European Radon Solutions Database

Prepared by
: ERRICCA 2 *European Radon Research and Industry Collaboration Concerted Action*
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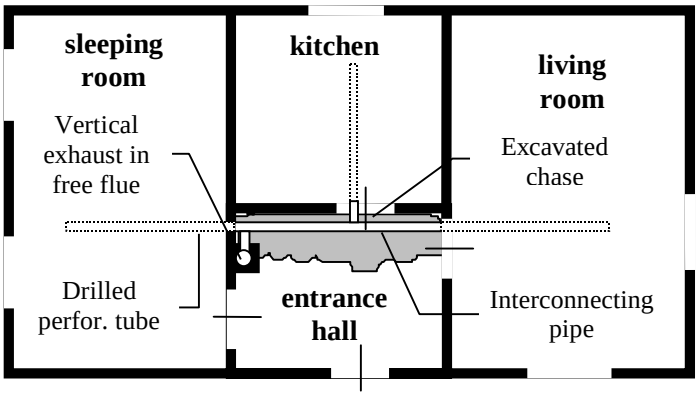
Existing Buildings

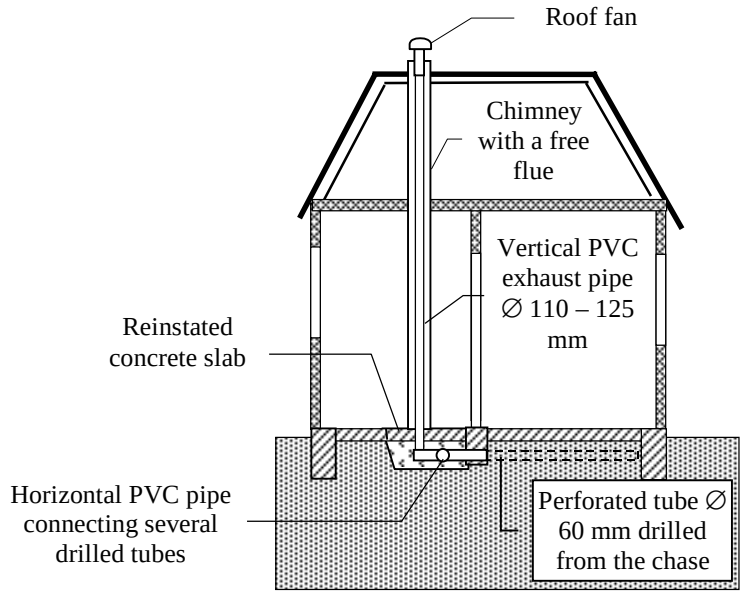
Generic Solution

Sheet N° CZ/GS/04

Type	**SUB-SLAB DEPRESSURIZATION BASED ON PERFORATED TUBES DRILLED FROM INTERNAL CHASE**
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. The air pressure in the sub-floor region is lowered by means of a fan, which draws air from several perforated tubes drilled beneath the existing floors from the chase excavated in one room of the house. Beneath each habitable room at least one suction pipe should be inserted. After fixing the pipework, the chase is backfilled and the concrete slab is reinstated.

Vertical exhaust pipe is usually used for the extraction of the soil air. The advantage of this solution is that the vertical exhaust pipe runs through the heated part of the house and thus it works partly as a passive system creating a slight underpressure in the subsoil without the help of a fan.

Fans

The most commonly used types of fans are paddle-wheel roof fans. These fans should have a flow rate from 100 m^3/h to 350 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 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.

Fans should be resistant to weathering and to moisture condensation inside pipes. Location of the fan at the top of the vertical exhaust pipe causes no visual problems with the condensation. Roof fans cause usually no problems with noise.

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, interconnecting horizontal pipes from 60 to 110 mm and vertical exhaust pipes from 110 to 125 mm. To reduce visual impact vertical pipe can be inserted inside a free flue or can be boxed-in in the corner of a room. In flueways only flexible PVC, aluminium or rustless pipes are used. 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 located well away from dormer windows and other vents.

All pipe penetrations through floors 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 without partial cellars or basements in cases, where it is not possible to excavate external chase. 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 condition 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

Among the disadvantages of this solution belong the higher labour consumption due to the excavation works and obstructions in the living space of the house. The system is not suitable for houses, where the internal excavations cannot be performed and where it is difficult to find a suitable route for the vertical exhaust pipe through the dwelling.

Common failure modes

The system can fail only in these situations:

- fan with inadequate pressure/flow rate characteristic is used,
- 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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