HPS® Electromagnetic Cv Valve

Operation and Maintenance Manual

HPS® Electromagnetic Cv Valve

July, 2003
Part # 100012234 Revision A

Part # CV_ _ - _ _ _ _ - _ _ _ _ _ - _ _ _ _

Please fill in the valve part and flange type numbers in the space above and have them readily available when calling for service or additional information.

(The part number can be found on your packing slip. Both the part number and serial number are located on the bottom side of the housing.)

For more information or literature, contact:

HPS® Products of MKS Instruments, Inc.
5330 Sterling Drive
Boulder, CO 80301 USA

Phone: 1- 303-449-9861
1-800-345-1967

Fax: 1-303-442-6880

Web: www.mksinst.com/hpshome.html

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Package Contents

Before unpacking the HPS® Electromagnetic Cv (ECv) valve, check all surfaces of the packing material for shipping damage.

Confirm that the electromagnetic Cv valve package contains these items:

- One HPS® Electromagnetic Cv valve
- One *HPS® Electromagnetic Cv Valve Operation and Maintenance Manual*

Inspect the components for visible evidence of damage during shipment. If anything has been damaged, notify the carrier immediately. Keep all shipping materials and packaging for claim verification.

If any items are missing from the package, call MKS Customer Service at 1-303-449-9861 or 1-800-345-1967.

Do not return the product to MKS unless specified to do so by MKS Customer Service.

MKS customer service and support:

MKS Instruments, Inc. 5330 Sterling Dr. Boulder, CO 80301 USA	Telephone Toll-Free Facsimile	1-303- 449-9861 1-800-345-1967 (USA only) 1-303- 449-2003

Symbols Used in this Manual

CAUTION: Risk of electrical shock.

CAUTION: Refer to the manual. Failure to heed the message could result in personal injury, serious damage to the equipment, or both.

Calls attention to important procedures, practices, or conditions.

Safety Precautions

Do not substitute parts or modify instrument. Do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to an MKS Calibration and Service Center for service and repair to ensure that all of the safety features are maintained.

Allow only qualified technicians to service the electromagnetic Cv valve. Users should not remove covers, casing, or plug-in components. Injury may result. A qualified technician must perform any part replacement or internal adjustments.

Use safety precautions when using hazardous materials. If hazardous materials are used, users must take responsibility to observe the proper safety precautions and insure that the material used is compatible with those materials from which the valve is fabricated.

Install with flanges and fittings consistent with the valve. All flanges and fittings interfacing with the valve must be consistent with those on the valve. Assemble and tighten vacuum flanges according to standards and carefully check for leaks before operation. Solenoid wires should be properly grounded.

Keep intrusive materials away from the valve. Keep fingers, clothing, hair, and other intrusive materials away from the valve ports during operation. Do not operate in explosive atmospheres.

Keep the unit free of contaminants. Do not allow contamination of any kind to enter the unit before or during use. Contaminants such as dust, dirt, lint, glass chips, and metal chips may permanently damage the unit.

