BUILDCHECK

Report in Accordance with
BS EN ISO 10077-1:2006

Thermal Performance of Windows, Doors & Shutters

Calculation of Thermal Transmittance
Part 1: Simplified Method

CONFIDENTIAL

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1 Introduction

This document details the thermal performance calculation of the Montanstahl W20 steel double doorset with kick plate, configuration as detailed below.

The frame profile results detailed below are provided by computer simulation using LBL software program THERM 5.2 and validated against proofs in Annex D (D1 to D10) of BS EN ISO 10077-2:2012. The frame profile results detailed below are provided from methods contained in BS EN ISO 10077-1:2006.

2 Summary of Results

2.1 Frame thermal transmittance (in accordance with BS EN ISO 10077-1: 2006)

Frame Profile	Frame Thermal Transmittance (U_f)
Threshold and bottom jambs	6.0 W/m^{2}K
Head and top jambs	6.2 W/m^{2}K
Mid rails	5.8 W/m^{2}K
Bottom rail	5.6 W/m^{2}K
Meeting edge (glazing/glazing)	6.1 W/m^{2}K
Meeting edge (panel/panel)	6.0 W/m^{2}K

2.2 Linear thermal transmittance (in accordance with BS EN ISO 10077-1: 2006)

Frame Profile	Linear Thermal Transmittance (ψ)
Threshold and bottom jambs	0.056 W/m.K
Head and top jambs	0.066 W/m.K
Mid rails	0.14 W/m.K
Bottom rail	0.12 W/m.K
Meeting edge (glazing/glazing)	0.13 W/m.K
Meeting edge (panel/panel)	0.11 W/m.K

2.3 Centre pane U-Value of glazing calculated in accordance with BS EN 673: 2011

Glazing unit	Centre pane U-value (U_g)
Nominal dimensions 4-10-4 90% krypton 10% air filled, normal emissivity 0.01 (4mm float, 10mm cavity, 4mm Planitherm One) with Swisspacer V spacer	0.96 W/m^{2}K

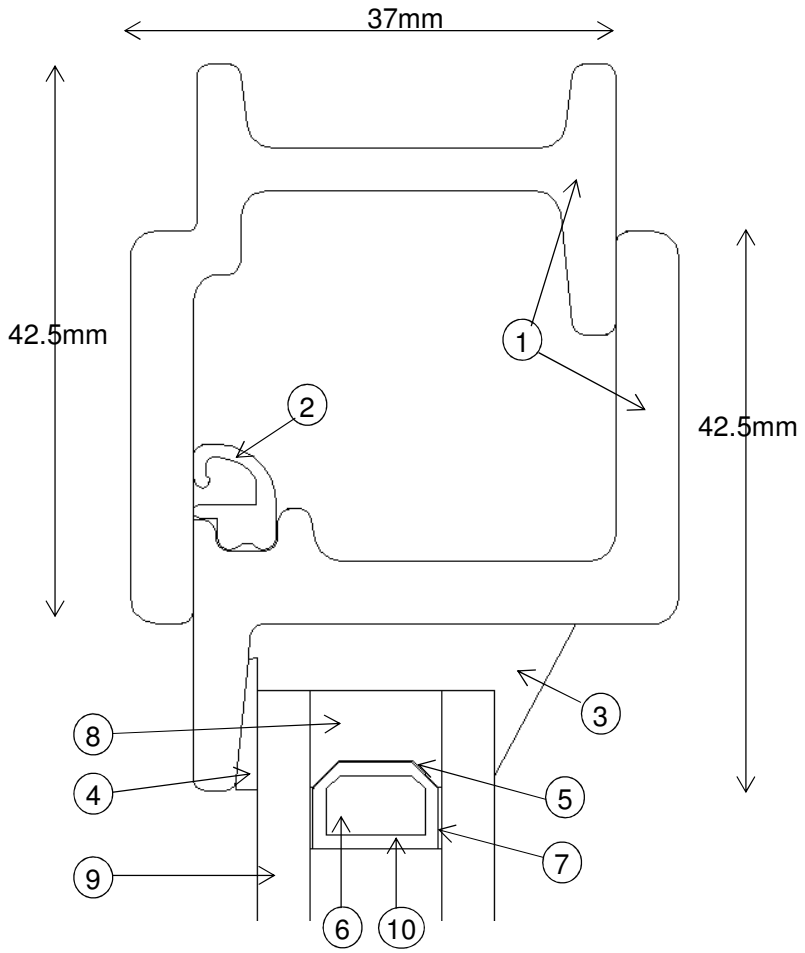
2.4 U-Value

The thermal performance of the window (U_W) in accordance with EN ISO 10077-1:2006 is:

2.5 W/m^{2}K

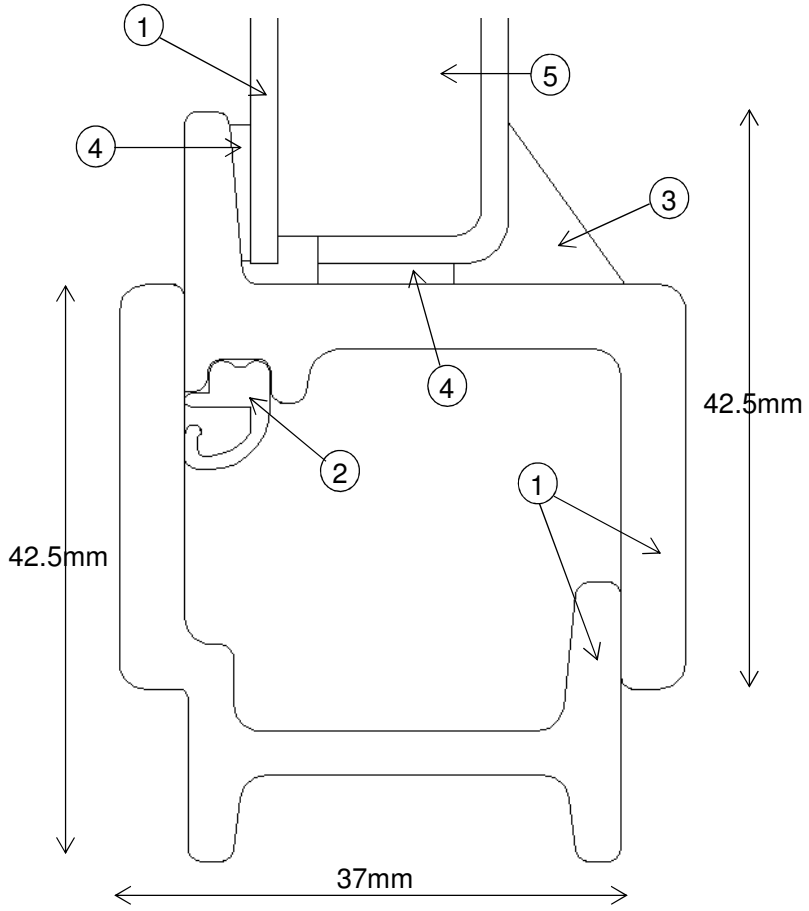
All profile calculations based on BS EN ISO 10077-2:2012

Figure 1. Technical drawing of head and top jambs.



Material		Thermal Conductivity W/(m.K)
1	Steel, Annex A of BS 10077-2	50.0
2	EPDM, Annex A of BS 10077-2	0.24
3	Silicone, Annex A of BS 10077-2	0.35
4	PVC flexible, Annex A of BS 10077-2	0.14
5	Stainless steel, Annex A of BS 10077-2	1.42
6	Molecular sieve desiccant, Annex A of BS 10077-2	0.10
7	Polyisobutylene, Annex A of BS 10077-2	0.20
8	Polysulfide/polyurethane, Annex A of BS 10077-2	0.40
9	Soda lime glass, Annex A of BS 10077-2	1.0
10	Fibre-glass (UP Resin), Annex of BS 10077-2	0.4

Figure 2. Technical drawing of threshold and bottom jambs profile.



Material		Thermal Conductivity W/(m.K)
1	Steel, Annex A of BS 10077-2	50.0
2	EPDM, Annex A of BS 10077-2	0.24
3	Silicone, Annex A of BS 10077-2	0.35
4	PVC flexible, Annex A of BS 10077-2	0.14
5	Plywood (density 70kg/m^3), Annex A of BS 10077-2	0.17

Figure 3. Technical drawing of mid rails profile.

