

# VHS-4

## NRC Diffusion Pump And Components



VHS-4 Diffusion Pump



NRC 316-4 Cryotrap



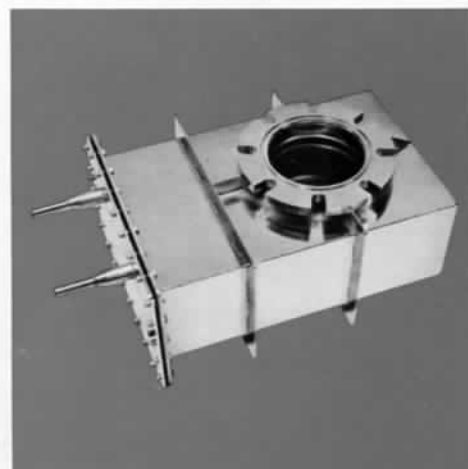
Mexican Hat Cold Cap



NRC 334 Low-Profile Water-Cooled Baffle



NRC 1293S-4 Aluminum Solid-Body Slide Valve



NRC 326-4 Long-Life Cryotrap



## VHS-4 Diffusion Pump

The VHS-4 is the fastest and cleanest diffusion pump of its size available today. It comes closer than any other pump to the theoretically perfect pump—one that removes every gas molecule without discharging any molecules into the chamber being evacuated. Here's why:

**HIGHEST SPEED:** the patented bulge contour doubles gas capture and maintains lower pressures for your process.

**CLEANEST OPERATION:** a low boiler temperature minimizes pumping fluid breakdown; fully compartmented jet separates and ejects any light fractions that are produced.

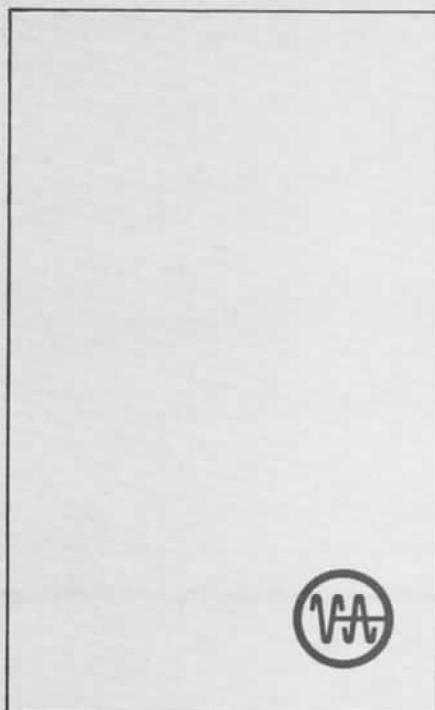
**LOWEST BACKSTREAMING:** the patented Cold Cap\* intercepts 98% of the backstreaming fluid (by actual measurement) without significantly affecting pumping speed.

Full thermostatic protection is ensured against inadequate cooling water, low pump fluid level, or inoperative forepump. Ejector stage at the foreline provides high fore pressure tolerance and allows use of a smaller forepump.

\*licensed exclusively from Edwards High Vacuum Ltd.; U.S. patent No. 2919061

## Mexican Hat Cold Cap

The Mexican Hat is an optional extended cold cap which fits inside the VHS-4 Diffusion Pump in place of the standard cold cap. It stops backstreaming as effectively as an optically dense baffle, yet retains 66% of the pump's intrinsic speed. Residual backstreaming cannot be measured by the American Vacuum Society's standard collection method. Available only from Varian/NRC, the Mexican Hat makes optical baffles redundant in most cases, especially when used together with cryogenic traps. In fact, the Long-Life Cryotrap (NRC 326-4) is designed to complement the Mexican Hat.



## NRC 326-4 Long-Life Cryotrap

A large, built-in reservoir allows 20 hours of uninterrupted operation of this cryogenic trap. Efficient baffle geometry provides fully effective trapping while retaining about 45% of the VHS-4 pump speed when used without other baffles. Cryogenic temperatures are sustained even as the liquid nitrogen level drops. More than 25,000 l/s intrinsic pumping speed for water vapor is provided by the large cryogenic surface of this trap.

An additional feature is a built-in ambient temperature\* partial baffle designed specifically to supplement the pump's cold cap or Mexican Hat. This stops backstreaming before it can reach the underside of the cryogenic surface, preventing pump fluid buildup during sustained operation, even for many weeks, and generally improving trapping efficiency for cycles of any length.

The complete reservoir/baffle/trap assembly is easily removed from the outer shell without dismantling the diffusion pump system. The ambient baffle can be easily detached from the trap assembly if desired. Construction is of electropolished stainless steel with a nickel-plated copper central disc.

