Termografi og Måleteknikk as

Blowerdoor

Tightness – Big buildings

Tightness – Big buildings

How large is a large building?

EN 13289 post 5.3.4 b):

Large buildings – greater than a volume of approxi mately 4000 m^3. (about 140 000 $foot^3$)

Tightness – Big buildings

Air change rate at 50 Pa after Norwegian rules

$n_{50} \leq 1{,}5\ h^{-1}$

Passive house shal have an air change rate lower than

$n_{50} \leq 0{,}6\ h^{-1}$

Tightness – Big buildings

Swedish rules:

q_{50} = 0,6 liter/second * m² envelope

The same as

q_{50} = 2,16 m³/hour * m² envelope

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The hole building is to be tested as one.
The requirement is for the hole building.

What if the building is too big?
What if the the whole building is not ready and part of it is unsuited for control at current time?

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Maybe we can control for instance one floor?

First of all we have to check that fire sectioning between the floors are working, so that the construction is tight between the floors.

Tightness – Big buildings

The ventilaton system?
Does the system cover more than one floor?

If the system covers more than one floor it might be actual to tape each ventile in the actual floor.

Can be a big job.

Tightness – Big buildings

Maybe it is necessary to shut down or disconnect one or more ventilation ducts?

What about shafts that goes through many floors?

Tightness – Big buildings

When we control one floor, it can be necessary to back pressure adjacent floors and apartements.

Tightness – Big buildings

While doing the test, the Δt between outside and inside should not be too big. If so the chimneyeffect might be to big, and we will get to much difference in pressure in the building.

Tightness – Big buildings

Back pressure can be done in two ways:

1. Use your own fans.
2. Use the ventilation system in the building. Can be difficult.

Tightness – Big buildings

A case

A new hospital is to be build in Norway now. The envelope 50 000 m². which means about 4 200 element.

Price of the hospital: about 1 billion US$

What do we do to measure tightnes of the envelope?

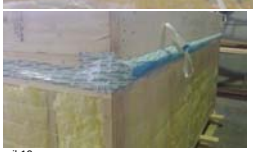
Tightness – Big buildings

We started with a test at the factory where elements where produced. That was in another country.

Tightness – Big buildings

A box of the same size as the element was made and a with a hight of about one meter.

We used elements from the BlowerDoor system to make pressuredifference and to measure the flow.



An element was placed at the top of the box, sealed and tapet together.

A heater was used to get enough Δt between inside the box and the envirement.

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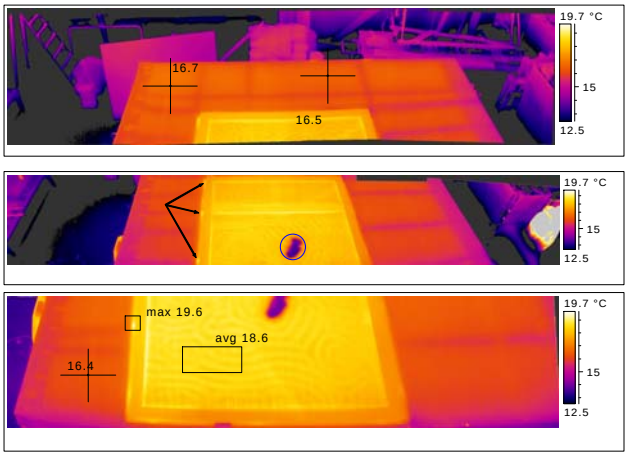
After a couple of hours we made a pressure in the box to look for airleaks wit IR.

Tightness – Big buildings



No leaks

No isolation failure

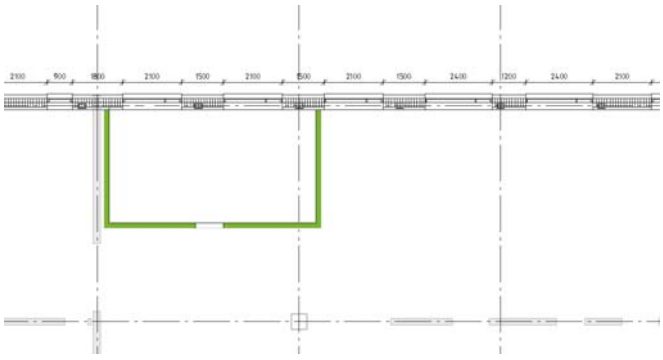
Tightness – Big buildings

Next step.

Look at elements hanging on the wall.

1. Control the connections between the elements.
2. Damage because of transportation. (with truck, boat and truck again, about 1000 km om different type of road)

Tightness – Big buildings



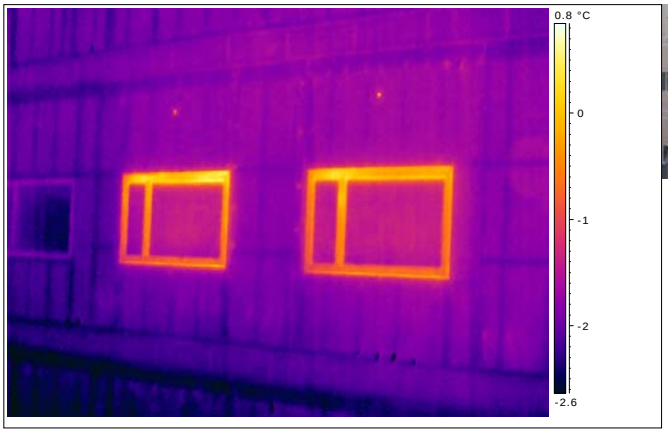
An area inside was restricted with temporary walls. Then we can make a ΔP and a Δt.

Tightness – Big buildings

Which elements to be tested?

The elements mounted on the wall.
We used pressure on the inside to look for airleaks and failure withe isolation.

Tightness – Big buildings



Exepts for the windows the elemnt and their connection looks excellent.

The two hotpoints above the windows are electrical tubes. They are taped, but still leading heat.

Tightness – Big buildings

A quick wiev of some of the buildings we have tested

Tightness – Big buildings

n_{50} = 0,4

n_{50} = 0,1

n_{50} = 0,5

Tightness – Big buildings

Drammensbadet-
swimingpool and waterpark

Volume: 69 000 m³
Requirement: less than 0,5
Measured: 20 700 m³
N_{50} = 0,3

Tightness – Big buildings

Sports hall

Volume: 27 000 m³
Requirement:
100 % tight
Measured 12960 m³
n_{50} < 0,5

Tightness – Big buildings

Schoolhouse

Volume: 19 700 m³
Requirement: 1,5
Measured 21 700 m³
n_{50} = 1,1

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Tightness – Big buildings

Schoolhouse

Volume: 61200 m³
Requirement: n_{50} = 1,0
Measured 19 250 m³
n_{50} = 0,38

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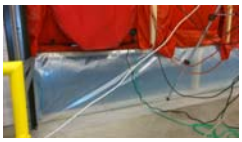
Tightness – Big buildings

Warehouse

Volum: 57 000 m³
Requirement: n_{50} = 1,5
Measured 12 700 m³
n_{50} = 0,2



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Tightness – Big buildings

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Sometimes one have to be a little creative to install the fans