Operating Instructions
Model 9126 Pneumatic Sample Injector

1.0 DESCRIPTION

Model 9126 is a six-port sample injection valve with a pneumatic actuator built around the valve. The combination permits the user to operate the injector manually or automatically. The sample is loaded through a built-in needle port in the front of the valve. Model 9126 is made of biocompatible PEEK.

A position sensing switch is built into the Model 9126. The position sensing switch is recessed into the side of the actuator body. See Section 7.3.

Figure 1 shows the flow diagram of the valve. The circles represent the ports in the valve stator. The dark and white grooves represent the connecting passages in the rotor seal. The larger circle represents the needle port.

The sample loop is loaded through the needle port in the LOAD position. Rotation of the knob 60° switches the valve from LOAD to INJECT. In INJECT, the sample flows through the loop onto the column.

2.0 SUPPLIED WITH THE VALVE

Supplied with the valve in a separate bag are fitting sets for all ports and the items below. A 20 µL sample loop comes standard with the valve.

- Hex Key(s)
- Needle Port Cleaner
- Mounting Screw(s)
- Vent Tube(s)
- Needle Adapter Assembly

The #22 gauge needle supplied in the valve should be removed from the needle port before using the valve.

3.0 SPECIFICATIONS

- Maximum Operating Temperature: 50°C
- Maximum Operating Pressure: 34 MPa (345 bar, 5000 psi)
- Flow Passage Diameters: 0.3 mm (0.013") and 0.5 mm (0.018")
- Wetted Surfaces: PEEK, alumina ceramic, and an inert polymer
- Gas Supply for Pneumatic Actuator: 0.4 MPa (4.1 bar, 60 psi) to 0.7 MPa (6.9 bar, 100 psi)
- Manual or Automatic Operation

4.0 IMPORTANT SAFETY NOTICES

4.1 Warning: When using sample loops larger than 100 µL, shield yourself from mobile phase coming out of the needle port when the valve is turned from INJECT to LOAD. Example: 1 mL loop ejects 20 µL upon decompression from 19 MPa (200 bar, 2898 psi).

4.2 Warning: When using the Needle Port Cleaner, empty the syringe slowly to prevent solvent from squirting back at you.

4.3 Warning: A pinhole rupture in the PEEK tubing can cause a high velocity jet of fluid that can penetrate skin and eye tissue.

4.4 Caution: Temperature, solvents, and length of use affect the burst pressure of PEEK tubing. PEEK tubing usually burst at pressures much lower than the rated pressure of the valve.

4.5 Caution: Use only PEEK fittings sets in the stator ports. Metal ferrules can cause irreparable damage to the plastic stator.

5.0 USING PROPER SYRINGES

Use syringes with #22 gauge syringe needle, without electrotaper and with 90° point style (square cut). Using the incorrect needle size will damage the injector.

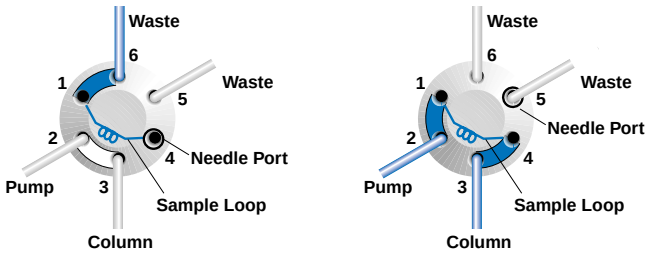

Fig. 1. Flow paths of the LOAD and INJECT positions of Model 9126.

6.0 INSTALLATION

a) To mount the valve on a panel, remove the handle by loosening the two handle set screws. Use the two screws supplied to fasten the valve to a panel.

b) Confirm that the handle protrusions are out of the slots in the pressure adjusting screw. Replace the handle by tightening the two set screws on the two flats of the shaft.

c) See **Caution 4.5**. Connect the two vent tubes supplied to Ports 5 and 6. Place the outlet ends of both at the same horizontal level as that of the needle port to avoid siphoning (see Figure 2).

d) Connect the pump to Port 2 and the column line to Port 3. Leave the column disconnected from the valve during initial flushing.

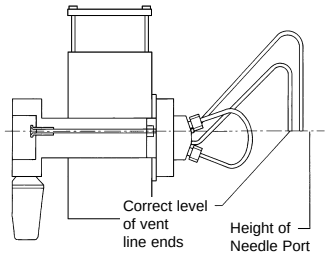

Fig. 2. Correct position of vent lines.

