

# HS-2 Diffusion Pump

## User Manual



# Notices

## Manual Part Number

699901150

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## Safety Notices

### CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

### WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

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# 1

## Technical Information

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## About this manual

### Validity

This manual lists the instructions for the users of the HS-2, with particular reference to the notions relating to safety, operation and first level maintenance, limited to maintenance operations for which the user is responsible.

The maintenance operations, illustrated in the specific sections, with specific provisions relating to the higher level of maintenance (personnel specifically trained for maintenance operations) must not be carried out by the user.

#### NOTE

- 1 This manual contains useful information so that all personnel using the HS-2 can operate it safely and guarantee perfect efficiency, for its entire life span.
  - 2 Keep this manual, together with all the related publications, in an accessible place known to all operators/maintenance personnel.
-

## Definitions and terminology

### Definition of Caution, Warning and Note

Some important references of this manual are highlighted and framed in contrasting color.

#### **WARNING**



Warning messages draw the operator's attention to a specific procedure or practice which, if not performed correctly, could result in serious personal injury.

#### **CAUTION**

Caution messages are displayed before procedures which, if not observed, could cause damage to the equipment.

#### **NOTE**

Notes are intended to call attention to important information and provide more detail regarding specific steps.

## Warning Symbols

The following is a list of symbols that appear in conjunction with warnings on the HS-2. The hazard they describe is also shown.

A triangular symbol indicates a warning. The meanings of the symbols that may appear alongside warnings in the documentation are as follows:



Dangerous voltages



Hot surface



Generic hazard



Presence of dangerous substances



Crushing hazard



Cutting hazard



Wear protective gloves



Wear personal protective equipment



Wear accident-prevention shoes



European Declaration of Conformity



Waste Electrical and Electronic Equipment















## Technical Information

The following symbol may be used on warning labels attached to the instrument. When you see this symbol, refer to the relevant operation or service manual for the correct procedure referred to by that warning label.



The following symbols appear on the instrument for your information.

	Corrosive substances
	Explosive Material
	Toxic Gases Asphyxiation
	Wear face shield
	Production date
	Dangerous voltages
	Hot surfaces
	Generic hazard
	CE certification
	Wear safety helmet
	RoHS China certification
	Waste Electrical and Electronic Equipment

# Safety

This section contains the information, prescribed by the Low Voltage Directive 2014/35/EU, which is essential for the compliance and observance of the safety regulations both generally and in relation to the specific use of the product.

Failure to comply with these instructions and the other instructions contained in this manual may render the safety conditions envisaged in the design phase inefficient and cause accidents to those operating the product.

Agilent Technologies declines all responsibility for damage to the product or for the physical safety of the operator or third parties deriving from the non-observance of the safety rules indicated in the technical documentation.

## Proper use

This manual contains important warnings and safety instructions to be observed in order for the unit to work safely.

The product described in this manual is intended exclusively for the area of application specified in the instructions. The manual also provides indications regarding the essential requirements for the application and operation of the product as well as the safety measures that can be adopted to guarantee regular operation. Agilent Technologies does not provide any guarantee or assume any responsibility for applications other than those described in this manual or in which the essential requirements and safety measures are not respected.

The product must only be used by qualified personnel who are able to take the necessary safety measures under conditions that do not cause damage or injury. Any accessories and equipment used with the product must be supplied or approved by Agilent Technologies.

Any adjustment or maintenance operation must be performed by a professional technician informed about the risks.

Repairs on the product must be carried out exclusively by Agilent authorized personnel.

## Technical Information

### Improper use

Agilent Technologies declines all responsibility, deriving from the improper use of the HS-2.

Improper use will cause all claims for liability and warranties to be forfeited.

Personnel responsible for pump operation and maintenance must be well-trained and must be aware of the accident prevention rules. The accident prevention precautions contained in this section must be continuously respected during operation and maintenance of the pump to avoid damage to operators and to the pump. These precautions are provided in the form of WARNING and CAUTION notes.

#### WARNING



**Operating procedures, technical information and precautions which, if not respected and/or implemented correctly may cause body harm to operators.**

#### CAUTION

**Operating procedures, technical information and precautions, which, if not respected and/or implemented correctly, may cause damage to the pump.**

## Disposal

### Meaning of the "WEEE" logo found in labels.

The following symbol is applied in accordance with the EC WEEE (Waste Electrical and Electronic Equipment) Directive.

This symbol (valid only in countries of the European Community) indicates that the product it applies to must NOT be disposed of together with ordinary domestic or industrial waste but must be sent to a differentiated waste collection system. The end user is therefore invited to contact the supplier of the device, whether the Parent Company or a retailer, to initiate the collection and disposal process after checking the contractual terms and conditions of sale.



**Figure 1** Logo "WEEE"

For more information refer to:

<http://www.agilent.com/environment/product/index.shtml>

## Service

Should a customer need an advanced exchange or repair service, please contact local distributor or directly mail to

[vpt-customer@agilent.com](mailto:vpt-customer@agilent.com)

[vpl-customer@agilent.com](mailto:vpl-customer@agilent.com)

Completion of the "Request for Return" form is required to return your pump to Agilent for service (provided at the end of this manual).

## Diffusion Pump Hazards

Designers of systems utilizing diffusion pumps must design out hazards wherever possible. For hazards that cannot be designed out, warnings, procedures, and instructions on proper use and servicing are provided. Please use guards, safety features, and interlocks as recommended.

