BS 4065:1966

Specification for

Plain setting rings for use with internal diameter measuring machines —

Inch units

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
Association of Consulting Engineers
Association of Mining Electrical and Mechanical Engineers
Board of Trade
British Chemical Plant Manufacturers' Association
British Compressed Air Society
British Electrical and Allied Manufacturers' Association
British Gear Manufacturers' Association
British Internal Combustion Engine Manufacturers' Association
British Iron and Steel Federation
British Mechanical Engineering Federation
British Railways Board
Crown Agents for Oversea Governments and Administrations
Electricity Council, the Generating Board and the Area Boards in England and Wales
Engineering Equipment Users' Association
Gas Council
Institute of Marine Engineers
Institution of Civil Engineers
Institution of Gas Engineers
Institution of Heating and Ventilating Engineers
Institution of Mechanical Engineers
Institution of Mechanical Engineers (Automobile Division)
Institution of Production Engineers
Locomotive and Allied Manufacturers' Association of Great Britain
London Transport Board
Machine Tool Trades Association
Ministry of Defence, Army Department
Ministry of Defence, Navy Department
Ministry of Labour (H.M. Factory Inspectorate)
Ministry of Power
Ministry of Public Building and Works
Ministry of Technology — National Engineering Laboratory
Ministry of Transport
National Coal Board
National Physical Laboratory (Ministry of Technology)
Radio Industry Council
Royal Institute of British Architects

This British Standard, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on
22nd September 1966

The following BSI references relate to the work on this standard:
Committee reference MEE/59
Draft for comment D64/10832

ISBN 0 580 32431 1

Amendments issued since publication

Amd. No.	Date	Comments

Contents

Foreword

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 4 000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook. The BS Yearbook may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

BS 1044, *Gauge blanks.*

BS 1134, *Centre-line average height method for the assessment of surface texture.*

BS 3730, *Methods for the assessment of departures from roundness.*

This standard has been prepared under the authority of the Mechanical Engineering Industry Standards Committee. It forms one of a series of standards, published and in course of preparation, for engineers' precision tools and has been prepared with the co-operation of the manufacturers and in close collaboration with the National Physical Laboratory. It provides only for inch setting rings; similar requirements for metric rings are given in a separate standard.

Numerous types of instruments are now available for the measurement of internal diameters. They vary in design, application and accuracy of performance. Many of these instruments effect measurements by means of two-point contacts but some use three-point contacts and indicate a derived diameter and others, notably air gauges, do not use contacts at all.

The present standard covers requirements for plain rings intended for setting such instruments and suitable for use with those employing two-point or three-point measuring contacts and with those which are independent of physical contact. They are in three grades of accuracy and the standard has been based on considerations aimed at providing a series of plain setting rings that will serve for all types of internal measuring equipment whilst at the same time avoiding the high costs entailed in manufacturing unnecessarily close to a specified size.

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 4, 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.

Introduction

The first requirement for a setting ring is that its measuring surface is cylindrical to within close limits. The actual diameter of the ring is relatively unimportant providing its size is known, or known to be within specified limits. Separate tolerances have therefore been allocated for truth of cylindrical form and for departure of diameter from nominal size; thus, Columns 2 and 3 of the table in **5.4** give values designed to ensure that the bore of the ring is round and parallel within limits consistent with its grade of accuracy and Column 4 gives the recommended maximum departures of the mean measured diameter from the nominal size specified by the user. Although, as has already been stated, the actual diameter of the ring is less important than its geometrical form, it is nevertheless essential to know, when setting an instrument, how closely the size stated for the ring has been established and Column 5 accordingly specifies the accuracy of determination appropriate to the various grades.

Further, when considering the diametral tolerances for setting rings, it is important that the effect of possible departures from ideal roundness be clearly understood. It is a well known fact that uniform diametral measurements of a cylinder, obtained by using two diametrically opposite measuring contacts, do not necessarily mean that the cylinder is truly circular in section. It may suffer from departures from ideal roundness. Measurement of a cylinder by means of three contacts, for example, may reveal form deviations undetected when only two opposite contacts are used. In order to ensure that departures from roundness can be expressed numerically and consistently controlled and assessed, a British Standard, BS 3730[1)], has been published and deals in detail with the numerical assessment of departures from ideal roundness. All references in the present standard to the departures of setting rings from ideal roundness are based on the procedures recommended in BS 3730.