7.0 OPERATION

7.1 PNEUMATIC CONNECTIONS

Automatic operation requires a gas (air or nitrogen) supply of 0.4 MPa (4.1 bar, 60 psi) to 0.7 MPa (6.9 bar, 100 psi). Figure 3 shows the suggested pneumatic and electrical connections using a Model 7163 Solenoid Valve. Model 7164 Air Control Valve is an alternative to Model 7163.

7.2 CONNECTING THE NEEDLE ADAPTER

Use the Needle Adapter for automatic unattended operation. Refer to Figure 4 and proceed as follows:

a) Insert the Needle Adapter into the needle port.

b) Push the Adapter to the bottom.

c) Insert screw through the holes in the knob and Adapter walls and tighten to fingertight.

d) Refer to Loading By Suction (Section 7.5.3) to use the Needle Adapter.

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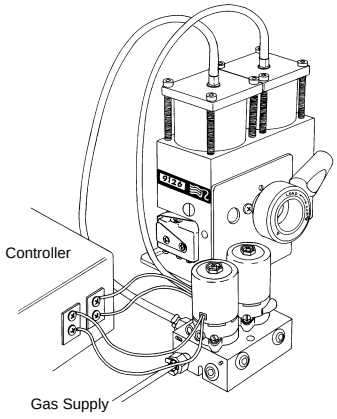

Fig. 3. Pneumatic and electrical connections with Model 9126.

7.3 POSITION SENSING SWITCH

The position sensing switch is recessed into the side of the actuator body. The switch starts an external action such as an event mark or a computer run.

The SPDT (single pole double throw) switch has three electrical connections (see Figure 5). One electrical wire will connect to the C (common) terminal. If you want to make contact when turning from LOAD to INJECT, then connect the second electrical wire to the NC (normally closed) terminal. If you want to make contact when turning from INJECT to LOAD, then connect the wire to the NO (normally open) terminal.

The switch is rated for 125/250 VAC and 5 A.

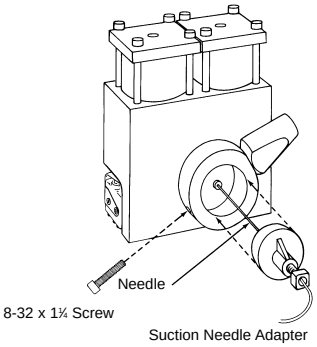

Fig. 4. Installation of Needle Adapter assembly.

7.4 FLUSHING THE INJECTOR

In the INJECT position, flush the needle port with about 1 mL of mobile phase using the Needle Port Cleaner as shown in Figure 6. At this time, the pump flushes the loop.

CAUTION: To avoid liquid squirting back at you, discharge syringe slowly.

7.5 MANUAL LOOP LOADING

7.5.1 COMPLETE LOOP FILLING

In complete-filling, the volume of sample injected is set by the volume of the loop (this includes the valve passages). This method produces the highest precision.

Overfill the loop with at least two to five loop volumes of sample. Six to ten loop volumes will provide even better precision. An excess of sample is needed because mobile phase near the wall of the loop is displaced slowly due to the laminar flow effect shown in Figure 7.

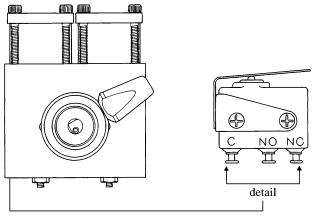

Fig. 5. Location and detail of Position Sensing Switch on Model 9126.

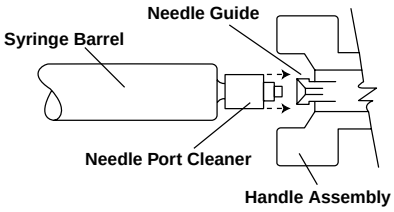

Fig. 6. Use of Needle Port Cleaner.

To completely fill the loop:

a) See **Warning 4.1** and turn to LOAD.

b) Insert the syringe into the needle port. You will feel tightness during the last 2-3 mm of travel as the needle passes through the needle seal and then stops against the stator face.

c) Load the sample.

d) Leave the syringe in and turn to INJECT.

7.5.2 PARTIAL LOOP FILLING

If you only have small quantities of sample, this is the method of choice. In the partial-filling method the volume of sample injected is set by the syringe. In this method, no more than half a loop volume of sample should be loaded into the loop. For example, load no more than 10 µL into a 20 µL loop. With larger than half the loop volume, some of the sample is lost out Vent Line 6. This is because sample flows down the center of the loop at twice the average velocity due to the laminar flow effect shown in Figure 7.

