DENEY SERTİFİKASI
Test Certificate

TÜRKAK
Test
TS EN ISO/IEC 17025
AB-0531-T

AB-0531-T
140.1745.1/2022
21.03.2022

Façade Testing Institute

***Müşterinin Adı ve Adresi** / Customer's Name & Address:* Selectron Elektrokimya San. Ve Tic. Ltd. Şti.
Atatürk Bulvarı Köstemir Cad. No:74 Silivri / İstanbul / TURKEY

***Numunenin Adı ve Tarifi** / Sample's Name & Description:* Arbor Fenex 90s Series Balcony Door

***Numune Kabul Tarihi** / Acceptence Date of Item:* -

***FTI Proje No** / FTI Project No:* 2022.1480

***Uygulanan Normlar** / Norms Applied:* EN ISO 10077-1, EN ISO 10077-2

***Sonuçlar** / Results:* U_W = 0,8144 W/m²K

***Test Tarihi** / Date of Test*
17.03.2022

***Sayfa Sayısı** / Number of Pages*
1 / 24

Deney laboratuvarı olarak faaliyet gösteren FTI Fasad Teknoloji Merkezi, TÜRKAK 'tan AB-0531-T numarası ile TS EN ISO/IEC 17025 standardına göre akredite edilmiştir.
FTI Facade Testing Institute accredited by TURKAK under registration number AB-0531-T for TS EN ISO/IEC 17025 as test laboratory.

Türk Akreditasyon Kurumu (TÜRKAK) deney laboratuvarlarının tanınırlığı konusunda Avrupa Akreditasyon Birliği (EA) ile Çok Taraflı Anlaşma ve Uluslararası Laboratuvar Akreditasyon Birliği (ILAC) ile karşılıklı tanıma anlaşması imzalamıştır.
Turkish Accreditation Agency (TURKAK) is a signatory to the European co-operation for Accreditation (EA) Multilateral Aggrement (MLA) and to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognation Arrangement (MRA) for the recognation of test reports.

Deney ve/veya ölçüm sonuçları, genişletilmiş ölçüm belirsizlikleri (olması halinde) ve deney metotları bu sertifikanın tamamlayıcı kısmı olan takip eden sayfalarda verilmiştir. Bu sertifika yalnız test edilen numuneye ait sonuçları içerir ve ekte sunulan ilgili test raporu ile birlikte geçerlidir.
The test and/or measurement results, the uncertainties (if applicable) with confidence probability and test methods are given on the following pages. This certificate includes the test results of the specimen which is identified above and its valid with the related test report.

FAÇADE TESTING INSTITUTE FTI

***Mühür** / Seal*

***Tarih** / Date*
21.03.2022

***Hazırlayan** / Prepared by*
Onur ÖZBEK
Test Mühendisi / Testing Engineer

***Onaylayan** / Approved by*
Emre ARSLAN
Laboratuvar Müdürü / Laboratory Manager

FTI Fasad Teknoloji Merkezi / *FTI Façade Testing Institute*
Çakıl Mahallesi Şehit Teğmen Tamer Aydın Sok. No: 76/2 34540 Çatalca / İstanbul / TÜRKİYE
Tel: +90 212 776 42 25 Fax: +90 212 776 40 58-59
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ANALYSIS REPORT

Referenced Method : EN ISO 10077-1 Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: Simplified method

Product / Project : Arbor Fenex 90s Series Balcony Door

Prepared by : Onur ÖZBEK

1. PREFACE

This report contains the results of thermal transmittance analysis, which were performed by FTI Facade Testing Institute at the address; Çakıl Mah. Şehit Teğmen Tamer Aydın Sok. No: 76/2 34540 Çatalca – Istanbul / TURKIYE.

Test sample is *Arbor Fenex 90s Series Balcony Door* has been designed by Selectron Elektrokimya San. Ve Tic. Ltd. Şti.

2. CLIENT

Selectron Elektrokimya San. Ve Tic. Ltd. Şti.
Atatürk Bulvarı Köstemir Cad. No:74
Silivri / İstanbul

3. ANALYSIS METHODS

Thermal transmittance analysis has been carried out according to the standards indicated below.

Document No	Date of Publication	Content of Document
EN ISO 10077-1	2017	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: Simplified method
EN ISO 10077-2	2017	Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part2: Numerical Method for Frames

Single equivalent thermal conductivity method is used in accordance with EN ISO 10077-2 for assessment of cavities. Frame details results in the report are provided by computer simulation using Frame Simulator Software Program.

Details submitted by the customer are taken into account in material assignments. Non-continuous materials such as corner wedges, glass supporter elements etc. are disregarded for frame analysis.

4. ANALYZING TEAM

Thermal transmittance analysis was performed on 17.03.2022 by the followings:

Emre ASRSLAN	FTI	Laboratory Manager
Onur ÖZBEK	FTI	Testing Engineer

5. DESCRIPTIONS OF THE SYSTEM

Type of sample	Door System
System name	Arbor Fenex 90s Series Balcony Door
Dimensions of sample	1003 x 2380 mm
Surface area of sample	2,387 m²
Dimensions of operable parts	925 x 2327 mm
Area of operable parts	2,152
Total length of operable parts	6,504 m
Wooden Panel type	External: 9 mm PlyWood (Birch-Marine)
Ug = 0,6028 W/m²K	Gap : 50 mm Cellofoam (Cello F700 FR HO) Internal : 9 mm PlyWood (Birch-Marine)

Please refer to detailed drawings presented on pages 20-24 for the system details. Information in the table above, detailed system drawings and information inside have been submitted to FTI Façade Testing Institute under the responsibility of customer.

6. INITIAL CONDITIONS

Outdoor Temperature	0 ^{0}C
Indoor Temperature	20 ^{0}C

7. SYSTEM DETAILS & THERMAL TRANSMITTANCE ANALYSIS

System details and thermal conduction analysis are detailed below:

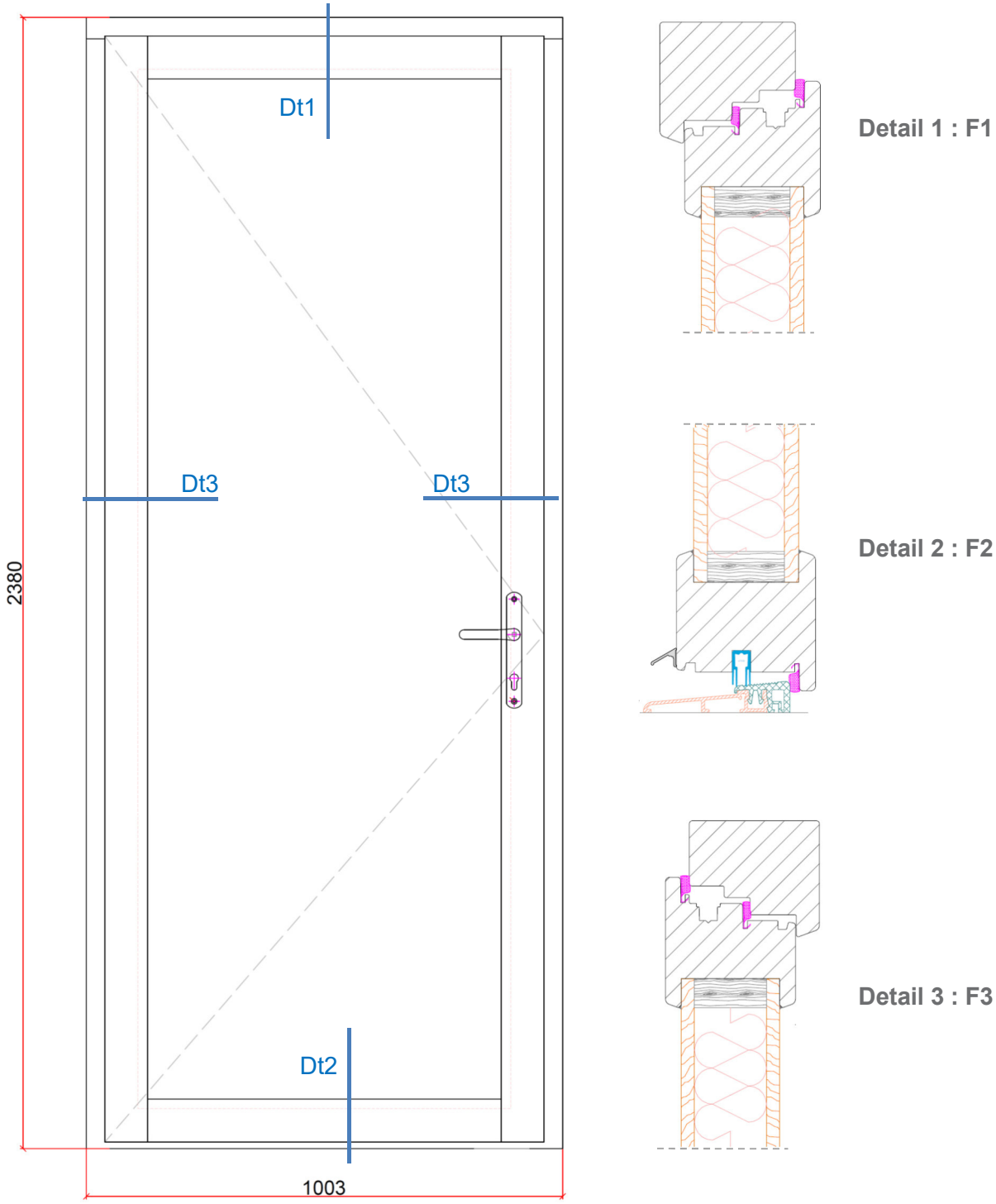
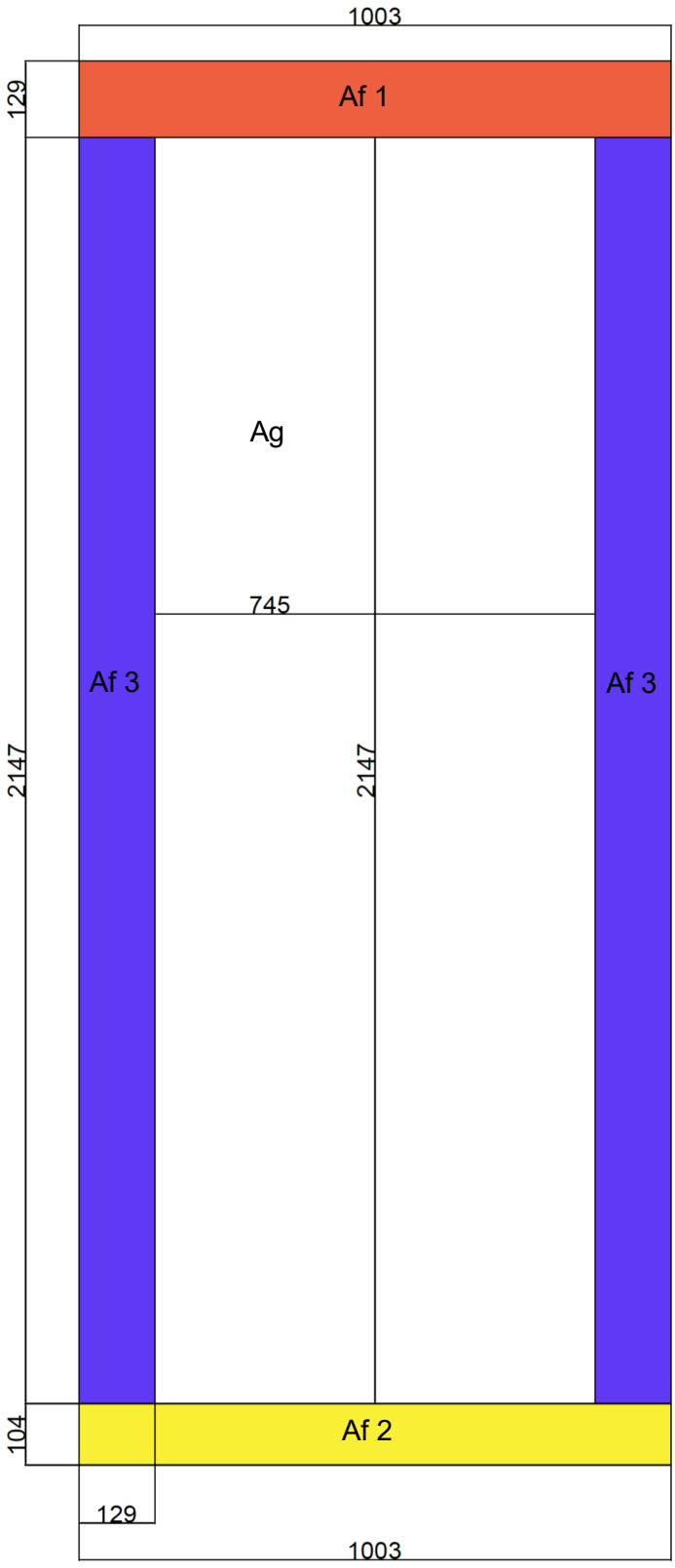


