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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 362

MEASUREMENT OF NOISE EMITTED BY VEHICLES

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1st EDITION

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BRIEF HISTORY

The ISO Recommendation R 362, *Measurement of Noise Emitted by Vehicles*, was drawn up by Technical Committee ISO/TC 43, *Acoustics*, the Secretariat of which is held by the British Standards Institution (B.S.I.).

Work on this question by the Technical Committee began in 1958 and led, in 1960, to the adoption of a Draft ISO Recommendation.

This first Draft ISO Recommendation (No. 419) was circulated to all the ISO Member Bodies for enquiry, in November 1960. Taking into account the observations put forward by the Technical Committee ISO/TC 22, *Automobiles*, regarding mechanical specifications, Technical Committee ISO/TC 43 presented a Second Draft ISO Recommendation, which was circulated to all the ISO Member Bodies in May 1962, and which was approved, subject to a few modifications of an editorial nature, by the following Member Bodies:

Australia	France	Poland
Austria	Germany	Portugal
Belgium	Greece	Spain
Brazil	Hungary	Sweden
Canada	India	Switzerland
Chile	Ireland	United Kingdom
Czechoslovakia	Israel	U.S.A.
Denmark	Netherlands	U.S.S.R.
Finland	New Zealand	Yugoslavia

One Member Body opposed the approval of the Draft: Japan.

The second Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1964, to accept it as an ISO RECOMMENDATION.

MEASUREMENT OF NOISE EMITTED BY VEHICLES

1. SCOPE

This ISO Recommendation describes methods of determining the noise emitted by motor vehicles, these being intended to meet the requirements of simplicity as far as is consistent with reproducibility of results and realism in the operating conditions of the vehicle.

2. GENERAL REQUIREMENTS

2.1 Test conditions

This ISO Recommendation is based primarily on a test with vehicles in motion, the ISO reference test. It is generally recognized to be of primary importance that the measurements should relate to normal town driving conditions, thus including transmission noise etc. Measurements should also relate to vehicle conditions which give the highest noise level consistent with normal driving and which lead to reproducible noise emission. Therefore, an acceleration test at full throttle from a stated running condition is specified.

Recognizing, however, that different practices already exist, specifications of two other methods used are also given in the Appendix. These relate to:

- (a) a test with stationary vehicles (see Appendix A1) and
- (b) a test with vehicles in motion, under vehicle conditions which (in the case of certain vehicles) are different from those in the ISO reference test (see Appendix A2).

When either of these tests is used, the relation between the results and those obtained by the ISO reference test should be established for typical examples of the model concerned.

2.2 Test site

The test methods prescribed call 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,
- for measurements at the manufacturing stage, and
- for measurements at official testing stations.

It is desirable that spot checking of vehicles on the road should be made in a similar 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 ISO Recommendation, it should be recognized that the results obtained may deviate appreciably from the results obtained using the specified conditions.

2.3 Interpretation of results

The results obtained by the methods specified give an objective measure of the noise emitted under the prescribed conditions of test. Owing, however, to the fact that the subjective appraisal of the annoyance or noisiness of different classes of motor vehicles is not simply related to the indications of a sound level meter, it is recognized that the correct interpretation of results of the measurements in this ISO Recommendation may require different limits to be set for the corresponding annoyance of different classes of vehicles.

3. MEASUREMENT EQUIPMENT

A high quality sound level meter should be used. The weighting network and meter time constant employed should be curve "A" and "fast response" respectively, as specified in Recommendation No. 123 of the International Electrotechnical Commission for Sound Level Meters. A detailed technical description of the instrument used should be supplied.

NOTES

1. The sound level measured using sound level meters having the microphone close to the instrument case may depend on the orientation of the instrument with respect to the sound source, as well as on the position of the observer making the measurement. The instructions given by the manufacturer concerning the orientation of the sound level meter with respect to the sound source and the observer should therefore be carefully followed.
2. If a wind shield is used for the microphone, it should be remembered that this may have an influence on the sensitivity of the sound level meter.
3. To ensure accurate measurements, it is recommended that before each series of measurements the amplification of the sound level meter be checked, using a standard noise source and adjusting as necessary.
4. It is recommended that the sound level meter and the standard noise source be calibrated periodically at a laboratory equipped with the necessary facilities for free-field calibration.

