

## Report in Accordance with BFRC Guidelines and Regulations

### Product description: “Montanstahl SMW steel window”

#### CONFIDENTIAL

Client:	Fabco Sanctuary Ltd Unit 1 Hobbs New Barn Climping Littlehampton West Sussex BN17 5RE
Project:	SMW steel window
Project reference:	CU13018-3
Prepared By:	Clive Cox Test Engineer
Issue date:	7 June 2013

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Approved Simulator 047

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## 1 Introduction

The U-value calculations of the Montanstahl SMW Steel window detailed below were commissioned by David Cane of Fabco Sanctuary Ltd.

## 2 Validation of Program

The Therm 5.2 analysis software has been validated against proofs in Annex D (D1 to D10) of BS EN ISO 10077-2:2012.

## 3 Analysis Method

The frame profile results detailed below are provided by computer simulation using LBL software program THERM 5.2 and BFRC guidelines and regulations.

## 4 Summary of Results

A summary of results are detailed in the following sections. The details supplied for the analysis as well as all information required to verify the analysis can be found in the attached CD.

### 4.1 Frame thermal transmittance (following the principles of BS EN ISO 10077-2)

Montanstahl SMW Frame Profile	Frame Thermal Transmittance ( $U_f$ )
Fixed	6.4 W/(m <sup>2</sup> ·K)
Sash	6.4 W/(m <sup>2</sup> ·K)
Mullion	6.0 W/(m <sup>2</sup> ·K)

### 4.2 Linear thermal transmittance (following the principles of BS EN ISO 10077-2)

Montanstahl SMW Frame Profile	Linear Thermal Transmittance ( $\psi$ )
Fixed	0.054 W/(m·K)
Sash	0.055 W/(m·K)
Mullion	0.106 W/(m·K)

### 4.3 Centre pane U-Value of glazing calculated in accordance with BS EN 673

Glazing Unit	Centre Pane U-value ( $U_g$ )
4-8-4 Low-E 0.05 uncorrected emissivity (Planitherm Total+), 90% Krypton, 10% Air filled, low iron (Diamant) glazing unit with Swisspacer V spacer bar with polysulfide/polyurethane secondary seal to give 12mm sightline.	1.3 W/(m <sup>2</sup> ·K)

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#### 4.4 The thermal performance of the windows ( $U_w$ ) in accordance with BFRC guidelines and regulations

Montanstahl SMW Frame Profile	Window U-Value
Steel frame system with 4-8-4 Low-E 0.05 uncorrected emissivity (Planitherm Total+), 90% Krypton, 10% Air filled, low iron (Diamant) glazing unit with Swisspacer V spacer bar with polysulfide/polyurethane secondary seal to give 12mm sightline.	2.11 W/(m <sup>2</sup> ·K)

#### 4.5 The Effective $L_{50}$ in accordance with BFRC guidelines and regulations

Montanstahl SMW Frame Profile	Effective $L_{50}$
Air permeability at 50 pa	0.02 W/(m <sup>2</sup> ·K)

#### 4.6 Total solar energy transmittance ( $g$ ) in accordance with EN 410

Montanstahl SMW Frame Profile	$g_{window}$
Steel frame system with 4-8-4 Low-E 0.05 uncorrected emissivity (Planitherm Total+), 90% Krypton, 10% Air filled, low iron (Diamant) glazing unit with Swisspacer V spacer bar with polysulfide/polyurethane secondary seal to give 12mm sightline.	0.58


### 5.0 BFRC Rating

#### 5.1 Montanstahl SMW window system

Montanstahl SMW Frame Profile	Rating
Steel frame system with 4-8-4 Low-E 0.05 uncorrected emissivity (Planitherm Total+), 90% Krypton, 10% Air filled, low iron (Diamant) glazing unit with Swisspacer V spacer bar with polysulfide/polyurethane secondary seal to give 12mm sightline.	- 19 (Rating Scale C)

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**6.0 Authorisation**

	<b>Prepared by:</b>
<b>Signature:</b>	
<b>Name:</b>	Clive Cox
<b>Title:</b>	Test Engineer

## Technical Specification

Profiles	Ref. No.	Material Type/Manufacturer's Name & Density (Timber only)	Dimensions (Height & Width)
Outer Frame *	655 P	Steel – Montanstahl	32.5mm x 25.5mm
Transom/ Mullion	233	Steel – Montanstahl (polyethylene foam was fitted in the cavity between the glazing unit and mullion)	46.5mm x 25.5mm
Casement Vent	655 P	Steel – Montanstahl	32.5mm x 25.5mm
Glazing Bead	N/A	Bedded on silicone	-

