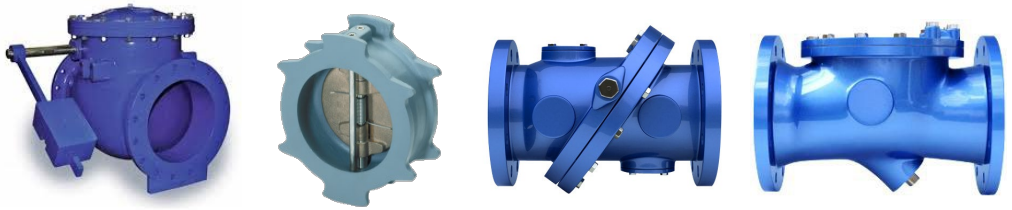
If **Check** Valves



Were **Cars!**

Today's Focus

Topics of Discussion

- Cimco-GC Systems Update
- Purpose of a Check Valve
- Purpose of a Car
- Selecting a Check Valve Like Choosing a Car

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Cimco-GC SYSTEMS

- 80+ years of experience
- Local Technical Support & Service

  Maintenance, Troubleshooting, Start-Ups
- Only Factory Authorized Cla-Val Field Service Team in WA, OR, ID, & AK

CLA-VAL

VAL-MATIC

Cimco-GC PACKAGED SYSTEMS

Cimco-GC Systems VALVE SERVICE

SAFE-T-COVER

Primary Contacts

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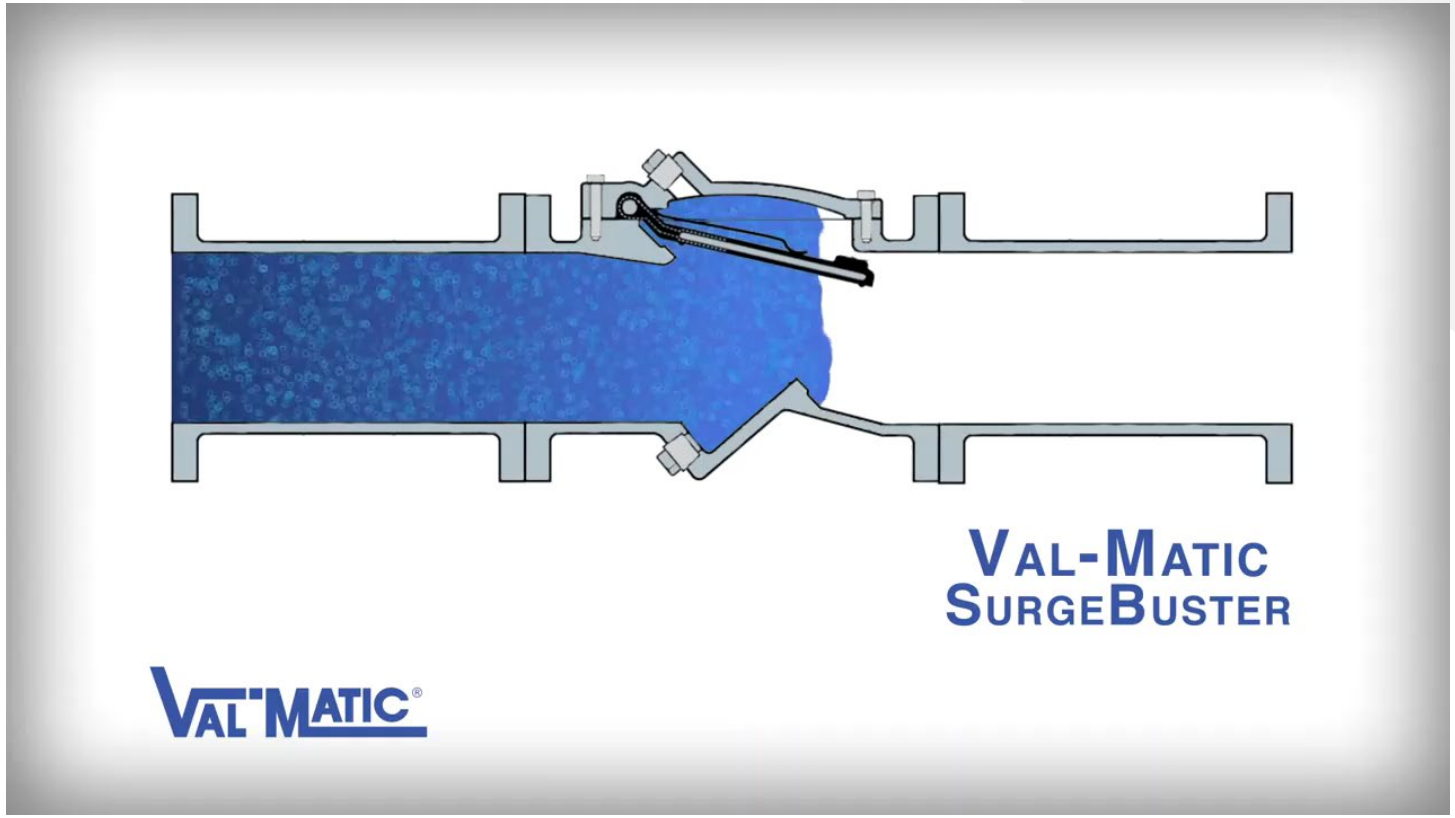
Defining Check Valves

- What is a check valve?
- What makes one check valve better than others?
- What information do you need to select a check valve?



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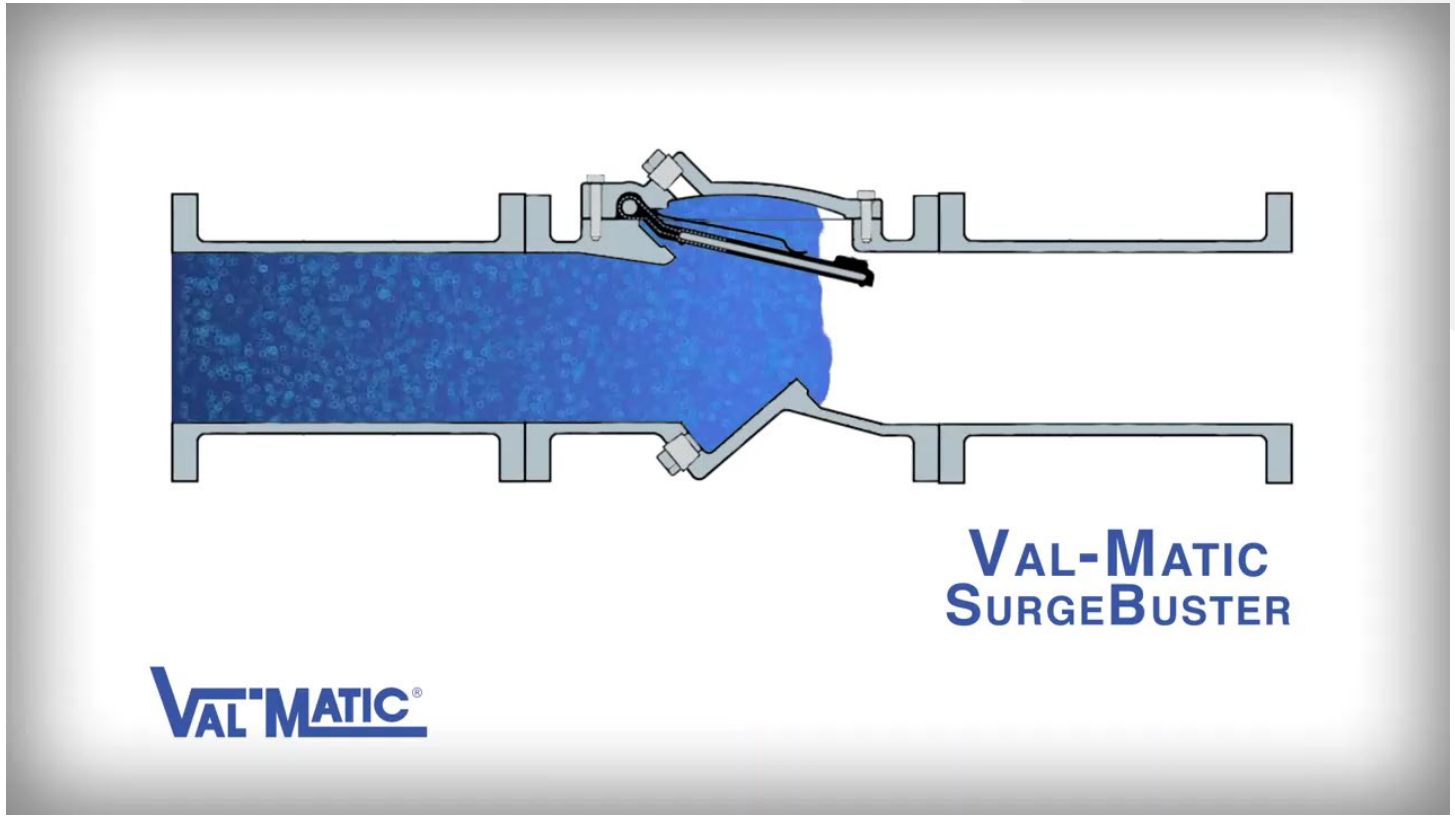
Defining Check Valves

What is its Purpose?

"Automatically opens to allow forward flow and automatically returns to the closed position to prevent reverse flow"



- Minimizes energy consumption at pump start up
- Protects pump and pipe system

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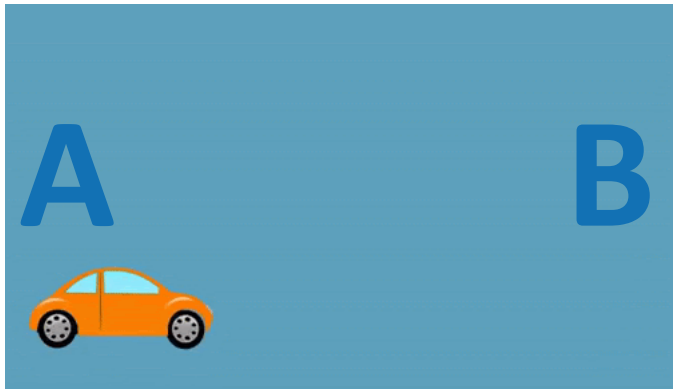
Defining Cars

What is its Purpose?

A car transports people and things from A to B.

- Some cars are designed to be cheap.
- Some cars are designed for high cargo capacity.
- Some cars are designed for speed and less air resistance.
- Some cars are designed to be energy efficient.
- Some cars are designed for status.



Valve Advantages

Benefits to the System

- Prevents Reverse Flow into Pump
  - Protects pump against surges
  - Prevents pump from spinning in reverse which causes damage when the pump starts again.

- Maintains System Pressure
  - Water/Wastewater plants in the US consume 75 billion kW-h annually.
  - 80% of that energy is consumed by high service pumping costs to overcome static head and friction losses.
  - Check valves help pumps start back up

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Valve Advantages

Benefits to the System

- Prevents Up-Thrust
  - Pipe drains water back into source
  - Creates reduced head condition
  - Pump starts up against reduced back pressure
  - Phenomenon damages pumps

Initial Considerations

For a car purchase

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Initial Considerations

For a car purchase

- Gas vs. Hybrid
- Mileage
- Cargo
- Style/Appearance
- Performance
- Cost
- Reliability
- Safety Record

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Initial Considerations

Details to Consider: Check Valves

- Potable Water vs Wastewater
- Direction of Flow (Vertical vs Horizontal)
- Allowable Head Loss & Energy Costs
- Initial Cost & Installation
- Maintenance Cost & Time
- Installation Space
- Slamming; Subsequent Water Hammer

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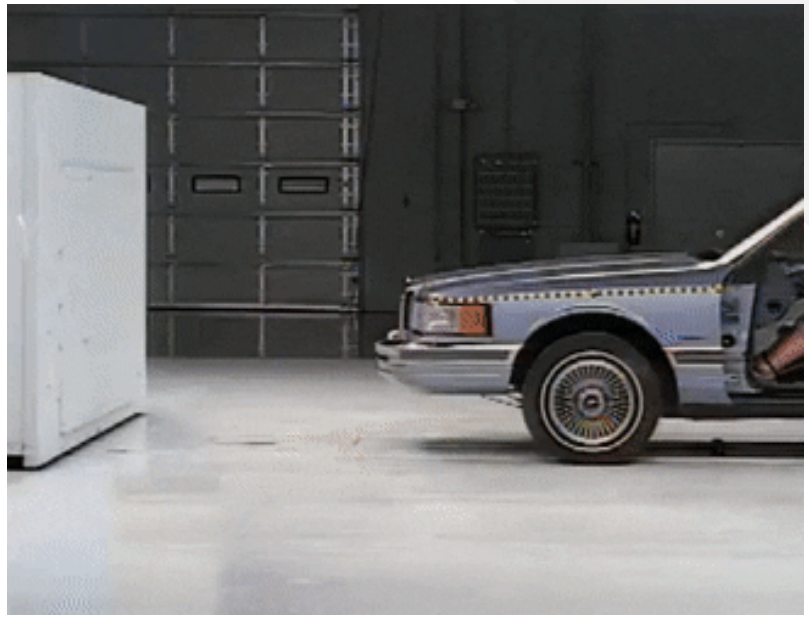
Slamming

Excess Noise and Damage

- Caused by sudden reversal of velocity in pipeline
- Loud noise and shock on system
  - Noise is not caused by physical slamming of the valve.
  - Instantaneous stretching of the pipeline creates noise, stress on joints
- Valve must go closed very quickly or very slowly to prevent slam from happening
- Slamming causes water hammer



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Slamming

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- Slamming causes water hammer

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Slam Types

Different Categories

- Slight Slam
  - Annoying noise but no actual harm to system
  - .5ft./sec increase in velocity

- Moderate Slam
  - Moderate noise, moderate damage which can cause failures over time
  - “Pounds” the system and can overstress pipe and joints resulting in leaks and unplanned maintenance

- Hard Slam
  - Produces explosive noise and vibrations that can cause immediate and catastrophic damage
  - Every 1 ft./sec increase in velocity results in a 50 psi pressure spike

Sealing Abilities

For Different Applications

Resilient (Rubber) Seats

- Buna-N is standard, up to 200F
- EPDM better for Chloramines
- Viton anything above 300F
- Can Seal against uneven Surfaces
- Adjustable
- Resists Abrasion
- Best for Low Pressure Applications
- Less Expensive**

Metal Seats

- Bronze, Welded Nickel, Stainless
- Typically Used at Higher Pressures
- Could be used for Low Pressure
  - Valve standards allow leakage at a rate of 1 fluid ounce per hour per inch of valve size, at low pressure the valve may leak at a greater rate.
- More Expensive

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Check Valve Styles

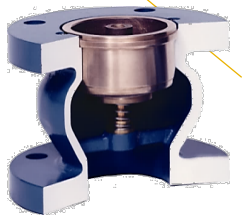
Tilted Disc

Swing Check

Dual Disc

Swing Flex

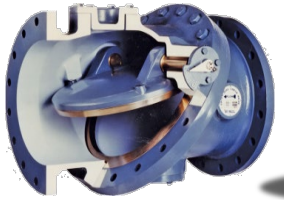
Hydraulic Control



Silent Check

VAL-MATIC®

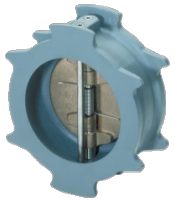
Check Valve Styles



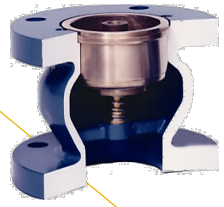
Check Valve Applications

Clean Media Only

Tilted Disc



Dual Disc



Silent Check

Hydraulic Control

Clean & Wastewater

Swing Check

Swing Flex

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Silent Check

The Domestic Sports Car

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Silent Check

It’s fast, but it burns a lot of gas.

