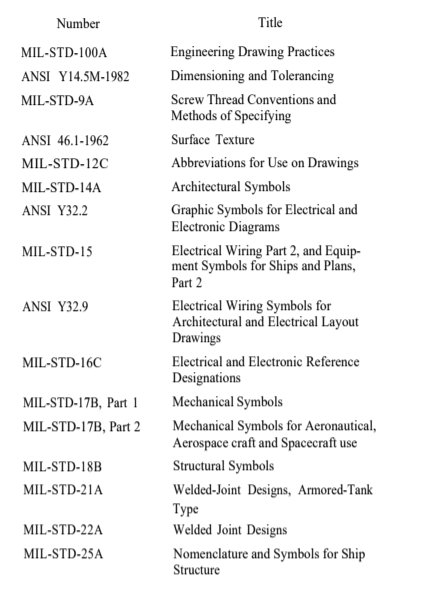
**Blueprint Reading Notes:**

Blueprints (prints) are copies of mechanical or other types of technical drawings. The term blueprint reading, means interpreting ideas expressed by others on drawings, whether or not the drawings are actually blueprints. Blueprints show the construction details of parts, machines, ships, aircraft, buildings, bridges, roads, and so forth.

The standards and procedures prescribed for military drawings and blueprints are stated in military standards (MIL-STD) and American National Standards Institute (ANSI) standards.

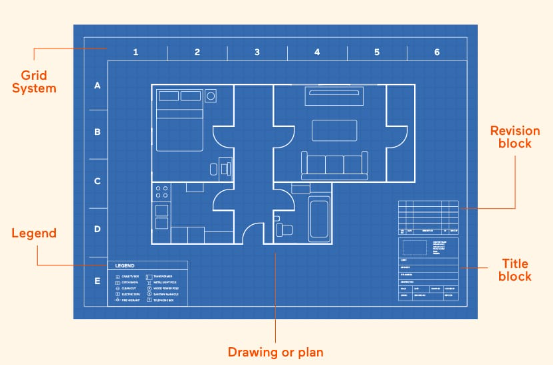
Military Standard and American Nation Standards Institute common standards are shown below:



Some general parts of blueprints include information blocks, finish marks, notes, specifications, legends, and symbols.

The draftsman uses information blocks to give the reader additional information about materials, specifications, and so forth that are not shown in the blueprint or that may need additional explanation.

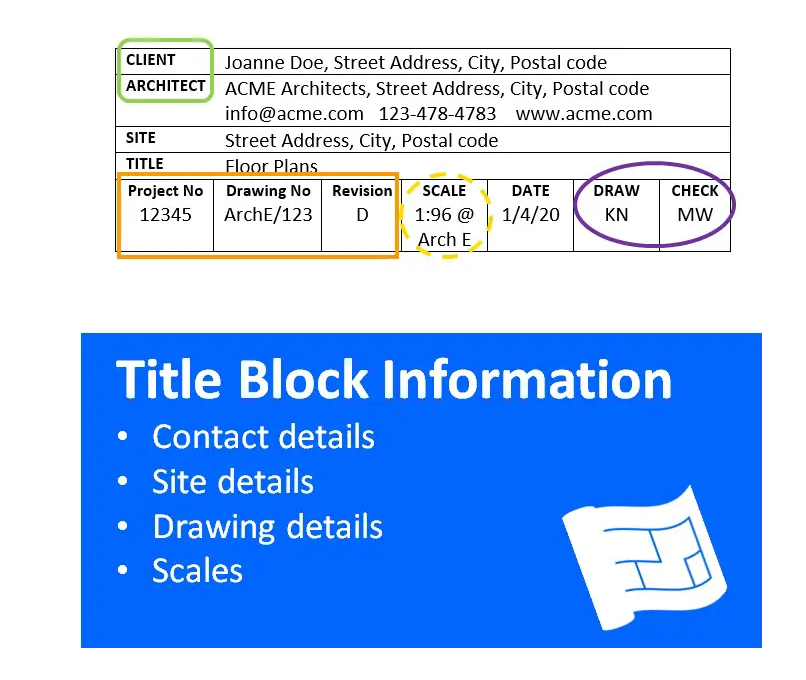
A basic layout for many blueprints is demonstrated below:



A grid system in a blueprint is a network of horizontal and vertical lines that divide the drawing area into squares or rectangles, providing a precise coordinate system for design elements. It helps create accurate drawings, measure and scale designs, and align elements with ease. The grid consists of grid lines, squares or modules, and coordinates that enable precise location and communication among designers, making it a fundamental tool in architecture, engineering, and design.

