Test Report P15-043e/2020

Determination of the Reduction of the Heating Demand by Inside Curtains

Products
"Phos Delitherm"
"Eos Delitherm"

Client:
Delius GmbH & Co. KG
Goldstraße 16-18
Deutschland

Stuttgart, February 21, 2020

1 Aufgabenstellung

The Fraunhofer Institute for Building Physics IBP, Stuttgart, was ordered by Delius GmbH & Co. KG to determine by means of calculation in a case study the reduction of the heating demand by a window equipped with the curtain "Eos Delitherm" and "Phos Delitherm". Base of operation were measurements of the reduction of the thermal transmittance U carried out on a test window with an additional inside curtain [1] and [2].

2 Description of Samples

2.1 Curtain and window

The tests in [1] and [2] were carried out with the following products of Delius GmbH:

"Eos Delitherm"   Curtain, white (art No. 41777),

                                     75 % polyester and 25 % metallized yarn
                                     specific weight 120 g/m²
                                     (details from client).

"Phos Delitherm"   Curtain, grey (art. No. 41755),

                                     80 % polyester und 20 % metallized yarn,
                                     specific weight 240 g/m²
                                     (details from client).

The window with the dimensions of 1.23 m x 1.48 m consisted of a PVC sash and a PVC frame and an uncoated double insulating glazing without gas filling, and was provided and installed by the Fraunhofer IBP Stuttgart. The curtain was installed towards the room side. A sketch of the installation is shown in figure 1, the final test set-up for [1] and [2] is shown in figure 2.

2.2 Case study

A hotel room was chosen for the case study of the test set-up:

Building	Old building, partly renovated
Specific demanded heating p.a.	150 kWh/m²a
Area of hotel room	30 m² (5 m x 6 m)
Area of façade	15 m² (5 m x 3 m), 1 outside wall
Area of window	6 m², 9 m² 12 m²
Area percentage of window	20 %, 40 %, 80 %
Window	double insulating glazing, with and without curtain with a mean distance of ca. 219 mm to the glazing
Location, degree day figure	Würzburg, (mean case for Germany) $G_{t20,\,15}$ = 3883 Kd/a.

3   Examinations

Testings were carried out in two stages:

a) Calculation of the mean annual reduction of the transmission heat requirement for all window areas, based on aged isolating glazing of an existing building,

b) Determination of the main energy demand of an oil heating for the supply of the heat requirement difference of a), and determination of annual cost savings.

According to [2], the maximum possible heat requirement reduction with curtains was determined for the reference location Würzburg and the example mentioned in 2.2. In this case it was assumed that the curtains are closed all day long, that is for 24 hours. In practice, deviations of the results below can be considered to a good approximation by a factor X = ("number of hours curtain is closed" / 24h).

4   Results

In [1] and [2], a reduction of the original value U from 2.4 W/(m²K) (of the window without the curtain) to 2.0 W/(m²K) was measured. This equals a reduction of a transmission heat loss of 16.7 % of the window.

Reduction of heat requirement:
Based on the assumptions of section 2.2 of the case study on a window without an additional curtain, the starting value of the heat requirement is 4500 kWh/year.

By means of curtains according to section 2.1 and the assumption of similar operation situations referring to [1] and [2], the reduction of heat requirement ranges from 224 kWh/year to 447 kWh/year, depending on the percentage of the window area.

Assuming an heating oil price of 0.68 €/litre light heating oil [4] with a lower heating value of 42700 kJ/kg and an annual degree of usage of a standard oil-fired heating system of 75%, the maximal possible savings of heat costs per year and hotel room range from € 20.12 to € 40.23 depending on the percentage of the window area. The results are shown in table 2.

5 Literature

[1]   P5-036e/2020: Determination of the Influence of a Curtain "Phos Delitherm" on the Thermal Transmittance of a Window, Test Report, Fraunhofer-Institut für Bauphysik IBP, Stuttgart, 2020.

[2]   P5-037e/2020: Determination of the Influence of a Curtain "Eos Delitherm" on the Thermal Transmittance of a Window, Test Report, Fraunhofer-Institut für Bauphysik IBP, Stuttgart, 2020.

[3]   VDI 3807-1: 06-2013, Verbrauchskennwerte für Gebäude. Grundlagen.

[4]   www.tecson.de/pheizoel.html, Preise im Bundesschnitt bei Abnahmemenge von 3000 l, Stand 21.2.2020.
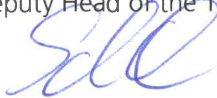
Note:
The results exclusively refer to the test specimen.

This test report comprises 4 pages of text, 2 tables and 3 figures.

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Responsible Engineer

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Table 1:   Reduction of transmission heat loss by the windows with inside curtain for 24 h/day on the basis of section 3.1 and an original specific annual heating demand of 150 kWh/m²a of the case study.

