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Pneumatic fluid power — Test methods for measuring acoustic emission pressure levels of exhaust silencers

Transmissions pneumatiques — Méthodes d'essai de mesure du niveau de pression d'émission acoustique des silencieux d'échappement

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 131, *Fluid power systems*, Subcommittee SC 5, *Control products and components*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This acoustic test procedure is intended to provide a common framework to industrial companies to evaluate the sound pressure levels of pneumatic exhaust silencers.

It defines two methods of measuring the level of acoustic pressure at the outlet of an exhaust silencer. These methods should be capable of being applied by pneumatic equipment manufacturers in their facilities on test benches in accordance with ISO 6358-1 and ISO 6358-2.

The first method, called "steady-state mode”, is intended to evaluate the noise level under steady state flow, i.e. constant upstream pressure. This measurement is performed at 6,3 bar at least to permit comparison between silencers at the most frequently used operating pressure (or at the maximum admissible pressure if lower than 6,3 bars).

The second method, called “discharge”, is intended to measure the noise level during the decrease of the pneumatic pressure (discharge test according to ISO 6358-2). To ensure the compatibility with the steady-state flow method, the pressure range includes 6,3 bar (or the maximum admissible pressure if lower than 6,3 bars).

Pneumatic fluid power — Test methods for measuring acoustic emission pressure levels of exhaust silencers

1 Scope

This document specifies two methods of measuring the level of acoustic pressure at the outlet of an exhaust silencer:

— the first method, called "steady-state mode", is intended to evaluate the noise level under steady state flow, i.e. constant upstream pressure (steady-state test according to ISO 6358-1); and

— the second method, called "discharge", is intended to measure the noise level during the decrease of the pneumatic pressure (discharge test according to ISO 6358-2).

This document is applicable to pneumatic exhaust silencers and devices designed to reduce the sound produced by discharges of compressed air, entering in the scope of application of ISO 6358-1 and ISO 6358-2.

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.

ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 6358-1, *Pneumatic fluid power — Determination of flow-rate characteristics of components using compressible fluids — Part 1: General rules and test methods for steady-state flow*

ISO 6358-2, *Pneumatic fluid power — Determination of flow-rate characteristics of components using compressible fluids — Part 2: Alternative test methods*

ISO 11202:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections*

IEC 60942, *Electroacoustics — Sound calibrators*

IEC 61672-1, *Electroacoustics — Sound level meters — Part 1: specifications*

IEC 61260, *Electroacoustics. Octave-band and fractional-octave-band filters*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11202 and ISO 6358-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
emission sound pressure
p
sound pressure, at a specified position near a noise source, when the source is in operation under specified operating and mounting conditions on a reflecting plane surface, excluding the effects of background noise as well as the effects of reflections other than those from the plane or planes permitted for the purpose of the test

Note 1 to entry: Emission sound pressure is expressed in pascals.

3.2
emission sound pressure level
*L*p
ten times the logarithm to the base 10 of the ratio of the square of the emission sound pressure, *p*, to the square of a reference value, p_0

$$Lp = 10\log\left(\frac{p^2}{{p_0}^2}\right)$$

where the reference value, p_0, is equal to 20 µPa

Note 1 to entry: Emission sound pressure level is expressed in decibels.

3.3
measured equivalent continuous sound pressure level (A-weighted)
L_{Aeq}
ten times the logarithm to the base 10 of the ratio of the time average of the square of the emission sound pressure, *p*, during a stated time interval of duration, *T* (starting at t_1 and ending at t_2), to the square of a reference value, p_0

$$L_{Aeq,T} = 10\log\frac{\frac{1}{T}\int_{t_1}^{t_2} p_A^2(t)dt}{p_0^2}\,\mathrm{dB(A)}$$

where the reference value, p_0, is equal to 20 µPa and L_{Aeq} is the measured value obtained using the "L_{Aeq}" position of the sonometer

Note 1 to entry: Measured equivalent continuous sound pressure level is expressed in decibels.

Note 2 to entry: If specific frequency and time weightings as specified in IEC 61672-1 and/or specific frequency bands are applied, this is indicated by appropriate subscripts, e.g. L_{Aeq} denotes the A-weighted emission sound pressure level.

Note 3 to entry: The formula in 3.3 is equivalent to that for the environmental noise descriptor "equivalent continuous sound pressure level". However, the emission quantity defined above is used to characterize the noise emitted by a source under test and assumes that standardized measurement and operating conditions as well as a controlled acoustical environment are used for the measurements.

