
9650 Valve Series

Installation And Maintenance Manual July 2019



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9650 Valve Series

Instruction Manual

9640-1103

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About this Manual

*This instruction manual describes the installation and maintenance of the 9650 Valve Series as supplied by **Fossil Power Systems Inc.***

Although care was exercised to make this Manual specific and complete, it is not intended that it should cover all potential operating and maintenance conditions. It must be recognized that no amount of written instruction can replace intelligent thinking and reasoning on the part of qualified personnel. It is the responsibility of operations and maintenance personnel to become completely familiar with the mechanical, electrical and control systems involved, including their characteristics and performance under various operating conditions.

This knowledge can be obtained through the basic information provided in this manual, supplemented by field experience and by advice and recommendations from this Company's field agents.

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1 OVERVIEW

1.1 AUTOMATIC VALVES

The FPS automatic valve assembly consists of an FPS Fire-Safe Ball Valve, FPS Rack & Pinion/Scotch Yoke Type Spring Return or Double-Acting Actuator, ASCO Solenoid Control Valve and FPS Rotary Type Limit Switch.

Available Certifications:

- CSA 6.5-2000/ANSI Z21.21-2015 – Automatic Valves for Gas Appliances
- CGA 3.9-M94 – Automatic Safety Shut-off Gas Valves
- CSA – Commercial / Industrial (C/I)
- API 607 4th Edition Fire Safe
- FM Class 7400 – Liquid and Gas Safety Shutoff Valves

The following sections of this manual discuss in detail the individual components which comprise the automated valve assembly.

1.1.1 Definition

Automatic valves are available in both normally open and normally closed variations. The assembly is comprised of the same parts for normally open and normally closed valves so it is imperative to follow assembly procedures properly and take care while assembling the valve.

- Normally closed valves fail to a closed position when power is lost to the automatic valve.
- Normally open valves fail to an open position when power is lost to the automatic valve.

1.2 MANUAL VALVES

FPS manual valves may be supplied as CSA/API approved for use with natural gas or propane, or the valves may be supplied without specific approvals.

Available Certifications:

- API 607 4th Edition Fire Safe
- CSA Interim Requirement No.60 – Lever Operated Gas Shut-Off Valves
- CSA 3.16-15

Section 6 of this manual details and discusses the specifications of the ball valves, and their maintenance.

IT IS THE SOLE RESPONSIBILITY OF ANY USER TO ENSURE PROPER VALVE OPERATION AND INTEGRITY AFTER SERVICING. FPS BEARS NO RESPONSIBILITY, EXPRESSED OR IMPLIED FOR CLAIMS OR LIABILITIES ARISING OUT OF IMPROPER USE OR INADEQUATE SERVICING OF THE VALVE ASSEMBLIES.



CAUTION



CAUTION: Never place any part of your body inside the valve at any time. Unexpected actuation of the valve will result in the valve ball turning causing severe personal injury.

CAUTION: De-pressurize system and turn off electrical power to the valve before attempting repair.

CAUTION: Label all wires and air connections prior to disconnection when servicing valves. Wiring and/or air connection errors can cause improper and dangerous operation.

CAUTION: Verify Proper Operation after servicing.

CAUTION: All wiring to valve must conform to National Electrical Code, ANSI/NFPA 70 and or Canadian Electrical Code CSA C22.1, Part 1.

2 SPECIFICATIONS

2.1 CSA AUTOMATIC GAS VALVE OPERATING SPECIFICATIONS

Maximum Operating Pressure:	1380kPa (200psig)
Maximum Ambient Operating Temperature:	50°C (122°F)
Minimum Ambient Operating Temperature	- 45°C (-49°F)
Mounting:	Multi-position
Flow:	Bi-Directional
Materials:	CF8M or WCB Valve Body; 316 S/S Ball; Stem and Hardware
Actuator:	Spring Return

2.2 CSA MANUAL GAS VALVE OPERATING SPECIFICATIONS

Maximum Operating Pressure:	CSA Interim Requirement 60:	1380kPa (200 psig)
	CSA 3.16	860 kPa (125 psig)
Maximum Ambient Operating Temperature:	65°C (149°F)	
Minimum Ambient Operating Temperature:	- 40°C (-40°F)	
Mounting:	Multi-position	
Flow:	Bi-Directional	
Materials:	CF8M or WCB Valve Body; 316 S/S Ball; Stem and Hardware	

2.3 FM AUTOMATIC LIQUID & GAS VALVE OPERATING SPECIFICATIONS

Maximum Operating Pressure:	1380kPa (200psig)
Maximum Ambient Operating Temperature:	60°C (140°F)
Minimum Ambient Operating Temperature:	- 10°C (14°F)
Mounting:	Multi-position
Flow:	Bi-Directional
Materials:	CF8M Valve Body; 316 S/S Ball; Stem and Hardware
Actuator:	Spring Return

2.4 ALL OTHER VALVE OPERATING SPECIFICATIONS

Maximum Operating Pressure:	Consult Factory
Maximum Ambient Operating Temperature:	Consult Factory
Minimum Ambient Operating Temperature:	- 45°C (-49°F)
Mounting:	Multi-position
Flow:	Bi-Directional
Materials:	CF8M or WCB Valve Body; 316 S/S Ball; Stem and Hardware
Actuator:	Spring Return or Double Acting

3 SOLENOID

3.1 GENERAL INFORMATION

FPS's valve range includes both spool and poppet type solenoids depending on the particular valve.

The spool solenoid valve body is made of anodized aluminum that mounts directly to the spring return or double-acting pneumatic valve actuator, which has been manufactured to accept the NAMUR pattern of mounts and port holes.

Poppet solenoid valve bodies mount to the limit switch of the valve. These are tubed with stainless steel to the actuator. Wiring is terminated at the limit switch terminal block.

Various voltages are available for seamless system integration. Explosion proof and low power models are also available to meet the specific application needs (see specification table – page 6).

Media filtration: Filtration to 5 microns is recommended in all cases. Foreign material in the media may cause excessive leakage, wear or in exceptional cases, malfunction. Install the filter on the inlet side as close to the valve as possible. Clean periodically depending on service condition.

Lubrication: Lubrication is not required.

Coil Temperature: Valves are supplied with coils designed for continuous duty service. Normal free space must be provided for proper ventilation. When the coil is energized continuously for long periods of time, the coil assembly will become hot. The coil is designed to operate permanently under these conditions. Any excessive heating will be indicated by smoking and/or odour of burning coil insulation.

3.2 STANDARD SOLENOID AIR SUPPLY SPECIFICATIONS

- Non-corrosive lubricated or non-lubricated air or other inert gas
- Min 414 kPa (70psig)
- Max 828 kPa (120psig)

3.3 LOW PRESSURE SOLENOID AIR SUPPLY SPECIFICATIONS

- Non-corrosive lubricated or non-lubricated air or other inert gas
- Min 345 kPa (50psig)
- Max 414 kPa (70psig)

3.4 SOLENOID VOLTAGE / RATING FOR ASCO & PARKER SOLENOIDS

MODEL/ MODEL #	VOLTAGE	FPS PN	RATING	Inrush Current	Steady State Current
ASCO WT8551A1MMS	12VDC/WT	1250-0016	NEMA 2, 3, 3S, 4, 4X	0.82A	0.58A
ASCO EF8551A1MMS	12VDC/EXP	1250-0017	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.82A	0.58A
ASCO WT8551A1MMS	24VDC/WT	1250-0013	NEMA 2, 3, 3S, 4, 4X	0.42A	0.30A
ASCO EF8551A1MMS	24VDC/EXP	1250-0014	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.42A	0.30A
ASCO 8551 WT8551A1MMS	120VAC/WT	1250-0011	NEMA 2, 3, 3S, 4, 4X	0.08A	0.06A
ASCO 8551 EF8551A1MMS	120VAC/EXP	1250-0012	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.08A	0.06A
ASCO 8551 WT8551A001MMS0	120VDC/WT	1250-0053	NEMA 2, 3, 3S, 4, 4X	0.08A	0.06A
ASCO 8551 WT8551A1MMS	240VAC/WT	1250-0010	NEMA 2, 3, 3S, 4, 4X	0.05A	0.03A
ASCO 8551 EF8551A1MMS	240VAC/EXP	1250-0015	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.05A	0.03A
ASCO EF8320G202-12	12VDC/EXP	1250-0103	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.97	0.97
ASCO 8320G202-24	24VDC/WT	1250-0095	NEMA 1, 2, 3, 3S, 4, 4X	0.48	0.48
ASCO EF8320G202-24	24VDC/EXP	1250-0081	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.48	0.48
ASCO 8320G202-120	120VAC/WT	1250-0094	NEMA 1, 2, 3, 3S, 4, 4X	0.42A	0.21A
ASCO EF8320G202-120	120VAC/EXP	1250-0080	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.42A	0.21A

