CASH ACME®

TECH TIP #36

WATER PRESSURE REDUCING VALVE HINTS

DESCRIPTION

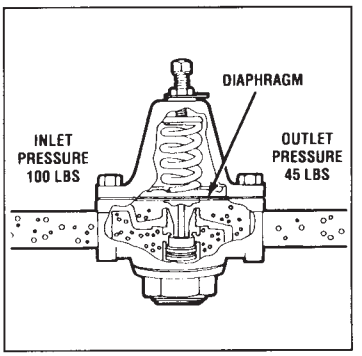
Pressure reducing and regulating valves, generally called pressure regulators, are designed to automatically reduce a high inlet pressure to a lower outlet pressure and maintain that lower pressure within relatively close limits. Many plumbing codes require pressure reducing valves to be installed whenever water pressure exceeds 70 to 85 psi. E Series pressure regulators are designed primarily for residential or commercial water regulation; however, within the design limitations of each valve, they can prove functional and reliable for other water and air applications.

OPERATION

INSTALLATION INSTRUCTIONS

All E Series pressure regulators are supplied with the requested delivery pressure pre-adjusted at the factory. Pressure adjustment is accomplished by loosening the lock nut and turning the adjusting screw either clockwise to increase delivery pressure or counter-clockwise to reduce delivery pressure. In actual operation, turning the adjusting screw clockwise forces the pressure spring to act against the diaphragm assembly (or directly against the piston in the case of the Type E-56 regulators) and move the internal valve seat to the open position. When high inlet pressure is applied, it flows into the regulator, through the open seat, under the diaphragm or piston and out through the outlet. As the initial inlet pressure builds up under the diaphragm or piston to the adjusted psi setting, the downward adjusting spring pressure is overcome and the regulating valve closes tightly thus maintaining the required delivery pressure.

PIPE SIZE CONSIDERATIONS



Water supply system pipe lines must be large enough to assure ample pressure and capacity at the highest fixture, on the topmost floor or in the most remote location. A flowing pressure of about 20 psi is generally considered the minimum for household service; industrial and commercial applications frequently require pressures to be higher.

A properly designed water supply system should provide the required capacity and pressure without allowing water velocity of more than 10 feet per second. A mistaken attempt at economy, however, often results in the installation of undersized piping which cannot provide adequate capacity without excessive water velocity. When water velocity exceeds 10 feet per second, highly undesirable pipe noises such as "singing," "humming," or "water hammer" may result. A pressure reducing and regulating valve is designed to reduce high water pressure, but it can only work effectively if the entire system is properly designed. Pipe lines, therefore, should always be sized to provide adequate flow with reasonable water velocities and pressure losses.

GENERAL REGULATOR INFORMATION & INSTALLATION INSTRUCTIONS

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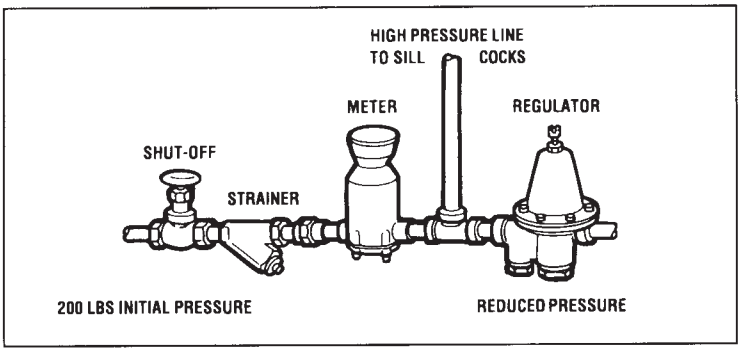


GENERAL INSTALLATION INFORMATION

A water pressure regulator will normally give years of satisfactory service when correctly installed. The piping should first be thoroughly flushed out to assure removal of all foreign matter. Improperly cleaned pipelines are a common source of regulator damage and seat leakage. The pipe should be anchored firmly at the valve, and the valve must be installed with its inlet and outlet in proper relation with the rest of the system. It is highly recommended that a separate strainer be installed in the pipeline ahead of every regulator that does not have an inbuilt strainer.

For ease of maintenance and repair, it is suggested that a shut-off valve be installed ahead of the regulator. In commercial installations, a second shut-off valve following the regulator and either a pressure gauge or tapping are also recommended.

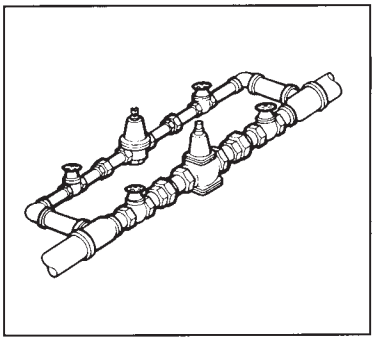
TECH TIP #36 (Cont)

All E Series regulators are furnished with the reduced pressure setting clearly marked on a tag attached to the valve. The range of adjustment is also marked on the tag; the factory setting may be easily changed to any pressure within that range.

