Report for the U-value of a Door System in Accordance with BS EN ISO 10077-1:2006

Product description:

Legend Fully Glazed Double Door (Outward Opening) with Full Reinforcement – 1.7 U-value

SYN-00167-1-Rev1

Client:	Synseal Extrusions Ltd
Project:	Synseal Legend Door 1.7 U-value
Project reference:	SYN-00167-1-Rev1
Prepared By:	Greg Tabberer R&D Technician
Issue date:	24th September 2010

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1 Introduction

The U values of the Legend door detailed below were commissioned by George Luca of Synseal Extrusions 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 10077-2:2003.

3 Analysis Method

The frame profile results detailed below are provided by computer simulation using LBL software program THERM 5.2 and regulations set in BS EN ISO 10077-1:2006.

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 on the attached CD or is available on request from Synseal Extrusions Ltd.

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

Synseal Legend Frame Profile	Frame Thermal Transmittance (U_f)
Door Vent with Steel	1.7 W/(m²·K)
Vent & Mullion with Steel	1.7 W/(m²·K)

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

Synseal Legend Frame Profile	Linear Thermal Transmittance (ψ)
Door Vent with Steel	0.063 W/(m·K)
Vent & Mullion with Steel	0.142 W/(m·K)

4.3 Centre pane U-value of the glazing calculated in accordance with BS EN 673

Glazing Unit	Centre Pane U-Value (U_g)	Solar Energy Transmittance ($g_\perp$)
4-20-4 Low-E 0.15 uncorrected emissivity (e.g. Pilkington K Glass), 90% Argon 10% Air filled, Float Outerpane (e.g. Pilkington Optifloat) glazing unit with Aluminium spacer bar with polysulfide (PS) secondary seal to give 12mm spacer sight line.	1.5 W/(m²·K)	0.72

4.4 The thermal performance of the door (U_D) in accordance with BS EN ISO 10077-1:2006

Synseal Legend Frame Profile	Door U-value
Legend PVC-u frame with full reinforcements to system supplier requirements with 4-20-4 Low-E 0.15 uncorrected emissivity (e.g. Pilkington K Glass), 90% Argon 10% Air filled, Float Outerpane (e.g. Pilkington Optifloat) glazing unit with Aluminium spacer bar with polysulfide (PS) secondary seal to give 12mm spacer sight line.	1.7 W/(m²·K)

5 Authorisation

Prepared By: Greg Tabberer

Signature: 

Date: 24th September 2010

6 Technical Specification

Profiles	Ref. No.	Material type / Manufacturers name	Dimensions (Height x Width)
Outer Frame:	5F2	Synseal – PVC-u	72mm x 70mm
Door Vent:	5DV2	Synseal – PVC-u	107mm x 70mm
Floating Mullion:	5T1	Synseal – PVC-u	72mm x 70mm
Glazing Bead:	5OJB28	Synseal – PVC-u	27mm x 22.5mm
Joint type	N/A	N/A	
Joint Adhesives	N/A	N/A	

Reinforcements	Ref. No.	Material type / Manufacturers name	Dimensions (Height x Width)
Outer Frame:	5RS-F2	Synseal – Steel	31mm x 41.5mm
Door Vent:	5RS-DV1	Synseal – Steel	40mm x 41mm
Floating Mullion:	5RS-FT1L	Synseal – Steel	13mm x 41.5mm

Weather Seals	Ref. No.	Material type / Manufacturers name	Continuous or joined at corners
Sash Vent:	N/A	Co-Extruded - PVC-P	
Glazing Seal:	N/A	Co-Extruded - PVC-P	
Glazing Bead:	N/A	Co-Extruded - PVC-P	

Glazing Component	Specification	
Overall Sealed Unit	Thickness:	28mm
Outer Pane	Thickness:	4mm
	Manufacturer:	Pilkington
	Description:	Optifloat (float)
Inner Pane	Thickness:	4mm
	Manufacturer:	Pilkington
	Description:	K glass (low-e 0.15)
Spacer Bar	Manufacturer:	N/A
	Description:	Aluminium spacer bar (generic)
Cavity	Distance:	20mm
	Gas %:	Argon 90%, Air 10%
Edge Seal	Manufacturer:	N/A
	Description:	Polysulfide (PS) secondary seal to give 12mm sightline

Additional Notes:

Metallic reinforcement present in all profiles

The secondary sealant used for this simulation (PS) covers the use of polyurethane (PU) and butyl hot melt sealant types to give the same result or marginally better.

