HOW TO CALCULATE MOISTURE LOAD FROM INFILTRATION

INTRODUCTION

This document aims to show how to calculate a moisture from infiltration by showing what information is required and by means of an example. Be aware that the source of a moisture load might be something else than infiltration. For more details about calculating moisture load in general, please refer to the document: How to; estimate moisture loads.

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INFILTRATION

In many applications, unwanted moisture is mainly coming in through leaks in the building boundaries including door, windows, the roof, etc. This is what we call infiltration. When calculating the moisture load from infiltration we need to know the following:

- x_{out} The humidity outside in worst case – usually on a hot summer day
- X_{in} The desired humidity inside
- V The size of the room
- P Air density. At nominal conditions the density of air is 1.2 kg/m^3
- n The *infiltration factor** for the room

*The infiltration factor relates to the amount of air-change in the building. Thus, an infiltration factor of 0.2 [h^{-1}] tells us, that 20% of the air in the room is changed with fresh air every hour. The amount of leakages/infiltration depends on the building quality and space density. In Europe, the table below offers a good guideline on the infiltration factor depending on the building size.

Room volume, V [m^3]	Infiltration factor, n_{leak} [h^{-1}]
V < 4,000	0.20
4,000 < V < 10,000	0.18
10,000 < V < 18,000	0.15
18,000 < V < 30,000	0.12
30,000 < V_____ _	0.10

Infiltration can then be calculated by multiplying room size with density, infiltration factor and difference in absolute humidity outside and inside:

$$\text{Infiltration} = V_{room} \cdot \rho \cdot n_{vent} \cdot \Delta x$$ equation

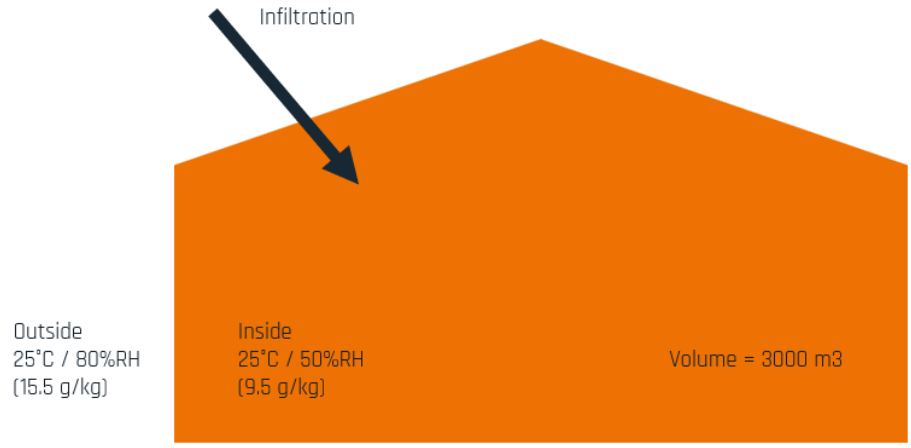
To make sure values end up correctly, make sure all units are SI (except hour [h] for time).

$$\left[\frac{kg}{h}\right] = [m^3] \cdot \left[\frac{kg}{m^3}\right] \cdot [h^{-1}] \cdot \left[\frac{kg}{kg}\right]$$ units

A calculation example is shown in the following section.

EXAMPLE

Underneath is shown a schematic of a building. The only moisture load in the building comes from leakage through the building boundaries, infiltration. How is moisture load from infiltration calculated?



It is possible to determine the absolute water content in the air inside and outside from temperature and relative humidity by using the Mollier diagram. (see next page)

- x_{out} = 0.0155 [kg/kg]
- x_{in} = 0.0095 [kg/kg]

The room have a size of 3000 m3. According to the table on the previous page, the infiltration factor is then 0.2. Let's also assume standard density of the air:

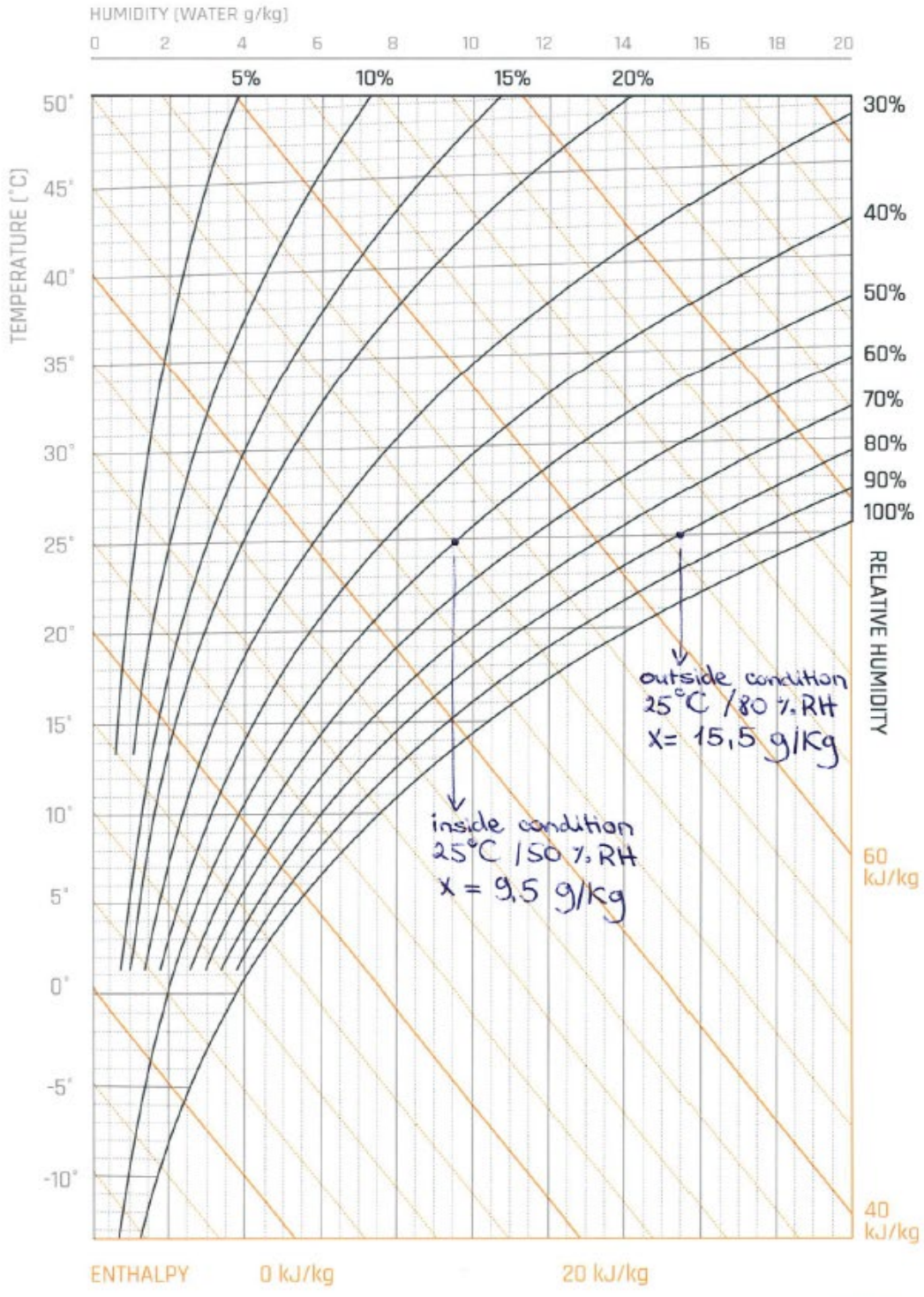
- V = 3000 [m^3]
- n = 0.2 [1/h]
- ρ = 1.2 [kg/m^3]

We are now able to calculate the moisture load from infiltration:

$$\text{Infiltration} = V_{room} \cdot \rho \cdot n_{vent} \cdot \Delta x$$ equation

$$\text{Infiltration} = 3000[m^3] \cdot 1.2 \left[\frac{kg}{m^3}\right] \cdot 0.2 \left[\frac{1}{h}\right] \cdot (0.0155 - 0.095) \left[\frac{kg}{kg}\right] = 4.32 \left[\frac{kg}{h}\right]$$

MOLLIER DIAGRAM PRESSURE: 1.012 bar



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