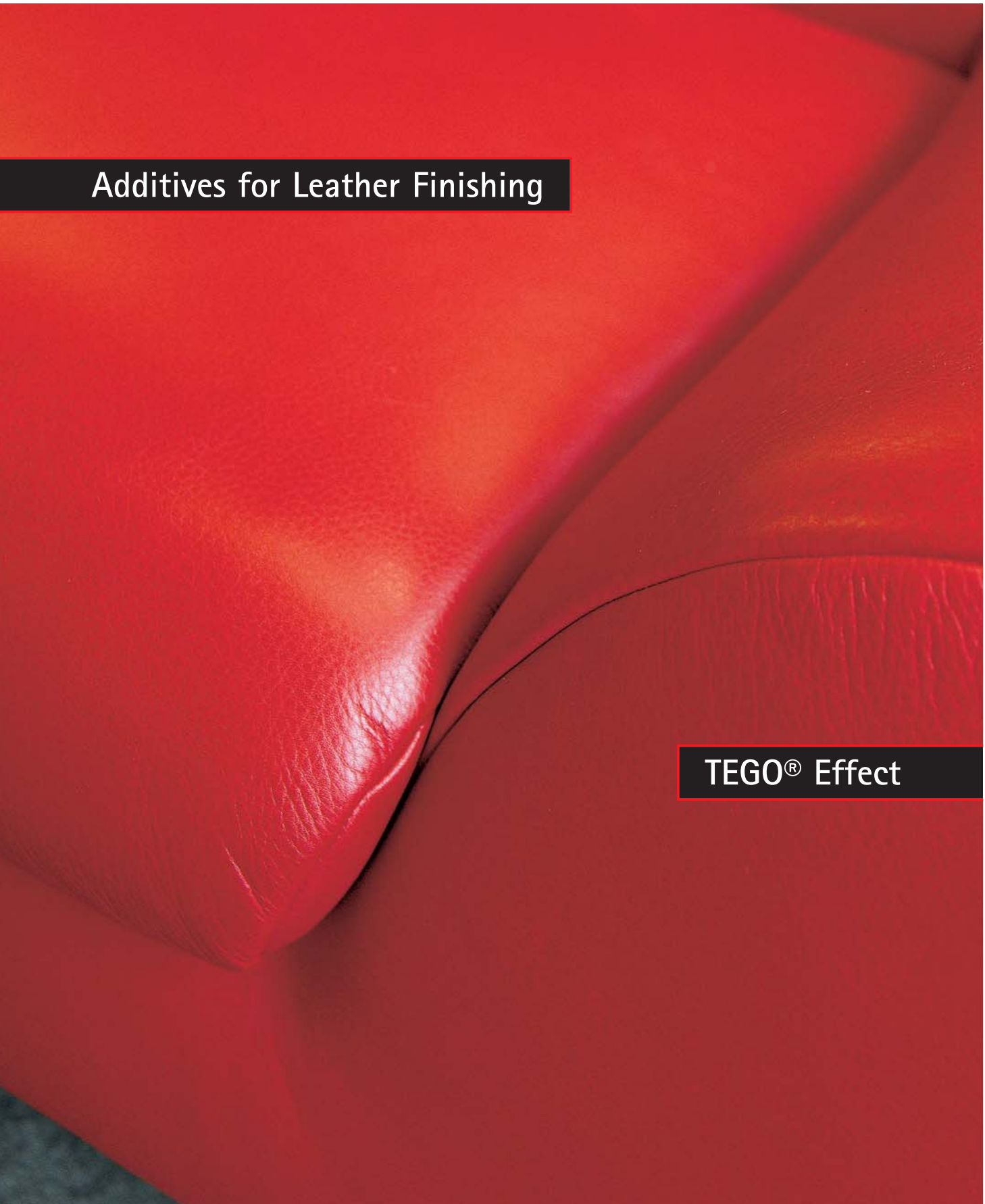

Additives for Leather Finishing

TEGO® Effect

Leather is a material manufactured from tanning the skins of animals such as cattle, goats, pigs, crocodiles and horses.

