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Agilent Technologies

Vacuum Products Division

UHV All–Metal Bakeable Valves

INSTRUCTION MANUAL

Manual No. 699912010
Revision E
May 2004

UHV All-Metal Bakeable Valves



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Warranty

Products manufactured by Seller are warranted against defects in materials and workmanship for twelve (12) months from date of shipment thereof to Customer, and Seller's liability under valid warranty claims is limited, at the option of Seller, to repair, to replace, or refund of an equitable portion of the purchase price of the Product. Items expendable in normal use are not covered by this warranty. All warranty replacement or repair of parts shall be limited to equipment malfunctions which, in the sole opinion of Seller, are due or traceable to defects in original materials or workmanship. All obligations of Seller under this warranty shall cease in the event of abuse, accident, alteration, misuse, or neglect of the equipment. In-warranty repaired or replaced parts are warranted only for the remaining unexpired portion of the original warranty period applicable to the repaired or replaced parts. After expiration of the applicable warranty period, Customer shall be charged at the then current prices for parts, labor, and transportation.

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If it is found that Seller's Product has been returned without cause and is still serviceable, Customer will be notified and the Product returned at Customer's expense; in addition, a charge for testing and examination may be made on Products so returned.

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Preface

Hazard and Safety Information

This manual uses the following standard safety protocols:

WARNING



Warnings indicate a particular procedure or practice, which if not followed correctly, could lead to serious injury.

CAUTION



Cautions indicate a particular procedure or practice, which if not followed, could cause damage to the equipment.

NOTE



Notes contain important information.

Before operating or servicing equipment, read and thoroughly understand all operation/ maintenance manuals provided by Agilent. Be aware of the hazards associated with this equipment, know how to recognize potentially hazardous conditions, and how to avoid them. Read carefully and strictly observe all cautions and warnings. The consequences of unskilled, improper, or careless operation of the equipment can be serious.

In addition, consult local, state, and national agencies regarding specific requirements and regulations. Address any safety, operation, and/or maintenance questions to your nearest Agilent office.

Vacuum Equipment and Cleanliness

Cleanliness is vital when servicing any vacuum equipment.

CAUTION *Do not use silicone oil or silicone grease.*



Use powder-free butyl or polycarbonate gloves to prevent skin oils from getting on vacuum surfaces.

NOTE



It is usually unnecessary to use vacuum grease. If it must be used, use it sparingly. Krytox® GPL207 *grease (*P/N 695400010*) is recommended.* Do not use silicone based grease.

Contacting Agilent

In the United States, you can contact Agilent Customer Service at 1-800-882-7426. See the back cover of this manual for a listing of our sales and service offices.

Visit our web site at: http://www.chem.agilent.com/en-US/Products/Instruments/vacuum/pages/default.aspx.

UHV All-Metal Bakeable Valves

This manual consists of the following sections:

- "Description and Specifications"
- "Installation" on page 1-5
- "Maintenance" on page 1-6

Description and Specifications

Agilent bakeable valves are designed for ultra-high vacuum systems with bakeout temperatures up to 890°F (450°C). All-metal valves give maximum sealing efficiency and reliability from atmospheric pressure to 10^{-11} mbar. These all-metal valves utilize the same sealing principle used in ConFlat®, Mini-ConFlat® flanges. A hard conical steel surface (the valve body) presses into a copper alloy gasket. The specific hardness of the gasket and its restraint result in a high interface pressure. During thermal cycling, the restraining feature counteracts the different rates of expansion and maintains the interface pressure necessary for a perfect seal (Figure 1-1).

Proper lubrication of the drive mechanism is necessary to prevent galling the thread.

Relubricate the valves:

- after every 1000 cycles at room temperature
- after every bakeout.

