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Symbols for machine tools —

Part 1: General symbols

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Board of Trade	Institution of Heating and Ventilating Engineers
British Chemical Plant Manufacturers' Association	Institution of Mechanical Engineers
British Compressed Air Society	Institution of Mechanical Engineers (Automobile Division)
British Electrical and Allied Manufacturers' Association	Institution of Production Engineers*
British Gear Manufacturers' Association	Locomotive and Allied Manufacturers' Association of Great Britain
British Internal Combustion Engine Manufacturers' Association	London Transport Board
British Mechanical Engineering Confederation	Machine Tool Trades Association*
British Pump Manufacturers' Association	Ministry of Defence
British Steel Industry	Ministry of Defence, Army Department
Crown Agents for Oversea Governments and Administrations	Ministry of Power
Department of Employment and Productivity (H.M. Factory Inspectorate)	Ministry of Public Building and Works
Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales	Ministry of Technology
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	Ministry of Transport
	National Coal Board
	National Physical Laboratory (Ministry of Technology)
	Royal Institute of British Architects

The 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.

Machine Tool Industry Research Association

This British Standard, having been approved by the Mechanical Engineering Industry Standards Committee, was published under the authority of the Executive Board on 31 March 1971

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Amendments issued since publication

Amd. No.	Date	Comments
1310	February 1974	
3974	June 1982	Indicated by a sideline in the margin

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Foreword

This standard makes reference to the following British Standards:

BS 381C, *Specification for colours for identification, coding and special purposes.*

BS 2917, *Graphical symbols for use in diagrams for hydraulic and pneumatic systems.*

BS 4099, *Colours and their meaning when used for indicator lights, annunciators and digital readouts in industrial installations.*

BS 5378, *Safety signs and colours.*

BS 5378-1, *Specification for colour and design.*

This British Standard has been prepared under the authority of the Mechanical Engineering Industry Standards Committee.

The first edition of this standard was published in 1963. In addition to the symbols which appeared in ISO Recommendation R 369, “*Symbols for indications appearing on machine tools*”, it also included a number of additional items as a result of comments from members of the British Machine Tool Industry.

This second edition has been produced as the result of a request from the Machine Tool Trades Association. The range of national symbols has been increased to cater for present day developments. Some of the additional symbols are new British ones, whilst others have been adopted from overseas standards. The symbols are grouped and numbered in sections, thus allowing for any future extensions which experience may show to be necessary.

It is emphasized that all the sketches show basic symbols only. In many cases it will be found advantageous to carry out the grouping of certain symbols on instruction plates. Such grouping is entirely related to individual requirements and therefore this standard makes no attempt to specify which groupings should be used, although examples are shown for guidance purposes in Appendix A. It is important to note, however, that in all cases only the standard basic symbols should be used within any group.

Symbols representing elements may be replaced by others similar but nearer the actual shape of the machine element. Symbols relating to pneumatic and hydraulic connections are omitted from this standard because they fall within the scope of BS 2917¹⁾, which deals with graphical symbols for fluid power transmission.

A subsequent Part of this standard will deal with additional symbols particularly required for numerically controlled machine tools.

This standard was amended in 1982 to take account of the requirements of BS 5378-1:1980²⁾ and the Safety Signs Regulations, 1980 (SI 1980, No. 1471), because machine tools are used in places of work where the requirements of these regulations apply. Symbols in this standard are intended primarily for purposes of operator information, but where a symbol is used for safety reasons attention is also drawn to BS 5378-1.

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 25 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⁾ BS 2917, “Graphical symbols for use in diagrams for hydraulic and pneumatic systems”.

²⁾ BS 5378-1, “Safety signs and colours, Part 1. Specification for colour and design”

0 General

0.1 Scope

This British Standard specifies basic designs for symbols intended for use on machine tools.

Drawings in this standard relate to the form of symbols only and are not absolute dimensional representations.

The standard makes recommendations for proportions to be used in the design of symbols, independent of actual dimensions.

The standard provides for the grouping together of symbols selected from the same or different sections of the standard according to individual requirements.

Examples of groupings of symbols are given in Appendix A for guidance purposes.

0.2 Sizes and proportions

The symbols shown in this standard are accurately reproduced at basic size to a 0.8 mm grid. Where it is necessary to establish actual sizes then the symbols shown may be measured using a 0.8 mm transparent grid.

The absolute size of symbol is at the designer's discretion and indeed it may be desirable to have symbols in two different basic sizes to achieve proper display balance; again, when using two different basic sizes the proportions shown here will give a consistent appearance within each of the two size ranges selected.

The symbols have been designed using a basic reference grid of 5 units by 5 units where 1 unit = 0.8 mm. Each symbol is built up so that, with only a few exceptions, the symbol is circumscribed by rectangles which are modular with respect to the 5 unit grid, e.g. 5×10 , 10×15 , 10×40 . In no case does the largest dimension of a symbol exceed 40 units.

The normal line thickness is 0.8 mm; where it has proved necessary to depart from the standard 0.8 mm line thickness this is immediately apparent.

In certain symbols, points and circles need to appear in contact with one another. However, if reproduced touching (no matter which method of reproduction is used) blurring of points and fusing of tangential circles would occur. To minimize these effects, certain symbols show a small but deliberate clearance of 0.4 unit between some of the constituent elements of the symbol.

