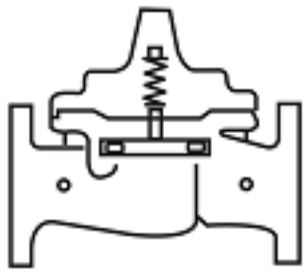
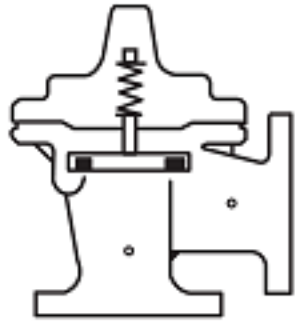
CLA-VAL
AUTOMATIC CONTROL VALVES

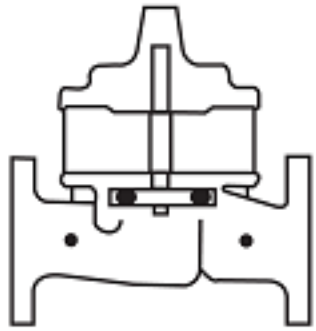
90-99
Place this manual with personnel responsible for maintenance of this valve



Installation



Operation



Maintenance

CLA-VAL • 1701 Placentia Avenue • Costa Mesa, CA 92627 • (949) 722-4800 • info@cla-val.com
CLA-VAL CANADA LTD. • 4687 Christie Drive • Beamsville, Ontario, LOR 1B4 Canada • (905) 563-4963
www.cla-val.com • info@cla-val.com

Recommended Inspections

Cla-Val recommends that an inspection be performed on our products annually. The inspection should include both a visual and functional test of the main valve/component and the pilot system. The inspection ensures that no damage or premature wear occurred due to velocity, pressure, or foreign matter within the fluid that may have exceeded the valve's design. Please consult the maintenance manual for specific information on the model. Manuals are available for download at Cla-Val.com, as well as contact information for a company representative.

Accurate record-keeping is a best practice for any preventative maintenance program, and Cla-Val strongly recommends this action through an asset management program. Cla-Val provides a free asset management tool, Link2Valves Link2Valves - Cla-Val (cla-val.com), to assist in preventative maintenance record-keeping and scheduling.

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MODEL 90-99

Pressure Reducing Valve with Low Flow By-Pass



- **Modulating Control**
- **Maintains Constant Outlet Pressure Over a Wide Range of Flows**
- **Durable Construction**
- **Convenient, Compact, Space Saving Design**

The Cla-Val Model 90-99 Pressure Reducing Valve with Low Flow By-Pass automatically reduces a higher inlet pressure to a steady lower downstream pressure, regardless of changing flow rate. The low flow by-pass capability is achieved by using a 2" grooved end 90-01 Pressure Reducing Valve as an integral part of the main valve. This compact design saves space and makes for an easier installation process.

The pressure reducing valve is hydraulically operated and controlled by a Cla-Val CRD pilot control, which senses pressure at the main valve outlet. An increase in outlet pressure forces the CRD pilot control to close and a decrease in outlet pressure opens the control. This causes the main valve cover pressure to vary, modulating the main valve, thereby maintaining constant outlet pressure.

The pressure reducing low flow by-pass valve is also controlled by a Cla-Val CRD pilot control, which is preset to a higher pressure than the CRD pilot control on the main valve. The pressure reducing low flow by-pass valve responds to pressure at the main valve outlet. When the CRD on the main valve closes, the CRD on the pressure reducing low flow by-pass remains open, allowing flow to by-pass the main valve. The bypass valve closes when the flow decreases and the downstream pressure reaches the set-point of its CRD pilot control.

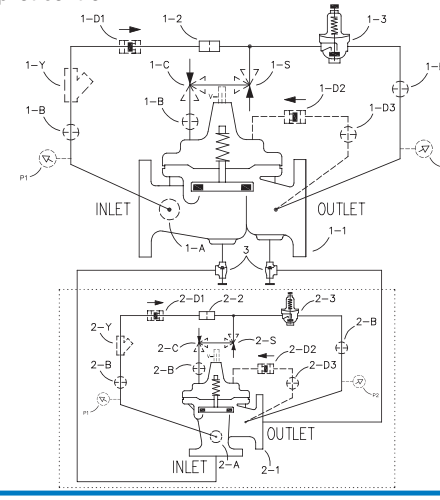
Schematic Diagram

Item	Description
1	90-01 Pressure Reducing Valve
1-1	100-01 Hytrol Main Valve
1-2	X58C Restriction Tube Assembly
1-3	CRD Pressure Reducing Control
2	90-01 Pressure Reducing Valve (Bypass)
2-1	100-01 Hytrol, Grooved End (Main Valve)
2-2	X58C Restriction Tube Assembly
2-3	CRD Pressure Reducing Control
3	CGA Angle Valve

Optional Features

Item	Description
A	X46A Flow Clean Strainer
B	CK2 Isolation Valve
C	CV Flow Control (Closing)*
D	Check Valves with Isolation Valve
P	X141 Pressure Gauge
S	CV Flow Control (Opening)*
V	X101 Valve Position Indicator
Y	X43 "Y" Strainer

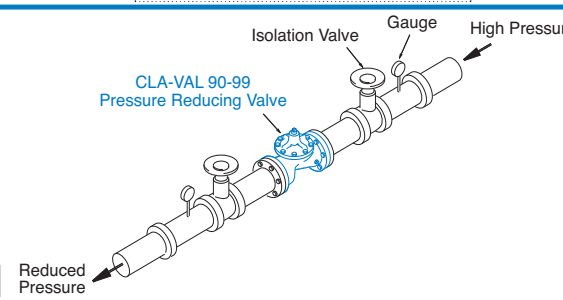
*The optional closing speed control on this valve should always be open at least three (3) turns off its seat.



Typical Applications

This valve has the flexibility to be installed in a distribution system where the demand varies over a wide range. This frequently occurs in industrial, residential, educational, high-rise buildings and other applications. Another important feature of the valve is its space efficient configuration, allowing easy installation and maintenance.

We recommend providing adequate space around valve for maintenance work



90-99 Valve Selection	100-01 Pattern: Globe (G), Angle (A), End Connections: Threaded (T), Grooved (GR), Flanged (F) Sizes					
	Inches	4	6	8	10	12
	mm	100	150	200	250	300
Main Valve 100-01	Pattern	G, A	G, A	G, A	G, A	G, A
	End Detail	F, Gr	F, Gr*	F, Gr*	F	F
Suggested Flow (gpm)	Maximum	800	1800	3100	4900	7000
	Maximum Intermittent	990	2250	3900	6150	8720
	Minimum	1	1	1	1	1
Suggested Flow (Liters/Sec)	Maximum	50	113	195	309	442
	Maximum Intermittent	62	142	246	387	549
	Minimum	0.06	0.06	0.06	0.06	0.06

100-01 Series is the full internal port Hytrol.
For Lower Flows Consult Factory *Globe Grooved Only

Pilot System Specifications

Adjustment Ranges
CRD

2 to 30 psi
15 to 75 psi
20 to 105 psi
30 to 300 psi*

*Supplied unless otherwise specified Other ranges available, please consult factory.

Temperature Range: Water: 180°

Materials

Standard Pilot System Materials

Pilot Control: Low Lead Bronze
Trim: Stainless Steel Type 303
Rubber: Buna-N® Synthetic Rubber

Optional Pilot System Materials

Pilot Systems are available with optional Stainless Steel or Monel materials.

Note: Available with remote sensing control

Materials

Component	Standard Material Combinations		
Body & Cover	Ductile Iron Epoxy	Cast Steel	Bronze
Available Sizes	4" - 12"	4" - 12"	4" - 12"
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.			

Pressure Ratings (Recommended Maximum Pressure - psi)

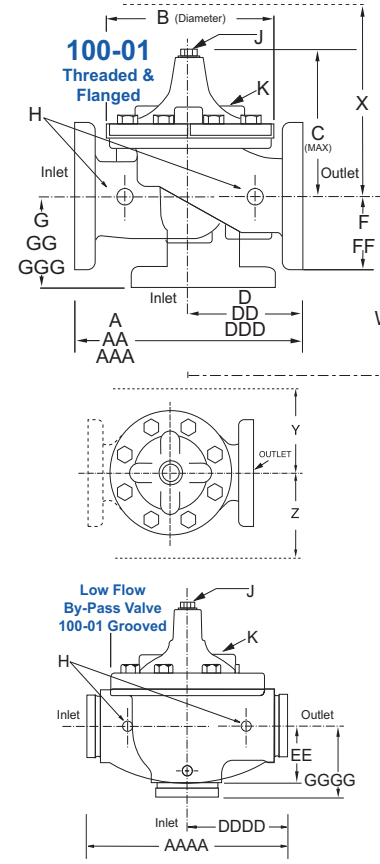
Valve Body & Cover		Pressure Class			
		Flanged			Threaded
Grade	Material	ANSI Standards*	150 Class	300 Class	End‡ Details
ASTM A536	Ductile Iron	B16.42	250	400	400
ASTM A216-WCB	Cast Steel	B16.5	285	400	400
UNS 87850	Bronze	B16.24	225	400	400

Note: * ANSI standards are for flange dimensions only.
Flanged valves are available faced but not drilled.
‡ End Details machined to ANSI B2.1 specifications.
Valves for higher pressure are available; consult factory for details

Model 90-99 Dimensions (In Inches)

Valve Size (Inches)	**4**	**6**	**8**	**10**	**12**
A Threaded	—	—	—	—	—
AA 150 ANSI	15.00	20.00	25.38	29.75	34.00
AAA 300 ANSI	15.62	21.00	26.38	31.12	35.50
AAAA Grooved End	15.00	20.00	25.38	—	—
B Dia.	11.50	15.75	20.00	23.62	28.00
C Max.	10.62	13.38	16.00	17.12	20.88
CC Max. Grooved End	9.31	12.12	14.62	—	—
D Threaded	—	—	—	—	—
DD 150 ANSI	7.50	10.00	12.69	14.88	17.00
DDD 300 ANSI	7.88	10.50	13.25	15.56	17.75
E	3.19	4.31	5.31	9.25	10.75
EE Grooved End	4.25	6.00	7.56	—	—
F 150 ANSI	4.50	5.50	6.75	8.00	9.50
FF 300 ANSI	5.00	6.25	7.50	8.75	10.25
G Threaded	—	—	—	—	—
GG 150 ANSI	5.00	6.00	8.00	8.62	13.75
GGG 300 ANSI	5.31	6.50	8.50	9.31	14.50
H NPT Body Tapping	.75	.75	1	1	1
J NPT Cover Center Plug	.75	.75	1	1	1.25
K NPT Cover Tapping	.75	.75	1	1	1
Stem Travel	1.1	1.7	2.3	2.8	3.40
Approx. Ship Wt. Lbs.	300	350	655	845	1165
X Pilot System	17	29	31	33	36
Y Pilot System	12	20	22	24	26
Z Pilot System	12	20	22	24	26
W Pilot System	34	34	36	38	42

Many factors should be considered in sizing pressure reducing valves, including inlet pressure, outlet pressure and flow rates. For sizing questions or cavitation analysis, consult Cla-Val with system details.

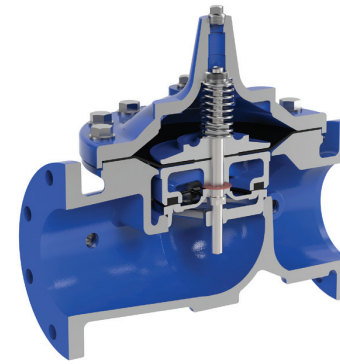


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Model 100-01
HYTROL VALVE

DESCRIPTION

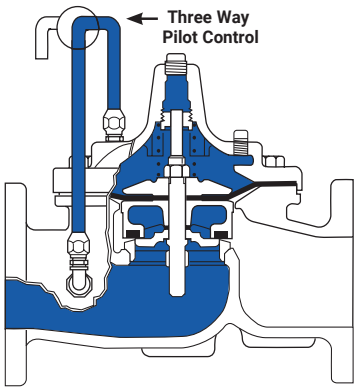
The Cla-Val Model 100-01 Hytrol Valve is a main valve for Cla-Val Automatic Control Valves. It is a hydraulically operated, diaphragm-actuated, globe or angle pattern valve. This valve consists of three major components; body, diaphragm assembly, and cover. The diaphragm assembly is the only moving part. The diaphragm assembly uses a diaphragm of nylon fabric bonded with synthetic rubber. A synthetic rubber disc, contained on three and one half sides by a disc retainer and disc guide, forms a seal with the valve seat when pressure is applied above the diaphragm. The diaphragm assembly forms a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.



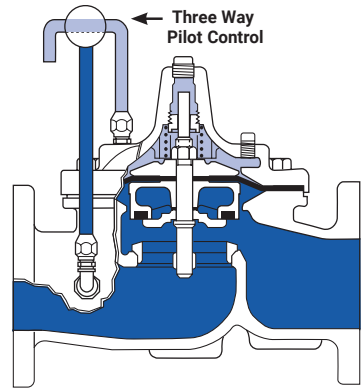
Installation

1. Before valve is installed, pipe lines should be flushed of all chips, scale and foreign matter.
2. It is recommended that either gate or block valves be installed on both ends of the Model 100-01 Hytrol Valve to facilitate isolating the valve for preventive maintenance and repairs.
3. Place the valve in the line with flow through the valve in the direction indicated on the inlet nameplate. (See "Flow Direction" Section) **Note: Valve can be installed in the vertical or horizontal position.**
4. Allow sufficient room around valve to make adjustments and for disassembly.
5. Cla-Val Model 100-01 Hytrol Valves operate with maximum efficiency when mounted in horizontal piping with the cover UP, however, other positions are acceptable. Due to size and weight of the cover and internal components of 8 inch and larger valves, installation with the cover UP is advisable. This makes internal parts readily accessible for periodic inspection.
6. Caution must be taken in the installation of this valve to insure that galvanic and/or electrolytic action does not take place. The proper use of dielectric fittings and gaskets are required in all systems using dissimilar metals.
7. If a pilot control system is installed on the Model 100-01 Hytrol Valve, use care to prevent damage. If it is necessary to remove fittings or components, be sure they are kept clean and replaced exactly as they were.
8. After the valve is installed and the system is first pressurized, vent air from the cover chamber and pilot system tubing by loosening fittings at all high points.

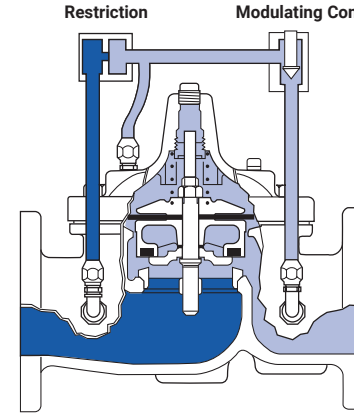
Principles of Operation



Tight Closing Operation
When pressure from the valve inlet (or an equivalent independent operating pressure) is applied to the diaphragm chamber the valve closes drip-tight.



Full Open Operation
When pressure in diaphragm chamber is relieved to a zone of lower pressure (usually atmosphere) the line pressure (5 psi Min.) at the valve inlet opens the valve.

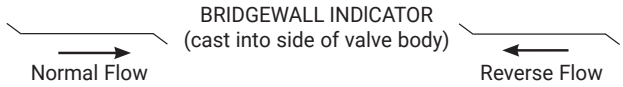


Modulating Action
Valve modulates when diaphragm pressure is held at an intermediate point between inlet and discharge pressure. With the use of a Cla-Val. "Modulating control," which reacts to line pressure changes, the pressure above the diaphragm is varied, allowing the valve to throttle and compensate for the change.

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Flow Direction

The flow through the Model 100-01 Hytrol Valve can be in one of two directions. When flow is "up-and-over the seat," it is in "normal" flow and the valve will fail in the open position. When flow is "over-the seat-and down," it is in "reverse" flow and the valve will fail in the closed position. There are no permanent flow arrow markings. **The valve must be installed according to nameplate data.**



Recommended Tools

1. Three pressure gauges with ranges suitable to the installation to be put at Hytrol inlet, outlet and cover connections.
2. Cla-Val Model X101D Valve Position Indicator. This provides visual indication of valve position without disassembly of valve.
3. Other items are: suitable hand tools such as screwdrivers, wrenches, etc., soft jawed (brass or aluminum) vise, 400 grit wet or dry sandpaper and water for cleaning.

Troubleshooting

The following troubleshooting information deals strictly with the Model 100-01 Hytrol Valve. This assumes that all other components of the pilot control system have been checked out and are in proper working condition. (See appropriate sections in Technical Manual for complete valve).

All trouble shooting is possible without removing the valve from the line or removing the cover. It is highly recommended to permanently install a Model X101D Valve Position Indicator and three gauges in unused Hytrol inlet, outlet and cover connections.

After checking out probable causes and remedies, the following three checks can be used to diagnose the nature of the problem before maintenance is started. They must be done in the order shown.

Service Suggestions		
Symptom	Possible Cause	Solutions
Fails to Close	Closed isolation valves in control system, or in main line.	Open Isolation valves.
	Lack of cover chamber pressure	Check upstream pressure, pilot system, strainer, tubing, valves, or needle valves for obstruction.
	Diaphragm damaged. (See Diaphragm Check.)	Replace diaphragm.
	Diaphragm assembly inoperative. Corrosion or excessive scale build up on valve stem. (See Freedom of Movement Check)	Clean and polish stem. Inspect and replace any damaged or badly eroded part.
	Mechanical obstruction. Object lodged in valve.(See Freedom of Movement Check)	Remove obstruction.
	Worn disc. (See Tight Sealing Check)	Replace disc.
	Badly scored seat (See Tight Sealing Check)	Replace seat.
Fails to Open	Closed upstream and/or downstream isolation valves in main line.	Open isolation valves.
	Insufficient line pressure.	Check upstream pressure. (Minimum 5 psi flowing line pressure differential.)
	Diaphragm assembly inoperative. Corrosion or excessive buildup on valve stem. (See Freedom of Movement Check)	Clean and polish stem. Inspect and replace any damaged or badly eroded part.
	Diaphragm damaged. (For valves in "reverse flow" only)	Replace diaphragm.

Three Checks

The Model 100-01 Hytrol Valve has only one moving part (the diaphragm and disc assembly). So, there are only three major types of problems to be considered.

First: Valve is stuck - that is, the diaphragm assembly is not free to move through a full stroke either from open to close or vice versa.

Second: Valve is free to move and can't close because of a worn out diaphragm.

Third: Valve leaks even though it is free to move and the diaphragm isn't leaking.

CAUTION: Care should be taken when doing the troubleshooting checks on the Model 100-01 Hytrol Valve. These checks do require the valve to open fully. This will either allow a high flow rate through the valve, or the downstream pressure will quickly increase to the inlet pressure. In some cases,this can be very harmful. Where this is the case, and there are no block valves in the system to protect the downstream piping, it should be realized that **the valve cannot be serviced under pressure**. Steps should be taken to remedy this situation before proceeding any further.

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Three Checks (cont.)

DIAPHRAGM CHECK (#1)

1. Shut off pressure to the Hytrol Valve by slowly closing upstream and downstream isolation valves. **SEE CAUTION.**
2. Disconnect or close all pilot control lines to the valve cover and leave only one fitting in highest point of cover open to atmosphere.
3.With the cover vented to atmosphere, slowly open upstream isolation valve to allow some pressure into the Hytrol Valve body. Observe the open cover tapping for signs of continuous flow. It is not necessary to fully open isolating valve. Volume in cover chamber capacity chart will be displaced as valve moves to open position. Allow sufficient time for diaphragm assembly to shift positions. If there is no continuous flow, you can be quite certain the diaphragm is sound and the diaphragm assembly is tight. If the fluid appears to flow continuously this is a good reason to believe the diaphragm is either damaged or it is loose on the stem. In either case, this is sufficient cause to remove the valve cover and investigate the leakage. (See "Maintenance" section for procedure.)

