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vacuum technologies

UHV All-Metal Bakeable Valves

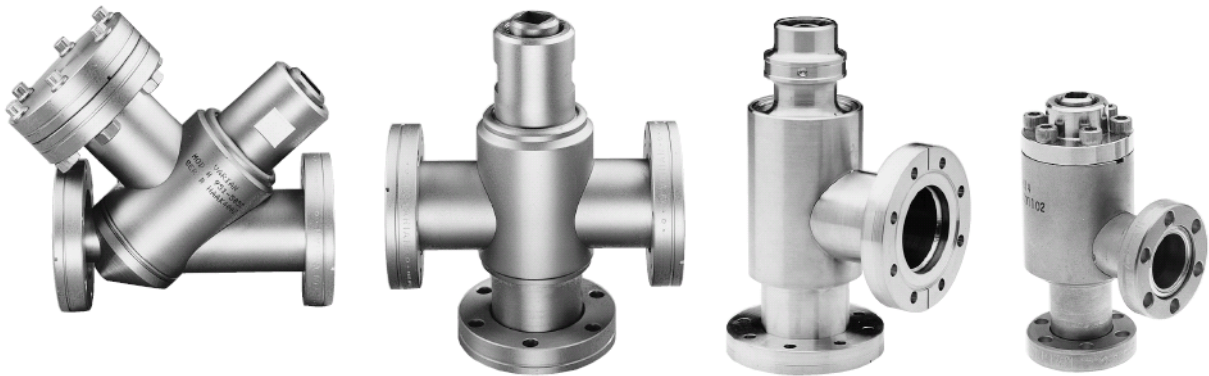
INSTRUCTION MANUAL

Manual No. 699912010

Revision E

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UHV All-Metal Bakeable Valves



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.

Reasonable care must be used to avoid hazards. Seller expressly disclaims responsibility for loss or damage caused by use of its Products other than in accordance with proper operating procedures.

Except as stated herein, Seller makes no warranty, express or implied (either in fact or by operation of law), statutory or otherwise; and, except as stated herein, Seller shall have no liability under any warranty, express or implied (either in fact or by operation of law), statutory or otherwise. Statements made by any person, including representatives of Seller, which are inconsistent or in conflict with the terms of this warranty shall not be binding upon Seller unless reduced to writing and approved by an officer of Seller.

Warranty Replacement and Adjustment

All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto, and must be received within the applicable warranty period by Seller or its authorized representative. Such claims should include the Product serial number, the date of shipment, and a full description of the circumstances giving rise to the claim. Before any Products are returned for repair and/or adjustment, written authorization from Seller or its authorized representative for the return and instructions as to how and where these Products should be returned must be obtained. Any Product returned to Seller for examination shall be prepaid via the means of transportation indicated as acceptable by Seller. Seller reserves the right to reject any warranty claim not promptly reported and any warranty claim on any item that has been altered or has been returned by non-acceptable means of transportation. When any Product is returned for examination and inspection, or for any other reason, Customer shall be responsible for all damage resulting from improper packing or handling, and for loss in transit, notwithstanding any defect or non-conformity in the Product. In all cases, Seller has the sole responsibility for determining the cause and nature of failure, and Seller's determination with regard thereto shall be final.

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 Vacuum Technologies. 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 Vacuum Technologies 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 Vacuum Technologies

In the United States, you can contact Vacuum Technologies Customer Service at 1-800-8VARIAN.

Internet users:

- Send email to Customer Service & Technical Support at vpl.customer.support@varianinc.com
- Visit our web site at www.varianinc.com/vacuum
- Order on line at www.varianinc.com

See the back cover of this manual for a listing of our sales and service offices.

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

Vacuum Technologies 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.

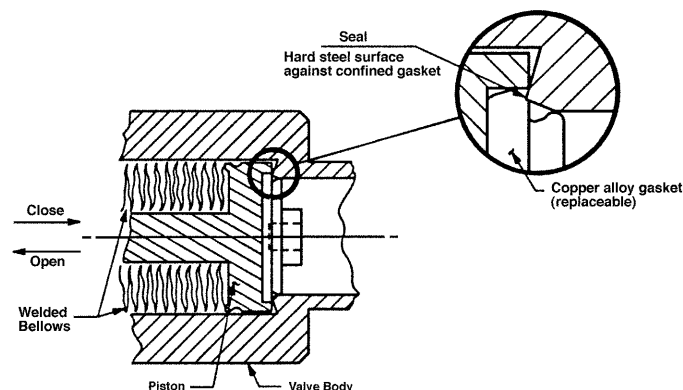


Figure 1-1 Sealing Principle

UHV All-Metal Bakeable Valves



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			
<i>Material</i>				
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			

UHV All-Metal Bakeable Valves

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).



