Series AP3004, AP3604, & AP3624

Diaphragm Valves

INSTALLATION AND OPERATION MANUAL

Part Number 00-15000014

Revision 0

Advanced Pressure Technology (“AP Tech”)

687 Technology Way

Napa, CA 94558

Phone: (707) 259-0102

FAX: (707) 259-0117

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1. DESCRIPTION

This installation and operation manual covers the Series AP3004, AP3604, and AP3624 diaphragm valves. The AP3004 is a high pressure rated, pneumatically actuated, normally closed, diaphragm valve. The AP3604 is a high pressure rated, multi-turn, manually actuated, diaphragm valve. The AP3624 is a high pressure rated, 1/4 turn, manually actuated, diaphragm valve. All valves have the following features.

- Metal to metal seal to atmosphere
- 15 µinch (0.4 µm) Ra surface finish standard with 10 µinch (0.25 µm), 7 µinch (0.18 µm), or 5 µinch (0.13 µm) optional
- Secondary remelt 316L VAR body material
- Replaceable seat
- Multiport configurations are available
- 3700 psig (255 bar) pressure rating

The Series AP3004, AP3604, and AP3624 valves are available with any of the porting configurations shown in AP Tech Technical Bulletin 203 *Valve Porting Guide*. Technical Bulletin 203 details the order that port connections should be listed in the model number.

The Series AP3004, AP3604, and AP3624 valves may be available with options other than those described in this manual.

Typical model numbers are comprised of the following information:

Series	AP3004 = pneumatic, normally closed AP3604 = manual, multi-turn AP3624 = manual, 1/4 turn
Body Material	S = 316L stainless steel (VAR)
Surface Finish	= 15 µinch (0.4 µm) Ra max M = 10 µinch (0.25 µm) Ra max V = 7 µinch (0.18 µm) Ra max X = 5 µinch (0.13 µm) Ra max
Porting	2PW = 2 ports butt welded 3PW = 3 ports butt welded 4PW = 4 ports butt welded Refer to Technical Bulletin 203 for porting options.
Connections	FV4 = 1/4 inch female face seal MV4 = 1/4 inch male face seal TW4 = 1/4 inch tube butt weld Refer to Technical Bulletin 203 to determine order connections are specified.
Options	VS = Vespel seat IS = Indicator switch (AP3004 only)

Sample Order Number: AP3604SM 2PW FV4 FV4 VS

2. SAFETY

The user is strongly recommended to carefully read this section covering general safety information and to adhere to specific safety information located throughout this manual.

2.1. General Safety Information

All technicians that install, operate, or maintain this equipment should be trained in the use and hazards of compressed gases. Technicians should also be familiar with the hazards associated with the particular gas being delivered. These hazards can include high pressure, asphyxiation, toxicity, flammability, corrosivity, etc. Material safety data sheets are available from gas suppliers that provide detailed information on the hazards associated with a particular gas.

Appropriate personal protective equipment should be worn at all times as recommended by the material safety data sheet for the particular gas and as required by safety practices at the installation site. This equipment may include safety glasses, safety shield, rubber gloves, aprons, etc.

Never exceed the maximum operating pressure of the equipment.

Equipment shall be installed in a manner that meets local, state, and federal regulations and safety guidelines. General guidelines for compressed gases can be obtained from the Compressed Gas Association (http://www.cganet.com/) and the European Industrial Gases Association (www.eiga.org).

Prior to disassembling gas system lines, the system may need to be purged using nitrogen or other suitable inert gas to remove any hazardous gases.

2.2. AP3004, AP3604, and AP3624 Specific Safety Information

An overpressure relief device or other appropriate method of overpressure protection should be installed as appropriate to prevent system pressure from exceeding the valve maximum operating pressure.

A leak test should be performed after valve installation to ensure the system is leak tight. Leak test procedures depend greatly on equipment and operator preference. Below are several different types of tests that could be used.

- **Inboard helium leak test** per SEMI F1 protocol (component inboard method).
- **Outboard pressure decay leak test** using nitrogen. This test should pressurize the component to the maximum outlet pressure (or maximum system pressure), isolate the pressure and monitor for a long period of time (at least 24 hours is recommended) for a drop in pressure.
- **Outboard sniffer probe helium leak test** per SEMI F1 protocol (system outboard method).

