

Method of

Measuring noise from machine tools excluding testing in anechoic chambers

Co-operating organizations

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices Technical Committee	Electricity Council, the Central Electricity
Association of Consulting Engineers	Generating Board and the Area Boards in
Association of Hydraulic Equipment	England and Wales*
Manufacturers Ltd.	Engineering Equipment Users' Association*
Association of Mining Electrical and	Gas Council*
Mechanical Engineers	Institution of Civil Engineers*
British Chemical Plant Manufacturers'	Institution of Gas Engineers
Association	Institution of Heating and Ventilating
British Compressed Air Society*	Engineers*
British Electrical and Allied Manufacturers'	Institution of Mechanical Engineers
Association*	Institution of Mechanical Engineers
British Gear Manufacturers' Association	(Automobile Division)
British Internal Combustion Engine	Institution of Plant Engineers
Manufacturers' Association	Institution of Production Engineers
British Mechanical Engineering	Locomotive and Allied Manufacturers'
Confederation	Association of Great Britain
British Pump Manufacturers' Association*	London Transport Executive
British Steel Industry*	Machine Tool Trades Association*
Crown Agents for Oversea Governments and	Ministry of Defence
Administrations	Ministry of Defence, Army Department
Department of Employment and	National Coal Board
Productivity (HM Factory Inspectorate)*	National Physical Laboratory
Department of the Environment	(Department of Trade and Industry)
Department of Trade and Industry	Royal Institute of British Architects
Department of Trade and Industry —	Telecommunications Engineering
National Engineering Laboratory*	Manufacturing Association
	Water-tube Boilermakers' Association

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Federation of Master Printers	Institute of Physics and the Physical Society
British Occupational Hygiene Society	Institute of Sound and Vibration Research
British Printing Machinery Association	Institution of Heating and Ventilating
British Ship Research Association	Engineers
Department of Employment and Productivity	Institution of Mining Engineers
(HM Senior Medical Inspector of Factories)	Machine Tool Industry Research Association
Electrical Research Association	Ministry of Defence (Navy Department)
Federation of Manufacturers of Constructional	National Sawmilling Association
Equipment and Cranes	Society of Environmental Engineers
Federation of Master Printers	Society of Motor Manufacturers and
Furniture Industry Research Association	Traders Ltd.
Heating and Ventilating and Air Conditioning	Timber Research and Development
Manufacturers' Association	Association
Imperial College of Science and Technology	Trades Union Congress
Institute of Marine Engineers	University of Southampton

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Foreword

This standard makes reference to the following British Standards:

BS 2475, *Octave and one-third octave band-pass filters*.

BS 4196, *Guide to the selection of methods of measuring noise emitted by machinery*.

BS 4197, *A precision sound level meter*.

This British Standard has been prepared as part of the Institution's work on the noise testing of machinery. The committee gratefully acknowledges the help given by earlier work on the noise testing of machine tools by such organizations as The Machine Tool Industry Research Association.

The object of this British Standard is to define a method whereby the noise of a machine tool may be measured with reasonable accuracy and repeatability but without necessitating the use of facilities and instrumentation unlikely to be in the hands of manufacturers and users of the machine tools. Some compromises with acoustically desirable features of a test method have been inevitable but are not considered serious in the context of the basic object.

The noise of many machine tools, when in use, is more a function of the load and the workpiece than of the machine tool itself. Noise levels established during a test with the machine tool in a particular loaded condition may well be peculiar to that condition which must therefore be described in detail and may be agreed between manufacturer and purchaser.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard relates to the procedure to be followed in carrying out noise tests on machine tools. It deals with general conditions, e.g. room suitability, background noise, etc., and with the measuring process, e.g. instrumentation, measuring points, units of measurement, etc., and gives details of a standard format for the statement of results. Where appropriate, the standard accords with BS 4196, which is based on ISO Recommendation R 495.

NOTE The recommendations in the present standard apply to continuous noise measured by conventional instruments. No completely reliable guidance is as yet available on the measurement of impulsive noise but when circumstances permit consideration will be given to the possibility of making suitable recommendations.

The test conditions specified are in general idealized but it is recognized that it may not always be practicable to achieve them and some indication is accordingly given of permissible departures from the ideal.

The machine should be tested in the unloaded condition and preferably also in the loaded condition but the resultant values are not to be quoted without stating the condition in which the machine was tested and, if in the loaded condition, what the loading conditions were.

It will be realized that these latter cannot be specified here since the variations in the factors that have to be taken into account, such as type of machine, type of material, nature of operation, speed, method of feed, etc., may be almost endlessly permutated, thus making it impossible to devise standard, universally applicable tests likely to give truly comparable results.

A full description of the test piece should be given.

Measurements are expressed as sound levels in dB(A) and as band pressure levels in dB for octave bands having centre frequencies from 63 Hz to 8 000 Hz.

