Evidence of Performance
Calculation of thermal transmittance

Test Report
No. 17-002121-PR02
(PB-K20-06-en-01)

Client
ALUMINCO S.A.
Megali Rahi
32011 Inofita Viotias
Greece

Product
Metal profiles with thermal break
Profile combinations: Casement-threshold, casement-frame, casement-casement

Designation: ALUMINCO D75 (NOVEL DOOR)

Performance-relevant product details: Material Aluminium alloys; Surface treatment Powder coated or painted; View width B in mm 85 to 223; Thermal break; Material Polyamide 6.6 with 25% glass fibre"; Surface in thermal break untreated; Height of bars in mm 39; Inlay foam in glazing rebate; Material PE foam "POL PE 22x12"; Thermal conductivity W/(mK) 0.038; Casement; Item numbers 075-201 / 075-203 / 075-205; Width in mm 85 / 109; Thickness in mm 74.5; Additional profile; Item number 075-501; Width in mm 54; Thickness in mm 72; Frame; Item number 075-101; Width in mm 86; Thickness in mm 74.5; Threshold; Item number 075-902; Width in mm 13; Thickness in mm 65; Panel; Thickness in mm 52 / 74.5; Face layer; Material Aluminium alloys; Inlay; Material EPS "NEOCOAT"; Thermal conductivity in W/(mK) 0,030; Replacement panel; Edge cover in mm 18; Thickness in mm 44

Special features: Partially with casement overlapping panel outside or outside and inside

Results

Calculation of thermal transmittance
according to EN ISO 10077-2:2012-02

U_f = 1.5 to 1.7 W/(m²K)
$U_{f,Edge}$ = 1.5 to 2.3 W/(m²K)
U_p = 0.40 to 0.56 W/(m²K)

ift Rosenheim
01.09.2017

Konrad Huber, Dipl.-Ing. (FH)
Head of Testing Department
Building Physics

Till Stübben, Dipl.-Ing. (FH)
Operating Testing Officer
Building Physics

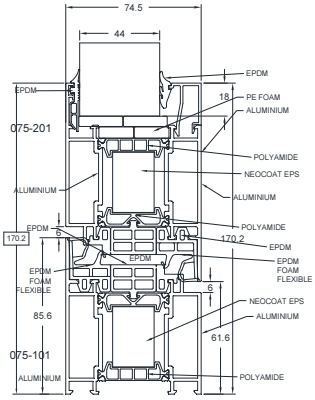
Basis *)

EN ISO 10077-2:2012-02
EN ISO 6946:2007-12
SG 06-verpflichtend
NB-CPD/SG06/11/083 2011-09

*) Correspond/s to the national standard/s (e.g. DIN EN)

Representation

Test specimen PK02



Further drawings see annex.

Instructions for use

The results obtained can be used as evidence in accordance with the above basis.

Validity

The data and results given relate solely to the tested and described specimen. This test does not allow any statement to be made on further characteristics of the present structure regarding performance and quality.

Notes on publication

The ift-Guidance Sheet "Conditions and Guidance for the Use of ift Test Documents" applies. The document may only be published in full.

Contents

The report contains a total of 12 page/s and annexe (6 pages).

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1 Object

1.1 Description of test specimen

Metal profiles with thermal break
Profile combinations: Casement-threshold, casement-frame, casement-casement

Manufacturer	ALUMINCO S.A.
System designation	ALUMINCO D75 (NOVEL DOOR)
Material	Aluminium alloys
Surface treatment	Powder coated or painted
Thermal break	
Insulation bars	
Material	Polyamide 6.6 with 25% glass fibre
Surface in thermal break	untreated
Thickness of bars in mm	0.8 + 0.8 / 0.8 + 1.1
Height in mm	39
Distance of metal shells d in mm	33
Inlay foam in thermal break	
Material	EPS “NEOCOAT”
Thermal conductivity W/(mK)	0,030
Width in mm	33
Thickness in mm	23
Casement	
Inlay foam in glazing rebate	
Quantity	2
Material	PE foam “POL PE 22x12”
Thermal conductivity W/(mK)	0.038
Width in mm	12 (6 + 6)
Thickness in mm	50 (PK01 to PK03) / 27 (PK04 to PK06)
Additional profile	
Item number	075-501
Profile cross section, width in mm	54
Profile cross section thickness in mm	72
Frame	
Item number	075-101
Profile cross section, width in mm	86
Profile cross section thickness in mm	74.5

Threshold	
Material	Aluminium alloys
Item number	075-902
Profile cross section, width in mm	13
Profile cross section thickness in mm	65
Insulation bars	
Number of bars	1
Thickness of bars in mm	1.6
Height in mm	15
Distance of metal shells d in mm	9
Panel	
Face layer	
Material	Aluminium alloys
Inlay	
Material	EPS “NEOCOAT”
Thermal conductivity in W/(mK)	0.030
Type 1	PK04 / PK05 / PK06 / PK10
Thickness in mm	52
Construction in mm	2/48/2
Edge cover in mm	22
Special feature	Casement overlapping panel (outside)
Type 2	PK07 / PK08 / PK09 / PK11
Thickness in mm	74.5
Construction in mm	2/70.5/2
Edge cover in mm	0
Special feature	Casement overlapping panel (outside and inside)
Replacement panel	PK01 / PK02 / PK03
Length in mm	190 / 2 x 190
Edge cover in mm	18
Thickness in mm	44

