

**D&ID** - Ducting & Instrumentation Diagram

**DA** - Double Acting

**DAC** - Distance / Amplitude Curve

**Dall Tube** - a fluid-flow measurement device, similar to a venturi tube, inserted as a section of a fluid-carrying pipe; flow rate is measured by pressure drop across a restricted throat.

**Damage Tolerance** - the ability of a structure to maintain its load-carrying capability after exposure to a sudden increase in load.

**Damper** - a device for introducing a variable resistance for regulating the volumetric flow of gas or air.

**Damping Capacity** - the ability of a material to absorb mechanical energy during a cycle of reasonably rapid loading and unloading. If a metal rod is set in vibration by hitting it with a hammer, the amplitude of this vibration will slowly decrease as time goes on. This characteristic is called the damping capacity.

**Dashpot** - a mechanical damping device consisting of a cylinder and piston apparatus arranged so as to dampen the movement of a valve stem. A less preferred term; [see Snubber](#).

**Dashpot Cylinder** - that part of the non-return mechanism of a piston non-return valve in which the piston works.

**Datum** - 1) a direction, level, or position from which angles, heights, speeds or distances are conveniently measured; 2) any numerical or geometric quantity or value that serves as a base reference for other quantities or values (such as a point, line, or surface in relation to which others are determined.)

**Davit** - a curved device used as a crane on a ship, such as one of a pair of devices from which a lifeboat is hung and by means of which it can be lowered over the side of a ship.

**DB** - Double Beam

**DBB** - Double Block and Bleed

**DBM** - Design Basis Manual

**DC** - 1) Direct Current, 2) Drain Closed

**DC Voltage** - a voltage that forces electrons to move through a circuit in the same direction continuously, thereby producing a direct current.

**DCS** - Distributed Control System

**DDD** - Draft DEPs for Development

**DDP** - Delivery Duty Paid

**DDU** - Delivery Duty Unpaid

**DE** - De-Energized

**De Energized** - no current is flowing through the coil. The return spring holds the plunger against the body orifice. A normally closed valve is de-energized in a closed position.

**De Superheater** - a type of valve, usually automatic in operation, used for injecting cold water into a steam pipeline to convert superheated steam into saturated steam for certain process conditions.

**Dead Band** - a specific range of values in which an input signal can be altered without causing a change in the output signal.

**Dead Mild Steel** - steel containing 0.07 to 0.15% carbon, suitable for bending, drawing, pressing and flanging.

**Dead Weight Safety Valve** - a safety valve which is loaded by a heavy metal weight, the valve being usually small and the pressure low; also called Cowburn Valve

**Deaerator** - a device in which oxygen, carbon dioxide, or other non-condensable gases are removed from boiler feedwater, steam condensate, or a process stream.

**Deblooming** - the process by which the fluorescence, or bloom, is removed from petroleum oils by exposing them in shallow tanks to the sun and atmospheric conditions or by using chemicals.

**Decalescence** -

**Decalescence** - darkening of a metal surface upon undergoing a phase transformation on heating; the phenomenon is caused by isothermal absorption of the latent heat of transformation.

Decalescence - the absorption of heat that occurs when iron or steel is heated through the **arrest points**.

### **Decarburize -**

Decarburize - removing carbon from the surface layer of a steel or other ferrous alloy by heating it in an atmosphere that reacts selectively with carbon; atmospheres that are relatively rich in water vapor or carbon dioxide are typical deoxidizing atmospheres.

Decarburize - the removal of carbon from the surface of steel by heating in an atmosphere in which the concentration of decarburizing gases exceeds a certain value.

Decarburize - to remove carbon from; also called Decarbonize.

**Declaration of Compliance** - a document in which the manufacturer declares that the electrical apparatus complies with the relevant standard for such apparatus or has an equivalent level of safety.

**Deep Penetration Electrode** - used for the arc welding of heavy steel components. It is economical of weld metal, quick in action and it reduces the need for accurate edge preparation.

**Defect** - a departure of any quality characteristic from its specified or intended value that is severe enough to constitute cause for rejecting the object or service.

**Defects of Steel Ingots** - when molten metal, well above its solidification temperature, is cast into a metal mold, the portion in contact with the cold surface solidifies instantly, while the metal at the center is still in the liquid state. In the beginning, a shower of seed crystals is formed in the outer skin of the cast metal. Growth takes place in all directions but contact is soon made with adjacent crystals, resulting in the formation of very **equiaxed** crystals known as chilled crystals. If the casting temperature is very high, these chilled crystals may remelt and form columnar crystals. Sand cast ingots form equiaxed crystals due to almost uniform cooling rate. Sharp corners in a mold should always be avoided as these form planes of weakness at the junction of the crystal growth.

**Defender** - a machine or facility which is being considered for replacement.

**Deflashing** - removing fins or protrusions from the parting line of a die casting or molded plastics part.

**Deflection** - the amount of bending or twisting of a structure or machine part under load.

Deform - to change the shape of something without breaking it.

### **Deformation -**

Deformation - another term for deflection which also embraces the plastic movement of a structure.

Deformation - any alteration of shape or dimensions of a body caused by stresses, thermal expansion or contraction, chemical or metallurgical transformations, or shrinkage and expansions due to moisture change.

**Deformation Curve** - a curve showing the relationship between the stress or load on a structure, structural member, or a specimen and the strain or deformation that results; also known as Stress-Strain Curve.

**DEG** - Degree

**Degas** - to remove gas from a liquid or solid

**Degasifier** - 1) an element or compound added to molten metal to remove dissolved gases; 2) a process or type of vessel that removes dissolved gases from molten metal.

**Degassing** - the intentional, but controlled, outgassing of a rubber substance or other material.

**Degree of Protection 'W'** - the degree of protection 'W' is intended for internally air-cooled machines with open circuit cooling.

**Degrees of Protection of Enclosures** - an international system of rating standard levels of protection provided by enclosures for the protection of persons against contact with live or moving parts inside the enclosure, as well as the protection provided by an enclosure against ingress of solids and/or liquids. This type of protection classification is in addition to (and not an alternative to) the types of protection necessary to ensure protection against ignition in hazardous (classified) locations. Definitions are found in IEC Publications 529 and 144. This system is similar to the NEMA enclosure rating system in the United States.

**Delivery Duty Paid (DDP)** - shipper pays tax

**Delivery Duty Unpaid (DDU)** - receiver pays tax

**Delivery Order** - an itemized list of materials shipped. The receiver signs and stamps (chops) the Delivery Order upon receipt of goods, and the shipper gets back a signed, stamped copy.

**Delta P** - Differential Pressure. The inlet pressure (P1) minus the outlet pressure (P2).  
Example:  
P1 = 100 psig  
P2 = 25 psig

$$\Delta P = 75$$

**Dendrite** - a crystal which exhibits branched growth.

### **Density** -

Density - mass per unit volume. Common units are kilograms per cubic meter (SI metric), grams per cubic centimeter (CGS metric), pounds per cubic foot (British).

Density - the mass per unit volume of a substance.

Density - the weight per unit volume of a substance.

**Deoxidation** - the process of reduction or elimination of oxygen from molten metal before casting by adding elements with a high oxygen affinity, which forms oxides that tend to rise to the surface.

**DEP** - Design and Engineering Practice

**Dephosphorization** - a partial or complete elimination of phosphorus from steel in basic steel making process, accomplished by forming a slag rich in lime.

**Deposited Metal** - in a weldment, filler metal added to the joint during welding.

### **Depth of Fusion** -

Depth of Fusion - the depth to which a new weld has extended into the underlying metal or a previous weld.

Depth of Fusion - the distance from the original surface that the molten zone extends into the base metal during welding.

**Derate** - to reduce the rating of a component or device.

**Derrick** - metal tower above a well the purpose of which is to lift and lower tubes and tools into the well

**Desalting** - removal of salt from crude oil. Desalting is preferably performed prior to commercialization of the crude. Desalting must be performed prior to refining.

### **Descaling** -

Descaling - 1) the removal of scale from metal surfaces by mechanical or chemical means, such as sand-blasting, shot-blasting, tumbling or pickling; 2) the removal of scale from the inner surface of boilers and tubes.

Descaling - removing adherent deposits from a metal surface, such as thick oxide from hot rolled or forged steel, or inorganic compounds from the interior of boiler tubes; it may be done by chemical attack, mechanical action, electrolytic dissolution or other means, alone or in combination.

**Desiccant** - a substance that removes water, and so can be used as a drying agent to remove water from, or prevent absorption of water by, other substances.

**Design Code** - the code or standard specified by the buyer to which the equipment or piping is to conform.

**Design Load** - the most stressful combination of weight or other forces a building, structure, or mechanical system or device is designed to sustain.

**Design Standards** - generally accepted uniform procedures, dimensions, materials, or parts that directly affect the design of a product or facility.

### **Design Thickness** -

Design Thickness - the sum of required thickness and corrosion allowance utilized for individual parts of a boiler or pressure vessel.

Design Thickness - the sum of thickness required to support service loads. This method of specifying material thickness is used particularly when designing boilers, chemical process equipment, and metal structures that will be exposed to atmospheric environments, soils or seawater.

### **Desorption** -

Desorption - release or outgassing of gases or vapors adsorbed by the interior walls of the

vacuum envelope. Low desorption rates are made possible by selecting correct materials, cleaning processes, optimum surface finish and proper engineering techniques.

Desorption - removing adsorbed material.

**Desulfurization** - an operation that injects a chemical mixture into a ladle full of hot metal to remove sulfur prior to its charging into the Basic Oxygen Furnace. Sulfur enters the steel from the coke in the blast furnace smelting operation, and there is little the steelmaker can do to reduce its presence. Because excess sulfur in the steel impedes its welding and forming characteristics, the mill must add this step to the steelmaking process.

#### **Detent -**

Detent - a catch in a machine that prevents motion until released.

Detent - a catch or lever in a mechanism which initiates or locks movement of a part, especially in **escapement** mechanisms.

Detent - a catch or lever that initiates or prevents movement in a mechanism, especially an escapement.

Detent - a catch which, on removal, initiates the motion of a machine.

**Detruding** - thrusting or forcing down or pushing down forcibly, as when a hole gets punched in a plate, leaving the plate strained.

**Deutsche Industrie Norm (DIN)** - (Abbreviation for German Industrial Standard) - any of a series of technical standards originating in Germany and used internationally, especially to designate electrical connections and film speed.

#### **Dew Point -**

Dew Point - the temperature of a given air water-vapor mixture at which condensation starts.

Dew Point - the temperature of air at which its moisture content will begin to condense. For example when air comes into contact with a cooler surface, droplets of water are formed. The dew point temperature varies with the moisture content (relative humidity) of the air.

**Dezincification** - a form of pitting corrosion which attacks certain zinc bearing copper-based alloys, often called "Yellow Brasses", when in contact with sea water or fresh water that is high in oxygen and carbon dioxide. (ASTM B61 and B62 are "red brasses" and not susceptible to dezincification.)

**DFL** - Diagnostic Film Length

**DFT** - Dry Film Thickness

**Diabatic** - a thermodynamic change of state of a system in which there is a transfer of heat across the boundaries of the system.

**Diagnostics** - information on what tests a device has failed and how they were failed; used to aid in troubleshooting.

**Diagram, Combination** - a drawing using a combination of graphical, cutaway, and pictorial symbols.

**Diagram, Cutaway** - a drawing showing principal internal parts of all components, controls, and actuating mechanisms, as well as all inter-connecting lines and functions of individual components.

**Diagram, Graphical** - a drawing or drawings showing each piece of apparatus including all interconnecting lines by approved standard symbols; also known as Schematic Diagram.

**Diagram, Pictorial** - a drawing showing each component in its actual shape according to the manufacturer's installation.

**Diagram, Schematic** - **see Diagram, Graphical**

**Diamond Indenter** - an instrument that measures hardness by indenting a material with a diamond point.

Diamond Pyramid Hardness - a material hardness determined by indenting a specimen with a diamond pyramid indenter having a 136° angle between opposite faces then calculating a hardness number by dividing the indenting load by the pyramidal area of the impression; also known as Vickers Hardness.

#### **Diamond Pyramid Hardness Test -**

Diamond Pyramid Hardness Test - an indentation hardness test in which a square diamond

pyramid, with an angle between opposite faces of 136 degrees, is forced under a standard load into the surface of the specimen under test. The Diamond Pyramid Hardness (DPH) number is determined by the division of the applied load in kilograms with the surface in square millimeters of the indentation produced, computed by measuring the diagonal of the impression.

**DIAPH - Diaphragm**

**Diaphragm -**

Diaphragm - a dividing membrane or thin partition.

Diaphragm - a flexible material used to separate the control medium from the controlled medium and which actuates the valve stem.

Diaphragm - a flexible pressure-responsive element that transmits force to the diaphragm plate and actuator stem.

Diaphragm - the flow control element of a diaphragm valve or the working element of a diaphragm actuator. It is a flexible membrane that separates regions having different pressures.

**Diaphragm Pressure - see Bench Set**

**Diaphragm Pressure Span** - the difference between high and low values of a diaphragm pressure range.

**Diaphragm Valve -**

Diaphragm Valve - a bi-directional valve which is operated by applying an external force to a flexible element, or diaphragm (typically an elastomer). Diaphragm valves may be used for slurries (where other valve designs might clog) or in hygienic applications.

Diaphragm Valve - a bi-directional valve which is operated by applying an external force to a flexible element, or diaphragm (typically an elastomer). Diaphragm valves may be used for slurries (where other valve designs might clog) or in hygienic applications. There are several types of these valves but the general operation is the same.

Diaphragm Valve - a flexible member which is moved into the fluid flow passageway of a body to modify the rate of flow through the valve.

Diaphragm Valve - a glandless valve, which uses a flexible elastomeric diaphragm as the closing member and in addition, effects an external seal. Diaphragm valves are usually multi-turn in operation and are available as weir type and full bore.

Diaphragm Valve - a type of valve that uses a diaphragm as a flow control element. The diaphragm lines one side of the fluid path and is pushed across the fluid path.

Diaphragm Valve - a valve in which the open-close element is a flexible diaphragm; used for fluids containing suspended solids, but limited to low-pressure systems.

Diaphragm Valve - a valve which relies upon the deflection of a flexible diaphragm, by fluid pressure applied, to shut off the fluid flow.

Diaphragm Valve - a valve with a flexible linear motion closure member that is forced into the internal flow passageway of the body by the actuator. Pinch or Clamp valves and Weir-type valves fall into this category.

Diaphragm Valve - a valve with a flexible linear motion closure component which is moved into the fluid flow passageway of the body to modify the rate of flow through the valve by the actuator.

Diaphragm Valve - closes by means of a flexible diaphragm attached to a compressor. When the compressor is lowered by the valve stem onto a weir, the diaphragm seals and cuts off flow. The diaphragm valve handles corrosive, erosive and dirty services.

**Die -**

Die - 1) in extrusion forming of metal or plastic members, the die is the piece having the opening through which the material is squeezed, the opening giving shape to the item being formed; 2) a tool used for cutting threads on a pipe or bolt; 3) a tool used in a punch press for forming, punching out a shape from flat stock, or piercing metal.

Die - a metal device for shaping or molding a semisoft solid metal or material.

Die - a tool or mold used to impart shapes to, or to form impressions on, materials such as metals and ceramics.

**Die Casting -**

Die Casting - a casting process in which molten metal is forced under pressure into the cavity of a metal mold.

- Die Casting** - a form of casting in which molten metal or plastic is forced under pressure into cooled dies, usually in order to produce large numbers of small items of a particular shape.
- Die Casting** - a metal casting process in which molten metal is forced under pressure into a permanent mold; the two types are hot-chamber and hot-chamber.
- Die Casting** - casting where the mold is in several pieces so it can be taken away from the hardened item made.
- Die Casting** - the casting of metals or plastics in permanent metal molds. Aluminum, zinc, copper, tin, and lead-base alloys are suitable for this purpose.

**Dielectric** - a substance with very low electrical conductivity, i.e., an insulator.

## Differential -

**Differential** - differing or varying according to circumstances or relevant factors.

**Differential** - the difference between two values of a measured quantity, generally the difference between the highest and lowest values of the quantity; also called the Delta of the Quantity.

**Differential Aeration Cells** - Rates of corrosion are related directly to how fast electrochemical reactions can proceed, and they increase with higher temperatures, greater humidity and usually a steady oxygen supply. However, corrosion can occur more rapidly in areas that have a limited oxygen supply, i.e. in concealed corners or under dirt deposits, and these are known as Differential aeration Cells.

**Differential Producing Primary Device** - an instrument that modifies the flow pattern of a fluid passing through a pipe, duct, or open channel, and thereby produces a difference in pressure between two points, which can then be measured to determine the rate of flow.

**Diffuser** - a duct of varying cross section designed to convert a high-speed gas flow into low-speed at an increased pressure.

**Diffusion** - the mixing of two or more substances (solids, liquids, gases, or combinations of them) due to the intermingling motion of their individual molecules. Gases diffuse more readily than liquids; similarly, liquids diffuse more readily than solids.

**Diffusion Welding** - a welding process in which coalescence is produced by the application of pressure at elevated temperatures. At high temperature and pressure, diffusion of atoms takes place to form the weld. The working principle of diffusion welding process is as follows. Every surface has a number of hills and valleys. The layer may also contain oxides, oil, grease, dirt and absorbed moisture. In the first stage high pressure is applied at the portion to be welded. It affects the rough surfaces and disrupts the surface layer. In the next phase heat is applied as a result of which diffusion and grain growth takes place and induces complete metallic bonding across the area of contact. The pressure applied in diffusion welding ranges from 350 to 700 kg/cm<sup>2</sup>. In order to increase diffusion rate, the temperature applied varies from 80° to 1200° C depending upon the characteristics of the materials.

**Digital Valve** - a single valve casing containing multiple solenoid valves whose flow capacities vary in binary sequence (1, 2, 4, 8, 16,...); to regulate flow, the control device sends operating signals to various combinations of the solenoids; applications are limited to very clean fluids at moderate temperatures and pressures, but within these limitations precise flow control and rapid response are possible - an eight element valve, for example, yields flow resolution of 0.39% (1 part in 256).

**Dimensional Analysis** - in scale model analysis of various structures affected by the flow of liquids, the principal of dynamic similarity, applied to determine the relationship between variables, like speed and density of fluid and the length of a scale model compared with that of its full size prototype.

**Dimetcote** - an inorganic zinc coating composed of two materials, 1) a reactive liquid and 2) a finely divided powder which are mixed together. The mixture reacts in place with a steel surface to form an insoluble coating.

## DIN -

**DIN** - abbreviation for the standards institution of the Federal Republic of Germany.

**DIN** - Deutsches Institute fur Normung (German Industrial Standard)

**Diode** - a two electrode electronic component containing merely an anode and a cathode.

**Dipping** - immersion in a bath of liquid to produce a surface treatment such as pickling or

galvanizing.

**Direct Acting** - this term has several different meanings depending upon the device it is describing. A Direct Acting Actuator is one in which the actuator stem extends with an increase in diaphragm pressure. A Direct Acting Valve is one with a push down to close plug and seat orientation. A Direct Acting Positioner or a Direct Acting Controller outputs an increase in signal in response to an increase in set point.

**Direct Acting Instrument** - an instrument in which the air pressure supplied to a controlled device increases as the quantity being measured by the instrument increases.

**Direct Acting Valve** - a normally open valve which requires fluid pressure to close it.

**Direct Action** - 1) a controller in which the value of the output signal increases as the value of the input (measured variable or controlled variable) increases; 2) an actuator that extends the actuator stem when the power supply increases.

**Direct Coupled** - joined without intermediate connections.

**Direct Coupling** - the direct connection of the shaft of a prime mover (such as a motor) to the shaft of a rotating mechanism (such as a pump or compressor).

**Direct Current Arc Welding** - an arc welding process carried out by direct current power supply.

#### **Direct Reduced Iron (DRI) -**

Direct Reduced Iron (DRI) - iron ores that have been reduced to essentially metallic iron by heat and reducing agents, but without melting, and processed into suitable shapes for use as a charge material in a melting operation.

Direct Reduced Iron (DRI) - processed iron ore that is iron-rich enough to be used as a scrap substitute in electric furnace steelmaking. As mini-mills expand their product abilities to sheet steel, they require much higher grades of scrap to approach integrated mill quality. Enabling the mini-mills to use iron ore without the blast furnace, DRI can serve as a low residual raw material and alleviate the mini-mills' dependence on cleaner, higher-priced scrap. The impurities in the crushed iron ore are driven off through the use of massive amounts of natural gas. While the result is 97% pure iron (compared with blast furnace hot metal; which, because it is saturated with carbon; is only 93% iron), DRI is only economically feasible in regions where natural gas is attractively priced.

**Direct Spring Loaded** - in which the load is applied directly to the valve head by spring.

**Direct Weight Loaded** - in which the load is applied directly to the valve head by weight.

#### **Directional Control Valve -**

Directional Control Valve - a control valve serving primarily to direct hydraulic fluid to the point of application.

Directional Control Valve - a valve whose chief function is to control the direction of flow within a fluid system.

Directional Control Valve - a valve whose primary function is to direct or prevent flow through selected passages.

#### **Disc -**

Disc - a generic term for the closing component of a valve, irrespective of its shape, on which the disc face is formed, or to which the disc facing ring is secured. For needle valves the disc may be integral with the stem; also called Flow Control Element or Flow Control Member.

Disc - That part of the plug that contacts the seat and seals off the fluid flow. Valve plugs are sometimes built so that the part of the plug contacting the seat is replaceable. This type of plug is known as the Renewable Disc type. A common example is an ordinary hot water faucet in the kitchen sink. The renewable discs are usually made of a composition material softer than metal. Many valves having all metal or nonrenewable discs have to be "ground in" to restore a damaged seating surface. The term "disc" is sometimes used to refer to the combination of plug and disc.

Disc - the closing component on which the disc face gets formed or to which the disc facing ring gets secured. The disc may be integral with the stem of a needle valve.

Disc - the components carried in the belt eye, on which the disc faces are machined.

Disc - the flow control element of a globe valve, check valve, or butterfly valve.

Disc - the generic term for the closing component, irrespective of its shape, on which the disc face is formed, or to which the disc facing ring is secured. For needle valves the disc may be integral with the stem; also variously called Blade, Door, Vane, Clack,

Flap, Lid, Stopper, Valve Head.

**Disc and Wiper Lubricated Bearing** - a bearing in which a disc mounted on and concentric with the shaft dips into a reservoir of oil. As the shaft rotates, the oil is diverted from the surface of the disc by a scraper action into the bearing.

**Disc Centralizing Device** - a device for centralizing the disc with respect to the body seat along the line of the shaft (s).

**Disc Check Valve** - a type of lift check valve in which the non-return mechanism is, or incorporates, a disc.

**Disc Components** - those parts which are associated, but not integral, with the disc.

#### **Disc Face -**

Disc Face - 1) the seating surface on the disc or on the disc facing ring; 2) machined faces which make contact with body seats when the valve is closed. They may be machined on the disc themselves or on the disc facing rings; also variously called Lid Face, Valve Head Face, Disc Seat.

Disc Face - a machined face which makes close contact with the body seat when the valve is closed. It may be machined on the disc itself or on the disc facing ring.

Disc Face - a machined face which makes contact with the body seat when the valve is closed.

#### **Disc Facing Ring -**

Disc Facing Ring - a ring of a different material to the disc, permanently secured to the disc, on which the disc face gets machined.

Disc Facing Ring - a ring of different material from the disc and permanently secured to it, on which the disc face is machined or formed. NOTE: the term "permanently secured" refers to a ring which is separate and secured in such a way that it can only be removed by machining, such as a weld-deposit ring; also variously called Lid Body, Valve Head Facing, Valve Head Ring, Disc Seat Ring.

Disc Facing Ring - a ring of different material from the valve disc and permanently secured to it, on which the disc face is machined. (The term 'permanently secured' refers to a ring which is separate and secured in such a way that it can only be removed by machining, such as a weld-deposit ring.)

**Disc Facing Ring Bolting** - comprising studs, set screws, nuts or other components used to secure the disc facing ring to the disc.

#### **Disc Guide -**

Disc Guide - 1) the valve part, integral with or separate from the body, cover or body seat ring, in which the non-return mechanism is guided; 2) the part of the non-return mechanism which, when in the form of a pin, engages with the disc guide.

Disc Guide - a valve part, integral with or separate from the body, bonnet or body seat ring, in which the disc or disc holder is guided.

Disc Guide - the part of a valve in which the disc or disc holder gets guided.

#### **Disc Guide Pin -**

Disc Guide Pin - 1) the part of the valve disc or disc holder which, when in the form of a pin, engages with the disc guide; 2) the part of the non-return mechanism which, when in the form of a pin, engages with the disc guide.

Disc Guide Pin - the part of a valve disc or disc holder which, when in the form of a pin, engages with the disc guide.

Disc Guide Pin - the pin which engages with the disc guide in a valve.

#### **Disc Guide Wings -**

Disc Guide Wings - 1) the part of the valve disc, disc holder or disc retaining nut which, when in the form of wings, guides the disc to the body seat; 2) the part of the non-return mechanism which, when in the form of wings, guides the disc to the body seat.

Disc Guide Wings - the part of a valve disc, disc holder or disc retaining nut which, when in the form of wings, guides the disc to the body seat.

Disc Guide Wings - the part of the disc assembly in the form of wings, which guides the disc in a valve.

#### **Disc Holder -**

Disc Holder - a valve part which holds a renewable type of disc.

Disc Holder - that part which hold a renewable type of disc.

Disc Holder - valve face holder

**Disc Hub** - a boss or housing formed on the disc to provide sufficient metal for the accommodation of the shaft.

**Disc Locking Device** - a device for locking the disc in the opened or closed position.

**Disc Non Return** - a non-return valve in which the non-return mechanism is, or incorporates, a disc.

#### **Disc Retaining Nut** -

Disc Retaining Nut - a nut which retains a renewable type disc in the disc holder of a valve.

Disc Retaining Nut - a nut which retains a renewable type disc in the disc holder; also known as Valve Face Retaining Nut, or Valve Head Facing Retaining Nut.

**Disc Seal** - a renewable ring of non-metallic material, made separate from the disc and secured to it, which makes contact with the body seat facing when the valve is closed; also known as Resilient Set Ring, or Sealing Ring.

**Disc Seal Retaining Ring** - a solid or segmented ring to support the disc seal and secure it to the disc; also known as Retaining Ring, or Seal Clamp Ring.

**Disc Seal Retaining Ring Bolting** - comprises stud, set screws and nuts used for securing the disc seal retaining ring to the disc.

**Disc Slip** - a part which restricts the spreading of the discs in the open position.

**Disc Spring** - a spring inserted between the disc to maintain contact between the disc seats and the body seats.

#### **Disc Stem Nut** -

Disc Stem Nut - a nut which secures the stem button or stem end collar in the valve disc or disc holder.

Disc Stem Nut - a nut which secures the stem button or stem end collar in the disc or disc holder; also variously called Disc Nut, Disc Stem Ring, Valve Head Nut, Valve Ring Follower, Gland Follower.

#### **Disc Stem Nut Lock Washer** -

Disc Stem Nut Lock Washer - a device for locking the disc stem nut of a valve.

Disc Stem Nut Lock Washer - a device for locking the disc stem nut; also called Valve Head Nut Lock Washer.

#### **Disc Thrust Plate** -

Disc Thrust Plate - a plate inserted between the stem end and the disc or disc holder to take the thrust of the stem end; also called Valve Head Thrust Plate.

Disc Thrust Plate - a plate inserted between the valve stem end and the disc or disc holder to take the thrust of the stem end.

**Disc Wedge** - the wedge-shaped component of a double disc gate valve, introduced between the discs, which contacts a stop in the body and forces the disc against the body seats when the valve is closed.

**Discharge** - the volume of water which flows through a section of a channel or pipe per second.

**Discharge Channel** - the passage in a pressure-relief device through which the fluid is released to the outside of the device.

#### **Discharge Valve** -

Discharge Valve - a self-acting valve which is used for controlling the rate of discharge of a fluid from a pipe or centrifugal pump.

Discharge Valve - a valve which is used to retard or accelerate flow through a pipe, as distinct from a stop valve.

**Dishing** - in metal-forming or plastics-molding operations, producing a shallow concave surface.

**Dishplate** - the receptacle attached to the valve on which the valve head face is formed.

**Disk Cam** - a disk with a contoured edge which rotates about an axis perpendicular to the disk, communicating motion to the cam follower which remains in contact with the edge of the disk.

**Disk Spring** - a mechanical spring consisting of a dished circular plate and washer supported in such a way that one opposing force is distributed uniformly around the periphery and the second acts at the center. Washer type disk springs are sometimes known as Belleville Washers.

**Dislocation Line** - layers of atoms can slide relative to each other, which explains the malleability of metals and their ability to be formed into complex shapes by mechanical pressure. Sometimes this is not an advantage in structural metals, and

methods of processing are used to prevent the slippage of atoms. The boundary between the slipped and unslipped part of a crystal is known as a Dislocation Line, and these dislocations can be complex. If pressure is put on a metal, dislocations can interact and start to prevent slippage. This mechanism is called Strain Hardening, and there comes a point when the metal cannot be deformed further without fracture.

**Displacement** - the volume of fluid that can pass through a pump, motor, or cylinder in a single revolution or stroke.

**Dissociation** - the breaking up of a compound into simpler components, as with heat or a solvent, frequently in a reversible manner so that the components may recombine.

**Distillate** - 1) the distilled product from a fractionating column; 2) the overhead product from a distillation column; 3) in the oil and gas industry the term distillate refers to a specific product withdrawn from the column, usually near the bottom.

#### **Distillation -**

**Distillation** - a method of purifying a liquid by heating it to boiling point and condensing the vapor formed to a liquid (called the distillate) which is then collected.

**Distillation** - vaporization of a substance with subsequent recovery of the vapor by condensation.

**Divergent** - moving away from each other; for example, the inner wall of a tube that flares outward.

**Diversion** - to flow into the side opening and out both ends (of a 3 way, 2 port valve).

**Diverter** - a three-way valve; the flow can be diverted from one outlet to another, or different inlets can be selected and sent to a common outlet.

#### **Diverter Valve -**

**Diverter Valve** - a valve which can change the direction of the flow of a medium to two or more different directions.

**Diverter Valve** - a valve which can change the direction of the flow of a medium to two, three or more different directions. This will save the user having to connect several single valves and piping together to achieve the same thing.

**DN** - Diameter Nominal (Metric)

**DNC** - Does Not Comply

**DO** - 1) Delivery Order; 2) Drain Open

**Document** - a data medium and the data recorded on it. Documents include drawings, paper documents, tapes, discs, radiographs, etc.

#### **Dog -**

**Dog** - a mechanical gripping device

**Dog** - any of several simple devices for fastening, gripping or holding.

**Dog** - any of various simple devices for holding, gripping, or fastening, such as a hook, rod, or spike with a ring, claw, or lug at the end.

**DOM** - Drawn Over Mandrel

**DOSH** - Department of Occupational Safety and Health

**Double Acting** - 1) acting in two directions, as in a reciprocating compressor or valve actuator where each piston has a working chamber at both ends of the cylinder; 2) an actuator in which the power supply acts both to extend and retract the actuator stem.

**Double Beat Valve** - a hollow cylindrical lift valve having two seating faces at the two ends of only slightly different areas. When exposed to pressure, the valve gets nearly balanced and easily operated. It is used for controlling high-pressure fluids; also called Cornish Valve.

#### **Double Block And Bleed -**

**Double Block and Bleed** - a valve configuration in which positive shut-off is achieved at both the inlet and outlet sides. A small port is fitted to discharge fluid in the intermediate space. Fitting a gas detector to the port provides assurance of the integrity of the upstream seal. This configuration is often required to isolate high pressure sections of a system to facilitate safe maintenance, etc.

**Double Block and Bleed** - a valve configuration in which positive shut-off is achieved at both the inlet and outlet sides. A small port is fitted to discharge fluid or gas in the intermediate space. This port can help a user check if the valve is leaking.

