

TEST REPORT No. 391542/14889/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

METALOUMIN S.A.

AG. Fanouriou 20 Str. 13671 - KTIPIITO, ACHARNES - Greece

Item*

**frames constructed from aluminium profiles with thermal break
named "ENERGY 24"**

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

Section	Thermal transmittance** "U _f " [W/(m ² · K)]
24140-24230	2,6
24142-24241	2,6
24230-24620-24230	2,5
24241-24624-24241	2,5
24142-glass pane	2,4
24230-24350-24230	2,6
Glass pane-24350-glass pane	1,9
24151-24232	2,6
24140-24234	2,5
24234-glass pane	3,6
24142-24241 with neopor insulation	2,4
24241-24624-24241 with neopor insulation	2,2

(**) value rounded to the second significant digit.

(*) according to that stated by the customer.

Bellaria-Igea Marina - Italy, 14 February 2022

Chief Executive Officer

Order:
91389

Technical documentation origin:
supplied by the customer

Technical documentation received date:
3 February 2022

Activity date:
from 7 February 2022 to 14 February 2022

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

Contents	Page
Description of item*	2
Manufacturing site*	5
Normative references	6
Method	6
Results	7

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The results relate only to the item examined, as received, and are valid only in the conditions in which the activity was carried out.

The original of this document consists of an electronic document digitally signed pursuant to the applicable Italian Legislation.

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Page 1 of 19

Description of item*

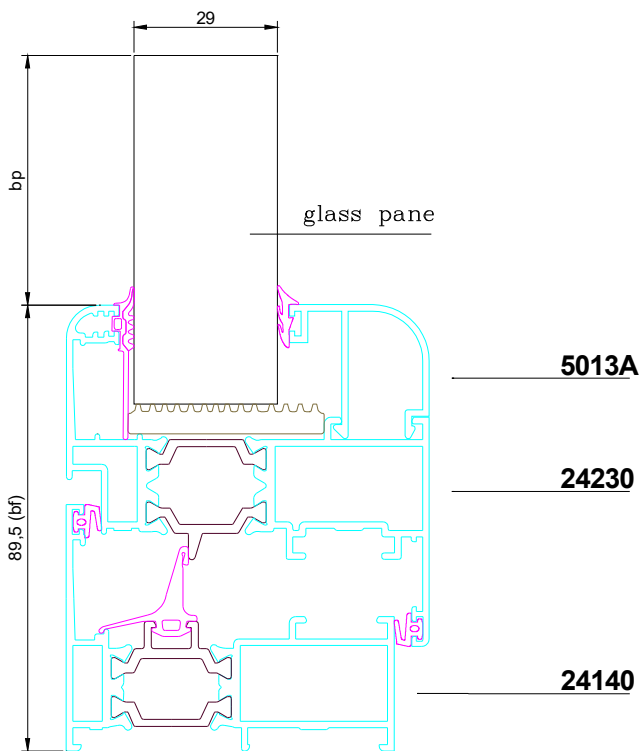
The item under examination consists of frames having aluminium profiles with polyamide strips to provide thermal break.

The cavities between the polyamide have an emissivity equal to 0,6, according to that stated by the customer.

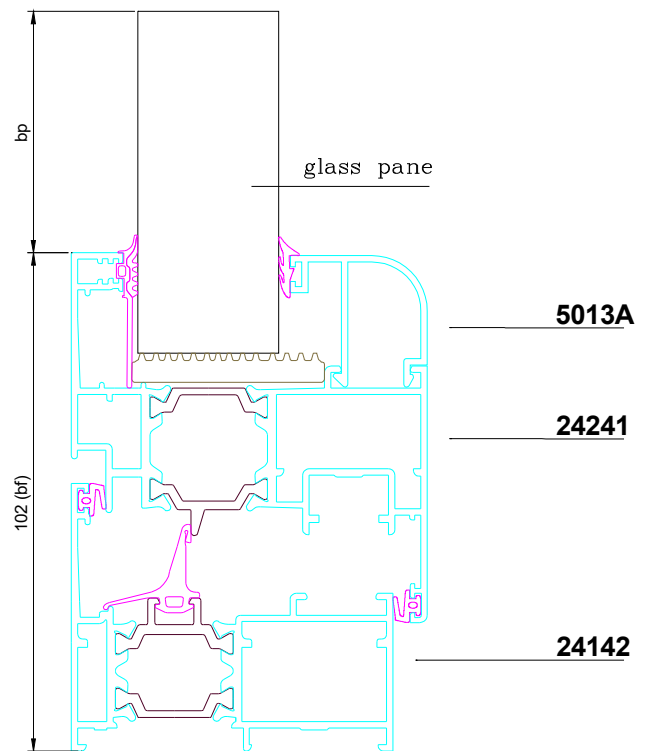
The nominal sash thickness is 72,6 mm and the nominal fixed part thickness is 65,6 mm.

DRAWINGS OF THE SECTIONS CONSIDERED

- Aluminium
- EPDM
- Expanded foam
- Polyamide (25% glassfibre)
- Insulant panel
- EPS neopor
- Brush (polypropylene 25% glassfibre)

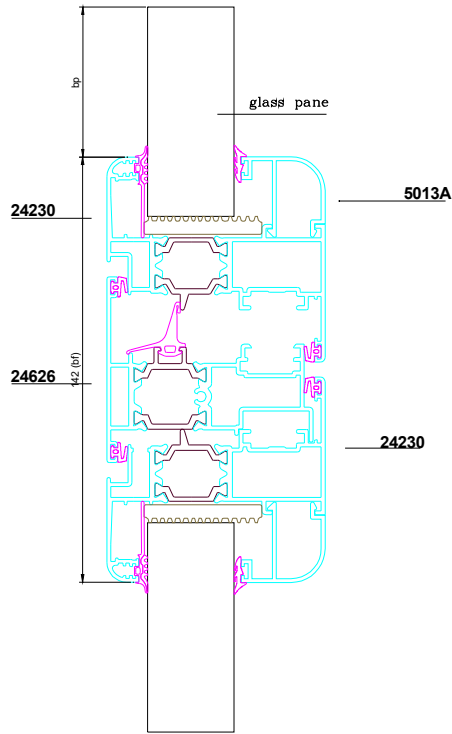


Section 24140-24230

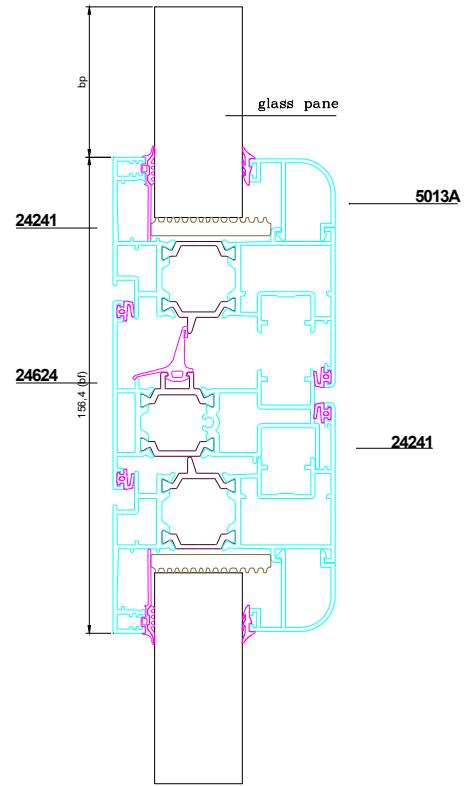


Section 24142-24241

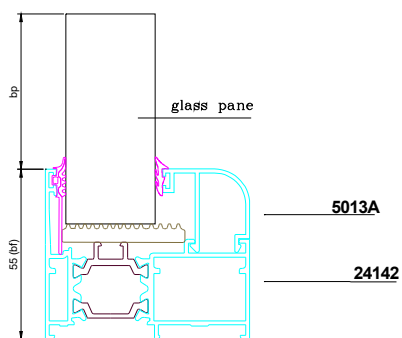
(*) according to that stated by the customer, apart from characteristics specifically stated to be measurements. Istituto Giordano declines all responsibility for the information and data provided by the client that may influence the results.



