SLOVENSKI STANDARD
oSIST prEN 14366-1:2022

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Laboratorijsko merjenje zvoka, ki se prenaša po zraku in konstrukciji zaradi servisne opreme - 1. del: Pravila uporabe pri napravah za odvajanje odpadne vode

Laboratory measurement of airborne and structure-borne sound from service equipment - Part 1: Application rules for waste water installations

Bauakustik - Messung von Luftschall und Körperschall von gebäudetechnischen Anlagen im Prüfstand - Teil 1: Anwendungsregeln für Abwasserinstallationen

Mesurage en laboratoire des bruits aériens et structuraux des équipements techniques - Partie 1 : Règles d'application aux installations d'évacuation des eaux usées

Ta slovenski standard je istoveten z: prEN 14366-1

ICS:

17.140.20	Emisija hrupa naprav in opreme	Noise emitted by machines and equipment
91.140.80	Drenažni sistemi	Drainage systems

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Laboratory measurement of airborne and structure-borne sound from service equipment - Part 1: Application rules for waste water installations

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 126.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 14366-1:2022) has been prepared by Technical Committee CEN/TC 126 “Acoustic properties of building elements and of buildings”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 14366:2004+A1:2019.

Introduction

Noise from waste water installations is generated by the flow of water in the piping system. There are many different ways to install such systems in buildings, depending on national building codes. They may be firmly cemented into walls and floors, fixed by clips in walls and covered slabs, or hung exposed in the plenum above a suspended ceiling or hidden by an enclosure. It seems advisable, therefore, to define measuring methods for both structure-borne and airborne sound. The first standard on laboratory sound measurements of waste water installations (EN 14366) was published in 2004. The present standard is a revision of EN 14366:2004+A1:2019, and is still focused on laboratory characterization of waste water installations for both airborne and structure-borne sound, but now uses the same characterization methods as for building service equipment, i.e. EN 15657. In particular, structure-borne sound is now characterized by vibration measurements and therefore only one test room is required in the standard for airborne sound measurement.

NOTE The room is particularly necessary to keep the former standard configuration, where the piping system mounting conditions in a room are similar to the ones in buildings. A method based on acoustical intensity could be used with no room at all; such a method is not precisely defined and validated yet, but could be standardized in a future revision of the standard.

Important noise sources are bends after vertical sections, bends for pipe deviation, but also discontinuities, e.g. inlets, couplings and sleeves. The revised standard keeps the standard configuration defined in the former one (straight pipe system connected to walls), but also considers vertically deviated pipes connected to walls and horizontal pipes connected to ceilings.

In addition, the revised standard includes measuring the performance of mitigation measures such as pipe enclosures (technical shaft) and pipe lining.

The title and numbering of the revised document have been changed, now opened to other application standards for equipment systems such as water supply installations.

1 Scope

This document is a revised version of EN 14366:2004+A1:2019 in which waste water or rain water piping systems are characterized as airborne sound source and structure-borne sound source using the same method as the one described in EN 15657 for characterizing building service equipment. It therefore applies to equipment installed in any type of buildings (heavy or lightweight).

This document:

— specifies laboratory measuring methods for determining the input data required for both comparing products and materials, and predicting sound levels in buildings using EN 12354-5. These input quantities are the piping system sound power level for airborne sound and three quantities for structure-borne sound (piping system free velocity, blocked force and mobility), from which the piping system installed power, source input for EN 12354-5, is determined;

— specifies the method for the measurement of the equipment airborne sound power;

— only considers piping systems connected to one supporting building element in a first step;

NOTE Simultaneous structure-borne transmissions to wall and floor are more difficult to handle. In the configurations proposed in this document, the piping system is only connected to one supporting element and mechanically decoupled from the other elements.

— includes configurations of vertical pipes with offset (deviated horizontally) connected to walls and horizontal pipes connected to ceilings, for which the measuring method is the same as the one defined for straight vertical pipes connected to walls. These complementary configurations are described in (normative) Annex A;

— specifies laboratory test procedures for determining the performance of mitigation measures such as pipe enclosures (technical shaft) and pipe lining. The corresponding specifications are given in (normative) Annex B;

— defines the expression of the results for use in comparing products and materials and for use as input data for prediction;

— indicates a method to transform the quantities measured according to EN 14366:2004+A1:2019, to the quantities used in this document; this method is given in (informative) Annex C.

