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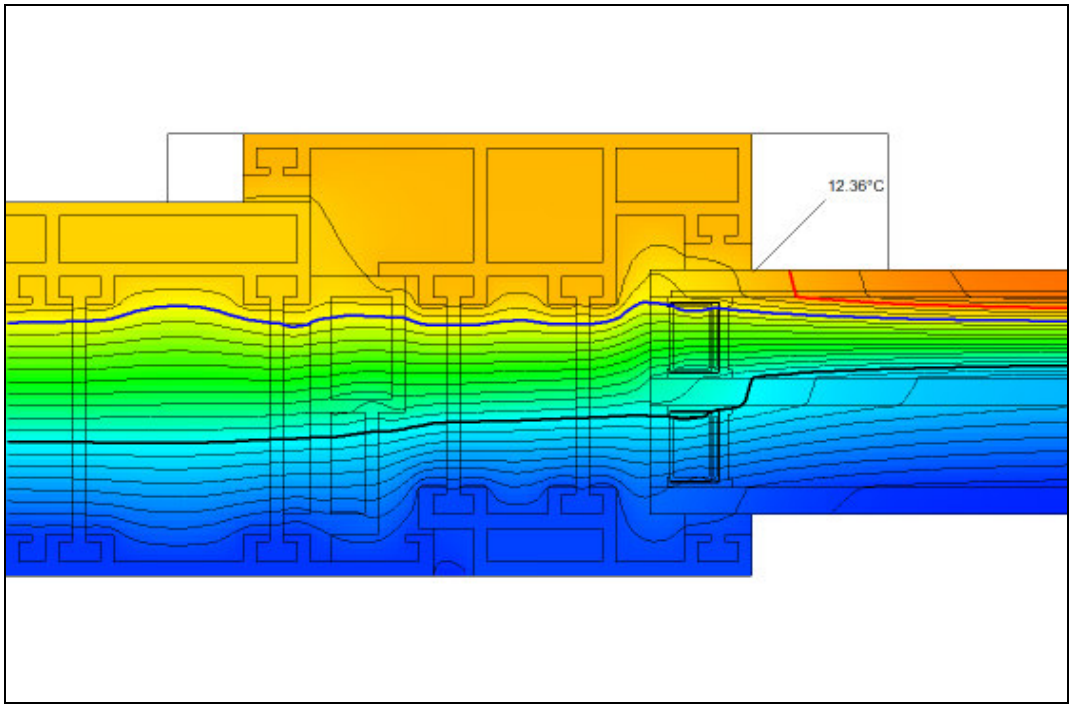
Report number: 060504-02

Date	October 24th 2006
Client	TruSeal Technologies 23150 Commerce Park Beachwood, Ohio 44122 Mr. Werner Lichtenberger
Application	• Thermal simulation of windows consisting of frame sections and insulating glass units with glass edge spacers ○ Calculation of the linear thermal transmittance Ψ of the spacers ○ Calculation of the internal surface temperature of the glass edge ○ Calculation of total U-value of windows U_w ○ Creating thermograms of the sections



Content:

The report contains 39 pages.

1. Foreword

TruSeal Technologies, Ohio, USA, mandated BAUWERK to simulate thermal performance of windows with frame sections, insulating glass units and glass edge spacers according to EN ISO 10077-1 and EN ISO 10077-2.

Geometry and material characteristics were provided by TruSeal. The results are only valid for the frames, glazing and spacer used for the simulation.

2. Normative references

- DIN EN ISO 10077-1:2000-11, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance – Part 1: Simplified method
- DIN EN ISO 10077-2:2003-12, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance – Part 2: Numerical method for frames
- EN ISO 10211-1:1995-11, Thermal bridges in building construction – Heat flows and surface temperatures – Part 1: General calculation methods
- EN ISO 10211-2:2001-06, Thermal bridges in building construction – Heat flows and surface temperatures – Part 2: Linear thermal bridges
- DIN EN 673:2003-06, Glass in building – Determination of thermal transmittance (U-value) – Calculation method

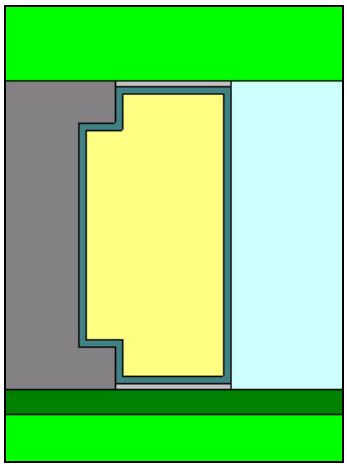
3. Subject

3.1 Glass edge spacers and sealing

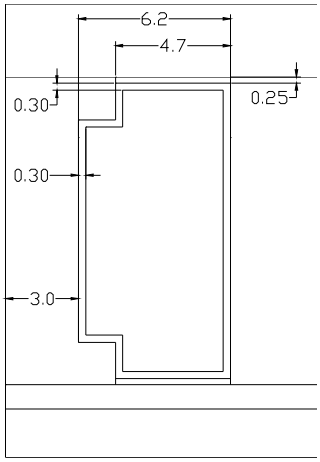
Below the materials, thermal characteristics of the materials and the geometry of the spacers are pictured and listed. Dimensions shown in the drawings are mm.

3.1.1 Aluminum (Dual Seal)

	material	thermal conductivity in W/mK
	aluminum 0,30 mm	160,000
	butyl	0,240
	polysulfide	0,400
	drying agent	0,130



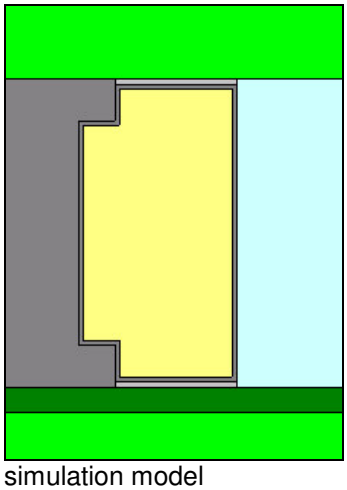
simulation model



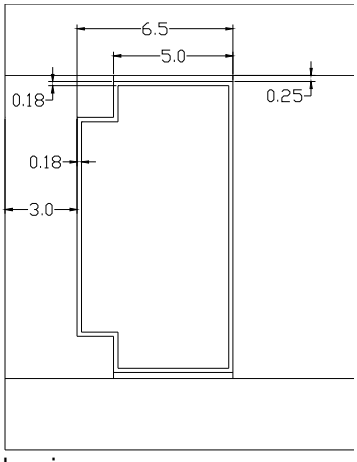
drawing

3.1.2 Stainless steel (Dual Seal)

	material	thermal conductivity in W/mK
	stainless steel 0,18 mm	17,000
	butyl	0,240
	polysulfide	0,400
	drying agent	0,130



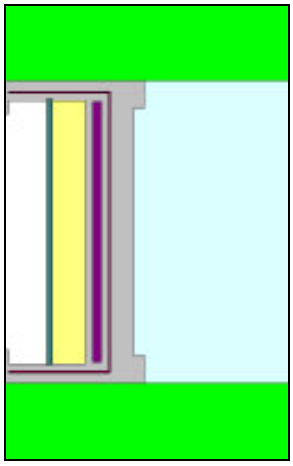
simulation model



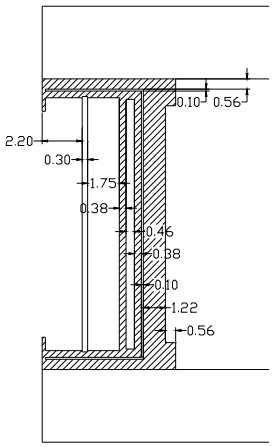
drawing

3.1.3 TruSeal, DuraSeal (Single Seal)

	material	thermal conductivity in W/mK
	aluminum 0,3 mm	160,000
	butyl	0,231
	polyethylene HD	0,520
	polypropylene	0,220
	still air cavity	according to DIN EN ISO 10077-2
	cavity linked to respective adjacent cavity	according to DIN EN ISO 10077-2



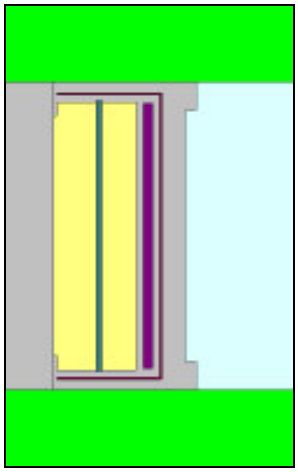
simulation model



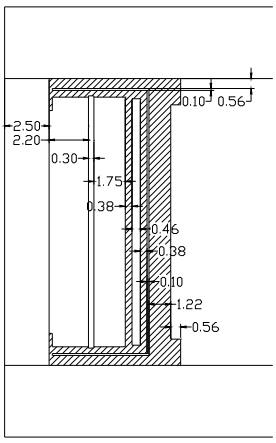
drawing

3.1.4 TruSeal, DuraSeal TDS (Dual Seal)

	material	thermal conductivity in W/mK
	aluminum 0,3 mm	160,000
	butyl	0,231
	polyethylene HD	0,520
	polypropylene	0,220
	still air cavity	according to DIN EN ISO 10077-2



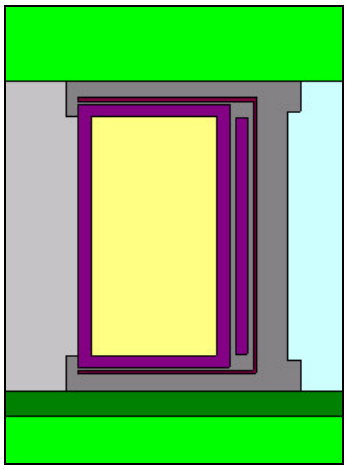
simulation model



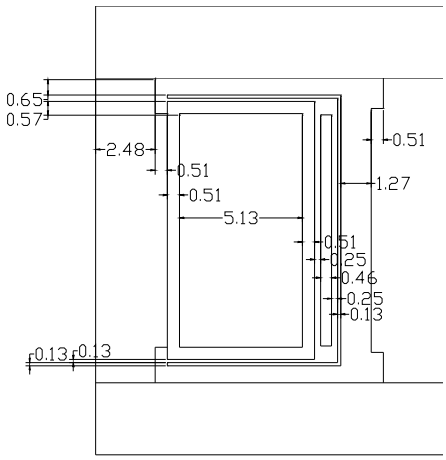
drawing

3.1.5 TruSeal, InsulEdge TDS (Dual Seal)

	material	thermal conductivity in W/mK
	butyl	0,240
	polyethylene HD	0,520
	polypropylene	0,220
	synthetic material InsulEdge	0,181
	still air cavity	according to DIN EN ISO 10077-2



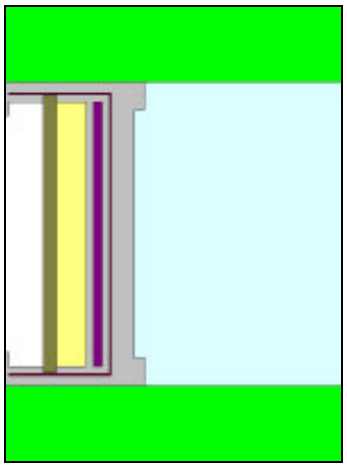
simulation model



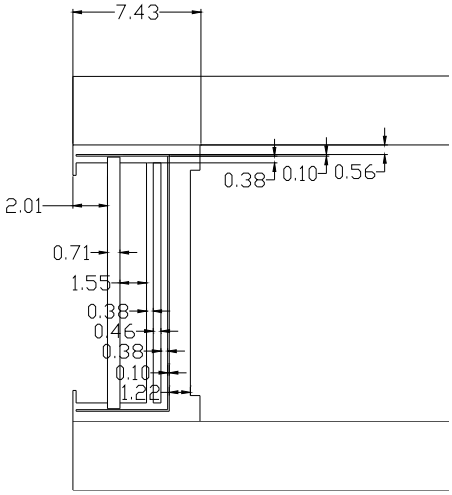
drawing

3.1.6 TruSeal, DuraLite (Single Seal)

	material	thermal conductivity in W/mK
	polycarbonate 0,71 mm	0,210
	butyl	0,231
	polyethylene HD	0,520
	polypropylene	0,220
	still air cavity	according to DIN EN ISO 10077-2
	cavity linked to respective adjacent cavity	according to DIN EN ISO 10077-2



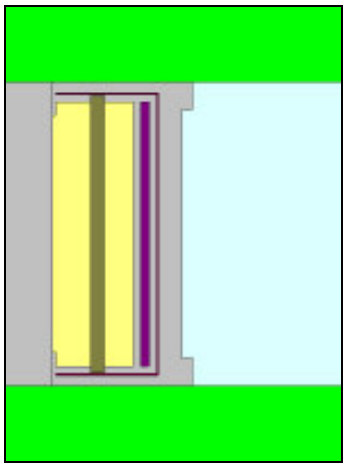
simulation model



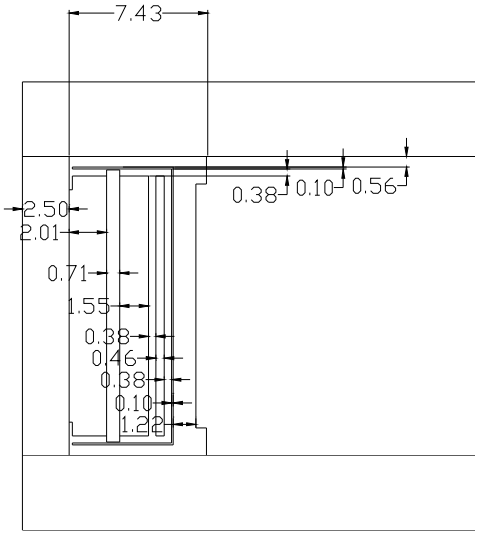
drawing

3.1.7 TruSeal, DuraLite TDS (Dual Seal)

	material	thermal conductivity in W/mK
	polycarbonate 0,71 mm	0,210
	butyl	0,231
	polyethylene HD	0,520
	polypropylene	0,220
	still air cavity	according to DIN EN ISO 10077-2



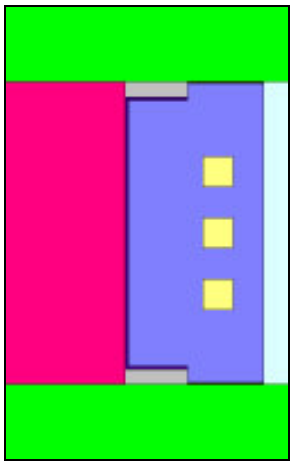
simulation model



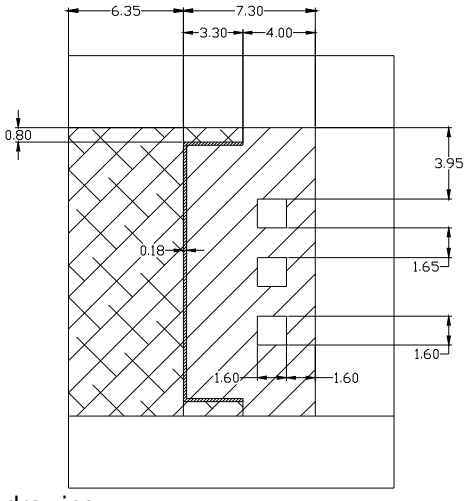
drawing

3.1.8 Edgetech, SuperSpacer Triseal

	material	thermal conductivity in W/mK
	metallized mylartape SuperSpacer 0,18 mm	1,100
	butyl	0,240
	pressure sensitive sealant	thermally not relevant
	synthetic material SuperSpacer (silicon foam)	0,168
	silicone	0,350
	still air cavity	according to DIN EN ISO 10077-2



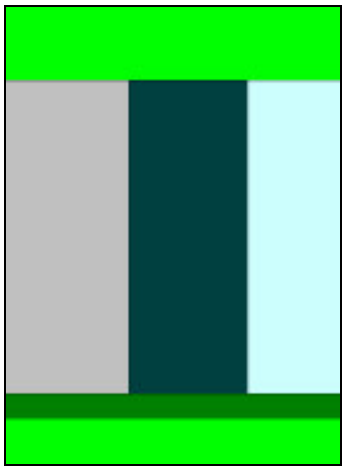
simulation model



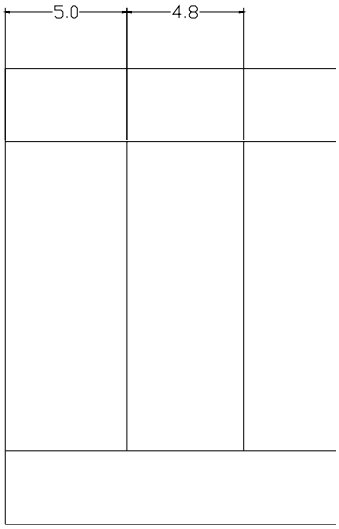
drawing

3.1.9 ADCO – Kömmerling, TPS Residential 4,8 mm (Dual Seal)

	material	thermal conductivity in W/mK
	butyl	0,240
	synthetic material TPS	0,285



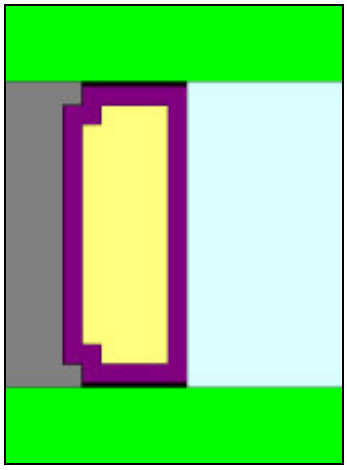
simulation model



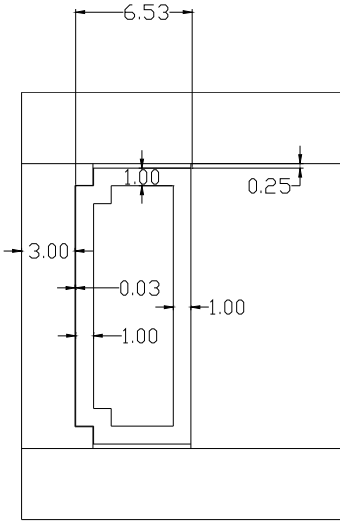
drawing

3.1.10 Saint-Gobain - Swisspacer (Dual Seal)

	material	thermal conductivity in W/mK
	aluminum 0,03 mm	160,000
	butyl	0,240
	polysulfide	0,400
	synthetic material	0,190
	drying agent	0,130



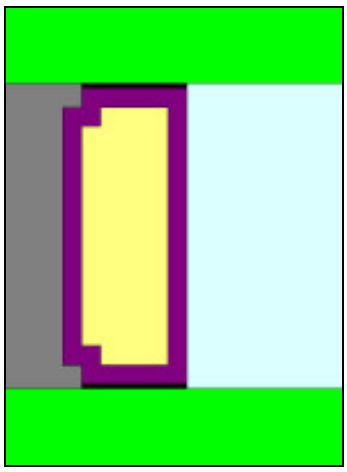
simulation model



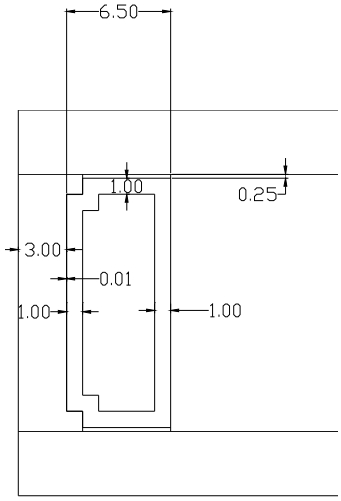
drawing

3.1.11 Saint-Gobain - SwisspacerV (Dual Seal)

	material	thermal conductivity in W/mK
	stainless steel 0,01 mm	15,000
	butyl	0,240
	polysulfide	0,400
	synthetic material	0,190
	drying agent	0,130



simulation model



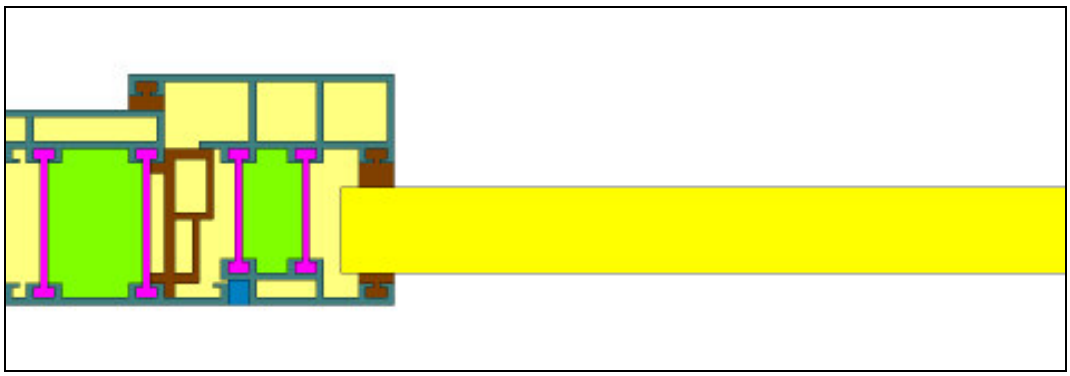
drawing

3.2 Frame section

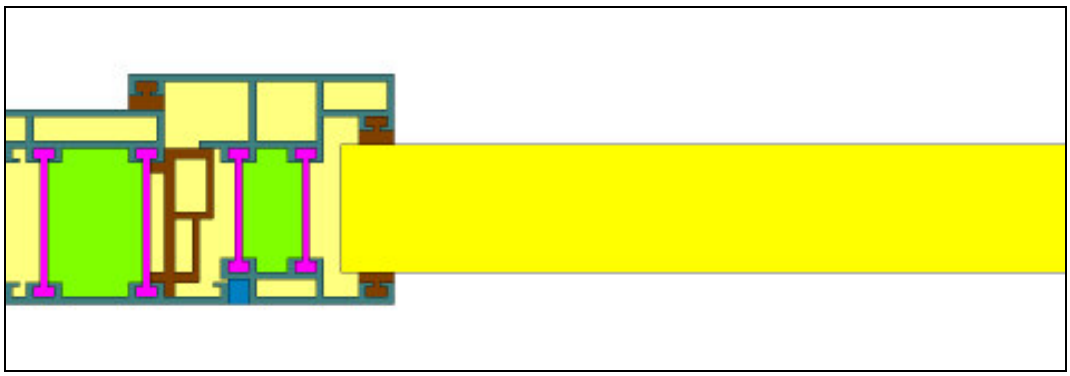
Below the geometry of the frame sections are pictured and listed. The materials and thermal characteristics of the materials are listed in capture 4.
The sections are taken from DIN EN ISO 10077-2 annex D.2 and partly modified.
Because of the varying thickness of the glass units (24 mm and 36 mm) the sections are also modified.
The aluminum section additionally is improved by insulating foams.

At the following graphics the internal side of the sections is up.