The end user must ensure the pump is properly protectively bonded to the end product's protective earthing system as determined in the end product standard for the End Product Design. End Product Design provides a compliant fire enclosure as defined in the End Product's standard.

Refer to Table 1 for a list of general hazards and recommended actions, Table 2 for a list of prohibited actions that can result in explosions, and Table 3 for a list of pressurization hazards that can result in damage to equipment.

The installation, operation, and servicing of diffusion pumps involves one or more of the hazards in 1, any one of which in the absence of safe operating practices and precautions, could potentially result in death or serious harm to personnel.

**Table 1 General Hazards**

Hazard	Suggested Corrective Action
Loss of utility: water and/or electricity	Provide sufficient backup water and power supply as necessary to effect a safe shutdown under worst case conditions
Overpressure in foreline	Provide an interlock to ensure that the power supply to the pump heater cannot be activated if the foreline pump is not running and/or the pressure in foreline is above 0.5 Torr (0.38 mbar)
Overtemperature	Fit temperature sensors and pump fluid level sensors with a feedback to an interlock on the heater power supply
Insufficient water flow through the main cooling coils	Use water flow sensor and feedback to interlock the heater power supply
Water trapped between inlet and outlet of Quick Cool coil, or liquid nitrogen trapped between inlet and outlet of liquid nitrogen trap	Provide vent or pressure relief valves for both Quick Cool coil and liquid nitrogen trap
Loss of electrical ground integrity	Incorporate ground fault interrupt circuit into heater power supply
Positive pressure in pumping system	Integrate pressure relief valve in vacuum system
High voltage	Prevent personnel contact with high voltages; design and attach warnings
Toxicity and Corrosivity	Vent toxic and/or corrosive gases to a safe location; ensure adequate dilution or scrubbing to safe levels; take all actions required to meet air quality standards
Explosion	Integrate pressure relief valves Do not use hydrocarbon-based pumping fluids

# Explosion

- Operation of the diffusion pump without continuous evacuation below 0.5 Torr (0.67 mbar), or without coolant and introducing a strong oxidizer (such as air) or explosive vapors or powders or materials which may react with pumping fluids in a hot pump (above 300 °F or 150 °C) can cause an explosion. Such an explosion can violently expel valves and other hardware, slam open doors that are not designed for appropriate pressure relief, or burst other components of the vacuum system. Serious injury or death may result from expelled parts, doors, shrapnel, and shock waves.
- Three elements are required for explosion: fuel, oxidizer, and an ignition. A combination of temperature and pressure can be a source of ignition. Most diffusion pump fluids are fuels. Hydrocarbon fluids are more prone to oxidize and explode than synthetic silicone-based fluid. The oxidizer can be air, which can be introduced by a leak, deliberately brought in via a process, or inadvertently admitted by operator error.  
Oxygen and other strong oxidizers are even more dangerous than air. Certain conditions of temperature and pressure can cause a combustible mixture to explode. The larger the diffusion pump, the greater the risk of explosion and the greater the risk of damage and injury. Never operate large diffusion pumps utilizing hydrocarbon oils without a complete safety analysis for the entire system and for the application.
- Explosion and Fire from Acetone and Alcohol: Diffusion pumps are typically cleaned with acetone and alcohol. When combined with air, oxygen, and other oxides, alcohol and most other solvents are very flammable and explosive. Never permit any trace of these cleaners to remain in or on the pump. Always remove all traces of alcohol and acetone and other cleaners with clean, dry, oil-free compressed air

## Technical Information

Never operate a large diffusion pump under the conditions listed in the following table. Any of these situations increases the probability of an explosion.

**Table 2 Explosive Conditions**

Hazard	Suggested Corrective Action
Do not run pump without cooling water	Overtemperature
Do not run pump with low level of pump fluid	Overtemperature
Do not run pump without proper backing or holding pump	Overpressure
Do not run pump when not evacuated below 0.5 Torr (0.66 mbar)	Overpressure
Do not admit air to, or rough through, a pump with hot boiler	Overpressure plus strong oxidizer
Do not open drain or fill plug while pump is under vacuum, especially when it is hot	Overpressure plus strong oxidizer
Do not contaminate pump with explosive vapors	Lower explosive threshold of gas mixtures
Do not remove, defeat, or override safety counter-measures such as pressure and thermal switches and valve sequencer interlocks	Overtemperature, overpressure, more combustible mixtures
Do not machine or weld any part of the pump without removing all fluid or solvent residue in pump	Source of ignition
Do not use unsuitable pumping fluid	Lower explosive threshold of gas mixture



Pressurization Hazards

Large vacuum pumps and their components are designed for vacuum service. They are not designed for pressurization, which could cause them to burst possibly expelling shrapnel at lethal velocities. Serious accidents have been caused by intentional pressurization of vacuum systems and their components.

- Never pressurize any part of a vacuum system for test or any other purpose.
- Always provide pressure relief when designing diffusion pumps into systems and ensure that pressure relief motion is limited to safe envelopes.
- Never permit the hazards in the following table to develop.