Any peak which is obviously out of character with the general sound level being read should be ignored.

4. ACOUSTICAL ENVIRONMENT

The test site should be such that hemispherical divergence exists to within ± 1 dB.

NOTE.—A suitable test site, which could be considered ideal for the purpose of the measurements, would consist of an open space of some 50 m radius, of which the central 20 m, for example, would consist of concrete, asphalt or similar hard material.

In practice, departure from the so-called "ideal" conditions arises from four main causes:

- (a) sound absorption by the surface of the ground;
- (b) reflections from objects, such as buildings, trees, or from persons;
- (c) ground which is not level or of uniform slope over a sufficient area;
- (d) wind.

It is impracticable to specify in detail the effect produced by each of these influences. It is considered important, however, that the surface of the ground within the measurement area be free from powdery snow, long grass, loose soil or ashes.

To minimise the effect of reflections, it is further recommended that the sum of the angles subtended at the position of the test vehicle by surrounding buildings within 50 m radius should not exceed 90° and that there be no substantial obstructions within a radius of 25 m from the vehicle.

Acoustical focussing effects and sites between parallel walls should be avoided.

Wherever possible, the level of ambient noise (including wind noise and—for stationary tests—roller stand and tyre noise) should be such that the reading produced on the meter is at least 10 dB below that produced by the test vehicle. In other cases, the prevailing noise level should be stated in terms of the reading of the meter.

NOTE.—Care should be taken that gusts of wind do not distort the results of the measurements.

The presence of bystanders may have an appreciable influence on the meter reading, if such persons are in the vicinity of the vehicle or the microphone. No person other than the observer reading the meter should therefore remain in the neighbourhood of the vehicle or the microphone.

NOTE.—Suitable conditions exist, if bystanders are at a distance from the vehicle which is at least twice the distance from vehicle to microphone.

5. MEASUREMENTS WITH VEHICLES IN MOTION

5.1 Testing ground

The testing ground should be substantially level, and its surface texture such that it does not cause excessive tyre noise.

5.2 Measuring positions

The distance from the measuring positions to the reference line *CC* (Fig. 1) on the road should be 7.5 m. The path of the centre line of the vehicle should follow as closely as possible the line *CC*.

The microphone should be located 1.2 m above the ground level.

5.3 Number of measurements

At least two measurements should be made on each side of the vehicle as it passes the measuring positions.

NOTE.—It is recommended that preliminary measurements be made for the purpose of adjustment. Such preliminary measurements need not be included in the final result.

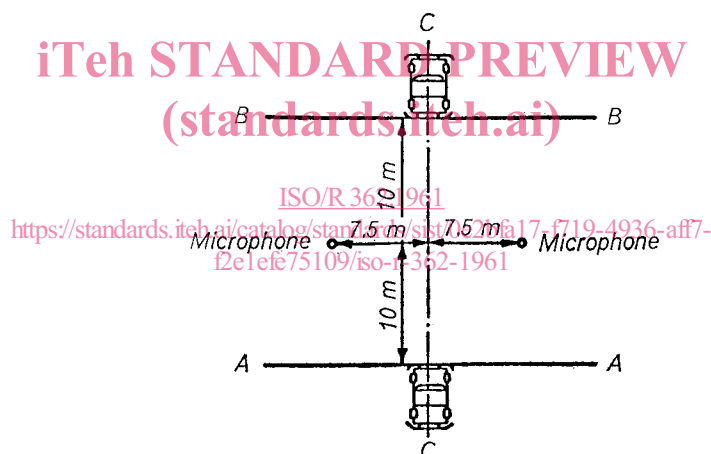


Fig. 1. — Measuring positions for measurement with vehicles in motion

5.4 Test procedure

5.4.1 General conditions

The vehicle approaches the line *AA* in the appropriate conditions specified below:

When the front of the vehicle reaches the position, in relation to the microphone, shown as *AA* in Figure 1, the throttle is fully opened as rapidly as practicable and held there until the rear of the vehicle reaches position *BB* in Figure 1, when the throttle is closed as rapidly as possible.