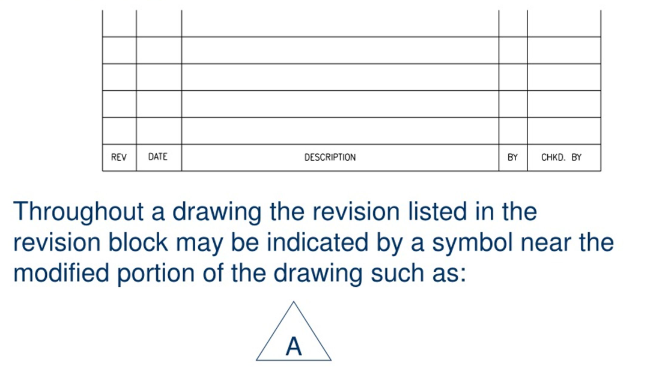
A legend in a blueprint is a key that explains the symbols, abbreviations, and conventions used in the drawing, ensuring clear communication and understanding of the design. It provides a reference guide for the various elements and notations, defining graphical symbols, abbreviations, and drawing conventions, and often includes additional notes and explanations. Located in a corner of the blueprint, the legend is an essential component that helps architects, engineers, and builders accurately interpret and execute the design.

The title block is often located in the lower-right corner of all blueprints and drawings. It contains the drawing number, name of the part or assembly that it represents, and all information required to identify the part or assembly.



A space within the title block with a diagonal or slant line drawn across it shows that the information is not required or is given elsewhere on the drawing.

Revision blocks: a dedicated section that tracks changes and updates made to the design. It includes essential information such as revision number, date, description of changes, and approval details. This block provides a record of modifications, ensuring accuracy and accountability in architectural, engineering, and construction drawings. These are frequently found in the upper right corner of a blueprint.



When a blueprint is revised, the letter A in the revision block is replaced by the letter B and so forth.

Reference numbers that appear in the title block refer to numbers of other blueprints. A dash and a number show that more than one detail is shown on a drawing. When two parts are shown in one detail drawing, the print will have the drawing number plus a dash and an individual number.

In addition to appearing in the title block, the dash and number may appear on the face of the drawings near the parts they identify. A dash and number identify changed or improved parts and right-hand and left-hand parts.

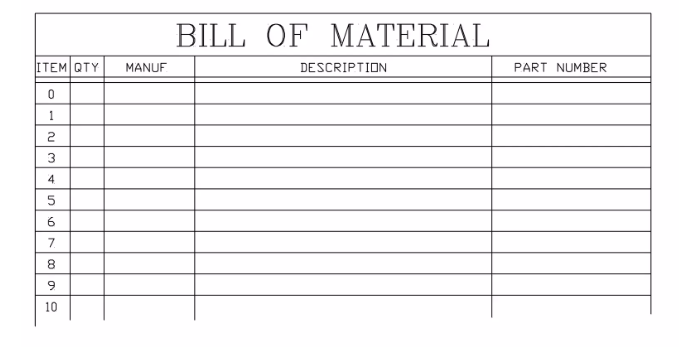
On some prints you may see a notation above the title block such as “159674 LH shown; 159674-1 RH opposite.” Both parts carry the same number. LH means left hand, and RH means right hand. Some companies use odd numbers for right-hand parts and even numbers for left-hand parts.

Zone numbers serve the same purpose as the numbers and letters printed on borders of maps to help you locate a particular point or part.

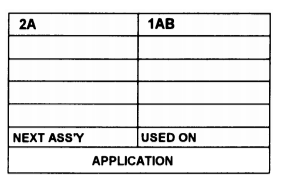
The scale block in the title block of the blueprint shows the size of the drawing compared with the actual size of the part. The scale is chosen to fit the object being drawn and space available on a sheet of drawing paper.

Never measure a drawing; use dimensions. The print may have been reduced in size from the original drawing. Read the dimensions on the drawing; they always remain the same.

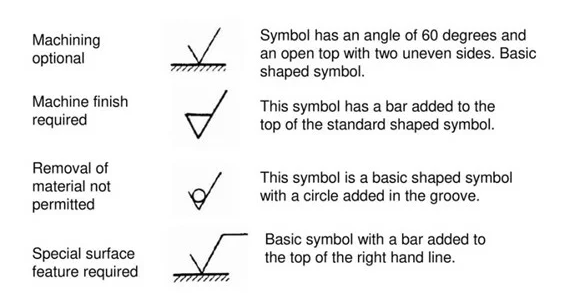
The bill of material block contains a list of the parts and/or material needed for the project. The block identifies parts and materials by stock number or other appropriate number, and lists the quantities requited.



