UDC 774.43

December 1992

Engineering drawing practice
Dimensioning
Principles of application

DIN 406 Part 11

Technische Zeichnungen; Maßeintragung; Grundlagen der Anwendung

This standard supersedes July 1975 edition of DIN 406 Part 3 and, together with December 1992 editions of DIN 406 Part 10 and Part 12, also supersedes August 1981 edition of DIN 406 Part 2.

See Explanatory notes for connection with International Standard ISO 129 : 1985 published by the International Organization for Standardization (ISO).

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

References to DIN 406 Part 10 are to the December 1992 edition.

Dimensions in mm

Contents

1 Scope and field of application

This standard specifies how dimensions are to be indicated on technical drawings. The dimensions indicated apply to the end product, i.e. the final state of an object as represented in a given drawing.

NOTE. The final state represented in the drawing can be the raw, intermediate or finished state of the object.

What dimensions need to be indicated is a function of the use to which the drawing is to be put (e.g. design drawing, production drawing, test drawing, assembly drawing (cf. DIN 199 Part 1)). The arrangement of the dimensions in the drawings or the choice of the termination style may depend on the technique used to produce the drawing (manual or machine-drawn).

The figures shown in this standard are examples serving to indicate the principles concerned. They are only as complete as is necessary to illustrate the text.

2 Concepts

See DIN 406 Part 10.

Continued on pages 2 to 30

3 Elements of dimensioning

3.1 Dimension lines

Dimension lines shall be drawn

- parallel to the length to be dimensioned in the case of linear dimensions (see figures 1 and 2);
- as an arc around the vertex of the angle or the centre of the curve in the case of angular dimensions (see figures 3 and 4).

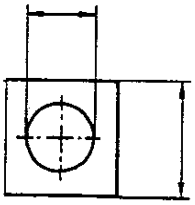


Figure 1
(figure 8 in ISO 129)

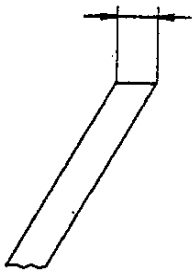


Figure 2

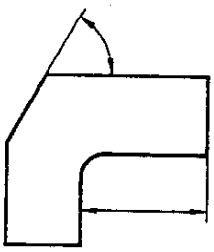


Figure 3

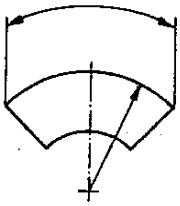


Figure 4

Angular dimensions up to 30° may be indicated by straight dimension lines drawn approximately perpendicular to the bisecting line of the angle (see figure 5).

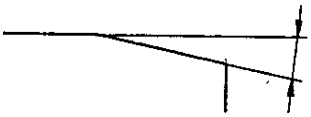


Figure 5

Where features are represented as interrupted views, the dimension lines shall be shown unbroken (see figure 6).

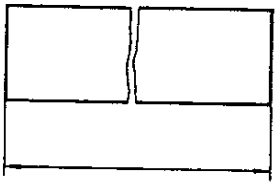


Figure 6
(figure 9 in ISO 129)

Dimension lines shall not generally intersect or cross other lines. If that cannot be avoided, they shall be shown without a break (see figures 1, 4, 7 and 11).

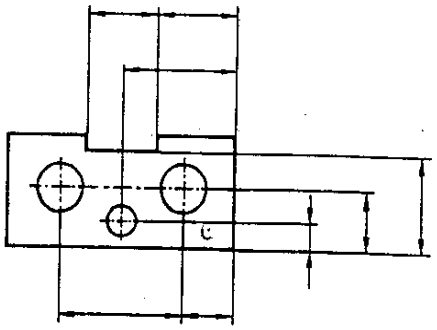


Figure 7
(modified version of figure 10 in ISO 129)

Dimension lines may be shortened when

- used to indicate diameters (see figures 35 and 56);
- only one half of a symmetrical feature is represented in a view or section (see figure 27);
- an object is shown half as a view and half as a section (see figure 8);
- the reference points of dimensions fall outside the limits of the space available (see figure 9).

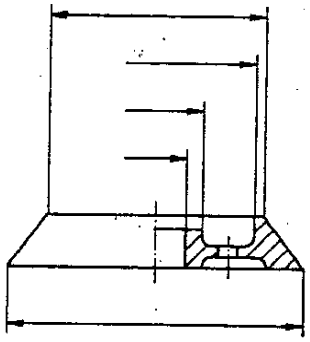


Figure 8

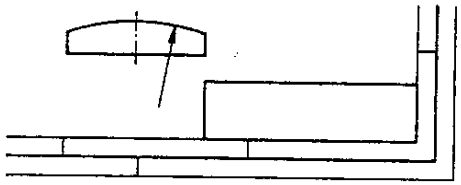


Figure 9

3.2 Projection lines

Projection lines for linear dimensions shall be drawn at right angles to the feature being dimensioned (see figures 1 to 3, 6 to 8 and 10).

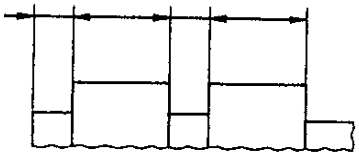


Figure 10

Where necessary for the sake of clarity, projection lines may be drawn obliquely (preferably at an angle of less than 60°) but parallel to each other (see figure 11).

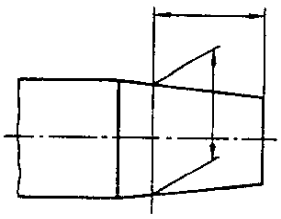


Figure 11
(figure 6 in ISO 129)

Intersecting extension lines from feature outlines shall be drawn so as to extend slightly beyond their point of intersection (see figure 12).

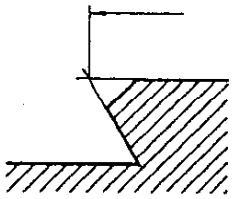


Figure 12
(figure 7 in ISO 129)

In the case of projected outlines at transitions, etc., the projection lines shall be drawn to the point at which the extension lines intersect (see figure 13).

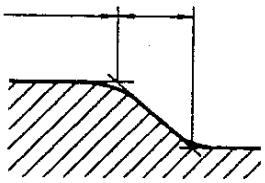


Figure 13

Projection lines may be shown broken if the continuation of the line after the break is clearly recognizable (see figures 14 and 15).

In the case of angular dimensions, the projection lines shall take the form of extensions to the legs of the angle (see figure 15).

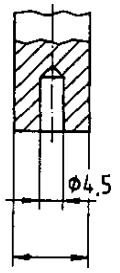


Figure 14

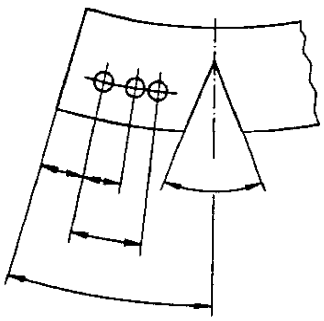


Figure 15

The vertical and opposite angle may also be indicated (see figure 16).

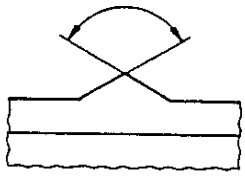


Figure 16

To emphasize that features repeated at intervals have the same dimensions and tolerances, the features concerned may be shown connected by a common projection line (see figure 17).

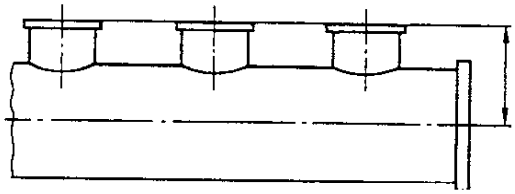


Figure 17

In drawings in which, for special purposes, thick lines are to be used (e.g. in printing block drawings), the projection lines for external dimensions shall be drawn on the outside edge of the outline and those for internal dimensions on the inside edge (see figures 18 and 19).

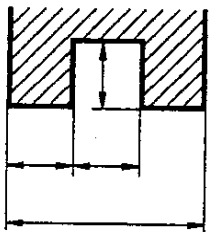


Figure 18

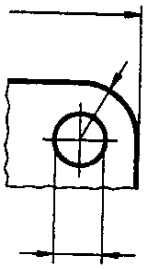


Figure 19

Projection lines shall not be continued from one view to another, and shall not be drawn parallel to the direction of hatching.

3.3 Leader lines

Leader lines shall be drawn obliquely to the object represented. They shall terminate with

- an arrowhead if they end on the outline of the object (see figures 20, 86 and 87);
- a dot or a circle if they end within the outline of an object (see figures 21, 84 and 85);
- without termination symbols when ending on all other lines, (e.g. dimension lines, centre lines) (see figures 22, 24, 25 and 36);
- with termination symbols when used to establish references (see figure 79).

NOTE. These principles on the use of leader lines correspond to those given in ISO 128 : 1982. They are to be amplified and defined more accurately in the course of the revision of that standard and will then be issued as a separate standard.

Figure 20

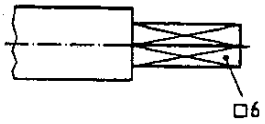


Figure 21

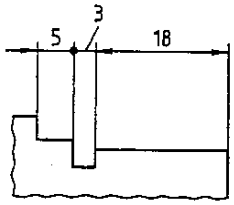


Figure 22

3.4 Terminations

Dimension lines shall terminate:

- with a solid black arrowhead, as shown in figure 23 a (the normal termination; see figure 24);
- preferably, in the case of computer-aided drawings, with a closed unfilled arrowhead, as shown in figure 23 b;
- for special applications (e.g. drawings in the building and construction industries), with a closed unfilled arrowhead, as shown in figure 23 c (see figures 25 and 26);
- for special applications (e.g. drawings in the building and construction industries), with an oblique stroke, as shown in figure 23 d (see figure 25);
- where space is limited, preferably with a solid dot as shown in figure 23 e (see figure 24);
- with an unfilled circle, as shown in figure 23 f, to indicate the origin when dimensioning from a common feature (see figure 26).

NOTE. For dimensions of arrowheads, oblique lines, dots and circles, see DIN 406, Part 10.

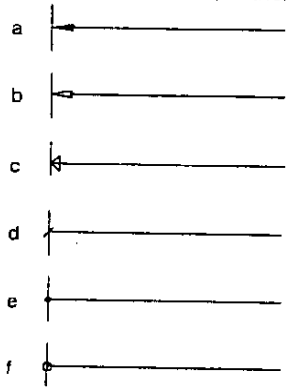


Figure 23

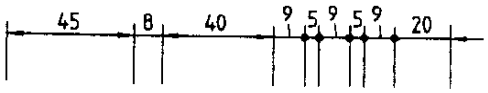


Figure 24

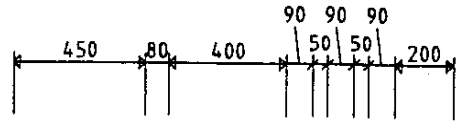


Figure 25

Figure 26

Outlines and/or other lines in close proximity to each other shall be interrupted to ensure that the line to which the arrowhead termination refers can be clearly distinguished (see figure 27).

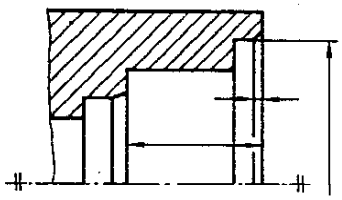


Figure 27

Only one style of arrowhead termination, or oblique strokes, where necessary in conjunction with dots, shall be used on a single drawing.

3.5 Dimensional values

3.5.1 Size and style of lettering

Character height shall be as specified in DIN 6774 Part 1, the style of lettering shall be style B, vertical, as specified in DIN 6776 Part 1.

3.5.2 Indication in two reading directions (method 1)

This method is the preferred method. The dimensional values shall generally be placed so that, in the viewing direction of the drawing (see DIN 406 Part 10), they can be read from the bottom and from the right-hand side of the drawing (see figures 28 to 41).

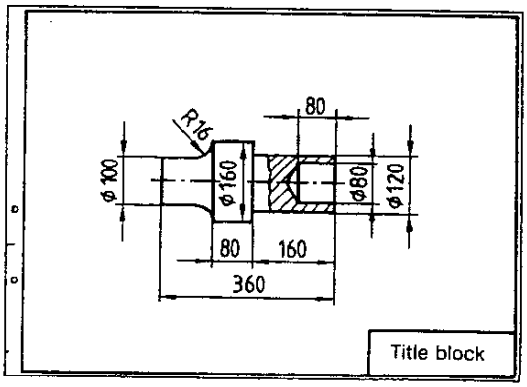


Figure 28

In parallel dimensioning, the dimensional values are generally placed parallel or at a tangent to their dimension lines, and in the middle, above and clear of them (see figures 28 to 37).

See figures 29, 35 to 37 and 59 for exceptions.

NOTE. See DIN 6771 Part 6 for preprinted drawing sheets.