3.4
frequency range of interest
sound levels determined for frequencies from 100 Hz to 20 000 Hz

3.5
background noise
noise from all sources other than the source under test

Note 1 to entry: Background noise can include contributions from airborne sound, noise from structure-borne vibration and electrical noise in instrumentation.

3.6
background noise correction
K_{1A}
correction applied to the measured sound pressure levels to account for the influence of background noise

3.7
environmental correction
K_{2A}
term to account for the influence of reflected sound on the mean sound pressure level on the reference measurement surface

Note 1 to entry: Environmental correction is expressed in decibels.

4 Symbols and abbreviated terms

Symbols and units are in accordance with those defined in ISO 6358 and ISO 11202.

5 Test set-up

5.1 Test bench

According to the test method chosen, the test bench shall be in accordance with ISO 6358-1 (steady-state mode) or ISO 6358-2 (discharge mode). In particular, the size of the upstream measurement tube shall be in accordance with ISO 6358-1 specifications.

Relevant for the comparison of the sound emission is the pressure and the flow rate (flow rate is in this case a functional value to ensure that the silencer fits to the application). Therefore, it is recommended to use the test bench from ISO 6358-1 if possible as the measured flow rate is based on a stable pressure. If part two is chosen, the values of pressure and flow change significantly within the test due to the nature of the discharge method. Therefore, the value of the flow rate shows a wider tolerance range

5.2 Pneumatic pressure measurement

Only the pressure in the upstream pressure-measuring tube shall be measured. The instrumentation shall be in accordance with ISO 6358-1.

5.3 Flow measurement

The flow during the sound pressure measurement shall be recorded. The test set-up shall be strictly in accordance with ISO 6358-1.

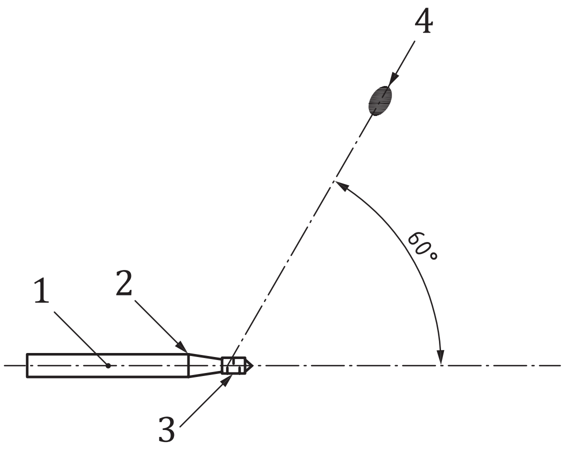
NOTE Correlative flow characteristic values are also recorded according to ISO 6358-1 or ISO 6358-2.

5.4 Sound pressure measurement

The measurement of sound pressure can be done at one or three positions. Measurement at three positions increases the precision of the result and reduces the uncertainty of the measurement. Direct incident flow on microphones should be avoided, due to noise generation by the microphones.

5.4.1 Measurement at one position

In this case, sound pressure shall be measured at one point positioned at 60° from the axis of the measurement tube, at 1 m from the centre of the end of the transition connector and at a height of 1 m, as shown in Figure 1.



Key

1 upstream pressure measurement tube

2 upstream transition adapter

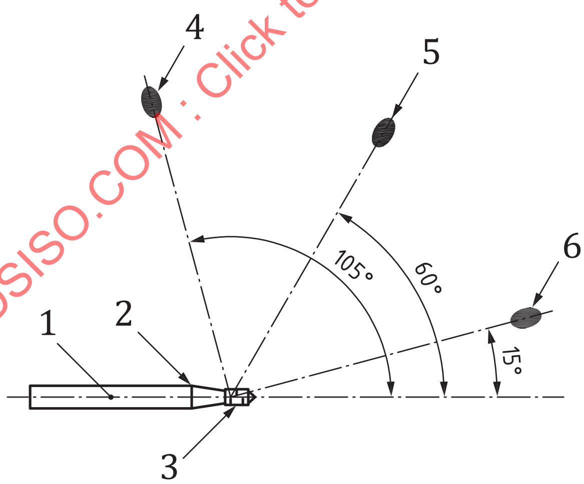
3 silencer under test

4 measurement point

Figure 1 — Arrangement of sound pressure measurement point (1 microphone)

5.4.2 Measurement at three positions

In this case, sound pressures shall be measured at three positions distributed around the arc of a circle 1m in radius and from the centre of the end of the pressure measurement tube and at a height of 1 m. The points shall be positioned at 15°, 60° and 105° from the axis of the tube, as shown in Figure 2.



