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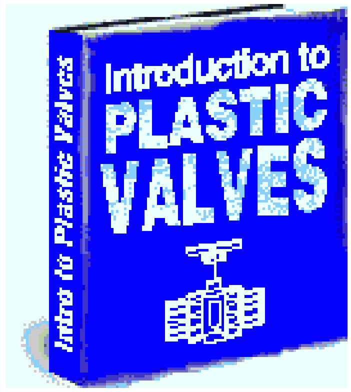

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PLAST-O-MATIC VALVES INC.

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Definition of a Valve

> **Valve** *noun* -- any device for closing or modifying the passage through a pipe, outlet, inlet, or the like, in order to stop, allow, or control the flow of a fluid media.

In its simplest form, by squeezing a garden hose to stop flow, your hand and that section of hose become a valve. In its most complex form, a valve has built in electronics or other sensing devices that react to real-time conditions, and the valve will control flow with extreme precision according to how it is programmed.

Practically speaking, most valves have an inlet, an orifice or seat, a disk (or plug, seal etc.) that seals against the orifice, and an outlet. The inlet(s) and outlet(s) are also known as "ports."

The orifice seat and seal principle can be accomplished a number of ways, in fact, it seems that the valve industry is constantly inventing new ones. Perhaps the most common is the globe style valve, in which the seal moves to press against a "volcano" style orifice. Another common type is the ball valve, in which a ball with a hole through it is rotated within two seals. When the hole is aligned with the inlet and outlet, the valve is open. When the ball is turned, and the solid sides of the ball align with the inlet and outlet, the valve is closed. A plug valve is similar; it has a through hole in a cylindrical or conical shape instead of a ball.

As stated above, the orifice seat and seal appear in many forms. In a typical pinch valve, an all-rubber sleeve is "pinched" closed -- very much like the garden hose -- in this case, the sleeve functions both as seat and seal. In a swing-type check valve, the seal is a flapper that swings to seal against the orifice. It is held closed by pressure from the valve outlet, and opens under pressure from the inlet.

Beyond these most basic principles, a number of other factors come into play, most notably, **actuation**. In other words, the force or mechanism that makes the valve open, close, or do whatever its function is.

The simplest form of actuation is **manual**. A manual valve requires the operator to open, close, or otherwise control the valve "by hand." Your kitchen faucet is a manual valve. Common industrial manual valves include hand-operated shutoff valves and manual ball valves.

Automatic valves, also known as self-actuating, perform their specific function without external assistance. A safety relief valve on a home water heater is an example of an automatic valve. When pressure in the tank is greater than the spring force built into the valve, the safety valve automatically pops open. Common automatic industrial valves include pressure regulators, check valves, vacuum breakers, and by-pass relief valves.

Mechanically actuated valves require an external device, motor, or other force to operate. These are referred to simply as **actuated** valves. An example is the solenoid valve in your automatic dishwasher. An electric signal acts upon a coil, which electromagnetically pulls a metallic stem that is attached to the seat; the valve opens and allows flow. At the instant the external force (electricity) is removed, the magnetic field vanishes and a spring closes the valve. Common "actuated" industrial valves include air-actuated ball valves, motorized ball valves, and solenoid valves. A well-designed actuator is modular; it can be mounted on different valves and can be service/replaced without disturbing the liquid handling components.

Some valves use a combination of manual and automatic, automatic and actuated, or manual and actuated. The simplest example is found in the everyday toilet tank; the valve requires manual opening, but then has automatic shutoff via a float. An example of an industrial valve is an air-actuated ball valve with a limit stop; it requires an external force (compressed air to the actuator) to open, but then stops automatically depending on where the limit stop is set.

Other considerations center on what the valve actually does. Most valves are "normally closed." They remain closed until acted upon by some force. If the valve then closes again when the force is removed, it is a "fail-safe" valve. The solenoid valve in your automatic dishwasher is normally closed and -- hopefully -- fail safe.

Another type of valve is "normally open." They are open until acted upon, and often are described as "fail-safe/open." Normally-open valves are frequently found in cooling systems, where maximum flow is desired at all times, and the valve is closed only when system maintenance is required.

"Throttling" valves are valves that are opened or closed incrementally, restricting flow. The spigot you attach your garden hose to is regularly used as a throttling valve -- you open it a little to gently water a flower bed, or wide open for washing a car.

"Diverter" or sampling valves are used to re-direct flow. These have three ports -- two inlets or two outlets -- and are commonly referred to as 3-way valves. The small adapter you attach to your spigot that enables you to switch between two garden hoses is a diverter valve. In industrial applications, diverter valves are used for blending two inlets, isolating output, sampling, and similar applications.

"Multi-port" valves theoretically includes diverter valves, but more often refers to valves with four or more ports.

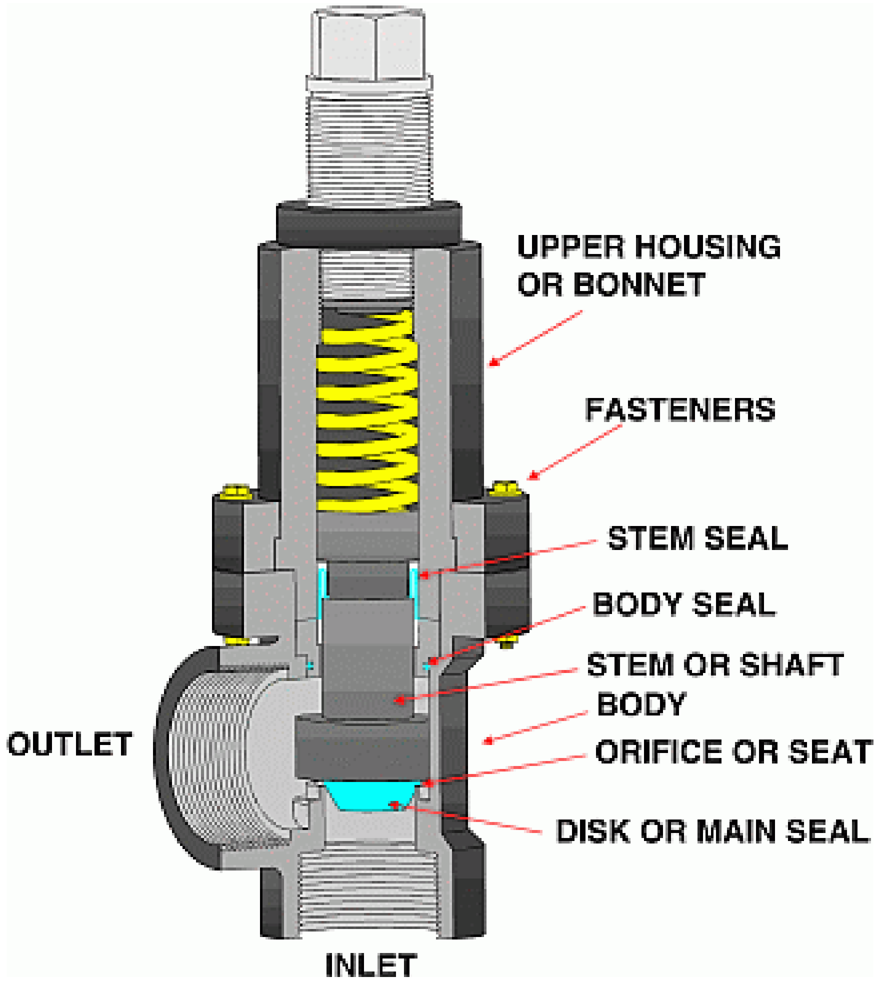
Multi-port valves tend to be more complex, and are often designed as a "manifold" instead. Manifold port configurations are limited only by the designer's imagination and the constraints of the material used for the manifold body. Manifolds can not only have a variety of inlet/outlet combinations and flowpaths, they can also be used to combine a number of different types of valves into one functioning system.

Plastic Valves

NOTE: Most of the plastic valves people come in contact with in everyday life are radically different from the rugged industrial valves described on these pages. The average plastic valve used on a home aquarium or swimming pool tends to be molded of low-grade white plastics, and is designed for low-cost. For a more detailed explanation of the differences between consumer-oriented plastic valves and industrial plastic valves, please click here.

The basic principles described above could apply to virtually any type of valve material, whether it is a large cast metal valve at an oil refinery, a rigid polyethylene valve for an irrigation system, or an exotic alloy valve for high pressure steam cleaning at a pharmaceutical firm.

More specifically, the industrial plastic valves found on these pages have many elements in common that enable you to better understand their design, construction, and ultimately, selection for a given application.



The basic components common to most industrial plastic valves are:

1. The body. This is usually an all-plastic material. Because this is the primary part in contact with liquid, the plastic material is selected based on its compatibility with the process liquid.
2. The bonnet (spring housing, seal housing, air chamber, etc.) also built of plastics. This looks like, and is often confused with, the valve body. As a rule of thumb, if the valve appears to have separate top and bottom sections, the top is generally the bonnet. The bonnet is frequently constructed of the same material as the body, but in cases where it does not contact liquid, it is often built of a different material for cost considerations.
3. The main seal (also known as the disk), built of elastomers or fluoroplastics.
4. The stem, shaft or other sealing mechanism. The stem is frequently a combination of plastic and steel, sometimes working in combination with a spring. Wetted parts are built of plastics. This is generally housed in the bonnet.
5. The body and stem seals, built of elastomers. These are necessary to create a completely sealed unit.
6. Fasteners (if any), available in a variety of materials, but usually

stainless steel. Because plastic valves tend to be used in either high purity or highly corrosive applications, it is important that the fasteners not be exposed to any process liquid, and have minimal atmospheric exposure.

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The Why, When & Where of Plastic Valves

Mention plastic valves and most people picture the low cost, bright white valves connected to their swimming pool or aquarium. In reality, many plastic valves are well-designed, rugged products that sometimes cost more than the metal valves they supplant. Wherever valves routinely fail due to corrosion, or when purity concerns require exotic alloys that are cost prohibitive in most cases, very high quality plastic valves are specified...but with some important exceptions that must be considered.

The first thermoplastic valves were the result of corrosion-prone process industries searching for an alternative to constantly replacing metal valves. One plastic valve pioneer got started when a manufacturer of dry cleaning equipment was searching for a replacement air-operated shut-off valve used to deliver an extremely corrosive chemical. The manufacturer was constantly replacing valves and was in danger of losing customers, and noticed that the plastic filter units it was using showed no ill effects. The filter manufacturer declined an invitation to develop a replacement valve, but permitted a staff engineer to work on the project. Word of his successful plastic design spread, and an industry was launched.

Plastic piping systems have a distinct advantage in applications with either highly corrosive or ultra pure liquid media. The high quality plastic valves used in corrosive chemical and ultrapure semiconductor manufacturing are technologically equal to the best metal valves. In these applications it is generally agreed that plastics usually do a better, more cost effective job.

In the photo at right, the large dark grey PVC shutoff valves are just about the only items not affected by the highly corrosive atmosphere. These heavy-duty valves are only remotely related to the cheap white "swimming pool valves" most people associate with plastics.

In corrosive applications, plastic valves are not prone to "stick" or fail due to rust, scaling, or other corrosive build up. Similarly, plastic piping provides the benefit of remaining smooth and free of build up, which means that flow rates and pressure drop will be unaffected after years of use. Externally, plastic valves resist attack by airborne corrosives, which eliminates the need for painting or special coatings.

In ultra-pure applications, certain plastics such as Teflon, Kynar, and natural unpigmented polypropylene are preferable for their non-leaching properties. They also are highly resistant to adherence and subsequent growth of organic impurities, which is a paramount concern in processes such as semiconductor fabrication.

Beyond corrosion and purity advantages, plastic valves and piping have the added benefit of being generally lighter in weight and therefore less costly to ship. The polyvinyls also install easily, either with simple hand-threading or solvent cementing.

Plastic ABCs

The "alphabet soup" of different plastic materials may seem daunting, but in reality the industry uses only a few common resins. The most prevalent plastic valve material, Grade 1 Type 1 PVC (polyvinylchloride), has been used successfully for over 35 years in such areas as chemical processing, wastewater treatment, industrial plating and electronics manufacturing. It carries a pressure rating of approximately 150 psi -- at 75º F -- depending on valve design. As temperature rises, pressure ratings fall. Maximum safe temperature rating of PVC is 140ºF; minimum safe temperature is 40ºF. Chlorinated PVC (CPVC) is rated to 180º. These ratings can change drastically depending on the properties of the process media.

As applications requiring the benefits of plastic began demanding higher pressure and temperature ratings, higher performance resins such as Kynar PVDF and Teflon PTFE became popular. Certain Kynar valve designs are rated to 230 psi. Teflon is capable of withstanding temperatures to 500ºF, although it is not recommended in valve use beyond 300ºF. Some materials, such as PEEK (Polyetheretherketone) are rated even higher, but tend to be cost prohibitive and thus defer to metal or lined metal as the material of choice.

Other popular materials used in better quality plastic valving are Teflon PFA and polypropylene. In less demanding applications such as irrigation, nylon and polyethylene are popular resins due to their lower costs. Each of these plastics fills a niche in the market.

Notable limitations of plastic valves are high pressure and extreme temperatures. Many system designers are simply unaware that plastic valves are not suited for temperatures below freezing, or may soften at elevated temperatures when used with certain chemicals. Furthermore, plastic valves are not as forgiving as metal valves in terms of abuse such as errant hammer blows. Plastics are also restricted to certain types of media.

Most plastic valves are designed for liquids, and many are suitable for slurries. Powders tend to scour the valve body, and most gas applications are simply not suited to plastic. ABS (Acrylonitrile-butadiene-styrene) is a popular plastic material for compressed air piping, but has reduced capability versus metals, and tends to be used only where atmospheric corrosion impacts the life and safety of metal piping.

Plastic Valves vs. Metal Valves

Overall valve design is similar between materials. The plastic counterpart to cast metal valves is injection molding, done when quantities warrant. Like a cast valve body, some finishing machining is needed prior to final assembly. More specialized valves have machined bodies, performed with the same CNC machining centers and lathes used in a metal machine shop. Plastic valve bodies are generally threaded or cemented together, or assembled with fasteners. In addition, elastomers perform generally the same function in plastic valves as they do in the metal versions. One of the few basic differences is that virtually no high quality plastic valve design has a plastic plug or stem seal against a plastic orifice.

Service tends to be easier with plastic valves. No unusual tools or equipment are needed to disassemble the typical plastic valve; with proper design considerations the seals and key parts can be replaced in the field with minimal downtime.

The overall ease of service and installation does have its drawbacks, however, as most mechanical contractors unfamiliar with plastic valves try to install them in the same manner as metal valves: pipe wrench, channel locks, cheater bars, and plenty of force. A well-designed threaded plastic valve should be installed hand tight only, with an additional quarter-turn using a strap wrench. Most plastic valve "defects" are the result of too much installation muscle, which stresses the plastic body and can eventually lead to cracking under prolonged stress conditions.

Summary

As the plastic valve industry approaches the half-century mark, it is clear that while not a threat to the mainstream metal business, it has found a highly successful niche. Although it may never overcome the stigma of its cheap white cousins, engineered plastic valves will certainly continue to make inroads wherever corrosive or high purity liquids are involved.

* * * * *

Endnote

The valve pioneer mentioned above was Plast-O-Matic founder Bruce L. DeLorenzo, who virtually launched an industry from one laundry valve application. Throughout his 30+ years as President of Plast-O-Matic, Mr. DeLorenzo developed a number of valve innovations that have since been adopted as industry standards.

Valve Terms & Acronyms Explained

ABS:

Acrylonitrile Butadien Styrene. A rugged plastic compound typically used for housings, some external valve parts. A form of ABS is also used for low-pressure air piping systems in harsh environments.

AFLAS:

An elastomer used for high temperature/high purity or highly aggressive applications; particularly suited to ozone-treated water.

ASQ:

American Society for Quality

ASTM:

American Society for Testing and Materials.

BCF:

Bead and crevice free. Also known as fusion. A means of connecting pipes, valves and fitting via heat fusion, with a perfectly smooth internal joint.

BS, BSP:

British Standard, British Standard Piping. A piping specification.

BUNA or BUNA-N:

Nitrile rubber, used to make o-rings and other seals used in valves. Buna-N is the least expensive type of seal, and it lacks the chemical compatibility of other more costly elastomers.

CHEMRAZ:

A fluorinated elastomer used for high temperature/high purity or highly aggressive applications.

CNC:

Computer numerically controlled. Popular type of control system for vertical machining centers, lathes, injection molding machines, and other tools used to fabricate a valve.

CPVC:

Chlorinated polyvinyl chloride. While not as popular as PVC, it is able to withstand higher temperatures. Plast-O-Matic is an authorized vendor of Corzan® CPVC, a brand name of Noveon Corp .

CSA:

Canadian Standards Association.

DIVERTER:

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

EPDM:

Ethylene propylene diene monomer. A popular rubber seal material, compatible with a wide range of chemicals.

FLANGE:

A type of pipe fitting that attaches via nuts and bolts.

FLARE:

A type of pipe fitting that uses a socket and a type of union nut to form a connection with minimal crevice, for ultrapure processes.

GPM:

Gallons per minute. Expresses volume of flow.

GPP:

Glass-filled polypropylene. Offers the chemical resistance of polypropylene, with glass fibers added for strength.

HALAR:

Ethylene-chlorotrifluoroethylene. Plast-O-Matic uses this material for some external components; it is also a valve body material for high temperature/high purity applications.

IAPD:

International Association of Plastics Distributors. Formerly NAPD, National Assoc. etc.

ISA:

The Instrumentation Systems and Automation Society. Formerly Instrument Society of America.

KALREZ:

A fluorinated elastomer used for high temperature/high purity or highly aggressive applications.

KYNAR:

Brand of Polyvinylidene flouride. A dense, high-purity plastic that is used in critical applications, such as semiconductor manufacturing. Plast-O-Matic is an authorized reseller of Kynar® PVDF. Kynar is a trademark of Elf-Atochem.

NATURAL:

Describes resins, frequently PP or PVDF, that have not had colorants, fibers, or other components added prior to processing. Sometimes mistakenly interchanged with "virgin."

NC:

Normally-Closed. Describes a valve that is "fail-safe" to the closed position. This is usually accomplished by a spring built into the valve.

NEMA:

National Electrical Manufacturers Association. Used in valve terminology to define the level of external resistance an enclosure or solenoid coil is suited for. e.g.: NEMA 1 is dustight, NEMA 9 is explosion proof, etc.

NO:

Normally-Open. Describes a valve that is "fail-safe" to the open position. This is usually accomplished by a spring built into the valve.

NPT:

"National Pipe Thread." A specification for tapered pipe threads from ANSI (American National Standards Institute). Actually taken from American National Standard Taper Pipe Threads. When listed as NPT-F, indicates female ends.

O-RING:

A type of seal. An O-ring is a round elastomeric ring, ideally suited to be a compressed, static seal between non moving parts. O-rings can be used as a face seal on a valve, and used on rotating shafts inside a valve.

PECTFE:

Ethylene-chlorotrifluoroethylene. Plast-O-Matic uses this material, in HALAR brand, for some external components; it is also a valve body material for high temperature/high purity applications.

PET or PETRA:

Polyethylene terephthalate. (PETRA is a brand) Used on certain housings.

PP or PPL, Polypropylene:

A lightweight plastic that offers relatively high purity characteristics at a price well below PVDF or Teflon. Impervious to many chemicals.

PSI:

Pounds per square inch. Used to indicate the amount of pressure in a given piping system.

PTFE:

Polytetrafluoroethylene. A type of fluorinated thermoplastic sold under the brand name Teflon®.

PVC:

Polyvinyl chloride. This is the most popular material used for plastic piping systems.

PVDF:

Polyvinylidene flouride. A dense, high-purity plastic that is used in critical applications, such as semiconductor manufacturing. Plast-O-Matic is an authorized reseller of Kynar® PVDF. Kynar is a trademark of Elf-Atochem.

PVF:

Pipes, valves, fittings. Used to describe a segment of the plastics industry, or distributors who specialize in these products.

REGRIND:

Thermoplastic that has been processed once, then is placed in a grinder to be shredded/pelletized for re-molding. In injection molding, runners etc. are often re-ground. No thermoplastic can be successfully reground and remolded indefinitely; eventually the molecular bond begins to break down and the plastic is no longer usable.

ROLLING DIAPHRAGM:

A type of seal, also senses pressure. This is a diaphragm formed in a convoluted shape. It gets its name because as the stem moves, the diaphragm "rolls" at the convolution. It is frequently used in a manner similar to a u-cup, that is, to seal the gap between a linear moving shaft and the valve body.

SOLENOID VALVE:

A valve that uses an electromagnetic coil for actuation.

SPIGOT:

A type of fitting, essentially a section of pipe fused cleanly into a valve. This protruding pipe is then fused into the piping system. Usually found in high purity systems.

TEFLON:

Any one of a number of fluorinated polymers with excellent thermal and chemical resistance properties; Teflon® is a trade mark of E.I. DuPont de Nemours.

TEFLON BELLOWS:

A sealing mechanism that is made of Teflon, formed in a bellows shape, used on many Plast-O-Matic solenoid valves.

TEMPRITE:

This is a formulation of Corzan® CPVC that is used for injection molded valve bodies.

THERMOPLASTIC, THERMOSET:

Two basic types of plastic resins. Thermoplastics are resins that can be reground after molding, and molded again. Thermosets can be molded once only; they tend to be denser materials for special purposes. PVC is a thermoplastic. A PVC valve could conceivably be reground, then molded into a coffee mug. The resin used on a solenoid coil is a thermoset. A good analogy is paraffin wax vs. paraffin paste; both are petroleum products, but the wax can be melted and reformed while the lubricant cannot. Just as paraffin cannot be melted and reshaped indefinitely, no thermoplastic can be successfully reground and remolded indefinitely; eventually the molecular bond begins to break down and the plastic is no longer usable. In another popular analogy, thermosets are often compared to an egg; once the egg is hard boiled it can't be returned to a liquid and recooked as sunny side up.

U-CUP:

A type of seal. A u-cup is an o-ring formed into a u-shaped channel. Liquid or air pressure "inflates" the u-cup and affects a seal. The u-cup is used in instances where an o-ring is not desirable.

VIRGIN:

Describes thermoplastic resins that have no "regrind" in the processing mix. Sometimes mistakenly interchanged with "natural."

VITON:

A fluorinated elastomer, used in making o-rings and other seals. Viton® is a trade mark of DuPont Dow Elastomers.

WOG:

Water/Oil/Gas. Describes a common type of brass valve.

Intro to Plastic Valves: Seals

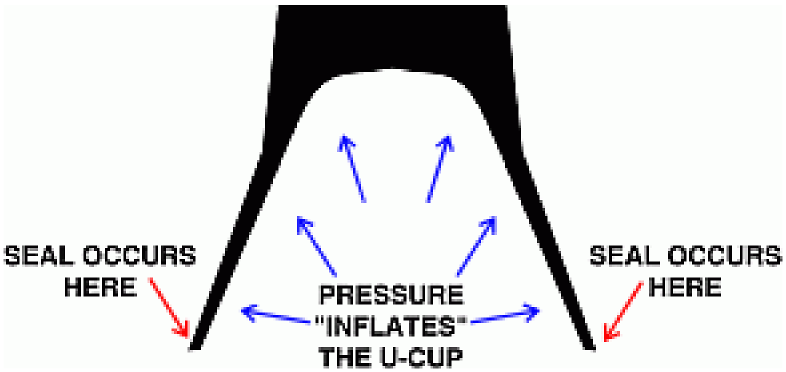
O-Rings

An O-ring is a round elastomeric ring. O-rings are ideally suited to be a compressed, static seal between non moving parts. O-rings can be used as a face seal on a valve, and used on rotating shafts.

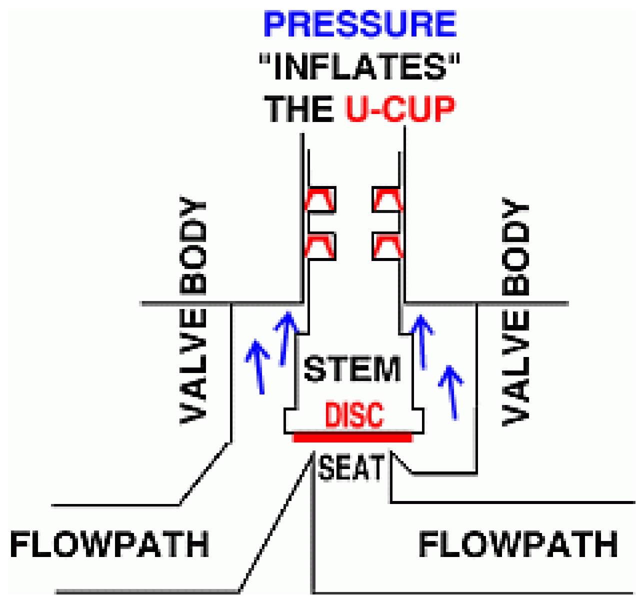
Use of o-rings on linear moving shafts is sometimes not recommended, due to the fact that they create friction, and in extreme cases will rollover, bind, and ultimately cause the valve to stick.

U-Cups

A u-cup is an o-ring formed into a u-shaped channel. Liquid or air pressure "inflates" the u-cup and affects a seal. The u-cup is ideal for use on linear moving shafts and piston heads, because unlike an o-ring the shape does not try to roll with the movement and create friction. The sides of the u-cup allow the shaft to move virtually unhindered, and seal with a wiping action.



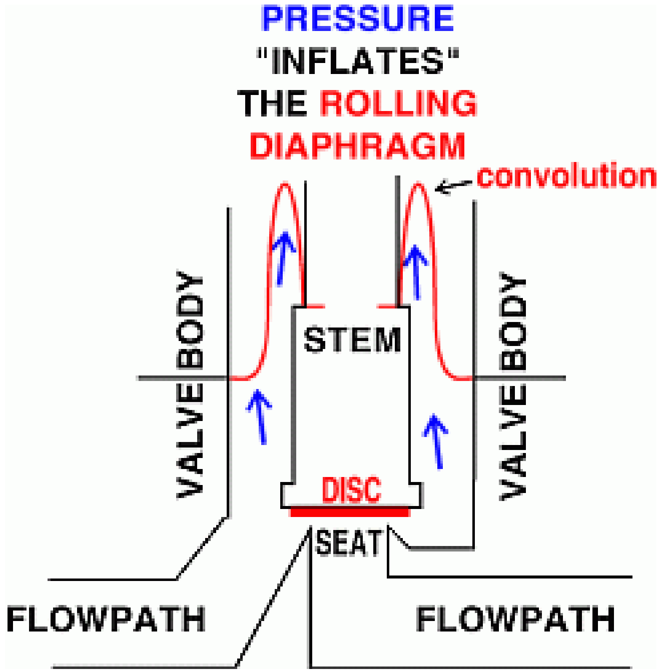
If a secondary or even a series of u-cups are used in the design, only the first one is pressurized, so friction is kept to a minimum. Secondary u-cups are used as backup seals in case the first u-cup fails.



Flat Diaphragms

Flat diaphragms are a flat round disc, usually cut from a sheet material, designed to affect a seal when forced against a valve seat.

Rolling Diaphragms



This is a diaphragm formed in a convoluted shape. It gets its name because as the stem moves, the diaphragm "rolls" at the convolution. It is frequently used in a manner similar to a u-cup, that is, to seal the gap between a linear moving shaft and the valve body. But unlike the u-cup, the rolling diaphragm is permanently affixed to both the shaft and the valve body. Because it is affixed to the shaft and also "inflates" from fluid pressure, the force of the fluid directly impacts the movement of the shaft. In some cases, such as a relief valve, this force is used to accelerate the movement of the shaft. In a pressure regulator, the force on the rolling diaphragm is what causes the shaft to move, so it is referred to as a "sensing" diaphragm.

It is important to eliminate any possibility of water hammer in a piping system where rolling diaphragms are used, as they can be ruptured by the explosive surge.

Sealing Discs

As shown in the illustration above, a disc is referred to as the elastomeric part affixed to the part of the valve stem that affects a seal against the seat. Discs are frequently flat washer-shaped pieces that are assembled into a retainer; they are also frequently a specially-molded shape that is slipped onto the end of the valve stem. Pressure (usually either spring, air, or line pressure) forces the disc firmly against the orifice seat, affecting a seal.

Elastomer Sleeves

A pinch valve uses a round rubber tube (sleeve) that is "pinched" to affect a seal. It is pinched either mechanically or with air pressure. Sometimes the sleeve may be formed in a special shape, so that the external force will cause it to fold or collapse at specific points.

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Plastic Body Materials

IMPORTANT NOTE There are many variables that affect success or failure of a particular material with any given chemical, including concentration, temperature, and the specific compound of the plastic. A material deemed suitable for a specific application does not mean that it is suitable for every application, nor that every version of that material is suitable. Plastic compounds vary between manufacturers, and the design of a valve may affect compatibility as well.

The information presented below is generally accurate, but your application may have variables that affect the performance of the material. Plast-O-Matic presents this information and any links solely as a convenience. Your distributor can help with compatibility questions, and you are welcome to contact our Technical Group at (973) 256-3000, but **the ultimate determination of suitability of any information, product or material, for use contemplated by the user, the manner of that use, and whether there is any infringement of patents, is the sole responsibility of the user. To the extent that any hazards are listed, we neither suggest nor guarantee that such hazards are the only ones that exist.**

It is important to note that any information obtained should be used only as a guide. In many cases a physical test of the material under operating conditions is the only way to ensure the success of a particular material for that application.

We recommend that anyone intending to rely on any recommendation, or use of any equipment, processing technique, or material mentioned in this e-book or linked websites should satisfy themselves as to suitability, and that all applicable health and safety standards are met. We strongly recommend the user seek and adhere to material manufacturers' and chemical suppliers' current instructions for for handling.

GEON® PVC (Polyvinyl Chloride Type 1, Grade 1)

This material has been successfully used for over 30 years in such areas as chemical processing, waste and wastewater treatment, industrial plating and deionized water lines and is the most frequently specified of all thermoplastic materials. PVC provides excellent chemical resistance to a wide variety of acids, alkalies, salt solutions and many other chemicals. It is attacked, however, by some solvents, aromatics and chlorinated organic compounds. The maximum service temperature of PVC is 140°F (60°C).

PVC is joined by solvent cementing, threading or flanging.

CORZAN® CPVC (Chlorinated Polyvinyl Chloride) Type 4. Grade 1

This material's physical properties (at 73°F or 23°C) and chemical resistance are very similar to those of PVC. Its major advantage over PVC is the ability to handle hot corrosive liquids in service temperatures up to 180°F (82°C).

The molded version of Corzan is Temprite®, which like Corzan, is manufactured by Noveon. (Note that Noveon purchased the CPVC and other polymer business from BF Goodrich in 2001).

CPVC is joined by solvent cementing, threading, or flanging.

Please click here for chemical resistance information specific to Corzan CPVC.
(External website hosted by Noveon)

Polypro (Polypropylene) Type 1

Natural Polypropylene -- Homopolymer polypropylene is a thermoplastic with low specific gravity and excellent chemical resistance to a wide range of acids, alkalies and organic solvents. It is also used in deionized water distribution. It is not recommended for use with strong oxidizing acids, chlorinated hydrocarbons and aromatics. The polypropylene used by Plast-O-Matic, unless indicated as "GPP" or "Glass-Filled," is 100% natural, virgin (unprocessed) resin with no pigments or other fillers whatsoever. These high purity properties make Natural Polypro an ideal altervative to PTFE and PVDF in many instances. The maximum service temperature is 130°F (82°C). Although polypropylene has a low melting point, it offers excellent structural rigidity.

Polypropylene is joined by heat fusion, threading or flanging.

Glass-Filled Polypropylene -- The addition of glass fibers to Polypropylene provides greater mechanical strength and therefore higher pressure & temperature capabilities. This type of polypropylene generally has a small amount of pigmentation.

Glass-filled polypropylene is joined by heat fusion, threading or flanging.

KYNAR® PVDF (Polyvinylidene Fluoride)

This fluoropolymer material has superior chemical and abrasion resistance, mechanical strength and temperatire capabilities in comparison to all other thermoplastic materials. It offers substantially greater strength and wear resistance over other common fluoroplastics (PTFE, PFA, etc.). It is chemically resistant to most strong acids, mild alkalies, organic solvents, wet or dry chlorines, bromine and other halogens and is also used extensively in the conveyance of high purity deionized water due to its absence of colorants or additives. Because of its outstanding mechanical properties and that it is similarly impervious and non-leaching, PVDF is sometimes used for certain parts in polypro and PTFE valves for design strength. You should check the specifications, or consult factory if this is a concern.

The maximum service temperature is 280°F (138°C); melting point is 170°C.

Kynar PVDF is joined by heat fusion, threading or flanging.

Please click here for information specific to Kynar PVDF.
(External website hosted by Elf-Atofina Chemicals)

TEFLON® PTFE (Polytetrafluoroethylene)

This fluoropolymer material is practically insoluble and chemically inert to most chemicals and solvents. It is widely used in the handling of high purity deionized water. While Teflon is capable of 500°F (260°C) Plast-O-Matic does not recommend its use in valve designs beyond 300°F (149°C).

The main advantages of Teflon in valve design is that it is ideal for both high purity and highly corrosive applications, because it is virtually impervious to corrosion, and is extremely low in terms of leaching. It is also excellent for valve parts due to its low frictional properties. Its limitations are that it will "cold flow," i.e., PTFE can be reshaped after contact with other parts. It is also not ideal for higher pressure threaded connections on larger pipe sizes.

Teflon PTFE is joined by threading or flanging.

TEFLON PFA (Perfluoroalkoxy resin)

PFA is a melt processible fluoroplastic equal to PTFE in chemical resistance. It is used for many valve parts such as bellows in solenoid valve, and encapsulation of springs when used as a wetted part. PFA is also used for molded body valves, and although the PTFE valve has a different appearance and translucence, the PTFE valve can be used in place of a PFA valve with no change in chemical resistance. Both materials are equally inert and have the same dielectric constant.

TEFLON FEP (Flourinated ethylene propylene)

FEP is a relatively soft fluoroplastic, with the same inert, low dielectric, and low friction properties of PTFE and PFA. It does not offer quite the same mechanical properties at elevated temperatures as PTFE and PFA.

PYREX® (borosilicate glass)

This low alkali glass is used on sight glasses and level indicators. It resists attack from most bases and acids with the exception of hydrofluoric acid and sodium hydroxide. It is the same material used in glass piping systems in the food, beverage, chemical, and pharmaceutical industries.

Please click here for a material safety data sheet
(External website hosted by Corning Glass.)

IMPORTANT: It should be noted that plastic pipe and fittings have varying resistance to weathering. PVC for example undergoes surface oxidation and embrittlement with exposure to sunlight over a period of several years. Also, ultraviolet sterilizers for killing bacteria in deionized water are becoming common and the intense light generated will, over time, stress-crack PVC piping & fittings that are directly connected to the sterilizer.

Elastomers

Buna-N (Nitrile Rubber)

This elastomer is recommended for general purpose sealing of water, petroleum oils, solvents and some alkalies. It is superior to most other elastomers with regard to compression set, abrasion and tear resistance. The maximum service temperature of Buna-N is 200°F (94°C). In 1999 Plast-O-Matic began phasing out standard use of Buna-nitrile in favor of EPDM (see below), with the exception of seals in air chambers and those used in oil-based applications when ordered specifically with Buna seals.

EPDM (Ethylene Propylene Diene Monomer)

EPDM, commonly known as ethylene-propylene rubber, is an olefinic thermoplastic elastomer with good temperature performance and good compression and tensile set. This elastomer has good abrasion and tear resistance while offering excellent chemical resistance to a variety of acids, alkalines, alcohols and oxidizing chemicals. However, it is susceptible to attack by oils. The maximum service temperature of EPDM is 250°F (121°C). EPDM has a low specific gravity, usually 0.8 to 1.0, and consequently offers low part weight.

Viton® (Vinylidene Fluoride - Hexafluoropropylene) Fluorocarbon

This fluoroelastomer provides chemical resistance to a wide range of chemicals, concentrations and temperatures involving mineral acids, salt solutions, chlorinated hydrocarbons and petroleum oils. Although its chemical compatibility to most acids is excellent it can be mechanically swollen by some. In such cases Plast-O-Matic uses a specially cured Viton to reduce the swell factor encountered with standard Viton-A. The maximum service temperature of Viton is 300°F (149°C).

Teflon PTFE (Polytetrafluoroethylene)

Teflon is not an elastomer but has superior qualities for use in plastic valves as a diaphragm or bellows seal. Teflon shafts in conjunction with elastomer seals are also used successfully in Plast-O-Matic products. The most prevalent use of Teflon is in the ball valve, where the sealing "seats" are Teflon (backed with elastomer seals) and various bearings etc. are Teflon. In addition to chemical inertness and exceptionally low coefficient of friction, Teflon provides non-sticking, long cycle life capabilities.

Fluorosilicone Rubber

This elastomer is noted for its retention of flexibility, resilience and tensile strength over a wide temperature range. It is not, however, noted for its chemical resistance.

Kalrez® & Chemraz® (Perfluoroelastomer)

This elastomer combines the chemical resistance of Viton and Teflon, making it far superior to most other elastomers. However, because of its high cost it is only used where absolutely required. It is only available in O-ring and sheet form so it cannot be used with all valve designs.

Aflas® TFE (Tetrafluoroethylene/propylene dipolymer)

Is an alternative to perfluoroelastomers in many applications. It offers excellent chemical and electrical resistance, and service temperatures to 400 degrees F (204 C) It is especially resistant to newer specification automotive lubricants, battery acids, jet and rocket fuels, oilfield applications, and more. The most common use in plastic valves is in ozone water treatment systems, where it is excellent.

Other materials found in plastic valves

While valve bodies are generally either thermoplastics or fluoroplastics, and seals are generally thermoplastic elastomers, many plastic valves use metals in some fashion. In a properly designed valve, these metals have no contact with process media and minimal external exposure. Valve bodies that are not threaded together require a fastener of some type; the best combination of strength and resistance is a stainless steel fastener. In many cases valve bodies are threaded together to eliminate the need for external fasteners, but in certain types of valves the fastener improves the design via added strength and rigidity. Pressure valves, for instance, tend not to perform as well if the body is threaded from two separate parts (note that Plast-O-Matic's pressure valves without fasteners have a unibody design and use separate parts specifically for threading).

Springs are used in fail-safe and automatic pressure valves (relief valves, pressure regulators, etc.) and are generally some type of steel; often stainless steel or other steel, determined by the spring rate and other specific properties required by the valve design and function.

Solenoid Valves use many other materials. In a good plastic valve design, these materials are intentionally isolated from any contact with liquid (unless specified in the design) but can have exposure to atmosphere. Solenoid core tube parts frequently include stainless steel, stainless steel with some ferrous properties, sometimes copper, silver, and other metal parts. Solenoid coils are generally some type of polyester and another plastic material. Some solenoid coils have metal housings. It is important to check the specifications for each valve to ensure that materials are compatible with your process and/or environment.

Acrylics are used in valve and piping components design where visual verification is desired. Sight glasses and level indicators use acrylic and many shutoff valves also use acrylic. It offers excellent abrasion resistance, and excellent optical quality. It also resists UV light.

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SOLVENT CEMENTING

DANGER: PRIMER AND/OR SOLVENT CEMENT/GLUE USED IMPROPERLY WILL PERMANENTLY DAMAGE A PVC OR CPVC VALVE.

