

# **Thermal and Solar Energy Performance Report**

for

**Breezway Altair Louvre Window  
with Western Red Cedar Blades  
(Rebated and Straight-Cut),  
in Easyscreen Frame**

**26 October 2010**

**Peter Lyons & Associates • Building Energy Consultants**

ABN 84 160 401 737 • 24 Bellinger Crescent, Kaleen ACT 2617, AUSTRALIA • +61 (408) 808 556 • Fax +61 (2) 6103 9033

[www.fenestralia.com](http://www.fenestralia.com)

[peter.lyons@fenestralia.com](mailto:peter.lyons@fenestralia.com)

## 1. Introduction

This document reports the simulated U-value, solar heat gain coefficient (SHGC) and visible transmittance (VT) of the Breezway Altair 152 Louvre Window with Western Red Cedar blades in an Easyscreen frame. All final properties are system properties including frame, in accordance with NFRC procedures.

*The results in this report apply equally to rebated and straight-cut timber blades.*

The optical properties of cedar are not contained in the International Glazing Database (IGDB). Instead, known, default properties for cedar were used to create an entry in the User Database of Optics 5.1. This information was then exported to WINDOW 6.3 to enable the 'centre of louvre' properties to be calculated.

The louvre window performance indices (U, SHGC, VT) were determined using the Optics 5.1 and WINDOW 6.3 software in the normal way<sup>1</sup>. All calculations were at NFRC 100-2010 environmental conditions, which are the reference conditions used by the Australian Fenestration Rating Council and are a mandatory requirement of the Building Code of Australia (BCA). The AFRC follows procedures of the U.S. National Fenestration Rating Council (NFRC).

*This report is based on calculations that are beyond those of current AFRC procedures. Therefore it does not meet all AFRC requirements for a whole-window energy rating report. While the calculated performance indices are suitable for comparison with information on the Australian Window Association's WERS database, this report is not an authorised WERS rating. Instead, it should be regarded as a research report.*

## 2. Methodology

### 2.1 Optical properties of cedar

Spectral data for cedar was imported into Optics 5.1. These data are shown in Table 1. Default values (from NFRC 101-2010) were used for surface emittance. A surface solar reflectance of 0.7 was used, which corresponds to a solar absorptance of 0.3. This absorptance is consistent with that used for window frames and the opaque portion of garage doors, as rated under NFRC 200-2010.

---

<sup>1</sup> Note that WINDOW 6.3 and Optics 5.1 from Lawrence Berkeley National Laboratory (<http://windows.lbl.gov/software>) are unrelated to Microsoft Windows.

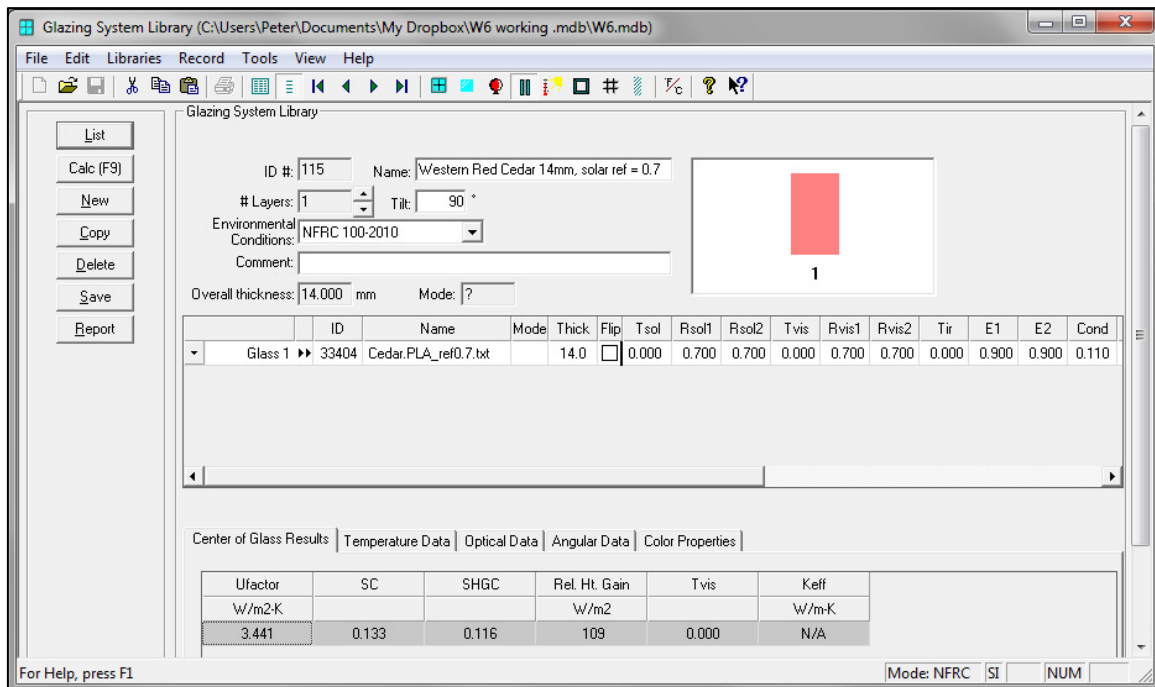
**Table 1:** Optical characteristics of Western Red Cedar, used in Optics 5.1 and WINDOW 6.3.

