finishing, waxes as emulsions are used as aqueous dispersing agents along with other finishing agents to impart what is known as waxy feel in the trade. Hard waxes with high melting point are emulsified with triethanolamine soap and used in protein glaze finishing giving a pleasant waxy feel to touch. Tailor made protein binders containing casein and wax emulsions with or without oils capable of giving different characteristics like gloss, feel, smoothness, touch are marketed particularly for glaze finishing. Wax emulsions with or without oils capable of giving different characteristics like gloss, feel, smoothness, touch are marketed particularly for glaze finishing. Wax emulsions are particularly important in resin finishing helping release in hot plating. Leather which are finishing based on acrylic polymers when plated at pressure and temperature have a tendency to stick to the plates. The use of wax emulsions (low melting waxes) in suitable quantities along with resin binders reduces the tendency to stick on to the plate due to the melting of the dispersed wax and releasing the leather from the plate. This plate releasing wax dispersions should be used in optimum quantities as if excess used in bottom coats may no longer adhere properly.

#### **e) Plasticizers**

Binding materials like casein, albumin, gelatin etc., do not give films sufficiently elastic to withstand natural movements and flexing of the surface on which they are applied. The film has to be plasticized in sufficient quantities to prevent it from cracking and flexing. Sulphated oils are popular and most popular amongst them are sulphated castor oil (TRO). TRO is also used in making aqueous pigment pastes from dry pigment powers. In protein finishes, TRO acts as not only a plasticizer but also as a wetting agent. It promotes uniform flow of the finish on less absorbent leathers but on highly absorbent leathers, it may cause the finish to penetrate too deep. An excessive amount of plasticizer may make the film very soft, make the grain surface tacky and also prevent gloss. Wet rub fastness is also affected. Normally in finishes, weakly sulphated



castor oil, which is miscible with water is preferred to highly sulphated castor oil as besides one plasticizing effect, it does not have a pronounced setting effect.

#### **f) Preservatives**

Casein and other protein binders besides aqueous pigment pastes are required to be preserved against putrefaction. A small quantity of suitable preservative has to be used in stock solutions of binders, finishes and seasons to be used. The most commonly used are PCMC (CMK), sodium trichlorophenate, sodium orthophenyl phenate, sodium pentachlorophenate etc. About 0.5 - 2.0 gm of preservative upon the dry weight of proteinous material is required.

#### **g) Feel Modifiers**

Feel modifiers give the final finished leathers an excellent touch, silky, smooth and also this plays a major role in avoiding the removal of finish by tape test method, it also improves the dry and wet rub fastness. Feel modifiers have two ways of touch one is slippery feel and other one is waxy feel there are two separate products which can be introduced according to the final product of the buyer's sample.

#### **h) Cross Linkers**

Mostly cross linkers play a major role of physical properties in leather finishes but it is banned in the leather industries.

#### **i) Fixing Agents**

##### **Formaldehyde**

It is generally used as a fixing agent on protein finishes or on finishes where protein binders are added. If used alone, it is used along acids like acetic and sometimes with chrome salts and methylated spirit. Fixing is brought about by chemical combination of formaldehyde with casein to form a hard resin 'galalith'. A stronger effect of the formation is effected at low pH for which acid is used. A combination of 300 parts of formaldehyde (40%), 20 parts acetic acid and 680 parts water has proved to be more suitable mixture for fixing.

##### **Nitro cellulose (N.C.) lacquers and lacquer emulsions**

These auxiliaries are predominately used for the top surface coating of the already finished leathers (mostly polymer finished in order to make them glossy, remove tackiness and make water fast is resistant to dry and wet rubbing. As the name suggests the products are based on nitrocellulose i.e. nitration. Weak nitration gives more viscous nitro cellulose and as the viscosity increases, it has lesser filling power, better elasticity of the film, better crack resistance and less



gloss. Conventionally strong nitration gives niter cellulose of lower viscosity, more fullness, lower elasticity, high gloss and lesser crack resistance. In leather finishing normally nitrocellulose of viscosity 1/2 second to 20 seconds are used, to produce the effect desired on a specific type of leather. NC is not soluble in water but only in solvents.

### **Solvents for NC**

Solvents of high evaporation rate when used in making NC lacquers have more solvent action thereby decreasing the viscosity. If quick evaporating solvents are used alone they evaporate quickly and as evaporation cause cooling this lead to “blushing”. This is due to the fall in temperature during drying which results in deposition of moisture from atmosphere (humid) and subsequent precipitation of nitro cellulose. Quick evaporating solvents based NC products lesser gloss. Now evaporation solvents if used in excess take a long time in drying and also the film will be tacky. It may give more gloss. Evaporation period is a measure of volatility of the solvent and need not necessarily depend upon the boiling point of the solvent. Very often blend of low medium and high evaporating solvents is used along with diluents for dissolving nitro cellulose.

### **1.2.2 Types of leather finishing machine**

- Dry shaving
- Buffing
- Plating
- Ironing
- Embossing
- Dry drumming/milling
- Polishing
- Glazing/ Fin-flex
- Plush wheeling
- Toggling
- Plush wheeling
- Rolling
- Roller coating:
- Spray coating machine
- Padding

### **Pad coating machine**

Padding is a process of slight hand wiping or swabbing of a leather surface by finish dipped pad/a wooden block covered with absorbent fabric or plush/ as quickly as possible before drying of the finish. This work should be done on moving smooth rubber conveyor which is easily cleanable so as to prevent the soiling of the flesh side of the leather by surplus finishes. Padding can have different modifications as:

- Plush padding-done by a wooden block covered with absorbent fabric or plush called mohair. It is especially used for the thick bottom and pigment coats.
- Soft hair brush – it is mainly used for light top coating like shoe brushing.
- Sponge or cotton swab-sponge wrapped with finish permeable cotton fabric-mainly used for very light coats like staining and tipping.

This manual process is mainly used in chip labor nations and less automated tanneries. Actually, it needs skilled operators/padders/ in achieving a smooth finishes application without any pad marks or leaving excess liquid finishes which may ‘float’ due to differences of specific gravities of pigments when the leather is dried horizontally and thus causes undesired two-tone effects after drying. Related to this, as pigment particles have a tendency to settle, the finish should continually be stirred.

Of course, there is also automatic padding by which the finish is first sprinkled on to the leather by airless pressure and then the finish is uniformly spread or padded on the leather by moving or automatic padding arms fitted to conveyors.

Besides, in case of preference, padding is more selective to apply bottom coating on splits, strongly fatliquored and poorly absorbent leathers, like water proof leathers, from roller, curtain or spray coatings as the rubbing of finish on leather surface with the pad or brush can improve penetration and bondage. However, top coat seasons and lacquers are preferably sprayed. It also allows us to treat specifically to the much defected parts of the leather.

Its main limitations are that it may produce streaking effect and pad marks especially when the handlings of the pad and the finish are wrong; due to poor skill, carelessness and non-continual stirring. Still dirtiness of the flesh side may be a problem.

### **Curtain coating machine**

In this method the season/finish is applied to the leather while the finish is circulated continuously to avoid settling of parts with the help of constant pressure or pump and a set of conveyors. Simply

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curtain coater is a ‘flow coater’ machine like flooding. In other words, while the finish circulates continuously, part of it is applied to leather through slots/orifices forming full curtain and then the leather moves a certain distance in open air and then through a drying tunnel.

We can infer from this process that curtain application has the best advantages over other methods/like padding, spraying etc. / in waste reduction/due to finish circulation/, uniform application, higher rate of production and thicker film application. Thus, it is more economical and ecological tool. Unlike roller coater, it doesn’t have any difficulty to apply finish on leather which may have different thicknesses. Its weakness is that the finish applied by this method has lower adhesion than other methods.

It is evident that while the finish circulates, a considerable turbulence is created. Thus, a major duty will be the avoidance of froth/foam which may result in air bubbles entering to the curtain which causes instability and uneven coverage of the leather. Hence, float should be free from foam, bubble and possesses adequate viscosity so that it will not break the curtain abruptly by air whirls i.e. this stability of the curtain can be increased by increasing the viscosity of the finish. The other means to minimize foaming is to dip the feeding/sucking pump into the finish deeply in the storage tank not to allow any air pass through the hose and to apply or use an inclined apron fitted in the finish fountain. In addition application of anti-foaming agent in the recipe can help to reduce foam formation.

Besides, if the falling rate of the curtain/ season and the speed of the conveyors are exactly equal, the leather surfaces are uniformly coated with a layer of liquid film of finish while it passes through the liquid curtain. Higher conveyor speed than the falling rate can break the curtain; while the reverse condition can accumulate too much finish on leather surfaces. In this latter case, there may result in a higher hydration of the leather surface and hence swelling which in turn accentuates grain defect as well as consuming excess finish. So it is important to regulate the speed of the conveyor and the falling rate of the curtain.

Of course, the falling rate and the thickness of the curtain/amount of finish/depends on:

- The width of the slot in the pouring gate
- Height of the orifice of the slot from the leather surface
- Viscosity of the finish mixture and its compositions.

It is clear that the amount of finish applied to leather increases with the rate of flow from the slot and decreases with higher conveyor speed.

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Generally, a height of fall of about 20cm, a viscosity of about 20sec/in 4cmFord cup/ and a conveyor speed of about 30m/minute are suitable in most cases of curtain coating.

As the viscosity of some finish mixes may decrease due to continuous and vigorous agitation/ called thixotropy mixture, e.g. mixture containing polyurethane/, it should be checked frequently.

Relative to other methods, the amount of finish applied by curtain coating, as mentioned above, is higher (15-30g/ft<sup>2</sup>). But the drying of such a heavy wet coat can pose some problems. Related to this, too rapid high temperature drying may result in ‘skinning’ or film distortion or poor adhesion; on the contrary, slower drying can restrict the through-put. Thus to resolve such paradoxes, after curtain coating, the leather should move certain distances horizontally on conveyors before it enters the drying tunnel so as to allow the finish to flow-out evenly and settle properly at room temperature.

To summarize, curtain coating is particularly successful where absolutely uniform dosage is required, e.g. for impregnation of resins and for heavy gloss coating for patent or ‘wet look’ leather. But this intended uniformity of finish is more effective in normal corrected grain or for slightly snuffed leather. That is, it may not be suitable for leathers like splits which are too hungry or not sealed, as they have higher absorbency and hence causes non-uniformity of coats nor full grain leather which has poor absorbency and hence impairs uniform flow-out of the finish.

### **Dry shaving machine**

Dry shaving or crust shaving is preferred for exact adjustment of the final thickness and uniformity throughout the area, especially for very thin nappa garment, dress glove and suede leathers made from the skins of small animals. This can give not only a chance for retaining the required substance and thickness , which may be lost during wet shaving, but also, additional softening of the leather due to the racking/toggling and stretching effects of the cylinder of the dry shaving blade. In this type of machine the shaving blades are and should be arranged very closely twisted together on the wider working width of blade cylinder in order to achieve a uniform, fine and smooth cut on the leather. There also should be dust exhauster attached to the shaving machine to control and manage the dry shaving dust. Thus, the advantages of dry shaving/over wet shaving/ include:

- More precision in thickness and thickness uniformity
- Convenient to handle during work/wrapping and creasing problems over the

- shaving blades are reduced due to the stiffness of the dried crust, which are the serious problems in wet shaving/
- The shaving blades can give the staking and toggling effect/softening and stretching/ which are important for soft leathers.
- Unnecessary untimely/before fatliquoring/ fiber stretching/causes unattractive appearance/ of the flesh side occurring during the wet shaving can be reduced.

