

Pictorial Drawings

PICTORIAL DRAWINGS

The ability to quickly make a pictorial drawing is useful for communicating technical information. A *pictorial drawing* is a three-dimensional representation of an object. Pictorial drawings are easy to understand because they convey a sense of realism by combining height, width, and depth in one drawing.

Three basic types of pictorial drawings are axonometric, oblique, and perspective. See **Figure 4-1**. Each type of pictorial drawing represents a different relationship between the viewer and the object and depicts the object in a different way.

Pictorial drawings are often made from multiview drawings. A *multiview drawing* is a two-dimensional representation of a three-dimensional object shown with no distortion of lines or angles. See **Figure 4-2**. Multiview drawings show each unique view separately and in true view. A *true view* is a view where the face of the object being shown is parallel to the picture plane and has no distortion. A true view shows all angles and features as their actual shape and size.

Pictorial drawings are drawn using visible lines. Hidden lines are not often included in pictorial drawings. Pictorial drawings are based on the conventions described in ANSI/ASME Standard Y14.4M, *Pictorial Drawing*.

Pictorial Drawings

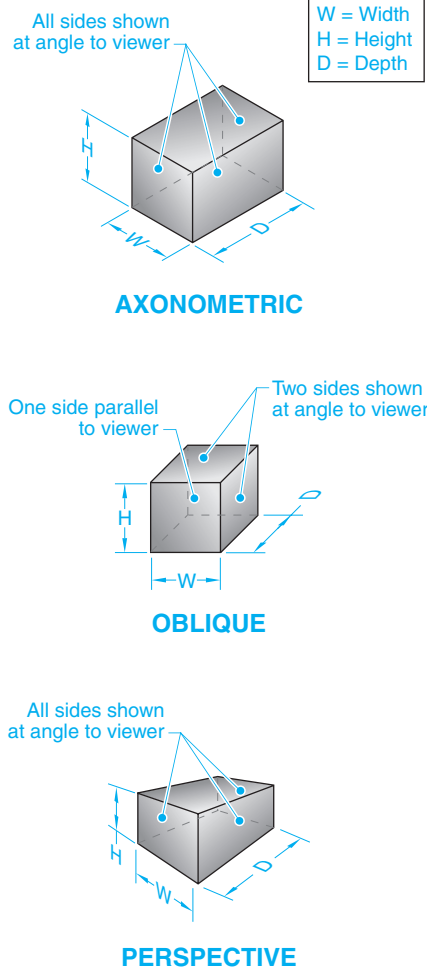


Figure 4-1. Axonometric, oblique, and perspective are three types of pictorial drawings.

Multiview Drawings

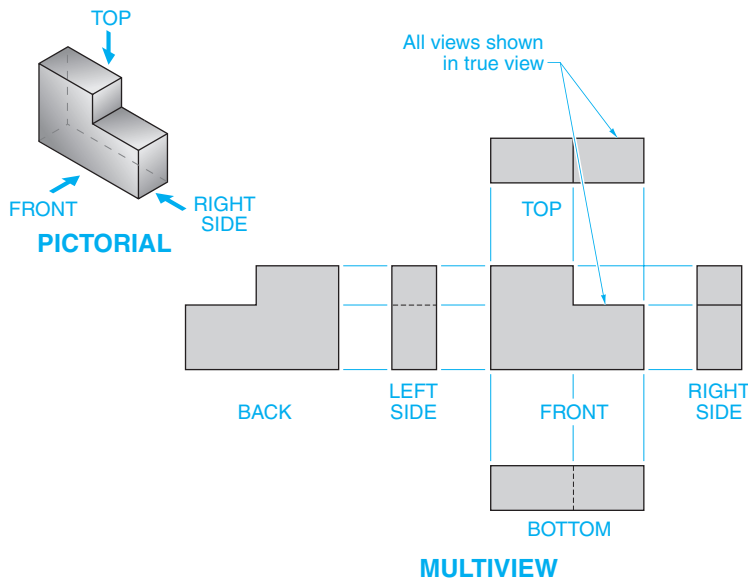


Figure 4-2. A multiview drawing is a two-dimensional representation of an object with all sides drawn in true view.



Axonometric Drawings

An *axonometric drawing* is a pictorial drawing that shows three sides of an object and contains no true view of any side. In an axonometric drawing, planes are created by the three axes of height, width, and depth. A *frontal plane* is a plane that is parallel to the height and width axes. A *horizontal plane* is a plane that is parallel to the width and depth axes. A *profile plane* is a plane that is parallel to the height and depth axes. An *angled plane* is a plane that is not parallel to any of the axonometric axes. See Figure 4-3.