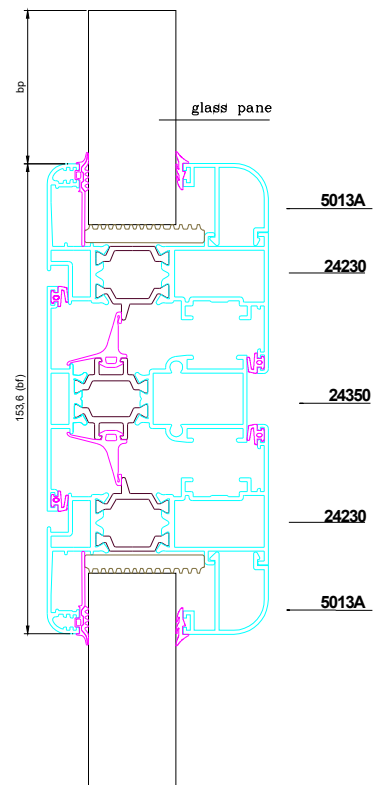
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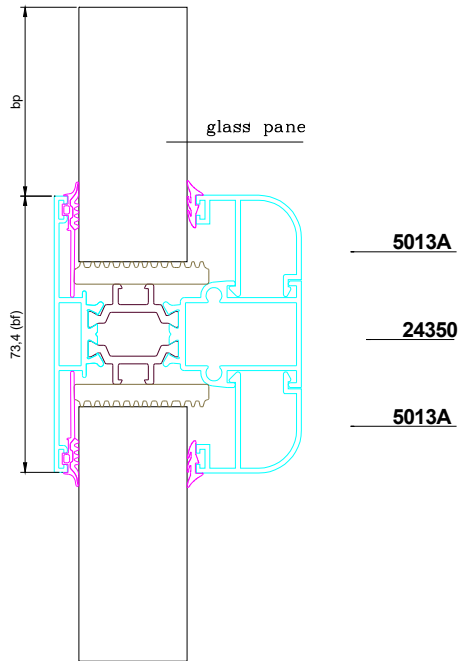
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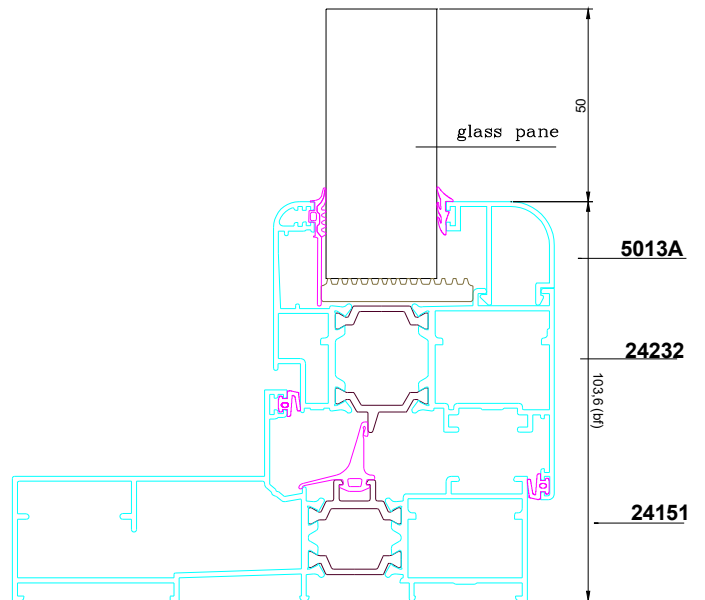
Section 24142-glass pane



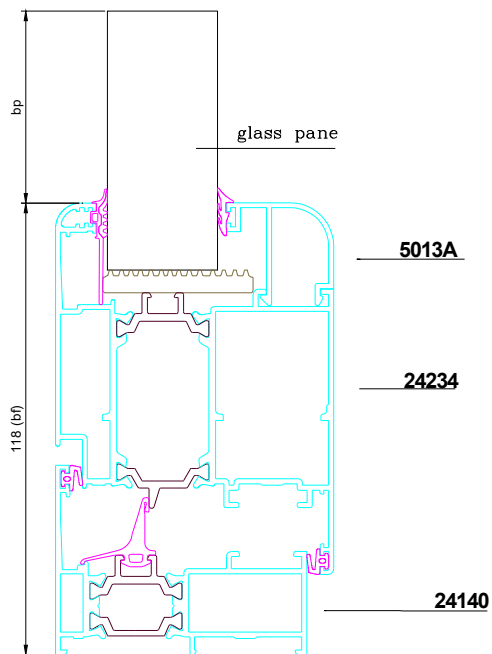
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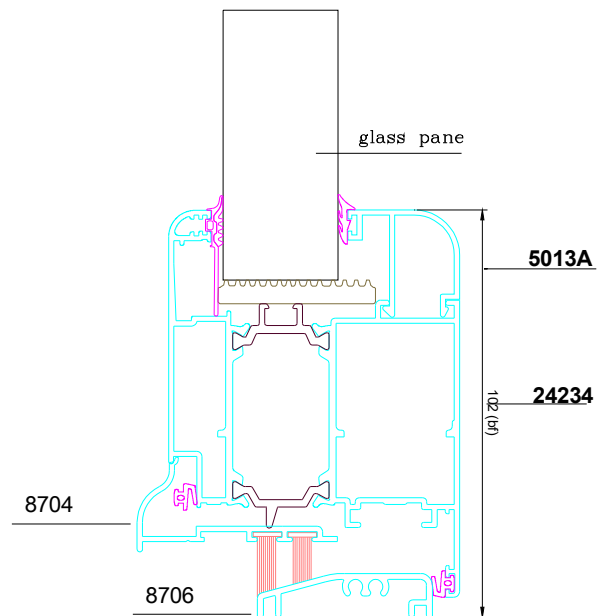
Section Glass pane-24350-glass pane



