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U.S.A.
## Safety Practices and Precautions

### Safety First
This product has been designed and tested in accordance with IEC Publication 1010-1, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the product in a safe condition.

### Terms in This Manual
- **WARNING** statements identify conditions or practices that could result in personal injury or loss of life.
- **CAUTION** statements identify conditions or practices that could result in damage to the equipment or other property.

### Terms as Marked on Equipment
- **DANGER** indicates a personal injury hazard immediately accessible as one reads the markings.
- **CAUTION** indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property, including the equipment itself.

### Symbols in This Manual
This symbol indicates where applicable cautionary or other information is to be found.

### Symbols Marked on Equipment
- **DANGER** - High voltage
- Protective ground (earth) terminal
- **ATTENTION** - Refer to Manual
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<td><strong>Danger Arising From Loss of Ground</strong></td>
<td>Any interruption of the grounding conductor inside or outside the equipment or loose connection of the grounding conductor can result in a dangerous unit. Intentional interruption of the grounding conductor is not permitted.</td>
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<td><strong>Safe Equipment</strong></td>
<td>If it is determined that the equipment cannot be operated safely, it should be taken out of operation and secured against unintentional usage.</td>
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<td><strong>Use the Proper Fuse</strong></td>
<td>To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified in the parts list for your product. Use of repaired fuses or short circuiting of the fuse switch is not permitted.</td>
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| **Safety Guidelines**                        | DO NOT open the equipment to perform any adjustments, measurements, maintenance, parts replacement or repairs until all power supplies have been disconnected.  

Only a properly trained technician should work on any equipment with power still applied.  

When opening covers or removing parts, exercise extreme care "live parts or connections can be exposed".  

Capacitors in the equipment can still be charged even after the unit has been disconnected from all power supplies. |
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Section 1: Introduction

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Overview

The Model 20 Valve Maintenance Manual offers maintenance, repair, and test instructions to trained technicians who are responsible for in-plant maintenance of the equipment.

Siemens Energy & Automation, Inc. continues to repair valves and stock parts for immediate delivery. Valves can be returned for repair. Include a purchase order or repair authorization with appropriate charge number.

Model 20 Valve Description

The Model 20 Valve is an air-pressure actuated, diaphragm valve designed and produced by Siemens Energy & Automation, Inc. It is used for critical situation valving as required by process chromatography and serves process chromatograph systems equally well as a liquid or vapor sample valve, column switching valve, or column backflush valve, depending upon the application.

Model 20 Valve features include: uniform sample volume, low internal volume, high pressure (to 1500 psi, 10350 kPa), fast switching (in milliseconds), reliability, and durability. Critical components are designed with minimal movement (only thousandths of an inch) for maximum efficiency, dependability, and consistency. The valve components are designed to eliminate air leakage during valve actuation. This feature is especially beneficial when helium or nitrogen is used for valve actuation.

The Model 20 Valve is constructed for ease of maintenance. The body and cap are each secured with three Allen-head cap screws allowing easy access for internal maintenance of the valve without removing the unit from the chromatograph. The only tool needed to disassemble or assemble the valve is an Allen wrench. Figure 1-1 shows a typical Model 20 Valve.
Figure 1-1: Model 20 Valve
Physical Description

Model 20 Valves have three control ports and six stream ports. Control ports are located on the valve base, and are identified by their position on an upright valve as lower, center, and upper (see Figure 1-1). Stream ports are arranged in a circular pattern on the valve cap, and are identified as ports 1 through 6 (as indicated by the small numbers inside the inner circles on Figure 1-2 and 1-3).

Model 20 Valves made of 316 stainless steel are standard. However, optional valve caps made of 316L stainless steel, Monel K, or Hastelloy C-276 also are available (see the parts list in Table 6-1).

Valve caps are manufactured with 6 in. (152 mm) lengths of 1/16 in. (1.6 mm) O.D. tubing soldered to each of the stream ports. The I.D. dimension of the tube depends upon the type of cap, as explained below. The tubing is made from the same material as the cap.

Four types of valve caps are available for different applications:

1. External Loop 1 
2. External Loop 2 
3. Capillary Tube 
4. Internal Loop

The first three types of caps are used on EXTERNAL LOOP valves (see Figure 1-2). The tubes from stream ports 2 and 5 are joined by a Swagelok® union to form an external sample loop. The volume of the sample is determined by the length and the I.D. dimension of the tubing used to form the external loop.

1. External Loop 1 caps have 0.015 in. (0.381 mm) I.D. tubes from ports 2, 4, and 5, and 0.031 in. (0.787 mm) I.D. tubes from ports 1, 3, and 6.

