



Agilent Technologies

Vacuum Products Division

VS Harsh Environment Probe

INSTRUCTION MANUAL

Manual No. G8600-90001

Revision A

September 2012

VS HE Probe

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.

3/1/00

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Request for Return Health and Safety Certification

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Preface

This manual gives the procedure for installation and operation of the Harsh Environment (HE) Probe with the VS leak detector.

Hazard and Safety Information

This manual uses the following standard safety protocols:

WARNING



The warning messages are for attracting the attention of the operator to a particular procedure or practice which, if not followed correctly, could lead to serious injury.

CAUTION



The caution messages are displayed before procedures, which if not followed, could cause damage to the equipment.

NOTE



The notes contain important information.

Operators and service personnel must be aware of all hazards associated with this equipment. They must know how to recognize hazardous and potentially hazardous conditions, and know how to avoid them. The consequences of unskilled, improper, or careless operation of the equipment can be serious. Every operator or service person must read and thoroughly understand operation/maintenance manuals and any additional information provided by Agilent. All warning and cautions must be read carefully and strictly observed. Consult local, state, and national agencies regarding specific requirements and regulations. Address any safety, operation, and/or maintenance questions to your nearest Agilent office.

Contacting Agilent

In the United States, you can contact Customer Service at 1 800 882 7426.

Internet users:

- ❑ Send email to Customer Service & Technical Support at vpl.customercare@agilent.com
- ❑ Visit our web site at www.agilent.com

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

Introduction

The VS Harsh Environment (HE) Probe enables helium leak testing in hot, wet applications, such as the condenser system of an electrical power generation facility, without the need for dryers, chillers, a secondary vacuum pump, or throttling valves. The patent-pending probe is specifically designed to operate with Agilent's VS Series leak detectors. Together with the VS wireless remote control and VS graphic leak rate display, they deliver superior leak testing capability for large power plants.

The probe consists of a corrosion resistant stainless steel tube with a composite permeable membrane at its tip. The membrane readily permeates helium tracer gas used for leak testing while protecting the leak detector from water vapor that would destroy the pumps, valves, and spectrometers. For maximum sensitivity, the probe is designed to be installed in the condenser piping upstream from the vacuum pump(s) or alternately, the probe is inserted directly into the vacuum pump(s) exhaust used to evacuate the condenser system.

Probe Installation

1. Remove the probe from the packaging. Connect the probe to the hose fitting and tighten firmly to ensure it is leak tight (Figure 1). Tighten the hose coupling nut finger-tight, then using two wrenches, tighten the coupling nut 1-1/4 additional turns.

CAUTION

Overtightening the coupling nut can damage the hose.

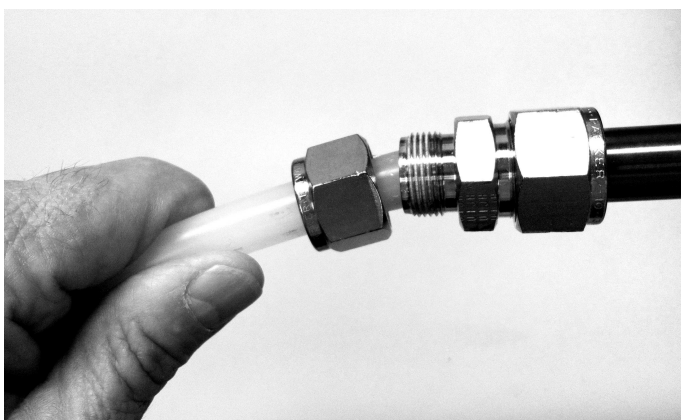


Figure 1 Probe Connection

VS HE Probe

2. Connect the probe assembly to the leak detector inlet via a standard ISO-25 flange (also known as NW25) with the temperature resistant hose (Figure 2).

