



A.R.I. VALVE RELATED TERMS

ABSOLUTE PRESSURE - The pressure expressed in bar, Pascal or PSI, as measured above a perfect vacuum.

ACCUMULATOR - A vessel in which a gas is trapped and compressed by the **liquid** in a hydraulic system, thus storing energy to supply **liquid** under pressure to the system when needed.

ACTUATOR - The mechanical, hydraulic, electric or pneumatic device or mechanism used to open, position, or close a valve.

ADAPTER SPOOL - An extension which is added to a short face-to-face valve, to conform to standard API 6D face-to-face dimensions.

AIR LOCK, AIR BOUND - Obstructed, as to the free **flow** of water, because of air entrapped in a high point; used to describe a pipeline or pump in such condition.

AIR RELEASE VALVE - A hydro-mechanical valve designed to slowly release air automatically and continuously from **liquid** (Water/Wastewater) piping systems. The three available designs are compound **lever**, simple **lever** and direct acting. The **lever** designs control float movement disallowing it from contacting the valve **body**. Direct acting type allows the float to come into contact with all valve surfaces. An **Air Release valve** will not release large volume of air upon system start up or provide vacuum protection. An **Air/Vacuum** or **Combination air valve** is required for these purposes.

AIR/VACUUM VALVE – A float operated valve designed to discharge large volumes of air upon pump start up and provide vacuum protection by admitting large volumes of air upon pump shut down or if a column separation occurs. **Air/Vacuum valves** typically have equal inlet and outlet sizes. An **Air/Vacuum valve** will not continuously release accumulated air. An **Air Release valve** is required for this purpose.

AIR VALVE - Generic name used to describe a family of valves used to control the discharge, release and intake of air to a pipeline or **liquid** handling system. Common names for specific types include Air Release, Air/Vacuum, Combination, Sewage, hydraulically controlled and Non Slam.

AIR VENT - An opening in a penstock or other pipeline, covered tank, or well, that allows inflow of air.

ALLOY STEEL - A steel consisting primarily of iron with some percentage of one or more other elements such as chromium, nickel, manganese, or vanadium deliberately added to enhance its properties.

ALTITUDE CONTROL VALVE - Maintains a preset water level in a reservoir or water tank, and is activated by line pressure according to the hydrostatic pressure.



Operates by an extremely sensitive diaphragm pilot without floats or other external devices.

AMBIENT TEMPERATURE - The prevailing temperature of the environment immediately surrounding an object - generally considered to be -20° F to +100° F.

ANCHOR PIN - A pin welded onto the **body** of ball valves. This pin aligns the adapter plate and restrains the plate and gear operator from moving while the valve is being operated.

ANGLE VALVE - A variation of the straight valve, in which the end connections are at right angles to each other.

ANSI - American National Standards Institute—standards organization responsible for coordinating the work of U.S. standards writing groups with each other and with other national standards organizations. It was known as **ASA** until 1967.

ANSI CLASS - A strength designation for valves which show the maximum pressures at various temperatures at which a valve can be expected to work safely.

ANTI-SLAM VALVE (COMPONENT) - Device used on **Air/Vacuum valves** and Combination AIR VALVES to regulate the valve's **closure** and prevent the valve from being slammed closed during critical operation. The device is sometimes referred to as a non-slam device or surge check valve.

ASA - American Standards Association—former name of what is now ANSI. It was renamed United States of America Standards Institute in 1967, then American National Standards Institute in 1969.

ASME - American Society of Mechanical Engineers—organization responsible for maintaining several codes and large numbers of standards, covering numerous different industries.

ASTM - American Society for Testing and Materials—organization responsible for maintaining standards covering materials, testing methods, and in some cases such as plastics, the dimensional and manufacturing standards for finished products.

ATMOSPHERIC PRESSURE - The external pressure exerted on a **body** by the atmosphere: 14.7 psi (absolute) at sea level.

AUSTENITIC STAINLESS STEEL - The common stainless steel, where the primary micro structure is austenite and the composition is primarily iron but also includes both chromium and nickel. The steels are designated as 300 series such as 304, 316, CF8M, etc.



BACKFLOW ACTUATOR - Provided for opening and holding open the **check valve disc** to allow backflow through the **line**. Used to backwash a **line**, drain a system or fill a wet well.

BACK PRESSURE - The pressure exerted on the downstream side of a valve.

BACKSEAT - A shoulder on the stem of a **gate** or **globe valve** which seals against a mating surface inside the bonnet to prevent leakage of media through the bonnet stuffing box when the valve is fully opened.

BACKWASHING - The act of running clean water backwards through a valve for the purpose of cleaning.

BALL VALVE - A valve that has a spherical, or section of a spherical, **closure element** that opens and closes by rotating one-quarter turn.

BAR - A metric unit of pressure. One **bar** equals 14.5 psi.

BEARING - The cylindrical journal located in the **body hubs** that is used to support the valve shaft(s).

BELLEVILLE SPRING OR BELLEVILLE WASHER - A disc-shaped conical spring, resembling a washer, which provides spring **force** along its own centerline. Also sometimes known as a cup spring.

BERNOULLI'S LAW - A physical law of hydraulics that states that under conditions of uniform steady **flow** of water in a conduit or stream channel, the sum of the velocity head, pressure head, and **head** due to elevation at any given point along such conduit or channel is equal to the sum of these heads at any other point along such conduit or channel plus or minus the losses in **head** between the two points due to **friction** (plus if the latter point is upstream, minus if downstream).

BEVEL GEAR OPERATOR - Device facilitating operation of a **gate** or **globe valve** by means of a set of bevel gears having the axis of the pinion gear at right angles to that of the larger ring gear. The reduction ratio of this gear set determines the multiplication of torque achieved

BI-DIRECTIONAL - A valve that is capable of sealing or regulating in both direct and reverse pressure.

BHN - Brinell Hardness Number - A dimensionless indicator of hardness. The Brinell hardness test is defined in **ASTM-E10**. The higher the number, the harder the material. Also known as HRB.



BLOCK AND BLEED - A valve configuration in which the **flow** through the valve, from the **inlet port** to the outlet port, is blocked, while another small port is provided for the purpose of bleeding down (draining or depressurizing) the cavity in between. Sometimes a single valve so equipped, sometimes an assembly of two or three valves.

BLOW-OFF VALVE - A valve installed in a low point or depression on a pipeline to allow drainage of the **line**. Also called washout valve.

BODY - The pressure containing shell of a valve.

BOLT - A fastener having a square or hex head and threaded on the opposite end to receive a nut sometimes used to make up a flanged connection.

BOLTED BONNET - A bonnet which is connected to a valve **body** with **bolts** or studs and nuts.

BONNET - The cover or removable top component of a valve, containing the packing gland and stem opening. Generally **gate** and globe valves are considered to have a **bonnet**. The same part on other valves is called the cover or cap.

BORE (OR PORT) - The inside diameter of the smallest opening through a valve, e. g., inside diameter of a seat ring, diameter of hole through ball in a ball valve.

BSI - British Standards Institution—organization responsible for standards in Great Britain and Northern Ireland.

BS 6755: The British Standard specification dealing with the fire testing of pipeline valves. Once a particular size and pressure **class** valve is tested and passes the **BS 6755** fire test, like valves can be also identified with the **BS 6755** standard.

BUBBLE-TIGHT - A seat leakage condition in which, during the allotted time of the test, no perceptible leakage comes past the seat being tested. Applies to air-under-water testing—the same test using water-under-air is referred to as drop tight. Defined in API 598, MSS-SP-61, AND **ANSI B16.34**.

BUNA-N - Common term for nitrile rubber. One trade name is Hycar (trademark of Goodrich Chemical Co.)

BURST CONTROL VALVE - The valve is normally open. Where the flow rate is higher than the maximum preset, the valve closes automatically. It can only be reopened by external intervention.

BURST PRESSURE - That pressure at which rupture of a stressed element or pressure-containing vessel takes place. See “Ultimate Strength.”



BUTT WELD - Weld where the adjoining edges to be welded are parallel and facing each other. The weld well preparation for a butt weld can be a single- or double-angle bevel, a J-bevel or U-bevel, or parallel without bevel for very thin welds.

BUTTERFLY VALVE - A quarter-turn valve design which includes a circular **body**. It has a rotary motion disk **closure** member, which is pivotally supported by its stem, allowing the disk to rotate 90° to open and close the valve. Butterfly valves come in various styles, including eccentric and high-performance (zero-leakage) valves. Butterfly valves are high recovery valves and thus tend to induce **cavitation** in **liquid** services at much lower pressure drops and **fluid** temperatures than the globe style valve.

BVR - Ball Valve Regulator: An automatic throttling valve controlling **flow** or pressure in a pipeline; comprising a package involving a **ball valve actuator**, positioner, and controlling instrument

BYPASS - A smaller **line** containing a valve that comes off of a larger **line** just upstream of a major valve and rejoins the same **line** just downstream of the valve. The **line** provides a way to **bypass** the main valve.

BYPASS VALVE - A small pilot valve used in connection with a larger valve to equalize the pressure on both sides of the disk of the larger valve before the larger valve is opened.

CAPACITY - The mass **flow** rate through a valve under specified conditions.

CAPSCREW - A fastener having a head and whose shank is normally threaded throughout its entire length. Not used with a nut, but rather engagement is made with a female thread in the piece to be joined.

CARBON STEEL (CS) - Iron containing carbon in the form of carbides, about 0.1 to 0.3 percent carbon with no other alloying elements other than the sulfur, phosphorus, and other elements present in almost all steels.

CAST IRON - The common term for cast gray iron or iron containing flake carbon in the range of $\frac{1}{2}$ % to 2 $\frac{1}{2}$ %. **Cast iron** is brittle, exhibiting very little ductility before fracturing.

CASTING - A product or the act of producing a product made by pouring molten metal into a mold and allowing it to solidify, thus taking the shape of the mold.

CAVITATION - The phenomenon in which the local pressure at a point in a flowing **fluid** becomes lower than the vapor pressure of the **fluid**, thus causing small bubbles to form. The bubbles then implode when the local pressure rises again, causing shock waves that are very destructive to the walls of the passageway or the valve trim in the area of the **cavitation**.



CENTRIFUGAL PUMP - A pump consisting of an impeller fixed on a rotating shaft and enclosed in a casing, and having an inlet and a discharge connection. The rotating impeller creates pressure in the **liquid** by the velocity derived from centrifugal **force**.

CHAIN WHEEL OPERATED VALVE - An overhead valve operated by a chain drive wheel instead of a hand wheel.

CHECK VALVE - A unidirectional valve which is opened by the **fluid flow** in one direction and which closes automatically to prevent **flow** in the reverse direction.

CHARPY IMPACT TEST - A destructive mechanical test conducted on a precisely machined coupon of steel to be tested. The coupon is clamped in a special machine and subjected to lateral hammer blow. The test provides a relative measure of the toughness of the steel or its resistance to shock or impact loads and is usually required for material used in low temperature applications.

CHEVRON PACKING- Packing that consists of endless rings of molded plastic or fiber, with a chevron-shaped cross section such that pressure from under the chevron tends to force the edges of the packing ring more tightly against the walls of the packing chamber, thus increasing the seal.

CHEZY FORMULA - A basic hydraulic formula developed by Chezy in 1775 for determining the **flow** of water in open channels. See Manning Formula, Manning Roughness Coefficient.

CHOKED FLOW - Also known as critical **flow**, it can occur in gas, steam, or **liquid** services. **Choked flow** happens when, at a fixed upstream pressure, the **flow** cannot be further increased by lowering the downstream pressure. Basic **fluid flow** equations show that **flow** is proportional to the square root of the pressure drop. This means that higher pressure drops allow more **fluid** to go through the valve. **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**. However, if the pressure drop becomes too high, the **flow** reaches a point where it no longer increases, this is considered choked **flow**. 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 for gas and steam services is that if the pressure drop across the valve equals or exceeds one half the absolute inlet pressure, then there is a good chance of a choked **flow** condition.

CLADDING - A method of coating metals by which the coating becomes an integral part of the material. This can be done by **casting** or hot working. It is generally done on valves where special trims are required for difficult applications.



CLAPPER - Another name for the **disc** in a swing check valve.

CLASS - A pressure rating expressed as a dimensionless number. The **class** rating charts give actual pounds per square inch (psi) or barg maximum allowable pressure at a given temperature.

COLD RATING - The maximum pressure that a valve or **fitting** is designed to withstand at room temperature.

CLOSURE - The device or object that is placed into or across an opening in a pressure-retaining **body** for the purpose of closing it off.

CLOSURE ELEMENT - The moving part of a valve, positioned in the **flow** stream, which controls the **flow** through the valve, e. g., wedge, plug, clapper, ball.

COLUMN SEPARATION - Phenomena which occurs when a column of water in a pipeline separates creating a vacuum. Example: Water draining from a highpoint in opposite directions.

COMPOUND LEVER AIR RELEASE VALVE - **Air release valve** in which the float and orifice buttons are mounted on separate arms. Utilized in medium to large **Air Release valves** requiring a significant amount of mechanical advantage for the valve to open.

COMBINATION AIR VALVE - AIR VALVE which combines the function of an **Air Release valve** with that of an **Air/Vacuum valve**. Available in both single **body** and dual **body** configurations. See also **Air Release Valve** and **Air/Vacuum Valve**

COMPRESSIBLE FLUID_- A gaseous **fluid** such as steam, which has a significant change in volume and density as pressure increases.

CONTAMINANT - A particle or material which is foreign to the **fluid** media.

CONTROL VALVE - Valve that is **actuator** or **diaphragm** operated electrical, for the purpose of controlling or varying the **fluid flow** in the pipeline.

CONTROLLER - A device that directs and monitors the **flow** of a valve. **Controllers** can be either pneumatic or electronic. There are pressure, temperature, pH, level, differential and **flow controllers**. The job of the **controller** is to sense one of the above variables and compare it to a set point that has been established. The **controller** then outputs a signal, either pneumatic or electronic, to the control valve, which then responds to bring the process variable to the desired set point

CORROSION - The deterioration of a material due to chemical action.

COULISSE - Of or using runners or slides as a guiding mechanism; as in a "**Coulisse**" style **gate valve**.



CRACKING PRESSURE - The pressure required to push a **check valve disc** off its seat.

CUSHION SWING CHECK VALVE - A Swing **Check Valve** designed to reduce slamming by providing an external cushion to dampen the **disc's closure**.

C_v / K_v - **Flow coefficient** expressed as the number of gallons of water that would **flow** through an opening, such as a valve port, in 1 minute under a **differential pressure** of 1 psi.

CWP - Cold working pressure - the maximum allowable pressure under non-shock conditions at **ambient temperature** (-20° F to +100° F).

CYCLE TEST - A procedure whereby a product is put through an interval of time during which a phenomena is completed. This can be a set number of events or it can be a continuous operation until something in the product fails.

CYCLE - A single complete operation or process returning to the starting point. A valve, stroked from full open to full close and back to full open, has undergone one **cycle**.

CYLINDER ACTUATOR - An **actuator** which converts hydraulic or pneumatic pressure action on a piston within a cylinder into mechanical **force** which moves the valve or gate **closure** member.

DASHPOT - A device used to dampen and control a motion, in which an attached piston is loosely fitted to move slowly in a cylinder containing oil.

DEAD-TIGHT - Slang for **Bubble-Tight** or Drop-Tight.

DEEP-WELL TURBINE PUMP - A **centrifugal pump** adapted for deep well use and consisting of a series of stages. Each stage comprises a set of vanes in a case or bowl, and the number of stages increases with the operating head.

DELRIN - Trademark of E.I. du Pont de Nemours Co, Inc. for acetal plastic.

DELTA P OR ΔP - The **differential pressure** between two points, numerically equal to $P_1 - P_2$.

DESIGN PRESSURE - The pressure used in calculating required wall thicknesses, operating torques, **flange** ratings, and other variables. Generally the **design pressure** is set at a value higher than the operating pressure, to include all the reasonable allowances for surge pressures and variation in operating conditions.

DESIGN TEMPERATURE - The temperature that is used to determine allowable stresses for the purposes of design calculations. Generally, the **design temperature** is set at a value higher (or farther from ambient) than the operating temperature, and includes allowances for upsets and variation in operating conditions.



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**.)

DIAPHRAGM - A round or elliptical sealing device secured and sealed around its outer edge – and sometimes around a central hole in the **diaphragm** – with its unsupported area free to move by flexing.

DIFFERENTIAL PRESSURE – The same as Delta *P* or ΔP .

DIN - Deutsche Industries Norme—West German national standard organization.

DIRECT ACTUATOR - An **actuator** in which the stem extends with an increase in **diaphragm** pressure.

DIRECT PRESSURE - Pressure applied by the **flow** against the back of the valve **closure** member and/or opposite the seat end of the valve.

DISC - The **closure** member in a gate, globe, check, or butterfly valve.

DISCHARGE HEAD - A measure of the pressure exerted by a **fluid** at the point of discharge, usually from a pump.

DISCHARGING AIR - The removal of air from a pipeline through an **Air/Vacuum valve** or Combination Air Valve. Also known as Purging Air.

DISC COUNTERACTION - Non-slam characteristic of a **check valve disc** which allows **flow** above and below the **disc**. The **flow** passing below the **disc** pivot is countered by the **flow** pushing above the **disc** providing a cushioning effect upon **closure**. See also Tilting Check Valve.

DISC STABILIZATION - Under **flow** conditions, a valve **disc** which is held in a fixed position.

DISC STROKE - The movement of a valve **disc** from the closed to open position or vice versa.

DN - Nominal Diameter—standard abbreviation for pipe size used in **ISO** standards.

DOUBLE BLOCK AND BLEED - Either a pair of block valves with a section of piping between them that contains a bleed point, or a single valve that seals in two locations with a bleed point between the two. The bleed may or may not be valved itself, and may be normally open or normally closed.



DOUBLE GUIDED FLOAT - Combination Air/Vacuum - float which is guided to its closed position by upper and lower guide shafts.

“DOUBLE” PISTON EFFECT PRINCIPAL (DPE) - The sealing principal of a **ball valve** whereby **line** pressure is used on both the upstream and downstream floating seats to affect a **dead-tight** seal simultaneously on both sides of the ball. With the **DPE** seat configuration when the upstream seat leaks, the pressure entering into the **body** cavity acts on the downstream seat, which being of the PPE design, is then pushed against the ball and the valve seals in both directions.

DRAIN PLUG - A **fitting** at the bottom of a valve, the removal of which permits draining and flushing the **body** cavity.

DRIVE PINS - The two pins which fit into the bottom of a **ball valve** stem and engage corresponding holes in the ball. As the operator turns the stem, the drive pins turn the ball.

DROOP -A drop in set (outlet) pressure of a regulator or **control valve** due to the travel of its valve or poppet, as the required **flow** increases from low to maximum. A slight change in the control spring length due to the valve travel will result in spring **force** variations, translating into a change of set (outlet) pressure.

DROP TIGHT - See BUBBLE-TIGHT.

DUO-CHECK - A **check valve** utilizing two **discs**. The **discs** are half circle in shape, hinged on their straight edge and mounted to a hinge pin on the valve's centerline. **Closure** is mechanically assisted through the use of a spring(s) mounted on the back side of the discs. The valve has good non-slam characteristics and is used in non-solids bearing **flows** and air service.

DUROMETER - A device for determining hardness of resilient materials, or the hardness measured using the device, trademark of Shore Instrument Co. Hardness is expressed in Shore units, defined in **ASTM-D2240**.

DYNAMIC HEAD - See Total Dynamic Head.

DYNAMIC SUCTION HEAD - The static suction **head** plus the velocity **head** minus the **friction head** in the suction **line**.

DYNAMIC SUCTION LIFT - The static suction lift minus the velocity **head** plus the **friction head** in the suction **line**.

ECCENTRIC ACTION - The movement of a valve plug or **disc** which has a pivot axis off center from the seat or **body**. Allows movement in and out of the seat without rubbing.



ECCENTRIC PLUG VALVE - A quarter turn shut-off valve in which the plug or **disc** has a pivot axis off center from the valves seat or body. The **Eccentric Action** of the **disc** allows movement of the plug in and out of the seat without rubbing.

EFFLUENT - (1) A **liquid** which **flows** out of a process or confined space. (2) Wastewater or other **liquid**, partially or completely treated, or in its natural state, flowing out of a reservoir, basin, treatment plant, or industrial treatment plant, or part thereof. (3) An outflowing branch of a main stream or lake. (4) An emission of gas. See also **influent**.

ELASTOMER - A natural or synthetic elastic material, often used for O-ring seals. Typical materials are Viton, **Buna-N**, EPDM (ethylene propylene di-monomer), etc.

ELBOW - A female threaded or socket **fitting** used for changing direction in a run of pipe or tubing. See "**EII**," "Street **EII**."

ELECTRIC ACTUATOR - Also known as an Electro-Mechanical Actuator uses an electrically operated motor-driven gear train or screw to position the **actuator** stem. The **actuator** may respond to either a digital or analogue electrical signal

ELECTROLESS NICKEL PLATING - A plating process which requires no external electrical power and is the result of a chemical reaction between the part and the plating solution. A uniform consistent deposit and plating rate can be produced by controlling and adjusting the chemistry of the plating bath.

ELECTRIC CONTROL VALVE - Activated by line pressure, opened or closed by an electric command through a solenoid valve. The solenoid is energized or de-energized by an electric pulse to open or close the valve.

A normally closed solenoid is used with a normally open valve (N.O. – with no energy the valve is opened by line pressure) and a normally open solenoid is used with a normally closed valve (N.C. – with no energy the valve is closed by line pressure).

ELECTROLYTIC CORROSION - **Corrosion** resulting from stray DC currents in underground pipe.

ELEVATION HEAD - The energy possessed per unit weight of a **fluid** because of its elevation above some datum. Also called position head, potential head.

ELL - A pipe or tubing **fitting** that has the shape of an "L." See "**Elbow**."

EMO – Electric Motor Operated: The actuation of a valve by electric motor. See "Power Operator."

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 TO END DIMENSION - The dimension from the end of one port to the end of the opposite port of a valve, **fitting** or pipe.

ENERGY HEAD - The height of the **hydraulic grade line** above the center line of a conduit plus the velocity **head** of the mean-velocity water in that section.

EXHAUSTING AIR - The removal of air from a pipeline through an **Air/Vacuum Valve** or **Combination Air Valve**.

EXPANDING GATE VALVE - A **gate valve** that is comprised of a separate **gate** and segment that as the valve operates the **gate** and segment move without touching the seats, permitting the valve to be opened and closed without wear. In the closed position the **gate** and segment are forced against the seat. Continued downward movement of the **gate** causes the **gate** and segment to expand against the seats. When the valve reaches its full open position, the **gate** and segment seal off against the seats while the **flow** is isolated from the valve **body**.

EXPANSION JOINT - A joint installed in a structure to provide, without distortion of the structure, for changes in length due to expansion or contraction resulting from changes in temperature.

EXTENDED BDV (Blowdown Valve) - Used on buried valves where the **drain plug** is inaccessible. Instead, a **line** is piped above grade, terminating in a small valve. **Line** pressure is used to blowout condensates and other material which settles out in the bottom of the **body** cavity. See "BDV."

FABRICATED VALVE - The **body** and **hub** parts are not cast – but rather are formed from plate or pipe and the welded, or bolted together.

FACE-TO-FACE DIMENSION - The dimension from the face of the **inlet port** to the face of the outlet port of flanged valves or fittings.