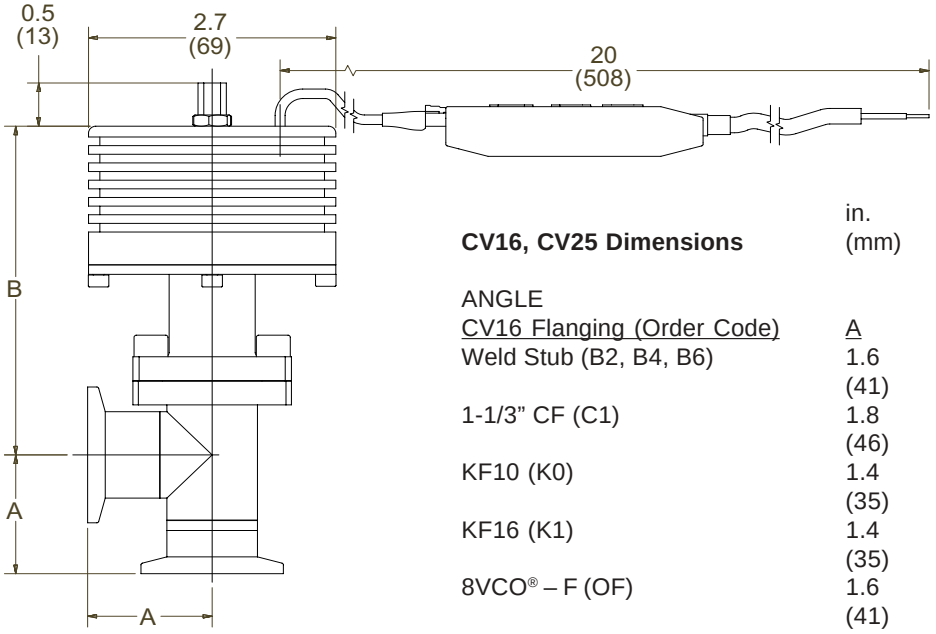
General Specifications

Voltage requirements	12VDC 24VDC		
Amperage requirements	12DC 24DC	2.7 A (initial) 1.4 A (initial)	0.6 A (running) 0.3 A (running)
Solenoid coil power	32 Watts (initial)		7 Watts (running)
Opening/closing response time	60 milliseconds		
Blow-by pressure	Normally Closed Normally Open		35 psi 50 psi
Vacuum range	Atmosphere to below 10^{-9} Torr		
Helium leak test	Less than $1x10^{-9}$ std cc/sec		
Typical valve weight	38.7 oz (1090 gm) (angle KF25 flanges)		
Wetted volume	1.09 in^3 (17.8 cm^3) (angle KF16 flanges)		
Operating temperature	-26°C to 60°C		
Maximum bakeout temperature	150°C (with solenoid coil removed)		
Life cycle	1,000,000 Cycles		
Orientation	Seals against atmosphere at either port		
Limit switch rating (single-pole, single-throw)	.5 A- 115 VAC .5 A- 24 VDC		

Chemical Exposure

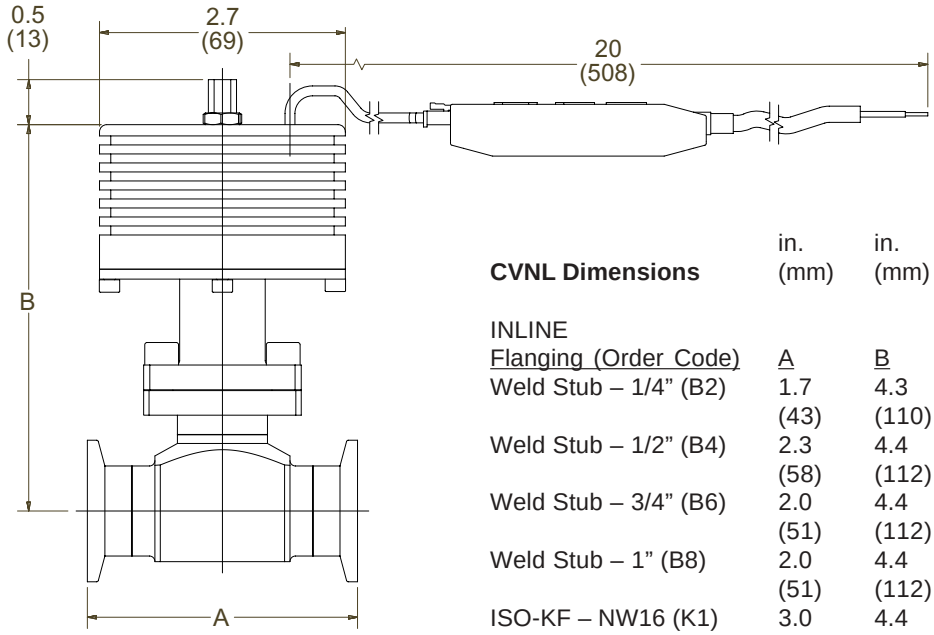
The exterior of the valve is designed to resist alcohol and acetone. The solenoid, coil-saver circuit, and electrical wiring are resistant to alcohol. The internals of the valve maybe exposed to process gasses and chemicals. The materials exposed to these process gasses and chemicals are the valve body (304 stainless), bellows (321 stainless), and the o-rings (copper, Kalrez®, nickel, silicone, Viton®, or Chemraz®). Refer to chemical-resistant specifications for these materials.