Cover Chamber Capacity (Liquid Volume displaced when valve opens)		
Valve Size (Inches)	Displacement	
	Gallons	Liters
1-1/4"	0.020	0.07
1-1/2"	0.020	0.07
2"	0.032	0.12
2-1/2"	0.043	0.16
3"	0.080	0.30
4"	0.169	0.64
6"	0.531	2.0
8"	1.26	4.8
10"	2.51	9.5
12"	4.00	15.1
14"	6.50	24.6
16"	9.57	36.0
18"	11.00	41.6
20"	12.00	45.4
24"	29.00	109.8
30"	42.00	197.0
36"	90.00	340.0

FREEDOM OF MOVEMENT CHECK (#2)

4. Determining the Hytrol Valve's freedom of movement can be done by one of two methods.
5. For most valves it can be done after completing Diaphragm Check (Steps 1, 2, and 3). **SEE CAUTION**. At the end of step 3 the valve should be fully open.
6. If the valve has a Cla-Val X101D Position Indicator, observe the indicator to see that the valve opens wide. Mark the point of maximum opening.
7. Re-connect enough of the control system to permit the application of inlet pressure to the cover. Open pilot system cock so pressure flows from the inlet into the cover.
8. While pressure is building up in the cover, the valve should close smoothly. There is a hesitation in every Hytrol Valve closure, which can be mistaken for a mechanical bind. The stem will appear to stop moving very briefly before going to the closed position. This slight pause is caused by the diaphragm flexing at a particular point in the valve's travel and is not caused by a mechanical bind.
9. When closed, a mark should be made on the X101D Valve position indicator corresponding to the "closed" position. The distance between the two marks should be approximately the stem travel shown in chart.
10. If the stroke is different than that shown in stem travel chart this is a good reason to believe something is mechanically restricting the stroke of the valve at one end of its travel. If the flow does not stop through the valve when in the indicated "closed" position, the obstruction probably is between the disc and the seat. If the flow does stop, then the obstruction is more likely in the cover. In either case, the cover must be removed, and the obstruction located and removed. The stem should also be checked for scale build-up. (See "Maintenance" section for procedure.)

Stem Travel (Fully open to fully closed)			
Valve Size (Inches)		Travel (Inches)	
Inches	MM	Inches	MM
1-1/4"	32	0.04"	10
1-1/2"	40	0.04"	10
2"	50	0.06"	15
2-1/2"	65	0.07"	18
3"	80	0.08"	20
4"	100	1.1"	28
6"	150	1.7"	43
8"	200	2.3"	58
10"	250	2.8"	71
12"	300	3.4"	86
14"	350	4.0"	100
16"	400	4.5"	114
18"	450	5.1"	130
20"	500	5.6"	143
24"	600	6.7"	165
30"	800	7.5"	190
36"	900	8.5"	216

11. For valves 6" and smaller, the Hytrol Valve's freedom of movement check can also be done after all pressure is removed from the valve. **SEE CAUTION.** After closing inlet and outlet isolation valves and bleeding pressure from the valve, check that the cover chamber and the body are temporarily vented to atmosphere. Insert fabricated tool into threaded hole in top of valve stem, and lift the diaphragm assembly manually. Note any roughness. The diaphragm assembly should move smoothly throughout entire valve stroke. The tool is fabricated from rod that is threaded on one end to fit valve stem and has a "T" bar handle of some kind on the other end for easy gripping. (See chart in Step 4 of "Disassembly" Section.)
12. Place marks on this diaphragm assembly lifting tool when the valve is closed and when manually positioned open. The distance between the two marks should be approximately the stem travel shown in stem travel chart. If the stroke is different than that shown, there is a good reason to believe something is mechanically restricting the stroke of the valve. The cover must be removed, and the obstruction located and removed. The stem should also be checked for scale build-up. (See "Maintenance" section for procedure.)

TIGHT SEALING CHECK (#3)

13. Test for seat leakage after completing checks #1 & #2 (Steps 1 to 12). **SEE CAUTION**. Close the isolation valve downstream of the Hytrol Valve. Apply inlet pressure to the cover of the valve, wait until it closes. Install a pressure gauge between the two closed valves using one of the two ports in the outlet side of the Hytrol. Watch the pressure gauge. If the pressure begins to climb, then either the downstream isolation valve is permitting pressure to creep back, or the Hytrol is allowing pressure to go through it. Usually the pressure at the Hytrol inlet will be higher than on the isolation valve discharge, so if the pressure goes up to the inlet pressure, you can be sure the Hytrol is leaking. Install another gauge downstream of isolating valve. If the pressure between the valves only goes up to the pressure on the isolation valve discharge, the Hytrol Valve is holding tight, and it was just the isolation valve leaking.

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PREVENTATIVE MAINTENANCE

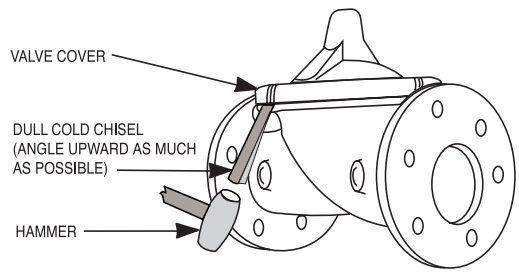
The Cla-Val Model 100-01 Hytrol Valve requires no lubrication or packing and a minimum of maintenance. However, a periodic inspection schedule should be established to determine how the operating conditions of the system are affecting the valve. The effect of these actions must be determined by inspection.

DISASSEMBLY

Inspection or maintenance can be accomplished without removing the valve from the line. Repair kits with new diaphragm and disc are recommended to be on hand before work begins.

WARNING: Maintenance personnel can be injured and equipment damaged if disassembly is attempted with pressure in the valve. **SEE CAUTION.**

1. Close upstream and downstream isolation valves and **independent operating pressure when used** to shut off all pressure to the valve.
2. Loosen tube fittings in the pilot system to remove pressure from valve body and cover chamber. After pressure has been released from the valve, use care to remove the controls and tubing. Note and sketch position of tubing and controls for re-assembly. The schematic in front of the Technical Manual can be used as a guide when reassembling pilot system.
3. Remove cover nuts and remove cover. If the valve has been in service for any length of time, chances are the cover will have to be loosened by driving upward along the edge of the cover with a **dull** cold chisel.



On 6" and smaller valves block and tackle or a power hoist can be used to lift valve cover by inserting proper size eye bolt in place of the center cover plug. on 8" and larger valves there are 4 holes (5/8" — 11 size) where jacking screws and/or eye bolts may be inserted for lifting purposes. **Pull cover straight up** to keep from damaging the integral seat bearing and stem.

Cover Center Plug Size	
Valve Size (Inches)	Thread Size (NPT)
1-1/4" - 1-1/2"	1/4"
2" - 3"	1/2"
4" - 6"	3/4"
8" - 10"	1"
12"	1-1/4"
14"	1-1/2"
16"	2"
18" - 24"	1"
30" & 36"	2"

4. Remove the diaphragm and disc assembly from the valve body. With smaller valves this can be accomplished by hand by **pulling straight up on the stem so as not to damage the seat bearing.** On large valves, an eye bolt of proper size can be installed in the stem and the diaphragm assembly can be then lifted with a block and tackle or power hoist. Take care not to damage the stem or bearings. The valve won't work if these are damaged.

Valve Stem Thread Size	
Valve Size (Inches)	Thread Size (UNF Internal)
1-1/4" - 2-1/2"	10 - 32
3" - 4"	1/4 - 28
6" - 14"	3/8 - 24
16"	1/2 - 20
18"	3/4 - 16
20"	3/4 - 16
24"	3/4 - 16
30"	3/4 - 16
36"	3/4 - 16

5. The next item to remove is the stem nut. Examine the stem threads above the nut for signs of mineral deposits or corrosion. If the threads are not clean, use a wire brush to remove as much of the residue as possible. Attach a good fitting wrench to the nut and give it a sharp "rap" rather than a steady pull. Usually several blows are sufficient to loosen the nut for further removal. On the smaller valves, the entire diaphragm assembly can be held by the stem in a vise **equipped with soft brass jaws** before removing the stem nut.

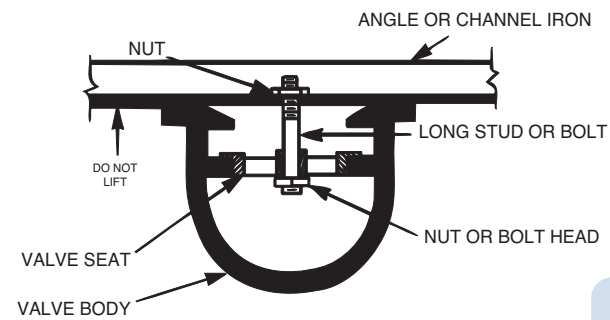
The use of a pipe wrench or a vise without soft brass jaws scars the fine finish on the stem. No amount of careful dressing can restore the stem to its original condition. Damage to the finish of the stem can cause the stem to bind in the bearings and the valve will not open or close.

6. After the stem nut has been removed, the diaphragm assembly breaks down into its component parts. Removal of the disc from the disc retainer can be a problem if the valve has been in service for a long time. Using two screwdrivers inserted along the outside edge of the disc usually will accomplish its removal. Care should be taken to preserve the spacer washers in water, particularly if no new ones are available for re-assembly.

7. The only part left in the valve body is the seat which ordinarily does not require removal. Careful cleaning and polishing of inside and outside surfaces with 400 wet/dry sandpaper will usually restore the seat's sharp edge. If, however, it is badly worn and replacement is necessary, it can be easily removed.

Seats in valve sizes 1 1/4" through 6" are threaded into the valve body. They can be removed with accessory X109 Seat Removing Tool available from the factory. On 8" and larger valves, the seat is held in place by flat head machine screws. Use a tight-fitting, long shank screwdriver to prevent damage to seat screws. If upon removal of the screws the seat cannot be lifted out, it will be necessary to use a piece of angle or channel iron with a hole drilled in the center. Place it across the body so a long stud can be inserted through the center hole in the seat and the hole in the angle iron. By tightening the nut a uniform upward force is exerted on the seat for removal.

NOTE: Do not lift up on the end of the angle iron as this may force the integral bearing out of alignment, causing the stem to bind.



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Lime Deposits

One of the easiest ways to remove lime deposits from the valve stem or other metal parts is to dip them in a 5-percent muriatic acid solution just long enough for the deposit to dissolve. This will remove most of the common types of deposits. **CAUTION: USE EXTREME CARE WHEN HANDLING ACID.** Rinse parts in water before handling. If the deposit is not removed by acid, then a fine grit (400) wet or dry sandpaper can be used with water.

Inspection of Parts

After the valve has been disassembled, each part should be examined carefully for signs of wear, corrosion, or any other abnormal condition. Usually, it is a good idea to replace the rubber parts (diaphragm and disc) unless they are free of signs of wear. These are available in a repair kit. Any other parts which appear doubtful should be replaced. WHEN ORDERING PARTS, BE SURE TO GIVE COMPLETE NAMEPLATE DATA, ITEM NUMBER AND DESCRIPTION.

NOTE: If a new disc isn't available, the existing disc can be turned over, exposing the unused surface for contact with the seat. The disc should be replaced as soon as practical.

Reassembly

1. Reassembly is the reverse of the disassembly procedure. If a new disc has been installed, it may require a different number of spacer washers to obtain the right amount of "grip" on the disc. When the diaphragm assembly has been tightened to a point where the diaphragm cannot be twisted, the disc should be compressed very slightly by the disc guide. Excessive compression should be avoided. Use just enough spacer washers to hold the disc firmly without noticeable compression.
2. **MAKE SURE THE STEM NUT IS VERY TIGHT**. Attach a good fitting wrench to the nut and give it a sharp "rap" rather than a steady pull. Usually several blows are sufficient to tighten the stem nut for final tightening. Failure to do so could allow the diaphragm to pull loose and tear when subjected to pressure.
3. Carefully install the diaphragm assembly by lowering the stem through the seat bearing. Take care not to damage the stem or bearing. Line up the diaphragm holes with the stud or bolt holes on the body. On larger valves with studs, it may be necessary to hold the diaphragm assembly up part way while putting the diaphragm over the studs.
4. Put spring in place and replace cover. Make sure diaphragm is lying smooth under the cover.
5. Tighten cover nuts firmly using a cross-over pattern until all nuts are tight.
6. Test Hytrol Valve before re-installing pilot valve system.

Test Procedure After Valve Assembly

There are a few simple tests which can be made in the field to make sure the Hytrol Valve has been assembled properly. Do these before installing pilot system and returning valve to service. These are similar to the three troubleshooting tests.

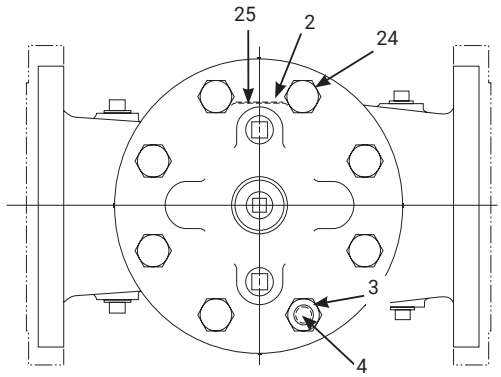
1. Check the diaphragm assembly for freedom of movement after all pressure is removed from the valve. **SEE CAUTION**. Insert fabricated tool into threaded hole in top of valve stem, and lift the diaphragm assembly manually. Note any roughness, sticking or grabbing. The diaphragm assembly should move smoothly throughout entire valve stroke. The tool is fabricated from rod that is threaded on one end to fit valve stem (See chart in Step 4 of "Disassembly" section.) and has a "T" Bar handle of some kind on the other end for easy gripping.

Place marks on this diaphragm assembly lifting tool when the valve is closed and when manually positioned open. The distance between the two marks should be approximately the stem travel shown in stem travel chart. (See "Freedom of Movement Check" section.) If the stroke is different than that shown, there is a good reason to believe something is mechanically restricting the stroke of the valve. The cover must be removed, the obstruction located and removed. (See "Maintenance" section for procedure.

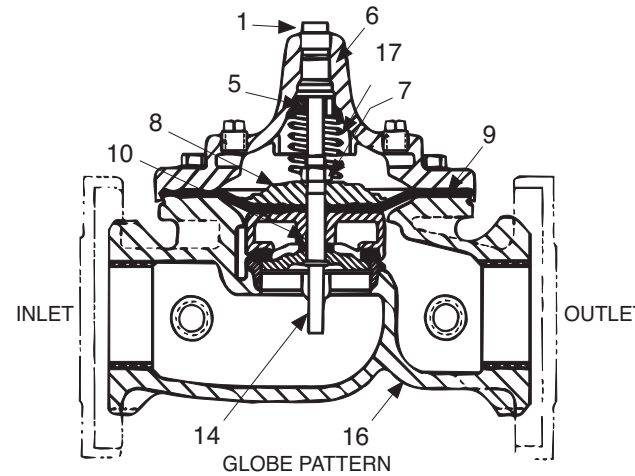
Due to the weight of the diaphragm assembly this procedure is not possible on valves 8" and larger. on these valves, the same determination can be made by carefully introducing a low pressure-less than five psi) into the valve body with the cover vented. **SEE CAUTION**. Looking in cover center hole see the diaphragm assembly lift easily without hesitation, and then settle back easily when the pressure is removed.

2. To check the valve for drip-tight closure, a line should be connected from the inlet to the cover, and pressure applied at the inlet of the valve. If properly assembled, the valve should hold tight with as low as ten PSI at the inlet. See "Tight Sealing Check" section.)
3. With the line connected from the inlet to the cover, apply full working pressure to the inlet. Check all around the cover for any leaks. Re-tighten cover nuts if necessary to stop leaks past the diaphragm.
4. Remove pressure, then re-install the pilot system and tubing exactly as it was prior to removal. **Bleed air from all high points**.
5. Follow steps under "Start-Up and Adjustment" Section in Technical Manual for returning complete valve back to service.

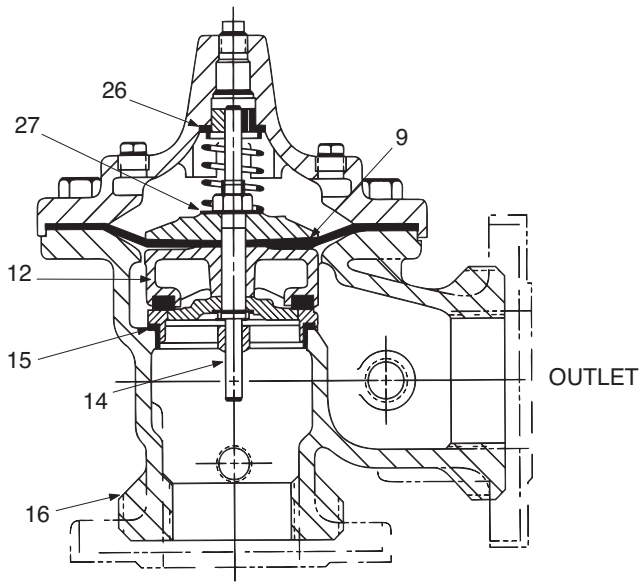
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TOP VIEW

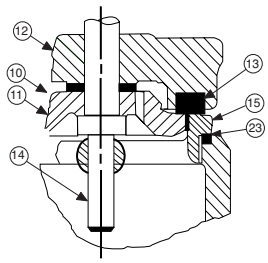


GLOBE PATTERN

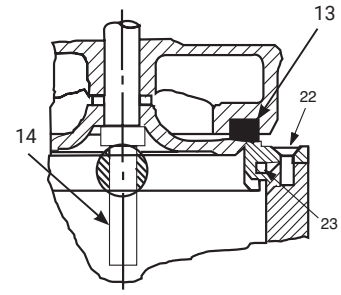


INLET
ANGLE PATTERN

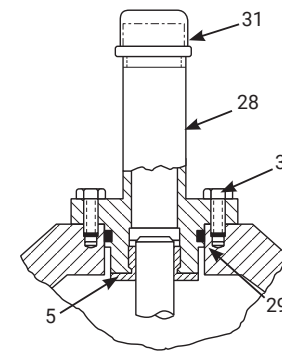
Item No.	Description
1	Pipe Plug
2	Drive Screws (for nameplate)
3	Hex Nut (8" and larger)
4	Stud (8" and larger)
5	Cover Bearing
6	Cover
7	Stem Nut
8	Diaphragm Washer
9	Diaphragm
10	Spacer Washers
11	Disc Guide
12	Disc Retainer
13	Disc
14	Stem
15	Seat
16	Body
17	Spring
22	Flat Head Screws (8" and larger)
23	Seat O-Ring
24	Hex Head Bolt (1-1/4" thru 4")
25	Nameplate
26	Upper Spring Washer (Epoxy coated valves only)
27	Lower Spring Washer (Epoxy coated valves only)
28	Cover Bearing Housing (16" only)
29	Cover O-Ring (16" only)
30	Hex Bolt (16" only)
31	Pipe Cap (16" only)



1-1/4" - 6" SEAT DETAIL



8" - 24" SEAT DETAIL



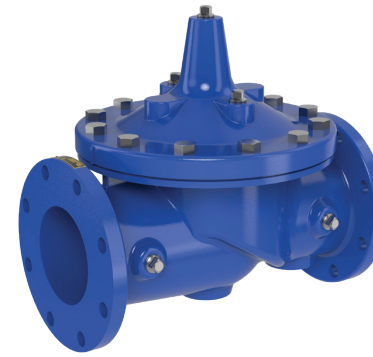
16" COVER DETAIL

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Model 100-01
HYTROL VALVE SERVICE DATA

DESCRIPTION 100-01 HYTROL VALVE

The Cla-Val Model 100-01 Hytrol Valve is a main valve for Cla-Val Automatic Control Valves. It is a hydraulically operated, diaphragm-actuated, globe or angle pattern valve. This valve consists of three major components; body, diaphragm assembly, and cover. The diaphragm assembly is the only moving part. The diaphragm assembly uses a diaphragm of nylon fabric bonded with synthetic rubber. A synthetic rubber disc, contained on three and one half sides by a disc retainer and disc guide, forms a seal with the valve seat when pressure is applied above the diaphragm. The diaphragm assembly forms a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.