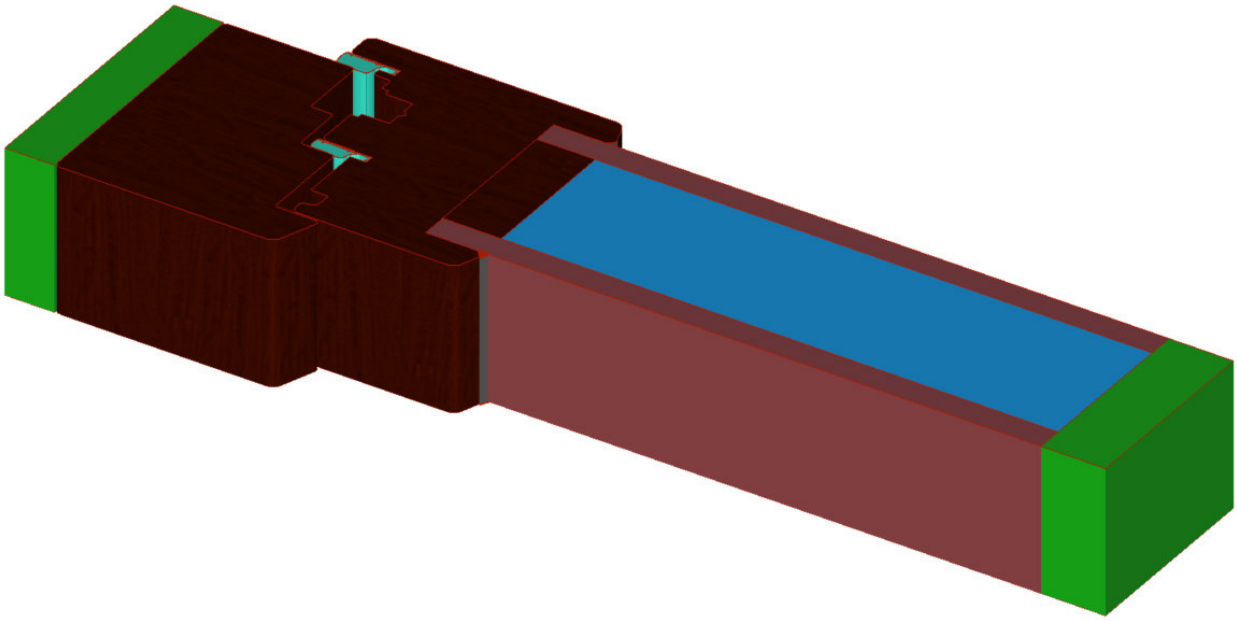
Figure 1. System details of sample



Af 1 = 0,129 m²
Af 2 = 0,104 m²
Af 3 = 0,554 m²
Ag = 1,599 m²

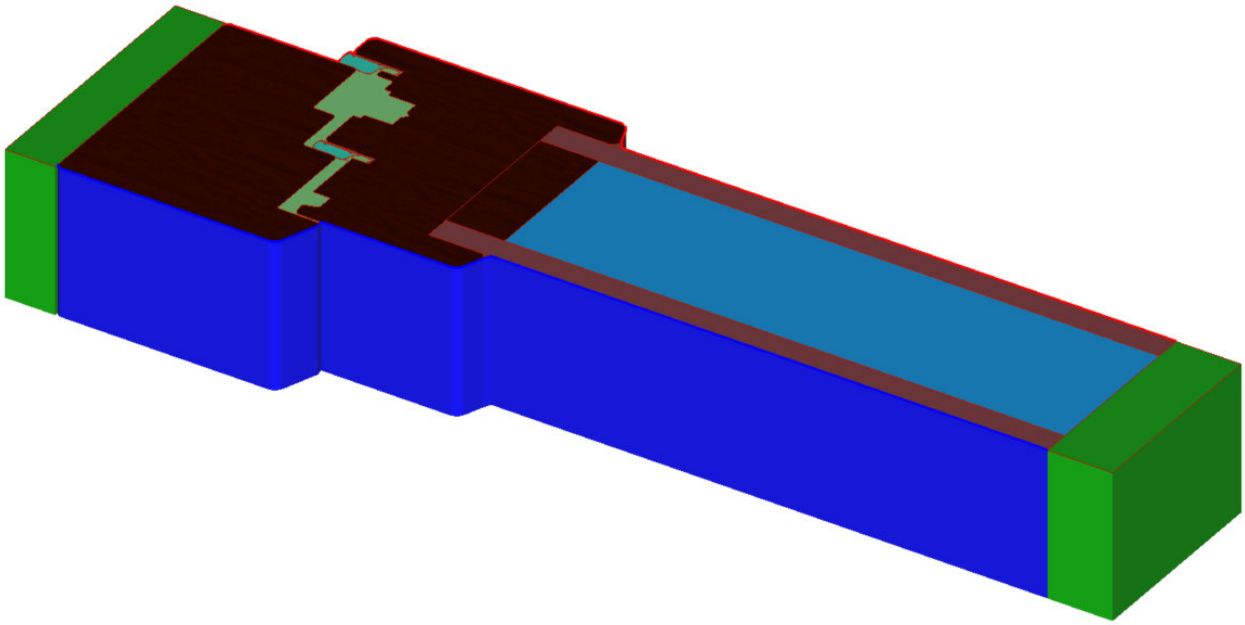
Figure 2. Areas of system details

7.1 Thermal Transmittance of Frame – (F1)



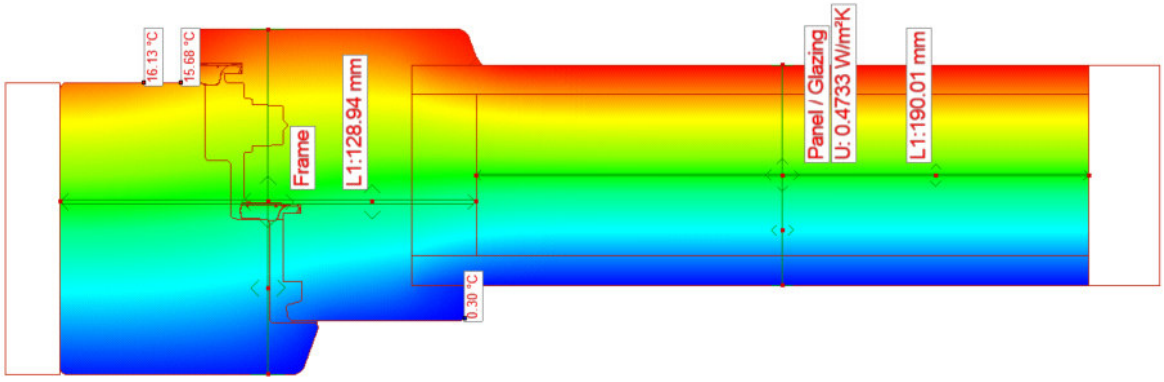
Materials

Name	Type	Cavity type	λx [W/mK]	λy [W/mK]	ε	Qperm [g/m²]	Color
Adiabatic	Adiabatic		0.0000	0.0000	0.900	500.000	
Softwood	Standard		0.1300	0.1300	0.900	500.000	
QL-3053	Standard		0.0410	0.0410	0.900	500.000	
Hardwood	Standard		0.1800	0.1800	0.900	500.000	
CELLO F700 FR HO	Standard		0.0360	0.0360	0.900	500.000	
Silicone pure	Standard		0.3500	0.3500	0.900	500.000	



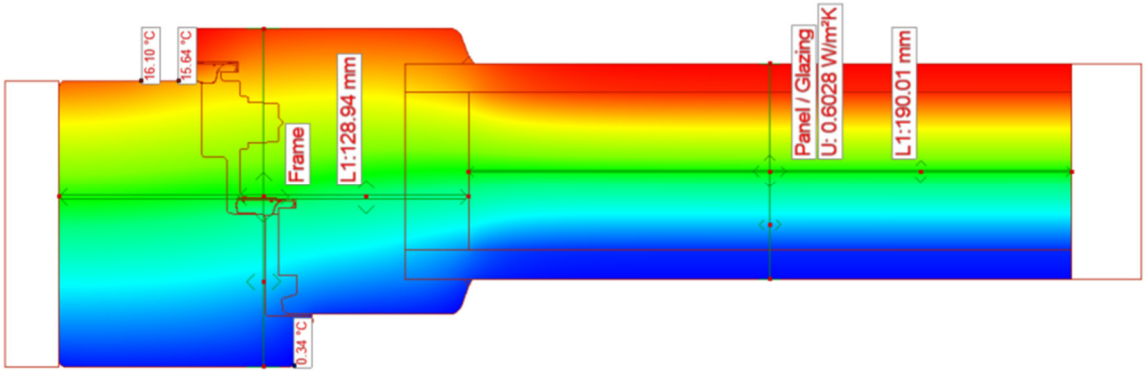
Boundaries

ID	Name	Type	Col.	Boundary T [°C]	R type	R [m²K/W]	Gas type	Flow rate type	Flow rate [W/m²]	U-Factor surface	Flow dir.
0	Internal	Environment air		20.000	Constant	0.1300	Air	Constant	0.000	Use segment settings	-
1	External	Environment air		0.000	Constant	0.0400	Air	Constant	0.000	Use segment settings	-



U_f	Thermal transmittance of frame (W/m²K)
L_f^{2D}	Linear thermal conduction value related to Uf value (W/m.K)
U_p	Thermal transmittance of opaque panel (W/m²K)
b_p	Visible width of the opaque panel (m) *190 mm*
b_f	Projected width of the frame section (m)
ϕ_p	Heat Flow of opaque panel (insulation panel) (W/m)
ΔT	Temperature Difference (^{0}C)

$$U_f = \frac{L_f^{2D} - U_p.b_p}{b_f} \qquad L_f^{2D} = \frac{\phi_p}{\Delta T}$$



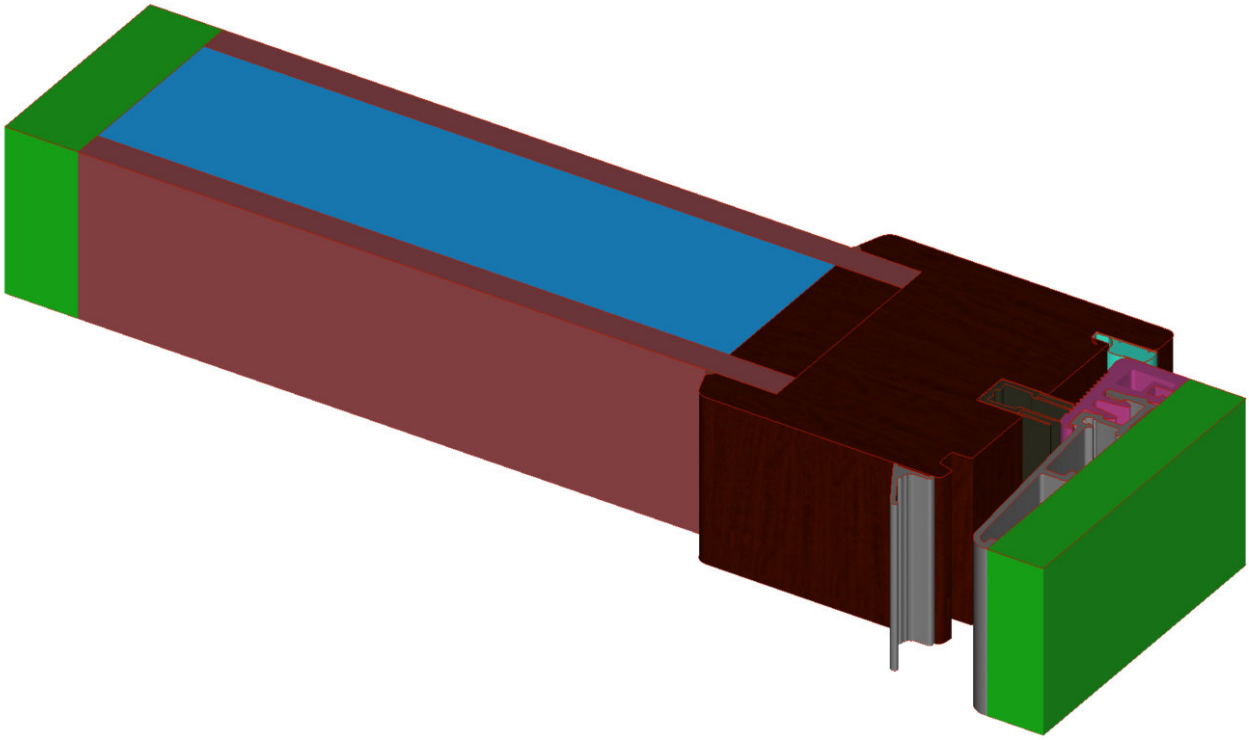
$$\Psi_{spacer} = L_\Psi^{2D} - U_f.b_f - U_g.b_g \qquad L_\Psi^{2D} = \frac{\phi_g}{\Delta T}$$

U_f	Thermal transmittance of frame (W/m²K)
Ψ_{spacer}	Linear thermal transmittance due to combined effect of glazing, spacer and frame (W/m.K)
L_Ψ^{2D}	Thermal conductance of the section s (W/m.K)
U_g	thermal transmittance of the central area of the wooden panel (W/m²K)
b_g	Visible width of the wooden panel (m) *190 mm*
b_f	Projected width of the frame section (m)
ϕ_g	Heat Flow of the wooden panel (W/m)
ΔT	Temperature difference (^{0}C)

