

AS 1100.201—1992
Reconfirmed 2014

Australian Standard[®]

Technical drawing

**Part 201: Mechanical engineering
drawing**

This Australian Standard was prepared by Committee ME/72, Technical Drawing. It was approved on behalf of the Council of Standards Australia on 25 August 1992 and published on 16 November 1992.

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This Standard was issued in draft form for comment as DR 90109.

STANDARDS AUSTRALIA

RECONFIRMATION

OF

AS 1100.201—1992

Technical drawing

Part 201: Mechanical engineering drawing

RECONFIRMATION NOTICE

Technical Committee ME-072 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 6 December 2013.

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NOTES

Australian Standard[®]

Technical drawing

Part 201: Mechanical engineering drawing

For history before 1992, see Preface.
Second edition AS 1100.201—1992.

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PREFACE

This Standard was prepared by the Standards Australia Committee on Technical Drawing to supersede AS 1100.201–1984. AS 1100.201 was a revision and amalgamation of AS 1100 Parts 9 to 11 all published in 1974 and AS 1100 Part 12 published in 1979.

AS 1100 Parts 9 to 12 ran concurrently with AS CZ1.1 of 1976 which was withdrawn in 1982. AS CZ1.1 was a revision of AS CZ1 which was first published in 1941 with further editions published in 1944, 1946, 1951, 1966 and 1973. The 1966 edition also superseded AS Z8 of 1956 (endorsement of BS 308.2—1953 without amendment).

The AS CZ1 Standards were endorsements of The Institution of Engineers, Australia publications entitled, *Engineering Drawing Practice*. The document from which these publications originated, was published by the Institution under the title, *Recommended Engineering Drawing Practice* but this was not endorsed by this Association.

This Standard is one of a series dealing with technical drawing, the other Standards in the series being as follows:

- Part 101: *General principles*
- Part 301: *Architectural drawing*
- Part 401: *Engineering survey and engineering survey design drawing*
- Part 501: *Structural engineering drawing*

In the preparation of this Standard, the committee took account of changes in Australian technical drawing practice and recommendations of the International Organization for Standardization. Also considered were the equivalent British and American Standards.

In its preparation, many changes in the layout of the text and figures have taken place resulting in greater consistency and improved ease of use of the document.

New material introduced in this edition includes the simplified representation of pipelines, centre holes, seals and a guide to general tolerancing of castings.

The section on dimensioning and tolerancing which previously was in this part of the Standard is now contained in Part 101. Reference to Part 101 is required for the source and definition of some of the contents of this part.

This Standard is in agreement with the following International Standards:

ISO	
128	<i>Technical drawings — General principles of presentation</i>
1302	<i>Technical drawings — Method of indicating surface texture on drawings</i>
2162	<i>Technical drawings — Representation of springs</i>
2203	<i>Technical drawings — Conventional representation of gears</i>
2768	<i>General tolerances</i>
2768–1	<i>Part 1: Tolerances for linear and angular dimensions without individual tolerance indications</i>
2768–2	<i>Part 2: Geometrical tolerances for features without individual tolerance indications</i>
6410	<i>Technical drawings — Conventional representation of threaded parts</i>
6411	<i>Technical drawings — Simplified representation of centre holes</i>
6412	<i>Technical drawings — Simplified representation of pipelines</i>
6412–1	<i>Part 1: General rules and orthogonal representation</i>
6412–2	<i>Part 2: Isometric projection</i>
6413	<i>Technical drawings — Representation of splines and serrations</i>
8062	<i>Castings — System of dimensional tolerances</i>
8826	<i>Technical drawings — Rolling bearings</i>
8826–1	<i>Part 1: General simplified representation</i>
9222	<i>Technical drawings — Seals for dynamic application</i>
9222–1	<i>Part 1: General simplified representation</i>
9222–2	<i>Part 2: Detailed simplified representation</i>

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STANDARDS AUSTRALIA

Australian Standard
Technical drawing

Part 201: Mechanical engineering drawing

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard sets out requirements and recommendations for mechanical engineering drawing practice. It is complementary to [AS 1100.101](#).

The Standard provides information on surface texture and welding, and the simplified representation of pipelines. Details are also provided on various mechanical features and parts used on mechanical drawings.

Appendices provide guidance on the tolerancing of machined components and castings.

1.2 APPLICATION The principles given in this Standard are intended for adoption by engineers, draftspersons, and workshop personnel in the preparation and interpretation of mechanical engineering drawings.

1.3 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

1100	Technical drawing
1100.101	Part 101: General principles
1100.301	Part 301: Architectural drawing
1100.401	Part 401: Engineering survey and engineering survey design drawing
1100.501	Part 501: Structural engineering drawing

1101	Graphical symbols for general engineering
1101.1	Part 1: Hydraulic and pneumatic systems
1101.2	Part 2: Ventilation systems in ships
1101.3	Part 3: Welding and non-destructive examination
1101.4	Part 4: Machine elements
1101.5	Part 5: Piping, ducting and mechanical services for buildings
1913	Centre drills
2075	Glossary of terms and notations for gears
2536	Surface texture

ISO

6412	Technical drawings — Simplified representation of pipelines
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1.4 TERMINOLOGY For the purpose of this Standard, the terminology given in [AS 1100.101](#) applies.

1.5 ABBREVIATIONS Abbreviations for all technical drawings are given in [AS 1100.101](#). Those related only to mechanical engineering drawing are given in Table 1.1 and are decoded in Table 1.2.

Abbreviations should be used only where brevity and conservation of space make it necessary and then only when their meanings are unquestionably clear to the intended reader. WHEN IN DOUBT SPELL IT OUT.

NOTES:

- 1 An abbreviation may or may not be recognized internationally.
- 2 The abbreviations given in Tables 1.1 and 1.2 are not exhaustive. Other abbreviations and other meanings for those given may be used, provided that —
 - (a) their common usage in particular fields is clear;
 - (b) the meaning is clarified on the drawing; or
 - (c) the meaning is clarified in a reference document.

TABLE 1.1
ABBREVIATIONS

Term	Abbreviation
across flats	AF
annealed	ANL
balancing valve	BV
boiling point	BP
boiling water unit	BWU
bottom of pipe	BOP
case harden	CH
compression ratio	COMP R
counterbore	CBORE
crystal	XTAL
dedendum	DED
diametrical pitch	DP
electrochemical machining	ECM
electrodischarge machining	EDM
freezing point	FP
full indicator movement	FIM
pitch circle diameter	PCD
pressure angle	PA
regardless of feature size	RFS
root mean square	RMS
roughness value (arithmetic mean deviation)	R_a
specific heat	SP HT
specific volume	SP VOL
spot face	SF
unless noted otherwise	UNO

TABLE 1.2
ABBREVIATIONS DECODING

Abbreviation	Term
AF	across flats
ANL	annealed
BOP	bottom of pipe
BP	boiling point
BV	balancing valve
BWU	boiling water unit
CBORE	counterbore
CH	case harden
COMP R	compression ratio
DED	dedendum
DP	diametrical pitch
ECM	electrochemical machining
EDM	electrodischarge machining
FIM	full indicator movement
FP	freezing point
PA	pressure angle
PCD	pitch circle diameter
R_a	roughness value (arithmetic mean deviation)
RFS	regardless of feature size
RMS	root mean square
SF	spot face
SP HT	specific heat
SP VOL	specific volume
UNO	unless noted otherwise
XTAL	crystal

SECTION 2 GENERAL APPLICATIONS

2.1 DIMENSIONING AND TOLERANCING

2.1.1 General The units and methods used in the dimensioning and tolerancing of drawings shall be in accordance with [AS 1100.101](#).