DESCRIPTION 100-20 600 SERIES HYTROL VALVE

The Cla-Val Model 100-20 Hytrol Valve (600 Series main valve) have only one part -the body- that is different from standard 100 Series Cla-Val main valve parts. The remaining parts of the 600 series main valve are standard Cla-Val main valve parts. All service and maintenance information for the standard 100 Series main valves also apply to the 600 series main valves. The most important thing to remember when ordering main valve repair kits and replacement parts, except for the body, all other parts are going to be for a smaller size main valve. Cla-Val identifies main valve parts with the flange size of the standard 100 Series main valve. Refer to the "Main Valve Sizes" chart below.

Hytrol Service Data

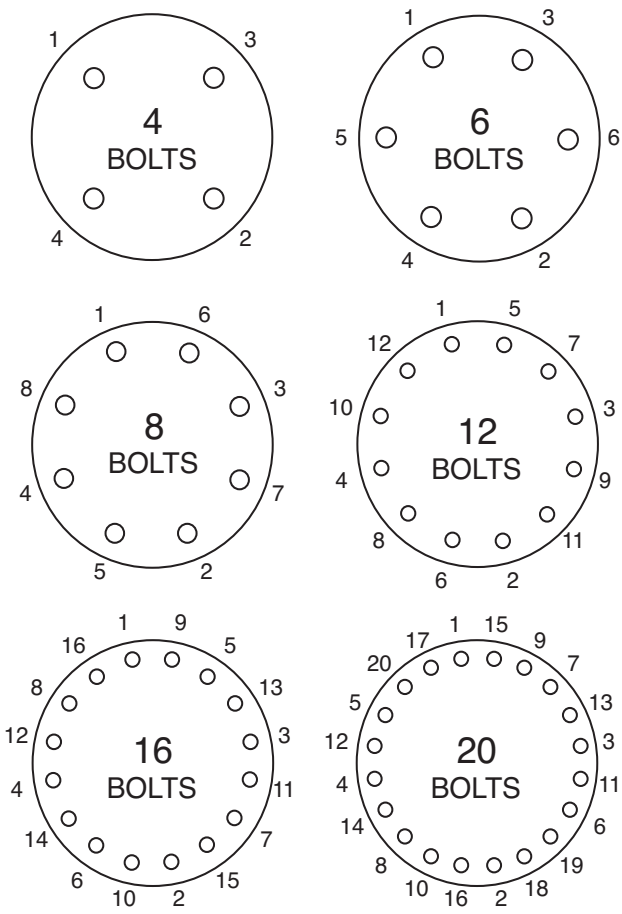
Hytrol Service Data

Hytrol Size				Stem Travel		Cover Capacity Displacement		Cover Center NPT	Cover Nut or Bolt (1)					Cover Lifting Holes	Valve Stem Internal Thread	Stem Nut (3)			
100-01		100-20							Thread	Socket	Qty	Torque, Lubricated(2)				Thread	Socket (Long)	Torque, Lubricated(2)	
IN	MM	IN	MM	IN	MM	Gallons	Liters					FT. LBS	IN. LBS					FT. LBS	IN. LBS
1	25	–	–	0.24	6	0.02	–	1/4	1/4 – 20	7/16	8	–	80	–	–	3/8 – 24	9/16	–	80
1 1/4	32	–	–	0.49	12	0.02	0.08	1/4	5/16 – 18	1/2	8	12	–	–	#10 – 32	7/16 – 20	11/16	12	–
1 1/2	40	–	–	0.49	12	0.02	0.08	1/4	5/16 – 18	1/2	8	12	–	–	#10 – 32	7/16 – 20	11/16	12	–
2	50	3	80	0.59	15	0.03	0.12	1/2	3/8 – 16	9/16	8	20	–	–	#10 – 32	1/2 – 20	3/4	16	–
2 1/2	65	–	–	0.71	18	0.04	0.16	1/2	7/16 – 14	5/8	8	36	–	–	#10 – 32	5/8 – 18	15/16	32	–
3	80	4	–	0.84	21	0.08	0.3	1/2	1/2 – 13	3/4	8	50	–	–	1/4 – 28	5/8 – 18	15/16	32	–
4	100	6	–	1.09	28	0.17	0.64	3/4	3/4 – 10	1 1/8	8	125	–	–	1/4 – 28	3/4 – 16	1 1/8	55	–
6	150	8	–	1.58	40	0.53	2.01	3/4	3/4 – 10	1 1/8	12	125	–	–	3/8 – 24	7/8 – 14	1 5/16	100	–
8	200	10	–	2.24	57	1.26	4.77	1	3/4 – 10	1 1/4	16	125	–	5/8 – 11	3/8 – 24	1 1/8 – 12	1 3/4	180	–
10	250	12	–	2.71	69	2.51	9.5	1	7/8 – 9	1 7/16	20	160	–	3/4 – 10	3/8 – 24	1 1/4 – 12	1 7/8	300	–
12	300	14, 16	350, 400	3.34	85	4.00	15.14	1 1/4	1 1/8 – 7	1 13/16	20	320	–	3/4 – 10	3/8 – 24	1 1/2 – 12	2 1/4	500	–
14	350	–	–	4.08	104	6.50	24.61	1 1/2	1 1/4 – 7	2	20	450	–	1 – 8	3/8 – 24	1 1/2 – 12	2 1/4	500	–
16	400	18, 20, 24	450, 500, 600	4.58	116	9.60	36.34	2	1 1/4 – 7	2	20	450	–	1 – 8	1/2 – 20	2 – 16	3	600	–
18	500	–	–	5.13	130	11.00	42	1	1 1/4 – 7	2	24	450	–	1 – 8	3/4 – 16	2 1/4 – 16	3 7/16	1000	–
20	500	–	–	5.63	143	12.00	45.42	1	1 3/8 – 6	2 3/16	24	600	–	1 – 8	3/4 – 16	2 1/4 – 16	3 7/16	1000	–
24	600	30	–	6.50	165	29.00	109.78	1	1 1/2 – 12	2 3/8	24	850	–	1 1/8 – 7	3/4 – 16	3 – 12	4 5/8	1600	–
30	750	36	900	8.00	203	42.00	158.99	2	1 1/2 – 12	2 3/8	32	850	–	1 1/8 – 7	3/4 – 16	3 – 12	4 5/8	3000	–
36	900	42, 48, 56	1050, 1200, 1400	8.71	221	90.00	340.69	2	1 3/4 – 10	2 3/4	36	1250	–	1 1/4 – 12	3/4 – 16	3 1/2 – 8	6	3000	–

(1) Valve sizes 6" and smaller use hex bolts for cover fasteners. Valve sizes 8" and larger use studs with hex nuts.
(2) Clean all threads and apply anti-seize prior to reassembly of threaded fasteners. Torque values are based on standard SST material.
(3) Only stem nuts supplied by CLA-VAL shall be used.

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Bolt/Nut Torquing Procedures on Valve Covers

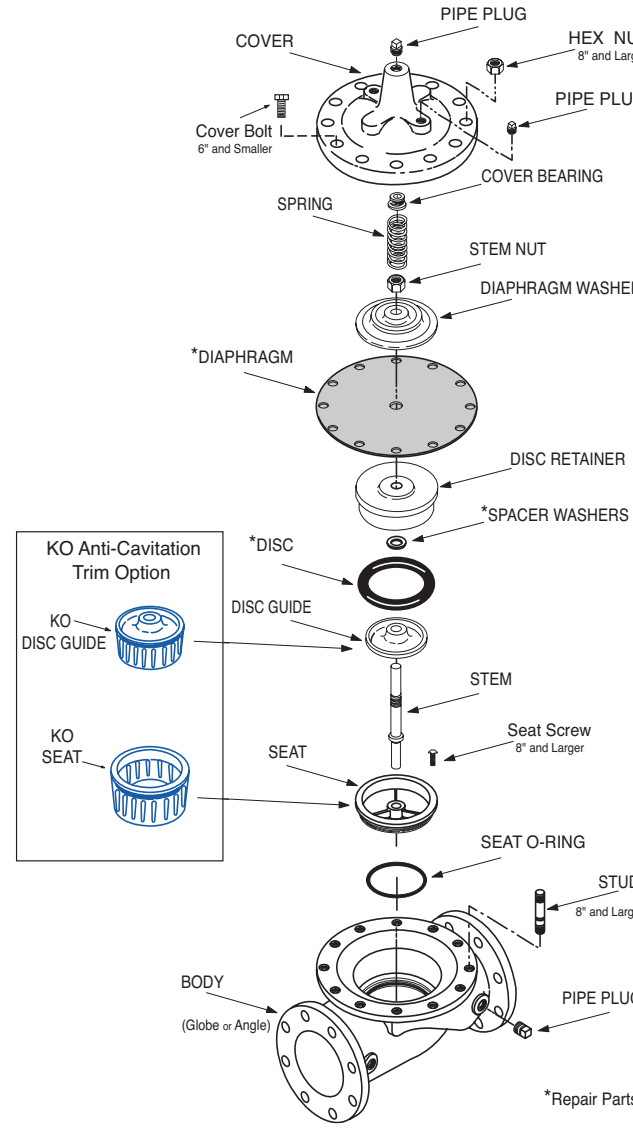


Follow this procedure when reassembling Main Valve:
1. Tightens bolts/nuts in a “Star” or “Cross-Over” pattern following the numbers shown above to insure that cover seats evenly on the diaphragm material and body.

2. Torque the bolt/nuts in three stages with a “Star” or “Cross-Over” pattern for each stage:
   A To approximately 10% of final torque.
   B. To approximately 75% of final torque.
   C. To final required torque.

3. Valves that are to be tested to 375 PSI or higher should be re-torqued after 24 hours.

100-01 Hytrol Main Valve Assembly



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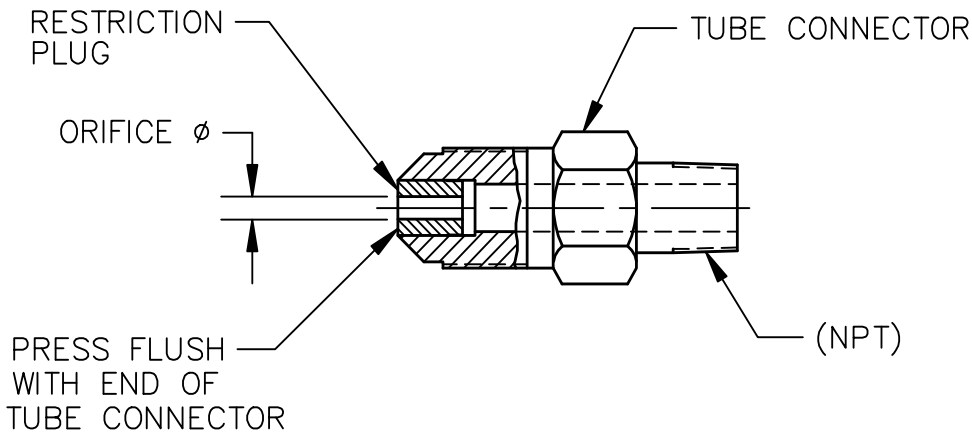
CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

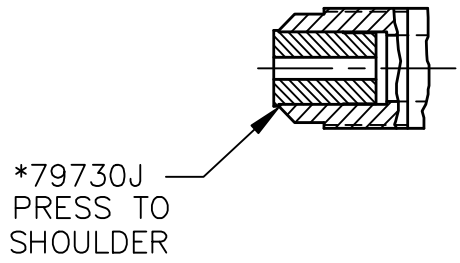
CATALOG NO.	DRAWING NO.	REV
X58C	48834	AP

TYPE OF VALVE AND MAIN FEATURES

X58C RESTRICTION ASSEMBLIES

DESIGN		
DRAWN	JC	12-3-85
CHK'D	JC	12-4-85
APV'D	CH	12-11-85





NOTES:

1. *FOR IDENTIFICATION, THESE STOCK NO'S ARE TO BE STAINED BLUE WITH 74234-03.
2. **FOR IDENTIFICATION, THESE STOCK NO'S ARE TO BE STAINED RED WITH 74234-05.
3. SEE DWG 76740 FOR STAINLESS STEEL X58C.
4. SEE SHEETS 3 & 4 FOR UL APPROVED DRAWING.

LTR	DESCRIPTION	BY	DATE
A-AK	SEE REVISION FILE		
AL	REDRAWN ON CAD (ECO 14229)	EK	11-18-93
AM	REINSTATED PN 68565B & 64673H (ECO 15043)	TLC	10-18-94
AN	ADDED PN 48834-05F (NED 43663)	AK	09-15-98
AP	ADDED PN 48834-06D (NED 75779)	EK	9-29-11

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CLA-VAL CO. NEWPORT BEACH, CALIFORNIA

CATALOG NO.	DRAWING NO.	REV
X58C	48834	AP

TYPE OF VALVE AND MAIN FEATURES

X58C RESTRICTION ASSEMBLIES

DESIGN		
DRAWN	JC	12-3-85
CHK'D	JC	12-4-85
APV'D	CH	12-11-85

X58C STOCK NO.	TUBE CONNECTOR SIZE TUBE X NPT	TUBE CONNECTOR MATERIAL	RESTRICTION PLUG ORIFICE DIA	RESTRICTION PLUG MATERIAL
	37° FLARE			
**44734C	3/8 X 3/8-18 NPT	ALUMINUM	.125 (1/8)	S. STEEL
	45° FLARE			
*37814B	1/4 X 1/8-27 NPT	BRASS	.031 (1/32)	S. STEEL
*80500C	1/4 X 1/8-27 NPT	BRASS	.062 (1/16)	S. STEEL
*67739D	3/8 X 1/8-27 NPT	BRASS	.040	S. STEEL
*64672K	3/8 X 3/8-18 NPT	BRASS	.062 (1/16)	S. STEEL
*99329-01D	3/8 X 3/8-18 NPT	BRASS	.094 (3/32)	S. STEEL
**79730J	1/2 X 1/2-14 NPT	BRASS	.125 (1/8)	S. STEEL
**48834-05F	3/8 X 3/8-18 NPT	BRASS	.125 (1/8)	S. STEEL
*85484E	1/4 X 1/8-27 NPT	BRASS	.031 (1/32)	DELRIN
*85486K	1/4 X 1/8-27 NPT	BRASS	.040	DELRIN
**48834-03A	1/4 X 1/8-27 NPT	BRASS	.125 (1/8)	DELRIN
*48834-04J	1/4 X 1/8-27 NPT	BRASS	.093	DELRIN
*88409-01G	3/8 X 1/8-27 NPT	BRASS	.031 (1/32)	DELRIN
*88409J	3/8 X 1/8-27 NPT	BRASS	.052	DELRIN
*42346H	3/8 X 1/8-27 NPT	BRASS	.062 (1/16)	DELRIN
**48834-01E	3/8 X 1/8-27 NPT	BRASS	.125 (1/8)	DELRIN
*42775H	3/8 X 1/4-18 NPT	BRASS	.062 (1/16)	DELRIN
**63604D	3/8 X 1/4-18 NPT	BRASS	.156 (5/32)	DELRIN
*10253D	3/8 X 3/8-18 NPT	BRASS	.031 (1/32)	DELRIN
*46946A	3/8 X 3/8-18 NPT	BRASS	.062 (1/16)	DELRIN
**64673H	3/8 X 3/8-18 NPT	BRASS	.125 (1/8)	DELRIN
*68565B	3/8 X 3/8-18 NPT	BRASS	.094 (3/32)	DELRIN
**43302K	3/8 X 3/8-18 NPT	BRASS	.188 (3/16)	DELRIN
**12900H	1/2 X 1/2-14 NPT	BRASS	.125 (1/8)	DELRIN
**48834-02C	1/2 X 1/2-14 NPT	BRASS	.188 (3/16)	DELRIN
**48834-06D	1/2 X 1/2-14 NPT	BRASS	.250 (1/4)	DELRIN

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
	SEE SHEET 1		

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Model CRD for UL
PRESSURE REDUCING CONTROL

DESCRIPTION
The Cla-Val Model CRD Pressure Reducing Control automatically reduces a higher inlet pressure to a lower outlet pressure. It is a direct acting, spring loaded, diaphragm type control that operates hydraulically or pneumatically. It may be used as a self-contained valve or as a pilot control for a Cla-Val main valve. It will hold a constant downstream pressure within very close pressure limits.

OPERATION
The CRD Pressure Reducing Control is normally held open by the force of the compression spring above the diaphragm; and delivery pressure acts on the underside of the diaphragm. Flow through the valve responds to changes in downstream demand to maintain a pressure.

INSTALLATION
The CRD Pressure Reducing Control may be installed in any position. There is one inlet port and two outlets, for either straight or angle installation. The second outlet port can be used for a gage connection. A flow arrow is marked on the body casting.

ADJUSTMENT PROCEDURE
The CRD Pressure Reducing Control can be adjusted to provide a delivery pressure range as specified on the nameplate.
Pressure adjustment is made by turning the adjustment screw to vary the spring pressure on the diaphragm. The greater the compression on the spring the higher the pressure setting.
1. Turn the adjustment screw in (clockwise) to increase delivery pressure.

2. Turn the adjustment screw out (counter-clockwise) to decrease the delivery pressure.

3. When pressure adjustment is completed tighten jam nut on adjusting screw and replace protective cap.

4. When this control is used, as a pilot control on a Cla-Val main valve, the adjustment should be made under flowing conditions. The flow rate is not critical, but generally should be somewhat lower than normal in order to provide an inlet pressure several psi higher than the desired setting

The approximate minimum flow rates given in the table are for the main valve on which the CRD is installed.

Valve Size	3”	4” - 8”	10” - 12”
Minimum Flow GPM	1 - 2	4 - 15	35 - 95

MAINTENANCE
Disassembly
To disassemble follow the sequence of the item numbers assigned to parts in the sectional illustration.

Reassembly
Reassembly is the reverse of disassembly. Caution must be taken to avoid having the yoke (17) drag on the inlet nozzle of the body (18). Follow this procedure:
1. Place yoke (17) in body and screw the disc retainer assembly (16) until it bottoms.

2. Disc retainer must enter guide hole in plug as it is assembled. Screw the plug in by hand. Use wrench to tighten only.

3. Place diaphragm (12) diaphragm washer (11) and belleville washer (20) on yoke. Screw on hex nut (10).

4. Hold the diaphragm so that the screw holes in the diaphragm and body align. Tighten diaphragm nut with a wrench. At the final tightening release the diaphragm and permit it to rotate 5° to 10°. The diaphragm holes should now be properly aligned with the body holes.

To check for proper alignment proceed as follows:
Rotate diaphragm clockwise and counterclockwise as far as possible. Diaphragm screw holes should rotate equal distance on either side of body screw holes ±1/8”.

Repeat assembly procedure until diaphragm and yoke are properly aligned. There must be no contact between yoke and body nozzle during its normal movement. To simulate this movement hold body and diaphragm holes aligned. Move yoke to open and closed positions. There must be no evidence of contact or dragging.

