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Institution for testing, supervision and certification, officially recognized by the building supervisory authority. Approvals of new building materials, components and types of construction

Director
Prof. Dr. Klaus Peter Sedlbauer

## Test Report P-BA 16/2015e

# Insertion loss $D_e$ of pipe clamps for 1" pipes in the laboratory

**Client:** Gripple Europe S.à.r.l.
1 Rue du Commerce
67210 Obernai
France

**Test object:** "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple

**Content:**

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| Figure 3: | Measurement Set-up |
| Annex D: | Realisation of measurement, Evaluation of measuring data and determination of acoustic parameters, Scope of the measurements |
| Annex M: | Installation plan |
| Annex P: | Description of test facility |

**Test date:** The measurement was carried out on 13 March 2015 in the test facilities of the Fraunhofer Institute for Building Physics in Stuttgart.

Stuttgart, 24 March 2015

Responsible Test Engineer: Head of Laboratory:

i.V. S. Öhler

M.BP. Dipl.-Ing.(FH) S. Öhler M.BP. Dipl.-Ing.(FH) S. Öhler

The test was carried out in a laboratory, accredited according to DIN EN ISO/IEC 17025:2005 by DAkkS. The accreditation certificate is D-PL-11140-11-01.



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ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-11140-11-01

# Determination of the insertion loss $D_e$ and the IGN-sound level $L_{IGN}$ in the laboratory

**P-BA 16/2015e**
**Results sheet 1**

**Client:** Gripple Europe S.à.r.l., 1 Rue du Commerce, 67210 Obernai, France

**Test specimen:** "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple (S 10784-2), compared to reference set-up with steel pipe clamps without rubber inlay.

**Test set-up:** "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple, consisting of a base (material: ZA2) with dual connection thread (Ø M8/M10) and a wire rope (Ø 2 mm, length 400 mm). ZA2 base covered by a "Rubber Pad" (hardness: ca. 40 ShoreA). Wire rope covered by the "Retractable Sleeve".
A 1" steel pipe (zinc-plated, length: 2 m, external diameter: 33.7 mm; wall thickness: min. 2.6 mm, acc. DIN EN 10 220) was fixed with two pipe clamps to the ceiling (concrete, thickness: 19 cm, mass per unit area: 440 kg/m²) of the test facility.
- Reference set-up: Rigid attachment of the steel pipe with steel pipe clamps without rubber inlay (indicated dimension: 3/4", ND25-30).
- Test set-up: Attachment of the steel pipe with "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple.

The pipe clamps were fixed to the ceiling with dowels and screws.
Noise excitation by a standardized source of installation noise (IGN, flow pressure 0.3 MPa). Low-noise water supply and waste water installation in the installation room with a flexible tube.
Test set-up according to Figure 3 (details in Annex M).

**Test facility:** Installation test facility P12, mass per unit area: ceiling 440 kg/m²; installation wall 220 kg/m², installation room: UG front (basement); measuring room: EG front (details in Annex P).

**Test method:** Measurement according to DIN EN ISO 10052:2010-10, DIN 4109-11:2010-05 and DIN 4109:1989; noise excitation by a standardized source of installation noise (IGN) according to German Standard DIN EN ISO 3822-1:2009. (see Annex D)

**Result:**

| "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple | measuring room<br>EG front (vertical) |
|---|---|
| **A-weighted sound level reduction $\Delta L_{A,F}$ in dB**<br>noise excitation by a standardized source of installation noise (IGN) | **15** |
| IGN-sound level $L_{IGN}$ [dB(A)]<br>Reference set-up: Rigid attachment of the steel pipe with steel pipe clamps without rubber inlay. | 49 |
| IGN-sound level $L_{IGN}$ [dB(A)]<br>Test set-up: Attachment of the steel pipe with "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve". | 34 |



