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Zulassung neuer Baustoffe, Bauteile
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Forschung, Entwicklung,
Demonstration und Beratung auf
den Gebieten der Bauphysik

Institutsleitung
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Test report P-BA 133/2012e

Noise Behaviour of a Wastewater System Consisting of Cast Iron Pipes (SML) with Pipe and Fitting Insulating Coverings "Climaflex®Stabil"

Client: NMC sa
Gert-Noël-Straße
R&D Halle 7
B-4731 RAEREN
BELGIUM

Test specimen: Wastewater structure-borne sound insulation system "Climaflex®Stabil" (manufacturer: NMC) in combination with a wastewater system consisting of cast iron pipes (SML, DN 100). The assembly was carried out at an installation wall with a mass per unit area of 220 kg/m² in a brick duct in front.

Contents:

The tests were performed in a laboratory accredited by the German Accreditation System for Testing (DAP, file no. PL-3743.26) according to standard EN ISO/IEC 17025.

Stuttgart, June 19, 2012

Responsible Test Engineer: Head of Laboratory:

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Determination of the installation sound level L_{In} in the laboratory (following DIN EN 14366)

P-BA 133/2012e

Table 1

Client: NMC sa, Gert-Noël-Straße, R&D Halle 7, B-4731 RAEREN, BELGIUM

Test specimen: Wastewater structure-borne sound insulation system "Climaflex®Stabil" manufactured by NMC (test specimen S 10494-04) in combination with a wastewater sytem consisting of cast iron pipes (SML, DN 100).

Test set-up: See annex J and figures 2 and 3. The test set-up was performed following DIN EN 14366: 2005-02. The test set-up included the following components:

- -Commercial wastewater system consisting of cast iron pipes and fittings (SML, DN 100), wall thickness 3.5 mm, weight 8.4 kg/m, density 7.2 kg/dm³.
- Wastewater structure-borne sound insulation system "Climaflex®Stabil" (manufacturer NMC). Polyethylene-based closed-cell-foam pipe insulation with robust shell and friendly gliding foil (Ref. 100-09, thickness 9 mm). Insulating tubes for straight pipes and yard-ware to insulate the fittings.
- Installation without pipe clamps or other fastening parts.

The waste water system was installed in a brick duct in front (HLZ, L x W x H = 240 mm x 115 mm x 240 mm, with mortar on the installation wall). The pipe was covered by means of expanded metal and an additional layer of 25 mm of gypsum plaster. The duct was only installed in the basement of the test facility (UG front).

- Reference Set-up: Rigid installation of the waste water pipe system without structure-borne sound insulation system.
- Test Set-up: Installation of the waste water pipe system in the duct with wastewater structure-borne sound insulation system "Climaflex®Stabil" (manufacturer NMC).

- Test set-up according to figures 2 and 3. The test set-up was mounted by a technical firm.

Test facility: Installation test facility P12, mass per unit area of the installation wall: 220 kg/m², installation rooms: Basement (UG) front; measuring room: UG rear (details in Annex P and EN 14366: 2005-02)

Test method: The measurements were performed following German standard DIN 4109 and EN 14366; noise excitation by constant water flow with 1.0 l/s and 2.0 l/s (details in Annex J).

Results:

Installation sound level L_{In} [dB(A)]		
Wastewater system (cast iron pipes SML, without pipe clamps) plastered in the installation duct	Flow rate (l/s)	
	1,0	2,0
Wastewater structure-borne sound insulation system "Climaflex®Stabil", manufactured by NMC	13	18
Without structure-borne sound insulation system	33	37

Date of tests: April 26, 2012

Comments:

- Measurements were carried out without applying pipe clamps or other fastening elements in order to exclusively determine the sound-insulating properties of the insulation material without additional structure-borne sound via pipe anchorage. The measured value thus are the lower limit for the installation sound level, which can be expected with the existence of similar types of structure borne sound bridges, when applying the analysed waste water structure-borne insulation system.