Table 3 Pressurization Hazards

Hazard	Suggested Corrective Action
Do not block inlet or vent of liquid nitrogen trap and lines	LN2 trap and/or lines burst
Do not close isolation valves at inlet and discharge of main water cooling coils when pump is heated	Water turns to steam and bursts coils
Do not pressurize the pump body (above 1 atm.)	Body of pump bursts
Do not make a hole through the vacuum wall	Loss of structural integrity of wall

- **Pressure Relief Devices:** Systems must be designed with pressure relief devices to provide safe pressure relief from internal explosions. Always recognize that safety devices can fail or malfunction. Provide redundant protection by installing devices having different failure modes, failure mechanisms, and failure causes. Be certain that exhaust duct materials are capable of withstanding the corrosiveness, temperature, and pressure of exhausted products.

### Dangerous Substances

- **Chemical Dangers of Acetone and Alcohol:** Diffusion pumps are typically cleaned with acetone or alcohol. Acetone, alcohol, and most other solvents are irritants, narcotics, and depressants, and/or carcinogenic. Their inhalation and ingestion may produce serious effects. Even absorption through the skin can result in moderate toxicity. Always ensure that cleaning operations are performed in large, well-ventilated rooms. Use of self-contained breathing apparatus may be necessary, depending upon the solvent type and vapor concentration in surrounding air.
- **Poisonous and Corrosive Compounds:** When pumping poisonous, reactive, and/or corrosive gas, vapors, or chemicals, proper operation and regeneration do not always ensure that all hazardous materials have been totally removed. If hazardous gas, vapors, chemicals, or combustible mixtures are pumped, sufficient quantities may exist during operation or remain after regeneration to cause severe injury or death.
- **Pump Fluids:** Overheating the pump fluid, exposing it to air or reactive materials, or over-pressurizing it above the normal operating range, approximately  $1 \times 10^{-3}$  Torr ( $1.3 \times 10^{-3}$  mbar) decomposes the fluid and possibly makes it toxic. This is especially true of backstreamed mechanical pump fluids which are more volatile (unstable). Overheating of accidentally introduced or backstreamed mechanical pump fluids cannot be protected against by thermal switches which are set for diffusion pump fluid.
- **Process Gases:** Process gases are frequently toxic, flammable, corrosive, explosive, or otherwise reactive. Agilent has no control over the types of gasses passing through the user's diffusion pump as these are entirely under the control of the process user and/or the hardware systems integrator. Since these gasses can cause serious injury or death, it is very important to plumb the exhaust of the pump to the facility's hazardous gas exhaust system which incorporates appropriate filters, scrubbers and similar components to ensure that the exhaust meets all air and water pollution control regulations.

## Technical Information

### High Temperatures

- **Hot Surfaces:** Boiler temperatures reach 530 °F (275 °C) which can cause serious burns. Always ensure that surfaces have cooled to near room temperature before touching them.
- **Hot Cooling Water and Steam:** The water used to cool the pump can reach scalding temperatures. Touching or rupture of the cooling surface can cause serious burns. Water left inside Quick Cool coils from previous use turns to steam when the pump is reheated. This steam must be allowed to escape without contacting personnel. Whenever possible, design the water system with interlock valves so that power cannot be applied to the pump unless water is flowing in the main cooling coils (not Quick Cool coils).

### Cold Surfaces

Liquid nitrogen cooled traps are commonly used in diffusion pumps. Metal surfaces at liquid nitrogen temperature can cause severe frostbite. These surfaces remain cold in excess of 30 minutes after liquid nitrogen evaporation.

### Cold Coolant

Liquid nitrogen, a cryogenic liquid, is used in traps. If it is splashed on body tissues or eyes, it can cause severe frostbite or blindness. The extremely low temperature of liquefied nitrogen can cause skin damage similar to high temperature burns. Contact with the cold gas evolving from the liquid can produce the same effect. Delicate tissues, such as the eye tissues, are most easily damaged by exposure to cold gas or liquid. To minimize the risk of hazardous contact of cold gaseous nitrogen with any part of the body, wear personal safety equipment recommended for use with cryogenic materials, including:

- Face shield
- Full-sleeved lab coat
- Clean, dry gloves which fit loosely so they can be thrown off quickly if frozen by contact with the gas.

## Technical Information

### High Voltages

Diffusion pump heaters operate at voltages (up to 480 V) high enough to kill. Design systems to prevent personnel contact with high voltages. Securely attach prominent hazard warnings. Personnel should always break the primary circuit to the power supply when direct access to the heater or wiring is required.

### Asphyxiation

Death from suffocation can result if a large amount of liquid nitrogen is spilled in a small, poorly ventilated room or equipment. All diffusion pumps are typically cleaned with acetone or alcohol. Acetone, alcohol, and most other solvents are very volatile (unstable). During cleaning, the volatility of these cleaners may permit their gases to displace air and its life-supporting oxygen which could cause death or serious injury by asphyxiation. Always ensure that cleaning operations are performed in large, well-ventilated areas.

## Description of the HS-2 Diffusion Pump

Diffusion pumps are used where throughput for heavy gas loads is important. The diffusion pumps begin to work at approximately  $10^{-3}$  Torr after a mechanical backing pump has exhausted most of the air in the system.



**Figure 2** HS-2 Diffusion Pump

There are no moving parts in a diffusion pump, the heart of which is the multistage jet assembly, a group of concentric cylinders that are capped to leave small openings through which vapor can be deflected down and out toward the pump walls. A cold cap, mounted on top of the jet assembly helps keep pump fluid vapor out of the evacuation chamber. The pumps are water-cooled.

The vacuum fluid heater is mounted at the bottom of the pump body. The pumps also have a fill and drain assembly, and thermal protection switches. The inlet is at the top, and the exhaust is through the foreline.

### Pump Operation

The diffusion pump works by heating the pump fluid to its boiling point. The vapors travel upward inside the jet assembly and are accelerated out and downward through the jet nozzles toward the cool outer walls of the pump, where the vapor condenses back into a fluid. As the vapor passes the inlet, it picks up elements of the gas to be exhausted and carries them to the ejector and out of the pump via the foreline. The pump's ability to reach low pressures is governed in part by the inlet size. The gas migrates by thermal motion and is captured and expelled, thus lowering the pressure in the evacuation vessel.

# Installation

Before unpacking and installing this pump, read the safety precautions and general installation, operation and maintenance instructions in the "Preface", as well as the following specific instructions and specifications which pertain to the HS-2 water cooled diffusion pump.

The pump must be installed in an installation that meets the pumps operating environment.

The end user must ensure there is adequate clearance from combustible materials. After storage, transport and startup in high humid conditions, ensure the pump is grounded to system for continued safety.

The end user must ensure the product has a connection from a correctly sized roughing pump on the diffusion pump's vacuum inlet, and that the end product has an appropriately sized and certified mains voltage disconnecting device and/or mains power switch.

For overcurrent protection, the pump must have supplementary fusing when installed in a system. The fuse cannot be larger than 15A.

In order to avoid damage during shipment, our conduction cooled cold cap is packaged separately from the jet assembly. Accordingly, it is necessary to install the cold cap on the jet assembly prior to use.

Each cold cap assembly has been individually cleaned and is shipped in a polyethylene bag. Inspect the carton and its contents for transit damage. Damage in transit is the responsibility of the transportation company and must be reported to them. Protect all components from dirt before and during installation. Do not open the plastic containers until the diffusion pump is ready to receive the cold cap installation, after preparatory pump inspection.

Figure 3 shows the cold cap correctly mounted on the top jet. Refer to Figure 5 and Figure-6 during installation. To install the cold cap:

To install the cold cap:

- 1** Mount the PTFE button (Item 3) on the jet cap.
- 2** Install the jet (Item 1) in the pump body.
- 3** Install the cold cap (Item 2) as shown in Figure 3, ensuring that it is resting firmly on the shoulder of the PTFE button:
  - a** Attach the stand-off (Item 6) to the threaded portion of the tie rod (Item 3) of the jet assembly (Item 1). Secure the stand-off hand-tight only. Do not use force.

## Technical Information

- b** Insert the cold cap (Item 4) into the pump barrel by compression of the thermal contact spring against the pump wall.
- c** Slide the cold cap into the pump barrel until the underside of the end of the copper cup rests against the stand-off (Item 6). The spacer bar opposite the spring firmly contacts the pump wall. The other two will be equally distant from it.
- d** Align the jet assembly until the hole in the cap is in line with the tapped hole in the stand-off and the spacer bars are equidistant from the top of the pump.
- e** Insert the retaining screw (Item 5) and tighten the assembly gently to secure the cap. *Do not use excessive force.*

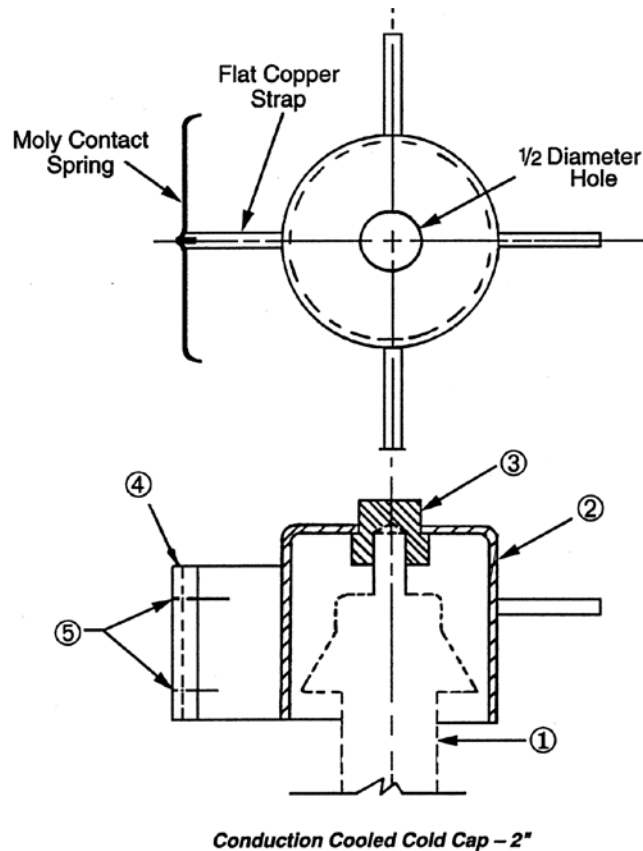


Figure 3 Cold Cap Installation



### **Pump Fluid Installation**

HS-2 diffusion pumps do not have fill and drain fittings. The pumps are filled by pouring the appropriate amount of fluid along the diffusion pump body sidewall or by removing the foreline baffle and pouring the appropriate amount of fluid down the foreline tube.