2. External Loop 2 caps have 0.031 in. (0.787 mm) I.D. tubes from all six ports.

3. Capillary Tube caps have 0.010 in. (0.254 mm) I.D. tubes from all six ports.

Caps used on INTERNAL LOOP valves (see Figure 1-3) differ in design. Stream ports 2 and 5 are connected internally by a groove machined into the cap face. The standard sample volume is 2 microliters. The cap has only four tubes. The tubes from ports 1, 3, and 6 are 0.031 in. (0.787 mm) I.D., and the tube from port 4 is 0.010 in. (0.254 mm) I.D.
Functional Description

Sample and carrier streams enter the Model 20 Valve through the tubes from the ports in the cap (see Section Physical Descriptions, page 3). Internally, the streams contact only the valve cap and a Teflon® diaphragm, which serves as a seal to prevent process fluids from contacting other components of the valve. Beneath the Teflon disc, a Dacron® disc is inserted as a cushion to protect the sealing diaphragm from rupture by the valve's plungers.
Six plungers control the stream flow through the valve. A plunger is positioned in the circular passage between each pair of adjacent ports. The plungers move the cushion and sealing diaphragms up or down ten-thousandths of an inch, opening or closing the passage between the ports. The plungers operate in two sets of three plungers each. Each set of plungers is controlled by a spring-loaded, air-actuated piston. The two actuating pistons operate so that one set of plungers closes three passages as the other set opens three passages. When the valve is deactivated, passages between ports 1 and 6, ports 4 and 5, and ports 2 and 3 are closed; and at the same time, passages between ports 1 and 2, ports 3 and 4, and ports 5 and 6 are open.

The two actuating pistons are spring loaded in a manner that assures all six passages between the ports are momentarily closed during the switching operation (both actuating and deactuating). This arrangement prevents unwanted stream mixing while switching cycles. (Figure 1-4 illustrates the operating positions of the valve.)

When the Model 20 Valve is in the "pre-sampling" mode (deactuated), the sample stream passes continuously through the sample loop, either an external loop or an internal loop (as explained in the Physical Description section on page 3 and shown in Figures 1-2 and 1-3). This provides a current sample at the valve. The carrier stream is bypassed through ports 3 and 4. When the valve is in the "switching" mode, all of the ports are closed, trapping a fixed volume of the sample in the loop. Then, when the valve is in the "sampling" mode (actuated), the sample stream is diverted through ports 1 and 6, while the carrier flows through the loop ports, sweeping the trapped sample from the loop into the chromatographic column(s).

![Figure 1-4: Valve Operating Positions](image)

The two actuating pistons are powered by air pressure at the control ports. When the valve is used at low pressure (below 200 psig, or 1380 kPa), one on-off air supply (at 50 psig, or 345 kPa) is connected to the center control port. With air on, the valve is actuated, and with air off, the valve is deactuated. When the valve is used at high pressure (above 200 psig, or 1380 kPa), the on-off air supplies (at 80 psig, or 550 kPa, maximum) are connected to the center and lower control ports. The valve is actuated with air on to the center port and air off to the lower port. The valve is deactuated with air off to the center port and air on to the lower port. The upper control port vents air from the other control ports, or it may be used for vacuum assist on extremely low-pressure applications.
Applications

Two examples of Model 20 Valves used in column-switching applications are shown in Figure 1-5 and 1-6. See the "Column Application Data Sheets" provided with the equipment for specific information about your application.

For column switching applications, a Model 20 Valve with an external loop type of cap (as explained in the Physical Description, page 3) is used. In such cases, an external loop is not formed; instead, each of the six 1/16 in. (1.6 mm) tubes from the stream ports in the cap is connected to a chromatographic column or to some other unit.

A Model 20 Valve can be connected to two columns in a "forward stepping" arrangement as shown in Figure 1-5. Easily separated components pass only through Column 1, and then they are "stepped" to the detector (with the valve actuated). Components more difficult to separate are passed from Column 1 through Column 2, then again through Column 1 before eluting to the detector (with the valve deactuated).

In a "column backflush" arrangement, a Model 20 Valve is connected to two columns as shown in Figure 1-6. Normally, such applications have a "precut" column (Column 1) followed by an "analysis" column (Column 2) connected in series. All components in the sample are injected into Column 1 (with the valve deactuated). When the components of interest have passed through Column 1 and into Column 2, the "precut" is made (by switching the valve to actuated). This valve switching prevents the heavier components from reaching Column 2, and causes the carrier to backflush Column 1, sending the unwanted components to vent. Meanwhile, the desired lighter components pass through Column 2 and are separated for analysis. Before the next sample is injected, the valve switches back (to deactuated), returning to a normal (series) flow through both columns.

Figure 1-5: Column Switching Forward Stepping

Figure 1-6: Column Switching Backflush
Filtering

Model 20 Valves must be protected from contamination (dirt, filings, packing material, etc.) that can affect the Teflon-to-metal seals. Filters with 5 micrometer elements are recommended.

Specifications

Body Size: 2-3/4 in. (70 mm) diameter by 2-3/4 in. (70 mm).