Test specimen	**PK01**	**PK02**	**PK03**
Profile combination	**Cas.-Threshold**	**Cas.-Frame**	**Cas.-Cas.**
Sealing system	2 x internal 1 x centre	2 x internal 2 x external	2 x internal 2 x external
View width B in mm	115	170	223
Casement			
Quantity	1	1	2
Item number	075-201	075-201	075-201
Profile cross section width in mm	109	109	109
Profile cross section thickness in mm	74.5	74.5	74.5
Additional profile			
Item number	-/-	-/-	075-501
Replacement panel	See above	See above	See above

Test specimen	**PK04**	**PK05**	**PK06**
Profile combination	**Cas.-Threshold**	**Cas.-Frame**	**Cas.-Cas.**
Sealing system	2 x internal 1 x centre	2 x internal 2 x external	2 x internal 2 x external
View width B in mm	115	170	223
Casement			
Quantity	1	1	2
Item number	075-203	075-203	075-203
Profile cross section width in mm	109	109	109
Profile cross section thickness in mm	74.5	74.5	74.5
Additional profile			
Item number	-/-	-/-	See above
Panel	Type 1	Type 1	Type 1

Test specimen	**PK07**	**PK08**	**PK09**
Profile combination	**Cas.-Threshold**	**Cas.-Frame**	**Cas.-Cas.**
Sealing system	2 x internal 1 x centre	2 x internal 2 x external	2 x internal 2 x external
View width B in mm	85	140	163
Casement			
Quantity	1	1	2
Item number	075-205	075-205	075-205
Profile cross section width in mm	79	79	79
Profile cross section thickness in mm	74.5	74.5	74.5
Additional profile			
Item number	-/-	-/-	See above
Panel	Type 2	Type 2	Type 2

The description is based on specifications provided by the client and on inspection of the test specimen at the **ift.** (Item designations/ numbers as well as material specifications were provided by the client, unless designated as „***ift**-tested*“.)

Test specimen are described in the annex "Product/Sample description".

1.2 Sampling

The following data for sampling have been presented to **ift**:

Sampler: ALUMINCO S.A., 32011 Inofita Viotias (Greece)

Date: 30.08.2017

Documentation: ift Rosenheim did not receive a sampling report.

ift-test specimen-No.: 17-002121-PK02

2 Procedure

2.1 Basic documents *) of the processes

EN ISO 10077-2:2012-02
Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2 - Numerical method for frames

EN ISO 6946:2007-12
Building components and building elements - Thermal resistance and thermal transmittance - Calculation method

SG 06-verpflichtend NB-CPD/SG06/11/083 2011-09
EN 14351-1:2006 Treatment of unventilated rectangular cavities when calculating thermal properties to EN ISO 10077-2

*) correspond/s to the national standard/s, e.g. DIN EN

2.2 Short description of process

Calculation of thermal transmittance U_f / $U_{f,Edge}$
The profile section is subdivided into a sufficient number of elements; with subdivision into smaller elements not having any effect on the total heat flow. The relevant materials / boundary conditions are determined and the total heat flow calculated. The heat flow is used to determine the thermal transmittance.

Calculation of the thermal transmittance U_p
The thermal transmittance of a panel with several homogeneous layers, lying in a row, is calculated from the inverse of the sum of the thermal resistance of the individual layers and the internal and external surface resistance.

3 Detailed results

Calculation of thermal transmittance

Project No.	17-002121-PR02	**Task No.**	17-002121
Basis of testing	EN ISO 10077-2:2012-02 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2 - Numerical method for frames SG 06-verpflichtend NB-CPD/SG06/11/083 2011-09 EN 14351-1:2006 Treatment of unventilated rectangular cavities when calculating thermal properties to EN ISO 10077-2		
Test equipment used	Sim/020990 - flixo 7.0.612		
Test specimen	Metal profiles with thermal break		
Number of test specimen	17-002121-PK02		
Date of test	25.07.2017		
Testing personnel in charge	Till Stübben		
Test personnel	Till Stübben		

Information on test setup / test method

Test method	There are no deviations of the testing method according to the standards.

Boundary Conditions

Boundary conditions			Values	Source[1)]
θ_i	Air temperature inside	°C	20	-/-
θ_e	Air temperature outside	°C	0	-/-
ΔT	Temperature difference	K	20	-/-
R_{si}	Internal heat transfer resistance	(m²·K)/W	0,13	-/-
R_{si}	Internal heat transfer resistance (increased)	(m²·K)/W	0,20	-/-
R_{se}	External heat transfer resistance	(m²·K)/W	0,04	-/-

Material properties

Material properties			Values	Source[1)]
ε_n	Emissivity		0,9	-/-
ε_n	Emissivity in thermal break		0,1	-/-
λ	Thermal conductivity aluminium (Si - alloy)	W/(m·K)	160	-/-
λ	Thermal conductivity EPDM (ethylene propylene diene monomer)	W/(m·K)	0,25	-/-
λ	Thermal conductivity elastomer foam	W/(m·K)	0,05	-/-
λ	Thermal conductivity polyamide 6.6 with 25 % glass fibre	W/(m·K)	0,30	-/-
λ	Thermal conductivity EPS "NEOCOAT" [2)]	W/(m·K)	0,030	Client
λ	Thermal conductivity PE foam "POL PE 22x12" [3)]	W/(m·K)	0,038	Client
λ	Thermal conductivity replacement panel EN ISO 10077-2	W/(m·K)	0,035	-/-

1) Unless stated otherwise, data originate form standards EN ISO 10456 and EN ISO 10077-2.
The emissivity of low emitting layers must be taken to ensure through a factory production control.