Physical Parameters



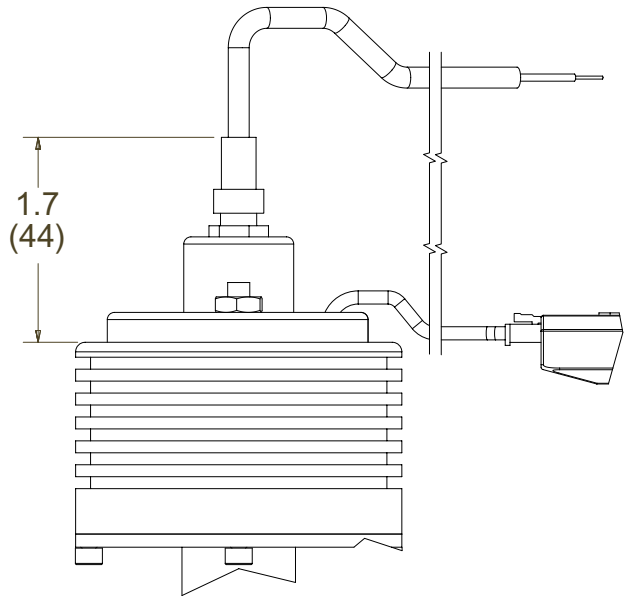
Angle

CV16, CV25 Dimensions	in. (mm)	in. (mm)
ANGLE		
CV16 Flanging (Order Code)	A	B
Weld Stub (B2, B4, B6)	1.6 (41)	3.7 (93)
1-1/3” CF (C1)	1.8 (46)	3.7 (93)
KF10 (K0)	1.4 (35)	3.7 (93)
KF16 (K1)	1.4 (35)	3.7 (93)
8VCO® – F (OF)	1.6 (41)	3.7 (93)
8VCO® – M (OM)	2.1 (54)	3.7 (93)
4VCR® – F (4F)	2.2 (55)	3.7 (93)
4VCR® – M (4F)	2.2 (55)	3.7 (93)
8VCR® – F (RF)	2.3 (57)	3.7 (93)
8VCR® – M (RM)	2.3 (57)	3.7 (93)
ANGLE		
CV25 Flanging (Order Code)	A	B
Weld Stub (B8)	1.8 (45)	3.8 (97)
2-1/8” CF (C2)	2.0 (50)	3.8 (97)
2-3/4” CF (C3)	2.0 (51)	3.8 (97)
KF25 (K2)	1.4 (35)	3.8 (97)



Inline

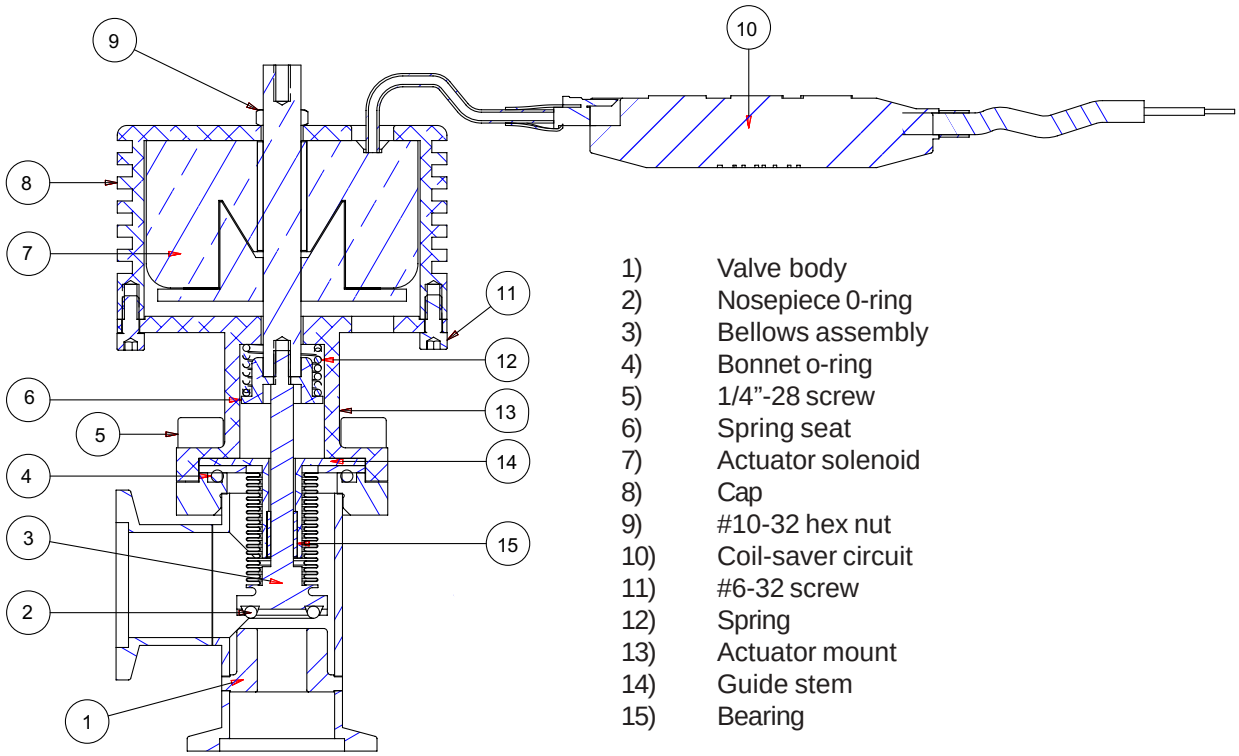
CVNL Dimensions	in. (mm) A	in. (mm) B
INLINE		
Flanging (Order Code)	A	B
Weld Stub – 1/4” (B2)	1.7 (43)	4.3 (110)
Weld Stub – 1/2” (B4)	2.3 (58)	4.4 (112)
Weld Stub – 3/4” (B6)	2.0 (51)	4.4 (112)
Weld Stub – 1” (B8)	2.0 (51)	4.4 (112)
ISO-KF – NW16 (K1)	3.0 (76)	4.4 (112)
ISO-KF – NW25 (K2)	3.0 (76)	4.3 (109)
4VCR® – F (4F)	2.8 (71)	4.3 (110)
8VCR® – F (RF)	3.5 (89)	4.4 (112)



Limit Switch

Feature Locations

The figure below illustrates the parts of the ECv valve.