**Double Block And Bleed** - the capability of a valve under pressure to obtain a seal across both the upstream and downstream seat rings and to have its body cavity bled down to atmospheric pressure.

**Double Block and Bleed System** - a valve system configuration in which a full-flow vent valve is installed in a pipeline between two shutoff valves to provide a means of releasing excess pressure between them.

**Double Block and Bleed Valve** - a valve with two seating surfaces which, in the closed position, provides blockage of flow from both valve ends when the cavity between the seating surfaces is vented or drained. A means is provided for draining or venting the cavity between the seating surfaces.

**Double Disc Gate** - a flow control element of a gate valve that has two separate, parallel seating surfaces.

#### **Double Disc Gate Valve -**

**Double Disc Gate Valve** - a gate valve in which the gate consists of two discs forced apart by a spreading mechanism at the point of closure against both parallel body seats to ensure effective sealing of the valve without the help of the fluid pressure.

**Double Disc Gate Valve** - a valve in which the gate consists of two disc which are forced apart by a spreading mechanism at the point of closure against both parallel body seats, thus ensuring an effective sealing of the valve without the assistance of the fluid pressure; also called Parallel Gate Valve.

**Double Flanged Valve** - a valve having flanged ends for connection to pipe flanges by individual bolting.

**Double Seated Valve** - a valve that has two separate seating surfaces in its body. The flow control element comes into contact with both seats when the valve is closed.

**Double Tempering** - a treatment in which normalized or quench-hardened steel is given two complete tempering cycles (cooling to a suitable temperature after each cycle) with the second tempering cycle performed at a temperature at or below the first tempering temperature. The object is to temper any martensite that may have formed during the first tempering cycle.

**Double U Groove Weld** - a welding operation carried out on a workpiece having U-shaped grooves on both sides.

**Double V Groove Weld** - welding carried out on workpieces having V-shaped grooves on both sides.

**Double Welded Butt Joint** - a butt welded joint in which welding operations are performed on both sides.

**Double Welded Lap Joint** - a lap welded joint in which overlapped edges of the members to be joined are welded along the edges of both members.

**Dowel** - a thin cylindrical peg used to join two pieces by fitting into corresponding holes in each piece.

**Downhand Welding** - the welding position in which welding is performed from the upper side of the joint and the face of the weld is approximately horizontal.

#### **Downstream -**

**Downstream** - refining, marketing, supply, and transportation activities in the oil and gas industries.

**Downstream** - the portion of a product stream that has already passed through the system; that portion located after a specific process unit.

**DPDT** - Double Pole Double Throw

**DPI** - Dye Penetrant Inspection

**DPT** - Dye Penetrant Testing

**DPTS** - Draft Petronas Technical Standard

#### **Drag -**

**Drag** - the lower part of a molding flask

**Drag** - the resistance to motion that is encountered by an object traveling through a fluid.

**DRAI** - Drain

**Drain** - an opening in a valve body for the removal of fluid from the valve or the pipeline. It may be filled with a removable plug or with a pipe nipple and a stop valve that is normally closed.

### **Drain Boss -**

**Drain Boss** - a body boss which is used for drainage purposes.

**Drain Boss** - a boss formed on the exterior of a body to provide sufficient metal to permit a tapped connection to drain the outlet side of the valve body.

**Drain Boss** - a boss formed on the exterior of a valve body to provide sufficient metal to permit a tapped connection for drainage purposes.

**Drain Boss** - a boss formed on the exterior of the body to provide for a tapped connection for drainage purposes.

**Drain Boss** - a boss to provide for a tapped connection for drainage purposes.

### **Drain Plug -**

**Drain Plug** - a fitting at the bottom of a valve, the removal of which permits draining and flushing the body cavity.

**Drain Plug** - a plug for sealing a tapped hole in a drain boss.

**Drain Plug** - a plug for sealing a tapped hole in a drain boss.

**Drain Valve** - a valve used to drain off material that has separated from a fluid or gas stream, or one used to empty a process line, vessel, or storage tank.

**Draw** - to make (wire) by pulling metal through successively smaller holes.

### **Drawing -**

**Drawing** - in metal working, the process of pulling a material through a die to reduce its size of shape, or to harden the material.

**Drawn Over Mandrel** - a procedure for producing specialty tubing using a drawbench to pull tubing through a die and over a mandrel, giving excellent control over the inside diameter and wall thickness. Advantages of this technique are its inside and outside surface quality and gauge tolerance. Major markets include automotive applications and hydraulic cylinders.

**Drawpoint** - a steel point used to scratch lines or to pierce holes.

**Dress** - to smooth, finish or shape a material

### **Drift -**

**Drift** - 1) a gradual deviation from a set adjustment, such as frequency or balance current, or from a direction; 2) the deviation, or the angle of deviation, of a borehole from the vertical or from its intended course; 3) to measure the size of a pipe opening by passing a mandrel through it.

**Drift** - a term which is used on occasions to describe creep at normal temperatures when under constant elastic stress; also called Elastic Drift.

**Drift Bolt** - a bolt used to force out other bolts or pins.

**Drift Plug** - a plug that can be driven into a pipe to straighten it or to flare its opening.

**Drill** - a rotating-end cutting tool for creating or enlarging holes in a solid material; also known as drill bit.

**Drill Out** - to locate and delineate the area of a subsurface ore body or of petroleum by a series of boreholes.

**Drill Pipe** - pipe used in the drilling of an oil or gas well. Drill pipe is the conduit between the wellhead motor and the drill bit. Drilling mud is pumped down the center of the pipe during drilling, to lubricate the drill bit and transmit the drilled core to the surface. Because of the high stress, torque and temperature associated with well drilling, drill pipe is a seamless product.

**Drill Press** - a drilling machine in which a vertical drill moves into the work, which is stationary.

**Drilling** - the creation or enlarging of a hole in a solid material with a drill.

**Drive** - 1) to produce motion in something; 2) to make something operate.

**Drive Fit** - a fit in which the larger (male) part is pressed into a smaller (female) part; the assembly must be effected through the application of an external force.

**Drivescrew** - a screw that is driven all the way in, or nearly all the way in, with a hammer.

**Drop** - a casting defect caused by dropping of the upper surface of the mold cavity in the molten metal. This defect occurs in castings due to a) low green strength of sand, b) low mold hardness, and c) insufficient reinforcements in sand projections.

**Drop Forging** - the difference between drop forging and smith forging is that in drop forging closed-impression dies are used and there is drastic flow of metal in the dies due to repeated blows, the impact of which compels the plastic metal to conform to the

shape of the dies.

**Drop Valve** - a conical-seated valve with rapid operation by a trip-gear and return spring.

**Dropping Valve** - a valve which is used for reducing the supply pressure by a constant.

**Dropwise Condensation** - condensation of a vapor on a surface in which the condensate forms into drops.

**Drosometer** - an instrument used to measure the amount of dew deposited on a given surface.

**Dross** - metallic oxides that rise to the surface of molten metal in metallurgical processes.

**Drossing** - removal of scums, oxidized films and solidified metals from molten metals.

**Drum** - tower or vessel in a refinery into which heated products are conducted so that volatile portions can separate.

**Dry Abrasive Cutting** - frictional cutting using a rotary abrasive wheel without the use of a liquid coolant.

#### **Dry Blast Cleaning** -

Dry Blast Cleaning - blasting the surface of a work piece with abrasive material traveling at a high velocity, including sand-blasting.

Dry Blast Cleaning - cleaning of metallic surfaces by blasting with abrasive material traveling at a high velocity; abrasive may be accelerated by an air nozzle or a centrifugal wheel.

Dry Blast Cleaning - using a dry abrasive medium such as grit, sand or shot to clean metal surfaces by driving it against the surface with a blast of air or by centrifugal force.

**Dry Box Process** - the passing of coke-oven or other industrial gases through boxes containing trays of iron oxide coated on wood shavings or other supporting material in order to remove hydrogen sulfide.

**Dry Bulb Temperature** - the temperature of the air indicated by thermometer not affected by the water vapor content of the air.

#### **Dry Bulb Thermometer** -

Dry Bulb Thermometer - a thermometer that is not covered with a wet cloth; **compare with Wet-Bulb Thermometer**

Dry Bulb Thermometer - an ordinary thermometer, especially one with an unmoistened bulb; not dependent upon atmospheric humidity.

**Dry Corrosion** - atmospheric corrosion taking place at temperatures above the dew point.

**Dry Desiccant Dehydration** - the use of silica gel or other solid absorbent to remove liquids from gases, such as water from air, or liquid hydrocarbons from natural gas.

**Dry Film Thickness** - the thickness, in microns, of the dried or cured paint or coating film; abbreviated DFT.

**Dry Galvanizing** - a process in which steel is fluxed in hot ammonium chloride and subsequently dried by hot air before being passed through a path of molten zinc.

**Dry Gas** - gas containing no water vapor.

**Dry Strength** - in casting, when molten metal is poured in the mold cavity, sand adjacent to the hot metal quickly loses its water as steam. The dry sand must possess sufficient strength to resist erosion and pressure of the metal acting on mold walls.

**Dry Test Meter** - a gas-flow rate meter with two compartments separated by a movable diaphragm which is connected to a series of gears that actuate a dial; when one chamber is full, a valve switches to the other empty chamber; it is used to measure household gas-flow rates and to calibrate flow-measurement instruments.

**Dry Welding** - a type of underwater welding carried out in a pressurized enclosure having a controlled atmosphere. The weld metal is not in direct contact with water.

**Drying Oven** - a closed chamber for drying an object by heating at relatively low temperatures.

**DS** - Drilling Supervisor

**DSAW** - Double Submerged Arc Weld

**DSS** - Duplex Stainless Steel

**Dtd** - dated (Abbreviation).

**Dual Gravity Valve** - a float-operated valve that operates on the interface between two **immiscible** liquids of different specific gravities.

**Dual Metal** - two metals of different composition that are fusion bonded at all interfacial surfaces by casting metal of one composition against metal of a second composition.

#### **Dual Sealing Valve** -

**Dual Sealing Valve** - a valve which uses a resilient seating material for the primary seal and a metal to metal seat for a secondary seal.

**Dual Seating** - a valve is said to have dual seating when it uses a resilient or composition material such as TFE, Kel-F, or Buna-N, etc. for its primary seal and a metal-to-metal seat as a secondary seal. The idea is that the primary seal will provide tight shut-off Class VI and if it is damaged the secondary seal will backup the primary seal with Class IV shut-off.

**Duckfoot** - in a piping system, a support fitted to the bend of a vertical pipe to permit the direct load of the pipework and fittings to be transferred to the floor, foundation, or associated installations.

### **Ductile** -

**Ductile** - a material which can be drawn to form wire. The most common ductile metals are mild steel, wrought iron, copper, lead and light alloys.

**Ductile** - describes metal that can be stretched, drawn or hammered thin without breaking; not brittle.

**Ductile** - the capacity of metal to be stretched or pressed into shape; pliable.

**Ductile Cast Iron** - cast iron in which the free graphite has been induced to form as nodules by adding cerium or magnesium in the molten state, which gives a marked increase in ductility; [see Cast Iron](#).

**Ductile Fracture** - a type of fracture in any material where substantial deformation has occurred away from fracture surfaces, usually associated with yielding in materials; [see Fibrous Fracture](#).

**Ductile Iron** - a cast iron that has been treated in the liquid state so as to cause substantially all of its graphitic carbon to occur as spheroids or nodules in the as-cast condition.

### **Ductility** -

**Ductility** - a property of a metal describing the degree to which it can deform beyond its elastic limit before breaking; (opposite of brittleness)

**Ductility** - ability of steel to undergo permanent changes in shape without fracture at room temperature.

**Ductility** - the ability of a material to undergo large permanent deformations in tension i.e., property which enables a material to be drawn into a wire.

**Ductility** - the ability of a metal to be drawn into wires without breaking. Copper, mild steel, aluminum etc. are ductile and hence can be drawn into wires.

**Ductility** - the property of a metal that indicates its relative ability to deform without fracturing; it is usually measured as percent elongation or reduction of area in a uniaxial tensile test.

**Ductility** - this is the term used when plastic deformation occurs as the result of applying a tensile load. A ductile material combines the properties of plasticity and tenacity (tensile strength) so that it can be stretched or drawn to shape and will retain that shape when the deforming force is removed. For example, in wire drawing the wire is reduced in diameter by drawing it through a die.

**Ductility and Brittleness** - the ability of a metal to deform plastically without fracturing. It is most commonly measured by means of elongation and reduction of area in a tensile test.

### **Dump Valve** -

**Dump Valve** - a large valve in the bottom of a tank or container that can quickly empty the tank in an emergency.

**Dump Valve** - a large valve located at the bottom of a tank or container used in emergency situations to empty the tank quickly; for example, equipped with a body that discharges its contents by gravity.

**Dunnage** - padding material placed in a container to protect shipped goods from damage.

**Duplex** - consisting of two parts working together or in a similar fashion.

**Duplex (Austenitic / Ferritic) Stainless Steel** - a stainless steel whose microstructure at room temperature consists primarily of a mixture of austenite and ferrite.

### **Duplex Stainless Steel** -

**Duplex Stainless Steel** - a category of stainless steel with high amounts of chromium and moderate nickel content. The duplex class is so named because it is a mixture of austenitic (chromium-nickel stainless class) and ferritic (plain chromium stainless

category) structures. This combination was originated to offer more strength than either of those stainless steels. Duplex stainless steels provide high resistance to stress corrosion cracking (formation of cracks caused by a combination of corrosion and stress) and are suitable for heat exchangers, desalination plants, and marine applications.

**Duplexed System** - a system with two distinct and separate sets of facilities, each of which is capable of assuming the system function while the other assumes a standby status; also known as Redundant System.

**Durham Fitting** - in plumbing, pipe fitting used for drainage and vent piping systems where the threads of the fitting are recessed so the inside diameter of the fitting matches the inside diameter of the pipe to provide a smooth water passageway.

#### Durometer -

Durometer - a) an instrument for measuring the hardness of rubber. Measure the resistance to the penetration of an indenter point into the surface of rubber; b) a numerical scale of rubber hardness.

Durometer - an instrument consisting of a small drill or blunt indenter point under pressure; used to measure hardness of metals and other materials.

**Durometer Hardness** - the hardness of a material as measured by a durometer.

**Duty** - the statement of the load(s) to which the machine is subjected, including, if applicable, starting, electric braking, no-load and rest and de-energized periods, and including their duration and sequence in time.

**Dye Penetrant** - a low viscosity liquid containing a dye used in nondestructive examination to detect surface discontinuities such as cracks and laps in both magnetic and nonmagnetic materials.

**Dye Penetrant Inspection** - it is used for detecting surface porosity or cracks, more particularly in non-magnetic substances. The part to be examined gets cleaned and coated with a dye which penetrates any small cracks or openings. The surface then gets wiped clean and coated with a white powder. The dry powder soaks up the dye which is still held in the defects and thereby indicates their position.

#### Dynamic -

Dynamic - an application in which the seal is subject to movement or moving parts contact the seal.

Dynamic - of force relating to movement

**Dynamic Creep** - creep resulting from fluctuations in a load or temperature.

**Dynamic Hardness Number** - the number which is given by a Herbert pendulum or a Shore Scleroscope; also called Rebound Hardness.

**Dynamic Leak Test** - a type of leak test in which the vessel to be tested is evacuated and an external tracer gas is applied; an internal leak detector will respond if gas is drawn through any leaks.

**Dynamic Load** - a load exerted on a bearing in motion.

**Dynamic Packing** - a packing used in a joint whose members are in relative motion.

**Dynamic Penetration Test** - a test which is similar to the **Raymond standard test**.

**Dynamic Performance** - the speed that a check valve closes.

**Dynamic Seal** - a seal required to prevent leakage past parts which are in relative motion.

**Dynamic Torque** - turning force exerted on a valve stem due to fluid flow through the valve, and its effect on the closure element.

**Dynamic Unbalance** - the total force produced on the valve plug in any stated open position by the fluid pressure acting upon it. The particular style of valve; (i.e. single-ported, double-ported, flow-to-open, flow-to-close) has an effect on the amount of dynamic unbalance.

#### Dynamics -

Dynamics - that branch of mechanics which deals with the motion of a system of material particles under the influence of forces, especially those which originate outside the system under consideration.

Dynamics - the study of the motion of objects and the forces that cause such motion.

#### Dyne -

Dyne - a unit of force that will accelerate a particle having a mass of one gram, one centimeter

per second per second. Derived from the Greek word for power.

Dyne - the unit of force in centimeter-gram-second system of units, equal to the force which imparts an acceleration of  $1 \text{ cm/s}^2$  to a 1 gram mass.

**E** - 1) Essential; 2) hydrocarbon, multiphase, sweet

**E&P** - Exploration And Production

**E45B** - Elbow 45 degree Butt-Weld Ends

**E90B** - Elbow 90 degree Butt-Weld Ends

**EAI** - End Area Inspection

**Ear** -

Ear - a permanent projection on an object for its support; also called a Lug

Ear - a projection integral with, or attached to, an object, for supporting it, or attaching another part to it pivotally; also called Fin Plate, Lug.

**Easing Lever** - a lever by which the valve head may be manually eased off its seat

**EBD** - Emergency Blowdown

**EBW** - Electron Beam Welding

**EC** - 1) European Council; 2) hydrocarbon, multiphase, corrosive

**ECC** - Eccentric

**Eccentric** -

Eccentric - a circle or disk mounted off center.

Eccentric - distant from a center

Eccentric - not concentric

Eccentric - not having the same center

Eccentric - said of an orbit: not circular; said of a wheel: not having the axis at the center.

**Eccentric Disc** - an offset disc, used in high performance butterfly valves.

**Eccentric Gear** - a gear whose axis deviates from the geometric center.

**Eccentric Orifice** - an orifice whose centre does not coincide with the centerline of the pipe or tube; usually, the eccentricity is toward the bottom of a pipe carrying flowing gas and toward the top of a pipe carrying liquid, which tends to promote the passage of entrained water or air rather than allowing entrained water or gas to build up in front of the orifice.

**Eccentric Reducer** - a threaded or butt-welded fitting for pipes whose ends are not the same size and are eccentric to each other.

**Eccentric Valve** - a rubber-lined slurry or fluid valve with an eccentric rotary cut-off body to reduce corrosion and wear on mechanical moving valve parts.

**Eccentricity** - the distance of the geometric center of a revolving body from the axis of rotation.

**Edge Preparation** - a prepared contour on the edge of the workpieces to be welded.

**Edge Rolling** - rolling a strip of steel to smooth the edges. By removing the burr off the coil; it is safer for customers to manipulate; also called Edge Conditioning.

**EDMS** - Electronic Document Management System

**Effective Area (for a Diaphragm Actuator)** - the effective area is that part of the diaphragm area that is effective in producing a stem force. Usually the effective area will change as the valve is stroked - being at a maximum at the start and at a minimum at the end of the travel range. Flat sheet diaphragms are most affected by this, while molded diaphragms will improve the actuator performance, and a rolling diaphragm will provide a constant stem force throughout the entire stroke of the valve.

**Effective Depth** - the thickness of weld overlay or back cladding having the specified chemical composition.

**Effective Discharge Area** - a nominal or calculated area of flow through a pressure relief valve for use in flow formulas to determine valve capacity.

**Efficiency** - the ratio of the output power to the input power, generally expressed as a percentage.

**Effluent** - mixture of oil, gas, water and sand discharged from a well.

**Egress** - to go out or depart; (opposite of Ingress)

**EHS** - Environment, Health and Safety

**EIS** - Electrochemical Impedance Spectroscopy

**Elastic** -

Elastic - a material is said to be elastic if it expand or contracts by amounts which can be calculated, regaining its original shape on the removal of known loads.

Elastic - capable of sustaining deformation without permanent loss of size or shape.

**Elastic Aftereffect** - the delay of certain substances in regaining their original shape after being deformed within their elastic limits; also known as Elastic Lag.

**Elastic Body** - a solid body for which the additional deformation produced by an increment of stress completely disappears when the increment is removed; also known as Elastic Solid.

### **Elastic Deformation** -

Elastic Deformation - any change in shape in response to an applied force in which the initial shape is recoverable with no **sensible** time delay when the applied force is removed.

Elastic Deformation - reversible alteration of the form or dimensions of a solid body under stress or strain.

**Elastic Failure** - failure of a body to recover its original size and shape after a stress is removed.

**Elastic Hysteresis** - a phenomenon exhibited by some solids in which the deformation of the solid depends not only on the stress applied to the solid but also on the previous history of this stress; analogous to magnetic **hysteresis**, with magnetic field strength and magnetic induction replaced by stress and strain respectively.

**Elastic Lag** - **see Elastic Aftereffect**

### **Elastic Limit** -

Elastic Limit - the greatest stress a material can withstand without permanent elongation when the load is removed the sample will return to its original length.

Elastic Limit - the limiting value of the force deforming a body beyond which it does not return to its original shape and dimensions after the force gets removed; that is, no permanent deformation. For steels it is usually regarded to coincide with the limit of proportionality.

Elastic Limit - the maximum stress a solid can sustain without undergoing permanent deformation.

Elastic Limit - the maximum stress to which a material may be subjected without any permanent strain remaining upon complete release of stress.

Elastic Limit - the maximum unit stress to which a material can be subjected and still be able to return to its original form after removal of stress.

**Elastic Modulus** - **see Modulus of Elasticity**

### **Elastic Ratio** -

Elastic Ratio - the ratio of the elastic limit to the ultimate strength of a solid.

Elastic Ratio - the ratio of the elastic limit to the ultimate strength of a material.

**Elastic Recovery** - that **fraction** of a given deformation of a solid which behaves elastically.

**Elastic Solid** - **see Elastic Body**

### **Elastic Strain** -

Elastic Strain - 1) strain in a material which disappears with the removal of the straining force; 2) the amount of such a strain.

Elastic Strain - the recoverable strain or fractional deformation undergone by a material, i.e. that which disappears as the straining force is removed.

**Elastic Strength** - the greatest stress which a bar or structure is capable of sustaining within the elastic limit.

### **Elasticity** -

Elasticity - the ability of a material to deform and return to its original shape after removal of the load.

Elasticity - the ability of a material to deform under load and return to its original size and shape when the load is removed.

Elasticity - the ability of a material to undergo deformation upon the application of external forces and to regain its original shape or form when these forces are removed. All metals are elastic to some extent. Rubber is an excellent example of elastic materials.

Elasticity - the degree to which a material can be stretched, twisted, bent, or otherwise deformed and return to its original dimensions when the applied force is removed.

Elasticity - the existence of forces which tend to restore to its original position any part of a medium (solid or fluid) which has been displaced.

Elasticity - the property of a body which returns, or tends to return, the body to its original size or

shape after deformation by external forces.

Elasticity - the property of an article which tends to return to its original shape after deformation.

Elasticity - the tendency of a body to return to its original size and shape, after having been stretched, compressed or deformed. The ratio of the stress in the body to the strain is termed as the Coefficient or Modulus of Elasticity.

**Elasticity Modulus** - [see Modulus of Elasticity](#)

### **Elastomer** -

Elastomer - a general term for high polymers having the property of extensibility and elastic recovery, i.e., the ability to be stretched and to retract rapidly to approximately the original size; [see Polymer](#).

Elastomer - a material that can be stretched to approximately twice its original length with relatively low stress at room temperature, and which returns forcibly to about its original size and shape when the stretching force is released.

Elastomer - a natural or synthetic elastic material, often used for o-ring seals. Typical materials are Viton; Buna-n; EPDM (ethylene propylene dimonomer), etc.

Elastomer - a synthetic, non-metallic, rubber-like substance that may experience large and reversible elastic deformations (as in a rubber band).

Elastomer - any of various plastic materials resembling rubber which can be stretched and which return to their original dimensions when released.

Elastomer - any synthetic or natural material with resilience or memory sufficient to return to its original shape after major or minor distortion.

Elastomer - refers to rubber-like materials which have resilience. After they are stretched, they return to their original shape.

Elastomer - synthetic rubber

**Elastomeric** - a highly flexible material which can be extruded and is used primarily as a sealant and as a preformed joint filler. Some elastomerics also have adhesive properties.

**Elastomeric Energized Liner** - a resilient elastomeric ring under the main liner in a butterfly valve body is compressed by the disk acting through the main liner, thus generating a resilient sealing action between the disk and the main liner.

**Elastoplasticity** - the state of a substance subjected to a stress greater than its elastic limit but not so great as to cause it to rupture, in which it exhibits both elastic and plastic properties.

### **Elbow** -

Elbow - 1) a fitting that connects two pipes at an angle, usually 90 degrees but may be any other angle less than 100 degrees; 2) a sharp bend in a pipe.

Elbow - a fitting that connects two pipes at an angle, often of 90 degrees.

**Elbow Meter** - a pipe elbow used as a liquids flow meter; flow rate is measured by determining the differential pressure developed between the inner and outer radii of the bend by means of two pressure taps located midway on the bend.

**Electric Actuator** - [see Actuator, Electric](#)

### **Electric Arc Furnace (EAF)** -

Electric Arc Furnace (EAF) - these furnaces make use of electric current at low voltage and high amperage. Graphite electrodes are used for producing arc. These may be direct arc type, indirect arc type or induction type.

Electric Arc Furnace (EAF) - steelmaking furnace where scrap is generally 100% of the charge. Heat is supplied from electricity that arcs from the graphite electrodes to the metal bath. Furnaces may be either an alternating current (AC) or direct current (DC). DC units consume less energy and fewer electrodes, but they are more expensive.

**Electric Failsafe Actuator** - electrically driven actuator that contains an internal spring to close the valve on loss of electricity.

**Electric Motor Operator (EMO)** - [see Actuator, Electric](#)

**Electric Resistance Welded (ERW) Pipe** - pipe made from strips of hot-rolled steel which are passed through forming rolls and welded. While seamless pipe is traditionally stronger and more expensive than comparable ERW pipe, ERW technology is improving and the technique now accounts for approximately 48% of OCTG shipments by tonnage.

**Electric Resistance Welding** - a form of plastic welding in which high currents at low voltage are

passed through the metal to be joined or welded, causing a local heating due to their resistance to flow of current. The heat raises the work temperature to the welding heat and the metals are simultaneously pressed together by mechanical pressure, forcing the two pieces to join together to form a weld. The metallic pieces to be joined are placed between two water-cooled copper electrodes incorporating a low-pressure circuit. The heat required for resistance welding is generated by passing a large electrical current of the order of 3000 to 100,000 amps with a voltage between 1 and 25 through two pieces of metal.

**Electrical Apparatus Category 'ia'** - an electrical apparatus that is incapable of causing ignition in normal operation, with a single fault and with any combination of two faults applied, with safety factors of 1.5 in normal operation and with one fault and 1.0 with two faults.

**Electrical Apparatus Category 'ib'** - an electrical apparatus that is incapable of causing ignition in normal operation and with a single fault applied, with safety factors of 1.5 in normal operation and with one fault and 1.0 with one fault, if the apparatus contains no unprotected switch contacts in parts likely to be exposed to a potentially explosive atmosphere and the fault is self revealing.

**Electrical Steel** - [see Silicon Electrical Steel](#)

**Electro Slag Welding** - a welding process in which the weld is produced by the molten slag which melts the filler metal and the surfaces of the workpieces to be welded. In this process, firstly, the arc is initiated between the filler metal electrode and the workpiece. This arc heats the flux and melts it to form a slag. The arc is then extinguished and the slag is maintained in the molten condition by the resistance offered by it to the flow of electric current between the electrode and the work piece. Molten slag also acts as a shield to the molten metal. In the beginning an electric arc is struck between the electrode and the workpiece and flux is added. The heat of arc melts the molten metal. Then the arc is stopped and the slag is maintained in the molten state by the resistance to the electric current passing between the electrode and the workpiece through it. The inside temperature of the molten metal pool is nearly 1950° C and the outside temperature is nearly 1650° C. This temperature is sufficient to melt the base metal and filler material, to form a strong weld after solidification. It is a progressive process of melting as solidification takes place from the bottom towards upward direction. The welding flux used in electro slag welding reduces oxidation, removes impurities from the molten metal and has a small rate of consumption.

**Electrode** -

Electrode - a conductor through which electricity enters or leaves something.

Electrode - a conductor which leads an electric current into a welding implement.

Electrode - a material in the form of a wire or a rod through which current for welding is conducted between the electrode holder and the arc. (Electrodes used generally are of parent metal, tungsten and carbon).

Electrode - a material in the form of a wire or a rod through which current is conducted between the electrode holder and the arc. (Electrodes used generally are of parent metal, tungsten and carbon.)

**Electrode Holder** - a mechanical device used for holding electrodes.

**Electrode Lead** - the electrical conductor used for conducting electricity between the electrical source and the electrical holder.

**Electro galvanizing** - a continuous process used to produce a zinc coating on steel sheet by electroplating. Both sulfuric or hydrochloric acid solutions are used. The most common method uses sulfuric acid with insoluble anodes. Produces thin coatings generally less than 10 um (0.4 mils) thick.

**Electro gas Welding** - a gas metal-arc welding process in which an external shielding is formed by the gas and the molding shoe confines the molten metal for vertical position weldings. This process has been developed from electro slag welding. The two methods commonly used in electro slag welding are (a) solid electrode process, and (b) flux cored electrode process.

**Electroless** - nickel-plating using chemical rather than electrical means.

**Electroless Nickel Plating** - used on metals for the purpose of improving the wear resistance of the base metal (carbon steels and stainless steels). Also used for the purpose of

corrosion protection. It may be used for operating temperatures up to 200° Celsius, but in the presence of hydrogen sulfide or sulfur compounds, the maximum operating temperature should be restricted to 80° Celsius; abbreviated ENP.

**Electrolysis** - decomposition by electric current

**Electromanometer** - an electronic instrument used for measuring the pressure of gases or liquids.

### **Electron Beam Welding -**

**Electron Beam Welding** - a fusion welding process where the heat required for fusion is obtained from the kinetic energy of a dense beam of high velocity electrons that are directed at the joint to be welded. Before welding the workpieces are thoroughly cleaned and demagnetized. Demagnetization is necessary, as a small amount of magnetism in materials causes deflection in the electron beam. The workpieces are then placed in the welding chamber and the distance between the electron gun and the job is adjusted. The chamber is pumped down to the required vacuum. The voltage and current required are adjusted and the equipment is switched on. The welding proceeds automatically to form a coalesced mass.

**Electron Beam Welding** - using an electron beam for fusing the metal to make a joint.

**Electron Volt** - a unit of energy in atom calculations, equal to  $1.602 \times 10^{-12}$  ergs.

### **Electroplate -**

**Electroplate** - a process of putting a thin layer of metal onto another metal by electrolysis. The metal to be plated is dipped into a conducting solution (called the electrolyte). Electrons from the metal to be deposited (called the anode) flow to, and are deposited on, the metal to be plated which acts as the cathode.

**Electroplate** - to coat an object with metal by electrolysis.

**Electroplating** - a batch process used to produce a zinc coating on manufactured articles. These may be functional (for corrosion protection) or decorative coatings. Electric current is used to force the deposition of negatively charged zinc ions from an acid solution onto the positively charged cathode, which is the article to be coated. Produces thin coatings generally less than 10  $\mu\text{m}$  (0.4 mils) thick.

**Electroplating** - electroplating is carried out for several reasons, one of which of course is corrosion protection; another application is to impart a decorative finish. One special application is in the case of gauges, where a layer of chrome can be deposited to give an improved measure of wear resistance. The process of electroplating, as the name suggests, involves the use of an electric current and relies on the fact that when a direct current flows from a positive anode to a negative cathode, in the presence of a conducting fluid, then atoms of the anode are carried to and deposited on to the cathode. Nuts, bolts and washers are sometimes electroplated with cadmium to resist corrosion.

**Element** - 1) any one of the 105 known substances that cannot be split by chemical means into simpler substances; 2) a piece, segment, or feature; part of a larger whole.