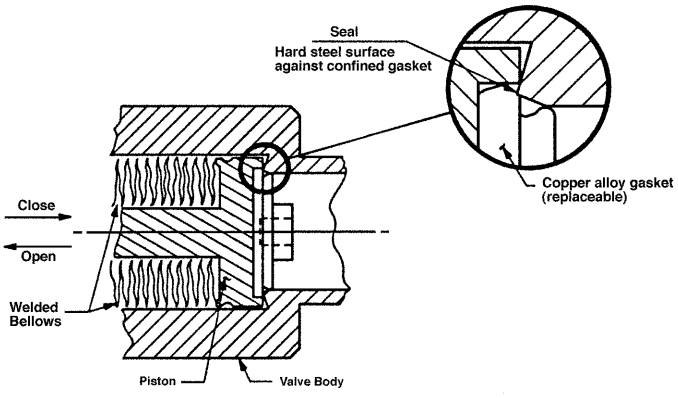


Figure 1-1 Sealing Principle

NOTE



Foreign particles may lodge in the seal area and create a leak path. High torques must then be applied to achieve complete sealing. Keep systems scrupulously clean to avoid particle contamination of the gasket.

Table 1-1 lists the valves covered in this manual.

Table 1-1 Valve Ordering Information

Part #	Size	Description
9515014	¾″ (15 mm) ID	Right-angle valve with NW 16 mini-CFF
9515027	1½″ (35 mm) ID	Right-angle valve with NW 35 CFF
9515017	1½″ (35 mm) ID	Tee valve with NW 35 CFF
9515052	1½″ (35 mm) ID	Straight-through valve with MW 35 CFF
9515032	2½″ (63 mm) ID	Right-angle valve with MW 63 CFF

Specifications

Table 1-2 list the valve specifications.

Table 1-2 Specifications

Valve Model Number				
Specification	**9515014**	**9515017 /9515027**	**9515052**	**9515032**
Pressure Range	ATM to 10^{-11} Torr			
Leak Free	5 x 10^{-11} Std. cc/sec helium			
Material				
Body	AISI 304 SST			
Bellows	AM350 welded SST	AISI 321/347 welded SST		
Main gasket	Copper alloy			
Bellows gasket	Silver–plated SST	–	–	–
Flange gasket	OHFC copper			
Bakeability (max)	400°C (750°F)	450°C (890°F)		
Conductance	5 l/sec	36 l/sec	22 l/sec	118 l/sec
Operating Position	Any orientation			

Table 1-2 Specifications (Continued)

Valve Model Number	
Drive Mechanism	Isolated from the vacuum system by a welded SST bellows
Lubrication	Fel-Pro C-102

Bakeout

The valves can be baked to temperatures up to 890°F (450°C) while in the closed or open position.

A dry gas or reduced pressure, for example, roughing pump evacuating a roughing line, is desirable to reduce oxidation of the bellows and copper alloy seat during bakeout, especially above 570°F (300° C).

NOTE



Outgassing studies show that bakeout of stainless steel from 150° C to 250°C reduces outgassing rates sufficiently for most ultrahigh vacuum work.

Closing Torques

All new metal valves have been given the initial torque, sealed with their proper torque, and leak-checked at the factory.

After baking and reclosing, an increase in closing torque may be needed to achieve a perfect seal on succeeding cycles. The maximum allowable closing torque may be exceeded after as few as 30 cycles, however, and a replacement gasket must be installed.

NOTE



If a valve is baked each time after reclosing, small leaks apparent before baking will close during bakeout. Therefore, refrain from increasing the closing torque prior to bakeout.

Refer to Table 1-3 on page 1-4 for valve closing torques.

