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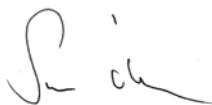
## **Guidelines on the testing of the acoustic performance of wastewater systems according to DIN EN 14366**

This information consists of  
4 pages of text  
2 figures.

Test Laboratory Building Acoustics and Environmental Noise Control

Stuttgart, June 1, 2016

Head of test laboratory:



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## 1 Introduction

In the following the procedure of testing the acoustic performance of wastewater systems according to DIN EN 14366 is described. It is particularly focused on presenting the regulations applicable for performance of the test of wastewater systems at the test laboratory of the Fraunhofer Institute for Building Physics. By introducing the "Guidelines on the testing of the acoustic performance of wastewater systems" particular attention shall be paid to ensuring a high degree of reproducibility and comparability of the measurement results of different wastewater systems, as well as the applicability of the results in practice.

## 2 Test facility and test setup

The Fraunhofer Institute for Building Physics is a testing laboratory approved by the German Institute for Building Technology (DIBt) accredited acc. to DIN EN ISO/IEC 17025:2005 by the DAkkS. The accreditation certificate is D-PL-11140-11-01.

The noise of sanitary installations is measured in a special test facility for testing of sanitary equipment (see Figure 1). This test facility especially designed for the measurement of low sound levels allows to test all kinds of domestic installations under practical conditions. The installation wall mounted in the test facility has a mass per unit area of 220 kg/m<sup>2</sup>, thus corresponding to the lightest single-leaf solid wall as according to DIN 4109 admissible for sanitary installations without verification of suitability.

The test setup and the performance of the measurements are carried out according to DIN EN 14366. In the test facility, the wastewater system is, as in practice, extending over several floors (see Figure 2). The measurements are performed with stationary water flow at volume flows rates of 0.5, 1.0, 2.0, and 4.0 l/s (for pipes having an inner diameter of 100 – 125 mm).

The measurement results permit the comparison of products, materials and system components of wastewater installations with regard to their sound insulation properties (building component testing). In addition, the determined sound pressure levels (installation sound levels) can be compared to the requirements specified in DIN 4109 and VDI 4100. This requires that the constructional conditions of the real building situation regarding sound insulation are comparable to or even better than those of the test facility at the Fraunhofer Institute for Building Physics. When comparing the requirements, it should also be noted that a simultaneous operation of the sanitary installations or interaction between the sanitary components may lead to differing results. As comparative value for the requirements, the measurement value obtained at a flow rate of 2l/s should be used, as this value approximately corresponds to the average flow rate of a toilet flushing.

Furthermore the standard DIN EN 12354-5 allows to predict the sound pressure level as well for different building situations as by taking into account additional values representing the installation noise of other building services systems such as toilet facilities, shower areas, bathtubs, etc.

Alternatively, it is possible to perform so-called "prototype building tests" whereby wastewater systems can be tested in our test facilities under practical conditions in connection with further

sanitary installations ("system tests"). The results of "prototype building tests" can be compared directly with sound insulation requirements.

### 3 Determination of the acoustic performance of wastewater systems

The measurement results presented in test reports basically apply only for the combination of wastewater pipe and pipe clamp. In the room behind the installation wall which the wastewater pipe is fixed to (basement test-room "UG rear", Figure 1 and 2), the installation sound level (structure-borne sound characteristic level  $L_{s,c,A}$ ) is mainly affected by the type of the pipe clamp and by the way it is installed. However, the Airborne sound pressure level ( $L_{a,A}$ ) in the installation room the wastewater pipe is installed in (basement test-room "UG front", Figure 1 and 2), mainly reflects the acoustic characteristics of the pipe material.

To what extent the pipe clamp establishes contact between wastewater pipe and installation wall thus determines the level of the disturbing noise. With regard to the modalities the pipe clamps are installed, the measurement results can be influenced strongly (e.g. use of spacers, tightening torque, etc.). Even if in test reports the used pipe clamps and their installation conditions are described in detail, these influencing parameters often require considerable effort to be transferred into practice. Furthermore, it must be expected a limited reproducibility of the measurement values.

#### 3.1 Regulations and requirements for the testing of wastewater systems

Depending on the mounting conditions of the pipe clamps (tightening torque, centering of the pipe in the brackets, load distribution, etc.), the resulting sound level in the measuring room behind the installation wall (basement test-room "UG rear", Figure 1 and 2), may vary by up to 15 dB(A) while using the identical wastewater pipe system. In order to obtain best possible test results, it turned out in the past repeatedly that the installation by the client was carried out in a way that is non-transferable to practical installations and therefore the measurement values do not have practical relevance anymore. Although the installation conditions are described in the test report exactly, there is still a risk that the relevant details of the report are overlooked and the measured values are transferred into practice without considering the modifications. Therefore we expressly point out that some of the test reports published before 2014 include measurement values that are only comparable to a limited extent and are partially not effective in practice. Thus, we do no longer support these reports.

