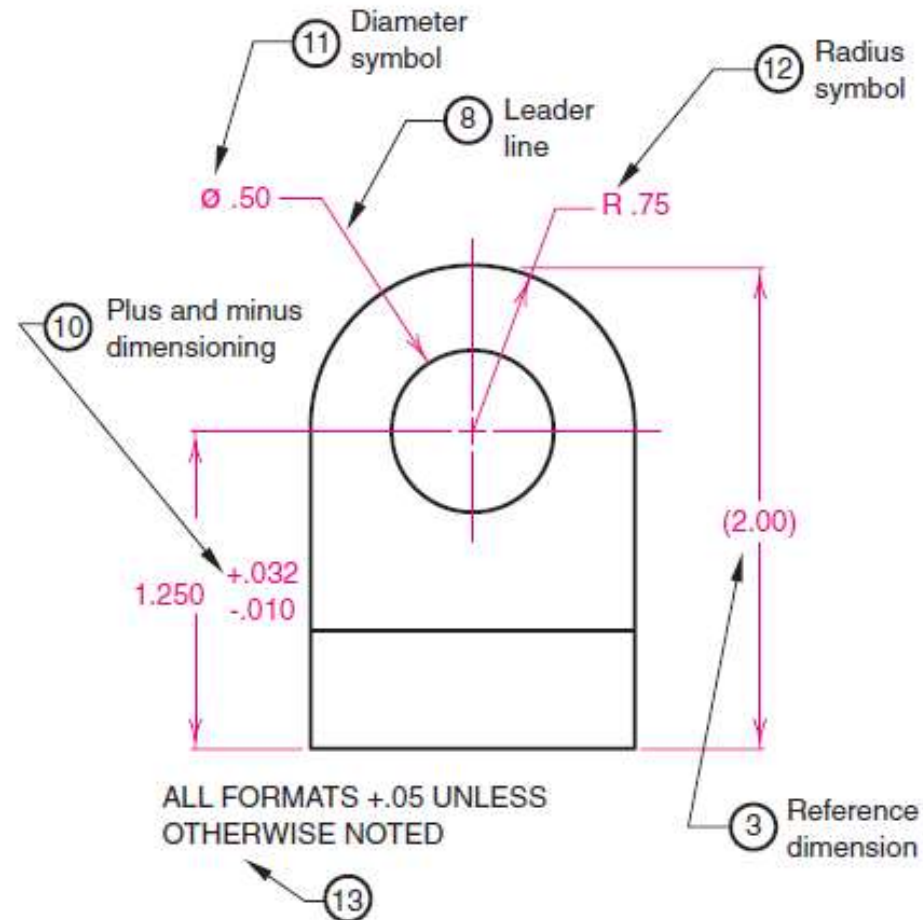
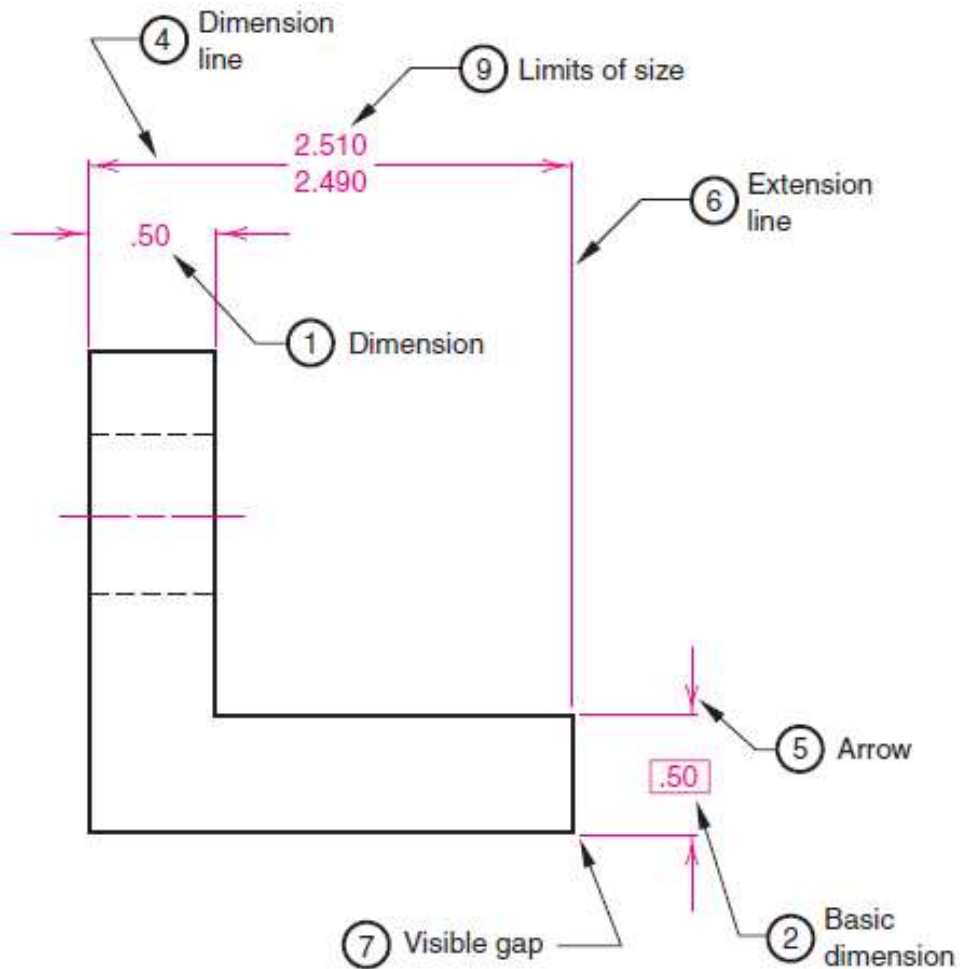


Basic Dimensioning, Tolerancing, and Threads

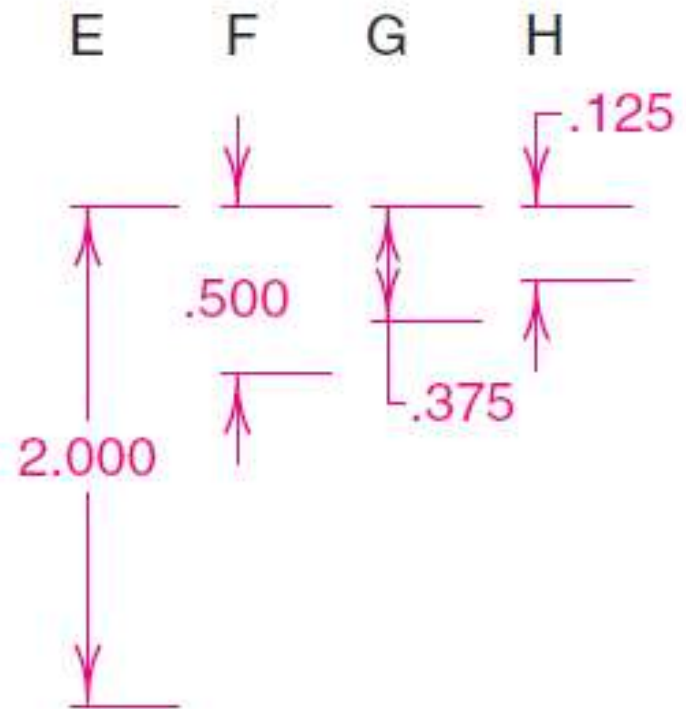
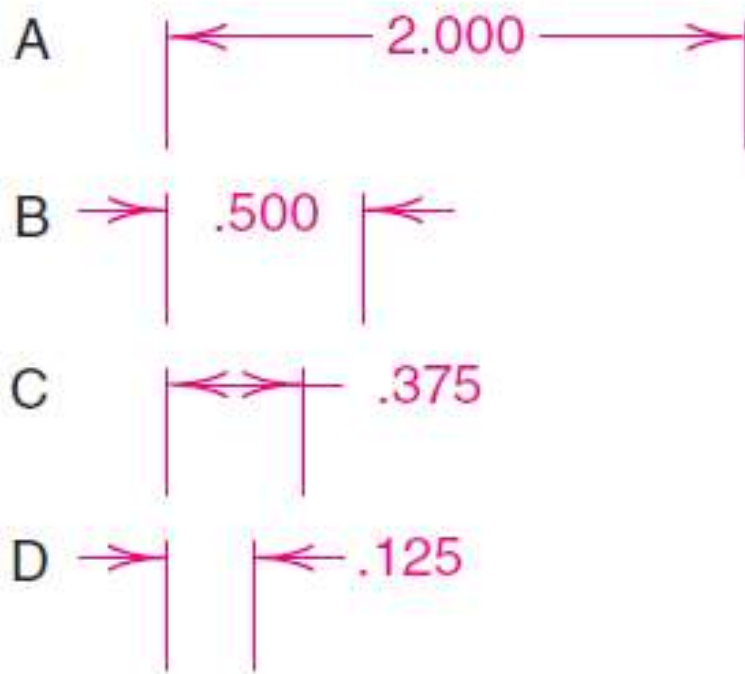
Dr. Hodge Jenkins

