Air-to-Air Heatrecovery and the Airtightness of Dwellings in the Netherlands — The Increase of Through Ventilation

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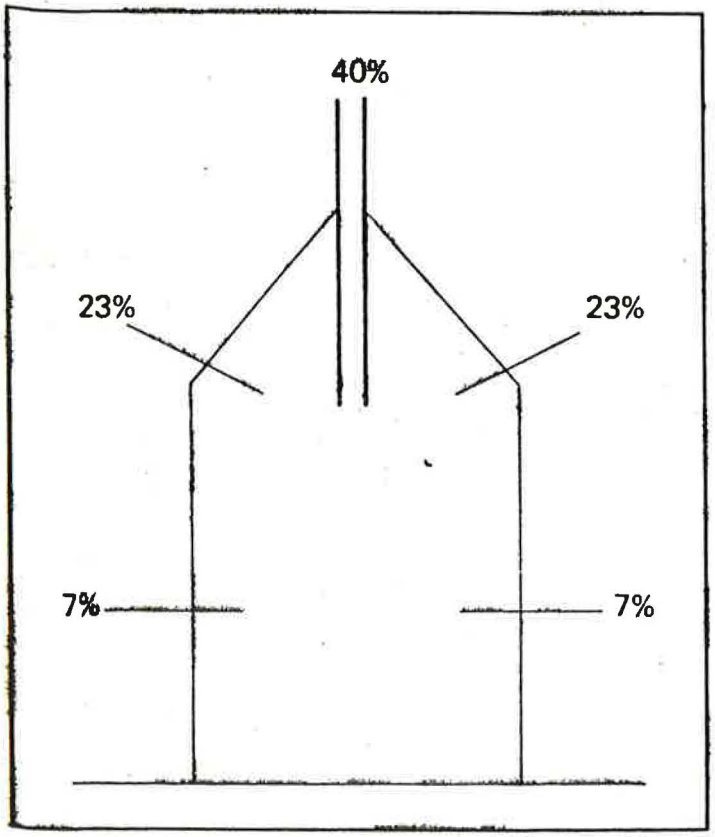
Much interest has recently been shown in the use of balanced ventilation systems incorporating air-to-air heat exchangers. In this article, Willem de Gids and Hans Phaff from the Institute for Environmental Hygiene-TNO, Netherlands describe how through ventilation can reduce the effectiveness of this type of system.

To minimize the energy losses due to ventilation and infiltration, air-to-air heat recovery is generally recommended. In the case of heat recovery, the effect of through ventilation is often neglected or underestimated. Quantitative values about the effectiveness of air-to-air heat recovery in relation to airtightness are rarely given. In this short note, we would like to pay attention to this aspect.

From previous investigations, the estimate of airtightness based on measurements of 130 Dutch dwellings is 0.1 m^3/s at 1Pa pressure difference. This is equal to about 11 air changes at 50Pa. Our best estimate for the distribution of air leakages over the building envelope, based on existing data, is shown in Figure 1.

Figure 1



The ventilation simulation program of our Institute was used to determine the ventilation rate of this house for the following sets of conditions.

- Variations in wind velocity and external air temperature.
- Natural, mechanical exhaust and balanced ventilation systems.
- Retrofitting of roof/wall joints.

In terms of air flow, the balanced ventilation system is comparable with an air-to-air heat exchanger.

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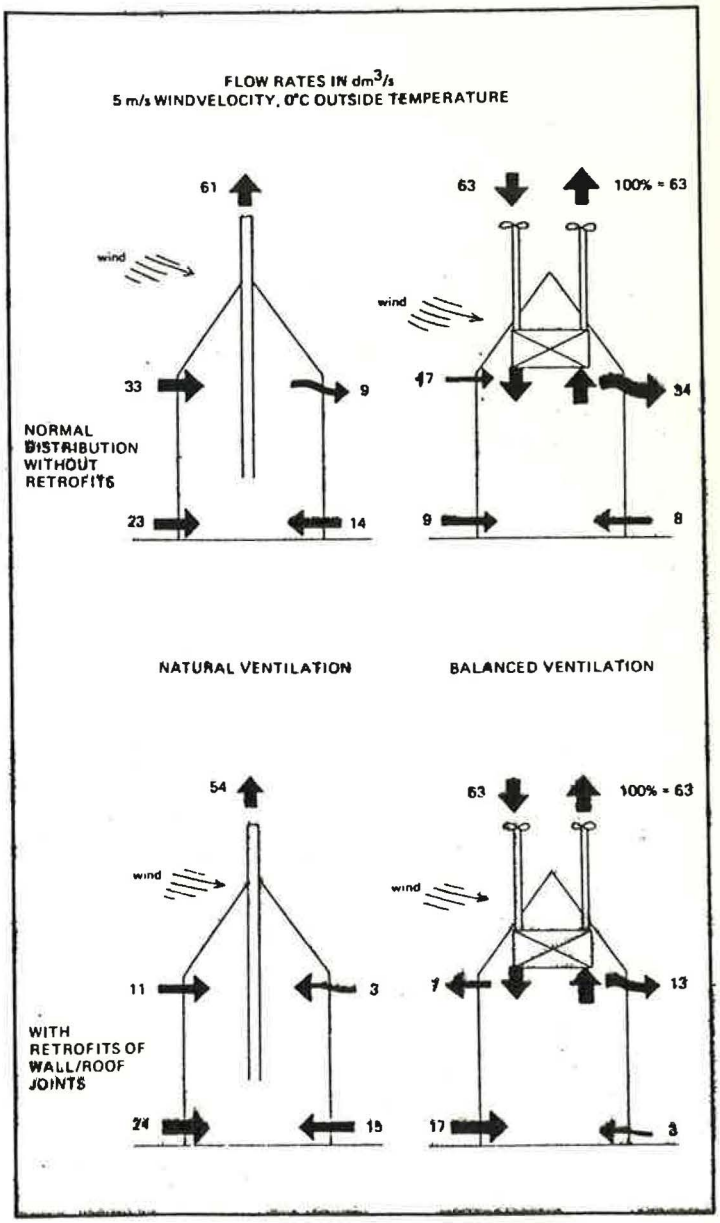
The results of some of these calculations are illustrated in Figure 2. For the balanced ventilation system, a desired volume flow rate of 63 cm^3/s is assumed. In this example, the excess flow rate due to through ventilation, expressed as a percentage of the desired flow rate, is

- without retrofitting 54%
- with retrofitting the wall/roof joints 32%

Figure 2



Thus, through ventilation will increase the total ventilation. This increased ventilation gives an extra energy loss of up to about 50%. This extra energy loss cannot be recovered by the heat exchanger because it is flowing out through the building fabric and not through the heat exchanger. Furthermore, the improvement due to retrofits on wall/roof joints is small, it is therefore recommended that, when predicting the overall efficiency of air-to-air heat exchangers, the excess due to through ventilation should be considered carefully.