TEST LABORATORY

The test laboratory is accredited in compliance with DIN EN ISO/IEC 17025 by the Deutsche Akkreditierungsstelle GmbH. The accreditation is also valid for products of Regulation EU 2016/425. Test methods not included in the scope of accreditation are marked by a *.

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SÄCHSISCHES TEXTIL FORSCHUNGS INSTITUT e.V.

Authorized for the testing of heat and flame-resistant protective clothing for car racers according to FIA 8856-2000 standard by the Fédération Internationale de l'Automobile (FIA) Paris.

TEST REPORT

Order number STFI: **20190331.4**

Report date: 25 February 2019
Person responsible: Reinhardt

Orderer:
Vescom B.V.
Sint Jozefstraat 20
5753 AV Deurne
NETHERLAND

Test order:

Date: 4 February 2019
Order received: 8 February 2019
Material received: 13 February 2019

Chairman of the Board
Prof. Dr.-Ing. Hilmar Fuchs
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Material to analyse:

3 samples sun protective material

signed by client	colour	code for order processing
SINDO 8027	04	P0331_19_13
SINDO 8027	24	P0331_19_14
SINDO 8027	27	P0331_19_15

The sampling was supplied by the client. The test department is not informed about the sampling procedure.

Analysis content:

(1) Remission and transmission in the visible light range in accordance with DIN EN 410: 2011-04 (DIN EN 14500: 2008-08)

(2) Remission and transmission in the global radiation range in accordance with DIN EN 410: 2011-04 (DIN EN 14500: 2008-08)

(3)* Calculation of the total energy permeability degree g_{tot} of a window system with sun protective material, following DIN EN ISO 52022-1: 2018-01 and approximate calculation of the reduce factor F_c following DIN EN 14501: 2006-02

(4)* Calculation of the total energy permeability degree g_{tot} and the direct solar transmittance $\tau_{e,tot}$ of a window system with sun protective material, following DIN EN ISO 52022-1: 2018-01 and approximate calculation of the reduce factor F_c and the secondary heat transfer factor $q_{i,tot}$ following DIN EN 14501: 2006-02 (only for reference glazing C of DIN EN 14501: 2006-02)

(5) Direct und diffuse transmission measurement in the visible light range in accordance with DIN EN 410: 2011-04 (DIN EN 14500: 2008-08)

(6)* Classification of glare control in accordance with DIN EN 14501: 2006-02 (p.15; paragraph 6.3; table 8)

(7)* Classification of privacy night in accordance with DIN EN 14501: 2006-02 (p.16; paragraph 6.4; table 9)

(8)* Classification of the visual contact with the outside in accordance with DIN EN 14501: 2006-02 (p.17; paragraph 6.5; table 10)

(9)* Classification of the daylight utilisation in accordance with DIN EN 14501: 2006-02 (p.18; paragraph 6.6; table 11) on the basis of the rotational symmetric diffuse/hemispherical light transmission degree $\tau_{v,dif-h}$, approximately calculated after equation 18 in DIN EN 14500: 2008-08

(10) Measurement of the protective properties against ultraviolet solar radiation in accordance with DIN EN 13758 -1: 2007-03

* Standards for calculation and assessment are not allowed for accreditation

Conditions and equipment for optical tests:

test parameter	symbol	range of radiation
light transmission degree	$\tau_{v,n-h}$	380...780 nm (standard light D65)
light remission degree	$\rho_{v,n-h}$	380...780 nm (standard light D65)
light absorption coefficient	α_v	380...780 nm
UV - transmission degree	$\tau_{t,uv}$	280...380 nm (UV-radiation)
solar transmission degree	$\tau_{e,n-h}$	280...2500 nm (global radiation)
solar remission degree	$\rho_{e,n-h}$	280...2500 nm (global radiation)
solar absorption coefficient	α_e	280...2500 nm
normal/normal light transmission degree	$\tau_{v,n-n}$	380...780 nm (standard light D65)
normal/diffuse light transmission degree	$\tau_{v,n-dif}$	380...780 nm (standard light D65)

Equipment: UV/Visible/NIR spectrophotometer Lambda 900, PERKIN - ELMER Corp., USA; 150 mm integrating sphere; irradiation perpendicular to the integrating sphere opening; 8° slope of the sample area to the light incidence axis for remission measurements

For each material sample of the client three samples in the format (55 x 75) mm are taken, one in the machine direction, one in the cross machine direction and one diagonally. The irradiation takes place, if not otherwise noted, on the material side which is faced to the window system (marked by the client). During the measurement an circular area with a diameter of 25 mm (integrating sphere port) is covered by the sample.

Description of classification for visual comfort:

Description of classification for glare control, privacy night, visual contact with the outside and the daylight utilisation is given in DIN EN 14501: 2006-02 (p.13; paragraph 6.1 table 5).

Influence on visual comfort					
class	**0**	**1**	**2**	**3**	**4**
	very small effect	small effect	moderate effect	high effect	very high effect

Conditions for UV - transmission tests:

Equipment: Labsphere Ultraviolet Transmittance Analyzer UV-2000F

The samples were tested under normal climate conditions (20°C, 65% r. H.) without elongation.

The UV-transmission was measured in a wavelength range from (280 – 400) nm, whereas the UV-A range extends from (315 – 400) nm and the UV-B range from (280 – 315) nm. The solar spectrum of Albuquerque was used to calculate the UPF-rating.