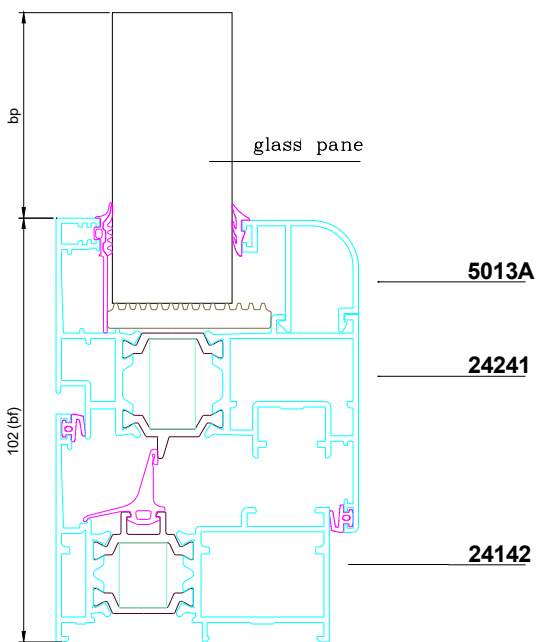
Section 24151-24232



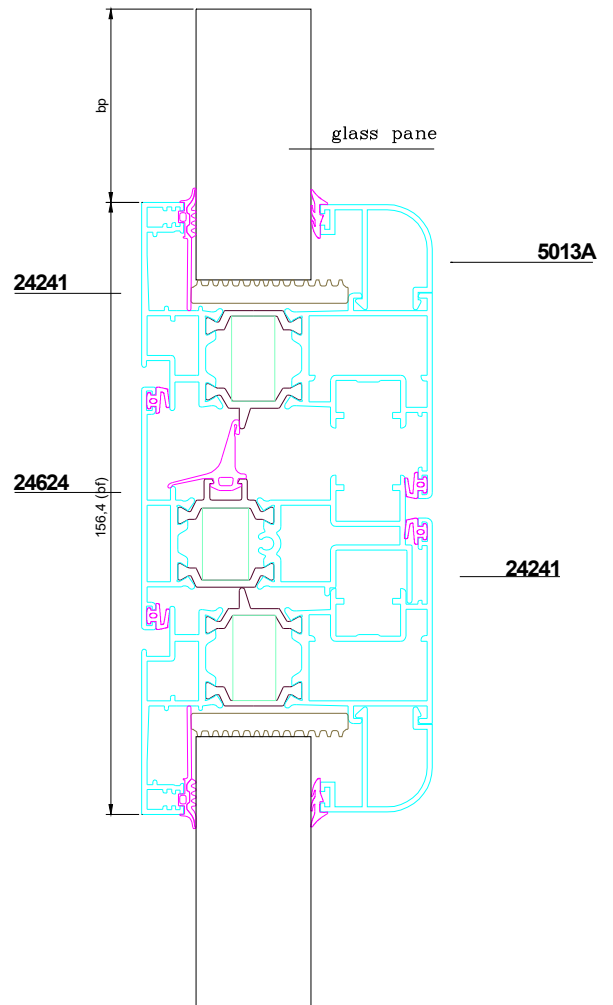
Section 24140-24234



Section 24234-glass pane



**Section 24142-24241
with neopor insulation**



**Section 24241-24624-24241
with neopor insulation**

Manufacturing site*

METALOUMIN S.A. - AG. Fanouriou 20 Str. 13671 - KTIPITO, ACHARNES - Greece.

(*) according to that stated by the customer.



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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)

(**) 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 0,5 mm, from 43901 to 106477 points. Air spaces were calculated by assigning each one an equivalent thermal conductivity calculated in accordance with the equation specified by clause 6.4.3 of standard EN ISO 10077-2 (single equivalent thermal conductivity method), assuming that the emissivity of materials is 0,9 except aluminium between the thermal break bars for which the emissivity was assumed equal to 0,6. 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 F of standard EN ISO 10077-2. The frame thermal transmittance value " U_f ", expressed in $\text{W}/(\text{m}^2 \cdot \text{K})$, 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 $\text{W}/(\text{m} \cdot \text{K})$;

U_p = thermal transmittance of the central area of the panel, expressed in $\text{W}/(\text{m}^2 \cdot \text{K})$;

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

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

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 $\text{m}^2 \cdot \text{K}/\text{W}$	EN ISO 10077-2, table E.1
	Internal surface thermal resistance for surfaces with standard view factor " R_{si} "	0,13 $\text{m}^2 \cdot \text{K}/\text{W}$	
	Internal surface thermal resistance for surfaces with reduced view factor	0,20 $\text{m}^2 \cdot \text{K}/\text{W}$	



LAB N° 0021 L

		Value	Data source
Characteristics of materials used for the calculation of the parameter "U_f"	Emissivity of all the materials except aluminium between the thermal break bars	0,9	EN ISO 10077-2, table D.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)	
	Thermal conductivity of elastomeric foam	0,05 W/(m · K)	
	Thermal conductivity of polypropylene with 25 % glass fibre	0,25 W/(m · K)	
	Declared thermal conductivity of EPS	0,031 W/(m · K)	Manufacturer's data sheet provided by the customer
	Emissivity of the aluminium between the thermal break bars	0,6	Value declared by the customer
	Thickness of the insulating panel inserted instead of glazing "d _p "	32 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:

Section	Width considered "b _f " [mm]	Thermal transmittance "U _f " [W/(m ² · K)]	Thermal transmittance* "U _f " [W/(m ² · K)]
24140-24230	89,5	2,60	2,6
24142-24241	102	2,59	2,6
24230-24620-24230	142	2,55	2,5
24241-24624-24241	156,4	2,51	2,5
24142-glass pane	55	2,39	2,4
24230-24350-24230	153,6	2,60	2,6
Glass pane-24350-glass pane	73,4	1,92	1,9
24151-24232	103,6	2,64	2,6
24140-24234	118	2,52	2,5
24234-glass pane	102	3,65	3,6
24142-24241 with neopor insulation	102	2,36	2,4
24241-24624-24241 with neopor insulation	156,4	2,24	2,2

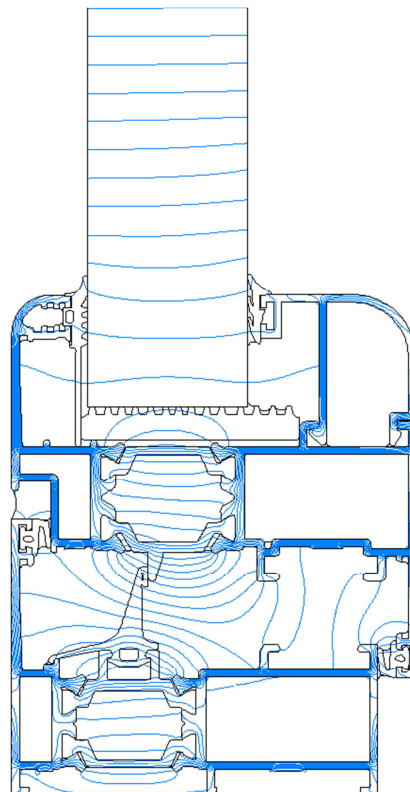
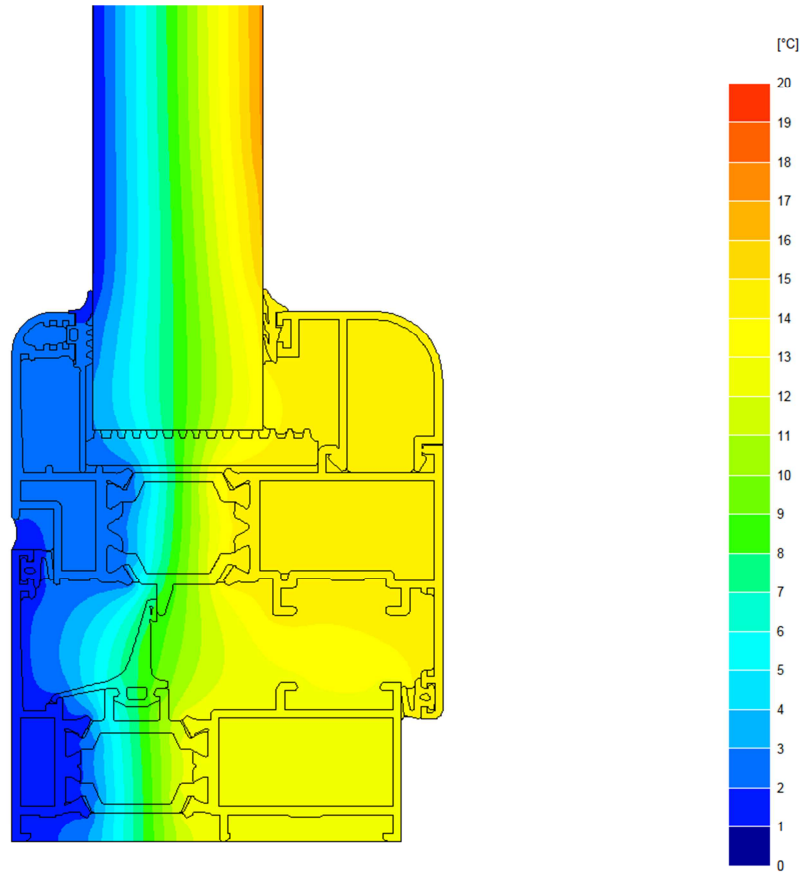
(*) value rounded to the second significant digit.

Note: thermal transmittance values given in the tables above have been calculated for glazing with thickness 32 mm.