1) Valve body
2) Nosepiece 0-ring
3) Bellows assembly
4) Bonnet o-ring
5) 1/4”-28 screw
6) Spring seat
7) Actuator solenoid
8) Cap
9) #10-32 hex nut
10) Coil-saver circuit
11) #6-32 screw
12) Spring
13) Actuator mount
14) Guide stem
15) Bearing

About the ECv Series Valve

The HPS® Electromagenetic Cv valve is actuated by a direct-current electric power supply. The ECv valve does not require the use of a pneumatic system; therefore, it is ideal for use when a pneumatic setup system is not available.

The valve is available as either CV16, CV25, or CVNL bodied. Solenoid options are 12VDC or 24VDC.The valve can be built with either a normally open or normally closed configuration.

Available Options

The tables on the following pages summarize the available options for the ECv valve.

Electromagnetic Cv Valve Options

Electromagnetic Cv Angle Valve Ordering Information

Body Style CVXX	Flanging (bottom port) -XX	Flanging side port) XX	Actuator Type -XX	Limit Switch X	Bonnet Seal X	Nose Seal X	Control Port Accessories -XXXX
CV16 3/4" port	**B2** 1/4" Tube Stub **B4** 1/2" Tube Stub **B6** 3/4" Tube Stub **C1** 1/1/3" CF **K0** KF 10 **K1** KF 16 **OF** 8 (1/2") VCO-F **OM** 8 (1/2") VCO-M **4F** 4 (1/4") VCR®-F **4M** 4 (1/4") VCR®-M **RF** 8 (1/2") VCR®-F **RM** 8 (1/8") VCR®-M	**B2** 1/4" Tube Stub **B4** 1/2" Tube Stub **B6** 3/4" Tube Stub **C1** 1/1/3" CF **K0** KF 10 **K1** KF 16 **OF** 8 (1/2") VCO-F **OM** 8 (1/2") VCO-M **4F** 4 (1/4") VCR®-F **4M** 4 (1/4") VCR®-M **RF** 8 (1/2") VCR®-F **RM** 8 (1/8") VCR®-M	**EC** Electromagnetic Normally Closed **EO** Electromagnetic Normally Open	**N** No Switch Limit **L** With Switch Limit	**C** Copper **K** Kalrez **N** Nickel **S** Silicon **V** Vitron **Z** Chemraz	**K** Kalrez **S** Silicon **V** Vitron **Z** Chemraz	**12DC** 12VDC Solenoid **24DC** 24VDC Solenoid
CV25	**B8** 1" Tube Stub **C2** 2-1/8" CF **C3** 2-3/4" CF **K2** KF25	**B8** 1" Tube Stub **C2** 2-1/8" CF **C3** 2-3/4" CF **K2** KF25					

Electromagnetic Cv Inline Valve Ordering Information

Body Style CVXX	Flanging -XX	Actuator Type -XX	Limit Switch X	Bonnet Seal X	Nose Seal X	Control Port Accessories -XXXX
CVNL16 1" port	**B2** 1/4" Tube Stub **B4** 1/2" Tube Stub **B6** 3/4" Tube Stub **B8** 1" Tube Stub **K1** KF 16 **K2** KF25 **4F** 4 (1/4") VCR®-F **RF** 8 (1/2") VCR®-F	**EC** Electromagnetic Normally Closed **EO** Electromagnetic Normally Open	**N** No Switch Limit **L** With Switch Limit	**C** Copper **K** Kalrez **N** Nickel **S** Silicon **V** Vitron **Z** Chemraz	**K** Kalrez **S** Silicon **V** Vitron **Z** Chemraz	**12DC** 12VDC Solenoid **24DC** 24VDC Solenoid

Installation Information

Installation Orientation

Any orientation is acceptable; it will seal against atmosphere at either port. Note, however, that horizontal orientation allows for better natural convection cooling air flow over the valve.

Electrical Connections

Make electrical connections with the power input wires going into the coil-saver circuit, and whenever a limit switch is used.

Use care when soldering leads to the terminals of the power input wires or limit switches. Use a soldering iron with thermostatically controlled tip.

Power Requirements

The 12VDC version requires 12VDC at 2.7A power at the initial actuation. After startup, power consumption reduces to 0.5A.

The 24VDC version requires 24VDC at 1.4A power at the initial actuation. After startup, power consumption reduces to 0.28A.

Operating Temperatures

Do not allow the valve to heat up over 60^{o}C; the solenoid coil will become too hot and the valve may cease to function properly. See the **Operation Principles** section for details. Allow for ample natural convection air flow or other air-cooling considerations (such as a fan) around the valve when installing and operating.