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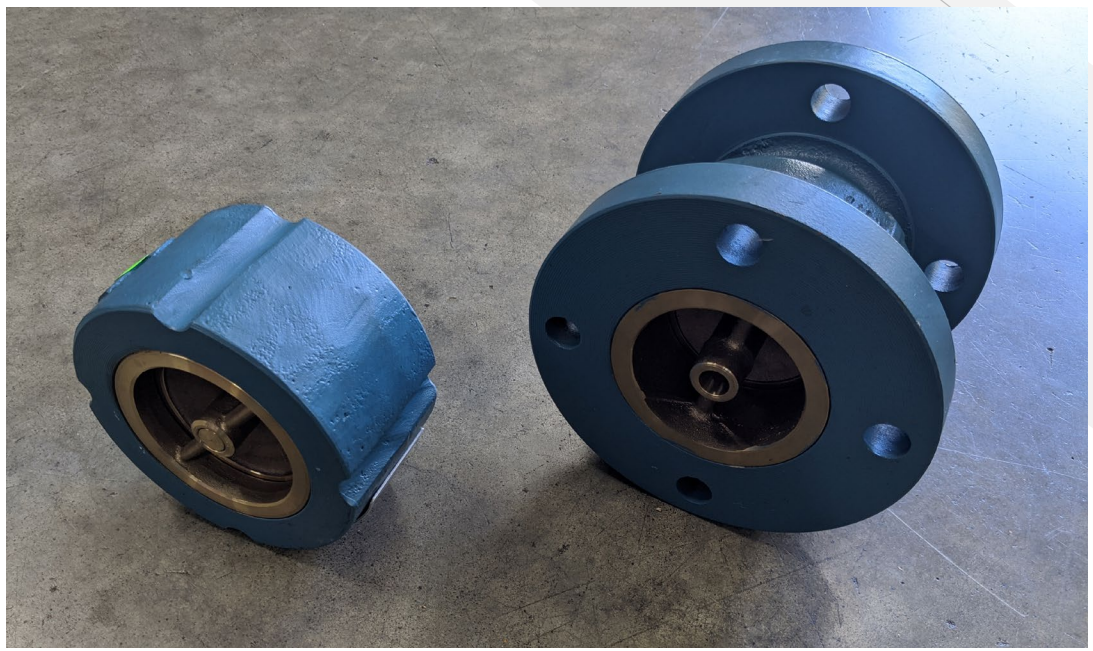
Silent Check

The Specs



- 2.5” to 42” Globe Style
- 2” to 10” Wafer Style (Compact)
- Clean Water Only (Treated Effluent OK)
  - WTP, Pump Stations, Wells, Distribution, etc.
- No Open/Closed Indication
- High level head loss

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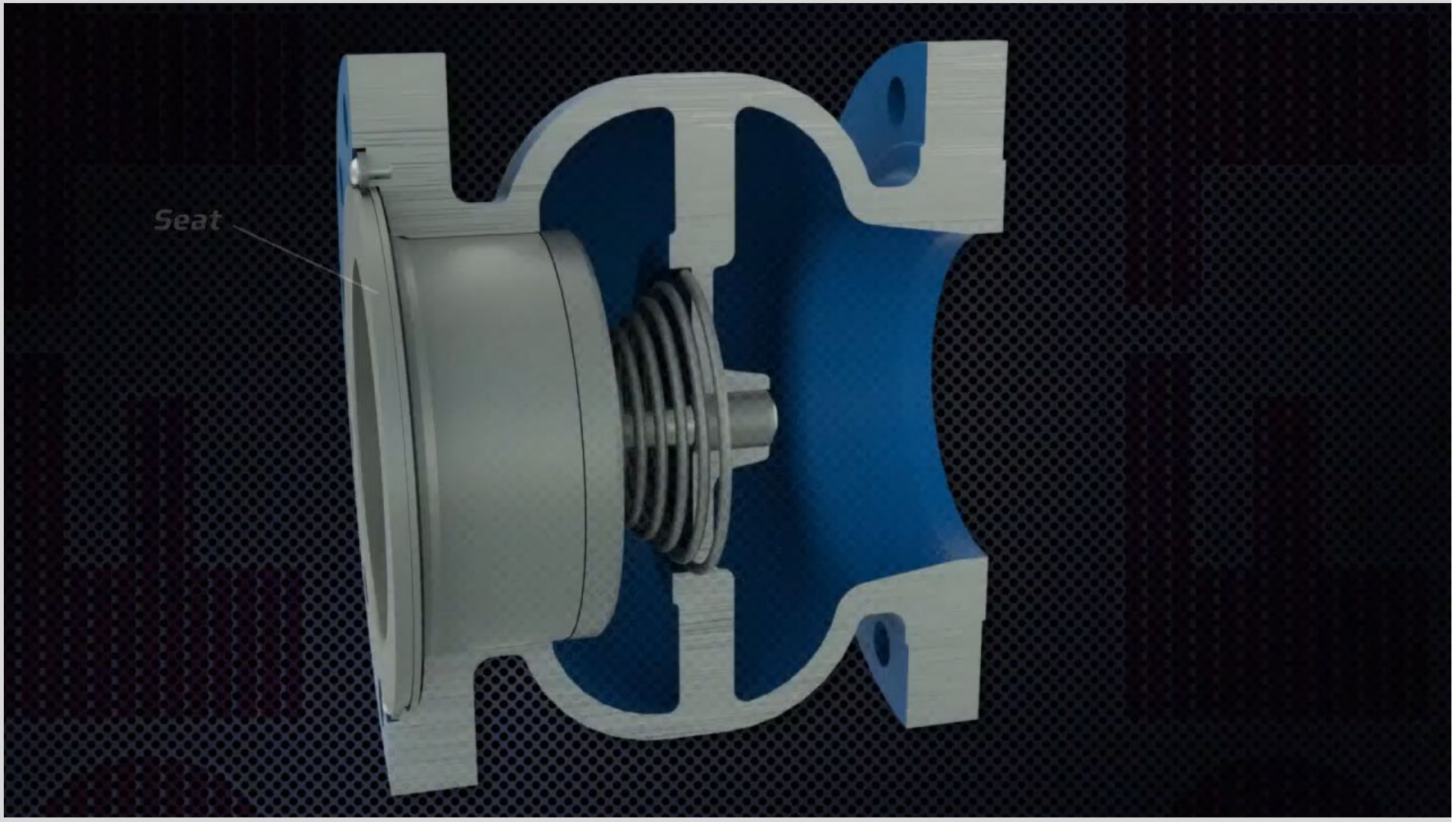
Silent Check Operation



Great Non-Slam Characteristics

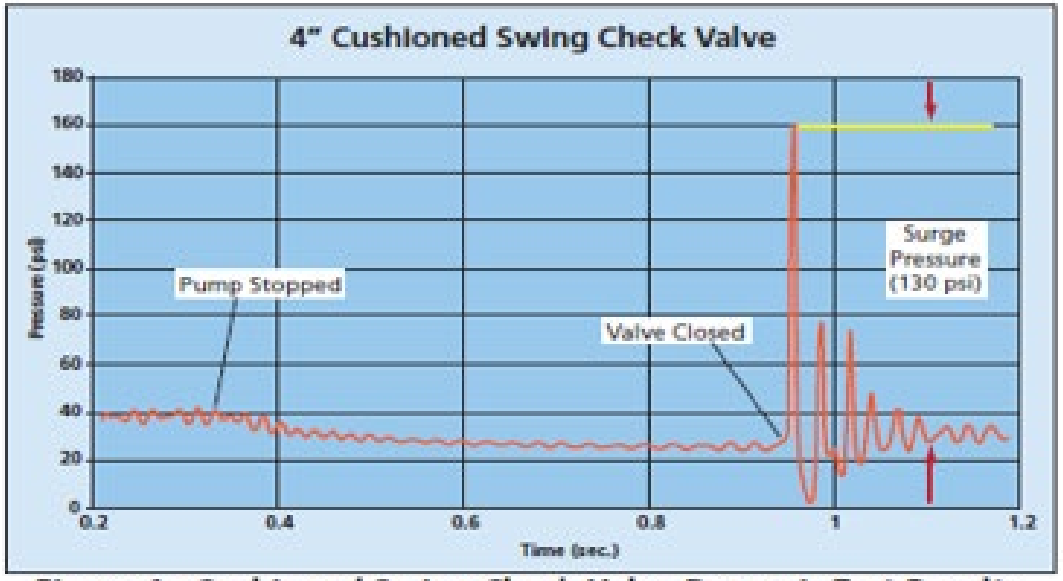


Figure 1 - Cushioned Swing Check Valve Dynamic Test Results

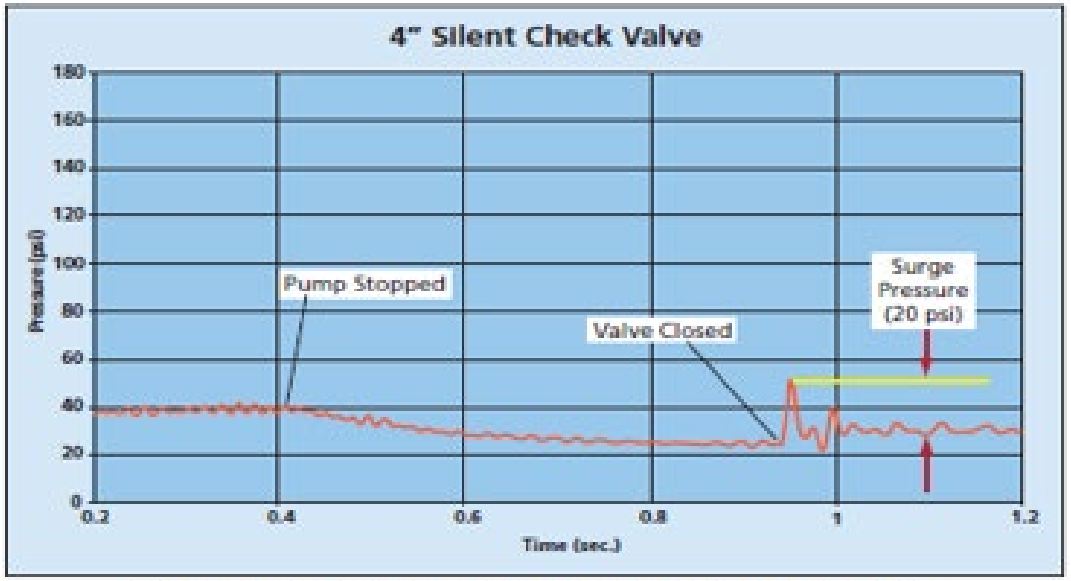
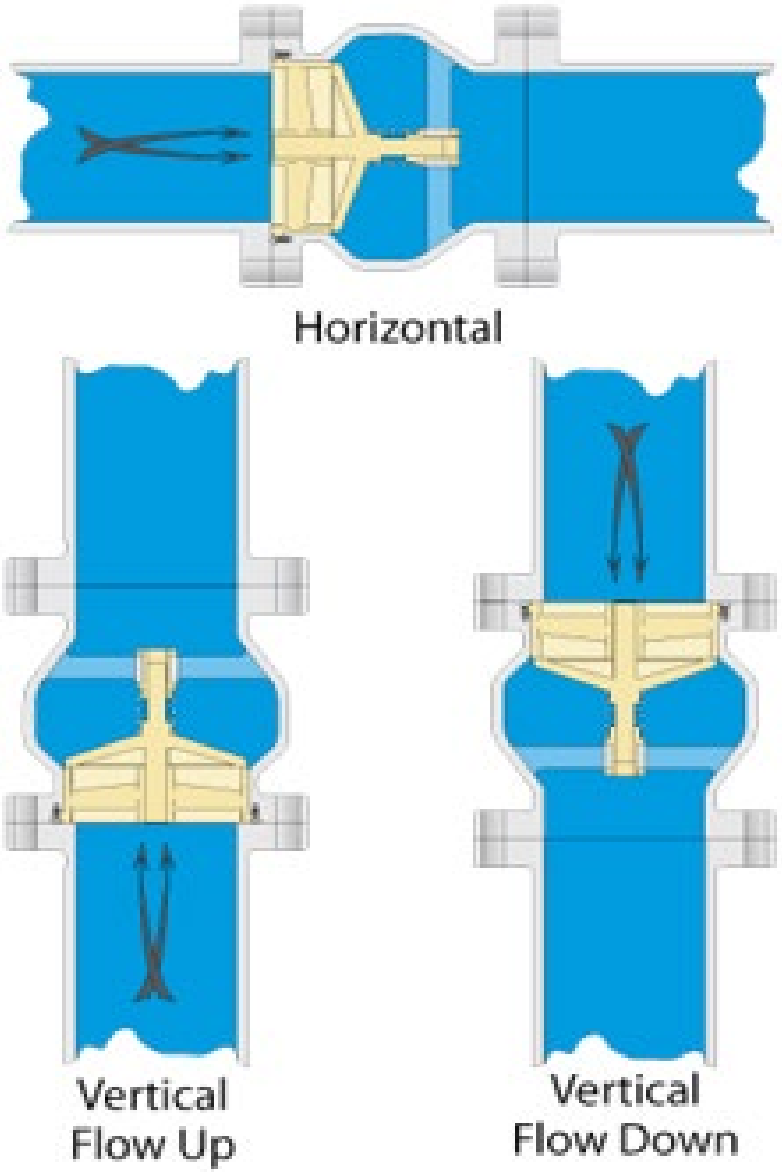


Figure 2 - Silent Check Valve Dynamic Test Results



Installation can be Horizontal or Vertical. Flow can be up or down.

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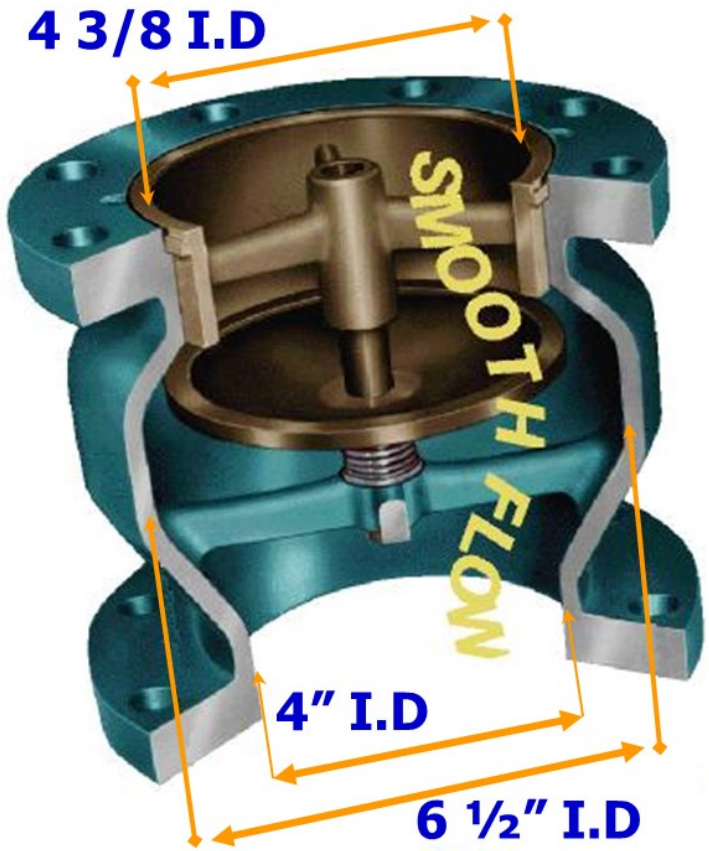
Expanded Body

More Efficient Design

- Inner Body Diameter is Larger than Pipe
- 100% Flow Area Helps Reduce Head Loss
- Closing Stroke 1/4 of Line Size
- Does require three diameters of pipe length upstream of the valve for proper operation.



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Maintenance

Costly but Infrequent Maintenance

- How do you know if/when failure occurs? Stethoscope!
- After pump stops, hissing indicates a leak and will soon result in valve failure
- Checks for “hissing” should be done annually
- Requires complete removal for service/replacement

Silent Check

Limitations

- No Open/Closed Indication
- High level head loss, “burns a lot of gas”.

VAL-MATIC®

Silent Check

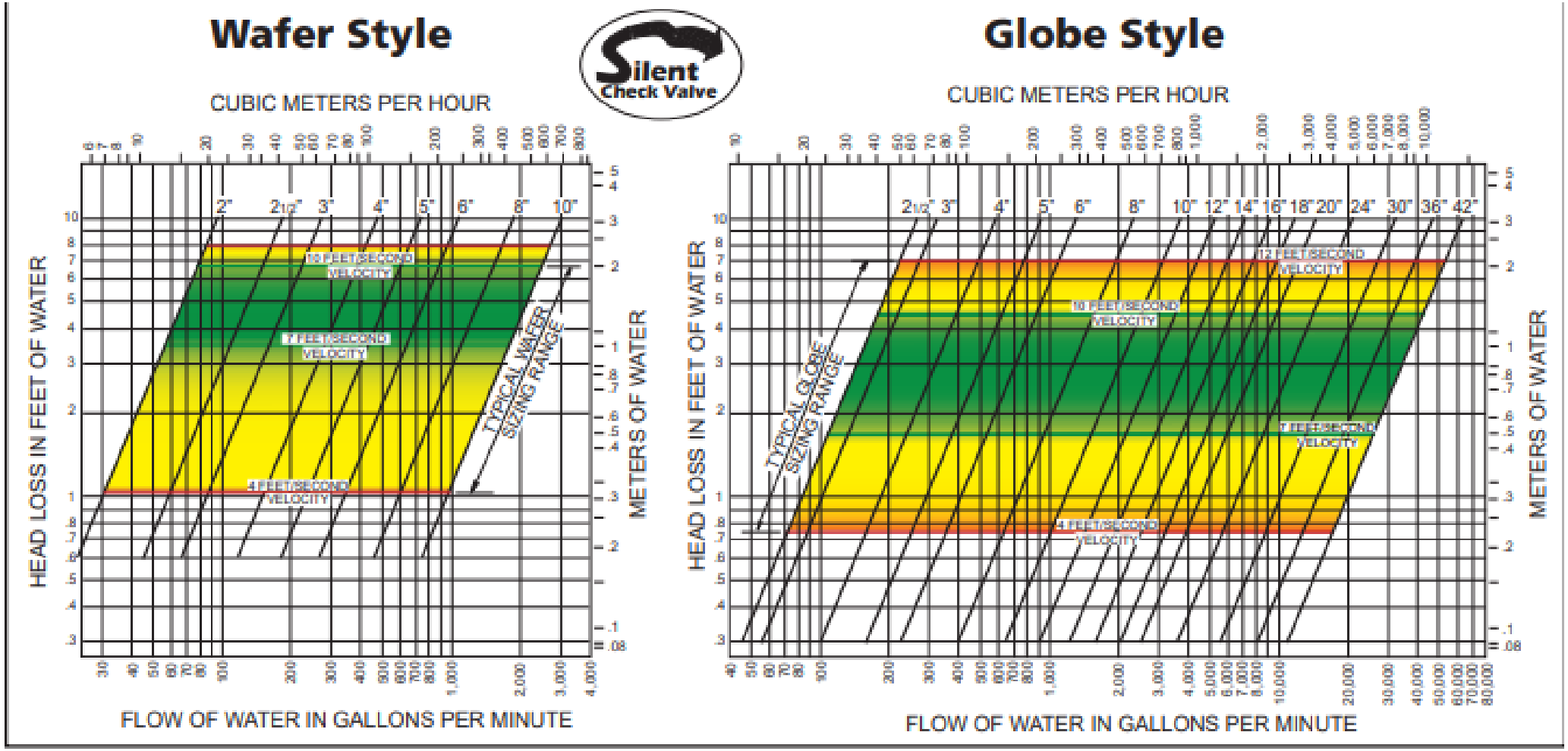
Like a domestic sports car, they have their place:

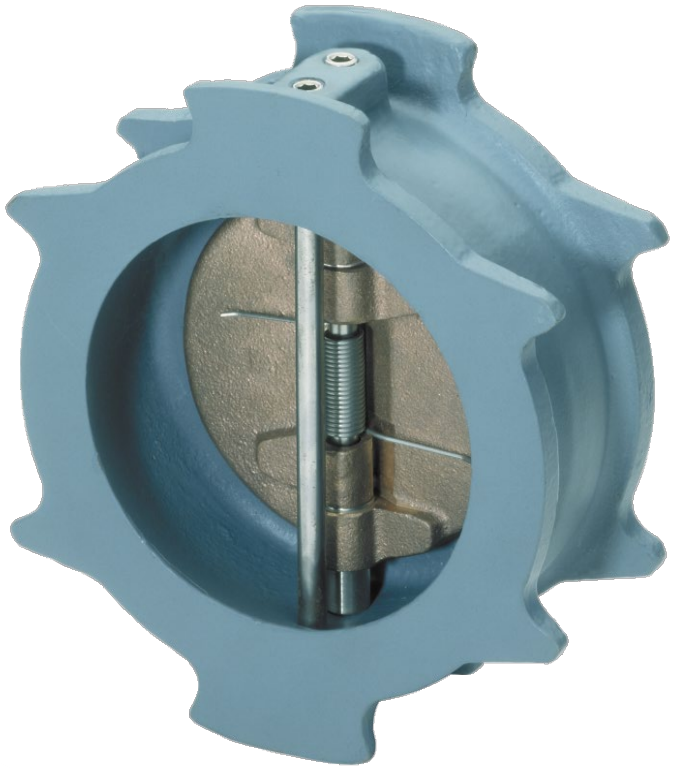
- Shorter runs w/ high head systems
- High rise buildings
- Steep or vertical/near vertical pipe

Since these applications have high head, designers who choose a silent check valve are choosing performance… like a sports car driver.