1. **DO NOT** allow primer and/or solvent cement to touch any area other than the piping socket.
2. **USE OF EXCESSIVE AMOUNTS** may run, drip or otherwise enter sensitive working parts of the valve.
3. **THE PROCESS OF CONNECTING THE PIPE OR FITTINGS** may squeeze excess solvent cement into the valve body, which will damage the valve.
4. **FOLLOW THE INSTRUCTIONS** provided with the primer and/or solvent cement or adhesive, as well as ASTM standard D2855-96.
5. **DO NOT USE** a valve damaged by solvent cement.

Plast-O-Matic Valves, Inc.
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Application Briefs

The Plast-O-Matic Quality Assurance Team turns an angry customer into a satisfied -- and very thankful -- customer.

A leading international semiconductor manufacturer recently cut out and sent a section of pipe to Plast-O-Matic complaining of a leaking check valve, pointing to cracks on both the inlet and outlet. Cracked ports on a new valve generally indicate that the installer used a pipe wrench or channel locks, where only a strap wrench should be used. With tell-tale teeth marks on a nipple, it initially appeared that overtightening was the cause.

In this particular case, inspector Ron Cline found an unusually high number of cracks...not only on the Plast-O-Matic check valve, but also on other valves and fittings in the pipe section. Ron turned his findings over to Greg Michalchuk, Plast-O-Matic's Quality Assurance Manager, who immediately discounted excessive elbow grease:

"If a crack develops in a PVC part due to radial stress, the crack widens under load, but usually no additional cracks develop," Greg explains. If an additional crack were to develop, it would most certainly not form within such close proximity to the others.

A liberal amount of thread sealant was cause for suspicion. At this point, Plast-O-Matic Vice President-Sales Bob Sinclair and Technical Sales Manager Andy Ryan got involved and called our regional representative, Jim Pringle, to investigate further. The customer explained that the contractor was using Swak® anaerobic thread sealant throughout the piping system. A call was made to Swagelok Corp. to obtain a Material Safety Data Sheet, known as an MSDS.

Two ingredients in Swak were immediate suspects: A dimethylacrylate (30 - 40%) and Propylene Glycol Azelate (20 - 30%). A spokesperson from Swagelok immediately confirmed that Swak is an excellent sealant for stainless steel piping, but incompatible with PVC!

The customer had many of these subassemblies in-line, and in a semiconductor fab the potential loss was staggering. Proper installation techniques were used for the rest of the job, and the parts installed using the incompatible sealant were replaced prior to certain failure.

Because of Plast-O-Matic's team effort to find the true cause of the problem, an angry customer was turned into a thankful one.

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Vacuum Breaker Solves IBC Leak Problem

.... Beneficial for All Types of Storage Tanks

Cedar Grove, New Jersey USA & London, England- Intermediate Bulk Storage Containers (IBC's) are commonly used in Europe to transport chemicals to companies which have minimal on-site requirements. Vacuum breakers are used on the tanks to prevent implosion during drainage, yet must not allow fumes to escape from the tank.

A leading U.K. manufacturer of 1000 litre IBC's was experiencing problems with a spring-operated vacuum breaker. The spring design did not provide an effective seal and permitted fugitive emissions. The problem was most significant during transport, when sudden motion resulted in severe product leakage. Because the IBC manufacturer's largest customer was primarily shipping a solution of 36% hydrochloric acid, the situation was critical.

The company tested a number of vacuum breakers, but was unsatisfied until finding a U.S. manufactured product from **Plast-O-Matic Valves, Inc.,** based in Cedar Grove, New Jersey. The **Plast-O-Matic True-Blue** Vacuum Breaker, with a one-of-a-kind elastomeric diaphragm, was the only corrosion-resistant device able to meet the design criteria: Prevent tank implosion, yet remain sealed in all other situations regardless of motion or mounting position.

Patented Diaphragm

The diaphragm in the **Plast-O-Matic** vacuum breaker creates a bubble-tight seal, and sealing is unaffected by motion or direction. Installation at the highest location in a tank is recommended. After breaking a vacuum, the patented design causes the diaphragm to reposition and close in an identical location - a quality known as "positive repetitive sealing" - which means that it will prevent emissions and leaks throughout the life of the IBC.

To maintain the bubble-tight seal, the **True-Blue** Vacuum Breaker requires a minimum vacuum of at least 2" Mercury (1 PSI) to open, which is well within the maximum negative pressure of 10" of Mercury for an IBC. The flow rate of the vacuum breaker at 10" of Mercury is 50 cubic feet of air per minute. For tanks that can withstand 20" of Mercury, the flow rate is 95 cubic feet of air per minute. The breakers are manufactured in PVC, Polypropylene, Kynar® (PVDF) or Teflon® (PTFE) and fulfill the need for corrosion resistance in chemical IBCs.

After reviewing case histories of the **Plast-O-Matic** vacuum breaker in other tank applications, the IBC manufacturer tested and soon specified it into the product line. Since the switch, the emissions and leaks have been eliminated.

Useful in Many Tank Applications

Plast-O-Matic's vacuum breakers are designed to protect many different types of tanks and storage vessels from collapse or structural damage during draining or pumping, as well as to prevent liquids from siphoning back into a tank. In one popular tank design, the breaker prevents liner separation It is also used in large underground storage systems, where the **True-Blue** Vacuum Breaker is installed in an above-ground housing and connected to the tank or cavity via piping. The breaker is surprisingly compact, in pipe sizes from 1/2" to 1" npt with total height ranging from 4.3" to 5.1". Maximum working pressure is 6,9 bar @ 24ºC (100 PSI @ 75ºF).

A special cap protects the **Plast-O-Matic** vacuum breaker, by preventing foreign matter from entering the valve. It is also designed to minimize the "whistling" commonly associated with these devices. But for tank manufacturers and system designers - who know that vacuum conditions can wreak havoc - a little whistling is music to the ear!

* * * * * * * *

Sight Glasses Provide Leak Monitoring in Dual Containment Piping System

... Beneficial for Liquid & Gas Pipelines

Cedar Grove, New Jersey & Odessa, Texas--To satisfy a need for visual monitoring of leakage in dual containment systems, a petroleum plant has installed a series of **Plast-O-Matic's** "sight glasses" in its diesel fuel piping. The devices, which are simpler and less expensive than other monitoring methods, provide instant visual confirmation of a leak in the primary pipeline.

The Sight Glasses are installed on 1/2" connections at key points in the bottom of the outer containment pipe. In the event of a leak, the fuel will collect at the lowest point--the sight glass--and raise a day-glo float in the chamber. As the brightly colored float rises above a blackened portion of the sight glass, it creates instantly recognizable visual confirmation of the problem.

Constructed of corrosion-resistant Pyrex® on the inside wall and high-impact acrylic on the outside, the **Plast-O-Matic** sight glass meets the need for for dual containment throughout the system. O-rings allow the indicators to seal at low pressure as well as high pressure, an attractive feature for dual containment systems. A full 360° viewing area in the sight glass permits inspection from anywhere near the piping.

Useful in Many Applications

Plast-O-Matic's sight glasses are designed to give instantaneous visual confirmation of pipeline flow. In another application, the sight glass is installed directly in a soil remediation system, where streamers within the chamber flutter when flow is present. It is also frequently used to visually confirm the presence of a process additive; in these cases the sight glass is installed downstream of an injection system. The sight glass is surprisingly rugged, and is available in pipe sizes from 1/2" to 8" npt. Standard O-ring seals are of Viton or Buna-N.

The sight glasses, from **Plast-O-Matic's** **True-Blue** line, are manufactured with PVC, Corzan® CPVC, Polypropylene, Kynar® PVDF or Teflon® PTFE ends.

CKS Replaces Ball Check in RO Water System

A flexible circuit manufacturer in Chandler, Arizona was having a problem with backflow from a large reverse osmosis water storage tank.

In this application, water is fed from a degassifier (removes air bubbles) into a 1 hp, 30-50 GPM pump. The pump is used to push the RO water approximately 30 feet up a 2" vertical pipeline into a large storage tank. To prevent backflow and siphoning when the pump was off, a check valve ws

installed 8 feet high on the vertical pipeline.

Unfortunately, a ball-type check valve was specified. According to Joe Ujvari, Ryan Herco, Tempe, "The typical ball check would never create a positive seal on the vertical column up to the top of the storage tank". He explains that the lack of a positive seal would cause water to back up and flood the reservoir coming out of the degassifier.

When the electronics firm called Joe in to troubleshoot the system, he turned to Plast-O-Matic's Series CKS Check Valve. Designed with a special Teflon® encapsulated spring (not a "coated" spring), the CKS provides a bubble-tight seal without compromising the ultrapure requirements of the application. Unlike ball-type check valves, the CKS does not require back flow to close - it automatically seals bubble tight with merely the absense of inlet pressure.

Water Utility Problems Solved in Florida

by Mike Johnson, Harrington Industrial Plastics, Jacksonville

The Jacksonville Electric Authority provides electric, water, and sewer utility services. The city uses sodium hypochlorite in lieu of traditional gas chlorination to disinfect the water supply.

In several applications, they use a brine solution to generate their own sodium hypochlorite. This generator process involves mixing sea salt with soft water to create a brine solution, which is then electrolyzed and produces a dilute chlorine solution.

The original construction used common metal solenoid valves for the soft water make-up lines to the fiberglass brine tanks. After just six months of operation, one badly corroded metal valve stuck in the energized open position which caused a tank overflow.

When the plant maintenance crew called Harrington Industrial Plastics for help, we recommended **Plast-O-Matic** non-metallic **EASMT** direct acting solenoid valves to solve the problem. They have since replaced the water make up valves on all four tanks with **Plast-O-Matic**.

While working in the plant we were approached with another challenge. They had PVC ball check valves in a horizontal line of diluted brine solution which would not check when the line depressurized. Due to the close tolerances of the piping system, it would prove difficult to re-install another type check valve in the same position without doing substantial re-piping. Enter the **Plast-O-Matic CKM**. Because of the **CKM's** unique design, it could be installed downstream in a vertical, north to south flow orientation and still provide reliable checking. The original check valve was left in position (minus the ball) and the newly installed **Plast-O-Matic** check valve is working great! The **CKM** was soon retrofitted on each of the generator skids.

Jacksonville also installed numerous **GGMT** Gauge Guards on filtration units added during the plant upgrade. Plant maintenance then replaced several corroded gauges with **Plast-O-Matic GGMT's** and added **RVDT** back pressure regulators at the feed pump.

Schedule 40/Schedule 80 Comparison

Tested at 73° F:			
	Sch. 40	**Sch. 80**	**% difference**
Max. Working Pressure	300 psi	470 psi	42 %
Short-Term Collapse Pressure	356 psi	927 psi	160 %

Resistance to Load (uncompacted soil)	1084 lb/ft	2809 lb/ft	159 %
Wall Thickness	.145"	.200"	38 %

This chart is only a general guideline, based on laboratory conditions. In real applications, systems vibrate, UV rays affect performace, temperature fluctuates....these and a myriad of other everyday conditions will adversely affect plastic piping.

As temperatures rise, the plastic softens. As temperatures decrease, plastic becomes brittle. Ultravilot rays (sunlight) slowly degrades the molecular structure of most plastics. Vibrations create inherent stresses, which can lead to cracking.

UV Stabilized Valves

PVC and Polypropylene valves are highly weather resistant, but will become oxidized after extended exposure to ultra-violet light. UV rays affect valves by degrading the molecular structure of the polymer.

The degree of oxidation is dependent on the level and intensity of exposure: In sunlight, oxidation can take a number of years and will result in discoloration and embrittlement. This does not affect performance or pressure capacity - so you may not have a problem - but it does make the valve vulnerable to impact damage.

When a PVC or polypropylene valve is connected to a UV sterilizer the level of exposure is much greater, and the thermoplastic is eventually prone to stress cracking. For UV sterilizers, PVDF is generally the valve material of choice and is not subject to the same type of degradation.

In outdoor applications, heavily pigmented common latex paint will inhibit the damage from sunlight. In some situations, however, painting may not be practical. In polypropylene applications, paint does not properly adhere to the thermoplastic. PVDF may not be cost-effective or desired in certain applications as well.

Plast-0-Matic now offers UV-Resistant thermoplastics as an optional valve material for applications exposed to UV where paint or PVDF is not practical. Manufactured from Grade 1, Type 1 PVC or polypropylene with added carbon black, these valves generally withstand UV exposure with less oxidation and molecular degradation.

The added carbon black effectively blocks the UV component, and allows the valve to maintain its properties even in installations with high UV exposure.

UV-resistant PVC or polypropylene eliminates the need for paint and other costly maintenance techniques, yet costs only slightly more than standard resins.

The UV-Resistant feature is available on most popular Plast-O-Matic valves up to 2" pipe sizes. Minimum quantities apply and these materials may not be practical in every situation with UV exposure. To determine the best solution for your specific application, contact our Technical Sales Team in Cedar Grove at 973-256-3000.

Case History: Pilot Solenoid Valves at Bremerton Public Works

The City of Bremerton, Washington needed to build a system to bring its pH levels in line with the Lead and Copper laws, with the flexibility to compensate for a variety of water sources.

Dealing with pH levels below neutral, the Engineering Division of Bremerton Public Works and Utilities had to provide a system for injecting caustic soda into the water main. "We deal with a number of different sources," explains Tom Knuckey, head engineer, "a few surface water sources, supplemented by some wells, so the pH varies."

