Series 203

Granville-Phillips® Variable Leak Valve

Instruction Manual

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Granville-Phillips® Variable Leak Valve

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Instruction Manual

Contents

Series 203 Variable Leak Installation and Operating Instructions

1 Safety Hazards

⚠ WARNING

Use of certain corrosive gases can cause gases to leak through the sealed valve or into the atmosphere, resulting in serious personal injury.

Before using a gas with the valve, check the gas for compatibility with the following materials:

- Fine silver
- Type 304S ST

⚠ WARNING

Exceeding the maximum internal pressure specified below can cause an explosion, resulting in property damage or serious personal injury.

- Inlet pressure should never exceed 200 psig.
- For inlet pressures less than one atmosphere, connect the gas source to either port.
- For gas pressures greater than one atmosphere, connect the gas source to the center port.

2 Important Precautions

The Variable Leak is a carefully designed and manufactured variable conductance device. With proper care and use it will give long and trouble free service under the most extreme conditions. The following are important precautions which must be observed at all times to prevent possible irreparable damage or poor performance.

2.1 DO NOT remove the valve from its container until these instructions have been read completely.

2.2 Always cover the ports with plastic cap plugs or rubber stoppers and place the entire unit in a clean polyethylene bag whenever the Leak is stored, shipped or not connected to the vacuum system. Do not use cork stoppers or adhesive tape.

2.3 Carefully exclude dust, dirt, chips, moisture and other contaminants. A liquid seal, formed from condensed vapors on the sealing surface, will result in loss of leak control. Foreign or corrosive material will permanently damage the sealing surfaces.

2.4 Due to the closing torques required, use care when it is necessary to support the valve by the ports only.

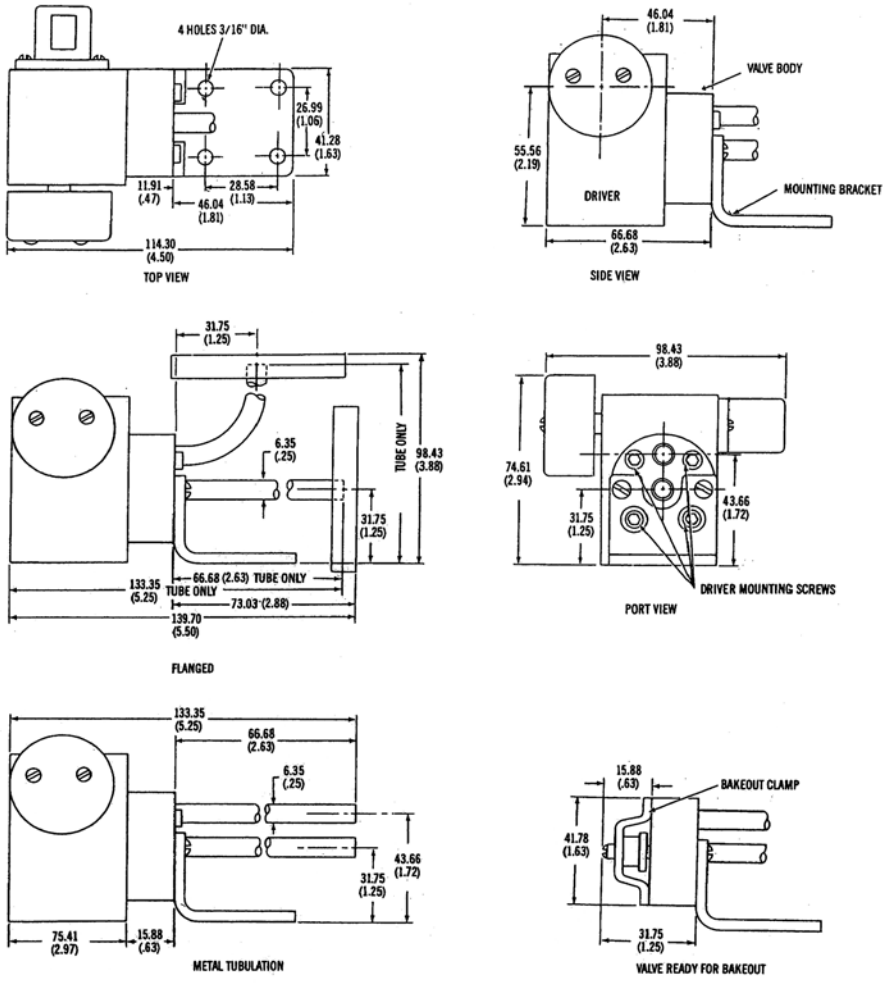
2.5 High temperature bake the Leak valve body only when the Driver Assembly is removed and the Leak held open with a bake-out clamp.

