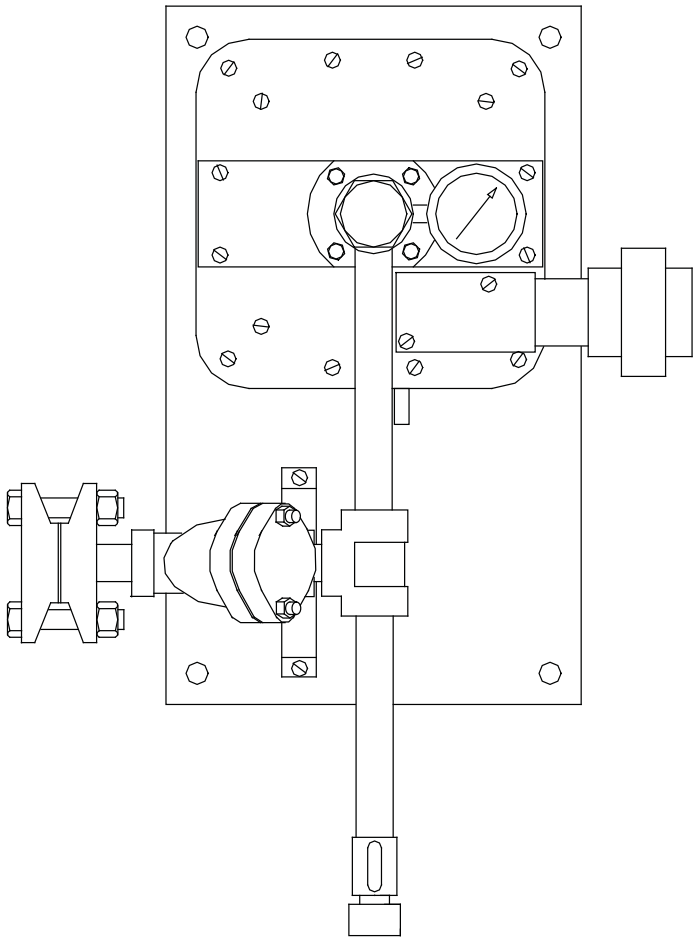
Instruction Manual — Remote Vacuum Regulator, 2000 to 10,000 PPD (40 to 200 kg/h)

DE NORA



These instructions describe the installation, operation and maintenance of the subject equipment. Failure to strictly follow these instructions can lead to an equipment rupture that may cause signifi cant property damage, severe personal injury and even death. If you do not understand these instructions, please call De Nora Water Technologies for clarifi cation 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

The ADVANCE® vacuum regulator is a spring-opposed diaphragm type design which serves, via the throttling action of the inlet valve, to reduce the gas from a varying supply pressure to a constantly regulated vacuum. This allows for safe transport of gas to the point or points of application.

The vacuum regulator has a vacuum sealing o-ring which stops the gas flow in the event the operating vacuum becomes excessive. This condition can be caused when the supply of gas is exhausted, or when the gas supply valve(s) is closed during ejector operation.

The vacuum regulator is equipped with a gas pressure gauge to provide local indication of the gas supply status.

1.1 Reference Literature

Throughout this manual, the following literature may referenced:

Series 4000 floor cabinets: 105.6005

Series 4100 wall cabinets: 105.6050

Series 4800/4900 compact floor cabinets: 105.6020

Fixed orifice ejectors: 122.6051

Variable orifice ejectors: 122.6050

Vacuum line size requirements: 121.3003

1.2 Specifications

Gas Manifold Piping Requirements: 3/4", Schedule 80, seamless steel pipe or gas pressure piping suitable for the gas being dispensed.

Gas Inlet Connection: 3/4", forged steel flanged union

Gas Outlet Connection:

2000 PPD (40 kg/h): 1" PVC union
8000 PPD (150 kg/h): 1 1/2" PVC union
10,000 PPD (200 kg/h): 2" PVC union

Vent Connection:

2000 PPD (40 kg/h): 1/2" tubing fitting
8000 PPD (150 kg/h): 5/8" tubing fitting
10,000 PPD (200 kg/h): 5/8: tubing fitting

Gas Pressure Gauge: Dual indicating in pounds per square inch (psig) and kilopascals (kPa).

Heater Power Requirements: 120 Vac, 60 Hz or 240 Vac, 50 Hz, single phase, 25 watt (not for ammonia gas service)

2 INSTALLATION

This instruction manual covers the vacuum regulators only. Refer to other instruction manuals for the individual components. Figures 3, 4 and 5

2.1 Mounting

NOTE: The drip leg with heater and flange union are shipped separately and must be field assembled. This assembly should be completed before the vacuum regulator panel is mounted. The flange union may be positioned to the left or right as convenient to the installation requirements.

