INTERNATIONAL STANDARD

ISO 362

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

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

Reference number
ISO 362:1994(E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 362 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO 362:1981), which has been technically revised and now incorporates Amd.1:1985.

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

1 Scope

This International Standard specifies an engineering method for measuring the noise emitted by accelerating road vehicles.

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

The specifications are intended to reproduce the noise levels in urban traffic flow of irregular character which requires the use of intermediate gears with full utilization of the engine power available.

The test method calls for an acoustical environment which can only be obtained in an extensive open space. Such conditions can usually be provided for:

— type approval measurements of vehicles,

— measurements at the manufacturing stage, and

— measurements at official testing stations.

It should be noted that spot checking of vehicles chosen at random can rarely be made in an ideal acoustical environment. If measurements have to be carried out on the road in an acoustical environment which does not fulfil the requirements stated in this International Standard, it should be recognized that the results obtained may deviate appreciably from the results obtained using the specified conditions.

2 Normative references

The following International Standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards

ISO 1176:1990, *Road vehicles — Masses — Vocabulary and codes.*

ISO 10844:1994, *Acoustics — Specification of test tracks for the purpose of measuring noise emitted by road vehicles.*

IEC 651:1979, *Sound level meters.*

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1 automatic downshift: A gear change to a lower gear (higher numerical ratio) which occurs outside the control of the driver.

3.2 external downshift: A gear change to a lower gear (higher numerical ratio) which can be initiated at the will of the driver. An external downshift may be initiated, for example, by a change of pressure on the throttle pedal, or by a change in the position of the throttle pedal, thereby activating an external switch which effects the downshift.

4 General requirements

4.1 Principle

This International Standard is based primarily on a test with vehicles in motion, the ISO reference test. Measurements shall relate to operating conditions of the vehicle which give the highest noise level consistent with urban driving and which lead to reproducible noise emission. Therefore, an acceleration test at full throttle from a stated engine speed is specified.

4.2 Interpretation of results

The results obtained by this method give an objective measure of the noise emitted under the specified conditions of test. However, it is necessary to consider the fact that the subjective appraisal of the

annoyance of different classes of motor vehicles is not simply related to the indications of a sound level meter.

5 Instrumentation

5.1 Instrumentation for acoustical measurements

The sound level meter (or the equivalent measuring system) shall at least meet the requirements of a type 1 instrument in accordance with IEC 651.

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

The calibration of the sound level meter shall be checked and adjusted according to the manufacturer's instructions or with a standard sound source (for example, a pistonphone) at the beginning of the measurements and rechecked and recorded at the end of them. Any deviations shall be recorded in the test report.

It is recommended that, if the errors of the sound level meter obtained from these calibrations change by more than 1 dB during a series of measurements, the test be considered invalid.

At intervals of not more than 2 years, the sound level meter shall be calibrated for compliance with IEC 651.

NOTE 1 If a windscreen is used, it should be of a type specified by the manufacturer as suitable for the particular microphone. It should be ascertained from the manufacturer that the use of the windscreen does not detectably influence the accuracy of the sound level meter under the ambient conditions of test.

5.2 Instrumentation for speed measurements

The rotational speed of the engine and the road speed of the vehicle during the approach shall be measured to an accuracy of 3 % or better.

6 Acoustical environment, meteorological conditions and background noise

6.1 Test site

The test site shall be substantially level. The surface of the test track shall be dry and its texture such that it does not cause excessive tyre noise. The test track surface shall meet the requirements of ISO 10844.

The test site shall be such that when a small omnidirectional noise source is placed in its surface at point O in figure 1, deviations from hemispherical divergence shall not exceed ± 1 dB.