A guide to the general tolerancing of machined components is given in Appendix A and a guide to the general tolerancing of castings is given in Appendix B.

2.1.2 General tolerancing examples All features on components always have a size and geometric shape. The tolerancing should be complete to ensure that the deviations of size and geometry for all features are controlled. The use of general tolerances simplifies this task by obviating the need to tolerance individually the size and geometry for all features.

An example of the application of general tolerances for length, angle and geometry for features not explicitly toleranced is shown in Figure 2.1. The interpretation of the general tolerances in Figure 2.1 is given in Appendix A which also lists the permissible variations for grades of accuracy.

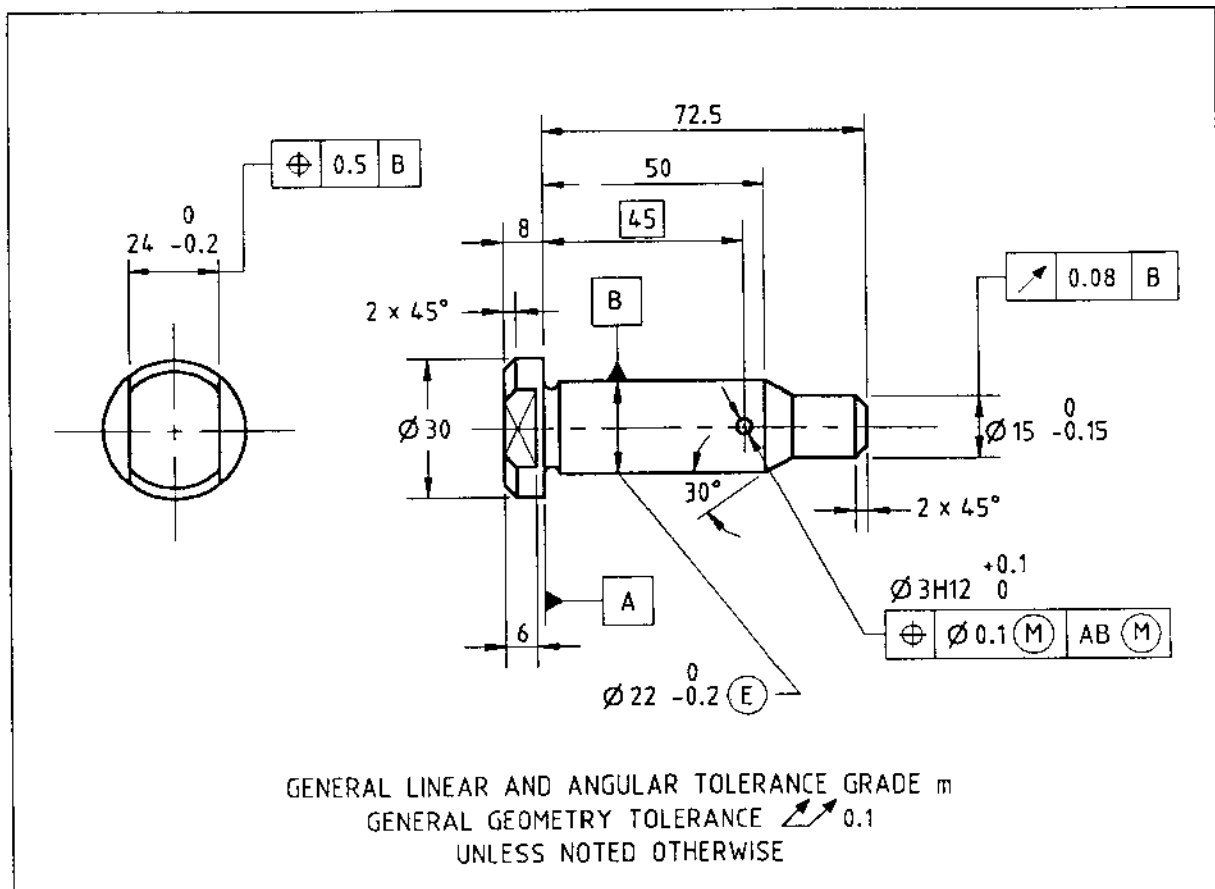


FIGURE 2.1 DRAWING INDICATION OF GENERAL TOLERANCES

2.1.3 Geometry tolerancing Typical examples of geometry tolerancing applied to mechanical engineering components are shown in Figures 2.2 and 2.3. Figure 2.2 shows the drawing of a simple component using the tolerance frame method. Figure 2.3 shows the drawing of a complicated component using the tolerance tabular method.