If the thickness of the crust leather is not uniform throughout the area, both the mechanical and chemical effects of finishing like staking, glazing, pressing, ironing and season application, say by roll coating, will be non-uniform on the ultimate leather surface. Thus, even buffing operation of flesh side/before grain side buffing/ can be applied to solve those possible problems, besides dry shaving.

### **Buffing machine**

The buffing operation consists of the grinding of leather surface with an abrasive and is a kin to sand papering. Other terms related to buffing include fluffing/removal of excess flesh and adipose tissues/ and snuffing/finer buffing on grain side to remove surface blemishes and to get more uniform surface, to which pigments and other finishes can be applied/.

It is performed by means of cylinder-type buffing machine or cylinder-type through-feed buffing machine. Both types have two cylinders. One of which called, buffing cylinder, has a larger diameter and is covered with sand paper.

The other is rubber-covered contrast, called elastic back-up roller, which is soft enough to absorb all the small thickness differences in the surface of the hides. This rubber covered cylinder presses the leather against the abrasive/buffing bcylinder while both cylinders rotate in the same direction, and hence performing buffing. As it is known, buffing papers or abrasive papers are natural glued or synthetic resinoid bond aluminum oxide abrasive backed /supported by a special coarse or rough paper. Buffing papers are graded by the size of the grit/sprinkled sand.

Thus the grain sizes of these abrasives are standardized numbers and the aggressiveness of the buffing effect is increased as the distance between the granules increased on the paper. Fine light buffing is done by using fine grit abrasives, by reducing the pressure or using pneumatic/air filled pressure/ feed roller. Still, wet buffing at high pressure may be used especially for goat suede with very fine paper/ to achieve very fine nap or velvet nap/, though the wet leather or conditioned leather which is very soft and sufficiently plastic to accommodate irregularities in

thickness or hardness. There have been several developments in papers, such as sanitizing, whereby very sharp pieces of grit are eliminated, and in bonding techniques to allow buffing in damp leather./Usually buffing is carried out on the dry leather which gives a cleaner, sharper ‘cut’ on grease free leather/. Note also that the effectiveness of the buffing paper is reduced mainly not because of the abrasive material loses its cutting capability, but because the fatty substances contained in the removed organic materials remained stuck to the emery paper and clogs up the space between grains.

The standard grain sizes available in the market include: 60, 80, 100, 120, 150, 180, 240, 280, 320, 360, 400, 500, 600, 800, 1000& 1200. However, the common grain sizes for leather making are 180, 220, 280, 320, 400, 600 and 800.

Purposes:

- For refining and smoothening the flesh side of crust for making velour items.
- For completely removing the grain to obtain soft, opaque surface for making nubuck items
- For removing a more or less significant amount of surface material from low quality hides, depending on the grain size of the sand paper, for eliminating the hide defects..

### **Plating machine**

It refers to pressing the leather against the smooth, polished and heated steel surface with relatively higher pressure. It is mainly for flattening out of the leather grain with no print effect. In practice, leathers which demand high pressure/up to 250bar or 250kg/cm<sup>2</sup>/ at comparatively low temperature/40-70 oc/ are generally pressed; say by rotto press machine which has the advantage of smoothening or fiber compressing as well as glossy effect. Before plating the leather must be dried otherwise, the grain will be mottled. For light plating vacuum drying machine/kiss-plate type/ can also be used, say, for slightly sealing of the leather before finish application or to restrict the finish penetration. In plating, a smooth, polished surface is used and the humidity and temperature causes the leather to flatten out permanently, though the degree of gloss and flatness varies according to the type of finish or retanning. Note that plating/pressing and ironing are intermediate and final operations in the building up of the finish film and can help facilitate the plasticity or adhering of the resins to the leather. Besides, plating machine can give the nearest alternative effect to glazing and polishing machine and doesn’t need the same

amount of skill for operation. Actually, the new through-feed plating machines have at least two rollers mounted on revolving turret/tower for automatic changing; one for polishing and pressing and the other for embossing or ‘false graining’. The mechanism of pressing or plating by this through-feed machine is somewhat similar to through-feed sammying machine as it uses different heavy rotary rollers.

### **Ironing machine**

Ironing is done at low pressure, but with high temperature, say by fin flex machine, to give the final finished soft, a shiny appearance and pleasant feel. The relatively higher temperature may give improved flexibility/plasticity of film and hence softness. Thus, the ironing process can provide the grain side with a final touch that makes it smoother by calendaring and polishing of specially very thin and soft nappa to completely eliminate the typical ‘roughness’ of the leather pores, hence giving it a higher polish and brighter colors. The mechanism of ironing is somewhat similar to setting out operation as it has a spreading roller, besides chrome plated heated polishing roller, and pressing roller coated with felt sleeve/cover. In rotary-ironer/fini-flexer/, the speed of the feed roller is one process variables, as well as temperature and pressure. Thus, rotary ironing gives the leather a smooth, glossy surface and softness by the combination of temperature, heat, pressure and friction which are caused between the faster moving of the heated cylinder and slow moving leather. The optimum temperature of the heated blade is between 70-100 °C.

### **Embossing machine**

It is the process of pressing the leather surface against a raised, patterned, hard, hot steel surface that makes the fiber structure of the leather distorted, and on release, it retains the mirror image of the hard patterned surface. It is to graining or coarse patterning with highlighted print, though it includes hair-cell or somewhat smooth prints. In this case, very high pressure at elevated temperature and relatively for a long period of time and flattened felt with less cushion effect is required; though the result/print retention is mainly depend on the retanning effect of the leather and its thickness. Besides, leather at normal moisture content/14%/ becomes more plastic towards finish at high temperature, embosses better and retains the print better than when is damp/wet conditioned. Note also that print retention/embossing can be pronounced at higher moisture/~22%/but should be at lower or intermediate temperature/<70°C/. However, if temperature and humidity increases simultaneously the reverse can occur, i.e. no good print

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retention occurs. Besides, vegetable tanned leather/firm leather/ is more suitable for embossing than the elastic natural full chrome tanned leather, which requires higher pressure, temperature, humidity and longer dwell time. The softer the leather, the easier it is to emboss but the less permanent the print to the subsequent flexing or handling operations, say, when shoe lasting or wearing. For embossed finish impregnation is eliminated as grain break is not significant. There are hydraulic flat embossing machines or engraved through-feed roller types.

### **Dry drumming/milling machine**

This operation with the fast revolving (~20rpm) drum having several pegs & shelves is increasingly used to produce very soft leather with a relaxed surface appearance or grain break/special grain design/ , i.e. dry drumming breaks up the surface appearance and hides the defects underneath as well as unloaded appearance, i.e. a less plastic and more natural look. It also helps to intensify or brighten color shades for velour and suede due to the heat effect developed especially at full load. Grain break is the way or the appearance of the leather in which the grain of the leather wrinkles or creases when the leather is folded grain inwards, as occurred in the vamp of the shoe while flexed or at working or handling.

This process could be applied for upholstery, garments or casual/sports/ shoes like floater and softy uppers. There are degrees of development, with dust extraction to clean any fibers from the atmospheres and to control temperature and automatic moisture conditioning units, when needed. This steam dosing/conditioning unit is used for lightly moisturizing the leather being drummed and hence facilitates the softening operation.

### **Polishing machine**

It is done with a fast revolving chrome plated cylindrical grooves made from stone, felt or resin roller and used on all types of hides and skins. Both can flatten the grain, increases the glossy and softens the leather due to the pressing, racking and staking effects, by applying it before and between different finishing coats. But felt polishing is softer and kinder to the leather and is more usual on fragile grain structure. However, stone polishing is used on harder grained leather like goat and camel. Though the latter has a greater grain flattening effect, it may cause grain looseness. There is also grooved wool roller polishing machine with longer working width especially for hides.

Rubbing-off polishing is the variant of normal polishing, with a hard brush cylinder so-called “buffing wheel cylinder, mainly used for ‘brush-off’ leather products in the shoe industry.



Usually polishing or glazing is followed by rotary pressing or finiflex ironing at high temperature to increase the gloss and give a settled appearance.

### **Glazing/fin-flex machine**

Glazing is a process of smoothing the protein –finished or non-thermoplastic finish coats on the leather surface by freely rotating or oscillating steel roller or a fixed glazing glass or agate cylinder held in a clamp. The thermos plasticity of finish, is important so as to stand up the friction of glazing or melting of finish. Thus glazing can produce a high gloss effect due to the smoothing out and flattening of the grain surface by the glazing pressure, especially easily for vegetable tanned or semi- chrome tanned leather which is well shaved or buffed flesh side. It is done stepwise from low pressure to high pressure, i.e. from grain flattening to glazing. Glazing can accentuate the natural appearance of the grain and hence is the type of aniline finish /no pigment/, say for glazed-kid finish. Leather to be glazed shall not be over-fatliquored on the surface zone. Besides, uniform thickness, dense fiber texture, slight stiffness and flatness of the leather are the four main requirements of better glazing as well as the hardness and thermal resistance of the finish and perfect drying of the finish film before glazing.

### **Plush wheeling machine**

The leather is polished/brushed/ by holding it against a cylinder covered with velvet plush/ a cotton or wool base/ revolving at about 300rpm. This method is mainly used for leathers with a high natural gloss, e.g. dress glove. There is also a felt wheeling by which a running cylinder at about 600rpm is covered with a hard, compressed felt sleeve. Then, the skin is polished while the skin is held firmly over the cylinder and the heat generated by the friction brings the oil from the skin to the surface and produces a very deep luster.

### **Toggling machine**

Its purpose is to stretch and flatten the dried or milled leather into its normal possible area. This gives the leather about 10% more area yield than that of only hung dried leather. Besides, it prevents finish film opens-up/grinning/ or crack while the finished leather is stretched at any encounter as it has already been well flattened before the application of finish. It also helps us to improve the grain or leather smoothness and dimensional stability as it is done at higher temperature. It can be used for upholstery, side clothing, splits, lining and any softie leathers, except dress gloves which need running. Always take care to avoid unnecessarily trimming or area loss caused by improper use of the clips.

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## **Rolling machine**

Vegetable leather especially soles are rolled first at moderate pressure and finally at heavy pressure (50,000kg/cm<sup>2</sup>) under a hydraulically operated rolling or oscillating machine to give the leather a strong solidity and water impermeability or resistance due to the stiffness of the rolled grain and due to the effect of some amount of emulsified fat for better gloss and elasticity of grain. A moisture content of about 22-24%, not the normal crust moisture content, is recommended for rolling to get more flat grain.

## **Roller coating machine**

Roller coating is the process of finish transferring on to leather by a roller whose surface has been impregnated a prime coat of finish or color. The surface of this roller actually has a honeycombed cell that permits it to pick up and transfer the required amount of finish. Thus the volume or size of the honeycomb cells is one of the factors that limit the amount of finish to be applied to the leather for covering. Degree of covering is the amount or level of finish/pigment/per unit area of leather. It is the most economical/least wasteful method and/ and most productive.

## **Spray coating machine**

Spray coating is started with a fixed booth and manually or automatically operated guns. Generally, spray gun is a finish applying equipment with three main controls: fan shape, amount of finish and mixed air, which are to be dealt latter on in detail. The use of spray gun can be resembled to using a very flexible, very even; hairless continuously supplied” paint brush”.

Types of spray machines

- Based on Automation:
  - ✓ Hand or manual spray/gun/
  - ✓ Automatic spray/gun/
- Based on Direction of Motion:
  - ✓ Rotary or carousel spraying
  - ✓ Transverse spraying

## **Weighing balance**

A weighing balance is an instrument that is used to determine the weight or mass of finishing chemicals. It is available in a wide range of sizes with multiple weighing capacities and is an essential tool in laboratories.