\*during operation this temperature is lower than that provided by water cooling

## NRC 334 Low-Profile Water-Cooled Baffle

This compact, optically dense chevron baffle provides complete interception of backstreaming while retaining about 45% of pumping speed. (Residual backstreaming cannot be measured by the American Vacuum Society's standard collection method.) This is useful in applications without cryogenic traps where clean operation at  $10^{-8}$  Torr or above is required, but traces of pump fluid vapor are not objectionable. The vapor pressure of modern pump fluids is in the  $10^{-8}$  to  $10^{-10}$  Torr range at room temperature. Mechanical refrigeration can be used to produce lower temperatures than possible by water cooling. The low profile adds only 2 inches of height to the pumping combination.

## NRC 316-4 Cryotrap

This trap is ideal for applications requiring critical cleanliness or pressures below  $10^{-8}$  Torr, or high pumping speed for condensables. While retaining about 45% of the VHS-4 pump speed, its compact, optically-dense circular-chevron geometry assures the interception of molecules by cryogenic surfaces regardless of the direction from which they come. Filling is easy with the concentric fill/vent tube which also accepts standard liquid level control probes. Duration of a charge is typically 4.5 hours.








## NRC 1293S-4 Aluminum Solid-Body Slide Valve

Because of its low profile and full-diameter opening, the NRC 1293S-4 slide valve provides the highest possible conductance. With the mechanism under vacuum, the solid cast-aluminum body and the double-pumped stem seal combine to give low gas contribution to your system. The self-adjusting disc with  $90^\circ$  motion at point of contact gives a no-scuff O-ring seal against the seat and provides long trouble-free service.

# VHS-4 Diffusion Pump And Components

NRC's outstanding VHS series diffusion pumps provide twice the speed of other like-sized pumps and less than a twentieth of the backstreaming of the closest rival.

Nominally a 4-inch pump, the VHS-4 actually performs as well as most competitive 6-inch pumps. Here you'll see the VHS-4 with a complete array of matching components, together with performance information on various combinations. Now you can easily select the best combination for your requirements at the lowest possible cost.

COMBINATIONS	TYPICAL APPLICATIONS	PUMPING SPEED l/s (air)	
		With Cold Cap	With Mexican Hat
<b>PUMP ONLY</b> <ul style="list-style-type: none"> <li>• highest speed</li> <li>• lowest cost</li> </ul> 	GENERAL PURPOSE VACUUM TUBE EVACUATION VACUUM FURNACES	1200	800
<b>PUMP AND LOW-PROFILE BAFFLE</b> <ul style="list-style-type: none"> <li>• high speed</li> <li>• clean</li> <li>• fast cycles (valved)</li> </ul>  	METALLIZING PROTECTIVE COATINGS (Cadmium, etc.) VACUUM FURNACES  $10^{-4}$ to $10^{-7}$ Torr range	500	Water-Cooled Baffle not necessary when Mexican Hat is used
<b>PUMP AND CRYOTRAP</b> <ul style="list-style-type: none"> <li>• high speed</li> <li>• very clean</li> <li>• fast cycles (valved)</li> </ul> 	THIN FILM DEPOSITION OPTICAL COATINGS ELECTRONIC COATINGS SOLID-STATE RESEARCH MOLECULAR BEAMS  $10^{-6}$ to low $10^{-8}$ Torr range	550	450
<b>PUMP AND LONG-LIFE CRYOTRAP</b> <ul style="list-style-type: none"> <li>• high speed</li> <li>• extremely clean</li> <li>• long LN<sub>2</sub> duration</li> </ul> 		450	380
		550	450
<b>PUMP LOW-PROFILE BAFFLE CRYOTRAP AND SLIDE VALVE</b> <ul style="list-style-type: none"> <li>• extremely clean</li> <li>• extra protection</li> </ul> 	THIN FILM DEPOSITION OPTICAL COATINGS ELECTRONIC COATINGS SOLID-STATE RESEARCH MOLECULAR BEAMS  $10^{-6}$ to low $10^{-8}$ Torr range	310	Water-Cooled Baffle not necessary when Mexican Hat is used
		310	

The combinations given below are included for information purposes, but the Mexican Hat and Long-Life Cryotrap. Also, they reduce pumping speed protection against accidental exposure of the diffusion pump to pressure.

\*Backstreaming rates near ambient temperatures vary directly with vapor pressure of  
 \*\*Approximate values at inlet of pumping combination; system ultimate depends on ch  
 \*\*\*Too small to be measured by standard collection method of American Vacuum Societ

Start with the VHS-4 pump. Then choose low-profile water-cooled baffles, high-conductance cryogenic traps, and aluminum slide valves. You also have further choice: the Mexican Hat Cold Cap for even lower pump backstreaming rates. Long-Life Trap for extended holding times, and air-operated valves for remote or automatic cycles.

With the comprehensive selection table below, you can now eliminate tedious calculations and benefit from our years of application experience as you choose a pumping combination to meet your needs. You'll gain superior performance and reduced cost through the use of Varian/NRC vacuum components.

