Selecting Valves & Gates

Water Control Gates
TEN CRITICAL QUESTIONS

• 1. WHAT IS THE MEDIA OR FLUID?
• 2. WHAT IS THE OPERATING TEMPERATURE?
• 3. WHAT IS THE MAXIMUM AND MINIMUM PRESSURE? IS THERE A POSSIBILITY OF REVERSE PRESSURE?
• 4. WILL THE VALVE BE USED FOR ON-OFF, THROTTLING, DIVERSION OR A COMBINATION?
• 5. HOW WILL THE VALVE BE ACTUATED?
• 6. IS PRESSURE LOSS THROUGH THE VALVE CRITICAL?
• 7. WHAT CLASS OF SHUT-OFF IS REQUIRED?
• 8. WHAT IS THE CYCLE LIFE REQUIRED?
• 9. DOES LOCATION OR EASE OF MAINTENANCE NEED TO BE CONSIDERED?
• 10. ARE THERE ANY SPECIAL CONDITIONS THAT NEED TO BE CONSIDERED?
WHAT IS THE MEDIA OR FLUID?

- LIQUIDS - CLEAN, DIRTY, VISCOUS, CORROSIVE
- SLURRIES - SLUDGE, ABRASIVE, FIBROUS
- STEAM - LOW PRESSURE, SATURATED, SUPERHEATED
- GASES - CLEAN, DIRTY, CORROSIVE
- DRY MATERIAL
MEDIA/FLUID

- WATCH SEAT MATERIALS FOR COMPATIBILITY WITH PARTICULAR MEDIA
- WATCH BODY, STEM., SHAFT, AND DISC FOR COMPATIBILITY WITH PARTICULAR MEDIA
- WATCH DESIGN CRITERIA FOR USE WITH PARTICULAR SLURRIES, GASES, CORROSIVE AND EROSIVE MEDIA
WHAT IS THE OPERATING TEMPERATURE?

- WATCH SEAT MATERIALS FOR COMPATIBILITY WITH HIGH AND LOW TEMPERATURE REQUIREMENTS
- WATCH BODY, SHAFT, DISC, AND PLUG FOR COMPATIBLY WITH HIGH AND LOW TEMPERATURE
- CONSULT MANUFACTURER CHARTS FOR ELASTOMER AND MATERIAL TEMPERATURE GUIDE
WHAT IS THE MAXIMUM AND MINIMUM PRESSURE? IS THERE A POSSIBILITY OF REVERSE PRESSURE?

• ESPECIALLY CRITICAL FOR THROTTLING VALVES
• NOT ALL VALVES ARE DESIGNED FOR FLOW IN BOTH DIRECTIONS
• NOT ALL VALVES ARE DESIGNED FOR DEAD END SERVICE
• SAVE MONEY BY SIZING CONTROL VALVES PER FLOW REQUIREMENTS VERSUS LINE SIZE
WILL THE VALVE BE USED FOR ON-OFF, THROTTLING, DIVERSION OR A COMBINATION?

• MOST VALVES ARE DESIGNED FOR EITHER ON-OFF OR THROTTLING SERVICE

• NOT ALL DESIGNS CAN BE USED FOR BOTH ON-OFF OR THROTTLING
HOW WILL THE VALVE BE ACTUATED?

• MULTI-TURN VALVES ARE APPROXIMATELY THREE TIMES MORE EXPENSIVE TO AUTOMATE THAN QUARTER TURN VALVES, THIS NEEDS TO BE CONSIDERED DURING DESIGN STAGES

• TORQUE AND THRUST VALUES NEED TO BE CONSIDERED WHEN SELECTING A VALVE DESIGN
IS PRESSURE LOSS THROUGH THE VALVE CRITICAL?

- VALVE DESIGNS WHERE THE DISC OR PLUG IS MOVED OUT OF THE FLOW PATH WHEN IN THE OPEN POSITION WILL HAVE MUCH LOWER PRESSURE LOSSES
- VALVE DESIGNS WITH FULL PORTS WILL HAVE LOWER PRESSURE LOSSES
- PARTICULARLY IMPORTANT WHEN SELECTING CHECK VALVES
WHAT CLASS OF SHUT-OFF IS REQUIRED?

