Mooney
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22/22H Series Pilots

Instruction Manual (Rev.A)

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Table of Contents

This manual provides installation, operation and maintenance instructions for the Mooney Series 22/22H Pilots.

Product Description

The Mooney Series 22 Pilot is a two stage pressure control regulator designed for use on Mooney FlowMax™ HP valves. It is intended to precisely control the Loading pressure to the FlowMax HP actuator in gas applications.

Series 22 – Stainless steel construction with a 3 to 450 psig (0.2 barg - 31 barg) control pressure range.

Series 22H - High pressure, stainless steel construction with a 200 to 900 psig (14 barg - 62 barg) control pressure range.

The parts in all constructions are interchangeable. The high pressure construction on the Series 22H differ from the Series 22 with the addition of a diaphragm spacer assembly that reduces the effective area of the diaphragm and increases the spring range of the black and white/green springs.

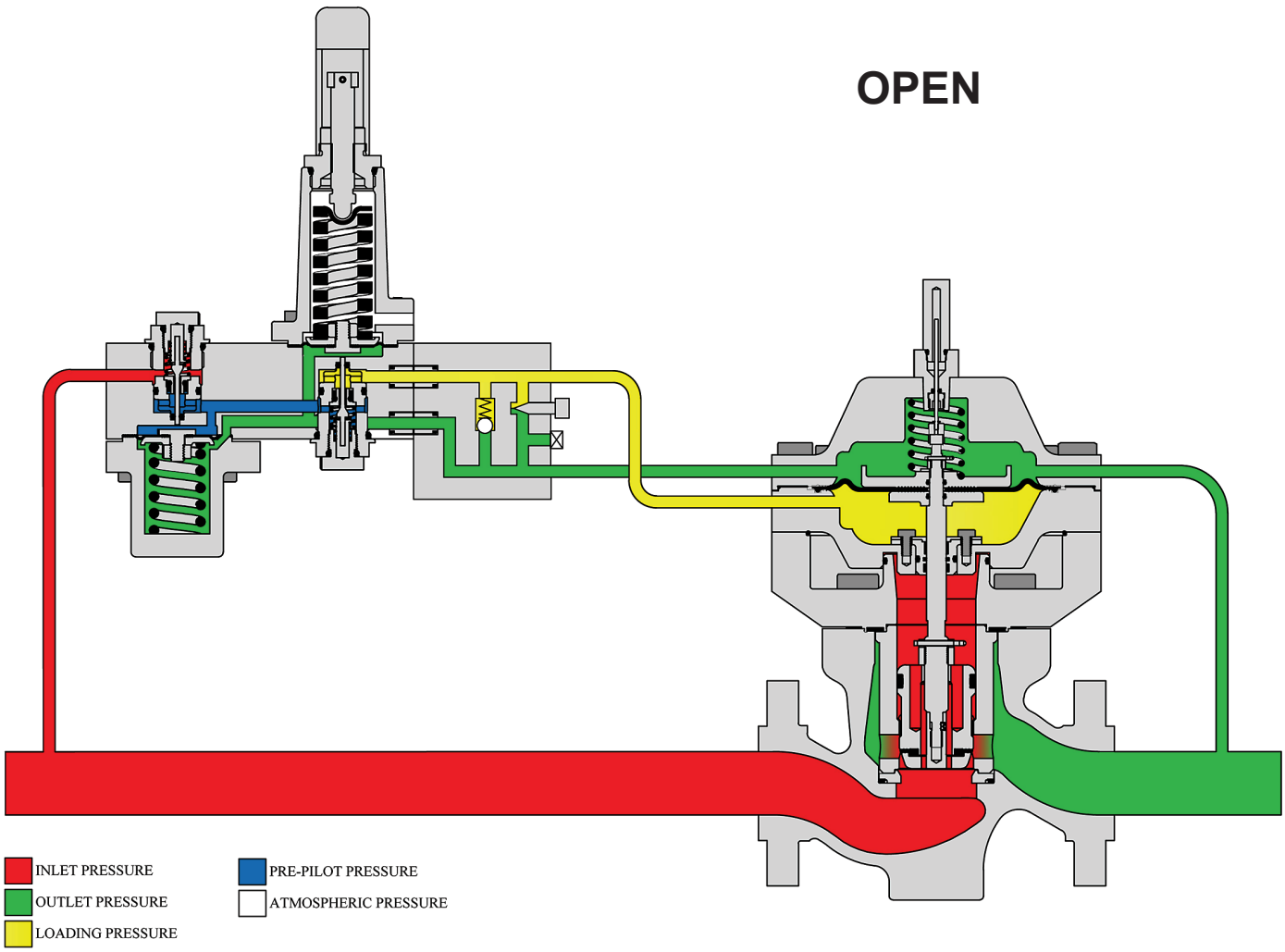


Figure 1 - Series 22/22H Schematic

General Description

Spring Housing (1): – The Pilot Spring Housing is provided with a 1/4 inch NPT vent connection which may be piped to a safe area or pressure loaded for remote control of the pressure setting. The Main Spring may be changed by simply removing the Closing Cap (1A).

Body Insert Assembly (2): A removable Body Insert Assembly (cartridge), at the bottom of the Pilot Body, contains the inner valve mechanism. The cartridge may be replaced with a spare unit for fast troubleshooting or repair. The Body Insert Assembly is also field repairable. The same Body Insert Assembly is used on the Pre-Pilot section of the Series 22 Pilot and the cartridges are interchangeable.

Inlet and Loading Ports (3): The INLET port is where upstream supply pressure is connected to the Series 22 Pilot Assembly. The LOADING port is used to connect the controlling signal from the pilot to the loading port on the actuator.

Sensing Port (4): The Series 22 Pilot has multiple Sensing options with the standard configuration being the ½" NPT connection directly connected to the FlowMax HP actuator with flow passing through the Type 27 Restrictor, to the Upper Actuator Housing, then downstream to the point of control.