**ISOTHERMS AND FLOW LINES
SECTION 24140-24230**



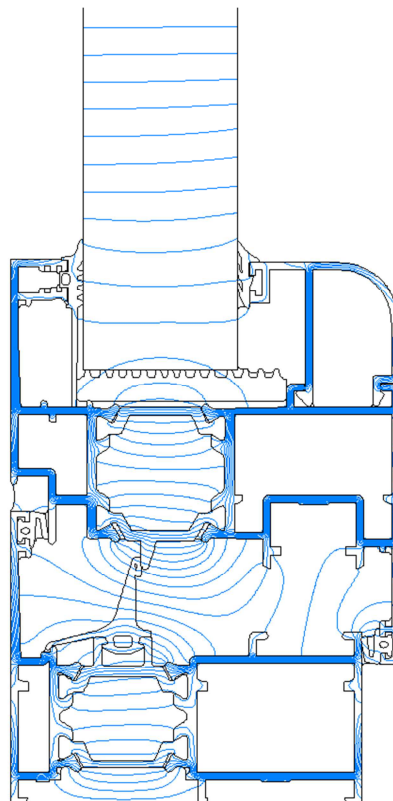
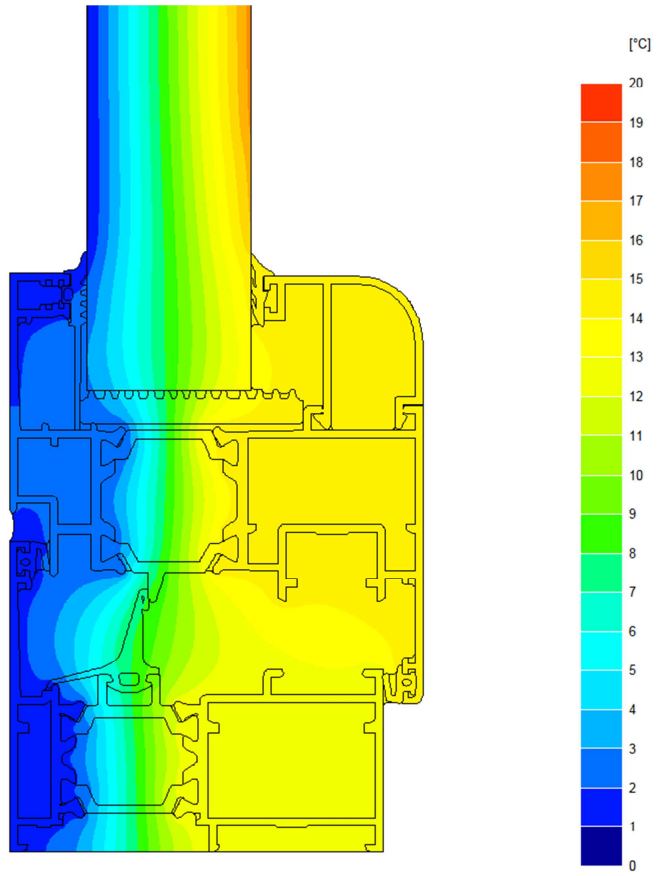
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**ISOTHERMS AND FLOW LINES
SECTION 24142-24241**



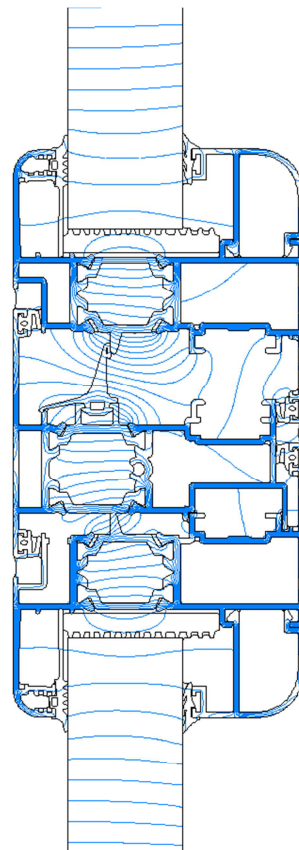
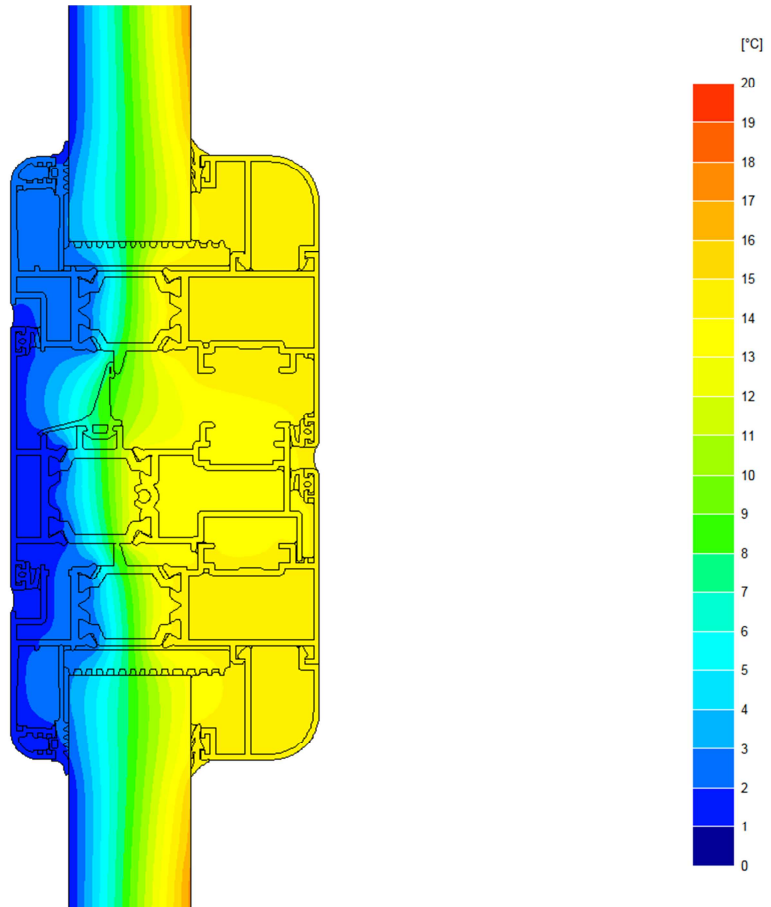
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SECTION 24230-24620-24230**



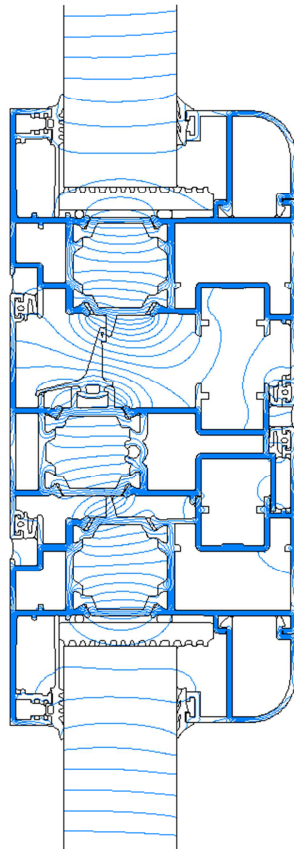
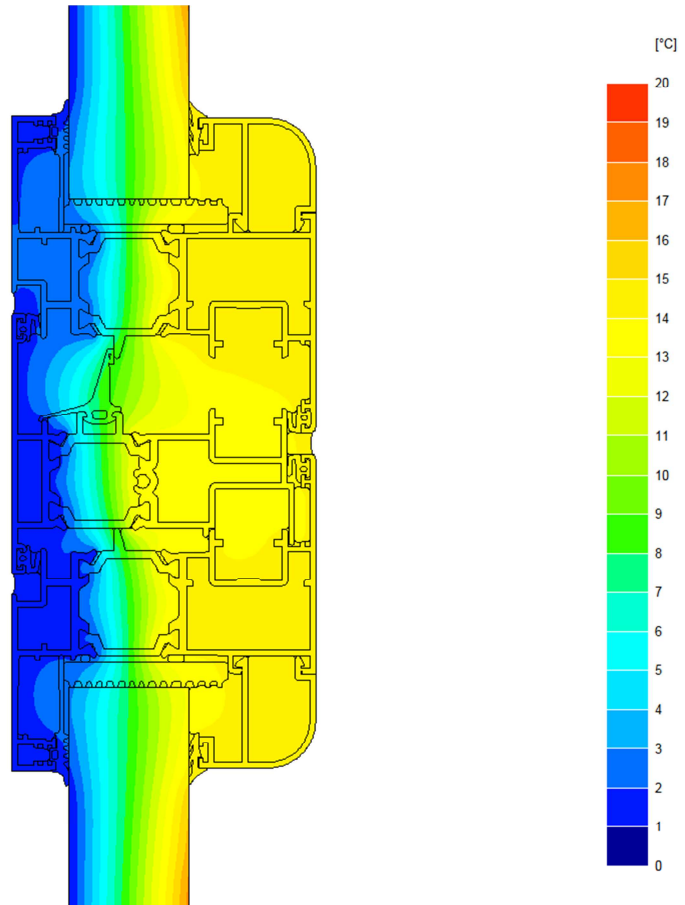
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**ISOTHERMS AND FLOW LINES
SECTION 24241-24624-24241**