3.2.1 Aluminum section

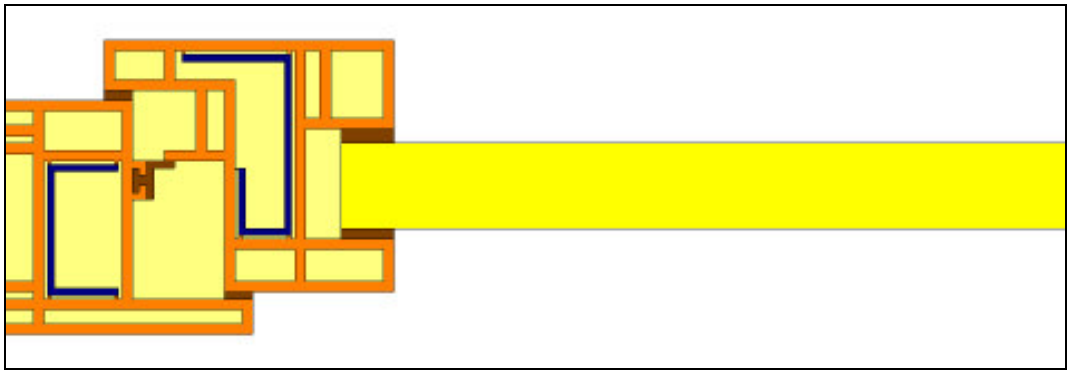


aluminum section with 24 mm glass, thermally broken
thickness frame section: 55 mm
thickness casement section: 65 mm
width of entire section : 110 mm
depth of glass in section: 15 mm
thermal transmission coefficient U_f: 2,0 W/m²K (2,025 W/m²K) according to DIN EN ISO 10077-2
thermal transmission coefficient U_f: 0,352 Btu/h ft² °F according to DIN EN ISO 10077-2

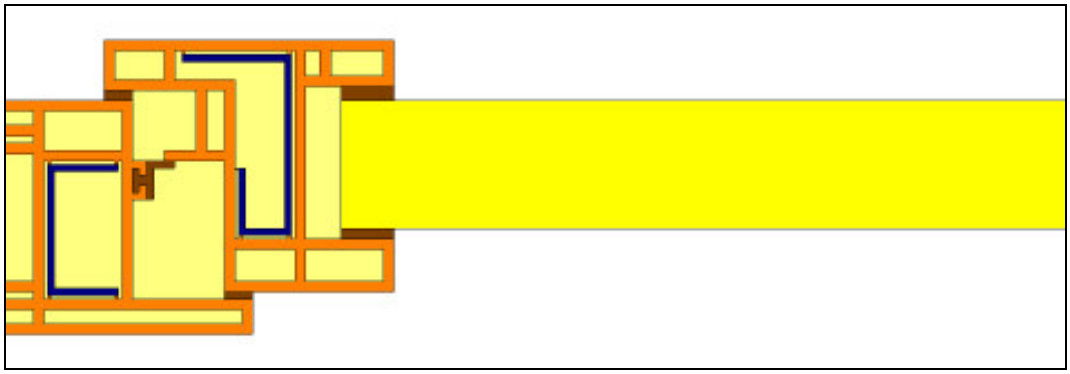


aluminum section with 36 mm glass, thermally broken
thickness frame section: 55 mm
thickness casement section: 65 mm
width of entire section : 110 mm
depth of glass in section: 15 mm
thermal transmission coefficient U_f: 2,0 W/m²K (1,998 W/m²K) according to DIN EN ISO 10077-2
thermal transmission coefficient U_f: 0,352 Btu/h ft² °F according to DIN EN ISO 10077-2

3.2.2 Vinyl section

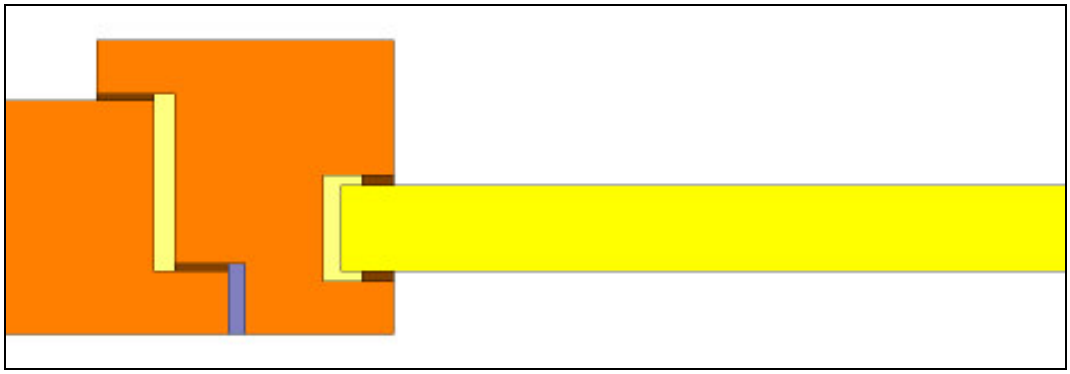


vinyl section with 24 mm glass
thickness frame section: 66 mm
thickness casement section: 71 mm
width of entire section : 110 mm
depth of glass in section: 15 mm
thermal transmission coefficient U_f: 1,9 W/m²K (1,893 W/m²K) according to DIN EN ISO 10077-2
thermal transmission coefficient U_f: 0,335 Btu/h ft² °F according to DIN EN ISO 10077-2

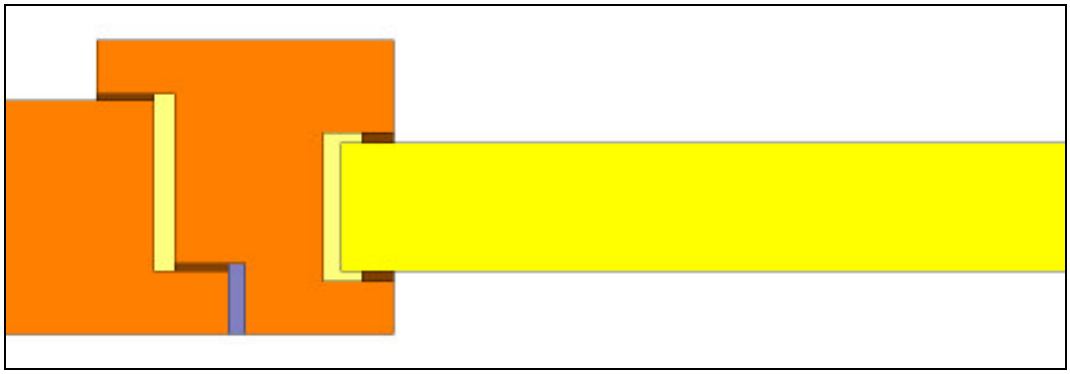


vinyl section with 36 mm glass
thickness frame section: 66 mm
thickness casement section: 71 mm
width of entire section : 110 mm
depth of glass in section: 15 mm
thermal transmission coefficient U_f: 1,9 W/m²K (1,879 W/m²K) according to DIN EN ISO 10077-2
thermal transmission coefficient U_f: 0,335 Btu/h ft² °F according to DIN EN ISO 10077-2

3.2.3 Wood section



wood section with 24 mm glass
thickness frame section: 66 mm
thickness casement section: 83 mm
width of entire section : 110 mm
depth of glass in section: 15 mm
thermal transmission coefficient U_f: 1,3 W/m²K (1,345 W/m²K) according to DIN EN ISO 10077-2
thermal transmission coefficient U_f: 0,229 Btu/h ft² °F according to DIN EN ISO 10077-2



wood section with 36 mm glass
thickness frame section: 66 mm
thickness casement section: 83 mm
width of entire section : 110 mm
depth of glass in section: 15 mm
thermal transmission coefficient U_f: 1,3 W/m²K (1,308 W/m²K) according to DIN EN ISO 10077-2
thermal transmission coefficient U_f: 0,229 Btu/h ft² °F according to DIN EN ISO 10077-2

3.3 Insulating glass unit

3.3.1 Double glazing 1 (clear – air – clear)

Double insulating glass unit with following assembly (from external to internal):

layer 1:	4 mm clear float glass
layer 2:	16 mm air cavity
layer 3:	4 mm clear float glass

total thickness: 24 mm

thermal transmission coefficient U_g: 2,7 W/m²K (2,730 W/m²K) according to DIN EN 673
thermal transmission coefficient U_g: 0,476 Btu/h ft² °F according to DIN EN 673

3.3.2 Double glazing 2 (clear – air – low-E)

Double insulating glass unit with following assembly (from external to internal):

layer 1:	4 mm clear float glass
layer 2:	16 mm air cavity
layer 3:	4 mm coated float glass (low-E 4%)

total thickness: 24 mm

thermal transmission coefficient U_g: 1,4 W/m²K (1,406 W/m²K) according to DIN EN 673
thermal transmission coefficient U_g: 0,247 Btu/h ft² °F according to DIN EN 673

3.3.3 Double glazing 3 (clear – argon – low-E)

Double insulating glass unit with following assembly (from external to internal):

layer 1:	4 mm clear float glass
layer 2:	16 mm argon cavity
layer 3:	4 mm coated float glass (low-E 4%)

total thickness: 24 mm

thermal transmission coefficient U_g: 1,1 W/m²K (1,105 W/m²K) according to DIN EN 673
thermal transmission coefficient U_g: 0,194 Btu/h ft² °F according to DIN EN 673

3.3.4 Triple glazing 1 (clear – air – clear – argon – low-E)

Double insulating glass unit with following assembly (from external to internal):

layer 1:	4 mm clear float glass
layer 2:	12 mm air cavity
layer 3:	4 mm clear float glass
layer 4:	12 mm argon cavity
layer 5:	4 mm coated float glass (low-E 4%)

total thickness: 36 mm

thermal transmission coefficient U_g: 1,0 W/m²K (1,002 W/m²K) according to DIN EN 673
thermal transmission coefficient U_g: 0,176 Btu/h ft² °F according to DIN EN 673

4. Boundary conditions and thermal characteristics of materials

The following thermal characteristics of frame materials according to DIN EN ISO 10077-2 were used:

	material	thermal conductivity in W/mK
frame section		
	aluminum	160,000
	wood	0,130
	vinyl	0,170
	sealing material (EPDM)	0,250
	polyamide 25% glass fiber reinforced	0,300
	polyurethane (insulation in aluminum section)	0,035
	air cavity	according to DIN EN ISO 10077-2
	slightly ventilated air cavity	according to DIN EN ISO 10077-2
glass		
	float glass	1,000
	low-E-coating	1,000
	argon cavity	according to DIN EN 673
	air cavity	according to DIN EN 673

The following boundary conditions were used for the calculation of the thermal transmission coefficients and the linear thermal transmittance according to DIN EN ISO 10077-2:

position	internal R_{si} (m²K/W) / T (°C)	external R_{se} (m²K/W) / T (°C)
general	0,13 / 20	0,04 / 0
corners	0,20 / 20	

The following boundary conditions were used for the calculation of isothermal lines and surface temperatures:

position	internal R_{si} (m²K/W) / T (°C)	external R_{se} (m²K/W) / T (°C)
general	0,13 / 20	0,04 / -10
corners	0,20 / 20	

5. Realization

The simulation was made according to DIN EN ISO 10077-2:2003 using the software WinIso2D, release 4.0. WinIso2D calculates two-dimensional heat flow and moisture flow using the Finite Element Method.

Firstly the thermal transmission coefficient U_f of the frame section was calculated using an insulating panel instead the actual glazing according to DIN EN ISO 10077-2.

U_f is defined by:

$$U_f = \frac{L^{2D} - U_p * l_p}{l_f}$$

with
L_{2D}: two-dimensional thermal conductance or thermal coupling coefficient in W/mK
U_p: thermal transmission coefficient of the insulating panel in W/m²K
U_f: thermal transmission coefficient of the frame section in W/m²K
l_p: visible width of the insulating panel in m
l_f: projected width of the frame section in m

Afterwards instead of the insulating panel the actual glazing was placed in the simulation model with the original IGU spacer and the linear thermal transmittance Ψ was calculated.

Ψ is defined by:

$$\Psi = L^{2D} - U_g * l_g - U_f * l_f$$

with
Ψ: linear thermal transmittance in W/mK
L_{2D}: two-dimensional thermal conductance or thermal coupling coefficient in W/mK
U_g: thermal transmission coefficient of the glazing in W/m²K
U_f: thermal transmission coefficient of the frame section in W/m²K
l_g: visible width of the glazing in m
l_f: projected width of the frame section in m

At the simulation model now temperatures at the glass surface can be read. The temperature were read at the point of intersection between frame section and glazing and in a distance from this point of 0,5", 1", 1,5", 2" and 2,5".

With the thermal transmittance coefficient of the frame and the glazing and the linear thermal transmittance of the spacer as well as the projected areas of frame section and glazing and the length of the visible glass edge the thermal transmittance coefficient U_W of a entire window with a width of 1,23 m and a height of 1,48 m were calculated.

U_W is defined by:

$$U_W = \frac{U_f * A_f + U_g * A_g + \Psi * l_g}{A_{w(total)}}$$

with
U_w: thermal transmission coefficient of the window in W/m²K
U_g: thermal transmission coefficient of the glazing in W/m²K
U_f: thermal transmission coefficient of the frame section in W/m²K
Ψ: linear thermal transmittance in W/mK
l_g: visible width of the edge of the glazing in m
A_f: projected width of the frame section in m²
A_g: visible area of the glazing in m²
A_g: total area of the window in m²

6. Results

6.1 Aluminum section

6.1.1 Double glazing 1 (clear – air – clear)

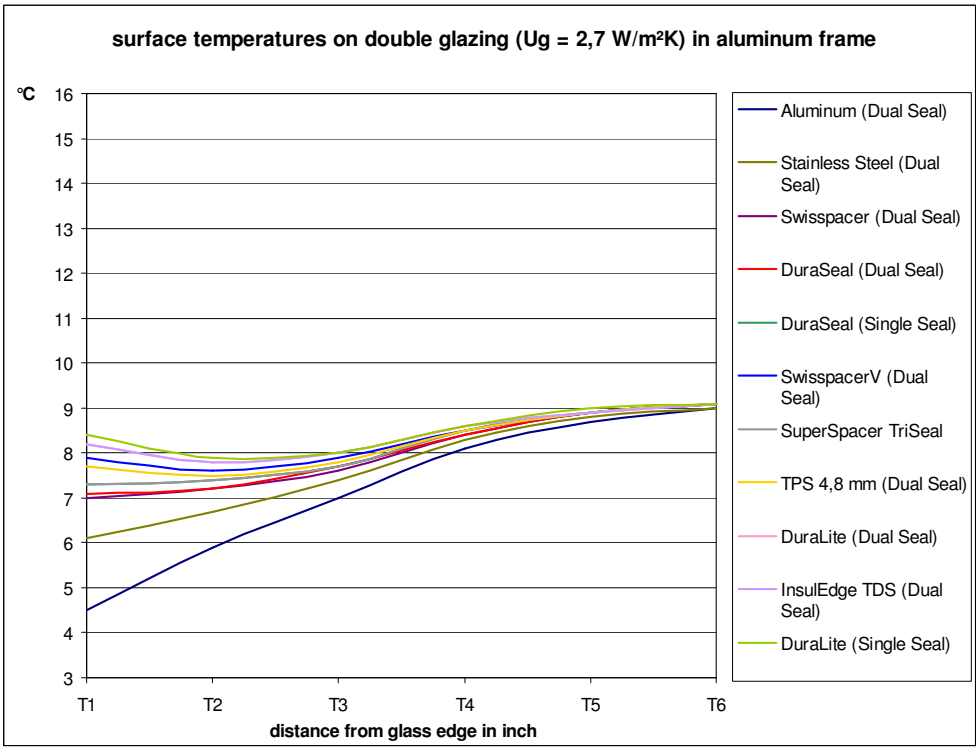
all results (tabularly)

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Aluminum	Cl-Air-Cl (2,7)	Aluminum (Dual Seal)	2,0	2,7	0,078	1,23	1,48	1,82	0,55	1,27	4,54	2,71	4,5	5,9	7,0	8,1	8,7	9,0
2	Aluminum	Cl-Air-Cl (2,7)	Stainless Steel (Dual Seal)	2,0	2,7	0,053	1,23	1,48	1,82	0,55	1,27	4,54	2,65	6,1	6,7	7,4	8,3	8,8	9,0
3	Aluminum	Cl-Air-Cl (2,7)	Swisspacer (Dual Seal)	2,0	2,7	0,043	1,23	1,48	1,82	0,55	1,27	4,54	2,62	7,0	7,2	7,6	8,4	8,9	9,1
4	Aluminum	Cl-Air-Cl (2,7)	DuraSeal TDS (Dual Seal)	2,0	2,7	0,040	1,23	1,48	1,82	0,55	1,27	4,54	2,62	7,1	7,2	7,7	8,4	8,9	9,1
5	Aluminum	Cl-Air-Cl (2,7)	DuraSeal (Single Seal)	2,0	2,7	0,039	1,23	1,48	1,82	0,55	1,27	4,54	2,62	7,3	7,4	7,7	8,5	8,9	9,1
6	Aluminum	Cl-Air-Cl (2,7)	SuperSpacer TriSeal	2,0	2,7	0,034	1,23	1,48	1,82	0,55	1,27	4,54	2,61	7,3	7,4	7,7	8,5	8,9	9,1
7	Aluminum	Cl-Air-Cl (2,7)	TPS 4,8 mm (Dual Seal)	2,0	2,7	0,029	1,23	1,48	1,82	0,55	1,27	4,54	2,59	7,7	7,5	7,8	8,5	8,9	9,1
8	Aluminum	Cl-Air-Cl (2,7)	SwisspacerV (Dual Seal)	2,0	2,7	0,028	1,23	1,48	1,82	0,55	1,27	4,54	2,59	7,9	7,6	7,9	8,5	8,9	9,1
9	Aluminum	Cl-Air-Cl (2,7)	DuraLite (Dual Seal)	2,0	2,7	0,021	1,23	1,48	1,82	0,55	1,27	4,54	2,57	8,2	7,8	8,0	8,6	8,9	9,1
10	Aluminum	Cl-Air-Cl (2,7)	InsulEdge TDS (Dual Seal)	2,0	2,7	0,020	1,23	1,48	1,82	0,55	1,27	4,54	2,57	8,2	7,8	8,0	8,6	8,9	9,1
11	Aluminum	Cl-Air-Cl (2,7)	DuraLite (Single Seal)	2,0	2,7	0,020	1,23	1,48	1,82	0,55	1,27	4,54	2,57	8,4	7,9	8,0	8,6	9,0	9,1

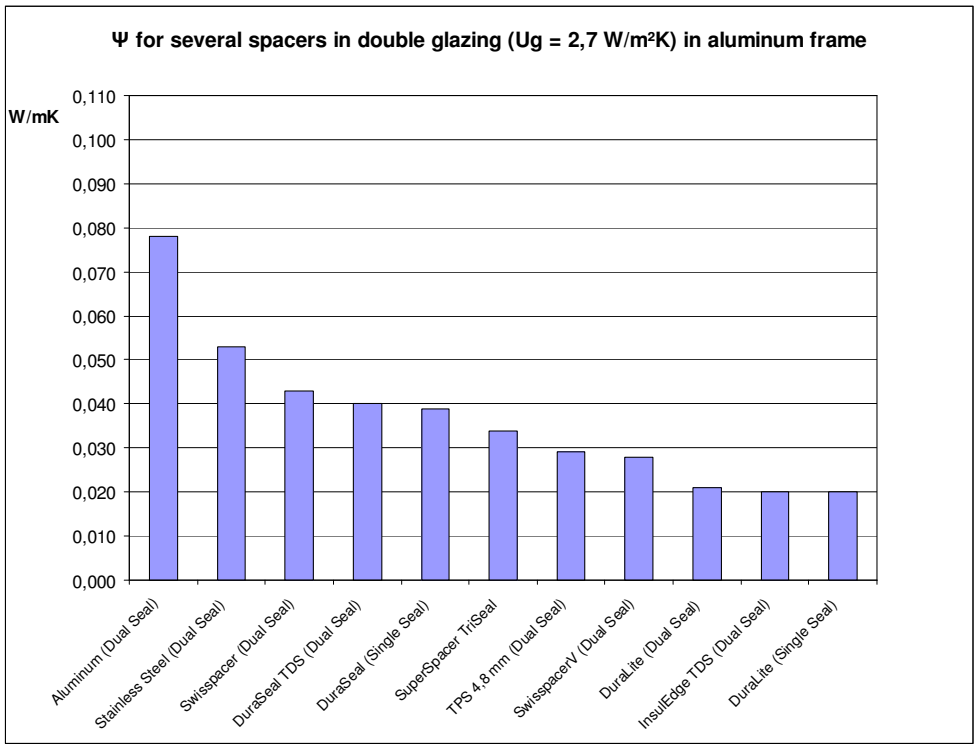
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Aluminum	Cl-Air-Cl (2,7)	Aluminum (Dual Seal)	0,352	0,476	0,0451	4,04	4,86	19,59	5,92	13,67	14,89	0,478	40,1	42,6	44,6	46,6	47,7	48,2
2	Aluminum	Cl-Air-Cl (2,7)	Stainless Steel (Dual Seal)	0,352	0,476	0,0306	4,04	4,86	19,59	5,92	13,67	14,89	0,467	43,0	44,1	45,3	46,9	47,8	48,2
3	Aluminum	Cl-Air-Cl (2,7)	Swisspacer (Dual Seal)	0,352	0,476	0,0249	4,04	4,86	19,59	5,92	13,67	14,89	0,462	44,6	45,0	45,7	47,1	48,0	48,4
4	Aluminum	Cl-Air-Cl (2,7)	DuraSeal TDS (Dual Seal)	0,352	0,476	0,0231	4,04	4,86	19,59	5,92	13,67	14,89	0,462	44,8	45,0	45,9	47,1	48,0	48,4
5	Aluminum	Cl-Air-Cl (2,7)	DuraSeal (Single Seal)	0,352	0,476	0,0225	4,04	4,86	19,59	5,92	13,67	14,89	0,462	45,1	45,3	45,9	47,3	48,0	48,4
6	Aluminum	Cl-Air-Cl (2,7)	SuperSpacer TriSeal	0,352	0,476	0,0197	4,04	4,86	19,59	5,92	13,67	14,89	0,460	45,1	45,3	45,9	47,3	48,0	48,4
7	Aluminum	Cl-Air-Cl (2,7)	TPS 4,8 mm (Dual Seal)	0,352	0,476	0,0168	4,04	4,86	19,59	5,92	13,67	14,89	0,456	45,9	45,5	46,0	47,3	48,0	48,4
8	Aluminum	Cl-Air-Cl (2,7)	SwisspacerV (Dual Seal)	0,352	0,476	0,0162	4,04	4,86	19,59	5,92	13,67	14,89	0,456	46,2	45,7	46,2	47,3	48,0	48,4
9	Aluminum	Cl-Air-Cl (2,7)	DuraLite (Dual Seal)	0,352	0,476	0,0121	4,04	4,86	19,59	5,92	13,67	14,89	0,453	46,8	46,0	46,4	47,5	48,0	48,4
10	Aluminum	Cl-Air-Cl (2,7)	InsulEdge TDS (Dual Seal)	0,352	0,476	0,0116	4,04	4,86	19,59	5,92	13,67	14,89	0,453	46,8	46,0	46,4	47,5	48,0	48,4
11	Aluminum	Cl-Air-Cl (2,7)	DuraLite (Single Seal)	0,352	0,476	0,0116	4,04	4,86	19,59	5,92	13,67	14,89	0,453	47,1	46,2	46,4	47,5	48,2	48,4