2.1.1 Bolt the vacuum regulator panel assembly vertically on a wall convenient to the gas manifold piping. Secure using four (4) 1/2" lag bolts.

2.2 Gas Manifold

2.2.1 Connect the manifold to the vacuum regulator via the 3/4" inlet, forged steel flanged union.

2.2.2 Orient the flange with the mating flange on the vacuum regulator.

2.2.3 Place a lead gasket in the flange seat, then join and tighten (not excessively) the connection to ensure a gas-tight seal.

2.3 Vacuum Line Connections

The size of the vacuum line is determined by the gas feed rate and the total distance from the vacuum regulator to the gas feeder cabinet, and to the remote ejector. Refer to Bulletin 121.3003 for vacuum line size requirements.

Rigid vacuum piping runs must be as free as possible from bends and obstructions, minimizing the number of fittings. Mechanical protection of vacuum lines may be necessary to prevent abuse. When vacuum lines are run in conduit, ensure that the conduit is well ventilated.

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.

2.3.1 Connect the 1" (2000 PPD/40 kg/h), 1 1/2" (8000 PPD/150 kg/h), or 2" (10,000 PPD/200 kg/h) PVC gas vacuum outlet union provided on the vacuum regulator with a length of vacuum pipe.

2.3.2 Orient the flange with the mating flange on the vacuum regulator.

2.3.3 Be sure the o-ring is in place in the union, then join and tighten the connection, do not over-tighten.

2.3.4 Connect the other end of the vacuum pipe to the gas vacuum inlet connection in the cabinet. Refer to the cabinet instruction manual.

NOTE: The vacuum pipe size must be the same diameter if the vacuum outlet union.

2.3.5 If a multiple metering arrangement is required, connect the vacuum line by the use of tees and run separate vacuum lines to each flowmeter and ejector. Vacuum isolating valves are recommended on each vacuum line installed before each flowmeter to permit service to individual gas flowmeters without interruption of the entire system.

2.4 Vent Lines

NOTE: Regardless of the vacuum regulator location, or mounting, it is equipped with a vent connection. For proper equipment operation and to ensure that any vent will function correctly, proceed as follows:

2.4.1 Connect a length of 1/2" (2000 PPD/40 kg/h) or 5/8" (8000 and 10,000 PPD/150 and 200 kg/h) polyethylene tubing to the vacuum regulator vent connection using the fitting supplied.

2.4.2 Run the vent line to a safe area where discharge of chlorine gas can be tolerated (e.g. outside the building).

2.4.3 The vent must discharge to atmospheric pressure. A low (vacuum) pressure or high pressure can cause improper operation. **DO NOT CONNECT THE VENT TO THE EJECTOR VACUUM LINE.**

2.4.4 Slope the vent line downward from the vacuum regulator to provide a positive drain. This prevents moisture accumulation.

2.4.5 If there must be low points in the vent line, provide a means for drainage (e.g. a plugged drain valve) at the low points.

2.4.6 Install an insect screen at the discharge point to prevent line blockage.

2.4.7 If several vacuum regulators are involved, provide a separate vent line for each vacuum regulator. **DO NOT MANIFOLD VENT LINES**. Run separate and independent vents to a safe area.

2.5 Drip Leg Heater (not for use with ammonia gas service)

Prior to starting up the system, apply power to the heater located at the bottom of the trap assembly. This heater keeps the gas from reliquefying in the trap. Heaters should be kept powered at all times.