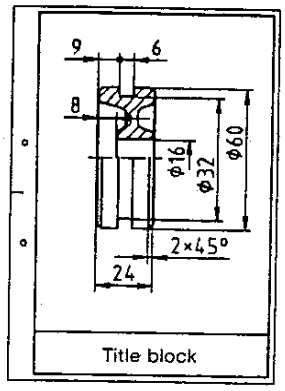


Figure 29

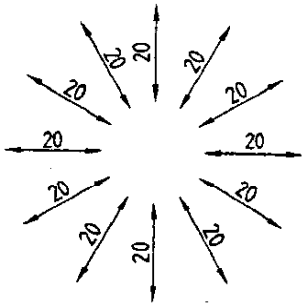


Figure 30
(figure 17 in ISO 129)

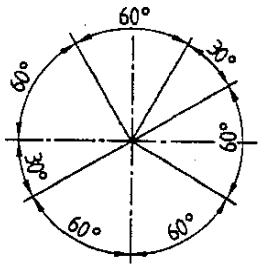


Figure 31
(figure 19 in ISO 129)

Even when the orientation of the object in acutal service does not correspond to the reading direction of the drawing, the dimensional values shall still be placed in the reading directions from below and from the right (see figure 32).

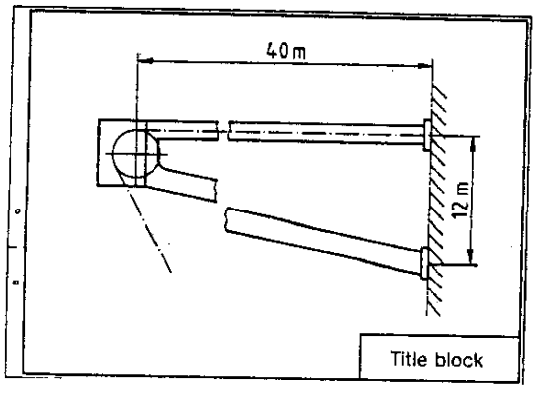


Figure 32

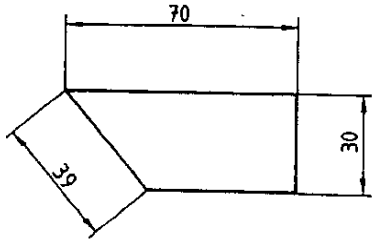


Figure 33
(figure 16 in ISO 129)

When several parallel or concentric dimension lines are required, the dimensional values shall be staggered (see figures 29 and 35).

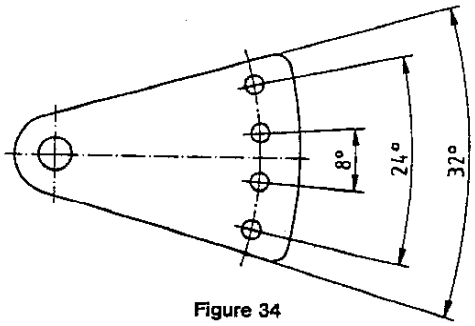


Figure 34

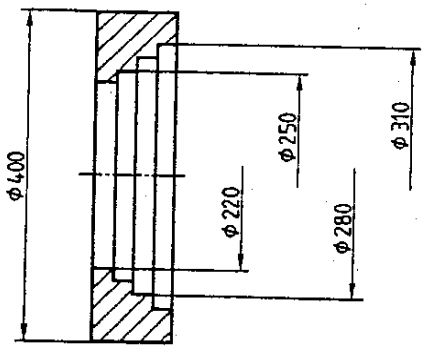


Figure 35
(figure 23 in ISO 129)

If there is insufficient space above the dimension line, the dimensional value shall be placed on a leader line (see figure 36) or above the extension of the dimension line (see figure 37).

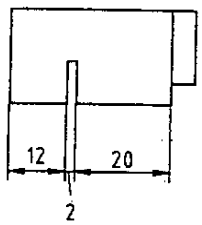


Figure 36

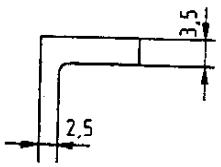


Figure 37

In superimposed running dimensioning, the dimensional values shall be placed either

– close to the terminations shown in figure 23 a, b, c or f, parallel to the corresponding projection line (see figures 38 and 39);

– close to the terminations shown in figure 23 a, b, c or f, parallel or at a tangent to the dimension line, and above and clear of it (see figures 40 and 41).

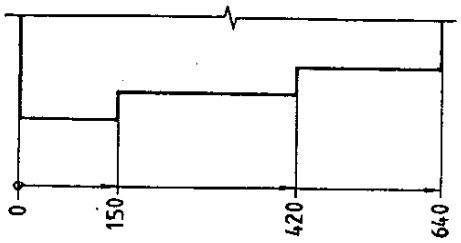


Figure 38
(figure 34 in ISO 129)

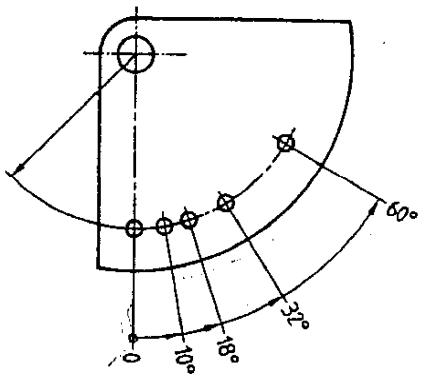


Figure 39

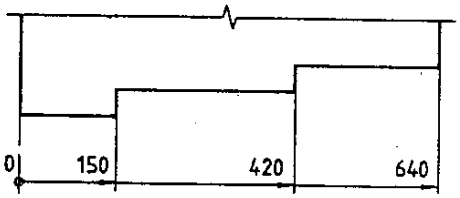


Figure 40
(figure 35 in ISO 129)

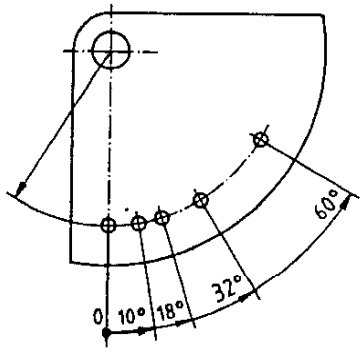


Figure 41

3.5.3 Indication in one reading direction (method 2)

All dimensions may also be indicated in the same reading direction as the title block (see DIN 406 Part 10).

Non-horizontal dimension lines shall be interrupted, preferably near the middle, to permit the dimensional values to be inserted (see figures 42 to 44, 47 and 48).

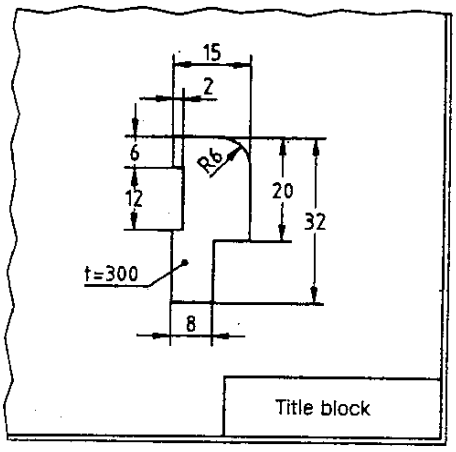


Figure 42

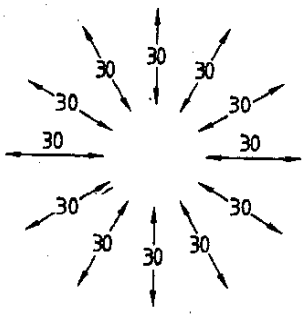


Figure 43

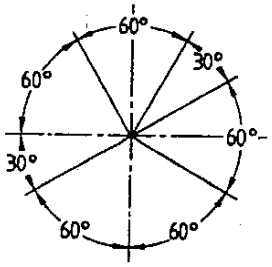


Figure 44
(figure 22 in ISO 129)

Angular dimensions may also be indicated in the reading direction of the title block without the dimension line being interrupted (see figure 45).

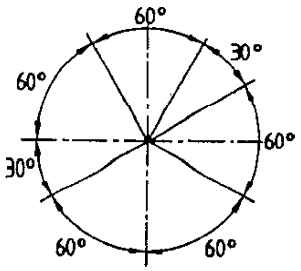


Figure 45
(figure 18 in ISO 129)

Dimensions may also be indicated on a horizontal extension to a dimension line (see figure 46).

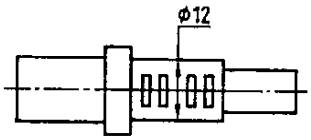


Figure 46
(modified version of figure 25 in ISO 129)

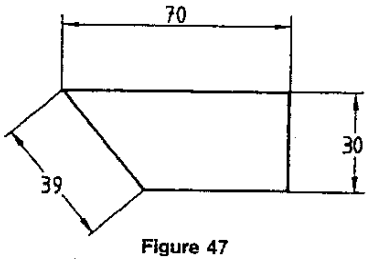


Figure 47
(figure 21 in ISO 129)

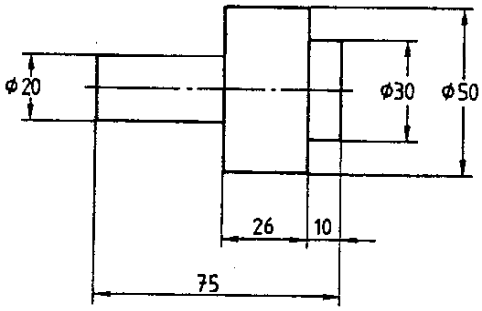


Figure 48
(figure 20 in ISO 129)

3.6 Dimensional units

See subclause 3.5.3 in DIN 406 Part 10.

4 Indication of dimensions

4.1 Arrangement of dimensions

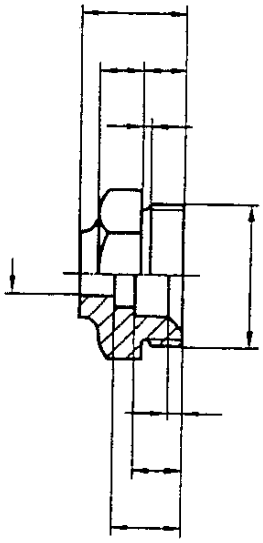


Figure 49

Dimensions for internal and external forms and for individual features (e.g. groove, projection, hole) shall wherever possible be indicated in the same view/section, arranged in groups of associated dimensions (see figures 49 and 50).

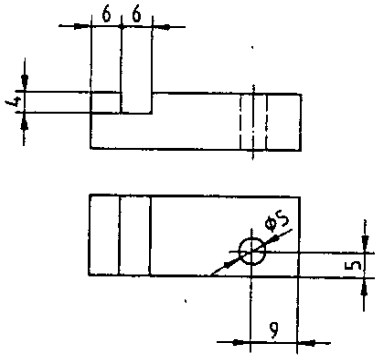


Figure 50

Where several parts are drawn and dimensioned in an assembly, the dimensions (e.g. the linear and diametral dimensions) relating to each part shall be grouped together and the groups kept as separate as possible (see figure 51).

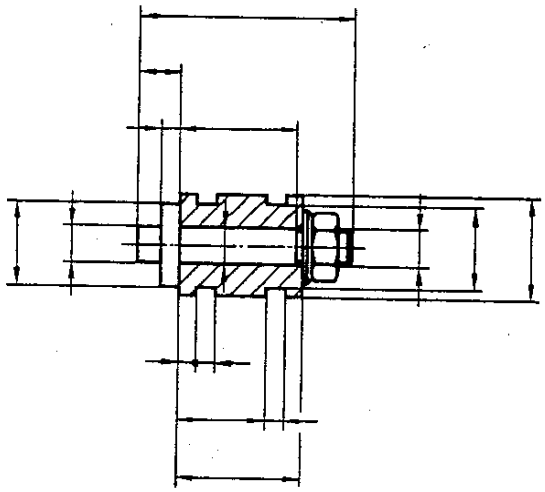


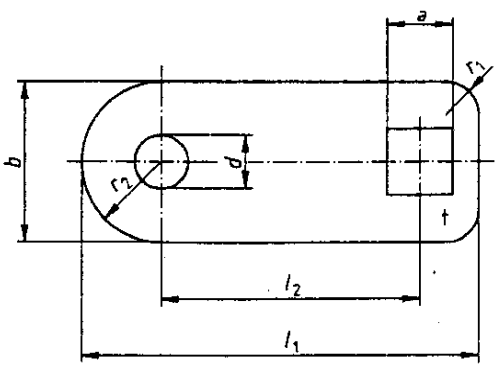
Figure 51
(modified version of figure 58 in ISO 129)

In master drawings (i.e. drawings representing a part which is to be produced to the same configuration but in different sizes), the variable dimensions shall be indicated on the drawing by letters instead of the respective dimensional values, the numerical values of the latter being assigned in a table to the appropriate letter (see figure 52).

Each line of the table applies to one size of the part and is given an identification number.

The appropriate graphical symbols and signs (e.g. ϕ for diameter, ∩ for arc length, ( ) for auxiliary dimensions, or M for metric screw thread), are to be assigned to the dimensional values and not to the dimension letters (see figure 52).

NOTE. See ISO 3898 for specifications for letters used to represent dimensions.



Nr.	l_1 +2	b ±0,2	d	a +0,1	l_2 ±0,2	r_1	r_2	t
1	80	32	ø 10	□12	50	R 6	(R 16)	2
2	100	40	M 12	□16	64	R 8	(R 20)	16
3	120	48	ø 16	□20	78	R 10	(R 24)	6

Figure 52

The simplified indication of dimensions with the letter t may be used:

- within the outline (see figure 54);
- on a horizontal extension to a leader line (see figures 42 and 56);
- in the table on a master drawing (see figure 52).