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.



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.

UHV All-Metal Bakeable Valves

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.



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.



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 (3/4") 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.



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).

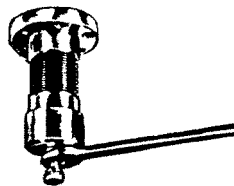


Figure 1-2 Gasket Removal Tool

- 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).

UHV All-Metal Bakeable Valves

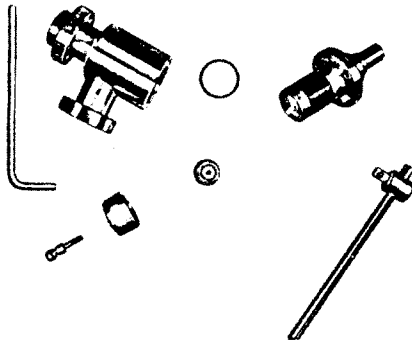


Figure 1-3 Gasket Replacement

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.

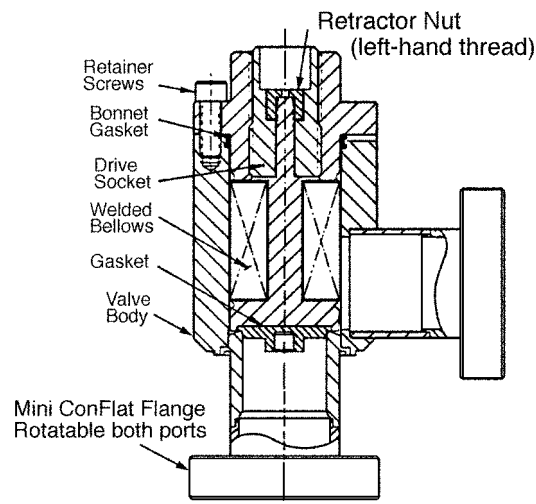


Figure 1-4 Cross-Section Drawing of 3/4" (15 mm) Valve

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.

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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.



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.

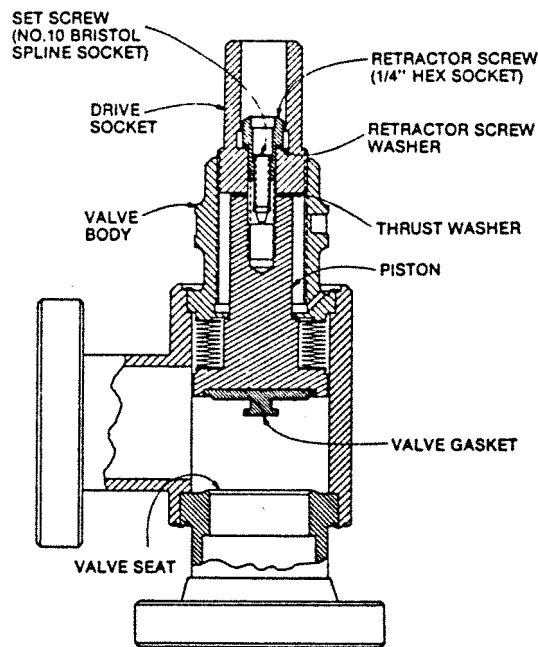


Figure 1-5 Cross-Section Drawing of 1½” (35 mm) and 2½” (63 mm) Valves

UHV All-Metal Bakeable 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.

