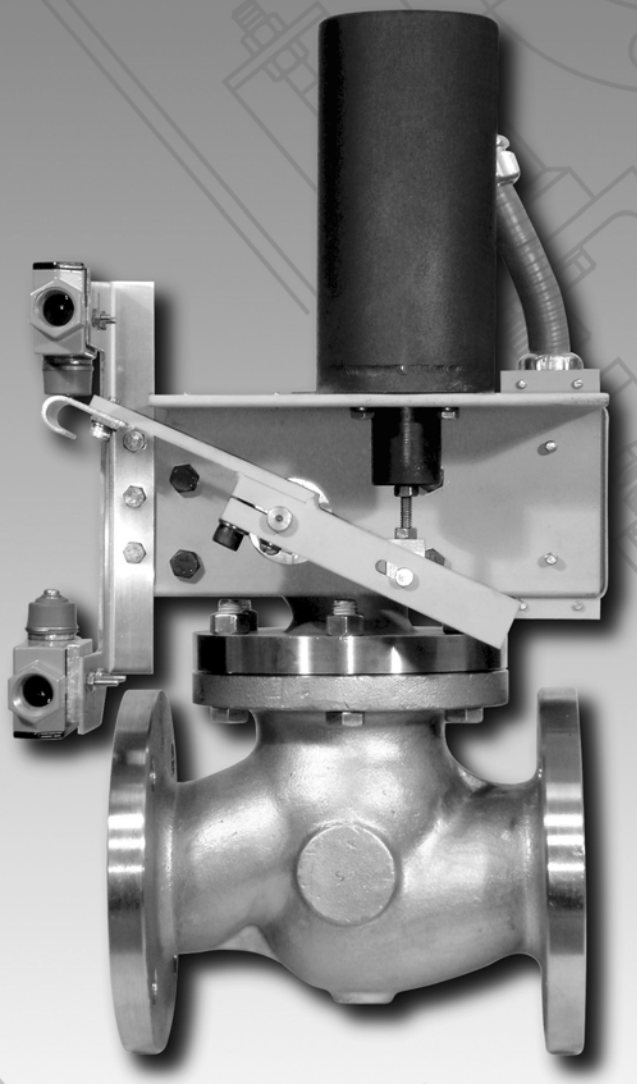
CLARK - COOPER DIV.
MAGNATROL VALVE CORPORATION
STANDARD & HIGH PRESSURE SOLENOID VALVES

ROTARY SHAFT STYLE SOLENOID VALVES



Installation, Operation and Maintenance Manual

Controls The Flow Of:

- Extremely Corrosive Fluids
- Dirty Or Viscous Liquids
- Cryogenics
- High Temperature Liquids & Gases

Technical Manual ER – 4.0

General Information about valve sizing:

Valves with a “Full Port” have an internal seat diameter that is the same as the nominal pipe size, i.e. a 1 inch pipe size valve with a full port has a 1 inch diameter seat. Valves with a “Reduced Port” have an internal seat diameter that is smaller than the nominal pipe size.

The valve’s flow coefficient, Cv, is a value that is determined by flow testing for each valve size. Full port valves will have a higher Cv than reduced port valves. The Cv rating for each valve is listed in the tables found in the valve catalog.

The definition of Cv is the # of gallons of water that will flow through the valve with a 1 PSI pressure differential when the valve is open.

The equations below can be used to determine:

- Flow Rate, given the Cv and ΔP
- Cv, given the Flow Rate and ΔP
- ΔP, given the Flow Rate and Cv

Cv = Valve’s flow coefficient (dimensionless value)
S = Specific Gravity (1.0 for air or water)
T = Absolute Temperature in °R (°R = °F + 460)
P_1 = Inlet Pressure in PSIG
ΔP = Pressure Differential in PSI across valve in the open position
V = Specific Volume in Cubic Feet per Pound

For Liquids:

A

$$GPM = Cv\sqrt{\frac{\triangle P}{S}}$$

B

$$Cv = GPM\sqrt{\frac{S}{\triangle P}}$$

C

$$\triangle P = \left(\frac{GPM}{Cv}\right)^2 (S)$$

For Air and Gasses:

A

$$SCFH = 1360\ Cv\sqrt{\frac{(P_1 + 15)\triangle P}{T\ S}}$$

B

$$Cv = \frac{SCFH}{1360}\sqrt{\frac{T\ S}{(P_1 + 15)\triangle P}}$$

C

$$\triangle P = \left(\frac{T\ S}{P_1 + 15}\right)\left(\frac{SCFH}{1360\ Cv}\right)^2$$

For Steam:

A

$$LB/HR. = 63\ Cv\sqrt{\frac{\triangle P}{V}}$$

B

$$Cv = \frac{LB/HR.}{63}\sqrt{\frac{V}{\triangle P}}$$

C

$$\triangle P = (V)\left(\frac{LB/HR.}{63\ Cv}\right)^2$$

Installation: Before installing the valve, make sure the operating pressure, service and electrical requirements are compatible with your installation. Never apply incompatible fluids or exceed the pressure and temperature rating of the valve. Valve should be installed and maintained by qualified personnel only.