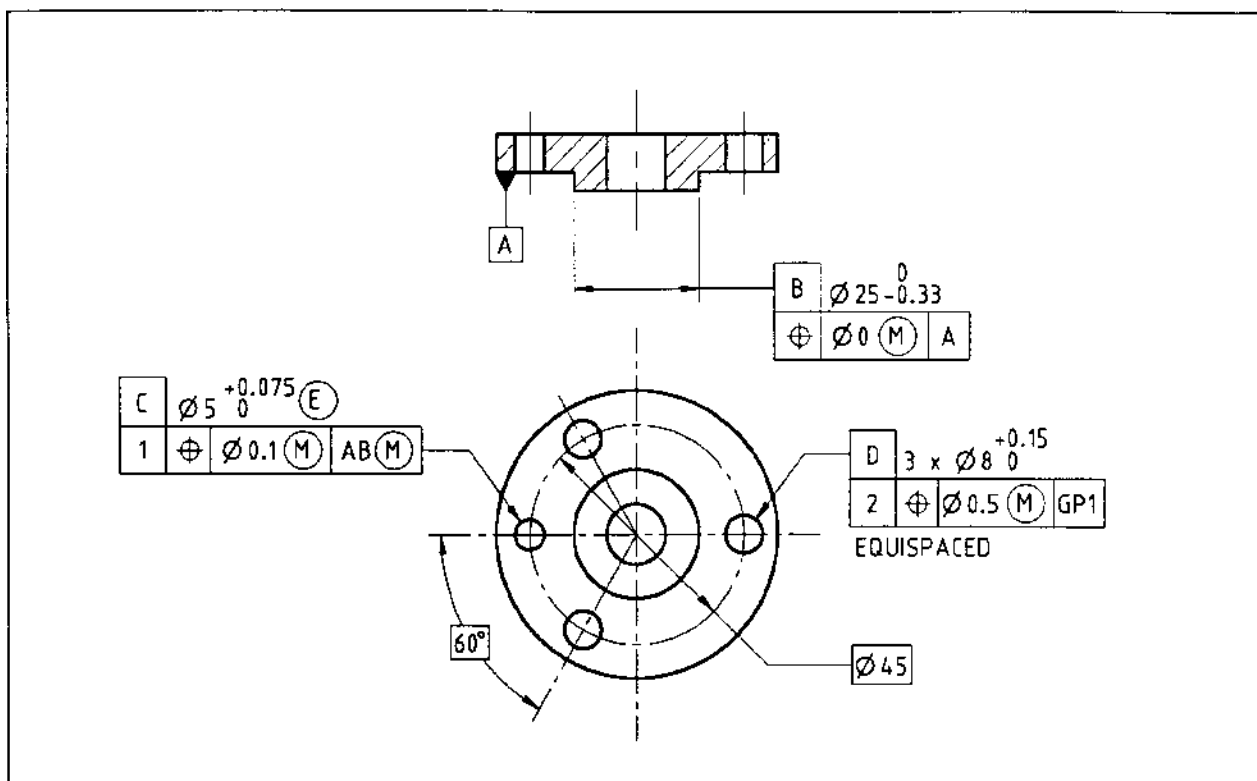


FIGURE 2.2 SIMPLE COMPONENT—TOLERANCE FRAME METHOD

2.1.4 Dimensioning of keyways Keyways should be dimensioned by one of the methods shown in Figures 2.4 and 2.5.

2.2 LINES

2.2.1 Type of line A type of line appropriate for each application should be selected from and used in accordance with AS 1100.101.

2.2.2 Line thickness Line thicknesses should be selected in accordance with AS 1100.101.

2.2.3 Application of lines Typical application of lines in mechanical drawings are shown on Figure 2.6. The letters refer to the various line types given in AS 1100.101.

2.3 SYMBOLS The symbols given in AS 1100.101 and AS 1101.1, AS 1101.2, AS 1101.3, AS 1101.4 and AS 1101.5 should be used to indicate relevant features or requirements on drawings.

The use of dimensioning and tolerancing symbols is shown on Figures 2.2 and 2.3.

Welding symbols and their application are given in AS 1101.3.

Symbols for surface texture are given in Section 3, for centre holes in Section 5, and for splines in Section 9.

2.4 DRAWING SCALES Drawing scales shall comply with the requirements of AS 1100.101. Different scales on one sheet should be kept to a minimum, with all scales clearly indicated.

2.5 CONVENTIONAL REPRESENTATION Conventional representation is a simplified drafting technique for depicting a component or repetitive feature to obviate unnecessary detailing. A conventional representation drawing, is drawn to scale and to the line types specified in AS 1100.101. Dimensions and other details may be applied directly to this drawing or by means of tabulated data or other suitable methods.

The conventional representation of springs, gears, splines, rolling element bearings, seals, and knurling is given in this Standard.

For general and particular discipline conventions, reference should be made to AS 1100.101, AS 1100.301, AS 1100.401 and AS 1100.501.