2.6 Stable ambient temperature is necessary to maintain conductance at any specific setting.

2.7 Do not increase the counter reading beyond 270 or decrease below the number at which the Leak seals mass spectrometer leak tight.

Variable Leak Valve Dimensions

Dimensions in mm (in.)



3 Description

The Variable Leak consists of the Leak Valve, Driver Assembly and the Mounting Bracket. The Leak Valve has a precisely machined 304 SS nosepiece welded in the center of a thin 304 SS diaphragm. The diaphragm is welded to the 304 SS body. The nosepiece seats on a carefully proportioned pure silver gasket in the valve body.

The removable Driver Assembly actuates the nosepiece, changing the effective aperture and thus changing the conductance. A high-ratio worm and gear make it possible to accurately set any conductance value within the operating range. The counter attached to the driver provides a convenient method of reproducing approximate leak rates.

3.1 Conductance

The conductance of the Variable Leak is continuously variable from 400 cc per second to 10-10 cc per second. When sealed, the leakage conductance with one atmosphere across the seal is less than 10-10 standard cc per second. All metal-to-metal seals suffer from hysteresis, especially at very low flow rate. Hence, at low flow rates the conductance will, in general, be higher at a given counter reading when the leak is being opened than at the same counter reading when the leak is being closed.

If the leak is sealed after use at high flow rates, some gas will continue to emerge from the seal for several minutes, even though the seal is mass spectrometer leak tight. This is a normal condition with metal-to-metal seals.

3.2 Throughput

The maximum throughput is 400 standard cc per second with atmospheric pressure on the inlet. Larger throughputs are attained with higher inlet pressures. Much lower throughputs may be achieved by reducing the inlet pressure. Low inlet pressures are advantageous where very low flow rates are required.

3.3 Maximum Inlet Pressures

The maximum inlet pressure depends on how the valve is connected to the system. For inlet pressures less than one atmosphere either port may be connected to the gas source. For gas pressures greater than one atmosphere the gas source must be connected to the center port, to prevent damage to the valve diaphragm. Inlet pressure should never exceed 200 psig.

3.4 Gases Controlled

All dry gases, non-corrosive to Leak Valve materials, can be controlled. Moist gases, such as undried atmosphere or gases containing oil or other condensable gases, are difficult to control because a liquid film forms quickly on the sealing surfaces. This produces a liquid seal which has only ON or OFF properties. If this condition occurs, a brief vacuum bakeout is usually sufficient to restore the control properties of the metal-to-metal seal.

3.5 Materials

304 Stainless Steel and fine silver are the only materials in contact with vacuum in all Leak Valves. All fabrication is by heliarc welding.

3.6 Temperature

The conductance of the Variable Leak is slightly temperature dependent and will vary if the ambient temperature varies. Bakeout temperatures up to 450°C may be used, provided the driver is removed and the leak is held open by the bakeout clamp. Do not bake the leak with the driver attached to a temperature higher than 70°C.

3.7 Vacuum Connections

A wide variety of connections are available to make any Variable Leak adaptable to existing or new systems. Metal tubulation or flanged connections may be ordered.

Metal tubulation is of Type 304 Stainless Steel in V4 inch 00 x 0.035 inch wall. The Stainless Steel tubes may be welded to any other 300 Series except the free machining grades.

Rotatable flanges made of Type 304 Stainless Steel, heliarc welded to Type 304 tubulation, are available. Both the 2¾ inch CuSeal® and 115/16 inch Mini-CuSeal® flanges are manufactured to geometries licensed by Varian Associates, Inc. Each of the Flange styles use a different replaceable OFHC copper gasket between two mating flanges, and type 18-8 bolts, nuts, and washers, Also available are versions using Cajon® VCR and VCA fittings.

