

DIMENSIONING FUNDAMENTALS

Graphic entities on drawings describe shape and position. Dimensions and notes describe size, location and necessary manufacturing and building processes instruction for a fabricator, builder, shop technician , etc.



DIMENSIONING FUNDAMENTALS

After covering this section you will know how to do the following:

Use conventional dimensioning techniques to describe size, shape and locations on an engineering drawing.

Create and read at a specified scale.

Create drawings using metric, engineering and architect scales.

Correctly place dimension lines, extension lines, angles and notes.

Recognize aligned and unidirectional dimension systems.

Dimension circle, arcs and inclined surfaces.

Apply finish symbols and notes to a drawing.



We have all heard the “rule of thumb”. At one time, an inch was defined by the width of a man’s thumb, and a foot, simply was the length of a man’s foot.

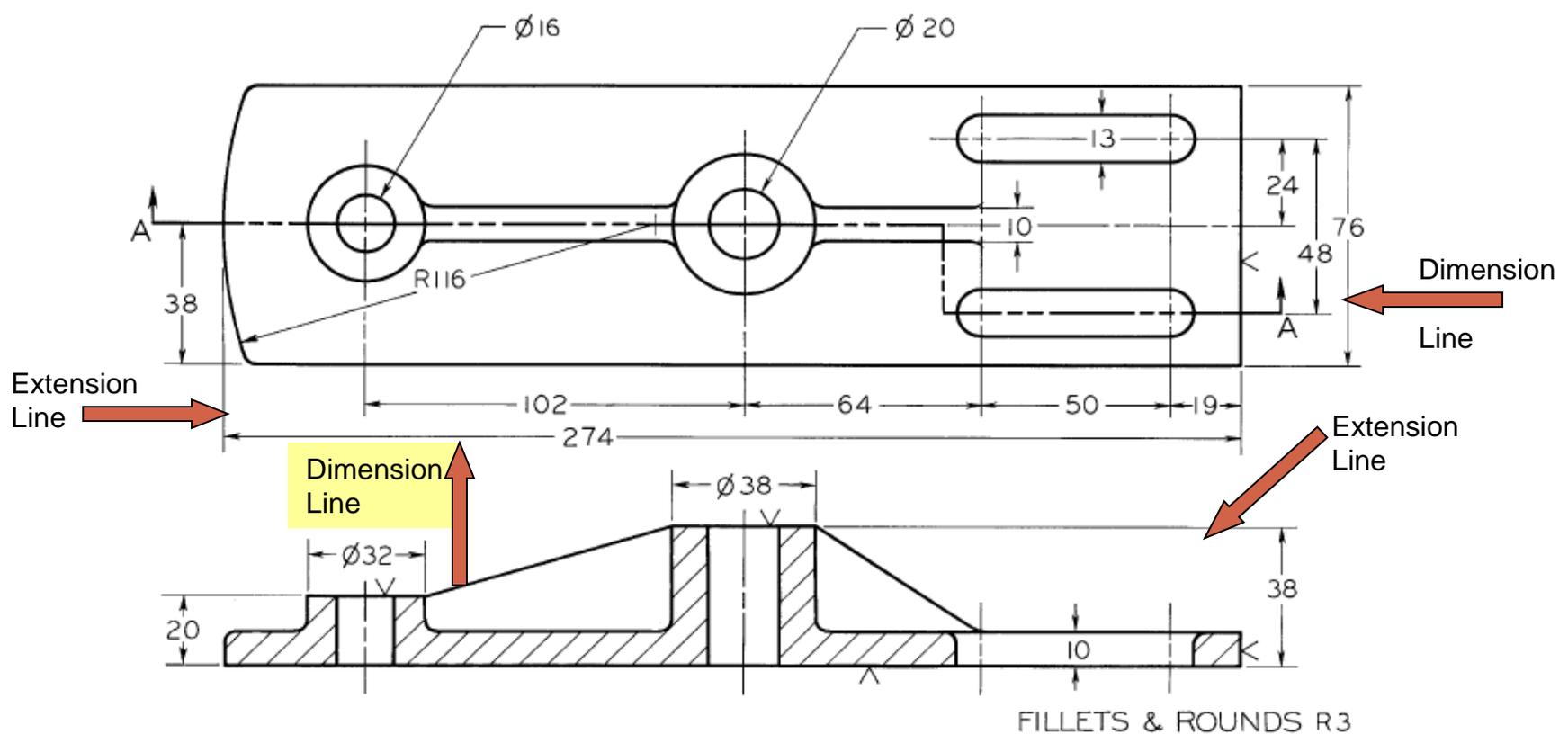
THE RULE OF THUMB



A FOOT



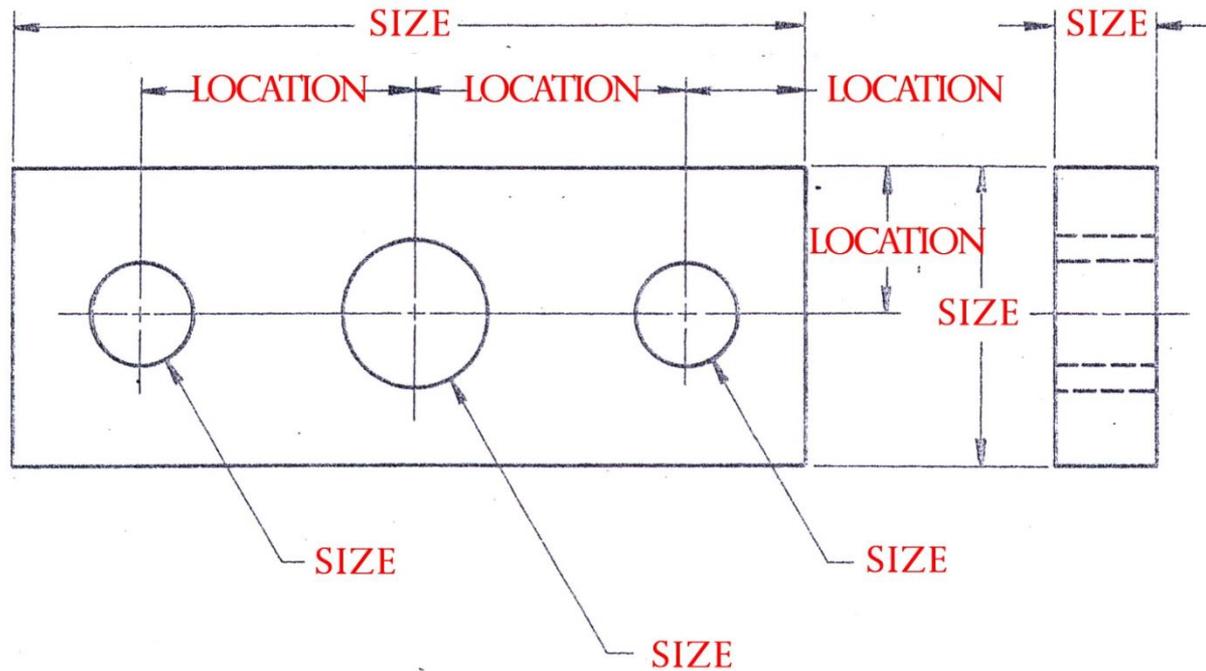
DIMENSIONS



DIMENSION LINES AND EXTENSION LINES

Dimension Lines: A thin, dark, solid line terminated by arrowheads, which indicate the direction and extent of a dimension.

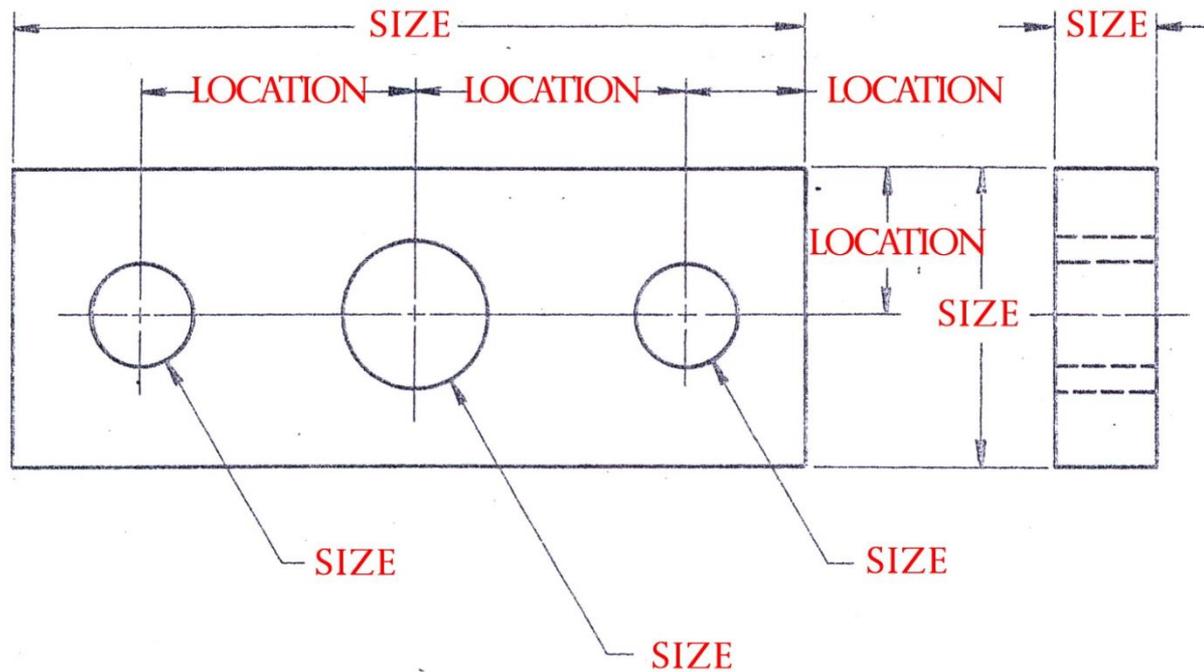
Extension Lines: A thin, dark solid line that "extends" from a point on the drawing to which a dimension refers.



LOCATION AND SIZE DIMENSIONS ON A DRAWING

In addition to drawing a complete **shape description** of an object, a drawing must also give complete **size** and **location descriptions**.

By doing this you are dimensioning the drawing.



LOCATION AND SIZE DIMENSIONS ON A DRAWING

Shape description: What does the object look like? The Shape of the object.

Size Dimensions: How big or small is something? For example, what is the size of the circle being drilled through the block? How big is that block, what is it's size?

Location Dimensions: Where should that hole be drilled through the block?

LOCATION AND SIZE DIMENSIONS ON A DRAWING

- Dimensions on a drawing need to be **exact and clear**.
- Dimensions on a drawing should be given so workers building or fabricating the part **do not have to assume** anything, measure anything, and dimensions given should always be to points or surfaces accessible to the worker.
 - Dimensions should **not be duplicated or excessive**.
 - Drafters should be **familiar with and understand the materials** used in their parts so they can exercise proper judgment in the engineering matters itself.

UNDERSTAND
THE PART



DON'T MAKE SOMEONE ASSUME



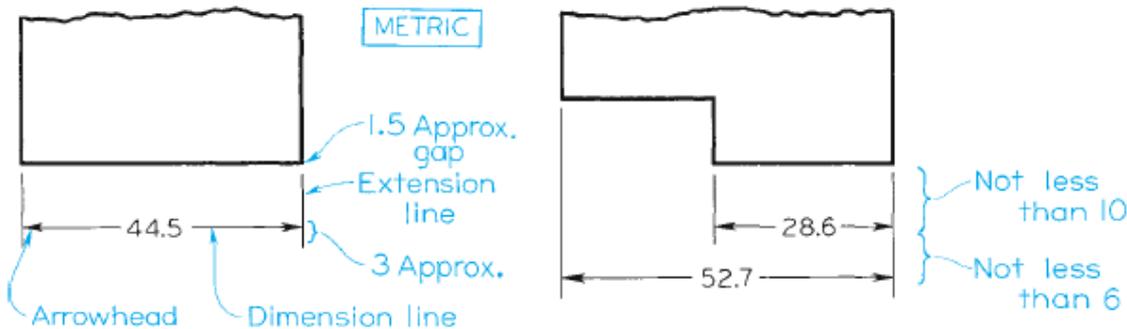
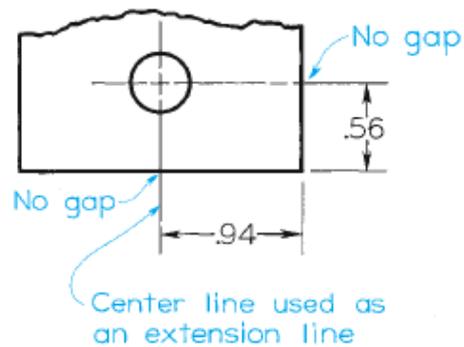
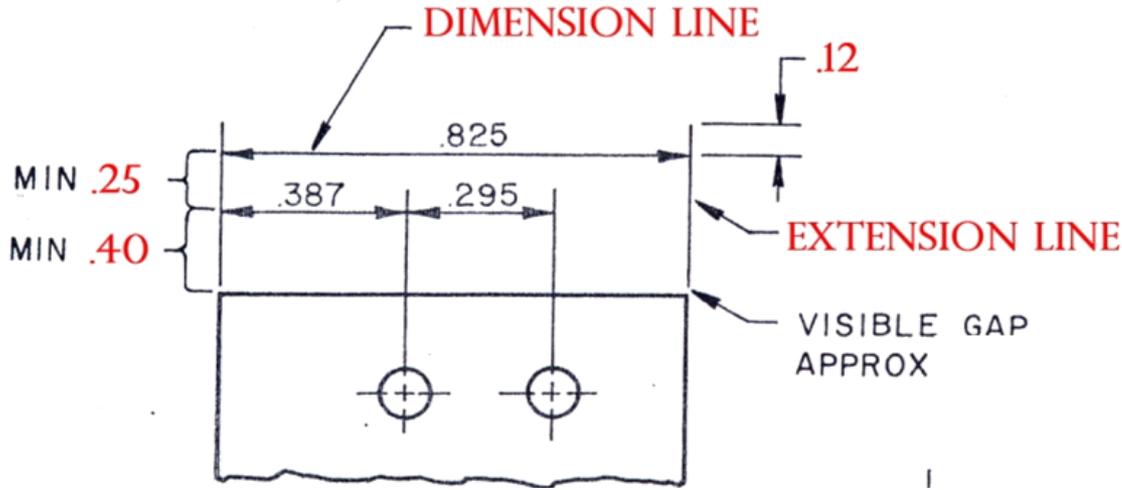
DIMENSIONS SHOULD BE EXACT AND CLEAR



clear

DON'T DUPLICATE OR PUT EXCESSIVE DIMENSIONS

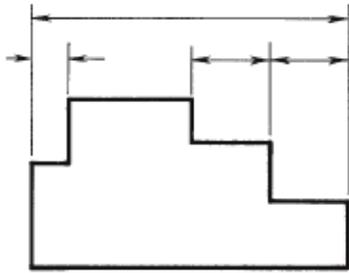
PLACEMENT OF DIMENSION LINES



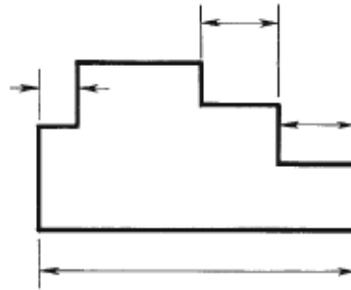
QUICK TIPS

- Place the shorter dimensions nearest to the object outline.
- Dimension lines should NEVER cross extension lines. (This would only happen if you placed the shorter dimensions outside of longer dimensions)
- Be sure to leave a small gap between the Extension Line and the object.
- Keep dimension line spacing consistent throughout the drawing.

PLACEMENT OF DIMENSION LINES

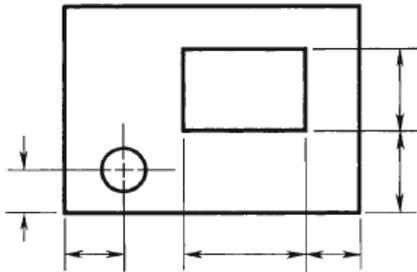


(a) CORRECT

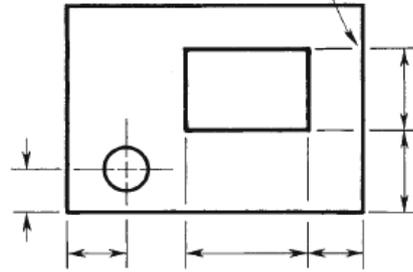


(b) NO!

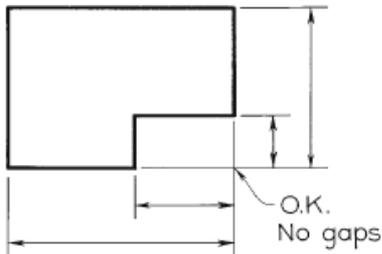
Avoid gaps



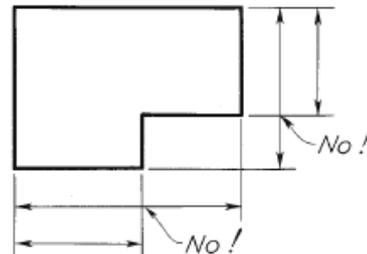
(a) CORRECT



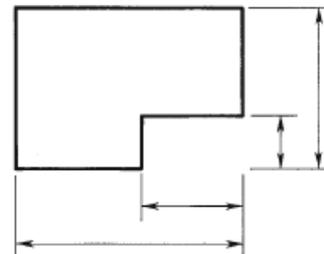
(b) NO!



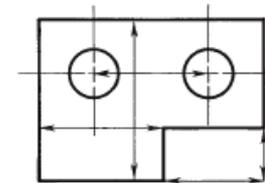
(a) CORRECT



(b) NO!



(c) NO!

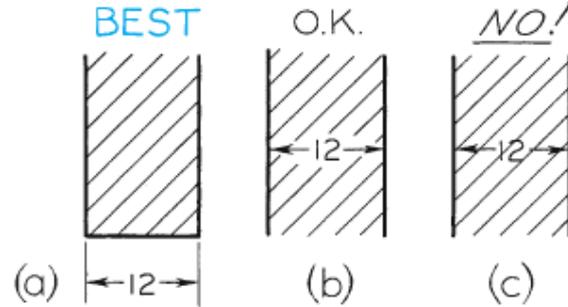
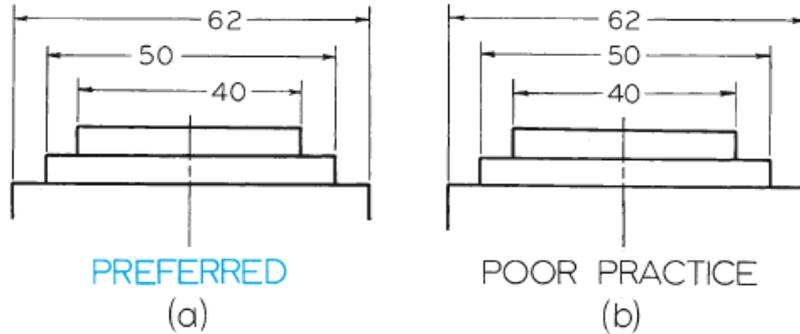


(d) NO!

QUICK TIPS

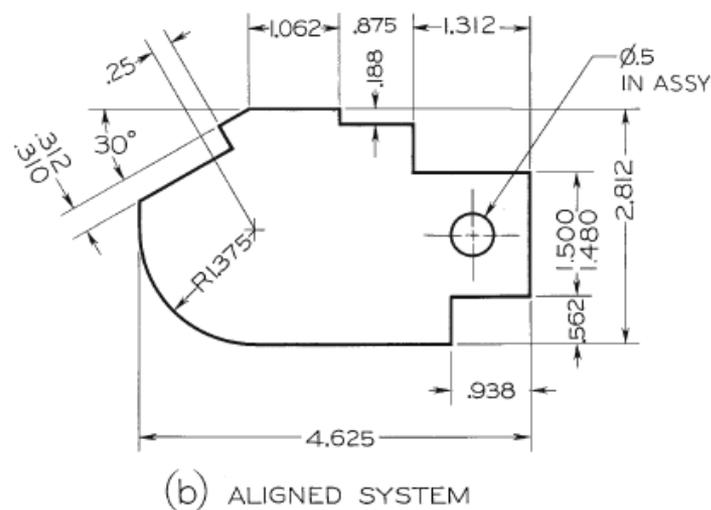
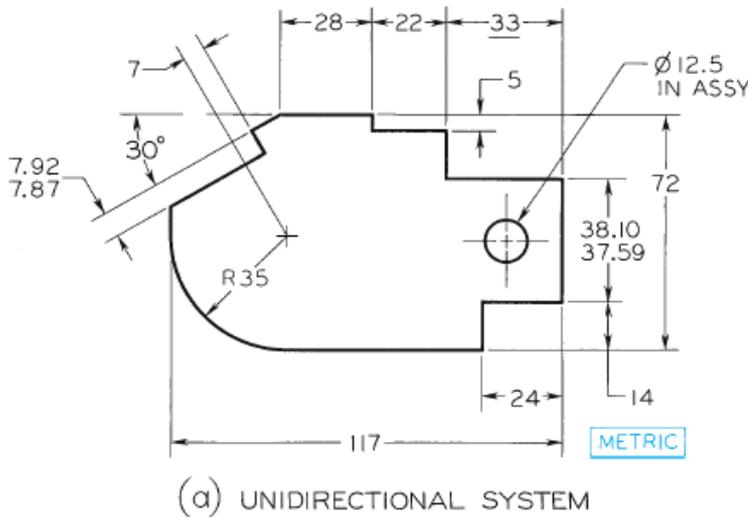
- Line up and group dimensions as much as possible so the drawing looks neat and keep spacing consistent everywhere.
- Don't break extension lines around the object lines.
- Hold dimension lines off of the object. Dimensions should only be on the object in a last resort.

PLACEMENT OF DIMENSION LINES



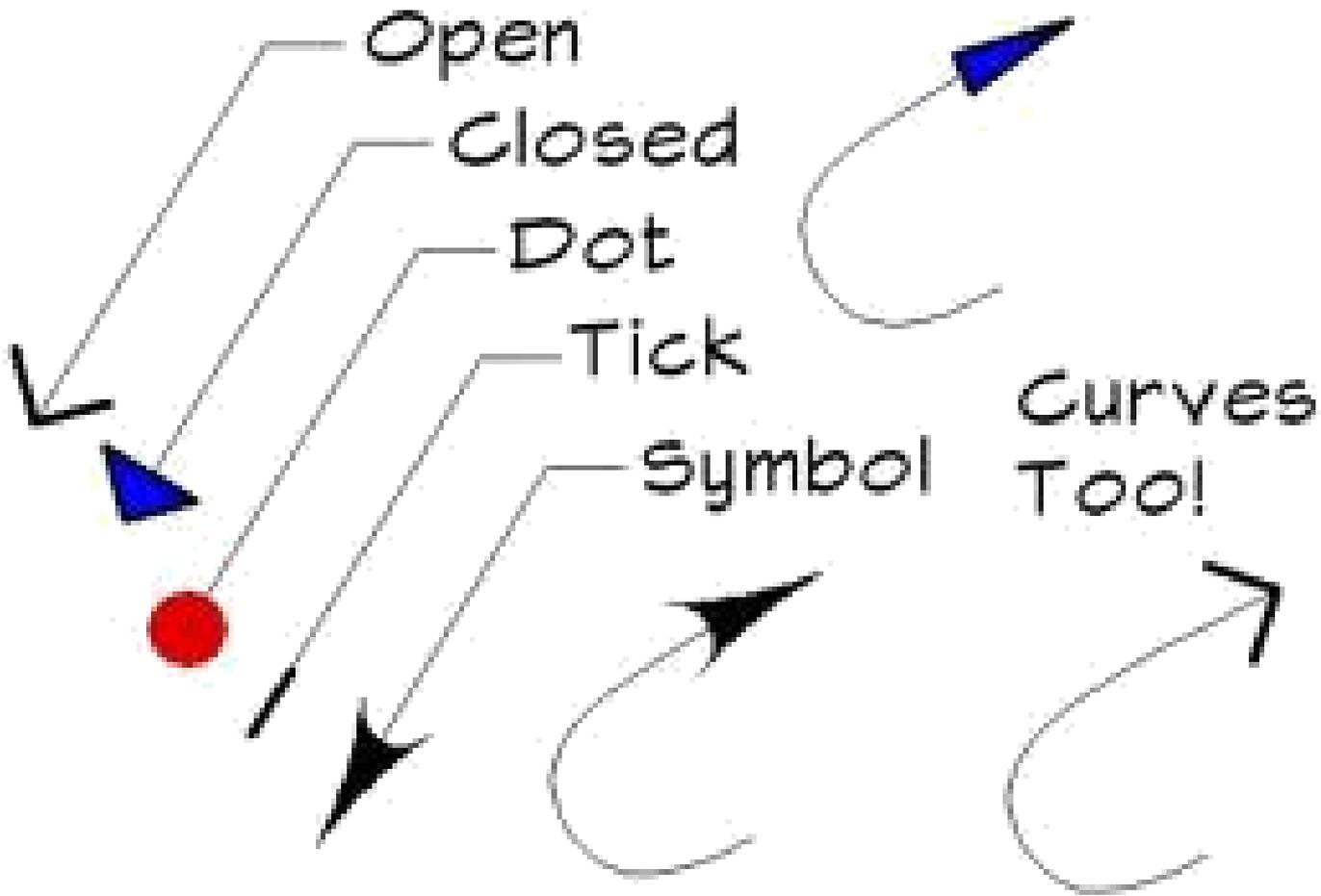
QUICK TIPS

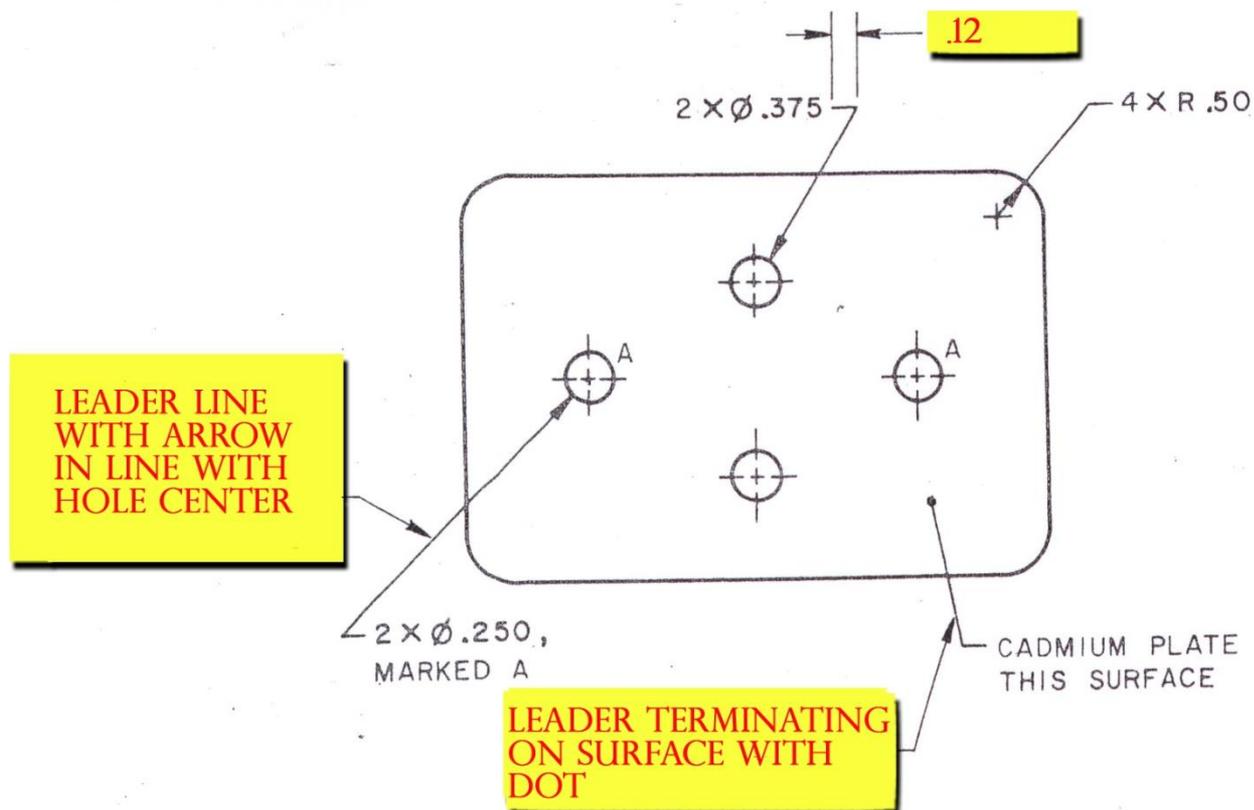
- Stagger dimension values when they are close to make it easier to read.
- If you dimension within a section, hold the dimension off of the object or clear the section lining from within.
- Unidirectional system is the preferred way of including dimension figures.
- If a dimension is not to scale a heavy black line will be present under it.



LEADER LINES

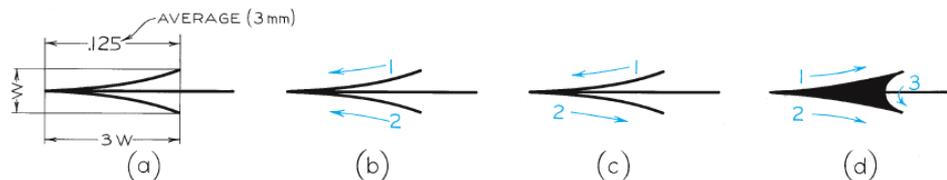
LEADER LINES



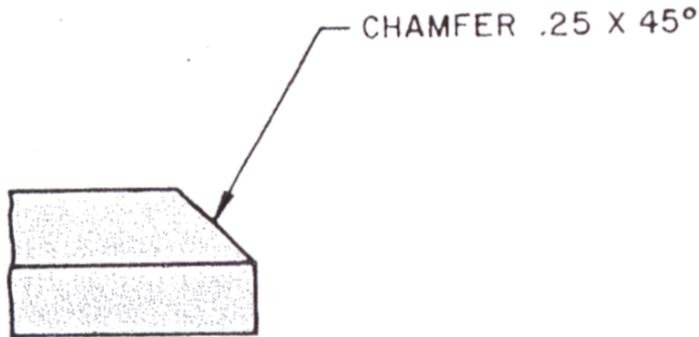


LEADER LINES

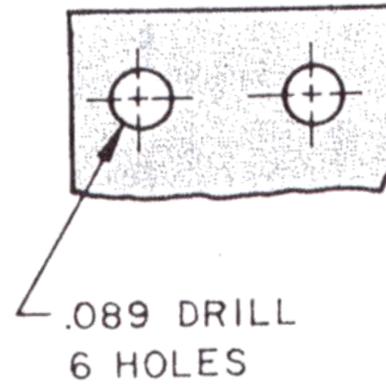
Leader Lines: A thin, dark, solid line leading from a note or dimension and terminating into an arrowhead or dot, touching the part to which the attention is directed.



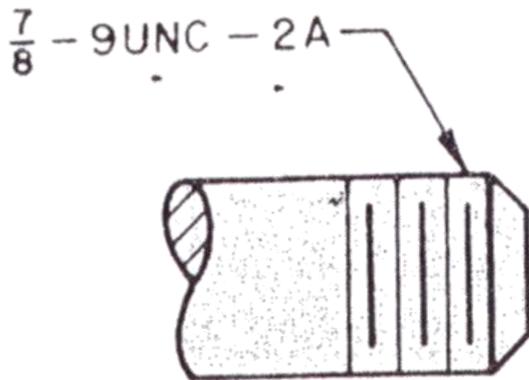
Leader used to describe form.



Leader used to describe hole size.



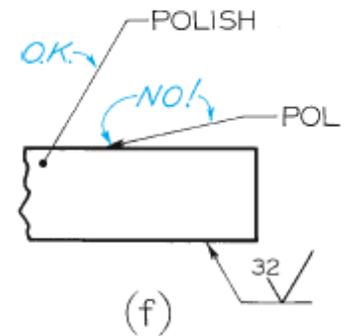
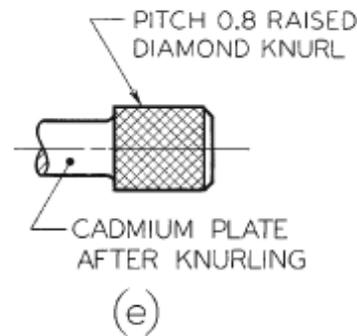
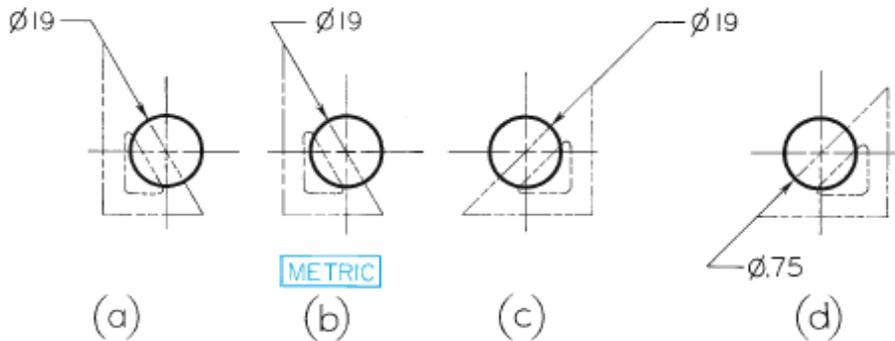
Leader used to describe a part.



QUICK TIPS

- A leader to a circle should be radial, that is, if extended would pass through the center.
- Leaders drawn near each other should be parallel

Examples of Leader Lines in Use



Leader used to describe cuteness.



Leader used to describe cuteness.



FRACTIONAL, DECIMAL, & METRIC DIMENSIONS

FRACTIONAL, DECIMAL, & METRIC DIMENSIONS

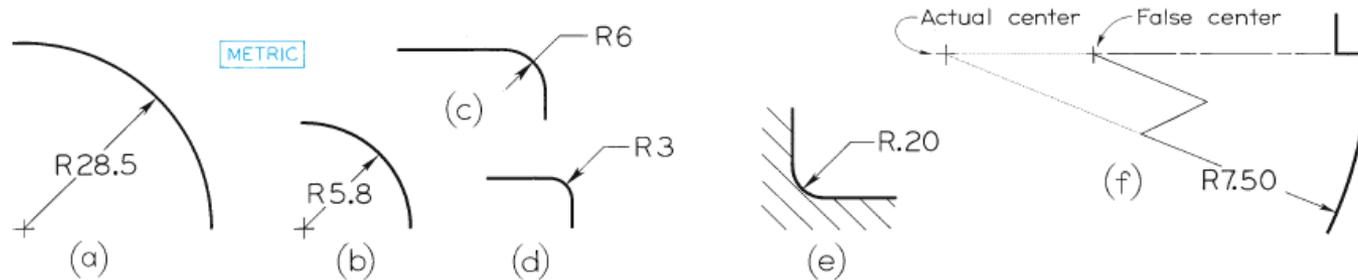
- In the early days, those who were manufacturing the goods would scale drawings for dimensions and it was their responsibility to see the parts fit.
- As industry progressed a greater demand for more accurate dimensions are required. It became cumbersome to use $1/128$ or $1/256$ so decimals began being used such as 4.2340 etc. However some dimensions such as standard nominal sizes of materials, punched holes, drilled holes, threads, keyways and other features produced by tools are so designed to use whole numbers and common fractions.
- Therefore, drawings can be dimensioned with whole number and common fractions, decimals, or both. But more recent practice was to adopt the decimal-inch system because millimeters and inches in the decimal form are easier to add and subtract than fractions.
- Millimeters are used on most engineering drawings but to facilitate the changeover to metric dimensions, some drawings are dual-dimensioned in mm and decimal inches.

DIMENSIONING ARCS, ANGLES, AND CYLINDERS

DIMENSIONING ARCS, ANGLES, & CYLINDERS

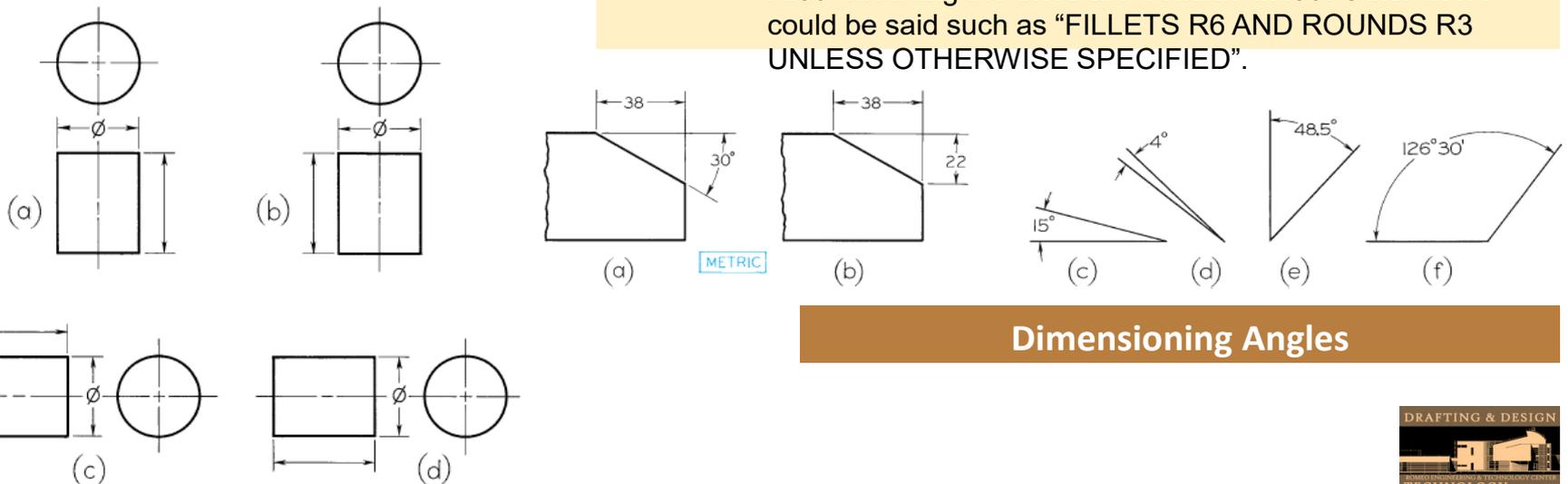
There are various ways to dimension arcs, angles, and cylinders. The key is to select the best method for the drawing and keep it consistent.

Dimensioning Arcs



Dimensioning Cylinders

Fillets and Rounds are dimensioned as arcs. If there are only a few and they are all obviously the same size, one typical radius note is sufficient and could be dimensioned as “4X R.50” meaning the there are 4 radius at .50. Other notes could be said such as “FILLETS R6 AND ROUNDS R3 UNLESS OTHERWISE SPECIFIED”.

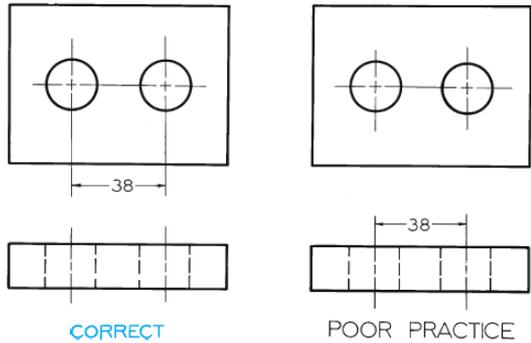
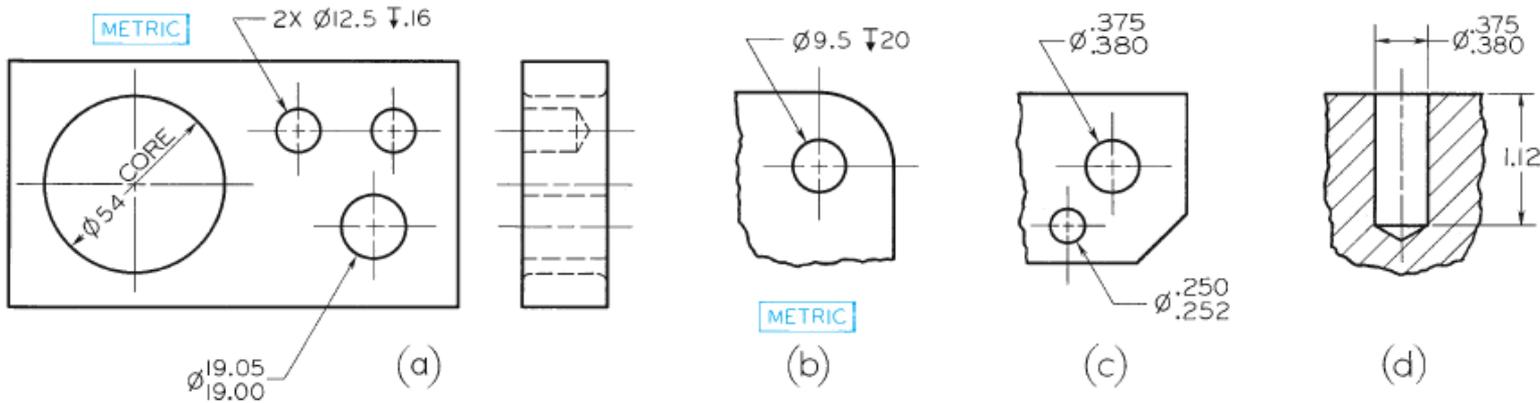


Dimensioning Angles

DIMENSIONING HOLES

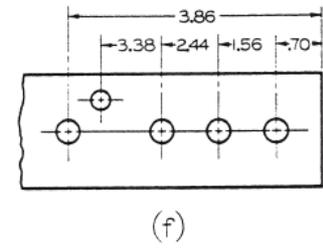
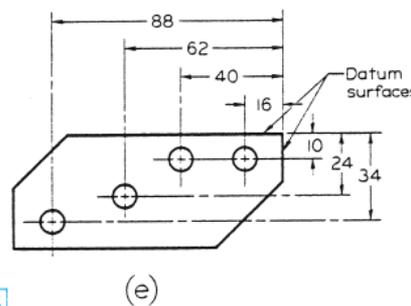
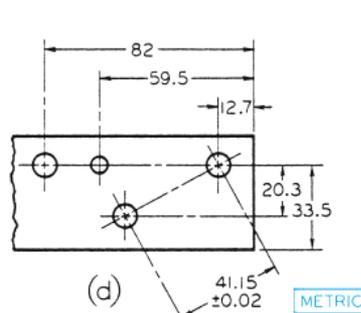
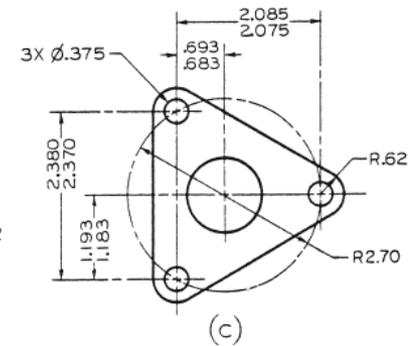
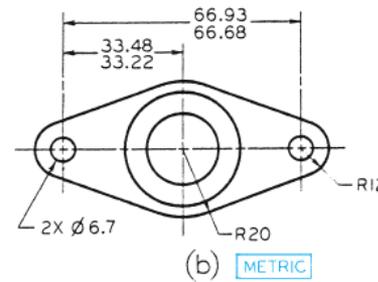
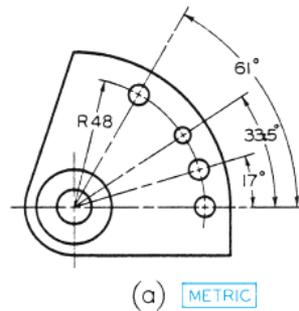
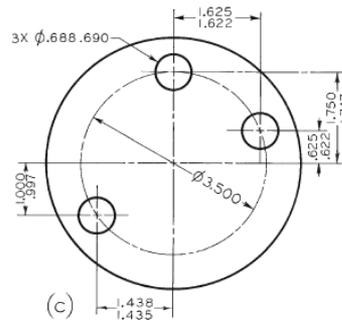
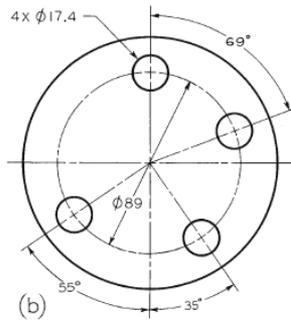
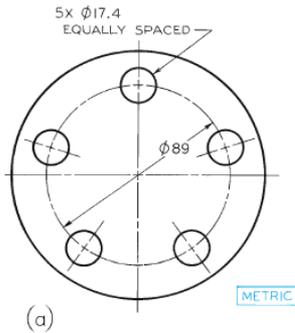
DIMENSIONING HOLES

- Holes that are drilled, bored, reamed, punched, cored, etc., are specified by symbols. The order of the items in a note corresponds to the order of procedure in the shop in producing the hole.
- When the circular view of the hole has two or more concentric circles as for counter bored, countersunk or tapped holes, the arrowhead should touch the outer circle.
- The leader should point to the circular view of the hole, and only in the rectangular view when it improves clarity.



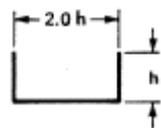
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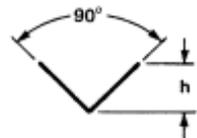


DIMENSIONING SYMBOLS

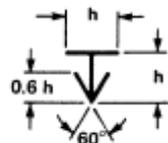
DIMENSIONING SYMBOLS



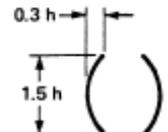
COUNTERBORE OR SPOTFACE



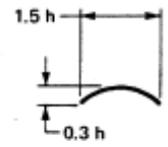
COUNTERSINK



DEPTH (OR DEEP)



REFERENCE



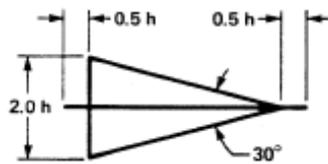
ARC LENGTH



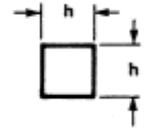
SLOPE



DIMENSION ORIGIN



CONICAL TAPER



SQUARE (SHAPE)



PLACES, TIMES OR BY



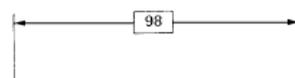
RADIUS



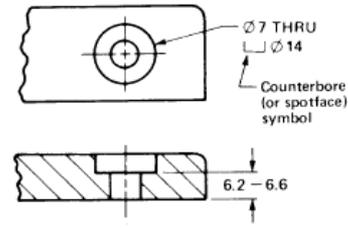
SPHERICAL RADIUS



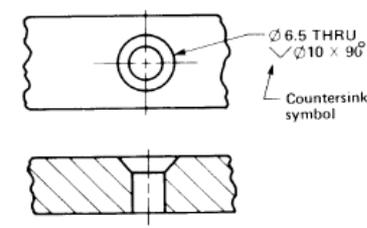
SPHERICAL DIAMETER



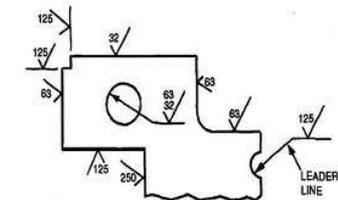
(a) BASIC DIMENSION SYMBOL



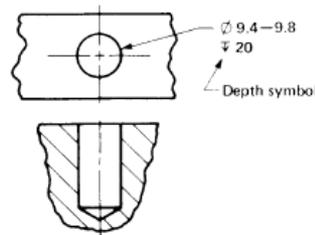
(b) COUNTERBORE OR SPOTFACE SYMBOL



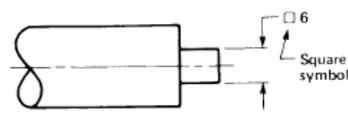
(c) COUNTERSINK SYMBOL



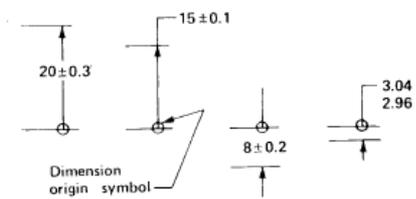
FINISH MARKS (FAO)
Finish All Over



(d) DEPTH SYMBOL



(e) SQUARE SYMBOL



(f) DIMENSION ORIGIN SYMBOL

DIMENSIONING TERMS

DIMENSIONING TERMS:

Mating Dimensions: An instances where a feature on a part must fit into or onto another part. The “mating dimension” must be specified in the corresponding locations on the 2 parts so they can be given the proper fitting of the parts .

Superfluous Dimensions: Dimensions that are repeated on the same view or on different views, or the same information be given in two different ways.

General Note: A note that applies to the entire drawing

Local Note: Applies to specific operations only and are connected by a leader to the point. The leader should be attached to the front of the first word, or at the end of the last word.

Taper: A conical surface on a shaft or in a hole. The usual method of dimensioning a taper is to give the amount of taper in a note, such as TAPER 0.167 ON DIA. And then give the diameter at one end, plus the length, or give the diameter at both ends and omit the length.

Knurl: The roughened surface to provide a better handgrip. Often labeled as PITCH 0.8 DIAMOND KNURL.

ANSI: stands for the American National Standards Institute

ISO: stands for the International Standards Organization

DIMENSIONED DETAIL DRAWING