BACKSTREAMING RATE *		ULTIMATE PRESSURE **		TOTAL HEIGHT	MODEL NUMBER	LN <sub>2</sub> DURATION
Mg/cm <sup>2</sup> /min. (DC-704)		Torr		inches		hours
With Cold Cap	With Mexican Hat	Using DC-704	Using DC-705 or S-5	With Cold Cap or Mexican Hat	Specify Mexican Hat Separately	With Cold Cap or Mexican Hat
5x10 <sup>-4</sup>	<1x10 <sup>-4***</sup>	<5x10 <sup>-8</sup>	<5x10 <sup>-9</sup>	18	VHS-4	—
<1x10 <sup>-4***</sup>	<1x10 <sup>-4***</sup>	<5x10 <sup>-8</sup>	<5x10 <sup>-9</sup>	20	VHS-4, 334	—
<1x10 <sup>-4***</sup>	<1x10 <sup>-4***</sup>	5x10 <sup>-8</sup>	1x10 <sup>-8</sup>	24.5	VHS-4, 334, 1293S-4	—
1x10 <sup>-7</sup>	1x10 <sup>-7</sup>	5x10 <sup>-9</sup>	1x10 <sup>-9</sup>	23.5	VHS-4, 316-4	4.5
1x10 <sup>-7</sup>	1x10 <sup>-7</sup>	<1x10 <sup>-8</sup>	<5x10 <sup>-9</sup>	28	VHS-4, 316-4, 1293S-4	4.5
<1x10 <sup>-7</sup>	<1x10 <sup>-7</sup>	<5x10 <sup>-9</sup>	<1x10 <sup>-9</sup>	26	VHS-4, 326-4	20
<1x10 <sup>-7</sup>	<1x10 <sup>-7</sup>	5x10 <sup>-9</sup>	2x10 <sup>-9</sup>	30.5	VHS-4, 326-4, 1293S-4	20
<1x10 <sup>-7</sup>	<1x10 <sup>-7</sup>	<1x10 <sup>-8</sup>	<5x10 <sup>-9</sup>	30	VHS-4, 334, 316-4, 1293S-4	4.5
<1x10 <sup>-7</sup>	<1x10 <sup>-7</sup>	5x10 <sup>-9</sup>	2x10 <sup>-9</sup>	32.5	VHS-4, 334, 326-4, 1293S-4	24

are not usually recommended because they offer no significant advantages over the combinations which utilize and by approximately 20% (310 l/s vs. 380 l/s for valved combinations). These systems may provide added exceeding the normal operating range.

mid.  
number design, type of seals, and process outgassing.



## Specifications

### VHS-4 DIFFUSION PUMP

<b>Speed (maximum):</b>	<b>Air</b>	1200 l/s
	<b>Helium</b>	1500 l/s
<b>Forepressure (maximum):</b>		6.5 x 10 <sup>-1</sup> Torr (no load)
		5.5 x 10 <sup>-1</sup> Torr (at 2.0 Torr l/s)
<b>Fluid Charge:</b>		300 cc
<b>Heat-up:</b>		10 minutes
<b>Cool-down:</b>		10 minutes
<b>Water:</b>		0.15 gpm at 60°F to 85°F
<b>Heater Rating:</b>		1400 watts (120/240/1/60) ±5%
<b>Jet Assembly:</b>		Four-stage self-aligning, stainless steel
<b>Foreline Baffle:</b>		Stacked half-moon
<b>Water Connections:</b>		1/8 inch F.P.T.
<b>Body and Flanges:</b>		Stainless steel, copper cooling coils
<b>Foreline Baffle:</b>		Stainless steel
<b>Heater Skirt:</b>		Aluminum
<b>Net Weight:</b>		27 pounds
<b>Shipping Weight:</b>		55 pounds

### NRC 334 LOW-PROFILE WATER-COOLED BAFFLE

<b>Conductance:</b>	900 l/s
<b>Recommended Flow:</b>	0.1 to 0.2 gpm

### NRC 316-4 CRYOTRAP

<b>Conductance</b>	
<b>(below 10<sup>-4</sup> Torr):</b>	950 l/s
<b>Reservoir Volume:</b>	925 cc
<b>Liquid Nitrogen required</b>	
<b>to fill and cool</b>	
<b>initially (approx):</b>	3300 cc
<b>Holding Time for single</b>	
<b>Liquid Nitrogen charge</b>	
<b>using auxiliary water</b>	
<b>baffle below NRC 316-4</b>	
<b>Cryotrap (approx.):</b>	4½ hours

### NRC 326-4 LONG-LIFE CRYOTRAP

<b>Conductance</b>	
<b>(below 10<sup>-4</sup> Torr):</b>	950 l/s
<b>Reservoir Volume:</b>	8.5 liters
<b>Liquid Nitrogen Duration:</b>	20 hours
<b>Initial Cooling:</b>	14 liters

### NRC 1293S-4 SLIDE VALVE

<b>Conductance:</b>	2450 l/s
<b>Seal (nonscuff):</b>	O-ring

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