FACING - The finish of the **gasket** contact surface of a flange.

FATIGUE ASSESSMENT - Fatigue resistance verification of a component subjected to a number of operating **cycles**.

FAIL-CLOSED OR NORMALLY 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.

FAIL-OPEN - A condition in which a valve or other component that is normally in some position, open, closed, or in between, will open if power or signal is lost.

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.



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.

FEEDING LEG - The segment of a pipeline upstream of a change in grade.

FEMALE THREAD - An internal screw thread designed to mate with a component having male (external) threads of the same size and type.

FIELD SERVICEABLE - A statement indicating that normal repair of the valve or replacement of operating parts can be accomplished in the field without return to the manufacturer.

FINAL EFFLUENT - The **effluent** from the final treatment unit of a wastewater treatment plant.

FIRE GATE - A **gate** or **ball valve** which is positioned in a pipeline at the entrance to a compressor station. This valve is closed in case of fire in the compressor station. Closing the valve prevents the gas in the pipeline from feeding the fire.

FIRE SAFE - 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.

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.

FLANGE - A cast or formed pipe **fitting** consisting of a projecting radial collar with **bolt** holes to provide means of attachment to piping components having a similar fitting. The end piece of flanged-end valves.

FLANGELESS - A valve that does not have integral **line** flanges, 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.

FLAP VALVE - A valve that is hinged at one edge and that opens and shuts by rotating about the hinge. See also check valve.

FLASHING - Is the boiling or vaporizing of a **liquid**. See the definition of **Cavitation**

FLAT FACE - (FF) A **flange** surface in which the **gasket** sealing area is the entire surface from the inside diameter to the outside edge of the flange.

FLOW AREA - The total area minus obstructions at a given cross sectional point in a valve.



FLOW CHARACTERISTICS - The curves relating to the percentage of **flow** versus the **closure** member travel. Inherent **flow** characteristics assume a constant pressure across the valve while the **installed flow characteristic** includes the impact of the system on the valve's performance.

FLOW COEFFICIENT - See the definition for **C_v**.

FLOW CONTROL VALVE - Activated by line pressure and partly open to allow a preset constant flow rate.

Flow rate is determined by an orifice plate. Head loss across the orifice is proportional to the actual flow rate. With increasing head loss, the control valve automatically closes, with decreasing head loss, it opens. Combined operation of the orifice plate and the pilot enables a constant flow rate to remain, regardless of line pressure fluctuations.

FLOATING BALL - 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.

FLOW COEFFICIENT - The number of gallons of water per minute that will **flow** through a valve with a pressure drop of 1 psi. Also referred to as the **C_v** of the valve.

FLOW LAMINAR - The **flow** of a viscous **fluid** in which the **fluid** moves in parallel layers with a fixed velocity **gradient** from the centerline to the containing walls of the conduit. Sometimes referred to as "streamline" **flow**.

FLOW METER -An instrument used to measure **flow rate** or total **flow** or both.

FLOW RATE - The volume or weight of a **fluid** passing thru a pipeline or conductor per unit of time, i.e., 3000 barrels of oil per day; 4 MMCF of gas per hour.

FLOW, TURBULENT - The random **flow** of a **fluid** in which the velocity at a certain point in the **fluid** varies irregularly.

FLOW -A **fluid** in motion in a conducting **line**.

FLUID - (1) Having molecular particles which easily move and change their relative position without separation of the mass, and which easily yield to shear stress; capable of flowing; **liquid** or gaseous. (2) A sludge or solid suspension capable of **flow**.

FOOT VALVE - (1) A valve placed in the bottom of the suction pipe of a pump, which opens to allow water to enter the suction pipe but closes to prevent water from passing out of it at the bottom end. (2) A valve with the reverse action attached to drainage pipe of a vacuum chamber. It allows water to drain out but closes to hold the vacuum.

FORCE - The intensity of an influence tending to produce motion, distortion or change of shape. The product of unit **force** (PSI) and the area over which it acts. Usually expressed in pounds.



FORCE MAIN - A pressure pipe joining the pump discharge at a water or wastewater pumping station with a point of gravity **flow**.

FRICTION - The resistance to motion between two contacting surfaces or substances. **Friction** is also developed between a flowing **fluid** and the inner wall of the conducting pipe – resulting in a drop in pressure.

FRICTION HEAD - The **head** lost by water flowing in a stream or conduit as the result of the disturbances set up by the contact between the moving water and its containing conduit and by intermolecular **friction**. In laminar **flow**, the **head** lost is approximately proportional to the first power of the velocity; in turbulent **flow** to a higher power, approximately the square of the velocity. While, strictly speaking, **head losses** such as those due to bends, expansions, obstructions, and impact are not included in this term, the usual practice is to include all such **head losses** under this term.

FRICTION LOSS - The **head** lost by water flowing in a stream or conduit as the result of the disturbances set up by the contact between the moving water and its containing conduit and by intermolecular **friction**. See also **friction** head.

FRICTION SLOPE - The **friction head** or loss per unit length of conduit. For most conditions of **flow** the **friction slope** coincides with the energy **gradient**, but where a distinction is made between energy losses due to bends, expansions, impacts, etc., a distinction must also be made between the **friction slope** and the energy **gradient**. In uniform channels the **friction slope** is equal to the bed or surface slope only for uniform **flow**.

FTU - (Formazin Turbidity Unit) - A standard unit of turbidity based upon a known chemical reaction that produces insoluble particulates of uniform size. The **FTU** has largely replaced the **JTU**. See also **JTU**.

FULL BORE OR FULL PORE - A valve or other component in which the seat area has substantially the same cross section and cross-sectional area as the end connections have. Depending on what the valve will be used for, sometimes having the same area is sufficient, but sometimes the same internal diameter all the way around is required.

FULL OPENING - Describes a valve whose **bore** (port) is nominally equal to the **bore** of the connecting pipe. Full penetration weld: Describes the type of weld wherein the weld metal extends through the complete thickness of the parts being joined.

GALLING - The tearing of metal when two elements rub against each other. Usually caused by lack of lubrication

GALVANIC CORROSION - **Corrosion** that occurs where dissimilar metals are in close proximity in an electrolytic solution, such as water. The anode side is the one that loses metal (is less noble).



GASKET - A component whose purpose is to seal a joint between two larger components, softer than the surfaces of the joint being sealed and usually squeezed by means of bolting to affect the seal.

GATE - The **closure element** of a **gate valve** (sometimes called wedge or **disc**)

GATE VALVE - A valve whose **closure** member is a gate, wedge, **disc** or double **disc** which moves on an axis perpendicular to the direction of **flow**.

GLAND FOLLOWER - The **flange** that is used to hold down or retain the gland on a packing chamber.

GLAND OR GLAND BUSHING - The ring that compresses or retains the packing.

GLOBE VALVE - A valve, originally somewhat globe shaped, in which the closing member in cross section and moves along a **line** concentric with the seat axis to open and close.

GRADIENT - The rate of change of any characteristic per unit of length, or slope. The term is usually applied to such things as elevation, velocity, pressure. See slope.

GRAPHITE -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 affect the seal.

GREASE FITTING - A device which permits injection of grease into a bearing surface.

GRIT SEAL - Used to minimize valve **bearing** and shaft seal contact with **flows** containing suspended solids.

HAND WHEEL - 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.

HARDY CROSS METHOD - A mathematical method of analyzing **flow** in a water distribution system, devised by Hardy Cross in 1936.

HAZEN-WILLIAMS FORMULA - An equation developed in 1902 by Gardner Williams and Allen Hazen to express **flow** relations in pressure conduits.

HAZEN-WILLIAMS ROUGHNESS COEFFICIENT - A coefficient related to the influence of the type of conduit material on velocity characteristics used in the Hazen-Williams Formula



HEAD - (1) The height of the free surface of **fluid** above any point in a hydraulic system; a measure of the pressure or **force** exerted by the **fluid**. (2) The energy, either kinetic or potential, possessed by each unit weight of a **liquid**, expressed as the vertical height through which a unit weight would have to fall to release the average energy possessed. It is used in various compound terms such as pressure head, velocity head, and loss of head.

HEADER - A large pipe installed to intercept the ends of a series of pipes; a manifold.

HEAD LOSS - Energy losses due to the resistance of **flow of fluids**. May be classified into conduit surface and conduit form losses.

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 TREATMENT: - Describes any process or procedure by which the internal structure of steel is altered by heating to produce desired physical and mechanical characteristics.

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.

HIGH POINT - The location on a pipeline or piping system where the grade changes from upward to downward.

HORIZONTAL CONTROL VALVE - Maintain a constant preset water level in a reservoir or water tank. Activated by line pressure according to a modulating 2-way horizontal float.

HORIZONTAL PUMP - (1) reciprocating pump in which the piston or plunger moves in a horizontal direction. (2) A **centrifugal pump** in which the pump shaft is in a horizontal position.

HORIZONTAL SCREW PUMP - A pump with a horizontal cylindrical casing in which operates a runner with radial blades like those of a ship's propeller. The pump has a high efficiency at low heads and high discharges, and is used extensively in drainage work. Also called wood screw pump.

HRB OR HRC - Rockwell B or C hardness—hardness measured on scales comparing the sizes of indentations made in the tested material. The larger the number, the harder the material. Defined by **ASTM-EI 0**, see BHN.

HUB - An integrally cast raised area or "boss" on the valve **body** used to support the valves shaft(s) and **bearings**. Sometimes called a trunnion.



HYDRAULIC GRADE - In a closed conduit under pressure, artisan aquifer, or groundwater basin, a **line** joining the elevations to which water would rise in pipes freely vented and under atmospheric pressure. In an open channel, the **hydraulic grade** is the water surface.

HYDRAULIC GRADE LINE - A **hydraulic profile** of the piezometric level of water at all points along a **line**. The term is usually applied to water moving in a conduit, open channel, or stream, but may also be applied to free or confined groundwater. In an open channel, it is the free water surface. See also hydraulic grade.

HYDRAULIC GRADIENT - The slope of the **hydraulic grade line**; the rate of change of pressure head; the ratio of the loss in the sum of the pressure **head** and position **head** to the **flow** distance. For open channels, it is the slope of the water surface, and is frequently considered parallel to the invert. For closed conduits under pressure, it is the slope of the **line** joining the elevations to which water would rise in pipes freely vented and under atmospheric pressure. A positive slope is usually one which drops in the direction of **flow**.

HYDRAULIC HEAD - The height of the free surface of a **body** of water above a given point beneath the surface. See also head.

HYDRAULIC JUMP - (1) The sudden and usually turbulent passage of water in an open channel, under conditions of free **flow**, from low stage below critical depth to high stage above critical depth; during this passage the velocity changes from supercritical to subcritical. It represents the limiting condition of the surface curve, in which that curve tends to become perpendicular to the stream bed. (2) In a closed conduit, the sudden rise from part-full **flow** at a supercritical velocity to full **flow** under pressure; the depth plus the pressure **head** downstream from the **hydraulic jump** equals the high stage obtained for open-channel **flow**. (3) A device to dissipate energy in an open channel, in a sewer, or at the toe of a spillway section of a dam. (4) A device to promote turbulence. (5) An abrupt rise in water surface which may occur in an open channel when water flowing at a high velocity is retarded.

HYDRAULIC PROFILE - (1) A vertical cross section of the water table or the piezometric surface of an aquifer or groundwater basin. (2) A profile along the axis of **flow** of a stream or conduit showing elevations of the bottom and of the energy **line**. (3) A profile along the axis of flow through a wastewater or water treatment plant, showing elevations of the free water surface.

HYDRAULIC SLOPE - The slope of the **hydraulic grade line**. See also hydraulic gradient.

HYDROFOIL DISC DESIGN - A **check valve disc** designed to come off its seat, quickly reach its full open position and become fully stabilized under minimal **flow** conditions. Provides exceptionally low head loss and excellent non-slam characteristics. By quickly stabilizing there is minimal **disc** oscillation and therefore minimal wear.



HYDRO-PNEUMATIC SYSTEM - A water system, usually small, in which a water pump is automatically controlled by the air pressure in a compressed-air tank.

HYDROSTATIC TEST - A static pressure test using water, in which the item or system to be tested is filled with water and pressurized to detect leaks and verify structural integrity.

IBBM - Iron **body**, bronze mounted—common term for valves with iron **body** and **bonnet** (pressure-retaining parts) and bronze trim (seats, stem, bushings).

ID - **INSIDE DIAMETER**—the distance, either nominal or actual, from the inside wall of an annular surface to the opposite inside wall.

INCOMPRESSIBLE FLOW - A **fluid** such as water, which has no significant change in volume and density as the pressure increases.

INCONEL - Trademark of International Nickel Co. for any of numerous nickel-chrome-iron alloys.

INCREMENTAL SEAT TEST - The leakage testing of valve seats in an assembled valve by increasing the applied pressure in prescribed pressure steps.

INFLUENT - Water, wastewater, or other **liquid** flowing into a reservoir, basin, or treatment plant, or treatment process. See also **effluent**.

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**.

INHERENT FLOW CHARACTERISTIC - The relationship between valve **capacity** and valve travel, 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.

INLET PORT - That end of a valve which is connected to the upstream pressure zone of a **fluid** system.

INNER SEAT RING - The inner part of a two-piece valve seat assembly.

INORGANIC COMPOUNDS - All those combinations of elements that do not include organic carbons.

INORGANIC MATTER - Mineral-type compounds that are generally non-volatile, not combustible, and not biodegradable. Most inorganic-type compounds, or reactions, are ionic in nature, and therefore, rapid reactions are characteristic.



INSIDE-OUT AIR SEAT TEST - A pressure test that can be performed only on independent seating trunnion mounted ball valves. By closing the valve and pressurizing the **body** cavity, all of the seals in an independent seating **ball valve** can then be pressure tested.

“INSITU” (Maintenance) - To maintain or repair a product “in its original place,” such as a top entry **ball valve** or regulator.

INSTALLED FLOW CHARACTERISTIC - 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.

INTEGRAL FLANGE - A valve **body** whose **flange** connection is an integral or cast part of the **body**.

INTEGRAL SEAT - The **flow** control orifice and seat that is an integral part of the valve **body** or cage. The seat is machined directly out of the valve **body** and is normally not replaceable without replacing the **body** itself – although some can be repaired by welding and re-machining.

INTERNAL PRESSURE RELIEF - A self-relieving feature in non-independent seating valves that automatically relieves excessive internal **body** pressure caused by sudden changes in **line** pressures. By means of the piston effect principle the excessive **body** pressure will move the seat away from its seating surface and relieve it to the lower pressure side.

INVERTED SIPHON - A pipeline crossing a depression or passing under a structure and having a reversal in grade on a portion of the **line**, thus creating a V- or U-shaped section of conduit. The **line** is under positive pressure from inlet to outlet and should not be confused with a siphon. Also called depressed sewer.

ISO - International Standards Organization - Worldwide standards coordinating organization.

ISOLATION VALVE - A shut-off valve used to isolate part of a pipeline, a process or piece of equipment.

ISRS - Inside screw, rising stem - 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.

JRS - Japan Industrial Standard - Designation for standards published by the national standards organization of Japan.

JTU (Jackson Turbidity Unit) - A standard unit of turbidity based on the visual extinction of a candle flame when viewed through a column of turbid water containing suspended solids. It



varies with the solids composition (barium sulfate, diatomaceous earth, etc.) The **JTU** has largely been replaced by the more reproducible **FTU**. See also **FTU**.

KINETIC AIR VACUUM VALVE - An **Air/Vacuum valve** in which the valve float is typically unguided and allowed to make contact with the valve **body**. A Kinetic **Air/Vacuum valve** typically has a smaller discharge port than **inlet port** and is said to be based on Bernoulli's Law. The air flowing around the float produces a **force** to maintain the float in an open position.

KINETIC ENERGY - Energy possessed by a body of matter as a result of its motion.

KINETIC-FRICTION COEFFICIENT - A numerical quantity used as an index of the amount of **force** necessary to keep a **body** sliding at a uniform velocity on the surface of another **body**. It is equal to the ratio of the horizontal **force** required to slide the **body** along a horizontal plane surface at a uniform velocity to the weight of the **body**, and is expressed as a decimal. The coefficient may change with velocity.

KINETIC HEAD - The theoretical vertical height through which a **liquid body** may be raised by virtue of its kinetic energy. It is equal to the square of the velocity divided by twice the acceleration due to gravity. See also velocity head.

LAMINAR FLOW - The **flow** of a viscous **fluid** in which particles of the **fluid** move in parallel layers each of which has a constant velocity but is in motion relative to its neighboring layers. Also called streamline **flow**, viscous **flow**.

LAMINAR VELOCITY - The velocity at which, in a particular channel or conduit, and for a particular **fluid**, **laminar flow** will always exist.

LANTERN RING - A rigid spacer ring used in the Lantern Ring type of Packing Chamber to permit lubrication of the Packing, purging of the Shaft or Stem area, or a leak-off system.

LEVER - A handle type operating device for quarter-turn valves.

LIFT PUMP - A pump used to elevate wastewater **flow** in a sewer to facilitate gravity flow in a portion of a collection system, before treatment, or afterwards, before **effluent** discharge.

LIFT STATION - A structure that contains pumps and appurtenant piping, valves, and other mechanical and electrical equipment for pumping water, wastewater, or other **liquid**. Also called pump station.

LIFT & TILT - The movement of a Tilting **check valve disc** which is designed to first lift out of the seat prior to moving to its open position. It is designed to reduce wear to the mating surfaces.



LIFTING LUGS - Lugs provided on large air, ball, gate, and check valves, for lifting and positioning valves. Also called lifting eyes.

LIMIT SWITCH - An electrical device providing a signal to a remote observation station indicating when the valve is in the fully open or fully closed position. Usually a component of a valve operator.

LINE - A pipe, tube or hose for conducting **fluids**.

LINEAR DISC TRAVEL - A valve **disc** which opens and closes in a straight line. The valve **disc** orientation is perpendicular to the valve seat providing **flow area** equal to **disc stroke** position.

Example: If the valve is ten percent open there will be ten percent **flow area** through the valve seat.

LINEAR FLOW CHARACTERISTIC -A characteristic where **flow capacity** or (C_v) 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).

LINEAR VALVE - Another name for a globe valve. It refers to the linear or straight-line movement of the plug and stem.

LIQUID - A substance that flows freely. Characterized by free movement of the constituent molecules among themselves, but without the tendency to separate from one another characteristic of gases. **Liquid** and **fluid** are often used synonymously, but **fluid** has the broader significance, including both **liquids** and gases. See also **fluid**.

LONG PIPE - A pipeline the length of which is usually more than 500 times its diameter. In such pipes, the **loss of head** due to entrance and to velocity **head** is negligible and is usually disregarded.

LOSS OF HEAD - (1) The decrease in **energy head** between two points resulting from **friction**, bend, obstructions, expansions, or any other cause. It does not include changes in the elevation of the **hydraulic grade line** unless the hydraulic and energy **grade lines** parallel each other. (2) The difference between the total heads at two points in a hydraulic system.

LUG TYPE VALVE - A valve with short **face-to-face dimension** in proportion to the **fluid** passage diameter designed to be bolted to one or both flanges in a line by the use of fasteners, which are threaded into lug protrusions of the valve **body**.



MAGNETIC PARTICLE INSPECTION - A nondestructive method of detecting the presence of surface cracks and imperfections through use of fine iron particles in an electrical field. Abbreviated as MPI or MT.

MAIN SEWER - (1) In larger systems, the principal sewer to which branch sewers and sub mains are tributary; also called trunk sewer. In small systems, a sewer to which one or more branch sewers are tributary. (2) In plumbing, the public sewer to which the house or building sewer is connected.

MALE THREAD - The external thread on pipe, fittings or valves used in making a connection with mating female (internal) threaded parts.

MANHOLE - (1) A structure atop an opening in a gravity sewer to permit entry for servicing. Usually placed at all points of change in sewer grade and at least every 300 to 400 feet along the **line**. (2) An opening in the top or side of an enclosed vessel to permit human entry.

MANIFOLD - A pipe **fitting** with numerous branches to convey **fluids** between a large pipe and several smaller pipes or to permit choice of diverting **flow** from one of several sources or to one of several discharge points. See also header.

MANNING FORMULA - A formula for open-channel **flow**, published by Manning in 1890, which gives the value of C in the Chezy Formula. See also Chezy Formula, Manning Roughness Coefficient.

MANNING ROUGHNESS COEFFICIENT - The roughness coefficient in the Manning Formula for determination of the discharge coefficient in the Chezy Formula.

MANOMETER - An instrument for measuring pressure. It usually consists of a U-shaped tube containing a **liquid**, the surface of which in one end of the tube moves proportionally with changes in pressure in the **liquid** in the other end.

MANUAL CONTROL VALVE - A basic control valve assembled with a 3- way ball valve, manually opens and closes.

MATERIAL TEST REPORTS (MTR) - Certificates provided by the steel manufacturer indicating the chemical analysis and mechanical properties of a specific batch of steel traced by sequentially assigned heat numbers or codes.

MDS – MATERIAL DATA SHEET - The material data sheet defines the minimum requirements for the required materials, i.e., chemical requirements, manufacturing, qualification of supplier, mechanical testing and properties, non- destructive examination, repair, marking, and certification.



MEAN VELOCITY - The average velocity of a stream flowing in a channel or conduit at a given cross section or in a given reach. It is equal to the discharge divided by the cross-sectional area of the section, or the average cross-sectional area of the reach. Also called average velocity.

MECHANICAL SEAL - In a valve, a shut off that is accomplished by a mechanical means rather than with **fluid** or **line** pressure. The wedging action of a **gate** against the seats or the seat springs pushing the seat against the ball or **gate** are examples of mechanical seals in a valve.

MECHANICAL JOINT - A bolted pipe joint utilizing a compressed **gasket** and gland.

METAL TO METAL - A seating design characterized by the lack of any soft deformable seating material. Metal-to-metal seats can withstand much higher pressures and temperatures than soft seats, but leakage rates are usually greater except in special valve designs.

MIXED-FLOW PUMP - A **centrifugal pump** in which the **head** is developed partly by centrifugal **force** and partly by the lift of the vanes on the **liquid**. This type of pump has a single inlet impeller; the **flow** enters axially and leaves axially and radially.

MMCF - An abbreviation for "million cubic feet." Used to designate gas volume and gas **flow** rates in pipelines (MMCF per hour or day).

MODULATE - Positioning of a valve **closure** member in response to a variable control signal.

MOLD, MOULD - A hollow cavity, frequently in packed sand, for giving a desired shape to a material in a molten or plastic shape.

MSS - Manufacturers Standardization Society of the Valve and Fitting Industry—trade organization responsible for issuing voluntary standards for valves and piping material. MSS withdraws its standards when another standards-issuing body such as **ASME** issues one covering the same subject.

MUD VALVE - A plug valve for draining out sediment, inserted in the bottom of settling tanks.



MWP – Maximum Working Pressure or **CWP** (Cold Working Pressure) - The maximum working pressure (pounds per square inch) at which a valve can be operated. The maximum working pressures for various pressure **classes**. Per Table 2.1 of API-6D, within temperature limits of -20°F and +100°F, are as follows:

CLASS	MWP (CWP)	CLASS	MWP (CWP)
150	275	900	2160
300	720	1500	3600
400	960	2500	6000
600	1440		

NAMUR - NAMUR was a group founded in Germany to represent the interests of measurement and control technology users in the chemical industry. The founding members settled on the name "Standardization Association for Measurement and Control in the Chemical Industries". This leads to the acronym NAMUR "Normen Arbeitsgen Mess Und Regeltechnik" in German. NAMUR is now an association of users of process control technology defining amongst other things, the mounting standard for solenoid valves. NAMUR and VDI/VDE cooperate which is why the NAMUR solenoid interface appears as part of [VDI/VDE 3845](#) standard

NEEDLE VALVE - A valve with a circular outlet through which the **flow** is controlled by means of a tapered needle which extends through the outlet, reducing the area of the outlet as it advances and enlarging the area as it retreats.

NEGATIVE HEAD - (1) The **loss of head** in excess of the static **head** (a partial vacuum). (2) A condition of negative pressure produced by clogging of rapid sand filters near the end of a filter run.

NEGATIVE PRESSURE - A pressure less than the local **atmospheric pressure** at a given point.

NET POSITIVE SUCTION HEAD - The amount of energy in the **liquid** at the inlet of the pump expressed in feet of water, absolute.

NIPPLE - A short length of small size pipe, threaded on both ends. Used on end connections of screwed-end valves and in small size piping systems.

NON-SLAM VALVE - A **check valve** designed to close prior to reverse **flow** taking place or, close very slowly in the presence of reverse **flow** allowing the **flow** energy to dissipate.

NON-RISING STEM - A **gate valve** having its stem threaded into the gate. As the stem turns, the **gate** moves, but the stem does not rise. Stem threads are exposed to **line fluids**.



NORMALLY CLOSED SOLENOID VALVE - An electrically operated valve whose inlet orifice is closed when the solenoid coil is not energized. Energize to open. See “Solenoid Valve.”

NORMALLY CLOSED - A state in which a valve or other component stays closed in the absence of a signal or manual intervention. Any such outside action will open the valve.

NORMALLY OPEN - A state in which a valve or other component stays open in the absence of a signal or manual intervention. Any such outside action will close the valve.

NPS - Nominal pipe size—dimensionless number used as designator for sizes of pressure pipe.

NPT - National Pipe Taper - standard tapered thread for pressure pipe and components. Requirements defined in ASEM B1.20.1.

NRS - Non-rising stem - A **gate valve** having its stem threaded into the gate. As the stem turns the **gate** moves but the stem does not rise. Stem threads are exposed to the **line fluid**.

OD - The measurement of the outside diameter of a circular part.

OPEN LEFT - Indicates CW rotation to close valve.

OPEN RIGHT - Indicates CCW rotation to close valve.

OPERATING NUT - The square, tapered nut that fits on top of a valve shaft and allows it to be turned by a tee-handle from above. Usually installed on buried valves.

OPERATING PRESSURE - The pressure that a component normally sees during the course of day-to-day operation. This pressure, plus any other factors such as upsets that may occur, is used to determine the design pressure.

OPERATING TEMPERATURE - The temperature that a component normally sees during day-to-day operation. This temperature, plus any other factors such as excursions that may occur, is used to determine the design temperature.

OPERATOR - A device which converts manual, hydraulic, pneumatic or electrical energy into mechanical motion to open and close a valve. See “Power Operator,”; “**EMO**”; “**GO**”; “**HWO**”; “**MGO**”; “**MO**.”

ORIFICE BUTTON - The resilient **closure element** in an **Air Release Valve**. Sometimes referred to as needle.



O-RING - An **elastomeric** or synthetic seal ring of circular cross section.

OS&Y - Outside Screw & Yoke - A valve design in which the stem threads are above the packing **gland** or outside the valve **body** and there is a yoke to support the top or outer end of the stem.

OSCILLATION - A periodic movement to and fro, or up and down.

OUTFALL - (1) The point, location, or structure where wastewater or drainage discharges from a sewer, drain, or other conduit. (2) The conduit leading to the ultimate disposal area. Also see outfall sewer, wastewater outfall.

OUTFALL SEWER - A sewer that receives wastewater from a collecting system or from a treatment plant and carries it to a point of final discharge. See also outfall.

OUTSIDE THE FENCE - Water or wastewater **lines** and appurtenances located outside the boundaries of a water or wastewater treatment plant.

OZONATION - The process of contacting water, wastewater, or air with ozone for purposes of disinfection, oxidation, or odor control.

OZONE - Oxygen in a molecular form with three atoms of oxygen forming each molecule (O_3).

OZONIZER - A device for producing ozone from pure oxygen or air. It consists essentially of two electrodes between which a current of the dry gas is passed. High voltage electric discharges pass through the air between the electrodes and cause the formation of ozone.

PACKING - Any soft substance used to seal the area of a shaft where it protrudes from inside a pressure boundary, such as a valve or pump.

PACKING GLAND - A device installed on a packing chamber to retain the packing and to maintain pressure on it.

PARSHALL FLUME - A calibrated device developed by Parshall for measuring the **flow of liquid** in an open conduit. It consists essentially of a contracting length, a throat, and an expanding length.

PARTIAL VACUUM - The description of a space condition in which the pressure is less than atmospheric.

PATTERN - A duplicate made of wood or metal of a part to be cast. Used to form the mold into which the molten metal is poured.

PENSTOCK - The pipeline or conduit which carries water under pressure from the fore bay or last free water surface to the turbines in a power generating facility.



pH³ - A measure of the hydrogen-ion concentration in a solution, expressed as the logarithm (base ten) of the reciprocal of the hydrogen-ion concentration in gram moles per liter. On the pH scale (0-14), a value of 7 at 25°C represents a neutral condition. Decreasing values, below 7, indicate increasing hydrogen-ion concentration (acidity); increasing values, above 7, indicate decreasing hydrogen-ion concentration (alkalinity).

PHENOLIC COATING - A thermo-setting resin applied to valve interiors and/or exteriors to inhibit **corrosion**, a plastic material.

PIEZOMETER - An instrument for measuring pressure **head** in a conduit, tank, or soil. It usually consists of a small pipe or tube tapped into the side of the container, with its inside end flush with, and normal to, the water face of the container, and connected with a manometer pressure gage, mercury or water column, or other device for indicating pressure head.

PIG - Also known as a scraper—the solid object placed in a pipeline, to be pushed along by line pressure, for the purpose of separating one **fluid** from a different one being shipped through the same line or to clean (scrape) the walls of the pipe.

PILOT - A spring loaded pressure regulator used to control the pressure and **flow** of other larger pressure regulators or instruments.

PILOT-OPERATED REGULATOR - A regulator which is controlled by a second small volume high accuracy regulator or pilot. This arrangement has the advantages of improving performance by minimizing the effects of unbalance and **droop**. The number of possible applications is also increased since a wide range of pilot configurations are feasible.

PINHOLE - Numerous small gas holes at the surface or just below the surface of **castings**, generally occurring in the thicker parts of the **casting** as a reduction in the solubility of gases in the metal as the metal cools.

PINCH VALVE - A valve having a flexible center tube or hose which is "pinched" to effect **closure**.

PINION SHAFT - The external input shaft of certain gear operators which drive the internal reduction gearing.

PIPE COLLAPSING PRESSURE - The internal negative pressure at which a pipe will collapse in on itself.

PIPE GRADE - The slope or fall of the pipe in the direction of **flow**.

PIPELINE PROFILE - A cross-sectioned view of a pipeline showing elevation and length.



PISTON ACTUATOR - A fluid-powered, normally pneumatic device in which the **fluid** acts upon a movable cylindrical member, the piston, to provide linear motion to the **actuator** stem. These units are spring or air-opposed, and operate at higher supply pressures than a spring return **actuator**.

PISTON EFFECT - The sealing principle involved in utilizing **line** pressure to affect a seal across the floating seats of some valves.

PISTON PUMP - A reciprocating pump in which the cylinder is tightly fitted with a reciprocating piston.

PITCH & LEAD - Pertaining to screw threads. The pitch refers to the measurement between adjacent threads. The lead refers to the distance the screw advances in one complete revolution. Worm gears of gear operators, are also identified by pitch and lead. Speed of operation and torque required are related to pitch and lead.

PLASTICS - A broad classification covering a variety of nonmetallic, synthetic or organic materials capable of being molded or formed into desired shapes. Also used as a protective coating for valves.

PITOMETER - A device operating on the principle of the Pitot tube, principally used for determining the velocity of flowing **fluids** at various points in a water distribution system, and to ascertain waste, leakage, or clogging of pipes.

PLUG - (1) A **fitting** for the bell end of **cast iron** pipes to close the opening. (2) A **fitting** that has an exterior pipe thread and a projecting **head** by which it is screwed into the opening of a fitting. (3) The movable part of a tap, cock, faucet, plug, valve. (4) A clogging of a pipe.

PLUG VALVE - A type of valve in which a cylindrical or tapered cylindrical (truncated cone) section turns one-quarter turn to close and open the **flow** passageway. - Nominal pressure—standard abbreviation for pressure rating used in **ISO** standards.

PMI - Positive material identification - a method for cross checking the identity of a piece of material, often using a portable spectrometer, usually with x-rays (TN 9266, nuclear analyzer) or a welding arc (Arc Met 900, optical spectrometer).

PNEUMATIC TEST - A test in which a valve is tested with air - usually a seat **closure** test.

PNEUMATIC EJECTOR - A device for raising wastewater, sludge, or other **liquid** by alternately admitting it through an inward swinging **check valve** into the bottom of an airtight pot and then discharging it through an outward swinging **check valve** by admitting compressed air to the pot above the **liquid**.



PNEUMATIC PUMPING - Pumping by means of an air-lift pump.

POPPET VALVE - A valve consisting of a flat disk which raises and lowers without rotation about the valve opening and which is kept in position and on its path of travel by a rod or shaft attached to the disk at right angles to it and extending through the valve opening into a groove or hole which guides its movement. Also called a mushroom valve.

POROSITY - A defect found in **castings** or welds consisting of gas bubbles or voids in the solidified metal.

PORT - An opening in a valve **body** or **closure** element, usually used in **control valve** terminology.

POSITION INDICATOR - Any external device which visually indicates the open and closed position of valve.

POSITION TRANSMITTER - A device that is mechanically connected to the valve stem and will generate and transmit either a pneumatic or electric signal that represents the valve stem position.

POSITIONER VALVE - A control device used to modulate a valve closure member in response to a position signal from a control system.

POSITIVE HEAD - The energy possessed per unit weight of a **fluid**, due to its elevation above some datum. Also called elevation head.

POSITIVE ROTARY PUMP - A type of displacement pump consisting essentially of elements rotating in a pump case which they closely fit. See also rotary pump.

POTABLE WATER - Water that does not contain pollution, contamination, minerals, or infective agents and is considered satisfactory for domestic consumption.

PPM - Parts per million, a unit of concentration on a weight or volume basis. Obsolete; replaced by mg/l.

PRESSURE - The **force** exerted by a **fluid** on the surfaces containing it.

PRESSURE CLASS - A pressure rating expressed as a dimensionless number. The **class** rating charts give actual pounds per square inch maximum allowable pressure at a given temperature.

PRESSURE DROP - The decrease in pressure along the direction of **flow** in a piping system, caused by **fluid friction**, restrictions, and by change-of-direction fittings. Pressure drop is related to velocity, specific gravity, viscosity and to the size and roughness of the pipe interior. See "Differential Pressure."



PRESSURE HEAD - The **head** represented by the expression of pressure over weight. The **head** is usually expressed as height of **liquid** in a column corresponding to the weight of the **liquid** per unit area; for example, feet **head** of water corresponding to pounds per square inch.

PRESSURE MAIN - Pressurized sewer **lines** that deliver wastewater from a pumping station to a treatment plant, a receiving stream, or a higher point in the system. Also called **force main**.

PRESSURE REDUCING VALVE - Automatically reduces upstream pressure to a predetermined downstream pressure, which remains steady and unaffected by either fluctuating inlet pressure and /or changing flow rate.

PRESSURE SUSTAINING & REDUCING – A dual pilot valve, activated by line pressure.

The two pilots operate to sustain constant pressure upstream of the valve and at the same time, reduce the pressure downstream to a preset pressure. One pilot is sensitive to upstream pressure and the other to downstream pressure.

PRESSURE SUSTAINING VALVE - The valve is normally closed. When the line pressure rises above a preset point, the valve opens to relieve the excess pressure downstream. When the line pressure drops, the valve closes to maintain a minimum upstream pressure.

PRESSURE TANK - A tank used in connection with a water distribution system, for a single household, for several houses, or for a portion of a larger water system, which is airtight and holds both air and water, and in which the air is compressed and the pressure so created is transmitted to the water.

PRESSURE-TEMPERATURE RATINGS - The maximum allowable working pressures at specified temperatures. For steel valves, the ratings are defined by "**classes**" and found in **ASME B16.34**. For iron and bronze valves, the ratings are defined in the applicable MSS specifications.

Pre-stressed Concrete Pipe - A reinforced concrete pipe placed in compression by a highly stressed, closely spaced helical wire winding. The reinforcement permits a concrete pipe to withstand tension forces at the same time it is under compression from surrounding wires.

PTFE (Polytetrafluoroethylene) - a soft polymer that is compatible with almost any substance.

PRIMING - (1) The first filling with water of a canal, reservoir, or other structure built to containing water. (2) The action of starting the **flow** in a pump or siphon.

PRODUCT ANALYSIS - The chemical analysis of a material done on a finished component to show compliance with the material specifications. Usually has tolerances defined for each element to allow for differences in the completed product compared to the molten metal.



PROOF PRESSURE - A **hydrostatic test** pressure, usually 1 ½ times the rated working pressure, applied to an assembled valve to verify the structural integrity of the pressure containing parts. Synonymous with hydrostatic shell test.

PSI - Pounds per square inch - the **force** per unit area exerted against a resisting body.

PUMP CAPACITY - The ability of a pump to pump against a given head, usually stated in **flow** and/or pressure.

PUMP - A rotary or reciprocating device using mechanical energy to propel **liquids** through pipelines or to draw **liquids** from tanks or sumps by suction.

PUMP CONTROL VALVE – Non-return control valve that opens fully or shuts off in response to an electric signal. It isolates the pump from the system during pump starting and stopping, to prevent pipeline surges.

PUMP EFFICIENCY - The ratio of energy converted into useful work to the energy applied to the pump shaft, or the energy difference in the water at the discharge and suction nozzles divided by power input at the pump shaft.

PUMP PIT - A dry well or chamber, below ground level, in which a pump is located.

PUMP PRIMER - A vacuum pump attached to the suction end of a pump for priming the pump automatically.

PUMP STATION - A structure containing pumps and appurtenant piping, valves and other mechanical and electrical equipment for pumping water, wastewater, or other **liquids**. Also called lift station.

PUMP STRAINER - A device placed on the inlet of a pump to strain out suspended matter that might clog the pump.

PUMP SUBMERGENCE - Vertical distance of pump inlet or suction below water level in pump pit or after bay.

PUMPING HEAD - The sum of the static **head** and **friction head** on a pump discharging a given quantity of water.

PUMPING LEVEL - The elevation at which water stands in a well when the well is being pumped at a given rate.

PUMPING LINE - The discharge pipe from a pump.

PURGING AIR - The removal of air from a pipeline through an **Air/Vacuum valve** or Combination AIR VALVE. Also known as discharging air.



PSI - Pounds per square inch—measure of **force**, either pressure **force** or tensile or compressive stress in a material.

PSIA - Pounds per square inch, **absolute pressure force** expressed without reference to ambient pressures.

PSIG - Pounds per square inch, gage pressure **force** expressed with reference to standard atmospheric pressure. Standard **atmospheric pressure** is defined as 14.7 psi.

QUALIFICATION TEST - An investigation, independent of a purchasing function that is performed on a product to determine whether or not the product conforms to all of the requirements of a particular specification. This is generally done by a third independent party to qualify a product for a specific application.

QUALITY ASSURANCE - Planned regular and/or preventive actions which are used to ensure that materials, products, or services will meet specified requirements.

QUARTER TURN VALVE - Shut-off valve that pivots one-quarter turn about its vertical centerline to open and close.

QUICK CLOSING - Quick closing and quick opening refers to a valve designed to require a smaller turn to be fully closed or opened.

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 characteristic is used for on/off control.

QUICK PRESSURE RELIEF VALVE - Normally closed valve exposed to upstream pressure. As line pressure reaches the preset level, the valve opens quickly to relieve the excessive pressure.

RA - Abbreviation for "arithmetic average roughness height" - the measure of the roughness of a surface expressed in micro-inches. The higher the number, the rougher the surface. Used to designate the desired surface finish for end **flange** raised faces.

RADIOGRAPHIC INSPECTION - A nondestructive inspection method using x-rays to locate internal flaws in **castings**, fabricated parts and welds. Abbreviated as RT.

RAISED FACE - (RF) A **flange** sealing surface in which the **gasket** seating area is a portion of the diameter covering the region from the inside diameter to some radius lying just inside the **bolt** holes, with that portion raised slightly above the remainder of the **flange** surface. This increases the effective load on the **gasket** and increases the sealing effectiveness. The



gasket seating surface is usually serrated or grooved, either with concentric or phonographic (spiraling) serrations.

RANGEABILITY - The range over which a **control valve** can operate. It is the ratio of the maximum to minimum controllable **flow** coefficients. Rangeability is affected by three factors: the geometry of the valve, the seat leakage and the **actuator's** accuracy or stiffness at near **closure** of the valve.

RATE - (1) The speed at which a chemical reaction occurs. (2) **Flow** volume per unit time.

RATE OF FLOW - The rate of **flow** of water, silt, or other mobile substance which emerges from an opening, pump, or turbine or passes along a conduit or channel, usually expressed as cubic feet per second, cubic meters per second, gallons per minute, or million gallons per day.

RECIPROCATING PUMP - A type of displacement pump consisting essentially of a closed cylinder containing a piston or plunger, as the displacing mechanism, drawing **liquid** into the cylinder through an inlet valve and forcing it out through an outlet **valve**. When the piston acts on the **liquid** in one end of the cylinder, the pump is termed single-action, and when it acts in both ends, it is termed double-action.

REDUCED PORT - A valve port opening that is smaller than the **line** size or the valve **end connection** sizes.

REDUCED TRIM - Is an undersized orifice. A reduced or restricted **capacity** trim is used for several reasons including, adjusting a large valve to handle smaller **flow** requirements, reduced inlet and outlet **fluid** velocities, and correct errors in over sizing.

REDUCER - A pipe **fitting** designed to be the transition from one pipe size to another size. The term increaser is used only for fittings with end connections that are one-way, such as male and female or bell and spigot, and the **fitting** is designed to be installed in the direction that the **line** size increases.

REFLUX VALVE - A non-return valve used in a pipeline at a rising **gradient** to prevent water that is ascending the **gradient** from flowing back in the event of a burst lower down.

REGULATOR - A throttling valve which exercises automatic control over some variable (usually pressure). Not an on-off valve.

RELEASING AIR - The removal of air from a pipeline. See AIR VALVE.



RELIEF VALVE - A valve designed to open when the pressure under the seat reaches a preset value, by means of a spring or a poppet or any one of several other devices. All relief valves, by definition, are self-actuating.

RESILIENT SEAT - A valve seat containing a soft seal such as an O-ring or plastic to assure tight shut-off.

REVERSE FLOW - A **flow** in which the **fluid** is traveling in the opposite direction of the systems normal operating condition.

REVERSE PRESSURE - Pressure applied by the **flow** against the face of the valve's **closure** member and/or the seat end of the valve.

RING TYPE JOINT (RTJ) - A **flange** connection using a specially shaped soft metal ring as a **gasket**. Generally used on high pressure valves. May be the **body** and **bonnet** connection and/or the end **flange** connection.

RISER PIPE - (1) In plumbing, a water supply pipe in a building that extends vertically one full story or more to convey water to branches or fixtures. (2) The vertical supply pipe to an elevated tank.

RISING STEM BALL VALVE - A single seated **ball valve** that is designed to seal by using the valves stem to mechanically wedge the valves ball into a stationary seat affecting a bubble tight seal. The valves stem operates through a guide sleeve assembly that guides the stem through a quarter turn of rotation as the stem is raised or lowered by a hand wheel (or **actuator**). The mechanical action of the stem moves the ball away from the seat prior to the 90° rotation of the ball. This design provides lower operating torques and longer seat life while assuring bubble tight shut off.

RISING STEM - A valve stem which rises as the valve is opened.

RJ or RTJ - Ring joint or ring-type joint—a **flange** sealing surface in which the **gasket** seating area is two narrow lines of metal-to-metal contact along a metal ring, softer than the flange, that is set into a groove in each **flange** face.

ROCKWELL HARDNESS - See HRB or HRC.

ROTARY PUMP - A type of displacement pump consisting essentially of elements rotating in a pump case which they closely fit. The rotation of these elements alternately draws in and discharges the water being pumped. Such pumps act with neither suction nor discharge valves, operate at almost any speed, and do not depend on centrifugal **forces** to lift the water.



ROTARY VALVE - A valve consisting of a casing more or less spherical in shape and a **gate** that turns on trunnions through 90 deg. when opening or closing, and having a cylindrical opening of the same diameter as that of the pipe it serves.

ROUGHNESS - A measure of the resistance to **fluid flow** of a channel, pipe, or other conduit, as a result of its fabrication, scale formation, biological growth, or other causes.

ROUGHNESS COEFFICIENT - A factor, in the Chezy, Darcy-Weisbach, Hazen-Williams, Kutter, Manning, and other formulas for computing the average velocity of **flow** of water in a conduit or channel, which represents the effect of roughness of the confining material on the energy losses in the flowing water.

RS: RISING STEM - A valve stem with threads arranged so that as the stem turns, the threads engage a stationary threaded area and lift the stem along with the **closure element** attached to it.

RUPTURE DISC (BLOW-OUT DISC) - An emergency over-pressure relief device, employing a relatively thin **diaphragm**, designed to burst at a specified pressure. Cannot be reset – must be replaced after rupture event.

SADDLE - (1) A steel or concrete structure used for supporting a pipe or penstock laid above the surface of the ground. (2) A depression in a ridge. (3) An assembly of circumferential metal straps on a pipe where a connection is to be installed.

SAFETY FACTOR - The ratio between an ultimate property (typically strength) and that required under design conditions.

SAFETY VALVE - A valve design to relieve overpressure. Mechanically the same as a relief valve, but the reasons for locating one versus the other are not always the same.

Schedule: A system for indicating the wall thickness of pipe. The higher the schedule number, the thicker the wall for a certain pipe size.

Scraper - (1) A device for insertion in pipelines that is pushed or hauled through by some method or device such as water pressure, rope, cable, to remove accumulated organic or mineral deposits.

Scrapers are used principally in pipe too small for access by man and are of various designs and sizes. (2) A device used in the bottom of a sedimentation tank to move settled sludge to a discharge port. (3) A blade used to separate accumulated sediment from filter or screen surfaces. See also squeegee.



Screw-feed Pump - A pump with either horizontal or vertical cylindrical casing, in which operates a runner with radial blades like those of a ship's propeller. See also horizontal screw pump, vertical screw pump.

SCREWED ENDS: Internally threaded end connections supplied on some valves. Usually tapered pipe threads (NPT).

Seal weld: A weld that does not contribute anything to the mechanical integrity of an assembly, but is made purely to seal or prevent leakage from, for instance, a threaded joint.

SEAL, DYNAMIC - A sealing element is used between parts that have relative motion, i.e., stem seals, seat seal O-rings, etc.

SEAL, STATIC -A sealing element used as a **gasket** between two non-moving parts, i.e. valve **bonnet** O-ring, **ball valve body** O-ring, **flange gasket**.

Seat - The fixed component, mounted in the valve **body** that the **closure element** contacts in order to close off **flow**.

Seat Load -The contact **force** between the seat and the valve plug. When an **actuator** is selected for a given control valve, it must be able to generate enough **force** to overcome static, stem and dynamic unbalance with an allowance made for seat load.

Seat Ring - A part of the **flow** passageway that is used in conjunction with the **closure** member to modify the rate of **flow** through the valve.

Sectionalizing Valve - A large valve installed in a pipeline to shut off **flow** in a section for the purpose of inspection or repair. Such valves are usually installed in the main **lines**.

Sewage AIR VALVE - AIR VALVE used in sewage applications. See also AIR VALVE, **Air Release Valve**, **Air/Vacuum Valve** and Combination AIR VALVE.

Shaft - The valve component through which outside motion is applied to the **closure** member.

Shrinkage -Internal defect in **castings** that are internal voids, irregular in shape, caused by volume contraction during solidification. Can be caused by not maintaining a **fluid** channel to the riser during solidification.

Shutoff Pressure - The actual **differential pressure** against which the valve's **closure** member is closed.



SHUTOFF VALVE - A valve whose primary purpose is to act as a main block valve, usually as an emergency shutdown but not necessarily integrated into the control system as a true emergency shutdown valve would be.

SILENT CHECK VALVE - See Poppet Valve.

SIMPLE LEVER AIR RELEASE VALVE - **Air Release Valve** in which the float and orifice button are mounted on a single arm. Utilized in small valves requiring minimal mechanical advantage for the valve to open.

SINGLE GUIDED FLOAT - Air/Vacuum or Well Service AIR VALVE float which is guided from its open to its closed position from beneath the float only. (See also Double Guided Float).

SIPHON - A closed conduit a portion of which lies above the **hydraulic grade line**, resulting in a pressure less than atmospheric and requiring a vacuum within the conduit to start **flow**. A siphon utilizes **atmospheric pressure** to effect or increase the **flow** of water through the conduit.

SIPHON SPILLWAY - An enclosed spillway which utilizes the principle of the siphon.

SLAB GATE - A **gate** having flat, finely finished, parallel faces – as opposed to a wedge gate. Such a **closure element** slides across the seats and does not depend on stem **force** to achieve tight shut off.

SLAM RETARDER - A device designed to prevent the clapper of a **check valve** from slamming as it closes upon **flow** reversal. Hydraulic damping cylinders, rotary vanes, and torsional springs are all used for this purpose.

SLAMMING - The phenomena which occurs when a valve **disc** travels from an open position to the closed position due to the **force** exerted by reverse **flow**. (see also non---slam valve and Water Hammer)

SLOPE - A measure of pipe rise expressed as rise divided by run.

SLUDGE - (1) The accumulated solids separated from **liquids**, such as water or wastewater, during processing. (2) Organic deposits on bottoms of streams or other bodies of water. (3)The removed material resulting from chemical treatment, coagulation, flocculation, sedimentation, flotation, and/or biological oxidation of water or wastewater. (4) Any solid material containing large amounts of entrained water collected during water or wastewater treatment. See also activated sludge, settleable solids.

SLUICE- (1) A conduit for carrying water at high velocity. (2) An opening in a structure for passing debris. (3) To cause water to **flow** at high velocities for wastage, for purposes of excavation, ejecting debris, and other purposes.



SLUICE GATE - A gate, used for sluicing, constructed to slide vertically and fastened into or against the masonry of dams, tanks, or other structures.

SLURRY - A thin watery mud, or any substance resembling it, such as lime slurry.

SOCKET END - An **end connection** in which a pipe or tube is inserted into a counter-bored hole and then brazed or fillet welded.

SOCKET WELD END (SWE) - The **end connection** of a valve suitably prepared for socket welding to a connecting pipe.

SPECIFIC GRAVITY - The ratio of the weight of a given volume of **fluid** to the weight of an equal volume of water (if the **fluid** is a **liquid**) or to the weight of an equal volume of air (if the **fluid** is a gas).

SPECIFICATION - A document that defines the requirements that a finished product must conform to - may include chemical and mechanical properties, tolerances, marking, shipping, etc.

SPLINE - A set of grooves somewhat similar to gear teeth, for the purpose of interlocking male and female members such as a shaft and an internal splined coupling.

SPUR GEAR - The simplest of gears - in a gear set, the pinion and ring gear are aligned on parallel shafts. Can be added to another gear operator to further increase the mechanical advantage afforded by the gear.

SQUARE OPERATING NUT - A nut, usually 2" x 2", which is attached to a valve stem or the pinion shaft of a gear operator allowing use of wrenches to quickly operate the valve.

STAINLESS STEEL (SS) - Any of a number of types of iron alloy with chrome, nickel, or other elements that does not oxidize in free air.

STANDPIPE - (1) A pipe or tank connected to a closed conduit and extending to or above the **hydraulic grade line** of the conduit. It is often installed to afford relief from surges of pressure in pipelines. (2) A tank resting on the ground having height greater than diameter and used for storage of water in distribution systems. (3) In a building or structure, a fixed vertical pipe equipped with valve hose outlets, usually at each floor, to provide water for hose lines for firefighting.

STATIC HEAD - (1) The total **head** without reduction for velocity **head** or losses; for example, the difference in elevation of headwater and tail water of a power plant. (2) The vertical distance between the free level of the source of supply and the point of free discharge or the level of the free surface.



STATIC SUCTION HEAD - The vertical distance from the source of supply when its level is above the pump to the center **line** of the pump.

STATIC SUCTION LIFE - The vertical distance between the center of the suction end of a pump and the free surface of the **liquid** being pumped. Static lift does not include **friction** losses in the suction pipes. Static suction **head** includes lift and **friction** losses.

STEM - A rod or shaft used to transmit motion from an operator to the **closure element** of a valve. See shaft.

STEM GUIDE - A guide bushing closely fitted to the valve stem and aligned with the seat. Good stem guiding is essential to minimize packing leakage

STEM INDICATOR (VPI – Visible Position Indicator) - A position indicating rod supplied with **gate valves**. It extends from the top of the valve stem and serves to indicate the relative position of the gate.

STOP VALVE - A large valve installed in a pipeline to shut off **flow** in a section to permit inspection or repair. Such valves are usually installed in the main lines. Also called sectionalizing valve.

STORM SEWER - A sewer that carries storm water and surface water, street wash and other wash waters, or drainage, but excludes domestic wastewater and industrial wastes. Also called storm drain.

STORM WATER - Surface water from rain, snow, or ice melting and running off from the surface of a drainage area. It is normally collected in sewers separate from the sanitary sewers, and receives minimal, if any, treatment prior to discharge. When collected in a combined sewer system, the resulting mixture of sewage and storm water is called combined wastewater.

STRAIGHT-WAY VALVE - A valve through which the **fluid** passes without deviation. Such valves offer the least resistance to **flow**.

STREAMLINE FLOW - **Flow** of a **fluid** in which there is no turbulence; particles of the **fluid** follow well-defined continuous paths, and the **flow** velocity at a fixed point either remains constant or varies in a regular fashion with time.

STREET ELL - A 90° pipe **fitting** with **male thread** and female threaded or socket weld ends.

STRESS - An engineering parameter used in the design of valves. The value of unit **force** (psi) produced within material as the result of an applied **force** or load. Developed stress



STUD - A **bolt**, threaded on both ends, often used in bolting together bodies and **bonnets** or bodies and **closures**.

STUFFING BOX - Also known as packing box, the volume surrounding a shaft at the area on the shaft where it emerges from a pressurized or isolatable space, used to contain the packing.

SUB-MAIN SEWER - A sewer into which the wastewater from two or more lateral sewers is discharged and which subsequently discharges into a main, a trunk, or other collector.

SUCTION HEAD - The **head** at the inlet to a pump.

SUCTION LIFT - The vertical distance from the **liquid** surface in an open-top tank or reservoir to the centerline of a pump drawing from the tank or reservoir and set higher than the **liquid** surface.

SUCTION PUMP - A pump set above the surface of the body of water which supplies the pump, necessitating the lifting of the water from such surface to the pump cylinder or casing.

SUPPLY PRESSURE - The pressure at the supply **port** of a device such as a **controller**, positioner or transducer. Common values of control valves supply pressure are 20 psig. for a 3-15 psig. output and 35 psig. for a 6-30 psig. output.

SURGE - (1) A momentary increase in **flow** (in an open conduit) or pressure (in a closed conduit) which passes longitudinally along the conduit, usually due to sudden changes in velocity or quantity.
(2) Any periodic, usually abrupt, change in **flow**, temperature, pH, concentration, or similar factor.

SURGE, AIR RELATED - Pipe surge created by air within a piping system. See also Surge.

SURGE CHECK - See Anti-Slam device.

SURGE RELIEVER - A valve designed to relieve pressure surges in **liquid** pipelines, thus preventing **line** rupture due to transient pressures exceeding design limits of the pipe. A special flexible tube type valve can function as a fast acting surge reliever.



SURGE TANK - A tank or chamber located at or near a hydroelectric powerhouse and connected with the penstock above the turbine. When the **flow** of water delivered to the turbine is suddenly decreased, the tank absorbs the water that is held back, and cushions the increased pressure on the penstock which is caused by the rapid deceleration of the water flowing in it; also, when the **flow** delivered to the turbine is suddenly increased, the tank supplies the increased quantity of water required until the **flow** in the penstock has been accelerated sufficiently. Also used in connection with the pumping systems.

SWING CHECK - A **check valve** in which the **closure element** is suspended from the top and swings out of the way.

TEAR DROP CONTOUR - Geometric valve **body** shape designed to minimize **head loss**.

TEE - A pipe or tubing **fitting** with a side outlet at right angles. Resembles a "T".

TENSILE STRENGTH - The maximum stress a material subjected to a stretching load can withstand without tearing. Also known as hot strength.

TENSILE TEST - A destructive test performed on a specially machined specimen taken from material in its delivered condition to determine mechanical properties, such as tensile strength, yield strength, and percent elongation.

THEORETICAL VELOCITY - The velocity which water or other **liquid** under a given **head** would attain in passing through an orifice, conduit, or other structure were its **flow** not reduced by **friction** or other losses.

THROTTLE VALVE - A valve installed to reduce the **flow** through a pipeline; it may be any one of a number of types of valves designed for this purpose.

THROTTLING - The act of reducing the pressure or **flow rate** of a **fluid** passing through a valve.

THROTTLING DEVICE - A device mounted on the discharge of an **Air/Vacuum Valve** to control the rate of discharge of air upon system pressurization.

THRUST - A linear **force** applied to the shaft of a valve, usually expressed in units of pounds.

THRUST BEARING - A flat, washer shaped device used to support axial loads on the valve shaft.



TILTING CHECK VALVE - A check valve with an eccentrically mounted **disc** allowing **flow** above and below the **disc**. The design combines extremely low **head loss** with excellent non-slam characteristics. It can be supplied with top or bottom mounted dash pots to further reduce any slamming potential, especially in high **head** applications.

TOP ENTRY - The design of a particular valve or regulator where the unit can be serviced or repaired by leaving its **body** in the **line**, and its internals can be accessed by removing a top portion of the unit.

TORQUE - The rotational **force** imposed on or through a shaft.

TOTAL DYNAMIC DISCHARGE HEAD - Total **dynamic head** plus the dynamic suction **head** or minus the **dynamic suction lift**.

TOTAL DYNAMIC HEAD - The difference between the elevation corresponding to the pressure at the discharge **flange** of a pump and the elevation corresponding to the vacuum or pressure at the suction **flange** of the pump, corrected to the same datum plane, plus the velocity **head** at the suction **flange** of the pump.

