UNIVERSITEIT GENT

FACULTY OF ENGINEERING AND ARCHITECTURE

Durability and measurement uncertainty of airtightness in extremely airtight dwellings

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Outline

- Introduction
- Repeatability and seasonal variations
- Durability of airtightness
- Conclusions

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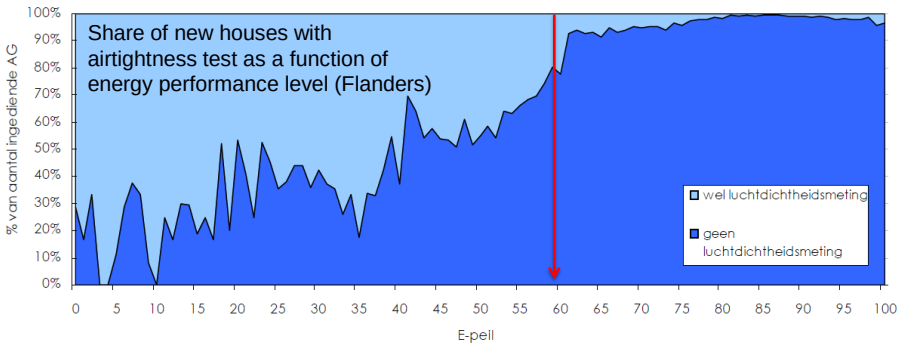
Introduction

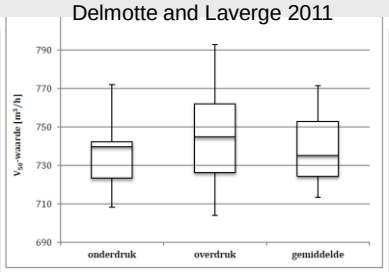
- Airtightness important to meet energy performance requirements
- Increasing number of new houses with airtightness test
- Result of test may have financial consequences (fines, subsidies)
- Reliability of test?
- Long-term performance of airtightness, specifically for airtight houses?



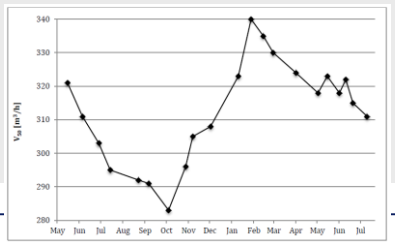
Introduction: what is known from literature?

- Repeatability (EN13829, method A)
  - St. deviation: 2%
  - Max. variation: 4%
- Reproducability (EN13829, method A)
  - St. deviation: 3%
  - Max. variation: 8%
- Seasonal variation
  - Reported variations < 45%
  - Swelling-shrinkage of wood
- Durability
  - 59 passive houses: + 30% after 2 years (+ 0.09 ACH)

Delmotte and Laverge 2011



Kim and Shaw 1986



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Test objects for analysis of airtightness test repeatability and seasonal variation of airtightness

- Semi-detached passive show house
- Masonry construction
- ACH_{50} = 0.55 (°2009)

Figuur 20: Kijkwoning 1

- Detached passive show house
- Woodframe construction
- ACH_{50} = 0.21 (°2009)

Figuur 21: Geïsoleerde raamkader van de kijkwoning 2

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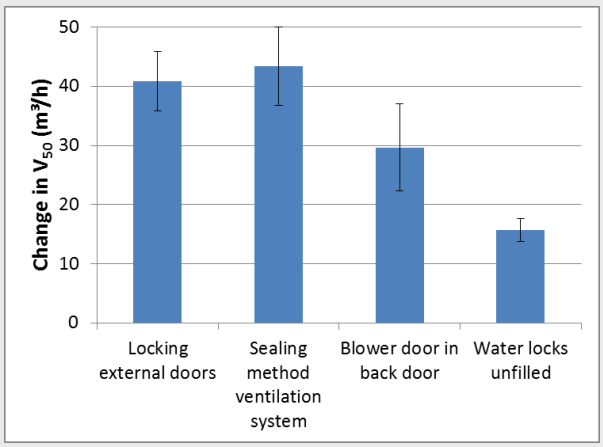
Op Figuur 22 zijn de technische installaties van de woning te zien. Het ventilatiesysteem is luchtdicht aangesloten met twee uitkomen, een recuperatie in de luchtmachoer, en één na de warmtewisselaar wordt verwarmd wordt toegevoerd.

Influence of differences in preparation
- room for interpretation EN13829

- Position of blower door
- Locking of external doors
- Method of disconnecting and sealing ventilation system
- Filling water locks

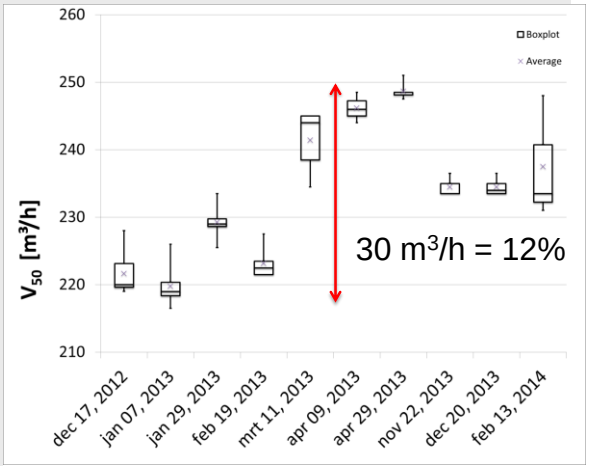
Influence of differences in preparation



- Apparently small differences in preparation
- Relatively large impact on measured leakage in passive houses
- ΔV_{50} of 50 m³/h represents 20 to 35% change in ACH_{50}

Repeatability and seasonal variation masonry house

- 10 days in 15 months
- 58 tests in total
- Repeatability in line with literature
  - Day 1: 12 measurements
  - Stdev: 1%, max var: 4%
- Variation result of changes in ductwork connections?