Key

1 upstream pressure measurement tube

2 upstream transition adapter

3 silencer under test

4 measurement point n°3

5 measurement point n°2

6 measurement point n°6

Figure 2 — Arrangement of sound pressure measurement points (3 microphones)

5.5 Acoustic instrumentation

The entire measurement line, including the microphone and the cable, shall be in accordance with the instructions relating to instruments of class 1 specified in IEC 61672-1, and the filters shall, in this case, comply with class 1 requirements specified in IEC 61260. The microphones shall be equipped with windscreens. For the measurement in “steady-state mode”, a class 1 integrating sound meter shall be used. Measurements in “discharge mode” demand the simultaneous acquisition of pneumatic pressure and sound pressure and shall therefore only be performed with an acquisition system having at least two measurement channels.

Before and after each series of measurements, the entire measuring system shall be checked by means of a sound calibrator, which shall fulfil the requirements for sound calibrators of at least precision class 1 according to IEC 60942, on one or more frequencies of the range of frequencies of interest. The difference between the two calibration series shall not exceed 0,5 dB. If the difference is over 0,5 dB, the results shall be rejected.

The acoustic calibrator shall be calibrated every year by a laboratory that performs calibrations under traceability conditions in conformity with appropriate standards. The measurement channel (sound meter or other) shall be verified at least every two years by a laboratory that can issue at least a verification certificate as per appropriate standards.

The dynamics of the measurement channel shall be adapted.

The pneumatic pressure sensor shall be in accordance with the recommendations of ISO 6358 and permit acquisition at a minimum sampling frequency of 10 Hz for working in discharge mode.

NOTE The reverberation time option for the sonometer is an advantage for qualifying the facilities.

6 Test procedure

6.1 Characterization and validation of the test facilities

The acoustic quality of the test facilities shall be characterised by determining its environmental correction K_{2A}.

This environmental correction can be obtained either from measuring the reverberation time, or through knowledge of the absorbent surfaces. The methods for determining factor K_{2A} are described in Annex A.

The measurements can only be made in an environment conforming to K_{2A} < 4 dB(A). Suggestions to improve the K_{2A} are given in Annex B.

In addition, the facilities shall permit a minimum distance between the microphones with respect to any reflecting object and component tested, i.e. at least 1 m (excluding the measurement tube and tank, if any). If the walls or ceilings are within 2 m of the microphone, they shall be covered with an absorbent material of class A, according to ISO 11654. In the case where the space is limited, the measurement points shall be positioned on the side with the most clearance.

The floor shall be acoustically reflective within the frequency range of interest.

6.2 Quantities to be measured

6.2.1 Basic quantities to be measured

The basic quantities that shall be measured are the pneumatic pressure in the upstream measuring tube and the equivalent continuous A-weighted sound pressure level L_{Aeq} at the positions specified in 5.4.

6.2.2 Acquisition parameters of basic quantities — Steady-state mode

6.2.2.1 Noise level

The equivalent continuous A-weighted sound pressure level L_{Aeq} shall be measured for at least 10 s in steady state (no starting or stopping of the test bench during the measurement period).

For programmable acquisition systems, the measurements shall be performed in the minimum useful frequency band 100 Hz to 20 kHz.

6.2.2.2 Test pressure

The temporal evolution of the operating pressure shall be controlled during the noise measurement period. A measurement shall be made at least once a second. The pressure shall not vary by more than ISO 6358-1 specifications (±0,02 bar) for the test to be valid.

The test shall be performed at 6,3 bar and additional scanning from minimum to maximum pressure with 1 bar step is recommended. If the device under test is not able to withstand a pressure of 6,3 bar, the test shall be performed at the maximum pressure specified by the manufacturer and additional scanning from minimum to the maximum pressure with 1 bar step is recommended.

6.2.3 Acquisition parameters of basic quantities — Discharge mode

The pressure and noise measurements shall be synchronous.

6.2.3.1 Noise level

The temporal evolution of the equivalent continuous A-weighted sound pressure level L_{Aeq} shall be measured for the whole discharge of the tank with an integration time set in the range 50 ms to 200 ms.

For programmable acquisition systems, the measurements shall be performed in the minimum useful frequency band 100 Hz to 20 kHz.

6.2.3.2 Test pressure

The upstream pressure shall be acquired at a sampling frequency of at the minimum 10 Hz and shall be consistent with the sound pressure integration time.