6” Silent Check @500gpm

Globe = 1.6 FT in Head Loss Wafer = 2.2 FT Head Loss

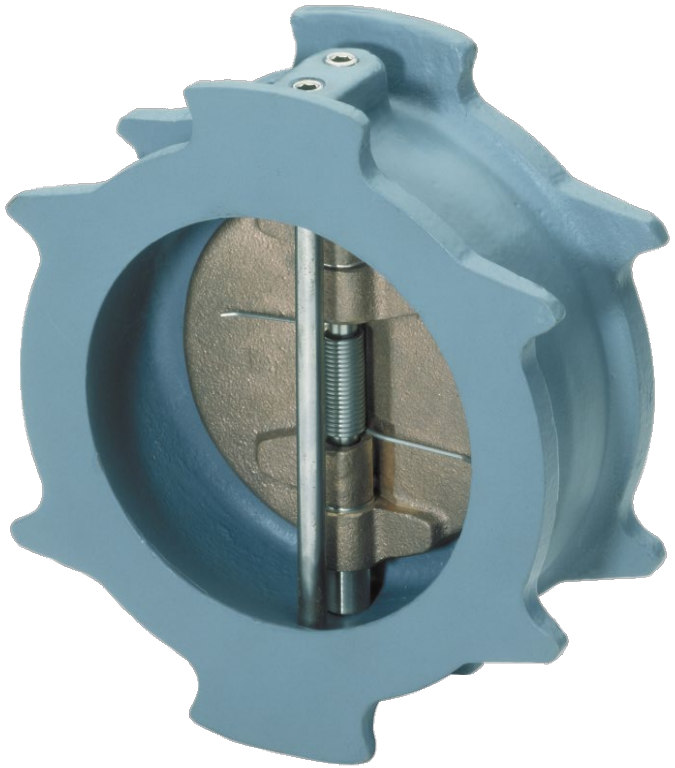




Dual Disc Check

The Economy, Compact Check Valve

VAL-MATIC®



Dual Disc Check

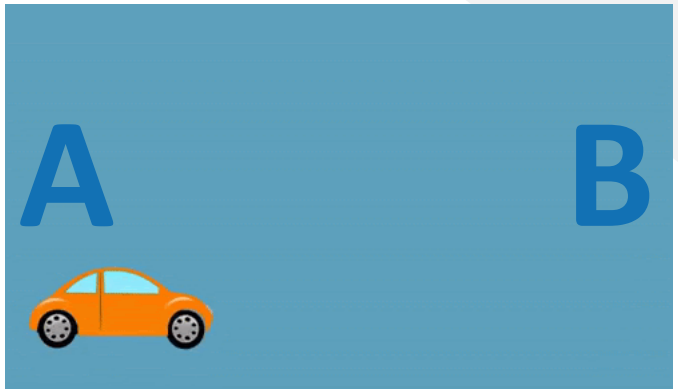
The Economy, Compact Check Valve

VAL-MATIC®

Dual Disc Check

Main Details

- 2” to 60”
- **Inexpensive**
- Wafer & Grooved End
- **Great Non-Slam Characteristics**
- Clean Water & Treated Effluent Only
- Horizontal Flow & Vertical (Up Only)
- No Open/Closed Indication
- Port size is 80% of pipe area = head loss
- Fits between two pipe flanges
- Requires 3 pipe diameter lengths of pipe upstream of the valve.



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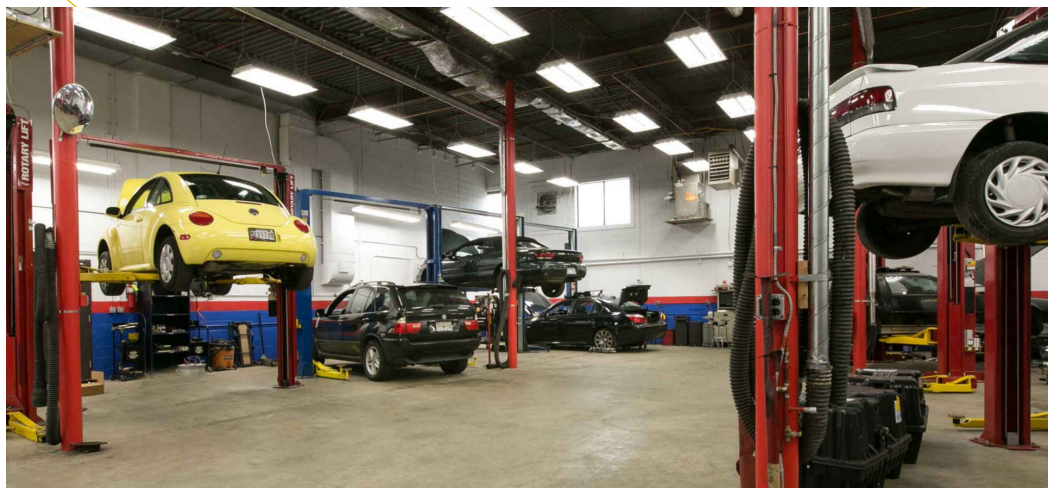
Dual Disc Operation

Dual Disc Maintenance

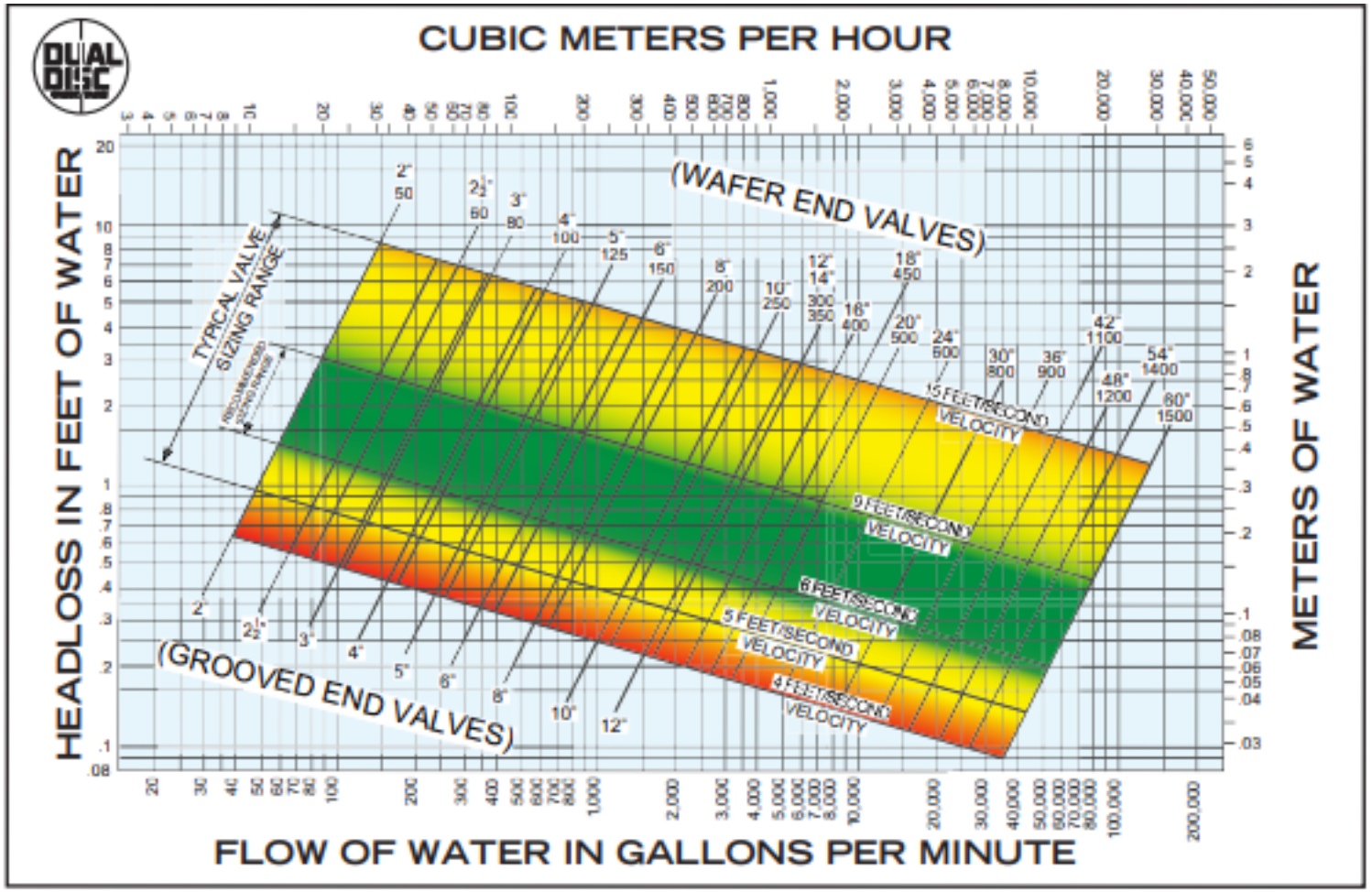
Infrequent but Costly Maintenance

- Many moving parts = costly to maintain
- Check for leakage annually
- Must be removed from line for service/replacement



VAL-MATIC®

6” Dual Disc Check @500gpm = .6 FT in Head Loss



Dual Disc

Just a simple, economical valve that does the job:

- Compact in size… park it anywhere
- Good performance… low head loss, good anti-slam properties
- Used on well pumps, plant pumps, and various industrial water systems.

VAL-MATIC®

Hydraulic Check

The Versatile Utility Check Valve

CLA-VAL™

Hydraulic Check

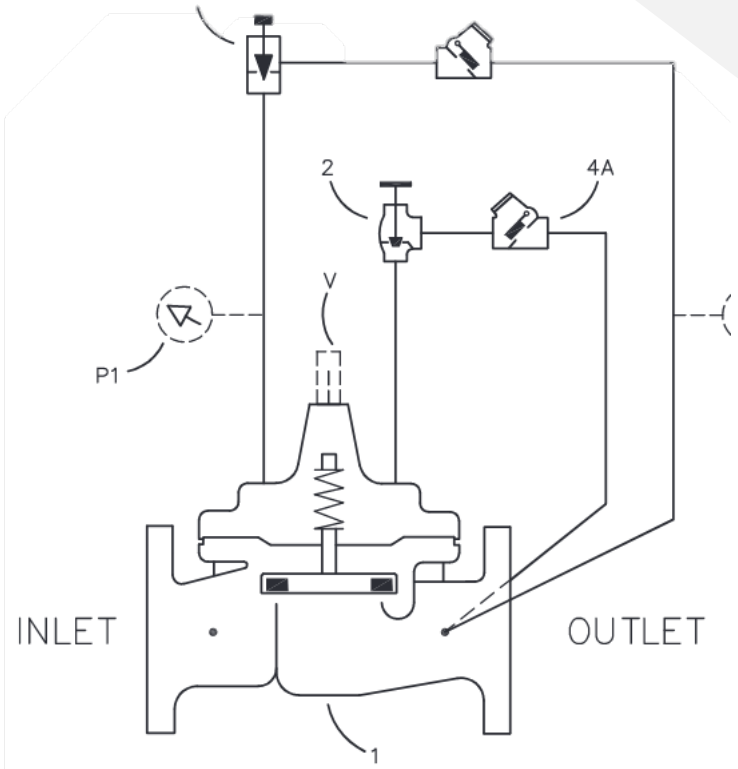
One Vehicle, Many Uses

CLA-VAL™

Hydraulic Check

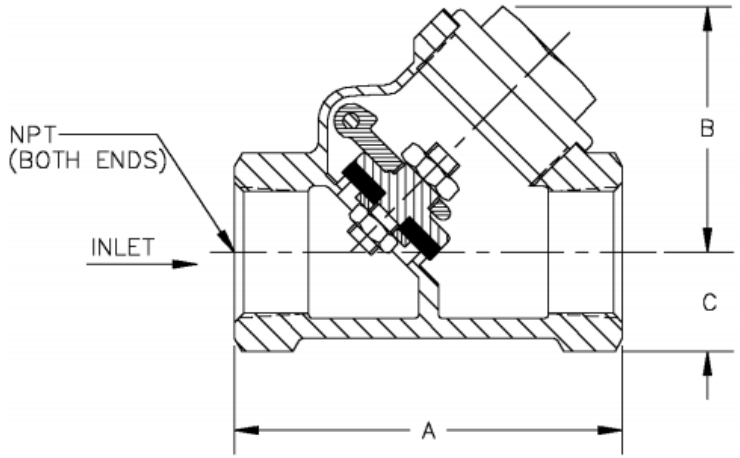
Main Details

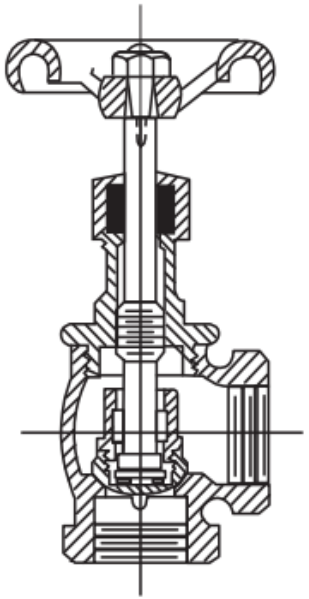
- Uses 100-01 Cla-Val Hytrol installed in reverse
- 2” to 24”
- Clean water only
- Horizontal or vertical Installation (8”<)
- Slow closing to prevent slam (Good!)
- Open and closing speed controls
- Opens and remains open under normal flow conditions
- Closes on pressure reversal
- Many uses, customizable



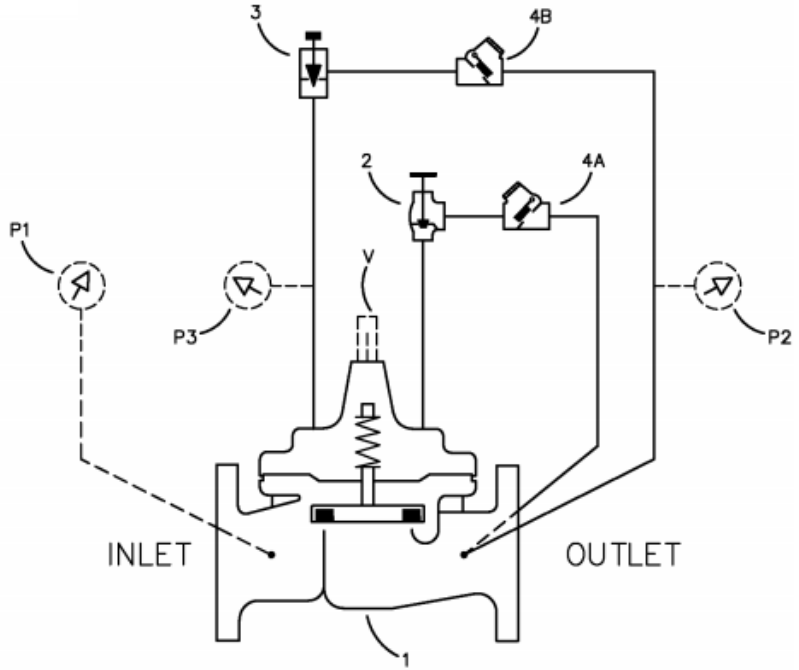
CLA-VAL™

Cla-Val 81-02





CAT. NO. CGA
ANGLE



Hydraulic Check

One Vehicle, Many Uses

Hydraulic Check

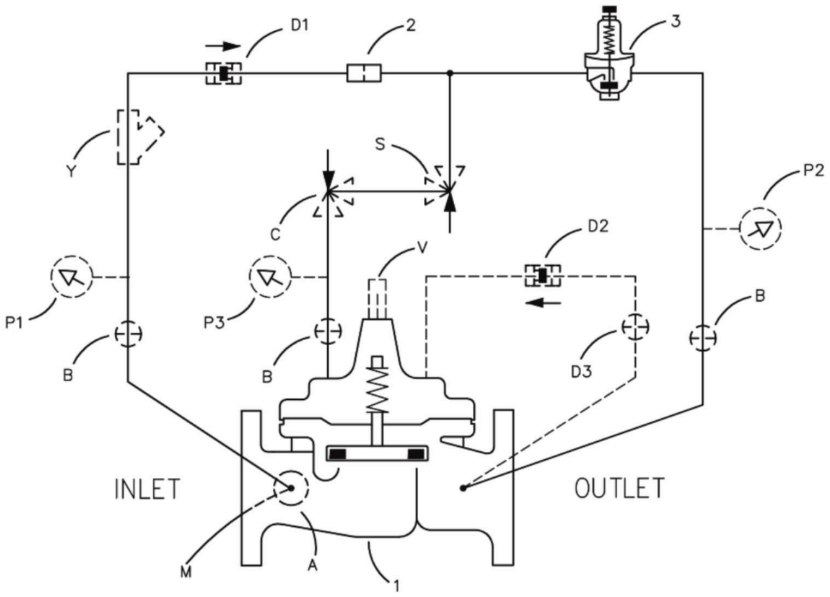
One Vehicle, Many Uses

- Cla-Val 90-01 w/ Check Feature
- Cla-Val 131-01 w/ Check Feature: Flow control, slow open/close, and check
- Power Check Valve
- Hydraulic Check for Deep Well Pump Control

