Customer:

TGI Technoform Glass Insulation GmbH
Matthäus-Merian-Str. 6
34253 Lohfelden, GERMANY

Project/Customer:

TGI Georgian Bars in double and triple insulating glass units

Content:

- U_f simulation of profiles in accordance to EN ISO 10077-2
- U_g calculation of insulating glass in accordance to EN 673
- Ψ_g simulation of IG Georgian bars in accordance to EN ISO 10077-2 and EN ISO 10211
- U_w calculation of windows in accordance to EN ISO 10077-1
- Simulation of isothermal lines, surface temperatures and temperature factor f_{Rsi}

Object:

- Profile: Reinforced PVC window profile in accordance to IFT guideline WA-08/2
- Insulating glass units:
  - Double insulating glass unit 4-16-4, U_g = 1.1 W/m²K, 90% Argon filling, Low-E coating at face #3 (ε_n= 0.03)
  - Triple insulating glass unit 4-12-4-12-4), U_g = 0.7 W/m²K, 90% Argon filling, Low-E coating at face #2 and #5 (ε_n= 0.03)
- Insulating glass edge spacer: TGI M Spacer with 3 mm secondary sealant (Polysulphide or equal/better)
- Georgian Bar: TGI Georgian Bar 1000138.AZ and 1000140.AZ (see drawing)

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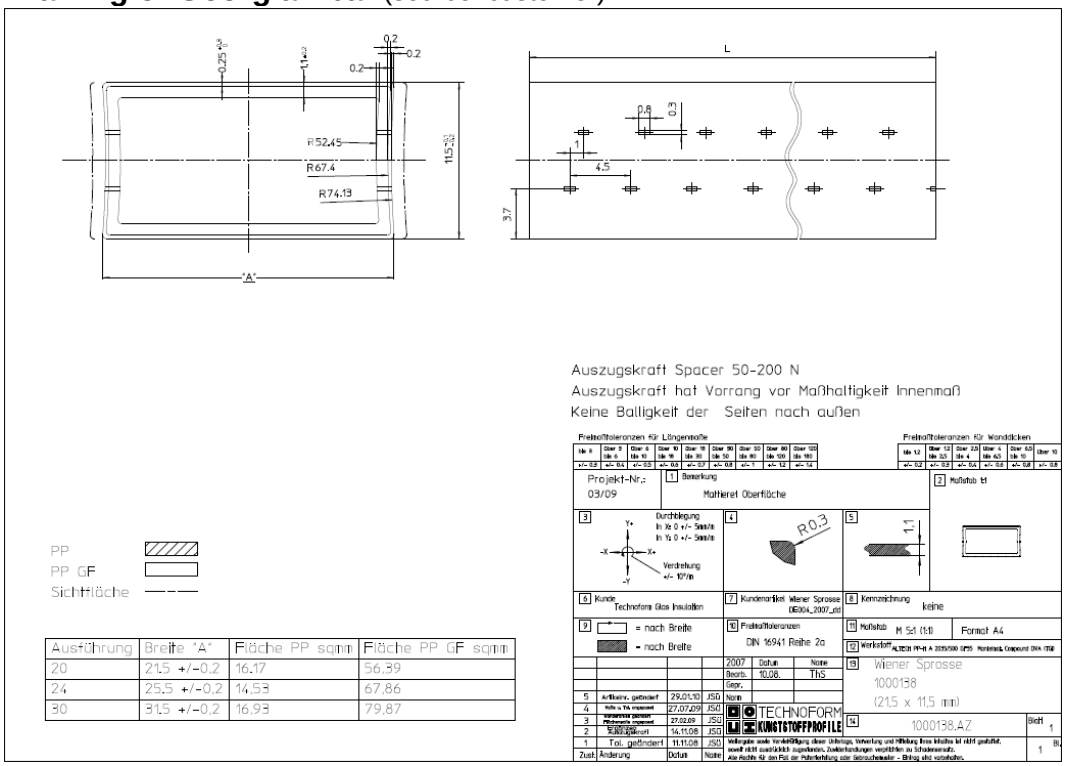
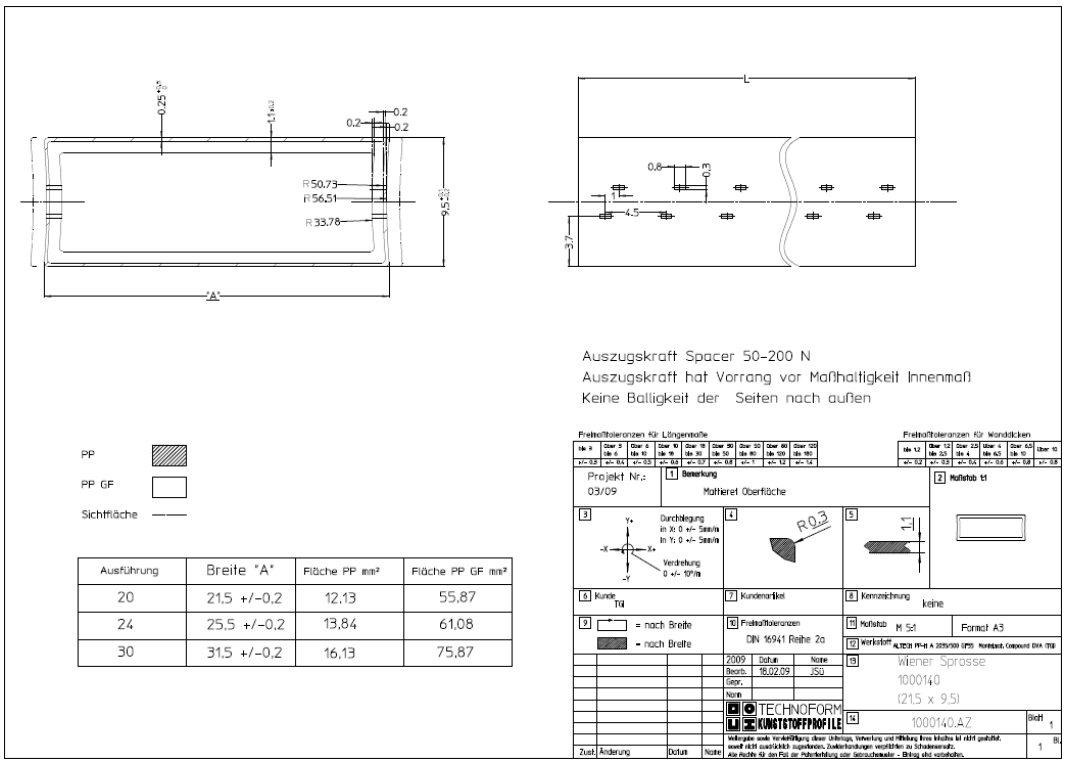
Rosenheim, 17th November 2014