Artificial leather is a leather substitute consisting of natural or synthetic fiber cloth coated with plasticized polyvinyl chloride (PVC) or polyurethane (PUR). These coatings can be dense or foamed depending on the application. Usually the surface is shagreened to give the appearance of natural leather. Artificial leather is used for shoes, bags and tops of convertible cars.

Surface Finishing

Directive 94/11/CE of 23-03-94 and UNI 10857
"Requirements for labeling of leather goods"

- If the thickness of the finishing film is greater than 0.15 mm, but less than 1/3 of the total thickness of the product, including the finishing film, the material is defined as "COATED LEATHER"
- If the finishing film constitutes more than 1/3 of the total thickness of the hide, the name "leather" is replaced with other terms and the leather serves only as the foundation for the material which constitutes the final product.

Processing

After flaying, the raw skins are trimmed. Parts that are not usable in the manufacture of the leather are removed. The skin is then preserved by salting to prevent decay and damage which would lower the quality. In regions where salt is scarce and the climate permits, skins and hides are dried. The basic principle of conservation, whether by salting or drying, is lowering the water content of the skin to keep fouling bacteria from growing. Where distances are short and supply chains suitable, skins can also be preserved for a short period by cooling without the use of salt.

In the subsequent processing the skin is first soaked to eliminate salt, dirt, etc. After that the hair is removed and the rawhide preserved by treatment with mineral, synthetic organic or herbal tanning agents.

The smooth side of the leather is called the grained side. It is the original outer surface of the skin of the animal and has a structure characteristic of the particular animal. For most applications further surface treatment is necessary, such as application of a finish or embossing an artificial grain.

What is finishing?

Finishing refers to the chemical, physical and mechanical processes carried out on the hide. In general they give the final appearance to the hide and determine its quality. Different finishing processes are used depending on the purpose to which the leather will be put. Finishing alters the touch of the leather, evens out irregularities in the color and structure and corrects imperfections in the grain. It also imparts the right appearance, for example a particular degree of gloss and color. By applying a coating layer and embossing the effect of a natural grain can be recreated.

This is all done while trying to perform as little modification as possible so as not to alter the unique characteristics of the leather.

Binders for leather finishing

Acrylic binders

These are emulsions of acrylic copolymers such as butyl- and ethylacrylate and acrylonitrile with lowest film forming temperature below 1 °C and glass transition temperature below 0 °C. They are also used as thermoplastic binders to provide good printability, water permeability and high rub resistance.

Waterborne polyurethanes

In general aliphatic urethane polymers are used. These are produced by reacting linear polyester polyglycols, polycarbonates and aliphatic isocyanates. They give the coating flexibility, dry and wet rub resistance and a high degree of gloss.

Caseins

Water soluble protein binders with a solids content of 13 to 19 % in alkaline solution are used. Casein binders impart high degrees of gloss and hardness.

Nitrocelluloses cellulose acetate butyrate

These are water- or solventborne glossy and matt binders generally modified with plasticizers and silicone additives. They are used as a final dressing to improve water resistance and confer a pleasant touch.

Solventborne polyurethane and vinyl resins, 1- or 2-pack formulations

These are matt and glossy film formers with high physical and chemical performance. They are mainly used where high water repellency and solvent resistance are required. They also confer good light and ageing resistance.

What is the purpose of finishing?

Besides ensuring performance and giving the desired appearance to the hide, finishing frequently serves to conceal imperfections. Such flaws, generally in the grain, are natural defects or sometimes occur because of errors in processing. There are very few hides which do not have natural surface imperfections requiring corrections to the grain. Those which do are destined for use in products of the highest quality. By reducing, hiding or eliminating anomalies, the finishing operations improve the final appearance of the leather.

The finishing processes generally involve the application at least three or four layers of various chemicals. This may be repeated several times. After drying, they form a film which varies in thickness, transparency and elasticity. The following steps are usual:

Spray dyeing, carried out with more or less diluted dye solution, sometimes in combination with small quantities of binders, serves to make the color of the leather surface as uniform as possible.

Impregnation serves to regulate the absorption of the leather and to strengthen the grain surface.

Application of base coat, used to even out the entire surface of the hide in preparation for successive applications, which serves as an adhesive bridge between the hide base and the successive layers. The selection of the proper characteristics and of the precise type of polymer/s, is very important.

