ME 101

ENGINEERING GRAPHICS

CHAPTER 8

DIMENSIONING AND NOTES

8.1. DIMENSIONING

After the shape of an object has been described by Orthographic or pictorial views, the size of the object can be described by putting on the values of the distances between drawings. Dimensions are the distances between the surface, the position of some parts, such as holes and other geometric parts.

The dimensions put on the drawing are not necessarily those used in making the drawing but are those required for the proper functioning of the part after assembly, selected so as to be readily usable by the workers who are to make the piece.

Before dimensioning the drawing, study the machine and understand its functional requirements and discover which dimensions would best give the information.

8.2 LINES AND SYMBOLS

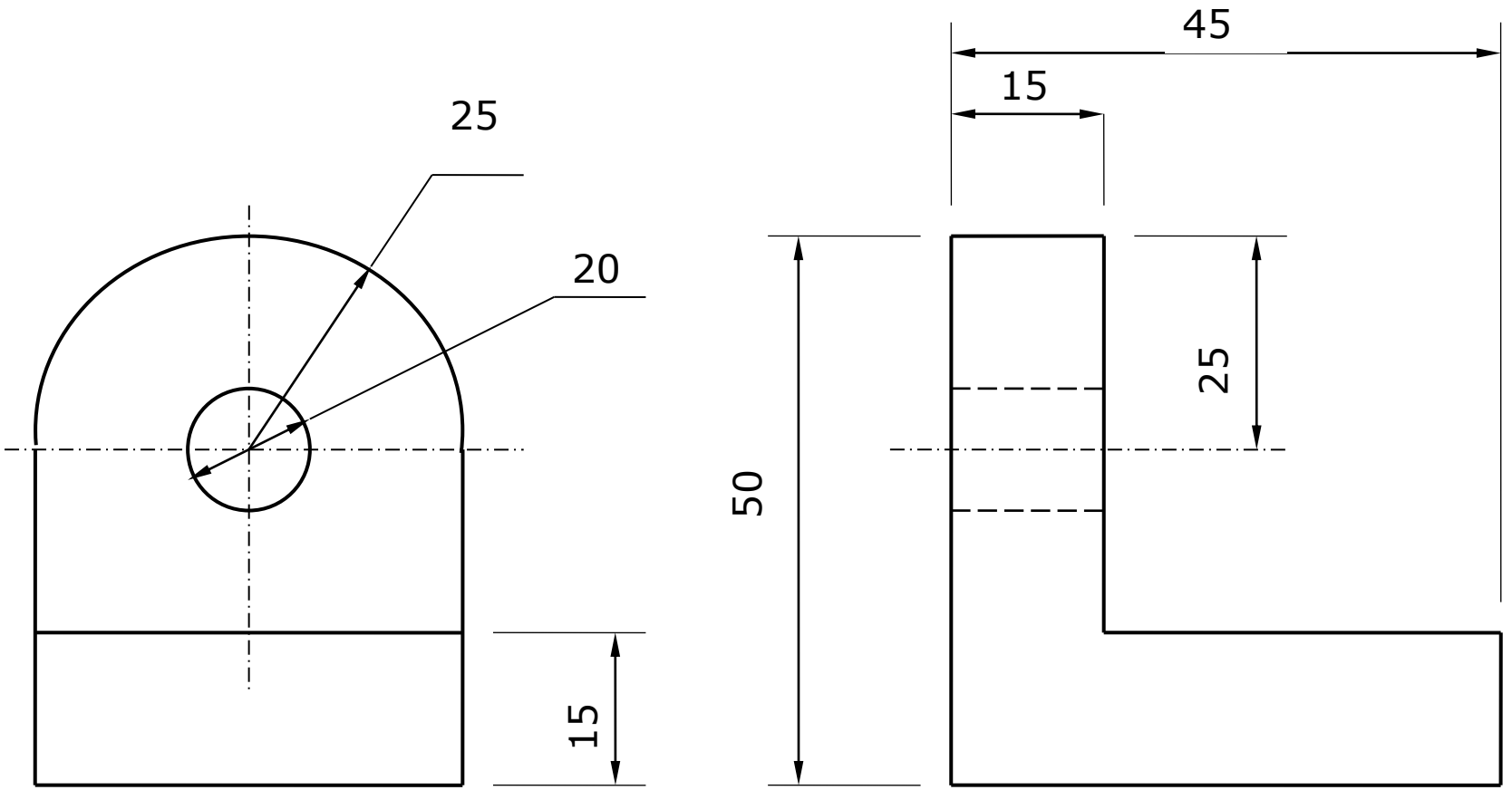


Fig. 8.2.

8.2 LINES AND SYMBOLS

a) Extension Line (Ölçü Sınır Çizgisi, Bağlama Çizgisi)
b) Dimension Line (Ölçü Çizgisi)
c) Arrow Head (Ölçü Oku)
d) Dimension Value (Ölçü Değeri))

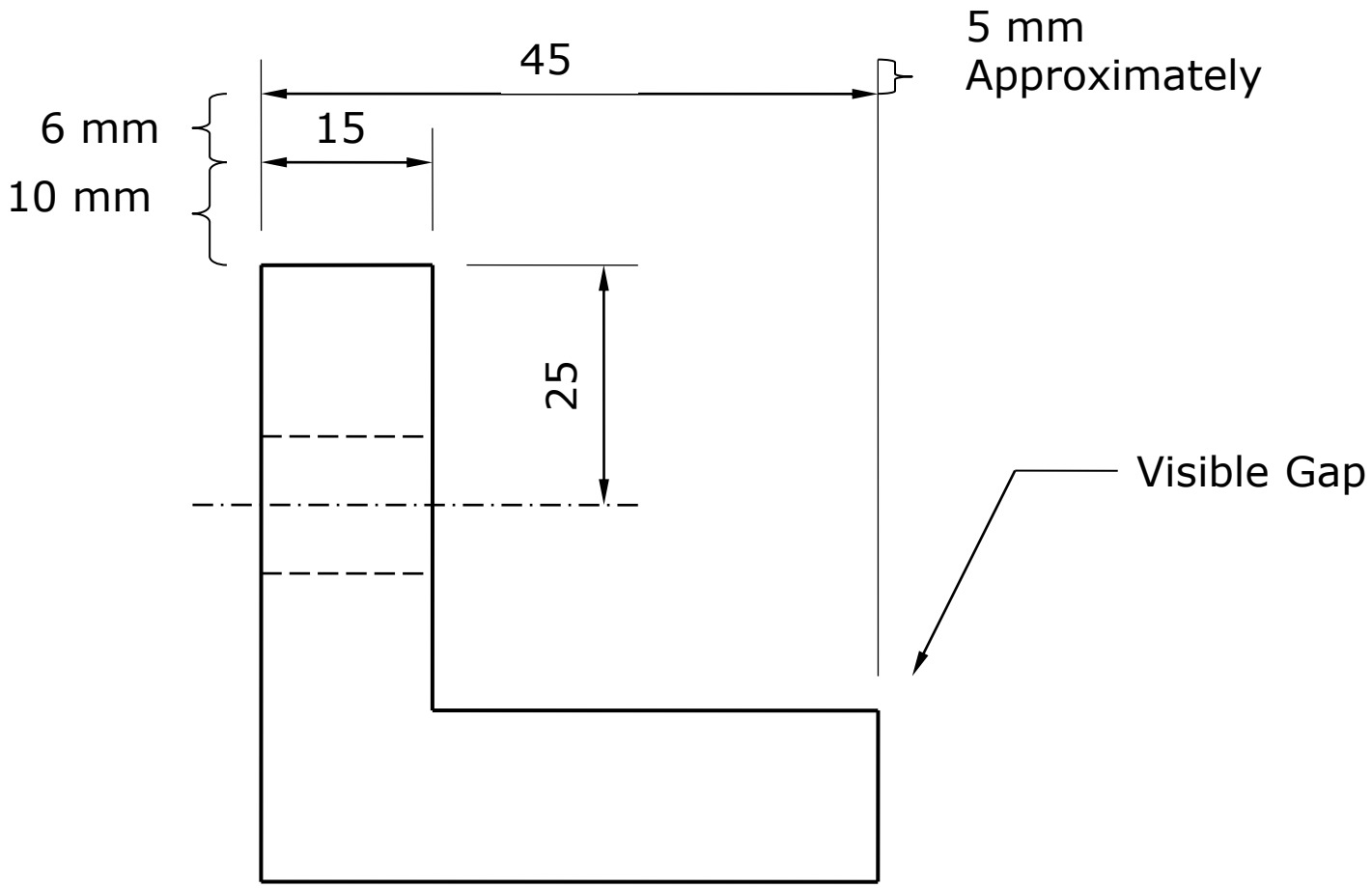
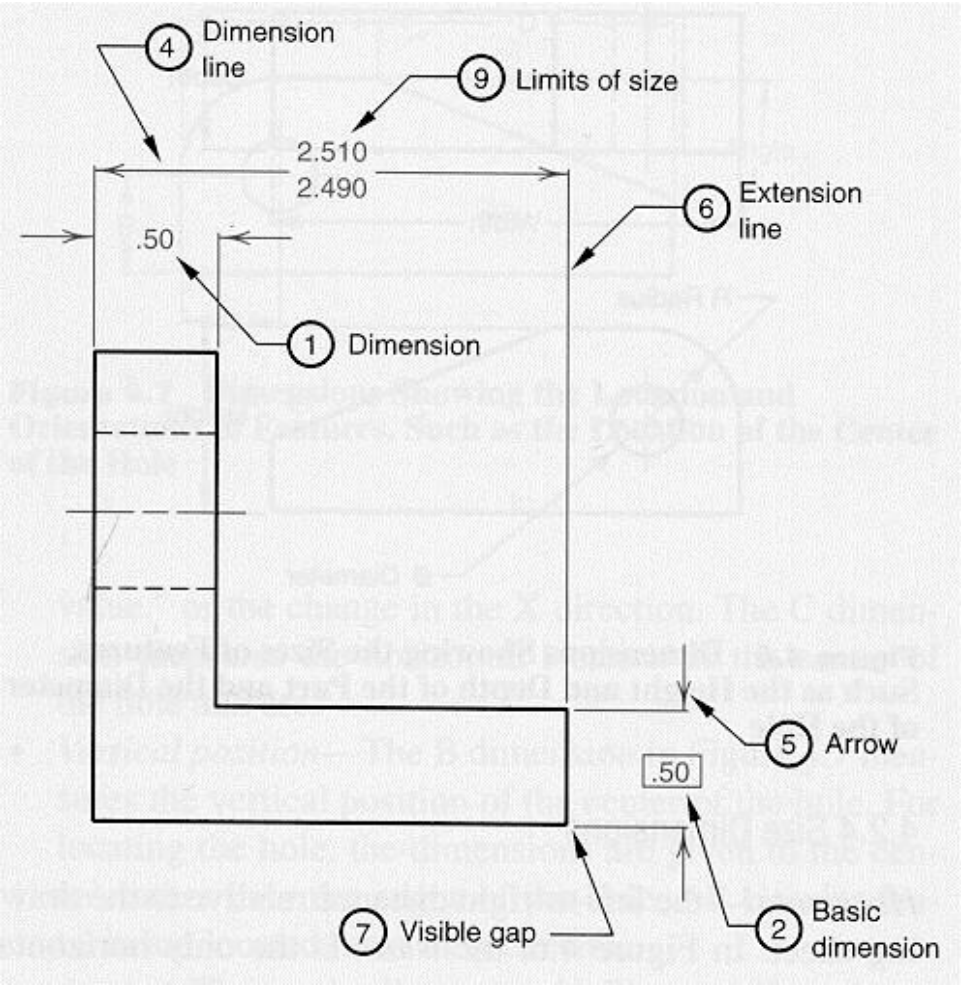


Fig. 8.1.

