Setting the Standard for Automation™

Control Valves
Refresher & Overview

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Control Valves Refresher: Overview

- Wide view first & then focused view on most commonly used
- Control Valves vs. ON/OFF
- Go over some general terminology / by ISA
- Various Control valves designs
- Go over control valves assembly components/ Globe:
- Various types of positioning devices
- Accessories
- Standards used
- Actual CV Specification samples
- Sizing datasheet review
- How to size control valves (as general recommendation)
- Some practical considerations for CV selection & purchasing
- QA section

Control Valves vs. ON/OFF valves

- ON/OFF valve main function is: to block the flow in shut off mode and provide lowest possible dP while open.
- Normally NO leak allowed when closed.
- Normally valves have to meet pipe size
- Such valves often are manual or electrically actuated
- Most common types are: ball, gate, butterfly, wage and others
- ON/OFF applications are not a CV manufacturer’s turf

Control Valves vs. ON/OFF valves

- Main Function of Control valves is to ***CONTROL***.
- They are normally Pneumatically actuated via positioner (P/P, I/P, HART, FF are the most common).
- Very often they have accessories associated with their control function (boosters; quick exhaust; hand-wheels and others)
- Tight (leak free) shut off normally is not required.
- Shut off Class III, IV or V are most common for them.
- Very often they are (up to two sizes) smaller then corresponding pipe connections. (Make sure you clear on who provides expender/reducers in such case)
- Most common designs are:
  - Linear type – Globe
  - Rotary type - Butterfly, Ball, Eccentric Plug

Control Valve – Basics of Operations

- Main Function of Control valves is to ***CONTROL*** *(over some Process Variable)*.
- Feedback control loop is the most common
- Feed forward controls also maybe used (i.e. Turbine Bypass systems)

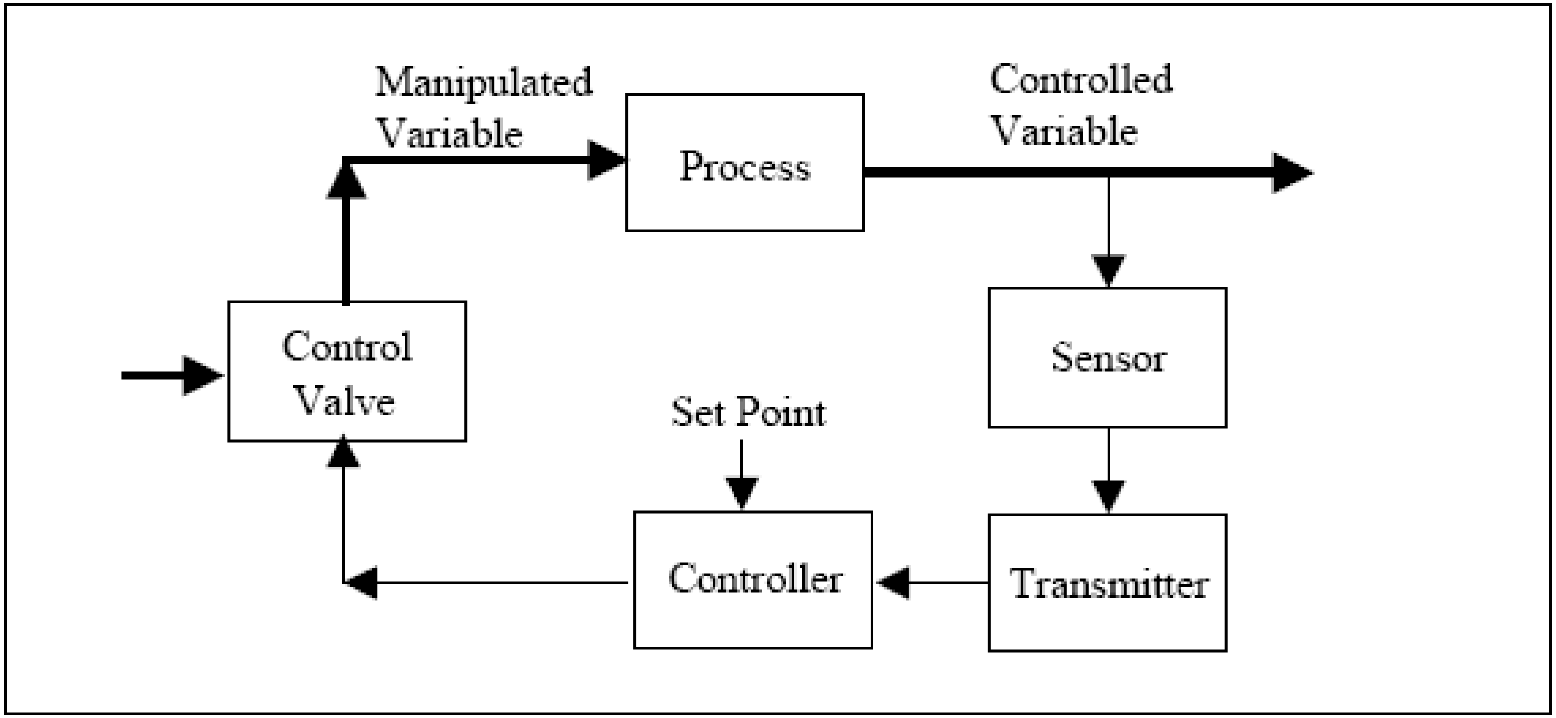


Figure 2-1. Feedback control loop

Terminology from ANSI/ISA–75.05.01–2005

- **3.40 Control valve:** a power actuated device which modifies the fluid flow rate in a process control system. It consists of a valve connected to an actuator mechanism (including all related accessories) that is capable of changing the position of a closure member in the valve in response to a signal from the controlling system.
- **3.14 Body:** the main pressure boundary of the valve that also provides the pipe connecting ends, the fluid flow passageway, and supports the valve trim.
- **3.172 Trim:** the internal components of a valve that modulate the flow of the controlled fluid.
- **3.35 Closure member:** the movable part of the valve that is positioned in the flow path to modulate the rate of flow through the valve.
- **3.3 Actuator:** a pneumatic, hydraulic, or electrically powered device which supplies force and motion to position a valve's closure member at or between the open or closed position.
- **3.28 Capacity:** the rate of flow through a valve usually stated in terms of Cv or Kv.
- **3.69 Flow coefficient (Cv or Kv):** a constant related to the geometry of a valve, for a given valve travel, that establishes flow capacity.
- **3.33 Class**: a convenient round number used to designate allowable pressure/temperature ratings for valves and pipe fittings using arbitrary Class numbers from tables developed by ASME and ISO for a variety of materials.

