



## BFRC WER & U-Value Report

Report Number: 05096-11

Window System	Kömmerring 70 – C70		
Window Type	Casement Window		
Size & Style	1230mm x 1480mm		
Frame Material	PVC-U		

Outer Frame	7502	Reinforcement	N/A
Vent	7581	Reinforcement	S2917 (Steel)
Mullion	7588	Reinforcement	676 (Steel)
Glazing Bead	1932	Gasket	CO-EX
Glazing Gasket	CO-EX		
Weather Seal	CO-EX		

Glazing Unit	28mm	Arrangement	4/20/4
Outer Pane	Planiclear	Low-e Coating	-
Cavity	-		
Centre Pane	-	Low-e Coating	-
Cavity	Argon 90%		
Inner Pane	Planitherm ONE	Low-e Coating	0.01

Spacer Bar	SWISSPACER ULTIMATE		
Primary Sealant	Polyisobutylene		
Secondary Sealant	Polysulfide	Sealant depth	3mm

### RESULTS

U-value ( $U_{window}$ ):	1.2	(W/(m <sup>2</sup> ·K))
Solar Energy Transmittance ( $g_{window}$ ):	0.32	
Effective Air Leakage ( $L_{factor}$ ):	0.01	(W/(m <sup>2</sup> ·K))
Energy Index:	-15	(kWh/m <sup>2</sup> /year)
BFRC Energy Rating Band:	C	

Prepared by: Phil Brown  
R&D and Product Manager  
Profine UK Extrusions Ltd

Signed: 

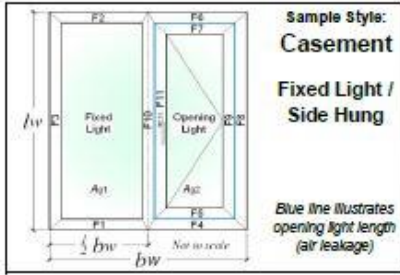
Date: 03 December 2021



BFRC Certified Simulator 141

Report in Accordance with BFRC rules. Simulations in accordance with BS EN ISO 10077-2:2017, performed with WinIso® 2.7.6 Using the radiosity approach to cavity modelling

# BFR Spreadsheet



Sample style:  
**Casement**  
**Fixed Light / Side Hung**

Blue line illustrates opening light length (air leakage)

Report Number: 05096-11 Issue No 22.3: 04/01/2016  
 Report Date: 03 December 2021  
 Project Details: Kommerfing 70 - C70 (4/20/4) Planiclear, Argon 90%, Planitherm ONE, SWISSPACER ULTIMATE

**THIS SPREADSHEET IS THE PROPERTY OF THE BFR AND CAN ONLY BE USED IN CONJUNCTION WITH A BFR LICENCE APPLICATION**

**Input Values:**  
 Yellow Input, green intermediary, blue finals X: DP is no. of decimal places to enter

Frame offset:  Yes

Nominal 4mm etc to 0DP, others 1DP	
<b>Glazing dimensions and properties:</b>	
Thickness of pane 1	4 mm
Pane 1/2 distance	20 mm
Gas fill (1/2)	Argon 90%
Thickness of pane 2	4 mm
Complete next 3 cells for TG IGU	
Pane 2/3 distance	mm
Gas fill (2/3)	
Thickness of pane 3	mm
Glazing Trans. - 3DP	$U_g$ 1.070 $W/(m^2 \cdot K)$
g-value - 2DP	$g$ 0.52

Thermal transmittance of window from hot box test  
 $U_w$  - 2DP  $W/(m^2 \cdot K)$

Window Dimensions:		Area		
Section	Length (m)	Width (m)	No gasket (m <sup>2</sup> )	With gasket (m <sup>2</sup> )
Fixed Light	1.3740	0.5270	0.7241	0.7184
Opening light	1.2780	0.4310	0.5508	0.5457
Total glazing, $A_g$			1.2749	1.2641
Frame	(m)	(m)	(m <sup>2</sup> )	(m <sup>2</sup> )
F1	0.6150	0.0530	0.0303	0.0311
F2	0.6150	0.0530	0.0303	0.0311
F3	1.4800	0.0530	0.0756	0.0777
F4	0.6150	0.0530	0.0303	0.0303
F5	0.5270	0.0480	0.0230	0.0236
F6	0.6150	0.0530	0.0303	0.0303
F7	0.5270	0.0480	0.0230	0.0236
F8	1.4800	0.0530	0.0756	0.0756
F9	1.3740	0.0480	0.0636	0.0656
F10	1.4800	0.0700	0.0999	0.1019
F11	1.3740	0.0480	0.0636	0.0656
Total Frame			0.5455	0.5563
Total Window, $A_w$			1.8204	1.8204
Percentage fixed light glass area			39.78%	39.46%
Percentage opening light glass area			30.26%	29.98%
Percentage glass area (total)			70.03%	69.44%