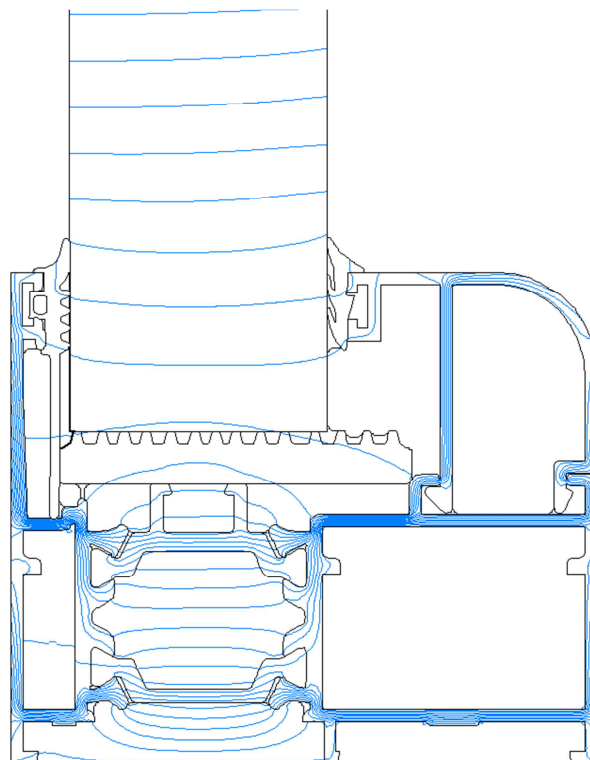
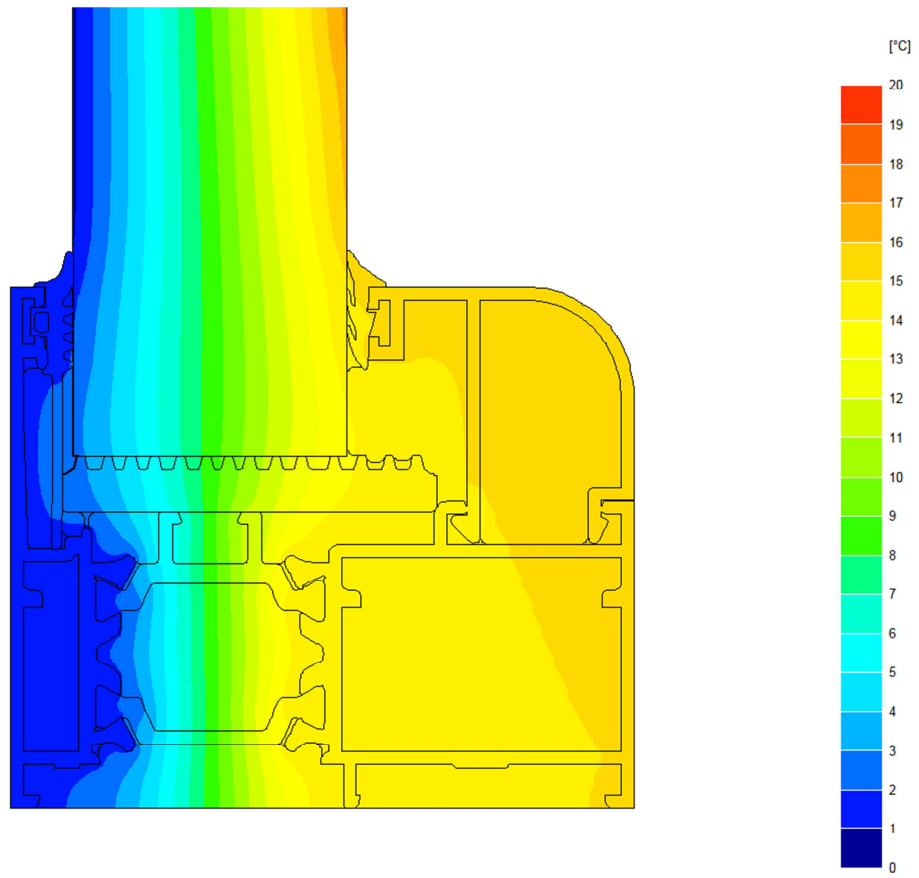
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**ISOTHERMS AND FLOW LINES
SECTION 24142-GLASS PANE**



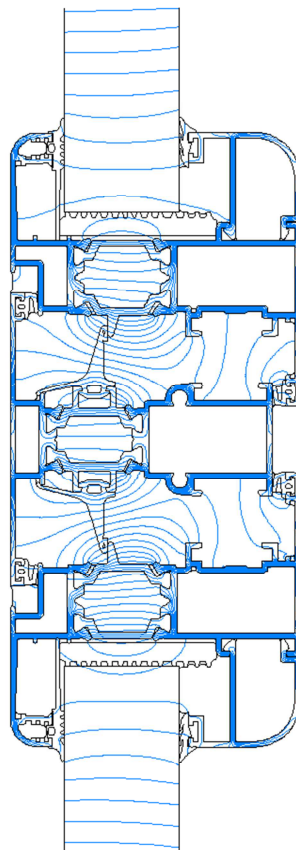
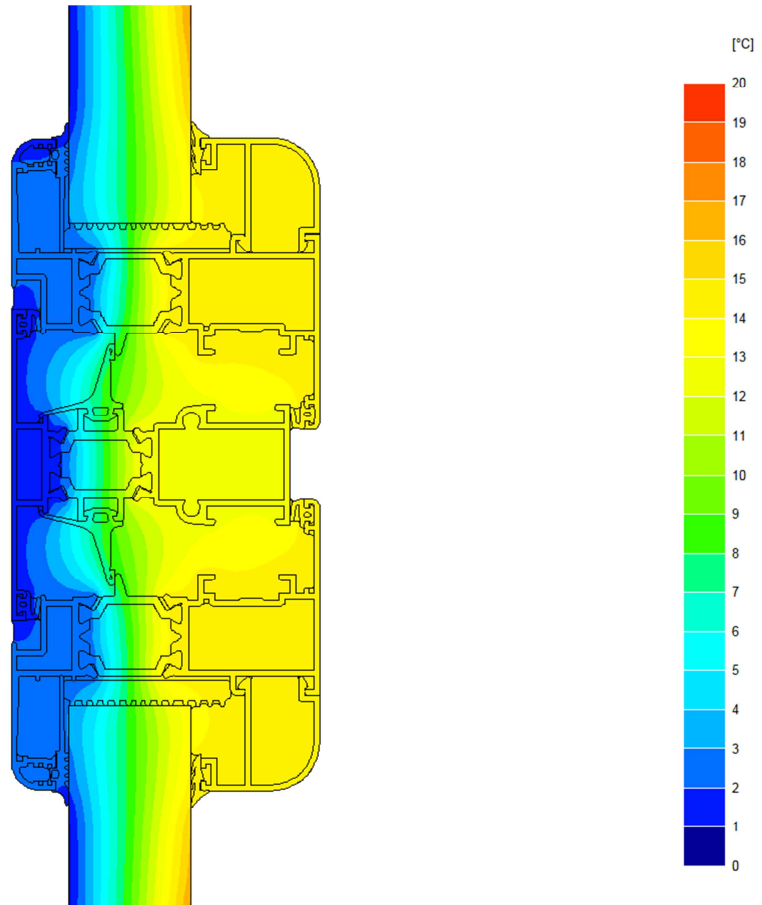
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**ISOTHERMS AND FLOW LINES
SECTION 24230-24350-24230**



