



**CONFIDENTIAL**

**Report: Chilt/T09002-1**

**Thermal Performance Report in  
Accordance with EN 10077 requirements**

**Issue date: May 2009**



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## Thermal Performance Report in Accordance with EN 10077 requirements For

**FIRAT PLASTİK VE KAUCUK A.S.**

### CONFIDENTIAL THERMAL REPORT

Report reference: Chilt/T09002-1 Issue 02  
Product Description: S60 PVC-U Casement Window  
Issue date: 28<sup>th</sup> May 2009  
Prepared for: FIRAT PLASTİK VE KAUCUK A.S.  
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Signed: 

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Report for: FIRAT PLASTİK VE KAUCUK A.S.  
Ref: Chilt/T09002-1

Page 1 of 9

## 1 Introduction

The thermal performance calculations of the window configurations detailed below were commissioned by Nihan Karaaslan of Standart BM TRADA certification co. under Chiltern Dynamics contract MTP/F08164 (Thermal Contract MTT/F09002) on behalf of FIRAT PLASTIK VE KAUCUK A.S.

The frame profile results detailed below are provided by computer simulation using LBNL software program THERM 5.2 (Validated against proofs in Annex D (D1 to D10) of BS EN ISO 10077-2:2003) and calculated in line with EN10077-2 with whole window U-Value calculated in line with EN10077-1.

Issue Status:

Issue 01	Original report
Issue 02	Re-issue report to clarify calculation methodology

## 2 Summary of Results

Results are shown for FIRAT PLASTIK VE KAUCUK A.S. / S60 range of Extruded PVC-U window products with the Insulating Glass Unit specification as detailed below only. Report covers fully reinforced or partially reinforced windows. Details of simulated profiles and materials are shown in Appendix A. The standard sample window used for analysis is shown in Appendix B. Drawings and Specification of the profiles to be analysed are given in Appendix C. Calculation spreadsheets used in the calculation are attached in Appendix D.

### 2.1 Thermal Conductance of frame with Insulating Panel ( $L_f^{2D}$ ) (in accordance with EN10077-2)

Please refer to the Calculations in Appendix D for values.

### 2.2 Thermal Conductance of frame with Glazing Options ( $L_{\psi}^{2D}$ ) (in accordance with EN10077-2)

Please refer to the Calculations in Appendix D for values.

### 2.3 Centre pane U-Value ( $U_g$ ) of glazing options (calculated in accordance with BS EN 673, see appendix D)

Glazing unit	Centre pane U-value ( $U_g$ )
IGU Option 1 (4 – 16 - 4) External – 4mm Float Glass with or without Low Emissivity coating of $\epsilon_n$ 0.04 Gas fill – 90% Argon / 10% Air Internal – 4mm Float Glass with or without Low Emissivity coating of $\epsilon_n$ 0.04 Spacer – 15.5 mm Standard Aluminium Spacer Bar Sightline Height – 12mm Primary Edge Sealant – 0.25mm x 2 – Polyisobutylene Secondary Edge Sealant – Hot Melt Butyl	1.163 W/m <sup>2</sup> K
Note: For U-Value to apply, IGU must comply with the above specification and have a Low Emissivity coating as listed above applied to surface 2 or surface 3.	

### 2.4 The thermal performance of the window ( $U_w$ ) (in accordance with EN10077-1)

Window Configuration	Whole Window U-Value
As per appendix B with Option 1 IGU	1.6 W/m <sup>2</sup> K