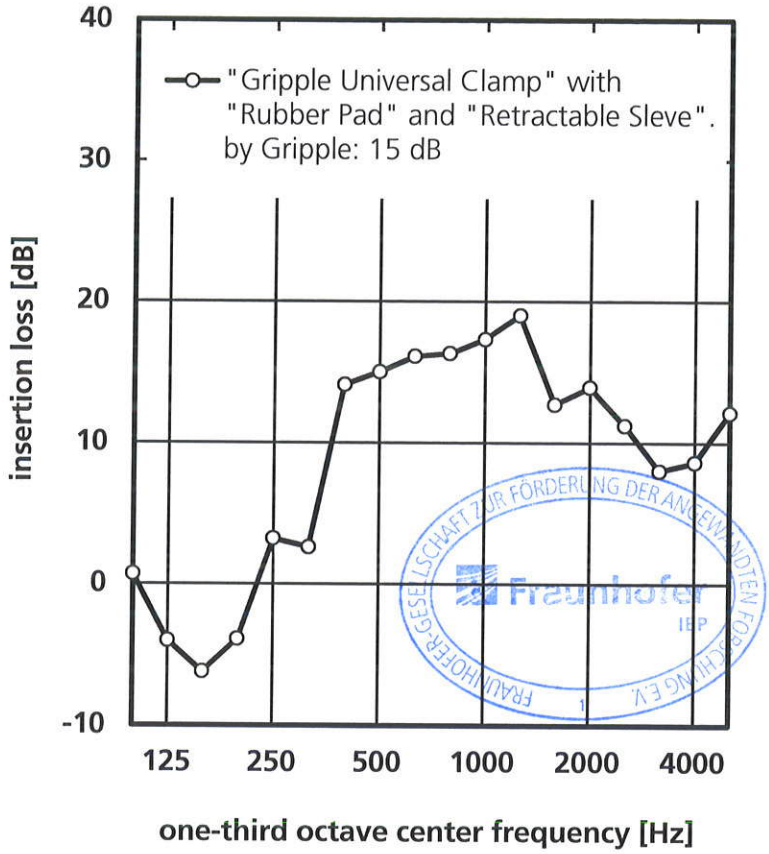
**Test date:** 13 March 2015

**Notes:**
- Neither the measured insertion loss De (respectively the A-weighted sound level reduction $\Delta L_{A,F}$,) nor the IGN-sound level are subject to noise control requirements. In case of excitation by an IGN, the measured total sound level $L_{A,F,10}$ (corresponds to the IGN-sound level $L_{IGN}$ according to German standard DIN 4109) enables the approximation of the maximal appliance sound pressure level $L_{ap}$, that taps are allowed to have, to ensure that the resulting installation noise level $L_{In}$ meets the requirements according to German standard 4109 (see Annex D).

Fraunhofer IBP

The test was carried out in a laboratory, accredited according to DIN EN ISO/IEC 17025:2005 by DAkkS. The accreditation certificate is D-PL-11140-11-01.

Stuttgart, 24 March 2015
Head of Laboratory:

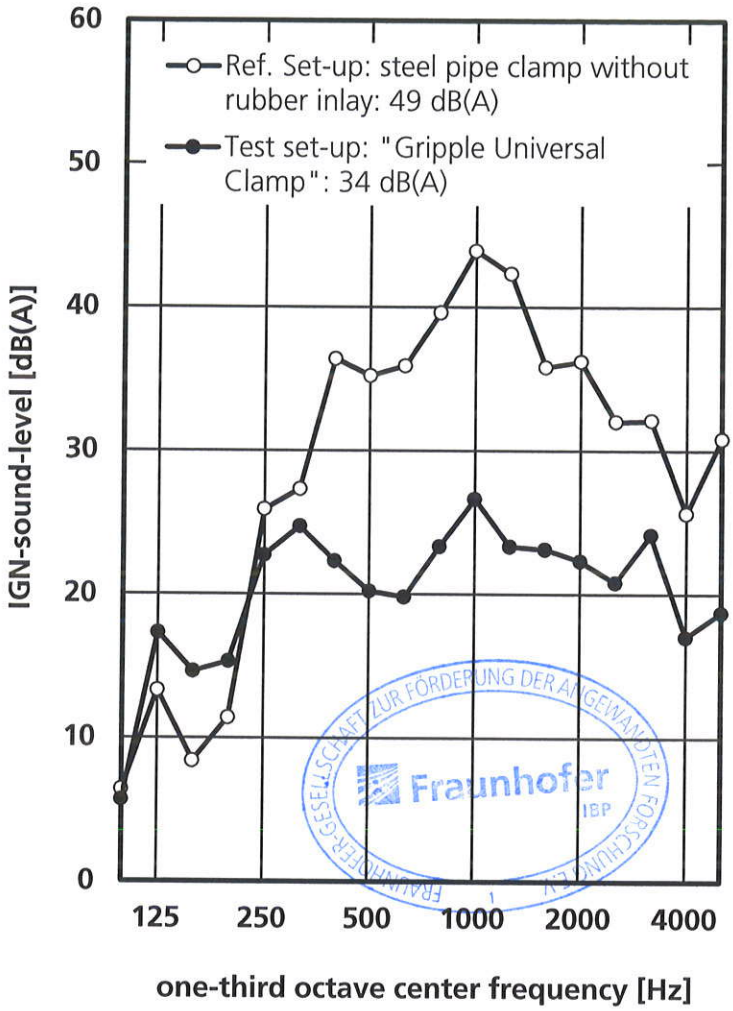



Frequency response of the insertion loss by noise excitation by a standardized source of installation noise (IGN), measured in the test room EG front (vertical, installation room UG front). The A-weighted sound level reduction $\Delta L_{A,F}$ in dB (referring to IGN noise excitation), for the reproduced frequency range from 100 to 5000 Hz, is represented in the legend.

Test specimen:

"Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple.
The same 1"-steel pipe with steel pipe clamps without rubber inlay was used as reference set-up.

Details about the test set-up in results sheet 1 and figure 3.




Frequency response of IGN-sound level $L_{IGN}$ by a standardized source of installation noise (IGN), measured in the test room EG front (vertical, installation room UG front). The IGN-sound level $L_{IGN}$ ($L_{In}$) in dB(A) according DIN 4109, for the reproduced frequency range from 100 to 5000 Hz, is represented in the legend.

Test specimen:

"Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple.
The same 1"-steel pipe with steel pipe clamps without rubber inlay was used as reference set-up.

Details about the test set-up in results sheet 1 and figure 3.



above: Measurement Set-up: "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve" for pipe sizes 3/8" (ND10) to 3" (ND80), manufacturer: Gripple used for fixation of a 1" steel pipe to the installation ceiling in the installation room UG front. The water supply was provided bottom up by a flexible tube. The noise excitation and the flowing off were realized by a standardized source of installation noise (IGN).

below left: steel pipe clamps without rubber inlay.

below right: "Gripple Universal Clamp" with "Rubber Pad" and "Retractable Sleeve".

**Realization of measurement**

The insertion loss $D_e$ describes the reduction of the installation sound level of water pipes by means of structure-borne sound insulating tubes or elastic mounting elements (e.g. pipe clamps, insulating tubes) compared to a rigid attachment of the pipe to the ceiling. The measurements are performed according to German standard DIN EN ISO 10052, in which in situ measurements of the noise behavior of water installations are described. The execution of the measurements take place in two steps:

1. Measurement of the installation sound level of a reference set-up with a rigid attachement of the pipe to the installation ceiling.
2. Measurement of the installation sound level of the same pipe supplied with the structure-borne sound insulating tube or the elastic mounting element under test.

Noise excitation

The noise excitation is carried out by a standardized source of installation noise (IGN) according to German standard DIN EN ISO 3822-1, which is operated with a pressure of 0.3 MPa and a steady water flow of 0.26 l/s. This procedure ensures a practical and reproduceable noise excitation.

Reference set-up

To determin the insertion loss of the samples a drinking water pipe (length approx. 2 m, with bends at both ends) is attached to the ceiling (mass per unit area m'' = 440 kg/m²) of the installation test facility. The used set-up is shown schematically in annex M. The pipe is attached to the ceiling by means of two pipe clamps without profile rubber lining, adjusted to the outside diameter of the pipe,that are closed completely. At one end of the pipe the IGN is connected, at the other end the water is led in by means of flexible tube.

The noise generated by the IGN is transferred by the pipe and the clamps into the installation ceiling and radiated as airborne-sound in the room above. Differing from German standard DIN EN ISO 10052 the sound pressure level is recorded at six points spread in the receiving room. In this way an averaging in space and time is reached, causing an improvement of exactness and reproducibility of the measuring results to take account to the raised requirements for laboratory measurements.

Measurement set-up with test object

The measurement set-up with test object is almost identical with the reference set-up. The only difference is, that the rigid clamps are replaced by the elastic ones under test. In case of structure-borne sound insulating tubes the pipe is completely encased in the insulating material. The rigid clamps are exchanged by clamps, which are adjusted to the outside diameter of the insulating tube and usually have no profile rubber lining.