Fraunhofer IBP

The tests were performed in a laboratory accredited by the German Accreditation System for Testing (DAP, file no. PL-3743.26) according to standard EN ISO/IEC 17025.

Stuttgart, June 21, 2012

Head of Laboratory: i.V. [signature]

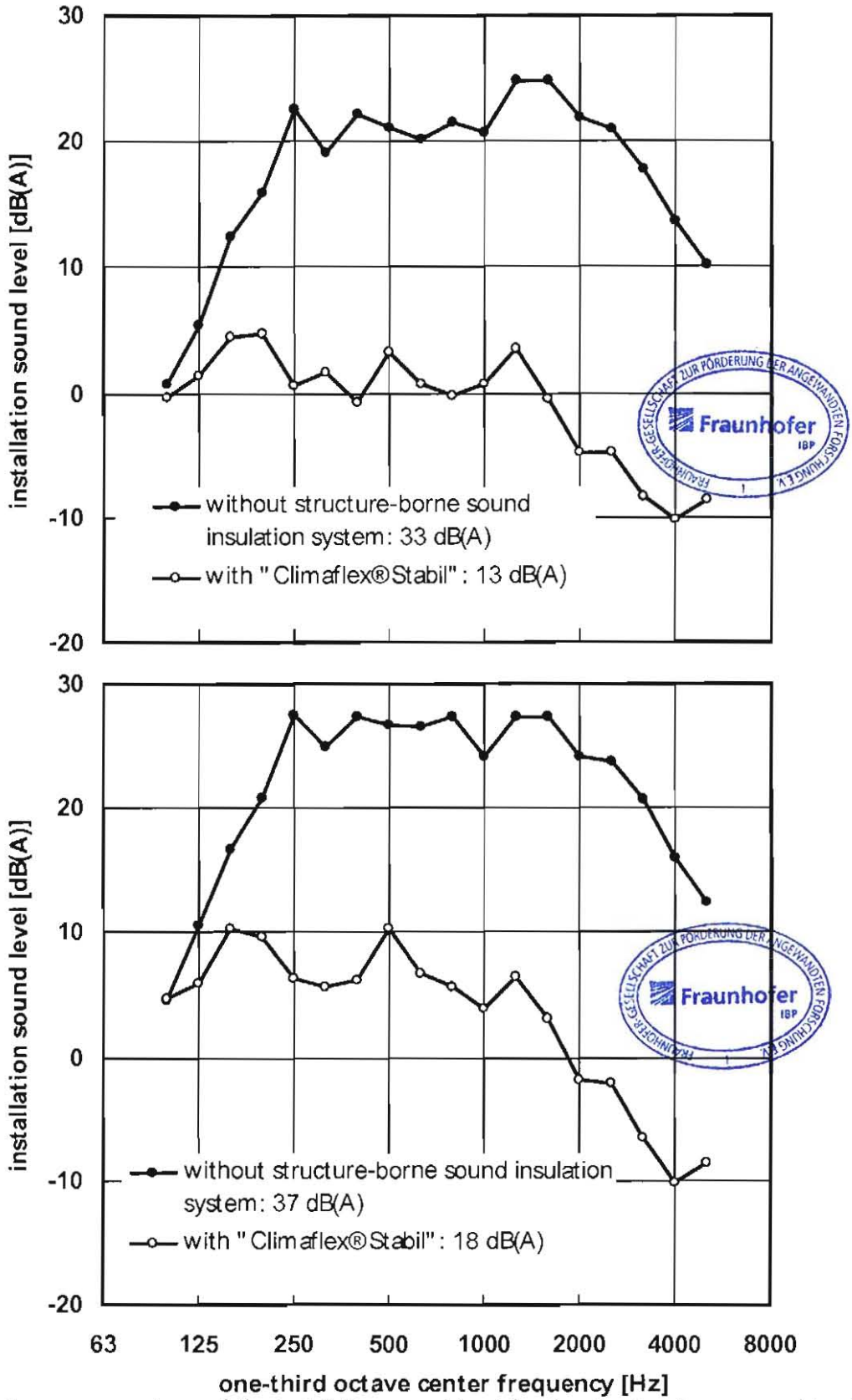


Figure 1 Frequency spectrum of the installation sound level for the structure-borne sound insulation system "Climaflex®Stabil" (manufacturer NMC) in combination with a wastewater system (cast iron pipes, without pipe clamps). The installation sound level was measured at a flow rate of 1.0 l/s (above) and 2.0 l/s (below) in the measuring room UG rear (behind the installation wall).

The tests were performed in a laboratory accredited by the German Accreditation System for Testing (DAP, file no. PL-3743.26) according to standard EN ISO/IEC 17025.

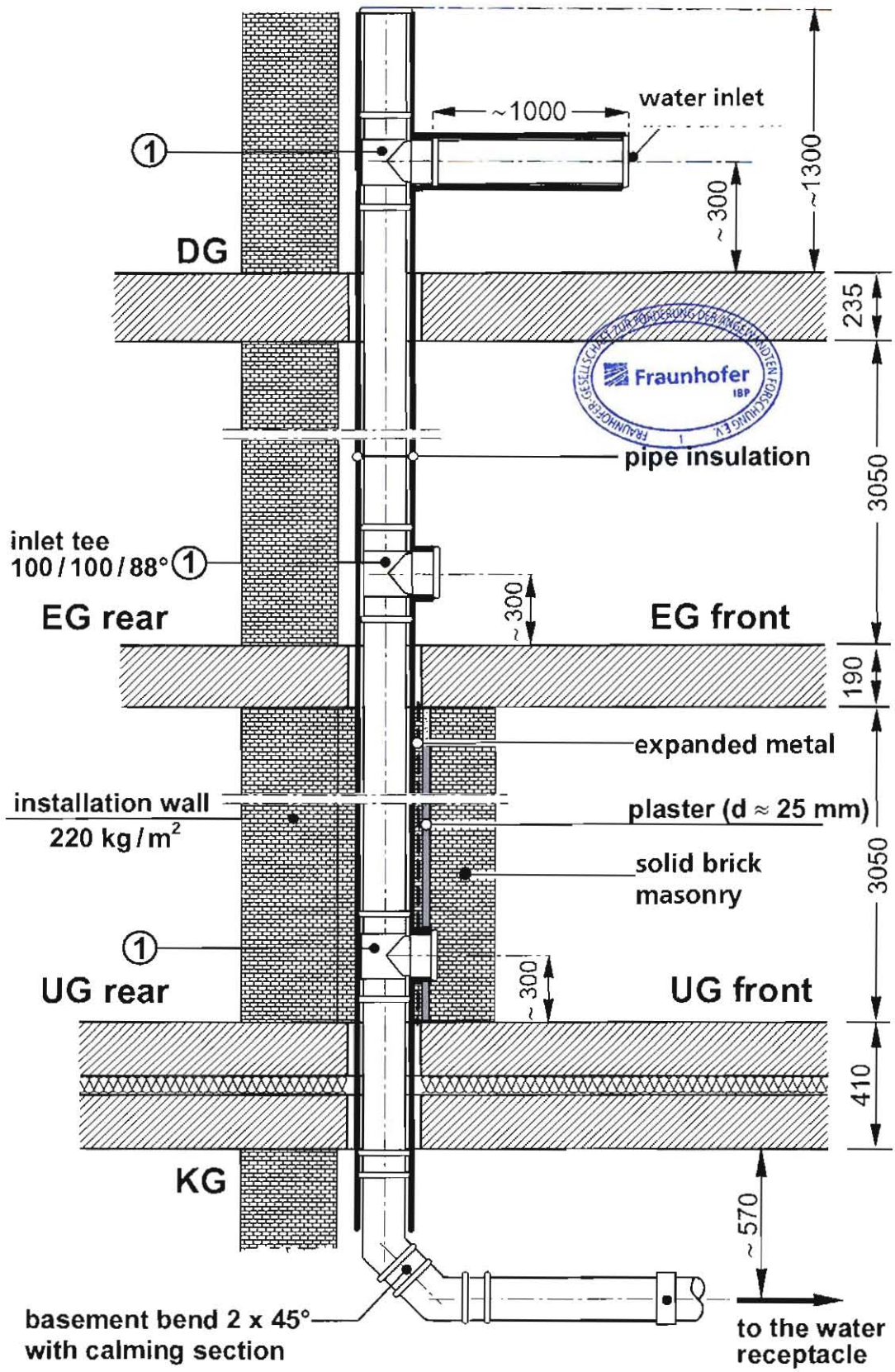


Figure 2 Installation plan of the pipe system (cast iron pipes, SML, without pipe clamps) with the structure-borne sound insulation system "Climaflex®Stabil" manufactured by NMC (drawing not to scale, dimensions in mm).

