European Radon Solutions Database

Prepared by

: ERRICCA 2 *European Radon Research and Industry Collaboration Concerted Action*

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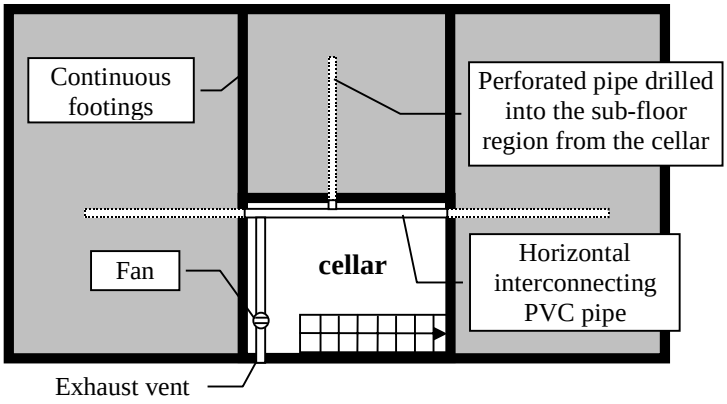
Existing Buildings

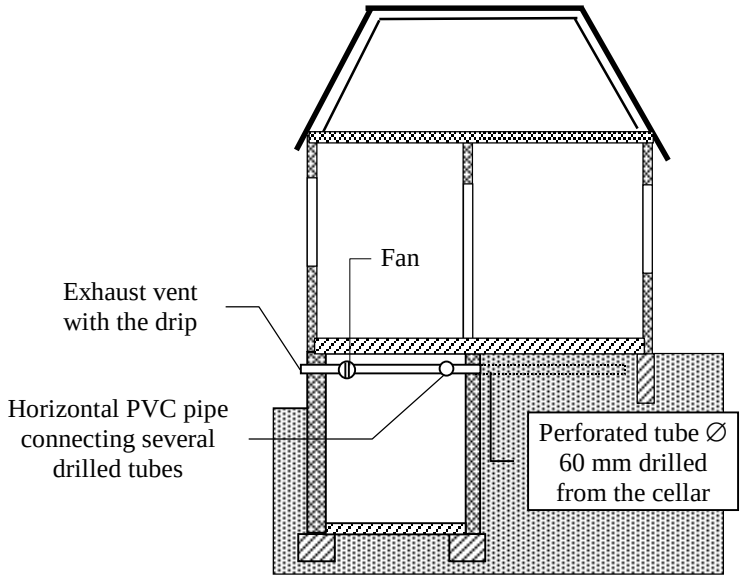
Generic Solution

Sheet N° CZ/GS/02

Type	**SUB-SLAB DEPRESSURIZATION BASED ON PERFORATED TUBES DRILLED FROM CELLAR- VERSION 2 WITH EXHAUST ABOVE GROUND LEVEL**
Country	**Czech Republic**

Illustration





Description

This system is designed to lower the air pressure under the building and to decrease the radon concentration in the sub-slab region. Applicability of this form of sub-slab depressurization is nearly the same as for version 1 with the exhaust vent above the roof level. The advantage of this solution is that it is not so labour consuming, it causes no obstructions in the living space of the house and it requires less material to construct.

Fans

The most commonly used types of fans are in-line paddle-wheel fans with airtight casing. These fans should have a flow rate from 100 m^3/h to 200 m^3/h at a pressure difference from 250 Pa to 150 Pa and power consumption between 40 and 70 W. The power of fan is controlled by means of a voltage regulator. To minimise negative effects (reduced underfloor temperatures and increased air exchange rate) the fan should be switched to intermittent mode with the frequency of operating periods depending on soil permeability, floor tightness and radon concentration in the soil. Usually fan operates less than 8 hours per day.

Fans should be resistant to moisture condensation inside pipes. To avoid disturbing noise effects the fan should be installed away from the occupied rooms or it must be protected by sound insulation.

Pipework

Standard PVC-U pipes can be used. The diameter of pipes should correspond to the amount of air that is transported inside pipes. Drilled tubes have usually the diameter around 60 mm and interconnecting horizontal pipes from 60 to 125 mm. Due to the condensation inside pipes all pipes should be installed in a slight slope towards the perforated tubes so that water can escape (discharge) in the soil. Exhaust outlet should be provided with the drip to stop outgoing water wetting the external wall. Exhaust outlet should be located well away from windows, doors and other vents.

All pipe penetrations through basement walls should be carefully sealed by gun applied flexible acrylic or low modulus silicone sealants or by expanding polyurethane sealants.

When to use the system

This form of sub-slab depressurization and ventilation systems is convenient for houses with partial cellars or basements without habitable rooms. It is suited for use in cases where it is not possible to install vertical pipes inside the living space of the house. It can be used also in houses with untight timber floors placed directly on the soil and in houses built on soils with medium or low permeability.

Pre-installation Diagnosis

To find source rooms (radon entry routes) and to prepare information for the effective design of the remedial measure, these parameters must be measured:

- Radon concentration in all habitable rooms performed at least by one weak measurements under conservative conditions (lower ventilation and good conditions for radon entry into the house)
- Radon concentration in the soil gas in 15 points around the house (the measuring depth is 0,8 m)
- Permeability of the soil around the house

Following measurements are recommended:

- Radon concentration in sub-floor layers and permeability of sub-floor layers
- Changes of soil permeability with depth

Typical radon reductions achieved

The effectiveness of such systems varies between 70 and 98 %, which means that indoor radon concentration decreases to 30 % up to 2 % of the initial values. The effectiveness is mainly influenced by the vertical profile of soil permeability and by the air tightness of the building substructure.

Limitations

The great disadvantage of this solution is the location of the exhaust outlet on the external wall. Condensed water going out from the pipe can cause wetting of the external wall and in periods with external temperature below freezing point icicles can appear on exhaust vent.
The system is not suitable for houses, where:

- there is no cellar,
- the location of the exhaust outlet on the external wall is not acceptable.

Common failure modes

The system can fail only in these situations:

- fan with inadequate pressure/flow rate characteristic is used,
- fan is damaged by condensed water,
- house owner switches off the system.

System enhancements

The intermittent operation of fans is recommended. The merits are: savings in operation costs, prolonged life of fans and reduced negative effects to subsoil (drying, freezing etc.). Operating periods of the fan should be adjusted according to continuous measurements of indoor radon concentration.

Numerical modelling is recommended for the optimisation of the design (fan power, number of drilled tubes, their location and length in dependence on the house substructure and soil characteristics). At this time three models are available: TLAK3D that solves pressure and air velocity fields in three dimensions, WIND2D solving temperature fields as a result of heat transfer caused by conduction and convection of soil air and RADON2D that calculates radon concentration fields in two dimensions.

Further Information

More detailed information can be found in the Czech Standard CSN 730601 “Protection of houses against radon from the soil”, in detailed guides published by State Office for Nuclear Safety and on website www.suro.cz. All these information are in Czech language.

Information in English:

- Jiránek. M, Neznal M., Neznal M.: Czech Experience with Sub-slab Depressurization Systems. In: Radon Investigations in the Czech Republic VII, pp.119-124, Prague, 1998
- Jiránek. M.: Efficiency and Side Effects of Sub-slab Depressurization Systems. In: Radon Investigations in the Czech Republic IX, Prague, 2002

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