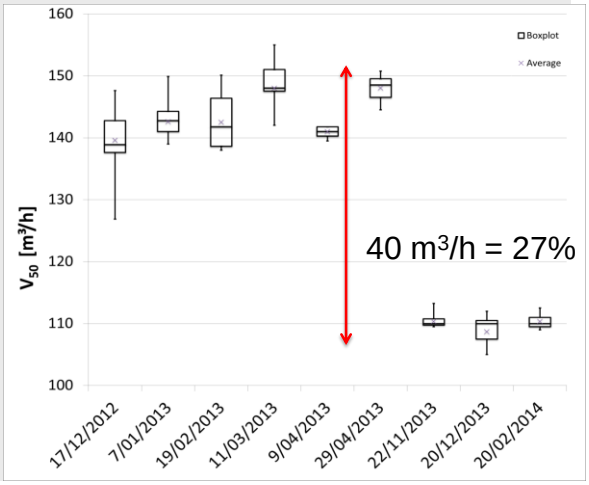


Figuur 20: Kijkwoning 1 *Figuur 21: Geïsoleerde raamkaders + luchtdichting*

On Figure 22 you see the technical installation in the making to see. Het ventilatiesysteem is luchtdicht afgesloten met twee ballonnen, één rechtstreeks in de luchtafvoer, en één na de warmtewisselaar waarlangs verse lucht wordt toegevoerd.

Repeatability and seasonal variation woodframe house

- 9 test days in 15 months
- 53 tests in total
- Repeatability in line with literature
  - Day 2: 12 measurements
  - Stdev: 2%, max var: 5%
- No seasonal variation



Figuur 24: Kijkwoning 2

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Test objects for analysis of durability

- 15 inhabited dwellings from passive house estates
  - +2 show houses
- Semi-detached and terraced masonry construction
- Age 3 - 27 months
- New test results compared to original certification tests
  - Identical test preparation?

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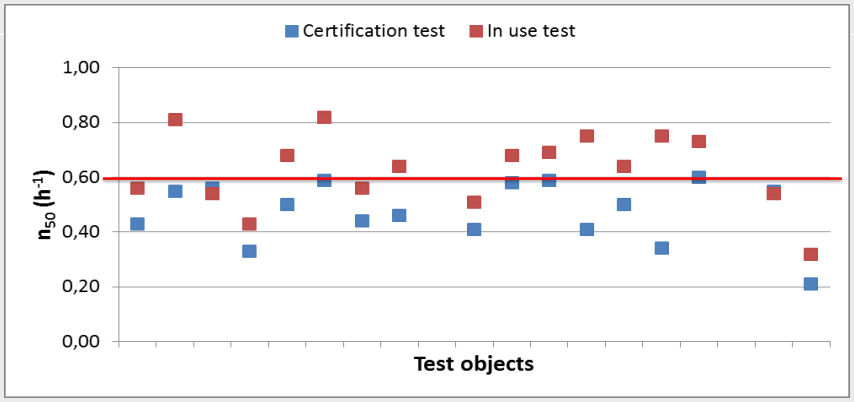
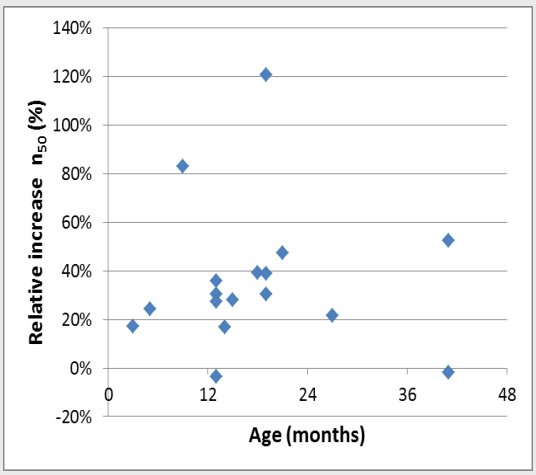
Durability of airtightness



- Average increase in air leakage by 32%
- Workmanship reproducability: stdev original measurements = 19%

Durability of airtightness: relative increase

- No significant relation with age
- Part of increase might be explained by differences in building preparation
  - Ventilation systems
  - Locking doors
- Observed leakage
  - Doors
  - Service penetration



Durability of airtightness: problems

Conclusions

- Study on air leakage in extremely airtight houses
- Relative repeatability intervals in line with literature
  - More specific building preparation guidelines needed for better reproducibility of ambitious leakage requirements
- No clear evidence of seasonal variation of air leakage
- Long-term performance of airtightness
  - 90% of houses showed larger leakage over time
  - Relative degradation of airtightness, but small in absolute values
- Questions?