

### **3 Retannage**

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**Last updated: 8/23/2006 4:25:46 PM**

The objects are:

- a) To produce different types of leather from the semi-finished leather; 'wet blue' is considered here.
- b) To optimise the serviceability of the leather and adapt it to meet fashion requirements and the demands of customers.
- c) To create the crust leather to allow satisfactory finishing of the leather surface.

The neutralization, retannage, dyeing and fat-liquoring wet operations are almost always carried out in that order in one operation, with a total time of 3-7 hours. They are done in a drum, or sectioned dyeing vessel, at a range of temperatures between 35-60°C. Drum speed is about 12 rpm. Re-tannage is often understood to include all the four stages.

The individual stages of the operation influence each other, so there are adjustments needed to obtain optimum effects for high-quality finished leather. The properties which can be influenced by the re-tannage include fullness, grain tightness, softness, fat distribution, leather colour, levelness of the dyeing, light-fastness, grain fineness, smoothness, buffing, dry-drumming, embossing, buffing, water repellence and chemical and physical analytical results. It is obviously of great importance in determining the final quality.

Special treatments, such as water repellency, are an integral part of all leather process design but there will be a part of the retannage which involves special chemicals. It has to be realised that such leathers have to be designed from the initial wet work to minimise all hydrophilic chemicals.

#### **NEUTRALISE**

The object is to remove strong free acids from the leather by using milder chemicals. This weakens the strong positive surface charge of the chrome leather so that anionic tanning materials, dyestuffs and fat-liquors agents can penetrate and are not restricted to the surface. The leather is said to be 'de-acidified' because it does not usually reach the neutral point of pH 7. Surface pH is below 5.0 externally and 4.5 internally. If a deep neutralisation is needed to allow other chemicals to penetrate deeper, the external and internal values are about 5.5. It controls the reactivity of wet blue leather and has to produce the same level in all the pieces of leather in one retanning load. It is, therefore, important for treating a selection of wet blue from different suppliers.

#### **RETAN**

The object is to control the properties of the resultant crust leather. It is the main use for the synthetic organic tanning materials, but vegetable tannins, polymeric, resin and mineral tanning agents (chrome included) are also used. The environmental concern for trivalent chrome has affected how this material is used.

The character of leather is determined by the first tanning operation, but the retannages are an adjustment to that. There are 3 main types of result, depending on the crust required:

- a) Filling of the looser structure of wet blue by vegetable tannins, replacement syntans and resin tanning materials with a selective filling effect. This leather is also designed to have good tightness, buffing, embossing and finishing properties. This is for corrected grain leather, which is the lowest quality of the wet blue selection.
- b) The full grain selection has the good grain and cutting value. It is important to retain that natural elegance with a good break, full colour shades from dyeing and an attractive feel from a full handle, even into the belly area, or flanks, of the hide. Softness and an attractive look are often more important than the tightness of the lower grades.
- c) A compromise of the others, so that there can be further sorting in the crust to optimise quality, value and profit for the tannery. It is a valuable option to have a versatile retannage, suitable for finishing as either full grain or corrected grain.

## **DYE**

The object is to colour the leather as required by the customer, or sales forecasts. This should be an even colour and should cover any grain defects. If the leather will not have a covering finish, the colour should be light fast, and wash fast. It is usually done in drums, or sectioned dyeing vessels, with different levels of float and temperatures. Not all leathers are drum dyed. This may be done to leave more choice in deciding the product to make from the crust and to save the cost. Dry crust leather can be dyed by through feed continuous methods. At present, this does not produce the same qualities as the batch dyeing due to the limitations of time, temperature and dyestuff type. There are many controls to affect the results and there is a wide choice of dyestuffs, which are high cost materials. These are often in liquid form for easier, and healthier, handling. Health concerns have also banned the use of dyes containing known carcinogenic chemicals, and these are not produced by any reputable company. Dyeing can be with anionic and cationic types but the whole retannage process needs to be designed according to the dyeing conditions. Colour matching is an old established human art, being replaced by instrumental colour measurement in larger tanneries.

Wet white leathers are often required to be dyed with dyes free of heavy metals, to meet the ecological requirements.