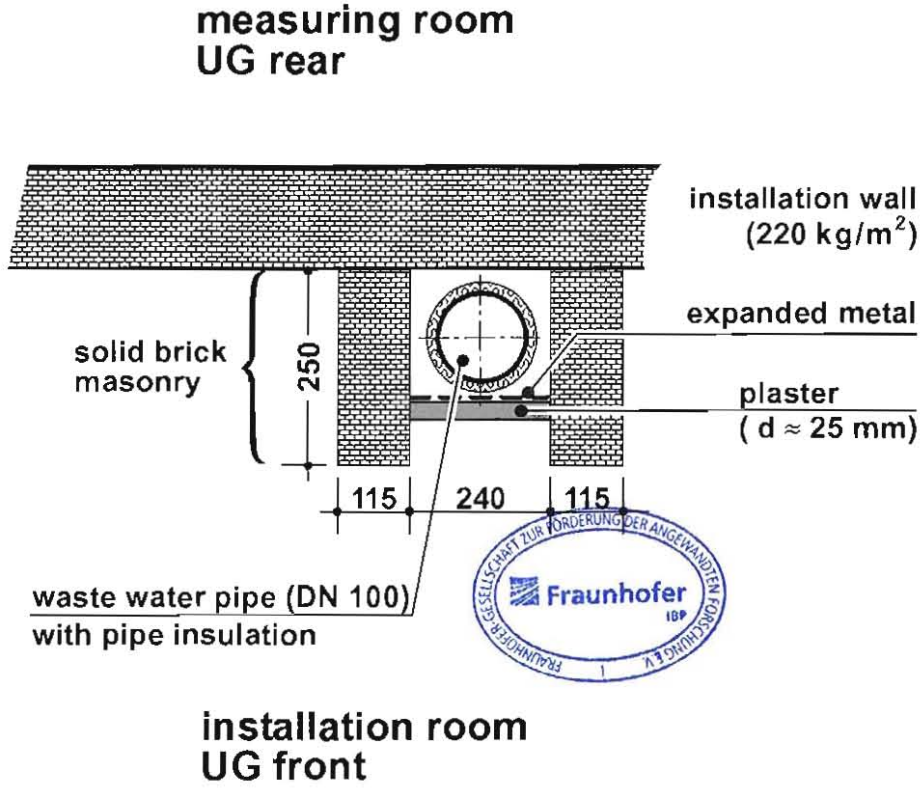


Figure 3 Sectional drawing of the test set-up (horizontal section of the installation duct in the UG front of the installation test facility, drawing not to scale, dimensions in mm).