2) Confirmation of thermal conductivity by attestation of conformity (deposited at ift) - according standards without addition

3) Confirmation of thermal conductivity by statement (deposited at ift) - according standards without addition

Determination of thermal transmittance U_f

Thermal transmittance of a frame profile is calculated as described below:

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

	Definitions	Units
U_f	thermal transmittance of frame profile	W/(m²K)
b_f	projected width of frame profile	m
b_p	visible width of replacement panel	m
d_p	thickness of replacement panel	m
U_p	thermal transmittance replacement panel	W/(m²K)
Q_{ges}	linear heat flow rate	W/m
L_f^{2D}	two-dimensional thermal conductance	W/(mK)

Sp-No.	Description	U_f	Q_{ges}	L_f^{2D}	b_{ges}	b_f	b_{pl}	d_{pl}	U_{pl}
Sp. 01	Casement-Threshold	1,73	6,637	0,332	0,305	0,115	0,190	0,044	0,701
Sp. 02	Casment-Frame	1,46	7,629	0,381	0,360	0,170	0,190	0,044	0,701
Sp. 03	Casement-Casement	1,47	11,891	0,595	0,603	0,223	0,380	0,044	0,701

Test Result

Calculated thermal transmittance:

Sp-No.		
Sp-No.01	U_f =	**1,7 W/m² K**
Sp-No.02	U_f =	**1,5 W/m² K**
Sp-No.03	U_f =	**1,5 W/m² K**

Calculation of thermal transmittance

Project No.	17-002121-PR02	**Task No.**	17-002121
Basis of testing	EN ISO 10077-2:2012-02 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2 - Numerical method for frames SG 06-verpflichtend NB-CPD/SG06/11/083 2011-09 EN 14351-1:2006 Treatment of unventilated rectangular cavities when calculating thermal properties to EN ISO 10077-2		
Test equipment used	Sim/020990 - flixo 7.0.612		
Test specimen	Metal profiles with thermal break		
Number of test specimen	17-002121-PK02		
Date of test	25.07.2017		
Testing personnel in charge	Till Stübben		
Test personnel	Till Stübben		

Information on test setup / test method

Test method

There are following deviations of the testing method according to the standards:
The thermal transmittance Uf_{Edge} is related to EN ISO 12631 considered to be thermal loss through the frame profile U_f together with the thermal loss caused by the thermal interaction between the frame and the connected glas or panel (Ψ-value). Please regard the remark below.

Boundary Conditions

Boundary conditions			Values	Source[1)]
θ_i	Air temperature inside	°C	20	-/-
θ_e	Air temperature outside	°C	0	-/-
ΔT	Temperature difference	K	20	-/-
R_{si}	Internal heat transfer resistance	(m²·K)/W	0,13	-/-
R_{si}	Internal heat transfer resistance (increased)	(m²·K)/W	0,20	-/-
R_{se}	External heat transfer resistance	(m²·K)/W	0,04	-/-

Material properties

Material properties			Values	Source[1)]
ε_n	Emissivities		0,9	-/-
ε_n	Emissivity in thermal break		0,1	-/-
λ	Thermal conductivity aluminium (Si - alloy)	W/(m·K)	160	-/-
λ	Thermal conductivity butyl rubber	W/(m·K)	0,24	-/-
λ	Thermal conductivity EPDM (ethylene propylene diene monomer)	W/(m·K)	0,25	-/-
λ	Thermal conductivity elastomer foam	W/(m·K)	0,05	-/-
λ	Thermal conductivity polyamide 6.6 with 25 % glass fibre	W/(m·K)	0,30	-/-
λ	Thermal conductivity EPS "NEOCOAT" [2)]	W/(m·K)	0,030	Client
λ	Thermal conductivity replacement panel EN ISO 10077-2	W/(m·K)	0,035	-/-

[1)] Unless stated otherwise, data originate form standards EN ISO 10456 and EN ISO 10077-2.

[2)] Confirmation of thermal conductivity by attestation of conformity (deposited at ift) - according standards without addition

Determination of thermal transmittance $U_{f,\,Edge}$

Thermal transmittance of a frame profile is calculated as described below:

$$U_{f,Edge} = \frac{L_f^{2D} - U_{p/g} \cdot b_{p/g}}{b_f}$$

	Definitions	Units
U_f	thermal transmittance of frame profile	W/(m²K)
b_{ges}	total width	m
b_f	projected width of frame profile	m
$b_{p/g}$	visible width of filling	m
$d_{p/g}$	thickness of filling (panel or glas)	m
$U_{p/g}$	thermal transmittance filling (panel or glas)	W/(m²K)
Q_{ges}	linear heat flow rate	W/m
L_f^{2D}	two-dimensional thermal conductance	W/(mK)

Sp-No.	Description	$U_{f,\,Edge}$	Q_{ges}	L_f^{2D}	b_{ges}	b_f	$b_{p1/g1}$	$d_{p1/g1}$	$U_{p1/g1}$
Sp-No.04	Casement-Treshold	1,81	9,790	0,490	0,615	0,115	0,500	0,052	0,565
Sp-No.05	Casment-Frame	1,49	10,737	0,537	0,670	0,170	0,500	0,052	0,565
Sp-No.06	Casment-Casement	1,54	18,157	0,908	1,223	0,223	1,000	0,052	0,565
Sp-No.07	Casement-Treshold	2,27	7,808	0,390	0,585	0,085	0,500	0,075	0,397
Sp-No.08	Casment-Frame	1,70	8,746	0,437	0,640	0,140	0,500	0,075	0,397
Sp-No.09	Casement-Casement	1,94	14,271	0,714	1,163	0,163	1,000	0,075	0,397

