TEST Reg.No. 2

DANISH TECHNOLOGICAL INSTITUTE

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DENMARK

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|---|---|
| Order no. | 0301/601322-U-2-UK |
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| Initials | MOJ/LTN |

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# Test Report

Test specimen: Insulated loft hatch, **Model CF36**, further details can be found on page 2.

Sampling: The test specimen was forwarded by the client and received at the Danish Technological Institute 2014-06-02. The specimen was marked “601322 CF36” by the laboratory.

Method:

| | |
|---|---|
| EN ISO 8990:1997 | Thermal insulation – Determination of steady-state thermal transmission properties – Calibrated and guarded hot box. |
| EN ISO 12567-1:2010 + EN ISO 12567-1:2011/AC: | Thermal performance of windows and doors – Determination of thermal transmittance by hot box method – Part 1: Complete windows and doors. |

Period: The testing was carried out from 2014-11-03 to 2014-11-05.

Result:
U-value: **1,0 W/m²·K**
Uncertainty: ±5% ~ ±0,05 W/m²·K
Detailed testing results are shown in Appendix 1 and 2.

Terms: The test has been performed according to the enclosed conditions, which are according to the guidelines laid down by DANAK (The Danish Accreditation Scheme). The testing is only valid for the tested specimen. The test report may only be extracted if the laboratory has approved the extract.

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2014-12-10, Danish Technological Institute, Sustainable Building

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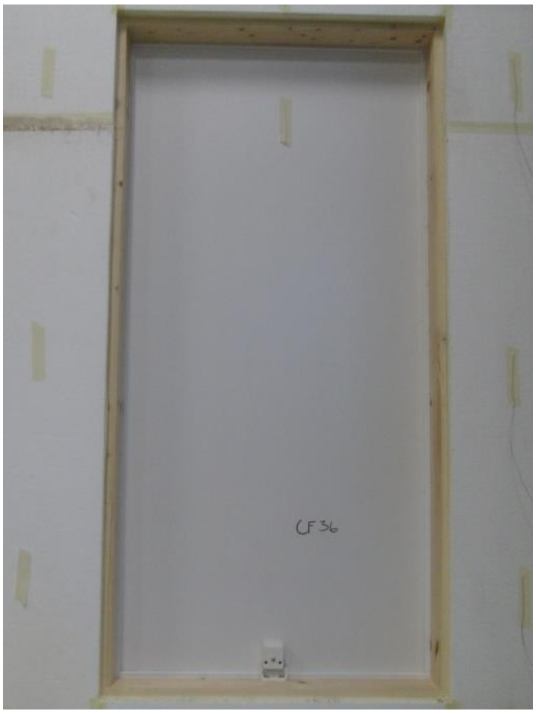
## Description of test specimen and installation

The test specimen consists of a loft hatch made of an insulating plastic material, see drawings in Appendix 3. The test specimen was mounted vertical in the test aperture so that the warm side surface was level with the test specimen surface, see pictures below.


*Test specimen seen from the warm side*




*Test specimen seen from the cold side*

As the test specimen is smaller than the test aperture, the remaining part of the test aperture was filled with edge insulation made of EPS with a thermal conductivity of 0,038 W/(m·K). The joint between the test specimen and the edge insulation, between the edge insulation and the test aperture as well as in the edge insulation was covered with adhesive tape. Furthermore, the warm side joint between the casement and frame was covered with adhesive tape. The dimensions of the test aperture, the test specimen and the edge insulation was measured by the laboratory and appear from the table below.

| | Width [mm] | Height [mm] | Thickness [mm] | Area [m²] |
|---|---|---|---|---|
| | Test aperture | 1230 | 1480 | 158 |
| | Test specimen | 676 | 1375 | 110 |
| | Edge insulation | - | - | 148 |

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## Results

The determination of the U-value of the combined construction, which consists of the test specimen and the edge insulation, is conducted according to EN ISO 8990 and EN ISO 12567-1 and the result is that $U_{total} = 0{,}65\ \mathrm{W/m^2 \cdot K}$, see appendix 1.

