LAB N° 0021 L

TEST REPORT No. 387017/14420/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

Customer

EXALCO S.A.

5th km Old National Road Larisas-Athinas - 41110 LARISA - Greece

Item*

frames constructed from aluminium profiles with thermal break named “905C Advanced”

Activity

calculation of thermal transmittance in accordance with standard EN ISO 10077-2:2017, with reference to harmonised standard UNI EN 14351-1:2016

Results

N.	Section	Thermal transmittance rounded to the second significant digit “U_f” [W/(m² · K)]
1	Tilt&turn window with shutter frame vertical	**2,5**
2	Fixed window vertical	**2,3**
3	Tilt&turn window vertical	**2,4**
4	Double-sash Tilt&turn window horizontal	**2,4**
5	Tilt&turn window with shutter frame vertical 2	**2,5**
6	Fixed window vertical 2	**2,4**
7	Tilt&turn window vertical 2	**2,4**
8	Double-sash Tilt&turn window horizontal 2	**2,4**

(*) according to that stated by the customer.

Bellaria-Igea Marina - Italy, 24 September 2021

Chief Executive Officer

Order:
89877

Technical documentation origin:
supplied by the customer

Technical documentation received date:
22 September 2021

Activity date:
from 22 September 2021 to 24 September 2021

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

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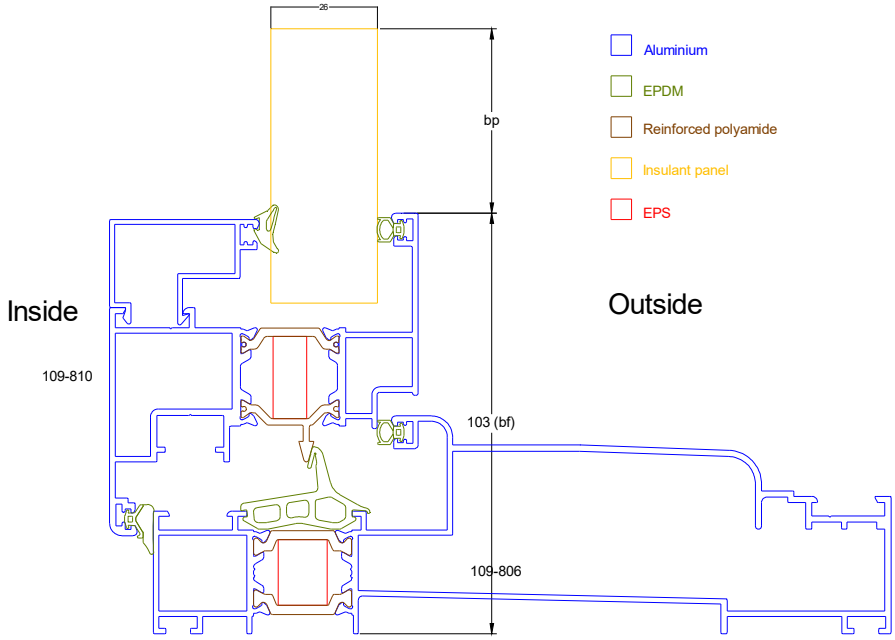
Reviewer: Dott. Ing. Gabriele Graci

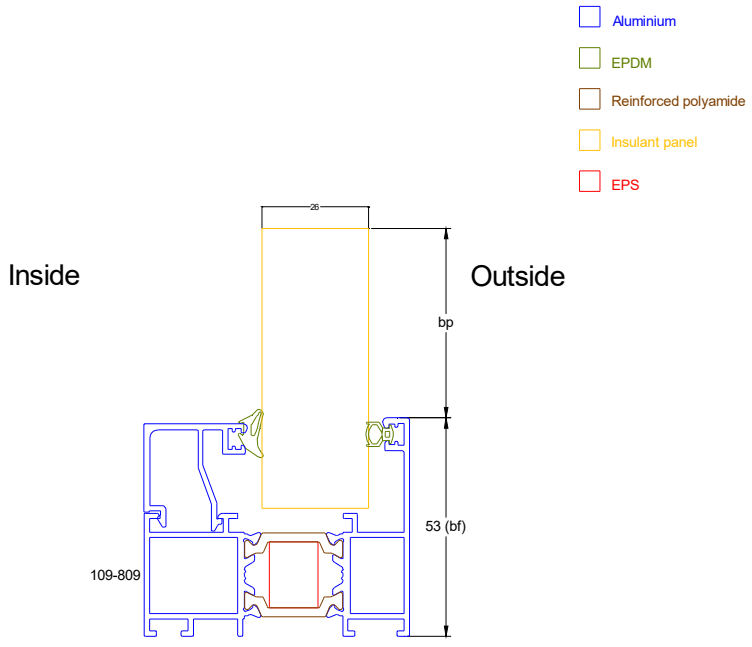
Description of item*

The item under examination consists of frames having aluminium profiles with polyamide strips to provide thermal break. The cavities between the polyamide strips are filled with Expanded Polystyrene with graphite.