The application block on a blueprint tells you where the part or assembly shown fits into a bigger machine or system. It points out what larger unit the part belongs to.



Finish marks- checkmarks- are used on machine drawings show surfaces to be finished by machining. Machining provides a better surface appearance and a better fit with closely mated parts.

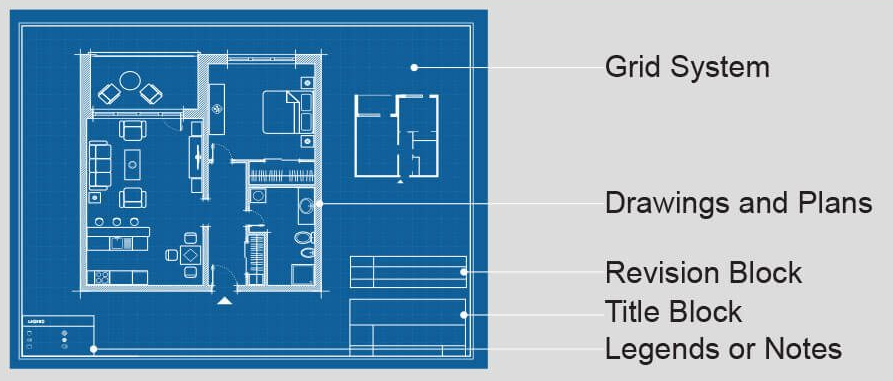


Notes are placed on drawings to give additional information to clarify the object on the blueprint.

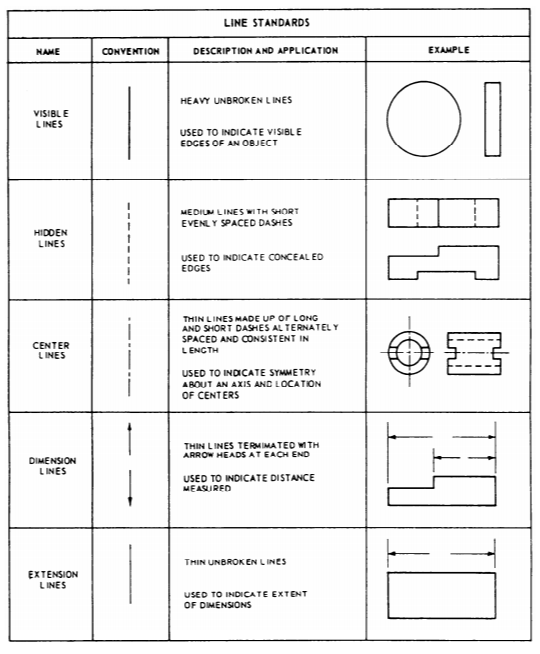


A specification is a statement or document containing a description such as the terms of a contract or details of an object or objects not shown on a blueprint or drawing.

The legend explains or defines a symbol or special mark placed on the blueprint.



Lines in blueprints, also known as engineering drawings, are a visual language that convey important information about the design, dimensions, and features of a structure or component. Different types of lines are used to distinguish between elements, enhance clarity, and convey specific information.



Preliminary plans are submitted with bids or other plans before a contract is awarded.

Contract plans illustrate mandatory design features of a ship.

Contract guidance plans illustrate design features of a ship subject to development.

Standard plans illustrate arrangement or details of equipment, systems, or parts where specific requirements are mandatory.

Type plans illustrate the general arrangement of equipment, systems, or parts that do not require strict compliance to details as long as the work gets the required results.

Working plans are those the contractor uses to construct a ship.

Corrected plans are those that have been corrected to illustrate a final ship and system arrangement, fabrication, and installation.

