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Guidelines on the testing of the acoustic performance of wastewater systems in the test facility according to DIN EN 14366-1

This information consists of
4 pages of text
2 figures.

Test Laboratory Acoustics

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1 Introduction

The DIN EN 14366:2020 standard has been replaced by the newly published DIN EN 14366-1:2023-09 standard. Since its release in September 2023, test reports have now been exclusively issued in accordance with the updated DIN EN 14366-1 standard.

According to DIN EN 14366-1, wastewater or rainwater piping systems are characterized as sources of both airborne and structure-borne sound sources, using the same procedures described in DIN EN 15657, which outlines the acoustic characterization of building services. As a result, the standard is applicable to installations in all types of buildings, whether heavy structures (e.g., solid buildings) or lightweight constructions (e.g., timber buildings).

This document outlines the procedures for conducting acoustic tests on wastewater systems in accordance with DIN EN 14366-1. In particular, it details the regulations applicable at the Fraunhofer Institute for Building Physics test facility for conducting tests on wastewater systems. The "Guidelines for the Performance of Acoustic Testing on Wastewater Systems" (see Section 4) aim to ensure a high degree of reproducibility and comparability of measurement results across different systems, as well as the transferability of the measurement results to practice.

2 Application of Results according to DIN EN 14366-1

Product Comparison

To compare the sound insulation performance of different products, materials, and system components used in wastewater installations, three Single Number Quantities (SNQ) are reported in the test report (Result Sheet 3) according to DIN EN 14366-1. These values are derived from prediction calculations based on example building configurations (from DIN EN 12354-5). The single number quantities determined by this method are not intended for use in evaluating compliance with other building sound insulation requirements. Please use these values for marketing purposes, specifying the volume flow, the specific installation conditions, and the pipe clamp configuration applied during the test.

Prediction and comparison with acoustic requirements

Using the source data from a specific wastewater system, sound levels in noise-sensitive rooms can be calculated in combination with the acoustic properties of any given building.

The methods for predicting noise from building service systems are described in the DIN EN 12354-5 standard. The Fraunhofer IBP provides an online tool (www.prenoise.app) to perform such calculations. The predicted sound pressure levels (installation sound levels) can then be compared to acoustic requirements specified in standards such as DIN 4109 or VDI 4100. This requires that the real construction conditions are acoustically equivalent or more favorable than those assumed in the prediction model.

Upon request, we offer custom calculations and include building-specific predictions in the test report. By default, Table 1 in our test report contains prediction results of the P12 test facility at the Fraunhofer IBP in Stuttgart. These comparative values are intended solely for comparison with earlier test reports and not for comparison with requirements for other building situations.

3 Noise Testing on Wastewater Systems

The Fraunhofer Institute for Building Physics is a notified testing body recognized by the German Institute for Building Technology (DIBt), accredited according to DIN EN ISO/IEC 17025:2018 by the DAkkS under accreditation number D-PL-11140-11-00.

Measurements of installation noise are carried out in a dedicated test facility for sanitary objects (see Figure 1), specifically designed for measuring low sound levels, allowing all types of domestic installations to be tested under realistic conditions. The test facility includes an installation wall with a mass per unit area of 220 kg/m², which corresponds to the lightest single-shell solid wall permitted for sanitary installations without suitability testing according to DIN 4109.

The test setup and the measurements are carried out in accordance with DIN EN 14366-1. In the test facility, the wastewater system is installed under realistic conditions across several floors (see Figure 2). The measurements are taken with a stationary water flow at various flow rates of 0.5, 1.0, 2.0, and 4.0 l/s (for pipes with an inner diameter of 100 to 125 mm, other diameters are possible).

As defined in DIN EN 14366-1, the following source quantities are determined for each flow rate and presented as spectra in the test report:

- Airborne sound power level L_{Wa} and corresponding single-number value $L_{Wa,A}$;
- Single equivalent free velocity level of the specimen $L_{vf,eq}$;
- Single equivalent blocked force level of the specimen $L_{Fb,eq}$;
- Magnitude of the single equivalent mobility of the specimen $|Y_{S,eq}|$.

The measurement results presented in test reports are generally only valid for the specific combination of the wastewater pipe and the pipe clamp used during testing. The blocked force, the free velocity, and the source mobility, and thus the resulting installation sound level in the room behind the installation wall to which the wastewater pipe is attached (measurement room, basement rear in Figure 1 and Figure 2), are significantly influenced by the type and installation conditions of the pipe clamp. In contrast, the airborne sound power level measured in the installation room in which the wastewater pipe is installed (measurement room, basement, at the front in Figure 1 and Figure 2), mainly reflects the acoustic behavior of the pipe material itself.

4 Guidelines and Requirements for Testing Wastewater Systems

Apart from the pipe properties, the installation of the pipe clamps (tightening torque, use of spacers, centering, load distribution, etc.) can have a significant effect on the acoustic performance of the system, even when all other installation parameters of the wastewater pipe system remain unchanged.