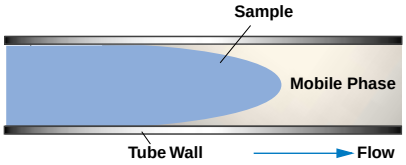

Fig. 7. Laminar flow effect.

To partially load the loop:

a) In INJECT, use the Needle Port Cleaner to flush out the needle port with about 1 mL of mobile phase. This will flush out contamination from the earlier injection. This liquid will exit out Vent Line 5.

b) Follow steps **a-d** in Section 7.5.1.

7.5.3 LOADING BY SUCTION

The two methods above expose the sample to the metal needle of the loading syringe. Metal can be completely avoided by using a syringe to suck sample into the loop.

Refer to Figure 8 and proceed as follows:

a) In LOAD, dip the tube attached to Port 6 into the sample.

b) Insert an empty syringe into the needle port and suck up sample into the loop. Alternatively, use the Needle Adapter. Use of this needle adapter is shown in Figure 8.

c) Leave the syringe in position and turn to INJECT.

The metal needle of the syringe will contact the sample if an excess of sample is drawn into the syringe, but this excess sample is external to the sample loop and will not be injected. The syringe can be used many times before it needs to be emptied.

To load the loop with all of the available sample, the loop should be at least four times the volume of sample loaded. The loop is first filled with mobile phase via the dip tube, then the whole sample is drawn into the dip tube and loop, followed by more mobile phase. The sample is now sandwiched between two zones of mobile phase in the loop.

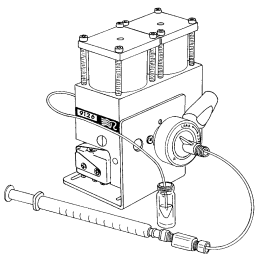

Fig. 8. Loading by suction using the Needle Adapter assembly.

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7.6 CONVERTING A FRONT LOADING TO REAR LOADING INJECTOR

An alternative to loading Model 9126 from the needle port, the valve can be converted to allow loading through the stator end of the valve. The conversion requires replacing the standard rotor seal with a three groove rotor seal (see Figure 9).

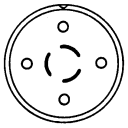

Fig. 9. Three groove rotor seal.

Refer to **Disassembly**, and **Reassembly** sections, and proceed as follows:

a) Follow steps **a-e** in Section 9.1 Disassembly.

b) Remove the needle port tube by pulling off the needle guide and letting the tube slip out of the rotor assembly (see Figure 15).

c) Push the shaft back into place.

d) Orient the three groove rotor seal as illustrated in Figure 10. Ensure that the needle port tube hole is in the 6 o'clock position and that the notch on the rotor seal is at 12 o'clock.

e) Rotate the handle end of the valve while pushing in on the rotor seal until the two rotor drive pins enter the mating holes on the shaft assembly. Refer to Figure 14 and 15.

f) Follow steps **d-g** in Section 9.2 Reassembly.

With the new three groove rotor seal installed, the converted valve now injects through the stator end. The needle port is no longer functional. The sample loop is now

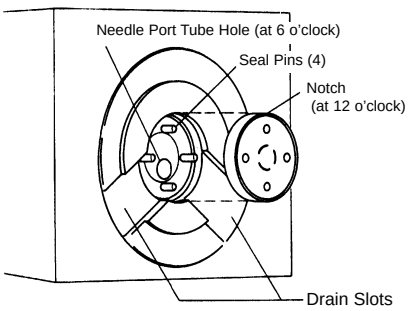

Fig. 10. Orienting the three groove rotor seal on a rear loading pneumatic valve.

loaded using one of the stator ports from an autosampler or syringe using an external Loop Filler Port (P/N 9012).

If using manual injection, plumb the valve as illustrated in Figure 11. For example, if the valve is in LOAD, and the sample loads through Port 5, the excess sample will exit through Port 6. In the INJECT position, Port 5 can be flushed and the excess sample will exit out Port 6.

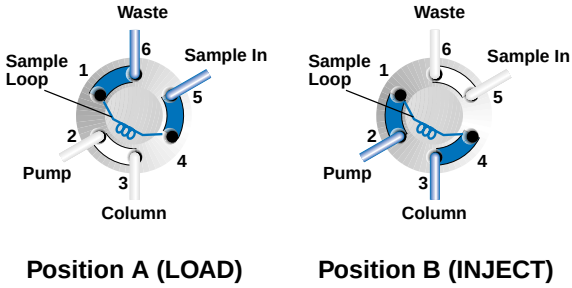

Fig. 11. Plumbing the converted valve.