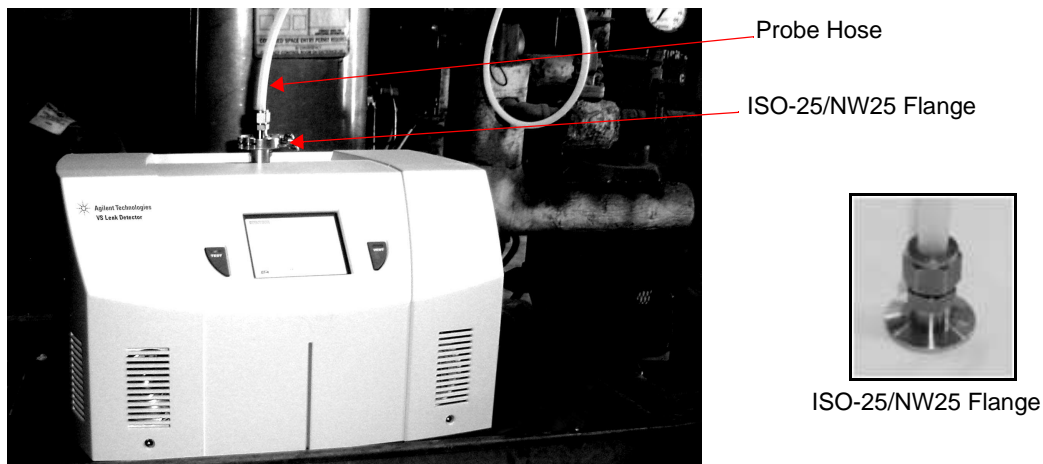


Figure 2 Connection To The Leak Detector

WARNING



Use appropriate precautions when connecting the HE probe to piping of a plant facility. The pipes could be extremely hot and contain heated water or hot steam.

3. Connect the stainless steel probe tube (Figure 3) to the condenser system using appropriate hardware to fit the local installation. The probe tube has an adjustable (sliding) ISO-25/NW25 flange adaptable to a wide variety of ASA or ISO flanges, threaded pipe adaptors, etc. for easy connection to condenser piping (See Figure 7 on page 10).

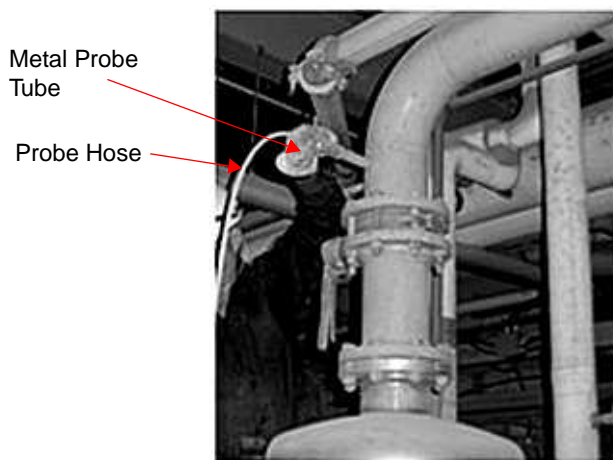


Figure 3 Connection To The System



For peak helium sensitivity, install the probe in the vacuum piping just in front of the system vacuum pump(s). The density of gas molecules is low in vacuum, which enables helium to travel rapidly through a leak, along the pipe and into the detector. The maximum gas flow in any pipe is near the center while gas flow at the wall is nearly zero due to wall friction. Helium tracer gas is therefore concentrated in the high flow region near the center of the pipe so maximum leak sensitivity is found with the probe tip positioned near the center of the vacuum pipe. Sensitivity is low if the probe tip is positioned near the pipe inner wall or in a lateral port.

4. Slide the adapter flange (Figure 4) up or down the stainless steel tube to position the probe tip near the center of the vacuum pipe (running from the condenser to the vacuum pumping system) to achieve maximum leak test sensitivity. To move the adaptor fitting on the probe tube, loosen the compression ring, slide the adaptor fitting to the desired position on the probe tube and retighten the compression ring hand-tight.



Figure 4 Probe Head

Alternately, remove the adaptor flange and insert the probe directly into the vacuum pump(s) exhaust used to evacuate the condenser system (See Figure 7 on page 10).