8.2 LINES AND SYMBOLS



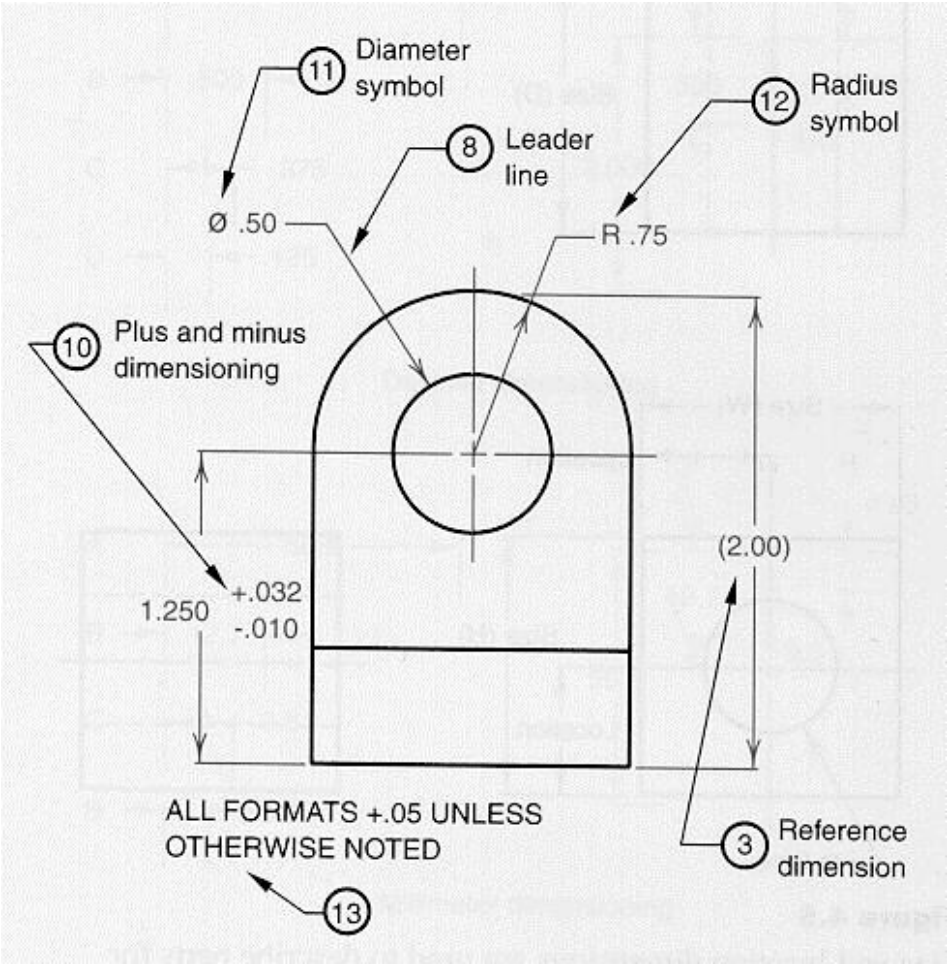


Fig. 8.2.

The arrow heads are put on the dimension lines usually inside the extension lines. If the distance in between two extension line is small the arrow heads are put out. Some times dots are put instead of arrow heads if the distance is very small.

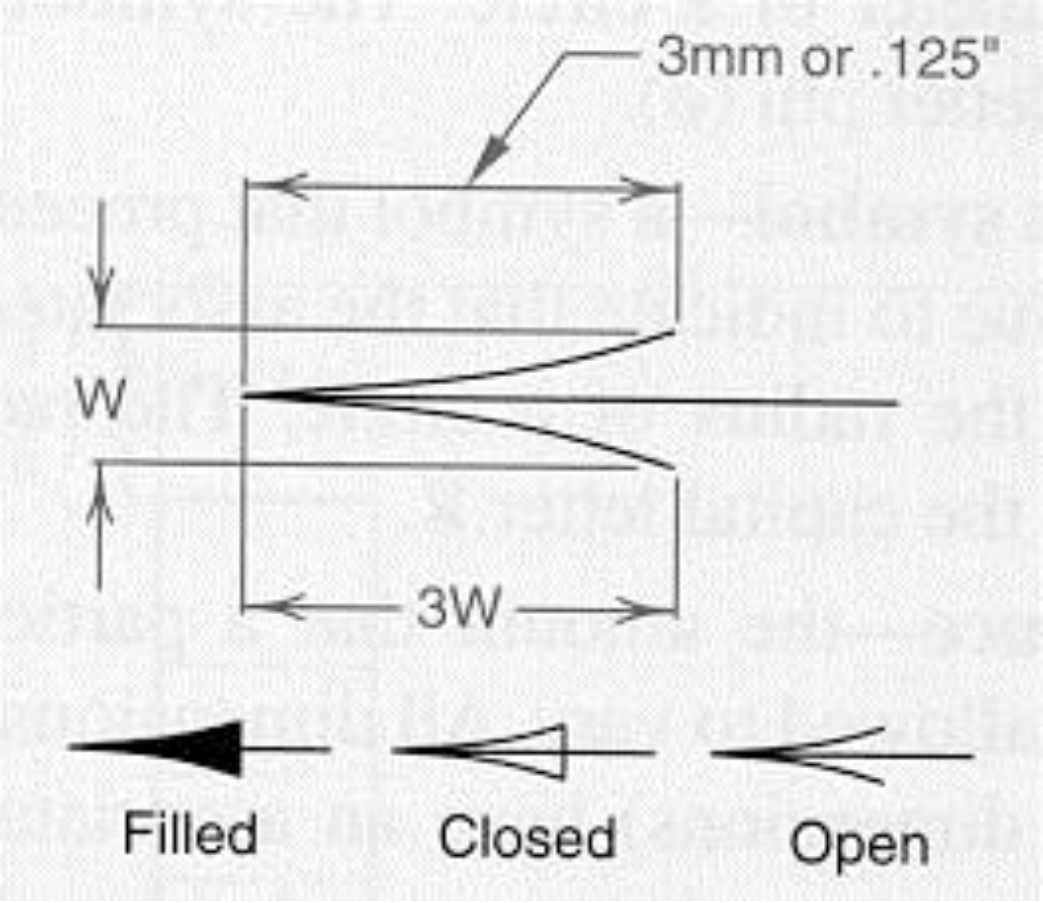


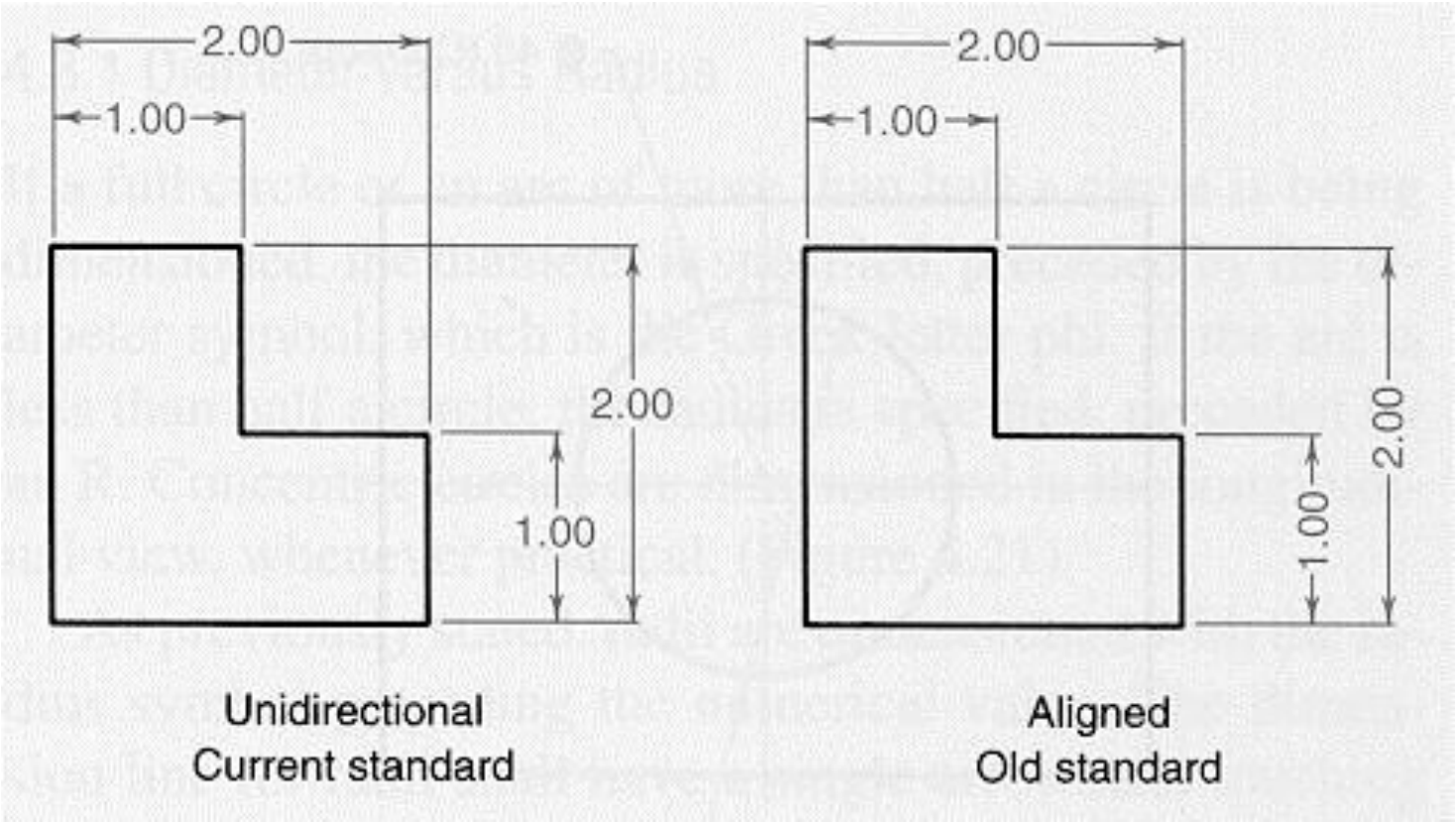
Fig. 8.2.

8.3. WRITING THE DIMENSION VALUES

There are two methods, the alligned system and unidirectional system.

The Alligned system is older of the two methods, in this method the dimensions are written so that, they can be read from bottom and right. They are put on the dimension line.

The Unidirectional system originated in the automotive and aircraft industries, and is sometimes called the horizontal system. Angels sometimes are put unidirectionally.