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ASCO EVX8316G081MF/15444- 24VDC	24VDC/EXP	1250-0092	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.48	0.48
ASCO EVX8316G081MF/15444- 120-60	120VAC/EXP	1250-0093	Ex. Coil; Haz Loc CLI, Div 1, GR A, B, C, D CL II, Div 1, GR E, F & G NEMA 3, 3S, 4, 4X, 6, 6P, 7, 9	0.42A	0.21A
PARKER 73417AKDKN7AN0C111C1	12VDC/WT	1250-0009	Class F, NEMA 4X		
PARKER 73417AKDKN7AN0H111C1	12VDC/EXP	1250-0033	Class F, NEMA 4X, 7, 9		
PARKER 73417AKDKZ02N0C111C2	24VDC/WT	1250-0028	Class F, NEMA 4X	0.57A	0.41A
PARKER 73417AKDKN7AN0H611C2	24VDC/EXP (Low Power)	1250-0031	Class F, NEMA 4X, 7, 9	0.09A	0.06A
PARKER 73417AKDKZ02N0C111P3	120VAC/WT	1250-0050	Class F, NEMA 4X	0.23A	0.14A
PARKER 73417AKDKN7AN0H111P3	120VAC/EXP	1250-0027	Class F, NEMA 4X, 7, 9	0.23A	0.14A
PARKER 73417AKDKN7AN0C111Q3	240VAC/WT	1250-0029	Class F, NEMA 4X	0.12A	0.08A
PARKER 73417AKDKN7AN0H111Q3	240VAC/EXP	1250-0032	Class F, NEMA 4X, 7, 9	0.12A	0.08A

3.5 MAINTENANCE (NAMUR MOUNT SPOOL TYPE SOLENOID) - REPLACING SOLENOID

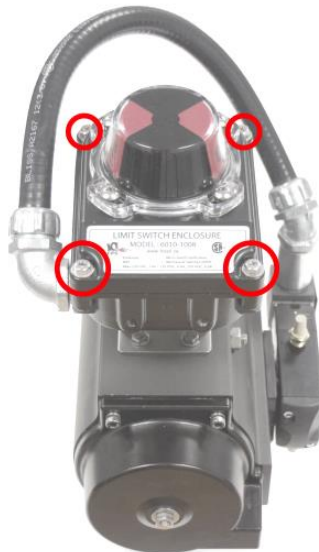
Caution: following ANY valve maintenance it is required to fully test valve operation and to complete FPS valve automated valve repair check sheet FP081.0.

Note: for replacement of Parker spool-type solenoids with ASCO poppet type solenoids, refer to FPS instruction bulletin 9640-1106.

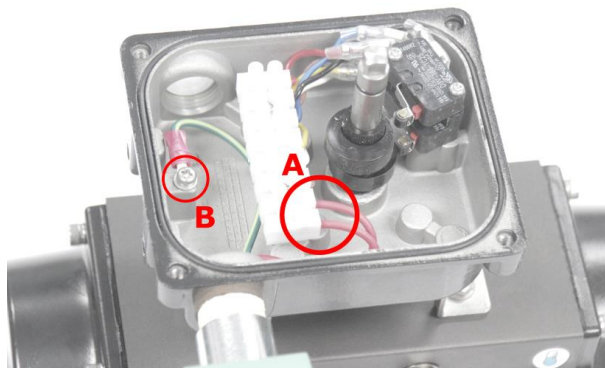
Disassembly:

To remove the solenoid:

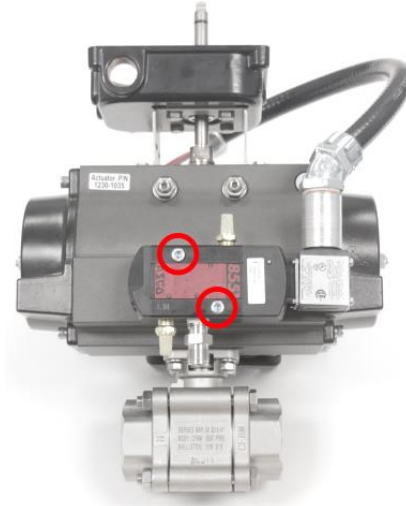
- 1) Ensure valve is in its fail-safe (not actuated) position fully open or closed before disassembly. Pressure trapped in the valve or actuator if partially stroked could be hazardous.
- 2) De-pressurize process media and instrument air and turn off electrical power to the valve before attempting any repair.
- 3) Remove limit switch cover by loosening four capscrews shown.



- 4) Disconnect the two power leads **A** from the limit switch terminal block (terminals 7 and 8), and the ground lead **B** from the ground stud.



- 5) Remove the electrical conduit from the limit switch housing leading to the solenoid.
- 6) Loosen the two capscrews holding the solenoid onto the actuator.



- 7) Remove the solenoid, taking care not to lose the adapter plate, rubber gasket or two O-rings.



- 8) Note whether the adapter plate is for 5/2 or 3/2 configuration from the markings.



- 9) Also note the location of the set screw in the actuator. This mates with a hole in the adapter to ensure it is located properly.



- 10) If the solenoid is to be replaced, remove and clean the conduit elbow for use with the new solenoid.

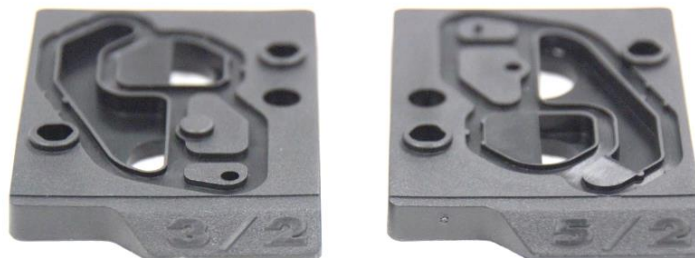
Assembly:

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

- 1) Ensure the same model of solenoid is used in reassembly and confirm contents of solenoid package.



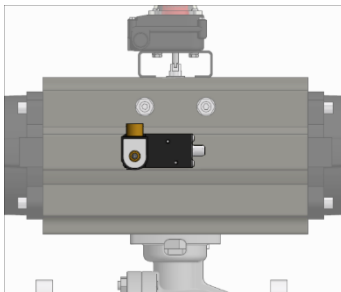
- 2) Apply Masters Orange T-Tape or similar to the clean conduit elbows before installing in the solenoid and limit switch.
- 3) Ensure the correct adapter plate (indicated by markings shown) is used depending on whether the solenoid is in 5/2 or 3/2 configuration.



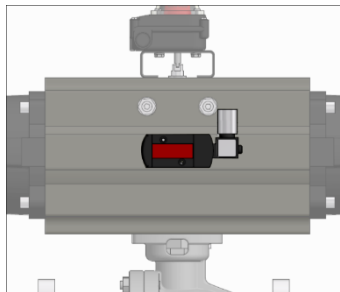
- 4) Apply Molykote 55 O-ring grease or equivalent to the two O-rings and rubber gasket. The O-rings should face the actuator and the adapter plate should be oriented so the set screw mates with the hole in the plate as shown.



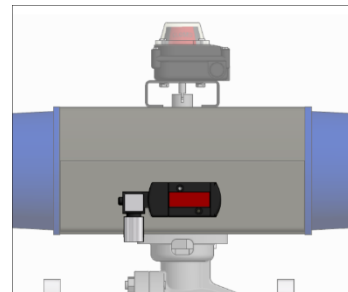
- 5) Note correct orientation of solenoid depending on combination of actuator and solenoid.



**A125-A11000 Actuator
Parker 74317 Solenoid**



**A125-A11000 Actuator
ASCO 8551 Solenoid**



**AS125-AS160 Actuator
ASCO 8551 Solenoid**

- 6) Follow assembly steps 2) to 7) in reverse for assembly.
- 7) Following solenoid replacement, refer to section 7 for valve testing.

Note:

For explosion proof solenoids, solenoid coil must be wired as per Class 1 Division 2 wiring methods using class 1 Division 2 rated sealing fittings as required.

3.6 MAINTENANCE (POPPET TYPE SOLENOID) - REPLACING SOLENOID

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete FPS valve automated valve repair check sheet FP081.0.

Note: for replacement of Parker spool-type solenoids with ASCO poppet type solenoids, refer to FPS instruction bulletin 9640-1106.

Procedure shows an explosion proof limit switch (6010-1009), follow a similar procedure for the watertight model (6010-1008).

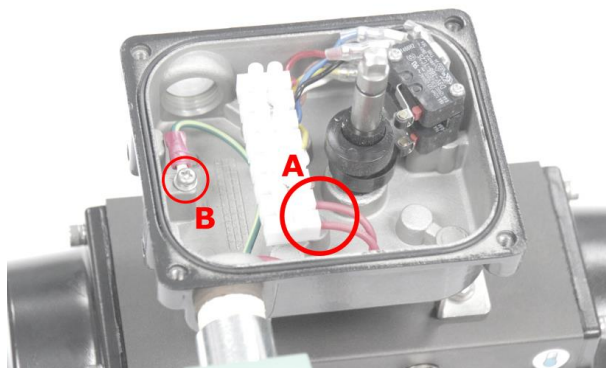
Disassembly:

To remove the solenoid:

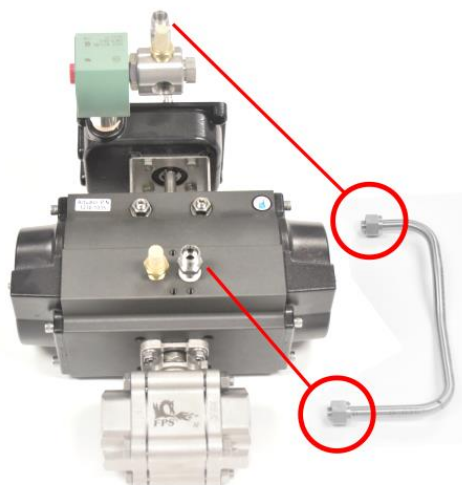
- 1) Ensure valve is in its fail-safe (not actuated) position fully open or closed before disassembly. Pressure trapped in the valve or actuator if partially stroked could be hazardous.
- 2) De-pressurize process media and instrument air and turn off electrical power to the valve before attempting any repair.
- 3) Remove limit switch cover by loosening four capscrews.