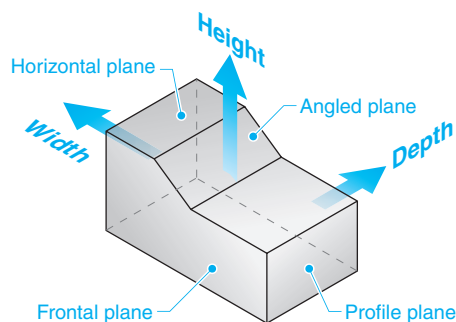


Figure 4-3. Horizontal, frontal, profile, and angled planes are determined based on the axonometric axes they are parallel to.

Foreshortening is a technique used to create an illusion that a surface or distance on an object not seen in true view is shorter than actual size. Foreshortening the surfaces and lengths of an object that recede in space makes the object appear more realistic in a drawing. All lengths that are not parallel to the viewing plane in an axonometric drawing are foreshortened to appear more realistic. Drawn lines that signify the object's width and depth are usually drawn at an angle and are foreshortened, while drawn lines that signify the object's height remain at full size. Parallel lines remain parallel whether or not they are foreshortened.

Three types of axonometric drawings include isometric, dimetric, and trimetric. The type of axonometric drawing selected for use is the one that most clearly portrays the object. Isometric is the most commonly used type.

Isometric Drawings. An *isometric drawing* is an axonometric drawing with the axes equally spaced 120° apart. Isometric drawings clearly show three surfaces of an object with no surfaces in true view. See Figure 4-4. Lines that signify the object's width and depth are drawn at 30° from the horizon, while lines that signify the object's height are drawn vertically.

Isometric Drawings

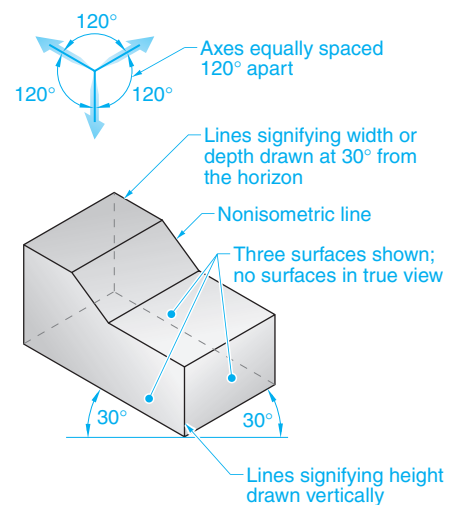


Figure 4-4. An isometric drawing is an axonometric drawing with the axes drawn equally spaced at 120° apart.

Any feature that is not parallel to the height, width, or depth of the object, and therefore not parallel to one of the three isometric axes, is considered *nonisometric*. Nonisometric features are drawn by measuring and marking their end points on isometric lines. Irregularly shaped objects can be drawn in or around a rectangular box to assist with shape and placement. Grids or numbered lines can also be used to measure and transfer irregularly shaped features from a true view to an isometric view. See Figure 4-5.

Transferring Irregularly Shaped Features

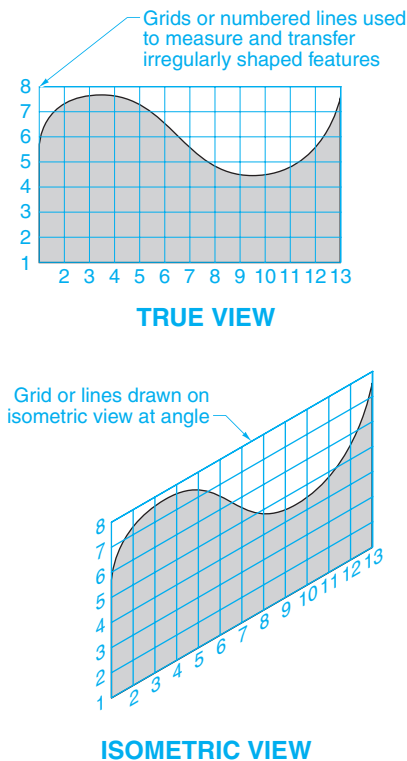


Figure 4-5. Grids or numbered lines can be used to measure and transfer curves or other irregular shaped features from a true view to an isometric view.