The probe assembly uses rugged, industry-standard fittings so component lengths can be optimized for each installation. For example:

- ❑ Cut the probe tube shorter using a commercial tube cutter. De-burr the cut tube end before reconnecting the hose fitting and always use a new compression ferrule on the metal tube end. The recommended minimum probe tube length is 150 millimeters (6").
- ❑ When reconnecting hose compression fittings, use new front and back ferrules. Cut the hose squarely just behind the old ferrules to remove them. Install new ferrules and reconnect using the tightening procedure in step 1.
- ❑ Cut the hose to any convenient length and reconnect it using the compression fittings. In general, the shorter the hose length, the faster the leak response with faster recovery from a large helium dose.
- ❑ Extend the hose, if required, up to a recommended maximum of 15 meters (50'). Helium response time will be slightly longer with a longer hose and recovery time will be noticeably longer. Hose lengths in excess of 15 meters (50') are possible, but may result in undesirable response and clean up times.

- ❑ When used in the pump exhaust of two-pump installations, two probes can be connected together in parallel using a compression tee and a second probe assembly. (See Figure 8 on page 11).

Probe Operation

Agilent can provide in-depth technical assistance for set up and operation of the probe, or for help with your leak testing methodology. Contact your local Agilent Sales Engineer or Agilent Technical Support for assistance.

CAUTION



The VS HE Probe is designed to perform optimally with Agilent's VS Series Leak Detectors. Performance with other leak testing equipment may not deliver acceptable results.

To leak test with the HE probe assembly:

1. Connect the hose flange to the VS inlet port and the metal probe to the system.
2. Remove the plastic protective cap and connect the probe to the system.
3. Operate the VS leak detector per the QUICKSTART CARD or the VS Operator's Manual.
4. Spray helium tracer gas around the outside of the condenser joints and pipes. Helium leaking into the condenser manifold is detected and reported by the VS leak detector.

NOTE



The displayed leak rate readings represent only a sampling of the helium that has leaked into the system. This is an effective method to locate leaks and give a relative leak size, however the displayed leak rate is a qualitative indication and is not the actual leak size.

The probe substantially blocks air as well as water vapor so the inside of the probe is at a low vacuum pressure, typically E-03 mbar/Torr (E-01 Pa) depending on temperature, so helium can readily flow through the probe tip and into the leak detector.

CAUTION



The probe assembly can tolerate a wide temperature range, however, it is recommended that if a probe has been stored at an extremely cold temperature, permit it to warm to ambient before exposing it to extremely hot gas or bending the hose in a small radius. Industrial high density polyethylene hose is recommended to withstand the external force on the evacuated hose at elevated temperature. The wide range of temperature that the probe assembly can tolerate is greater than for the VS leak detector.

Leak Testing with the HE Probe

1. The graphic display screen is extremely effective for leak testing in power plants due to the large pipe volumes and long distances helium must travel in order to be detected. You can see leak indications versus time to help pin point a leak location. Once the leak is fixed and helium is sprayed again, you know how long to wait to be sure it is fixed.
2. The wireless remote control (Figure 5) is used to simplify leak testing in large plants. Wireless control gives you freedom to walk through the plant spraying helium on joints while the leak detector remains connected to the condenser system. You can continuously monitor leak response on the wireless display screen or via the remote audio signal. Refer to the wireless remote control section of the *VS Operations Manual* (6999-09-943) for more information.



Figure 5 Wireless Remote Control

3. Leak Test Data Wizard software (Figure 6) enables real-time viewing of leak information with a test log of results versus time. Data can also be captured and stored for later review, or downloaded to a spreadsheet for analysis offline or for archiving. The Leak Test Data Wizard software is installed on any laptop or PC and connected directly to the VS leak detector.

