# MODERN COW LEATHER PROCESSING

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INTRODUCTION

Since **pre-historic times** animal skins have been used for **protection against the elements**. The primitive preservation process was through smoking and drying. Later, vegetable extracts were used to **create the first leathers**.

**Leather making became one of the oldest known industries.** The earliest tanning recipe was created **around 700 BC**. Chemistry and tanning processes have continued to evolve down through the generations.
Working with hides and skins started as a craft. The biggest evolution in the industry came during the Roman Empire when vegetable leathers were standardized. Later, chemistry and biochemistry were applied to the processes, and leathers obtained outstanding characteristics that were considered almost magic. During the Renaissance, art was involved in leathermaking through the application of colors and shapes.

Biochemistry defined the composition and structure of the hides. Chemistry brought the performance. Physics brought the processes. Engineering brought the automation and process controls. Today, 21st-century leathermaking is still a powerful blend of art, science and technology as well as safe and compliant.
TODAY SUSTAINABLE LEATHER IS PRODUCED for performance, fashion and luxury

Hides are a no-waste by-product of the food industry. The leather industry uses the hides and skins produced by the meat industry, and only exists because of the meat industry.

No meat = no leather

Hides are very complex organs composed mostly of proteins, fats, water and minerals.

The main proteins in a hide are:

- **Collagen** – to be turned into leather
- **Keratins** – hair and epidermis, that are removed
- **Globular proteins** – removed

### Cow hide composition

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proteins</td>
<td>33%</td>
</tr>
<tr>
<td>Fats</td>
<td>2-6%</td>
</tr>
<tr>
<td>Minerals</td>
<td>0.5%</td>
</tr>
<tr>
<td>Water</td>
<td>65%</td>
</tr>
</tbody>
</table>
DIFFERENCES BETWEEN
hide, skin and leather

HIDE + TANNING = LEATHER
SKIN + TANNING = LEATHER

TANNING is the chemical process that stabilizes the hide thermically, mechanically, chemically and microbiologically. Only a few chemicals have tanning properties. They are safe and non-toxic when used correctly.

HIDES are defined as skins of large animals. Eg, cows have hides, goats and sheep have skins.

SUN TANNING IS A DIFFERENT STORY
DEFINING LEATHER

ISO STANDARD 15115:2019
(International Organization for Standardization)

<material> hide (3.48) or skin (3.88) with its original fibrous structure more or less intact, tanned to be imputrescible, where the hair or wool may or may not have been removed, whether or not hide (3.48) or skin (3.88) has been split into layers or segmented either before or after tanning (3.97) and where any surface layer, however applied, is not thicker than 0.15 mm

NOTE 1 TO ENTRY
If the tanned hide or skin is disintegrated mechanically and/or chemically into fibrous particles, small pieces or powders, and is then, with or without the combination of a binding agent, made into sheets or other forms, such sheets or forms are not leather.

NOTE 2 TO ENTRY
If the grain layer has been completely removed, the term leather is not to be used without further qualification, eg, split leather (3.93), suede leather.

NOTE 3 TO ENTRY
The material shall be of animal origin
Here is a cross section of salted hide (bottom) that shows the fat on the lower layer, the hide matrix in the middle and the hair on top layer (this is the grain side).

After processing to remove the hair and the lower layer we have a thick piece of hide. The color is light gray and has a rubbery feel.

The hide can be tanned with chromium, synthetic tanning agents or vegetable extracts. In our illustration we see the full thickness of the hide compared to the size of a one cent coin.
COW HIDES IN NUMBERS

The total number of cow hides available for tanning is about 270 million each year.

A typical fleshed cow hide weighs 25 kg (55 lb.) and has an area of 4.5 m² or 50 ft².
There are big differences between cow hides. Here are the main variables:

**AGE**
In most countries, beef steers, heifers and cows are matured to around 24 months. Milk cows and bulls can be a good deal older. The older animals may have lower quality hides due to parasites, scratches, manure damage, growth marks and wrinkles.

**BREEDS**
Breed determines the size, thickness, fiber structure, shape and hair type of the hide.

**SEX**
Better quality hides in commercial quantities are usually obtained from steers and heifers. In general, bulls produce bigger and thicker hides. Certain European bulls have an excellent grain quality that’s ideal for automotive and residential upholstery. Cows usually have thinner hides, with more spread and often have empty bellies and pocketing.