**ELL** - Elbow

### **Elongation -**

**Elongation** - 1) the total extension produced in a tensile test and determined after fracture by holding together the pieces of the fractured tensile test piece, and measuring between pop marks applied beforehand. It is expressed as a percentage of the original gauge length, which should also be given. It is a measure of the ductility of the steel. 2. the extension produced, as in rolling.

**Elongation** - in tensile testing, the increase in the gage length, measured after fracture of the specimen within the gage length, usually expressed as a percentage of the original gage length.

**Elongation** - it generally means "ultimate elongation" or percent increase in original length of a specimen when it breaks.

**Elongation** - the fractional increase in a material's length due to stress in tension or to thermal expansion.

**Elongation** - the ratio of stress to strain within the elastic limit. It is a measure of stiffness.

**Elongation** - the ratio of the increase in gauge length to the original gauge length expressed in percentage.

**Elongation** - the total extension produced in a test specimen during a tensile test. It is expressed

as a percentage of the original length of the specimen.

**Elute** - to wash out or remove by dissolving.

**Elutriation** - separation of fine, light particles from coarser, heavier particles by passing a slow stream of fluid upward through a mixture so that the finer particles are carried along with it.

### **Embrittlement** -

**Embrittlement** - a reduction in toughness developing after heat treatment or over a period of service. Some metals and plastics exhibit reduced impact toughness at subzero temperatures or may degrade at ordinary temperatures in ways which reduce their ability to absorb energy when stressed to the point of fracture.

**Embrittlement** - reduction or loss of ductility or toughness in a metal or plastic with little change in other mechanical properties.

**Embrittlement Cracking** - a form of metal failure that occurs in steam boilers at riveted joints and at tube ends, the cracking being predominantly intercrystalline.

**EMEPMI** - ExxonMobil Exploration and Production Malaysia Incorporated

**Emergency Panel** - the main panel to shut off all the mechanical valves. The panel is located at a safe distance from the valves to be operated.

### **Emergency Shut Down Valve** -

**Emergency Shut Down Valve** - used for critical service duties; abbreviated ESD Valve

**Emergency Shutdown Valve** - ESVs are hydraulic, pneumatic and motor-operated rising stem gate valves or ball valves, the largest percentage being ball valves with hydraulic actuators. The ESVs are intended to isolate each section of a platform in the event of a line break or fire, preventing hydrocarbons from flowing into the affected system. They isolate the platform from both the oil / gas source and the distribution headers. They are also located in other flow streams on the platform. An emergency shutdown control system monitors many parameters and periodically sends automatic signals to the valves to isolate the platform during emergency shutdown events. The valves are also connected to the platform's main control system, a separate system.

**EMI** - Electro-Magnetic Inspection

**EMR** - Extra Moisture Resistant

**EMU** - European Economic Monetary Unit

**Encapsulated Body Liner** - in a butterfly valve body, all surfaces of the body are covered by a continuous surface layer of a different material, usually an elastomeric or plastic material. A soft elastomer behind a harder encapsulating material may be used to provide interference for disk and stem sealing areas.

**Encapsulation** - an international term describing a type of protection in which the parts that could ignite an explosive atmosphere by either sparking or heating are enclosed in an encapsulant in such a way that this explosive atmosphere cannot be ignited. This type of protection is referred to by CENELEC as "Ex m" in draft standard EN50028. NOTE: encapsulation is the potting or casting of electrical components with epoxy, elastomer, silicone, asphaltic, or similar compounds for the purpose of excluding moisture or vapors.

### **End Connection** -

**End Connection** - the configuration provided to make a pressure tight joint to the pipe carrying the fluid to be controlled.

**End Connection** - the configuration provided to make a pressure-tight joint to the pipe carrying the fluid to be controlled. The most common of these connections are threaded, flanged, or welded.

**End Connection** - the type of connection supplied on the ends of a valve which allows it to be connected to piping; may be Weld End, Flanged End, Threaded or Socket Weld.

**End Connections, Flanged** - end connections incorporating flanges that mate with corresponding flanges on the piping.

**End Connections, Split Clamp** - end connections of various proprietary designs using split clamps to apply gasket or mating surface loading.

**End Connections, Threaded** - end connections incorporating threads, either male or female.

**End Connections, Welded** - end connections that have been prepared for welding to the line pipe or other fittings. May be butt weld (BW), or socket weld (SW).

**End Quench Test** - see Jominy Test

### **End to End Dimension** -

End To End Dimension - see Face to Face Dimension and Center to End Dimension

End to End Dimension - the length of a non-flanged-end valve; *compare with* Face to Face

**Endothermic Reaction** - any process, especially a chemical reaction, that involves the absorption of heat.

### **Endurance Limit** -

Endurance Limit - in fatigue testing, the maximum stress for any material below which fractures will not occur. For steel this limit will get reached after from 6 to 10 million cycles of stress.

Endurance Limit - the maximum stress that a member subjected to a completely reversed load can withstand for an infinite number of load applications without failure; also called Fatigue Limit.

**Energized** - current is flowing through the coil. The magnetic flux resulting from electricity passing through the coil forces the plunger to pull against the end stop. When a normally closed valve is energized, the valve opens and stays open until the electrical current stops.

**Energy** - the ability or capacity to do work.

**Engage** - to cause part of a machine (such as the gears) to fit into and lock with another part.

**ENP** - Electroless Nickel Plating

**Ensis MD** - an easily removable rust protective fluid, manufactured by Shell.

**EO** - Ethylene Oxide

**EOR** - Enhanced Oil Recovery

**EP** - 1) Exploration and Production; 2) Ethylene-Propylene (Nordel)

**EPDM** - Ethylene-Propylene (Nordel)

**EPM** - Ethylene Propylene Rubber (Keltan)

**EPMI** - Esso Production Malaysia, Inc.

**Epoxy** - any of a group of synthetic thermosetting resins that are tough, resistant to abrasion and chemical attack, and forms strong adhesive bonds.

**EPR** - Ethylene-Propylene Rubber

**EPT** - Ethylene-Propylene

**EQA** - Environment Quality Act (Malaysia)

**Equal Percentage** - a term used to describe a type of valve flow characteristic where for equal increments of valve plug travel the change in flow rate with respect to travel may be expressed as a constant percent of the flow rate at the time of the change. The change in flow rate observed with respect to travel will be relatively small when the valve plug is near its seat and relatively high when the valve plug is nearly wide open.

**Equal Percentage Plug** - a valve plug shaped to allow flow of a medium in direct proportion to the amount of plug lift.

**Equilibrium** - a state of balance between opposing forces or actions.

**Equipment Specification** - a project specific document which details the specific requirements for the work or equipment being procured.

**Equivalent Pipe Length** - a measure of a valve's resistance to flow where the resistance is equal to and expressed as a length of pipe of the same size as that connected to the valve.

**ER&E** - Exxon Research & Engineering

**Erg** - a unit of energy (in the Centimeter-Gram-Second system) equal to one dyne centimeter or approximately equal to the work done by a force of 1 milligram causing a movement of 1 centimeter.

**Erode** - to wear away or destroy gradually

### **Erosion** -

Erosion - 1) deterioration by the abrasive action of fluids, usually accelerated by the presence of solid particles in suspension; 2) the wearing away of refractory or of metal parts by gas borne dust particles; 3) progressive destruction of a structural member by the abrasive action of a moving fluid, often one that contains solid particles in suspension; if the fluid is a gas, erosion may be caused by liquid droplets carried in

the moving gas stream.

**Erosion** - the gradual destruction of metal or other material by the abrasive action of liquids, gases, solids or mixtures thereof.

**Erosion** - the gradual destruction or alteration of a metal or alloy caused by direct chemical attack or by electromechanical reaction.

**Erosion** - the wearing away of a valve seat due to high velocity flow.

**ERW** - Electric Resistance Welding

**Escape Valve** - a safety valve or relief valve

**ESD** - Emergency Shut Down

**ESV** - Emergency Shutdown Valve

**ESW** - Electro Slag Welding

**ETC** - End Torque Close

**Etch Cracks** - shallow cracks in the surface of hardened steel due to hydrogen embrittlement that sometimes occurs when the metal comes in contact with an acidic environment.

**ETD** - Estimated Time of Departure

**ETFE** - Ethylene-Tetrafluoroethylene (Tefzel)

**Ethylene** - a gaseous hydrocarbon occurring in natural gas; a colorless flammable gas with a sweet smell.

**Ethylene Propylene** - a non-metallic material used as valve trim. It is an elastomer also known as EPT, EPDM, EP, EPR Rubber, and Nordel®. It has very good resilience and good abrasion resistance.

**Ethylene Propylene Diene Monomer (EPDM)** - a popular rubber seal material, compatible with a wide range of chemicals.

**ETO** - End Torque Open

**Eutectic Welding** - a low-temperature metal welding process which uses the eutectic property of the metals involved, there being a lower melting point for the mixture of the particular combination of metals, which then behave like a pure compound with simultaneous recrystallization after melting.

**Evaporation** - the direct conversion from liquid state to vapor state of a given fluid.

**Ex** - out of

**Ex(d)** - Explosion Proof

**Ex(e)** - Increased Safety

**Expander Flange** - a type of butt-welded flange designed with a tapered bore so that various pipe sizes can be matched.

**Expansion Joint** - a pipe coupling which, under temperature change, allows movement of a piping system without hazard to associated equipment.

**Expansion Loop** - a complete loop installed in a pipeline to mitigate the effect of expansion or contraction of the line.

**Expansion Opening** - a chamber in line with a pipe or tunnel and of larger diameter than the conduit containing liquid or gas, to allow lowering of pressure within the conduit by expansion of the fluid.

**Expansion Valve** - a valve in which fluid flows under falling pressure and increasing volume.

**Expected Lifetime** - the expected lifetime of a motor is the time during which the motor remains suitable for the application for which it was made when regularly inspected, examined and serviced in accordance with the manufacturer's instructions, with replacement of lubricants and of parts subject to wear.

**Exploration and Production (E&P)** - see Upstream

**Explosion Proof Enclosure** - an enclosure that is capable of withstanding an explosion of a gas or vapor within it and of preventing the ignition of an explosive gas or vapor that may surround it and that operates at such an external temperature that a surrounding explosive gas or vapor will not be ignited thereby. Refer also to flameproof enclosure.

**Explosionproof Apparatus** - apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor which may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and which operates at such an

external temperature that a surrounding flammable atmosphere will not be ignited thereby.

**Explosionproof Enclosure** - an enclosure that is capable of withstanding an explosion of a gas or vapor within it and of preventing the ignition of an explosive gas or vapor that may surround it and that operates at such an external temperature that a surrounding explosive gas or vapor will not be ignited thereby. This type enclosure is similar to a flameproof enclosure.

**Explosive Cladding** - producing a bimetallic material by explosion welding a thin layer of one metal on a substrate; it is used most advantageously to yield a material with one surface having a unique property, such as resistance to corrosion by certain strong chemicals, while the bulk of the material possesses good fabrication and structural properties.

**Explosive Decompression** - this occurs when gas at high pressure permeates into seal materials. When the gas pressure is reduced, the absorbed gas expands, which causes the seals to swell and blister.

### **Explosive Welding** -

Explosive Welding - a solid state process for creating a metallurgical bond by driving one piece of metal rapidly against another with the force of a controlled explosive detonation.

Explosive Welding - a process of welding metallic pieces by high velocity movement. High velocity movement is produced by a controlled detonation. In this process a high velocity plate is propelled by an explosive charge to a stationary plate. This arrangement consists of an anvil, parent plate, flyer plate, buffer zone, explosive, and detonator. The parent plate and the flyer plates are maintained at proper stand off distance. The parent plate is joined by the flyer plate. Above the flyer plate there is a buffer. The buffer consists of rubber, cardboard, or a similar material. The buffer helps in protecting the top surface of the flyer plate from damage due to detonation of the explosive charge. The parent plate is placed on the anvil to restrict distortion of the final product after welding. A large explosive is placed above the buffer. The detonation of the explosive takes place from the lower edge. As the detonator is ignited, the detonation wave front progresses towards the right. The explosion produces high pressure impulse. It produces high pressure normal to the surfaces and shearing pressure between the flyer and the parent metal. It produces high temperatures and high velocity impact. Consequently the metals behave as fluids which obey laws of fluid mechanics. The explosives used in explosive weldings are PETN, RDX, TNT, Metabel (ICI) and Tetryl.

**Extended Body Valve** - a small forged-steel gate or globe valve that has a body with one end extended substantially for direct connection to pressure vessels, piping headers, etc., without the use of a pipe nipple.

### **Extended Bonnet** -

Extended Bonnet - a bonnet with a packing box that is extended above the body to bonnet connection so as to maintain the temperature of the packing above (cryogenic service) or below (high-temp service) the temperature of the process fluid. The length of the extension depends upon the difference between the fluid temperature and the packing design temperature limit, as well as upon the valve body design.

Extended Bonnet - used on a valve when the media is at high or low temperatures, to avoid damage to the sealing elements.

Extended Bonnet - used when the media is at high or low temperatures, to avoid damage to the sealing elements.

**Extended Operating Gear** - an operating means located above its normal position on a valve, to allow above-ground access when the valve is installed below ground.

### **Extensometer** -

Extensometer - an instrument designed to measure minute deformations of small objects subjected to stress.

Extensometer - an instrument which is used for measuring minute extensions of a test piece during a tensile test. This is necessary when determining the limit of proportionally or proof stress.

**External Centerless Grinding** - a process by which a metal work piece is finished on its external surface by supporting the piece on a blade while it is advanced between a

regulating wheel and grinding wheel.

**External Grinding** - grinding the outer surface of a rotating piece of work.

**External Thread** - a screw thread cut on an outside surface.

**Extra Hard Temper** - a level of hardness and strength in nonferrous alloys and some ferrous alloys corresponding approximately to a cold worked state one third of the way from full hard to extra spring temper.

**Extra Spring Temper** - a level of hardness and strength for nonferrous alloys and some ferrous alloys corresponding to a cold worked state above full hard beyond which hardness and strength cannot be measurably increased by further cold work.

**Extrude** - to squeeze or force out

**Extrusion** -

Extrusion - any item manufactured by forcing material through a Die. Many plastic and aluminum products are formed by the extrusion process.

Extrusion - distortion of flow, under pressure, of portion of seal into clearance between mating metal parts.

**Extrusion Billet** - a slug of metal, usually heated into the forging temperature range, which is forced through a die by a ram in an extrusion process.

**EXW** - 1) Explosion Welding; 2) Ex-Works

**Eye Bolt** -

Eye Bolt - a bolt provided with a hole or eye at one end, instead of the usual head. The eye receives a pin, stud, or hook, which takes the pull of the bolt.

Eye Bolt - a bolt with a loop at one end.

Eye Bolt - a bolt with a steel loop forged at one end instead of a head, a thread being cut at the other end.

Eye Bolt - a bolt with one eye instead of the normal head, used for lifting or fastening.

**Eye Screw** - a screw with an open loop head.

**Eyelet** - a small ring or barrel-shaped piece of metal inserted into a hole for reinforcement.

**Eyeletting** - forming a lip around the rim of a hole.

**F** - 1) Fluorine; 2) Fahrenheit degrees; 3) Final; 4) Filter

**F & D** - Faced and Drilled

**F&G** - Fire and Gas

**F, D&SF** - Faced, Drilled & Spotfaced

**FA** - For Approval

**FAB** - Fully As-Built

### **Fabrication -**

**Fabrication** - refers to the preparation of structural steel components in a workshop by detailed operations like spearing, drilling, bending, straightening, sawing, oxygen profiling and cutting.

**Fabrication** - the manufacture of parts, usually structural or electromechanical parts.

**Face** - the surface of a flange on a pipe that is fitted against another flange.

**Face Milling** - milling flat surfaces perpendicular to the rotational axis of the cutting tool.

### **Face to Face Dimension -**

**Face to Face Dimension** - the dimensions from the face of the inlet opening to the face of the outlet opening of a valve or fitting; see End to End Dimension.

**Face to Face Dimension** - the distance between the face of the inlet opening and the face of the outlet opening of a valve or fitting. These dimensions are governed by ANSI / ISA specifications.

**Face to Face Dimension** - the length of a flanged-end valve; compare with End to End

**Face to Face Dimension** - the overall dimension from the inlet face of a valve to the outlet face of a valve (one end to another) allowing valves of the same size and pressure class to be mutually interchangeable, regardless of manufacturer.

### **Facing -**

**Facing** - a raised machined surface to which another part is to be attached.

**Facing** - an outer layer of trim, coating the underlying material (contrasted to solid).

**Facing** - machining the end of a flat rotating surface by applying a tool perpendicular to the axis of rotation in a spiral planar path.

**Facing** - the finish of the gasket contact surface of a flange.

**Facing Sand** - special sand that contains a small amount of carbonaceous material. It is used on the inner surface of the molding cavity to give better surface finish to castings.

**Factor of Safety** - the ratio of ultimate strength of a material to the allowable stress.

**FAHR** - Fahrenheit degrees

**Fahrenheit** - the temperature scale using the freezing point of water as 32 and the boiling point as 212, with 180 equal divisions between, called degrees.

### **Fail Closed -**

**Fail Closed** - a condition in which the valve closure member moves to a closed position when the actuating energy source fails; see Normally Closed.

**Fail Closed** - another way of describing an air to open actuator. Approximately 80% of all spring return diaphragm operators in the field are of this construction; also known as Normally Closed.

**Fail Closed** - spring return pneumatic actuator is applied to the valve such that the spring will drive the valve to the close position upon loss of air; also called Air-To-Open.

### **Fail In Place -**

**Fail In Place** - a condition in which the valve closure component stays in its last position when the actuating energy source fails.

**Fail In Place** - a term used to describe the ability of an actuator to stay at the same percent of travel it was in when it lost its air supply. On spring return actuators this is accomplished by means of a lock up valve. On piston actuators a series of compressed air cylinders must be employed.

### **Fail Open -**

**Fail Open** - a condition in which the valve closure member moves to an open position when the actuating energy source fails; see Normally Open.

**Fail Open** - another way of describing an air to close actuator; also known as Normally Open.

**Fail Open** - spring return pneumatic actuator is applied to the valve such that the spring will drive the valve to the open position upon loss of air; also called Air-To-Close.

## Fail Safe -

**Fail Safe** - a characteristic of a particular valve and its actuator, which upon loss of actuating energy supply, will cause a valve closure member to fully close, fully open or remain in fixed position. Fail safe action may involve the use of auxiliary controls connected to the actuator; 2) protection against effects of failure of equipment, for example, burner fuel shut off on flame failure.

**Fail Safe** - a term used to describe the desired failure position of a control valve. It could fail closed; fail open; or fail in place. For a spring-return operator to fail-in-place usually requires the use of a lock-up valve.

**Fail Safe** - said of a mechanism: ensuring a return to a safe condition when something goes wrong.

**Fail Safe Device** - a component, system or control device so designed that it places the controlled parameter in a safe condition in case of a power interruption, controller malfunction or failure of a load carrying member.

**Fail Safe Valve** - a valve that either fails in the open position or closes to prevent a costly or dangerous situation within a system.

**Failure Mode** - the position to which the valve closure component moves when the actuating energy source fails.

**FAS** - Free Alongside Steamer

**Fast Joint** - pertaining to a joint with a permanently secured pin.

**Fast Moving (equipment and materials)** - those in transit or at supply bases, construction sites or storage yards for less than 6 months.

**Fast Pin** - a pin that fastens immovably, particularly the pin in a fast joint.

**Fastmet** - a process to directly reduce iron ore to metallic iron pellets that can be fed into an electric arc furnace with an equal amount of scrap. This process is designed to bypass the coke oven-blast furnace route to produce hot metal from iron ore. It is also one of several methods that mini-mills might use to reduce their dependence on high-quality scrap inputs; see [Direct Reduced Iron and Hot Briquetted Iron](#).

**FAT** - Factory Acceptance Test

## Fatigue -

**Fatigue** - 1) a diminishing resistance to fracture caused by continued application of varying or alternating stresses; 2) weakness caused by a long period of use and stress; 3) failure attributed to repeated loading and unloading.

**Fatigue** - a description of the behavior of metals under the action of alternating (cyclic) loads as distinguished from the behavior under steady loads. Cyclic stressing may take place in bending, tension, compression, and torsion or in combination of these and may be found in such diverse applications as axles, connecting rods, springs, etc.

**Fatigue** - a phenomenon of metals leading to fracture, whereby repeated reversals of stress cause a weakening of the metal such that failure can occur at a lower stress than would normally be expected.

**Fatigue** - failure of a material by cracking resulting from repeated or cyclic stress.

**Fatigue** - progressive fracture of a material by formation and growth of minute cracks under repeated or fluctuating stresses whose maximum value is less than the material's tensile strength, and is often wholly within the elastic stress range.

**Fatigue** - the failure of a metal due to repeated stress.

**Fatigue** - the failure of a metal under cyclically repeated stresses. Fatigue is the only cause of failure of over 50% and some cases it is even 90% in components of modern high speed machines. Almost everyone has heard the failure of connecting rod, crankshafts, piston rods, spring, pin, etc. All these failures are due to fatigue. Tests like strength, hardness, impact, etc, describe the behavior of metals when they are stressed only once. In practice, metals have to be subjected to thousands, or even millions of reversals of stresses. Practically, it has been seen that fracture takes place at a much lower statistical ultimate strength when a piece is subjected to repeated stresses. It has also been found that if the stresses are reversed, the resistance to fracture is much less than if the stresses applied are of the same nature. It is said in such cases that a material has fatigued. A careful examination of the specimen after failure reveals important information about the causes of failure. These may be summarized as follows: a) initially the crack starts from a

point of high stress concentration such as an oil hole, slag inclusion, keyway, etc. This type of fatigue failure is more often due to bad design rather than the quality of the metal. b) The fatigue limit increases by carburizing, cold working and nitriding but decreases with decarburization. c) There is no direct relationship between Izod impact, hardness, etc, but approximately the fatigue limit is 40 to 55% of the ultimate tensile stress. d) The size of test piece has much effect on the fatigue also. The fatigue strength of steels decreases with the increasing size of the test piece.

**Fatigue** - the process leading to the failure of metals (or other materials) under the repeated action of a cycle of stress. The failure is dependent on the mean stress, the range of stress and the number of cycles. With a decreased amount of stress, a material can be able to withstand a greatly increased number of repetitions before failure, or failure may not occur after millions of stress cycles. With a large amount of stress, failure may take place after a relatively small number of reversals.

#### **Fatigue Life** -

**Fatigue Life** - the life of a test-piece, or of a part of a structure or mechanism, expressed as the number of applications of a load before failure.

**Fatigue Life** - the number of applied repeated stress cycles a material can endure before failure.

**Fatigue Life** - the number of stress cycles that a material can sustain prior to fracture for a given set of fatigue conditions.

#### **Fatigue Limit** -

**Fatigue Limit** - refers to the maximum value of the applied alternating stress which a test piece can withstand indefinitely.

**Fatigue Limit** - the maximum stress that a material can endure for an infinite number of stress cycles without breaking. Also known as endurance limit.

**Fatigue Limit** - the upper limit of range of stress that a metal is able to withstand indefinitely.

**Fatigue of Metals** - the phenomenon of the failure of metals under the repeated application of a cycle of stress; factors involved include amplitude, average severity, rate of cyclic stress and temperature effect; notch brittleness commences at a scratch or blemish.

**Fatigue Range** - refers to the maximum range of stress which a metal will withstand indefinitely. When the maximum stress in tension is equal to that in compression, the fatigue range must be stated to define conditions.

**Fatigue Ratio** - the ratio of the fatigue limit or fatigue strength to the static tensile strength; also known as Endurance Limit.

**Fatigue Resistance** - the property of a material which enables it to overcome fatigue caused by repeated stresses.

#### **Fatigue Strength** -

**Fatigue Strength** - it can be increased by selecting suitable material, cold working, shot peening, under stressing and **overdressing (coaxing)**.

**Fatigue Strength** - the maximum stress a material can endure for a given number of stress cycles without breaking; also known as Endurance Strength.

**Fatigue Strength** - the maximum stress that ordinarily leads to fatigue fracture in a specified number of stress cycles; if the stress is not completely reversed during each stress cycle, the minimum stress also should be given; **see also Endurance Limit.**

#### **Fatigue Test** -

**Fatigue Test** - a test on a sample of a material or on a complete piece of assembled equipment. The test item has been subjected to repetitive loading, usually to verify a safe fatigue life.

**Fatigue Test** - a test to determine the range of alternating stress which a material can withstand without breaking.

**Faucet** - a valve on the end of water pipe by means of which water can be released from, or held within, the pipe.

**Faying Race** - the portion of a work piece which is especially prepared to fit a mating part; also called Faying Surface.

#### **Faying Surface** -

**Faying Surface** - either of two surfaces in contact with each other in a welded, fastened or bonded joint, or in one about to be welded, fastened or bonded.

Faying Surface - the surfaces of materials in contact with each other and joined or about to be joined together.

**FB** - Full Bore

**FBH** - Flat Bottom Hole

**FCA** - Free Carrier

**FCAW** - Flux Cored Arc Welding

**FCC** - Fluid Catalytic Cracker, or cat unit.

#### **FCCU** -

FCCU - Fluid Catalytic Cracking Unit.

FCCU - Fluidized Catalytic Cracking Unit

**FCPA** - Foreign Corrupt Practices Act

**FCV** - Flow Control Valve

**FD** - Fuel, Diesel

**FDT** - Final Drawings Transmittal

**Fe** - Iron

**Fe<sub>3</sub>C** - Cementite

#### **Feather** -

Feather - to blend or otherwise form a tapering transition between one material or surface and another.

Feather - to turn (the disc of a check valve) more parallel to the line of movement, to offer the least resistance to the process fluid.

**Feather Joint** - a joint made by cutting a mating groove in each of the pieces to be joined and inserting a feather in the opening formed when the pieces are butted together; also known as Ploughed-and-Tongued Joint.

**Feed Check Valve** - a non return valve in the delivery pipe between a feed water pump and a boiler.

**Feed Control Valve** - a small valve, usually a needle valve, on the outlet of the hydraulic-feed cylinder on the swivel head of a diamond drill, used to control minutely the speed of the hydraulic piston travel and hence the rate at which the bit is made to penetrate the rock.

**Feed Pipe** - a pipe through which water is conducted into a boiler.

#### **Feedback** -

Feedback - a transfer of energy from the output of a device to its input.

Feedback - the process of bringing back information about the condition under control to compare it with a target value.

**Feedback Controller** - a mechanism which measures the value of a controlled variable, compares it to a command or set value, and manipulates a controlled system in order to maintain a desired relationship between controlled variable and command.

#### **Feedback Signal** -

Feedback Signal - the return signal that results from a measurement of the directly controlled variable. An example would be where a control valve is equipped with a positioner. The return signal is usually a mechanical indication of valve plug stem position which is fed back into the positioner.

Feedback Signal - the signal which is returned to the input of a system and compared to a reference signal to establish an actuated signal which returns the controlled variable to the desired value.

**Feedhead** - a reservoir of molten metal that extends above a casting to supply additional molten metal and compensate for solidification shrinkage; also known as Riser; Sinkhead.

#### **Feedstock** -

Feedstock - any raw material

Feedstock - crude oil, natural gas liquids, natural gas or other materials used as raw ingredients for making gasoline or other petroleum products.

**Feet of Head** - [see Head](#)

**Female Fitting** - in a paired pipe or an electrical or mechanical connection, the portion (fitting) that receives, contrasted to the male portion (fitting) that inserts.

**FEP** - Fluorinated Ethylene-Propylene

## **Ferrite -**

Ferrite - 1) a form of pure iron occurring in low-carbon steel; 2) a **body-centered cubic crystalline phase** of iron-based alloys.

Ferrite - an almost pure form of iron. The maximum percentage of carbon in the form of solid solution is 0.025% at 723° C. It is soft, malleable and ductile. The hardness of ferrite lies between 80 BHN and 100 BHN.

## **Ferritic Steel -**

Ferritic Steel - a steel whose microstructure at room temperature consists predominately of ferrite. Ferritic stainless steels are hardened and strengthened by cold work because they are not heat treatable.

Ferritic Steel - the second largest class of stainless steel, constituting approximately 25% of stainless production. Ferritic stainless steels are plain chromium steels with no significant nickel content; the lack of nickel results in lower corrosion resistance than the austenitics (chromium-nickel stainless steels). Ferritics are best suited for general and high-temperature corrosion applications rather than services requiring high strength. They are used in automotive trim and exhaust systems, interior architectural trim, and hot water tanks. Two of the most common grades are type 430 (general-purpose grade for many applications, including decorative ones) and type 409 (low cost grade well suited to withstanding high temperatures).

**Ferritize** - to increase the quantity of ferrite in the matrix of a ferrous casting through an appropriate heat treatment.

**Ferritizing Anneal** - the process of producing a predominantly ferritic matrix in cast iron through an appropriate heat treatment.

**Ferro-** - a prefix meaning "containing iron"

## **Ferroalloy -**

Ferroalloy - a metal product commonly used as a raw material feed in steelmaking, usually containing iron and other metals, to aid various stages of the steelmaking process such as deoxidation, desulfurization, and adding strength. Examples are ferrochrome, ferromanganese and ferrosilicon.

Ferroalloy - alloy containing iron and one or more other metals. Used as a raw material in steel mills for obtaining the desired composition of the steel.

**Ferrochrome** - an alloy of iron and chromium with up to 72% chromium. Ferrochrome is commonly used as a raw material in the making of stainless steel.

**Ferrometer** - an instrument used to make permeability and hysteresis tests of iron and steel.

Ferrous - metals that consist primarily of iron.

Ferrous Alloy - any alloy containing at least 50% of the element iron by weight.

Ferrous Alloy - **see Alloy Steel**

## **Ferrous Metal -**

Ferrous Metal - a metal in which the major constituent is iron.

Ferrous Metal - those containing iron as the principal constituent e.g., cast iron, wrought iron and various types of steels.

## **Ferrule -**

Ferrule - 1) a metallic sleeve, joined to a pipe end, into which a plug is screwed that can be removed for the purpose of cleaning or examining the interior of the pipe; 2) a tube-connecting device, which is compressed by tightening a nut to effect the connection.

Ferrule - 1) a ring, which may be in two halves, inserted between the adjusting screw and the cover to prevent overloading; 2) the ring inserted between the collar of the spring loading bolt and the body prevent overloading; also variously called Adjusting Ring, Pressure Adjusting Ring, Safety Ring, Split Safety Ring.

Ferrule - a metal band which is forming or strengthening a joint.

Ferrule - a metal ring or cap attached to the end of a tool handle, post, or other device to strengthen and protect it.

Ferrule - a metal ring or cap that is fitted onto the end of a tool handle, post or other similar member to strengthen and protect it.

**FF** - Flat Face

**FFQ** - Full Face

**FG** - Fuel, Gas

**FGS** - Fire and Gas System

**FHF** - Full Hard Faced

**FI** - For Information

**Fibrous Fracture** - failure of a material resulting from a ductile crack; broken surfaces are dull and silky; also known as Ductile Fracture.

**Fibrous Structure** - 1) in fractography, a ropy fracture surface appearance, which is generally synonymous with "silky" or "ductile fracture"; 2) in forgings, a characteristic macrostructure indicative of metal flow during the forging process, which is revealed as a ropy appearance on a fracture surface or as a laminar appearance on a macroetched section; a ropy appearance on the fracture surface of a forging does not carry the same implication as a ropy fracture of other wrought metals, and should not be considered the same as a silky or ductile fracture; 3) in wrought iron, a microscopic structure consisting of elongated slag fibers embedded in a matrix of ferrite.

**FIC** - Foreign Investment Committee

**FIFO** - First In, First Out

**File and Hammer** - these are some of the accessories needed by the welder to clean the surface of the weld prior to welding and removal of chips, etc., if any. It is also used to finish the weld.

**Filler** - chemically inert, finely divided material added to the elastomer to aid in processing and improve physical properties, i.e., abrasion resistance and strength-give it varying degrees of hardness.