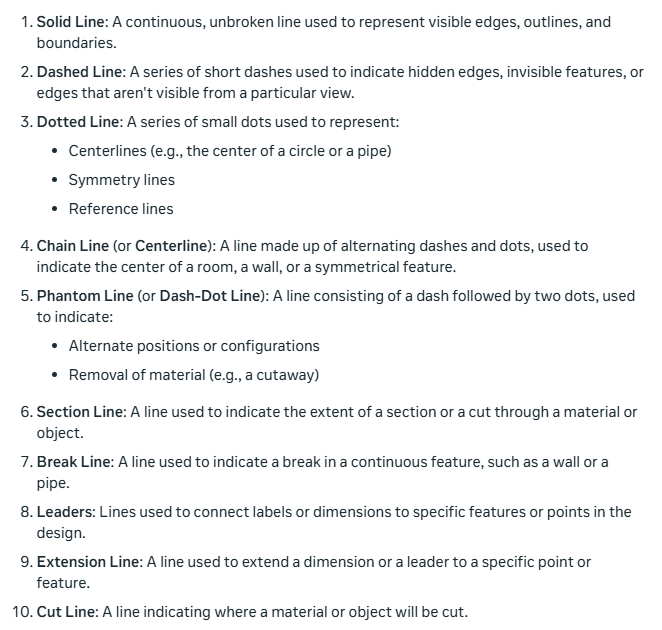
Onboard plans are those considered necessary as reference materials in the operation of a ship.

An SPI (ship’s plan index) lists all plans that apply to a ship except those for certain miscellaneous items covered by standard or type plans.

Blueprints can be fragile documents. Some simple tips to care for them include:

* Keep them out of sunlight to prevent fading
* Try to keep them from grease or other types of chemical smudging
* Don’t make pencil or other notations without authority from proper personnel
* Keep them stored away just as they were received to prevent tearing or folding

Below is a list of common line types in blueprints. Some were already discussed, but this is a more extensive list.



By integrating CAD and CNC, designers and manufacturers can produce high-quality parts with increased efficiency and accuracy, reducing the time and cost associated with traditional manufacturing methods.

The process of preparing engineering drawings on a computer is known as computer-aided drafting (CAD).

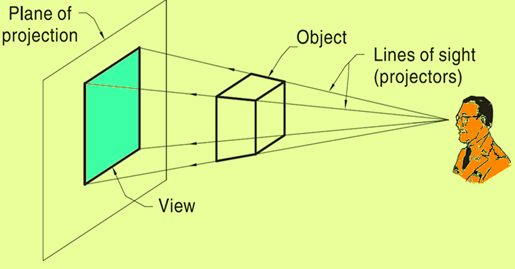
A CNC (Computer Numerical Control) machine is a computer-controlled manufacturing device that uses programming language to execute precise movements and actions, such as cutting, drilling, or shaping, on various materials like metal, wood, or plastic.

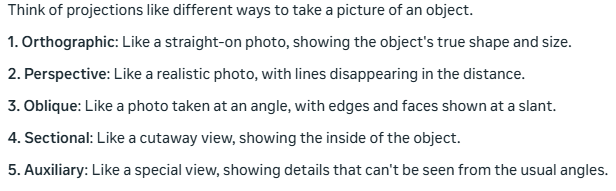
Computer-generated instructions can be stored in a central computer’s memory, or on a disk, for direct transfer to one or more CNC machine tools that will make the parts. This is known as direct numerical control (DNC).

CAM (Computer-Aided Manufacturing) is software used to control machine tools and manufacturing processes by taking a CAD instruction and converting it to machine-readable instructions (G-code).

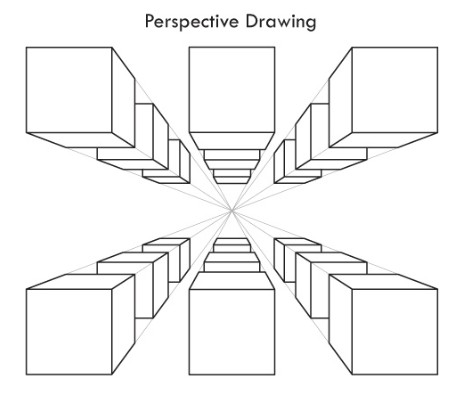
CAD/CAM stands for Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM). It's a combination of two technologies that work together to streamline the design-to-manufacturing process.

In blueprint reading, a view of an object is known technically as a projection. Projection is done, in theory, by extending lines of sight called projectors from the eye of the observer through lines and points on the object to the plane of projection.

