



Aqueous finishing of waterproof shoe upper leathers and waterproof pull-ups

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The end consumer's requirements for shoe upper leather are in a state of steady development. Footwear used for outdoor activities — such as hiking, climbing or trekking, and sports and golf shoes — needs to be waterproof; such properties are also demanded by high quality casual and so called mainstream fashion footwear. Because the price level for these products is higher than for standard articles, waterproof leathers are commercially of high interest. Waterproofing a leather definitely adds value.

(i) Waterproof shoe upper leathers

For waterproof leather in general there are many different requirements and specifications to be considered. Before finishing commences, it is essential to know and understand these requirements, so a very close co-operation between wet end and finishing departments is vital. Many factors need taking into account — for example, a high water vapour permeability (wvp) does not allow a very thick sealing coat, and thus requires a well adjusted product selection. Furthermore, high heat and UV-resistance prohibits the use of products which yellow under severe heat/light/UV-impact. Last, but not least, it is imperative that the finish should not adversely affect the waterproofness of the crust leather.



High abrasion resistance on waterproof leathers

The preparation of crust leathers

It is essential to secure a high adhesion of the initial finishing coat onto the crust leather. In addition to a good adhesion, it is also important that a uniform absorption is achieved. For this reason, a staking operation before finishing not only softens the leather, but also opens the surface by loosening the fibres. Naturally, this operation needs careful control to avoid a loose grain, but the process assists the penetration of the initial finish application.

In addition, a very light snuffing with a fine buffing paper (400/600) also supports the surface wetting. On the other hand, smooth or hair-cell plating may close a grain that is too open, and leads to a more even absorption of finish applications.

The adhesion coat, process and products

The first application of finish is the most important, either as an adhesion coat or a preground. Since leather articles are produced both as full grain and corrected grain, two procedures have to be taken into account.

FULL GRAIN LEATHERS

In most cases, full grain leathers receive an adhesion coat either by spraying or by using a reverse roller-coater machine. It is essential to achieve both a specified adhesion and maintain waterproofness.

CORRECTED GRAIN LEATHERS

A preground can be used to seal the surface, and this is preferably performed by using a reverse roller-coating machine. In this event, the mechanical action helps to penetrate the mix into the surface of the leather. If labour costs are not an



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important factor to be considered, this application can be carried out by hand padding.

Another way is to apply an adhesion coat by spraying. This applies to both full grain and corrected grain leathers in order to:

- improve the adhesion
- equalise the absorption for the following base coat application (*if possible by reverse roller-coater*).

PRODUCT CHOICE FOR THE ADHESION COAT

The following details are common for both full grain and corrected grain waterproof leathers:

- In general, no hydrophilic products should be used. Very often fine particle sized polyacrylic dispersions¹ are used, but polyurethane dispersions² also offer an opportunity. Due to synergetic effects, a combination of both types of product often leads to better penetration, hence better adhesion values.
- It is important to select suitable resins, as they should neither swell with water, nor have a negative influence regarding the waterproofness of the crust leather.
- To improve the penetration a small amount of co-solvents can be used. However, as there are increasing limitations in their use, the addition of co-solvents should be kept as low as possible or avoided.
- The use of surfactants is also limited as they can destroy the waterproofness of the crust leather. For this crucial need very special products are available, and in general the products have to be chosen with great care.

The following details must also be taken into account to improve the adhesion:

- an increase in the amount of the finish application leads to deeper penetration;
- cross-linking is especially important for wet white crusts, for white sports and golf shoes, and washable leathers;
- an increase in mechanical action by reverse roller-coater adjustment;
- a possible decrease of the solid content of the mix to improve the penetration;
- a possible increase of the solid content of the mix to increase the "add on".

Choice of product for the base coat

For light shades — especially for white leathers — the base coat has to provide good covering performance. Over and above this issue, the ingredients have to be chosen with the same care as for the adhesion coat:

- the resins should not swell with water^{3,4}.
- the auxiliaries must not be hydrophilic⁵.
- surfactants containing additives must not be used.
- proteins in general must not be used — pigment preparations should be casein-free.

Because of these limitations, the use of base coat compounds is very problematical. Only specially developed compounds for this special application should be used. (*For dark or even black leathers the base coat does not necessarily have to cover as much as for white leathers, and levelling the leather surface is normally sufficient.*)

Cross-linkers can be used in the base coat, where they both improve the water resistance of the finishing film and improve the intercoat adhesion. However, it is important that for white leathers — especially when high heat and UV-resistance is required — no amine-based cross-linkers may be used. The only choice is a polyisocyanate cross-linker⁶.

The finish application can be performed in almost every way. Depending on the equipment and general situation, the base coat can be either sprayed, applied by reverse roller-coater or curtain coater, or even applied by hand padding.

The demands of the top coat

The aqueous top coat follows the same guidelines as for the base coat. Although CAB-top coats are still used they are under ecological pressure, and so the aqueous top coats steadily gain importance. In this case only water resistant polyurethane and polyacrylic based resins⁷ should be used. Accordingly, normal shoe upper leather top coat products that contain proteins and other additives should be avoided. For white (*sport and golf*) shoes only polyisocyanate cross-linkers are valid.

The use of feel agents is also an important issue for these top coats, as they are used to both adjust the feel of the final leather and to reach the physical specifications. However, they should not be hydrophilic, so when a high abrasion resistance has to be reached the addition of special silicon- or wax-based additives is essential⁸.

Panel I: General guidelines for finishing waterproof leathers

Finishing Operation

	Haircell Article	Haircell Article: Nappa Style	Floater Type
Pre-Treatment	Buffing 400/600 Paper Emboss Haircell print	Emboss Haircell	Pre-mill Stake
Adhesion Coat	1 x spray or Reverse Roller-Coater or pad	1 x spray or Reverse Roller-Coater or pad	1 x spray or Reverse Roller-Coater or pad
Base Coat	1 x Curtain Coater 2 x spray	1 x spray (to avoid lines when padding) 1-2 x padding alt.: 2 x Reverse Roller-Coater	1 x spray (to avoid lines when padding) 1-2 x padding alt.: 2 x Reverse Roller-Coater
Top Coat and Final Treatment	2 x spray Stake Emboss Haircell Possibly final Stake	1 x spray Stake Emboss Haircell 1 x spray Stake	1 x spray Stake Emboss Floater Grain 1 x spray Short Mill and Stake