Valve Installation

1. Install the valve in the piping system using the flanges.

Note: The coil-saver circuit is a free-hanging entity on the power input cable.

2. Connect the power-input wires to the correct voltage (12 or 24) on the direct-current power supply. The red wire is positive, the black wire is ground. The power input wires have bare leads on the ends to accommodate any connection options.

3. Connect the limit switch wires, if applicable.

4. Apply power to the valve to induce actuation.

CE Testing

This product is CE marked. The ECv valve passed the Electromagnetic Compatibility (EMC) Part 6-2: Generic Standards Immunity for Industrial Environments Test (Test Criteria EN 61000-6-2:1999)

The ECv valve is rated only for a cable length of less than 10 meters. There is no surge protection built into the device. It is recommended to add surge protection devices inline with the valve if the cable length will be greater than 10 meters.

Operation Principles

The electromagnetic Cv valve is actuated by a low-profile linear solenoid which is mounted on top of the valve by a mounting bracket. The solenoid is fastened directly to the poppet stem and is coupled with a spring that can be configured as either Normally Open or Normally Closed.

Each ECv valve is coupled with a coil-saver circuit which is installed inline with the input power supply. The coil-saver circuit applies full power to the solenoid coil upon initial open or close (depending on whether the valve was configured as normally open or normally closed), then decreases the applied power once the valve has reached its energized state.

Without a coil-saver circuit, the valve may run hot, or may not function at all. For example, when the solenoid is in the energized position for a period of time, the excessive influx of electric power heats up the coil. This causes the resistance to go up and the flow of current to go down, which decreases the potential magnetic force of the solenoid. The coil-saver circuit applies less power to the solenoid, so it does not heat up as much. This allows the valve to operate in the energized state indefinitely.

When power is applied to the solenoid through the coil-saver circuit, the solenoid is energized, which causes the valve to open or close (depending upon how the valve was configured). When power is first applied, the full voltage is applied to the solenoid for approximately half a second. After the initial surge, the coil-saver circuit only applies voltage for approximately half of the time (for example, 250 milliseconds of every 500 milliseconds).

The coil-saver circuit senses when power is removed from the coil and resets the circuit. This prevents short power interruptions from causing the solenoid to release and not recover the energized position again.

Limit Switch Actuation

Limit Switches: Optional limit switches are available for remote indication of the open position of the valve.

Observing that the limit switch is not actuated (closed position) does not necessarily verify that the valve is sealed in a leak-tight state, as contamination or damage to the seal or seat could affect seal integrity. It does confirm, however, that the valve and its control obeyed the command to move to the closed position.

Technical Data:

- Switch is a single-pole, single-throw
- Rated at 1/2 A for 115V (AC) and 24V (DC)
- Switch has 24 in (61 cm) wire lead with an inline clip

Service

Removal from System

Before removing the entire valve or a valve's actuator assembly from a vacuum system, it is necessary to bring the system up to atmospheric pressure. Purge and vent hazardous gasses appropriately.

Disconnect the solenoid actuator leads. See the **Actuator Service** section for details on solenoid valve repair.

To avoid electric shock or electrocution, be sure the power to the valve is off before disconnection.

If the valve is equipped with limit switches, they can be removed from the valve without disconnecting the leads. To unscrew the limit switch from the housing, unscrew the compression set nut, then unscrew the limit switch. Alternatively, remove the limit switch housing assembly by unscrewing the two 10-32 K-locking nuts.

Loosen and remove the clamps or bolts on the port flanges. If possible, pull one of the flanges mating to a port flange directly away from the valve to allow removal of the valve without scraping sealing surfaces. Replace the protective plastic caps on the port flanges or cover the ports with aluminum foil.

Avoid touching the interior surfaces of the valve. Moisture, skin oils, and dirt may contaminate the interior of the valve, affecting its performance upon reinstallation, and/or, more importantly, films deposited on the interior surfaces of the valve may be toxic.

Actuator Assembly

Actuator Assembly Removal and Disassembly

The following procedure does not require removal of the valve body from the system. However, several aspects of the procedure are more easily performed if the entire valve is removed. See the **Removal from System** section for information on solenoid wire and limit switch removal

The actuator assembly is attached to the bonnet of the valve by four screws.

Sometimes the elastomer nosepiece o-ring seal and the bonnet seal will stick to clean metal sealing surfaces. This is most prevalent with valves that have been run warm.

After the screws have been removed, pull the actuator assembly out of the valve body. The bellows is fabricated of .004" thick 321 stainless steel. While withdrawing the actuator assembly, care should be exercised to avoid damaging the bellows. If the bonnet o-ring has adhered to the sealing surface in the body, carefully remove it by hand. If a tool is required for this task, it should be made of a material softer than stainless steel to avoid scratching the sealing surface.

