Description of Operation

The Bray S90 Pneumatic Actuator features a double piston, rack and pinion mechanism designed to automate quarter-turn valves. Pressure introduced through Port A (the left port when facing the ports) forces the pistons away from each other and causes the pinion to rotate in a counterclockwise direction. Pressure introduced through Port B (the right port when facing the ports) is directed through a cross bore to the outside of the pistons, which forces the pistons together and rotates the pinion in a clockwise direction. Normally, the clockwise rotation (pistons moving together) closes the attached valve, and the counterclockwise rotation (pistons moving apart) opens the attached valve.

Spring cartridges may be added to push the pistons together by spring force in the event the compressed air pressure is lost. This spring force normally closes the attached valve. However, the pinion may be removed and rotated 90° so that the springs will open the valve.

Operating Fluid

The recommended operating medium is clean dry air at 40 - 140 psig (3 - 10 bar). An air line lubricator is suggested for fast cycling applications, i.e. more than 10 cycles per minute. Other media such as hydraulic oil, water, or certain gases may also be used in certain instances, but the factory should be consulted for specific applications.

Operating Temperature

The recommended operating temperature range is -15°F to 200°F (-25°C to 95°C). Below 32°F (0° C) care must be taken to prevent condensed moisture from freezing in the air supply lines.

Installation

Bray S90 Actuators are designed to mount directly on the top plate of Bray Valves. Normally, the actuator is mounted with its centerline parallel to the pipe line. A double acting actuator will normally rotate the valve stem clockwise to close, and counterclockwise to open. Spring return actuators will normally rotate the valve stem clockwise to close with the spring stroke, and counterclockwise to open with the air stroke. The normal operation of the spring cartridges is therefore *fail closed*.

Direction of operation may be changed to *fail open* by any one of several different methods. Refer to the Assembly Instructions and Exploded View in Figure 4 for more details.

Method 1 - Turn the actuator so the centerline is perpendicular to the pipeline. This will allow the spring cartridges to rotate the valve stem clockwise to open, and the air stroke to rotate the valve stem counterclockwise to close. This is the easiest method if there is sufficient room to mount the actuator.

Method 2 - Remove the pinion, rotate it 90°, and reinstall the pinion in the actuator. This will also allow the spring cartridges to rotate the valve stem clockwise to open, and the air stroke to rotate the valve stem clockwise to close. This is the second easiest method, and allows the actuator to be mounted with its centerline parallel to the pipeline.

Method 3 - Remove the spring cartridges, endcaps and pistons from the actuator. Rotate the pistons so that the racks turn the pinion counterclockwise as the pistons move toward each other. (With the air input ports of the actuator body facing you, the left hand piston rack should be on the side with the air ports.) This is the third easiest method, and allows the actuator to be mounted with is centerline parallel to the pipeline, and clockwise to close rotation to be maintained.

Spring return actuators may be operated with only one air supply connected to Port A, since the spring cartridges will move the pistons when the air pressure in removed. This operation, however, will draw the surrounding atmosphere into the spring chambers through Port B. To prevent contamination from entering the spring chamber, a filter with a 40 micron (or finer) element should be installed in Port B.

Even better service may be obtained on spring return actuators by installing a four-way solenoid, covering both Port A and Port B. A four-way solenoid will fill the spring chambers with compressed air from the plant air supply with each stroke. The plant air supply is often cleaner than the surrounding atmosphere, especially in heavy industrial or chemical areas.

Before the actuator is mounted on a valve, it is a good practice to lubricate the output bore of the actuator with a thick grease. The grease will make it easier to remove the actuator from the valve stem, even after years of service.

Maintenance

The rugged components and factory lubrication combine to ensure a long and trouble-free service life for S90 actuators. Dirt is the most common cause for shortened service life, and dirt enters the actuator through the air supply line. Therefore, it is strongly recommended that an adequately sized filter with a 40 micron (or finer) element be installed adjacent to the inlet of the directional control valve. Air line lubricators are recommended for rapid cycling applications (10 cycles or more per hour.)