IMPORTANT: Before installing the valve, be sure the system is clean and free from debris that may become lodged inside the valve preventing proper operation.

Valve Orientation:

Many Clark-Cooper valves are customized for specific applications. Unless otherwise indicated, Rotary Shaft Style Solenoid Valves are designed to operate in a horizontal pipeline with the solenoid vertical and upright.

The arrow on the valve body indicates the direction of flow.

Pipelines need to be properly supported to prevent strains on the valve body.

IMPORTANT: To protect pilot operated valve internals and ensure trouble free operation, install a suitable strainer or filter on the inlet side as close to the valve as possible. Follow manufacturer's recommendations for installation and maintenance. ♦ Note: Direct operated valves do not require a filter or strainer.

End Connections:

Female Pipe Thread: The use of Teflon® tape, or other appropriate thread sealant, on all pipe thread connections is recommended. Care must be taken to prevent excess tape from entering the valve. Always use the hexagonal portion of the valve body casting when applying torque or clamping. Never apply torque or pressure to other areas of the valve.

Welded End: It is recommended that any end connection requiring welding be performed with the valve internals removed from the valve body. Damage to the seals inside of the valve may occur if temperature rises above 550°F. If necessary, the body may be wrapped with a water soaked rag to help dissipate heat. Ensure that any slag or debris is not allowed to enter the valve.

Flanged, Union or other type end connection: Always use appropriately rated, mating end connections when connecting to the valve. Any seals or gaskets should be made from materials compatible with the fluid or valve service.

Electrical Connections:

Wiring, conduit and conduit connections must comply with National and Local Electrical Codes, as appropriate.

Solenoids that are rated as explosion-proof and are being installed in a hazardous atmosphere must have an explosion-proof, conduit isolation fitting installed no more than 6 inches from the solenoid's conduit connection.

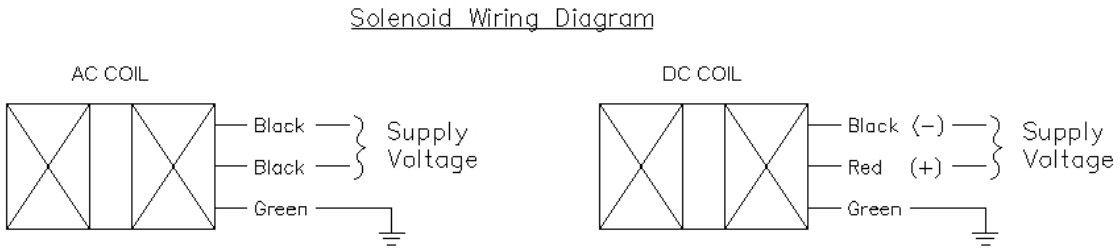
The standard solenoid enclosure has a 1/2" FNPT conduit connection. The solenoid may be rotated in 90° increments to facilitate wiring connections. Simply remove the (4) solenoid mounting bolts located on the underside of the bracket, rotate the solenoid to the desired position, then insert the mounting bolts and tighten to secure the solenoid.

Lead wires supplied with the solenoid are a minimum of 18" long. The wire gauge size is determined by the solenoid's power requirements and is a minimum of 18 AWG. The wire used to connect to the power source should be the same or heavier gauge wire size as the lead wires.

Unless otherwise indicated, all solenoids are designed to operate at ± 10% of the nominal voltage. Check the valve nameplate for specific voltage and amperage requirements.

Fuses or circuit breakers are recommended and should be sized according to the inrush amperage and holding amperage requirements of the solenoid (see nameplate or contact the factory, phone: 856-829-4580, email: techsupport@clarkcooper.com).

Wiring diagram:



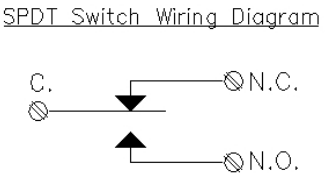
CAUTION: During normal operation, the solenoid can become hot. DO NOT touch solenoid during operation. Allow to cool before handling.