results in charts

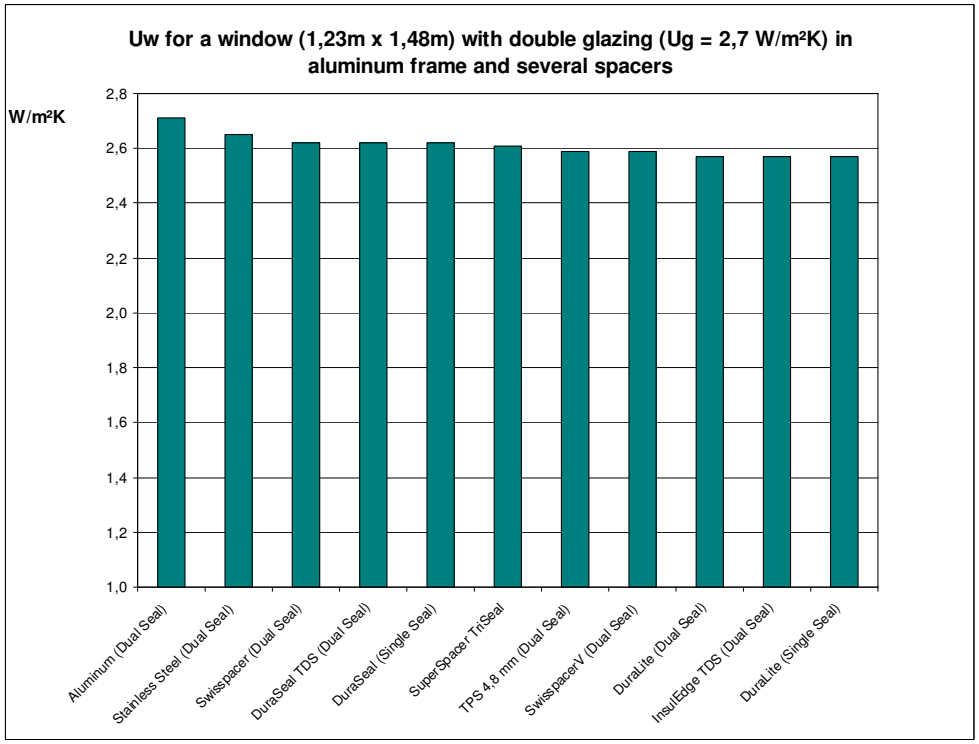
surface temperatures



Ψ-value of the spacer



U-value of the window

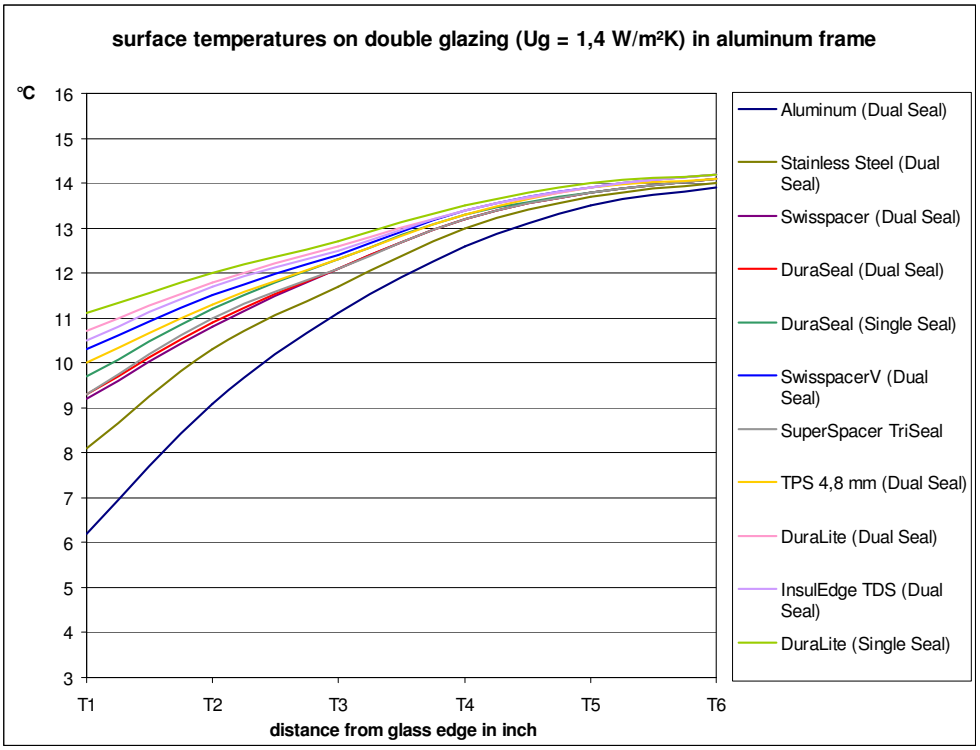


6.1.2 Double glazing 2 (clear – air – low-E)
all results (tabularly)

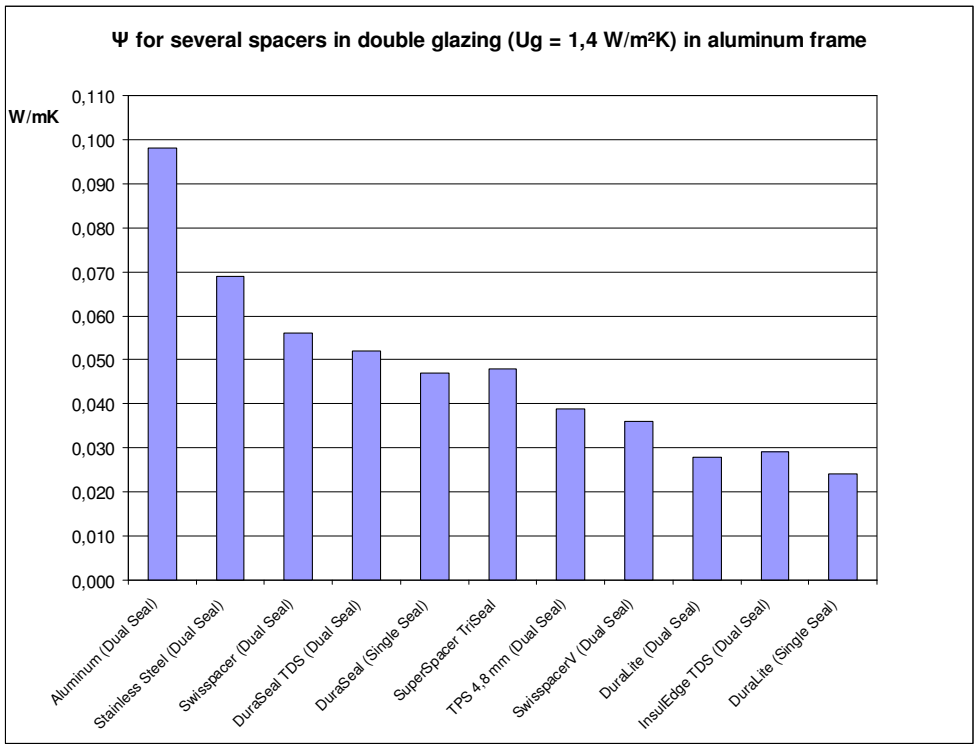
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Aluminum	CI-Air-LowE (1,4)	Aluminum (Dual Seal)	2,0	1,4	**0,098**	1,23	1,48	1,82	0,55	1,27	4,54	**1,84**	6,2	9,1	11,1	12,6	13,5	13,9
2	Aluminum	CI-Air-LowE (1,4)	Stainless Steel (Dual Seal)	2,0	1,4	**0,069**	1,23	1,48	1,82	0,55	1,27	4,54	**1,77**	8,1	10,3	11,7	13,0	13,7	14,0
3	Aluminum	CI-Air-LowE (1,4)	Swisspacer (Dual Seal)	2,0	1,4	**0,056**	1,23	1,48	1,82	0,55	1,27	4,54	**1,73**	9,2	10,8	12,1	13,2	13,8	14,1
4	Aluminum	CI-Air-LowE (1,4)	DuraSeal TDS (Dual Seal)	2,0	1,4	**0,052**	1,23	1,48	1,82	0,55	1,27	4,54	**1,73**	9,3	10,9	12,1	13,2	13,8	14,1
5	Aluminum	CI-Air-LowE (1,4)	DuraSeal (Single Seal)	2,0	1,4	**0,047**	1,23	1,48	1,82	0,55	1,27	4,54	**1,71**	9,7	11,2	12,3	13,3	13,8	14,1
6	Aluminum	CI-Air-LowE (1,4)	SuperSpacer TriSeal	2,0	1,4	**0,048**	1,23	1,48	1,82	0,55	1,27	4,54	**1,72**	9,3	11,0	12,1	13,2	13,8	14,1
7	Aluminum	CI-Air-LowE (1,4)	TPS 4,8 mm (Dual Seal)	2,0	1,4	**0,039**	1,23	1,48	1,82	0,55	1,27	4,54	**1,69**	10,0	11,3	12,3	13,3	13,9	14,1
8	Aluminum	CI-Air-LowE (1,4)	SwisspacerV (Dual Seal)	2,0	1,4	**0,036**	1,23	1,48	1,82	0,55	1,27	4,54	**1,68**	10,3	11,5	12,4	13,4	13,9	14,2
9	Aluminum	CI-Air-LowE (1,4)	DuraLite (Dual Seal)	2,0	1,4	**0,028**	1,23	1,48	1,82	0,55	1,27	4,54	**1,66**	10,7	11,8	12,6	13,4	13,9	14,2
10	Aluminum	CI-Air-LowE (1,4)	InsulEdge TDS (Dual Seal)	2,0	1,4	**0,029**	1,23	1,48	1,82	0,55	1,27	4,54	**1,67**	10,5	11,7	12,5	13,4	13,9	14,2
11	Aluminum	CI-Air-LowE (1,4)	DuraLite (Single Seal)	2,0	1,4	**0,024**	1,23	1,48	1,82	0,55	1,27	4,54	**1,65**	11,1	12,0	12,7	13,5	14,0	14,2

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Aluminum	CI-Air-LowE (1,4)	Aluminum (Dual Seal)	0,352	0,247	**0,0567**	4,04	4,86	19,59	5,92	13,67	14,89	**0,324**	43,2	48,4	52,0	54,7	56,3	57,0
2	Aluminum	CI-Air-LowE (1,4)	Stainless Steel (Dual Seal)	0,352	0,247	**0,0399**	4,04	4,86	19,59	5,92	13,67	14,89	**0,312**	46,6	50,5	53,1	55,4	56,7	57,2
3	Aluminum	CI-Air-LowE (1,4)	Swisspacer (Dual Seal)	0,352	0,247	**0,0324**	4,04	4,86	19,59	5,92	13,67	14,89	**0,305**	48,6	51,4	53,8	55,8	56,8	57,4
4	Aluminum	CI-Air-LowE (1,4)	DuraSeal TDS (Dual Seal)	0,352	0,247	**0,0301**	4,04	4,86	19,59	5,92	13,67	14,89	**0,305**	48,7	51,6	53,8	55,8	56,8	57,4
5	Aluminum	CI-Air-LowE (1,4)	DuraSeal (Single Seal)	0,352	0,247	**0,0272**	4,04	4,86	19,59	5,92	13,67	14,89	**0,301**	49,5	52,2	54,1	55,9	56,8	57,4
6	Aluminum	CI-Air-LowE (1,4)	SuperSpacer TriSeal	0,352	0,247	**0,0278**	4,04	4,86	19,59	5,92	13,67	14,89	**0,303**	48,7	51,8	53,8	55,8	56,8	57,4
7	Aluminum	CI-Air-LowE (1,4)	TPS 4,8 mm (Dual Seal)	0,352	0,247	**0,0225**	4,04	4,86	19,59	5,92	13,67	14,89	**0,298**	50,0	52,3	54,1	55,9	57,0	57,4
8	Aluminum	CI-Air-LowE (1,4)	SwisspacerV (Dual Seal)	0,352	0,247	**0,0208**	4,04	4,86	19,59	5,92	13,67	14,89	**0,296**	50,5	52,7	54,3	56,1	57,0	57,6
9	Aluminum	CI-Air-LowE (1,4)	DuraLite (Dual Seal)	0,352	0,247	**0,0162**	4,04	4,86	19,59	5,92	13,67	14,89	**0,293**	51,3	53,2	54,7	56,1	57,0	57,6
10	Aluminum	CI-Air-LowE (1,4)	InsulEdge TDS (Dual Seal)	0,352	0,247	**0,0168**	4,04	4,86	19,59	5,92	13,67	14,89	**0,294**	50,9	53,1	54,5	56,1	57,0	57,6
11	Aluminum	CI-Air-LowE (1,4)	DuraLite (Single Seal)	0,352	0,247	**0,0139**	4,04	4,86	19,59	5,92	13,67	14,89	**0,291**	52,0	53,6	54,9	56,3	57,2	57,6

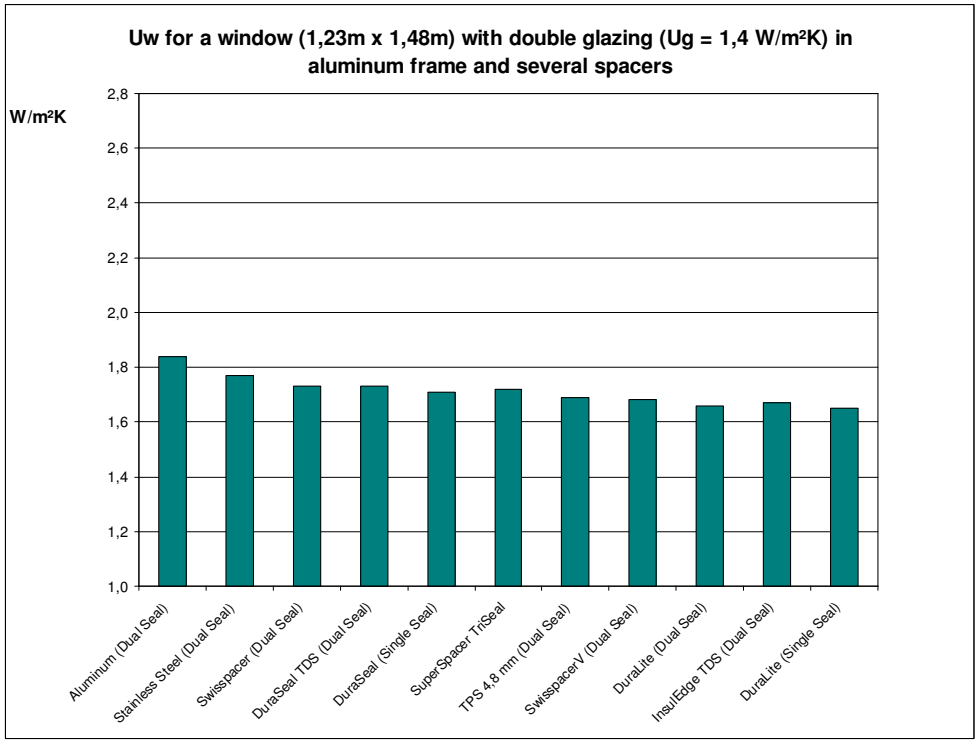
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

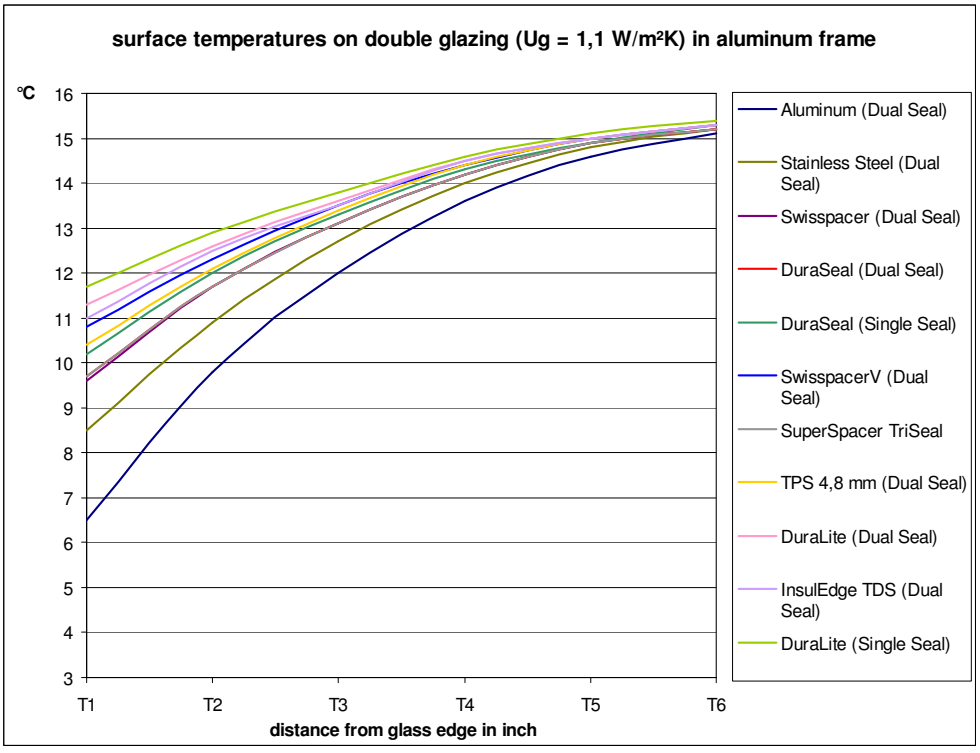


6.1.3 Double glazing 3 (clear – argon – low-E)
all results (tabularly)

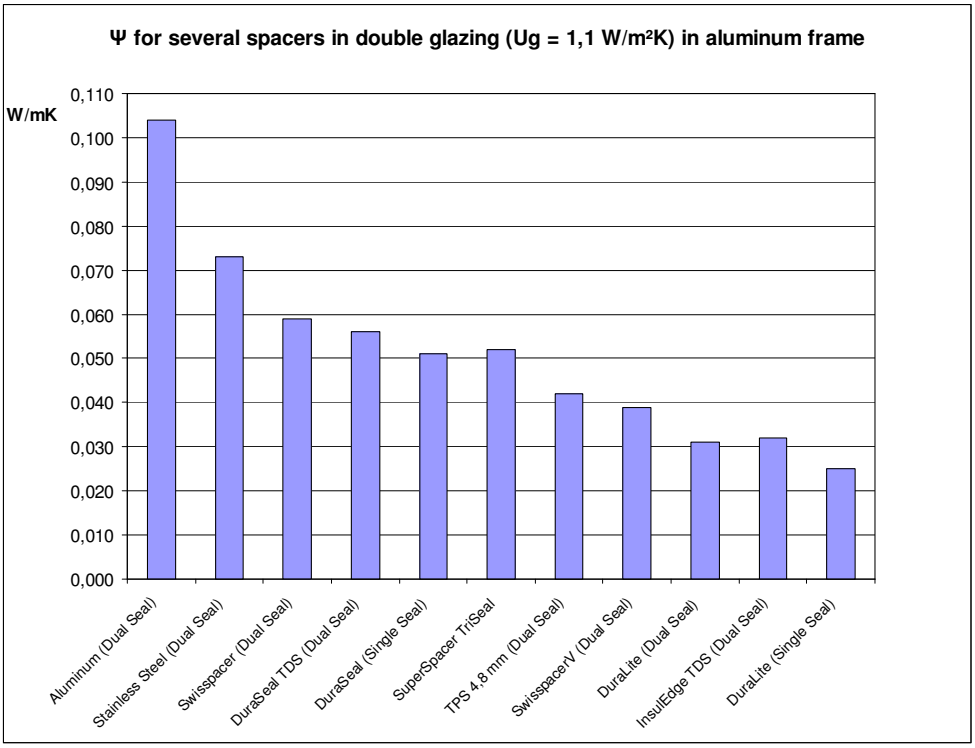
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Aluminum	Cl-Ar-LowE (1,1)	Aluminum (Dual Seal)	2,0	1,1	**0,104**	1,23	1,48	1,82	0,55	1,27	4,54	**1,64**	6,5	9,8	12,0	13,6	14,6	15,1
2	Aluminum	Cl-Ar-LowE (1,1)	Stainless Steel (Dual Seal)	2,0	1,1	**0,073**	1,23	1,48	1,82	0,55	1,27	4,54	**1,57**	8,5	10,9	12,7	14,0	14,8	15,2
3	Aluminum	Cl-Ar-LowE (1,1)	Swisspacer (Dual Seal)	2,0	1,1	**0,059**	1,23	1,48	1,82	0,55	1,27	4,54	**1,53**	9,6	11,7	13,1	14,2	14,9	15,2
4	Aluminum	Cl-Ar-LowE (1,1)	DuraSeal TDS (Dual Seal)	2,0	1,1	**0,056**	1,23	1,48	1,82	0,55	1,27	4,54	**1,52**	9,7	11,7	13,1	14,2	14,9	15,2
5	Aluminum	Cl-Ar-LowE (1,1)	DuraSeal (Single Seal)	2,0	1,1	**0,051**	1,23	1,48	1,82	0,55	1,27	4,54	**1,51**	10,2	12,0	13,3	14,3	14,9	15,3
6	Aluminum	Cl-Ar-LowE (1,1)	SuperSpacer TriSeal	2,0	1,1	**0,052**	1,23	1,48	1,82	0,55	1,27	4,54	**1,51**	9,7	11,7	13,1	14,2	14,9	15,2
7	Aluminum	Cl-Ar-LowE (1,1)	TPS 4,8 mm (Dual Seal)	2,0	1,1	**0,042**	1,23	1,48	1,82	0,55	1,27	4,54	**1,49**	10,4	12,1	13,4	14,4	15,0	15,3
8	Aluminum	Cl-Ar-LowE (1,1)	SwisspacerV (Dual Seal)	2,0	1,1	**0,039**	1,23	1,48	1,82	0,55	1,27	4,54	**1,48**	10,8	12,3	13,5	14,4	15,0	15,3
9	Aluminum	Cl-Ar-LowE (1,1)	DuraLite (Dual Seal)	2,0	1,1	**0,031**	1,23	1,48	1,82	0,55	1,27	4,54	**1,46**	11,3	12,6	13,6	14,5	15,0	15,3
10	Aluminum	Cl-Ar-LowE (1,1)	InsulEdge TDS (Dual Seal)	2,0	1,1	**0,032**	1,23	1,48	1,82	0,55	1,27	4,54	**1,47**	11,0	12,5	13,5	14,5	15,0	15,3
11	Aluminum	Cl-Ar-LowE (1,1)	DuraLite (Single Seal)	2,0	1,1	**0,025**	1,23	1,48	1,82	0,55	1,27	4,54	**1,44**	11,7	12,9	13,8	14,6	15,1	15,4