To avoid duplication of tolerances and the accumulation of individual tolerances in respect of the overall dimension, the dimensions in a chain of single dimensions shall not all be indicated (see figures 53 and 54).

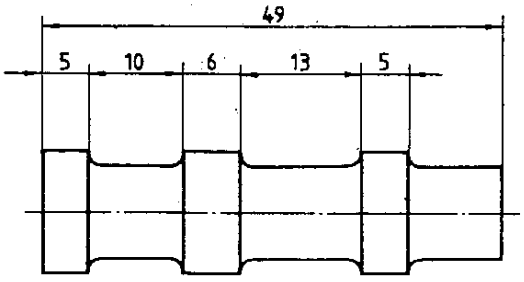


Figure 53

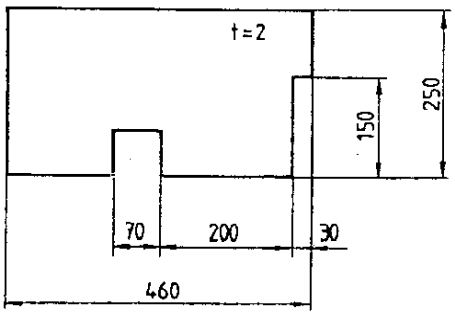


Figure 54
(modified version of figure 32 in ISO 129)

All dimensions in a chain of single dimensions may be separately indicated if

- one dimension in the chain is indicated as an auxiliary dimension (see figures 148 and 149), or
- the dimensions are indicated as theoretically exact dimensions (see figures 151 to 154).

4.2 Diameters

The graphical symbol ø shall always precede the dimensional value (see figures 55 to 59).

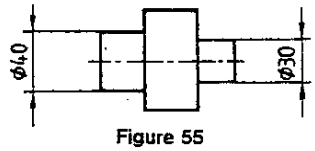


Figure 55
(figure 27 in ISO 129)

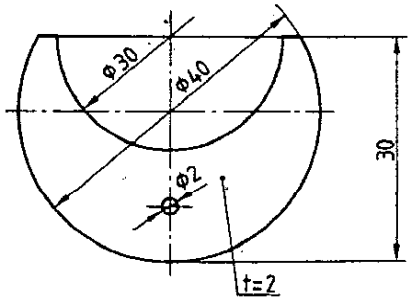


Figure 56

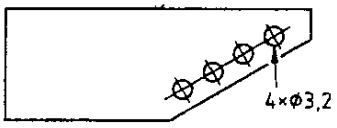


Figure 57

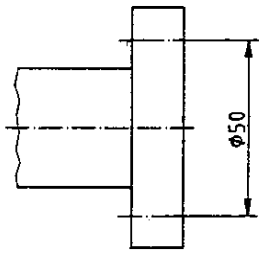


Figure 58

Where there is insufficient space, diameters may also be placed outside the features to which they refer (see figure 59).

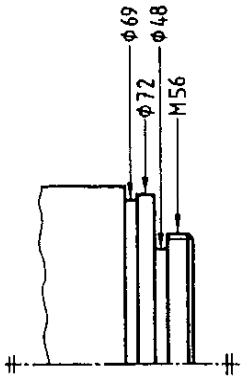


Figure 59

4.3 Radii

The capital letter R shall always precede the dimensional value. The dimension lines for radii shall be drawn from or in line with the centre of the circle of which the arc is a part and shall be terminated with an arrowhead touching the arc, inside or outside the feature outline (see figures 60 to 66 and 68 to 72).

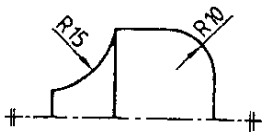


Figure 60
(figure 28 in ISO 129)

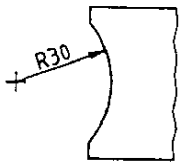


Figure 61

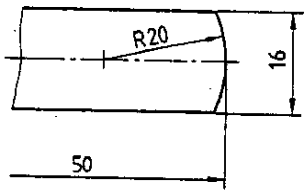


Figure 62

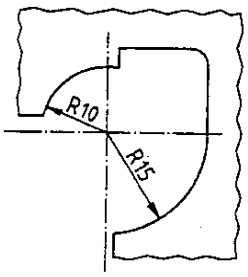


Figure 63

The dimension lines for two or more radii of the same magnitude may be combined (see figures 64 and 65).

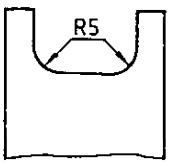


Figure 64

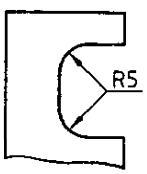


Figure 65

The radius of a semicircle which connects parallel lines must be indicated (see figure 68), may be indicated as an auxiliary dimension (see figure 66), or it may, if the geometry is sufficiently clear without it, be omitted (see figure 67).

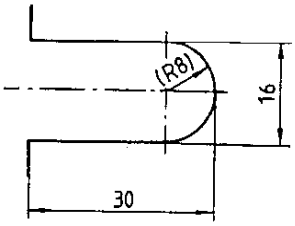


Figure 66

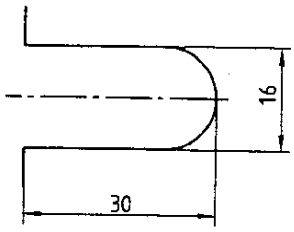


Figure 67

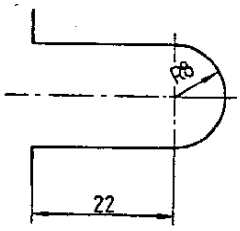


Figure 68

If the centre of a radius is not given by the geometry of adjacent features, the dimensions required to define its location shall be indicated (see figure 69).

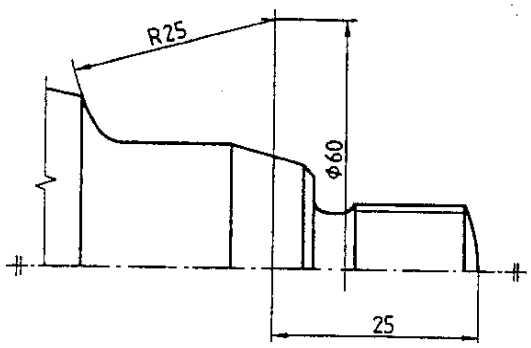


Figure 69

Dimension lines for large radii, where the centre of the arc falls outside the limits of the space available but needs to be located, shall be drawn in the form of a right-angled zigzag. The dimensional value shall be indicated on the section which touches the arc and be aligned with the geometrical centre of the radius (see figures 70 and 71). In the case of computer-aided drawings, only straight dimension lines (without a zigzag) are to be used.

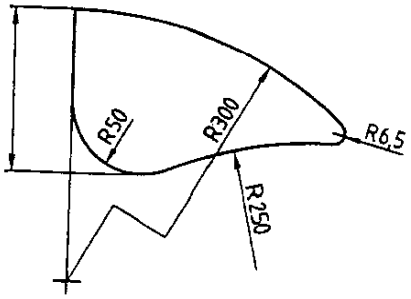


Figure 70
(figure 15 in ISO 129)

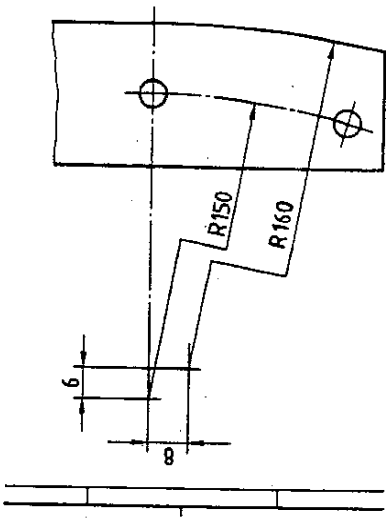


Figure 71

Where a number of radii share a common centre, the dimension lines shall either terminate at a small auxiliary arc or be interrupted (see figure 72).

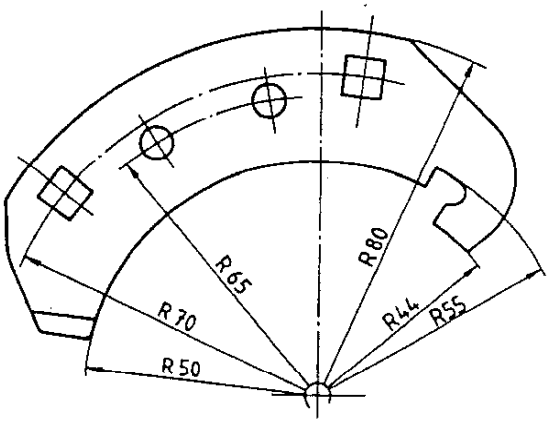


Figure 72

4.4 Spheres

The capital letter S shall always precede the diameter or radius indication (see figures 73 to 75).

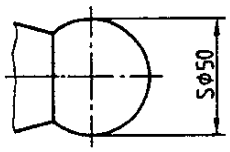


Figure 73
(figure 31 in ISO 129)

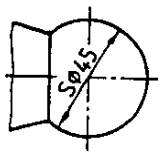


Figure 74

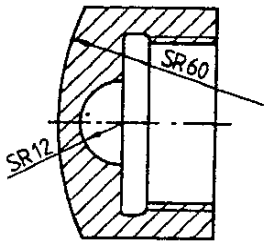


Figure 75
(figure 30 in ISO 129)

4.5 Arcs

The graphical symbol ⌒ shall normally precede the dimensional value (see figure 76). In drawings produced manually, a modified form of the symbol may be placed above the dimensional value (see figure 77).

In the case of central angles up to 90°, the projection lines shall be drawn parallel to the bisecting line of the angle. Each arc dimension shall be indicated with its own projection lines. Contiguous arc dimensions and linear and angular dimensions contiguous to arc dimensions shall not be indicated on the same projection line (see figure 78).

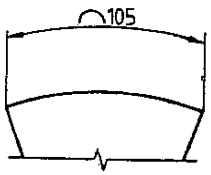


Figure 76
(figure 43 in ISO 129)

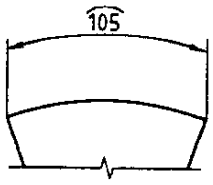


Figure 77

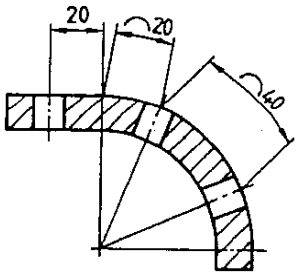


Figure 78

In the case of central angles greater than 90°, the projection lines shall be drawn in line with the centre of the arc. Where the reference is not clear, the connection between arc length and the dimensional value shall be indicated by a line with arrowhead and dot or circle on the dimension line (see figure 79). Contiguous arc dimensions or linear and angular dimensions contiguous to arc dimensions shall be indicated on the same projection line (see figure 79).

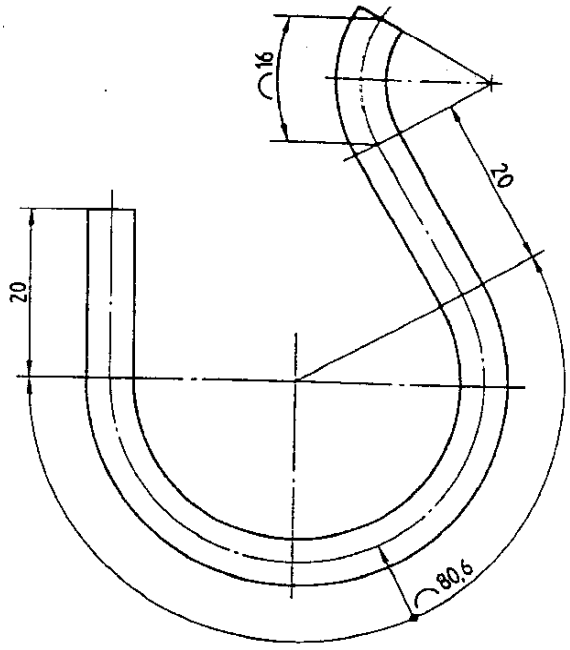


Figure 79

4.6 Squares

The graphical symbol □ shall always precede the dimensional value. Only one side length of the square shall be indicated (see figures 80 to 83).

NOTE. Square features should, for dimensioning purposes, preferably be represented in a view in which the shape is evident (see figures 81 and 82). In accordance with DIN 6 Part 1, crossed diagonal lines (type DIN 15 – B line) indicate a flat surface (see figures 80 and 83).

In other fields, crossed diagonal lines may have a different meaning (e.g. be used to indicate an aperture; cf. DIN 1356).