Realization of measurement and determination of acoustic parameters

Test Set-Up

The reduction of waste water noise by means of structure-borne sound insulation systems can be analysed under practical conditions in the installation test facility of the Institute of Building Physics. A description of the test facility is given in annex P. In the test facility a down-pipe is installed leading from the top floor (DG) down to the sub-basement (KG). This down-pipe is connected to a (DN 100) water inlet pipe on the top-floor level. The water is introduced through an S-shaped bend according to the standard EN 14366. In the sub-basement, the down-pipe is connected to a bend (2 x 45 degree, usually) and merges into a horizontal discharge section, which in turn is joined to a water receptacle. The waste-water pipe on the ground floor (EG) and in the basement (UG) is fitted with conventional branches from main lines (usually, DN 100). Pipes and fittings are mounted according to the instructions given by the manufacturer. The air gaps between the tube and floor in the entrance and exit openings are filled with porous absorber in order to prevent any structure-borne sound bridges influencing the building.

In order to simulate a mounting situation with structure-borne sound bridges between the building and the wastewater system (as they may occur, when pipes are installed inside ducts or slots, for instance) the down-pipe of the wastewater system in the room UG front was laid inside a duct that was attached in front of the installation wall. The following mounting variations can be considered.

1) Measurement without pipe clamps or other fasteners in order to record only the acoustic properties of the structure-borne sound insulation system.
   1a) pipes and fittings completely covered with the insulation.
   1b) pipes and fittings without insulation.
2) Measurement with commercial pipe clamps in order to examine the acoustic properties of the structure-borne sound insulation system with fasteners. Thereby the pipes and fittings were completely covered with the insulation and the pipe clamps were applied above the insulation.

Concerning measurements without fasteners (1), the down-pipe in the duct is covered by expanded metal abutted to the pipe or pipe insulating covering. The expanded metal is then covered with a layer of 25 mm of gypsum plaster causing structure-borne sound bridges between waste water system and the building. Measurements with fasteners (2) are carried out with or without expanded metal and gypsum plaster.

In order to record only the structure–borne sound transmitted across the expanded metal and the plaster layer, the first measurement series (1) was performed without using pipe clamps or other fasteners. During the second measurement series (2) the influence of the fixing system was also considered. The pipe clamps with rubber inlay were applied above the structure-borne sound insulation system.

The air gaps between the tube and floor in the entrance and exit openings are filled with porous absorber in order to prevent any structure-borne sound bridges influencing the building and to prevent lateral displacement of the down-pipe. In addition the wastewater system is fixed in the sub-basement (KG). This does not have any influence on the installation sound level, as this part of the test facility has a sound insulation towards the measurement rooms.