Terminology from ANSI/ISA–75.05.01–2005 (cont.)

- **3.66.4 Fail-safe:** a characteristic of a particular valve and its actuator, which upon loss of actuating energy supply, will cause a valve closure member to be fully closed, fully open or remain in the last position, whichever position is defined as necessary to protect the process. Fail-safe action may involve the use of auxiliary controls connected to the actuator.
- **3.47 Dead band, Control valve:** the range through which a control valve's input signal may be varied, upon reversal of direction, without initiating an observable change in the position of the closure member.
- **3.76 Hysteresis:** the maximum difference in output value for any single input value during a calibration cycle, excluding errors due to dead band. This difference is sometimes called hysteretic error.
- **3.77 Hysteresis plus dead band:** the maximum difference for the same input between the upscale and downscale output values during a full range traverse in each direction. This is the summation of hysteresis and dead band.
- **3.89 Linearity:** the closeness to which a curve relating to two variables approximates a straight line.
- **3.145 Sensitivity:** the ratio of the change in output magnitude to the change of the input which causes it, after steady-state has been reached.

Various Control Valve Designs: Broad View

- There are a great variety of control valves designs that were developed to fit practically in each possible control application that exists on the market.
- Some of them just simple valve assembly arrangements, that include some kind of control valve assembly, actuator and positioner.
- Other have more complicated constructions that may include some additional (welded-on) or added on assembly parts (i.e. desuperheaters or noise-reducing external units and others).
- For the purpose of this presentation we will consider only simple “most common” designs.

Various Control Valve Designs: Ball Valves

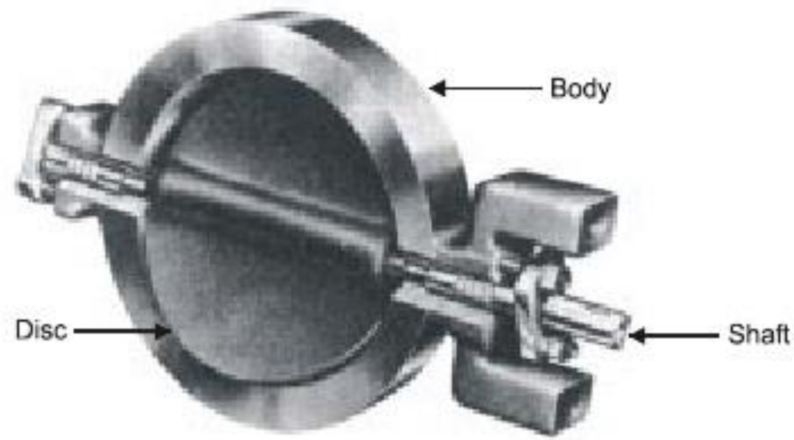
Definition by ISA. 3.11 Ball valve: a valve with a rotary motion closure member consisting of a full ball or a segmented ball.

- **Ball** valve is a rotary type of CV. Available with Full port, reduced port, V-Notch type designs
- **Advantages**
  - Suitable for general to mild severe service.
  - May have a very high range-ability (300:1).
  - Can to be used in DIRTY service.
  - Soft seat allows for Class VI.
- **Disadvantage**s.
  - Normally limited in sizes (1-16) and pressure classes (up to 600#)
  - High recovery designs (tend to choke easier)
  - Somewhat limited materials of construction
  - Limited trim options (to combat noise or cavitation)
  - Actuator position on the pipeline is very specific and needs to be confirm (depending on valve & actuator type)

Various Control Valve Designs: Butterfly

By ISA. 3.25 Butterfly valve: a valve with a circular body and a rotary motion disk closure member, pivotally supported by its shaft

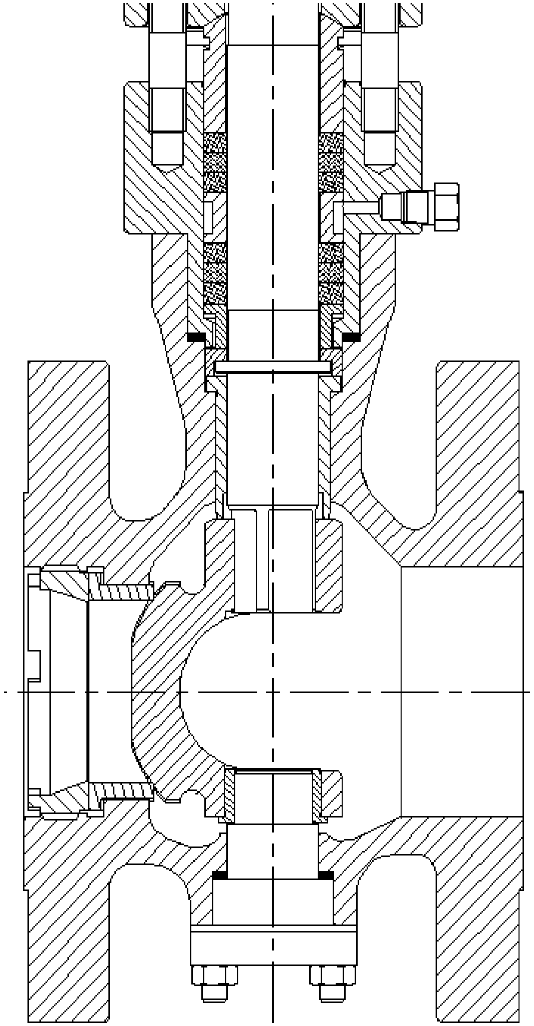
- **Butterfly** is a rotary (90 degree) type of Control Valve.
- **Advantages**.
  - Suitable for general to mild severe service.
  - Overall a variety of designs available on the market: Fish-tail, Double and triple offset.
  - Available soft seat provides class VI shut off.
  - Takes very little space in the piping.
  - Its greatest benefit comes in a larger sizes due to its competitive pricing.
- **Disadvantages**.
  - Limited low pressure classes (150# and 300#)
  - High pressure recovery design-tend to choke easier
  - Limited pipe connection type (flanged, lug, wafer options)
  - Limited possible trim selection for given design
  - Actuator location is sensitive