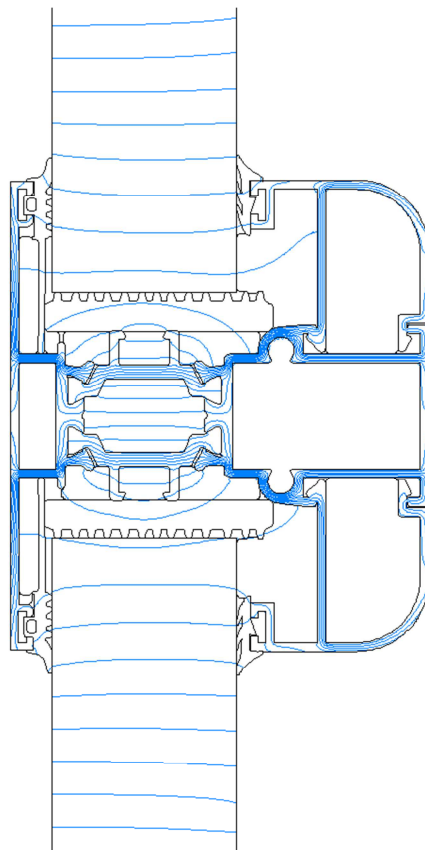
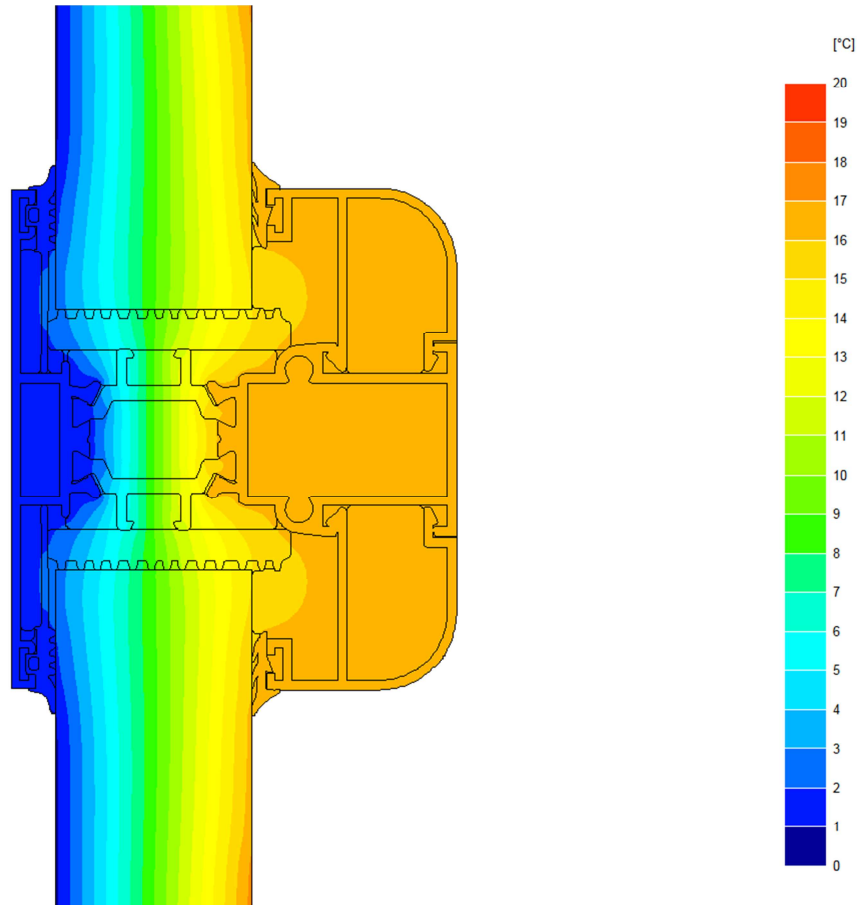
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**ISOTHERMS AND FLOW LINES
SECTION GLASS PANE-24350-GLASS PANE**



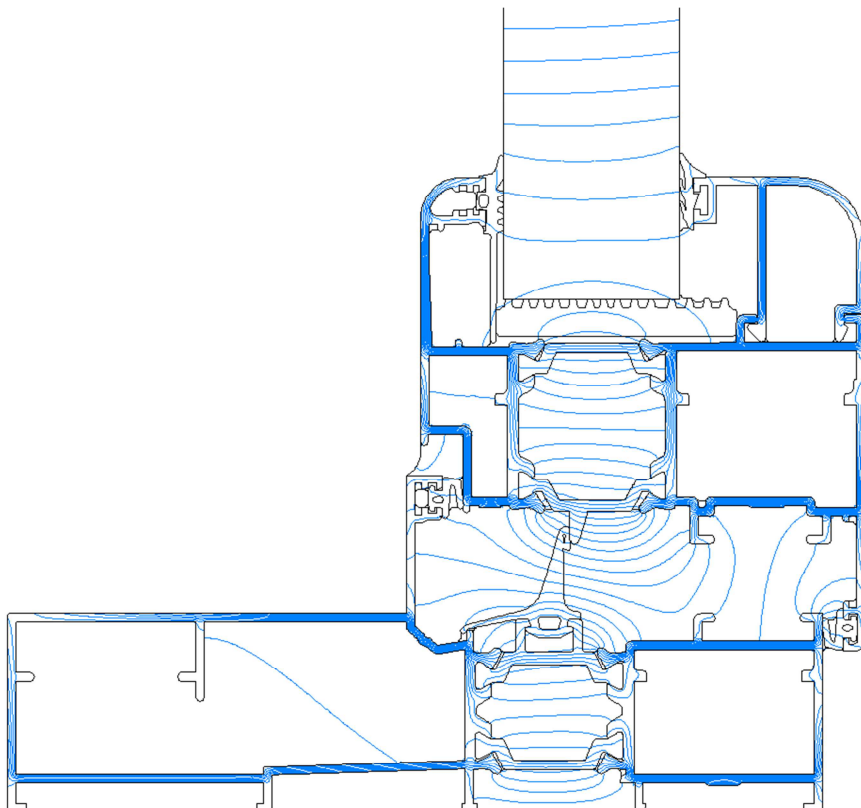
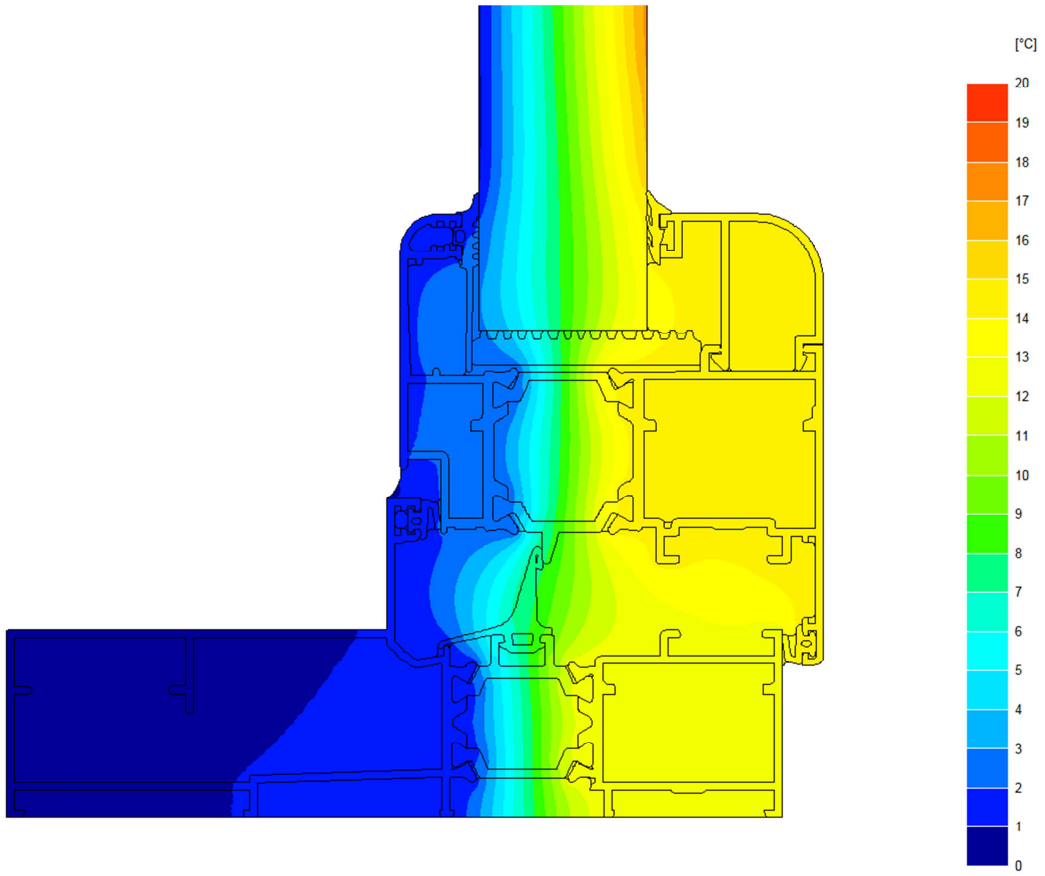
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SECTION 24151-24232**



