

Implementation of ISO 9902 : 1993

**Textile machinery acoustics —
Determination of sound
pressure levels and sound
power levels emitted by textile
machines — Engineering and
survey methods**

UDC 677.05 : 534.6

National foreword

This British Standard reproduces verbatim ISO 9902 : 1993 and implements it as the UK national standard.

This British Standard is published under the direction of the Textiles and Clothing Standards Policy Committee whose Technical Committee TCM/33 has the responsibility to:

- aid enquirers to understand the text;
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- monitor related international and European developments and promulgate them in the UK.

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**Textile machinery acoustics —
Determination of sound pressure levels and
sound power levels emitted by textile
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methods**

*Acoustique du matériel pour l'industrie textile — Détermination des
niveaux de pression acoustique et des niveaux de puissance acoustique
émis par les machines textiles — Méthodes d'expertise et de contrôle*



Reference number
ISO 9902:1993(E)

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International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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 9902 was prepared by Technical Committee ISO/TC 72, *Textile machinery and allied machinery and accessories*.

Annexes A, B, C, D and E form an integral part of this International Standard. Annex F is for information only.

Textile machinery acoustics — Determination of sound pressure levels and sound power levels emitted by textile machines — Engineering and survey methods

1 Scope

This International Standard specifies engineering and survey methods applied to textile machinery with reference to ISO 3744 and ISO 3746 for measuring the sound pressure levels on a measurement surface enveloping the source and for calculating the sound power produced by the source. It specifies the test environment and instrumentation as well as techniques for obtaining the surface sound pressure level from which the A-weighted sound power level of the source and octave band sound pressure levels, if required, are calculated.

This International Standard provides specifications for measuring the noise emitted by textile machines into the ambient air (noise emission) according to uniform methods so that the results are comparable. It contains requirements for carrying out airborne sound measurements in the vicinity of textile machines, including at the operator position, under given operating conditions.

The term “textile machines” as used in this International Standard includes all machinery used in the textile industry for the production and processing of textile fibres, yarns and fabrics and other fibre-based textile materials, but does not include machines designed for the manufacture of clothing and other sewn or similarly assembled products.

This International Standard also specifies the measurement of sound pressure levels at the operator position for specified typical conditions, with reference to ISO 6081.

As the working parameters for many textile machines are variable, the operating conditions must be clearly defined for the specific machinery. Specifications for operating conditions for various types of machines are given in the annexes.

NOTE 1 The operating conditions specified in the annexes may also be used if the reverberation method (see ISO 3741 and ISO 3742) is used to determine the sound power of textile machines instead of the enveloping surface method.

Many textile machines are multiposition machines. As most multiposition machines are built in sections, it is possible, under certain circumstances, to make acoustic measurements on a machine part instead of on the complete machine.

2 Normative references

The following 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 3744:1993¹⁾, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane*.

1) To be published.

ISO 3745:1977, *Acoustics — Determination of sound power levels of noise sources — Precision methods for anechoic and semi-anechoic rooms.*

ISO 3746:1979, *Acoustics — Determination of sound power levels of noise sources — Survey method.*

ISO 6081:1986, *Acoustics — Noise emitted by machinery and equipment — Guidelines for the preparation of test codes of engineering grade requiring noise measurements at the operator's or bystander's position.*

IEC 651:1979, *Sound level meters.*

IEC 804:1985, *Integrating-averaging sound level meters.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 3744, ISO 3745 and ISO 3746 apply, some of which are repeated here for the user's convenience.

3.1 free field over a reflecting plane: A sound field in a homogeneous, isotropic medium in the half-space above an infinite, rigid plane surface on which the source is located.

[ISO 3744:1993, 3.8]

3.2 semi-anechoic room: Test room with a hard, reflecting floor whose other surfaces absorb essentially all the incident sound energy over the frequency range of interest, thereby affording free-field conditions above a reflecting plane.

[ISO 3745:1977, 3.4]

3.3 sound pressure level, L_p : Ten times the logarithm to the base 10 of the ratio of the square of the sound pressure radiated by the sound source under test to the square of the reference sound pressure. Sound pressure levels are expressed in decibels.