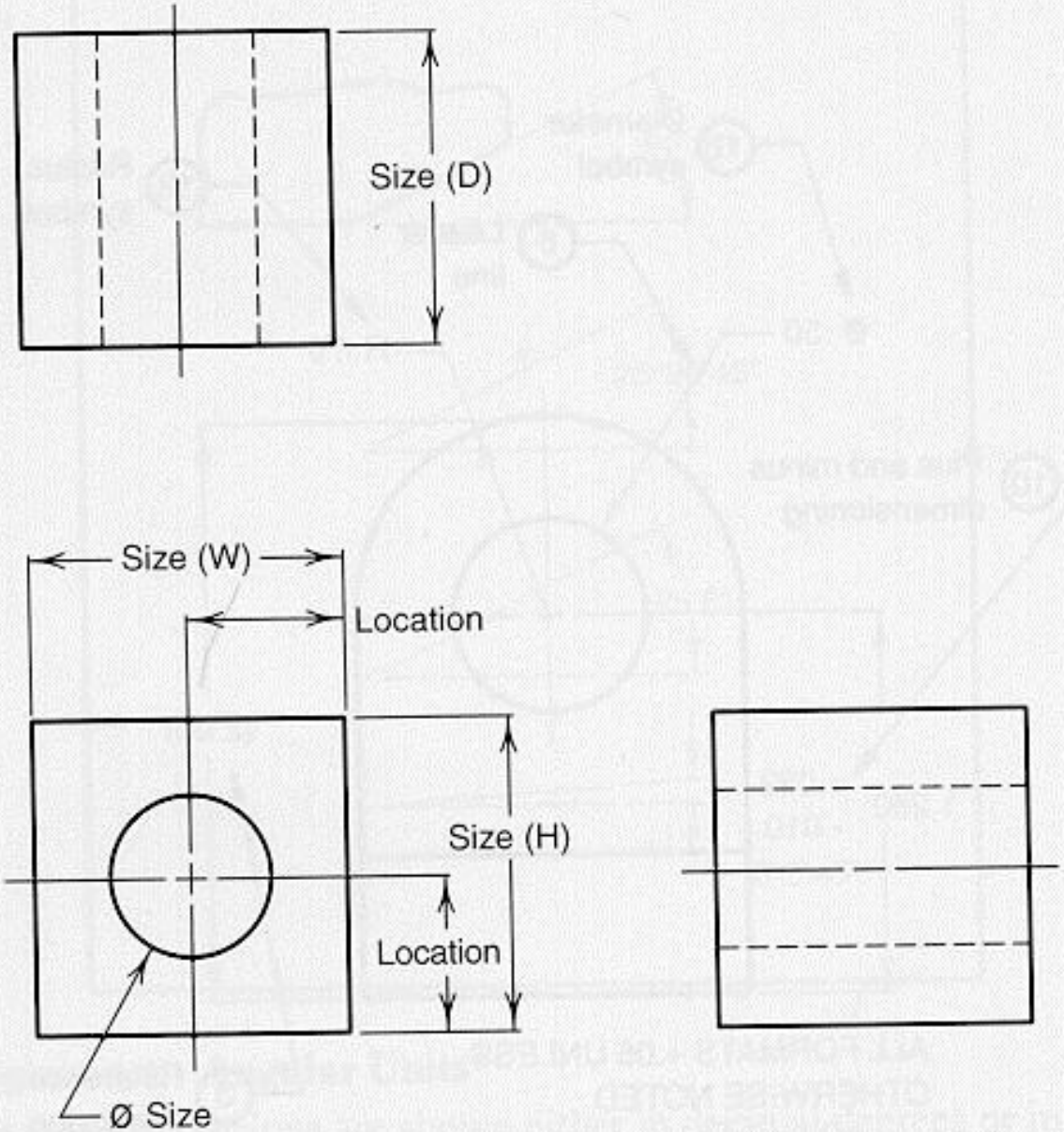


8.3. WRITING THE DIMENSION VALUES

Notes must be lettered horizontally and read from the bottom of the drawing in either system.

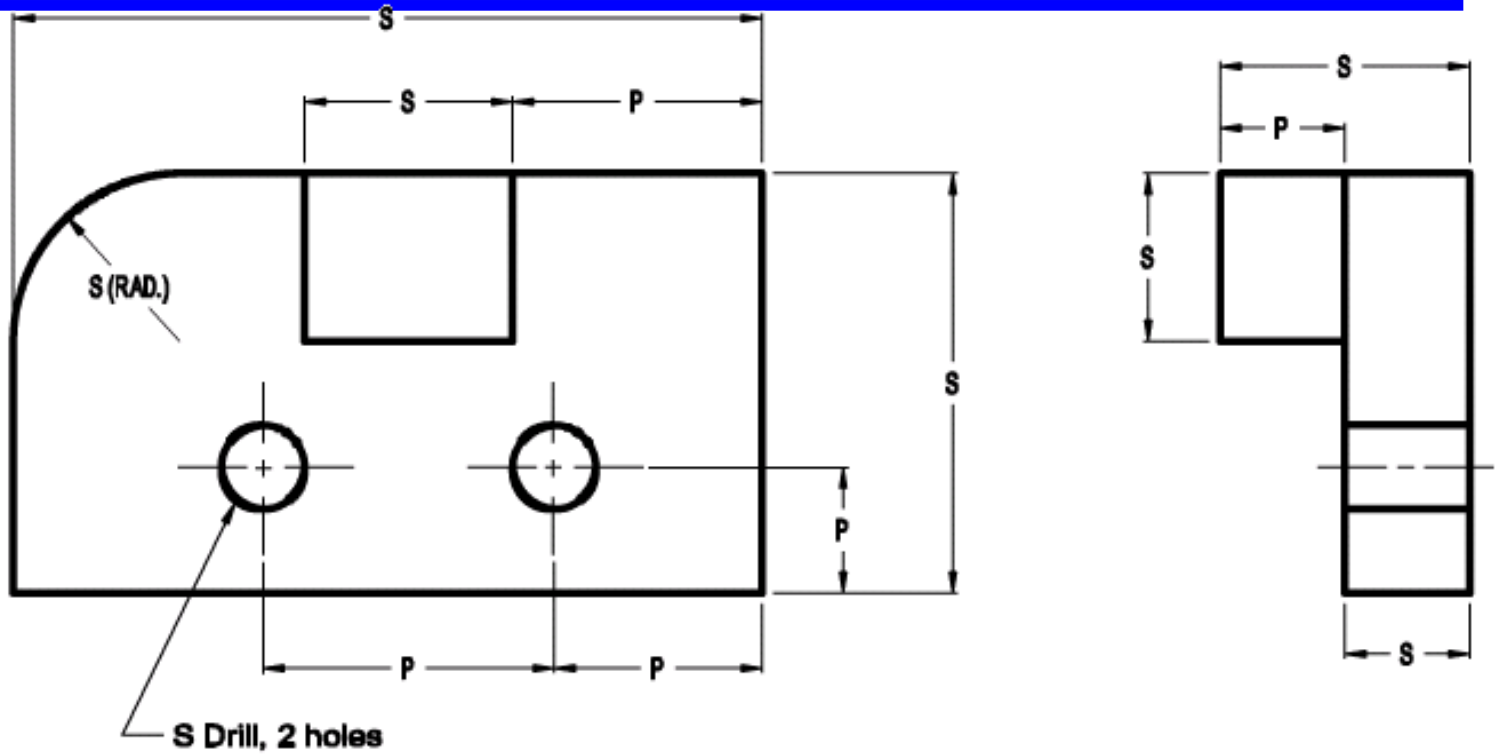
In dimensioning the sectional views leave some space for the dimension value.

8.4. BASIC CONCEPTS



A size dimension might be the overall width of a part or structure, or the diameter of a drilled hole. (Figure 5) A location dimension might be the length from the edge of an object to the center of a feature. The basic criterion is, "What information is necessary to manufacture or construct the object?" For example, to drill a hole, the manufacturer would need to know the diameter of the hole, the location of the center of the hole, and the depth to which the hole is to be drilled. These three dimensions describe the hole in sufficient detail for the feature to be made using machine tools.

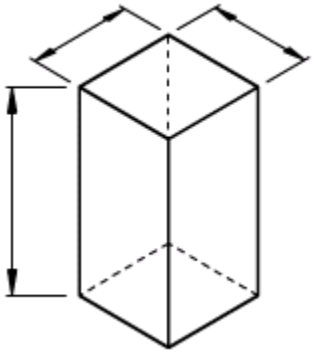
8.4. BASIC CONCEPTS: SIZE AND POSITION DIMENSIONING

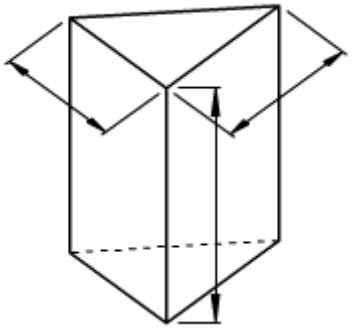


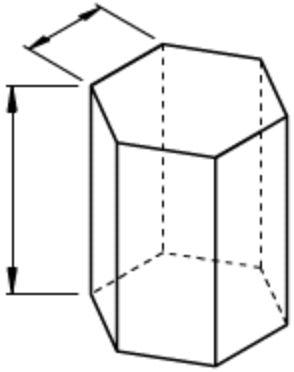
* S: Size P: Position

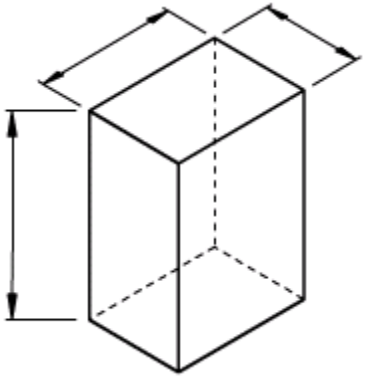
After the basic shapes have been dimensioned for, size the position of each relative to the others must be given. Again position must be established in height, width and depth directions.

8.4. BASIC CONCEPTS: SIZE DIMENSIONING





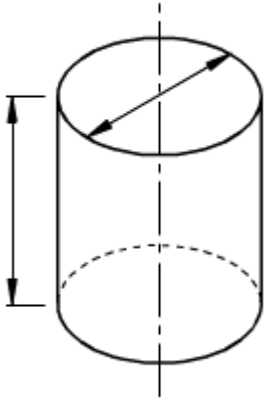




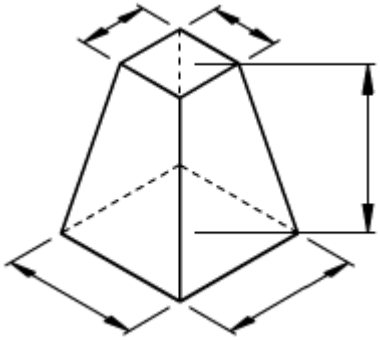
For regular hexagon or octogonal type prisms require 2 dimensions