In order to enhance the comparability of wastewater measurements and to obtain practically relevant measurement results, the Fraunhofer Institute for Building Physics introduced in the recent years, in addition to the standards included in DIN EN 14366, the following new guidelines for the performance of acoustic examinations of wastewater systems.

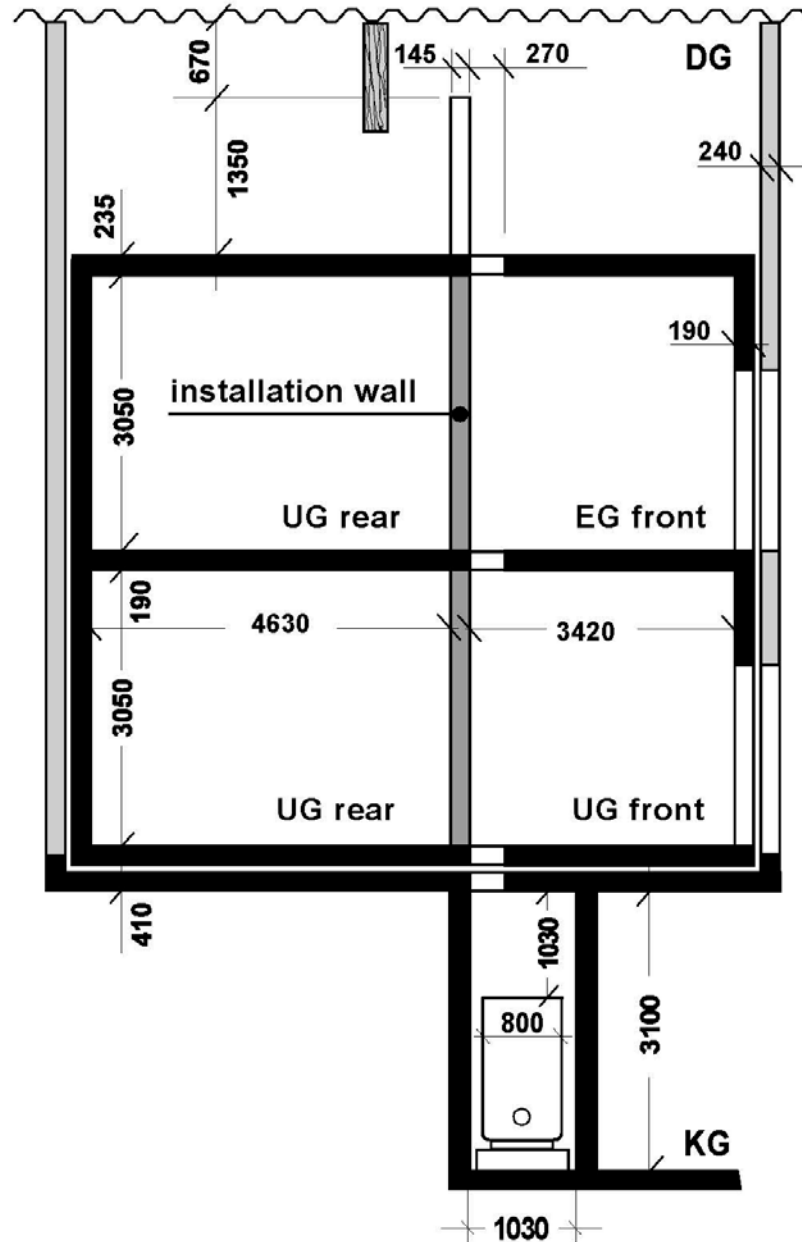
##### Guidelines for the performance of acoustic examinations of wastewater systems:

- Measuring results below 10 dB(A) are not mentioned in the test report, since they are subject to an increased measurement uncertainty and moreover are not noticeable in a normal living environment.  
(valid as of 2009).