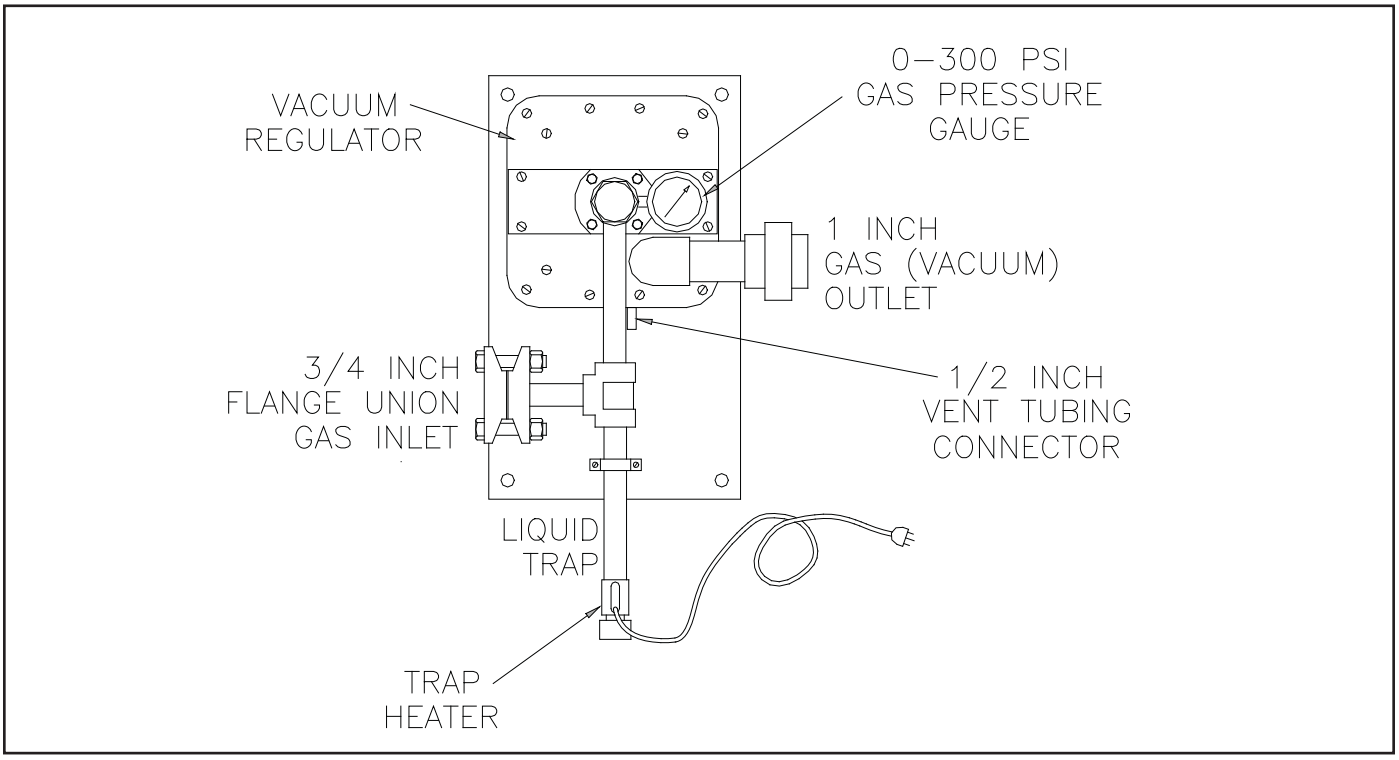

Figure 1 - 2000 PPD (40 kg/h) Vacuum Regulator Assembly

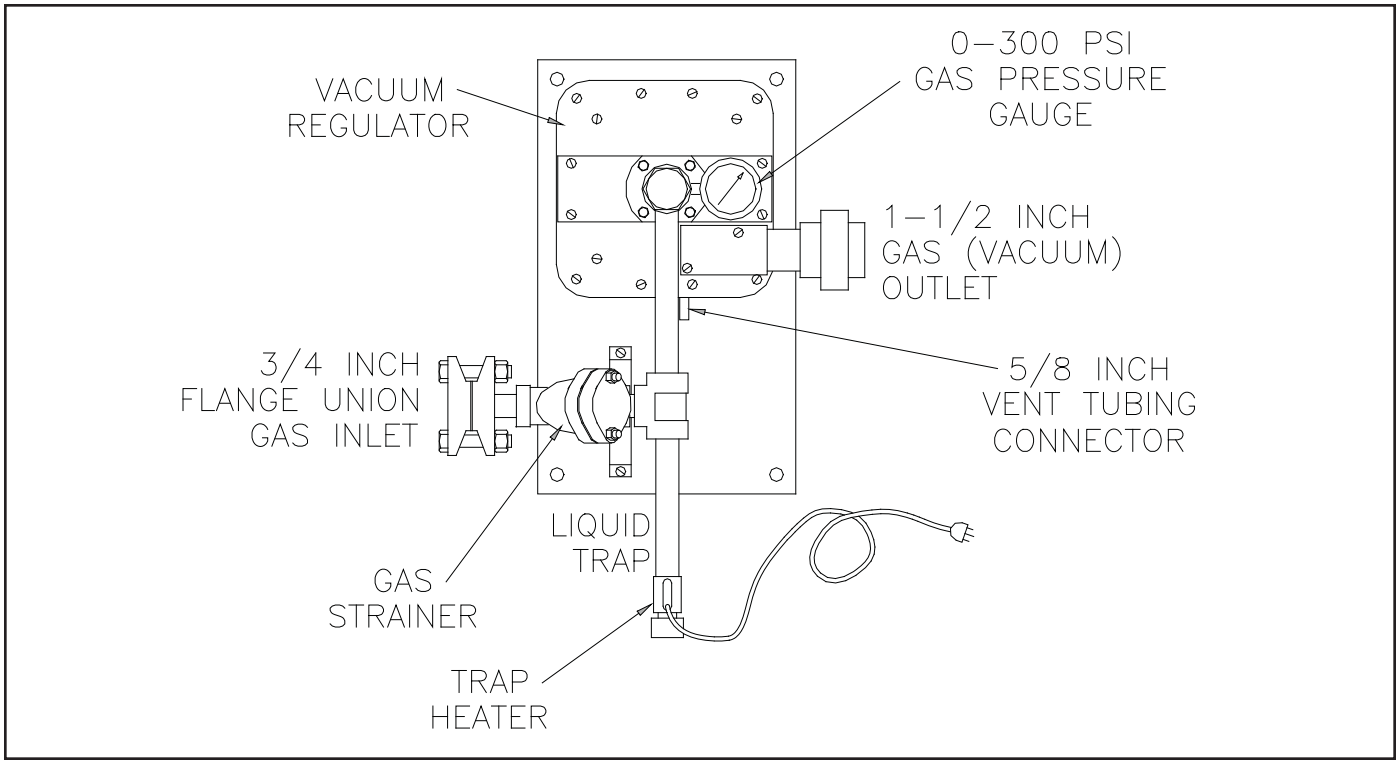

Figure 2 - 8000 PPD (150 kg/h) Vacuum Regualtor Assembly

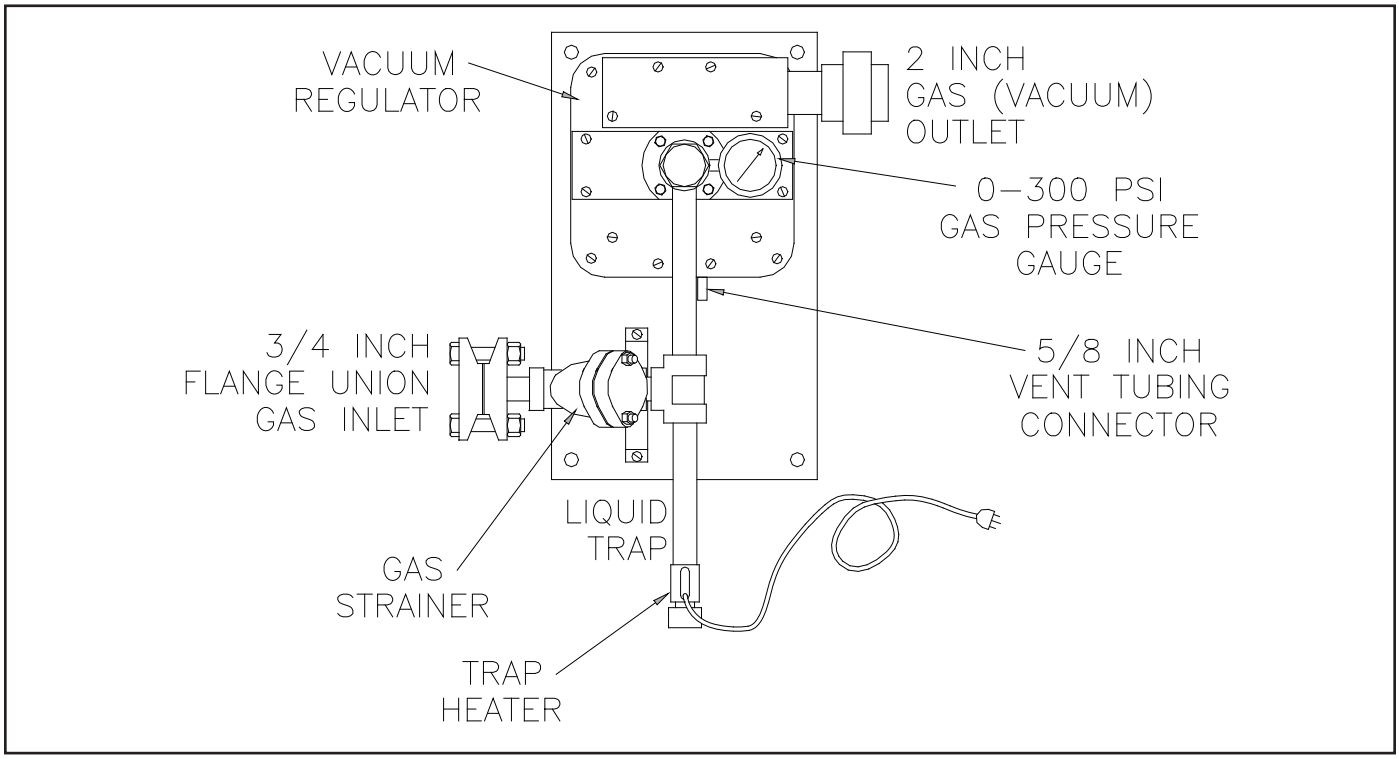

Figure 3 - 10,000 PPD (200 kg/h) Vacuum Regulator Assembly

3 OPERATION

3.1 Ejector Check

The ejector, with its water supply and solution lines, must be properly installed, water pressure tested and operating before checking the gas feeder (refer to ejector instruction manual). Unless the ejector is creating a vacuum, the gas feed system will not work.

3.1.1 Disconnect the vacuum line from the ejector at the PVC union.

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

3.1.3 Place the palm of your hand over the end of the inlet pipe and feel the vacuum. The vacuum created is strong and there should be no doubt that a vacuum exists.

3.1.4 Reconnect the vacuum line to the ejector.

3.2 Gas Feeder Check

Have a plastic squeeze bottle available 1/4 full of leak test solution. Use a strong ammonia (26° Baume) solution to check for chlorine or sulfur dioxide leaks. Use sodium hypochlorite to check for ammonia leaks.

3.2.1 With the ejector operating, and the gas supply valve closed, the float in the metering tube should drop to the bottom and remain there. If the float does not drop, or bounces up and down, there is an air leak somewhere in the system. An air leak may be caused by a loose connection or dirt on the sealing surface. Refer to Service section 4.1.

3.2.2 Close the ejector water supply valve.

3.2.3 Open the gas supply valve 1/4 turn and close immediately.