5. Install spring (9) with spring guide (8).

6. Install cover (5), adjusting screw (2) and nut (3), then cap (1).

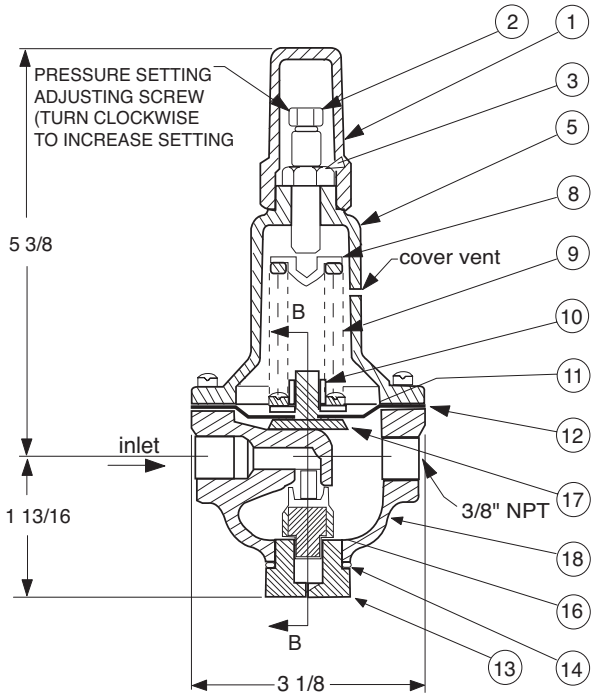
Service Suggestions		
Symptom	Possible Cause	Solutions
Fails to open when pressure lowers	No spring compression	Tighten adjusting screw
	Damaged spring	Disassemble and replace.
	Spring guide (8) is not in place	Assemble property
	Yoke dragging on inlet nozzle	Disassembled and reassemble property (refer to Reassembly)
Fails to close when delivery pressure rises	Spring compressed solid	Back off adjusting screw
	Mechanical obstruction	Disassembled and reassemble property (refer to Reassembly)
	Worn disc	Disassemble, remove and replace disc retainer assembly.
	Yoke dragging on inlet nozzle	Disassembled and reassemble property (refer to Reassembly)
Leakage from cover vent hole	Damaged diaphragm	Disassemble and replace
	Loose diaphragm nut	Remove cover and tighten nut

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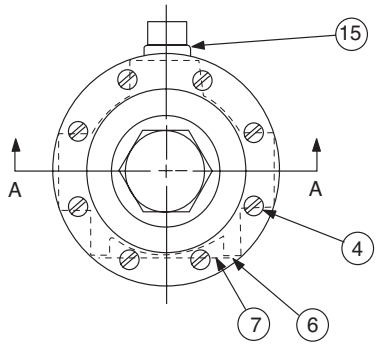
Model CRD

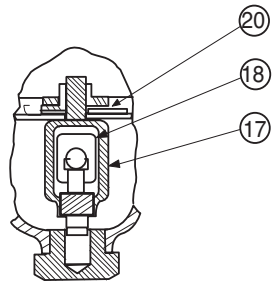
PRESSURE REDUCING CONTROL (BRONZE BODY WITH 303SS TRIM)

PARTS LIST



SECTION A-A
OPEN POSTION
FOR HIGH PRESSURE CONTROL





SECTION B-B
CLOSED POSITION

Size (inch)	Stock Number	PSI	FT of water
3/8	7194309G	50 - 175	115 - 403
Factory Set Pressure			**PSI per Turn***
50 - 175 set at 60 psi			27.0
*Approximate-Final Adjustment should be with a pressure gauge and with flow.			

Item No.	Description	Material
1	Cap	PL
2	Adjusting Screw	BRS
3	Jam Nut (3/8-16)	SS
4*	Machine Screw (Fil.Hd.) 8 Required	303
5	Cover	BRS
6	Nameplate Screw	SS
7	Nameplate	BRS
8	Spring Guide	302
9	Spring (50 - 175 psi)	CHR/VAN
10	Hex Nut	303
11	Diaphragm Washer	302
12*	Diaphragm	NBR
13	Plug, Body	BRS
14*	Gasket	Fiber
15	Plug	BRS
16*	Disc Retainer Assembly (50 - 175 psi)	SS/Rub
17	Yoke	316
18	Body & 1/4" Seat Assembly	BR/SS
20	Belleville Washer	STL
*	Repair Kit	Buna®-N

*Recommended Spare Parts

When Ordering, Please Specify

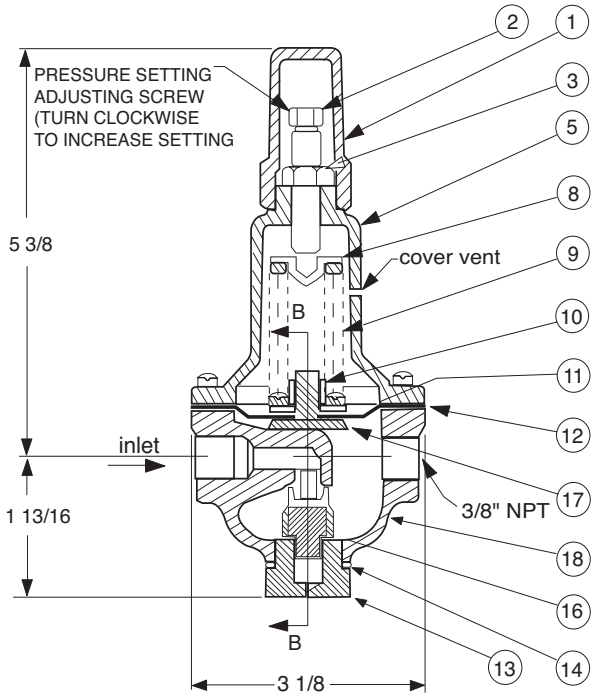
1. All Nameplate data
2. Item Number
3. Description

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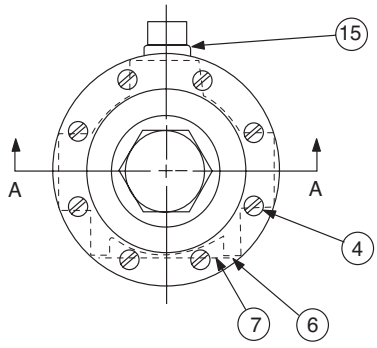
Model CRD

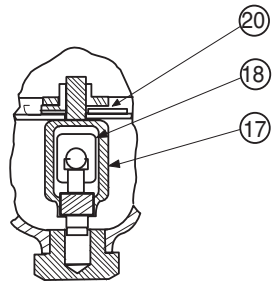
PRESSURE REDUCING CONTROL (BRONZE BODY WITH 303SS TRIM)

PARTS LIST



SECTION A-A
OPEN POSTION
FOR HIGH PRESSURE CONTROL





SECTION B-B
CLOSED POSITION

Size (inch)	Stock Number	PSI	FT of water
3/8	7194309G	50 - 175	115 - 403
Factory Set Pressure			**PSI per Turn***
50 - 175 set at 60 psi			27.0
*Approximate-Final Adjustment should be with a pressure gauge and with flow.			

Item No.	Description	Material
1	Cap	PL
2	Adjusting Screw	BRS
3	Jam Nut (3/8-16)	SS
4*	Machine Screw (Fil.Hd.) 8 Required	303
5	Cover	BRS
6	Nameplate Screw	SS
7	Nameplate	BRS
8	Spring Guide	302
9	Spring (50 - 175 psi)	CHR/VAN
10	Hex Nut	303
11	Diaphragm Washer	302
12*	Diaphragm	NBR
13	Plug, Body	BRS
14*	Gasket	Fiber
15	Plug	BRS
16*	Disc Retainer Assembly (50 - 175 psi)	SS/Rub
17	Yoke	316
18	Body & 1/4" Seat Assembly	BR/SS
20	Belleville Washer	STL
*	Repair Kit	Buna®-N

*Recommended Spare Parts

When Ordering, Please Specify

1. All Nameplate data
2. Item Number
3. Description

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Model 90-01
PRESSURE REDUCING VALVE

The Cla-Val Model 90-01/690-01 is an automatic control valve designed to reduce higher inlet pressure to a steady lower downstream pressure regardless of changing flow rate and/or varying inlet pressure. It is a hydraulically operated, pilot-controlled, diaphragm type globe or angle valve. When downstream pressure exceeds the pressure setting of the control pilot, the main valve and pilot valve close drip-tight. The control system is very sensitive to slight pressure changes and immediately controls the main valve to maintain the desired downstream pressure. Pressure setting adjustment is made with a single adjusting screw that has a protective cap to discourage tampering.

INTRODUCTION

1. Allow sufficient room around the valve assembly to make adjustments and for servicing.
2. It is recommended that gate or line block valves be installed on both ends of the Model 90-01/690-01 valve assembly to facilitate isolating the valve for maintenance. At a minimum of one pipe diameter apart.

NOTE: BEFORE THE VALVE IS INSTALLED, PIPE LINES SHOULD BE FLUSHED OF ALL CHIPS, SCALE, AND FOREIGN MATTER.

3. Place the valve assembly in the line with flow through the valve in the direction indicated on the inlet plate or by flow arrows. Check all fittings and hardware for proper makeup and that no apparent damage is evident. Be sure main valve cover nuts/bolts are tight. As pressure in some applications can be very high, thorough inspection for proper installation and makeup is strongly recommended.
4. Cla-Val Valves operate with maximum efficiency when mounted in horizontal piping with the cover UP, however, other positions are acceptable. Due to size and weight of cover and internal components of six-inch and larger valves, installation with the cover up is advisable and provides greater accessibility to internal parts for periodic inspection.
5. Caution must be taken in the installation of this valve to insure that galvanic and/or electrolytic action does not take place. The proper use of dielectric fittings and gaskets are required in all systems using dissimilar metals.

OPERATION AND START-UP

1. Prior to pressurizing the valve assembly, ensure that the necessary gauges to measure pressure in the system are installed as required by the system engineer. A Cla-Val X101D Valve Position Indicator may be installed in the center cover port to provide a visual indication of the valve movement during start-up.

CAUTION: During start-up and test procedures, a large volume of water may be discharged downstream. Check that the downstream venting is adequate to prevent damage to personnel and equipment. All adjustments in pressure should be made slowly while under flowing conditions. If the main valve closes too fast, it may cause surging in upstream piping.

2. If isolation valves (B) are installed in pilot system, open these valves (see schematic).
3. Optional Cla-Val CV Flow Controls (C or S) provide adjustable regulation of flow in and out of the main valve chamber to minimize pulsations that sometime occur at very low flow rates. If CV Controls are installed, loosen jam nut and turn adjustment screw counterclockwise from closed position 3.5 turns for an initial setting.
4. Open the upstream gate or block valve just slightly to allow the main valve assembly and pilot system to fill with liquid.
5. Carefully loosen tube fittings at highest points and bleed air from pilot control system. Carefully loosen the plug at top of main valve cover to bleed air from cover. If an indicator is installed, carefully loosen the air bleed valve at top of indicator. Tighten tube fittings. 6. Open the upstream gate or block valve fully.
7. Slowly open the downstream gate or block valve. Flow should occur and pressure should remain constant.
8. Adjust the CRD Control to desired pressure. To change pressure setting, turn the adjusting screw clockwise to increase pressure, counterclockwise to decrease pressure. There must be liquid flowing through the valve during pressure adjustments. When the desired setting has been made, tighten jam nut and replace cover.
9. To check the operation of the valve, open and close the downstream gate valve. The downstream pressure should remain constant.
10. If opening and closing speed controls (C or S) are installed in the valve pilot system, fine tune the opening and closing speed of the main valve while performing step 9. Turn the CV adjustment screw clockwise on the opening speed control to make the main valve open slower. Turn the adjustment screw clockwise on the closing speed control to make the main valve close slower. When adjustments have been completed, tighten jam nuts.

MAINTENANCE

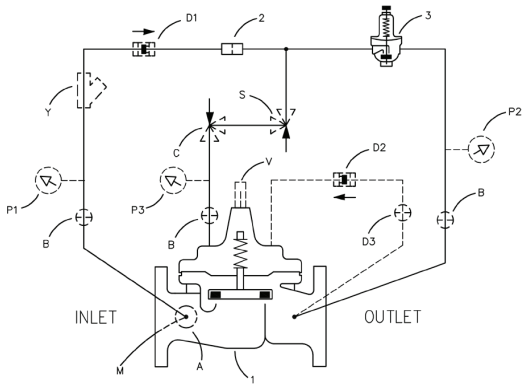
1. Cla-Val Automatic Control Valves require no lubrication or packing, however, should be inspected a minimum of once annually.
2. Repair and maintenance procedures of the Cla-Val Hytrol Main Valve and pilot control components are included in a more detailed IOM manual. It can be downloaded from our website (www.cla-val.com) or obtained by contacting a Cla-Val Regional Sales Office.
3. When ordering parts always refer to the catalog number and stock number on the valve nameplate.

Service Suggestions

Symptom	Possible Cause	Solutions
Main valve won't open	No pressure at valve inlet	Check inlet pressure
	Main valve diaphragm assembly inoperative	Disassemble, clean and polish stem, replace detective parts
	Pilot Valve (CRD) not opening: 1. No spring compression 2. Damaged spring 3. Spring guide not in place 4. Yoke dragging on inlet nozzle	 1. Tighten adjusting screw 2. Disassemble and replace 3. Assemble properly 4. Assemble properly
	Flow Control (CV) disc inoperative. Corrosion or excessive scale buildup on stem	Disassemble, clean and polish stem. Replace worn parts
Main valve won't closed	Foreign matter between disc and seat or worn disc. Scale on stem or diaphragm ruptured	Disassemble main valve, remove matter, clean parts and replace defective parts
	Flow Clean Strainer plugged	Remove and clean or replace
	CK2 (isolation valves) closed	Open isolation valves
	Pilot Valve (CRD) remain open: 1. Spring compressed solid 2. Mechanical obstruction 3. Worn disc 4. Yoke dragging on inlet nozzle diaphragm nut 5. Diaphragm damaged or loose diaphragm nut. Leakage from vent hole in cover	 1. Back off adjusting screw 2. Disassemble and remove obstruction 3. Disassemble remove and replace disc retainer assembly 4. Assemble properly 5. Disassemble. Replace diaphragm and/or tighten nut
Fails to regulate	Air in main valve cover and/or tubing	Loosen top cover plug and fittings and bleed air
	Pilot Valve (CRD) yoke dragging on inlet nozzle	Assemble properly
	Pilot Valve (CRD) spring not in correct range to control	Check outlet pressure requirements and compare existing spring with Spring Chart

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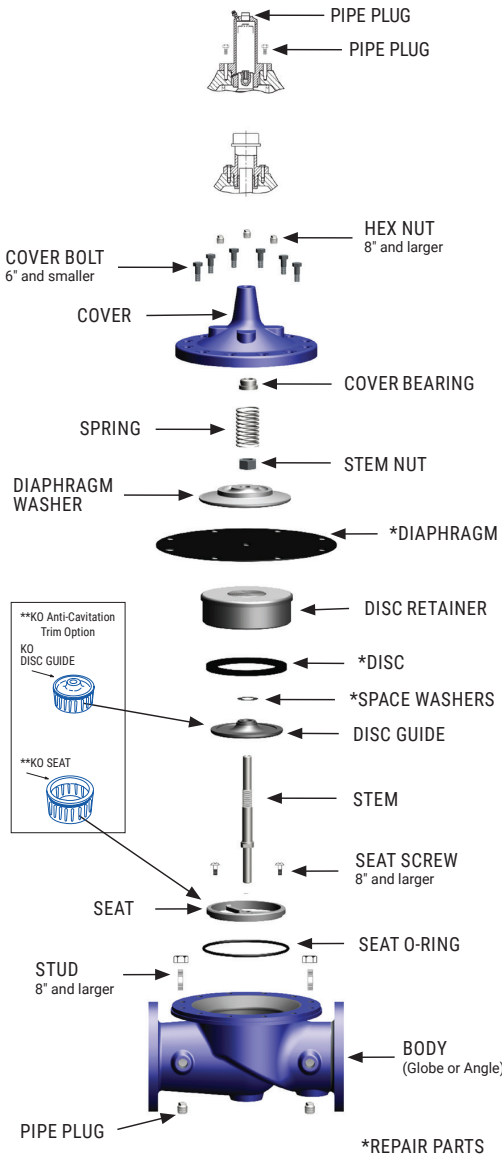
90-01/690-01 Schematic



Basic Components	
Item	**Description**
1	100-01 Hytrol (Main Valve)
	100-20 600 Series Hytrol (Main Valve)
2	X58C Restriction Fitting
3	CRD Pressure Reducing Control

Optional Features	
Item	**Description**
A	X46A Flow Clean Strainer
B	CK2 (Isolation Valves)
C	CV Speed Control (Closing)
D	Check Valves with Isolation Valve
P	X141 Pressure Gauge
S	CV Speed Control (Opening)
V	X101D Valve Position Indicator
Y	X43 "Y" Strainer

1. HYTROL MAIN VALVE

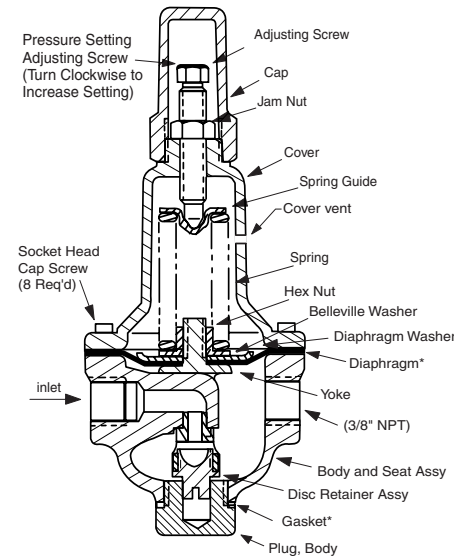


2.X58C



3. CRD





A. X46A



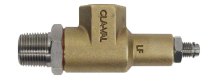
CRD adjustment range (psi)	Spring Color	PSI change per turn*
2 - 30	Stainless Steel	3
15 - 75	Red	9
75 - 300	Green	27

*Approximate. Use gauge at valve inlet to set.

B. CK2



C & S. CV



D. CDC-1



Y. X43



V. X101D



X140-1
Security Cap Option



**** KO Anti-Cavitation Trim can be added to any hydro valve**

***Suggested Repair Parts**

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Model CV
FLOW CONTROL

DESCRIPTION
The CV Control is an adjustable restriction which acts as a needle valve when flow is in the direction of the stem. When flow is in the reverse direction, the port area opens fully to allow unrestricted flow. When installed in the control system of a Cla-Val automatic valve, it can be arranged to function as either an opening or closing speed control.

OPERATION
The CV Flow Control permits full flow from port A to B, and restricted flow in the reverse direction. Flow from port A to B lifts the disc from seat, permitting full flow. Flow in the reverse direction seats the disc, causing fluid to pass through the clearance between the stem and the disc. This clearance can be increased, thereby increasing the restricted flow, by screwing the stem out, or counter-clockwise. Turning the stem in, or clockwise reduces the clearance between the stem and the disc, thereby reducing the restricted flow.

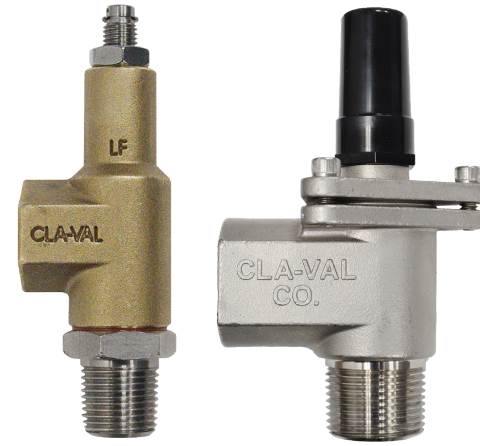
INSTALLATION
Install the CV Flow Control as shown in the valve schematic. All connections must be tight to prevent leakage.

DISASSEMBLY
Follow the sequence of the item numbers assigned to the parts in the cross sectional illustration for recommended order of disassembly.

Use a scriber, or similar sharp-pointed tool to remove O-ring from the stem.

INSPECTION
Inspect all threads for damage or evidence of cross-threading. Check mating surface of seat and valve disc for excessive scoring or embedded foreign particles. Check spring for visible distortion, cracks and breaks. Inspect all parts for damage, corrosion and cleanliness.

CLEANING
After disassembly and inspection, cleaning of the parts can begin. Water service usually will produce mineral or lime deposits on metal parts in contact with water. These deposits can be cleaned by dipping the parts in a 5-percent muriatic acid solution just long enough for deposits to dissolve. This will remove most of the common types of deposits. **CAUTION: Use extreme care when handling acid.** If the deposit is not removed by acid, then a fine grit (400) wet or dry sandpaper can be used with water. Rinse parts in water before handling. An appropriate solvent can clean parts used in fueling service. Dry with compressed air or a clean, lint-free cloth. Protect from damage and dust until reassembled.