Solar Factor, g-value:  
 $F_w$  0.9  
 $g_w$  0.32

$U_{window}$	No bars; or attached bars	1.24	$W/(m^2 \cdot K)$
	Single cross bar in IGU	1.3	
	Multiple cross bar in IGU	1.4	
	Glazing bar (Georgian bar)	1.6	

Energy Window Energy Index	<b>-15</b>	Window Rating	<b>C</b>	BFR Rating $W/(m^2 \cdot yr)$										
					<table border="1"> <tr><td>≥20</td><td>A++</td></tr> <tr><td>&gt;10 to 20</td><td>A+</td></tr> <tr><td>0 to &lt;10</td><td>A</td></tr> <tr><td>-10 to &lt;0</td><td>B</td></tr> <tr><td>-20 to &lt;-10</td><td>C</td></tr> <tr><td>-30 to &lt;-20</td><td>D</td></tr> <tr><td>-40 to &lt;-30</td><td>E</td></tr> </table>	≥20	A++	>10 to 20	A+	0 to <10	A	-10 to <0	B	-20 to <-10
≥20	A++													
>10 to 20	A+													
0 to <10	A													
-10 to <0	B													
-20 to <-10	C													
-30 to <-20	D													
-40 to <-30	E													

Parameter	Symbol	Units
Total window height 0DP	$L_w$	1480 mm
Total window width 0DP	$b_w$	1230 mm

Frame dimensions:	(b <sub>i</sub> )	Frame width, b <sub>i</sub> (mm)	Frame offset, b <sub>o</sub> (mm)	Gasket protrusion, b <sub>g</sub> (mm)	Frame & gasket widths (mm)	
All frame values round to nearest 1mm, gaskets to 1DP	F1 fixed sill	53		1.5	54.5	Total
	F2 fixed head	53		1.5	54.5	
	F3 fixed jamb	53		1.5	54.5	
F4 + F5 sash sill	F4 fixed sash sill	53		n/a	53.0	102.5
	F5 moving sash sill	48		1.5	49.5	
F6 + F7 sash head	F6 fixed sash head	53		n/a	53.0	102.5
	F7 moving sash head	48		1.5	49.5	
F8 + F9 sash jamb	F8 Fixed sash jamb	53		n/a	53.0	102.5
	F9 moving sash jamb	48		1.5	49.5	
F10 + F11 mullion	F10 fixed mullion	70		1.5	71.5	121.0
	F11 moving mullion	48		1.5	49.5	
Total gasket area				0.010812	m <sup>2</sup>	

Where a $U_w$ value from hot box testing is available, no $L_f^{2D}$ or $L_w^{2D}$ values need to be entered							
Frame conductance:		All L values to 4DP. All b values to 0DP					
		$W/(m^2 \cdot K)$	$b_g$ (mm)			$W/(m^2 \cdot K)$	$b_g$ (mm)
F1 fixed sill	$L_f^{2D}$	0.2580	190	$L_w^{2D}$		0.2930	190
F2 fixed head		0.2580	190		0.2930	190	
F3 fixed jamb		0.2580	190		0.2930	190	
F4 + F5 sash sill		0.3262	190		0.3609	190	
F6 + F7 sash head		0.3262	190		0.3609	190	
F8 + F9 sash jamb		0.3262	190		0.3609	190	
F10 + F11 mullion		0.5552	380		0.6251	380	