Routine maintenance of S90 actuators consists primarily of maintaining the air supply system by changing filter elements before they start by-passing and adding oil to lubricators before they run dry.

The second most common cause of shortened service life is misalignment between the valve and the actuator. This can cause premature failure due to excessive side loads on the bearings and gear teeth.

Troubleshooting

Table 1 shows several common symptoms and their remedies.

Symptom	Probable Cause	Check	Remedy
Loss of Power	Low air supply pressure, or damaged O-rings	Air supply pressure at actuator, leakage across O-rings	Boost air supply pressure, repair air supply line leaks, replace O-rings
Binding between valve and actuator	Misalignment of coupling	Alignment	Realign coupling
Valve "pops" out of seat and slams open	Valve torque too high, actuator sized too small, or insufficient air supply flow	Valve torque, actuator sizing calculations, size of air supply lines and/or solenoid valve	Repair valve, use proper size actuator, use larger air supply lines and/or solenoid valve with higher flow

Assembly

To identify component names and shapes, refer to the Exploded View of the actuator shown in Figure 4.

Insert the upper and lower bearing into the pinion, and install the top and bottom O-rings onto the pinion. Insert the pinion into the actuator body from the bottom of the body. Place the acetal washer over the pinion and secure with retaining ring on the top of the pinion. Place the actuator body with the input air ports towards you. Grease the actuator body bore and pinion.

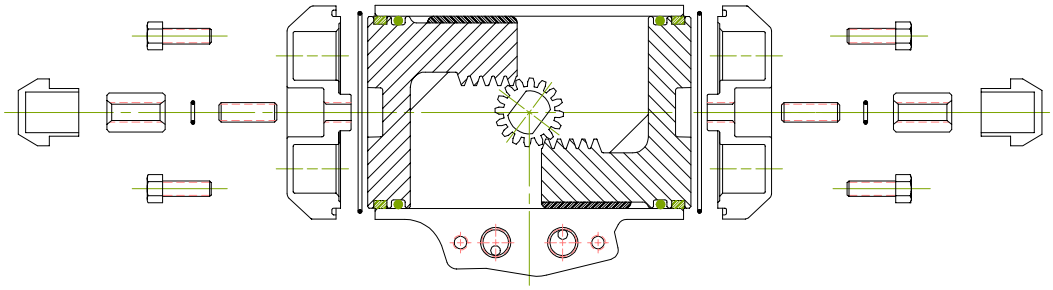


Figure 1 - S90 Top View as Pistons are Inserted (45 degrees)

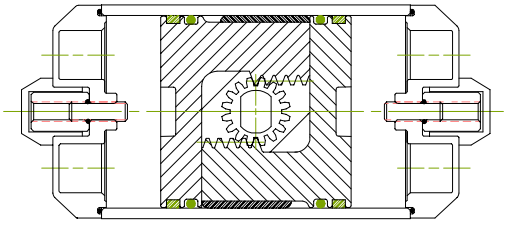


Figure 2 - S90 Top View, Fully Closed (0 degrees)

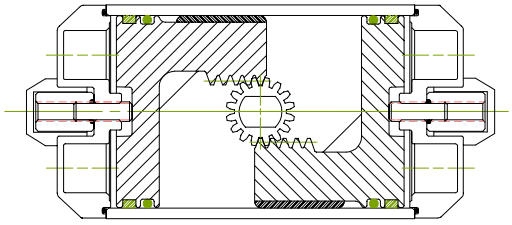


Figure 3 - S90 Top View, Fully Open (90 degrees)

Assemble the piston wear pad, piston wear ring and O-ring onto each piston. Place the actuator body so the air input ports are facing you. Turn the pinion so that the flats on the top are at a 45° angle with the body as shown in Figure 1. Insert the pistons as shown in Figure 1, so that as the pistons move inward, the pinion turns in a clockwise direction. The right hand piston rack should be on the side with the air ports. Once the pistons have engaged the pinion teeth, turn the pinion counterclockwise until the mechanical stop is reached. At this point, the flats on the top of the pinion should be at 0° as shown in Figure 2.

