



HOUSTON COMMUNITY COLLEGE

# *SECTION VIEWS*

CHAPTER SEVEN

# *OBJECTIVES*

1. Understand sections and cutting-plane lines.
2. Apply correct section-lining practices.
3. Recognize and draw section lining for 10 different materials.
4. Draw a section view given a two-view drawing.
5. Demonstrate correct hidden-line practices for section views.
6. Identify seven types of sections.
7. Apply section techniques to create clear, interpretable drawings.
8. Demonstrate the proper techniques for sectioning ribs, webs, and spokes.
9. Use hatching when using conventional breaks to show elongated objects.
10. Interpret drawings that include section views.

# UNDERSTANDING SECTIONS

*Section views are used for three main purposes:*

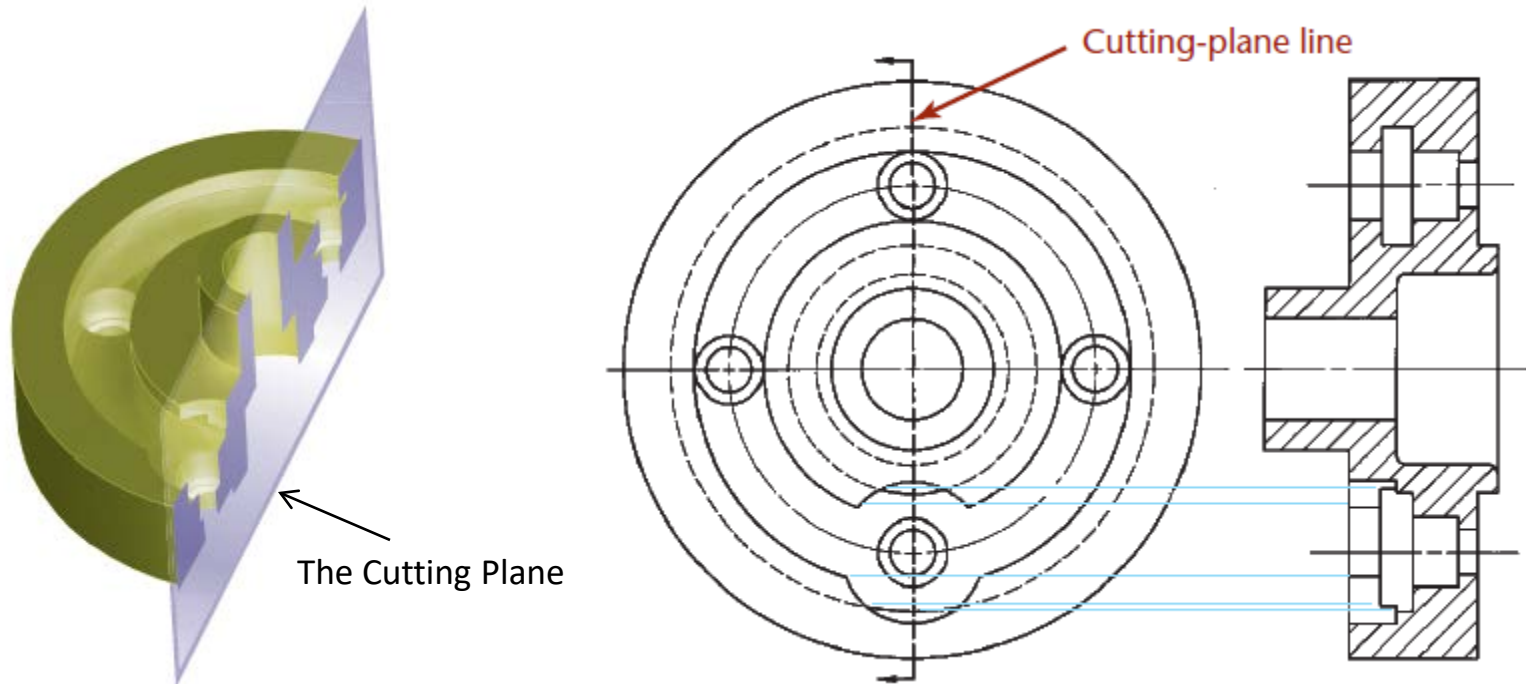
- To document the design and manufacture of single parts that are manufactured as one piece.
- To document how multiple parts are to be assembled or built.
- To aid in visualizing the internal workings of a design.



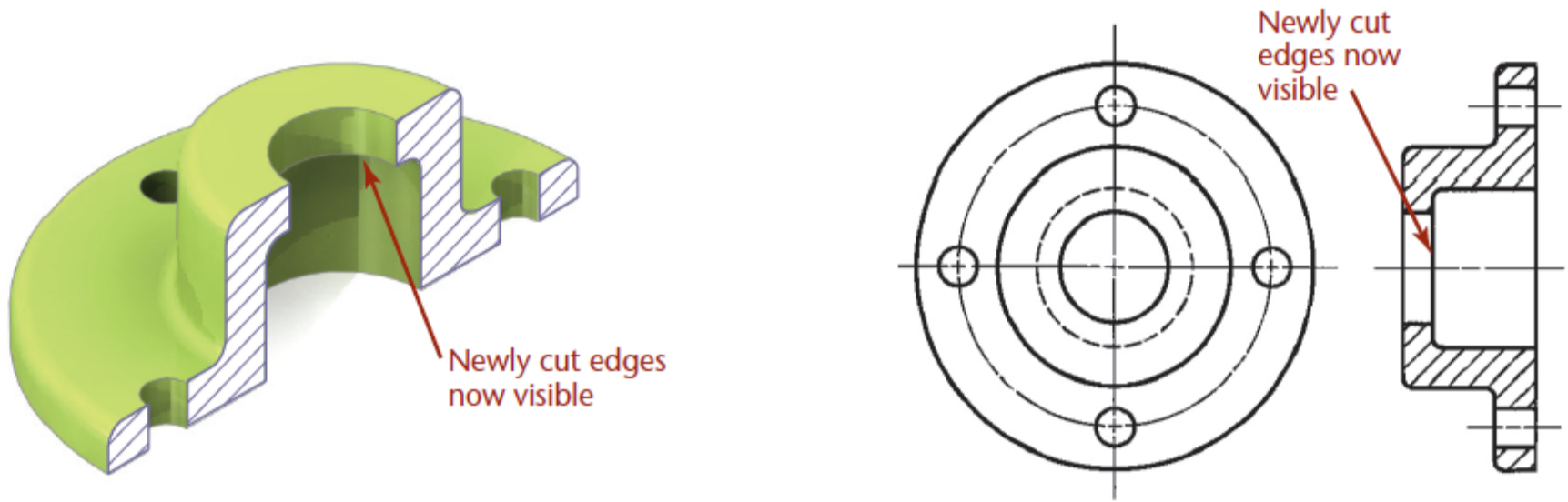
When the part is cut fully in half, the resulting view is called a *full section*.

# The Cutting Plane

The cutting plane appears edgewise as a thick dashed line called the cutting-plane line. The arrows at the ends of the cutting-plane line indicate the direction of sight for the sectional view.

