

TEST REPORT No. 329324/9539/CPR

issued by Istituto Giordano in the capacity of notified testing laboratory (No. 0407)
pursuant to Regulation 305/2011/UE of the European Parliament and of the Council of 09/03/2011

This test report cancels and replaces calculation report No. 324153/9135/CPR
dated 29/04/2015 issued by Istituto Giordano

Place and date of issue: Bellaria-Igea Marina - Italy, 23/11/2015

Customer: ELVIAL S.A. - 25th km New National Road THESSALONIKI-KIKLIS - Greece

Date test requested: 15/04/2015

Order number and date: 66235, 15/04/2015

Date drawing received: 16/03/2015

Date test performed: 27/04/2015

Purpose of test: calculation of thermal transmittance of a frame constructed from aluminium profiles with thermal break in accordance with standard UNI EN ISO 10077-2:2012 with reference to product standard UNI EN 14351-1:2010

Test venue: Istituto Giordano S.p.A. - Blocco 2 - Via Rossini, 2 - 47814 Bellaria-Igea Marina (RN) - Italy

Drawing origin: supplied by Customer

Name of window assembly*

The window assembly for which the calculation is performed is called "EL4600".

(*) according to that stated by the Customer.

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This test report consists of 7 sheets.

Sheet
1 of 7

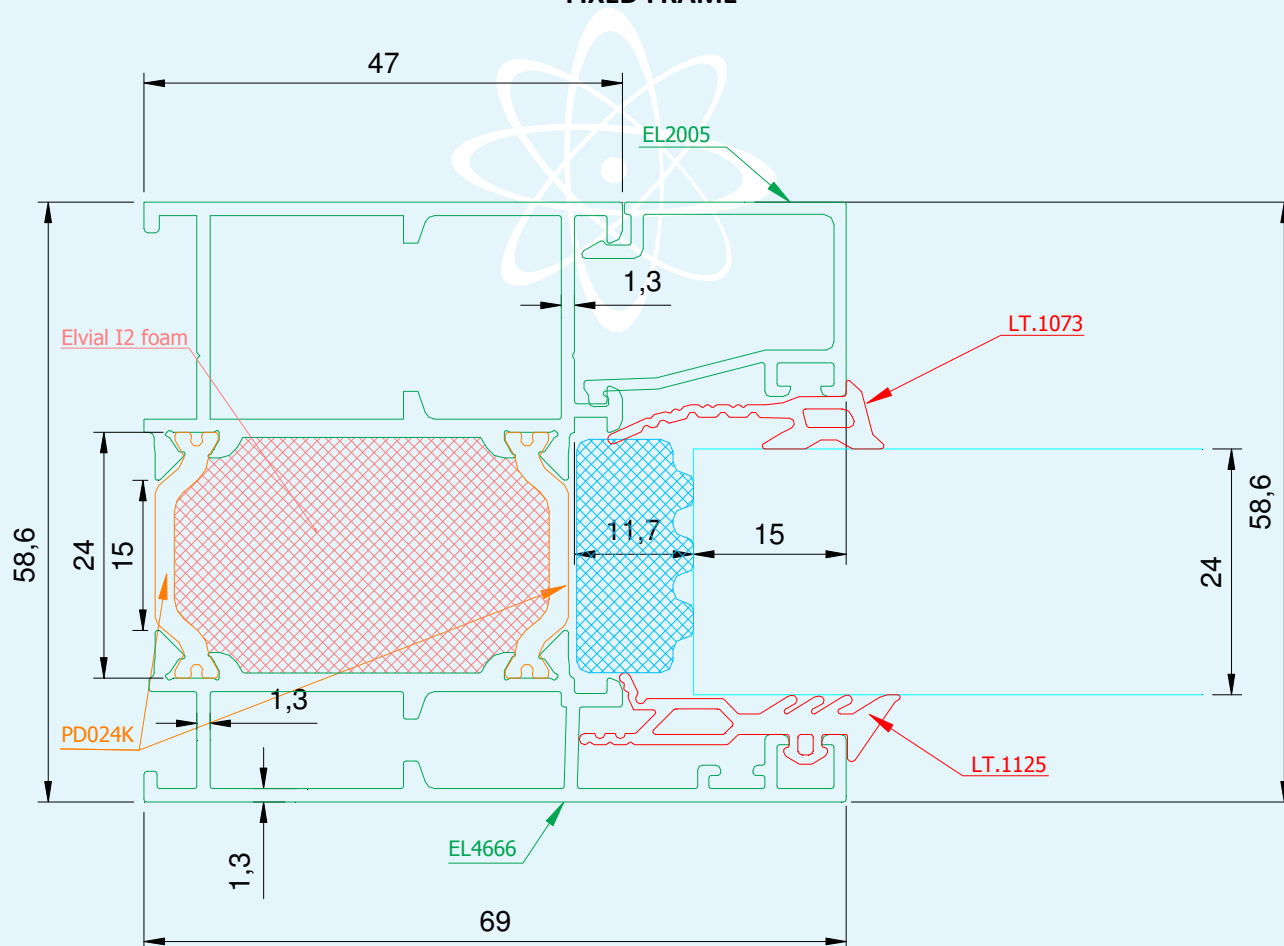
Description of window*

The frame assembly for which the calculation is performed consists of aluminium profiles with polyamide strips of length 15 mm to provide thermal break. The sash frame nominal thickness is 67 mm and the fixed frame nominal thickness is 59 mm.

The cavities between the polyamide bars are filled with "ELVIAL I² foam" and in the cavity of the junction with the glazing there is a strip of polyethylene foam.

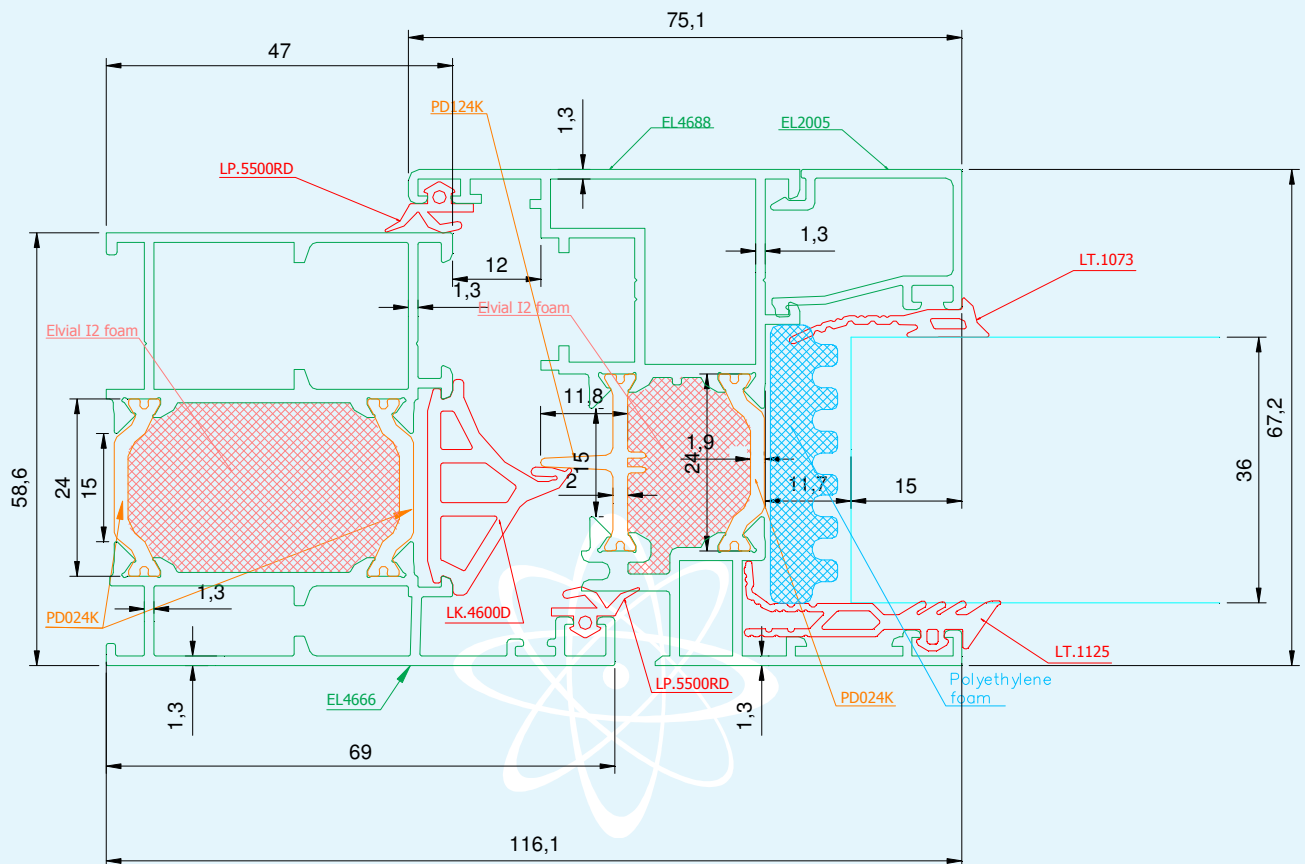
The calculation was performed on the basis of Customer-supplied drawings using the glazing with thickness 24 mm for fixed frame and using the glazing with thickness 36 mm for sash frame.