Prisms (square, rectangular or triangular) requires 3 dimensions

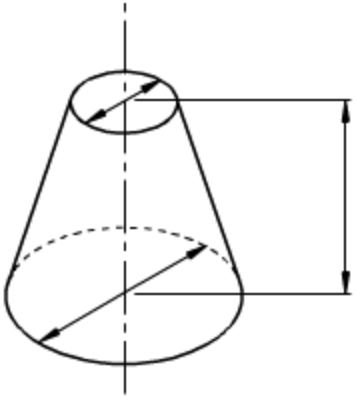
8.4. BASIC CONCEPTS: SIZE DIMENSIONING



Cylinders require 2 dimensions

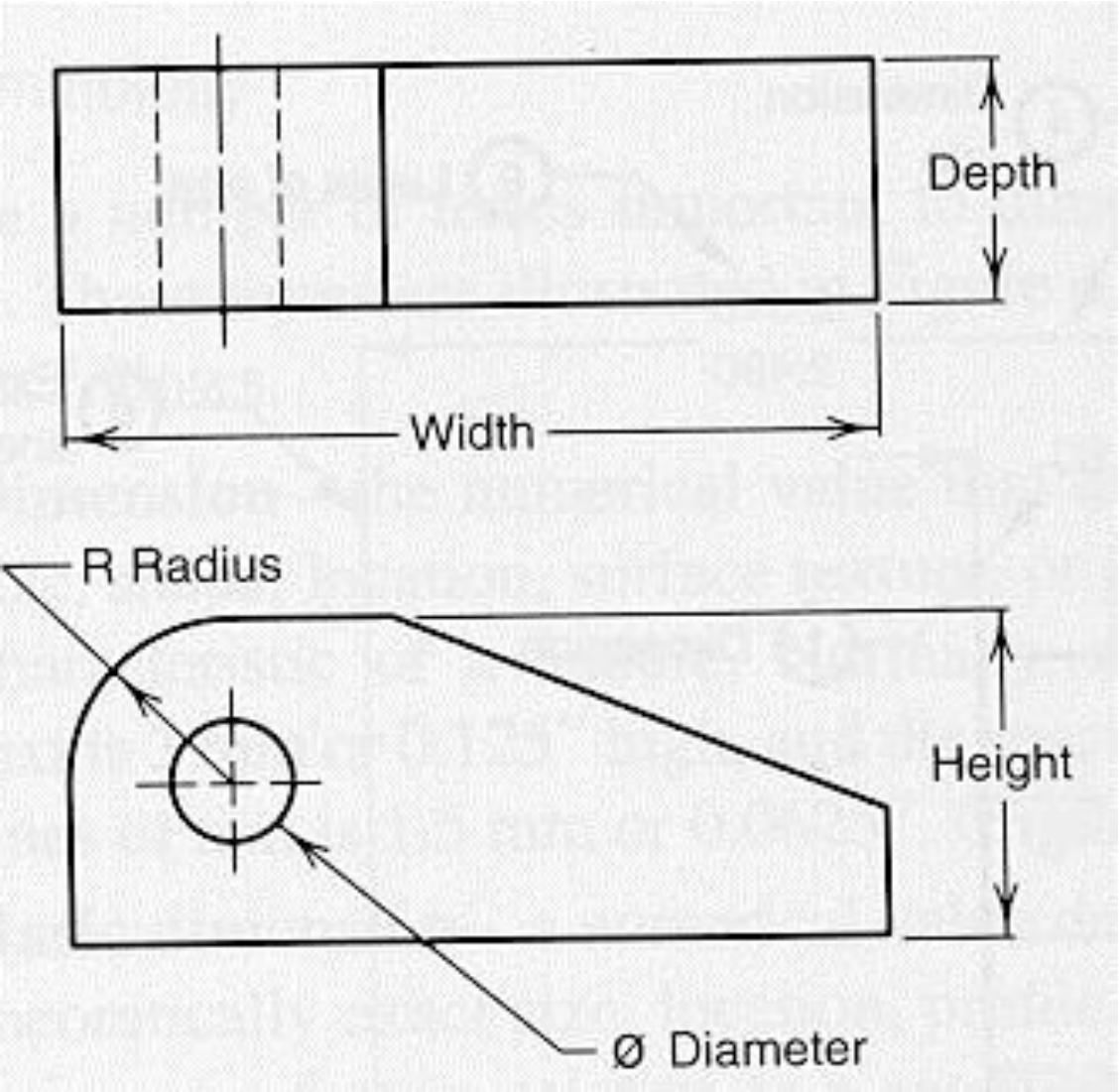


Right pyramid requires 5 dimensions



Right cone requires 3 dimensions

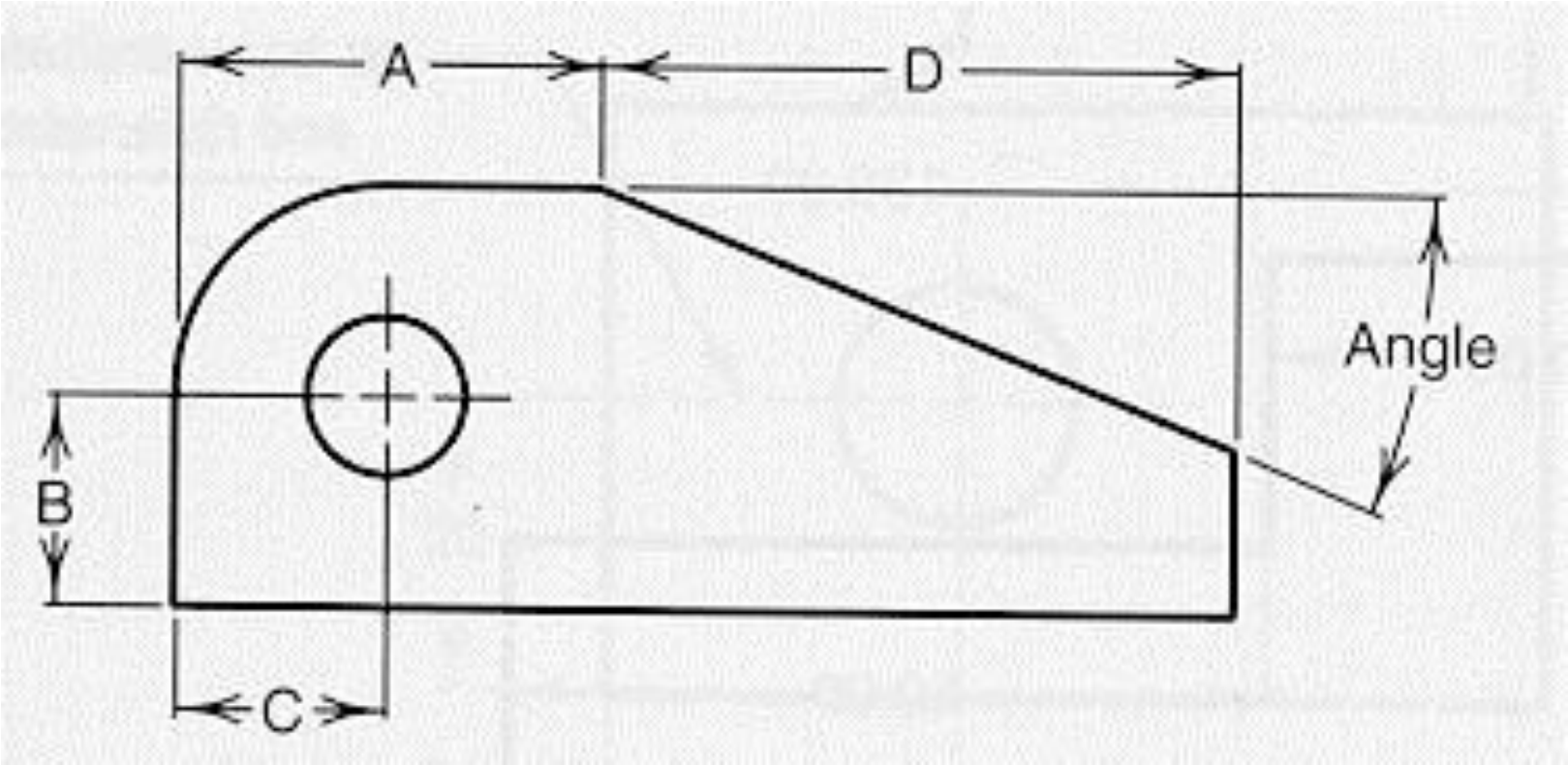
8.5. Location and Orientation Dimensions



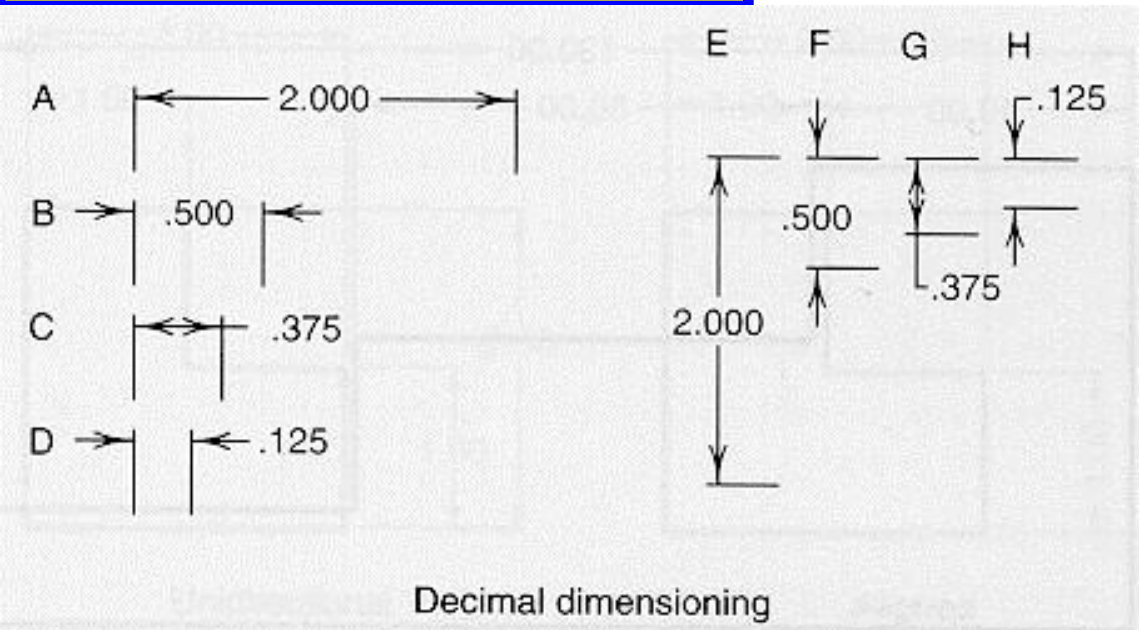
•*Horizontal position*—In Figure 7, dimensions A and D are horizontal position dimensions that locate the beginnings of the angle. Dimension A measures more than one feature—the sum of the arc's radius and the straight line. The measurement for dimension A is taken parallel to the dimension line. Dimension D is the measurement of a single feature—the sloping line—but it is not the true length of the line. Rather, it is the left-to-right distance that the line displaces. This is called the "delta X value or the change in the X direction. The C dimension measures the horizontal location of the center of the hole and arc.

***Vertical position*—**The B dimension in Figure 7 measures the vertical position of the center of the hole. For locating the hole, the dimensions are given to the center, rather than the edges of the hole. All circular features are located from their centers.

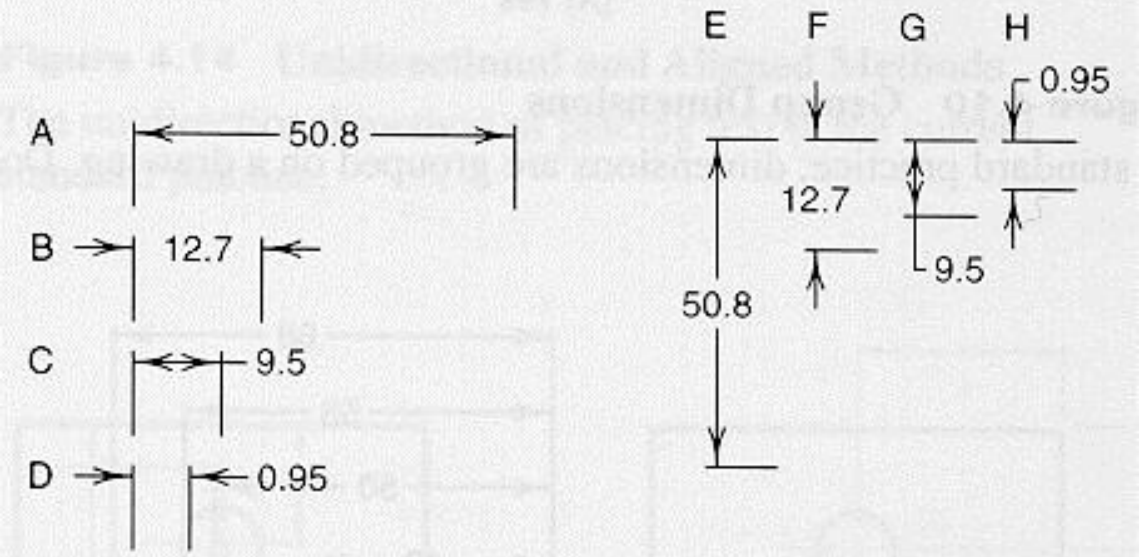
• *Angle*—The angle dimension in Figure 7 gives the angle between the horizontal plane and the sloping surface. The angle dimension can be taken from several other directions, measuring from any measurable surface.



