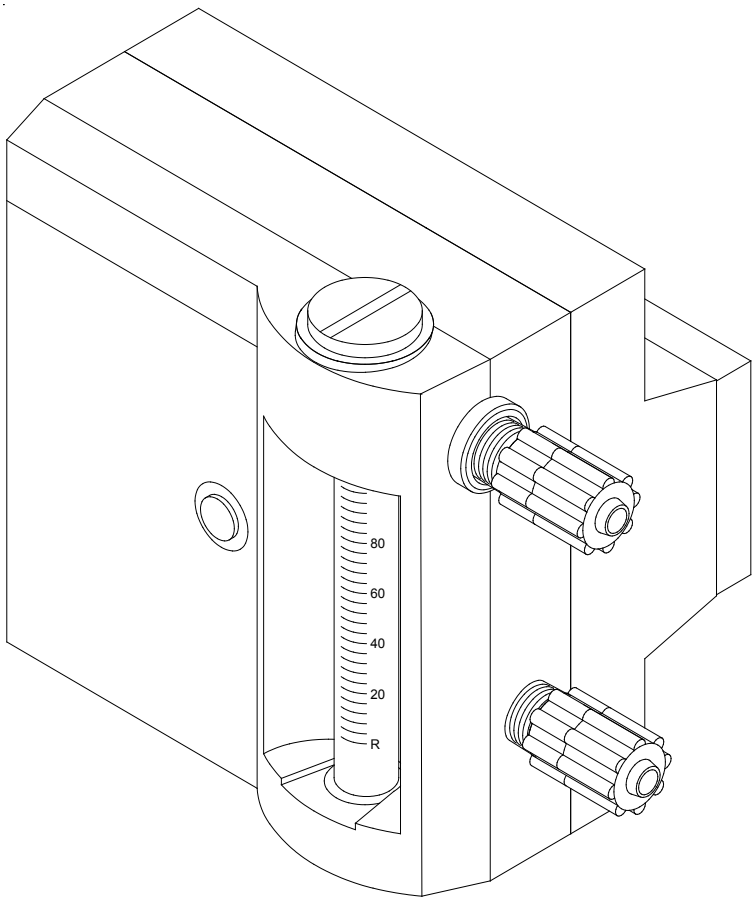
Instruction Manual — ADVANCE® Series 480 Vacuum Regulator

DE NORA



These instructions describe the installation, operation and maintenance of the subject equipment. Failure to strictly follow these instructions can lead to equipment rupture that may cause significant property damage, severe personal injury and even death. If you do not understand these instructions, please call De Nora Water Technologies for clarification before commencing any work at +1 215-997-4000 and ask for a Field Service Manager. De Nora Water Technologies, Inc. reserves the rights to make engineering refinements that may not be described herein. It is the responsibility of the installer to contact De Nora Water Technologies, Inc. for information that cannot be answered specifically by these instructions.

Any customer request to alter or reduce the design safeguards incorporated into De Nora Water Technologies equipment is conditioned on the customer absolving De Nora Water Technologies from any consequences of such a decision.

De Nora Water Technologies has developed the recommended installation, operating and maintenance procedures with careful attention to safety. In addition to instruction/operating manuals, all instructions given on labels or attached tags should be followed. Regardless of these efforts, it is not possible to eliminate all hazards from the equipment or foresee every possible hazard that may occur. It is the responsibility of the installer to ensure that the recommended installation instructions are followed. It is the responsibility of the user to ensure that the recommended operating and maintenance instructions are followed. De Nora Water Technologies, Inc. cannot be responsible deviations from the recommended instructions that may result in a hazardous or unsafe condition.

De Nora Water Technologies, Inc. cannot be responsible for the overall system design of which our equipment may be an integral part of or any unauthorized modifications to the equipment made by any party other that De Nora Water Technologies, Inc.

De Nora Water Technologies, Inc. takes all reasonable precautions in packaging the equipment to prevent shipping damage. Carefully inspect each item and report damages immediately to the shipping agent involved for equipment shipped “F.O.B. Colmar” or to De Nora Water Technologies for equipment shipped “F.O.B Jobsite”. Do not install damaged equipment.

DE NORA WATER TECHNOLOGIES, COLMAR OPERATIONS
COLMAR, PENNSYLVANIA, USA
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1 INTRODUCTION

1.1 General

The ADVANCE® vacuum regulators are expertly engineered and carefully tested to assure years of satisfactory operation. They are constructed of the finest materials available for gas service. Correct installation and proper care will ensure best operation. Read these instructions carefully and save for future reference.

This instruction manual covers the Model 480 vacuum regulator. Refer to the following bulletins for other components:

Changing Gas Cylinders - 100.9001

Vacuum Line Size Requirements - 121.3003

Manifolds - 120.6001

Remote Meter Panels - 100.6002

Diaphragm Ejectors -122.6001

Switchover Module - 100.6030

1.2 Warranty and Service

See Bulletin 005.9001 for ADVANCE® equipment warranty.

NOTE: The Model 480 Chlorinator is designed for use in systems where the feed rate is manually set and operation is continuous or stop/start. The ADVANCE® equipment warranty and service policy is null and void, as it pertains to user protection, if the Model 480 Chlorinator is misapplied.

Gas dispensing system must be inspected and serviced a minimum of once per year. Maintenance kits (see parts list) should be replaced once per year.

More frequent service periods may be required due to: 1) the type, quality and quantity of the gas being handled, 2) the complexity of the gas supply system and 3) operation procedures.

More frequent service periods are especially indicated when venting of the VR is occurring during the one year operational period. This is usually indicative of foreign debris holding the inlet valve open or destruction of the inlet valve parts caused by the gas quality not up to industry purity standards.

1.3 Standard Equipment

1.3.1 The Model 480 gas feeder system consists of the following major components and accessories:

a. Vacuum regulator, which connects to the gas cylinder valve or to a similar valve on a gas manifold.

b. Ejector-check valve assembly with nozzle and diffuser which is covered separately in Instruction Manual 122.6001.

c. If remote metering or multiple feed points are provided, separate meter panels are included which is covered separately in Instruction Manual 100.6002.

d. If a standby gas source is provided, an automatic switchover module is included and covered separately in Instruction Manual 100.6030.

e. Accessories:

1. An adequate length of 3/8" or 1/2" tubing vacuum line and 3/8" vent tubing line.

2. Lead gaskets for connecting yoke to gas cylinder valve.

3. Insect screen

4. Spare parts.

1.3.2 Additional items needed for proper installation:

a. An adequate length of polyethylene or rubber hose for connecting the ejector water supply to the nozzle.

b. A water supply hose adapter.

c. Hose clamps.

d. Water supply shutoff valve.

e. Y-Strainer for water line.

f. Pressure gauge.

NOTE: This instruction manual covers the vacuum regulator only. However, the vacuum regulator requires an ejector to operate, Therefore, ejectors are referenced throughout. The installation of this complete system is covered.

1.4 Specifications

1.4.1 Flowmeter Capacities: 4, 10, 25, 50, 100 PPD, 250 PPD (75, 200 g/h, 0.5, 1, 2, 5 kg/h).

1.4.2 Flowmeter length 3: (76 mm)

1.4.3 Accuracy: ±4% of maximum flowmeter capacity

1.4.4 Tubing Connections: 3/8" or 1/2" vacuum and 3/8" vent.

2 OPERATION

2.1 General

The vacuum regulator design provides for conveying the gas under vacuum from the vacuum regulator to the ejector-check valve assembly to ensure complete system safety. The vacuum regulator design permits the entire system to be vacuum checked in the field without using special tools or manometers. The vacuum regulator is constructed of materials specially selected for wet or dry gas services. All springs used in the vacuum regulator are of a tantalum alloy for chlorine and sulfur dioxide, and stainless steel for ammonia. The rate valve and seat are constructed of fine silver for chlorine and sulfur dioxide, and stainless steel for ammonia. A main diaphragm is provided for vacuum regulation.