MAE 205

Important Elements of Dimensioning

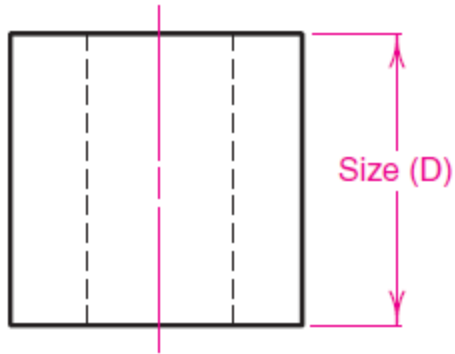


Dimension locations

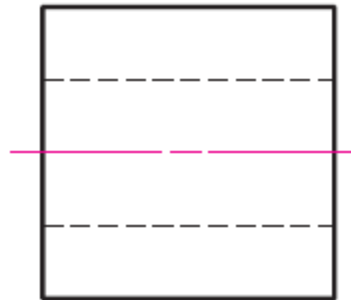
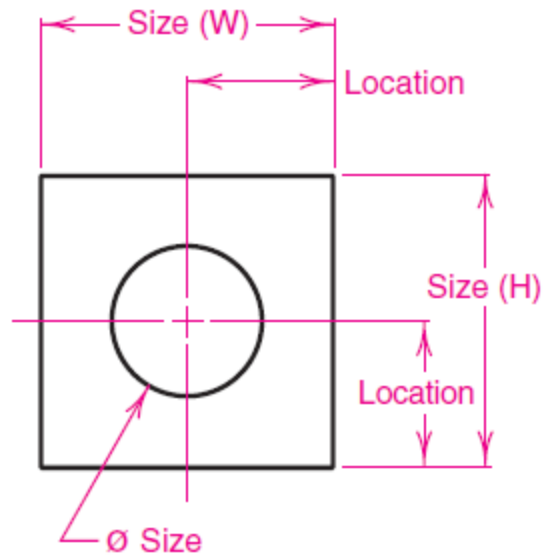


Dimensions and all text are ALWAYS horizontal

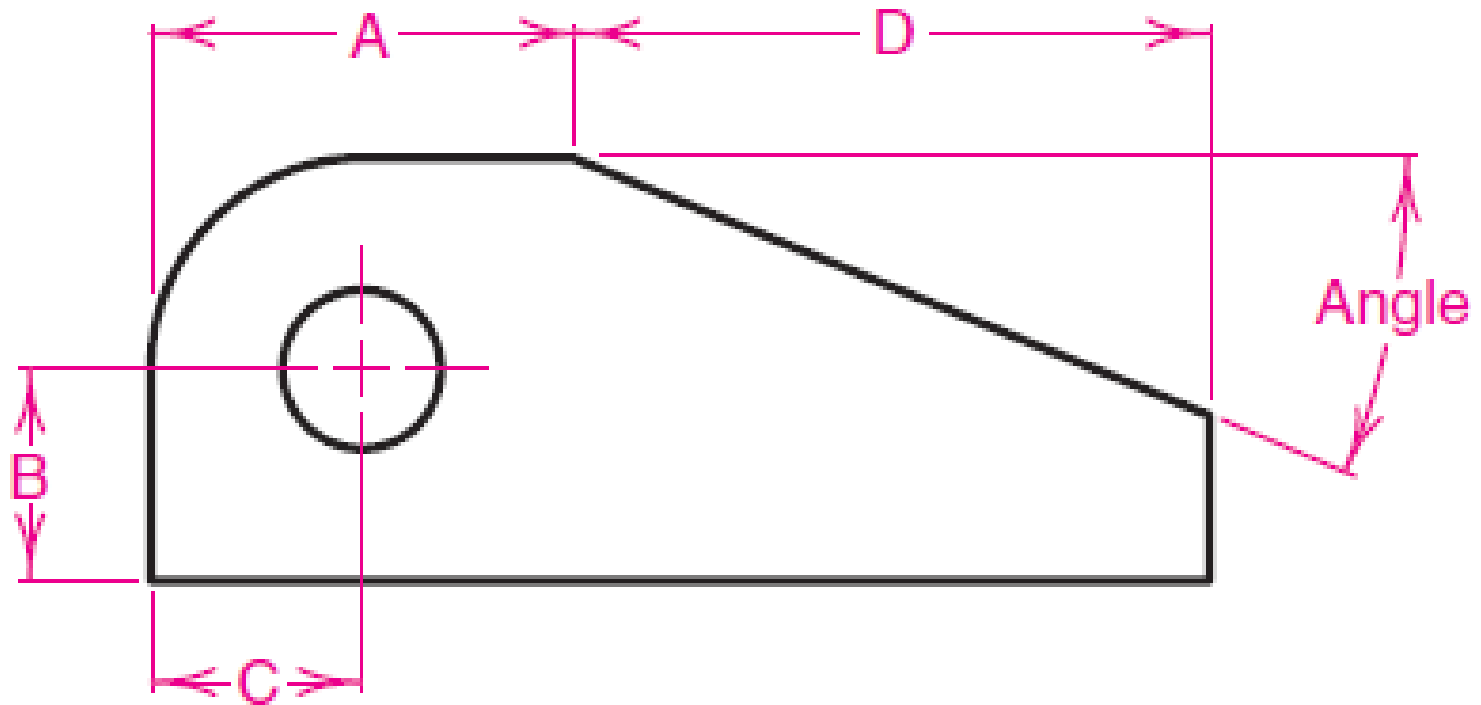
Size and Location of Features





Dimension features in the view best seen.





Dimension Examples




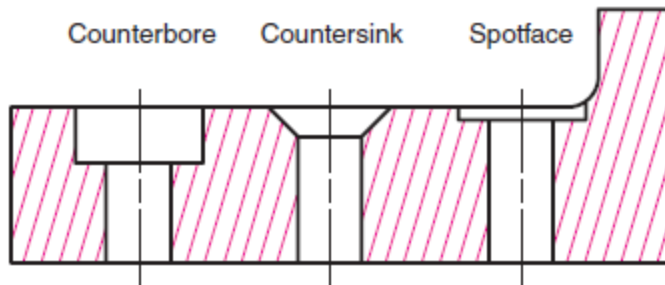
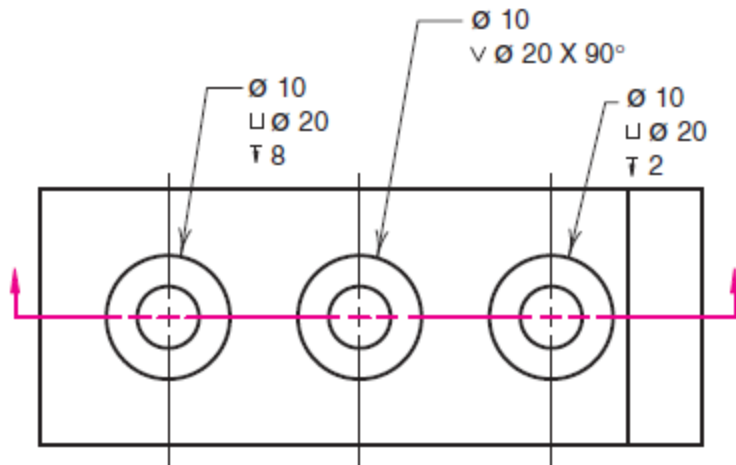
 Counterbore or spotface symbol

 Countersink symbol

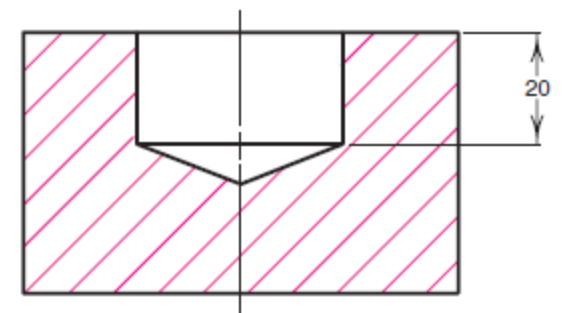
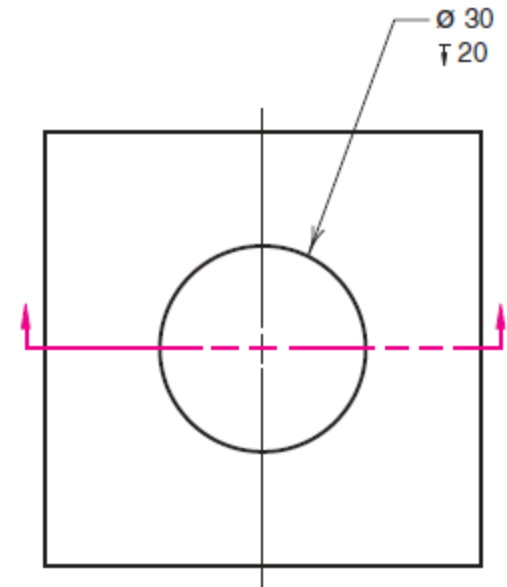
 Diameter symbol