8.0 ADJUSTING FOR LEAKAGE OR HIGHER PRESSURE OPERATION

There is a single pressure adjusting screw at the handle end of the valve body. The handle assembly is designed to be used as a tool for adjusting this screw. If you need operation up to a higher pressure or if there is a leak between the stator and stator ring, loosen the two set screws so that the handle slips down the shaft and the two protrusions fit into the slots on the adjusting screw. Tighten the adjusting screw about 1/20th turn. Use the 20 dial markings on the body and the painted spot on the adjusting screw as guides, see Figure 13. If there is still leakage at this new setting, repeat the process. Replace the rotor seal if the leak continues.

Note: When the valve is not panel mounted, the adjusting screw can be hard to turn. In this case, loosen the three stator screws a 1/4 turn prior to adjusting the screw. Retighten the stator screws before testing for leaks.

Replace the handle and tighten the two set screws on the two flats of the shaft. Confirm that the handle protrusions are out of the slots in the body before tightening the set screws. This step is important. If the handle engages the pressure adjusting screw the shaft will not rotate between LOAD and INJECT. See Figure 12.

Note: If the vent lines from Ports 5 and 6 do not have their outlet ends at the same horizontal level as the needle port, siphoning can result, which is often misinterpreted as a leak. A siphoning leak will stop when the vent lines and needle port tube are empty. A leak due to a damaged rotor seal will continue.

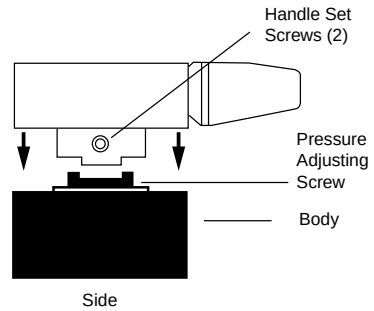

Fig. 12. Valve handle acting as wrench to adjust valve pressure adjusting screw.

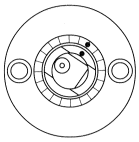

Fig. 13. Guides on adjusting screw and body.

9.0 MAINTENANCE

The only parts that may need eventual replacement are the rotor seal, isolation seal, and stator face assembly.

The main causes of early failure are:

a) The wrong needle tip can damage the stator face which then causes deep scratching of the rotor seal surface.

b) Abrasive particles in the sample can scratch the rotor seal surface.

Genuine Rheodyne parts are easily replaced by following the instructions.

9.1 DISASSEMBLY

To disassemble the valve, refer to Figure 15 and proceed as follows:

a) Remove the handle assembly.

b) Remove the three stator screws.

c) Remove the stator and stator face assembly. The stator face assembly may remain on the stator.

d) Push the shaft slightly in the direction of the rotor seal until the rotor seal is exposed above the stator ring.

e) Remove the rotor seal by lifting it off the four seal pins.

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9.2 REASSEMBLY

To reassemble the valve, refer to Figure 14, 15, and 16, and proceed as follows:

a) Line up the rotor seal as shown in Figure 16. The rotor seal slots face the stator.

b) Push the shaft assembly back into place.

c) Rotate the handle end of the valve while pushing in on the rotor seal until the two rotor drive pins enter the mating holes on the shaft assembly. The needle port tube will be at about the 6 o'clock position.

d) Put the stator face assembly on the stator. The three pins on the assembly fit into the mating holes in the stator only one way.

e) Replace the stator and stator face assembly on the valve so that the pin in the stator ring enters the mating hole in the stator.

f) Add the three stator screws. Tighten each screw a 1/2 turn past fingertight.

g) Replace the handle and tighten the two set screws on the two flats of the shaft. Confirm that the handle protrusions are out of the slots in the body before tightening the set screws. This step is important. If the handle engages the pressure adjusting screw the shaft will not rotate between LOAD and INJECT. See Figure 12.

10.0 OPERATING SUGGESTIONS AND TROUBLESHOOTING

10.1 LEAKAGE

If you see liquid between the stator and stator ring, or from the needle port or a vent tube, tighten the pressure adjusting screw as explained in Section 8.0. If this fails to stop the leak then replace the rotor seal and/or stator face assembly.

10.2 NEEDLE SEAL LEAKAGE

Since the outside diameter of syringe needles can vary, the needle seal (Teflon sleeve in the rotor seal) may not seal correctly around a needle that is smaller than average. This will result in the loss of accuracy in loading the sample. To make a good seal, remove the needle from the needle port and push in on the plastic needle guide with the eraser end of a pencil. Repeat if necessary.

10.3 USE OF AQUEOUS BUFFERS OR SALT SOLUTIONS

To prevent the formation of salt crystals in the valve which can scratch the rotor seal, flush out the flow passages and the needle port with water after using salt solutions.