REPAIR AND REPLACEMENT
Minor nicks and scratches may be polished out using a fine grade of emery or crocus cloth; replace parts if scratches cannot be removed.

Replace O-ring packing and gasket each time CV Flow Control is overhauled.

Replace all parts which are defective. Replace any parts which create the slightest doubt that they will not afford completely satisfactory operation. Use Inspection steps as a guide.

REASSEMBLY
Reassembly is the reverse of disassembly; no special tools are required.

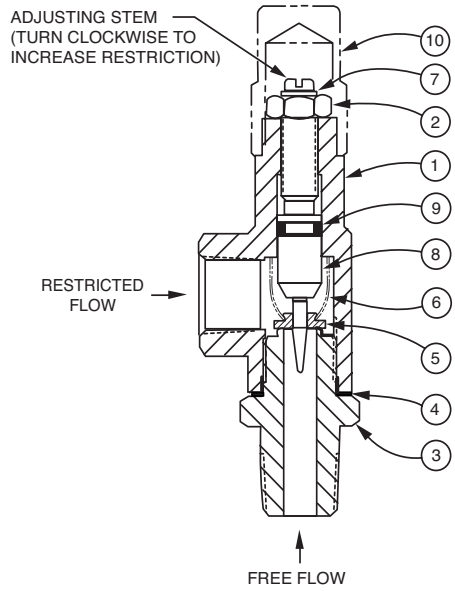
TEST PROCEDURE
No testing of the flow Control is required prior to reassembly to the pilot control system on Cla-Val Main Valve.

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Model CV
FLOW CONTROL

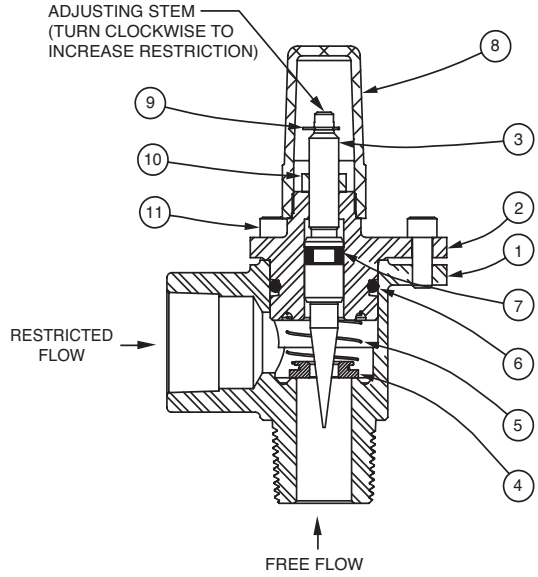
PARTS LIST

3/8" CV Flow Control



Item No.	Description	QTY
1	Housing	1
2	Nut, Jam	1
3	Seat	1
4	Gasket	1
5	Disc	1
6	Spring	1
7	Ring, Retaining	1
8	Stem	1
9	O-Ring	1
10	Cap (SS only)	1

1/2", 3/4", and 1" CV Flow Control



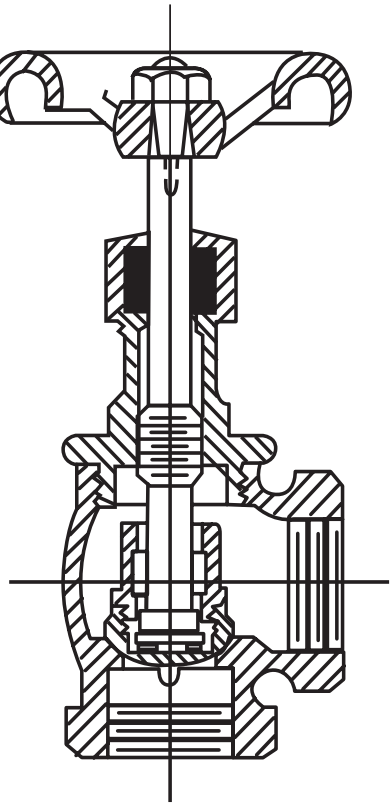
Item No.	Description	QTY
1	Body	1
2	Cover	1
3	Stem	1
4	Disc	1
5	Spring	1
6	O-Ring	1
7	O-Ring	1
8	Cap	1
9	Ring, Retaining	1
10	Nut, Jam	1
11	Socket Head Cap Screw	3

When Ordering, Please Specify

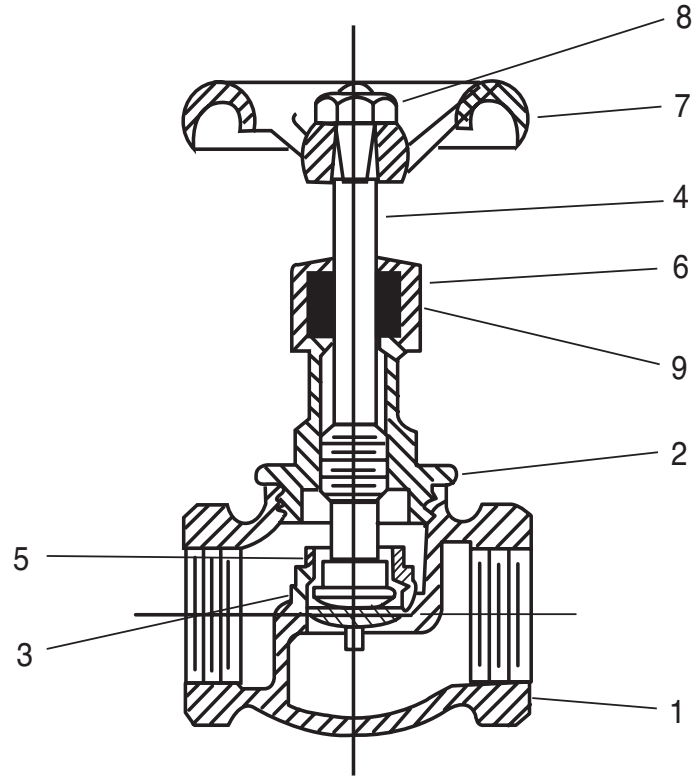
1. All Nameplate/Stamped data
2. Item Number
3. Description
4. Material

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CG Series
GLOBE AND ANGEL VALVES CG SERIES



CAT. NO. CGA
ANGLE



CAT. NO. CG8
GLOBE

Parts List for illustration only
Valve sold only as a compete unit.

When Ordering, Please Specify

1. All Nameplate data
2. Item Number
3. Description
4. Assembly

Item No.	Description
1	Body
2	Bonnet
3	Disc
4	Stem
5	Gland
6	Nut
7	Handwheel
8	Nut
9	Packing

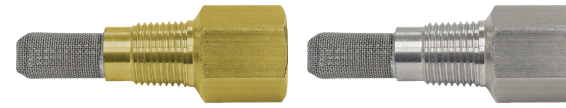
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Model X46
PRESSURE REDUCING CONTROL

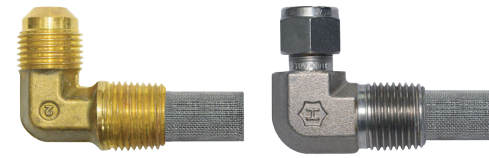
- Self Scrubbing Cleaning Action
- Straight Type or Angle Type

The Cla-Val Model X46 Strainer is designed to prevent passage of foreign particles larger than 0.015". It is especially effective against such contaminant as algae, mud, scale, wood pulp, moss, and root fibers. There is a model for every Cla-Val valve.

The X46 Flow Clean strainer operates on a velocity principle utilizing the circular "air foil" section to make it self cleaning. Impingement of particles is on the "leading edge" only. The low pressure area on the downstream side of the screen prevents foreign particles from clogging the screen. There is also a scouring action, due to eddy currents, which keeps most of the screen area clean.



Model X46A Straight



Model X46B Angle

INSTALLATION
The strainer is designed for use in conjunction with a Cla-Val Main Valve, but can be installed in any piping system where there is a moving fluid stream to keep it clean. When it is used with the Cla-Val Valve, it is threaded into the upstream body port provided for it on the side of the valve. It projects through the side of the Main Valve into the flow stream. All liquid shunted to the pilot control system and to the cover chamber of the Main Valve passes through the Model X46 Flow Clean Strainer.

INSPECTION
Inspect internal and external threads for damage or evidence of cross-threading. Check inner and outer screens for clogging, embedded foreign particles, breaks, cracks, corrosion, fatigue, and other signs of damage.

DISASSEMBLY
Do not attempt to remove the screens from the strainer housing.

CLEANING
After inspection, cleaning of the Model X46 can begin. Water service usually will produce mineral or lime deposits on metal parts in contact with water. These deposits can be cleaned by dipping Model X46 in a 5-percent muriatic acid solution just long enough for deposit to dissolve. This will remove most of the common types of deposits.

CAUTION: use extreme care when handling acid. If the deposit is not removed by acid, then a fine grit (400) wet or dry sandpaper can be used with water. Rinse parts in water before handling. An appropriate solvent can clean parts used in fueling service. Dry with compressed air or a clean, lint-free cloth.

Protect from damage and dust until reassembled.

REPLACEMENT
If there is any sign of damage, or if there is the slightest doubt that the Model X46 Flow Clean Strainer may not afford completely satisfactory operation, replace it. Use Inspection steps as a guide. Neither inner screen, outer screen, nor housing is furnished as a replacement part. Replace Model X46 Flow Clean Strainer as a complete unit.

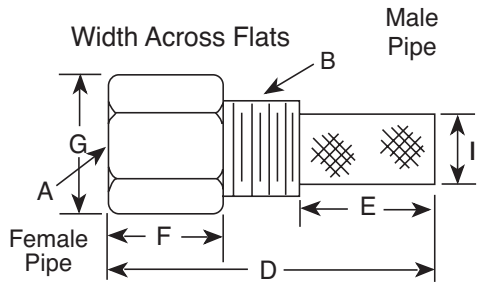
When ordering replacement Flow-Clean Strainers, it is important to determine pipe size of the tapped hole into which the strainer will be inserted (refer to column A or F), and the size of the external connection (refer to column B or G).

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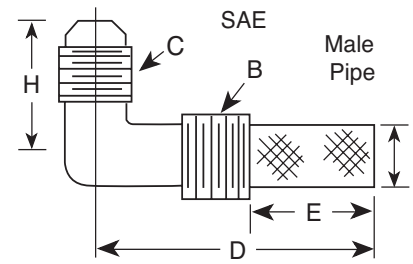
Dimensions (in Inches)

X46 Straight Type A (In Inches)						
A (NPT)	**C** (NPT)	**D**	**E**	**F**	**G**	**I**
1/8	1/8	1-3/4	3/4	1/2	1/2	1/4
1/4	1/4	2-1/4	1	3/4	3/4	3/8
3/8	3/8	2-1/2	1	7/8	7/8	1/2
3/8	1/2	2-1/2	1-1/4	1/2	7/8	3/4
1/2	1/2	3	1-1/4	1	1-1/8	3/4
3/8	3/4	3-3/8	2	1/2	1	7/8
3/4	3/4	4	2	1	1-1/2	7/8
3/8	1	4-1/4	2-3/4	1/2	1-3/8	7/8
1	1	4-1/2	2-3/4	1-1/4	1-3/4	7/8
1/2	1	4-1/4	2-3/4	1/2	1-3/8	7/8

X46 Angle Type B (In Inches)					
B (NPT)	**C** (SAE)	**D**	**E**	**H**	**I**
1/8	1/4	1-3/8	5/8	7/8	1/4
1/4	1/4	1-3/4	3/4	1	3/8
3/8	1/4	2	7/8	1	1/2
3/8	3/8	1-7/8	7/8	1	1/2
1/2	3/8	2-3/8	1	1-1/4	5/8



Model X46A



Model X46B

When Ordering, Please Specify

1. Catalog number X46
2. Straight or Angel Type
3. Size inserted into and size connection
4. Materials

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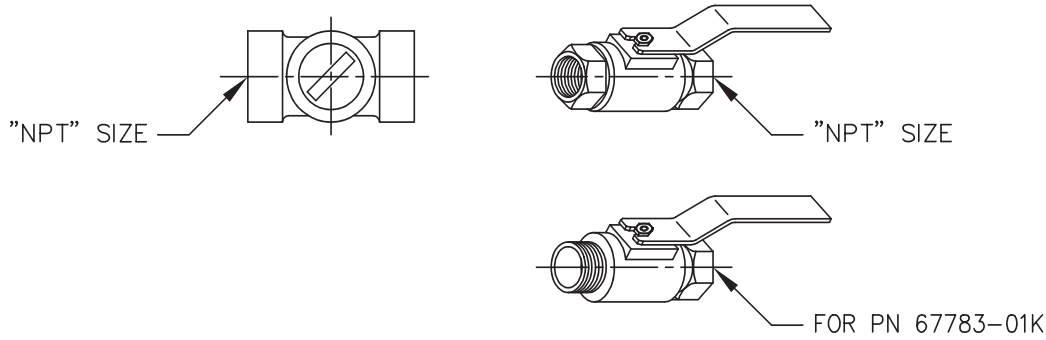
CLA-VAL CO. NEWPORT BEACH, CALIFORNIA	CATALOG NO.	DRAWING NO. 67783	REV BD

TYPE OF VALVE AND MAIN FEATURES

CK2 COCK/BALL VALVE

DESIGN		
DRAWN	MGR	4-02-80
CHK'D	KD	4-03-80
APV'D	CH	4-07-80

SCALE: NONE



CLA-VAL PART NO. AND MATERIAL

BRONZE WITH HANDLE	STEEL WITH HANDLE	IRON WITH HANDLE	316 SST WITH HANDLE	316 SST W/ LOCKING HANDLE	BRONZE WITH HANDLE	MONEL WITH HANDLE	MONEL W/ LOCKING HANDLE	SIZE "NPT"
67783-01K*	-09C	-17F	-25J SUPSD BY-26G		-41F SUPSD BY-01K			1/8"
-02H	-10A	-18D	-26G	-51E SUPSD BY-26G -52C	-42D SUPSD BY-02H	-55F		1/4"
-03F* -59H***	-11J	-19B	-27E	-46E SUPSD BY-27E -53A	-45G -57B**	-48A SUPSD BY-49J	-63K	3/8"
-04D -60F ***	-12G	-20K	-28C	-54J	-43B SUPSD BY-04D	-49J	-62B	1/2"
-05A -61D ***	-13E	-21H	-29A	-64H	-44K SUPSD BY-05A	-56D		3/4"
-06J	-14C	-22F	-30J			-58K		1"
-07G	-15K	-23D	-31G					1 1/4"
-08E	-16H	-24B	-32E					1 1/2"
-50G			-47C					2"

* SEE ENGINEERING APPROVED VENDORS TABLE (SHEET 2 OF 2).

** HAMMOND VALVE 8501 ONLY.

*** WILKINS CK2 (SEE SHEET 2 OF 2)

CAD REVISION RECORD - DO NOT REVISE MANUALLY

LTR	DESCRIPTION	BY	DATE
A-AY	SEE REVISION FILE		
BA	ADDED PN'S 67783-59H, 67783-60F & 67783-61D (ECO 20434)	AK	03-14-06
BB	ADDED PN'S 67783-62B (NED 62200)	AK	07-10-08
BC	ADDED PN'S 67783-63K (NED 62218)	AK	08-14-08
BD	ADDED PN 67783-64H (NED 62446)	PC	10-1-2008

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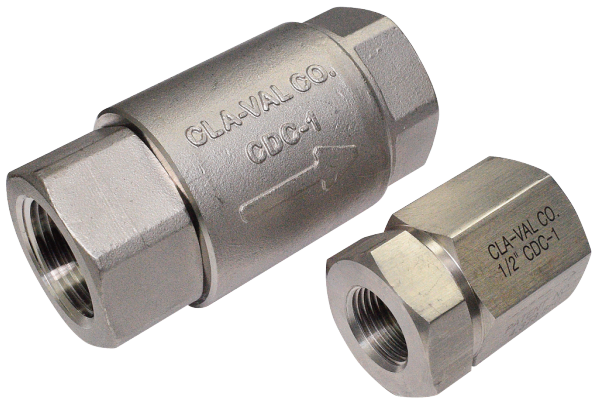
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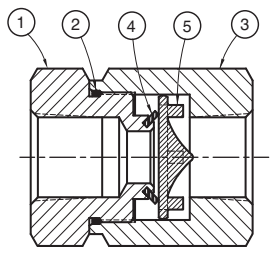
MODEL — CDC-1

Check Valve

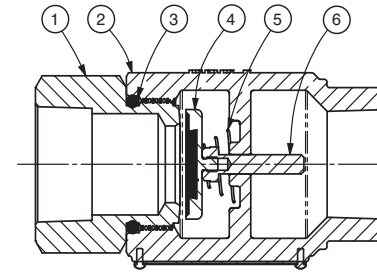
Sizes 3/8", 1/2", 3/4" and 1"



- **Meets Low Lead Requirements**
- **Patented Seal Design Allows for Drip Tight Shut-off at Low DP**
- **No Spring Required due to Patented Seal Design**
- **Delrin® Disc with Flow Profile Designed to Minimize Head Loss**
- **Delrin® Disc Resists Corrosion and/or Mineral Build-up**
- **Drip Tight Seating at both Low and High Operating Pressures**
- **Temperature Range: 10°F to 210°F**
- **EPR, NBR and Fluorocarbon Seal Options**



CDC-1 - 3/8" and 1/2"		
Item	**Description**	**Quantity**
1	Retainer, Seal	1
*2	O-Ring	1
3	Retainer, Valve	1
*4	Seal, Valve Ring	1
*5	Plate, Valve	1

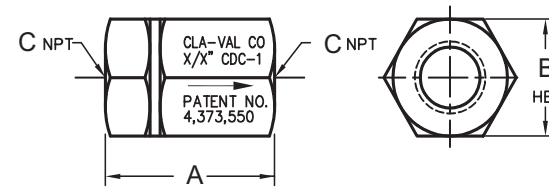


CDC-1 - 3/4" and 1"		
Item	**Description**	**Quantity**
1	Seat, Valve	1
2	Body, Valve	1
*3	O-Ring	1
*4	Disc Retainer Assembly	1
*5	Spring	1
*6	Stem, Valve	1

* Included in Repair Kit

Dimensions

Size (NPT)	A	B	C
3/8"	2.06	1.06	0.38 (3/8) - 18.0 NPT
1/2"	2.12	1.38	0.50 (1/2) - 14.0 NPT
3/4"	4.06	2.26	0.75 (3/4) - 14.0 NPT
1"	4.06	2.19	1.00 (1) - 11.5 NPT



CLA-VAL CHECK VALVE (1/2" SIZE SHOWN)

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CLA-VAL™

— MODEL — **X141**

Cla-Val Gauge Option



Model X141
4" Pressure Gauge

- **Liquid-Filled**
- **Dual Scale (PSI / BAR)**
- **Long Life Stainless Steel Construction**
- **Tamper-Resistant Design**
- **2 ½" and 4" Diameter Sizes**
- **Isolation Valve Included**

The Cla-Val Model X141 Pressure Gauge Option consists of glycerin-filled pressure gauges with the Cla-Val Logo and ¼" CK2 Bronze Isolation Valves on the main valve inlet and outlet. Cla-Val gauges are waterproof, shock resistant, and fully enclosed with a stainless steel case and bronze wetted parts. Ambient temperature ratings are -4 Degrees F to +140 Degrees F (-20 Degrees C to +60 Degrees C).

All gauges have dual scale (PSI/BAR) and are supplied with a 1/4" NPT bottom connection. Model X141 gauges are available installed on new valves and must be specified on the customer Purchase Order. Consult factory for other available materials.

