

Specification for
Jig bushes —

Part 1: 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 Pump Manufacturers' Association
- Crown Agents for Oversea Governments and Administrations
- Electricity Council, the Central Electricity 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
- 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

The Government department 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:

- Gauge & Tool Makers' Association
- Ministry of Defence (Navy Department)
- National Federation of Engineers' Tool Manufacturers
- Society of British Aerospace Companies Ltd.
- Society of Motor Manufacturers and Traders Ltd.
- Twist Drill Association

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Foreword

This standard makes reference to the following British Standards:

BS 122, *Milling cutters and reamers — Part 2: Reamers, countersinks and counterbores*.

BS 328, *Twist drills and combined drills and countersinks — Part 1: Twist drills*.

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

BS 1580, *Unified screw threads*.

BS 1916, *Limits and fits for engineering — Part 1: Limits and tolerances*.

BS 2634, *Roughness comparison specimens — Part 1: Ground flat and cylindrical types*.

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

The main purposes of this revision of BS 1098 are to bring it up to date by providing bore tolerances which will enable the bushes to accommodate drills and reamers made in accordance with the latest revision of BS 328, “*Twist drills and combined drills and countersinks*”. Part 1, “*Twist drills*”, and BS 122 “*Milling cutters and reamers*”, Part 2, “*Reamers, countersinks and counter-bores*”, and to incorporate requirements for accuracy designed to control the form and surface texture as well as the dimensions of the bushes.

Thus, in addition to the close dimensional tolerances previously specified, the standard now contains tolerances on concentricity and roundness and states a roughness value for the ground bore. A minimum hardness for the bushes is also stated.

The tolerances on the outside diameters of press fit bushes and liners remain unaltered as they are considered to be those most likely to ensure that the bushes will be a good fit in the jig plate holes which it is recommended should be made to the limits of tolerance specified for H6 in BS 1916, “*Limits and fits for engineering*”, Part 1, “*Limits and tolerances*”.

A detailed study of the phenomenon of “closing-in” disclosed that whatever control is exercised the actual amount of “closing-in” is unpredictable.

In those instances therefore where maximum precision results are required, or where appreciable “closing-in” would prevent acceptance of a standard reamer, the user is recommended to make actual measurements of the outside diameters of the bushes before boring holes in the jig-plates.

Part 2 of this standard specifies dimensions for jig bushes in metric units.

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 13 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 bushes to be fitted to jigs for the purpose of guiding twist drills or reamers. It is primarily dimensional, and the bushes standardized are intended for use with inch or metric drills and reamers as specified in BS 328-1¹⁾ and BS 122-2²⁾ respectively.

Provision is made for the following types of bushes:

- 1) Press fit bushes, which may be either headed or headless.
- 2) Renewable bushes, fixed type.
- 3) Renewable bushes, slip type.
- 4) Liners, which may be either headed or headless.

2 Nomenclature and definitions

For the purposes of this British Standard the following definitions apply:

2.1

press fit bush

a bush pressed directly into the appropriate hole in the jig and used for guiding a drill or reamer in cases where it is not anticipated that replacement of the bush will be necessary, or where the dimensions between the centres of adjacent holes are such as to preclude the use of renewable bushes and liners. A press fit bush is available with or without a head (See Figure 1.)

2.2

renewable bush

a bush intended for insertion in a liner which has been fitted directly into a part of the jig. There are two types of renewable bushes: the "slip" bush designed to facilitate rapid changing in cases where, for instance, several differing operations and tools are required to follow the same general guide, and the "fixed" type which is intended to remain in the jig until too worn for further use (See Figure 2 and Figure 3.)

2.3

liner

a bush, with or without a head, fitted permanently in a jig plate for the purpose of accommodating renewable bushes (See Figure 4.)

2.4

locking device

a means for ensuring that renewable bushes do not turn or otherwise move during operation (See Appendix A and Figure 5 and Figure 6.)

3 General features of design

3.1 General. All bores shall be provided with a chamfer or radius at the upper edge which shall blend with the bore by means of a slight radius. (See Figure 1 to Figure 4.)

3.2 Headed bushes and headed liners. These shall be provided with an undercut, both on body diameter and face, at the intersection of the underside of the head with the outside diameter of the body. (See Figure 1 to Figure 4.)