Various Control Valve Designs: Eccentric Rotary Plug

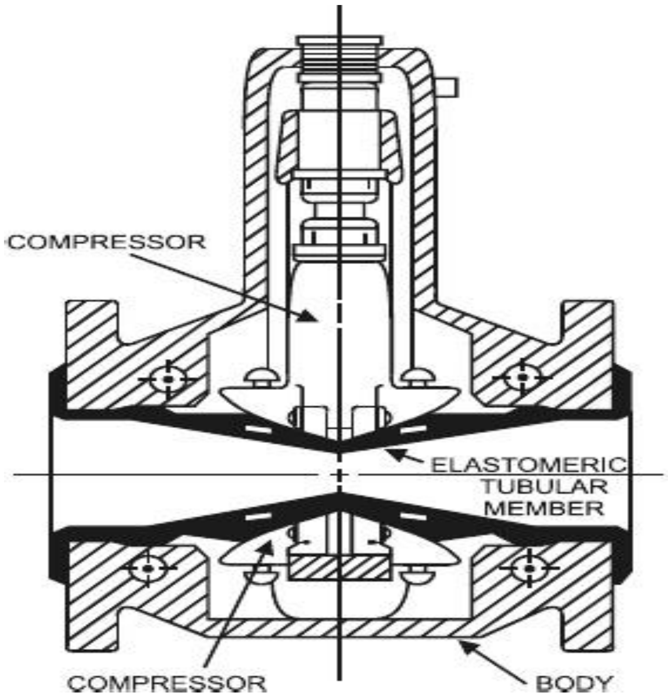
By ISA. **3.36.3 Eccentric rotary plug:** closure member face of a rotary motion valve that is not concentric with the shaft centerline and moves into seat when closing.

- **Eccentric Rotary Plug** is a rotary type of CV.
- **Advantages**.
  - Suitable for general to mild severe service.
  - Seat wear decreased because the plug lifts off the seat “immediately”.
  - Plug does not contact the seat during throttling.
  - Required plug breakaway torque is ZERO
  - High range-ability (140:1)
- . **Disadvantages**.
  - Limited sizes (1-12),
  - Limited pressure classes (up to 600#) ,
  - Limited pipe connection types (flanged and flangeless)
  - Limited possible trim selection for given design.
  - Actuator position on the pipeline is very specific.



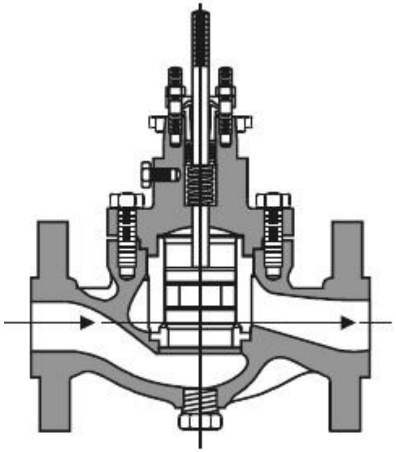
Various Control Valve Designs: Pinch type

- By ISA. **3.115 Pinch or clamp valve:** a valve consisting of a flexible elastomeric tubular member where flow control and shut off is accomplished by mechanically squeezing the flexible member.
- Obvious advantage: chemical resistance due to wetted parts being made out of Elastomer only.

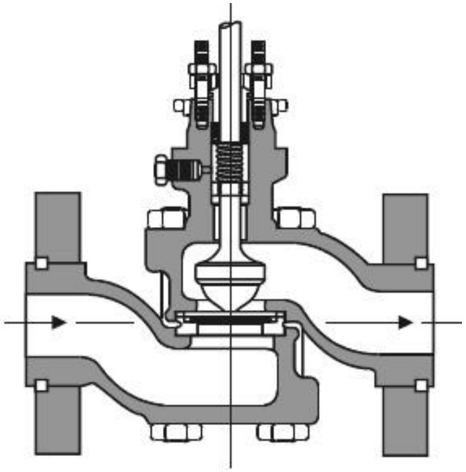


Various Control Valve Designs: Globe !!!

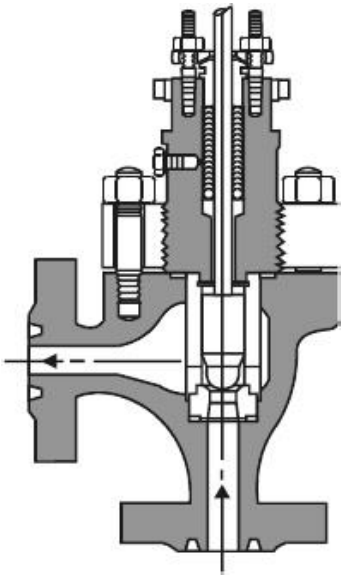
- **By ISA. 3.70 Globe valve:** a valve with a linear motion closure member whose seal is perpendicular to the stem motion, one or more ports and a body distinguished by a globular shaped cavity around the port region. (See below 4a/b.)
- Can be also in Angle configuration.
- It is the most used control valve design. "True control valve".



(A) Globe Body, Cage Guided



(B) Split Body, Stem Guided



Various Control Valve Designs: Globe !!!

- **Globe.** This type of valve is the most commonly used type of Control Valve.

- **Advantages**.
  - Suitable for general to very severe service.
  - Provides great flexibility in size, configuration (globe/angle),
  - All pressure classes (standard, special, special interpolated)
  - All basic pipe connections available
  - Most diverse materials of construction
  - Variety of trim options available (anti-cavitation, anti-noise, reduced capacity and others)
  - Variety of actuation options (pneumatic, electric.., quick stroke, slow stroke, partial stroke)
  - Very often it is the only option for the application

- **Disadvantages**.
  - In larger sizes can be very costly.

Control Valves Assembly / Wide view

Practically all control valve assemblies consist of:

- **Control valve (body assembly)** of a type recommended for the application with its add-on parts (DSH, outlet anti-noise devices or others).
- **Actuator Assembly**
  - Yoke
  - Actuator
- **Positioning device**
- **Accessories** (maybe located on the Yoke, externally on the actuator itself, internally or externally inside/on positioner or remotely from valve assembly for T, vibration or other reasons)
  - Hand-wheel
  - Limit Switches
  - Volume boosters
  - Quick Exhaust
  - Needle valves
  - Solenoids
  - Volume tank
  - Others to provide required functions

