Dimensioning in Engineering Drawing

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EDITED

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It is essential not only to be able to describe the form, shape, or structure of engineering objects or features, but to also be able to describe their sizes and locations. If you have defined the shape of an object by geometrical description on paper or computer, you would need to use the technique of dimensioning to add size information to engineering objects, parts, or structures in the form of dimensions.

When creating 2D or 3D drawings or models either by hand or computer-aided design/drafting (CAD) systems, you have to strictly adhere to widely or universally accepted standards for dimensioning (or setting dimensions) in engineering drawing in order to get your information across by making it understandable to whomever may come across it.

Selecting particular locations or spots for placement/locating dimensions requires some level of understanding and intelligence that CAD systems may not be able to teach you. Proper placement ensures clarity. Therefore, it's up to you or any CAD user to understand how to use dimensioning in ways that can carry along every individual who has business with a drawing.

1. Definition of *dimensioning* and *dimensions* in engineering drawing: what is dimensioning in engineering drawing?

Dimensioning in engineering drawing is the process of adding data/information about the size of an engineering object, part, feature, or structure to a drawing. Dimensioning can also be defined as the process of inscribing or expressing the geometry (length, area, volume, etc.) or spatial shape and alignment of an object or feature through the use of numbers or numerical values. In other words, dimensioning is the process of indicating dimensions or measurements and their respective magnitudes and directions and the tolerance required for each, on engineering drawings.

A dimension on the other hand is the magnitude or extent of a numerical value (especially length, width, or height) in a particular direction, expressed in appropriate units of measurement to define the size, form, structure, orientation, or location of an object, a feature, or part of something. Dimensions help to describe an object clearly and completely.

Dimensions are expressed through widely recognized standard symbols during dimensioning to provide more details that graphic drawings or representations won't be able to communicate or provide in entirety on engineering drawings.

2. Classification of dimension in engineering drawing

Each complete detail in engineering drawing usually has multi-views and dimensions that describe the shape and size of the object in the drawing. Dimensions in engineering drawing are of two classifications: size (or functional) dimension and location (or datum) dimension.

Size (or functional) dimensions are used directly on graphic engineering objects or features to express specific sizes, and they can be linked to a part or feature in the form of a note. Location (or datum) dimensions, on the other hand, express the relationship between different features of an object.

3. Units of dimensions/measurements in engineering drawing

The standard units of linear measurement used when dimensioning in engineering drawing and on documents include metric units in millimeters (abbreviated as *mm*) and the U.S. (United States) customary units in inches (abbreviated as *in*).

However, the use of either millimeters or inches depends on the intention or needs of the individual. Most countries outside the USA use the metric or international system of units (SI), while the customary system is widely used in the United States because of multinational company affiliations and global trade.

Whenever all dimensions on an engineering drawing are either in millimeters or inches, the general note "UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS (or INCHES, as applicable)" would be indicated on such a drawing.

If all dimensions on a drawing are in millimeters, then the term or word *METRIC* should be at the upper right corner of the drawing. If dimensions are expressed in inches and indicated beside millimeter dimensions on a millimeter-dimensioned drawing, then the abbreviation *IN* should follow any inch dimension value.

If millimeter dimensions are shown on an inch-dimensioned drawing, then the symbol *MM* would be used. Occasionally, companies use dual dimensioning which expresses both metric and inch dimensions or measurements on drawings, as indicated in Figure 1.