DRAWINGS OF THE SECTIONS CONSIDERED FIXED FRAME



(*) according to that stated by the Customer.

DRAWINGS OF THE SECTIONS CONSIDERED SASH FRAME



Manufacturing site*

ELVIAL S.A. - 25th km New National Road THESSALONIKI-KIKLIS - Greece.

Normative references

The calculation was carried out in accordance with the requirements of the following standards:

- UNI EN ISO 10077-2:2012 del 12/04/2012 “Prestazione termica di finestre, porte e chiusure - Calcolo della trasmittanza termica - Metodo numerico per i telai” (*“Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Numerical method for frames”*);
- UNI EN 14351-1:2010 del 15/04/2010 “Finestre e porte - Norma di prodotto, caratteristiche prestazionali. Parte 1: Finestre e porte esterne pedonali senza caratteristiche di resistenza al fuoco e/o di tenuta al fumo” (*“Windows and doors - Product standard, performance characteristics. Part 1: Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics”*), subclause 4.12 “Trasmittanza termica” (*“Thermal transmittance”*) and Annex E “Determinazione delle caratteristiche” (*“Determination of characteristics”*).

Test method and conditions

Calculation of frame thermal transmittance

The calculation was performed using a finite-element numerical programme complying with standard UNI EN ISO 10077-2 and with a discretisation, with the maximum side 0,5 mm, of 44761 points and of 72701 points. Air spaces were calculated by assigning each one an equivalent thermal conductivity calculated in accordance with the equation specified by standard UNI EN ISO 10077-2, assuming that the emissivity of materials is 0,9.

The frame thermal transmittance value “ U_f ” was calculated by inserting an insulation panel of thermal conductivity $\lambda = 0,035 \text{ W}/(\text{m}^2 \cdot \text{K})$ in place of the glazing, as specified by Annex C of standard UNI EN ISO 10077-2. This value does not include the additional heat flow caused by the interaction of the frame and the glass edge, including the effect of the spacer. This effect is represented by the value of the linear thermal transmittance, “ Ψ_g ”.

Calculation data

Data for determining frame thermal transmittance

Frame thermal transmittance was calculated under the following conditions:

Temperature	External temperature	0 °C
	Internal temperature	20 °C
Surface thermal resistance	External surface thermal resistance " R_{se} "	0,04 m ² · K/W
	Internal surface thermal resistance for surfaces with standard view factor " R_{si} "	0,13 m ² · K/W
	Internal surface thermal resistance for surfaces with reduced view factor	0,20 m ² · K/W
Thermal characteristics of frame	Thermal conductivity of aluminium	160 W/(m · K)
	Thermal conductivity of polyamide	0,30 W/(m · K)
	Thermal conductivity of EPDM	0,25 W/(m · K)
	Thermal conductivity of polyethylene foam	0,05 W/(m · K)
	Thermal conductivity of polyurethane "ELVIAL I ² foam"*	0,023 W/(m · K)

(*) data provided by the Customer using certified measurements by an accredited body according to the UNE EN 12667:2002 "Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance".