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### 1.2.3 Finishing tools and equipments

#### Cart and trolley

Cart and trolley is that cart is a small, open, wheeled vehicle, drawn or pushed by a person or animal, more often used for transporting goods and chemicals from one station to other station.

#### Buckets, jugs,

Is a container used to hold fluid or transfer fluid from one container to other in small amount?

#### Cutter/knives

Is tool used to cut trim material specially in finishing operation and.

#### Viscometer

A viscometer (also called viscosimeter) is an instrument used to measure the viscosity of a fluid. For liquids with viscosities which vary with flow conditions, an instrument called a rheometer is used to measure drag caused by relative motion of the fluid and a surface is a measure of the viscosity.

#### Padding Sponges

Padding Sponges constitute the phylum Porifera, and have been defined as sessile metazoans (multi celled immobile animals) that have water intake and outlet openings.

## 1.3 Preparing finishing formulations for different types of leather products

### Why and what additives in finishing formulation

#### In the season formulation:

- **Oils**/~10-25% on weight of binder/ e.g. sulphated castor or linseed bases, can lubricate the binder though it is not true plasticizer. But the flexibility of natural water base binders .e.g. casein and albumen can be increased by increasing the amount of the true plasticizers, in this case water.
- **Waxes** /~5-10% on weight of binder/ e.g. carnauba, paraffin and other synthetic waxes emulsified in water with stock solution containing 10-15% solid wax can give wax feel, fill the grain, reduce tackiness and sticking to hot glazing or polishing disk, hot plating and embossing plates etc./ N.B. As these waxes are emulsified in water, they don't have any water repellent effect, if not accelerating absorption. /

- **Flaming dyestuffs** /~1/2% on volume of finish/ can be used. These types of dyes are anionic in charge with high color values or intensities, rather than covering, and miscible with binders with the help of glycols or ethanol together with water, high solidity to water drops and light.
- **Formalin/formaldehyde in water**/: 5-10% formalin, on weight of binders, is used for fixing the season of all water soluble binders which have no fastness to subsequent washing and rubbing. This fixing agent should be used together in the season mix to get better fastness, if the finish can be used immediately; otherwise, sprayed later alone to prevent precipitation. Then, air-off cool before hot drying to reduce the volatility of the formaldehyde. Other fixing agents are acetic acids/as casein is acid insoluble/, and chrome salt and cationic resins. Formaldehyde is nowadays not recommended to use due to environmental and safety reasons.

### Application of the season and process of formation

Thus, season or film formation is always started by wetting of the surface fibers. That is higher wettability of the leather surface means higher surface charge of leather and/or higher concentration of the binders and hence high precipitation or film forming on the surface. Note that buffing can increase the immediate wettability of leather fibers to form surface film than penetration, of course, if there no unnecessary open –up of fibers by over-buffing or scuffing. The other method to increase fast wettability, especially for synthetic binders, is using surfactants, like glycols or ethanol, though it needs care while selecting them and the amount used as otherwise they may make the leather permanently wettable and hence poor wet rub fastness. On the contrary, there is no fast wettability means there will be a chance of penetration of binders through the capillaries of the hair follicles and scuffed parts which in turn causes less gloss and highly stiffed leather. That is, while applying, if the binder in the solution is absorbed by the leather surface together with the solvent and the binder remains in solution, the bulk of the binder will be taken **below** the leather surface and leaves little surface film. This resulted in poor gloss. On the other hand, the leather becomes hard due to the sticking effect on fibers below the surface, as impregnation does.

But when we say “fast wettability” it is relative and a time factor is important in that the binder solution must be evenly spread over or flow-out on the leather surface before coagulates superficially.

### **Example**

**Acidity** in chrome crust leather/PH~4/ can cause coagulation or gelling of the anionic casein and many dispersion binders. This limits the penetration of binders and then can lead to good surface build-up i.e. film build-up to give shiner or glossier season.

**Top coats fall into three categories:**

**Solvent lacquers/SL/:** can be diluted only with organic solvents, especially by esters and ketones, like butyl acetate and can form true solution than emulsion and gives good luster and dry drumable film. The components or ingredients can include NC or PU lacquers together with some feel modifiers like silicones.

**Emulsion Lacquers /EL/:** It is self emulsifiable and can be diluted either with water or with organic solvents but with same ingredients as above, SL. However,EL has the following limitations:

- Less fast to wet rub than SL
- Slower drying film or needs more energy
- More expensive and
- Not stable, unlike SL, in the ready-to-spray formulation Still they are ideal:
- For clothing leather where light coats are preferred
- For intermediate/inter-coat sprays/ to prevent sticking of the base coat while plating, piling, printing, dry drumming etc.
- For transition materials/coats/ when moving into water based coats

**Aqueous Emulsions or Water Based Top Coats:** can be diluted only with water or water miscible solvents. The main ingredients are aliphatic PU resins, polyacrylates and some protein bases with cross linkers. In the mix acrylates can enhance adhesion and PU wet and light fatness and feel properties. PU is the most expensive type of top coats, usually applied by roller coater due to its higher viscosity and expensiveness, unlike the above lacquers/SL&EL/ which are preferably applied by spaying method. Besides, some amorphous compounds like waxes and silicones can be added to improve matting, feel and still other rheologic auxiliaries.

Cross-linkers are absolutely necessary in this system for increasing the molecular sizes of the polymers through reactions that, in turn, destroy or block the hydrophilic groups present on the polymers that affect the wet fastness of leather, by neutralization; and most importantly, the adhesion of film to the leather increases, too. Note that over-cross linking may harden the film and cause film crack.

These cross-linkers can be categorized into two on the basis of film drying rate or time required to complete cross-linking:

- **Carodiamides** that require about 3-4 days cross-linking period and are more suitable for covering or base coat layers
- Aziridines and isocyanates that require only short period of time to dry and are suitable for top coat films.

Lacquer coating is one of the most hazardous steps both safety-wise and in environmental issue in tanneries due to the use of different solvents /VOC/ and cross-linker.

### Model finishing formulation

#### I. Aniline

**Input: goat crust**

**Grade: I-III**

**Finishing Type: classic**

Table 1 **Aniline**

Chemical/ Product	Coat type					Finish application and mechanical finishing techniques
	1.Dye stain	2.pre-base coat/ (A <sup>+</sup> or A <sup>-</sup> )	3.polishin g	4.lacquer	5.handle/ touch	
Water	850-500	780-630	710-470	500	720	1.2x spray, dry
Dye/pigment	50-250	0-50	20-50			2.1x spray, dry,
Penetrator	100-250	20-70	20-50			plating
PU		100-150	50-100			3.2x spray, dry,
wax		80-100	50-100		250	stone polish
oil		0-50				1x spray, dry, ironing
casein		20-50	70-100			4. 2x spray, dry
RA			80-100			5. ½ x spray, dry,
NC emulsion						fini-flex

diluted/glossy modifier			0-30	500	30	
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\*A<sup>+</sup>= cationic, A<sup>-</sup>= anionic

## II. Semi-Aniline

Input: hide crust

Grade: IV

Finishing Type: brush-off

Table 2 Semi-Aniline

Chemical/ Product	Coat type				Finish application and mechanical finishing techniques
	1.adhesive (A <sup>+</sup> or A <sup>-</sup> )	2.semi- pigment	3. luster effect	4.color effect top lacquer	
Water	700-630	610-440		680-450	*snuff, if necessary
RA	250-300/PU1	150-200			1.1x RC, with add-
Penetrator	50-70				on~25g/ft <sup>2</sup> , leave
PU2		150-200		20-30	o/n
Light color pigment					Vac.
/mainly organic		50-100			plate@60°C/1'
wax		40-60		60-80	2.2x RC, dry,
PU3/undiluted,					sandblast/hair
possibly compact			980		cell@80°C/40bar
Dye/light color			20		2x RC, dry
NC/dark or black				150-180	3. 2x RC, dry
NC/Matt				170-200	4. 2 x spray, dry,
Pigment/dark				15-20	brush-off, felt
Dye dark				5-10	polish
modifier				0-20	
cross linker				0-10	

## III. Pigment Finish

Input: hide crust

Grade:

Finishing Type: corrected grain smooth

Table 3 Pigment Finish

Chemical/ Product	Coat type				Finish application and mechanical finishing techniques
	1. Impr.	2.pigment base coat	3. effect/ intermediate	4.top	
Water	650-550	430-300	650	490	*buff, with 280 and 320 respectively & well dedust  1.1x RC, with add-on~25g/ft <sup>2</sup> , leave o/n, Vac plate@70°C/2' & rebuff with 400 grit  2.2x RC, having vis~25 sec. with add-on ~8-12g/ft <sup>2</sup> , dry,& with~6-8g/ft <sup>2</sup> respectively and rotor/plate @90°C/50bar  3. 2x spray, dry, smooth iron@110 °c/250 bar  4. 1 x spray, with add-on~3-4g/ft <sup>2</sup> , dry, rotto press
RA1	250-300				
Penetrator	100-150				
RA2/NH <sub>3</sub> thickenable		150-170			
BU		150-180			
PU/water resistant		30-50			
PU/scuff “		50-70			
P/casein		0-50			
Pigment/covering		150-200			
Filler/wax+non wax/ NH <sub>3</sub> (50/50)		40-60			
		0-20			
NC/emulsion lacquer			300		
Water miscible solvent/alcohol			50		
NC/Water base				490	
Handle modifier				0-20	
Cross linker				20-30	

When you formulate a finishing recipe, consider always not only parts per weight but also the solid content of the main ingredients, especially the binders and pigments.

When you reformulate the main ingredients or parts from the existing formulation, the proportion of water or solvent will also automatically be changed. That is, if the existing formulation of impregnation is 650, 250 and 100 parts of water, RA and penetrator respectively, but you now decide to increase the RA to 300 part, you are expected to reduce the water part to 600, too.



## Self-Check

**Directions:** Answer all the questions listed below.

### Instruction

#### I Choice

- Which one of the following is protein finish?  
a, aniline      b, semi-aniline finish      c, glaze finish      d, all
- This finish is primarily based on polymer emulsions and top coated with lacquer.  
a, Resin Finish      b, Glaze Finish      c, Lacquer Finish      d, all
- The object of finishing is to give a treatment of coatings to the grain surface to protect it against dirt, staining, wetting, mechanical stresses like rubbing, scuffing, flexing etc.  
a, true      b, false
- Which one of the following is finishing chemical?  
a, Pigment paste      b, Dye solution      c, Binders      d, Plasticizers      e, none
- It is the process of pressing the leather surface against a raised, patterned, hard, hot steel surface that makes the fiber structure of the leather distorted, and on release  
a, Embossing machine      b, Roller coating machine      c, Spray coating machine

#### **II, Matching**

##### A

- Finishing
- Lacquer Finish
- Buckets, jugs
- Toggling
- spray machines

##### B

- Coatings to the grain surface
- finishing machine
- Transverse spraying
- Finishing tools
- Nitrocellulose or cellulose nitrate

### **III Short answer:**

1. When develop the top coat in aniline finish what are chemicals that used for formulation?
2. How you going to prepare crust leather for finishing?
3. When develop the top coat in semi- aniline finish what are chemicals that used for formulation?
4. When develop the season coat in semi- aniline finish what are chemicals that used for formulation?
5. When develop the top season coat in aniline finish what are chemicals that used for formulation?
6. When develop the base coat in semi- aniline finish what are chemicals that used for formulation?
7. What is the purpose of glazing machine?
8. What is the purpose of ironing machine?

