

## Section 7

### Design View Projections

7.1 **Methods of Projections.** Third-angle orthographic projection shall be used for engineering drawings. Isometric perspective, etc. may be used where particular advantage exists. Draw only necessary views to illustrate the required characteristics of the object.

7.1.1 **One-View Drawings.** One-view drawings are permissible for objects where one view and feature characteristics such as thickness or length, stated as a dimension or note, can completely define an object.

7.1.2 **Partial Views of Symmetrical Object.** Partial views of symmetrical objects are permissible and may be represented by half views. Half views shall extend slightly beyond centerline of symmetry and terminate with a break line. If the adjacent view is beyond centerline of symmetry it shall terminate with a break line. If the adjacent view is full or half section, the far half of the symmetrical view shall be drawn.

7.1.3 **Three-View Drawings.** Three-view drawings may be arranged at any three adjacent views in standard orthographic projection. Where two side views are required to illustrate an object, they may not be completed views if together they depict the shape of the object. When space is limited, or the part can be more clearly indicated, the side view may be placed near the top view.

7.1.4 **Auxiliary Views.** Objects having inclined faces or other features not parallel to any of the three principal planes of projection require auxiliary views to show the true shape of these features. Partial auxiliary views, showing only pertinent features shall be employed to illustrate features not clearly shown by principal views. Auxiliary sectional views may also be employed to advantage in many cases to illustrate features not clearly shown by principal views. Views not projected directly shall be clearly to indicate location and direction from which viewed.

7.1.5 **Detail Views.** A detail view shows a part of the drawing in the same plane and in the same arrangement, but in detail if necessary drawn to a larger scale than shown in the principal view. The part of the drawing to be detailed shall be suitable identified.

7.1.6 **Spacing and Identification of Views.** Ample space shall be provided between views to permit placing of dimensions without crowding and to preclude the possibility of notes pertaining to one view overlapping or crowding the other views.

7.1.7 **Intentional Exaggeration of Views.** When features are too small to be drawn to scale, they shall be drawn exaggerated as necessary to illustrate the feature.

7.2 **Delineation of Implied Features.** Drawings need show only the information necessary to clearly delineate the part. Excessive illustration of superfluous details shall be avoided, if in doing so, this practice does not reduce the clarity of completeness of the drawings. Where a feature of an item occurs many times in a continuous regular pattern, only sufficient information to illustrate the feature and its regularity is necessary, e.g., rows of bolts or rivet heads, long consistent section lines, repetition of holes, features in a bolt circle, repetition of slots, spines or gears, or any other details of a repetitious nature.

7.3 **Variations From True Projection.** Variations from the rules of true projection are permissible for clarity.

7.4 **Views, Sections and Cutting Planes.** A section or sectional view is obtained by cutting away part of an object to show the shape and construction at the cutting plane. They shall be used when the interior construction or hidden features of an object cannot be shown clearly by outside views. Hidden lines and details beyond the cutting plane can be omitted unless required to adequately portray the object. A sectional view shall be made through an outside view and not through another sectional view, unless a drawing is so clarified. Sectional Views may be rotated, provided an explanatory note is shown adjacent to the view.

7.4.1 *Cutting Plane and Viewing Plane Indications.* Cutting plane lines together with symbols make up a cutting plane indication. Symbols at the end of cutting plane lines are used to indicate direction in which the sections are viewed. The cutting plane may be a single continuous plane, or offset if the detail can be shown to better advantage. Viewing planes are indicated similar to the cutting plane indications, except that they are placed outside the object to indicate the surfaces shown in the auxiliary views.

7.4.2 *Identification of Cutting Planes.* Cutting plane indications shall be suitably identified by use of reference letters. Where a change in direction of the cutting plane is not clear, reference may also be placed at each change of direction. Cutting plane indications shall be identified in alphabetical series.

7.4.3 *Sectional Views on Separate Sheet.* Sectional views should appear on the same sheet as the subassembly, assembly, or detail drawings from which they are taken. When it is necessary to draw sectional views on a separate sheet, views shall be arranged from left to right in alphabetical order, or suitably cross-referenced by zone designations. When a sectional view appears on a sheet separated from one containing the cutting plane indication, the sheet number where the cutting plane indication appears shall be cross-referenced.

7.5 **Scales of Sections.** Sectional views are preferred drawn to the same scale as the outside views from which they are taken.