CAUTION: The actuator assembly contains a spring under some compression at all times. Replacement of malfunctioning actuators with new assemblies is recommended (see the **Accessories and Part Replacement** section for a parts list).

O-ring Replacement

The bonnet o-ring can be removed easily without a special fixture.

Removal of the nosepiece o-ring usually requires a thin tool to pry it out of its trapezoidal groove. Use care to avoid damaging the sealing surface at the bottom of the groove. Start prying at the vent hole and carefully move around far enough to allow grasping the seal with the fingers, then pull the seal from the remainder of the groove.

Be sure that no dust or other contamination is in the grooves or on the o-rings.

To install the o-rings into the trapezoidal grooves, nest the o-ring on the opening of the groove. With the thumbs at points 180° apart, firmly press the o-ring into the groove. Move 90° and press again. Move 45° and press again. Alternately press the o-ring into the groove until it is completely in the groove. Hand installation will likely leave humps on the installed o-ring. As long as the o-ring has not twisted during assembly, this will disappear after a small number of cycles, after which the valve should function properly.

Actuator Assembly Installation

Insert the actuator assembly into the valve body. As with removal, take care to avoid damaging the bellows. Be sure that the bonnet o-ring is in place. Tighten the four actuator assembly screws until the mount bottoms out on the valve body. The screws should be lightly tightened in an X pattern, the X pattern should be repeated two-to-three times to ensure all screws are fully seated. These screws should be sufficiently tight to compress the bonnet o-ring and prevent themselves from loosening.

Reconnect the electrical connections.

It is highly recommended to check the assembly for leaks using a high-quality Helium mass spectrometer leak detector. The nosepiece seal, port flange seals, and bonnet seal can be tested through a variety of methods and will not be detailed in this manual.

Actuator Service

In normal use, solenoid actuators should last millions of cycles.

The entire solenoid valve must be replaced in the event of solenoid valve malfunction. See the **Accessories and Part Replacement** section for part numbers.

Troubleshooting

The following sections outline diagnoses of possible problems encountered when using HPS® Electromagnetic Cv Series valves and detail possible causes and their remedies.

Problems and Diagnosis

Won't Close Completely

The most common reason for the ECv valve not to close completely is due to failure of the compression springs. Further evidence of spring failure would include high-magnitude leak across nosepiece seal.

Won't Open Completely

Failure to open completely can be detected directly by the absence of a signal from the open limit switch (if so equipped), by the position of the solenoid shift, or by a significant decrease in the valve's conductance. When the valve opens there should be a sharp metallic sound as the two parts of the solenoid magnet contact each other.

Won't Open or Close at All

The valve not opening or closing at all indicates a failure with the solenoid coil or coil saver circuit or the wire connections. This would also be caused by the valve becoming too hot or +24VDC or +12VDC applied to slowly.

Leaks Across Closed Nosepiece Seal

Detection of leakage across the nosepiece seal when the valve is closed can be symptomatic of several problems. See the **Won't Close Completely** section if the valve is also not closing completely.

Refer to the **Nosepiece Seal Omission** section. If the o-ring is present, particles, contamination, and corrosion may be the problem, see the **Particulates, Condensation, and Corrosion** section. If the valve continues to leak after the seat and sealing area have been cleaned, see the **Bonnet Seal Failure** section.

Leaks from Atmosphere When Closed

If leakage is detected from atmosphere when the valve is closed, see the **Improper Assembly** section. If the assembly is correct, refer to the **Bonnet Seal Failure** section. Last, see the **Body Damage** section.

Leaks from Atmosphere When Open

If leakage is detected from atmosphere when the valve is open, see the **Bellows Failure** section.

Leaks from Atmosphere at All Times

If leakage is detected from atmosphere at all times, see the **Bellows Failure** section. If the bellows has not failed, refer to the **Bonnet Seal Failure** section. Also see the **Bonnet Seal Omission**, **Improper Assembly**, and **Port Flange Damage** sections.

Limit Switches Don't Send Signal

Be sure that the valve is opening and/or closing completely, see the **Won't Close Completely** and **Won't Open Completely** sections. If the valve has traveled its full stroke, see the **Limit Switch Failure** section.

Causes and Remedies

Spring Failure

The normal ECv valve springs have lifetimes greater than 1,000,000 cycles. In the rare event of a failure, the valve must be returned for service. See the **Return to Factory for Repair or Service** section.

Body Damage

All ECv valves are thoroughly tested after assembly. Body damage serious enough to result in detectable leakage could be caused by mishandling or abuse in shipping or in the installation. A damaged body is not easily repaired, usually costing more than a replacement. Often, with serious body damage, the actuator assembly has also been damaged, making replacement of the entire valve the best solution.