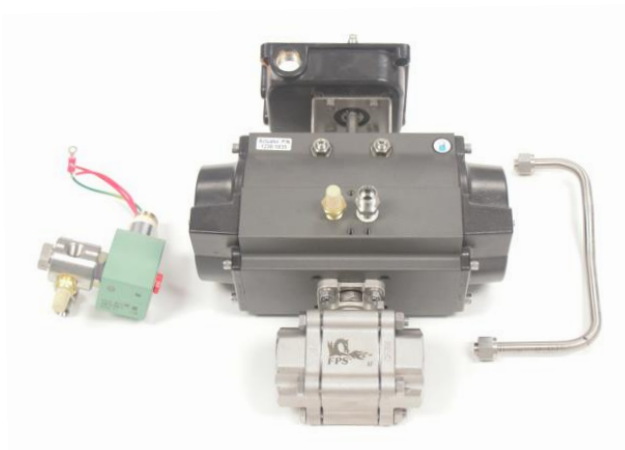
- 4) Disconnect the two power leads **A** from the limit switch terminal block (terminals 7 and 8) and the ground lead **B** from the ground stud.



- 5) Disconnect the stainless steel tubing to the actuator by loosening the $11/16$ " swaged tube fittings on both ends then remove.



- 6) Unscrew the solenoid from the limit switch housing and pull out electrical leads to remove.



Assembly:

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet.

- 1) **Ensure the same model of solenoid is used in reassembly.**
- 2) Apply Loctite 567 Thread Sealant or similar to the solenoid threads.
- 3) Follow assembly steps 2) to 6) in reverse for assembly.
- 4) Following solenoid replacement, refer to section 7 for valve testing.

4 LIMIT SWITCH

4.1 GENERAL INFORMATION

The FPS Model 6010-1008 is designed to meet the IP67 weatherproof enclosure standard (NEMA 6), providing protection from the entry of water and dust.

The FPS Model 6010-1009 is designed to be Explosionproof for Class 1, Division 1, Groups A, B, C and D; Flameproof for Class I, Zone 1, AEx d IIC; and Dust-Ignitionproof for Class II/III, Division 1, Group E, F and G hazardous locations. It also meets the following standards:

FM Class 3600
 FM Class 3615
 FM Class 3810
 ANSI/ISA 60079-0
 ANSI/ISA 60079-1
 ANSI/IEC 60529

Features of the FPS Limit Switches:

- 1) Visual Position Indicator
 - a. Standard color code is RED for CLOSED and YELLOW for OPEN, other color codes are available. Position is also indicated with black text (English)
 - b. "Quick-Set Cam"
 - c. FPS Limit Switch adjustment cams are splined and spring loaded. The switch cam position can be quickly and easily adjusted without tools **Note: On all approved valves, cam position is factory set and cannot be altered.**
- 2) Multipoint Terminal Strip
 - a. An 8 point terminal strip is standard for limit switches and allows for easy connection to the valve
- 3) Model 6010-1008 – Dual ½" conduit entry
- 4) Model 6010-1009 – Dual ¾" conduit entry
- 5) Captive Cover Bolts designed to stay in place attached to the cover when cover is removed
- 6) Die-Cast aluminum body
- 7) Polycarbonate indicator housing

4.2 LIMIT SWITCH WIRING

Limit switches are pre-set at the factory for normally open or normally closed. FPS does not recommend that the user perform service on any of the internal components within the limit switch enclosure. In the event that foreign material enters the enclosure and impairs proper operation the limit switch enclosure should be replaced. Figure No. 1 below shows the wiring configuration.

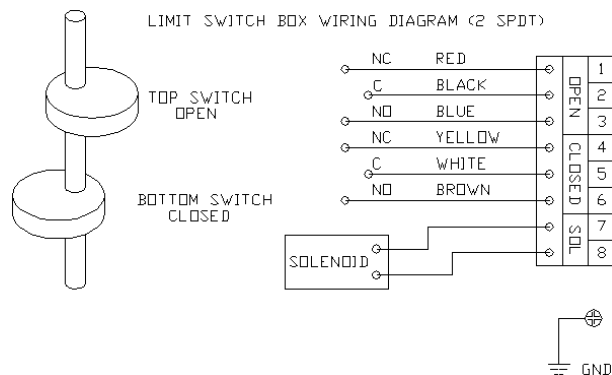


FIGURE NO. 1

4.3 LIMIT SWITCH CONTACT RATINGS

4.3.1 FPS 10 - WATERTIGHT LIMIT SWITCH (FPS PN 6010-1008)

Enclosure Rating: IP67
Bracket: ISO 5211
Cable Entry: 2 x ½" PF
Terminal Strip: 8 Points
Position Indicator: 0-90°; Beacon-Type
(Open=yellow / Closed=red)
Switch Type: 2 x SPDT, Mechanical
Switch Rating: 15A – 120VAC/240VAC
0.6A – 125VDC
0.3A – 250VDC

4.3.2 FPS 20 - EXPLOSION PROOF LIMIT SWITCH (FPS PN 6010-1009)

Enclosure Rating: Explosionproof Cl.I / Div.1 / Gr. ABCD / T5;
Dust Ignitionproof Cl.II,III / Div.1 / Gr.EFG / T5;
AEx d IIC / Cl.I / Zone1 / T5;
IP67

Standards: FM Class 3600
FM Class 3615
FM Class 3810
ANSI/ISA 60079-0
ANSI/ISA 60079-1
ANSI/IEC 60529

Bracket: ISO 5211
Cable Entry: 2 x ¾" Threaded Conduit
Terminal Strip: 8 Points
Position Indicator: 0-90°; Beacon-Type
(Open=yellow / Closed=red)
Switch Type: 2 x SPDT, Mechanical
Switch Rating: 15A – 120VAC/240VAC
0.6A – 125VDC
0.3A – 250VDC

4.4 MAINTENANCE - REPLACING LIMIT SWITCH

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete FPS valve automated valve repair check sheet FP081.0.

Procedure shows a watertight limit switch (6010-1008), follow a similar procedure for the explosion proof model (6010-1009).

For explosion proof limit switches (6010-1009) limit switch must be wired as per Class 1 Division 2 wiring methods using class 1 Division 2 rated sealing fittings as required.

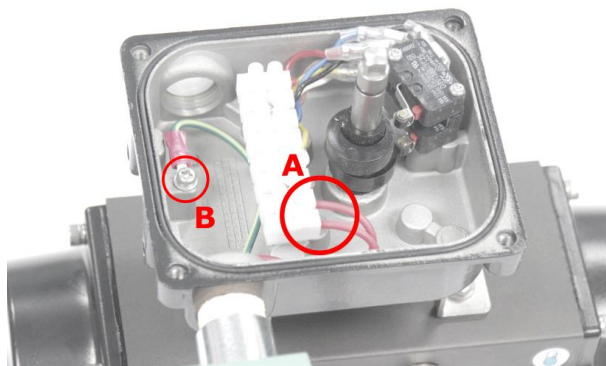
Disassembly:

To remove the limit switch:

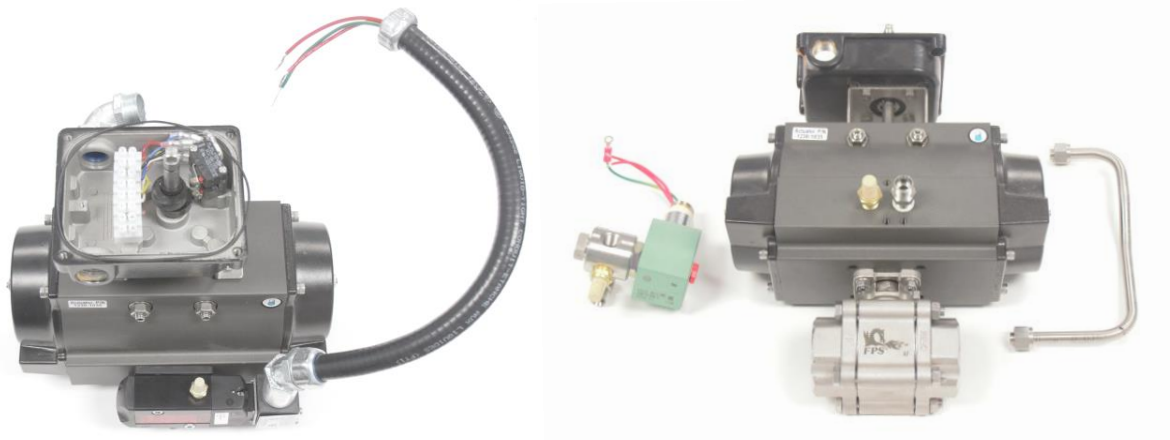
- 1) Ensure valve is in its fail-safe (not actuated) position fully open or closed before disassembly. Pressure trapped in the valve or actuator if partially stroked could be hazardous.
- 2) De-pressurize process media and instrument air and turn off electrical power to the valve before attempting any repair.
- 3) Remove limit switch cover by loosening four capscrews.



- 4) Disconnect the two power leads from the limit switch terminal block and the ground lead from the ground stud. Also remove all field connections, taking note of where each lead is landed.