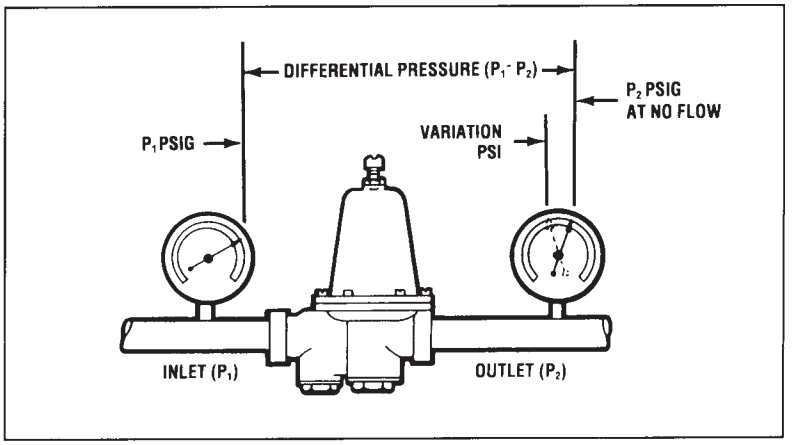
MULTIPLE REGULATOR INSTALLATIONS

In systems where the inlet pressure exceeds 200 psi, there are certain advantages in carrying out the reduction in two stages. The first regulator reduces the pressure to approximately 100 psi; the second to 45 psi. Excessive wear on the inner working parts of each valve is avoided by such an arrangement.

For installations in hospitals, schools and commercial buildings, it is frequently advisable to install two regulators connected in parallel. This arrangement permits a smaller regulator to operate when demand is low (as for a drinking fountain in a large system); the larger regulator operates during periods of peak demand and provides the higher capacity necessary in such situations. Parallel installations also result in quieter operation since the larger valve is not required to handle low flows. In addition, the larger valve can be expected to offer longer life expectancy and require less maintenance.



For a parallel installation to be effective, the smaller valve should be sized to handle approximately 10 to 20 percent of the system capacity with the larger regulator to handle the balance. In this arrangement, the smaller valve should be set for a pressure of approximately five psi higher than the larger valve. The larger valve will then begin operating when the smaller valve reaches full capacity and the outlet pressure begins to fall off.



CONTROLLING THERMAL EXPANSION

It is important to note that a pressure regulator tends to create a "closed" system, that is, water cannot normally flow back through the regulator. In a closed system, water pressure may rise due to thermal expansion - the phenomenon by which water increases in volume when heated, as in hot water heaters or boilers. Relief valves installed on these hot water heating devices are designed to open when system pressure reaches a pre-determined point, allowing water to escape until the pressure returns to a safe level.

To eliminate nuisance problems of pressure relief due to thermal expansion, Cash-Acme offers an inbuilt back-pass check valve in Types EB-24U regulators. When the pressure on the outlet (downstream) side of the regulator becomes greater than the inlet (upstream) pressure, the back-pass check allows the excess downstream pressure to bleed to the upstream side of the regulator until the pressure becomes equal. But because it can only allow water to flow back through the regulator when the system pressure is higher than the inlet pressure, a back-pass check valve is not effective when the pressure setting of the relief valve is equal to or lower than the inlet pressure.

The inbuilt back-pass check valve is not designed to replace an approved, properly sized and rated pressure and temperature relief valve. A relief valve should be installed in every system where a hot water heating device is installed.

CAPACITY INFORMATION

For a given type and size, the amount of water a regulator will pass is governed by the difference between the inlet pressure (P_1) and the outlet pressure (P_2) of the valve. As this pressure differential increases, the volume of water increases. Inherent in all regulators of this type is a characteristic which causes the outlet pressure (P_2) to drop off slightly as flow starts through the valve and to drop off even more as increased demand requires increased flow. The maximum capacity of a direct-acting regulator, then, is determined both by the differential between the inlet pressure (P_1) and the outlet pressure (P_2) and by how accurately the outlet pressure (P_2) is to be maintained.

As pointed out above, reduced pressures must drop off slightly from the setting of the valve as flow starts. As flow increases, the pressure must continue to fall. The amount of flow (capacity) is then entirely dependent on where and how the valve is to be used. In the average water supply system where water is piped to lavatories, toilets, bath tubs and showers in homes, schools, apartments and hospitals, a pressure drop-off of 25 to 30 percent is considered satisfactory. In industrial or commercial applications such as laundries, car washers and commercial dishwashers, it may be desirable to hold the reduced pressure closer to the setting and permit only a 10 to 15 percent drop-off.

