INTERNATIONAL STANDARD

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Acoustics — Measurement of noise emitted by accelerating road vehicles — Engineering method —

Part 3: Indoor testing M and N categories

Acoustique — Mesurage du bruit émis par les véhicules routiers en accélération — Méthode d'expertise —

Partie 3: Essais en intérieur pour les catégories M et N

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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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, Acoustics, Subcommittee SC 1, Noise.

This second edition cancels and replaces the first edition (ISO 362-3:2016), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Improvement of the wording for a better understanding

— Definition of a data exchange format for the tyre-/road noise coefficients

— Introduction of an energetic model of the tyre torque influence (Annex C)

— Revision of 9.7, Annex B and Annex E.

A list of all parts in the ISO 362 series can be found on the ISO website.

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

The external sound emission of a vehicle is one out of a multitude of requirements that needs to be considered by manufacturers during design and development of vehicles. For health and environmental protection reasons, the sound emission should be reduced under all relevant driving conditions. However, there is a growing awareness that vehicles should not be too quiet either to ensure that they are still acoustically perceivable by pedestrians and don't endanger them as they might be missed.

To meet all these demands, an efficient test site is needed that can be operated the whole year round, independent of weather conditions or other outside factors. In many countries, the meteorological conditions are so adverse that outdoor testing on a classical proving ground is only possible in a very limited timeframe. While this was acceptable in the past, the increasing workload in the future will make it nearly impossible to do the complete development of a vehicle on a single test track at one particular place. However, performing sound emission tests on various test tracks highly increases the uncertainty and multiplies the workload for a manufacturer.

This document gives specifications for an indoor noise test bench and a test procedure that delivers precise results for indoor testing, comparable to a certified type approval test track. The results are intended to be within the run-to-run variation of the actual valid exterior noise test described in ISO 362-1, which is the test standard used for type approval of vehicles.

An indoor test bench requires tight specifications for the equipment and set up, such as the acoustical treatment, the microphone arrays, the roller bench, the adjustment for the dynamic behaviour of the vehicle on the roller test bench, the preconditioning of the vehicle, as well as the thermal conditions for testing. Special treatment needs to ensure that all rolling sound components of the tire are comparable to the rolling sound on a road surface as specified in ISO 10844 and as applied in type approvals.

It is conceivable that in the future, certain sound emissions of vehicles (like e.g. minimum sound emission of electric vehicles) can be verified on an indoor test bench, as the natural background noise might prohibit testing on a classical outdoor test track. The specifications set forth in this document could be transferred to a future minimum noise test procedure.

This document provides all necessary specifications and procedures to ensure comparability between todays common and well accepted testing on outdoor test tracks with future indoor facilities. It incorporates all relevant International Standards for equipment, measurement uncertainty, and test procedures.

Acoustics — Measurement of noise emitted by accelerating road vehicles — Engineering method —

Part 3: Indoor testing M and N categories

1 Scope

This document specifies an engineering method for measuring the noise emitted by road vehicles of categories M and N by using a semi anechoic chamber with a dynamometer installed.

The specifications are intended to achieve an acoustical correlation between testing the exterior noise of road vehicles in a semi anechoic chamber and outdoor testing as described in ISO 362-1.

This document provides all necessary specifications and procedures for indoor testing to obtain results which are comparable to typical run-to-run variations of measurements in today's type approval tests.

This document provides a method designed to meet the requirements of simplicity as far as they are consistent with the reproducibility of results under the operating conditions of the vehicle.

NOTE 1 The results obtained by this method give an objective measure of the noise emitted under the specified conditions of test. It is necessary to consider the fact that the subjective appraisal of the noise annoyance of different classes of motor vehicles is not simply related to the indications of a sound measuring system. As annoyance is strongly related to personal human perception, physiological human conditions, culture, and environmental conditions, there is a large variation and annoyance is therefore not useful as a parameter to describe a specific vehicle condition.

NOTE 2 If measurements are carried out in rooms which do not fulfil the requirements stated in this document, the results obtained can deviate from the results using the specified conditions.

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 362-1, *Measurement of noise emitted by accelerating road vehicles — Engineering method — Part 1: M and N categories*

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 2416, *Passenger cars — Mass distribution*

ISO 3745, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for anechoic rooms and hemi-anechoic rooms*

ISO 10844, *Acoustics — Specification of test tracks for measuring sound emitted by road vehicles and their tyres*

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

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

IEC 60942, *Electroacoustics — Sound calibrators*

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

IEC 61672-3, *Electroacoustics — Sound level meters — Part 3: Periodic tests*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 362-1, ISO 1176 and ISO 2416 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 https://www.electropedia.org/

3.1
virtual vehicle speed
virtual speed of the test vehicle calculated from the circumference and the revolutions of the roller

Note 1 to entry: See Formula 1.

3.2
virtual line AA'
virtual position for the definition of the *virtual vehicle speed* (3.1), $v_{AA'}$

3.3
virtual line PP'
virtual position for the definition of the *virtual vehicle speed* (3.1), $v_{PP'}$

3.4
virtual line BB'
virtual position for the definition of the *virtual vehicle speed* (3.1), $v_{BB'}$

4 Symbols and abbreviated terms

Table 1 lists the symbols used in this document and the clause number where they are used for the first time.

Table 1 — Symbols used and corresponding clauses

Symbol	Unit	Clause	Designation
a, a_{PTN}	m/s^2	B.3.3	vehicle acceleration (at power train noise measurement)
AA'	—	3.1	line perpendicular to vehicle travel which indicates beginning of zone in which to record sound pressure level during test
BB'	—	3.1	line perpendicular to vehicle travel which indicates end of zone in which is 10,00 m behind line PP'
d_{absorb}	m	7.2	thickness of absorbing elements
d_{roller}	m	5.1.1	diameter of dynamometer roller
F	N	B.4.1	propulsion force of the vehicle
F_{Cor}	dB	D.4	correction for tyre/road noise in variant B
F_{PTN}	N	B.4.4	propulsion force of the vehicle to be tested indoor
F_{TRN}	N	B.4.3	propulsion force of the tyre test vehicle
K	dB/°C	B.2.4	temperature correction coefficient