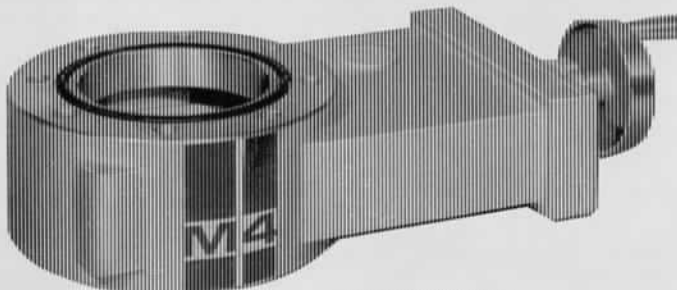


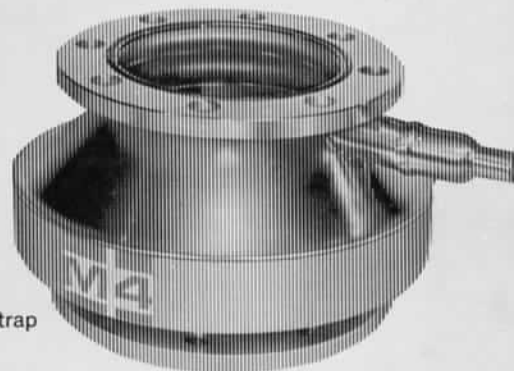
M-4 Diffusion Pump



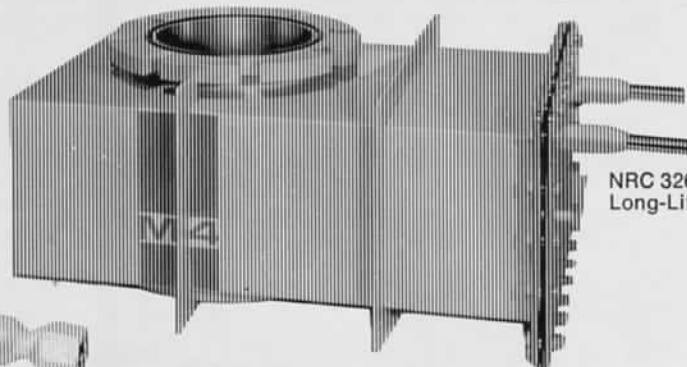
NRC 1293S-4
Aluminum Solid-Body
Slide Valve



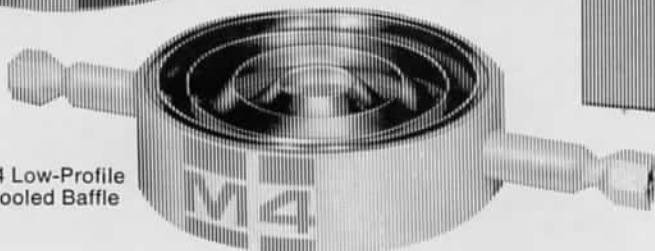
NRC 316-4 Cryotrap



NRC 326-4
Long-Life Cryotrap



NRC 334 Low-Profile
Water-Cooled Baffle



M-4 Diffusion Pump

The M-4 Diffusion Pump belongs to a family of pumps designed to combine high performance and unusually low cost when used alone or with matching components.

The backstreaming rate of the M-4 pump is less than $0.0001 \text{ Mg/cm}^2/\text{min}$.—five times better than other diffusion pumps. As a result of this superior performance, it is often possible to use the M-4 without traps or baffles. However, when these components are added, the degree of cleanliness at the inlet of the topmost component is greater than that possible with other pumping systems.

The standard patented cold cap*, which intercepts over 98% of backstreaming vapor, has been redesigned to keep it colder by more efficient heat transfer, and it is easier to install and maintain.

The ejector stage is a critical area for performance. The large condensing surface makes the M-4 virtually insensitive to variations in voltage and type of pump fluid. Because vapor is more thoroughly condensed, the loss that sometimes occurs under high-throughput conditions is minimized. The condenser's horizontal orientation and added length provide the most efficient degassing of the condensed fluid before it returns to the boiler.