The shapes of angles and circles are distorted on receding planes. Angles appear skewed. Circles appear as ellipses. The minor axis of an ellipse is equal to the isometric axis that is perpendicular to the

isometric axis of the plane on which the circle is located. For example, an ellipse on the horizontal plane always has a minor axis parallel to the height axis, an ellipse on the frontal plane always has a minor axis parallel to the depth axis, and an ellipse on the profile plane always has a minor axis parallel to the width axis. See Figure 4-6.

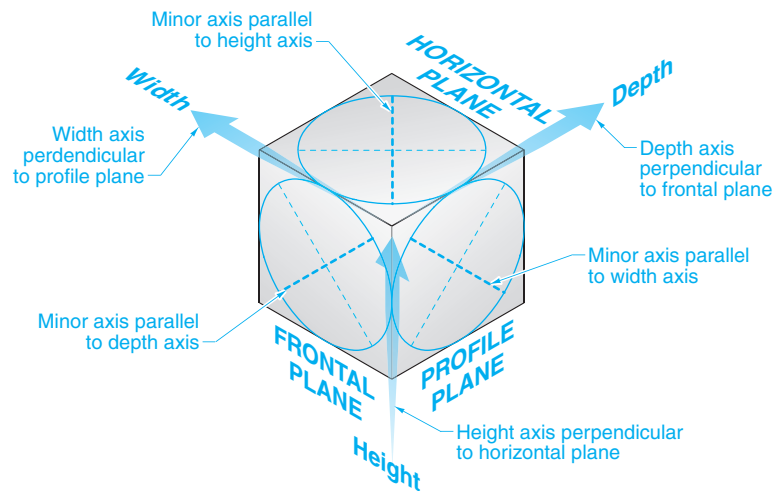
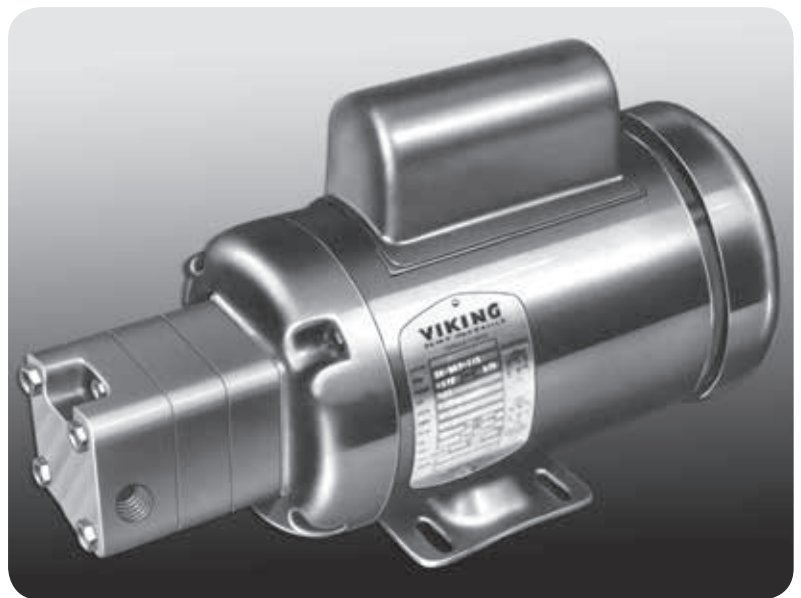
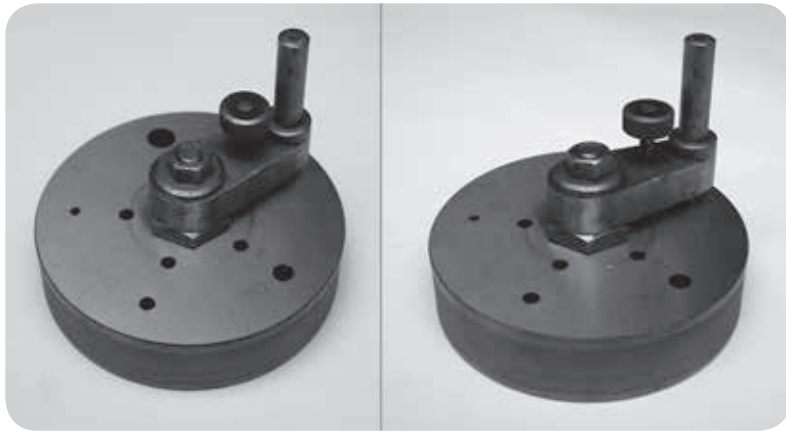


Figure 4-6. Circles or other round features appear as ellipses on receding planes and are drawn with the minor axis matching the isometric axis the plane is perpendicular to.