Trailers, including the trailer portion of articulated vehicles, are ignored when considering the crossing of line *BB*.

NOTE.—If the vehicle is specially constructed with equipment (such as concrete mixers, compressors, pumps, etc.), which is used whilst the vehicle is in normal service on the road, this equipment should also be operating during the test.

5.4.2 Particular conditions

5.4.2.1 VEHICLE WITH NO GEAR-BOX. The vehicle should approach the line *AA* at a steady speed corresponding

either to an engine speed of three quarters of the speed at which the engine develops its maximum power,

or to three quarters of the maximum engine speed permitted by the governor,

or to 50 km/h,

whichever is the lowest.

5.4.2.2 VEHICLE WITH A MANUALLY OPERATED GEAR-BOX. If the vehicle is fitted with a two-, three-, or four-speed gear box, the second gear should be used. If the vehicle has more than four speeds, the third gear should be used. Auxiliary step-up ratios ("overdrive") should not be engaged. If the vehicle is fitted with an auxiliary reduction gear box, this should be used with the drive allowing the highest vehicle speed.

The vehicle should approach the line *AA* at a steady speed corresponding

either to an engine speed of three quarters of the speed at which the engine develops its maximum power,

or to three quarters of the engine speed permitted by the governor,

or to 50 km/h,

whichever is the lowest.

5.4.2.3 VEHICLE WITH AN AUTOMATIC GEAR-BOX. The vehicle should approach the line *AA* at a steady speed of 50 km/h or at three quarters of its maximum speed, whichever is the lower. Where alternative forward drive positions are available, that position which results in the highest mean acceleration of the vehicle between lines *AA* and *BB* should be selected.

The selector position which is used only for engine braking, parking or similar slow manoeuvres of the vehicle should be excluded.

5.4.2.4 AGRICULTURAL TRACTORS, SELF-PROPELLED AGRICULTURAL MACHINES AND MOTOR CULTIVATORS. The vehicle should approach the line *AA* at a steady speed of three quarters of the maximum speed which can be achieved, using the gear-box ratio which gives the highest road speed.

5.5 Statement of results

All readings taken on the sound level meter should be stated in the report.

The basis of horsepower rating, if appropriate, should be stated in the report.

The state of loading of the vehicle should also be specified in the report.

APPENDICES

A1. MEASUREMENTS WITH STATIONARY VEHICLES

A1.1 Measuring positions

Measurements are made in each of the four main directions at a distance of 7.0 m from the nearest surface of the vehicle. The actual positions used for the measurements are shown in Figure 2. If measurements are required in more than the four measuring positions shown in Figure 2, they should be taken from chosen positions on the circles shown — i.e. the circles with radius 7.0 m.

The microphone should be located 1.2 m above the ground level.