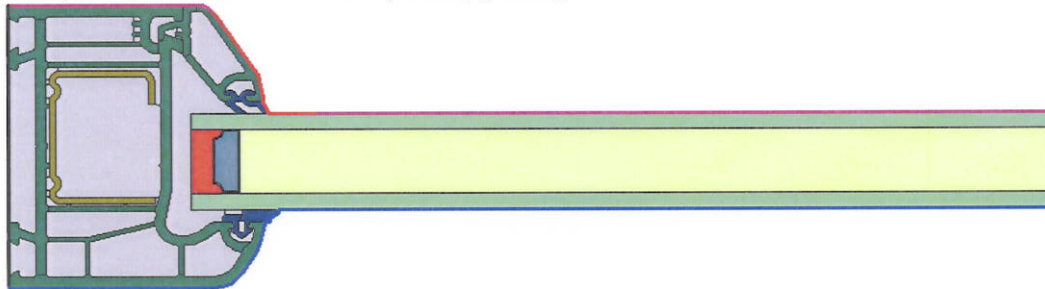
## Appendix A

### Casement Window Simulated Sections

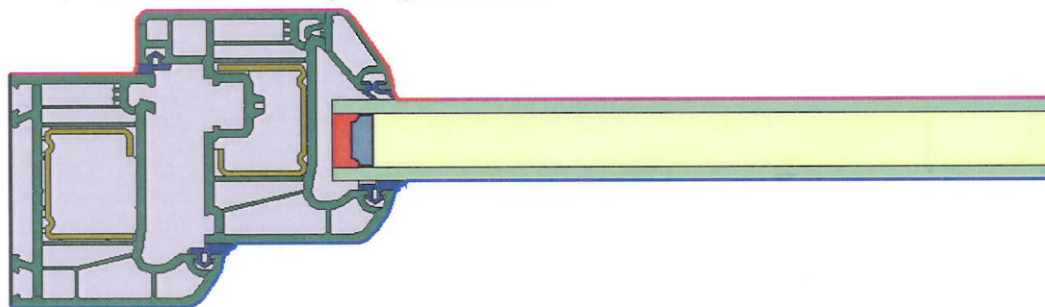
Appendix A – Material Specifications All values taken from EN10077-2 or EN12524 unless stated	Thermal Conductivity W/(m K)	Use
Soda Lime Glass	1.00	All glass panes
PVC-U	0.17	All Extruded PVC-U Profiles & Beads
Steel	50	All Reinforcement Profiles
EPDM / TPE Rubber	0.25	All weather seals and glazing gaskets
Aluminium	160	IGU Spacer Bar
Polyisobutylene	0.20	IGU Primary Sealant
Hot Melt Butyl	0.24	IGU Secondary Sealant
Molecular Sieve Desiccant	0.10	IGU Spacer Bar Desiccant Fill
K effective value from EN673 Calculation*	*	IGU Gas Space including Low Emissivity Coating

### Simulated Frame Sections *(All Simulations carried out with glazing in vertical orientation)*

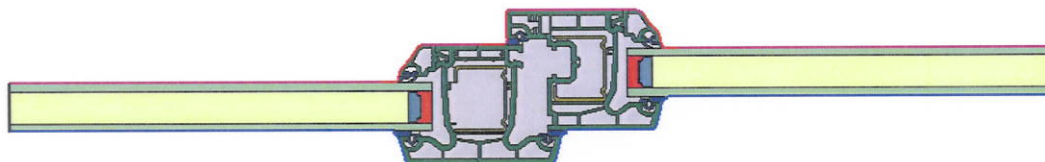
#### Head, Jamb and Sill with Fixed (Direct) glazing