TECH TIP #37
GAS REGULATOR SELECTION

Sizing Gas Regulators and Meters

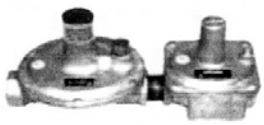
When sizing a **gas regulator** the following must be known:
> Available inlet pressure
> Desired outlet (regulated) pressure
> Required maximum flow rate (capacity) Btu/h, ft3/h or m3/h
> Pipe size

Helpful things to also know:
> Is the application requiring:
-- service regulator (normally outside the building to convert "pounds to ounces") example brands -- Sensus, Fisher
-- line regulator (frequently inside the building to reduce 2-5 psi to 1/2 psi, and ventless) example brand -- Maxitrol
-- appliance regulator (frequently furnished on an appliance, having a max. pressure of ½ psi) example brand -- Maxitrol
> Will the regulator be used for main burner and pilot application OR main burner only?
> Will the regulator provide positive dead-end lock up? (dead-end lock up means pressure will not "creep up" while regulator is in closed, no-flow position)
With this information, one can go to the literature of the manufacturers and make the selection. Accessories may include moisture protectors, vent restrictors, and relief valves.

Helpful Facts and definitions:
Pressure conversion in gas service:
1 psi = 16 ounces = 27.7 inches, w.c. (water column)
With this relationship, one can convert pressure from psi to oz. to in. wc
CFH – cubic feet per hour
Natural gas – normally 1 CFH = 1000 Btu/hr
Propane – normally 1 CFH = 2550 Btu/hr
Butane – normally 1 CFH = 3200 Btu/hr
SCFH – standard cubic feet per hour flow (at 14.4 psia -- sea level atmospheric pres. at 60F)



SERVICE REGULATOR

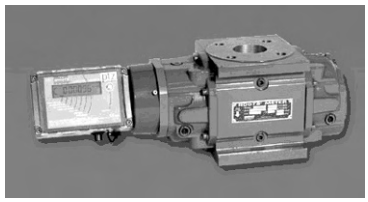

LINE REGULATOR


APPLIANCE REGULATOR

Proper sizing of **gas meters** involve two main variables:
- ▷ Inlet pressure
- ▷ Volume of flow

With these two pieces of information, a type of regulator is selected:
- ▷ Diaphragm – normally used in residential and commercial applications up to 800 CFH, example brand -- Sensus
- ▷ Rotary – popular because of size, weight and ease of installation, used up to 7000-8000 CFH, example brand – Dresser Roots
- ▷ Turbine – for applications over 7000-8000 CFH, example brand -- Sensus


DIAPHRAM


ROTARY


TURBINE

TECH TIP #38
VALVE BASICS

CHOOSE THE RIGHT VALVE FOR THE RIGHT JOB.

Valves are the controlling element in any fluid-handling system. They should be properly selected and cared for to give the best service at the lowest cost.

Essentially valves have these primary functions:

1. Starting and stopping flow.
2. Regulating flow or throttling by change of direction or restriction
3. Preventing Backflow
4. Relieving and regulating pressure.

The secret to good valve performance is selecting the right valve for the service required.

Consider Service Conditions

In selecting the valve which will give the best service and, in turn, keep plant maintenance and operating cost at a minimum, the following things should be considered.

A. Type Medium to be Handled

1. What liquid or gas will the valve handle?
2. Is it a true fluid or does it contain solids?
3. Does it remain a liquid throughout its flow or does it vaporize and become a gas along the way? Does it crystallize?
4. Is it corrosive or erosive?

B. Pressure and Temperature

These may vary throughout the handling system and should be considered in selecting the right valve materials.

C. Flow Considerations

1. Is pressure drop critical?
2. Is valve to be for simple shutoff or for throttling?
3. Is valve needed for prevention of backflow?

D. Frequency of Operation

1. Will valve be normally open with infrequent operation?
2. If operated frequently, will valve design chosen provide maximum wear?

The Proper Type of Valve

Basic types of valves with which we will deal on the following pages are

1. Gate
2. Globe and Angle
3. Check
4. Plug
5. Butterfly
6. Ball
7. Slurry

MATERIALS OF CONSTRUCTION

Special attention must be given to selecting proper valve materials. It is often advisable to choose the valve body bonnet material first and then the trim.

Aside from the primary function of the valve (shutoff, throttling, etc.), other factors govern the basic material selection.

1. **Pressure-temperature ratings.**
2. **Corrosion resistance requirements.**
3. **Thermal shock.**
4. **Physical shock.**
5. **Line stresses.**
6. **Fire hazards.**

Trims are generally selected to meet corrosive conditions. In other cases, trims may be selected to solve problems from erosion or other conditions.