**Filler Metal** - material added during welding

**Fillet** - a concave transition surface between two surfaces that meet at an angle.

**Fillet Weld** -

Fillet Weld - a roughly triangular weld that joins two members along the intersection of two surfaces that are approximately perpendicular to each other.

Fillet Weld - a weld of approximately triangular cross-section used for joining two surfaces approximately at right angles to each other. It is used in lap, tee or corner joints.

Fillet Weld - a weld of triangular cross-section which joins two plates at right angles or at the edge of a thick plate overlapped by another.

Fillet Weld - a weld which is approximately triangular in cross section.

**Filter** -

Filter - a device through which air is passed to separate particle matter held in suspension. Using filters prolongs the life of both cylinders and valves.

Filter - a device used to separate contaminants from a fluid flowing through it.

Filter - a device whose primary function is the retention by a porous media of insoluble contaminants from a fluid.

**Filter Element** - the porous device that performs the actual process of filtration.

**Filter Glass** - colored glass used in welding helmets, goggles and hand shields.

**Filter Media** - the porous materials that perform the actual process of filtration.

**Filter Media, Surface** - Porous materials that primarily retain contaminants on the influent face.

**Fin** -

Fin - a defect consisting of a very thin projection of excess material at a corner, edge or hole in a cast, forged molded or upset part, which must be removed before the part can be used.

Fin - a thin, unintended projection on surface of a casting. Fins usually occur at the parting line. Fins are produced a) due to too flexible bottom boards, b) loose pattern plates, and c) inadequately weighted sand. Incorrectly assembled molds and cores also produce fins. Fins are also produced by high metal pressure due to too long sprue, insufficient weighting of the mold and improper clamping of flask.

**Final Documentation** - documentation to be delivered with, or soon after the equipment or material. It contains "as-built" vendor documentation and user manuals.

**Fineness** - in casting, fineness and permeability of sand are in conflict with each other and must be balanced for optimum results. Fine sand particles resist metal penetration and show good surface finish.

**Fineness Modulus** - a number denoting the fineness of a fine aggregate or other fine material such as sand or paint.

**Finger Plate** - a plate used to restrict the upward motion of the diaphragm and prevent diaphragm extrusion into the bonnet cavity in the full open position.

### **Finish** -

Finish - 1) the surface texture given to an item; 2) to give a particular treatment to the surface of an item.

Finish - the surface appearance of steel after final treatment.

**Finish Turning** - the operation of machining a surface to accurate size and producing a smooth finish.

**Finmet** - the process reduces iron ore fines with gas in a descending series of fluidized bed reactors. The reduced iron is hot briquetted.

**Fire Fighting Valve** - a valve, usually of the globe type, specifically designed for use on the outlet of fire fighting hoses.

**Fire Resistant** - resistant to combustion and to heat of standard intensity for a specified time without catching fire or failing structurally.

### **Fire Safe Valve** -

Fire Safe Valve - a valve design that is capable of passing a fire test with specified limits on leakage to the atmosphere and downstream after being closed subsequent to fire exposure.

Fire Safe Valve - a valve design which by nature of its features / properties is capable of passing a fire test.

**Fire Tested Valve** - 1) a valve design which has successfully passed prototype fire testing. Fire testing shall be done in accordance with BS 6755 part 2 or API spec. 6FA; 2) a designation applied to a valve that has been verified by testing to adequately seal against external and internal leakage during a fire. It is usually used in conjunction with a soft-seated valve.

**Fireproof** - resistant to combustion or to damage by fire under all but the most severe conditions.

**First Block Valve Off** - the first **block valve** on a "normally non-flowing" branch connection on a process fluid line or the closest block valve to the vessel in piping connected to a pressure vessel nozzle.

**Firth Hardometer** - a hardness tester which uses a diamond indenter with loads of 10, 30, or 120 kg for hardened steels, or a steel ball for soft materials.

**Fisheye** - an area on a fracture surface having a characteristic white crystalline appearance, usually caused by internal hydrogen cracking.

**Fishtail** - excess metal at the trailing end of an extrusion or a rolled billet or bar, which is generally cropped and either discarded or recycled into a melting operation.

**Fissure** - a small, cracklike surface discontinuity, often one whose sides are slightly opened or displaced with respect to each other.

### **Fit** -

Fit - the closeness of mating parts in an assembly, as determined by their respective dimensions and tolerances; fits may be classified as running (sliding), locational, transition or force (shrink) fits, depending on the size and direction (positive for running or negative for force fits) of the dimensional allowance; fits may also be termed clearance or interference depending on whether there is always a gap between mating parts or always interference, as long as the parts are within specified tolerances.

Fit - to install or put something in place; to join together to form a whole.

Fitting - a small auxiliary part of standard dimensions used in the assembly of an engine, piping system, machine, or other apparatus; **see Fitment**.

Fitting - any component, other than valves, used with pipe as part of the pressure system and normally referring to items covered by a national standard.

### **Fittings** -

Fittings - 1) small auxiliary but essential parts of an engine, machine or mechanism; 2) accessories, especially for boilers, such as valves, gauges, etc.

Fittings - fitted accessories or parts

Fittings - this is the general term used to describe parts such as flanges, crossovers etc. than can

be fitted onto other pieces of equipment.

**FJ** - Fuel, Jet

**FKM** - Fluoro Rubber of the Polymethylene type (Viton)

**Flake** - an internal hydrogen crack such as may be formed in steel during cooling from high temperature; also known as Fisheye; Shattercrack; Snowflake.

#### **Flame Cutting** -

**Flame Cutting** - it is possible to cut steel and other metals with an oxyhydrogen, oxycoal gas, or oxyacetylene flame up to thickness of about 40 in. Modern flame cutting profiling machines operate to close tolerance.

**Flame Cutting** - severing metal by means of the chemical reaction of oxygen with the metal at elevated temperatures.

#### **Flame Hardening** -

**Flame Hardening** - a form of surface hardening that uses the inherent hardenability of a steel or other hardenable alloy to produce a hardened surface layer by spot heating the metal with a fuel gas flame to a shallow depth and then rapidly cooling the heated metal.

**Flame Hardening** - a process of hardening localized areas of a ferrous alloy part by heating with a high-temperature flame followed by controlled cooling.

**Flame Hardening** - a type of case hardening in which the component is heated by a continuously moving oxy-acetylene flame, followed by a quenching jet of water, air or nitrogen.

**Flameproof Enclosure** - a term describing an enclosure that can withstand the pressure developed during an internal explosion of an explosive mixture and that prevents the transmission of the explosion to the explosive atmosphere surrounding the enclosure and that operates at such an external temperature that a surrounding explosive gas or vapor will not be ignited thereby. **Refer also to Explosionproof Enclosure.** This type of protection is referred to by IEC as "Ex d".

#### **Flange** -

**Flange** - a broad, flat projecting rim around the end of a valve, pipe, etc., added for strength and for connecting with another object.

**Flange** - a rim on the end of a valve, pipe or fitting for bolting onto another pipe element.

**Flange** - a type of pipe fitting that attaches via nuts and bolts.

**Flange, Blind** - a flange without a bored center, used to completely close off a flanged end/ outlet connection.

**Flange, Loose** - a flange not intended to be made integral with another piece of API spec 6A equipment. Under this heading you could find blind, threaded, spacer, welding neck, studded, adapter and more.

**Flange, Threaded** - a flange with a sealing face on one side, and a thread on the other (female).used to join flanged connections to threaded ends.

**Flange Facing** - the finish on the end connection gasket surfaces of flanged or flangeless valves.

**Flange Retained Liner** - a liner retained in the body of a butterfly valve by the pipe flanges or by a continuous or segmented ring. The segmented ring provides a means of adjusting the liner to disk interference to achieve improved sealing. The bore of the pipe flanges is smaller in diameter than the body bore; therefore, the flanges retain the liner in the body.

**Flange Taps** - **see Orifice Flange Taps**

**Flange Union** - a pair of flanges that are screwed to the ends of pipes and then bolted or welded together to hold two pipes together.

**Flanged Body** - valve body with full flanged end connections.

#### **Flanged End** -

**Flanged End** - a valve end that has an integral flange for bolting to a connecting pipe having a similar flange.

**Flanged Ends** - valve end connections incorporating flanges which allow pressure seals by mating with corresponding flanges on the piping.

**Flanged Pipe** - a pipe with flanges at the ends, which can be bolted end to end to another pipe.

**Flangeless** - a valve that does not have integral line flanges. This type of valve is sometimes referred to as a Wafer Style Valve. The valve is installed by bolting it between the companion flanges with a set of bolts or studs called line bolting. Care should be

taken that strain-hardened bolts and nuts are used in lieu of all-thread, which can stretch when subjected to temperature cycling.

**Flangeless Body** - this type of valve is very economical from a manufacturing and stocking standpoint because a valve that is rated as a 600# ANSI valve can also be used between 150# and 300# ANSI flanges thus eliminating the need to manufacture three different valve bodies or stock three different valve bodies. The down side is that valves with flangeless bodies are not acceptable in certain applications - particularly in refinery processes; [see also Flangeless.](#)

**Flangeless Control Valve** - a valve without integral line flanges, which is installed by bolting between companion flanges, with a set of bolts, or studs, generally extending through the companion flanges; also called a Wafer Style or Wafer Body Control Valve.

**Flanging** - a forming process in which the edge of a metal is bent over to make a flange at a sharp angle to the body of the part.

**Flap Trap** - refers to a non-return valve to prevent flooding.

#### **Flap Valve** -

Flap Valve - a valve fitted with a hinged flap or disk that swings in one direction only.

Flap Valve - a valve with a hinged flap or disc that swings in only one direction.

Flap Valve - refers to a non-return valve having a hinged disc which will open for a normal flow and close by gravity or when the flow is reversed.

**Flapper** - the flow control element of a swing check valve; also called a Disc or a Clapper.

#### **Flare** -

Flare - a type of pipe fitting that uses a socket and a type of union nut to form a connection with minimal crevice, for ultrapure processes. Usually seen on fluoropolymer or natural polypropylene valves.

Flare - an open flame at an oil refinery; it burns off excess gas at the top of the pipe.

**Flaring** - the burning of gases in a thermal destruction device.

#### **Flash** -

Flash - excess rubber left around rubber part after molding due to space between mating mold surfaces; removed by trimming.

Flash - in plastics or rubber molding or in metal casting, that portion of the charge which overflows from the mold cavity at the joint line.

#### **Flash Point** -

Flash Point - the lowest temperature at which an oil releases enough vapor to ignite when open flame is applied.

Flash Point - the temperature at which a fluid first gives off enough vapor to ignite with a spark or flame.

Flash Point - the temperature to which a liquid must be heated under specified conditions of the test method to give off sufficient vapor to form a mixture with air that can be ignited momentarily by a specified flame.

#### **Flash Welding** -

Flash Welding - a resistance type weld in which mating parts are brought together under considerable pressure and a heavy electrical current is passed through the joint to be welded.

Flash Welding - a resistance welding operation carried out over the entire area of abutting surfaces, by the heat obtained by the resistance to the flow of currents between the two surfaces by application of pressure. It produces the flash at the surfaces of contact.

Flash Welding - a resistance welding process commonly applied to wide, thin members, irregularly shaped parts and tube to tube joints, in which the faying surfaces are brought into close proximity, electric current is passed between them to partly melt the surfaces by combined arcing and resistance heating, and the surfaces are then upset forged together to complete the bond.

Flash Welding - similar to butt welding but the parts have been first brought lightly into contact, then the full forging pressure is applied as electric arc flashing commences.

Flash Welding - the term flash welding derives its name from the flash produced during the welding process. Flash welding is a resistance welding process in which

coalescence is produced simultaneously over the entire area of abutting surfaces, by the heat obtained from resistance to electric current between the two surfaces, and by application of pressure after heating is substantially completed. The process is similar to butt welding, but differs in the method of heating the metals. In flash welding, the parts are brought slowly in a very light contact together. The two parts to be welded are clamped in the jaws of the machine and connected to current supply through a transformer. One jaw is fixed while the other is movable and is mounted on a slide through which pressure is applied. The current is switched on and a little pressure is applied simultaneously to produce an arc between the contact surfaces of the parts. Then a sharp blow is given and the weld is completed. It is widely used for tubular furniture, rear axle, housing, steel rims, steel forgings and rolled sections.

### **Flashing -**

**Flashing** - in painting, the irregular appearance difference in color or gloss. Improper sealing of porous surfaces usually causes it.

**Flashing** - a rapid change in fluid state, from liquid to gaseous. This frequently occurs when frictional energy is added to a liquid as it passes between the primary seal faces or when the fluid pressure is reduced below the fluid's vapor pressure because of a pressure drop across the sealing faces.

**Flashing** - the boiling or vaporizing of a liquid. When the vapor pressure downstream of a control valve is less than the upstream vapor pressure, part of the liquid changes to a vapor and remains as a vapor unless the downstream pressure recovers significantly, in which case cavitation occurs. Flashing will normally cause a choked flow condition to occur. In addition the vapor bubbles can also cause mechanical damage to the valve and piping system; [see also Cavitation and Choked Flow.](#)

**Flask** - in casting, the part that holds the molding sand and keeps it intact. Depending upon the position of the flask in the mold structure, it is called by various names such as Cope, Drag and Cheek. It is generally made of mild steel. For temporary applications sometimes it is made of wood.

**Flat Face (FF)** - a flange surface in which the gasket sealing area is the entire surface from the ID to the outside edge. Usually used for class 125 cast iron valves.

**Flat Position Welding** - welding from above the work, with the face of the weld in the horizontal plane; also known as Downhand Welding.

**Flat Rolled Steel** - a category of steel that includes Sheet, Strip, and Tin Plate, among others.

**Flaw** - a discontinuity or other physical attribute in a material that exceeds acceptable limits; the term flaw is nonspecific, and more specific terms such as defect, discontinuity or imperfection are often preferred.

**FLEX** - Flexible

**Flex Cracking** - a surface cracking induced by repeated bending or flexing.

**Flex Resistance** - the relative ability of a rubber article to withstand dynamic bending stresses.

**Flexible Lip Seal** - in a butterfly valve, a seal ring retained in the body bore with raised flexible lip which contacts an offset disk in the closed position yet is clear of the disk in other positions.

**Flexible Wedge Gate** - a wedge design flow control element of a gate valve made of a single piece that has a groove around its perimeter to provide flexibility and some movement of its seating surfaces; also called a Flex Wedge.

**FLG** - Flanged

### **Flinching -**

**Flinching** - in inspection, failure to call a borderline defect a defect.

**Flinching** - in quality control inspection, failure of an inspector to call a borderline defect a defect.

**Float Chamber** - a vessel in which a float regulates the level of a liquid.

**Float Switch** - a switch actuated by a float at the surface of a liquid.

### **Float Valve -**

**Float Valve** - 1) a valve provided in liquid tanks for preventing overflow; 2) valves installed on inlets to services reservoirs and tanks which close automatically at a predetermined height; 3) automatic valves to control pressure head in a pipeline. They shut off when excess water accumulates in the lower portion of the pipeline and prevents

more water from entering the line.

**Float Valve** - a valve which automatically opens or closes as the level of a liquid changes. The valve is operated mechanically by a float which rests on the top of the liquid.

**Float Valve** - a valve which automatically opens or closes as the level of a liquid changes. The valve is operated mechanically by a float which rests on the top of the liquid.

**Float Valve** - a valve whose on-off action is controlled directly by the fall or rise of a float concurrent with the fall or rise of liquid level in a liquid-containing vessel.

**Float Valve** - an on-off type valve whose action is triggered by the rise or fall of a float.

**Float Valve Equilibrium** - an automatic flow control valve, usually of the globe type, designed for operation by a float mechanism for regulating flow or maintaining liquid level in a tank.

#### **Floating Ball** -

**Floating Ball** - a flow control element of a ball valve that is held in position in the valve body solely by the seat rings of the valve.

**Floating Ball** - a full ball positioned within the ball valve that contacts either of two seat rings and is free to move toward the seat ring opposite the pressure source when in the closed position to effect tight shutoff.

#### **Floating Ball Valve** -

**Floating Ball Valve** - a ball valve design in which the ball is not rigidly held on its rotational axis and so is free to float between the seat rings.

**Floating Ball Valve** - a valve with a full ball positioned within the valve that contacts either of two seat rings and is free to move toward the seat ring opposite the pressure source when in the closed position to effect shutoff.

**Flock** - fibrous filler sometimes used in rubber compounding.

**Flow** - a forward movement in a continuous stream or sequence of fluids or discrete objects or materials, as in a continuous chemical process or solids-conveying or production-line operations.

**Flow Bean** - calibrated orifice used to measure effluent flow.

#### **Flow Characteristic** -

**Flow Characteristic** - the relationship between the position of a valve's flow control element and the rate of fluid flow through the valve.

**Flow Characteristic** - The relationship between the stem travel, expressed in percent of travel, and the flow of the fluid through the valve, expressed in percent of full flow.

**Flow Characteristic** - the relationship between valve capacity and valve travel. It is usually expressed graphically in the form of a curve. Control valves have two types of characteristics: inherent and installed. The inherent characteristic is derived from testing the valve with water as the fluid and a constant pressure drop across the valve. When valves are installed into a system with pumps, pipes, and fittings, the pressure drop across the valve will vary with the travel. When the actual flow in a system is plotted against valve opening, the curve is known as the installed flow characteristic. Valves can be characterized by shaping the plugs, orifices, or cages to produce a particular curve. Valves are characterized in order to try to alter the valve gain. Valve gain is the flow change divided by the control signal change. This is done in an effort to compensate for nonlinearities in the control loop.

#### **Flow Characteristic, Equal Percentage** -

**Flow Characteristic, Equal Percentage** - a flow characteristic in which equal increments of flow control element travel distance produce equal percentage changes in the flow rate through the valve. Changes in the flow rate are small at the start of flow control element travel (when the valve begins to open) and become increasingly larger; see [Flow Characteristic; compare with Flow Characteristic, Linear and Flow Characteristic, Quick Opening](#).

**Flow Characteristic, Equal Percentage** - In a valve having an equal percentage characteristic, like movements of the valve stem at any point of the flow range changes the existing flow an equal percentage regardless of the existing flow. Example: Suppose a valve stem has been lifted 30 percent of its total lift and the flow at this time is 3.9 gal/min. Now assume that the valve opens an additional 10 percent of its full travel and that the flow increases to 6.2 gal/min or a 60 percent increase. Next, suppose that the valve stem moves an additional 10 percent so that it is now 50 percent

open. The flow now will be 10 gal/min or another 60 percent increase in flow. Equal percentage discs are especially useful for control jobs where occasional wide variations in loads occur.

Flow Characteristic, Equal Percentage - the inherent flow characteristic which, for equal increments of rated travel, will ideally give equal percentage changes of the existing flow coefficient (Cv).

#### **Flow Characteristic, Inherent -**

Flow Characteristic, Inherent - the flow characteristic of a valve if the pressure drop across the valve is held constant.

Flow Characteristic, Inherent - the relationship between the flow rate through a valve and the travel of the closure member as the closure member is moved from the closed position to rated travel with constant pressure drop across the valve.

Flow Characteristic, Inherent - the relationship between the flow rate through a valve and the travel of the closure member as the closure member is moved from the closed position to rated travel with constant pressure drop across the valve.

Flow Characteristic, Inherent - the relationship between valve capacity and valve travel and is usually expressed graphically. It is derived from testing a valve with water as the fluid and with a constant pressure drop across the valve. The most common types of inherent flow characteristics are: Linear, Equal Percentage, Modified Parabolic, and Quick Opening.

#### **Flow Characteristic, Installed -**

Flow Characteristic, Installed - the flow characteristic exhibited by a valve when the valve is installed in a pipeline. (The pressure drop across the valve varies.)

Flow Characteristic, Installed - the flow characteristic when the pressure drop across the valve varies with flow and related conditions in the system in which the valve is installed. The purpose of characterizing a control valve is to help compensate for nonlinearities in the control loop.

Flow Characteristic, Installed - the relationship between the flow rate through a valve and the travel of the closure member as the closure member is moved from the closed position to rated travel when the pressure drop across the valve varies as influenced by the system in which the valve is installed.

#### **Flow Characteristic, Linear -**

Flow Characteristic, Linear - a characteristic where flow capacity or (Cv) increases linearly with valve travel. Flow is directly proportional to valve travel. This is the preferred valve characteristic for a control valve that is being used with a distributive control system (DCS) or programmable logic controller (PLC).

Flow Characteristic, Linear - a flow characteristic where equal increments of flow control element travel distance produce equal increments of change of flow rate through the valve. Flow rate is directly proportional to the position of the flow control element; [see Flow Characteristic; compare with Flow Characteristic, Equal Percentage and Flow Characteristic, Quick Opening.](#)

Flow Characteristic, Linear - an inherent flow characteristic which can be represented by a straight line on a rectangular plot of flow coefficient (CV) versus percent rated travel. Therefore, equal increments of travel provide equal increments of flow coefficient (CV) at constant pressure drop.

Flow Characteristic, Linear - This flow-lift relationship, if plotted on rectilinear coordinates, approximates a straight line, giving equal volume changes for equal lift changes, regardless of percent of valve opening.

**Flow Characteristic, Modified Parabolic** - an inherent flow characteristic which provides fine throttling action at low valve plug travel and approximately a linear characteristic for upper portions of valve travel. It is approximately midway between linear and equal percentage.

#### **Flow Characteristic, Quick Opening -**

Flow Characteristic, Quick Opening - a flow characteristic in which there are large changes in the flow rate at the start of flow control element travel (valve begins to open), with progressively smaller changes with flow control element travel; [see Flow Characteristic; compare with Flow Characteristic, Equal Percentage and Flow Characteristic, Linear.](#)

Flow Characteristic, Quick Opening - A flow characteristic that provides maximum change in flow rate at low travels. The curve is basically linear through the first 40% of travel. It then flattens out indicating little increase in flow rate as travel approaches the wide open position. This decrease occurs when the valve plug travel equals the flow area of the port. This normally happens when the valve characteristics is used for on / off control.

Flow Characteristic, Quick Opening - an inherent flow characteristic in which there is a maximum flow with minimum travel.

Flow Characteristic, Quick Opening - Maximum possible flow as soon as the stem starts to move from a closed position. This characteristic is usually selected for two-position rather than modulating valves.

### Flow Coefficient -

Flow Coefficient - a measure of the flow capacity of a valve, designated as CV. It is the flow rate in gallons per minute (gpm) of 60° Fahrenheit water that passes through the fully open valve at 1 psi (pounds per square inch) pressure differential; [see Coefficient of Volume](#).

Flow Coefficient - [see Cv](#)

Flow Coefficient - a constant (Cv), related to the geometry of a valve, for a given valve opening, that can be used to predict flow rate.

**Flow Control Element** - the part of a valve that obstructs and controls fluid flow. It determines the valve type and the nature of fluid control for which the valve is suited.

### Flow Control Valve -

Flow Control Valve - a valve used to control the rate of fluid flow.

Flow Control Valve - a valve whose flow opening is controlled by the rate of flow of the fluid through it; usually controlled by differential pressure across an orifice at the valve; also known as Rate-of-Flow Control Valve.

Flow Control Valve - a valve whose primary function is to control flow rate.

**Flow Control Valve, Self Acting** - a self-contained automatic valve for the control of flow in a pipeline. Control is effected by upstream and downstream pressure differential on a piston.

**Flow Cracks** - surface imperfections due to improper flow and failure of stock to knit or blend with itself during the molding operation.

### Flow Rate -

Flow Rate - the mass, weight or volume of a fluid flowing through a conductor per unit of time

Flow Rate - the volume, mass, or weight of a fluid passing through any conductor per unit of time.

**Flow Valve** - [a valve that closes itself when the flow of a fluid exceeds a particular value.](#)

### Flow, Choked -

Flow, Choked - flow under conditions of critical pressure and temperature. The flow rate at this point cannot be increased by lowering the outlet pressure.

Flow, Choked - the condition that exists when, with the upstream conditions remaining constant, the flow through a valve cannot be further increased by lowering the downstream pressure.

Flow, Choked - this condition exists when at a fixed upstream pressure the flow cannot be further increased by lowering the downstream pressure. This condition can occur in gas, steam, or liquid services. Fluids flow through a valve because of a difference in pressure between the inlet (P1) and outlet (P2) of the valve. This pressure difference (Delta-P) or pressure drop is essential to moving the fluid. Flow is proportional to the square root of the pressure drop, which means that the higher the pressure drop is the more fluid can be moved through the valve. If the inlet pressure to a valve remains constant, then the differential pressure can only be increased by lowering the outlet pressure. For gases and steam, which are compressible fluids, the maximum velocity of the fluid through the valve is limited by the velocity of the propagation of a pressure wave which travels at the speed of sound in the fluid. If the pressure drop is sufficiently high, the velocity in the flow stream at the vena contracta will reach the velocity of sound. Further decrease in the outlet pressure will not be felt upstream because the pressure wave can only travel at sonic velocity and the signal will never translate upstream. Choked Flow can also occur in liquids but only if the fluid is in a flashing or cavitating condition.

The vapor bubbles block or choke the flow and prevent the valve from passing more flow by lowering the outlet pressure to increase the pressure drop. A good rule of thumb on gases and steam service is that if the pressure drop across the valve equals or exceeds one half the absolute inlet pressure, then there is a good chance for a choked flow condition.

Example:

P1	=	100	psig
P2	=	25	psig

Delta P = 75

P1 (ABS) = 100 + 14.7 or 114.7 1/2 of 114.7 = 57.35  
 Actual pressure drop = 75  
 Choked Flow is probable.

The style of valve (that is, whether it is a high recovery or a low recovery style) will also have an effect on the point at which a choked flow condition will occur. Choked Flow is also known as Critical Flow.

**Flow, Clearance** - that flow below the minimum controllable flow with the closure member not seated.

**Flow, Coefficient** - a constant (Cv) that is used to predict the flow rate through a valve. It is related to the geometry of the valve at a given valve opening; [see Cv.](#)

**Flow, Cold** -

Flow, Cold - continued deformation under stress

Flow, Cold - creep in polymer plastics

Flow, Cold - permanent deformation (of a seat)

**Flow, Compressible** - fluid flow under conditions which cause significant changes in density.

**Flow, Confined** - flow of a continuous stream fluid within a process vessel or conduit.

**Flow, Counter** - flow of a single fluid in opposite directions in adjacent portions of the same device, such as a U bend tube; [contrast with Flow, Countercurrent.](#)

**Flow, Countercurrent** - flow of two fluids in opposite directions within the same device, such as a tube in shell heat exchanger; [contrast with Flow, Counter.](#)

**Flow, Elastic** - return of a material to its original shape following deformation.

**Flow, Fluid** - the stream or movement of a fluid, or the rate of its movement.

**Flow, Grain** - fibrous appearance on a polished and etched section through a forging, which is caused by orientation of impurities and inhomogeneities along the direction of working during the forging process.

**Flow, Isothermal** - flow of a gas in which its temperature does not change.

**Flow, Knudsen** - Gas flow in a long tube at pressures such that the mean free path of a gas molecule is significantly greater than the tube radius.

**Flow, Laminar** -

Flow, Laminar - 1) a type of streamline flow most often observed in viscous fluids near solid boundaries, which is characterized by the tendency for fluid to remain in thin, parallel layers to maintain uniform velocity; 2) a nonturbulent flow regime in which the stream filaments glide along the pipe axially with essentially no transverse mixing; also known as Viscous or Streamline Flow; 3) flow under conditions in which forces due to viscosity are more significant than forces due to inertia.

Flow, Laminar - a condition of flow in which fluid moves in parallel layers. It occurs in situations where the Reynolds number is less than approximately 2000.

Flow, Laminar - a flow in which the paths of individual particles do not cross or intersect one another, and the velocity at any point remains constant both in magnitude and direction.

Flow, Laminar - a flow situation in which fluid moves in parallel layers; also referred to as streamline flow.

Flow, Laminar - fluid flow where fluid "particles" move in definite paths parallel to the overall direction of flow; also called Viscous Flow and Streamline Flow; [compare with Turbulent Flow.](#)

Flow, Laminar - it is the flow in which paths of individual particles of liquid do not cross each other. For laminar flow, Reynold's number is less than 2000.

**Flow, Metered** - flow at a controlled rate.

**Flow, Multiphase** - a mixture of two or more distinct phases (such as oil, water, and gas) flowing through a closed conduit.

**Flow, Non Uniform** - it is the flow in which velocities of liquid particles at all sections of the pipe or channel are not equal.

**Flow, One Dimensional** - it is the flow whose stream lines may be represented by straight lines.

**Flow, Pipe** - the conveyance of fluids in closed conduits.

**Flow, Plastic** - the deformation of a plastic material beyond the point of recovery, accompanied by continuing deformation with no further increase in stress; also known as Plastic Deformation.

**Flow, Pulsating** - irregular fluid flow in a piping system often resulting from the pressure variations of reciprocating compressors or pumps within the system.

#### **Flow, Rated** -

Flow, Rated - 1) design flow rate for a piping system or process vessel; 2) normal operating flow rate for a fluid passing through a piping system.

Flow, Rated - 1) the normal operating flow rate at which a fluid product is passed through a vessel or piping system; 2) the flow rate for which a vessel or process system is designed.

**Flow, Reverse** - flow of fluid in the opposite direction from that normally considered the standard direction. Some rotary valves are considered to be bi-directional although working pressure drop capabilities may be lower and leakage rates may be higher in reverse flow.

#### **Flow, Steady** -

Flow, Steady - a flow in which the velocity, pressure, and temperature at any point in the fluid does not vary with time.

Flow, Steady - it is the flow in which the quantity of liquid flowing per second is constant.

**Flow, Streamline** - [see Flow, Laminar](#)

**Flow, Three Dimensional** - the flow of liquid whose stream lines may be represented by a curve.

#### **Flow, Turbulent** -

Flow, Turbulent - a flow condition in which the fluid moves in a random manner. It generally occurs when the Reynolds number is greater than approximately 4000.

Flow, Turbulent - a flow is said to be turbulent when its path lines are irregular curves which continually cross each other. In turbulent flow the velocity varies from point to point in magnitude and direction. A flow of a liquid in a state of turbulence (state of agitation, unsteady motion) as distinguished from laminar flow, which occurs along a steady stream line. Any fluid subjected to forced circulation within the confines of a pipe or other form of enclosed conduit and the Reynolds number exceeds 3100; also known as Non-Viscous Flow.

Flow, Turbulent - a flow regime characterized by random motion of the fluid particles in the transverse direction as well as motion in the axial direction. This occurs at high Reynolds numbers and is the type of flow most common in industrial fluid systems.

Flow, Turbulent - a flow situation in which the fluid particles move in a random manner.

Flow, Turbulent - fluid flow in which fluid "particles" move in irregular paths, and no two particles have similar paths. The motion of a particle at a given distance is not necessarily parallel to the overall direction of flow. Turbulent flow is not caused by changes in fluid direction or by obstacles in its path but is the result of fluid properties and velocity; [compare with Laminar Flow](#).

Flow, Turbulent - it is the flow in which paths of individual particles cross each other and particles do not have definite paths. For turbulent flow, Reynold's number is more than 4000.

Flow, Turbulent - refers to the flow of a liquid at a speed greater than the critical velocity; it is characterized by eddies and is the opposite of streamline flow.

**Flow, Two Dimensional** - the flow whose stream lines may be represented by a curve.

**Flow, Uniform** - it is the type of flow in which the velocities of liquid particles at all sections of the pipe or channel are equal. This generally refers to flows in channels.

**Flow, Unsteady** - the flow in which the quantity of liquid flowing per second is not constant.

**Flow, Viscous** - [see Flow, Laminar](#)

**Flow, Vortex** - rotation of a fluid particle about a given axis, say the Z-axis, is defined as the average angular velocity of two infinitesimal line elements in the particle which are at right angles to each other and to the given axis. If the fluid particles within a region have rotation about an axis, the flow is called rotational flow, or vortex flow. If the fluid within a region has no rotation, the flow is called irrotational flow.