Application of intermediate layers, which may be transparent or opaque, and normally form the thickest part of the finish, add a certain hardness. This makes it possible to carry out several physical and mechanical operations that give the final look of the hide, including pressing or embossing a grain. They also bind the lower softer layers of the coating with the upper more rigid ones.

Application of a top coat, the final finishing layer which is composed of harder polymers than those of the previous layers. They give the finish the chemical and physical resistance required for the end application. "Touch and handle" additives give the leather the desired haptic or "feel".

The greater the thickness and number of the layers applied during finishing, the stiffer and less elastic the leather. However, depending on the application, a certain minimum degree of elasticity must be maintained. Additionally the characteristics of the leather should be preserved as far as possible so that it is not turned into something else. In many cases this requires careful judgment of the thickness of the coating.

Additives for leather finishing

The TEGO® Effect high performance range of additives for finishing leather is based on silicone-containing and silicone-free substances and comprises a broad spectrum of defoamers, touch and handle modifiers, wetting and dispersing additives and flow and anti-cratering additives. TEGO® Effect additives can be used in waterborne and solventborne formulations for application by roller coaters, spraying or curtain coaters.

Emulsifiers TEGO® Effect 96xx

Emulsifiers are used during tanning of the raw leather and finishing as:

- degreasing agents for tanning
- emulsifiers for nitrocellulose.

Touch and handle modifiers TEGO® Effect 93xx and 98xx

Touch and handle additives change the unpleasant plastic feel to an attractive soft leather haptic. These additives are siloxanes modified with organic chains or are based on pure organic structures with non-ionic, anionic or cationic character suitable for waterborne formulations. The most common examples are waxes, fluorosurfactants and polysiloxanes.

Figure 1: Testing leather quality

Defoamers/deaerators
TEGO® Effect 91xx and 92xx
Defoamers prevent macro- and microfoam during the production and/or application of waterborne finishes. Deaerators prevent air entrapment and pinholing which can impair transparency or produce other surface defects thereby affecting performance. Such problems occur particularly with high viscosity formulations with binders containing high levels of surfactants in spray and roller application.

Flow and leveling additives
TEGO® Effect 93xx and 94xx
This class of additives prevents cratering and pigment floating and also gives a more natural appearance in spray application.

Substrate wetting and anti-cratering additives TEGO® Effect 95xx
Good substrate wetting is the prerequisite for a continuous film. Wetting is difficult with low-energy substrates or surfaces contaminated with dirt particles or grease.

Substrate wetting and anti-cratering agents are necessary to enable the film to wet the substrate uniformly without problems.

Wetting and dispersing additives
TEGO® Effect 90xx
Wetting and dispersing additives prevent pigment floating, flooding and settling. They also improve the coating's color strength and transparency.

Steps in the application of finishes

The finish coats are applied to the leather mainly by spray or curtain coaters. Roller coating is another typical method used particularly to apply thicker films to the leather. Hot roller coaters are used to apply products such as waxes or oils. Depending on the hiding power and desired effect, finishing products can be applied in several coats.

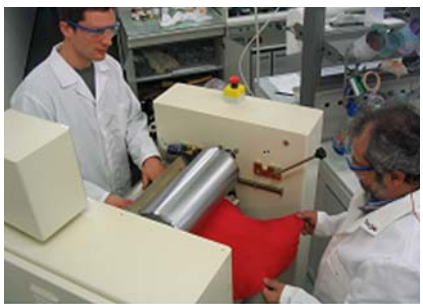

Figure 2: Roller coating

Testing leather quality

The above operations transform an animal skin into leather. As with every other product, it is necessary to check that all the effort has brought the required results. The leather must be subjected to various tests to ensure that it possesses all the quality characteristics required for the final product and that the purchaser/end-user considers essential.

QUALITY is the sum of the aesthetic and functional characteristics of the leather. It must satisfy the requirements for its anticipated use and the user's expectations.

Products made of leather appeal to all the senses of the purchaser. The cultural background of the individual also plays an important role in the purchasing decision: the leather must be functional and beautiful, two concepts which vary from culture to culture and from generation to generation.