Detailed Results of Frame

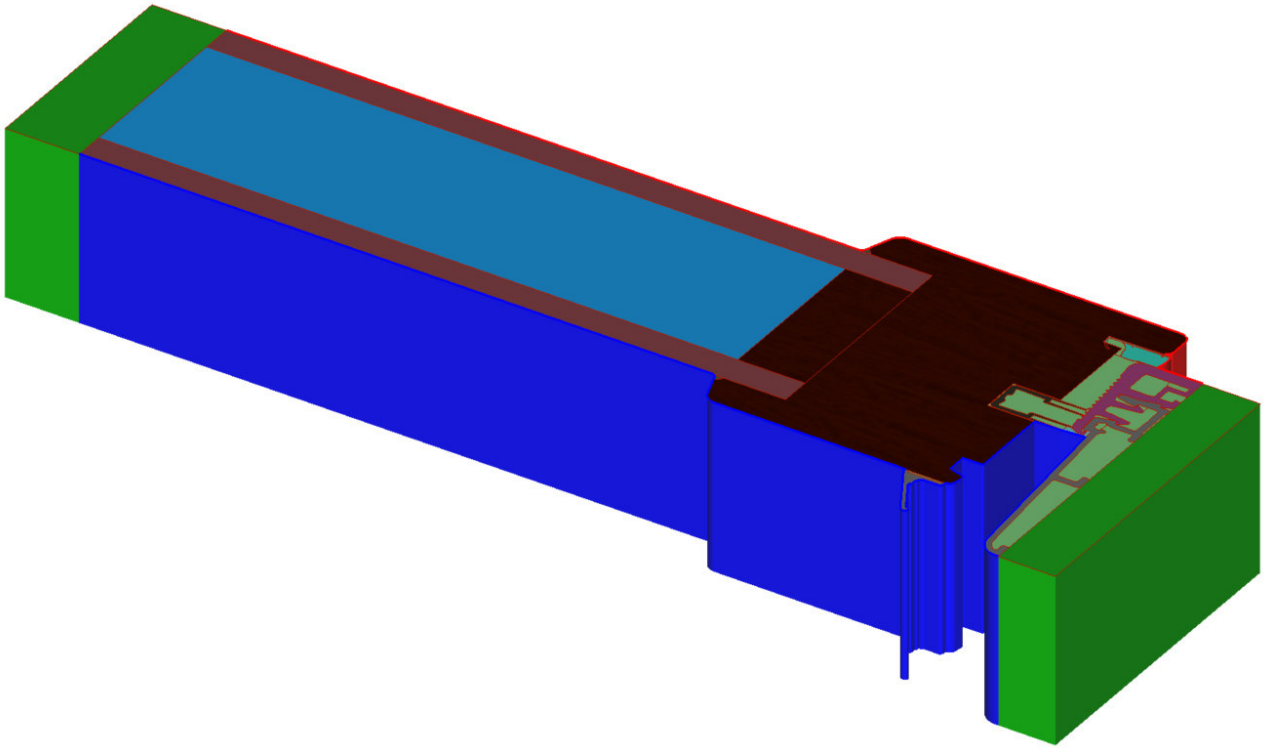
Indication	Description	Result	Unit
Ψ_{f1}	Linear Thermal Transmittence	0,01934	W/mK
Φ_g Flow with Wooden Panel	Heat Flow For Wooden Panel	5,3194	W/m
L_{Ψ}^{2D}	Two Dimensional Thermal Conductance For Wooden Panel	0,3959	W/mK
ΔT	Difference Of Temperatures	20	°C
$b_p=b_g$	Width Of Wooden Panel	0,190	m
b_f	Width Of Frame	0,129	m
U_g	Thermal Transmittence For Wooden Panel	0,6028	W/m²K
L_{f1}	perimeter for Ψ_{f1} value	0,745	m
Φ_p Flow with panel	Heat Flow For Frame (with Insulation panel)	4,4403	W/m
U_p	Thermal Transmittence For Panel Under İnsulation Panel Condition	0,4733	W/m²K
L_f^{2D}	Two Dimensional Thermal Conductance For Frame	0.2220	W/mK
U_{f1}	Thermal Transmittence For Frame	1,0244	W/m²K
A_{f1}	Area of F_1 section	0,129	m²

7.2 Thermal Transmittance of Frame – (F2)



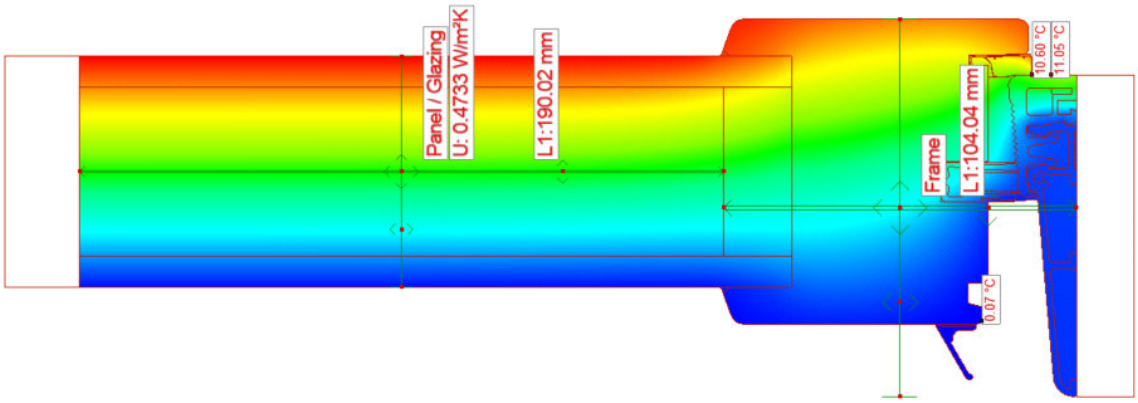
Materials

Name	Type	Cavity type	λx [W/mK]	λy [W/mK]	ε	Qperm [g/m²]	Color
Softwood	Standard		0.1300	0.1300	0.900	500.000	
Hardwood	Standard		0.1800	0.1800	0.900	500.000	
Silicone pure	Standard		0.3500	0.3500	0.900	500.000	
CELLO F700 FR HO	Standard		0.0360	0.0360	0.900	500.000	
Adiabatic	Adiabatic		0.0000	0.0000	0.900	500.000	
Aluminium (anodized/coated)	Standard		160.0000	160.0000	0.900	500.000	
PVC rigid	Standard		0.1700	0.1700	0.900	500.000	
QL-3053	Standard		0.0410	0.0410	0.900	500.000	
Deventer s7639(TPV)	Standard		0.0770	0.0770	0.900	500.000	



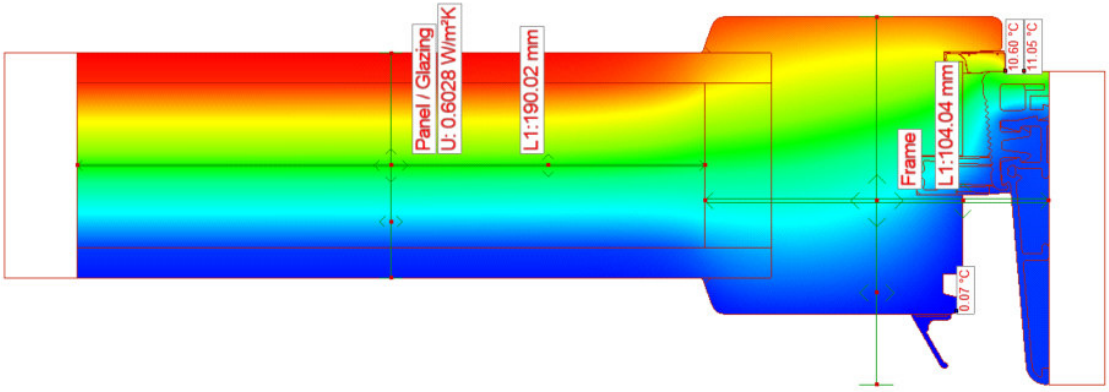
Boundaries

ID	Name	Type	Col.	Boundary T [°C]	R type	R [m²K/W]	Gas type	Flow rate type	Flow rate [W/m²]	U-Factor surface	Flow dir.
0	Internal	Environment air		20.000	Constant	0.1300	Air	Constant	0.000	Use segment settings	-
1	External	Environment air		0.000	Constant	0.0400	Air	Constant	0.000	Use segment settings	-



U_f	Thermal transmittance of frame (W/m²K)
L_f^{2D}	Linear thermal conduction value related to Uf value (W/m.K)
U_p	Thermal transmittance of opaque panel (W/m²K)
b_p	Visible width of the opaque panel (m) *190 mm*
b_f	Projected width of the frame section (m)
ϕ_p	Heat Flow of opaque panel (insulation panel) (W/m)
ΔT	Temperature Difference (^{0}C)

$$U_f = \frac{L_f^{2D} - U_p b_p}{b_f} \qquad L_f^{2D} = \frac{\phi_p}{\Delta T}$$



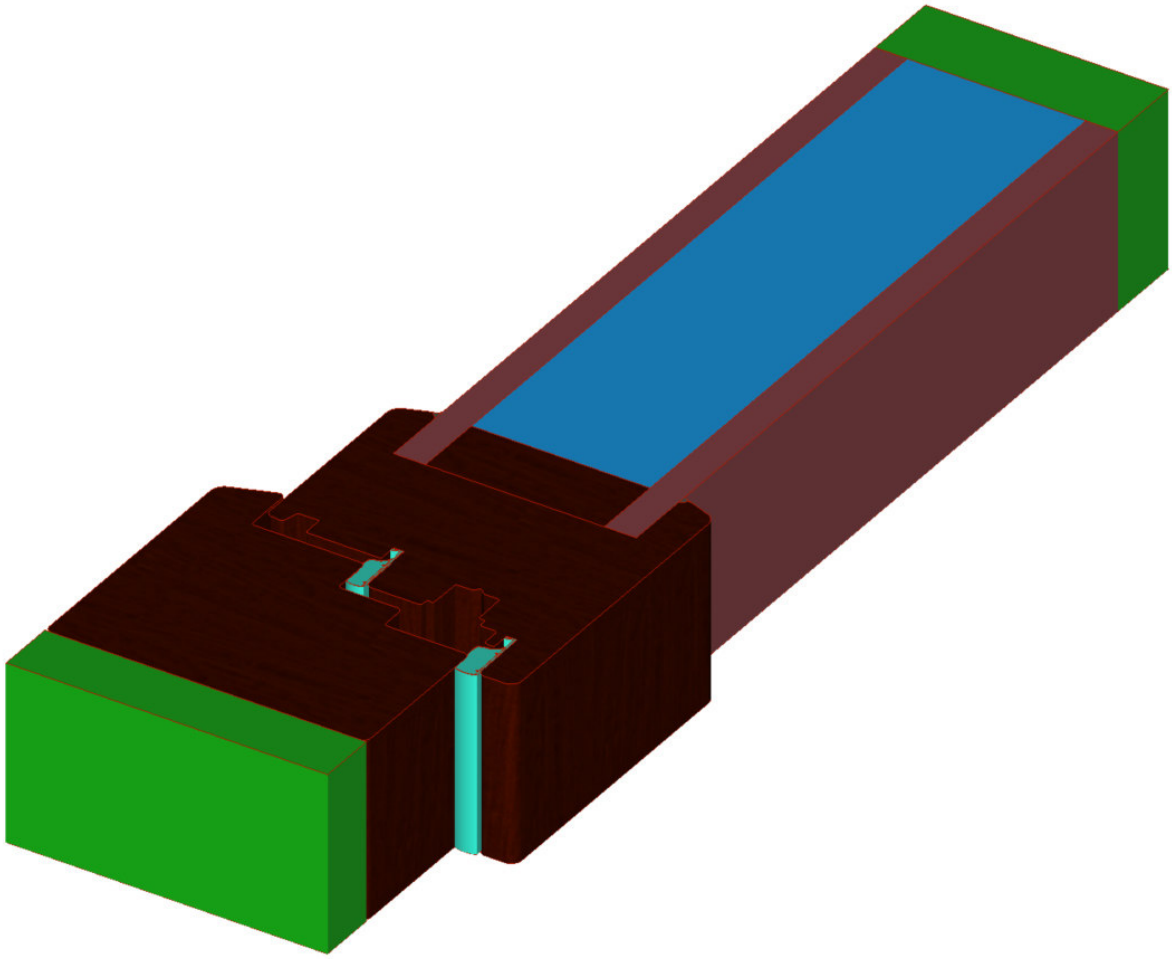
$$\Psi_{spacer} = L_\Psi^{2D} - U_f . b_f - U_g . b_g \qquad L_\Psi^{2D} = \frac{\phi_g}{\Delta T}$$