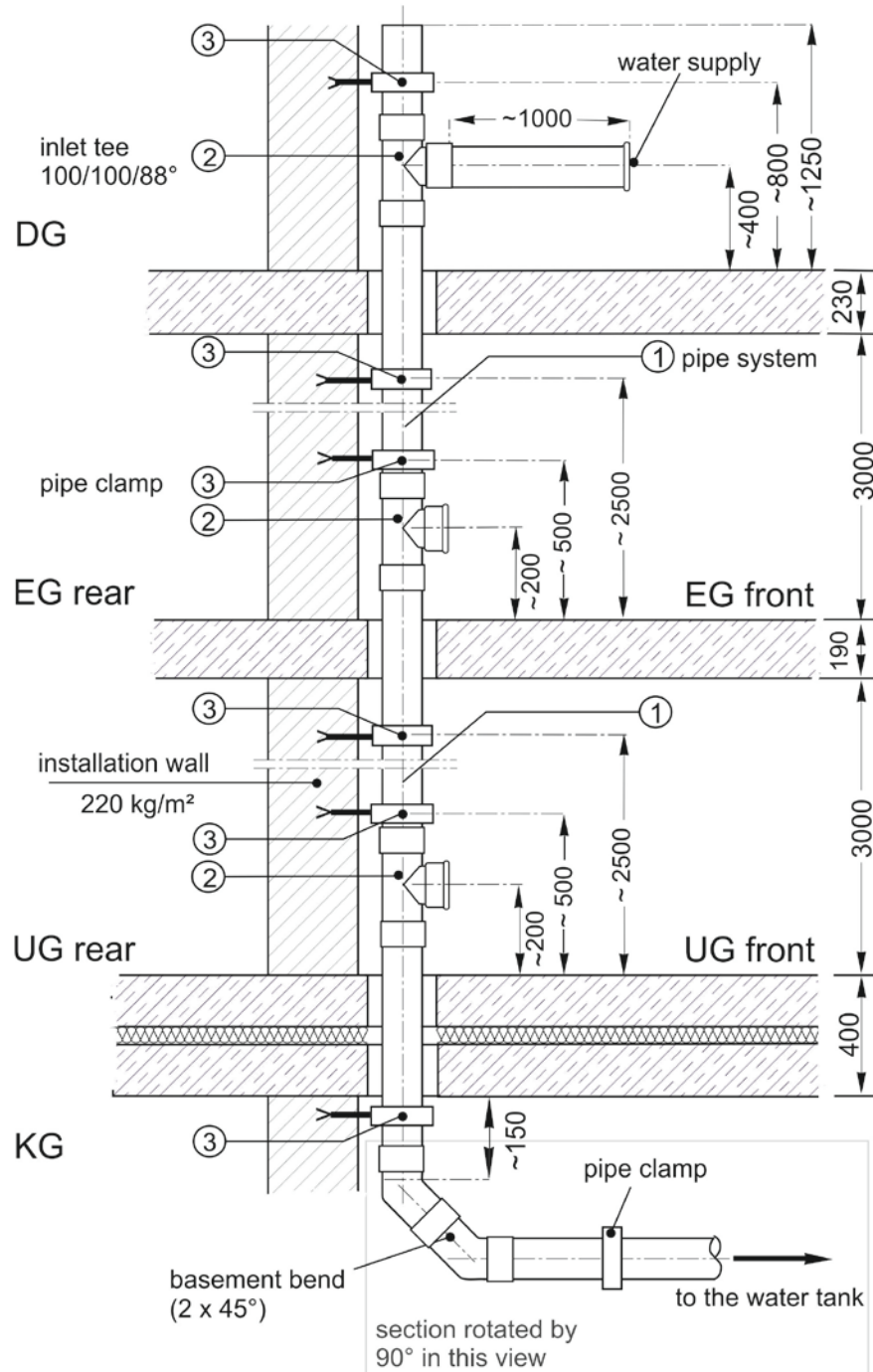
- The test setup for acceptance measurements shall be installed exclusively by staff of the Fraunhofer IBP, or by staff authorized by the IBP. Immediately after setting up the test, the acceptance measurement shall be carried out. Any subsequent changes of the wastewater system and the pipe clamps aiming to improve the measurement results shall not be possible. (valid as of 2014).
- The used pipe clamps in the installation and measuring rooms (EG front and UG front) relevant for the sound transmission have to be designed and installed in such a way that when opening the pipe clamps in the lower basement (KG) this will not lead to a sliding down of the pipe system (valid as of 2014).
- In order to ensure that both the test procedures and the test objects are up-to-date, the Fraunhofer IBP usually assumes a validity of the test reports of 5 years (following the validity period of "general building authority test certificates - abP") and recommends a reexamination of the wastewater systems after a maximum of 10 years.

### **3.2 Reference clamp for the comparability of wastewater pipes**

In order to allow a direct comparison between different wastewater pipes without influence of the used clamps, since the beginning of 2014 an additional measurement with a reference pipe clamp prespecified by the Fraunhofer IBP is offered with every acceptance measurement. This reference pipe clamp is a common commercial steel pipe clamp with elastomeric insert. The reference pipe clamps are always mounted at the same fixing points at the installation wall, carried out always in the same way (completely closed with a tightening torque of the screw plugs of 3 Nm). By comparative measurements at a reference wastewater system it is examined whether the acoustic performance of the reference pipe clamps changes. Furthermore, the acoustic long-term performance of the reference pipe clamps is controlled regularly in a special test facility designed to determine the insertion loss of pipe clamps.



**Figure 1:** Section drawing of the test facility for sanitary elements at the Fraunhofer Institute for Building Physics (dimensions in mm). The test facility consists of two rooms on the first floor and basement (EG and UG), each located on top of each other. Including attic and basement (DG and KG), this allows to test also installations extending over several floors, as for example wastewater systems.



**Figure 2:** Basic installation diagram for the sound examination of a wastewater system (diagram not true to scale, dimensions in mm).