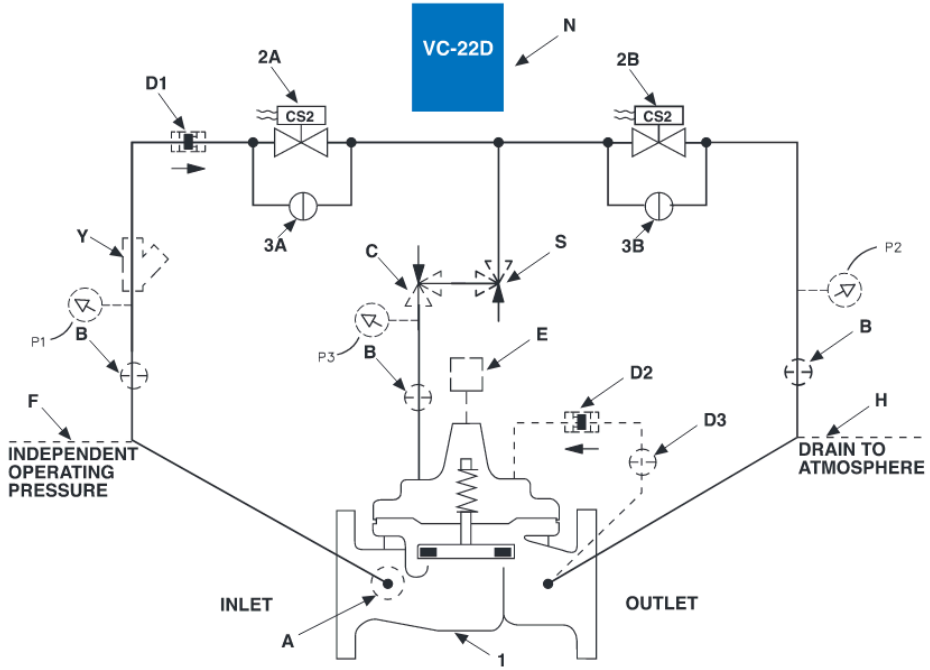
Hydraulic Check

One Vehicle, Many Uses

Cla-Val 90-01 w/ Check Feature:

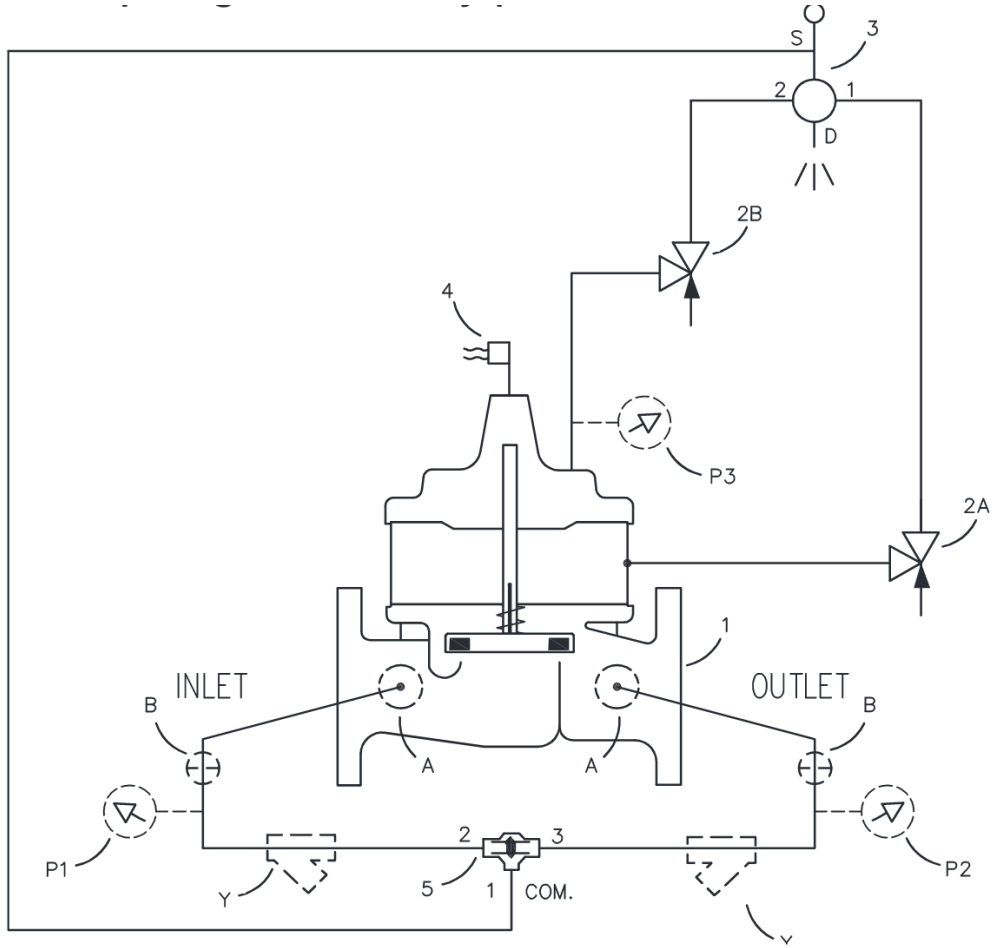


Cla-Val 131-01 w/ Check Feature: Flow Control + Check Valve



Hydraulic Check: Power-Check

Typical Application: Booster Pump Control



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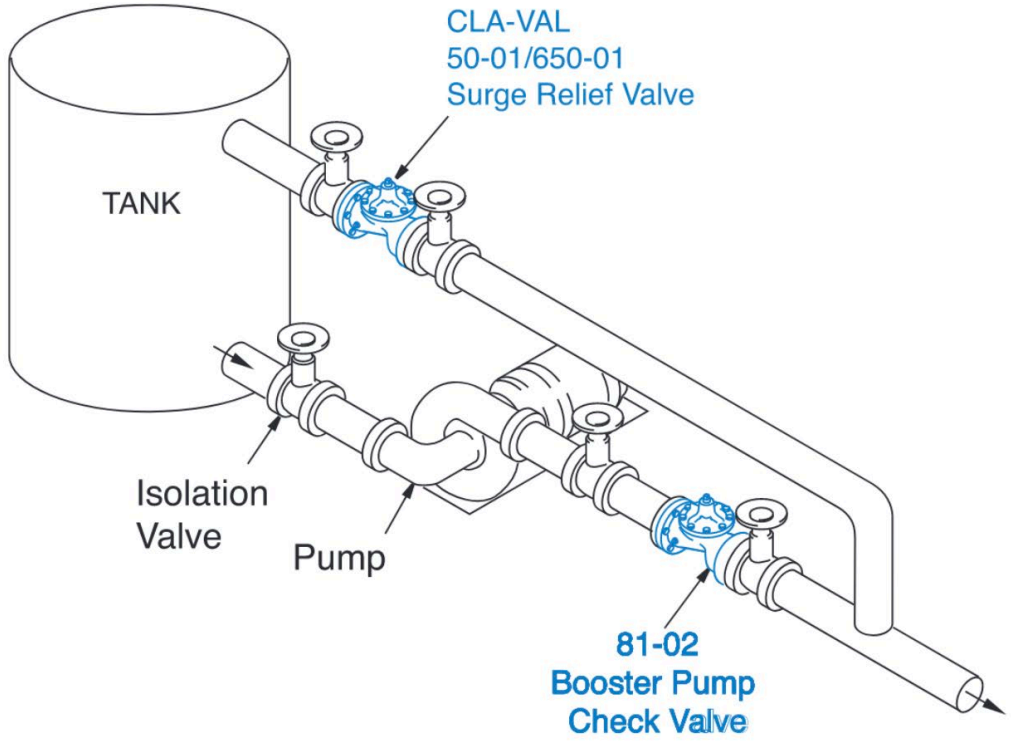
Hydraulic Check

Typical Application: Booster Pump Control



Booster Pump

Install on the discharge of booster pumps to prevent return flow into tank when pump is off. Relief valve as shown is good practice to minimize surges when pump stops.

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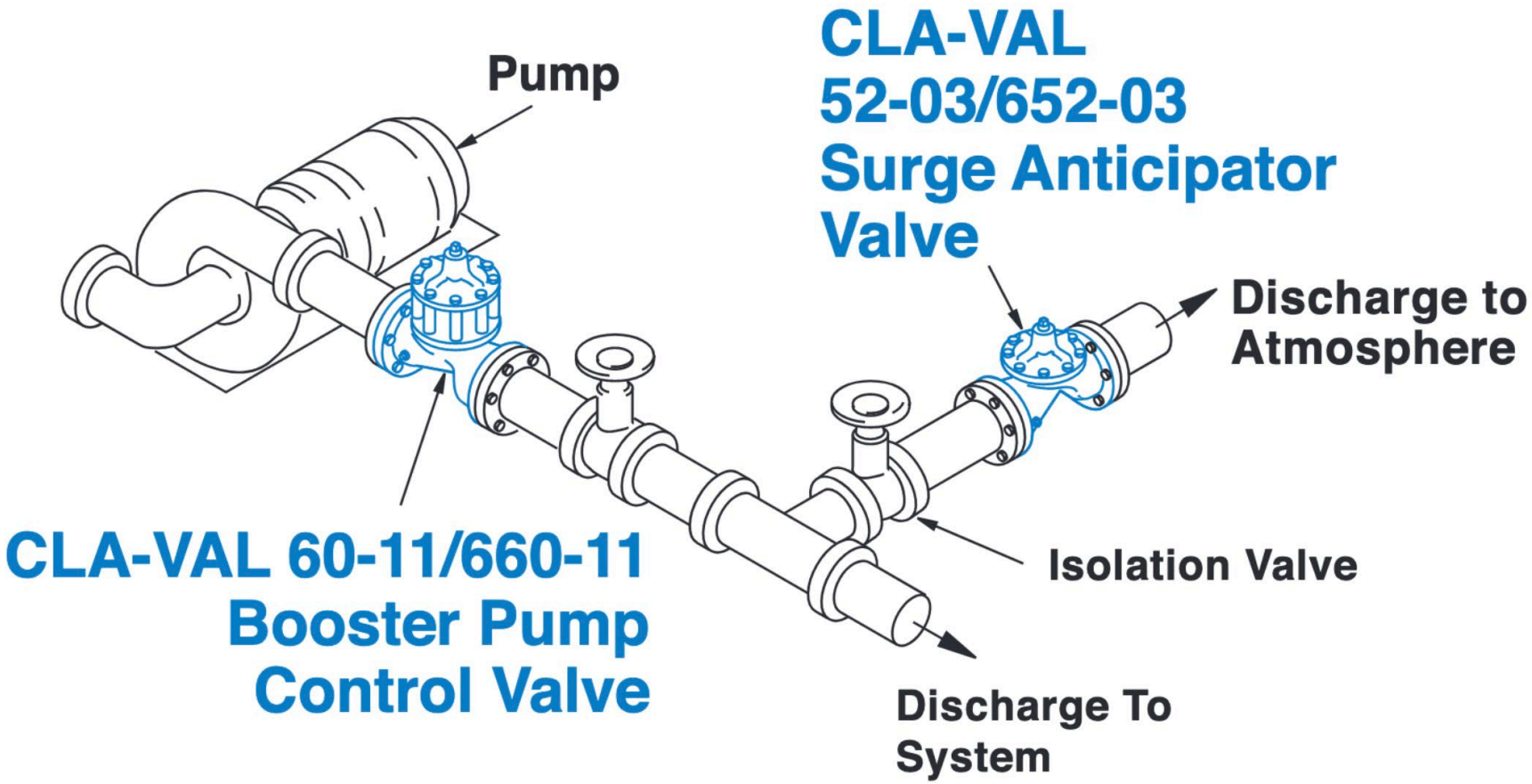
Hydraulic Check

Typical Application: Booster Pump Control



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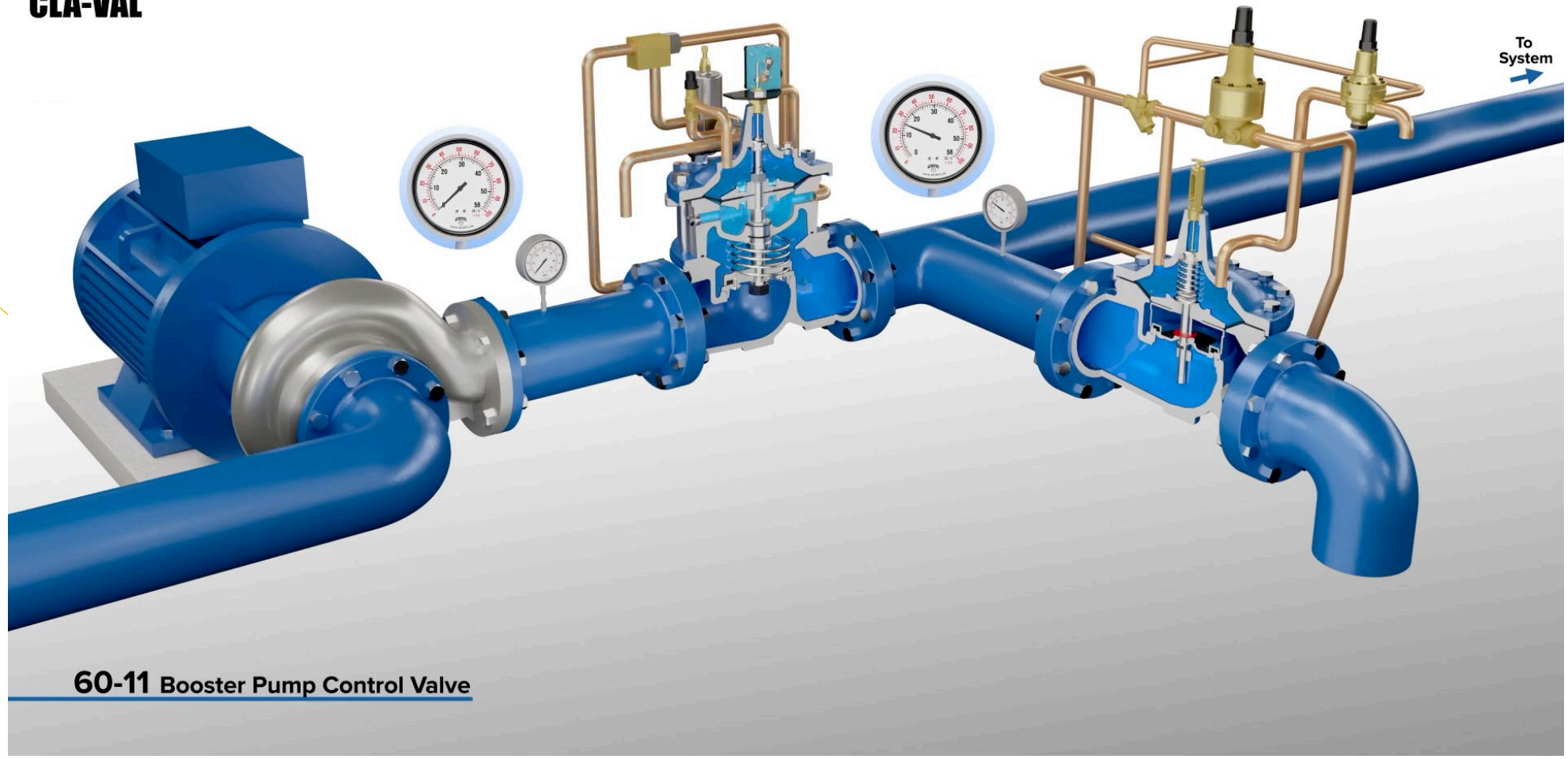
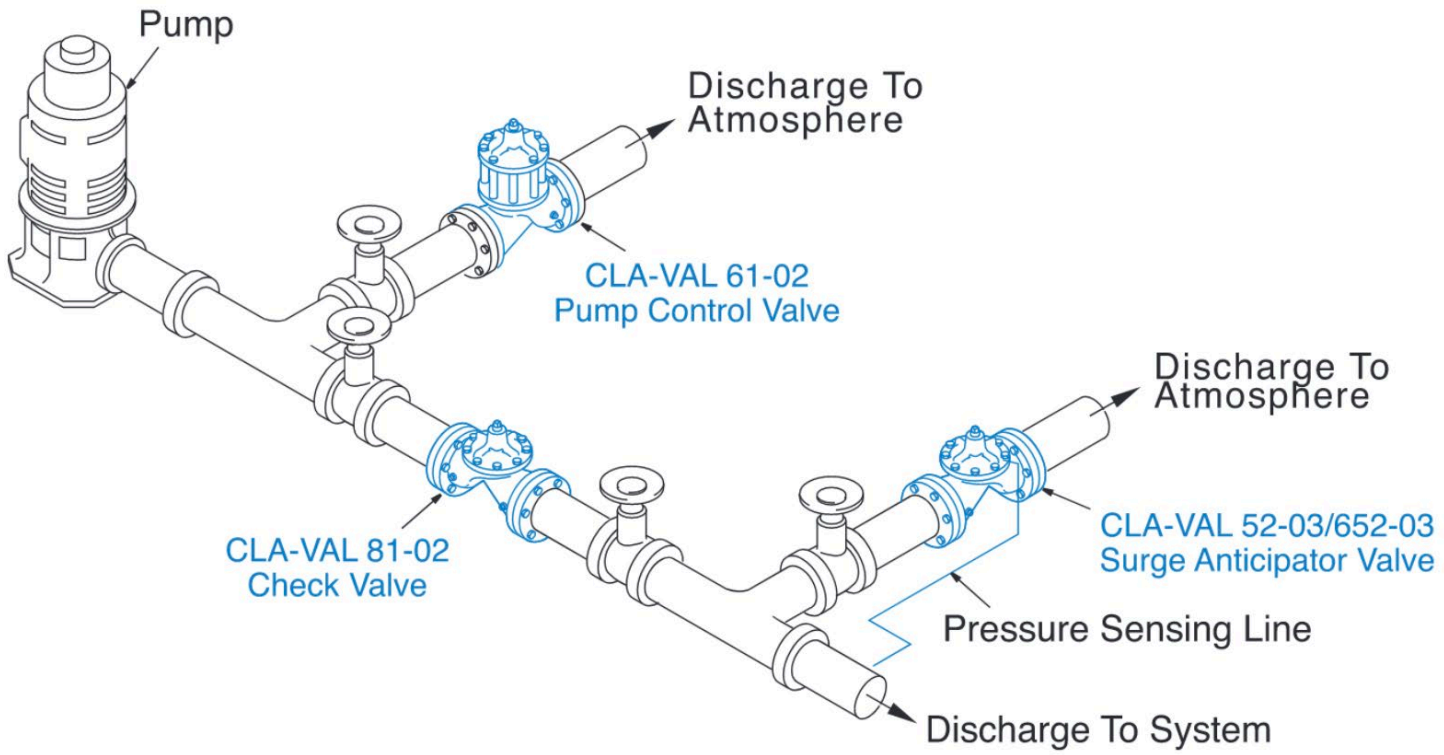
Hydraulic Check

Typical Application: Booster Pump Control



Hydraulic Check

Typical Application: Deep Well Pump Control



Deep Well Pump

This valve should be an integral part of any well designed pumping system. It is used to prevent damaging and sometimes expensive flow reversal.