2.2 Installation

2.2.1 Gas Cylinder

When handling potentially dangerous gas, the following rules must always be followed:

a. Never move a cylinder unless the valve protection cap is screwed on tightly.

b. Locate the cylinders where they will not be bumped or damaged.

c. A safety chain should be placed around the cylinders and secured to a wall or support.

d. To achieve the desired feed rate, the temperature should be 68°F (20°C) or higher. Air circulation should be provided around the cylinders with a fan. Never apply direct heat to a cylinder. As the ambient temperature decreases, maximum feed rates will be reduced.

2.2.2 Ton Container

When handling potentially dangerous gas, the following rules must always be followed:

a. Never move the ton container unless the valve protection hood is in place.

b. Locate the container(s) where they will not be bumped or damaged.

c. A pair of trunnions should be placed under the container for support and ease of positioning of the outlet valves.

d. Mounting the vacuum regulator directly on the ton container, in most cases, eliminates the need for a heated room.

2.2.3 Mounting the Vacuum Regulator on a Cylinder - (Refer to Instruction Card 100.9010 and Figure 1)

a. Unscrew the valve protection cap from the gas cylinder. Ensure the gas cylinder valve is closed.

b. Unscrew the cap nut that covers the gas cylinder valve outlet. Check for leaks around the cylinder valve.

c. Remove all shipping tape from the vacuum regulator. (DO NOT remove the filter floss or inlet filter screen inserted in the vacuum regulator inlet.)

d. Remove any dirt in the cylinder valve outlet or on the cylinder outlet gasket surface.

e. Unscrew the vacuum regulator yoke screw until the slide bar can be pushed all the way back.

f. Place a 1/16" thick lead gasket over the gas inlet of the vacuum regulator. Never re-use the lead gasket. Replace the lead gasket each time the gas cylinder is changed.

g. Place the vacuum regulator yoke over the cylinder, engage the vacuum regulator inlet properly with the valve outlet, and tighten the yoke screw. Excessive tightening should be avoided.

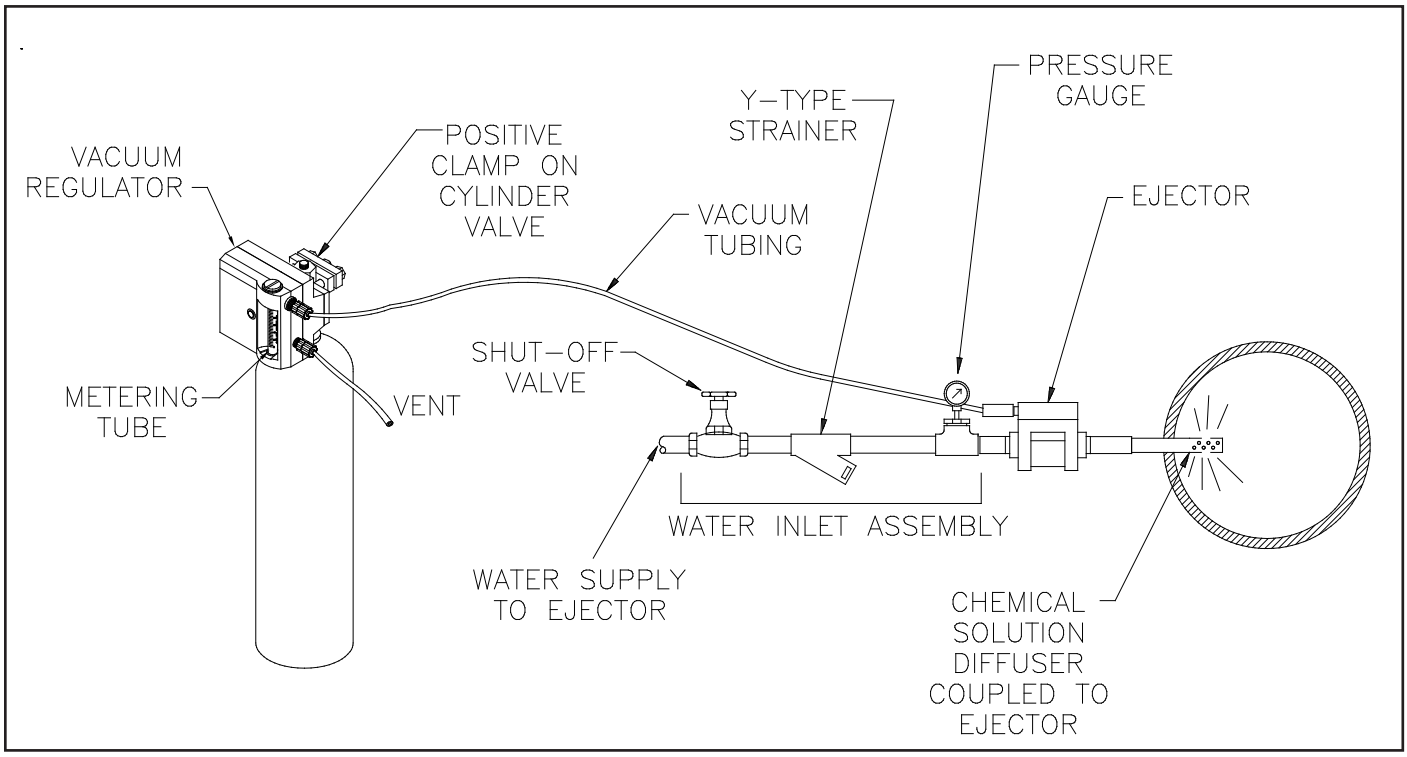

Figure 1 - Typical Cylinder Mounted Installation

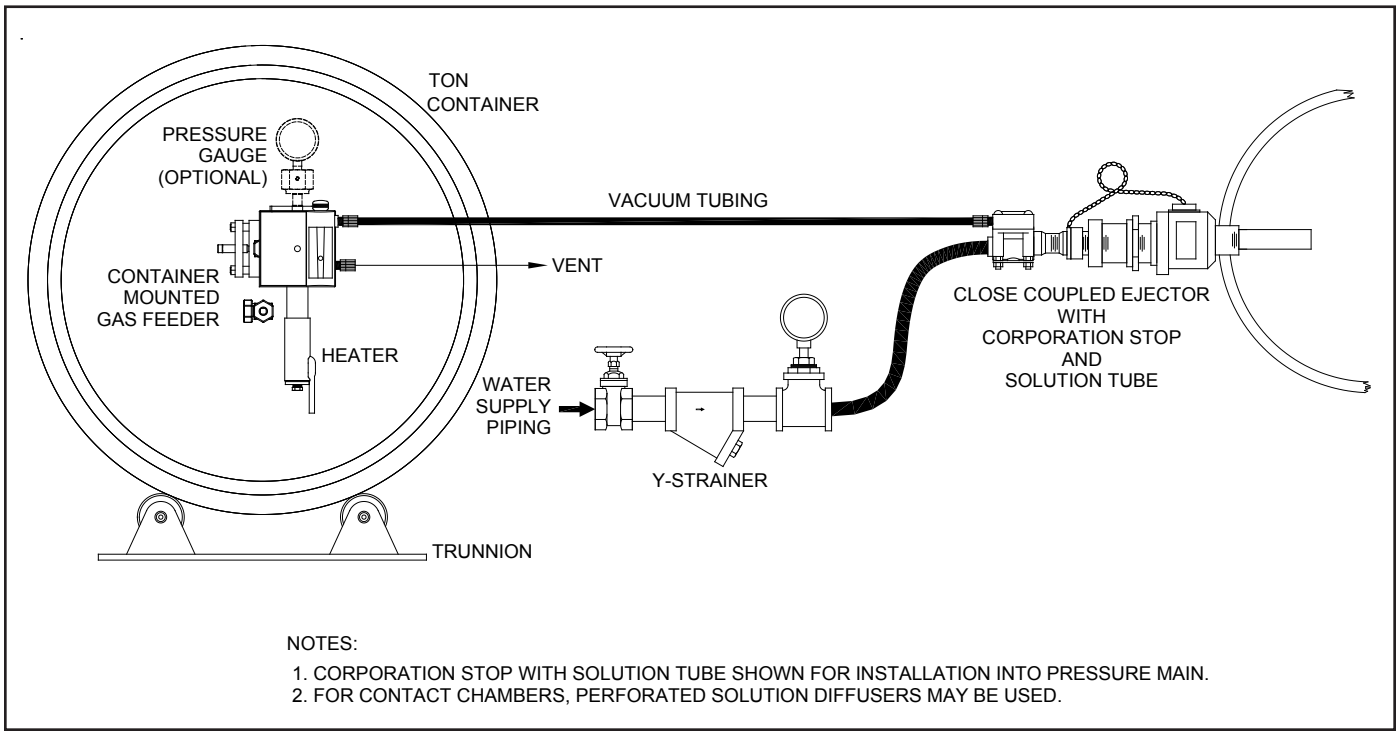

Figure 2 - Typical Ton Container Mounted Installation

2.2.4 Mounting the Vacuum Regulator on a Ton Container - (Refer to Instruction Card 100.9005 and Figures 2, 4, 5, 6 and 7.)

On ton containers, there are two valves; a gas outlet valve and a liquid outlet valve. The valve's function is dependent upon the position of the ton container. After rotating the ton container, aligning one valve directly over the other valve, the top valve will be the gas outlet and the bottom valve the liquid outlet valve. If the container is then rotated 180°, the valve now on top will be the gas outlet valve. (Refer to Figure 5.)

Figure 5 shows the top gas valve facing right. Effective January 1993, the Chlorine Institute standardized on this valve direction and eliminated left facing valves. However, it is not known when and if all chlorine suppliers have made this change. The drip leg may be mounted either in the right or left hand attitude. (Refer to Figures 6 and 7.)

The drip leg/heater assembly is shipped separate from the vacuum regulator and must be assembled in the field. (Refer to Figures 6 and 7.) Prior to mounting the drip leg to the ton container, assemble the vacuum regulator to the drip leg using the two bolts, flat and lock washers and lead gasket provided. Tighten the bolts evenly to compress the lead gasket taking care that the spacing between the vacuum regulator back plate is parallel to the drip leg. After attaching the completed assembly to the ton container check for leaks as instructed in Section 3, Start-Up and 100.9005.

To mount the vacuum regulator on the ton container valve, proceed as follows:

a. With the ton container in place, remove the protection hood.

b. Rotate the ton container until the valves are in their vertical position (gas outlet valve over the liquid outlet valve).

c. Facing the end of the ton container, observe the direction of the top valve outlet. Should it face to the right, a right inlet will be required on the vacuum regulator, Verify the correct inlet on your vacuum regulator.

d. Before removing the cap nut, which covers the ton container valve outlet, check to be sure the gas valve is closed. Remove the cap nut.

e. Remove all shipping tape from the vacuum regulator. (Do NOT remove the filter floss or inlet filter screen inserted into the vacuum regulator inlet).

f. Remove any dirt that may be in the container valve or on the outlet gasket surface.

g. Unscrew the vacuum regulator yoke screw until the slide bar can be pushed all the way to the back.

h. Place a 1/16" thick lead gasket over the gas inlet of the vacuum regulator. NEVER re-use lead gasket. Replace the lead gasket each time the gas cylinder is changed.

I. Mount the vacuum regulator on the container valve by placing the yoke over the valve, engage the gas inlet with the valve outlet, and tighten the yoke screw. Excessive tightening should be avoided.

j. Power the 25 watt heater to warm the liquid trap.

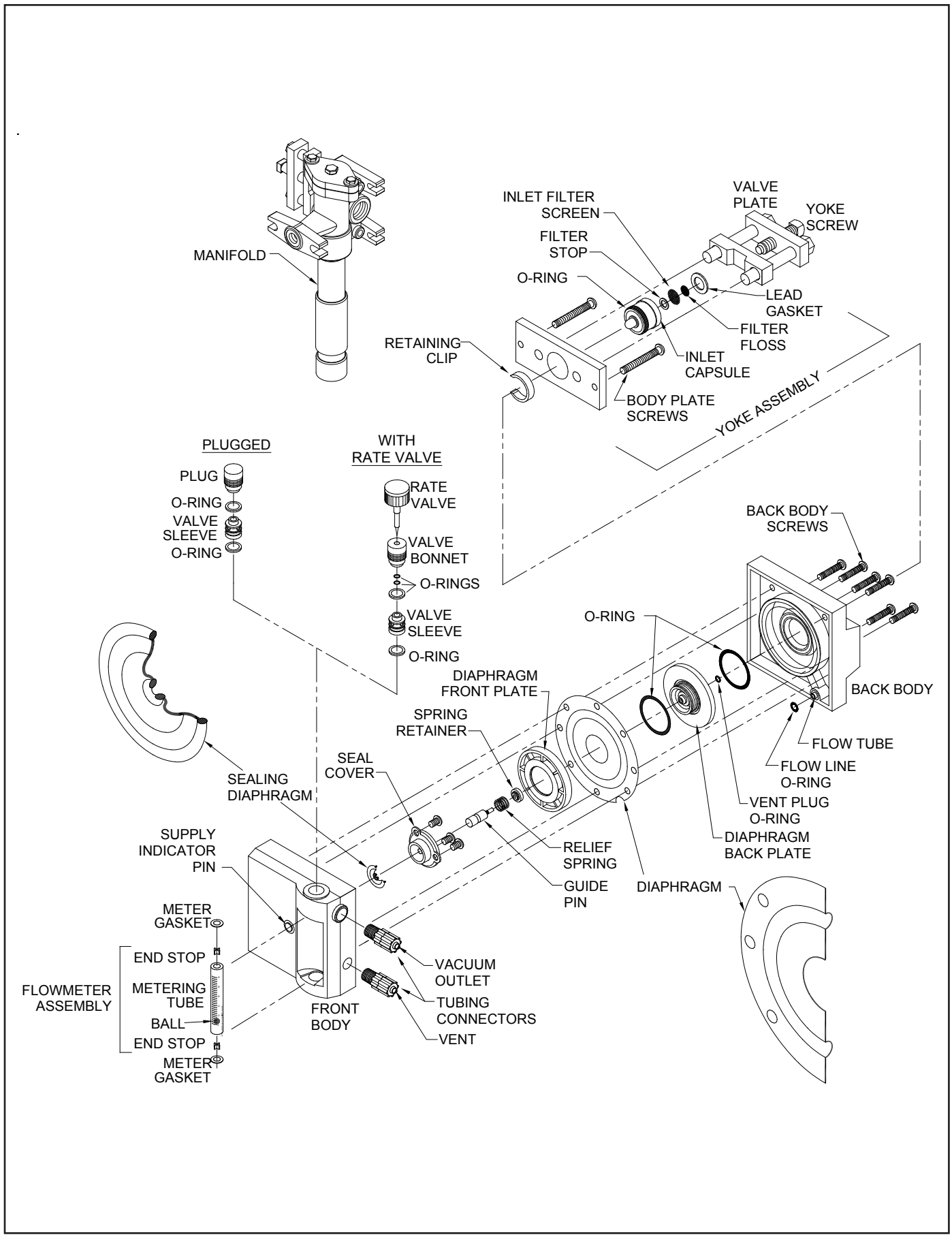

Figure 3 - Vacuum Regulator Exploded View

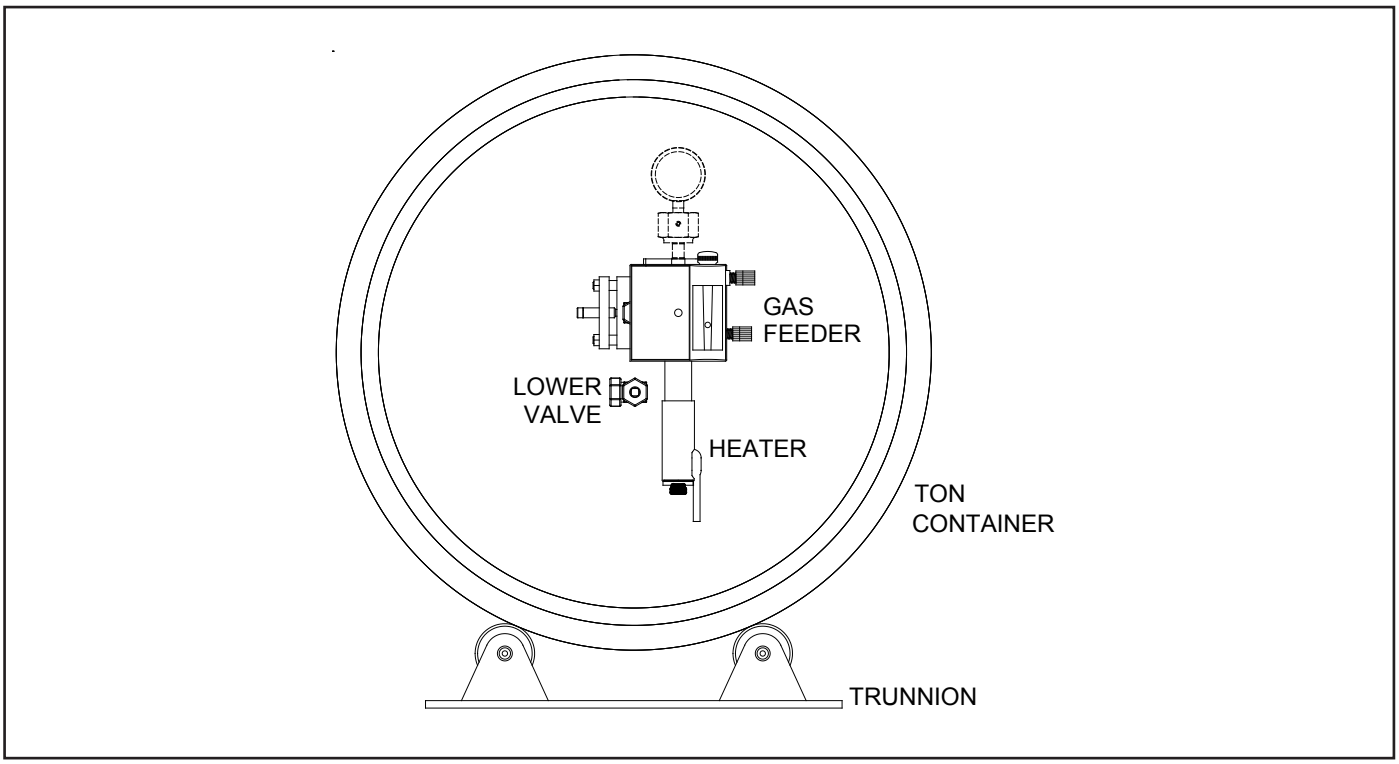

Figure 4 - Ton Container Valve Positioning

2.2.5 Mounting on a Manifold Assembly

The manifold assembly (supplied or existing) provides a gas valve identical to the cylinder valve (less fusible plug) for mounting on the vacuum regulator. During periods of manifold maintenance, the vacuum regulator may be direct cylinder mounted or ton container mounted. Direct mounting eliminates the potential of gas leaks and is always the preferred mounting. Also refer to the manifold assembly Instruction Manual 120.6001 (B3.8021). For mounting vacuum regulators on a manifold valve, follow instructions given previously in Operation, Section 2.2.3, items b-g.

2.2.6 Connecting the Vacuum Regulator to the Ejector and Vent - (Refer to Figures 1 and 2)

Black polyethylene tubing is normally used for the vacuum line between the vacuum regulator and ejector, and for the emergency vent. Use enough length for each line to allow vacuum regulator movement from one gas source to another.

Remove the connector nut from the connector and slip it onto the tubing. Push the tubing onto the connector and tighten the connector nut HAND TIGHT.

The upper connection on the vacuum regulator is for vacuum tubing to ejector. The lower connection is for a vent line to a safe location outside the building.

General Design Note: Routing vacuum tubing through unventilated conduit is discouraged. A minute portion of gas flowing through tubing under vacuum conditions, will slowly diffuse at a molecular level through its walls and collect in the closed conduit over an extended period of time.

2.2.7 Vent Line(s)

Whatever the vacuum regulator size, location, or mounting, it is equipped with a vent connection. DO NOT MANIFOLD VENT LINES from several vent equipped devices; run separate and independent vents to a safe area where a discharge of gas being dispensed can be tolerated. The vent line must slope downward from the vacuum regulator to provide a positive drain, preventing accumulation of any moisture in the vent line. The vent line must be vented to an atmospheric source in order for the vacuum regulator to operate. The end of the vent line(s) must be turned downward to prevent entrance of water. The insect screen(s) must be installed over the outlet(s) to prevent blockage.

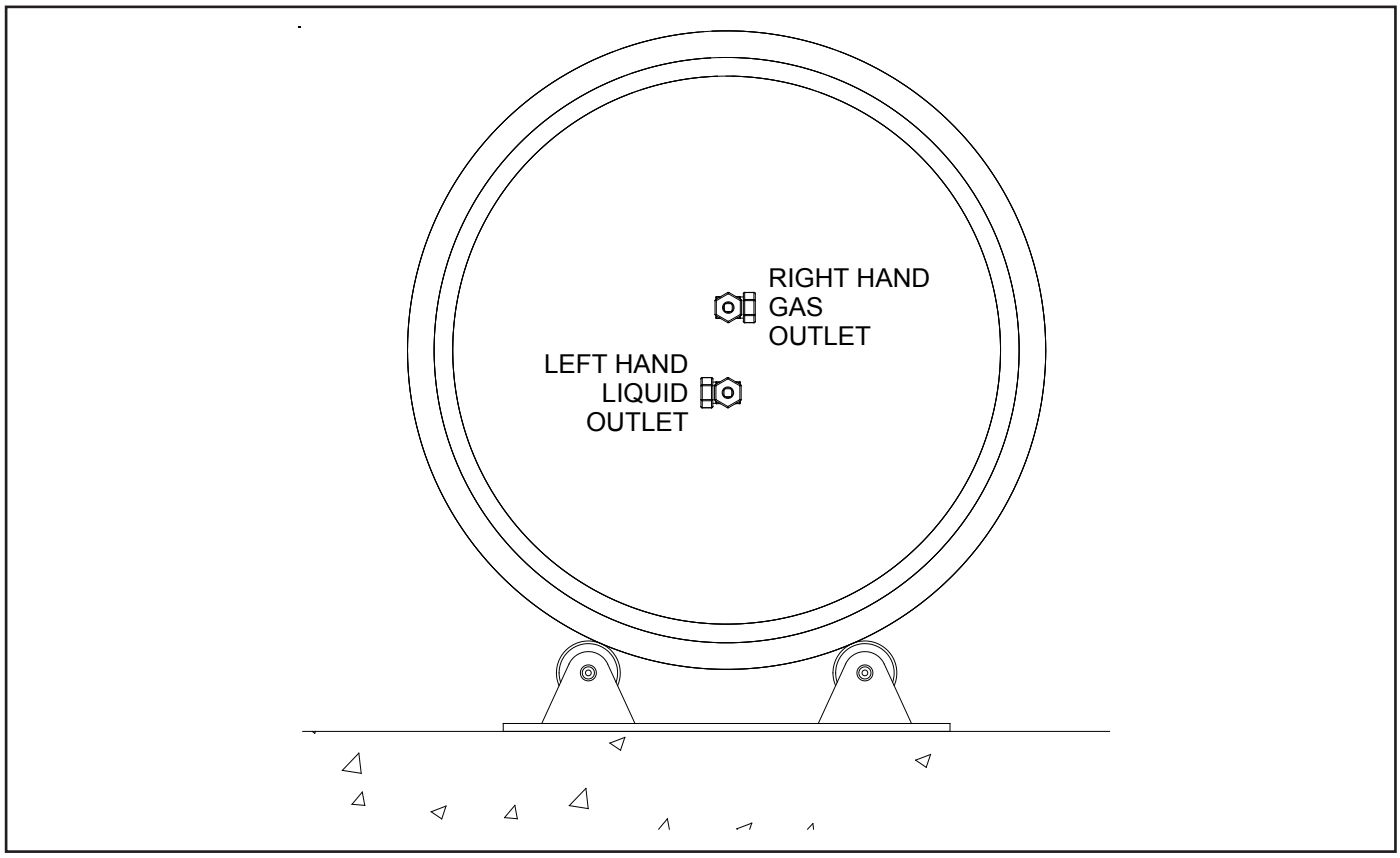

Figure 5 - Ton Container Gas and Liquid Valve Positions

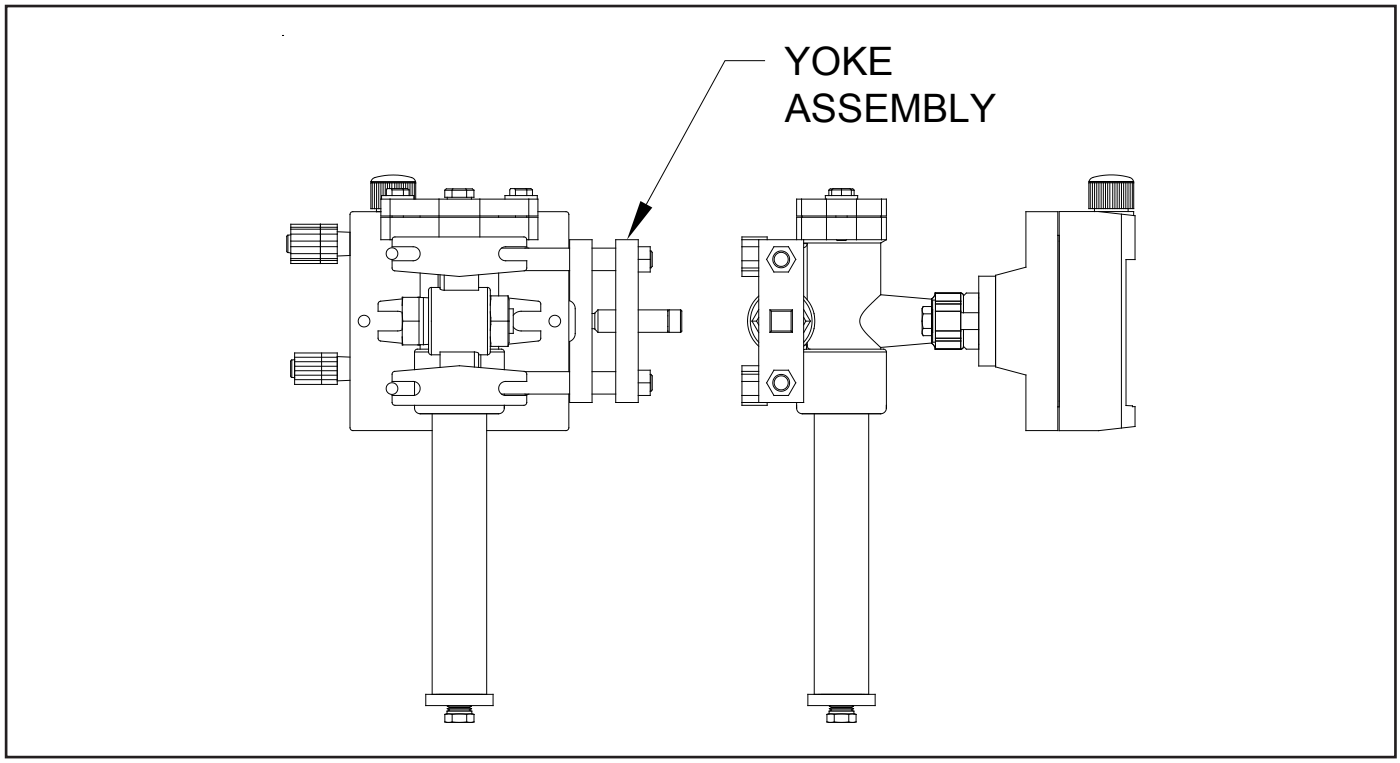

Figure 6 - Universal Yoke Assembly

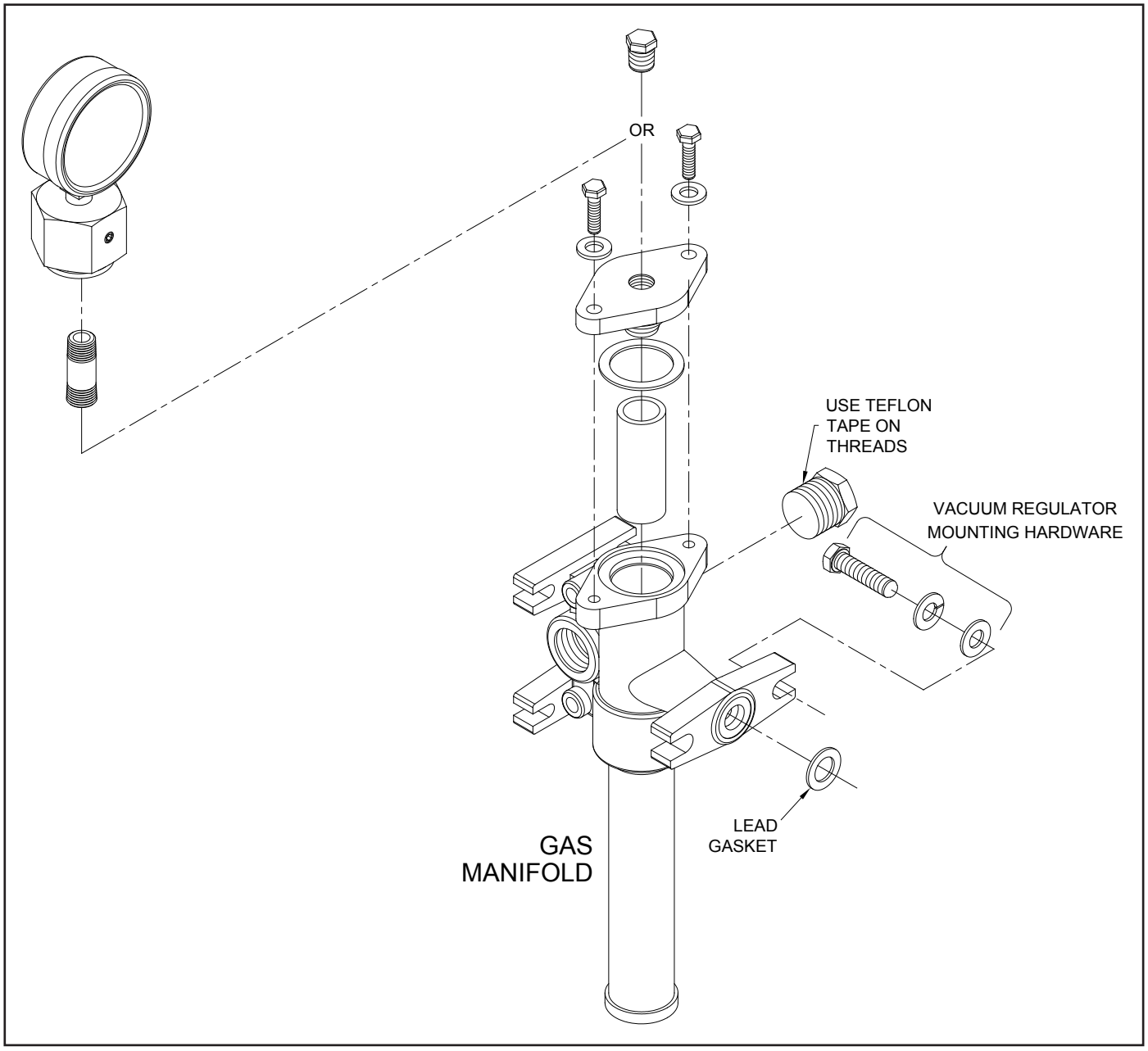

Figure 7 - Gas Manifold

2.2.8 Special Offset Valves

There are some chlorine cylinders and chlorine cylinder valves that do not permit the standard Model 480 yoke assembly to be mounted on the cylinder.

Generally speaking, this occurs when the shoulder of the cylinder interferes with the vacuum regulator body.

To accommodate these conditions, an offset yoke is necessary. This yoke raises the body and provides the clearance required.

3 START-UP

3.1 Ejector - Figure 1

The ejector, its water supply and solution lines, must be properly installed and operating before checking the vacuum regulator. The ejector must create a vacuum for the vacuum regulator to operate. Proceed as follows:

3.1.1 Disconnect the vacuum tubing from the ejector.

3.1.2 Open the ejector water supply valve. The ejector should now be in operation and create a vacuum.

3.1.3 Put your finger on the vacuum connector opening and feel the vacuum. There should be no doubt that a vacuum exists. If there is no vacuum, refer to Section 2.2.4, and be certain the water supply pressure is sufficient and either the inlet nozzle/outlet diffuser/connection or piping is not plugged. Correct the condition and obtain proper vacuum before proceeding.

3.1.4 Reconnect the vacuum tubing to check the vacuum regulator. Keep the water supply to the ejector open.

3.2 Check Vacuum Regulator For Leaks

Have a squeeze bottle 1/4 full of household ammonia or stronger ammonia solution to check for the presence of chlorine gas.

3.2.1 With the ejector water supply on, and the gas cylinder valve closed, the ball in the metering tube will drop to the bottom and remain there. If the ball does not drop or bounces, there is a leak in the system. Check all fittings and connections, (O-rings on the rate valve, gaskets on the metering tube, lead gasket connection, etc.) and correct.

3.2.2 When the ball in the metering tube drops, the supply indicator pin on the face of the vacuum regulator should be recessed and remain recessed.

3.2.3 Close the ejector water supply valve to stop operation of the ejector.

3.2.4 Disconnect the vacuum tubing at the vacuum regulator to allow air to enter the system. The supply indicator pin should now be exposed and visible on the face of the vacuum regulator.

3.2.5 Reconnect the vacuum tubing.

3.2.6 Open the gas cylinder valve 1/4 turn and close immediately.

3.2.7 Test the yoke assembly and lead gasketed connection for leaks, by holding the squeeze bottle filled with ammonia solution below the lead gasket and squeeze (fumes only). If gas is leaking, white smoke will appear. Tighten or replace the lead gasket to eliminate the leak.

3.2.8 Open the gas cylinder valve 1/4 turn, and leave open. Recheck for leaks.

3.2.9 Turn on the water supply valve to the ejector and adjust the rate valve to the desired gas flow rate. The flow rate in PPD (pounds per 24/hours), g/h (grams per hour) or kg/h (kilograms per hour) is read on the meter scale at the center of the ball.

NOTE: NEVER use the rate valve to shut off the gas supply. This valve is used to adjust flow rate while the system is in operation. If used for shutoff, this valve can be damaged. To shut off the gas, close the cylinder valve.

3.3 Ton Container Considerations

3.3.1 Liquid Trap Heater (Never supplied for ammonia)

The function of the liquid trap is to collect the initial surge of liquid chemical from the gas valve when it is first opened. (See Section 3.3.2).

The function of the trap heater is to provide heat to vaporize the collected liquid.

The trap may collect liquid after the initial surge is vaporized, therefore, it is essential that the heater remain powered continuously.

3.3.2 Excessive Liquid Chemical in the Drip Leg

The volume of the drip leg on a vacuum regulator is 5 ½ cubic inches. This is more than adequate to accept the volume of liquid which may be educted from the gas discharge valve from the ton container when it is first opened. The volume of a 1/2" diameter eduction pipe in a U.S. standard ton container is approximately 3.7 cubic inches.

If the upper eduction pipe in a full ton container is faulty, or if it becomes necessary to remove the vacuum regulator from the ton container shortly after the ton container has been first opened, the drip leg of the ton container mounted vacuum regulator may be flooded with liquid chemical.

If this occurs, proceed as follows:

a. Isolate the faulty eduction pipe from the drip leg by closing the upper valve.

b. Be sure the drip leg heater and ejector are operating and the rate valve is open.

   NOTE: The drip leg will function as a low-power vaporizer, and is capable of producing chlorine gas at an average rate of about 10 PPD (200 g/h) and sulfur dioxide gas at an average rate of about 8 PPD (160 g/h).

c. Allow about 90 minutes for complete vaporization. During this period, the vacuum regulator will feed intermittently because gas is drawn through the rate valve faster than it becomes available by vaporization. This cycle will cease when the drip leg is empty.

d. When the drip leg is empty, remove the vacuum regulator and rotate the ton container 180°. The valve to which the vacuum regulator was connected is now on the bottom of the container.

e. Re-connect the vacuum regulator and drip leg assembly to the upper valve on the ton container.

4 SHUTDOWN

4.1 Periodic Shutdown

4.1.1 Continue ejector operation.

4.1.2 Close the gas valve on the container NOT THE RATE VALVE ON THE VACUUM REGULATOR.

41.3 When the supply indicator pin is depressed below the vacuum regulator surface, all gas in the vacuum's system is depleted.

4.1.4 Close the ejector water supply valve.

4.2 Long Term Shutdown

4.2.1 Continue ejector operation.

4.2.2 Close the gas valve on the container NOT THE RATE VALVE ON THE VACUUM REGULATOR. OR REMOTE METER PANEL IF PROVIDED)

3.2.3 Allow float in flowmeter to drop to zero. Indicator pin on front of vacuum regulator should be depressed below the surface to indicate no gas.

3.2.4 Wait approximately one minute. Float should remain at zero. If float flutters or does not drop to zero, valve may not be closed tightly. Make certain valve is closed before proceeding.

4.2.5 When all of these steps have been completed, it is safe to remove the vacuum regulator from the gas container valve. Continue ejector operation.

4.2.6 Momentarily disconnect, then re-connect the tubing at the vacuum regulator outlet. The vacuum sealing o-ring will open, drawing air through the gas inlet.

4.2.7 Allow the vacuum regulator to operate on air for a few minutes to purge the remaining gas from the system.

4.2.8 Turn off the ejector water supply and drain the ejector. Disconnect the tubing and hoses. Disconnect the vacuum regulator and ejector. Store the vacuum regulator and ejector in a clean and dry environment.

4.3 Changing Cylinders (Refer to Instruction Card 100.9010)

After shutdown of system, as previously detailed, follow this procedure to change a cylinder:

4.3.1 Loosen the vacuum regulator yoke screw. Remove the vacuum regulator from the gas container valve.

4.3.2 Replace cylinder.

4.3.3 Remove the old lead gasket and discard. Remove filter floss and replace, being careful not to lose the screen under the filter. (Do not over stuff inlet. Replace only amount removed). Inspect and clean the mating surfaces of the vacuum regulator and the gas valves.

4.3.4 Place a new 1/16" thick lead gasket over the gas inlet of the vacuum regulator. Never use other types of gaskets or gasket materials. Never re-use the lead gasket.

4.3.5 Mount the vacuum regulator on the cylinder valve by placing the yoke over the valve, engage the vacuum regulator inlet properly with the valve outlet, and tighten the yoke screw. Do not tighten excessively. Make certain the ejector water supply is turned off.

4.3.6 Slightly open the cylinder gas valve and immediately close. Check for leaks with ammonia vapor. If leaks exist, turn on the ejector and repeat steps 4.2.1-4.2.4 of the Long-Term Shut Down, Section 3.2. Correct leaks.

4.3.7 Turn on the ejector water supply.

4.3.8 Open gas container valve slowly, approximately 1/4 turn and leave wrench on the valve. Reset the gas supply indicator on the vacuum regulator.

4.4 Changing Ton Containers

After shut-down of system, as previously detailed, follow this procedure to change ton container: (Refer to 100.9010)

4.4.1 Loosen the vacuum regulator yoke screw. Remove the vacuum regulator from the gas valve.

4.4.2 Replace the ton container. Make sure the full container is oriented with the valves in the vertical position (one valve above the other).

4.4.3 Remove and discard the old lead gasket and discard. Remove filter floss and replace, being careful not to lose the screen under the filter. (Do not over stuff inlet. Replace only amount removed). Inspect and clean the mating surfaces of the vacuum regulator and the gas valves.

4.4.4 Place a new 1/16" thick lead gasket over the gas inlet of the vacuum regulator. Never use other types of gaskets or gasket materials. Never re-use the lead gasket.

4.4.5 Position the vacuum regulator on the upper valve on the new ton container and tighten the yoke screw. Do not tighten excessively. Make certain the ejector water supply is turned off.

4.4.6 Be sure the heater is powered and operating. An operating heater provides the heat of vaporization to any trapped liquid.

4.4.7 Slightly open the ton container gas valve and immediately close. Check for leaks with ammonia vapor. If leaks exist, turn on the ejector and repeat steps 4.2.1-4.2.4 of the Long-Term Shutdown, Section 4.2. Correct leaks.

4.4.8 Turn on the ejector water supply.

4.4.9 Open gas container valve slowly, approximately 1/4 turn and leave wrench on the valve. Reset the gas supply indicator on the vacuum regulator.

5 SERVICE

NOTE: Preventative maintenance kits for each of the assemblies are available from the factory. Each kit contains all the parts and detailed instructions that are required for complete maintenance. All o-rings and gaskets that have been disturbed during the disassembly must be replaced during reassembly in order to insure safe, trouble free operation. Failure to replace these parts could result in a shortened operation period and bodily injury.

Gas dispensing system must be inspected and serviced a minimum of once per year. Maintenance kits (see parts list) should be replaced once per year.

5.1 Replacing Inlet Capsule (Refer to Figure 3)

5.1.1 Remove the two (2) screws holding the metal body plate to the vacuum regulator body.

5.1.2 Pull the entire yoke assembly from the vacuum regulator body. A clockwise rotation will aid when the o-ring seal is tight.

NOTE: If the yoke assembly is the offset type, it contains an extra lead gasket connection (one at the vacuum regulator and one at the inlet valve). Refer to Figure 8.

5.1.3 Remove the plastic retaining clip and slide the capsule out of the yoke assembly.

5.1.4. Clean valve seat or replace capsule as required.

5.1.5 Reassemble as follows:

a. Insert a new capsule in the metal body plate.

b. Connect the retaining clip.

c. Insert the yoke assembly in the vacuum regulator body using a clockwise rotation. A thin film of Fluorolube™ grease on the inlet capsule o-ring is recommended.

d. Install the two (2) screws holding the metal plate to the vacuum regulator body.

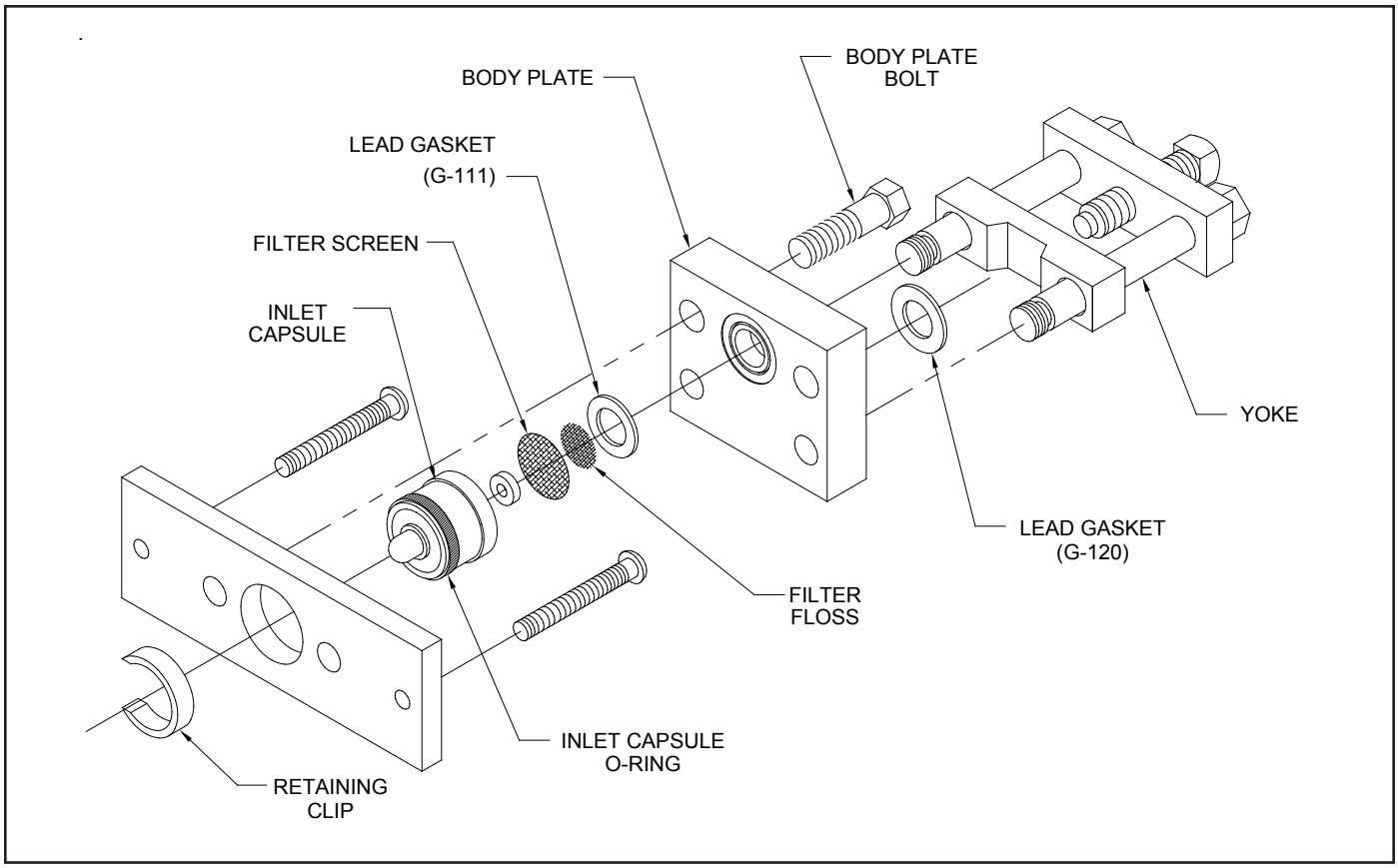

Figure 8 - Offset Yoke Assembly

5.2 Cleaning the Flowmeter Assembly

5.2.1 Remove the rate valve from the valve bonnet by turning counterclockwise and pulling upward.

5.2.2 Hold the metering tube and unscrew the rate valve bonnet 3 to 4 turns. Push up on the metering tube and pull out at the bottom.

5.2.3 Bend a paper clip or wire and pull out the ball stops on each end of the glass tube. DO NOT LOSE THE METERING BALL.

5.2.4 Clean the inside of the glass tube with a pipe cleaner using a suitable solvent such as denatured alcohol and rinse thoroughly with warm water.

5.2.5 Clean the metering ball using a suitable solvent such as denatured alcohol and rinse thoroughly with warm water.

5.2.6 Thoroughly dry the glass metering tube. Reassemble the meter stops and ball.

5.2.7 Reinstall the meter assembly by tightening the valve bonnet making sure that it is on center with the top and bottom gasket.

5.3 Cleaning Rate Valve

NOTE: For plugged vacuum regulators with a remote meter panel, refer to instruction manual 100.6002.

5.3.1 Unscrew the rate valve plug from the valve bonnet.

5.3.2 Remove the valve bonnet from the top of the front body.

5.3.3 To aid in removing the valve sleeve, use a round head slotted screw (1/4-20 thread) available from the vacuum regulator back body and screw into the valve sleeve. Pull up on the screw to remove the valve sleeve. CAUTION: Hold the metering tube while pulling up on the screw. Be careful not to drop metering tube.

