
**Acoustics — Measurements of sound
pressure level emitted by stationary
road vehicles**

*Acoustique — Mesurages du niveau de pression acoustique émis par
les véhicules routiers en stationnement*

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 5130:2019](https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-f9f48effe5ef/iso-5130-2019)

[https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-
f9f48effe5ef/iso-5130-2019](https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-f9f48effe5ef/iso-5130-2019)



iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 5130:2019

<https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-f9f48effe5ef/iso-5130-2019>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	2
4 Instrumentation.....	2
4.1 Instrumentation for acoustical measurement.....	2
4.1.1 General.....	2
4.1.2 Operational check.....	2
4.1.3 Verification.....	3
4.2 Instrumentation for engine-speed measurement.....	3
5 Acoustical environment, meteorological conditions and background noise.....	3
5.1 Test site.....	3
5.2 Meteorological conditions.....	4
5.3 Background noise.....	4
6 Test procedure.....	4
6.1 General comments.....	4
6.2 Positioning and preparation of the vehicle.....	4
6.3 Microphone position.....	5
6.4 Target engine speed.....	10
6.4.1 General.....	10
6.4.2 Vehicles of category L.....	10
6.4.3 Vehicles of category M, N.....	11
6.5 Engine operating conditions.....	11
6.6 Multi-mode exhaust system.....	11
7 Measurements.....	11
8 Interpretation of results.....	12
9 Measurement uncertainty.....	12
10 Test report.....	12
Annex A (informative) Technical background information.....	14
Annex B (informative) Measurement uncertainty — Framework for uncertainty analysis based on ISO/IEC Guide 98-3.....	15
Bibliography.....	18

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This third edition cancels and replaces the second edition (ISO 5130:2007) which has been technically revised. It also incorporates the Amendment ISO 5130:2007/Amd.1:2012. The main changes compared to the previous edition are as follows:

- In the scope, it has been clarified that this document applies only to vehicles of categories L, M and N equipped with internal combustion engines, and furthermore that vehicles with an internal combustion engine which cannot operate when the vehicle is operated at stationary are outside the scope of this document.
- The microphone position to be used, depending on the location of the exhaust outlets, has been modified to include new variations of exhaust outlet design. New and updated figures have been added to clarify the position of microphone to be used.

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 sound pressure level measurement procedure has been developed for use in the engineering evaluation of the sound pressure level performance of road vehicles in the vicinity of the exhaust systems. The method is intended to check vehicles in use and also to determine variations in the exhaust sound pressure level that can result from

- the wear, maladjustment or modification of particular components, when the defect does not appear by visual inspection;
- the partial or complete removal of devices increasing the emission of certain sound pressure levels.

It is possible to determine some of these variations by comparing the measurements with reference measurements made under similar conditions, for example during the type approval of the vehicle, using the same method. Other variations can be detected only when the engine is operated at a realistic load.

The document incorporates certain provisions of SAE J1492:2008-10^[1] for measuring the sound pressure levels of exhaust systems of passenger cars and light trucks.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[ISO 5130:2019](#)

<https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-f9f48effe5ef/iso-5130-2019>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 5130:2019

<https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-f9f48effe5ef/iso-5130-2019>

Acoustics — Measurements of sound pressure level emitted by stationary road vehicles

1 Scope

This document specifies a test procedure, environment and instrumentation for measuring the exterior sound pressure levels from road vehicles under stationary conditions, providing a continuous measure of the sound pressure level over a range of engine speeds.

This document applies only to road vehicles of categories L, M, and N equipped with internal combustion engines. Vehicles where an internal combustion engine cannot operate when the vehicle is at stationary conditions are outside the scope of this document.

The method is designed to meet the requirements of simplicity as far as they are consistent with reproducibility of results under the operating conditions of the vehicle.

It is within the scope of this document to measure the stationary A-weighted sound pressure level during

- type approval measurements of vehicle;
- measurements at the manufacturing stage;
- measurements at official testing stations;
- measurements at roadside testing.

This document specifies a test method to determine a reference sound level which is unique for the vehicle and therefore not suitable to compare against a general limit, as test condition, microphone condition location relative to the sound sources can vary significantly. The test conditions in proximity and at engine speeds significantly higher compared to real operation conditions in traffic are deliberately chosen to enable in-use tests at higher background conditions, which are typical for roadside checks.

Technical background information is given in [Annex A](#).

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/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 26101:2017, *Acoustics — Test methods for the qualification of free-field environments*

IEC 60942:2017, *Electroacoustics — Sound calibrators*

IEC 61183, *Electroacoustics — Random-incidence and diffuse-field calibration of sound level meters*

IEC 61260-1, *Electroacoustics — Octave-band and fractional-octave-band filters — Part 1: Specifications*

IEC 61260-3, *Electroacoustics — Octave-band and fractional-octave-band filters — Part 3: Periodic tests*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 rated engine speed

S
engine speed at which the engine develops its rated maximum net power as stated by the manufacturer

Note 1 to entry: If the rated maximum net power is reached at several engine speeds, the rated engine speed *S* used in this document is the highest engine speed at which the rated maximum net power is reached.