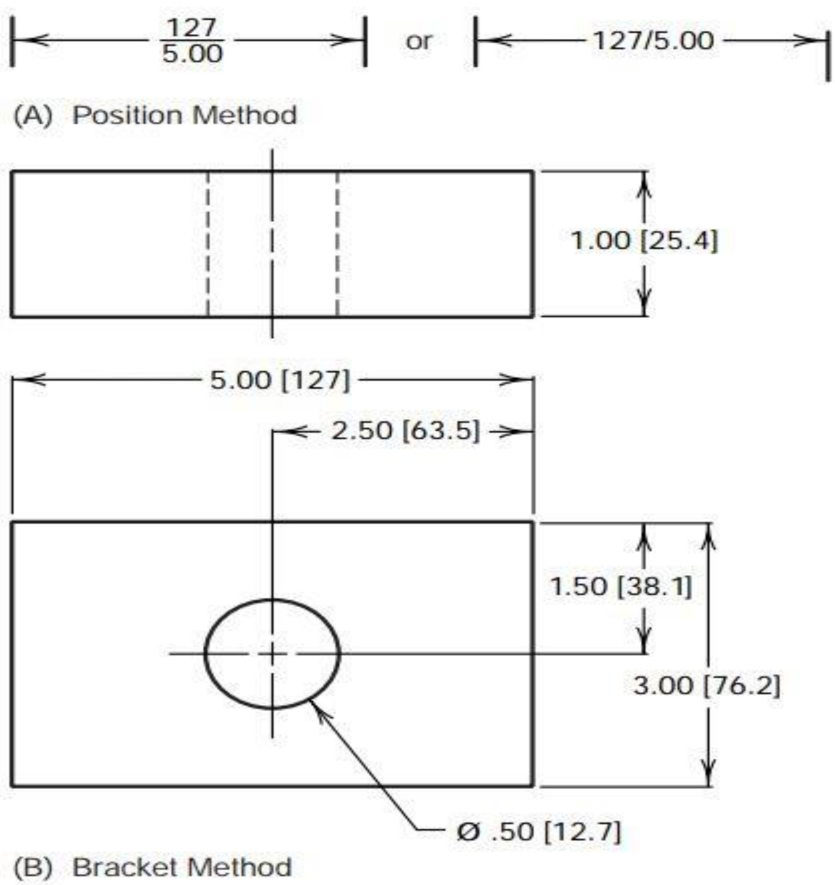

Figure 1: Dual-dimensioned engineering drawing indicating both millimeter and inch measurements

4. Seven types of dimension in engineering drawing

1. Linear dimension

Linear dimension is the type of engineering drawing dimension that can be expressed as any of the following two distances:

(A) ***Horizontal*****:** this distance or measurement is made from left to right (or vice versa) relative to the drawing plane (paper or computer), as shown by the *width* (the horizontal dimension) in Figure 2. Horizontal and vertical distances can be expressed in standard units of linear measurement—mainly in meters, millimeters, inches, and feet.

(B) Vertical**:** this distance or measurement is made from up to down (or vice versa) relative to the drawing plane (paper or computer), as shown by *depth* or *height* (the vertical dimension) in Figure 2.

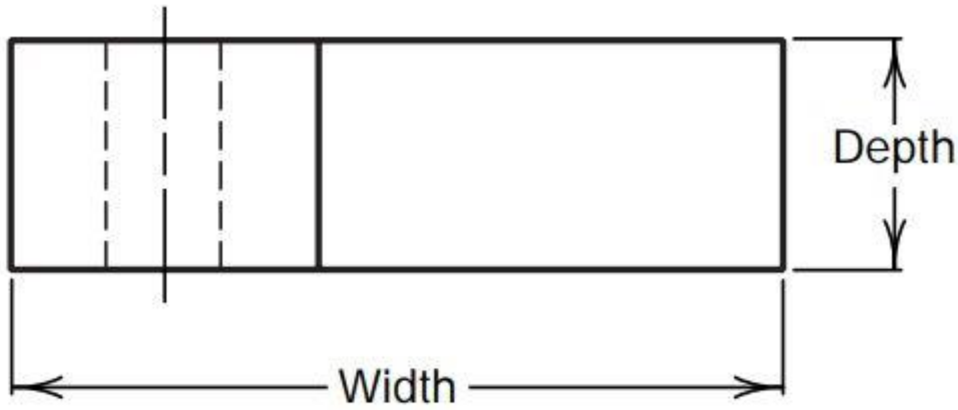

Figure 2: Dimensions indicating the width and depth (or height) of an object

2. Angular dimension

Angular dimension is the type of engineering drawing dimension that is indicated either in only degrees or a combination of degrees (°), minutes (′), and seconds (″) which are the units of angular dimension. In any situation(s) where only minutes and seconds are specified, a zero (0) is placed before the number of minutes or seconds, as shown on the last diagram in Figure 2—examples of angular units used in angular dimensioning.