#### **Flowability -**

Flowability - a general term describing the ability of a slurry, plasticized material or semisolid to behave like a fluid.

Flowability - in casting, the sand should be easily flowable and respond to molding processes.

#### **Flowmeter -**

Flowmeter - a device which is used to indicate either flow rate, total flow or a combination of both.

Flowmeter - an instrument used to measure pressure, flow rate, and discharge rate of a liquid, vapor, or gas flowing in a pipe; also known as Fluid Meter.

Flowmeter - an instrument used to measure quantity or the flow rate of a fluid motion.

#### **Fluid -**

Fluid - a gas or liquid

Fluid - a general term for any liquid, gas, vapor or slurry used in a piping system.

Fluid - a liquid or gas.

Fluid - a substance deforming **contiguously** when subjected to a shear stress regardless of how small the shear stress may be. A fluid may be a gas, liquid or fluidized solid powder and is considered to consist of finite particles each much larger than a molecule but infinitesimal in size compared to total volume of fluid.

Fluid - the state of matter that is not solid and is able to flow and change shape. The term fluid includes both the liquid state and the gas or vapor state.

**Fluid Catalytic Cracking** - an oil refining process in which the gas-oil is cracked by a catalyst bed fluidized by using oil vapors.

**Fluid Controlled Valve** - a valve for which the valve operator is activated by a fluid energy, in contrast to electrical, pneumatic, or manual energy.

**Fluid Film Bearing** - an antifriction bearing in which rubbing surfaces are kept apart by a film of lubricant such as oil.

**Fluid Friction** - friction due to the viscosity of fluids.

**Fluid Meter** - **see Flowmeter**

**Fluid Power** - energy transmitted and controlled through use of a pressurized fluid.

**Fluid, Fire-Resistant** - a fluid difficult to ignite, which shows little tendency to propagate flame.

**Fluidity** - the degree to which a substance flows freely.

**Fluorel®** - **see Viton**

**Fluorinate** - to introduce fluorine into a compound.

**Fluorocarbon** - 1) a compound formed by replacing one or more of the hydrogen atoms in a hydrocarbon with fluorine atoms; 2) a class of nonreactive organic compounds containing carbon, fluorine, and in some cases, hydrogen. They are used as aerosols, lubricants, and electrical insulators.

**Flush Welding** - in it the parts are brought together lightly with current flowing, and then separated slightly; a flash occurring at the interface.

**Flutter** - the irregular alternating motion of the parts of a relief valve due to the application of pressure where no contact is made between the valve disk and the seat.

**Flutter Valve** - a valve that is operated by fluctuations in pressure of the material flowing over it; **used in carburetors.**

#### **Flux -**

Flux - 1) In metal refining, a substance added to the melt to remove undesirable substances such as sand, dirt or ash, and sometimes to absorb undesirable elements or compounds such as sulfur in steelmaking or iron oxide in copper refining; 2) in welding, brazing and soldering, a substance preplaced in the joint or fed into the molten zone to prevent formation of oxides or other undesirable compounds, or to dissolve them and make it easy to remove them.

Flux - 1) in welding and soldering, a material that aids in the fusion of metals by preventing oxidation; 2) in steel production, a material such as limestone, used in a blast furnace to absorb and segregate impurities.

Flux - 1) the rate of flow of energy, fluids, etc. across a surface; 2) a substance, such as borax or rosin, used to help fuse metals together by preventing oxidation, as in soldering; 3) a substance mixed with a solid to lower the melting point in soldering or smelting.

Flux - a fusible material or gas used to prevent formation of oxides, nitrides, etc. during welding.

Flux - a substance which is added to a solid or applied when the solid gets melted to increase its fusibility, by dissolving the oxides which would prevent it adhering to the mating part. It is usual to use flux when soldering, brazing or galvanizing.

Flux - an iron cleaning agent. Limestone and lime react with impurities within the metallic pool to form a slag that floats to the top of the relatively heavier (and now more pure) liquid iron.

Flux - welding of workpieces is always carried out at high temperatures. Due to working at high temperatures, oxides are formed readily, which produce low strength poor quality welds. To avoid the formation of oxides and get strong perfect welds, fluxes are added to the welding areas. Fluxes absorb oxides and make the welding process easier.

**Flux Cored Arc Welding** - a form of electric arc welding in which the electrode is a continuous tubular wire of filler metal whose central cavity contains welding flux; welding may be performed with or without a shielding gas such as CO<sub>2</sub> or argon; abbreviated FCAW.

**Flux Cored Electrode Process** - a type of electrogas welding process in which the outer surface of the electrode is made of low carbon steel with flux filled inside the core. Calculated quantities of alloying elements are added with the flux to adjust the composition of weld pool. Thus in this process, a thin layer of slag is formed over the welding pool. The equipment used for electrogas welding is similar to one used in electro slag welding, with the exception of arrangement of the electrogas. This process is suitable for welding workpieces between 20 to 75 mm thicknesses.

**Flux Oxygen Cutting** - severing metal by using a flux and oxygen.

**Fly Cutting** - cutting with a milling cutter provided with only one tooth.

#### **FOB -**

FOB - 1) Freight On Board; 2) Free On Board

FOB - Free On Board. FOB prices exclude all insurance and freight charges.

**FOC** - Free Of Charge

**FOF** - Face Of Flange

**Fog Quenching** - rapidly cooling an item by subjecting it to a fine mist, usually of water.

**Fogged Metal** - a metal surface whose luster has been greatly reduced by the creation of a film of oxide or other reaction products.

**Follower** - 1) a toothed wheel which is driven by another wheel; 2) a pinion which is driven by a toothed wheel; 3) that part of a mechanism, such as a lever arm, which is driven by a cam and usually returned by a spring.

**Foot Check Valve** - 1) a valve which is fitted to the bottom of a suction pipe, usually with a strainer; the lowest valve in a pump; 2) a non-return valve at the inlet end of a suction pipe.

#### **Foot Pound -**

Foot Pound - 1) a unit of energy or work in the English gravitational system, equal to the work done by 1 pound of force when the point at which the force is applied is displaced 1 foot in the direction of the force; equal to approximately 1,355818 joule; abbreviated ft-lb; ft-lbf. 2) a unit of torque in the English absolute gravitational system, equal to the torque produced by 1 pound of force acting at a perpendicular distance of 1 foot from an axis of rotation; also known as Pound-foot. Abbreviated lbf-ft.

Foot Pound - a force of one pound applied to a lever one foot long.

Foot Pound - the energy needed to raise one pound to a height of one foot.

#### **Foot Valve -**

Foot Valve - a check valve fitted to the bottom of a suction pipe. A strainer is often fitted to this valve.

Foot Valve - a non-return valve at the inlet end of a suction pipe.

Foot Valve - a non-return valve fitted to the bottom of suction pipe. A strainer is often fitted to this

valve.

**Foot Valve** - a non-return valve which is present at the foot of a length of suction pipe attached to a pump.

**Foot Valve** - a type of check valve specifically for 'open-end' and totally immersed location on the suction side of a pump. It is always supplied with a filter or strainer.

**Foot Valve** - a valve in the bottom of the suction pipe of a pump which prevents backward flow of water.

**Force** - that influence on a body which causes it to accelerate; quantitatively it is a vector, equal to the body's time rate of change of momentum.

#### **Force Fit -**

**Force Fit** - a class of interference fit involving relatively large amounts of negative allowance, which requires large amounts of force to assemble and results in relatively large induced stresses in the assembled parts.

**Force Fit** - [see Press Fit](#)

**Force Majeure** - an unforeseeable or uncontrollable course of events which excuses a party from fulfilling its part of a contract.

**Forced Circulation** - the use of a pump or other fluid-movement device in conjunction with liquid-processing equipment to move the liquid through pipes and process vessels; contrasted to gravity or thermal circulation.

**Forced Lubricated Bearing** - a bearing in which a continuous flow of lubricant is forced over the journal or bearing.

#### **Forehand Welding -**

**Forehand Welding** - a gas welding process in which the flame is directed towards the progress of welding.

**Forehand Welding** - welding in which the palm of the welder's torch or electrode hand faces the direction of weld travel; it has special significance in oxyfuel gas welding, where the welding flame is directed ahead of the weld puddle and provides preheating; [contrast with Backhand Welding](#).

#### **Forge -**

**Forge** - to shape metal by compressing, rolling, hammering, etc.

**Forge** - to shape metal by heating and hammering, or by heating and gradually applying pressure.

**Forge** - to work hot metal into shape by hammering or pressing.

#### **Forge Welding -**

**Forge Welding** - a group of pressure welding process carried out by heating parts by external heating and completing the weld by pressure or blows. The metals are heated in a large furnace to a plastic state and then joined by pressure. Wrought iron and low carbon steels are heated to a temperature of 1300° C. Forge welding is classified according to the manner of joining the materials, i.e., hammer welding, roll welding and die welding. The wrought iron and low carbon steels are joined by forging. In this process, flux is used to avoid oxidation. Properly made forge welded joints are as good in strength as arc or oxy-acetylene welded joints. However, forge welding requires considerable skill. This process is also slower as compared to other welding processes.

**Forge Welding** - a group of pressure welding processes (blacksmith, roll or hammer welding) carried out by heating parts by external heating and completing the weld by pressure or blows.

#### **Forging -**

**Forging** - 1) a metal article which is formed as a result of a forging process; 2) the operation of shaping metal parts when hot by means of hammers or presses.

**Forging** - 1) using compressive force to plastically deform and shape metal; it is usually done hot, in dies or between rolls; 2) a shaped part made by impact, compression or rolling; if by rolling, the part is usually referred to as a "roll forging."

**Forging** - a metalworking process that involves hammering or squeezing, with or without a die, at hot working temperatures to form a specific shape.

**Forging** - plastically deformed metal shaped by a forging method. Forgings are shaped via compression making them superior than castings.

## **Forming -**

Forming - a process for shaping or molding sheets, rods, or other pieces of hot glass, ceramic ware, plastic, or metal by the application of pressure.

Forming - applying pressure to shape a material by plastic deformation without intentionally altering its thickness.

**Forming Tool** - a non-rotating tool that produces its inverse form on the work piece.

**FOT** - Free On Truck (Acronym); [see FOB](#)

**Foul** - to become entangled with something so as to hinder its movement or functioning.

## **Foundry -**

Foundry - a building where metal castings are produced.

Foundry - a workshop for melting and casting metal.

Foundry - foundry practice includes various basic production processes such as melting of metal, manufacture of molds, pouring of the metal into molds, solidification, [shakeout](#) and [fettling](#) of the castings.

**Four Way Pilot Valve** - a pilot valve used with double acting actuators.

**Four Way Valve** - a valve at the junction of four waterways which allows passage between any two adjacent waterways by means of a movable element operated by a quarter turn.

**FR** - 1) Filter Regulator; 2) For Review

**Fraction** - in chemical distillation, the proportion of a solution of two liquids consisting of a specific chemical substance.

## **Fractional Distillation -**

Fractional Distillation - a thermal process whereby a mixture of liquids that boil at different temperatures is heated at a series of increasing temperatures, and the distillates boiled off at each temperature are collected separately.

Fractional Distillation - the separation by distillation of the various constituents of a mixture of liquids with different boiling points.

**Fractional Sampling** - mechanical sampling having equipment which is able to select samples of uniformly graded material without segregation.

**Fractionate** - to separate the components of a liquid by distillation, particularly fractional distillation.

**Fractionating Column** - an apparatus for fractional distillation in which rising vapor and falling liquid are brought into intimate contact.

**Fractography** - the study of microscopic fractures in metal surfaces.

## **Fracture -**

Fracture - the propagation of a crack through a material, usually due to repeated application of a load.

Fracture - the type of surface which is formed on breaking a piece of steel.

**Fracture Strength** - [see Fracture Stress](#)

## **Fracture Test -**

Fracture Test - a method for determining composition, grain size, case depth or material soundness by breaking a test specimen and examining the fracture surface for certain characteristic features.

Fracture Test - macro- or microscopic examination of a fractured surface to determine characteristics such as grain pattern, composition, or the presence of defects.

**Frame-Surface Cooled Machine** - a closed machine with its surface cooled by means of surrounding medium.

**Frangible** - breakable, fragile, or brittle.

**Free Machining** - a material description that indicates some alteration of chemical composition to substantially improve machinability - such as by the addition of sulfur, phosphorus or lead to steel, or lead to nonferrous metals; also called Free Cutting.

**Free Machining Brass Rod** - commonly known as commercial brass

**Free Machining Steel** - steel to which elements such as sulfur, selenium, or lead have been added intentionally to improve machinability.

**Freefit** - a type of clearance fit having a relatively large allowance; it is used when accuracy of assembly is not essential, or when large temperature variations may occur, or both; also known as Free Running Fit.

**Freight On Board (FOB)** - the cost of shipping materials only from the factory to the ship or plane.

**Fremont Test** - a notched bar impact test in which a beam specimen notched with a rectangular groove gets broken by a falling weight.

### **Fretting** -

Fretting - a combination of corrosion and wear. In a mechanical seal, a common example of fretting occurs when the rubbing motion of a secondary seal continually wipes the oxide coating from a shaft or sleeve.

Fretting - a form of wear that occurs between closely fitting surfaces subjected to cyclic relative motion of very small amplitude; it is usually accompanied by corrosion, especially of the very fine wear debris; also known as Chafing Fatigue; Fretting Corrosion; Friction Oxidation; Molecular Attrition; Wear Oxidation; and in rolling element bearings, False Brinelling.

Fretting - wearing away slowly by friction between two surfaces, similar to sharpening a cutting on an oil stone. Fretting is an undesirable phenomenon.

**Fretting Fatigue** - fatigue which is accelerated by fretting; also called Chafing Fatigue.

### **Friction** -

Friction - a force which always resists motion.

Friction - resistance to motion due to the contact of surfaces.

Friction - the sliding resistance to the relative motion of two bodies in contact with each other.

**Friction Bearing** - a solid bearing that directly contacts and supports an axle end.

**Friction Fit** - a perfect fit between two parts.

**Friction Loss** - in a piping system, the loss of pressure between the inlet and outlet of a pipe due to the frictional resistance, or drag, as the fluid flows through the pipe.

**Friction Oxidation** - [see Fretting](#)

**Friction Torque** - the torque which is produced by frictional forces and opposes rotational motion, such as that associated with journal or sleeve bearings in machines.

### **Friction Welding** -

Friction Welding - a weld may be obtained by the heat generated by mechanical friction. For example, dissimilar metal shafts can be joined if one has been spun up against the other, with both being allowed to spin as the weld temperature is reached. Also, some bolts can be attached to plates by firing them with a special gun, with the impact temperature welding them on.

Friction Welding - a welding process for metals and thermoplastics materials in which two members are joined by rubbing the mating faces together under high pressure.

Friction Welding - in this process coalescence is produced by the heat obtained from mechanically induced sliding motion between rubbing surfaces produces. The parts to be welded are held together under pressure. The sequence of operation of friction welding is: 1) thoroughly clean the surfaces to be welded. 2) Hold the components in perfect axial alignment. 3) One component is held rigidly and the other component is rotated to the desired speed with the help of the motor. 4) Pressure and rotation are maintained until the resulting high temperatures makes the component metals plastic for welding. 5) When the temperature rises sufficiently, the rotating part is stopped and the axial force is increased to join the metallic portions together. 6) The upset portion is removed and the weld is finished to shape. Friction weld quality and productivity depends upon many variables like relative speed of rotation, friction pressure, duration of heating, type of materials and forge pressure. Materials can be welded by friction welding process aluminum, copper, magnesium, nickel, titanium, tantalum, molybdenum and its alloys. All types of steels (stainless steels, high speed steels, tool steel, heat resisting steels) and many dissimilar metals can be welded by this process.

Friction Welding - the welding of similar or dissimilar metals, the necessary temperature being generated by friction between the two parts being welded. The parts are rotated against one another under an applied load for a given time to form a plastic layer at the interface, then the rotation is stopped. Then the parts are forged together, without rotation of the materials becoming molten, forming binds having the strength of the parent metal; also called Solid Phase Welding.

**Friction, Break-Out** - friction developed during initial or starting motion.

**Friction, Running** - constant friction developed during operation of a dynamic o-ring.

**Front Slagging** - skimming slag from the mixture of slag and molten metal as it flows through a tap hole.

**FS** - Forged Steel

**FSC** - Full Size Container

**FTTG** - Fitting

**FTZ** - Free Trade Zone

**Fuel, Aromatic** - fuel which contains benzene or aromatic hydrocarbons. Causes high swell of rubber.

**Fuel, Distillate** - any of the fuel hydrocarbons obtained during the distillation of petroleum which have boiling points higher than that of gasoline.

**Fuel, Non Aromatic** - fuel which is composed of straight chain hydrocarbons. Causes little swell of rubber.

**Fugitive Emissions** - a name used by environmental protection agencies for the external leakage of hazardous gases from piping components and process equipment, such as valves, flanges, pump and compressor seals, as well as tanks where hydrocarbons are exposed to atmosphere.

**Fulcrum Fork** - the component which carries the fulcrum pin

**Fulcrum Fork Locking Nut** - the nut which locks the fulcrum fork in position

**Fulcrum Pin** - the pin about which the lever moves

**Full** - a term signifying slightly larger than the specified dimensions.

#### **Full Annealing** -

**Full Annealing** - an imprecise term that implies heating to a suitable temperature followed by controlled cooling to produce a condition of minimum strength and hardness.

**Full Annealing** - annealing a ferrous alloy by austenitizing and then cooling slowly through the transformation range. The austenitizing temperature for hypoeutectoid steel is usually above Ac3 and for hypereutectoid steel usually between Ac1 and Ac cm.

**Full Ball** - a valve closure member that is a complete spherical surface with a flow passage through it. The flow passage may be round, contoured or otherwise modified to yield a desired flow characteristic.

#### **Full Bore** -

**Full Bore** - describes a valve in which the bore (port) is nominally equal to the bore of the connecting pipe; also called Full Port.

**Full Bore** - [see Full Port](#)

**Full Bore** - term used e.g. of a ball valve, to indicate that the internal diameter of the valve opening is the same as that of the piping to which it is fitted.

**Full Bore Ball Valve** - a ball valve having full bore round ports in the body, body connector (s) and ball.

**Full Bore Valve** - a valve whose closure mechanism has the same bore dimensions as the valve.

**Full Face Gasket** - a flat gasket which contacts the entire flat contact surface of two mating flanges, extending past the bolt holes. This term applies to flat face flanges only.

**Full Fillet Weld** - a fillet weld whose size is equal to the thickness of the thinner member to be welded.

**Full Hard Temper** - a level of hardness and strength for nonferrous alloys and some ferrous alloys corresponding to a cold worked state beyond which the material can no longer be formed by bending.

**Full Lift Safety Valve** - a safety valve in which the valve head lifts automatically a distance giving, when the valve head is fully lifted, a discharge area round the edge of the valve seat equal to the area through the seat orifice after deducting the area of guides or other obstructions. NOTE: high lift and full lift safety valves are mainly proprietary types.

**Full Load** - the highest value of load specified for a machine operating at rated output.

**Full Penetration Weld** - describes the type of weld in which the weld metal extends through the complete thickness of the parts being joined.

**Full Port** - a bore (port) of a valve that is approximately the same size as the inside diameter of the connecting pipe; also called Full Bore; [compare with Regular Port, Reduced](#)

### Port, and Venturi Port.

**Function** - (mathematics) a quantity whose value depends on the varying values of others.

**Fungible** - relating to petroleum products whose characteristics are so similar they can be commingled.

**Furnace Brazing** - a brazing process carried above 423° C in a furnace with the help of non-ferrous metals.

**Fusibility** - the ability of a metal to become fluid through the application of heat.

### Fusion Welding -

Fusion Welding - a welding method whereby fusion of parts to be joined is accomplished by a high-contact pressure and heat.

Fusion Welding - any welding process that involves melting of a portion of the base metal.

Fusion Welding - various welding process by which metals are welded by bringing the workpieces in the molten state at the surfaces to be joined. The process may be carried out with or without filler metal.

**Fusion Zone** - in a weldment, the area of base metal melted, as determined on a cross section through the weld.

**FVO** - First Valves On

**FW** - 1) Friction Welding; 2) Fire Water

**G** - 1) Gas; 2) process Gas, sweet; 3) process Gas, non corrosive, onshore or offshore

**GA** - 1) General Assembly (Drawing); 2) General Arrangement

**Gain** - the relationship of input to output. If the full range of the input is equal to the full range of the output; then the gain is 1. Gain is another way to describe the sensitivity of a device.

**Gall** - to wear or irritate by rubbing.

**Galling** - localized adhesive welding with subsequent spalling and roughening of rubbing metal surfaces as a result of excessive friction and metal to metal contact at high spots.

**GALV** - Galvanized

**Galvanic** - relating to electric currents produced by chemical action.

**Galvanic Cell** - if two differing metals or alloys are adjacent, and if there is a medium which allows for the passage of electrons (and hence a current to be carried), the difference in potential can generate the formation of ions, and the metals form a corrosion couple known as a Galvanic Cell. Electrons travel from the more negative metal (anode) to the more positive metal (cathode).

### **Galvanic Corrosion** -

Galvanic Corrosion - the accelerated corrosion of metal due to electrical contact with a more passive metal.

Galvanic Corrosion - when two dissimilar metals come into contact and one of them is farther down the electromotive series than the other, and if moisture is present, current will flow from one to the other ([see Electrolysis](#)) causing corrosion of the one lower in the electromotive series.

### **Galvanize** -

Galvanize - refers to the protective process of dipping metals like mild steel into molten zinc after fabrication, or of coating the metal with zinc by electrolytic action.

Galvanize - the coating of steel or iron with zinc by immersion in a bath of molten zinc covered with a flux.

Galvanize - to coat a metallic surface (usually iron or steel) with a thin layer of zinc, in order to protect it from corrosion.

Galvanize - to dip steel into a bath of molten zinc. A zinc-iron alloy is formed at the steel surface, which resists corrosion.

**Galvanized Steel** - steel coated with a thin layer of zinc to provide corrosion resistance in underbody auto parts, garbage cans, storage tanks, or fencing wire. Sheet steel normally must be cold-rolled prior to the galvanizing stage. There are two main types of galvanizing: 1) Hot-Dipped - steel is run through a molten zinc coating bath, followed by an air stream "wipe" that controls the thickness of the zinc finish; 2) Electrogalvanized - a zinc plating process in which the molecules on the positively charged zinc anode attach to the negatively charged sheet steel. The thickness of the zinc coating is readily controlled. By increasing the electric charge or slowing the speed of the steel through the plating area; the coating will thicken. Electrogalvanizing equipment is more expensive to build and to operate than hot dipped, but it gives the steelmaker more precise control over the weight of the zinc coating. The automotive manufacturers, because they need the superior welding, forming and painting ability of electrogalvanized steel, purchase 90% of all tonnage produced.

**Gamma (g) Radiation** - electromagnetic disturbance (photons) emanating from an atom nucleus. This type of radiation travels in wave form much like x-rays or light, but has shorter wave length (approximately  $1 \text{ \AA}$  or  $10^{-7} \text{ mm}$ ). It is very penetrating.

**Gamma Ray Radiography** - Radium and its salts decompose at a constant rate, giving off gamma rays, which are of shorter wavelength and are more penetrating than x-rays. Originally radium and radon were used as a source of gamma rays, but these days cobalt 60 is used. Cobalt 60 is an isotope of cobalt produced by neutron irradiation, which is cheaper than radium and radon. The gamma ray apparatus consists of a cobalt 60 source with dimensions of 3 x 3 to 6 mm enclosed in a sealed container or capsule.

### **Gas Carburizing** -

Gas Carburizing - a surface hardening process in which steel or an alloy of suitable alternative composition is exposed at elevated temperature to a gaseous atmosphere with a

high carbon potential; hardening of the resulting carbon rich surface layers is done by quenching the part from the carburizing temperature or by reheating and quenching.

**Gas Carburizing** - refers to the carburizing of steel by heating it in a current of carbon monoxide or hydrocarbon gas.

### **Gas Cutting** -

**Gas Cutting** - refers to the process of cutting ferrous metals by utilizing the chemical action of oxygen on elements in the base metal.

**Gas Cutting** - severing metal pieces by means of chemical action of oxygen on the base metal.

**Gas Duct Isolator** - a type of valve primarily for use in waste heat recovery systems, individual process control and environmental pollution protection equipment. Gas duct isolators are of glandular guillotine, pivoted flap or louver design. They are used in single or multiple modular form for the isolation and control of gas flow.

**Gas Holes** - holes that appear after machining of a casting. The gases generated during cooling of a casting must escape easily. If the coreprint is of insufficient size, then gases cannot escape easily, and produce gas holes. Other causes of gas holes are a) faulty and poor quality of metal, b) non-directional solidification, and c) excessive moisture content in sand.

**Gas Lift** - the technique of raising a liquid in a vertical flow line by injecting a gas below a portion of the liquid column causing upward flow.

**Gas Metal Arc Welding (GMAW)** - a form of electric arc welding in which the electrode is a continuous filler metal wire and in which the welding arc is shielded by supplying a gas such as argon, helium or CO<sub>2</sub> through a nozzle in the torch or welding head; the term GMAW includes the methods known as MIG Welding.

**Gas Oil** - a type of fuel oil distilled from petroleum and heavier than paraffin oil (kerosene).

**Gas Pliers** - pliers for gripping round objects such as pipes, tubes, and circular rods.

### **Gas Regulator** -

**Gas Regulator** - a device for controlling the delivery of gas at a substantially constant pressure.

**Gas Regulator** - an automatic valve which is used for maintaining a steady gas pressure in gas supply mains.

**Gas Shielded Arc Welding** - an all inclusive term for any arc welding process that utilizes a gas stream to prevent direct contact between the ambient atmosphere and the welding arc and weld puddle.

**Gas Torch** - [see Cutting Torch or Welding Torch](#)

### **Gas Welding** -

**Gas Welding** - in it heat is supplied by burning a mixture of oxygen and acetylene (usually). The gases are mixed in a torch or blowpipe, which controls the welding flame. Ratio of 1:1 of oxygen and acetylene produces neutral flame.

**Gas Welding** - it uses an oxy-acetylene or oxy-hydrogen flame to get the desired temperature.

**Gas Welding** - the process of melting the edges or surfaces to be joined by a gas flame and allowing the molten metal to flow together, thus forming a solid continuous joint upon cooling. It is suitable for joining sheets up to 50mm thickness. In lower thicknesses filler metals are not used, whereas in greater thicknesses a filler metal is used. The composition of welding rod used as a filler metal is nearly the same as that of the metals to be joined. A flux is always used to prevent oxidation except in welding of mild steel. A filler metal is added in the form of a filler rod and must be having the same composition as that of the parent metal. Flux is also needed for proper flow of metal and for avoiding oxidation of the metal surfaces to be joined during welding. It also removes impurities present on the surface of the metal.

**Gas Welding** - various welding process carried out with gas flames with or without the application of pressure.

**Gas Welding and Cutting** - as opposed to arc welding, the heat required to melt and fuse the metal parts together is supplied by a torch using a flammable gas burning in air or oxygen. Propane and butane torches are used but do not produce a temperature high enough for welding some metals. Since the burning of a flammable gas in pure oxygen results in a higher temperature, the oxyacetylene torch is most often used. A mixture of oxygen and acetylene generates an intense flame which, for welding, melts the metal on each side of the joint and simultaneously a filler metal,

in the form of a rod, is melted into the space between the part to be joined. For cutting, the metal is first heated where the cut is to be made and then a controllable jet of oxygen is discharged from the nozzle to produce extremely high temperatures and is directed into the area to burn through the metal.

### **Gasket -**

**Gasket** - 1) a seal between two stationary parts of a machine; 2) packing material such as cotton rope impregnated with graphite grease for packing stuffing boxes on valves, pumps, etc.; 3) any ring or washer of packing material; 4) a soft thin metal sheet having ridges which partially flatten on assembly.

**Gasket** - a component whose purpose is to seal a joint between two larger components. It is softer than the surfaces of the joint being sealed and usually squeezed by means of bolting to effect the seal.

**Gasket** - a device used to retain fluids under pressure or seal out foreign matter. Normally refers to a static seal.

**Gasket** - a flat, yielding, ring-shaped part placed between mating components (such as body and bonnet, flanges) in pressure-containing assemblies to form a fluid seal.

**Gasket** - a material used for sealing a joint in a piping system. It usually is a flat piece of elastomer, cork, asbestos compound or similar material and is used between mating flanges or similar surfaces. It provides a static permanent seal.

**Gasket** - a packing made of deformable material, usually in the form of a sheet or ring, used to make a pressure-tight joint between stationary parts; also known as Static Seal.

**Gasket** - A sealing device used in between two parts to prevent leakage. Types include inside the bolt circle, (no bolt holes) & full face, (has bolt holes, and is as large as flange diameter).

**Gasket** - a sealing member, usually made by stamping from a sheet of cork, rubber, metal or impregnated synthetic material and clamped between two essentially flat surfaces to prevent pressurized fluid from leaking through the crevice; typical applications include flanged joints in piping, head seals in a reciprocating engine or compressor, casing seals in a pump, or virtually anywhere a pressure tight joint is needed between stationary members; also known as Static Seal.

**Gasket** - a thin, flat seal placed between two joining parts to prevent leakage of air or liquid.

**Gasket** - material used between two static surfaces to prevent leakage.

**Gasket** - the replaceable, deformable metal or elastomeric component which, when compressed, prevents the passage of gas from one side of the seal to the other. Gaskets are used in the bonnet seal, the closure seal and the flange seals (when flanges are used). Metal gaskets provide the best seal by virtue of their low permeability, low outgassing rate and higher bakeout temperature. Elastomeric gaskets, chiefly Viton, are used when vacuum requirements are less stringent. They are economical and within limitations are reusable. Metal closure seals are reusable, but must be replaced more often than elastomeric closure seals.

**Gasoil** - an intermediate distillate product used for diesel fuel, heating fuel and sometimes as feedstock. Term is often used interchangeably with No. 2 heating oil.

### **Gate -**

**Gate** - in casting, the actual entry point of molten metal to a mold cavity.

**Gate** - the closure element of a gate valve (sometimes called wedge or disc).

**Gate** - the flow control element of a gate valve; also called a Wedge or Slide.

**Gate / Poppet** - the gasket carrier which moves the closure gasket into position with the valve seat and transfers the sealing force to the gasket.

### **Gate Valve -**

**Gate Valve** - 1) a valve with a linear motion closure member that is a flat or wedge shaped gate which may be moved in or out of the flow stream. It has a straight through flow path; 2) a type of valve whose flow control element is a disc or plate that undergoes translational motion in a plane transverse to the flow passage through the valve body.

**Gate Valve** - a general service valve used primarily for on-off, non-throttling service. The valve is closed by a flat face, vertical disc, or gate that slides down through the valve to block the flow.

**Gate Valve** - a multi-turn valve which has a gate-like disk and two seats to close the valve. The

gate moves linearly, perpendicular to the direction of flow. This type of valve is normally used in the fully opened or fully closed position; it is not suited to throttling applications. Gate valves provide robust sealing, and are used extensively in the petrochemicals industries. This class of valves also includes knife gate valves, conduit gate valves and wedge gate valves. Knife gate valves have much thinner gates with a knife-like edge, making them suited to use with floating solids, e.g., as in the pulp & paper industries. Conduit gate valves have a rectangular disk as the closing element. One half of the disk is solid, to close the valve; the other has a circular port, which can be used to open the valve. Wedge gate valves have a wedge-shaped gate which 'wedges' between floating seats to close the valve tightly.