A periodic system inspection should be performed to check for signs of external leakage or component damage.

3. TECHNICAL SPECIFICATIONS

3.1. AP3004, AP3604, and AP3624 Common Specifications

3.1.1. Physical Dimensions and Mounting

- Dimensions are shown in Figure 1 for the AP3004 valve, Figure 2 for the AP3604 valve, and Figure 3 for the AP3624 valve.
- Dimensions for standard connections from valve centerline to the end of the connection are given in Table 1. Contact the factory for custom configuration dimensional information.
- Each valve should be mounted to a secure bracket by the holes in the base of the body. This will secure the valve during operation and is critical for the AP3604 and AP3624 valves to prevent knob actuation torque from being transferred to other system piping components.
- The valves are intended for indoor installation. Installation outdoors in an environment protected from direct rain or salt spray may be acceptable, but is the user responsibility.

Connection	"A" Dimension	Tolerance
FV4	1.39 inch (35.3 mm)	± 0.01 inch
MV4	1.39 inch (35.3 mm)	± 0.01 inch
TW4	1.06 inch (26.9 mm)	± 0.01 inch

Table 1. Connection Dimensions

(Reference Figure 1, Figure 2, and Figure 3)

3.1.2. Operating Parameters and Specifications

- Maximum operating pressure: 3700 psig (255 bar)
- Proof pressure: 5000 psig (345 bar)
- Burst pressure: 15000 psig (1034 bar)
- Operating temperature: -40 to +160º F (-40 to +71º C)
- Inboard helium leak rate: 2 x 10^{-10} sccs
- Across-the-seat helium leak rate: 1 x 10^{-9} sccs
- Outboard helium leak rate: 2 x 10^{-9} sccs

3.1.3. Materials of Construction

- Body: 316L VAR (secondary remelt), electropolished and passivated
- Diaphragms: Elgiloy®
- Seat: PCTFE standard, Vespel® optional
- AP3004 non-wetted materials: brass, nickel plated brass, 300 series stainless steel, 400 series stainless steel, silicon o-rings, and lubricated carbon steel.
- AP3604 non-wetted materials: 300 series stainless steel, 400 series stainless steel, plated steel, brass, and ABS plastic.

- AP3624 non-wetted materials: 300 series stainless steel, 400 series stainless steel, anodized aluminum, and powder coated aluminum.

3.2. AP3004 Specific Specifications

3.2.1. Operating Parameters Unique to AP3004 Valve

- Operation: Pneumatic actuation, normally closed (NC)
- Actuation port: 1/8-27 NPT on top of valve
- Actuation pressure: 70-110 psig (4.8-7.6 bar)
- Actuation gas: nitrogen or clean dry air
- Flow coefficient: 0.17 minimum

3.3. AP3604 Specific Specifications

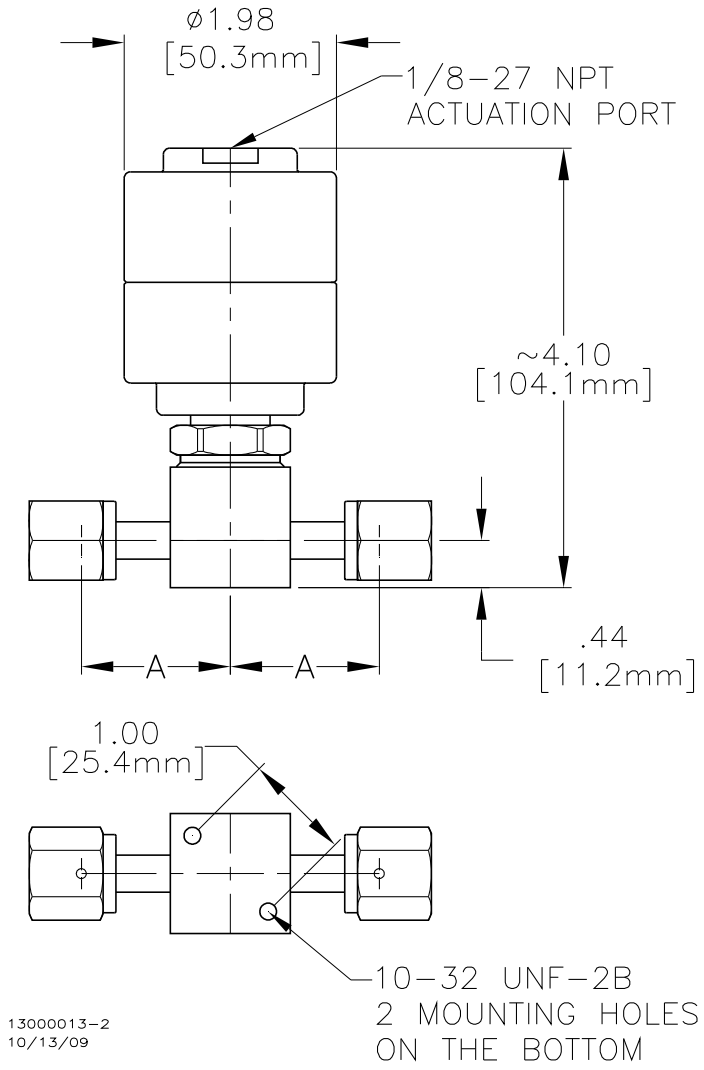
3.3.1. Operating Parameters Unique to AP3604 Valve

- Operation: Manual, multi-turn
- Flow coefficient: 0.23 minimum
- Standard handle color is black.

3.4. AP3624 Specific Specifications

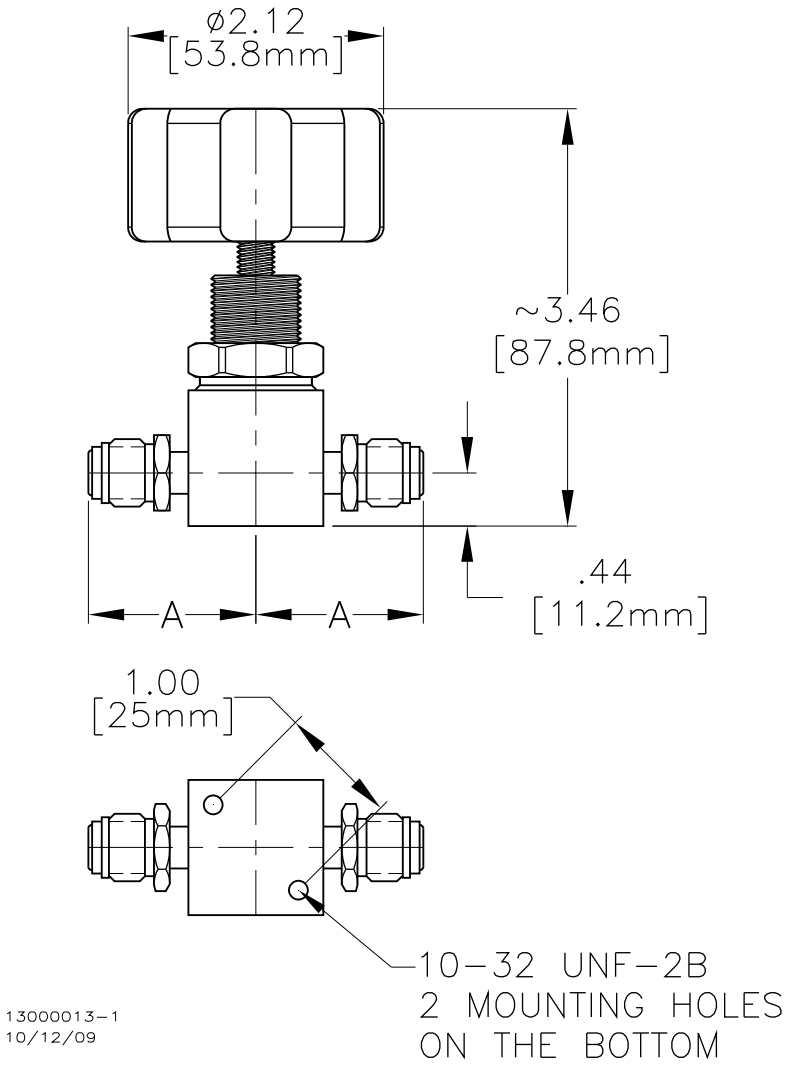
3.4.1. Operating Parameters Unique to AP3624 Valve

- Operation: Manual, 1/4 turn
- Flow coefficient: 0.23 minimum
- Standard handle color is black; optional colors available.



