



## Pressure Reducing Valve Fig.505

### Installation, Operating And Maintenance Instructions

#### General Description

Pressure Reducing Valves are indispensable in any fire protection system. The diaphragm actuated design is proven highly reliable and easy to maintain. The Rapidrop Fig.505 Pressure Reducing Valve is designed to automatically reduce a higher inlet pressure to a steady lower outlet pressure regardless of changing flow rate and/or varying inlet pressure.

The Fig.505 consists of the following components (see principal schematic below):

**1. Basic Control Valve:**

A hydraulically operated, diaphragm actuated globe valve with an elastomer-on-metal seal.

**2. Pressure Reducing Pilot Valve:**

A two way, normally open pilot valve which senses downstream pressure below the diaphragm and balances this against an adjustable spring load. An increase in downstream pressure closes the pilot.

**3. Restriction**

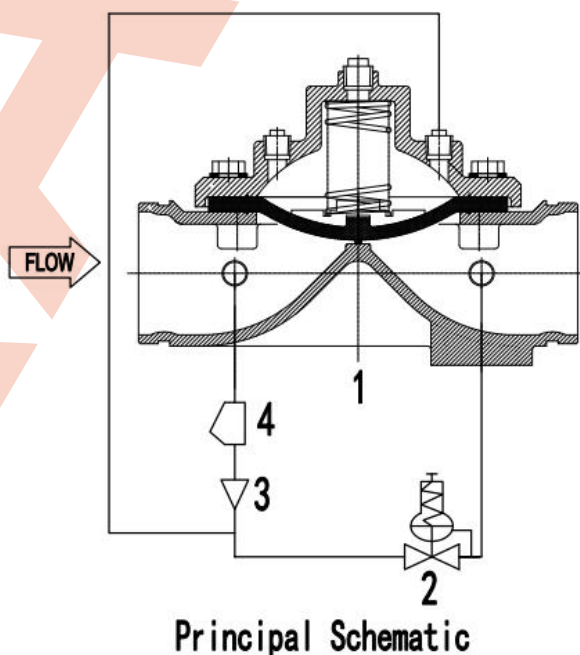
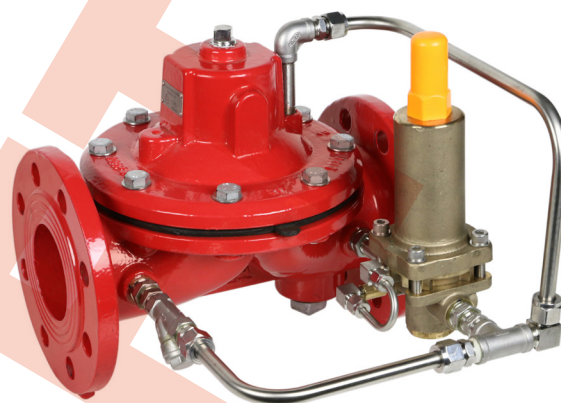
A ferrule fitting connection with a fixed orifice in the upstream port.

**4. Y-Strainer**

The Strainer protects the pilot system from solid contaminants in the detection line.

#### Operation

When downstream pressure increases above the set point of the pressure reducing pilot, the pilot moves towards the closed position. This results in an increase in the diaphragm chamber pressure of the basic control valve. The basic control valve then closes slightly to restore the downstream pressure to the set point. Conversely as downstream pressure decreases below the set point, the pilot moves towards the open position. This results in a decrease in the diaphragm chamber pressure of the basic control valve. The basic control valve then opens slightly to bring the downstream pressure back up to the set point. The net result is a constant modulating action by the pilot and the basic control valve to maintain a constant downstream pressure despite fluctuations in demand or inlet pressure.



No	No	No
1	Basic Control Valve	1
2	Pressure Reducing Pilot	1
3	Restriction	1
4	Y-Strainer	1



## Pressure Reducing Valve Fig.505

### Installation

The Fig.505 is fully factory assembled, tested and ready for installation at the appropriate position within the system. In order to ensure safe, accurate and efficient operation of the Fig.505, the following guidelines should be adhered to

1. Valve size is correctly selected to meet the minimum and maximum design flow.
2. Conduct an appropriate inspection of the delivered valve to ensure there is no damage to the external piping, fittings and controls. Check that all pipe joints are tight.
3. It is recommended that isolation valves are installed on either side of the pressure reducing valve to facilitate preventive or corrective maintenance without draining the pipe system
4. Prior to mounting the valve, all interconnecting piping should be thoroughly flushed.
5. Install the valve with the flow arrow on the valve body pointing downstream.
6. Allow sufficient room around the valve for ease of adjustment and maintenance.
7. For maximum efficiency, the control valve should be mounted in a piping system so that the valve bonnet is in the top vertical position. Other positions are acceptable but may not allow the valve to function to its full potential