Mounting: Clamp type.

Sample Size
   Internal Loop: 2 microliter standard.
   External Loop: 170 microliter standard.

   Other sizes are available on special request.

Switching Time: 150 milliseconds (total time from command signal initiation to valve switching completion).

Sample Filter: 5 micrometer recommended (not furnished with valve).

Operating Temperature: 250°F (121°C) maximum for standard valve.

Operating Pressure: 1500 psig (10350 kPa) maximum for standard valve. Higher operating pressure available on special request.

Leak Rate: Less than 1 microliter per minute between ports.

Sample Contact Material: 316 Stainless Steel and Teflon standard. Other materials available on special request.

Connections: 1/16 in. (1.6 mm) O.D. tubing with Swagelok fittings.

Actuating Air: 50 psig (345 kPa) air standard. 80 psig (550 kPa) maximum. Helium or nitrogen may be used for instrument air.

Other: A helium purge may be used (an external supply of low pressure helium is required).
Addendums

Special Model 20 Valves (or special plumbing) are required for any one or more of the following applications:

- An additional actuating air line is needed for control pressure of 200 to 1500 psig (1380 to 10350 kPa).
- Operating temperature above 250°F (121°C).
- Operating pressure greater than 1500 psig (10350 kPa).
- Operating in conditions corrosive, or damaging, to standard Model 20 Valves.
Section 2: Maintenance Concepts

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Overview

If system performance or visual inspection of the analyzer (and in particular, observation of the Model 20 Valve) indicates a real or potential malfunction exists, the following remarks will assist in expeditiously correcting the problem and returning the valve to productive operation.

In considering possible repair of the Model 20 Valve, you should consider and be guided by the following points.

1. If you are certain the problem is directly related to system performance of the Model 20 Valve, would not direct replacement of the faulty valve with a tested unit be the best immediate solution? Such a replacement, taking about 30 minutes, assures a positive correction of the problem.

2. Are you certain you have all of the proper replacement parts to repair the valve?

3. Would not the shop offer better facilities for such repair than the analyzer house environment?

Maintenance and Diagnostic Procedures

The most expeditious maintenance of the Model 20 Valve is conveniently divided into two phases - MINI-MAINTENANCE and MAXI-MAINTENANCE. The choice of which to follow will depend on the nature of the observed valve fault, the availability of spare valve component parts, the experience of maintenance personnel, and the availability of tools and special facilities to perform the work.

Mini-Maintenance Procedures

Mini-Maintenance procedures are based on attempting to fix a faulty Model 20 Valve without removing it from the analyzer, which is a logical first step for maintenance personnel if they have no idea what the problem is.

The first step of the procedure is the removal of the valve cap (refer to Figure 6-1 and 6-2 and the steps outlined in Section 4, Disassembly and Inspection of the Cap). All fittings and tubing should be cleaned and the diaphragms inspected for cleanliness Catalyst or polymer buildup on the cap or body faces should be wiped off. New diaphragms should be installed as described in Section 4, Disassembly and Inspection of the Cap. The valve cap may then be reinstalled in accordance with Section 4, Assembling the Cap and the valve tested for proper operation in the system.

Should the Mini-Maintenance procedure just described fail to correct the operation of a faulty valve, or if visual inspection detects a noticeable amount of foreign material on the diaphragm, it is recommended that the Model 20 Valve be returned to Siemens Energy & Automation, Inc. for repair. Or you may prefer to repair it yourself in accordance with the proper facilities and components to perform the procedure are available.
Valve Diagnostic Procedures

If a replacement Model 20 Valve is not available, or circumstances make it necessary to determine the cause of the valve's malfunction without delay, follow the diagnostic procedures discussed in Section 3. These tests generally can be conducted without removing the valve from the analyzer. They cover the following:

1. Valve leakage
2. Plugged valve
3. Ruptured diaphragm
4. Slow or erratic switching

The above diagnostic tests will indicate specific areas of fault or trouble involving valve performance in the analyzer system.

Maxi-Maintenance Procedures

If a Mini-Maintenance procedure cannot correct the valve problems, you have the option of either replacing the Model 20 Valve with a tested unit or performing a series of Maxi-Maintenance procedures involving complete disassembly, thorough cleaning, and rebuilding of the valve.

Once the decision has been made to completely disassemble, repair as needed, and reassemble the Model 20 Valve, you should follow the procedures detailed in Section 4.
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Trouble Reporting Error! Bookmark not defined.

Overview

Some of the tests identified below are performed with the valve in the analyzer. Other tests require analyzer shut down and valve port disconnection, depending upon the installation.

Valve Leakage

Analyzers generally have sample pressure lower than the carrier pressure, so any leakage would be from a carrier port to a sample port within the valve. With the sample inlet flow turned off, the sample outlet flow should be zero in either the actuated or deactuated condition.