The above-mentioned U-value is valid for the combined construction only – the U-value for the test specimen is calculated in appendix 2 and the result of this calculation is that $U_{spc} = 1{,}0\,\mathrm{W/m^2 \cdot K}$. However, it is pointed out that this calculation is out of the scope of EN ISO 8990 and EN ISO 12567-1.

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**Measurement**

| | |
|---|---|
| Begin of measurement | 2014-11-03 13:50 |
| End of measurement | 2014-11-05 12:06 |

**Specimen**

| | |
|---|---|
| Projection area of specimen | 1,82 m² |

**Calibration data**

| | | |
|---|---|---|
| Thermal resistance of surround panel | $R_{sur}$ | -0,0081 · θme,sur + 3,3630 m²·K/W |
| Total surface thermal resistance | $R_{st}$ | 0,2130 · qsp exp(-0,06477) m²·K/W |
| Convective fraction, warm side | $F_{ci}$ | 0,002474 · qsp + 0,3969 |
| Convective fraction, cold side | $F_{ce}$ | 0,0008122 · qsp + 0,7719 |

**Results**

| | | |
|---|---|---|
| Air temperature, warm side | $\theta_{ci}$ | 19,98 °C |
| Air temperature, cold side | $\theta_{ce}$ | 0,44 °C |
| Baffle temperature, warm side | $\theta_{si,b}$ | 19,52 °C |
| Baffle temperature, cold side | $\theta_{se,b}$ | 0,58 °C |
| Surround panel temperature, warm side | $\theta_{si,sur}$ | 19,12 °C |
| Surround panel temperature, cold side | $\theta_{se,sur}$ | 0,81 °C |
| Reveal temperature, warm side | $\theta_{si,p}$ | 19,04 °C |
| Reveal temperature, cold side | $\theta_{se,p}$ | 0,79 °C |
| Air flow, warm side | $v_i$ | 0,27 m/s |
| Air flow, cold side | $v_e$ | 0,64 m/s |
| Input power | $\theta_{in}$ | 47,36 W |
| Air temperature difference | $\Delta\theta_c$ | 19,54 K |
| Surround panel temperature difference | $\Delta\theta_{s,sur}$ | 18,31 K |
| Mean temperature of surround panel | $\theta_{me,sur}$ | 9,97 °C |
| Thermal resistance of surround panel | $R_{sur}$ | 3,282 m²·K/W |
| Thermal conductivity of surround panel | $\lambda_{sur}$ | 0,048 W/(m·K) |
| Linear thermal transmittance of the edge zone | $\Psi_{edge}$ | 0,000 W/(m·K) |
| Heat flow through surround panel | $\theta_{sur}$ | 24,71 W |
| Heat flow through edge zone | $\theta_{edge}$ | 0,000 W |
| Heat flow density of specimen | $q_{sp}$ | 12,44 W/m² |
| Convective fraction, warm side | $F_{c,i}$ | 0,428 |
| Convective fraction, cold side | $F_{c,e}$ | 0,782 |
| Total surface thermal resistance | $R_{s,t}$ | 0,181 m²·K/W |
| Environmental temperature, warm side | $\theta_{n,i}$ | 19,72 °C |
| Environmental temperature, cold side | $\theta_{n,e}$ | 0,47 °C |
| Environmental temperature difference | $\Delta\theta_n$ | 19,25 K |
| Overall thermal transmittance | $U_m$ | 0,6464 W/(m²·K) |
| Total surface resistance | $R_{(s,t),st}$ | 0,17 m²·K/W |
| Standardized thermal transmittance | $U_{st}$ | 0,6510 W/(m²·K) |

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To determine the U-value of the test specimen, the heat flow through the edge insulation and the combined construction must be calculated. The edge insulation has a declared heat conductivity of 0,038 W/(m·K) which by experience is known to have a heat conductivity of 0,035 W/(m·K).