NOTE The British Standards referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this British Standard the definitions given in BS 4196, together with the following, apply:

machine tool

a power driven machine, not portable by hand when working, intended to be used for working metal, wood, plastics and other materials by the removal of chips or swarf or by erosion, chipless formation or physico-chemical processing or a combination of some of these techniques

3 Test conditions

3.1 General

3.1.1 The machine should be tested with all the ancillary equipment essential for its operation, for example, hydraulics, power supplies, frequency converters, bar feeds etc.

If such equipment is remote from the machine, it should be the subject of separate tests.

3.1.2 Allowance should be made for running the machine up from cold to normal conditions.

3.2 Specific room suitability. The suitability of a room for testing machine tools may be determined by placing a small broad band random noise source with omnidirectional characteristics in the centre of the room and determining the sound level at the selected measuring points, either in dB(A) or in dB in each octave band as specified in 4.3, and at corresponding points twice their distance from the source.

NOTE If the outer measuring points are less than 3 m from a reflecting surface, the desired drop in sound level may not be obtained.

The drop in average sound level, determined as in Appendix B, between the inner and outer measuring points should be at least 5 dB. Sufficient measurements should be taken to establish the maximum distance that the inner measuring points can be from the reference source whilst still enabling this difference in readings to be achieved; this will indicate the maximum size of machine that can be tested in the room.

In situations where the required 5 dB differences in level cannot be achieved, the room may be used for machine noise measurements of a lower order of accuracy provided that the variations from 5 dB are stated separately.

The limitations on the accuracy with which the noise of some machine tools can be measured in a practical situation are both real and significant. The data obtained by a test to this British Standard must therefore be interpreted with a proper degree of caution especially when a machine tool may be placed in an acoustical environment different from that in which it was tested; for instance, placing a machine tool in a smaller room having boundary surfaces more reflective of sound will tend to increase the noise levels which would be measured in a repeat test.

For presentation of results, the measurements in dB(A) and octave bands shall be averaged in accordance with the procedure in Appendix B and included on the test record sheet.

Measurements should be expressed in dB(A) and in octave bands. Variations from 5 dB(A) should be stated.

3.3 Site testing. Many machines will be too large for the room under consideration to meet the room suitability criteria and these must be tested under site conditions. In this case, the machine itself may be used as the reference source and the doubling of distance should be related to the geometric centre or to the major noise source of the machine.

3.4 Background noise. The background noise level when the machine is not on test, expressed in either dB(A) or octave bands, as specified in 4.3 should be determined in each measuring position. The readings with the machine running should be taken at the same points and under the same conditions and should exceed the background level by at least 10 dB. When the differences are less than 10 dB the corrections given in Table 1 should be applied. If the difference between the measured sound and the background noise is less than 3 dB, a valid measurement cannot be obtained.

Table 1 — Background noise

Increase in level to nearest dB produced by the machine	Amount to be subtracted from the measured value
dB	dB
3	3
4–5	2
6–9	1

Noise measurements at each measuring point should be recorded for the machine and the background noise and the corrected values should also be recorded where applicable.

Ideally the background noise level should remain constant during the period of test. However, if any changes in the background noise level do occur, then these changes should be noted so that the appropriate corrections can be made to the total noise.

3.5 Mounting conditions. The machine should be mounted in accordance with the manufacturer's instructions. Mounting conditions, e.g. type of floor, anti-vibration mounting, etc., should be recorded.

4 Measurements

4.1 Measuring points

4.1.1 Prescribed path positions. The prescribed path should be taken as 1 m from the vertically projected plan of the machine at a height of 1.5 m, ignoring small projections caused by, e.g. handwheels, stop bars, etc. In the case of machine tools whose operation necessitates or permits a change in the projected plan due to, for example, a travelling table, the prescribed path should be drawn 1 metre from the extremities of the change in the projection plan.

Microphone positions should be at horizontal separations of not more than 1.5 m along the prescribed path around the machine commencing on the major axis of the machine. The number of measuring points should not be less than 5 and should include the point at which the sound level in dB(A) is the highest. Typical measuring positions for representative types of machines are illustrated in Appendix A.

4.1.2 Other positions. In addition to the above, measurements should be taken at the operating position and at any other positions that may be occupied by personnel for a significant proportion of their working day. Such measurements should be reported separately and excluded from the calculations of mean sound levels.

4.2 Measuring instruments

4.2.1 Type of instrument. The instruments used for making measurements for the purpose of the tests specified in this standard should be precision grade sound level meters in accordance with BS 4197 and octave band filters in accordance with BS 2475, used strictly in accordance with the manufacturer's instructions.

The instruments should be calibrated in accordance with the requirements of these standards both before and after the test.

If any other equipment, such as a tape recorder or graphic level recorder is used, its stability and frequency response should be at least equal to that of the sound level meter and microphone system over the frequency range specified.