To compensate for the fluctuation, a pair of 4,000 gallon tanks with a series of metering pumps and analyzers allow the caustic soda to be diluted when the water supply is closer to neutral. "It may start at full strength, then go to 50% strength, 25%...whatever is needed," explains Knuckey.

The system design called for precise dosing into the pipeline from a pair of valves controlled by pH sensors upstream and downstream of the treatment point. The 30 PSI backpressure created by the city water main was a primary concern. The valves specified would have to open and close accurately against the high backpressure, and resist corrosion from the sodium hydroxide.

Overcoming the corrosion problem was relatively simple; thermoplastics would provide significantly better performance than metals. Of the common plastic valve materials, polyvinylchloride (PVC) was selected for its compatibility and relatively low cost. At that point, the possibilities covered a wide range of valve styles and actuation package combinations.

For speed and dosing accuracy, solenoid valves were the most likely candidates. The main pipeline, however, posed a problem since most standard 1" pipe size PVC solenoid valves cannot actuate against 30 psi backpressure a deliver a high flow rate.

While searching for a solution, Bremerton Public Works contacted Plast-O-Matic Valves, Inc. of Cedar Grove, New Jersey. Plast-O-Matic, one of the longest established plastic valve manufacturers, suggested a solenoid valve with a "pilot" orifice. Known commonly as a "pilot-operated" solenoid valve, it uses a standard sized coil to first open and close against a small amount of flow. The line pressure, in turn, is used to actuate a much larger main orifice. The pilot design is slightly slower than a direct-acting solenoid valve, but is able to provide excellent flow capacity with relatively high pressure. The split-second hesitation inherent to the pilot provides the added benefit of virtually eliminating the water hammer that an instantaneous solenoid valve might cause.

The valve specified, Series PS from Plast-O-Matic, offers flow capacity from 5.2 Cv to 80 Cv depending on size. The design provides an inlet pressure rating to 140 psi and backpressure to 70 psi. A pressure differential of 5 psi is required for the valve to operate properly. In the Bremerton installation, a 1" valve was specified, which provides a Cv of 9.5. The Series PS also offers a number of appealling safety features to the public works team: It provides a patented "Fail-Dry" safety vent, which allows the valve to continue operation in the event of a primary seal failure. The PS also has a Teflon bellows dynamic seal, offering the ultimate protection against fugitive emissions.

To further enhance the accuracy of the system, Knuckey's crew also specified a corrosion-resistant back pressure/relief valve from Plast-O-Matic. Known as the Series RVDT, these valves provide a constant backpressure on the discharge of the caustic soda metering pumps. This allows for a repeatable, constant fluid discharge per stroke, and enhances the system accuracy.

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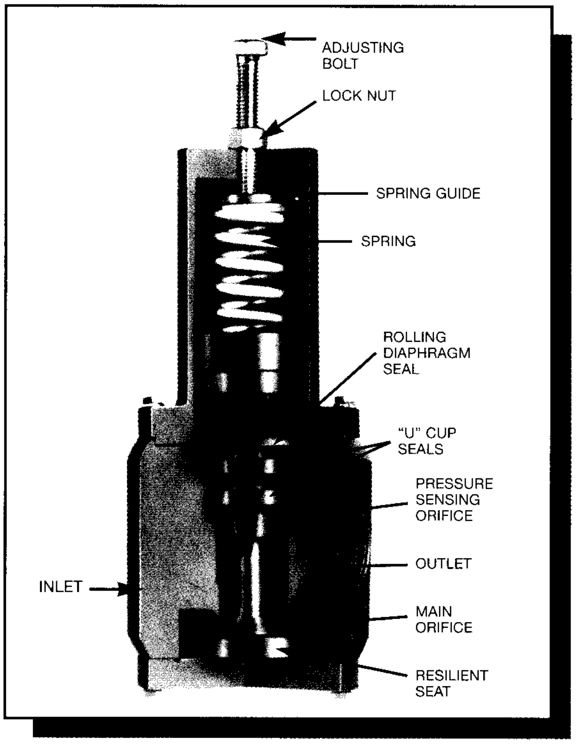
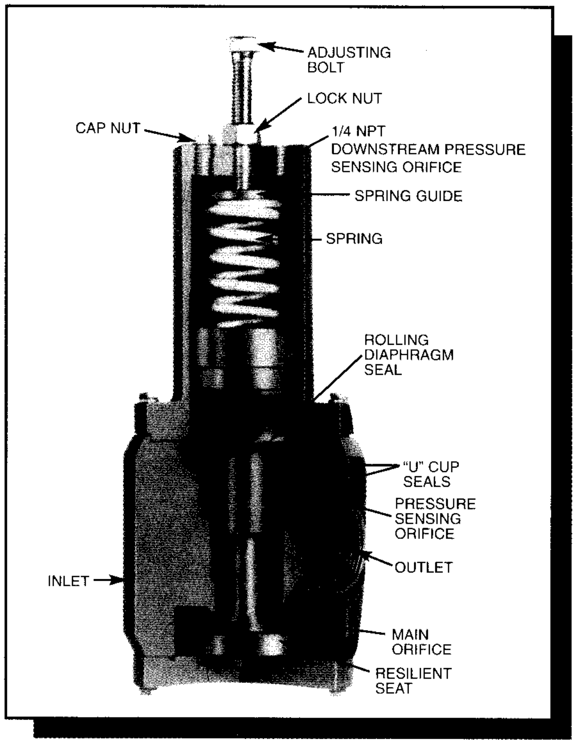
The What, How, Where and Why of Pressure Regulators

(AKA Pressure Reducing Valves)



PRESSURE REGULATOR



DIFFERENTIAL PRESSURE REGULATOR

I. WHAT styles are available?

A. Standard/low pressure set (5 - 50 PSI) **Series "PR"**

B. High pressure set (30 - 125 PSI) **Series "PRH"**

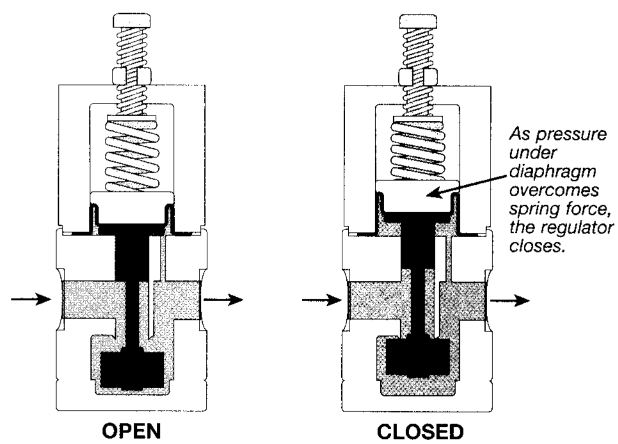
C. Compact, lower flow-pressure set (10 - 125 PSI) **Series "PRE"** (3/4" and 1" only)

D. Pressure differential regulator (5 - 70 PSI) **Series "PRD"**

II. HOW do they operate?

A, B & C: These styles are *normally open* and respond to downstream (outlet) pressure. A small orifice at the outlet of the valve (called the "sensing orifice") allows liquid up under a large area rolling diaphragm. This causes the rolling diaphragm to sense - and react to - the downstream (outlet) pressure. The valve seat, shaft and piston are all attached to the sensing diaphragm. As the force (force = pressure x area) sensed under the rolling diaphragm becomes less or greater than the spring force, it causes the regulator seat to move toward the full open or full closed position.

The pressure setting is done manually by turning the adjusting bolt clockwise to raise the pressure setting and counter-clockwise to lower it. This varies the compressive force of the internal spring, pushing the seat away from the regulator's orifice. The more it is compressed, the higher the set pressure will be. When the downstream pressure reaches the pre-determined set pressure, the force created by the downstream pressure beneath the rolling diaphragm is greater than the force exerted by the spring and the seat rises to and seals against the orifice, closing the regulator.



PLAST-O-MATIC VALVES, INC.
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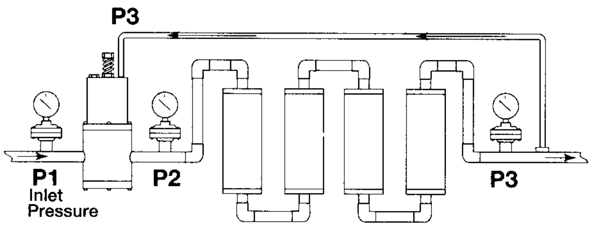
D. Pressure differential regulators sense the difference between the pressure into and out of a piece of equipment and adjust their opening such that the pressure differential across the equipment will not exceed the regulator's setting. The operation of a pressure differential regulator is similar to a pressure regulator, except that a sensing line (capillary tube) is connected from the downstream side (P3) of the piece of equipment being protected to the spring chamber of the pressure differential regulator.
(Refer to illustration)



Schematic of typical filtering system with Plast-O-Matic Differential Pressure Regulator

Take for example, the bank of filters shown above. The filter manufacturer rates their product for a maximum pressure drop of 20 PSI. When the filters are "clean", we would like to get as much flow through them as possible, but as they become "dirty", we want to limit the ΔP to 20 PSI, the manufacturer's rating.

As you see from the performance test data below, the pressure differential regulator is fully open allowing maximum flow (77 GPM) when the filters are clean (ΔPD = 2). At this point, the piping downstream of the filters is the main restriction in the system (ΔP across filters is low, and P3 is high). As the filtering system begins to collect more sediment, it obstructs and lessens flow (GPM) and the pressure (PSI) at P3 drops. When the filters are significantly clogged, the flow drops to 27 GPM. The filters are now the main restriction in the system. The ΔP or pressure differential is now 16 PSI across the filtering system but is still below the set pressure of 20 PSI.

PERFORMANCE TEST DATA
1½" Series PRD150B-PV

Inlet Pressure (PSI)	Set Pressure (PSI)	P2 Pressure *(before filters)* (PSI)	P3 Pressure *(after filters)* (PSI)	Flow Rate (through filters) (GPM)	ΔP Pressure (drop across filters) (PSID)
75	20	22	20	77	2
80		23	19	72	4
85		22	13	61	9
100		18	8	49	10
116		18	2	27	16

III. WHERE would I use a Pressure Regulator?

A, B & C: Typically, pressure regulators are specified wherever systems, equipment and/or components need to be protected from pressures higher than they are rated for (i.e. filters, membranes, control sensors, etc.). If the pressure at the equipment/components reaches the regulator's setting, the regulator will close (bubble-tight, no "creep") preventing an increase in pressure and possible damage.

NOTE: Pressure regulators should not be confused with pressure relief valves in system, equipment and/or component protection. For discussion of these valves, please refer to *"The What, How, Where and Why of Relief Valves"*.

D: Wherever pressure drops across a component (i.e. filters) must not exceed a pre-set value.

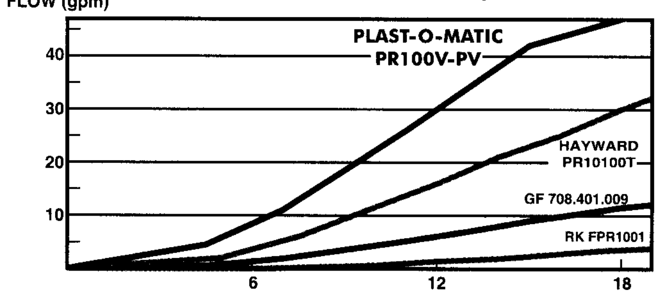
IV. WHY would I use a Regulator versus some other comparable function valve?

Generally speaking, the only other style valve used to control varying upstream pressures to a predetermined maximum downstream pressure is either an air-operated 3 to 15 PSI or 4 to 20 milli amp electrical control valve. These alternatives, however, require various accessory items (transducers, positioners, air regulators, filters, lubricators, etc.) for their operation and are considerably more expensive and complex.

Pressure regulators are most popular due to their compact size, ease of setting/readjustment, repeatability, and self contained operation.

Special caution must be used, however, in the proper sizing of pressure regulators since there are *considerable differences* in both flow capacity and pressure drop-off values amongst identical sizes of competitive models. The following graph provides ample evidence (1" size) of the variances that can seriously effect the ultimate performance of one's systems, equipment, and/or components.

COMPARISON OF 1" PRESSURE REGULATORS PERFORMANCE CURVES
Flow Capacity vs. Pressure Drop-Off



DROP-OFF FROM SET PRESSURE
(Difference Between Set Pressure and Actual Downstream Pressure)

For further assistance with your specific application involving pressure regulators, contact our Technical Sales Department.