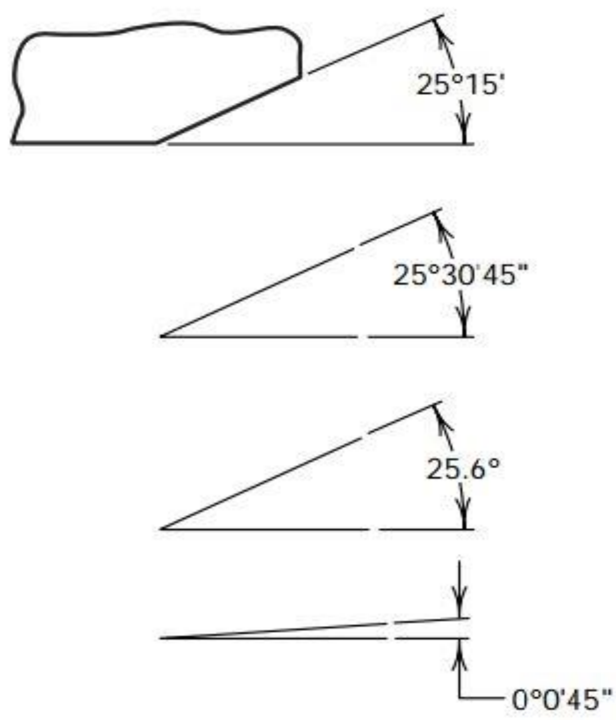

Figure 3: Examples of angular dimensions expressed in degrees and a combination of degrees, minutes, and seconds

3. Diametral dimension

Diametral dimension is the type of engineering drawing dimension that expresses the magnitude of the diameter or straight line connecting the center of a circle with two points on its perimeter. Diametral dimension is used on mostly full circles or arcs whose magnitude is more than half of a full circle. The symbol for diameter is the Greek letter phi Ø.

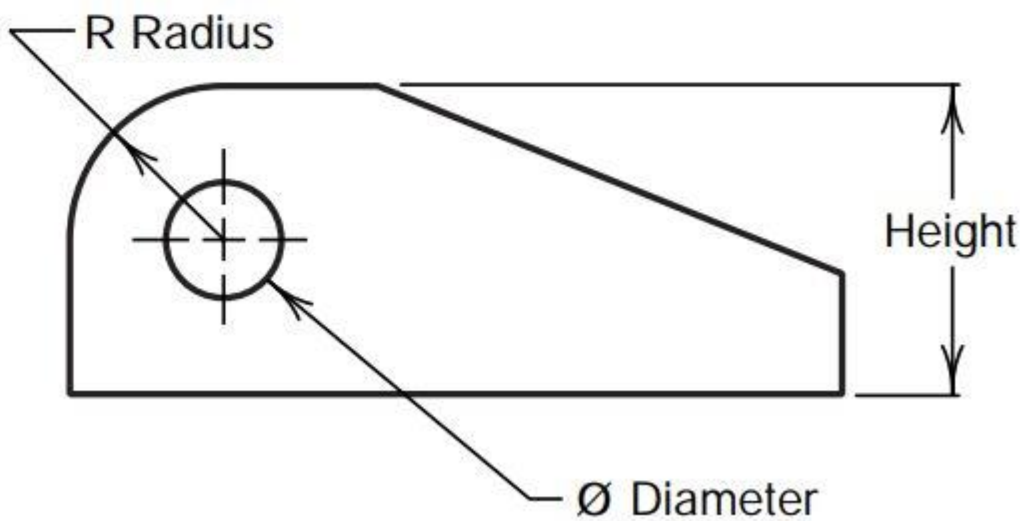

Figure 4: Dimensions showing the diameter and radius of a hole

4. Radial dimension

Radial dimension is the type of engineering drawing dimension that expresses the magnitude of the radius or distance between the center of a circle or arc (that is less than half of a circle) and any point on a circle's or arc's perimeter. The symbol for radius is the capital letter R as shown in Figure 4 above.