**Evaluation of measuring data and determination of acoustic parameters**

The measured sound pressure level is given as a time and space averaged one-third octave spectrum in the frequency range between 100 Hz and 5 kHz. First, the value is corrected for background noise. Subsequently, the measurement signal is normalized to an equivalent sound absorption area $A_0$ = 10 m² and A-weighted:

(1) $$L_{n,AF,10} = 10 \cdot \lg\left(10^{\frac{L_{n,F}}{10}} - 10^{\frac{L_{n,S}}{10}}\right) + 10 \cdot \lg\frac{A_n}{A_0} + k_{A,n} \quad \text{[dB(A)]}$$

| | | |
|---|---|---|
| $L_{n,F}$ | space and time averaged sound pressure level in one-third octave band n (time constant: Fast) | [dB] |
| $L_{n,S}$ | background noise level in one-third octave band n | [dB] |
| $A_n = \frac{0.16 \cdot V}{T_n}$ | sound absorption area of test room for one-third octave band n | [m²] |
| $V$ | volume of test room | [m³] |
| $T_n$ | reverberation time of test room in one-third octave band n | [s] |
| $k_{A,n}$ | A-weighting for one-third octave band n | [dB] |

If the difference between the two levels (i.e. the measured one-third octave level and the background noise level) is less than 3 dB, the correction for background noise will not be performed. Instead, the measured background noise level will be used (as an estimated maximum level). The total sound pressure level is obtained by energetically adding the one-third octave values.

(2) $$L_{AF,10} = 10 \cdot \lg\left(\sum_{n=1}^{18} 10^{\frac{L_{n,AF,10}}{10}}\right), \quad \text{[dB(A)]}$$

where n indicates the number of one-third octave bands from 100 Hz through 5 kHz. The calculated level $L_{AF,10}$ corresponds to the sound pressure level resultant in a sparsely furnished reception room under otherwise equal conditions.

The acoustic influence of the structure-borne sound insulating tube or the elastic mounting element under test is described by the frequency-dependent insertion loss $D_e$. The one-third octave values of the insertion loss $D_{n,e}$ are the difference between the one-third octave levels $L_{n,AF,10\text{-}0}$, measured with rigid pipe clamps, and the levels $L_{n,AF,10\text{-}1}$, measured with the insulating tube or the elastic mounting element under test

(3) $$D_{n,e} = L_{n,AF,10\text{-}0} - L_{n,AF,10\text{-}1} \quad \text{[dB]}$$

Additionally the reduction of the A-weighted sound level $\Delta L_{AF}$ by the test object is determined. For this purpose the A-weighted total sound pressure levels are subtracted from each other instead of the one-third octave levels.

(4) $$\Delta L_{AF} = L_{AF,10\text{-}0} - L_{AF,10\text{-}1} \quad \text{[dB]}$$

The reduction of the A-weighted sound level represents a measure for the decrease of noise felt by human ear using structure-borne sound insulating tubes or elastic mounting elements. It refers exclusively to the noise

spectrum of an IGN (as used at the measurements) and can't be transferred directly to other types of noise sources.

**Scope of the measurements**

Transferability of the results to other building situations

Concerning the practical application of the measuring results it has to be noted that the reduction of the A-weighted sound level achieved in situ can deviate from the value indicated in the test report, if taps are used, whose noise spectrum differs substantially from that of the IGN. The same applies to water installations with different shape or other pipe diameter. Different variations of installation, as for example the mounting under plaster, the mounting with other elastic mounting elements, etc., likewise influence the insertion loss. Moreover it has to be considered, that the attainable noise reduction in practice can be decreased by structure-borne sound bridges between the tap or the pipe and the building. In the values given here these side paths are not considered.