Material	Thick-ness (mm)	Thermal conduct-ivity (W/m.K)	Direct solar trans-mittance	Solar outdoor reflect-ance	Solar indoor reflect-ance	Visible trans-mittance (VT)	Visible outdoor reflect-ance	Visible indoor reflect-ance	Infrared trans-mittance	Front emit-ance	Back emit-ance
Western Red Cedar	14	0.11	0.000	0.700	0.700	0.000	0.700	0.700	0.000	0.900	0.900

## 2.2 Centre-of-louvre properties of cedar blades

Following standard NFRC procedures, the data were added to the User Database of Optics 5.1 before being exported to the glass library of WINDOW 6.3. Finally, a calculation was performed in WINDOW 6.3 to determine the ‘centre-of-louvre’ properties of cedar blades in a vertical orientation. The low SHGC is due to the opaque nature of the cedar and its thermal resistance (0.13 m<sup>2</sup>.K/W for 14mm thickness). Similarly, the relatively low U-value, compared to 6mm glass, is due to its thickness. As noted above, the centre-of-louvre properties apply equally to rebated and straight-cut blades, since from a thermal point of view there is no difference.

**Figure 1:** Thermal, solar and optical indices of Western Red Cedar, calculated in WINDOW 6.3.



### 2.3 Modelled U-value of aluminium frame and polypropylene clips

Based on CAD drawings supplied by Breezway, THERM 6.3 was used to model sections for the head, jambs and sill. Screenshots and results are shown in Figures 2, 3 and 4. Note that under NFRC modelling rules, jambs are modelled with the glass in an apparently vertical orientation. This is just convention; the attributes of each cross-section type are correctly defined so that THERM accounts for the gravity vector in each case. Similarly, in Figures 1-4 the cedar blades appear as 'glass' but this is merely a consequence of WINDOW 6 convention. Per standard practice, discontinuous components such as bearings are not modelled.

Figure 2: THERM 6.3 results for head.