Position Indicating Switches:

Valves can be supplied with position indicating switches. Many Clark-Cooper valves are customized for specific applications, including switches. See the switch nameplate for specific information. Information for the most commonly used switches is shown below.

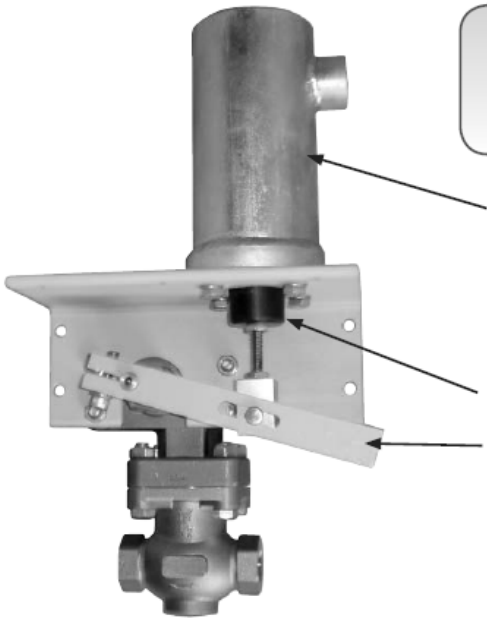
Model	Description	Electrical Rating
EX-AR & OP-AR	Roller arm, CW actuation, SPDT	UL & CSA Listed: L96*
EX-AR30 & OP-AR30	Roller arm, CCW actuation, SPDT	UL & CSA Listed: L96*

* 15 amps, 125, 250 or 480 VAC; 1/8 Hp, 125 VAC; 1/4 Hp, 250 VAC; 1/2 amp, 125 VDC; 1/4 amp, 250 VDC



IMPORTANT: After the valve has been installed, it is recommended to cycle the valve dry and under normal operating conditions to allow the seals to properly seat under pressure.

General Information:



BASIC OPERATION:
When the Solenoid is energized, the Plunger pulls the External Lever upwards. The lever rotates the Rotary Shaft, which penetrates the valve's pressure boundary, to open or close the Piston Assembly.

The **Solenoid** is completely isolated from the process fluid allowing the valve to easily handle extremely corrosive and/or high temperature fluids.

- ***Continuous Duty, Encapsulated Coil with Class H Insulation***
- ***NEMA 4X - Watertight and Corrosion Resistant Enclosure***
- ***Certified Explosion-proof Enclosure for Hazardous Atmospheres***

The **Plunger** is Teflon® coated to provide superior corrosion resistance.

The **External Lever** provides visual position indication and manual override.

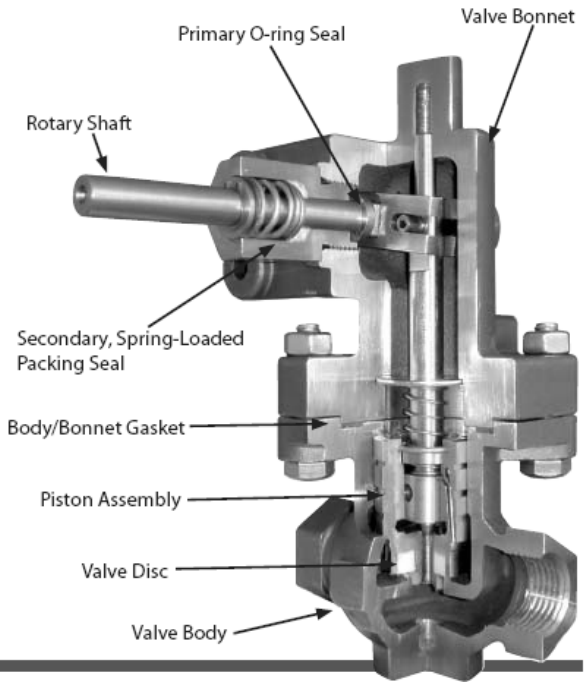
ROTARY SHAFT ASSEMBLY: The Rotary Shaft Assembly has a primary o-ring seal and a secondary, spring-loaded packing seal, providing zero leakage to the environment.

The rotary shaft rotates approximately 20° to 30° to open and close the Piston Assembly inside the valve, virtually eliminating seal wear.

PISTON ASSEMBLY: The Piston Assembly is directly connected to the Rotary Shaft Assembly allowing all valves to operate from 0 PSI up to the valve's rated pressure.