3.2.3 Hold the plastic squeeze bottle of test solution below all pressure connections and the inlet to the vacuum regulator. Squeeze the plastic bottle to exhaust FUMES ONLY of the test solution. If gas is leaking, smoke will appear similar to cigarette smoke. Refer to Service section 4.1 and Troubleshooting Chart Sections and correct.

3.2.4 Turn on the gas supply.

3.2.5 Proceed to the start-up section of the cabinet instruction manual.

3.3 Shut-Down

3.3.1 Close the gas supply valve - DO NOT USE THE RATE CONTROL VALVE TO SHUT-OFF THE GAS SUPPLY.

3.3.2 When the flowmeter float drops to 0 and the pressure gauge reads 0 psi (kPa), the gas is exhausted from the system.

3.3.3 Run the ejector for about one minute to ensure gas depletion in the system

3.3.4 Close ejector water supply valve.

4 SERVICE

It is recommended that the Gas Dispensing System be inspected and serviced a minimum of 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, 3) the quality and quantity of water or process liquid being used to operate the ejector(s), and 4) 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.

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.

4.1 Gas Leak

4.1.1 Container gas supply valve and isolating valve packing.
This valve is serviced by the chemical supplier at each filling and leakage at this point is unusual. If a leak develops, tighten the gas valve packing nut, without exerting excessive force. If this does not eliminate the leak, close the valve and call the gas supplier.

4.1.2 Lead Gaskets
A leak can be caused by reusing a lead gasket, dirt on the gasket surface, under-tight or over-tight connections, or installations without a lead gasket. Use a new lead gasket each time the seal has been broken. Make certain the gasket and gasket surfaces are clean and smooth.