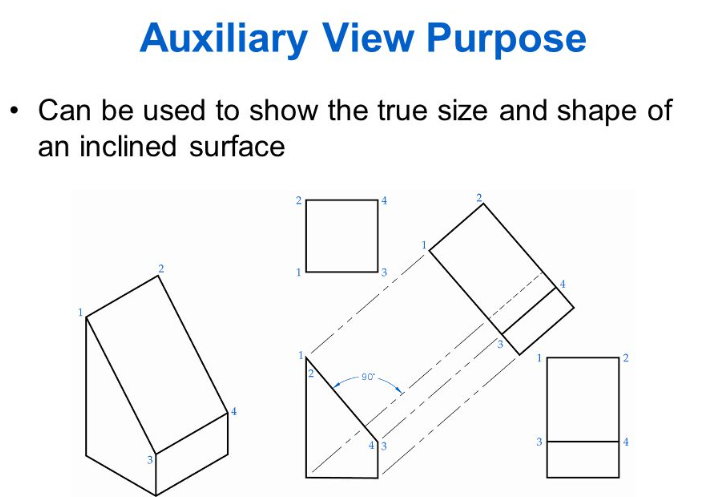




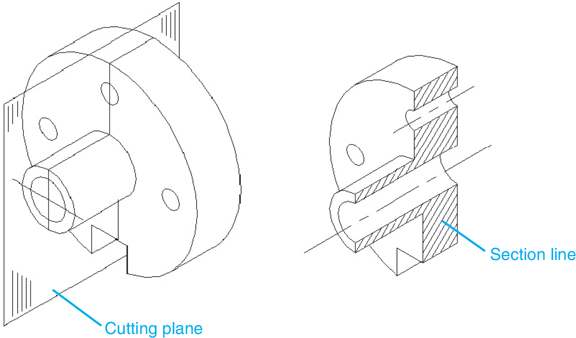
A perspective drawing is the most used method of presentation used in technical illustrations in the commercial and architectural fields. The drawn objects appear proportionately smaller with distance, as they do when you look at the real object.



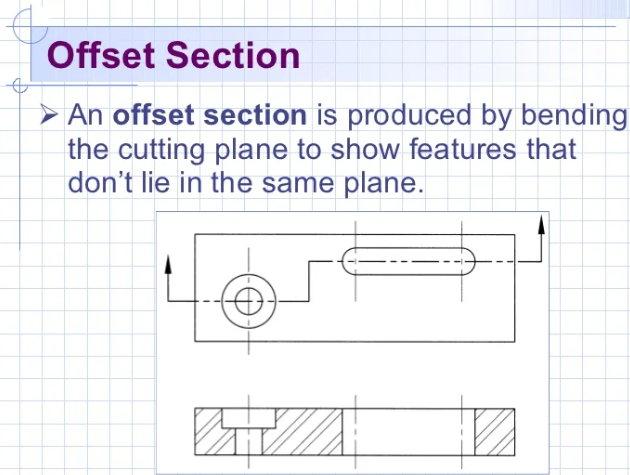
Auxiliary views are often necessary to show the true shape and length of inclined surfaces, or other features that are not parallel to the principal planes of projection.



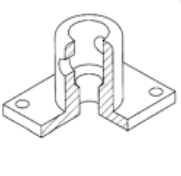
Section views give a clearer view of the interior or hidden features of an object that you normally cannot see clearly in other views. A section view is made by visually cutting away a part of an object to show the shape and construction at the cutting plane. When sectional views are drawn, the part that is cut by the cutting plane is marked with diagonal (or crosshatched), parallel section lines.



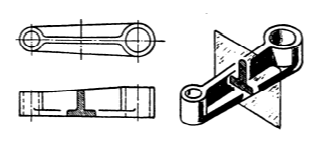
In blueprints, an offset section is a type of view that shows a portion of the building or object at an angle, usually to clarify the relationship between different parts of the structure.



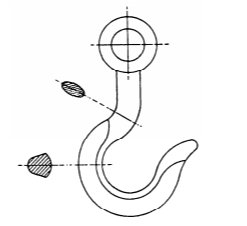
Half section—This type of section is used when an object is symmetrical in both outside and inside details. One-half of the object is sectioned; the other half is shown as a standard view.



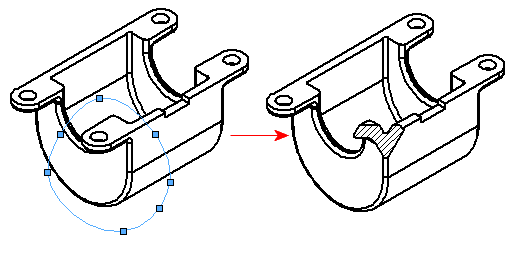
Revolved section—This type of section is used to eliminate the need to draw extra views of rolled shapes, ribs, and similar forms. It is really a drawing within a drawing, and it clearly describes the object’s shape at a certain cross section.