**FEED**
Confined animals (feed yards or lots) may have less new damage but, during winter, manure can accumulate on the hide and lead to grain damage. Grass-fed animals in open fields or savanna are more prone to parasitic damage and subsequent scratch damage.

**CLIMATE CONDITIONS**
Dictate which breeds are suitable for a specific location. Some breeds can tolerate severe winters, others tropical or hot climates. Geographical and climate conditions determine the best breed for locations that are suitable for meat production, not for the quality of leather they produce.

**BRANDS**
Animal control by RFID (Radio Frequency Identification Device) is growing in use as it also works as a powerful traceability tool. Fire or freezing brands are still used (by law in some locations); these brands severely reduce the quality of a hide, particularly when multi-branding is used.
<table>
<thead>
<tr>
<th>Country</th>
<th>Volume Millions</th>
<th>Animal Feed System</th>
<th>Grades</th>
<th>Main Breeds</th>
<th>Uses</th>
<th>Other</th>
<th>Hide Preservation Methods</th>
</tr>
</thead>
</table>
| Brazil    | 38              | Mostly grass-fed (80%) | • 5% full grain  
• 70% corrected grain  
• 20% low grades | Zebu Brahma  
Upholstery, shoe uppers, leather goods and automotive | • Damage by ticks, wire and grubs  
• Hides are thin, have a hump  
• Branded                       | • Short term preservation and salting                           |
| USA       | 34              | Grass-fed, grain finished | • Full grain 30%  
Varieties: Angus and Hereford breeds | All uses | • Largest global supplier of hides with consistent thickness, size and seasonal quality  
• Branded                       | • Fresh processing of hides  
• 65% brine cured for export                                           |
| Europe    | 26              | Mostly Grass-fed | • Mostly full grain  
Various breeds | All uses | • Wide range of sizes and qualities  
• Calf and veal for premium leathers  
• Heavy bulls of top and medium quality for upholstery  
• Steer, heifers and beef cows of good quality | • Fresh and salted                                                   |
| China     | 25              | Grass-fed | • Mostly full grain  
Various breeds | Shoes and leather goods | • Hides are sold by area  
• Production concentrated on third and fourth quarters | • Salted                                                             |
| Argentina | 14              | Grass-fed | • 90% full grain  
• 10% corrected grain  
European Angus and Angus cross-bred | All uses | • Hides are smaller and thick, making good quality full grain and good suede  
• Spring hides may have parasites | • Salted and fresh                                                   |
| Mexico    | 7               | Mostly grass and feed lots | • 20% full grain  
• 40% corrected grain/auto  
• 40% low grades | Various | Automotive upholstery, shoes, leather goods | • North has better selections  
• Damage by ticks and parasites  
• Broad types of hides, variation in size and weight. Branded by law | • Fresh processing of hides and salting                             |
| Australia | 7               | Grass and grain-fed | • Mostly corrected grain  
Various breeds | Upholstery, shoes, corrected grain | • 55% is produced in Queensland – ticks an issue  
• NSW/Victoria produce better quality but have flies in the summer and lice/mites in the winter | • Fresh and salted                                                   |
# UNITED STATES COW HIDE CLASSIFICATION