## Unit Two: Operate machines to produce finished leathers

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

- Machine setting and adjustment
- Work place procedures and OHS practices
- leather finishing machine
- leather finishing machine operation

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:

- All necessary settings and preparation for machine operation are identified and assessed in accordance with specifications and workplace procedures
- Leather is fed through or into the machine in the appropriate manner and in accordance with workplace procedures and OHS practices
- Machines operated safely and any malfunctions are reported

## 2.1. Machine setting and adjustment

### Preparation of leather for finishing:

- The absorbency of full grain leathers is generally poor and not uniform throughout the entire surface area.
- Grain cleaning is done by brushing with dilute ammonia or dilute acetic acid. Ammonia is used only when the absorbency of leather is poor because of presence of oil on the surface. It increases mechanical bondage of the season and also gives rise to wrinkled grain surface after finishing.
- Acid cleaning increases the cationic nature of leather surface. Flow of anionic season on the surface decreases and the season remain on the leather surface being firmly fixed by specific bondage.
- If the leather surface is not too absorbent, then the leather is plated under hydraulic press at elevated temperature (900 C) but low pressure.
- If the leather is moderately absorbent then the leather surface is polished under rotating stone polishing machine. Such polishing has a tendency to make the leather loose.
- Too absorbent type of leathers is generally glazed under glazing machine.
- Trimmed leather properly before finishing to avoiding machine damage.
- Handling and piling of leather should be done proper way.

### Machine setting and adjustment; Roller coater

The first aesthetic operation that the leather undergoes is coating .This operation covers the grain side with one or more, more- or- less thick coats of pigment, depending on the degree to which the grain side needs to be coated



Figure 2. 1 *Roller coater*

By this application finishing is uniform and homogeneous. The leather is spread on the feed table. The finish film fixes on the leather with a strong mechanical action, binding it too firmly to the base of the leather. The film is continuous and follows the surface of the leather keeping the same thickness, even if there are significant variations in the leather substance. Deep defects including cuts can be well filled. Using the appropriate cylinder the range of cover obtainable is between 4 gms /sqft to a maximum of 15gms/sqft according to the article obtained. Reverse coating is used for impregnation, the application of adhesives, basecoat, lacquer hot oils and waxes (with heated cylinders), foam finishing and any type of padding. Reverse cylinder engravings are positive, shaped like truncated pyramid with a larger internal base and a smaller upper face. The product is deposited by the doctor blade in the depressions formed by pyramid base shoulders from where it is transferred to the leather and spread evenly by the face of the pyramid. The quantity of product deposited can be controlled by varying the speed of the cylinder.

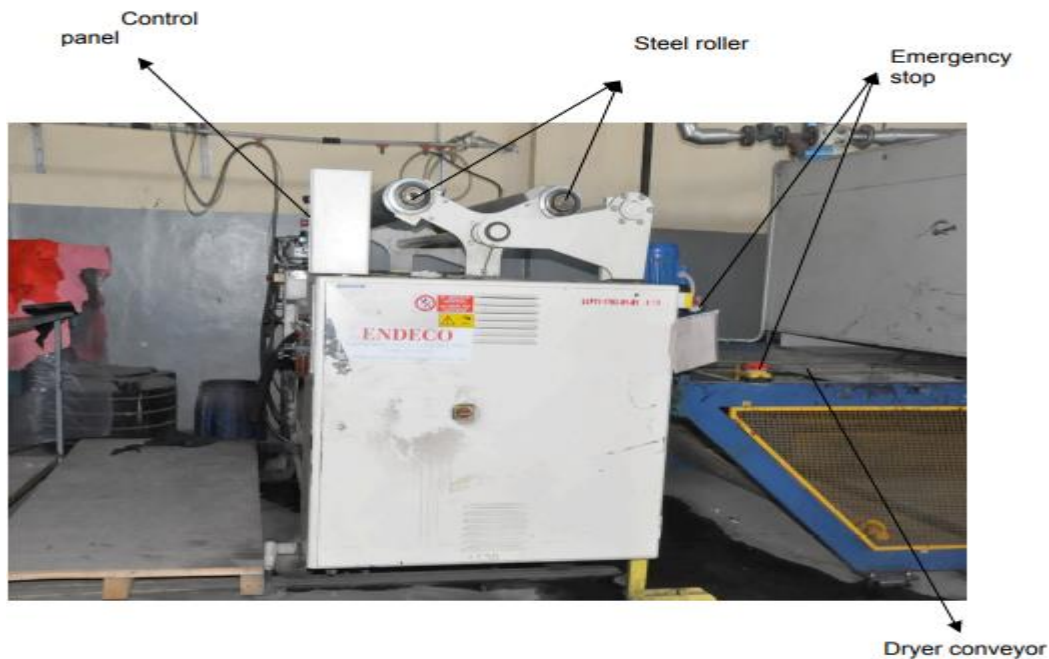
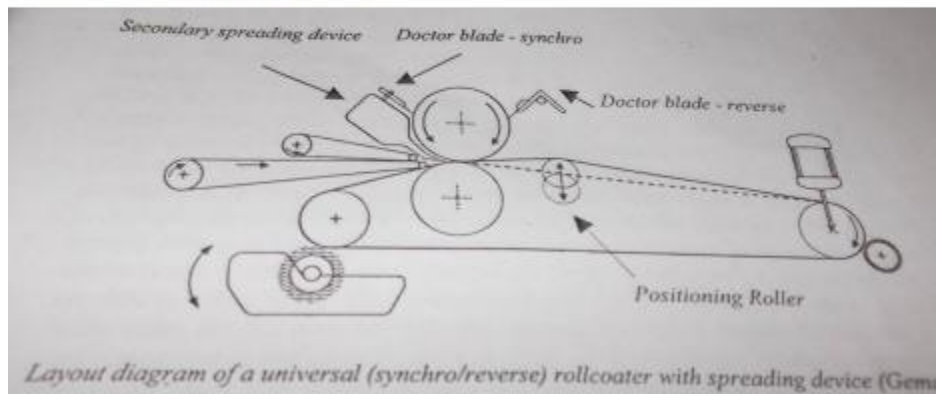


Figure 2. 2Parts of roller coater

#### ROLLER COATER (SIDE VIEW)

##### Cross section-roller coater



**Note;** for other leather machines refer 2.3and operation sheet one this unit.

## 2.2. Work place procedures and OHS practices

### 2.2.1. Work Place Standard Operating Procedures of Finishing Machines

Putting company procedures down on paper can no longer be avoided. With increasing requirements for compliance to quality standards such as ISO 9000, companies need to document

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their operating procedures. The process of documentation can be either a dreaded burden or if properly planned, just another task to be completed.

Unlike other forms of writing, standard operating procedures are written from a technical perspective.

This means they must be:

- Clear and concise—getting directly to the point and avoiding wordy sentences. Standard operating procedures should be communicated in the fewest possible words, phrases, and paragraphs.
- Complete—containing all the necessary information to perform the procedure,
- Objective—containing facts, not opinions, and
- Coherent—showing a logical thought process and sequentially listing all steps necessary to complete the procedure.

### **Standard operating procedures**

Standard operating procedures can serve as benchmarks for performance reviews, training aids, or in the case of quality standards, a starting point for improvement

Following tips may help while writing standard operating procedures:

1. Always have a specific reader in mind. You should know the type of person who will be reading the procedure. When you know the level of experience of the reader, you can tailor the writing accordingly.
2. Before starting to write, decide the exact purpose of the procedure. For instance, will the procedure serve as a detailed tool for training purposes, or as a summary to provide a periodic refresher? Once you have decided the exact purpose of the procedure, make sure everything you write contributes to that purpose.
3. Use the principle: "Tell readers what you are going to tell them, then tell them, then tell them what you have just told them." Quite simply, this means starting with an introductory paragraph that briefly describes the procedure. This is followed by a complete description of the procedure, using the most appropriate writing technique (paragraphs, bullet points, and so on) to communicate key aspects of the procedure. Finally, a concluding paragraph should be written that summarizes the main points covered.
4. Make an outline of the procedure prior to writing. The purpose of an outline is to establish an orderly relationship between groups of activities. An outline provides a framework for any

documentation. When writing an outline: Make a list of topics to be covered. The order is not important; just don't omit anything that you feel is appropriate to the topic. Decide on major groups. Groups may include introduction, responsibilities, safety issues, operating characteristics, background information, and summary. Insert the topics under the appropriate major group.

5. Write the rough draft. Keep in mind that a good procedure is rarely achieved on the first draft. Write rapidly, ignoring spelling, punctuation, and grammar. Write as you talk so you can maintain a train of thought. Write the draft with the outline in front of you to serve as a guide.
6. Revise the draft. Wait 24 hours before making revisions. Revising too soon is less effective because the writer often sees not what is on the paper, but what was meant. Examine what the sentences say, and then be willing to rewrite every part of the procedure.
7. Write the final draft. Incorporate all of the latest revisions.
8. Watch for your own boredom. If you become bored as you are writing, there is a good chance that readers will also.

### **Pitfalls**

In addition to the preceding tips on writing standard operating procedures, there are pitfalls to avoid, including:

- Vague, meaningless words,
- Excessive words to describe an activity,
- Long, complicated sentences or paragraphs,
- Acronyms, abbreviations, slang, symbols, or other shortcuts of expression that are not clearly defined for the reader,
- Repeating the same points too often, and
- Assuming conclusions are obvious to the reader. Many people do not like to write; however, anyone can write standard operating procedures if they understand the mechanics of the procedures and employ some of the tips previously discussed.



### 2.2.2. Safety Instructions

Safety must be taken into account right from the design stage and must be kept in mind at all stages in the life of a machine: design, manufacture, installation, adjustment, operation, maintenance and eventual scrapping.

Do not operate any machinery without complete and clear instructions from your supervisor. It is his/her responsibility to make certain that each employee knows and understands the proper operation of the machine as well as any potential hazards involved. If you have any questions or doubts what-so-ever about the hazards or operation of any machine, do not run it before your supervisor has answered your questions.

Since machine-related accidents are usually very serious, any written rules or supervisor's directions which are not explicitly followed will result in strong disciplinary actions.

#### Machinery Safety

1. The motor safety switch must be OFF before you work on a machine. The safety switch should be locked and tagged off, if the machine should not be started. This is the only way to prevent an accident if someone should accidentally brusher press against the starting button or lever.
2. No machine should be oiled, cleaned or adjusted while it is in operation unless specific provisions have been made for this purpose.
3. Safety devices should not be by-passed, blocked or tied down.
4. The safety interlock should never be used as a starting device.
5. Guards are placed at all hazardous points on the machine. They must be in place when the machinery is in operation. When this is not the case, a supervisor signed Danger Tag with printed operating instructions must be posted on the unguarded area and on the safety switch. The department head and safety officer must be duly informed.
6. If, of necessity, a guard must be removed and the machine power operated, keep a safe distance. Never attempt a repair or adjustment in an area that cannot breached safely.
7. Don't make any alterations on your own. Tell your supervisor if you feel a guard needs changing.
8. You may make only those operating adjustments stated in the machine operation instructions. You must shutoff the safety switch and lockout the MCC (motor control center) if you are going into an unguarded area.