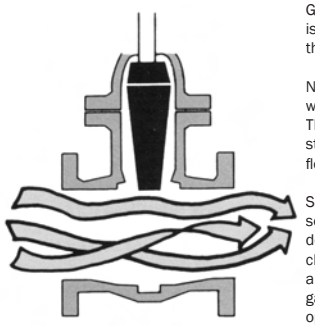
Temperature limitations on various valve materials as follows:

Range	Temperature (°F)	Material
Very High	2000	Refractory Metals, Ceramics
High	1600 1200	High Temperature Alloy Steels
Intermediate	1000 650 550 450 150	Carbon Steel Ductile Iron Bronze Cast Iron PVC Plastic
Low	-250	Low Alloy Steels, Bronze
Very Low (Cryogenic)	-450	Bronze, Austenitic Ductile Iron, Austenitic Stainless Steels

ON-OFF

Do you need an on-off valve, i.e., one that operates fully open or fully closed, non-throttling; a valve with minimum resistance to line flow; infrequent operation?

GATE VALVES

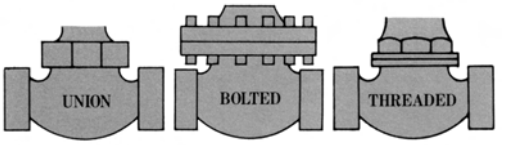


Gate valves are used where it is important that pressure drop through the valve is minimal.

Normally use gate valves either wide open or completely closed. They are designed to permit a straight, full and free flow or no flow at all.

Service conditions dictate the selection of the most suitable design options. Not only must you choose the right valve type, but also the right design options. On gate valves, the primary design options are the bonnet, stem and disc. A simplified approach to these considerations is shown here.

BODY BONNET CONNECTIONS



Is the primary service critical or noncritical?

Generally noncritical services such as plumbing and heating shutoff valves allow the use of threaded bonnet gate valves where possible on smaller lines.

Critical services, involving applications which could seriously endanger persons or property with piping or valve failure, call for union bonnets, bolted bonnets or pressure seal bonnets.

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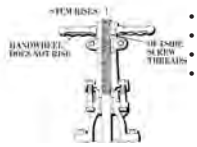
COURTESY STOCKHAM VALVES & FITTINGS

TECH TIP #38 (Cont.)

STEM CONSTRUCTION

Rising Stem-Outside Screw and Yoke



- Keeps threads out of media.
- Stem rises through bushing in handwheel.
- Stem threads easily lubricated.
- Visually detected open or closed.

Rising Stem-Inside Screw

- Most common design.
- Visually detected open or closed.
- When fully open, threads are protected.

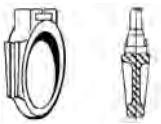
Non-rising Stem-Inside Screw

- Requires minimal headroom.
- Packing wear minimized.
- Most competitive.

DISC CONSTRUCTION

Solid Wedge Disc

- Most widely used.
- Can be installed in any position.
- Recommended for steam service.



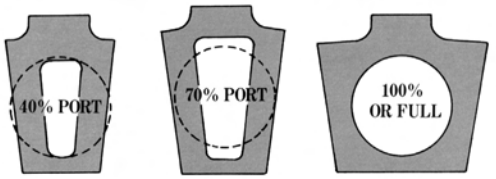
Split Wedge or Double Disc

- Ball and socket design reduce wear.
- Recommended for non-condensing gasses and liquids.
- Aligns on each side of seat in event of scale buildup.
- Used in vertical position only.

Flexible Disc

- Compensates for variable temperatures on either side.
- Operates at lower torques.
- Usually offered on steel valves.

PLUG VALVES



Like the gate valve, the plug valve is used primarily for on-off service, non-throttling.

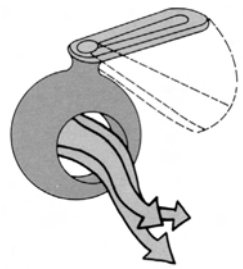
The advantage of plug valves over gate valves are:

- Minimum amount of installation space.
- Simple operation.
- Quick acting (90° rotation of the plug stops fluid flow).
- Ease of actuation.
- Tight shutoff characteristics of the tapered plug.
- Available in many port openings (larger opening, higher cost).

After determining the end connections needed for the piping, the next step is to narrow the selection to either lubricated or non-lubricated plug valves. Consider these factors:

	Lubricated	Nonlubricated		
		Lift Type	Nonmetallic Sleeve Type	Eccentric Plug Type
Temperatures above 450° F		√		
Some throttling (with minimum abrasion)	√			√
Slurries	√	√		
Minimum operating torques		√		√
Low operating cost (no lubrication)		√	√	√
Protected body seats		√		
Coking Service		√		

BALL VALVES



Quick operating 90° open-close Ball valves offer a quick-operating design that is self-sealing, with dependence on torque for seating force.