## GUIDE TO PACKER HIDE SELECTIONS WITH ESTIMATED WEIGHTS

<table>
<thead>
<tr>
<th>Selection</th>
<th>Type</th>
<th>Description</th>
<th>Trimmed &amp; Fleshed</th>
<th>NET WEIGHT RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra Heavy Native</td>
<td>Steers and heifers</td>
<td>Free of brands</td>
<td>64 up</td>
<td></td>
</tr>
<tr>
<td>Heavy Native</td>
<td>Steers and heifers</td>
<td>Free of brands</td>
<td>47 up</td>
<td></td>
</tr>
<tr>
<td>Extra Heavy Butt-branded</td>
<td>Steers and heifers</td>
<td>Branded one or more times back of break in flank</td>
<td>64 up</td>
<td></td>
</tr>
<tr>
<td>Butt Branded</td>
<td>Steers and heifers</td>
<td>Branded one or more times back of break in flank</td>
<td>47 up</td>
<td></td>
</tr>
<tr>
<td>Extra Heavy Colorado (Side branded)</td>
<td>Steers and heifers</td>
<td>Branded one or more times forward of break in flank</td>
<td>64 up</td>
<td></td>
</tr>
<tr>
<td>Colorado Branded</td>
<td>Steers and heifers</td>
<td>Branded one or more times forward of break in flank</td>
<td>47 up</td>
<td></td>
</tr>
<tr>
<td>Extra Heavy Branded</td>
<td>Steers and heifers</td>
<td>Branded one or more times</td>
<td>67 up</td>
<td></td>
</tr>
<tr>
<td>Branded</td>
<td></td>
<td></td>
<td>47 up</td>
<td></td>
</tr>
<tr>
<td>Extra Heavy Texas</td>
<td>Steers and heifers</td>
<td>Texas Panhandle Area origin</td>
<td>64 up</td>
<td></td>
</tr>
<tr>
<td>Native – Light</td>
<td>Steers and heifers</td>
<td>Free of brands</td>
<td>55 down</td>
<td></td>
</tr>
<tr>
<td>Texas – Light</td>
<td>Steers and heifers</td>
<td>Mix of Texas</td>
<td>55 down</td>
<td></td>
</tr>
<tr>
<td>Branded – Light</td>
<td>Steers and heifers</td>
<td>Branded one or more times</td>
<td>55 down</td>
<td></td>
</tr>
<tr>
<td>Heavy Native Cows (Dairy)</td>
<td>Milk breed cows</td>
<td>Free of brands</td>
<td>45 up</td>
<td></td>
</tr>
<tr>
<td>Native Cows (Dairy) Light</td>
<td></td>
<td></td>
<td>45 down</td>
<td></td>
</tr>
<tr>
<td>Heavy Native Cows (Beef)</td>
<td>Beef breed cows</td>
<td>Free of brands</td>
<td>45 up</td>
<td></td>
</tr>
<tr>
<td>Native Cows (Beef) Light</td>
<td>Beef breed cows</td>
<td>Free of brands</td>
<td>45 down</td>
<td></td>
</tr>
<tr>
<td>Heavy Branded Cows (Beef)</td>
<td>Beef breed cows</td>
<td>Branded one or more times</td>
<td>45 up</td>
<td></td>
</tr>
<tr>
<td>Branded Cows Light (Beef)</td>
<td>Beef breed cows</td>
<td>Branded one or more times</td>
<td>45 down</td>
<td></td>
</tr>
</tbody>
</table>

## Selection

<table>
<thead>
<tr>
<th>Selection</th>
<th>Type</th>
<th>Description</th>
<th>Curved Conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native Bull</td>
<td>Males</td>
<td>Free of brands</td>
<td>85 up</td>
</tr>
<tr>
<td>Branded Bull</td>
<td>Males</td>
<td>Branded one or more times</td>
<td>85 up</td>
</tr>
</tbody>
</table>
In the United States, wet blue is sold by surface area (ft²) or weight in pounds (lb) (considering 50-60% moisture). Price varies by class and type.

<table>
<thead>
<tr>
<th>Class name</th>
<th>Characteristics</th>
<th>Hide type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>No brands</td>
<td>Heifer, steer or jumbo</td>
</tr>
<tr>
<td>Butt Branded</td>
<td>Only one brand below the center of the leather</td>
<td>Heifer, steer or jumbo</td>
</tr>
<tr>
<td>Colorado</td>
<td>Multiple brands or one brand above the center line</td>
<td>Heifer, steer or jumbo</td>
</tr>
<tr>
<td>M Cattle</td>
<td>Mexican breeds raised in the US – distinctive mark on the right butt cheek</td>
<td>Mix of heifer, steer and jumbo</td>
</tr>
<tr>
<td>Special</td>
<td>Over a third of the leather is defective through natural or process defects</td>
<td>Mix of heifer, steer and jumbo</td>
</tr>
</tbody>
</table>

**Note:** wet blue types made in the USA do not include cow leather

**OTHER CLASSES**

- **Heifer** (best quality): HNH (Heavy Native Heifer) > BBH (Butt Branded Heifer) > BH (Branded Heifer)
- **Steer** (best quality): HNS (Heavy Native Steer) > BBS (Butt Branded Steer) > BS (Branded Steer) > HTS (Heavy Texas Steer)

**HIDE TYPE WEIGHTS**

- **Heifer**: fresh hide weight up to 58 lb. (26 kg)
- **Steer**: fresh hide weight between 59 and 92 lb. (27 to 42 kg)
- **Jumbo**: fresh hide weight above 93 lb. (42 kg)