- Gate Valve - a multi-turn valve which has a gate-like disk and two seats to close the valve. The gate moves linearly, perpendicular to the direction of flow. This type of valve is normally used in the fully opened or fully closed position; it is not suited to throttling applications. Gate valves provide robust sealing, and are used extensively in the petrochemicals industries. This class of valves also includes knife gate valves, conduit gate valves and wedge gate valves. Knife gate valves have much thinner gates with a knife-like edge, making them suited to use with floating solids, e.g., as in the pulp & paper industries. Conduit gate valves have a rectangular disk as the closing element. One half of the disk is solid, to close the valve, the other has a circular port, which can be used to open the valve. Wedge gate valves have a wedge-shaped gate which 'wedges' between floating seats to close the valve tightly.
- Gate Valve - a straight through pattern valve in which closure element is a wedge situated between two fixed seating surfaces, with means to move it in or out of the flow stream in a direction perpendicular to the pipeline axis. Used as a block valve, or on-off valve.
- Gate Valve - a type of valve in which the flow control element enters the fluid path from the side and traverses it.
- Gate Valve - a type of valve which is usually multi-turn in operation and use a gate-like disc and two seats for closure. In wedge gate valves, the closing member is tapered and may be solid, flexible or double disc type. Parallel slide gate valves have two parallel slide discs usually separated by a spring. Conduit gate valves use a parallel disc, which is extended with a circular port to obtain a smooth full bore in the open position. Knife gate valves use a narrow section parallel disc, usually tapered at the end to provide a simple cutting edge. Knife gate valves are often referred to as Slide or Blade valves. Gate valves are usually screwed or otherwise fitted to the valve body.
- Gate Valve - a valve in which a sliding disc or gate is moved by an actuator perpendicular to the direction of flow. They are normally used in the fully opened or fully closed position and not for throttling purposes.
- Gate Valve - a valve in which the flow of water is controlled by means of a circular disk fitting against, and sliding on, machine-smoothed faces. The motion of the disk is raised or lowered by turning a threaded stem connected to the handle of the valve. The opening of the valve is usually as large as the full bore of the pipe. Gate valves enable shut-off of certain pipe sections without the necessity of draining the entire system. Their use is preferred to globe valves because they offer less resistance to water flow.
- Gate Valve - a valve that works by lowering a gate to block the flow of fluid, the gate can be lifted to resume the flow of fluid.
- Gate Valve - a valve which provides a straight-through passage for the flow of a fluid. The gate gets moved between the body seats by a stem whose axis is at right angles to that of the body ends which are themselves in line. The actuating thread of the stem is either contained inside the valve or is exterior to the bonnet.
- Gate Valve - a valve which provides a straight-through passage for the flow of fluid. The body seats by stem whose axis is at right angles to that of the body ends.
- Gate Valve - a valve with disk-shaped closing elements that fits tightly over an opening through which water passes.
- Gate Valve - gate valves have a rising and lowering gate, when the gate is lowered it will shut off the flow, the gate acts to block the flow.

**Gate Valve** - refers to a stop valve which is able to control flow of liquid in a pipe by a plate at right angles to the direction of flow.

**Gate Valve** - this type of valve has three advantages: It offers a full line of sight transmission from port to port; it has the best conductance available; and it can be made in large sizes at a reasonable price.

### **Gauge** -

**Gauge** - an instrument used for measuring some physical property such as pressure, temperature, etc.

**Gauge** - the thickness of sheet steel. Better quality steel has a consistent gauge to prevent weak spots or deformation.

### **Gauge Cock** -

**Gauge Cock** - a valve attached to a water column or drum for checking water level.

**Gauge Cock** - a valve located on a water column of a boiler drum.

**Gauge Length** - in materials testing, the original length of an elongated specimen over which measurements of strain, thermal expansion or other properties are taken.

**Gauge Snubber** - a device installed in the line to the pressure gauge used to dampen pressure surges and thus provide a steady reading and a protection for the gauge.

**Gauge, Bellows** - a gauge in which the sensing element is a convoluted closed cylinder. A pressure differential between the outside and the inside causes the cylinder to expand or contract axially.

**Gauge, Bourdon Tube** - a pressure gauge in which the sensing element is a curved tube that tends to straighten out when subjected to internal fluid pressure.

**Gauge, Diaphragm** - a gauge in which the sensing element is relatively thin and its inner portion is free to deflect with respect to its periphery.

**Gauge, Pressure** - a gauge that indicates the pressure in the system to which it is connected.

**Gauge, Vacuum** - a pressure gauge for pressures less than atmospheric.

**GBP** - General Business Principles

**Gbp** - pound sterling (Abbreviation)

**GC** - 1) General Correspondence; 2) process Gas, Corrosive, onshore or offshore

**Gear** - A toothed wheel, sometimes referred to as a cog.

**Gear Operator** - the operator of a valve that uses a gear set to reduce the force required to close the valve.

**Gear Ratio** - the ratio of the number of teeth on two engaged gearwheels.

**Gear Wheel** - a wheel that meshes gear teeth with another part.

### **Gearbox** -

**Gearbox** - used to ensure easier operation of larger valves by requiring less torque to open or close and are used when people want to use smaller actuators or use less force to open or close.

**Gearbox** - used to ensure easier operation of larger valves, particularly ball valves.

**General Specification (GS)** - a document which defines the minimum standards of quality for the execution of work and / or supply of equipment or systems.

**GF** - CO2 fire extinguisher

**Gib** - a removable plate designed to hold other parts in place or act as a bearing or wear surface.

**Girbotal Process** - a regenerative absorption process to remove carbon dioxide, hydrogen sulfide, and other acid impurities from natural gas, using **mono-, di-, or tri-ethanolamine as the reagent.**

**GJ** - Ground Joint

**GKTI** - Gasket, RF Tanged Insert

### **Gland** -

**Gland** - 1) a device for preventing a pressurized fluid from leaking out of a casing at a machine joint, such as at a shaft penetration; also known as Gland Seal; 2) a movable part that compresses the packing in a stuffing box; **see Packing Follower; see also Lantern ring.**

**Gland** - 1) a device for preventing leakage at a machine joint, as where a shaft emerges from a vessel containing a pressurized fluid; 2) a movable part used in a stuffing box to compress the packing.

**Gland** - 1) a device which is used to prevent leakage at a point where a shaft emerges from a vessel containing fluid under pressure or from a vacuum; 2) a sleeve or nut of one-piece or two-piece design which retains and forms a means of compressing the packing in a stuffing box.

**Gland** - 1) a moveable tubular part that fits over a valve stem or shaft that is used to compress the packing in a stuffing box on a valve; 2) a sleeve used to produce a seal around a shaft; 3) a device for preventing leakage at the point where a rotating or reciprocating shaft emerges from a vessel containing fluid under pressure; also called a Gland Bushing.

**Gland** - a part which retains and forms a means of compressing the packing. Glands are usually of the screwed or bolted type, of one-piece or two-piece design.

**Gland** - a sleeve which is used to compress the packing in the stuffing box of a valve or pump.

**Gland** - a valve part which retains and forms a means of compressing the packing. Glands are usually of the screwed or bolted type, of one-piece or two-piece design.

**Gland** - cavity into which o-ring is installed. Includes the groove and mating surface of second part which together confines the o-ring.

**Gland** - follower, gland follower

**Gland** - the cavity of a stuffing box into which the packing is stuffed.

**Gland** - the part of the valve which retains or compresses the stem packing in a stuffing box; also called Gland Bushing.

#### **Gland Bolting** -

**Gland Bolting** - comprises bolts, eye-bolts, stud bolts, studs, set screws and nuts by which pressure is applied to bolted glands.

**Gland Bolting** - valve parts comprised of bolts, eye-bolts, stud bolts, studs, set screws and nuts by which pressure is applied to bolted glands.

#### **Gland Bush** -

**Gland Bush** - a bush which is inserted in a gland.

**Gland Bush** - a bush which is inserted in the gland of a valve.

**Gland Cock** - a taper-seated cock in which the plug is retained in the body by means of gland and gland packing.

#### **Gland Flange** -

**Gland Flange** - a part that fastens to the bonnet of a valve and used to apply load (force) against the packing gland to prevent external leakage. It is adjustable, and usually found on valves with outside-screw-and-yoke stem designs.

**Gland Flange** - the flange, of a bolted one-piece or two piece gland, by which pressure is transmitted to the gland of a valve.

**Gland Flange** - the flange, of a bolted one-piece or two-piece gland, by which pressure is transmitted to the gland.

**Gland Follower** - the component used to hold down or retain the gland in the stuffing box; also called Gland Flange.

#### **Gland Nut** -

**Gland Nut** - a nut that threads onto or into the top of the bonnet of a valve to apply force to the gland.

**Gland Nut** - the nut of a screwed gland of a valve, by which pressure is transmitted to the gland.

**Gland Nut** - the nut of a screwed gland, by which pressure (load) is transmitted to the gland.

#### **Gland Packing** -

**Gland Packing** - compressible material inserted into the stuffing box or packing nut to prevent leakage of fluid; 2) for gland cocks, material inserted into the stuffing box to prevent leakage of fluid and to retain the plug in the body.

**Gland Packing** - material inserted into the stuffing box or packing nut of a valve to prevent leakage of fluid.

**Gland Packing** - material which is inserted into a gland to disallow leakage of fluid.

**Gland Plate** - an end plate which connects the stationary assembly of a mechanical seal to the seal chamber.

**Glassed Steel** - process piping or vessels lined with glass; a glassed-steel composite has structural strength of steel and corrosion resistance of glass.

**Glazed** - an abrasive surface that has become smooth and cannot abrade efficiently.

## **Globe Valve -**

- Globe Valve - 1) a valve with a linear motion closure member, one or more ports and a body distinguished by a globular shaped cavity around the port region; 2) a type of flow regulating valve consisting of a movable disc and a stationary ring seat in a generally spherical body. In the general design, the fluid enters below the valve seat and leaves from the cavity above the seat.
- Globe Valve - a device for regulating flow in a pipeline, consisting of a movable disk-type element and a stationary ring seat in a generally spherical body.
- Globe Valve - a family of valves characterized by a closure member which travels in a line perpendicular to the valve seat. They are used primarily for throttling purposes and general flow control.
- Globe Valve - a multi-turn valve with a closing element that moves perpendicularly to the valve body seat and generally seals in a plane parallel to the direction of flow. This type of valves is suited both to throttling and general flow control.
- Globe Valve - a multi-turn valve with a closing element that moves perpendicularly to the valve body seat and generally seals in a plane parallel to the direction of flow. This type of valves is suited both to throttling and general flow control.
- Globe Valve - a piping valve similar to a gate valve but having a stopper-like disk which screws down to seat over an opening that is at right angles to the direction of the flow.
- Globe Valve - a screw-down valve having the casing or body of a spherical shape. The axis of the stem is at right angles to the body ends, which are in line with each other.
- Globe Valve - a type of valve in which the flow control element moves parallel to the direction of fluid flow. Its name derives from the spherical shape of its body.
- Globe Valve - a type of valve which is multi-turn in operation and use a disc and seat closure. Seats are integrally cast into the valve body or are of the screwed-in renewable type. Soft seated valves have an elastomer insert in the seat or disc. Valve bodies may be straight, angle or oblique. Special forms of oblique globe valves are available for use as regulating and commissioning valves in heating systems. In the piston valve, the disc and seat is replaced by a piston sealing arrangement. Stop and Check valves combine the functions of the two valve types using the lift check principle. Three Port or Changeover valves have two separate seats in the valve body.
- Globe Valve - a valve having generally a spherical body in which the body ends are in line with each other and in which the axis of the stem is at right angles to that of the body ends.
- Globe Valve - a valve having generally a spherical body in which the body ends are in line with each other and in which the axis of the stem is at right angles to that of the body ends.
- Globe Valve - a valve which is formed by a circular metal disk which, when forced on to a seating in a pipe, stops the flow.
- Globe Valve - a valve whose closure element is a flat disc or conical plug sealing on a seat which is usually parallel to the flow axis. Can be used for throttling services.
- Globe Valve - a valve with a linear motion closure component, one or more ports and a body distinguished by a globular shaped cavity around the port region.
- Globe Valve - a valve with a linear motion, push-pull stem, whose one or more ports and body are distinguished by a globular shaped cavity around the port region. This type of valve is characterized by a torturous flow path and is also referred to as a low recovery valve because some of the energy in the flow stream is dissipated, and the inlet pressure will not recover to the extent that it would in a more streamlined high recovery valve.
- Globe Valve - effects closure by a plug with a flat or convex bottom lowered onto a matching horizontal seat located in the center of the valve. Raising the plug opens the valve, allowing fluid flow. The globe valve is used for on-off service and handles throttling applications.
- Globe Valve Plug Guides** - the means by which the plug is aligned with the seat and held stable throughout its travel. The guide is held rigidly in the body or bonnet.

**GLVF** - Globe Valve Flanged

**GMAW** - [see Gas Metal Arc Welding](#)

**GMAWP** - Pulsed Arc Welding  
**GMAWS** - Short-Circuit Arc Welding  
**GMAWST** - Spray Transfer (welding)  
**GO** - Gear Operator

**Go / No-Go Gauge** - a composite gauging device that enables an inspector to quickly judge whether specific dimensions or contours are within specified tolerances; in many instances, the device is so constructed that the part being inspected will fit one part of the gauge easily and will not fit another part if it is within tolerance, and will pass both parts or pass neither if it is not within tolerance.

#### **Go / No-Go Test -**

**Go / No-Go Test** - a test based on the measurement of one or more parameters but which can have only one of two possible results: to pass or reject the device under test.

**Go / No-Go Test** - a test in which one or more parameters are determined, but which can result only in acceptance or rejection of the test object, depending on the value(s) measured.

**Goggles** - tinted lenses used during welding or gas cutting to protect the eyes from harmful radiations.

**GP** - General Purpose

**GPA** - General Platform Alert

**GPM** - Gallons Per Minute; expresses volume of flow.

**GPP** - Gas Processing Plant

**GFP** - Glass-Filled Polypropylene; offers the chemical resistance of polypropylene, with glass fibers added for strength.

**GR** - Grade

#### **Grain -**

**Grain** - a roughness of surface or texture

**Grain** - in metals and other crystalline substances, an individual crystallite in a polycrystalline mass.

**Grain Growth** - an increase in the average grain size in a metal, usually as a result of exposure to high temperature.

#### **Grain Size -**

**Grain Size** - 1) for metals, the size of crystallites in a polycrystalline solid, which may be expressed as a diameter, number of grains per unit area, or standard grain size number determined by comparison with a chart such as those published by ASTM; in most instances the grain size is given as an average, unless there are substantial proportions which can be given as two distinct sizes; if two or more phases are present, grain size of the matrix is given; 2) for abrasives, also known as Grit Size.

**Grain Size** - in killed steels, grain size is specified as either coarse (grain size 1 to 5 inclusive) or fine (grain size 5 to 8 inclusive), determined in accordance with ASTM Designation E1 12. Standard Methods for Estimating the Average Grain Size of Metals (by the comparison procedure).

**Granular Fracture** - a rough, irregular fracture surface, which can be either transcrystalline or intercrystalline, and which often indicates that fracture took place in a relatively brittle mode, even though the material involved is inherently ductile.

**Graphite** - a flexible carbon material used to make gaskets and packing. The gaskets may be flat graphite sheet or have metal inserts for added strength. The packing is a combination of lattice braided rings used as anti-extrusion or wiper rings and die-formed rings which are compressed to effect the seal.

#### **Graphite Rosette -**

**Graphite Rosette** - a form of graphite present in gray cast iron which appears in the microstructure as graphite flakes extending radially outward from a center of crystallization.

**Graphite Rosette** - arrangement of graphite flakes in which the flakes extend radially from centers of crystallization in gray cast iron.

**Graphite, Compacted** - a graphite shape that is intermediate between flake graphite and nodular graphite that typically appears in a polished section as thick flakes with blunt ends.

#### **Graphite, Flake -**

**Graphite, Flake** - a form of graphite present in gray cast iron which appears in the microstructure as an elongated, curved inclusion.

**Graphite, Flake** - an irregularly shaped particle of graphite, usually appearing in a polished section as curved plates, such as found in gray cast irons.

### **Graphite, Nodular** -

**Graphite, Nodular** - graphite in the form of nodules or spheroids in iron castings.

**Graphite, Nodular** - spheroidal shaped graphite typically found in ductile irons and compact clusters of graphite typically found in malleable irons.

**Graphite, Primary** - graphite precipitated in cast iron during solidification.

**Graphite, Spheroidal** - spheroidal shaped graphite having a polycrystalline radial structure, usually found in ductile iron and to a controlled, limited extent in compacted graphite iron.

**Graphitic Carbon** - free carbon present in the microstructure of steel or cast iron; it is an essential feature of most cast irons but is almost always undesirable in steel.

**Graphitic Corrosion** - corrosion of gray cast iron in which the iron matrix is slowly leached away, leaving a porous structure behind that is largely graphite but that may also be held together by corrosion products; this form of corrosion occurs in relatively mild aqueous solutions and on buried pipe and fittings.

**Graphitic Steel** - alloy steel in which some of the carbon is present in the form of graphite.

**Graphitization** - formation of graphite in iron or steel; it is termed primary graphitization if it forms during solidification, and secondary graphitization if it forms during subsequent heat treatment or extended service at high temperature.

### **Graphitize** -

**Graphitize** - to precipitate graphite in an iron-carbon alloy.

**Graphitize** - to put graphite in or on; to change into graphite, such as by heating.

**Graphitizing** - annealing a ferrous alloy in such a way that at least some of the carbon present is converted to graphite.

**Grease Fitting** - a device which permits injection of grease into a bearing surface.

**Green strength** - in casting, the sand used for molding after water has been mixed in it. Green sand must possess adequate strength and plasticity for making and handling of the mold.

### **Grey Cast Iron** -

**Grey Cast Iron** - grey cast iron shows grey color on fracture. A high carbon and high silicon content followed by a slow rate of cooling encourages the production of grey cast iron. Most of the carbon in the grey cast iron is present in the form of graphite. The production of grey cast iron depends on the following factors: a) chemical composition of the melt, b) the rate of cooling, and c) the temperature of casting. Large flakes of graphite produce a soft, weak casting, while short flakes of graphite produce a strong casting. If the graphites present are small, round, well distributed particles, their weakening effects are much less pronounced and the iron develops much better mechanical properties. If the graphite constituent of a casting is controlled, almost all the properties of grey cast iron are controlled. The presence of graphite in grey cast iron depends on the following factors: a) the ratio of carbon to silicon. Silicon is a strong graphitizer; b) addition of steel to the melt; c) high temperature of melting dissolves graphite and thus reduces the tendency to graphitize; d) the rate of cooling; and e) the addition of special alloys to cast iron like nickel and chromium.

**Grey Cast Iron** - if cast iron is melted and then slowly cooled, most of the carbon separates out as graphite and a softer and less brittle variety of iron, known as grey iron, is obtained. The composition of grey cast iron is 92% iron, 3% graphite, 0.5% carbon and remaining other impurities. The grey color of this cast iron is due to the presence of graphite flakes. Grey cast iron is cheap and its melting point is low. Its tensile strength is low and ranges from 2 to 2.5 tonnes per sq. cm. It is brittle and breaks under an impact.

**Grey Cast Iron** - iron containing carbon in the free form. Generally it contains high percentages of carbon and silicon.

**Grey Cast Iron** - [see Cast Iron](#)

**Grey Iron** - cast iron containing free graphite in flake form; so named because a freshly broken

bar of the alloy appears gray.

**Grey Iron** - cast iron that has a relatively large proportion of the graphitic carbon present in the form of flake graphite. The metal has a gray fracture.

**Grid** - that part of a vertical ball non-return valve which restricts the travel of the ball and through which the fluid passes.

**Grinding Test** - residual tensile or compressive test, or a combination of both, on the surface of a material due to grinding.

#### **Grit Blasting** -

**Grit Blasting** - a process used in preparation for a coating system (painting), which cleans the surface and gives it the required roughness to retain the applied coating system.

**Grit Blasting** - abrasively cleaning metal surfaces by blowing steel grit, sand or other hard particulate against them to remove soil, rust and scale; also known as Sandblasting.

**Grommet** - 1) a metal washer or eyelet; 2) a piece of fiber soaked in a packing material and used under bolt and nut heads to preserve tightness.

**Groove** - an opening provided between two members to be joined.

**Grooved End** - a valve end that has a circumferential groove around it to receive a clamping mechanism, which couples the valve to similarly grooved connecting pipe.

**GRP** - Glass Reinforced Polyester

#### **Grub Screw** -

**Grub Screw** - a headless screw that is slotted at one end to receive a screw driver.

**Grub Screw** - a headless screw with a slot at one end to receive a screwdriver.

**Grub Washer** - a screw having no head but with a slot across the top end for the insertion of a screwdriver.

**Grummel Washer** - a washer which is made of spun yarn or tar twine, etc. It is used to make a watertight joint under the head of a square-shouldered bolt; also called Grommet Washer.

**GS** - General Specifications

**GSI** - Global Solutions International (Shell)

**GST** - Government Sales Tax

**GTAW** - Gas Tungsten Arc Welding

**GTAW-HW** - Hot Wire Welding

**GTAW-P** - Pulsed Arc Welding

**GTL** - Gas To Liquid

**Gudgeon** - a pivot

**Guide** - That part of the valve plug that keeps the plug aligned with the valve seat. Top or bottom guides on a valve plug are usually located so they do not influence flow but merely accomplish the centering function. Valve guides often have the added function of determining the valve flow characteristic. These are known as skirt guides and usually have notches or Vs cut into them to characterize flow.

#### **Guide Bearing** -

**Guide Bearing** - a plain bearing used to guide a machine element in its lengthwise motion, usually without rotation of the element.

**Guide Bearing** - a plain bushing used to prevent lateral movement of a machine element while allowing free axial translation, with or without (usually without) simultaneous rotation; also known as Guide Bushing.

**Guide Bushing** - see Bushing

**Gunmetal** - a copper-tin alloy with lead and zinc added.

**GW** - Gravity Welding

**GWP** - Global Warming Potential

**Gyration** - the act of turning or whirling, as around a fixed center; a circular or spiral motion; motion about an axis; rotation; revolution.

**H** - 1) Hydrogen; 2) High

**H<sub>2</sub>S** - Hydrogen Sulphide

**Habitual Welding** - an underwater welding process used for joining large pipelines. It is applicable in large chambers containing sufficient amount of breathable atmosphere with a life support system for the welder. This system requires seal-proof chambers. Another drawback of these processes is maintenance of proper pressure inside the chamber.

**Hair Line Cracks** - fine, random cracks in a coating such as paint or any rigid surface.

**Halar** - Ethylene-Chlorotrifluoroethylene. This material is sometimes used for some external valve components; it is also a valve body material for high temperature / high purity applications.

**Half Dog Setscrew** - a setscrew with a short, blunt point.

**Half Nut** - a nut split lengthwise so that it can be clamped around a screw.

**Hammer Lug Unions** - used to join (union) two parts together. The Lug refers to the nut that can be hit with a hammer to uncouple the union. Sometimes referred to as Wing Unions, Couplings, Sleeves or just Unions.

**Hamming** - forming of an edge by bending the metal back on itself.

**Hand Shield** - a protective device used by a welder to protect the hands from heat and spatter during welding.

**Hand Valve** - a valve with a manual actuator.

**Handle Extension** - a length of bar or pipe used to manually operate a valve. The handle extension is sized to fit the head. The handle extension is separable from the head that is attached to the valve stem.

#### **Handwheel** -

Handwheel - a manual override device to stroke a valve or limit its travel.

Handwheel - a manual override device used to stroke a valve or limit its travel. The handwheel is sometimes referred to as a hand jack. It may be top mounted, side mounted, in-yoke mounted or shaft mounted and declutchable.

Handwheel - a wheel by which a valve is manually operated.

Handwheel - a wheel consisting of a rim connected to a hub by spokes, which is used to manually operate a valve requiring multiple turns.

Handwheel - a wheel-shaped valve operating device intended to be grasped with one or both hands which allows turning the valve stem or operator shaft to which it is attached.

Handwheel - the wheel by which a valve is manually operated. (normally applicable to gear-operated valves).

Handwheel - the wheel by which the valve is manually operated.

#### **Handwheel Fixing** -

Handwheel Fixing - a nut, set screw washer, key, feather or other means used to secure the handwheel to the valve stem.

Handwheel Fixing - the nut, washer, set screw, set screw washer, key, feather or other means used to secure the hand wheel to the stem.

**Handwheel, In-Yoke Mounted** - in-yoke gear types are designed with a worm gear drive which is contained in a lubricated housing. The gear box is integral with the yoke which is usually elongated to provide space for the worm gear assembly. With this type of handwheel, stops may be set in either or both directions to limit the travel of the valve stem. This type of handwheel is declutchable.

**Handwheel, Shaft-Mounted, Declutchable** - a shaft-mounted worm gear drive that can be declutched from the power actuator.

**Handwheel, Side-Mounted** - bellcrank lever types are externally mounted on the control valve yoke. They can provide a limit to the extent a valve stem will travel in either direction, but not in both directions.

**Handwheel, Top-Mounted** - the handwheel is mounted on top of the valve actuator case. This type of handwheel does not have a clutch; is usually used to restrict the motion of the valve stem in one direction only.

#### **Hard Facing** -

Hard Facing - a hard material, such as Stellite®, that is deposited on a relatively soft base metal by welding to produce surfaces that are wear and corrosion resistant.

- Hard Facing - a material harder than the surface to which it is applied. Used to resist fluid erosion and/or to reduce the chance of galling between moving parts, particularly at high temperature.
- Hard Facing - a material that is harder than the surface to which it is applied. It is normally used to resist fluid erosion or to reduce the chance of galling between moving parts. Hard facing may be applied by fusion welding; diffusion; or spray coating the material. Alloy #6 or Stellite is a common material used for this purpose.
- Hard Facing - a surface preparation in which an alloy is deposited on a metal surface, usually by weld overlay, to increase resistance to abrasion and or corrosion.
- Hard Facing - a welding process used for producing hard surfaces with a soft core. This process is not only used for repair but also for manufacture of cutting tools, rock drills, forging dies, and wear-resisting tools. Alloying additions resembling the cutting tool materials are incorporated in the electrode and the flux used for hard surfacing. During welding these alloys form a molten pool that produces hard surfaces after solidification. This process can be carried out by oxy-acetylene as well as gas welding.
- Hard Surfacing** - application of a hard, wear resistant alloy to the surface of a softer metal by an arc or gas welding process.

### **Hardenability** -

- Hardenability - in a ferrous alloy, the property that determines the depth and distribution of hardness induced by quenching.
- Hardenability - in welding, this term refers to the loss of ductility between weld and parent metal. This brittleness in a metal may cause cracking and even failure.
- Hardenability - the response of a metal to quenching to improve its hardness. The effectiveness is frequently assessed by a joining test.

### **Hardening** -

- Hardening - a process that increases the hardness of steel, i.e., the degree to which steel will resist cutting, abrasion, penetration, bending and stretching. The increased endurance provided by hardening makes steel suitable for additional applications. Hardening can be achieved through various methods; including a) heat treatment, where the properties of steel are altered by subjecting the steel to a series of temperature changes; and b) cold working, in which changes in the structure and shape of steel are achieved through rolling, hammering or stretching the steel at a relatively low temperature.
- Hardening - producing increased hardness in a metal by quenching from high temperature, such as hardening steel, or by precipitation hardening (aging) a dilute alloy, such as hardening certain aluminum or other nonferrous alloys.
- Hardening - steel having more than 0.5% of carbon may be hardened by rapid cooling from a temperature of about 800° Celsius in water, oil or air. Tempering generally follows this process.
- Hardening - when high carbon steel is heated to bright redness and slowly cooled, it is comparatively soft. If it is rapidly cooled, by quenching in water, oil or mercury, it becomes harder than glass. This hardened steel can be tempered for hardness and toughness. Medium and high carbon steels are generally hardened. Low carbon steels do not show any marked hardness due to low carbon contents. The samples of steel are heated in the same manner as in annealing, soaked at that temperature for some time and then quenched in cold water, oils or in molten-salt bath. As a result of rapid cooling, the austenite so formed does not get sufficient time to be transformed to the normal constituents of pearlite and cementite, but is forced to form a solid solution of carbon in ferrite called martensite. Martensite being a hard, brittle and unstable material makes steel hard and brittle. The hardness and brittleness of hardened steels tends to disappear slowly due to the unstable nature of martensite.

### **Hardness** -

- Hardness - a property of metals that is discussed frequently when speaking of various component parts used in valve construction; particularly valve trim. There are two hardness scales which are commonly used - Rockwell and Brinell.
- Hardness - it is the ability to resist very small indentation, abrasion and plastic deformation. It is

a combination of several properties.

- Hardness - resistance to a distorting force. Measured by the relative resistance of the material to an indenter point of any one of a number of standard hardness testing instruments.
- Hardness - the ability of a material to withstand the effects of indentation, penetration, wear, abrasion and scratching. The commonly used tests for measuring hardness are Brinell, Rockwell, Vicker's, Knoop and Shore Scleroscope.
- Hardness - the ability of a material to withstand the effects of indentation, penetration, wear, abrasion and scratching. The commonly used tests for measuring hardness are Brinell, Rockwell, Vicker's, Knoop and Shore scleroscope.
- Hardness - the ability of a metal to cut another metal. High-speed steel and high carbon steel are hard metals, hence they are suitable for making cutting tools.
- Hardness - the resistance of metal to plastic deformation usually by indentation. However, the term may also refer to stiffness or temper, or to resistance to scratching, abrasion or cutting. Indentation hardness may be measured by various hardness tests, such as Brinell, Rockwell and Vickers.
- Hardness - the resistance of metal to plastic deformation, usually by indention.
- Hardness - the resistance to deformation which is usually measured by the resistance to indentation by one of various hardness tests.
- Hardness - this is the ability of a material to withstand scratching (abrasion) or indentation by another hard body. It is an indication of the wear resistance of a material. Processes which increase the hardness of material also increase their tensile strength. At the same time the toughness of the material is reduced as it becomes more brittle. Hardenability must not be confused with hardness. Hardenability is the ability of a metal to respond to the heat treatment process of quench hardening. To harden it, the hot metal must be chilled at a rate in excess of its critical cooling rate. Since any material cools more quickly at the surface than at the center there is a limit to the size of bar which can cool quickly enough at its center to achieve uniform hardness throughout. This is the ruling section for the material. The greater its hardenability the greater will be its ruling section.
- Hardness - this is usually measured by determining resistance to indentation, as in the Brinell, Diamond Indenter, Rockwell and Shore tests. The values of hardness obtained by the different methods have been to some extent related to each other, and to the ultimate tensile strength of non-brittle metals. In Moh's scale, comparative hardness has been determined by testing against ten standard minerals: (1) talc, (2) gypsum, (3) calcite, (4) fluorite, (5) apatite, (6) orthoclase, (7) quartz, (8) topaz, (9) corundum, (10) diamond. Thus, a mineral with "hardness 5" will scratch fluorite, but will be scratched by orthoclase.

### **Hardness Number -**

Hardness Number - a number representing the relative hardness of a mineral, metal, or other material as determined by any of more than 30 different hardness tests.

Hardness Number - any arbitrary scale of numbers which are determined by one of various hardness tests.

**Hardness Shore A** - the rubber durometer hardness as measured on a Shore "A" gauge. Higher numbers indicate harder material. 35 Shore "A" durometer reading is considered soft. 90 is considered hard.

### **Hardness Test -**

Hardness Test - a single hardness reading in either the weld metal, base metal or HAZ (Heat Affected Zone).

Hardness Test - a test to determine the relative hardness of a metal, mineral, or other material according to one of several scales, such as Brinell, Mohs, or Shore.

Hardness Test - any of various tests which determine either (a) the ability of one solid to scratch another ([see Scratch Hardness](#)), or (b) the area of indentation formed in a given test ([see Indentation Hardness](#)). Dynamic tests are used to measure rebound hardness by a Herbert pendulum or Shore scleroscope.

Hardness Test - the hardness of a material is the property by virtue of which a material resists indentation, penetration or scratching. It is mainly a surface property. More than thirty tests are used throughout the world to measure hardness.

**Hartfield Time Yield** - refers to a short time criterion of creep test. A specimen placed under the

time yield stress should not show an extension exceeding 0.5% of the gauge length in the first 24 hours, and during the next 48 hours, should show no further extension, within a sensitivity of measurement of 1 over 10,000 in. on a 2-in. gauge length. This approximates a rate of creep of one-millionth of an in./in. hr during this period.

**Hastelloy B®** - an International Nickel co. alloy having a nominal composition of nickel (Ni) 66.7%; iron (Fe) 5%; molybdenum (Mo) 28%; vanadium (V) 0.3%.

#### **Hastelloy C®** -

**Hastelloy C®** - a nickel based, 16% chromium, 16% molybdenum alloy. It is used in severe service conditions that usually involve acids at high temperatures.

**Hastelloy C®** - an International Nickel Co. alloy having a nominal composition of nickel (Ni) 59%; iron (Fe) 5%; molybdenum (Mo) 16%; tungsten (W) 4%; chromium (Cr) 16%.

**Hastelloy®** - a trade name for a hard, non-corroding metal.

**HAZ** - Heat Affected Zone

**Hazardous (Classified) Location** - a location where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or easily ignitable fibers or flyings.

#### **Hazardous Area** -

**Hazardous Area** - an area in which an explosive gas mixture is or may be expected to be present in a quantity such as to require special precautions for the construction and use of electrical apparatus, cables and accessories.

**Hazardous Area** - an area in which explosive gas/air mixtures are, or may be expected to be, present in quantities such as to require special precautions for the construction and use of electrical apparatus.

**Hazardous Area Classifications** - 1) Division 1 (hazardous). Where concentrations of flammable gases or vapors exist a) continuously or periodically during normal operations; b) frequently during repair or maintenance or because of leakage; or c) due to equipment breakdown or faulty operation which could cause simultaneous failure of electrical equipment. (See "National Electrical Code, Paragraph 500 4(a)" for detailed definition); 2) Division 2 (normally nonhazardous). Locations in which the atmosphere is normally nonhazardous and may become hazardous only through the failure of the ventilating system, opening of pipe lines, or other unusual situations. (See "National Electrical Code, Paragraph 500 4(b)" for detailed definition); 3) Nonhazardous. Areas not classified as Division 1 or Division 2 are considered nonhazardous. NOTE: It is safe to have open flames or other continuous sources of ignition in nonhazardous areas.

**Hazardous Atmosphere** - 1) a combustible mixture of gases and/or vapors; 2) an explosive mixture of dust in air.

**Hazardous Material** - any substance that requires special handling to avoid endangering human life, health or well being. Such substances include poisons, corrosives, and flammable, explosive or radioactive chemicals.

**HB** - Hardness Brinell

**HC** - Hydrocarbon

**HDPE** - High Density Polyethylene

**He** - Helium

#### **Head** -

**Head** - 1) a measure of fluid pressure used by piping designers. A foot of head exerts a pressure equal to that produced by the weight of a column of the flowing fluid one foot high; 2) fluid pressure expressed in terms of the height of a column of the fluid.

**Head** - the height of a column of liquid above a specified point expressed in units such as feet of water, inches of mercury, etc. It is a measure of pressure exerted by the column of liquid.

**Head** - the height of a column or body of fluid above a given point expressed in linear units. Head is often used to indicate gauge pressure. Pressure is equal to the height times the density of the fluid.

**Head** - the height of a column or body of fluid above a given point, expressed in linear units.

**Head** - the height of a liquid column and the pressure resulting from that height.

#### **Head, Friction** -

**Head, Friction** - the head required to overcome the friction at the interior surface of a conductor and between fluid particles in motion. It varies with flow, size, type, and condition of conductors and fittings, and fluid characteristics.

**Head, Friction** - the loss of energy due to friction in a pipe.

**Head, Lost** - friction loss in a pipe or channel expressed in terms of potential energy, in ft.

**Head, Static** - the height of a column or body of fluid above a given point.

**Head, Velocity** - the equivalent head through which the liquid would have to fall to attain a given velocity. Mathematically it is equal to the square of the velocity (in feet) divided by 64.4 feet per second square.

### **Header** -

**Header** - a conduit or chamber that receives fluid flow from a series of smaller conduits connected to it, or that distributes fluid flow among a series of smaller conduits.

**Header** - a manifold which supplies fluid to a number of tubes or passages, or connecting them in parallel.

**Header** - a pipe, tube, etc. that brings together other pipes to direct the flow of a fluid through them.

### **Heat** -

**Heat** - 1) a single heating of metal, ore, etc. in a furnace or forge; 2) the amount processed in a single heating.

**Heat** - Cast lot, Material originating from a final melt. For remelted alloys it is defined as the raw material originating from one remelted ingot.

**Heat** - the total molten metal output from a single heating in a batch melting process or the total metal output from essentially a single heating in a continuous melting operation using basically constant charge and processing conditions and targeted at a fixed metal chemistry at the furnace spout. A heat can also be defined as a fixed time period for a continuous melting operation provided that it is shorter than the time period covered by the above definition.

**Heat (of steel)** - a batch of refined steel. A basic oxygen or electric furnace full of steel. One heat of steel will be used to cast several slabs, blooms or billets.

### **Heat Affected Zone (HAZ)** -

**Heat Affected Zone (HAZ)** - 1) the zone of the base metal affected by the heat input of welding; 2) that portion of the base metal that was not melted during brazing, cutting, or welding, but whose microstructure and properties were altered by the heat of these processes.

**Heat Affected Zone (HAZ)** - in welding, the portion of the base metal which has not been melted, but whose microstructure and mechanical properties have been altered due to the heat produced by the electric arc or gas flame.

**Heat Affected Zone (HAZ)** - refers to the area of a base metal of which the structure of property could be altered by the heat of welding.

**Heat Analysis** - a chemical analysis conducted by a foundry immediately prior to pouring which measures the exact chemical composition of a particular batch of molten metal.

**Heat Check** - a condition of minute radial cracks on and beneath the surface of a seal face caused by highly localized thermal stresses.

**Heat Distortion Point** - the temperature at which a standard test bar (American Society for Testing and Materials test) deflects 0.010 inch (0.254 millimeter) under a load of either 66 or 264 pounds per square inch, as specified.

**Heat Exchanger** - a device that transfers heat through a conducting wall from one fluid to another.

**Heat Seal** - a union between two thermoplastic surfaces by application of heat and pressure to the joint.

### **Heat Treatment** -

**Heat Treatment** - controlled heating/ cooling of materials that change a materials properties.

**Heat Treatment** - a process in which steel in the solid state has been taken through one or more temperature cycles in order to obtain certain desired properties. Heating for the sole purpose of hot working gets excluded from the meaning of this definition.

**Heat Treatment** - altering the properties of steel by subjecting it to a series of temperature changes. Used to increase the hardness, strength, or ductility of steel so that it is

suitable for additional applications. The steel is heated and then cooled as necessary to provide changes in the structural form that will impart the desired characteristics. The time spent at each temperature and the rates of cooling have significant impact on the effect of the treatment.

**Heat Treatment** - controlled heating and cooling to alter the properties or structure of a metal, alloy or glass like material.

**Heat Treatment** - describes any process or procedure by which the internal structure of steel is altered by heating to produce desired physical and mechanical characteristics.

**Heat Treatment** - heat treatment of metals involves heating and then cooling at a suitable rate in a medium. This has a remarkable effect in changing the properties of steel. This treatment is done to bring about certain desired properties in steel. In the past and even up to this day this treatment is carried out in the Blacksmith's fire. This is a crude method as heating is not uniform except in the case of small tools and the estimation of temperature depends upon the experience of the Blacksmith, which is not reliable. In the present age of advanced technology with strict quality control, Blacksmith's experience in this field has been replaced by certain refined, practical and reliable methods of heat treatment. Furnaces with provision for temperature monitoring are utilized. The methods of heating are usually by coal, oil, gas or electricity. The properties obtained in a sample of heat treated steel depend on the range of heating temperature, rate of cooling temperature, and form and quantity of carbon contents. Carbon contents in plain carbon steel undergo various changes in microstructure as a result of different methods of heating and cooling. These changes are effective in altering the mechanical properties of steel. Changes in the microstructure of steel take place between a critical range of temperature, with a lower critical temperature and an upper critical temperature. Steel is an alloy of iron and carbon. Carbon in steel may remain either in the form of a chemical compound with iron, or in the form of solid solution with iron, or in a combination of both the forms. The aim of heat treatment is to bring about the desired changes in the form of carbon combination in steel. All metals are crystalline in structure. The crystals of pure iron are called ferrites. Ferrite may contain a very little amount of carbon in solid solution with iron. It is soft, ductile and strongly magnetic. A chemical compound of ferrite and carbon is called Cementite. It remains as round particles in steel. Cementite is a hard, brittle and magnetic substance. A mechanical mixture of ferrite and cementite is called pearlite, which is hard, strong and machinable. A solid solution of cementite and ferrite is called austenite. It is not stable at temperatures below 723° C. At lower temperature, austenite breaks up into ferrite and cementite or pearlite. When high carbon solids are heated to temperatures above 850° C and suddenly cooled down to room temperature, the cementite in steel is forced to enter into a solid solution in ferrite. This force solution of cementite in ferrite is called martensite, which is a very hard, brittle and unstable substance. The principal heat treatment processes are a) annealing or normalizing, b) hardening, c) tempering and d) case-hardening.

**Heat Treatment** - heating and cooling a solid metal or alloy in such a way as to obtain desired properties. Heating for the sole purpose of hot working is not considered heat treatment; [see Hot Working and also Solution Heat Treatment.](#)

**Heat Treatment** - heating and cooling a solid metal or alloy in such a way as to obtain desired conditions or properties. Heating for the sole purpose of hot working is excluded from the meaning of this definition.

**Heavy Ends** - the fraction of a petroleum mixture having the highest boiling point.

**Heavy Fraction** - the final products retrieved by distilling crude oil.

**Heavy Oil** -

**Heavy Oil** - A viscous fraction of petroleum or coal tar oil having a high boiling point.

**Heavy Oil** - any of the relatively dense hydrocarbons (denser than water) derived from petroleum, coal tar, and similar substances.

**Heavy Structural Shapes** - a general term given to rolled flanged sections that have at least one dimension of their cross sections three inches or greater. The category includes beams, channels, tees and zees if the depth dimension is three inches or greater, and angles if the length of the leg is three inches or greater.

**Heli Arc Welding** - welding using helium as the inert gas; [see Gas Tungsten Arc Welding](#)

### **Helium Arc Welding -**

Helium Arc Welding - a welding process in which helium is used to shield the weld area from contamination by atmospheric oxygen and nitrogen.

**Helix** - a spiral-like coil; the threads of a screw form a helix.

**Herbert Pendulum** - a massive pendulum having a 1.588 mm (1/16 in) diameter steel ball as a pivot which rocks over the surface of a specimen. The period of the pendulum and its rate of damping give a measure of the hardness and ductility of the metal.

**Hereditary Mechanics** - a field of mechanics in which quantities, such as stress, depend not only on other quantities, such as strain, at the same instant but also on integrals involving the values of such quantities at previous time.

### **Hermetic Seal -**

Hermetic Seal - an airtight seal evidencing no detectable leakage.

Hermetically Sealed - a container that is closed or sealed completely; made airtight.

**Hertz** - a unit of frequency, equal to one cycle per second; abbreviated Hz.

**HEX** - Hexagonal

Hex Nut - a nut in the shape of a hexagon.

**Hexagonal Head Bolt** - a standard wrench head bolt with a hexagonal head.

**Hexagonal Nipple** - a nipple for joining pipe with a hexagonal configuration around the center of the exterior surface to permit tightening with a spanner.

### **Hexagonal Nut -**

Hexagonal Nut - a plain nut in hexagon form.

**HF** - 1) Hard Faced; 2) Hydro Fluoric

**HFI** - High Frequency Induction (Welding)

**HGO** - Heavy Gas Oil

**HH** - High High

**HIC** - 1) Hydrogen Induced Cracking; 2) Hydrogen Induced Corrosion

### **High Alloy Steel -**

High Alloy Steel - an iron-carbon alloy containing at least 5% by weight of additional elements.

High Alloy Steel - stainless steels, 12% chromium and higher

**High Brass** - a commercial wrought brass containing 65% copper and 35% zinc.

### **High Carbon Steel -**

High Carbon Steel - a plain carbon steel with a carbon content of at least 0.6%.

High Carbon Steel - carbon steel, having more than 0.5% of carbon. It is used for springs and similar components; stronger and more easily tempered but less ductile than mild steel.

High Carbon Steel - iron containing 0.55 to 2.0% carbon

High Carbon Steel - steel containing carbon from 0.5 to 1.5% and have granular structures.

High Carbon Steel - steel with more than 0.3% carbon. The more carbon that is dissolved in the iron, the less formable and the tougher the steel becomes. High-carbon steel's hardness makes it suitable for plow blades, shovels, bedsprings, cutting edges, or other high-wear applications.

**High Lift Safety Valve** - a safety valve in which the valve head lifts automatically at least  $D/12$ , where  $D$  = bore of valve seat.

**High Performance Butterfly Valve (HPBV)** - a butterfly valve in which the disc seating surface is offset from its axis of rotation, producing an uninterrupted seating surface and "camming" action when seating and unseating.

**High Recovery Valve** - a valve design that dissipates relatively little flow stream energy due to streamlined internal contours and minimal flow turbulence. Therefore, pressure down stream of the valve vena contracta recovers to a high percentage of its inlet value. These types of valves are identifiable by their straight-through flow paths. Examples are most rotary control valves, such as the eccentric plug, butterfly, and ball valve.

**High Solids Coating** - for the heavy-duty protective coatings industry, it is assumed that "high solids" coatings have a minimum volume solids content of 65%. A volume solids content of 80% is considered as the general accepted standard for high solids coating.

### **High Speed Steel -**

**High Speed Steel** - high alloy steel which is capable of intense hardening. It is used for metal-cutting tools. It retains its hardness at a low red heat, so that such tools can be used in lathes and other machine tools operating at high speed. Generally it has 12-22% tungsten, up to 5% chromium, up to 1% carbon, and varying amounts of vanadium, cobalt, etc. Half its weight of molybdenum may replace part or all of the tungsten.

**High Speed Steel** - steels capable of cutting materials at red hot temperatures.

**High Speed Steel** - when ordinary steel is used for making cutting tools, they become soft if they are used at temperatures other than normal temperatures. Thus, they become useless. In order to increase the hardness of steel up to 660° C, tungsten is added to steel. This tungsten-alloyed steel is used for making cutting tools. These can be used to cut the metals at a higher speed as compared to the tools of plain carbon steel, and hence the name high speed is assigned to this steel. The tungsten-alloyed steel is used for making parts of drilling machines, high-speed tools, lathe tools etc. High Speed Steel is also known as Tungsten Steel.

**High Strength Alloy** - a metallic material having a strength considerably above that of most other alloys of the same type or classification.

**High Temperature Alloy** - a metallic material suitable for use at 500° C (930° F) or above. This classification includes iron base, nickel base and cobalt base superalloys, and the refractory metals and their alloys, which retain enough strength at elevated temperature to be structurally useful and generally resist undergoing metallurgical changes that weaken or embrittle the material.

**High Tensile Bolt** - a bolt that is adjusted to a carefully controlled tension by means of a calibrated torsion wrench; used in place of a rivet; also known as High-Tension Bolt.

### **High Tensile Steel -**

**High Tensile Steel** - a type of structural steel which is having a maximum yield point.

**High Tensile Steel** - steel in which enhanced mechanical properties and increased resistance to corrosion have been obtained by the incorporation of some alloying elements.

**Hindley Screw** - an endless screw or worm of hourglass shape that fits a part of the circumference of a worm wheel so as to increase the bearing area and thus diminish wear; also known as Hourglass Screw; Hourglass Worm.

### **Hinge -**

**Hinge** - a pair of metal leaves forming a jointed device in which a swinging part turns.

**Hinge** - the part or parts of swing non-return valve, which enable the disc to swing.

**Hinge / Disc Connection** - comprises stud, nut, washer and cotter pin which secure the hinge to the disc when the hinge is separate from the disc.

**Hinge Pin** - the pin about which the disc of a swing non-return valve swings.

### **Hinge Pin Boss -**

**Hinge Pin Boss** - a boss formed on or in the body of a swing check valve to accommodate the hinge pin and hinge pin plug.

**Hinge Pin Boss** - a boss formed on or in the body of swing non-return valve to accommodate the hinge pin and hinge pin plug.

### **Hinge Pin Plug -**

**Hinge Pin Plug** - a plug fitted in the body of a swing check valve to retain the hinge pin.

**Hinge Pin Plug** - a plug fitted in the body to retain the hinge pin.

**Hinge Valve** - [see Check Valve](#)

**HKD** - Hong Kong dollar (Acronym)

**HM** - Heating Medium (hot oil)

**HMI** - Human Machine Interface

**Hob** - 1) a master model made from hardened steel which is used to press the shape of a plastics mold into a block of soft steel; 2) a rotary cutting tool with its teeth arranged along a helical thread; used for generating gear teeth.

**Hobbing** - 1) in plastics manufacturing, the act of creating multiple mold cavities by pressing a hob into soft metal cavity blanks; 2) cutting evenly spaced forms, such as gear teeth, on the periphery of cylindrical work piece.

**Hobbing Machine** - a machine for cutting gear teeth in gear blanks or for cutting worm, spur, or helical gears; also known as Hobber.

**Hold Point** - a mandatory inspection point. No work can proceed until the applicable inspection activity has been completed or manufacturer receives a formal written waiver.

#### **Holiday** -

Holiday - 1) pinholes and small size defects in a coating system, penetrating the entire thickness of the coating; 2) voids in protective coating.

Holiday - an undesirable discontinuity or break in the anticorrosion protection on pipe or tubing.

**Holiday Detector** - an electrical device used to determine the location of a gap or void in the anticorrosion coating of a metal surface.

**Hollow Jet Valve** - essentially a needle valve with the needle, or closure member, pointing upstream. The nozzle is eliminated, allowing the water to discharge from the bell shaped body in a tubular or hollow jet.

#### **Homogeneous** -

Homogeneous - a) general - a material of uniform composition throughout; b) in seals - a rubber seal without fabric or metal reinforcement.

Homogeneous - uniform consistency

**Honing** - the process of removing a relatively small amount of material from a cylindrical surface by means of abrasive stones to obtain a desired finish or extremely close dimensional tolerance.

**Hood Test** - a leak detection method in which the vessel under test is enclosed by a metallic casing so that the dynamic leak test may be carried out on a large portion of the external surface.

**Hook Bolt** - a bolt with a hook or L band at one end and threads at the other to fit a nut.

#### **Hooke's Law** -

Hooke's Law - it states that for the materials loaded within elastic limits the stress is proportional to strain.

Hooke's Law - strain is proportional to stress in an elastic material below the elastic limit.

Hooke's Law - the characteristic of a material to deform in exact proportion to the intensity of the stress within it, and to resume its original shape after the removal of stress. The ratio of stress to strain is a constant for each material and is called its Modulus of Elasticity.

**HORIZ** - Horizontal

**Horizontal Pattern** - in which the body ends are in line with each other, for installation in a horizontal position.

**Horizontal Pattern Check Valve** - a check valve design in which the body ends are in line with each other, for installation in a horizontal position; **compare with Angle Pattern Check Valve and Vertical Pattern Check Valve.**

#### **Horsepower** -

Horsepower - the unit of power in the British engineering system, equal to 550 foot-pounds per second, approximately 745.7 watts; abbreviated hp.

Horsepower - the unit of power in the British system of units. One horsepower equals 550 ft-lb/sec.

**Hose** - a flexible tube used for conveying fluids.

**Hot Band (Hot-Rolled Steel)** - a coil of steel rolled on a hot-strip mill (hot-rolled steel). It can be sold in this form to customers or further processed into other finished products.

**Hot Bar Forging** - this process is used for reducing an ingot heated at around 1300° Celsius into bars.

**Hot Briquetted Iron (HBI)** - direct reduced iron that has been processed into briquettes. Instead of using a blast furnace, the oxygen is removed from the ore using natural gas and results in a substance that is 90%-92% iron. Because DRI may spontaneously combust during transportation, HBI is preferred when the metallic material must be stored or moved.

**Hot Chamber Die Casting** - a die-casting process in which a piston is driven through a reservoir of molten metal and thereby delivers a quantity of molten metal to the die cavity.

**Hot Dip Coating** - refers to the process of dipping metal components in molten tin or zinc to protect them against corrosion.

### **Hot Dip Galvanizing -**

Hot Dip Galvanizing - a process for rust proofing iron and steel products by the application of a coating of metallic zinc.

Hot Dip Galvanizing - a process in which steel articles are zinc coated by immersion in a molten zinc bath.

**Hot Dip Galvanizing After Fabrication** - a batch process used to produce a zinc coating on manufactured steel products by total immersion of structural or fabricated steel in a bath of molten zinc. The process provides a metallurgically bonded coating, generally 100 um (4 mils) thick, consisting of iron-zinc alloy layers covered with zinc.

### **Hot Dipping -**

Hot Dipping - a process for coating parts by briefly immersing them in a molten metal bath, then withdrawing them and allowing the metal to solidify and cool.

Hot Dipping - the hot dipping process consists of dipping finished articles into another molten metal, rather as we can paint by dipping, the difference being that because of the elevated temperature some alloying takes place between the parent metal and the coating metal. The most common hot dipping process consists of dipping steel components into molten zinc and is called galvanizing. Zinc is a good choice because it is relatively cheap with a low melting point (460° C) and has a high level of resistance to atmospheric corrosion. Low-carbon steel sheet may be purchased already coated with an even layer of zinc and on examination of the surface of such a sheet, grains of zinc are clearly visible. The zinc coating will adhere to the steel through vigorous bending and rolling operations, but if the sheet is to be cut, punched or drilled, then the steel will be exposed at the cut edges. It is sometimes more advantageous to produce an article in uncoated carbon steel and then dip the completed job into the molten zinc.

**Hot Draw** - to draw a material while it is hot.

**Hot End** - the section of a steelmaking complex from the furnace up to, but not including, the hot-strip mill.

**Hot Gas Welding** - joining of thermoplastic materials by softening first with a jet of hot air, then joining at the softened points.

**Hot Isostatic Pressing** - a process in which a ceramic or metal powder is consolidated by heating and compressing the powder equally from all directions inside a sealed flexible mold; abbreviated HIP.

**Hot Metal** - the name for the molten iron produced in a blast furnace. It proceeds to the basic oxygen furnace in molten form or is cast as pig iron.

**Hot Pressing** - fabrication of a composite material through joining the reinforcement and the matrix by means of heat and pressure, usually in a hydraulically actuated press.

**Hot Rolled Products** - in the "as-rolled condition" from any hot mill operation.

### **Hot Rolling -**

Hot Rolling - forming of structural steel shapes by forcing a molten bar through a succession of rollers, each one of which changes the shape slightly toward the shape desired, such as to an Angle, Bar, Channel, or I-Beam.

Hot Rolling - hot working a metal through dies or rolls to obtain a desired shape.

Hot Rolling - hot working of metal, using a rolling process, which can remove some defects in the metal, such as voids in the original cast metal.

**Hot Saw** - a power saw used to cut hot metal.

### **Hot Short -**

Hot Short - brittleness resulting from working hot metal; in the case of steel it is caused by a low manganese and a high sulphur content.

Hot Short - said of a metal that becomes brittle when hot.

**Hot Spraying** - a paint-spraying technique in which paint viscosity is reduced by heat rather than a solvent.

**Hot Stamp** - an impression on a forging made in a heated condition.

### **Hot Strength -**

Hot Strength - in casting, sand must possess sufficient strength at elevated temperatures, i.e. above 100° C. **Metallostatic** pressure of the liquid-metal bearing against the mold

walls may cause mold enlargement, or if the metal is still flowing, erosion, cracks or breakage may occur in molds. Thus sand must possess adequate hot strength.

**Hot Strength** - [see Tensile Strength](#)

**Hot Strip Mill** - a rolling mill of several stands of rolls that converts slabs into hot-rolled coils. The hot-strip mill squeezes slabs, which can range in thickness from 2-10 inches, depending on the type of continuous caster, between horizontal rolls with a progressively smaller space between them (while vertical rolls govern the width) to produce a coil of flat-rolled steel about a quarter-inch in thickness and a quarter mile in length.

**Hot Tap** - a connection made to a pipeline while the line is under pressure or in service. A special procedure is required to make an opening in the pipe without leaking any of the line contents.

### **Hot Tears** -

**Hot Tears** - a defect occurring in castings caused where partially solidified or weak, newly solidified sections are subjected to a pull resulting from the contraction of thinner parts that have solidified earlier. A hot tear is an intergranular failure.

**Hot Tears** - internal or external ragged discontinuities or crack on a casting surface. Metals have low strengths immediately after solidification. At high temperatures, this defect occurs due to high stresses developed during solidification. Hot tears are produced due to a) excessive mold hardness, b) high dry and hot strength, c) too much shrinkage of metal, d) faulty casting design, e) low flowability of molten metal, and f) too low pouring temperature of the metal.

### **Hot Working** -

**Hot Working** - deforming metal plastically at such a temperature and strain rate that recrystallization takes place simultaneously with the deformation, thus avoiding any strain hardening.

**Hot Working** - refers to the shaping of metal components by extrusion forging, hot rolling or similar processes at temperatures which are high enough to prevent the hardness and brittleness caused by cold working.

**Hourglass Screw** - [see Hindley Screw](#)

**Hourglass Worm** - [see Hindley Screw](#)

**Howell Bunger Valve** - [see Cone Valve](#)

**HP** - 1) Hold Point; 2) High Pressure

**HPBV** - High Performance Butterfly Valve

**HPU** - Hydraulic Power Unit

**HR** - Hardness Rockwell

**HRA** - Rockwell "A" Hardness

**HRC** - Rockwell "C" Hardness

**HS** - 1) High Solid; 2) High Sulfur

**HSE** - Health, Safety and Environment

**HSE - MS** - Health, Safety and Environment Management System

**HU&C** - Hook Up and Commissioning

### **Hub** -

**Hub** - a component secured to the plug head through which the bar of a bar-operated valve passes.

**Hub** - a short coupling that joins plumbing pipes.

**Hub** - the central part of a wheel or disc, rotating on or with the axle; a pivot.

**Huddling Chamber** - a space adjacent to the seating surfaces of a safety valve or a safety relief valve that captures high-pressure fluid at disc unseating, producing higher unseating force and instantaneous full valve opening.

**HUET** - Helicopter Underwater Escape Training

**Huey Test** - a corrosion resistance test for stainless steels, most useful for predicting resistance to intergranular corrosion.

**Hunting Tooth** - an extra tooth on the larger of two gear wheels so that the total number of teeth will not be an integral multiple of the number on the smaller wheel.

**HV** - 1) High Voltage; 2) Hand Valve

**HW** - Hand Wheel

**HWO** - Hand Wheel Operation

**HY** - Hydraulic oil

**Hydrant Valve** - a valve in an underwater pipe with its operating mechanism and outlet above ground, usually a globe valve with the valve head below the seat so that the pressure will tend to close the valve.

### Hydraulic -

Hydraulic - operated or effected by the action of water or other fluid of low viscosity.

Hydraulic - referring to any device, operation or effect that uses pressure or flow of oil, water or any other liquid of low viscosity.

**Hydraulic Circuit** - a fluid flow circuit that operates somewhat like an electric circuit.

**Hydraulic Fluid** - a light oil or other low viscosity liquid used in a hydraulic circuit.

**Hydraulic Friction** - resistance to flow due to roughness in a pipe or channel.

**Hydraulic Packing** - packing material that resists the effects of water even under high pressure.

**Hydraulic Test** - a test for pressure tightness and strength or for fatigue, by pumping water into a vessel up to a prescribed pressure.

**Hydraulic Valve** - a valve for controlling liquid.

### Hydraulics -

Hydraulics - engineering science relating to liquid pressure and flow.

Hydraulics - the science of the behavior of fluids.

### Hydrocarbon -

Hydrocarbon - a chemical compound of hydrogen and carbon.

Hydrocarbon - a compound consisting mainly of hydrogen and carbon, often of fossil origin. Examples: oil, coal, natural gas.

Hydrocarbon - any of a large group of organic and chemical compounds that contain only carbon and hydrogen, occurring notably in oil, natural gas and coal.

Hydrocarbon - compound formed from Carbon and Hydrogen, for example oil and gas.

**Hydrocracker** - a chemical reactor in which large hydrocarbon molecules are fractured in the presence of hydrogen.

**Hydrodynamics** - refers to that branch of hydraulics which relates to the flow of liquids over weirs, or through pipes, channels and openings.

**Hydrofluoric Acid** - an acid composed of hydrogen and fluorine.

**Hydroforming** - a forming process in which a tube is placed into a forming die. The tube is then formed to the shape of the die through the application of internal water pressure. The hydroforming process allows for severe shape deformation, making it ideal for automotive structural parts such as engine cradles, radiator supports and body rails. Various shaped and sized holes can be punched in the tube almost anywhere during the process.

**Hydrogen Brazing** - the process of furnace brazing in a hydrogen atmosphere.

**Hydrogen Damage** - any of several forms of metal failure caused by dissolved hydrogen, including blistering, internal void formation, and hydrogen induced delayed cracking.

**Hydrogen Sulfide (H<sub>2</sub>S)** - a colorless, toxic gas composed of hydrogen and sulfur with a characteristic smell of rotten eggs, found in natural gas, and produced by decaying matter.

**Hydrometer** - an instrument for determining the specific gravities of liquids.

**Hydrophilic** - referring to a substance that readily absorbs water or is easily wetted by water.

**Hydrophobic** - referring to a substance that repels or does not absorb water.

**Hydropneumatics** - relating to the combination of hydraulic and pneumatic fluid power.

### Hydrostatic Test -

Hydrostatic Test - a pressure test in which a valve is tested with water to detect leaks; it may be a shell test or a seat closure test.

Hydrostatic Test - determining the burst resistance or leak tightness of a fluid component or system by imposing internal pressure.

Hydrostatic Test - refers to the hydraulic or water test to which newly laid drains are subjected to expose any leakage.

Hydrostatic Test - test of strength and leak-resistance of a vessel, pipe, or other hollow equipment by internal pressurization with a test liquid.

## Hydrostatics -

Hydrostatics - deals with the behavior and power of fluids which are not in motion.

Hydrostatics - engineering science relating to the energy of liquids at rest.

**Hydrotreating** - oil refinery catalytic process in which hydrogen is contacted with petroleum intermediate or product streams to remove impurities, such as oxygen, sulfur, nitrogen, or unsaturated hydrocarbons.

**Hygienic Valve** - a valve which will not contaminate the flowing fluid, built under clean conditions with no internal cavities and capable of internal cleaning, e.g. a cleaning fluid.

## Hypalon® -

Hypalon® - a thermoplastic used as a trim material. It is also known as CSM (chloro-sulfonated polyethylene). It has excellent tear and abrasion resistance, but poor compression-set resistance. It is used for butterfly valve liners and diaphragm valve diaphragms.

Hypalon® - DuPont trade name for chlorosulphonated polyethylene, an elastomer.

**Hyperbasic Welding** - an underwater welding process carried out in a dry chamber constructed around the joint to be welded. Water is expelled by providing a gaseous atmosphere in the chamber. The pressure inside the chamber is equal to water pressure. It keeps the water out.

## Hysteresis -

Hysteresis - in a cyclic process, hysteresis is the failure to follow the same path in the forward direction as in the backward direction.

Hysteresis - refers to the **loop which** water is boiled and the boiling temperature noted. It is used either for determining altitude by calculating the air pressure or for calibrating a thermometer.

