ORTHOGRAPHIC PROJECTIONS

Ms. Sicola
Objectives

- List the six principal views of projection
- Sketch the top, front and right-side views of an object with normal, inclined, and oblique surfaces
Objectives (cont.)

- Understand which views show depth in a drawing that shows top, front, and right-side views
- Know the meaning of normal, inclined, and oblique surfaces
- Compare and contrast using a CAD program to sketching on a sheet of paper to create 2-D drawing geometry
Objectives (cont.)

• Know which dimensions transfer between top, front, and right-side views
• Transfer the depth between the top and right-side views
• Label points where surfaces intersect
Views of Objects

- Drawings are two-dimensional representations of objects that allow you to record sizes and shapes precisely.
- To provide a complete and clear description, the views must be systematically arranged.
- The system of views is called multiview projection.
The Six Standard Views

- Any object can be viewed from six mutually perpendicular views
The Six Standard Views

- These views are called principal views and are arranged in a standard way.
The Six Standard Views

- The top, front, and bottom views align vertically.
- The rear, left-side, front, and right-side views align horizontally.
- To draw a view out of place is a serious error.
Principal Dimensions

- The three principal dimensions of an object are:
  - Width
  - Height
  - Depth
Principal Dimensions

- Any principal view shows two of the three principal dimensions
- **Height** is shown in the rear, left-side, front, and right side
- **Width** is shown in the rear, top, front, and bottom
- **Depth** is shown in the left-side, top, right-side, and bottom views
Projection Method

- Frontal plane – the plane upon which the frontal view is projected
- Horizontal plane – the plane upon which the top view is projected
- Profile plane – the plane upon which the side view is projected
The Glass Box

• One way to understand the standard arrangement of views on a sheet of paper is to envision the object in a glass box

• The outside observer would see six standard views of the object through the sides of this imaginary glass box
The Glass Box
Orthographic Projection

When the glass cube is unfolded:

- **Front view**: Height and Width
- **Top view**: Width and Depth
- **Right view**: Depth and Height
Transferring Depth Dimensions

- The depth dimensions in the top and side views must correspond
  - You may find it convenient to use dividers, a scale, or a 45-degree miter line to project dimensions
Necessary Views

• A sketch or drawing should only contain the views needed to clearly and completely describe the object
  • Choose the views that have the fewest hidden lines and show essential contours or shapes most clearly
  • Complicated objects may require more than three views
  • Some objects only need one or two views
Necessary Views
Orientation of the Front View

- The front view should:
  - Show a large surface of the part parallel to the front viewing plane
  - Show the shape of the object clearly
  - Show the object in a usual, stable, or operating positions
Orientation of the Front View

- When possible, a machine part is drawn in the orientation it occupies in the assembly.
- Usually screws, bolts, shafts, tubes, and other elongated parts are drawn in a horizontal position.
Orientation of the Front View

(Shows shape clearly)

(No! Show large surfaces parallel to the view)

(No! Other views show shapes better)

(No! Use a usual, stable or operating position)
Hidden Lines

• An advantage of orthographic views is that each view shows the object all the way through as if it were transparent
  • Thick dark lines represent visible features
  • Dashed lines represent features that would be hidden behind other surfaces
  • When possible, choose views that show features with visible lines
Centerlines

- The centerline is used to:
  - Show the axis of symmetry of a feature or part
  - Indicate a path of motion
  - Show the location for bolt circles or other circular patterns
- The centerline pattern is composed of three dashes, one long dash on each end with a short dash in the middle
Centerlines

\[ \overline{L} = \text{Center Line} \]

(a)  
(b)  
(c)  

(d)  
(e)  
(f)  

Bolt circle (BC)  
Path of motion
Precedence of Lines

- When lines coincide on a drawing the rules of precedence are:
  - Visible lines always take precedence over hidden or centerlines
  - Hidden lines take precedence over centerlines
Precedence of Lines
Visualization

• Even those with experience can’t always look at a multiview sketch and instantly visualize the object represented
• You will learn to interpret lines in a logical way in order to visualize the object as a whole
Views of Surfaces

- A plane surface that is perpendicular to a plane of projection appears on edge as a straight line.
- If a plane is parallel to the plane of projection, it appears true size.
- If a plane is angled to the plane of projection, it appears foreshortened.
Views of Surfaces

(a) EV = Edge view
(b) TS = True size
(c) FS = Foreshortened
Views of Surfaces

- A plane surface always projects either on edge or as a surface in any view
  - It can appear foreshortened, smaller than actual size, but it can never appear larger than its true size in any view
Normal Surfaces

- A normal surface is parallel to a plane of projection
Inclined Surfaces

- An inclined surface is perpendicular to one plane of projection but inclined to adjacent planes.
Oblique Surfaces

- An oblique surface is tipped to all principal planes of projection and does not appear true size in any standard view.
Edges

- The intersection of two plane surfaces of an object produces an edge which shows as a straight line in a drawing.
- If an edge is perpendicular to a plane of projection it appears as a point, otherwise it appears as a line.
Parallel Edges

- When edges are parallel to one another on an object, they will appear as parallel lines in every view unless they align one behind the other.
Angles

- If an angle is in a normal plane, it will show true size on the plane of projection to which it is parallel.
- If an angle is in an inclined plane, it may be projected either larger or smaller than the true angle depending on its position.
Angles

(a) Angle in normal plane
(b) Angle in inclined plane
(c) Angle in inclined plane
(d) Projections of 90° angles appear true size whenever one leg of the triangle appears true length
Interpreting Lines

• A straight, visible, or hidden line in a sketch has three possible meanings:
  • An edge between two surfaces
  • The edge view of a surface
  • The limiting element of a curved surface

• Since no shading is used on orthographic views, you must examine all views to determine a line’s meaning
Interpreting Lines

Contour

Edge view of surface

Intersection of surfaces

Edge view of surface