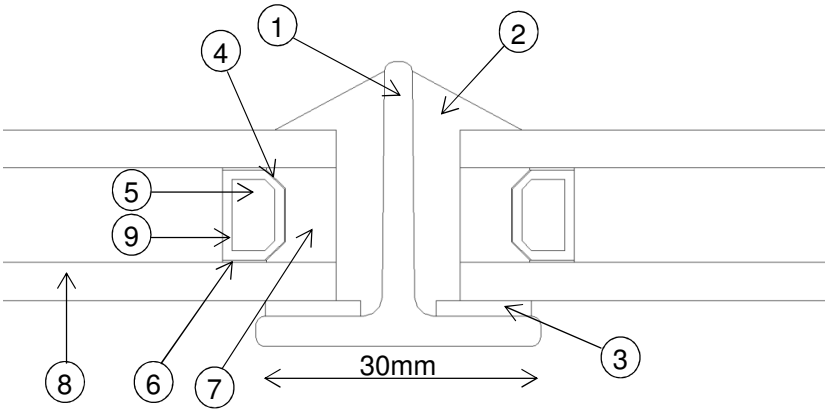
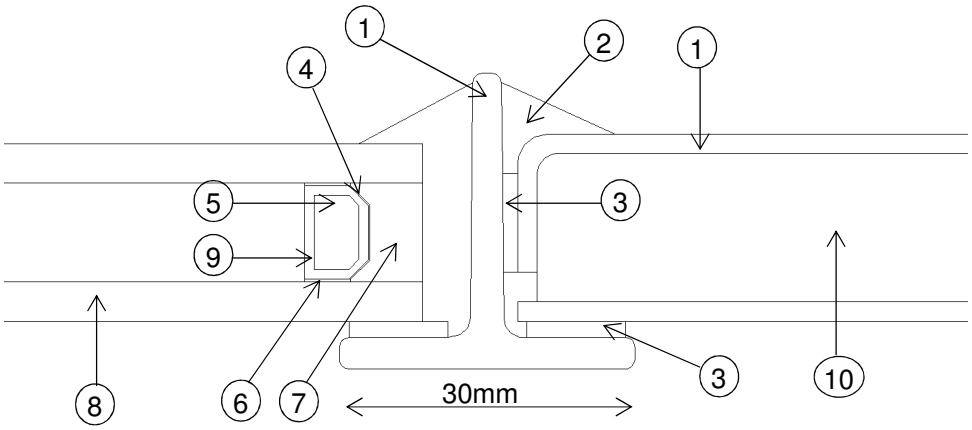


Figure 4. Technical drawing of bottom rail profile.



Material		Thermal Conductivity W/(m.K)
1	Steel, Annex A of BS 10077-2	50.0
2	Silicone, Annex A of BS 10077-2	0.35
3	PVC flexible, Annex A of BS 10077-2	0.14
4	Stainless steel, Annex A of BS 10077-2	1.42
5	Molecular sieve desiccant, Annex A of BS 10077-2	0.10
6	Polyisobutylene, Annex A of BS 10077-2	0.20
7	Polysulfide/polyurethane, Annex A of BS 10077-2	0.40
8	Soda lime glass, Annex A of BS 10077-2	1.0
9	Fibre-glass (UP Resin), Annex of BS 10077-2	0.4
10	Plywood (density 70kg/m³), Annex A of BS 10077-2	0.17

Figure 5. Technical drawing of meeting edge (glazing/glazing) profile.