Tight shutoff is achieved with plastomer or elastomer seat rings. Temperatures are limited by the seating material, which is usually synthetic rubber, TFE, reinforced TFE or nylon.

Why use ball valves? Generally many shut-off applications are suited to ball valves. Seals are easily replaced.

The valves have a low profile and are compact. The flow path through the ball and ports is smooth and unobstructed, permitting the handling of viscous fluids and slurries.

Selection can lead to the use of either end entry or top entry ball valves.

Some pressure drop is experienced through conventional ball valves, which have reduced ports. Full port valves are available, but are not as common.

Metal backup seats enable ball valves to be used in fire-safe situation.

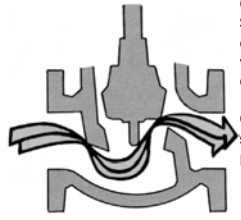
Although ball valves are sometimes used for throttling, they are most effective when fully open or closed because the seals are subject to damage from throttling.

Remote actuation can be accomplished rather easily by ball valves with compact actuators and remote controls.

THROTTLING

Throttling valves are used for flow regulation, frequent operation, increased flow resistance or for positive shutoff when closed.

GLOBE VALVES



Globe valves are used to throttle efficiently. Seating is parallel to the lone of flow. The change in direction of fluid flow through these valves produces increased resistance and considerable pressure drop.

Globe valves are also recommended for services requiring frequent operation and positive shutoff.

COURTESY STOCKHAM VALVES & FITTINGS

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TECH TIP #38 (Cont.)

As in the case of gate valves, select the proper bonnet design for globe valves. In some non-critical services, threaded bonnet globe valves are adequate in smaller sizes.

Critical services require union bonnets, bolted bonnets and, in some cases, pressure seal bonnets.

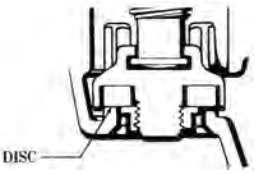
Discs and seats in most globe valves can be repaired or replaced without removing the valve body from the line.

The selection of the most suitable disc-seat design is the key to good performance in throttling service.

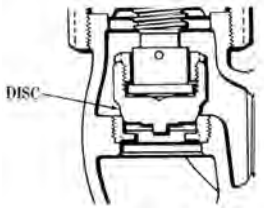
DISC CONSTRUCTION

Teflon or Composite Disc

- Offers tight shutoff.
- Recommended for light throttling in many services.
- Easily replaced.



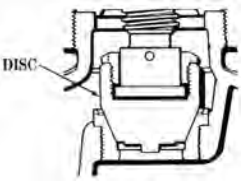
Fullway or Spherical-type Disc



- Small seat surface breaks through build-up.
- Discs can be re-machined.

Plug-type Disc

- Wide seat surface.
- Recommended for severe throttling services.
- Often available in S.S.

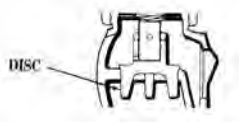


Needle-type Disc

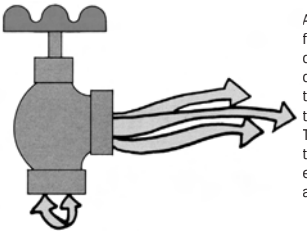
- Allows for more exact throttling.
- Good for instrumentation services.

Screw-down Check Type

Globe valves with screw-down check features have sliding action between the disc and stem so that they serve as globe valves and as check valves.



ANGLE VALVES

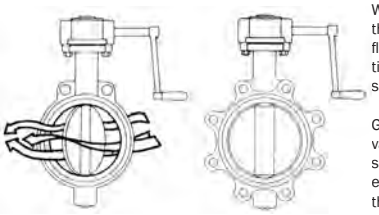


Angle valves have the same features of stem, disc and seat ring design as the globe valve. The fundamental difference between the two is that the fluid flow through the angle valve makes a 90° turn. These valves offer less resistance to flow than a globe valve with an elbow which it would replace. An angle valve reduces the number joints in a line, in addition to saving installation time.

SLURRY VALVES

These special service valves are useful in handling coarse and fine slurries, red mud and caustic alumina liquor. They are available in such patterns as: angle, three-way, straight-through, tee, bayonet, 45° bayonet, and 45° angle valves. They function basically as other throttling valve types discussed, but are especially designed for rugged slurry service with minimum flow resistance. They may be lined with special alloys, such as nickel, for corrosion resistance.

BUTTERFLY VALVES



When selecting larger throttling valves using flanged piping connections, butterfly valves should be considered.

