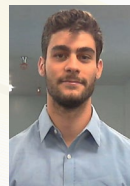
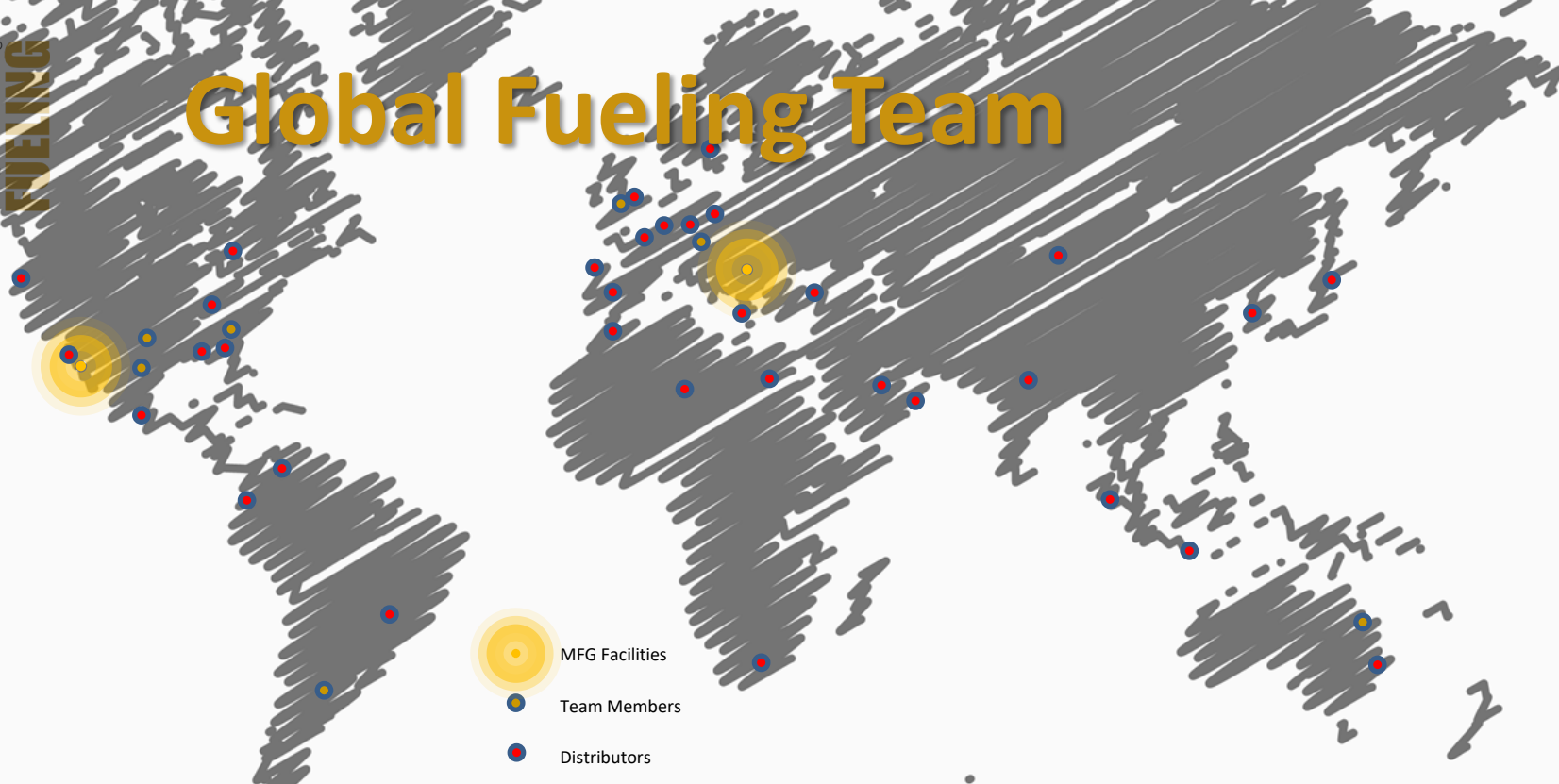


# Diaphragm Control Valves in Fuel Systems





# Global Fueling Team

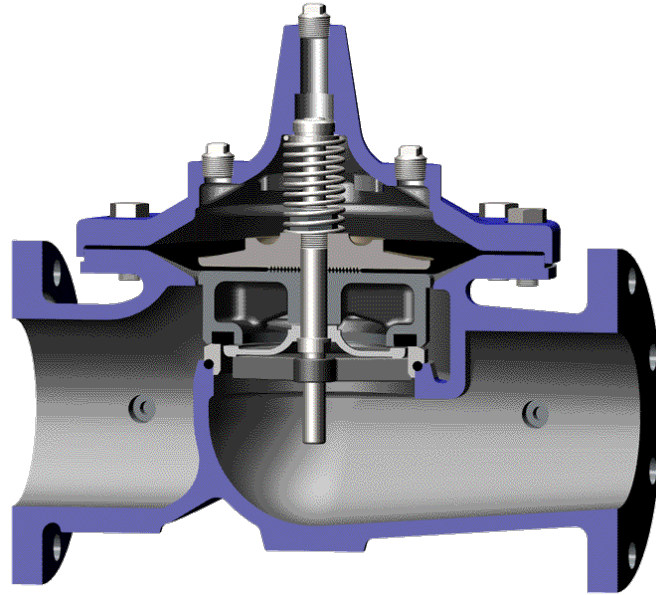


# Tank Farm to the Aircraft Solutions





# Cla-Val Hytrol Main Valve



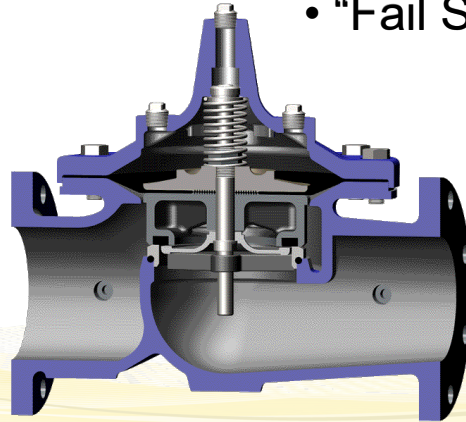
100-34



# 100-34 Hytrol Main Valve

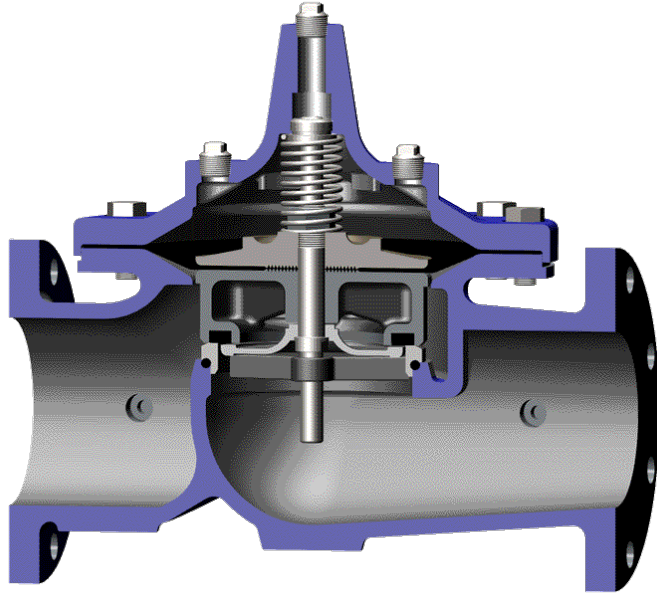


- Modified Globe Design
- Diaphragm Actuated
- Hydraulically Operated
- Pilot Controlled
- “Fail Safe”





# 100-34 Hytrol Main Valve

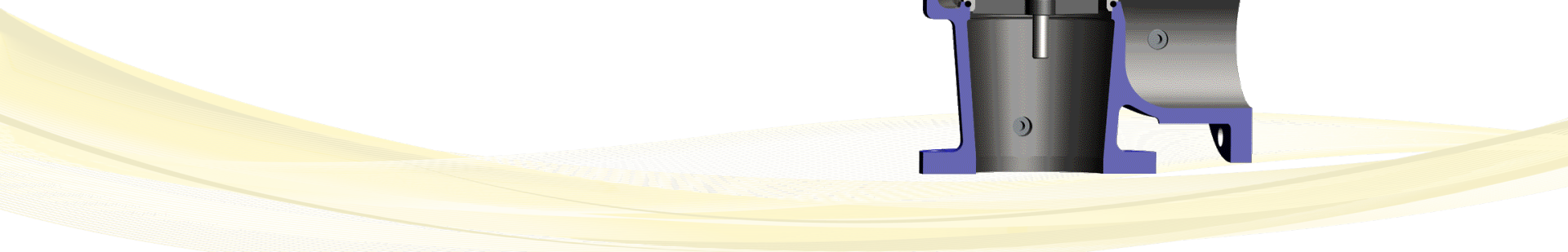
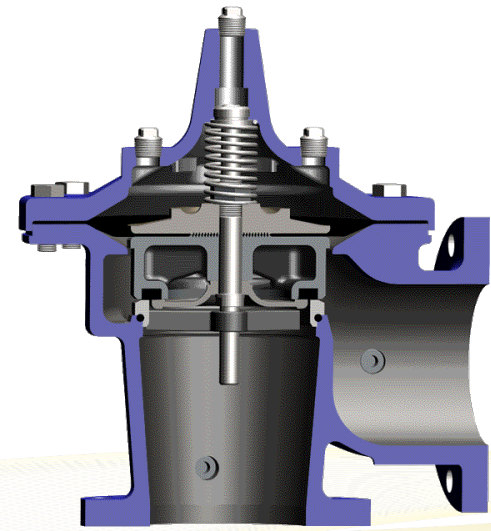
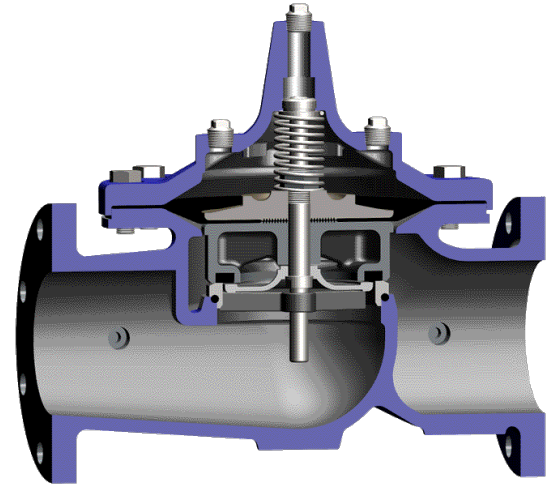


## Features

- Drip Tight Shutoff
- No packing glands
- No breakaway friction
- No external linkages
- No lubrication needed
- Lowest operating friction



# Globe and Angle Pattern





# Main Valve Specifications

## Available Sizes

Pattern	Threaded	Flanged	Grooved End
Globe	3/8" - 3"	1 1/2" - 36"	1 1/2"-2"- 2 1/2"- 3"- 4"- 6"- 8"
Angle	1 1/2" - 3"	2" - 16"	2" - 3" - 4"

## Operating Temp. Range

Fluids
-40° to 180° F

## Pressure Ratings (Recommended Maximum Pressure - psi)

Valve Body & Cover		Pressure Class			
		Flanged			Threaded
Grade	Material	ANSI Standards*	150 lb.	300 lb.	End** Details
ASTM A536	Ductile Iron	B16.42	250	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400
ASTM B62	Bronze	B16.24	225	400	400

Note: \* ANSI standards are for flange dimensions only.  
 Flanged valves are available faced but not drilled.  
 \*\* End Details machined to ANSI B2.1 specifications.

\* As seen  
in the Cla-  
Val catalog

Larger sizes  
available.  
Consult factory.





# Main Valve Standard Materials

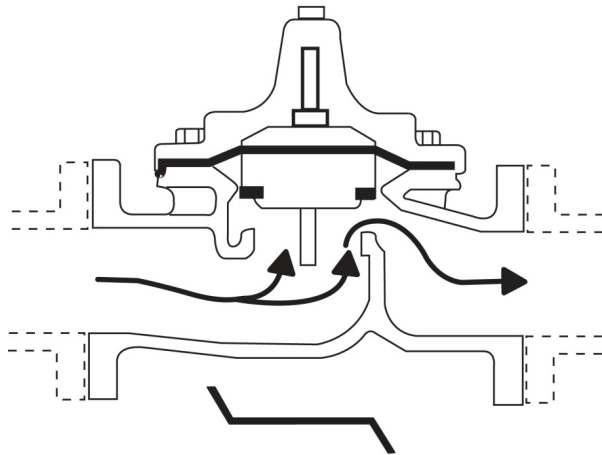
## Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron	Cast Steel	Bronze
Available Sizes	1¼" - 48"	1¼" - 16"	1¼" - 16"
Disc Retainer & Diaphragm Washer	Cast Iron	Cast Steel	Bronze
Trim: Disc Guide, Seat & Cover Bearing	Bronze is Standard Stainless Steel is optional		
Disc	Buna-N® Rubber		
Diaphragm	Nylon Reinforced Buna-N® Rubber		
Stem, Nut & Spring	Stainless Steel		
For material options not listed, consult factory. Cla-Val manufactures valves in more than 50 different alloys.			