Integrated Check Valve (5):
Prevents damage to the diaphragm in situations where pressure is reversed and downstream pressure exceeds upstream pressure.

Diaphragm Spacer Assembly (not shown): The addition of this assembly converts the Series 22 Pilot into the high pressure Series 22H. It reduces the pilot diaphragm area and increases the spring range of the black and white/green springs.

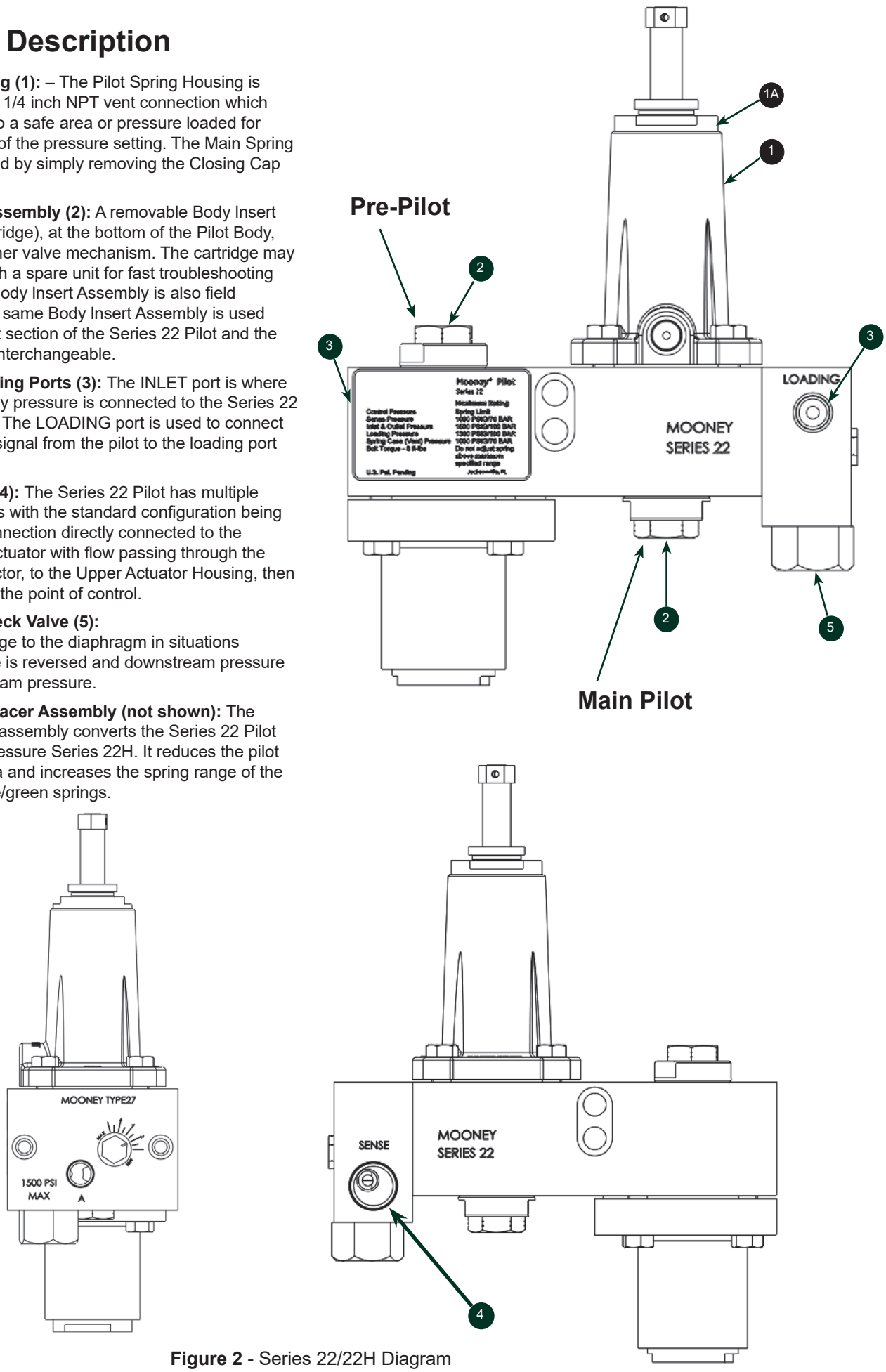


Figure 2 - Series 22/22H Diagram

Table 1.

Materials of Construction Series 22 and 22H	
Body & Spring Housing	Stainless Steel
Body Insert & Closing Cap	Stainless Steel
Diaphragm Spacer Assembly	Stainless Steel
Orifice	Stainless Steel or Delrin
Plug & Stem	Nitrile/Stainless Steel FKM/Stainless Steel Stainless Steel
Diaphragm	Nitrile/Nylon or FKM/Nylon
O-Rings	Nitrile or Viton

FKM Table 2.

Specifications All Series 22 Pilots	
Control Application	Pressure Reducing (PRV)
Orifice Size	0.15 in (3.81 mm)
Connections	1/4 in NPT
Temperature	Working -20°F to 150°F (-29 °C to 66°C) Emergency -40°F to 200°F (-40°C to 93°C)
Maximum Inlet Pressure	1500 psig (100 barg)
Maximum Loading Pressure	1500 psig (100 barg)
Maximum Outlet Pressure	1500 psig (100 barg)
Maximum Emergency Sensing Pressure	1000 psig (70 barg)
Maximum Spring Housing Pressure	1000 psig (70 barg)
Set Pressure Range	3-900 psig (0.2 - 62 barg) [1]

1. Refer to Table 3 for specific spring ranges.

Table 3.

