

Engineering Drawing Special Views

- **Section Views**
 - **Full**
 - **Half**
 - **Offset**
 - **Broken Out (Local)**
 - **Revolved**
- **Webs, Ribs & Spokes in Sections**
- **Conventional Rotation**
- **Hole Feature Callouts**

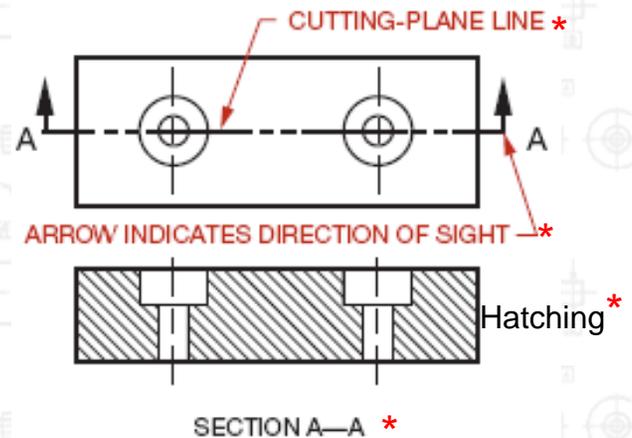
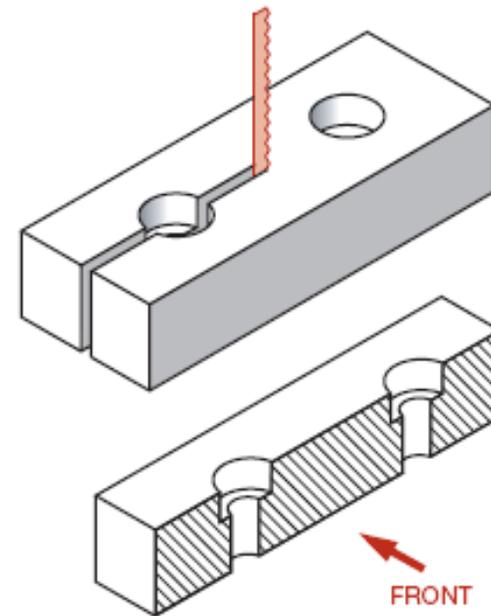
Sections

Section views, are used:

- To clearly show the internal features of a part or assembly***
- To convert hidden lines to solid lines***
- When there is a need to dimension internal features* (Never, Never, Never Dimension to Hidden Lines!!)**

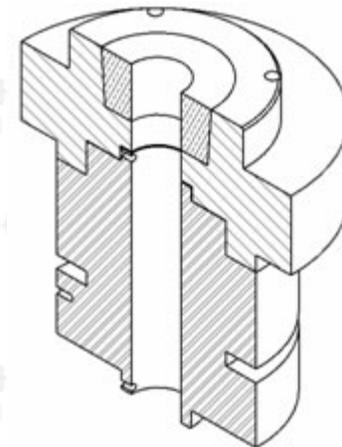
Cutting Plane Lines

- Cutting Plane Lines represent the cutting plane through a part*
- The cutting plane line is capped on the ends with arrowheads that show direction of sight of the sectional view*
- The cutting plane line and related sections should be labeled with letters beginning with “A” in the first section view of the drawing set, “B” for the second, Etc.
- Hatching is added where the view is cut*



Section Lines/Lining (Hatching)

- **Section Hatching** are thin lines used in the view of the section to show where the cutting-plane line has cut through the material (“Where the saw made noise”)
 - The **General Use or Default hatch material** is “**Cast Iron**” *
 - Usually drawn at a **45° angle** equally spaced **1/8 inch**
 - (alternative angles: **30°,60°**)
 - **Never draw horizontal or vertical**
 - **Assembly Section Views:**
 - Draw at **opposite angles** on adjacent assembly components
 - **Larger components** have larger spacing



Symbolic Material Hatching



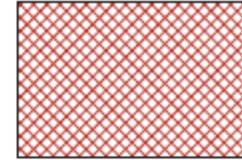
CAST IRON
OR
GENERAL USE



STEEL



BRONZE, BRASS,
COPPER AND
COMPOSITIONS



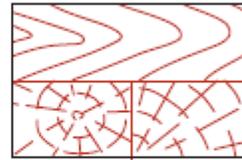
WHITE METAL, LEAD,
ZINC, BABBITT AND
ALLOYS



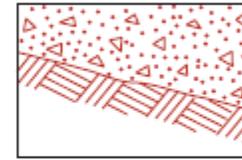
MAGNESIUM,
ALUMINUM AND
ALUMINUM ALLOYS



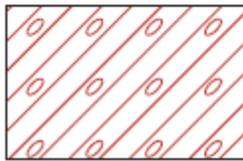
RUBBER, PLASTIC,
ELECTRICAL
INSULATION



CROSS GRAIN
WOOD



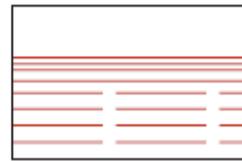
BEDROCK



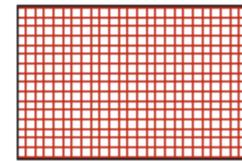
SOLID
INSULATION



MARBLE, SLATE,
GLASS, PORCELAIN,
ETC.



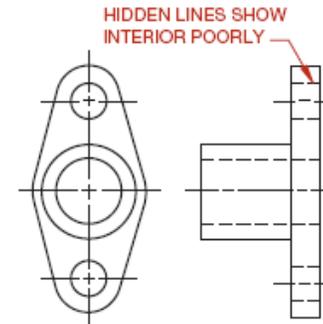
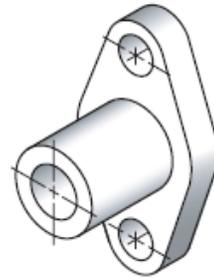
LIQUIDS



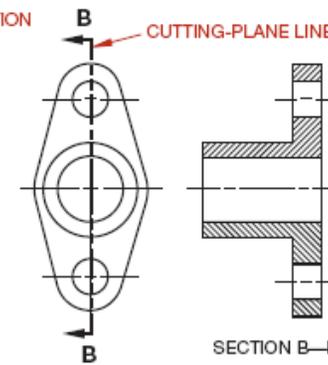
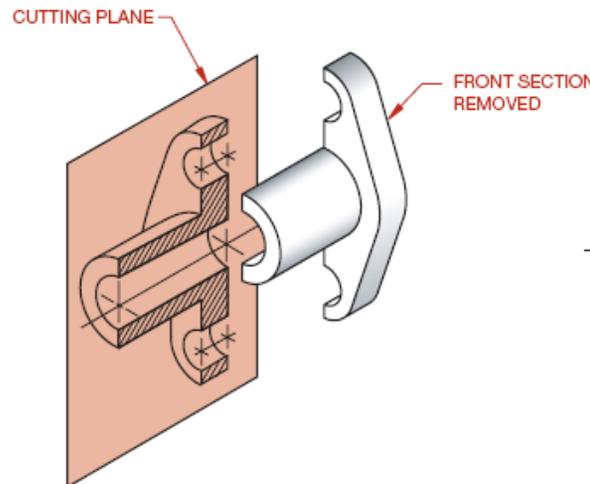
ELECTRIC WINDINGS
AND CABLES

Full and Half Sections

- Full Sections remove half of the part
- The Cutting Plane* line is always shown



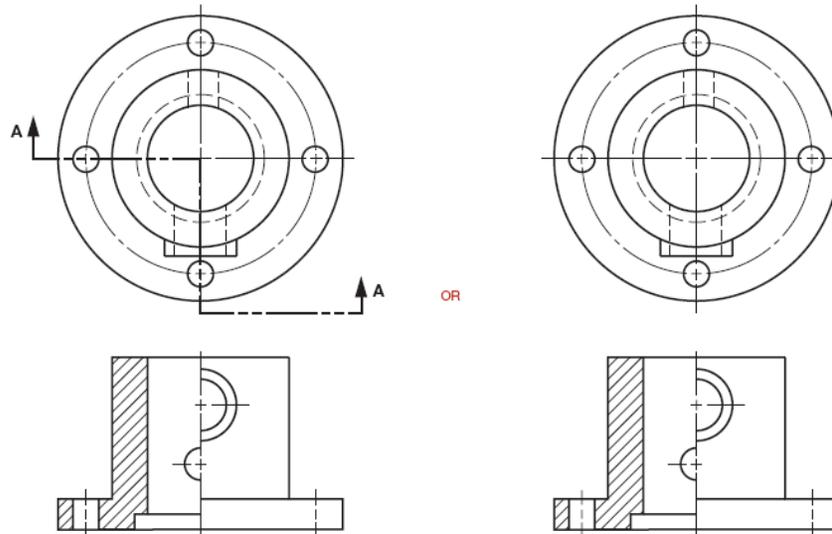
(A) SIDE VIEW NOT SECTIONED



(B) SIDE VIEW IN FULL SECTION

Half Section Views

- Half Section views remove $\frac{1}{4}$ of the part*
- Generally used on symmetrically-shaped parts
- Creates a convenient “Inside Outside” View
- The cutting plane can be omitted if the section view is directly projected



SECTION A—A

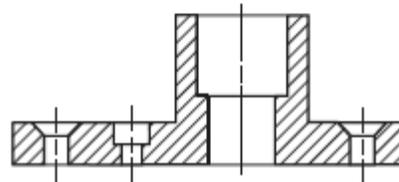
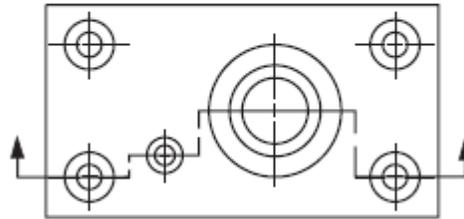
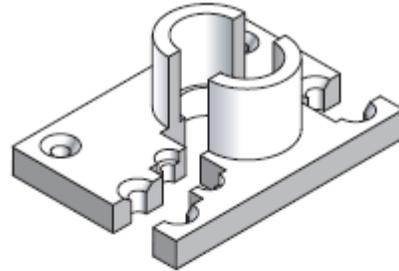
LETTERS, SUBTITLE AND CUTTING-PLANE LINE USED WHEN MORE THAN ONE SECTION APPEARS ON A DRAWING OR WHEN THEY MAKE THE DRAWING CLEARER.

OR

LETTERS, SUBTITLE AND CUTTING-PLANE LINE MAY BE OMITTED WHEN THEY CORRESPOND WITH THE CENTER LINE OF THE PART AND WHEN THERE IS ONLY ONE SECTION VIEW ON THE DRAWING.

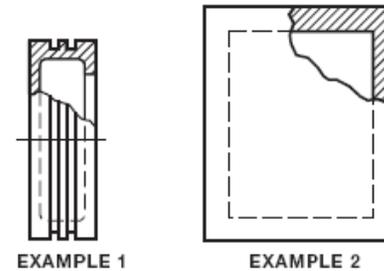
Offset Sections

- **Offset Section views bend the cutting plane at right angles to pass through the desired internal features***
- **The cutting plane line is always shown**

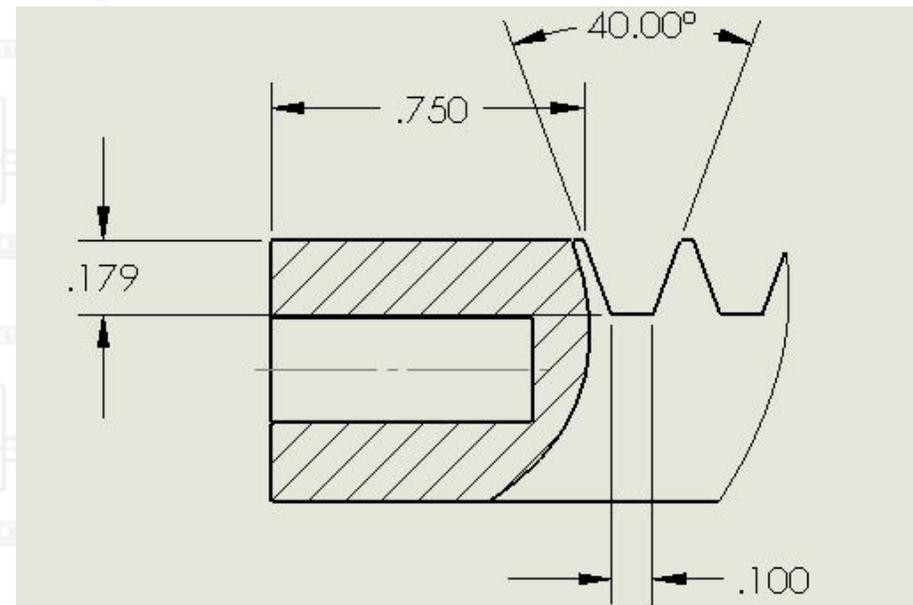


Broken-Out (Local) Sections

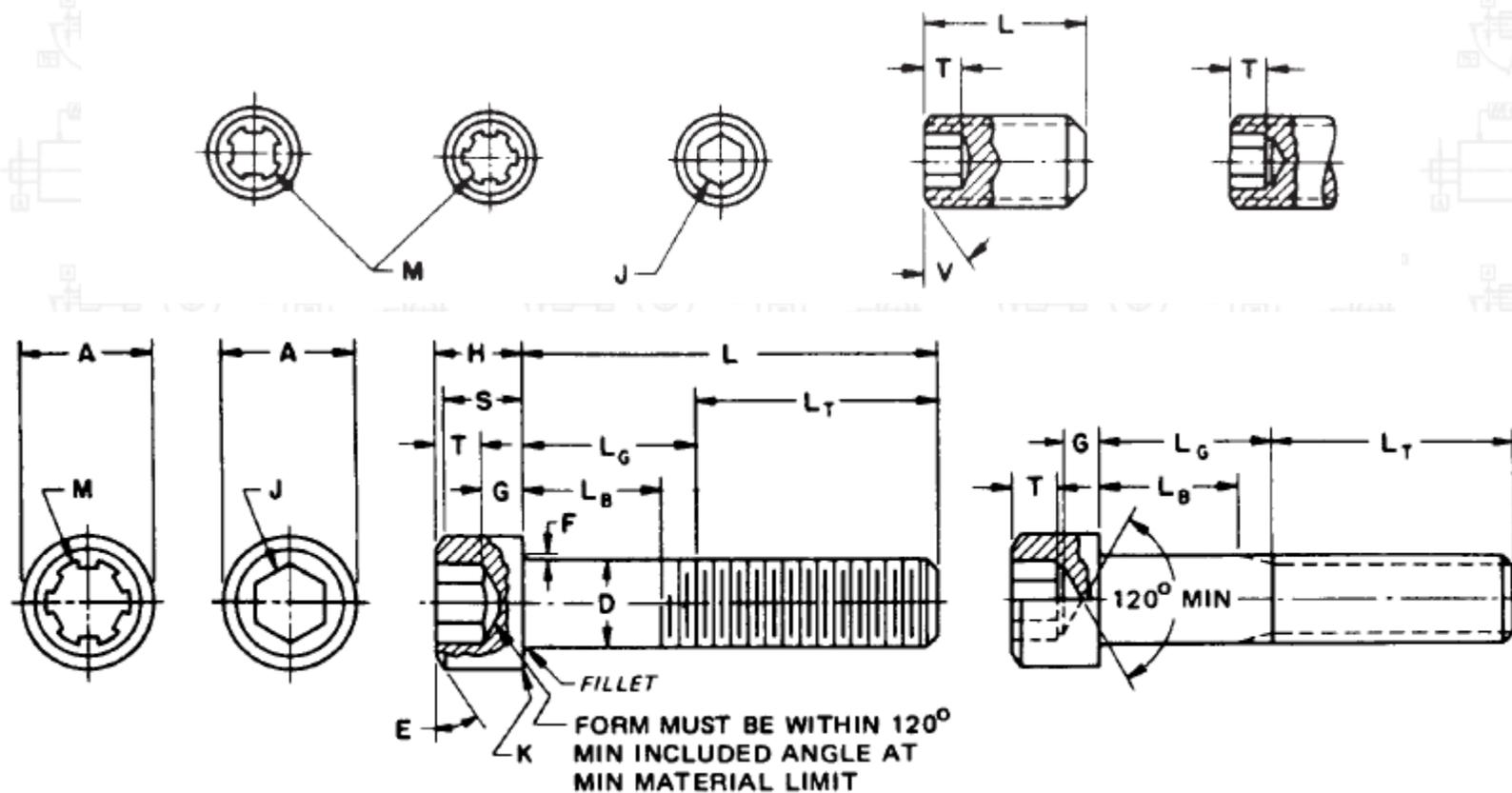
- Broken-out sections are used to show certain internal features of a part without drawing another view*
- The cutting plane is usually not shown
- The desired section area is simply “Torn” away
- The depth of the section is assumed to be the center of the part unless otherwise indicated



(A) BROKEN-OUT SECTIONS

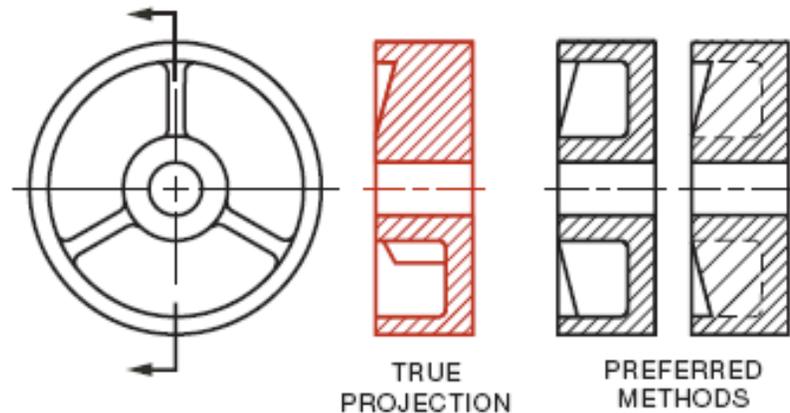


Broken-Out (Local) Sections



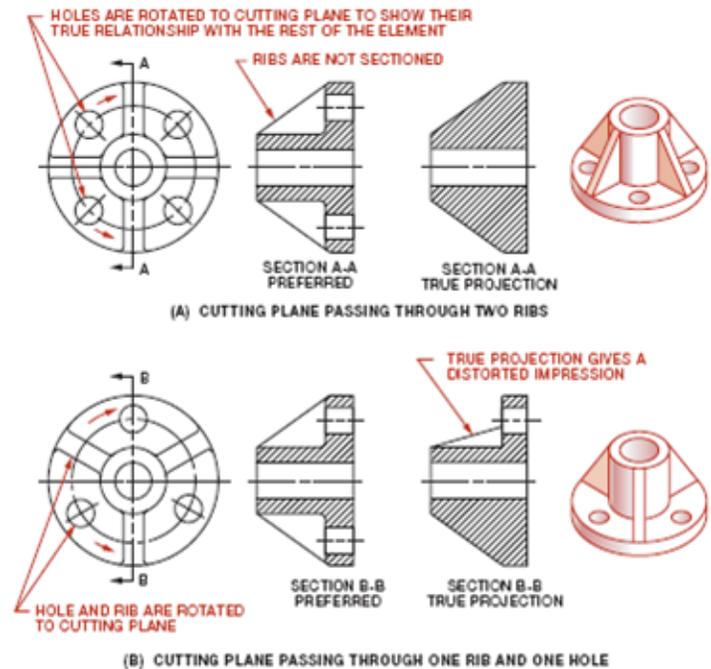
Webs, Ribs and Spokes in Section

- Generally, webs, ribs and spokes are not hatched even though the cutting plane cuts through them
- Conventional Rotation is used for clarity
 - Foreshortened features are rotated to be along the cutting plane

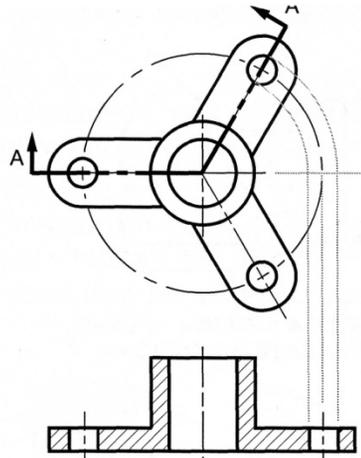


Webs, Ribs & Holes in Section and Aligned or Conventional Rotation Views

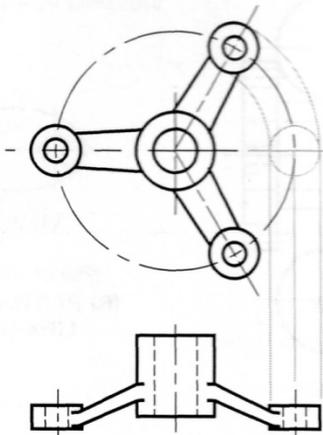
- Webs, ribs and spokes are not generally hatched
- All features at a foreshortened angle are rotated in the view to lie on the cutting plane*



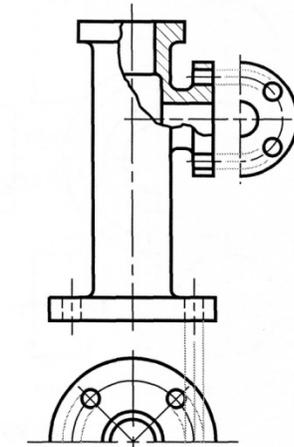
More Aligned/Conventional Rotation Views*



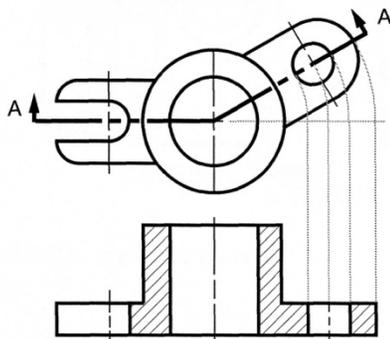
(A) LUGS ALIGNED IN SECTION



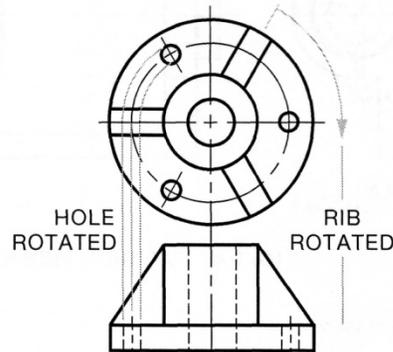
(B) ALIGNMENT OF ARM



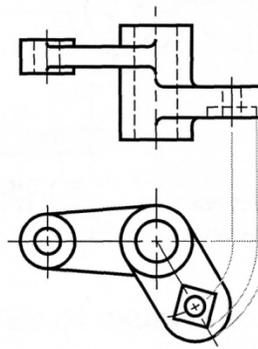
(C) ALIGNMENT OF HOLES



(D) PARTS ALIGNED IN SECTION



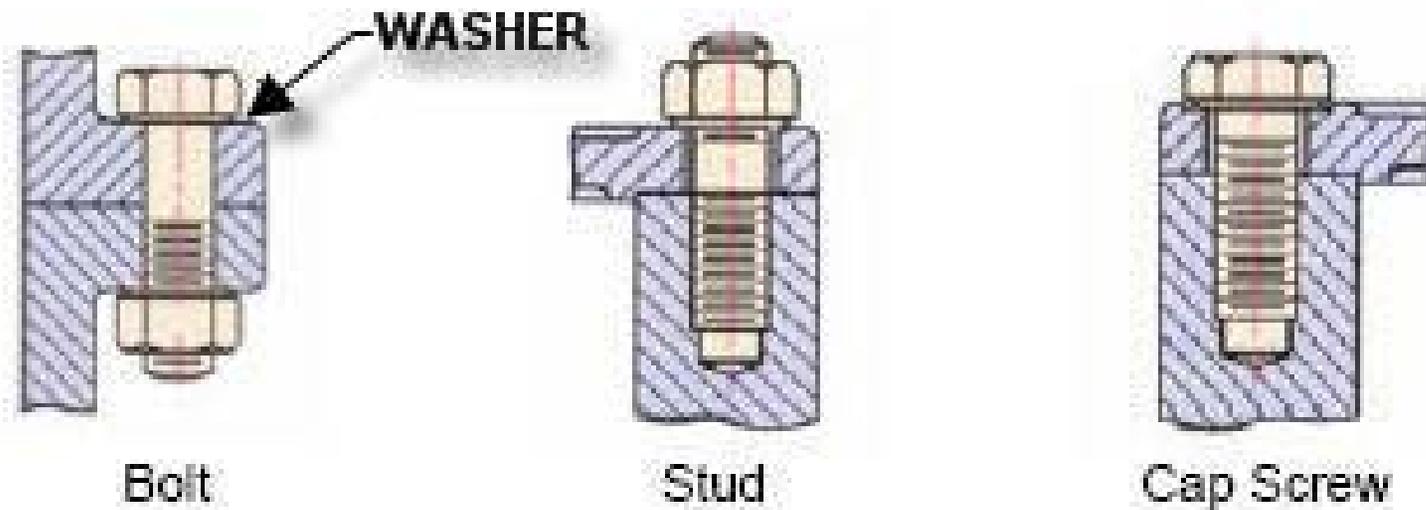
(E) ALIGNMENT OF RIBS AND HOLES



(F) ALIGNMENT OF PART

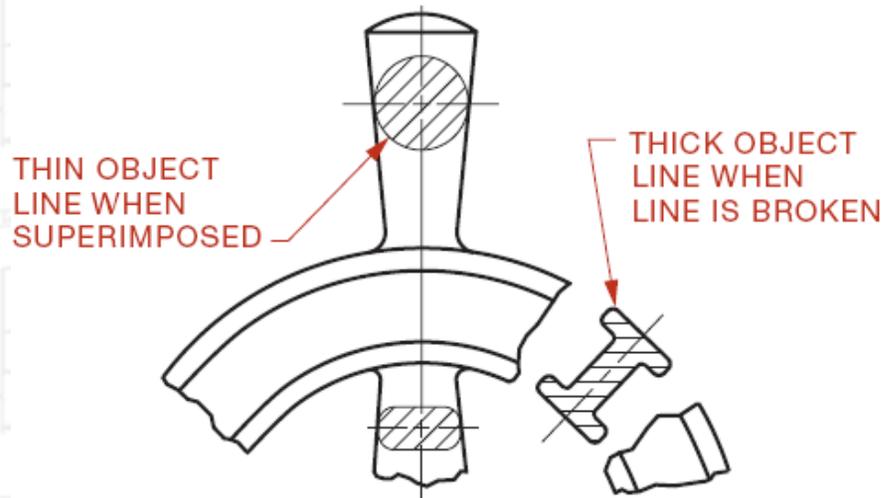
Aligned/Conventional Rotation is not always used Section Views *

Fasteners and Washers are not Hatched in Assembly Sections

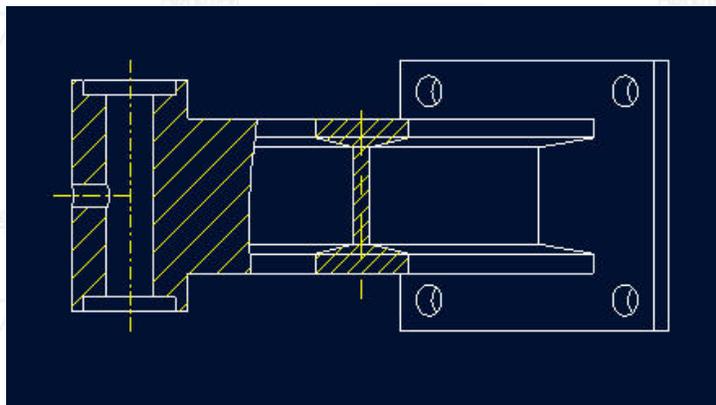
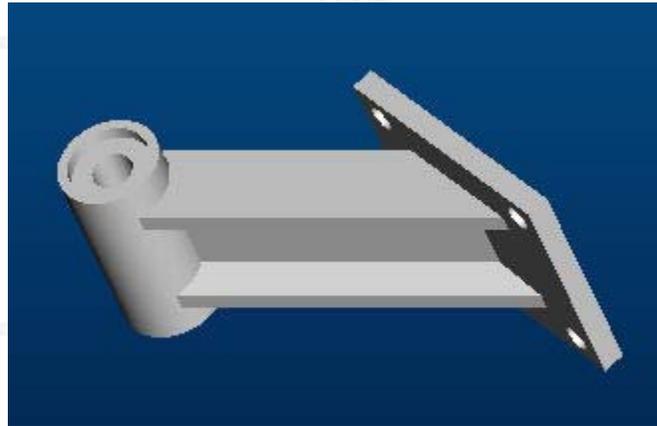


Revolved Section Views

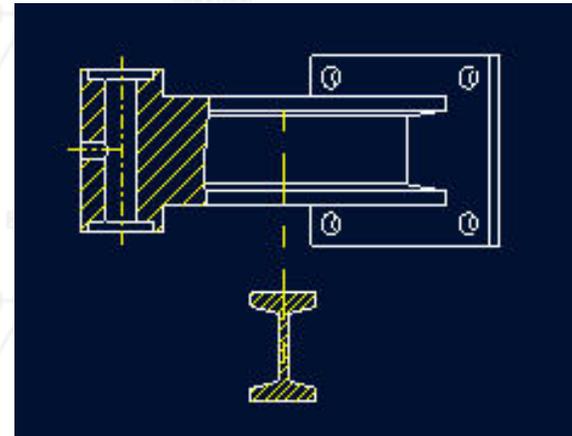
- The cutting plane is imagined to be rotated 90 degrees, and the view is superimposed on or just outside the view*
- Revolved sections are an efficient method to show the cross-sectional shape of ribs, spokes, or arms, where a regular section view would be difficult to display
- Centerlines are used to indicate the cutting plane



Revolved Section Comparison

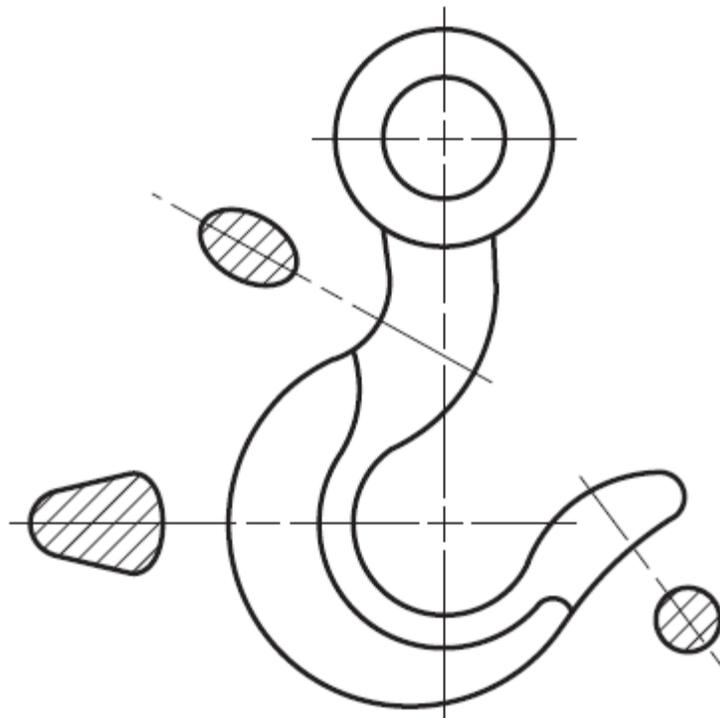


Revolved Section View



Revolved & Removed Section View

Revolved & Removed Section Views

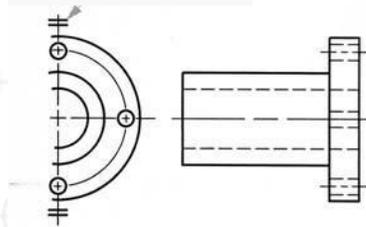


Partial Views

Partial Views:

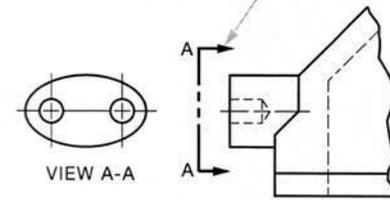
- Save Time
- Conserve Space
- Increase Clarity

PARTIAL SIDE VIEWS

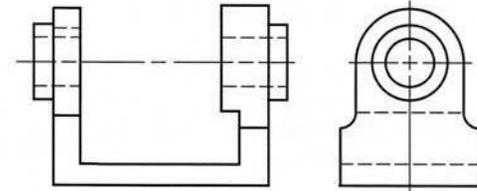


(A) WITH HALF VIEW

VIEWING PLANE LINE (THICK)



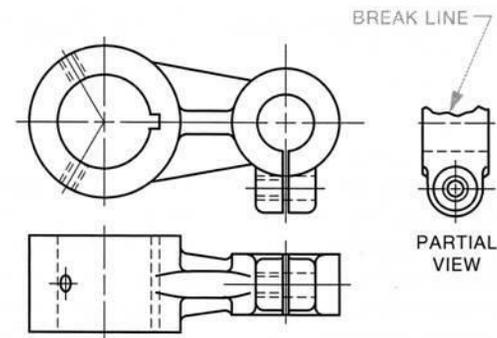
(B) PARTIAL VIEW WITH A VIEWING - PLANE LINE USED TO INDICATE DIRECTION



PARTIAL SIDE VIEW

(C) PARTIAL SIDE VIEWS

FIGURE 29-2 ■ Partial views.



BREAK LINE

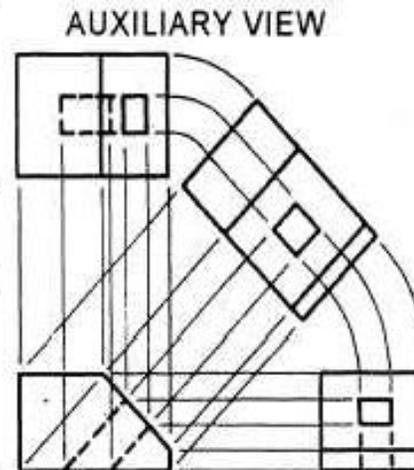
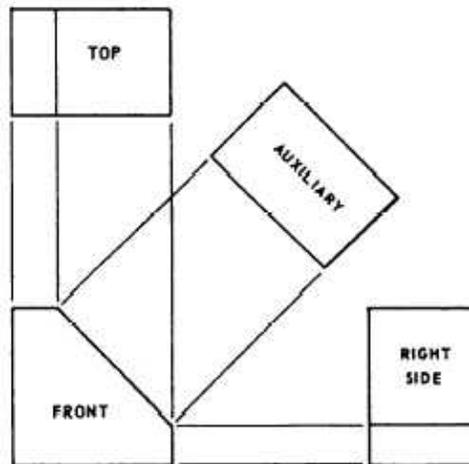
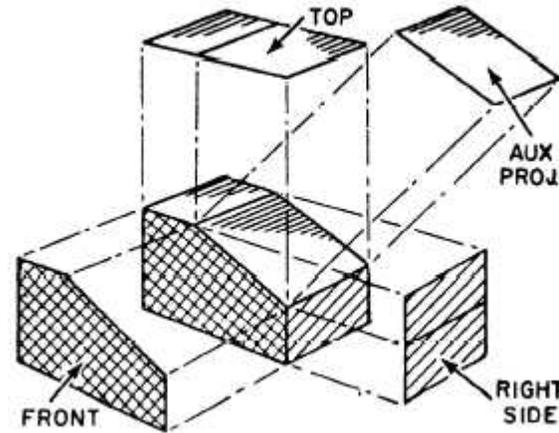
PARTIAL VIEW

FIGURE 29-3 ■ Partial side view.

Auxiliary Views

Auxiliary Views:

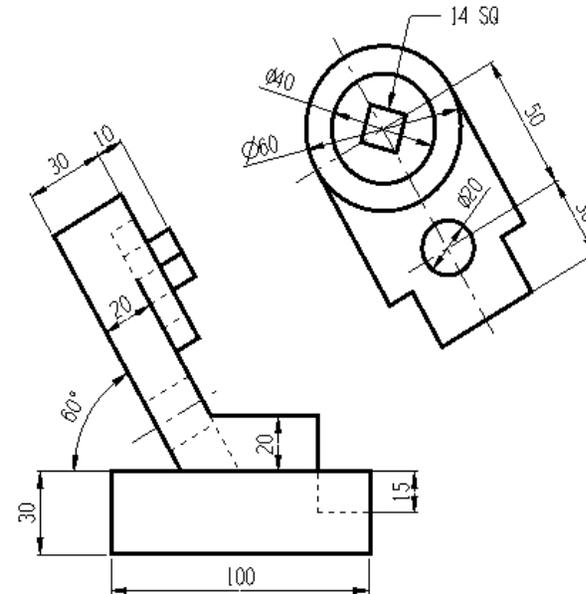
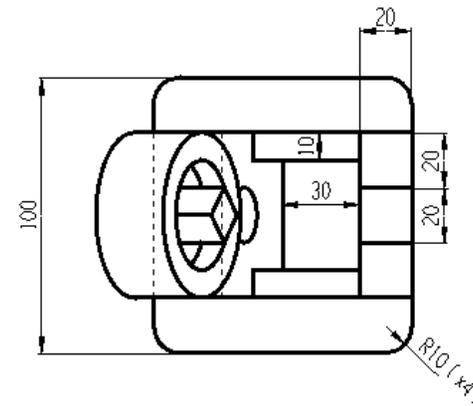
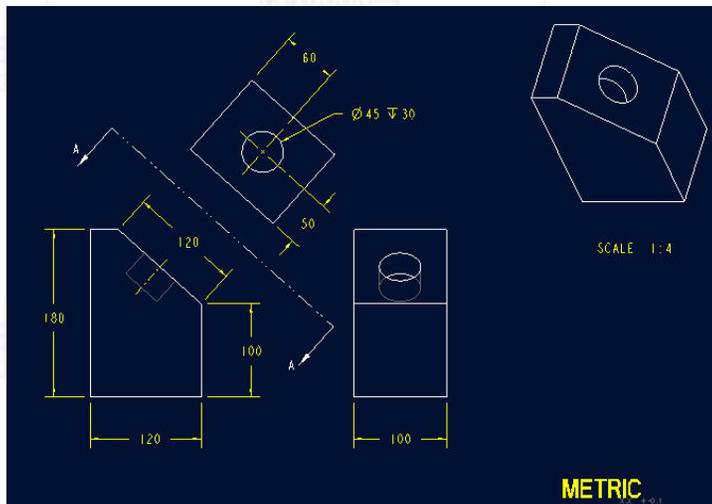
- Are Projected From Inclined Surfaces*
- The Surface Must Have One or More Features to Justify the View



Auxiliary Views

Auxiliary Views:

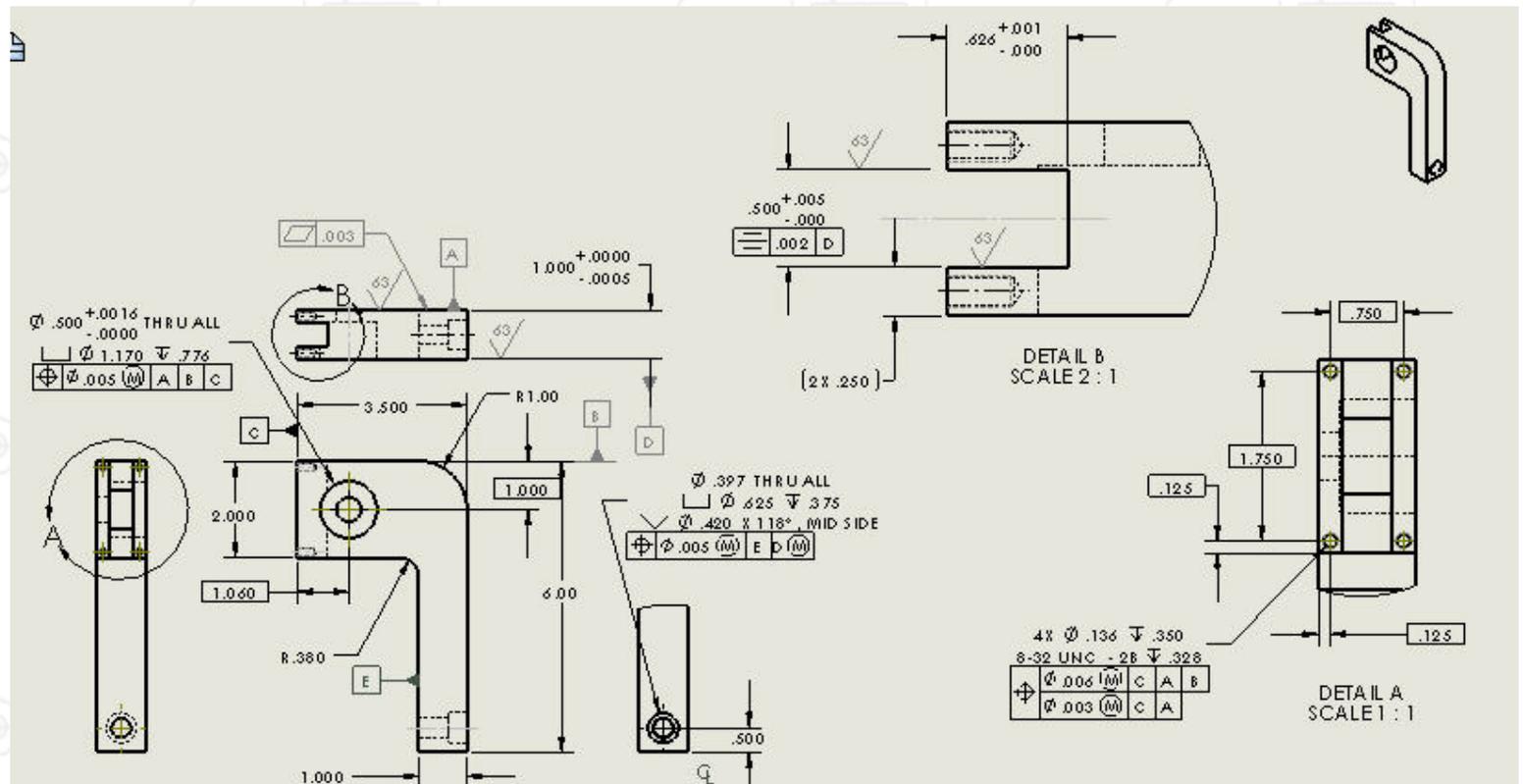
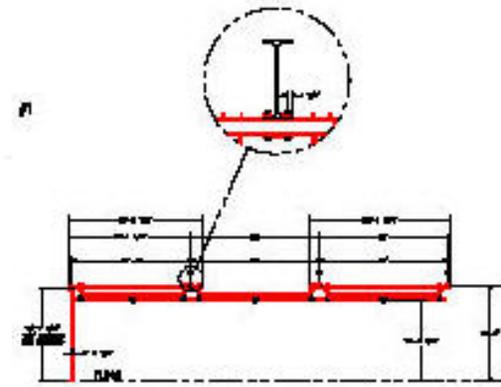
- Are Usually for Clarity and Dimensioning Purposes
- Often, the View is Displayed as a Partial View



Detailed Views

Detailed Views:

- Are Partial Views Used to Scale up a Small Portion of a Drawing View*



Hole Callout Notes - are created in the order of the machining process

Countersunk Holes

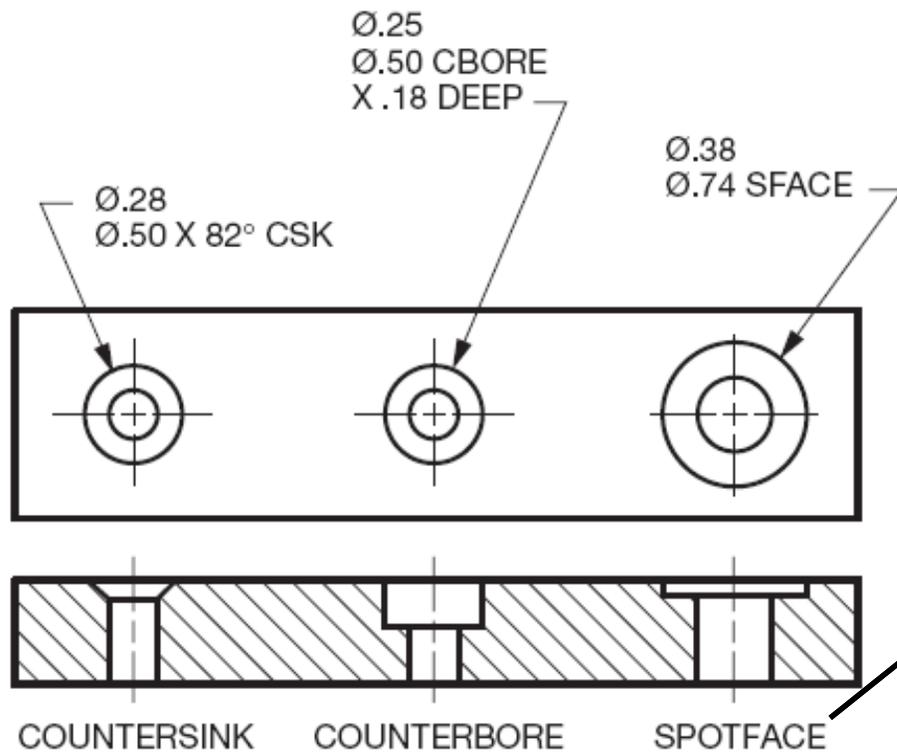
- A countersunk hole is a conical depression cut in a piece to receive a countersunk type of flathead screw or rivet
- Countersinks are specified by a callout giving the diameter of the through hole first, followed by the counterbore diameter and angle

Counterbore Holes

- Counterbored hole is one which has been machined larger to a given depth to receive a fillister, hexhead, or similar type of bolt head
- Counterbores are specified by a callout giving the diameter of the through hole first, followed by the counterbore diameter and then the depth of the counterbore

Countersunk, Counterbore and Spotface Holes *Text Callouts*

Old Text-Based Standard

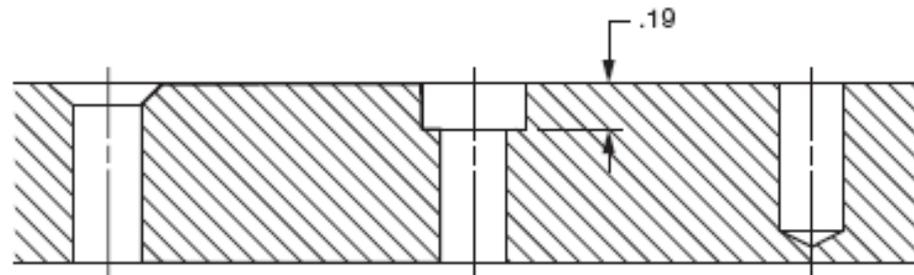
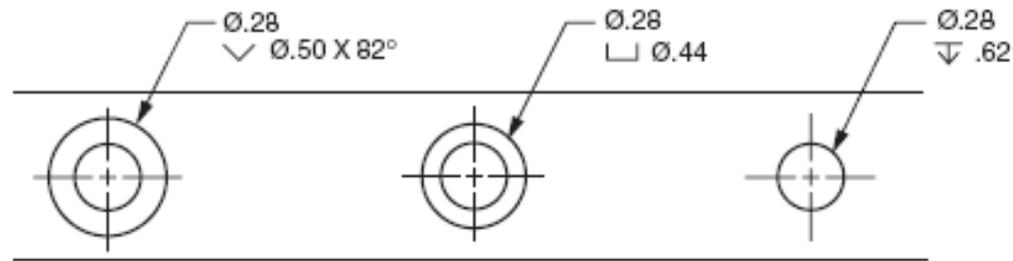


Countersunk, Counterbore and Spotface Holes *Symbol Callouts**

New Symbol-Based Standard

- ✓ COUNTERSINK SYMBOL
- ┌ COUNTERBORE OR SPOTFACE SYMBOL
- ⌞ DEPTH SYMBOL

(A) SYMBOLS



COUNTERSINK SYMBOL

COUNTERBORE OR SPOTFACE SYMBOL

DEPTH SYMBOL