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Aluminum	Cl-Ar-LowE (1,1)	Aluminum (Dual Seal)	0,352	0,194	**0,0601**	4,04	4,86	19,59	5,92	13,67	14,89	**0,289**	43,7	49,6	53,6	56,5	58,3	59,2
2	Aluminum	Cl-Ar-LowE (1,1)	Stainless Steel (Dual Seal)	0,352	0,194	**0,0422**	4,04	4,86	19,59	5,92	13,67	14,89	**0,277**	47,3	51,6	54,9	57,2	58,6	59,4
3	Aluminum	Cl-Ar-LowE (1,1)	Swisspacer (Dual Seal)	0,352	0,194	**0,0341**	4,04	4,86	19,59	5,92	13,67	14,89	**0,270**	49,3	53,1	55,6	57,6	58,8	59,4
4	Aluminum	Cl-Ar-LowE (1,1)	DuraSeal TDS (Dual Seal)	0,352	0,194	**0,0324**	4,04	4,86	19,59	5,92	13,67	14,89	**0,268**	49,5	53,1	55,6	57,6	58,8	59,4
5	Aluminum	Cl-Ar-LowE (1,1)	DuraSeal (Single Seal)	0,352	0,194	**0,0295**	4,04	4,86	19,59	5,92	13,67	14,89	**0,266**	50,4	53,6	55,9	57,7	58,8	59,5
6	Aluminum	Cl-Ar-LowE (1,1)	SuperSpacer TriSeal	0,352	0,194	**0,0301**	4,04	4,86	19,59	5,92	13,67	14,89	**0,266**	49,5	53,1	55,6	57,6	58,8	59,4
7	Aluminum	Cl-Ar-LowE (1,1)	TPS 4,8 mm (Dual Seal)	0,352	0,194	**0,0243**	4,04	4,86	19,59	5,92	13,67	14,89	**0,263**	50,7	53,8	56,1	57,9	59,0	59,5
8	Aluminum	Cl-Ar-LowE (1,1)	SwisspacerV (Dual Seal)	0,352	0,194	**0,0225**	4,04	4,86	19,59	5,92	13,67	14,89	**0,261**	51,4	54,1	56,3	57,9	59,0	59,5
9	Aluminum	Cl-Ar-LowE (1,1)	DuraLite (Dual Seal)	0,352	0,194	**0,0179**	4,04	4,86	19,59	5,92	13,67	14,89	**0,257**	52,3	54,7	56,5	58,1	59,0	59,5
10	Aluminum	Cl-Ar-LowE (1,1)	InsulEdge TDS (Dual Seal)	0,352	0,194	**0,0185**	4,04	4,86	19,59	5,92	13,67	14,89	**0,259**	51,8	54,5	56,3	58,1	59,0	59,5
11	Aluminum	Cl-Ar-LowE (1,1)	DuraLite (Single Seal)	0,352	0,194	**0,0145**	4,04	4,86	19,59	5,92	13,67	14,89	**0,254**	53,1	55,2	56,8	58,3	59,2	59,7

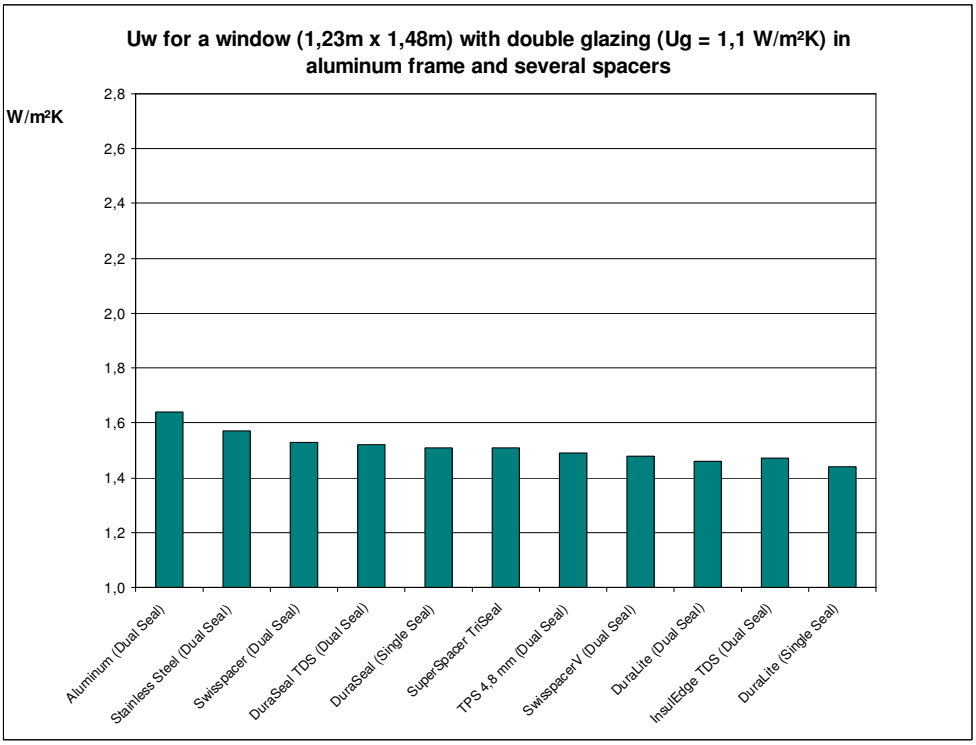
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

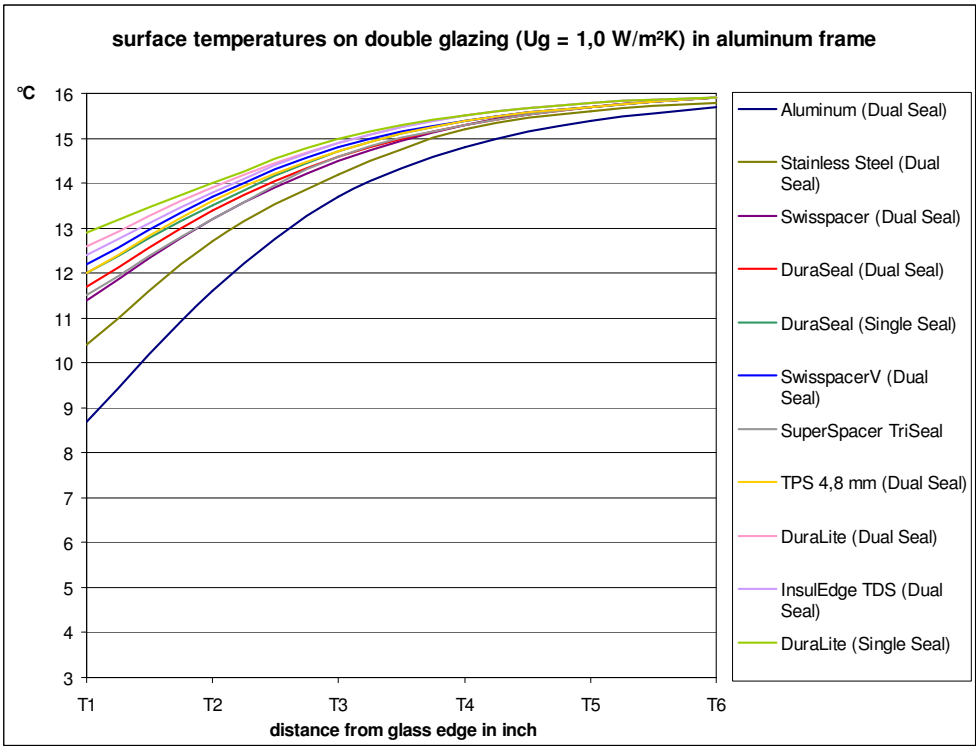


6.1.4 Triple glazing 1 (clear – air – clear – argon – low-E)
all results (tabularly)

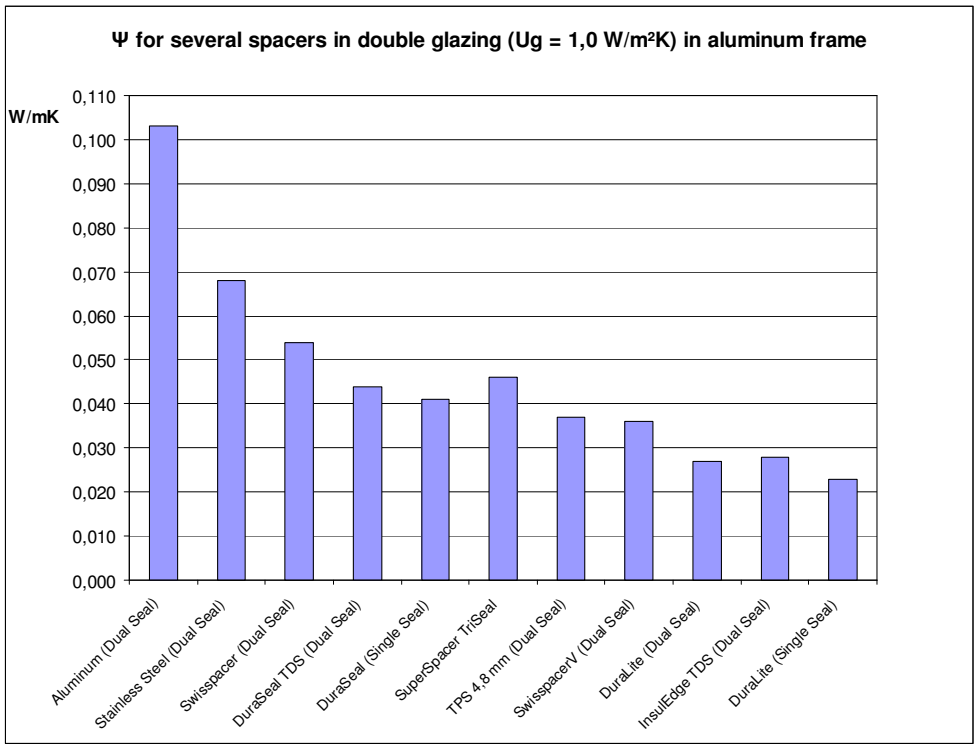
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	Aluminum (Dual Seal)	2,0	1,0	0,103	1,23	1,48	1,82	0,55	1,27	4,54	1,56	8,7	11,6	13,7	14,8	15,4	15,7
2	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	Stainless Steel (Dual Seal)	2,0	1,0	0,068	1,23	1,48	1,82	0,55	1,27	4,54	1,48	10,4	12,7	14,2	15,2	15,6	15,8
3	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	Swisspacer (Dual Seal)	2,0	1,0	0,054	1,23	1,48	1,82	0,55	1,27	4,54	1,44	11,4	13,2	14,5	15,3	15,7	15,9
4	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal TDS (Dual Seal)	2,0	1,0	0,044	1,23	1,48	1,82	0,55	1,27	4,54	1,42	11,7	13,4	14,6	15,3	15,7	15,9
5	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal (Single Seal)	2,0	1,0	0,041	1,23	1,48	1,82	0,55	1,27	4,54	1,41	12,0	13,5	14,7	15,4	15,7	15,9
6	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	SuperSpacer TriSeal	2,0	1,0	0,046	1,23	1,48	1,82	0,55	1,27	4,54	1,42	11,5	13,2	14,6	15,3	15,7	15,9
7	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	TPS 4,8 mm (Dual Seal)	2,0	1,0	0,037	1,23	1,48	1,82	0,55	1,27	4,54	1,40	12,0	13,6	14,7	15,4	15,7	15,9
8	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	SwisspacerV (Dual Seal)	2,0	1,0	0,036	1,23	1,48	1,82	0,55	1,27	4,54	1,39	12,2	13,7	14,8	15,4	15,7	15,9
9	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Dual Seal)	2,0	1,0	0,027	1,23	1,48	1,82	0,55	1,27	4,54	1,37	12,6	13,9	14,9	15,5	15,8	15,9
10	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	InsulEdge TDS (Dual Seal)	2,0	1,0	0,028	1,23	1,48	1,82	0,55	1,27	4,54	1,38	12,4	13,8	14,9	15,5	15,8	15,9
11	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Single Seal)	2,0	1,0	0,023	1,23	1,48	1,82	0,55	1,27	4,54	1,36	12,9	14,0	15,0	15,5	15,8	15,9

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	Aluminum (Dual Seal)	0,352	0,176	0,0595	4,04	4,86	19,59	5,92	13,67	14,89	0,275	47,7	52,9	56,7	58,6	59,7	60,3
2	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	Stainless Steel (Dual Seal)	0,352	0,176	0,0393	4,04	4,86	19,59	5,92	13,67	14,89	0,261	50,7	54,9	57,6	59,4	60,1	60,4
3	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	Swisspacer (Dual Seal)	0,352	0,176	0,0312	4,04	4,86	19,59	5,92	13,67	14,89	0,254	52,5	55,8	58,1	59,5	60,3	60,6
4	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal TDS (Dual Seal)	0,352	0,176	0,0254	4,04	4,86	19,59	5,92	13,67	14,89	0,250	53,1	56,1	58,3	59,5	60,3	60,6
5	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal (Single Seal)	0,352	0,176	0,0237	4,04	4,86	19,59	5,92	13,67	14,89	0,248	53,6	56,3	58,5	59,7	60,3	60,6
6	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	SuperSpacer TriSeal	0,352	0,176	0,0266	4,04	4,86	19,59	5,92	13,67	14,89	0,250	52,7	55,8	58,3	59,5	60,3	60,6
7	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	TPS 4,8 mm (Dual Seal)	0,352	0,176	0,0214	4,04	4,86	19,59	5,92	13,67	14,89	0,247	53,6	56,5	58,5	59,7	60,3	60,6
8	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	SwisspacerV (Dual Seal)	0,352	0,176	0,0208	4,04	4,86	19,59	5,92	13,67	14,89	0,245	54,0	56,7	58,6	59,7	60,3	60,6
9	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Dual Seal)	0,352	0,176	0,0156	4,04	4,86	19,59	5,92	13,67	14,89	0,241	54,7	57,0	58,8	59,9	60,4	60,6
10	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	InsulEdge TDS (Dual Seal)	0,352	0,176	0,0162	4,04	4,86	19,59	5,92	13,67	14,89	0,243	54,3	56,8	58,8	59,9	60,4	60,6
11	Aluminum	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Single Seal)	0,352	0,176	0,0133	4,04	4,86	19,59	5,92	13,67	14,89	0,240	55,2	57,2	59,0	59,9	60,4	60,6

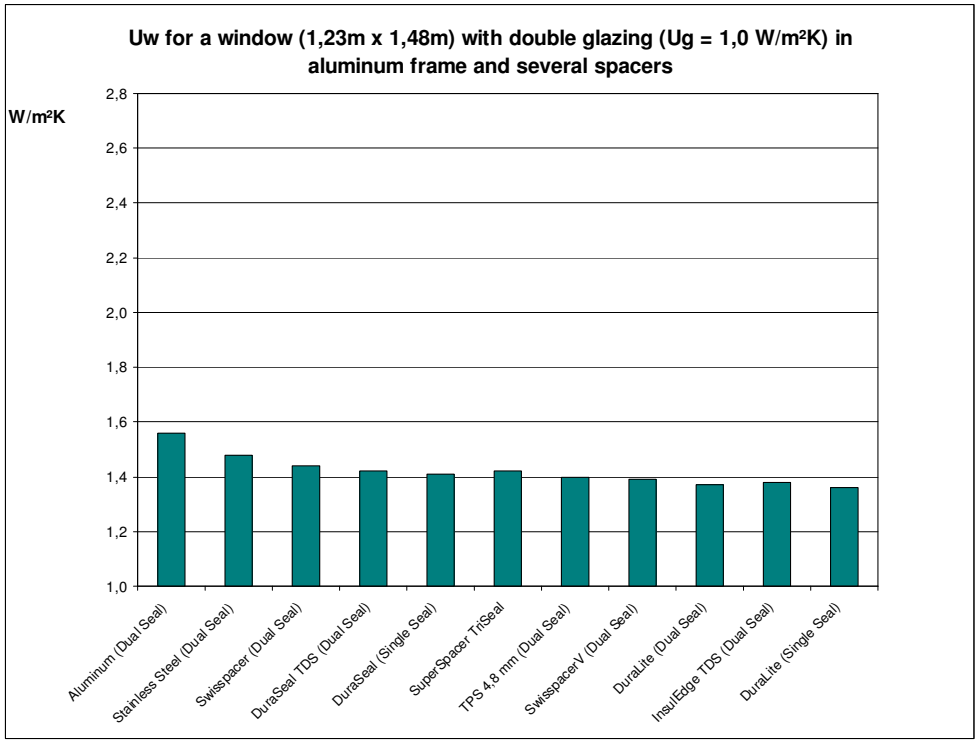
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window



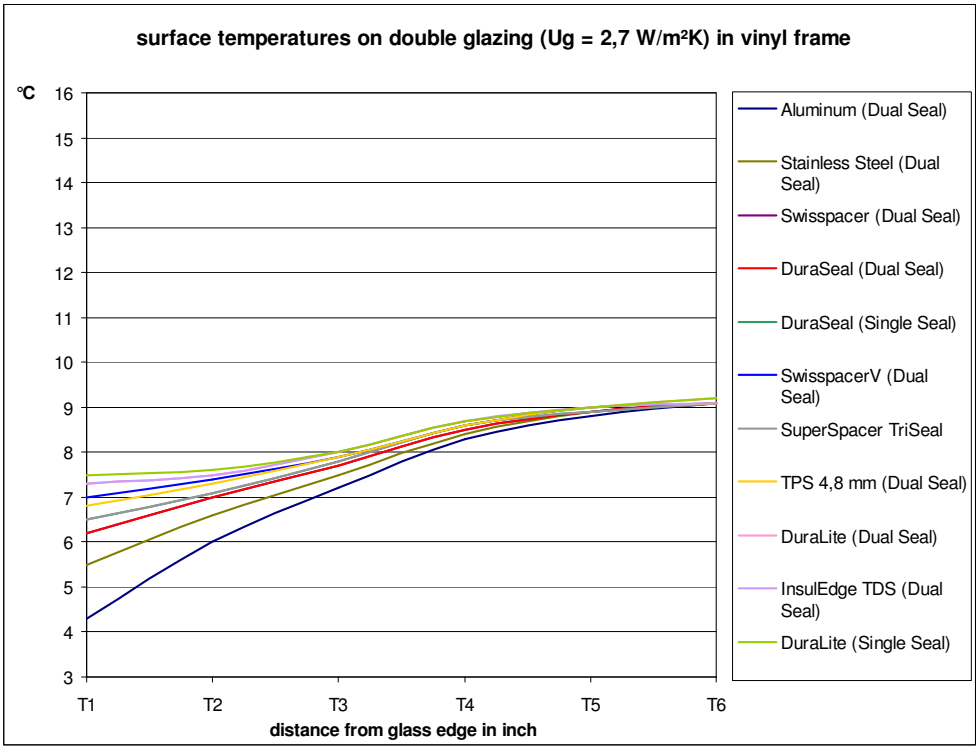
6.2 Vinyl section

6.2.1 Double glazing 1 (clear – air – clear)
all results (tabularly)

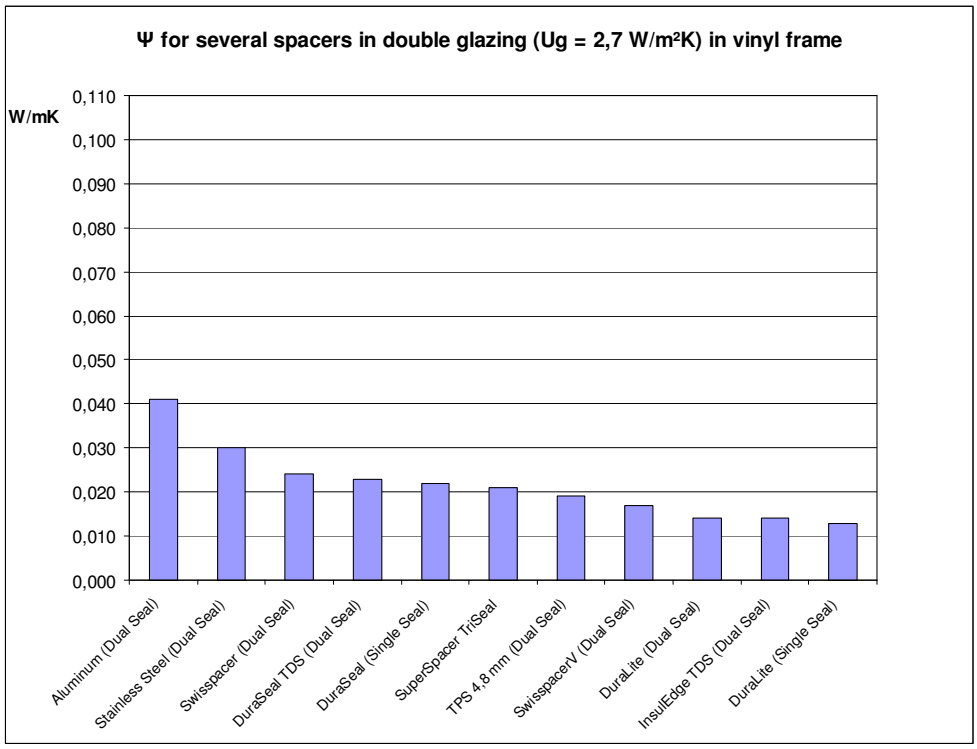
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Vinyl	Cl-Air-Cl (2,7)	Aluminum (Dual Seal)	1,9	2,7	0,041	1,23	1,48	1,82	0,55	1,27	4,54	2,58	4,3	6,0	7,2	8,3	8,8	9,1
2	Vinyl	Cl-Air-Cl (2,7)	Stainless Steel (Dual Seal)	1,9	2,7	0,030	1,23	1,48	1,82	0,55	1,27	4,54	2,55	5,5	6,6	7,5	8,4	8,9	9,1
3	Vinyl	Cl-Air-Cl (2,7)	Swisspacer (Dual Seal)	1,9	2,7	0,024	1,23	1,48	1,82	0,55	1,27	4,54	2,54	6,2	7,0	7,7	8,5	8,9	9,1
4	Vinyl	Cl-Air-Cl (2,7)	DuraSeal TDS (Dual Seal)	1,9	2,7	0,023	1,23	1,48	1,82	0,55	1,27	4,54	2,54	6,2	7,0	7,7	8,5	8,9	9,1
5	Vinyl	Cl-Air-Cl (2,7)	DuraSeal (Single Seal)	1,9	2,7	0,022	1,23	1,48	1,82	0,55	1,27	4,54	2,53	6,5	7,1	7,8	8,6	8,9	9,1
6	Vinyl	Cl-Air-Cl (2,7)	SuperSpacer TriSeal	1,9	2,7	0,021	1,23	1,48	1,82	0,55	1,27	4,54	2,53	6,5	7,1	7,8	8,6	8,9	9,1
7	Vinyl	Cl-Air-Cl (2,7)	TPS 4,8 mm (Dual Seal)	1,9	2,7	0,019	1,23	1,48	1,82	0,55	1,27	4,54	2,53	6,8	7,3	7,9	8,6	9,0	9,1
8	Vinyl	Cl-Air-Cl (2,7)	SwisspacerV (Dual Seal)	1,9	2,7	0,017	1,23	1,48	1,82	0,55	1,27	4,54	2,52	7,0	7,4	7,9	8,6	9,0	9,1
9	Vinyl	Cl-Air-Cl (2,7)	DuraLite (Dual Seal)	1,9	2,7	0,014	1,23	1,48	1,82	0,55	1,27	4,54	2,51	7,3	7,5	8,0	8,7	9,0	9,2
10	Vinyl	Cl-Air-Cl (2,7)	InsulEdge TDS (Dual Seal)	1,9	2,7	0,014	1,23	1,48	1,82	0,55	1,27	4,54	2,51	7,3	7,5	8,0	8,7	9,0	9,1
11	Vinyl	Cl-Air-Cl (2,7)	DuraLite (Single Seal)	1,9	2,7	0,013	1,23	1,48	1,82	0,55	1,27	4,54	2,51	7,5	7,6	8,0	8,7	9,0	9,2