U_f	Thermal transmittance of frame (W/m²K)
Ψ_{spacer}	Linear thermal transmittance due to combined effect of glazing, spacer and frame (W/m.K)
L_Ψ^{2D}	Thermal conductance of the sections (W/m.K)
U_g	thermal transmittance of the central area of the wooden panel (W/m²K)
b_g	Visible width of the wooden panel (m) *190 mm*
b_f	Projected width of the frame section (m)
ϕ_g	Heat Flow of the wooden panel (W/m)
ΔT	Temperature difference (^{0}C)

Detailed Results of Frame

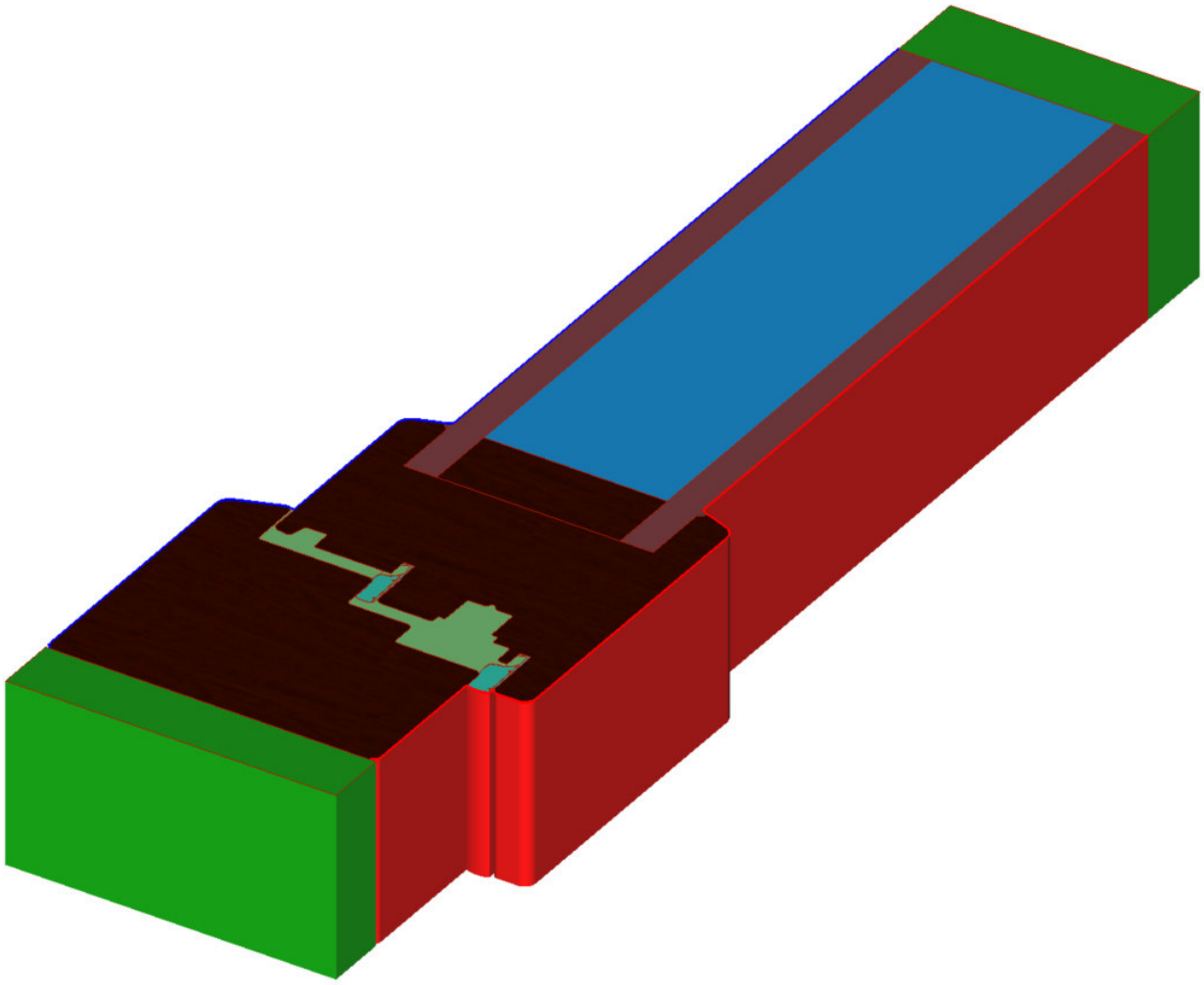
Indication	Description	Result	Unit
Ψ_{f2}	Linear Thermal Transmittence	0,01909	W/mK
Φ_g Flow with Wooden Panel	Heat Flow For Wooden Panel	5,0989	W/m
L_{Ψ}^{2D}	Two Dimensional Thermal Conductance For Wooden Panel	0,2549	W/mK
ΔT	Difference Of Temperatures	20	°C
$b_p=b_g$	Width Of Wooden Panel	0,190	m
b_f	Width Of Frame	0,104	m
U_g	Thermal Transmittence For Wooden Panel	0,6028	W/m²K
L_{f2}	perimeter for Ψ_{f2} value	0,745	m
Φ_p Flow with panel	Heat Flow For Frame (with Insulation panel)	5,0989	W/m
U_p	Thermal Transmittence For Panel Under İnsulation Panel Condition	0,4733	W/m²K
L_f^{2D}	Two Dimensional Thermal Conductance For Frame	0,2549	W/mK
U_{f2}	Thermal Transmittence For Frame	1,5860	W/m²K
A_{f2}	Area of F_2 section	0,1043	m²

7.3 Thermal Transmittance of Frame – (F3)



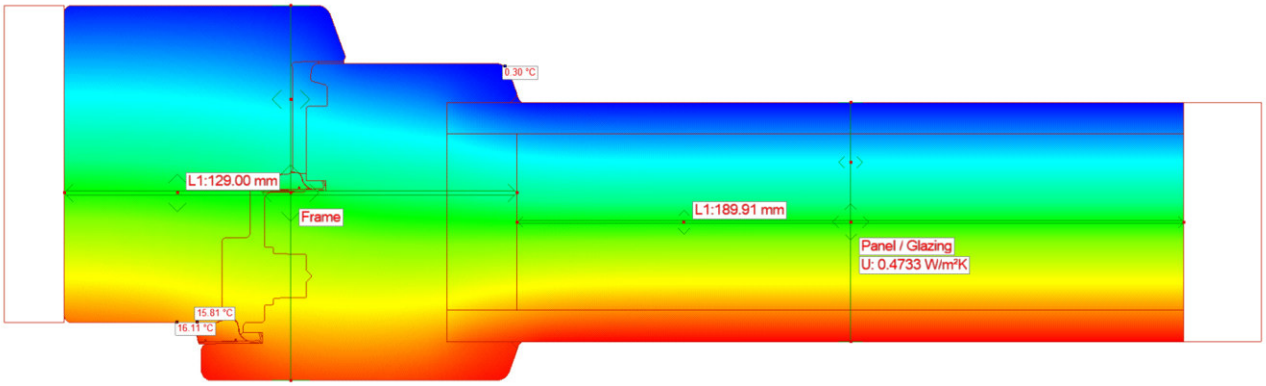
Materials

Name	Type	Cavity type	λx [W/mK]	λy [W/mK]	ε	Qperm [g/m²]	Color
Softwood	Standard		0.1300	0.1300	0.900	500.000	
Adiabatic	Adiabatic		0.0000	0.0000	0.900	500.000	
CELLO F700 FR HO	Standard		0.0360	0.0360	0.900	500.000	
Hardwood	Standard		0.1800	0.1800	0.900	500.000	
QL-3053	Standard		0.0410	0.0410	0.900	500.000	
Silicone pure	Standard		0.3500	0.3500	0.900	500.000	