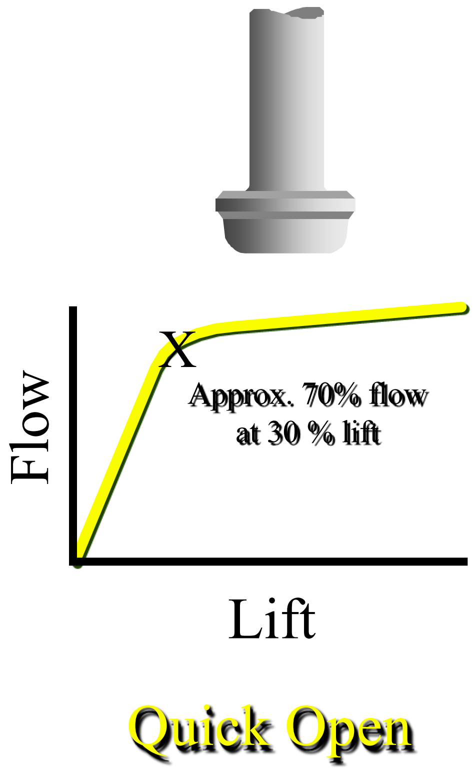
Valve Body / Focused view of GLOBE valve design

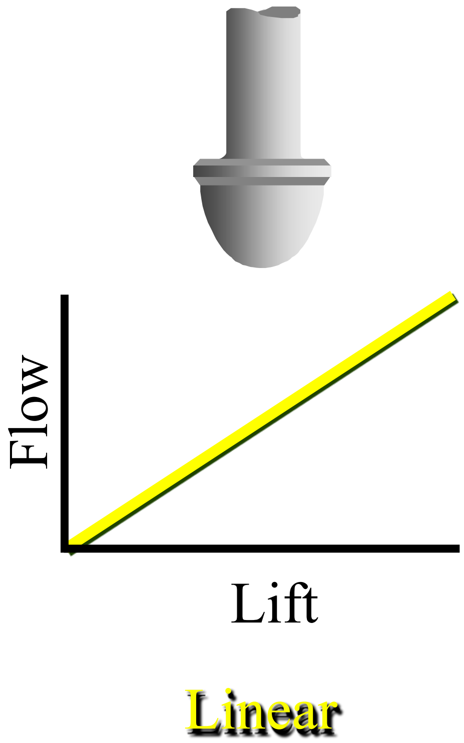
- **3.14 Body:** the main pressure boundary of the valve that also provides the pipe connecting ends, the fluid flow passageway, and supports the valve trim. (SGS: Control valves can be designed to a variety of standard ANSI B16.34, API, DIN, JIS…)
- **3.16 Bonnet:** the portion of the valve that contains the packing box and stem seal and may guide the stem. It provides the principal opening to the body cavity for assembly of internal parts or it may be an integral part of the valve body. It may also provide for the attachment of the actuator to the valve body. Typical bonnets are bolted, threaded, welded, pressure-sealed, or integral with the body.
- **3.172 Trim:** the internal components of a valve that modulate the flow of the controlled fluid.
- **3.106 Packing:** a sealing system consisting of deformable material contained in a packing box which usually has an adjustable compression means to obtain or maintain an effective seal. (SGS: Live-loaded packing very often used to minimize the maintenance effort. TFE or Graphite based, Low Emission or ZERO leak- bellows).
- **3.107 Packing box:** the chamber, in the bonnet, surrounding the stem and containing packing and other stem sealing and guiding parts.
- **3.117 Plug:** a term frequently used to refer to the closure member. (SGS: maybe of unbalanced balanced type to minimize actuator size. OTP vs. UTP / PDTC vs. PDTO terminology)
- **3.143 Seat ring:** a part of the valve body assembly that provides a seating surface for the closure member and may provide part of the flow control orifice. (SGS: quick change trim vs. threaded-in seat ring design).
- Cage (or disc stack) if required for noise or cavitation control or simply as seat ring retainer. (SGS: Various designs used to provide “staged” pressure drop to minimize or avoid cavitation or reduce noise generated by the valve).
- Bonnet & seat ring gasket, dynamic seals are the soft goods associated with valve body.
- Spiral-Wound (for thermal compensation (Inconel form+Graphite Filler / 316SS form+Composition Filler)

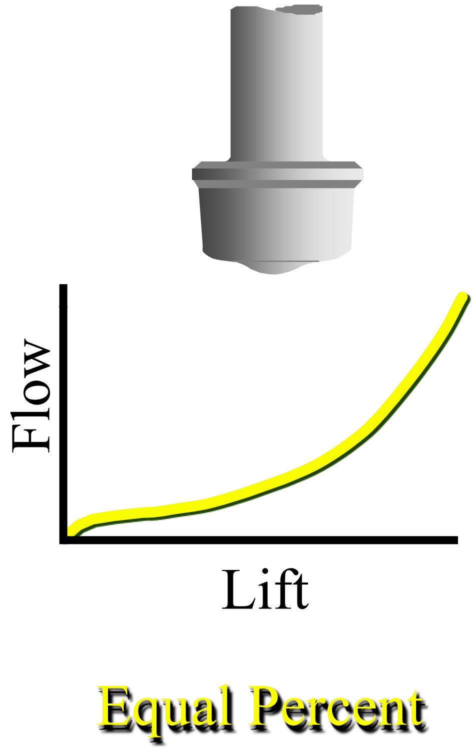
Valve Body / Focused view of GLOBE valve design (cont.)

Flow Characteristics (can be done by plug or cage)

(The purpose of valve characterizing is to provide uniform control loop stability over expected range of operating conditions, basically to match the valve gain to the system gain for OPTIMUM performance)







Actuator Assembly / Focused view of GLOBE valve design

- **3.181 Yoke:** the structure that rigidly connects the actuator power unit to the valve.(SGS: Most yokes made of castings and maybe made of CS, SS, AL and even exotic materials on request. Due to that delivery for them may have a longer lead time. Some yoke will have visual travel indicators as well as some other accessories mounted on them.)
- **3.3 Actuator:** a pneumatic, hydraulic, or electrically powered device which supplies force and motion to position a valve's closure member at or between the open or closed position. (SGS: Most common type of actuator used in industry is a PNEUMATICALLY powered. Each actuator has its plusses and minuses.
- Out of pneumatic ones used on Globe type valves the most common types are:
  - Spring-Diaphragm
  - Piston
- Single acting vs. double acting actuator
- Direct acting (extends steam out at air P increase) / Reverse (retracts)… PDTC vs. PRTC
- Spring-Diaphragm:
  - Very popular and works nicely with smaller valves. On the larger sizes maybe too bulky.
  - Spring provides Fail-Safe option, but not too good if Fail-in-place mode required.
  - Air supply pressure are limited to 30 psig (Most common) or 60 psig (less common) and that limit the force it can output.
  - Diaphragm itself is a weak point for calibration and from structural integrity stand point.
- Piston:
  - Also very popular. More compact then spring-diaphragm unit for the same valve.
  - Upper or low chamber may (or may not) have spring, thus it can be used for all possible fail-safe modes.
  - Air supply pressure can be up to 150 psig (but normally is limited by positioning device air supply pressure limitations).
  - Calibration can be done easier due to hard stops on upper and lower side of travel.
- Both designs are pretty similar from maintenance stand point.
- Bench set (S-D Actuators only):
  - Air P range that is required co compress the spring a distance that is equal to the rated valves travel when CV is disconnected from the actuator