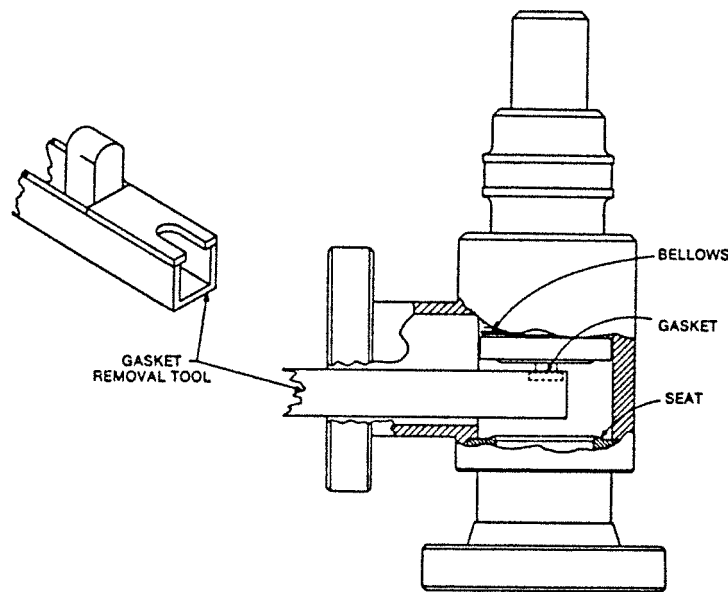


Figure 1-6 Gasket Replacement, 35-mm (1½”) and 63 mm (2½”) Valves



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.

UHV All-Metal Bakeable Valves

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.



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



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:

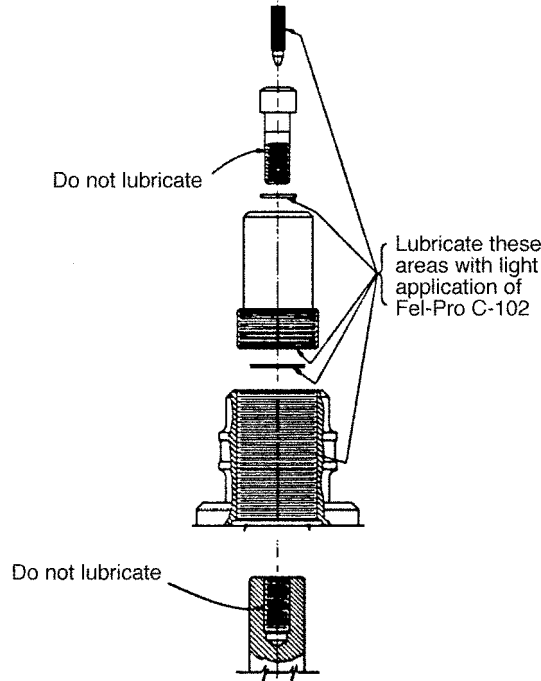


Figure 1-7 Threads and Washer Lubrication of 35 and 63 mm Valves

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.



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. Thoroughly lubricate the bottom threads so that they support high closing stress.

UHV All-Metal Bakeable Valves

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



*Request for Return
Health and Safety Certification*



- Return authorization numbers (RA#) **will not** be issued for any product until this Certificate is completed and returned to a Varian, Inc. Customer Service Representative.
- Pack goods appropriately and drain all oil from rotary vane and diffusion pumps (for exchanges please use the packing material from the replacement unit), making sure shipment documentation and package label clearly shows assigned Return Authorization Number (RA#) VVT cannot accept any return without such reference.
- Return product(s) to the nearest location:

North and South America

Varian, Inc.
Vacuum Technologies
121 Hartwell Ave.
Lexington, MA 02421
Fax: (781) 860-9252

Europe and Middle East

Varian S.p.A.
Via F.lli Varian, 54
10040 Leini (TO) – ITALY
Fax: (39) 011 997 9350

Asia and ROW

Varian Vacuum Technologies
Local Office

For a complete list of phone/fax numbers see www.varianinc.com/vacuum

- If a product is received at Varian, Inc. in a contaminated condition, **the customer is held responsible** for all costs incurred to ensure the safe handling of the product, and **is liable** for any harm or injury to Varian, Inc. employees occurring as a result of exposure to toxic or hazardous materials present in the product.

<i>CUSTOMER INFORMATION</i>		
Company name:		
Contact person: Name:	Tel:.....	
Fax:	E-mail:	
Ship method:	Shipping Collect #:	P.O.#:
Europe only: VAT Reg Number:	USA only: <input type="checkbox"/> Taxable <input type="checkbox"/> Non-taxable	
Customer ship to:	Customer bill to:	
.....	
.....	