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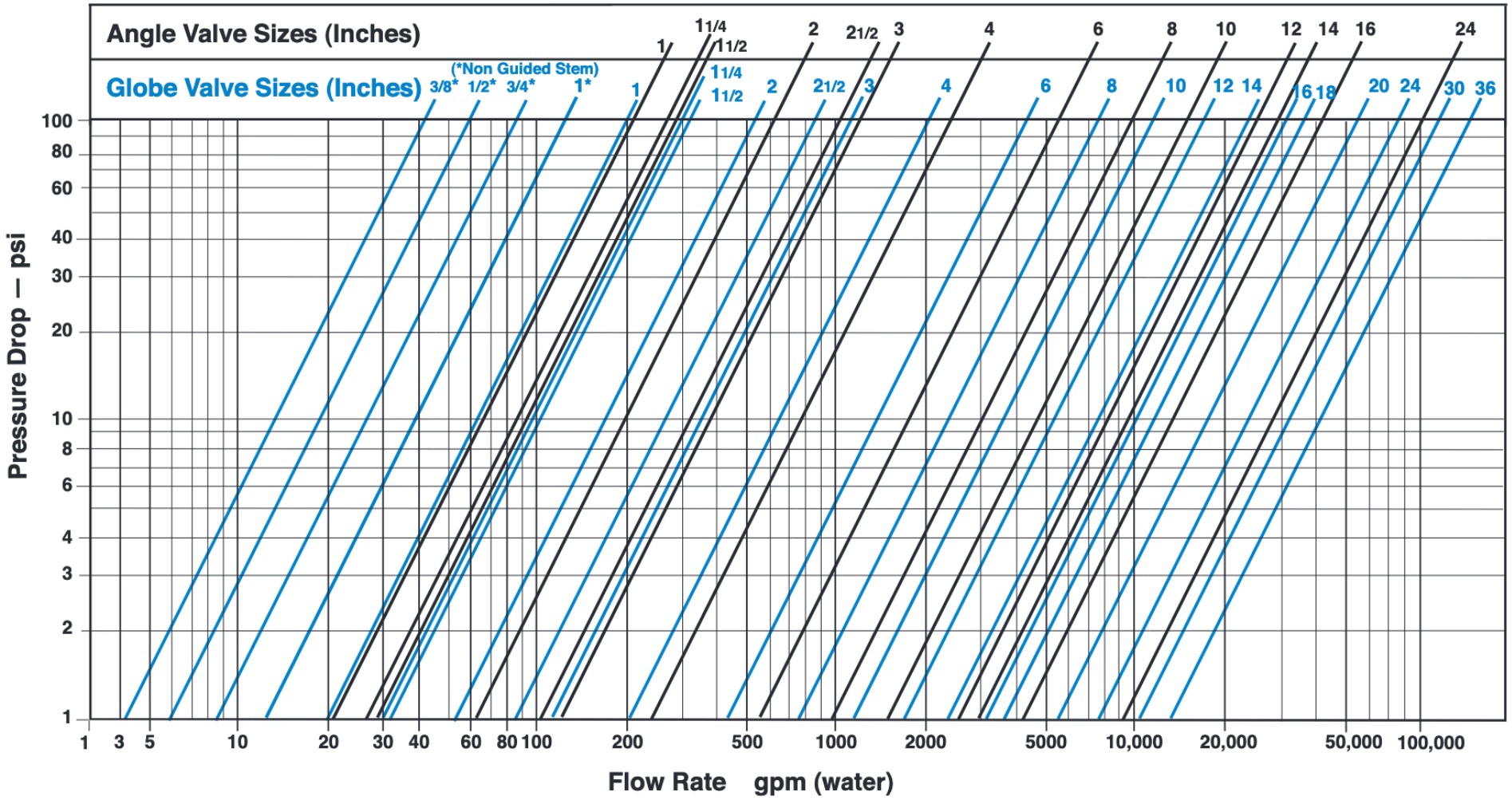
Hydraulic Check

Utility but at a Cost

- Expensive
- High head loss, “low gas mileage”

6” Hydraulic Check @500gpm = 3.46 FT in Head Loss



CLA-VAL™

Hydraulic Check

One Valve, Many Uses

CLA-VAL™

- Power Check (Internal Drop Check)
- Hydraulic Check for Deep Well Applications

- Customizable
- Standard Check Function
- Pressure Control w/ Check Function

Swing Check

First of Its Kind

VAL-MATIC®

Swing Check

First of Its Kind; Still Used Today

VAL-MATIC®

1930’s

1970’s

1990’s

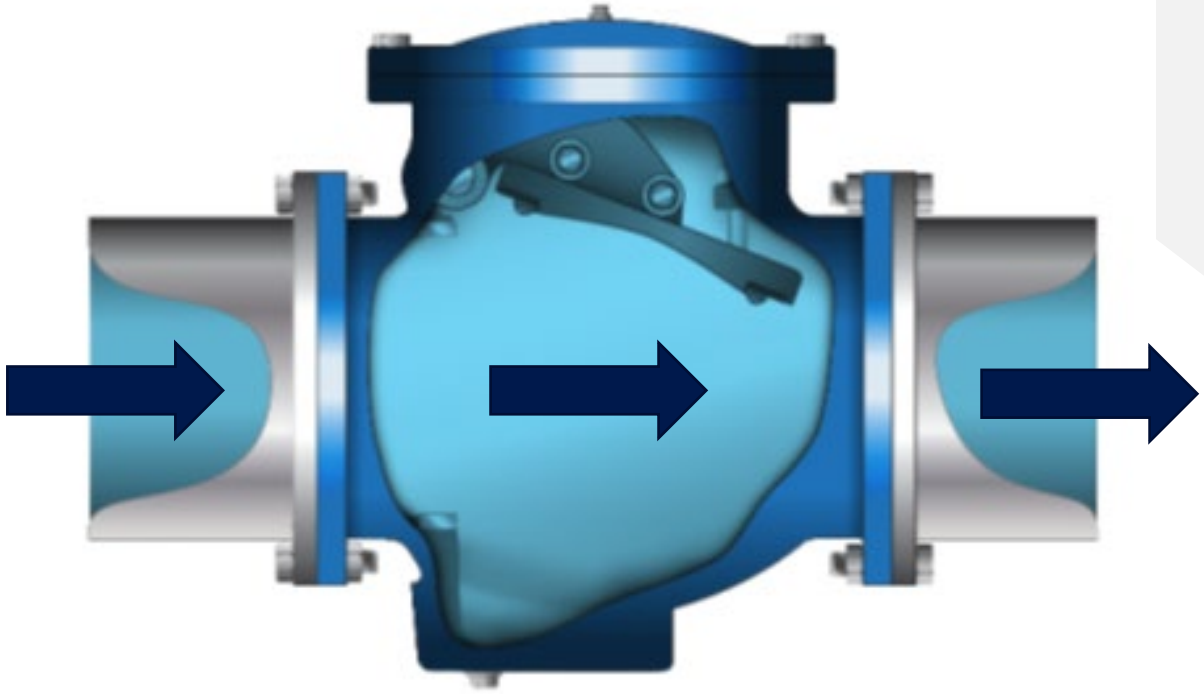
2010’s

VAL-MATIC®

Swing Check

Main Details

- Invented in 1936; the most common check valve
- 2” to 48”
- Clean or Wastewater
- Horizontal or vertical Installation
- Vertical Installation Flow-Up Only (requires special mounting of any external lever and weight)
- Metal or Resilient Seats
- Open/Close Indication
- Characterized by “Swinging” Arm
- Full Flow Area
- Disc Stroke about 90 Degrees



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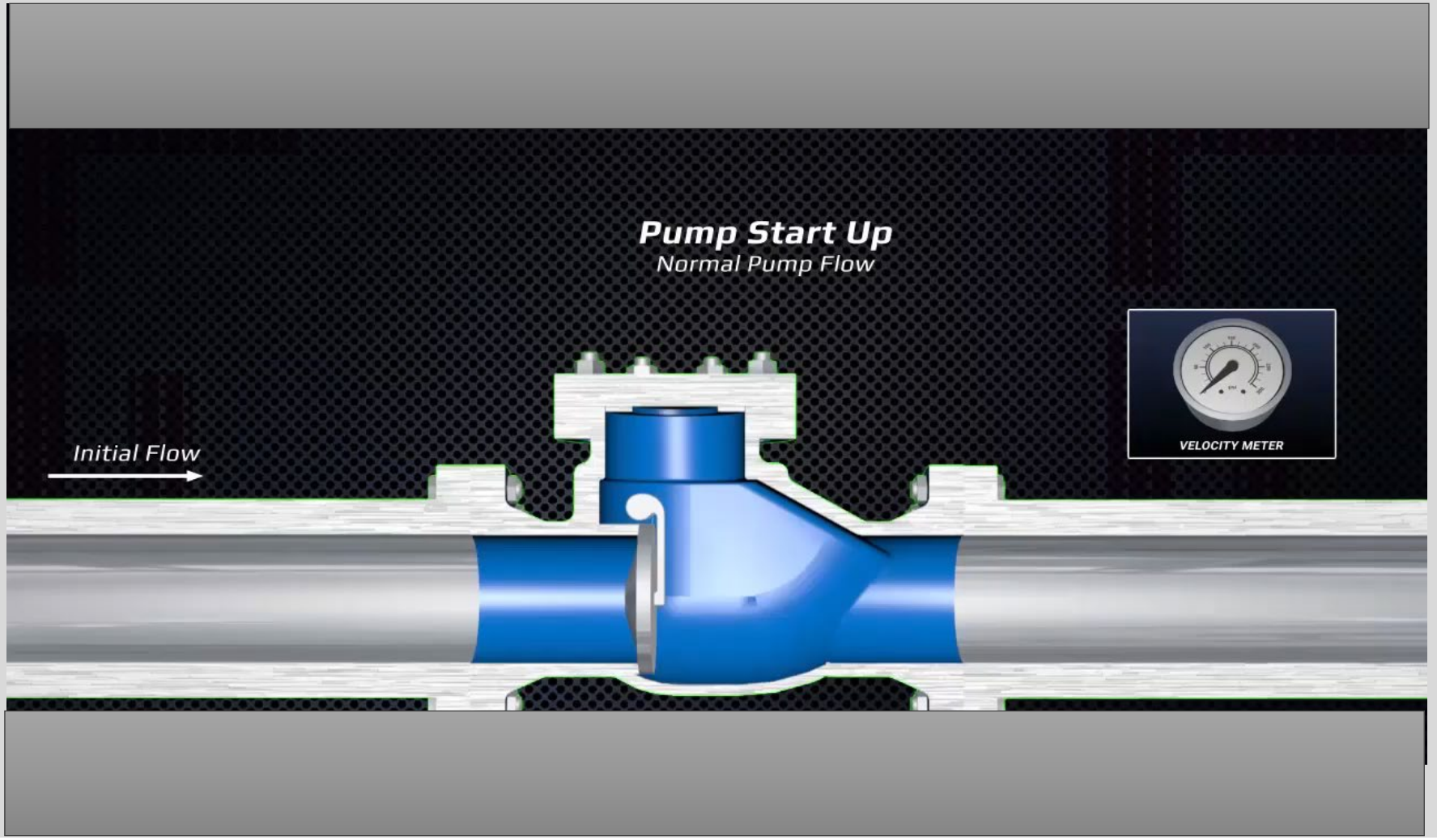
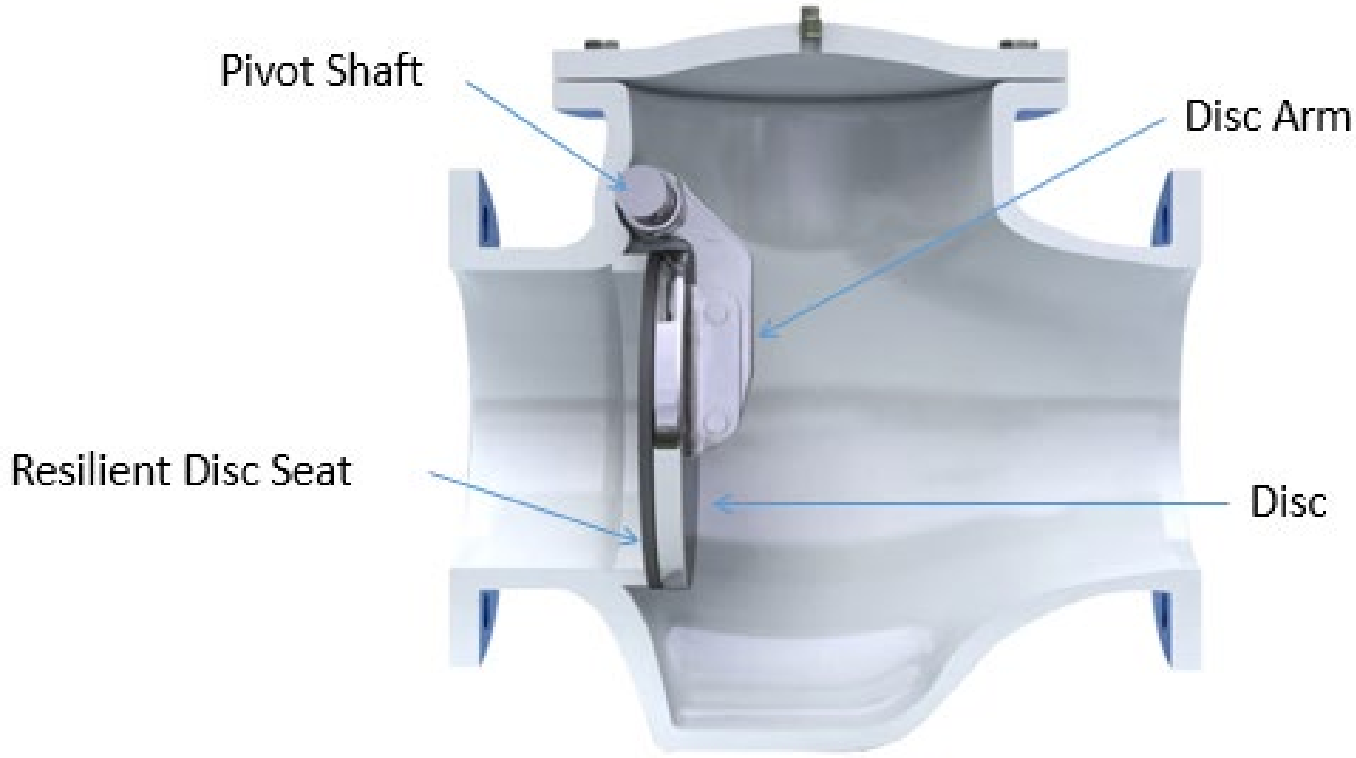
Swing Check Operation



Swing Check – Disc Stroke

Main Details

- Stroke = fully open to closed
- Long stroke, inertia of disc will result in slam in most pump applications
- Lever and weight = most common accessory
  - Limits the stroke of the disc
  - Allows the disc to therefore close faster due to less travel of disc
  - Downside: increases head loss through the valve



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Swing Check – Slam Properties

Main Details

- Stroke = fully open to closed
- Long stroke, inertia of disc will result in slam in most pump applications
- Lever and weight = most common accessory
  - Limits the stroke of the disc
  - Allows the disc to therefore close faster due to less travel of disc
  - Downside: increases head loss through the valve

VAL-MATIC®

Avoiding Slam

Closing Modifications*

Lower Slam Risk

- Lever & Weight
- Lever & Spring

- Air Cushion

Moderate to Hard Slam Risk

- Side Mounted Oil Control

- Bottom Mounted Buffer

*Any added external apparatus increases the purchase and maintenance costs.

VAL-MATIC®

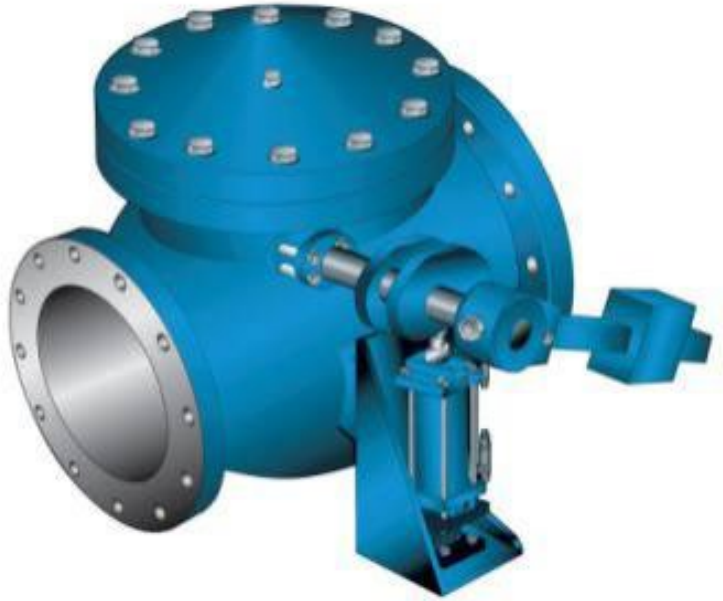
100% No Slam!!!