Port Flange Damage

Flanges are easily damaged after the protectors have been removed. Avoid contact between the flanges and any surface. Small sealing surface defects can sometimes be corrected with application of a good quality vacuum grease, such as Apiezon®, to the seal. Larger defects might be repaired by rubbing out the scratch or dent with a light abrasive, such as ScotchBrite®. Working of the abrasive should always be parallel to the direction of the seal. For example, a scratch on a surface sealed by a circular o-ring should, likewise, be worked with the abrasive in a circular fashion. Heavier damage would require replacement of the body.

Particulates, Condensation, and Corrosion

In normal use, airborne particulates, process condensation, and/or corrosion, may affect seal integrity. Particulates might be moved by simple turbulent gas flow. However, condensed or sublimated films nearly always require further cleaning. Additionally, corroded sealing surfaces may be irreparable. In this case, replacing the component would be the only remedy.

Bellows Failure

Although the mean time between failures for the ECv bellows is greater than 1,000,000 cycles, nearly all valve failures are the result of bellows failures. Stress cracks in the convolution crowns are first detected when the valve is open and the bellows are in compression. At this time, the outside of the bellows material is in tension, opening minute cracks wider than when the bellows is relaxed or in extension. Eventually, the crack(s) will propagate around the entire convolution and the bellows will separate. Long before the cracks appear, the atmospheric leak will be detected constantly. The only remedy is to replace the actuator assembly.

Nosepiece Seal Failure

Elastomer seals that have remained in a compressed condition for long periods of time may not return to their circular cross sectional shape when released. Such seals may stick to the mating sealing surface as they are pulled apart, leaving bits of the seal behind. Old elastomers tend to lose some of their elasticity and may crack. Various process gasses and/or high temperatures accelerate all of these effects. See the **O-ring Replacement** section.

Bonnet Seal Failure

Elastomer seals that have remained in a compressed condition for long periods of time may not return to their circular cross sectional shape when released. Such seals may stick to the mating sealing surface as they are pulled apart, leaving bits of the seal behind. Old elastomers tend to lose some of their elasticity and may crack. Various process gasses and/or high temperatures accelerate all of these effects. See the **O-ring Replacement** section.

Bonnet Seal Omission

After service, during reassembly, omission of the bonnet seal will cause the valve to leak from atmosphere at all times. Remove the actuator assembly and install the seal.

Nosepiece Seal Omission

After service, during reassembly, omission of the seal will cause the valve to leak. Remove the actuator assembly and install the seal.

Improper Assembly

After service, the solenoid actuator must be threaded to its stop. Failure to do so could result in the valve not opening or closing completely, or leaking.

Limit Switch Failure

First, refer to the **Limit Switch Actuation** section to insure the switch is wired properly. Second, if the switch appears to be wired properly, try adjusting the switch location by loosening the compression nut and screwing the limit switch up and down until indication of the limit switch is achieved. If the switch does not function, it must be replaced, see the **Accessories and Part Replacement** section.

Coil Saver Circuit Failure

The coil-saver circuit is designed to handle most power glitches and interrupts, but not huge power surges. In the event the coil-saver circuit fails, verify that the device is outputting the required voltage when it is plugged in.

Valve Opening and Closing Failure

The valve may not open or close (depending on orientation) because the solenoid and valve became too hot. When the valve is too hot, the solenoid resistance goes up and loses its magnetic force. Verify that the valve is not running hot. If it is, place fans or install other cooling methods to keep the valve from overheating.

Also the valve may not open or close at all if the coil saver circuit does not get the right amount of power quickly. If the power supply is turned on and ramps up too slowly to full power, the valve may not open/close. Because the coil saver circuit had insufficiant power to induce actuation. It is recommended that the power supply be on and switch to actuate the valve.

Return to Factory for Repair or Service

Before shipping an Electromagnetic Cv valve to the factory, please observe the following procedure:

Call the Factory

The HPS® Customer Service Department or any MKS Service Center will prepare a Returned Materials Report (RMR) and assign an RMR number specific to this return. Consequently, when the item is received, it will be dispositioned in a timely manner. The customer service technician will need information on the following:

- What is the problem?
- What are the symptoms, and how were they observed?
- What is the application?
- Is it an urgent repair?
- What is the valve's serial number?
- What is the user's name and where can he/she be reached?
- Was the valve used with any dangerous, toxic, or radioactive materials?

HPS® is not equipped to handle hazardous materials. Items having *any* unidentified coatings or films will be treated as hazardous waste and appropriately disposed at the sender's expense. The shipment of hazardous materials through the mail or on any private carrier not specifically licensed for the handling of such materials is a federal offense.

Prepare for Shipment

Be sure the valve is clean and free of any hazardous materials. Cap the ports to prevent entry of foreign material and to protect the sealing surfaces. Place the valve in a sealed plastic bag and pack securely in a sturdy shipping container. Poor packing can result in damage to the valve. Insert a packing slip or letter referencing the RMR number issued by the customer service technician.

Payment

Warranty repairs or replacement are performed at no cost. If the item returned is no longer under warranty, a purchase order for the cost of the repair will be required. An estimate of the repair cost will be provided.