9. When you leave your machine, shut OFF the safety switch. No machine should be left running unattended unless specifically designed for that purpose. If the machine should not be operated, be sure to tag and lock the safety switch OFF.
10. Wait for the machine to stop! Do not try to slow down or brake a moving machine by hand or with a makeshift device. If there is a problem, notify your supervisor. He/she will inform the proper authorities.
11. Before clearing a jam, be sure to turn the safety switch OFF unless there are other written procedures from the Safety Department.
12. Make sure everyone is clear of the machine before you start it.
13. Adjusting tools or keys should not be left in places where they can fall, slide or be thrown into the machine when it is started.
14. Only use those machines and equipment for which you have been trained and authorized.
15. Do not wear jewelry, gloves, neckties, long sleeves or loose clothing around machines. Hair should not be loose or straggly. Revolving shafts can catch onto these. Extreme caution is always necessary around running machinery.
16. Machines should always be clean and free of rags, tools or other devices. The floor around the machine must be clean and dry to avoid stumbling, slipping or bumping. Use the proper brush, hook or tool to remove residue such as chips or shavings. Never use your hands or an air hose. Transparent guards must be clean at all times. Do not use pins, projecting set screws, etc. on rotating parts unless properly guarded.
17. Use special tools such as pliers, push sticks, hooks, etc. Keep fingers and hands clear of operating surfaces.
18. Report all hazards to your supervisor.

### **2.2.3. Safety Guidelines for Working with Solvents, Resins and other Chemicals**

1. Learn about the chemicals that you are planning to use before opening them. Read the instructions and MSDS (Material safety data sheets).
2. Use water-based cleaners instead of solvents where possible.
3. Avoid skin contact. Wear latex gloves.
4. Work in a fume hood if possible. Respirators are available when necessary.
5. Do not use solvents around hot metal surfaces and flames.
6. Do not smoke or light flames in areas where solvents are used and stored.

7. Report and clean up any spills immediately.
8. Do not pour any chemicals down the drain. Waste containers are available in the solvent cabinet.
9. Only use solvents in well ventilated areas - do not work with them in confined, unventilated areas.
10. Do not drink alcoholic beverages or take medications containing alcohol before or during working with solvents. Alcohol in the bloodstream sometimes causes synergistic reactions with various solvents that can lead to loss of consciousness, and even possibly, death
11. Report any ill effects and skin disorders to the area supervisor.
12. Develop and maintain good personal hygiene habits. Remove protective equipment and wash thoroughly after contact with solvents.
13. Fumes from paints, solvents, adhesives, and the abrasive cut-off saw used on the patio can drift into the shop. Work with staff to minimize these problems.
14. Mix resins in small batches

## 2.3 Leather finishing machine

### Safety aspect of finishing machine

In order to maintain the highest level of safety and efficiency in the work area, it is necessary to conform to standard work practice behavior. When working with equipment of any kind you must be aware of the potential for injury and observe behaviors that will eliminate risk.

Organization and planning are fundamental aspects of safety.

### Work Behavior

Please observe the following in the work area. You are using a shared space, so sensible and considerate behavior will enhance the community experience.

- Do not rush. Be organized and plan in advance what equipment you will use
- Plan the type of work activities you will be engaged in
- Respect others' space and working time. Distractions cause accidents
- Keep your working area tidy and organized.
- Ask questions about equipment and technique. If you are unsure, request individual help

- Do not run or move quickly in the space
- Be aware of who is using what, and the location of others in the room
- Concentrate when using hand tools and larger equipment
- Wear sensible clothing • Use the right tool for the right job
- Do not eat, drink or smoke in the work area
- Wash your hands when you have finished
- Do not work in inappropriate areas

## 2.4 Leather finishing machine operation

### Roller coater

- **Working principle**

The purpose of the device is to wipe the surface of the cylinder clear of any product leaving only that contained in the engraved or sunken patterns to be transferred to the leather. The well behind the blade is designed to hold the application product, which is continuously replenished as it flows in to the patterns of the application cylinder. A pump recycles the product continuously. An electric heating element is provided when the product needs to be dispensed at elevated temperatures. Mechanical agitation of the product contained in the well/container. The blade is mounted on a rigid bridge and is normally presented at an acute angle to the cylinder periphery with the leading edge pointing in the direction of cylinder rotation. The angle of contact is mechanically variable in some design of the doctor blade support. The correct pressure is usually obtained by inserting a writing paper between the blade and the cylinder at either end of the blade and then gradually tightens.

The setting until the paper can be pulled out against moderate pressure. Wear of the blade edge must be expected as it is a “sacrificial” Component in the sense that it has to the experience the wear rather than the application cylinder surface. Two methods of transferring the pigment from the roller to the leather are

1. The syncro technique
2. Reverse techniques

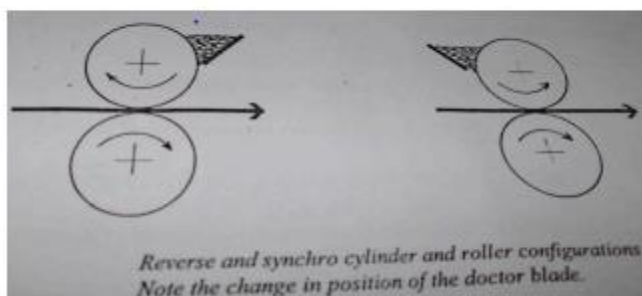
Since the leather has to pass between two rollers, it seems logical that the rollers have to rotate in a converging manner so as to be able to feed the leather through the rollers .such a technique is called syncro .

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**Leather feeding** :- The roller coating machine substantially works like a calendar. Since the leather is anything but flat, it is easy to understand that the only way to obtain an acceptable coating quality is to have the leather pass through the rollers without forming any wrinkles, and coating its surface completely and uniformly.

**Roller changing** :-The wide range of leathers that can be worked with the roller coating machine and ,consequently , the wide range of various types of finish that can be applied ,makes it wise to provide the machine with various types of inking rollers that can meet many different requirements,

**Cross section- doctor blade**



The unit has a main chamber through which the conveyor runs and a lateral compartment holding one or two centrifugal fans or axial flow fans, the heater and air filter. At about 70mm 100mm above the strings carrying the leather sits plenum chamber. Depending upon the dryer working width of centrifugal fans suck air from underneath the conveyor and push through the adjacent heater from where it is ducted to the plenum chamber via a filter. The plenum chamber has slots across the width of the unit acting as nozzles to produce air jets which impinge upon the surface of the leather finish at a velocity sufficiently high to disturb the boundary layer of air adhering to it. The boundary layer needs to be “blown away” as it is effectively acts as an insulation stratum preventing heated air in circulation from reaching the surface finish at the required temperature.

The volume of air ducted in to plenum chamber , the dimensions of which and the area of slots are related to obtain a degree of pressure within the chamber pressure is needed to achieve the required air jet velocity at a uniform rate across the width of the dryer unit. The plenum chamber are normally built as a trapezoid with the smallest section furthest away from the air entry point to ensure uniform airflow and pressure over the leather finish.

An important factor of the internal layout with high air velocity units is to avoid lifting or flutter of light substance leather. The air circuit described above minimizes this problem as the fan suction below the conveyor creates a small degree of depression helping to keep the leather lying flat on the conveyor strings.

### **Auto spray machine**

There has been a gradual switch to the construction and use of automatic spray lines , where the leathers , placed in rows on the conveyor belts ,are sprayed on the surface inside the spray booths equipped with multiple guns moving crosswise to the advance movement of the leathers.



Figure 2. 3Auto spray machine

- **Objective**

Auto spray is used in applying bottom coat, pre finishing and finishing coat with finish drying machinery. To Increasing in the volume of leather production and the demand for uniformity in finishing coats. Rotary gun carriers fitted with 4-8 guns will give adequate spray patterns. The speed is kept at 5-30 rpm and the conveyor speed 10m/minute. There is an electronic sensor near the feeding table senses the area and those places the finish are sprayed so as to save of the chemicals

- **Working principle**

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The spraying booths are equipped with an electronic device called economizer, which makes it possible to use the guns only when they pass over the leather. This system is fixed between the feeding table and the spray area. It is practically a “reading barrier” placed in the front of the booth, composed of a set of photoelectric cells fixed at one inch intervals and constantly illuminated by a luminous source situated below the conveyor belt. When the leather passes under the barrier its shadow obscures the overlaying cells, which, at established intervals, send a signal to a simple processor which processes them determining leather width, shape and position. The signal, which drives the guns, consequently starts from the processor to carry out spraying only at the moment in which they pass over the leather. This device drastically reduces the waste of chemicals product.

The spray booth will have the following part \

- Rotating booth
- Suction and abatement turret
- Drying tunnel
- Wire cleaning
- Economizer
- Hide cooler

### **Ironing out machine**

After the surface of the leather has been finished, the grain side is given a final “beautifying” touch that flattens and polishes it.

In some cases , it may be desired to refurbish the grain side’s original pattern that has been lost, either partially or totally, due to ,for example ,excessive grinding that was done to eliminate serious hide surface damage or imperfections.

This embossing is done by pressing a hot steel surface against the grain side and holding it in place for a certain length of time.

The pressure and temperature values depend, on the one hand, on the characteristics that are desired to be emphasized on the final product and, on the other hand, the type of leather and chemical products used for the surface paint.

The various types of presses used for performing this operation differ according to the type of leather to be treated and the type of operation to which it is to be subjected.

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As regards aesthetic appearance, ironing provides the grain side with a final touch that makes its smoother by completely eliminating the typical “roughness “of the leather pores, thus giving it a higher polish and brighter colors



Figure 2. 4Ironing machines

### The different types of ironing machines

The primary difference between the various types of pressing and ironing machines lie in their operating principal .The differentiation is made as follows:

1. Plate press;
2. Through-feed press with one or more rollers;
3. Reciprocating rotary press.

**Plate press:** -The upper plate is heated and kept at the desired temperature by means of automatic devices, while the lower plate ,which has a vertical opening and closing movement ,is covered with a layer of felt and a sheet of rubberized canvas .

With the machine open, the leather is placed on the lower plate and spread appropriately with its grain side up and free of any wrinkles. The operator then starts the work cycle, brings the lower plate up to and in cont act with the heated plate and applies the required pressure for the amount of time set my means of the provided thermostat and timer .

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**Through-feed press with one or more rollers:-**these presses are used for through-feed ironing of finished leathers and for embossing slightly deep patterns. Although a leather has been fattened very well and has a uniform thickness, when it is ready to be calendered, it still has development differences along its generatrices. The first problem encountered with calendaring was wrinkling .wrinkles on the finished leather represent a type of defect that is not acceptable.

**Reciprocating rotary press:-** plate presses or through-feed presses cannot be used for calendaring and polishing very soft, thin leathers because a plate press would make the leathers very stiff and the through-feed press would cause absolutely unacceptable wrinkling .the leather is fed in with its grain side facing downward and is rested on the heated roller. When the machine is closed, the movement of the rollers feeds the leather forward

### Hand spray



Figure 2. 5hand spray

- **Introduction**

Spraying is usually done when light coating of solution are required to finish good quality leather that have no obvious defects that need to be covered. Spraying is usually used for finishing full grain leather. For sample lots in small quantity will be done on spray booth. The operation was carried out by hand to obtain regular pigment distribution two or more coats were usually applied; the operation was obviously very slow. It must also be considered that coating regularity

was very poor and depended on the operator's skill. The unit to produce the compressed air, the pigment tank and the real spray arm. It is simply a sloped plane on which the leathers may be placed to be sprayed

- **Objective**

The finish solution is fed to a spray gun by gravity or compressed air where it is ejected from a fine nozzle or orifice by pressure as a spray of fine “atomized” droplets which are blown to the leather surface. In most cases it is desirable that these droplets should then flow together to give a continuous wet film on the leather before drying. Failure to flow out may result in poor anchorage, poor rub fastness, and loss of gloss, poor film strength or non smooth film surface.

- **Working principle**

The compressed air passes through a pressure regulator which removes any trace of oil or water and then to the spray gun. The gun will have the following parts to adjust the air flow, fluid adjustment, spreader adjustment valve. The air cap nozzle has an annular space round the fluid jet through which the compressed air blows the finish out as conical spray droplets. It also has two air ports situated at opposite sides of the central jet which distort the conical spray in to a fan shape. By revolving the air nozzle, the shape of the fan may be altered according to the type of spraying required.