Check for carrier and sample gas leaks by immersing the sample outlet tubing in a beaker of water. Bubbles indicate internal leakage. With liquid carrier, check for liquid dripping from the sample outlet tube.

Some sample streams have pressure higher than the carrier. Leakage between ports shows on the analyzer recorder as a base-line shift when the sample pressure is removed from the valve.

Plugged Valve

Plungers in the valve are pressed upward by air or spring action, but depend on their own weight and sample pressure to drop them into the "open" position when released. Very low sample pressure may not open the flow path if the Teflon is held against the cap for long periods of time (such as a valve in storage). Check the flow across alternate flow paths, actuated and deactuated. It may be necessary to temporarily increase the sample pressure to start the flow, and then reduce sample pressure to normal after a few cycles.

Ruptured Diaphragm

To test for a ruptured diaphragm, apply air pressure to the valve ports, one at a time, while sealing all other ports. Place a small amount of Leak Tec®, or equivalent, over the valve vent hole, upper control port. Escaping air from the vent hole indicates a ruptured diaphragm. Ruptured diaphragms must be replaced. Liquid systems are tested by checking for liquid substances escaping from the valve vent hole.
**Slow or Erratic Switching**

Improper lubrication or contamination on the O-rings can cause excessive friction on valve-actuating pistons. As a result, the valve switching is erratic, slow, or inoperative. These conditions can cause a leak port to port (across the diaphragm), double sampling, or complete flow blockage between ports.

To correct power switching conditions:

1. Disassemble the valve body.
2. Discard the old O-rings.
3. Thoroughly clean all the components.
4. Lubricated components.
5. Install new O-rings.
6. Reassemble the valve.
Section 4: Repair

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Overview

Under normal operating conditions, the Model 20 Valve will perform a minimum of 500,000 cycles without failure. However, contamination or abuse will drastically shorten the life of a valve. Process upsets, improper filtering, and improper maintenance procedures introduce foreign material into the valve causing component damage, or complete valve failure.

Cleanliness is essential for good valve operation. Clean operating conditions are required at all times. Contamination must be cleaned quickly to prevent damage (reference page 15). Clean hands, tools, and a dust-free environment are required for valve maintenance and repair.

Disassembly and Inspection

Port-to-port leakage, low flow rate (plugging), double sampling and other simple flow problems usually do not require disassembly. However more serious problems (like a ruptured diaphragm) will require valve disassembly. Disassembly instructions follow. Bracketed numbers, [ ], in the descriptions refer to the callout number on Figure 4-1. Callout numbers also correspond with item numbers on the part list in Table 6-1.

Figure 4-1: Model 20 Valve Components
Disassembly and Inspection of the Cap (Refer to Figures 6-1 and 6-2, and to Tables 6-1 and 6-2.)

1. Loosen the three screws [16] holding the body [13] to the base [14] to relieve the spring pressure approximately 1/8 in. (3 mm). Do not remove the screws.


3. Remove the cap [1] from the body [13].

   **NOTE**
   
   Do not place the polished cap face against any other surface.


5. If the diaphragm is brittle, dirty but not ruptured, or ruptured but clean, do not disassemble the rest of the valve. Visually inspect the rest of the valve. If it is clean and in good order, install a new diaphragm seal and cushion, and reassemble the cap. Assembly instructions are given in "Assembling the Cap", reference page 17.

   If the valve actuator assembly appears to be contaminated, or if the valve does not operate properly, continue disassembly as described below.

Disassembly and Inspection of the Actuator

1. Check the plungers [6] for sticking. Using even finger pressure around the edges of the valve body [13], push the valve body against the base [14]. All of the plungers will rise. Release the valve body. The plungers should drop. If not, there may be an oil film holding them. Apply gentle pressure to the top of each plunger. If they drop without excessive application of pressure, the valve is operating and does not need additional disassembly. If the plungers stick, or operate sluggishly, a thorough cleaning, repair, or replacement is needed.

2. Turn the actuator assembly on its side and remove the three screws [16].

3. Remove the valve body [13] while it is horizontal. Do not allow the plungers to fall from the body. Carefully remove all six plungers [6].

4. Place the base [14] upright. Insert a #6 - 32 screw into the center threaded hole and pull to remove the pistons [12 and 15].

   **NOTE**

   Another method may be used to remove the piston assembly. Carefully apply approximately 10 psig (70 kPa) air pressure on the bottom port of the base [14]. The pistons will extend and can be pulled out by hand. Do not use more than 30 psig (200 kPa) air pressure when using this method.

5. Inspect the cylinder walls and the three Belleville washers [20]. These components must be clean and undamaged. Clean, or replace them as required.

6. Separate the upper and lower pistons [12 and 15]. Inspect the pistons [12 and 15], valve springs [12c], and O-rings [18 and 19]. They must be clean and undamaged. Clean or replace them as needed.
Cleaning

Contamination in flow passage or excessive friction in the lower valve section causes operating difficulties. If port-to-port leakage, or blockage, exists when a passage is switched open, the valve must be cleaned thoroughly.