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Vinyl	Cl-Air-Cl (2,7)	Aluminum (Dual Seal)	0,335	0,476	0,0237	4,04	4,86	19,59	5,92	13,67	14,89	0,455	39,7	42,8	45,0	46,9	47,8	48,4
2	Vinyl	Cl-Air-Cl (2,7)	Stainless Steel (Dual Seal)	0,335	0,476	0,0173	4,04	4,86	19,59	5,92	13,67	14,89	0,449	41,9	43,9	45,5	47,1	48,0	48,4
3	Vinyl	Cl-Air-Cl (2,7)	Swisspacer (Dual Seal)	0,335	0,476	0,0139	4,04	4,86	19,59	5,92	13,67	14,89	0,448	43,2	44,6	45,9	47,3	48,0	48,4
4	Vinyl	Cl-Air-Cl (2,7)	DuraSeal TDS (Dual Seal)	0,335	0,476	0,0133	4,04	4,86	19,59	5,92	13,67	14,89	0,448	43,2	44,6	45,9	47,3	48,0	48,4
5	Vinyl	Cl-Air-Cl (2,7)	DuraSeal (Single Seal)	0,335	0,476	0,0127	4,04	4,86	19,59	5,92	13,67	14,89	0,446	43,7	44,8	46,0	47,5	48,0	48,4
6	Vinyl	Cl-Air-Cl (2,7)	SuperSpacer TriSeal	0,335	0,476	0,0121	4,04	4,86	19,59	5,92	13,67	14,89	0,446	43,7	44,8	46,0	47,5	48,0	48,4
7	Vinyl	Cl-Air-Cl (2,7)	TPS 4,8 mm (Dual Seal)	0,335	0,476	0,0110	4,04	4,86	19,59	5,92	13,67	14,89	0,446	44,2	45,1	46,2	47,5	48,2	48,4
8	Vinyl	Cl-Air-Cl (2,7)	SwisspacerV (Dual Seal)	0,335	0,476	0,0098	4,04	4,86	19,59	5,92	13,67	14,89	0,444	44,6	45,3	46,2	47,5	48,2	48,4
9	Vinyl	Cl-Air-Cl (2,7)	DuraLite (Dual Seal)	0,335	0,476	0,0081	4,04	4,86	19,59	5,92	13,67	14,89	0,442	45,1	45,5	46,4	47,7	48,2	48,6
10	Vinyl	Cl-Air-Cl (2,7)	InsulEdge TDS (Dual Seal)	0,335	0,476	0,0081	4,04	4,86	19,59	5,92	13,67	14,89	0,442	45,1	45,5	46,4	47,7	48,2	48,4
11	Vinyl	Cl-Air-Cl (2,7)	DuraLite (Single Seal)	0,335	0,476	0,0075	4,04	4,86	19,59	5,92	13,67	14,89	0,442	45,5	45,7	46,4	47,7	48,2	48,6

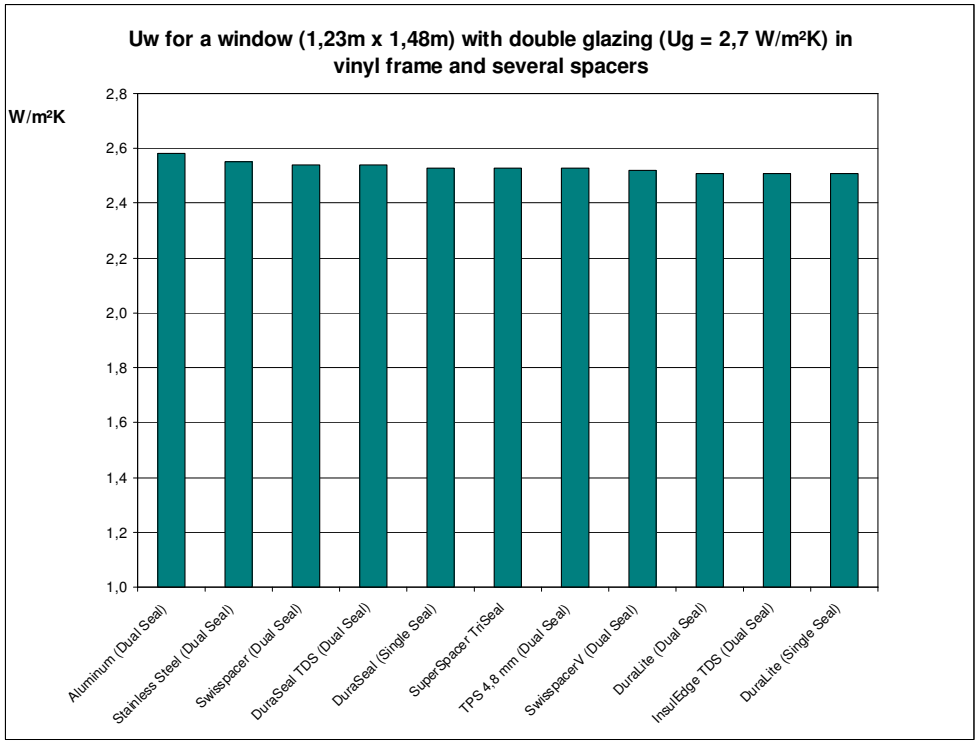
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

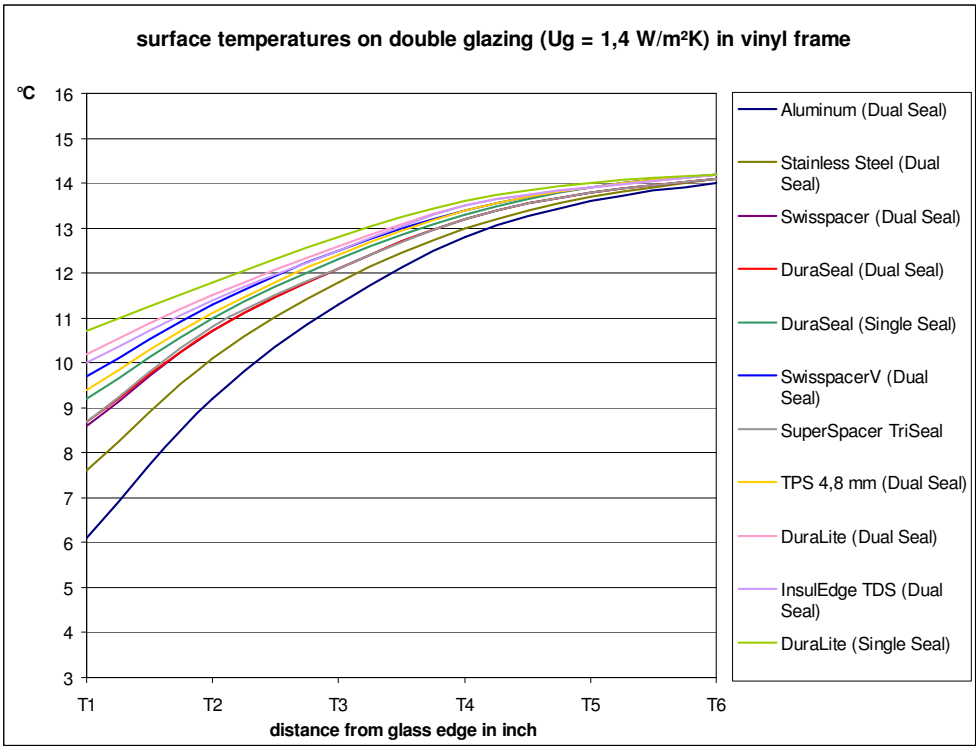


6.2.2 Double glazing 2 (clear – air – low-E)
all results (tabularly)

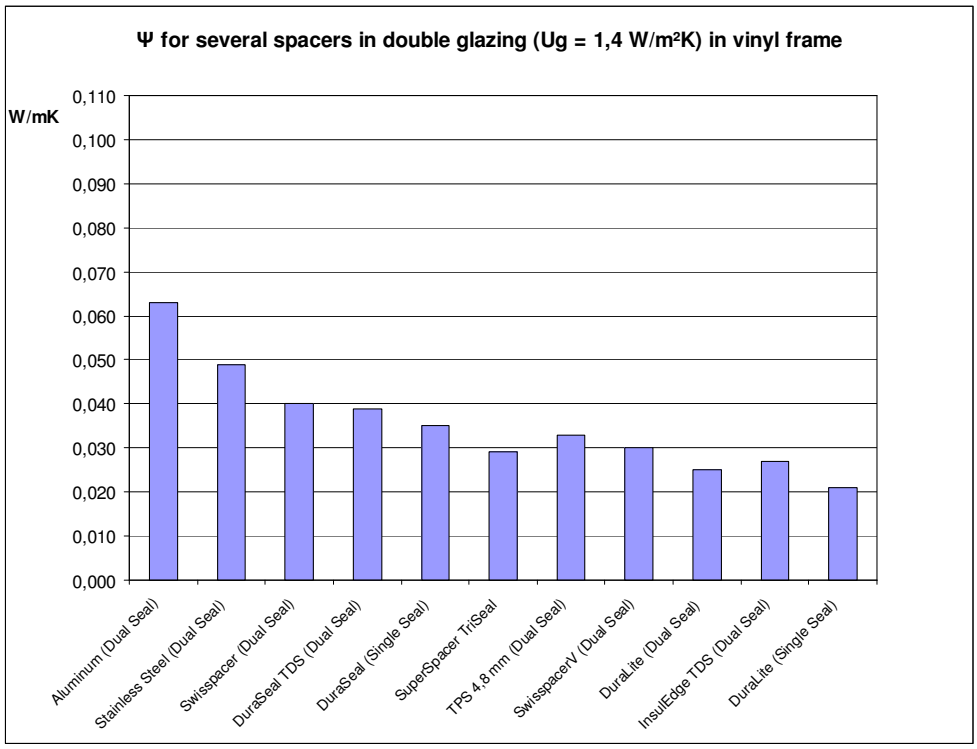
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Vinyl	Cl-Air-LowE (1,4)	Aluminum (Dual Seal)	1,9	1,4	0,063	1,23	1,48	1,82	0,55	1,27	4,54	1,71	6,1	9,2	11,3	12,8	13,6	14,0
2	Vinyl	Cl-Air-LowE (1,4)	Stainless Steel (Dual Seal)	1,9	1,4	0,049	1,23	1,48	1,82	0,55	1,27	4,54	1,67	7,6	10,1	11,8	13,0	13,7	14,1
3	Vinyl	Cl-Air-LowE (1,4)	Swisspacer (Dual Seal)	1,9	1,4	0,040	1,23	1,48	1,82	0,55	1,27	4,54	1,65	8,6	10,7	12,1	13,2	13,8	14,1
4	Vinyl	Cl-Air-LowE (1,4)	DuraSeal TDS (Dual Seal)	1,9	1,4	0,039	1,23	1,48	1,82	0,55	1,27	4,54	1,65	8,7	10,7	12,1	13,2	13,8	14,1
5	Vinyl	Cl-Air-LowE (1,4)	DuraSeal (Single Seal)	1,9	1,4	0,035	1,23	1,48	1,82	0,55	1,27	4,54	1,64	9,2	11,0	12,3	13,3	13,9	14,2
6	Vinyl	Cl-Air-LowE (1,4)	SuperSpacer TriSeal	1,9	1,4	0,029	1,23	1,48	1,82	0,55	1,27	4,54	1,63	8,7	10,8	12,1	13,2	13,8	14,1
7	Vinyl	Cl-Air-LowE (1,4)	TPS 4,8 mm (Dual Seal)	1,9	1,4	0,033	1,23	1,48	1,82	0,55	1,27	4,54	1,63	9,4	11,1	12,4	13,4	13,9	14,2
8	Vinyl	Cl-Air-LowE (1,4)	SwisspacerV (Dual Seal)	1,9	1,4	0,030	1,23	1,48	1,82	0,55	1,27	4,54	1,63	9,7	11,3	12,5	13,4	13,9	14,2
9	Vinyl	Cl-Air-LowE (1,4)	DuraLite (Dual Seal)	1,9	1,4	0,025	1,23	1,48	1,82	0,55	1,27	4,54	1,62	10,2	11,5	12,6	13,5	13,9	14,2
10	Vinyl	Cl-Air-LowE (1,4)	InsulEdge TDS (Dual Seal)	1,9	1,4	0,027	1,23	1,48	1,82	0,55	1,27	4,54	1,62	10,0	11,4	12,5	13,5	13,9	14,2
11	Vinyl	Cl-Air-LowE (1,4)	DuraLite (Single Seal)	1,9	1,4	0,021	1,23	1,48	1,82	0,55	1,27	4,54	1,60	10,7	11,8	12,8	13,6	14,0	14,2

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Vinyl	Cl-Air-LowE (1,4)	Aluminum (Dual Seal)	0,335	0,247	0,0364	4,04	4,86	19,59	5,92	13,67	14,89	0,301	43,0	48,6	52,3	55,0	56,5	57,2
2	Vinyl	Cl-Air-LowE (1,4)	Stainless Steel (Dual Seal)	0,335	0,247	0,0283	4,04	4,86	19,59	5,92	13,67	14,89	0,294	45,7	50,2	53,2	55,4	56,7	57,4
3	Vinyl	Cl-Air-LowE (1,4)	Swisspacer (Dual Seal)	0,335	0,247	0,0231	4,04	4,86	19,59	5,92	13,67	14,89	0,291	47,5	51,3	53,8	55,8	56,8	57,4
4	Vinyl	Cl-Air-LowE (1,4)	DuraSeal TDS (Dual Seal)	0,335	0,247	0,0225	4,04	4,86	19,59	5,92	13,67	14,89	0,291	47,7	51,3	53,8	55,8	56,8	57,4
5	Vinyl	Cl-Air-LowE (1,4)	DuraSeal (Single Seal)	0,335	0,247	0,0202	4,04	4,86	19,59	5,92	13,67	14,89	0,289	48,6	51,8	54,1	55,9	57,0	57,6
6	Vinyl	Cl-Air-LowE (1,4)	SuperSpacer TriSeal	0,335	0,247	0,0168	4,04	4,86	19,59	5,92	13,67	14,89	0,287	47,7	51,4	53,8	55,8	56,8	57,4
7	Vinyl	Cl-Air-LowE (1,4)	TPS 4,8 mm (Dual Seal)	0,335	0,247	0,0191	4,04	4,86	19,59	5,92	13,67	14,89	0,287	48,9	52,0	54,3	56,1	57,0	57,6
8	Vinyl	Cl-Air-LowE (1,4)	SwisspacerV (Dual Seal)	0,335	0,247	0,0173	4,04	4,86	19,59	5,92	13,67	14,89	0,287	49,5	52,3	54,5	56,1	57,0	57,6
9	Vinyl	Cl-Air-LowE (1,4)	DuraLite (Dual Seal)	0,335	0,247	0,0145	4,04	4,86	19,59	5,92	13,67	14,89	0,285	50,4	52,7	54,7	56,3	57,0	57,6
10	Vinyl	Cl-Air-LowE (1,4)	InsulEdge TDS (Dual Seal)	0,335	0,247	0,0156	4,04	4,86	19,59	5,92	13,67	14,89	0,285	50,0	52,5	54,5	56,3	57,0	57,6
11	Vinyl	Cl-Air-LowE (1,4)	DuraLite (Single Seal)	0,335	0,247	0,0121	4,04	4,86	19,59	5,92	13,67	14,89	0,282	51,3	53,2	55,0	56,5	57,2	57,6

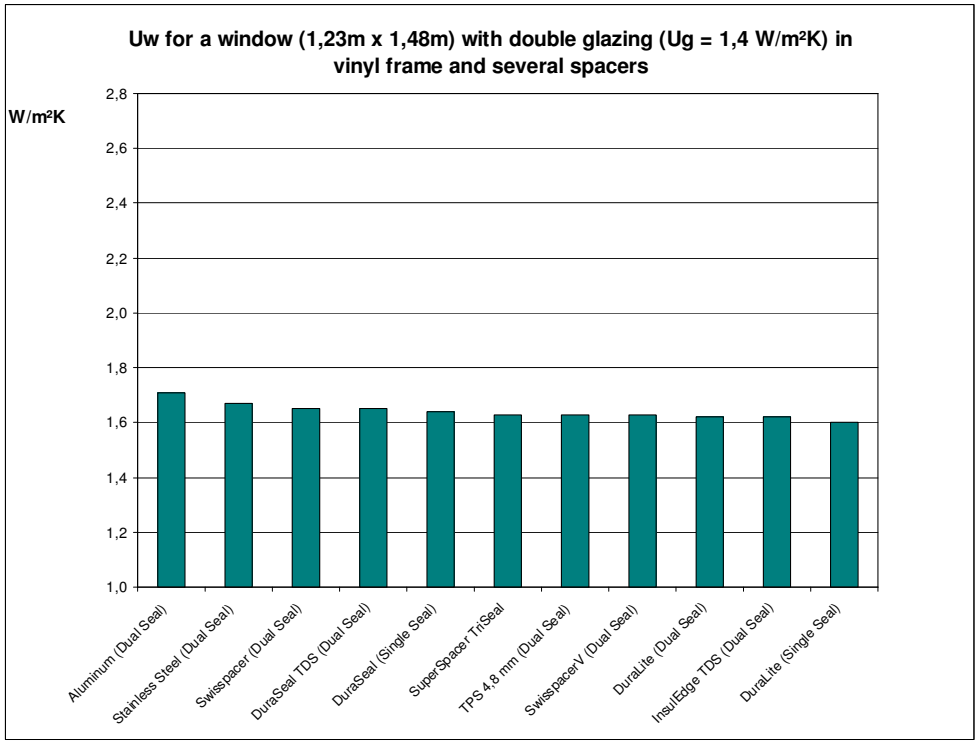
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

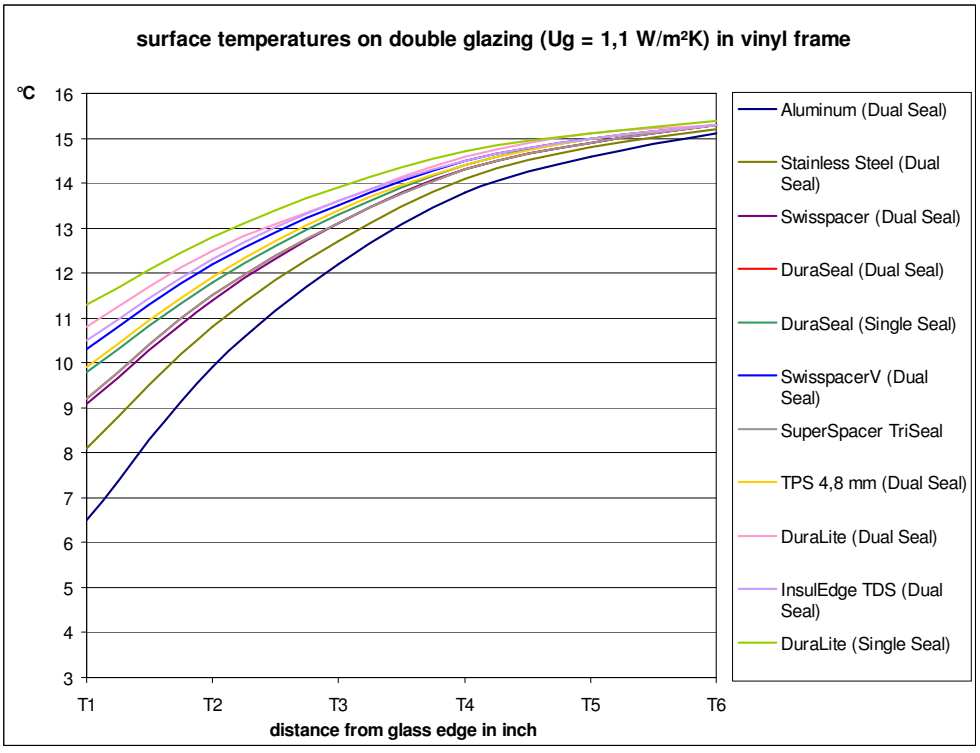


6.2.3 Double glazing 3 (clear – argon – low-E)
all results (tabularly)

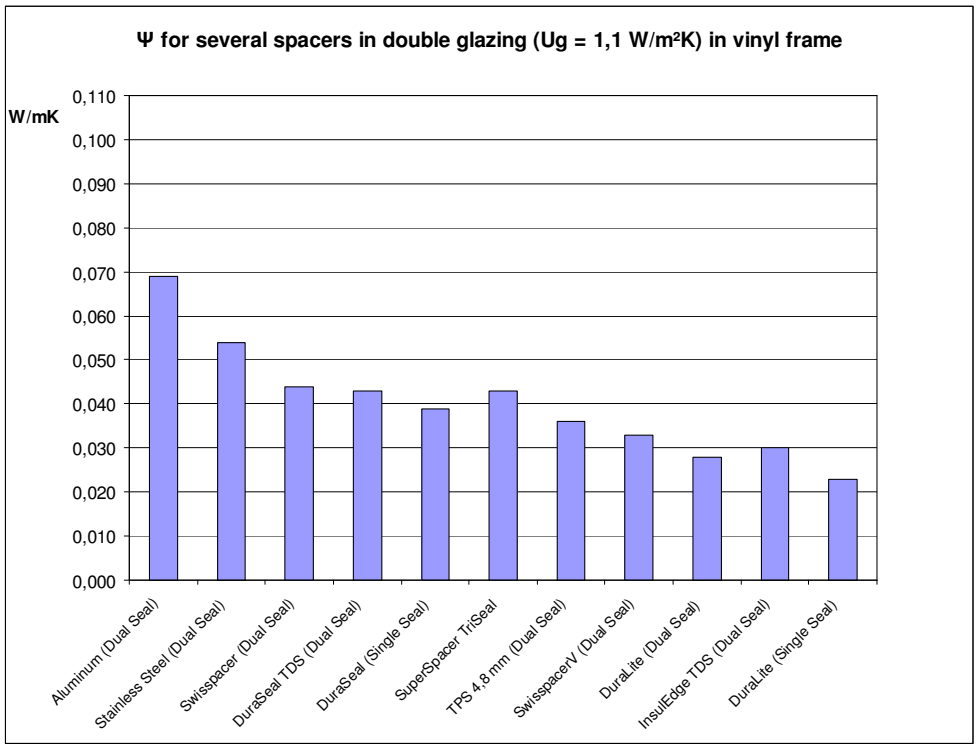
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Vinyl	Cl-Ar-LowE (1,1)	Aluminum (Dual Seal)	1,9	1,1	0,069	1,23	1,48	1,82	0,55	1,27	4,54	1,51	6,5	9,9	12,2	13,8	14,6	15,1
2	Vinyl	Cl-Ar-LowE (1,1)	Stainless Steel (Dual Seal)	1,9	1,1	0,054	1,23	1,48	1,82	0,55	1,27	4,54	1,48	8,1	10,8	12,7	14,1	14,8	15,2
3	Vinyl	Cl-Ar-LowE (1,1)	Swisspacer (Dual Seal)	1,9	1,1	0,044	1,23	1,48	1,82	0,55	1,27	4,54	1,45	9,1	11,4	13,1	14,3	14,9	15,3
4	Vinyl	Cl-Ar-LowE (1,1)	DuraSeal TDS (Dual Seal)	1,9	1,1	0,043	1,23	1,48	1,82	0,55	1,27	4,54	1,45	9,2	11,5	13,1	14,3	14,9	15,3
5	Vinyl	Cl-Ar-LowE (1,1)	DuraSeal (Single Seal)	1,9	1,1	0,039	1,23	1,48	1,82	0,55	1,27	4,54	1,44	9,8	11,8	13,3	14,4	15,0	15,3
6	Vinyl	Cl-Ar-LowE (1,1)	SuperSpacer TriSeal	1,9	1,1	0,043	1,23	1,48	1,82	0,55	1,27	4,54	1,45	9,2	11,5	13,1	14,3	14,9	15,3
7	Vinyl	Cl-Ar-LowE (1,1)	TPS 4,8 mm (Dual Seal)	1,9	1,1	0,036	1,23	1,48	1,82	0,55	1,27	4,54	1,43	9,9	11,9	13,4	14,4	15,0	15,3
8	Vinyl	Cl-Ar-LowE (1,1)	SwisspacerV (Dual Seal)	1,9	1,1	0,033	1,23	1,48	1,82	0,55	1,27	4,54	1,42	10,3	12,2	13,5	14,5	15,0	15,3
9	Vinyl	Cl-Ar-LowE (1,1)	DuraLite (Dual Seal)	1,9	1,1	0,028	1,23	1,48	1,82	0,55	1,27	4,54	1,41	10,8	12,5	13,6	14,6	15,1	15,3
10	Vinyl	Cl-Ar-LowE (1,1)	InsulEdge TDS (Dual Seal)	1,9	1,1	0,030	1,23	1,48	1,82	0,55	1,27	4,54	1,42	10,5	12,3	13,6	14,5	15,0	15,3
11	Vinyl	Cl-Ar-LowE (1,1)	DuraLite (Single Seal)	1,9	1,1	0,023	1,23	1,48	1,82	0,55	1,27	4,54	1,40	11,3	12,8	13,9	14,7	15,1	15,4