Specifications				
Series	**Spring Range**		**Color**	**Part Number**
22	3 - 12 psig	(0.2 - 0.8 barg)	Red	040-014-01
	10 - 40 psig	(0.7 - 2.7 barg)	Plated	040-011-01
	25 - 90 psig	(1.7 - 6.2 barg)	Blue	040-012-01
	60 - 200 psig	(4 - 14 barg)	Purple	040-008-01
	100 - 260 psig	(7 - 18 barg)	Black	040-009-01
	200 - 450 psig	(14 - 31 barg)	White/Green	040-020-01
22H	200 - 520 psig	(14 - 36 barg)	Black	040-009-01
	400 - 900 psig	(27 - 62 barg)	White/Green	040-020-01

Pilot Markings (Figure 3)

1. Location of the Pilot nameplate.
2. Location of spring range nameplate. The factory marks the nameplate to indicate which spring is installed at manufacture date. If the spring is changed make sure to note it on the nameplate.
3. The month and year the pilot is manufactured is noted on the Spring Case, Body, and Body Insert of the pilot. (Located on the back of the Pilot Assembly)

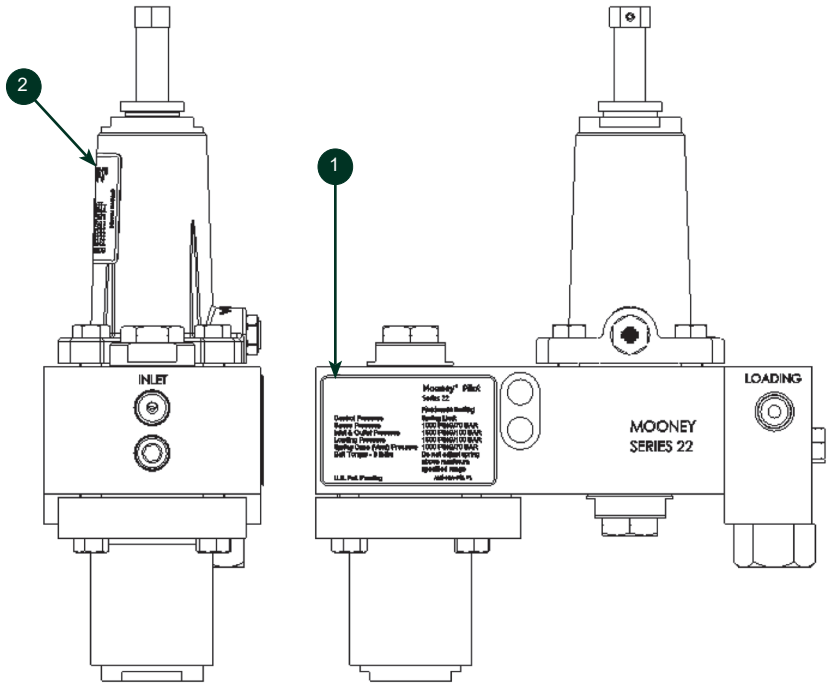


Figure 3 - Pilot Markings

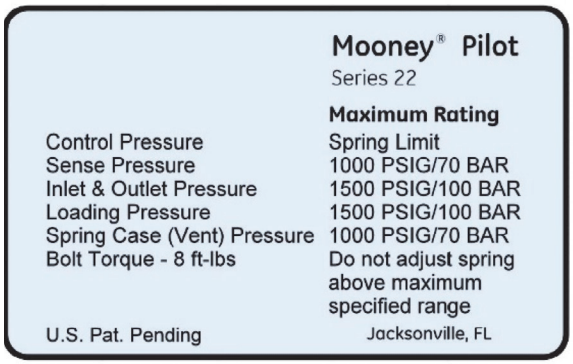


Figure 4 - Nameplate for Series 22 & 22H Pilots

Figure 5 - Nameplate for Series 22 Pilots

Figure 6 - Spring Range Nameplate for Series 22H Pilots

Table 4.

Item	Definition
Mooney Pilot	Trademarked name of pilot.
Series	Model number of pilot.
Control Pressure	The control pressure is limited to the spring range of the spring on the pilot (Refer to Figures 5 and 6).
Sense Pressure	Maximum allowable pressure in sense port.
Inlet & Outlet Pressure	Maximum allowable pressure (psig) to the Inlet and Outlet ports.
Loading Pressure	Maximum allowable pressure (psig) to the Loading port.
Spring Case (Vent) Pressure	Maximum allowable pressure (psig) to the Spring Case (Vent) port.
Bolt Torque	Recommended bolt torque for spring case in foot pounds.
Red, Plated, Blue, Purple, Black and White/Green	Each spring is color coded to indicate the control pressure range

Series 22 Pilot - Piping Schematics - Loading Type Valves

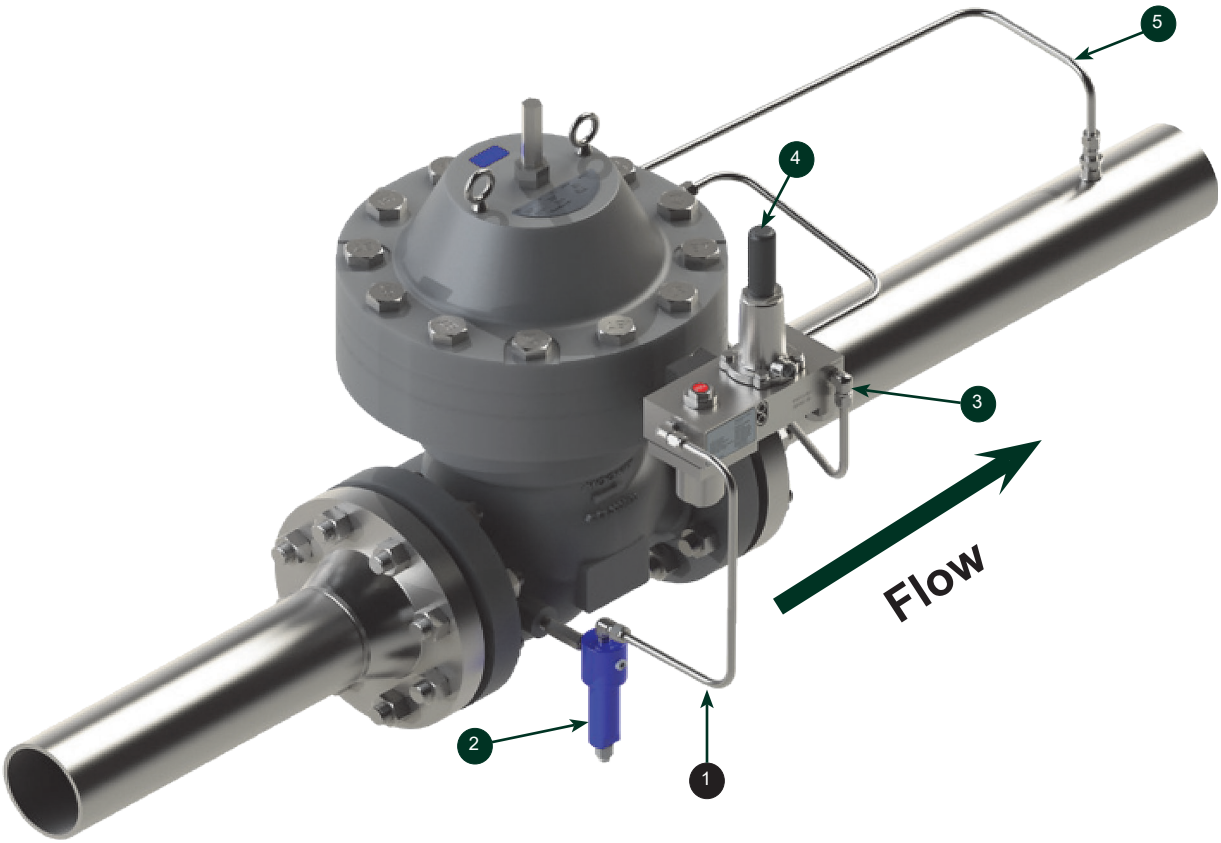


Figure 7 - Loading Type Valve (Pressure Reducing Valve)

1. Pilot supply tubing from filter OUTLET connection to the Series 22 pilot INLET port.
2. Type 30 filter mounted in inlet piping.
3. LOADING port of Series 22 pilot connected to Loading connection on the actuator housing of the FlowMax HP regulator
4. Sense line connecting the SENSE Port on the Series 22 pilot to the sense port on the FlowMax HP actuator.
5. Sense line connecting the FlowMax HP regulator to the downstream piping.

Series 22 Pilot - Loading Type Valve Installation

⚠WARNING

Personal injury, equipment damage, leakage or explosion of accumulated gas or bursting of pressure containing parts may result if this valve/ regulator is over pressured or is installed where service conditions could exceed the limits given in the specification of this manual or on the nameplate, or where conditions exceed any ratings of the adjacent piping or piping connections. Verify the limitations of valve, pilot and pipeline to ensure no device is over pressured. To avoid such injury or damage, provide pressure relieving or pressure limiting devices (as required by the U.S. code of Federal Regulations, by the National Fire Codes of the National Fire Protection Association, or by other applicable codes) to prevent service conditions from exceeding those limits. Additionally, physical damage to the regulator, pilot, or tubing can cause personal injury and/or property damage due to explosion of accumulated gas. To avoid injury and damage, install the valve in a safe location.

⚠WARNING

Gas regulators installed in confined or enclosed spaces should be provided with adequate ventilation to prevent the possibility of gas buildup or accumulation from leaks and venting. Leaks or vented gas may accumulate causing personal injury, death, or property damage. Pilot spring cases and the regulator enclosure should be vented to a safe area away from air intakes, or any hazardous location. The vent lines and stacks must be protected against condensation and plugging.

NOTE: For Series 22 pilots, lubricate the adjusting screw with a light, nitrile rubber compatible grease such as Lubriplate™ #105, or equivalent, at first opportunity, and thereafter, annually and during any interim maintenance.

For Series 22 Pilots, inspect the closing cap for thread wear by verifying the torque required to modify the set point is less than 6 ft-lbs (8.14 Nm) and inspect for metal particles on the adjusting screw or on the closing cap threads. This should be completed at the first opportunity, and thereafter, annually and during any interim maintenance.

The Series 22 pilot with Purple, Black, or White with a Green Stripe springs have higher tendency to wear due to higher spring pressure. Spring range (color) is indicated on the spring range label located on the pilot.

If it is determined that closing cap thread wear has occurred, it is recommended that the cap and adjusting screw be replaced with a Closing Cap Assembly. For Closing Cap Assembly retro-fit kits, contact your local sales representative for ordering information.

1. **PERSONNEL:** Installation of the Series 22 Pilot on the FlowMax HP Valve or any other manufacturer valve should be made by qualified personnel familiar with high-pressure piping and Pilot-operated Regulators.
2. **PRIOR INSPECTION:** Inspect the Pilot for any damage that might have occurred in shipping.
3. **CONTROL ACTION:** Inspect to make sure the Body Insert Assembly (Cartridge) is in the correct operational mode. Remove the Body Insert Assembly and measure the stem extension from the Body Insert. (Refer to the Maintenance section of this manual – Figure 17.

   Pressure Reducing Mode (PRV): the stem extends 0.32 inches (8.12 mm).

   If incorrect, follow the Body Insert Assembly disassembly and assembly instructions in the Maintenance section of this manual.
4. **ORIENTATION:** The Series 22 Pilot may be installed in any position - the best position being one that provides easiest access for pilot adjustment and valve maintenance.
5. **PILOT MOUNTING:** It is recommended that the Series 22 Pilot be mounted to the FlowMax HP regulator using the two threaded mounting holes on the front of the Adapter Housing.