#### Head, Jamb and Sill with Opening Casement



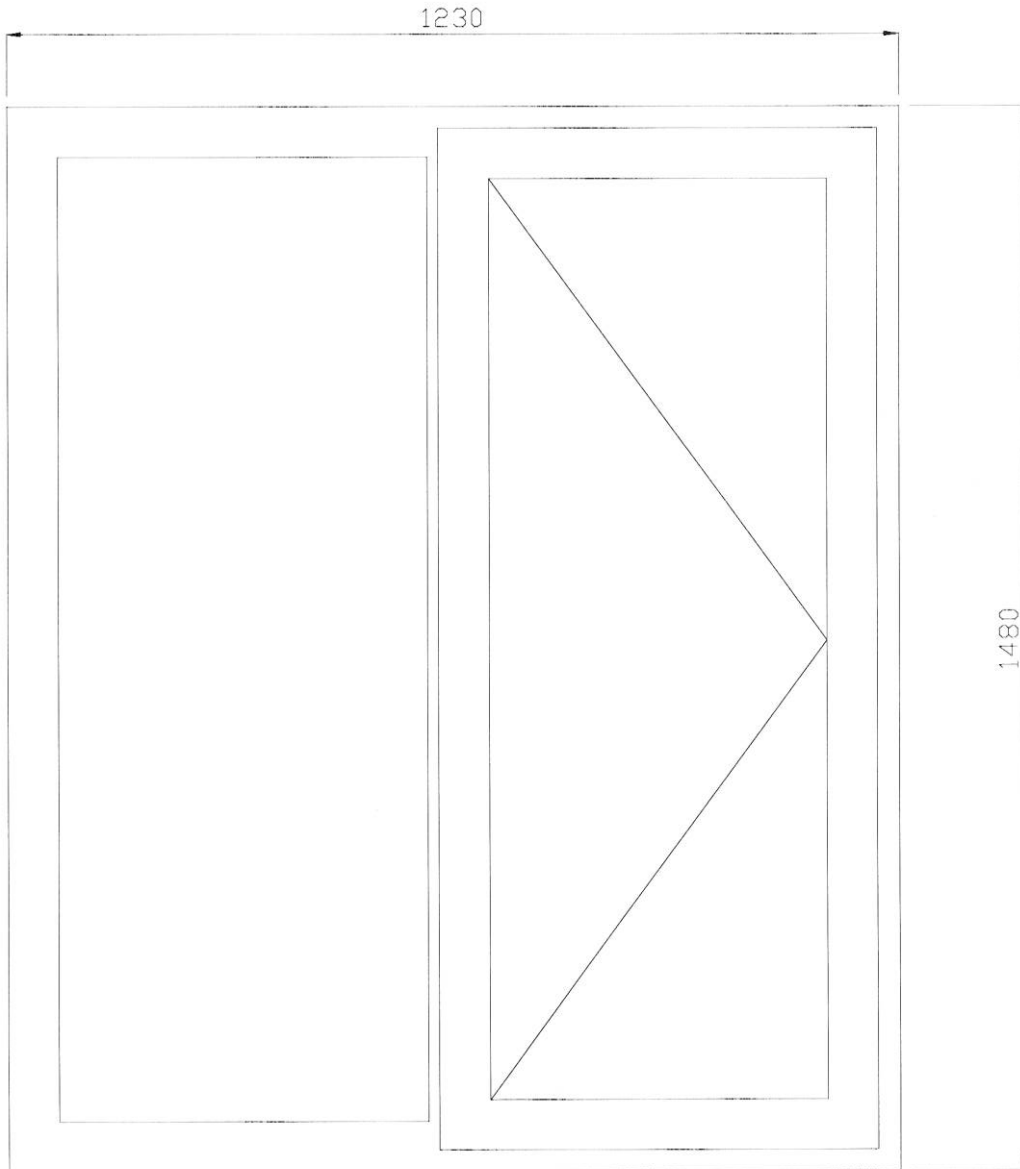
#### Mullion with fixed (Direct) glazing and Opening Casement



## Appendix B

Sample window:

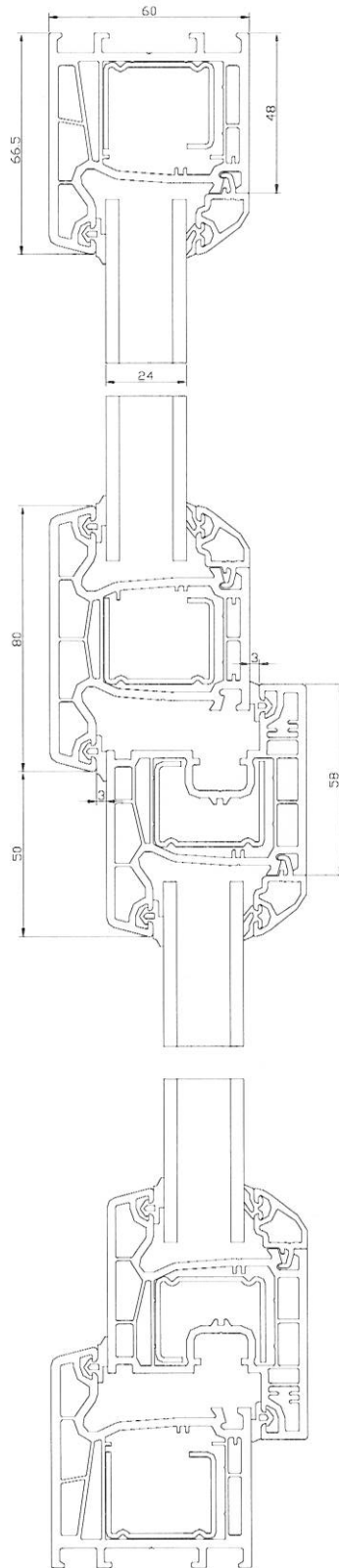
Side hung next to fixed light casement window with central mullion (1230mm wide x 1480mm high = 1.8204 m<sup>2</sup>)



Refer to Calculation Spreadsheets (Appendix D) attached for details of window cross section heights, areas, seal perimeter lengths and glazing fraction.