- 5) For a spool type 8551 solenoid, remove the electrical conduits from the limit switch housing leading to the solenoid and the plant field connection (not shown). For poppet type 8320 or 8316 solenoids, disconnect the instrument air tubing and plant field connection (not shown) and remove the solenoid from the limit switch housing.



- 6) Unscrew the four capscrews holding the limit switch adapter onto actuator and remove the limit switch.



- 7) If the limit switch is to be replaced, remove and clean the conduit elbow for use with the new limit switch.

Assembly (Normally closed Valve):

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete FPS valve automated valve repair check sheet FP081.0.

Note: For all FPS CSA approved normally closed valves requiring closed/proof of closure (POC) limit switch, follow the steps in Section 4.5 below.

Note: A normally closed valve blocks flow through the valve when no instrument air or electrical signal is being sent to the solenoid. It will fail closed in this configuration. FPS normally closed valves will have one of the following numbers as the last digit in their item code. For example item code 9650-xxx-xxx-xxx-xxx0 is for a normally closed valve with no approvals.

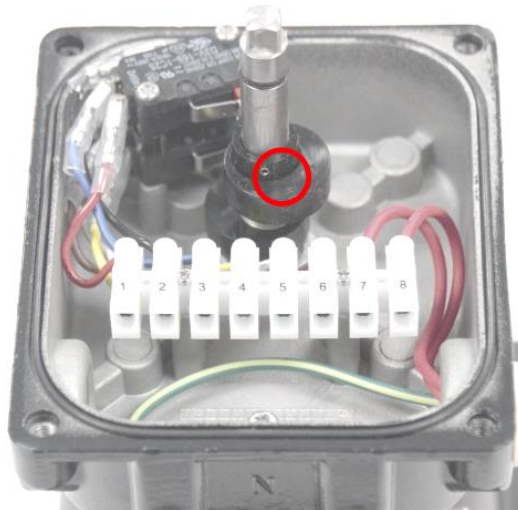
Last Digit	Service Requirements
0	No Approval – Normally Closed
2	CSA Gas Safety Shutoff Valve – Normally Closed
4	Steam – Normally Closed
5	FM Safety Vent Valve – Normally Closed
8	FM/CSA Safety Vent Valve – Normally Closed

- 1) **Ensure the same model of limit switch is used in reassembly.**
- 2) Apply Masters Orange T-Tape thread sealant or similar to the cleaned conduit elbows before installing in the limit switch.
- 3) Ensure field wire connections in the terminal block are landed on the correct terminals as removed in step 4). Refer to figure no. 1.
- 4) Follow disassembly steps 4) to 6) in reverse for installation of the replacement limit switch. Do not install the cover in this step.
- 5) Connect instrument air supply to the solenoid and apply power to stroke the valve open.
- 6) Set the open (upper) limit switch cam by rotating it until the limit switch makes. Monitor the output of the open limit switch with a multimeter between terminals 1 and 2. There should be continuity when the limit switch is made.

Note: Color of limit switch cams can be different to illustrations and does not indicate open or closed limit switch. Upper cam/limit switch is always open and lower cam/limit switch is always closed.



- 7) Remove power to let the valve close and ensure the open (upper) limit switch loses contact just as the valve begins to travel. Set the closed (lower) limit switch cam when the valve is in the fully closed position. Monitor the output of the closed limit switch with a multimeter between terminals 4 and 5. Apply power to stroke the valve open and ensure the closed (lower) limit switch loses contact as the valve begins to travel but before it opens. Seal the limit switch cams in position with a bead of Permatex Red Hi-Temp Silicone RTV or similar in the location shown.



- 8) Ensure the limit switch cover is oriented properly so the driveshaft engages with the limit switch indicator. The limit switch indicator should show "Closed" when power is not applied.
- 9) Tighten the four cover capscrews and stroke the valve to confirm operation.
- 10) Following limit switch reassembly, refer to section 7 for valve testing.

Assembly (Normally open Valve):

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

Note: A normally open valve allows flow through the valve when no instrument air or electrical signal is being sent to the solenoid. It will fail open in this configuration. FPS normally open valves will have one of the following numbers as the last digit in their item code. For example item code 9650-xxx-xxx-xxx-xxx1 is for a normally open valve with no approvals.

Last Digit	Service Requirements
1	No Approval – Normally Open
3	CSA Gas Safety Vent Valve – Normally Open
6	FM Safety Vent Valve – Normally Open
7	Steam – Normally Open
9	FM/CSA Safety Vent Valve – Normally Open

- 1) **Ensure the same model of limit switch is used in reassembly.**
- 2) Apply Masters Orange T-Tape thread sealant or similar to the cleaned conduit elbows before installing in the limit switch.
- 3) Ensure field wire connections in the terminal block are landed on the correct terminals as removed in step 4). Refer to figure no. 1.
- 4) Follow assembly steps 4) to 6) in reverse for installation of the replacement limit switch. Do not install the cover in this step.
- 5) Connect instrument air supply to the solenoid but do not actuate it.
- 6) Set the open (upper) limit switch cam by rotating it until the limit switch makes. Monitor the output of the open limit switch with a multimeter between terminals 1 and 2. There should be continuity when the limit switch is made.

Note: Color of limit switch cams can be different to illustrations and does not indicate open or closed limit switch. Upper cam/limit switch is always open and lower cam/limit switch is always closed.



- 7) Apply power to stroke the valve to its fully closed position, ensuring that the open (upper) limit switch loses contact just as the valve begins to travel. Set the closed (lower) limit switch cam when the valve is in the fully

closed position. Monitor the output of the closed limit switch with a multimeter between terminals 4 and 5. Remove power to let the valve open and ensure the closed limit switch loses contact as the valve begins to travel but before it opens. Seal the limit switch cams in position with a bead of Permatex Red Hi-Temp Silicone RTV or similar in the location shown.



- 8) Ensure the limit switch cover is oriented properly so the driveshaft engages with the limit switch indicator. The limit switch indicator should show “Open” when power is not applied.
- 9) Tighten the four cover capscrews and stroke the valve to confirm operation.
- 10) Following limit switch reassembly, refer to section 7 for valve testing.

4.5 CSA CLOSED/PROOF OF CLOSURE LIMIT SWITCH

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

For all FPS CSA approved normally closed valves requiring closed/proof of closure (POC) limit switch, follow the steps in the proof of closure limit switch setting section below.

Proof of closure limit switch setup:

This procedure is required on the following CSA approved automatic valves with POC limit switch.

Size	Part Number
½"	9650-0220-20xx-11yy-00z2
¾"	9650-0230-20xx-11yy-00z2
1"	9650-0240-20xx-11yy-00z2
1 ¼"	9650-0250-21xx-11yy-00z2
1 ½"	9650-0260-22xx-11yy-00z2
2"	9650-0270-22xx-11yy-00z2

xx = various solenoid options

yy = various end connection and seat options

z = various limit switch options

- 1) The valve is checked to ensure that it is in its de-energized and "Normally closed" state
- 2) The bottom limit switch (Closed/POC) in the limit switch enclosure is adjusted so that the NO contact (Terminals 5&6) is closed.
- 3) The upstream side of the valve body is pressurized to 300psig
- 4) The valve solenoid is energized.
- 5) Instrument air is applied to the valve solenoid and the instrument air pressure is raised in order to have the valve open slowly.
- 6) As the valve is opening, the bottom limit switch (Closed/POS) in the limit switch enclosure NO contact (Terminals 5&6) must open prior to any leakage of the 300psig air through the valve.
- 7) Leakage through the valve is verified by means of a bubble flow meter on the downstream side of the valve, leakage must be zero.
- 8) The valve solenoid is de-energized.
- 9) As the valve is closing the bottom limit switch (Closed/POC) in the limit switch enclosure NO contact (Terminals 5&6) is checked to ensure that it is closed only when flow across the valve ceases.
- 10) The limit switch is sealed via a rubberized compound.
- 11) Instrument air pressure is set to 70psig.
- 12) The valve is stroked 10 times and checked for proper operation of all components including limit switch, solenoid operation, actuator operation and valve operation.
- 13) Following limit switch reassembly, refer to section 7 for valve testing.

5 ACTUATOR

5.1 GENERAL INFORMATION

FPS does not recommend that the user perform service on any of the internal components within the rack and pinion type actuator assembly. If foreign material enters the actuator and impairs proper operation the actuator should be replaced.

Actuators are of the Rack and Pinion type and available in either spring-return or double-acting configurations. The actuators are sized with the appropriate torque for the valve size and operation required.

