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Registro Imprese di Rimini n. 00 549 540 409

TEST REPORT No. 353141/11562/CPR

issued by Istituto Giordano in the capacity of notified test laboratory (No. 0407)
pursuant to Regulation 305/2011/EU of the European Parliament and of the Council of 9 March 2011

Place and date of issue: Bellaria-Igea Marina - Italy, 29/06/2018

Customer: EXALCO S.A. - 5th km Old National Road Larisas-Athinas - 41110 LARISA - Greece

Date testing requested: 08/05/2018

Order number and date: 76639, 15/05/2018

Date technical documentation received: 03/04/2018

Date of testing: 15/05/2018

Purpose of testing: calculation of thermal transmittance of frames constructed from aluminium profiles with thermal break in accordance with standard EN ISO 10077-2:2017, with reference to harmonised standard UNI EN 14351-1:2016

Place of testing: Istituto Giordano S.p.A. - Blocco 2 - Via Gioacchino Rossini, 2 - 47814 Bellaria-Igea Marina (RN) - Italy

Technical documentation origin: supplied by Customer

Name of item under examination*

The item for which the calculation is performed is called “905C Exalco”.

(*) according to that stated by the Customer.

LAB N° 0021

LAB N° 0021

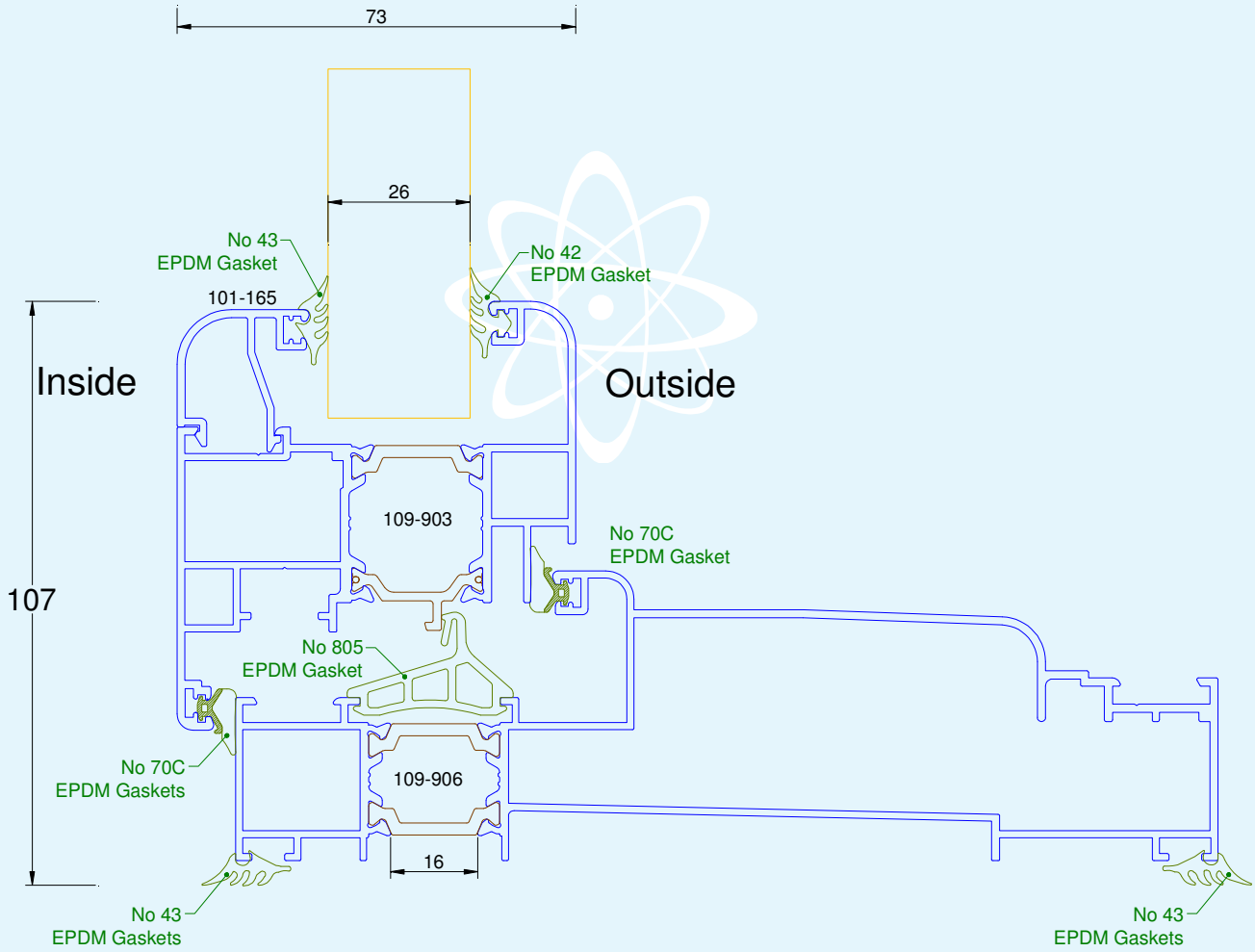
Description of item under examination*

The item for which the calculation was performed consists of frames having aluminium profiles with polyamide strips to provide thermal break.