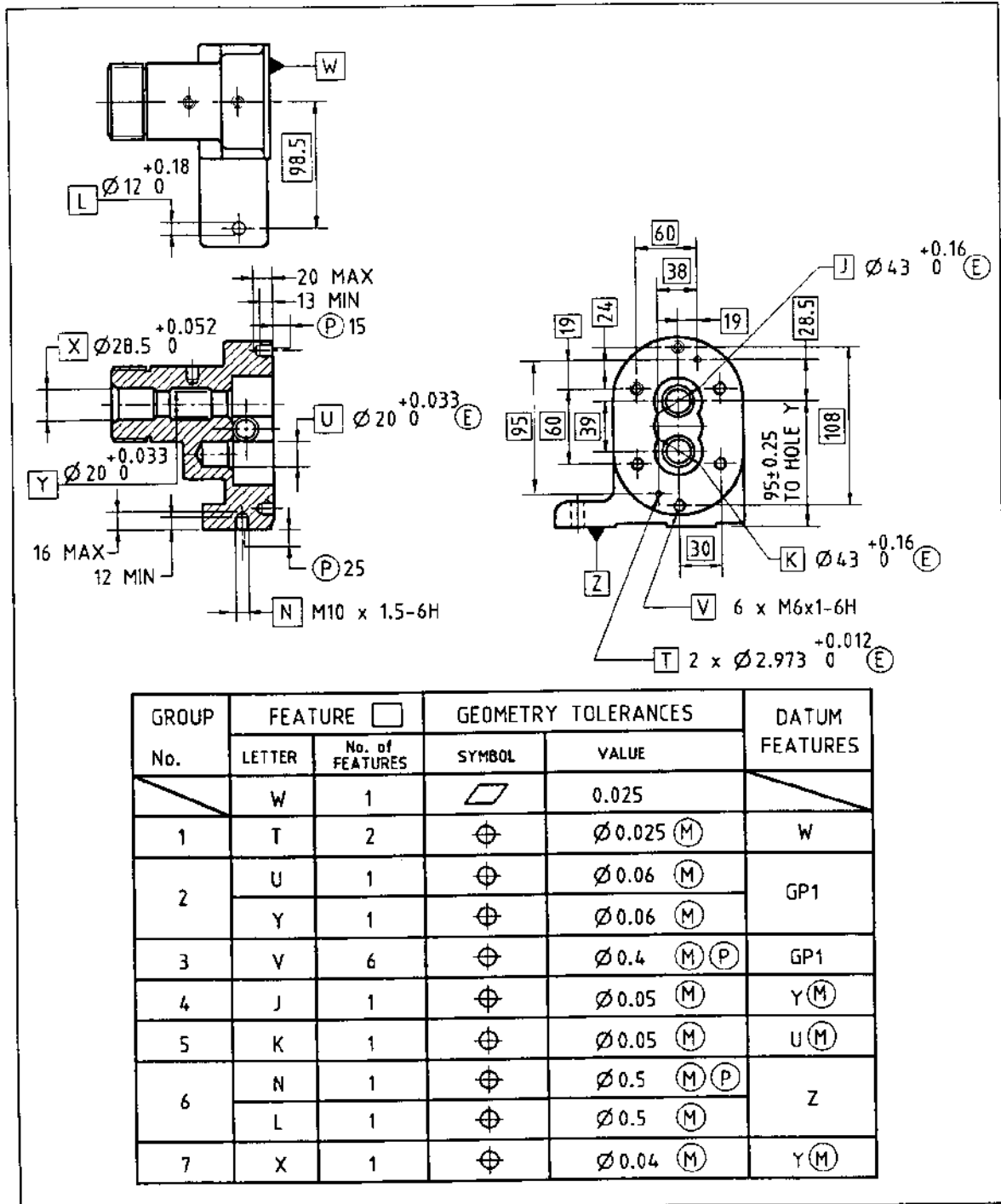


FIGURE 2.3 COMPLICATED COMPONENT—TABULAR METHOD

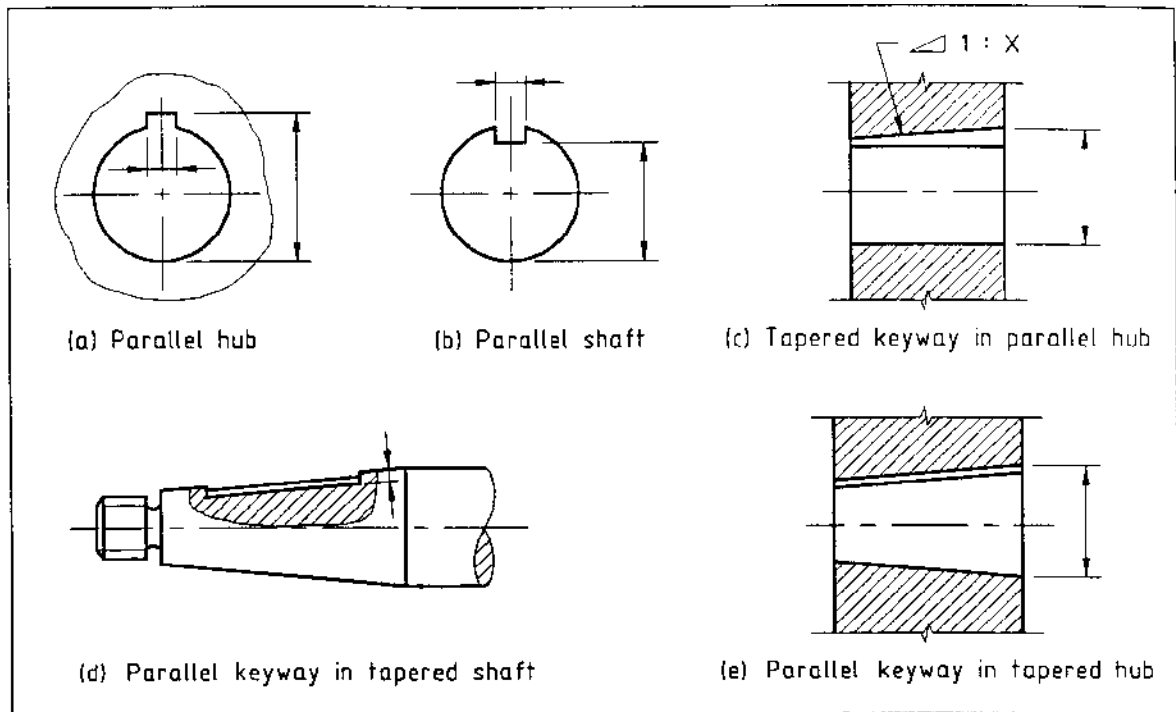


FIGURE 2.4 KEYWAYS FOR SQUARE AND RECTANGULAR KEYS

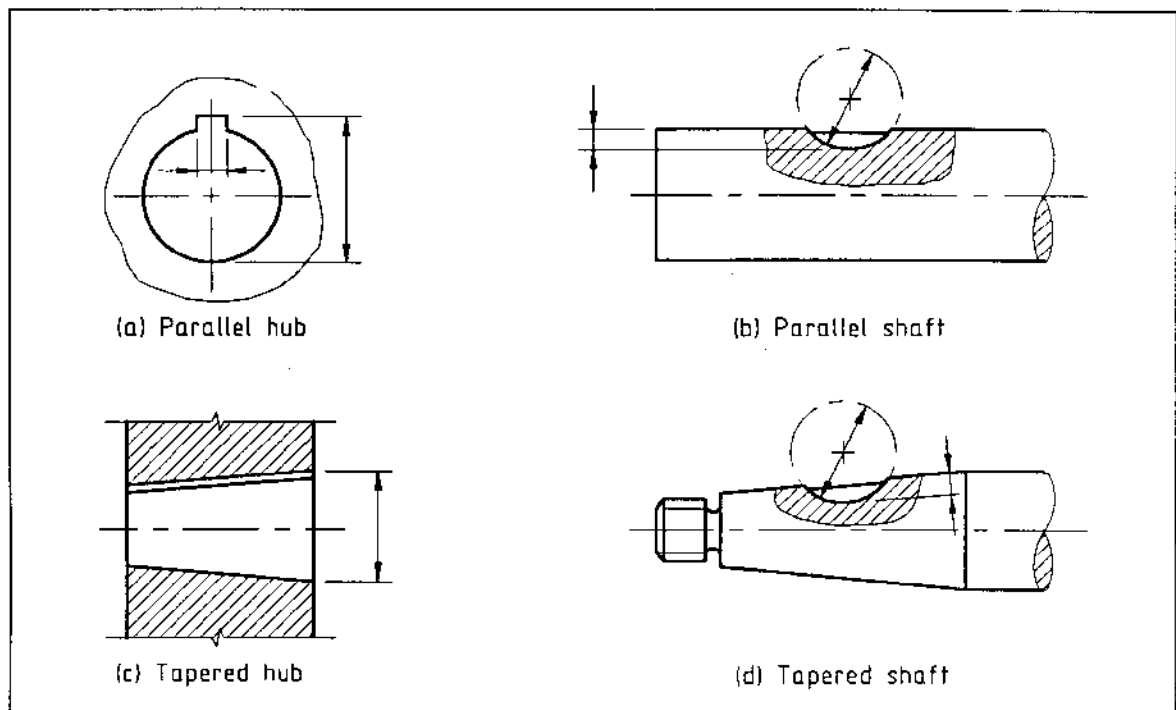


FIGURE 2.5 KEYWAYS FOR WOODRUFF KEYS



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SECTION 3 SURFACE TEXTURE

3.1 SCOPE OF SECTION This Section provides information on the indication of surface texture on mechanical engineering drawings and similar applications. For a more complete understanding of surface texture, reference should be made to [AS 2536](#).

3.2 SYMBOLS

3.2.1 Basic symbol The basic symbol is shown in Figure 3.1. The dimensions of surface texture symbols are shown in Figure 3.2. Sloping lines in the symbol are at 60° to the horizontal.

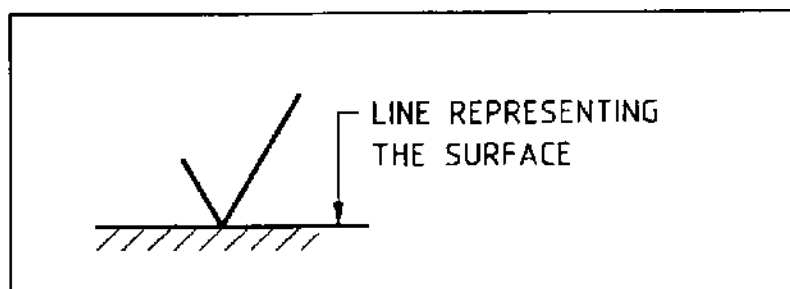
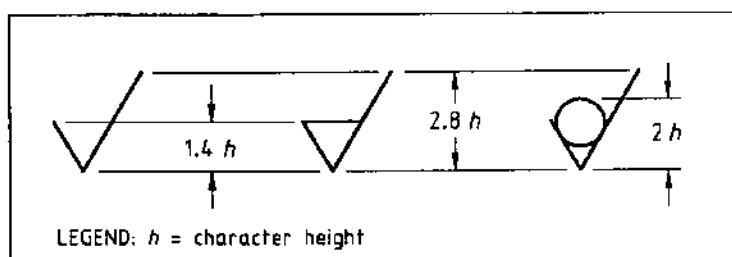


FIGURE 3.1 BASIC SYMBOL



h	$1.4h$	$2h$	$2.8h$
2.5	3.5	5.0	7.0
3.5	5.0*	7.0	10*
5.0	7.0	10	14
7.0	10*	14	20*
10	14	20	28
14	20*	28	40*
20	28	40	56

* These figures are rounded upwards.