### **Power Plug Installation**

If a plug attached to the power cord is needed, it is recommended to buy the following plug from the market:

- For 115 V, mates with Hubbell plug model #5269 or equivalent.
- For 240 V, mates with Hubbell plug model #5666C or equivalent.

## Maintenance

### Changing Heater Element

If a change of heater is indicated by electrical tests:

- 1** Disconnect the electrical power leads to the heater terminal box.
- 2** Remove the polished reflector cover.
- 3** Remove the block containing the defective heater.
- 4** Remove the heater from its hole and replace with a new element. Coat the replacement heater with milk of magnesia before inserting in the block. This prevents seizing of the element on repeated heat up, and make future servicing easier.
- 5** Reconnect the heater electrically and check continuity and rating.
- 6** Replace the polished reflector.

### Cleaning

Complete cleaning of the pump may be required due to the gradual deterioration of pump fluids. Removal of the pump from the system is necessary. To clean the pump:

- 1** Turn off the power and disconnect the power supply.
- 2** Allow the pump to cool, then turn off the cooling water and disconnect the cooling lines.
- 3** Unbolt the inlet flange and foreline connections.
- 4** Remove the pump from the system.
- 5** Remove all O-rings, then remove the cold cap assembly, the jet assembly, and the foreline baffle from the pump.
- 6** Drain the diffusion pump of all fluid.
- 7** Thoroughly clean the diffusion pump body interior and the jet assembly using acetone followed by an Isopropyl alcohol rinse.
- 8** Dry the pump and the jet assembly with clean, dry, oil-free compressed air.
- 9** Install the foreline baffle and jet assembly. Verify that the ejector nozzle is properly aligned with the foreline. Install the cold cap assembly into the pump body.
- 10** Charge the pump with the proper amount of fluid.
- 11** Reinstall the diffusion pump in the system using all new O-rings.
- 12** Reconnect the water cooling lines and the power supply.
- 13** Evacuate the diffusion pump with the appropriate mechanical pump and turn on the cooling water.
- 14** After the pump has been evacuated to a pressure below 0.5 Torr (.66 mbars), turn on the power to the diffusion pump

## Technical Specifications

This section gives the physical and operating specifications for the Model No. 82906301 (120 V) and 82906302 (240 V) pumps (Type No. 0160).

The following figure shows the HS-2 speed curve.

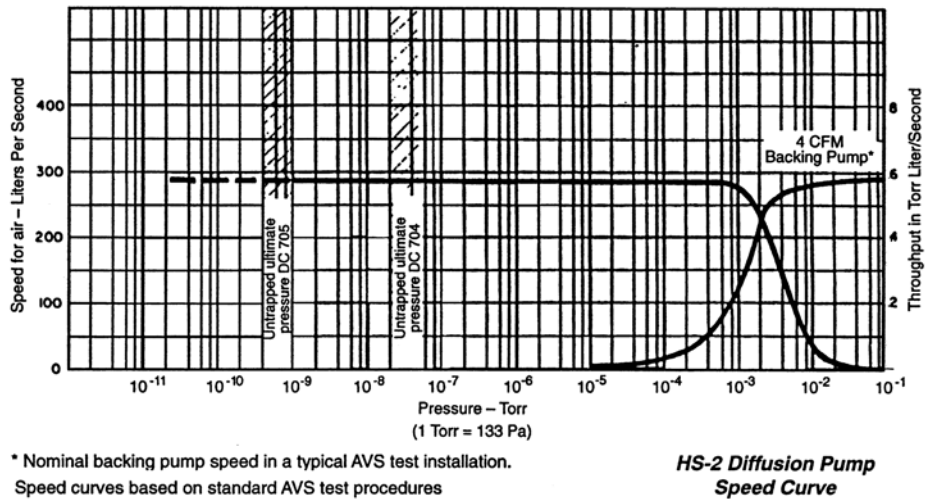


Figure 4 HS-2 Speed Curve

## Technical Information

The following figure shows the HS-2 cross section.