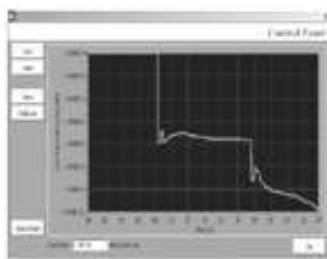


Figure 6 Leak Test Data Wizard Software

4. When ready to leak test, press the **Test** button to begin and the VS system progresses through ROUGHING to TEST and to FINE TEST until it reaches baseline. This typically is in the E-11 range or higher, depending on the condenser helium background. The best test sensitivity is achieved in FINE TEST.
5. ROUGHING indicates the system is pumping air from the probe and hose in order to begin testing. Once the system reaches the transfer pressure of 1 Torr (133 Pa) default, 10 Torr (1333 Pa) maximum, it progresses to TEST and the system is ready for leak testing.

6. When the VS reaches a leak rate of $1\text{E-}07$ atm-cc/second or less and a test probe internal pressure of $1\text{E-}01$ mbar/Torr (10 Pa), the VS transfers into FINE TEST mode. If the condenser helium background is very high (above $1\text{E-}07$ atm-cc/sec) the VS system will not transfer into FINE TEST mode until the helium background has pumped away or the background is suppressed by ZEROING (see step 10 below). Leak testing operations can continue in TEST mode with slightly reduced leak sensitivity.
7. The VS test port probe pressure appears in black characters just below the leak rate and is labeled *TP Pressure*. Since the VS is only pumping the volume of the probe and hose, the test port vacuum pressure rapidly pumps down to approximately $5\text{E-}03$ mbar/Torr ($5\text{E-}01$ Pa) or less.
If the probe has been exposed to humid air, it may take several minutes to pump away condensed water vapor from inside the hose and achieve that pressure.
8. If the test port vacuum pressure does not achieve E-03 range, use the VS system to check the tightness of the hose fittings. A simple way to leak test the hose is to place the probe tip in a small container of water to shield it from atmospheric helium. Then lightly spray helium on each fitting and watch for a leak indication on the VS display. If a leak is identified, typically, tightening the hose coupling nut by $1/8$ to $1/4$ turn is sufficient to seal the leak.

CAUTION

Overtightening the coupling nut can damage the hose.



9. FINE TEST provides a high level of leak test sensitivity so that only a small amount of helium need be sprayed. By spraying small amounts of helium, the *clean up* time (the time it takes the system to recover from a large leak signal and reach baseline again) can be minimized so the leak test process is more efficient.
10. As leak testing is performed over time and residual helium builds up in the condenser system, the signal displayed by the VS system may increase by several decades. The ZERO function can be used to suppress the background in either TEST or FINE TEST modes so that leak testing can continue. Press the **ZERO** button to suppress the background signal; the displayed leak rate decreases to E-11 (E-08 if in TEST mode).

NOTE



Agilent recommends zeroing up to 2 decades maximum, for example, E-08 becomes E-10. If a greater value is zeroed, it is possible that small leaks will not be apparent.

11. Leak response time can vary from a few seconds to several minutes depending on the distance from the VS system to the leak location.

12. *Clean up* time (the time it takes the leak detector to recover from a large leak signal and reach baseline again) varies significantly depending on the volume of the condenser system, the distance to the leak location, and the helium pumping performance of the condenser system vacuum pump(s). Vacuum pumps vary significantly in their ability to pump a very small gas species such as helium. Since the VS leak detector needs to pump only the probe hose, it *cleans up* very rapidly.

Maintaining the Probe and VS System

13. The stainless steel probe tube is extremely durable and resists corrosion. The probe tip is robust and impact resistant, however it should be protected from scratching or nicks. Keep the protective plastic cap in place to protect the membrane surfaces when the probe is not in use. The cap is temperature resistant and can be installed on a hot probe. The probe assembly can be used continuously in hot, wet environments up to 95° C (200° F) and can operate even when submerged in water. Over time and with repeated usage, the hose material may yield. Periodically verify tightness of the compression fittings to ensure leak tight connections. If a leak is identified, typically, tightening the hose coupling nut by 1/8 to 1/4 turn is sufficient to seal the leak.