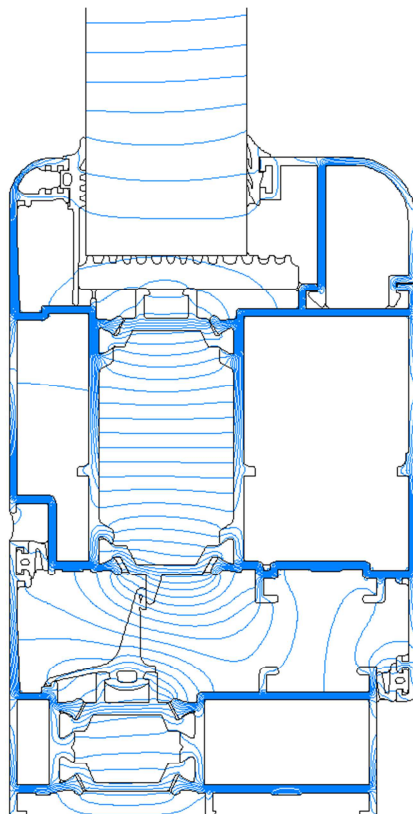
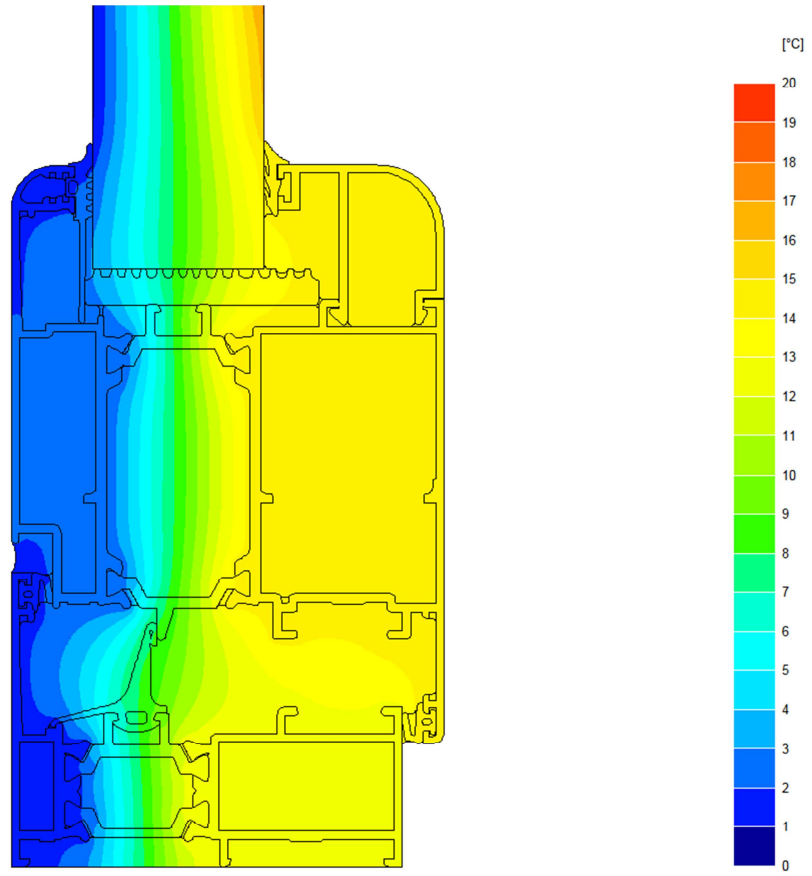
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ISOTHERMS AND FLOW LINES
SECTION 24140-24234



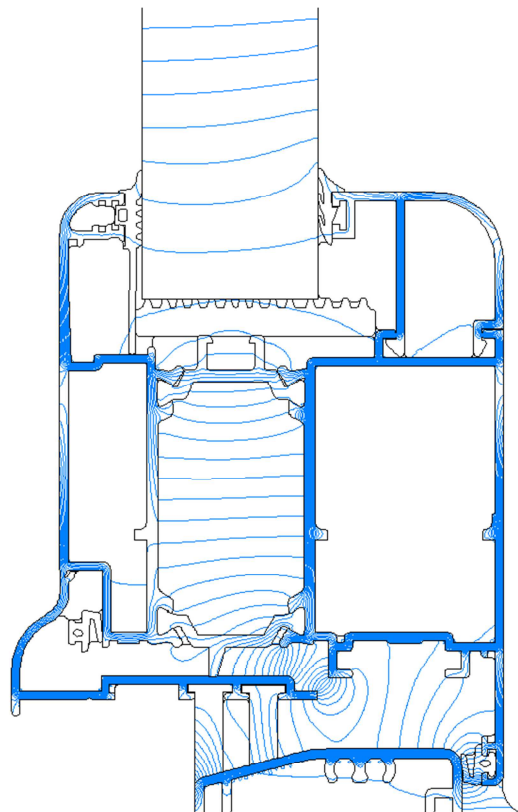
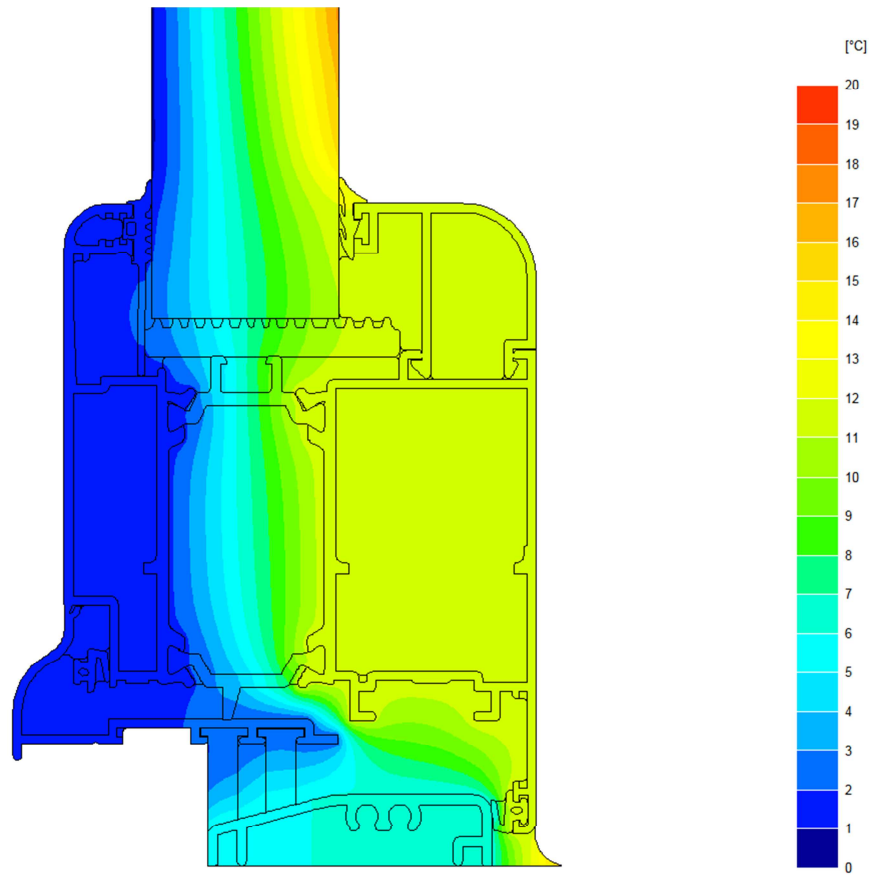
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**ISOTHERMS AND FLOW LINES
SECTION 24234-GLASS PANE**