The glazing thickness is 26 mm.

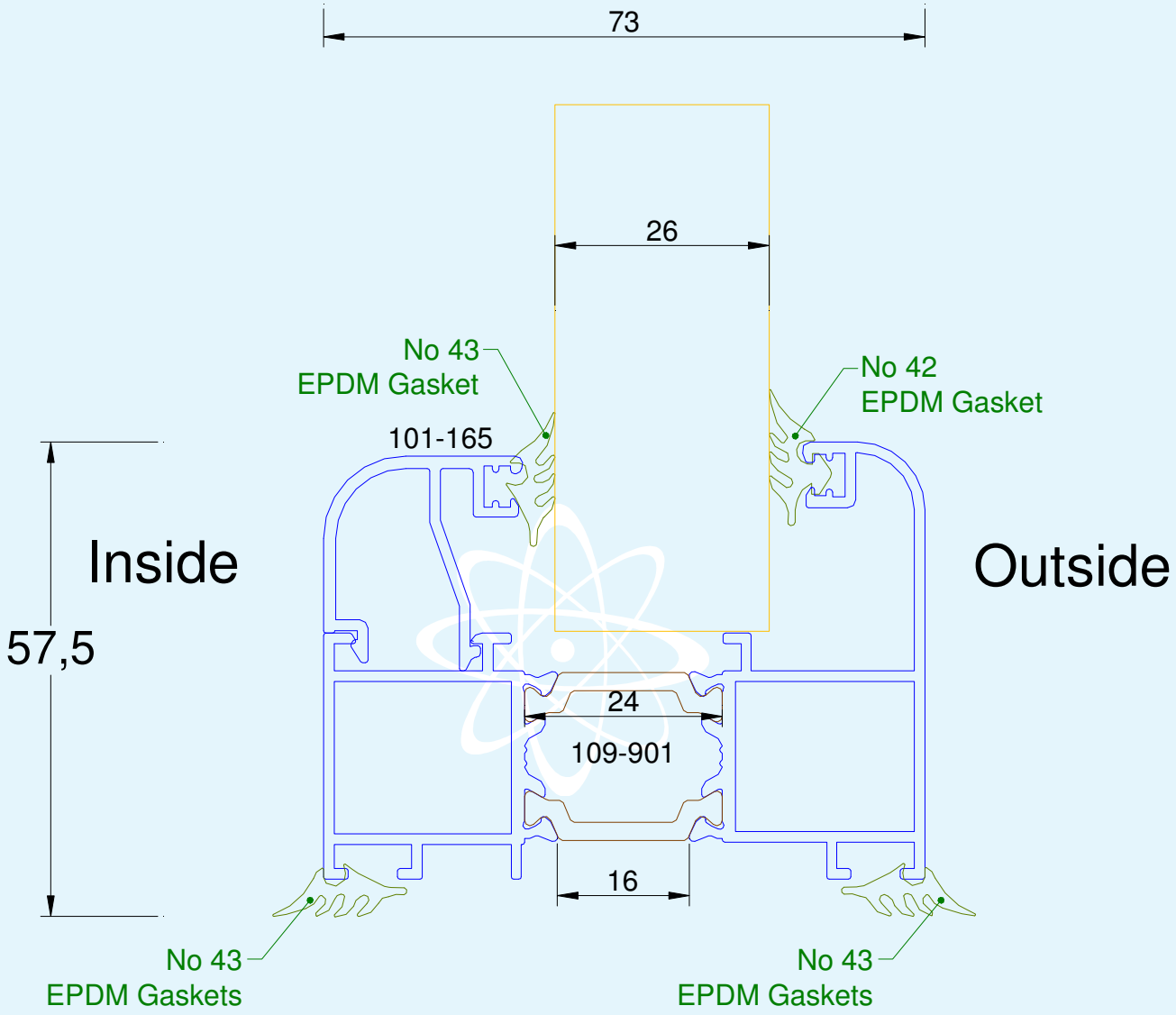
The calculation was performed on the basis of Customer-supplied drawings.

DRAWINGS OF THE SECTIONS CONSIDERED



Single sash tilt&turn window vertical section (inside & outside)

(*) according to that stated by the Customer.