**Geographic influence.** Usually, the best hides are from above the 37th parallel; manure damage can occur during the winter season.
### BRAZIL

#### Wet blue classification

This is the typical wet blue grading, ranging from premium to lower grade quality:

<table>
<thead>
<tr>
<th>Classification</th>
<th>Average Area</th>
<th>Average Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extra Heavy</strong></td>
<td>52-56 ft²</td>
<td>28-30 kg</td>
</tr>
<tr>
<td><strong>Leathers</strong></td>
<td>come from 100% Zebu bulls. They are apt for heavy finished leathers, shoe leathers, waxy leathers, belts, horse saddlery and upholstery. Better grades can have lighter finishes.</td>
<td></td>
</tr>
</tbody>
</table>

| **Standard** | 48-52 ft² | 24-26 kg |
| **This is the main type of leather from the central part of Brazil, which has the largest herds and produces better beef cattle. Leathers can have a wide number of applications: shoes, upholstery, automotive and leather goods.** |

| **TR I** | Average area 52-56 ft², Average weight 28-30 kg |
| **Leathers** | for shoes, automotive and price-conscious upholstery, and some types of leather goods. As the grading reduces so the amount of finishing increases, to hide the imperfections. |

| **TR II** | Average area 46-48 ft², Average weight 22-24 kg |
| **TR III** | Average area 46-48 ft², Average weight 21-23 kg |
| **TR IV** | Average area 46-48 ft², Average weight 20-22 kg |
| **R** | Average area 46-48 ft², Average weight 18-20 kg |
| **Economic** | Average area 46-48 ft², Average weight 18-20 kg |
| **Reject** | Average area 46-48 ft², Average weight 18-20 kg |
| **Leathers** | used for shoes with a heavy finish, such as safety shoes and safety items. |
PARTS OF A HIDE AND TYPICAL DEFECTS

Belly: F and G  
Bend: D and E  
Croupon: D+E  
Side: A, B, D and A, C, E  
Shoulder: B+C

- Neck wrinkles
- Insect bites
- Scratches
- Belly drawn
- Veins
- Manure damage
- Brand
- Belly drawn
TYPICAL NATURAL DEFECTS FOUND ON LEATHER

- BRANDS
- SCRATCHES
- VEINS
- WRINKLES
- PARASITES AND INSECT BITES
**Hides can be processed fresh** after removal from the animal, or they can be preserved. Globally, about 30% of hides are processed fresh; 70% of them are preserved by salting (or brine curing) then processed locally or overseas. Salted hides have solid salt added to dehydrate and saturate the hide. In brine curing the hides are immersed in a salt solution for 24 hours to saturate the hides with brine.

Salting is the **most efficient and cost-effective way of** preserving hides for up to one year. The hides are put on pallets with **about 40 hides each. A container can hold around 600 hides (USA).**

Increasingly, the global trend is to avoid salting by processing fresh hides either with or without refrigeration.
Here is a typical cross section of an American cow hide stained with Hæmatoxylin. It shows the different thicknesses and lengths of the hairs. The area shown is the grain area, which is defined as being from the surface (epidermis) to the bottom of the hair follicles. This is the most valuable area of the leather.
A LOOK AT LEATHER’S STRUCTURE

LEATHER GRAIN
Area from the surface to the bottom of the hair follicle. Fibers are fine and elastic on the top and get bigger and thicker going down. To get the required thickness, grain leathers usually contain part of the split.

LEATHER SPLIT
Area from the bottom of the hair follicle to the flesh side. Fibers are closely interwoven. Closer to the bottom, fibers get finer and sit parallel to the flesh side.

LEATHER TYPES

- full grain
- snuffed grain
- corrected grain
- nubuck

- splits
- suede
- PU splits
Hides are trimmed to remove parts that cannot be used to make leather. They are fleshed to remove the endodermis before curing or after processing (liming). After hair removal, collagen, the central part of the hide (dermis), will be transformed into leather. Only a few cow hides are tanned ‘hair on’.

Hair consists of keratins and can be used for hydrolysates (e.g., cosmetics) and industry. This is the dermis that will become leather. It can also be used to make collagen for feed, industry, cosmetics, medical and hundreds of other applications. Collagen doesn’t have the same nutritional value as meat.
THANK YOU FOR YOUR ATTENTION