Frame:	Frame width, b <sub>i</sub> (m)	Frame U-value, U <sub>i</sub> (W/(m <sup>2</sup> ·K))	Frame area, A <sub>i</sub> (m <sup>2</sup> )	Frame heat flow, H <sub>i</sub> (W/K)	Linear trans, Ψ (W/(m·K))	Linear length, l <sub>l</sub> (m)	Junction heat flow, H <sub>j</sub> (W/K)
F1 fixed sill	0.0530	1.1721	0.0303	0.0355	0.0276	0.5270	0.0145
F2 fixed head	0.0530	1.1721	0.0303	0.0355	0.0276	0.5270	0.0145
F3 fixed jamb	0.0530	1.1721	0.0756	0.0887	0.0276	1.3740	0.0379
F4 + F5 sash sill	0.1010	1.2903	0.0533	0.0687	0.0273	0.4310	0.0118
F6 + F7 sash head	0.1010	1.2903	0.0533	0.0687	0.0273	0.4310	0.0118
F8 + F9 sash jamb	0.1010	1.2903	0.1393	0.1797	0.0273	1.2780	0.0349
F10 + F11 mullion	0.1180	1.3851	0.1635	0.2265	0.0551	1.3260	0.0730
Totals				0.5455	0.7033		Total 0.1963

Other parameters needed for calculation, taken from simulations:  
 $\lambda_p = 0.035$   $W/(m \cdot K)$   $R_{sp} = 0.04$   $m^2 \cdot K/W$   $d_p = d_g = 0.028$  m  
 $R_p = 0.8000$   $m^2 \cdot K/W$   $R_{ext} = 0.9700$   $m^2 \cdot K/W$   $R_{sp} = 0.13$   $m^2 \cdot K/W$   
 $U_p = 1.0309$   $W/(m^2 \cdot K)$

<b>Air Leakage loss:</b>		
Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - 2DP		0.15 $m^3/(m \cdot h)$
Opening light length	3.8020 m	Total air leakage 0.570 $m^3/h$
$L_{50}$	0.31 $m^3/(m^2 \cdot h)$	Heat loss = 0.0165 $L_{50}$ $W/(m^2 \cdot K)$

BFR Rating =	218.6g $W/(m^2 \cdot yr)$ - 68.5 x ( $U_{window}$ + Effective $L_{50}$ ) =	<b>-14.25</b>
Climate zone is:		<b>UK</b>
Thermal transmittance, $W/(m^2 \cdot K)$	$U_{window}$	<b>1.2</b>
Solar factor	$g_{window}$	<b>0.32</b>
Window air leakage heat loss, $W/(m^2 \cdot K)$	$L_{factor}$	<b>0.01</b>
Simulator Name:	Phil Brown	<b>141</b>

The legal validity of this report can only be claimed on presentation of the complete report with supporting electronic information.

Simulations in accordance with BS EN ISO 10077-2:2017. Simulation Program: SommerGlobal WinISO.

## EN 673 Spreadsheet

Version 12 18/06/2015. Calculations according to BS EN 673:2011

Number of spaces
1

		Spaces	1		
Glazing orientation		Outside Pane 1   90%   Pane 2			
	Vertical				
Resistivity panes	1	m·K/W			
		Gas			
		Argon			
Thickness (mm)	4.0	20	4.0		
Normal emissivity	0.89	0.01			
$\sum d_j \cdot r_j =$	0.008	Uncoated			

For uncoated surfaces input 0.89 for normal emissivity, which corresponds to a corrected emissivity of 0.837

External, $R_{se}$	0.04	$(m^2 \cdot K)/W$
Internal, $R_{si}$	0.13	$(m^2 \cdot K)/W$
Iteration number	U value	$\sum 1/h_s$
	$W/(m^2 \cdot K)$	$(m^2 \cdot K)/W$
1	1.070	0.75659
2	1.070	0.75659

$\lambda_{eff}$	$\Delta T$
$W/(mK)$	
0.0264	15
0.0264	15

## Additional Notes

N/A

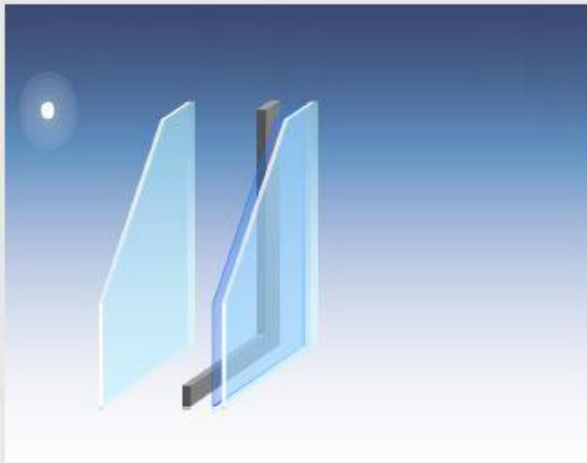
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*Simulations in accordance with BS EN ISO 10077-2:2017. Simulation Program: SommerGlobal WinISO.*