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Vinyl	Cl-Ar-LowE (1,1)	Aluminum (Dual Seal)	0,335	0,194	0,0399	4,04	4,86	19,59	5,92	13,67	14,89	0,266	43,7	49,8	54,0	56,8	58,3	59,2
2	Vinyl	Cl-Ar-LowE (1,1)	Stainless Steel (Dual Seal)	0,335	0,194	0,0312	4,04	4,86	19,59	5,92	13,67	14,89	0,261	46,6	51,4	54,9	57,4	58,6	59,4
3	Vinyl	Cl-Ar-LowE (1,1)	Swisspacer (Dual Seal)	0,335	0,194	0,0254	4,04	4,86	19,59	5,92	13,67	14,89	0,256	48,4	52,5	55,6	57,7	58,8	59,5
4	Vinyl	Cl-Ar-LowE (1,1)	DuraSeal TDS (Dual Seal)	0,335	0,194	0,0249	4,04	4,86	19,59	5,92	13,67	14,89	0,256	48,6	52,7	55,6	57,7	58,8	59,5
5	Vinyl	Cl-Ar-LowE (1,1)	DuraSeal (Single Seal)	0,335	0,194	0,0225	4,04	4,86	19,59	5,92	13,67	14,89	0,254	49,6	53,2	55,9	57,9	59,0	59,5
6	Vinyl	Cl-Ar-LowE (1,1)	SuperSpacer TriSeal	0,335	0,194	0,0249	4,04	4,86	19,59	5,92	13,67	14,89	0,256	48,6	52,7	55,6	57,7	58,8	59,5
7	Vinyl	Cl-Ar-LowE (1,1)	TPS 4,8 mm (Dual Seal)	0,335	0,194	0,0208	4,04	4,86	19,59	5,92	13,67	14,89	0,252	49,8	53,4	56,1	57,9	59,0	59,5
8	Vinyl	Cl-Ar-LowE (1,1)	SwisspacerV (Dual Seal)	0,335	0,194	0,0191	4,04	4,86	19,59	5,92	13,67	14,89	0,250	50,5	54,0	56,3	58,1	59,0	59,5
9	Vinyl	Cl-Ar-LowE (1,1)	DuraLite (Dual Seal)	0,335	0,194	0,0162	4,04	4,86	19,59	5,92	13,67	14,89	0,248	51,4	54,5	56,5	58,3	59,2	59,5
10	Vinyl	Cl-Ar-LowE (1,1)	InsulEdge TDS (Dual Seal)	0,335	0,194	0,0173	4,04	4,86	19,59	5,92	13,67	14,89	0,250	50,9	54,1	56,5	58,1	59,0	59,5
11	Vinyl	Cl-Ar-LowE (1,1)	DuraLite (Single Seal)	0,335	0,194	0,0133	4,04	4,86	19,59	5,92	13,67	14,89	0,247	52,3	55,0	57,0	58,5	59,2	59,7

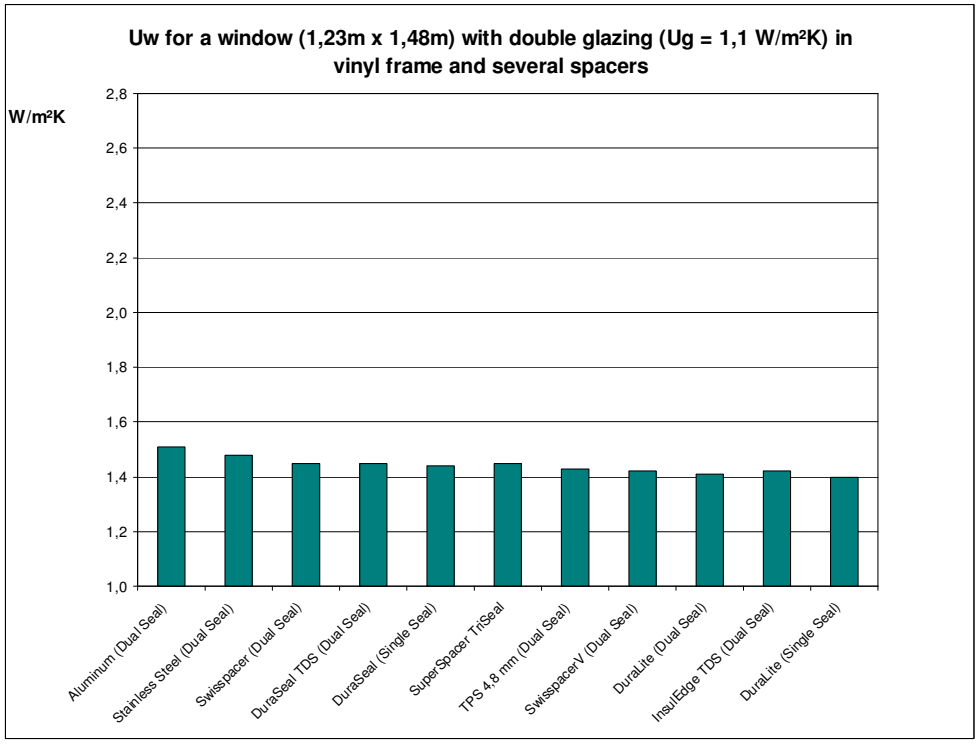
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

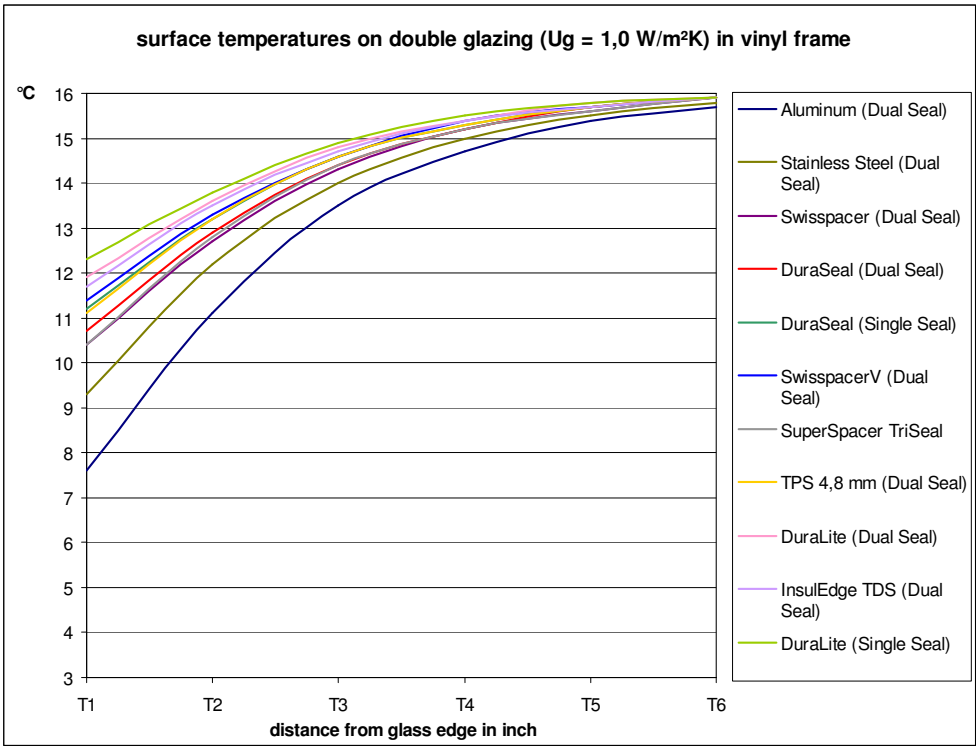


6.2.4 Triple glazing 1 (clear – air – clear – argon – low-E)
all results (tabularly)

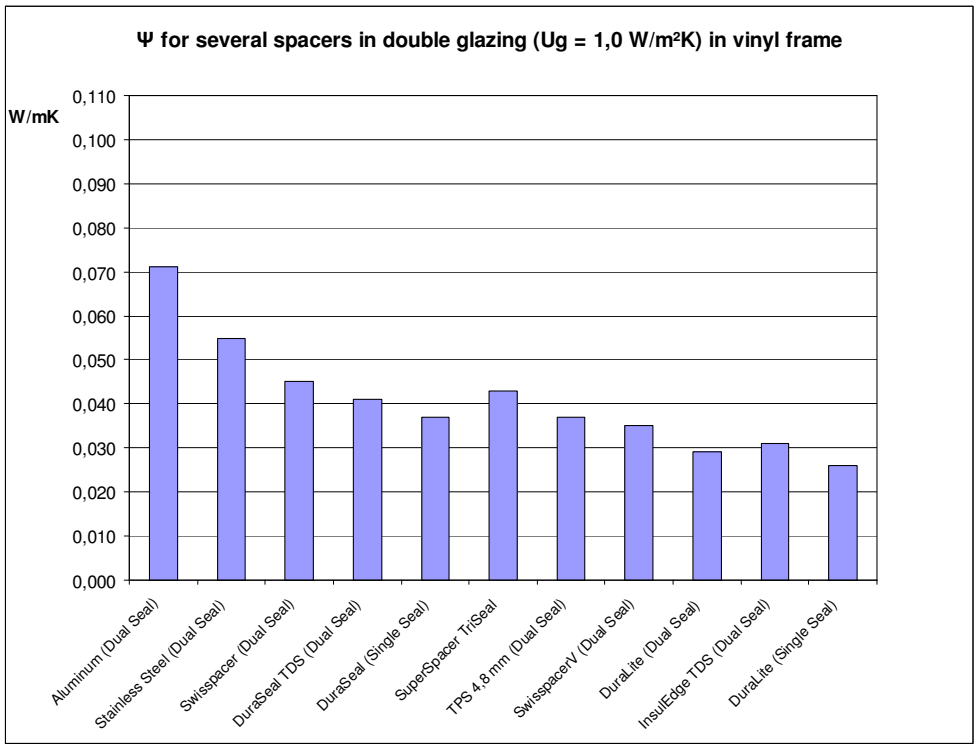
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	Aluminum (Dual Seal)	1,9	1,0	**0,071**	1,23	1,48	1,82	0,55	1,27	4,54	**1,44**	7,6	11,1	13,5	14,7	15,4	15,7
2	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	Stainless Steel (Dual Seal)	1,9	1,0	**0,055**	1,23	1,48	1,82	0,55	1,27	4,54	**1,40**	9,3	12,2	14,0	15,0	15,5	15,8
3	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	Swisspacer (Dual Seal)	1,9	1,0	**0,045**	1,23	1,48	1,82	0,55	1,27	4,54	**1,38**	10,4	12,7	14,3	15,2	15,6	15,9
4	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraSeal TDS (Dual Seal)	1,9	1,0	**0,041**	1,23	1,48	1,82	0,55	1,27	4,54	**1,37**	10,7	12,9	14,4	15,2	15,7	15,9
5	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraSeal (Single Seal)	1,9	1,0	**0,037**	1,23	1,48	1,82	0,55	1,27	4,54	**1,36**	11,2	13,2	14,6	15,3	15,7	15,9
6	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	SuperSpacer TriSeal	1,9	1,0	**0,043**	1,23	1,48	1,82	0,55	1,27	4,54	**1,37**	10,4	12,8	14,4	15,2	15,6	15,9
7	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	TPS 4,8 mm (Dual Seal)	1,9	1,0	**0,037**	1,23	1,48	1,82	0,55	1,27	4,54	**1,36**	11,1	13,2	14,6	15,3	15,7	15,9
8	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	SwisspacerV (Dual Seal)	1,9	1,0	**0,035**	1,23	1,48	1,82	0,55	1,27	4,54	**1,35**	11,4	13,3	14,6	15,4	15,7	15,9
9	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraLite (Dual Seal)	1,9	1,0	**0,029**	1,23	1,48	1,82	0,55	1,27	4,54	**1,34**	11,9	13,6	14,8	15,4	15,8	15,9
10	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	InsulEdge TDS (Dual Seal)	1,9	1,0	**0,031**	1,23	1,48	1,82	0,55	1,27	4,54	**1,34**	11,7	13,5	14,7	15,4	15,7	15,9
11	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraLite (Single Seal)	1,9	1,0	**0,026**	1,23	1,48	1,82	0,55	1,27	4,54	**1,33**	12,3	13,8	14,9	15,5	15,8	15,9

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	Aluminum (Dual Seal)	0,335	0,176	**0,0410**	4,04	4,86	19,59	5,92	13,67	14,89	**0,254**	45,7	52,0	56,3	58,5	59,7	60,3
2	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	Stainless Steel (Dual Seal)	0,335	0,176	**0,0318**	4,04	4,86	19,59	5,92	13,67	14,89	**0,247**	48,7	54,0	57,2	59,0	59,9	60,4
3	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	Swisspacer (Dual Seal)	0,335	0,176	**0,0260**	4,04	4,86	19,59	5,92	13,67	14,89	**0,243**	50,7	54,9	57,7	59,4	60,1	60,6
4	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraSeal TDS (Dual Seal)	0,335	0,176	**0,0237**	4,04	4,86	19,59	5,92	13,67	14,89	**0,241**	51,3	55,2	57,9	59,4	60,3	60,6
5	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraSeal (Single Seal)	0,335	0,176	**0,0214**	4,04	4,86	19,59	5,92	13,67	14,89	**0,240**	52,2	55,8	58,3	59,5	60,3	60,6
6	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	SuperSpacer TriSeal	0,335	0,176	**0,0249**	4,04	4,86	19,59	5,92	13,67	14,89	**0,241**	50,7	55,0	57,9	59,4	60,1	60,6
7	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	TPS 4,8 mm (Dual Seal)	0,335	0,176	**0,0214**	4,04	4,86	19,59	5,92	13,67	14,89	**0,240**	52,0	55,8	58,3	59,5	60,3	60,6
8	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	SwisspacerV (Dual Seal)	0,335	0,176	**0,0202**	4,04	4,86	19,59	5,92	13,67	14,89	**0,238**	52,5	55,9	58,3	59,7	60,3	60,6
9	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraLite (Dual Seal)	0,335	0,176	**0,0168**	4,04	4,86	19,59	5,92	13,67	14,89	**0,236**	53,4	56,5	58,6	59,7	60,4	60,6
10	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	InsulEdge TDS (Dual Seal)	0,335	0,176	**0,0179**	4,04	4,86	19,59	5,92	13,67	14,89	**0,236**	53,1	56,3	58,5	59,7	60,3	60,6
11	Vinyl	Cl-Air-Cl-Ar-Ar-LowE (1,0)	DuraLite (Single Seal)	0,335	0,176	**0,0150**	4,04	4,86	19,59	5,92	13,67	14,89	**0,234**	54,1	56,8	58,8	59,9	60,4	60,6

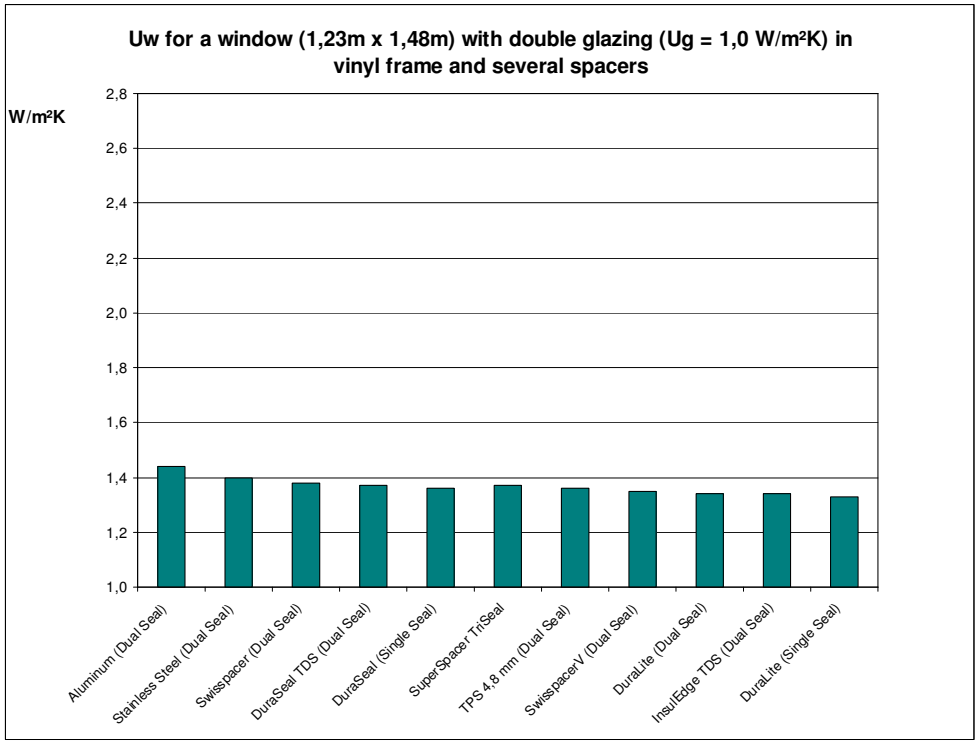
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window



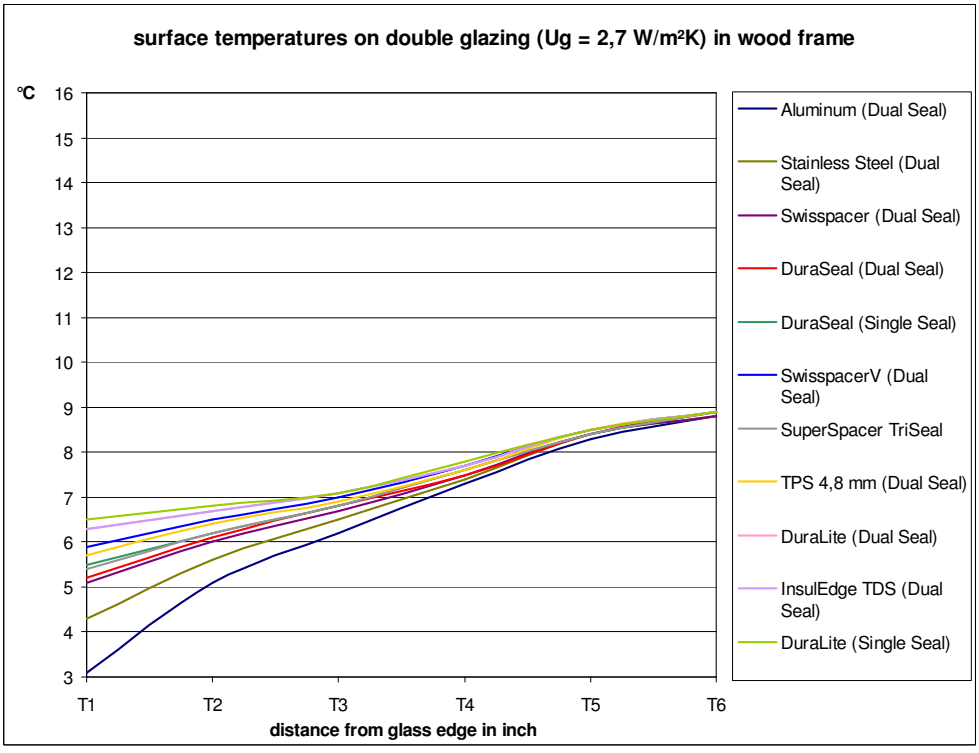
6.3 Wood section

6.3.1 Double glazing 1 (clear – air – clear)
all results (tabularly)

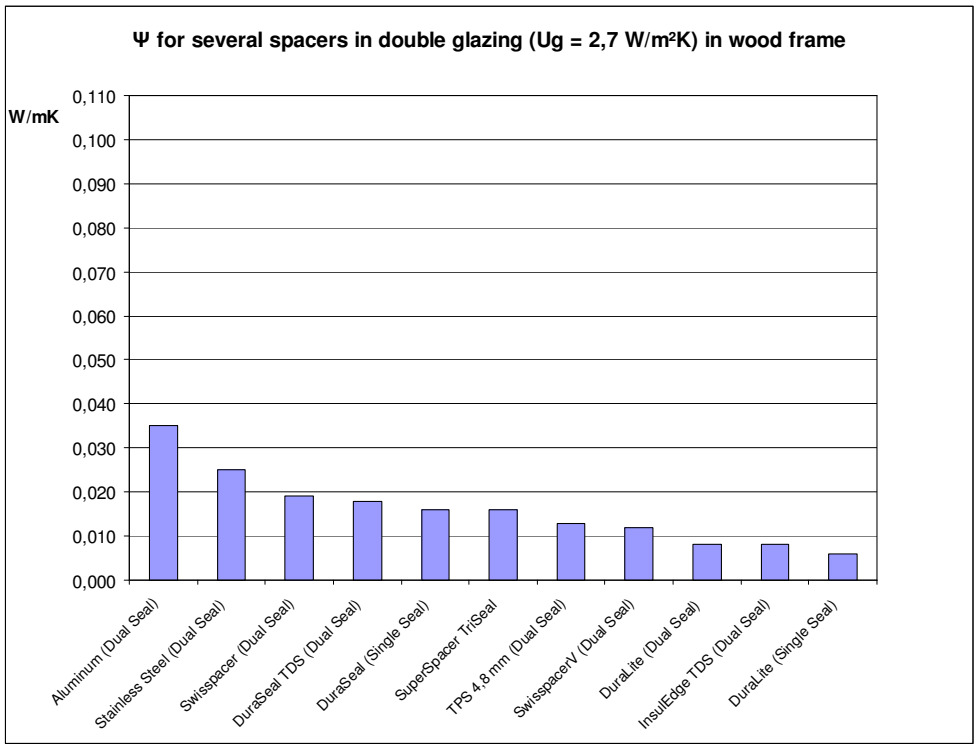
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Wood	Cl-Air-Cl (2,7)	Aluminum (Dual Seal)	1,3	2,7	0,035	1,23	1,48	1,82	0,55	1,27	4,54	2,40	3,1	5,1	6,2	7,3	8,3	8,8
2	Wood	Cl-Air-Cl (2,7)	Stainless Steel (Dual Seal)	1,3	2,7	0,025	1,23	1,48	1,82	0,55	1,27	4,54	2,38	4,3	5,6	6,5	7,4	8,4	8,8
3	Wood	Cl-Air-Cl (2,7)	Swisspacer (Dual Seal)	1,3	2,7	0,019	1,23	1,48	1,82	0,55	1,27	4,54	2,36	5,1	6,0	6,7	7,5	8,4	8,8
4	Wood	Cl-Air-Cl (2,7)	DuraSeal TDS (Dual Seal)	1,3	2,7	0,018	1,23	1,48	1,82	0,55	1,27	4,54	2,36	5,2	6,1	6,8	7,5	8,4	8,9
5	Wood	Cl-Air-Cl (2,7)	DuraSeal (Single Seal)	1,3	2,7	0,016	1,23	1,48	1,82	0,55	1,27	4,54	2,35	5,5	6,2	6,8	7,6	8,4	8,9
6	Wood	Cl-Air-Cl (2,7)	SuperSpacer TriSeal	1,3	2,7	0,016	1,23	1,48	1,82	0,55	1,27	4,54	2,35	5,4	6,2	6,8	7,6	8,4	8,9
7	Wood	Cl-Air-Cl (2,7)	TPS 4,8 mm (Dual Seal)	1,3	2,7	0,013	1,23	1,48	1,82	0,55	1,27	4,54	2,35	5,7	6,4	6,9	7,6	8,5	8,9
8	Wood	Cl-Air-Cl (2,7)	SwisspacerV (Dual Seal)	1,3	2,7	0,012	1,23	1,48	1,82	0,55	1,27	4,54	2,34	5,9	6,5	7,0	7,7	8,5	8,9
9	Wood	Cl-Air-Cl (2,7)	DuraLite (Dual Seal)	1,3	2,7	0,008	1,23	1,48	1,82	0,55	1,27	4,54	2,33	6,3	6,7	7,1	7,7	8,5	8,9
10	Wood	Cl-Air-Cl (2,7)	InsulEdge TDS (Dual Seal)	1,3	2,7	0,008	1,23	1,48	1,82	0,55	1,27	4,54	2,33	6,3	6,7	7,1	7,7	8,5	8,9
11	Wood	Cl-Air-Cl (2,7)	DuraLite (Single Seal)	1,3	2,7	0,006	1,23	1,48	1,82	0,55	1,27	4,54	2,33	6,5	6,8	7,1	7,8	8,5	8,9