CAUTION

Overtightening the coupling nut can damage the hose.



For best leak response, wipe the probe tip clean after each use to prevent the buildup of rust or dirt. The probe assembly can be cleaned, if required, using light soap and water or with a light solvent such as isopropyl alcohol (IPA).

WARNING



When heated, sprayed, or exposed to high-temperature equipment, solvents, such as IPA, can become flammable and explosive, causing serious injury or death. Do not use these solvents near a high-temperature source. Ventilate the working area with a blower and work in a large, well-ventilated room. Solvents are irritants, narcotics, depressants and/or carcinogens. Their inhalation and/or ingestion may produce serious side effects. Prolonged or continued contact with the skin results in absorption through the skin and moderate toxicity. Always ensure that cleaning operations are carried out in large, well-ventilated rooms, and wear eye shields, gloves, and protective clothing.

NOTE



To maintain flexibility of the adapter flange O-ring, periodically coat it with a small amount of vacuum grease, such as Apiezon. Use only enough grease to make the O-ring shiny. DO NOT use excess grease.

VS HE Probe

Normal use of the VS system over time results in contamination such as dust, oil vapor and smog being pumped into the system. This appears as an increased baseline level or eventually as an unstable baseline leak rate. Preventative maintenance and periodic servicing of the system by trained Agilent staff will maintain the unit in optimum condition.

Specifications

Table 1 Specifications

Item	Description
Operating temperature range	+10°C (+50°F) to +95°C (+200°F)
Storage temperature range	-18°C (0°F) to +65°C (+150°F)
Operating vacuum pressure	Atmospheric pressure to low vacuum 1μ Hg, <1e-03 mbar/Torr, 1e-01 Pa
Maximum internal overpressure	1 Bar (14.7 PSI) (10 ⁵ Pa)
Probe length	450 mm (17.7")
Hose	High density polyethylene, 5 meters (16.4') long
Weight of probe assembly	0.5 kilogram (1 pound)
Hose fitting size	½" (12.7 mm) Swagelok™ compression or equivalent
Vacuum flanges	ISO KF25
Adaptor flange O-ring	Butyl rubber Parker B2-016 or equivalent
Chemical resistance	Probe resists virtually all chemicals except complex halogenated compounds.