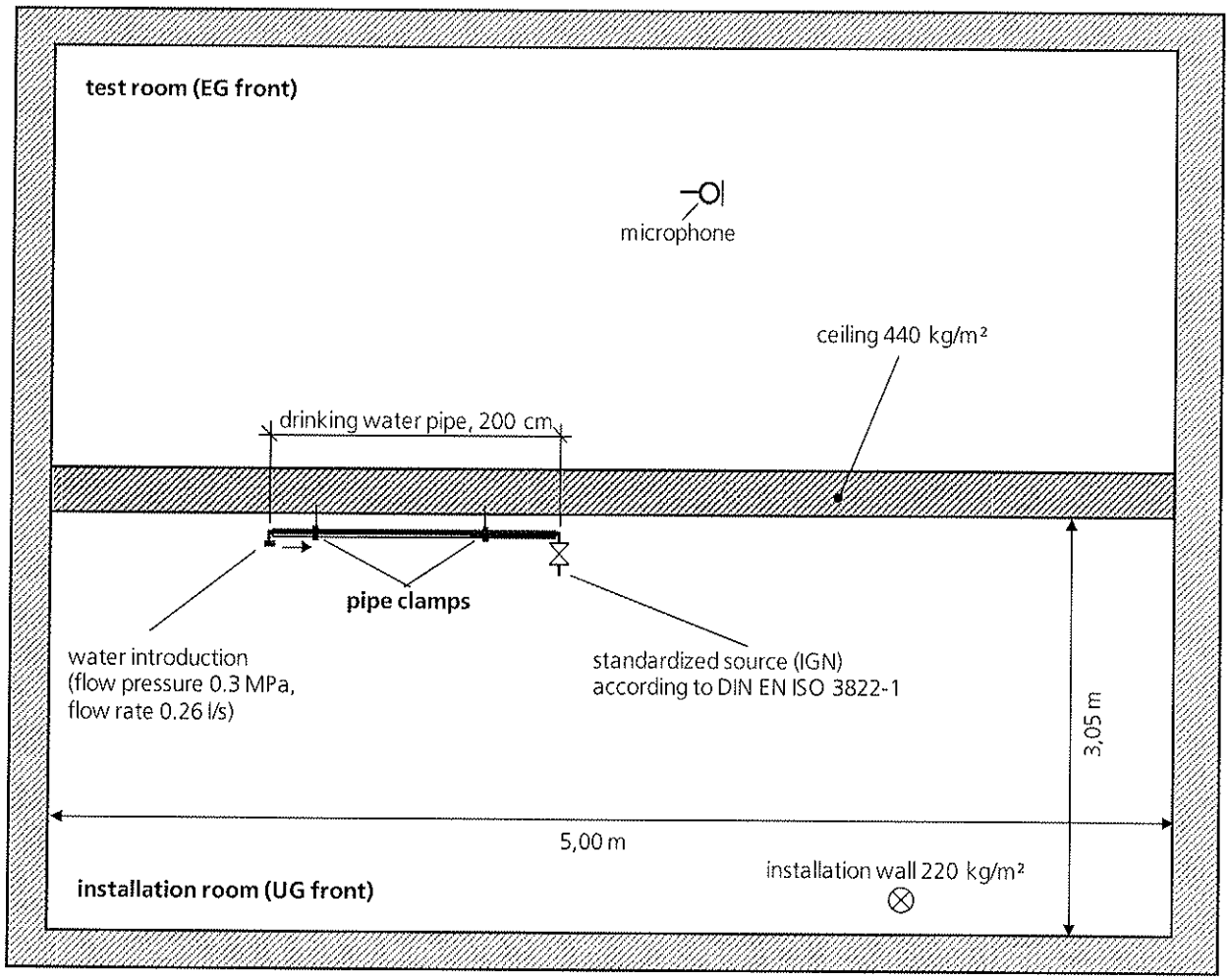
Proof of sound protection requirements

Neither the measured insertion loss $D_e$ nor the installation-sound level used for determination of $D_e$ are subject to noise control requirements. Nevertheless, in case of excitation by a IGN, the measured total sound level $L_{AF,10}$ (corresponds to the IGN-sound level $L_{IGN}$ according to German standard DIN 4109) in a model building (in the present case the test facility for water installations in the IBP serves as a model building) enables the approximation of the maximal appliance sound pressure level $L_{ap}$, that taps are allowed to have, to ensure that the resulting installation noise level remains below $L_{In}$ = 35 dB(A). The approximation is valid for the water installation under test in conjunction with building conditions similar to the model building. According to German standard 4109, equation (5), the maximal value of the appliance sound pressure level is:

(5) $$L_{ap} \leq 72 - L_{IGN} (- 5)^*$$ dB(A)

*) Since the current requirement according to DIN 4109/A1:2001 for noise sensitive rooms $L_{In} \leq 30$ dB(A), the $L_{ap}$-value of the tap must be at least 5 dB lower than the value calculated by the equation in DIN 4109.