Dimension in metres

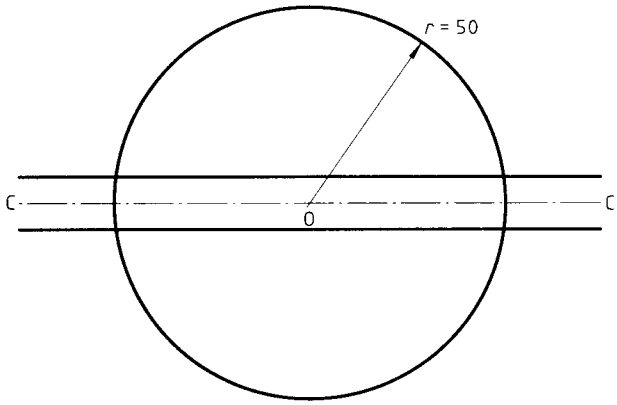

Figure 1 — Test site

This condition is deemed to be satisfied if the following requirements are met.

a) Within a radius of 50 m around the centre of the track, the space shall be free of large reflecting objects, such as fences, rocks, bridges or buildings.

b) The test track surface, to the extent required in ISO 10844, shall be free of any absorbing material such as powdery snow or ashes.

c) In the vicinity of the microphone, there shall be no obstacle that could influence the acoustical field and no person shall remain between the microphone and the noise source.

d) The meter observer shall be positioned so as not to influence the meter reading.

6.2 Meteorological conditions

The measurements shall not be made in adverse weather conditions.

Measurements shall not be carried out if the wind is gusty.

It is recommended that tests should not be carried out if the wind speed exceeds 5 m/s at microphone height.

6.3 Background noise

The background noise (including any wind noise) shall be at least 10 dB below that produced by the vehicle under test.

7 Test procedure

7.1 Microphone positions

The distance from the microphone positions to the reference line CC (see figure 2) on the test track shall be 7,5 m ± 0,1 m.

The microphone shall be located 1,2 m ± 0,05 m above ground level. Unless otherwise indicated by the manufacturer of the sound level meter, its reference axis for free-field conditions (see IEC 651) shall be horizontal and directed perpendicularly towards the path of the vehicle (line CC).

7.2 Number of measurements

At least two measurements shall be made on each side of the vehicle.

7.3 Readings to be taken

The maximum sound pressure level indicated during each passage of the vehicle between the two lines AA and BB (see figure 2) shall be noted. If a sound peak obviously out of character with the general sound level is observed, the measurement shall be discarded.

The results shall be considered valid if the difference between two consecutive measurements made on the side of the vehicle which gives the higher sound pressure level does not exceed 2 dB.

The highest value given by these measurements shall constitute the result.

Dimensions in metres

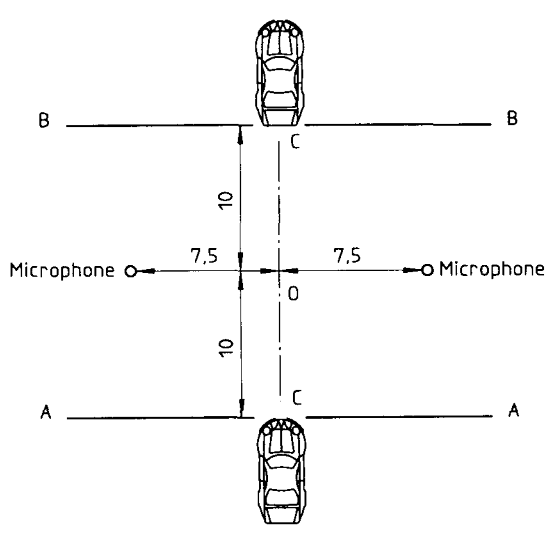

Figure 2 — Microphone positions for measurements

7.4 Conditions of the vehicle

Measurements shall be made on vehicles unladen except for the driver and, except in the case of non-separable vehicles, without trailer or semitrailer.

The tyres of the vehicle shall be of the type normally fitted by the manufacturer to the vehicle and shall be inflated to the pressure(s) recommended by the manufacturer for the vehicle in its unladen condition.

Before the measurements are started, the engine shall be brought to its normal operating conditions with respect to temperatures and turning, and shall be supplied with fuel, spark plugs, carburettor(s), etc., as recommended by the manufacturer.

7.5 Operating conditions

7.5.1 General conditions

The vehicle shall approach the line AA with the path of its centreline following as closely as possible the line CC as specified in 7.5.2.1 to 7.5.2.3, as appropriate.

When the front of the vehicle reaches the line AA, the throttle shall, as rapidly as possible, be opened as fully as possible to ensure acceleration without external downshift occurring (for example, by kick-down, if any) and shall be held in this position until the rear of the vehicle reaches line BB; the throttle shall then be closed as rapidly as possible.

Any trailer which is not readily separable from the towing vehicle shall be ignored when considering the crossing of the line BB.