Fixed window vertical section (inside & outside)

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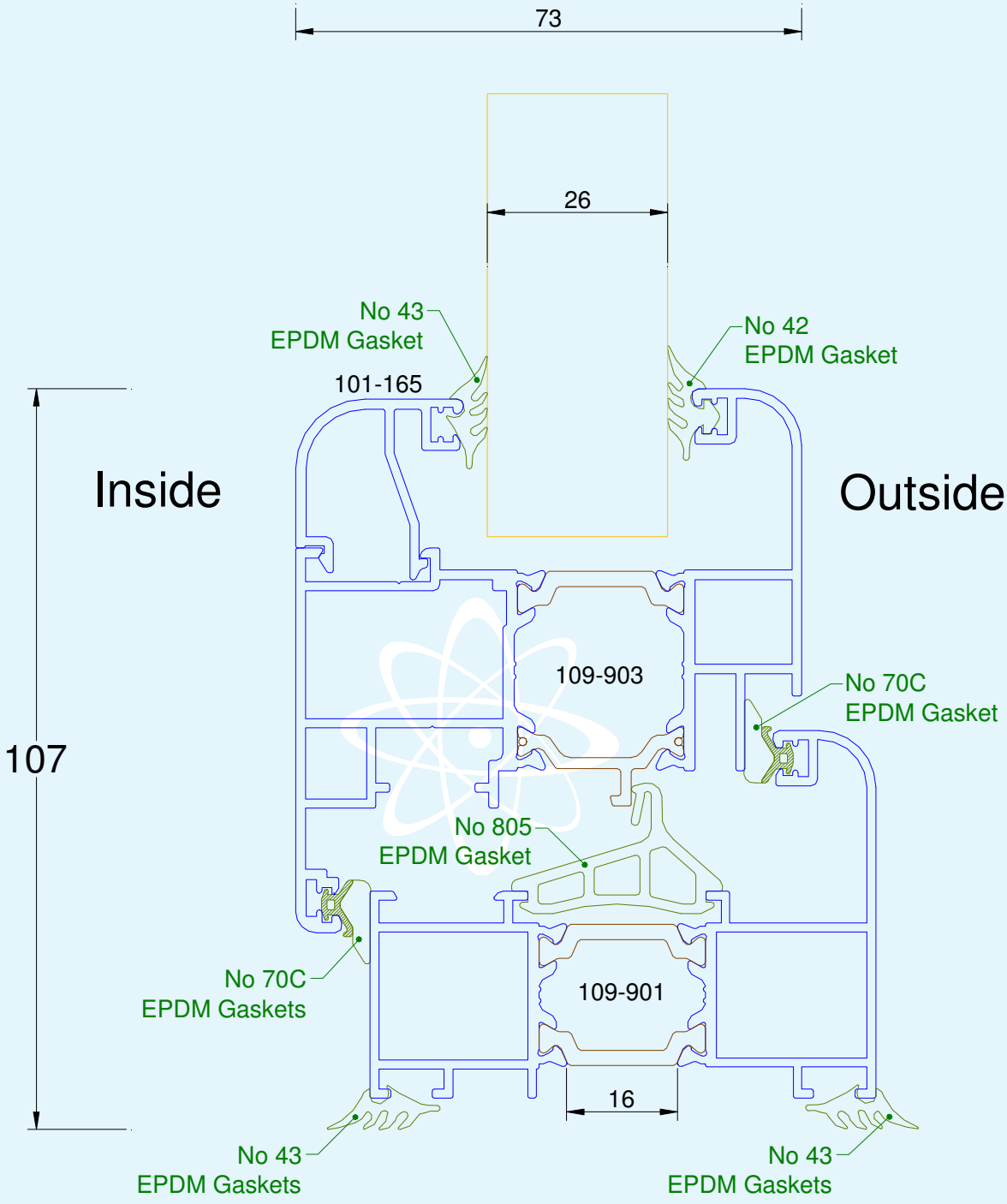

Single sash tilt&turn window vertical section (inside & outside)