\* As seen in the Cla-Val catalog

# Flow Direction

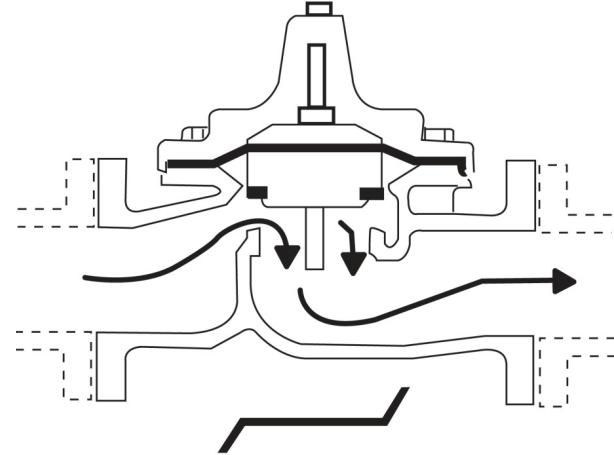
NORMAL FLOW



UP-AND-OVER-SEAT

Fail Safe Open

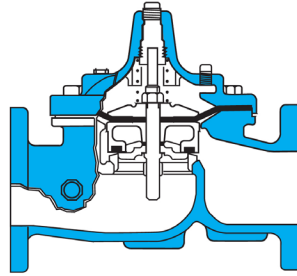
REVERSE FLOW



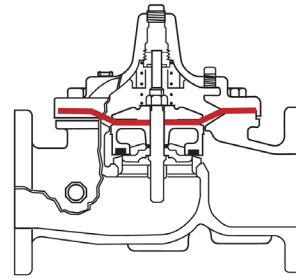
OVER-SEAT-AND-DOWN

Fail Safe Closed

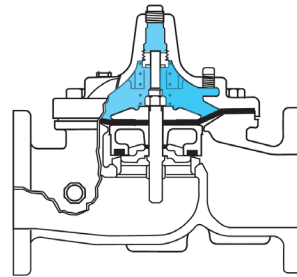
# Four Basic Design Ideas



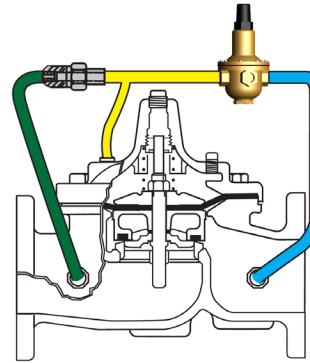
Modified Globe Design



Diaphragm Actuated

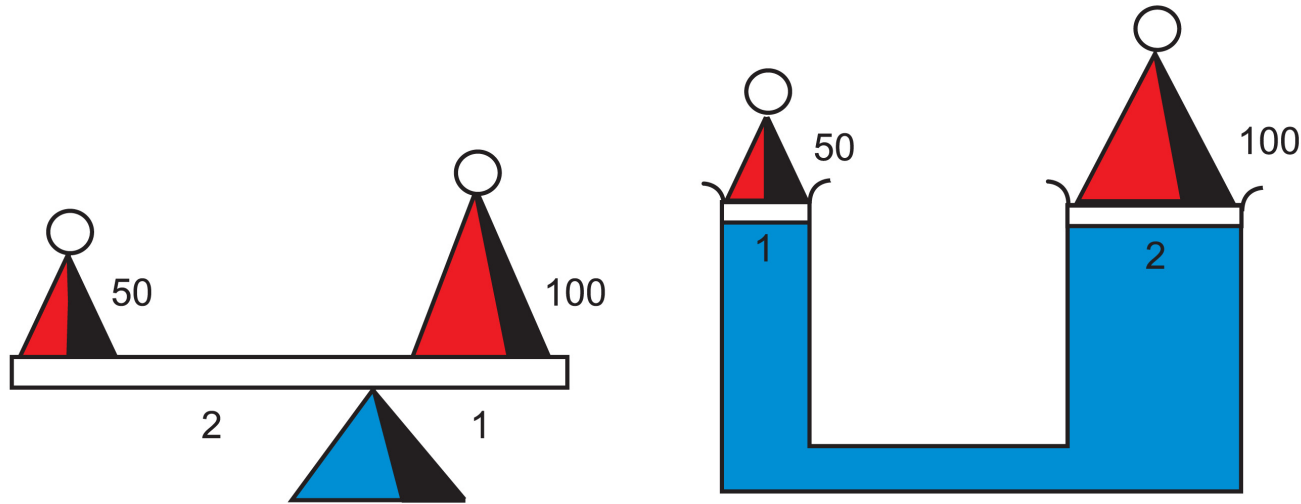


Hydraulically Operated



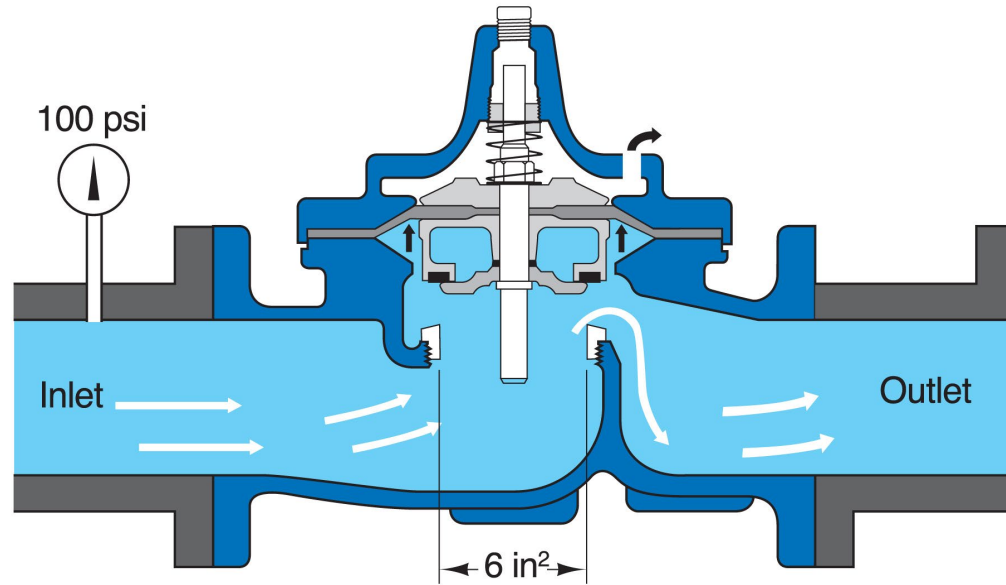
Pilot Controlled

# The Hydraulic Advantage



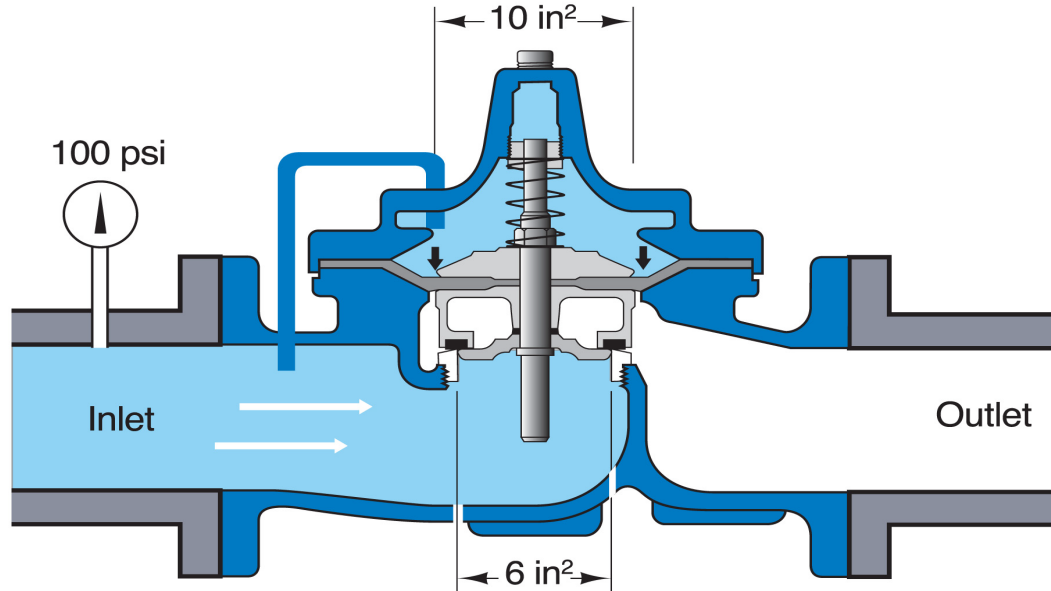
Fluid can be used like levers

# Line Pressure to Open



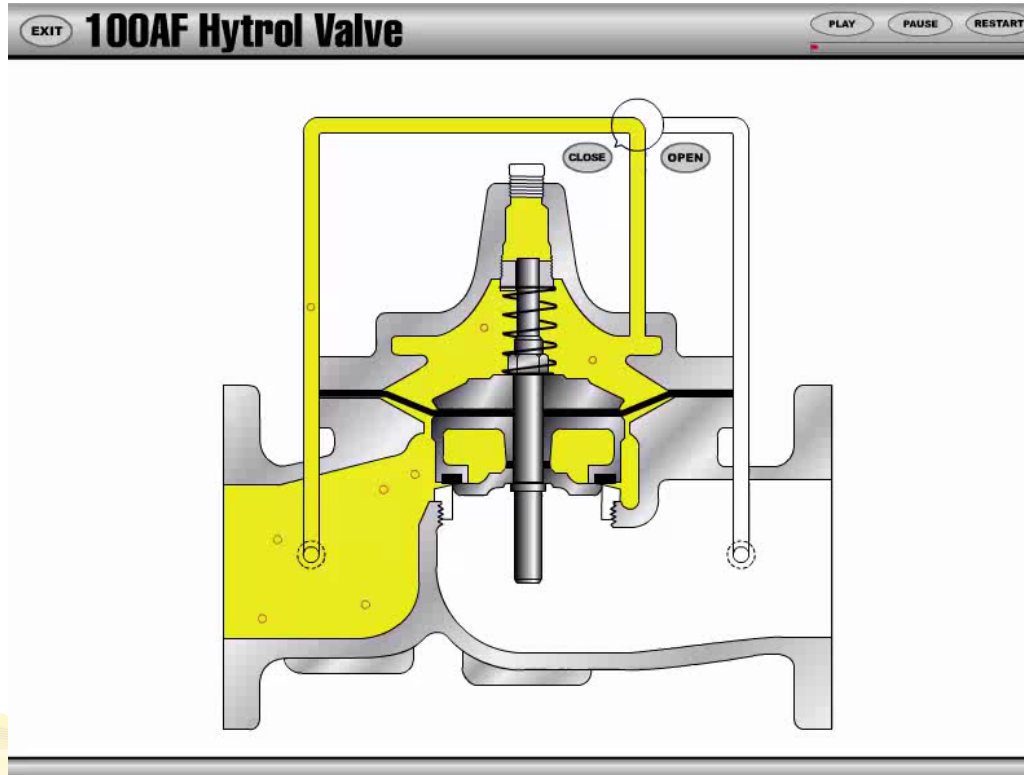
$$100\text{psi} \times 6 = 600\text{lbs.}$$

# Line Pressure to Close

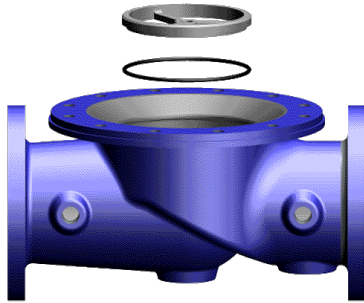


$$\begin{aligned} \text{Closing Force} & 100 \times 10 = 1000 \text{ lbs.} \\ \text{Opening Force} & 100 \times 6 = \underline{600 \text{ lbs.}} \\ \text{Difference} & = 400 \text{ lbs.} \end{aligned}$$