5.3.4 Clean the parts by immersing in alcohol or soapy water, and dry thoroughly with a clean cloth.

5.3.5 Examine the o-rings on the valve bonnet and the valve sleeve. Replace if scratched or bruised.

5.3.6 Inspect the rate valve opening in the valve sleeve, valve bonnet and front body and clean with a damp cloth if necessary. DO NOT use any sharp tools that may scratch the internal surface. Never use any solvent for cleaning the plastic, as it will deteriorate rapidly. Wood alcohol can, however, be used successfully.

5.3.7 Apply a thin film of fluorolube grease to o-rings and slide the valve sleeve into the front body. Remove the round slotted head screw and replace into the body. Position the metering tube in the center of the gaskets (G-100) and tighten the valve bonnet by hand until the metering tube cannot be turned.

5.4 Vacuum Regulator Disassembly

5.4.1 Remove the yoke assembly, the metering tube, and rate adjustment valve as described in Sections 5.1-5.3.

5.4.2 Remove the six (6) screws which hold the body assembly together. Separate the front and back bodies.

5.4.3 Examine the diaphragm. The diaphragm is made of tough, gas-resistant material and failure is unusual.

5.4.4 Clean parts using wood alcohol. DO NOT USE A STRONG SOLVENT on the plastic or it will soften.

5.4.5 Check the following:

a. Ensure the sealing surfaces of both bodies are free of nicks, dirt, and scratches.

b. Check the o-ring in the flow tube between the bodies. This usually requires replacement.

5.4.6. Reassemble the unit by reversing steps 5.4.1-5.4.2

a. Use the seal cover and guide pin assembly as a centering guide for the diaphragm assembly.

NOTE: The most critical part of the assembly is centering of the diaphragm assembly. A centering tool, part number X-102 for the inlet section is desirable. If one is desired, it can be ordered from the factory.

b. Reassemble using the six (6) screws to join the bodies.

c. Reassemble the other parts as described in Sections 5.1-5.3.

5.4.7 Ton Container Yoke Assembly - Universal Conversion - Refer to Figure 6

FILTER CARTRIDGE SHOULD BE REPLACED ANNUALLY.

The vacuum regulator is supplied with either a right or universal yoke assembly. Universal yoke assemblies can be used for either right or left mounted valves (See Figure 5). If the position of the Universal yoke requires changing, proceed as follows:

a. Shut down the gas feeder according to the procedures in the Shut-Down section.

b. Remove the vacuum regulator after ensuring that the container valve is closed tightly.

c. Remove the two (2) hex bolts (N-381) holding the yoke assembly to the inlet adapter and remove the yoke assembly. See Figure 6.

d. Remove the G-111 lead gasket from the inlet adapter.

e. Re-assemble the yoke assembly on the opposite side of the inlet adapter using a new lead gasket (G-111). Replace the two (2) hex bolts (N-381) in the yoke assembly and tighten evenly to compress the lead gasket.

f. Mount the vacuum regulator on the ton container following the mounting procedures in Operation, Section 2. Connect the drip leg pad heater to the power source.

g. Test for and correct any leaks following the procedures in the Start-Up section.

h. Resume operation.

5.5 Torque Values

The following torque values are used at the factory. These values are recommended guidelines for Reassembly of a repaired unit.

Back Body screws (qty - 6): 10 inch pounds

Body Plate screws (qty - 2): 10 inch pounds

5.6 Tubing Replacement

Replacement of all vacuum tubing when it shows signs of wear (cracking, etc) is recommended. In high humidity situations, external blistering may occur. This does not effect the performance of the tubing.

6 TROUBLESHOOTING CHART

Normally it is not necessary to completely disassemble the vacuum regulator unless the unit is to be cleaned throughout. DO NOT DISASSEMBLE THE UNIT UNLESS NECESSARY. All of the units have been factory tested.

CONDITION	PROBABLE CAUSE	CORRECTIVE ACTION
1.Gas Leak - There are few possible points of gas pressureleaks. These are not normal but ifa gas leak is detected, it must be corrected immediately. Even asmall leak can create a safety hazard and cause serious corrosion to other equipment..	a. Gas leak at cylinder valve or isolating valve packing. b. Leak at lead gasket from dirt on the gasket, under or over-tightened connection, or installation without a gasket. NOTE: Offset yoke assemblies contain two (2) lead gasket connections. Be sure to check both. c. Gas leaking out of the vent line may be from dirt on the vacuum regulator inlet valve seat	a. Tighten the cylinder valve packing nut without exerting excessive force. If this does not eliminate the leak, close the valveand call the gas supplier. b. Use a new lead gasket each time the seal has been broken. Ensure the gasket surfaces are clean and smooth. c. Verify the leak by closing the water supply valve to the ejector, then submerge the end of the vent tubing in a glass of water. Continuous bubbling is an indication of a leak. Close the gas cylinder valve, turn on the watersupply and allow the vacuum regulator to operate until the float drops to the bottom of the metering tube. Keep the system operating for a few minutes until any gas remaining in the system is evacuated. Replace the inlet capsule. Refer to Section 4.1
2. The required gas feed rate is not achieved at start-up.	a. Insufficient ejector vacuum due to insufficient water supply pressure for existing back pressure conditions. b. Leakage at vacuum line connections at flowmeter outlet, vacuum regulator and/or inlet toejector. c. Vacuum line(s) crimped. d. Length of vacuum line(s)exceeds maximum allowable transport distance.	a. Refer to Condition 4. b. Inspect each connection and remake as necessary. c. Replace vacuum tubing andar range line(s) to eliminate crimping d. Refer to Bulletin 121.3003.
3. Out-of-gas indication occurs during normal operation.	a. Gas supply valve(s) closed. b. Gas supply empty. c. Filter in vacuum regulator inlet plugged.	a. Open gas supply valve(s). b. Replenish gas supply. c. Replace filter.

CONDITION	PROBABLE CAUSE	CORRECTIVE ACTION
4. Insufficient ejector vacuum.	a. Y-strainer in water supply linedirty. b. Back pressure is greater than the value listed for one of the following reasons: 1) solution valve, if supplied, not fully open; 2) solution line, if present, partially blocked; 3) back pressure at point of injection has increased above its original value. c. Ejector nozzle and/or throat dirty.	a. Clean or replace Y-strainer screen. b. Open solution valve; clean solution line; correct high back pressure condition. c. Clean nozzle and or throat. Refer to Ejector instruction manual 122.6001.
5. Loss of gas feed.	a. Dirty or plugged ejector nozzle. b. Insufficient water pressure for ejector operation. c. No gas supply. d. Plugged gas inlet filter.	a. Clean ejector. Refer to Ejector instruction manual 122.6001. b. Check and correct hydraulic conditions. c. Replenish gas supply. d. Clean the inlet filter screen in hot, soapy water
6. Flowmeter float bounces and/or maximum gas feed rate can not be achieved during normal operation	a. Gas inlet filter dirty. b. Rate valve dirty. c. Flowmeter dirty. d. Ejector water supply pressure fluctuating causing insufficient ejector vacuum (float bouncing only).	a. Replace gas inlet filter. b. Clean the rate valve. See Section 4.3. c. Clean the flowmeter. See Section 4.2. d. Check water supply pressure. Correct as necessary
7. Flooded flowmeter	a. Dirt on the ejector check valve seat. b. Worn seat.	a. Clean or replace ejector check valve seat. See Ejector instruction manual 122.6001. b. Disassemble and clean the vacuum regulator. The vacuum regulator can be full of chlorine solution.

CONDITION	PROBABLE CAUSE	CORRECTIVE ACTION
8. Vacuum leaks	a. Rate valve o-ring worn. b. Dirty diaphragm or worn o-ring. c. Dirty o-ring between front and back bodies. d. Dirty or worn o-ring at inlet capsule.	a. Replace o-ring. See Section 4.3. b. Clean or replace diaphragmand/or o-ring. c. Replace o-ring. d. Replace o-ring. See Section 4.1.
9. Failure to repeat or start up	a. Dirty flowmeter or rate valve. b. Insufficient water flow to ejector.	a. Clean the flowmeter and ratevalve. See Sections 4.2 and 4.3. b. Check and correct hydraulic conditions.

Design improvements may be made without notice.

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