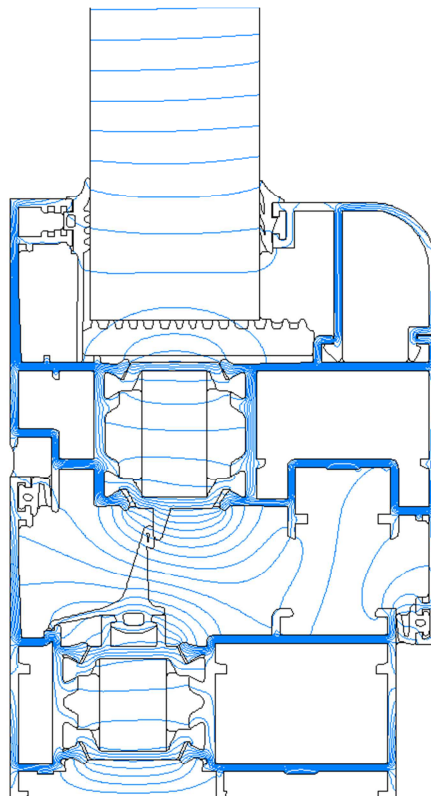
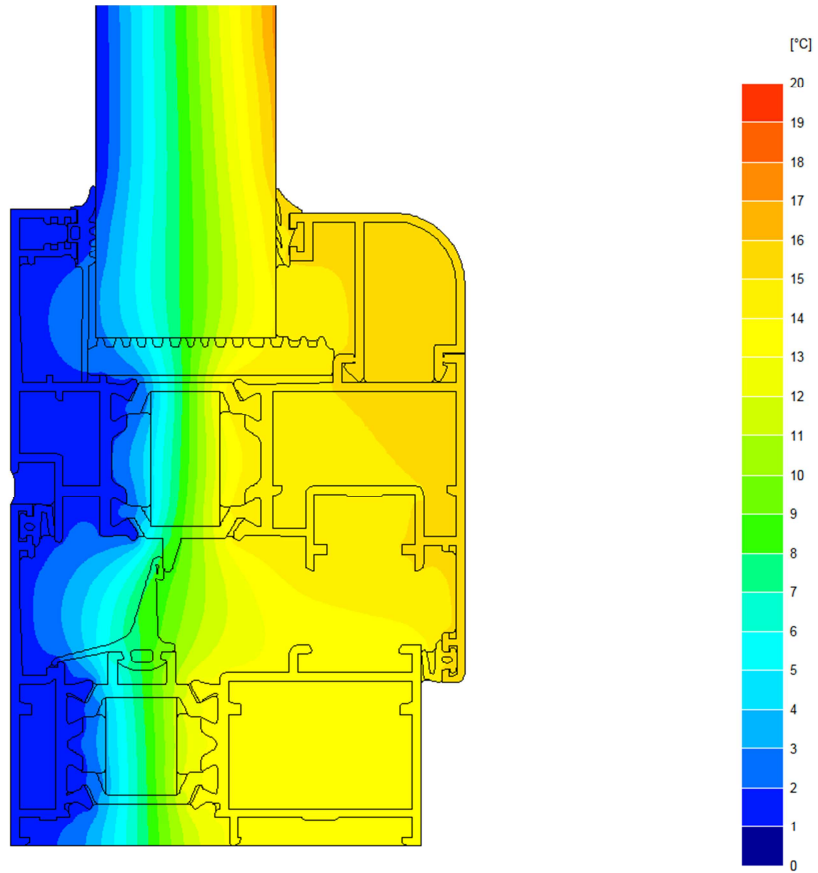
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ISOTHERMS AND FLOW LINES
SECTION 24142-24241 WITH NEOPOR INSULATION

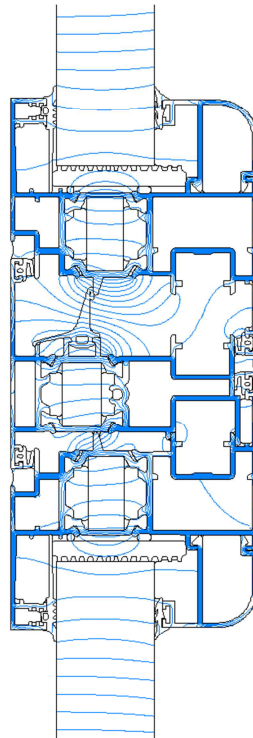
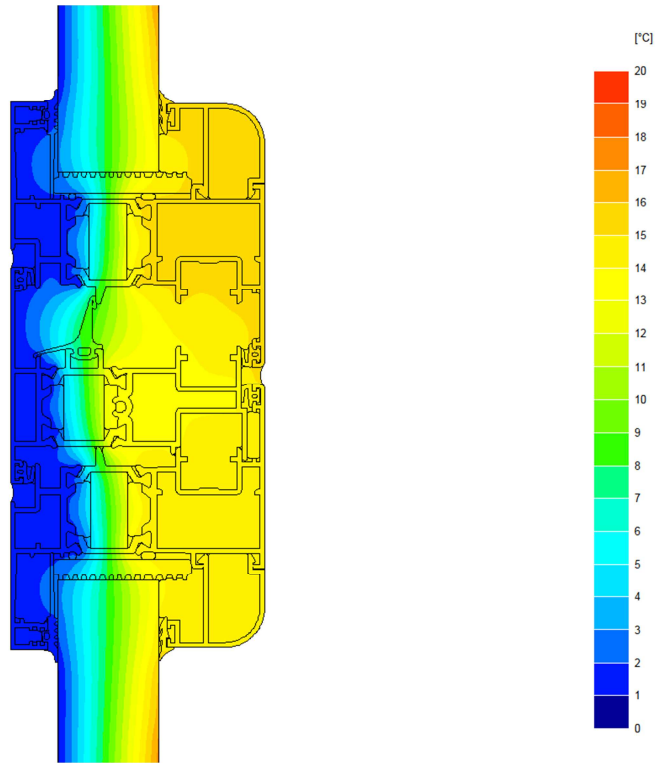
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**ISOTHERMS AND FLOW LINES
SECTION 24241-24624-24241 WITH NEOPOR INSULATION**



LAB N° 0021 L



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