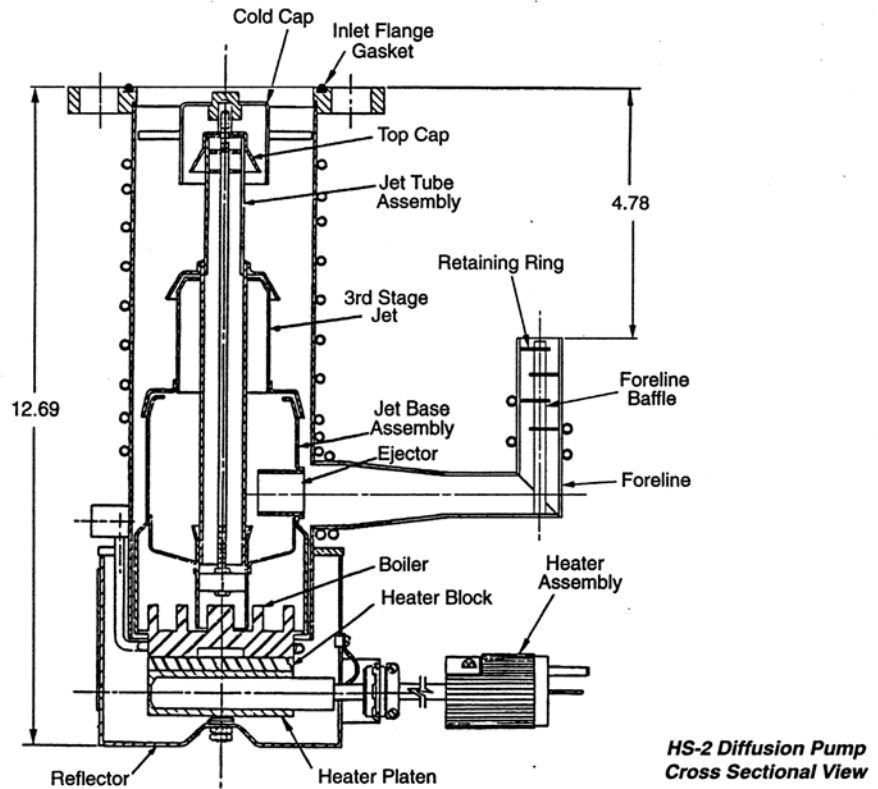


Figure 5 HS-2 Cross Section

## Technical Information

The following figure shows the HS-2 flange and pump dimensions and connections.

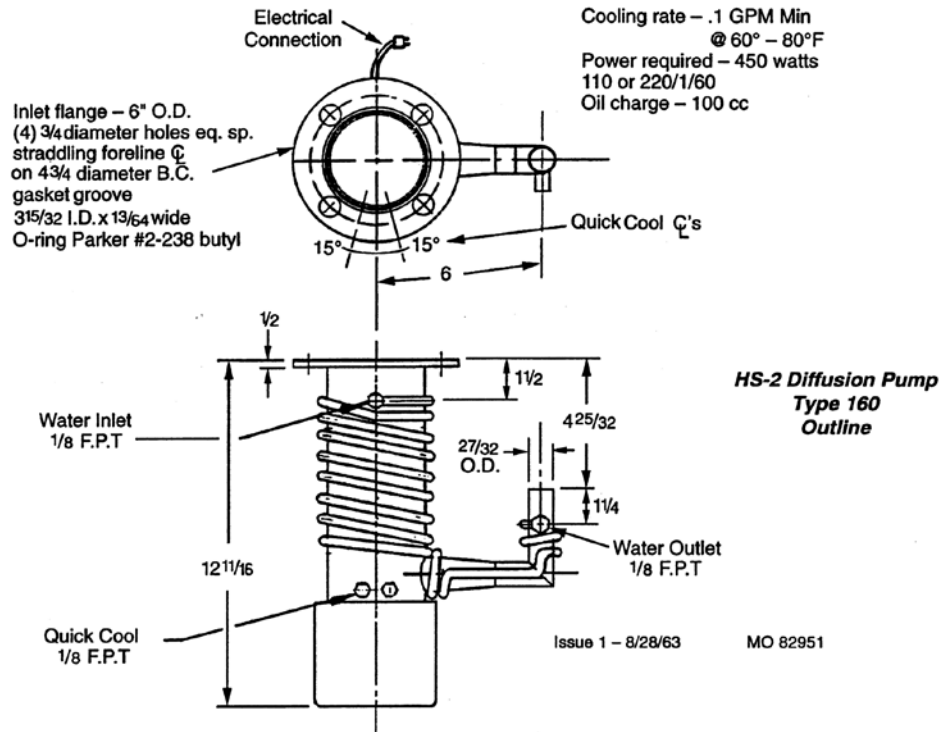


Figure 6 HS-2 Flange and Pump

### Operating Specifications

The following table gives the HS-2 operating specifications.

**Table 4 Operating Specifications**

Specification	Value
Optimum Operating Range	$2 \times 10^{-3}$ Torr (2.7 mbar) to $< 5 \times 10^{-8}$ Torr (6.7 mbar)
Maximum Pumping Speed	285 liters/second for air
Maximum Forepressure	No Load $5.5 \times 10^{-1}$ Torr (.73 mbar) Full Load $4.0 \times 10^{-1}$ Torr (.53 mbar)
Maximum Throughput	0.5 Torr liter/second (.67 mbar)
Backstreaming Rate at Pump Inlet	$1 \times 10^{-3}$ mg/cm <sup>2</sup> /min (with cold cap)
Power Required	450 W nominal, 575 W maximum
Heat-up Time	15 minutes
Cool-down Time	Less than 5 minutes to break jet Less than 10 minutes to vent pump
Fluid Charge	100 cc. All conventional and high performance pump fluids
Cooling Water Requirements	0.1 gpm at 60 °F to 80 °F (15.6 °C to 26.7 °C) inlet temperature
Backing Pump Size	5 cfm or larger for optimum throughput
Environmental	Maximum ambient temperature 113 °F (45 °C) Maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40 °C
Installation	Indoor use, Installation Category 2, Pollution Degree 2
Altitude	6562' (2000m)

### Physical Specifications

The following table gives the HS-2 physical specifications.