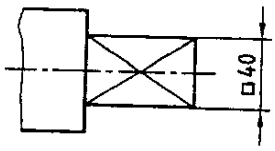


Figure 80
(figure 29 in ISO 129)

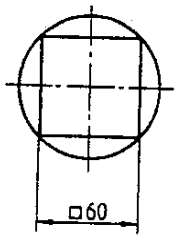


Figure 81

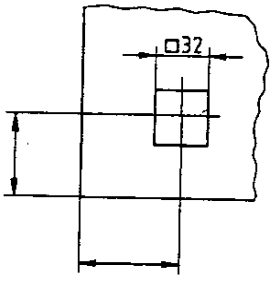


Figure 82

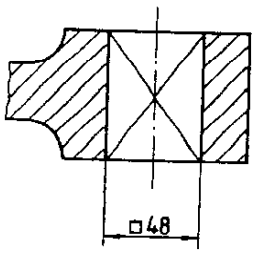


Figure 83

4.7 Widths across flats

The capital letters SW shall always precede the dimensional value when the clearance of the flats cannot be dimensioned in the drawing (see figures 84 and 85).

NOTE. See DIN 475 Part 1 for selected widths across flats.

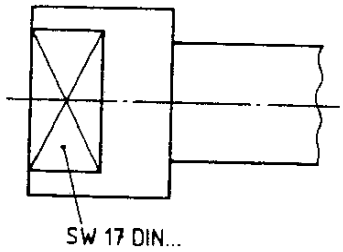


Figure 84

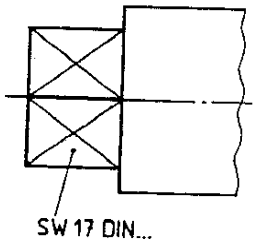


Figure 85

4.8 Rectangles

The side lengths of a rectangle in a drawing may be indicated on a horizontal extension to a leader line. The dimension of the side length at which the leader line terminates shall be indicated first (see figures 86 and 87).

Combination of the side lengths with the dimension of the third side (side length × side length × thickness or depth) is permitted (see figure 87). In this case, a second view or a section shall be drawn.

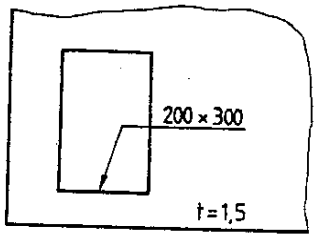


Figure 86

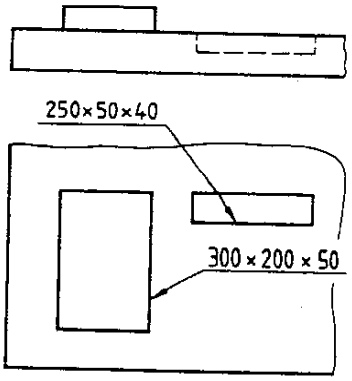


Figure 87

4.9 Slopes

The graphical symbol ◺ shall always precede the dimensional value of the slope (as a ratio or percentage). This indication should preferably be placed on a horizontal extension to a leader line (see figure 88). It may also be placed above the line of the sloped area (see figure 90) or horizontally to it (see figure 89). The symbol ◺ symbolizes the shape of the part at the slope (see figure 88).

The angle of inclination may, if relevant for production reasons, be indicated as an auxiliary dimension (see figure 90).

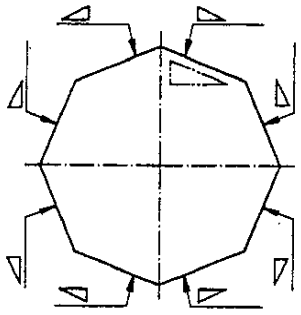


Figure 88

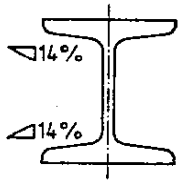


Figure 89

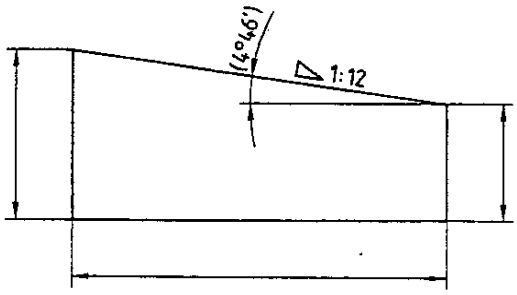


Figure 90

4.10 Tapers

The graphical symbol ▷ shall always precede the taper (as a ratio or percentage) on a horizontal extension to a leader line (see figures 91 and 92).

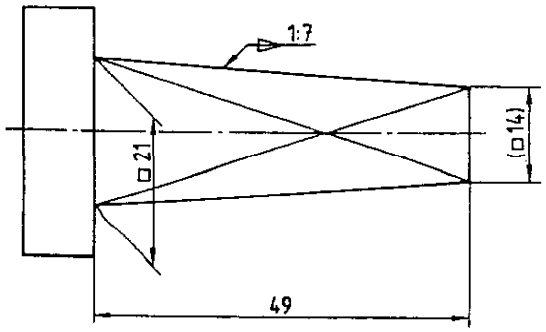


Figure 91

The orientation of the symbol shall be the same as that of the taper (see figures 91 and 92).

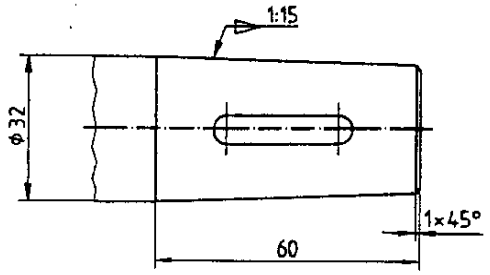


Figure 92

NOTE. See ISO 3040 for the indication of dimensions and tolerances of cones.

4.11 Chamfer, edges and countersinks

Dimensions of chamfers with an angle other than 45 % shall be indicated using dimension lines and projection lines (see figures 93 to 95).

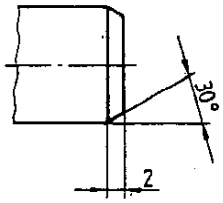


Figure 93
(modified version of figure 52 in ISO 129)

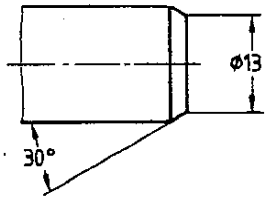


Figure 94
(modified version of figure 52 in ISO 129)

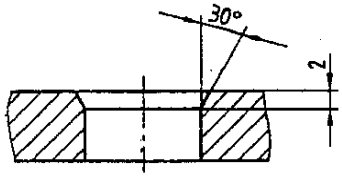


Figure 95

Dimensions of chamfers with an angle of 45° shall be indicated in simplified form as the chamfer width × 45° (see figures 96 to 102).

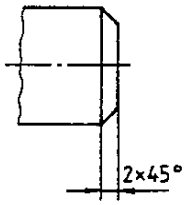


Figure 96
(figure 53 in ISO 129)

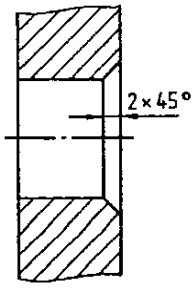


Figure 97
(figure 54 in ISO 129)

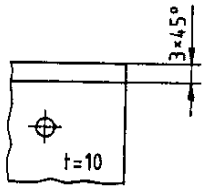


Figure 98

The dimensions of the chamfer, both when represented and not represented in the drawing, may be indicated by means of a leader line (see figures 99 to 102).

NOTE 1. Figures 99 to 102 represent cylindrical parts or holes.

NOTE 2. See DIN 6784 for the indication of specifications on workpiece edges.

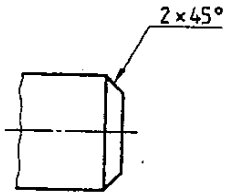


Figure 99
(figure 53 in ISO 129)

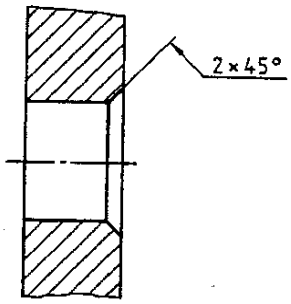


Figure 100
(figure 54 in ISO 129)

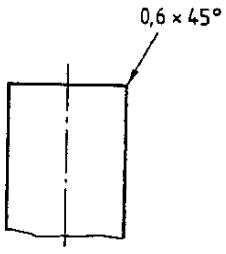


Figure 101

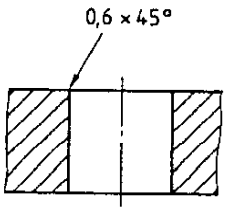


Figure 102

Conical countersinks shall be dimensioned by way of the diameter and angle of the countersink (see figure 103) or by its depth and angle (see figure 104).

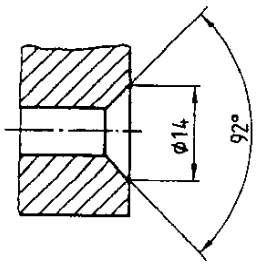


Figure 103
(modified version of figure 55 in ISO 129)

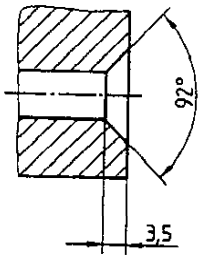


Figure 104
(modified version of figure 55 in ISO 129)

4.12 Repeated features

Linear or angular dimensions for repeated and equidistant features shall be indicated as shown in figures 105 to 108 and figures 113 and 114.

The overall dimension of the spacings between the features shall be indicated as an auxiliary dimension without further designation or specification.

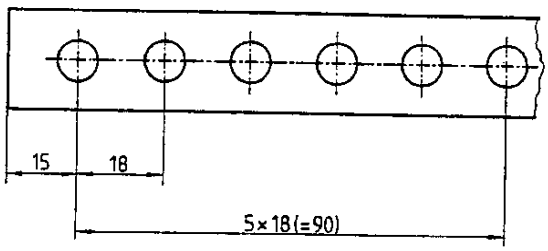


Figure 105
(modified version of figure 45 in ISO 129)

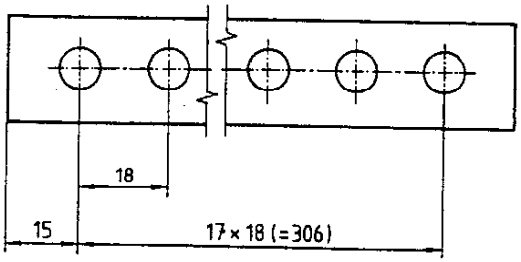


Figure 106
(figure 47 in ISO 129)

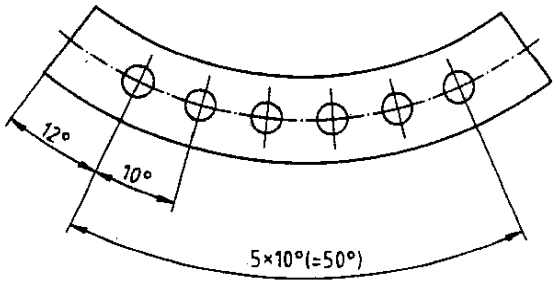


Figure 107

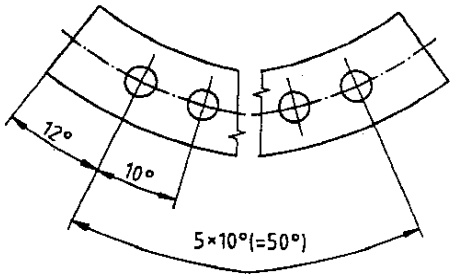


Figure 108

Repeated and associated features may be represented:

- complete as to number and size (see figures 112 and 115);
- only once in full (see figure 113);
- as interrupted views (see figure 114);
- in half or quarter views (see figure 109);
- only as centre lines or axes of coordinates (see figures 110 and 111);

The number of features shall be shown:

- by their being represented in full (number and size) (see figures 112 and 115);
- by indication of the number of spacings or the dimensions of the spacing (see figures 113 to 115 and 152);
- by direct specification (see figures 109 to 111).

In addition to the number of spacings or the dimensions of the spacing, the number of features may also be stated (see figure 113). That does not apply when features are represented in full (number and size).

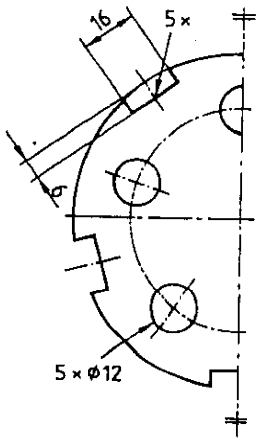


Figure 109
(modified version of figure 49 in ISO 129)

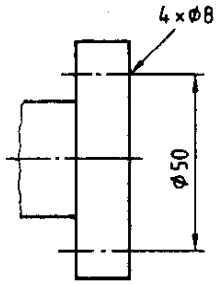


Figure 110

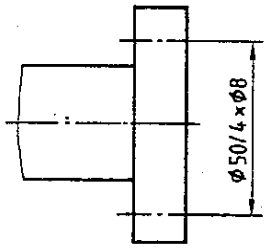


Figure 111

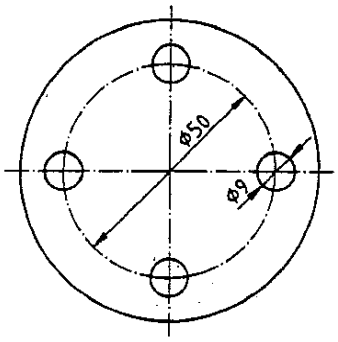


Figure 112
(modified version of figure 48 in ISO 129)

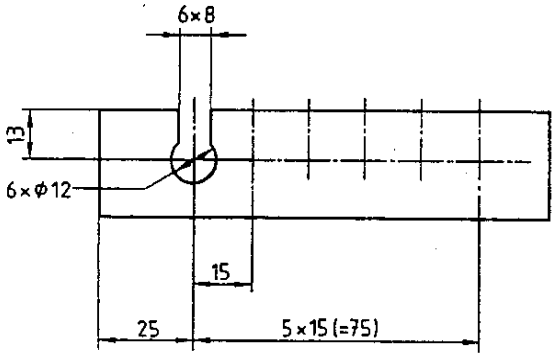


Figure 113

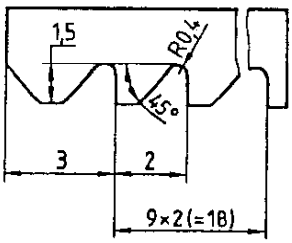


Figure 114

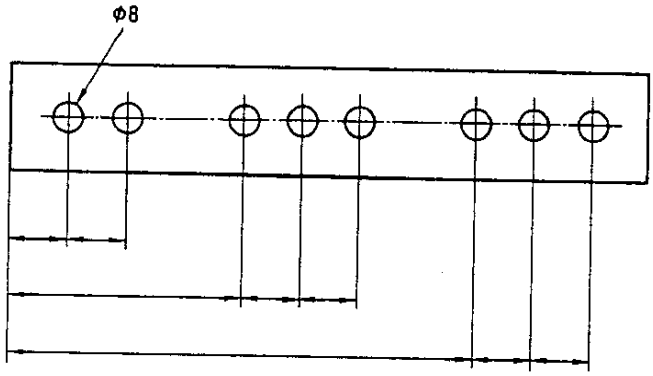
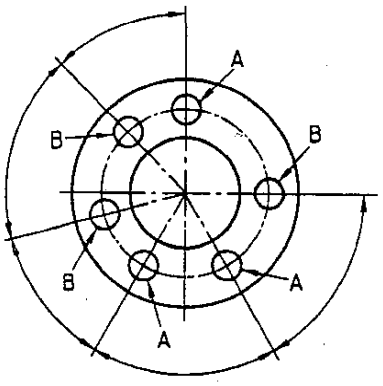


Figure 115
(modified version of figure 50 in ISO 129)

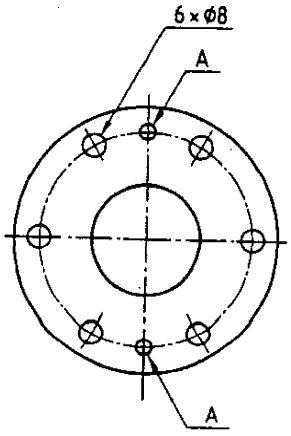
Groups of repeated features of different sizes shall be identified by capital letters, their significance being indicated on the drawing close to the object concerned (see figure 116).



A = Φ12
B = Φ10,8

Figure 116
(modified version of figure 51 in ISO 129)

Where the majority of the repeated features of a part are of the same size, with only a few repeated features being of different size, dimensioning may be effected by a combination of direct indication of the dimensions and indication by capital letters (see figure 117).



A = Φ4

Figure 117

4.13 Screw threads

For standardized screw threads, the codes specified in DIN 202 shall be used. As a rule, these codes consist of the code for the thread type (e.g. M, R, Tr), the nominal diameter (thread size), the pitch, the number of threads per inch/mm, and, where relevant, other data, such as thread direction or tolerance.

See example in figure 118.

Chamfers for external and internal threads are only to be dimensioned if they do not correspond to the thread major or minor diameter (see figure 119).

For further details, see ISO 6410-1.

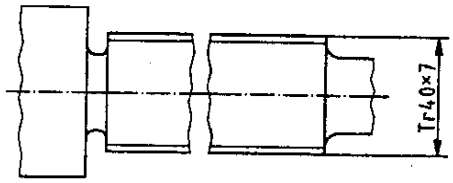


Figure 118

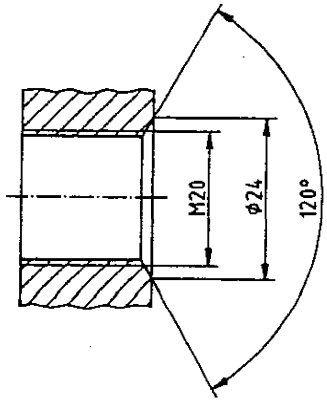


Figure 119

4.14 Grooves

Grooves shall be dimensioned as shown in figures 120 to 134. The depth of grooves which are open on at least one side shall be dimensioned from the opposite side (see figure 120), and in all other cases, from the groove side (see figures 121 to 126). The groove depth is defined as the greatest distance from the external diameter of the body to the bottom of the groove.

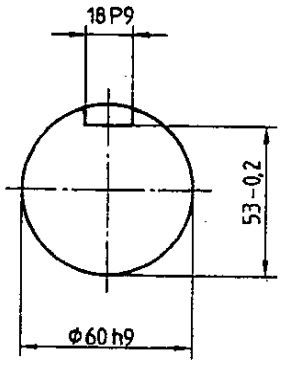


Figure 120

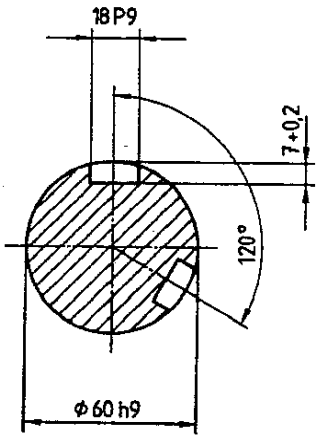


Figure 121

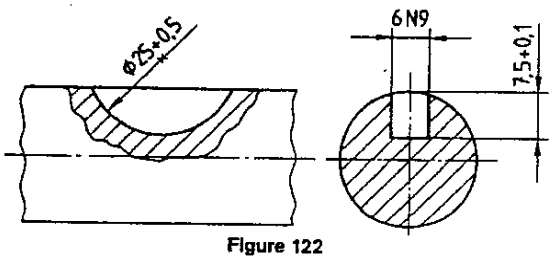


Figure 122

See figure 123 for the dimensioning of the groove depth when the bottom of the groove runs parallel to the surface line of a cone.

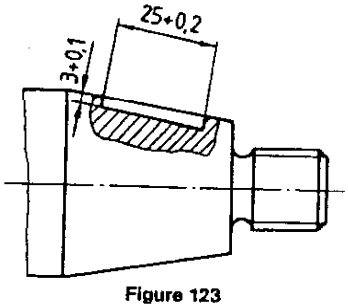


Figure 123

When the bottom of the groove runs parallel to the cc axis, the depth of the groove shall be dimensioned from t surface line of the larger cylinder (see figure 124).

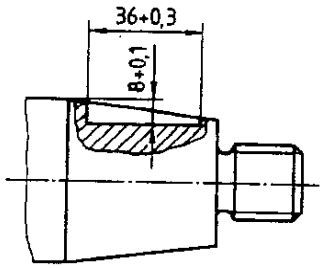


Figure 124

When represented in the view from above, the depth of the groove may be dimensioned in simplified form by way of the letter h and the dimensional value (see figure 125) or in combination with the groove width (see figure 126).

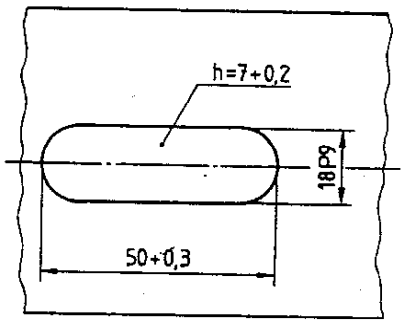


Figure 125

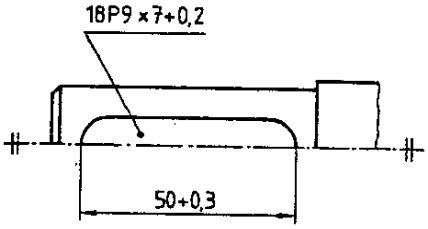


Figure 126

See figure 127 for the dimensioning of keyways in cylindrical bores.

NOTE. To ensure proper function, the dimensioning of keyways may further require, where corresponding accuracy requirements have been made, the specification of geometrical tolerances as given in ISO 1101 (e.g. for parallelism or symmetry).

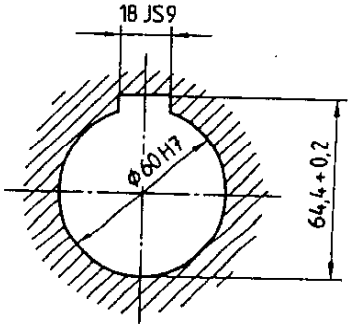


Figure 127

See figure 128 for the dimensioning of keyways in tapered hubs (where bottom of groove runs parallel to surface of cone).

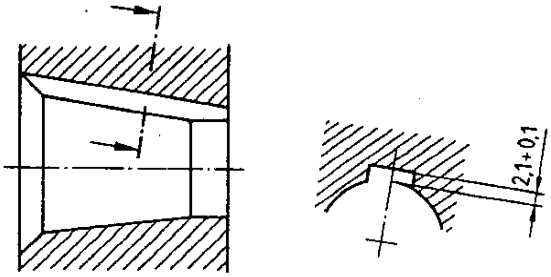


Figure 128

See figure 129 for the dimensioning of keyways in tapered hubs (where bottom of groove runs parallel to cone axis).

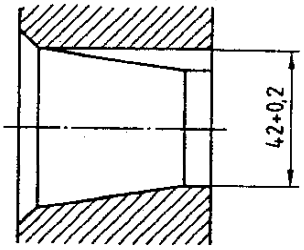


Figure 129

See figure 130 for the indication of direction of slope in the case of parallel hubs with tapered keyways by means of the graphical symbol for 'slope'.

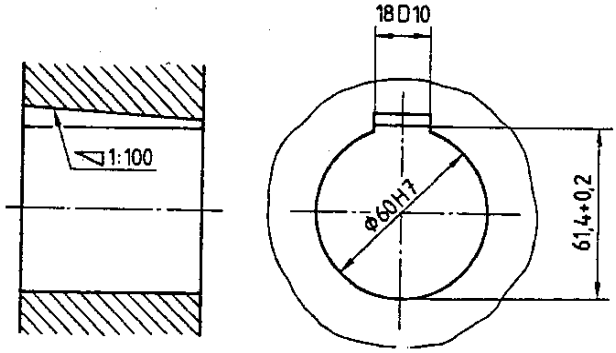


Figure 130

See figures 131 and 132 for the complete dimensioning of grooves/undercuts (e.g. for retaining rings).

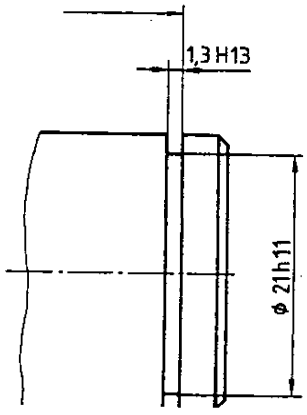


Figure 131

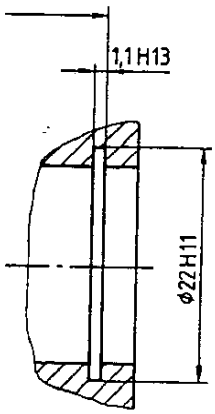


Figure 132

See figures 133 and 134 for simplified dimensioning of grooves undercuts (e.g. for retaining rings).

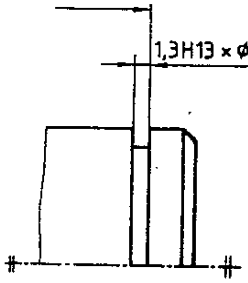


Figure 133

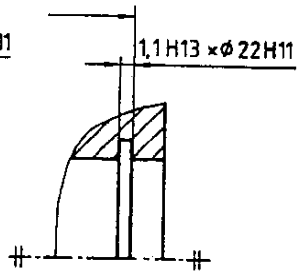


Figure 134

4.15 Developed views

See figure 135 for the dimensioning of the initial outlines of a part as auxiliary dimensions.

NOTE. A type DIN 15 – K line is to be used for drawing the initial outlines.

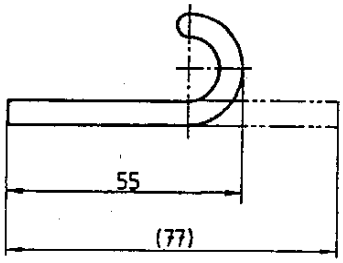


Figure 135

Where the initial outline is not represented, the symbol for 'effective length' may be used to indicate this dimension; see figure 136.

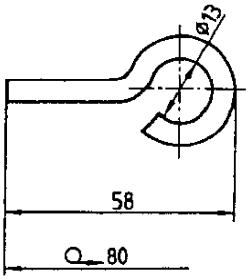


Figure 136

4.16 Limited areas

A limited area which is subject to special conditions shall be indicated by a type DIN 15 – J line (see figures 137 to 141). Where there is no risk of confusion, rotationally symmetrical parts need only be thus marked on one side (see figure 137), but marking on both sides is permitted (see figures 140 and 141).