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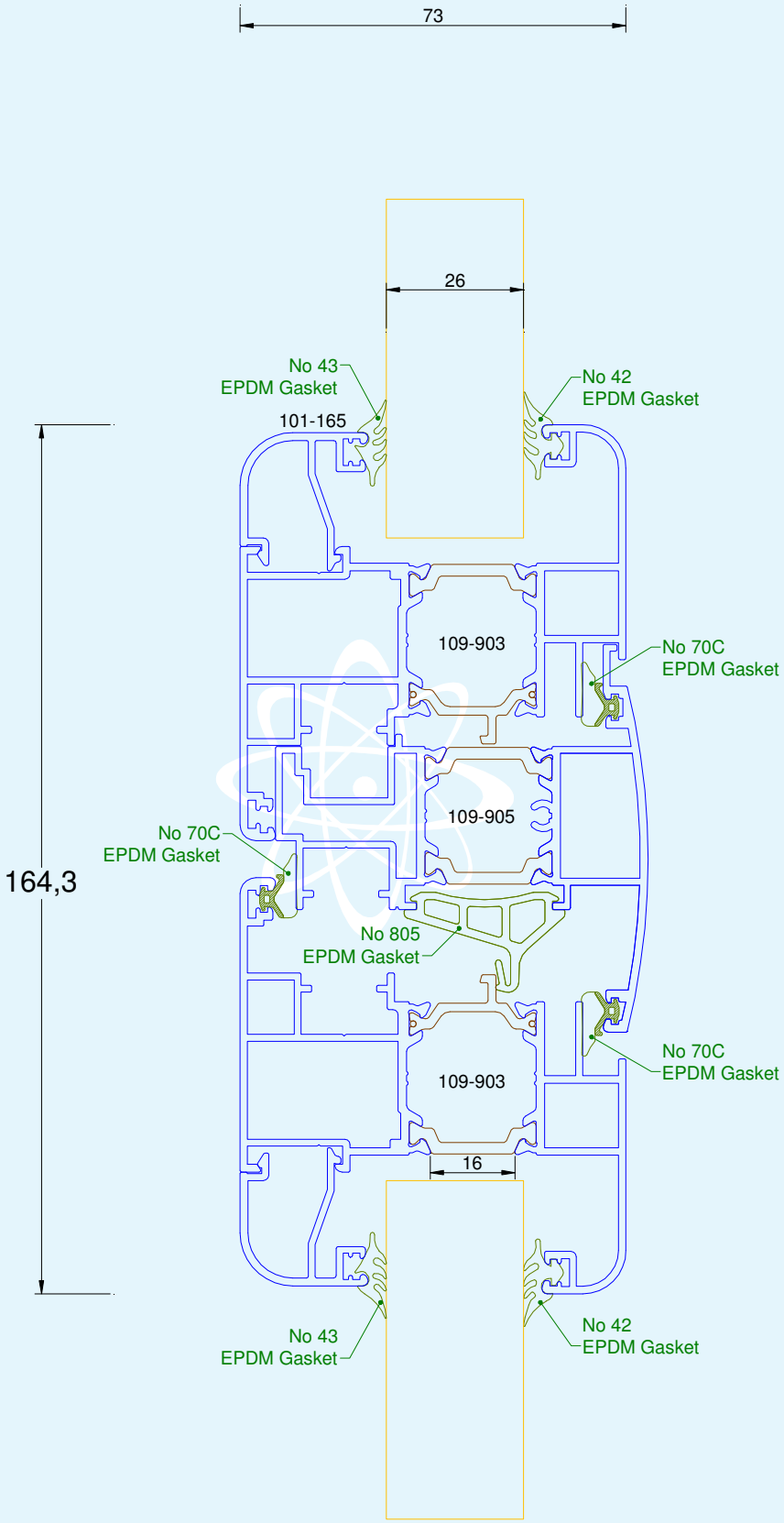

Double-sash tilt&turn window horizontal section (inside & outside)

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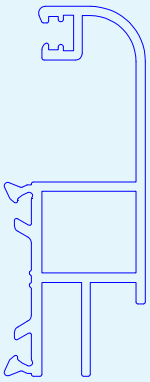
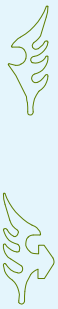
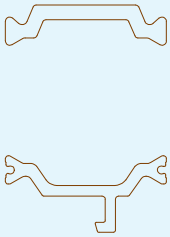
Aluminium Profile
λ = 160 W/(m·K)

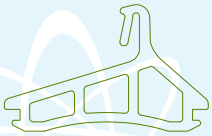


EPDM Gasket
λ = 0,25 W/(m·K)



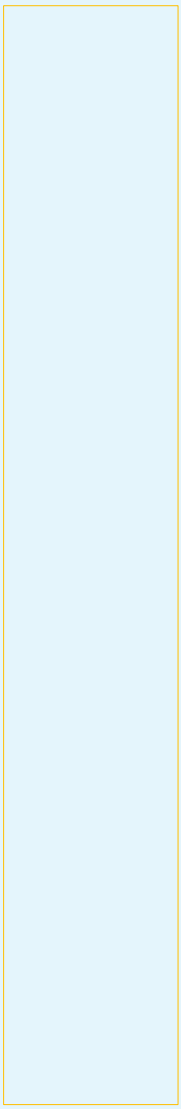
Polyamide 6.6 With 25 % Glassfibre
λ = 0,30 W/(m·K)