5. Ordinate (or coordinate) dimension

Ordinate dimension is the type of engineering drawing dimension that is indicated via rectangular coordinates or *rectangular coordinate dimensioning* in which a datum line or baseline is established for each Cartesian coordinate and every other dimension is positioned with respect to the datum line or baseline.

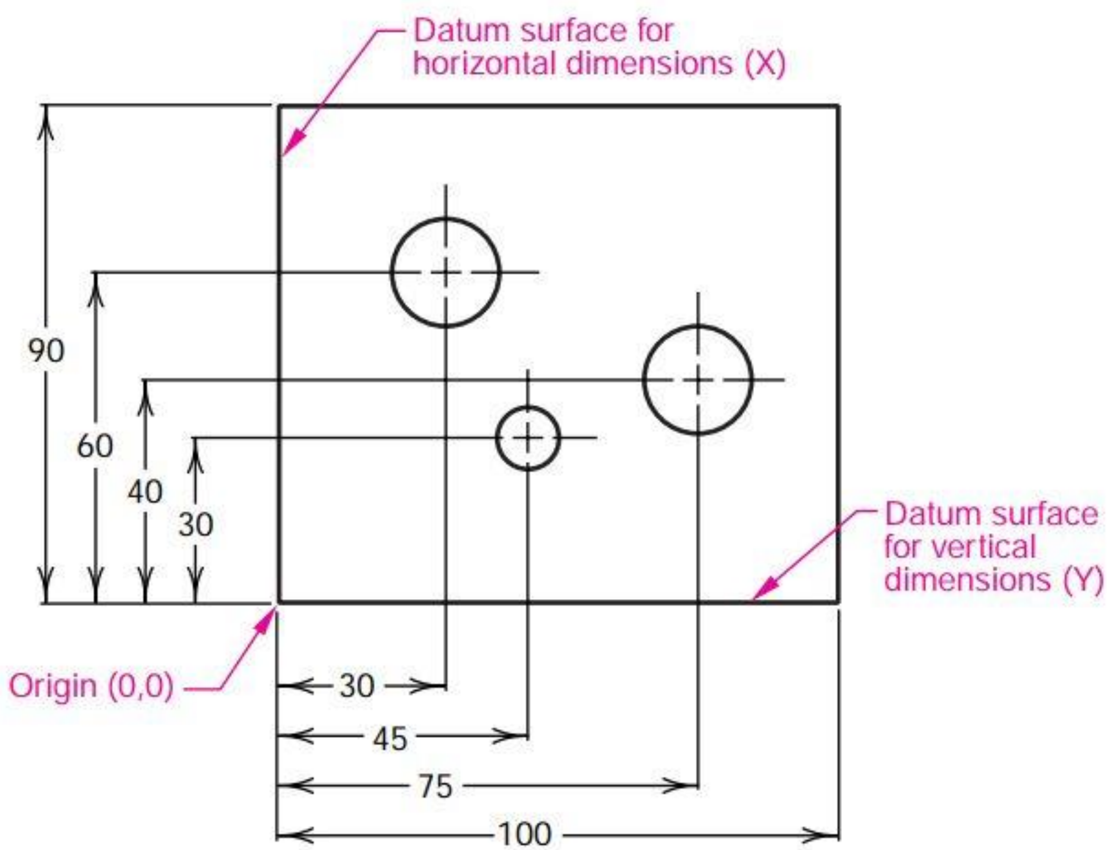

Figure 5: An object dimensioned by coordinate dimensions, with a baseline or datum surface as starting point

6. Reference dimension

Reference dimension is the type of engineering drawing dimension that provides extra information that is not essential for fabricating or creating a part or feature. Reference dimension is usually enclosed in parentheses [such as (2.00) as shown in Figure 6] on drawings, only providing certain information which cannot be used to fabricate a feature or part.