Positioning devices / Wide view of Globe valve design

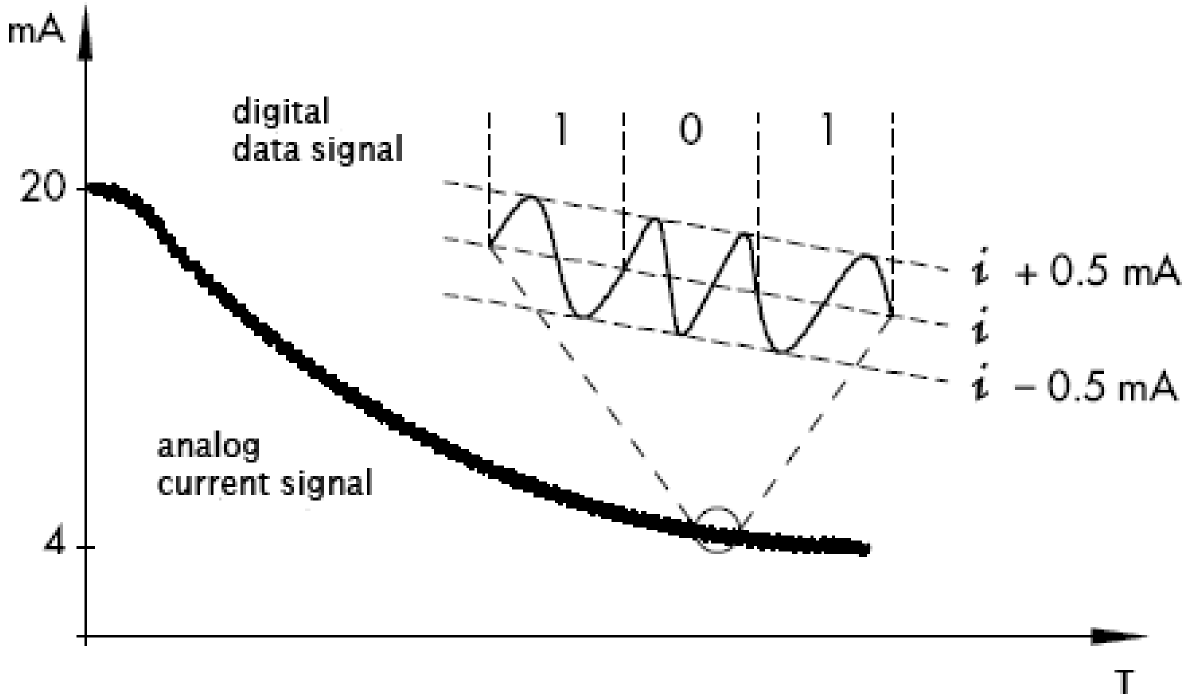
- **Manual** (No control signal). Driving force – manual by hands. Not for a very precise control. Basically hand-wheel operated. Not “control valve” as defined.
- **3.167 Transducer:** a device that is actuated by power from one system and transmits power in another form to a second system, such as a pressure transducer that sends a signal proportional to the measured pressure. (SGS: or I/P transducer).
- **Pneumatic** (3-15 psi control signal). Driving force – pneumatic supply (can be air or other compressible media. Feedback normally visual type or separate electric. It is an “old” type approach.
- **Electric** (4-20 mA control signal). Driving force electric power (24 VDC/VAC, 110-220-360 VAC. Mainly used wherever Air supply is not available at the job site. Fail-Safe done by Spring or Battery pack back up. Comment: Power to open/spring…
- **Electro-Pneumatic or Digital** (control signal 4-20 maybe with HART, Digital). Driving force – air (or other gas). Most common. Variety of options and diagnostics available.
- **Electro-Hydraulic** (control signal 4-20 mA). Driving force hydraulic power unit. This type of unit have main advantage of being the fastest, but also the most complicated from maintenance Stand-point.

Positioning devices / Focused view of Globe valve design

- **Electro-Pneumatic** (control signal 4-20 maybe with HART, Digital). Driving force – air (or other gas). Most common. Variety of options and diagnostics available.
- Each positioning device has to have a stem position feedback to operate correctly (to saturate required port). I will not go over specifics of its operation due to time limit.
- Most common now are: “Smart” type devices that use HART protocol over 4-20 mA signal.
- HART is a master-slave protocol.
- FF (digital) is the other lesser common one (but it is more common in some industries and on new installations) Pier to pier protocol that allows to 300-400 various pieces of info to be used.
- Digital Positioners normally have various tiers of diagnostics from simple (valve has to be off-line) to most sophisticated (allowing to see and check on valve performance while valve is in operation).
- Each control valve assembly normally provided by vendor after battery of tests (seat leak, pressure, possibly other NDE, whatever normally requested by the client), performance test (the factory normally has a copy of the valve digital signature as tested before shipment)
- Positioner may have at least two pressure gauges: air supply/output pressure
- Optional 4-20 mA feed-back
- Positioner will have internal sensors which used for diagnostic purposes 24/7/365:
  - Ramp Test, Step test, Supply pressure, friction, pneumatic leak, T, Long-Term trending, partial stroke test, other info related to actuator/valve/control and many more
- It needs to be clearly understood that to utilize full extend of the diagnostics one needs to have AMS (or vendor provided software). They will provide all diagnostic functions and trending features of “Smart” positioners. Without software only limited options are available.
- Calibration and set up can be done easily. In case of failure the device set up can be easily duplicated to a new unit

Positioning devices – HART / Focused view of Globe valve design

- **Electro-Pneumatic** - control signal 4-20 with HART ("Smart positioners").
- Driving force – air (or other gas). Most common.
- HART – Highway Addressable Transducer protocol. It is OPEN protocol was developed by Rosemount
- Uses the Bell 202 US telephone standard Frequency Shift Keying signal to communicate at 1200 baud
- 1200Hz as "1" and 2200 Hz as "0". The signal is superimposed at low level (+/- 0.5 mA)



Accessories / Focused view of Globe valve design

- Hand-Wheel (manual over-ride) used to control to drive valve in a desired position upon air supply failure. Can be top or side mounted. Often has required specified torque value for operation.
- Limit Switches. Variety of external or internal to positioner switch arrangements are available. The switches are subject to electrical specifications (type SPDT/DPDT, NEMA ratings, Amp ratings and other have to be met).
- Volume boosters & Quick Exhausts used to meet a specific quick opening time for the valve. Normally are sized by the vendor. The required stroke time than may be verified by the performance test (if required).
- Needle Valves used to significantly slowdown the stroke time. Normally are sized by the vendor. The required stroke time than may be verified by the performance test (if required).
- Solenoids. Variety of solenoids are available on the market in variety of materials. As the limit switches they are subject to comply with electrical specs.
- Volume tank. Main functions (a) is to drive the valve to a fail-safe when other means are not available (i.e. spring can not be used due to large size of the valve/actuator) and/or (b) have enough air to stroke the valve predetermined amount of cycles.
- Connecting tubing. Various materials and sizes maybe required as well as the type of connections (i.e. Swagelok) and sizes (i.e. 3/8” or ¼”)

Specification & sizing datasheet review

Sample of ***standards*** used for Control valve designs.