NOTE

The recommended method of cleaning valve components is using an ultrasonic cleaner filled with a suitable cleaning solution (which leaves no residue on evaporation), like hexane or Chlorethene®. Other methods of cleaning may be used; however, it is essential that all components are thoroughly clean and dry before assembly.

1. Clean the valve cap [1]. Use a syringe filled with cleaning fluid to flush contamination from each tube as follows:

   a. Prepare a large syringe with a tubing adapter. Fill the syringe with suitable clean solvent (which leaves no residue on evaporation), such as hexane or Chlorethene.

NOTE

Clean solvent is required for each step below. If the solvent is contaminated during one of the following steps, replace it with a clean supply in a clean beaker.

   b. Connect the syringe to valve port 1. Place a length of tubing from port 2 into a small beaker half filled with solvent. Flush the passage with the syringe action by forcing the solvent back and forth through the passage between ports 1 and 2.

   c. Remove the tubing from port 2 and install it on port 6 and into the beaker. Actuate air pressure to switch the valve. Flush the passage with the syringe action by forcing the solvent back and forth through the passage between ports 1 and 6. Remove actuating air pressure.

   d. Remove the syringe from port 1 and attach it to port 3. Remove the tubing from port 6 and install it on port 4 and into the beaker. Flush the passage between ports 3 and 4.

   e. Remove the tubing from port 4 and attach it on port 2 and into the beaker. Actuate air pressure to switch the valve. Flush the passage between ports 2 and 3. Remove actuating air pressure.

   f. Remove the syringe from port 3 and attach it to port 5. Remove the tubing from port 2 and install it on port 6 and into the beaker. Flush the passage between ports 5 and 6.

   g. Remove the tubing from port 6 and attach it to port 4 and into the beaker. Actuate air pressure to switch the valve. Flush the passage between ports 4 and 5. Remove actuating air pressure.

CAUTION

Do not allow the polished face of the valve cap to rest on any other surface.

Shake excess cleaning fluid from the tubes and let the cap air dry before assembling.
NOTE

Use a cleaning solution on metal parts only.

2. Clean all other valve components and allow them to air dry.

Assembling the Actuator

NOTE

Cleanliness cannot be overemphasized when assembling a Model 20 Valve. Clean hands, clean tools, and a clean, dust-free environment are essential.

1. Install three Belleville washers [20] in the base [14]. The washers must be positioned bevel up, bevel down, bevel up as shown in Figure 6-2.

2. Apply a bead of lubricant (Krytox 240 AC, or equivalent) in both O-ring grooves of the piston [15]. Install new O-rings [18 and 19]. Apply a coat of lubricant over the O-rings.

3. Apply a bead of lubricant in the O-ring groove of the upper piston [12a]. Install a new O-ring [19] and apply a coat of lubricant over the O-ring.

4. Place the upper piston [12] over the small diameter of the lower piston [15], and position the pistons with the guide pin [12b].

5. Lubricate the finger spring [12c]. Apply lubricant (Krytox 240 AC, or equivalent) to each of the six fingers of the spring at the point where the fingers contact the body [13].

6. Position the valve upright with its three ports on the left. Put a #6 - 32 screw in the center threaded hole of the piston assembly [12 and 15]. Lift the assembly and orient it with the upper piston index pin [12b] toward you. Press the piston assembly into the base. Remove the #6 - 32 screw.

7. Align the valve body [13] and insert the piston index pin into one of the three bottom holes of the valve body. Rotate the valve body to align the body screw holes with the base threaded holes. Install three screws [16] with washers [17]. Hand tighten the screws, but do not compress the Belleville washers [20] in the base.


9. Place a small drop of Krytox 143 AY, or equivalent oil, between each plunger. Lift each plunger with tweezers and move it up and down, to allow the oil to flow around the plunger.
Assembling the Cap

1. Place the actuator assembly upright on a clean surface.


   **NOTE**
   Always install a new seal and cushion. Do not install a previously used seal or cushion. Remove lint and dust particles from the seal and cushion before installing them on the valve body.

3. Hold a Teflon disc [4] by its edges with tweezers and clean the disc by sliding it between your index and middle fingers. Remove lint, dust, and oil from the disc before installing it. Install the Teflon disc over the Dacron cushion just installed.

4. Align the valve cap [1] over the three guide pins of the body [13] with port 1 toward the upper control port. Lower the cap over the guide pins and onto the body.

5. Install the three screws [3], each with two washers [2], and tighten in rotation according to the following sequence.
   a. Finger tight
   b. 20 inch pounds (2.3 N•m)
   c. 40 inch pounds (4.5 N•m)
   d. 60 inch pounds (6.8 N•m)

   **NOTE**
   Torques listed may be approximated with a hand-held Allen wrench.

6. Tighten the three body screws [16] to approximately 30 to 40 inch pounds (3.4 to 4.5 N•m). Be certain all three screws are tight.
Section 5: Leak Test Procedures

NOTES

- The numbers in parentheses in the following steps refer to similarly numbered callouts on Figures 5-1 and 5-3.

- Figures 5-2 and 5-4, Test Flow Diagrams, can help you visualize the flow at various ports when the actuating air switch (6) is operated.

1. Connect a 100 psig [690 kPa] air supply to the test stand (see Figure 5-1 or 5-3).

2. Connect the actuating air line (7) to the middle input port on the base of the valve (8).

3. For valves with external loop caps only, a short leak test can be performed by doing the following:
   a. Hook up the test stand and valve as described in steps 1 and 2 (see Figures 5-1 and 5-2).
   b. Connect the tubing from port 2 to the tubing from port 5 using a 1/16 in. Swagelok union.
   c. Plug the ends of the tubing from ports 6 and 3 with 1/16 in. Swagelok caps (3).
   d. Connect the sample air (9) to port 1.
   e. Slide a bubble tube (11) over the ferrule on the tubing to port 4, and slightly submerge the open end of the tube in a beaker (10) half full of water.
   f. Set the actuating air-pressure regulator (5) to 50 psig [345 kPa], and set the sample air-pressure regulator (12) to 100 psig [690 kPa].
   g. Turn the sample air switch (2) "ON," and check the end of the bubble tube (11) submerged in the beaker (10). Bubbles from the end of the tube indicate a leak (refer to Section 4 for repair procedures). If no bubble forms, continue with step h.
   h. Turn the actuating air switch (6) "ON" while observing the end of the bubble tube (11) submerged in the beaker (10). When the loop between ports 2 and 5 is switched from the pressure side to the outlet side, a slug of air should escape from the bubble tube, then shut off completely. When the actuating air switch is turned "OFF," switching the loop back to the pressure side, no air should escape. Bubbles forming at the end of the submerged tube indicate a leak (refer to Section 4 for repair procedures).
ITEM NO.
1 SAMPLE AIR PRESSURE GAUGE 0-100 psig (0-690 kPa)
2 1/16 in. SWAGELOK UNION
3 1/16 IN. SWAGELOK CAP
4 ACTUATING AIR PRESSURE GAUGE 0-60 psig (0-414 kPa)
5 ACTUATING AIR PRESSURE REGULATOR
6 ACTUATING AIR SWITCH
7 ACTUATING AIR CONNECTION
8 MODEL 20 VALVE
9 SAMPLE AIR CONNECTION
10 BEAKER OF WATER
11 BUBBLE TUBE (TYGON)
12 SAMPLE AIR SWITCH
13 SAMPLE AIR PRESSURE REGULATOR

Figure 5-1: Test Stand Assembly for Model 20 Valve with External Loop Cap
Figure 5-2: Flow Test Diagram for Model 20 Valve With External Loop Cap
4. For valves with internal loop caps only, a short leak test can be performed by doing the following:
   a. Hook up the test stand and valve as described in steps 1 and 2 (see Figure 5-3 and 5-4).
   b. Plug the ends of the tubing from ports 6 and 3 with 1/16 in. Swagelok caps (3).
   c. Connect the sample air (9) to port 1.
   d. Slide the bubble tube (11) over the ferrule on the tubing to port 4, and slightly submerge the open end of the tube in a beaker (10) half full of water.
   e. Set the actuating air-pressure regulator (5) to 50 psig [345 kPa], and set the sample air-pressure regulator (12) to 100 psig [690 kPa].
   f. Turn the sample air switch (2) "ON," and check the end of the bubble tube (11) submerged in the beaker (10). Bubbles from the end of the tube indicate a leak (refer to Section 4 for repair procedures). If no bubble forms, continue with step g.
   g. Turn the actuating air switch (6) "ON" while observing the end of the bubble tube (11) submerged in the beaker (10). When the internal loop between ports 2 and 5 is switched from the pressure side to the outlet side, a slug of air should escape from the bubble tube, then shut off completely. When the actuating air switch is turned "OFF", switching the loop back into the pressure side, no air should escape. Bubbles forming at the end of the submerged tube indicate a leak (refer to Section 4 for repair procedures).
ITEM NO.