Hysteresis - the difference between up-scale and down-scale results in instrument response when subjected to the same input approached from the opposite direction. Example: A control valve has a stroke of 1.0 inch and we give the valve a 9 psig signal. The valve travels 0.500 of an inch. We then give the valve a 12 psig signal, and the valve travels to 0.750 of an inch. When the valve is then given a 9 psig signal, the stroke is measured at 0.501. That represents hysteresis. Hysteresis can be caused by a multitude of variables - packing friction, loose linkage, pressure drop, etc. If someone asks you what the hysteresis of your control valve is, it is a bum question because hysteresis is more aptly applied to an instrument than to a control valve. There are simply too many variables in the valve and the system to answer the question properly. The control valve only responds to the controller signal and will move to a position to satisfy the controller - thus negating the effects of hysteresis.

**I Beams** - structural sections on which the flanges are tapered and are typically not as long as the flanges on wide-flange beams. The flanges are thicker at the cross sections and thinner at the toes of the flanges. They are produced with depths of 3-24 inches.

**I.S.** - see **Intrinsic Safety**

**I/P** - an abbreviation for current-to-pneumatic signal conversion. This term is commonly used to describe a type of transducer that converts an electric (4-20 mA) input signal to a pneumatic (3-15 psig) output signal.

**IA** - Instrument Air

**IAPD** - International Association of Plastics Distributors; formerly NAPD

**IATA** - International Air Transport Association

**IBBM** - Iron Body, Bronze Mounted (bronze trim)

**ICAO** - International Civil Aviation Organization

**ICC** - International Chamber of Commerce

**ICT** - Information and Communications Technology

**ID** -

**ID** - Inside Diameter

**ID** - the measurement of the Inside Diameter of a circular part.

**Identification** - colored dots or stripes on seals for identification purposes. Seldom used today.

**Idle Wheel** - 1) a wheel introduced in a gear train either to reverse rotation or to fill up a gap in the spacing of centers, without affecting the drive ratio; also called Cock Wheel; 2) an intermediate wheel; also called Carrier Wheel.

**Idler Gear** -

**Idler Gear** - a gear placed between two other gears to transfer motion from one to the other without changing their direction or speed; also call an Idle Wheel.

**Idler Gear** - a gear situated between a driving gear and a driven gear to transfer motion, without any change of direction or of gear ratio.

**Idler Gear** - when one gear drives another, the driven gear rotates in a direction opposite to that of the driving gear. If an idler gear is introduced, the relative speeds of the two gears remain unaltered but the driven gear will now rotate in the same direction as the driving gear.

**Idler Wheel** - a wheel used to transmit motion or to guide and support something.

**IEC** - International Electrotechnical Commission

**IEE** - Institution of Electrical Engineers

**IEEE** - Institute of Electrical and Electronics Engineers

**IFB** - 1) Issued For Bid; 2) Invitation to Bid

**IFC** - Issued For Construction

**IG** - Instrument Gas

**IHPP** - Industrial Hygiene Personnel Protection

**IIQ** - Indicators of Image Quality

**IIR** - Butyl Rubber (Butyl)

**IMM** - Institute of Materials, Malaysia

**Immediate Set** - the deformation found by measurement immediately after removal of the load causing the deformation.

**Immersion** - placing an article into a fluid, generally so it is completely covered.

**Immersion Coating** - applying material to the surface of a metal or ceramic by dipping into a liquid.

**Immunity** - an inherent or induced electrochemical condition that enables a metal to resist attack by a corrosive solution.

**IMO** - International Maritime Organization

**IMP** - Inspection and Maintenance Philosophy

**Impact** -

**Impact** - a forceful collision between two bodies which is sufficient to cause an appreciable change in the momentum of the system on which it acts; also known as Impulsive Force.

**Impact** - refers to the sudden application or fall of a load upon a specimen, structure, etc.

**Impact** - the single, instantaneous stroke or contact of a moving body with another, either moving or at rest, such as a large lump of material dropping onto a conveyor belt.

**Impact Bar** - a specimen used to test the relative susceptibility of a plastic material to fracture by shock.

**Impact Energy** - the energy necessary to fracture a material; also known as **Impact Strength**.

#### **Impact Strength** -

**Impact Strength** - a material property that indicates its ability to resist breaking under extremely rapid loading, usually expressed as energy absorbed during fracture.

**Impact Strength** - a measure of the resistance of a material to impact loading applied in an impact test. It is not a true strength, but is a measure of the energy absorbed per unit area of fractured material.

**Impact Strength** - the ability of a material to resist shock loading.

**Impact Strength** - the ability of a material to withstand shock loading.

#### **Impact Test** -

**Impact Test** - a test to determine the behavior of materials when subjected to high rates of loading, usually in bending, tension or torsion. The quantity measured is the energy absorbed in breaking the specimen by a single blow, as in the Charpy or Izod tests.

**Impact Test** - a test which is used to determine the resistance of a material to a shock load. A notched test piece is normally used, the test machines being the Izod impact and Charpy. Resistance is generally given as the energy in ft/lb, or kg/m required to break or bend the test piece, or as kg m/cm square of section behind the notch.

**Impact Test** - under very rapid loading, the response of a material may be very different to that under slower rates of loading. If the loading rate is comparable to the velocity of elastic waves in the material, interactions can occur which greatly increase the stress locally. Testing the response of material under impact loading, together with the tensile tests and hardness tests are among the most widely used mechanical tests on materials, and usually employ standard specimens whose shape and dimensions are prescribed by BSI, ASTM, ISO or DIN. The tests are classified by their deformation mode, as tensile, flexed beam or flexed plate. Tensile impact is essentially a high-speed variant of the tensile test where loading is by a falling pendulum in the pendulum impact test.

**Impact Testing Machine** - a machine which is used for testing the strength of test specimens under a single blow and for measuring the amount of energy absorbed in a fracture of the specimen. The commonest form of test piece is a notched bar.

**Impeller** - rotating element of a centrifugal pump driven by a motor or turbine. The impeller has vanes or grooves to impart rotary velocity to the product.

**Imperial Gallon** - a British measure, equal to 4.546 liters, as opposed to U.S. gallon, which is 3.785 liters.

**Imperial Units** - non-metric measures or weights

#### **Impingement** -

**Impingement** - removal of liquid droplets from a flowing gas or vapor stream by causing it to collide with a baffle plate at high velocity, so that the droplets fall away from the stream; also known as Liquid Knockout.

**Impingement** - the striking or dashing upon with a clash or sharp collision, such as air impinging upon the rotor of a turbine or motor.

**Impulse Sealing** - heat-sealing of plastic materials by applying a pulse of intense thermal energy to the sealing area for a very short time, followed immediately by cooling.

**Impulse Turbine** - a turbine driven by a fluid at high velocity under relatively low pressure.

**Impulse Welding** - a welding process in which two layers of thermoplastic film are heated and fused to form a welded seam by clamping them together in close contact with a shielded electric heating element.

**IN LB** - Inch Pound

**In Line Valve** - a valve having a piston actuated closure member shaped like a globe valve plug which moves to seat axially in the direction of the flow path. In line valves are normally operated by a fluid energy source but may be operated mechanically.

**In Situ** - on site

**Inch Pound** - the lifting of a pound weight a distance of one inch. Foot-pound is the more

commonly used unit of work.

- Inch Ton** - the lifting of a ton weight a height of one inch. Foot-ton is the more commonly used unit of work.
- Incident** - an unplanned event or chain of events that has or could have caused injury, illness and / or damage.
- Incipient Cavitation** - a term used to describe the early stages of cavitation. At this point the bubbles are small, and the noise is more of a hiss, like the sound of frying bacon. There is normally no mechanical damage associated with incipient cavitation, although it could have an effect on the corrosive properties of some fluids.
- Inclusion** - a small amount of foreign solid, liquid or gas encapsulated in a metal.
- Incolloys** - a proprietary range of corrosion resistant and high temperature alloys containing 30% nickel, 20% chromium and 48% iron with small amounts of carbon, aluminum and titanium.
- Incompressibility** - quality of a substance which maintains its original volume under increased pressure.
- Inconel** - a series of International Nickel Co. high nickel, chromium and iron alloys characterized by inertness to certain corrosive fluids.
- Incorrect Shape of Weld** - a welding defect caused by use of improper electrodes, which causes slag traps and forms convex welds in intermediate runs. It produces incorrect shape of the weld. Unsymmetrical fillet welds and very weak welds are caused by wrong procedures. Incorrect current setting, travel spreads or electrode manipulation may result in excessive deposits at the weld.
- Increased Safety** - a type of protection by which measures are applied so as to reduce the probability of excessive temperatures and of the occurrence of arcs or sparks in the interior and on the external parts of electrical apparatus which does not produce them in normal service and which is intended for use in hazardous locations defined by the IEC as Zone 1. Referred to by IEC as type "Ex e" protection.
- Increaser** - an adapter for connecting a small-diameter pipe to a larger-diameter pipe.
- Indent** -
- Indent - 1) an official order or requisition for goods; 2) an order form used in foreign trade and usually drawn up in duplicate or triplicate, specifically, a) any order for foreign merchandise, or b) an export order to buy certain goods at stated terms.
- Indent - to make out a written order, usually for foreign goods; an official requisition for goods.
- Indentation Hardness** -
- Indentation Hardness - in metal working, hardness means resistance to scratching, abrasions, or cutting. Indentation hardness is generally measured in terms of Brinell hardness number or Vicker's pyramid number or Rockwell (Scale B or C) hardness number.
- Indentation Hardness - the estimation of the hardness of a material by the permanent deformation formed in a material by an indenter. The hardness is expressed in terms of the load and the area of the indentation formed. Bell-shaped indenters find use to measure Brinell hardness number and Meyer hardness number. Ludwik introduced conical indenters and the hardness number is equal to the load divided by the surface area of contact between indenter and material. Pyramidal indenters get shaped like a square-based pyramid and are used for determining Vickers hardness numbers, in Rockwell hardness tests, in Knoop hardness tests, and in the Firth hardness meter. Dynamic or rebound hardness is measured by the Shore rebound scleroscope and the Herbert pendulum.
- Indenter** - an instrument used for making indentations in materials. The depth of indentation gives a measure of their hardness.
- Index Center** - one of two machine-tool centers used to hold work and to rotate it by a fixed amount.
- Indication** - in ultrasonic testing, determination of the presence of a flaw by detection of a reflected ultrasonic beam.
- Indicator** - device on the valve showing the position of the disc, plug ports, or ball ports.
- Indium** - a metal, element No. 49 in the Periodic Table. It is ductile and softer than lead with a very low vapor pressure. It is used for radiation resistant seals.
- Induction** - the production of an electric or magnetic state by the proximity (without contact) of an electrified or magnetized body.

## **Induction Hardening -**

**Induction Hardening** - a process for hardening steel surfaces by induction heating followed by quenching.

**Induction Hardening** - a type of case hardening in which the surface of the component is heated to red hot by passing it through a high frequency induction coil. The component is then passed through a quenching jet. The speed at which the component passes through the coil and the frequency of current determines the depth of hardness.

**Induction Hardening** - refers to a process of hardening steel by heating it with an alternating magnetic field, to a temperature within or above the transformation range, and by following immediately with quenching. This process is applicable to both surface hardening and full hardening.

**Induction Hardening** - using high frequency induction to heat a metal part for surface hardening. The heating is rapid and lends itself to control of the thermal gradient as well as the depth of hardening, since the penetration is inversely proportional to the frequency.

**Induction Heating** - the heating of a material by inducing an electric current within it.

**Induction Machine** - a machine comprised of a magnetic circuit interlinked with two or more electrical circuits moving relative to one another, of which one is connected to an alternating current system. Power is transferred from the stationary part to the moving part, or vice versa, by electromagnetic induction.

**Induction Valve** - [see Inlet Valve](#)

**Inelastic** - not capable of sustaining a deformation without permanent change in size or shape.

**Inert** - without active chemical properties; unreactive or little reaction with other chemicals.

**Inert Gas Carbon-Arc Welding** - an arc welding process carried out by heating with an electric arc between a carbon electrode and the work. Shielding is obtained from inert gas such as helium and argon.

## **Inert Gas Metal-Arc Welding (MIG) -**

**Inert Gas Metal-Arc Welding (MIG)** - an arc welding process carried out by striking an arc between the metal electrode and the workpiece.

**Inert Gas Metal-Arc Welding (MIG)** - this process utilizes a consumable electrode and hence, the term "metal" appears in the title. The process is similar to the TIG process. This process is used for welding stainless steel and high temperature melting metals and alloys. Inert gas metal arc welding (MIG) is also known as Gas Metal Inert Gas Welding (GMAW).

**Inertia** - the tendency of a body at rest to remain at rest, and a body in motion to continue to move at a constant speed along a straight line, unless the body is acted upon in either case by an unbalanced force.

**Inertia Welding** - inertia welding is similar to friction welding. In both the process heat is developed by friction to form the weld. In both the cases, the temperatures developed are below the melting point of the metals. The difference between friction and inertia welding is the process of providing rotation to the shafts. In friction welding the energy is supplied from conventional source (an electric welding or hydraulic motor) whereas in inertia welding the energy is supplied through the rotating flywheel. Inertia welding has the following advantages over friction welding: 1) the flywheel is an effective source of continuous power. 2) The supply of power can be controlled by proper selection of the flywheel.

**In-Feed Centerless Grinding** - a metal-cutting process by which a cylindrical work piece is ground to a prescribed surface smoothness and diameter by the insertion of the work piece between a grinding wheel and a canted regulating wheel; the rotation of the regulating wheel controls the rotation and feed rate of the work piece.

## **Ingot -**

**Ingot** - a form of semi-finished steel. Liquid steel is teemed (poured) into molds, where it slowly solidifies. Once the steel is solid, the mold is stripped, and the 25 to 30 ton ingots are then ready for subsequent rolling or forging.

**Ingot** - a mass of metal cast in a form convenient for storage or transportation. The cross section of most ingots approximates a square or rectangle with rounded corners. All ingots are tapered and are commonly cast big-end-down. For certain purposes, however, ingots are cast big-end-up.

**Ingot** - a metal casting in a shape suitable for subsequent hot working, e.g. for rolling or forging.

**Ingot** - a metal casting of a suitable shape for subsequent rolling or forging.

**Ingot** - a vertical casting, usually of metal such as aluminum, iron, or steel, for melting, storing, transporting, to a manufacturer, or otherwise processing into a finished product.

**Ingress** - to go in or enter; (opposite of egress)

**Inherent Diaphragm Pressure** - the high and low values of pressure applied to the diaphragm to produce rated valve plug travel with atmospheric pressure in the valve body. This is more commonly referred to as Bench Set.

#### **Inhibitor** -

**Inhibitor** - a substance that interferes with a chemical process.

**Inhibitor** - any substance which slows or prevents chemical reactions such as corrosion or oxidation.

**Injection Mold** - a plastics mold into which the material to be formed is introduced from an exterior heating cylinder.

**Injection Molding** - molding metal, plastic, or non-plastic ceramic shapes by injecting a measured quantity of the molten material into dies.

**Injection Ram** - in injection molding, the ram that applies pressure to the feed plunger in the process of either injection or transfer molding.

**Inlay** - to embed one material into another material in such a way that the surfaces are flat.

#### **Inlet** -

**Inlet** - 1) the body end opening through which fluid enters the valve; 2) a passage or opening where fluid enters a conduit or chamber.

**Inlet** - an entrance or orifice for the admission of fluid

**Inlet Port** - a tubular opening, usually flanged, through a chamber wall, permitting access or installation of a device into the chamber.

**Inlet Valve** - the valve through which a fluid is drawn into the cylinder of a positive-displacement engine, pump, or compressor; also known as Induction Valve.

**Inline Valve** - a valve with the outlet port parallel to, but not necessarily axial with, the inlet port.

**Inoculating Alloy** - an alloy added to molten iron for the principle purpose of nucleating a primary phase such as graphite. Inoculating alloys are frequently used to avoid the formation of primary carbide by enhancing the nucleation of graphite.

**Insert** - that component which features a body throat and sometimes acts as a body seat ring follower. In axial entry valves it also provides accessibility to the ball.

**Insert Component** - those components which are associated, but not integral, with the insert.

**Insert Fastenings** - those components, including set-screws, pins and clips which retain the insert in the body.

**Insert Gasket** - the gasket for effecting a fluid-tight joint between the body and insert.

**Insert Seal** - the seal for effecting a fluid-tight joint between the body and insert.

**Inside Diameter** - the length of a line which passes through the center of a hollow cylindrical or spherical object, and whose end points lie on the inner surface of the object; abbreviated ID.

#### **Inside Screw** -

**Inside Screw** - in which the actuating thread of the stem is contained inside the valve. This may take three forms: a) inside screw, rising stem. Where the hand wheel is attached to the stem and rises with it when the valve is opened; b) Inside screw, non-rising stem. Where the hand wheel is attached to a non-rising stem, the gate rising on the stem when the valve is opened; c) Inside screw, rising spindle, rising stem. Where the handwheel is attached to a rising spindle, and the stem rises within and with the spindle when the valve is opened.

**Inside Screw** - the actuating thread of the valve stem is engaged within the bonnet; **compare with Outside Screw.**

**Inside Screw** - where the actuating thread of the stem is engaged within the bonnet.

#### **Inside Screw Rising Stem (ISRS)** -

**Inside Screw Rising Stem (ISRS)** - a common term for any valve design in which the stem threads are exposed to the fluid below the packing and the stem rises up through the packing when the valve is opened.

**Inside Screw Rising Stem (ISRS)** - a stem design in which male threads on the stem mate with female threads in the valve bonnet. Turning the stem causes it to move out of (rise)

or into the valve.

**Inspect** - to examine an object to determine whether it conforms to standards; may employ sight, hearing, touch, odor, or taste.

### **Inspection** -

**Inspection** - the critical examination of a product to determine its conformance to applicable quality standards or specifications.

**Inspection By Variables** - a quality control inspection method in which the sampled articles are evaluated on the basis of quantitative criteria.

**Inspection Lot** - with the exception of bolting, a group of components from the same heat number from which a (metal) sample is drawn. For bolting, a lot is a group of similar components in terms of alloy type and size.

**Inspector** - refers to a buyer or owner representative appointed to carry out shop or field inspection.

**Installed Diaphragm Pressure** - the high and low values of pressure applied to the diaphragm to produce rated travel with stated conditions in the valve body. The "stated conditions" referred to here mean the actual pressure drops at operating conditions. Example: A control valve may have an inherent diaphragm pressure or bench set of 8 to 15 psig. But when subjected to a 600 psig inlet pressure, it may start to open at 3 psig and be full open at 15 psig. It is because of the forces acting on the valve plug and the direction of flow through the valve (flow-to-open or flow-to-close) that the installed diaphragm pressure will differ from the inherent diaphragm pressure.

**Instantaneous Strain** - the immediate deformation of a solid upon initial application of a stress; **compare with Creep Strain.**

**INSTL** - Installation

**Instructions to Bidders** - printed instructions issued to bidders on larger projects indicating the time and date set for opening of bids and other items of information pertaining to the legality of the bids; a part of contract documents.

**Instrument** - a device for measuring and sometimes also recording and controlling the value of a quantity under observation.

**Instrument Correction** - a correction of measurement made on a unit under test for either inaccuracy of the instrument or eroding effect of the instrument.

**Instrument Housing** - a case or enclosure to cover and protect an instrument.

**Instrument Shutoff Valve** - the valve or valve manifold of the sample line located nearest the instrument; also referred to as Component Isolation Valve.

**Instrumental Analysis** - the use of an instrument to measure a component, to detect the completion of a quantitative reaction, or to detect a change in the properties of a system.

**Instrumentation, Systems, and Automation Society (ISA)** - a U.S. society of instrument and controls professionals.

**INT** - Integral

**Integral** - a necessary part of a whole; included as part of a whole.

**Integral Bonded Cladding** - represents composite materials produced by roll bonding or explosion welding (**EXW**).

**Integral Controls** - pertaining to equipment that is supplied and housed or mounted locally with the valve and actuator.

### **Integral Flange** -

**Integral Flange** - a flange on a length of pipe, a nozzle or a pressure vessel which is cast or forged with the item itself, or is permanently attached to it by welding.

**Integral Flange** - a flange which is forged or cast with, or butt-welded to, a nozzle neck, pressure vessel, or piping wall.

**Integral Flange** - a valve body whose flange connection is an integral or cast part of the body. Valves with integral flanges were traditionally known to have the ANSI short face to face dimension ANSI / ISA S75.03. However many manufacturers now produce valve bodies with both integral and separable flanges that will meet both the ANSI short and long face to face dimensions.

**Interbraid** - a type of braiding used in making packing materials. Strands of yarn are wound so

that the strands criss-cross from the surface diagonally through the body of the packing.

**Interceptors** - in plumbing, box-like devices in a building drainage and vent piping system to trap and retain material not suitable for discharge into public sewers, such as grease, oil or sand. They consist of an inlet and outlet pipe and a baffle or baffles to prevent through-flow of the **deterious** material. They must be cleaned out periodically. According to their intended use they are called grease traps or sand traps. Interceptors are also called Separators.

**Interchangeability** - the ability to replace the components, parts, or equipment of one manufacturer with those of another, without losing function or suitability.

**Intercooler** - a device which is designed to cool air or gas between one stage and another in a multi-stage compressor.

**Intercrystalline Failure** - metal fractures that follow the crystal boundaries instead of passing through the crystals, as in the usual transcrystalline fracture. It is frequently due to the combined effect of stress and chemical action, but may be produced by stress alone when the conditions permit a certain amount of recrystallization under working conditions.

#### **Interference Fit -**

**Interference Fit** - a fit in which one of the mating parts of an assembly is forced into a space provided by the other part in such a way that the condition of maximum metal overlap is achieved.

**Interference Fit** - a fit in which the external dimension of one part exceeds the internal dimension of the part into which it has to fit.

**Interference Fit** - a negative fit, necessitating force sufficient to cause expansion in one mating part, or contraction in the other, during assembly.

**Interlock** - 1) to arrange the control of machines or devices so that their operation is interdependent in order to assure their proper coordination; 2) instrument which will not allow one part of a process to function unless another part is functioning; 3) a device such as a switch that prevents a piece of equipment from operating when a hazard exists.

**Intermediate Gear** - an idler gear **interposed** between a driver and driven gear.

**Intermesh** - **see Interfit**

#### **Intermittent Duty -**

**Intermittent Duty** - a rating given to a coil whose heat rise is too high for continuous duty. By using the coil with minimum 'ON' time, the coil will not reach extreme temperatures that would cause the valve not to operate, or fail prematurely.

**Intermittent Duty** - an operating cycle that consists of alternating periods of use and idle time - for example, on and off, load and no load, load and rest, or load, no load and rest; in most instances, successive periods of use or idle time vary widely in length, although some intermittent duty cycles follow well defined patterns.

#### **Intermittent Weld -**

**Intermittent Weld** - a weld having broken unwelded spaces.

**Intermittent Weld** - a weld whose continuity is broken by unwelded spaces is not suitable where maximum strength is required. However, where welds are not critical nature, such welds can be employed to reduce the cost of welding.

#### **Internal Gear -**

**Internal Gear** - an annular gear having teeth on the inner surface of its rim.

**Internal Gear** - any ring type or annular gear whose teeth are on the inner surface of the rim.

**Internal Screw Thread** - a screw thread cut on the inside of a cylindrical surface, as distinct from an external screw thread.

**Internal Soundness** - relative freedom from segregation and porosity, as evaluated by means of a macroetch test which is performed on representative samples.

**Internal Thread** - a screw thread cut on the inner surface of a hollow cylinder.

**International Standard (IS)** - The third (and highest) stage of the ISO standard process. Prospective ISO standards are balloted three times. The first stage is a Draft Proposal (DP). After a Draft Proposal has been in use a period of time (typically six months to a year) the standard, frequently with corrections and changes, is reballoted as a Draft International Standard (DIS). After the Draft International

Standard has been in use for a period of time (typically one to two years) it is rebalotted as an International Standard (IS).

### **International Thread -**

**International Thread** - a metric system in which the pitch of the thread is related to the diameter of the thread; it has a rounded root and flat crest and a 60 degree **included** angle.

**International Thread** - a standardized metric system in which the pitch and diameter of the thread are related, with the thread having a rounded root and flat crest.

**Interpolate** - to estimate the value of a function at a point between values that are already known.

**Interrupted Screw** - a screw with longitudinal grooves cut into the thread, and which locks quickly when inserted into a similar mating part.

**Intrinsic** - belonging to something as an inherent and essential part of its nature.

**Intrinsic Safety (I.S.)** - 1) a type of protection in which a portion of the electrical system contains only intrinsically safe equipment (apparatus, circuits, and wiring) that is incapable of causing ignition in the surrounding atmosphere. No single device or wiring is intrinsically safe by itself (except for battery-operated self-contained apparatus such as portable pagers, transceivers, gas detectors, etc., which are specifically designed as intrinsically safe self-contained devices) but is intrinsically safe only when employed in a properly designed intrinsically safe system. This type of protection is referred to by IEC as "Ex I." **see also Associated Equipment (Apparatus)**; 2) design methodology for a circuit or an assembly of circuits in which any spark or thermal effect produced under normal operating and specified fault conditions is not capable under prescribed test conditions of causing ignition of a given explosive atmosphere; 3) a method to provide safe operation of electric process control instrumentation where hazardous atmospheres exist. The method keeps the available electrical energy so low that ignition of the hazardous atmosphere cannot occur; 4) a protection technique based upon the restriction of electrical energy within apparatus and of interconnecting wiring, exposed to a potentially explosive atmosphere, to a level below that which can cause ignition by either sparking or heating effects. Because of the method by which intrinsic safety is achieved, it is necessary to ensure that not only the electrical apparatus exposed to the potentially explosive atmosphere but also other electrical apparatus with which it is interconnected is suitably constructed; 5) Certification method for use of electrical equipment in flammable atmospheres.

**Intrinsically Safe Apparatus** - apparatus in which all circuits are intrinsically safe.

**Intrinsically Safe Circuit** - a circuit in which no spark nor any thermal effect produced under prescribed test conditions (which include normal operation and specified fault conditions) is capable of causing ignition of a given explosive atmosphere.

**Intrinsically Safe Equipment And Wiring** - equipment and wiring which are incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration.

**Intumesce** - to swell up

**Invar** - an alloy having one-third nickel with two-thirds iron and other elements. It is used to make surveying tapes and some instruments owing to its very low coefficient of expansion.

**Inverse Cam** - a cam that acts as follower instead of a driver.

**Inverse Proportion** - the relation that exists between two quantities when an increase in one of them produces a corresponding decrease in the other.

**Invitation to Bid** - a document distributed as part of the contract documents to prospective bidders on a project. It gives a brief description of the project and summarizes its requirements so that a bidder can decide whether or not he wants to submit a bid.

**Involute Gear Tooth** - a gear tooth whose profile is established by an **involute** curve outward from the base circle.

**Involute Spline** - a spline having the same general form as involute gear teeth, except that the teeth are one-half the depth and the pressure angle is 30 degrees.

**IOM** - Instruction for Installation, Operation and Maintenance

**IP** - 1) International Practices; 2) Ingress Protection

**IPF** - Instrumented Protective Function

**IPP** - Independent Power Producer

**IPS** - 1) Instrumented Protective System; 2) Iron Pipe Size

**IQI** - Image Quality Indicators

**IRD** - Inland Revenue Department of Malaysia

**Iris Valve** - a valve with a flexible flow tube, usually rubber, one end of which is rotated about the flow axis and closes like the aperture in a camera lens.

**Iron (Fe)** - a strong, hard silvery-white metallic element that is naturally magnetic.

**Iron Body, Bronze Mounted (IBBM)** -

Iron Body, Bronze Mounted (IBBM) - a common term for valves with a cast iron body and bonnet and bronze trim (seating surfaces, stem, and bushings).

Iron Body, Bronze Mounted (IBBM) - a phrase used to describe a cast iron valve with bronze trim.

**Iron Carbide** - one of several substitutes for high-quality, low-residual scrap for use in electric furnace steelmaking. Iron carbide producers use natural gas to reduce iron ore to iron carbide.

**Iron Carbon Equilibrium** - an alloy of iron and carbon containing a maximum of 1.7% carbon is known as steel. If the percentage of carbon is more than 2.0% the alloy is known as cast iron. Steel containing 0.8% carbon is known as eutectoid steel. If the percentage of carbon is less than 0.8%, it is known as hypoeutectoid steel. Steel containing more than 0.8% carbon is known as hypereutectoid steel. Commercially, steels are classified as mild steel, medium carbon steel and high carbon steel. Steel containing up to 0.3% carbon is known as mild steel. If the percentage of carbon lies between 0.3 and 0.6%, it is known as medium carbon steel. Steels containing more than 0.6% carbon are designated as high carbon steels.

**Iron Ore** - a mineral containing enough iron to be a commercially viable source of the element for use in steelmaking. Except for fragments of meteorites found on Earth, iron is not a free element; instead, it is trapped in the earth's crust in its oxidized form.

**Iron Oxide Process** - a process by which a gas is passed through iron oxide and wood shavings to remove sulfides.

**IS** - 1) Intrinsically Safe; 2) [see International Standard](#)

**ISA** -

ISA - 1) Instrument Society of America; 2) [see Instrumentation, Systems, and Automation Society](#)

ISA - the Instrumentation Systems and Automation Society. Formerly Instrument Society of America.

**ISNRS** - Inside Screw Non-Rising Stem

**ISO** - International Standards Organization

**ISO 9001** - international Standards Organization. Model for Quality Assurance in Design & Development, Production, Installation and Servicing

**Isobaric** - proceeding at constant pressure

**Isoclinic** - within a stressed body, it refers to the imaginary line along which all points have corresponding principal stresses with the same orientation.

**Isocracking** - a hydro cracking process for conversion of hydrocarbons into more valuable, lower-boiling products; operates at relatively low temperatures and pressures in the presence of hydrogen and a catalyst.

**Isolation Valve** - The isolation valve nearest the instrument, grab sample point, or in line component which is available to personnel during normal plant operation. The root valve may or may not perform the function of the isolation valve, depending on its location.

**Isothermal Annealing** - austenitizing a ferrous alloy and then cooling to and holding at a temperature at which austenite transforms to a relatively soft ferric carbide aggregate.

**Isothermal Expansion** - expansion of a substance while its temperature is held constant.

**Isothermal Layer** - a layer of fluid, all points of which have the same temperature.

**Isotropic** - a material which has the same elastic properties in all directions.

**ISRS** - Inside Screw Rising Stem

**ITB** - Invitation To Bid

**ITCS** - Impact Tested Carbon Steel

**ITP** - Inspection and Test Plan

**Izod Test** -

Izod Test - a flexed cantilever beam, notched specimen impact test in which one end of a notched specimen is held in a vice while the other end is struck by a striker carried on a pendulum. The energy absorbed in fracture is then calculated from the height to which the pendulum rises as it continues its swing.

Izod Test - a pendulum type of single-blow impact test In which the specimen, usually notched, is fixed at one end and broken by a falling pendulum. The energy absorbed, as measured by the subsequent rise of the pendulum, is a measure of impact strength or notch toughness.

Izod Test - an impact test in which a test piece of 10 mm square in section is notched transversely by a V-cutter to a depth of 2 mm and an angle of 45 degrees. The radius at the bottom of the notch is one-quarter mm. The piece is fixed vertically in the vice of the machine by the lower end, with the notch at the level of the face the vice. When the pendulum of the machine gets released it swings freely, and a knife-edge carried in the tup of the machine strikes the piece at a distance of 22 mm above the notch, on the same side as the notch. The angle of swing of the pendulum beyond the vertical after breaking the test piece would be indicated by a pointer, which should have been previously set to zero. From the amount by which the angle falls short of the angle to which the pendulum would have swung if there had been no test piece would be known, and would be indicated by the pointer in ft. lb. The height of fall of the center of mass of the pendulum would be 2 ft 6 in, and the capacity of the machine 150 ft. lb or 120 ft. lb., the distance from the pivot to the striking edge being 4 ft. the striking velocity, when using the full capacity of the machine, has been 13.6 ft/sec.

**Izod Value** - the energy absorbed in fracturing a standard specimen in an Izod pendulum impact testing machine.