1. A lot of valves designed to ANSI B16.34. This standard allows to determine required pressure class (valve wall thickness) based on valve materials and design P & T. (GSG: design P/T…)
2. Face-to-Face dimensions, Flange sizes are specified in ANSI B16.5
3. **Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)**
4. *ASME B16.10 Face-to-Face and End-to-End Dimensions of Valves*
5. ASME B16.25 Butt Weld Ends and Socket Ends ASME B16.11, Threaded Ends ASME B1.20.1
6. American Society for Testing and Materials
    1. *ASTM A105 Standard Specification for Carbon Steel Forgings for Piping Applications*
    2. *ASTM A182 Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*
7. *ANSI/ISA 75.01.01 Flow Equations for Sizing Control Valves*
8. *ANSI/ISA 75.05.01 Control Valve Terminology*
9. *ANSI/ISA 75.08.06 Face-to-Face Dimensions for Flanged Globe-Style Control Valve Bodies (ANSI Classes 900, 1500 and 2500)*
10. *ANSI/ISA 75.19.01 Hydrostatic Testing of Control Valves*
11. International Electrotechnical Commission
    1. *IEC 60534-8-3 Industrial Process Control Valves, Part 8-3: Noise Considerations: Control Valves Aerodynamic Noise Prediction Method*

Specification & sizing datasheet review / cont.

Sample of ***wording*** from some customer's specs related to their RFQ:

1. Seat leakage shall meet the ANSI/FCI 70-2 or MSS-SP-61
2. The manufacturer is responsible for the valve flow capacity sizing, noise calculations and actuator sizing. Control valve sizing shall be based on ANSI/ISA 75.01.01 or IEC 60534-2-5 as applicable.
3. The manufacturer is responsible for correctly sizing the actuators based on the specification
4. Each control valve shall be provided with a digital positioner, unless otherwise specified.
5. HART positioner. A 2-wire loop powered 4-20 mA signal HART protocol smart positioners shall be locally configurable by push buttons and a HART handheld terminal and remotely by a HART handheld terminal and through the DCS.
6. Manufacturer shall test, record and submit control valve signatures, or tested hysteresis data…
7. Positioners shall be fully configured with all user information.
8. The total maximum inaccuracy of the valve travel position due to any limitation (e.g., repeatability, dead band, resolution, hysteresis, non-linearity, etc.) shall be: 1.5% for valve sizes below 12" and 2.5% for valves of 14"-18"
9. Pneumatic tubing and fittings shall be AISI 316 stainless steel minimum.
10. All control valves shall be provided with a suitably sized air filter regulator set.
11. Actuators shall meet the control stroke time specified on the DS for all specified operating conditions

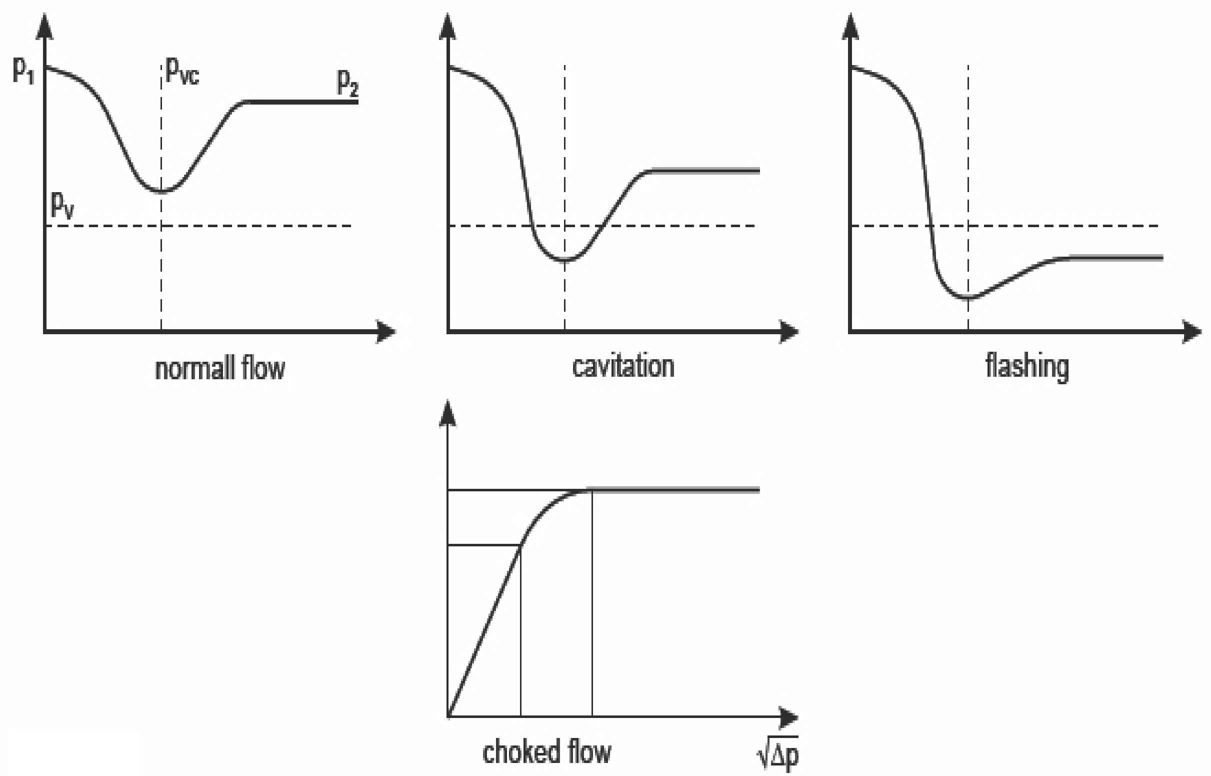
Specification & sizing datasheet review / cont.