If the limited area is defined by the contour of the feature, no dimensions shall be indicated (see figure 139).

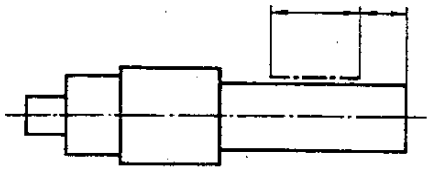


Figure 137

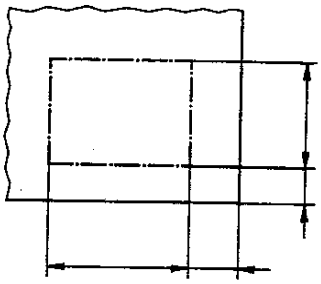


Figure 138

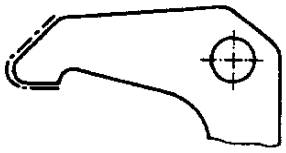


Figure 139
(modified version of figure 60 in ISO 129)

4.17 Coated objects

In the case of objects with surfaces which are to be coated, the dimensions prior and subsequent to coating may be indicated (see figure 140).

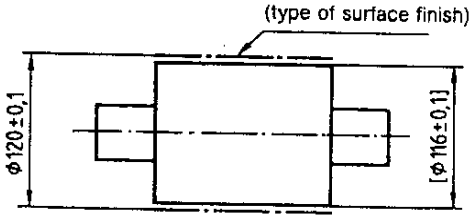


Figure 140

Where the coating requires subsequent treatment, the coating dimension may also be indicated in square brackets (see figure 141).

NOTE. Cf. DIN 50 960 Part 2 for specifications with respect to finishes.

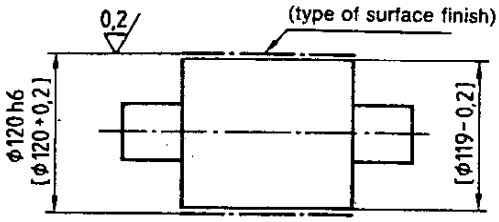


Figure 141

4.18 Symmetrical parts

The dimensions of symmetrically arranged features shall be indicated, irrespective of the type of representation (in full, half or quarter view), only once. The dimensions of individual features shall wherever possible be indicated together (see figure 143).

The symmetry of features need not generally be dimensioned (see figures 142 to 144).

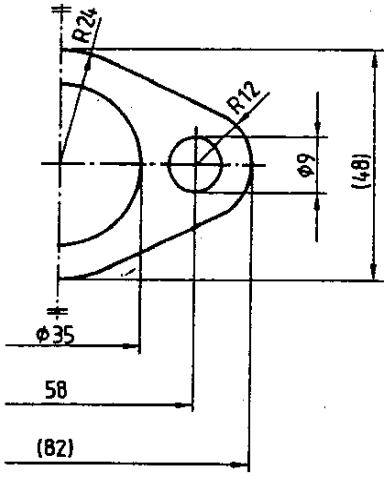


Figure 142

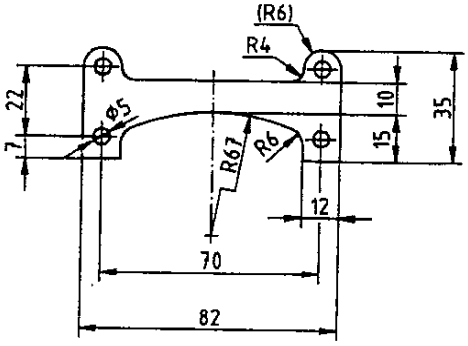


Figure 143

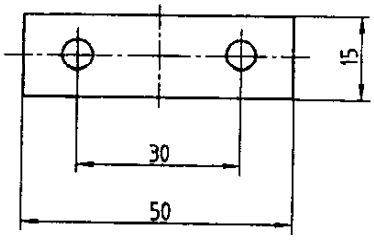


Figure 144

4.19 Measuring points

The position of measuring points shall be indicated by the symbol ⊕ and the corresponding dimensions (see figures 145 and 146).

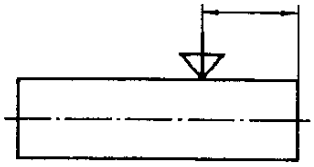


Figure 145

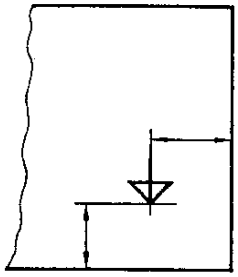


Figure 146

See DIN 6773 Parts 2 to 5 and DIN 50 960 Part 2 for further examples.

5 Special dimensions

5.1 Auxiliary dimensions

Auxiliary dimensions as specified in DIN 406 Part 10 shall be placed in round brackets. See figure 147 for the use of auxiliary dimensions to indicate functional relationships.

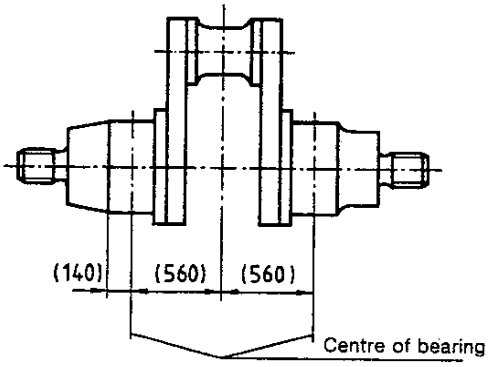


Figure 147

Figures 148 and 149 show how auxiliary dimensions may be used to avoid closed chains of single dimensions.

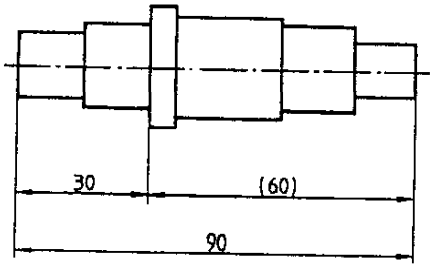


Figure 148

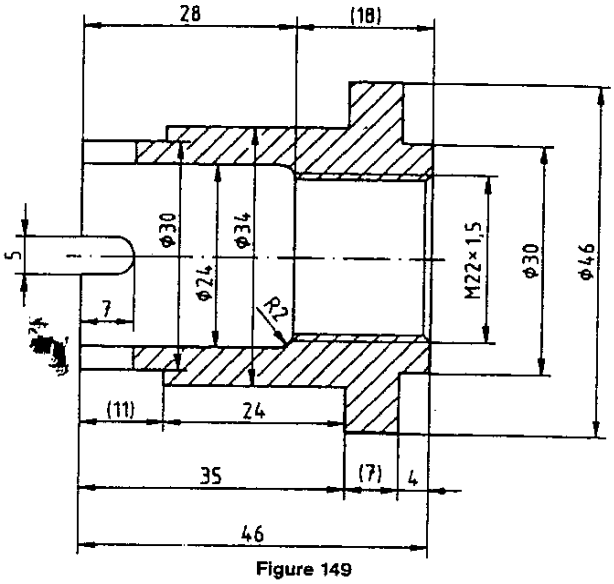


Figure 149

5.2 Informative dimensions

Informative dimensions as specified in DIN 406 Part 10 are indicated in appropriate product documentation without further identification (e.g. as overall dimensions; see figure 150).

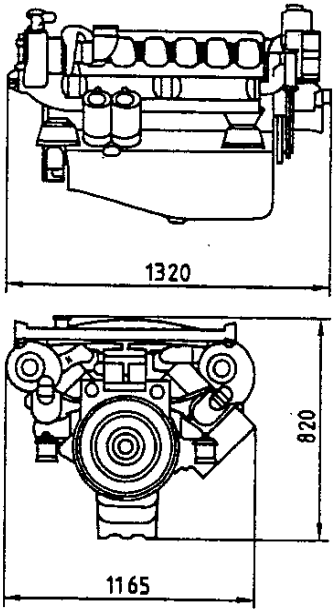


Figure 150

5.3 Theoretically exact dimensions

Theoretically exact dimensions as specified in DIN 406 Part 10 are to be placed in a rectangular frame and indicated without tolerance (see figures 151 and 152). That also applies for theoretically exact dimensions in tables (see figures 153 and 154).

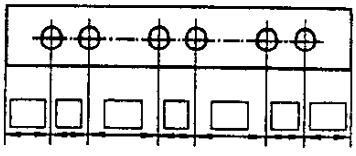


Figure 151

The position of the features shall be located by other specifications (e.g. by way of a tolerance of position; see figure 152).

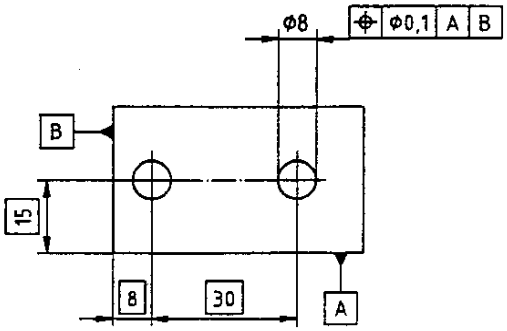
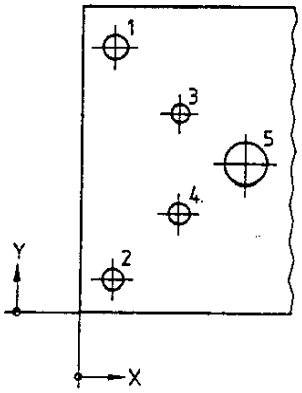
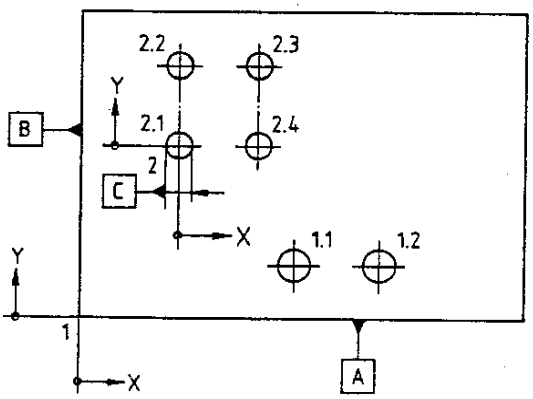


Figure 152



Item	x	y	*d*
1	20	160	ø 15,5
2	20	20	ø 13,5
3	60	120	ø 11
4	60	60	ø 13,5
5	100	92	ø 26
6			
7			

Figure 153



Origin	Item	x	y	*d*	Tolerance of position
1	1	0	0	–	–
1	1.1	50	20	ø 18	⌖ ø 0,1 A B
1	1.2	70	20	ø 18	⌖ 0,1 B ⌖ 0,2 A
1	2	30±0,3	70±0,3	–	–
2	2.1	0	0	ø11 H13	–

Figure 154

5.4 Raw dimensions

Raw dimensions as specified in DIN 406 Part 10 are indicated in production drawings in square brackets when a drawing of the object in its raw state is not made (see figure 155). The significance of the brackets shall be indicated above the title block.

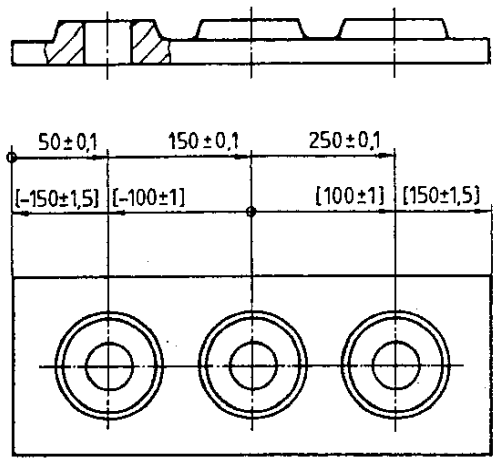


Figure 155

5.5 Dimensions for initial processing with reference to a datum

The dimensions for the initial processing of unfinished parts (see DIN 199 Part 2 for concept) involving material removal may be indicated by way of a datum as specified in DIN 406 Part 10 (see figures 156 and 157). Where the centre of a feature serves as the origin for processing, a datum triangle shall be placed on the dimension line of that feature and joined to the line of symmetry from which the datum derives (see figure 156).

If the datum and the dimension of initial processing cannot be joined or if it would not be expendient to do so, the datum shall be indicated by a capital letter in a box, as specified in ISO 5459 (see figure 157).

In the case of unworked surfaces and other surfaces which can differ considerably from their theoretically exact shape, datum targets as specified in ISO 5459 shall be specified (see figure 157).

The indication of a datum is only required if the datum dimension does not clearly define the datum feature or datum target. Other possibilities of indicating the dimensions for initial processing are to identify bearing or reference surfaces (e.g. as specified in DIN 7523 Part 1), or to identify the surfaces with symbols for surface texture as specified in ISO 1302, where appropriate with geometrical tolerances as specified in ISO 1101.