Test Result

Calculated thermal transmittance:

Sp-No.04	$U_{f,Edge}$ =	**1,8 W/m² K**
Sp-No.05	$U_{f,Edge}$ =	**1,5 W/m² K**
Sp-No.06	$U_{f,Edge}$ =	**1,5 W/m² K**
Sp-No.07	$U_{f,Edge}$ =	**2,3 W/m² K**
Sp-No.08	$U_{f,Edge}$ =	**1,7 W/m² K**
Sp-No.09	$U_{f,Edge}$ =	**1,9 W/m² K**

Remark for the application of the $U_{f,Edge}$-value:

The thermal transmittance $U_{f,Edge}$ can be calculated when special features of the frame profile causes that the thermal transmittance of the frame U_f can not be calculated or leads to no adequate result. Related to the EN ISO 12631 the $U_{f,Edge}$ contains the thermal transmittance U_f of the frame and all linear thermal transmittance Ψ of the joints between the frame and the glazing or panel. The thermal transmittance $Uf,Edge$ can only be used in combination with the panel or glazing unit that is considered in the calculation.

A calculation for the application of the Uf_{Edge}-value is for example:

$$U_D = \frac{\sum A_f \cdot U_{f,Edge} + \sum A_p \cdot U_p}{A_{ges}}$$

Test Report No. 17-002121-PR02 (PB-K20-06-en-01) dated 01.09.2017
Client: ALUMINCO S.A., 32011 Inofita Viotias (Greece)

Calculation of the thermal transmittance

Project No.	17-002121-PR02	**Process No.**	17-002121
Basis	EN ISO 6946:2007-12 Building components and building elements - Thermal resistance and thermal transmittance - Calaculation method		
Test equipment used	Sim/020841 - ift calculation program		
Test specimen	Door panel		
Test specimen No.	17-002121-PK02		
Date of test	26.07.2017		
Testing personnel in charge	Till Stübben		
Testing personnel	Till Stübben		

Information on test setup / test specimen

Test method/s

There have been the following deviations from the test method/s set out by the standards.
In the calculation of the thermal transmittance coefficient instead of the normative required value for "NEOCOAT EPS" the measured value was used. This fits with the EN ISO 10456 because the boundary conditions to determine the mesured value are conform with practical usage.

Determination of thermal transmittance of a panel U_p

The heat transfer coefficient is derived from the general formula:

$$U_p = \frac{1}{R_T} = \frac{1}{R_{si} + \frac{d_1}{\lambda_1} + \frac{d_2}{\lambda_2} + \ldots + R_{se}}$$

	Definition	Einheit
U_p	thermal transmittance coefficient	W/(m²K)
R_{si}	internal heat transfer resistance	(m²K)/W
d	layer thickness	m
λ	specific thermal conductivity of the layer	W/(mK)
R_{se}	external heat transfer resistance	(m²K)/W

Layer	d_i	λ_i	R_i	Material	Source
internal			0,13	Thermal heat flow direction - horizontal	
1	0,002	160		Aluminium (Si-Aloying)	-/-
2	0,048	0,030		EPS "NEOCOAT"	client [2)]
3	0,002	160		Aluminium (Si-Aloying)	-/-
external			0,04	Thermal heat flow direction - horizontal	

Unless stated otherwise, data originate form standards EN ISO 10456 and EN ISO 10077-2.
[1)] The emissivity of low emitting layers must be taken to ensure through a factory production control.
[2)] Confirmation of thermal conductivity by attestation of conformity (deposited at ift) - according standards without addition

Total thickness: d = 0,052 m
Heat transfer resistance: R_T = 1,770 (m² K)/W

Test result

Calculated thermal transmittance: Sp-No. Sp-No.10 U_p= **0,56 W/(m² K)**

Remark:
According to EN ISO 6946 the Up-value has to be declared with 2 decimales.

Test Report No. 17-002121-PR02 (PB-K20-06-en-01) dated 01.09.2017
Client: ALUMINCO S.A., 32011 Inofita Viotias (Greece)

Calculation of the thermal transmittance

Project No.	17-002121-PR02	**Process No.**	17-002121
Basis	EN ISO 6946:2007-12 Building components and building elements - Thermal resistance and thermal transmittance - Calaculation method		
Test equipment used	Sim/020841 - ift calculation program		
Test specimen	Door panel		
Test specimen No.	17-002121-PK02		
Date of test	26.07.2017		
Testing personnel in charge	Till Stübben		
Testing personnel	Till Stübben		

Information on test setup / test specimen

Test method/s

There have been the following deviations from the test method/s set out by the standards.
In the calculation of the thermal transmittance coefficient instead of the normative required value for "NEOCOAT EPS" the measured value was used. This fits with the EN ISO 10456 because the boundary conditions to determine the mesured value are conform with practical usage.