DRAWINGS OF THE SECTIONS CONSIDERED

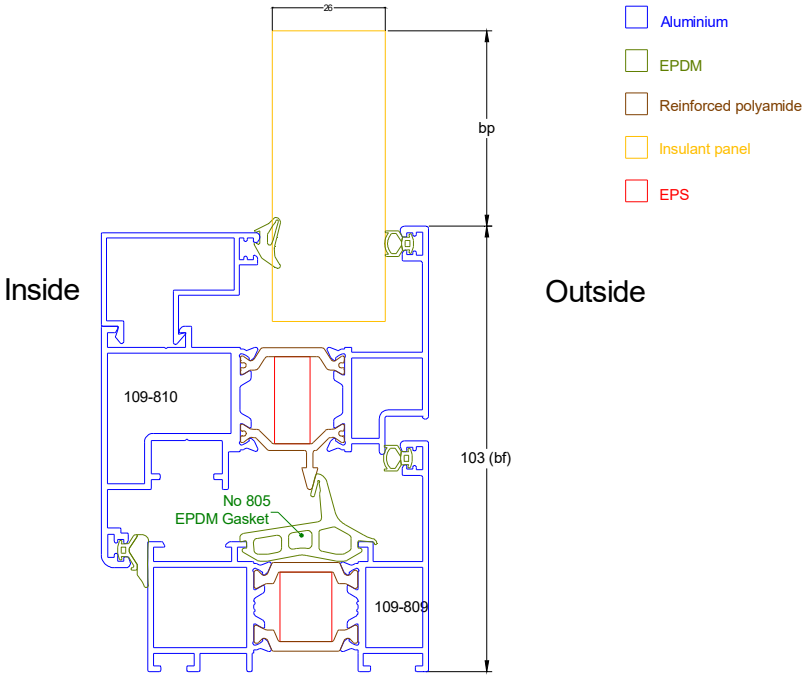


Tilt&turn window with shutter frame vertical

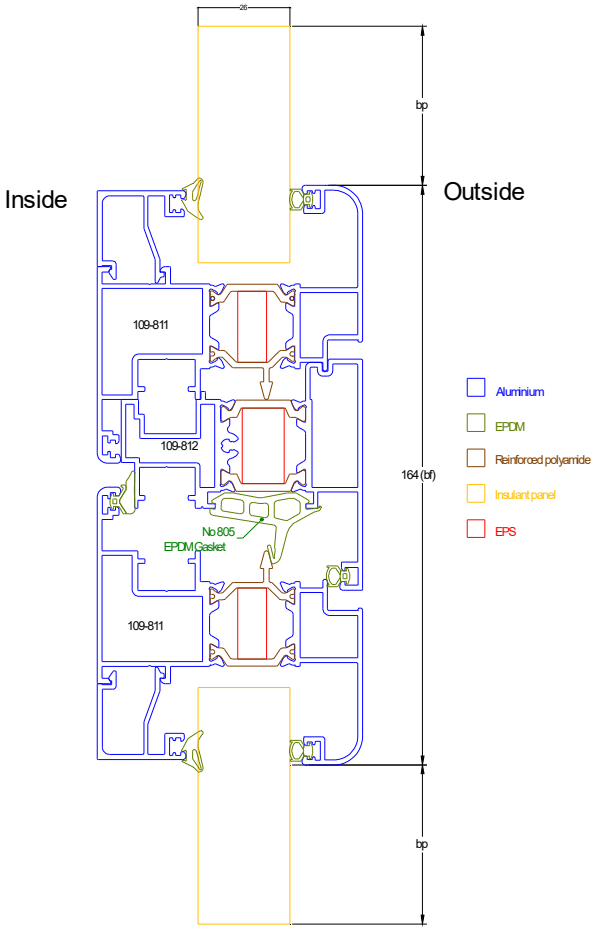


Fixed window vertical

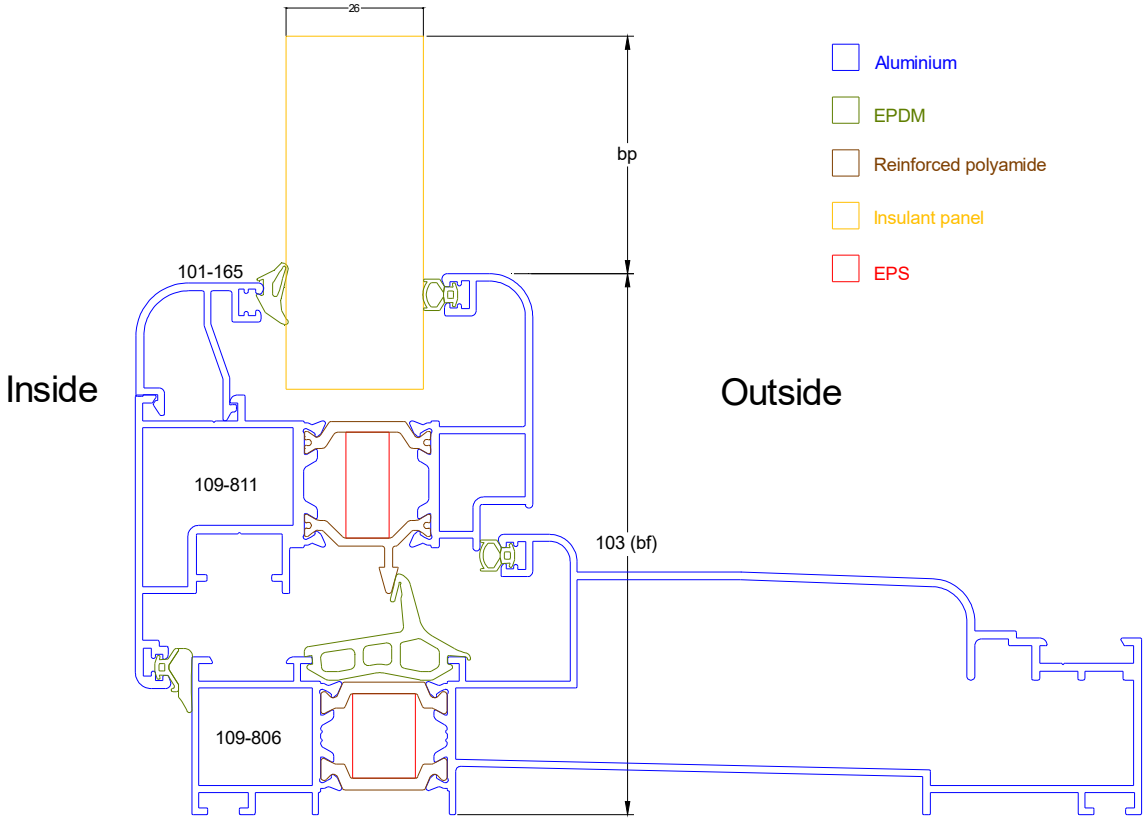
(*) according to that stated by the customer, apart from characteristics specifically stated to be measurements. Istituto Giordano declines all responsibility for the information and data provided by the client that may influence the results.