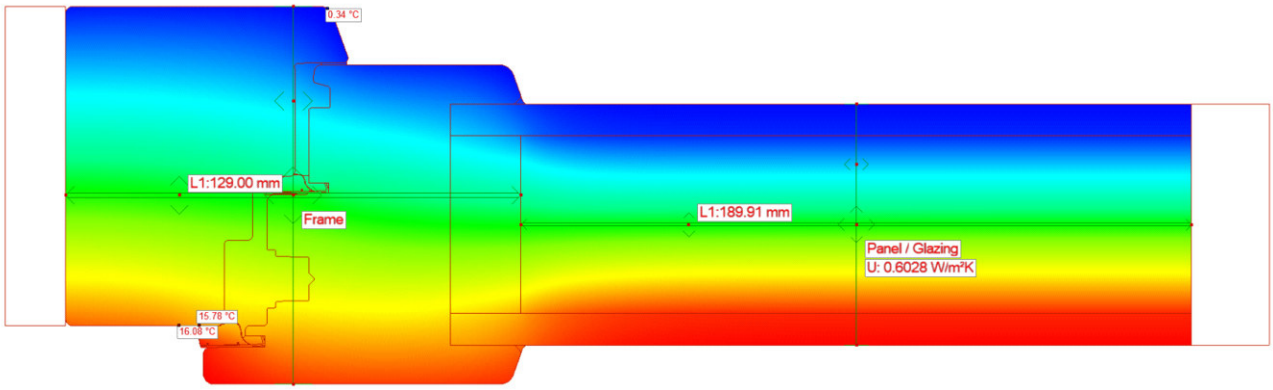
Boundaries

ID	Name	Type	Col.	Boundary T [°C]	R type	R [m²K/W]	Gas type	Flow rate type	Flow rate [W/m²]	U-Factor surface	Flow dir.
0	Internal	Environment air		20.000	Constant	0.1300	Air	Constant	0.000	Use segment settings	-
1	External	Environment air		0.000	Constant	0.0400	Air	Constant	0.000	Use segment settings	-



U_f	Thermal transmittance of frame (W/m²K)
L_f^{2D}	Linear thermal conduction value related to Uf value (W/m.K)
U_p	Thermal transmittance of opaque panel (W/m²K)
b_p	Visible width of the opaque panel (m) *190 mm*
b_f	Projected width of the frame section (m)
ϕ_p	Heat Flow of opaque panel (insulation panel) (W/m)
ΔT	Temperature Difference (^{0}C)

$$U_f = \frac{L_f^{2D} - U_p.b_p}{b_f} \qquad L_f^{2D} = \frac{\phi_p}{\Delta T}$$



$$\Psi_{spacer} = L_\Psi^{2D} - U_f.b_f - U_g.b_g \qquad L_\Psi^{2D} = \frac{\phi_g}{\Delta T}$$

U_f	Thermal transmittance of frame (W/m²K)
Ψ_{spacer}	Linear thermal transmittance due to combined effect of glazing, spacer and frame (W/m.K)
L_Ψ^{2D}	Thermal conductance of the sections (W/m.K)
U_g	thermal transmittance of the central area of the wooden panel (W/m²K)
b_g	Visible width of the wooden panel (m) *190 mm*
b_f	Projected width of the frame section (m)
ϕ_g	Heat Flow of the wooden panel (W/m)
ΔT	Temperature difference (^{0}C)

Detailed Results of Frame

Indication	Description	Result	Unit
Ψ_{f3}	Linear Thermal Transmittence	0,01938	W/mK
Φ_g Flow with Wooden Panel	Heat Flow For Wooden Panel	4,4537	W/m
L_{Ψ}^{2D}	Two Dimensional Thermal Conductance For Wooden Panel	0,2227	W/mK
ΔT	Difference Of Temperatures	20	°C
$b_p=b_g$	Width Of Wooden Panel	0,190	m
b_f	Width Of Frame	0,129	m
U_g	Thermal Transmittence For Wooden Panel	0,6028	W/m²K
L_{f3}	perimeter for Ψ_{f3} value	4,294	m
Φ_p Flow with panel	Heat Flow For Frame (with Insulation panel)	4,4537	W/m
U_p	Thermal Transmittence For Panel Under İnsulation Panel Condition	0,4733	W/m²K
L_f^{2D}	Two Dimensional Thermal Conductance For Frame	0,2227	W/mK
U_{f3}	Thermal Transmittence For Frame	1,0295	W/m²K
A_{f3}	Area of F_3 section	0,5540	m²

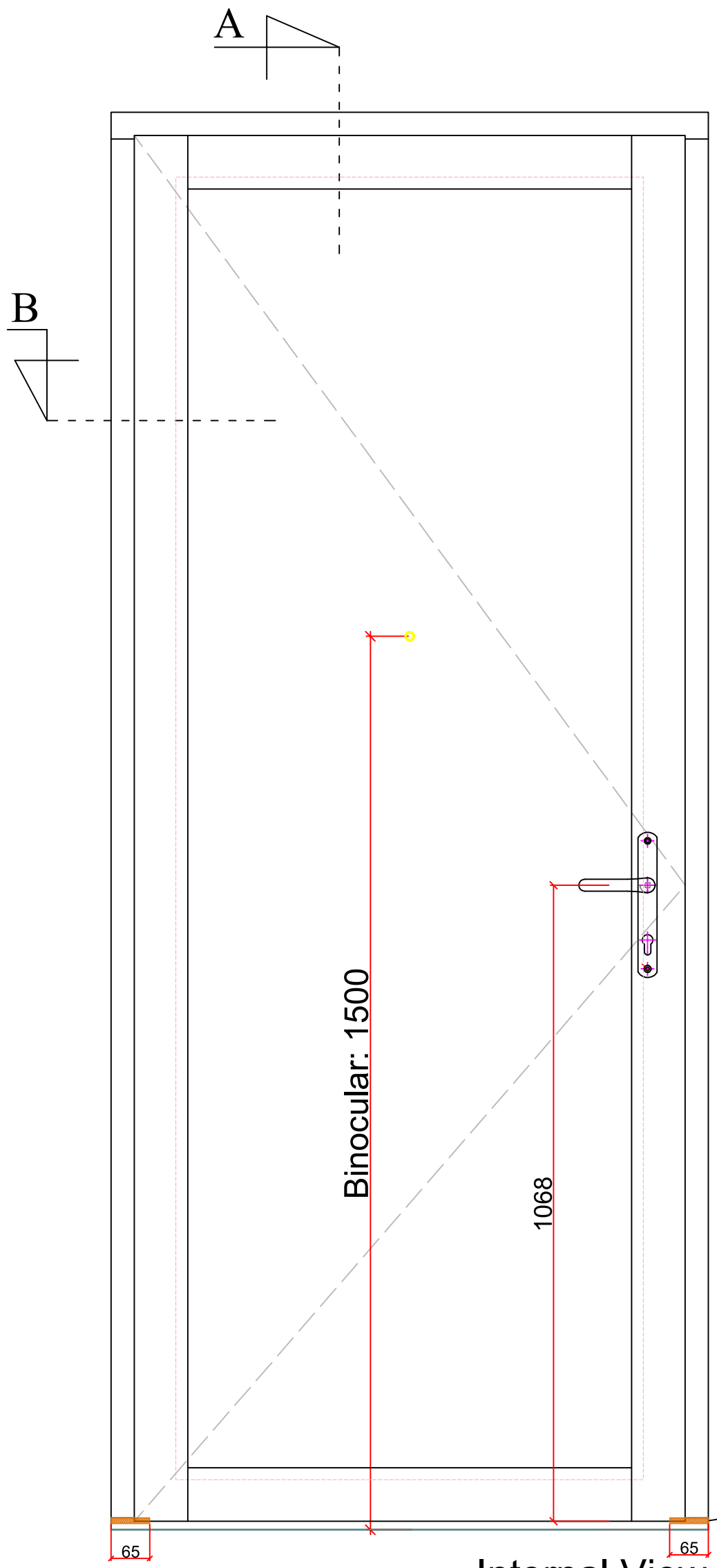
8. Uw - VALUE ANALYSIS OF MODUL

Parameters of F1detail	**U_{f1} (W/m²K)**	**A_{f1} (m²)**	**U_{f1}* A_{f1}**	**Ψ_{f1} (W/mK)**	**L_{f1} (m)**	**Ψ_{f1}*L_{f1}**
	1,0244	0,1290	0,1322	0,0193	0,745	0,0144
Parameters of F2 detail	**U_{f2} (W/m²K)**	**A_{f2} (m²)**	**U_{f2}* A_{f2}**	**Ψ_{f2} (W/mK)**	**L_{f2} (m)**	**Ψ_{f2}*L_{f2}**
	1,5860	0,1043	0,1654	0,0191	0,745	0,0142
Parameters of F3 detail	**U_{f3} (W/m²K)**	**A_{f3} (m²)**	**U_{f3}* A_{f3}**	**Ψ_{f3} (W/mK)**	**L_{f3} (m)**	**Ψ_{f3}*L_{f3}**
	1,0295	0,554	0,5703	0,01938	4,294	0,0832
Wooden Panel	**U_{p1} (W/m²K)**	**A_{p1} (m²)**	**U_{p1}* A_{p1}**	-	-	-
	0,6028	1,5995	0,9642	-	-	-