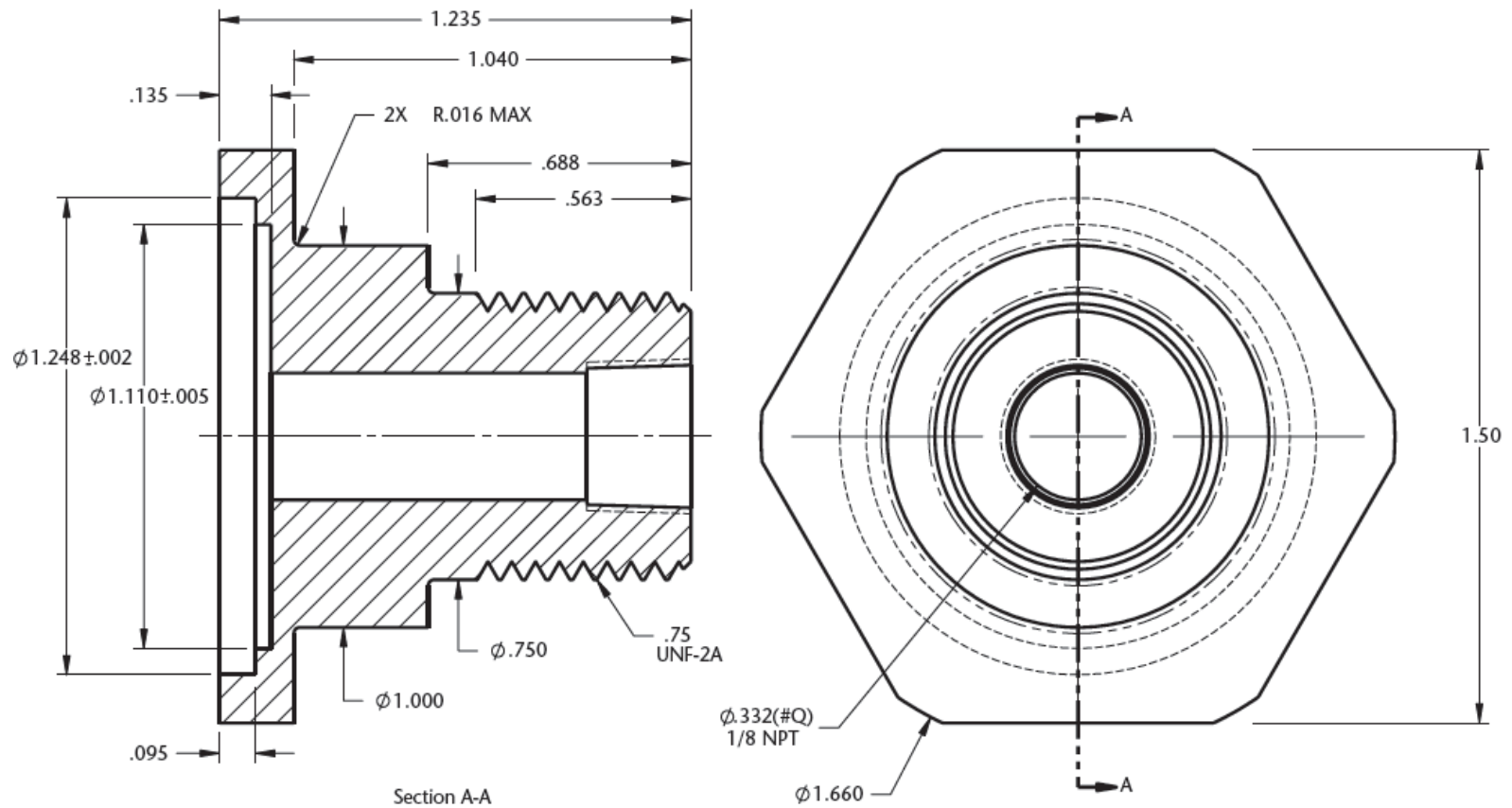


# Visible Edges on Cutting Planes



Newly visible edges cut by cutting plane are crosshatched with section lining.

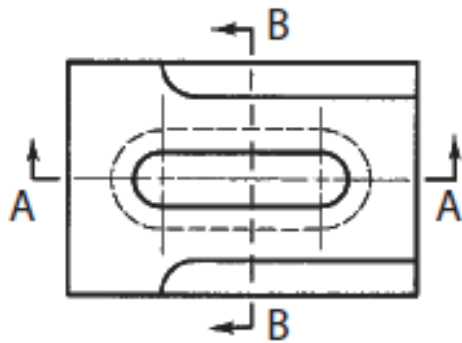
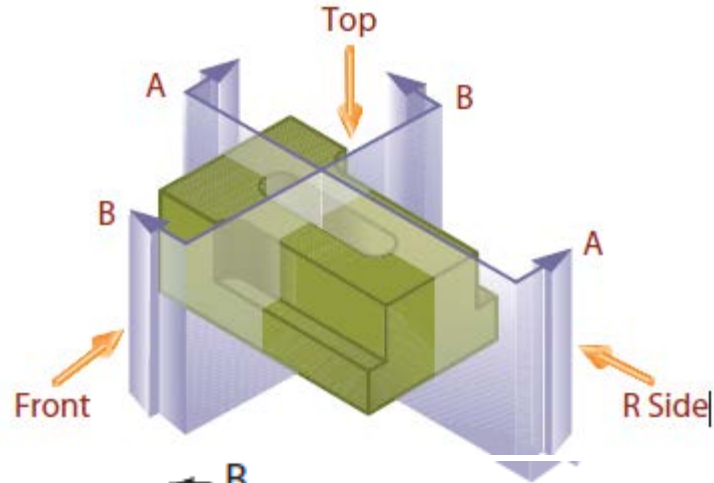
# PLACEMENT OF SECTION VIEWS



*Section views can replace standard orthographic views.*

*(Courtesy of Wood's Power-Grip. Co. Inc.)*

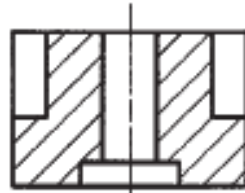
# *LABELING CUTTING PLANES*



Note that each section (A-A and B-B) is completely independent.



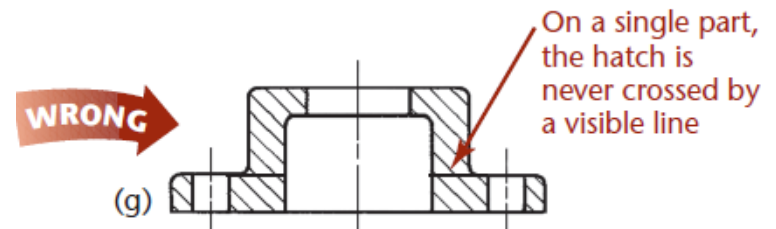
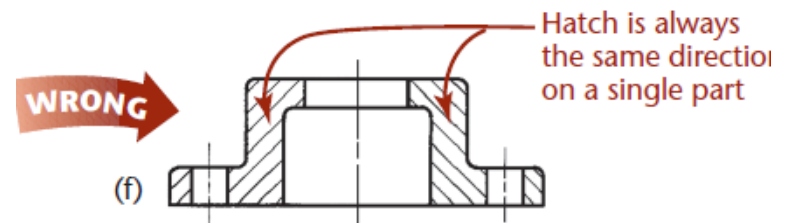
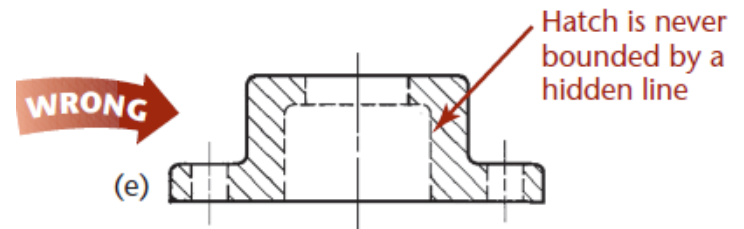
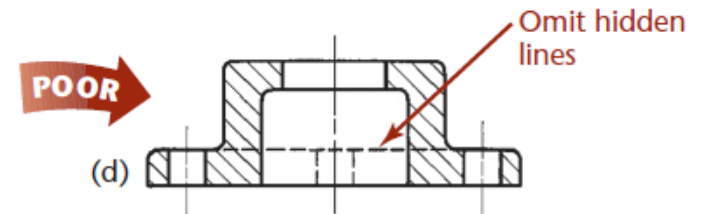
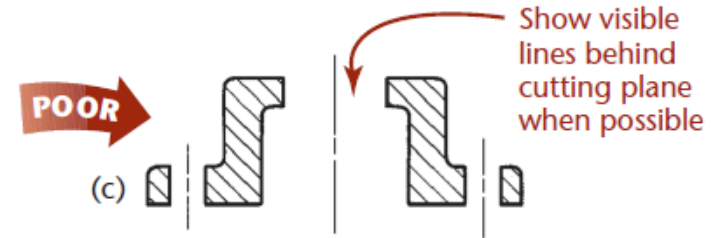
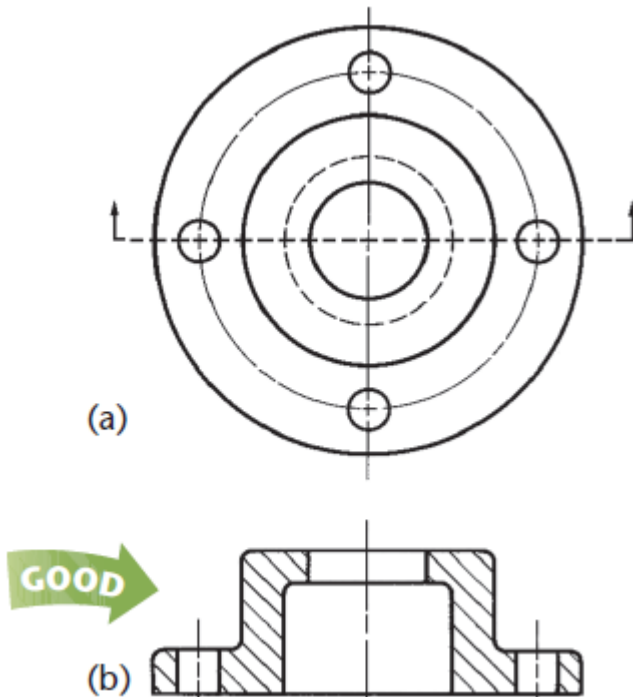
Section A-A



Section B-B

# RULES FOR LINES IN SECTION VIEWS

- Show edges and contours that are now visible behind the cutting plane.
- Omit hidden lines in section views.
- A sectioned area is always completely bounded by a visible outline—never by a hidden line.
- A visible line can never cross a sectioned area in a view of a single part.