Example Installations

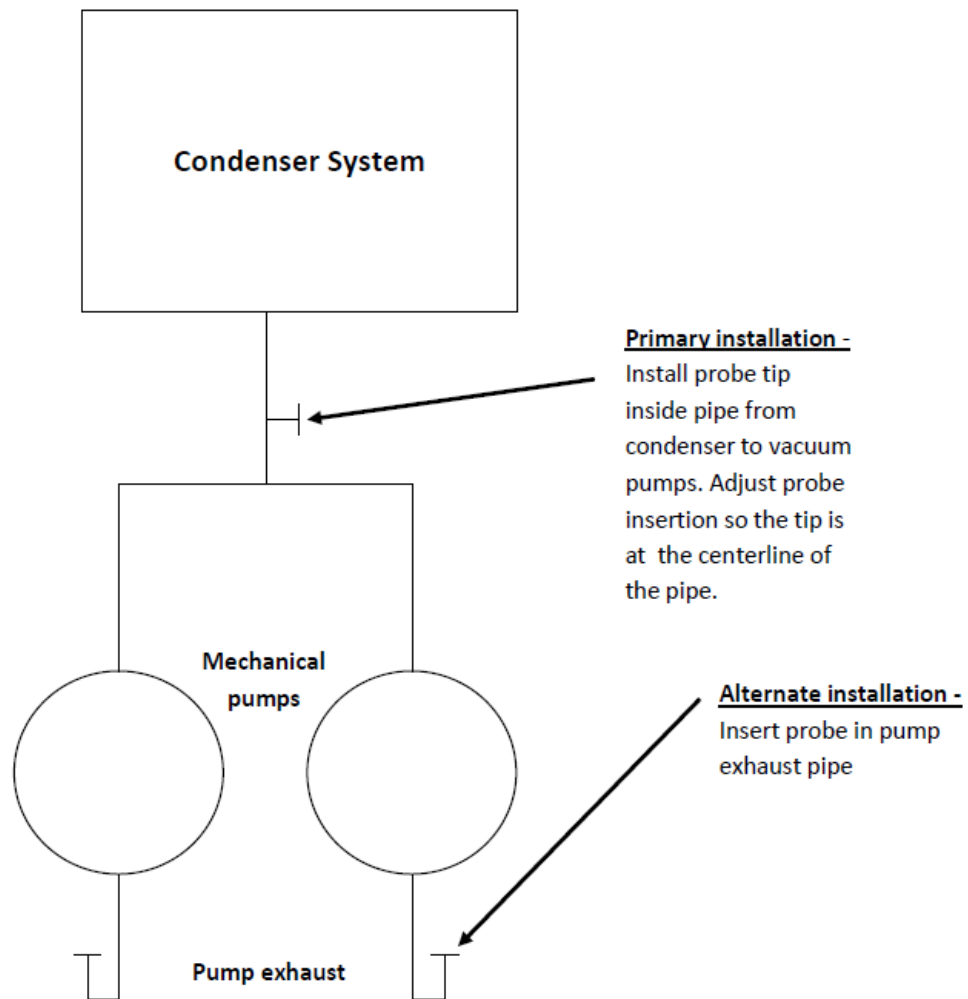


Figure 7 Typical HE Probe Installation

VS HE Probe

Some plants use two vacuum pumps in parallel. For two-pump testing, install two probes connected via a compression tee and hose, with a single hose connected to the leak detector inlet. Keep hose lengths as short as possible for best helium clean up.