The acoustic measurement shall be started at least 30 ms after opening the valve to exclude any possible parasite phenomena at the start of discharge.

The initial pressure shall be of more than 7 bar to allow calculating the sound level at 6,3 bar. If the device under test is not able to withstand a pressure of 6,3 bar, the test shall be performed at the maximum pressure specified by the manufacturer. It is also recommended that the acquisition be done from the initial relative pressure down to 2 bar in order to cover the silencer’s entire range of utilisation.

6.3 Measurements

6.3.1 Generalities

During the tests, it should be ensured that the noise of the compressed air generator and of the connections for the supply to the measurement tube is stabilised and does not contribute to the noise measured by the microphones during the test. It should also be ensured that the air flow in the upstream measurement tube is not disturbed by pneumatic elements liable to generate noise in the pipes (for example, narrowing or connection).

To overcome problems of acoustic reflection on the tank and the compressed air supply, the measurement tube should be extended.

6.3.2 Specimens tested

If data is to be used for publishing ratings in a catalogue, a sample consisting of at least five silencers selected from a random production lot shall be tested.

If the maximum difference between the samples is more than 5 dB, the measurement shall be rejected.

New silencers should be chosen.

6.3.3 Specific cases

6.3.3.1 Non-axisymmetric silencers

For silencers, with non-axisymmetric design, the angular position of the silencer chosen for the measurement shall be the position producing the highest sound level. The measurement shall be conducted according to 5.4.

6.3.3.2 Flow control silencers

For flow control valve with a silencer, the setting chosen for the measurement shall be the one producing the maximum flow (maximum opening).

6.3.4 Ambient conditions during measurement

The atmospheric pressure and temperature in the test facilities shall be recorded at the beginning of each test.

The ambient conditions shall comply with ISO 6358-1 and ISO 6358-2 requirements.

The ambient temperature in the test room immediately adjacent to the silencer subjected to the test shall be kept between 10 °C and 30 °C.

6.4 The acoustic quantity to be determined

For the 3-point measurement, the result of the measurement for each sample shall be the logarithmic mean of the A-weighted sound pressure levels obtained at the three measurement points.

The raw result of the measurement shall be L_{Aeq}. For a sample *j*, the logarithmic mean of the three measurements points shall be, see Formula (1):

$$L_{\mathrm{Aeq},j} = 10\log\left(\frac{1}{3}\sum_{i=1}^{3} 10^{\left(L_{\mathrm{Aeq},i}/10\right)}\right) \tag{1}$$

The result for the series of silencers shall be the arithmetic mean calculated over the five samples, see Formula (2):

$$\overline{L_{\mathrm{Aeq}}} = \frac{1}{5}\sum_{j=1}^{5} L_{\mathrm{Aeq},j} \tag{2}$$

The final result is the corrected A-weighted sound pressure level L_(pA,T) obtained after correction of the background noise factors, see Formula (3):

$$L_{\mathrm{Aeq}} = \overline{L_{\mathrm{Aeq}}} - K_{1\mathrm{A}} \tag{3}$$

where

$L_{\text{Aeq},i}$ is the A-weighted emission acoustic pressure measured at point i;

$L_{\text{Aeq},j}$ is the A-weighted emission acoustic pressure averaged over 3 measurement points;

$\overline{L_{\text{Aeq}}}$ is the A-weighted emission acoustic pressure averaged over five samples;

K_{1A} is the background noise correction factor.

6.5 Calculation of background noise correction K_{1A}

The background noise correction constitutes an essential point. In order to perform the tests correctly the room shall be well-isolated from external noises (continuous and intermittent production activities, etc.). Furthermore, noises inside the test room should be controlled (other equipment in operation, production, etc.).

If necessary, the tests should be performed at staggered hours, and/or to stop noisy machines and processes during tests.

6.5.1 Case of measurement in steady-state model

The background noise correction, in decibels, is given by the following formula:

$$K_{1\text{A}} = -10\log\left(1 - 10^{-0{,}1\Delta L}\right)\text{dB(A)} \tag{4}$$

Where ΔL is the difference between the sound pressure levels measured for the specified position, with the device in operation and then stopped.

For the needs of this procedure:

— if $\Delta L > 15$ dB(A), K_{1A} shall be taken equal to zero;

— $\Delta L \geq 3$ dB(A) is acceptable;

— $\Delta L < 3$ dB(A), the result shall be rejected. It is necessary to reduce the background noise of the test room or the measurements shall be abandoned.

This correction can only be applied in the case of continuous and stable background noise. The measurement shall be rejected if a noisy event emerging from the background noise occurs during the measurement.