The standard calls for all setting rings to be examined for departures from ideal roundness. This is to ensure that any ring complying with the standard will be suitable for checking all types of internal measuring equipment regardless of whether two or three measuring contacts are employed.

1 Scope

1.1 This British Standard relates to plain setting rings primarily intended to be used, either singly or in combination, for checking the scales on internal diameter measuring equipment.

It provides for a range of inch rings in sizes from 0 08 in to 6 inches in three grades of accuracy, viz.

Grades AA, A and B.

NOTE Sizes below 0 08 in are not included because it is impracticable to measure them.

Requirements are specified for material, hardness and surface texture and recommended sections for the setting rings covered by this standard are included in an appendix.

2 Material and hardness

2.1 Setting rings shall preferably be made of good quality steel suitably hardened and stabilized and free from inclusions.

The measuring surface of a steel setting ring shall have a hardness value of not less than 750 HV (59 HRC).

Other materials may be used only if the setting rings produced have properties of hardness and stability at least equal to those specified for steel setting rings.

NOTE Details of a method of stabilizing suitable for plain carbon steel are given in Appendix A.

3 General features of design

3.1 Both end faces of the rings shall be finished and the edges of the bore shall have a small chamfer or radius.

The axis of the bore shall be square to the supporting surface to within 0 001 in per inch and the ring, when placed on an accurately flat surface, shall be free from rock.

Recommended general dimensions for the outside diameter and depth of measuring surface of setting rings are given in Appendix B.

[1)] BS 3730, "Methods for the assessment of departures from roundness."

4 Surface texture

4.1 When assessed in accordance with BS 1134[2], the surface texture of the measuring surface of a setting ring shall have a roughness value not exceeding the following amounts:

Grade AA	2 micro-in CLA
Grade A	4 micro-in CLA
Grade B	8 micro-in CLA

Any defect in the measuring surface shall not influence the use of the ring nor, in the case of a new ring, detract from the appearance associated with a precision setting standard.

5 Accuracy

5.1 *General.* All measurements shall be referred to the standard temperature of 20 °C.

NOTE Care should be taken when using the rings to avoid excessive handling which might cause variations in size due to heating.

5.2 *Geometric form.* Within the middle half of the depth of the ring the cylindrical measuring surface, as measured with a two-point contact, shall be uniform in diameter, i.e. it shall be parallel, to within the values given in Column 2 of the table, and when assessed in accordance with BS 3730[3] departures from ideal roundness shall not exceed the permissible values given in Column 3.

The departure from roundness is defined as the difference in radii of two co-planar concentric circles, the annular space between which just contains the profile of the surface examined.

5.3 *Measured size.* The mean diameter of a setting ring shall be taken as the mean of at least four diameter measurements made at the mid-plane and it is recommended that this diameter does not depart from the nominal size of the ring by more than the amounts given in Column 4 of the table.

If required, the measured size at a localized plane may be specified for Grade AA rings.

5.4 *Accuracy of determination.* The measured size referred to in **5.3** above shall be determined with the accuracy specified for the grade in question in Column 5 of the table.

Accuracy of setting rings

Unit = 1 micro-inch (0·000 001 in)

1			2			3			4			5		
			Geometric form						Recommended maximum departures of mean measured size from nominal size (measured in the mid-plane)			Accuracy of determination of measured size		
			Uniformity of diameter as measured by two-point contact			Roundness[a]								
	Grade		AA	A	B	AA	A	B	AA	A	B	AA	A	B
Nominal diameter in inches	Over	Up to and including												
	0·079	1	20	50	100	10	25	50	30	80	150	± 10	± 30	± 50
	1	2	40	100	200	20	50	100	60	150	300	± 20	± 50	± 100
	2	4	60	150	300	30	75	150	90	230	450	± 30	± 80	± 150
	4	6	80	200	400	40	100	200	120	300	600	± 40	± 100	± 200

[a] See **5.2**

[2] BS 1134, "Centre-line-average height method for the assessment of surface texture."