 Square symbol

 Depth symbol



Slotted holes may be dimensioned
In several ways



Dimension Line Spacing

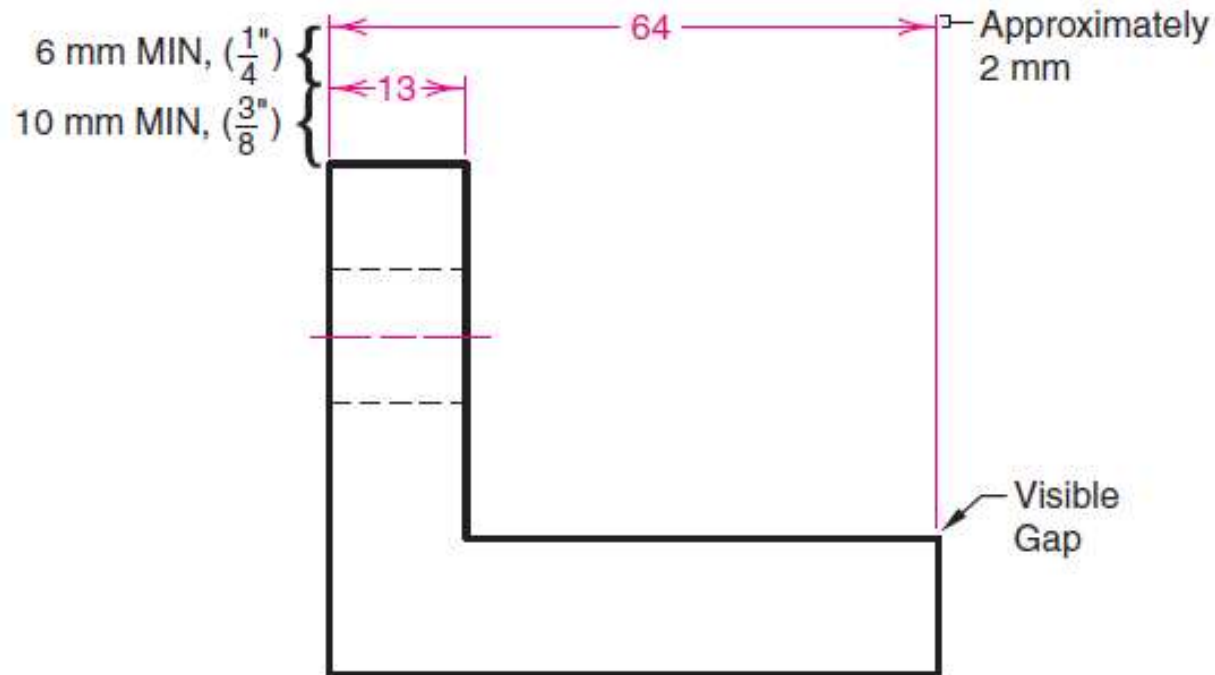
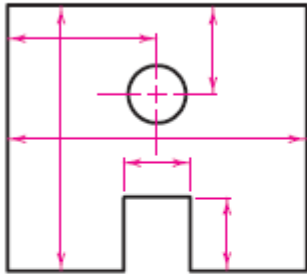


Figure 4.9 Minimum Dimension Line Spacing

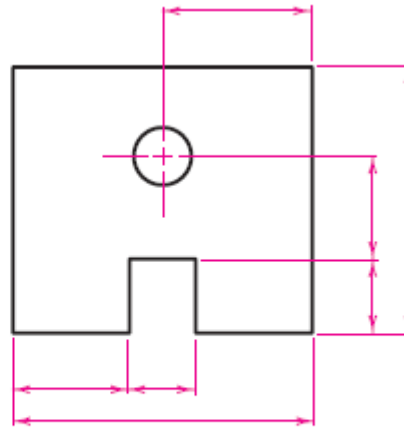
Standard practice for the spacing of dimensions is 10 mm from the view and 6 mm between dimension lines.

Dimension Locations

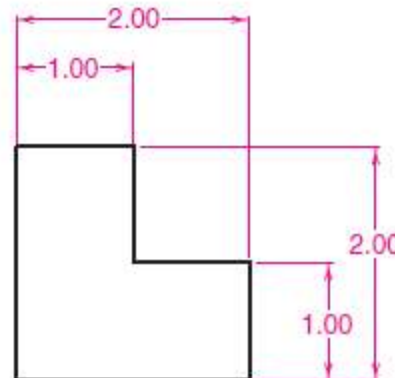


NO

Dimension out part
boundary

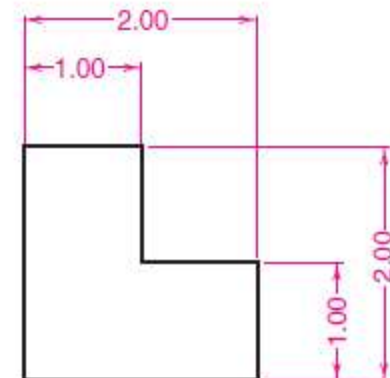


YES



YES

Unidirectional
Current standard

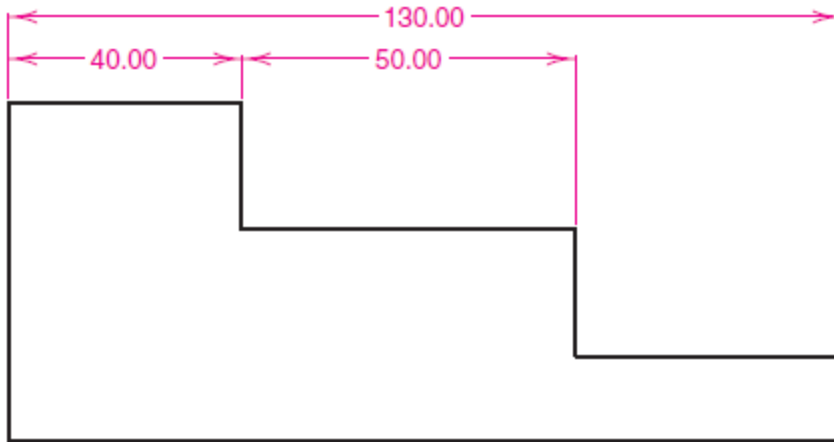


NO

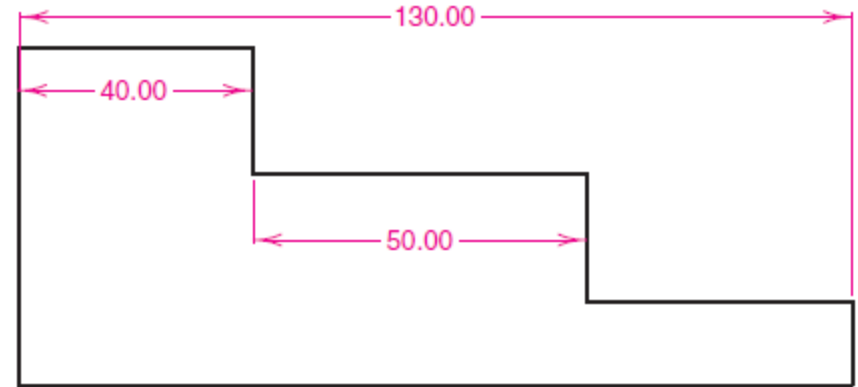
Aligned
Old standard NO

Dimensions and all text are ALWAYS
horizontal

Grouping of Dimensions



(A) Yes



(B) No!

Figure 4.10 Group Dimensions

In standard practice, dimensions are grouped on a drawing. Do not use object lines as extension lines for a dimension.

Grouped dimension

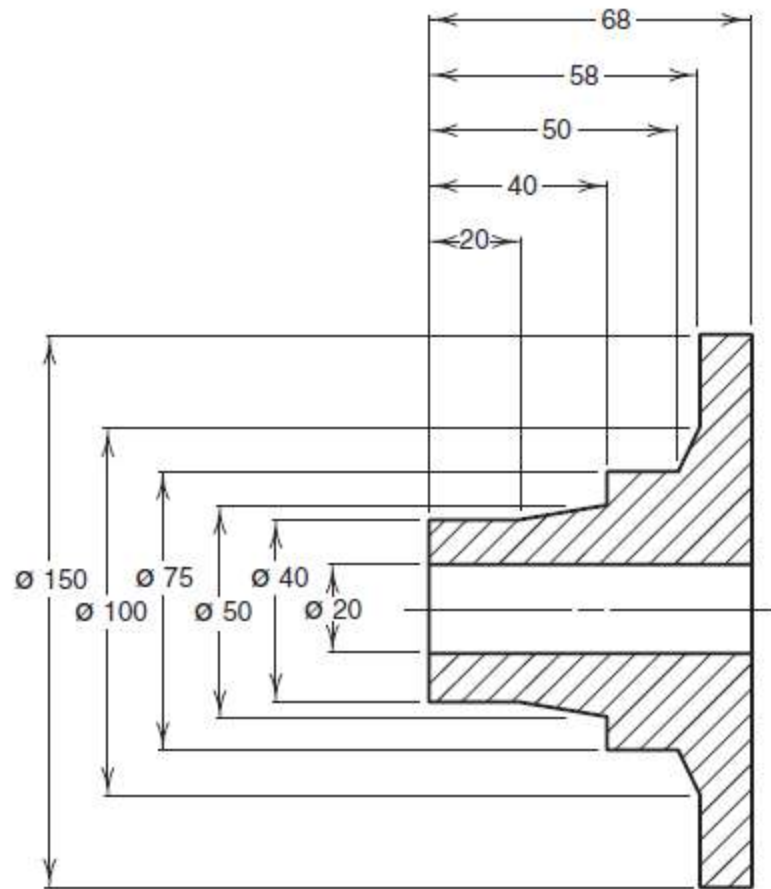


Figure 4.11 Stagger Dimension Text

The general practice is to stagger the dimension text on parallel dimensions.

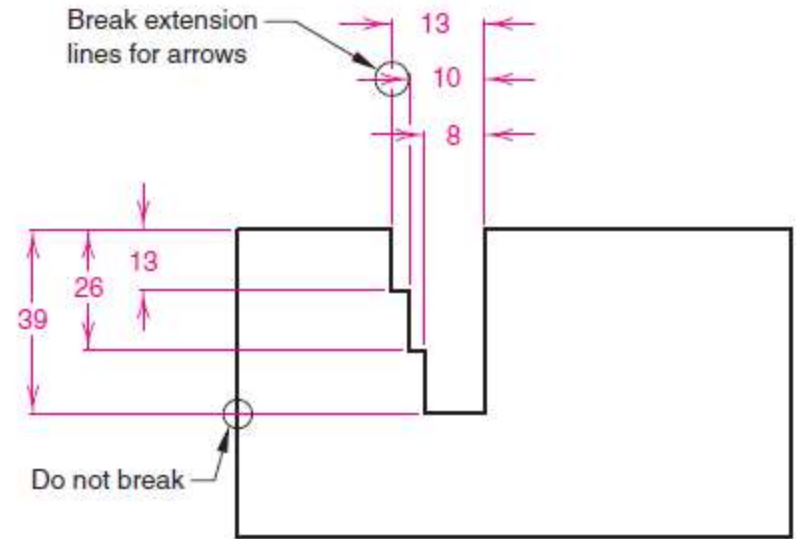
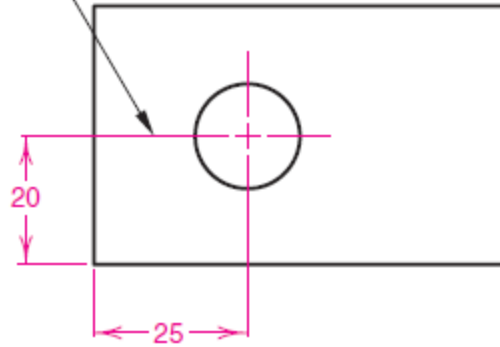


Figure 4.12 Extension Line Practice

Extension lines should not cross dimension lines, are not broken when crossing object or other extension lines, and are broken when crossing arrows.

Diameter Features

Center line used as
an extension line



(A)

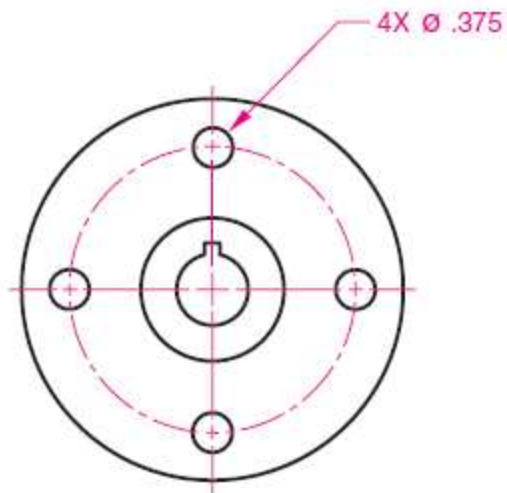
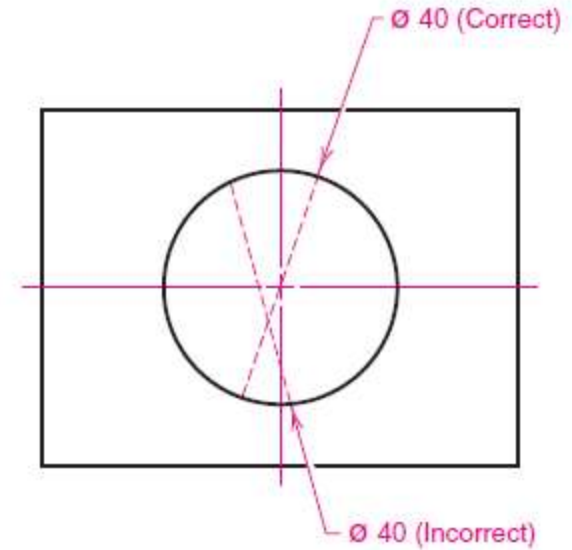


Figure 4.17 Radial Leader Lines

Leader lines used to dimension holes must be radial.

Diameter Features

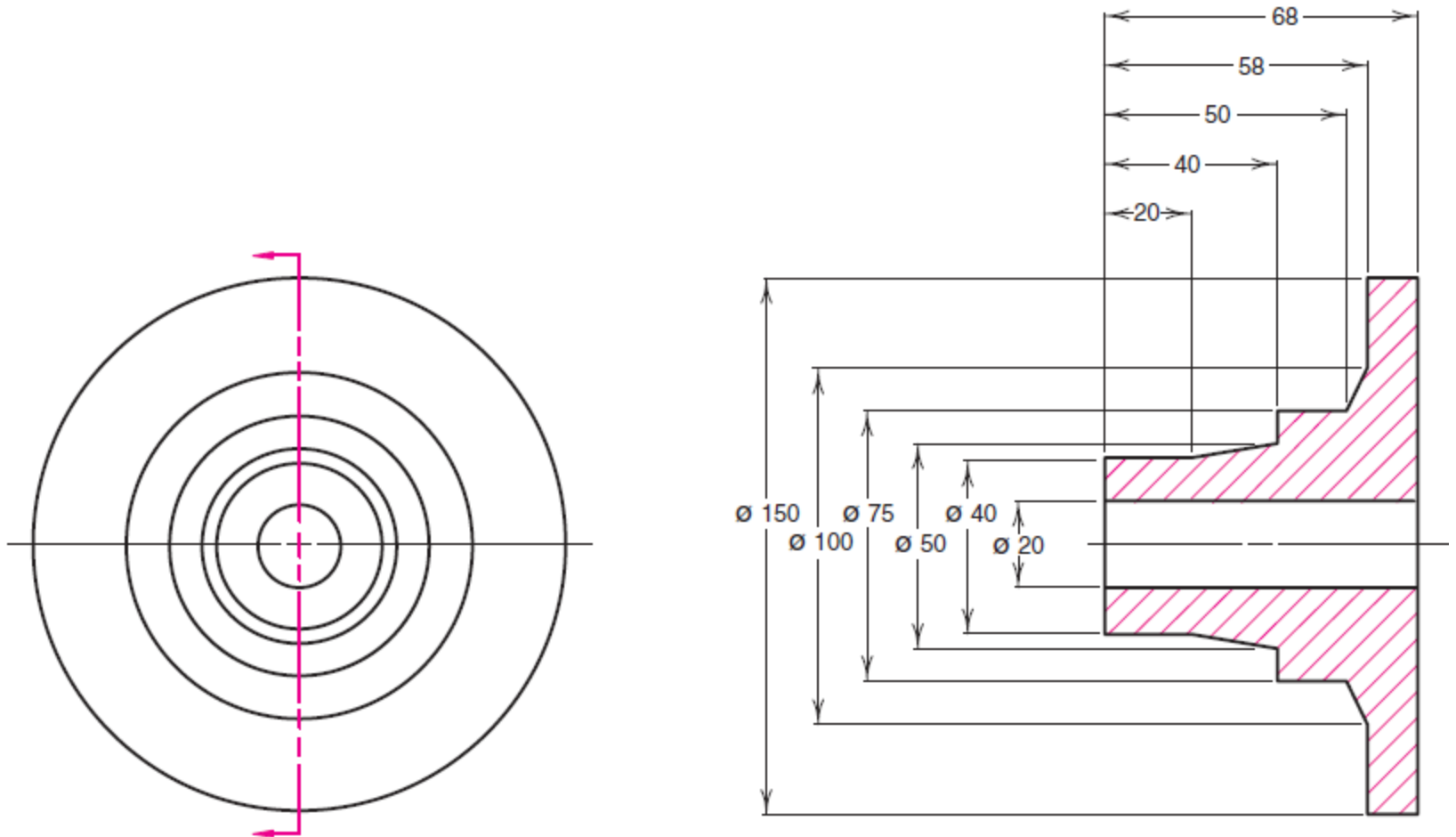


Figure 4.21 Dimensioning Concentric Circles
Concentric circles are dimensioned in the longitudinal view.

Dimensioning Slots

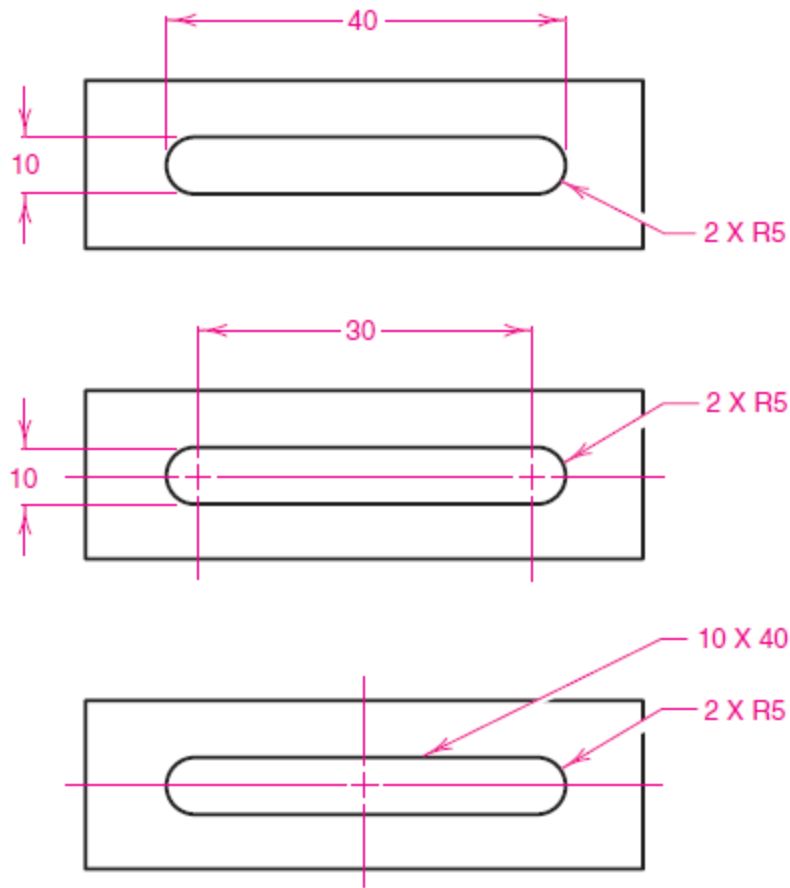


Figure 4.20 Dimensioning Slots

Several methods are appropriate for dimensioning slots.

Dimensioning Consideration

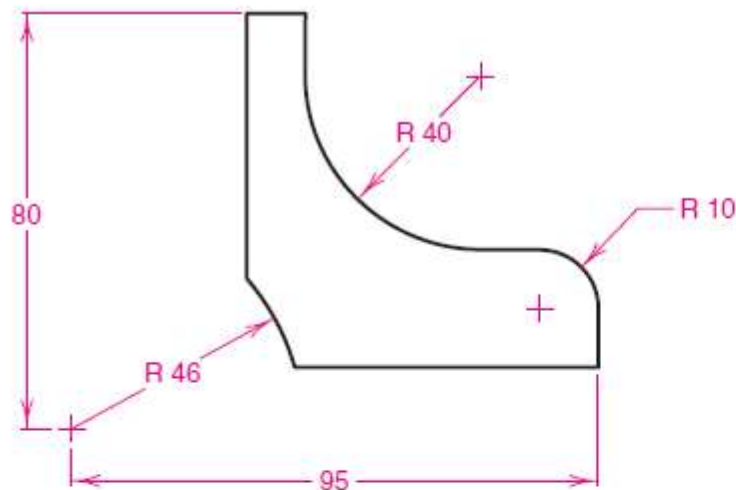
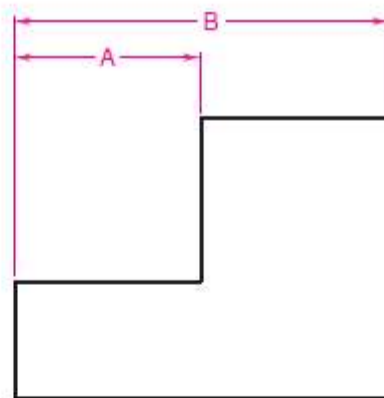
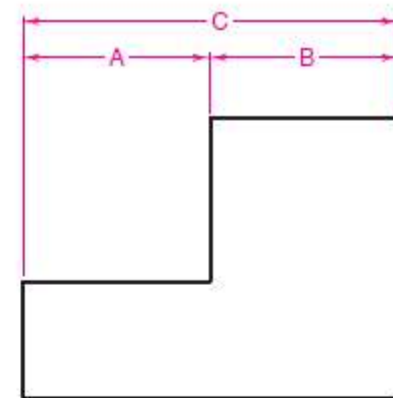


Figure 4.22 Dimensioning Arcs

Arcs of less than half a circle are dimensioned as radii, with the R symbol preceding the dimension value.



A. Correct



B. Avoid

Figure 4.23 Avoid Overdimensioning

Double dimensioning can cause problems because of tolerancing.

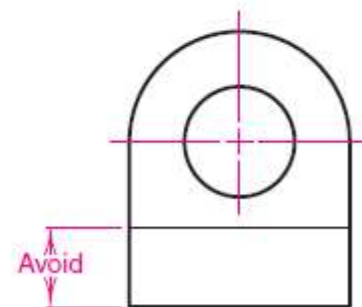
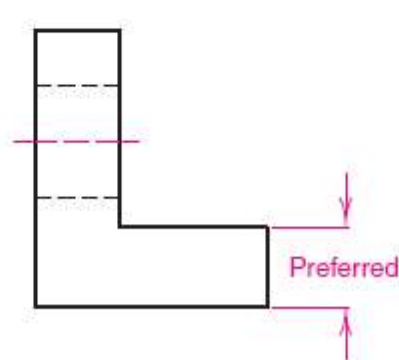


Figure 4.24 Dimension the Most Descriptive View

Dimensions are placed in the most descriptive or contour view.

Tolerancing

4.5.4 Single Limit Dimensions

When other elements of a feature will determine one limit dimension, MIN or MAX is placed after the other limit dimension. Items such as depth of holes, length of

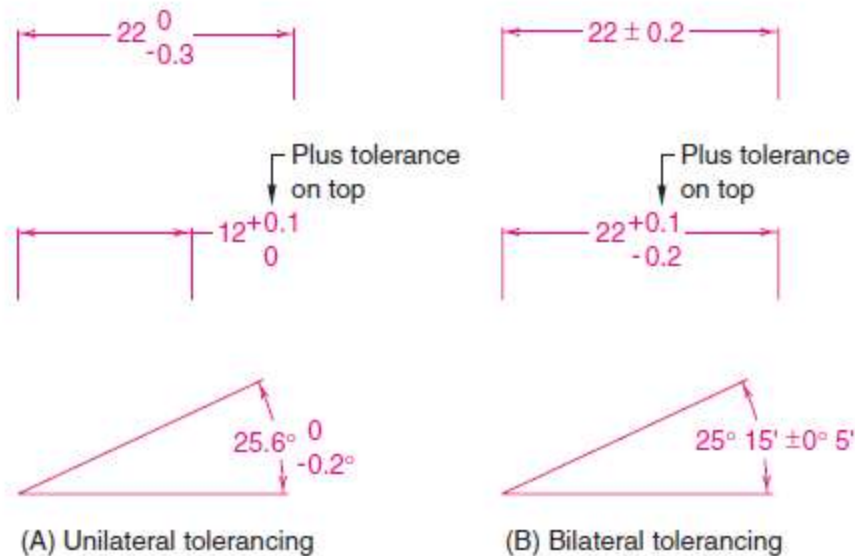


Figure 4.28 Plus and Minus Tolerance System Applied to Various Dimensioning Conditions

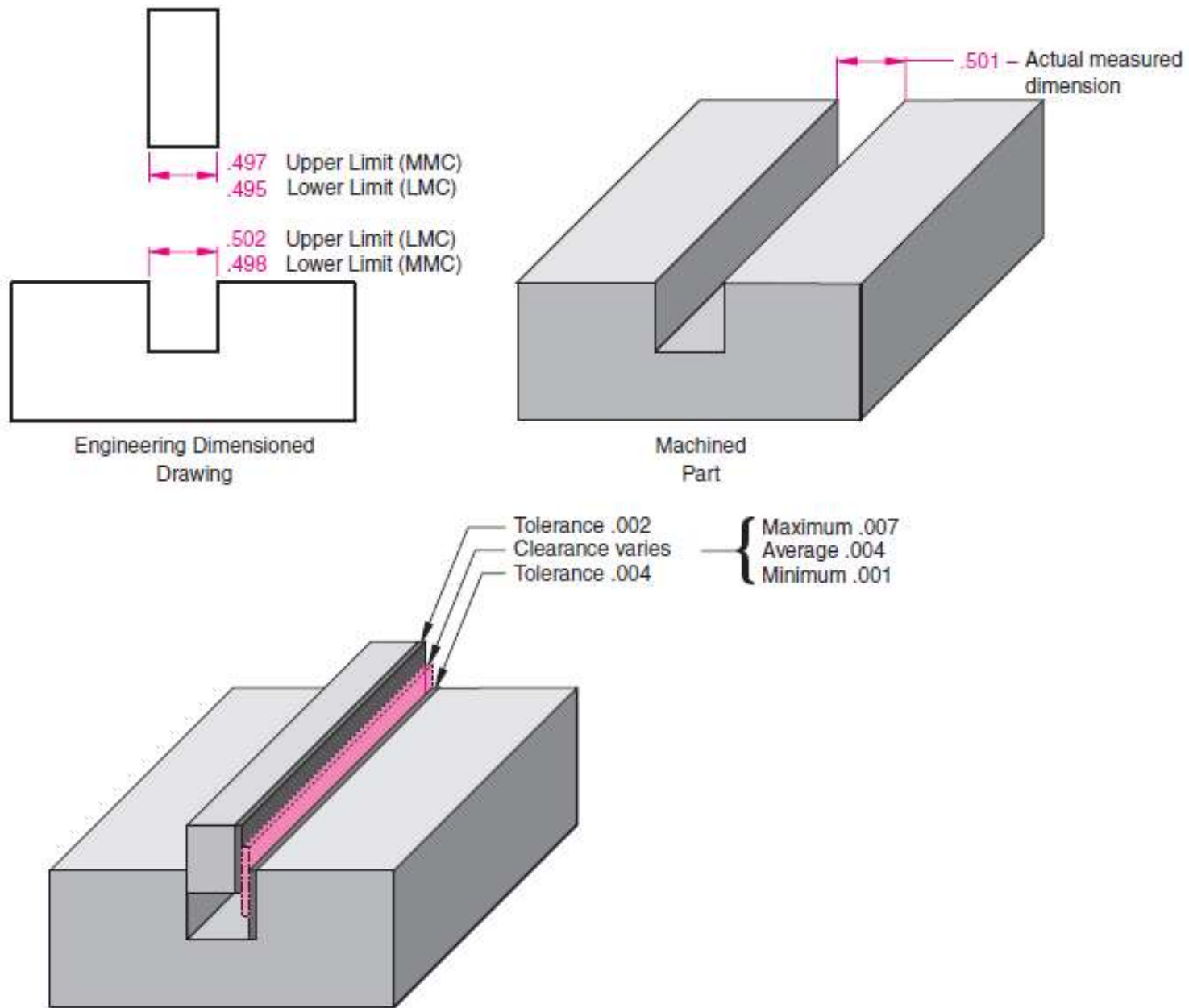


Figure 4.29 Toleranced Parts and the Important Terms

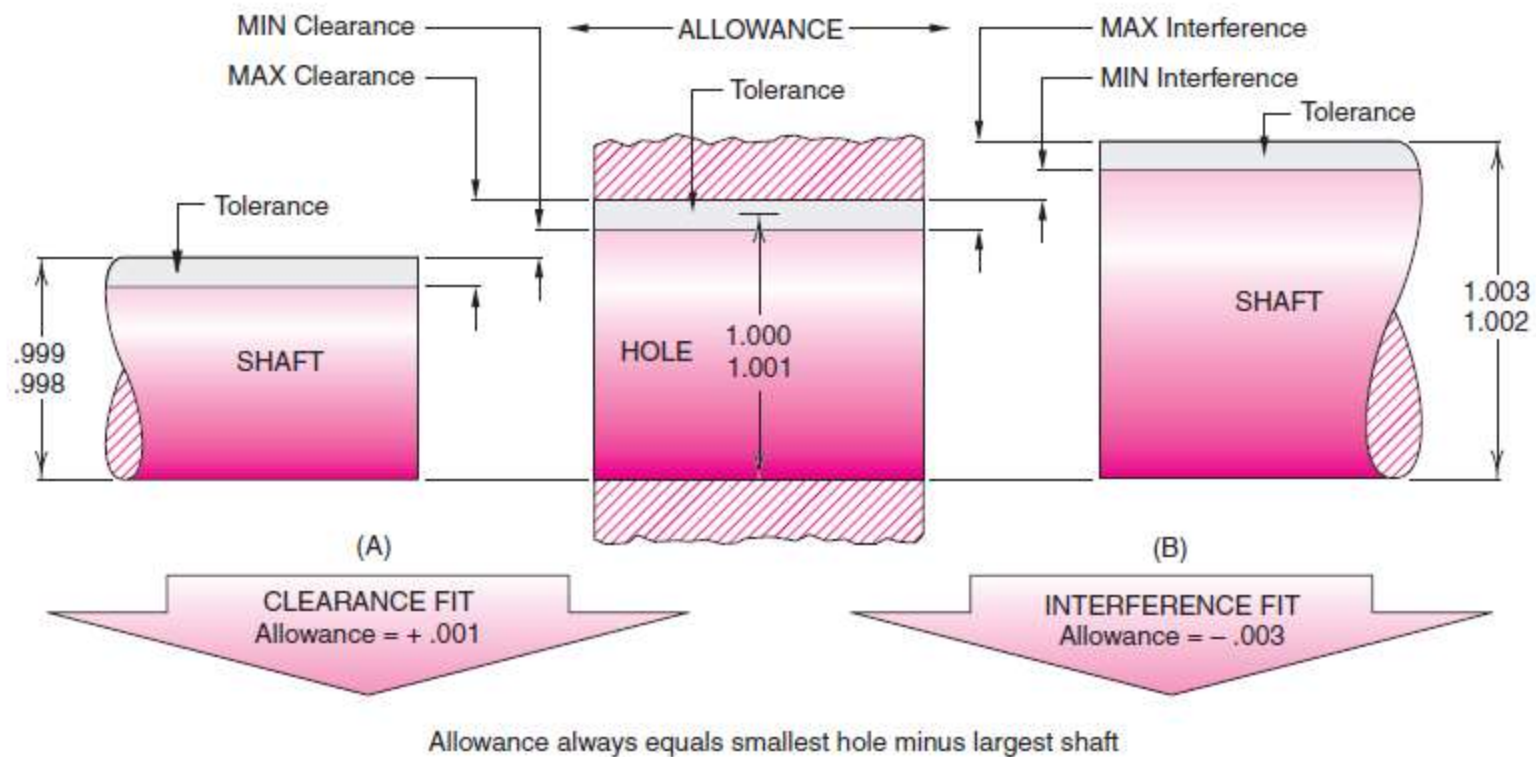


Figure 4.30 Clearance and Interference Fits between Two Shafts and a Hole
 Shaft A is a clearance fit, and shaft B is an interference fit.

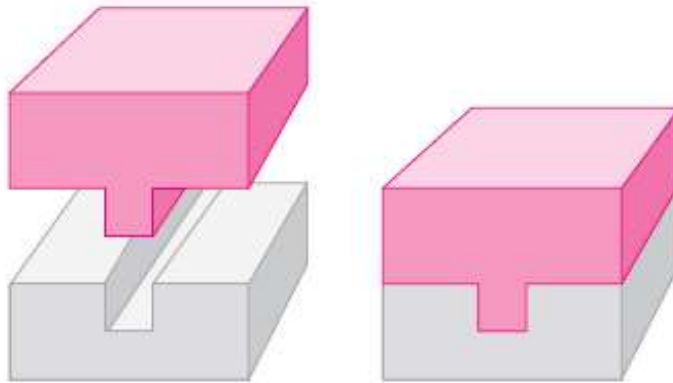
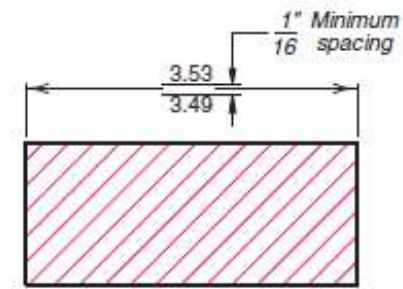
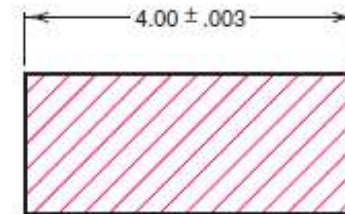


Figure 4.25
A system is two or more mating parts.



(A) Direct limits



(B) Tolerance values

Figure 4.26 Representing Tolerance Values
Tolerances are represented as direct limits or as tolerance values.

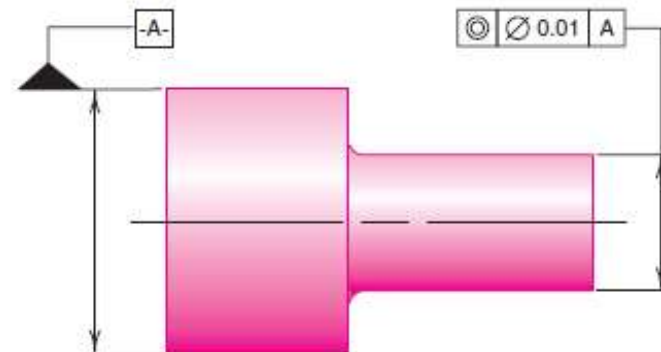
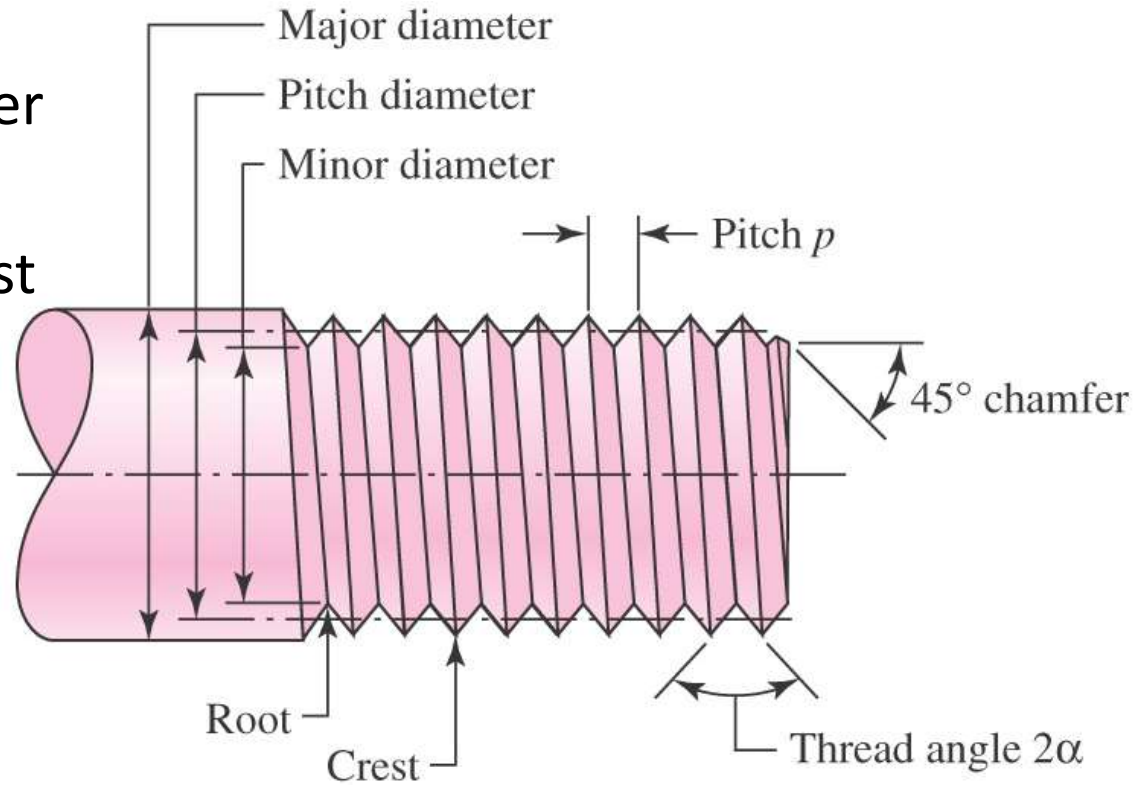


Figure 4.27 Geometric Tolerance System Used to Dimension Parts

Thread Standards and Definitions

- *Pitch* – distance between adjacent threads.
Reciprocal of threads per inch
- *Major diameter* – largest diameter of thread
- *Minor diameter* – smallest diameter of thread
- *Pitch diameter* – theoretical diameter between major and minor diameters, where tooth and gap are same width



Standardization

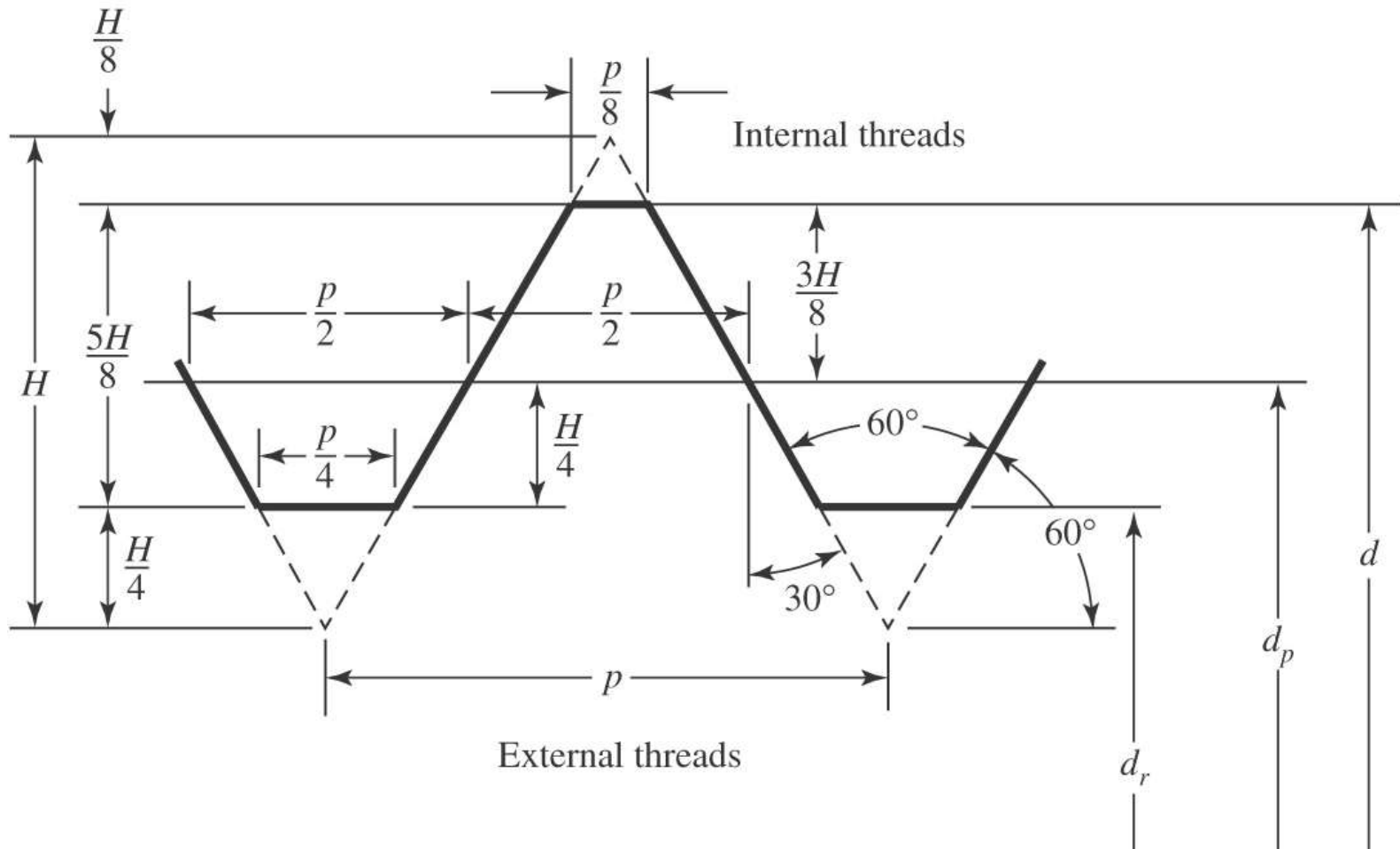
- The *American National (Unified)* thread standard defines basic thread geometry for uniformity and interchangeability
- American **National (Unified)** thread
 - UN normal thread
 - UNR greater root radius for fatigue applications
- **M**etric thread
 - M series (normal thread)
 - MJ series (greater root radius)

Standardization

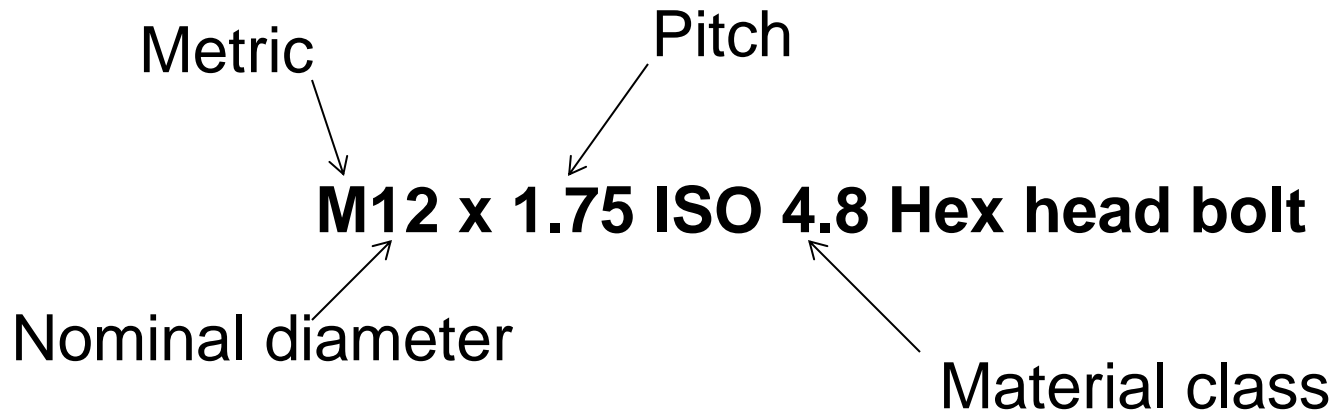
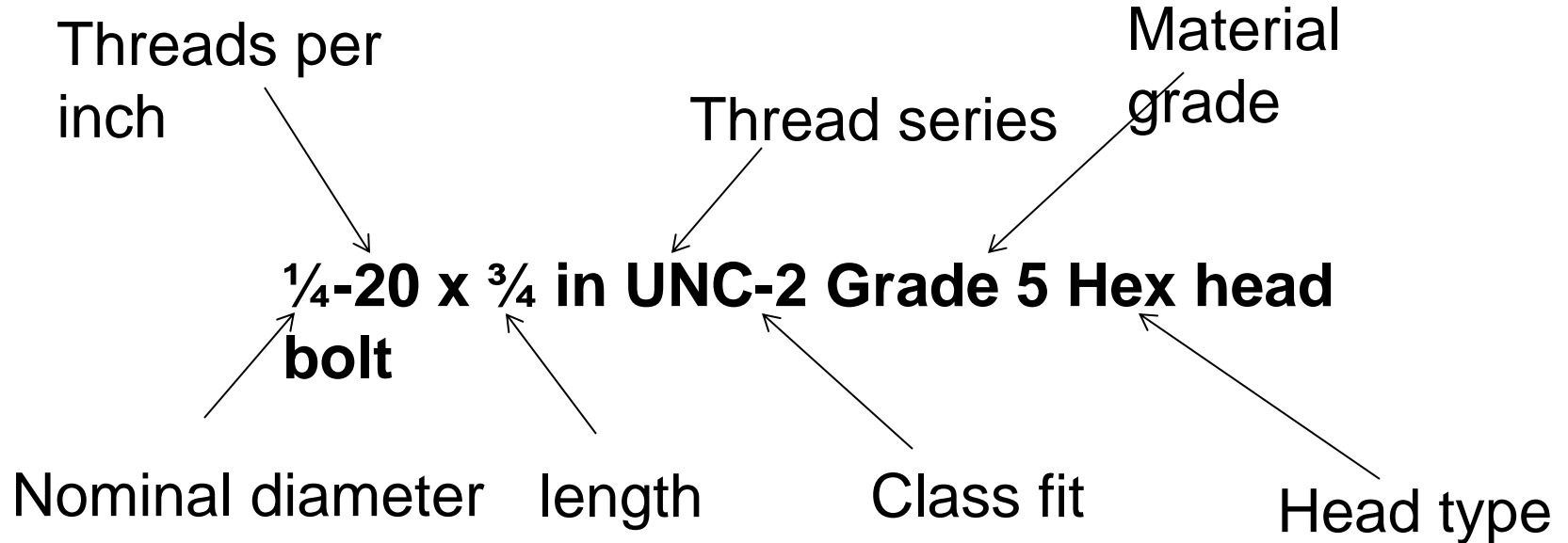
- **Coarse** series UNC
 - General assembly
 - Frequent disassembly
 - Not good for vibrations
 - The “normal” thread to specify
- **Fine** series UNF
 - Good for vibrations
 - Good for adjustments
 - Automotive and aircraft
- **Extra Fine** series UNEF
 - Good for shock and large vibrations
 - High grade alloy
 - Instrumentation
 - Aircraft

Standardization

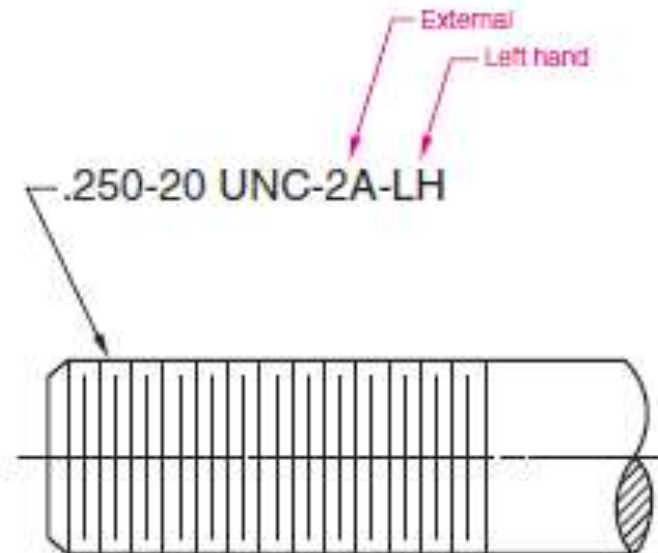
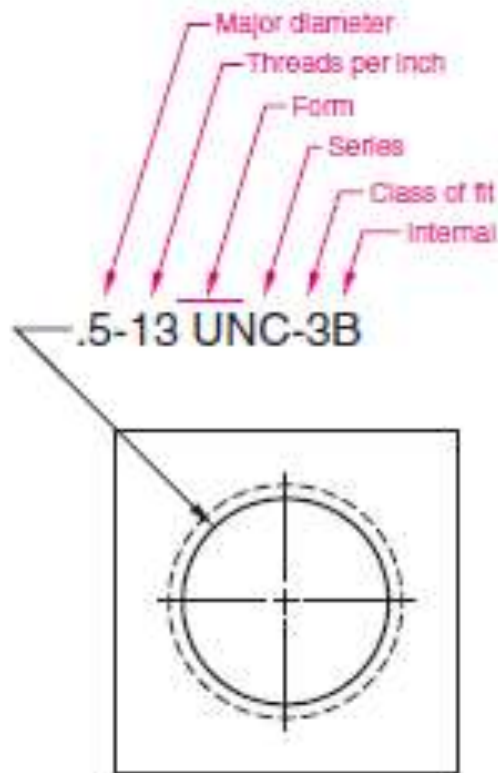
- Basic profile for metric M and MJ threads



Bolt Specification

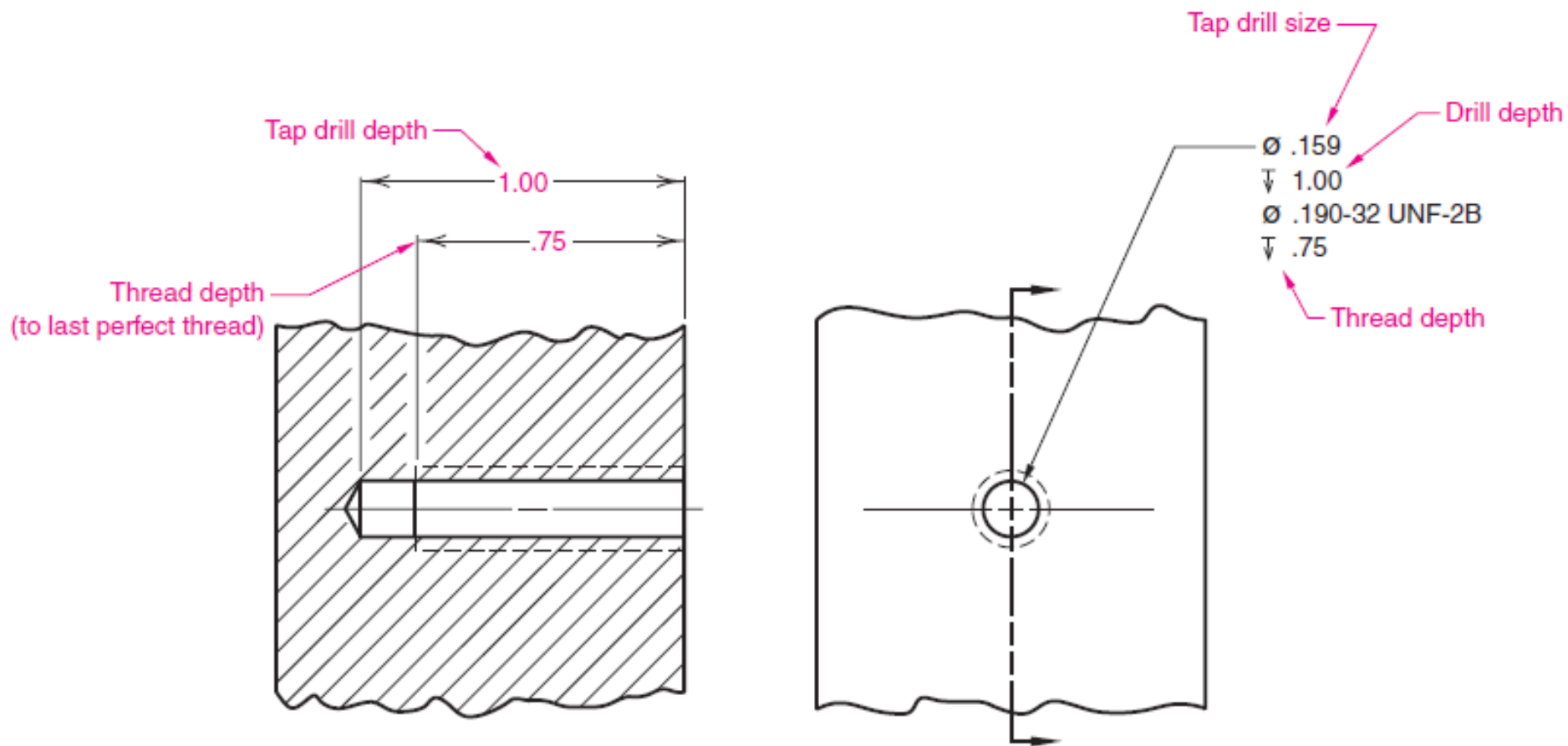


Threads and threaded fasteners



UNC	Means Unified National Coarse
UNF	Means Unified National Fine
UNEF	Means Unified Extra Fine Series
UN	Means Uniform Pitch Series
UNM	Means Unified Miniature Series
NC	Means National Coarse Series
NF	Means National Fine Series
UNR	Means Unified National Round

Figure 4.36 Standard Thread Note for English Dimension Fasteners



4.37 Standard Thread Note for Specifying Tap Drill Size