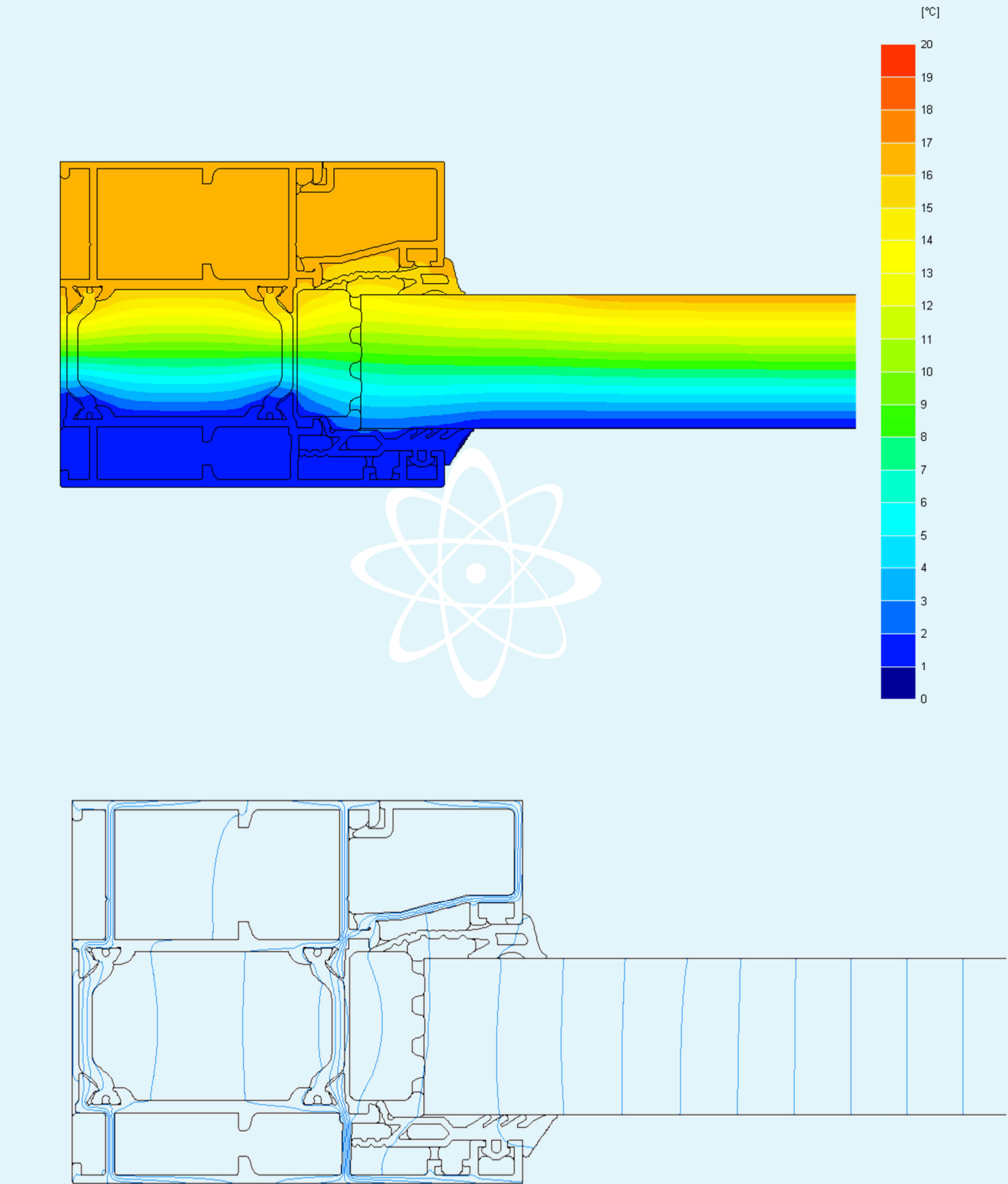
Test result

Frame thermal transmittance

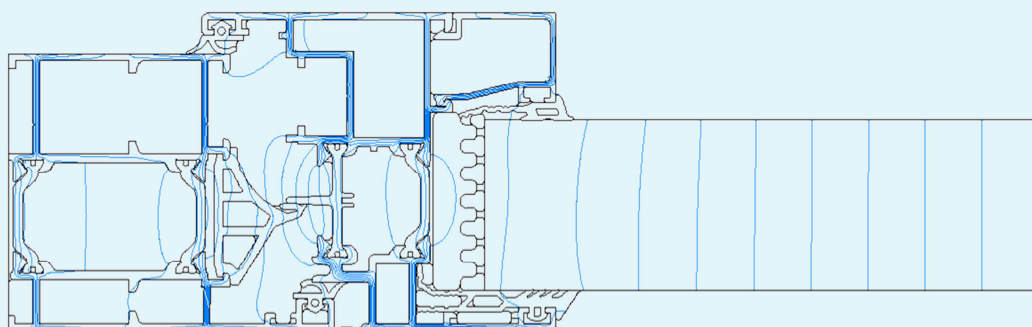
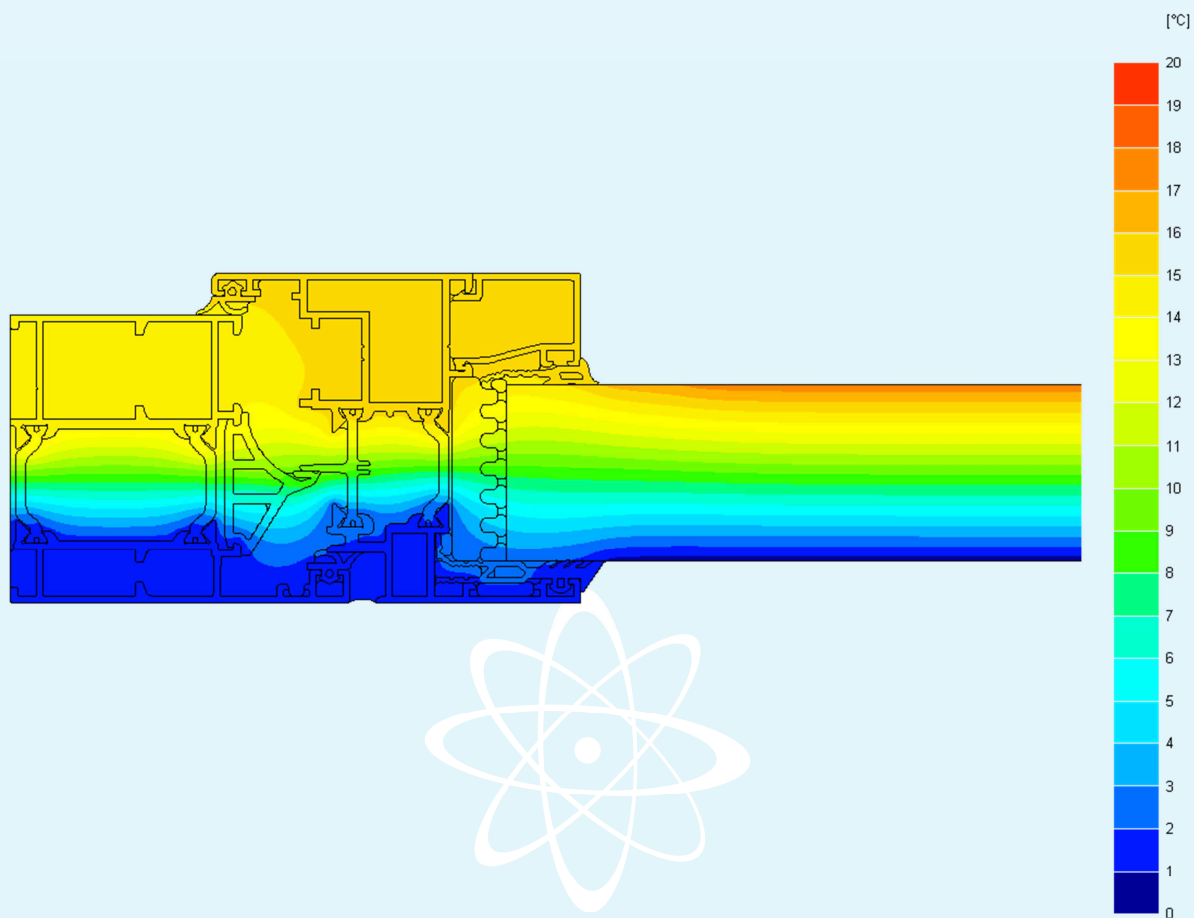
Frame thermal transmittance value calculated in accordance with standard UNI EN ISO 10077-2, including fixed and moveable parts (with reference to the widths given in the table), is:

Section	Width considered b_f [mm]	Thermal transmittance U_f [W/(m² · K)]
fixed frame	69	1,76
sash frame	116	2,16

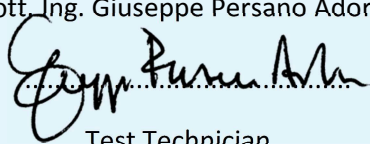
ISOTHERMS AND FLOW LINES FOR THE SECTIONS CONSIDERED
FIXED FRAME



ISOTHERMS AND FLOW LINES FOR THE SECTIONS CONSIDERED SASH FRAME



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