[3] BS 3730, "Methods for the assessment of departures from roundness."

6 Certificate and marking

6.1 *Certificate.* The manufacturer shall supply a certificate of measured size with each setting ring.

6.2 *Marking.* Each setting ring shall be legibly and permanently marked on the top face with the particulars given below.

The marking shall be applied in such a manner that it does not affect the accuracy of the setting ring.

1) The manufacturer's name or trade mark.

2) The number of this British Standard, BS 4065.

3) The grade, i.e. AA, A or B.

4) A serial number.

5) If required by the purchaser, the measured size of the ring.

NOTE The mark BS 4065 on or in relation to the product is a claim by the manufacturer that it complies with the requirements of the standard.

The British Standards Institution is the owner of a registered certification trade mark. This is shown below, enclosed in the words "Approved to British Standard". This mark can be used only by manufacturers licensed under the certification mark scheme operated by the BSI. The presence of this mark on or in relation to a product is an assurance that the goods have been produced to comply with the requirements of the British Standard under a system of supervision, control and testing operated during manufacture and including periodical inspection at the manufacturer's works in accordance with the certification mark scheme of the BSI.

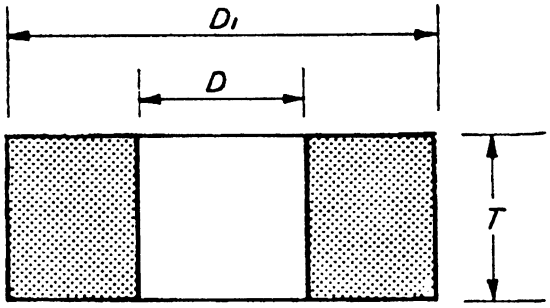
Further particulars of the terms of licence may be obtained from the Director, British Standards Institution, 2 Park Street, London, W.1.

Appendix A Stabilization of steel setting rings

A suitable method of stabilizing steel setting rings is as follows:

The rings are stabilized after hardening by heating them to, and maintaining them at, a temperature of 150 °C for a period of from 5 to 10 hours and allowing them to cool slowly in the furnace.

Appendix B Recommended general dimensions of setting rings



1	2	3	4
D		D_1	T
Over	Up to and including		
in	in	in	in
0·079	0·2	0·8	0·3
0·2	0·4	1·2	0·4
0·4	0·6	1·4	0·6
0·6	0·8	2·0	0·8
0·8	1·0	2·6	1·0
1·0	1·5	3·3	1·2
1·5	2·0	4·0	1·2
2·0	2·5	4·5	1·2
2·5	3·0	5·0	1·4
3·0	3·5	5·5	1·4
3·5	4·0	6·0	1·4
4·0	4·5	6·5	1·4
4·5	5·0	7·2	1·4
5·0	5·5	8·1	1·5
5·5	6·0	9·0	1·5

NOTE Although the dimensions given in the above table differ in some respects from those specified for plain ring gauges in BS 1044 "Gauge blanks", the nearest corresponding standard blank will in most cases be suitable.

BRITISH STANDARDS

The following are available on application:—
YEARBOOK
Including subject index and numerical list of British Standards
SECTIONAL LISTS. Gratis
Acoustics
Aircraft materials and components
Building materials and components
Chemical engineering
Chemicals, fats, oils, scientific apparatus, etc.
Cinematography and photography
Coal, coke and colliery requisites
Codes of Practice
Consumer goods
Documentation, including Universal Decimal Classification
Drawing practice
Electrical engineering
Farming, dairying and allied interests
Furniture, bedding and furnishings
Gas and solid fuel and refractories
Glassware including scientific apparatus
Hospital equipment
Illumination and lighting fittings
Industrial instruments, etc.
Iron and steel
Machine tools
Mechanical engineering
Nomenclature, symbols and abbreviations
Non-ferrous metals
Packaging and containers
Paints, varnishes, paint materials and colours for paints
Personal safety equipment
Petroleum industry
Plastics
Printing, paper and stationery
Road engineering
Rubber
Shipbuilding
Textiles and clothing
Welding

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL