ORGANISATION INTERNATIONALE
DE MÉTROLOGIE LÉGALE

INTERNATIONAL RECOMMENDATION

Sound calibrators
Annex B: Test methods for pattern evaluation
Annex C: Test report format

Calibreurs acoustiques
Annexe B: Méthodes d'essai de modèle
Annexe C: Format du rapport d'essai

OIML R 102
Annexes B & C

Edition 1995 (E)

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FOREWORD

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The two main categories of OIML publications are:

1) **International Recommendations (OIML R),** which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity; the OIML Member States shall implement these Recommendations to the greatest possible extent;

2) **International Documents (OIML D),** which are informative in nature and intended to improve the work of the metrological services.

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ANNEX B

TEST METHODS FOR PATTERN EVALUATION
(Informative)

B.1 Ambient conditions

Measurements of sound calibrators' sound pressure level, frequency and harmonic distortion should be performed at the following ambient conditions:

Static pressure:	(101.3 ± 1.5) kPa
Temperature:	19 °C to 23 °C
Relative humidity:	30 % to 70 %

Results may require correction to reference conditions.

B.2 Measuring method

B.2.1 Insert voltage technique

Where possible, measurements of the sound calibrators' sound pressure level should be performed by means of the insert voltage technique (insert voltage U_{ins} in V) using a test microphone with a well-known sensitivity level M (re 1 V/Pa) in dB. The calibrator's sound pressure level can be calculated from the following equation:

$$Lp = 20 \lg (U_{ins}/1\ V)\ dB - M - 20 \lg (20 \times 10^{-6})\ dB$$

Measurements should be performed on several days and mean values should be reported.

B.2.2 Position of the sound calibrator

For testing, the preferred orientation of the sound calibrator and microphone is vertical, unless the manufacturer specifies otherwise.

Note: For some types of sound calibrators a mechanical device may be necessary to fix the calibrator to the microphone.

B.2.3 Stabilizing times

At least 5 min should be allowed for the stabilization of the microphone-preamplifier configuration.

Note: The test method applied to assure that the test equipment has sufficiently stabilized should be reported together with the test results.

The sound calibrator should be left on the microphone for 5 min before switch-on and values shall be recorded 30 s after switch-on.

Note: The test method applied to assure that the sound calibrator under test has sufficiently stabilized should be reported together with the test results.

B.2.4 Environmental tests

Measurements of the dependence of the sound calibrators' sound pressure level, frequency and harmonic distortion on the ambient conditions should be performed using a microphone with well-known pressure and temperature coefficients. At least one set of increasing parameter and one set of decreasing parameter should be measured. At each parameter point, mean values should be taken for the result. The results shall be corrected for the pressure and temperature coefficients of the microphone. If, during the measurement of the dependence on any of the three ambient parameters (i.e. pressure, temperature, and humidity) any of the two other parameters deviate significantly from its value at the beginning of the measurement, it may also be necessary to correct the measurement results with respect to the dependence of the sound calibrator's performance on these parameters. When performing temperature or humidity tests, each calibrator should be stored under actual climatic conditions at least 3 h before a reading is taken. During this stabilizing time, the calibrator should be removed from the microphone.

Note: For some types of sound calibrators, more than 3 h is needed for stabilization.

ANNEX C

TEST REPORT FORMAT

Note: This Annex is informative with regard to implementation of OIML Recommendation R 102 in national regulations; however, use of the test report format is mandatory for application of the Recommendation within the OIML Certificate System.

The "Test report format", the subject of this Annex, aims at presenting, in a standardized format, the results of the various tests to which a pattern of a sound calibrator shall be submitted with a view to its approval. These tests are listed in Annex A of R 102. Possible test methods are described in Annex B.

All metrology services or laboratories evaluating patterns of sound calibrators according to national regulations based on R 102 are strongly advised to use this "Test report format" directly or after translation into a language other than English or French. Its direct use in English or in French, or in both languages, is strongly recommended whenever test results may be transmitted by the country performing these tests to the approval authorities of another country, under bi- or multi-lateral cooperation agreements.