PLAST-O-MATIC VALVES, INC.
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The What, How, Where and Why of Solenoid Valves

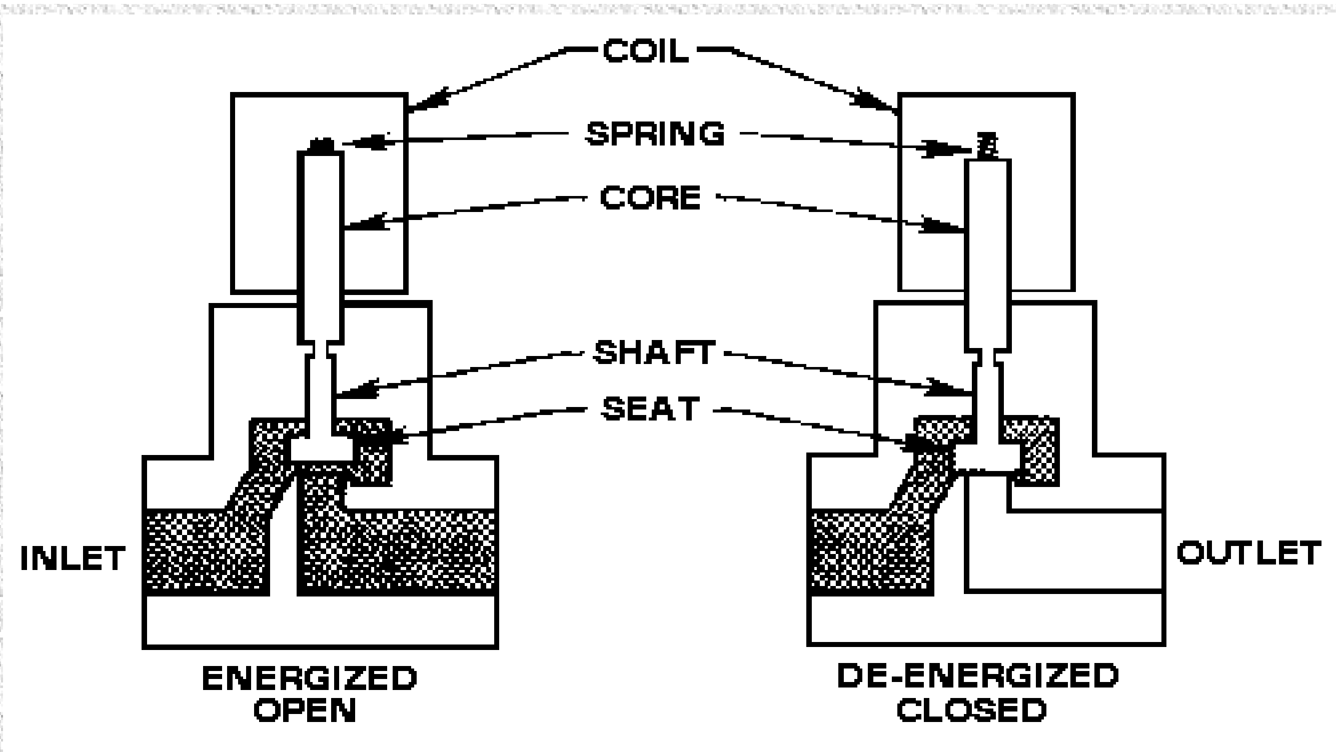
I. WHAT styles of solenoid valves are available?

A. Direct-Acting Solenoid Valves - Direct-Acting Solenoid Valves open and close regardless of the pressue and flow: so long as the published maximum inlet and back pressure are not exceeded.

B. Pilot-Operated (Servo-Assisted) - In Pilot-Assisted Solenoid Valves, a minimum inlet pressure/differential pressure (typically 5 PSI) is required for the valve to operate.

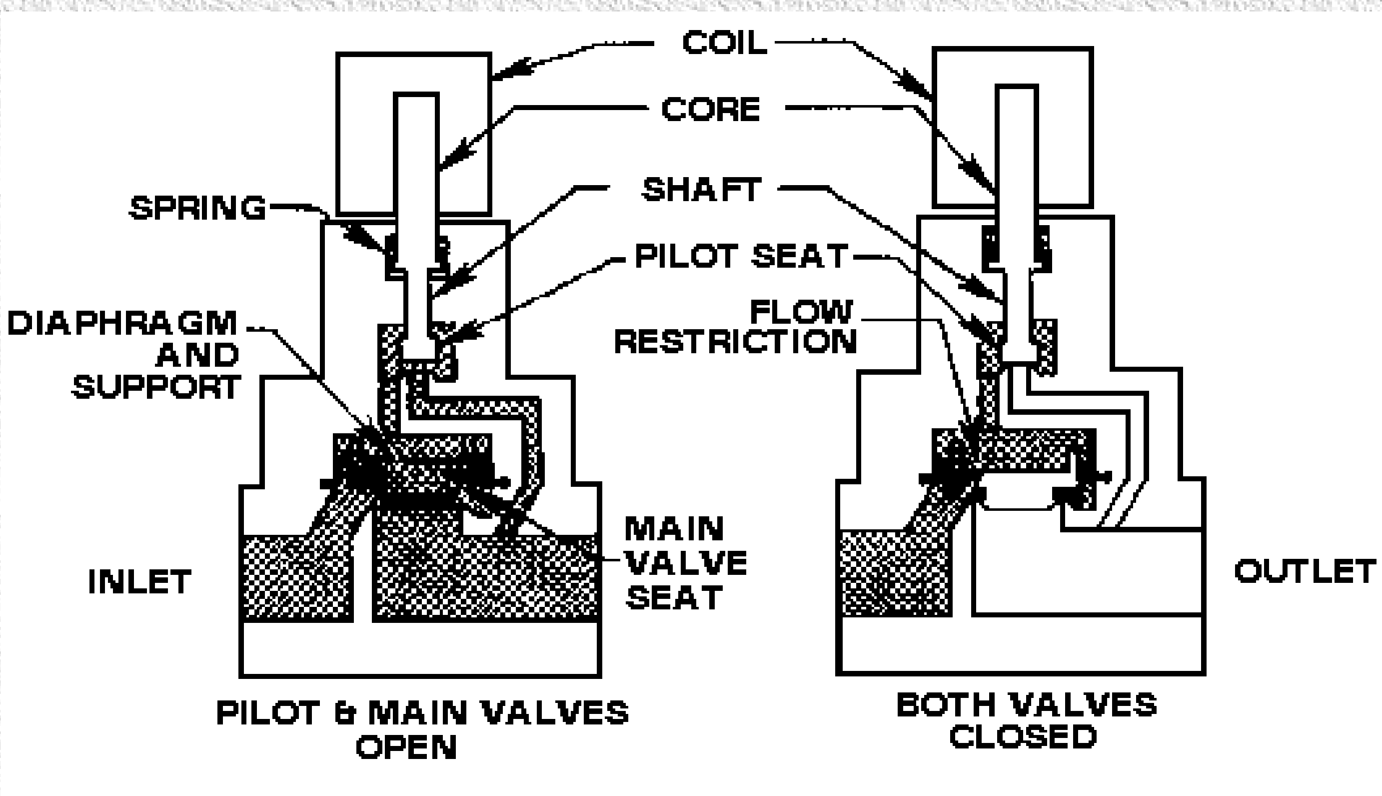
II. HOW do they operate?

A. Direct-Acting - In Direct-Acting Solenoid Valves the energized coil magnetically pulls-up on the core, which is attached to the shaft and seat, thus overpowering the spring and opening the valve orifice. For closing, the coil is de-energized and the spring now pushes the core, shaft and seat back to the normally closed position. This style valve does not require any minimum line pressures nor differentials to operate. (See below)



Examples of Direct-Acting Solenoid Valves include Plast-O-Matic Series EASYMT/EASMT, EAST, EASYM, EASM, EASTMD/EASMD and EUC Models.

B. Pilot-Operated (Servo-Assisted) - These valves have a pilot valve seat with corresponding orifice, a main valve seat with corresponding orifice and a main valve diaphragm with a restriction orifice. The upper section of the valve consists of the pilot seat and orifice which is actually a small direct-acting solenoid valve. (see below)



The lower section of the valve consists of the main valve seat and orifice which is sealed by a diaphragm that allows liquid line pressure to pass thru a restriction orifice thus pressurizing the valve's upper pilot area (that area above the diaphragm and below the pilot seat). This pressure exerts a downward force on the top-side of the main diaphragm keeping it in the closed position. To open the main valve, the coil is energized, lifting the core, shaft and seat off the pilot orifice, allowing the pressure above the diaphragm to vent thru the pilot outlet to the down-stream side of the main valve. With no force now working in the top-side of the main diaphragm, the inlet line pressure lifts the diaphragm and opens the main orifice allowing full flow. To close the valve, the coil is de-energized and the spring pushes down on the core, shaft and seat, closing off the orifice, thus stopping the venting of the pressure, and therefore, re-pressurizing the top-side of the main diaphragm which causes it to close against the main seat to stop flow.

The new Plast-O-Matic Series "PS" is a Pilot-Operated Solenoid Valve.

III. WHERE would I use a Solenoid Valve?

Typically, Solenoid Valves are specified where:

A. Speed of cycling/operation is required.

B. A fail-safe (normally closed or normally open) bubble-tight sealing valve is required.

C. Physical size (and weight) requires a smaller valve.

D. Lower cost is required.

Keep in mind that solenoid coils are available in a variety of voltages, frequency and class ratings.

IV. WHY would I use a Solenoid Valve versus a Motorized Ball Valve?

A. Speed of Operation - Generally speaking, motorized ball valves have a cycle time of 5 to 6 seconds (full open to full closed) which is nowhere near a fast-acting as a direct-acting solenoid valve at approximately 30 to 40 milliseconds. Therefore, in applications requiring speed of cycling (such as PH control via electronic sensors) to prevent overshooting of chemicals. fast acting solenoid valves are perferred. Although pilot-operated solenoid valves (approximately one second closing time) are not as fast-acting as direct-acting valves, they are still considerably faster than motorized ball valves.

B. Fail-Safe Design - Motorized ball valves are not normally of fail-safe design. Yes, they can be made fail-safe but require a cumbersome and very costly add-on accessory, which is simply not practical. Conversely, solenoid valves are normally of a fail-safe design.

The What, How, Where and Why of Relief Valves

I. <u>WHAT</u> styles of Relief Valves are available?

A. In a shaft design (Series RVT), a non-sticking solid Teflon® shaft passes through three (3) U-cup seals which effectively isolates the liquid from the spring. An elastomer seat at the end of the shaft seals across the valve orifice.

B. In a diaphragm design of either PTFE Teflon® or an elastomer the diaphragm becomes both the seal isolating the spring as well as the seal across the valve orifice.

Angle (90°) Porting Refief Valves have historically been the most popular design. Design and performance are the same. The benefit of a 90° angle pattern would be for simplifying the piping scheme by using the Relief Valve body in lieu of a 90° elbow. In-line valves can be installed anywhere in a straight piping run.

II. <u>HOW</u> do they operate?

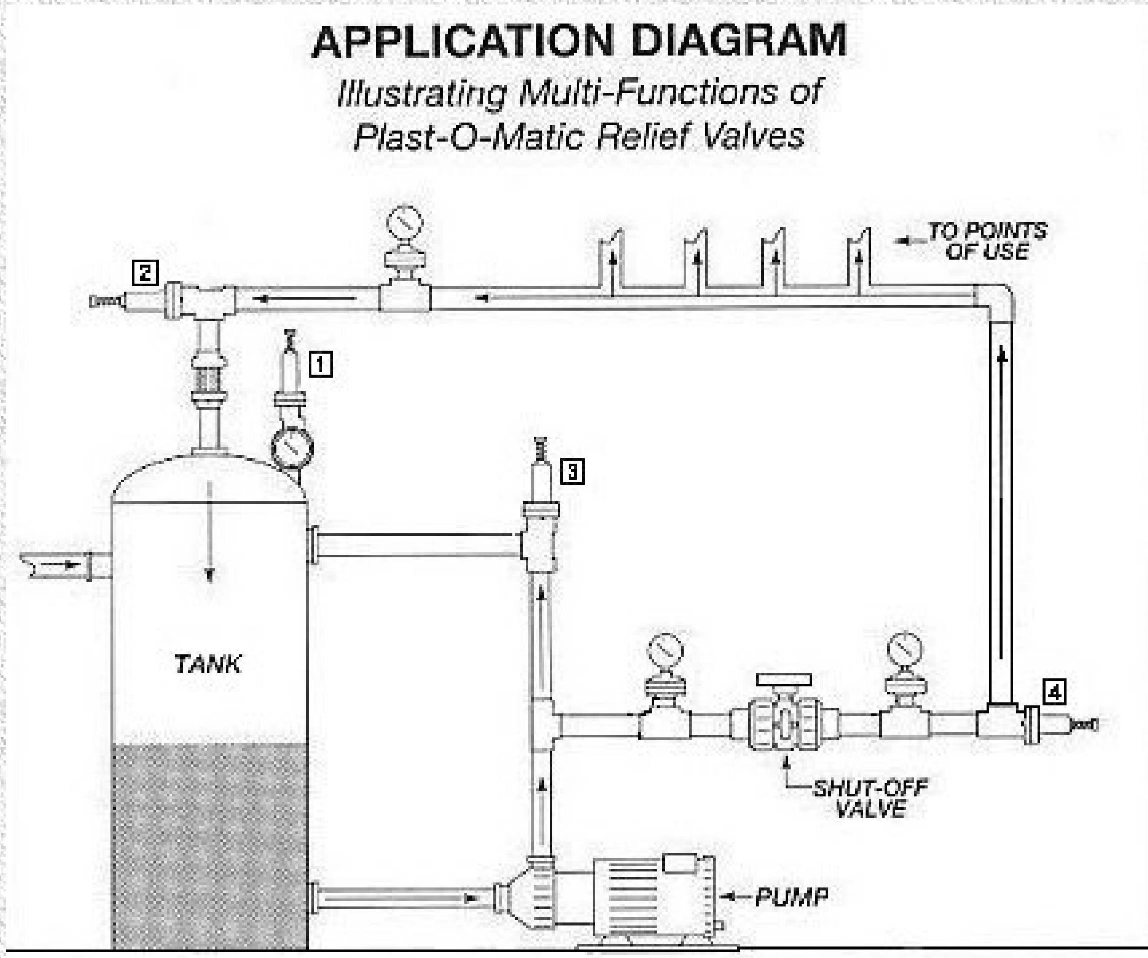
All styles are *<u>normally-closed</u>* and begin opening once the set pressure is reached. They use spring force to push down upon a shaft or diaphragm. The pressure setting is done manually by turning the adjusting bolt clockwise to raise the pressure setting, and counter-clockwise to lower it. This simply varies the compressive force of the internal spring across the valve orifice. The more it is compressed, the higher the set pressure will be.