8.6 Standard Practices



Decimal dimensioning



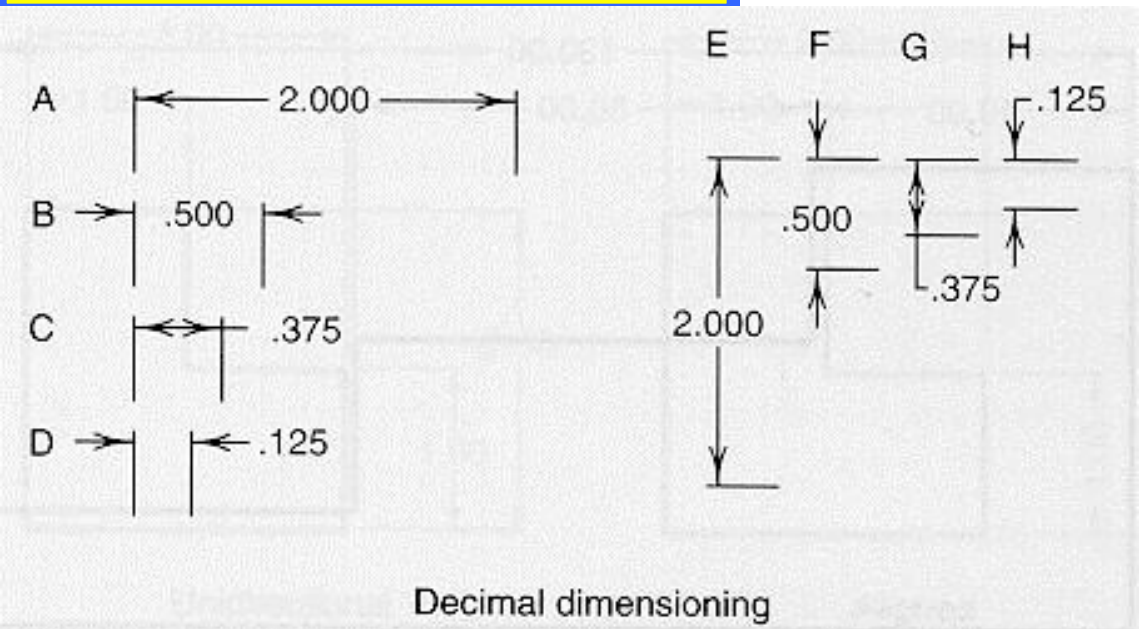
Millimeter dimensioning

The guiding principle for dimensioning a drawing is *clarity.* To promote clarity, standard practices are developed for showing dimensions on drawings.

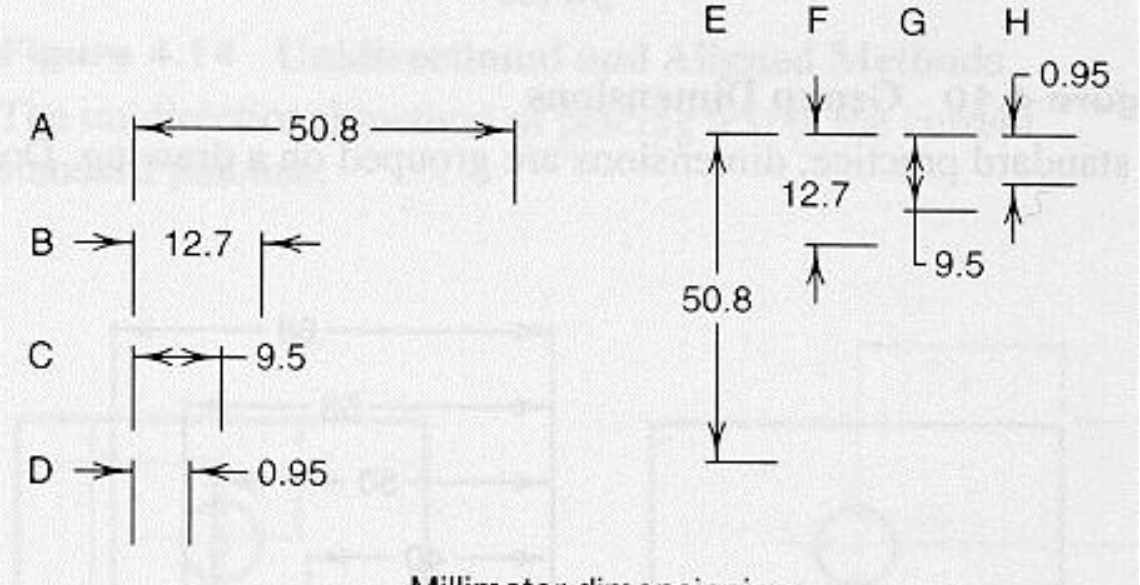
Placement

Dimension placement depends on the space available between extension lines. When space permits, dimensions and arrows are placed *between* the extension lines, as shown in Figures 8. A and E.

8.6 Standard Practices



Decimal dimensioning



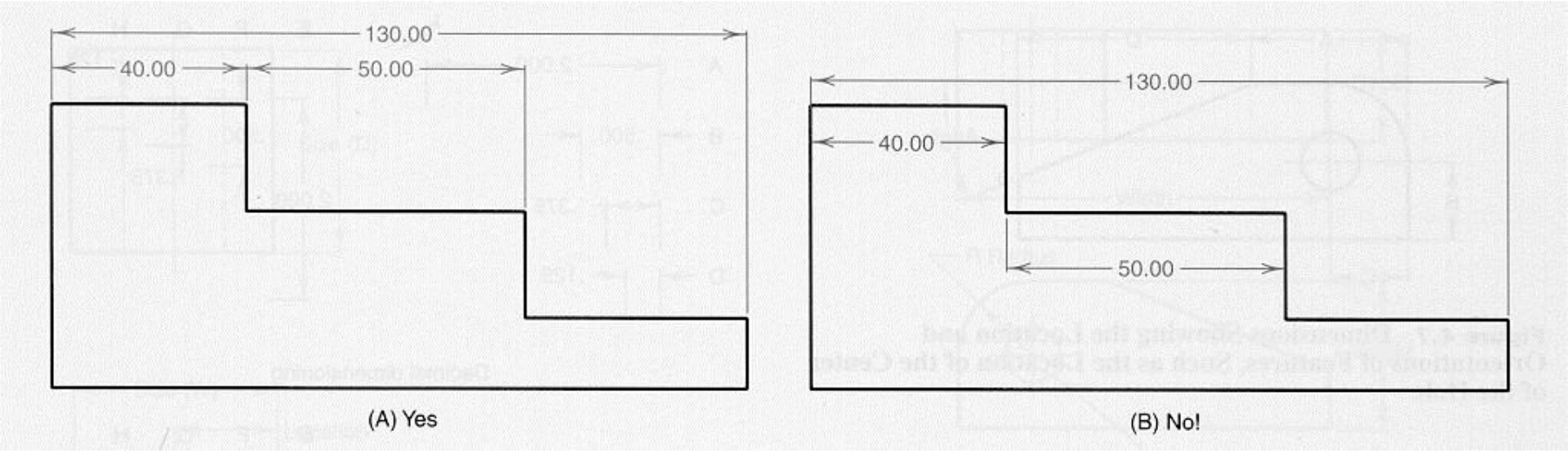
When there is room for the numerical value but not the arrows as well. the value is placed between the extension lines and the arrows are placed outside the extension lines, as shown in Figures 8.B and F.

When there is room for the arrows but not the numerical value, the arrows are placed between the extension lines, and the value is placed outside the extension lines and adjacent to a leader, as shown in Figures 8.C and G.

When the space is too small for either the arrows or the numerical value, both are placed outside the extension lines, as shown in Figures 8D and H

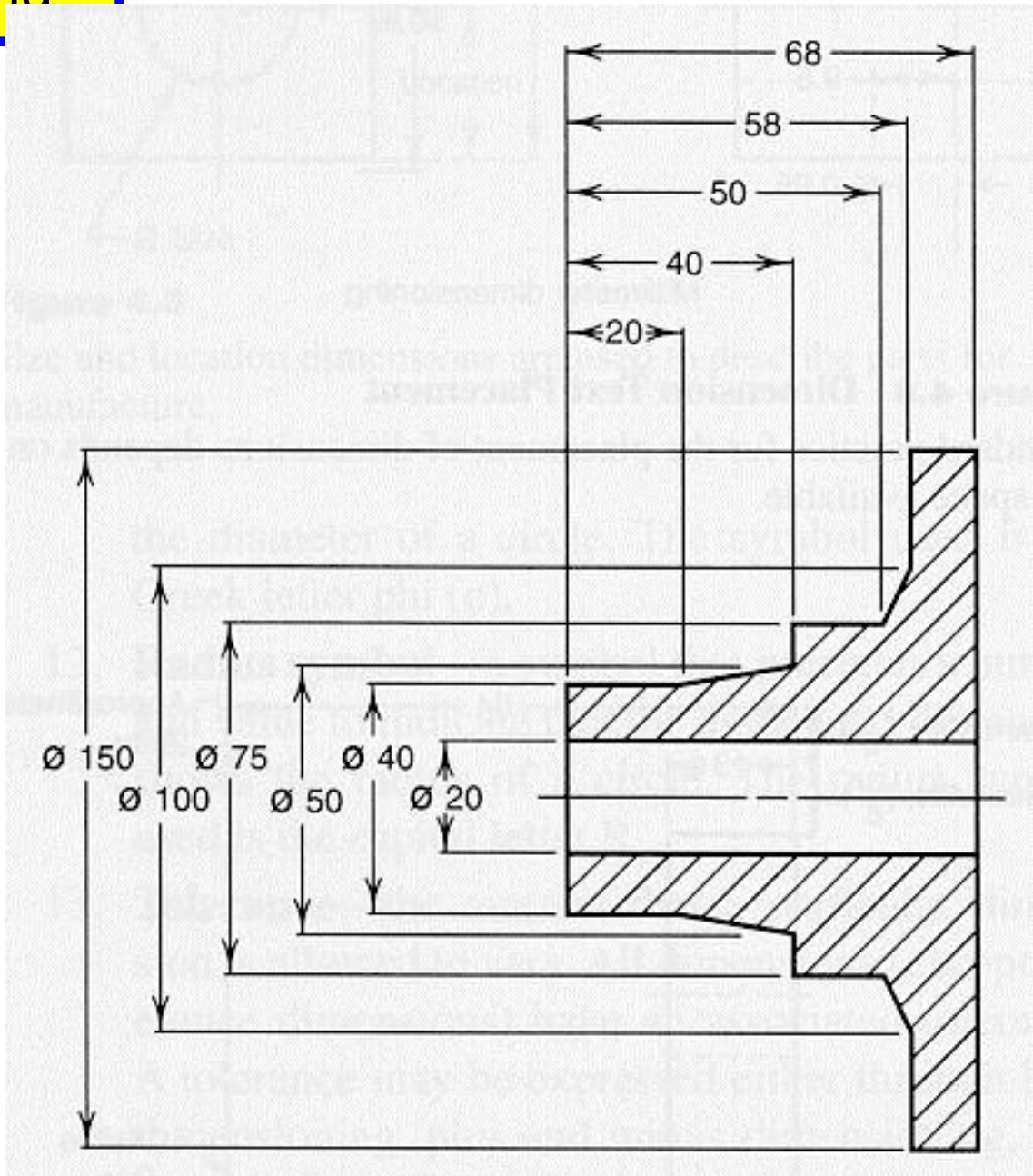
8.7 Grouping and Staggering

Dimensions should be grouped for uniform appearance, as shown in Figure 10. As a general rule, do not use object lines as part of your dimension (Figure 10B). Where there are several parallel dimensions, the values should be staggered, as shown in Figure 11.