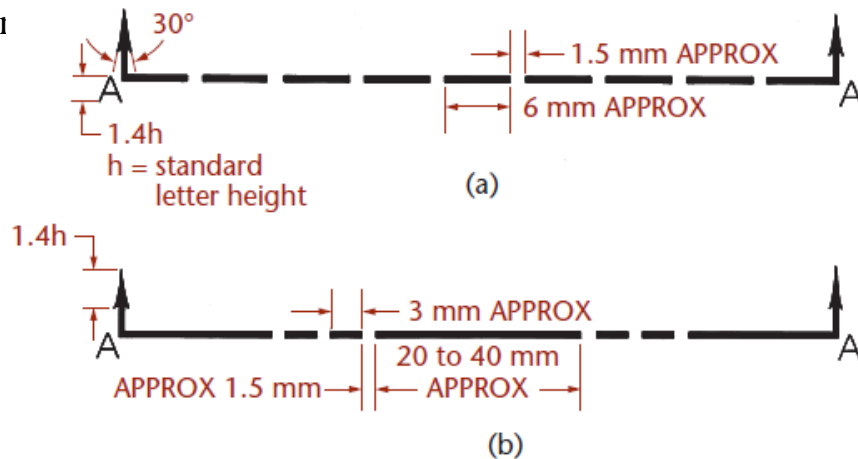




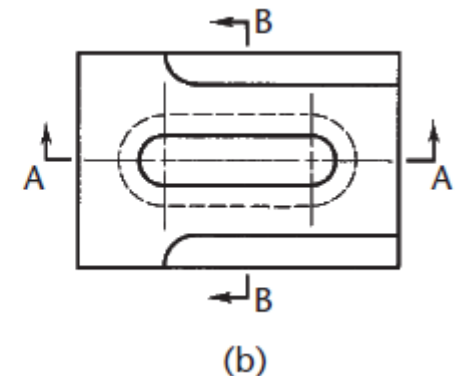
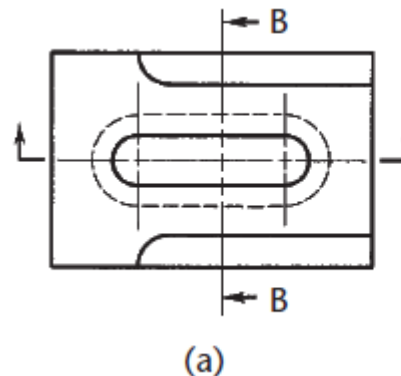
# CUTTING-PLANE LINE STYLE

It is made up of equal dashes, each about 6 mm (1/4") long ending in arrowheads. This form works

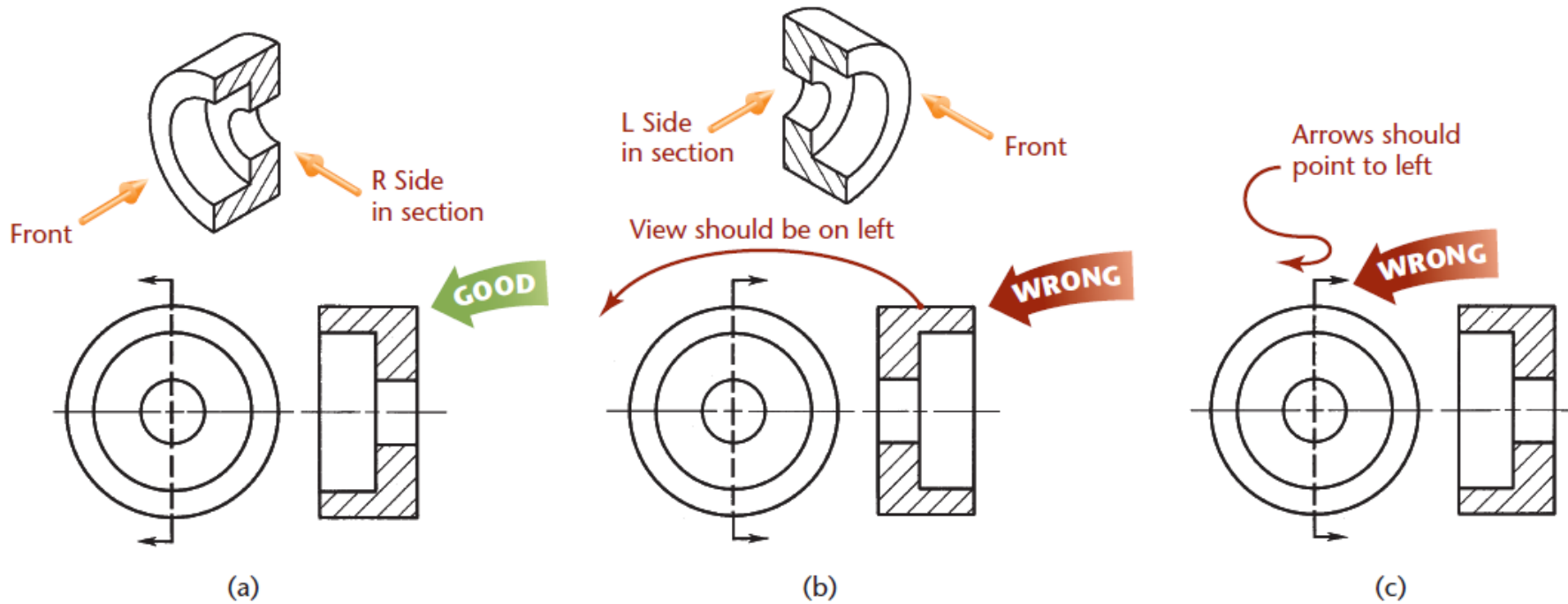
especially well for drawings. The alternative style, uses alternating long *dashes* and pairs of short dashes and ends with arrowheads. This style has been in general use for a long time, so you may still see it on drawings. Both lines are drawn the same thickness as visible lines. The arrowheads at the ends of the cutting plane



Alternative Methods for Showing a Cutting Plane A and B.



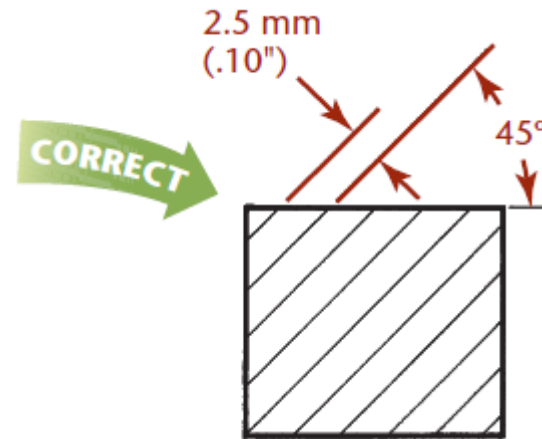
# Visualizing Cutting-Plane Direction



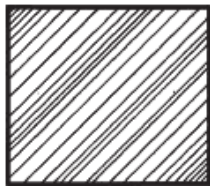
Correct and Incorrect Cutting-Plane Line Placement

# SECTION-LINING TECHNIQUE

- Uniformly spaced by an interval of about 2.5 mm
- Not too close together
- Uniformly thin, not varying in thickness
- Distinctly thinner than visible lines
- Neither running beyond nor stopping short of visible outlines

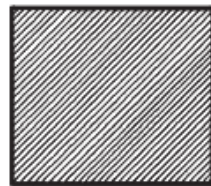


NO!



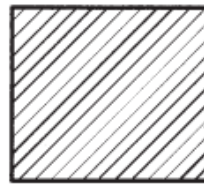
Spacing  
irregular

NO!



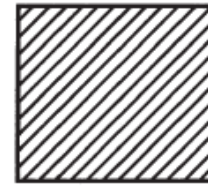
Lines too  
close

NO!



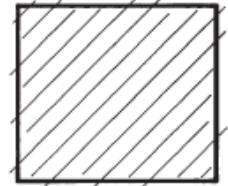
Varying  
line widths

NO!



Lines too  
thick

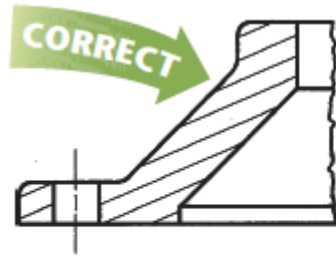
NO!



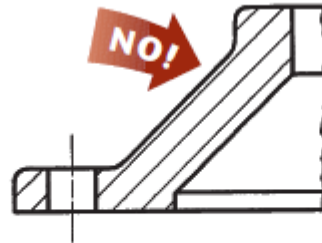
Lines short  
or overrunning

# SECTION-LINING TECHNIQUE

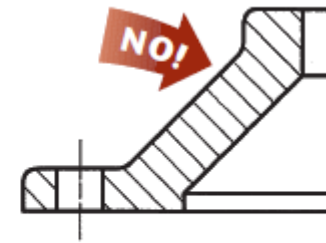
## *continued...*



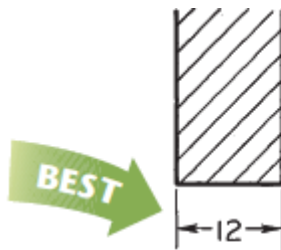
Angle of section lines is adjusted



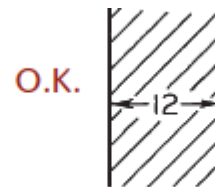
Lines should not be parallel to outline



Lines should not be perpendicular to outline



Extension lines and dimension values are not on hatched area



Section lines are omitted behind dimensioning

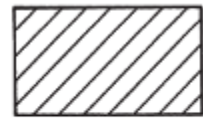


Dimensioning should not be on hatched area

# Section-Lining Symbols

*Section-lining symbols* may be used to indicate specific materials.

These symbols represent general material types only, such as cast iron, brass, and steel.



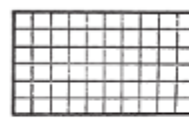
1

Cast or malleable iron and general use for all materials



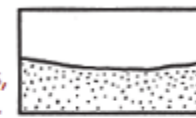
6

Rubber, plastic, and electrical insulation



11

Electric windings, electromagnets, resistances, etc.



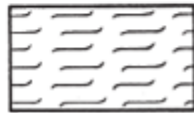
16

Sand



2

Steel



7

Cork, felt, fabric, leather, and fiber



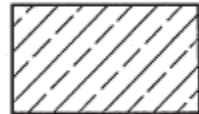
12

Concrete



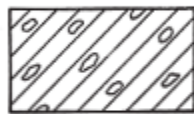
17

Water and other liquids



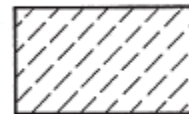
3

Bronze, brass, copper and compositions



8

Sound insulation



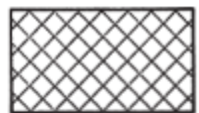
13

Marble, slate, glass, porcelain



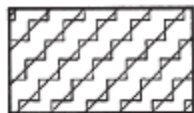
18

Across grain  
WOOD  
With grain



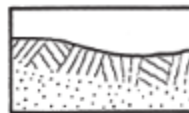
4

White metal, zinc, lead, babbitt, and alloys



9

Thermal insulation



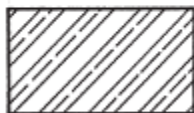
14

Earth



5

Magnesium, aluminum, and aluminum alloys



10

Titanium and refractory material



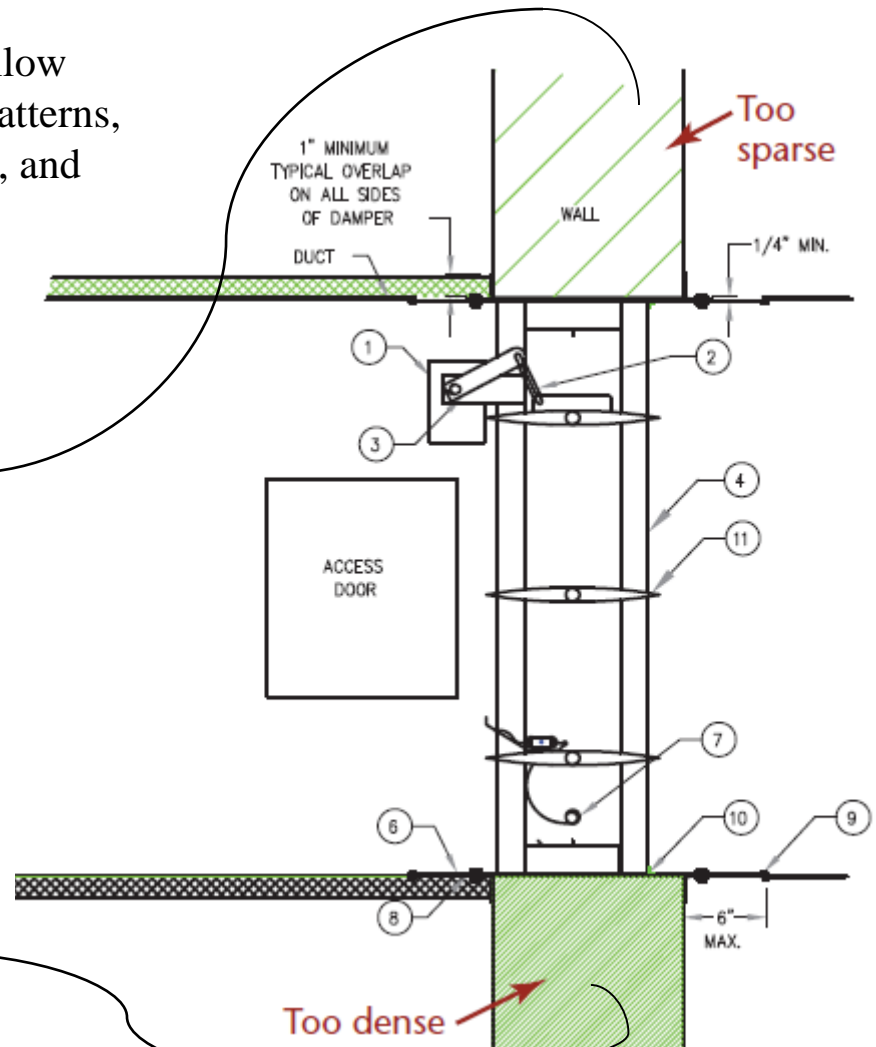
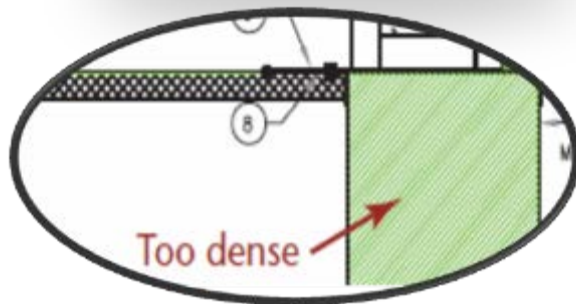
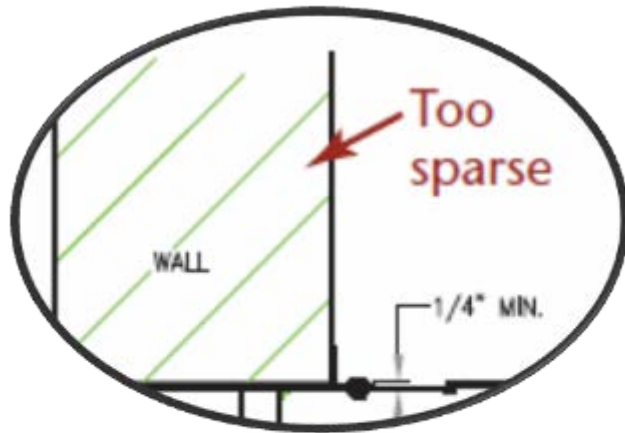
15