# Glazing g<sub>L</sub> Results




Thursday, November 18, 2021



Glazing 1	PLANICLEAR 4 mm
Cavity 1	Argon 90% 20 mm
Glazing 2	PLANITHERM ONE PLANICLEAR 4 mm

Last name: phil brown  
 Country: United Kingdom

Notes:

 <b>LUMINOUS FACTORS</b>	EN410 (2011-04)
Light Transmittance (TL)	72 %
Outdoor Reflectance (RLe)	22 %
Indoor Reflectance (RLi)	23 %

 <b>ENERGY FACTORS</b>	EN410 (2011-04)
Transmittance (TE)	46 %
Outdoor Reflectance (Ree)	40 %
Indoor Reflectance (Rei)	41 %
Absorptance A1 (AE1)	8 %
Absorptance A2 (AE2)	6 %

 <b>THERMAL TRANSMISSION</b>	EN673-2011
U <sub>g</sub>	1.1 W/(m <sup>2</sup> .K)
Angle relative to the vertical	0 °

 <b>SOLAR FACTORS</b>	EN410 (2011-04)
Solar Factor (g)	0.52
Shading Coefficient (SC)	0.80

 <b>MANUFACTURING SIZES</b>	
Nominal Thickness	28.00 mm
Weight	20.0 kg/m <sup>2</sup>

 <b>COLOR RENDERING</b>	
Transmission (Ra)	98
Reflection (Ra)	97

 <b>ACOUSTICS</b>	EN 12758
<i>Acoustic simulated values</i>	
R <sub>w</sub> (C;Ctr)	33 (-1; -5) dB
STC (ASTM E413)	34
OITC (ASTM E1332)	26

 <b>ANTI-BURGLARY</b>	EN 356
Burglar Resistance	NPD

 <b>SAFETY CLASS</b>	EN 12600
Pendulum Body Resistance	NPD



Calumen calculates the photometric characteristics and thermal transmission of glass using calculation algorithms which comply with the following standards: the European standards EN 410 and EN 673, the international standard ISO9050, the Japanese standard JIS R 3106/3107 and the Korean standard KS L 2514/2525. The functional output and calculation rules of Calumen for standards EN 410 and EN 673 have been validated by TÜV Rheinland (report 11923R-11-33705). The technical performances obtained according to these standards are provided for information only and are subject to amendment. Only the values entered in the performance declaration available on the CE marking site of Saint-Gobain Glass are official. The sound attenuation indices are measured under laboratory conditions according to the standards EN ISO 10140 and EN 12758. The calculated indices are provided for information only. The accuracy for R<sub>w</sub> index lies within a range of +/-2dB. The glass thickness calculations comply with the 2012 version of the DTU39-P4 description. The USER is responsible for ensuring that the correct calculation hypotheses are entered and the DTU39 is applied appropriately for the project concerned.

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# Glazing Spacer Bar Conductivity Data

April 2013 – No. W19 – Revision Index 4-06/2021 – valid until June 30th, 2023

'WARM EDGE' WORKING PARTY



## Data sheet Psi values for windows

based on determination of the equivalent thermal conductivity of spacers by measurement

### SWISSPACER

 Vetrotech Saint-Gobain (International) AG  
 Zweigniederlassung Kreuzlingen  
 Sonnenwiesenstrasse 15  
 CH-8280 Kreuzlingen

## SWISSPACER

Product name	Spacer height in mm	Material	Thickness d in mm
	6.5	Metalized multilayer polyester film 'High Tech Gas Barrier Foil' / SAN-GF	~0.05 1.0
	Spacer category C		

Representative glass constructions	Metal with thermal break	Plastic	Wood	Wood/Metal
<p>Double-sheet insulating glass  <math>U_g = 1.1 \text{ W/m}^2\text{K}</math></p>	<p>0.036</p>	<p>0.032</p>	<p>0.031</p>	<p>0.032</p>
<p>Triple-sheet insulating glass  <math>U_g = 0.7 \text{ W/m}^2\text{K}</math></p>	<p>0.031</p>	<p>0.030</p>	<p>0.029</p>	<p>0.030</p>