The high powered boiler achieves high throughput and forepressure tolerance. By using innovative design, the boiler temperature is still lower than in most diffusion pumps, thus minimizing pumping fluid breakdown. The fully compartmented jet separates and ejects whatever light fractions are produced from the vapor.

The M-4 pump has full thermostatic protection against inadequate cooling water, low pump fluid, or inoperative forepump.



NRC 316-4 Cryotrap

This trap is ideal for applications requiring critical cleanliness, pressures below 10^{-8} Torr, or high pumping speed for condensables. While retaining over 50% of the M-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. An adapter is provided with each trap to allow the use of mechanical refrigeration rather than liquid nitrogen.



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° motion at point of contact gives a no-scuff O-ring seal against the seat and provides long trouble-free service.



NRC 334 Low-Profile Water-Cooled Baffle

This compact, optically dense chevron baffle provides complete interception

of primary backstreaming while retaining 50% of pumping speed. This is useful in applications which don't require cryogenic traps, but where clean operation at 10^{-8} Torr or above is desired. 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 pump stack.

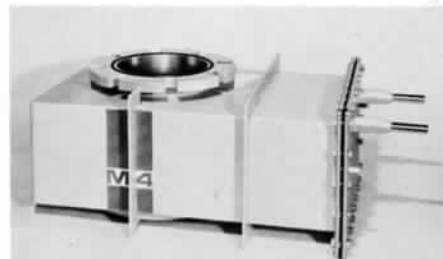


NRC 326-4 Long-Life Cryotrap

A large, built-in reservoir allows 20 hours of uninterrupted operation of this cryogenic trap. Efficient baffle geometry provides totally effective trapping while retaining over 50% of the M-4 pump speed when used without other baffles. Cryogenic temperatures are sustained even as the liquid nitrogen level drops. More than 25,000 1/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 M-4 pump's cold cap. This stops backstreaming before it can reach the underside of the cryogenic surface, preventing pump fluid build-up during sustained operation (even for many weeks) and generally improving trapping efficiency.

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.






*Licensed exclusively from Edwards High Vacuum Ltd.; U.S. Patent No. 2919061

*During operation this temperature is lower than that provided by water cooling.

MATCHED FOR TOP PERFORMANCE

M-4 Diffusion Pump
and Matching Components

Combinations		Typical Applications
<p>M-4 PUMP ONLY</p> <ul style="list-style-type: none"> ● Highest Speed ● Lowest Cost <p>PUMP AND LOW-PROFILE BAFFLE</p> <ul style="list-style-type: none"> ● High Speed ● Clean ● Fast Cycles (Valved) 		<p>GENERAL PURPOSE VACUUM TUBE EVACUATION VACUUM FURNACES</p> <p>METALLIZING PROTECTIVE COATINGS (Cadmium, etc.) VACUUM FURNACES</p> <p>10⁻⁴ TO 10⁻⁷ TORR RANGE</p>
<p>PUMP AND CRYOTRAP</p> <ul style="list-style-type: none"> ● High Speed ● Very Clean ● Fast Cycles (Valved) <p>PUMP AND LONG-LIFE CRYOTRAP</p> <ul style="list-style-type: none"> ● High Speed ● Extremely Clean ● Long LN₂ Duration 		<p>THIN FILM DEPOSITION OPTICAL COATINGS ELECTRONIC COATINGS SOLID-STATE RESEARCH MOLECULAR BEAMS</p> <p>10⁻⁶ TO LOW 10⁻⁸ TORR RANGE</p>
<p>The combinations given below are included for those who do not utilize the Long-Life Cryotrap. Also, they reduce the risk of damage against accidental exposure of the diffusion pump.</p>		
<p>PUMP, LOW-PROFILE BAFFLE, CRYOTRAP, AND SLIDE VALVE</p> <ul style="list-style-type: none"> ● Extremely Clean ● Extra Protection 		<p>THIN FILM DEPOSITION OPTICAL COATINGS ELECTRONIC COATINGS SOLID-STATE RESEARCH MOLECULAR BEAMS</p> <p>10⁻⁶ TO LOW 10⁻⁸ TORR RANGE</p>

With internal geometry and transition between adjacent components as primary design considerations, the M-Series components were built to completely match and complement the M-4 Diffusion Pump. This matching design enables the M-4 Pump/Baffle

combination to retain 50% of the basic pump speed—a much greater percentage than previously possible. Backstreaming is virtually eliminated—less than 0.0001 Mg/cm²/min. for the M-4 pump and almost zero* when used with the matching baffles.