10.4 ACCURACY OF SAMPLE LOOPS

Sample loop sizes are not actual values. The actual volume can differ by ± 40% for a 20 µL loop. There is a greater difference for smaller loops. Use partial-filling if you must know the actual volume injected.

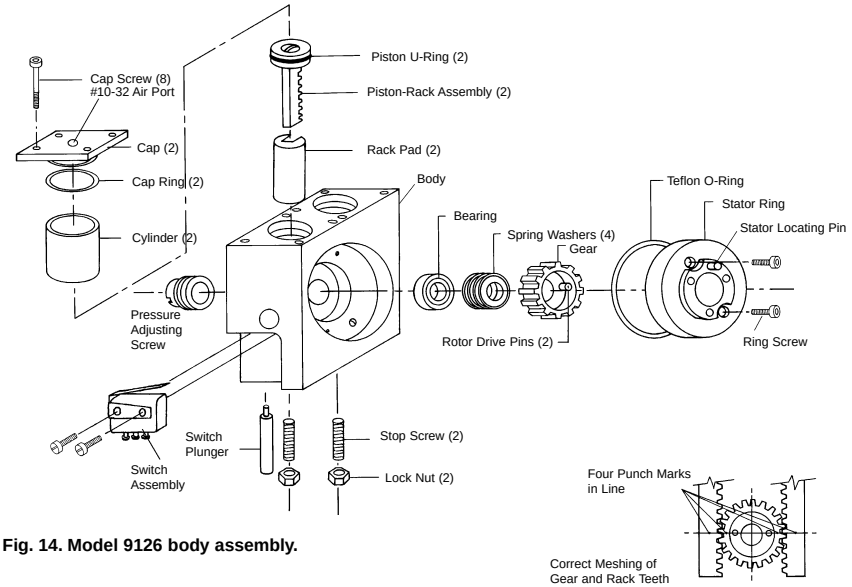

Fig. 14. Model 9126 body assembly.

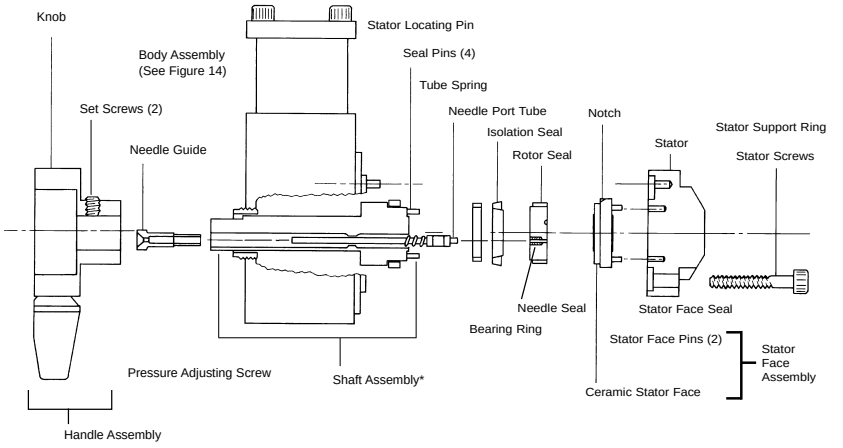

Fig. 15. Model 9126 valve assembly.

* Shaft Assembly includes Rotor, Shaft, and Pins.

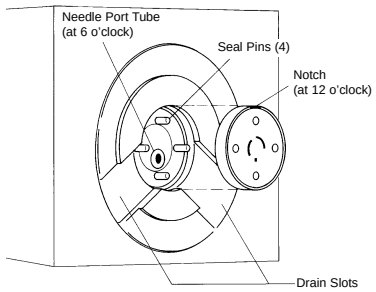

Fig. 16. Correct orientation of the rotor seal of a front loading Model 9126.

11.0 WARRANTY

All Rheodyne products are warranted against defects in materials and workmanship for a period of one year following the date of shipment by Rheodyne. Rheodyne will repair or replace any Rheodyne product that fails during the warranty period due to a defect in materials or workmanship at no charge to the customer. The product must be returned to Rheodyne's factory in original packaging or equivalent, transportation prepaid. Damage occurring in transit is not covered by the warranty. This limited warranty is Rheodyne's sole warranty of its products, and all other warranties of merchantability or fitness for any particular purpose are hereby disclaimed. Under no circumstances will Rheodyne be liable for any consequential or incidental damages attributable to a claimed failure of a Rheodyne product, even if Rheodyne has been placed on notice of possibility of such damages.

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