NOTE: To avoid galling when stainless steel to stainless steel connections are made, use a lubricant (such as NEVER SEEZ™ by Bostik). For best results lightly lubricate the female threads. Mixing the lubricant with pipe dope is also acceptable. When tightening do not exceed more than 1/4 turn past the point the threads start to bind.

6. **RESTRICTOR:** The Type 27 Restrictor block is mounted to the end of the Series 22 Pilot block using two socket head cap screws and two pressure retaining pins with o rings. The Type 27 Restrictor block also includes a Check valve to protect the diaphragm from damage in the case of sudden downstream pressure buildup sometimes associated with system start up.
7. **PILOT SUPPLY LINES:** Run a 3/8-inch tubing or 1/4-inch pipe supply line from the upstream piping or from the valve body connection on the inlet side of the valve to the pilot inlet port The pilot supply connection should have a full and clean opening.
8. **A FILTER** in the pilot supply line is recommended to remove dirt and other particulates that could affect the restrictor or variable orifice in the pilot. Refer to the Type 30 Filter IOM manual for installation instructions.

NOTE: A shutoff valve is not required in the supply to the pilot, but if one is installed it should be a full opening type.

9. **PILOT SENSE AND LOADING LINES:** Run 3/8 inch tubing or 1/4 inch pipe from the pilot LOADING port to the lower actuator port. Run ½ inch tubing from the SENSE port to the upper actuator port.

NOTE: The Actuator LOADING and SENSE lines are typically installed at the factory on new valves.

10. **PILOT GAS HEATERS (OPTIONAL):** Pilot supply gas can be heated to prevent the formation of ice or hydrates in the pilot system. Pilot supply gas heaters should be connected after the pilot filter (if one is used).
11. **CONTROL LINES:** The user will need to install a DOWNSTREAM SENSE line (CONTROL LINE) from the back port on the actuator to a location at least 8-10 pipe diameters downstream (see Figure 6). Since there is flow in the DOWNSTREAM SENSE line, ½" tubing is recommended

NOTE: The control line connection should be 8-10 pipe diameters away from areas of turbulence (such as valves, reducers, and elbows) and should have a full opening into the pipe, free from burrs, drill peels, and weld slag. Shutoff valves are not required in the control line(s), but if installed, they should be of the full opening type. The control line connection should be in a section of pipe where the gas velocity is less than 100 ft/s (30 m/s) for stability.

12. **VENT VALVES AND GAUGE CONNECTIONS:** Troubleshooting recommendation. To aid in maintenance and Troubleshooting, shut off and vent valves can be installed in tubing connections, and should be of the full open or ball style.

Maintenance

Pilot parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends on severity of service conditions and/or the requirements of local, state, and federal regulations. Be certain that the name plates are updated to accurately indicate any field changes in equipment, materials, service conditions, or pressure settings.

NOTE: Before disassembly make sure the regulator and pilot have been isolated from the process by closing block valves on the inlet and outlet sides of the regulator. Safely release pressure and process fluid from the regulator body and pilot system. Failure to properly complete these steps may result in personal injury and property damage.

1. After depressurizing the pilot and main valve unscrew and remove Body Insert Assembly.
2. Remove the Stem O-Ring from the pilot body using a suitable tool and being careful not to scratch the O-Ring Groove.

Figure 8 - A paper clip, or pick easily extracts the O-Ring out of the pilot body.

NOTE: A spare Body Insert assembly may be installed and the regulator returned to service if time is a factor. Make sure the Stem O-Ring is in place in the Pilot Body before installing the new Body Insert Assembly or, if removed, slip a new O-Ring over the Stem of the Body Insert assembly prior to installing it in the Pilot Body. Be sure to lube the new stem O-Ring prior to installation.

Pilot Disassembly - All Series 22 pilots

3. Remove the Bottom Cap from the Body Insert and remove the internal parts. The Orifice Assembly can be easily pushed out of the Body Insert using a heavy paper clip or 0.045" (1.14mm) diameter wire. See Figure 9.

NOTE: Do not scratch or damage the O-Ring sealing surface of the Body Insert.

Figure 9 - The orifice can be pushed out of the Body Insert (Cartridge) using a paper clip.

4. Inspect all parts for wear or damage. Replace as necessary.
5. **PILOT DIAPHRAGM:** Release all Main Spring tension by unscrewing Adjusting Screw. Remove Closing Cap, Spring Follower, and Main Spring. Remove Spring Housing Cap Screws and remove Diaphragm Assembly & Disassemble Diaphragm Assembly and inspect Diaphragm. Replace if necessary.

Pilot Assembly - Series 22

1. Diaphragm Assembly: Install the Pilot Diaphragm with convex side toward Diaphragm Plate and Main Spring (Refer to Figure 9). Tighten nut on the Diaphragm Retainer to approximately 5 to 6 ft-lbs. (6.78 - 8.1 n-m) torque.

NOTE: Over-tightening will distort the Pilot Diaphragm.

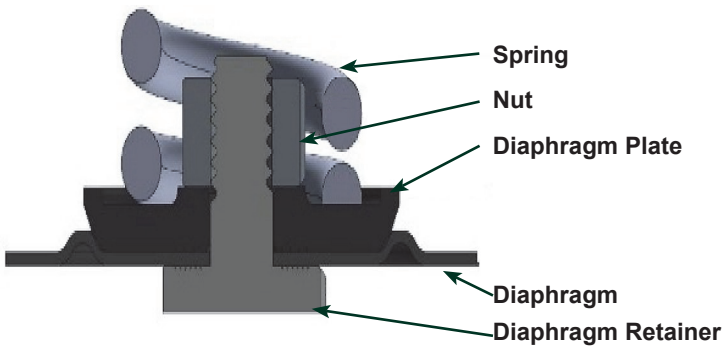


Figure 10 - Diaphragm Assembly for the 22 Series Pilot.