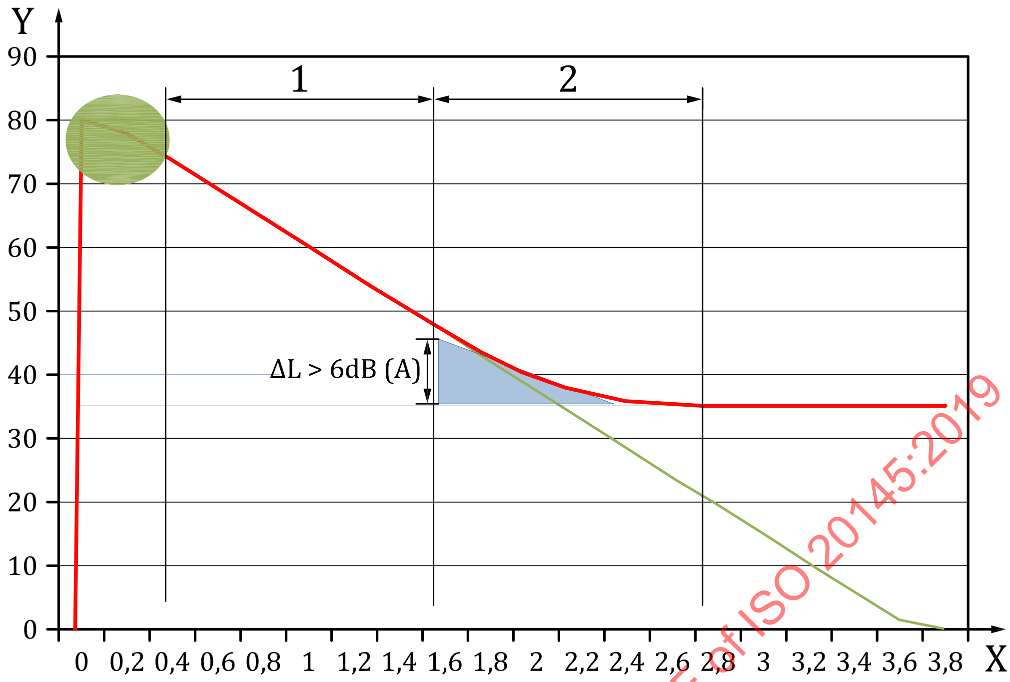
This correction shall be applied to the final result for each test pressure.

6.5.2 Case of measurement in discharge mode

For this type of test, the level of the noise measured varies as a function of time. Correction K_{1A} is therefore not constant.

If possible, each correction should be applied to each time step, then the rules defined in steady state case are applied.

If not possible (this treatment can be difficult to implement) the correction of K_{1A} shall be omitted by limiting the range of analysis to the part of the measurement where $\Delta L > 6$ dB(A).



Key

1 measure zone

2 background noise influence

X time(s)

Y L_{Aeq}dB(A)

non-linear behaviour

background noise

corrected value

measurement

Figure 3 — Discharge mode — Background noise influence on measurement

6.6 Uncertainty on measurement

In conformity with ISO 11202:2010, Clause 12 and Annex C, the parameters determining uncertainty are:

— the instrumentation,

— the number of microphones,

— the manufacturing dispersion.

Several items of practical information are given as indications in Annex D.

7 Presentation of test results

7.1 Information to be written in the test report

All the information liable to have an influence on the test results whether they concern the test conditions, the environment, the instrumentation or the equipment shall be recorded and documented in the test report.

The test report shall also mention the information required in ISO 11202:2010, Clause 14: date, operator, corrections K_{1A} and K_{2A}, accuracy class 2 (analysis) or 3 (control), extended uncertainty on measurement U, values rounded off to a tenth of a decibel.

7.2 Information to be declared

The value to be declared shall be a dissociated value according to ISO 4871. The sound emission value declared shall be rounded to the closest full decibel.

The presentation of the value declared shall be done as per the example given in ISO 4871:1996, Annex B.2.

Examples of test reports are given in Annex C.

Table 1 — Sound emission values declared dissociated

Sound emission values declared dissociated Of device no. ____________________ Type ____________________	
Quantities	Operating mode 1 ____________________
A-weighted acoustic pressure level (ref 20 µPa), L_{Aeq}, in decibels	XX
Flow measurement	XX
Uncertainty U in decibels	Y
Values determined as per test procedure zzzzzz using basic standard ISO 11202.	