### Commissioning Adjustments

The following procedures should be adhered to in the order below to commission the Fig.505 valve:

1. Install pressure gauges of the proper range upstream and downstream of the Fig.505 valve. The unused side ports on the basic control valve body may be used for this purpose if there are no convenient alternative locations available.
2. Remove the plastic cap from the pressure reducing pilot valve and loosen the adjusting screw lock nut. Turn the adjusting screw counter clockwise until it is free enough to be rotated by hand.
3. Start the pump, or flow of water through the piping system. The basic control valve will at this stage be either fully closed or partially open.
4. Carefully loosen the threaded plug in the basic control valve bonnet (located off centre opposite to the pilot pipework) until fluid appears around the threads. When only clear fluid (no air) is discharging, retighten the plug.
5. Check downstream pressure. It should be lower than the desired set point. If it is too high, open further valves downstream or increase demand until the pressure falls below the desired set point.
6. Slowly turn the adjusting screw of the pressure reducing pilot clockwise until downstream pressure rises to the desired set point. Tighten the adjusting screw lock nut, and replace the plastic cap.
7. Slowly close downstream valves to reduce flow to zero, while observing the pressure gauge. The pressure will rise above the set point. This is normal. However, to avoid a pressure increase, install a pressure relief valve downstream. The pressure relief valve have to be at least 1/2".  
**Note:** provision is required for adequate discharge of the relief valve.

8. If further pressure readjustment is required, the pressure reducing pilot is adjusted clockwise to increase pressure; counter clockwise to decrease pressure.

### Period Checks

Due to the simplicity of design of the Fig.505, required maintenance is minimal. However, the following periodic checks, will assist continual operating efficiently.

1. Check for damage or corrosion.
2. Check for leaks at all fittings, flanges and connections. Retighten as required.
3. Check the Y strainer screen for build up of solid material. Clean as required. This is important as a clogged strainer can hinder the correct operation of the valve. Following initial installation, it is recommended that the strainer be checked every couple of days until experience dictates otherwise.

### Troubleshooting

In the event of malfunction of the following guide should enable a competent person to identify the specific cause of the problem.

#### A. Basic Control Valve fails to open:

1. Valve closed downstream of the Fig.505. Open as required.
2. Pressure reducing pilot adjusted too far counter clockwise. See Adjustment instructions.
3. Stem of pressure reducing pilot binding. See Model PRP section of this manual.

#### B. Basic Control Valve fails to close:

1. Strainer clogged. Clean as required.
2. Pressure reducing pilot adjusted too far clockwise. See Adjustment instructions.
3. Diaphragm of pressure reducing pilot ruptured. This will be evident by a discharge of fluid from the vent port in the pilot bonnet. Disassemble pilot and replace diaphragm.
4. Pressure reducing pilot stem binding or seat badly deteriorated. Disassemble pilot and determine cause. See the PRP section of this manual.
5. The basic control valve diaphragm ruptured. Replace diaphragm. See Basic control valve section of this manual.
6. Object in Basic control valve. Disassemble valve and determine cause. See Basic Control Valve section of this manual.

#### C. Basic Control Valve open and closes but doesn't control pressure:

1. If pressure remains too high despite adjustment of the pressure reducing pilot, refer to Basic Control Valve fails to close, above.
2. If pressure remains too low despite adjustment of the pressure-reducing pilot, refer to Basic Control Valve Fails to open above.
3. If pressure oscillates, you may likely be in a period of very low demand. Frequently this problem will disappear as demand increase. In an extreme case try adjusting the pressure slightly higher.

#### D. Downstream pressure increases too high when flow demand is zero

1. Pressure Reducing Pilot leaking. Disassemble pilot and determine cause. See the PRP Pressure Reducing Pilot section of this manual.
2. Basic control Valve leaking. Disassemble basic control valve and determine cause. See the Basic Control Valve section of this manual.



## Pressure Reducing Valve Fig.505

### Basic Control Valve

#### General Description

The basic control valve is a hydraulically operated diaphragm actuated valve. The diaphragm is nylon-fabric bonded with synthetic rubber and forms a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. An elastomeric seat disc forms a tight seal with the valve seat when pressure is applied above the diaphragm.

