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**Acoustics — Engineering method for  
measurement of noise emitted by  
accelerating road vehicles —**

**Part 1:  
M and N categories**

*Acoustique — Méthode d'ingénierie pour le mesurage du bruit émis  
par les véhicules routiers en accélération —*

*Partie 1: 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](http://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](http://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](http://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 362-1:2015), which has been technically revised.

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

- Clarification on the measurement zone to provide equivalent results between hand held sound level meters and digital data acquisition systems.
  - Clarification of original intent of ISO 362-1 on M1/N1 gear ratio selection to account for practical lessons learned.
  - Clarification and examples of measures used to control vehicle operation so as to provide the specified accelerations of ISO 362-1
  - Addition of and clarification of tolerances, measurement precision, vehicle operation, vehicle physical attributes, and calculation methods where multiple interpretations could be possible.
  - Addition of a representative virtual vehicle for N3.
  - Update to measurement uncertainty.

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](http://www.iso.org/members.html).

## Introduction

An extensive review was conducted of actual in-use vehicle operations, beginning with data from the TUV Automotive study in the early 1990s and continuing with data developed through other committee members from 1996 through 2000. It includes nearly 100 vehicles operated on a variety of urban roads in Europe and Asia. The primary focus of the in-use measurements was to determine how vehicles are driven with a variety of vehicles, driving behaviours, and traffic situations. The in-use behaviour determined from these studies was successfully correlated to urban traffic use in the United States by evaluation of the fuel economy test cycles used by the United States Environmental Protection Agency (USEPA). The resulting test specifications are therefore valid for all global urban use conditions.

The procedure defined here provides a measure of the sound pressure level from vehicles under controlled and repeatable conditions. The definitions have been made according to the requirements of vehicle categories. In cases of vehicles other than very heavy trucks and buses, the working group found that attempts to conduct a partial load test as in actual use resulted in considerable run-to-run variability that significantly interfered with the repeatability and reproducibility of the test cycle. Therefore, two primary operating conditions (i.e. a wide-open-throttle acceleration phase and a constant speed phase) were used to guarantee simplicity. The combination was found to be equivalent to the partial throttle and partial power (engine load) actually used.

As a further consequence of the investigation of the requirements for an efficient test, it was decided to design a test which was independent of vehicle design and therefore safe and adaptable for future technologies, as well as for future traffic conditions. The test guarantees an excitation of all relevant noise sources, and the final test result reflects a combination of these sources as a compromise between normal urban use and “worst case”.

In 2004, the given test for M and N category vehicles was evaluated for technical accuracy and practical considerations by test programmes carried out by the Japan Automobile Standards Internationalization Center (JASIC), the European Automotive Manufacturers Association (ACEA), and the Society of Automotive Engineers, Inc. (SAE) in the United States. Over 180 vehicles were included in these tests. The reports of these test programmes were considered prior to preparation of this document.

This document was developed following demands for a new test procedure considering the following:

- “The test procedure (ISO 362) doesn't reflect realistic driving conditions” (1996 EU Green Paper);
- “In the case of motor vehicles, other factors are also important such as the dominance of tyre noise above quite low speeds (50 km/h)” (1996 EU Green Paper).
- “A new measurement procedure should require that the major noise sources of a vehicle be measured” (2001 Noise Emission of Road Vehicles – I-INCE).

This document, while maintaining the same technical procedures as the previous edition, has been revised based on practical experience to provide additional clarification where multiple interpretations were possible, to provide additional equivalent test modes for heavy commercial vehicles, and to incorporate provisions for addressing and including in the measurement external sound systems for M1 and N1 category vehicles.

# Acoustics — Engineering method for measurement of noise emitted by accelerating road vehicles —

## Part 1: 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 under typical urban traffic conditions. It excludes vehicles of category L1 and L2, which are covered by ISO 9645, and vehicles of category L3, L4, and L5, which are covered by ISO 362-2.

The specifications are intended to reproduce the level of noise generated by the principal noise sources during normal driving in urban traffic (see [Annex A](#)).

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.

The test method requires an acoustical environment that is obtained only in an extensive open space. Such conditions are usually provided for

- type approval measurements of a vehicle,
- measurements at the manufacturing stage, and
- measurements at official testing stations.

**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 measurement system. As annoyance is strongly related to personal human perception, physiological human conditions, culture, and environmental conditions, there is a large variation and it is, therefore, not useful as a parameter to describe a specific vehicle condition.

**NOTE 2** Spot checks of vehicles chosen at random are rarely made in an ideal acoustical environment. If measurements are carried out on the road in an acoustical environment that does not fulfil the requirements stated in this document, the results obtained can deviate appreciably from the results obtained 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 362-3, *Acoustics – Measurement of noise emitted by accelerating road vehicles – Engineering method, Part 3: Indoor testing M and N categories*

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

ISO 2416, *Passenger cars — Mass distribution*

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

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

IEC 60942, *Electroacoustics — Sound calibrators*

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

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in 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 Vehicle mass

##### 3.1.1

##### **kerb mass**

complete shipping mass of a vehicle fitted with all standard equipment necessary for normal operation plus the mass of the following elements for M1, N1, and M2 having a maximum authorized mass not exceeding 3 500 kg:

- lubricants, coolant (if needed), washer fluid;
- fuel (tank filled to at least 90 % of the capacity specified by the manufacturer);
- other equipment if included as basic parts for the vehicle, such as spare wheel(s), wheel chocks, fire extinguisher(s), spare parts, and tool kit

Note 1 to entry: The definition of kerb mass can vary from country to country, but in this part of ISO 362, it refers to the definition contained in ISO 1176.

[SOURCE: ISO 1176:1990, 4.4 and 4.6 — modified.]

##### 3.1.2

##### **maximum authorized mass**

*kerb mass* (3.1.1) plus the maximum allowable payload

##### 3.1.3

##### **unladen vehicle mass**

nominal mass of a complete N2, N3, or M2 vehicle having a *maximum authorized mass* (3.1.2) greater than 3 500 kg or an M3 vehicle as determined by the following conditions:

- mass of the vehicle includes the bodywork and all factory-fitted equipment and electrical and auxiliary equipment for normal operation of the vehicle, including liquids, tools, fire extinguisher, standard spare parts, chocks, and spare wheel, if fitted;
- the fuel tank is filled to at least 90 % of rated capacity and the other liquid-containing systems (except those for used water) are filled to 100 % of the capacity specified by the manufacturer

##### 3.1.4

##### **mass of the driver**

nominal mass of a driver

##### 3.1.5

##### **mass in running order**

nominal mass of a vehicle as determined by the following conditions: