

Safetygram #43

Air Products Bubbler Installation and Removal Procedures

Purpose

To define procedures for the safe installation and removal of Air Products quartz bubblers.

Scope

Applies to all Air Products breakseal and non-breakseal bubblers. A separate procedure is included for the POCI3 Cross Purge bubbler (see page showing Figure 4 Cross Purge Bubbler).

Responsibility

All people working with quartz bubblers are responsible for following the procedures outlined.

Safety

Handling quartz bubblers requires the use of cut-resistant gloves

SAFETY: Before proceeding, read the material safety data sheet (MSDS) for the specific chemical being used and wear appropriate personal protective equipment. An MSDS is included with every Air Products bubbler.

- Cut-resistant gloves must be worn when handling quartz bubblers.
- Do not lift or handle bubblers by the valves or fill stem.
- For installing or removing the bubbler from the temperature controller, use the fill stem and/or the quartz stem close to the bubbler body and below the bottom valve nut.
- It is critical that valve sequencing instructions be followed. End users must evaluate the effect of check valve placement on tool programming and make necessary changes.
- End users should adhere to the recommended carrier gas flow rates.

If you require additional assistance, please call your Air Products sales representative or the factory direct at 760-931-9555 or 1-800-545-9242 (Continental USA).



AIR PRODUCTS RECOMMENDED BUBBLER INSTALLATION AND REMOVAL PROCEDURE –

this procedure is only applicable when utilizing the recommended bubbler plumbing schematic (see Figure 1). Figure 2 shows a bubbler illustration.

CAUTION: Use white mineral oil to fill the thermowell (Air Products part number 1600-0001). Do not use water or volatile solvents such as acetone, alcohol, etc. Use of these or other liquids can create a serious safety hazard in bubblers containing water reactive chemicals and may cause damage to the temperature probe.

Air Products offers two types of bubblers: one with no breakseal, and one with a diaphragm breakseal in both the inlet and outlet stems. The bubblers have high-purity Teflon® valves attached to each stem. Breakseal bubblers are shipped under vacuum with the valves in the open position. Non-breakseal bubblers are shipped at approximately atmospheric pressure with the valves in the closed position. To gain access to the source chemical from either the breakseal or non-breakseal bubbler, please follow the instructions given below.

WARNING: The incoming gas pressure to the bubbler must not exceed 15 psig at any time. It is best to use a two-stage pressure regulator upstream of the mass flow controller (MFC).

Downstream from the mass flow controller there is to be a “safety,” such as a relief valve, to be activated at 16.5 psig and based on regulator/MFC orifice size and upstream pressure that will not allow pressure to exceed 16.5 psig if the regulator should fail fully open.

Ensure that a check valve (CV1) is installed between the bubbler inlet tubing and the pneumatic system valve (V2), preferably as close to the bubbler as possible.

1) **BUBBLER REMOVAL:** Follow steps below for removing the bubbler.

NOTE: The sequence of events is important (refer to bubbler plumbing schematic).

- a) Open valves V1, V4, and V5a. Close V2, V3, and V5b. Turn down the carrier gas to 10% of full scale.
- b) Close the 1/4" (6mm) manual bubbler inlet valve by slowly turning the valve handle clockwise until it stops. Support the valve body to prevent it from rotating on the stem.

Figure 1

Recommended Bubbler Plumbing Schematic

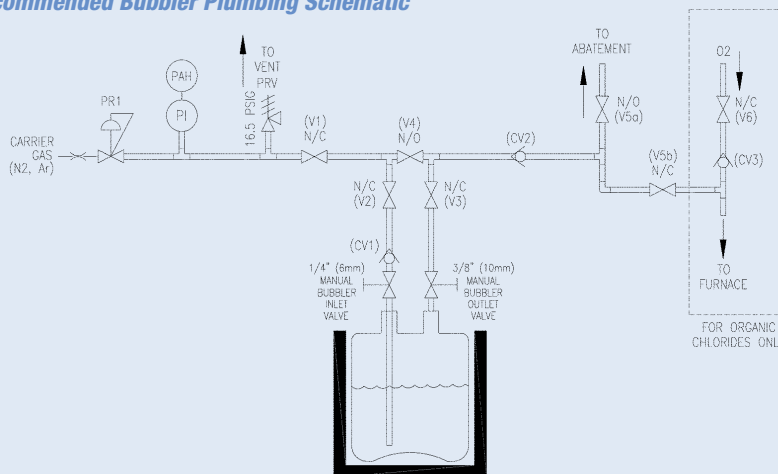
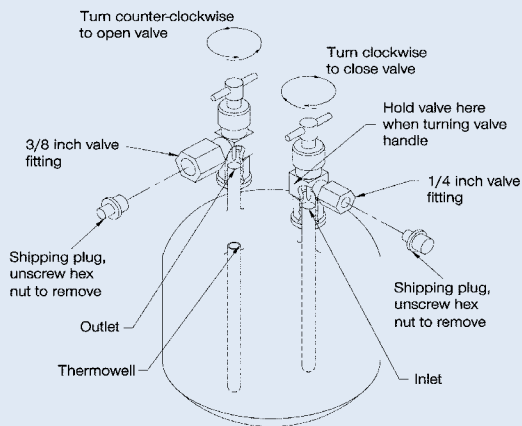


Figure 2

Bubbler



c) Close the 3/8" (10mm) manual bubbler outlet valve by slowly turning the valve handle clockwise until it stops. Support the valve body to prevent it from rotating on the stem.

2) **BUBBLER INSTALLATION:** Follow steps below for installing the bubbler.

NOTE: The sequence of events is important (refer to bubbler plumbing schematic).

- a) Place the bubbler in the temperature controller.
 - b) Cut shrink-wrap around valve if present. Do not move valve handle. Remove the plastic shipping plugs/caps from the valve fittings by unscrewing the hex nut/flare cap. This will back out the plug/cap until it is free from the fitting. DO NOT PULL ON THE SHIPPING PLUGS. This could break the bubbler stem. Save the shipping plugs for return shipment to Air Products.
- a) Disconnect the gas lines from each valve. While removing the gas lines, carefully support the valve body to prevent the possibility of breaking the quartz stem.
 - b) Re-insert the plastic shipping plugs/caps into each valve fitting and hand-tighten the ferrule nuts/caps.
 - c) The bubbler is now ready to be removed and packaged for return shipment

- c) Start carrier N₂ flow at 10% of full scale. Open valves **V1** and **V2**, keep **V3**, **V4**, **V5a** and **V5b** closed (refer to bubbler plumbing schematic).

Connect the incoming gas line (carrier gas) to the 1/4" (6mm) Teflon valve. Ensure the Teflon tubing is round and not indented by previous use. Replace when necessary. Carefully insert the gas line into the valve and tighten the ferrule nut, 1/8 of a turn past finger-tight. **Support the valve to prevent the possibility of breaking the quartz stem.**

- d) Close valves **V2**, **V5a** and **V5b**. Open valves **V1**, **V3** and **V4** (refer to bubbler plumbing schematic).

Connect the outlet gas line (the gas line from the bubbler to the furnace) to the 3/8" (10mm) Teflon valve.

Ensure the Teflon tubing is round and not indented by previous use. Replace when necessary. Carefully insert the gas line into the valve and tighten the ferrule nut, 1/8 of a turn past finger-tight. **Support the valve to prevent the possibility of breaking the quartz stem.**

3) BUBBLER LEAK CHECK: Follow steps below for leak checking the bubbler.

- a) Start carrier N₂ flow at 10% of full scale. Open valves **V1**, **V2**, **V3**, and **V4**. Close valves **V5a** and **V5b**. After several minutes, no more than 5 minutes, MFC flow rate should read 0 if connections are leak-tight.
- b) When completed, close valves **V2**, **V3** and **V5b**. Open **V1**, **V4** and **V5a**. Reduce the carrier flow to 10% of full scale. **Proceed with opening the bubbler.**

4) OPENING THE BUBBLER: OUTLET

Breakseal bubblers only POCl₃ / BBr₃:

- a) Break the outlet diaphragm by slowly turning the 3/8" (10mm) Teflon valve handle clockwise while holding the valve body to prevent it from rotating on the stem. Breaking the diaphragm can be heard as well as felt, and is usually accomplished at the third full turn of the valve handle.

Open the 3/8" (10mm) outlet valve by slowly turning the valve handle counterclockwise. **Support the valve body to prevent it from rotating on the stem.** Open the 3/8" (10mm) Teflon valve by continuing to turn the valve handle until it stops.

Non-breakseal bubblers only TRANS LC:

Open the 3/8" (10mm) outlet valve by slowly turning the valve handle counterclockwise. **Support the valve body to prevent it from rotating on the stem.** Open the 3/8" (10mm) Teflon valve by continuing to turn the valve handle until it stops.

5) OPENING THE BUBBLER: INLET

Breakseal bubblers only POCl₃ / BBr₃:

- a) Break the inlet diaphragm by slowly turning the 1/4" (6mm) Teflon valve handle clockwise while supporting the valve body to prevent it from rotating on the stem. Breaking the diaphragm can be heard as well as felt, and is usually accomplished at the third full turn of the valve handle.

Open the 1/4" (6mm) inlet valve by slowly turning the valve handle counterclockwise. **Support the valve body to prevent it from rotating on the stem.** Open the 1/4" (6mm) Teflon valve by continuing to turn the valve handle until it stops.

Non-breakseal bubblers only TRANS LC:

Open the 1/4" (6mm) inlet valve by slowly turning the valve handle counterclockwise. **Support the valve body to prevent it from rotating on the stem.** Open the 1/4" (6mm) Teflon valve by continuing to turn the valve handle until it stops.

6) EQUALIZE THE PRESSURE: Close all valves (except container valves), then open **V5a**, **V3**, **V4**, and **V2** in sequence. Wait 30 seconds, then close all valves (except container valves).

7) OPTIONAL TEST RUN: It is best to ensure the bubbler is fully operational by performing a test flow through the bubbler to vent.

To run the test flow, close all valves (except container valves), then open **V1**, **V2**, **V3**, and **V5a** in sequence. Allow 30 seconds for the flow to stabilize then close all valves (except container valves).

8) TO PLACE BUBBLER IN STANDBY MODE:

Close all valves (except container valves), then open **V1**, **V4** and **V5a** reduce the carrier flow to 10% of full scale.

**AIR PRODUCTS RECOMMENDED BUBBLER
INSTALLATION AND REMOVAL PROCEDURE –**

this procedure is only applicable when utilizing the recommended POC13 Cross Purge bubbler plumbing schematic (see Figure 3). Figure 4 shows a cross purge bubbler illustration.

CAUTION: Use white mineral oil to fill the thermowell (Air Products part number 1600-0001). Do not use water or volatile solvents such as acetone, alcohol, etc. Use of these or other liquids can create a serious safety hazard in bubblers containing water reactive chemicals and may cause damage to the temperature probe.

Air Products offers a style of bubbler with a diaphragm breakseal in both the inlet and outlet stems. The bubblers have high-purity Teflon valves attached to each stem. Breakseal bubblers are shipped under vacuum with the valves in the open position. To gain access to the source chemical from the breakseal bubbler, please follow the instructions given below.

WARNING: The incoming gas pressure to the bubbler must not exceed 15 psig at any time. It is best to use a two-stage pressure regulator upstream of the mass flow controller. Downstream from the Mass Flow controller (MFC) there is to be a “safety,” such as a relief valve, to be activated at 16.5 psig and based on regulator/MFC orifice size and upstream pressure that will not allow pressure to exceed 16.5 psig if the regulator should fail fully open.

Ensure that a Check valve (CV1) is installed between the bubbler inlet and the pneumatic system valve (V1), preferably as close to the bubbler as possible.

1) BUBBLER REMOVAL: Follow steps below for removing the bubbler.

NOTE: The sequence of events is important (refer to cross purge bubbler plumbing schematic).

- a) Close the 1/4" (6mm) manual bubbler inlet valve by slowly turning the valve handle clockwise until it stops. **Support the valve body to prevent it from rotating on the stem.**
- b) Close the 3/8" (10mm) manual bubbler outlet valve by slowly turning the valve handle clockwise until it stops. **Support the valve body to prevent it from rotating on the stem.**
- c) **Open valves V1, V2, and V3a.** Close V3b. Change the carrier gas flow to 100% of full scale. Allow carrier gas to flow for 20 minutes minimum.

Figure 3

Recommended POC13 Cross Purge Bubbler Plumbing Schematic

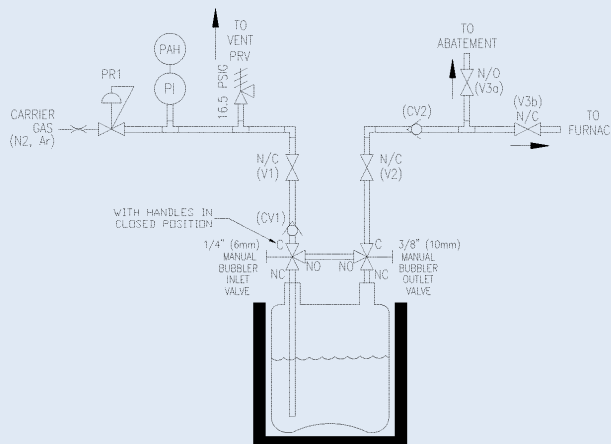
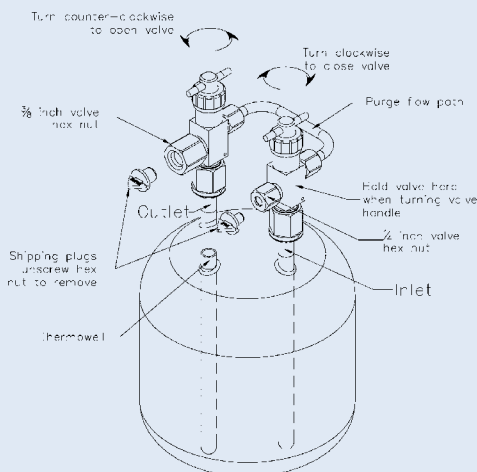


Figure 4

Cross Purge Bubbler



d) Stop carrier gas flow and close all valves (except container valves).

e) Disconnect the gas lines from each valve. Support the valve body carefully while removing the gas lines to prevent the possibility of breaking the quartz stem.

NOTE: Do not disconnect bypass line.

f) Re-insert the plastic shipping plugs/caps into each valve fitting and hand-tighten the nuts/caps.

g) The bubbler is now ready to be removed and packaged for return shipment.

2) BUBBLER INSTALLATION: Follow steps below for installing the bubbler.

NOTE: The sequence of events is important (refer to cross purge bubbler plumbing schematic).

a) Place the bubbler in the temperature controller.

b) Cut shrink-wrap around valves if present. **Do not move valve handle.** Remove the plastic shipping plugs/caps from the valve fittings by unscrewing the hex nut. This will back out the plug until it is free from the fitting. **DO NOT PULL ON THE SHIPPING PLUGS.** This could break the bubbler stem. Save the shipping plugs for return shipment to Air Products.

- c) Connect the incoming gas line (inert carrier gas) to the 1/4" (6mm) Teflon valve. Ensure the Teflon tubing is round and not indented by previous use. Replace when necessary. Carefully insert the gas line into the valve and tighten the ferrule nut, 1/8 of a turn past finger-tight. **Support the valve to prevent the possibility of breaking the quartz stem.**
- d) Connect the outlet gas line (the gas line from the bubbler to the furnace) to the 3/8" (10mm) Teflon valve. Ensure the Teflon tubing is round and not indented by previous use. Replace when necessary. Carefully insert the gas line into the valve and tighten the nut, 1/8 of a turn past finger-tight. **Support the valve to prevent the possibility of breaking the quartz stem.**
- 3) BREAKING THE BUBBLER BREAKSEAL: OUTLET**
Breakseal bubbler: POCl_3
- a) Break the outlet diaphragm by slowly turning the 3/8" (10mm) Teflon valve handle clockwise while holding the valve body to prevent it from rotating on the stem. Breaking the diaphragm can be heard as well as felt, and is usually accomplished at the third full turn of the valve handle. Leave the valve in the closed position.
- 4) BREAKING THE BUBBLER BREAKSEAL: INLET**
Breakseal bubbler: POCl_3
- a) Break the inlet diaphragm by slowly turning the 1/4" (6mm) Teflon valve handle clockwise while supporting the valve body to prevent it from rotating on the stem. Breaking the diaphragm can be heard as well as felt, and is usually accomplished at the third full turn of the valve handle. Leave the valve in the closed position.
- 5) PURGING PRIOR TO STARTUP:** Start carrier N_2 flow at 100% of full scale. Open valves **V1**, **V2**, and **V3a**. Close valve **V3b** (refer to cross purge bubbler plumbing schematic). Allow gas to flow for 10 minutes or more, then stop carrier gas flow and close all valves.
- 6) BUBBLER LEAK CHECK:** Follow steps below for leak checking the bubbler.
- a) Start carrier N_2 flow at 100% of full scale. **Open valve V1. Close valve V2, V3a and V3b.** After several minutes, no more than 5 minutes, MFC flow rate should read zero (0) if connections are leak-tight.
- b) When completed, Stop carrier gas flow and close all valves. Proceed with opening the bubbler.
- 7) OPENING THE OUTLET VALVE:** Open the 3/8" (10mm) outlet valve by slowly turning the valve handle counterclockwise. **Support the valve body to prevent it from rotating on the stem.** Open the 3/8" (10mm) Teflon valve by continuing to turn the valve handle until it stops.
- 8) OPENING THE INLET VALVE:** Open the 1/4" (6mm) inlet valve by slowly turning the valve handle counterclockwise. **Support the valve body to prevent it from rotating on the stem.** Open the 1/4" (6mm) Teflon valve by continuing to turn the valve handle until it stops.
- 9) EQUALIZING THE PRESSURE:** Close **V1** and **V3b** then open **V3a** and **V2** in sequence. Wait 30 seconds then close all valves (except container valves).
- 10) OPTIONAL TEST RUN:** It is best to ensure the bubbler is fully operational by performing a test flow through the bubbler to vent.
- To run the test flow start carrier gas flow at 10% of full scale, close **V3b**, then open **V1**, **V2**, and **V3a** in sequence. Allow 30 seconds for the flow to stabilize then close **V1**, **V2**, and **V3b** and stop carrier flow. Leave **V3a** open.
- 11) TO PLACE BUBBLER IN STANDBY MODE:**
Close **V1**, **V2**, and **V3b** and stop carrier flow. Leave **V3a** open.

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- Call: +1-610-481-7711 (other locations)
- 24 hours a day, 7 days a week
- For assistance involving Air Products and Chemicals, Inc. products

Product Safety Information

- For MSDS, Safetygrams, and Product Safety Information
www.airproducts.com/productsafety

Technical Information Center

- Call: 1-800-752-1597 (U.S.)
- Call: 1-610-481-8565 (other locations)
- Fax: 1-610-481-8690
- E-mail: gasinfo@airproducts.com
- Monday–Friday, 8:00 a.m.–5:00 p.m. ET

Information Sources

- Compressed Gas Association (CGA)
www.cganet.com
- European Industrial Gases Association (EIGA)
www.eiga.org
- American Chemistry Council
www.americanchemistry.com

For More Information**Corporate Headquarters**

Air Products and Chemicals, Inc.
7201 Hamilton Boulevard
Allentown, PA 18195-1501

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