TOTAL HEAD - (1) The sum of the pressure, velocity, and position heads above a datum. The height of the energy line above a datum. (2) The difference in elevation between the surface of water at the source of supply and the elevation of the water at the outlet, plus velocity **head** and lost head. (3) The high distance of the energy line above the datum; energy head. (4) In open channel **flow**, the depth plus the velocity head.

TOTAL PUMPING HEAD - The measure of the energy increase imparted to each pound of **liquid** as it is pumped, and therefore, the algebraic difference between the total **discharge head** and the total suction head.

TRANSFER PUMP - A pump specifically designed to convey water, wastewater, or chemical solutions from one tank to another.

TRANSIENT - A pulse, damped oscillation, or other temporary phenomenon occurring in a system prior to reaching a steady-state condition. See surge.

TRANSIENT ANALYSIS - The study of transients in a pipeline.

TRANSMISSION LINE - A main pipeline transporting oil or gas from wells or storage fields to refineries, loading docks or distribution companies. Generally, the pipeline is bigger than 6" and the pressure greater than 150 psi (10 **bar**).

TRIM - Commonly refers to the valve's working parts and to their materials. Usually includes seat ring sealing surfaces, **closure element** sealing surfaces, stems, and back seats. Trim numbers which specify the materials are defined in API 600 and API 602.



TRUNK MAIN - A large pipe serving as a supply main or feeder main in a water distribution system.

TRUNK SEWER - A sewer that receives many tributary branches and serves a large territory. See also main sewer.

TUBERCULATION - The formation of tubercle in the pipe, with an increase in frictional coefficient.

TUBERCULE - A small knob or button of rust formed on the inside of an iron pipe. (2) An attached deposit of metallic salts in pipes, usually botryoid.

TRIPLE ECCENTRIC (Butterfly Valves) - A particular design of a **butterfly valve** where the stem is located behind the **disc**, below the centerline of the **disc**, and its cone axis is offset from the centerline of the **disc**. This particular design is capable of a very tight shutoff at temperatures well above 100°F.

TRUNNION - That part of a **ball valve** which holds the ball on a fixed vertical axis and about which the ball turns. The torque requirement of a trunnion mounted **ball valve** is significantly less than that for a **floating ball** design.

TURBIDITY - (1) A condition in water or wastewater caused by the presence of suspended matter, resulting in the scattering and absorption of light. (2) Any suspended solids imparting a visible haze or cloudiness to water which can be removed by filtration. (3) An analytical quantity usually reported in turbidity units determined by measurements of light scattering. See also color, **FTU**, **JTU**.

TURBINE PUMP - A **centrifugal pump** in which fixed guide vanes partially convert the velocity energy of the water into pressure **head** as the water leaves the impeller.

TURBULENCE - (1) The **fluid** property that is characterized by irregular variation in the speed and direction of movement of individual particles or elements of the **flow**. (2) A state of **flow** of water in which the water is agitated by cross currents and eddies, as opposed to laminar, streamline, or viscous **flow**. See also turbulent **flow**.

TURBULENT VELOCITY - The velocity of water flowing in a conduit above which the **flow** will always be turbulent, and below which the **flow** may be either turbulent or laminar, depending upon circumstances.

ULTRASONIC INSPECTION - An inspection procedure using high frequency sound waves to detect wall thickness or flaws throughout the thickness of metal parts. Abbreviated as UT.

UNION BONNET - A type of valve construction in which the **bonnet** is held on by a union nut with threads on the **body**.



UNION CONNECTION - A small 3-piece **fitting** used to join two lengths of pipe. A female piece is installed on each of the two pipe ends and the connection is mechanically sealed by an external nut.

VACUUM - 1. Theoretically, a space in which there is no matter. 2. Practically, a space in which the pressure is far below normal **atmospheric pressure** so that the remaining gases do not affect processes being carried on in the space.

VACUUM BREAKER - A device for relieving a vacuum or partial vacuum formed in a pipeline, thereby preventing back siphoning.

VALVE - A device which isolates or controls **fluid** direction, or **flow rate**. Synonyms: Stop, Cock, Faucet, Tap, Bib.

VALVE BOX - A metallic or concrete box or vault set over a valve stem and rising to the ground surface, to allow access to the stem in opening and closing the valve. A cover is usually provided at the surface to keep out dirt and debris.

VALVE KEY - A metal wrench with a socket to fit a valve nut and with a long handle for operating a **gate valve** from a distance of several feet.

VALVE STEM - The rod by means of which a valve is opened or closed; the rod lifts and pushes down the gate.

VAPOR PRESSURE - A pressure at which, for a given temperature, vapor bubbles form in the **liquid**.

VARIABLE ORIFICE - A small variable profile valve put in a **flow line** and used with a pilot to restrict the **flow** into the pilot and make the pilot more or less sensitive to changing conditions.

VDI/VDE 3845 - VDI/VDE 3845 is a standard that defines interfaces between valves, **actuators** and their components. Primarily: Interfaces between valves and **actuators** (both rotary and linear) and **actuators** and components (positioners, monitors, transmitters, and solenoid valves).

VDI/VDE 3847 - VDI/VDE 3847 is a standard that defines the mechanical and pneumatic interface between a positioner and a linear **actuator**. This interface allows direct mounting and interchangeability of positioners that confirm to this standard. The overall dimensions of the **actuator** and positioner are reduced and the positioner can be installed or replaced quickly.

VELOCITY - The time rate of change of position of a **body**; it is a vector quantity having direction as well as magnitude. Also known as linear velocity.



VELOCITY HEAD - The energy of a **liquid** as a result of its motion. It is the equivalent **head** in feet through which the water would fall to acquire the same velocity.

VENT PIPE - A pipeline, usually vertical, to allow venting of air or other gases from another pipe or a chamber, or to prevent negative pressures due to siphoning of a pipeline. See also vent.

VENTING AIR - The removal of air from a pipeline. See AIR VALVE.

VENTING CAPACITY - The maximum **capacity** an AIR VALVE can vent air. Usually stated in CFM.

VENT PLUG - (Vent Plug Assembly) – (Safety Vent Plug): A special pipe plug having a small Allen wrench operated vent valve. These special plugs are located at the bottom of most ball valves. With the line valve closed (and under pressure) the **body** cavity pressure can be vented thru this small valve to check tightness of seat seals or to make minor repairs. Having vented the **body** pressure, the vent plug may be removed to blow out debris and foreign material or to flush the **body** cavity. On some **gate valves**, the vent plug is installed on the **bonnet** for the sole purpose of venting the **body**. Such valves have separate drain valves. See “Block and Bleed”; “Drain Valve.”

VENTURI FLUME - An open flume with a contracted throat which causes a drop in the **hydraulic grade line**. It is used for measuring **flow**. See also Parshall flume.

VENTURI METER- A differential meter for measuring **flow** of water or other **fluid** through closed conduits or pipes, consisting of a Venturi tube and one of several proprietary forms of flow-registering devices. The difference in velocity heads between the entrance and the contracted throat is an indication of the rate of **flow**. See also Venturi tube.

VENTURI TUBE - A closed conduit or pipe, used to measure the rate of **flow** of **fluids**, containing a gradual contraction to a throat, which causes a pressure **head** reduction by which the velocity may be determined. The contraction is usually, but not necessarily, followed by an enlargement to the original size.

VERTICAL PUMP - (1) A reciprocating pump in which the piston or plunger moves in a vertical direction. (2) A **centrifugal pump** in which the pump shaft is in a vertical position.

VERTICAL CONTROL VALVE - Maintain a preset minimum and maximum water level in a reservoir or water tank and is activated by line pressure according to a modulating bi-level float. Open when the water level reaches the lower preset level of the vertical float. As the water level reaches the maximum preset level, the valve gradually closes by re-pressurizing the control chamber.



VERTICAL SCREW PUMP - A pump, similar in shape, characteristics, and use to a horizontal screw pump, but which has the axis of its runner in a vertical position.

VERTICAL VELOCITY CURVE - A curve showing the relation between depth and velocity, at a given point and along a vertical line, of water flowing in an open channel or conduit. also called mean velocity curve.

VISCOSITY - A measure of the internal **friction** of a **fluid** or the resistance of a **fluid** to **flow**. Two **fluids** of identical specific gravity may have quite different viscosities.

VOLUTE PUMP - A centrifugal pump with a casing made in the form of a spiral or volute as an aid to the partial conversion of the velocity energy into pressure **head** as the water leaves the impellers.

VISCOUS FLOW - A type of **fluid flow** in which there is a continuous steady motion of the particles, the motion at a fixed point always remaining constant. Also called a streamline **flow**. See also laminar **flow**.

VPI – Visible Position Indicator: See “Stem Indicator”

WAFER - A valve designed for installation between mating pipe flanges. End to end dimensions are typically much shorter than a flanged or M.J. valve.

WALL THICKNESS - The thickness of the wall of the pressure vessel or valve. For steel valves, minimum thickness requirements are defined in **ASME** B16.34, API 600, and API 602.

WASTEWATER - The spent or used water of a community or industry which contains dissolved and suspended matter.

WASTEWATER COLLECTION SYSTEM - The sewer and pumping system used for the collection and conveyance of domestic, commercial, and industrial wastewater.

WATER - (1) A transparent, odorless, tasteless **liquid**, a compound of hydrogen and oxygen, H₂O, freezing at 32°F or 0°C and boiling at 212°F or 100°C which, in more or less impure state, constitutes rain, oceans, lakes, rivers, and other such bodies; it contains 11.188 percent hydrogen and 88.812 percent oxygen, by weight. It may exist as a solid, **liquid**, or gas and, as normally found in the lithosphere, hydrosphere, and atmosphere, may have other solid, gaseous, or **liquid** materials in solution or suspension. (2) To wet, supply, or irrigate with water.

WATER COLUMN - (1) The water above the valve in a set of pumps. (2) A measure of **head** or pressure in a closed pipe or conduit.



WATER HAMMER - The phenomenon of oscillations in the pressure of water about its normal pressure in a closed conduit, flowing full, which results from a too-rapid acceleration or retardation of **flow**. Momentary pressures greatly in excess of the normal static pressure may be produced in a closed conduit by this phenomenon.

WATER MAIN - The water pipe, located beneath a street, from which domestic water supply is delivered to the service pipe leading to specific premises.

WATER TOWER - A tower containing a tank in which water is stored, normally for providing local storage in a distribution system where ground-level storage would provide inadequate pressure. Also see standpipe.

WEDGE GATE - A type of **gate valve** in which the **gate** or **disc** is wedge shaped, thinner at the bottom, to wedge itself tightly between the two seats when closed.

WELD NECK FLANGE - A flanged piping element with a weld neck used in pipeline construction to provide a companion **flange** for installation of flanged valves. Also used to convert weld end valves to flanged valves or vice versa.

WELD REDUCERS - A reducing **fitting** used on weld end piping components to adapt from a large sized pipe to a smaller diameter pipe, or vice versa.

WELL SERVICE AIR VALVE - A modified **Air/Vacuum Valve** designed to withstand the critical pressure thrust during pump startup.

WET WELL - A compartment in which a **liquid** is collected, and to which the suction pipe of a pump is connected.

WOG - WATER-OIL-GAS - one of the early rating designations, still in use today for small valves, chiefly in low ratings. Also called non-shock rating. Normally this rating is meant to be the maximum working pressure at **ambient temperature** (32 to 100°F).

WORKING PRESSURE - WP - synonym for operating pressure.

WORKING PRESSURE HEAD - The actual **head** of water flowing at any point in a conduit; the vertical height from the center **line** of a conduit to the **hydraulic grade line**.

WORM GEARS - A gear set in which the input shaft is offset from and perpendicular to the output shaft, and driving gear is very small and perpendicular to the driven gear. Worm gear operators are used on ball valves.

YIELD STRENGTH - The limiting stress beyond which a material will sustain permanent deformation.

Yoke - That part of a valve assembly used to position the Stem Nut or to mount the valve actuator.