EXPLANATORY NOTES

Key to symbols and expressions used in the following pages:

\+ = Approved

– = Not approved

mpe = Maximum permissible error as specified in clause 2 of R 102

The "Summary of the tests" and the tables on "Inscriptions and marks" and "Instruction manual" shall be completed according to this example.

+	–	
×		Approved
	×	Not approved
/	/	Not applicable

"Date" in the test reports refers to the date of testing.

"Deviation" is the difference between the measured value and the expected value. In some cases, deviation is to be understood as the relative deviation.

GENERAL INFORMATION CONCERNING THE PATTERN

Application No:

Manufacturer:

Applicant:

Representative (name, telephone):

Instrument category:

Pattern designation:

Serial number: 1,..... 2,..... 3,..... 4....., 5,.....

Class of instrument (claimed by manufacturer):

Nominal frequency (Hz)	Model of microphone and of grid/adaptor, and/or equivalent volume of acoustic load (mm^3)	Nominal sound pressure level (dB) (state whether SPL, equivalent free-field SPL, or equivalent diffuse-field SPL)

Temperature range specified by manufacturer in accordance with IEC 942, clause 3.3.2 b):
from _____ to _____ (°C)

Humidity range specified by manufacturer in accordance with IEC 942, clause 3.3.3:
from _____ to _____ (%)

Pressure range specified by manufacturer in accordance with IEC 942, clause 3.3.1 b):
from _____ to _____(kPa)

Model of grid/adaptors:
Accessories:
Battery: type _____ ; nominal voltage _____ ; number required_____

Remarks:

1 Is one nominal sound pressure level greater than 90 dB? Yes/No

2 Is one nominal frequency in the range 160 Hz to 1000 Hz? Yes/No

3 Is one of the microphones specified capable of being calibrated (a) in accordance with IEC 1094, part 2, or (b) by direct comparison with a microphone calibrated in accordance with IEC 1094, part 2? Yes/No

Date: Observer:

SUMMARY OF THE TESTS

No	TESTS	+	–	Remarks	Page No of test report
C.1	Sound pressure level(s)				
C.2	Harmonic distortion				
C.3	Frequency				
C.4	Tone burst capability				
C.5	Battery voltage				
C.6	Ambient pressure				
C.7	Ambient temperature				
C.8	Ambient humidity				
C.9	Mechanical vibration				
C.10	Magnetic field				
C.11	Electromagnetic susceptibility				
C.12	Barometer				
C.13	Thermometer				
C.14	Examination of the construction of the device				
C.15	Inscriptions and marks				
C.16	Instruction manual				

Note: In the column “Remarks”, insertion of an “X” means that reference is made to a remark at the end of the corresponding paragraph on one of the following pages.

C.1 Sound pressure level(s) under reference ambient conditions (A.1)

Application No: Microphone

Model designation: Model: _____ ; _____ ; _____

Serial number: Serial number: _____ ; _____ ; _____

Date: Observer:

Model of microphone and of grid/adaptor	Nominal frequency (Hz)	Nominal SPL (dB)	Measured SPL* (dB)	Deviation (dB)	mpe (dB)		
					Class		
					0	1	2
					± 0.15	± 0.3	± 0.5
					± 0.15	± 0.3	± 0.5
					± 0.15	± 0.3	± 0.5

* The uncertainty of the measured SPL should be stated.

Supplementary information

Actual environmental conditions

Atmospheric pressure:

Temperature:

Relative humidity:

Values of any pressure, temperature and relative humidity coefficients of the sound calibrator, used by the testing laboratory to correct the measured sound pressure levels to reference ambient conditions (101.3 kPa, 20 °C, 65 % RH):

Remarks:

Stability of SPL

Model of microphone and of grid/adaptor	Nominal frequency (Hz)	Stabilizing time (s)	Mean level during 20 s (dB)	Fluc-tuation (dB)	Stability limit (dB)		
					Class		
					0	1	2
					± 0.05	± 0.1	± 0.2