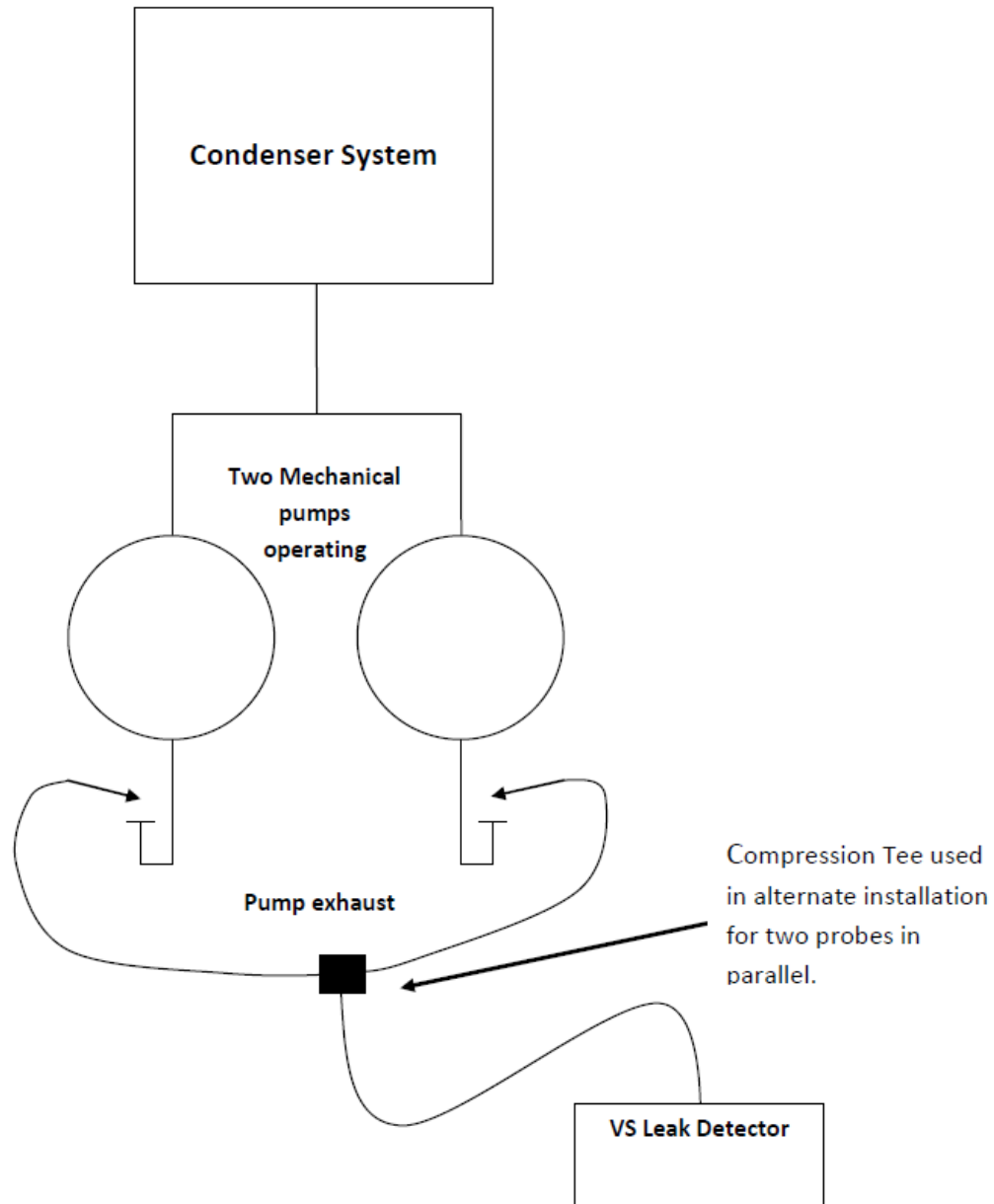


Figure 8 Two Vacuum Pump HE Probe Installation

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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:

Fax: 00 39 011 9979 330
Fax Free: 00 800 345 345 00
Toll Free: 00 800 234 234 00
vpt-customer care@agilent.com

NORTH AMERICA:

Fax: 1 781 860 9252
Toll Free: 800 882 7426, Option 3
vpl-ra@agilent.com

PACIFIC RIM:

please visit our website for individual
office information
<http://www.agilent.com>



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: <input type="checkbox"/> Taxable <input type="checkbox"/> 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:** _____

**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
<ul style="list-style-type: none"> - Does not start - Does not spin freely - Does not reach full speed - Mechanical Contact - Cooling defective 	<ul style="list-style-type: none"> - Noise - Vibrations - Leak - Overtemperature - Clogging 	<ul style="list-style-type: none"> - Vertical - Horizontal - Upside-down - Other:
		Power: Rotational Speed: Current: Inlet Pressure: Temp 1: Foreline Pressure: Temp 2: Purge flow: OPERATING TIME:

ION PUMPS/CONTROLLERS

<ul style="list-style-type: none"> - Bad feedthrough - Vacuum leak - Error code on display 	<ul style="list-style-type: none"> - Poor vacuum - High voltage problem - Other
---	--

VALVES/COMPONENTS

<ul style="list-style-type: none"> - Main seal leak - Solenoid failure - Damaged sealing area 	<ul style="list-style-type: none"> - Bellows leak - Damaged flange - Other
--	---

LEAK DETECTORS

<ul style="list-style-type: none"> - Cannot calibrate - Vacuum system unstable - Failed to start 	<ul style="list-style-type: none"> - No zero/high background - Cannot reach test mode - Other
---	--

INSTRUMENTS

<ul style="list-style-type: none"> - Gauge tube not working - Communication failure - Error code on display 	<ul style="list-style-type: none"> - Display problem - Degas not working - Other
--	---

SCROLL AND ROTARY VANE PUMPS

<ul style="list-style-type: none"> - Pump doesn't start - Doesn't reach vacuum - Pump seized 	<ul style="list-style-type: none"> - Noisy pump (describe) - Over temperature - Other
---	--

DIFFUSION PUMPS

<ul style="list-style-type: none"> - Heater failure - Doesn't reach vacuum - Vacuum leak 	<ul style="list-style-type: none"> - Electrical problem - Cooling coil damage - 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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Service & Support