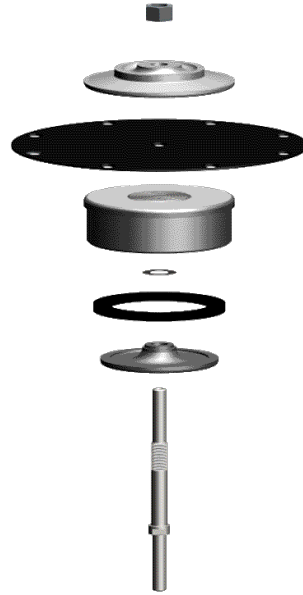
# 100-34 Hytrol Main Valve



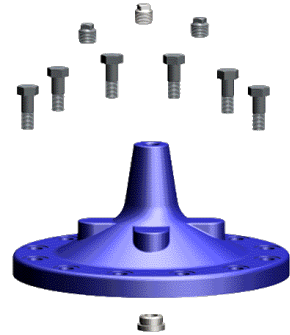
# Three Simple Assemblies



Valve Body & Seat  
Assembly



Diaphragm & Disc  
Assembly

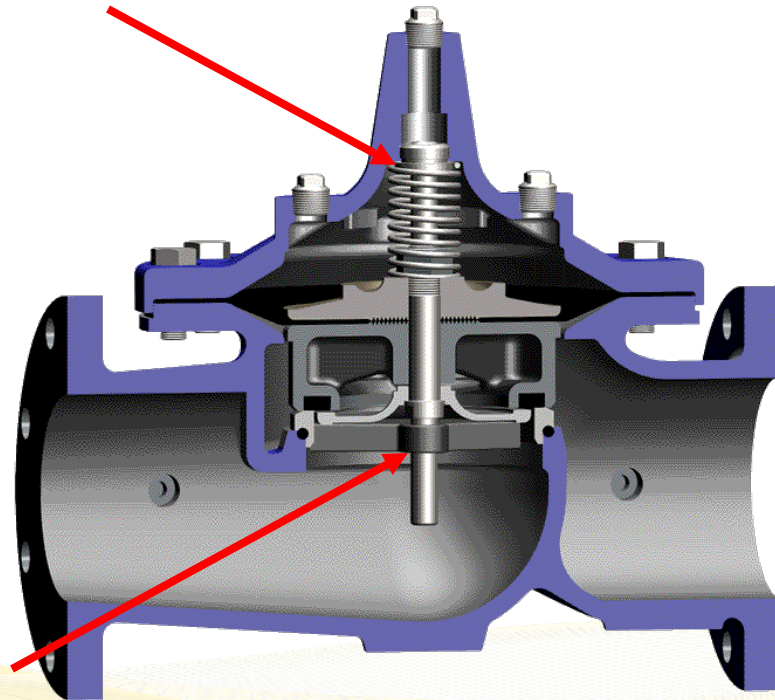


Cover & Bearing  
Assembly

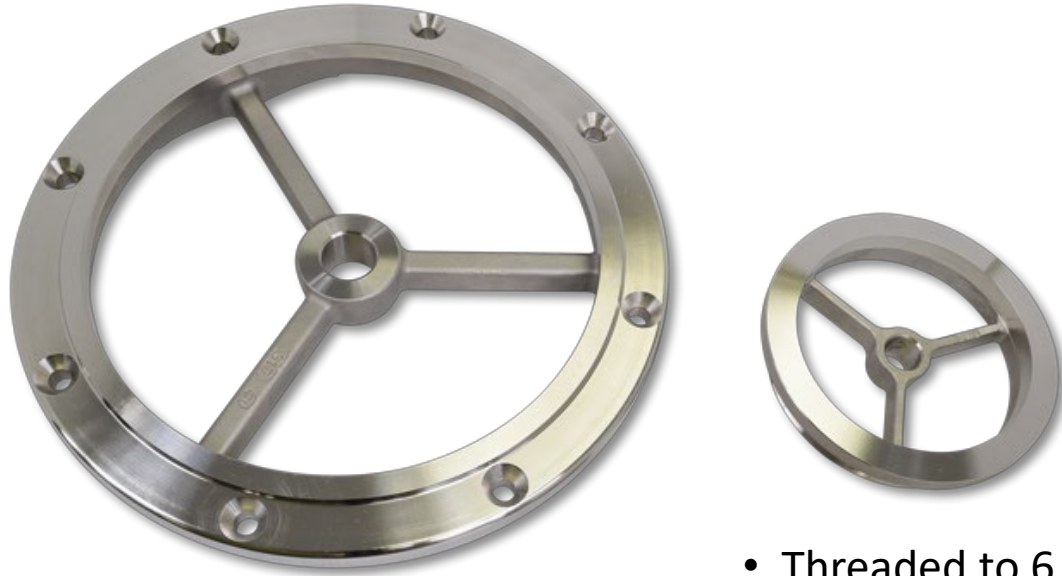




# 1-1/2-inch Valves and Larger Have Top and Bottom Stem Guides



# Renewable Seat

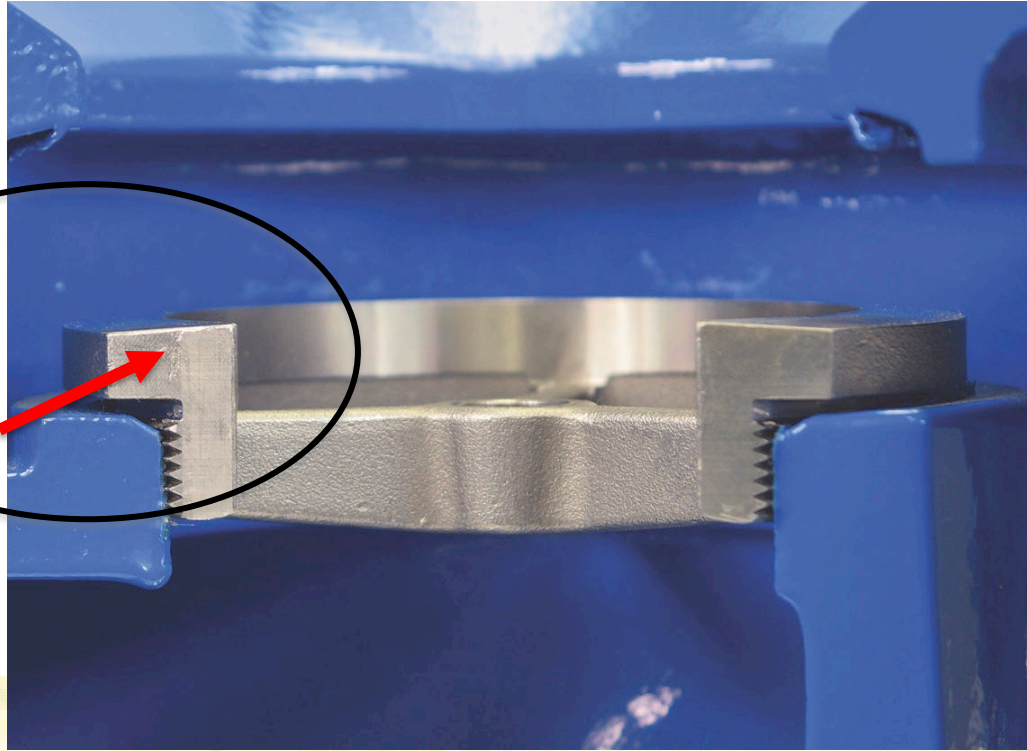


- Threaded to 6 inch size
- 8 inch and larger seat screws

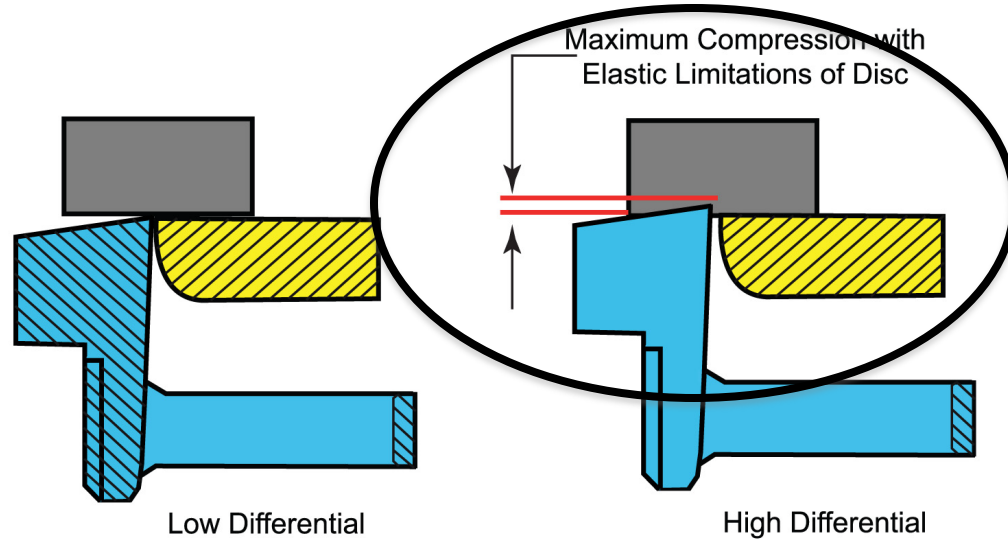


# Seat Design Features

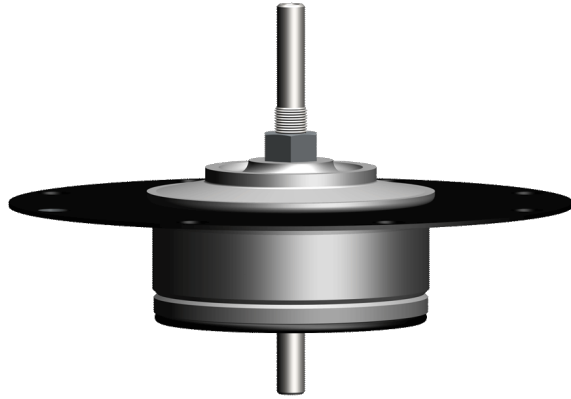
5°  
Taper



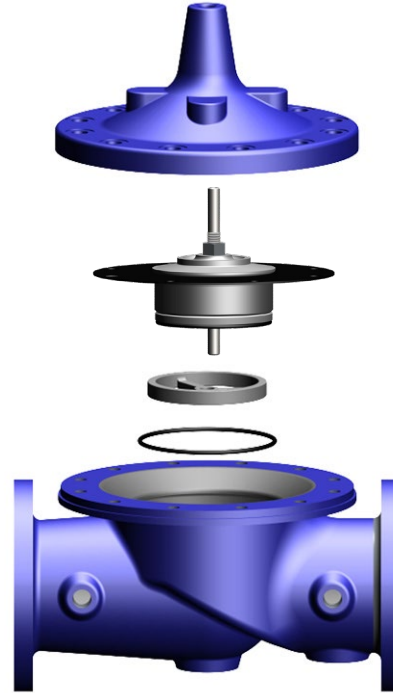
# Drip Tight Sealing



# One Moving Part Inside the Valve



Disc & Diaphragm  
Assembly



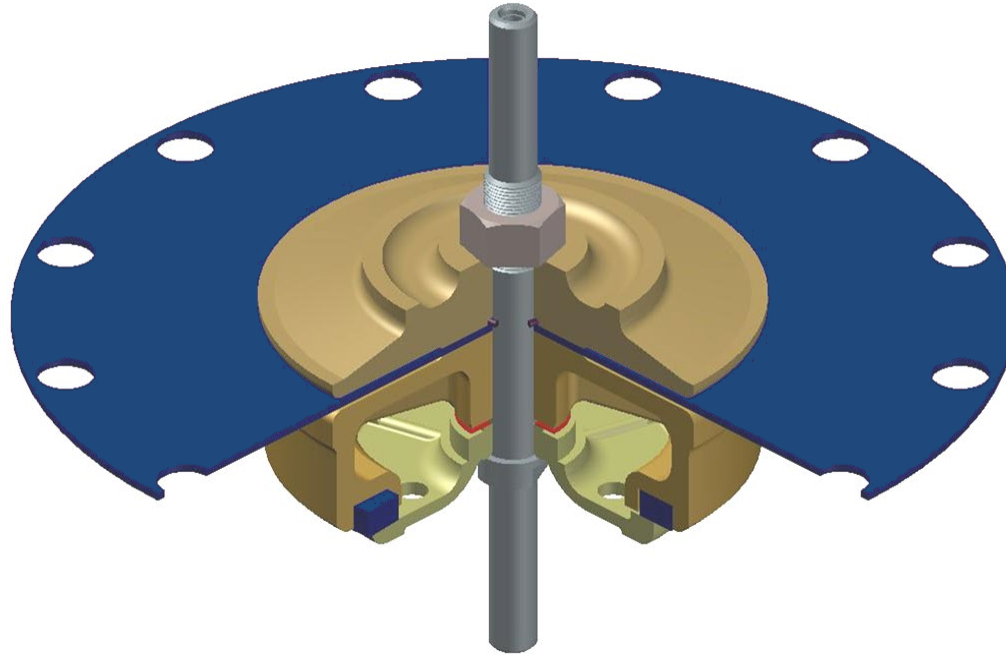


# Reinforced Non-wicking Diaphragm

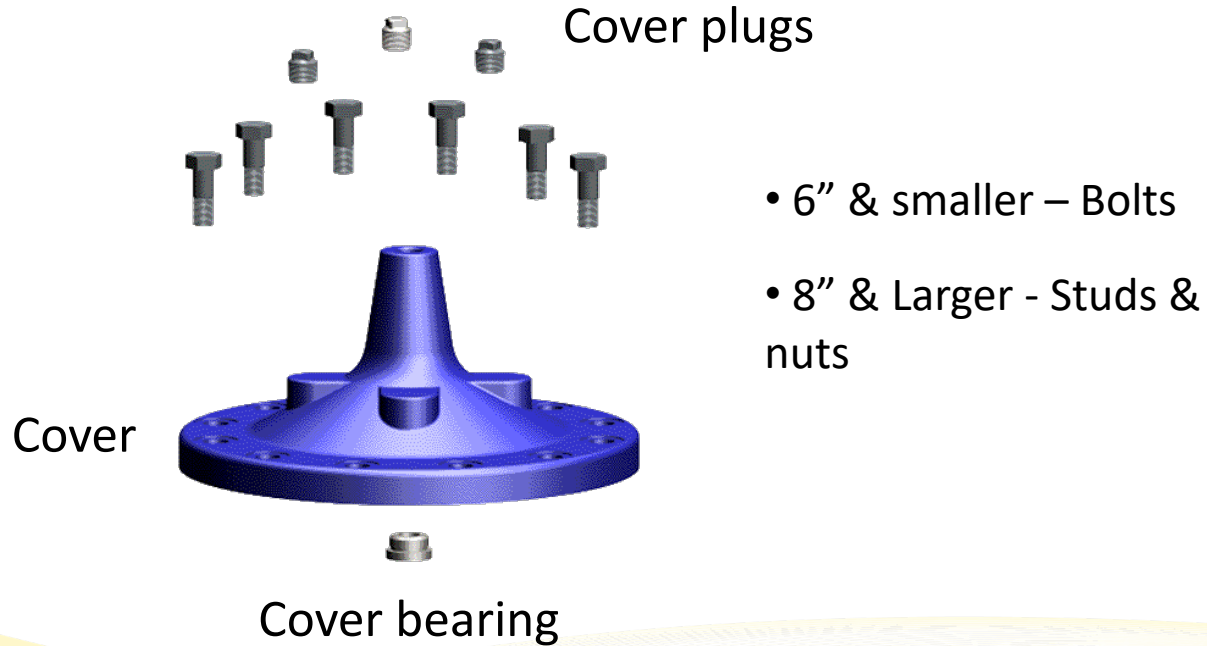




# Complete Diaphragm and Disc Assembly



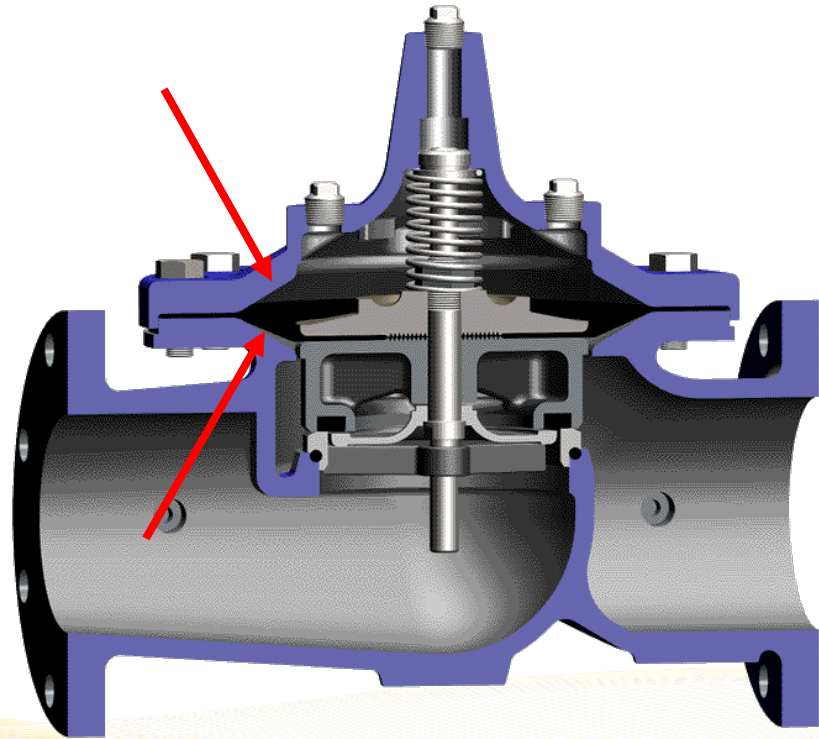
# Cover Assembly





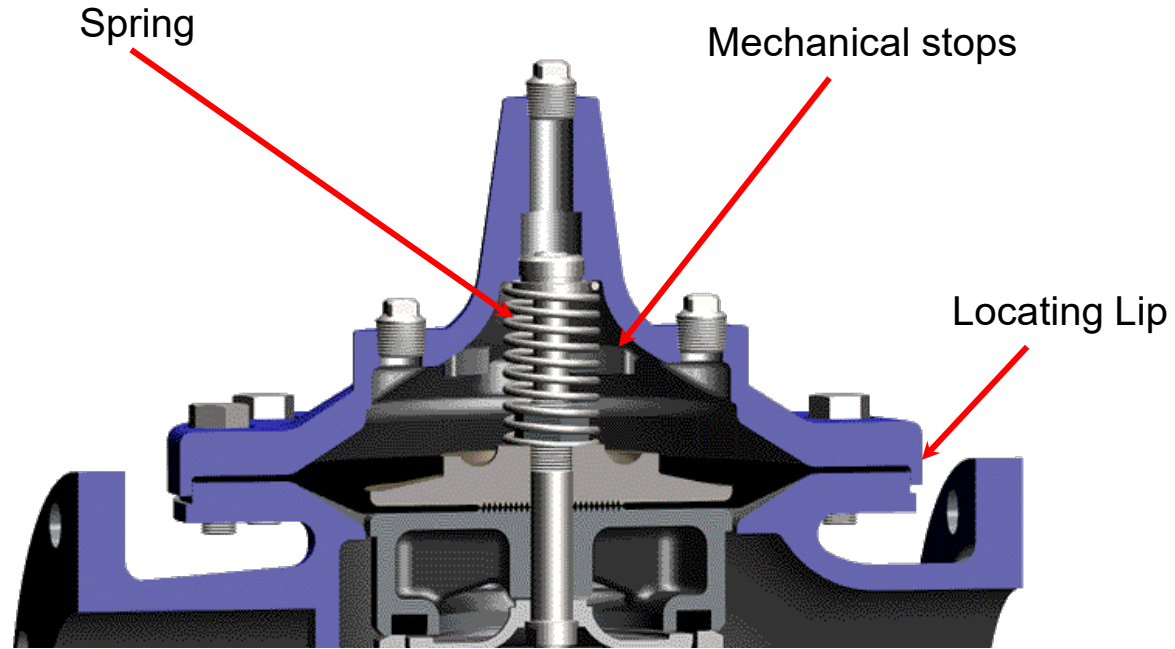


# Fully Supported Diaphragm

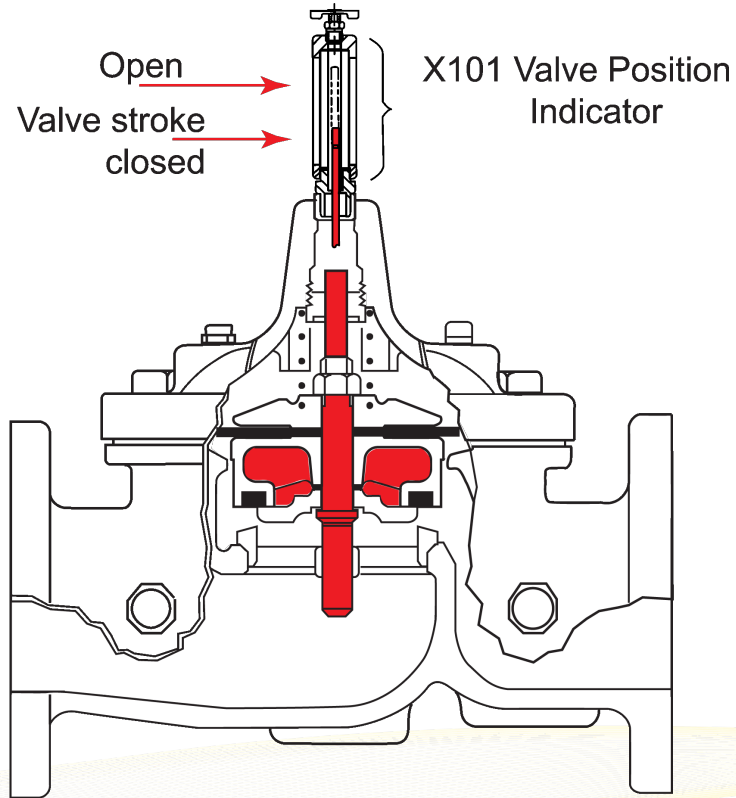




# Cover Spring



# Measured Stroke Formula



Valve stroke equals  
.28 x valve size on full  
ported valves

Valve stroke equals  
.28 x seat size on  
reduced port valves