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Irregular shapes on an object can be drawn using grids aligned to the axes in both the multiview and the isometric view.



In dimetric and trimetric drawings, the angle of the axes can be changed to show more of the top view or side view of the object.

Dimetric Drawings. A *dimetric drawing* is an axonometric drawing with two axes drawn on equal angles to the third, but with an unequal angle between them. See **Figure 4-7**. The main axis is generally placed perpendicular to the horizon with the other two axes varying. Adjusting the angles between the axes will allow more or less of the top view to be visible. Lines that run parallel to one of the two dimetric axes with equal angles are foreshortened at the same scale, whereas lines that run parallel to the third dimetric axis are foreshortened at a different scale.

Trimetric Drawings. A *trimetric drawing* is an axonometric drawing with all axes drawn at different angles. The axes can be

positioned to allow any side of an object to be more or less visible. In a trimetric drawing, each axis has a different scale of foreshortening. The use of three scales makes this method more time-consuming and, therefore, it is seldom used.

Drawing Axonometrics. Isometric, dimetric, and trimetric drawings are created in a similar way. When creating an axonometric drawing, each horizontal and vertical surface on the object is drawn parallel to one of the chosen axonometric axes, with angled or irregular surfaces drawn by determining their shape based on other lines.

To create an isometric drawing, complete the following procedure:

1. Draw the isometric axes and mark the height and width measurements of the frontal plane on the axes. Draw the outline of the frontal plane surface(s). See **Figure 4-8**.
2. Draw the receding lines for the horizontal and profile planes parallel to the isometric axes and mark the depth of the object. Draw lines parallel to the isometric axes to complete the horizontal and profile plane surfaces. Nonisometric lines are drawn by marking and connecting their end points on isometric lines.
3. Locate the center points of any circles and arcs. Draw the circles and arcs as ellipses.
4. Darken visible lines to complete the isometric drawing.

Dimetric and Trimetric Drawings

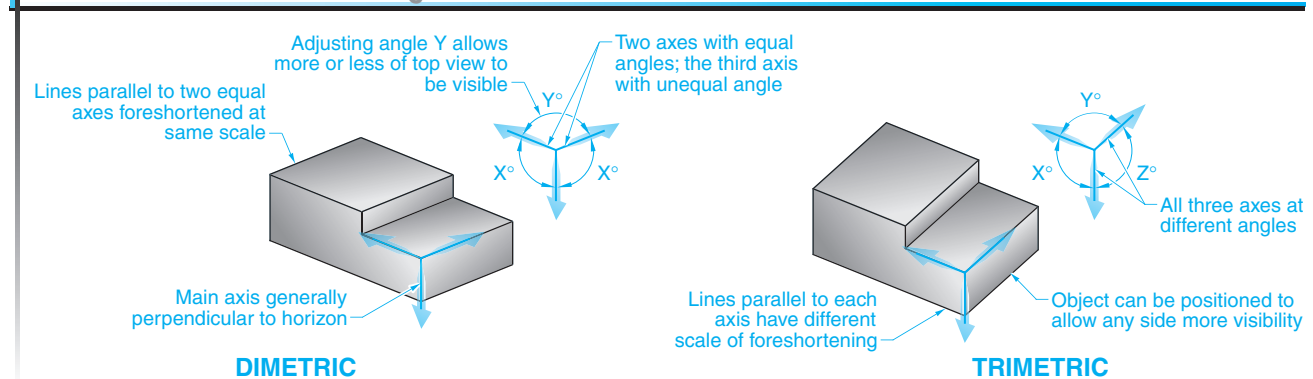


Figure 4-7. Dimetric and trimetric drawings are axonometric drawings with axes at varying angles.