Dipl.-Ing. (FH) Roland Steinert

Drawing of Georgian bar (source: customer):



Ausführung	Breite "A"	Fläche PP sqmm	Fläche PP GF sqmm
20	21,5 +/-0,2	16,17	56,39
24	25,5 +/-0,2	14,53	67,86
30	31,5 +/-0,2	16,93	79,87



Ausführung	Breite "A"	Fläche PP mm²	Fläche PP GF mm²
20	21,5 +/-0,2	12,13	55,87
24	25,5 +/-0,2	13,84	61,08
30	31,5 +/-0,2	16,13	75,87

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Materials:

	Boundary conditions	R_s / R (m^2K/W)	θ (°C)	10077-2 conform
	external air	0.040	0.0 / -10.0	X / -
	internal air (reduced radiation and convection)	0.20	20.0	X
	Material	λ* (W/mK)		10456 conform
	Float glass	1.0		X
	Gas in IGU cavity	according to EN ISO 673		X
	Polypropylene (TGI Georgian Bar)	**0.19		-
	Polypropylene glass fibre reinforced (TGI Georgian Bar)	**0.25		-

For thermal simulations designed values of thermal conductivity in accordance to EN ISO 10456 must be used. The tabulated values are designed values unless there are marked as different.
Values marked with " ** " are designed values taken from customers declaration. Certificates are available from the customer.

Assumptions/Advices:

- Due to the lack of missing normative definitions for calculating linear thermal transmittance of Georgian bars the values in this report were calculated in the following way: The gas cavity of the IGU as well as the gas cavities between the coated and uncoated glass panes and the Georgian bars were separately calculated in accordance to EN 673 and equivalent conductivities were determined. Convective exchanges between the gas cavities divided by the Georgian bars are not taken into account. Also differences of the convective performance in the gas between vertical and horizontal Georgian bars are not taken into account.
- The following results are only valid for the shown geometries and material characteristics. The geometries are based on drawing provided by the customer.