## Self-Check

Directions: Answer all the questions listed below based on one instruction.

Instruction 1: Short answer:

1. What do you mean by standard operating procedures of finishing machines?
2. For whom standard operating procedures could serve as benchmark.
3. List and explain as how standard operating procedures are written from a technical perspective
4. What do you mean by safety aspect of finishing machine?
5. What things primarily do you need to start operating finishing machines to eliminate hazardous?
6. Explain what do you mean finishing coats.
7. Write down few safety aspects to be kept in mind while using roller coater and auto spray machine.

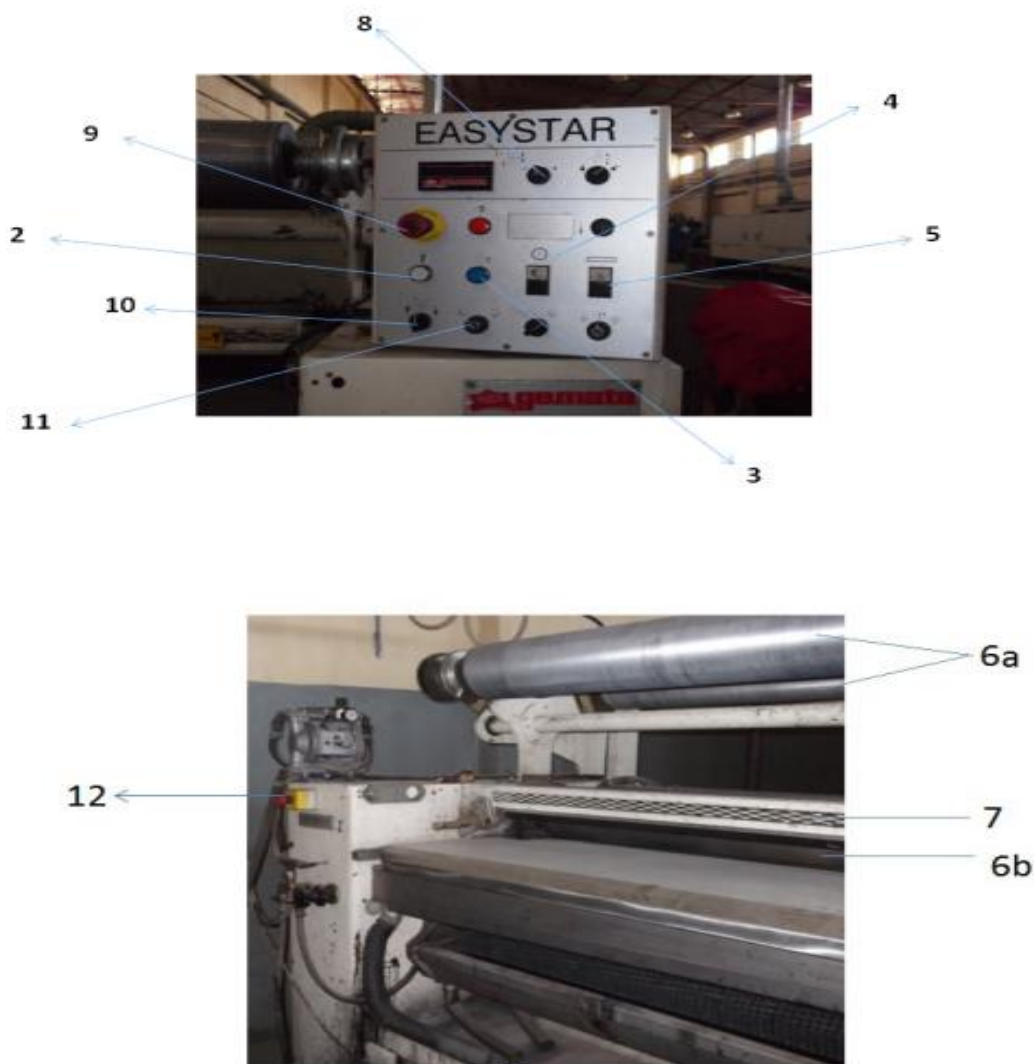
## Operation sheet 2.1

**Operation title:** Procedures of operating roller cottar

**Purpose:** To practice and demonstrate the knowledge and skill required in operating roller cottar machine

**Instruction:** Use the given figure below, the tools and equipment required in operating roller cottar machine. For this operation you have given 5 mints and you are expected to provide the answer on the given table.

### Operating Procedures- roller cottar



### Control Panel

- |   |  |
|---|--|
| 1. Main switch                            | 7. Master blade to the cylinder            |
| 2. Starters                               | 8. Thickness adjustments                   |
| 3. Conveyor to the cylinder               | 9. Stop switch                             |
| 4. Switch on the the cylinder             | 10. Change of the cylinder                 |
| 5. Start the conveyor                     | 11. Forward/ Backward movement of cylinder |
| 6. (a) Extra rollers, (b) Coating roller. | 12. Emergency stop                         |

### Procedure for operation: Roller Coater

1. Switch on the rollers and conveyor of the machine.
2. Take the chemicals that have to be coated and place it below the pump in the galvanized containers.
3. Switch on the machine.
4. Conveyor starts to move.
5. Adjust thickness between feed roller and the application roller.
6. Adjust the speed of the conveyor belt of feed roller.
7. Adjust the speed of application cylinder.
8. Place the leather one by one and feed through the machine.
9. Leather passes down the roller unit and then dried in the drier unit.
10. Conveyor speed of drier conveyor based on deposition of chemicals, which is applied to the leather surface.
11. Pick up the leather one by one and place it on the table to pile up (Flesh to Flesh).
12. Give second coat if necessary in the same manner.
13. Clean the machine and rollers
14. .Switch off the rollers of the machine.
15. .Switch off the machine.

### Safety precautions before operation: Roller Coater

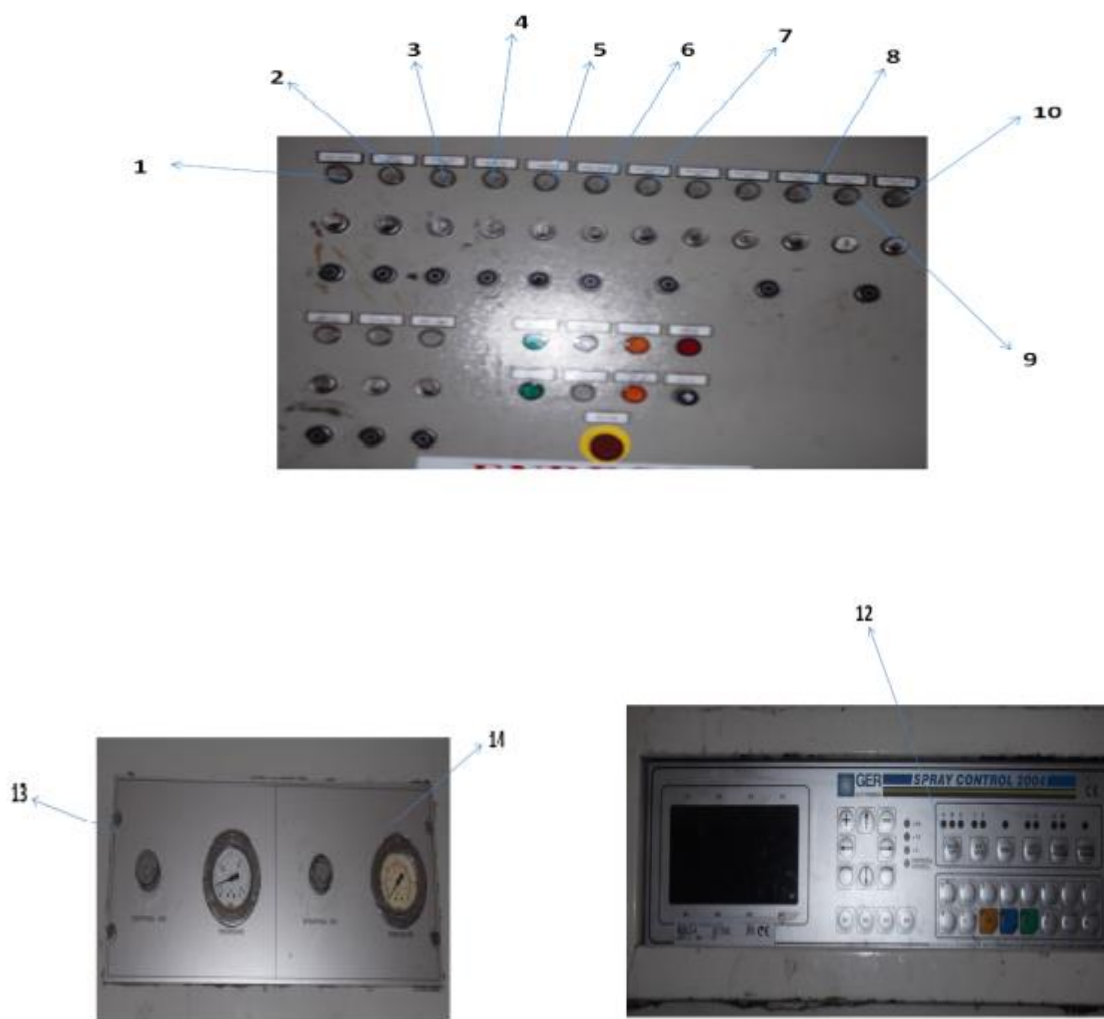
1. Check the air pressure is correct (4.0 to 6.0 bar).
2. Check that the all the safety switches/ emergency switches are in working order.
3. Check that all the machine guards/ doors are properly fixed/closed.
4. Check that there is water in the belt cleaning tray

## Operation sheet 2.2

**Operation title:** Procedures of operating Auto spray machine

**Purpose:** To practice and demonstrate the knowledge and skill required in Auto spray machine.

**Instruction:** Use the given figure below, the tools and equipment required in Auto spray machine. For this operation you have given 5 mints and you are expected to provide the answer on the given table.



### Parts:

- |                       |                      |
|-----------------------|----------------------|
| 1. Both exhaust start | 5. Wire scrapper     |
| 2. Water pump         | 6. Slow ventilator   |
| 3. Conveyor           | 7. Cooler ventilator |
| 4. Gun rotation       | 8. Economizer        |

9. Photo cell and light on
10. Start the rotation
11. Change the guns( season and lacquer)
12. Control switch
13. Control Air Flow
14. Adjust spray air pressure

#### **Procedure for operation: Auto spray**

1. Switch on the compressor of the machine.
2. Take the chemicals that have to be sprayed and place it below the pump in the galvanized containers.
3. Switch on the machine.
4. Conveyer strings starts to move.
5. Place the leather one by one such that there is no gap between each leather.
6. Leather passes down the spray unit and then dried in the drier unit.
7. Pick up the leather one by one and place it on the horse to pile up.
8. Give second coat if necessary in the same manner.
9. Finally apply the fixing coat in the same manner.
10. Switch off the machine.
11. Switch off the compressor of the machine.
12. .Clean the machine and strings.

#### **Safety precautions before operation: Auto-Sprayer**

1. Make sure the machine is clean. Especially photocells, cabinet lights and spray guns and all the safety guards are fixed well.
2. Ensure the conveyor strings; pigment pump and suction filter to pump are clean.
3. Open the compressed air and steam valves.
4. Switch on the electric mains and start the conveyor and carousel rotation.
5. Check the oil level in the gear box for conveyor drive and carousel rotation
6. Start the pigment pump with water and check the spray pattern of all the spray-guns. Adjust the gun openings and flow pattern in washing mode.
7. Change the spray mode from “washing” to “automatic”.
8. Ensure there is no spray when the photocells are not covered with leather. Adjust the front, back and lateral advanced spray in the economizer.