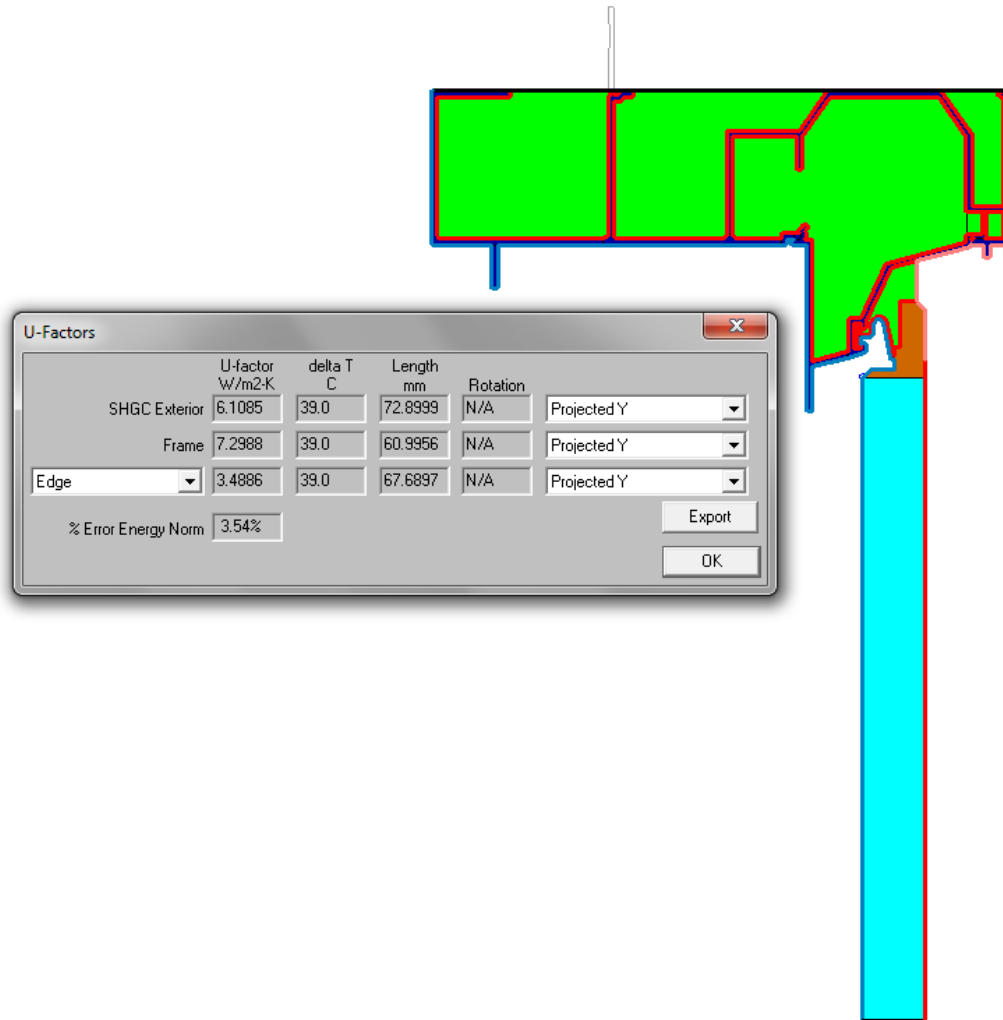


Figure 3: THERM 6.3 results for jamb.