#### Functional Description

The valve functions on a simple principle of pressure differential. The line pressure at the inlet of the valve is bypassed through the pilot control piping to the diaphragm chamber of the valve. This pressure together with the valve spring works against the pressure upstream the valve seat. Because the effective area of the pressure of the diaphragm chamber is greater than that of the pressure upstream, the valve is held closed. As the controlling pilot(s) allow the pressure to bleed from the diaphragm chamber the two opposing pressures begin to balance and the valve will begin to open. The valve can be used to perform a simple on-off function or with the proper pilot system a modulating or regulating function.

In cases where the line fluid is unusually dirty or is otherwise unsuitable for operating the valve an independent operating pressure source may be employed. The pressure available from such a source must be equal to, or greater than line pressure.

#### Installation

In order to insure safe accurate and efficient operation of the basic control valve the following list of checkpoints and procedures should be followed when installing the valve.

1. Make a careful visual inspection of the valve to insure that there has been no damage to the external piping, fittings or controls. Check that all fittings are tight.
2. Thoroughly flush all interconnecting piping of chips, scale and foreign matter prior to mounting the valve.
3. Install the valve in the line according to the flow arrow on the valve body. The arrow should point downstream.
4. Allow sufficient room around the valve for ease of adjustment and maintenance service.

#### In addition, it is highly recommended that:

1. Isolation valves (eg., gate or butterfly) be installed on the inlet and discharge sides of the valve to facilitate isolating the valve for maintenance.
2. Pressure gauges be installed at the inlet and outlet sides of the valve to provide monitoring of the valve during initial start up and during operation.
3. For maximum efficiency the control valve be mounted in a piping system so that the valve bonnet is in the top position. Other positions are acceptable but may not allow the valve to function to its fullest and safest potential. In particular please consult the factory before installing 8" and larger valves, or any valves with a limit switch in positions other than described. Space should be taken into consideration when mounting valves and their pilot systems.

### Maintenance

The basic control valve requires no lubrication and a minimum of maintenance. However, a periodic inspection should be established to determine how the fluid being handled is affecting the efficiency of the valve. In a water system, for example the fluid velocity as well as the substances occurring in natural waters such as dissolved minerals and suspended particles vary in every installation. The effect of these actions or substances must be determined by inspection. It is recommended that an annual inspection which includes examination of the valve interior be conducted. Particular attention should be paid to the elastomeric parts, i.e., the diaphragm. Any obviously worn parts should be replaced.

### Repair Procedures

In the event of malfunction of the control valve, this section will outline the procedures necessary to correct the problem.

Problems with the basic control valve can be classed in two basic categories:

#### 1. Valve fails to close:

##### a. Diaphragm damaged-See Procedure A

A diaphragm failure can prevent the valve from closing. Most water service valves flow "under the seat" in which case a diaphragm failure will keep the valve from closing.

##### b. Object lodged in valve-See Procedure A

#### 2. Valve opens and closes but leaks when closed

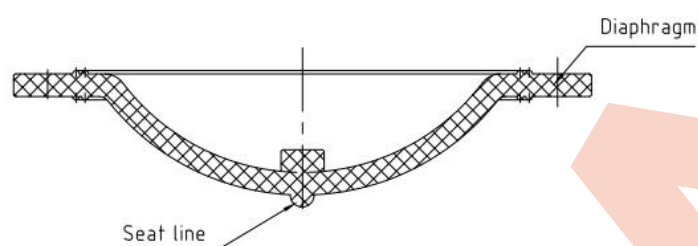
##### a. Seat line of the diaphragm damaged-See Procedure A

##### b. Seat surface of the body deteriorated-See Procedure A

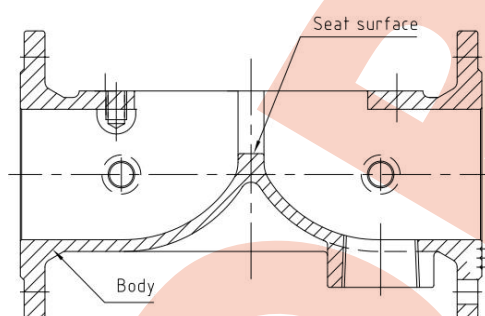
## Pressure Reducing Valve Fig.505

### Procedure A

1. Isolate the valve from the system by closing upstream and downstream isolation valves.
2. Loosen one of the tubing connections on the bonnet. Allow any residual pressure to bleed off.
3. Remove all tubing connected at the bonnet.
4. Remove the bonnet flange bolts.
5. Remove the bonnet. If the bonnet sticks in place it may be loosened by tapping gently around its edge with a rubber headed mallet. **NOTE:** 8" and larger valves are equipped with eye nuts through which a chain can be fastened to aid lifting the bonnet.
6. Remove the spring and spring retainer. Set them aside in a safe place.
7. Remove the diaphragm on which seat line lies. See the following figure.