5.1.1 ACTUATOR AIR SUPPLY SPECIFICATIONS

Standard Pressure Actuator:

- Non-Corrosive Lubricated or Non-Lubricated Air, Natural Gas or Inert Gas
- Min 414 kPa (70 psig)
- Max 828 kPa (120 psig)

Low Pressure Actuator:

- Non-Corrosive Lubricated or Non-Lubricated Air, Natural Gas or Inert Gas
- Min 345 kPa (50 psig)
- Max 414 kPa (70 psig)

5.1.2 DOUBLE ACTING ACTUATOR- TORQUE

Model	Air Torque Output @ Operating Pressure - PSIG				
	40 PSIG	60 PSIG	80 PSIG	100 PSIG	120 PSIG
A125	63	94	125	156	188
A250	125	187	250	312	375
A450	225	337	450	562	675
A1000	500	750	1000	1250	1500
A2250	1125	1687	2250	2812	3375
A3650	1825	2738	3650	4563	5475
A5000	2500	3750	5000	6250	7500
A11000	5500	8250	11000	13750	16500

5.1.3 SPRING RETURN ACTUATOR- TORQUE

Model	Spring Set	Spring	Torque	60 PSIG		80 PSIG		100 PSIG		120 PSIG	
				Start	End	Start	End	Start	End	Start	End
A250	4	140	90	88	31	151	93	213	156	276	218
A450	4	254	162	158	54	271	167	383	279	496	392
A1000	4	559	360	350	120	599	371	848	618	1097	867
A2250	4	1320	787	816	226	1379	788	2029	1351	2505	1914
A3650	4	2091	1217	1388	423	2300	1335	3211	2246	4123	3157
A5000	4	3130	1570	1980	414	3180	1600	4370	2800	5560	3990
A11000	4	6790	3430	4330	932	6930	3530	9520	6130	12100	8730
AS125	Med	4500	2665	2181	630	4167	3053	6008	5717	7268	7268
AS140	Med	6460	3630	3101	630	6105	3658	9012	6880	10950	9012
AS160	Med	10178	6815	4797	678	9327	5669	13663	11434	16473	15504

5.2 MAINTENANCE - REPLACING ACTUATOR

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

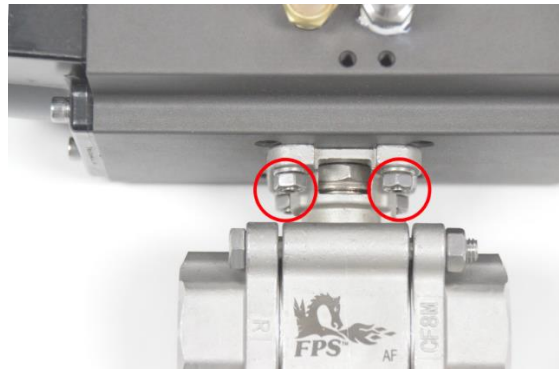
Note: FPS does not authorize body or actuator repairs on FM approved valves. Please contact the factory for any replacement of valve or actuator.

Procedure shows a watertight limit switch, explosion proof is similar.

Disassembly:

To remove the actuator:

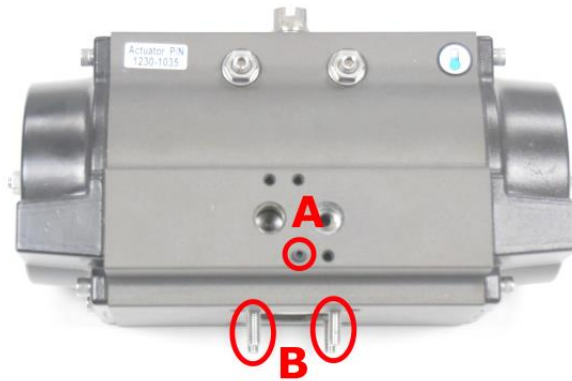
- 1) Ensure valve is in its fail-safe (not actuated) position fully open or closed before disassembly. Pressure trapped in the valve or actuator if partially stroked or a partially compressed actuator spring could be hazardous.
- 2) De-pressurize process media and instrument air and turn off electrical power to the valve before attempting any repair.
- 3) Remove limit switch and solenoid by following the steps in sections 3 and 4 above.
- 4) Remove the four nuts or bolts holding the actuator onto the valve and remove the actuator. Valve sizes larger than 2 inch and all flanged valves use bolts while smaller valves use studs threaded in the actuator and nuts.



- 5) Remove the actuator taking care not to lose the adapter insert **circled**. Take note of the order of assembly.



- 6) If the solenoid used in the assembly is a NAMUR mount, and the actuator is to be replaced, not the location of the set screw **A**, used to locate the solenoid adapter plate and remove it.



- 7) If the actuator is to be replaced, remove the four studs **B** (if equipped) in the bottom of the actuator using the appropriate hex key.

Assembly:

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

- 1) **Ensure the same model of actuator is used in reassembly.**
- 2) If the solenoid used in the assembly is a NAMUR mount, screw in solenoid locator screw 4 to 5 turns. Ensure that enough of the screw is protruding so that the mating hole in the solenoid adapter plate can locate properly.



- 3) Follow assembly steps 3) to 6) in reverse for assembly.

CAUTION: IF VALVE IS A "NORMALLY CLOSED" VALVE, ENSURE THE BALL VALVE IS IN THE CLOSED POSITION BEFORE RE-INSTALLING THE ACTUATOR. VALVE POSITION CAN BE CONFIRMED BY VISUALLY LOOKING AT THE BALL POSITION TO ENSURE FLOW IS BLOCKED AND VISUALLY CONFIRMING THE LINE SCRIBED ON THE STEM IS PERPENDICULAR TO FLOW

IF VALVE IS A "NORMALLY OPEN" VALVE, ENSURE THE BALL VALVE IS IN THE OPEN POSITION BEFORE RE-INSTALLING THE ACTUATOR. VALVE POSITION CAN BE CONFIRMED BY VISUALLY LOOKING AT THE BALL POSITION TO ENSURE FLOW IS NOT BLOCKED AND VISUALLY CONFIRMING THE LINE SCRIBED ON THE STEM IS PARALLEL TO FLOW

- 4) Place electrical service in operation and check valve for correct operation by means of visually verifying ball position both energized and de-energized.
- 5) Following actuator replacement, refer to section 7 for valve testing.

6 BALL VALVE

6.1 GENERAL INFORMATION

The FPS threaded and socket weld connection valves consist of a three-piece body design which allows the center section to be easily removed for replacement of the ball, seats and seals without disturbing the pipe connections. The FPS flanged connection valves consist of a two-piece body design.

All 1/4" - 2" valves are reduced-port, with all others being full-port design.

The ball valve seals in both directions ensuring successful pre-start leak testing.

316 Stainless Steel is used for the ball, stem and hardware.

6.1.1 SERIES 88 BODY BOLTS- TORQUE

Size	Threads	lbf-in	kgf-cm	N-m
1/4"	M6	87 ~ 95	100 ~ 110	9.8 ~ 10.8
3/8"	M6	87 ~ 95	100 ~ 110	9.8 ~ 10.8
1/2"	M6	95 ~ 130	110 ~ 150	10.8 ~ 14.7
3/4"	M8	122 ~ 156	140 ~ 180	13.7 ~ 17.6
1"	M8	165 ~ 200	190 ~ 230	18.6 ~ 22.5
1.1/4"	M10	191 ~ 217	220 ~ 250	21.6 ~ 24.5
1.1/2"	M10	330 ~ 365	380 ~ 420	37.2 ~ 41.2
2"	M12	365 ~ 399	420 ~ 460	41.2 ~ 45.1

6.1.2 SERIES 90D BODY BOLTS- TORQUE

Size	Threads	lbf-in	kgf-cm	N-m
1/2"	M8	174 ~ 200	200 ~ 230	19.6 ~ 22.5
3/4"	M8	200 ~ 217	230 ~ 250	22.5 ~ 24.5
1"	M10	260 ~ 286	300 ~ 330	29.4 ~ 32.3
1.1/4"	M10	347 ~ 391	400 ~ 450	39.2 ~ 44.1
1.1/2"	M12	286 ~ 304	330 ~ 350	32.3 ~ 34.3
2"	M12	347 ~ 391	400 ~ 450	39.2 ~ 44.1
2.1/2"	M12	347 ~ 391	400 ~ 450	39.2 ~ 44.1
3"	M14	477 ~ 521	550 ~ 600	53.9 ~ 58.8
4"	M14	477 ~ 521	550 ~ 600	53.9 ~ 58.8
6"	M14	477 ~ 521	550 ~ 600	53.9 ~ 58.8

6.1.3 SERIES 88 STEM NUT- TORQUE

Size	lbf-in	kgf-cm	N-m
1/4"	78	90	8.8
3/8"	78	90	8.8
1/2"	87	100	9.8
3/4"	87	100	9.8
1"	104	120	11.8
1.1/4"	104	120	11.8
1.1/2"	148	170	16.7
2"	148	170	16.7

6.1.4 SERIES 90D STEM NUT- TORQUE

Size	lbf-in	kgf-cm	N-m
1/2"	104	120	11.8
3/4"	104	120	11.8
1"	104	120	11.8
1.1/4"	148	170	16.7
1.1/2"	191	220	21.6
2"	191	220	21.6
2.1/2"	191	220	21.6
3"	260	300	29.4
4"	260	300	29.4
6"	347	400	39.2

6.2 MAINTENANCE – 3 PIECE THREADED/SOCKET WELD VALVES

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

NOTE: FPS DOES NOT AUTHORIZE BODY OR ACTUATOR REPAIRS ON FM APPROVED VALVES. PLEASE CONTACT THE FACTORY FOR ANY REPLACEMENT OF VALVE OR ACTUATOR.

CAUTION: BALL VALVES CAN TRAP FLUIDS IN THE BALL CAVITY WHEN CLOSED. RELIEVE LINE PRESSURE PRIOR TO SERVICING VALVE.

Rebuilding:

A repair kit may be ordered for these valves, consisting of seats, stem seals, stem O-ring, gland packing and gaskets. See Section 9 for applicable part numbers.