The ***Direct Operated Piston Assembly*** uses a solid piston with large clearance areas to easily accommodate dirty or viscous liquids.

The ***Direct Operated, Pilot Assisted Piston Assembly*** (shown here) uses an internal pilot orifice that assists the piston by relieving the pressure above it, thus accommodating higher pressures and/or larger pipe sizes.



All Rotary Shaft Style Solenoid Valves are designed to operate with the fluid flowing in one direction. Fluid flows into the valve above the seat and out of the valve below the seat. The valve will not prevent fluid from flowing in the reverse direction.

Maintenance and Repairs:

It is recommended to periodically inspect the valve to insure that it is operating properly.

If the valve is not functioning properly, it can be returned to the factory for a complete failure analysis. Upon authorization, the valve will be restored to "like new" condition.

The valve can also be repaired by qualified personnel in a properly equipped workshop. In many instances, the valve can be repaired while it is still installed in the pipeline.

DANGER: NEVER ATTEMPT TO DIS-ASSEMBLE A VALVE THAT IS UNDER PRESSURE. THIS MAY RESULT IN SERIOUS INJURY AND/OR DEATH.

These repair and maintenance instructions should be used as a guide. Many Clark-Cooper valves are customized for specific applications. Therefore, these instructions may not provide all the necessary information required to properly service all models.

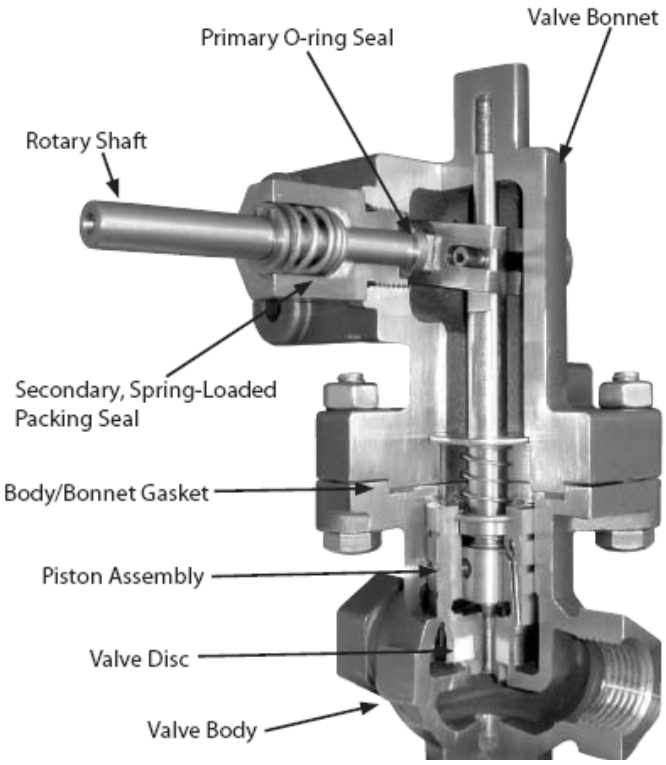
Solenoid Replacement:

The solenoid is the only item that can be replaced while the valve is under pressure.

1. Disconnect the solenoid from the power supply.
2. Remove the (4) solenoid mounting bolts located on the underside of the bracket.
3. Remove the solenoid by lifting it straight upwards and replace with new solenoid.
4. Position the conduit connection as necessary.
5. Insert the mounting bolts and tighten to secure the solenoid.
6. Reconnect the power supply.

Piston Assembly Replacement:

1. Lock out pressure to the valve. The valve inlet and outlet **MUST BE** at atmospheric pressure (0 PSIG) prior to servicing the valve.
2. Disconnect the solenoid from the power supply.
3. Remove the Body/Bonnet bolts.
4. While holding the lever to keep the valve in the open position, carefully lift the entire bracket and bonnet straight upwards off the valve body. The piston assembly should remain engaged in the bonnet assembly and be lifted out of the valve body.
5. Rotate the lever to dis-engage the piston assembly pin from the clevis inside the bonnet. Ref. Figure 1 on next page.
6. Install the new piston assembly making sure that the pin is fully engaged with the clevis and the top of the piston stem is inserted into the guide hole located inside the top of the bonnet.
7. Replace the body/bonnet gasket located in the top of the valve body.
8. While holding the lever to keep the valve in the open position, carefully lower the entire bracket and bonnet straight down onto the valve body. The piston assembly should slide easily into the valve body.
9. Insert the body/bonnet bolts and tighten.
10. Reconnect the power supply.