Isothermal lines:

-10°C to 20°C in 1°C steps
Red: **13°C isothermal line**
Blue: **10°C isothermal line (condensation critical temperature 20°C, 50%)**
Black: **0°C isothermal line**

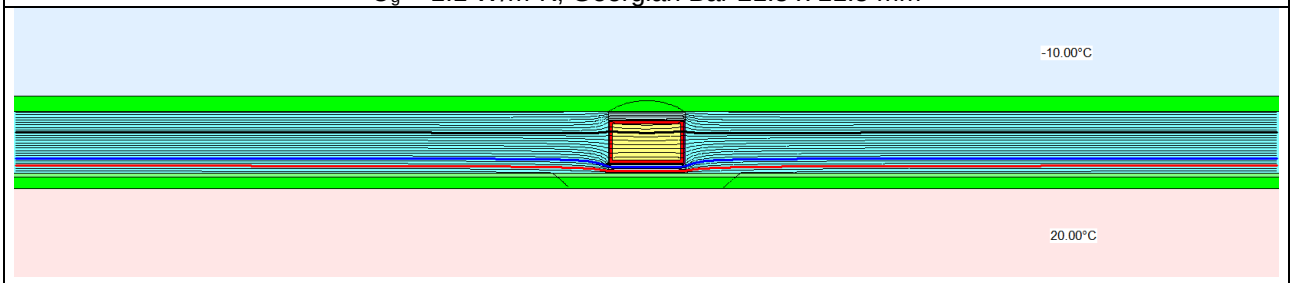
Normative references:

- EN ISO 10077-1:2010-05, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General
- EN ISO 10077-2:2012-06, Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2: Numerical method for frames
- EN ISO 10211:2008-04, Thermal bridges in building construction – Heat flows and surface temperatures
- EN 673:2011-04, Glass in building – Determination of thermal transmittance (U value) – Calculation method
- ift guideline WA-082:2013, Thermally improved spacers, Part 2 – Determination of representative Ψ values for profile sections of windows
- EN ISO 6946:2008-04, Building components and building elements – Thermal resistance and thermal transmittance – Calculation method
- EN ISO 10456:2010-05, Building materials and products – hygrothermal properties – tabulated values and procedure for determining declared and designed thermal values

TGI Georgian Bar in 24 mm double insulating glass unit

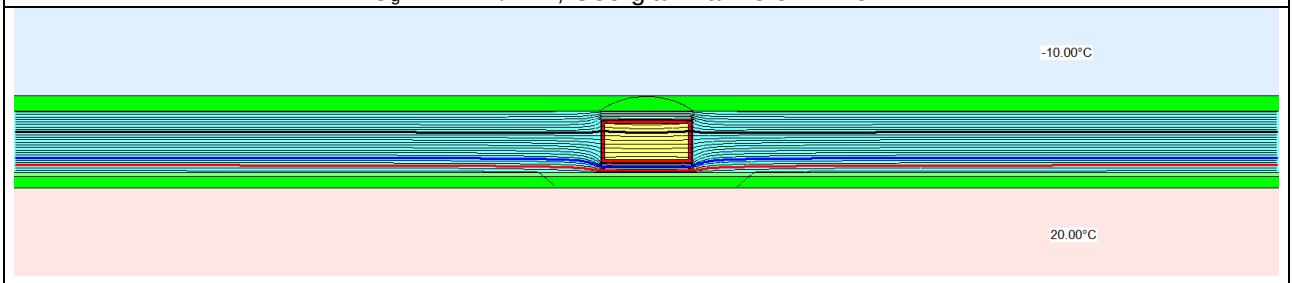
Results of the linear thermal transmittance, minimum surface temperatures with -10°C externally and the temperature factor f_{Rsi}