EPDM Gaskets
λ = 0,25 W/(m·K)

EPDM Foam Rubber
λ = 0,17 W/(m·K)



Panel
λ = 0,035 W/(m·K)

Materials and lambda values

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Manufacturing site*

EXALCO S.A. - 5th km Old National Road Larisas-Athinas - 41110 LARISA - Greece

Normative references

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

- UNI EN 14351-1:2016 dated 20/10/2016 "Windows and doors - Product standard, performance characteristics - Part 1: Windows and external pedestrian doorsets", subclause 4.12 "Thermal transmittance" and Annex E "Determination of characteristics";
- EN ISO 10077-2:2017 dated July 2017 "Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2: Numerical method for frames (ISO 10077-2:2017)".

Test method and conditions

The calculation was performed using detailed internal procedure PP072 in its current revision at testing date. The calculation was performed on the basis of the drawings provided by the Customer, using a numerical finite-element program**,** complying with standard EN ISO 10077-2, with a triangular discretization with the maximum side 0,5 mm, from 45473 to 108856 points. Air spaces were calculated according to clause 6.4.2 of standard EN ISO 10077-2 (radiosity method), 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 $\lambda = 0{,}035$ W/(m² · K) in place of the glazing, as specified by Annex F of standard EN ISO 10077-2. The frame thermal transmittance value "U_f", expressed in W/(m² · K), was calculated using the following equation:

$$U_f = \frac{L_f^{2D} - U_p b_p}{b_f}$$

where: L_f^{2D} = thermal conductance of the section, expressed in W/(m · K);

U_p = thermal transmittance of the central area of the panel, expressed in W/(m² · K);

b_p = visible width of the panel, expressed in m;

b_f = projected width of the frame section (without protrudine gaskets), expressed in m.

(*) according to that stated by the Customer.

Calculation data

		Value	Data source
Temperature	External temperature	0 °C	EN ISO 10077-2, clause 6.3.4
	Internal temperature	20 °C	
Surface thermal resistance	External surface thermal resistance "R_{se}"	0,04 m² · K/W	EN ISO 10077-2, table E.1
	Internal surface thermal resistance for surfaces with standard view factor "R_{si}"	0,13 m² · K/W	
	Internal surface thermal resistance for surfaces with reduced view factor	0,20 m² · K/W	
Characteristics of the joint used for the calculation of the parameter "U_f"	Emissivity of the materials, except aluminium between the thermal break bars	0,9	EN ISO 10077-2, table D.3
	Emissivity of aluminium between the thermal break bars	0,3	
	Thermal conductivity of aluminium	160 W/(m · K)	EN ISO 10077-2, table D.1
	Thermal conductivity of EPDM	0,25 W/(m · K)	
	Thermal conductivity of polyamide reinforced	0,30 W/(m · K)	

Test results

Frame thermal transmittance values calculated in accordance with standard EN ISO 10077-2, including fixed and moveable parts are:

Section	Width considered "b_f" [mm]	Thermal transmittance "U_f" [W/(m² · K)]	Thermal transmittance* "U_f" [W/(m² · K)]
Single sash tilt&turn window vertical section (inside & outside)	107	**3,02**	**3,0**
Fixed window vertical section (inside & outside)	57,5	**2,92**	**2,9**
Single sash tilt&turn window vertical section (inside & outside)	107	**2,73**	**2,7**
Double-sash tilt&turn window horizontal section (inside & outside)	164,3	**2,59**	**2,6**

(*) value rounded to the second significant digit.

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ISOTHERMS AND FLOW LINES
SECTION SINGLE SASH TILT&TURN WINDOW
VERTICAL SECTION (INSIDE & OUTSIDE)
U_f = 3,0 W/(m² · K)

ACCREDIA L'ENTE ITALIANO DI ACCREDITAMENTO

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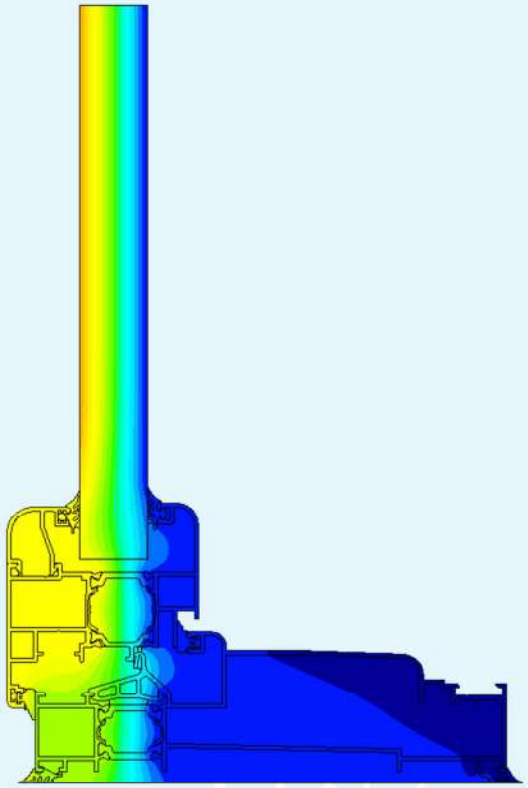