To replace the seats and seals:

Disassembly (Refer to exploded view of threaded/socket weld valve):

- 1) Ensure valve is in its fail-safe (not actuated) position fully open or closed position before disassembly. Pressure trapped in the valve or actuator if partially stroked could be hazardous.
- 2) De-pressurize process media and instrument air and turn off electrical power to the valve before attempting any repair.
- 3) Remove the handle/actuator/solenoid /limit switch.
- 4) Place the valve in the open position using a wrench on the valve stem.
- 5) Remove the end cap bolts.
- 6) Separate the end caps from the valve body.
- 7) Remove old seats and ball.
- 8) Remove the valve stem from the bottom of the valve body including the stem seals and O-ring.
- 9) Remove the gland packing from the top of the valve body.
- 10) Clean all sealing surfaces of the valve including the ball.

Notes:

The ball and surfaces against which the seats and seals are installed must be undamaged, clean and free of pit marks and scratches. Light marring from the action of the ball against the seats is normal and will not affect the operation of the valve. Flaws which can be seen but not detected with fingertips are acceptable. The stem and body surfaces that the thrust bearings and stem seals contact must be undamaged, clean and free from pit marks and scratches.

For Socket Weld connection valves, special care must be taken when welding the pipe to the valve as soft seat seals (ie PTFE, Teflon) are used. The following precautions and procedures must be taken:

- 1) Welding cannot be applied to the valve when assembled.
- 2) The end cap must be removed prior to welding.
- 3) The following procedures must be taken:
 - a. remove the end cap from the valve
 - b. weld the straight pipe to the end cap
 - c. wait until the end cap has cooled down
 - d. fit the end cap to the valve body; see section 6, page 10 for body bolt torque

Assembly (Refer to exploded view of threaded/socket weld valve):

- 1) Lightly lubricate the ball and seats with AeroShell Grease 22.
- 2) Place new gland seal on top of the valve body.
- 3) Place new stem seals, and O-ring on stem.
- 4) With the stem in the closed position replace the ball and seats. The scribed line on the top indicates direction of flow through the ball.
- 5) Place valve in the open position.
- 6) Ensure that all seats and body seals are in the correct position.

- 7) Replace and tighten body bolts evenly and diagonally opposite one another.

CAUTION: IF VALVE IS A “NORMALLY CLOSED” VALVE, ENSURE THE BALL VALVE IS IN THE CLOSED POSITION BEFORE RE-INSTALLING THE ACTUATOR. VALVE POSITION CAN BE CONFIRMED BY VISUALLY LOOKING AT THE BALL POSITION TO ENSURE FLOW IS BLOCKED AND VISUALLY CONFIRMING THE LINE SCRIBED ON THE STEM IS PERPENDICULAR TO FLOW

IF VALVE IS A “NORMALLY OPEN” VALVE, ENSURE THE BALL VALVE IS IN THE OPEN POSITION BEFORE RE-INSTALLING THE ACTUATOR. VALVE POSITION CAN BE CONFIRMED BY VISUALLY LOOKING AT THE BALL POSITION TO ENSURE FLOW IS NOT BLOCKED AND VISUALLY CONFIRMING THE LINE SCRIBED ON THE STEM IS PARALLEL TO FLOW

- 8) Pressurize process media and instrument air to the valve.
- 9) Place electrical service in operation and check valve for correct operation/orientation by means of visually verifying ball position both energized and de-energized.
- 10) Following valve replacement, refer to section 7 for valve testing.

6.2.1 EXPLODED VIEW OF THREADED / SOCKET WELD VALVE

Note: All highlighted parts are included in repair kit

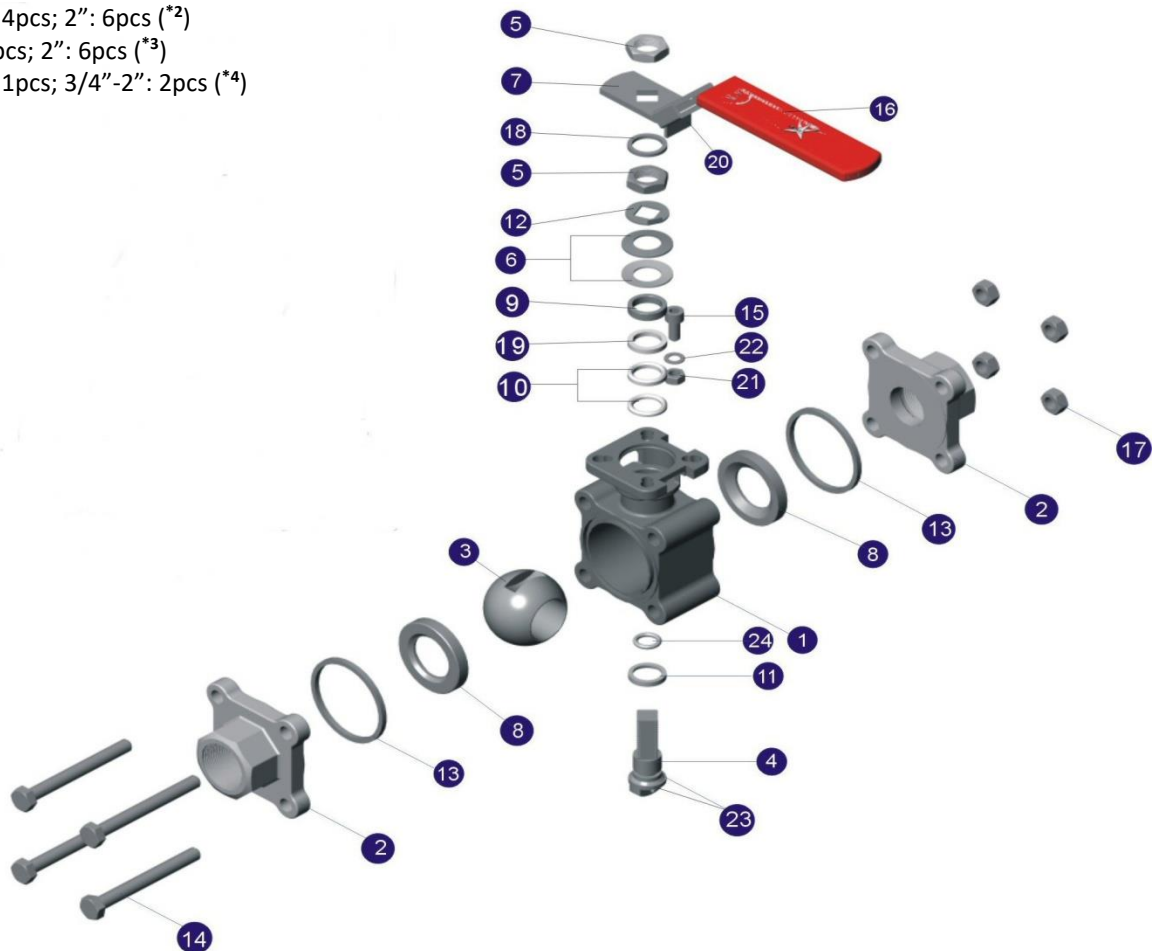
No.	Part Name	Material	Qty	No.	Part Name	Material	Qty
1	Body	ASTM A351 Gr. CF8M	1	13	Joint Gasket	PTFE	2
2	End Cap	ASTM A351 Gr. CF8M ^{*1}	2	14	Bolt	SUS 304	*2
3	Ball	SUS 316	1	15	Stop Pin	SUS 304	1
4	Stem	SUS 316	1	16	Handle Sleeve	Vinyl	
5	Stem Nut	SUS 304	2	17	Bolt Nut	SUS 304	*3
6	Belleville Washer	SUS 301	2	18	Stem Washer	SUS 304	1
7	Handle	SUS 304	1	19	Gland Packing	25% Glass Fiber Filled & PTFE	1
8	Seat	RPTFE	2	20	Locking Device	SUS 304	1
9	Gland	SUS 304	1	21	Pin Nut	SUS 304	1
10	Gland Packing	Graphite	1	22	Washer	SUS 304	1
11	Stem Seal	RPTFE	1	23	Antistatic Device	SUS 316	*4
12	Stop Washer	SUS 304	1	24	O'Ring	Viton	1

Socket Weld and butt weld uses CF3M material (*1)

¼"-1 ½": 4pcs; 2": 6pcs (*2)

¼"-1": 4pcs; 2": 6pcs (*3)

¼"-1/2": 1pcs; 3/4"-2": 2pcs (*4)



6.3 MAINTENANCE – 2 PIECE FLANGED VALVES

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

NOTE: FPS DOES NOT AUTHORIZE BODY OR ACTUATOR REPAIRS ON FM APPROVED VALVES. PLEASE CONTACT THE FACTORY FOR ANY REPLACEMENT OF VALVE OR ACTUATOR.

CAUTION: BALL VALVES CAN TRAP FLUIDS IN THE BALL CAVITY WHEN CLOSED. RELIEVE LINE PRESSURE PRIOR TO SERVICING VALVE.

Rebuilding: A repair kit may be ordered for these valves, consisting of seats, stem seals, stem O-ring, gland packing and gaskets. See Section 9 for applicable part numbers.

Disassembly (Refer to exploded view of flanged valve):

To replace the seats and seals:

- 1) Ensure valve is in its fail-safe (not actuated) position fully open or closed position before disassembly. Pressure trapped in the valve or actuator if partially stroked could be hazardous.
- 2) De-pressurize process media and instrument air and turn off electrical power to the valve before attempting any repair.
- 3) Remove the handle/actuator/solenoid /limit switch.
- 4) Place the valve in the open position using a wrench on the valve stem. Unscrew all flange bolts or studs & nuts and remove valve from the line.
- 5) Remove end cap bolts.
- 6) Remove end cap to expose the ball and ball seats.
- 7) Remove the valve stem from the bottom of the valve body including the stem seals and O-ring.
- 8) Remove body seal, ball & seat.
- 9) Remove the gland packing at the top of the valve body.
- 10) Clean all sealing surfaces of the valve including the ball.

