
International Standard



362

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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

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 362 was developed by Technical Committee ISO/TC 43, *Acoustics*, and was circulated to the member bodies in December 1979.

It has been approved by the member bodies of the following countries :

Austria	Hungary	Romania
Brazil	India	South Africa, Rep. of
Bulgaria	Ireland	Spain
Canada	Israel	Sweden
Czechoslovakia	Italy	Switzerland
Denmark	Japan	USSR
France	Netherlands	Yugoslavia
Germany, F. R.	Norway	
Greece	Poland	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Belgium
United Kingdom

This International Standard, together with ISO 5130, cancels and replaces ISO Recommendation R 362-1964, of which it constitutes a technical revision.

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

1 Scope and field of application

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 in 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.

NOTE — 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 References

ISO 1176, *Road vehicles — Weights — Vocabulary*.

IEC Publication 651, *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 Driving conditions

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 prescribed 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 according to IEC Publication 651.

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

NOTES

- 1 At intervals of not more than 2 years, the sound level meter shall be calibrated for compliance with IEC Publication 651.
- 2 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 influence the accuracy of the sound level meter detectably 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 with instruments with 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 dry and its texture such that it does not cause excessive tyre noise.
- The test site shall be such that hemispherical divergence exists between the noise source and the microphone to within ± 1 dB.
- This condition is deemed to be satisfied if the following requirements are met.

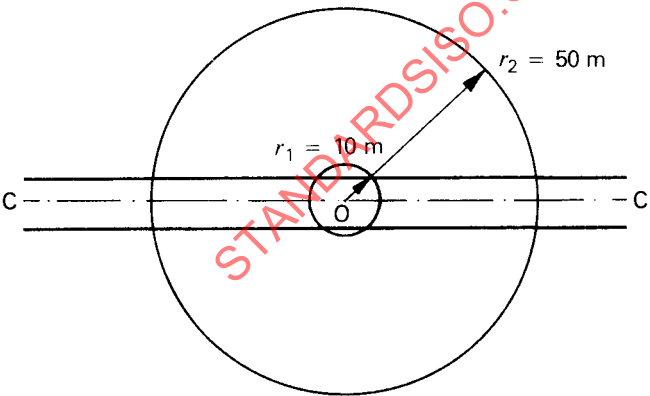


Figure 1 — Test site

- 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.
- The test track and the surface of the site up to 10 m from the centre O of the track shall consist of concrete, asphalt or similar hard material and be free from absorbing materials such as powdery snow, long grass or ashes.

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. 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.
- Gusts of wind shall not affect measurements.

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

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.
- The microphone shall be located 1,2 m above the ground level. Unless otherwise indicated by the manufacturer of the sound level meter, its reference axis for free field conditions (see IEC Publication 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.

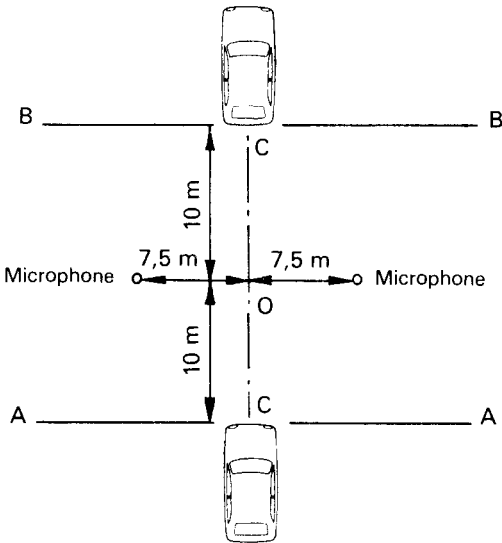


Figure 2 — Microphone positions for measurements

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 differences between two consecutive measurements made on the side of the vehicle which gives the higher sound pressure level do not exceed 2 dB.

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

7.4 Conditions of the vehicle

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

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 in respect of temperatures and tuning and shall be supplied with fuel, sparking 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 centre line 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 be fully opened as rapidly as practicable (without operating the kick-down, if any) and held fully open 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 — It is recommended that supplementary measurements be made with the equipment operating.

7.5.2 Special conditions

7.5.2.1 Vehicles without gear-box

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

- an engine rotational speed equal to $3/4$ of the speed, n , at which the engine produces its net maximum power, or
- $3/4$ of the engine maximum rotational speed allowed by the governor, at full load conditions of the engine, or
- 50 km/h¹⁾,

whichever is the lowest.

7.5.2.2 Manual transmission vehicle

a) Approach speed

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

- an engine rotational speed equal to $3/4$ of the speed, n , at which the engine produces its net maximum power, or
- $3/4$ of the engine maximum rotational speed allowed by the governor, at full load conditions of the engine, or
- 50 km/h¹⁾,

whichever is the lowest.

b) Choice of the gear ratio

Commercial vehicles having a maximum authorized total weight of not more than 3,5 tons and passenger cars fitted with a gear-box having four or fewer forward gears shall be tested in second gear. When fitted with a gear-box 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 weight 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 multi-gear 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.

Motor-cycles fitted with a gear-box having four or fewer gears shall be tested in second gear. Motor-cycles fitted with a gear-box having more than four gears shall be tested in third gear if their engine capacity is equal to or smaller than 350 cm³ or in second gear if their capacity is greater

1) Corresponding to 31 mile/h.

than 350 cm³. If, with the choice of gear so defined, the requirements of 7.5.2.2 a) lead to an approach speed lower than that corresponding to $n/2$, the tests of the motor-cycle shall be carried out at $n/2$.

7.5.2.3 Automatic transmission vehicle

Three cases may occur :

- a) Vehicles without a manual selector shall be tested at various uniform approach-speeds of 30, 40 and 50 km/h¹⁾ 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) If a manual selector with N forward positions is fitted to the vehicle, the test shall be performed with the selector in the position N ; external downshifts (for example by kick-down) shall be excluded. The approach speed shall be that specified in 7.5.2.2.
- 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 multi-gear 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) details of the test site, the testing ground conditions and weather conditions;
- c) the measurement equipment (including windscreen, if used);
- d) the A-weighted sound pressure level of the background noise;
- e) the identification of the vehicle, its engine and its transmission system;
- f) the transmission gears during the test;
- g) the road and engine speeds at the beginning of the period of acceleration;
- h) the auxiliary equipment, where appropriate, and its operating conditions;
- j) the number of measurements and the sound pressure levels recorded, in decibels.

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