

CONFIRMED
DECEMBER 2007

Accuracy of machine tools and methods of test —

Part 1: Specification for lathes, general purpose type

UDC 621.9.01 – 187.001.4:621.941

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Ball and Roller Bearing Manufacturers' Association	University of Aston in Birmingham
Federation of British Engineers' Tool Manufacturers	University of Manchester, Institute of Science and Technology

This British Standard, having been prepared under the direction of the Mechanical Engineering Standards Committee, was published under the authority of the Executive Board and comes into effect on 30 September 1981

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First published December 1970
First revision September 1981

The following BSI references relate to the work on this standard:
Committee reference MEE/6
Draft for comment 80/78071 DC

ISBN 0 580 12302 2

Amendments issued since publication

Amd. No.	Date of issue	Comments
7743	August 1993	Indicated by a sideline in the margin

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Foreword

This Part of this British Standard has been prepared under the direction of the Mechanical Engineering Standards Committee and implements agreements of the International Organization for Standardization (ISO).

This revision supersedes the 1969 edition which is therefore withdrawn. Amendment has been undertaken consequent upon the publication of the 1989 edition of ISO 1708 to which it is technically equivalent, except where stated below.

This standard differs from ISO 1708 in the following respects.

Clauses. Clauses 1 and 3 of this Part of this standard contain the same information that is given in ISO 1708 but they are presented in accordance with an accepted format which has been developed for the BS 4656 series. Clauses 4 and 5 have been added.

Inch dimensions. In accordance with the UK policy of metrication, inch dimensions given in ISO 1708 have not been included in this British Standard.

Tables. In column 6 of Table 1 reference to ISO/R 230 “Machine tool test code” has been replaced by reference to BS 3800.

In test G2 column 7 b) of ISO 1708 it states “The deviation of straightness of carriage movement shall, other than in exceptional cases, be concave relative to the axis of the centres”. This note has not been included.

In test G15, the qualification that the operation may be deleted if test P3 is carried out has been added.

In the observations column of test G15 of ISO 1708 there are two statements which have not been included in this standard, viz:

“However, for both classes of lathes, a record of the lead screw accuracy (over a specified length and checked along four generators shifted 90° forward) should be satisfactory.

NOTE By agreement between manufacturer and user on the measuring method and the values of the permissible deviation, total error may be checked over 300 mm.

Practical tests.

In test P1 (a), the tolerance for precision lathes has been reduced from 0.007 mm to 0.005 mm.

In test P2, the proportionality rule (see clause 4) has been, more correctly, introduced into the method of expressing permissible deviation.

In column 3 of test P3, it is stipulated that the pitch shall be equal to half that of the lead screw, as this will detect screw thread drunkenness. ISO 1708 calls for the pitch to be as close as possible to that of the lead screw, which is not a sufficiently stringent test.

In tests P1, P2, and P3, the test-piece material is free-cutting steel. ISO 1708 calls for steel or cast iron.

Appendix. Appendix A has been added.

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 Part of this British Standard specifies, with reference to BS 3800, both geometrical and practical tests for centre lathes of general purpose type and gives corresponding permissible deviations which apply.

This standard is applicable to machines of general purpose use and of two classes of accuracy: precision and normal accuracy.

It deals only with the verification of accuracy of the machine. It does not apply to the testing of the running of the machine (vibrations, abnormal noises, stick-slip motion of components, etc.) nor to its characteristics (speeds, feeds, etc.) which should generally be checked before testing accuracy.

2 References

The titles of the publications referred to in this standard are listed on the inside back cover.

3 Application of test methods

3.1 In applying the tests detailed in Table 1 and Table 2, reference should be made to BS 3800, especially concerning the installation of the machine before testing, warming up of spindles and other moving parts, the description of measuring methods and the recommended accuracy of testing equipment.

3.2 The tests may be applied in any order that is practicable and that makes for ease of mounting of instruments or gauging. The sequence in which the geometrical tests are listed in Table 1 is related to the sub-assemblies of the machine and it is not intended to impose the practical order in which the tests are to be done.

3.3 It is not always necessary for all the tests specified in this standard to be carried out. The purchaser shall be at liberty to select, in agreement with the manufacturer, those tests relating to the properties that are of interest to him. The appropriate tests are to be clearly stated when the machine is ordered.

3.4 Practical tests should be made with finishing cuts (e.g. depth 0.1 mm, feed 0.1 mm per revolution) and not with roughing cuts, which are liable to generate appreciable cutting forces.

3.5 When establishing the tolerance for a measuring range different from that given in this standard (see 2.311 of BS 3800:1964) it should be taken into consideration that the minimum value of tolerance is 0.005 mm for precision lathes and 0.01 mm for other lathes for geometrical and practical tests.

4 Abbreviations

For the purposes of this standard, various methods of expressing permissible deviations are employed, each having a particular type of application. The methods employed are as follows.

-- / -- This type of expression applies to deviations of perpendicularity that are ratios.

-- for any length of -- This type of expression applies to deviations of straightness and parallelism, and is used in fact for local permissible deviations, the measurement length being obligatory.

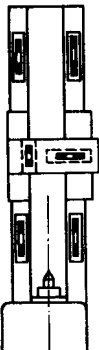
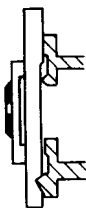
-- per -- This type of expression applies to deviations of straightness and parallelism and is used to recommend a measurement length, but in this case the proportionality rule comes into operation if the measurement length differs from that indicated.

5 Diagrams

For reasons of simplicity the diagrams in this standard illustrate only one type of machine.

Table 1 — Geometrical tests for centre lathes, general purpose type

All dimensions are in millimetres

1	2	3	4	5		6	7
No.	Diagram	Object	Permissible deviation		Measuring instruments	Observations and references to the test code BS 3800:1964	
			Precision lathes ^a $Da \leq 500$ ^b $DC \leq 1\ 500$	Other lathes $Da \leq 800$ $800 < Da \leq 1\ 600$			
G1	a) 	Checking of straightness of the slideways	$DC \leq 500$ 0.01 (convex) $500 < DC \leq 1\ 000$ 0.015 (convex) Local tolerance: 0.005 for any length of 250 $1\ 000 < DC \leq 1\ 500$ 0.020 (convex) Local tolerance: 0.005 for any length of 250	$DC \leq 500$ 0.01 (convex) $500 < DC \leq 1\ 000$ 0.020 (convex) Local tolerance: 0.0075 for any length of 250 $DC > 1\ 000$ 0.02 + 0.01 for each additional 1 000 (convex) Local tolerance: 0.015 for any length of 500	$DC \leq 500$ 0.015 (convex) $500 < DC \leq 1\ 000$ 0.030 (convex) Local tolerance: 0.010 for any length of 250 $DC > 1\ 000$ 0.03 + 0.02 for each additional 1 000 (convex) Local tolerance: 0.020 for any length of 500	Precision levels, optical or other methods	3.11, 5.212.21 and 5.212.21 Measurements shall be made at positions equally distributed throughout the length of the bed The levels shall be placed on transverse slide When the sides are not horizontal, use a special straightedge as mentioned in 5.212.21 b)
	b) 	b) Transverse check: slideways should be in the same plane	$0.03/1\ 000$	$0.04/1\ 000$	$0.04/1\ 000$	Precision levels	5.412.7 A level shall be placed transversely on the slideways and measurements taken at a number of positions equally spaced along the length of the slideways. The variation of level measured at any position shall not exceed the permissible deviation

Da means maximum permissible diameter above the bed.

DC means distance between centres.

See Appendix A.

Da means maximum permissible diameter above the bed.
 DC means distance between centres.
 See Appendix A.