• REFER TO THE ANSI SHUT OFF STANDARDS,
• CLASS 1 IS THE LOWEST,
• CLASS VI IS CONSIDERED “BUBBLE TIGHT”
• NOTE THAT ANSI PRESSURE RATING OF VALVES IS DIFFERENT FROM ANSI DIMENSIONAL AND ANSI SHUT-OFF
• NOT ALL VALVES ARE DESIGNED TO PROVIDE “BUBBLE TIGHT” SHUT OFF
CLASS OF SHUT-OFF

- METAL SEATED VALVES WILL NOT PROVIDE "BUBBLE TIGHT" SHUT-OFF
- MANY VALVES ARE DESIGNED TO TAKE HIGH C.W.P. BUT WILL ONLY SHUT-OFF AT A LOWER PRESSURE.
WHAT IS THE REQUIRED CYCLE LIFE?

• CONSIDER CYCLE LIFE WHEN DESIGNING A SYSTEM

• VALVES ARE DESIGNED FOR CYCLE LIFES OF ONE THOUSAND (1000) TO TWO OR THREE MILLION (2,000,000 - 3,000,000)

• ALSO CONSIDER CYCLE LIFE IF THE VALVE IS RARELY USED, ONCE EVERY YEAR OR LESS
DOES LOCATION OR EASE OF MAINTENANCE NEED TO BE CONSIDERED?

• NOT ALL VALVES ARE DESIGNED TO BE OUTSIDE OR SUBMERGED.

• DO YOU NEED SPECIAL PAINTING OR MATERIALS DUE TO LOCATION?

• WILL YOU NEED EXTENSION STEMS FOR ACTUATORS

• NOT ALL VALVES ARE DESIGNED TO BE REPAIRABLE, SOME VALVES CAN ONLY BE REPAIRED BY THE FACTORY.
LOCATION/MAINTENANCE

• MANY VALVES ARE DESIGNED TO BE “THROW-AWAY” TO SAVE ON MANUFACTURING COST.
• THERE IS NOTHING WRONG WITH THIS IF THE VALVE IS INEXPENSIVE AND NOT IN A CRITICAL AREA.
• PROPER VALVE INSTALLATION CAN EXTEND THE CYCLE LIFE AND PREVENT PREMATURE VALVE FAILURE.
LOCATION/MAINTENANCE

• IS THERE ENOUGH ROOM FOR THE VALVE THAT HAS BEEN SELECTED? YOU MIGHT NEED A LOW PROFILE OR DESIGNED TO FIT IN TIGHT SPACES

• DOES THE VALVE NEED TO BE INSTALLED UPSIDE DOWN OR SIDEWAYS BECAUSE OF SPACE RESTRICTIONS?

• SOME VALVES SHOULD ONLY BE MOUNTED IN ONE ORIENTATION AND CAN FAIL TO WORK OR WORK POORLY.
ARE THERE ANY SPECIAL CONDITIONS THAT NEED TO BE TAKEN INTO ACCOUNT?

• AWWA SPECIFICATIONS DICTATE A 150% SAFETY FACTOR WHEN SIZING AUTOMATED VALVES.

• BE CAREFUL DURING THE SUBMITTAL PROCESS TO BE SURE THIS IS PROVIDED.

• INCLUDE ADJUSTMENTS FOR OPEN AND CLOSE POSITION ON GEAR OPERATORS AND PNEUMATIC ACTUATORS.
FLOW COEFFICIENT - $C_v$

The flow coefficient - $C_v$ - and the flow factor - $K_v$ – are commonly used to specify the capacity of the valve.

