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# INTERNATIONAL STANDARD



# 2923

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## Acoustics — Measurement of noise on board vessels

*Acoustique — Mesurage du bruit à bord des bateaux*

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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 2923 was drawn up by Technical Committee ISO/TC 43, *Acoustics*, and circulated to the Member Bodies in January 1973.

It has been approved by the Member Bodies of the following countries :

Australia	Hungary	South Africa, Rep. of
Austria	India	Spain 23:1975
Belgium	Israel	Switzerland
Bulgaria	Italy	Thailand 2923-1975
Canada	Mexico	United Kingdom
Czechoslovakia	Netherlands	U.S.A.
Egypt, Arab Rep. of	Norway	U.S.S.R.
France	Portugal	
Germany	Romania	

The Member Body of the following country expressed disapproval of the document on technical grounds :

Sweden

# Acoustics – Measurement of noise on board vessels

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the conditions for obtaining reproducible and comparable measurements of the noise level and the noise spectrum on board vessels.

The results may be used, for example,

- to compare various vessels;
- to characterize the acoustic comfort on board these vessels;
- to orient a program of more elaborate measurements for the purposes of studying noise reduction procedures.

### NOTES

1 The test procedures specified in this International Standard are engineering methods as defined in ISO 2204, *Acoustics – Guide to the measurement of airborne acoustical noise and evaluation of its effects on man*. Note, however, that frequency band analysis is only required for type tests.

2 Measurements may be made on sources emitting noise of an impulsive character with an impulsive sound level meter (see clause 5).

## 2 REFERENCES

IEC Publication 179, *Precision sound level meters*.

IEC Publication 225, *Octave, half-octave and third-octave band filters intended for the analysis of sound and vibrations*.

## 3 NATURE OF TESTS

**3.1 type tests** : Measurements performed to prove that the vessel delivered by the manufacturer corresponds to noise specifications. The conditions prescribed for each test shall be complied with as closely as possible, but if unavoidable variations have to be made, these must be stated in the test report.

**3.2 monitoring tests** : Measurements performed in order to check that the noise of the vessel is still within prescribed limits and that no noticeable changes have occurred since the acceptance on initial delivery or after modification, as applicable.

For monitoring tests, slight deviations from the test conditions specified for type tests may be tolerated, for example the number of measurement positions and the number of engine operating conditions may be reduced.

Any variation shall be described in the test report.

## 4 MEASURED QUANTITIES

**4.1** All readings of the sound level meter are to be taken with the dynamic characteristic "slow".

**4.2** The values to be measured at all microphone positions in type and monitoring tests are A-weighted sound pressure levels  $L_A$  expressed in decibels (dB).

NOTE – If the weighting curve is not otherwise stated, the measured values shall be expressed in dB(A).

**4.3** In type tests for spectral analysis at some selected microphone positions, the values to be measured are octave band or 1/3 octave band sound pressure levels in decibels (dB).

NOTE – The spectral analysis shall be extended appropriately below 50 Hz, if strong low frequency components are to be expected.

## 5 MEASUREMENT EQUIPMENT

**5.1** The sound level meter shall comply with IEC Publication 179.

**5.2** If additional measuring equipment, including, for example, a tape recorder and/or level recorder is used, its overall electro-acoustic performance shall conform to the relevant clauses of IEC Publication 179.

**5.3** For the measurement of noise spectra, the filters shall correspond to IEC Publication 225.

**5.4** The overall acoustic performance of the measurement equipment shall be checked according to the instructions of the manufacturer, preferably with a standard sound source (for example pistonphone), at the beginning and at the end of each series of measurements.

At time-intervals no longer than 2 years, the sound level meter shall be calibrated for compliance with IEC Publication 179.

NOTES

1 A suitable wind-shield may be used to reduce the influence of wind on the reading.

2 If an impulse sound level meter in accordance with the amendment<sup>1)</sup> of IEC Publication 179 is available, it is recommended that, in addition, the values read with A-weighting and the "impulse" dynamic characteristics, symbol  $L_{A1}$ , be stated and that the values be expressed in decibels (dB), when measuring impulsive noises. The values shall be expressed in dB(A) if the weighting curve and the "impulse" dynamic characteristics are not otherwise stated.

**6 ACOUSTICAL ENVIRONMENT, METEOROLOGICAL CONDITIONS, BACKGROUND LEVEL**

**6.1** The depth of water under the vessel and the presence of large reflecting surfaces in its vicinity may affect the readings obtained, and shall therefore be mentioned in the test report.

**6.2** The meteorological conditions (such as wind, rain, etc.) shall be such that they do not influence the measurements.

**6.3** Care shall be taken to see that noise from extraneous sound sources (such as people, construction work, wind, waves, rain, etc.) does not influence the sound pressure level on board the vessel at the positions of measurement. If necessary, readings may be corrected for steady state background noise where this is obtainable, according to the energy summation principle as follows :

Difference between the A-weighted sound pressure level of the noise on board the vessel and of the background noise	Correction to be applied to the reading of the A-weighted sound pressure level of the noise on board the vessel
dB	dB
≥10	0
6 to 9	- 1
4 to 5	- 2
3	- 3

Care shall be taken that spurious signals due to vibration of the measuring device do not affect the sound pressure level or band pressure levels of the vessel under test.

**7 TEST COURSE**

**7.1** During the test, the course of the vessel shall be as straight as possible.

**7.2** Vessels being tested on inland water-ways shall be run either against the stress or tide or in slack water.

**8 OPERATING CONDITIONS FOR THE VESSEL DURING THE TEST**

**8.1 Loading condition**

Either ballasted or fully loaded.