Now, you can order a matched vacuum pumping array to suit your particular needs—with a minimum of speed/cleanliness compromise. The comprehensive table below will help you to make the ideal match.

*Too small to be measured using the standard collection method of the American Vacuum Society.

Pumping Speed l/s (air)	Backstreaming Rate* Mg/cm ² /min. (DC-704)	Ultimate Pressure** Torr		Total Height Inches	Model Number	LN ₂ Duration Hours
		DC-704	DC-705, S-5			
800	0.0001	< 5 x 10 ⁻⁸	< 5 x 10 ⁻⁹	16.5	M-4	—
420	< 5 x 10 ⁻⁵ ***	< 5 x 10 ⁻⁸	< 5 x 10 ⁻⁹	18.5	M-4 334	—
380	< 5 x 10 ⁻⁵ ***	5 x 10 ⁻⁸	1 x 10 ⁻⁸	22.5	M-4 334 1293S-4	—
470	1 x 10 ⁻⁷	5 x 10 ⁻⁹	1 x 10 ⁻⁹	23	M-4 316-4	4.5
430	1 x 10 ⁻⁷	1 x 10 ⁻⁸	1 x 10 ⁻⁸	27	M-4 316-4 1293S-4	4.5
470	1 x 10 ⁻⁷	< 5 x 10 ⁻⁹	< 1 x 10 ⁻⁹	24.5	M-4 326-4	20
430	1 x 10 ⁻⁷	1 x 10 ⁻⁸	1 x 10 ⁻⁸	28.5	M-4 326-4 1293S-4	20
Information purposes, but are not usually recommended because they offer no significant advantages over the combinations which pump speed by approximately 45% (240 l/s vs. 430 l/s for valved combinations). These systems may provide added protection to pressures exceeding normal operating range.						
240	1 x 10 ⁻⁷	1 x 10 ⁻⁸	1 x 10 ⁻⁸	29	M-4 334 316-4 1293S-4	4.5
240	1 x 10 ⁻⁷	1 x 10 ⁻⁸	1 x 10 ⁻⁸	30.5	M-4 334 326-4 1293S-4	24

*Backstreaming rates near ambient temperatures vary directly with vapor pressure of fluid.

**Approximate values at inlet of pumping combination; system ultimate depends on chamber design, type of seals, and process outgassing.

***Too small to be measured by standard collection method of American Vacuum Society.

Specifications

M-4 DIFFUSION PUMP

Speed (maximum): Air	800 1/s
Helium	1000 1/s
Forepressure (maximum):	6.5 x 10 ⁻¹ Torr (no load)
	4.5 x 10 ⁻¹ Torr (full load)
Maximum Throughput:	1.3 Torr-liters/sec
Fluid Charge:	250 cc
Heat-up:	12 minutes
Cooldown:	10 minutes
Water:	0.25 gpm at 60°C to 85°C
Heater Rating:	1000 W (120/240/1/60) ± 5%
Jet Assembly:	Four-stage self-aligning aluminum with cold cap
Foreline Baffle:	Stainless steel, half-moon
Water Connections:	1/8" FPT
Body:	Stainless steel
Flanges:	Mild steel
Heater Skirt:	Aluminum
Net Weight:	27 pounds
Shipping Weight:	45 pounds

NRC 334 LOW-PROFILE WATER-COOLED BAFFLE

Conductance:	900 1/s
Recommended Flow:	0.1 to 0.2 gpm

NRC 316-4 CRYOTRAP

Conductance (below 10 ⁻⁴ Torr):	950 1/s
Reservoir Volume:	925 cc
Liquid nitrogen required to fill and cool initially (approx):	3300 cc
Holding time for single liquid nitrogen charge using auxiliary water baffle below NRC 316-4 Cryotrap (approx.):	4½ hours