1  SAMPLE AIR PRESSURE GAUGE 0-100 psig (0-690 kPa)
2  SAMPLE AIR SWITCH
3  1/16 IN. SWAGELOK CAP
4  ACTUATING AIR PRESSURE GAUGE 0-60 psig (0-414 kPa)
5  ACTUATING AIR PRESSURE REGULATOR
6  ACTUATING AIR SWITCH
7  ACTUATING AIR CONNECTION
8  MODEL 20 VALVE
9  SAMPLE AIR CONNECTION
10  BEAKER OF WATER
11  BUBBLE TUBE (TYGON)
12  SAMPLE AIR PRESSURE REGULATOR

Figure 5-3: Test Stand Assembly for Model 20 Valve With Internal Loop Cap
Figure 5-4: Flow Test Diagram for Model 20 Valve With Internal Loop Cap
Section 6: Parts Catalog

Contents

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How to Return Parts ................................................ 26

Overview

This section is provided to help simplify identification of Model 20 Valve components. An exploded view and sectional view of the valve are used to illustrate the parts. The numerical callouts on the drawings relate to the item numbers on the parts list. Figures 6-1 and 6-2 use the same part list.

How to Order Parts

Parts may be ordered from:

Siemens Energy & Automation, Inc.
408 US Highway 60
Bartlesville, Oklahoma 74003

Tel: (800) 448-8224 (USA)
Tel: 001 918-662-7030 (International)
Fax: (918) 662-7482 (USA)
Fax: 001 918-662-7482

To ensure an immediate response to your request, you should provide the following information:

• Purchase order number (if ordering by phone, a confirming P.O. should be sent).
• Address where the parts are to be shipped.
• Address where the invoice is to be sent.
• Part numbers.
• Quantity needed of each part.
• Part serial number, analyzer number, or project number of the system (especially for warranty-related orders or application dependent parts).
• Preferred method of shipment.
• Type of order (Replacement parts, repair, exchange, rental, warranty, etc.)
How to Return Parts

Boards and assemblies may be returned to Siemens Energy & Automation, Inc. facility for testing and repair. Parts to be sent in for repair or returned for other reasons must also be identified with a pre-approved RETURN AUTHORIZATION number.
Figure 6-1: Exploded View - Model 20 Valve

NOTES

1. Callouts refer to items on parts list (see Table 6-1 for quantity of each item).

2. Item 11 includes all items 12 through 21 (see Table 6-1 for quantity of each item).

3. *Indicates parts which should be lubricated with Krytox 143 AY oil, as described on page 16.

4. **Indicates parts which should be lubricated with Krytox 240 AC grease, as described on page 16.
Figure 6-2: Section View - Model 20 Valve

NOTE

Callouts refer to items on parts list (see Table 6-1 for quantity of each item).
### Table 6-1: Parts List for Model 20 Valve

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY.</th>
<th>DESCRIPTION</th>
<th>STOCK NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>1</td>
<td>Assembly, Complete Model 20 Valve (see Note 1)</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>External Loop 1</td>
<td>V06002†</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>External Loop 2</td>
<td>V06000†</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Internal Loop</td>
<td>V06003†</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Capillary Tube</td>
<td>V06001†</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Cap, Valve (see Notes 2 and 3)</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>External Loop 1</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316 Stainless Steel</td>
<td>C04111</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316L Stainless Steel</td>
<td>C04112</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Monel K</td>
<td>C04113</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Hastelloy C-276</td>
<td>C04114</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>External Loop 2</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316 Stainless Steel</td>
<td>C04101</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316L Stainless Steel</td>
<td>C04102</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Monel K</td>
<td>C04103</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Hastelloy C-276</td>
<td>C04104</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Internal Loop 2μL</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316 Stainless Steel</td>
<td>C04116</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316L Stainless Steel</td>
<td>C04117</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Monel K</td>
<td>C04118</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Hastelloy C-276</td>
<td>C04119</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Capillary Tube</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316 Stainless Steel</td>
<td>C04106</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>316L Stainless Steel</td>
<td>C04107</td>
</tr>
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<td></td>
<td>Monel K</td>
<td>C04108</td>
</tr>
<tr>
<td>-</td>
<td></td>
<td>Hastelloy C-276</td>
<td>C04109</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Washer, Belleville, 3/16 in. ID</td>
<td>W10000</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Screw, Soc. Hd., #10-32 x 7/8 in., SS</td>
<td>H09614</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Seal, Teflon® Disc Diaphragm</td>
<td>D60900</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Cushion, Dacron Disc Diaphragm</td>
<td>D60901</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Plunger</td>
<td>P56700</td>
</tr>
<tr>
<td>7</td>
<td>4 or 6*</td>
<td>Fitting, Ferrule-Front, 1/16 in., SS</td>
<td>F35901</td>
</tr>
<tr>
<td>8</td>
<td>4 or 6*</td>
<td>Fitting, Ferrule-Back, 1/16 in., SS</td>
<td>F35701</td>
</tr>
<tr>
<td>9</td>
<td>4 or 6*</td>
<td>Fitting, Nut, 1/16 in., SS</td>
<td>F36801</td>
</tr>
<tr>
<td>10</td>
<td>2 or 3 in.*</td>
<td>Tubing, Teflon, 14 Ga., Std. Wall (Cut into four or six ½ in. [12.7 mm] lengths.)*</td>
<td>T93180</td>
</tr>
<tr>
<td>11**</td>
<td>1</td>
<td>Kit, Common Valve Parts</td>
<td>X10034</td>
</tr>
<tr>
<td>12</td>
<td>(1)</td>
<td>Assembly, Air Loaded Piston</td>
<td>P38001</td>
</tr>
<tr>
<td>12c</td>
<td>(1)</td>
<td>Spring, Finger-Type Loading</td>
<td>V11100</td>
</tr>
<tr>
<td>13</td>
<td>(1)</td>
<td>Assembly, Plunger Body</td>
<td>P56701</td>
</tr>
<tr>
<td>14</td>
<td>(1)</td>
<td>Base, Cylinder</td>
<td>B00060</td>
</tr>
<tr>
<td>15</td>
<td>(1)</td>
<td>Piston, Bottom Spring Loaded</td>
<td>B07770</td>
</tr>
<tr>
<td>16</td>
<td>(3)</td>
<td>Screw, Soc. Hd., #10-32 x 7/8 in., SS</td>
<td>H09614</td>
</tr>
<tr>
<td>17</td>
<td>(4)</td>
<td>Washer, Belleville, 3/16 in. ID</td>
<td>W10000</td>
</tr>
<tr>
<td>18</td>
<td>(1)</td>
<td>&quot;O&quot;-Ring, Silicone, 2-010, Small</td>
<td>V16038</td>
</tr>
<tr>
<td>19</td>
<td>(2)</td>
<td>&quot;O&quot;-Ring, Silicone, 2-133, Large</td>
<td>V16040</td>
</tr>
</tbody>
</table>