VAL-MATIC®

Swing Check – Maintenance

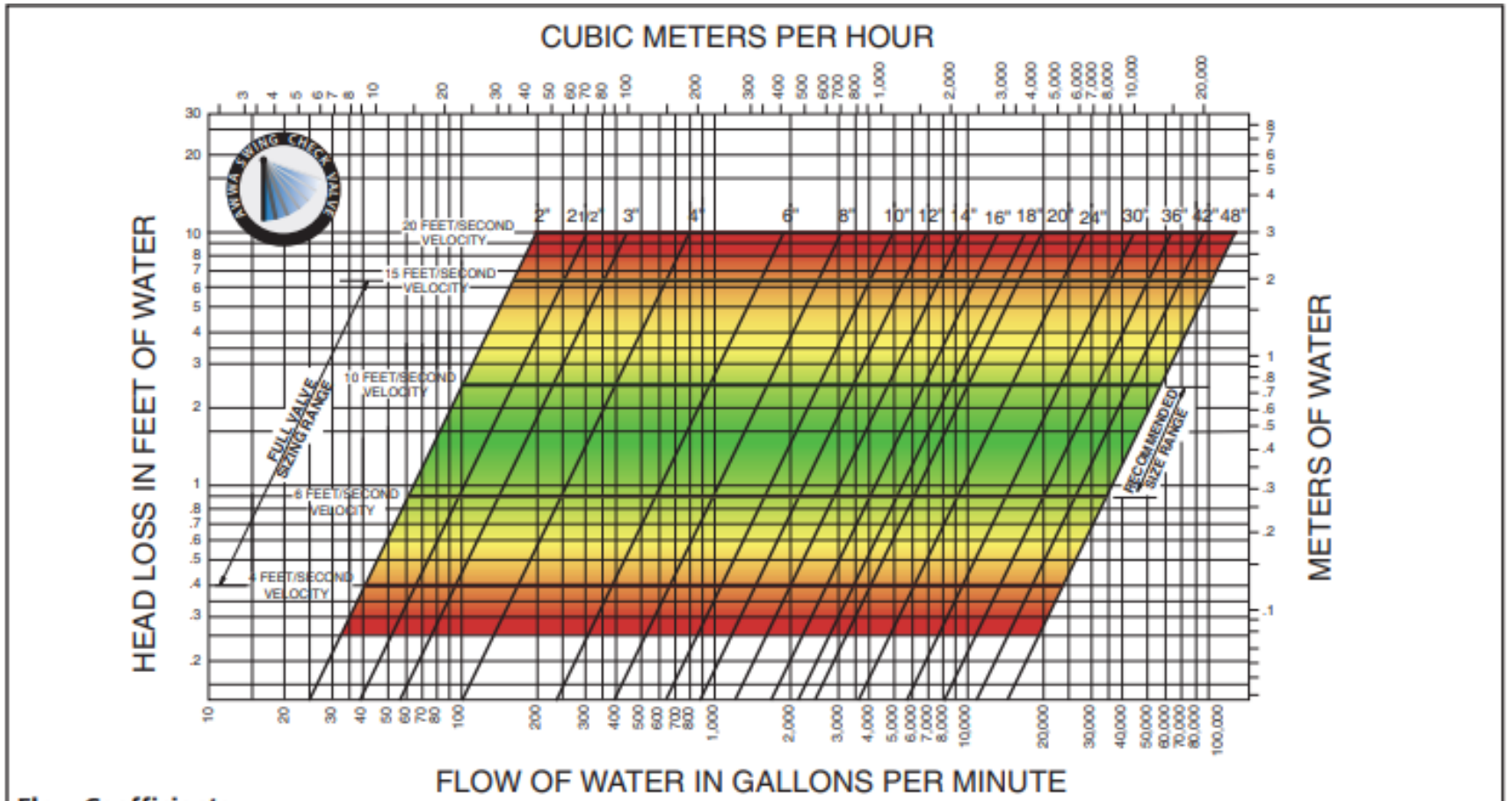
Costly to Maintain

- Many moving parts = more maintenance
- Valve packing and bearings need attention
- Because of maintenance requirements, manufacturers publish detailed maintenance schedules and procedures in operator's manuals, usually found online.
- Any additional apparatus mounted on a swing check = more maintenance
- Can be maintained without removal from line
- Involved start-up process when arm and weight or pneumatic systems included.



VAL-MATIC®

6” Swing Check @500gpm = .7 FT in Head Loss



Flow Coefficients

Size	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Cv	95	150	210	380	850	1,515	2,370	3,410	4,640	6,060	7,670	9,470	13,600	21,300	30,700	41,750	54,550

Swing Check

Old Favorite, but do better choices exist?

- Performs check function
- Versatile; clean and wastewater
- Expensive to maintain
- Tendency to slam
- Moderate head-loss, less efficient than other options

VAL-MATIC®

Swing Flex Check Valve

(Most reliable, new standard in check valves)

VAL-MATIC®

Swing Flex Check Valve

(Most reliable, new standard in check valves)

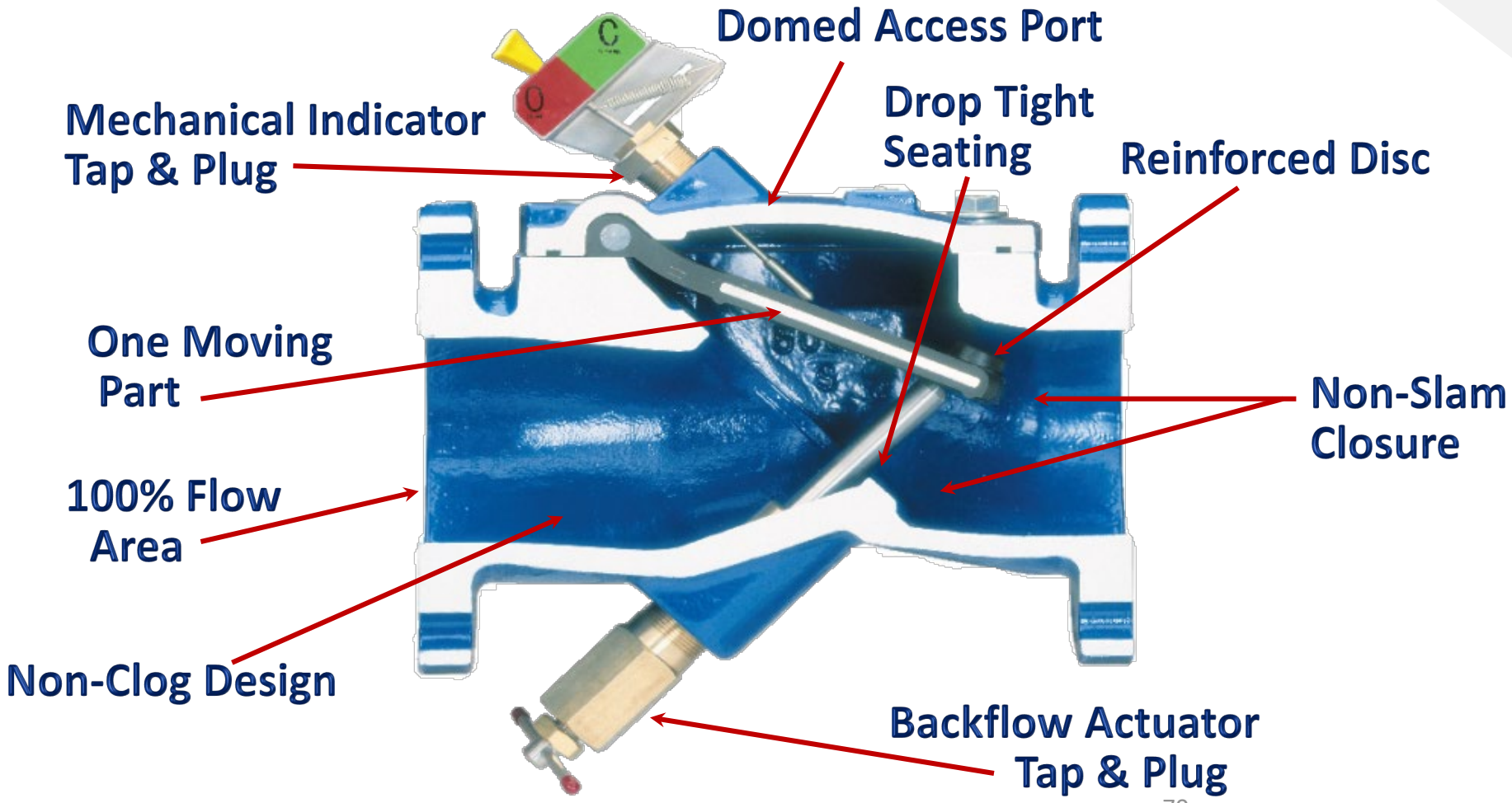
VAL-MATIC®

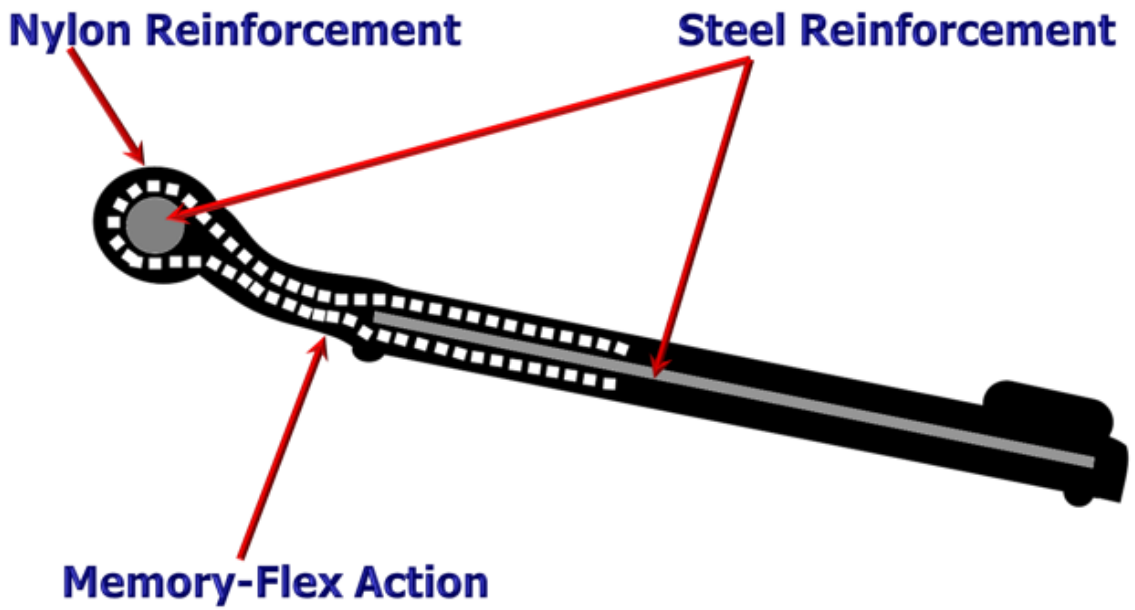
Swing Flex (Resilient Hinge) Check Valve

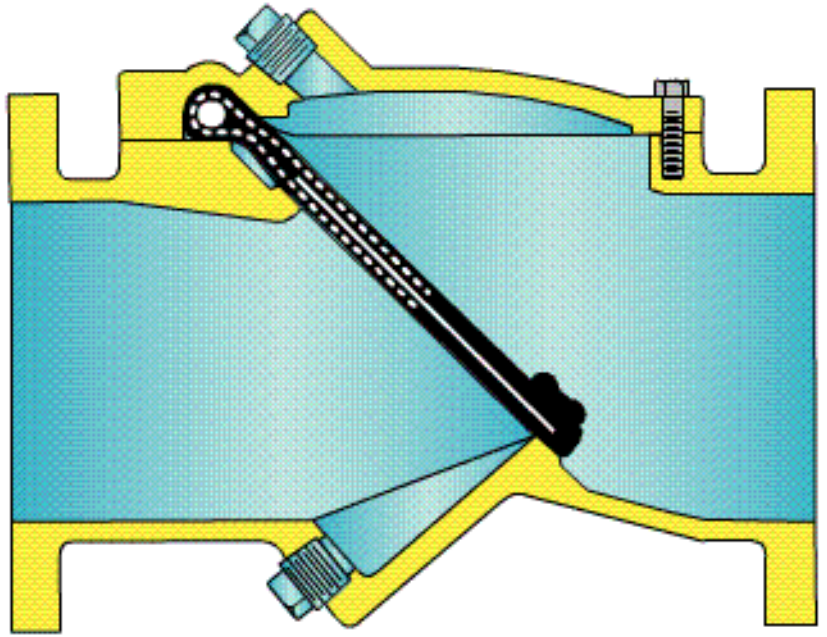
- 2” to 42”
- Clean or Wastewater
- High Velocity Applications (10fps+)
- Great Non-Slam Characteristics
- Open/Closed Indication Available
  - Mechanical & Electronic
- Competitively Priced
- 35 Degree Disc Stroke

VAL-MATIC®

Swing-Flex®


Domed Access Port
Mechanical Indicator Tap & Plug
Drop Tight Seating
Reinforced Disc
One Moving Part
Non-Slam Closure
100% Flow Area
Non-Clog Design
Backflow Actuator Tap & Plug


Nylon Reinforcement
Steel Reinforcement
Memory-Flex Action



VAL-MATIC®

Advantages

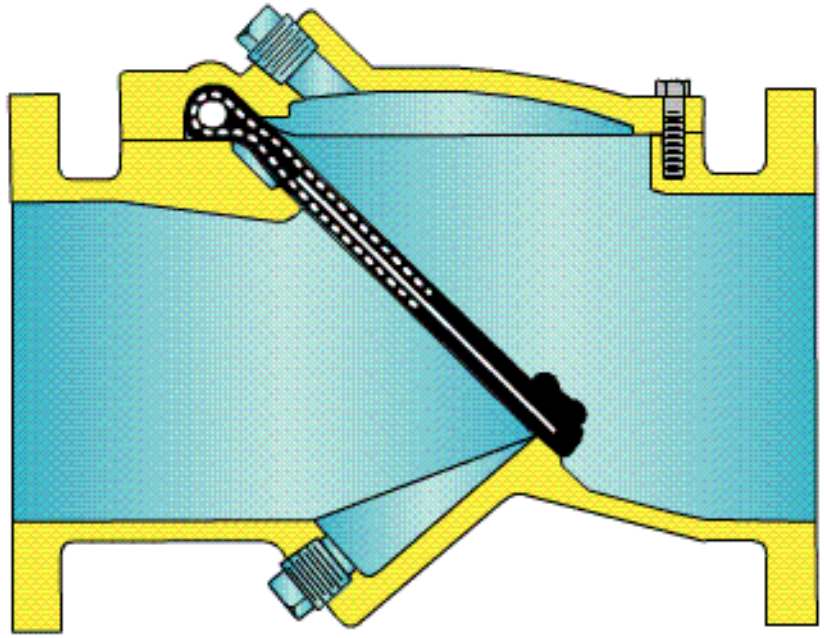
- Low Maintenance Costs
  - One Moving Piece
- Low Head Loss
- Can be fully Rubber Lined
- Opens at only .3psi Differential
- Drip Tight Shut
- Horizontal & Vertical Flow Up
- Encapsulated Steel Disc
- Reinforced Flex Area

More Advantages

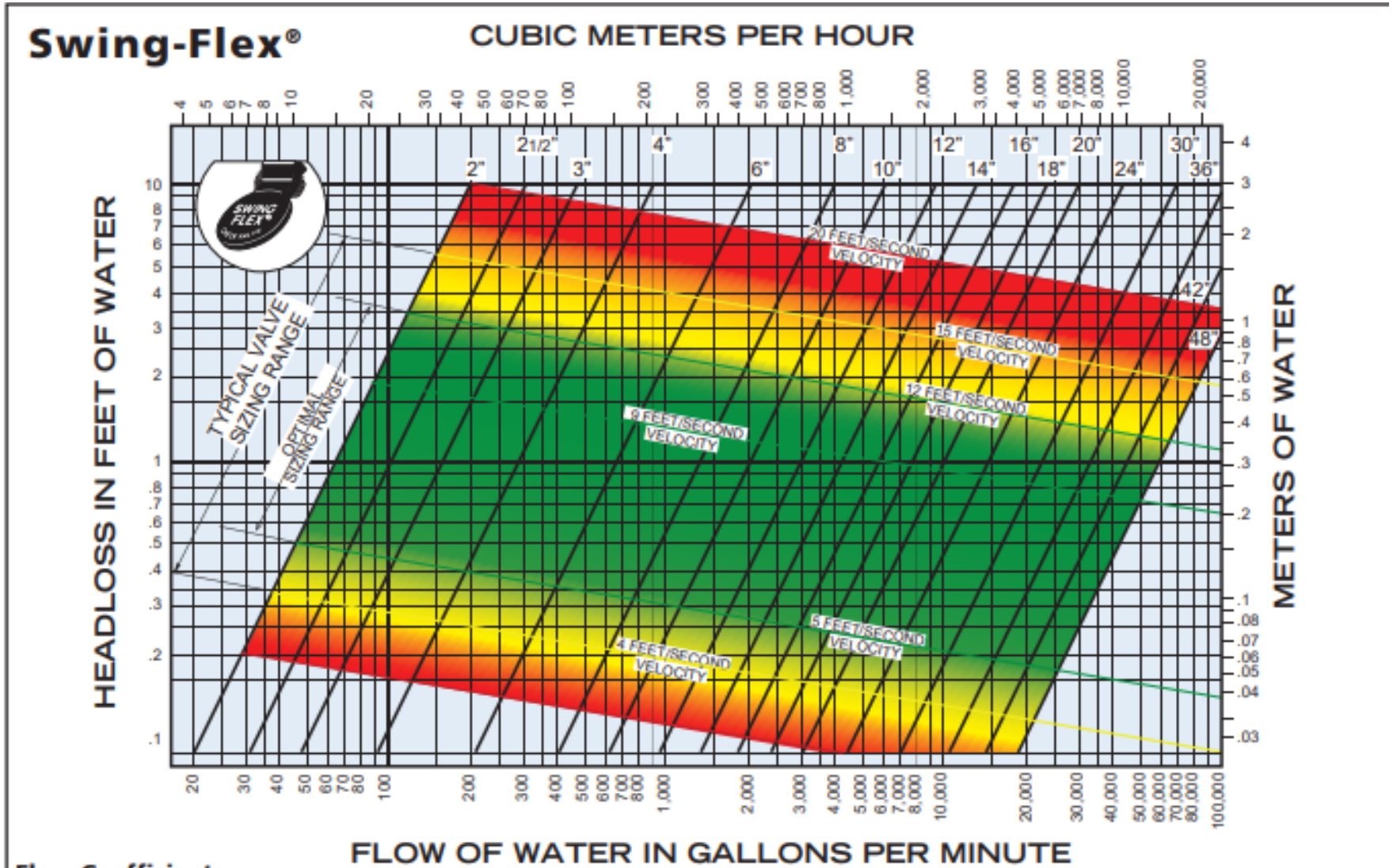
- AWWA C508 Certified since 1986
- Swing action occurs from flex action in the rubber molded disc instead of rotation on a hinge pin.
- Dependable with virtually no maintenance
- Valve has 100% capacity port, slanted at a 45° angle
- 35° full stroke, results in extremely fast closure
- Low head loss through the valve