# X101 Valve Position Indicator





# Types of Valve Applications

## **Non-Modulating Valves** (On - Off Service)

- High-Level Shutoff

## **Modulating Valves** (Throttling Service)

- Back Pressure Control
- Flow Control

## **Combination Valves** (Both of Above)

- Filter Separator Controls
- Hydrant Control



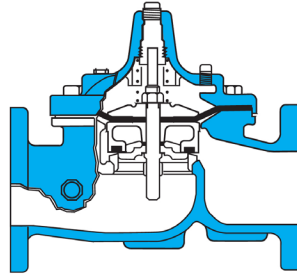
# Valve Catalog Series and Function

## VALVE SERIES

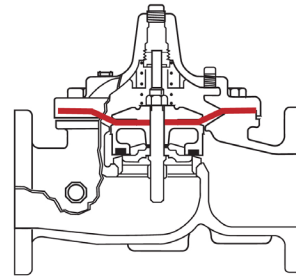
## PRIMARY FUNCTION

40	RATE-OF-FLOW LIMITING
50	PRESSURE RELIEF / UPSTREAM SUSTAINING
80	NON-SURGE OPENING
90	PRESSURE REDUCING
120	TANK HIGH LEVEL SHUTOFF, (INTERNAL FLOAT)
130	SOLENOID SHUTOFF / EMERGENCY STOP
300	HYDRANT & PANTOGRAPH FUELING
400	SHUTOFF VALVES W/FLOAT CONTROLS

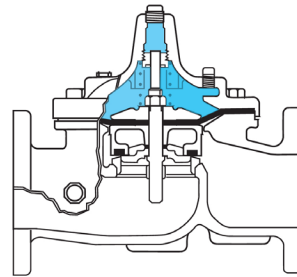
# Four Basic Design Ideas



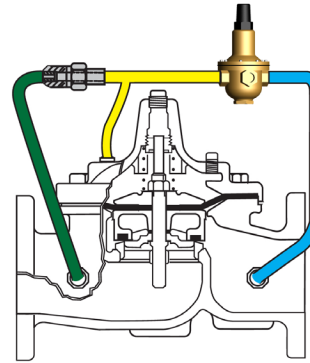
Modified Globe Design



Diaphragm Actuated



Hydraulically Operated



Pilot Controlled

# High Level Shutoff Valves







# High Level Shutoff Valve with Externally Mounted Float Control

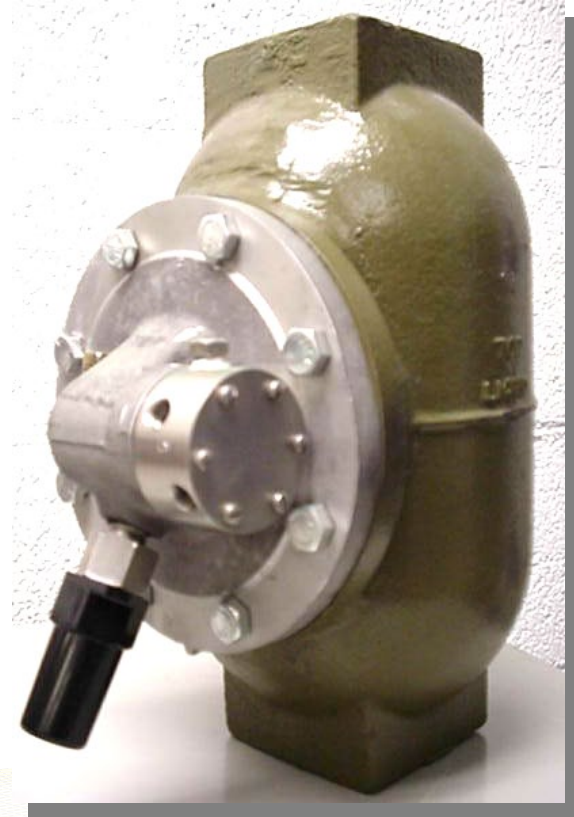
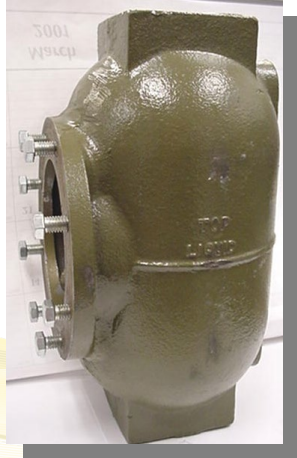
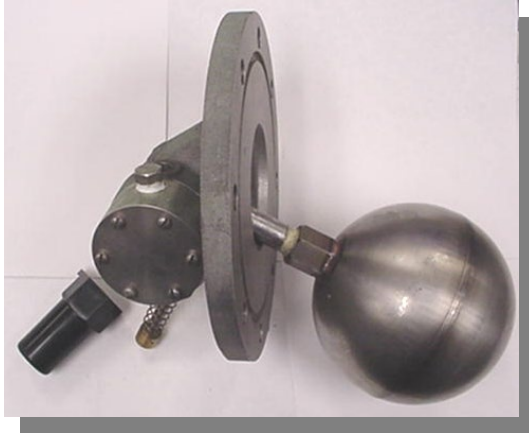


- 100-34 Main Valve
- Ejector
- X46 Flow Clean Strainer
- 100-01 Hytrol
- X101 VPI
- CV Speed Control
- 81-01 Hytrol Check Valves
- CFC2T-C1 Float Assembly



