Ingrid Quel
Beratungsbüro für warme Kante und Glas
Consultant for warm edge and glass

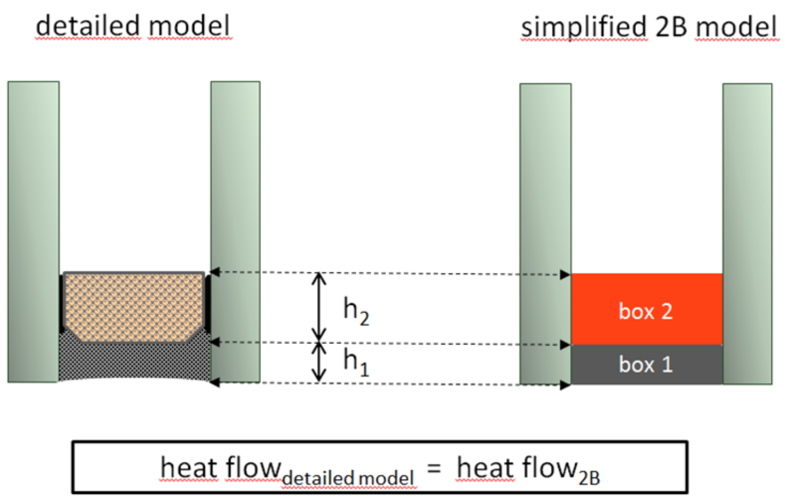
Thermal performance of insulating glass edge bond

Client: Thermoseal Group Ltd.
Gavin Way, Nexus Point, Holford Broadlands
Birmingham, B6 7AF
Great Britain

Object: Comparison of the thermal performance of insulating glass edge bond, consisting of spacer and secondary sealant, for several types of spacers

Method: Two-box-model

To make thermal simulations easier, the two-box-model substitutes the detailed geometry of the insulating glass edge bond with two rectangular boxes of the width of the cavity. Box 1 is representing the secondary sealant and box 2 the spacer. The height of box 2 (h_2) is identical with the actual height of the spacer [1]. The equivalent thermal conductivity value of box 2, $\lambda_{eq,2B}$ can either be determined by simulation of the detailed model or by means of measurement [2].



To compare the thermal performance of glass edge bond, usually a full thermal simulation according to EN 10077-2 including window frame and glass is required, which produces comparable Ψ-values of spacers, if simulated under exactly the same frame conditions.

www.warmedgeconsultant.com

Ingrid Quel
Nelkenstrasse 12
71083 Herrenberg
Germany

Telefon/phone +49-70 32-89 79 196
Mobil/mobile +49-1 71-64 69 801
Fax +49-70 32-89 79 178
E-Mail info@warmedgeconsultant.com

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For quick comparison, a rough and easy assessment can be done by just focusing on the heat flow through the edge bond. The lower the heat flow, the better the thermal performance.

The total heat flow through the edge bond is composed of the heat flow through box 1 and box 2. It is not only depending on the thermal conductivity values λ_1 and $\lambda_{eq,2B}$ of the materials, but also on the heights of the two boxes (E.g. twice the height of the same thermal conductivity would double the heat flow). Therefore, because height matters, it would be misleading to simply compare the equivalent thermal conductivity values $\lambda_{eq,2B}$. Furthermore, it might create wrong conclusions to only look into box 2 and ignore the contribution of box 1, the sealant, to the heat flow.

$$\text{heat flow}_{2B} \sim h_1 \cdot \lambda_1 + h_2 \cdot \lambda_{eq,2B}$$

The two-dimensional heat flow through a box of a fixed width (cavity) at a defined temperature difference ΔT is proportional to the height of the box and to the thermal conductivity value, i.e. it is proportional to the product $h \cdot \lambda$.

Input data:

Spacer	**Equivalent thermal conductivity $\lambda_{eq,2B}$ [W/m·K]**	**Height of box 2 h_2 [m]**	**Indication of source**
Thermoflex	0.27	0.0048	ift Rosenheim Test Report 12-003202-PR02, 16.12.2012
Thermobar	0.155	0.0065	ift Rosenheim Test Report 11-003104-PR02, 28.6.2012
Thermix TX.N	0.33	0.007	BF Data sheet Psi-value for windows, October 2008 No. 10
Super Spacer Standard (EPDM)	0.127	0.0048	NFRC, 2010, document 101-2010 [E5A29], March 2013

Box 1 and 2 were designed to always reach a total height of the edge bond of 10 mm. The width of the boxes (cavity) was 16 mm for all cases.

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Result:

Box 1			Box 2			Box 1 + 2
Sealant	**λ_1 * [W/m·K]**	**h_1 [m]**	**Spacer**	**$\lambda_{eq,2B}$ [W/m·K]**	**h_2 [m]**	**Σ (h·λ) [W/K]**
Hotmelt	0.24	0.0052	Thermoflex	0.27	0.0048	**0,0025**
Polysulphide	0.4	0.0035	Thermobar	0.155	0.0065	**0,0024**
Hotmelt	0.24	0.0035	Thermobar	0.155	0.0065	**0,0018**
Polysulphide	0.4	0.003	Thermix TX.N	0.33	0.007	**0.0035**
Hotmelt	0.24	0.003	Thermix TX.N	0.33	0.007	**0.0030**
Hotmelt	0.24	0.0052	Super Spacer Standard	0.127	0.0048	**0,0019**

* Source: EN ISO 10077-2:2012

Herrenberg, March 14th, 2013

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Literature:

[1] ift-Guideline WA-08engl/1, Thermally improved spacers Part 1 Determination of representative Ψ-values for profile sections of windows, November 2008, ift Rosenheim, Germany

[2] ift-Guideline WA-17engl/1, Thermally improved spacers Part 2 Determination of the equivalent thermal conductivity by means of measurement, February 2013, ift Rosenheim, Germany

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