This document is applicable to waste water piping systems and parts thereof, but not to the actual sources of waste water, e.g. lavatories, toilets and bathtubs or any active units, which are considered separately in EN 12354-5 and shall be characterized separately. It applies to pipes with natural ventilation and made of any common material in commonly used diameters (up to 150 mm).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12354-5:—[1], *Building acoustics - Estimation of acoustic performance of building from the performance of elements - Part 5: Sounds levels due to the service equipment*

[1] Under preparation. Current stage is prEN 12354-5:2022.

EN 15657:2017, *Acoustic properties of building elements and of buildings - Laboratory measurement of structure-borne sound from building service equipment for all installation conditions*

EN ISO 10140-3, *Acoustics - Laboratory measurement of sound insulation of building elements - Part 3: Measurement of impact sound insulation (ISO 10140-3)*

EN ISO 10848-1, *Acoustics - Laboratory and field measurement of flanking transmission for airborne, impact and building service equipment sound between adjoining rooms - Part 1: Frame document (ISO 10848-1)*

ISO 16063-21, *Methods for the calibration of vibration and shock transducers — Part 21: Vibration calibration by comparison to a reference transducer*

ISO 5348, *Mechanical vibration and shock — Mechanical mounting of accelerometers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
waste water
any type of water including rainwater evacuated from buildings into the sewer system

3.2
waste water installation
total of pipes and all fixing components, used to evacuate waste water, but excluding the actual sources of the waste water, e.g. sinks, toilets, bathtubs, gutter or any active units (pumps…)

3.3
specimen
simple waste water installation system with a single path of water flow

Note 1 to entry: A specimen is the object of tests according to this document.

Note 2 to entry: Any combination of commercial elements may be assembled to form a specimen.

3.4
test room
single room used for both airborne and structure-borne sound measurements

Note 1 to entry: The specimen is mounted inside the test room.

3.5
standard configuration
mandatory form of specimen used for comparison

3.6
test element
wall or floor on which the specimen is mounted

3.7
contact
point where pipe and receiving element are connected

4 Notations

Index j	Indicates that the quantity is obtained from a source applied at the contact j or is measured at contact *j*	-
Index cal	Indicates, that the quantity is obtained using a calibrated source	-
Index enclosed	Indicates that the quantity is obtained with an enclosure around the specimen	-
Index lining	Indicates that the quantity is obtained with a lining around the specimen	-
Index A	A-weighted quantity	-
$D_{A,k}$	Set of attenuation values for the A-weighting	dB
N	Number of 1/3 octave measured	-
D_{WA}	Airborne sound power insertion loss of an enclosure around the specimen	dB
D_{Ws}	installed power insertion loss of a pipe lining	dB
h	Falling height	m
d	distance	m
Δl	Pipe offset length	m
α	Deviation angle of the pipe offset bend	degree
$L_{p,total}$	Sound pressure level measured in the test room	dB re 20 µPa
$L_{n,total}$	Normalized sound pressure level measured in the test room	dB re 20 µPa
T_r	Reverberation time of the test room	s
V	Volume of the test room	m^3
$L_{Wa,total}$	Total sound power level measured in the test room	dB re 10^{-12} Watt
L_{Wa}	Airborne sound contribution to the total sound power level measured	dB re 10^{-12} Watt
$L_{Wa,struc}$	Structure-borne sound contribution to the total sound power level measured	dB re 10^{-12} Watt
$L_{Ws,i}$	Installed power level of a vibration source connected to the receiving element	dB re 10^{-12} Watt
$L_{\langle v \rangle}$	Space average vibration velocity level of the receiving element	dB re 10^{-9} m/s
$L_{vf,j}$	Free velocity level of the specimen at contact *j*	dB re 10^{-9} m/s
$L_{vf,eq}$	Single equivalent free velocity level of the specimen	dB re 10^{-9} m/s
$L_{Fb,eq}$	Single equivalent blocked force level of the specimen	dB re 10^{-6} m/s
$Re\left(Y_{R,low,j}\right)$	Real part of the mobility of the receiving element at contact *j*	m/sN

$Re\left(Y_{\mathrm{R,low,eq}}\right)$	Real part of the single equivalent mobility of the receiving element	m/sN
$\left\|Y_{\mathrm{S,eq}}\right\|$	Magnitude of the single equivalent mobility of the specimen	m/sN
L'_{ni}	*In situ* apparent impact sound pressure level in a receiving room due to the specimen mounted on element *i*	dB re 20 µPa
$L'_{\mathrm{ne,s,i}}$	Structure-borne contribution of the apparent normalized sound pressure level in a receiving room due to the specimen mounted on element *i*	dB re 20 µPa
$L'_{\mathrm{ne,s,0,i}}$	Structure-borne contribution of the apparent normalized sound pressure level in a receiving room due to a unit power source mounted on element *i*	dB re 20 µPa

5 Measuring method

5.1 Airborne sound measurements

The same method as in EN 14366:2004+A1:2019 is used.