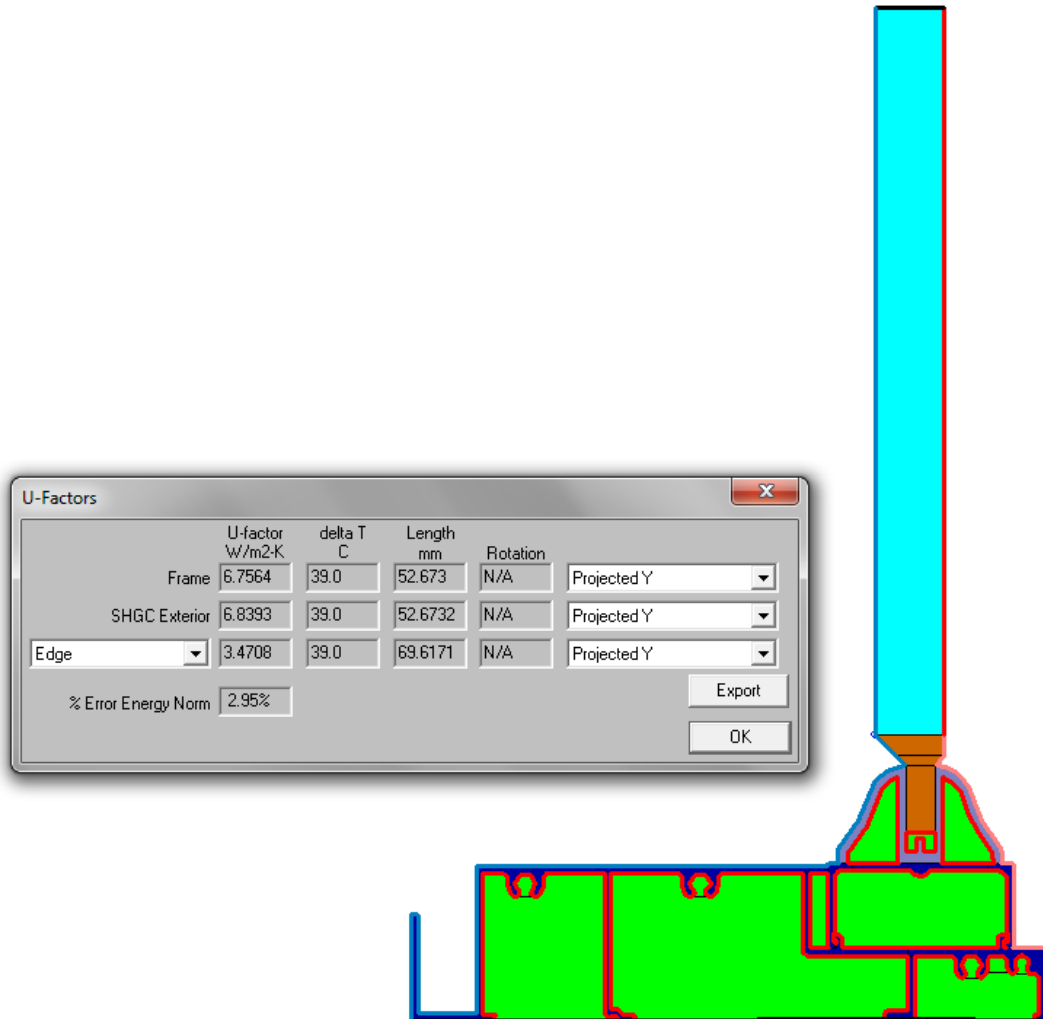
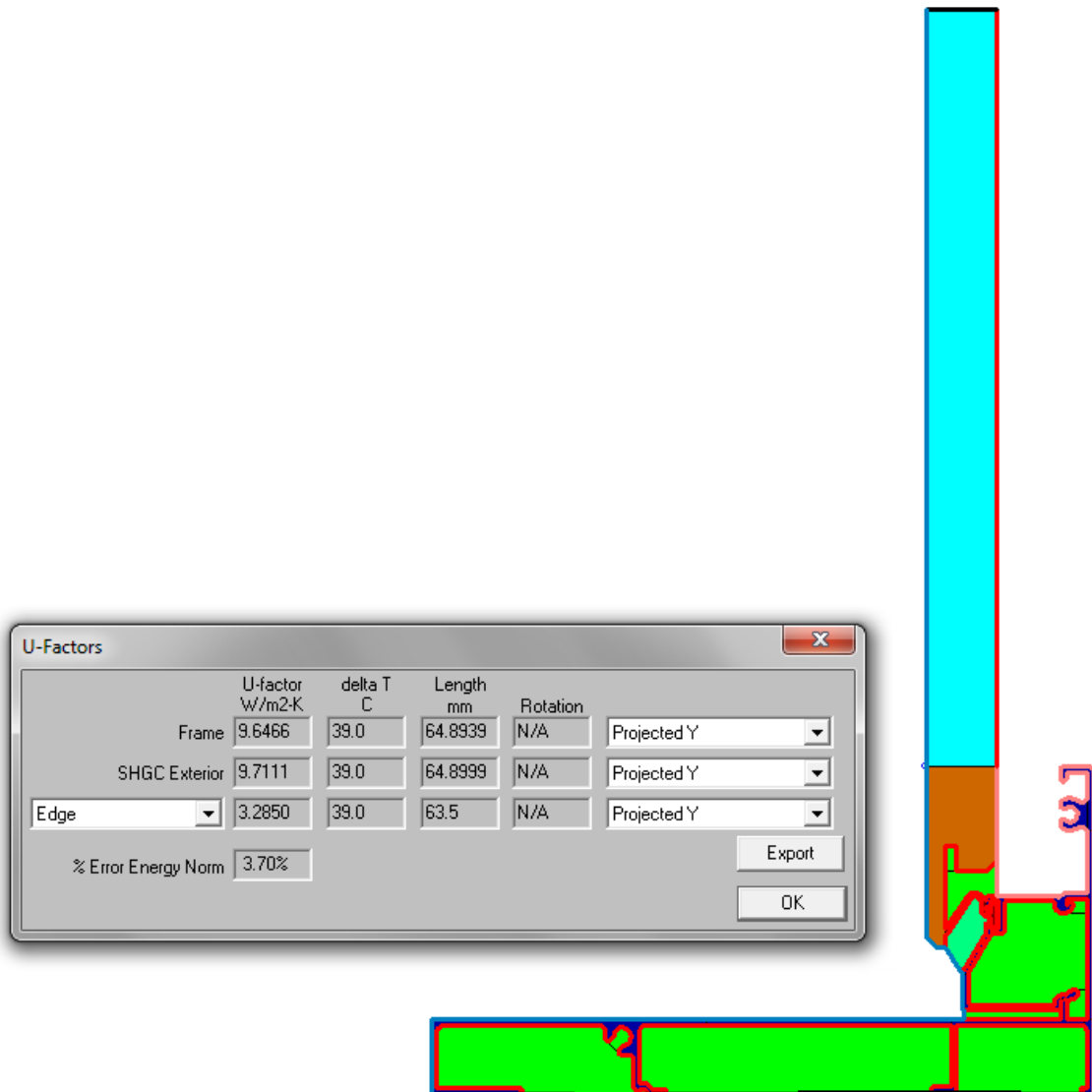