4-20-4 glazing unit used is classed as the "worst case" when compared to 6-16-6 and 6-18-4 units of identical specifications for the U-value performance of the door. This has been simulated in the Therm 5.2 software. Therefore it can be stated that this report covers these three glazing unit types to the "worst case scenario".

Size of Door simulated = 2725mm high x 2500mm wide which falls within specified tolerances of 2.18m ±25% high x 2.00m ±25% wide stated in BS EN 14351-1:2006 for doors of >3.6m^2 area
Therefore the stated U_D may only be used for doors of area greater than 3.6m^2. Any door of less than 3.6m^2 will need re-calculating to the sizes specified in BS EN 14351-1:2006

U-value Calculation Spreadsheet

Synseal Double Door U-value Calc Sheet
Ver. 1 08/09/2010

Project details

Input Values:

SYN-00167-1
24/09/2010

Legend Double Door (outward opening), 4/20/4 Float / Argon 90% / Pilkington K (0.15) with aluminium spacer bar (PS seal), full steel reinf

Yellow input, green intermediary, blue finals

U_D	1.7

Door Style: Double door, outward opener, fully glazed, no midrail, standard frame threshold

Parameter	Symbol		Units
Total door height	l_d	2725	mm
Total door width	b_d	2500	mm

Frame dimensions	No gasket (mm)	Gasket protrusion (mm)	With gasket (mm)	Total (mm)
F1 top fixed rail (b_f)	72.0		72	151
F2 top moving rail (b_f)	79.0	0	79	
F3 hinge fixed jamb (b_f)	72.0		72	151
F4 hinge moving jamb (b_f)	79.0	0	79	
F5 fixed threshold (b_f)	72.0		72	151
F6 moving threshold (b_f)	79.0	0	79	
F7 moving sash/mullion (bf)	230.0	0	230	230
F8 fixed/moving sash (bf)		0		
F8 top fixed rail (bf)	72.0		72	151
F9 top moving rail (b_f)	79.0	0	79	
F10 hinge fixed jamb(bf)	72.0		72	151
F11 hinge moving jamb(b_f)	79.0	0	79	
F12 fixed threshold (b_f)	72.0		72	151
F13 moving threshold (b_f)	79.0	0	79	
Total gasket area:		0	m^2	

				b_g (mm)
F1+F2 top left rail conductance	L_f^{2D}	0.4552	W/(m·K)	190
F3+F4 left door jamb hinge conductance		0.4552		190
F5+F6 left door threshold conductance		0.4552		190
F7 Sash/Mullion conductance		0.7840		190
				190
F8+F9 top right rail conductance		0.4552		190
F10+F11 right door jamb hinge conductance		0.4552		190
F12+F13 right door threshold conductance		0.4552		190
				b_g (mm)
F1+F2 top left rail conductance	L_w^{2D}	0.6131	W/(m·K)	190
F3+F4 left door jamb hinge conductance		0.6131		190
F5+F6 left door threshold conductance		0.6131		190
F7 Sash/Mullion conductance		1.1154		190
				190
F8+F9 top right rail conductance		0.6131		190
F10+F11 right door jamb hinge conductance		0.6131		190
F12+F13 right door threshold conductance		0.6131		190

Upper Panel - Glazing dimensions and properties			
Thickness of pane 1		4.0	mm
Pane1/2 distance		20.0	
Thickness of pane 2		4.0	
Pane2/3 distance			
Thickness of pane 3			
Thermal transmittance of glazing	U_g	1.529	W/(m²·K)
Glazing solar factor, g-value	$g_\perp$	0.72	

Where a U_{cf} value from hot box testing is available, no L_f^{2D} or L_w^{2D} values need to be entered

Thermal transmittance of door from hot box testing	U_{cf}		W/(m²·K)	

length of opening light (BS 6375-1)	0.11	m³/(m·h)

Door Dimensions:	Height (m)	Width (m)	Area - no gasket (m^2)	Area - with gasket (m^2)
Left door (Glazed)	2.4230	0.9840	2.3842	2.3842
Right door (Glazed)	2.4230	0.9840	2.3842	2.3842
		Total	4.7685	4.7685