4.1.3 Manifold and Shut-Off Valves
If the system uses multiple supply sources, each valve and connection in the manifold must be check for leaks.

4.1.4 Vent Line
Gas leaking out of the vent line is usually an indication of dirt on the shut-off valve seat. To make certain this is the problem area:

a. Shut off the ejector water supply.

b Submerge the end of the vent line in a container of water. Continuous bubbling is an indication of a gas leak. It may be necessary to connect a small, temporary piece of flexible tubing to the vent if the installation does not permit convenient submergence.

c. To prepare the system for disassembly, close the gas supply valve, turn on the ejector water supply and allow the system to operate until the float in the gas flowmeter drops to the bottom. Keep the system operating for a few minutes longer to evacuate any remaining gas. Refer to Figures 1-5, and proceed as follows:

1. Remove the two (2) bolts joining the flanged union on the gas inlet.

2. Remove the four (4) hex head bolts holding the inlet capsule assembly (flanged part) to the metal plate.

3. Remove the wall bracket clamps on the inlet piping to permit removal of the manifold.

4. Rotate the inlet assembly using a back and forth motion on the drip leg until the o-ring seal is broken.

5. Pry the inlet capsule assembly from the vacuum regulator using a pair of screwdrivers inserted in opposite sides of the groove in the adaptor exposed by the slots in the body plate. If the inlet capsule remains in the inlet assembly, remove it by pulling on the adapter.