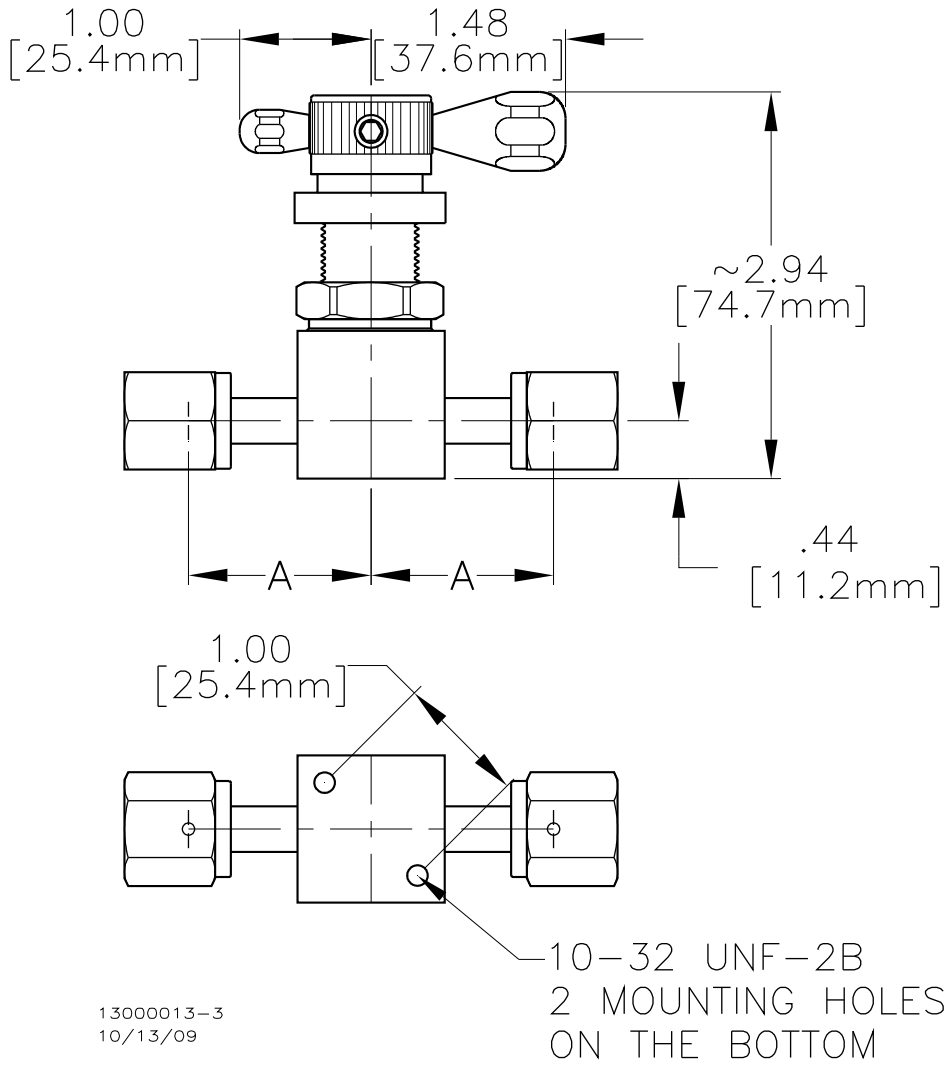
Note: All dimensions are in inches. Millimeter dimensions are for reference only.

Figure 1. AP3004 Valve Dimensions



Note: All dimensions are in inches. Millimeter dimensions are for reference only.

Figure 2. AP3604 Valve Dimensions



Note: All dimensions are in inches. Millimeter dimensions are for reference only.

Figure 3. AP3624 Valve Dimensions

4. INSTALLATION

This section describes how to install the valve at a user facility.

4.1. General

Inspect the valve after unpacking and before installation. If any damage is observed, contact the AP Tech factory or your local representative for repair.

Do not drop or jar the valve because damage to internal parts or connections may result.

4.1.1. Prior to installation

Verify that the operating characteristics of the valve as described below are appropriate for the system in which it will be installed.

- Verify the wetted materials of construction are compatible with the intended process gas.
- Verify the pressure and temperature ratings are acceptable for the intended application.
- Verify the actuation pressure supply is appropriate (for AP3004 only).
- Verify that the flow capacity (C_v) of the valve is appropriate for the application.