When the inlet pressure reaches the set pressure the force created by the inlet pressure is equal to the force exerted by the spring and liquid begins to trickle through the valve. As inlet pressure continues to increase the valve opens further, allowing more flow.

<u>CAUTION:</u> The RVT, RVD, RVDM, and RVDT series are *NOT "POP SAFETY"* valves and should not be used in applications requiring such valves.

III. <u>WHERE</u> would I use a Relief Valve?

In addition to relieving excess/dangerous pressure from closed-top vessels or piping systems these *normally-closed* valves provide system control benefits as shown. Depending upon the function performed they are given different names.



1. - **"Pressure Relief Valve"-** to protect a system (e.g. pump, pipe segment or tank) from excessive pressure (in excess of the set point).

2. - **"Back Pressure Regulator"-** to provide a means of retaining desired system pressure to points of use in upstrean line(s).

3. - **"Pressure By-Pass Valve"-** to protect a pump from 'dead-heading' by enabling the flow to by-pass an obstruction.

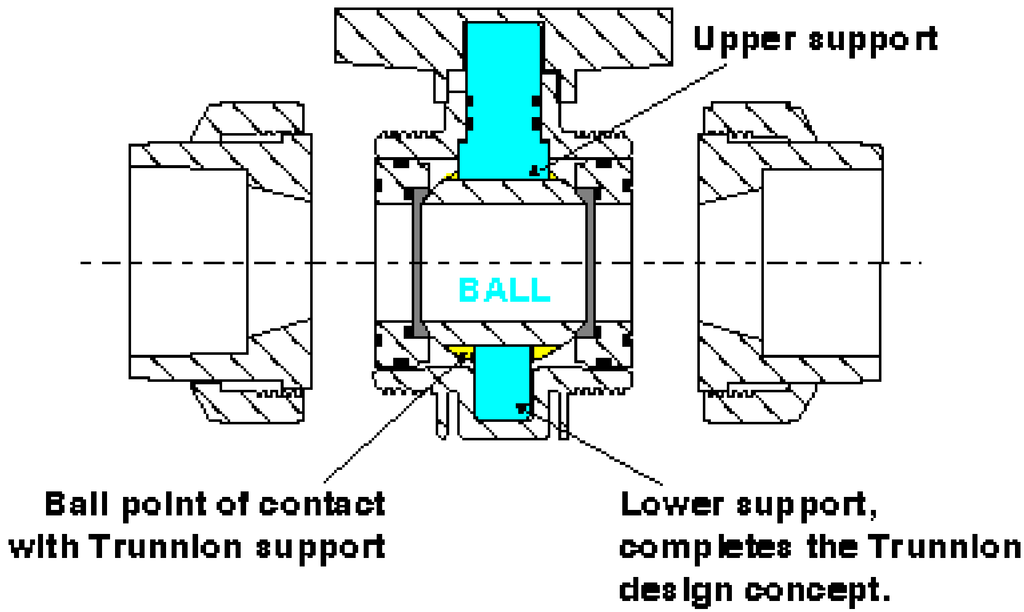
4. - **"Back Pressure Valve"-** to provide back pressure directly on the discharge of a pump to enhance its performance.

5. - **"Anti-Siphon Valve"-** (not depicted in illustration) to prevent unwanted chemical siphoning through a pump; when negative pressure at a lower elevation could create a siphon and drain a tank. The valve is set to open at the desired pumping pressure, but seals tightly when a vacuum occurs downstream.

IV. WHY would I use a Relief Valve versus some other comparable valve?

As shown in the application diagram above, this is a very versatile and widely utilized valve. Its compact size, ease of setting and re-adjustment and repeatability, all contribute to its popularity. There are Air-Loaded (aka. Dome Loaded) Relief Valves selectively available but require numerous accessory items (air regulators, filters, lubricators, etc.) for their operation.

Trunnion Design Explained...



Trunnion Design is simply the use of upper and lower supports to retain the ball under pressure. Named for the "trunnion" historically used to support a cannon, a ball valve trunnion essentially **doubles** the safety and usability of a ball valve.

The trunnion feature is common to many better quality metal ball valves, but in plastic, is found only on Plast-O-Matic True Blue brand ball valves. It permits the valve to be installed in either direction, since the trunnion prevents the ball from shifting -- or worse, blowing out -- under pressure.

This feature, and that the valve can be piped in either direction, leads to the concept that the True Blue Ball Valve can indeed be used in applications with reversing flow.

Another important benefit of the trunnion design is that it allows the True Blue Ball Valve to act as a *true* union: The downstream piping can be disconnected under full upstream pressure (user is responsible to ensure that downstream piping is drained of liquid and that valve is indeed closed and secured to upstream piping). Many plastic ball valves claim to be "true union" because of their union fittings, but cannot indeed be disconnected in this manner.

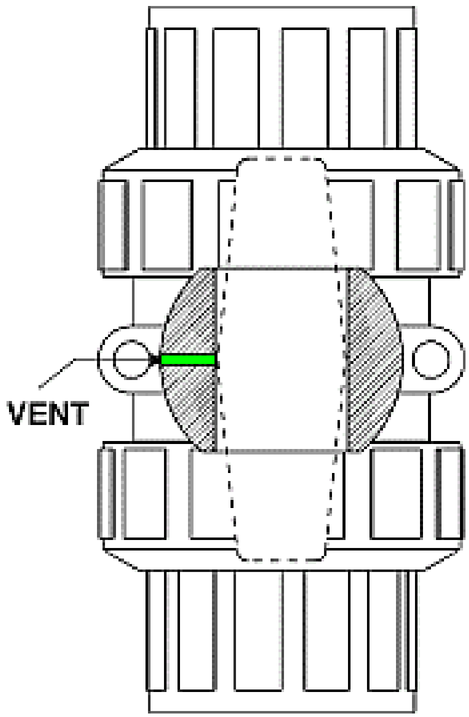
Vented Ball Valves for Sodium Hypochlorite

An optional vent is added to all True Blue trunnion ball valves specified for bleach applications. Without a vent of some sort, sodium hypochlorite would be trapped inside the ball whenever it is in the closed position, and give off gas (outgas). In the majority of poorly sealing valves, this gas wouldn't be a problem...but due to the absolute bubble-tight seal of the True Blue ball valve, the trapped gas could eventually cause an explosion inside the ball.

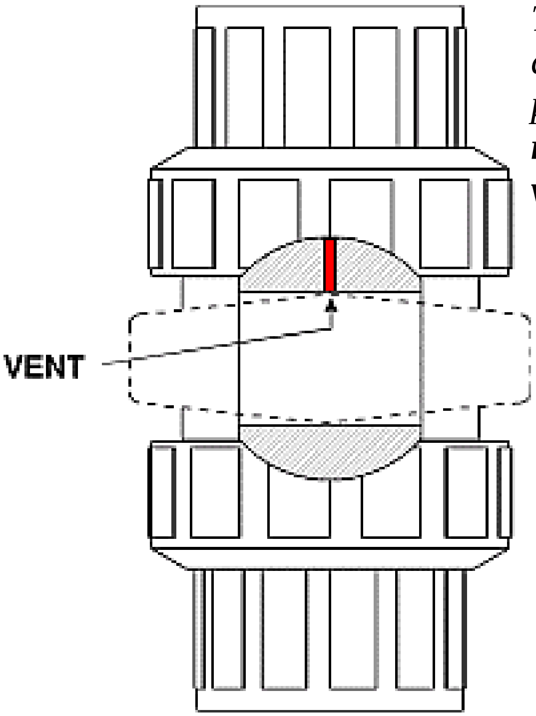
The vent is designed as a hole through the side of the ball. When turned to the closed position, the hole allows any liquid or gas in the ball to flow freely in and out of the ball. Thus the liquid remains in contact with the upstream side, or it simply vents away downstream, depending on which direction the valve is installed.

NOTE: Plast-O-Matic recommends that the valve be installed so that the vent is directed back upstream.

To specify the vent, and eliminate the possibility of an explosive headache, use option #Z-MBV-VENT



*This "top view"" illustration shows the ball in the **open** position (the dashed line represents the handle) and shows the vent directed to the side. When open, the vent has no bearing on flow or performance.*



*This "top view" illustration shows the ball in the **closed** position (the dashed line represents the handle) and shows the vent directed to the process. This allows outgasses to vent harmlessly away. **We recommend that Plast-O-Matic vented ball valves be installed to vent back upstream**.*

Actuated Ball Valves vs. Solenoid Valves

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Comparison of features and limitations, as well as recommendations when to use one or the other...

Actuated Ball Valves

- Very high flow rates w/low pressure drop
- Can be manual or actuated
- High inlet pressures permitted
- High back pressures permitted
- Air actuated valve has fail-safe option; explosion-proof
- Visual position indication
- Manual Override
- NEMA 4 type, CSA approved actuators available
- Slower acting than solenoid valve

Solenoid Valves

- Compact size & light weight
- Fail-safe design; normally-closed or normally-open
- Extremely high cycle life
- Very fast acting
- Many power choices in AC or DC
- High cycle capability
- NEMA 4X, CSA approved coils available as well as NEMA 7 & 9
- Back pressure and inlet pressure limitations based on size and design

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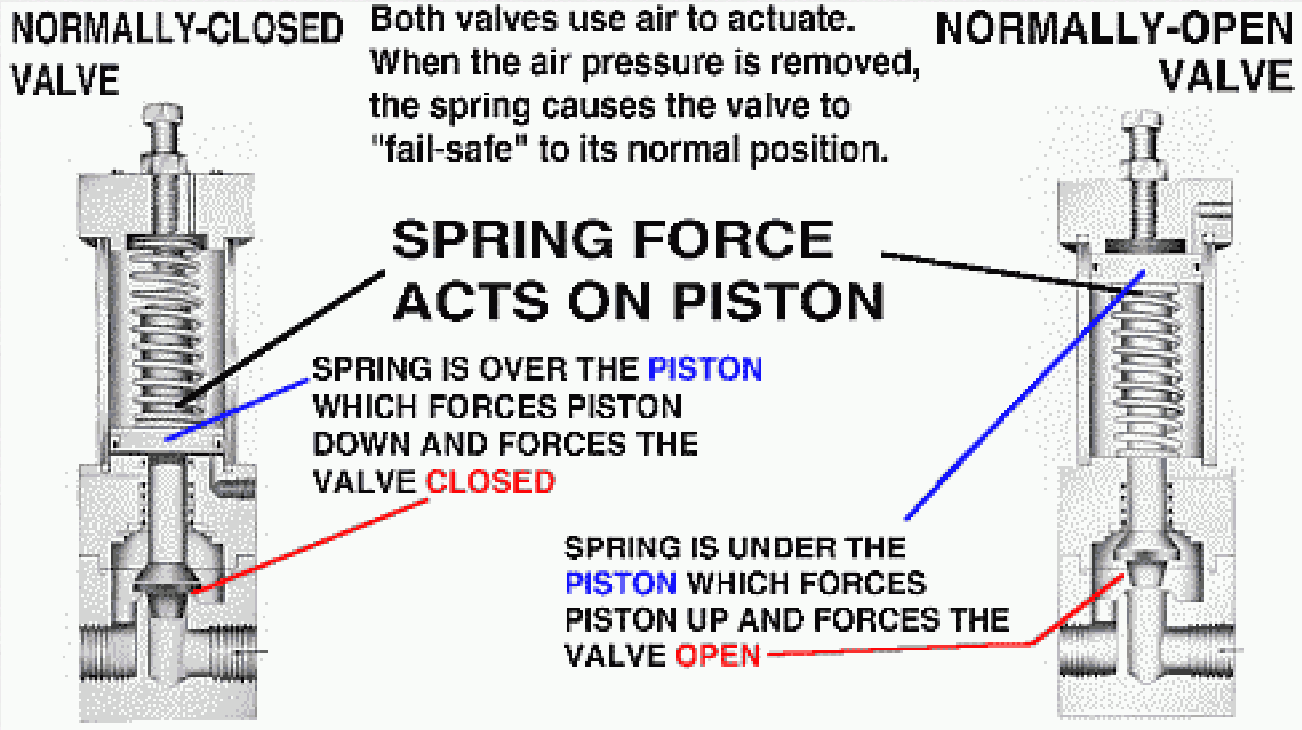
Fail-Safe Valves

Normally-Closed Valves, Normally-Open Valves, and Valves that can be Converted between Normally-Open and Normally-Closed

Actuated or automatic valves that revert to a pre-determined position after the actuating force is removed are referred to as "fail-safe" valves. The most common type is "fail-safe normally-closed." On the other hand, "fail-safe normally-open" valves are much less common, but are equally important. These are often found in cooling systems, or are used where flow is shut off only for periodic maintenance, etc. Some valves, such as spring-loaded air actuated ball valves, can be converted between types.