Available Pressure Ranges

X141 Gauge Assembly (2 1/2" Diameter Dial)

Pressure Range*	Part Number
0 - 60 psi	20534301A
0 - 100 psi	20534302K
0 - 200 psi	20534303J
0 - 300 psi	20534304H
0 - 400 psi	20534305G

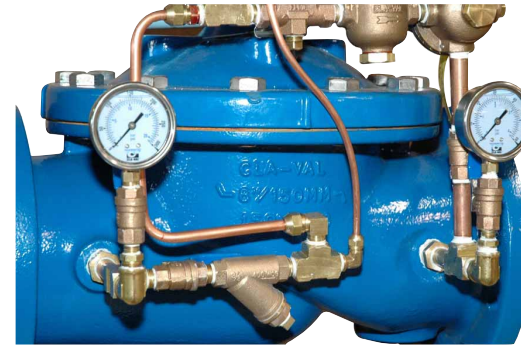
X141 Gauge Assembly (4" Diameter Dial)

Pressure Range*	Part Number
0 - 60 psi	20534306F
0 - 100 psi	20534307E
0 - 200 psi	20534308D
0 - 300 psi	20534309C
0 - 400 psi	20534310K

Typical X141 Installation



Typical Installation with two X141 Gauges



*Specify desired pressure range and valve location (inlet or outlet) on order.

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Model X141
2-1/2" & 4" GAUGE OPTION

PARTS LIST



Model X141
4" Pressure Gauge

- Liquid-Filled • Dual Scale (PSI / BAR)
- Long Life Stainless Steel Construction
- Tamper-Resistant Design
- 2-1/2" and 4" Diameter Sizes
- Isolation Valve Included

The Cla-Val Model X141 Pressure Gauge Option consists of liquid-filled pressure gauges with Cla-Val Logo installed with 1/4" CK2 Bronze Isolation Valves on main valve inlet and outlet. Gauges are waterproof, shock resistant, and fully enclosed with Stainless Steel case and Bronze wetted parts. All gauges have dual scale (PSI/BAR) and 1.5% F.S. accuracy with 1/4" NPT bottom connection. 2 1/2" Diameter Dial supplied with 6" and smaller valves. 4" Diameter Dial supplied with 8" and larger valves. Available installed on new valves and must be specified on customer Purchase Order. Other materials available consult factory.

Available Pressure Ranges

X141 Gauge Assembly for 6" and smaller valves (2-1/2" Diameter Dial)
*Pressure Range
0 - 60 psi
0 - 100 psi
0 - 160 psi
0 - 200 psi
0 - 300 psi
0 - 400 psi

X141 Gauge Assembly for 8" and larger valves (4" Diameter Dial)
*Pressure Range
0 - 60 psi
0 - 100 psi
0 - 200 psi
0 - 300 psi
0 - 400 psi

When Ordering, Please Specify

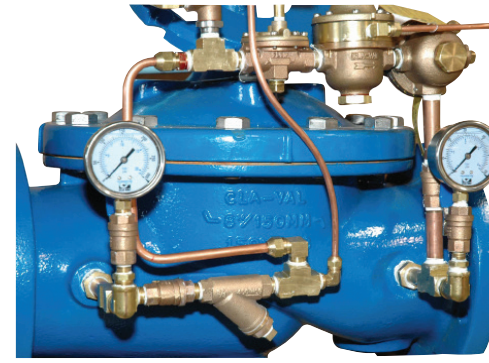
1. Pressure Range

2. Valve Location (inlet or outlet)

Typical Installation of X141



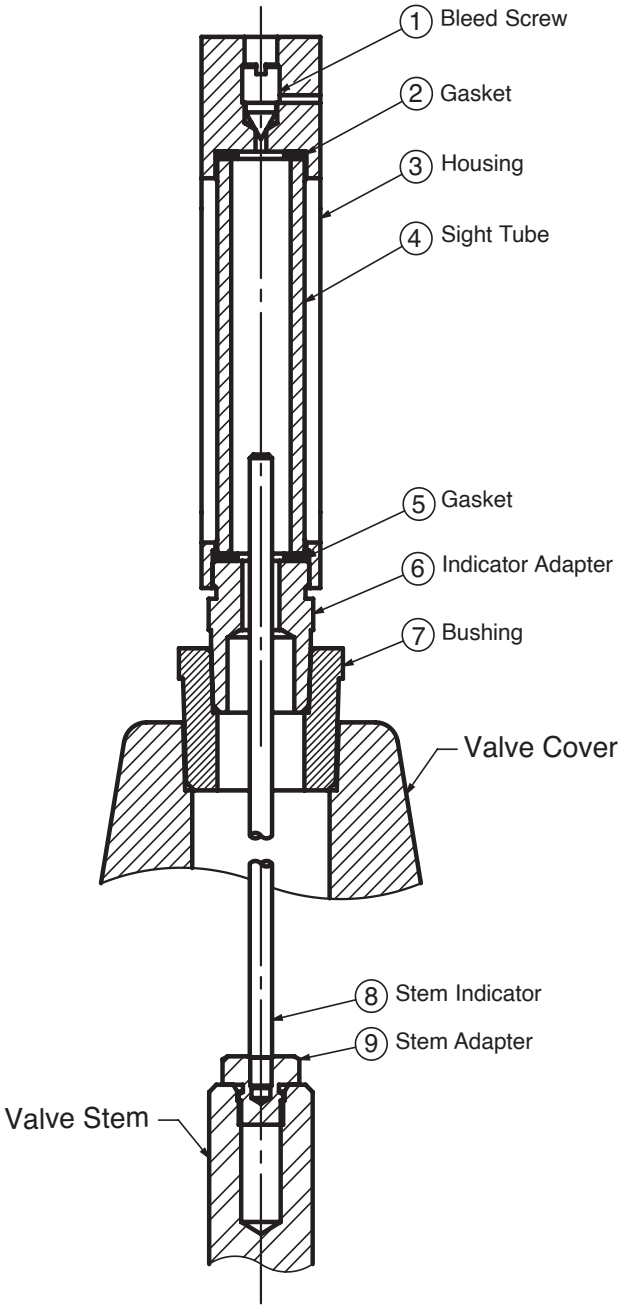
Typical Installation of X141 both Gauges Installed



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Model X101D
VALVE POSITION INDICATOR

PARTS LIST



Item No.	Description	Material
1	Bleed Screw	Stainless Steel
2	Gasket	Buna-N®
3	Housing	Stainless Steel
4	Sight Tube	Pyrex
5	Gasket	Buna-N®
6	Indicator Adapter	Stainless Steel
7	Bushing	Stainless Steel
8	Stem Indicator	Stainless Steel
9	Stem Adapter	Stainless Steel

When Ordering, Please Specify

1. All Nameplate data
2. Item Number
3. Description
4. Material

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CLA-VAL

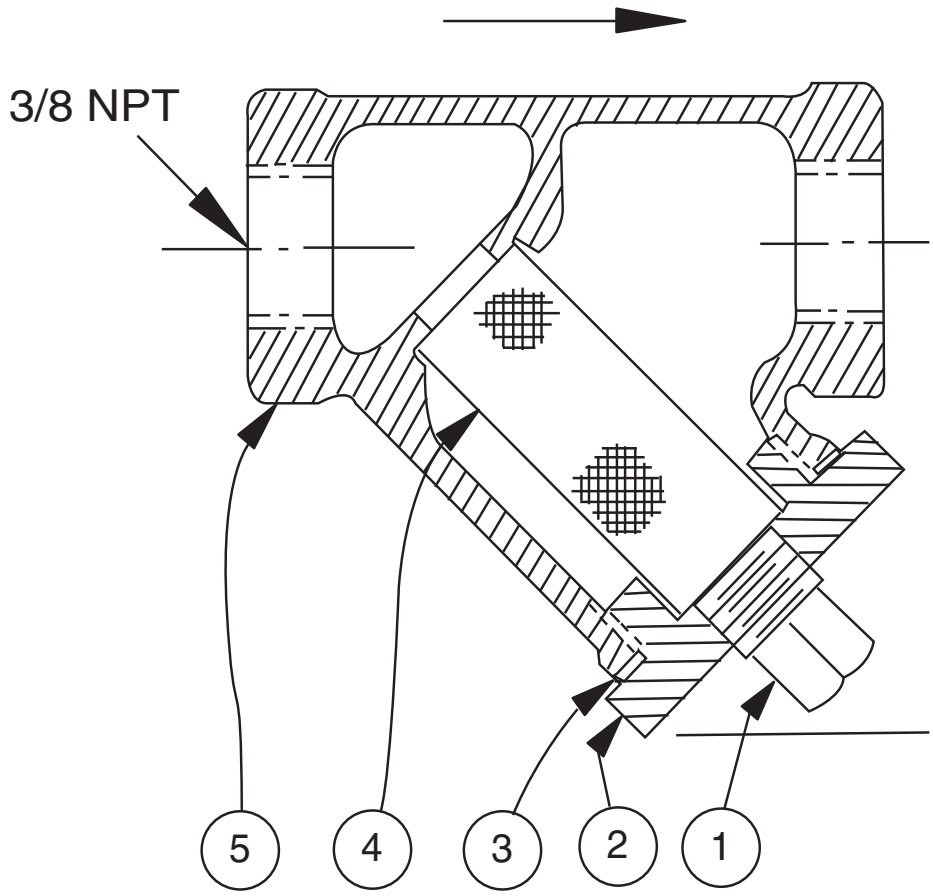
X43

Strainer

ITEM	DESCRIPTION	MATERIAL
1	Pipe Plug	Stainless Steel
2	Strainer Plug	Stainless Steel
3	Gasket	Fiber
4	Screen	Stainless Steel
5	Body	Stainless Steel
No parts available. Replacement assembly only.		

Standard 60 mesh pilot system strainer for fluid service.

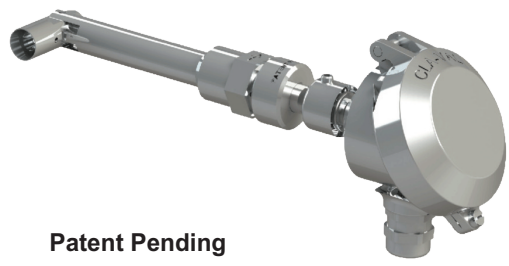
Size	Stock Number
3/8 x 3/8	8850604D



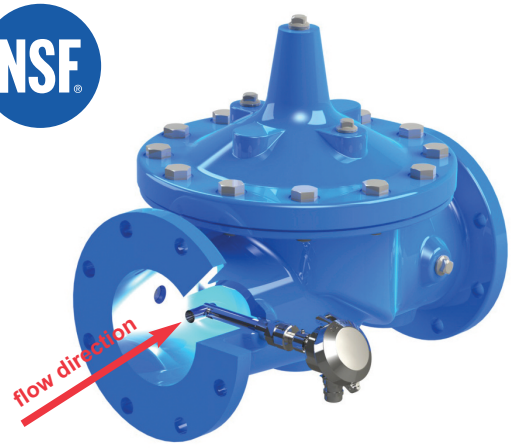
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MODEL X144

e-FlowMeter



Patent Pending



Installation view of the X144 e-FlowMeter

Note: Consult Factory for Angle Pattern Applications

- **The e-FlowMeter can be retrofitted to an existing Cla-Val Automatic Control Valve or factory assembled on a new valve**
- **Alleviates the need for an in-line meter and the associated installation costs**
- **IP68 Submersible (verfied by independent lab testing)**
- **Provides flow data with accuracy +/- 2% of Full Scale**
- **Mounts on either inlet body tapping of the Cla-Val Control Valve**
- **Stainless Steel Construction**
- **4-20mA Loop Powered**
- **Plug-and-Play Metering**
- **No Moving Parts**
- **Independent laboratory tested:**
  - **Utah State University,**
  - **Imperial College - London**

The Cla-Val Model X144 e-FlowMeter is a vortex shedding insertion flow meter designed to be retrofitted into a Cla-Val Automatic Control Valve to provide accurate flow measurement data without the need to install a separate meter.

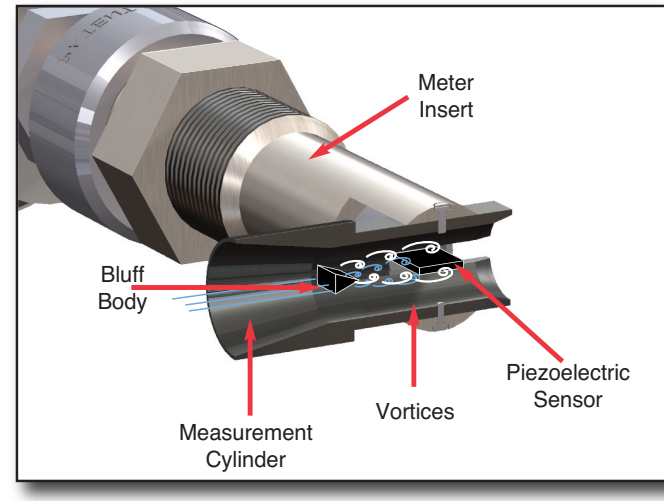
Configured for installation in the inlet tapping of a Cla-Val Automatic Control Valve, the X144 can be used in valves directly downstream of a flow disturbance such as elbows, valves or a reducer. (See page 2 for installation guidelines)

The X144 e-FlowMeter employs an innovative swivel mechanism which allows the meter to be inserted into tappings as small as 1/2-inch. For applications involving installation in close proximity to pump discharge, please consult factory with details.

Frequency Measurement

The X144 e-FlowMeter uses the vortex shedding method to measure flow. The meter is inserted into the inlet tapping of the valve and the measurement cylinder is oriented parallel to the direction of flow. The flow enters the measurement cylinder where it encounters the bluff body, generating vortices, which in turn, deflects off the piezoelectric sensor.

The sensor counts the vortices and communicates the data to the meter's integral circuit board. The flow data signal is converted to 4-20mA, or transistor (NPN) pulse, depending on the desired application.

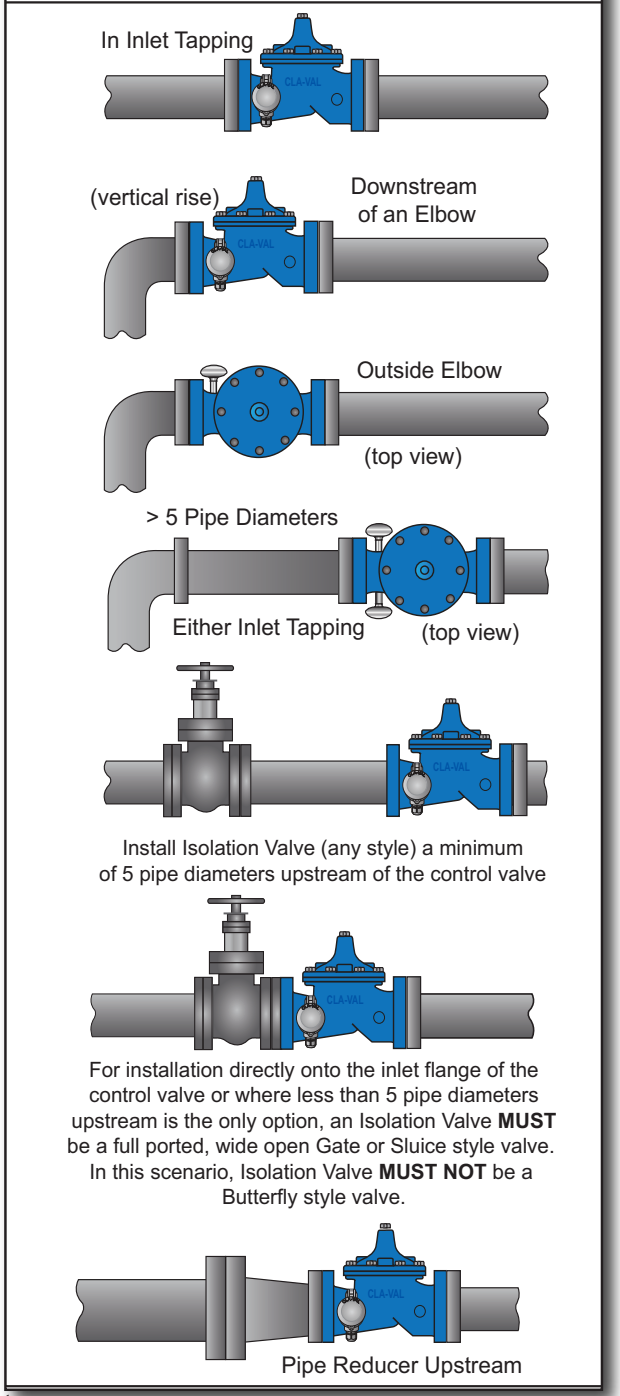


Installation Guidelines and Typical Applications

Installation Locations

For optimum performance, it is recommended that the valve in which the X144 e-FlowMeter is installed be located as shown below.

Optimum Installations



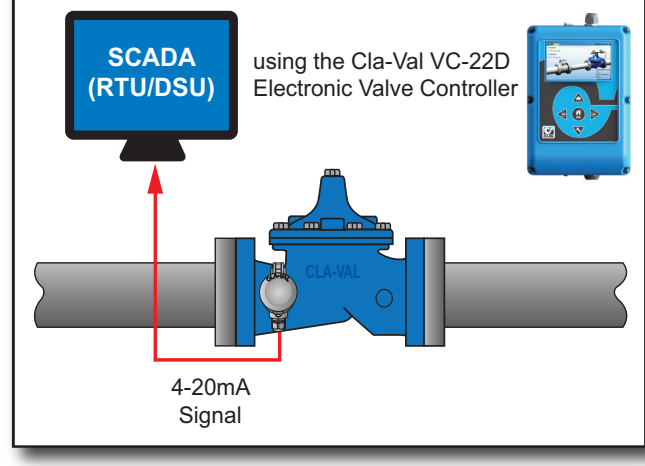
Notes:

- Consult factory for other installation configurations
- Do not use butterfly valves as isolation valves adjacent to X144 installations

Information Transmission

The X144 e-FlowMeter measures and transmits flow information via a 4-20mA signal to SCADA equipment.