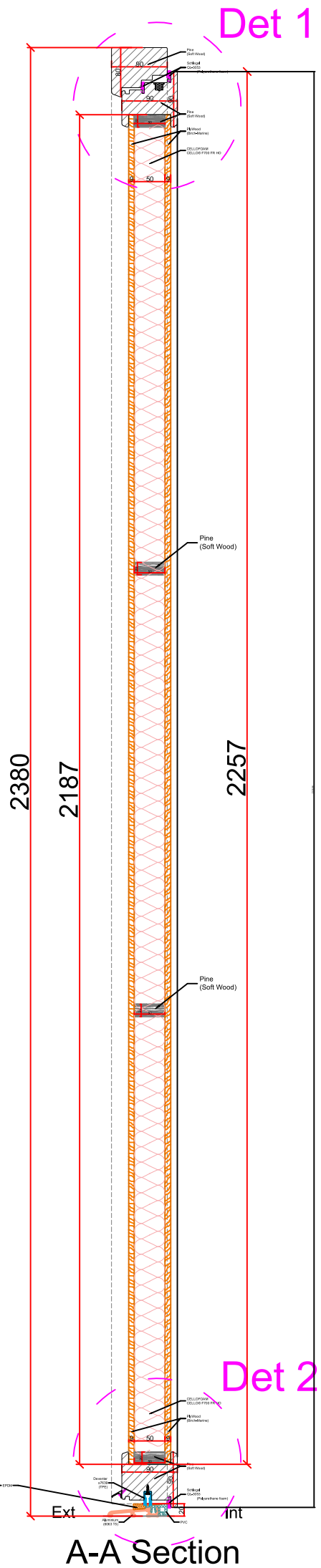
$$U_w = \frac{(U_{f1} * A_{f1}) + (U_{f2} * A_{f2}) + (U_{f3} * A_{f3}) + (\Psi_{f1} * L_{f1}) + (\Psi_{f2} * L_{f2}) + (\Psi_{f3} * L_{f3}) + (U_p * A_p)}{A_T}$$

$U_w =$ *0,8144 (W/m²K)*

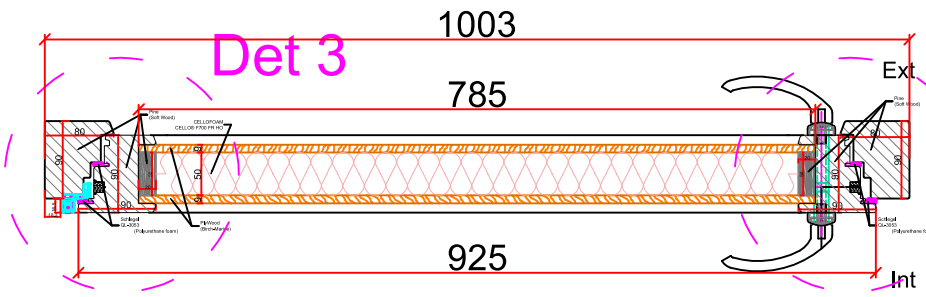
Measurement uncertainty is not included in the test / calculation results and declarations of conformity.



Internal View



A-A Section



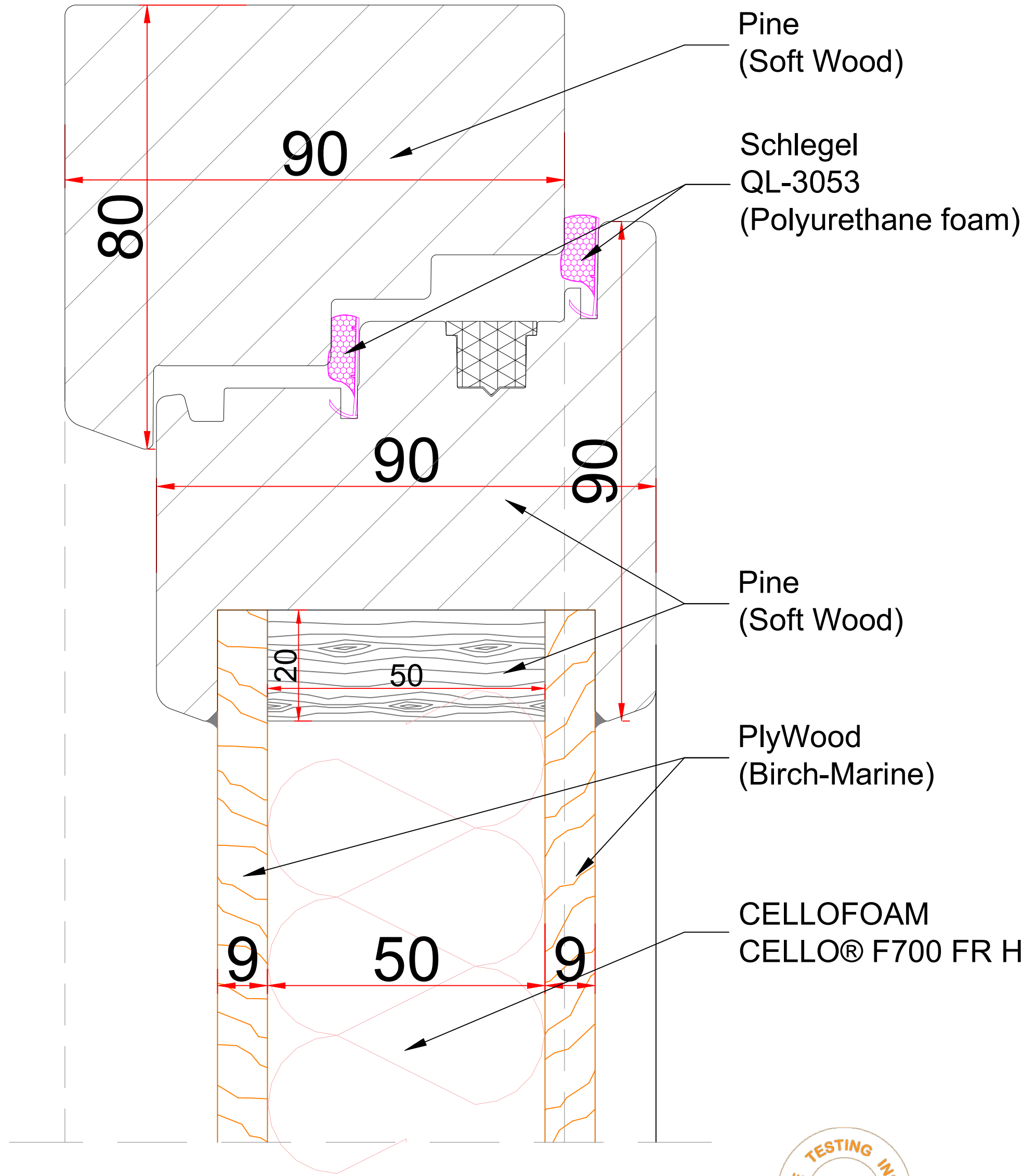
B-B Section

REPORT NO	140.1745.1/2022
PAGE NO	20/24

ARBOR
Selectron Ltd. Şti.
T.: +90 212 7360801 www.arbor.com.tr

Drawing No:	01	Rev. No:		Item:	90s
Date :	07.03.2022	Rev. Date:		Revision Notes:	
Drawing By:	Huseyin SEKER	Rev. By:		90s Internal Opening Door	
Controlled By:	Ilker YILMAZ				

Det 1



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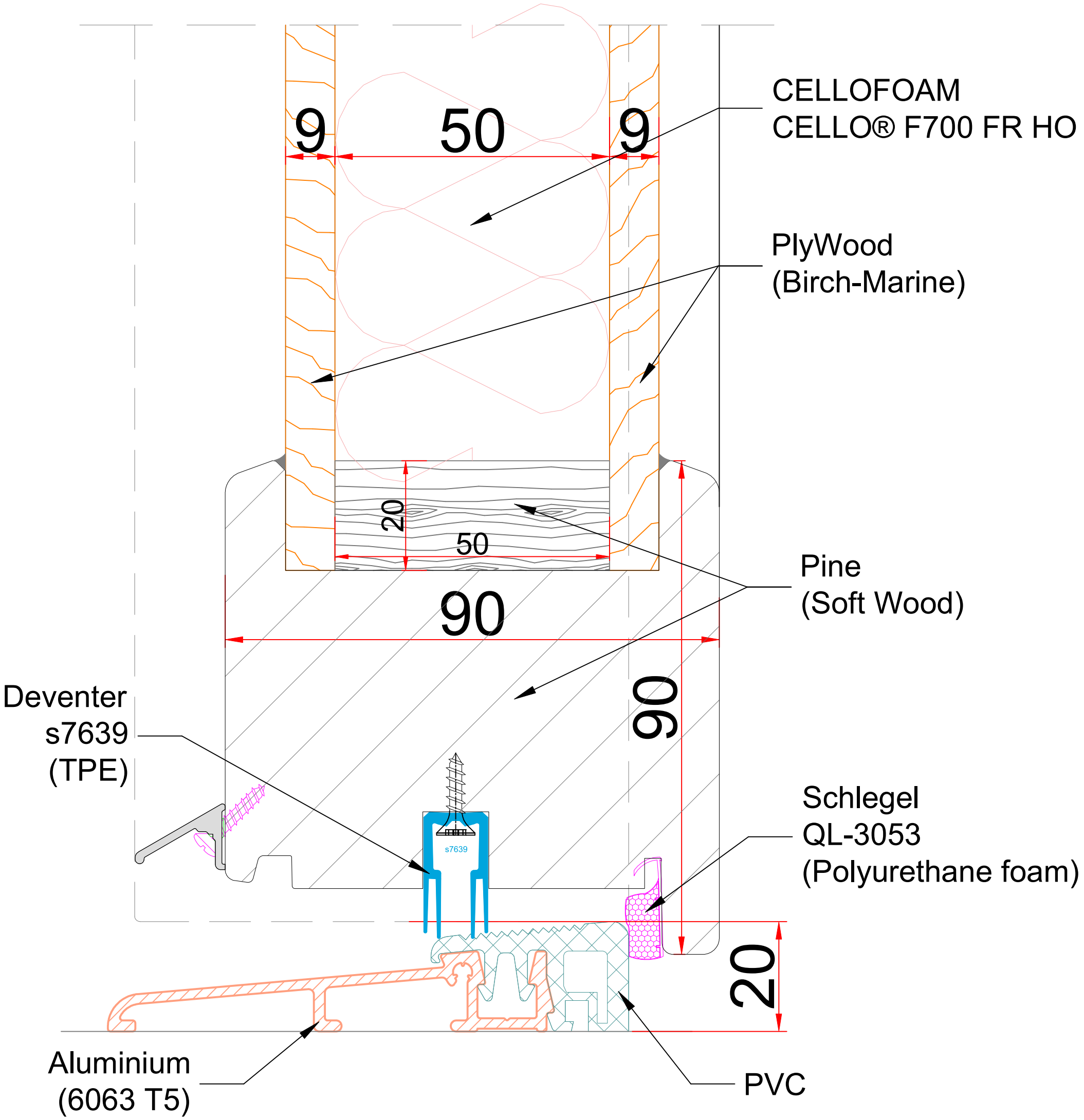
Det 2