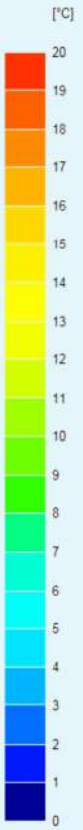

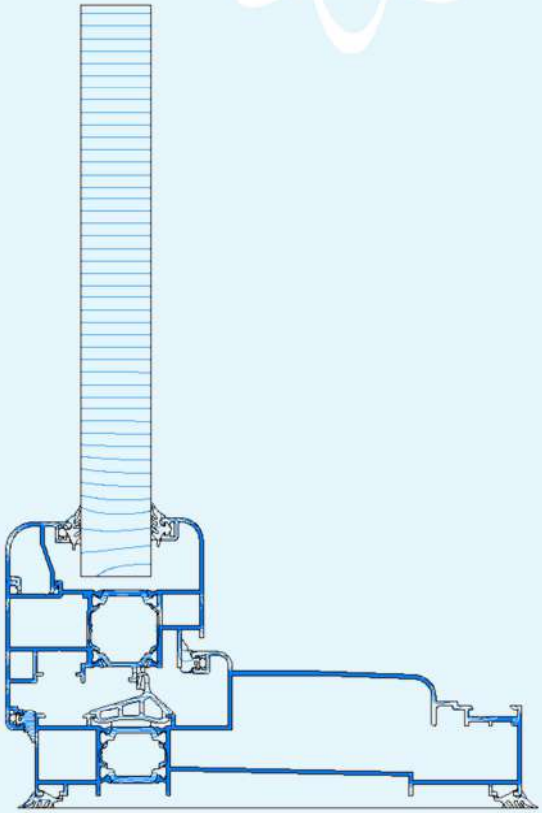

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ISOTHERMS AND FLOW LINES
SECTION FIXED WINDOW VERTICAL SECTION
(INSIDE & OUTSIDE)
U_f = 2,9 W/(m² · K)

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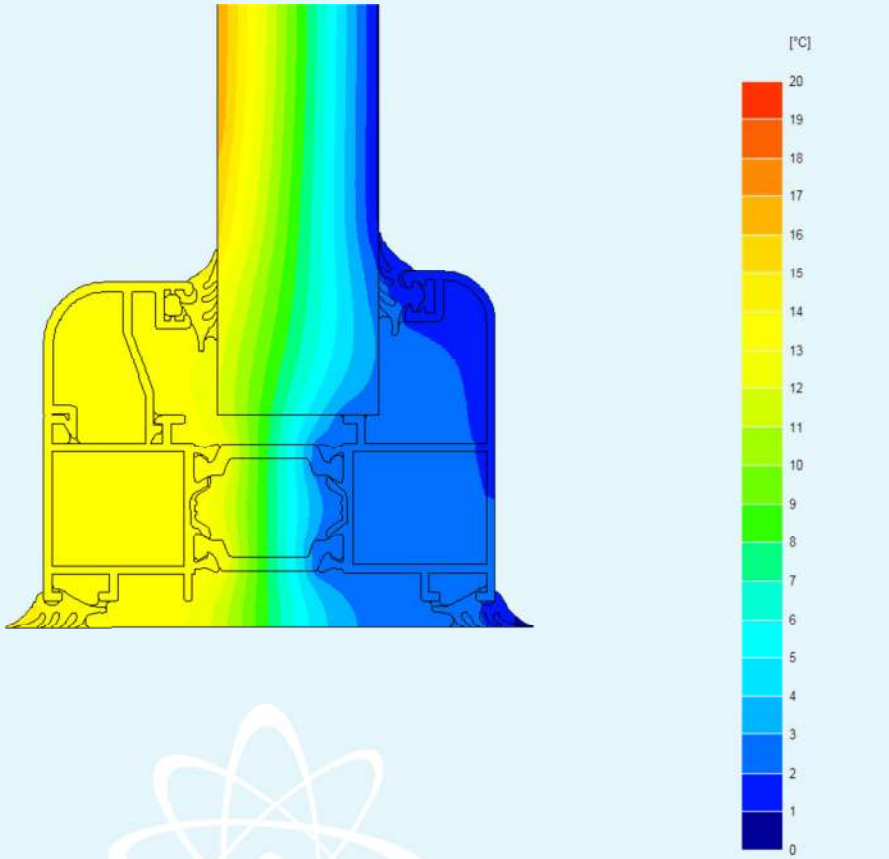
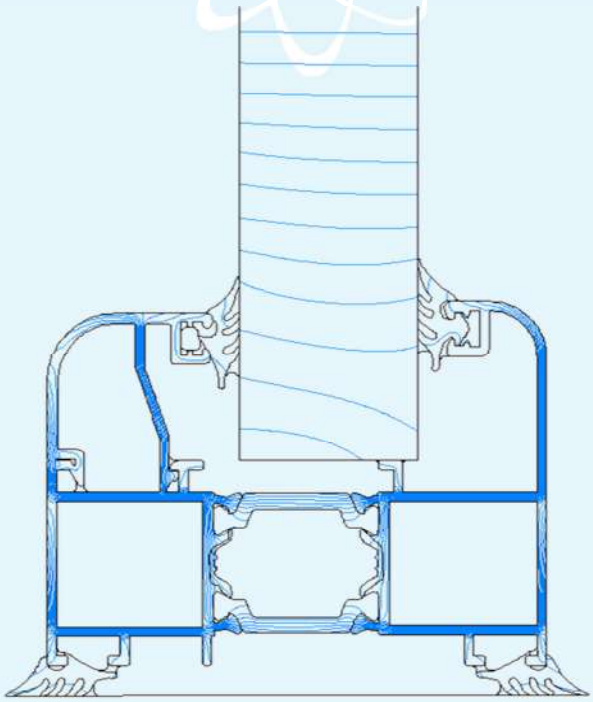
LAB N° 0021