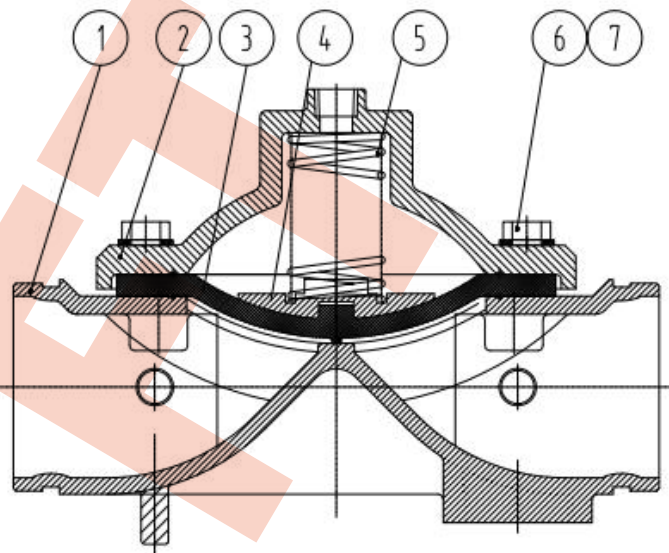


8. Carefully examine the diaphragm. If the diaphragm is ruptured or the seat line is deteriorated, replace the diaphragm.
9. Carefully examine the seat surface of the body (see the following figure) for debris or damage. Clean and repair as necessary.



10. Reinstall the diaphragm.
11. Replace the spring retainer and the spring.
12. Replace the bonnet and reinstall the bonnet bolts.
13. Tighten the bonnet bolts.
14. Reinstall the control tubing.
15. Reopen the upstream and downstream isolation valves.
16. Before placing the valve back in service perform the air bleed procedure described in 'commissioning' of this manual.

### Basic Control Valve Section View

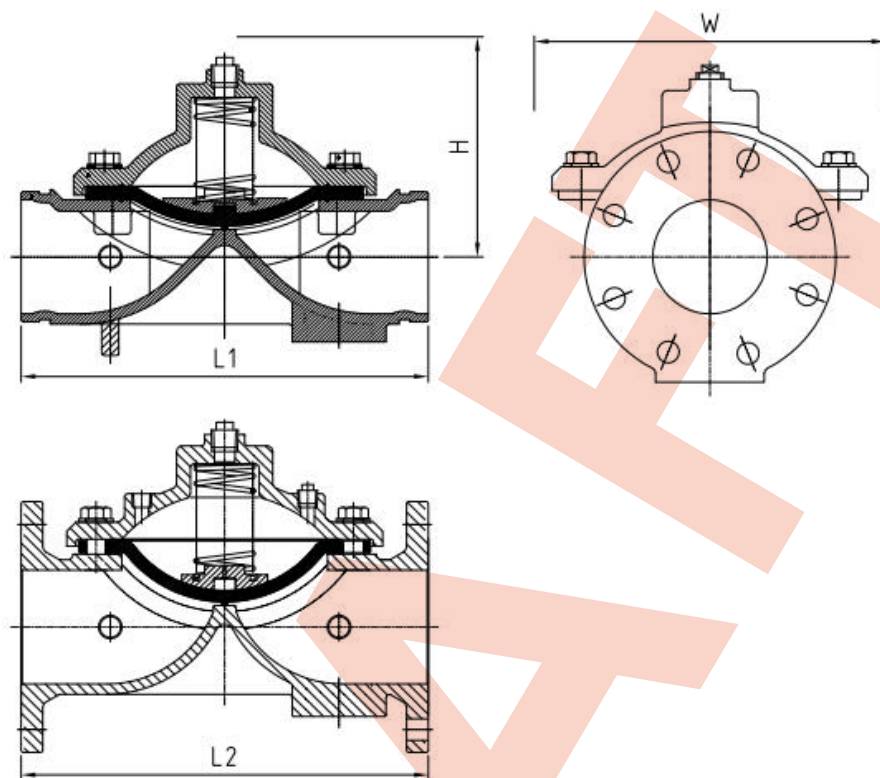


Part No.	Description	Material
1	Body	Ductile Iron ASTM A536
2	Bonnet	Ductile Iron ASTM A536
3	Diaphragm	NBR Nylon Reinforced
4	Spring Retainer	Ductile Iron ASTM A536
5	Spring	Stainless Steel 304
6	Galvanized Bolt	Carbon Steel
7	Galvanized Washer	Carbon Steel
8	Plug	