Determination of thermal transmittance of a panel U_p

The heat transfer coefficient is derived from the general formula:

$$U_p = \frac{1}{R_T} = \frac{1}{R_{si} + \frac{d_1}{\lambda_1} + \frac{d_2}{\lambda_2} + \ldots + R_{se}}$$

	Definition	Einheit
U_p	thermal transmittance coefficient	W/(m²K)
R_{si}	internal heat transfer resistance	(m²K)/W
d	layer thickness	m
λ	specific thermal conductivity of the layer	W/(mK)
R_{se}	external heat transfer resistance	(m²K)/W

Layer	d_i	λ_i	R_i	Material	Source
internal			0,13	Thermal heat flow direction - horizontal	
1	0,002	160		Aluminium (Si-Aloying)	-/-
2	0,071	0,030		EPS "NEOCOAT"	client [2)]
3	0,002	160		Aluminium (Si-Aloying)	-/-
external			0,04	Thermal heat flow direction - horizontal	

Unless stated otherwise, data originate form standards EN ISO 10456 and EN ISO 10077-2.
[1)] The emissivity of low emitting layers must be taken to ensure through a factory production control.
[2)] Confirmation of thermal conductivity by attestation of conformity (deposited at ift) - according standards without addition

Total thickness: d = 0,075 m
Heat transfer resistance: R_T = 2,520 (m² K)/W

Test result

Calculated thermal transmittance: Sp-No. Sp-No.11 U_p= **0,40 W/(m² K)**

Remark:
According to EN ISO 6946 the Up-value has to be declared with 2 decimales.

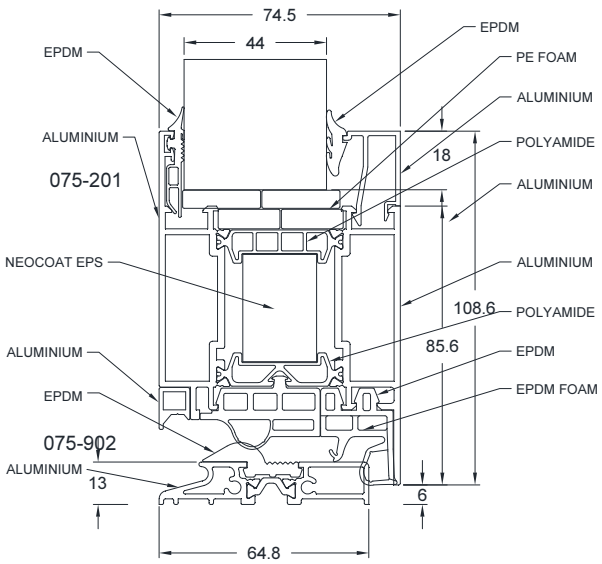

Fig. 1: Cross section test specimen PK01

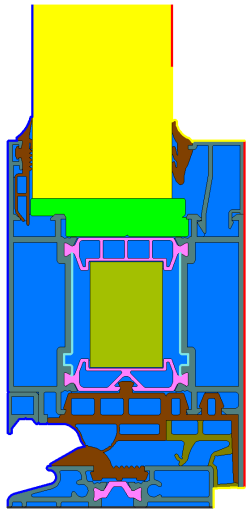

Fig. 2: Simulation model test specimen PK01
U_f calculation

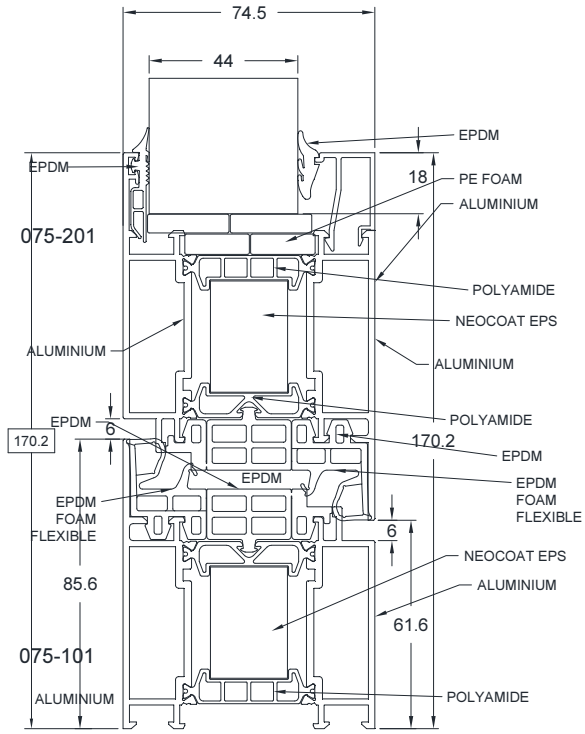

Fig. 3: Cross section test specimen PK02

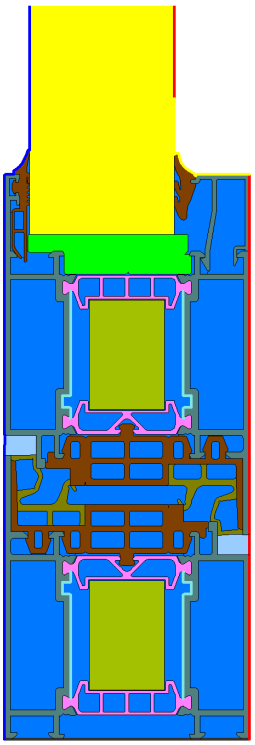

Fig. 4: Simulation model test specimen PK02
U_f calculation

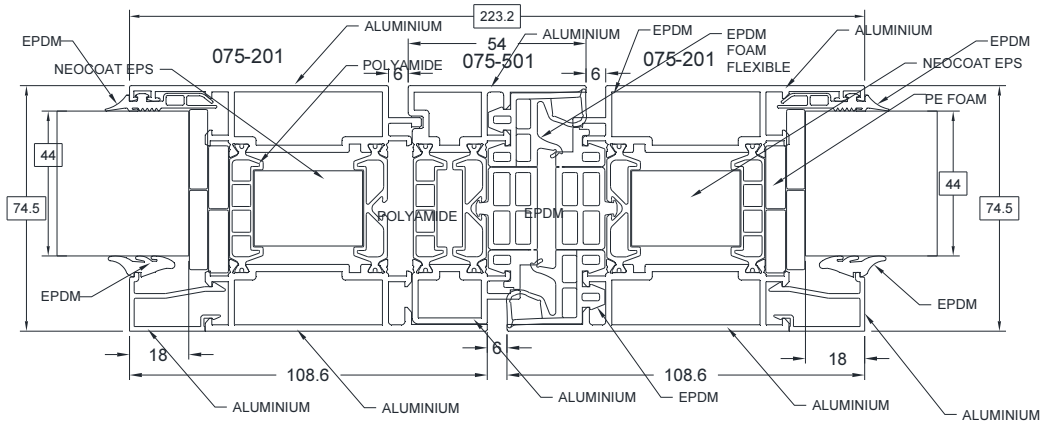

Fig. 5: Cross section test specimen PK03

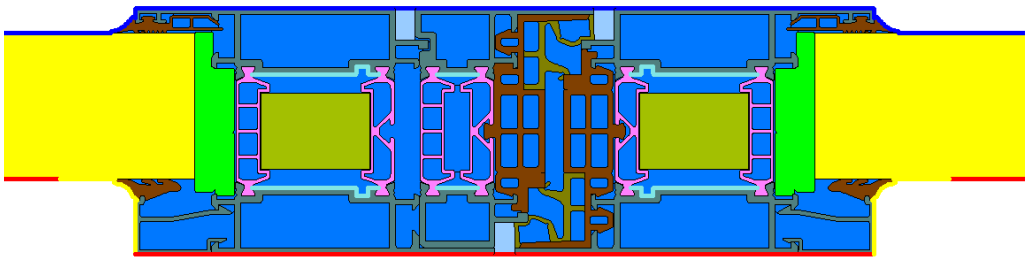

Fig. 6: Simulation model test specimen PK03
U_f calculation

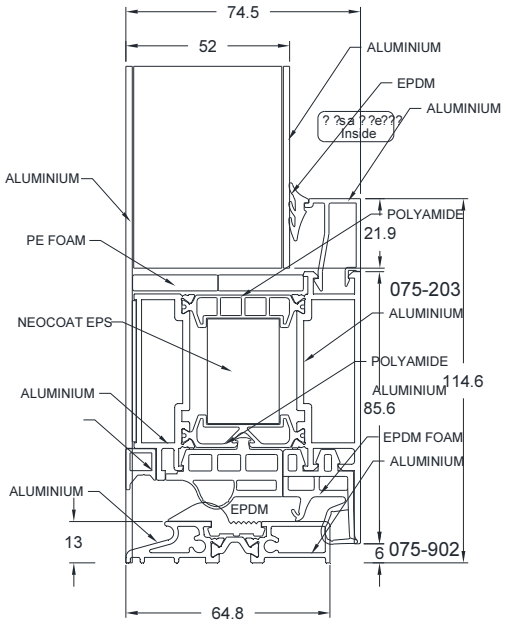

Fig. 7: Cross section test specimen PK04