9. Now you can use pigment, lacquer or other chemical solution meant for spray. Do not forget to start the drying fans in the drying chambers.
10. At each change of colour, chemical and at the end of work, the spray guns and pigment pump must be washed.
11. Switch off the machine after finishing the work and keep the needles, nozzles and air caps of the spray guns in solvent solution.
12. Scrap the conveyor strings and clean the exhaust chambers periodically.
13. If the conveyor strings are too thick due to deposition of pigment, spray 10% Ammonia solution while the drying chamber and exhaust fans are off(to avoid quick evaporation) by doing so, the deposition will be softened and easily can be scrapped.
14. Report any problems in the machine to your superiors.

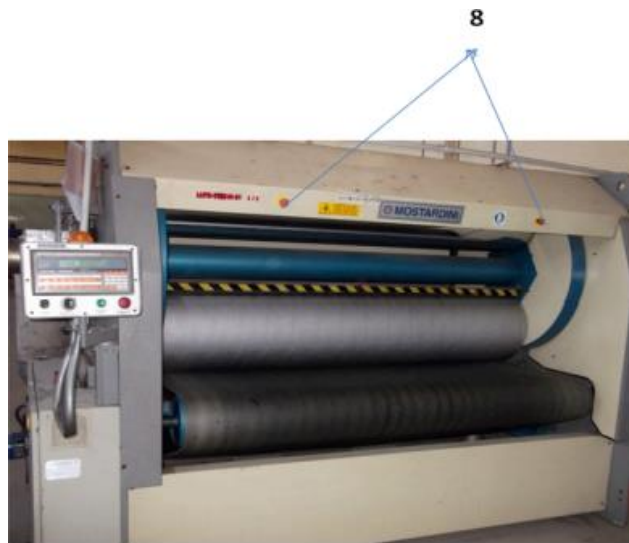


## Operation sheet 2.3

**Operation title:** Procedures of operating ironing machine

**Purpose:** To practice and demonstrate the knowledge and skill required in operating ironing machine

**Instruction:** Use the given figure below, the tools and equipment required in operating ironing machine. For this operation you have given 5 mins and you are expected to provide the answer on the given sheet.



Through feed ironing machine

### Control Panel

1. Main switch
2. Reset
3. Adjust pressure- on/ off
4. Heat adjustments-for roller
5. Start key
6. Stop
7. Air control valve
8. Emergency
9. Lights
10. Forward-backward movements

**Procedure for operation:** Through-feed ironing machine

1. Switch on the machine mains.
2. Set temperature and after attaining required temperature adjust the pressure
3. Feed the leather through conveyor.
4. Collect the ironed leather and pile
5. Clean the machine after the temperature reaches to room temperature

**Safety precautions before operation: Through-feed ironing machine**

1. Check that the machine is clean and no foreign object is lying on the feeding conveyor.
2. Check hydraulic oil level in the oil tank.
3. If there is heating oil tank, ensure the level is correct.
4. Ensure the chains are well lubricated.

5. Ensure any other device fixed with the machine like dust collector or dust wipers are clean.
6. Adjust the required temperature on the thermo-regulator, ironing pressure on the manometer (pressure gauge).
7. Switch electric mains and start heating of ironing roll.
8. Clean the ironing roller/rollers with soft cloth.
9. Start the conveyor belt and ensure the safety switches and emergency switches are functioning properly.
10. Ensure the feeding belt and felt centering devices are in working order.
11. After attaining preset temperature, machine is ready for bulk ironing. It is healthy habit to inspect initially few skins for best ironing effect.
12. Report any problems noticed to your superiors or maintenance personnel for corrective actions.
13. Always follow the instruction from your superiors.
14. Never touch the ironing roller as it may cause serious injury. Switch off the machine after use

## Operation sheet 2.4

**Operation title:** Procedures of operating Hand spray

**Purpose:** To practice and demonstrate the knowledge and skill required in operating Hand spray.

**Instruction:** Use the given figure below, the tools and equipment required in operating Hand spray. For this operation you have given 5 mins and you are expected to provide the answer on the given sheet.

### Hand spray



### Procedure of operation:

1. Switch on the exhaust blower of the spray booth.
2. Switch on the water circulation.
3. Switch on the lights inside the spray booth if area is poorly ventilated.
4. Ensure proper levels of pressure in compressor if not switch on the compressor for required air flow through spray gun for spray coating
5. Adjust the flow of air, spreader adjustment and fluid adjustment by using respective valves on the spray gun.

### Safety precautions before operation: manual spray booth

1. Maintain proper circulation of water through spray booth.
2. While working on spray booth please ensure to use proper gear for protection (Goggles, masks etc)
3. Ensure proper cleaning after using the spray booth.
4. Clean spray gun after use. Ensure its free from season and other materials.
5. If any problem report to supervisor

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## Lap test

Instructions to students:

1. Given the raw materials perform the below mentioned task.
2. You are given two (2) hours to complete any one of the following tasks.
  - a. Finish by roller coater
  - b. Finish by auto spray
  - c. Finish by manual spray
  - d. Ironing of leather
3. Request your teacher for evaluation and feedback of your work

### Unit Three: Apply formulated chemicals

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

- Stages of leather finishing coats
- Application methods of Leather finishing coats
- Handling and transporting of finished leathers
- Cleaning workplace area and waste disposal after finishing operations

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:

- Based on stages of finishing, finishing coats are prepared and applied as per work place procedures
- Finishing coats applied by machine or manually
- Work area around the machines is cleaned and maintained to meet workplace and safety standards
- Wastes disposed as per environmental and workplace procedures

### 3.1 Stages of leather finishing coats

**Bottom Coat:** The bottom coat may be either sealing or impregnation coat and clearing coat. The object of sealing or impregnating coat is to seal the grain to control the penetration of the season coat. The season coat should give a leveled and uniform filmed color coating and not overload the grain. Sealing should uphold firmly on the leather surface. Impregnation coat is applied for soft grain tightening and filling effects. The objective of the clearing coat is to make the grain devoid of any oils or fats and to improve the absorbance of the season coat by the leather.

**Season Coat:** The season coat is to impart a desired color to the leather and level out the surface defects. The effects like glossy or matt, soft or hard feel can be brought about by proper choice of auxiliaries added to the season coat. This coat can be done either by pad or hand spray or Auto spray. By spraying on we can achieve levelness in film formation.

**Top Coat:** It gives properties like appearance, handle, fastness to wet and dry rub resist to hot plating.

### 3.2 Applying methods of leather finishing coats

#### Introduction

The object of finishing is to give a treatment of coatings to the grain surface to protect it against dirt, staining, wetting, mechanical stresses like rubbing, scuffing, flexing etc., leveling or evening out the colour of the grain surface, hiding grain blemishes and upgrading its quality, improving the aesthetic appeal and the sales value of the product.

#### Application of finishes

There are essentially two methods of application

- (I) by pad / brush and
- (II) by spray.

In most cases the two methods are used in combination. In recent years another application method has been developed by curtain coating. Finishing using pad / brush coats have better anchorage of finish than by mere spraying. Instead of hand padding & spray automatic padding and automatic spraying (reciprocating and rotary types) are also used in big production units.

Airless spray is also used for certain types of finishes. Besides the composition of finishing techniques adopted and drying the mechanical treatment of leather surface during finishing plays an important part.

### **Manual Coating:**

- Manual coating is the application of finishing materials manually, usually by hand application
- Manual coating require higher degree of experience

Manual coating consists of following types:

- By Brushing
- By Padding
- By Spraying

### **Brushing:**

- Brushing is done by soft haired brush
- Finish materials are applied like a paint on the leather surface
- It is similar to the painting
- Brush is dipped into the season and the season is absorbed by the brush and is applied on the surface of the leather.

### **Drawbacks:**

- When the finish materials are applied by the brush there is a possibility of non-uniform it .
- Season may coagulate at the time of brushing and the color may vary at different portions of leather
- Setting of dust is a problem as the process is done manually and need an expertise

### **Padding:**

- Padding is application of finish materials by using pad(Wooden block covered with plush)

- If the coagulation is rapid, padding ensures good uniform penetration of binder into the surface and good adhesion of the finish

Drawbacks:

Build-up of buffing dust can occur on pads  
Need skilled professional for doing this operation

### **Spraying:**

- Manual spraying is done by using spray gun
- Compressed air is used for operation of spray gun
- Finish materials are filled into the pressure feed cup of the gun and the finish season is sprayed manually

### **Drawbacks:**

- Need skilled professional

### **Note:**

- ✓ For manual hand spraying refer to operation sheet 4 one unit two and
- ✓ For machine coating refer unit two and operation sheet one and two.

## **3.3 Handling of finished leather and cleaning workplace area**

Clean the place thoroughly and keep everything in its place.

- Clean everything including material, floor, containers, walls, windows etc.
- If necessary painting also should be done.
- While painting follow colour codes wherever applicable.
- Insist on regular cleaning at the end of the work

Maintain high standards of housekeeping at workplace at all times.

- Ensure that people keep the items at designated place after it's use.
- If possible, design the system such that if something is missing from the place, it is easily highlighted

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### 3.4 waste disposal after finishing operations

#### Physical and Chemical Nature of Finishing Operation Wastes

Finishing operation generates approximately 20% of the waste produced in leather processing (raw to finish), majority of the waste generated contribute to solid and gaseous wastes.

Types of wastes generated in finishing:-

- Liquid wastes
- Solid wastes
- Gaseous waste

Nature of finishing waste

- Odor is one of the issues to be dealt with in finishing yard.
- Finished leather trimmings are solid waste generated during trimming of finished leather to remove some unwanted parts of the leather.
- When finishing materials are sprayed on to leather the finer particles disperse onto air, there aerosols when breathed into causes health hazard.
- Liquid wastes generally contain 30-35% of solid content which however gets converted to solid waste when solvent phase evaporates.
- In non-aqueous type of formulations, there is a possible generation of volatile organic compounds when the solvent gets evaporated, which is again a health hazard to deal with.
- Pigments used in finishing are formulated with use of heavy metals, which have to be disposed of carefully

Air emissions occur generally in relatively small quantities. Traditionally tanneries have been associated with odor rather than any other air emissions, although the emissions of organic solvents are a major problem. Whether a tannery has the following air emissions depends on the type of processes employed. Air emissions from tannery are particulate, organic solvents; lacquers ammonia and odor.

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Emissions to air have effect beyond the tannery site, but also affect the workplace and possibly the health of the tannery workforce. Apart from odors, particular mention should be made here of organic solvent emissions, aerosols and dust.

### Machine Wastes

- Leather trimmings are the major wastes generated during machine operations
- Machine operations generate heat, when finished leather is subjected to such operations there is a possibility of VOC (Volatile Organic Compounds) emissions

### Self-Check

**Directions:** Answer all the questions listed below.

#### Instruction

#### I Choice

1, ..... serves the purpose of protecting the season coat

a, top coat                      b, base coat              c, bottom coat

2, Types of wastes generated in finishing is.....

a, Liquid wastes      b, Solid wastes              c, gaseous waste

3, Manual spraying is done by using?

a, spray gun              b,

#### II Short answer:

1. Explain what you mean by manual coating
2. Explain the types of manual coating
3. Explain the objective of finishing.
4. Explain padding.
5. Explain what you mean by physical and chemical nature of finishing operation wastes
6. Write down the types of waste generate during finishing?
7. . What are the drawbacks of brushing operation?