Two Box model Characteristic values	Space between panes in mm	$\lambda_{eq,2B}$ in W/mK	
		Box 1 · $h_1 = 3 \text{ mm}$	Box 2 · $h_2 = 6.5 \text{ mm}$
	Can be used for all spacer widths	0.40	0.14

**Explanation**

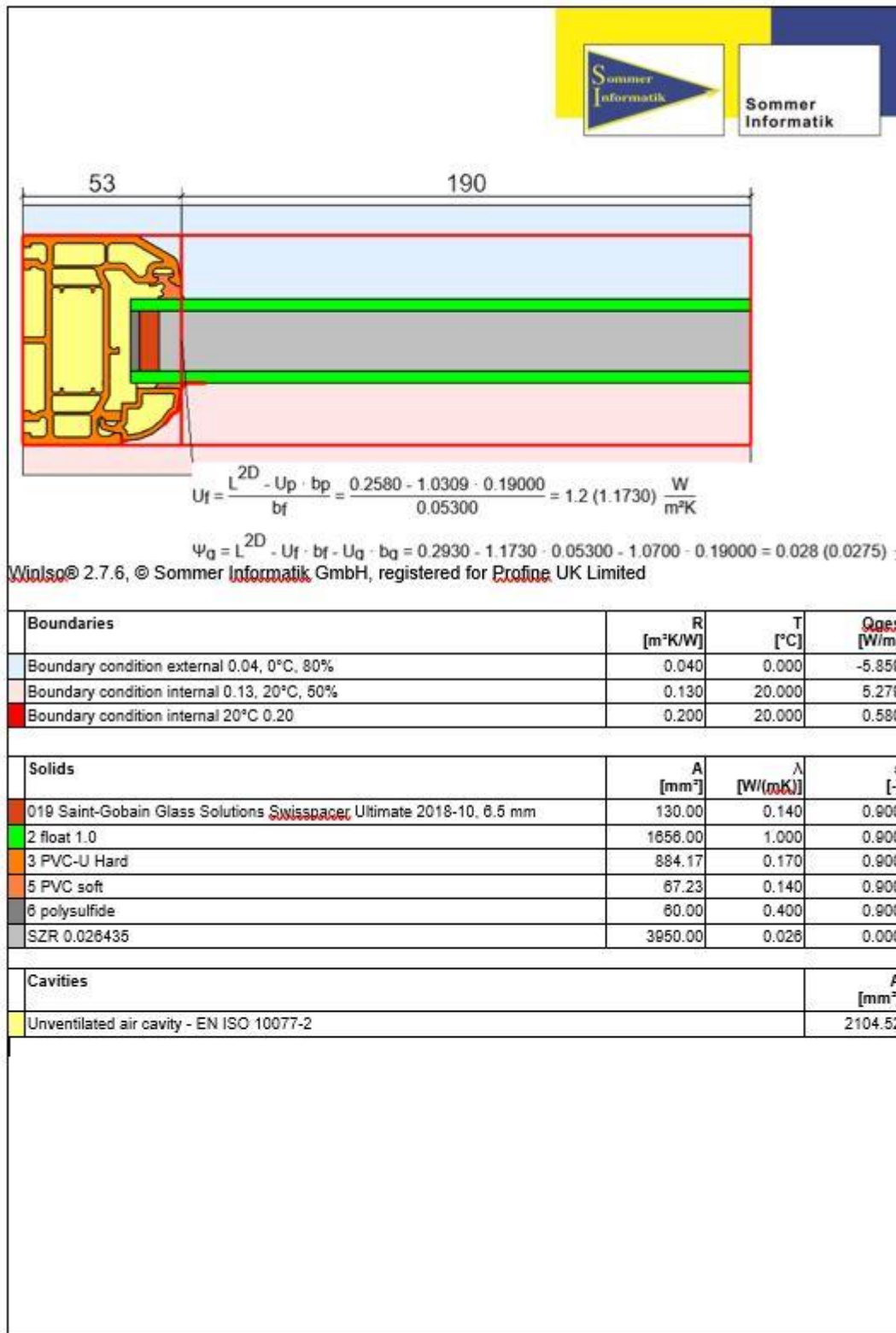
The equivalent thermal conductivity has been determined in accordance with the ift guideline WA-17 eng/1 "Thermally improved spacers – Determination of the equivalent thermal conductivity by measurement". The representative linear heat transfer coefficients calculated in this way (representative psi values) apply to typical frame profiles and glazing for the determination of the heat transfer coefficient  $U_w$  of windows. They have been determined under the boundary conditions (frame profiles, glazing, glass mounting depth, back covering, primary and secondary sealant) defined in the ift guideline WA-08 eng/3 "Thermally improved spacers – Part 1: Determination of the representative Psi value for window frame profiles". This guideline also governs the area of validity and application of the representative psi values. In order to avoid rounding errors, the psi values in the data sheet have been given at 0.001 W/mK. The method for the arithmetical determination of the psi values has an accuracy of  $\pm 0.003 \text{ W/mK}$ . Differences of less than 0.005 W/mK are not significant. For further information, refer to the Bulletin 004/2008 "Guide to Warm Edge" of Bundesverband Flachglas.