\* In accordance with EN 10077-2, the odd leg steel section of the profile where it overlaps the wall, was disregarded in the simulation

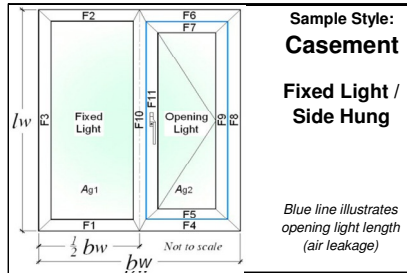
Weather Seals	Ref. No.	Material Type/ Manufacturer's Name	Continuous or Joined @ Corners
Glazing Bead	N/A	N/A	
Glazing Rebate	68130 K1	PVC – UK Industrial Tapes Ltd	
Casement Perimeter Seal	Kiso 141	EPDM	
Frame Rebate	Kiso 141	EPDM	

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Glazing Component	Specification
<b>Overall sealed unit:</b> 1. Thickness (mm)	1. 16mm
<b>Outer pane</b> 1. Thickness (mm) 2. Manufacturer 3. Description	1. 4mm 2. St Gobain 3. Diamant
<b>Inner pane:</b> 1. Thickness 2. Manufacturer 3. Description	1. 4mm 2. St Gobain 3. Planitherm Total+
<b>Spacer bar:</b> 1. Manufacturer 2. Description	1. SGG 2. Swisspacer V
<b>Cavity</b> 1. Distance (mm) 2. Gas %	1. 8mm 2. Krypton 90% Air 10%
<b>Edge seal</b> 1. Manufacturer 2. Description	1. N/A 2. PIB Primary seal / Polysulfide/Polyurethane secondary seal to give 12mm sightline

Additional Notes
<p>Air leakage data is taken from Build Check Ltd Test report ref. W13129-2 dated 4 June 2013 (data at 50Pa pressure = 0.66).</p> <p>Solar heat gain figures are calculated from g-values supplied by the product manufacturer from EN 410 calculations for the glass units used in this simulation. The value used is 0.74.</p>

# BFRC Spreadsheet



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

Blue line illustrates opening light length (air leakage)

Report Number: **U13018-3** Issue No 22.1: 11/03/2013  
 Report Date: **22 March 2013**  
 Project Details: **SMW Steel Window**

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

Parameter	Symbol	Units
Total window height <b>ODP</b>	$l_w$	1480 mm
Total window width <b>ODP</b>	$b_w$	1230 mm

Frame offset: **No**

Nominal 4mm etc to **ODP**, others **1DP**

**Glazing dimensions and properties:**

Thickness of pane 1	<b>4</b>	mm
Pane 1/2 distance	<b>8</b>	mm
Gas fill (1/2)	<b>Krypton 90%</b>	
Thickness of pane 2	<b>4</b>	mm
Complete next 3 cells for TG IGU		
Pane 2/3 distance		mm
Gas fill (2/3)		
Thickness of pane 3		mm
Glazing Trans. - <b>3DP</b>	$U_g$ <b>1.260</b>	W/(m <sup>2</sup> ·K)
g-value - <b>2DP</b>	$g_{\perp}$ <b>0.74</b>	

**Thermal transmittance of window from hot box test**

$U_w - 2DP$		W/(m <sup>2</sup> ·K)
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**Window Dimensions:**

Section	Length (m)	Width (m)	Area	
			No gasket (m <sup>2</sup> )	With gasket (m <sup>2</sup> )
Fixed Light	1.4400	0.5715	0.8230	0.8230
Opening light	1.4140	0.5455	0.7713	0.7713
Total glazing, $A_g$				
Frame	(m)	(m)	(m <sup>2</sup> )	(m <sup>2</sup> )
F1	0.6150	0.0200	0.0119	0.0119
F2	0.6150	0.0200	0.0119	0.0119
F3	1.4800	0.0200	0.0292	0.0292
F4	0.6150	0.0200	0.0119	0.0119
F5	0.5715	0.0130	0.0073	0.0073
F6	0.6150	0.0200	0.0119	0.0119
F7	0.5715	0.0130	0.0073	0.0073
F8	1.4800	0.0200	0.0292	0.0292
F9	1.4400	0.0130	0.0186	0.0186
F10	1.4800	0.0470	0.0686	0.0686
F11	1.4400	0.0130	0.0186	0.0186
Total Frame			0.2261	0.2261
Total Window, $A_w$			1.8204	1.8204
Percentage fixed light glass area			45.21%	45.21%
Percentage opening light glass area			42.37%	42.37%
Percentage glass area (total)			87.58%	87.58%