The illustration below shows two air-actuated shut-off valves, identical but for the fact that one is normally-open and the other is normally-closed. The only real difference between the valves is the location of the spring in relation to the piston. Because these valves use compressed air to overcome the spring force, the air acts on the opposite side of the piston. If you study the valves, you can see where the air is fed in.



Normally-Closed Valves

An example of a normally-closed actuated valve is Plast-O-Matic's Series EASMT Solenoid Valve. The valve opens when energized, and when that current is turned off, an isolated spring inside the valve forces it closed. The magnetic force of the solenoid coil must overcome the force of the spring to open the valve. Unless acted upon, the spring force keeps the valve closed. In the event of a power failure, the valve will automatically close.

An example of a normally-closed automatic valve is Plast-O-Matic's Series CKM Check Valve. The valve opens when pressure is present at the inlet (or upstream) side. When that pressure ceases, the diaphragm inside the valve automatically forces it closed. The inlet pressure must overcome the force of the diaphragm to open the valve. Unless acted upon by inlet pressure, the diaphragm force keeps the valve closed. In fact, the valve closes before reverse flow can take place. (note that the above refers exclusively to Series CKM/CKS; most check valves, including ball type, are **not** normally-closed valves.)

Normally-Open Valves

An example of a normally-open actuated valve is Plast-O-Matic's Series EASY-NO Solenoid Valve. The valve closes when energized, and when that current is turned off, an isolated spring inside the valve forces it open. The magnetic force of the solenoid coil must overcome the force of the spring to close the valve. Unless acted upon, the spring force keeps the valve open. In the event of a power failure, the valve will automatically open.

An example of a normally-open automatic valve is Plast-O-Matic's Series PRE Pressure Regulator. The valve is set to remain open at a predetermined pressure, and begins to close automatically when downstream pressure exceeds that predetermined pressure. When pressure downstream drops back to accepted levels, a spring inside the valve forces it back open. The downstream pressure must overcome the force of the spring to close the valve. Unless acted upon by excessive downstream pressure, the spring keeps the valve open.

Valves that can be Converted between Normally-Open and Normally-Closed

Air-Actuated, Spring-Return Ball Valves -- Plast-O-Matic Series ABVS, ABRS & ABMS -- are examples of valves that can be normally-open or normally-closed. In these valves, a rather large spring is used to force the actuator back to its original position, whether that is open or closed.

One of the advantages of a Plast-O-Matic Air x Spring Actuated Ball Valve is that it can be converted fairly easily between one type or the other. Because the spring forces the actuator one way or the other, it is simply a matter of redirecting what the spring acts upon.

With Series ABVS, this is done by backing off the adjusting cap (so the spring will not be compressed) then unscrewing the spring housing from one side of the actuator and moving it to the opposite side. (Likewise, the compressed air is swapped).

Valve Pressure Loss & Flow - Q&A and Equations

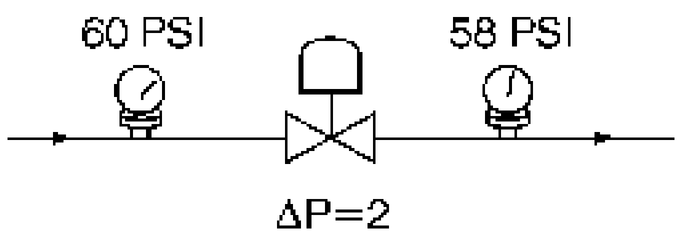
1. ***What does Cv factor mean?*** - The definition of Cv factor is the number of U.S. gallons per minute that will pass through a valve with a pressure drop of one (1) psi. This 'factor' is determined by physically counting the number of gallons that pass through a valve with one (1) psi applied pressure to the valve inlet and zero (0) pressure at the outlet. Cv is a mathematical constant. For a pressure drop other than one (1)psi, use the formula in answer number 10 below.

2. ***Does every valve have a Cv factor?*** - No. Cv factors typically apply to full open/full closed shut-off valves such as solenoid valves, ball valves, etc.. Valves that are held open without aid of liquid pressure in the pipeline.

3. ***Which valves do not have a Cv factor?*** - Cv factors typically do not apply to modulating or regulating valves, spring loaded check valves, etc. that incorporate a control spring since more than one (1) psi is required just to **begin** to position such valves.

4. ***What is Delta P?*** - A commonly used term, Delta P or its symbol ΔP usually refers to the pressure drop across a piping component such as a valve or filter.
"Δ" (from the Greek Delta) is the 'change' in something; in this case a change, or drop, in pressure. To determine the Delta P across a valve, simply subtract the outlet pressure (P2) from the inlet pressure(P1).

The equation is P1-P2 = ΔP



5. ***Why is pressure drop important?*** - Pressure drop is a critical element in valve sizing and valve application. Pressure drop must be known by the engineer designing the system to ensure proper valve selection.

6. ***What factors determine pressure drop across a valve?*** - The most critical factors are the orifice size and internal flow path. An example would be a full port/full open 1" ball valve with a typical

Cv of 40 versus a full open 1" diaphragm valve with a typical Cv of 15.

7. ***What is Back Pressure?*** - Back pressure is simply defined as the pressure found at the outlet or "back" of a valve. It is caused by downstream restrictions.

8. ***What creates back pressure & why is it important to know?*** - Resistance to flow in piping systems creates back pressure. Piping components such as spray nozzels, filters, reducing fittings, all can contribute to both back pressure and pressure loss. It is important to know the back pressure present (or potential) in a piping system when installing or specifying a valve since many valve designs can be adverely affected if their maximun ratings are exceeded.

9. ***What is the relationship between the flow rate (GPM) and pressure drop?*** - Pressure drop and flow rate are dependent on each other. The higher the flow rate through a restriction, such as a valve, the greater the pressure drop. Conversely, the lower the flow rate, the lower the pressure drop.

10. ***How do the GPM, Cv factor, and*** ΔP ***work together to size a valve?*** - At least two of these elements are necessary to properly specify a valve. Here are the flow formulas.

$$GPM = C_V\sqrt{\frac{\Delta P}{G}} \qquad C_V = \frac{GPM}{\sqrt{\frac{\Delta P}{G}}} \qquad \Delta P = \left[\frac{GPM}{C_V}\right]^2 G$$

Where G = Specific Gravity of the Fluid

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5 Most Common Mistakes When Specifying Valves

As the old saying goes, "If you have enough time to do something over again, you had enough time to do it right the first time."

Today business moves at a highly accelerated rate, particularly in the process industries, compared to even just a decade ago. Customers often demand that product be shipped overnight, spending exorbitant amounts of money on priority freight. And in an effort to accommodate the customer, most salespeople do not question the application for which a component(s) will be used. If pipe or fittings are being ordered, this does not usually create a problem. But when valves are concerned, this lack of scrutiny can result in problems of nightmarish proportions.

It behooves all parties involved to ask a few simple questions, and prevent the mistakes that can lead to disaster in a flow control system...

The Top Five Mistakes

1. The Name Game: Too many synonyms!

This is a case of "You say 'po-tay-to' I say 'po-tah-to'." Take pressure regulators, for example. Somebody might call it a "pressure sustaining valve," still another might know it as a "pressure reducer valve."

To muddy the waters even further, backpressure regulators are commonly mistaken for pressure regulators. The backpressure regulator is a normally closed valve installed at the END of a piping system to provide an obstruction to flow and thereby regulate upstream (back) pressure. This valve is called upon to provide pressure in order to draw fluid off the system. The pressure regulator is a normally open valve and is installed at the START of a system or before pressure sensitive equipment to regulate or reduce undesirable higher upstream pressure.

Because of this "name game," a normally open pressure regulator is sometimes installed to perform as a backpressure regulator, where it simply passes the fluid to the return tank and therefore does not maintain any pressure upstream.

Solenoid valves are often misapplied as well. Generally, a solenoid valve is required to default to a desired position, referred to as fail-safe, upon loss of power. In the case of a two way valve, either closed or open, or a three way valve, either left port or right port. Even the relatively universal "energize to open" is ocassionally mis-ordered as "normally open." In some of these cases the process control system will compensate for the one valve operating improperly, but in the event of a power loss the results might be disastrous.

The question to ask: What is the valve to accomplish? In the case of a "pressure regulator," will it be used to control pressure downstream or upstream? Is that actuated valve need to shut off or divert flow? Understand and write out precisely what function the valve is to perform.

2. Irreconcilable Differences: Media and Material

"If PVC works so well with water, why is my system is falling apart?!" So we ask: "Are there any impurities in your water?" The reply: "Of course not...and we keep it right at the boiling point!"

Even though this example sounds too absurd to be true, less obvious but equally ludicrous "time bombs" are installed around the world with alarming regularity.

Material compatibility is critical to the safe operation of a system and personnel safety. The result of a material misapplication can be catastrophic. Corroding pipe and valves can cause chemical leaks, which may injure workers, cause productivity losses and require reporting to OSHA and the EPA. Additional expenses for clean up of the chemical spills and fines may also be expected.

Proper material compatibility analysis requires knowledge of the type, concentration and temperature of fluid(s) being handled and the valve body and seal material. Every materials manufacturer publishes an easy to use chemical compatibility chart, which takes the guesswork out of specifying compatible materials. Unfortunately, anxious designers are notorious for ignoring the published temperature ratings of valve and seal materials, assuming that they all have a built in safety factor.

3. Size Matters...But Sometimes Pressure Matters More

If the pipe diameter is 2", most people assume that a 2" valve will do the job. In a few cases, that's true. But in general, pressure considerations are of utmost importance in a piping system, and therefore critical when specifying a valve. Unfortunately, there are no industry-wide standard pressures for valve sizes; no two manufacturers design a 2" valve the same way, and different designs have different pressure considerations.

Outlet pressure, for example, is critical to solenoid valves but frequently overlooked. If downstream pressure sufficiently exceeds the valve's outlet pressure rating, the core spring may not be powerful enough to close the valve. In the case of a pilot-operated solenoid valve, however, an unusually low inlet pressure can be just as problematic: If the pilot valve requires 5 psi pressure drop (delta P) to operate the main orifice, and the system has only 3 psi, the valve may not open.

The factors to consider before specifying a valve are minimum and maximum inlet pressures, minimum and maximum differential pressure, outlet or backpressures and set pressure.

4. The Autobahn in Disguise

Velocity is very often overlooked when specifying a valve. Unlike that famous European roadway, a piping system does have a "speed limit." The generally accepted safe velocity for a thermoplastic piping system is 5 feet per second. But like the pace of today's business environment, a "slow" 5 ft/second process system just isn't productive enough! Unfortunately, it is becoming the rare exception to the rule.

At higher velocities, such as an ultra-pure water system in a semiconductor fab facility, an improperly selected valve can easily create a water hammer situation if it closes too quickly. This dangerous energy surge travels at the speed of sound and frequently causes damage to pipe, fittings, valves, and instrumentation.

A classic example of this happened in a reverse osmosis water system at a major New York City hospital. Water was piped down to a sub-basement from storage tanks on the 16th floor. As the r.o. water was needed, a ball valve was opened, which ultimately fed a tiny gooseneck faucet. Unfortunately, the system designer didn't take the 16 floors of head into consideration. Every time the ball valve was opened, water slammed into the constriction caused by the gooseneck faucet, which resulted in a dangerous water hammer back through the system.

The problem could've been prevented with a little planning: Always consider liquid velocity, and valve closing time.

5. Letting the Electric Slide

Neglect of actuator voltages and electrical enclosure types is not quite as common as the mistakes above, but often creates the most headaches and is potentially the most dangerous.

If an incorrect voltage is specified on a solenoid valve or a valve actuated by an electric motor, it will not operate properly. Often the actuator or coil will overheat, and may cause a fire.

NEMA ratings on electrically actuated valves are designed to provide for safety. NEMA has ratings for many types of electrical enclosures for a variety of environments. Most common are general purpose, water tight, corrosion resistant, and explosion proof. Specifying the wrong enclosure type may endanger personnel and property.

In Review...

Too often, valves are purchase by pipe size and without enough consideration for pressure, flow, chemical compatibility, performance, or safety factors. The mistakes listed above are just the most common—and most obvious. To properly specify a valve, all components and aspects of the system should be taken into consideration.

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CHEMICAL RESISTANCE CAUTION:

There are many variables that affect success or failure of a particular material with any given chemical, including concentration, temperature, and the specific compound of the plastic. A material deemed suitable for a specific application does not mean that it is suitable for every application, nor that every version of that material is suitable. Plastic compounds vary between manufacturers, and the design of a valve may affect compatibility as well.

Your distributor can help with compatibility questions, and you are welcome to contact our Technical Group at (973) 256-3000, but **the ultimate determination of suitability of any information, product or material, for use contemplated by the user, the manner of that use, and whether there is any infringement of patents, is the sole responsibility of the user. To the extent that any hazards are listed, we neither suggest nor guarantee that such hazards are the only ones that exist.**

It is important to note that any information obtained should be used only as a guide. In many cases a physical test of the material under operating conditions is the only way to ensure the success of a particular material for that application.

We recommend that anyone intending to rely on any recommendation, or use of any equipment, processing technique, or material mentioned in this e-book or plastomatic.com should satisfy themselves as to suitability, and that all applicable health and safety standards are met. We strongly recommend the user seek and adhere to material manufacturers' and chemical suppliers' current instructions for safe handling. Thank you

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