8.7 Grouping and Staggering

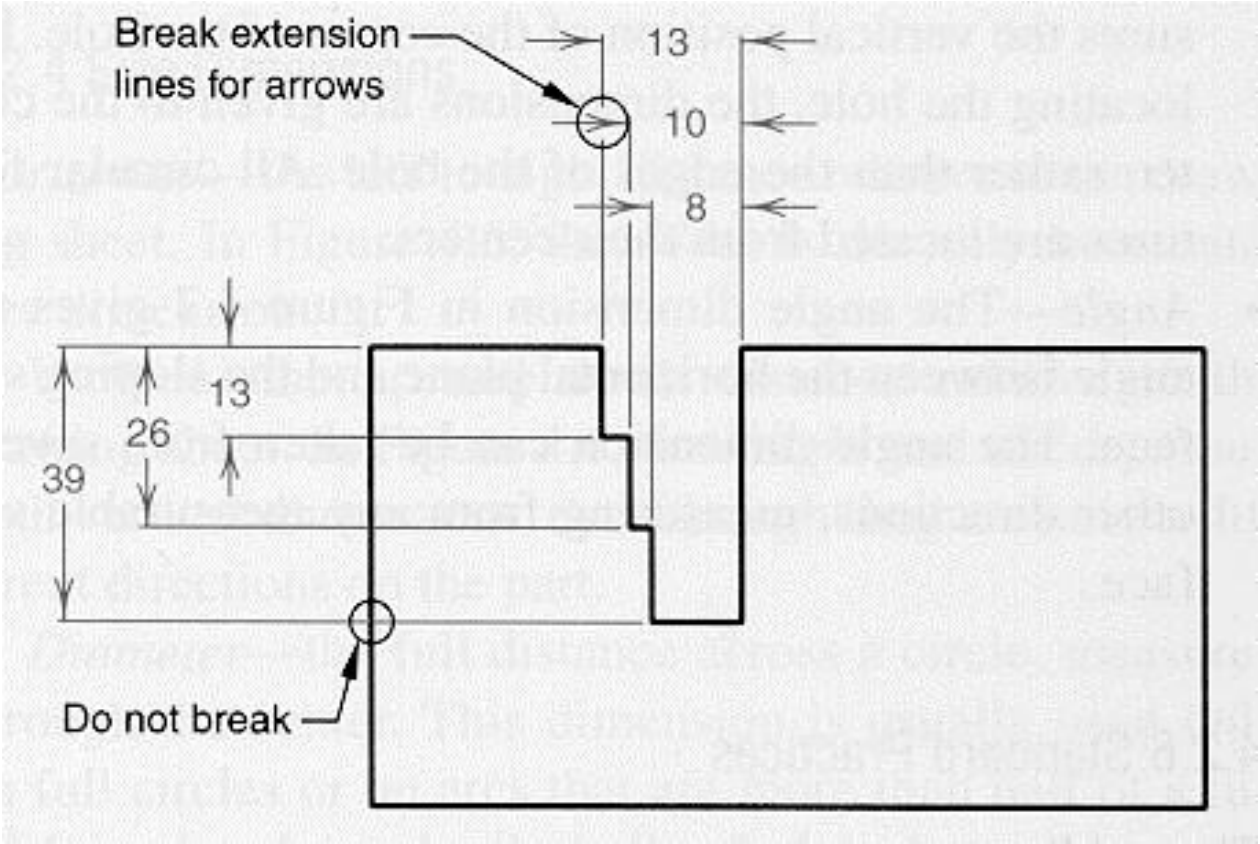
Where there are several parallel dimensions, the values should be staggered, as shown in Figure 11.



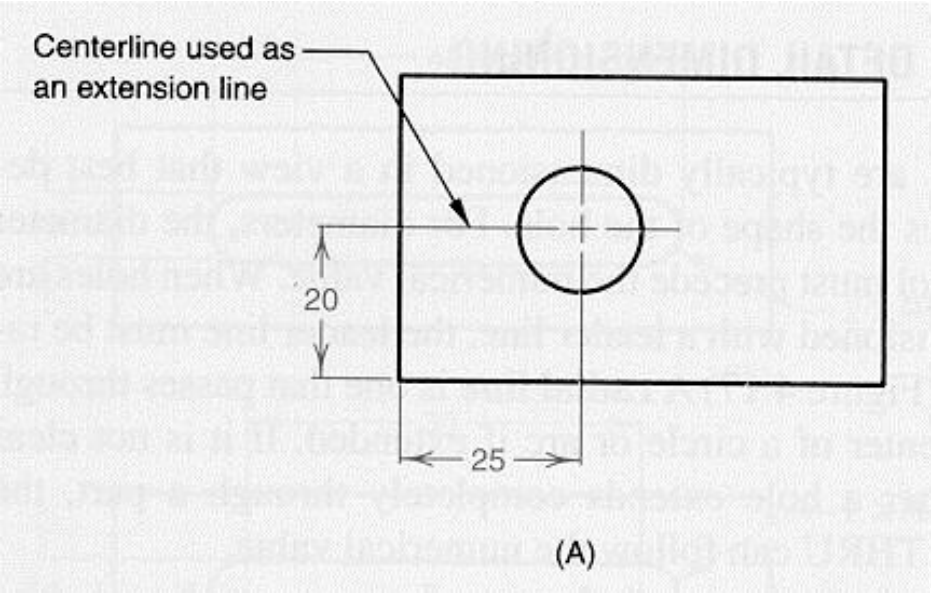
8.8 *Extension Lines*

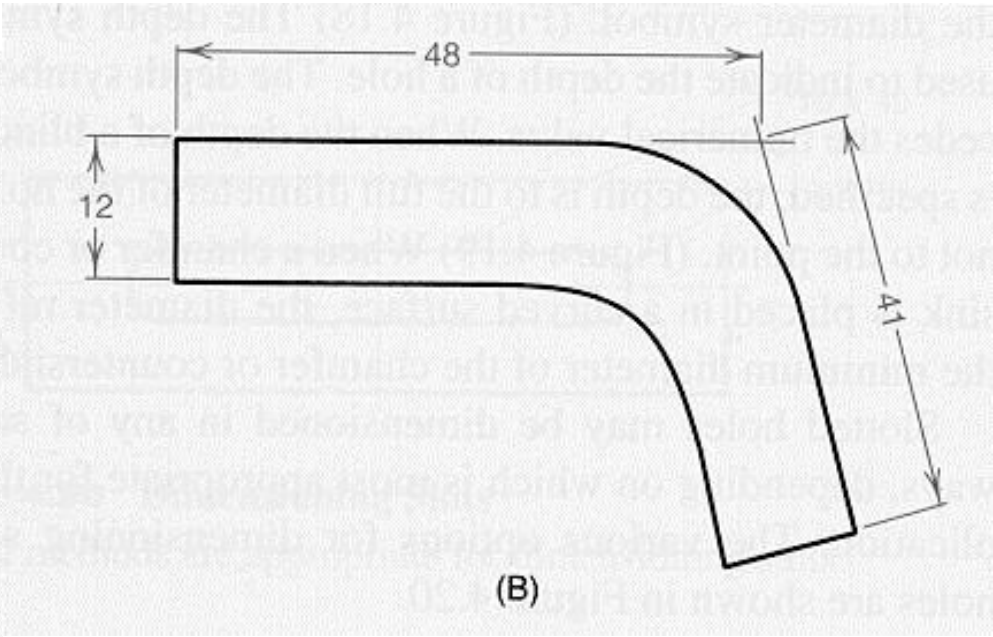
Extension lines are used to relate a dimension to one or more features and are usually drawn perpendicular to the associated dimension line. Where angled extension lines are used, they must he parallel, and the associated dimension lines must be drawn in the direction to which they apply.

Extension lines should not cross dimension lines, and should avoid crossing other extension lines whenever possible. When extension lines cross object lines or other extension lines, they should not be broken. When extension lines cross or are close to arrowheads, they should be broken for the arrowhead (Figure 12).



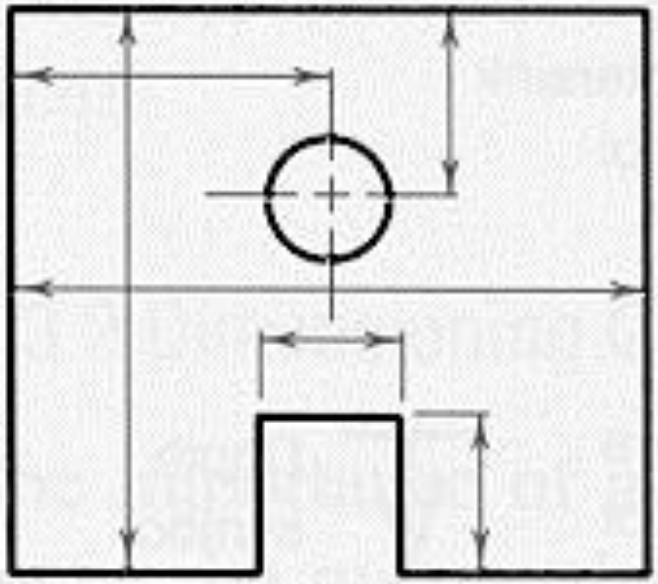
When the center of a feature is being dimensioned, the centerline of the feature is used as an extension line (Figure 13A). When a point is being located by extension lines only, the extension lines must pass through the point (Figure 13B).



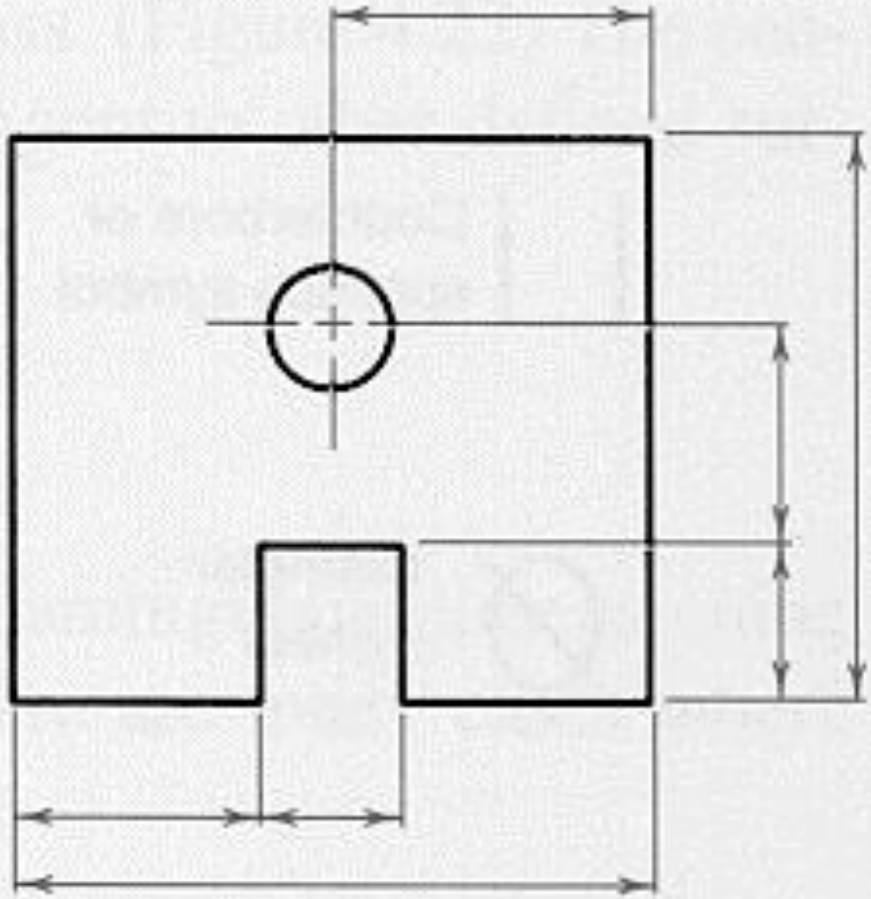


8.9 *View Dimensioning*

Dimensions are to be kept outside the boundaries of views, wherever practical (Figure15B). Dimensions may be placed within the boundaries where extension or leader lines would be too long or where clarity would be improved.