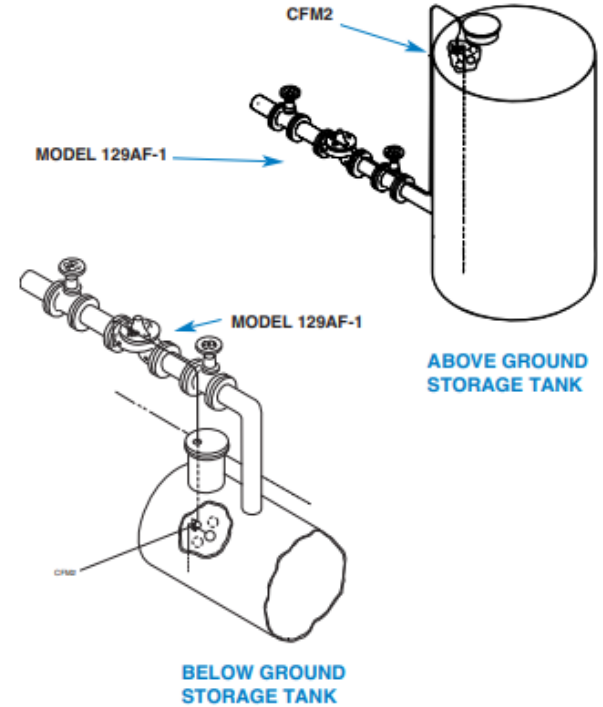
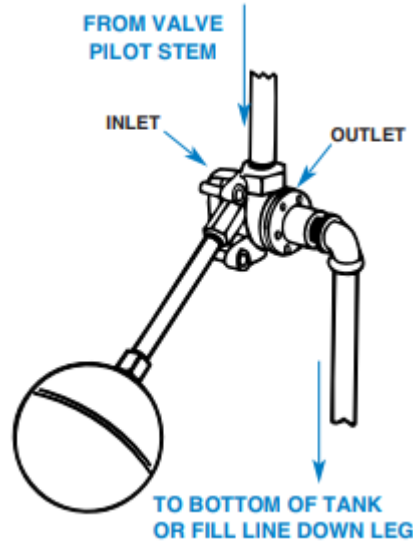
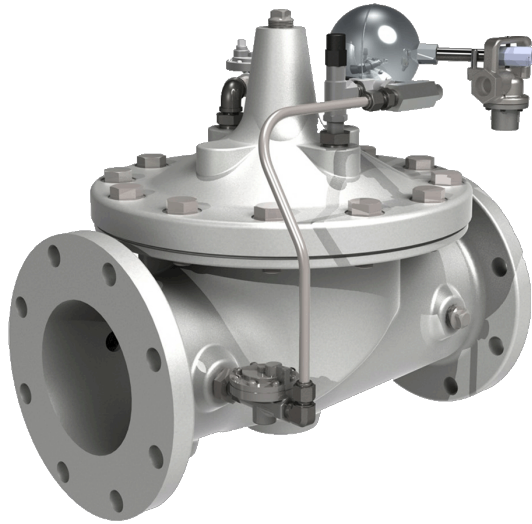


# CFC2T-C1 High Level Float Assembly



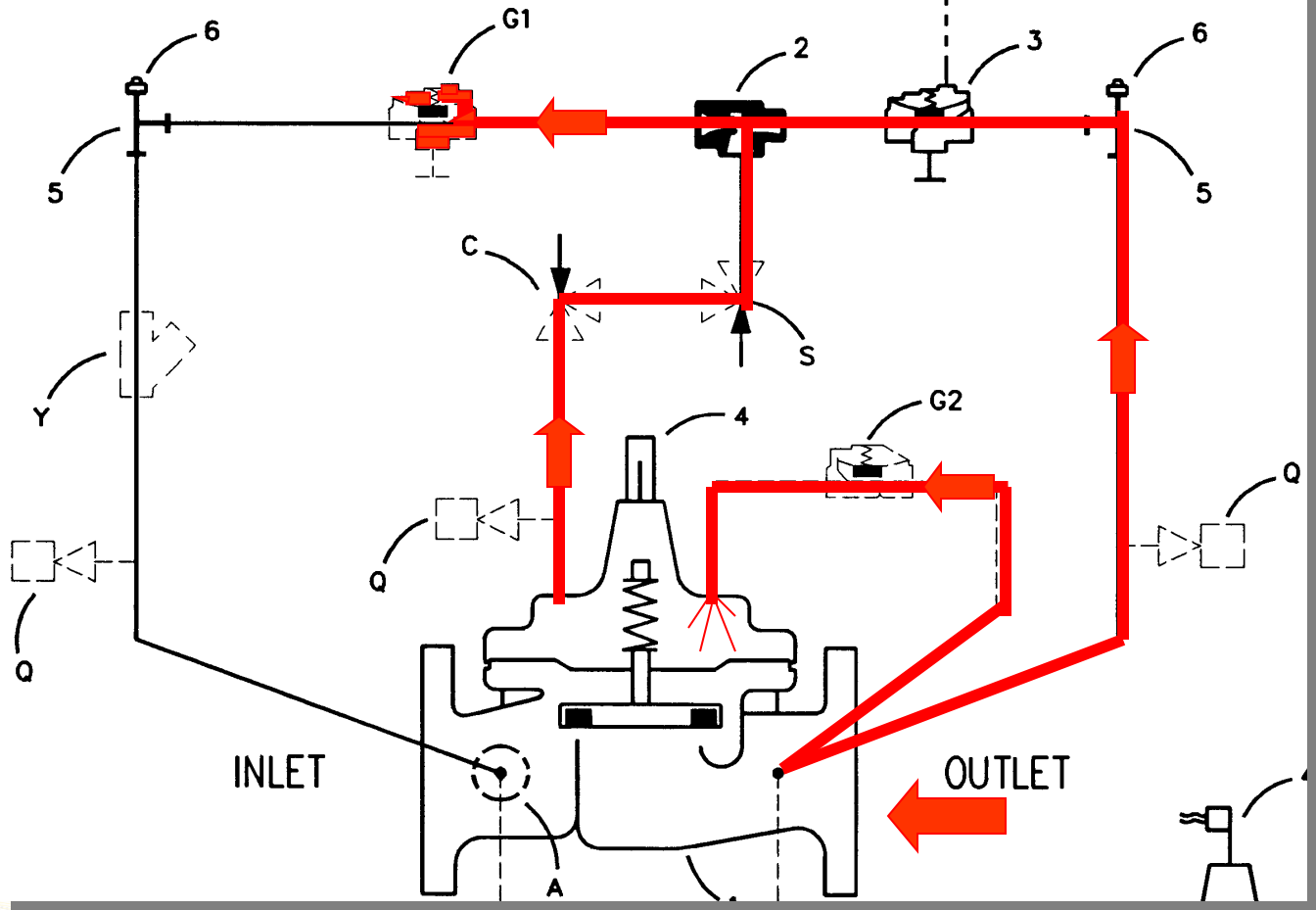


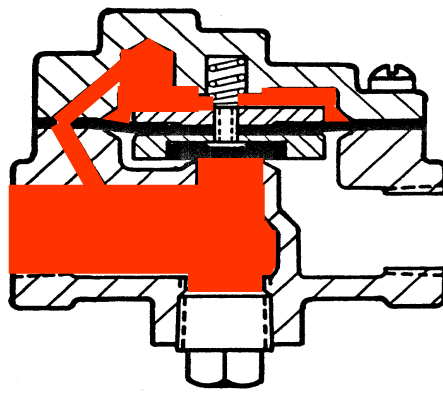
# High Level Shut Off Valve with Internally Mounted Float



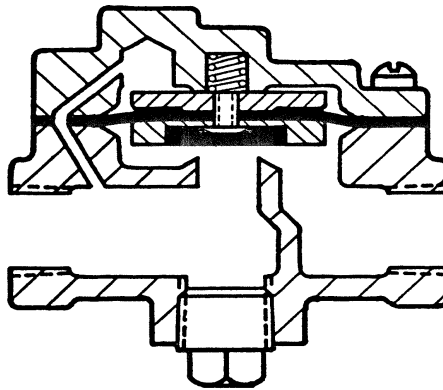
# Check Feature Function

REMOTE CONTROL PRESSUR



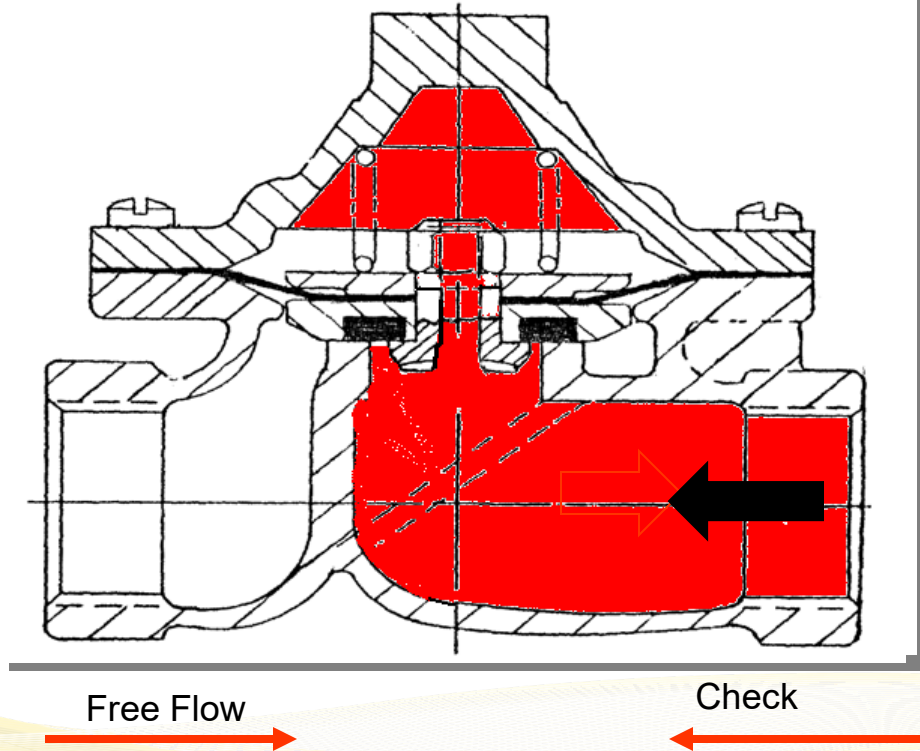


CHECK  
→

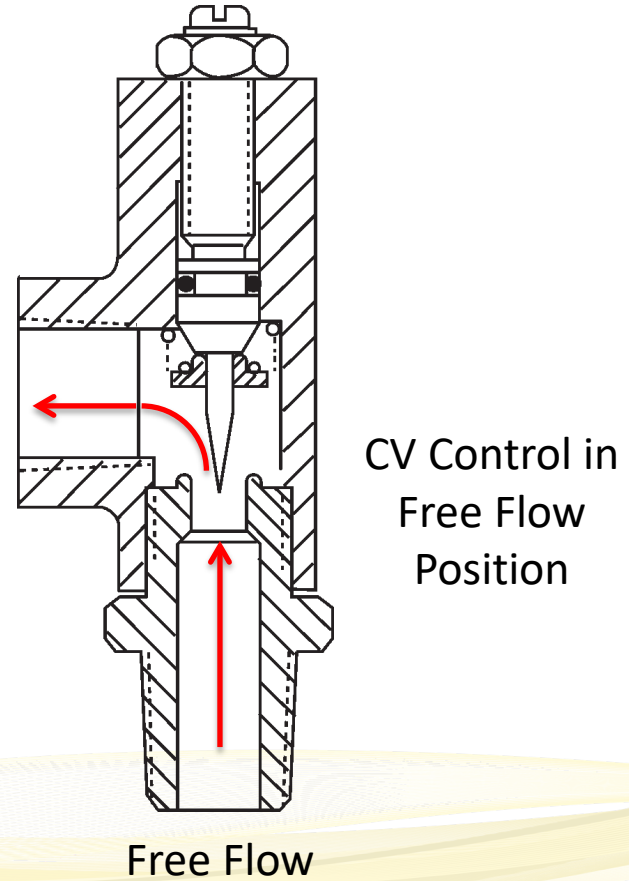
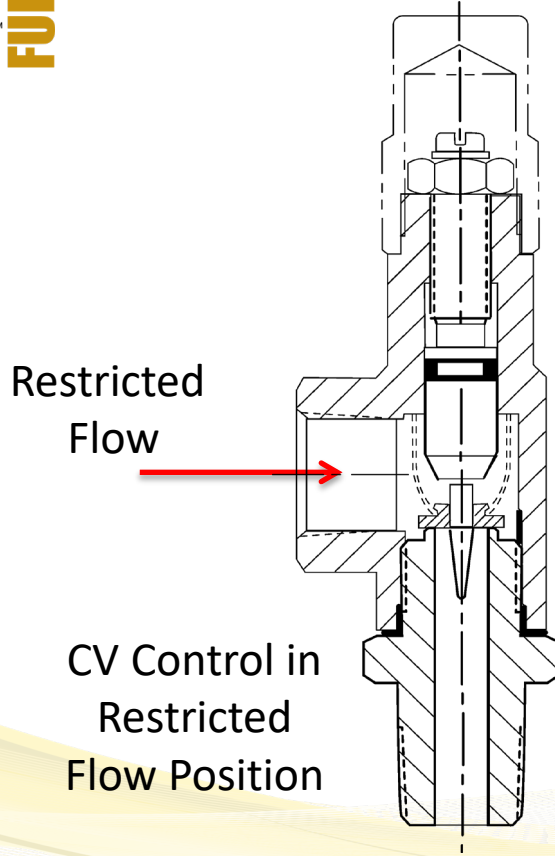


FREE FLOW  
←

# 1/2" and 3/4" Check Features



# CV Speed Controls





# 413-01 vs. 413-12

CVCL 1 2 3 4 DIST CODE G02A SHEET 1 OF 3

**CLA-VAL CO.** NEWPORT BEACH, CALIFORNIA CATALOG NO. 413-01/613-01 DRAWING NO. 25422 REV. D

**AVIATION FUELING**

FUEL DISCHARGE VALVE

--- NOT FURNISHED BY CLA-VAL CO. --- OPTIONAL FEATURES

\*MAIN VALVE OPTIONS = 9H5999

NEW	BASIC COMPONENTS		QTY
1	*100-34 HYTROL (413-01) REVERSE FLOW	1	6
1	*100-37 HYTROL (613-03) REVERSE FLOW	1	2
2	X47A EJECTOR (12" & SMALLER)	1	
3	X50A EJECTOR (14" & LARGER)	1	
3	100-01 HYTROL (REVERSE FLOW)	1	
4	X101 VALVE POSITION INDICATOR	1	
5	X105L SWITCH ASSEMBLY (OPTIONAL)	1	
	TEE, PIPE	2	