**Appendix C (1)**

Drawings used for analysis. The following drawings should not be scaled.



## Appendix C (2)

Window Specification used for analysis.

<b>Company:</b> FIRAT PLASTİK VE KAUCUK A.S.		
<b>Product Name:</b> S60 Internally Glazed, Outward Opening PVC-U Casement Window		
<b>Window Profiles</b>	Outer Frame: PVC-U	Firat Plastik; Ref 97260 (60 mm x 66.5 / 48 mm)
	Transom & Mullion: PVC-U	Firat Plastik; Ref 97273 (60 mm x 80 / 43 mm)
	Opening Light: PVC-U	Firat Plastik; Ref 97255 (60 mm x 76.5 mm)
	Glazing Bead: PVC-U	Firat Plastik; Ref 97267
<b>Reinforcement Profiles</b>	Outer Frame: Galv. Steel 1.5 mm	Firat Plastik; Ref 001 (33 mm x 26 mm U channel)
	Transom & Mullion: Galv. Steel	Firat Plastik; Ref 001 (33 mm x 26 mm U channel)
	Opening Light: Galv. Steel	Firat Plastik; Ref 001 (33 mm x 26 mm U channel)
<b>Weather-seals</b>	Frame Rebate: EPDM	Firat Plastik; Ref 001
	Glazing Rebate: EPDM	Firat Plastik; Ref 002
	Casement Perimeter: EPDM	Firat Plastik; Ref 002
	Glazing Bead: EPDM	Firat Plastik; Ref 003
<b>Notes:</b>		

## Appendix D

The following attached documents must accompany this thermal report to confirm validity:

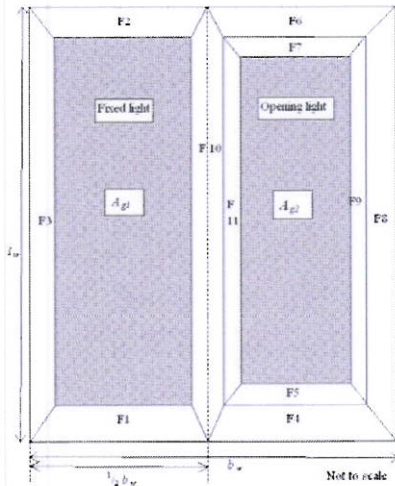
Centre pane U-Value ( $U_g$ ) calculation to EN 673 for each glass option.

U-Value Calculation Spreadsheet for each option.





# U-Value Calculation – Option 1



ML3/10/07  
U VALUE ONLY

Project details: FIRAT PLASTIK VE KAUCUK A.S.  
Chilt/T09002-1 Option 1 - S60 PVC-U Casement Window  
Input Values: Yellow input, green intermediary, blue final  
X' DP is no. of decimal points to enter

Parameter	Symbol	Units
Total window height ODP	$l_w$	1480 mm
Total window width ODP	$b_w$	1230 mm
of values to nearest 0.5 (not including gaskets):		
F1 fixed sill (b)	66.5	3 69.5
F2 fixed head (b)	66.5	3 69.5
F3 fixed jamb (b)	66.5	3 69.5
F4 fixed (b)	38.5	3 38.5
F5 moving (b)	76.5	3 76.5
F6 fixed (b)	38.5	3 38.5
F7 moving (b)	76.5	3 76.5
F8 fixed (b)	38.5	3 38.5
F9 moving (b)	76.5	3 76.5
F10 fixed (b)	53.5	3 56.5
F11 moving (b)	76.5	3 76.5
Total gasket area	0.021021	m <sup>2</sup>