NOTE 1 No airborne sound power measurement method is defined in EN 15657, which refers to EN ISO 3740 to 3747. However, measurements in the present standard are very particular, involving all together small rooms (at least 50 m^3), low frequencies (range down to 1/3 octave 50 Hz) and both stationary and non-stationary sources; consequently, they are fully described here.

The specimen is mounted on the test wall inside the test room (see Figure 2). Appropriate openings in the ceiling and in the floor are provided. A steady flow of tap water is applied. The total sound power level $L_{\mathrm{Wa,total}}$ in the test room, produced as airborne sound radiated directly from the specimen but also as structure-borne sound radiated by the test wall (and the other walls with smaller contributions) is measured according to the following method:

— the specimen shall be mounted in accordance with Clause 8;

— are measured in 1/3 octave bands and according to EN ISO 10140-3: (i) the sound pressure level in the room with the source operating, (ii) the sound pressure level of the back-ground noise (water flow stopped) and (iii) the reverberation time T_{r} of the room;

— the measured level is corrected for background noise according to EN ISO 10140-3 (leading to $L_{\mathrm{p,total}}$) and normalized to an equivalent absorption area of 10 m^2 (leading to $L_{\mathrm{n,total}}$):

$$L_{\mathrm{n,total}} = L_{\mathrm{p,total}} - 10\lg T_{\mathrm{r}} + 10\lg\left(0{,}16V / 10\right) \tag{1a}$$

where

V is the volume of the test room in cubic meters.

— the total sound power level $L_{\mathrm{Wa,total}}$ simply follows from:

$$L_{\mathrm{Wa,total}} = L_{\mathrm{n,total}} + 4\ \mathrm{db} \tag{1b}$$

The structure-borne contribution $L_{\mathrm{Wa,struc}}$, measured according to 5.2, is then subtracted to obtain the airborne sound power level L_{Wa} of the piping system:

$$L_{\mathrm{Wa}} = 10\lg\left(10^{\frac{L_{\mathrm{Wa,total}}}{10}} - 10^{\frac{L_{\mathrm{Wa,struc}}}{10}}\right) \quad (1c)$$

NOTE 2 In this document, the power levels are expressed in dB ref. 10^{-12} Watt.

5.2 Structure borne sound measurements

5.2.1 General

The test wall (see 7.1.2) shall be a low mobility wall compared to the specimen mobility), as specified in EN 15657:2017, C.4. To check the above assumption, the following applicability test can be performed: with the wall mechanically excited by a calibrated source according to 5.2.2, the velocity is measured on the wall at contact points with the specimen and without (before installing the specimen), and normalized to the excitation expressed in terms of installed power; a difference of less than 3 dB between the two normalized velocity levels obtained at each fixing point indicates a low mobility wall compared to the source mobility.

The required structure-borne sound measurements can be performed in two steps: a calibration of the test facilities (see 5.2.2), which can be done once and checked periodically, and the actual testing of the specimen considered (see 5.2.3 and 5.2.4).

5.2.2 Calibration of the test facilities

The test wall is mechanically excited using a calibrated vibration source (instrumented hammer or shaker as suggested in EN ISO 10848-1) successively applied on the side opposite to the test room at each contact *j* between the specimen and the test wall.

The following three quantities are then measured for each excitation location:

— the installed power level $L_{\mathrm{Ws,cal},j}$ of the calibrated vibration source determined according to EN ISO 10848-1,

— the sound power level $L_{\mathrm{Wa,struc,cal},j}$ radiated by the calibrated source, measured in the test room as in 5.1 and

— the space average vibration velocity of the test wall $L_{\langle \mathrm{v} \rangle,\mathrm{cal},j}$ measured according to EN 15657:2017, C.3.

NOTE In this document, the velocity levels are expressed in dB ref. 10^{-9} m/s.

The calibrated source shall be powerful enough so that $L_{\langle \mathrm{v} \rangle,\mathrm{cal},j}$ is well above the background noise.

There should be no significant difference if the above measurements are performed with or without the specimen connected to the wall.