8 Identification statement

Use the following statement in test reports, catalogues, and sales literature when electing to comply with this document:

"Acoustic level determined in accordance with ISO 20145, *Pneumatic fluid power — Test methods for measuring acoustic emission pressure levels of exhaust silencers*"

Annex A
(normative)

Calculation of environmental correction K_{2A}

A.1 General

This method shall only be used in the case of test rooms whose lengths and widths are less than three times their ceiling height.

The environmental correction, K_{2A}, shall be calculated using Formula (A.1):

$$K_{2A} = 10 \log \left(1 + \frac{4S}{A} \right) \quad \text{(A.1)}$$

where

A is the equivalent absorption area of the room in square meters;

S is the area in square meters of the measurement surface. In the case of this procedure, S is a sphere with a radius of 1 m, i.e. $S = 4\pi$.

NOTE The value of the environmental correction can also be determined according to the methods specified in ISO 3744 in the case where the dimensions of the room do not conform to the recommendations above.

A.2 Determination of the equivalent absorption area A by global observation of the room

$$A = \alpha S_v \quad \text{(A.2)}$$

where

α is the A-weighted mean absorption coefficient;

S_v is the total area in square meters of the surfaces bounding the test room (walls, ceiling and floor).

Approximate coefficients α are presented in Table A.1 below:

Table A.1 — Approximate values of the mean acoustic absorption coefficient α

Mean acoustic absorption coefficient α	Description of room
0,05	Room almost empty with smooth concrete, brick, plaster or tiled walls.
0,10	Partially empty room: room with smooth walls.
0,15	Furnished room with square cuboid shape: machine room or industrial facilities with square cuboid shape.
0,20	Irregular shaped furnished room: machine room or industrial facilities with irregular shape.
0,25	Room containing padded furnishing: machine room or industrial facilities with walls and ceiling lined with small quantities of absorbent material.

Table A.1 *(continued)*

Mean acoustic absorption coefficient α	Description of room
0,30	Room with absorbent ceiling but no absorbent material on the walls.
0,35	Room with absorbent material on the ceiling and walls.
0,50	Room with walls and ceiling amply lined with absorbent material.

A.3 Determination of the equivalent absorption area A by observation of the room's surfaces

$$A = \sum_i \alpha_i S_i \tag{A.3}$$

where

α_i is the acoustic absorption coefficient of each identified surface;

S_i is the area in square meters of each identified surface.

To determine K_{2A} directly from the A-weighted measured values, the α given for the median frequency band 1 kHz should be used.

Table A.2 — Typical α for non-acoustic materials

Tiles	0,03
Smooth concrete	0,02
Wood	0,07
Glass	0,2
Non-perforated cladding	0,15

For acoustic materials (suspended ceiling tiles, acoustic foams, perforated acoustic panels, etc.) refer to the information provided by their suppliers.

A.4 Determination of the equivalent absorption area A by measuring the reverberation time

The equivalent absorption area, A, in square meters of the room can be calculated using Sabine's reverberation equation. For an ambient temperature from 15 °C to 30 °C:

$$A = 0{,}16 \frac{V}{T_n} \tag{A.4}$$

where

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

T_n is the reverberation time in seconds (see ISO 3382-2), weighted A or by octave frequency bands.

To determine K_{2A} directly from the A-weighted measured values, the reverberation time measured in the 1 kHz octave frequency band should be used.

This method cannot be used for semi-anechoic rooms or for tests in the open air.

Annex B
(informative)

Example of the acoustic correction of industrial facilities

B.1 Description of the facilities

The facilities subject to this example are fictional. A small standard industrial facility was chosen (more complex treatment).

The facilities are presented in Figure 1. The walls and ceiling are made of concrete without any acoustic treatment. The facilities are empty. The reverberation time measured at the position of the measurement bench (red point) is T_r = 2,3 s.

The environmental correction calculated as per the method presented in A.3 is K_{2A} = 6,2 dB(A).

Thus, the facilities cannot be used for the measurement. It is therefore necessary to apply an acoustic treatment to limit the influence of the test environment on the measurement.