If the vehicle is fitted with more than two-wheel drive, it shall be tested in the drive which is intended for normal road use.

If the vehicle incorporates equipment such as a concrete mixer, a compressor, etc., this equipment shall not be in operation during the test.

NOTE 2 It is recommended that supplementary measurements be made with the equipment operating.

7.5.2 Special conditions

7.5.2.1 Vehicles without gearbox

The vehicle shall approach the line AA at uniform vehicle speed corresponding to one of the following:

a) an engine rotational speed equal to 3/4 of the speed, n, at which the engine produces its net maximum power, or

b) 3/4 of the engine maximum rotational speed allowed by the governor, at full-load conditions of the engine, or

c) 50 km/h [1],

whichever is the lowest.

7.5.2.2 Manual transmission vehicles

7.5.2.2.1 Approach speed

The vehicle shall approach the line AA at a uniform vehicle speed corresponding to one of the following:

a) an engine rotational speed equal to 3/4 of the speed, n, at which the engine produces its net maximum power, or

b) 3/4 of the engine maximum rotational speed allowed by the governor, at full load conditions of the engine, or

c) 50 km/h [1],

whichever is the lowest.

7.5.2.2.2 Choice of gear ratio

Commercial vehicles having a maximum authorized total mass (see ISO 1176) of not more than 3,5 tons and passenger cars fitted with a gearbox having four or fewer forward gears shall be tested in second gear. When fitted with a gearbox having more than four forward gears, they shall be tested in both second and third gears. The average value of the sound levels recorded for these two conditions shall be calculated.

Commercial vehicles having a maximum authorized total mass (see ISO 1176) of more than 3,5 tons and buses whose whole number of forward gears is N (including those obtained by means of an auxiliary transmission or multigear axle) shall be tested successively with the gear selection equal to or higher than $N/2$. Only the condition giving the highest sound pressure level shall be reported.

Motorcycles fitted with a gearbox having four or fewer gears shall be tested in second gear. Motorcycles fitted with a gearbox having more than four gears shall be tested in third gear if their engine capacity is equal to or smaller than 350 cm^3 or in second gear if their capacity is greater than 350 cm^3. If, with the choice of gear so defined, the requirements of 7.5.2.2.1 lead to an approach speed lower than that corresponding to $n/2$, the tests on the motorcycle shall be carried out at $n/2$

7.5.2.3 Automatic transmission vehicles

Three cases may occur.

a) Vehicles without a manual selector shall be tested at various uniform approach speeds of 30 km/h, 40 km/h and 50 km/h [2] or at 3/4 of the on-road maximum speed if this value is lower. The condition with the highest sound pressure level shall be reported.

b) The test shall be carried out in the selector position used for normal urban driving. External downshift (for example, by kick-down) as well as automatic downshift to the first ratio for gearboxes having more than two discrete ratios shall be excluded.

If an automatic downshift occurs after the line AA, the test shall be rejected and repeated using the position $N - 1$, $N - 2$, etc., as necessary, until the selector is placed in the highest position that allows the test to be performed without automatic downshift, external downshifts (kick-down) being always excluded.

c) If the vehicle is fitted with an auxiliary manual transmission or a multigear axle, the position used for normal urban driving shall be used.

In all cases, the special selector's positions for slow movements, parking or braking shall be excluded.

8 Test report

The test report shall include the following information:

a) reference to this International Standard;

b) test site specification as required in clause 8 of ISO 10844 (this may be specified in a separate document which then must be fully identified in the test report here);

c) the testing ground conditions and weather conditions;

d) the measurement equipment (including windscreen, if used);

e) the A-weighted sound pressure level of the background noise;

1) Corresponding to 31 mile/h.
2) Corresponding to 19 mile/h, 25 mile/h and 31 mile/h.

f) the identification of the vehicle, its engine and its transmission system;

g) the transmission gears during the test;

h) the road and engine speeds at the beginning of the period of acceleration;

i) the auxiliary equipment, where appropriate, and its operating conditions;

j) the number of measurements made and the sound pressure levels recorded, in decibels.

ICS 17.140.30

Descriptors: acoustics, road vehicles, acceleration, noise (sound), engine noise, tests, acoustic tests, determination, sound pressure, acoustic measurements.

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