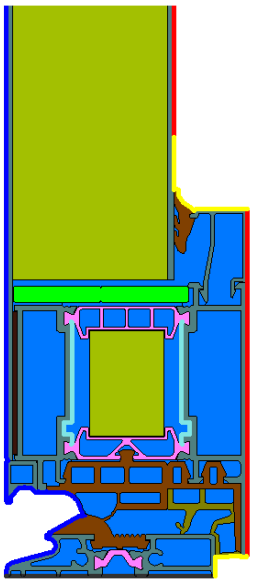

Fig. 8: Simulation model test specimen PK04
$U_{f,Edge}$ calculation

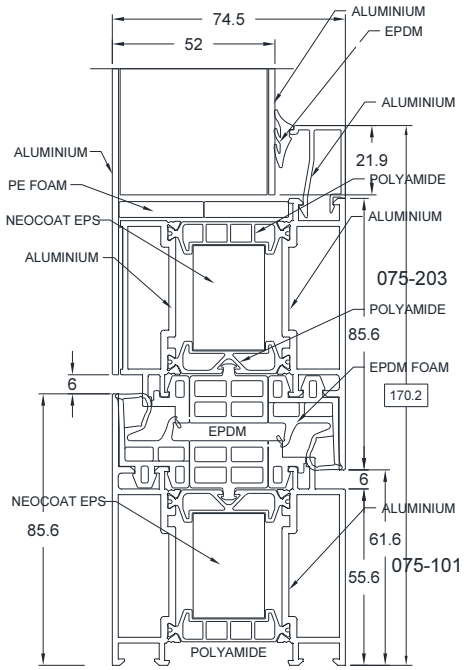

Fig. 9 Cross section test specimen PK05

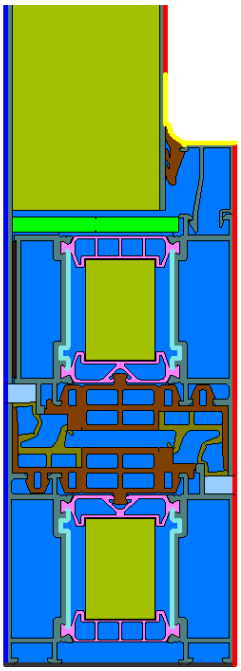

Fig. 10: Simulation model test specimen PK05
$U_{f,Edge}$ calculation

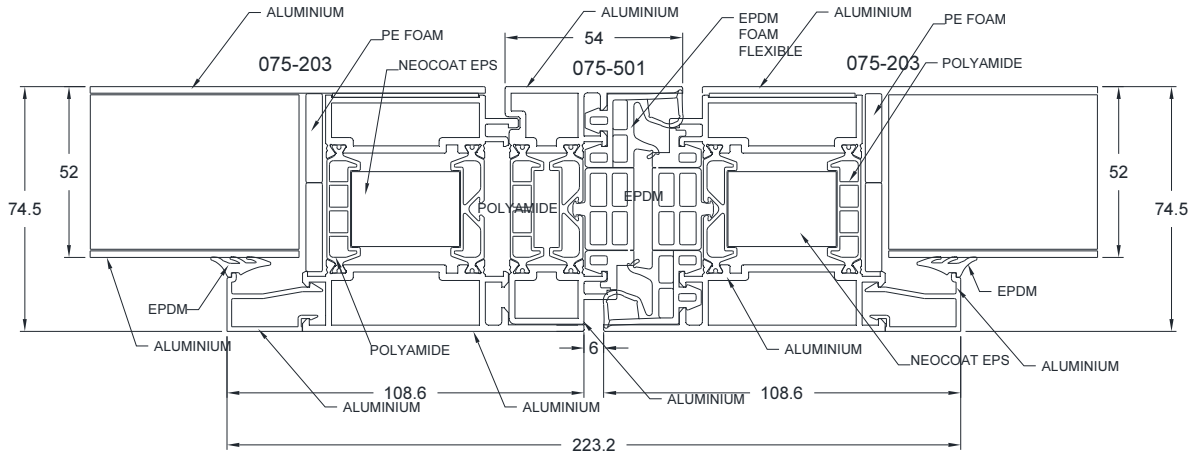

Fig. 11: Cross section test specimen PK06

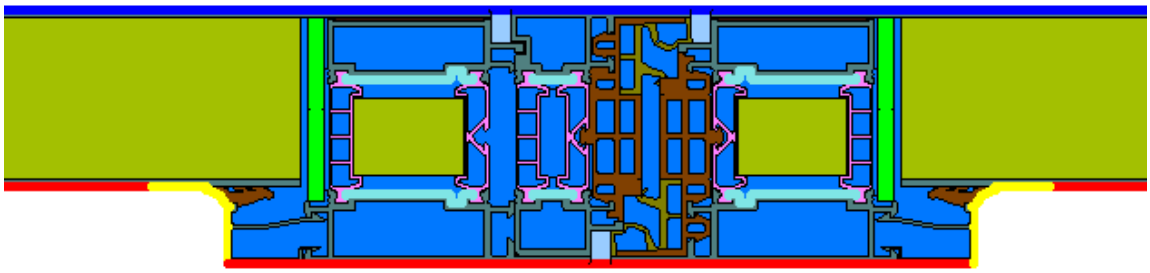

Fig. 12: Simulation model test specimen PK06
$U_{f,Edge}$ calculation

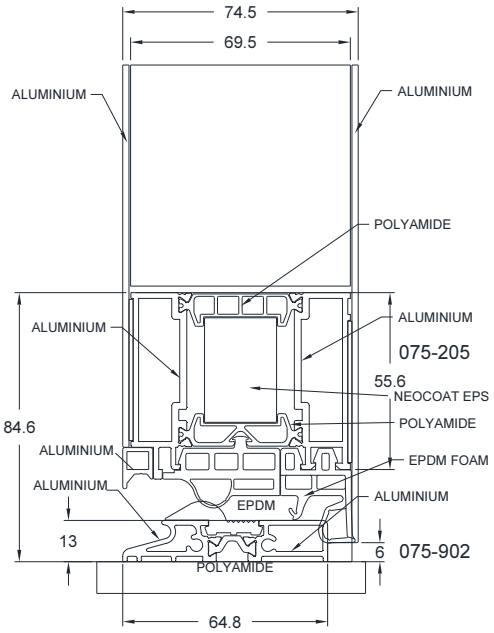

Fig. 13: Cross section test specimen PK07

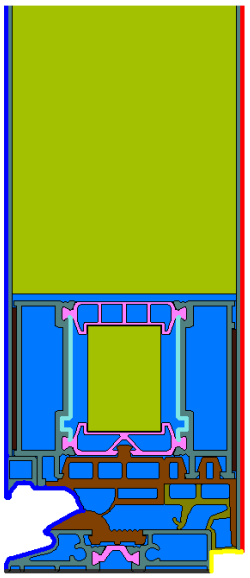