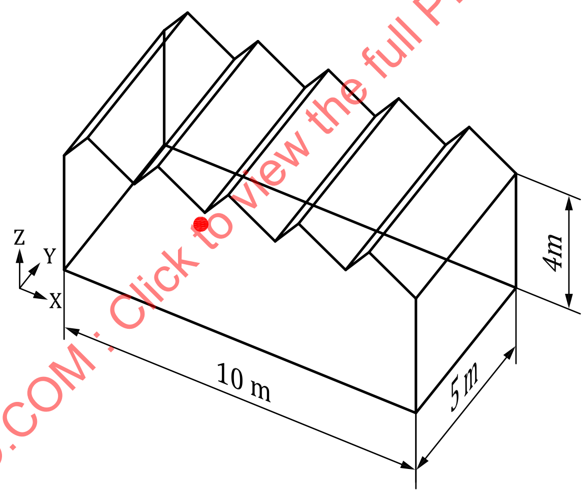
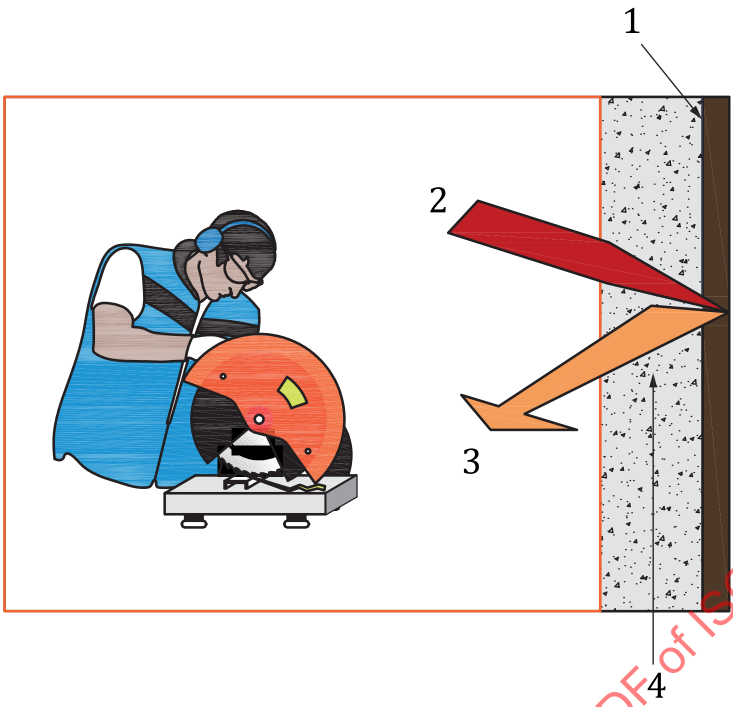


Figure B.1 — Example of facilities

B.2 Acoustic treatment

B.2.1 Principle

The walls are generally made of solid materials (concrete, steel sheet) that reflect nearly all the incident sound waves. Therefore, they are covered by a porous material that absorbs part of the sound energy before the wave reaches the wall (Figure B.2). Absorption is characterised by the absorption coefficient, denoted by α, which is the ratio between the absorbed energy and the total energy of the incident wave. α varies between zero (reflecting material) and one (totally absorbent material).



Key

1 absorbent material
2 incident wave
3 reflection
4 inside the building: absorption limit reflections

Figure B.2 — Absorption of the sound energy

B.2.2 Absorbent materials

The materials used for treating the acoustic of walls are generally of porous mineral fibre type (glass fibre, rockwool) or foams (melamine foam, polyurethane foam).

Their acoustic absorption varies with their thickness, porosity and density. They are often covered by a protective film. The main protective coatings are fibreglass films, microporous paint, vapour barriers, metalized films, and perforated plates. These coatings and linings affect their efficiency. Many industrial solutions offer absorption coefficients α close to one. They should be given preference as they guarantee efficiency.

