



On the use of infrared thermography to assess air infiltration in building envelopes

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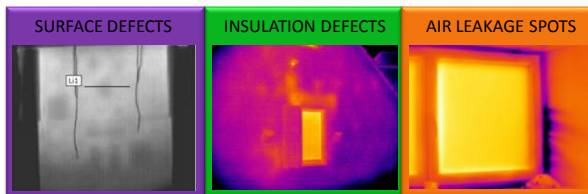
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Introduction

- 2020 goal → Reduction of greenhouse gas emissions
 - high performing building envelope
 - ✓ high insulation level
 - ✓ excellent airtightness
- Need for techniques to evaluate actual energy performance
 - Thermography
 - ✓ Nondestructive
 - ✓ Quick
 - ✓ Global



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Literature

- Very little information on airtightness survey

- Normative documents

TEMPERATURE DIFFERENCE	PRESSURE DIFFERENCE
$\Delta T_{i-e} > 1,7^{\circ}\text{C}$	$> 5 \text{ Pa}$
$\Delta T_{i-e} > 3^{\circ}\text{C}$	$> 10\text{-}20 \text{ Pa}$
$\Delta T_{i-e} > 5^{\circ}\text{C}$	

- ✓ Depressurization + evaluation from inside is most appropriate

- Scientific literature

- ✓ Qualitative detection of air leakage spots
- ✓ First approach for quantitative airtightness survey



Aim of the ongoing research

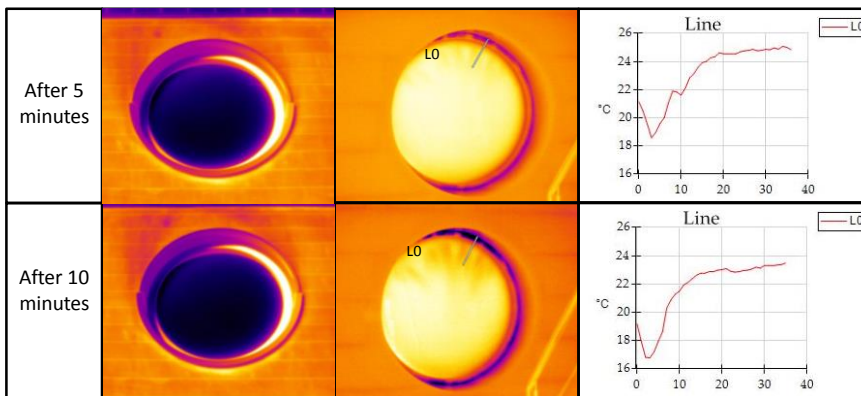
Establishment of a method

- to get an indication of the order of magnitude of air leakage spots
 - using infrared thermography in combination with pressurization fan
- based on
 - in situ measurements
 - simulations of typical air leakage spots
 - laboratory tests → model verification



In situ measurements

- Advantages of a pressurization fan
 - Pressurization / depressurization

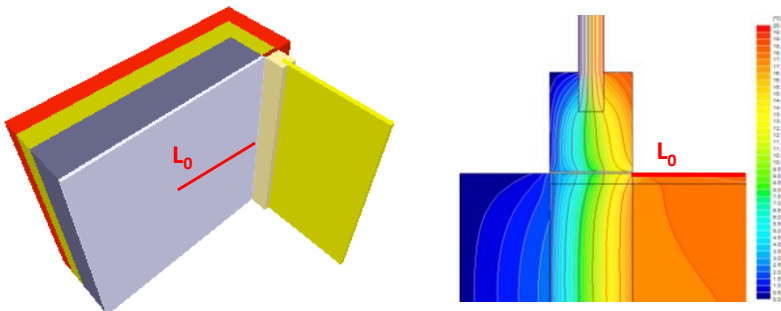


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Preliminary dynamic simulation

- Temperature profile along line L0
- Window-wall interface
- Simulations for different Δp and Δt

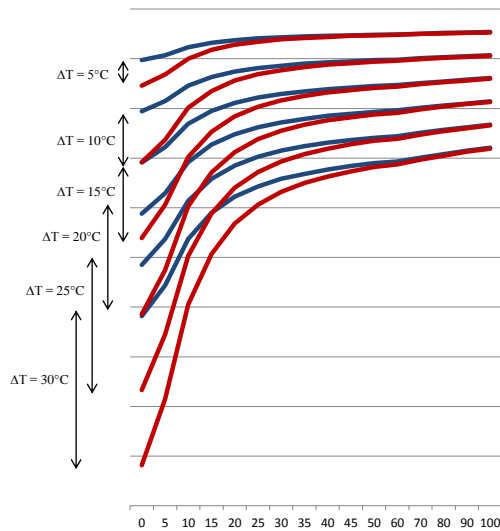


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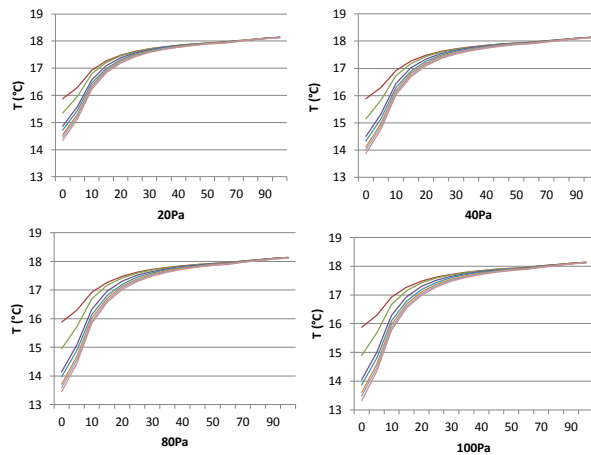
First results (1)


- ΔT has influence on the temperature drop
- How larger ΔT , how larger the temperature drop



First results (2)

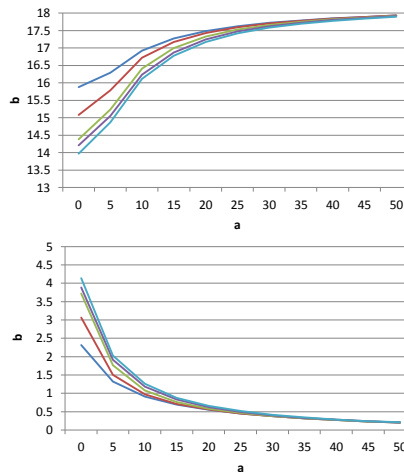
- ΔP has influence on temperature drop
- How larger ΔP , how larger the temperature drop
- $V = C \Delta P^n$





First results (3)

- In se no difference between pressurization / depressurization
- But influence of environmental parameters when measuring from outside (pressurization)



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Future work

- Refine simulation model
- Simulation model validation
 - tests in laboratory
- Simulation of other typical air leakage spots
 - Wall-wall interface
 - Ceiling-wall interface

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