Swing Flex Maintenance

- Low Maintenance Costs
  - One Moving Piece
- Can be serviced while valve is still inline
- Nylon reinforced rubber is tested to 1,000,000
- 25 year warranty



6” Swing-Flex Check @500gpm = .575 FT in Head Loss



Flow Coefficients

Size	2	2 1/2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
Cv	95	155	225	440	1040	1900	3050	4600	6600	8700	11,200	14,200	21,000	33,500	50,000	68,000	88,800

Swing Flex (Resilient Hinge)

- Reliable
- Anti-slam properties
- Versatile: Clean or Wastewater
- Efficient, low head-loss
- Long lasting
- Ease of use, start-up
- Competitively Priced

VAL-MATIC®

Surgebuster

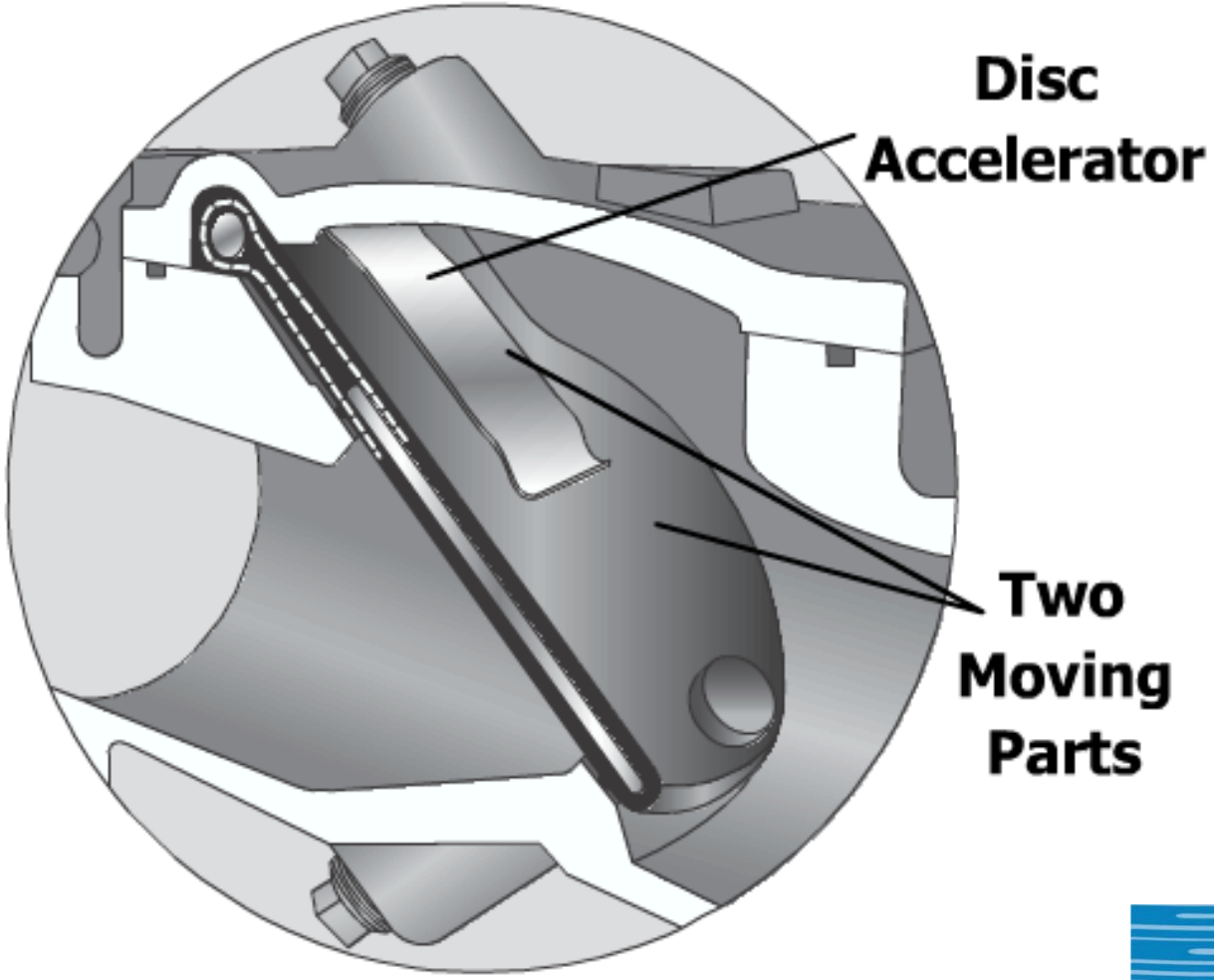
(Most reliable, versatile check valve)

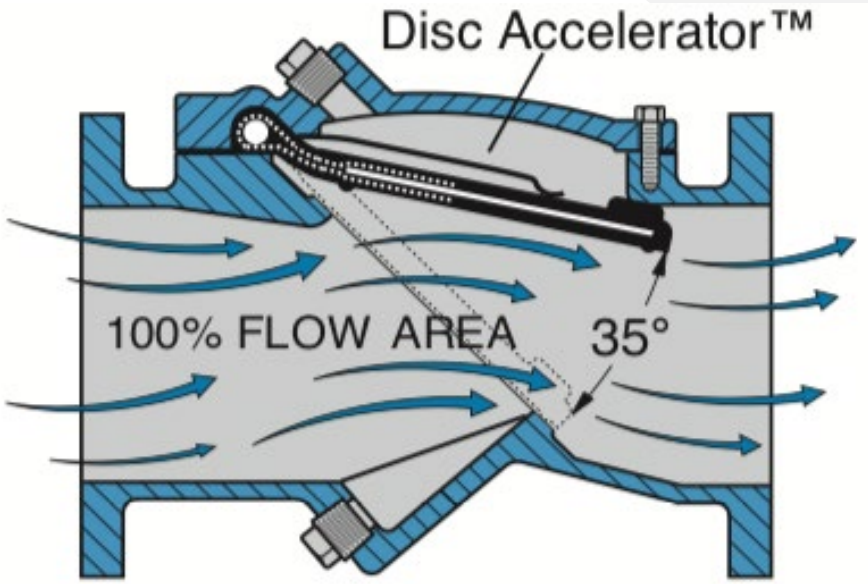
VAL-MATIC®

Surgebuster

VAL-MATIC®

Surgebuster: Disc Accelerator

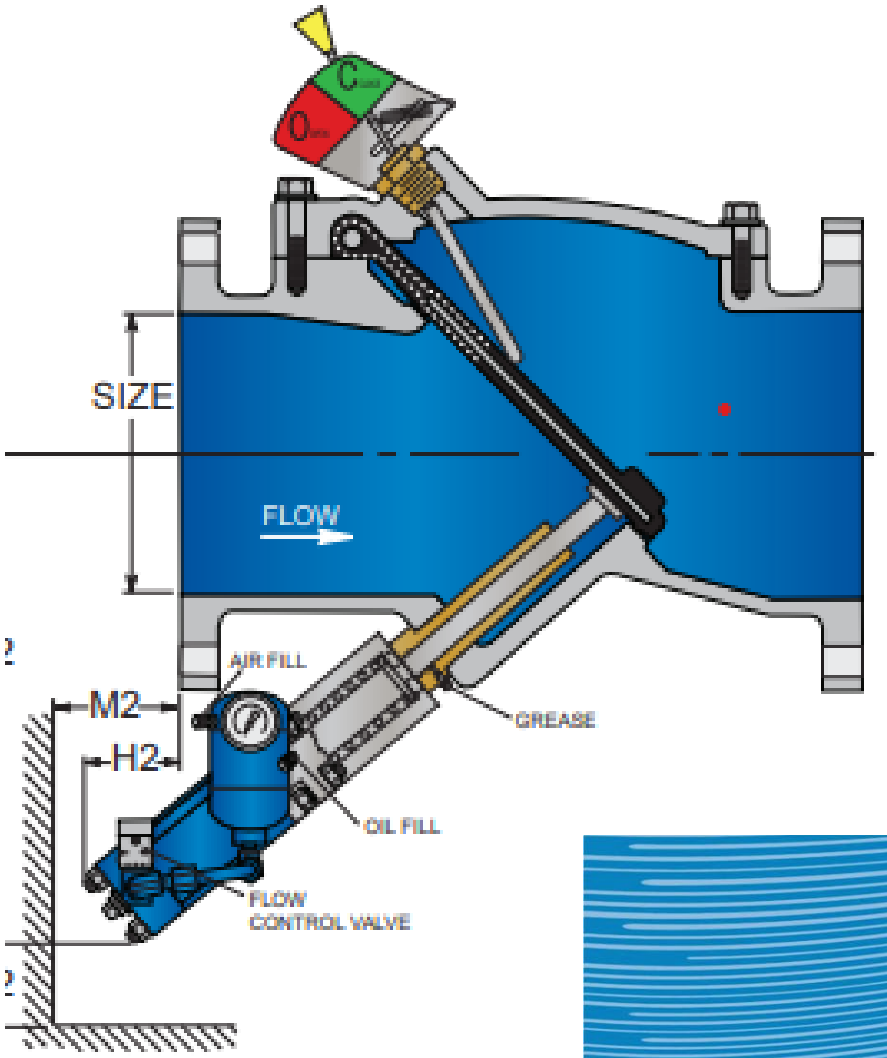




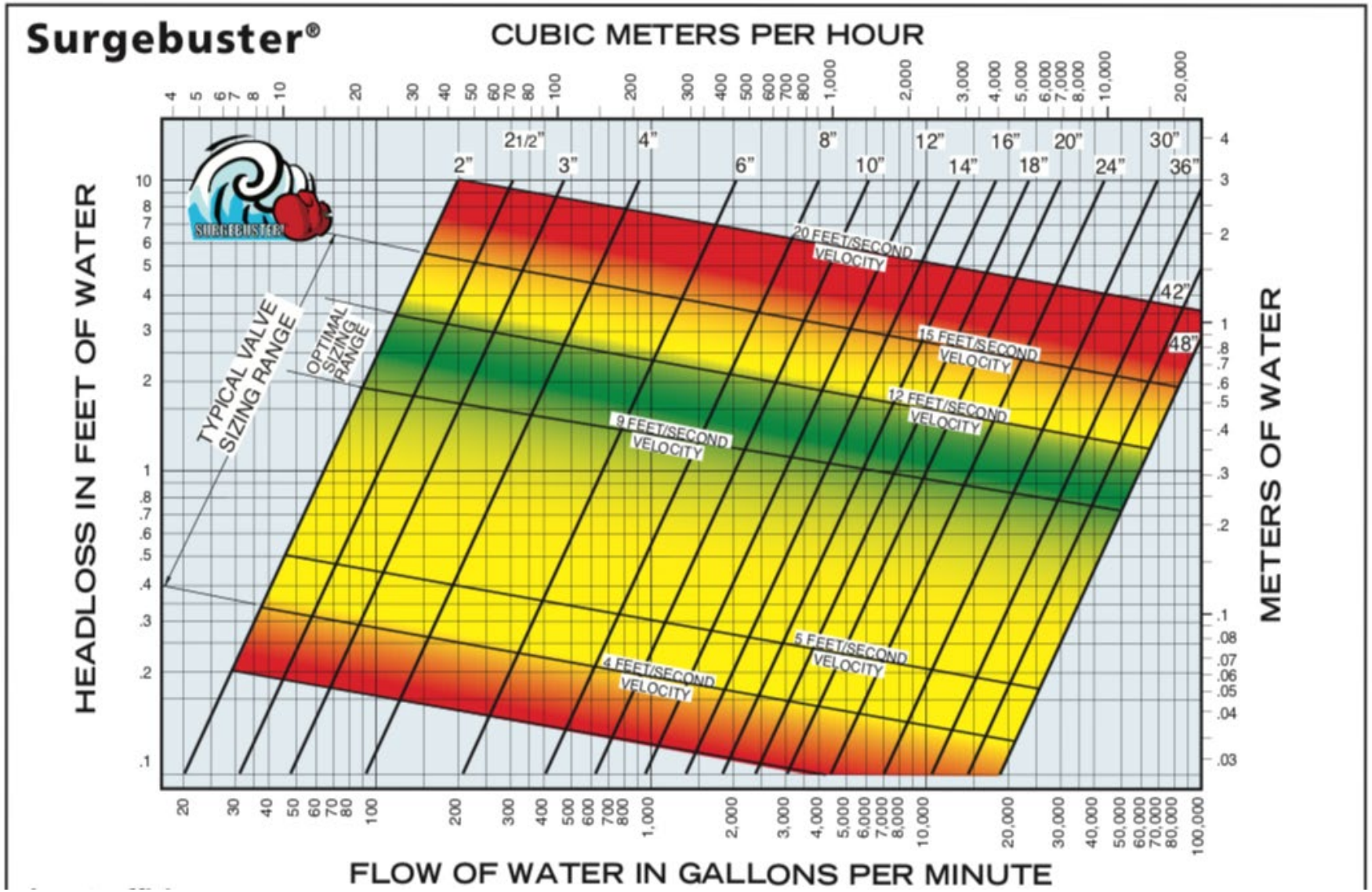
VAL-MATIC®

Bottom Mounted Oil Cushion

Series 500 w/Mechanical Indicator
& Oil Cushion



6” Surgebuster @500gpm = .6 ft. of head loss



Swing Flex (Resilient Hinge)

- Reliable
- Strong anti-slam properties
- Versatile: Clean or Wastewater
- Efficient, low head-loss
- Long lasting
- Ease of use, start-up
- Competitively Priced

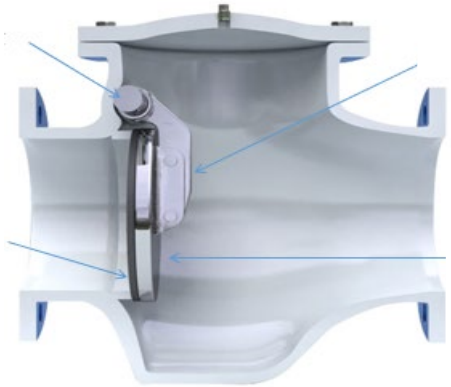
VAL-MATIC®

Swing Check
VS
Swing Flex

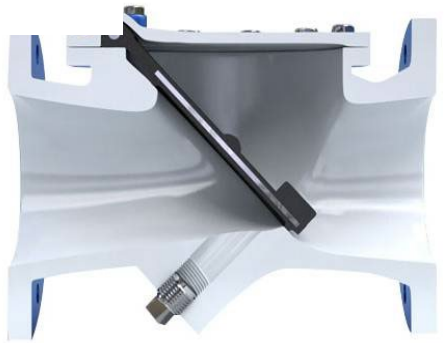
VAL-MATIC®

Swing Check vs Swing Flex

Feature	Val-Matic Swing-Flex®	Traditional Swing Check
Low Head Loss/Non-Slam Closing	Yes	No[1]
Backflow Capability	Yes	Yes
Rubber Lining Capability	Yes	No
Number of Wear Parts	1	10-15
Low Maintenance	Yes	No
Open/Closed Indication	Yes	Yes
Optional SCADA Compatible Signal Switch	Yes	No
Positive Shut-Off	Yes	No[2]
Competitively Priced	Yes	Yes
Independent 1,000,000 Cycle Test	Yes	No
Twenty-Five Year Disc Warranty[3]	Yes	No
Water /Wastewater Service	Yes	Yes
Sludge Service	Yes	Yes
Abrasive Service	Yes	No[4]
Corrosive Service	Yes[5]	No
Vertical Flow-up Service	Yes	Yes
Full Top Access Cover	Yes	Yes
Full Flow Area	Yes	Yes[1]