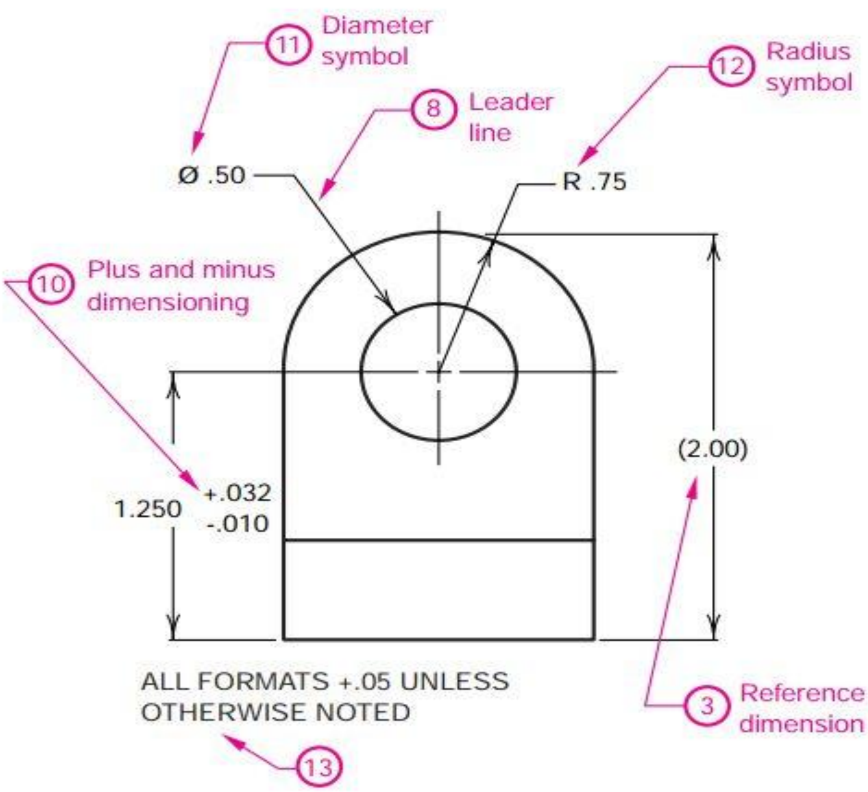

Figure 6: An object assigned a reference dimension of 2.00

7. Note dimension or notes

Notes are the type of engineering drawing dimension described by written specifications or words, more detailed than numerical values and clearly point out specific information and sizes of a feature or features.

There are two types of notes:

(A) Specific (or local) note: this is the type of engineering drawing dimension that provides information applicable or relevant to specific features and not the whole drawing. Local notes are linked to specific features on drawing views. Three examples of specific notes include:

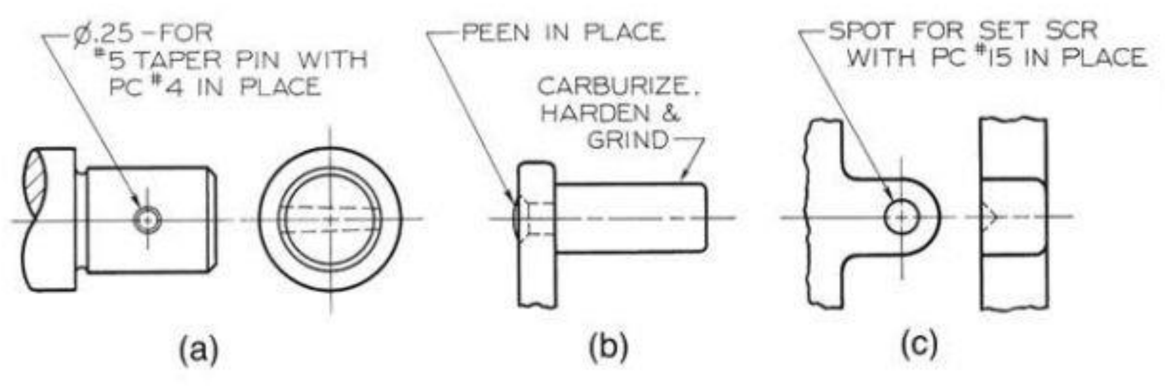

Figure 7: Three examples of specific notes

(B) General note**:** this is the type of engineering drawing note that provides information that is applicable or relevant to the whole drawing. General notes are linked to all drawing views of a drawing. Three examples of general notes include:

(a) FINISH ALL OVER (FAO)

(b) ALL DRAFT ANGLES 3° UNLESS OTHERWISE SPECIFIED

(c) DIMENSIONS APPLY AFTER PLATING