

Fraunhofer-Institut für Bauphysik IBP

Forschung, Entwicklung,
Demonstration und Beratung auf
den Gebieten der Bauphysik

Zulassung neuer Baustoffe,
Bauteile und Bauarten

Bauaufsichtlich anerkannte Stelle für
Prüfung, Überwachung und Zertifizierung

Institutsleitung

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Test Report P15-305e/2014

Determination of the Reduction of the Heating Demand by Inside Curtain "Alpha Delitherm"

Client:

Delius GmbH

Goldstraße 16-18

33602 Bielefeld

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1 Introduction

The Fraunhofer Institute for Building Physics IBP, Stuttgart, was ordered by Delius GmbH to determine by means of calculation in a case study the reduction of the heating demand by a window equipped with the curtain "Alpha 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].

2 Description of the test window

2.1 Curtain and window

The test in [1] was carried out with the following product of Delius GmbH:

| | |
|-------------------|---|
| "Alpha Delitherm" | Curtain, one piece (art. No. 29895), Linen weave made of 66% polyester and 34 % aluminum ribbon, Specific weight 62g/m ² (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] 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/m ² a |
| Area of hotel room | 30 m ² (5 m x 6 m) |
| Area of façade | 15 m ² (5 m x 3 m), 1 outside wall |
| Area of window | 6 m ² , 9 m ² 12 m ² |
| Area percentage of window window | 20 %, 40 %, 80 % double insulating glazing, with and without curtain with a mean distance of ca. 220 mm to the glazing |
| Location, degree day figure | Würzburg, (mean case for Germany) $G_{120, 15} = 3883 \text{ Kd/a.}$ |

3 Measurement

Testings were carried out in two stages:

- Calculation of the mean annual reduction of the transmission heat requirement for all window areas, based on aged isolating glazing of an existing building,
- 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 $X = (\text{"number of hours curtain is closed"} / 24\text{h})$.

4 Results

In [1], a reduction of the original value U from $2.4 \text{ W/(m}^2\text{K)}$ (of the window without the curtain) to $2.0 \text{ W/(m}^2\text{K)}$ 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], the reduction of heat requirement ranges from 224 kWh/year to 447 kWh/year, depending on the percentage of the window area.

Assuming a heating oil price of 0.90 €/litre, light heating oil 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 € 26,62 to € 53,24 depending on the percentage of the window area. The results are shown in table 2.

5 Literature

- [1] P5-058/2012: Untersuchung des Einflusses einer Gardine "Alpha Delitherm" auf den Wärmedurchgangskoeffizienten eines Fensters, Prüfbericht, Fraunhofer-Institut für Bauphysik IBP, Stuttgart, 2012.
- [2] VDI 3807: 3-2007, Energie- und Wasserverbrauchswerte für Gebäude.
- [3] www.tecson.de/pheizoel.html, Preise bei Abnahmemenge von 3000 l, Stand 4/2012.

Note:

The results exclusively refer to the test specimen.

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

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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/m²/a of the case study.

| Window area | Percentage of window area | Absolute reduction of heat requirement | Relative reduction of heat requirement for the case study |
|-------------------|---------------------------|--|---|
| [m ²] | [%] | [kWh/year] | [%] |
| 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 |
|-------------------|---------------------------|--|------------------------|
| [m ²] | [%] | [kWh/year] | [€/year] |
| 6 | 20 | 224 | 26.62 |
| 9 | 60 | 335 | 39.93 |
| 12 | 80 | 447 | 53.24 |



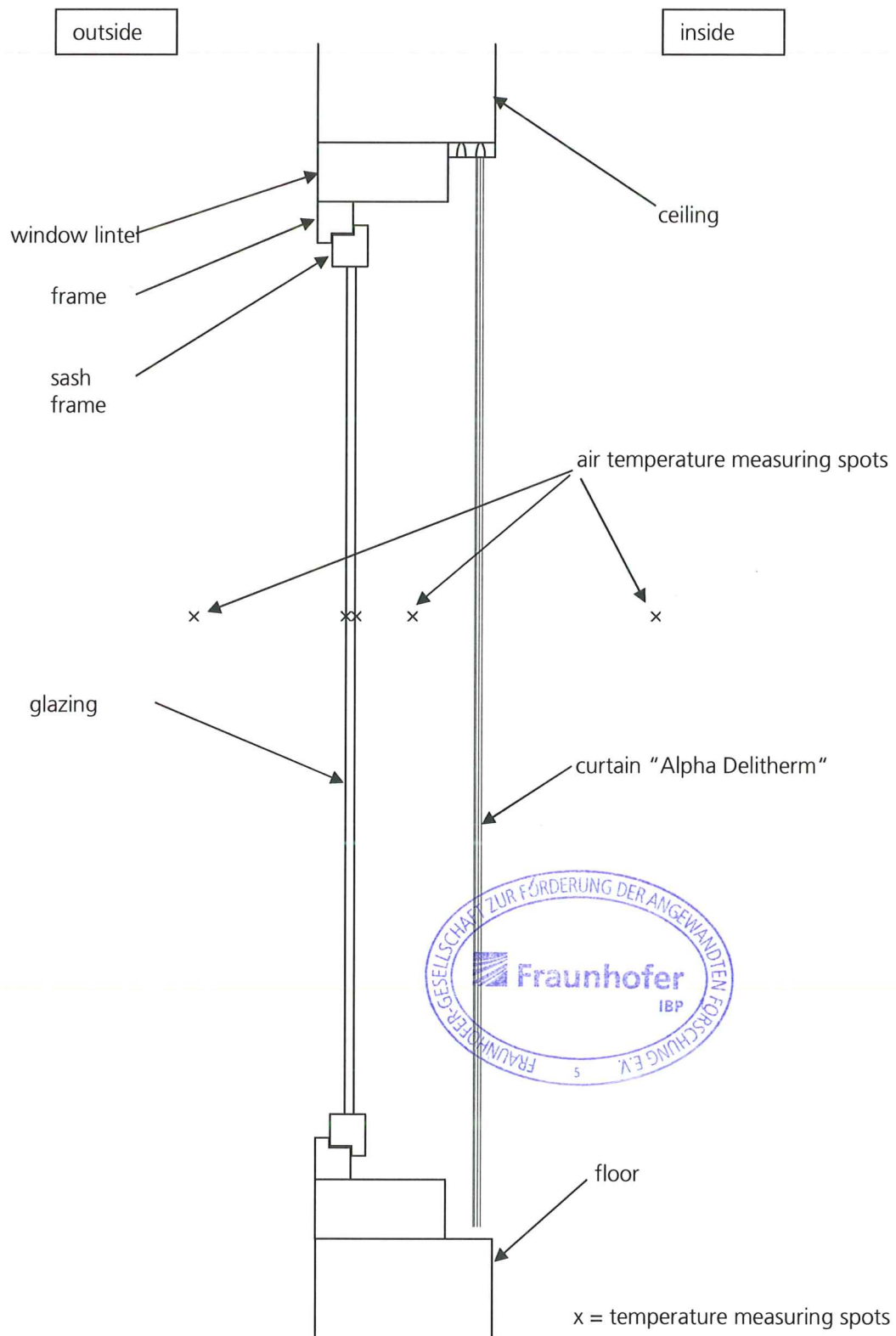


Figure 1: Sectional drawing of the window in [1]. Distance from glazing to rail system of the curtain is 219 mm, and distance to floor is 20 mm.



Figure 2: Test setup of section 2, inside view: window with curtain (below) [1].