6. Lubricate the o-rings using Fluorolube grease and re-assemble by reversing steps 1 to 5, making certain the inlet capsule assembly is aligned.

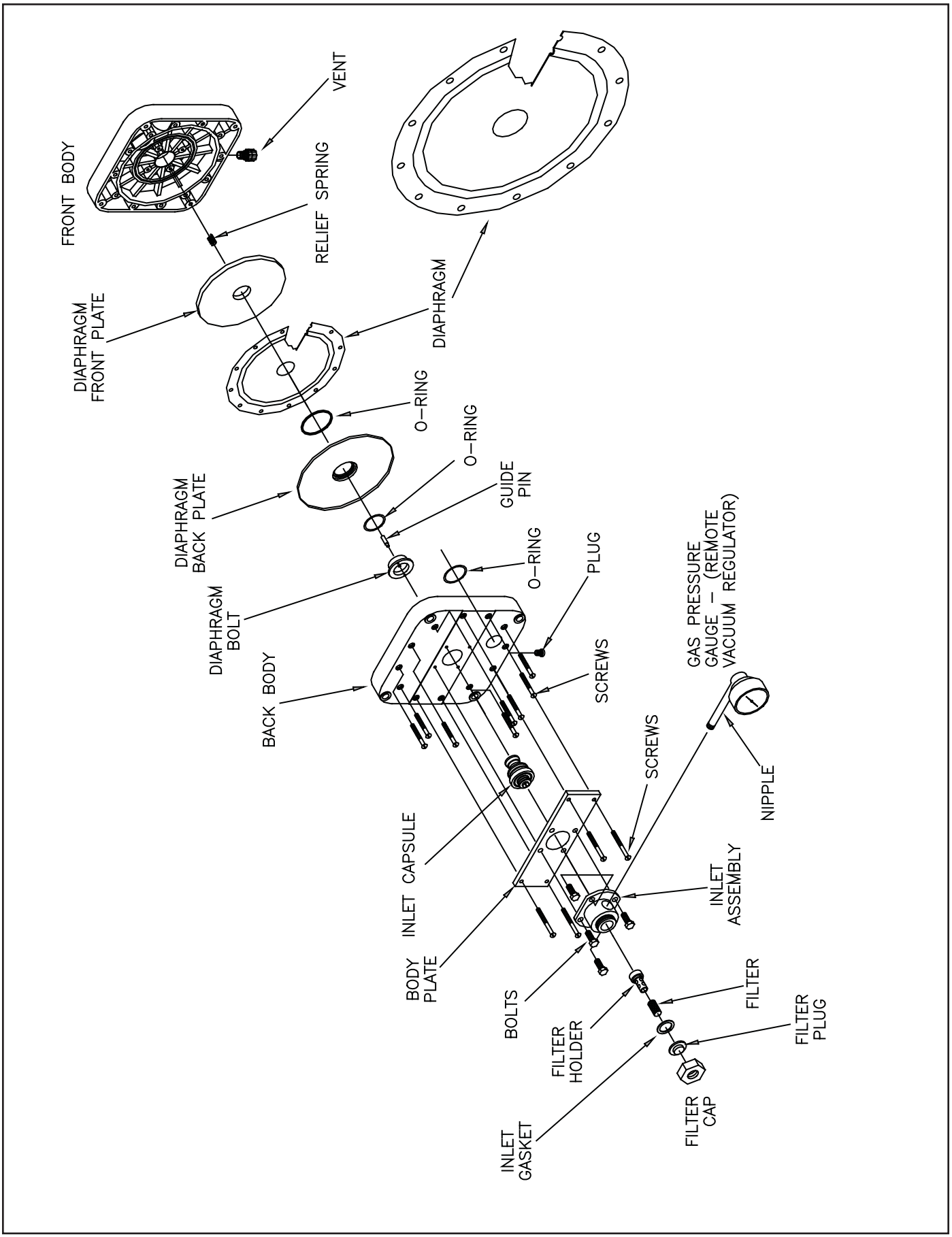

Figure 4 - 2000 PPD (40 kg/h) Vacuum Regualtor Assembly

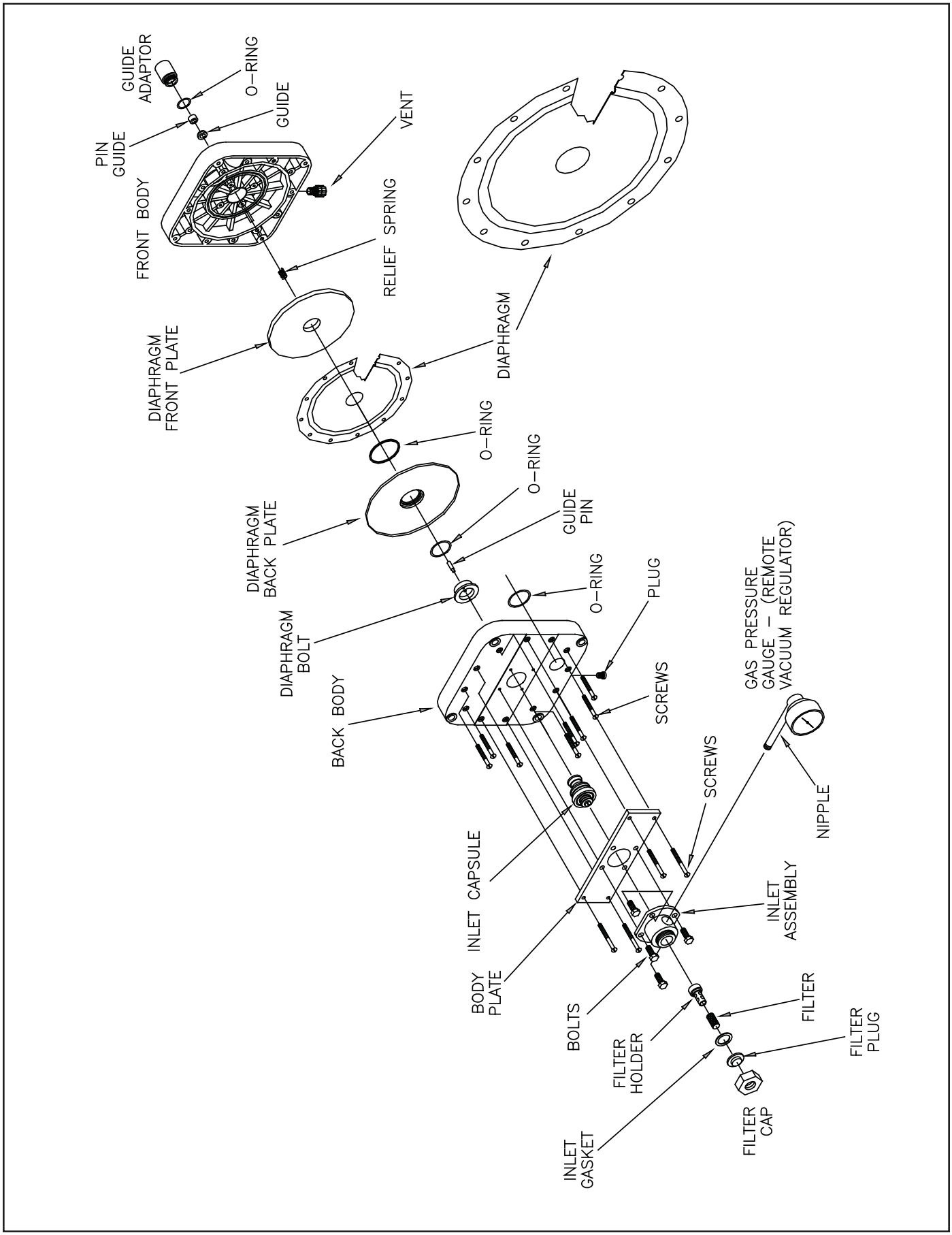

Figure 5 - 8000 & 10,000 (150 & 200 kg/h) Vacuum Regualtor Assembly

4.2 Loss of Gas Feed

4.2.1 Dirty or Plugged Ejector Nozzle (also refer to ejector instruction manual)

This can be checked by removing the vacuum line at the ejector and holding the palm of your hand over the end of the inlet pipe to the ejector check valve assembly.

Suitable vacuum will exert a strong pull. If there is no vacuum, the ejector nozzle may be plugged. To remove the nozzle, proceed as follows:

a. Shut-off ejector water supply.

b. Remove the ejector check valve assembly from the water line.

c. Refer to the ejector parts list and remove the bolts holding the flanged housings to the ejector body.

d. Unscrew the nozzle from the ejector body and clean out any large debris. A weak (approximately 10%) muriatic acid solution can be used to clean any additional material from the nozzle and throat.

e. Reassemble, reversing steps a to d, and recheck for vacuum.

4.2.2 Insufficient Ejector Water Pressure

Check the same as item 4.2.1. Ejector requirements vary with capacity and installation conditions. For zero back pressure applications, approximately 30 to 40 psig (2 to 3 bar) supply pressure is required. This can be confirmed by check the nozzle and throat flow and pressure requirements.