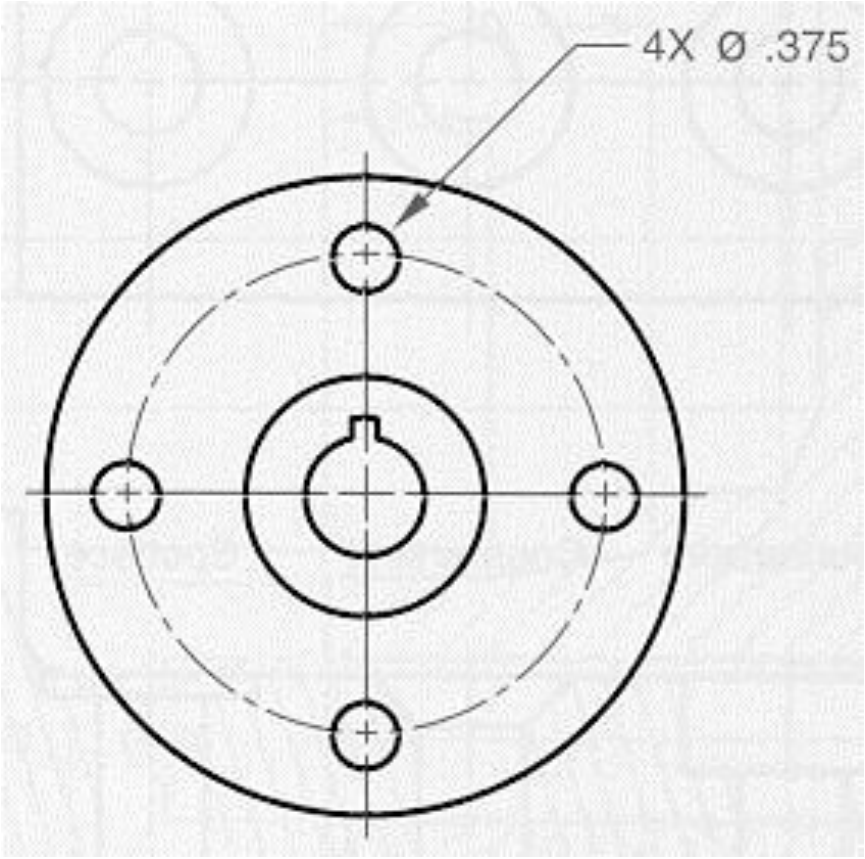
(A) No!



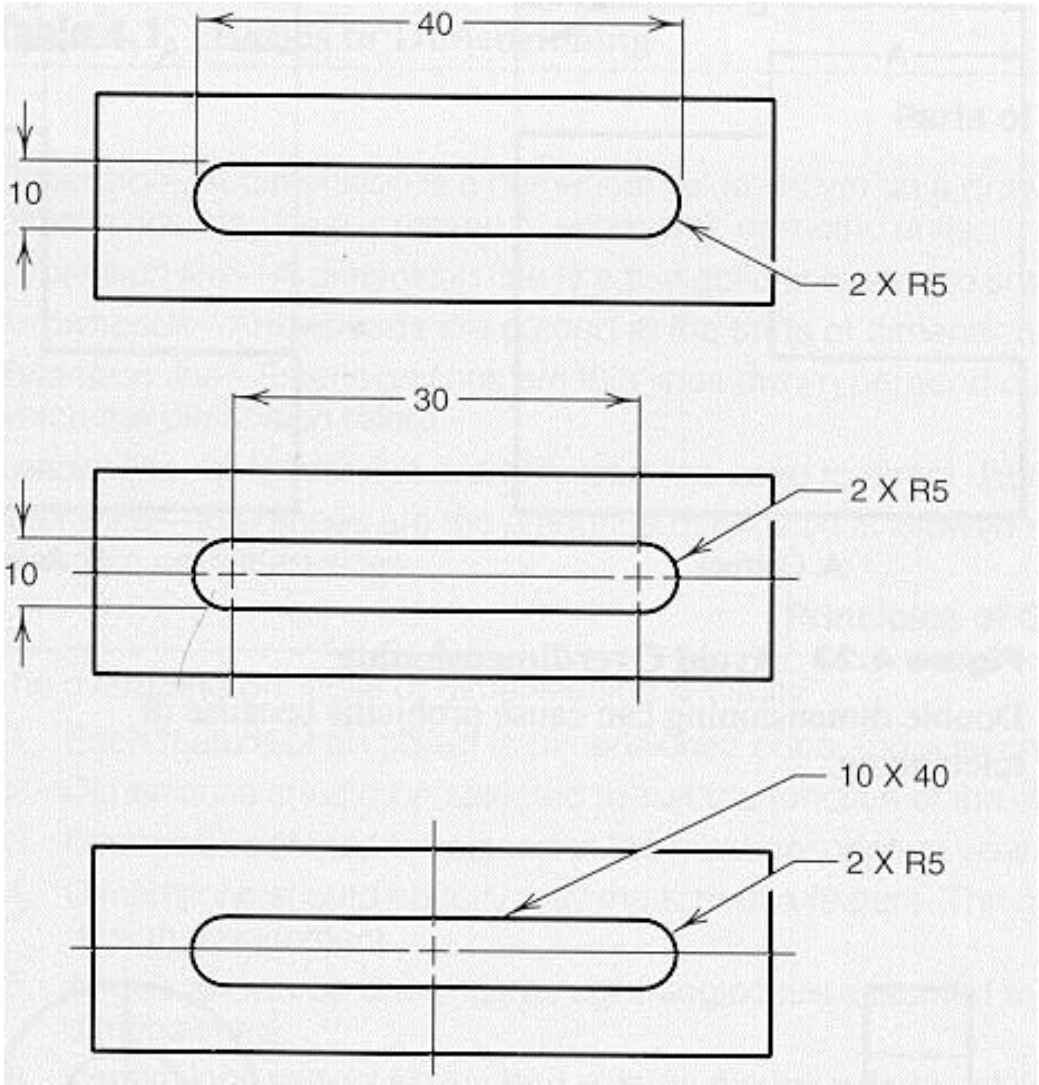
(B) Yes

8.10 *Repetitive Features*

The symbol X is used to indicate the number of times a feature is to be repealed. The number of repetitions, followed by the symbol X and a space, precedes the dimension text. For example, in Figure 16, 4X ∅ 0.375 means that there are 4 holes with a diameter of 0.375".

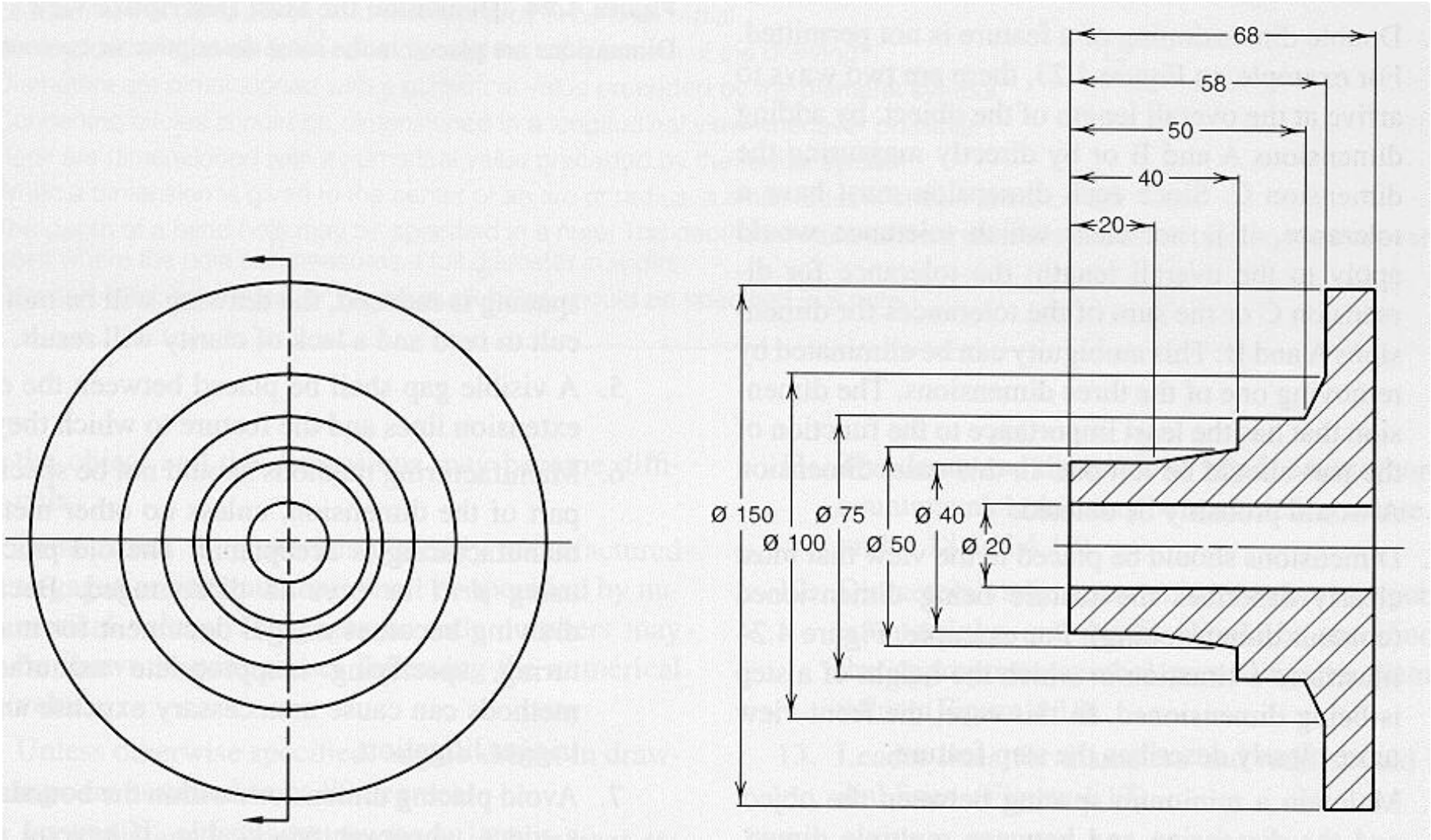


Slotted holes may be dimensioned in any of several ways, depending on which is most appropriate for the application. The various options for dimensioning slotted holes are shown in Figure 20

