SUB-SLAB DEPRESSURISATION: OVERVIEW OF IMPORTANT FAN CHARACTERISTICS ILLUSTRATED BY LABORATORY MEASUREMENTS

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Within the Belgian Radon Programme the Belgian Building Research Institute is responsible for the investigation of techniques for prevention and mitigation of radon problems in dwellings. One of the most regular actions is the installation of a sub-slab depressurisation (SSD) system. As there are no ready-to-use systems available on the Belgian market, a system has to be designed for every specific situation. In this case, one of the most difficult points is the choice of an appropriate fan. Important characteristics are the relation between air flow and pressure difference, the fan power, the acoustical performances, the durability, the electrical protection, etc. Some of these characteristics have an influence on the effectiveness of the radon reduction (e.g. air flow vs. pressure difference), while other parameters are important from the point of view of the occupant (e.g. acoustics, consumption).

Within the Belgian Radon Programme some of these performances (air flow vs. pressure difference, fan power vs. pressure difference, acoustics) were measured in the laboratory for a number of fans (10) available on the Belgian Market. Moreover a comparison was made with two ready-to-use SSD-systems sold abroad.

The paper will discuss the different characteristics in detail and use the measurement results of the 12 fans as illustrations.

The study revealed that only a limited number of fans is appropriate to be used for a sub-slab depressurisation. Some remarkable findings:

- Some fans with a high power (and as a consequence a high consumption) seemed to operate at about the same working point as fans with a much lower power. This means that the fan power is certainly not a good point of reference to evaluate the efficiency from the radon point of view.

- There seemed to be a very important difference from the acoustical point of view. It is important to keep in mind that a silent fan will be necessary to assure that the occupier will not stop the extraction due to irritating noise. The laboratory tests showed that it is possible to reduce the sound level importantly by the installation of a simple silencer.

Key words: Radon, sub-slab depressurisation, fan, fan power, acoustics, airflow.

INTRODUCTION

Within the Belgian Radon Programme the Belgian Building Research Institute is responsible for the investigation of techniques for prevention and mitigation of radon problems in dwellings. One of the most regular actions is the installation of a sub-slab depressurisation (SSD) system. As there are no ready-to-use systems available on the Belgian market, a system has to be designed for every specific situation. In this case, one of the most difficult points is the choice of an appropriate fan.

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RESULTS AND DISCUSSION

Airflow versus pressure difference

When comparing the relation between the air flow rate and the pressure difference of the 12 tested fans, there seems to be a large spread on the results. This is shown clearly in figure 1. It is important to keep in mind that the maximum pressure difference (at zero flow) is the most important parameter for a SSD-system, while the maximum air flow rate (when the fan is not connected to a system) has a much lower importance. Therefore, fans with a steep curve (i.e. a high maximum pressure difference and a relatively low air flow rate) are most convenient to be used for SSD.

The two ready-to-use systems seem to comply with this basic rule (which means that they are very interesting to be used for SSD), while some of the other tested fans are not convenient at all.

Electrical power

It has not always sense to install the fan with the highest power. First of all it is not always true that the fans with the highest power can create the highest pressure difference. Moreover, it is not always necessary to create the highest possible pressure differences under the slab to obtain a successful installation. In figure 2 the relationship is shown between the maximum pressure difference and the annual electrical consumption of the tested fans. There seem to be very important differences in consumption for fans with about the same maximum pressure (e.g. the consumption of fans with a pressure of about 300 Pa can differ a factor 4 !). The coloured background in the figure has a certain meaning: the fans in the light zone are most convenient for SSD as they can create important pressure differences with a low electrical consumption.

Acoustics

The acoustical performance of a SSD has no influence on the radon reduction but on the comfort of the occupants. If the level of noise is too high, the system will probably be put off…

There are different sources of noise: fan noise, noise caused by the movement of air in the ductwork and noise caused by vibrations. The fan noise of the 12 tested fans was measured in the laboratory for 3 different situations: at maximum air flow, at zero flow (situation about comparable with SSD) and at zero flow with a silencer connected to the fan. There seem to be important differences between the 12 fans (e.g. at zero flow without silencer: result between 56.1 dB(A) and 69.0 dB(A)). Moreover, it is possible to obtain a high reduction in the level of noise by using a simple silencer, made by putting a piece of mineral wool into the ductwork (reductions between –8.7 dB(A) and –17.4 dB(A)). These results are shown in figure 3.

Conclusion

Everyone can build his own SSD-system. The challenge is to optimise the performances of the installation by choosing the most appropriate fan. A lot of fans are available on the market which doesn’t make it easy for the installer to make the best choice. Very important parameters are
durability, the relation between maximum pressure difference and air flow rate, fan power, acoustical performances,… Laboratory tests in Belgium revealed that certain fans are interesting to use, while others aren’t.
Figure 1: Air flow vs. pressure difference

Figure 2: Maximum pressure vs. electrical consumption
Figure 3: Level of noise of the fans