Figure 4: THERM 6.3 results for sill.



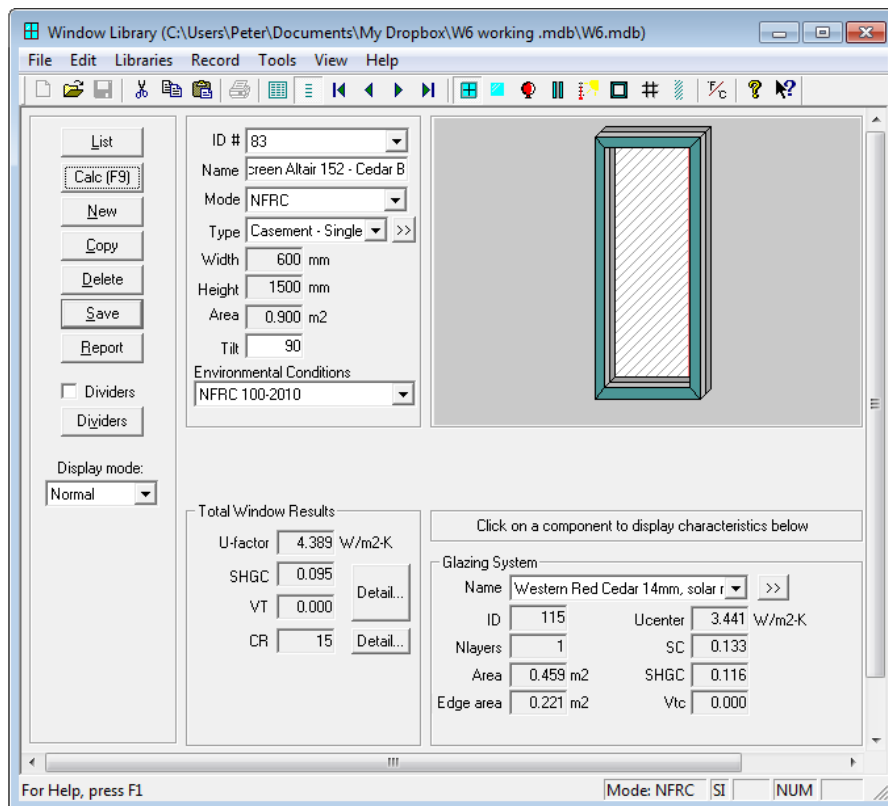
### 3. Results and Conclusions

Table 2 and Figure 5 show the final WINDOW 6.3 results for cedar blade louvre window. It is rated at the standard AFRC size for a louvre product (1500mm high x 600mm wide, AFRC Technical Interpretation Report). Table 3 presents a full WINDOW 6.3 detailed report for the product.

**Table 2:** Thermal, solar and optical performance results for Easyscreen frame, Altair 152, WRC Blades. Results were determined at standard NFRC 100-2010 environmental conditions and simulated using WINDOW 6.3.