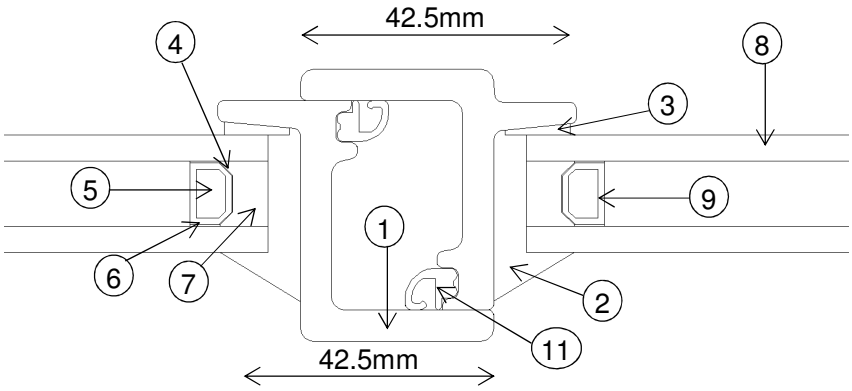
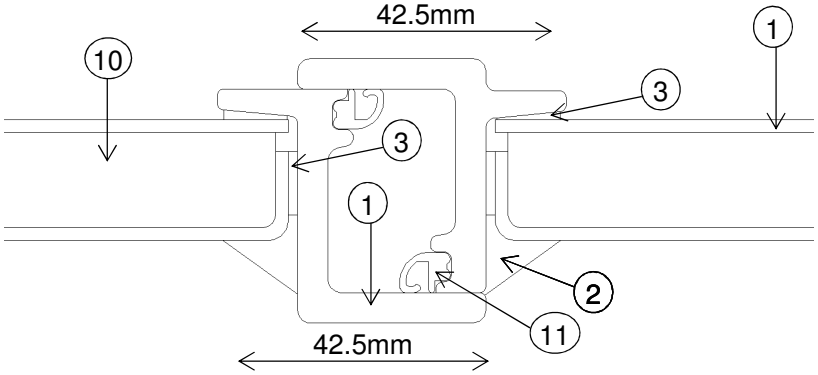
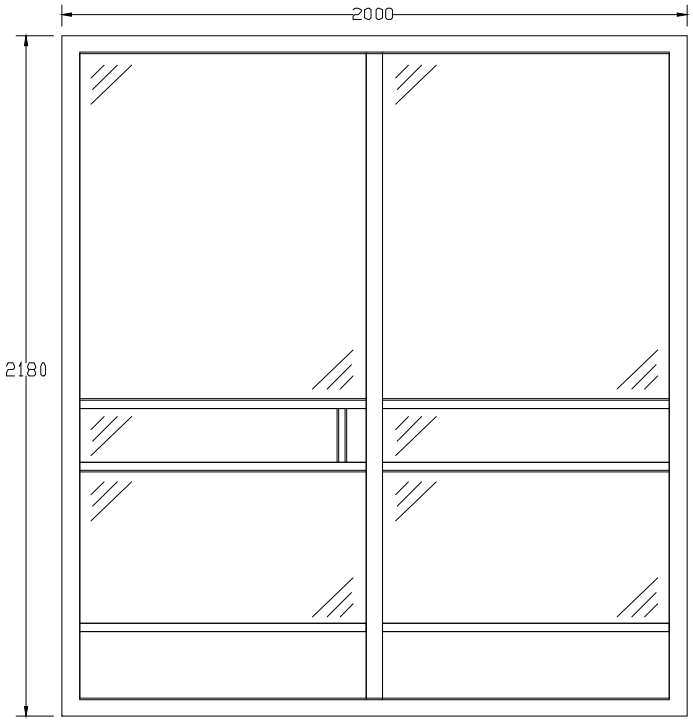


Figure 6. Technical drawing of meeting edge (panel/panel) profile.