Insert O-rings into the grooves of the endcaps. With the round part of the O-ring groove to the bottom, assemble the end caps to the body and fasten with hex head endcap bolts. Tigthen the bolts in a diagonal sequence to ensure the endcap is secured evenly.

Rotate the pinion fully counterclockwise until a mechanical stop is reached. In this position, there will be a few degrees of overtravel. Turn the pinion clockwise so the flats on the pinion are at the 90° open position, as shown in Figure 3.

Proceed to Final Assembly and Testing.

Final Assembly and Testing

Insert the travel stop assemblies in the endcaps until the travel stop screws touch the pistons. (*Do not adjust the travel stop screws with compressed air connected to the actuator!)* Tighten the travel stop nut to lock the travel stop in position and compress the sealing washer.

Connect the compressed air supply to the actuator input ports. Cycle the actuator fully open and fully closed to check for proper travel and absence of air leaks. If compressed air is applied to Port A and the actuator reaches the end of travel, there should be no air flow out of Port B, and vice versa. There should be no air flow between the end caps and the body, through the travel stops, or out the top or the bottom of the pinion. A solution of soap and water applied to the sealing points can indicate leaks that are too small to be audible.

Attach the indicator pointer with the indicator pointer screw.

Disassembly

Disconnect the compressed air from the actuator. Remove the indicator pointer. Remove both endcaps by loosening the hex head endcap bolts. Remove both pistons by rotating the pinion counterclockwise until the piston heads are protruding from the body. Pull the pistons out. Take off the pinion retaining ring and acetal washer, then remove the pinion from the body. The pinion bearings and O-rings may then be removed.

The pinion may be removed without removing the pistons. This may be done to check or replace the pinion bearings and O-rings, or to rotate the pinion 90° where spring fail closed operation is desired.

Adding Spring Cartridges

Move the pinion to the fully closed (0°) position, as shown in Figure 2. Remove the endcaps and insert the desired number of spring cartridges into the endcap pockets, up to a maximum of six cartridges per endcap.

Align the endcap with the body so the spring cartridges fit into the piston pockets. Attach the endcaps to the body with the hex head endcap bolts. Tighten the bolts in a diagonal sequence.

Proceed to Final Assembly and Testing.

Removing Spring Cartridges

Disconnect the compressed air from the actuator. An actuator with spring cartridges installed and no compressed air connected will move to the spring fail position. This may be either fully closed (0°) or fully open (90°). In either case, when the spring fail position is reached, remove the endcaps by loosening the hex head endcap bolts. Remove the spring cartridges. Replace the endcaps and tighten the bolts in a diagonal sequence.

Proceed to Final Assembly and Testing.

General Pneumatic System Recommendations

To maintain maximum efficiency with the S90 Actuator, as well as many other pneumatic devices, the following suggestions are offered:

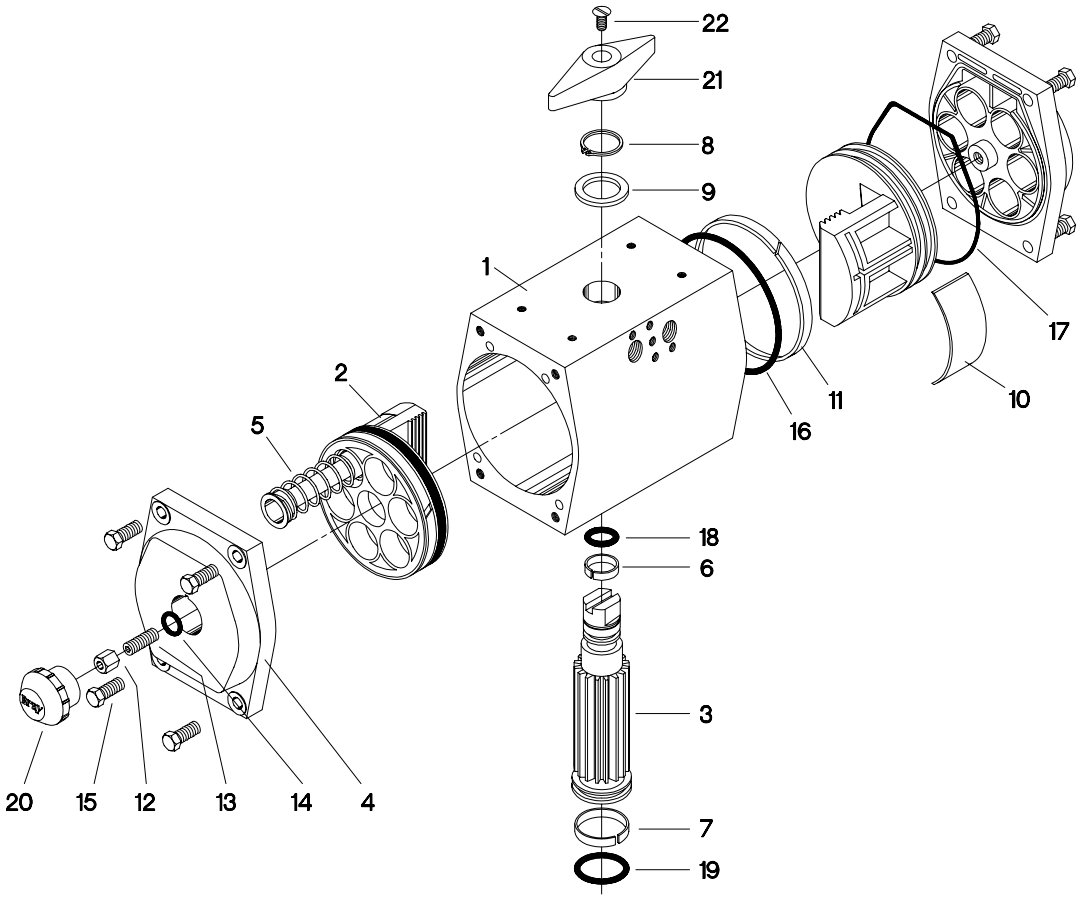
- Air supply lines should be run in accordance with a Standard Piping Practice, and should not have exaggerated loops which may trap condensate.
- All pipe ends should be thoroughly cleaned and deburred after cutting to ensure that the pipeline is clear of cuttings.
- Where air pipelines are subjected to extremes of temperature, the system should be fitted with air drying equipment.

- If pipelines are hydraulically tested, the lines should be "blown down" with high pressure air to clear all water prior to connecting the lines to the actuator.

- Where a system is dependent on air filter equipment, the air filters should be in positions that allow easy access for maintenance and/or draining.

- Where pneumatic valve positioners or pneumatic controllers are installed in a valve actuator assembly, oil mist lubricated air should not be used unless the manufacturer states specifically that the positioner or controller is compatible with lubricated air. In general, lubricated air is not recommended for a positioner.

- Where pipe fitting sealants or tapes are used, they should be applied to the male threads only. When applied to female threads, excess compound or tape can be transmitted into the actuator control lines and cause malfunctions in downstream equipment.



Item #	Qty	Description
1	1	Body
2	2	Piston
3	1	Pinion
4	2	Endcap
5*	12 max	Spring Cartridge
6	1	Upper Bearing
7	1	Lower Bearing
8	1	Retaining Ring
9	1	Pinion Washer
10	2	Piston Bearing Pad
11	2	Piston Guide Ring

Item #	Qty	Description
12	2	Stop Nut
13	2	Travel Stop Screw
14	2	Travel Stop O-Ring
15	8	Hex Head Cap Screw
16	2	Piston O-Ring
17	2	Endcap O-Ring
18	1	Upper Pinion O-Ring
19	2	Lower Pinion O-Ring
20	2	Dust Cap
21	1	Indicator Pointer
22	1	Indicator Pointer Screw