The U-value of the edge insulation is calculated:

$$U_{ins} = \frac{1}{R_i + R_e + \frac{s}{\lambda}} = \frac{1}{0{,}13 + 0{,}04 + \frac{0{,}148}{0{,}035}} = 0{,}2273\ \frac{\mathrm{W}}{\mathrm{m}^2 \cdot \mathrm{K}}$$

where

- $R_i$ is the internal surface resistance
- $R_e$ is the external surface resistance
- s is the thickness of the edge insulation
- $\lambda$ is the heat conductivity of the edge insulation

The heat flow through the edge insulation is then calculated:

$$\Phi_{ins} = U_{ins} \cdot A_{ins} \cdot \Delta T = 0{,}2273 \cdot 0{,}8909 \cdot 19{,}54 = 3{,}958\ \mathrm{W}$$

where

- $A_{ins}$ is the area of the edge insulation
- $\Delta T$ is the air temperature difference between the warm and cold side

Similarly the heat flow through the combined construction is calculated:

$$\Phi_{total} = U_{total} \cdot A_{total} \cdot \Delta T = 0{,}6510 \cdot 1{,}820 \cdot 19{,}54 = 23{,}16\ \mathrm{W}$$

where

- $U_{total}$ is the U-value of the combined construction found in appendix 1
- $A_{total}$ is the area of the combined construction

Using Therm 7.3.2.0, the linear thermal transmittance of the edge zone between the test specimen and the edge insulation is calculated at $\psi_{edge} = 0{,}003151\ \mathrm{W/(m \cdot K)}$ which results in a heat flow along the edge zone of $\Phi_{edge} = 0{,}2526$ W.

The heat flow through the test specimen is then calculated:

$$\Phi_{spc} = \Phi_{total} - \Phi_{ins} - \Phi_{edge} = 23{,}16 - 3{,}958 - 0{,}2526 = 18{,}95\ \mathrm{W}$$

The U-value of the test specimen is finally calculated:

$$U_{spc} = \frac{\Phi_{spc}}{A_{spc} \cdot \Delta T} = \frac{18{,}95}{0{,}9295 \cdot 19{,}54} = 1{,}043\ \frac{\mathrm{W}}{\mathrm{m}^2 \cdot \mathrm{K}}$$