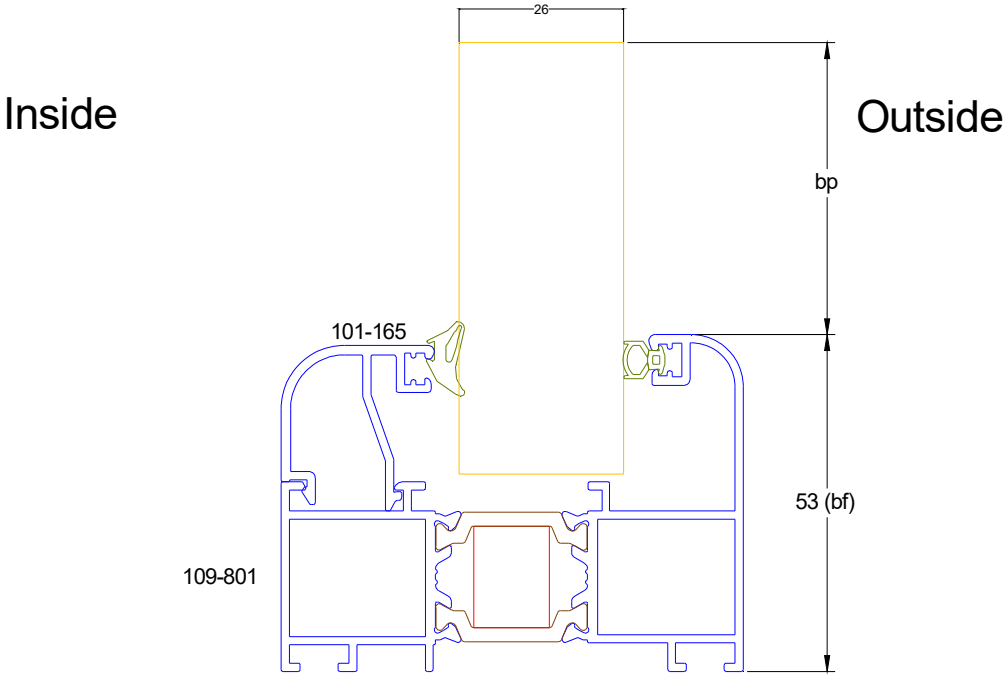
Tilt&turn window vertical



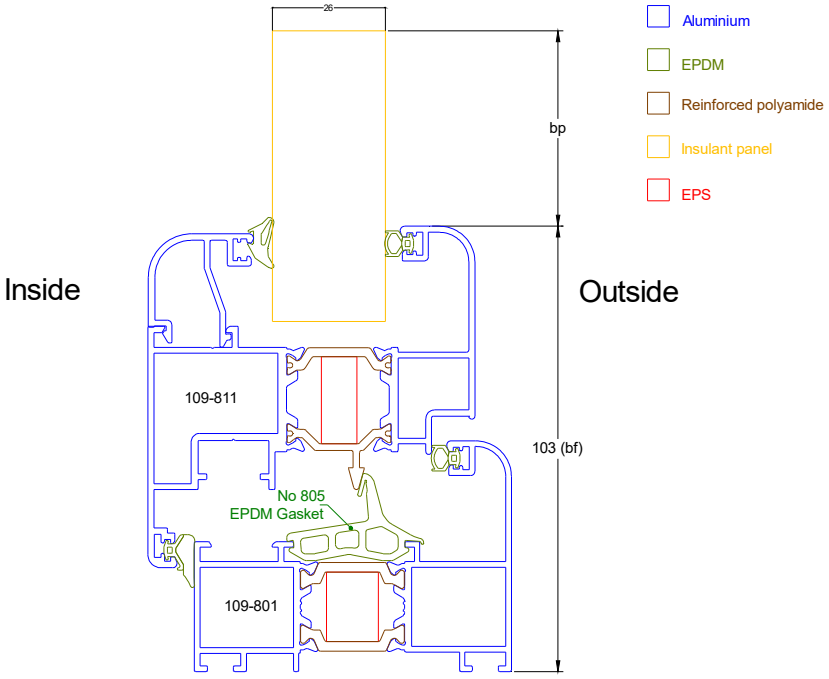
Double-sash Tilt&turn window horizontal



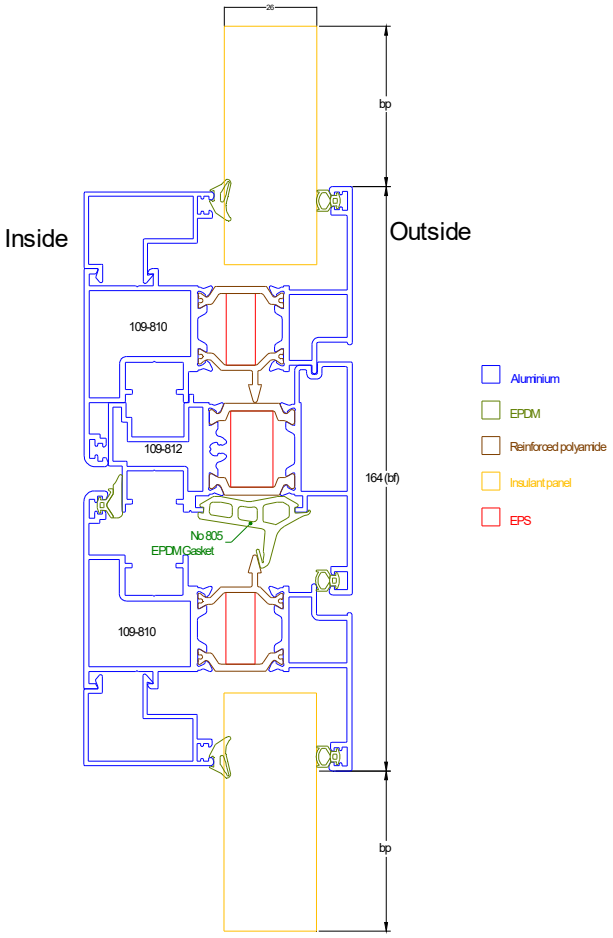
Tilt&turn window with shutter frame vertical 2



Fixed window vertical 2



Tilt&turn window vertical 2



Double-sash Tilt&turn window horizontal 2

Manufacturing site*

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

Normative references

Standard	Title
UNI EN 14351-1:2016**	Windows and doors - Product standard, performance characteristics - Part 1: Windows and external pedestrian doorsets
EN ISO 10077-2:2017	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2: Numerical method for frames (ISO 10077-2:2017)
UNI 10351:2015	Materiali e prodotti per edilizia - Proprietà termoigrometriche - Procedura per la scelta dei valori di progetto *(Materials and products for construction - Thermohygrometric properties - Procedure for the selection of project values)*

(**) subclause 4.12 "Thermal transmittance" and annex E "Determination of characteristics".