Sample wording from actual customer's RFQ (cont.)

1. Positioners shall be provided with gauges to indicate the air supply and signal pressures and positioner pneumatic output. For double acting actuators both top and bottom pressure gauges should be provided on the positioner.
2. If a hand-wheel is specified on the DS, manual operation of the hand-wheel shall override automatic operation. Hand-wheel mechanism shall not add any friction to the actuator. The hand-wheel operation shall be clockwise to close the valve and anti-clockwise to open the valve. Hand-wheel shall not be used as mechanical travel stop. The neutral position shall be clearly indicated.
3. Discrete limit switch shall be of the proximity or magnetic sensor type, as specified on the DS. Limit switch enclosures shall be hermetically sealed. Switch contact outputs shall be minimum, Single-Pole, Double-Throw (SPDT). Contact rating shall be minimum, 0.5 Amp inductive at 125 VDC and 2 Amp resistive at 120 VAC.
4. A solenoid valve shall move the valve to the fail-safe position when de-energized. The solenoid valve shall have Viton internal soft parts. The minimum solenoid valve size shall be 0.25 inches. Solenoid operated valves shall have class H insulation, stainless steel body and be selected from the list of approved manufacturers.
5. Volume tanks shall be mechanically designed to withstand a maximum pressure of 125 psig at 82°C. Volume tanks shall be manufactured in accordance with ASME section VIII (stamped UM). Volume tanks shall have a minimum capacity for two complete strokes of the control valve at instrument air pressure of 60 psig.
6. When mechanical limit stops are required, they shall be of a permanently welded type.

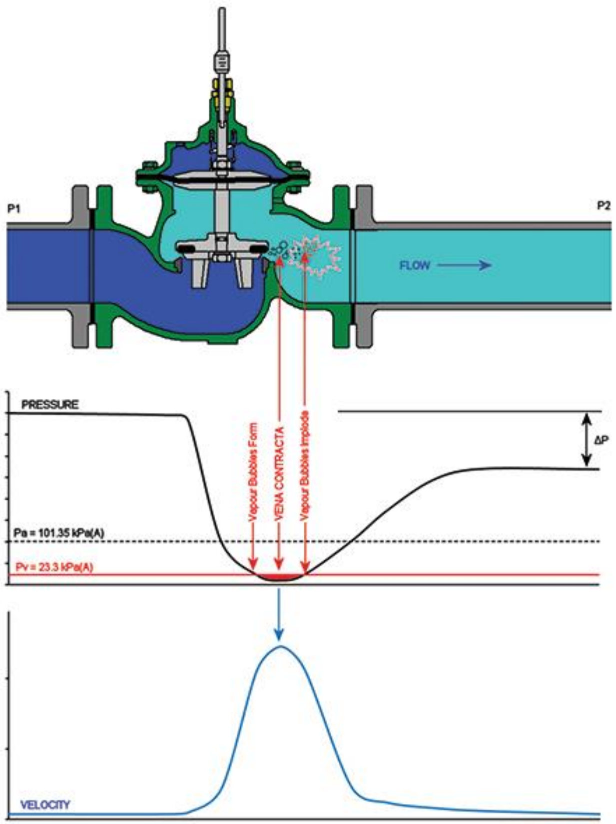
Samples of Control Valves applications

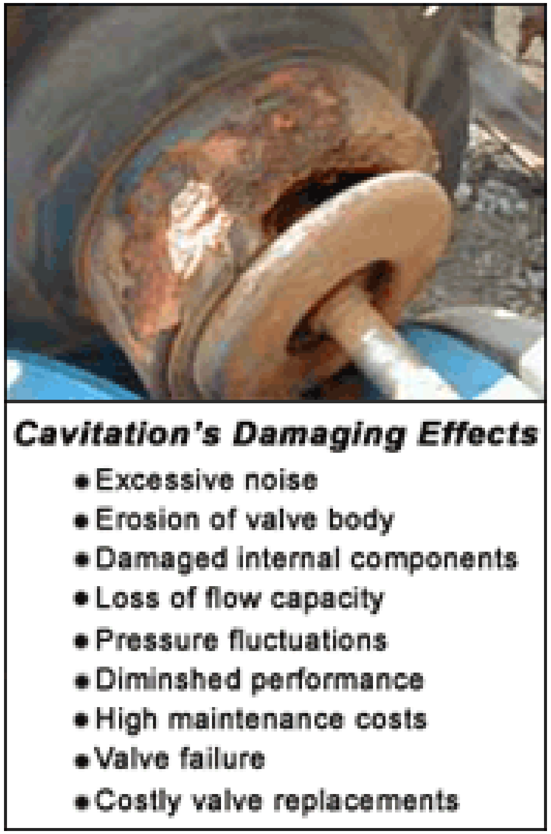
- Cavitation, flushing and noise brief review.
- It can be related to a lot of control valve actual applications.
- Cavitation: only non-compressible media & related to P_V of the media
- Noise: compressible media & related to sonic velocity (source vs. path treatment approach)



Samples of Control Valves applications

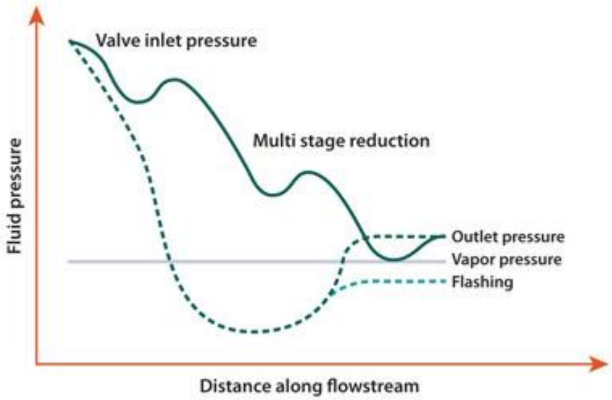
- Cavitation effects





Samples of Control Valves applications

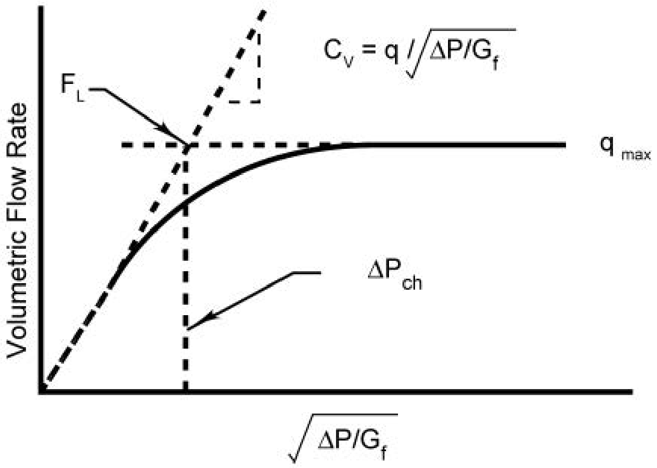
- Cavitation solutions:
  - Hardened trim materials
  - Staged pressure drop trim designs →