where

- $A_{spc}$ is the area of the test specimen

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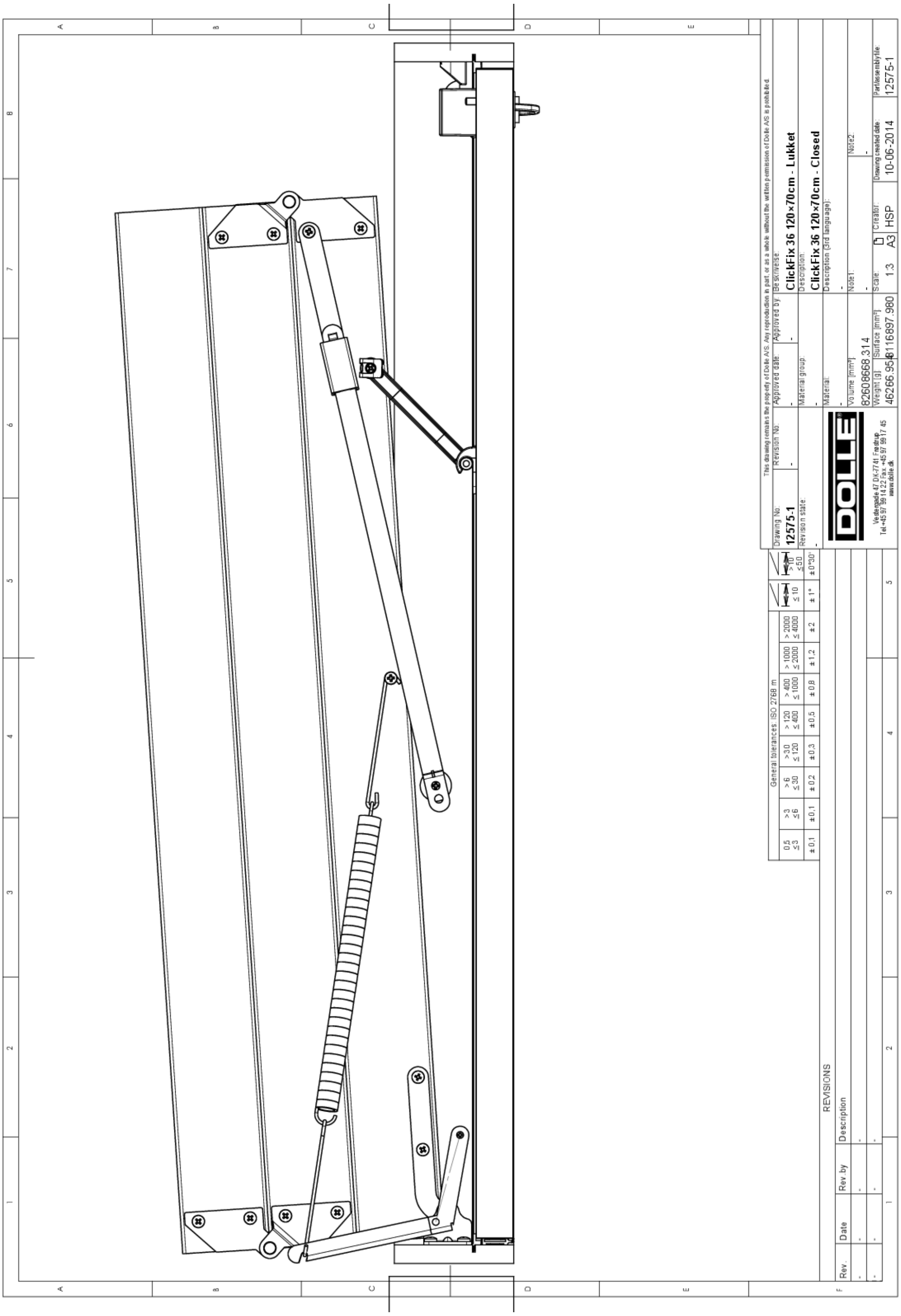

*Section of CF36 – The ladder was not mounted during the measurement.*

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The general conditions pertaining to assignments accepted by Danish Technological Institute shall apply in full to the technical testing and calibration at Danish Technological Institute and to the completion of test reports and calibration certificates within the relevant field.

## DANAK

The Danish Accreditation and Metrology Fund - DANAK - is managing the Danish accreditation scheme based on a contract with the Danish Safety Technology Authority under the Danish Ministry of Economics and Business Affairs who is responsible for the legislation on accreditation in Denmark.

The fundamental criteria for accreditation are described in DS/EN ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories". DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, the Danish Safety Technology Authority issues Technical Regulations prepared by DANAK with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- that the laboratory and its personnel are free from any commercial, financial or other pressures, which might influence their impartiality;
- that the laboratory operates a documented management system, and has a management that ensures that the system is followed and maintained;
- that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform;
- that the laboratory has at its disposal personnel with technical competence and practical experience in performing the services that they are accredited to perform;
- that the laboratory has procedures for traceability and uncertainty calculations;
- that accredited testing are performed in accordance with fully validated and documented methods;
- that accredited services are performed and reported in confidentiality with the customer and in compliance with the customer's request;
- that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test;
- that the laboratory is subject to surveillance by DANAK on a regular basis;
- that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.

Reports carrying DANAK's accreditation mark are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.