## **FAT-LIQUOR**

The object is to soften the leather, as required in the product, by lubricating the wet fibres so that they do not stick together on drying. Without fat-liquors, the leather would dry hard and any mechanical action would damage the fibre and limit the quality potential. It controls the feel of the dry leather. It is normally the last operation in retannage and can be combined into that float. These emulsions of materials can have different stabilities and care has to be taken that there is the required degree of penetration and fixation. Complete penetration produces leather with a cloth-like feel, suitable for garments, compared with a surface effect, which would feel greasy and be difficult to apply a top finish. Care and experience are needed to select the correct balance of materials. The method of drying also needs to be considered when deciding on the fat-liquors.

Fat-liquors, with suitable stability, are also applied during tannage to obtain a deeper coating of the fibres.

After the final wet operations (retannage etc.), the leather is generally horsed up or stacked on platforms overnight. The water content is about 70-75%, on the leather weight.

## **SAMM AND SET OUT**

The object is to reduce the water content and to spread the leather out by stretching it in all directions. The helical blades spread the hide, or skin, into a flat shape and squeeze out the surplus water. Animal skin is three dimensional to cover the animal shape, so this operation now starts to change that into two dimensions. The shapes need to be positioned on the rollers to avoid any creases forming in the surface; this can be difficult for the shanks. After setting out, the leather should be easier to handle for subsequent drying.

## **DRYING**

The object is to take the moisture level finally down to about 8-14 % for mechanical softening. Water evaporation from the surface is in two stages. The first is at constant rate when the surface is completely wet and the water can migrate to the surface from the centre of the hide at the same speed that it evaporates. This is unbound water and the heat of the drying does not affect the leather temperature.

The second stage, the falling rate stage, is when the surface is only partially wet and the temperature of the leather itself will start to rise. This is a critical stage and can damage the leather if moisture is trapped in the centre. Uncontrolled drying is not advisable. Shrinkage of the leather also occurs during drying and is a factor in costing. Higher temperatures create higher shrinkage. However, this shrinkage should not be physically restricted because the leather would become hard and unacceptable, with the fibres unable to reposition themselves at different moisture levels. Slow drying, at a low temperature, produces the softest leather

with the lowest shrinkage, but this is not normally economical.

There are 4 main methods:

- a) Suspension, or hang, drying where the leather is simply hung up in the drying room or tunnel, which has controlled conditions of heating, humidity and air circulation. The dried leather feels full and round with good softness, but has the disadvantage that area and smoothness is lost. All such leathers must be toggled after staking.
- b) Paste drying has the set out leathers pasted onto glass, or non-corrosive metal, plates with an aqueous adhesive solution and then dried in the through-feed tunnel dryer for 5-8 hours. The machines have 100-200 of these vertical plates and are 20-40 metres long. The leather passes through a number of sections, which have well controlled drying conditions and allow the drying rates to be progressively set to the different stages described above. The resultant leather needs some softening, but is flat and has a better area yield than suspension drying. The residual paste film means that full grain finishing is not really possible, but it is ideal for such buffed leathers as corrected grain or splits.
- c) Vacuum drying is the best method for most full grain leathers, whilst it is also perfectly satisfactory for corrected types. The set out leathers are laid flat, grain down, onto a stainless steel table, where they are also stretched out further by hand slickers as their shape dictates. The table top and flattened leathers are then enveloped by a sealing hood. Reduced air pressure then allows drying to take place at a lower temperature, whilst the hide, or skin, is kept flat by applied pressure to reduce shrinkage. The temperature is about 75°C, and even less. After a few minutes, the leather is removed with the grain side dry and the flesh side slightly damp. It must not be dried out completely to the lower limit, but hung to lose the final moisture freely. These driers have been developed into multi-table machines and the most sophisticated systems have a conveyor delivery from the setting out through vacuum driers, to staking and toggling operations. These have great potential for large productions. Process time and labour content is significantly reduced.
- d) Toggle drying stretches the leather manually onto perforated metal sheets, with the shape being retained by the toggling clips, which have pincer grips to hold the edge of the leather and a small foot underneath to fit into the perforations. The drying conditions and control are as for hang drying. The frames are sometimes assembled as a type of bookcase or, much better, as a form of conveyor which has greatly improved this whole operation and reduced the handling. Toggling is used for upholstery, side clothing, splits and lining leathers. It has 10% more area than hang drying but at the expense of quality, because of the tension from preventing some shrinkage. It is better for vegetable tanned light leathers, which shrink less, and for re-toggling damp leathers after mechanical softening and dry milling. Here it keeps the leather soft and pliant.