Information Transmission

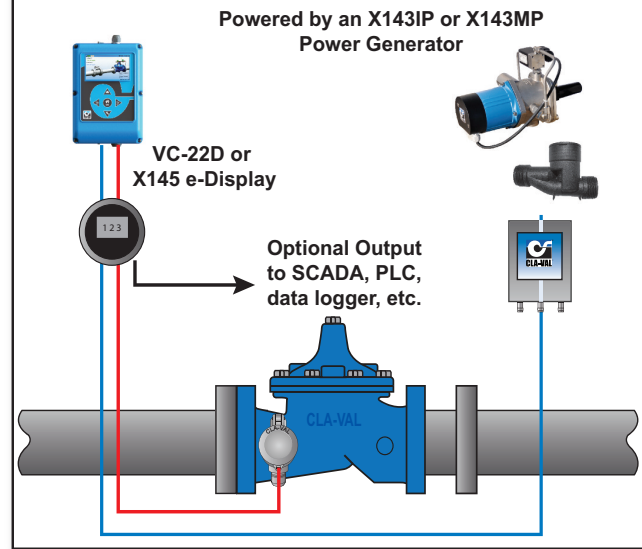


Data Acquisition and Storage using Cla-Val Power Generator

- The X144 e-FlowMeter connects to most commercially available loggers with the choice of 4-20mA or pulse output.
- The X145 e-Display is an ideal companion to the X144 e-flowMeter, providing access to real-time data
- Both the e-Display and the e-FlowMeter can be powered by the Cla-Val X143MP Micro-Turbine Power Generator

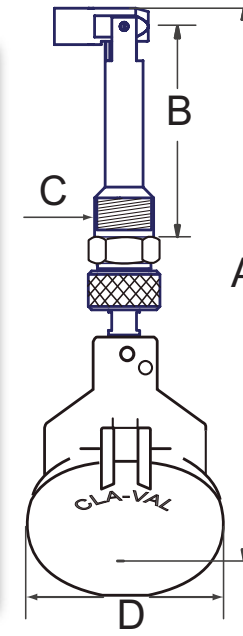
To learn more about the X143MP Power Generator, visit www.cla-val.com/electronic-products

Data Acquisition and Storage plus Power



X144 Dimensions

X144 Sizes		1	2	3	4
Full Port Valve Sizes		2*, 2-1/2, 3	4, 6	8, 10	12, 14, 16, 18, 20, 24, 30**
Reduced Port Valve Sizes		4	6, 8	10, 12	14, 16, 18, 20, 24**
Overall Length (in inches)	A	8.85	9.45	13.18	17.91
Insertion Length (in inches)	B	2.3	2.8	6.8	11.25
Pipe Thread (NPT)	C	1/2"	3/4"	1"	1"
Overall Width (in inches)	D	3.25	3.25	3.25	3.25

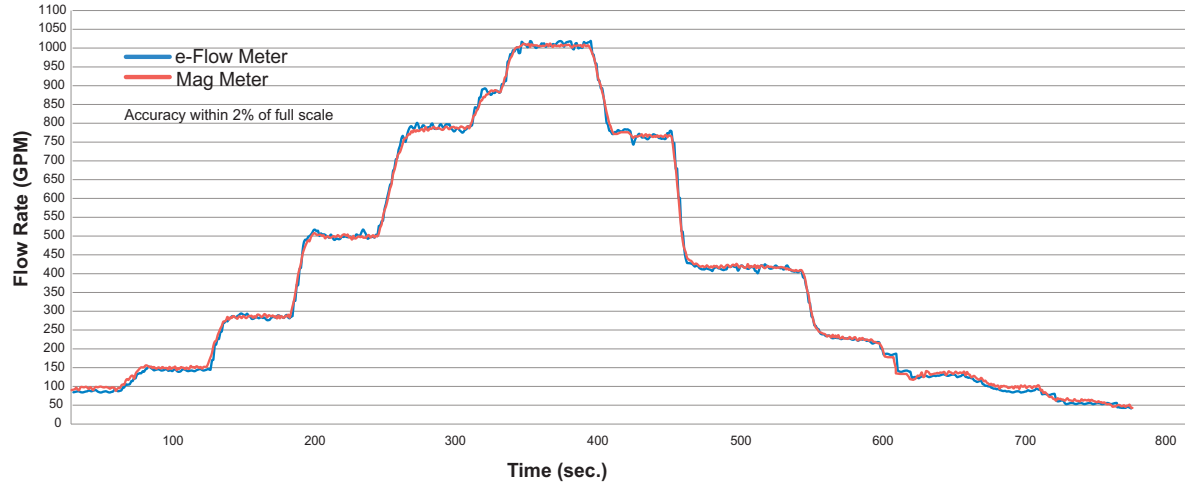


*2" X144 e-FlowMeter may be installed on new valves only
** Consult factory for larger applications

X144 e-FlowMeter Operational Flow Range = from 1 ft/s to 20 ft/s

Typical Performance

X144 e-FlowMeter vs. Mag Meter



Options

- Remote Mounted Display - X145 e-Display
- Field Optimization using e-FlowMeter Customer Software
- Pulsed output proportional to flow rate for low power consumption

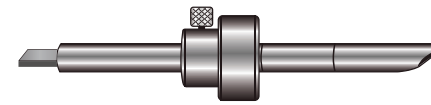


X145 e-Display

Product Details

Insertion Tool and Locking Ring

- Required for installation
- Tool allows the proper installation and alignment of the bluff body to be parallel to upstream flow.



X144 Insertion Tool

Power Requirement

- 12/24 VDC, 0.7 Watts minimum.

X144 e-Flow Meter Sizing

- The X144 threads directly into the inlet tapping of a Cla-Val Control Valve. The size of the e-FlowMeter is dependent on the specific valve size for which it has been calibrated - no additional fittings are required. **See dimension chart on previous page.**

Cabling

- The unit is supplied with 20 feet of shielded cable.

Maximum Operating Pressure : 400 PSI

X144 e-FlowMeter Analog Range (4-20mA Scaling): Factory Settings

Port Style	Line Size inches (mm)	**2" (50) (100-49 Body)	2-1/2" (65)	3" (80)	4" (100)	6" (150)	8" (200)	10" (250)	12" (300)	14" (350)	16" (400)	18" (450)	20" (500)	24" (600)	30" (750)
Full Port Valves 4mA = 0 (GPM - l/s)	20mA Range (GPM)	260	375	575	1000	2250	3900	6000	8750	10500	14000	17500	22000	31000	52000
	20mA Range (l/s)	16.4	23.7	36.3	63.1	140	245	380	550	660	880	1100	1390	1950	3280
Full Port Pulse Weight*	Gal/Pulse	5	6.5	9.5	17	38	65	100	150	175	235	290	365	515	865
	l/Pulse	19	25	36	65	145	245	380	565	660	890	1100	1380	1950	3275
Reduced Port Valves 4mA = 0 (GPM-l/s)	20mA Range (GPM)	not available			675	1600	2900	4500	5650	7750	9350	Consult Factory			
	20mA Range (l/s)				42.5	100	180	285	355	490	590				
Reduced Port Valves Pulse Weight*	Gal/Pulse				11.5	26	48	75	95	130	155				
	l/Pulse				44	99	180	285	360	495	585				

*** Note:** * Pulse Width = 250ms

**2" X144 e-FlowMeter may be installed on new valves only

CLA-VAL

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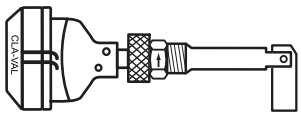
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Porte du Grand Lyon 1
ZAC du Champ du Périer
France - 01700 Neyron
Phone: 33-4-72-25-92-93
Fax: 33-4-72-25-04-17
E-mail: cla-val@cla-val.fr

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X144 e-FlowMeter
Quick Start Installation & Removal Instructions

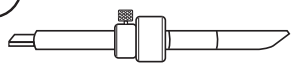
X144 e-FlowMeter Included Hardware

1 **Complete e-FlowMeter Assembly**



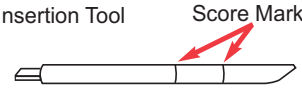
patent pending

2 **Complete Installation Kit**



a) Insertion Tool

Score Marks



b)

Thumb Set Screw

Locking Collar



Parts List

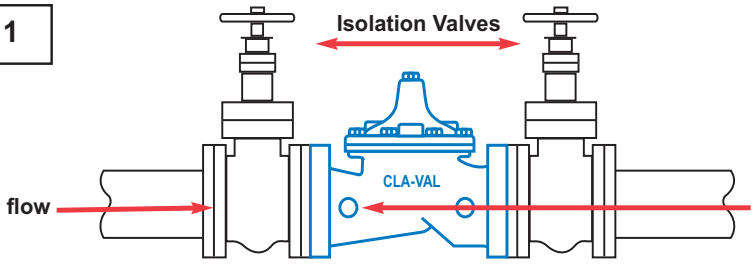
1) X144 e-FlowMeter Assembly with 20 foot cable
2) Installation Kit containing:
   a) Insertion Tool
   b) Locking Collar with Thumb Set Screw (a and b come assembled)

Installation Kit Part Numbers:

Small (2.5" - 6" + 8" reduced Port): 208450-21K
Large (8" Full Port - 16"): 208450-20A

Step-By-Step X144 e-FlowMeter Installation Instructions

1

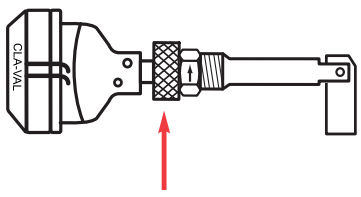


Step 1: Take necessary safety precautions

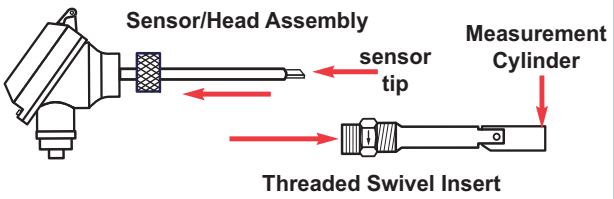
- Isolate the control valve using main line isolation valves
- Bleed pressure from valve before removing body plug
- Remove an inlet body plug

NOTE: If both inlet body tappings are used for the pilot system, consult factory for correct modification instructions.

2

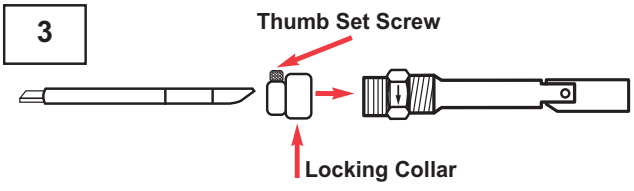


Step 2A:
Loosen Knurled Lock Nut on e-FlowMeter Assembly

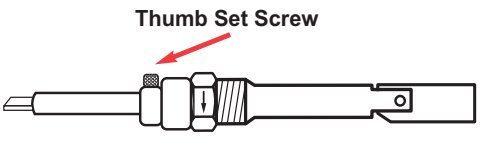


Step 2B: Pull apart. Straighten Measurement Cylinder by hand. Set aside Sensor/Head in safe location, protecting sensor tip

3

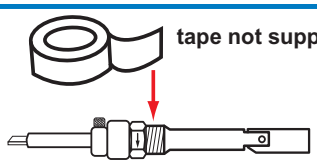


Step 3A: Screw Locking Collar on straight threads. Insert angled end of provided tool as shown, until it stops



Step 3B: Tighten Thumb Set Screw

4



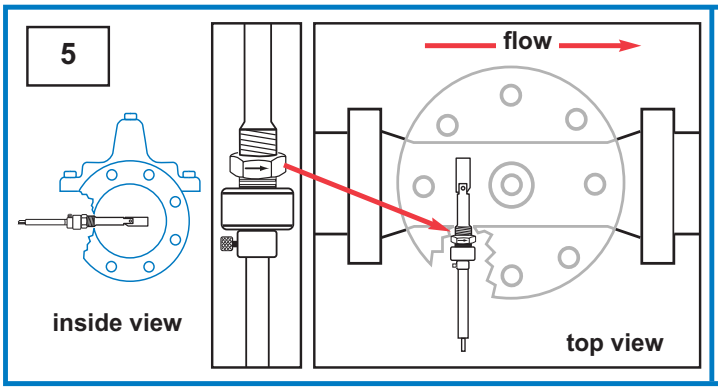


Step 4: Apply Teflon® tape to NPT Threads

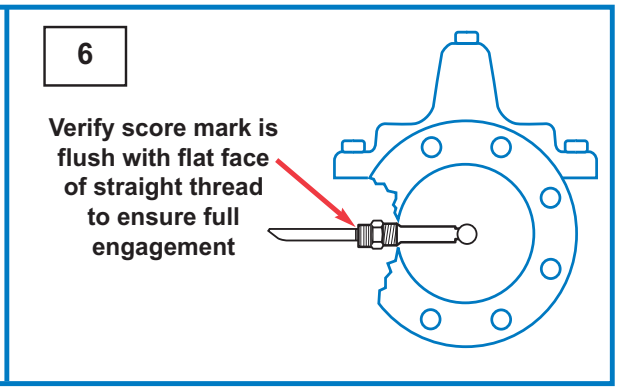
- Check threads on valve
- Use thread chasing tool (not supplied), if necessary

X144 e-FlowMeter
Quick Start Installation & Removal Instructions

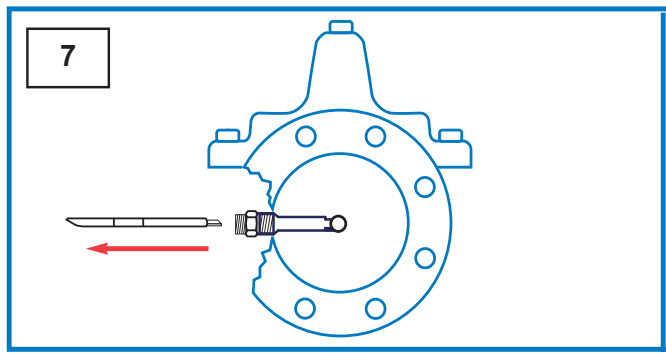
Step-By-Step X144 e-FlowMeter Installation Instructions (continued)



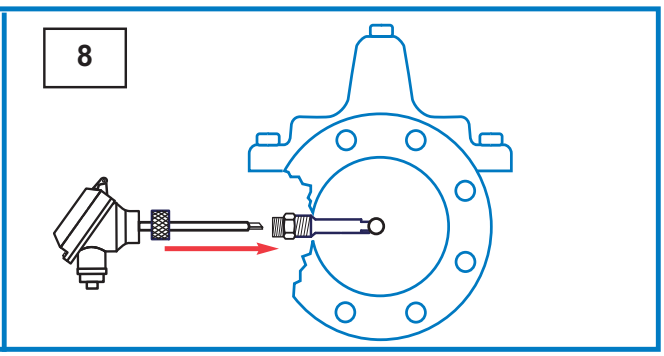
Step 5: Insert straightened Swivel Insert/Measurement Cylinder Assembly into valve, orient arrow on wrench flat to point downstream



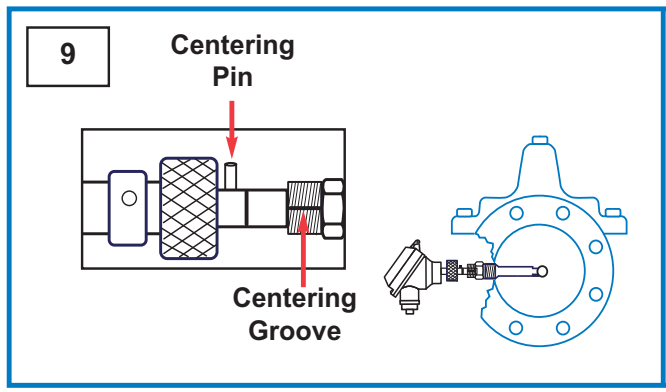
Step 6: Loosen Thumb Set Screw. Remove Locking Collar from tool. Remove tool and re-insert opposite end into Swivel Assembly. Engage the tool and push firmly to orient Measurement Cylinder 90˚ into flow path



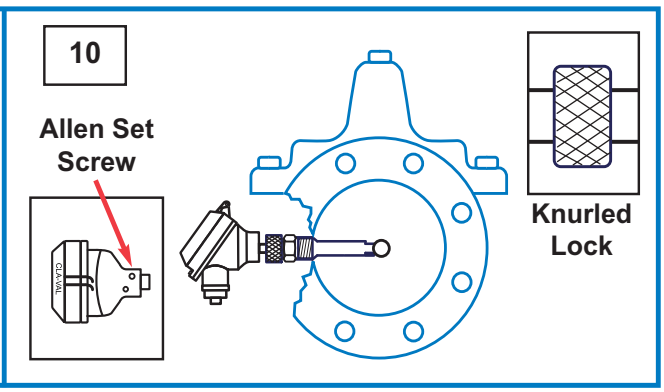
Step 7: Remove tool from Threaded Swivel Insert



Step 8: Insert tip of e-FlowMeter Sensor/Head Assembly into Threaded Swivel Insert



Step 9: Line-Up Centering Groove on straight threads with Centering Pin; push to seat o-ring

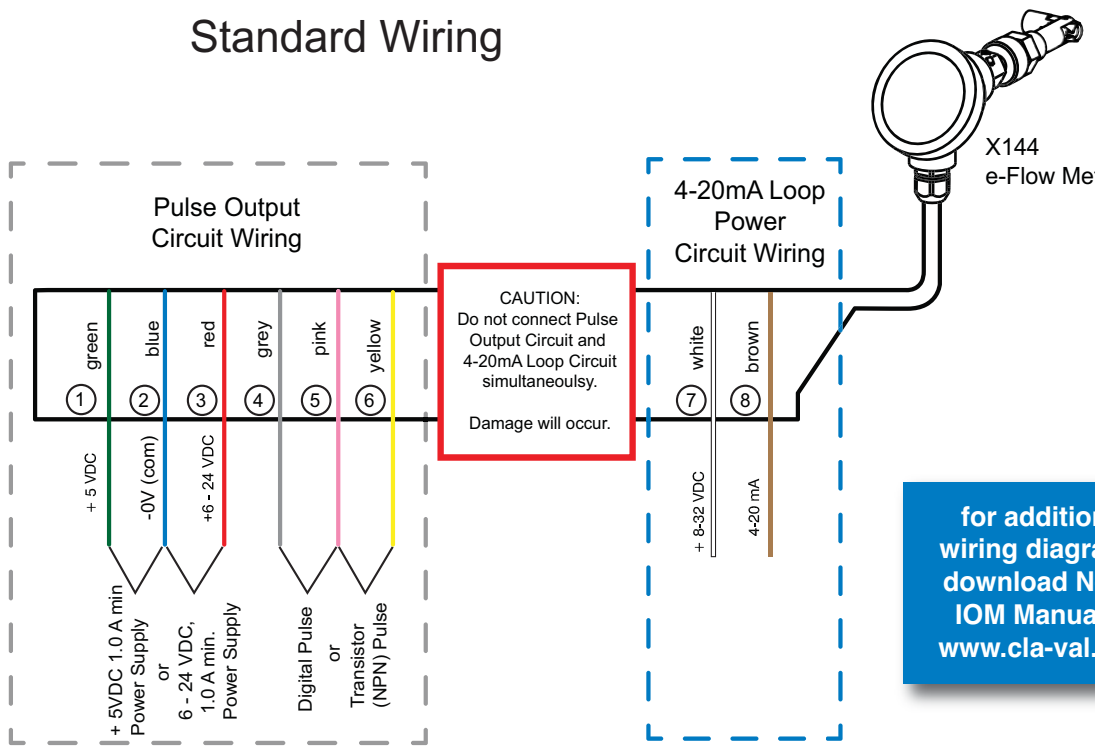


Step 10: HAND TIGHTEN Knurled Lock onto straight threads. Tighten Allen Set Screw with M3 Allen Wrench to lock Sensor Head Assembly.