NOTE: h = character height

FIGURE 3.2 SHAPE AND SIZE OF SURFACE TEXTURE SYMBOLS

3.2.2 Modification to basic symbol The following modifications may be made to the basic symbol:

- (a) The symbol to be used where machining is mandatory shall be the basic symbol with a bar added, as shown in Figure 3.3.

This symbol may be used alone to indicate that a surface is to be machined without defining either the surface texture or the process to be used.

- (b) The symbol to be used when the removal of material is not permitted shall be the basic symbol with a circle added, as shown in Figure 3.4. This symbol may be used alone to indicate that a surface is to be left in the state resulting from a preceding manufacturing process.

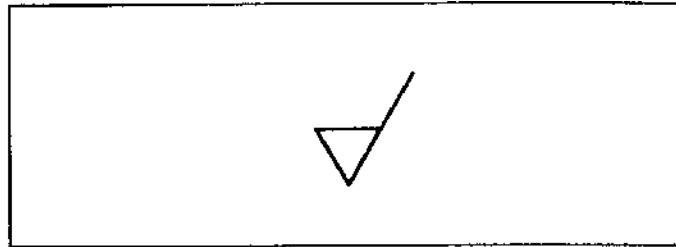


FIGURE 3.3 SYMBOL WHEN MACHINING IS MANDATORY

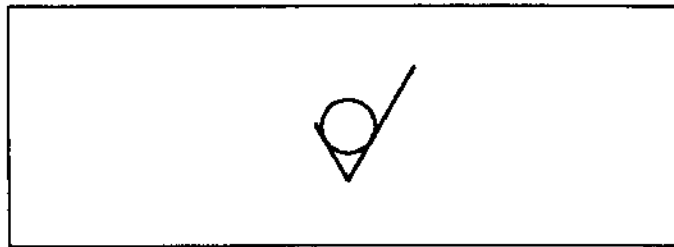


FIGURE 3.4 SYMBOL WHEN MATERIAL REMOVAL IS NOT PERMITTED

3.2.3 Extension of symbols When special surface characteristics are to be indicated (see Clause 3.4), the symbols shown in Figures 3.1, 3.3 and 3.4 may be extended by adding a line of appropriate length to the long leg, as shown in Figure 3.5.

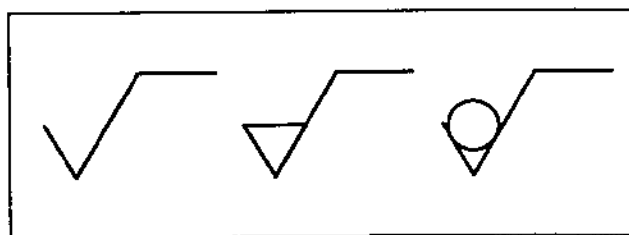


FIGURE 3.5 EXTENSION FOR SYMBOLS FOR SPECIAL SURFACE CHARACTERISTICS

3.3 INDICATION OF SURFACE ROUGHNESS

3.3.1 General The principle parameter used for describing and quantifying surface roughness is the arithmetic mean deviation (R_a). When specifying this parameter, the value should be selected from those given in Table 3.1.

The R_a value should be shown on the drawing by inscribing the R_a value in micrometres (see Column 1, Table 3.1).

NOTES:

- 1 The 'arithmetic mean deviation' (R_a) was previously known as the 'centre-line average value' (CLA).
- 2 The corresponding R_a value in microinches is shown for comparison in Column 2, Table 3.1.

TABLE 3.1
PREFERRED R_a VALUES

1	2
Roughness values R_a	
μm	μin
50	2000
25	1000
12.5	500
6.3	250
3.2	125
1.6	63
0.8	32
0.4	16
0.2	8
0.1	4
0.05	2
0.025	1

3.3.2 Method of indication The R_a values shall be placed above the appropriate symbol to indicate the degree of surface roughness required, as follows:

- (a) *One value only* Where only one value is specified, it represents the maximum permissible value of surface roughness (see Figure 3.6).

Figure 3.6(a) shall apply when the surface roughness may be obtained by any production method.

Figure 3.6(b) shall apply when the surface roughness must be obtained by machining.

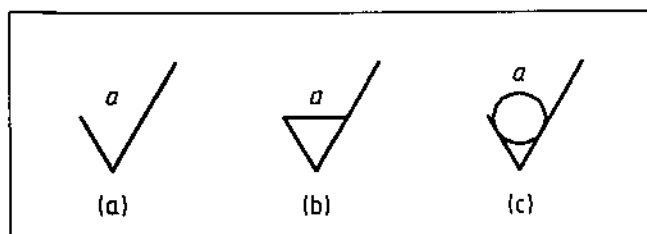
Figure 3.6(c) shall apply when the surface roughness must be obtained without machining.

- (b) *Two values* If it is necessary to impose maximum and minimum limits on the principal criterion of surface roughness, both values shall be shown with the maximum limit placed above the minimum limit (see Figure 3.7).

Figure 3.7(a) shall apply when the surface roughness may be obtained by any production method.

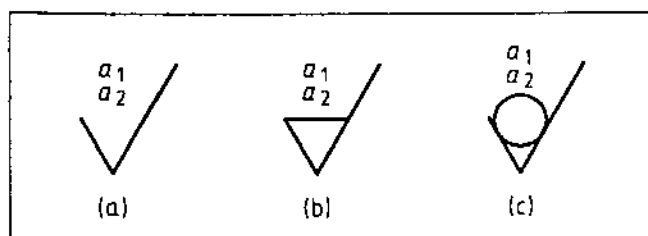
Figure 3.7(b) shall apply when the surface roughness must be obtained by machining.

Figure 3.7(c) shall apply when the surface roughness must be obtained without machining.



NOTE: 'a' represents a value selected from Table 3.1, Column 1.

FIGURE 3.6 MAXIMUM SURFACE ROUGHNESS ONLY SPECIFIED



NOTE: 'a₁' and 'a₂' represent values selected from Table 3.1, Column 1, 'a₁' is greater than 'a₂'.

FIGURE 3.7 MAXIMUM AND MINIMUM SURFACE ROUGHNESS SPECIFIED

3.4 INDICATION OF SPECIAL REQUIREMENTS

3.4.1 General It may be necessary to specify additional requirements associated with surface texture. Such requirements shall be indicated as shown in Figure 3.8 and Clauses 3.4.2 to 3.4.6.