## Pressure Reducing Valve Fig.505

Installing & Maintenance Space Dimension



Size		L1 (mm)	L2 (mm)	W (mm)	H (mm)
mm	inch				
DN50	2"	260	233	450	210
DN65	2 1/2"	310	290	485	220
DN80	3"	310	310	500	259
DN100	4"	356	356	520	270
DN125	5"	370	370	550	280
DN150	6"	436	436	590	290
DN200	8"	530	530	640	360
DN250	10"	636	636	700	380
DN300	12"	835	835	950	430



## Pressure Reducing Valve Fig.505

### Pressure Reducing Pilot Model PRP

#### General Description

The Model PRP Pressure reducing Pilot is a normally open direct acting, spring loaded, diaphragm type control valve. It is designed to maintain a constant pre-set discharge pressure from the main valve. It is a constant throttling device maintaining precise, positive control of the main valve.

The Pressure reducing Pilot may also be used by itself as a downstream pressure regulator. The Pressure reducing Pilot is available in bronze or stainless steel construction and with 3/8 NPT or 1/2NPT end connections.

#### Spring Range

65psi - 165psi

#### Functional Description

The downstream pressure under the diaphragm of the pilot is balanced against an adjustable spring load. As the downstream pressure decrease below the set point, the pilot opens wider, decreasing the pressure in the diaphragm chamber of the basic control valve, opening the valve a proportionate amount. Conversely as downstream pressure increases above the set point, the pilot closes further increasing the pressure in the diaphragm chamber of the basic control valve, closing the valve a proportionate amount. The net result is a constant modulating action of the pilot and the basic control valve keeping the downstream pressure at the set point within pre-defined limits.

#### Installation and Adjustment

The Pressure reducing Pilot is normally installed in the main valve control piping between the restriction and the downstream body tapping. Flow must be in the direction indicated. Typically a sense line is factory installed between the diaphragm sense port and the downstream pilot body side port. The pilot can also be remote sensed by running a line from the 1/8 NPT connection under the pilot diaphragm to the desired downstream point where the pressure control is desired.

Pressure adjustment is made by means of the single adjusting screw:

- Clockwise adjustment increases downstream pressure.
- Counter clockwise adjustment decreases downstream pressure.

#### Maintenance

The Pressure reducing Pilot requires minimal maintenance. Fittings and bolts should be periodically checked and retightened. The body should be inspected for damage or excessive build up of foreign material.

#### Troubleshooting

Other than improper adjustment there are only three malfunctions which can occur with the Pressure reducing Pilot. These are:

##### 1. Pilot Diaphragm Ruptured:

Results in failure of the main valve to close and/or increased downstream pressure. A ruptured pilot diaphragm will be evident by leakage through the vent hole in the pilot bonnet.

##### 2. Pilot Seat Disc Deteriorated:

Results in an increasing downstream pressure under dead end (zero flow) conditions.

##### 3. Pilot Stem Binding:

Typically results in poor pressure control though in extreme cases it can result in failure of the main valve to open or close.

#### Repair Procedures

Refer to the pressure reducing pilot assembly drawing for parts identification.

##### A. Diaphragm Replacement

1. Prior to disassembling the pilot, turn the adjusting bolt (15) fully counter clockwise until it is loose enough to be turned by hand.
  2. Remove the six bonnet cap screws (20).
  3. Remove the bonnet (12). Remove the adjusting spring (13) and spring retainer (14) and retain in a safe place.
  4. Remove the plug (1) from the bottom of the pilot. Remove bottom spring (3) and retain in a safe place.
  5. Using an appropriate wrench on the second nut from the top of stem(7), remove disc(4). Pull the diaphragm out of the body.
  6. Disassemble the diaphragm plate (19), remove the diaphragm plate (19) and old diaphragm (11).
  7. Inspect diaphragm plate O-ring (21). Replace if necessary.
  8. Replace diaphragm with new.
  9. Replace upper diaphragm plate (19), O-ring (21), and hex nuts (18). Tighten securely.
  10. Insert the diaphragm assembly into the body.
  11. Screw the disc (4) onto the bottom of stem (7). Tighten disc (4) securely using an appropriate wrench on the first nut from the top of stem(7).
  12. Reinstall plug(1).
  13. Hold adjusting spring (13) and spring retainer (14) together in the proper orientation and place them onto diaphragm plate (19).
  14. Replace the bonnet (12) over the adapter (22) and insert the bonnet screws (20). Tighten securely.
- NOTE:** The shorter screws should be screwed into the blind holes and the longer screws should be screwed into the through holes.
15. Place valve back in service, following the 'commissioning adjustment' procedures given in the main portion of this manual.