Description	U-value (W/m <sup>2</sup> .K)	Solar heat gain coefficient (SHGC)	Visible transmittance (VT)
Easyscreen frame, Altair 152, WRC Blades	4.39	0.095	0.000

**Figure 5:** WINDOW 6.3 summary results, Easyscreen frame, Altair 152, WRC Blades.







**Table 3.**

Window v6.3.9.0 Report Page 1 09/08/11 09:59:02

ID: 83

**Name: EasyScreen Altair 152 - Cedar Blades, sol ref=0.7, ATIR size**

EnvCond: 1 NFRC 100-2010

Type: Casement - Single

Tilt: 90

Width: 600.0 mm

Height: 1500.0 mm

Area: 0.90 m2

**U-value: 4.389 W/m2-K**

**SHGC: 0.095**

**Vt: 0.000**

**CI: 14.7 (Condensation Resistance)**

Data for Glazing Systems

ID	Name	COG Area m2	#Lay	Tilt	Uc W/m2	SCc	SHGCc	Vtc	RHG
115	Western Red Ced	0.459	1	90	3.441	0.133	0.116	0.000	109

Layer Data for Glazing System '115 Western Red Cedar 14mm, solar ref = 0.7'

ID	Name	D(mm)	Tsol	1 Rsol	2 Tvis	1 Rvis	2 Tir	1 Emis	2 Keff			
33404	Cedar.PLA_ref0.#	14.0	.000	.700	.700	.000	.700	.700	.000	.900	.900	.110

Frame Data

Location	ID	Name	Source	Frame Area m2	Edge Area m2	Uframe W/m2-K	Uedge
Header	238	Altair 152 Lo Therm		0.033	0.027	7.2988	3.4886
Left Jamb	239	Altair 152 Lo Therm		0.076	0.083	6.7564	3.4708
Right Jamb	239	Altair 152 Lo Therm		0.076	0.083	6.7564	3.4708
Sill	240	Altair 152 Lo Therm		0.036	0.027	9.6466	3.2850

Gas Data

ID	Name	Type	Cond	Visc	Cp	Dens	Pran
				x e-6			

No gas data for Single Glazing

Breezway Easyscreen Altair 152 Louvre Window - Energy Rating Report, October 2011

Window v6.3.9.0 Report Page 2 09/08/11 09:59:02  
 Environmental Conditions: 1 NFRC 100-2010

	Tout (C)	Tin (C)	WndSpd (m/s)	Wnd Dir	Solar (W/m2)	Tsky (C)	ESky
Uvalue	-18.0	21.0	5.50	Windward	0.0	-18.0	1.00
Solar	32.0	24.0	2.80	Windward	783.0	32.0	1.00

Frame Library Data

ID	Name	Source	U-value Frame	Edge	Edge Corr	GlzSys Width	GlzSys Uc	Width (PFD)	Abs
238	Altair 152 Lo	Therm	7.2988	3.4886	N/A	14.000	3.441	61.00	0.30
239	Altair 152 Lo	Therm	6.7564	3.4708	N/A	14.000	3.441	52.67	0.30
240	Altair 152 Lo	Therm	9.6466	3.2850	N/A	14.000	3.441	64.89	0.30

Divider Library Data

ID	Name	Source	U-value Div	Edge	Edge Corr	GlzSys Width	GlzSys Uc	Width (PFD)	Abs
----	------	--------	----------------	------	--------------	-----------------	--------------	----------------	-----

No Dividers for this Glazing System

Optical Properties for Glazing System '115 Western Red Ced'

Angle	0	10	20	30	40	50	60	70	80	90	Hemis
Vtc	: 0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rf	: 0.700	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.990
Rb	: 0.700	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.990
Tsol	: 0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rf	: 0.700	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.990
Rb	: 0.700	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.990
Abs1	: 0.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
SHGCc	: 0.116	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tdw-K	: 0.000										
Tdw-ISO	: 0.000										
Tuv	: 0.000										

Window v6.3.9.0 Report Page 3 09/08/11 09:59:02

Temperature Distribution (degrees C)

	Winter		Summer	
	Out	In	Out	In
Lay1	-13.4	3.6	37.6	37.7

Window v6.3.9.0 Report Page 3 09/06/11 14:32:04

Temperature Distribution (degrees C)

	Winter		Summer	
	Out	In	Out	In
Lay1	-13.4	3.6	37.6	37.7