Rock

Symbols for Section Lining

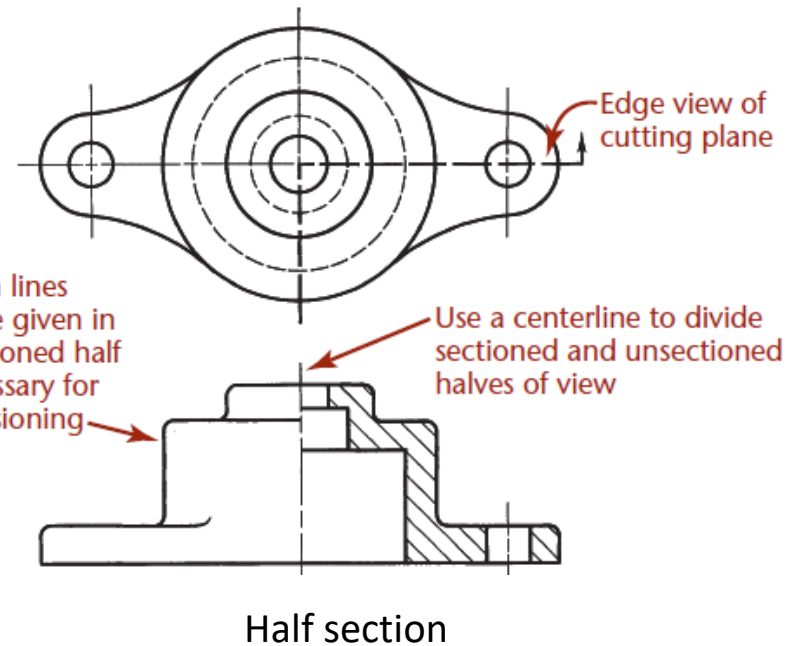
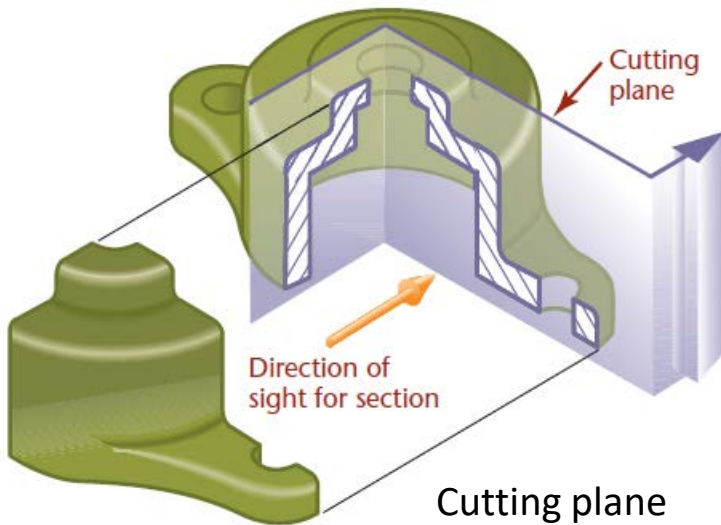
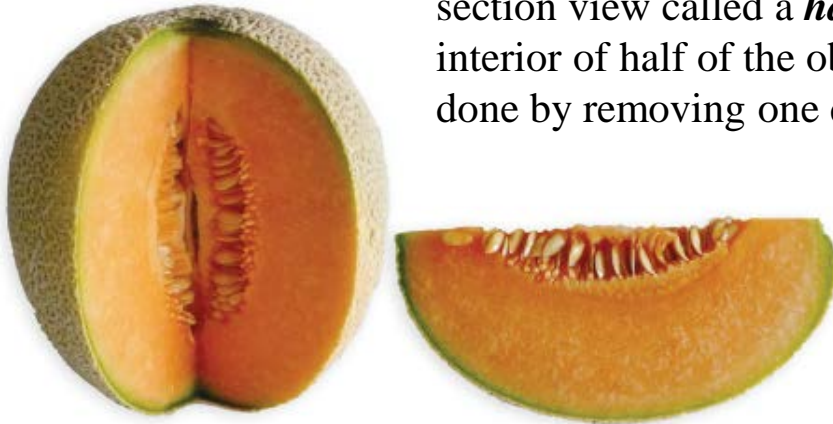
# Section-Lining in CAD

CAD programs usually include libraries that allow you to select from a variety of section-lining patterns, making it easy to use different patterns, angles, and scales for the spacing of the pattern.



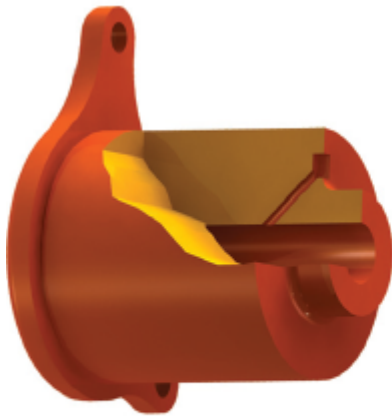
# HALF SECTIONS

Symmetrical objects can be shown effectively using a special type of section view called a *half section*. A *half section* exposes the interior of half of the object and the exterior of the other half. This is done by removing one quarter of the object.

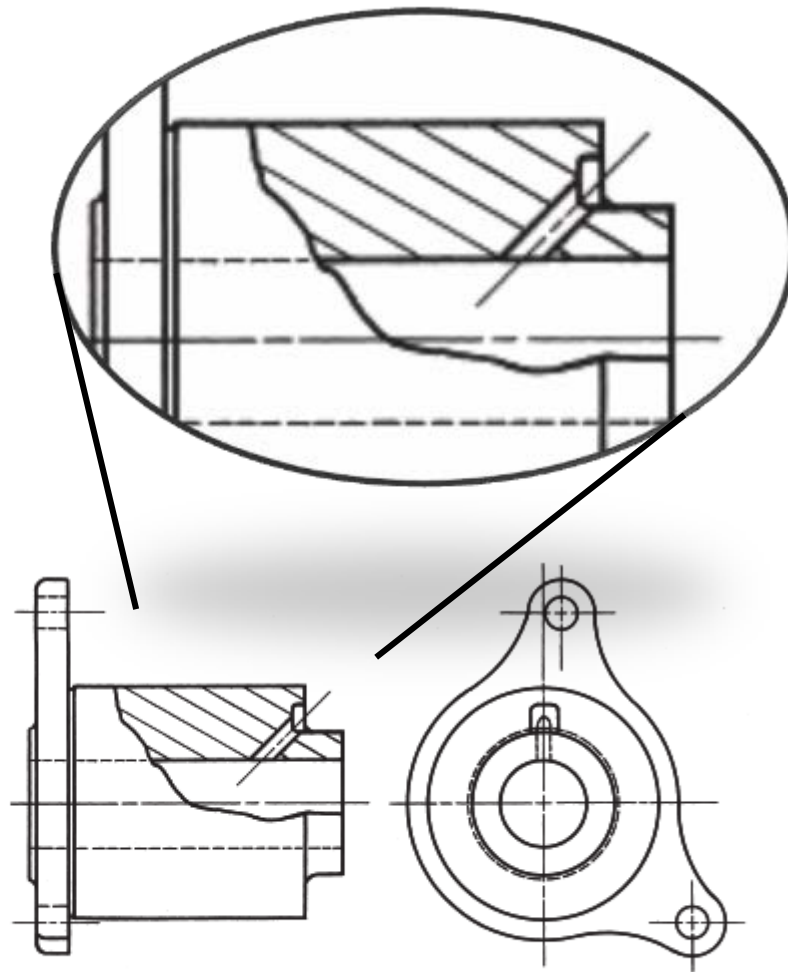


# BROKEN OUT SECTIONS

It often happens that only a partial section of a view is needed to expose interior shapes. Such a section, limited by a break line, is called a *broken out section*.