**Table 5 Physical Specifications**

Specification	Value
Inlet Flange Connection	<ul style="list-style-type: none"> <li>❑ OD – 6"</li> <li>❑ ID – 3<sup>11/32</sup>"</li> <li>❑ Thickness – 1/2"</li> <li>❑ Bolt Circle – 4<sup>3/4</sup> diameter</li> <li>❑ No. of Holes – 4</li> <li>❑ Size of Holes – 3/4 diameter</li> <li>❑ Orientation – Straddle</li> <li>❑ Gasket Groove – 315/32 ID x 13/64 wide</li> <li>❑ Gasket O-Ring – Parker #2-238 Butyl</li> </ul>
Foreline Connection	<ul style="list-style-type: none"> <li>❑ Tubing – 0.840 OD*</li> <li>❑ Height – 1211/16" allow additional 31/2" for heater removal</li> <li>❑ Jet Assembly – Self-aligning, fractionating design with 3 diffusion stages and one ejector stage</li> <li>❑ Foreline Baffle – Stacked half moons with snap ring retainer</li> <li>❑ Cold Cap - Conduction cooled</li> <li>❑ Water Connections - 1/8 FPT body and quick cool.</li> </ul>
Materials of Construction	<ul style="list-style-type: none"> <li>❑ Body – Stainless Steel</li> <li>❑ Flange – Mild Steel</li> <li>❑ Jet Assembly – Stainless Steel</li> <li>❑ Foreline Baffle – Stainless Steel</li> <li>❑ Cooling Coils – Copper, Welded to body</li> <li>❑ Heater Reflector – Polished Aluminum</li> <li>❑ Cold Cap – Copper, Nickel-Plated</li> </ul>
Heater, Cartridge Type	<ul style="list-style-type: none"> <li>❑ STD Voltage (Nom.) – 115V 1ø</li> <li>❑ Option (Nom.) – 240V 1ø</li> <li>❑ Power – 450 W (approximately)</li> </ul>
Actual Weight	10 lbs
Shipping Weight	20 lbs
* (Use 5/8 ID x 1 3/8 OD rubber hose for vacuum service)	

# Optional Components

The following table gives the HS-2 optional components.

**Table 6    Optional Components**

Part Number	Description
647302150	Heater, 450 W, 240 V
F0600301	Cold Cap (Conduction cooled)



## Accessories and Spare Parts

When ordering replacement parts, quote type number and serial number of pump.  
The following table gives the HS-2 accessories and spare parts.

**Table 7 Accessories and Spare Parts**

Part Number	Description
647302125	Heater Assembly, 450 W, 120 V
647302150	Heater Assembly, 450 W, 240 V
82920001	Heater Block
82918301	Heater Platen
K0377159	O-ring Kit
F0310301	Jet Assembly
82917301	Reflector
F0600301	Cold Cap Assembly
84166301	Foreline Baffle
660156010	Baffle Retaining Ring
648018010	Heater Clip
Standard Heater Clip Screws	#4-40 x 3/16 Rd. Hd. MS M/S Ni-Plated
Standard Reflector Nuts	10-32 Hex Hd. S/S
Standard Reflector Washers	#10 Std Flat – S/S
Standard Heater Screws	1/4 - 20 x 13/8, Hex. Hd. Cap Screw/Lock Washer - S/S

Technical Information

The following table gives the cold cap replacement parts.

Table 8 Cold Cap Replacement Parts

Part Number	Description
F0310301	Jet Assembly
F0600301	Cold Cap
F0597001	PTFE Button
F0600004	Moly. Spring
614120052	2-56 x 1/8" R.H.M.S. SS



## ***Vacuum Products Division***

*Dear Customer,*

*Thank you for purchasing an Agilent vacuum product. At Agilent Vacuum Products Division we make every effort to ensure that you will be satisfied with the product and/or service you have purchased.*

*As part of our Continuous Improvement effort, we ask that you report to us any problem you may have had with the purchase or operation of our products. On the back side you find a Corrective Action request form that you may fill out in the first part and return to us.*

*This form is intended to supplement normal lines of communications and to resolve problems that existing systems are not addressing in an adequate or timely manner.*

*Upon receipt of your Corrective Action Request we will determine the Root Cause of the problem and take the necessary actions to eliminate it. You will be contacted by one of our employees who will review the problem with you and update you, with the second part of the same form, on our actions.*

*Your business is very important to us. Please, take the time and let us know how we can improve.*

*Sincerely,*

**Giampaolo LEVI**

*Vice President and General Manager  
Agilent Vacuum Products Division*

**Note:** Fax or mail the Customer Request for Action (see backside page) to Agilent Vacuum Products Division (Torino) – Quality Assurance or to your nearest Agilent representative for onward transmission to the same address.

## CUSTOMER REQUEST FOR CORRECTIVE / PREVENTIVE / IMPROVEMENT ACTION

TO: AGILENT VACUUM PRODUCTS DIVISION TORINO – QUALITY ASSURANCE FAX

N°: XXXX-011-9979350

ADDRESS: AGILENT TECHNOLOGIES ITALIA S.p.A. – Vacuum Products Division –

Via F.Ili Varian, 54 – 10040 Leini (TO) – Italy

E-MAIL: [vpd-qualityassurance\\_pdl-ext@agilent.com](mailto:vpd-qualityassurance_pdl-ext@agilent.com)

NAME	COMPANY	FUNCTION
ADDRESS:		
TEL. N° : FAX N° :		
E-MAIL:		
PROBLEM / SUGGESTION :		
REFERENCE INFORMATION (model n°, serial n°, ordering information, time to failure after installation, etc.):		
DATE		
CORRECTIVE ACTION PLAN / ACTUATION (by AGILENT VPD)		LOG N°

XXX = Code for dialing Italy from your country (es. 01139 from USA; 00139 from Japan, etc.)