Conductance	$L_{g,20}$	W/(m <sup>2</sup> ·K)	$b_g$ (mm)
F1 fixed sill conductance	0.3387	190	190
F2 fixed head conductance	0.3387	190	190
F3 fixed frame conductance	0.3387	190	190
F4+F5 sash sill conductance	0.4261	190	190
F6+F7 sash head conductance	0.4261	190	190
F8+F9 sash jamb conductance	0.4261	190	190
F10+F11 mullion conductance	0.6719	380	380
All L values to 4DP. All b values to 0DP			
F1 fixed sill conductance	0.4065	190	190
F2 fixed head conductance	0.4065	190	190
F3 fixed frame conductance	0.4065	190	190
F4+F5 sash sill conductance	0.4929	190	190
F6+F7 sash head conductance	0.4929	190	190
F8+F9 sash jamb conductance	0.4929	190	190
F10+F11 mullion conductance	0.8052	380	380

Glazing dimensions and properties			
All to ODP	Thickness of pane 1	4	mm
	Pane1/2 distance	16	
	Thickness of pane 2	4	
No entry for DG	Pane2/3 distance		
No entry for DG	Thickness of pane 3		
Thermal transmittance of glazing-3DP	$U_g$	1.163	W/(m <sup>2</sup> ·K)

### Window Dimensions:

Section	Length (mm)	Width (mm)	Area No gasket (m <sup>2</sup> )	Area with gasket (m <sup>2</sup> )
Fixed light	1347	521.75	0.7028	0.691621
Opening light	1250	396.75	0.4959	0.486093
Total glazing, $A_g$				
1.1987 1.1777				
Frame				
F1	615	66.5	0.0378	0.0394
F2	615	66.5	0.0378	0.0394
F3	1480	66.5	0.0940	0.0960
F4	615	38.5	0.0224	0.0224
F5	549.75	76.5	0.0362	0.0374
F6	615	38.5	0.0224	0.0224
F7	549.75	76.5	0.0362	0.0374
F8	1480	38.5	0.0555	0.0555
F9	1403	76.5	0.1015	0.1052
F10	1480	53.5	0.0764	0.0804
F11	1403	76.5	0.1015	0.1052
Total Frame 0.6217 0.6427				
Total Window, $A_w$ 1.820400 1.8204				
Percentage glass area				
No gasket 65.85% With gasket 64.70%				

Frame: Data from EN.673,  $U_g$  and  $t_g$  to 2DP,  $k_{eff}$  to 4DP

Section	$b_g$ (with gaskets) (m)	$U_g$ (W/(m <sup>2</sup> ·K))	Frame areas (with gaskets) (m <sup>2</sup> )	Heat flow (WK)	$\psi$ (W/(m·K))	$l_g$ (m)	Heat flow (WK)
F1 fixed sill	0.0695	1.6786	0.0394	0.0661	0.0690	0.51575	0.0356
F2 fixed head	0.0695	1.6786	0.0394	0.0661	0.0690	0.51575	0.0356
F3 fixed frame	0.0695	1.6786	0.0980	0.1646	0.0690	1.341	0.0925
F4+F5 sash sill	0.118	1.7293	0.0598	0.1034	0.0680	0.39075	0.0266
F6+F7 sash head	0.118	1.7293	0.0598	0.1034	0.0680	0.39075	0.0266
F8+F9 sash jamb	0.118	1.7293	0.1607	0.2779	0.0680	1.244	0.0846
F10+F11 mullion	0.136	1.6752	0.1856	0.3110	0.1350	1.2925	0.1745
Totals				0.6427	1.0924	Total	0.4759

Other parameters needed for calculation, taken from simulations:			
$\lambda_g = 0.035$ W/(m·K)	$R_{f,g} = 0.6857$ m <sup>2</sup> ·K/W	Panel thickness, $d_p = d_g = 0.024$ m	
$R_{w,g} = 0.04$ m <sup>2</sup> ·K/W	$R_{w,f} = 0.13$ m <sup>2</sup> ·K/W		
$R_{w,p} = 0.8557$ m <sup>2</sup> ·K/W	$U' = 1.1686$ W/(m <sup>2</sup> ·K)		

U(window) 3DP 1.614

U(window) 1DP 1.6

Certified Simulator No.

32