U_g = 1.1 W/m²K, Georgian Bar 21.5 x 11.5 mm



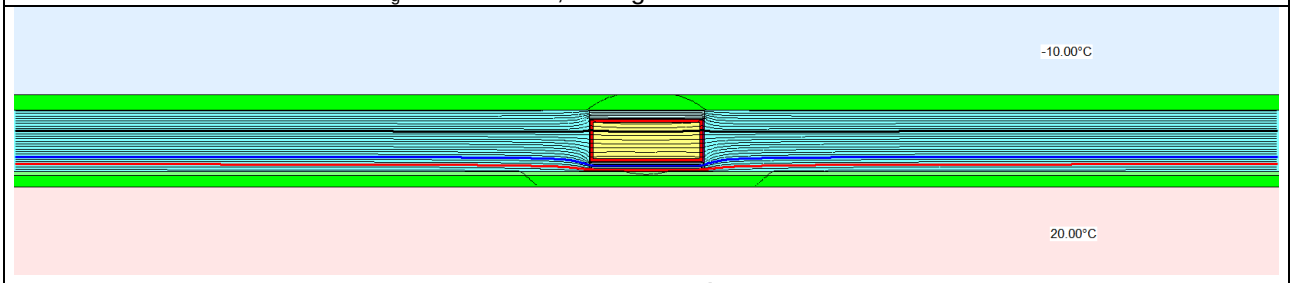
Ψ_S = 0.018 W/mK
Θ_{Si} = 14.5 C°
f_{Rsi} = 0.82

U_g = 1.1 W/m²K, Georgian Bar 25.5 x 11.5 mm



Ψ_S = 0.020 W/mK
Θ_{Si} = 14.3 C°
f_{Rsi} = 0.81

U_g = 1.1 W/m²K, Georgian Bar 31.5 x 11.5 mm



Ψ_S = 0.025 W/mK
Θ_{Si} = 14.1 C°
f_{Rsi} = 0.80

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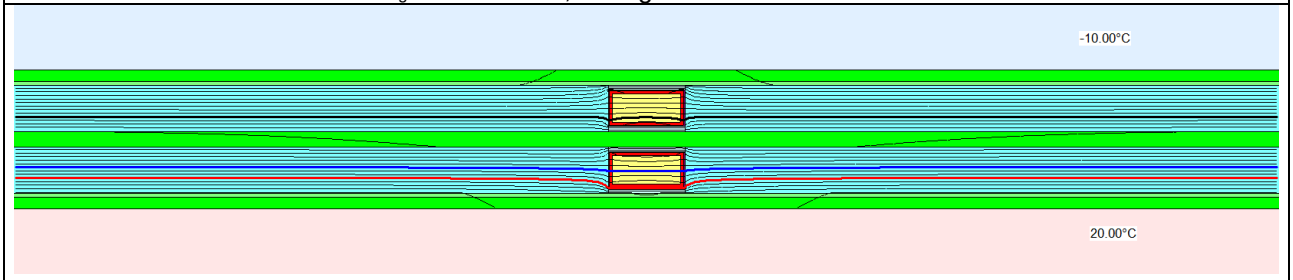
TGI Georgian Bar in 36 mm triple insulating glass unit

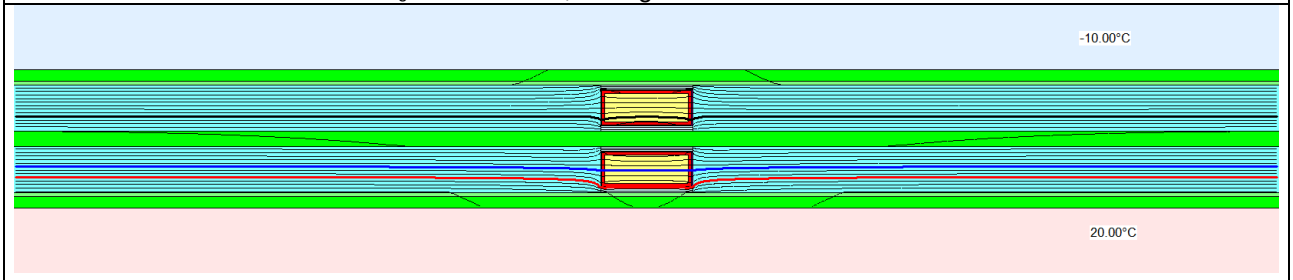
Results of the linear thermal transmittance, minimum surface temperatures with -10°C externally and the temperature factor f_{Rsi}