0.3 The use of the arrow

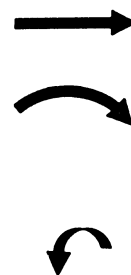
The arrow shape is a unique symbol in relation to all of the symbols in this standard and thus deserves special consideration on its own. It rarely appears as an isolated element, but is frequently used as the basis for a symbol, or qualifies another symbol to give it additional meaning.

There are four different applications using the arrow shape and it is desirable to use a different form in each of these instances:

- directional information,
- relative motion information,
- dimensional information,
- functional information.

0.3.1 Directional information arrows.

The recommended form of a directional arrow is shown on the right, the important dimensions being the shape and proportion of the head and the associated width of the shaft. Overall length is not crucial and may be varied to accommodate situations where the arrow is graphically combined with other symbol parts. The curved form is for rotational information, the perspective view being superimposed on a shaft representation.



0.3.2 Relative motion information.

Where it is not possible to define exactly the direction in space it is often useful to define relative motion between two machine parts; in this case the truncated arrow heads are used in pairs to define "in" (or towards) and "out" (or away from).



0.3.3 Dimension arrows.

For symbols where dimensional concepts are required, an open headed arrow with no shaft is used.



0.3.4 Functional arrows.

Many symbols require a functional dynamic in the form of an arrow to improve their ease of interpretation. It is inappropriate to use the same arrow form as is used to define spatial directions, as the arrow shown on such symbols need not imply a specific direction. A heavier, bolder form of functional arrow is used in these cases.



0.4 The grouping of symbols

It is comparatively rare for a single symbol to be used in isolation. The grouping of symbols on displays is implicit in their application. These groupings generally fall into one of three types of association.

1) Hierarchical arrangements. One symbol serves as a general label or heading for a further more detailed group of symbols, e.g.

pump		worktable	
start	stop	clockwise	anticlockwise

- 2) Pairing of symbols to build more complex symbol, e.g.
transverse feed; engage tracer
- 3) Association of symbol with value or quantity, e.g. feed X mm per revolution

0.4.1 Classification

To facilitate and rationalize these combinations, the standard has been structured as follows.

- Section 1. Modes
- Section 2. Elements
- Section 3. Values
- Section 4. Actions
- Section 5. Safety and status indications

These categories may need to be expanded in future to accommodate new symbols, especially for numerical control.

Section 6. Compound symbols

This shows some of the derived symbols which are directly related to the basic set. These show some of the more common symbol combinations, but in theory any combination is possible.

Section 1. Modes

The modes are categorized under four sub-headings.

1.1

Operating modes major machining functions.

1.2

Movement modes: defining the nature of linear and rotational motions. The direction in space is derived from the primary definition of directions in the introductory section and the element symbol to which the movement mode applies is combined with the movement mode symbol.

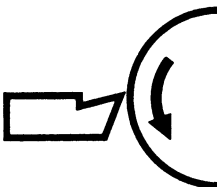
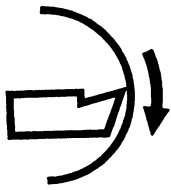
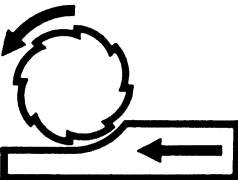
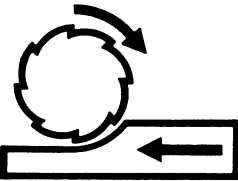
1.3

Control modes: these define the manner in which the machine or element is controlled.

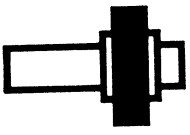
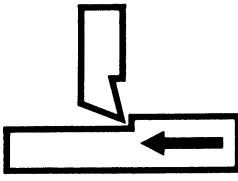
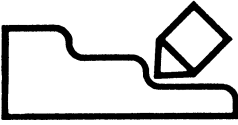
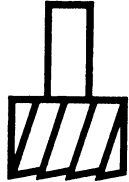
1.4

Auxiliary modes: these define sub-functions which support major machining functions.

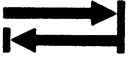
1.1 Operating modes

No.	Designation	Symbol	Remarks
1.1.1	Feed		
1.1.2	Drilling		
1.1.3	Threading		
1.1.4	Turning		
1.1.5	Boring		
1.1.6	Conventional milling		
1.1.7	Climb milling		

1.1 Operating modes (continued)

No.	Designation	Symbol	Remarks
1.1.8	Reaming		For shaping, associate arrow with tool instead of workpiece.
1.1.9	Grinding		
1.1.10	Planing		
1.1.11	Tapping		
1.1.12	Copying		Threads may be inclined to show either r.h. or l.h.
1.1.13	Parting off		
1.1.14	Vertical milling		

1.2 Movement modes

No.	Designation	Symbol	Remarks
1.2.1	Rectilinear motion		
1.2.2	Rectilinear motion in two directions		
1.2.3	Interrupted rectilinear motion (jog)		 In two directions ^a
1.2.4	Limited rectilinear motion		 In two directions ^a
1.2.5	Limited rectilinear motion and return		
1.2.6	Oscillating rectilinear motion		May be amplified ^a to indicate overtravel by using extension of arrow, e.g. 
1.2.7	Direction of continuous rotation		
1.2.8	Rotation in two directions		
1.2.9	Interrupted rotation		 In two directions ^a
1.2.10	Limited rotation		 In two directions ^a
1.2.11	Limited rotation and return		
1.2.12	Oscillating rotation		May be amplified ^a to indicate overtravel by using extension of arrow, e.g. 

^a Not included in ISO Recommendation.