PRODUCT IDENTIFICATION

Product Description	Varian, Inc. Part Number	Varian, Inc. Serial Number

TYPE OF RETURN (check appropriate box)

<input type="checkbox"/> Paid Exchange	<input type="checkbox"/> Paid Repair	<input type="checkbox"/> Warranty Exchange	<input type="checkbox"/> Warranty Repair	<input type="checkbox"/> Loaner Return
<input type="checkbox"/> Credit	<input type="checkbox"/> Shipping Error	<input type="checkbox"/> Evaluation Return	<input type="checkbox"/> Calibration	<input type="checkbox"/> Other

HEALTH and SAFETY CERTIFICATION

VACUUM TECHNOLOGIES CANNOT ACCEPT ANY BIOLOGICAL HAZARDS, RADIOACTIVE MATERIAL, ORGANIC METALS, OR MERCURY AT ITS FACILITY. CHECK ONE OF THE FOLLOWING:		
<input type="checkbox"/> I confirm that the above product(s) has (have) NOT pumped or been exposed to any toxic or dangerous materials in a quantity harmful for human contact.		
<input type="checkbox"/> I declare that the above product(s) has (have) pumped or been exposed to the following toxic or dangerous materials in a quantity harmful for human contact (<u>Must be filled in</u>):		
Print Name.....	Signature	Date

PLEASE FILL IN THE FAILURE REPORT SECTION ON THE NEXT PAGE

Do not write below this line

Notification (RA) #: Customer ID #: Equipment #:



FAILURE REPORT

(Please describe in detail the nature of the malfunction to assist us in performing failure analysis):

TURBO PUMPS AND TURBOCONTROLLERS

Claimed Defect	Position	Parameters
<input type="checkbox"/> Does not start <input type="checkbox"/> Does not spin freely <input type="checkbox"/> Does not reach full speed <input type="checkbox"/> Mechanical Contact <input type="checkbox"/> Cooling defective <input type="checkbox"/> Noise <input type="checkbox"/> Vibrations <input type="checkbox"/> Leak <input type="checkbox"/> Overtemperature <input type="checkbox"/> Clogging	<input type="checkbox"/> Vertical <input type="checkbox"/> Horizontal <input type="checkbox"/> Upside-down <input type="checkbox"/> Other	Power: Rotational Speed: Current: Inlet Pressure: Temp 1: Foreline Pressure: Temp 2: Purge flow: Operation Time:
Describe Failure:		
Turbocontroller Error Message:		

ION PUMPS/CONTROLLERS

<input type="checkbox"/> Bad feedthrough <input type="checkbox"/> Vacuum leak <input type="checkbox"/> Error code on display <input type="checkbox"/> Poor vacuum <input type="checkbox"/> High voltage problem <input type="checkbox"/> Other
Describe failure:
Customer application:

VALVES/COMPONENTS

<input type="checkbox"/> Main seal leak <input type="checkbox"/> Solenoid failure <input type="checkbox"/> Damaged sealing area <input type="checkbox"/> Bellows leak <input type="checkbox"/> Damaged flange <input type="checkbox"/> Other
Describe failure:
Customer application:

LEAK DETECTORS

<input type="checkbox"/> Cannot calibrate <input type="checkbox"/> Vacuum system unstable <input type="checkbox"/> Failed to start <input type="checkbox"/> No zero/high background <input type="checkbox"/> Cannot reach test mode <input type="checkbox"/> Other
Describe failure:
Customer application:

INSTRUMENTS

<input type="checkbox"/> Gauge tube not working <input type="checkbox"/> Communication failure <input type="checkbox"/> Error code on display <input type="checkbox"/> Display problem <input type="checkbox"/> Degas not working <input type="checkbox"/> Other
Describe failure:
Customer application:

ALL OTHER VARIAN, INC.

<input type="checkbox"/> Pump doesn't start <input type="checkbox"/> Doesn't reach vacuum <input type="checkbox"/> Pump seized <input type="checkbox"/> Noisy pump (describe) <input type="checkbox"/> Overtemperature <input type="checkbox"/> Other
Describe failure:
Customer application:

DIFFUSION PUMPS

<input type="checkbox"/> Heater failure <input type="checkbox"/> Doesn't reach vacuum <input type="checkbox"/> Vacuum leak <input type="checkbox"/> Electrical problem <input type="checkbox"/> Cooling coil damage <input type="checkbox"/> Other
Describe failure:
Customer application:

Sales and Service Offices

Argentina

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3956 CP Leersum
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Sao Paulo 04548 005
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Fax: (55) 11 3845 9350

Canada

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121 Hartwell Avenue
Lexington, MA 02421
USA
Tel: (781) 861 7200
Fax: (781) 860 5437
Toll Free: (800) 882 7426

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