Table 1-3 Closing Torque Values

Closing Torque	Valve ID		
	¾" (15mm)	1½" (35 mm)	2½" (63 mm)
Factory closing torque (min)	25 in-lb (0.29 kgm)	25 ft-lb (3.5 kgm)	45 ft-lb (6.2 kgm)
After bakeout	25 to 200 in-lb (0.29 to 2.30 kgm)	25 to 80 ft-lb (3.5 to 11.1 kgm)	45 to 152 ft-lb (6.2 to 21.0 kgm)
Maximum allowable torque	200 in-lb (2.30 kgm)	80 ft-lb (11.1 kgm)	152 ft-lb (21.0 kgm)
Torque to establish new seat	75 in-lb (0.86 kgm)	50 ft-lb (6.9 kgm)	75 ft-lb (10.4 kgm)

To apply closing torques:

1. Turn the socket head drive screw clockwise to the closed position. Apply torque (Table 1-3) for a new seal. Counteract the closing torque by holding the valve with an adjustable wrench.
2. Apply the same torque for each closure.

NOTE



Do not increase the closing torque unless leak-checking shows that the valve is not sealed. In that case, establish an increased closing torque for subsequent closures, as the greater force presses the valve seat further into the copper alloy gasket. This increases the area of contact and a greater force is required to achieve the necessary interface pressure for sealing.

Gasket Life

As the valve is exposed to high temperatures, the gasket becomes progressively annealed. This condition requires a deeper seal profile and a corresponding increase of torque closure.

When baked up to 750°F (400°C) for ¾" valves and 890°F (450°C) for 1½" and 2½" valves, gaskets must be changed after approximately 30 cycles. However, when operating at room temperature, hundreds of closure cycles are typical. Table 1-3 lists the torque levels for the different valves; replace the gasket when the maximum torque level is reached.

CAUTION



Do not exceed the maximum allowable torque values listed in Table 3-1, as the drive mechanism can be damaged.

Installation

Installation is comprised of:

- ❑ “Inspection”
- ❑ “Installation”

Inspection

Each valve is leak-checked in the open and closed positions prior to shipment. The valve is shipped in the closed position.

To inspect the valve:

1. Inspect for foreign matter and remove it with a compressed, clean, dry gas such as air, argon, helium, or nitrogen.
2. Inspect the ConFlat®, Mini-ConFlat® flange sealing surfaces for deep nicks or scratches. Nicks in the sealing edge deeper than 0.005” or radial scratches across the entire seal surface and edge can degrade the seal at bakeout temperatures.

Installation

To install:

1. Use a new copper gasket for each ConFlat®, Mini-ConFlat® flange seal.
2. Apply high temperature lubricant (Fel-Pro C-102) to the bolt threads.
3. Tighten each nut gradually and sequentially until the ConFlat flange faces mate together.

Maintenance

When the sealing force reaches the maximum allowable torque values listed in Table 1-3, replace the copper alloy gasket to avoid overstressing the drive threads.

Gasket Replacement – 15 mm ID (¾") Valve

Disassembly

To disassemble:

1. Open the valve, then remove the six bolts holding the bonnet to the body. If the valve is closed, extra stress is applied to the small retainer screws as the first screws are loosened.
2. Remove the drive and bonnet assembly.

NOTE *Avoid getting oxide flakes into the valve.*



3. Remove the copper alloy gasket from the piston as follows.
    a. Place the gasket removal tool over the gasket and turn the 8-32 screw into the tapped hole (Figure 1-2).

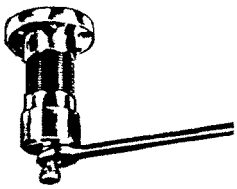


Figure 1-2 Gasket Removal Tool

    b. Turn the nut on the screw down against the removal tool.
    c. With a wrench, turn the nut further to exert a pulling force on the screw and thus on the valve gasket. This pulls the special alloy gasket out of the piston (Figure 1-3).

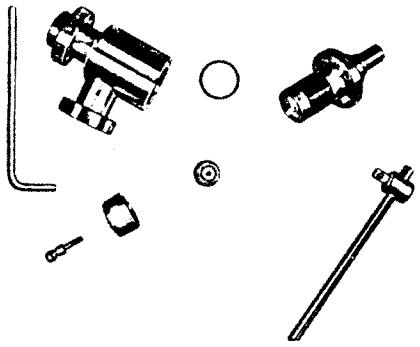


Figure 1-3 Gasket Replacement

Reassembly

To reassemble:

1. Insert a new gasket and press it into the piston by hand. Wear clean, lint-free gloves to avoid contaminating the gasket. Ensure that the gasket is not noticeably cocked (Figure 1-4).
2. Ensure that the seal area is free of particulate matter. Visually inspect at 3x magnification.