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ISOTHERMS AND FLOW LINES
SECTION SINGLE SASH TILT&TURN WINDOW
VERTICAL SECTION (INSIDE & OUTSIDE)
U_f = 2,7 W/(m² · K)

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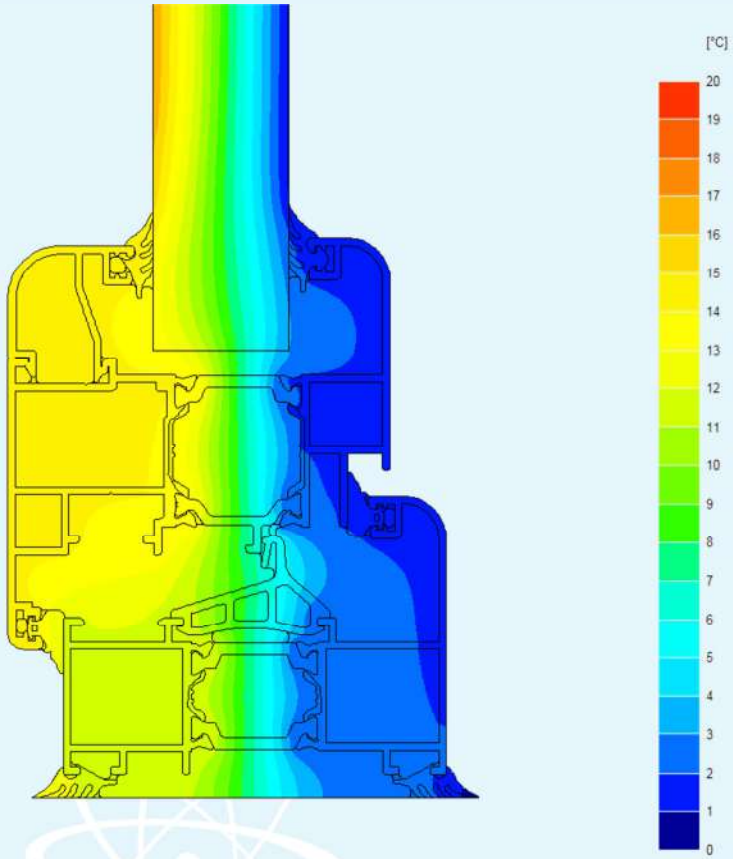