Fig. 14: Simulation model test specimen PK07
$U_{f,Edge}$ calculation

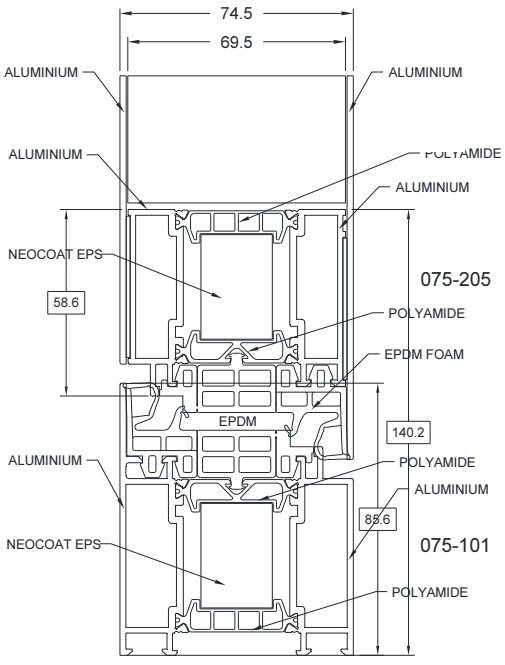

Fig. 15: Cross section test specimen PK08

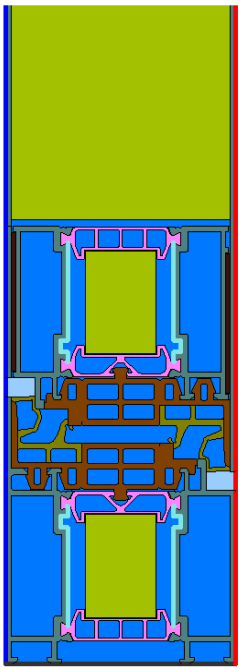

Fig. 16: Simulation model test specimen PK08
$U_{f,Edge}$ calculation

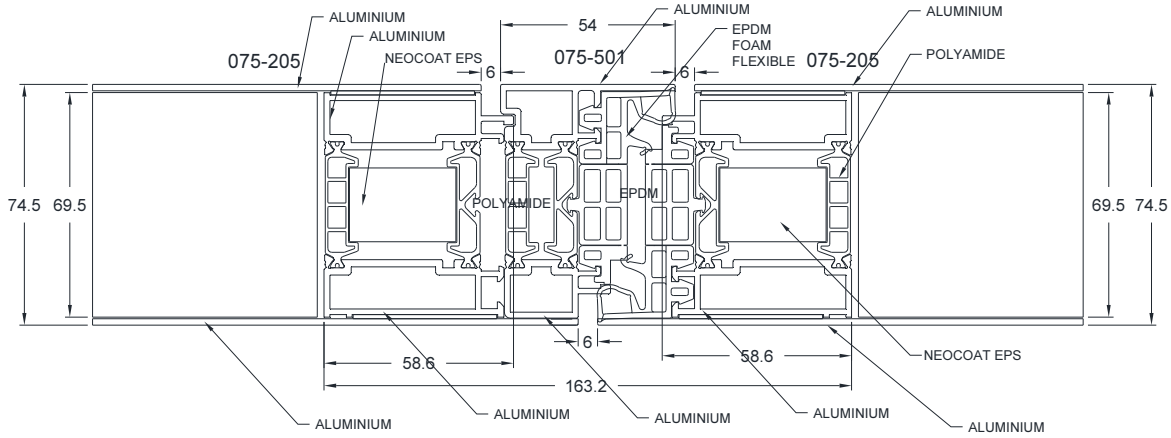

Fig. 17: Cross section test specimen PK09

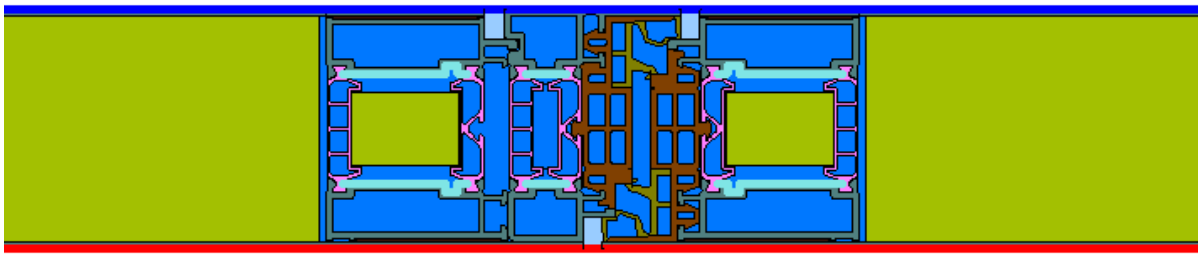

Fig. 18: Simulation model test specimen PK09
$U_{f,Edge}$ calculation

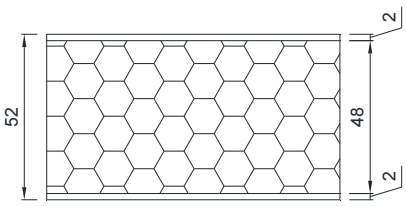

Fig. 19: Cross section test specimen PK10
U_p calculation

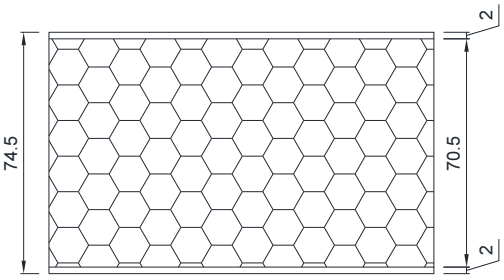

Fig. 20: Cross section test specimen PK11
U_p calculation