Note 2 to entry: ISO 80000-2^[2] defines this term as “rated engine rotational frequency”. The term “rated engine speed” was retained due to its common understanding by practitioners and use in government regulations.

3.2 Vehicle categories

3.2.1 category L

motor vehicles with fewer than four wheels

Note 1 to entry: United Nations Economic Commission for Europe (UN ECE) document TRANS/WP.29/78/Rev.6 (11 July 2017)^[3] extended the L category to four-wheeled vehicles as defined by L6 and L7 in ISO 362-1:2015^[4], 3.4.1.5 and 3.4.1.6.

3.2.2 category M

power-driven vehicles having at least four wheels and used for the carriage of passengers

3.2.3 category N

power-driven vehicles having at least four wheels and used for the carriage of goods

4 Instrumentation

4.1 Instrumentation for acoustical measurement

4.1.1 General

The instruments for measuring sound pressure levels, including microphone(s) as well as cable(s), windscreen(s), recording devices and other accessories, if used, shall meet the requirements for a class 1 instrument according to IEC 61672-1 for free field or random incidence application, as appropriate. Filters shall meet the requirements for a class 1 instrument according to IEC 61260-1.

The measurements shall be made using the frequency-weighting A and the time-weighting F.

4.1.2 Operational check

At the beginning and at the end of every measurement session, the entire sound pressure level measuring system shall be checked at one or more frequencies by means of a sound calibrator meeting the requirements for a class 1 instrument according to IEC 60942. Without any further adjustment, the

difference between the readings of two consecutive checks shall be less than or equal to 0,5 dB. If this value is exceeded, the results of measurements obtained after the previous satisfactory check shall be discarded.

In connection with each measurement session and at least at the beginning and the end of each measurement day, where possible, check the impact of residual sound levels on measured results to determine their potential impact on the measurement results.

4.1.3 Verification

Conformance of the sound pressure level measuring instrument including microphone, the filters and the sound calibrator with the relevant requirements of IEC 61672-1, IEC 61260-1 and IEC 60942, respectively, shall be verified by the existence of a valid certificate of conformance from the manufacturer. Conformance testing in accordance with IEC 61672-3, IEC 61260-3 and IEC 60942:2017, Annex B, respectively, is required for verification. If applicable, random incidence response of the microphone shall be verified by a procedure from IEC 61183.

All conformance testing shall be conducted by a laboratory meeting the requirements of ISO/IEC 17025 and the maximum-permitted uncertainty defined in IEC 61672-1, IEC 61260-1 and IEC 60942.

The sound calibrator should be calibrated at intervals not exceeding one year, the conformance of the instrumentation system with the requirements of IEC 61672-1 should be verified at intervals not exceeding two years, and the conformance of analog filters with the requirements of IEC 61260-1 should be verified at intervals not exceeding two years.

NOTE Testing in accordance with IEC 61672-3 does not fully verify conformance with the requirements of IEC 61672-1, unless it has been pattern approved in accordance with IEC 61672-2^[5].

4.2 Instrumentation for engine-speed measurement

The rotational speed of the engine shall be measured with an instrument meeting the specification limits of at least ± 2 % or better at the engine speeds required for the measurements being performed.

5 Acoustical environment, meteorological conditions and background noise

5.1 Test site

A suitable test site shall be outdoors and consist of a flat surface of level concrete, dense asphalt with no appreciable level of porosity or similar hard material surface. It shall be free from snow, grass, loose soil, ashes or other sound-absorbing material. It shall be in an open space free from large reflecting surfaces, such as parked vehicles, buildings, billboards, trees, shrubbery, parallel walls, people, etc., within a 3 m radius from the microphone location and any point of the vehicle.

As an alternative to outdoor testing, a hemi-anechoic chamber may be used. The hemi-anechoic chamber shall fulfill the acoustical requirements given above. In addition to the 3 m distance criteria described above, the testing facilities shall have a cut-off frequency below:

- one-third-octave band below the lowest fundamental frequency of the engine during test, or
- 100 Hz (whichever is the lower).

For a source located at the projection of the reference point on the reflecting plane, the broadband qualification criteria given in ISO 26101:2017, Annex A shall be met within a volume having a radius of at least 3 m.

In addition, the radius of the qualified volume, and the height of the hemi-anechoic chamber shall be at least two times the height of the measurement reference point.

NOTE The noise performance of indoor testing facilities is specified in terms of the cut-off frequency (Hz). This is the frequency above which the room can be assumed to act as a hemi-anechoic space.

5.2 Meteorological conditions

The tests shall not be carried out if the wind speed, including gusts, exceeds 5 m/s during the sound-measurement interval. Tests shall not be carried out during periods of precipitation.

5.3 Background noise

Readings on the measuring instruments produced by ambient noise and wind shall be at least 10 dB below the A-weighted sound pressure level to be measured. A suitable windscreen may be fitted to the microphone, provided that account is taken of its effect on the sensitivity of the sound level meter.

6 Test procedure

6.1 General comments

It is essential that persons technically trained and experienced in current sound measurement techniques select the test instrumentation and conduct the test.