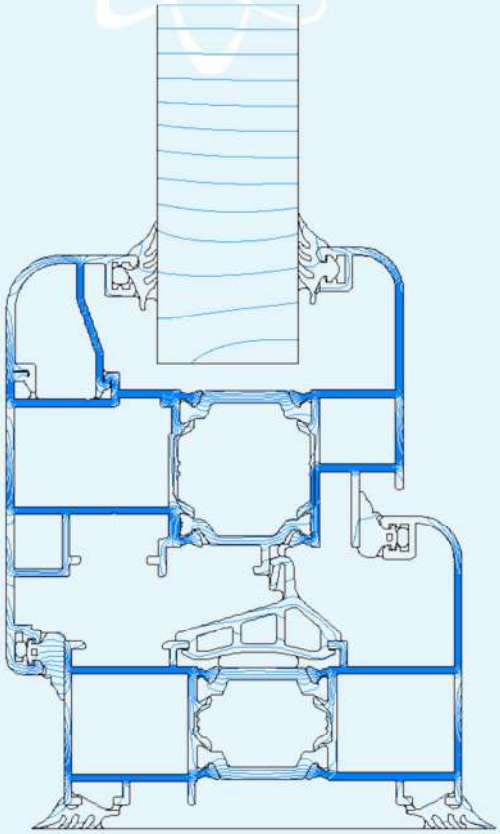

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ISOTHERMS AND FLOW LINES
SECTION DOUBLE-SASH TILT&TURN WINDOW
HORIZONTAL SECTION (INSIDE & OUTSIDE)
U_f = 2,6 W/(m² · K)

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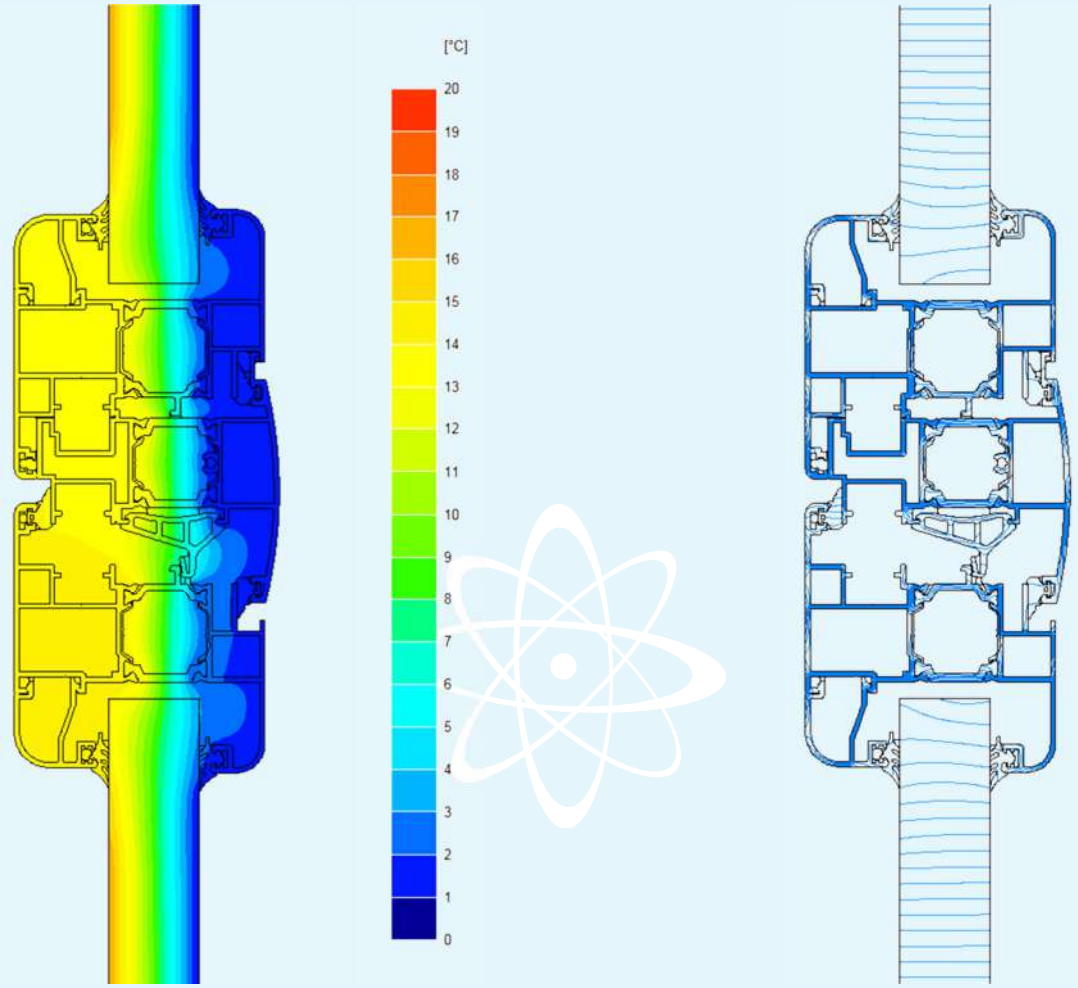
LAB N° 0021



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