(Table 6-1 is continued on the next page.)
Table 6-1: Parts List for Model 20 Valve (Continued)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY.</th>
<th>DESCRIPTION</th>
<th>STOCK NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>(3)</td>
<td>Washer, Belleville, 1 in. ID</td>
<td>V16034</td>
</tr>
<tr>
<td>21</td>
<td>(3)</td>
<td>Elbow, Male, Swagelok SS-100-2-1</td>
<td>F35102</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>Oil, Krytox 143 AY, 4 oz. Bottle</td>
<td>074995</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
<td>Grease, Krytox 240 AC, 8 oz. Tube</td>
<td>G87005</td>
</tr>
</tbody>
</table>

Table 6-2: Repair Kit for Model 20 Valve

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY.</th>
<th>DESCRIPTION</th>
<th>STOCK NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>1**</td>
<td>Kit, Repair</td>
<td>K21000</td>
</tr>
<tr>
<td>4</td>
<td>(1)</td>
<td>Seal, Teflon Disc Diaphragm</td>
<td>D60900</td>
</tr>
<tr>
<td>5</td>
<td>(1)</td>
<td>Cushion, Dacron Disc Diaphragm</td>
<td>D60901</td>
</tr>
<tr>
<td>18</td>
<td>(1)</td>
<td>&quot;O&quot;-Ring, Silicone, 2-010, Small</td>
<td>V16038</td>
</tr>
<tr>
<td>19</td>
<td>(2)</td>
<td>&quot;O&quot;-Ring, Silicone, 2-133, Large</td>
<td>V16040</td>
</tr>
<tr>
<td>+</td>
<td>(1)</td>
<td>Wrench, #10 Allen</td>
<td>T10758</td>
</tr>
<tr>
<td>+</td>
<td>(1)</td>
<td>Oil, Krytox 143 AY, 4 oz.</td>
<td>074995</td>
</tr>
<tr>
<td>+</td>
<td>(1)</td>
<td>Grease, Krytox 240 AC, 2 oz. Tube</td>
<td>G87004</td>
</tr>
</tbody>
</table>

NOTES

1. The valve serial number is stamped on the actuator assembly.
2. The valve cap stock number is stamped on the cap.
3. Reference page 3 for details concerning valve cap types, construction materials, and tubing dimensions.
4. + - Items not shown in Figure 6-1 and 6-2. Numbered items correspond to callouts on the illustrations.
5. † = When complete Model 20 Valves are ordered, 316 stainless steel caps are standard. For special applications, order the complete valve assembly and the special cap required (reference page 3 for details).
6. * = The number of fittings and the total length of tubing required depend on the type of valve cap (reference page 3 for details). An internal loop cap requires four of each fitting and 2 in. (50.8 mm) of tubing. External loop caps (type 1 and 2) and capillary tube caps require six of each fitting and 3 in. (76.2 mm) of tubing.
7. ** = The Common Valve Parts Kit includes items 12 through 21. When ordering these items separately, specify the quantity needed.
8. *** = The Model 20 Valve Repair Kit includes items 4, 5, 18 and 19, plus a #10 size Allen wrench, Krytox 143 AY oil, and Krytox 240 AC grease. When ordering these items separately, specify the quantity needed.