Generally, butterfly valves are valves with a simple 90° disc-stem operation. In some cases they are used as shutoff valves, although offering pressure drop through the valve opening.

The usefulness of butterfly valves has increased with the development of elastomer liners with a wafer body, which provides a tight shutoff. Such liners normally utilize backup rings in the body to effectively support the liner. This provides sealing of the liner against the discs as well as the adjacent flanges.

Check the liner material for temperature limitations. Buna-N is the most common liner material, not suitable for steam service.

Other plastomeric materials are available for higher temperatures and corrosion resistance.

Other advantages are initial low costs, ease of installation and actuation.

Lug wafer valves and flanged end valves are also available.

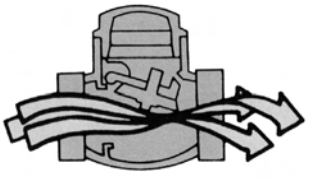
BACKFLOW PREVENTION CHECK VALVES

Prevent reversal of the direction of flow through a line.

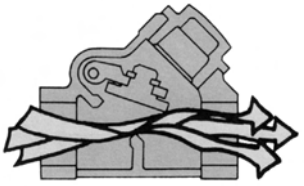
Check valves offer quick automatic reactions to flow changes. The pressure of flowing fluid keeps the valve open and any reversal of flow closes it.

SWING CHECK VALVES

- Minimum resistance to flow.
- Low velocity services, especially liquids.
- Infrequent change of direction in backflow prevention.
- Used generally with gate valves because of similar flow characteristics.



Y-PATTERN SWING CHECK VALVES



- Good flow characteristics.
- 45° seat aids in backseating under lower pressures.
- Screwed cap design allows for quick and easy removal of cap for internal inspection.
- May be installed in both horizontal and vertical lines with upward flow.

COURTESY STOCKHAM VALVES & FITTINGS

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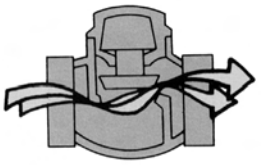
TECH TIP #38 (Cont.)

LIFT CHECK VALVES



- Frequent change of direction.
- Increased flow resistance.
- Prevention of backflow.
- Used with globe and angle valves because of compatible flow characteristics.

Special ball check valves are available for slurry applications.

WAFER CHECK VALVES

- Lighter, easier to install.
- Quick closing at zero flow.
- Used with gate and butterfly valves.

OTHER KEY FACTORS IN SELECTION OF VALVES

END CONNECTIONS

Threaded Ends

Threaded ends are tapped with ANSI Standard female taper pipe threads. Threaded end valves are the least expensive and can be easily installed.

Flanged Ends

Flanged ends make a strong, tight joint and are generally used for line sizes above 3" that are frequently disassembled and assembled.

Flanged joints are recommended for heavy viscous media handled in refineries and process chemical plants.

Weld Ends

Welded end steel valves are recommended where high temperatures and pressures are encountered and absolutely tight, leakproof connections must be maintained over a long period of time. Valves are furnished in either butt weld or socket weld ends.

Solder Ends

Solder end valves are used with types K, L, and M copper tubing for many lower pressure services. The use of solder joints is limited to maximum of 250^0 because of the low melting-point of the solder.

PACKING

The selection of packing is a factor which is as important as the selection of the valve itself. Valve manufacturers originally equip valves with a suitable general purpose packing. This packing may not be satisfactory for special services. It is best to specify the service conditions and allow the manufacturer to recommend the correct packing.

MECHANICAL PROPERTIES

	TENSILE STRENGTH-PSI	YEILD STRENGTH-PSI	ELONGATION IN 2" (Ductility)
Gray Iron ASTMA 126 Class B	31,000	None	None
Malleable Iron ASTM Spec. No. A-197	40,000	30,000	5%
Ductile Iron ASTM Spec. No. A-395	60,000	40,000	18%
Cast Composition Bronze ASTM-B-62	30,000	14,000	20%
Cast Carbon Steel ASTM-A-216	70,000	36,000	22%

STANDARDS AND SPECIFICATIONS

AAR - Association of American Railroads
ANSI - American National Standards Institute
API - American Petroleum Institute
ASTM - American Society for Testing and Materials
AWWA - American Water Works Association
FM - Associated Factory Mutual

MARINE ENGINEERING REGULATIONS AND MATERIAL SPECIFICATIONS, CD-115
Regulations established by the U. S. Coast Guard containing the requirements of boilers, pressure vessels, and appurtenances applicable to merchang vessels including tank vessels.

MILITARY SPECIFICATIONS
Specifications, standards, and related documents establisned by the Department of Defense for use by military agencies.

