Fundamentals of Drafting - Dimensioning

Objectives:

1. To recognise the general principles of dimensioning.
2. To classify dimensions according to their types and functions to ensure correct functioning of drawing components.
3. To identify the indication of dimensions in a drawing.
4. To apply techniques to place dimensions to working drawings.

General dimensioning principles

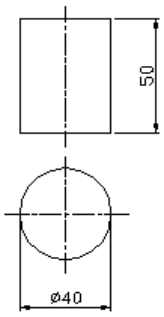
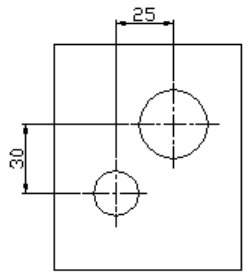
1. Each dimension defining a drawing feature should appear once only.
2. A dimension should not be calculated from other dimensions or measured from the scaled drawing.
3. Do not add a dimension that is not necessary to define the drawing feature.
4. Dimensions defining a drawing feature should preferably be placed on a single suitable view rather than on several.

Selection of dimensions

Dimensioning involves the selection of dimensions. This ensures the correct functioning of the drawing features and also enables the drawing to be interpreted without having to calculate any sizes.

To help selecting dimensions for a drawing feature, a typical classification of dimensions is considered below.

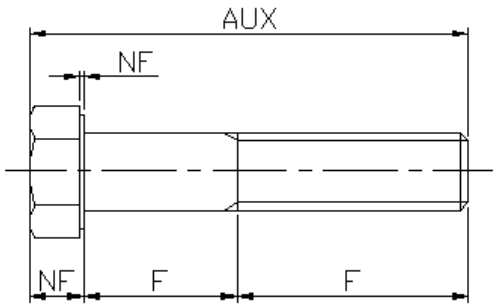
Types of dimensions

Size dimensions	Location dimensions
These dimensions define the size and shape of drawing components.	These dimensions specify the relative positions of drawing components.
	

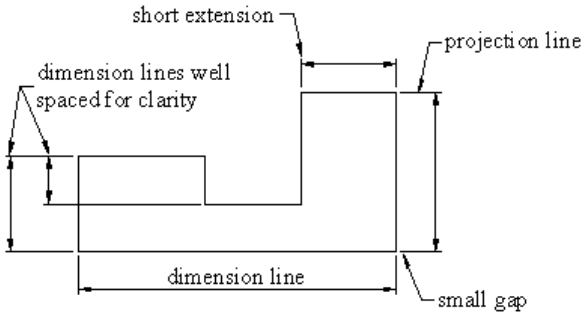
Functional dimensions

Dimensions may also be grouped according to whether these dimensions affect the function of the drawing component.

Functional dimensions (F)	Non-functional dimensions (NF)	Auxiliary dimensions (AUX)
These dimensions directly affect the function of the drawing component. They may be of the size or location type.	These dimensions do not directly affect the function of the drawing component and should be chosen to suit production and/or inspection purposes.	These dimensions are redundant dimensions which are placed for information only. They are not used in the machining or inspection of the drawing component.



Typical indication of dimensions



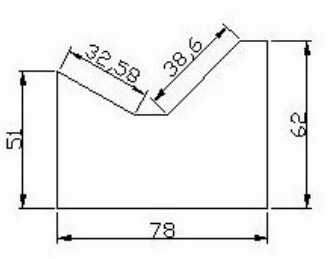
1. Dimensions should be placed outside the outline of a view.
2. A dimension line is drawn between two projection lines which are extended from points or lines on a view.
3. A small gap between the outline of a view and the projection line is preferred.
4. A short extension of the projection line beyond the dimension line is allowed.
5. Arrowheads of a dimension line should touch the projection lines. They should be clear, slender and solid, and preferably about 3 mm long.
6. Both projection lines and dimension lines are thin continuous lines.

Dimensioning techniques

1. Alignment of dimension figures

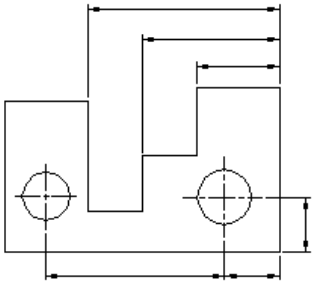
Dimension figures should be:

i) Normally expressed in mm. For dimension figures > 1 000, provide a space for each group of three digits.
ii) Preceded by 0 if figure <1, with a comma placed on the base line of the dimension figure.
iii) Placed normal to the dimension line, near its centre and clear of it.
iv) Positioned so that they can be read from the bottom or right-hand side of the drawing.



2. Placement of dimension and projection lines

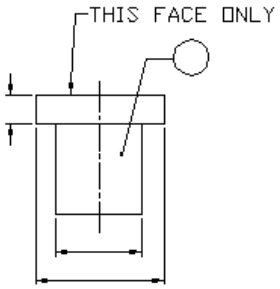
i) Centre lines, outlines and projection lines should not be used as dimension lines.
ii) Smaller dimensions should be placed nearest to the outline to avoid dimension and projection lines crossing.
iii) Dimension lines should be placed on the view which shows the drawing features to which they refer most clearly.



3. Use of leaders

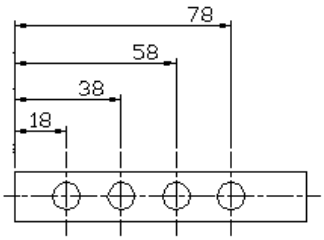
Leaders should

i) Be used to indicate where dimensions or notes are intended to apply.
ii) Nearly normal to the surface.
iii) Not be parallel to adjacent dimension or projection lines.
iv) Terminate in arrowheads or dots:
arrowhead when terminating on a line;
dot within the outline of the drawing object.

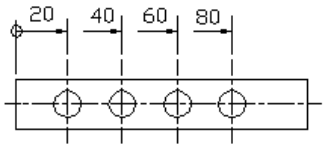


4. Dimensioning from a common datum

i) Dimensions are given from a common datum surface or line. This method should be used whenever practicable.
ii) Dimensions are given from a common origin. A circle of 3 mm minimum diameter and arrowheads should be used as terminals on the dimension lines..



Normal method



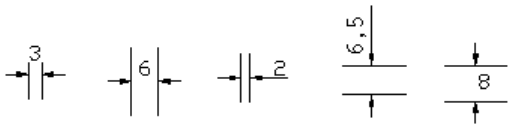
Alternative method

Dimensioning common features

Select a common feature to dimension

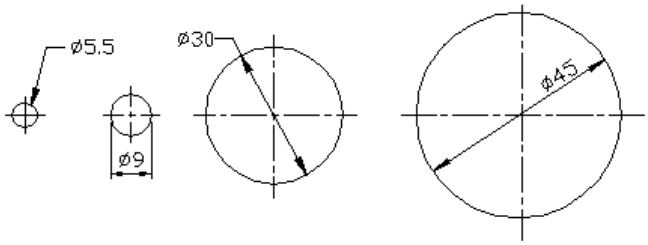
small features

When dimensioning narrow spaces or small features, the dimension figure should be placed centrally or above the extension of one of the arrowheads.



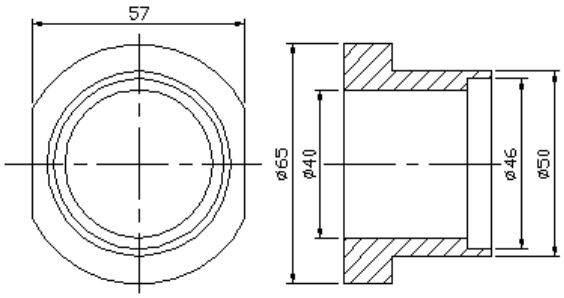
circles

Complete circles should be dimensioned by their diameters, using one of the methods shown. The dimension is preceded by the symbol Ø.

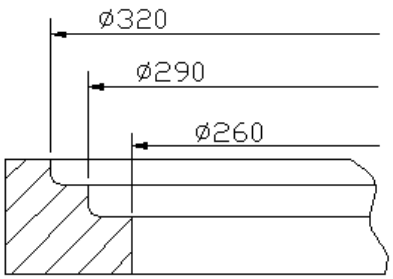


diameters

1.	Dimension should be preceded by the symbol Ø.
2.	The dimension should be placed on the most appropriate view to ensure clarity.

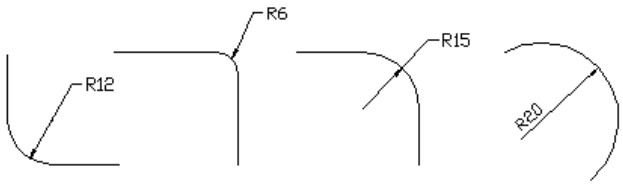


3.	Where space is limited, diameters can be dimensioned as shown below.



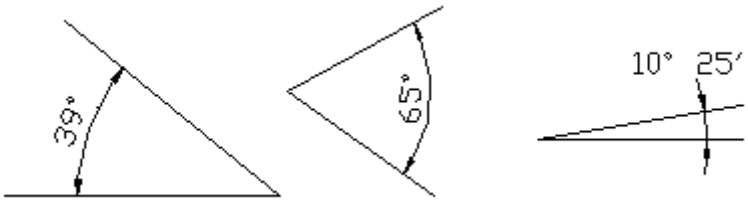
radii

1.	Radii are dimensioned using a dimension line which passes through, or in line with, the arc centre.
2.	The dimension line carries one arrowhead only, that touches the arc.
3.	The dimension figure is preceded by the abbreviation R.

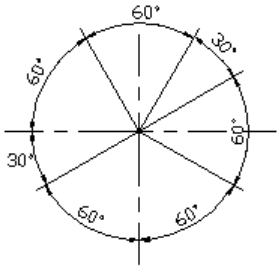


angles

1.	The dimension line for an angle is a circular arc having its centre on the point of the angle.
2.	Degrees, minutes and seconds are units used in dimensioning angles.

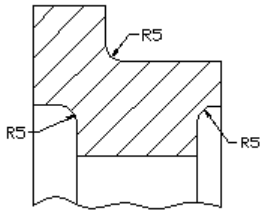


3.	Dimensions should be placed to read from the bottom or from the right-hand side of the drawing.

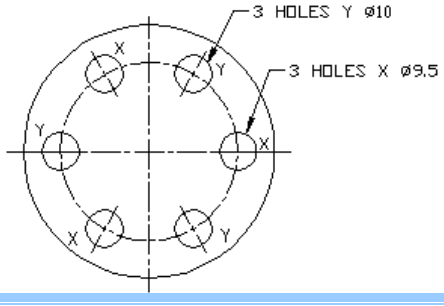


repeated features

1.	Dimensions or notes should be repeated to avoid placing long or intersecting leaders.

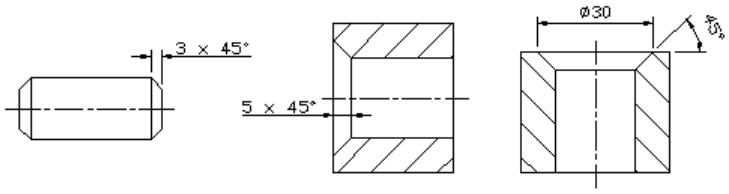


2.	Letter symbols may be used to indicate repeated features.

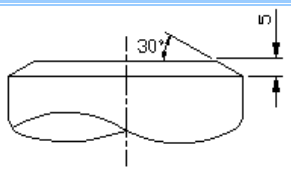


chamfers

1.	Chamfers at 45^0 should not be described by a note to avoid any misinterpretation. They should be dimensioned by one of the following methods.

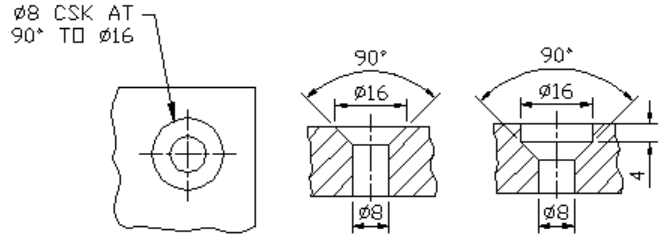


2.	Chamfers at angles other than 45^0 are dimensioned as follows.



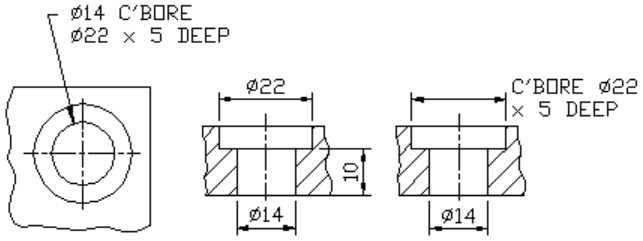
countersinks

1.	The dimension carries the diameter, the abbreviation for countersink namely CSK, the angle and then the diameter of the upper edge of the countersink; this should always be the sequence.
2.	Notes indicating countersinks, e.g. countersink to suit M10 x 1.5 CSK HD screw, are imprecise and should not be used in dimensioning.
3.	Recommended methods of dimensioning countersinks are shown below.



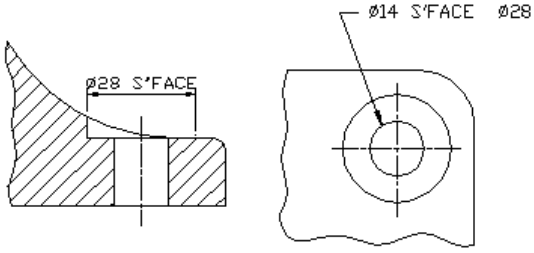
counterbores

1.	The dimension carries the diameter, the counterbore abbreviation CBORE, followed by the counterbore hole diameter and depth.
2.	Notes indicating counterbores, e.g. counterbore to suit M10 x 1.5 CH HD screw, are imprecise and should not be used in dimensioning.
3.	Recommended methods of dimensioning counterbores are shown below.



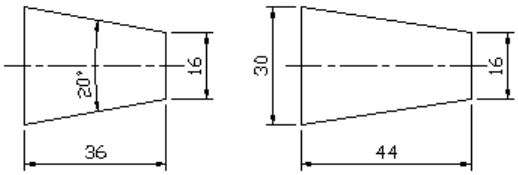
spotfaces

1.	A depth dimension of the spotface is usually not necessary.
2.	Recommended methods of dimensioning spotfaces are shown below.



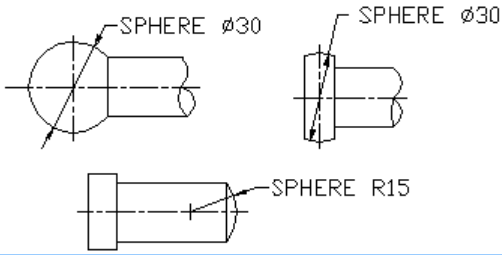
tapered features

1.	A tapered feature should be specified using a suitable combination of the following dimensions: (a) the diameter at each end of the tapered feature (b) the length of the tapered feature (c) the included angle or the rate of taper
2.	Recommended methods of dimensioning tapered features are shown below.



spherical surfaces

1.	A spherical surface should be dimensioned with the diameter or radius and preceded by SPHERE.
2.	Recommended methods of dimensioning spherical surfaces are shown below.



Drawing practice

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Question No. 29 (Referring to Figure 7.15)

Draw full size in third-angle projection the following views of the compressor crosshead shown in Figure 7.15.

(a) a sectional front view of AA

(b) a sectional plan on BB

(c) an end view showing hidden detail

Fully dimension accordingly.

(The following figure is extracted from textbook.)