- The definition of the flow coefficient - $C_v$ - the flow of water through a valve at 60 degrees F in US gallons/minute at a pressure drop of 1 PSI
Check Valves
Check Valves

- 2” – 36”
- Seats available in Bronze to Bronze, Bronze to Buna N or Stainless Steel to Buna N
- Lever / weight as the standard
- Lever / spring available
- Drain plug and hinge packing are available options
- EPDM available
Check Valves

- 2” – 72”
- Cast Iron Body
- 175 psi to 12”
- 150 psi 14” and larger
- Standard Seat - Bronze to Buna N
- Optional Seats – Bronze to Bronze, Stainless to Stainless or Stainless to Buna N
- Available with Lever and Weight or Lever and Spring
- Available with air or oil cushions
- 30” and larger standard with dual lever & weight
- Dual levers and weight available on smaller sizes
Eccentric Plug Valves
APPLICATIONS FOR ECCENTRIC PLUG VALVES

- Raw Sewage Intake
- Primary Treatment
- Scum Lines
- Sludge Lines
- Digester Gas
- Grit Chamber
- Gas Lines
- Lift Stations
- Force Mains
- Water Lines
Eccentric plug valves can be round or rectangular ported. The shape of the seat does not determine eccentricity. There is a double offset which allows a plug valve to be eccentric. The stem axis is eccentrically offset from the valve centerline and the shape of the plug is eccentric, not symmetric. This eccentric design allows the plug seat (whether spherical or cylindrical) to make contact with the nickel seat in the body only during the last 5 degrees of travel.
ECCENTRIC PLUG VALVES

• **Actuation Options:**
  - Direct Nut / Lever
  - Gear
    - Hand Wheel
    - Chain wheel
    - Buried Service
  - Cylinder
    - Pneumatic
    - Hydraulic
  - Electric Motor

• **Plug Coatings:**
  - Buna N
  - Neoprene
  - Natural Rubber
  - EPDM
  - Viton

• **Body Linings:**
  - Epoxy Lined
  - Glass Lined
  - Rubber Lined
ECCENTRIC PLUG VALVE PORT DESIGNS

Full Port

Reduced Port
Butterfly Valves

- **Styles**
  - Flanged
  - Wafer
- **Actuators**
  - ¼ Turn
  - Multi-turn
- **Cost less 😊**
- **Can be small or very large 😊**
Butterfly Valves

- Disc remains in the flow when valve is open
- Fibrous materials can get caught on the disc and stem
Globe Valves

- Usually small, but larger sizes are available
- Not the best for fibrous materials
- Multi-turn actuation
Globe Valves

- Repairable
- Materials of construction can be customized to meet almost any condition of temperature, chemistry, or pressure
Pinch Valves

- Flexible sleeve is sealed closed by:
  - Mechanical jaws
  - Pneumatic or Hydraulic Pressure

- Sleeve must be attached to jaws and pulled open for suction applications
Pinch Valves

- Open or Closed housings for mechanical actuation
Pinch Valves

• Available as a check valve
  – Can be mounted horizontally or vertically
  – Back pressure seals the opening
  – Fibrous materials can plug the opening or prevent proper sealing
Ball Valves

- Reliable when:
  - Lots of use
  - Operated rarely
- Seal Tight
- High Pressure capabilities
- Cost More
- Flow Control
Ball Valves

- Parts of a ball valve:
  - Ball
  - Stem
  - Seals
  - Housing

- Materials of construction can be customized to meet almost any condition of temperature, chemistry, or pressure
Ball Valves

• Available in 3-way or 4-way configurations
Gate Valves

• Common low pressure flow control valve
• Fibrous materials can be a problem
Gate Valves

• Most commonly use multi-turn actuator
• Stem can be rising or non-rising
• Gate can be flat or Wedge shape
Gate Valves

- Can use pneumatic or hydraulic actuator
- Wafer or Flanged configurations
- Low Cost 😊
Gate Valves

- Must use by-pass valve and piping for high pressure applications,
- Added engineering & Costs 😞
Large Gate Valves

- Self Contained Gate Frame – Yoke mounted Operator

1. Appropriate when distance from invert to operating floor elevation 2 - 10 ft.

2. End of Channel and in channel mounting applications.

3. Embedded / channel applications note: Vertical travel determines yoke location, stem diameter and operator size.
Large Gate Valves