Characteristic values determined by:

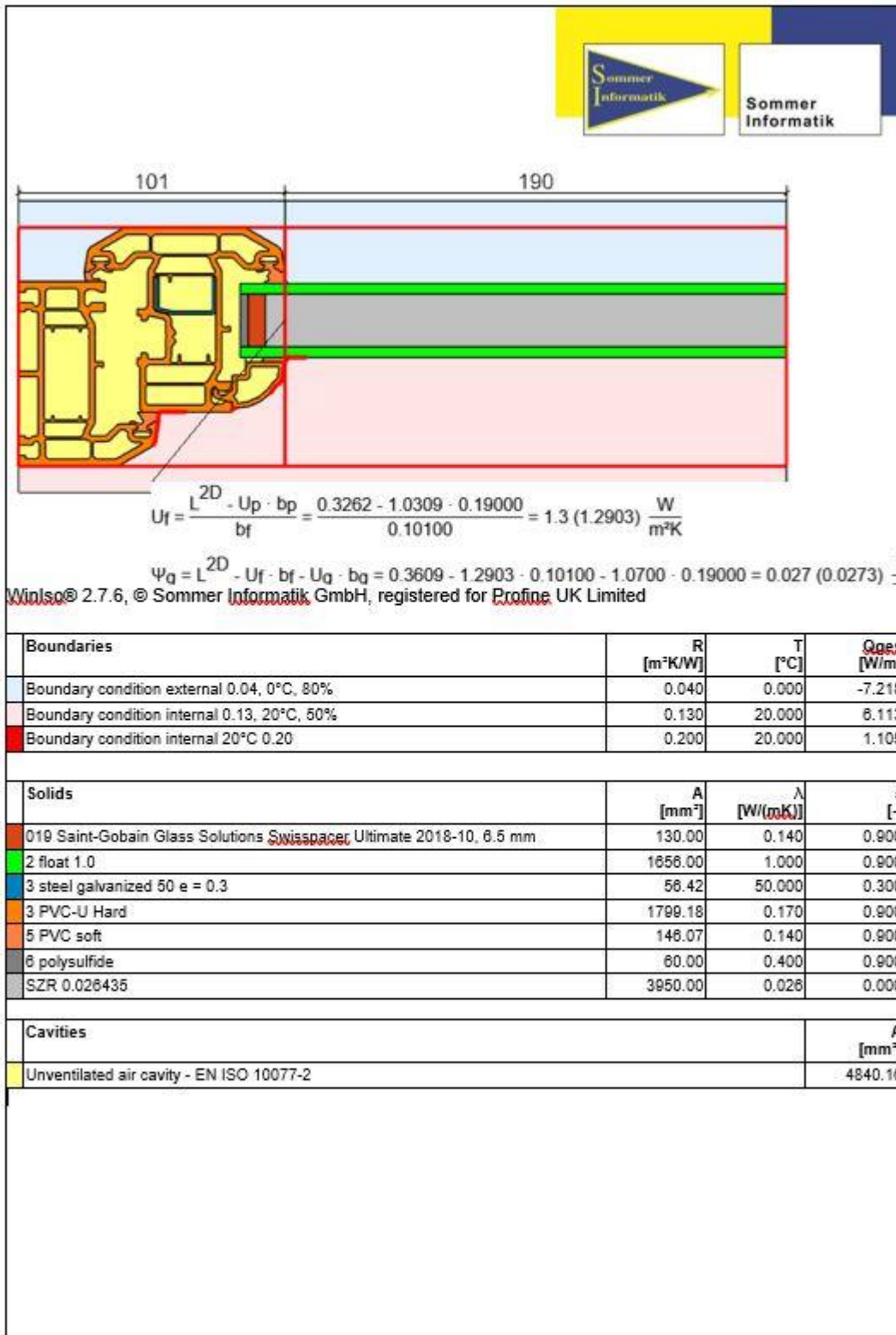


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