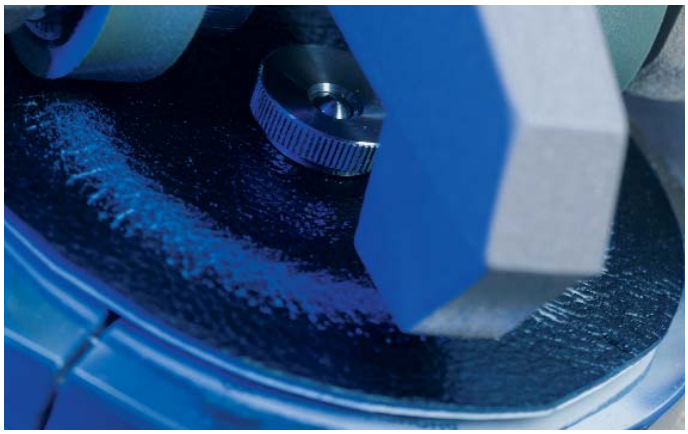

Figure 4: Abrasion test

Test methods

The leather must be subjected to various tests, depending on the end use.

Wet and dry rub resistance

Rub resistance is tested to DIN EN ISO 11640 using a VESLIC apparatus. The leather sample is first stretched by 10 %. A small white felt is passed back and forth under a defined pressure. The discoloring of the felt is then compared with a grey scale (fig. 3). The dry test is carried out with a dry felt, the wet procedure with a felt soaked in water or artificial perspiration.

Repeated flexural resistance, Flexometer test, DIN EN ISO 5402)

Samples of finished leather are clamped in a BALLY apparatus and the number of flexures which the sample resists without surface damage (e. g. cracking) determined. Measurements are carried out at room temperature and, for certain requirements, below 0 °C.

Water resistance (DI EN ISO 5403)

A penetrometer is used to determine how long and how often the leather must be compressed while in contact with water until it becomes permeable to water.

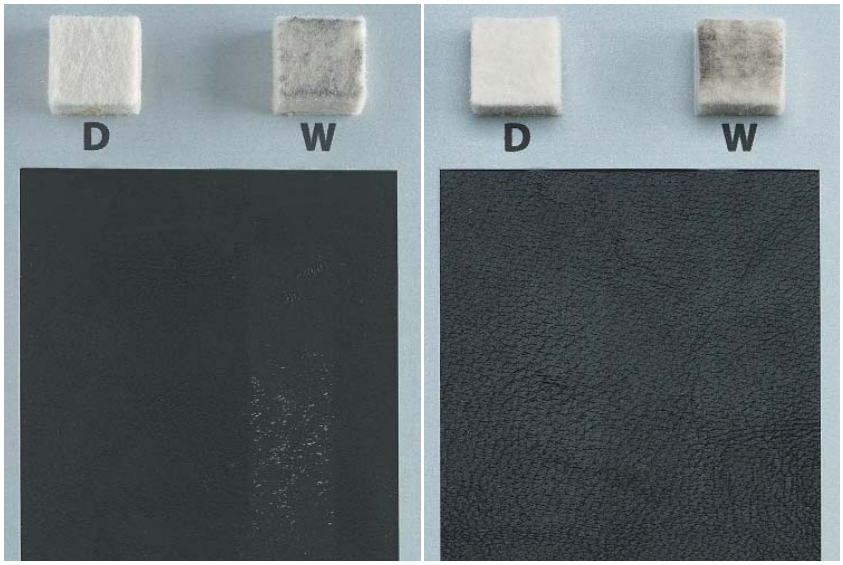

Figure 3: Dry rub resistance

Other tests

- Adhesion of finish to grain
  DIN EN ISO 11644
- Resistance to perspiration
  DIN EN ISO 11641
- Color fastness of leather to water spotting
  DIN EN ISO 15700
- Water absorption
  DIN EN ISO 2417
- Permeability to water vapor
  DIN EN ISO 14268
- Determination of water vapour absorption
  DIN EN ISO 17229
- Lightfastness
  DIN EN ISO 105-B02
- Fogging test
  DIN EN ISO 14288
- Color fastness to migration into plasticized polyvinyl chloride
  DIN EN ISO 15701
- Fastness to dry-cleaning
  DIN EN ISO 15700
- Hot lightfastness, hot light ageing
  VDA 75202