North America

Agilent Technologies
121 Hartwell Avenue
Lexington, MA 02421 USA
Tel.: +1 781 861 7200
Toll-Free: +1 800 882 7426
Fax: +1 781 860 5437
vpl-customerservice@agilent.com

Benelux

Agilent Technologies Netherlands B.V.
Herculesweg 8
4338 PL Middelburg The Netherlands
Tel: +31 118 671570
Fax: +31 118 671569
Toll free: 00 800 234 234 00

China

Agilent Technologies (China) Co. Ltd
No.3, Wang Jing Bei Lu, Chao Yang District, Beijing, 100102 China Tel.: +86 (10) 6439 7888
Fax: +86 (10) 6439 1318
Toll-Free: 800 820 8266
vpc-customerservice@agilent.com

France

Agilent Technologies France
7 avenue des Tropiques
Z.A. de Courtaboeuf - B.P. 12
91941 Les Ulis cedex France
Tel.: +33 (0) 1 69 86 38 84
Fax: +33 (0) 1 69 86 29 88
Toll free: 00 800 234 234 00
vpf.sales@agilent.com

Germany & Austria

Agilent Technologies
Lyoner Str. 20
60 528 Frankfurt am Main Germany
Tel.: +49 69 6773 43 2230
Fax: +49 69 6773 43 2250
Toll free: 00 800 234 234 00

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India

Agilent Technologies India Pvt. Ltd.
G01. Prime corporate Park,
230/231, Sahar Road,
Opp. Blue Dart Centre,
Andheri (East), Mumbai – 400 099. India
Tel: +91 22 30648287/8200
Fax: +91 22 30648250
Toll Free: 1800 113037
cag_india@agilent.com

Italy

Agilent Technologies Italia S.p.A.
via F.lli Varian 54
10040 Leini, (Torino) ITALY
Tel.: +39 011 997 9111
Fax: +39 011 997 9350
Toll-Free: 00 800 234 234 00
vpt.sales@agilent.com
vpt-customerservice@agilent.com

Japan

Agilent Technologies Japan, Ltd.
8th Floor, Sumitomo Shibaura Building
4-16-36 Shibaura Minato-ku
Tokyo 108 JAPAN
Tel.: +81 3 5232 1253
Toll-Free: 0120 655 040
Fax: +81 3 5232 1710
vpj-customerservice@agilent.com

Korea

Agilent Technologies
Shinsa 2nd Bldg. 2F
966-5 Daechi-dong
Kangnam-gu, Seoul KOREA 135-280
Tel.: +82 2 3452 2455
Toll-Free: 080 222 2452
Fax: +82 2 3452 2451
vpk-customerservice@agilent.com

Singapore

Agilent Technologies Singapore Pte. Ltd
No.1 Yishun Avenue 7 Singapore 768923
Tel: +65 6215 8045
Fax : +65 6754 0574
Toll-Free: 1 800 2762622
vps-customerservice@agilent.com

Southeast Asia

Agilent Technologies Sales Sdn Bhd
Unit 201, Level 2 uptown 2,
2 Jalan SS21/37, Damansara Uptown
47400 Petaling Jaya, Selangor, Malaysia
Tel : +603 7712 6106
Fax: +603 6733 8121
Toll-Free: 1 800 880 805
vps-customerservice@agilent.com

Taiwan

Agilent Technologies Taiwan Limited
20 Kao-Shuang Rd., Pin-Chen City, 324
Taoyuan Hsien, Taiwan, R.O.C. Tel. +886 34959281
Toll Free: 0800 051 342
vpw-customerservice@agilent.com

UK & Ireland

Agilent Technologies
6 Mead Road
Oxford Industrial Park
Yarnton, Oxford OX5 1QU UK
Tel.: +44 (0) 1865 291570
Fax: +44 (0) 1865 291571
Toll free: 00 800 234 234 00
vpt-customerservice@agilent.com

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