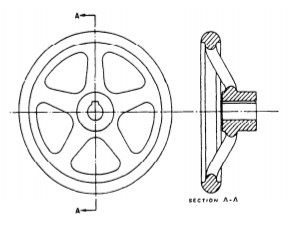
Removed section—This type of section is used to illustrate particular parts of an object. It is drawn like the revolved section, except it is placed at one side to bring out important details.



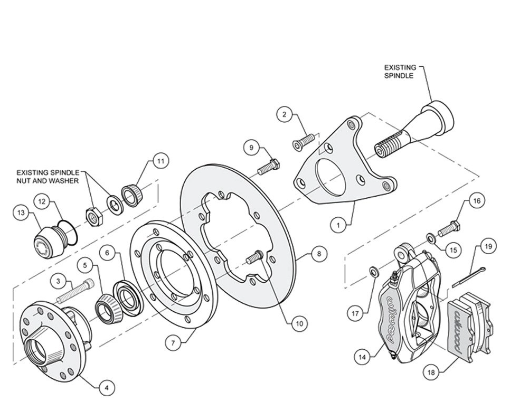
Broken-out section—The inner structure of a small area may be shown by peeling back or removing the outside surface.



An aligned section in blueprints shows angled parts as if they were cut and rotated to face the viewer directly. This makes it easier to see the real shape and size of complex features that aren't straight up-and-down or side-to-side in the main drawing.

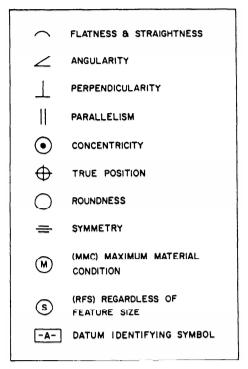


An exploded view in blueprint reading is a diagram that shows all the parts of an object separated but in the correct order. It's like the object has been pulled apart in mid-air, with the pieces floating in their relative positions. This type of view helps show how different parts fit together and makes it easier to understand the assembly process.



A detail drawing is a print that shows a single component or part. It includes a complete and exact description of the part’s shape and dimensions, and how it is made. A complete detail drawing will show in a direct and simple manner the shape, exact size, type of material, finish for each part, tolerance, necessary shop operations, number of parts required, and so forth.

In learning to read machine drawings, you must first become familiar with the common terms, symbols, and conventions.



Tolerances: A tolerance in engineering is the acceptable range of variation for a dimension or measurement. It defines how much a part can deviate from its ideal size or shape while still being considered functional and acceptable.

Fillets are smooth, curved inside corners in metal parts. They make cast metal stronger by helping it cool evenly. This reduces the chance of breaks. Rounds (or radii) are smooth, curved outside corners. They prevent chipping and remove sharp edges. Both fillets and rounds replace sharp angles with gentle curves, but fillets are on the inside and rounds are on the outside.

Slots and slides are used to mate two specially shaped pieces of material and securely hold them together, yet allow them to move or slide.

Keys, keyways, and keysets are used to join rotating parts in machines. A key is a small metal piece that fits into matching slots (keyways) in a shaft and the part it drives. This prevents the parts from spinning separately. The whole assembly is called a keyset. It's a simple way to transfer rotational motion between parts.

Thread classes used to be called "class of fit." The National Bureau of Standards changed the name to "class of thread" in their official standards. However, people will likely keep using the old term "class of fit" for a long time.

HELIX—The curve formed on any cylinder by a straight line in a plane that is wrapped around the cylinder with a forward progression.

EXTERNAL THREAD—A thread on the outside of a member. An example is the thread of a bolt.

INTERNAL THREAD—A thread on the inside of a member. An example is the thread inside a nut.

MAJOR DIAMETER—The largest diameter of an external or internal thread.

AXIS—The center line running lengthwise through a screw.

CREST—The surface of the thread corresponding to the major diameter of an external thread and the minor diameter of an internal thread.

ROOT—The surface of the thread corresponding to the minor diameter of an external thread and the diameter of an internal thread.

DEPTH—The distance from the root of a thread to the crest, measured perpendicularly to the axis.

PITCH—The distance from a point on a screw thread to a corresponding point on the next thread, measured parallel to the axis.

LEAD—The distance a screw thread advances on one turn, measured parallel to the axis. On a single-thread screw the lead and the pitch are identical; on a double-thread screw the lead is twice the pitch; on a triple-thread screw the lead is three times the pitch.