Remarks:

C.2 Harmonic distortion (A.2)

Application No:

Model designation:

Serial number:

Microphone

Model:

Serial number:

Date:

Observer:

Model of microphone and of grid/adaptor	Nominal frequency (Hz)	Nominal SPL (dB)	Harmonic distortion (%)	Maximum permissible harmonic distortion, Class 0, 1, 2 (%)
				3
				3
				3

Supplementary information

Actual environmental conditions

Atmospheric pressure:

Temperature:

Relative humidity:

Description of the test method employed:

Remarks:

C.3 Frequency under reference ambient conditions (A.3)

Application No:

Model designation:

Serial number:

Microphone

Model:

Serial number:

Date:

Observer:

Model of microphone and of grid/adaptor	Nominal SPL (dB)	Nominal frequency (Hz)	Measured frequency (Hz)	Deviation (%)	mpe (%)		
					Class		
					0	1	2
					± 1	± 2	± 4
					± 1	± 2	± 4
					± 1	± 2	± 4

Supplementary information

Actual environmental conditions

Atmospheric pressure:

Temperature:

Relative humidity:

Values of any pressure, temperature and relative humidity coefficients of the sound calibrator, used by the testing laboratory to correct the measured frequencies to reference ambient conditions (101.3 kPa, 20 °C, 65 % RH)

Remarks:

Stability of frequency

Model of microphone and of grid/adaptor	Stabilizing time (s)	Mean value during 20 s (Hz)	Fluctuation (%)	Stability limit (%)		
				Class		
				0	1	2
				± 0.3	± 0.5	± 1
				± 0.3	± 0.5	± 1
				± 0.3	± 0.5	± 1

Remarks:

C.4 Tone-burst capability (A.4)

Application No: Microphone

Model designation: Model:

Serial number: Serial number:

Actual environmental conditions Date:

Temperature: Observer:

Relative humidity:

Atmospheric pressure:

	Nominal value (ms)	Measured value (ms)	Deviation (%)	mpe (%) Class 0, 1, 2	Compliance with IEC 651 and IEC 804, where appropriate	
					+	–
Duration				2		
Interval				2		

Remarks:

C.5 Battery voltage (A.5)

Application No: Microphone

Model designation: Model:

Serial number: Serial number:

Actual environmental conditions Date:

Temperature: Observer:

Relative humidity:

Atmospheric pressure:

Battery voltage (V)		Nominal value	Measured value	Deviation	mpe			Indication of battery indicator
					Class			
					0	1	2	
	Fre (Hz)			%	± 1	± 2	± 4	
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5	
	Fre (Hz)			%	± 1	± 2	± 4	
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5	
	Fre (Hz)			%	± 1	± 2	± 4	
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5	

(By means of checking the battery voltage specified by manufacturer)

Remarks:

C.6 Ambient pressure (A.6)

Application No:	Microphone
Model designation:	Model:
Serial number:	Serial number:
Nominal SPL (dB):	Pressure coefficient (dB/kPa):
Actual environmental conditions	Temperature coefficient (dB/°C):
Temperature:	Date:
Relative humidity:	Observer:

Measured ambient pressure (kPa)	Indicated ambient pressure (if appropriate) (kPa)	Nominal frequency (Hz)	Expected SPL (dB)	Measured SPL (dB)	Deviation (dB)	mpe (dB)		
						Class		
						0	1	2
						± 0.15	± 0.3	± 0.5
						± 0.15	± 0.3	± 0.5
						± 0.15	± 0.3	± 0.5
						± 0.15	± 0.3	± 0.5
						± 0.15	± 0.3	± 0.5
						± 0.15	± 0.3	± 0.5

Notes:

The expected SPL is obtained from the nominal SPL by using the measured ambient pressure and the data supplied by the manufacturer in accordance with IEC 942, subclause 3.3.1(a). In cases of use of a barometer which indicates corrections directly in dB, it should be verified that the corrected value of SPL meets the specified tolerances.