OPTIONAL FEATURE SUFFIX		ADDED TO CATALOG NUMBER	
A	X46A FLOW CLEAN STRAINER	T	55F PRESSURE RELIEF CONTROL
B	CK2 COCK (ISOLATION VALVE)	Y	X43 "Y" STRAINER
C	CV FLOW CONTROL (CLOSING)		
G	CHECK FEATURE (81-01)		
Q	QUICK CONNECT ASSEMBLY		
S	CV FLOW CONTROL (OPENING)		

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SHEET 1 OF 5

**CLA-VAL CO.** NEWPORT BEACH, CALIFORNIA CATALOG NO. 413-12/613-12 DRAWING NO. 211812 REV. -

**AVIATION FUELING**

COMBINATION HIGH LEVEL AND SOLENOID SHUTOFF VALVE WITH DIFFERENTIAL CONTROL, PRESSURE SENSITIVE CLOSING, AND RAPID OPENING FEATURE

--- NOT FURNISHED BY CLA-VAL CO. --- OPTIONAL FEATURES

\*MAIN VALVE OPTIONS = 9H5999

\*\* THE 55F THERMAL RELIEF FEATURE IS USED ONLY WITH CHECK FEATURE (C)

NEW	BASIC COMPONENTS		QTY
1	M100-34 HYTROL (413-12) MAIN VALVE (REVERSE FLOW)	1	7
1	M100-37 HYTROL (613-12) MAIN VALVE (REVERSE FLOW)	1	8
2	100-01 AUXILIARY HYTROL (REV. FLOW)	2	9
3	X47A EJECTOR	1	10
4	CS3MM SOLENOID CONTROL	1	
5	CS2-7 DIFFERENTIAL CONTROL	1	
6	X101 VALVE POSITION INDICATOR	1	
	X105L SWITCH ASSEMBLY (OPTIONAL)	1	

OPTIONAL FEATURE SUFFIX		ADDED TO CATALOG NUMBER	
A	X46A FLOW CLEAN STRAINER	T	**55F THERMAL RELIEF
B	CK2 COCK (ISOLATION VALVE)	Y	X43 "Y" STRAINER
C	CV FLOW CONTROL (CLOSING)		
G	CHECK FEATURE (81-01)		
Q	QUICK CONNECT ASSEMBLY		
S	CV FLOW CONTROL (OPENING)		

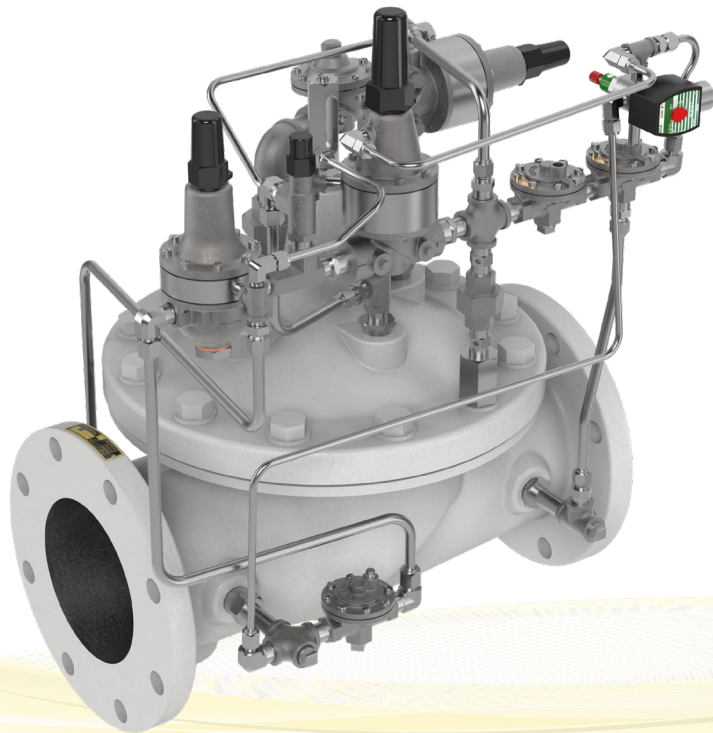
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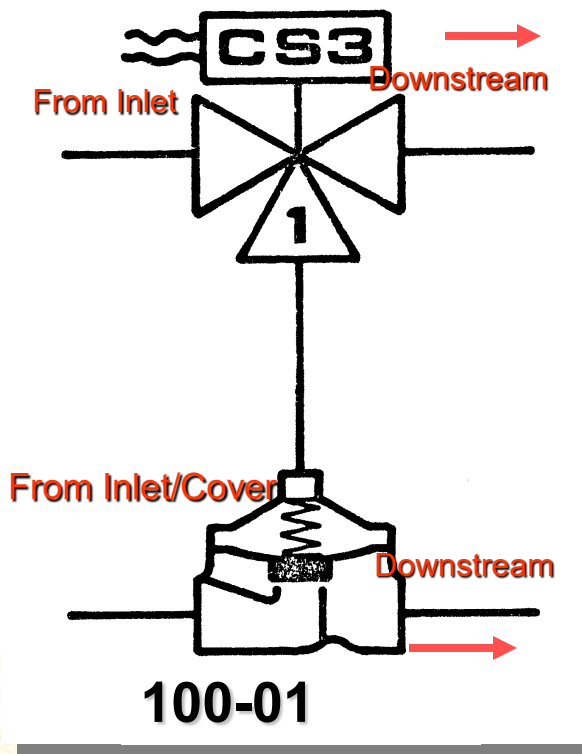


**413-12**

**Combination High Level & Solenoid Shutoff Valve  
with Differential Control, Pressure Sensitive Closing  
& Rapid Opening Feature**



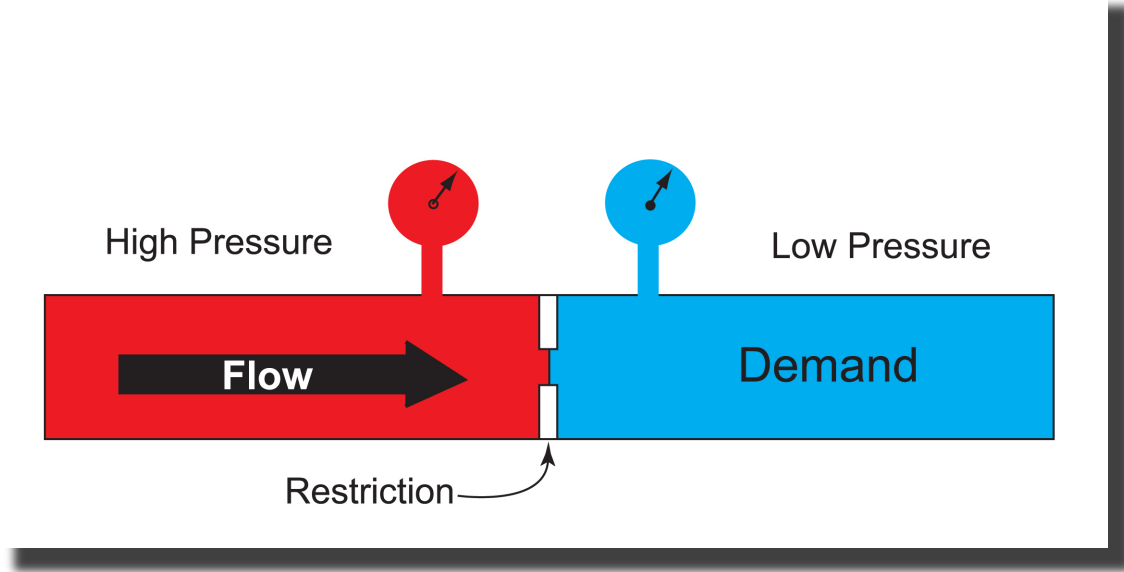
# Solenoid Shutoff Features



# Flow Control Valves



# Basic Definition of Constant Flow Rate



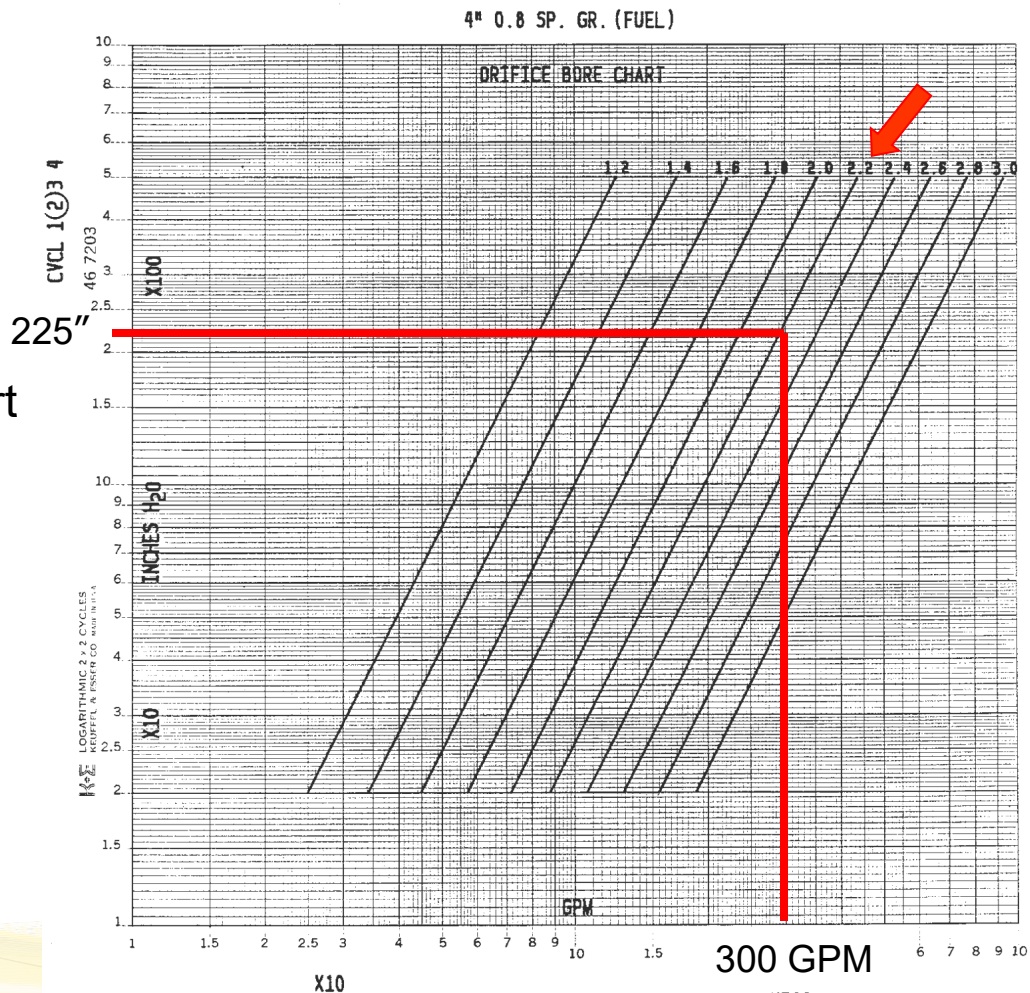
When a constant differential pressure is  
across a fixed restriction



# 4-inch Orifice Bore Chart for 0.8 Specific Gravity (27.75" of H<sub>2</sub>O = 1 psi)

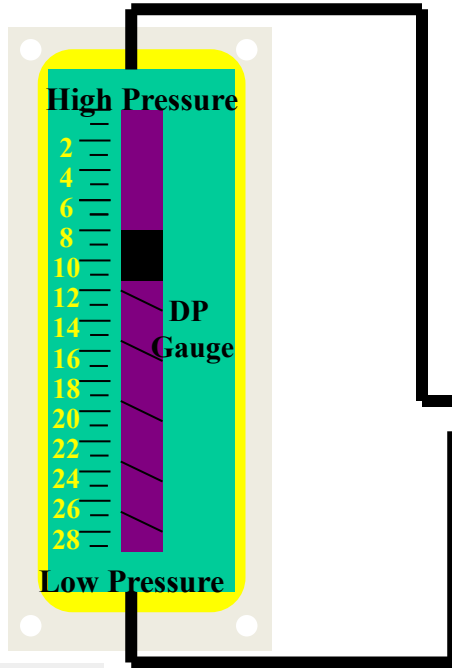
$$225 / 27.75 = 8.1 \text{ psid}$$

For 300 GPM



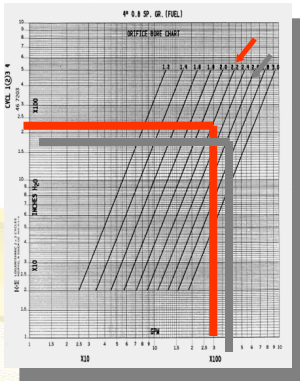
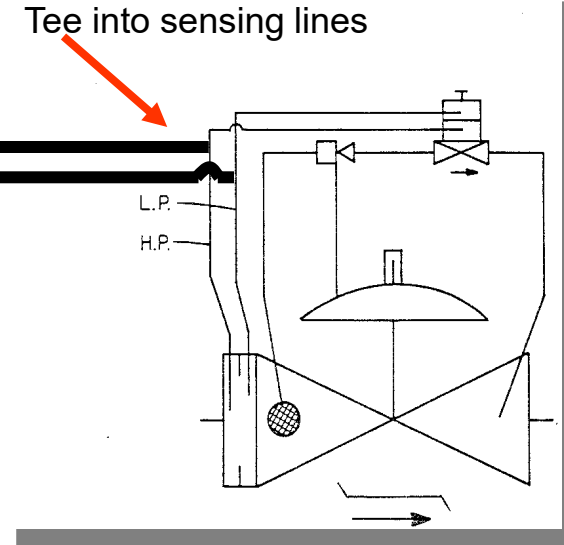


psi  
Diff.