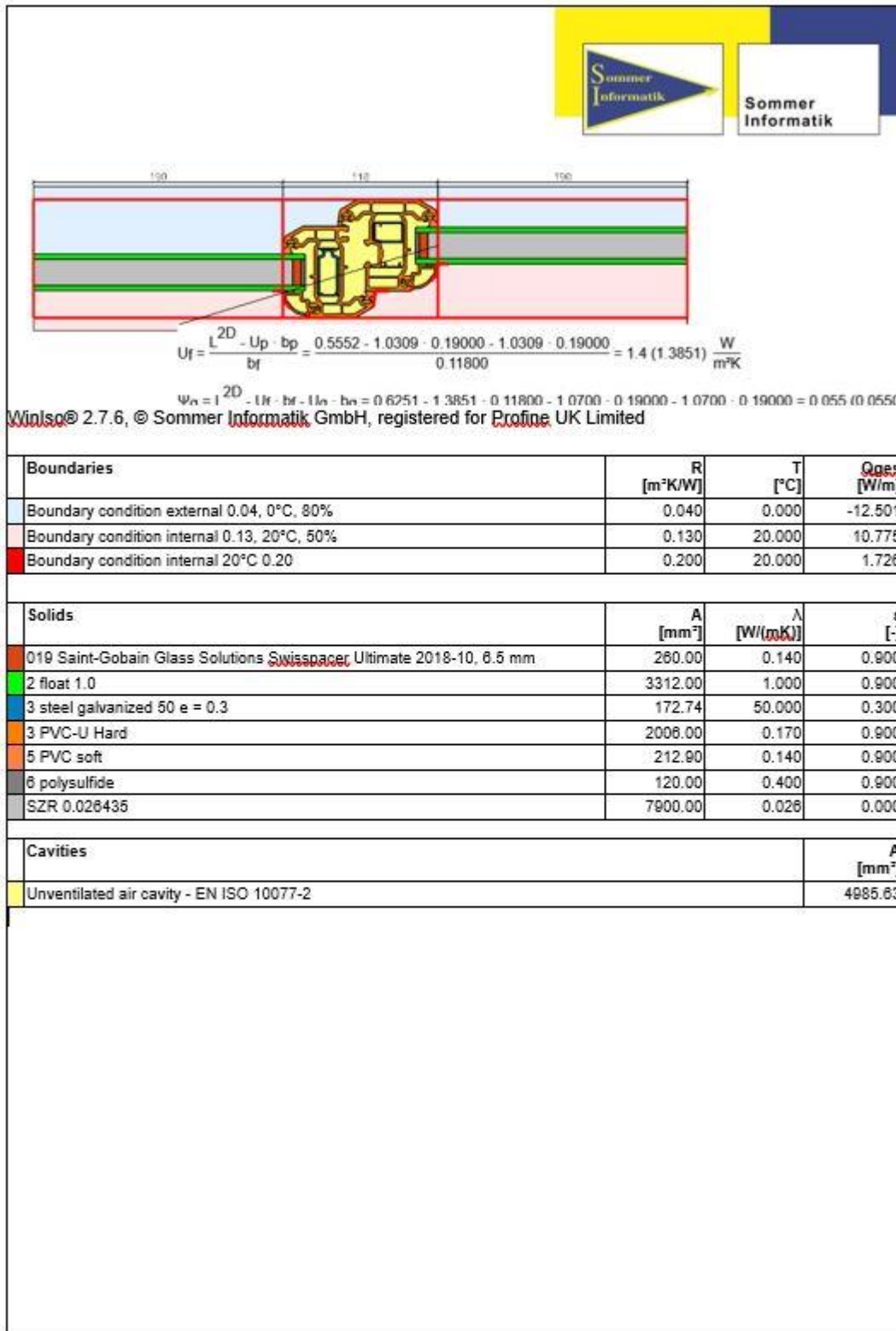


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