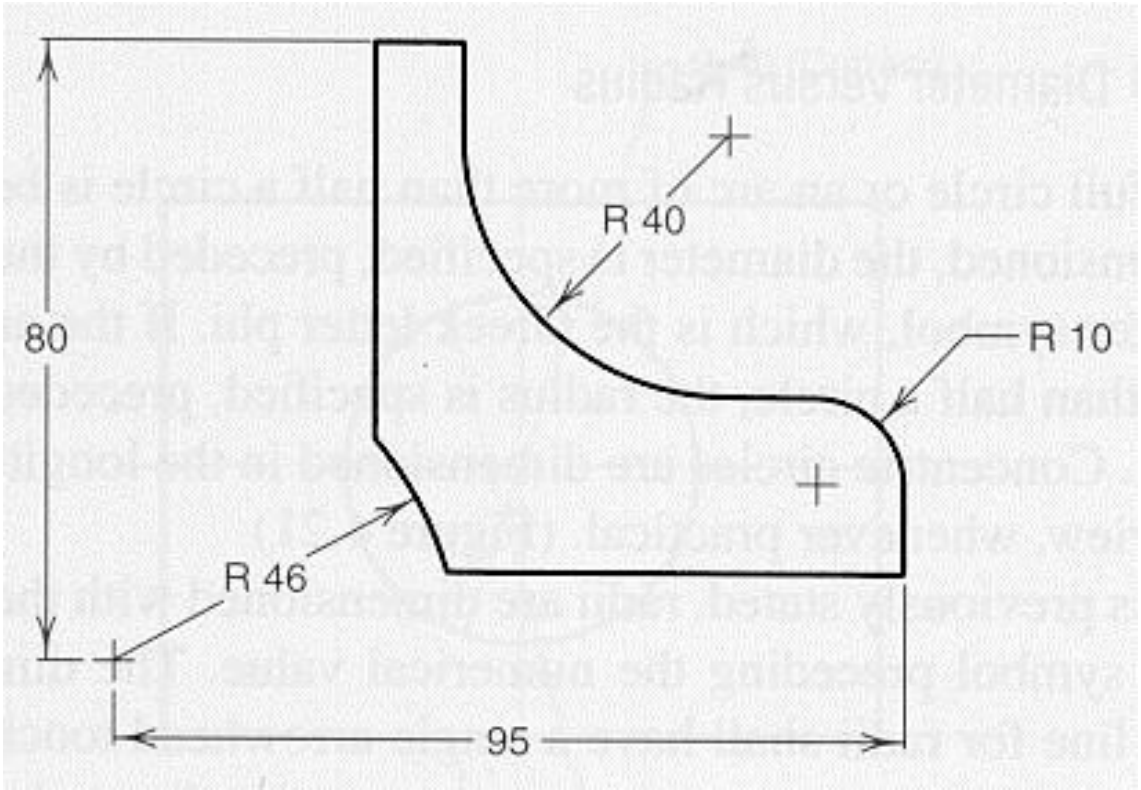


8.11 Diameter versus Radius

If a full circle or an arc of more than half a circle is being dimensioned, the diameter is specified, preceded by the diameter symbol ∅. If the arc is less than half a circle, the radius is specified, preceded by an R. Concentric circles are dimensioned in the longitudinal view, whenever practical (Figure 21)



As previously stated, radii are dimensioned with the radius symbol preceding the numerical value. The dimension line for radii shall have a single arrowhead touching the arc. When there is adequate room, the dimension is placed between the center of the radius and the arrowhead, (Figure 22). When space is limited, a radial leader line is used. When an arc is not clearly defined by being tangent to other dimensioned features on the object, the center of the arc is noted with a small cross (Figure 22). The center is not shown if the *arc* is tangent to other defined surfaces



8.12 Dimensioning Guidelines-1

The importance of accurate, unambiguous dimensioning cannot be overemphasized.

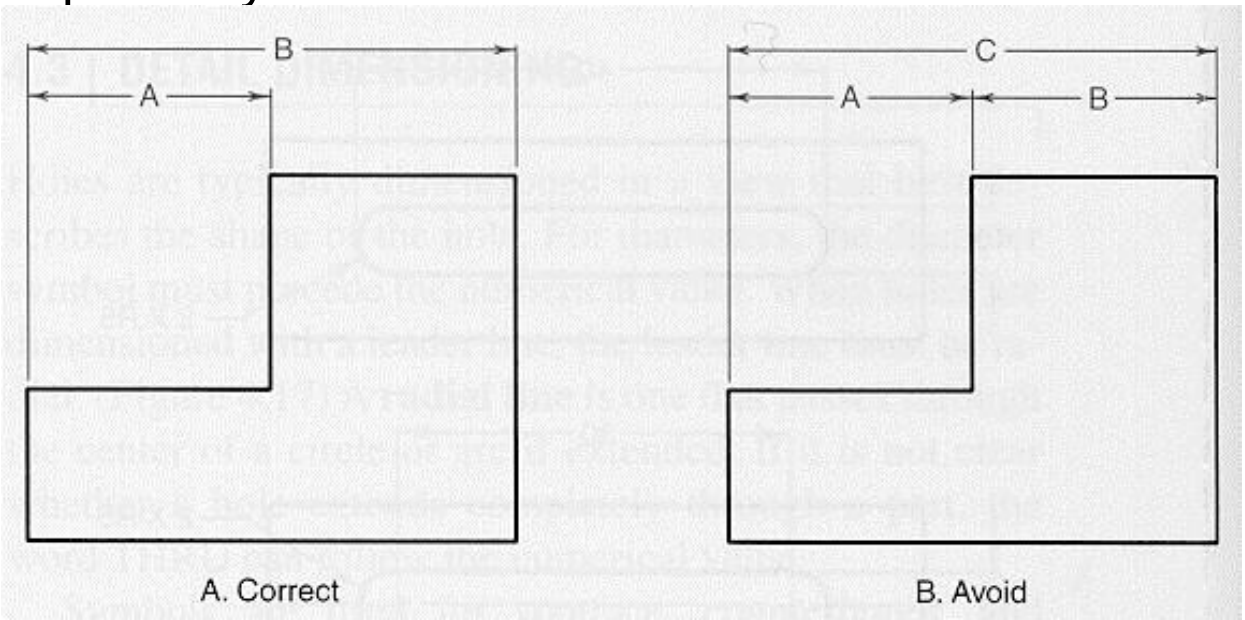
There are many cases where an incorrect or unclear dimension has added considerable expense to the fabrication of a product, caused premature failure, or, in some cases, caused loss of life.

The primary guideline is clarity: Whenever two guidelines appear to conflict, the method that most clearly communicates the size information shall prevail.

Use the following dimensioning guidelines:

8.12 Dimensioning Guidelines-2

1. Every dimension must have an associated tolerance, and that tolerance must be clearly shown on the drawing.
2. Double dimensioning of a feature is not permitted. For example, in Figure 23, there are two ways to arrive at the overall length of the object: by adding dimensions A and B or by directly measuring the dimension C. Since each dimension must have a tolerance, it is not clear which tolerance would apply to the overall length: the tolerance for dimension C or the sum of the tolerances for dimensions A and B. This ambiguity can be eliminated by removing one of the three dimensions. The dimension that has the least importance to the function of the part should be left out. In this case, dimension A would probably be deleted.

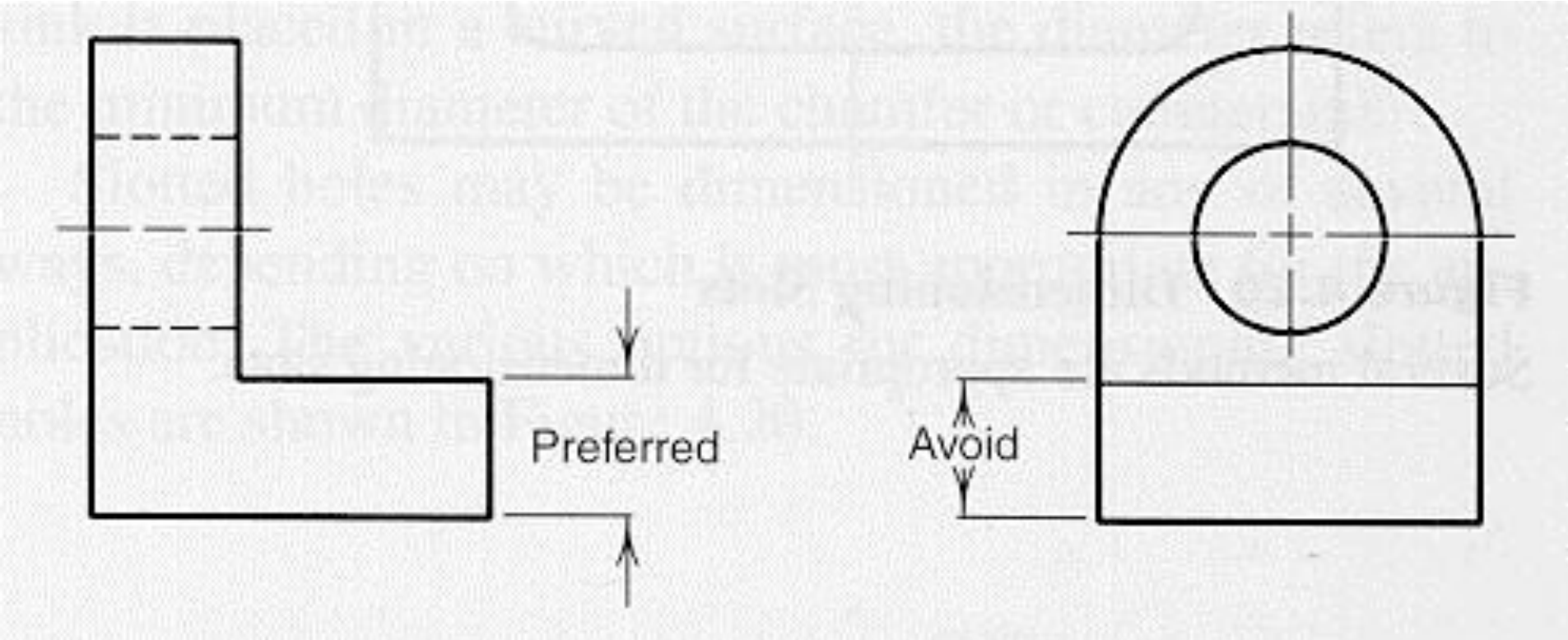


A. Correct

B. Avoid

8.12 Dimensioning Guidelines-3

3. Dimensions should be placed in the view that most clearly describes the feature being dimensioned (contour dimensioning). For example, Figure 24 illustrates a situation in which the height of a step is being dimensioned. In this case, the front view more clearly describes the step feature.



8.12 Dimensioning Guidelines-4

4. Maintain a minimum spacing between the object and the dimension and between multiple dimensions. This spacing is shown in Figure 9. If the spacing is reduced, the drawing will be more difficult to read and a lack of clarity will result.

5. A visible gap shall be placed between the ends of extension lines and the feature to which they refer.

6. Manufacturing methods should not be specified as part of the dimension, unless no other method of manufacturing is acceptable. The old practice of using *drill* or *bore* is discouraged. Because a drawing becomes a legal document for manufacturing, specifying inappropriate manufacturing methods can cause unnecessary expense and may trigger litigation.

7. Avoid placing dimensions within the boundaries of a view, whenever practicable. If several dimensions are placed in a view, differentiation between the object and the dimensions may become difficult.

8.12 Dimensioning Guidelines-5

8. Dimensions for materials typically manufactured to gages or code numbers shall be specified by numerical values. The gages or code numbers may be shown in parentheses following the numerical values.

9. Unless otherwise specified, angles shown in drawings are assumed to be 90 degrees.

10. Avoid dimensioning hidden lines. Hidden lines are less clear than visible lines.

11. The depth and diameter of blind, counter bored, or countersunk holes may be specified in a note (Figures 18 and 19).

12. Diameters, radii, squares, counter bores, spot faces, countersinks, and depths should be specified with the appropriate symbol preceding the numerical value (Figure 18).

13. Leader lines for diameters and radii should be radial lines (Figure 17).

8. 13. SCALES OF DRAWINGS

Full Scale (Gerçek Büyüklük) of a Drawing is : 1:1
Some times the drawing can be reduced or enlarged from full scale.

STANDARD SCALES FOR DRAWINGS

FULL SIZE :

SCALE : 1:1

FOR REDUCTION:

SCALE : 1:2.5, 1:5, 1:10, 1:20, 1:50, 1:100, 1:200, 1:500, 1:1000

FOR ENLARGEMENT:

SCALE : 2:1, 5:1, 10:1

THE END