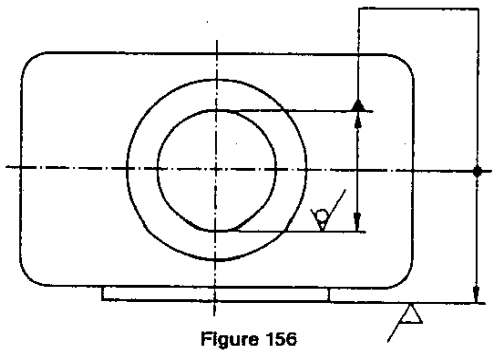


Figure 156

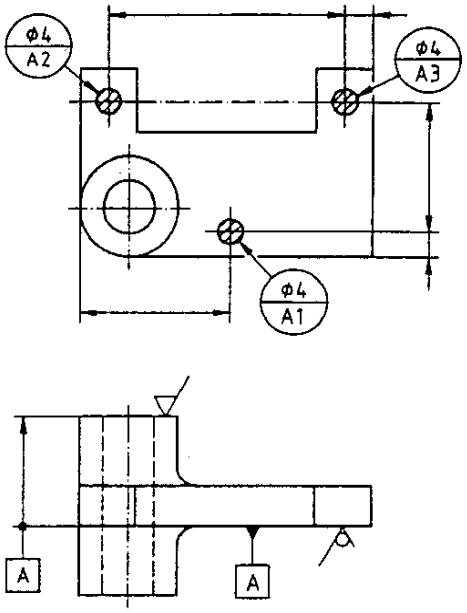


Figure 157

5.6 Check dimensions

Check dimensions as specified in DIN 406 Part 10 shall be placed in a frame formed with two semicircles (see figures 158 and 159).

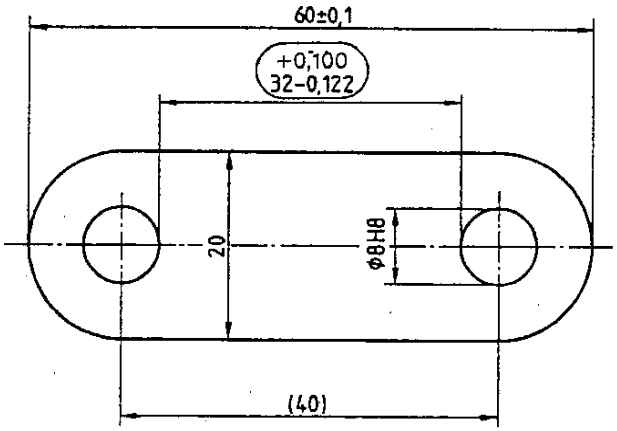


Figure 158

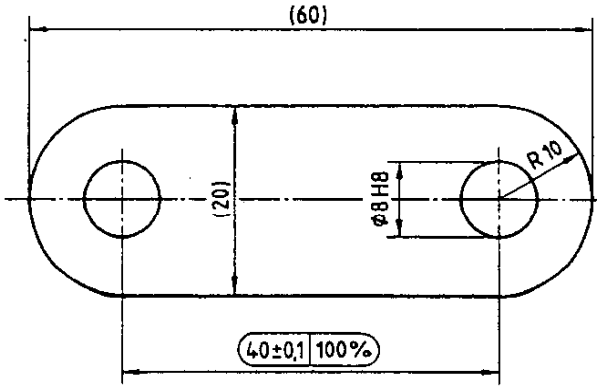
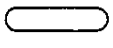


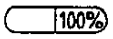
Figure 159

Where appropriate, the significance of the check dimensions and the scope of testing shall be indicated near the title block.



Dimensions will be checked by client (recipient) on acceptance

or



Dimensions will be subjected to 100 % inspection by client (recipient) on acceptance

5.7 Out-of-scale representation of features

In exceptional cases (e.g. where alterations have been made), features represented out-of-scale shall be identified as such by underlining the dimensional value (see figure 160), such marking not being permitted in the case of computer-assisted drawings.

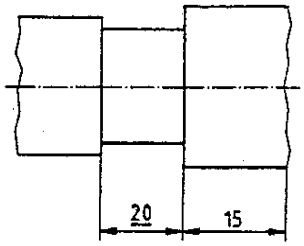


Figure 160

6 Types of indication

6.1 Parallel dimensioning

The dimension lines shall be drawn parallel in the same direction, in two or three directions perpendicular to each other, or concentrically (see figures 161 to 164).

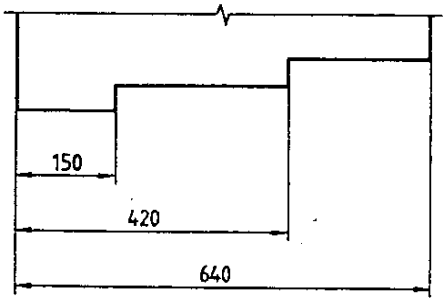


Figure 161
(modified version of figure 33 in ISO 129)

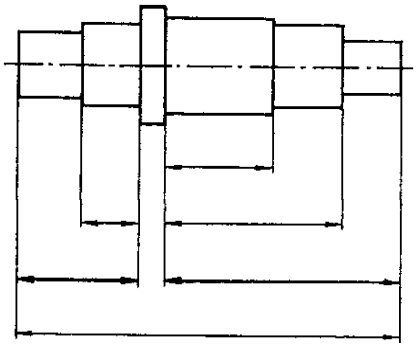


Figure 162
(modified version of figure 41 in ISO 129)

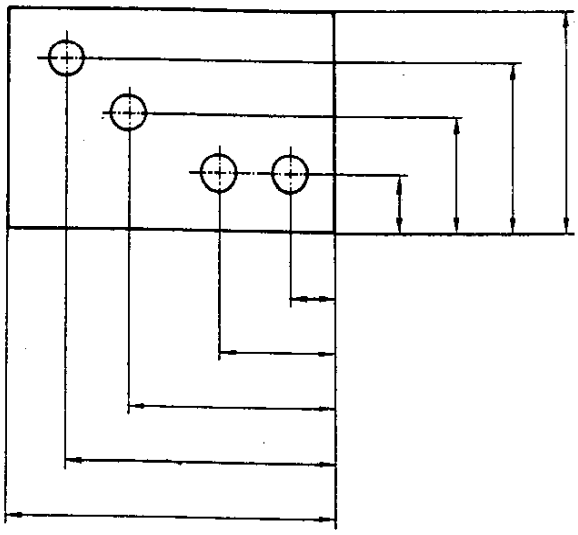


Figure 163

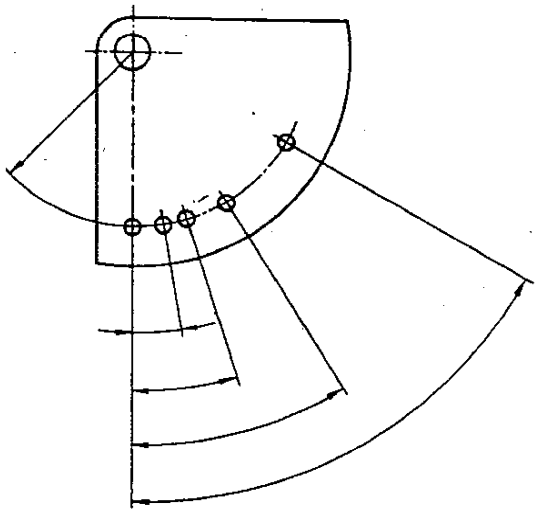


Figure 164

6.2 Superimposed running dimensioning

Starting from the origin, a single dimension line is generally drawn in each of the three possible directions perpendicular to each other (see figures 165 and 170 for exceptions) and terminated at the projection lines with an arrowhead, as shown in figure 23 a, b, c, and f (see figures 165 to 171).

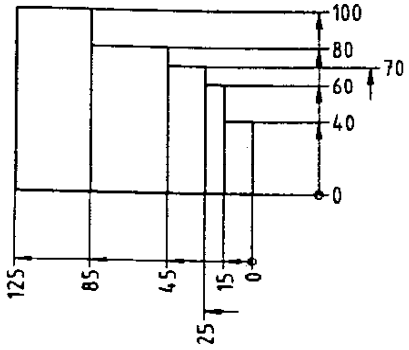


Figure 165

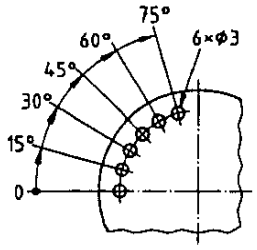


Figure 166

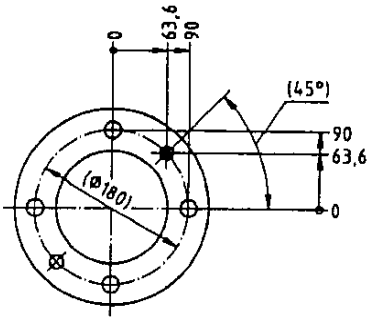


Figure 167

If, starting from the origin, dimensions are indicated in both directions (see figure 169 for example), then the dimensional values in one of the directions shall be preceded by a minus sign.

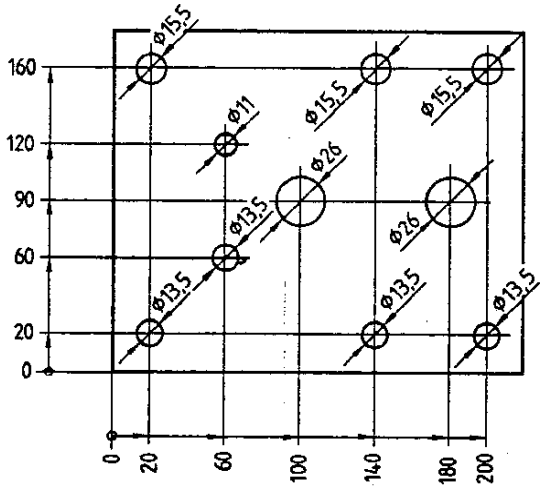


Figure 168

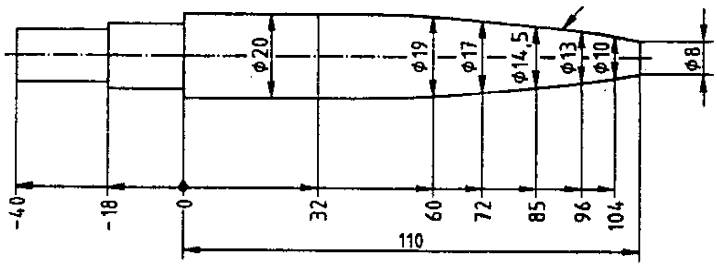


Figure 169

See figure 170 for superimposed running dimensions in two directions with interrupted dimension lines.

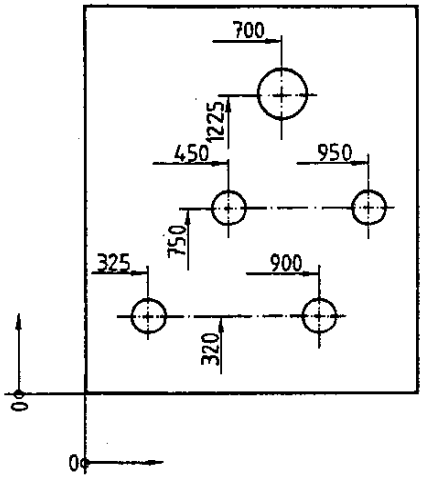


Figure 170

See figure 171 for superimposed running dimensions in three directions with four origins.

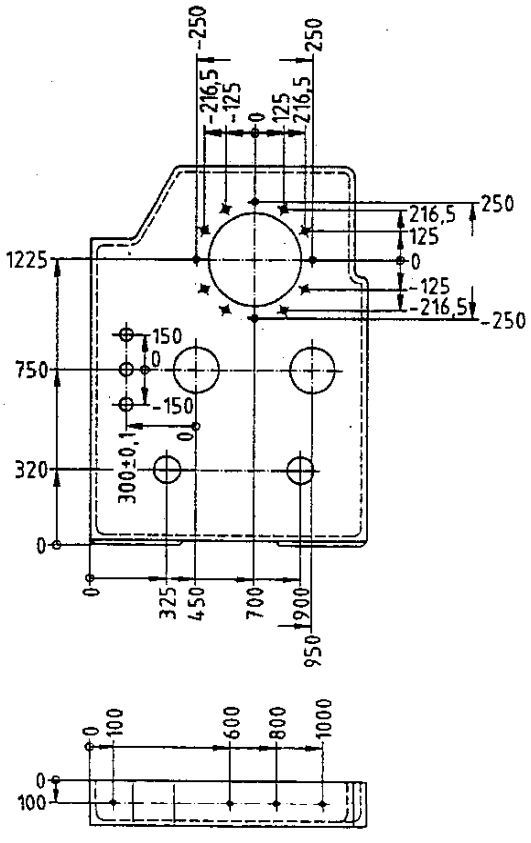


Figure 171

6.3 Dimensioning by coordinates

6.3.1 Polar coordinates

The polar coordinates are defined, starting from the origin, by a radius and an angle. They are always positive and are indicated, starting from the polar axis, in the counter-clockwise direction (see figure 172).

The coordinate values are entered in tables; see example in figure 179.