• Non-Self Contained Frame – Pedestal Mounted Operator

1. Appropriate when distance from invert to operating floor elevation (10+ ft.)

2. Straight Pedestal: Concrete floor slab & Wall corbels.

3. Wall Bracket Pedestals or Offset Pedestals: Anchorage into concrete headwall (photo)

4. Associated operating loads can be calculated
Gate Mounting Options

- **Surface Mounting (Most Applications)**
  - Non-shrink grout pad
  - Adhesive Anchor Bolts

- **Thimble Mounting**
  - High Unseating head applications
  - F-type - 125# Flange - Mechanical Joint (MJ) - Bell End
  - Clear definition of the connection type on the drawings or gate schedule facilitates less confusion for Customer and gate supplier.
Slide Gates

- Slide Gates

- Upward opening gate available with top seals.

- Leakage rates per AWWA standards.

- Incorporate industry standard seals alone without use of mechanical wedges.

- Most models incorporate fully-adjustable resilient seals.
Weir Gates

• Upward closing gates available with top seals.

• Leakage rates set by AWWA standards.

• Non geared, single or dual mechanical gear operator depending on gate width to height ratio.

• Most weir gates incorporate adjustable resilient seals.
Flap Gates

- Aluminum, Stainless steel & Spun Aluminum.
- Available in square or round configurations.
- Flap gates are equipped with flat-back or spigot-back flange for attaching to wall thimbles, variety of pipe types (corrugated, HDPE), new and existing concrete walls.
- Since the gates open automatically, a mechanical lifting device is not required.
Stop Gate

- Available in aluminum or stainless steel material.
- Stop gates are designed to block water flow in open channels.
- Guide rails for embedded, flatback or channel mounting are available.
- These gates are designed for a maximum head of one foot over the slide, unless otherwise specified and are used generally in diversion applications.
Stop Gate

- Options available include Neoprene seals for minimum leakage, UHMW bushings for increased ease of operation and special cut outs such as "V" notch or slot openings for water flow measurement.
- All frames feature welded construction. Available in an almost unlimited range of sizes and configurations.
Telescop ing valves

- Telescopic, or T-Valve Gates (can also be called bin-discharge or decanting).
- Applications: wastewater treatment plants and other water treatment applications to draw off surface fluids and scum.
- They have a lower (outer) tube which is connected to a drain pipe, and an upper (inner) tube which slides up and down, varying the level at which skimming is required to take place. Seals can be fitted between the inner and outer tubes to prevent leakage.
- Available in rising and non-rising stem configurations.
- Electric actuator, Hand wheel, Bevel gear and Rack and Pinion operation.
Level Control Gate

• The level control gate operates completely free of outside power and after initial adjustment absolutely no manual intervention is required. The initial purchase cost is competitive with other systems but can offer substantial lifecycle cost benefits. The costs associated with PLC relays, modulating actuators, maintenance, replacement and energy are relieved.
Level Control Gate

- Level control gates utilize force-balance control to automatically maintain a constant upstream water level at any given discharge while minimizing head loss.

- Sizes and materials of construction are available to meet a wide variety of flow control needs ranging from almost zero to 2000 cfs. The gate nearly closes at low discharge and progressively opens as the flow increases.
Level Control Gate

- OPERATING PRINCIPAL
- As a rule the gate is set so that its trunnion axis coincides with the maximum upstream water level. As long as this condition is fulfilled, the gate will remain in complete equilibrium, when flows vary the gate automatically adjusts up or down passing the exact discharge required to keep the upstream water level constant.
Level Control Gate

- OPERATING PRINCIPAL
- The gate consists of a cylindrical leaf with a cylindrical buoyant compartment provided on its upstream side and balancing ballast containers to the rear. The fabricated elements make up a rigid frame that rotates freely around a horizontal trunnion axis.
Level Control Gate

- OPERATING PRINCIPAL
- The gate is located over the center of axis so that hydraulic thrust on the gate leaf passes through the axis and does not effect the equilibrium. The torques generated by hydraulic force, buoyancy, and weight of the gate are equal and opposite for any angular position of the level control gate.
The Wrap Up:

• Ask the 10 critical questions before choosing a valve
• The best way to save money is to choose wisely:
  – Don’t buy more valve than the application requires!
  – Don’t buy LESS valve than the application requires!