Method

Calculation procedure and conditions

The calculation was performed using detailed internal procedure PP072 in its current revision at testing date, 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 0,9 mm, of 23219 and 73665 points. Air spaces were calculated in accordance with the equations specified by 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	
	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)	
	Thermal conductivity of EPS with graphite	0,030 W/(m · K)	Manufacturer's data sheet provided by the customer
	Emissivity of all the materials	0,9	EN ISO 10077-2, table D.3
	Thickness of the insulating panel inserted instead of glazing "d_p"	26 mm	Geometric data obtained from the drawings supplied by the customer

Results

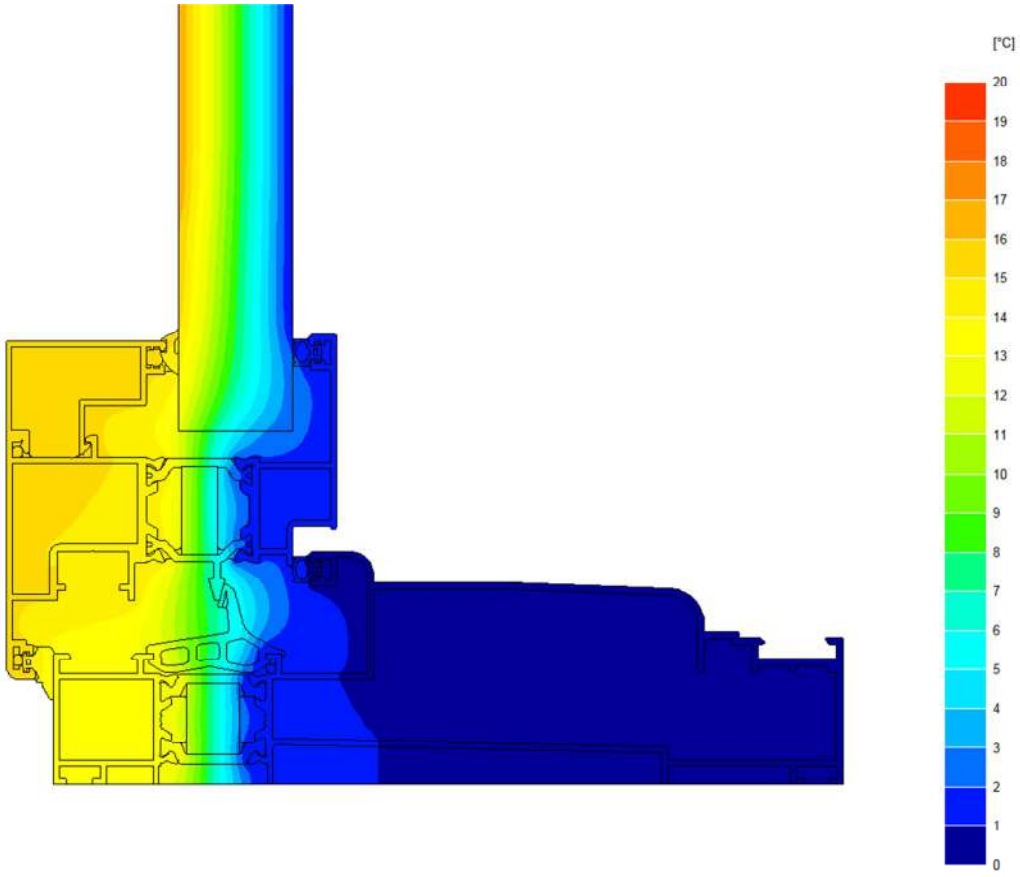
Frame thermal transmittance values calculated in accordance with standard EN ISO 10077-2, including fixed and moveable parts are:

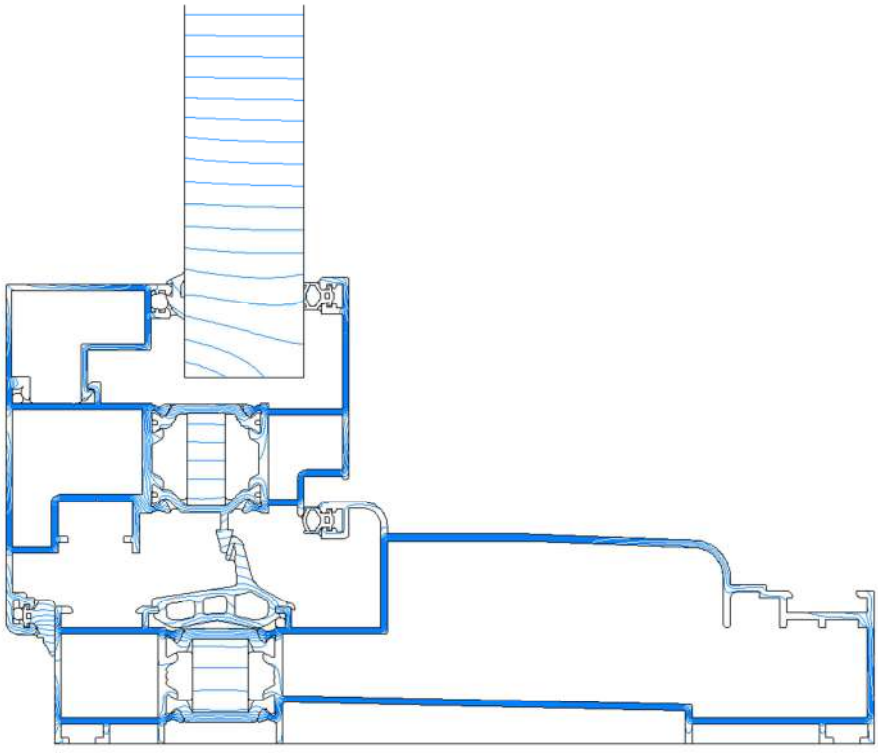
N.	Section	Width considered "b_f" [mm]	Thermal transmittance "U_f" [W/(m² · K)]	Thermal transmittance* "U_f" [W/(m² · K)]
1	Tilt&turn window with shutter frame vertical	103	2,51	**2,5**
2	Fixed window vertical	53	2,34	**2,3**
3	Tilt&turn window vertical	103	2,44	**2,4**
4	Double-sash Tilt&turn window horizontal	164	2,35	**2,4**
5	Tilt&turn window with shutter frame vertical 2	103	2,46	**2,5**
6	Fixed window vertical 2	53	2,37	**2,4**
7	Tilt&turn window vertical 2	103	2,42	**2,4**
8	Double-sash Tilt&turn window horizontal 2	164	2,38	**2,4**

(*) value rounded to the second significant digit.