Test results:

(1) Light range **UV-range**

Code	light transmission degree	light remission degree	light absorption coefficient	UV-transmission degree
P0331_19	$\tau_{v,n\text{-}h}$	$\rho_{v,n\text{-}h}$	α_v	τ_{uv}
13	0,2350	0,5860	0,1790	0,1637 [1)]
14	0,1320	0,4270	0,4410	0,0907
15	0,0127	0,0703	0,9170	0,0200

[1)] Because of optical brightener the measurement result of the UV-transmission degree could be defective (higher) under the use of the above described measuring method.

(2) Global radiation range

Code	solar transmission degree	solar remission degree	solar absorption coefficient
P0331_19	$\tau_{e,n\text{-}h}$	$\rho_{e,n\text{-}h}$	α_e
13	0,2657	0,6210	0,1133
14	0,2127	0,5387	0,2486
15	0,1413	0,3627	0,4960

(3)* Total energy permeability degree g_{tot} and reduce factor F_c

	Single glazing		Double glazing with air interspace		Double glazing with low emission degree and argon interspace		Triple glazing with low emission degree and argon interspace	
Code	U_g=5,8 W/(m²K) g=0,85		U_g=2,9 W/(m²K) g=0,76		U_g=1,2 W/(m²K) g=0,59		U_g=0,8 W/(m²K) g=0,55	
P0331_19	g_{tot}	F_c	g_{tot}	F_c	g_{tot}	F_c	g_{tot}	F_c
13	0,39	0,45	0,39	0,52	0,37	0,63	0,36	0,66
14	0,43	0,50	0,43	0,57	0,40	0,67	0,38	0,70
15	0,52	0,61	0,52	0,68	0,45	0,77	0,43	0,79

Code	Reference glass - DIN EN 13363-1: 2007-09			
	Triple glazing U_g=2,0 W/(m²K) g=0,65		Double glazing with thermal protective covering U_g=1,6 W/(m²K) g=0,70	
P0331_19	g_t	F_c	g_t	F_c
13	0,38	0,59	0,39	0,56
14	0,41	0,63	0,43	0,61
15	0,48	0,73	0,50	0,72

(4)* Total energy permeability degree g_{tot}, direct solar transmittance $\tau_{e,tot}$, reduce factor F_c and secondary heat transfer factor $q_{i,tot}$

	Double glazing with low emission degree (C)			
Code	U_g=1,2 W/(m²K) g=0,59		τ_e =0,49 ρ'_e =0,27	
P0331_19	g_{tot}	F_c	$\tau_{e,tot}$	$q_{i,tot}$
13	0,37	0,63	0,16	0,21
14	0,40	0,67	0,12	0,27
15	0,45	0,77	0,08	0,38

Mounting assumptions:

- sun protective material inside and closed
- aerated interspace to the glazing

The mathematical model in DIN EN ISO 52022-1: 2018-01 (simplified method) for calculation of g_{tot} and $\tau_{e,tot}$ is appropriated to a coarse compare of sun protection materials. The model is only valid for the following boundary requirements:

- $0 \leq \tau_{e,n-h} \leq 0,5$
- $0,1 \leq \rho_{e,n-h} \leq 0,8$

If the above mentioned boundary requirements are not fulfilled, the calculation of F_c from g_{tot} and g and the calculation of $q_{i,tot}$ from g_{tot} and $\tau_{e,tot}$ is not guaranteed either. The calculation is recommended in accordance with DIN EN ISO 52022-3: 2018-01 (detailed calculation method). Therefore it is necessary to measure reflection to the not the radiation exposed side and thickness at least in addition to the data of this order. In case of known conditions to be used at a building it is unalterable.

(5) Diffuse und normal transmission in the visible light range

Code	normal/hemispherical light transmission degree	normal/diffuse light transmission degree	normal/normal light transmission degree
P0331_19	$\tau_{v,n-h}$	$\tau_{v,n-dif}$	$\tau_{v,n-n}$
13	0,2350	0,2270	0,0080
14	0,1320	0,1273	0,0047
15	0,0127	0,0067	0,0060

(6-8)* Classification

Code	glare control	privacy night	sight contact with the outside
P0331_19			
13	1	2	0
14	1	2	1
15	3	2	2

(9)* Classification of the daylight utilisation

Code	diffuse/hemispherical light transmission degree	daylight utilisation
P0331_19	$\tau_{v,dif-h}$	
13	0,2081	2
14	0,1168	2
15	0,0104	0

The results are mean values from three measurements; spectrograms are kept in the test department.

(10) Solar UV protective properties

Code STFI	UPF		Transmission (UV-A) in %		Transmission (UV-B) in %		UPF-Rating
P0331_19	Mean	STD	Mean	STD	Mean	STD	
13	65,54	5,58	6,46	0,29	0,91	0,11	50+
14	79,68	7,05	4,58	0,20	0,82	0,10	50+
15	123,40	23,55	1,79	0,22	0,69	0,13	50+

The results are mean values from 10 measurements.

This UPF rating is for the fabric and does not address the amount of protection which is afforded by the design of the article. Manipulations involved in garment manufacture such as stretching and sewing may lower the UPF-value of the material.

The protection offered by this item may be lessened,

- at points where the fabric is in close contact with the skin such as across the shoulders
- if the fabric is stretched or wet
- with time, due to effects of normal wear

Unless otherwise agreed, all materials we received within this order will be kept for a maximum time of 6 month. Materials which are not stored because of technical or safety reasons are excluded from that

The testing period is defined as timeframe between receipt of samples and issue date of test report.

The test results are referring to the submitted samples. These test report is not allowed to copy in parts.

i.V. L. Hierhammer

Dipl.-Ing. Marian Hierhammer
head of test department

stfi geprüft

P. Reinhardt

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