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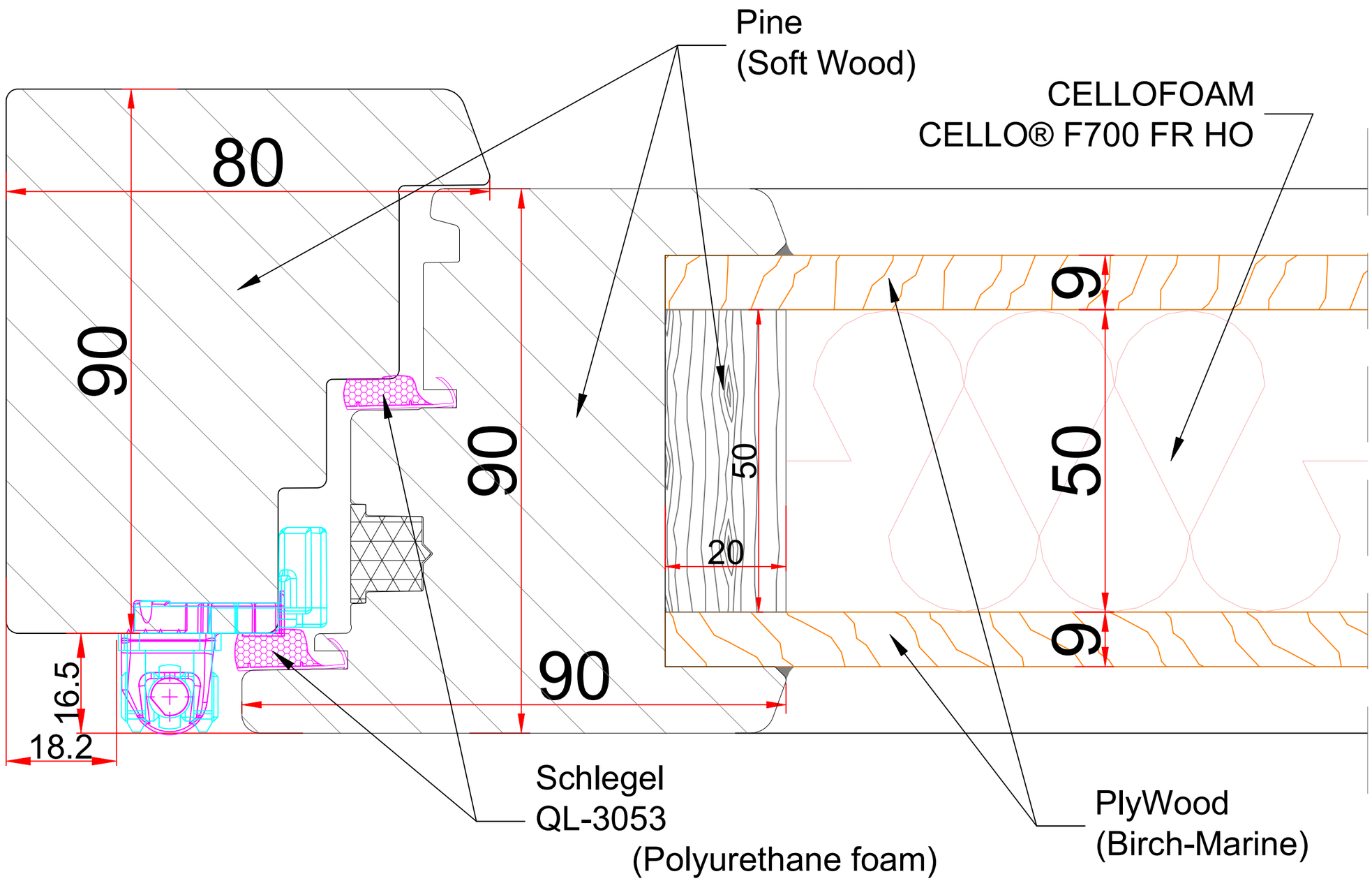
Det 3



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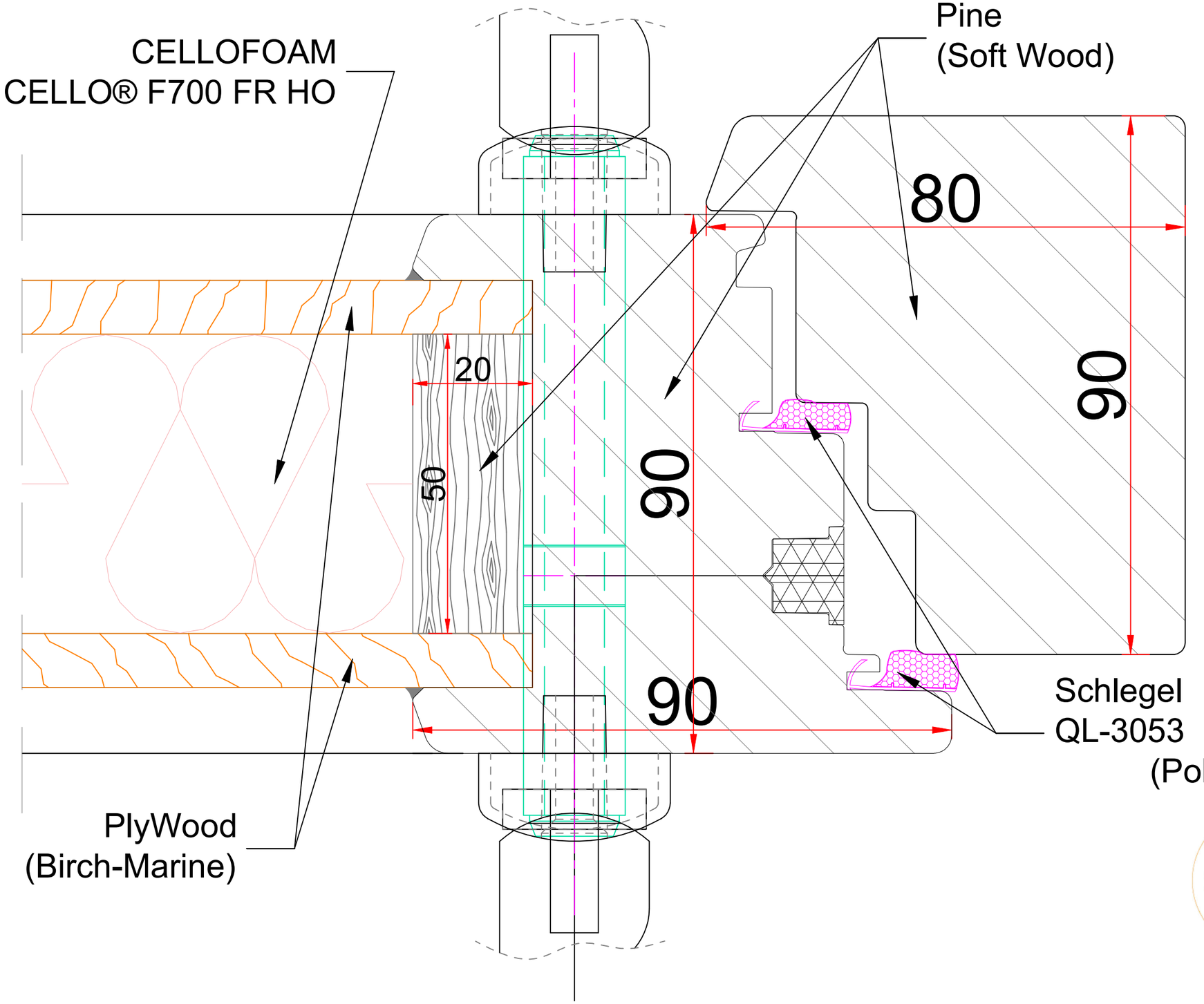
Det 4



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