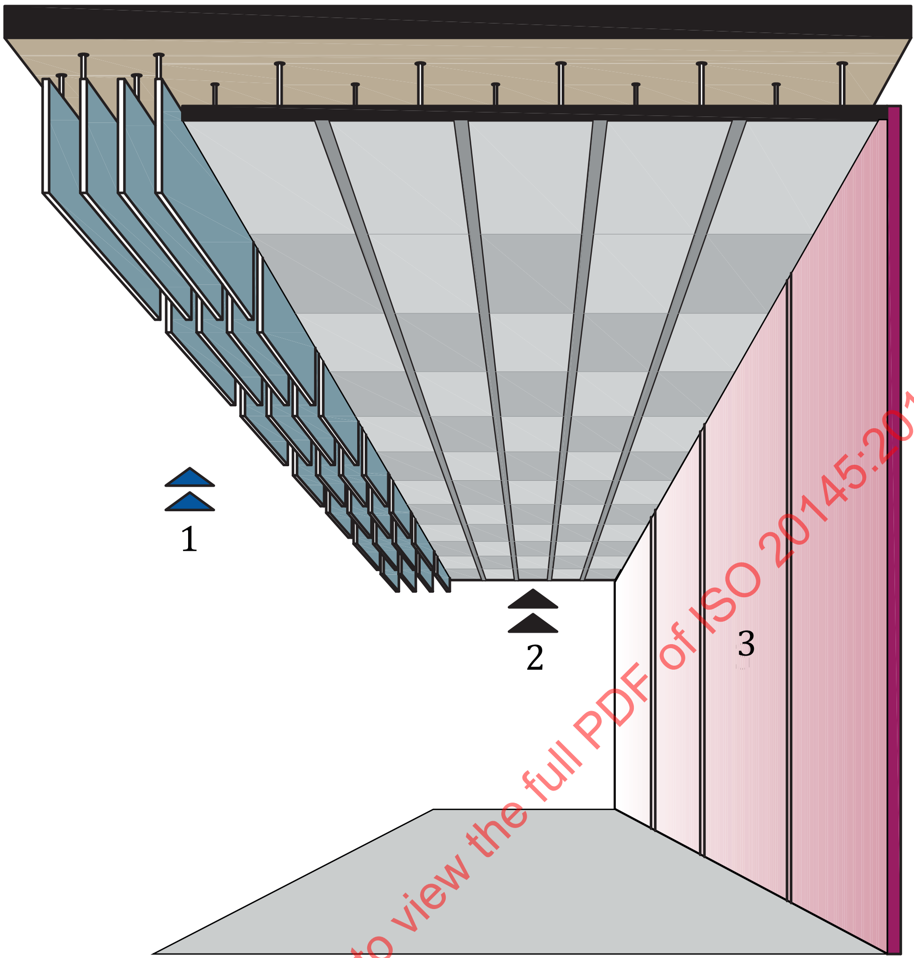
B.2.3 Implementation

There are several methods for implementing acoustic treatment in facilities (Figure B.3):

— by lining the ceiling or installing a suspended ceiling;

— by lining the walls. Absorption can then be decreased by protection as mentioned in B.2.2;

— by baffles suspended vertically. They are easier to install and thus used to correct facilities in active use. Installed at high density, they are more efficient than acoustic suspended ceilings.



Key

1 suspended baffles

2 suspended ceiling

3 wall lining

Figure B.3 — Different methods for implementing acoustic treatment in facilities

B.3 Examples of acoustic treatment of the facilities and the effect on coefficient K_2

B.3.1 Minimum treatment [objective K_2 = 4 dB(A)]

This treatment consists of installing a horizontal rockwool baffle 50 mm thick (α = 1) placed above the measurement bench (see Figure B.4).

With this treatment, the reverberation time is reduced to 1,1 s. The environmental correction is K_{2A} = 4 dB(A) and the facilities can henceforth be used in the framework of this document.

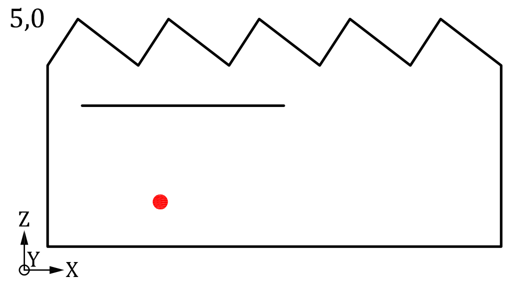


Figure B.4 — Minimum acoustic treatment (absorbent)

B.3.2 Additional treatment

Additional treatment consists of installing 50 mm thick rockwool panels on the walls surrounding the test bench (see Figure B.5).

With this addition, the reverberation time is reduced to 0,5 s, bringing the environmental correction to K_{2A} = 2,3 dB(A).

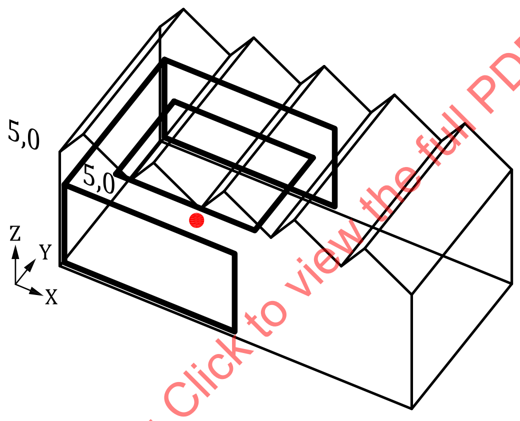


Figure B.5 — Additional acoustic treatment (absorbent)