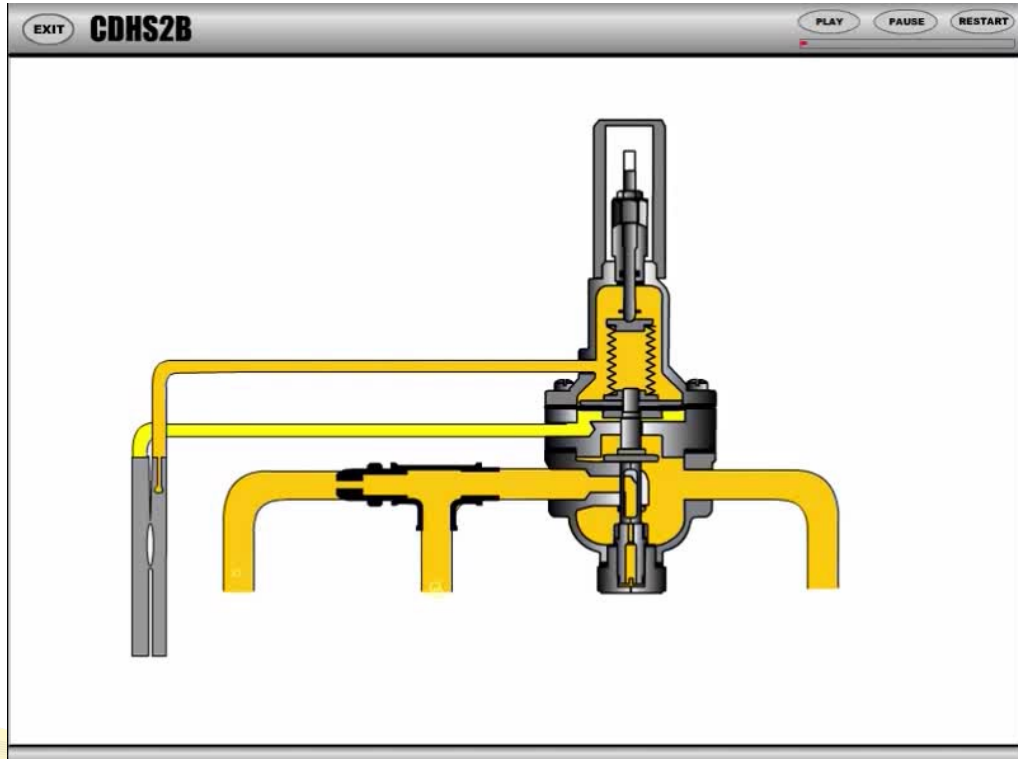


# Using a Differential Pressure Gauge and Orifice Bore Chart to Set the CDHS2B

Tee into sensing lines

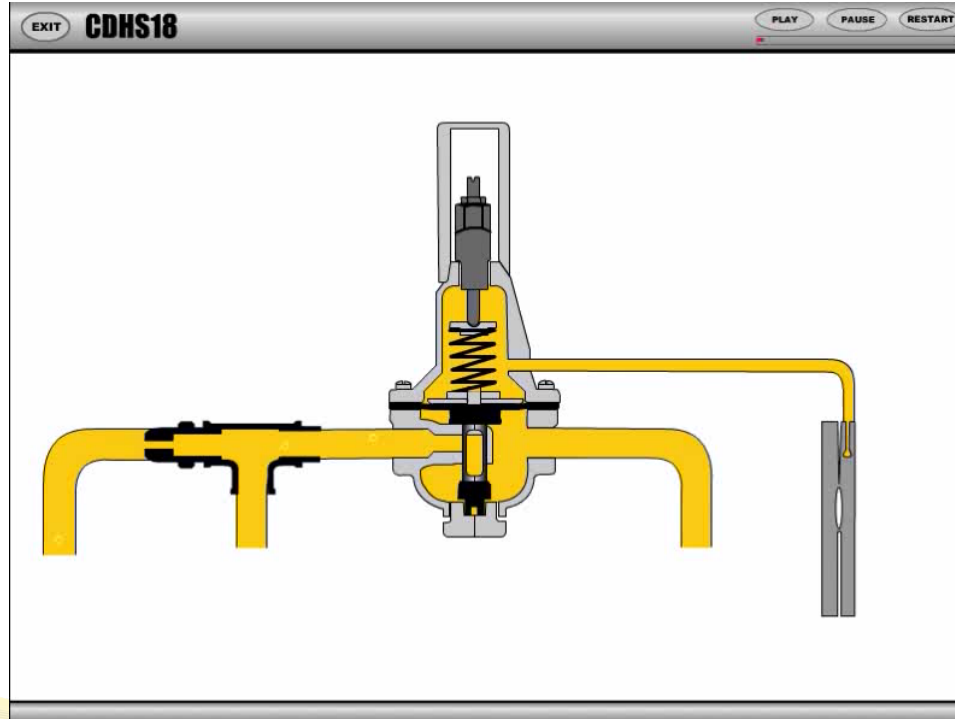


# CDHS2B Differential Control Pilot





# CDHS18 Differential Control Pilot







CFF21-H2 Filter  
Float Assembly  
With Removable  
Ballast Weight



CFF18T-H2  
Filter Float Assembly  
with Tester

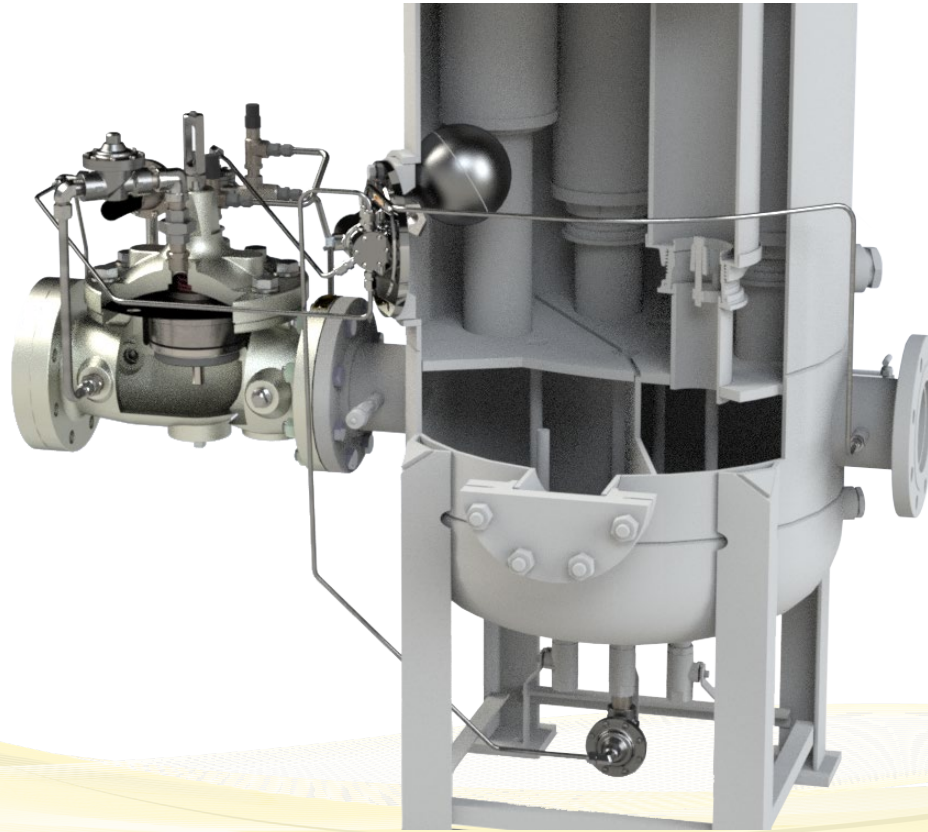


# Filter Separator Control Valves





# Filter Water Separator Slug Valve and Automatic Water Drain Installation



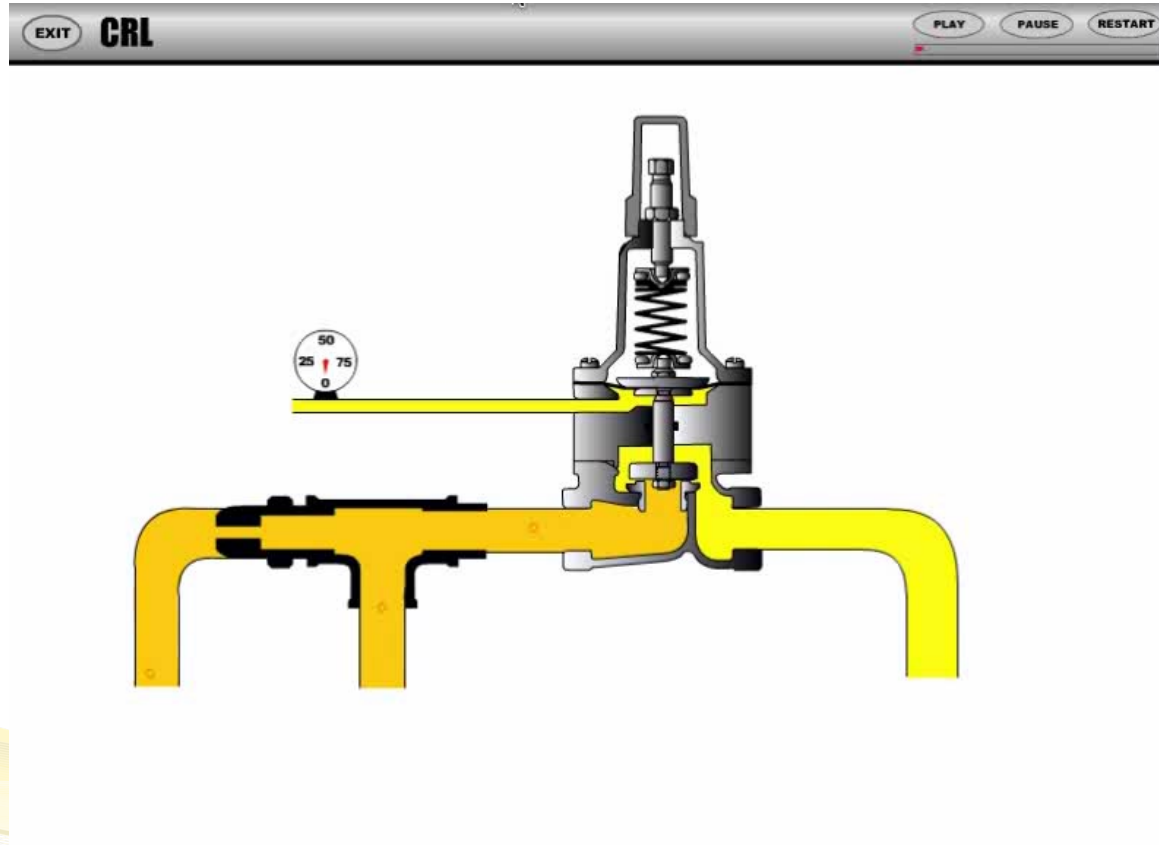
# Filter Separator Installation



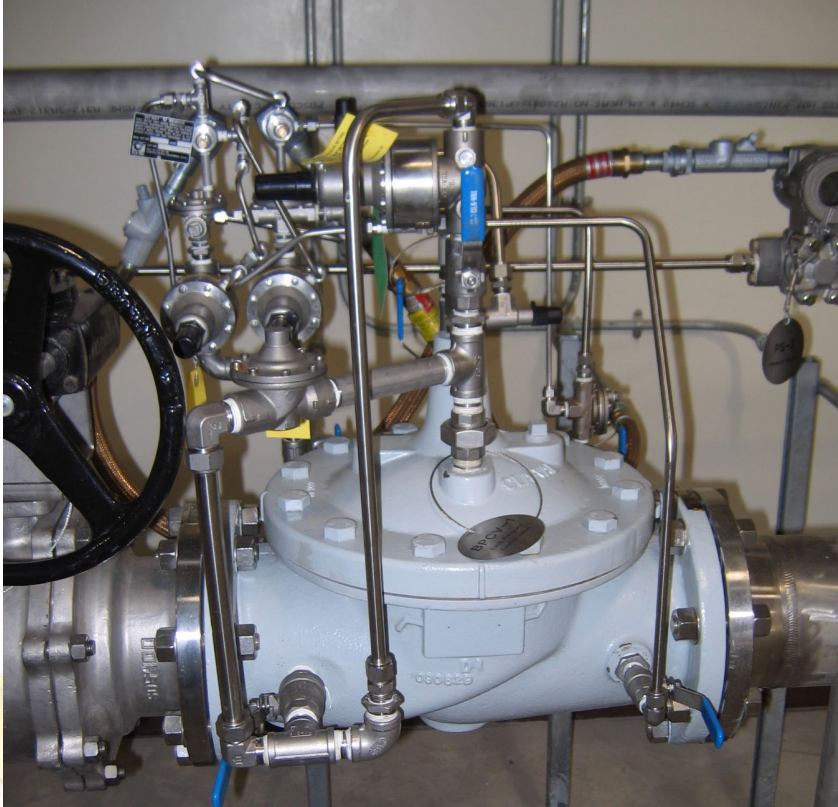
# Back Pressure Control Valves



# CRL – Back Pressure and Pressure Relief Control



# 58AF-19 Back Pressure Control Valve



- 100-34 Main Valve
- 2 ea. CRL5A Pressure Relief Pilots
- 2 ea. 3/8"-100-01s
- 2 ea. CS3XM Solenoids
- X101 VPI
- X46A
- 2 ea. CV Flow Controls
- 81-01 Check Valves
- CRL Pressure Relief
- Isolation Ball Valves