# Pressure Reducing Valve

## Fig.505

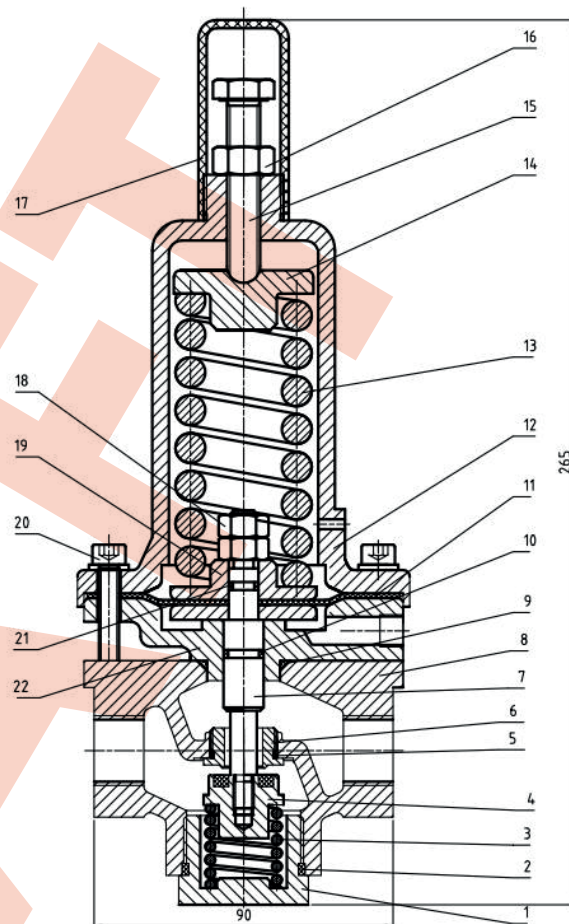
### B. Seat Disc Replacement

1. Follow steps one through to four as per Diaphragm replacement above.
2. Using an appropriate wrench on the second nut from the top of stem(7), remove disc(4).
3. Replace seat disc with new. Tighten Securely.  
**Note:** Tighten both the two nuts at the top the stem to prevent loosening.
4. Reassemble pilot following steps twelve through to fifteen as per Diaphragm replacement above.

### C. Stem Repair

1. Follow steps one through to five as per Diaphragm replacement above.
2. Inspect stem and O-ring (10) carefully.
3. Remove any foreign material or light scratches from the stem with fine grade emery cloth. A badly scored stem should be replaced.
4. Replace O-ring (10).
5. Lubricate the O-ring and stem liberally with Vaseline or similar lubricant.
6. Reassemble pilot following steps eleven through to fifteen as per Diaphragm replacement above.

Part No.	Description	Material
1	Plug	Brass
2	O-ring	NBR/EPDM
3	Bottom Spring	Stainless Steel 304
4	Disc	Stainless Steel 304 & NBR/EPDM
5	O-ring	NBR/EPDM
6	Seat	Stainless Steel 304
7	Stem	Stainless Steel 304
8	Body	Bronze/Brass/ Stainless Steel 304
9	O-ring	NBR/EPDM
10	O-ring	NBR/EPDM
11	Diaphragm	Nylon Reinforced Natural Rubber/NBR
12	Bonnet	Bronze/Brass/ Stainless Steel 304
13	Adjusting Spring	Stainless Steel 304
14	Spring Retainer	Stainless Steel 304
15	Adjusting Bolt	Stainless Steel 304
16	Jam Nut	Stainless Steel 304
17	Cap	PVC
18	Nut	Stainless Steel 304
19	Diaphragm Plate	Stainless Steel 304
20	Screw	Stainless Steel 304
21	O-ring	NBR/EPDM
22	Adaptor	Bronze/Brass/ Stainless Steel 304



**ADJUSTING SPRING RANGE**  
**65-165PSI**