2. Place Diaphragm Assembly in the pilot body with the diaphragm touching the grooved sealing surface of the pilot body. (Refer to Figure 11).

Figure 11 - Placing Diaphragm Assembly on Pilot Body.

3. Place Spring Housing on Pilot Body with vent connection in desired position. The standard factory installation will be with the vent facing directly away from the regulator.

Figure 12 - Placing the Spring Housing on the Pilot Body.

4. Install Spring Housing Cap Screws. Use cap screws supplied and tighten evenly to 8 ft-lbs (10.8 Nm) torque.
5. Install Spring and Spring Follower. Lubricate Spring Follower with a Petroleum Grease such as Lubriplate™ No. 105.

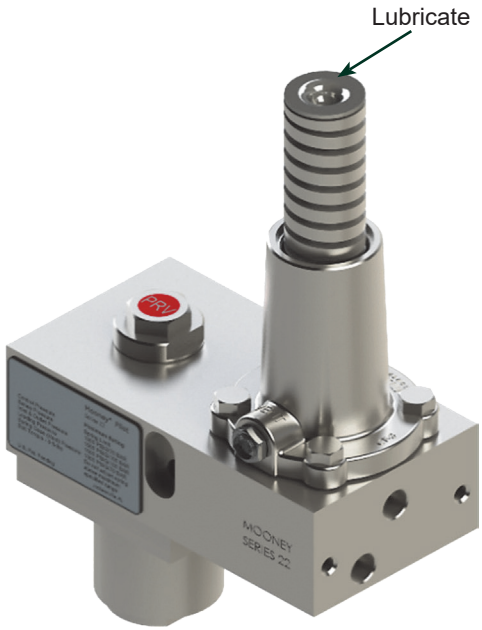


Figure 13 - Installing the Spring with lubricated Spring Follower: **Lubricate with Petroleum Grease such as Lubriplate™ No. 105.**

6. To avoid galling of adjusting screw, apply a small amount of lubricant (such as NEVER SEEZ™ by Bostik to the adjusting screw thread.

6A. **PILOTS WITH THE RED, PLATED, BLUE, AND PURPLE SPRINGS:** Install Closing Cap with Adjusting Screw and Sealing Nut and O-Ring.

Figure 14 - Installing the closing cap assembly for Pilot with the Red, Plated, Blue, and Purple Springs.

6B. PILOTS WITH BLACK AND WHITE/GREEN SPRING: Install Closing Cap with Adjusting Screw, Spacer, Sealing Nut, and O-Ring. The spacer prevents the Black and White/ Green springs from being over compressed.

Figure 15 - Installing the closing cap assembly with spacer (to prevent spring over compression) for Pilots with the Black and White/Green Springs.

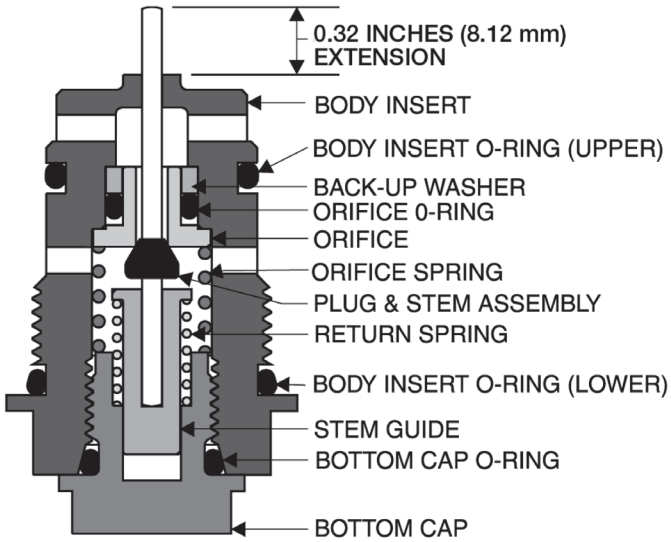


Figure 16 - Body Insert Assembly

7. Refer to Figure 17. Stack the following parts on the Bottom Cap in the order shown in the drawing:

Return Spring	Orifice
Stem Guide	Orifice O-Ring
Orifice Spring	Back-up Washer
Plug & Stem	

Figure 17 - Stack the Return Spring, Stem Guide, Orifice Spring, Plug and Stem, Orifice O-Ring, and Back up Washer on the Bottom Cap.

8. Lubricate both Body Insert O-Rings with Parker Super O-Lube™ (or equivalent Petroleum based Lubricant) and install on Body Insert (Cartridge).
9. **Body Insert Assembly:** Lift Bottom Cap complete with valve mechanism assembly and insert into Body Insert. The Orifice Spring should snap the Orifice into place as the Bottom Cap is screwed into place. Check the assembly by pushing the Stem against a hard surface to make sure it moves freely and returns to the extended position.

Figure 18 - Insert the assembly into the Body Insert - the orifice should “snap” into place.

10. Lubricate Stem O-Ring with Parker Super O-Lube™ (or equivalent silicone lubricant) and slip over Stem.
11. Insert Body Insert into Pilot Body and screw into place snugly.

Figure 19 - Insert Body Insert (Cartridge) with lubricated Stem O-Ring into the Pilot Body.

NOTE: Over tightening an O-Ring joint will not improve the seal. Screw in until metal parts make contact and snug slightly.

12. Pilot assembly is now complete.

Pilot Assembly - Series 22H

NOTE: The high pressure constructions (Series 22H) differs from the Series 22 with the addition of a diaphragm spacer assembly that limits the effective area of the diaphragm and doubles the spring range of the black and white/green springs.

1. Install the Pilot Diaphragm with convex side toward Diaphragm Plate and Main Spring (refer to Figure 20). Tighten nut on the diaphragm Retainer to approximately 5 to 6 ft-lbs. (6.78 – 8.14 N-m) torque.