MSS - Manufacturers Standardization Society of the Valve and Fittings Industry
UL - Underwriters Labratories
USASI - United States of America Standards Institute

VALVE TERMINOLOGY
TE - Threaded End
FE - Flanged End
SE - Solder End
BWE - Butt Weld End
SWE - Socket Weld End

BB - Bolted Bonnet
UB - Union Bonnet
TB - Threaded Bonnet

DD - Double Disc
SWD - Solid Wedge Disc
RWD - Resilient Wedge Disc

OS&Y - Outside Screw and Yoke
NRS - Nonrising Stem
RS - Rising Stem

FF - Flat Face
RF - Raised Face
MJ - Mechanical Joint
RTJ - Ring Type Joint
IBBM - Iron Body, Bronze Mounted
SB - Silver Brazed

TC - Threaded Cap
BC - Bolted Cap

COURTESY STOCKHAM VALVES & FITTINGS

TECH TIP #39

PRESSURE - TEMPERATURE RATINGS

Bronze - Gate, Globe, Angle and Check Valves

MANUFACTURER'S STANDARDIZATION SOCIETY (MSS) STANDARD PRACTICE SP-80.

MSS-SP 80 provides a temperature pressure chart for 125, 150, 200, 300 and 350 class bronze valves, covering temperatures from −20° F. to 550° F.

There are some special exceptions noted such as temperatures below −20° F. and for solder joints, but this is a chart that provides the basic temperature pressure relationships for the bronze valves themselves. The maximum recommended pressure temperature ratings for solder joints vary with the solder and the size and they are specified in ANSI B16.18.

	PRESSURE - PSI (SWP)							
Press. Class	125	150		200	300			350
End. Conn.	THD	THD	FLG	THD	THD	THD	FLG	THD
Temp.	MATERIAL							
deg. F	ASTM B-62			ASTM B-61				
−20° to 150°	200	300	225	400	1000	600	500	1000
200°	185	270	210	375	920	560	475	920
250°	170	240	195	350	830	525	450	830
300°	155	210	180	325	740	490	425	750
350°	140	180	165	300	650	450	400	670
400°	—	—	—	275	560	410	375	590
406°	125	150	150	—	—	—	—	—
450°	120	145	—	250	480	375	350	510
500°	—	—	—	225	390	340	325	430
550°	—	—	—	200	300	300	300	350

INNOVATION IN EVERY VALVE

MILWAUKEE VALVE

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TECH TIP #39 (Cont.)

PRESSURE - TEMPERATURE RATINGS

Iron - Gate, Globe and Check Valves

MANUFACTURER'S STANDARDIZATION SOCIETY (MSS)
STANDARD PRACTICE SP-70, SP-71 AND SP-85
MILWAUKEE IRON BODY GATE, GLOBE AND CHECK VALVES

MAXIMUM ALLOWABLE NON-SHOCK PRESSURE			
Material	ASTM A126 CLASS B		
Class	125		250
Temperature Degrees F.	Sizes 2″-12″	Sizes 14″-24″	Sizes 2″-12″
−20° to 150°	200	150	500
200°	190	135	460
225°	180	130	440
250°	175	125	415
275°	170	120	395
300°	165	110	375
325°	155	105	355
350°	150	100	335
375°	145	—	315
400°	140	—	290
425°	130	—	270
450°	125	—	250

INNOVATION IN EVERY VALVE

MILWAUKEE VALVE

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TECH TIP #40

DEFINITION OF THE TERM "Cv"

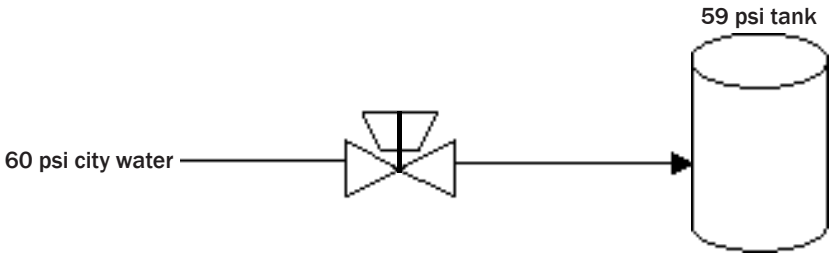
Now here is a term that strikes fear into the heart of experienced HVAC technicians and distributors alike. Let's see if we can help unbundle what it means.

The flow coefficient, or Cv, is a universal capacity index and is simply defined as "the number of US gallons of water per minute at 60F that will flow through a valve with a pressure drop of one psi.

Sometimes "pressure drop" is described as pressure differential or "delta P". Still confused..... well a picture is worth a thousand words, right? Here's the simplest of applications that I think will make the light come on.

APPLICATION: How many gpm will a 1" control valve pass?