**8.2 Main engines**

**8.2.1** Running at a speed producing the shaft speed specified for the vessel's acceptance on initial delivery or after being modified, as applicable.

The main engines of vessels on inland water-ways shall be run at at least 95 % of the speed specified in the certificate of the vessel.

**8.2.2** At reduced speed, as specified for running in fog or similar weather conditions, or under other specified sailing conditions : for measurements at selected places.

**8.2.3** Stopped as for harbour conditions : for measurements at selected places

**8.3 Controllable pitch propellers and Voith-Schneider propellers — if any**

In full power position.

**8.4 Auxiliary engines**

Running under conditions corresponding to those of the main engines (8.2.1, 8.2.2, 8.2.3) and as specified for the vessel's acceptance on initial delivery or after being modified, as applicable.

**8.5 Air-conditioning or ventilating systems**

**8.5.1** In operation.

**8.5.2** Stopped for additional measurements.

**8.6 Doors and windows**

**8.6.1** Shut.

**8.6.2** Open for additional measurements in rooms, where these conditions are normal; for instance, in the wheelhouse where the door on the lee side is normally open.

**8.7 Furnishings**

All spaces shall be furnished with all necessary equipment.

NOTE — For new vessels, the noise measurements may conveniently be carried out during the endurance trials.

1) In preparation.

## 9 MICROPHONE POSITIONS

If not otherwise stated, measurements shall be performed with the microphone directed vertically upwards at a height between 1,2 m and 1,5 m from the deck.

The distance between two measurement points shall be at least 2 m and all measurement points shall be at least 0,5 m from the boundaries of any space.

The microphone positions shall be as follows :

### 9.1 Living-quarters such as sleeping cabins, common rooms and hospitals, dining rooms, saloons

One measurement shall be made in the middle of the room. Additional measurements shall be performed at other points if appreciable differences in the loudness of the noise inside the room occur, especially near the head position of a sitting or lying person.

### 9.2 Engine room

Measurements shall be made at the principal working and control stations of the crew in the engine room and in the adjacent control rooms, if any, special attention being paid to telephone locations and to positions where the understanding of speech and other signals is important.

In addition, measurements shall be made at a distance of approximately 1 m from any particularly noisy machines or equipment.

### 9.3 Command stations

The noise shall be measured at all the points where the personnel work, including radio rooms.

If, inside these spaces, appreciable differences in the noise level occur, additional measurements shall be performed at all the points of interest where the differences exist.

### 9.4 Other unusually noisy locations

In addition to the spaces mentioned under 9.1 to 9.3, measurements shall be made in all unusually noisy locations where people may stay even for a relatively short period, or at special purpose machinery, for example cargo discharge pumps.

### 9.5 Deck

On deck, microphone positions shall be provided at all locations where the crew or the passengers may stay, especially near the intake and exhaust of the engine or the air-conditioning and cooling system and near the openings and/or skylights and windows of the engine room.

### 9.6 Intake and exhaust openings

When measuring sound levels at the intake and exhaust of the engine and ventilation, air-conditioning and cooling systems, it is recommended that the microphone be placed outside the gas stream at a distance of 1 m from the edge of the intake or exhaust opening at an angle of 30° to the

direction of the gas stream (see the figure) and as far as possible from reflecting surfaces.

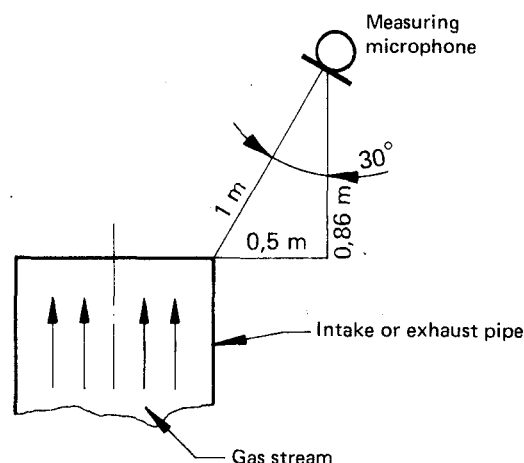


FIGURE — Positioning of the measuring microphone at the intake or exhaust apertures

### 9.7 Bridge wings

On bridge wings, the measurement shall be performed on the lee side.

## 10 TEST PROCEDURE

10.1 For each measurement under constant operating conditions, a measuring time of at least 5 s shall be allowed.

NOTE — It may be useful to move the microphone horizontally and/or vertically over a distance of about 1 m to get a more significant reading. In this case the mean value shall be retained.

If the level fluctuates, the mean value (or the most probable value) of the reading shall be estimated.

In addition, the average fluctuation range shall be stated.

The reading shall be rounded to the nearest integral decibel.

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

10.2 The presence of easily audible pure tones or noise of a distinctly impulsive character shall be stated in the test report.

## 11 TEST REPORT

The test report shall include a reference to this International Standard and all relevant details concerning :

11.1 The nature of the tests.

11.2 The test site, depth of water under the vessel and meteorological conditions, for example ambient temperature, barometric pressure and wind velocity, if relevant.

11.3 The measurement equipment.

11.4 The background noise level.

11.5 The vessel, its main engines, the engine and shaft speeds during the test, and the setting of controllable-pitch or Voith-Schneider propellers.

11.6 The auxiliary engines and equipment and their operating conditions.

11.7 The loading of the vessel.

11.8 The microphone positions.

11.9 The A-weighted sound pressure level  $L_A$  and the noise spectrum.

11.10 The presence of pure tones or noise of an impulsive character.

11.11 Indications concerning the probable noise sources in the vessel.

11.12 Position, open or shut, of windows and doors and their respective locations.

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