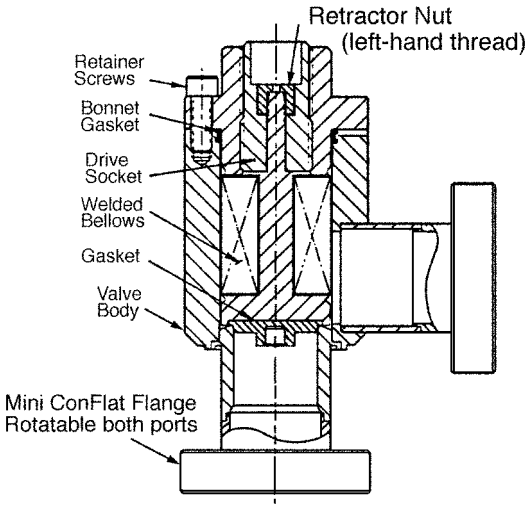


Figure 1-4 Cross-Section Drawing of ¾" (15 mm) Valve

3. Blow out the interior of the valve with dry gas.
4. Install the re-usable silver-plated bonnet gasket.
5. Install the retainer screws finger-tight.
6. Tighten the retainer screws with a standard Allen wrench. Firmly tighten but do not overtorque and therefore stretch the screws.

7. If needed, apply lubricant (Fel-Pro C-102) to the drive screw with some excess on the last two threads. The excess is pushed and spread into the bonnet threads as the drive screw is threaded in.
8. Apply lubricant to the under surface of the retractor nut.
9. Run the drive screw all the way down and back out. Check for smooth thread operation and inspect for complete coverage with lubricant inside the bonnet.
10. Install and lightly tighten the retractor nut with a screwdriver. This nut is self-tightening in operation.

NOTE

The retractor nut has left-hand threads; it is tightened in the counterclockwise direction.

11. Using the T wrench, gently close the valve to concentrically seal the gasket.
12. Open the valve fully and remove any copper chips using a foam Q-tip wet with alcohol, then blow-dry the valve with dry gas.
13. Establish the seat in the gasket by closing the valve with 75 in.-lb torque. Successive closures can be made beginning at 25 in.-lb.

Gasket Replacement – 35 mm ID (1½") Straight-through, and 63 mm ID (2½") Valves

Refer to Figure 1-5 for this procedure.

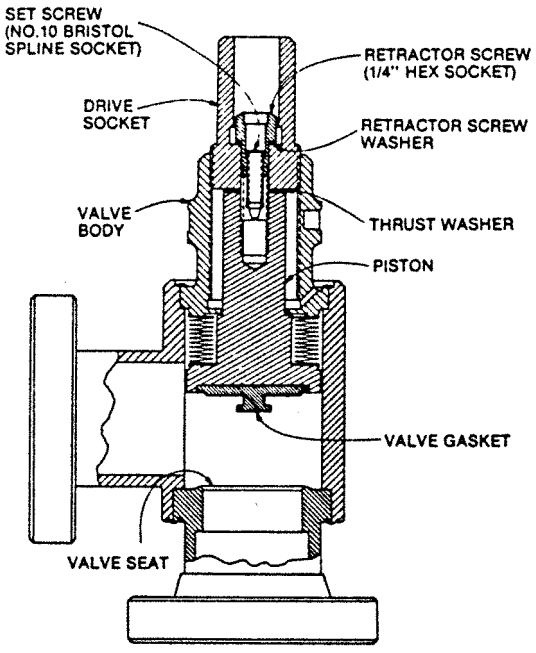


Figure 1-5 Cross-Section Drawing of 1½" (35 mm) and 2½" (63 mm) Valves

Disassembly

To disassemble:

1. Disconnect the side port flange to allow insertion of the gasket removal tool (Figure 1-6).
2. Open the valve until the tool notch can engage with the gasket boss. Make certain that the tool is fully inserted.
3. Continue opening the valve until the gasket pops free from the piston.