- Flushing solutions:
  - Hardened trim materials
  - Angle (OTP flow) valve (with outlet liner) →
  - Target plate designs

Control Valves sizing

- The valve industry uses C_v to describe the flow capacity of the valve
- C_v values has to be calculated for each sizing condition (min/norm/max flow cases)
- Basic Flow Equation: $C_v = q^* \sqrt{(SG/dP)}$
  - Where:
    - Cv is valve flow coefficient
    - Q is the Flow Rate (gpm)
    - SG is specific gravity (ratio of media density to water density at 60F
    - dP – is the lesser of (P1-P2) or dP_{choked}
      - where: $dP_{choked} = F_L^2 *(P1-P_{VC})$
      - F_{L} _ Flow Recovery coefficient (provided by the valve manufacturer and related to control valve design and to when the valve will be having a choked flow.
      - (*) for gas flow choked (max) flow is where the gas reaches its sonic velocity (speed of sound)
- There are some factors that need to be accounted for but for our purpose… above good enough to get the main idea.
- For compressible media the equation is more complicated and reflects:
  - Real Gas vs. Ideal gas/Gas expansion & density changes
- Two-phase flow: leave it to prose to make.



Specification & sizing datasheet review / cont.

© ISA S20.50, Rev. 1 — CONTROL VALVE DATA SHEET — Second Printing

	PROJECT UNIT P.O. ITEM CONTRACT *MFR. SERIAL	DATA SHEET ___ of ___ SPEC TAG DWG SERVICE

No.			Units	Max Flow	Norm Flow	Min Flow	Shut Off	
1		Fluid					Crit Press PC	
2	SERVICE CONDITIONS	Flow Rate					—	
3		Inlet Pressure						
4		Outlet Pressure						
5		Inlet Temperature						
6		Spec Wt/Spec Grav/Mol Wt					—	
7		Viscosity/Spec Heats Ratio					—	
8		Vapor Pressure P_V					—	
9		*Required C_V					—	
10		*Travel	%				0	
11		Allowable/*Predicted SPL	dBA	/	/	/		
12								

No.	Section	Field	No.	Section	Field
13	LINE	Pipe Line Size In	53	ACTUATOR	*Type
14		& Schedule Out	54		*Mfr & Model
15		Pipe Line Insulation	55		*Size Eff Area
16	VALVE BODY/BONNET	*Type	56		On/Off Modulating
17		*Size ANSI Class	57		Spring Action Open/Close
18		Max Press/Temp	58		*Max Allowable Pressure
19		*Mfr & Model	59		*Min Required Pressure
20		*Body/Bonnet Matl	60		Available Air Supply Pressure:
21		*Liner Material/ID	61		Max Min
22		End In	62		*Bench Range /
23		Connection Out	63		Actuator Orientation
24		Flg Face Finish	64		Handwheel Type
25		End Ext/Matl	65		Air Failure Valve Set at
26		*Flow Direction	66		
27		*Type of Bonnet	67		Input Signal
28		Lub & Iso Valve Lube	68	POSITIONER	*Type
29		*Packing Material	69		*Mfr & Model
30		*Packing Type	70		*On Incr Signal Output Incr/Decr
31			71		Gauges By pass
32	TRIM	*Type	72		*Cam Characteristic
33		*Size Rated Travel	73		
34		*Characteristic	74	SWITCHES	Type Quantity
35		*Balanced/Unbalanced	75		*Mfr & Model
36		*Rated C_V F_L X_T	76		Contacts/Rating
37		*Plug/Ball/Disk Material	77		Actuation Points
38		*Seat Material	78		
39		*Cage/Guide Material	79	AIR SET	*Mfr & Model
40		*Stem Material	80		*Set Pressure
41			81		Filter Gauge
42			82		
43	SPECIALS/ACCESSORIES	NEC Class Group Div	83	TESTS	*Hydro Pressure
44			84		ANSI/FCI Leakage Class
45			85		
46			86		
47					
48					
49					
50					
51					
52					

Rev	Date	Revision	Orig	App

*Information supplied by manufacturer unless already specified.

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Control Valves sizing/selection: What to look for…

- It will be beneficial if you would discuss with your vendor and find mutual understanding on below point:

- Acceptable materials of construction (metals/soft goods) that mainly related to: chemical compatibility with the media & its design T, also ambient T and... Design P. If media erosive? Pipe and upstream pumps materials are the good first place to start with and check.
- Are there any specific restrictions on materials being used: No China, No Sulphur content…
- Design standard (i.e. ANSI vs. API as it relates to weight of the valve) to be considered (Oil rigs…)
- How the valve will be operated (availability of air or electrical power).
- Make sure you clearly identify <u>Min</u> Air supply pressure or correct voltage.
- How the valve will be controlled (4-20mA/HART/FF). Feedback loop or feed forward loop?
- Criticality of the valve: how much diagnostics you need to make sure it work when required
- Discuss sizing conditions. Is there any special cases that may drive the valve design maybe to higher capacity or toward a special type trim: Start up, any system upset or transient cases. How long the cases may last and how often they can be encountered by the valve.
- Clearly understand Fail-Safe options set ups: loss of air / loss of electric power or signal
- Stroke speeds for both control mode (open/close) and any emergency mode.
- How the emergency mode needs to be implemented (solenoids, DCS, change of air supply P…)
- What accessories you'd like to have with the valve with some details if required.
- Position of the valve on the piping system (actuator up/sideway particular for rotary valve designs, any CV or actuator support required)
- Space restrictions around the valve / accessibility for maintenance for CV & actuator
- Spares (soft or metal, 1 or 3 years), any special tools (Chem. Cleaning/steam blow/ seat removal)?
- What documentation is expected with the valve (upon delivery or per some other schedule)
- What tests (including NDE) expected to be done and which of them require CERTIFICATES.
- Why do you need to do the above. Here are to reasons:
  - it always less costly to combat any problems on the paper that in metal.
  - In most cases you do not ask – you do not get!

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