Proceed in accordance with Wiring Diagram

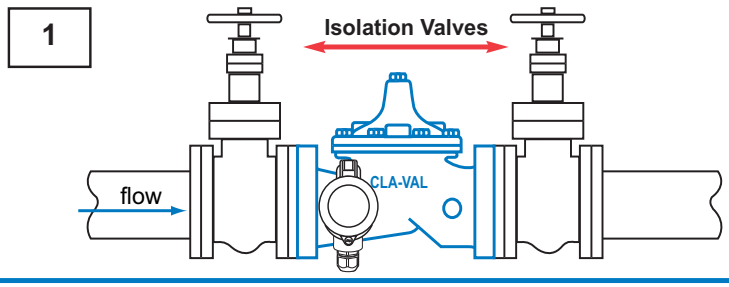
X144 e-FlowMeter
Quick Start Installation & Removal Instructions

Standard Wiring

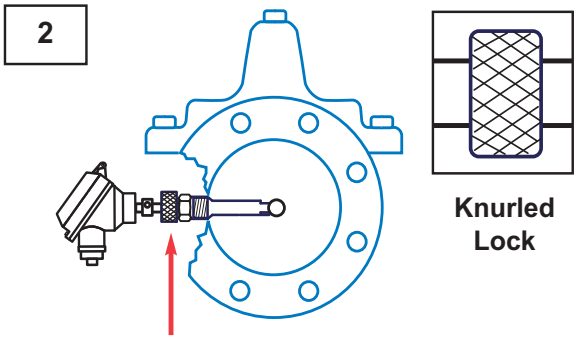


for additional wiring diagrams, download N-144 IOM Manual at www.cla-val.com

Step-By-Step X144 e-FlowMeter Removal Instructions



Step 1: Take necessary safety precautions
a) Isolate the control valve using main line isolation valves
b) Bleed pressure from valve before removing the e-FlowMeter
c) Disconnect power to all electronic devices on valve, including e-FlowMeter

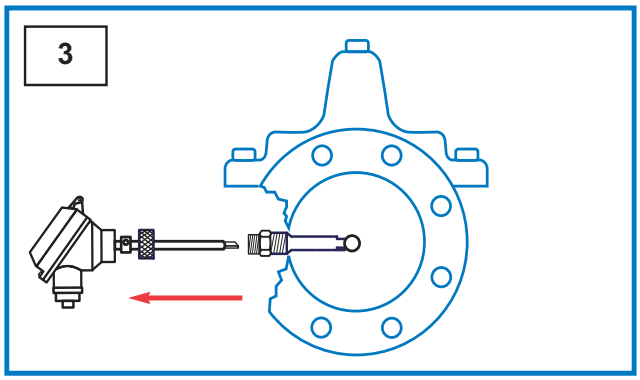


Step 2: After isolating the valve, bleeding pressure and disconnecting electronic devices, hand loosen the Knurled Lock from straight threads

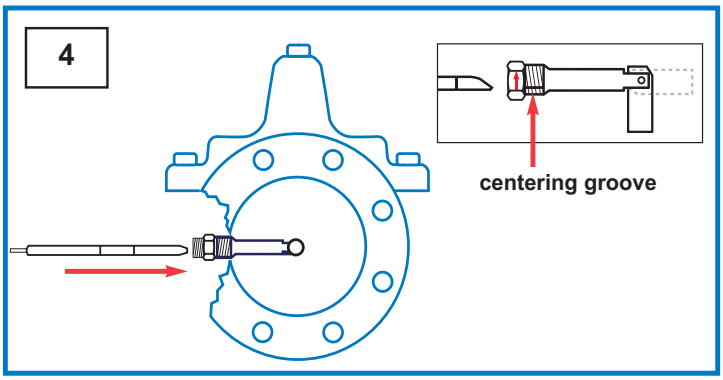
call 800.942.6326 for assistance or log-on to www.cla-val.com for more information

X144 e-FlowMeter
Quick Start Installation & Removal Instructions

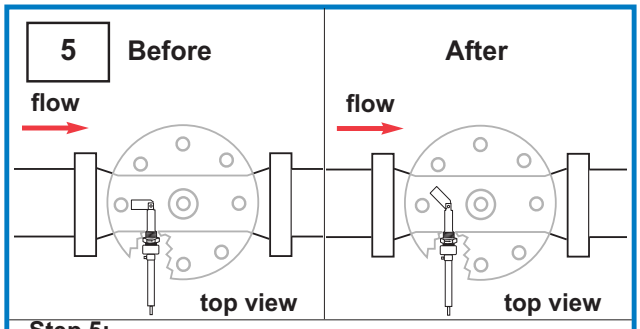
Step-By-Step X144 e-FlowMeter Removal Instructions (continued)



Step 3:
- Remove the e-FlowMeter Sensor/Head Assembly by pulling straight outward, being careful not to hit the sensor tip on the Threaded Swivel Insert tube
- Set Sensor/Head Assembly aside, taking care to protect the sensor tip



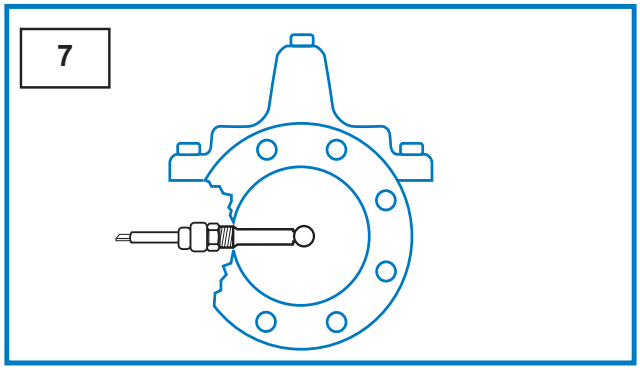
Step 4:
- Orient the Installation Tool so that the bevel is facing downstream, away from the centering groove as shown in detail drawing, and insert into the Threaded Swivel Insert



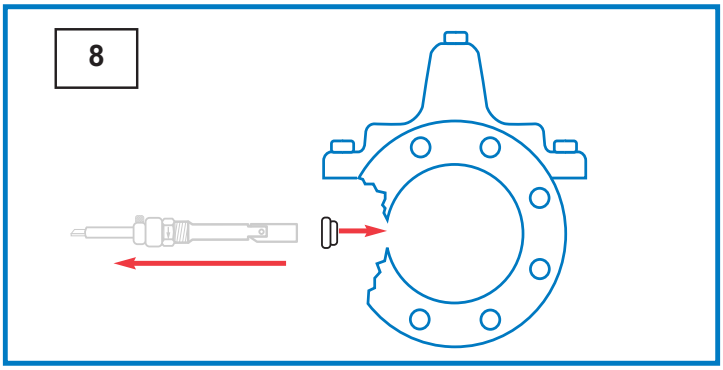
Step 5:
- Once inserted into the Threaded Swivel Insert tube, the Installation Tool will engage the top face of the Measurement Cylinder and force it to the 45° position, as shown above



Step 6:
- Slide Installation Tool straight out, then rotate 180° so that the bevel is facing upstream of the valve, which is now facing the same direction of the centering groove, see above
- The lip of the Installation Tool will engage the inside of the Measurement Cylinder as shown in photo



Step 7:
- Once engaged, use light force to straighten the measurement cylinder, and then secure the Installation Tool in place with Locking Collar in locked position



Step 8:
- Remove Threaded Swivel Insert from the valve tapping with the Measurement Cylinder straightened
- Insert body plug into tapping while servicing the e-FlowMeter

Cla-Val Product ID

HOW TO ORDER

PROPER IDENTIFICATION

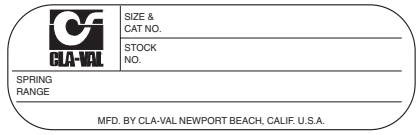
For ordering repair kits, replacement parts, or for inquiries concerning valve operation, it is important to properly identify Cla-Val products already in service by including all nameplate data with your inquiry. Pertinent product data includes valve function, size, material, pressure rating, end details, type of pilot controls used and control adjustment ranges.

IDENTIFICATION PLATES

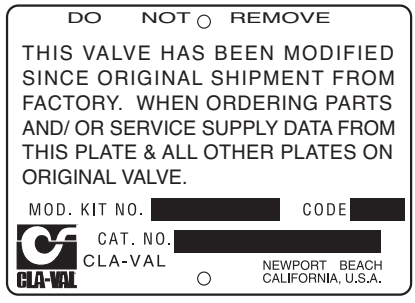
For product identification, cast-in body markings are supplemented by identification plates as illustrated on this page. The plates, depending on type and size of product, are mounted in the most practical position. **It is extremely important that these identification plates are not painted over, removed, or in any other way rendered illegible.**



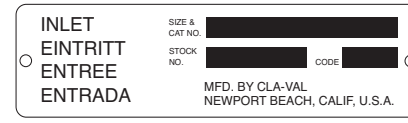
This brass plate appears on altitude valves only and is found on top of the outlet flange.



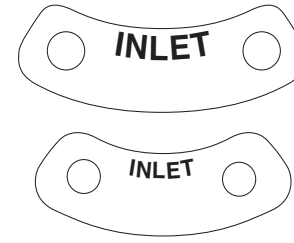
This tag is affixed to the cover of the pilot control valve. The adjustment range appears in the spring range section.



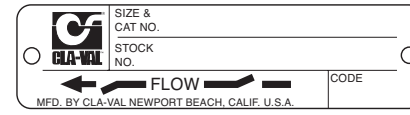
This aluminum plate is included in pilot system modification kits and is to be wired to the new pilot control system after installation.



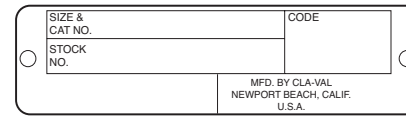
This brass plate appears on valves sized 21/2" and larger and is located on the top of the inlet flange.



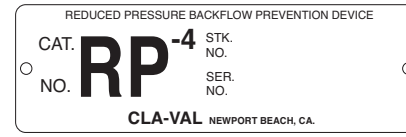
These two brass plates appear on 3/8", 1/2", and 3/4" size valves and are located on the valve cover.



These two brass plates appear on threaded valves 1" through 3" size or flanged valves 1" through 2". It is located on only one side of the valve body.



This brass plate is used to identify pilot control valves. The adjustment range is stamped into the plate.



This brass plate is used on our backflow prevention assemblies. It is located on the side of the Number Two check (2" through 10"). The serial number of the assembly is also stamped on the top of the inlet flange of the Number One check.

How to Order

Because of the vast number of possible configurations and combinations available, many valves and controls are not shown in published product and price lists. For ordering information, price and availability on product that are not listed, please contact your local Cla-Val office or our factory office located at:

P. O. Box 1325
Newport Beach, California 92659-0325
(949) 722-4800
FAX (949) 548-5441

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When Ordering, Please Specify

1. Model Number
2. Globe or Angle Pattern
3. Adjustment range (as application)
4. Valve Size
5. Threaded or Flanged
6. Body and Trim Materials
7. Optional Features
8. Pressure Class

Unless Otherwise Specified

- Globe or angle pattern are the same price
- Ductile iron body and bronze trim are standard
- X46 Flow Clean Strainer or X43 "Y" Strainer are included
- CK2 Isolation Valves are included in price on 4" and larger valve sizes (6" and larger on 600 Series)

Limited Warranty

Automatic valves and controls as manufactured by Cla-Val are warranted for three years from date of shipment against manufacturing defects in material and workmanship that develop in the service for which they are designed, provided the products are installed and used in accordance with all applicable instructions and limitations issued by Cla-Val. Electronic components manufactured by Cla-Val are warranted for one year from the date of shipment.

We will repair or replace defective material, free of charge, that is returned to our factory, transportation charges prepaid, if upon inspection, the material is found to have been defective at time of original shipment. This warranty is expressly conditioned on the purchaser's providing written notification to Cla-Val immediate upon discovery of the defect.

Components used by Cla-Val but manufactured by others, are warranted only to the extent of that manufacturer's guarantee.

This warranty shall not apply if the product has been altered or repaired by others, Cla-Val shall make no allowance or credit for such repairs or alterations unless authorized in writing by Cla-Val.

Disclaimer of Warranties and Limitations of Liability

The foregoing warranty is exclusive and in lieu of all other warranties and representations, whether expressed, implied, oral or written, including but not limited to any implied warranties or merchantability or fitness for a particular purpose. All such other warranties and representations are hereby canceled.

Cla-Val shall not be liable for any incidental or consequential loss, damage or expense arising directly or indirectly from the use of the product. Cla-Val shall not be liable for any damages or charges for labor or expense in making repairs or adjustments to the product. Cla-Val shall not be liable for any damages or charges sustained in the adaptation or use of its engineering data and services. No representative of Cla-Val may change any of the foregoing or assume any additional liability or responsibility in connection with the product. The liability of Cla-Val is limited to material replacements F.O.B. Newport Beach, California.

Terms of Sale

ACCEPTANCE OF ORDERS
All orders are subject to acceptance by our main office at Newport Beach, California.

CREDIT TERMS
Credit terms are net thirty (30) days from date of invoice.

PURCHASE ORDER FORMS
Orders submitted on customer's own purchase order forms will be accepted only with the express understanding that no statements, clauses, or conditions contained in said order form will be binding on the Seller if they in any way modify the Seller's own terms and conditions of sales.

PRODUCT CHANGES
The right is reserved to make changes in pattern, design or materials when deemed necessary, without prior notice.

PRICES
All prices are F.O.B. Newport Beach, California unless expressly stated otherwise on our acknowledgment of the order. Prices are subject to change without notice. The prices at which any order is accepted are subject to adjustment to the Seller's price in effect at the time of shipment. Prices do not include sales, excise, municipal, state or any other Government taxes. Minimum order charge $100.00.

RESPONSIBILITY
We will not be responsible for delays resulting from strikes, accidents, negligence of carriers, or other causes beyond our control. Also, we will not be liable for any unauthorized product alterations or charges accruing there from.

RISK
All goods are shipped at the risk of the purchaser after they have been delivered by us to the carrier. Claims for error, shortages, etc., must be made upon receipt of goods.

EXPORT SHIPMENTS
Export shipments are subject to an additional charge for export packing.

RETURNED GOODS
1. Customers must obtain written approval from Cla-Val prior to returning any material.
2. Cla-Val reserves the right to refuse the return of any products.
3. Products more than six (6) months old cannot be returned for credit.
4. Specially produced, non-standard models cannot be returned for credit.
5. Rubber goods such as diaphragms, discs, o-rings, etc., cannot be returned for credit, unless as part of an unopened vacuum sealed repair kit which is less than six months old.
6. Goods authorized for return are subject to a 35% ($100 minimum) restocking charge and a service charge for inspection, reconditioning, replacement of rubber parts, retesting, repainting and repackaging as required.
7. Authorized returned goods must be packaged and shipped prepaid to Cla-Val, 1701 Placentia Avenue, Costa Mesa, California 92627.

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Model **Repair Kits**

Model 100-01 Hytrol Main Valve

BUNA-N MATERIAL				
	RUBBER KIT STOCK #	REPAIR KIT STOCK #	REBUILD ASSEMBLY STOCK #	STUD & NUT KIT STOCK #
3/8"	9169801K		21176614B	21176633J
1/2"	9169802H	21176602F	21176615A	21176634H
3/4"	9169802H	21176602F	21176615A	21176634H
1" Non-Guided	9169803F	21176601G	21176616K	21176636F
1"	9169804D	21176603E	21176617J	21176636F
1 1/4"	9169804D	21176603E	21176617J	21176636F
1 1/2"	9169804D	21176603E	21176617J	21176636F
2"	9169805A	21176608K	21176618H	21176637E
2 1/2"	9169811J	21176609J	21176619G	21176638D
3"	9169812G	21176604D	21176620D	21176639C
4"	9169813E	21176605C	21176621C	21176640K
6"	9169815K	21176606B	21176622B	21176641J
8"	9817901D	21176607A	21176623A	21176642H
10"	9817902B	21176610F	21176654C	21176643G
12"	9817903K	21176611E	21176625J	21176644F
14"	9817904H	21176612D	21176626H	21176645E
16"	9817905E	21176613C	21176627G	21176645E

Model 100-20 Hytrol Main Valve

BUNA-N MATERIAL				
	RUBBER KIT STOCK #	REPAIR KIT STOCK #	REBUILD ASSEMBLY STOCK #	STUD & NUT KIT STOCK #
3"	9169805A	21176608K	21176618H	21176637E
4"	9169812G	21176604D	21176620D	21176639C
6"	9169813E	21176605C	21176621C	21176640K
8"	9169815K	21176606B	21176622B	21176641J
10"	9817901D	21176607A	21176623A	21176642H
12"	9817902B	21176610F	21176624K	21176643G
14"	9817903K	21176611E	21176625J	21176644F
16"	9817903K	21176611E	21176625J	21176644F

Model 100-30 Hytrol Main Valve

BUNA-N MATERIAL		
	RUBBER KIT STOCK #	REBUILD ASSEMBLY STOCK #
2 1/2"	21112704H	21235401C
3"	21112702K	21235402B
4"	21112703J	21235403A
6"	27496886J	21235404K
8"	21112701A	21235405J
10"	CF	21235406H

Rubber Kit Includes: Diaphragm, Disc, Spacer Washers. **Model 100-30 also includes:** Stem O-Ring, Seal, Bearing O-Ring.

Repair Kit Includes: Diaphragm, Disc, Spacer Washers, Epoxy Coated Disc Retainer, Epoxy Coated Diaphragm Washer, Protective Washer

Rebuild Assembly Includes: Diaphragm, Disc, Spacer Washers, Epoxy Coated Disc Retainer, Epoxy Coated Diaphragm Washer, Protective Washer, Stainless Steel Bolts & Washers (6" & Below), Stainless Steel Studs, Nuts, & Washers (8" & Above), Stem, Stem Nut, Disc Guide, Standard Cover Spring, Cover Washer. **Model 100-30 also includes:** Upper and Lower Stem and Stem Nut, Stem O-Ring, Seal, Lower Spring, PU Bearing, Bearing O-Ring, Bearing Retainer Ring.

Stud & Nut Kit Includes: Stainless Steel Bolts & Washers (6" & Below), Stainless Steel Studs, Nuts, & Washers (8" & Above)

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Consult factory for larger sizes

Repair Kits for 100-02/100-21 Powertrol and 100-03/100-22 Powercheck Main Valves
For: Powertrol and Powercheck Main Valves—**150 Pressure Class Only**
Includes: Diaphragm, Disc (or Disc Assembly) and O-rings and full set of spare Spacer Washers.

Valve Size	Kit Stock Number	Valve Size	Kit Stock Number	
	100-02		100-02 & 100-03	100-21 & 100-22
3/8″	9169901H	2 1/2″	9169910J	N/A
1/2″ & 3/4″	9169902F	3″	9169911G	9169905J
1″	9169903D	4″	9169912E	9169911G
1 1/4″ & 1 1/2″	9169904B	6″	9169913C	9169912E
2″	9169905J	8″	9169950E	9169913C
		10″	9169939H	9169950E
		12″	9169937B	9169939H
				Consult factory for larger sizes

Repair Kits for 100-04/100-23 Hy-Check Main Valves
For: Hy-Check Main Valves—**150 Pressure Class Only**
Includes: Diaphragm, Disc and O-Rings and full set of spare Spacer Washers.

Valve Size	Kit Stock Number		Valve Size	Kit Stock Number	
	100-04	100-23		100-04	100-23
4″	20210901B	N/A	12″	20210905H	20210904J
6″	20210902A	20210901B	14″	20210906G	N/A
8″	20210903K	20210902A	16″	20210907F	20210905H
10″	20210904J	20210903K	20″	N/A	20210907F
			24″	N/A	20210907F
					Consult factory for larger sizes

Repair Kits for Pilot Control Valves (In Standard Materials Only)
Includes: Diaphragm, Disc (or Disc Assembly), O-Rings, Gaskets or spare Screws as appropriate.

BUNA-N® (Standard Material)				**VITON** (For KB Controls)	
Pilot Control	**Kit Stock Number**	**Pilot Control**	**Kit Stock Number**	**Pilot Control**	**Kit Stock Number**
CDB	9170006C	CFM-7A	1263901K	CDB-KB	9170012A
CDB-30	9170023H	CFM-9	12223E	CRA-KB	N/A
CDB-31	9170024F	CRA (w/bucking spring)	9170001D	CRD-KB (w/bucking spring)	9170008J
CDB-7	9170017K	CRD (w/bucking spring)	9170002B	CRL-KB	9170013J
CDH-2	18225D	CRD (no bucking spring)	9170003K	CDHS-2BKB	9170010E
CDHS-2	44607A	CRD-18	20275401K	CDHS-2FKB	9170011C
CDHS-2B	9170004H	CRD-22	98923G	CDHS-18KB (no bucking spring)	9170009G
CDHS-2F	9170005E	CRL (55F, 55L)	9170007A	102C-KB	1726202D
CDHS-3C-A2	24657K	CRL60/55L-60	9170033G		
CDHS-8A	2666901A	CRL60/55L60 1"	9170042H		
CDHS-18	9170003K	CRL-4A	43413E		
CDS-4	9170014G	CRL-5 (55B)	65755B		
CDS-5	14200A	CRL-5A (55G)	20666E		
CDS-6	20119301A	CRL-18	20309801C		
CDS-6A	20349401C	Universal CRL	9170041K		
CDS-7	20349402B	CV	9170019F		
CDS-7DO	20349403A	X105L (O-ring)	00951E	Buna-N®	
CFCM-M1	1222301C	102B-1	1502201F		
CFM-2	12223E	102C-2	1726201F	CRD Disc Ret. (Solid)	C5256H
CFM-7	1263901K	102C-3	1726201F	CRD Disc Ret. (Spring)	C5255K

Repair Assemblies (In Standard Materials Only)

Control	Description	Stock Number
CF1-C1	Pilot Assembly Only	89541H
CF1-CI	Complete Float Control less Ball and Rod	89016A
CFC2-C1	Disc, Distributor and Seals	2674701E
CSM 11-A2-2	Mechanical Parts Assembly	97544B
CSM 11-A2-2	Pilot Assembly Only	18053K
33A 1″	Complete Internal Assembly and Seal	2036030B
33A 2″	Complete Internal Assembly and Seal	2040830J

When ordering, please give complete nameplate data of the valve and/or control being repaired. MINIMUM ORDER CHARGE APPLIES

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