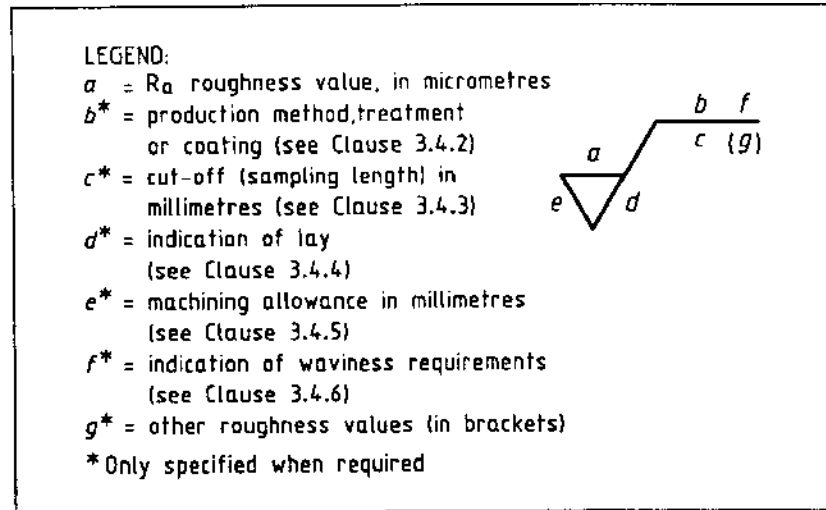


FIGURE 3.8 LOCATION OF SPECIAL REQUIREMENTS

3.4.2 Production processes If it is required that the final surface texture be produced by one particular method, this method shall be indicated in plain language above the extension of the symbol, as illustrated in Figure 3.9.

If the material requires a final treatment such as plating or chemical processing, the R_a roughness value applies after such treatment, unless otherwise indicated. If it is necessary to specify surface texture both before and after treatment, this should be indicated either in a special note or as in the example shown in Figure 3.10 where two symbols are used, one to a line to indicate the untreated surface and the other to a Type J line to represent the surface after treatment.

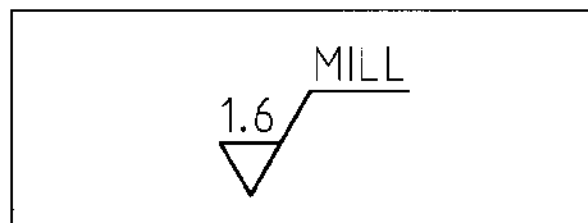


FIGURE 3.9 EXAMPLE OF INDICATION OF PRODUCTION PROCESS

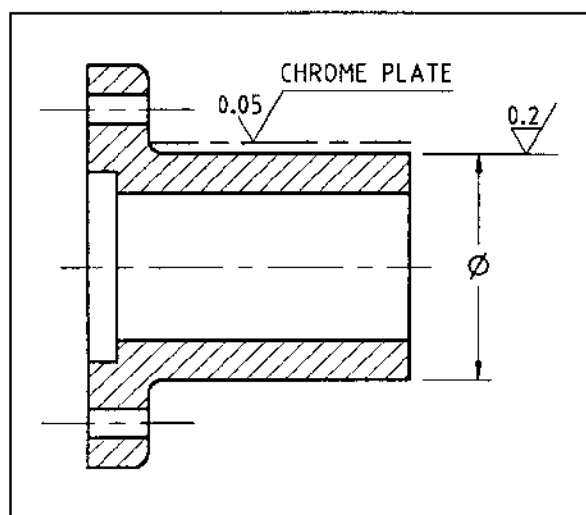
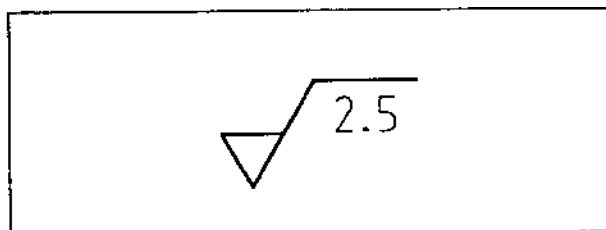


FIGURE 3.10 EXAMPLE OF SYMBOLS APPLIED TO PRETREATMENT AND POST-TREATMENT OF A SURFACE

3.4.3 Cut-off (sampling length) Where the cut-off is to be other than 0.8 mm, the selected value shall be indicated below the extension of the symbol, as illustrated in Figure 3.11. Cut-off shall be selected from the following preferred series:

0.08; 0.25; 0.8; 2.5; and 8



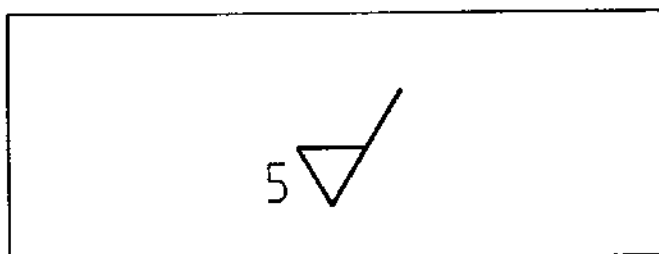
NOTE: Cut-off in millimetres.

FIGURE 3.11 EXAMPLE OF INDICATION OF CUT-OFF

3.4.4 Lay If it is necessary, for functional reasons, to specify the direction of lay, it shall be indicated by adding to the symbol the appropriate lay symbol selected from those given in Column 1, Table 3.2. Column 2 shows the method of indication of drawings and Column 3 gives the interpretation.

Should it be necessary to specify a lay not clearly defined in Table 3.2, then it shall be indicated by a suitable note on the drawing.

3.4.5 Machining allowance Where it is necessary to specify the value of the machining allowance, this shall be indicated on the left of the symbol (see example shown in Figure 3.12).



NOTE: Machining allowance in millimetres.

FIGURE 3.12 EXAMPLE OF INDICATION OF MACHINING ALLOWANCE

3.4.6 Waviness Where necessary, the value of the maximum waviness height selected from Table 3.3 shall be indicated above the extension of the symbol followed by the waviness spacing where required (see Figure 3.13). The indication of waviness requirements shall follow production process requirements.

3.5 INDICATION ON DRAWINGS

3.5.1 General principles Symbols and their inscriptions shall be orientated so that they can be read from the bottom or the right-hand side of the drawing.

If necessary, the symbol may be connected to the surface by a leader terminating in an arrow.

The symbol or the arrow shall point from outside the surface either to the line representing the surface or to a projection line from it. Figure 3.14 shows typical examples of the placement of symbols in drawings.

In accordance with the general principles of dimensioning, the symbol shall be used once only for a given surface and, if possible, on the view which carries the dimension defining the size or position of the surface. An example is shown in Figure 3.15.

