

TECHNICAL SPECIFICATION

RIGID OPAQUE

WOODGRAIN AND SOLID COLOUR LAMINATED SHEET

INTRODUCTION

COOLSKIN is a range of PVC sheets laminated with a unique and exclusive semi rigid PVC based foil. This foil is weatherable, durable and incorporates COOL COLOR® pigmentation technology from K. Hornschuch AG in Germany and exactly matches current wood grain foils utilised in window profile, roof line and conservatory applications.

These products exhibit a comprehensive technical advantage over products currently being used and offered into the fabricated door market;

- Superior scratch resistance
- Superior abrasion resistance
- Superior foil thickness
- Minimised heat absorption (NIR activity)
- Class 1 fire rating
- Highly weatherable
- Embossed finish
- Retention of embossing
- Exact match to window and door frame
- BBA accreditation
- Specified under BS ISO EN manufacturing controls
- External independent auditing

COMPOSITION

A. SUBSTRATE

The substrates have been derived from a well proven technology which has been used successfully for over 12 years to produce sheets for modular homes, outdoor sheds etc which withstand the extreme climatic conditions from the cold of North American such as Alaska to the summer heat of the Southern States such as Florida and Texas.

The composition of the rigid PVC substrate is designed to maximise impact performance in both hot and cold environments, generate excellence in vacuum formability with sharp definition and with pigmentation selection to minimise potential heat build up.

It's the heat of the daytime in spring, turning to summer and the contrast with the cold nights which causes failure of current inadequate door skins.

Whilst maintaining optimum impact performance during extremes of temperature the high Vicat Softening Point and Heat Deflection Temperature of the substrate reinforces the overall performance of the COOLSKIN sheet.

The rigid PVC substrate manufactured under licence is either offered as a brown or tan substrate to match the base colour of the laminating foil or as a white substrate.

There are significant technical advantages in using a white substrate, which will be described later.

These brown and tan substrates are manufactured with pigmentation consideration to minimise solar heat absorption onto and into the surface of the sheet.

B. FOIL LAMINATION

The foils specified as used in the COOLSKIN sheet range are manufactured and supplied exclusively by Konrad Hornschuch AG (KHAG) of Germany a leading and reputable manufacturer of decorative finishes and foils. These foils, developed by Hornschuch are patented under the trademark COOL COLOR®.

The rigid PVC substrate is laminated with a 300 micron thick foil, quite unique for PVC door skin fabrication. The lamination is based on a semi rigid PVC substrate overlaid with a print and then further overlaid with a matt highly weatherable and durable acrylic layer.

Current products available in the market for this application are either based on a hot stamp foil or a conventional PVC based foil.

The hot stamp foil is only 20 micron thick whilst the conventional PVC based foils are 230 micron thick.

All COOLSKIN sheets are Lead free and CFC free and produced from 100% virgin PVC with no added rework.

The decorative foils are laminated onto the PVC substrate during the extrusion process and produce a permanent bond between the substrate and decorative foil.

PERFORMANCE

SCRATCH RESISTANCE

Scratch resistance measured using Erichsen 413 according to DIN 53799 specification gives 0.7N for hot stamp foil and >1.0 N for COOLSKIN.

ABRASION RESISTANCE

Abrasion tests carried out show a superior performance of the COOLSKIN sheets over hot stamp foiled sheets:

Taber abrasion tests carried out using Erichsen 435 according to DIN 68861 Part 2 demonstrate the significant superior performance of COOLSKIN sheets over hot stamp foiled sheet surfaces. COOLSKIN sheets were also compared with conventional PVC decorative foils. The results of the tests undertaken by an independent test lab were;

Number of cycles required to wear through the laminated film:

Hot stamp foiled sheet	10 cycles
COOLSKIN	800 cycles
Competitor's PVC based foiled sheet	650 cycles

Hot stamp foil is abraded away to the substrate within 10 cycles, whereas the COOLSKIN with Hornschuch PVC foil takes 800 cycles.



HOT STAMP FOIL - TOTAL LOSS OF FOIL - WEAR INTO SUBSTRATE



COOLSKIN - MINIMAL WEAR



HOT STAMP FOIL - TOTAL LOSS OF FOIL - WEAR INTO SUBSTRATE

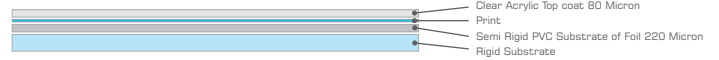


COOLSKIN - MINIMAL WEAR

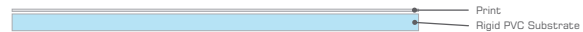
THICKNESS

The consequence of the poor scratch and abrasion resistance of the hot stamp foil in combination with the thickness of the hot stamp foiled sheet underlines the under par durability performance of hot stamp foils. Hot stamp foil in reality is purely a print laid onto the plastic sheet substrate with a thickness in the region of 20 microns.

COOLSKIN COLOUR FOILED SHEET



HOT STAMP FOILED SHEET



CONVENTIONAL DECORATIVE FOILED SHEET



THE EFFECT OF HEAT

INFRA RED SPECTRUM (NIR)

The major use for COOLSKIN products is for external doors, which are constantly subjected to the elements and in particular the sun and its harmful UV and IR rays. Within the full wavelength spectrum the UV rays attack the PVC molecules within the composition of the foil and can cause undesirable colour development and eventual structural breakdown. The effect of UV is explained later.

Heat from the sun comes from the infra red (IR) part of the spectrum. External doors are constantly subjected to the elements and in a 24 hour cycle can be subjected to a significant range of both ambient and surface temperatures, particularly during the height of summer.

The nature and composition of door skin surfaces in the market today define how much heat is absorbed onto and into the door structure.

Changes in surface temperature lead to expansion of the surface skin and once this becomes significant, distortion and other undesirable effects can and do easily occur.

Hornschuch have developed a range of foils which minimise the amount of heat absorbed and therefore the surface temperature fluctuation.

There are 3 layers within the make up of these products which require cool colour pigmentation in order to minimise heat absorption:

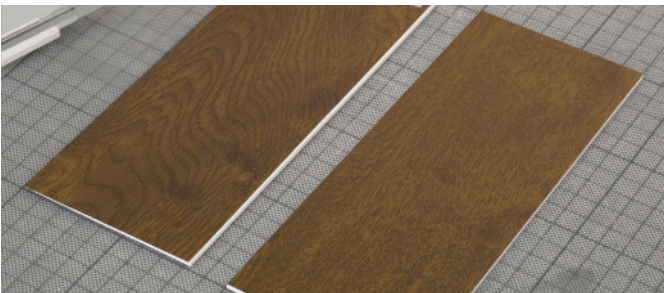
- The base rigid PVC substrate sheet.
- The semi rigid substrate of the laminating foil.
- The print sandwiched between the semi rigid substrate and the clear matt acrylic top layer.

It is important that the PVC substrate as well as the decorative foil is based on heat reflective technology. The COOLSKIN substrate contains pigmentations which resist heat at a much higher level than the current PVC sheets found in the market today.

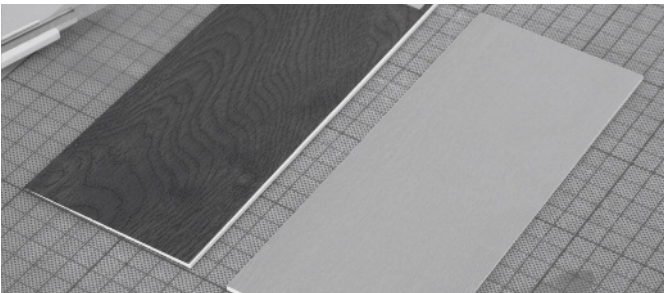
By use of an infra red camera the differences in heat reflectance/absorption between a cool colour foil and a conventional foil can clearly be illustrated by the photographs below.

A conventional camera shows no difference between the 2 types of foils, whilst the IR camera, shows the cool colour foil as white and the conventional foil as dark to black. The cool colour foil behaves as a white foil.

Conventional Camera

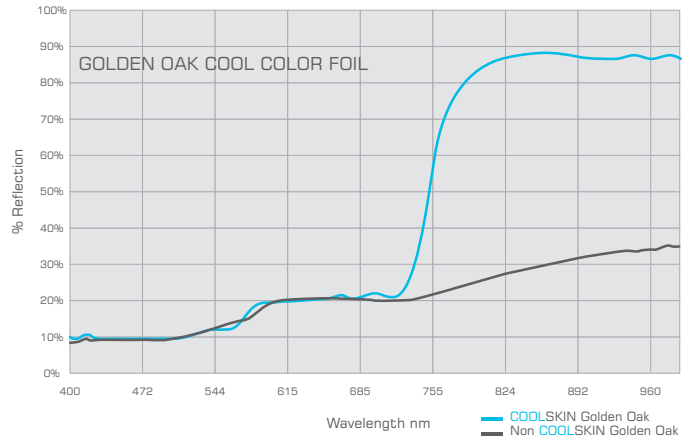


Infra Red Camera



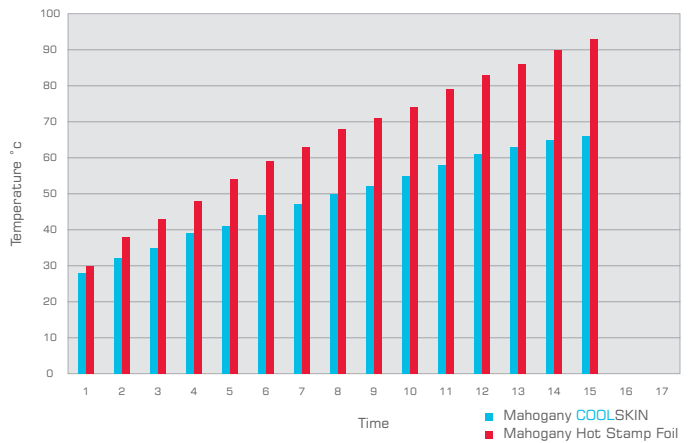
Measurement of heat build up in the IR spectrum can give as high as an 80% reflectance whereas a conventional wood grain foil of identical colour, the reflectance is only in the region of 30%. The measurements are made in the NIR section of the spectrum, which is where the solar heat is predominant.

Spectral Reflection of Foil Surfaces

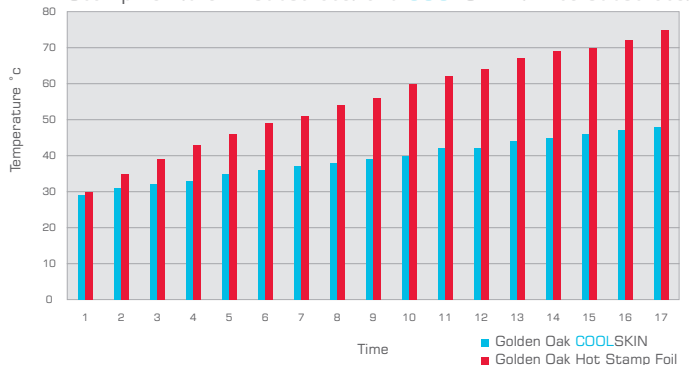


A practical demonstration with a heat source directed onto sheet surfaces clearly demonstrates the effect.

Heat Build Up comparison between Hot Stamp Foil (brown substrate) and COOLSKIN (brown substrate)



Surface Heat Build Up comparison between Mahogany Hot Stamp Foil (brown substrate) and COOLSKIN (white substrate)



The differences in heat build up as shown in the 2 graphs above also illustrates the additional heat resistance when using a white substrate.

Hot stamp foiled sheet is only 25 micron thick and offers little to no protection from heat build up. It is not just the thickness of the hot stamp foil, but also the make up of the print and the composition of the substrate which offers little to no protection.

The implication of this is obvious.

The major issue with wood grain laminated PVC based external doors, particularly when installed on south facing aspects is one of distortion and cracking, during hot weather.

This is caused by excessive solar absorption of the door skin, which is due to inadequate protection afforded by the hot stamp foils and conventional PVC based foils used today. COOLSKIN sheets with COOL COLOR® Hornschuch foils will significantly improve protection and minimise failures.

WEATHERING

ULTRA VIOLET SPECTRUM (UV)

The intensity of UV in the UK is increasing year on year and as such we need to continually improve the UV resistance of our externally installed plastic based products that are classed as 'sensitive' to the presence and attack of UV rays.

COOL COLOR® foils have been evaluated under both natural exposure and accelerated weathering programmes by Hornchurch's own laboratories as well as recognised independent test houses.

Results confirm that Hornschuch's COOL COLOR® foils exhibit excellent weathering stability (detail test data available upon request).

Under simulated MODERATE (warm and wet) climatic zone using DIN EN 513 Method 1 with a UV and UVIS intensity of 8GJ/m² and a weather cycle of 18 minutes water spray and 102 minutes dry, for 4,000 hours and for a HOT (hot and dry) climatic zone using DIN EN 513 Method 2 with a UV and UVIS intensity of 12GJ/m² and a weather cycle of 6 minutes water spray and 114 minutes dry for 6,000 hours the foils comfortably pass the new stringent S TEST for hot climates under RAL GZ 716/1 Section 1 part 7.

The effect of UV attack from solar power on the decorative foil system is protected by the presence of the clear acrylic layer which absorbs the UV. An initial thickness of 80 microns of acrylic layer which can be reduced to a minimum of 50 microns due to vacuum forming processes is more than sufficient to maintain acceptable colour stability.

Hot stamp foil has proven to give a significantly lower level of UV protection against long term colour stability in Northern European climates.

EMBOSSED FINISH

All COOLSKIN sheets are supplied with an embossing which exactly matches the equivalent wood grain foil present on window profile and roof line profile. This embossing effect is both visible to the eye and evident by feel.

The present hot stamp foiled sheet available in the market today, whilst having an embossed appearance is in fact an effect build into the print, which is visible but not evident by touch.

RETENTION OF EMBOSSING

One additional significant advantage of the COOLSKIN range is that the embossing is retained AFTER vacuum forming; a property not found in other PVC foiled sheet or in hot stamp foiled sheets.

8. BBA ACCREDITATION

All Hornschuch cool colour foils have been tested by BBA for weathering performance in moderate and hot/dry climates, colour stability under QUVA, abrasion resistance along with gloss retention after UV aging.

Documentation from BBA is available to confirm this.

February 2011