Rotary Shaft Assembly Replacement:

1. Lock out pressure to the valve. The valve inlet and outlet **MUST BE** at atmospheric pressure (0 PSIG) prior to servicing the valve.
2. Disconnect the solenoid from the power supply.
3. Measure the location of the plunger in relation to the bracket when the valve is fully closed. Ref. Figure 2.
4. The lever is attached to the rotary shaft with a clamping screw and a set screw. Ref. Figure 3. Remove both of these screws and the lever assembly.
5. If possible, place the valve on its side with the shaft pointing up. Unscrew the packing gland nut from the bonnet and carefully remove the rotary shaft assembly.
6. Install the new rotary shaft assembly into the bonnet. The square portion of the shaft must fit inside the square opening of the clevis and the round portion into the guide hole inside the back of the bonnet. Then tighten the packing gland nut.
7. Position the lever onto the shaft. Tighten the clamping screw just enough to rotate the shaft so that the valve is in the fully closed position, then loosen it again. Without rotating the shaft, position the lever so that the plunger is at the same location that was measured earlier. Then tighten the clamping screw.
8. Drill through the shaft to install the set screw that was removed earlier and tighten.
9. Reconnect the power supply.

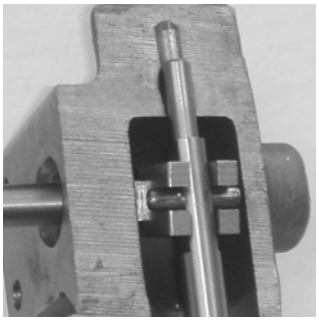


Figure 1 – Clevis engaged with the piston stem pin.

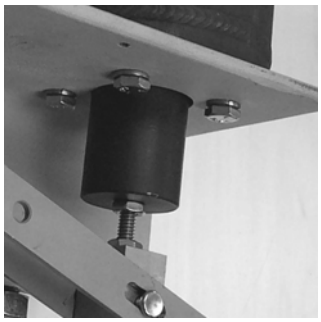


Figure 2 – Solenoid plunger and lever connection

Figure 3 – Lever and rotary shaft connection.

REQUEST FOR QUOTE

We appreciate the opportunity to quote on your requirements.

For immediate quote: Fill in the information below and CALL 856-829-4580
For same day quote: Fill in the information below and FAX to 856-829-7303
For next day quote: Email your requirements to techsupport@clarkcooper.com or use the Request For Quote form on our website www.clarkcooper.com

YOUR COMPANY INFORMATION

Date: _____

Name: _____ Dept. or Title: _____

Company: _____ Phone: _____

Address: _____ Fax: _____

City: _____ State: _____ Zip: _____ Email: _____

Type of Business: ❑ Resale / Distributor ❑ OEM ❑ End User

VALVE INFORMATION

Quantity: _____ Requested Delivery: _____

Valve Type: ER Series ❑ 2-Way or ❑ 3-Way

❑ Fully Electric *or* ❑ Electrically Tripped *or* ❑ Trips on Loss of Power *or* ❑ Heat Actuated _____°F

2-Way Flow Designation: *(check one)*
❑ Normally Closed (Energize to Open) *or* Trips Closed (Manually Reset Open)
❑ Normally Open (Energize to Close) *or* Trips Open (Manually Reset Closed)

3-Way Flow Designation: *(check one)*
❑ Supply Normally Closed (Vent Open) ❑ Supply Normally Open (Vent Closed)
❑ Diverting - 1 Inlet, 2 Outlets ❑ Selecting - 2 Inlets, 1 Outlet

Valve Features

Pipe Size: _____

End Connection: ❑ NPT ❑ 150#FL ❑ 300#FL
❑ Other: _____

Body/Bonnet Material: _____

Piston/RS Material: _____

Valve Disc/Seal Material: _____

Solenoid Features

Voltage: ❑ AC _____ Volts ____ Hz
❑ DC _____ Volts

Enclosure Construction:

❑ Watertight ❑ Explosion Proof

❑ Other: _____

Operating Conditions

Fluid: _____

Max. Op. Press. Diff.: _____

Fluid Temp: _____

Viscosity: _____

Flow Rate or C_v: _____

Max. Press. Drop: _____

Ambient Temp: _____

Options / Application Notes: _____

_____

_____

CONTACT INFORMATION

CLARK-COOPER DIVISION, MAGNATROL VALVE CORPORATION

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