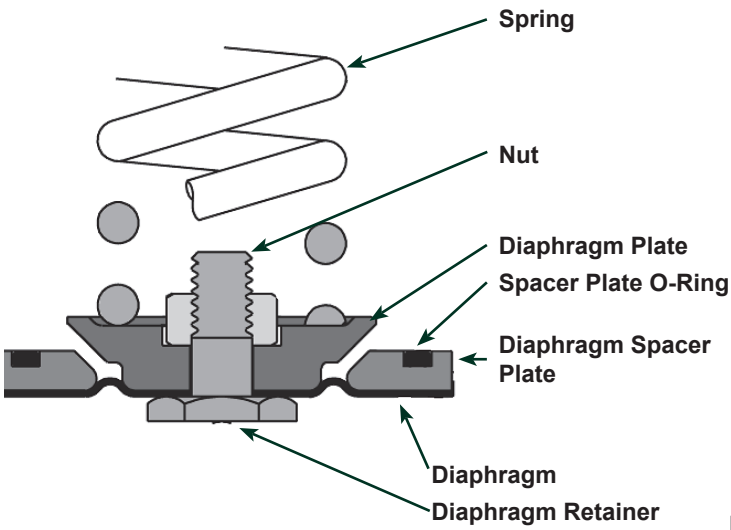


Figure 20 - HP Diaphragm Assembly

NOTE: Over tightening will distort the Pilot Diaphragm.

2. Place Diaphragm Assembly in the pilot body with the diaphragm touching the grooved sealing surface of the pilot body and the O-Ring facing up.

Figure 21 - Diaphragm Assembly

3. Place Spring Housing on Pilot Body with vent connection in desired position.

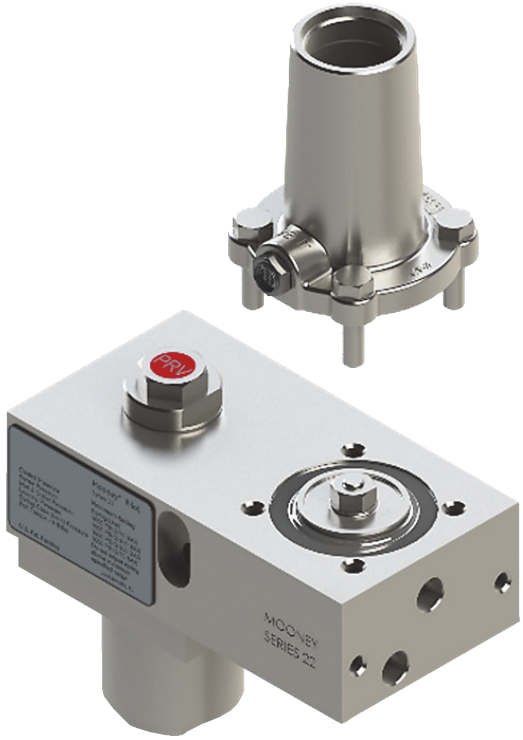


Figure 22 - Placing the Spring Housing on the Pilot Body.

4. Install Spring Housing Cap Screws. Use Cap Screws supplied and tighten evenly to 8 ft-lbs torque.
5. Install Spring and Spring Follower.

NOTE: The Mooney Series 22H uses only the Black and White/Green Springs.

6. Follow assembly directions for Series 22 Pilot for steps 6B through 10.

Type 27 Restrictor Assembly

The Type 27 Restrictor Assembly includes the adjustable orifice and an integrated check valve to protect the diaphragm from damage in case of a sudden spike in back pressure to the system.

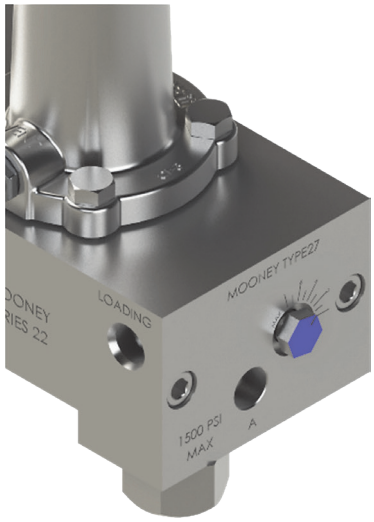


Figure 23 - Type 27 Restrictor Assembly

The Type 27 Restrictor is connected to the main body of the Series 22 pilot by two socket head cap screws and two pressure retaining pins.

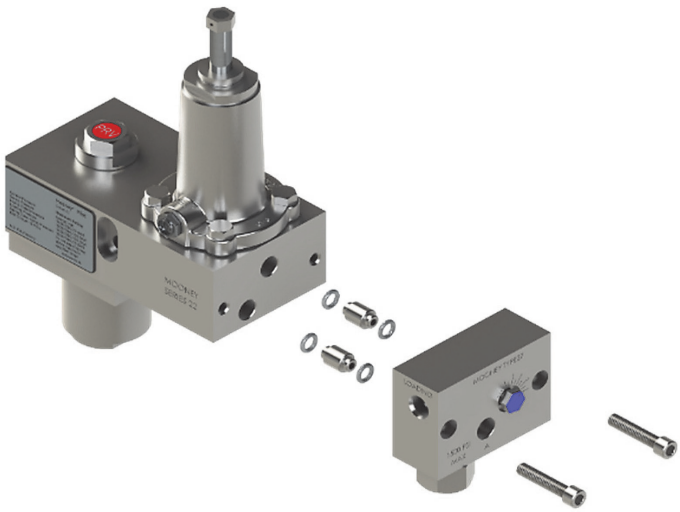


Figure 24 - Series 22 Pilot Assembly

Care should be taken to avoid damaging the pin O-Rings during assembly.

The variable orifice can only be removed from the Restrictor block after separation from the Series 22 block.