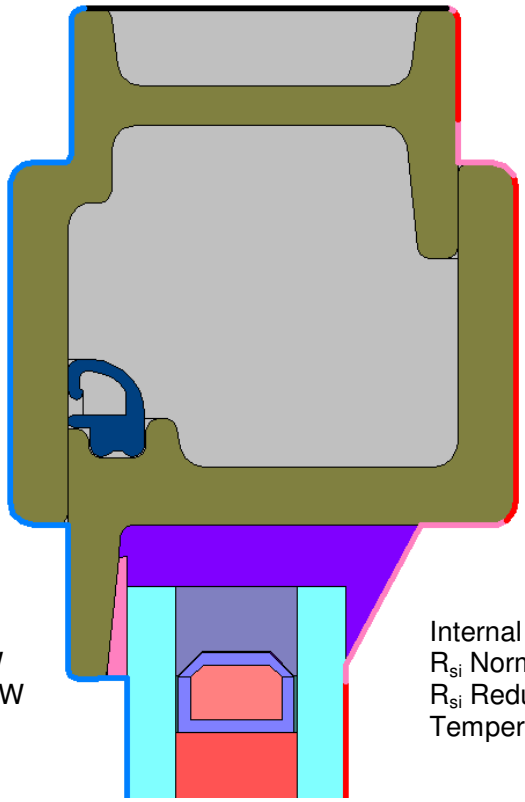
Material		Thermal Conductivity W/(m.K)
1	Steel, Annex A of BS 10077-2	50.0
2	Silicone, Annex A of BS 10077-2	0.35
3	PVC flexible, Annex A of BS 10077-2	0.14
4	Stainless steel, Annex A of BS 10077-2	1.42
5	Molecular sieve desiccant, Annex A of BS 10077-2	0.10
6	Polyisobutylene, Annex A of BS 10077-2	0.20
7	Polysulfide/polyurethane, Annex A of BS 10077-2	0.40
8	Soda lime glass, Annex A of BS 10077-2	1.0
9	Fibre-glass (UP Resin), Annex of BS 10077-2	0.4
10	Plywood (density 70kg/m^3), Annex A of BS 10077-2	0.17
11	EPDM, Annex A of BS 10077-2	0.24

Figure 7. Drawing of the window configuration and overall dimensions (from the internal face)



Internal projected frame area ($A_{f,i}$)	0.614 m^2
External projected frame area ($A_{f,e}$)	0.614 m^2
Glazed area of configuration (A_g)	3.237 m^2
Frame area of configuration (A_f)	0.614 m^2
Perimeter length of the glazing (l_g)	12.671 m

Figure 8. Head and top jambs profile simulation



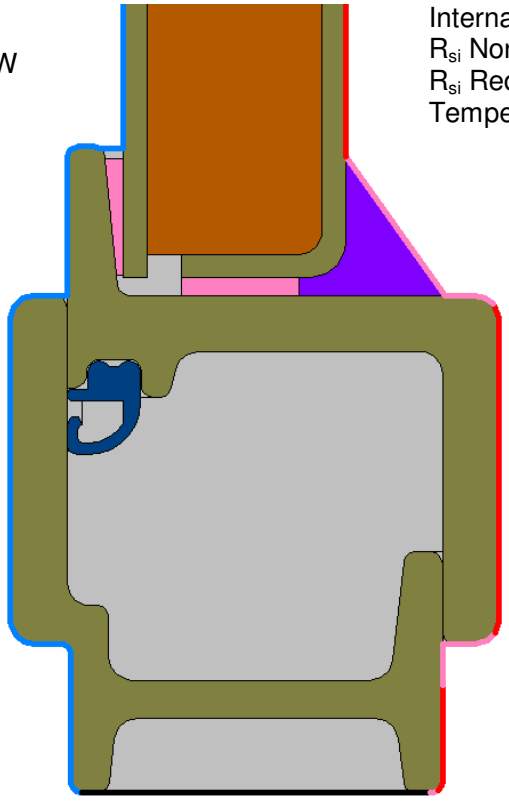
External Environment
R_{se} Normal = 0.04 m^2K/W
R_{se} Reduced = 0.04 m^2K/W
Temperature = 0^0C

Internal Environment
R_{si} Normal = 0.13 m^2K/W
R_{si} Reduced = 0.20 m^2K/W
Temperature = 20 ^0C

Quad Tree Mesh Parameter 9

Figure 9. Threshold and bottom jambs profile simulation

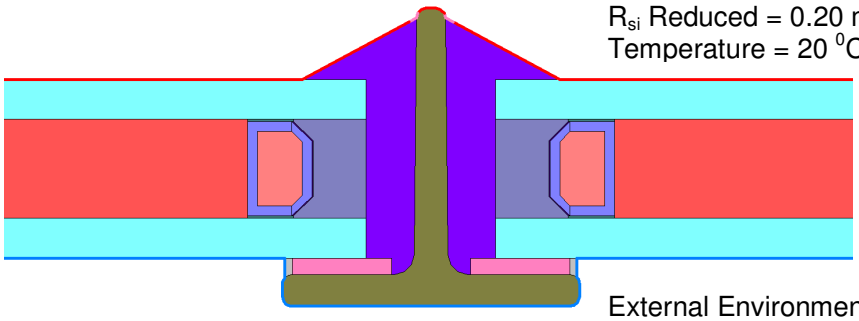
External Environment
R_{se} Normal = 0.04 m^2K/W
R_{se} Reduced = 0.04 m^2K/W
Temperature = 0^0C



Internal Environment
R_{si} Normal = 0.13 m^2K/W
R_{si} Reduced = 0.20 m^2K/W
Temperature = $20\ ^0C$

Quad Tree Mesh Parameter 9

Figure 10. Mid rails profile simulation

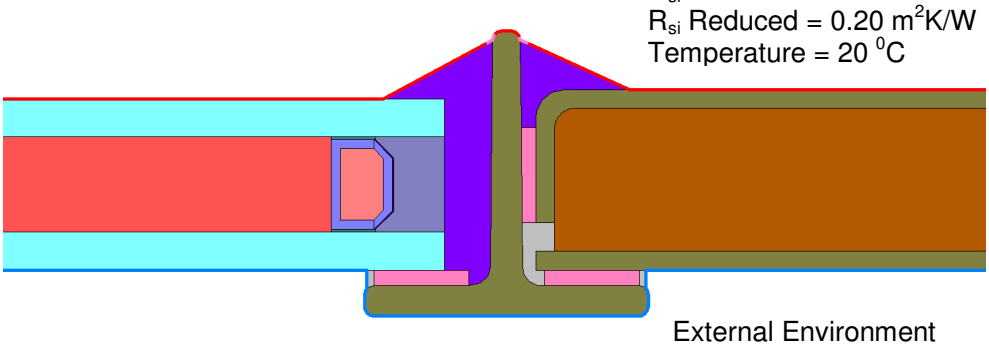


Internal Environment
R_{si} Normal = 0.13 m^2K/W
R_{si} Reduced = 0.20 m^2K/W
Temperature = 20 ^0C

Quad Tree Mesh Parameter 9

External Environment
R_{se} Normal = 0.04 m^2K/W
R_{se} Reduced = 0.04 m^2K/W
Temperature = 0^0C

Figure 11. Bottom rail profile simulation

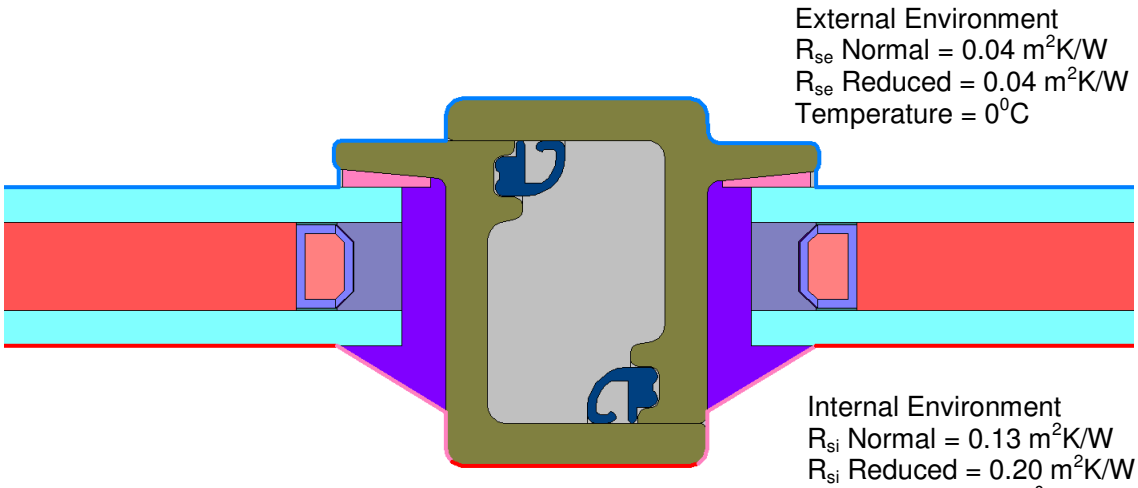


Internal Environment
R_{si} Normal = 0.13 m^2K/W
R_{si} Reduced = 0.20 m^2K/W
Temperature = 20 ^0C

Quad Tree Mesh Parameter 9

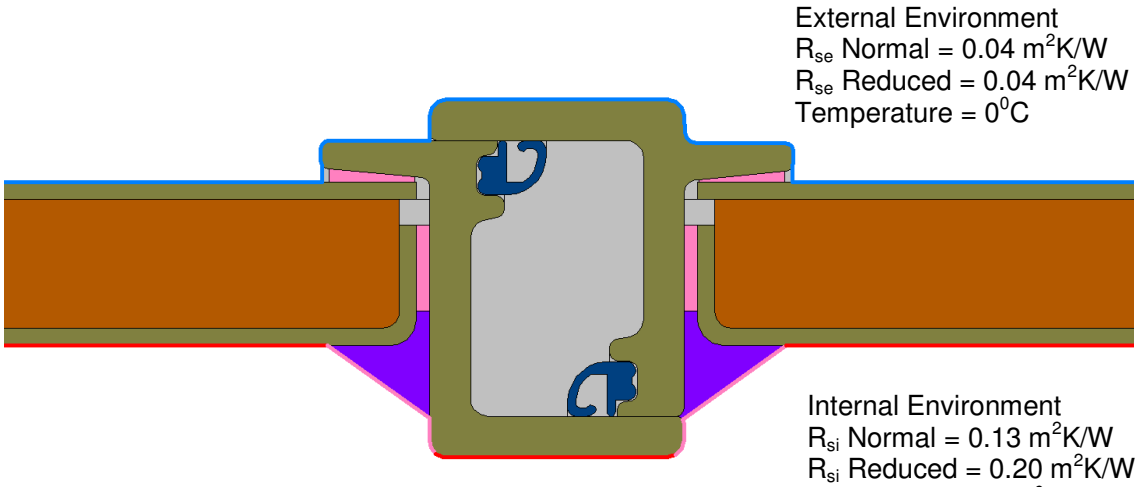
External Environment
R_{se} Normal = 0.04 m^2K/W
R_{se} Reduced = 0.04 m^2K/W
Temperature = 0^0C

Figure 12. Meeting edge (glazing/glazing) profile simulation



Quad Tree Mesh Parameter 9

Figure 13. Meeting edge (panel/panel) profile simulation



Quad Tree Mesh Parameter 9

Glazing unit 4-10-4 Low E 0.01 uncorrected 90% krypton 10% air filled

BS EN 673:2011 Glass in building- Determination of thermal transmittance (*U* value)-Calculation method.								
Standardised boundary conditions (section 8)								
r		1	m.K/w		Thermal resistivity of soda lime glass			
ε glass		0.837			Corrected emissivity of uncoated soda lime and borosilicate glass surface			
delta T		15	K		Temperature difference betw een bounding glass surface			
Tm		283	K		Mean temperature of gas space			
σ		5.67E-08	W/(m2K4)		Stefan-Boltzmann's constant			
he		25	W/(m2K)		External heat transfer coeff. for uncoated soda lime glass surfaces			
hi		7.7	W(m2K)		Internal heat transfer coeff. for uncoated soda lime glass surfaces			
A		0.035			Constant			
n		0.38			Exponent			
Gas properties (section 6)								
Density: ρ		3.3272	kg/m3					
Dynamic viscosity: μ		2.34E-05	kg/(ms)					
Thermal conductance: λ		0.010596	W/(m.K)					
Specific Heat Capacity: c		321.3	J/(kg.K)					
s		0.01	m		w idth of gas space			
ε 1		0.837			corrected emissivity of surface 1			
ε 2		0.013			corrected emissivity of surface 2	or 0.18		
Glass pane 1 d		0.004	m		thickness of glass 1			
Glass pane 2 d		0.004	m		thickness of glass 2			
Calculated values								
Pr		7.08E-01						
Gr		1.05E+04						
Nu		1.04E+00	1	1.04E+00	If Nu is less than 1, use Nu = 1.			
hr		6.48E-02						
hg		1.10E+00						
hs = hr + hg		1.16E+00						
1/ht		8.67E-01						
1/U = 1/he + 1/ht + 1/hi		1.04E+00						
Centre pane U value		**0.9644026**						