3.3 Press fit bushes and liners. These bushes, when finished, shall be provided with a lead of 1 degree per side. The length of lead, measured parallel to the axis of the bush, shall be in accordance with Column 9 of Table 1 and Table 4 respectively.

3.4 Renewable bushes. Both fixed and slip types of renewable bushes shall have a washer face on the underside of the head to facilitate removal; in addition, they may also be knurled on the periphery of the head.

The dimensions of the washer face shall be in accordance with Columns 11, 12 and 13 of Table 2 and Columns 12, 13 and 14 of Table 3 respectively.

4 Finish

4.1 All sharp edges shall be removed.

4.2 All surfaces of bushes and liners shall be free from cracks and other surface defects.

4.3 When assessed in accordance with BS 1134³⁾, the surface texture of the ground bore and outside diameters shall have a roughness value not exceeding 16 micro-inch CLA.

Production control of surfaces may be effected through the use of roughness comparison specimens to BS 2634-1⁴⁾.

5 Hardness

The bushes shall be hardened to a minimum hardness value of 746 HV.

¹⁾ BS 328, "Twist drills and combined drills, and countersinks", Part 1, "Twist drills".

²⁾ BS 122, "Milling cutters and reamers", Part 2, "Reamers, countersinks and counterbores".

³⁾ BS 1134, "Centre-line-average height method for the assessment of surface texture".

⁴⁾ BS 2634, "Roughness comparison specimens", Part 1, "Ground flat and cylindrical types".

6 Dimensions and tolerances

6.1 General. The dimensions and tolerances of jig bushes shall be in accordance with Table 1 to Table 6 inclusive and with the provisions of Clause 7.

6.2 Bore tolerances

6.2.1 Drill bushes. The tolerances on the bores of bushes for use with twist drills are related to the tolerances on the cutting diameters of drills as specified in BS 328-1⁵⁾.

6.2.2 Reamer bushes. The tolerances on the bores of bushes for use with reamers are related to the tolerances on the cutting diameters of reamers as specified in BS 122-2⁶⁾.

6.3 Outside diameter tolerances. The tolerances on the outside diameters of press fit bushes and liners are designed to enable them to be used in jig plates made to H6 tolerances as specified in BS 1916⁷⁾.

7 Accuracy

7.1 Concentricity. The bore of the bush shall be concentric with the outside diameter of the body to within 0.0003 in total indicator reading for bores up to and including $\frac{5}{8}$ in and 0.0005 in total indicator reading for larger bores.

7.2 Roundness of bore. Departures from ideal roundness, when assessed radially in accordance with BS 3730⁸⁾, shall not exceed one-third of the tolerance on the size of the bore under consideration.

8 Renewable slip bushes

8.1 Bore groups. The maximum bore diameter in any one group of renewable slip bushes shall be greater than the minimum bore diameter of the next larger group, as shown in Table 3, in order to enable a hole, the diameter of which approaches the nominal transitional dimensions between any two groups, to be both drilled and reamed through bushes from a common group.

8.2 Marking and identification. Renewable slip bushes shall be marked with the nominal bore size. In order to distinguish between those slip bushes intended for use with drills and those for use with reamers, reamer bushes shall, in addition, have a circumferential groove ground or machined around the periphery of the head. The groove may be of any convenient width but it is recommended that the depth be slightly greater than that of the knurling.

9 Locking screws

9.1 General dimensions. It is recommended that the general dimensions of locking screws, when provided, be in accordance with Table 7.

9.2 Screw threads. It is recommended that screw threads be $\frac{5}{16}$ – 18 UNC for bushes having body diameters up to and including $1\frac{3}{8}$ in and $\frac{3}{8}$ – 16 UNC for larger bushes and that they be made to Class 2A tolerances as specified in BS 1580⁹⁾.

⁵⁾ BS 328, "Twist drills and combined drills and countersinks", Part 1, "Twist drills".

⁶⁾ BS 122, "Milling cutters and reamers", Part 2, "Reamers, countersinks and counterbores".

⁷⁾ BS 1916, "Limits and fits for engineering", Part 1, "Limits and tolerances".

⁸⁾ BS 3730, "Methods for the assessment of departures from roundness".

⁹⁾ BS 1580, "Unified screw threads".