Comfortable and Healthy Indoor Climate EEN-E4001

Exercise 4 for Lecture 4/2019

Return date 6.2.2019

1. LCC :

Carry out a ten years LCC calculation for a filter with the following assumptions.

Interest rate	6%
Air flow	1 m³/s (constant)
Running time	6000 hours per year
Fan efficiency	η = 0.5 (50%)
Energy cost	0.10 €/kWh (increasing 5% per year)
Filter:	
Investment	80 € including filter, frame and labour cost
Maintenance/ replacement	40 € (no price increase)
Lifetime of filter	6000 hours (1 year)
Average pressure drop	120 Pa
Disposal cost	4 € (increasing 5%)

$C_p / C_n = [1 + (i - p)]^{-n}$

where
n = the number of years
p = the price increase
i = the interest rate (bank rate or any expected internal rate for investments within the company)
C_n = the cost paid after "n" years
C_p = the present cost of a single cost element, C_n

2. LCC:

Calculate the effect for the LCC breakdown if the filter price is doubled (80 €) and the average pressure drop is reduced to 80 Pa. Compere the cost structure of the this design solution to the previous one.

3. Particle concentration level:

Dust is generated in the room with a rate of 10 mg/h. The dust concentration of outdoor air is 0.1 mg/m³. What is the concentration in the room:

(a) with supply air flow rate of 30 m³/h without cleaning the supply air flow

(b) with supply air flow rate of 30 m³/h and a filter in supply air flow reducing the concentration of dust in outdoor air with 50%

(c) exhaust airflow rate is constant 30 m³/h. There is infiltration of 0.3 1/h in the room of volume of 30 m^3 and the rest of supply air is going through the filter (50 %).

(d) with supply air flow rate of 60 m³/h and outdoor air flow of 15 m³/h and a filter with efficiency of 50% in outdoor air flow and a filter with efficiency 80% in recirculation air flow

4. How much dust accumulates in a filter per week (15 h/d, 5 days a week) if its removal efficiency is 80%, the outdoor air has a concentration of 100 µg/m³ and the air flow is 1 m³/s?