## Unit four; Monitor product quality

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

- Quality requirements for finished leather
- Checking quality parameters of finished leather

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:

- Quality requirements for the required finished leather are correctly identified and applied for all stages of the processes
- Quality is checked visually or using appropriate testing equipment.

## 4.1. Quality requirements

The objective of this section is to provide an exact and measurable definition of quality for this definition is stated in terms of general quality factors, specific system-oriented quality criteria to be measured for each factor, and quantified quality targets and quality metrics. The quality factors, quality criteria and quality metrics must be consciously addressed, right from the start of the project life cycle.

Requirements of leather Finishes:

- Abrasion properties of finished coats.
- Resistance to detergents, cleaning agents and shoe polishes.
- Resistance to amines.
- Resistance to ageing
- Fastness to hot ironing, resistance to hot air.
- Fastness to hot steaming.

### Defect coverage

Defects that appear in the finished leather are the result of damage to the raw skin, poor storage or improper leather processing during manufacturing. Finishing is process, the grain surface of the leather is coated with various substances in order to cover the defects that are exist in leather. After the leather defect is covered by finishing film it more useful, attractive and appealing to users. Finishing may be employed to impart defect cover, colors, a uniform shade, special patterns, a smooth or grained or printed/embossed surface, luster (Matt or glossy) as well as opaque (covered) or transparent (aniline/semi-aniline) appearance to the leather surface.

### Adhesion

Correct adhesion of the finish coats to the leather is essential for further processing and the utility value of the materials. It depends on the absorption properties of the leather surface and the degree of penetration of the finishing floats, which is determined by their composition.

Adhesion is further influenced by the type of mechanical application and by the drying and processing methods. The adhesion of the finish coat is tested by a quick reference test in which adhesive tape is applied to the leather specimen and stripped off. A quantitative measurement adhesion is performed in the tensile strength tester. The leather specimens are glued onto a firm

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supporting surface by means of a two component adhesive and stripped off after a specified time. To test wet adhesion the leather specimens are only moistened after hardening of the adhesive.

### **Light Fastness**

In general, light fastness is determined by the leather undersurface. The thickness of coat, the binders and finishing auxiliaries used, top coats and amount of covering pigments are decisive for good light fastness of the finished leathers. Nitrocellulose films or finishes having a high content of butadiene binders are prone to yellow on exposure to light. Highly covering. Inorganic pigments and an adequate thickness of coat often improve poor light fastness properties of the leather.

### **Flexibility**

If leather is stretched, extended or deformed by bulging the finish should be so elastic that it does not tear or crack off. A quick reference test is performed by means of a key or a mandrel. These are drawn with pressure along the unfinished side of the leather to cause stretching and bulging of the leather. The finish is assessed for flaking or cracking. In the lastometer test a sharp mandrel is pressed upwards to determine the "bulging height". In the tensometer test a larger section of leather is stretched over a diaphragm to form a spherical cap. This also serves to test whether the finish flakes or cracks off.

### **Fastness to rubbing**

The finished leather surface should be largely fast to dry or wet rubbing. A quick reference test is carried out by rubbing the leather with a white cloth under the pressure of a finger. Reliable tests are performed with the SATRA or VESLIC rub fastness tester. The abrasion properties are tested by rubbing a dry or wet felt pad or standardized cotton fabric back and forth or by rotation, under a specified load and with a specified number of movements. The degree of damage or the change of the top coat, the staining of the felt pads and the change in colour of the test specimen are assessed.

### **Resistance to ageing**

A change of the finish due to ageing is mainly indicated by embrittlement of the film. This is mostly caused by migration of plasticizers from the pigment coat into the interior of the leathers. In a quick reference test the leather is stored in the drying oven for several days at different

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temperatures (50 and 80 °C). After conditioning, the leather samples are assessed as regards embrittlement, yellowing, elasticity and flexing endurance of the finish films.

### **Resistance to abrasion**

The surface of the final leather products is subject to the most different kinds of stress in everyday use. In order to determine optimum properties of the finish coats with regard to their fastness to erasing abrasion, reference tests are performed with standardized rubber test specimens. The degree of damage of the wet and dry leather and the change of colour of the finish are assessed. This is an additional test of the fastness to dry and wet rubbing besides the fastness test with felt pads.

### **Color uniformity**

Color uniformity as the name suggests means uniform color all over the finished leather, for example say if you are viewing a color, we can take the color green as an example here, if the shade of green you see in the middle of the finished leather is the same shade that you see on the corners or any other part of the finished leather then it can be uniform colored leather.

## **4.2 Quality is checked visually or using appropriate testing equipment**

### **Significance of testing**

Testing is a systematic method to examine the quality of a product. The following simple common methods are employed to test the quality of the products

- Feel Visual examination
- though skin contact
- Smell
- Taste
- Sound

The above tests are also termed as Non Destructive Tests (NDT) which are subjective and cannot be quantified. Simple to sophisticated tools like magnifier, microscope, sensors, magnets, pH papers and simple chemicals are also employed to improve the quality of these types of tests. These types of tests are used in leather tanning process to examine the materials, products and process while processing and after finishing.

- Visual : Colour, shade, wrinkles, defects, dye penetration etc.,

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- Feeling : Grain smoothness, fullness, break and pipiness
- Smell : Proper washing of leather during process
- Taste : Saline condition of water, astringency of vegetable tannins

However, these tests have limitations and are subjective. Therefore test results cannot be shared with other customers as a confirmatory report. Therefore more reliable test methods using specially designed testing machines, tools and accessories are developed to ensure the quality of leather.

### Visual quality mentoring

Monitoring is supportive and developmental in nature whereas quality audit is judgmental and determines whether or not the provider performing according to established criteria.

leather-quality monitoring requires regular testing of all leather to see if they are meeting the requirements. It also involves inspection, investigation, and analyses of each leather type.

The main differences between a control system and monitoring system are the architecture and principles for which they serve. The building control system is designed and installed with the critical parameters of the facility in mind. The sensors for that system are installed and provide feedback allowing for automatic compensation for out-of-spec events. A monitoring system is geared toward monitoring the process and product level of information.

This means that, if you feel better by observing on the product, we can say the product has good quality. The reverse is true. Monitoring should have been necessary in such a way that:

It is difficult to give a clear definition for the term “quality” as one cannot totally satisfy the customer. Therefore people try to define the term quality on their own method of understanding and also quality itself has been defined as fundamentally relational: 'quality is the ongoing process of building and sustaining relationships by assessing, anticipating, and fulfilling stated and implied needs.'

### Visual qualities of finished leather:

- **After finishing:**
  - ✓ Color of finish
  - ✓ Uniformity of finish
  - ✓ Up gradation of defects

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- ✓ Loading of finish
- ✓ Breaking of finish
- ✓ Gloss level of finish
- **During finishing:**
  - ✓ Penetration of finish mixtures
  - ✓ Drying of finished leather
  - ✓ Leveling of finish
  - ✓ Problem and defects of mechanical and handlings
  - ✓ Deposition of finish in padding and spray



## Self-Check

**Directions:** Answer all the questions listed below based on Instruction.

**Instruction:**

### I, choice

1. Which one of the following is requirements of leather Finishes.
  - a, Abrasion properties of finished coats
  - b, Resistance to amines.
  - C, Resistance to detergents, cleaning agents and shoe polishes.
  - D, all
2. Testing is a systematic method to examine the quality of a product.
  - A, true
  - b, false
3. Which one of the following is odd?
  - a, Visual examination
  - b, Feel though skin contact
  - c, Sound
  - d, none

### II, Short answer:

1. What makes the finished leather flexible?
2. What is fastness in leather finishing?
3. What is resistance to abrasion?
4. Explain what do you mean by visual quality monitoring?
5. Explain the difference between monitoring and quality Audi?
6. During leather finishing process, how do you monitor quality visually?
7. Explain as how do you identify quality of finished leather after completion of finishing visually?

## Operation sheet 4.1

**Operation title:** Rub fastness to circular rubbing

**Purpose:** To practice and demonstrate the knowledge and skill required to test Rub fastness to circular rubbing

**Instruction:** Use the given figure below, the tools and equipment required in circular rubbing. For this operation you have given 30 mins and you are expected to provide the answer on the given sheet.

**Objective;** The student will be able to develop the skill of the trainee by performing rub fastness test procedures for determine the quality of finished leather.

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

- ✓ circular rubbing
- ✓ finished leather
- ✓ wool felt

**Procedure** for wet Rub Test

1. Immerse a felt pad in cold water, boil for 1 minute for complete wetting of the felt pad.
2. Cool, remove excess water from the wet felt by slight squeezing,
3. attach to the spindle, adjust the weight to 7.1 N force, bring the spindle into contact with leather specimen, weight for 60 seconds,
4. operate the machine to
5. The desired number of cycles.
6. Assess for colour change and colour transfer after complete drying of the samples.

## Operation sheet 4.2

**Operation title:** Flexing endurance

**Purpose:** To practice and demonstrate the knowledge and skill required to test flexing endurance

**Instruction:** Use the given figure below, the tools and equipment required in Flexing endurance. For this operation you have given 15 mins and you are expected to provide the answer on the given sheet.

**Objective;** The student will be able to develop the skill of the trainee by performing flexing endurance test procedures for determine the quality of finished leather.

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

- ✓ vamp method
- ✓ skin and hide

**Procedures of selection:-**

1. Fold the test specimens evenly over the pair of V-shaped clamps and hold in place by fitting the upper V-shaped part of each clamp.
2. Mount half of the test specimens with their along direction running between the clamps, and the other half at 90° to this so that the across direction runs between the clamps.
3. Fully tighten the clamp at the end, ensure the test specimen is not slack and then tighten the clamp at the other end.
4. Slowly move the clamps together and watch the specimen to ensure that the center section of each specimen folds downwards.
5. If this is not the case, apply gently pressure to the center of the ridge as the clamps move together to see the downward fold.

## Operation sheet 4.3

**Operation title:** Adhesion machine

**Purpose:** To practice and demonstrate the knowledge and skill required to test Adhesion machine.

**Instruction:** Use the given figure below, the tools and equipment required in Adhesion machine . For this operation you have given 15 mints and you are expected to provide the answer on the given sheet.

**Objective;** The student will be able to develop the skill of the trainee by performing adhesion test procedures for determine the quality of finished leather.

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

- ✓ adhesion machine
- ✓ skin and hide

**Procedures of selection:-**

1. Cut sample of leather from different parts
2. Operate the adhesion machine on the surface of leather
3. Record the result from the machine.

## Lap test

Instructions to students:

1. Given the raw materials perform the below mentioned task.
2. You are given two (2) hours to complete any one of the following tasks.
  - Rub fastness to circular rubbing
  - Flexing endurance
  - Adhesion machine
3. Request your teacher for evaluation and feedback of your work

## Reference

- 1) Covington, A. D. (2009). Tanning chemistry: the science of leather. Royal Society of Chemistry.
- 2) Covington, A. D. (2006). The chemistry of tanning materials. In Conservation of leather and related materials (pp. 44-57). Routledge.
- 3) Tamilselvi, A., Jayakumar, G. C., Charan, K. S., Sahu, B., Deepa, P. R., Kanth, S. V., & Kanagaraj, J. (2019). Extraction of cellulose from renewable resources and its application in leather finishing. Journal of Cleaner Production, 230, 694-699.
- 4) Working Manual for Tannery Machineries (2013), Prepared by S.Krishnan, as a part of Twinning Project between CSIR- Central Leather Research Institute and Leather Industries Development Institut
- 5) The Tanning Engineering Notebooks, Assomac Edition 2002
- 6) Process vessel and machine operation manual, Machine manufacturer
- 7) Possible defects in leather production (Definitions, causes, consequences), Gerhard John, 1996

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