In order to achieve the best possible test results, it has been repeatedly found in the past that installations performed by the client were not carried out in a practical manner. In order to improve the comparability of wastewater measurements and practical relevance of laboratory measurements, the Fraunhofer Institute for Building Physics has introduced supplemental guidelines for acoustic testing of wastewater systems - in addition to the specifications contained in DIN EN 14366-1.

Guidelines for Conducting Acoustic Testing on Wastewater Systems:

- The test setup for approval measurements shall be carried out exclusively by Fraunhofer IBP employees or staff commissioned by the IBP. The approval measurement shall take place immediately after the test setup. Subsequent modifications to the wastewater system and pipe clamps intended to improve the measurement results are not permitted.
  (valid since 2014)

- The pipe clamps used in the installation and measurement rooms relevant for sound transmission (ground floor front "EG" and basement front "UG") must be designed and installed in such a way that opening the clamps in the sub-basement "KG" does not cause the pipe system to slip downward.
  (valid since 2014)

- To ensure that the test reports reflect the current status of the test procedures and objects, the Fraunhofer IBP assumes a default validity period of 5 years for test reports (following the validity period of an abP "general building approval test certificate") and recommends retesting the wastewater systems not later than 10 years after the initial testing.

- Measured or predicted values below 10 dB(A) are not specified in the test report, as they are subject to increased measurement uncertainty and are not perceptible in a normal living environment.
  (valid since 2009)