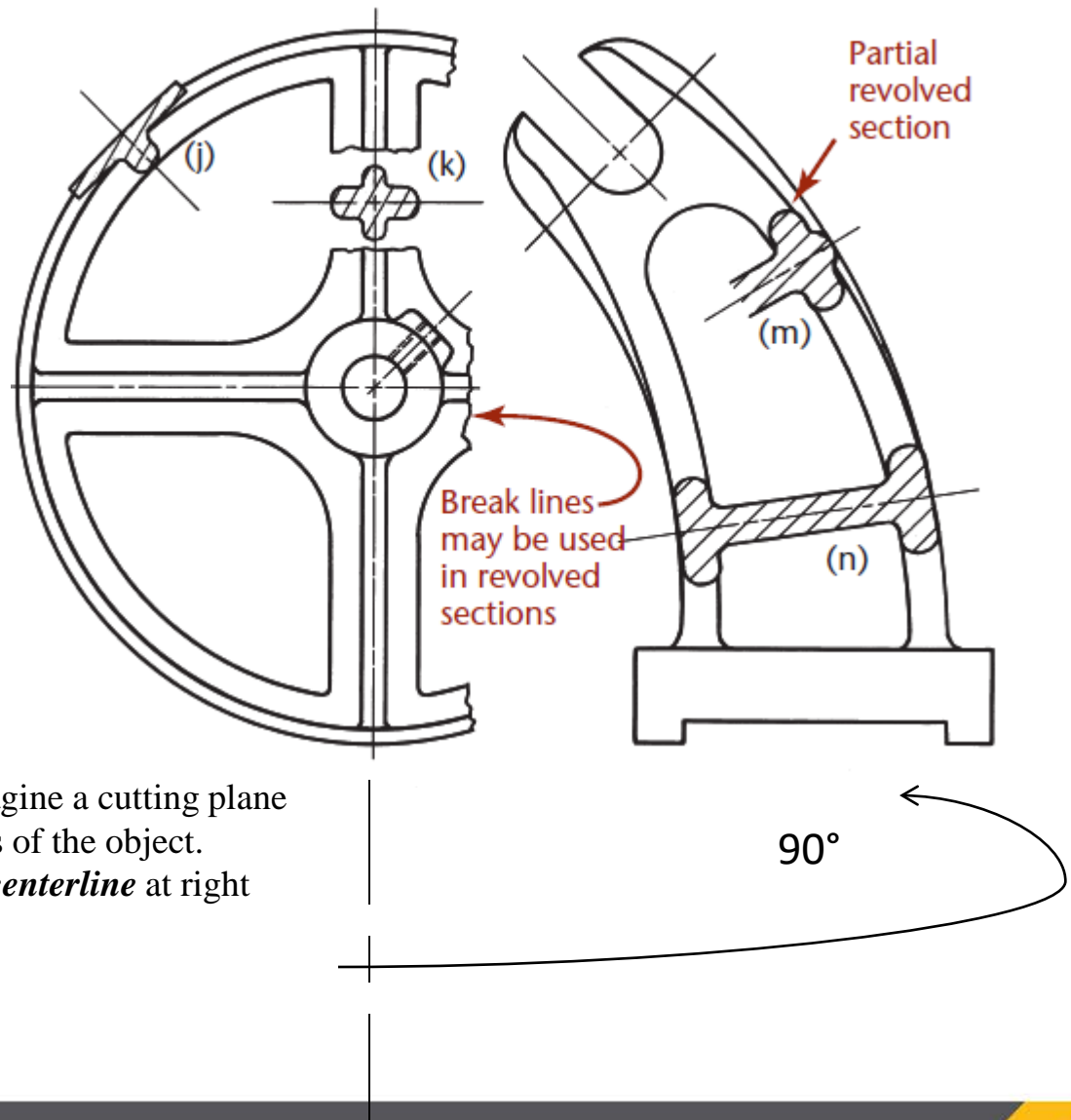
Broken Out Section





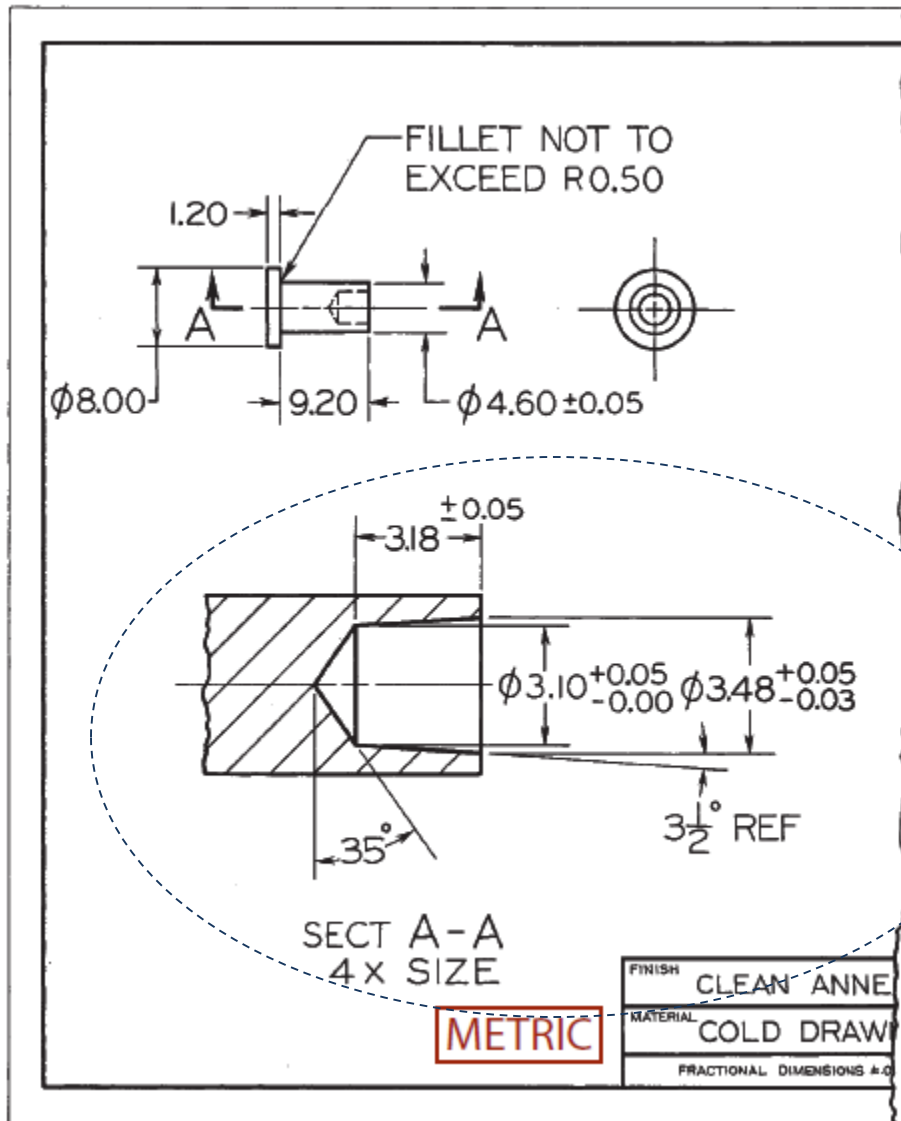
# REVOLVED SECTIONS

The shape of the cross section of a bar, arm, spoke, or other elongated object can be shown in the longitudinal view by using a *revolved section*.



To create a revolved section, first imagine a cutting plane perpendicular to the centerline or axis of the object. Next, revolve the *plane 90° about a centerline* at right angles to the axis.

# REMOVED SECTIONS

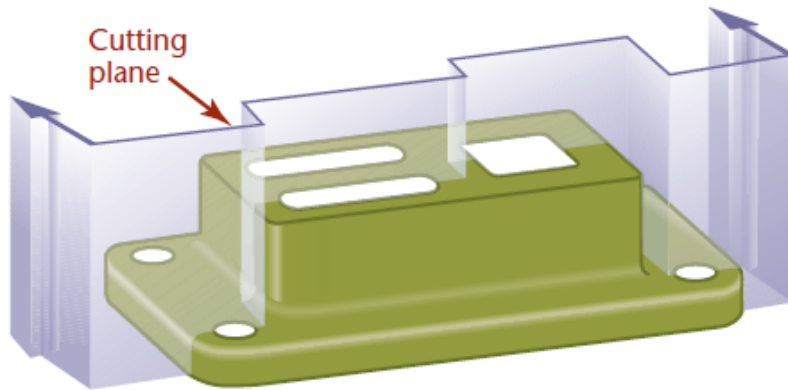


A *removed section* is one that is not in direct projection from the view containing the cutting plane — that is, it is not positioned in agreement with the standard arrangement of views.