- Valve mfg says the control valve has a Cv of 13.0
- City water pressure is 60 psi
- Water is filling a tank that is held at a constant 59 psi



1" control valve (13.0 Cv)

Using the above definition of Cv, this valve will flow 13 gpm because of 1 psi difference between the inlet pressure and outlet pressure of the solenoid valve...1# pressure differential, so the Cv is 13. Now let's change the tank to an open tank with 0 psi. The simplified formula for calculating GPM when you know the Cv of the valve and the delta P is:

GPM = Cv x (square root of the pressure drop)

Yuck....I knew I should have paid attention in algebra class! Anyway, the solution is:

- 60# inlet – 0# outlet (remember tank pressure is 0#) = 60# pressure drop
- square root of 60 = 7.75 (remember 7.75 x 7.75 = 60)

GPM = 13 x 7.75.....GPM = 100

The answer is this 1" valve will flow 100 gpm (provided the piping is large enough to get 100 gpm to the valve inlet at 60 psi delivery pressure, in this instance the piping would need to be 2-1/2") CAUTION: Other issues come into play, such as valve cavitation, minimum/maximum pressure differentials.....consult us to determine valve/piping sizes unless you have had plenty of experience selecting control valves, you can benefit from our 90+ years of selecting the proper control valves.

Cowabunga, now you can begin to see the importance of knowing what the pressure drop, Cv required and a few other parameters are before we can help you size a valve correctly. Undersized valves will cause a problem, but oversizing valves (such as just using a 3" valve on a 3" line) can cause ever more problems; such as premature valve wear, poor control, noise, etc.

ADVANCED TECHIP.....Want to learn more about this subject? Read the TECHTIPS on control valve sizing to see all the criteria that need to be looked at when selecting a control valve. Contact us to request ASCO's sizing guide or Honeywell's control valve sizing booklet. Let us walk you through a valve selection or two to help you get the hang of it. You may want to sign up for some of the training classes we offer throughout the year to get a better understanding of valve sizing & selection principles.

TECH TIP #41

INFORMATION REQUIRED TO PROPERLY SIZE A CONTROL VALVE

Many applications will not require all the following information, but we think that it is a good practice to collect all the data you can before making a choice. ASCO, the solenoid valve people, have developed a simple acronym to help collect the information, TOMSPAVE. Here's how it breaks down:

Type	2-way, 3-way, 4-way, on-off, modulating
Operation	Normally open, normally closed, universal
Media	Air, water, steam, oil, etc (remember temp!)
Size	Pipe size, required GPM, SCFH, PPH, Cv
Pressure	Inlet pressure minimum and maximum, psi drop
Atmosphere	Ambient temp, explosion-proof, watertight
Voltage	Also specify AC or DC
Extras	Special construction, manual operators, etc

This list is by no means exhaustive, but it does give the Prof. a good place to start. A drawing showing line sizes and any details on the equipment that the control valve is sizing will help greatly.

ADVANCED TECHTIPS...The ASCO catalog goes into detail about valve sizing. Call us to request one. We can provide other resources more specific to your application, let us know how we can help. We have been sizing control valves for over 90 years.

TECH TIP #42

BUTTERFLY VALVE INFORMATION

TABLE I
Wafer Body Valves Using Cross Bolting
Heavy Hex Bolts with 1 Heavy Hex Nut Each

Heavy Hex Bolts w/ 1 Heavy Hex Nut Each	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"
Diameter	⅝	⅝	⅝	⅝	¾	¾	¾	⅞	⅞	1	1	1⅛	1⅛
Length	4¼	4½	4¾	5	5¼	5¼	6	6¼	6¾	7¼	8¼	9	10
Number Required	4	4	4	8	8	8	8	12	12	12	16	16	20

TABLE II
Full Lug Body with Tapped Holes
Heavy Hex Screws with National Course Threads

Heavy Hex Bolts	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"
Diameter	⅝	⅝	⅝	⅝	¾	¾	¾	⅞	⅞	1	1	1⅛	1⅛
Length	1½	1¾	1¾	1¾	2	2	2¼	2¼	2¾	2¾	3¼	3½	4 & 3¼
Number Required	8	8	8	16	16	16	16	24	24	24	32	32	8 @ 3¼ & 32 @ 4

TABLE III
Wafer Body Valves Using Studs with 2 Nuts Each
All Thread Studs with 2 Heavy Hex Nuts Each

Stud with 2 Heavy Hex Nuts Each	2"	2½"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"
Diameter	⅝	⅝	⅝	⅝	¾	¾	¾	⅞	⅞	1	1	1⅛	1⅛
Length	5	5¼	5½	5¾	6¼	6¼	7	7¼	7¾	8½	9½	10¼	11¼
Number Required	4	4	4	8	8	8	8	12	12	12	16	16	20

FROM BRAY BUTTERFLY VALVE LITERATURE

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