**Solar Factor, g-value:**

$F_w$	0.9
$g_w$	0.58

**$U_{window}$**

No bars; or attached bars	<b>2.11</b>	W/(m <sup>2</sup> ·K)
Single cross bar in IGU	<b>2.2</b>	
Multiple cross bar in IGU	<b>2.3</b>	
Glazing bar (Georgian bar)	<b>2.5</b>	

BFRC Rating kWh/(m <sup>2</sup> ·yr)	Label index	EWER Rating Scale	Window Rating
≥10	<b>-19</b>	<b>A+</b>	<b>C</b>
0 to <10		<b>A</b>	
-10 to <0		<b>B</b>	
-20 to <-10		<b>C</b>	
-30 to <-20		<b>D</b>	
-50 to <-30		<b>E</b>	
-70 to <-50	<b>F</b>		

**Frame dimensions:**

Section	$b_i$ (mm)	Frame width, $b_f$ (mm)	Gasket protrusion, $b_{gf}$ (mm)	Frame & gasket widths (mm)	Total	
						All frame values round to nearest 1mm, gaskets to <b>1DP</b>
F4 + F5 sash sill	F1 fixed sill	<b>20</b>	<b>0.0</b>	20.0	33.0	
	F2 fixed head	<b>20</b>	<b>0.0</b>	20.0		
	F3 fixed jamb	<b>20</b>	<b>0.0</b>	20.0		
F6 + F7 sash head	F4 fixed sash sill	<b>20</b>	n/a	20.0	33.0	
	F5 moving sash sill	<b>13</b>	<b>0.0</b>	13.0		
F8 + F9 sash jamb	F6 fixed sash head	<b>20</b>	n/a	20.0	33.0	
	F7 moving sash head	<b>13</b>	<b>0.0</b>	13.0		
F10 + F11 mullion	F8 Fixed sash jamb	<b>20</b>	n/a	20.0	33.0	
	F9 moving sash jamb	<b>13</b>	<b>0.0</b>	13.0		
		F10 fixed mullion	<b>47</b>	<b>0.0</b>	47.0	60.0
		F11 moving mullion	<b>13</b>	<b>0.0</b>	13.0	
Total gasket area				<b>0</b>	<b>0</b>	m <sup>2</sup>

Where a  $U_w$  value from hot box testing is available, no  $L_f^{2D}$  or  $L_{\psi}^{2D}$  values need to be entered

**Frame conductance:** All  $L$  values to **4DP**. All  $b$  values to **ODP**

Section	$L_f^{2D}$	$b_p$ (mm)	$L_{\psi}^{2D}$	$b_g$ (mm)
F1 fixed sill	<b>0.4318</b>	<b>190</b>	<b>0.4226</b>	<b>190</b>
F2 fixed head	<b>0.4318</b>	190	<b>0.4226</b>	190
F3 fixed jamb	<b>0.4318</b>	190	<b>0.4226</b>	190
F4 + F5 sash sill	<b>0.5142</b>	190	<b>0.5056</b>	190
F6 + F7 sash head	<b>0.5142</b>	190	<b>0.5056</b>	190
F8 + F9 sash jamb	<b>0.5142</b>	190	<b>0.5056</b>	190
F10 + F11 mullion	<b>0.9640</b>	380	<b>0.9429</b>	380

**Frame:**

Section	Frame width, $b_f$ (m)	Frame U-value, $U_f$ (W/(m <sup>2</sup> ·K))	Frame areas, $A_f$ (m <sup>2</sup> )	Frame heat flow, $H_U$ (W/K)	near trans. (W/(m·K))	Linear length, $l_g$ (m)	Junction heat flow, $H_{\psi}$ (W/K)
F1 fixed sill	0.0200	6.4419	0.0119	0.0764	0.0544	0.5715	0.0311
F2 fixed head	0.0200	6.4419	0.0119	0.0764	0.0544	0.5715	0.0311
F3 fixed jamb	0.0200	6.4419	0.0292	0.1881	0.0544	1.4400	0.0783
F4 + F5 sash sill	0.0330	6.4012	0.0191	0.1224	0.0550	0.5455	0.0300
F6 + F7 sash head	0.0330	6.4012	0.0191	0.1224	0.0550	0.5455	0.0300
F8 + F9 sash jamb	0.0330	6.4012	0.0478	0.3057	0.0550	1.4140	0.0777
F10 + F11 mullion	0.0600	5.9680	0.0872	0.5202	0.1060	1.4270	0.1513
Totals			0.2261	1.4117		Total	0.4294