Do not attempt to remove the inlet assembly without first breaking the o-ring seal.

4.2.3 No Gas Supply

When the gas container is empty, the metering float in the gas flowmeter will not indicate gas feed and the gas pressure gauge will read zero.

4.2.4 Plugged Gas Inlet Filter

Dirt from the gas container may completely plug the gas inlet filter (silver screen). To clean, proceed as follows:

a. Close the gas supply valve(s) and operate the ejector until all gas is evacuated and the pressure gauge reads zero.

b. Remove the large hexagonal nut (filler cap) from the inlet assembly and pull out the inlet filter assembly.

c. Clean filter by submerging and agitating in hot soapy water.

d. Dry thoroughly with compressed air.

e. Reinstall the assembly using a new lead gasket.

4.3 Cleaning the Gas Strainer (8000 and 10,000 PPD/150 and 200 kg/h only)

4.3.1 Close the gas supply valve(s) and operate the ejector until all gas is evacuated and the pressure gauge reads zero.

4.3.2 Remove the nuts holding the strainer cover and remove the cover and screen from the body.

4.3.3 Clean the screen by submerging in hot soapy water.

Use a coarse bristle brush to remove dirt.

4.3.4 Dry with compressed air.

4.3.5 Reinsert the screen and replace the cover using a new lead gasket.

4.4 Recommended Torque Values

If you disassemble the vacuum regulator at any time, please use the following values for reassembly:

4.4.1 The eight (8) screws that hold the back body to the front body should be tightened evenly to 22 inch-pounds torque.

4.4.2 The four (4) body plate screws should be tightened evenly to 22 inch-pounds torque.

4.4.2.a "Torque the qty (4) 3" 1/4 20 screws securing the flow tube assembly with outlet to 10-15 inch pounds."

4.4.3 The plug and tubing connectors should be wrapped with Teflon tape and hand tightened plus 1/4 turn to a torque of 10 inch-pounds.

5 TROUBLESHOOTING CHART

NOTE: Also refer to Troubleshooting Charts for individual components.

Trouble	Probable Cause	Corrective Action
1. Required gas feed rate not achieved at start-up	a. Insufficient ejector vacuum resulting from insufficient water supply pressure or excessive back pressure conditions. b. Leakage at vacuum line connections in the flowmeter, vacuum regulator, and/or inlet to ejector. c. Vacuum line blocked. d. Length of vacuum lines exceed maximum allowable transport distance.	a. Refer to Trouble 3 b. Inspect each connection and fix as necessary. c. Check and correct vacuum line obstruction. d. Refer to Bulletin 121.3003.
2. Gas pressure gauge reads zero during normal operation.	a. Gas supply valve(s) closed. b. Gas supply exhausted. c. Vacuum regulator inlet filter plugged.	a. Open gas supply valve(s). b. Replenish gas supply. c. Clean filter.
3. Insufficient ejector vacuum.	a. Y-strainer in water supply line dirty. b. Back pressure too high 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 the point of application has increased above its original value. c. Ejector nozzle and/or throat dirty.	a. Clean Y-strainer. b. Open solution valve,clean solution line, determine the cause of high back pressure and correct as necessary. c. Clean ejector nozzle and/or throat. Refer to Ejector instruction manual.
4. Loss of gas feed.	a. Dirty or plugged ejector nozzle. b. Insufficient water pressure to operate ejector. c. No gas supply. d. Plugged gas inlet filter.	a. Clean ejector nozzle. Refer to Service section. b. Check hydraulic conditions and correct as necessary. c. Replenish gas supply. d. Clean gas inlet filter. See Service section.
5. Flowmeter float bouncing and/or maximum gas feed rate cannot be achieved.	a. Gas inlet filter dirty. b. Rate valve or flowmeter dirty. c. Ejector water supply pressure fluctuating. d. Air leak.	a. Clean gas inlet filter. See Service section. b. Clean rate valve and/or flowmeter. Refer to cabinet instruction manual. c. Check ejector water supply pressure and correct as necessary. d. Refer to trouble 1b.
6. Vacuum leaks.	a. Rate valve o-ring worn. b. Dirt on the sealing surface of the main diaphragm. c. Dirty or worn o-ring between the front and back vacuum regulator bodies. d. Dirty or worn o-ring at the vacuum regulator inlet capsule.	a. Replace rate valve o- ring. Refer to cabinet instruction manual. b. Clean main diaphragm. c. Clean or replace o-ring. d. Clean or replace o- ring.

Design improvements may be made without notice.

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