Accessories and Part Replacement

12VDC Solenoid Internal Rebuild Kits	
Normally Closed, Viton® O-rings	100012027
Normally Open, Viton® O-rings	100012028
24VDC Solenoid Internal Rebuild Kits	
Normally Closed, Viton® O-rings	100012029
Normally Open, Viton® O-rings	100012030
Retro Fit Kit	
Limit Switch, Normally Closed	100012185
Limit Switch, Normally Open	100012186
Damping, Normally Closed	100012187
Damping, Normally Open	100012188
Limit Switch and Damping, Normally Closed	100012189
Limit Switch and Damping, Normally Open	100012190
O-Ring Seal Kits	
O-Ring Seal Kit, Viton®	100012281
O-Ring Seal Kit, Chemraz®	100012282
O-Ring Seal Kit, Kalrez®	100012283
O-Ring Seal Kit, Silicone	100012284

Warranty

Extent of the Warranty
MKS Instruments, Inc. (MKS), HPS® Products, warrants the HPS® Electromagnetic Cv Series valves and its accessories to be free from defects in materials and workmanship for one (1) year from the date of shipment by MKS or authorized representative to the original purchaser (PURCHASER). Any product or parts of the product repaired or replaced by MKS under this warranty are warrantied only for the remaining unexpired part of its one (1) year original warranty period. After expiration of the applicable warranty period, the PURCHASER shall be charged MKS' current prices for parts and labor, plus any transportation for any repairs or replacement.

ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO THE WARRANTY PERIOD. NO WARRANTIES, EXPRESS OR IMPLIED, WILL APPLY AFTER THIS PERIOD.

Warranty Service
The obligations of MKS under this warranty shall be at its option: (1) to repair, replace, or adjust the product so that it meets applicable product specifications published by MKS or (2) to refund the purchase price.

What is Not Covered
The product is subject to above terms only if located in the country of the seller from whom the product was purchased. The above warranties do not apply to:

I. Damages or malfunctions due to failure to provide reasonable and necessary maintenance in accordance with MKS operating instructions.
II. Damages or malfunctions due to chemical or electrolytic influences or use of the product in working environments outside the specification.
III. Seals, bellows, and all expendable items which by their nature or limited lifetime may not function for a year. If such items fail to give reasonable service for a reasonable period of time within the warranty period of the product, they will, at the option of MKS, be repaired or replaced.
IV. Defects or damages caused by modifications and repairs effected by the original PURCHASER or third parties not authorized in the manual.

Condition of Returned Products
MKS will not accept for repair, replacement, or credit any product which is asserted to be defective by the PURCHASER, or any product for which paid or unpaid service is desired, if the product is contaminated with potentially corrosive, reactive, harmful, or radioactive materials, gases, or chemicals. When products are used with toxic chemicals, or in an atmosphere that is dangerous to the health of humans, or is environmentally unsafe, it is the responsibility of the PURCHASER to have the product cleaned by an independent agency skilled and approved in the handling and cleaning of contaminated materials before the product will be accepted by MKS for repair and/or replacement. In the course of implementing this policy, MKS Customer Service Personnel may inquire of the PURCHASER whether the product has been contaminated with or exposed to potentially corrosive, reactive, harmful, or radioactive materials, gases, or chemicals when the PURCHASER requests a return authorization. Not with standing such inquiries, it is the responsibility of the PURCHASER to ensure that no products are returned to MKS which have been contaminated in the aforementioned manner.

Other Rights and Remedies

I. These remedies are exclusive. HPS® SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES, FOR ANTICIPATED OR LOST PROFITS, INCIDENTAL DAMAGES OR LOSS OF TIME, OR OTHER LOSSES INCURRED BY THE PURCHASER OR BY ANY THIRD PARTY IN CONNECTION WITH THE PRODUCT COVERED BY THIS WARRANTY, OR OTHERWISE. Some states do not allow exclusion or limitation of incidental or consequential damage or do not allow the limitation on how long an implied warranty lasts. If such laws apply, the limitations or exclusions expressed herein may not apply to PURCHASER.
II. Unless otherwise explicitly agreed in writing, it is understood that these are the only written warranties given by HPS®. Any statement made by any persons, including representatives of MKS, which are inconsistent or in conflict with the terms of the warranty shall not be binding on MKS unless reduced to writing and approved by an authorized officer of MKS.
III. This warranty gives PURCHASER specific legal rights, and PURCHASER may also have other rights which vary from state to state.
IV. For MKS products sold outside of the U. S., contact your MKS representative for warranty information and service.

Warranty Performance
To obtain warranty satisfaction, contact the following: MKS Instruments, Inc., HPS® Products, 5330 Sterling Drive, Boulder, CO 80301, USA, at phone number 1-303-449-9861. You may be required to present proof of original purchase.