Window area	Percentage of window area	Absolute reduction of heat requirement	Relative reduction of heat requirement for the case study
[m²]	[%]	[kWh/Jahr]	[%]
6	20	224	7.5
9	60	335	11.2
12	80	447	14.9

Table 2:   Reduction of energy costs on the basis of the reduction of annual heating demand referring to table 1.

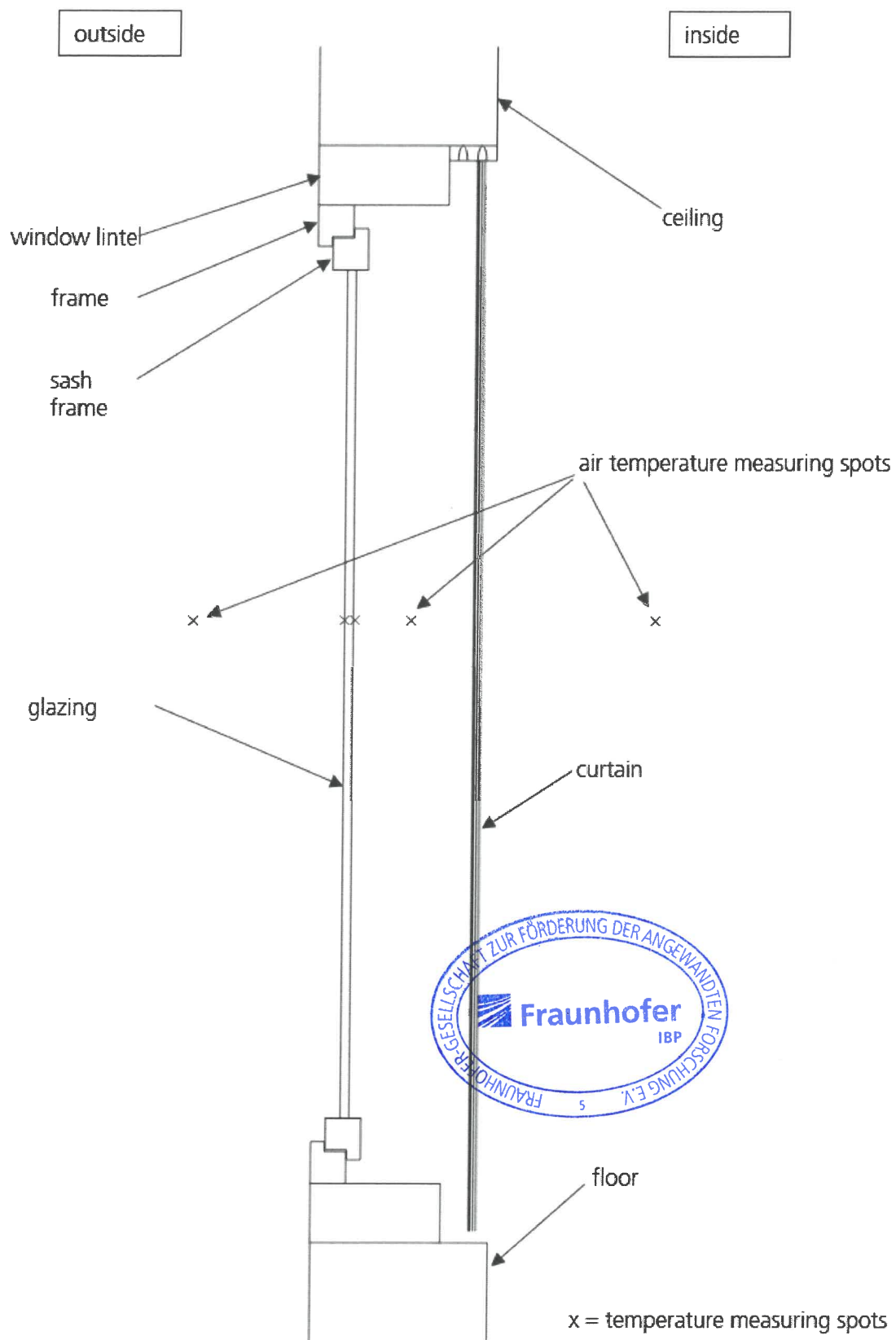| Window area	Percentage of window area	Absolute reduction of heat requirement	Savings per hotel room
[m²]	[%]	[kWh/Jahr]	[€/Jahr]
6	20	224	20.12
9	60	335	30.17
12	80	447	40.23

Figure 1: Sectional drawing of the window in [1]. Distance from glazing to rail system of the curtain is 219 mm, and distance to floor is 20 mm.

Figure 2: Test setup of section 2, inside view: window without curtain [1] and [2].

Phos Delitherm 41755   Eos Delitherm 41777

Figure 3:   Test setup of section 2, inside view: window with curtain [1] and [2].