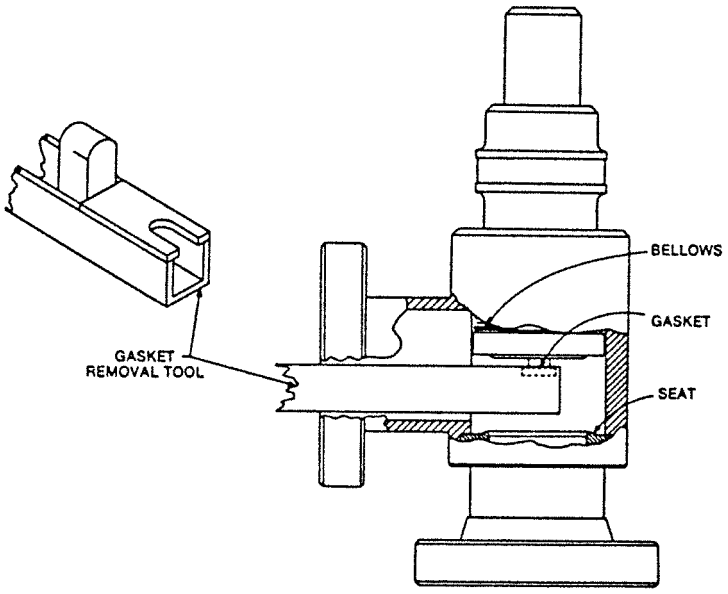


Figure 1-6 Gasket Replacement, 35-mm (1½") and 63 mm (2½") Valves

NOTE

Do not weld tubing to the side port of valves purchased without side port flanges. Such tubing prohibits access for gasket replacement.

Reassembly

To reassemble:

1. Insert the new gasket and press it into the piston by hand. Wear clean, lint-free gloves to avoid contaminating the gasket. Ensure that the gasket in the piston is not cocked in the piston face.
2. Blow out the interior of the valve with dry gas to assure cleanliness of the gasket.
3. Using the extractor tool, gently close the valve to concentrically seal the gasket.
4. Open the valve fully and remove any copper chips generated in step 3 using a foam Q-tip wet with alcohol, then blow-dry the valve with dry gas.

5. Establish the seat in the gasket by closing the valve with 50 ft-lb for the 1½″ valve, 75 ft.-lb torque for the 2½″ valve. Successive closures can be made beginning at 20 ft-lb for the 1½″ valve, 45 ft.-lb for the 2½″ valve.
6. Inspect the valve to see that the gasket lifts correctly from the valve seat when the valve is opened.

Lubricating the Drive Mechanism

It is not necessary to lubricate the drive mechanism in routine use. A permanent lubricating coating is baked onto the thread surfaces, eliminating this need. If, however, the coating of lubrication wears off, follow this procedure to re-lubricate the drive mechanism after every bakeout or 1000 cycles at room temperature. Relubrication as directed is necessary primarily to restore a fluid film for maximum drive efficiency, and secondly to replace any Fel-Pro C-102 which may have been worn off the mating surfaces.

After the valve has been baked in the open position, remove the drive screw and lubricate before applying sealing torque to the valve. After the valve has been baked in the closed position, relubricate it when it is opened for the first time. Apply the minimum amount of Fel-Pro C-102 that produces a thin, uniform film over all thread surfaces.

Disassembly

To disassemble:

1. Close the valve if it is to be lubricated while under vacuum. This prevents the piston from being forced against the seat by atmospheric pressure when the retractor screw is removed. If the valve is not under vacuum, it can be open or closed during lubrication.

NOTE



A few drops of light machine oil aides in disassembly following bakeout.

CAUTION



Avoid excessive use of oil because it flushes lubricant into the bellows. Damage can result from lubricant packing between the flexing members.

2. Loosen the retractor nut with a screwdriver (turn it clockwise; it has left-hand threads). Remove the retractor nut with a pick or fine tweezers.
3. Unscrew the drive screw and remove it from the valve.

Lubrication and Reassembly

Refer to Figure 1-7 for this procedure.

To lubricate and reassemble:

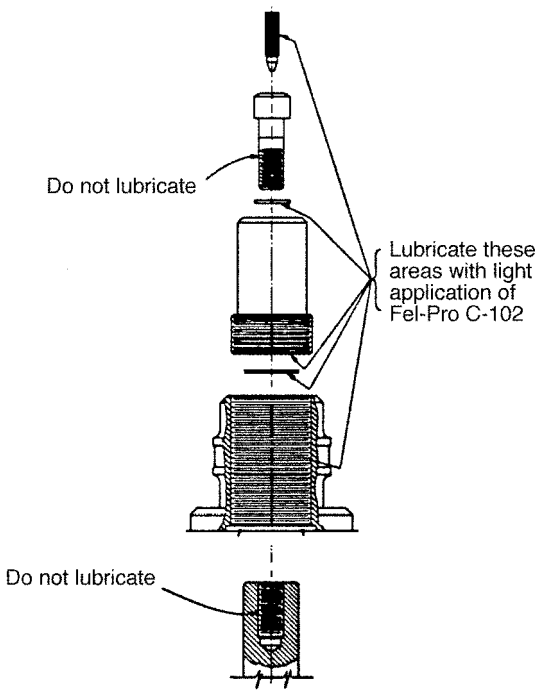


Figure 1-7 Threads and Washer Lubrication of 35 and 63 mm Valves

1. Remove excess lubricant crust from all threads and drive surfaces with a fine wire brush and blow off particles. Ensure that no wire bristles from the brush remain in the valve or its components.

NOTE

The lubricant baked onto the thread surfaces is an effective lubricant. Do not clean it down to the bare metal. Relubrication is needed to replenish areas where the lubricant has been worn off.

2. Apply Fel-Pro C-102 lubricant to the threads inside the bonnet. Use a strip of sheet metal or plastic approximately 1/8″ wide as an applicator.
    a. Squeeze a bead of Fel-Pro C-102 lubricant 1/16″ x 1/4″ long onto the end of the applicator.
    b. Wipe the lubricant onto the bottom threads at one location. The lubricant is spread around by the drive screw as it is installed.
    c. Thorougly lubricate the bottom threads so that they support high closing stress.

Leak Check

If normal pressure versus time is not achieved when evacuating the system, check for leaks with a mass spectrometer leak detector.

Avoid increasing torque on the valve unless a leak has been positively located.

Parts Lists

Table 1-4 lists replacement parts and accessories.

Table 1-4 Replacement Parts and Accessories

Part Number	Description
¾″ (15mm) ID Valves	
9620013	Repair Kit containing screw, retractor nut, main copper gasket, silver-plated gasket, high temp anti-sieze lubricant
9530079	Main Copper Gasket (2/pkg)
9530080	Silver–plated Gasket (2/pkg)
9530031	High Temperature Anti-sieze Lubricant
Q2736301	Gasket Removal Tool
1½″ (35mm) ID Valves	
9620012	Repair Kit containing screw, set screw, retractor screw, washer, washer (115/32" diameter), main gasket, high temp anti-sieze lubricant
9535033	Main Gasket (3/pkg)
9530031	High Temp Anti-sieze Lubricant (3/pkg)
Q2727301	Gasket Removal Tool
2½″ (63mm) ID Valves	
Q2721301	Repair Kit containing gasket, wire brush, high temp anti-sieze lubricant, spline wrench, hex key wrench
9535039	Gasket (1/pkg)
9530031	High Temp Anti-sieze Lubricant
Q2722301	Gasket Removal Tool

Agilent Technologies

Vacuum Products Division
Instructions for returning products

Dear Customer:

Please follow these instructions whenever one of our products needs to be returned.