Noise excitation and evaluation parameters

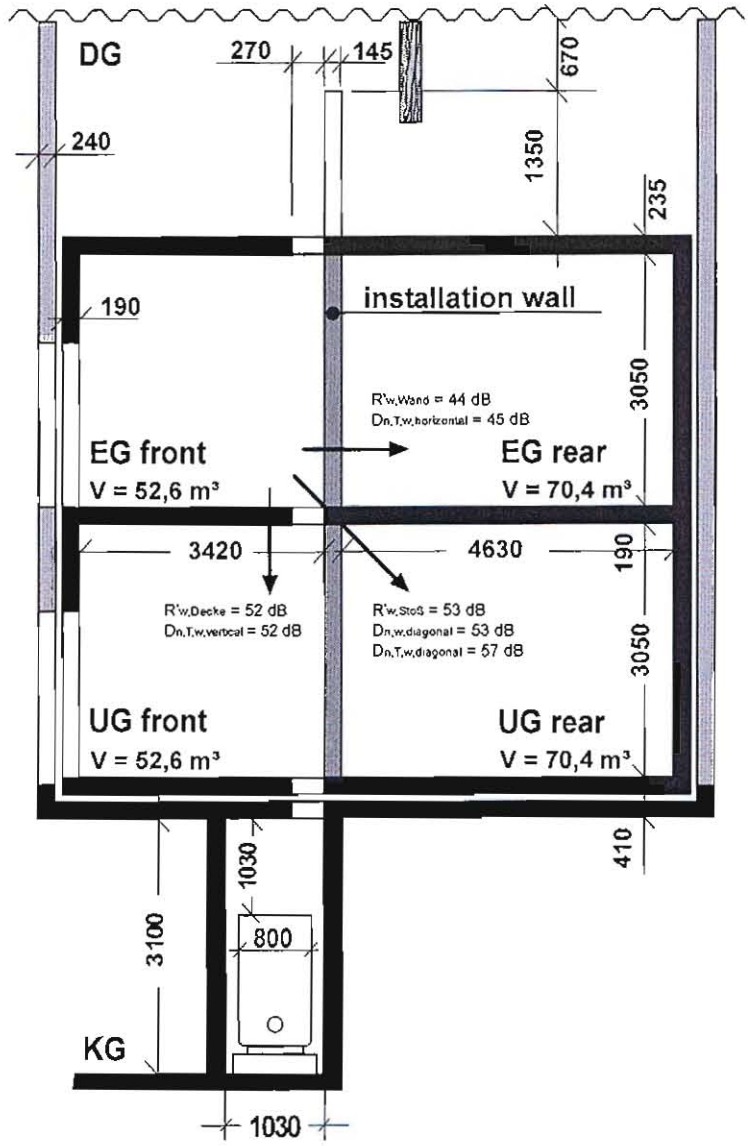
Any defined and metrological reproducible noise excitation requires steady-state flow conditions inside the waste water pipes. As the noise generation in waste water systems depends on the flow rate, noise measurements are performed at several flow rates Q which are typically encountered in practice:

1. Q = 1.0 l/s, corresponding to Q = 60 l/min,
2. Q = 2.0 l/s, corresponding to Q = 120 l/min,

In this specific test set-up, the vibrations of the pipe wall, that are caused by the flow of water are transmitted across the expanded metal and the plaster (measurement series 1) resp. across the expanded metal, the plaster and the pipe fixing (measurement series 2) onto the installation wall (structure-borne sound bridges). From this wall, and – to a lesser extent – also from the adjoining building units, these vibrations are then emitted as airborne noise into the measuring room behind the installation wall (UG rear). The structure-borne sound transmission can be reduced by applying a structure-borne sound insulation system (measurement series 1) or a structure-borne sound insulation system with suited fasteners (measurement series 2).

General information about the measuring

In the test room, the sound pressure level is picked up not at just one point, but at six points to be space and time-averaged (this procedure differs from the standard EN ISO 10052). In this way, precision and reproducibility of the measurement results are improved, in order to meet the advanced requirements for laboratory measurements. The value that was determined in this way ($L_{AF,10}$) is used as the installation sound level L_{In} in the test facility.



Sectional drawing of the installation test facility in the Fraunhofer-Institute of Building Physics (dimensions given in mm). The test facility comprises two couples of rooms in the ground floor (EG) and in the basement (UG) that are located above each other. Due to this construction, including the top floor (DG) and the sub-basement (KG), it is possible to perform tests on installation systems which extend across several floors, e.g. waste-water installation systems. The installation walls in the ground floor and in the basement can be substituted according to actual requirements. In the standard case, single-leaf solid walls with a mass per unit area of 220 kg/m² (according to German standard DIN 4109) are used. Since the sound insulation of these walls do not meet the requirements to be fulfilled by a wall separating different occupancies within the same building ($R'_w \geq 53$ dB), the next adjacent rooms to be protected from noise are located diagonally above or below the installation room (in case of a usual design of the ground plan). Due to its double-leaf construction with an additional structure-borne sound insulation, the installation test facility is particularly suited for measuring low sound pressure levels. The measuring rooms are designed in such a way that the reverberation times are between 1 s and 2 s within the examined frequency range. The flanking walls, with an average mass per unit area of approximately 440 kg/m², are made of concrete.