Supplementary results:

1 Pressure coefficient of sound calibrator at 101.3 kPa, derived from the measured ambient pressure and SPL = _____ dB/kPa

2 Are the deviations within the maximum permissible error for the ambient pressure range specified by the manufacturer? Yes/No

Remarks:

C.7 Ambient temperature (A.7)

Application No:
Model designation:
Serial number:
Sound calibrator pressure coefficient (dB/kPa):

Microphone
Model:
Serial number:
Temperature coefficient (dB/°C):
Pressure coefficient (dB/kPa):
Date:
Observer:

Quantity	Nominal value	Expected value	Measured value	Deviation	mpe		
					Class		
					0	1	2

Measured temperature (°C): ________ ; Atmospheric pressure (kPa): _______ ;	Indicated temperature (if appropriate) (°C): ______ Relative humidity (%): ________						
SPL (dB)				dB	± 0.15	± 0.3	± 0.5
Frequency (Hz)				%	± 1	± 2	± 4

Measured temperature (°C): ________ ; Atmospheric pressure (kPa): _______ ;	Indicated temperature (if appropriate) (°C): ______ Relative humidity (%): ________						
SPL (dB)				dB	± 0.15	± 0.3	± 0.5
Frequency (Hz)				%	± 1	± 2	± 4

Measured temperature (°C): ________ ; Atmospheric pressure (kPa): _______ ;	Indicated temperature (if appropriate) (°C): ______ Relative humidity (%): ________						
SPL (dB)				dB	± 0.15	± 0.3	± 0.5
Frequency (Hz)				%	± 1	± 2	± 4

Measured temperature (°C): ________ ; Atmospheric pressure (kPa): _______ ;	Indicated temperature (if appropriate) (°C): ______ Relative humidity (%): ________						
SPL (dB)				dB	± 0.15	± 0.3	± 0.5
Frequency (Hz)				%	± 1	± 2	± 4

Measured temperature (°C): _____ ; Atmospheric pressure (kPa): _____ ;			Indicated temperature (if appropriate) (°C): _____ Relative humidity (%): _____				
SPL (dB)				dB	± 0.15	± 0.3	± 0.5
Frequency (Hz)				%	± 1	± 2	± 4

Measured temperature (°C): _____ ; Atmospheric pressure (kPa): _____ ;			Indicated temperature (if appropriate) (°C): _____ Relative humidity (%): _____				
SPL (dB)				dB	± 0.15	± 0.3	± 0.5
Frequency (Hz)				%	± 1	± 2	± 4

Note:

The expected value is obtained from the nominal value by using the measured ambient temperature and the data supplied by the manufacturer in accordance with IEC 942, subclause 3.3.2(a). In cases of use of a thermometer which indicates corrections directly in dB, it should be verified that the corrected value of SPL meets the specified tolerances.

Supplementary results:

Are the deviations within the maximum permissible error for the ambient temperature range specified by the manufacturer? Yes/No

Remarks:

C.8 Ambient humidity (A.8)

Application No:
Model designation:
Serial number:
Actual environmental conditions
Temperature:
Atmospheric pressure:

Stabilizing time at given relative humidity:

Microphone
Model:
Serial number:
Pressure coefficient (dB/kPa):
Temperature coefficient (dB/°C):
Sound calibrator
Pressure coefficient (dB/kPa):
Temperature coefficient (dB/°C):
Date:
Observer:

Relative humidity (%)		Nominal value	Measured value	Deviation	mpe		
					Class		
					0	1	2
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5
	Fre (Hz)			%	± 1	± 2	± 4
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5
	Fre (Hz)			%	± 1	± 2	± 4
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5
	Fre (Hz)			%	± 1	± 2	± 4
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5
	Fre (Hz)			%	± 1	± 2	± 4
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5
	Fre (Hz)			%	± 1	± 2	± 4
	SPL (dB)			dB	± 0.15	± 0.3	± 0.5
	Fre (Hz)			%	± 1	± 2	± 4

Remarks:

C.9 Mechanical vibration (A.9)

Application No:

Model designation:

Serial number:

Date:

Observer:

Notes:

1 This refers to mechanical vibration generated by the sound calibrator, and to the spurious signal caused by this vibration.