Agilent Technologies



## Vacuum Products Division Instructions for returning products

Dear Customer,

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

Complete the attached **Request for Return** form and send it to Agilent Technologies (see below), taking particular care to include the completed **Health and Safety** declaration Section. No work can be started on your unit until we receive a completed copy of this form.

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).

### Product preparation

- Remove all accessories from the core product (e.g. inlet screens, vent valves).
- Prior to shipment and if applicable for your product, 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.
- Include a copy of the Health and Safety Declaration in the shipping documentation on the outside of the shipping box of your returning product.
- 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.
- Return only products for which the RA was issued.

### Shipping

- 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.
- Return shipments must comply with all applicable Shipping Regulations (IATA, DOT, ADR, 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](mailto:vpt-customer care@agilent.com)

#### NORTH AMERICA:

Fax: 1 781 860 9252

Toll Free: 800 882 7426

[vpl-ra@agilent.com](mailto:vpl-ra@agilent.com)

#### PACIFIC RIM:

please visit our website for individual  
office information

<http://www.agilent.com>



**TERMS AND CONDITIONS**

**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.**

- Unless otherwise pre-negotiated, 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.
- Agilent Technologies is not responsible for returning customer provided packaging or containers.
- 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.
- Products returned that have not been drained from oil will be disposed.
- A Special Cleaning fee will apply to all exposed products
- If requesting a calibration service, units must be functionally capable of being calibrated.

**Vacuum Products Division  
Request for Return Form**

Customer information		
Company :		Contact Name:
Address:		Tel: Fax:
		Email:

Equipment			
Product description	Agilent PartNo	Agilent Serial No	Original Purchasing Reference
Failure description		Type of process (for which the equipment was used)	

Type of return
<input type="checkbox"/> Non Billable <input type="checkbox"/> Billable ➡ New PO # (hard copy must be submitted with this form): _____
<input type="checkbox"/> Exchange <input type="checkbox"/> Repair <input type="checkbox"/> Upgrade <input type="checkbox"/> Consignment/Demo <input type="checkbox"/> Calibration <input type="checkbox"/> Evaluation <input type="checkbox"/> Return for Credit

Health and safety		Substances (please refer to MSDS forms)			
The product has been exposed to the following substances: (by selecting 'YES' you MUST complete the table to the right)		* Agilent will not accept delivery of any product that is exposed to radioactive, biological, explosive substances or dioxins, PCB's without written evidence of decontamination.			
		Trade name	Chemical name	Chemical Symbol	CAS Number
Toxic	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Harmful	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Corrosive	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Reactive	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Flammable	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Explosive (*)	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Radioactive (*)	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Biological (*)	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Oxidizing	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Sensitizer	<input type="checkbox"/> YES <input type="checkbox"/> NO				
Other dangerous substances	<input type="checkbox"/> YES <input type="checkbox"/> NO				

Goods preparation	
If you have replied YES to one of the above questions. Has the product been purged?	<input type="checkbox"/> YES <input type="checkbox"/> NO
If yes, which cleaning agent/method:	
Has the product been drained from oil?	<input type="checkbox"/> YES <input type="checkbox"/> NOT APPLICABLE
I confirm to place this declaration on the outside of the shipping box. <input type="checkbox"/>	

I declare that the above information is true and complete to the best of my knowledge and belief. I understand and agree to the terms and conditions on page 2 of this document.	
Name:	Authorized Signature:
Position:	
Date:	
<b>NOTE:</b> If a product is received at Agilent which is contaminated with a toxic or hazardous material that was not disclosed, <b>the customer will be held responsible</b> 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.	

## Agilent Vacuum Products Division/Sales and Service Offices

### United States

#### **Agilent Technologies**

121 Hartwell Avenue  
Lexington, MA 02421 - USA  
Ph. +1 781 861 7200  
Fax: +1 781 860 5437  
Toll-Free: +1 800 882 7426  
[vpl-customer@agilent.com](mailto:vpl-customer@agilent.com)

### Netherlands

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1186 DS Amstelveen  
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[customer@netherlands.agilent.com](mailto:customer@netherlands.agilent.com)

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Torre Jacarandá - Tamboré  
Barueri, Sao Paulo CEP: 06460-040  
Toll free: 0800 728 1405

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Toll free: 800 8206778 (landline)  
[vacuum.cnmarketing@agilent.com](mailto:vacuum.cnmarketing@agilent.com)  
[vpc-customerservice@agilent.com](mailto:vpc-customerservice@agilent.com)

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[vpt-customer@agilent.com](mailto:vpt-customer@agilent.com)

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[vpl-ra@agilent.com](mailto:vpl-ra@agilent.com)  
[Lexington-service@agilent.com](mailto:Lexington-service@agilent.com)

#### **EUROPE:**

Toll Free: 00 800 234 234 00  
[vpt-customer@agilent.com](mailto:vpt-customer@agilent.com)

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[www.agilent.com/chem/vacuum](http://www.agilent.com/chem/vacuum)

Representatives in most countries



## In This Book

The manual describes the following:

- Contents
- Technical information

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