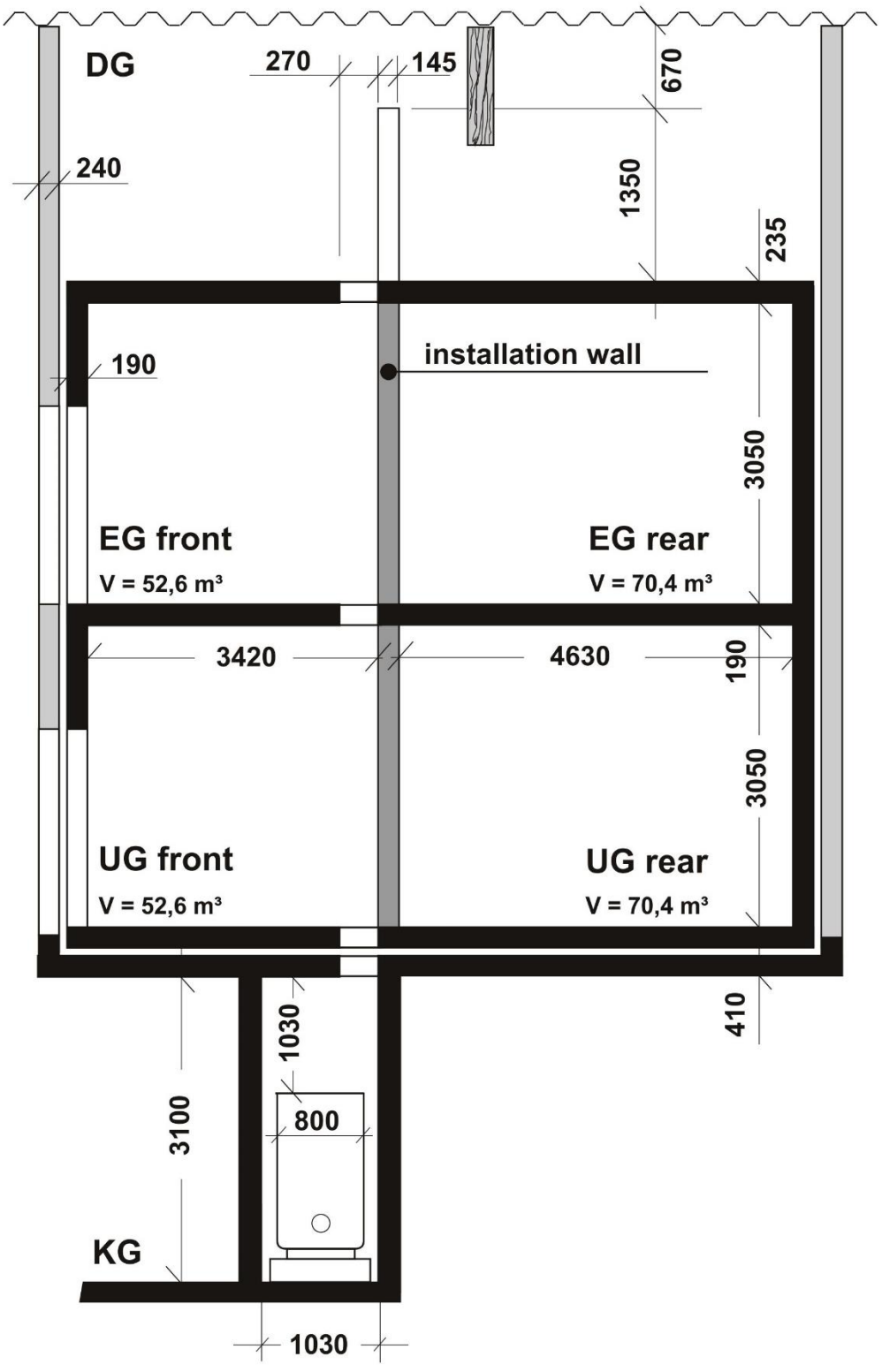


Figure 1: Cross-section drawing of the installation test facility at the Fraunhofer Institute for Building Physics (dimensions in mm). The test facility consists of two rooms, each above the other, on the first floor and basement (EG and UG), allowing the testing of multi-story installations, such as wastewater systems, in combination with attic and cellar level (DG and KG).

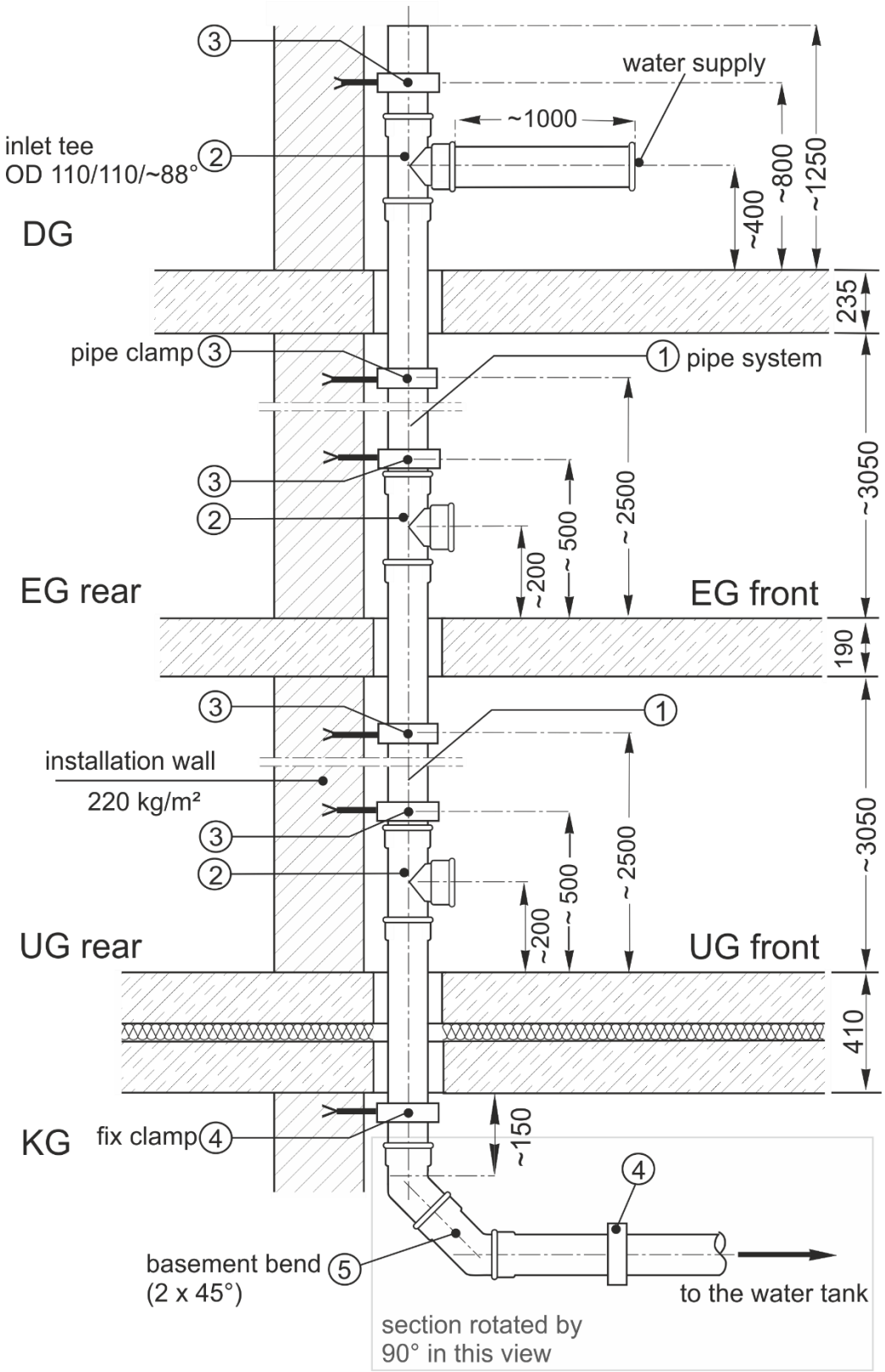


Figure 2: Schematic installation diagram for the acoustic investigation of a wastewater system (diagram not to scale, dimensions in mm).