



## Freihof Sulz

Author: Dagmar Exner (Eurac)

Addition of foils or coatings to the glass



## Windows

### *What is the solution?*

Enhancing the glazing properties by applying a foil to the glazing. Films are used to upgrade existing historical glass for safety reasons. By coating the existing glass with insulating or heat protection films, also the thermal properties of the glass can be improved. The applied foils in this case work like the coatings in case of heat protection or insulating double or triple glazing, only that they are applied afterwards to the existing glazing. Low-E glass is the abbreviation for low-emissivity glass (= low heat radiation) and refers to an insulating glass to which a wafer-thin metal layer of about 100 nm is applied. This reduces the emissivity of the glazing and serves as a thermal and/or solar control layer. The structure of the coating as well as its technical and optical properties can vary depending on the type of coating.

### *Why does the solution work?*

Safety regulations can be a reason to substitute historic glazing, e.g. in public buildings in Italy building regulations require safety glass when it comes to window retrofit. In this case the application of a foil can be a compromise and a solution to conserve and maintain valuable historic glazing. In case of solution 1B, the “Dante school building” a foil was applied to the existing inner and outer glazing of the coupled window in order to obtain a safety glazing. In this case the foil has no effect on the energy efficiency of the glazing. To improve thermal properties of the glazing, there are insulating or heat protection films

on the market whose application can improve slightly the energy efficiency of the glazing by reflecting the indoor heat or can reduce excessive solar radiation into a building and thus reduce overheating.

*Description of the context:*

Renovation of ecological “Freihof Sulz” (Vorarlberg, Austria): Holistic redevelopment of the listed building into a lively meeting place. Due to the protection of historical monuments (see link to pdf below: a special feature (of the building) are the windows with largely cambered glass, shutters and sandstone frame) and well-preserved cambered windows, the decision was made to retain the box-type windows. Repaired and replaced using old wood material parts that were rotten, fell off or were infested with pests. New wood was used for large, damaged areas. Holes were filled in; irregularities were sanded or puttied. Old varnish was sanded off, the oil rubbed off with spirit. The windows were glazed out, the old putty was removed. With a special tool, only loose spots were sanded and then patched because otherwise, the paint would not have adhered. Afterwards, they puttied with linseed oil putty. The renewed glass was coated with a low-E coating. Partly the glass was re-glazed. In the listed rooms on the ground floor, the old, cambered glass was used. The fittings were rubbed off and after a function check they were lubricated and set up. Windows were partly machined at the bottom with a planing machine to ensure tightness. Glazing was done without silicone, instead, oil glue putty was applied with a spatula. Weather shanks were removed, and new ones made of larch wood were fitted. For sealing, sheep's wool was stuffed from the outside and grouted with acrylic. Inside, the carpenter sanded, puttied and patched the frames and checked and reattached the fittings. In some cases, holes had to be drilled on the sides and the frames screwed to the masonry. Shutters are designed to match the sunlight. Depending on the floor, direction and use, the shutters are partly closed at the bottom and are equipped with fixed slats or adjustable slats for display. Shutters were partly in very bad condition. They were also repaired as described above.

*Pros and cons of the solution:*

The pros of the solution are the low impact on historic glazing and the fact that it can be the only possible solution if building regulations require safety glazing. The cons of the solution are the very low effect on energy efficiency. The windows remain the coldest part of the façade (even more if the walls are

insulated) and condensation could occur on the glass. Another disadvantage depending on the film, is that the appearance of the window may be altered (colouring, transparency etc. Furthermore might the solution not be suitable for very thin historical glass with many irregularities

*Available pictures or publications of the solution:*



© Martin Rhomberg



Window solution at Freihof Sulz before (middle above) and after renovation (box-type window), © Beate Nadler-Kopf



Window solution at Freihof Sulz after renovation (box-type window), © Lukas Schaller



Window solution at Freihof Sulz after renovation (box-type window), © Lukas Schaller



Window solution at Freihof Sulz after renovation (box-type window), © Lukas Schaller

Thermal properties	Existing window	Refurbished window
Window type	Box-type window	Box-type window
Glazing	Two single glazing as box-type windows	Two single glazing as box-type windows with low-e
Shading	Outer shutter	Outer shutter
U <sub>w</sub>	2,2	1,8
U <sub>g</sub>	2,0	2,0
U <sub>f</sub>		0,7
g-value glass		2006
Approximate installation year	1900	

[https://www.hiberatlas.com/smarteredit/projects/172/Bescheid der  
Unterschutzstellung 2005\\_1.pdf](https://www.hiberatlas.com/smarteredit/projects/172/Bescheid%20der%20Unterschutzstellung%202005_1.pdf)

Heritage assessment (German)

*Link to best practice example (Hiberatlas):*

<https://www.hiberatlas.com/de/freihof-sulz--2-172.html>