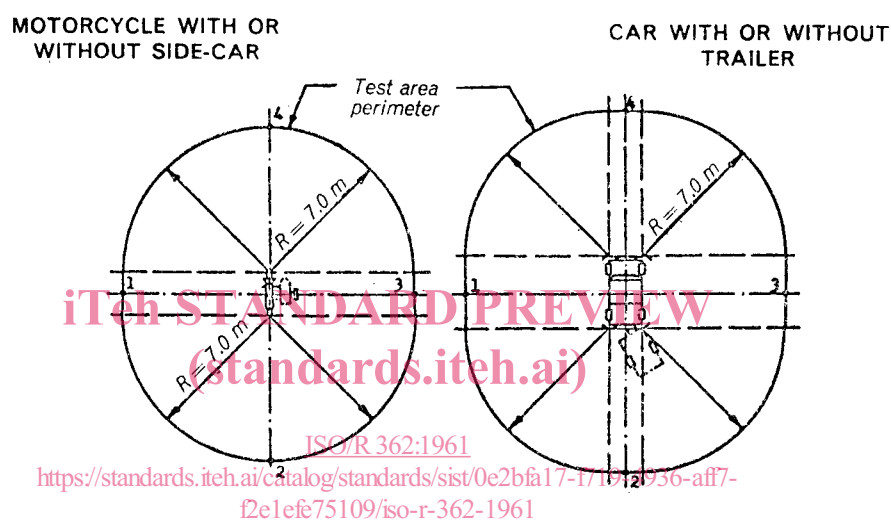


Fig. 2. — Measuring positions for measurement with stationary vehicles

A1.2 Number of measurements

At least two measurements should be made in each measuring position.

A1.3 Vehicle conditions

The engine of the vehicle without a speed governor should be run at three quarters of the number of revolutions per minute at which, according to the manufacturer, it develops its maximum power. The engine speed, expressed in revolutions per minute, is measured by means of an independent instrument, e.g. by the use of free-running rollers and a tachometer. A governed engine should be run at maximum speed.

The engine should be brought to its usual working temperature before measurements are carried out.

A1.4 Statement of results

All the sound level readings observed in each measuring position should be stated in the report.

A2. MEASUREMENTS WITH VEHICLES IN MOTION (MODIFIED METHOD)

A2.1 Testing ground

The testing ground should be substantially level, and its surface texture such that it does not cause excessive tyre noise.

A2.2 Measuring positions

The distance from the measuring positions to the reference line *CC* (Fig. 1) on the road should be 7.5 m. The path of the centre line of the vehicle should follow as closely as possible the line *CC*.

The microphone should be located 1.2 m above the ground level.

A2.3 Number of measurements

At least two measurements should be made on each side of the vehicle as it passes the measuring positions.

NOTE.—It is recommended that preliminary measurements be made for the purpose of adjustment. Such preliminary measurements need not be included in the final result.

A2.4 Test procedure

A2.4.1 General conditions

The vehicle approaches the line *AA* in the appropriate conditions specified below:

When the front of the vehicle reaches the position, in relation to the microphone, shown as *AA* in Figure 1, the throttle is fully opened as rapidly as practicable and held there until the rear of the vehicle reaches position *BB* in Figure 1, when the throttle is closed as rapidly as possible.

Trailers, including the trailer portion of articulated vehicles, are ignored when considering the crossing of line *BB*.

NOTE.—If the vehicle is specially constructed with equipment (such as concrete mixers, compressors, pumps, etc.), which is used whilst the vehicle is in normal service on the road, this equipment should also be operating during the test.

A2.4.2 Particular conditions

Vehicles should be driven in such a manner as to comply with either of the following conditions:

A2.4.2.1 VEHICLE WITH A MANUALLY OPERATED GEAR BOX, WITH OR WITHOUT AUTOMATIC CLUTCH. The vehicle should approach the line *AA* (Fig. 1) at a steady speed corresponding to three quarters of the revolutions per minute at which the engine (according to the manufacturer) develops its maximum power. The gear ratio should be chosen such that the road speed most closely approaches 50 km/h at this engine speed. However, if the vehicle has more than three forward gears, the first gear should not be used.

A2.4.2.2 VEHICLE WITH AN AUTOMATIC GEAR BOX. The vehicle should approach the line *AA* at a steady speed of 50 km/h or at three quarters of its maximum speed, whichever is the lower. Where alternative forward drive positions are available, the position which results in the highest sound level of the vehicle should be selected.

The selector position which is used only for engine braking, parking or similar slow manœuvres of the vehicle should be excluded.

A2.5 Statement of results

All readings taken on the sound level meter should be stated in the report.

The basis of horsepower rating, if appropriate, should be stated in the report.

The state of loading of the vehicle should also be specified in the report.