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Wood	Cl-Air-Cl (2,7)	Aluminum (Dual Seal)	0,229	0,476	0,0202	4,04	4,86	19,59	5,92	13,67	14,89	0,423	37,6	41,2	43,2	45,1	46,9	47,8
2	Wood	Cl-Air-Cl (2,7)	Stainless Steel (Dual Seal)	0,229	0,476	0,0145	4,04	4,86	19,59	5,92	13,67	14,89	0,419	39,7	42,1	43,7	45,3	47,1	47,8
3	Wood	Cl-Air-Cl (2,7)	Swisspacer (Dual Seal)	0,229	0,476	0,0110	4,04	4,86	19,59	5,92	13,67	14,89	0,416	41,2	42,8	44,1	45,5	47,1	47,8
4	Wood	Cl-Air-Cl (2,7)	DuraSeal TDS (Dual Seal)	0,229	0,476	0,0104	4,04	4,86	19,59	5,92	13,67	14,89	0,416	41,4	43,0	44,2	45,5	47,1	48,0
5	Wood	Cl-Air-Cl (2,7)	DuraSeal (Single Seal)	0,229	0,476	0,0093	4,04	4,86	19,59	5,92	13,67	14,89	0,414	41,9	43,2	44,2	45,7	47,1	48,0
6	Wood	Cl-Air-Cl (2,7)	SuperSpacer TriSeal	0,229	0,476	0,0093	4,04	4,86	19,59	5,92	13,67	14,89	0,414	41,7	43,2	44,2	45,7	47,1	48,0
7	Wood	Cl-Air-Cl (2,7)	TPS 4,8 mm (Dual Seal)	0,229	0,476	0,0075	4,04	4,86	19,59	5,92	13,67	14,89	0,414	42,3	43,5	44,4	45,7	47,3	48,0
8	Wood	Cl-Air-Cl (2,7)	SwisspacerV (Dual Seal)	0,229	0,476	0,0069	4,04	4,86	19,59	5,92	13,67	14,89	0,412	42,6	43,7	44,6	45,9	47,3	48,0
9	Wood	Cl-Air-Cl (2,7)	DuraLite (Dual Seal)	0,229	0,476	0,0046	4,04	4,86	19,59	5,92	13,67	14,89	0,411	43,3	44,1	44,8	45,9	47,3	48,0
10	Wood	Cl-Air-Cl (2,7)	InsulEdge TDS (Dual Seal)	0,229	0,476	0,0046	4,04	4,86	19,59	5,92	13,67	14,89	0,411	43,3	44,1	44,8	45,9	47,3	48,0
11	Wood	Cl-Air-Cl (2,7)	DuraLite (Single Seal)	0,229	0,476	0,0035	4,04	4,86	19,59	5,92	13,67	14,89	0,411	43,7	44,2	44,8	46,0	47,3	48,0

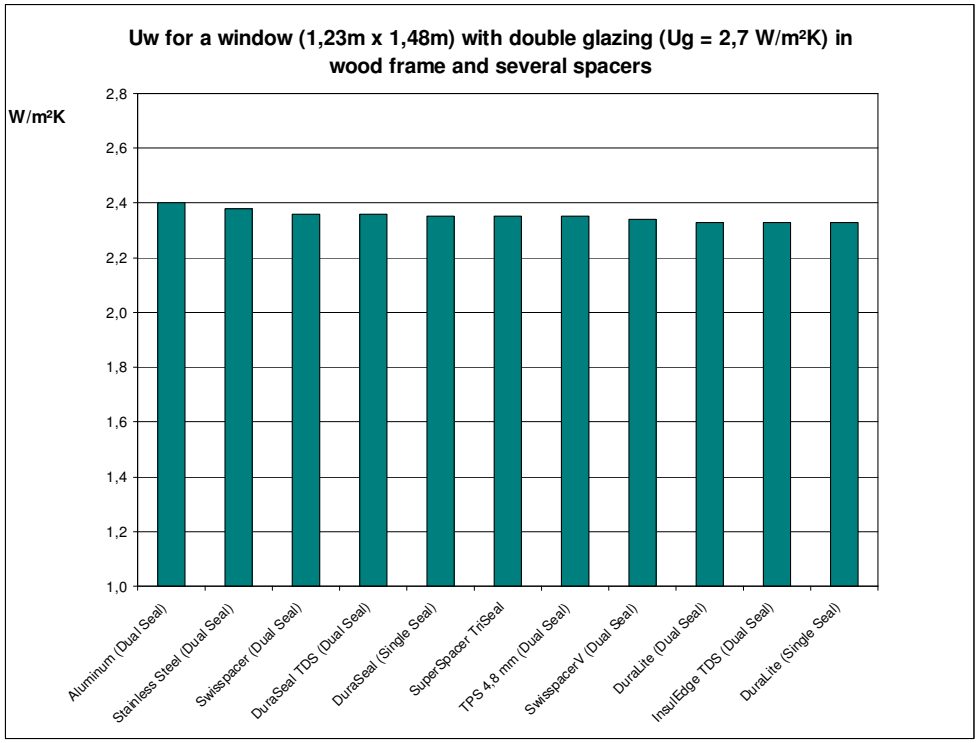
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

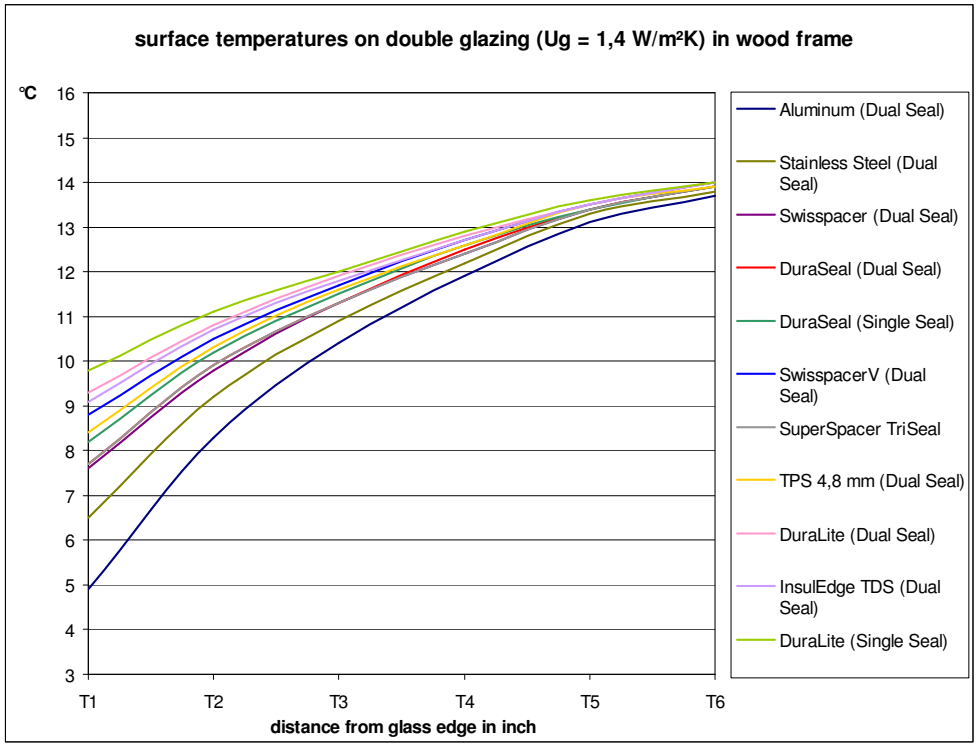


6.3.2 Double glazing 2 (clear – air – low-E)
all results (tabularly)

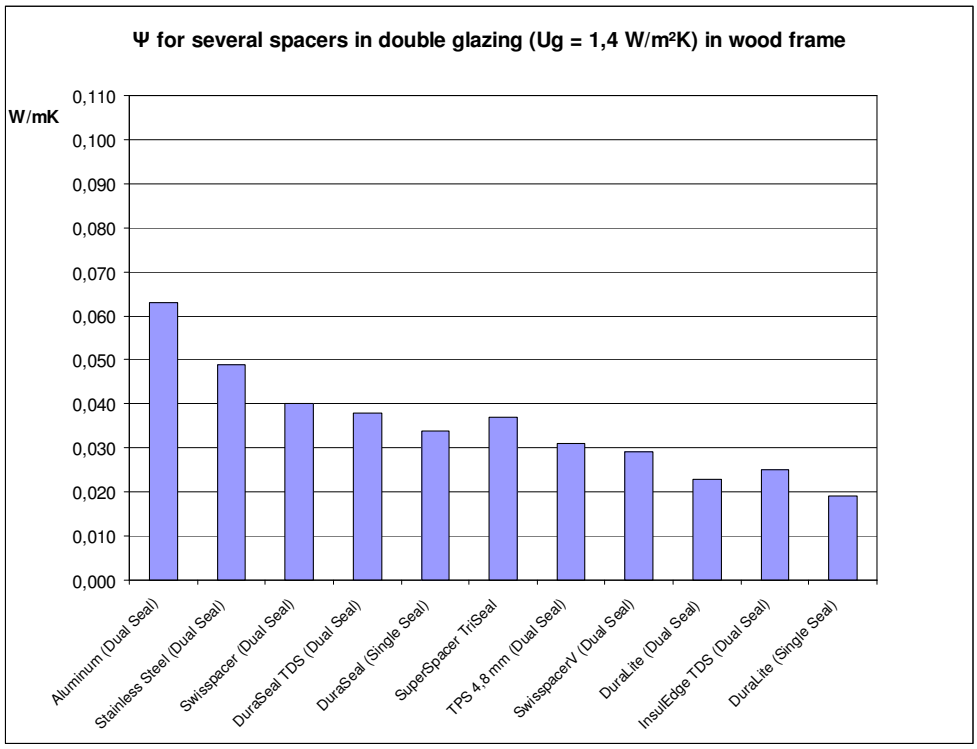
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Wood	Cl-Air-LowE (1,4)	Aluminum (Dual Seal)	1,3	1,4	**0,063**	1,23	1,48	1,82	0,55	1,27	4,54	**1,54**	4,9	8,3	10,4	11,9	13,1	13,7
2	Wood	Cl-Air-LowE (1,4)	Stainless Steel (Dual Seal)	1,3	1,4	**0,049**	1,23	1,48	1,82	0,55	1,27	4,54	**1,51**	6,5	9,2	10,9	12,2	13,3	13,8
3	Wood	Cl-Air-LowE (1,4)	Swisspacer (Dual Seal)	1,3	1,4	**0,040**	1,23	1,48	1,82	0,55	1,27	4,54	**1,49**	7,6	9,8	11,3	12,4	13,4	13,9
4	Wood	Cl-Air-LowE (1,4)	DuraSeal TDS (Dual Seal)	1,3	1,4	**0,038**	1,23	1,48	1,82	0,55	1,27	4,54	**1,48**	7,7	9,9	11,3	12,5	13,4	13,9
5	Wood	Cl-Air-LowE (1,4)	DuraSeal (Single Seal)	1,3	1,4	**0,034**	1,23	1,48	1,82	0,55	1,27	4,54	**1,47**	8,2	10,2	11,5	12,6	13,4	13,9
6	Wood	Cl-Air-LowE (1,4)	SuperSpacer TriSeal	1,3	1,4	**0,037**	1,23	1,48	1,82	0,55	1,27	4,54	**1,48**	7,7	9,9	11,3	12,4	13,4	13,9
7	Wood	Cl-Air-LowE (1,4)	TPS 4,8 mm (Dual Seal)	1,3	1,4	**0,031**	1,23	1,48	1,82	0,55	1,27	4,54	**1,47**	8,4	10,3	11,6	12,6	13,5	13,9
8	Wood	Cl-Air-LowE (1,4)	SwisspacerV (Dual Seal)	1,3	1,4	**0,029**	1,23	1,48	1,82	0,55	1,27	4,54	**1,46**	8,8	10,5	11,7	12,7	13,5	14,0
9	Wood	Cl-Air-LowE (1,4)	DuraLite (Dual Seal)	1,3	1,4	**0,023**	1,23	1,48	1,82	0,55	1,27	4,54	**1,45**	9,3	10,8	11,9	12,8	13,5	14,0
10	Wood	Cl-Air-LowE (1,4)	InsulEdge TDS (Dual Seal)	1,3	1,4	**0,025**	1,23	1,48	1,82	0,55	1,27	4,54	**1,45**	9,1	10,7	11,8	12,7	13,5	14,0
11	Wood	Cl-Air-LowE (1,4)	DuraLite (Single Seal)	1,3	1,4	**0,019**	1,23	1,48	1,82	0,55	1,27	4,54	**1,43**	9,8	11,1	12,0	12,9	13,6	14,0

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Wood	Cl-Air-LowE (1,4)	Aluminum (Dual Seal)	0,229	0,247	**0,0364**	4,04	4,86	19,59	5,92	13,67	14,89	**0,271**	40,8	46,9	50,7	53,4	55,6	56,7
2	Wood	Cl-Air-LowE (1,4)	Stainless Steel (Dual Seal)	0,229	0,247	**0,0283**	4,04	4,86	19,59	5,92	13,67	14,89	**0,266**	43,7	48,6	51,6	54,0	55,9	56,8
3	Wood	Cl-Air-LowE (1,4)	Swisspacer (Dual Seal)	0,229	0,247	**0,0231**	4,04	4,86	19,59	5,92	13,67	14,89	**0,263**	45,7	49,6	52,3	54,3	56,1	57,0
4	Wood	Cl-Air-LowE (1,4)	DuraSeal TDS (Dual Seal)	0,229	0,247	**0,0220**	4,04	4,86	19,59	5,92	13,67	14,89	**0,261**	45,9	49,8	52,3	54,5	56,1	57,0
5	Wood	Cl-Air-LowE (1,4)	DuraSeal (Single Seal)	0,229	0,247	**0,0197**	4,04	4,86	19,59	5,92	13,67	14,89	**0,259**	46,8	50,4	52,7	54,7	56,1	57,0
6	Wood	Cl-Air-LowE (1,4)	SuperSpacer TriSeal	0,229	0,247	**0,0214**	4,04	4,86	19,59	5,92	13,67	14,89	**0,261**	45,9	49,8	52,3	54,3	56,1	57,0
7	Wood	Cl-Air-LowE (1,4)	TPS 4,8 mm (Dual Seal)	0,229	0,247	**0,0179**	4,04	4,86	19,59	5,92	13,67	14,89	**0,259**	47,1	50,5	52,9	54,7	56,3	57,0
8	Wood	Cl-Air-LowE (1,4)	SwisspacerV (Dual Seal)	0,229	0,247	**0,0168**	4,04	4,86	19,59	5,92	13,67	14,89	**0,257**	47,8	50,9	53,1	54,9	56,3	57,2
9	Wood	Cl-Air-LowE (1,4)	DuraLite (Dual Seal)	0,229	0,247	**0,0133**	4,04	4,86	19,59	5,92	13,67	14,89	**0,256**	48,7	51,4	53,4	55,0	56,3	57,2
10	Wood	Cl-Air-LowE (1,4)	InsulEdge TDS (Dual Seal)	0,229	0,247	**0,0145**	4,04	4,86	19,59	5,92	13,67	14,89	**0,256**	48,4	51,3	53,2	54,9	56,3	57,2
11	Wood	Cl-Air-LowE (1,4)	DuraLite (Single Seal)	0,229	0,247	**0,0110**	4,04	4,86	19,59	5,92	13,67	14,89	**0,252**	49,6	52,0	53,6	55,2	56,5	57,2

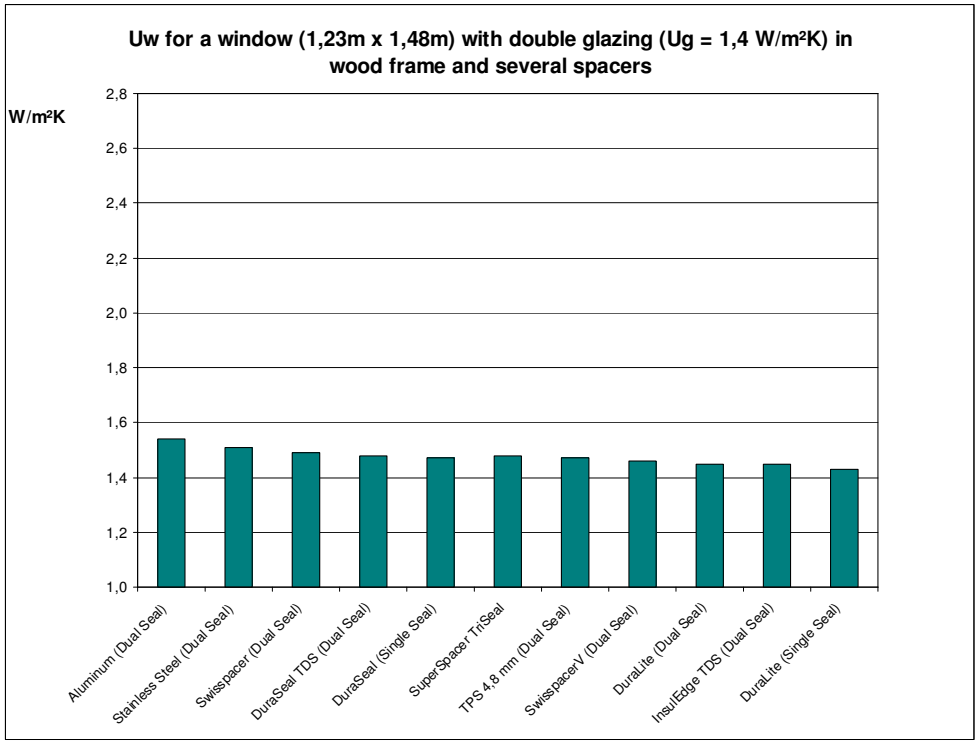
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

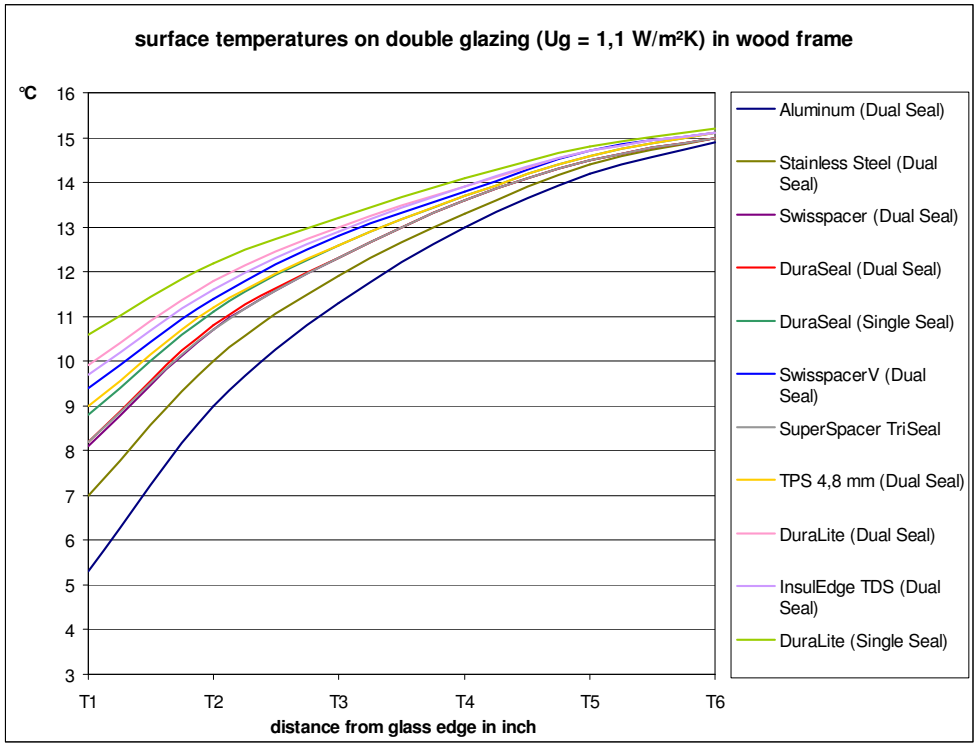


6.3.3 Double glazing 3 (clear – argon – low-E)
all results (tabularly)

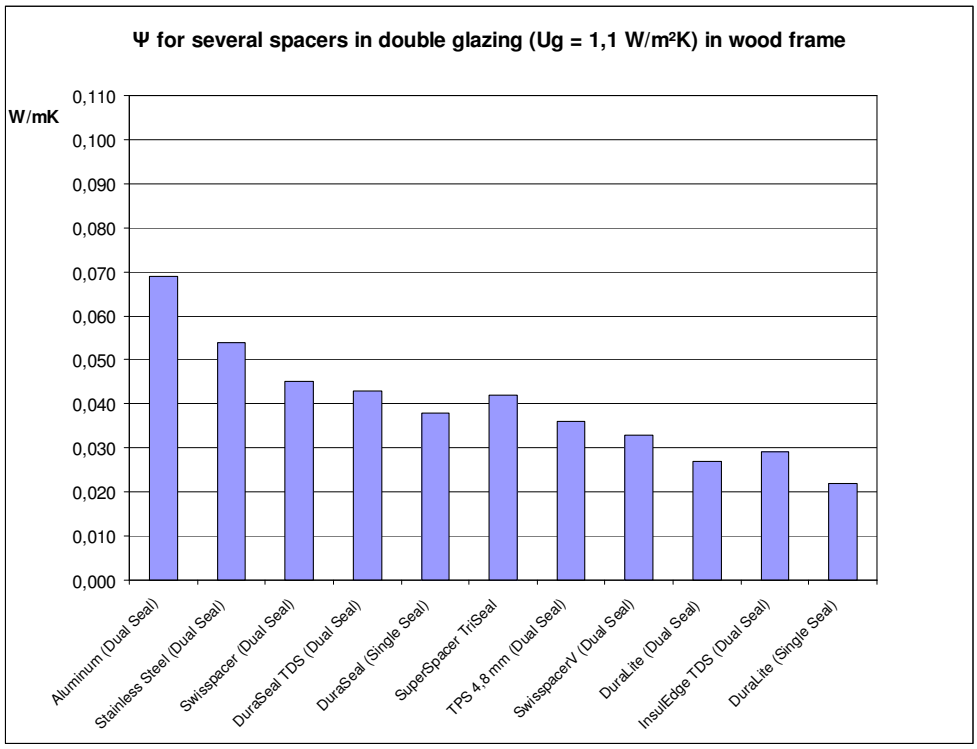
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Wood	Cl-Ar-LowE (1,1)	Aluminum (Dual Seal)	1,3	1,1	**0,069**	1,23	1,48	1,82	0,55	1,27	4,54	**1,35**	5,3	9,0	11,3	13,0	14,2	14,9
2	Wood	Cl-Ar-LowE (1,1)	Stainless Steel (Dual Seal)	1,3	1,1	**0,054**	1,23	1,48	1,82	0,55	1,27	4,54	**1,31**	7,0	10,0	11,9	13,3	14,4	15,0
3	Wood	Cl-Ar-LowE (1,1)	Swisspacer (Dual Seal)	1,3	1,1	**0,045**	1,23	1,48	1,82	0,55	1,27	4,54	**1,29**	8,1	10,7	12,3	13,6	14,5	15,0
4	Wood	Cl-Ar-LowE (1,1)	DuraSeal TDS (Dual Seal)	1,3	1,1	**0,043**	1,23	1,48	1,82	0,55	1,27	4,54	**1,28**	8,2	10,8	12,3	13,6	14,5	15,0
5	Wood	Cl-Ar-LowE (1,1)	DuraSeal (Single Seal)	1,3	1,1	**0,038**	1,23	1,48	1,82	0,55	1,27	4,54	**1,27**	8,8	11,1	12,6	13,7	14,6	15,1
6	Wood	Cl-Ar-LowE (1,1)	SuperSpacer TriSeal	1,3	1,1	**0,042**	1,23	1,48	1,82	0,55	1,27	4,54	**1,28**	8,2	10,7	12,3	13,6	14,5	15,0
7	Wood	Cl-Ar-LowE (1,1)	TPS 4,8 mm (Dual Seal)	1,3	1,1	**0,036**	1,23	1,48	1,82	0,55	1,27	4,54	**1,27**	9,0	11,2	12,6	13,7	14,6	15,1
8	Wood	Cl-Ar-LowE (1,1)	SwisspacerV (Dual Seal)	1,3	1,1	**0,033**	1,23	1,48	1,82	0,55	1,27	4,54	**1,26**	9,4	11,4	12,8	13,8	14,7	15,1
9	Wood	Cl-Ar-LowE (1,1)	DuraLite (Dual Seal)	1,3	1,1	**0,027**	1,23	1,48	1,82	0,55	1,27	4,54	**1,24**	9,9	11,8	13,0	13,9	14,7	15,1
10	Wood	Cl-Ar-LowE (1,1)	InsulEdge TDS (Dual Seal)	1,3	1,1	**0,029**	1,23	1,48	1,82	0,55	1,27	4,54	**1,25**	9,7	11,6	12,9	13,9	14,7	15,1
11	Wood	Cl-Ar-LowE (1,1)	DuraLite (Single Seal)	1,3	1,1	**0,022**	1,23	1,48	1,82	0,55	1,27	4,54	**1,23**	10,6	12,2	13,2	14,1	14,8	15,2

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Wood	Cl-Ar-LowE (1,1)	Aluminum (Dual Seal)	0,229	0,194	**0,0399**	4,04	4,86	19,59	5,92	13,67	14,89	**0,238**	41,5	48,2	52,3	55,4	57,6	58,8
2	Wood	Cl-Ar-LowE (1,1)	Stainless Steel (Dual Seal)	0,229	0,194	**0,0312**	4,04	4,86	19,59	5,92	13,67	14,89	**0,231**	44,6	50,0	53,4	55,9	57,9	59,0
3	Wood	Cl-Ar-LowE (1,1)	Swisspacer (Dual Seal)	0,229	0,194	**0,0260**	4,04	4,86	19,59	5,92	13,67	14,89	**0,227**	46,6	51,3	54,1	56,5	58,1	59,0
4	Wood	Cl-Ar-LowE (1,1)	DuraSeal TDS (Dual Seal)	0,229	0,194	**0,0249**	4,04	4,86	19,59	5,92	13,67	14,89	**0,226**	46,8	51,4	54,1	56,5	58,1	59,0
5	Wood	Cl-Ar-LowE (1,1)	DuraSeal (Single Seal)	0,229	0,194	**0,0220**	4,04	4,86	19,59	5,92	13,67	14,89	**0,224**	47,8	52,0	54,7	56,7	58,3	59,2
6	Wood	Cl-Ar-LowE (1,1)	SuperSpacer TriSeal	0,229	0,194	**0,0243**	4,04	4,86	19,59	5,92	13,67	14,89	**0,226**	46,8	51,3	54,1	56,5	58,1	59,0
7	Wood	Cl-Ar-LowE (1,1)	TPS 4,8 mm (Dual Seal)	0,229	0,194	**0,0208**	4,04	4,86	19,59	5,92	13,67	14,89	**0,224**	48,2	52,2	54,7	56,7	58,3	59,2
8	Wood	Cl-Ar-LowE (1,1)	SwisspacerV (Dual Seal)	0,229	0,194	**0,0191**	4,04	4,86	19,59	5,92	13,67	14,89	**0,222**	48,9	52,5	55,0	56,8	58,5	59,2
9	Wood	Cl-Ar-LowE (1,1)	DuraLite (Dual Seal)	0,229	0,194	**0,0156**	4,04	4,86	19,59	5,92	13,67	14,89	**0,219**	49,8	53,2	55,4	57,0	58,5	59,2
10	Wood	Cl-Ar-LowE (1,1)	InsulEdge TDS (Dual Seal)	0,229	0,194	**0,0168**	4,04	4,86	19,59	5,92	13,67	14,89	**0,220**	49,5	52,9	55,2	57,0	58,5	59,2
11	Wood	Cl-Ar-LowE (1,1)	DuraLite (Single Seal)	0,229	0,194	**0,0127**	4,04	4,86	19,59	5,92	13,67	14,89	**0,217**	51,1	54,0	55,8	57,4	58,6	59,4

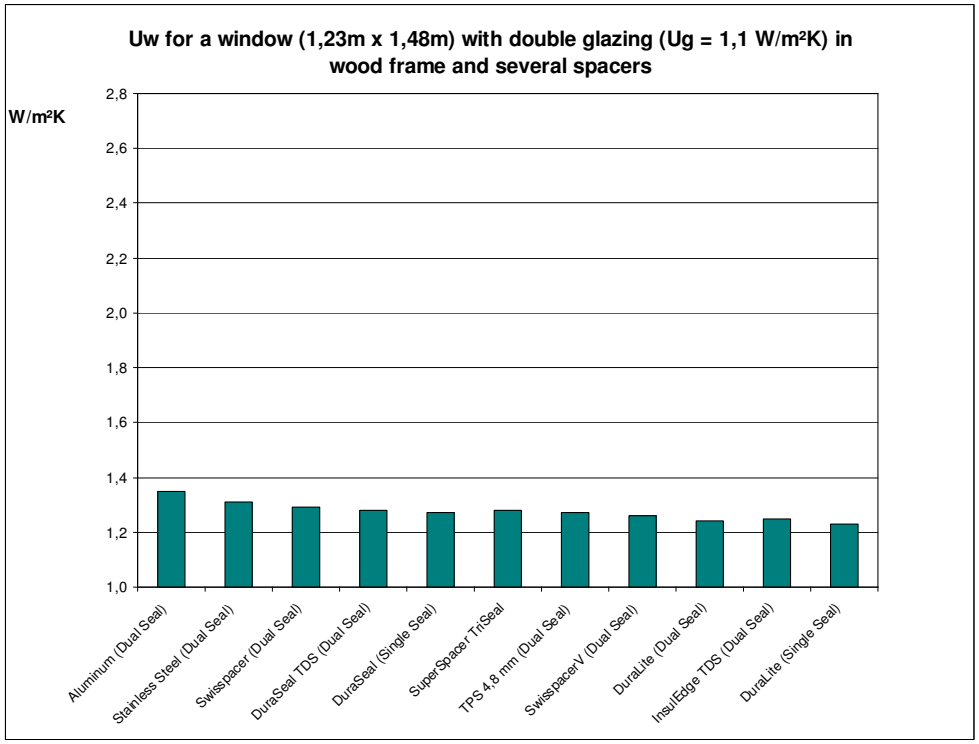
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window

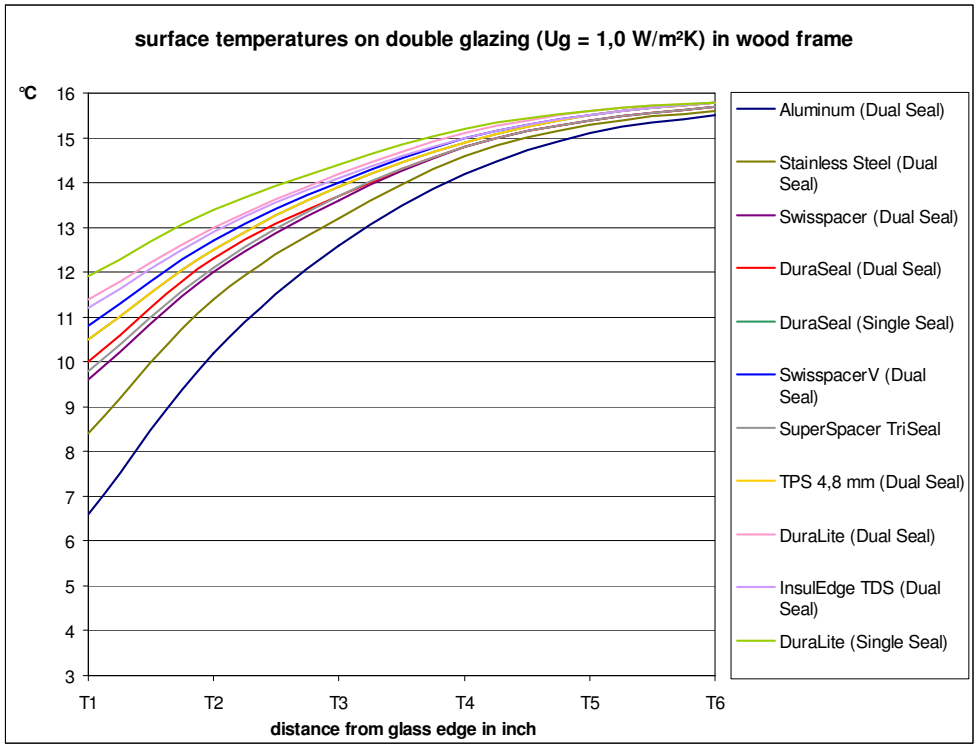


6.3.4 Triple glazing 1 (clear – air – clear – argon – low-E)
all results (tabularly)

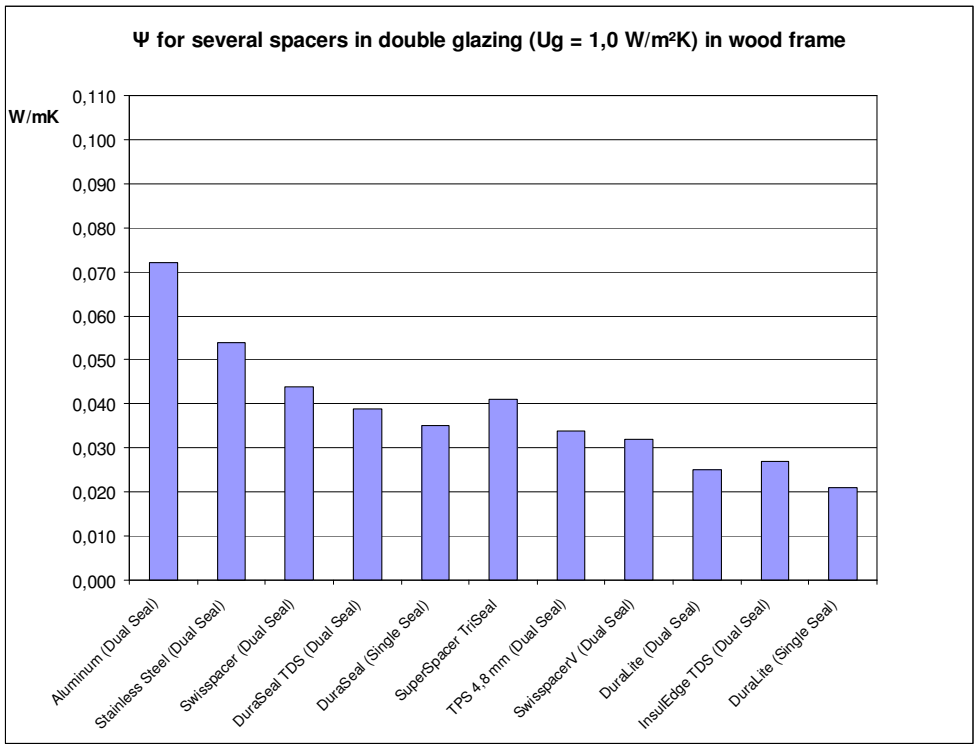
No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				W/m²K	W/m²K	W/mK	m	m	m²	m²	m²	m	W/m²K	°C	°C	°C	°C	°C	°C
1	Wood	Cl-Air-Cl-Ar-LowE (1,0)	Aluminum (Dual Seal)	1,3	1,0	0,072	1,23	1,48	1,82	0,55	1,27	4,54	1,27	6,6	10,2	12,6	14,2	15,1	15,5
2	Wood	Cl-Air-Cl-Ar-LowE (1,0)	Stainless Steel (Dual Seal)	1,3	1,0	0,054	1,23	1,48	1,82	0,55	1,27	4,54	1,23	8,4	11,4	13,2	14,6	15,3	15,6
3	Wood	Cl-Air-Cl-Ar-LowE (1,0)	Swisspacer (Dual Seal)	1,3	1,0	0,044	1,23	1,48	1,82	0,55	1,27	4,54	1,20	9,6	12,0	13,6	14,8	15,4	15,7
4	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal TDS (Dual Seal)	1,3	1,0	0,039	1,23	1,48	1,82	0,55	1,27	4,54	1,19	10,0	12,3	13,7	14,8	15,4	15,7
5	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal (Single Seal)	1,3	1,0	0,035	1,23	1,48	1,82	0,55	1,27	4,54	1,18	10,5	12,5	13,9	14,9	15,5	15,8
6	Wood	Cl-Air-Cl-Ar-LowE (1,0)	SuperSpacer TriSeal	1,3	1,0	0,041	1,23	1,48	1,82	0,55	1,27	4,54	1,20	9,8	12,1	13,7	14,8	15,4	15,7
7	Wood	Cl-Air-Cl-Ar-LowE (1,0)	TPS 4,8 mm (Dual Seal)	1,3	1,0	0,034	1,23	1,48	1,82	0,55	1,27	4,54	1,18	10,5	12,5	13,9	14,9	15,5	15,8
8	Wood	Cl-Air-Cl-Ar-LowE (1,0)	SwisspacerV (Dual Seal)	1,3	1,0	0,032	1,23	1,48	1,82	0,55	1,27	4,54	1,17	10,8	12,7	14,0	15,0	15,5	15,8
9	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Dual Seal)	1,3	1,0	0,025	1,23	1,48	1,82	0,55	1,27	4,54	1,16	11,4	13,0	14,2	15,1	15,6	15,8
10	Wood	Cl-Air-Cl-Ar-LowE (1,0)	InsulEdge TDS (Dual Seal)	1,3	1,0	0,027	1,23	1,48	1,82	0,55	1,27	4,54	1,16	11,2	12,9	14,1	15,0	15,5	15,8
11	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Single Seal)	1,3	1,0	0,021	1,23	1,48	1,82	0,55	1,27	4,54	1,15	11,9	13,4	14,4	15,2	15,6	15,8

No.	frame	glass	spacer	Uf	Ug	Psi	Bw	Hw	Atot	Af	Ag	Lpsi	Uw	T1	T2	T3	T4	T5	T6
				Btu/h ft² °F	Btu/h ft² °F	Btu/h ft °F	ft	ft	ft²	ft²	ft²	ft	Btu/h ft² °F	°F	°F	°F	°F	°F	°F
1	Wood	Cl-Air-Cl-Ar-LowE (1,0)	Aluminum (Dual Seal)	0,229	0,176	0,0416	4,04	4,86	19,59	5,92	13,67	14,89	0,224	43,9	50,4	54,7	57,6	59,2	59,9
2	Wood	Cl-Air-Cl-Ar-LowE (1,0)	Stainless Steel (Dual Seal)	0,229	0,176	0,0312	4,04	4,86	19,59	5,92	13,67	14,89	0,217	47,1	52,5	55,8	58,3	59,5	60,1
3	Wood	Cl-Air-Cl-Ar-LowE (1,0)	Swisspacer (Dual Seal)	0,229	0,176	0,0254	4,04	4,86	19,59	5,92	13,67	14,89	0,211	49,3	53,6	56,5	58,6	59,7	60,3
4	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal TDS (Dual Seal)	0,229	0,176	0,0225	4,04	4,86	19,59	5,92	13,67	14,89	0,210	50,0	54,1	56,7	58,6	59,7	60,3
5	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraSeal (Single Seal)	0,229	0,176	0,0202	4,04	4,86	19,59	5,92	13,67	14,89	0,208	50,9	54,5	57,0	58,8	59,9	60,4
6	Wood	Cl-Air-Cl-Ar-LowE (1,0)	SuperSpacer TriSeal	0,229	0,176	0,0237	4,04	4,86	19,59	5,92	13,67	14,89	0,211	49,6	53,8	56,7	58,6	59,7	60,3
7	Wood	Cl-Air-Cl-Ar-LowE (1,0)	TPS 4,8 mm (Dual Seal)	0,229	0,176	0,0197	4,04	4,86	19,59	5,92	13,67	14,89	0,208	50,9	54,5	57,0	58,8	59,9	60,4
8	Wood	Cl-Air-Cl-Ar-LowE (1,0)	SwisspacerV (Dual Seal)	0,229	0,176	0,0185	4,04	4,86	19,59	5,92	13,67	14,89	0,206	51,4	54,9	57,2	59,0	59,9	60,4
9	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Dual Seal)	0,229	0,176	0,0145	4,04	4,86	19,59	5,92	13,67	14,89	0,204	52,5	55,4	57,6	59,2	60,1	60,4
10	Wood	Cl-Air-Cl-Ar-LowE (1,0)	InsulEdge TDS (Dual Seal)	0,229	0,176	0,0156	4,04	4,86	19,59	5,92	13,67	14,89	0,204	52,2	55,2	57,4	59,0	59,9	60,4
11	Wood	Cl-Air-Cl-Ar-LowE (1,0)	DuraLite (Single Seal)	0,229	0,176	0,0121	4,04	4,86	19,59	5,92	13,67	14,89	0,203	53,4	56,1	57,9	59,4	60,1	60,4

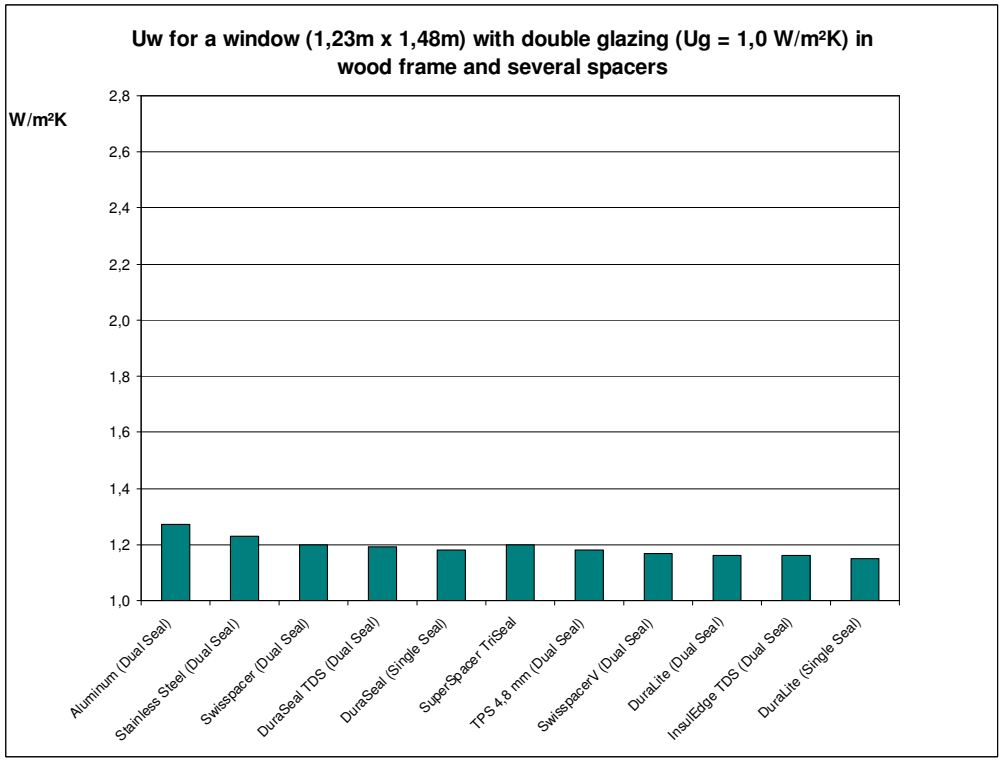
results in charts
surface temperatures



Ψ-value of the spacer



U-value of the window



Ingenieurbüro BAUWERK
Rosenheim, October 24th 2006

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