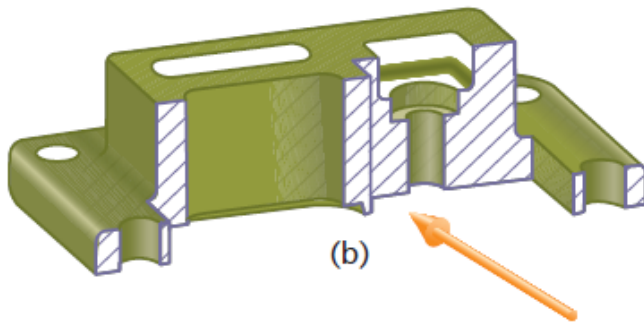
# OFFSET SECTIONS

In sectioning complex objects, it is often desirable to show features that do not lie in a straight line by “offsetting” or bending the cutting plane. These are called *offset sections*.

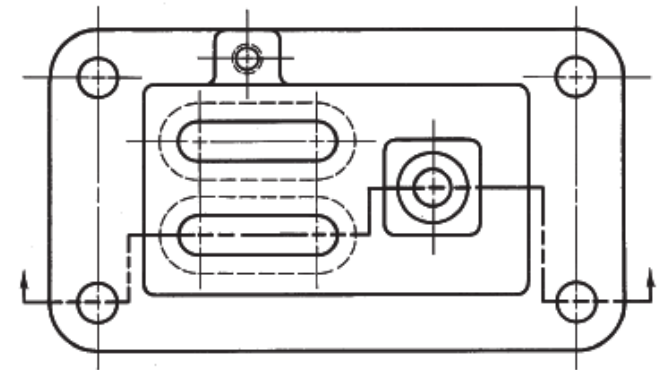
Note the offset cutting plane line



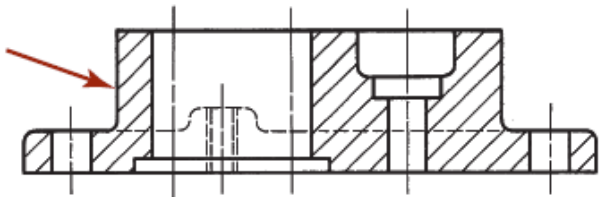
(a)



(b)



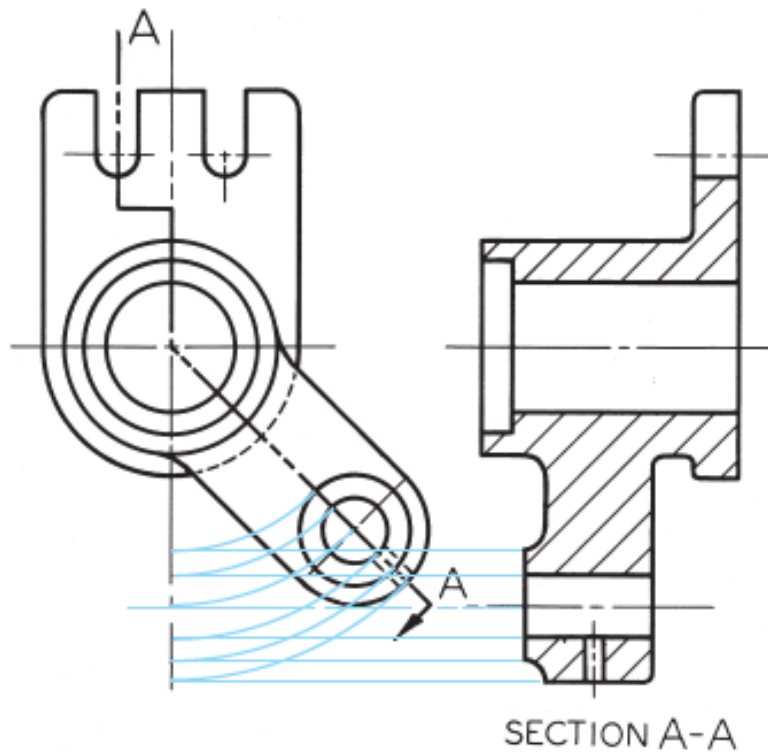
Do not show  
bends of the  
cutting plane



(c)

# ALIGNED SECTIONS

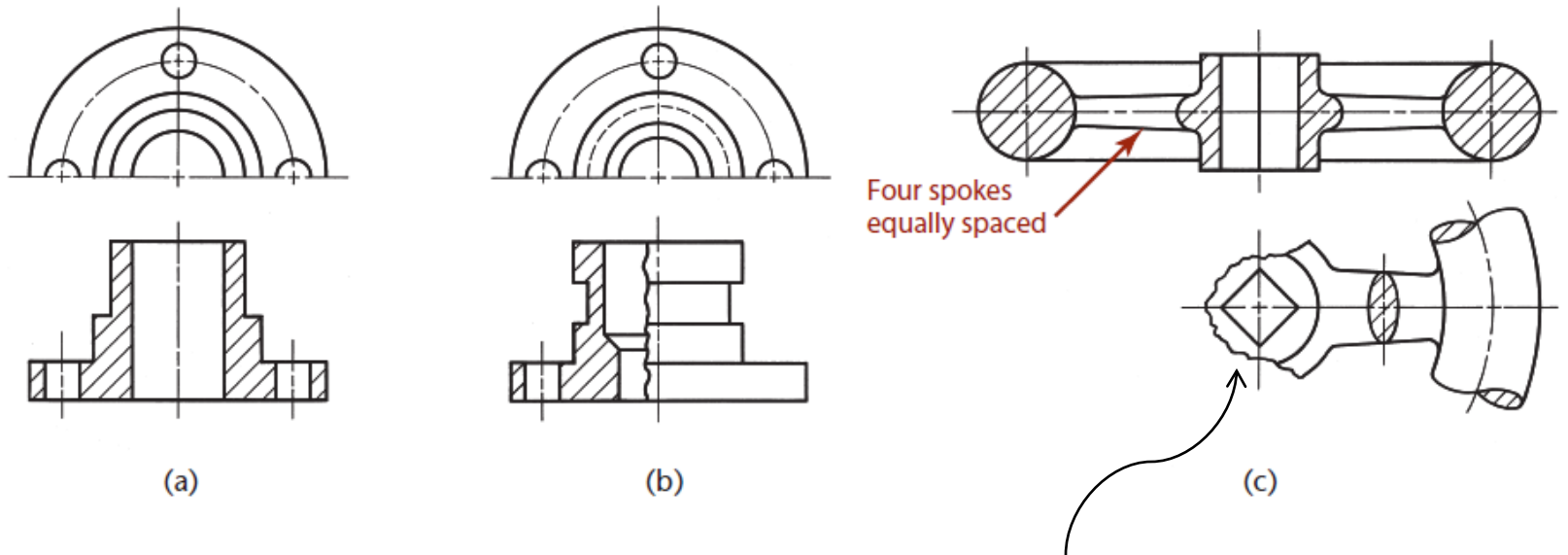
When parts with angled elements are sectioned, the cutting plane may be bent to pass through those features. The plane and features are then imagined to be revolved into the original plane.



The angle of revolution should always be less than  $90^\circ$  for an aligned section.

# PARTIAL VIEWS

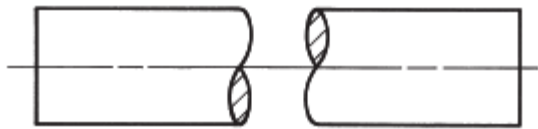
If space is limited on the paper or to save time, partial views may be used with sectioning.



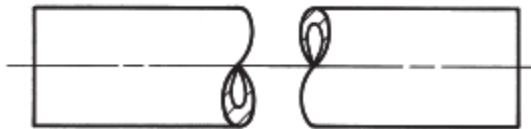
Another method of drawing a partial view is to break out much of the circular view, retaining only those features that are needed for minimum representation.

# CONVENTIONAL BREAKS AND SECTIONS

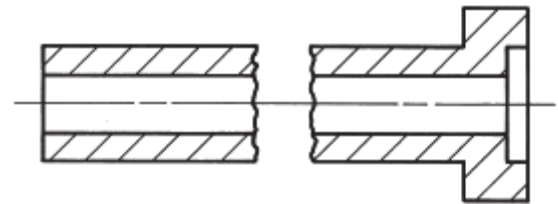
*Conventional breaks* are used to shorten the view of an object that is too long to show clearly at one scale on the drawing sheet.