4 Installation

Use every precaution to prevent contamination from entering the Leak. Keep plastic caps or rubber stoppers on the valve ports until the valve is ready to be connected to the system. Do not use cork or adhesive tape. When the unit is not installed, the valve should be left slightly open and placed in a clean polyethylene bag as protection against contamination.

For inlet pressures less than one atmosphere either port may be connected to the gas source. For pressures greater than one atmosphere the gas source must be connected to the center port, Port S, to prevent damage to the valve diaphragm.

All welding operations must be done with an inert atmosphere inside the valve to prevent the formation of oxide contamination which could enter the valve and cause failure. Heliarc welding with better than 99% pure argon inside and a 3 to 4 minute purge is satisfactory.

When flange connections are supplied on the Leak Valve, mating flanges of the same diameter and style must be provided on the system. Each design uses a specific OFHC copper gasket. Insert a new, clean gasket between mating flanges using care not to mar the gasket surfaces. Uniformly tighten Type 18-8 bolts and nuts with washers until the outer flange surfaces are in contact. Intimate contact is important for good mechanical strength.

5 Operation

Leak rate is increased as the counter reading is increased. Twenty-seven turns of the driver handle, or 270 counter numbers above the sealed position reference number, changes the Leak from full closed mass spectrometer leak tight to full open. Never increase the counter reading more than 270 numbers or decrease below the number at which the Leak seals. Exceeding these limits will not change the conductance but may shorten Leak Valve life.

The counter has been preset so that the Leak Valve is sealed mass spectrometer leak tight at a counter reading of about 0010. The counter may be removed and reset to establish the reference for the fully closed position at any value desired. It is also possible that the reference may change inadvertently when the driver is removed. However, the sealed position can readily be re-determined with a leak detector, and a new reference established. Damage to sealing surfaces is prevented by a preset clutch.

6 Removing the Driver

The driver must be removed for bakeout.

6.1 Remove the name plate.

6.2 Turn the driver handle until the counter reads approximately 150 digits above the previous sealing point to relieve all thrust on the nosepiece.

6.3 Remove the 6-32 x 1 5/8" retracting screw from the center of the worm gear.

6.4 Support the Driver Assembly and remove the four symmetrically placed 8-32 x 1" driver mounting screws and washers located on the tubulation side of the Leak Valve.

6.5 Place Driver Assembly in a clean polyethylene bag.

6.6 Attach the bakeout clamp to the nosepiece of the Leak Valve and retract the nosepiece until it contacts the bakeout clamp.

6.7 The Leak Valve is now ready for bakeout.

7 Bakeout

High temperature bakeout of a system will greatly decrease the required pump-down time for pressures below 1×10^{-6} Torr (1.33×10^{-6} mbar, 1.33×10^{-4} Pa). Leak Valves are designed to withstand repeated bakeout to 450 ° C if the driver is removed and the valve is held open with the bakeout clamp.

Do not subject the valve to high temperatures any longer than necessary. Excessive baking will shorten the useful life of the valve. Bakeout should only be done when the pressure on the interior of the valve is below 1×10^{-4} Torr (1.33×10^{-4} mbar, 1.33×10^{-2} Pa) so that oxidation is kept to a minimum.

8 Attaching the Driver

When the Leak Valve is cool to the touch, the Driver Assembly may be attached.

8.1 Remove the bake-out clamp.

8.2 Be certain the counter reads approximately 150 digits above the previous sealing point and the retracting screw is removed so that the valve seal cannot be damaged when the driver mounting screws are tightened.

8.3 Support the Driver Assembly, replace the four 8-32 x 1" driver mounting screws and washers, and tighten evenly. A small amount of lubricant should be used on the mounting screws.

8.4 Replace the 6-32 x 1 5/8" retracting screw and tighten until the shoulder of the screw bottoms on the nosepiece. Do not lubricate this screw. Compounds which contain sulfur should never contact the Monel® or nickel valve parts.

8.5 Turn the driver handle clockwise until a mass spectrometer leak tight seal is attained. This will require between 30 and 50 inch-ounces torque. If a leak detector is not available, close the valve in small increments until a satisfactorily low conductance is attained.

8.6 With the driver in the sealed position, remove the counter and set to read 0010. A properly adjusted clutch will now slip at counter reading 0000.