TABLE 3.2
LAY SYMBOLS, INDICATIONS AND INTERPRETATIONS

1 Lay symbols	2 Indication on the drawing	3 Interpretation
=		Parallel to the plane of projection of the view in which the symbol is used
⊥		Perpendicular to the plane of projection of the view in which the symbol is used
X		Crossed in two slant directions with regard to the plane of projection of the view in which the symbol is used
M		Multi-directional
C		Approximately circular relative to the centre of the surface to which the symbol is applied
R		Approximately radial relative to the centre of the surface to which the symbol is applied

TABLE 3.3
PREFERRED MAXIMUM WAVINESS HEIGHT VALUE
millimetres

Waviness height (maximum)		
0.0005	0.008	0.12
0.0008	0.012	0.2
0.0012	0.02	0.3
0.0020	0.03	
0.003	0.05	0.50
0.005	0.08	0.80

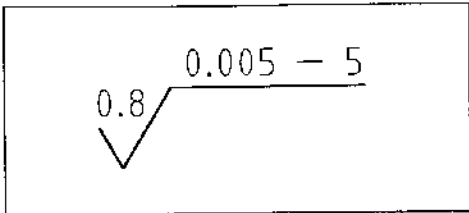
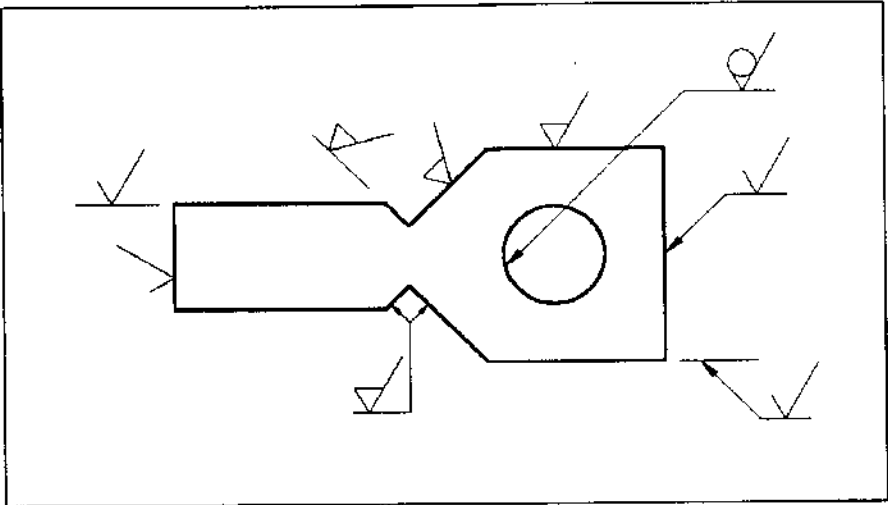


FIGURE 3.13 EXAMPLE OF INDICATION OF MAXIMUM WAVINESS HEIGHT AND SPACING



NOTE: Roughness values not shown.

FIGURE 3.14 PLACEMENT OF SYMBOLS

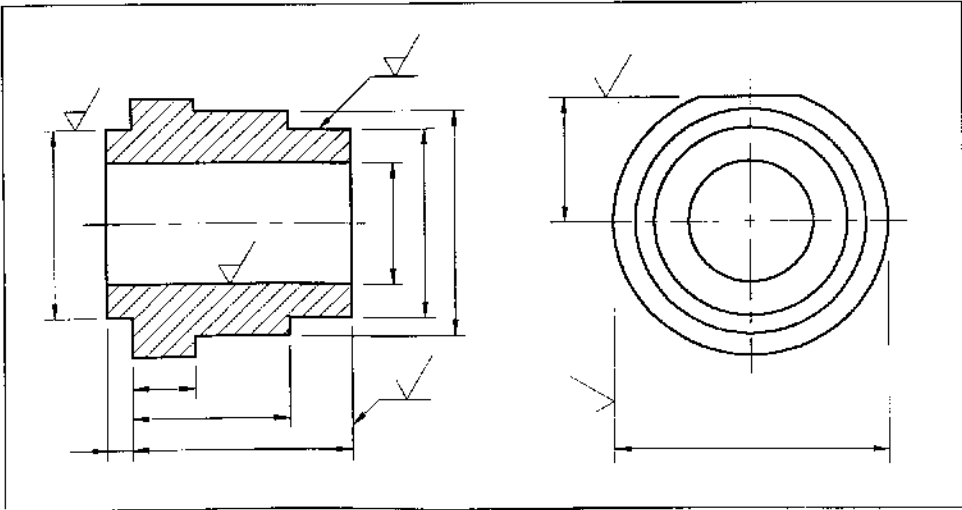


FIGURE 3.15 RELATIONSHIP BETWEEN SURFACE ROUGHNESS SYMBOLS AND DIMENSIONS

3.5.2 Simplified procedures If one or more textures are required on a number of surfaces of a part, a simplified procedure may be adopted.

The procedure involves either using a symbol which is qualified if necessary, or introducing a substitute symbol which is clearly defined. Such symbols should be placed near a view of the part, near the title block or in the space devoted to general notes.

Details and examples are given in (a) to (d) below:

(a) Where a single surface texture specification applies to all surfaces — the symbol may be qualified thus:

$\sqrt{a}$ ALL OVER

OR

∇^a ALL OVER

(b) Where a single surface texture specification applies to the majority of surfaces — the symbol may be qualified thus:

$\sqrt{a_1}$ ALL OVER EXCEPT WHERE
OTHERWISE INDICATED

Surface texture specifications which are exceptions to the major requirement shall be indicated on the corresponding surfaces by appropriate symbols.

(c) Where a single surface texture specification applies to a large number of surfaces — use basic symbol, Figure 3.1, as a substitute symbol on the appropriate surfaces and clearly define the meaning of the substitute symbol. See Figure 3.16.

e.g. $\sqrt{\quad}$ = $\sqrt{a_1}$

This procedure is recommended particularly where the surface specification is complicated and where space is limited.

Surface texture specifications which are exceptions to the major requirement shall be indicated on the corresponding surfaces by appropriate symbols.

(d) Where each of two or more surface texture specifications applies to a number of surfaces, use simplified symbols as substitute symbols on appropriate surfaces as illustrated in Figure 3.16. The meaning of each substitute symbol shall be clearly defined on the drawing.