Frames	Length (m)	Width(m)	Area (m^2)	Area (m^2)
F1	1.2500	0.0720	0.0874	0.0874
F2	1.1780	0.0790	0.0854	0.0854
F3	2.7250	0.0720	0.1910	0.1910
F4	2.5810	0.0790	0.1977	0.1977
F5	1.2500	0.0720	0.0874	0.0874
F6	1.1780	0.0790	0.0854	0.0854
F7	2.5810	0.2300	0.5755	0.5755
F8	1.2500	0.0720	0.0874	0.0874
F9	1.1780	0.0790	0.0854	0.0854
F10	2.7250	0.0720	0.1910	0.1910
F11	2.5810	0.0790	0.1977	0.1977
F12	1.2500	0.0720	0.0874	0.0874
F13	1.1780	0.0790	0.0854	0.0854
		Total Frame	2.0440	2.0440
		Total door, Ad	6.812500	6.812500
		Glazing percentage	70.00%	70.00%

Section	b_f (m)	U_f W/(m²·K)	Frame areas m^2	Heat flow W/K	Ψ W/(m·K)	l_g (m)	Heat flow W/K
F1+F2 top rail left door	0.1510	1.7174	0.1728	0.2968	0.0633	0.9840	0.0623
F3+F4 jamb hinge left door	0.1510	1.7174	0.3887	0.6675	0.0633	2.4230	0.1533
F5+F6 threshold left door	0.1510	1.7174	0.1728	0.2968	0.0633	0.9840	0.0623
F7 Sash/Mullion	0.2300	1.7054	0.5755	0.9814	0.1420	2.4230	0.3441
F8+F9 top rail right door	0.1510	1.7174	0.1728	0.2968	0.0633	0.9840	0.0623
F10+F11 jamb hinge right door	0.1510	1.7174	0.3887	0.6675	0.0633	2.4230	0.1533
F12+F13 threshold right door	0.1510	1.7174	0.1728	0.2968	0.0633	0.9840	0.0623
		Totals	2.0440	3.5035		Total	0.8997

U_{cf} = 1.72 W/(m²·K)

Other parameters needed for calculation, taken from simulations:

λ_g = 0.035 W/(m·K)
R_{se} = 0.04 m^2K/W R_{si} = 0.13 m^2K/W

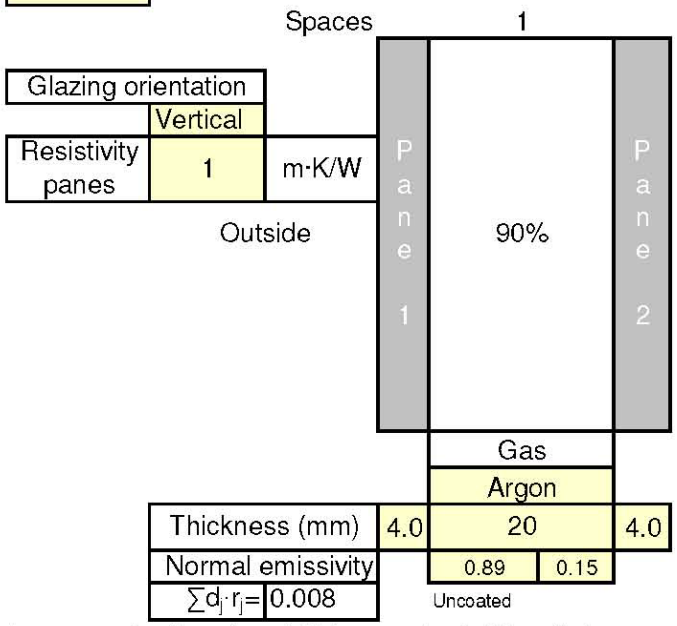
Glazing thickness, $d_g = d_g$ = 0.028 m R_g = 0.8000 m^2K/W
R_{tot} = 0.9700 m^2K/W U_g = 1.0309 W/(m²·K)

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

BS EN 673 Spreadsheet

Version 9 July 2010. Calculations according to BS EN 673:1998 (A1)

Number of spaces
1



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

Iteration number	U value	$\sum 1/h_s$	λeff	ΔT
	W/(m²·K)	(m²·K)/W	W/(mK)	
1	1.529	0.47771	0.0419	15
2	1.529	0.47771	0.0419	15

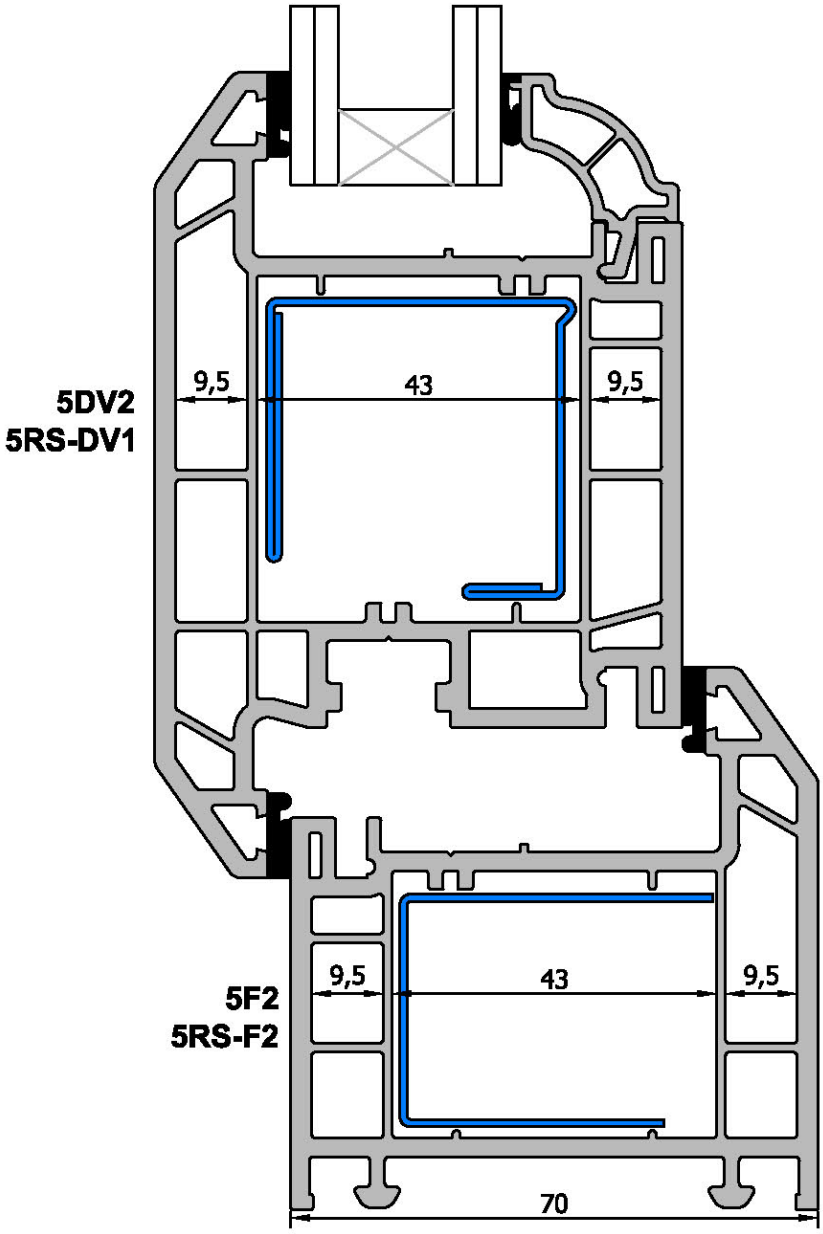
Thermal Conductance Values Used

Material / Conductance (W/m.K)	Reference
PVC-u / 0.17	(Annex A BS EN ISO 10077-2)
PVC-P / 0.14	(Annex A BS EN ISO 10077-2)
EPDM / 0.25	(Annex A BS EN ISO 10077-2)
Steel / 50	(Annex A BS EN ISO 10077-2)
Polysulfide (PS) / 0.4	(Annex A BS EN ISO 10077-2)
Soda lime glass / 1.0	(Annex A BS EN ISO 10077-2)
Molecular Sieve (desiccant) / 0.1	(Annex A BS EN ISO 10077-2)
Aluminium / 160	(Annex A BS EN ISO 10077-2)

Appendix

Profile Drawings

(Items on this page drawn to scale [1:1 where possible] as required in Clause 7 of BS EN ISO 10077-1:2006. Uncontrolled when printed)



Profile Drawings (continued…)