**Air Leakage loss:**

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - <b>2DP</b>	<b>0.66</b>	m <sup>3</sup> /(m·h)
Opening light length	4.0230 m	Total air leakage
$L_{50}$	1.46 m <sup>3</sup> /(m <sup>2</sup> ·h)	Heat loss = 0.0165 $L_{50}$
		0.02 W/(m <sup>2</sup> ·K)

Other parameters needed for calculation, taken from simulations:

$d_p = d_g =$	0.016 m
$\lambda_p =$	0.035 W/(m·K)
$R_{se} =$	0.04 °K/W
$R_p =$	0.4571 m <sup>2</sup> ·K/W
$R_{rot} =$	0.6271 °K/W
$R_{se} =$	0.13 m <sup>2</sup> ·K/W
$U_p =$	1.5945 W/(m <sup>2</sup> ·K)

**BFRC Rating =**  
 $218.6g_{window} - 68.5 \times (U_{window} + \text{Effective } L_{50}) =$  **-19.12**

Climate zone is: **UK**

Thermal transmittance, W/(m <sup>2</sup> ·K)	$U_{window}$	<b>2.1</b>
Solar factor	$g_{window}$	<b>0.58</b>
Window air leakage heat loss, W/(m <sup>2</sup> ·K)	$L_{factor}$	<b>0.02</b>



Simulator Name: **Clive Cox**

BFRC Certified Simulator **047**

## BS EN 673 Spreadsheet

Version 10 22/07/2011. Calculations according to BS EN 673:2011

Number of spaces	Help		Spaces		1
Glazing orientation	Vertical	Pan e 1		Pan e 2	
Resistivity panes	1	m·K/W	90%		
Outside		Gas		Krypton	
Emissivities		Calculate			
Thickness (mm)	4.0	8	4.0		
Normal emissivity	0.89	0.05	Uncoated		
$\sum d_j r_j =$	0.008				

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

Iteration number	U value		$\lambda_{eff}$	
	W/(m <sup>2</sup> ·K)	$\sum 1/h_s$ (m <sup>2</sup> ·K)/W	W/(mK)	$\Delta T$
1	1.260	0.61563	0.0130	15
2	1.260	0.61563	0.0130	15

## Thermal Conductance Values Used

Material/Conductance W/(m.K)	Reference
PVC Flexible / 0.14	(Annex A BS EN ISO 10077-2)
Steel / 50.0	(Annex A BS EN ISO 10077-2)
EPDM / 0.25	(Annex A BS EN ISO 10077-2)
Molecular Sieve / 0.10	(Annex A BS EN ISO 10077-2)
Polyisobutylene / 0.20	(Annex A BS EN ISO 10077-2)
Soda Lime Glass / 1.0	(Annex A BS EN ISO 10077-2)
Polysulfide/Polyurethane / 0.40	(Annex A BS EN ISO 10077-2)
Polyethylene foam / 0.05	(Annex A BS EN ISO 10077-2)
Silicone / 0.35	(Annex A BS EN ISO 10077-2)
Swisspacer body / 0.16	BFRC accepted value
Swisspacer V body with Stainless Steel / 0.29	BFRC accepted value

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# G Value Source

02 April 2013  
Worldwide Database

**Glazing design**

Outdoor Indoor

	First glazing	Second glazing
Gas		Krypton 99% 6.00mm
Quantity		PLANTHERM TOTAL
First glass	DuMANT 4.00mm	PLANTHERM 4.00mm
Coating		
Spacer		
Coating		
Second glass		
Coating		

**Manufacturing sizes**

Nominal thickness : **16.0 mm**  
 Weight : **20.0 kg/m²**

**Luminous factors (EN410-2011) :**

Transmittance : **81 %**  
 Outdoor reflectance : **12 %**  
 Indoor reflectance : **12 %**

**Energy factors (EN410-2011) :**

Transmittance : **63 %**  
 Outdoor reflectance : **21 %**  
 Indoor reflectance : **19 %**  
 Absorptance A1 : **3 %**  
 Absorptance A2 : **13 %**

Solar factor g : **0.74**  
 Shading coefficient : **0.85**

Save

Print

Quit

**Thermal transmission (EN675-2011)**

Ug : **1.3 W/(m².K)**      θ\* related to vertical position

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## Appendix

### Profile Drawings

(See Technical Specification for dimensions)