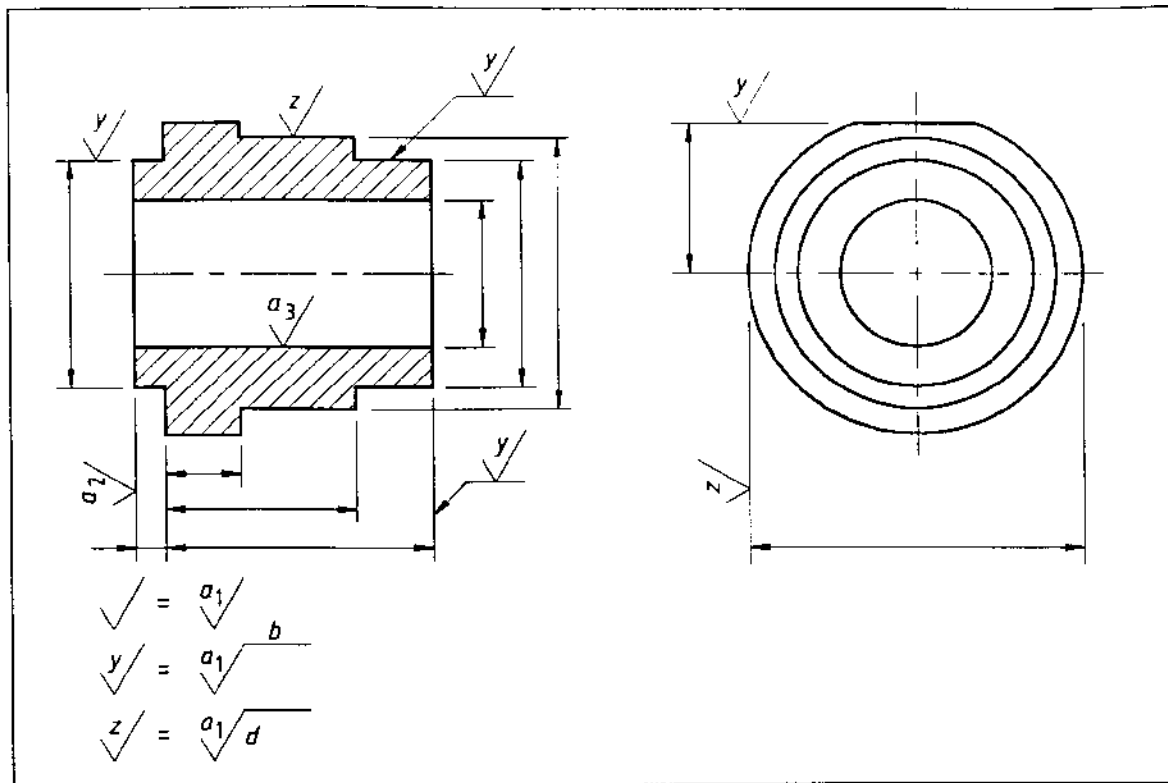
This procedure is recommended particularly where the surface texture specifications are complicated and where space is limited.

Surface texture specifications which are not covered by the above simplified symbols shall be indicated on the corresponding surfaces by appropriate symbols.

3.6 GENERAL APPLICATION OF R_a VALUES Appendices C and D indicate the appearance and application of various surface roughness R_a values and the production process by which each is generally achieved.

3.7 APPLICATION OF SURFACE TEXTURE SYMBOLS The application of surface texture symbols to indicate the principal criterion of roughness R_a is given in Table 3.4.

The application and placement of additional indications with the surface texture symbols is given in Table 3.5.



NOTES:

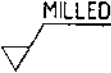
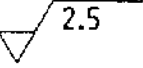
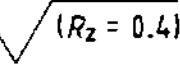
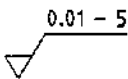
- 1 'a₁', 'a₂' and 'a₃' represent values selected from Table 3.1, Column 1.
- 2 'b' and 'd' represent a production method and lay respectively.
- 3 'y' and 'z' represent two selected letter characters.

FIGURE 3.16 EXAMPLE OF THE USE OF SUBSTITUTE SYMBOLS

TABLE 3.4
SYMBOLS WITH INDICATION OF THE PRINCIPLE CRITERION OF ROUGHNESS, R_a

Symbol			Meaning
Symoval of material by machine is			
optional	Obligatory	prohibited	
3.2 ✓	3.2 ▽	3.2 ⊙	A surface with a maximum surface roughness value R _a of 3.2μm
6.3 1.6 ✓	6.3 1.6 ▽	6.3 1.6 ⊙	A surface with a maximum surface roughness value of R _a of 6.3 μm and a minimum of 1.6 μm

TABLE 3.5
SYMBOLS WITH ADDITIONAL INDICATIONS

Symbol	Meaning of additional indication
	Production method - milled
	Cut-off—2.5 mm
	Direction of lay—perpendicular to the plan of projection of the view
	Machining allowance—2 mm
	Indication (in brackets) of a criterion of roughness other than that used for R_a , for example $R_z = 0.4 \mu\text{m}$
	Maximum waviness height 0.01 mm and maximum wavelength of 5mm

NOTE: Symbols may be used singly, in combination, or combined with an appropriate symbol from Table 3.4.

SECTION 4 WELDING

4.1 WELDING Symbols for depicting complete welding information on drawings shall comply with AS 1101.3. The typical application of weld symbols on a mechanical drawing is shown on Figure 4.1.

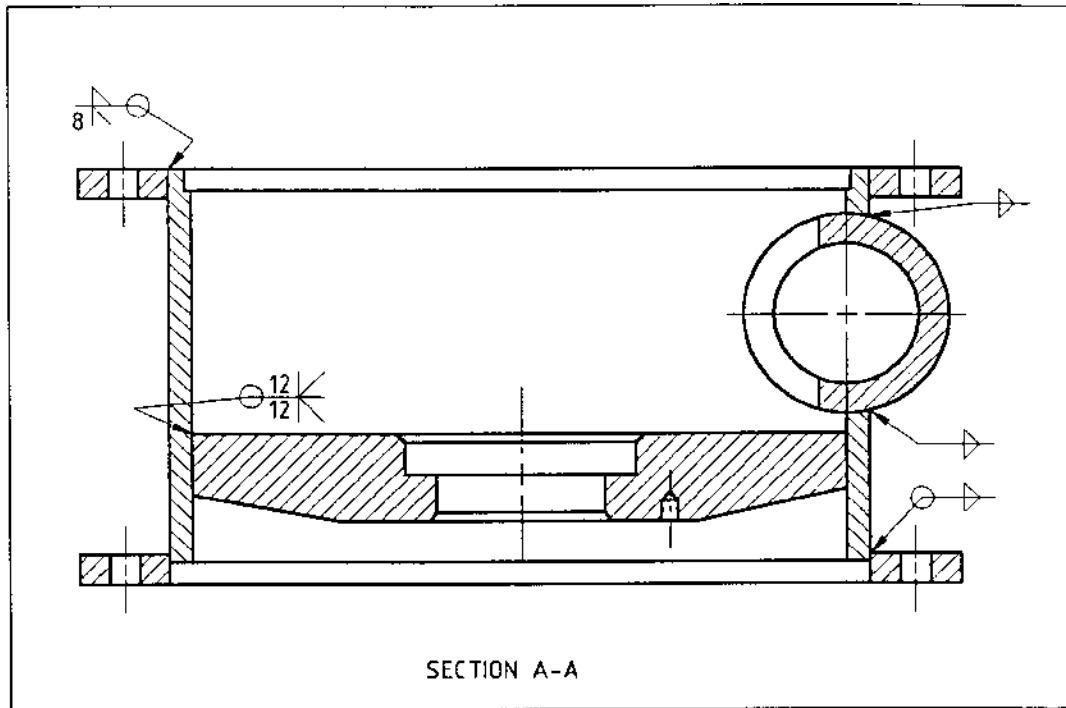


FIGURE 4.1 USE OF WELD SYMBOLS