U_g = 0.7 W/m²K, Georgian Bar 21.5 x 9.5 mm



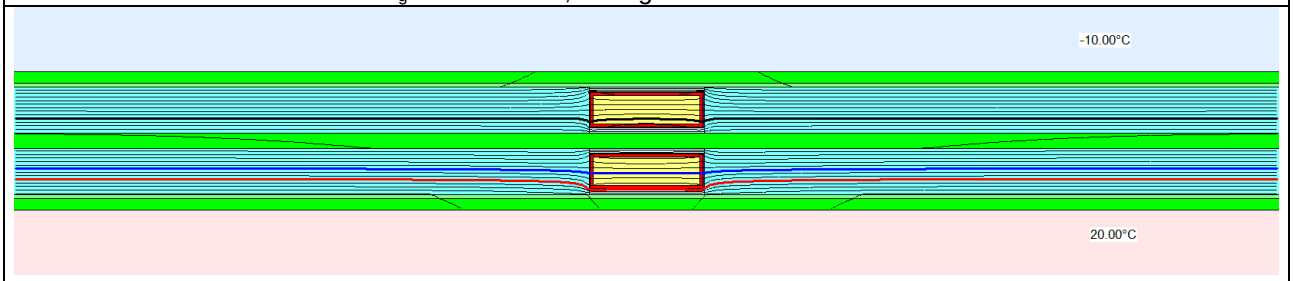
Ψ_S = 0.017 W/mK
Θ_{Si} = 16.1 C°
f_{Rsi} = 0.87

U_g = 0.7 W/m²K, Georgian Bar 25.5 x 9.5 mm



Ψ_S = 0.020 W/mK
Θ_{Si} = 16.0 C°
f_{Rsi} = 0.87

U_g = 0.7 W/m²K, Georgian Bar 31.5 x 9.5 mm



Ψ_S = 0.024 W/mK
Θ_{Si} = 15.8 C°
f_{Rsi} = 0.86

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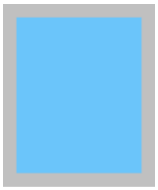
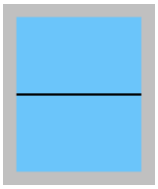
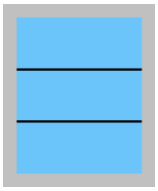
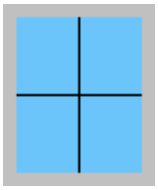
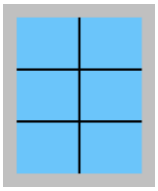
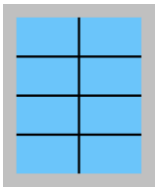
	U_w values in W/m²K for a single sash side hung window 1.23 x 1.48 m Frame: PVC, U_f = 1.2 W/m²K, 117 mm projected frame width	
	Glass: 4-16-4, U_g = 1.1 W/m²K Ψ_g = 0.040* W/mK	Glass: 4-12-4-12-4, U_g = 0.7 W/m²K Ψ_g = 0.038* W/mK
	TGI M Spacer / TGI Georgian Bar	
	**1.2** (1.23)	**0.95** (0.95)
	20 mm: **1.2** (1.24) 24 mm: **1.2** (1.24) 30 mm: **1.3** (1.24)	20 mm: **0.96** (0.96) 24 mm: **0.96** (0.96) 30 mm: **0.97** (0.97)
	20 mm: **1.3** (1.25) 24 mm: **1.3** (1.25) 30 mm: **1.3** (1.26)	20 mm: **0.97** (0.97) 24 mm: **0.97** (0.97) 30 mm: **0.98** (0.98)
	20 mm: **1.3** (1.25) 24 mm: **1.3** (1.26) 30 mm: **1.3** (1.26)	20 mm: **0.98** (0.98) 24 mm: **0.98** (0.98) 30 mm: **0.98** (0.98)
	20 mm: **1.3** (1.26) 24 mm: **1.3** (1.27) 30 mm: **1.3** (1.27)	20 mm: **0.98** (0.98) 24 mm: **0.99** (0.99) 30 mm: **1.0** (1.00)
	20 mm: **1.3** (1.27) 24 mm: **1.3** (1.28) 30 mm: **1.3** (1.29)	20 mm: **0.99** (0.99) 24 mm: **1.0** (1.00) 30 mm: **1.0** (1.01)

*according to BF datasheet No. , Revision index 0, October 2013

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