VS



Tilted Disc Check

VAL-MATIC®

Tilted Disc Check

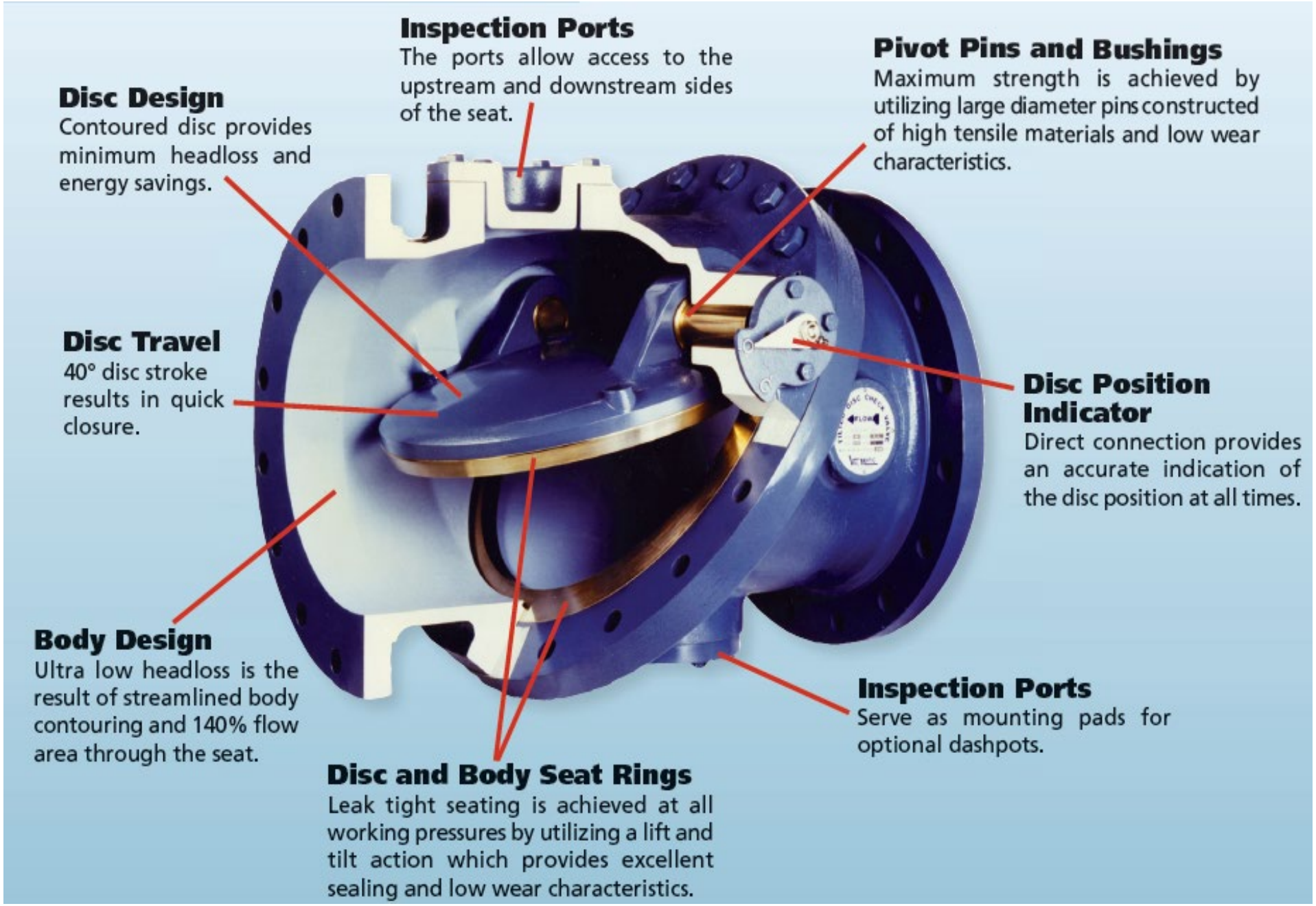
(Top performing sports valve)

VAL-MATIC®

Tilted Disc Check

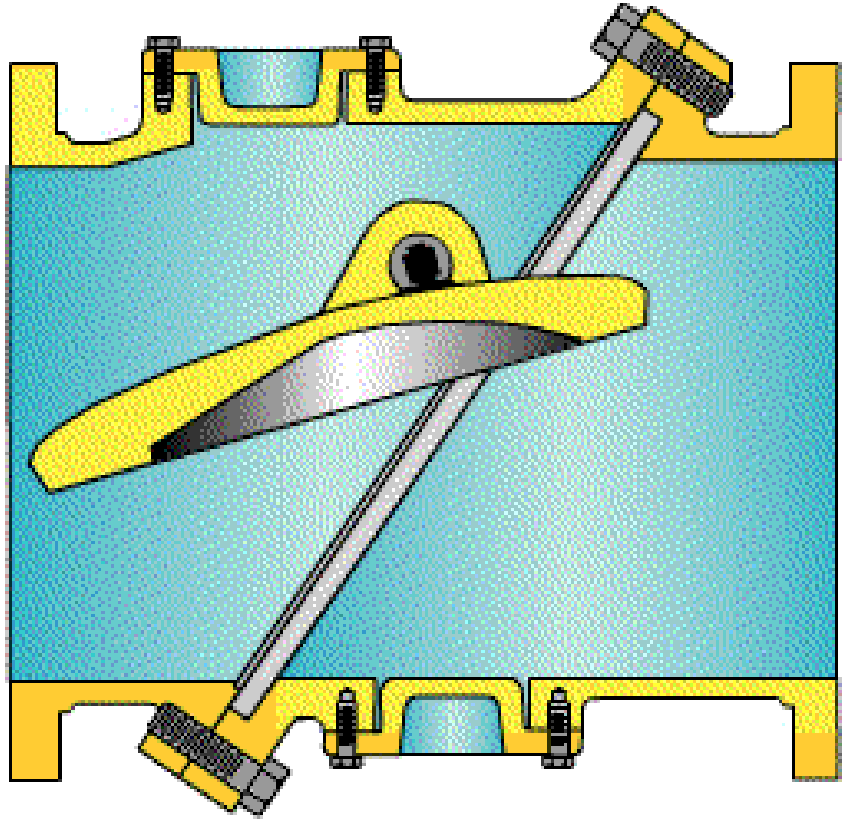
Main Details

- 3” to 72”
- Low Resistance (Low Head Loss)
- Non-Slam Closure
- High Pressure Applications
- High Velocity
- Great Under Continuous Pumping
- Open/Closed Indication


Inspection Ports
The ports allow access to the upstream and downstream sides of the seat.
Disc Design
Contoured disc provides minimum headloss and energy savings.
Pivot Pins and Bushings
Maximum strength is achieved by utilizing large diameter pins constructed of high tensile materials and low wear characteristics.
Disc Travel
40° disc stroke results in quick closure.
Disc Position Indicator
Direct connection provides an accurate indication of the disc position at all times.
Body Design
Ultra low headloss is the result of streamlined body contouring and 140% flow area through the seat.
Inspection Ports
Serve as mounting pads for optional dashpots.
Disc and Body Seat Rings
Leak tight seating is achieved at all working pressures by utilizing a lift and tilt action which provides excellent sealing and low wear characteristics.

Tilted Disc Check

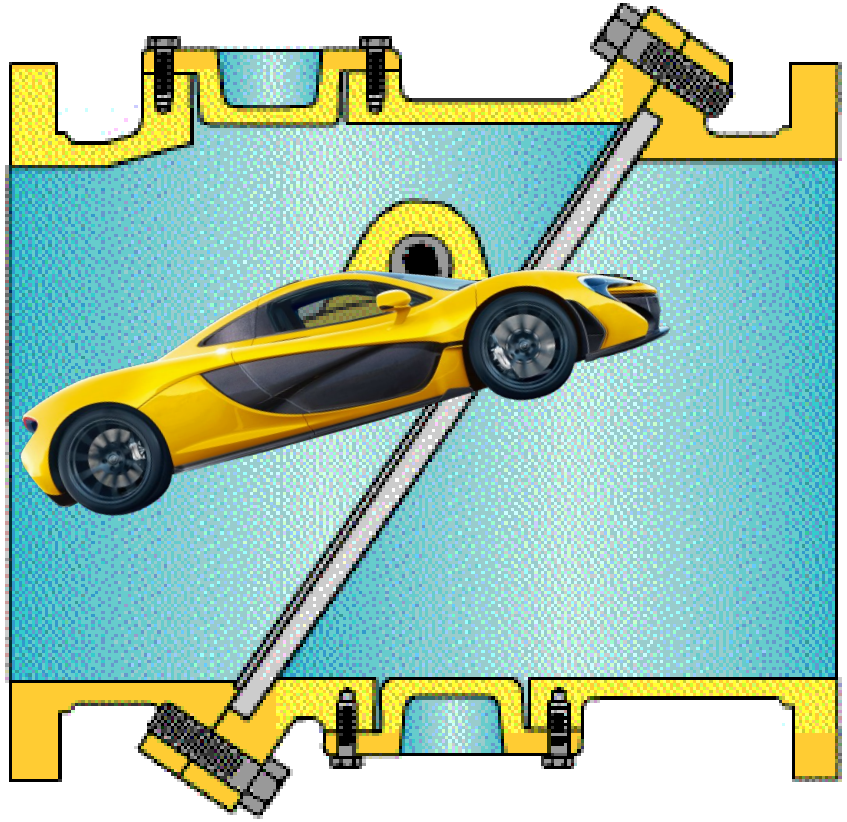
Main Details



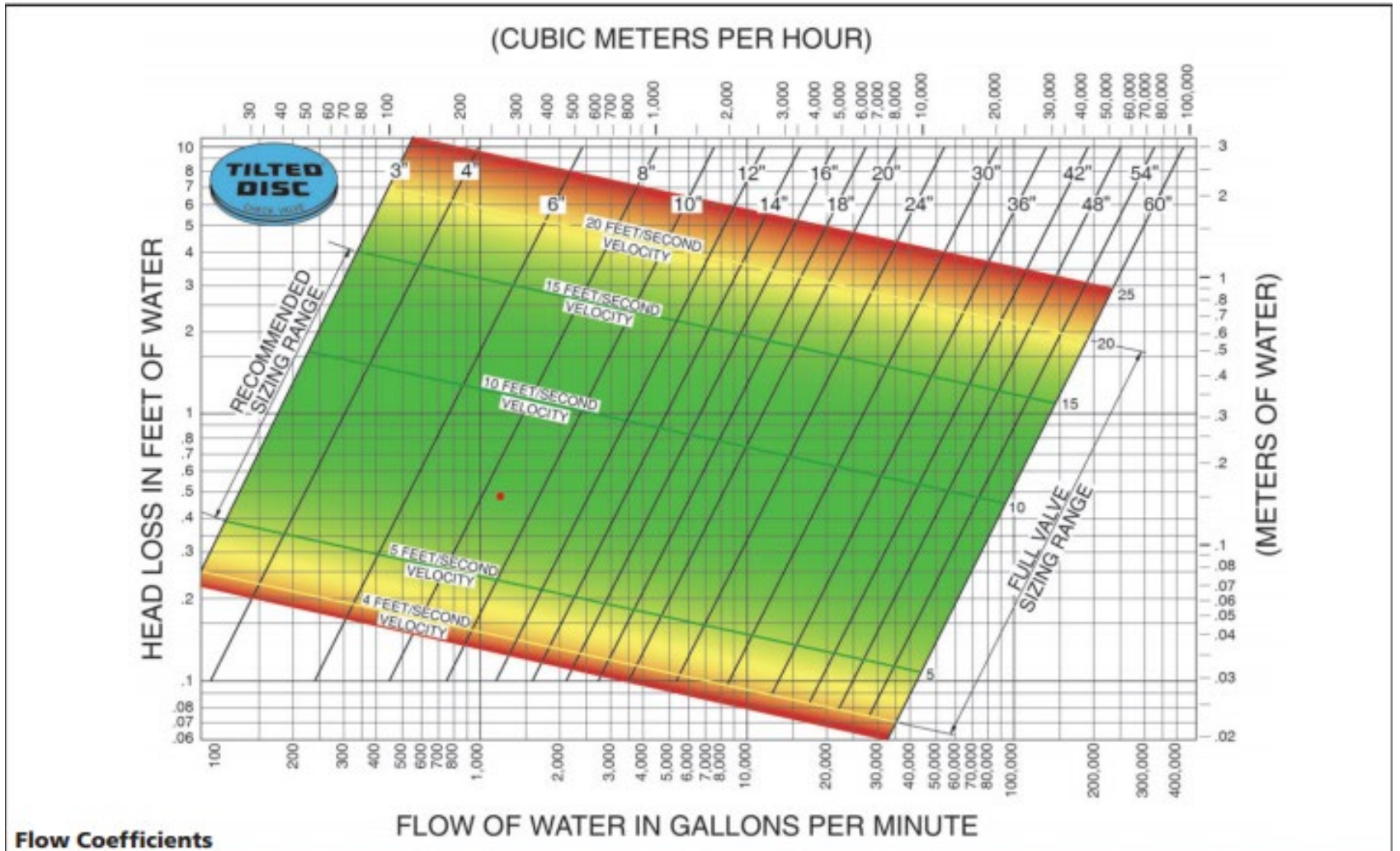
Tilted Disc Check

Main Details

- Lowest Head Loss Design
- “Wing” Shape Disc Creates Lift
- 40% Enlarged Disc Area
- Offset Disc Self Controls Closing Speed
- Lift and Tilt Disc Action Prevents Premature Wear
- 40 Degree Stroke



6” Tilted Disc Check @500gpm = .45 FT in Head Loss



Flow Coefficients

Size	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60
Cv	248	475	1,160	2,200	3,600	5,400	7,600	10,300	13,200	16,800	25,500	42,000	63,000	90,000	119,000	155,000	195,000

Tilted Disc Check

Performance Valve

- Lowest Head Loss Design
- Specific applications where performance is paramount
- Most expensive

So which do I choose?

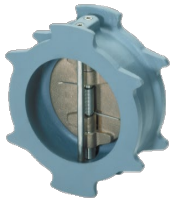
- What is the Application: Clean Water vs Wastewater
- Direction of Flow
- Allowable Head Loss/Energy Loss
- Initial Cost & Installation
- Maintenance Cost & Time
- Installation Space
- Slamming

VAL-MATIC®

Check Valve Applications

Clean Media Only

Tilted Disc



Dual Disc

Silent Check

Hydraulic Control

Clean & Wastewater

Swing Check

Swing Flex

VAL-MATIC®

Flow Orientation:

- All valves can be installed in horizontal or vertical orientations.
- Silent check can accept a vertical installation with downward flow.

Dual Disk:

Silent Check:

Tilted Disk:

Hydraulic Control

Swing Flex:

Swing Check:

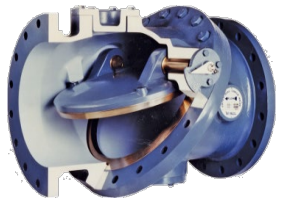
VAL-MATIC®

Check Valve Head Loss*:

Comparison of 6” check valves flowing 500gpm

Dual Disk: .6 ft.

Silent Check: 1.6 ft. (G)
2.2 ft. (W)



Tilted Disk: .45 ft.

Swing Flex: .575 ft. (standard)
.6 ft. (Surgebuster)

Swing Check: .7 ft.
(increases w/ addition of lever & weight or spring)

Hydraulic Control: 3.46 ft.

*Be careful with purposeful oversizing. Valves do require a minimum velocity for proper operation. Oversizing can result in chattering and therefore, more maintenance and/or early failure.

VAL-MATIC®

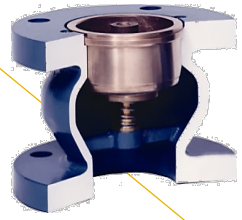
Cost Comparison: 8” Valves

Note: Installation can cost more than the valve!

Space: Some valves need 3-5 pipe lengths of straight diameter to avoid premature failure.

Weight: Valve 6” and larger may need weight support.

Dual Disk: $1,196



Silent Check: $1,683 (w)
$2,495 (g)

Tilted Disk: $7,721

Swing Flex: $2,528
Surgebuster: $4,282

Swing Check: $3,989

Hydraulic Control:

VAL-MATIC®

40 year Energy Costs

Assumes 50% usage, $0.06/kw-hr, 6 ft/sec velocity*

Val-Matic Cost Calculator: https://www.valmatic.com/resources/software/energy-cost-calculator-en

Dual Disk $3,350

Silent Check $7,397* (w)
$5,137* (g)

Tilted Disk $1,832

Swing Flex $2,356

Swing Check $2,931

*The head loss from valves can be converted into annual energy costs related to the electrical power needed by the pump to overcome the additional head loss.

VAL-MATIC®

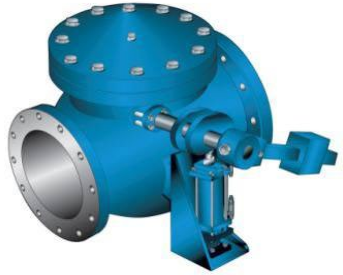
40 year Maintenance Expense*

General Rule: More moving parts = More maintenance

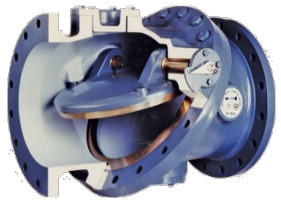
Dual Disk $2,392*

Swing Flex $1,600

Silent Check $3,366* (w)
$4,990* (g)



Swing Check $8,000



Tilted Disk $16,000

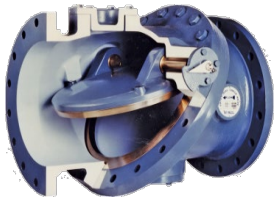
*Be careful with purposeful oversizing. Valves do require a minimum velocity for proper operation. Oversizing can result in chattering and therefore, more maintenance and/or early failure.

VAL-MATIC®

40 Year Total Expense

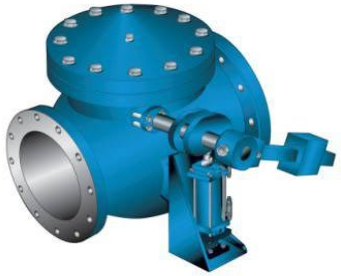
Dual Disk: $6,938

Silent Check: $12,446 (w)
$12,622 (g)



Tilted Disk: $25,553

Swing Flex: $6,484
Surgebuster: $8,238

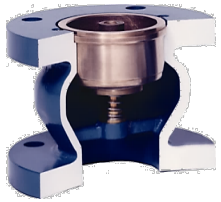


Swing Check: $14,920

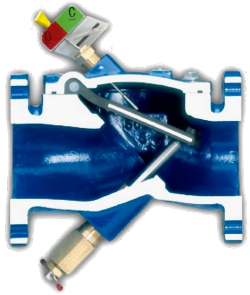
VAL-MATIC®

Slam

Fast Close

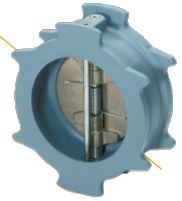


Silent Check



Surge Buster

Swing Flex



Dual Disc

Tilted Disc

Slow Close

Hydraulic Control

(Controlled close, prevents slam)

Swing Check

(Prone to slam)

VAL-MATIC®

Thank You!

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