(a) Round solid



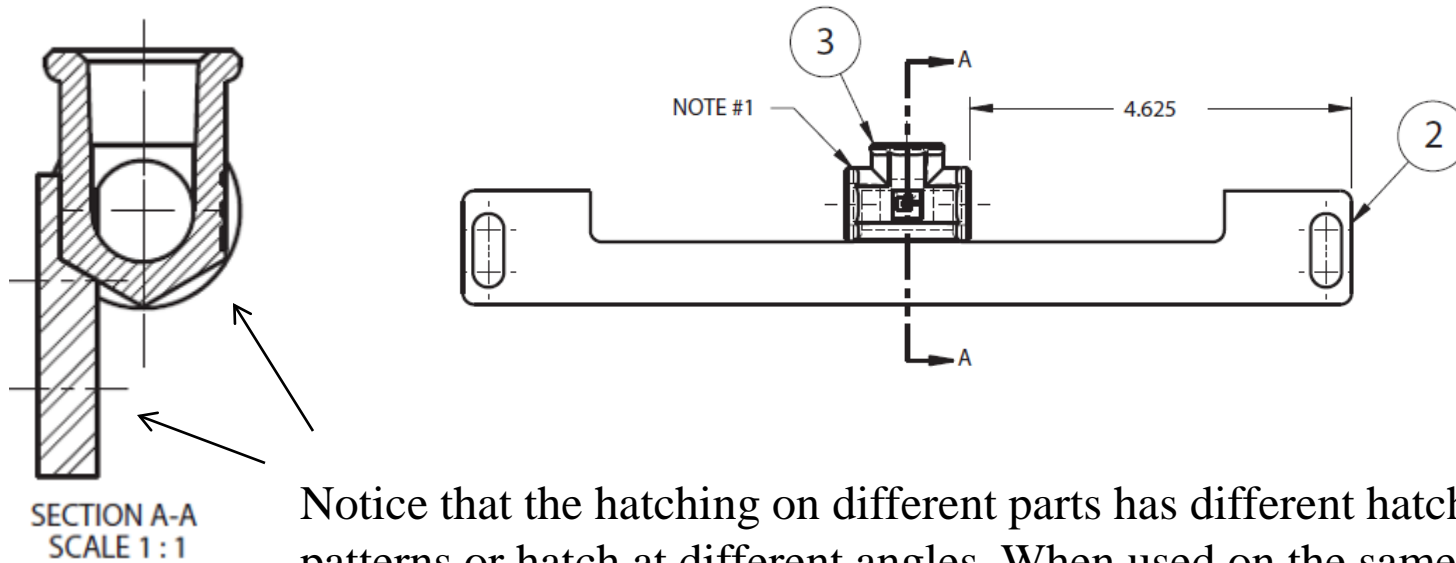
(b) Round tubular



(c) Round tubular

# ASSEMBLY SECTIONS

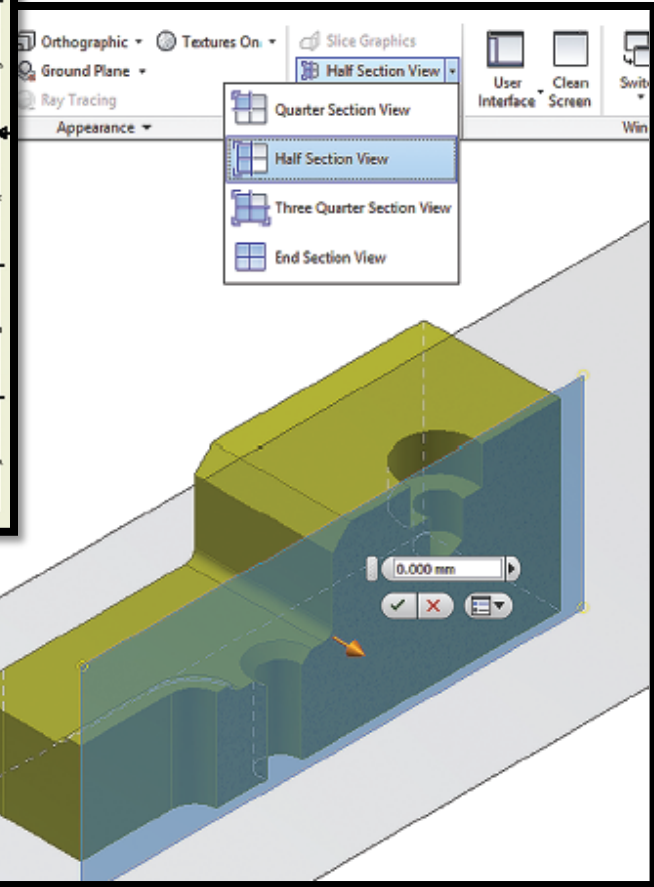
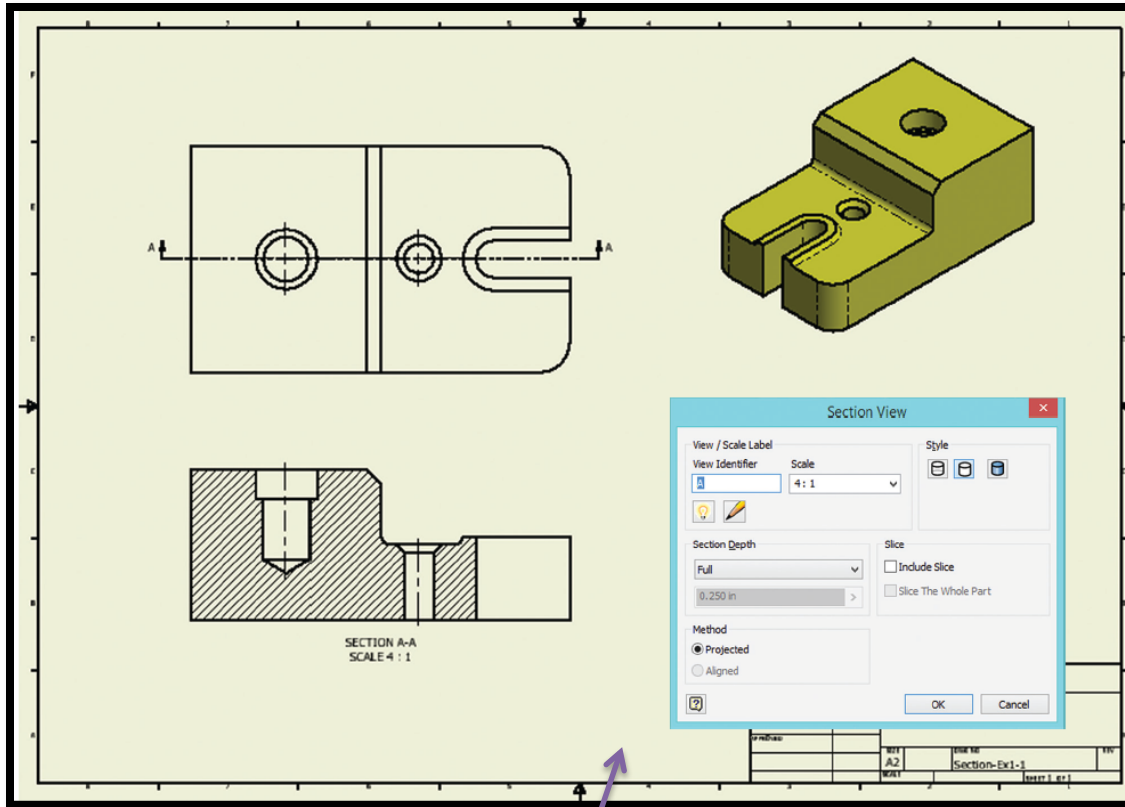
Section views are often used to create assembly drawings.



Notice that the hatching on different parts has different hatch patterns or hatch at different angles. When used on the same part, the hatching is always at the same angle to help you recognize the parts easily.

# COMPUTER TECHNIQUES FOR SECTIONS

2D and 3D sectional views are created using CAD. Most CAD systems have a “hatch” command to generate the section lining and hatch patterns to fill an area automatically.



Sections can quickly be added to orthographic drawings generated from a 3D model.

A Section Created in the 3D Model Using Autodesk Inventor (Autodesk screen shots reprinted courtesy of Autodesk, Inc.)



# Questions