The frequency weighting or the width of the frequency band used, and the time weighting (S, F or I, see IEC 651), shall be indicated. The reference sound pressure is 20 μPa (2×10^{-5} Pa).

NOTE 2 For example, the A-weighted sound pressure level with time weighting S is L_{pAS} .

[ISO 3744:1993, 3.2]

3.4 surface sound pressure level, $\overline{L}_{pf}$: The energy-average of the time-averaged sound pressure levels at all the microphone positions on the measurement surface, with the background noise correction, K_1 , and the environmental correction, K_2 , applied. It is expressed in decibels.

[ISO 3744:1993, 3.4]

3.5 sound power level, L_w : Ten times the logarithm to the base 10 of the ratio of the sound power radiated by the sound source under test to the reference sound power. It is expressed in decibels.

The frequency weighting or the width of the frequency band used shall be indicated; for example, A-weighted sound power level (L_{wA}). The reference sound power is 1 pW (10^{-12} W).

[ISO 3744:1993, 3.6]

3.6 frequency range of interest: For general purposes, the frequency range of interest includes the octave bands with centre frequencies from 125 Hz to 8 000 Hz.

[ISO 3744:1993, 3.9]

3.7 measurement surface: A hypothetical surface of area S , enveloping the source, on which the measuring points are located. The measurement surface terminates on one or more reflecting planes.

[ISO 3744:1993, 3.3]

3.8 reference box: A hypothetical surface which is the smallest rectangular parallelepiped that just encloses the source and terminates on the reflecting plane or planes.

[ISO 3744:1993, 3.10]

3.9 measurement distance, d : The distance from the reference box to a box-shaped measurement surface.

[ISO 3744:1993, 3.11]

3.10 time-averaged sound pressure level, $L_{p,eq,T}$: Sound pressure level of a continuous steady sound that, within a measurement time interval T , has the same mean-square sound pressure as a sound under consideration which varies with time.

Time-averaged sound pressure levels are expressed in decibels and shall be measured with an instrument which complies with the requirements of IEC 804.

[ISO 3744:1993, 3.2.1]

4 Acoustic environment

4.1 General

Test environments suitable for measurements according to this International Standard include:

- a) a laboratory room which provides a free field over a reflecting plane;
- b) a flat outdoor area that meets the requirements of 4.2 and annex A of ISO 3744:1993 or annex A of ISO 3746:1979;
- c) a room in which the contributions of the reverberant field to the sound pressures on the measurement surface are small compared with those of the direct field of the source.

4.2 Criteria for adequacy of the test environment

Ideally, the test environment should be free from reflecting objects other than a reflecting plane, so that the source radiates into a free field over a reflecting plane.

Test environments which are suitable for engineering or survey measurements shall permit the sound power level to be determined with an uncertainty that does not exceed the values given in 7.2.3.1.

NOTE 3 Annex A of ISO 3744:1993 and annex A of ISO 3746:1979 describe procedures for determining the magnitude of the environmental correction (if any) to account for departures of the test environment from the ideal condition.

The environmental correction K_2 (designated K in annex A of ISO 3746:1979) shall not exceed 2 dB for the engineering method and 7 dB for the survey method.

4.3 Criterion for background noise

At the microphone position, the sound pressure levels of the background noise shall be at least 3 dB for the survey method or at least 6 dB and preferably more than 10 dB for the engineering method below the sound pressure level to be measured in each frequency band of the frequency range of interest.

Care shall be taken to minimize the effects of wind, which may increase the apparent background noise. The appropriate instructions provided by the microphone manufacturer shall be followed.

5 Instrumentation

For the engineering method, instrumentation systems in accordance with ISO 3744 and, for the survey method, systems in accordance with ISO 3746 shall be used. Details of sound level meters for use in these systems are available from IEC 651 and IEC 804.

6 Installation and operation of the source

6.1 Test object

The test object is the fully operational textile machine. It is to be accurately determined which equipment belongs to the machine to be tested. All units that operate exclusively as part of the machine are considered to be part of the "textile machine". Suction systems which are in an integral part of the textile machine are to be considered as part of the test object. The test report shall contain accurate details describing the test object. A sketch of the machine with the principal dimensions is useful. Casing and/or means of soundproofing shall be especially mentioned.

From the determined sound power level of a multiposition machine, the sound power level of another machine equipped with a different number of operating positions can be calculated if the following conditions are met:

- a) operating conditions and technical construction of both multiposition machines are the same;
- b) the dimensions of both multiposition machines fulfil the requirement necessary for a multiposition machine:

$$l_1 > 5l_2; \quad l_1 > 5l_3$$

(see figure 4);

- c) the lengths of the headstock l_T and the lengths of the end support l_E are equal for both machines:

$$l_{T1} = l_{T2} = l_T; \quad l_{E1} = l_{E2} = l_E$$

(see figure 1);

- d) the average sound pressure level of the machine as measured at points 1 and 5 should be a maximum of 1 dB above the average sound pressure level measured at points 3 and 7 (see figure 4);
- e) the dimensional ratio $l_{i1}/(l_T + l_E)$ of the measured multiposition machine and the quotient i_1/i_2 of the number of operating positions of machine 1 and

machine 2 are within the permissible range shown in figure 1.

The sound power level L_{W2} should be calculated from the sound power level L_{W1} of the machine, determined in accordance with 7.2, according to the formula

$$L_{W2} = L_{W1} - 10 \lg \frac{i_1}{i_2} \text{ dB}$$

For the shaded area in figure 1, the error in the calculated sound power level L_{W2} is 1 dB max.

6.2 Operating conditions of the textile machine

As the development of noise from textile machines depends upon the operating conditions, these shall be fully recorded in the test report. Annexes A to E give specific information with regard to particular machines, including description of the test objects, operating conditions and additional information to be recorded.

Additional points which should be taken into account:

- a) For machines for which the idling noise alone is stated and this exceeds the working noise, this fact shall be indicated in the test report. For machines for which the operating noise is greater, but cannot be clearly measured and therefore only the idling noise, for example, is measured, it shall be noted in the test report that the operating noise is greater.
- b) If characteristic operating values are quoted for the measurement of the noise, it shall be noted to what extent deviations from them affect the uncertainty of the noise-measuring value. The operating conditions to be selected for noise measurements on particular types of machines are given in annexes A to E.
- c) Revolution counters installed on the machines do not always have the accuracy required to determine the exact number of revolutions. The number of revolutions thus shall be determined by other means.

6.3 Installation of the machine

The installation of the machine should correspond to that used in practice. Should this not be known or should there be more than one way to install the machine, the chosen method shall be mentioned in the test report.

7 Sound pressure levels on the measurement surface

7.1 Measurement surface and microphone positions

7.1.1 Reference surface

To facilitate the location of the microphone positions, a hypothetical reference surface, or reference box, is defined (see 3.8). When defining the dimensions of this reference box, elements protruding from the source which are not significant radiators of sound energy may be disregarded.

7.1.2 Measurement surface

The measurement surface is defined in 3.7.

7.1.3 Measurement distance (see 3.9)

The preferred measurement distance d between the measurement surface and the reference parallelepiped is 1 m. A distance $d < 1$ m may be taken if the measurement surface sound pressure level cannot be ascertained with certainty because the background noise is too high. Measurements made at very small distances (0,25 m min.) still allow a comparison of machines of the same type with similar dimensions. A measuring distance $d > 1$ m may be used when necessary to ensure safety during the measurement. Deviations from a measurement distance of 1 m shall be mentioned in the test report.

7.1.4 Microphone positions on the measurement surface

The microphones are positioned on the measurement surface in one of the following arrangements:

7.1.4.1 Complete measurement point arrangement

The measurement points shall be taken from figures 2, 3 and 4 according to the size of the reference parallelepiped for floor-mounted machines. The number of measurement points shall be increased if the horizontal distance between adjacent points exceeds 2 m or if the difference between the highest and the lowest values of the A-weighted sound pressure level is larger than the number of measurement points. Care shall be taken that the measurement points are proportionately distributed.