1) Complete the attached Request for Return form and send it to Agilent Technologies (see below), taking particular care to identify all products that have pumped or been exposed to any toxic or hazardous materials.

2) After evaluating the information, Agilent Technologies will provide you with a Return Authorization (RA) number via email or fax, as requested.
Note: Depending on the type of return, a Purchase Order may be required at the time the Request for Return is submitted. We will quote any necessary services (evaluation, repair, special cleaning, eg).

3) **Important steps for the shipment of returning product:**
   - Remove all accessories from the core product (e.g. inlet screens, vent valves).
   - Prior to shipment, drain any oils or other liquids, purge or flush all gasses, and wipe off any excess residue.
   - If ordering an Advance Exchange product, **please use the packaging from the Advance Exchange to return the defective product.**
   - Seal the product in a plastic bag, and package product carefully to avoid damage in transit. You are responsible for loss or damage in transit.
   - Agilent Technologies is not responsible for returning customer provided packaging or containers.
   - **Clearly label package with RA number**. Using the shipping label provided will ensure the proper address and RA number are on the package. Packages shipped to Agilent without a RA clearly written on the outside cannot be accepted and will be returned.

4) Return only products for which the RA was issued.

5) **Product being returned under a RA must be received within 15 business days.**

6) **Ship to the location specified on the printable label, which will be sent, along with the RA number, as soon as we have received all of the required information.** Customer is responsible for freight charges on returning product.

7) Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.

RETURN THE COMPLETED **REQUEST FOR RETURN** FORM TO YOUR NEAREST LOCATION:

EUROPE:	**NORTH AMERICA:**	**PACIFIC RIM:**
Fax: 00 39 011 9979 330		
Fax Free: 00 800 345 345 00	Fax: 1 781 860 9252	please visit our website for individual
Toll Free: 00 800 234 234 00	Toll Free: 800 882 7426, Option 3	office information
vpt-customercare@agilent.com	vpl-ra@agilent.com	http://www.agilent.com

Agilent Technologies

Vacuum Products Division
Request for Return Form
(Health and Safety Certification)

Please read important policy information on Page 3 that applies to all returns.

1) CUSTOMER INFORMATION

Company Name:	**Contact Name:**
Tel: **Email:**	**Fax:**
Customer Ship To:	**Customer Bill To:**
Europe only: **VAT reg. Number:**	USA/Canada only: ☐ **Taxable** ☐ **Non-taxable**

2) PRODUCT IDENTIFICATION

Product Description	Agilent P/N	Agilent S/N	Original Purchasing Reference

3) TYPE OF RETURN (**Choose one from each row** and supply Purchase Order if requesting a billable service)

3A. ☐ Non-Billable ☐ Billable ➡ New PO # (hard copy must be submitted with this form):

3B. ☐ Exchange ☐ Repair ☐ Upgrade ☐ Consignment/Demo ☐ Calibration ☐ Evaluation ☐ Return for Credit

4) HEALTH and SAFETY CERTIFICATION

AGILENT TECHNOLOGIES CANNOT ACCEPT ANY PRODUCTS CONTAMINATED WITH BIOLOGICAL OR EXPLOSIVE HAZARDS, RADIOACTIVE MATERIAL, OR MERCURY AT ITS FACILITY.
Call Agilent Technologies to discuss alternatives if this requirement presents a problem.