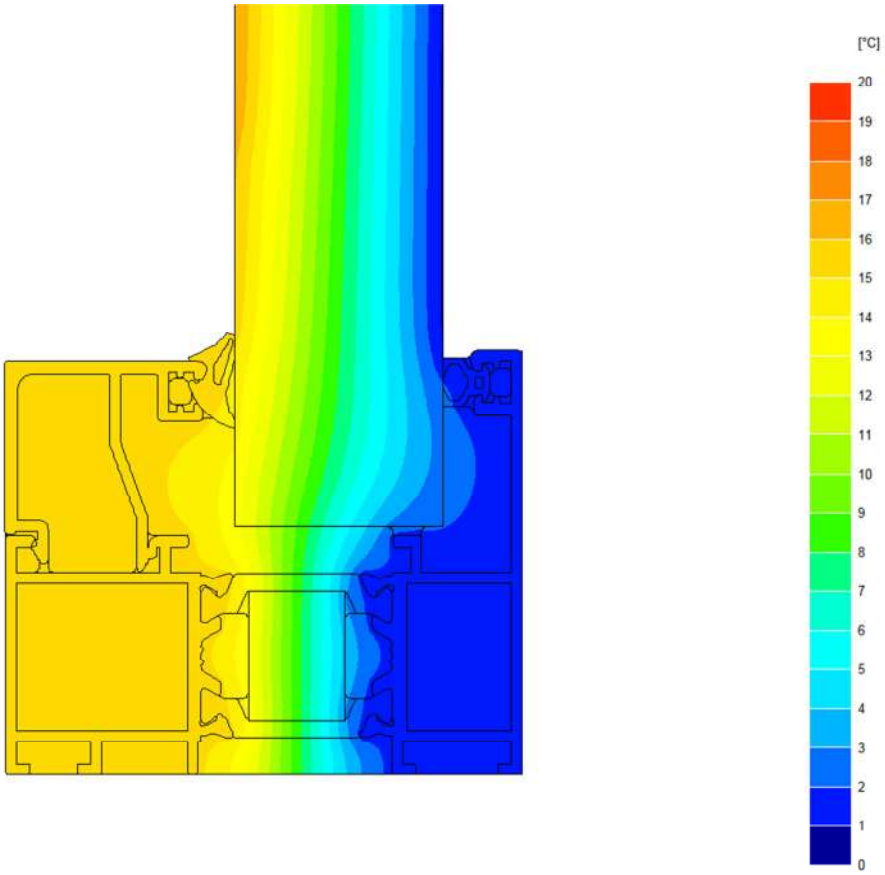
Note: thermal transmittance values given in the table above have been calculated for glazing with thickness 26 mm.