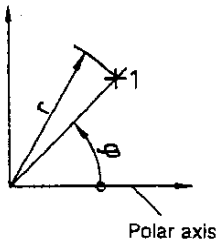
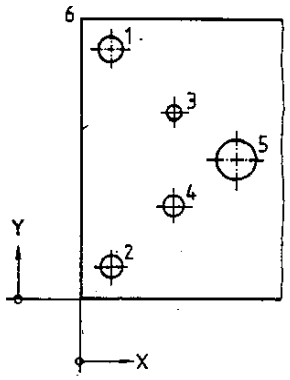


Figure 172

6.3.2 Cartesian coordinates

Starting from the origin, the cartesian coordinates are defined by linear dimensions running in two directions at right angles to each other (see figures 173 to 179). The coordinate values shall be entered in tables or indicated directly at the coordinate points. Dimension lines and projection lines shall not be drawn.



Item	x	y	d
1	20	160	ø 19
2	20	20	ø 15
3	60	120	ø 11
4	60	60	ø 13
5	100	90	ø 26
6	0	180	–
7			
8			

Figure 173

The positive and negative direction of the coordinate axes shall be defined as shown in figure 174. The dimensional values of dimensions in the negative direction of the coordinate axes shall be indicated with a minus sign (cf. DIN 5 Part 1 and ISO 6412 Part 2).

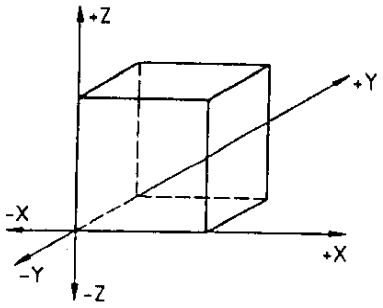
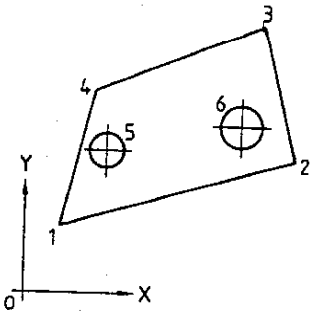


Figure 174

The origin of the coordinates may also lie outside the object represented (see figures 175 and 176).



Item	x	y	*d*
1	10	20	–
2	80	40	–
3	70	80	–
4	20	60	–
5	24	42	ø 10
6	64	50	ø 12

Figure 175
(modified version of figure 40 in ISO 129)

The coordinate values may also be indicated directly at the coordinate points (see figures 176 and 177).

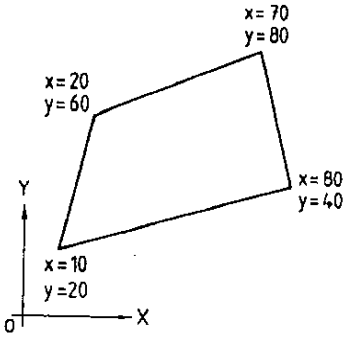


Figure 176
(modified version of figure 39 in ISO 129)

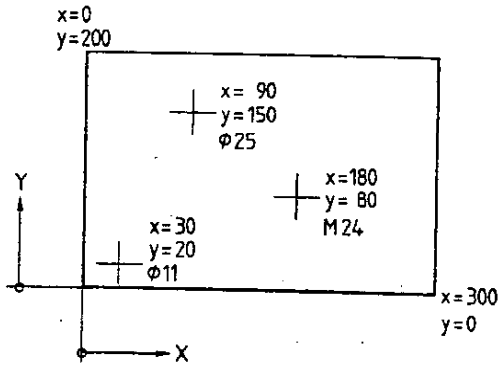


Figure 177

The combination of coordinate values with the dimensions of the features at the respective coordinate points is permitted (see figures 173, 175, 177 and 178). In complex drawings, a leader line may be drawn between the coordinate point and the associated dimensions (see figure 178).

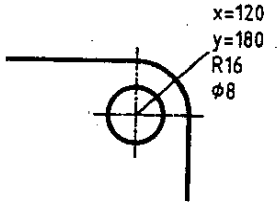
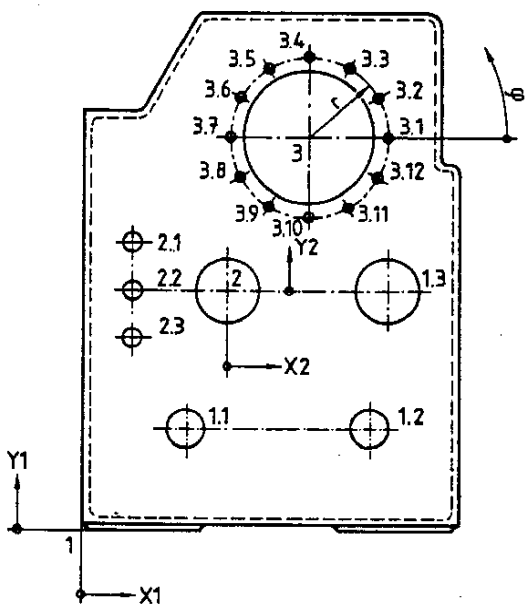


Figure 178

Secondary systems of coordinates may be assigned to the primary system. The origins of the systems of coordinate and the separate items within the systems shall be numbered continuously with arabic numerals, a point used as the separation sign. Figure 179 shows an example of dimensioning by coordinates with a primary system of coordinates and two secondary systems.



Origin of coordinates	Item	Dimensions in mm				
		Coordinates				
		X1 X2	Y1 Y2	r	φ	d
1	1	0	0			–
1	1.1	325	320			ø 120 H7
1	1.2	900	320			ø 120 H7
1	1.3	950	750			ø 200 H7
1	2	450	750			ø 200 H7
1	3	700	1225			ø 400 H8
2	2.1	-300	150			ø 50 H11
2	2.2	-300	0			ø 50 H11
2	2.3	-300	-150			ø 50 H11
3	3.1			250	0°	ø 26
3	3.2			250	30°	ø 26
3	3.3			250	60°	ø 26
3	3.4			250	90°	ø 26
3	3.5			250	120°	ø 26
3	3.6			250	150°	ø 26
3	3.7			250	180°	ø 26
3	3.8			250	210°	ø 26
3	3.9			250	240°	ø 26
3	3.10			250	270°	ø 26
3	3.11			250	300°	ø 26
3	3.12			250	330°	ø 26

Figure 179

6.4 **Combined dimensioning** (examples)

Superimposed running dimensioning combined with single dimensioning is illustrated in figure 180.

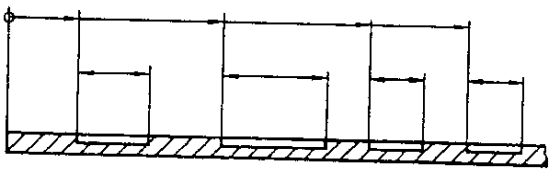


Figure 180
(modified version of figure 42 in ISO 129)

Parallel dimensioning combined with superimposed running dimensioning and chain dimensioning is illustrated in figure 181.

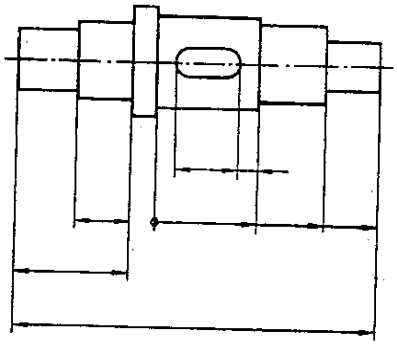


Figure 181
(modified version of figure 41 in ISO 129)

Appendix A

Examples of the use of dimensional and tolerance indications

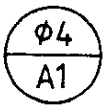
Table A.1

Example	Significance	Standards specifying form and size of indication
⌀50	Diameter (e.g. 50)	DIN 6776 Part 1
□50	Square (e.g. 50)	
R50	Radius (e.g. 50)	
S⌀50	Spherical diameter (e.g. 50)	
SR50	Spherical radius (e.g. 50)	
SW 13	Width across flats (e.g. 13)	
t=2	Thickness (e.g. 2)	
h=5	Depth or height (e.g. 5)	
50	Theoretically exact dimension (e.g. 50)	ISO 7083
(50)	Auxiliary dimension (e.g. 50)	DIN 6776 Part 1
50±0,02	Check dimension (e.g. 50 ± 0,02)	DIN 406 Part 10
[50]	Raw or preprocessing dimension (e.g. 50)	DIN 6776 Part 1
⌒50	Arc dimension (e.g. 50)	DIN 406 Part 10 and ISO 7083, figure 5
123,456	Arc dimension (e.g. 123, 456)	–
50 [1]	Out-of-scale dimension (e.g. 50)	–
1:10	Taper (e.g. 1 : 10)	ISO 3040 and DIN 406 Part 10
14%	Inclination (e.g. 14 %)	DIN 406 Part 10
98	Effective length (developed view) (e.g. 98)	DIN 406 Part 10

[1] Use deprecated.

(continued)

Table A.1 (concluded)

Example	Significance	Standards specifying form and size of indication
	Measuring point (e.g. measuring point no. 2)	DIN 406 Part 10
	Frame in which further requirements may be indicated (e.g. M to denote maximum material condition, or E to denote envelope condition)	ISO 7083
	Frame for indicating datum targets (e.g. datum target A1, with a diameter of 4 mm)	
	Indication of a datum NOTE. The triangle may be filled in black.	

Standards referred to

DIN 5 Part 1	Engineering drawing practice; axonometric projections; isometric projections
DIN 6 Part 1	Technical drawings; representation in normal projection; views and special presentations
DIN 15 Part 1	Technical drawings; lines; basic principles
DIN 199 Part 1	Terminology associated with drawings and item lists; drawings
DIN 199 Part 2	Terminology associated with drawings and parts lists; parts lists
DIN 202	Screw threads; general overview
DIN 406 Part 10	Engineering drawing practices; dimensioning; concepts and general principles
DIN 475 Part 1	Widths across flats for screws, bolts, valves and fittings
DIN 1356	Construction drawings
DIN 6771 Part 6	Printed forms for technical documentation; drawings
DIN 6773 Part 2	Heat treatment of ferrous materials; heat treated parts; representation and indications on drawings; hardening, hardening and tempering, quenching and tempering
DIN 6773 Part 3	Heat treatment of ferrous materials; heat treated parts, representation and indications on drawings; surface hardening
DIN 6773 Part 4	Heat treatment of ferrous materials; heat treated parts, representation and indications on drawings; case hardening
DIN 6773 Part 5	Heat treatment of ferrous materials; heat treated parts, representation and indications in drawings; nitriding
DIN 6774 Part 1	Technical drawings; rules of execution; drawings suitable for reproduction
DIN 6776 Part 1	Technical drawings; lettering; characters
DIN 6784	Workpiece edges; terminology, finishes, indications on drawings
DIN 7523 Part 1	Representation of steel drop forgings in engineering drawings
DIN 50 960 Part 2	Electroplated and chemically applied coatings; indications on drawings
ISO 128 : 1982	Technical drawings; general principles of presentation
ISO 129 : 1985	Technical drawings; dimensioning; general principles, definitions, methods of execution and special indications
ISO 1101 : 1983	Technical drawings; geometrical tolerancing; tolerancing of form, orientation, location and run-out; generalities, definitions, symbols, indications on drawings
ISO 1302 : 1978	Technical drawings; method of indicating surface texture on drawings
ISO 3040 : 1990	Technical drawings; dimensioning and tolerancing cones
ISO 3898 : 1987	Bases for design and structures; notations, general symbols
ISO 5459 : 1981	Technical drawings; geometrical tolerances; datums and datum-systems for geometrical tolerancing

ISO 6410-1 : 1981	Technical drawings; conventional representation of threaded parts
ISO 6412-2 : 1989	Technical drawings; simplified representation of pipelines; isometric projection
ISO 7083 : 1993	Technical drawings; symbols for geometrical tolerancing; porportions and dimensions

Other relevant standards

DIN 406 Part 12	Engineering drawing practice; dimensioning; tolerancing of linear and angular dimensions
DIN 6774 Part 10	Technical drawings; rules of execution; computer-assisted drawings
DIN 6790 Part 1	Written text in technical drawings; individual texts
ISO 2768-1 : 1989	Tolerances for linear and angular dimensions without individual tolerance indications
ISO 2768-2 : 1989	Geometrical tolerances for features without individual tolerance indications

Previous editions

DIN 406 Parts 1 to 3: 12.22; DIN 406 Part 4: 12.22, 05.37; DIN 406 Part 5: 11.24, 10.41; DIN 406 Part 6: 12.24, 01.26, 10.41; DIN 406: 09.49, 09.55; DIN 406 Part 3: 07.75; DIN 406 Part 2: 06.68, 04.80, 08.81; DIN 406 Part 1: 04.77

Amendments

The following amendments have been made to the August 1981 edition of DIN 406 Part 2 and the July 1975 edition of DIN 406 Part 3:

a) the content of ISO 129 has been largely incorporated in the standard and further examples added;
b) the content of DIN 406 Part 3 has been revised and incorporated;
c) the specifications relating to tolerancing have been transferred to DIN 406 Part 12;
d) the specifications relating to computer-assisted drawing have in part been simplified;
e) practical examples for the indication of dimensions and tolerances have been introduced;
f) the simplified methods of indicating dimensions specified in DIN 30 Part 1 have in part been adopted.