Note: The ball and surfaces against which the seats and seals are installed must be undamaged, clean and free of pit marks and scratches. Light marring from the action of the ball against the seats is normal and will not affect the operation of the valve. Flaws which can be seen but not detected with fingertips are acceptable. The stem and body surfaces that the stem seals contact must be undamaged, clean and free from pit marks and scratches.

Assembly (Refer to exploded view of flanged valve):

- 1) Lightly lubricate the ball and seats with AeroShell Grease 22.
- 2) Place new stem seal and O-ring on stem and insert assembly through the body cavity.
- 3) Place the new gland packing into the top of the valve body cavity.
- 4) Insert far seat in body ensuring that the seal rests firmly on the back surface of the recess.
- 5) Place stem in the closed position. The scribed line on the top indicates direction of flow through the ball.
- 6) Insert ball into body so that stem slot engages tang on stem.
- 7) Insert body seal ensuring that it is resting squarely on the seal surface of the body.
- 8) Insert seat in recess of end plug and slide the end plug into the body as far as it will go.
- 9) Secure the end cap in place by threading in the end plug body bolts and tightening each one firmly.
- 10) Ensure that all seats and body seals are in the correct position.
- 11) Replace the handle/actuator/solenoid /limit switch.

CAUTION: IF VALVE IS A “NORMALLY CLOSED” VALVE, ENSURE THE BALL VALVE IS IN THE CLOSED POSITION BEFORE RE-INSTALLING THE ACTUATOR. VALVE POSITION CAN BE CONFIRMED BY VISUALLY LOOKING AT THE BALL POSITION TO ENSURE FLOW IS BLOCKED OR VISUALLY CONFIRMING THE LINE SCRIBED ON THE STEM IS PERPENDICULAR TO FLOW

IF VALVE IS A “NORMALLY OPEN” VALVE, ENSURE THE BALL VALVE IS IN THE OPEN POSITION BEFORE RE-INSTALLING THE ACTUATOR. VALVE POSITION CAN BE CONFIRMED BY VISUALLY LOOKING AT THE BALL POSITION TO ENSURE FLOW IS NOT BLOCKED OR VISUALLY CONFIRMING THE LINE SCRIBED ON THE STEM IS PARALLEL TO FLOW

- 12) Pressurize the process media and instrument air to the valve.
- 13) Place electrical service in operation and check valve for correct operation by means of visually verifying ball position both energized and de-energized.
- 14) Following valve replacement, refer to section 7 for valve testing.

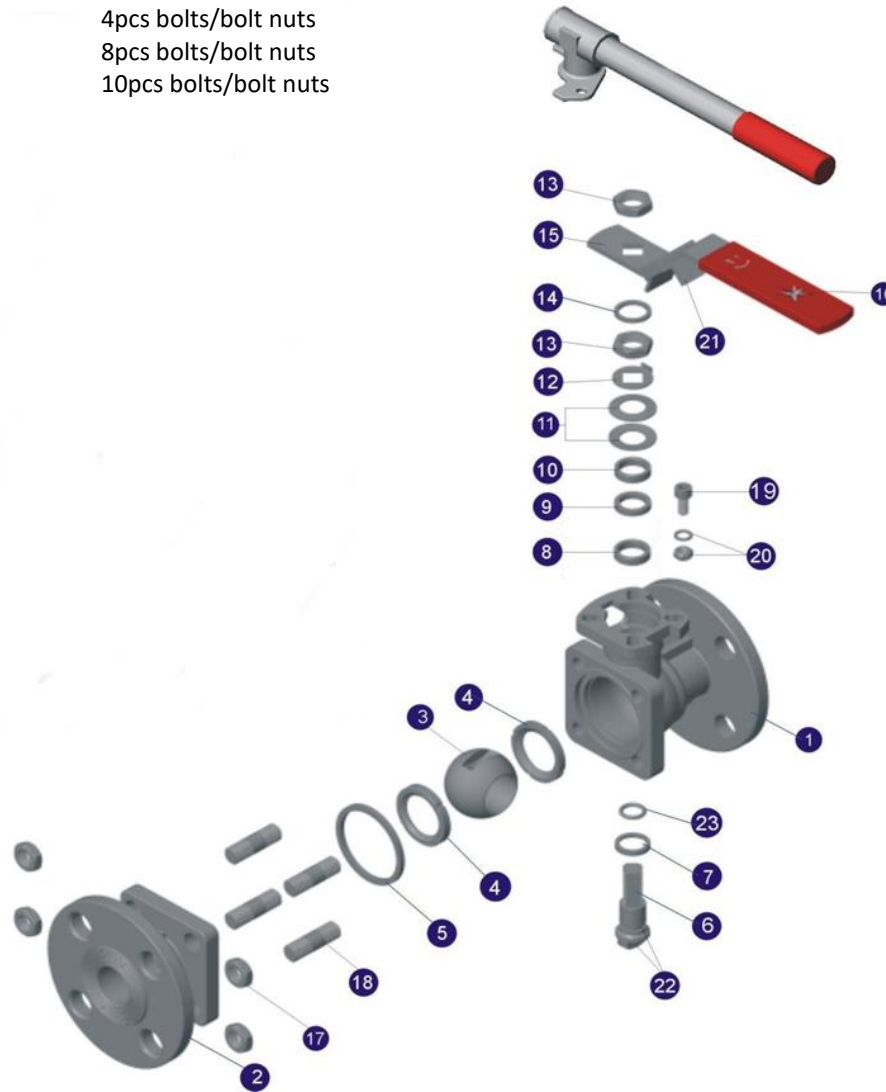
6.3.1 EXPLODED VIEW OF FLANGED VALVE

Note: All highlighted parts are included in repair kit

No.	Part Name	Material	Qty	No.	Part Name	Material	Qty
1	Body	CF8M / WCB	1	13	Stem Nut	SUS 304	2
2	End Cap	CF8M / WCB	1	14	Stem Washer	SUS 304	1
3	Ball	SUS 316	1	15	Handle	SUS 304	1
4	Seat	RPTFE	2	16	Handle Sleeve	Vinyl	1
5	Joint Gasket	Graphite/PTFE	*1	17	Bolt Nut	SUS 304	*2
6	Stem	SUS 316	1	18	Bolt	SUS 304	*2
7	Stem Seal	15% Glass Fiber Filled PTFE	1	19	Stop Pin	SUS 304	1
8	Gland Packing	Graphite	1	20	Pin Nut & Washer	SUS 304	1
9	Bushing	25% Glass Fiber Filled PTFE	1	21	Locking Device	SUS 304	1
10	Gland Bush	SUS 304	1	22	O'Ring	Viton	1
11	Belleville Washer	SUS 301	2	23	Anti-static Device	SUS 316	2
12	Stop Washer	SUS 304	1				

(*1) All sizes:
 (*2) ½"-2":
 (*2) 2 ½"-5":
 (*2) 6":

1pc graphite & 1pc PTFE **OR** 1pc graphite
 4pcs bolts/bolt nuts
 8pcs bolts/bolt nuts
 10pcs bolts/bolt nuts



7 VALVE TESTING

Caution: following ANY valve maintenance it is required to fully test valve operation and to complete fps valve automated valve repair check sheet FP081.0.

FOLLOWING VALVE MAINTENANCE, DISASSEMBLY OR REPLACEMENT OF ANY VALVE COMPONENT THE VALVE ASSEMBLY MUST BE TESTED AS FOLLOWS:

7.1 REPLACEMENT OF SOLENOID, ACTUATOR OR DISASSEMBLY OF VALVE BODY

7.1.1 ALL VALVE ASSEMBLIES:

Test	Description	Notes
Limit Switch Beacon Position	Valve placed in open position. Visually confirm flow is not blocked by valve ball and visually confirm indicator beacon shows "OPEN". Valve placed in closed position. Visually confirm flow is blocked by valve ball and visually confirm indicator beacon shows "CLOSED"	For normally open valves, power should be applied to close the valve and for normally closed valves, power should be applied to open the valve.
Operation Cycling	Valve is cycled between open and closed 10 times.	Ensure valve is operating smoothly and visually confirm valve ball is completely opening and closing. Also ensure open and closed limit switches are closing when valve is open and closed respectively.

7.1.2 CSA APPROVED VALVE ASSEMBLIES:

Approval Standard	Test	Description	Notes
CSA 6.5-2000/2.4.2	Internal Leakage @300psig	Valve placed in the closed position. Inlet pressurized and maintained @ 300psig for at least 2 minutes.	Maximum leakage = 14 in ³ /hr (1" and smaller seal off diameter) Maximum leakage = 14 in ³ /hr per inch of seal off diameter (for valves with greater than 1" seal off diameter)
	Internal Leakage @1/4psig (7" H2O)	Valve placed in the closed position. Inlet pressurized and maintained @ 1/4psig for at least 2 minutes.	Maximum leakage = 14 in ³ /hr (1" and smaller seal off diameter) Maximum leakage = 14 in ³ /hr per inch of seal off diameter (for valves with greater than 1" seal off diameter)
CSA 6.5-2000 /4.4	Closing Time	The valve shall be energized and subsequently de-energized; the valve shall close in a period of 2 seconds or less.	