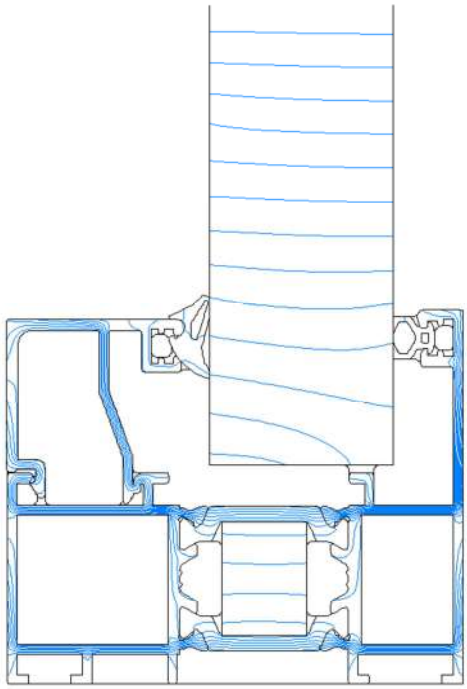
ISOTHERMS AND FLOW LINES
TILT&TURN WINDOW WITH SHUTTER FRAME VERTICAL SECTION



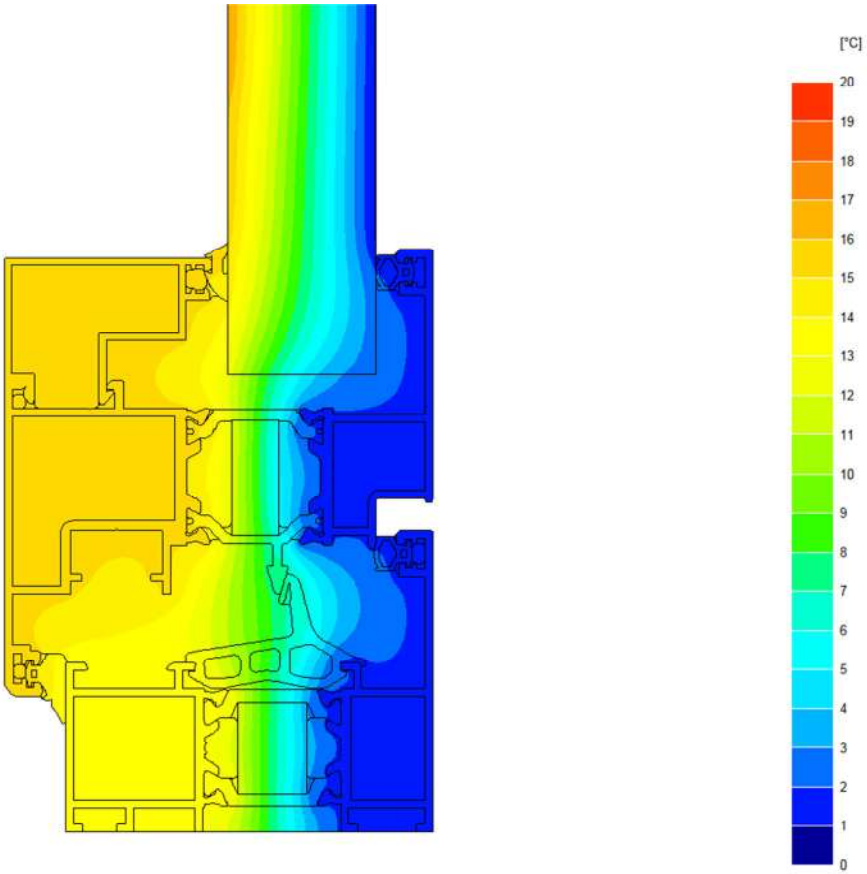


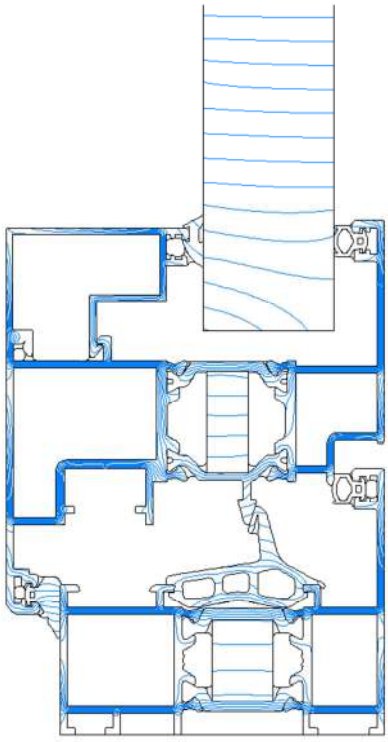
ISOTHERMS AND FLOW LINES
FIXED WINDOW VERTICAL SECTION



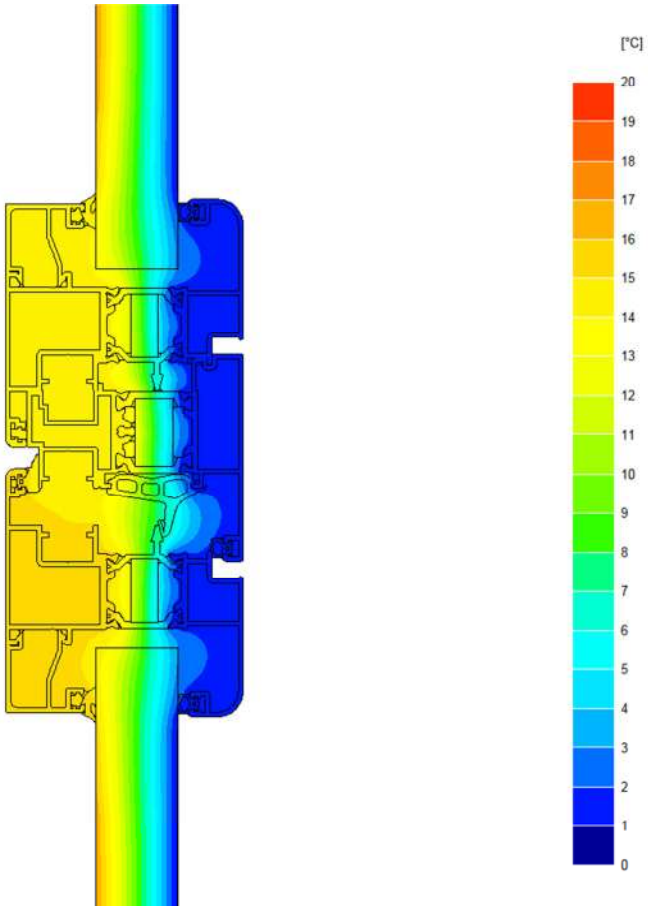


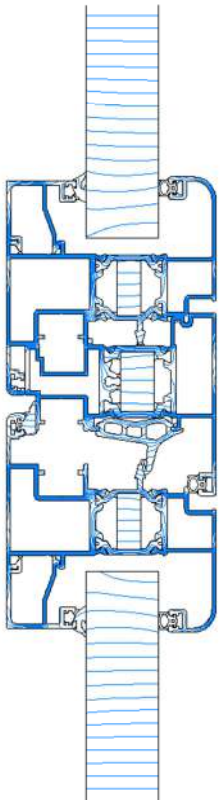
ISOTHERMS AND FLOW LINES
TILT&TURN WINDOW VERTICAL SECTION



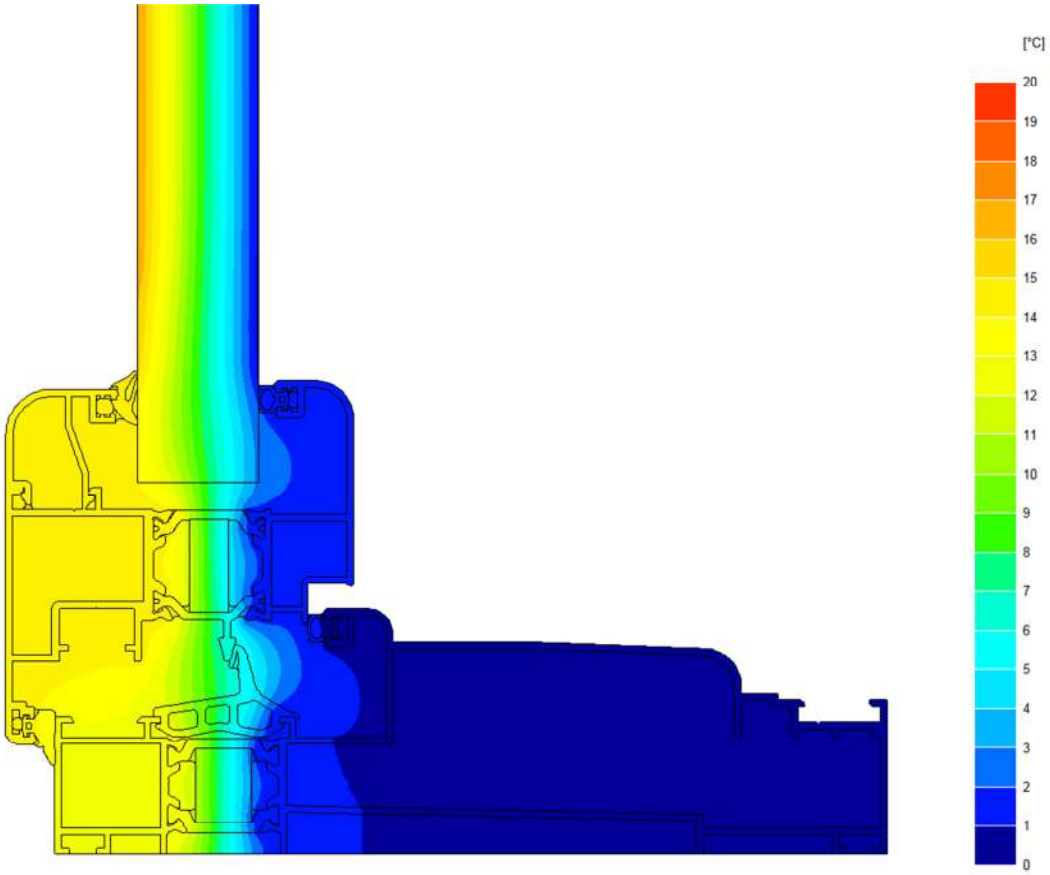


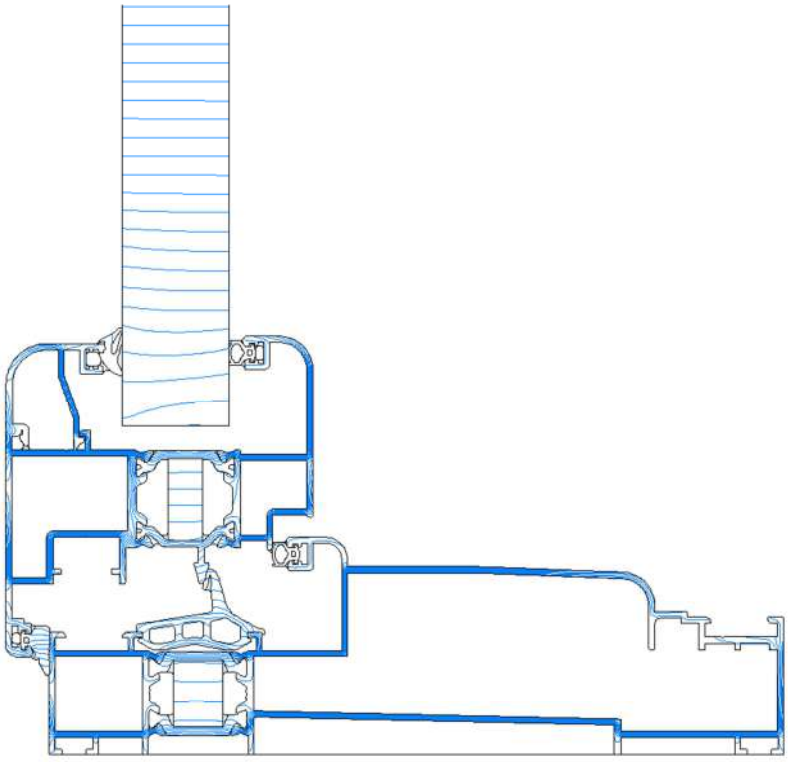
ISOTHERMS AND FLOW LINES
DOUBLE-SASH TILT&TURN WINDOW HORIZONTAL SECTION



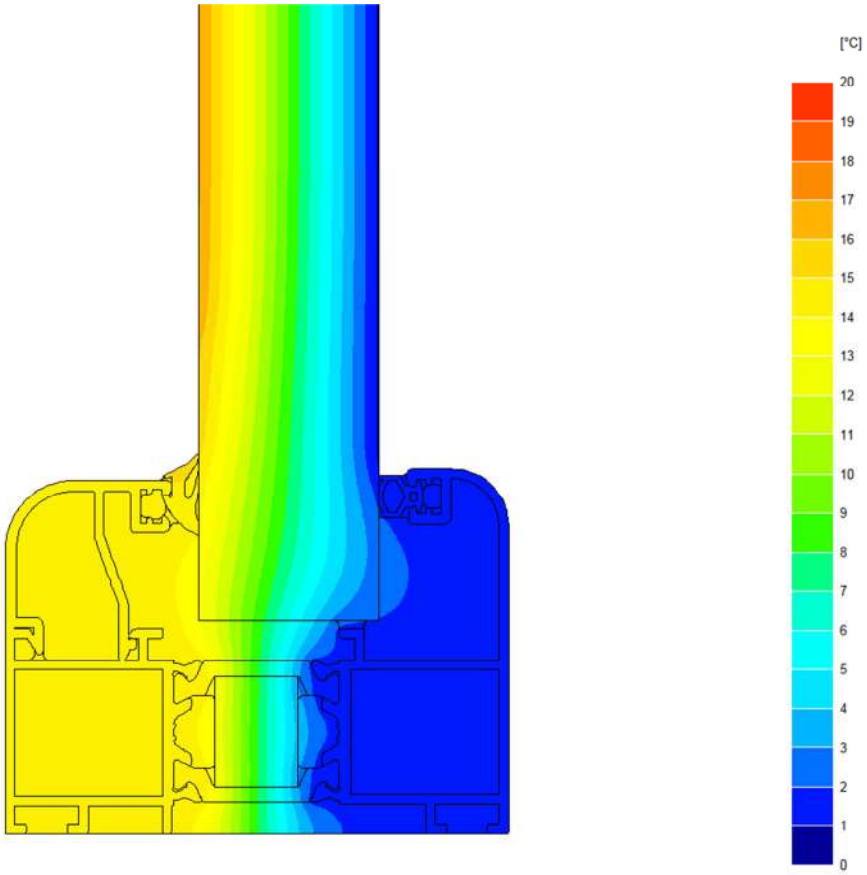


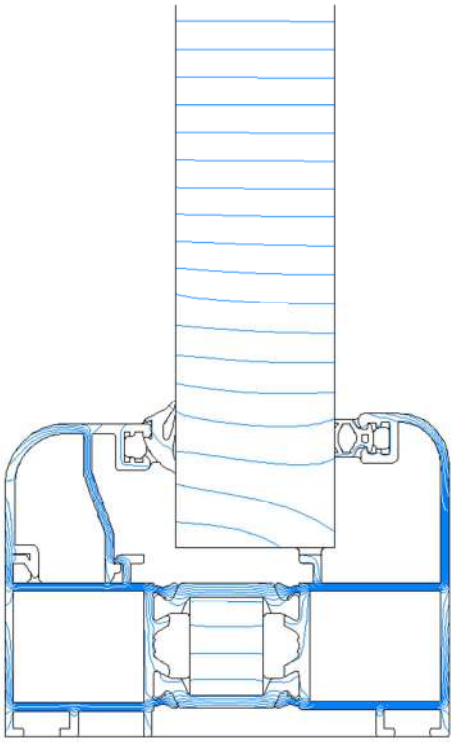
ISOTHERMS AND FLOW LINES
TILT&TURN WINDOW WITH SHUTTER FRAME VERTICAL 2
SECTION



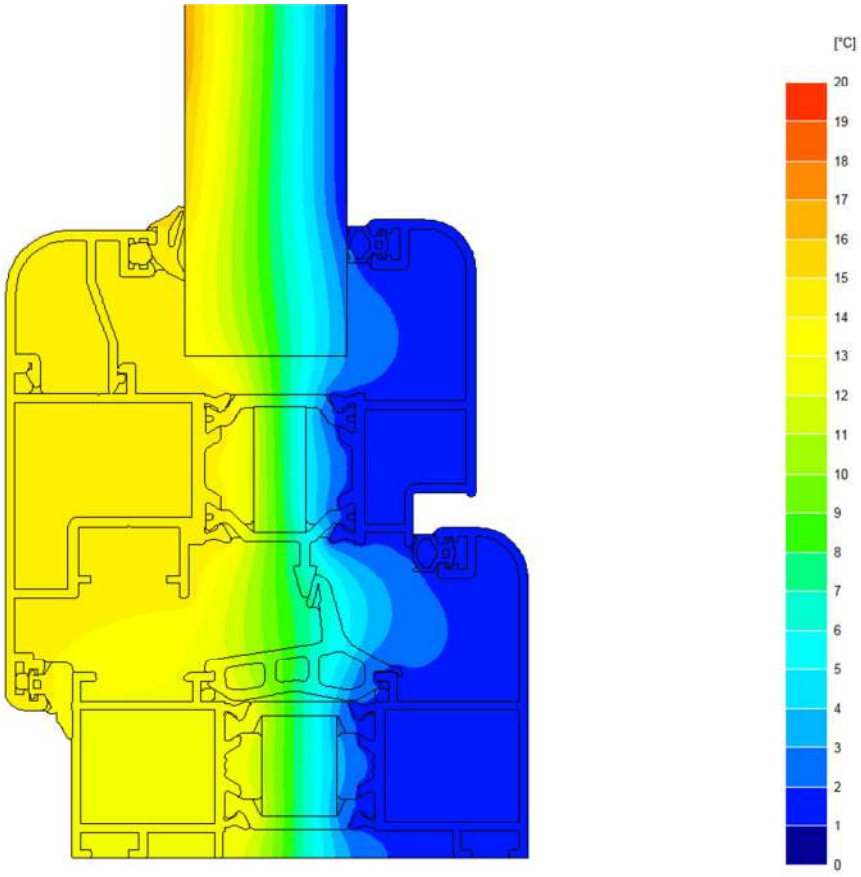


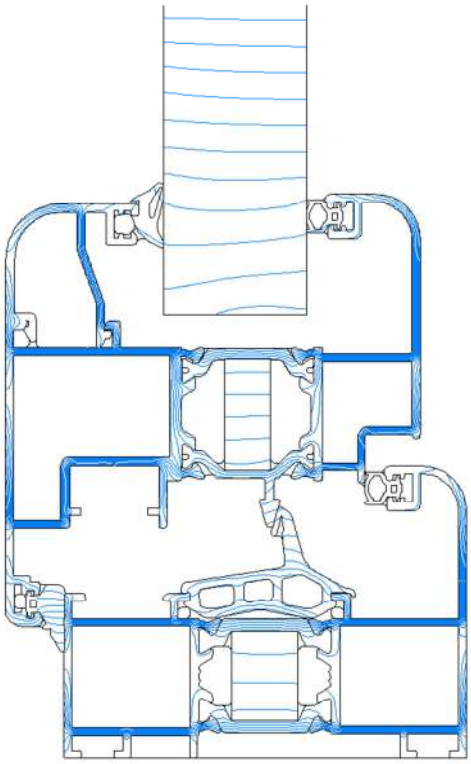
ISOTHERMS AND FLOW LINES
FIXED WINDOW VERTICAL 2 SECTION



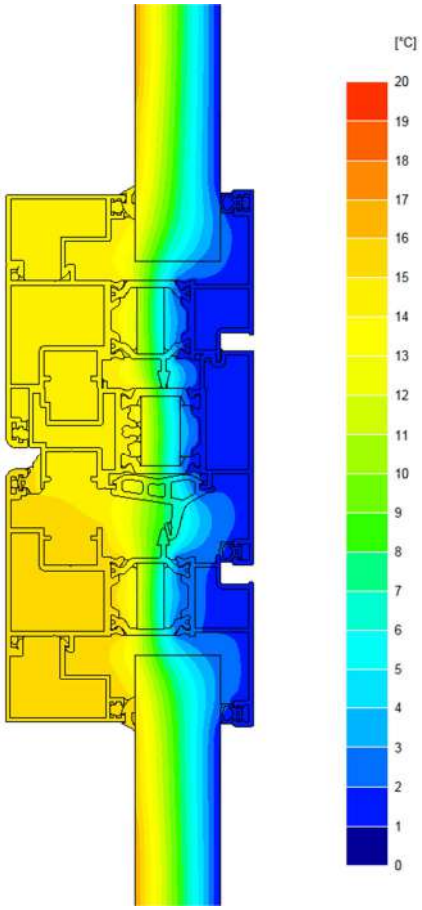


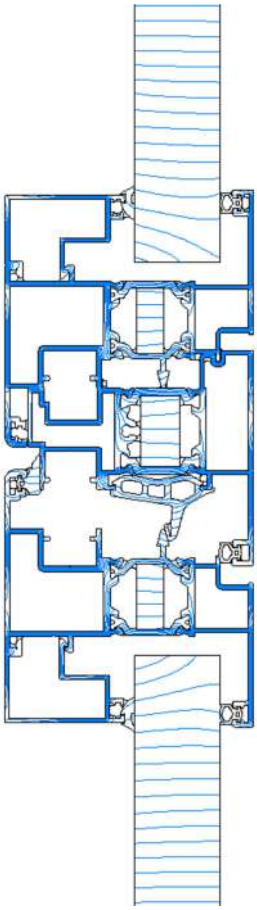
ISOTHERMS AND FLOW LINES
TILT&TURN WINDOW VERTICAL 2 SECTION





ISOTHERMS AND FLOW LINES
DOUBLE-SASH TILT&TURN WINDOW HORIZONTAL 2 SECTION





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