# Recirculation Control Valves





# Truck Fill Stand Control Valves

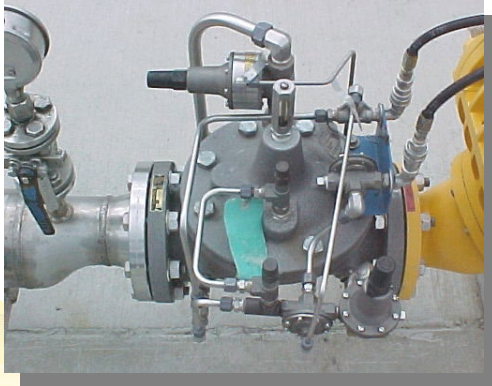




# Hydraulic Truck Fill Stand Control Valve 90AF-4A-3

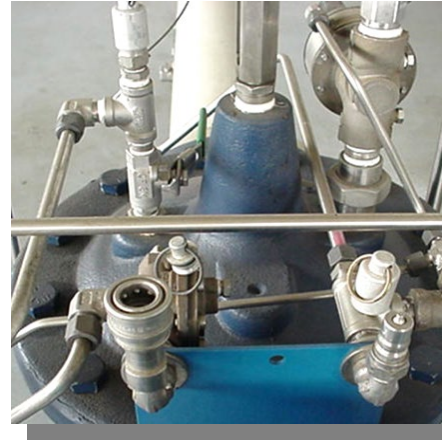


- 100-34 Main Valve
- X46A
- CRL
- X47A
- CV
- CRD
- X101
- 100-01 3/8"
- X58C
- QD Assembly
- X135H

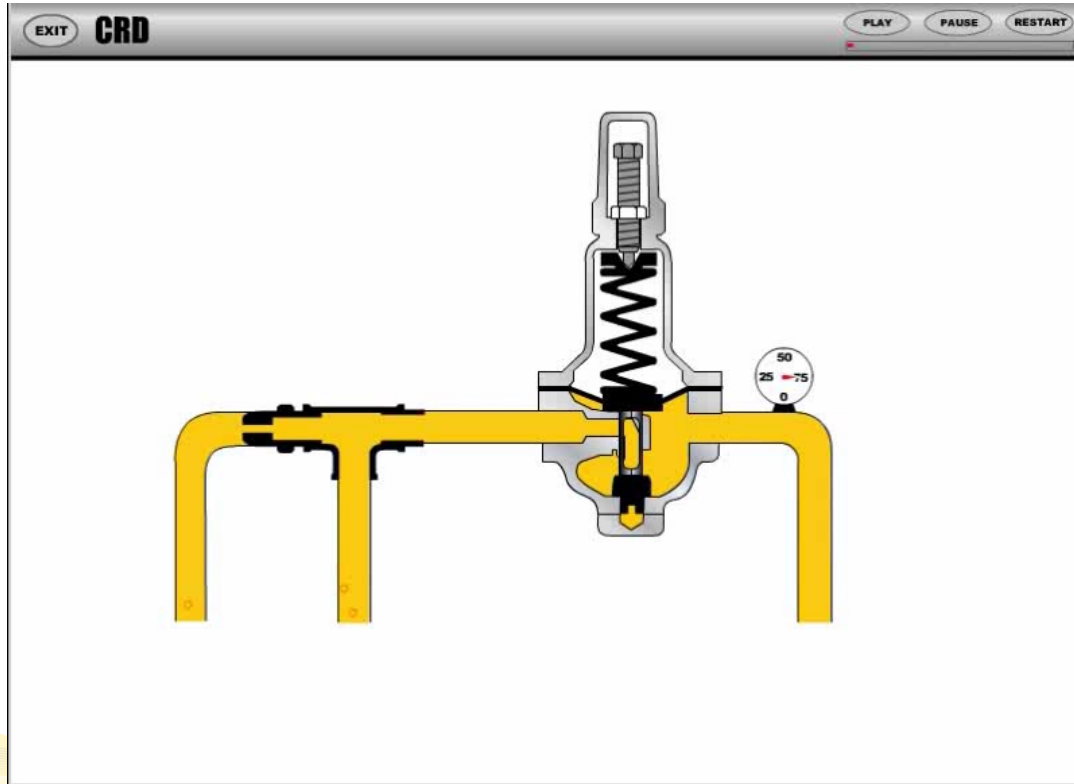




# X135H Hydraulic Deadman Control

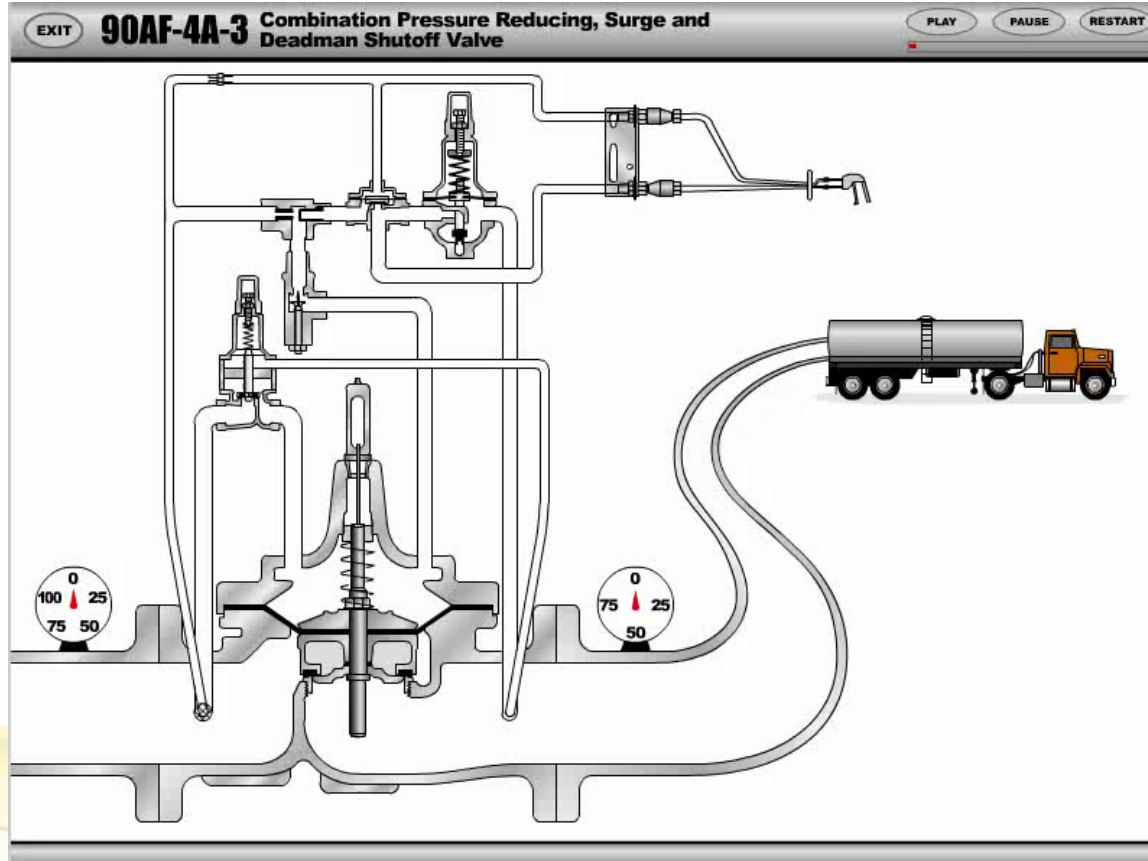


# CRD – Pressure Reducing Control



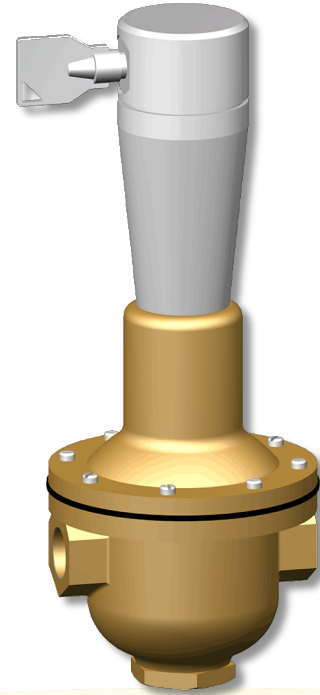


# Hydraulic Truck Fill Stand Control Valve 90AF-4A-3





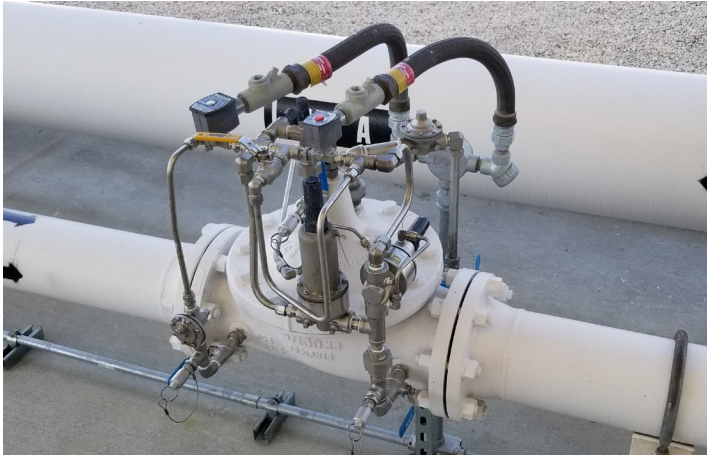
# Pilot Control Locking Caps



Available for all Pilots & Speed Controls



# Digital Control Valves

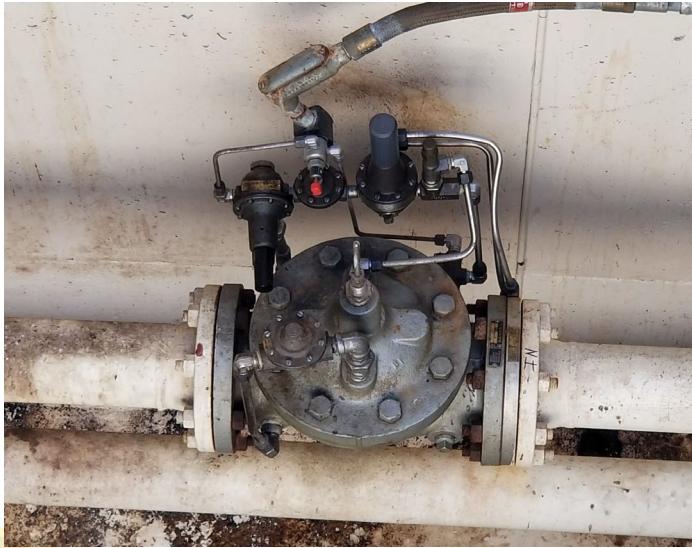


# Low Flow Bypass Applications

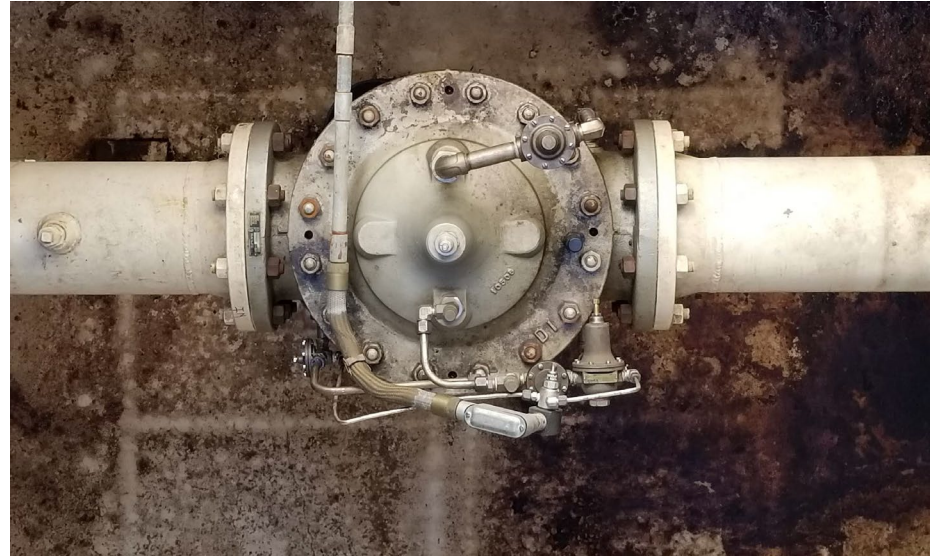




# Low Flow Bypass Applications



Low Flow Bypass with Rate of Flow  
& Pressure Reducing Functions



“Make up” Pressure Reducing Valve  
for Higher Flow Rates

# Questions ???





# CLA-VAL

AVIATION FUELING PRODUCTS & APPLICATIONS



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Exceptional Performance  
Unparalleled Support*