8.7 To adjust the clutch, remove the driver handle and tighten or loosen the set screw until the clutch slips about 10 counter numbers below the sealed position.

8.8 To open the Leak Valve, turn the operating handle counter clockwise.

9 Packaging for Shipment

It is necessary to protect the valve against contamination when returning it for service. Plastic caps or rubber stoppers should be installed on the valve ports and the entire assembly should be placed in a clean polyethylene bag as protection against contamination.

10 Troubleshooting

The Variable Leak provides long trouble free service if properly used and cared for. If difficulties are experienced in operating the Leak Valve, the following information will be useful. For additional assistance, contact the Granville-Phillips Technical Service Department at 1–303–652–4400 or email at *mks@mksinst.com*.

Symptoms, Causes, and Remedies

Symptom	Cause	Remedy
Leak has only on or off properties. Does not give smooth continuous control.	A liquid film on the sealing surfaces produced by allowing moist or vapor laden gases to flow through the Leak.	A brief vacuum bakeout at 200 to 300 ° C for a few hours.
Leak will not seal.	Insufficient thrust, clutch slips before seal is attained.	Remove the driver handle and tighten the clutch set screw. After the Leak is sealed, adjust the clutch to slip about 10 counter numbers below the sealed position.
	Insufficient thrust, driver dirty.	Remove the driver. Remove the clutch. Remove the retaining rings holding the drive shaft bearings in place. Remove the bearings and the worm shaft. The drive screw worm gear assembly should now be carefully unscrewed. Clean the drive screw threads with a solvent such as chlorothene. Do not allow the drive screw worm gear assembly to come in contact with heat. Clean the worm. Do not clean the bearings. Relubricate the contact surfaces of the worm and gear and drive screw with molybdenum disulfide. Reassemble. Remove the retracting screw. Loosen the set screw in the aluminum bushing and rotate one-eighth turn. Tighten set screw and replace the retracting screw. Test the valve for control. Repeat as necessary until smooth action is obtained.
	Sealing surfaces contaminated.	Replace Leak Valve body. Glass particles, lint, metal chips and dust cannot usually be removed.
Leak momentarily opens or closes in reverse reaction to the turning of the driver handle.	Misalignment of Driver Assembly and Leak Valve.	Re-attach the Driver and Leak Valve, tighten the mounting screws evenly.
	Driver Assembly parts out of alignment.	Remove the retracting screw. Loosen the set screw in the aluminum bushing and rotate one-eighth turn. Tighten set screw and replace the retracting screw. Test the valve for control. Repeat as necessary until smooth action is obtained.
Body mounting screws stick after bakeout.	Lubrication has evaporated.	Place drops of penetrating oil on each screw and let soak for 10 minutes.
Retracting screw strips out of nosepiece.	Retracting screw not properly seated.	Always make certain retracting screw is completely engaged before operating valve.

11 Certification

MKS/Granville-Phillips certifies that this product met its published specifications at the time of shipment from the factory.

12 Limited Warranty

This Granville-Phillips product is warranted against defects in materials and workmanship for one year from the date of shipment provided the installation and preventive maintenance procedures specified in this instruction manual have been followed. Granville-Phillips Company will, at its option, repair or replace or refund the selling price of an item which proves to be defective during the warranty period provided the item is returned to Granville-Phillips Company together with a written statement of the problem.

13 Specifications

Materials

Seal	Pure silver
All other interior surfaces	304 Stainless Steel

Physical Data

Bakeout temperature	450 ° C, bakeout clamp attached 70 ° C valve open or closed driver installed
Seal deformation vs. number of closures	Negligible
Increase in closing torque vs. number of closures	Negligible
Flow path, flange to flange, when fully open	168 mm (6.62 in)
Maximum conductance for dry nitrogen at 25 ° C	400 cc/sec.
Leakage conductance when fully closed	10^{-11} liters/sec.
Normal closing torque	50 inch-ounces
Standard connections	Type 304 Stainless Steel, Rotatable CuSeal or Mini-CuSeal flanges

Maximum Inlet Pressure

Connection type	**Port A**	**Port B**
CuSeal or Mini-CuSeal flange	25 psig	200 psig
Type 304 SS tubulation (welded to system)	25 psig	200 psig

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