The equipment listed above (check one):

☐ **HAS NOT** pumped or been exposed to any toxic or hazardous materials. OR
☐ **HAS** pumped or been exposed to the following toxic or hazardous materials. If this box is checked, the following information must also be filled out. Check boxes for all materials to which product(s) pumped or was exposed:

☐ Toxic ☐ Corrosive ☐ Reactive ☐ Flammable ☐ Explosive ☐ Biological ☐ Radioactive

List all toxic/hazardous materials. Include product name, chemical name, and chemical symbol or formula:

_____

NOTE: If a product is received at Agilent which is contaminated with a toxic or hazardous material that was not disclosed, **the customer will be held responsible** for all costs incurred to ensure the safe handling of the product, and **is liable** for any harm or injury to Agilent employees as well as to any third party occurring as a result of exposure to toxic or hazardous materials present in the product.

Print Name: **Authorized Signature: .....** **Date:**

5) FAILURE INFORMATION:

Failure Mode (REQUIRED FIELD. See next page for suggestions of failure terms):
Detailed Description of Malfunction: (Please provide the error message)
Application (system and model):

I understand and agree to the terms of Section 6, Page 3/3.
Print Name: **Authorized Signature: .....** **Date:**

Agilent Technologies

Vacuum Products Division
Request for Return Form
(Health and Safety Certification)

Please use these Failure Mode to describe the concern about the product on Page 2.

TURBO PUMPS and TURBO CONTROLLERS

APPARENT DEFECT/MALFUNCTION		POSITION	PARAMETERS	
- Does not start	- Noise	- Vertical	Power:	Rotational Speed:
- Does not spin freely	- Vibrations	-Horizontal	Current:	Inlet Pressure:
- Does not reach full speed	-Leak	-Upside-down	Temp 1:	Foreline Pressure:
- Mechanical Contact	-Overtemperature	-Other:	Temp 2:	Purge flow:
- Cooling defective	-Clogging	.....	OPERATING TIME:	

ION PUMPS/CONTROLLERS

- Bad feedthrough	- Poor vacuum
- Vacuum leak	- High voltage problem
- Error code on display	- Other

VALVES/COMPONENTS

- Main seal leak	- Bellows leak
- Solenoid failure	- Damaged flange
- Damaged sealing area	-Other

LEAK DETECTORS

- Cannot calibrate	-No zero/high backround
- Vacuum system unstable	- Cannot reach test mode
- Failed to start	- Other

INSTRUMENTS

- Gauge tube not working	- Display problem
- Communication failure	- Degas not working
- Error code on display	- Other

SCROLL AND ROTARY VANE PUMPS

- Pump doesn't start	- Noisy pump (describe)
- Doesn't reach vacuum	- Over temperature
- Pump seized	- Other

DIFFUSION PUMPS

- Heater failure	- Electrical problem
- Doesn't reach vacuum	- Cooling coil damage
- Vacuum leak	- Other

Section 6) *ADDITIONAL TERMS*

Please read the terms and conditions below as they apply to all returns and are in addition to the Agilent Technologies Vacuum Product Division – Products and Services Terms of Sale.

- Customer is responsible for the freight charges for the returning product. Return shipments must comply with all applicable **Shipping Regulations** (IATA, DOT, etc.) and carrier requirements.
- Customers receiving an Advance Exchange product agree to return the defective, rebuildable part to Agilent Technologies **within 15 business days**. Failure to do so, or returning a non-rebuildable part (crashed), will result in an invoice for the non-returned/non-rebuildable part.
- Returns for credit toward the purchase of new or refurbished Products are subject to prior Agilent approval and may incur a restocking fee. Please reference the original purchase order number.
- Units returned for evaluation will be evaluated, and a quote for repair will be issued. If you choose to have the unit repaired, the cost of the evaluation will be deducted from the final repair pricing. A Purchase Order for the final repair price should be issued within 3 weeks of quotation date. Units without a Purchase Order for repair will be returned to the customer, and the evaluation fee will be invoiced.
- A Special Cleaning fee will apply to all exposed products per Section 4 of this document.
- If requesting a calibration service, units must be functionally capable of being calibrated.

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