2 It is not yet possible to specify a method for evaluating the effect of this vibration, applicable to all types of sound calibrators. The testing laboratory should describe the method employed, and state the results.

Remarks:

C.10 Magnetic field (A.10)

Application No:

Model designation:

Serial number:

Date:

Observer:

Notes:

1 This refers to electromagnetic and electrostatic fields generated by the sound calibrator, and to the spurious signal caused by these fields.

2 It is not yet possible to specify a method for evaluating the effect of these fields, applicable to all types of sound calibrators. The testing laboratory should describe the method employed, and state the results.

Remarks:

C.11 Electromagnetic susceptibility (A.11)

Application No:

Model designation:

Serial number:

Date:

Observer:

Notes:

1 This refers to susceptibility to externally-applied electromagnetic fields, and to the spurious signal due to these fields.

2 It is not yet possible to specify a method for evaluating the effect of these fields. The testing laboratory should describe the method employed, and state the results.

Remarks:

C.12 Barometer (A.12)

Application No:

Model designation:

Serial number:

Actual environmental conditions Date:

Temperature: Observer:

Relative humidity:

Indicated pressure (kPa)							
Actual pressure (kPa)							
Deviation (kPa)							
mpe (kPa)							

Note:

The maximum permissible error is equal to the maximum uncertainty specified by the manufacturer in accordance with IEC 942, clause 3.3.1 c).

Remarks:

C.13 Thermometer (A.13)

Application No:

Model designation:

Serial number:

Actual environmental conditions Date:

Relative humidity: Observer:

Atmospheric pressure:

Indicated temperature (°C)							
Actual temperature (°C)							
Deviation (°C)							
mpe (°C)							

Note:

The maximum permissible error is equal to the maximum uncertainty specified by the manufacturer in accordance with IEC 942, clause 3.3.2 c).

Remarks:

C.14 Examination of the construction of the device

Note:

Particular attention should be paid as to whether the construction of the sound calibrator makes the sound pressure level of the sound calibrator susceptible to be affected by a high level of ambient noise.

Description:

Remarks:

C.15 Inscriptions and marks

Requirement as specified in R 102	Inscription or mark	+	–	Remarks
4.1	Manufacturer's name or trade mark			
	Manufacturer's model designation and serial number			
	Marking "IEC 942-1988"			
	Class and letter "L"			
	Marking of adaptors			
4.3	List of adaptors and accessories where appropriate			
5	Seals or marks to protect			
	Place for verification mark			

C.16 Instruction manual

Requirement as specified in R 102	Information	+	–	Remark
4.1	Nominal value(s) of sound pressure level(s) generated			
4.1	Nominal value(s) of frequency(ies) generated			
4.1	Preferred mode of use (where appropriate)			
4.1	Pressure range, and any correction data, in accordance with IEC 942, clause 3.3.1 a) and b)			
4.1	Temperature range, and any correction data, in accordance with IEC 942, clause 3.3.2 a) and b)			
4.1	Humidity range, in accordance with IEC 942, clause 3.3.3			
4.1	Maximum uncertainty in the measured value of ambient pressure, if appropriate, in accordance with IEC 942, clause 3.3.1 c)			
4.1	Maximum uncertainty in the measured value of ambient temperature, if appropriate, in accordance with IEC 942, clause 3.3.2 c)			
4.1	Nominal value(s) of equivalent free-field/diffuse-field sound pressure levels (where appropriate)			
4.2	Tone-burst capability (where appropriate)			
4.2	Battery requirements			
4.2	Nominal sound pressure levels for other microphone models, and the necessary adaptors/accessories			
4.2	Method of microphone calibration for calibrating sound calibrator			
4.2	Stabilizing time			
4.2	Extreme limits of temperature and humidity			
4.2	Effective volume of sound calibrator			
4.2	Temperature limits of battery, and use of external power supply			

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