Drawing Isometrics

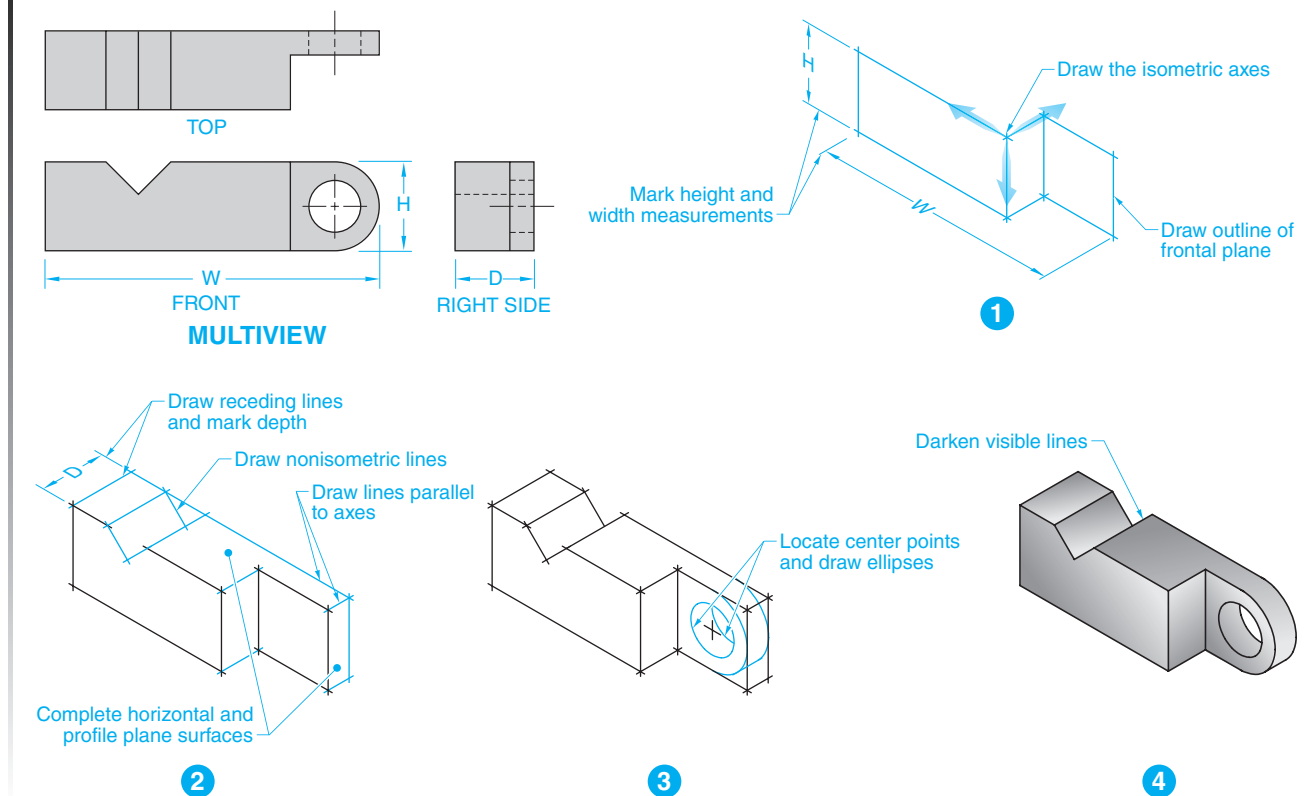


Figure 4-8. In an isometric drawing, each surface of the object is drawn with lines parallel to the axes.

Drawing Circles in Axonometrics. In axonometric drawings, circles are drawn as ellipses and arcs are drawn as portions of ellipses. For isometric drawings, a 35° ellipse template can be used, or ellipses can be constructed using the parallelogram method. To draw a circle in an isometric view using the parallelogram method, complete the following procedure:

Given: Circle with known diameter.

1. In the desired location of the ellipse, draw parallelogram ABCD with the sides equal to the diameter of the circle and at the angle of the isometric axes. **See Figure 4-9.**
2. Bisect sides AB and CD with line EF. Bisect sides AD and BC with line GH. Lines AB, CD, and GH should be parallel. Lines AD, BC, and EF should be parallel.
3. Draw line DE perpendicular to side AB. Draw line BF perpendicular to side CD. Draw line BG perpendicular to side AD. Draw line DH perpendicular to side BC. Lines DE and BG intersect at point I. Lines BF and DH intersect at point J.
4. Set a compass with the radius equal to line segment EI. With a center point of I, draw arc EF tangent to parallelogram ABCD. With a center point of J, draw arc GH tangent to parallelogram ABCD.
5. Set a compass with the radius equal to line segment DE. With a center point of D, draw arc EG tangent to parallelogram ABCD. With a center point of B, draw arc FH tangent to parallelogram ABCD.
6. Darken visible lines to complete the ellipse.