Variations in measured sound pressure levels can occur due to variations in test sites, atmospheric conditions and test equipment; see [Annex B](#).

Instrument manufacturers' specification for orientation of the microphone relative to the sound source and the location of the observer relative to the microphone shall be followed. The test may be performed with a hand-held sound level meter. However, the sound level meter or microphone should be mounted on a stand or fixture for stability. When possible, a microphone extension cable should be used and measurement or recording devices should be located away from the microphone.

CAUTION — Caution should be exercised when measuring rear- and mid-engine vehicles because engine and cooling-fan noise can prevent accurate measurement of exhaust noise.

6.2 Positioning and preparation of the vehicle

The vehicle transmission shall be in neutral position and the clutch engaged, or in parking position for automatic transmission, and the parking brake applied for safety.

The vehicle air conditioner, if equipped, shall be turned off.

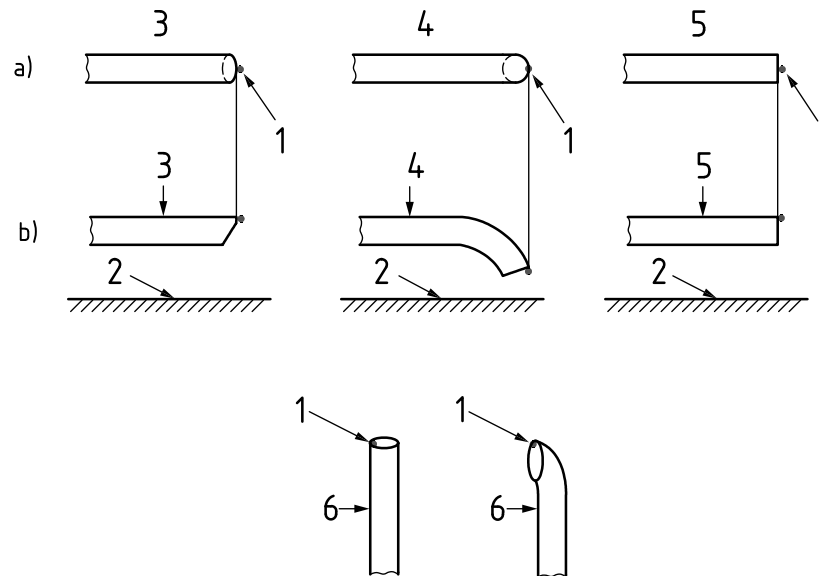
If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system shall not be interfered with during the sound pressure level measurements.

The engine hood or compartment cover shall be closed.

Before each series of measurements, the engine shall be brought to its normal operating temperature, as specified by the manufacturer.

In case of a two-wheeled motor-driven vehicle having no neutral gear position, measurements shall be carried out with the rear wheel raised off the ground so that the wheel can rotate freely.

If it is necessary to raise a two-wheeled vehicle off the ground to perform the test, the microphone measurement position shall be adjusted to achieve the specified distance from the reference point of the exhaust pipe; see [Figure 1](#) for the location of the reference points.



Key

- a) top view
- b) side view
- 1 reference point
- 2 road surface
- 3 mitered pipe
- 4 bent down pipe
- 5 straight pipe
- 6 vertical pipe

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 5130:2019

[https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-](https://standards.iteh.ai/catalog/standards/sist/5ddf2476-0f92-483b-989d-0f218effe5ef/iso-5130-2019)

0f218effe5ef/iso-5130-2019
Figure 1 — Reference point

6.3 Microphone position

The microphone shall be located at a distance of $0,5 \text{ m} \pm 0,01 \text{ m}$ from the reference point of the exhaust pipe defined in [Figure 1](#) and at an angle of $45^\circ \pm 5^\circ$ to the vertical plane containing the flow axis of the pipe termination. The microphone shall be at the height of the reference point, but not less than $0,2 \text{ m}$ from the ground surface. The reference axis of the microphone shall lie in a plane parallel to the ground surface and shall be directed towards the reference point on the exhaust outlet.

If two microphone positions are possible, the location furthest laterally from the vehicle longitudinal centreline shall be used.

If the flow axis of the exhaust outlet pipe is at 90° to the vehicle longitudinal centreline, the microphone shall be located at the point that is furthest from the engine.

If a vehicle has two or more exhaust outlets spaced less than or equal to $0,3 \text{ m}$ apart and connected to a single silencer, only one set of measurements shall be made. The microphone shall be located relative to the outlet furthest from the vehicle's longitudinal centreline, or, when such outlet does not exist, to the outlet that is highest above the ground.

For vehicles having an exhaust provided with outlets spaced more than $0,3 \text{ m}$ apart or more than one silencer, one set of measurements shall be made for each outlet.

For vehicles with a vertical exhaust (e.g. commercial vehicles), the microphone shall be placed at the height of the exhaust outlet. Its axis shall be vertical and oriented upwards. It shall be placed at a distance of $0,5 \text{ m} \pm 0,01 \text{ m}$ from the exhaust-pipe reference point as defined in [Figure 1](#), but never less than $0,2 \text{ m}$ from the side of the vehicle nearest to the exhaust.