7.1.3 FM APPROVED & NON-APPROVED VALVE ASSEMBLIES:

Approval Standard	Test	Description	Notes
FM 7400	Internal Leakage @300psig	Valve placed in the closed position. Inlet pressurized and maintained @ 300psig for at least 2 minutes.	Maximum leakage = 24 in ³ /hr air.
	Internal Leakage @20psig	Valve placed in the closed position. Inlet pressurized and maintained @ 20psig for at least 2 minutes.	Maximum leakage = 24 in ³ /hr air.
FM 7400	Closing Time	The valve shall be energized and subsequently de-energized; the valve shall close in a period of 5 seconds or less.	

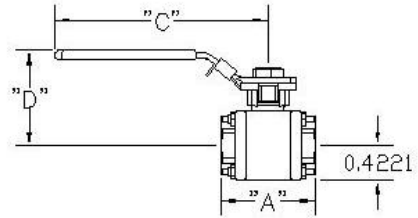
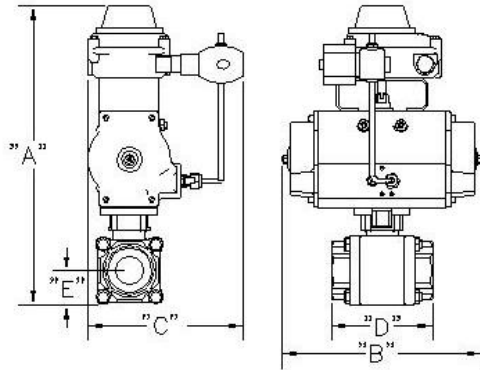
7.2 REPLACEMENT OF LIMIT SWITCH

Approval Standard	Test	Description	Notes
CSA 6.5-2000 /3.12 CSA 6.5-2000 /3.12	Proof of Closure/Open	The "Closed" and "Open" limit switches are to be set and verified by actuating the valve to both the open and closed positions. Continuity is to be measured at the limit switch terminal blocks to verify correct settings. Once set, these switches are to be sealed by the method depicted on the relevant valve assembly drawing.	

8 TROUBLE SHOOTING

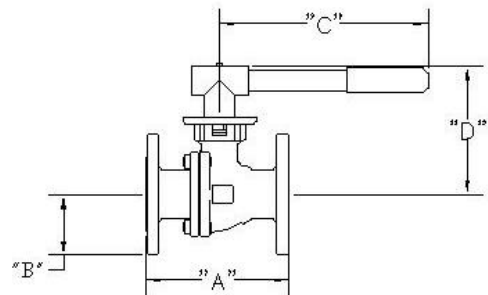
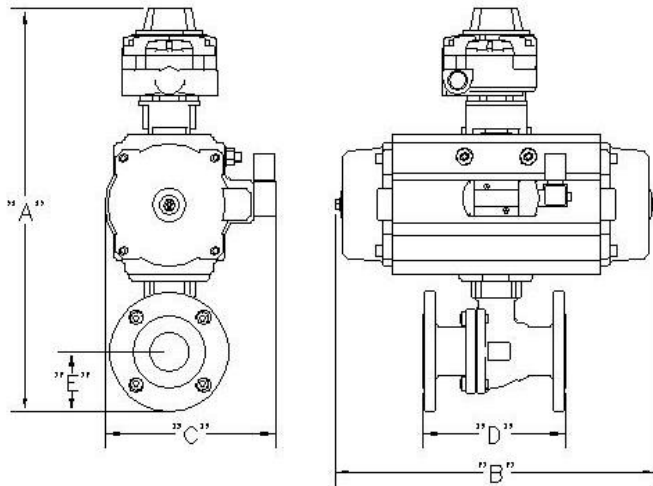
SYMPTOM	PROCEDURE
Valve fails to operate	Check electrical supply with voltmeter. Voltage must agree with nameplate rating. Check coil with ohmmeter for shorted or open coil. Make sure that pressure complies with nameplate rating. Pressure must not be less than 60psig.
Valve is sluggish or inoperative electrical supply and pressure check out	Disassemble ball valve as per Section 6 Disassembly Instructions. Clean out extraneous matter, replace faulty parts as required. Replace Solenoid. Replace Actuator.
Valve operates but limit switch does not indicate open/closed status correctly	Verify interrogation voltage supply for limit switch. Verify proper limit switch settings. Replace limit switch.

9 GENERAL DIMENSIONS



SIZE	CV	"A" In.(mm)	"B" In.(mm)	"C" In.(mm)	"D" In.(mm)	"E" In.(mm)	WEIGHT lbs.(kg)
1/4"	8	12.1(308.2)	7.4(188)	7.28(186)	2.95(74.9)	1.03(26.2)	11.9(5.4)
3/8"	8	12.1(308.2)	7.4(188)	7.28(186)	2.95(74.9)	1.03(26.2)	11.9(5.4)
1/2"	8	12.1(308.2)	7.4(188)	7.28(186)	2.95(74.9)	1.03(26.2)	11.9(5.4)
3/4"	15	12.5(317.6)	7.4(188)	7.28(186)	2.95(74.9)	1.03(26.2)	13(5.9)
1"	34	13.8(352)	7.4(188)	7.28(186)	3.41(86.6)	1.28(32.6)	16.7(7.6)
1-1/4"	56	14(355.4)	8.03(204)	8(205)	4.17(106)	1.34(34)	18.2(8.3)
1-1/2"	85	15.9(404.3)	9.87(250.8)	8.9(228)	4.29(109)	1.52(38.6)	26.0(11.8)
2"	125	17(431.1)	9.87(250.8)	8.9(228)	5.0(127)	1.69(42.9)	29.3(13.3)

SIZE	CV	"A" In.(mm)	"B" In.(mm)	"C" In.(mm)	"D" In.(mm)	WEIGHT lbs.(kg)
1/4"	8	2.95(74.9)	1.03(26.2)	5.2(133.3)	2.91(73.9)	1.9(0.86)
3/8"	8	2.95(74.9)	1.03(26.2)	5.2(133.3)	2.91(73.9)	1.85(0.85)
1/2"	8	2.95(74.9)	1.03(26.2)	5.2(133.3)	2.91(73.9)	1.75(0.79)
3/4"	15	2.95(74.9)	1.03(26.2)	5.2(133.3)	2.91(73.9)	1.8(0.82)
1"	34	3.41(86.6)	1.28(32.6)	5.2(133.3)	2.91(73.9)	3.04(1.38)
1-1/4"	56	4.17(106)	1.34(34)	6.8(172.7)	3.9(99)	4.74(2.15)
1-1/2"	85	4.29(109)	1.52(38.6)	6.8(172.7)	3.9(99)	6.15(2.79)
2"	125	5.0(127)	1.69(42.9)	8.45(214.6)	5(126.7)	9.4(4.26)



SIZE	CV	"A" In.(mm)	"B" In.(mm)	"C" In.(mm)	"D" In.(mm)	"E" In.(mm)	WEIGHT lbs.(kg)
1/4"	12	14.1(358)	7.8(195)	7.5(191)	4.3(108.3)	1.75(44.5)	11.5(5.2)
3/4"	32	14.5(368)	7.8(195)	7.7(196)	4.6(117.3)	1.94(49)	12.3(5.6)
1"	70	14.9(380)	8(204)	8(203)	5(127.1)	2.125(54)	15.9(7.2)
1-1/2"	240	17.5(443)	9.87(251)	8.9(228)	6.5(165.1)	2.5(63.5)	26.7(13)
2"	410	18.2(463)	13.8(350)	9.9(252)	7(178.3)	3(76)	45.5(20.6)
2-1/2"	680	20.3(515)	13.8(350)	10.4(264)	7.5(190)	3.5(89)	56.7(25.7)
3"	940	21.2(539)	15.9(404)	11.8(300)	8(203.5)	3.75(95.5)	86(38)
4"	1740	23(584)	19.2(488)	12.6(320)	9(228.6)	4.5(114.5)	130.9(59.4)
6"	5000	28.5(725)	25.2(640)	14.3(363)	15.5(394)	5.5(139.5)	280.8(127.3)

SIZE	CV	"A" In.(mm)	"B" In.(mm)	"C" In.(mm)	"D" In.(mm)	WEIGHT lbs.(kg)
1/4"	12	4.3(108.3)	1.75(44.5)	6.5(165)	3.3(82.7)	4(1.81)
3/4"	32	4.6(117.3)	1.94(49)	6.5(165)	3.4(87.2)	4.8(2.19)
1"	70	5(127.1)	2.125(54)	6.5(165)	3.7(94.8)	6.4(2.91)
1-1/2"	240	6.5(165.1)	2.5(63.5)	10.3(262)	5.8(147.1)	14.1(6.4)
2"	410	7(178.3)	3(76)	10.3(262)	6.1(154.6)	20.3(9.19)
2-1/2"	680	7.5(190)	3.5(89)	10.3(262)	6.9(174)	31.5(14.3)
3"	940	8(203.5)	3.75(95.5)	14.4(365)	7(178.7)	43(19.5)
4"	1740	9(228.6)	4.5(114.5)	14.4(365)	8(203.2)	68.3(31)
6"	5000	15.5(394)	5.5(139.5)	29.5(750)	10.9(278.7)	165.3(75)

10 SPARE PARTS

SPARE PARTS

For recommended spare parts, please consult factory.