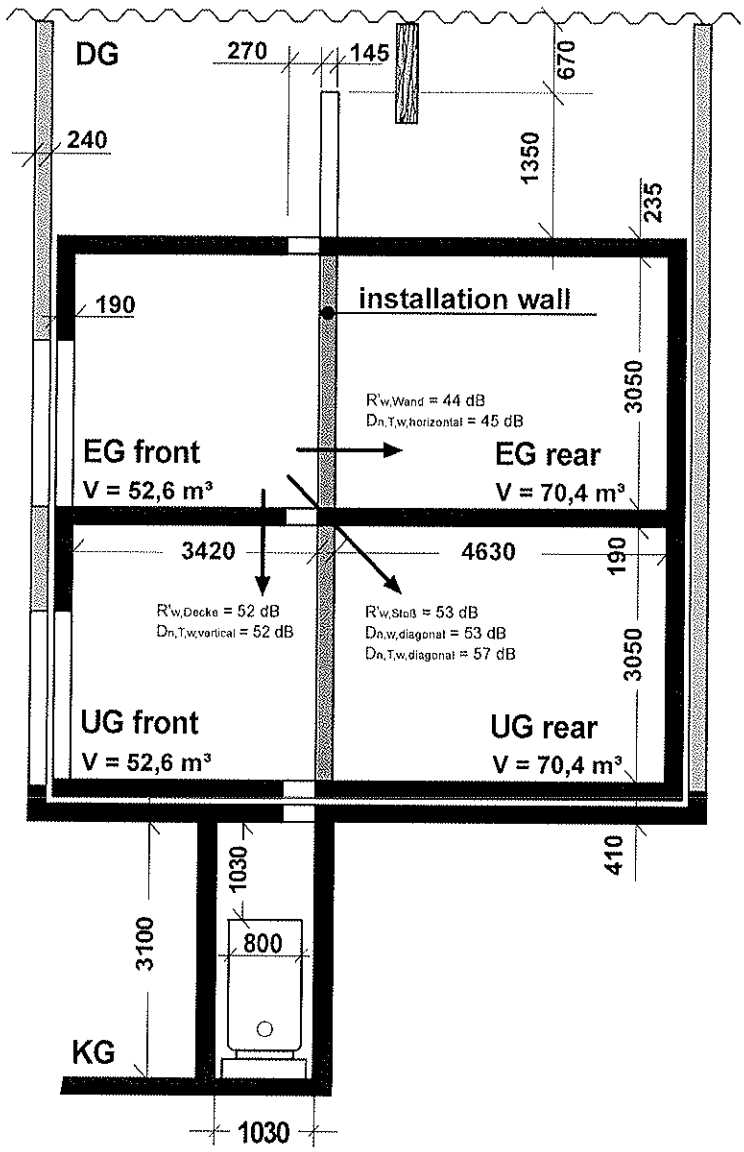
Taps are classified into group I if its appliance sound pressure level $L_{ap}$ is smaller or equal to 20 dB(A). Taps, whose appliance sound pressure level lies between 20 dB(A) and 30 dB(A), are classified into group II.




Test set-up for the determination of the insertion loss of structure-born insulating tubes or elastic mounting elements for drinking water pipes mounted on the ceiling (not to scale).

Status: 22 February 2012

**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.

**Measurement equipment**

Following measurement equipment was used for the measurments in the installation test facility P12 of the Fraunhofer-Institute for Building Physics:

| Device | Type | Manufacturer |
|---|---|---|
| Analyser | Soundbook_MK2_8L | Sinus Messtechnik |
| ½"-microphone-Set | 46 AF (Kapsel: Typ 40 AF-Free Field; Vorverstärker: Typ 26 TK) | G.R.A.S |
| 1"-microphone | 4179 | Bruel & Kjær |
| 1"-preamplifier | 2660 | Bruel & Kjær |
| Microphone-calibrator | 4231 | Bruel & Kjær |
| Accelerometer | 4371 und 4370 | |
| Conditioning amplifier | Nexus 2692-A-0l4 | Bruel & Kjær |
| Accelerometer-calibrator | VC11 | MMF |
| Amplifier | LBB 1935/20 | Bosch Plena |
| Loudspeaker | MLS 82 | Lanny |
| Reference sound source | 382 | Rox |
| Standard tapping machine | 211 | Norsonic |

All measurement devices are tested frequently by internal and external testing laboratories and, if possible and necessary, are calibrated and gauged.