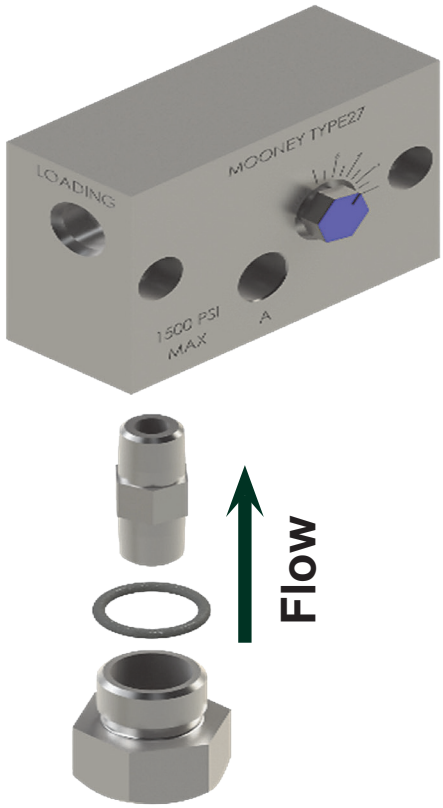


Figure 25 - Restrictor Block Assembly

The check valve can be removed from the Restrictor block while attached to the Series 22 block. Care should be taken to assure that the check valve is installed in the proper orientation as it is easily reversed due to its universal nature. Flow should be from the bottom (Cap side) to the Loading port.

The Type 27 Restrictor block has multiple options for control line mounting.

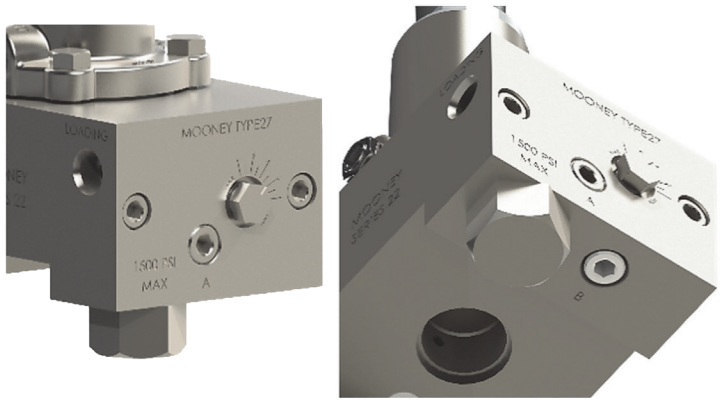


Figure 26 - Restrictor Block

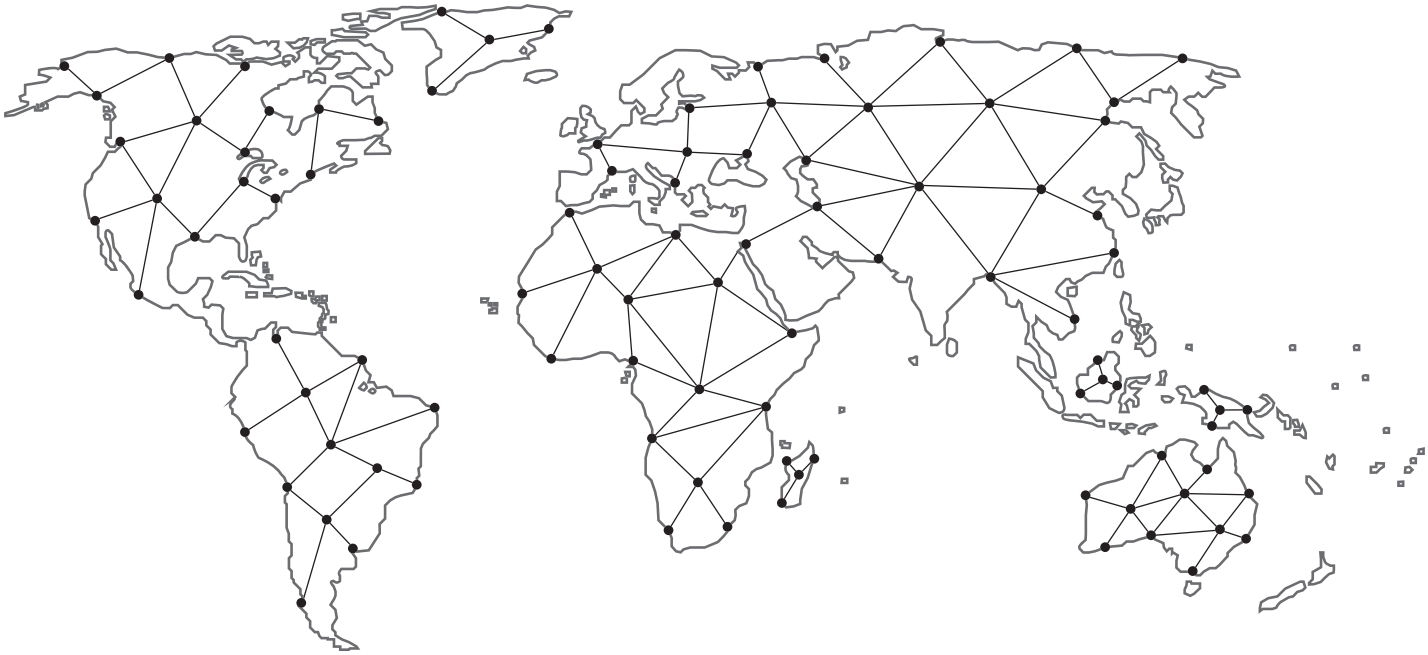
The standard option is to plug ports A and B. The ½" NPT Sense port is connected to the Upper Actuator housing connection (Sense Connection) on the FlowMax HP. The Loading port is connected to the Lower Actuator housing connection on the FlowMax HP.

Other control options are available. Please contact your Mooney Representative for additional information.

Notes:

Find the nearest local Channel Partner in your area:

valves.bakerhughes.com/contact-us



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