4.1.2. Inspect valve flow path

Inspect the valve to determine the flow path through the valve and how the valve will be installed in the system.

- An inlet (upstream) port is defined as a port connected to the region below the valve seat and is labeled with an “IN” marked into the body near the port.
- An outlet (downstream) port is defined as a port connected to the region above the seat and below the diaphragm. The outlet port is usually not labeled.
- The traditional flow direction is inlet to outlet, but AP Tech valves may be employed in either traditional flow direction or the reverse.

4.2. Installation

Install the valve using the appropriate method described below.

- For tube stub connections, follow standard industry practice to weld connectors or other components to the tube stubs (reference SEMI standard F78) and inspect completed welds (reference SEMI standard F81).
- For metal face seal connectors, assemble connections per standard practice described by fitting supplier (typically 1/8 turn past fingertight). Be sure to install an appropriate face seal gasket.
- For any other type connector, contact the fitting supplier or AP Tech factory for assistance.

For the AP3004, connect a nitrogen or clean dry air actuation pressure supply line to the valve actuator 1/8 NPT female thread connection.

4.3. Helium Leak Test

After installation, perform a helium leak test of all face seal connections and welds per standard industry practice (reference SEMI standard F1).

5. OPERATION

When a valve is in the closed position, the inlet ports are isolated from the outlet ports. When a valve is in the open position, all ports are common.

Caution: Do not use a tool to apply excessive opening or closing torque to the valve handle on manual valves as damage may result.

Caution: Frequent cycling of a diaphragm valve at high pressure can cause diaphragm fatigue failure. The customer is recommended to set up a periodic maintenance program to replace the valve diaphragms based on the intended usage.

The following sections describe how to open and close the AP3004, AP3604, and AP3624 valves.

5.1. AP3004 Operation

Perform the following to close the valve.

- Vent the valve actuation pressure to atmospheric pressure.

Perform the following to open the valve.

- Apply actuation pressure to the valve.

5.2. AP3604 Operation

Perform the following to close the valve.

Caution: Do not mistake an actuation torque increase due to internal pressure with that due to contacting the valve internal stop. This could result in the valve being in the open position.

- Rotate the valve handle clockwise until an increase in torque indicates that the internal stop in the valve body is reached.

Perform the following to open the valve.

- Rotate the valve handle counterclockwise until an increase in torque indicates that the internal stop in the actuator is reached. The torque will decrease as the valve is opened and will increase when the internal stop in the actuator is reached.

5.3. AP3624 Operation

Perform the following to close the valve.

Caution: Do not mistake an actuation torque increase due to internal pressure with that due to contacting the valve internal stop. This could result in the valve being in the open position.

- Rotate the valve handle clockwise until an increase in torque indicates that the internal stop in the valve actuator is reached. This is approximately 1/4 turn (90 degrees rotation) from the full open position.
- Verify that handle indicator is pointing toward the center of the word “CLOSED” on the status indication label.

Perform the following to open the valve.

- Rotate the valve handle counterclockwise until an increase in torque indicates that the internal stop in the actuator is reached. The torque will decrease as the valve is opened and will increase when the internal stop in the actuator is reached.
- Verify that handle indicator is pointing toward the center of the word “OPEN” on the status indication label.

6. TROUBLESHOOTING

The most common problem conditions and possible causes/corrections are described below. Please contact the factory for assistance with other problem conditions or to discuss a specific problem in more detail.

6.1. External leak at inlet or outlet connections

Possible causes:

Connection not assembled properly.

Metal face seal gasket not installed.

Correction:

Repair leak by disassembling the connection, inspecting parts, and reassembling using good shop practice. Perform a helium leak test after connection repair.

6.2. External leak at valve body

Possible causes:

Corrosion.

Overpressure condition.

Correction:

Check system pressure on gauge. If gauge reading is above maximum operating pressure, vent system pressure and prevent reoccurrence. Check for leakage once system pressure is below valve maximum operating pressure.

If gauge reading is acceptable, then remove and replace valve.

6.3. Valve does not shut off

Possible causes:

Valve not closed completely or in OPEN position.

Seat contamination.

Correction:

Check to verify valve is closed.

If valve was closed properly, then remove and replace valve.