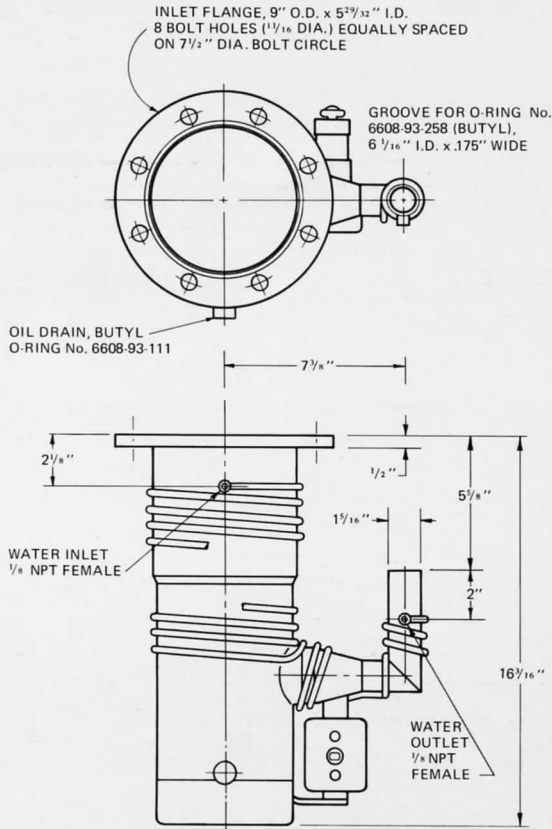
NRC 326-4 LONG-LIFE CRYOTRAP

Conductance (below 10 ⁻⁴ Torr):	950 1/s
Reservoir Volume:	8.5 liters
Liquid Nitrogen Duration:	20 hours
Initial Cooling:	14 liters

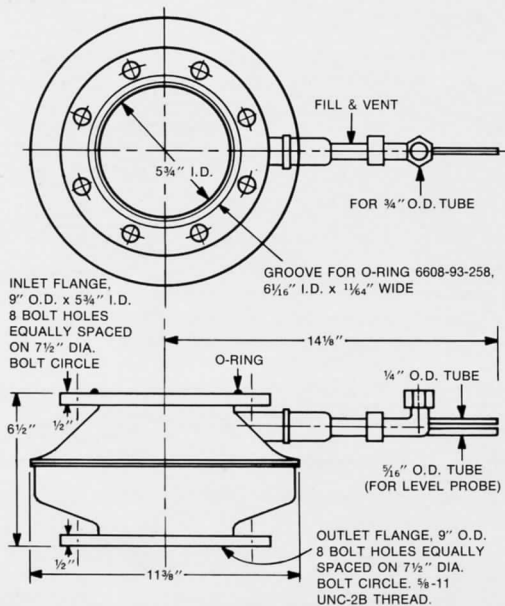
NRC 1293S-4 SLIDE VALVE

Conductance:	2450 1/s
Seal (nonscuff):	O-ring

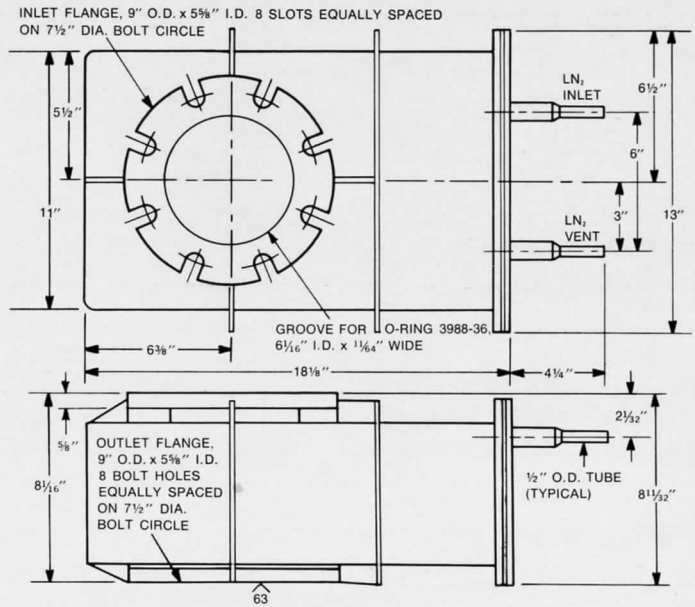
Dimension Drawings



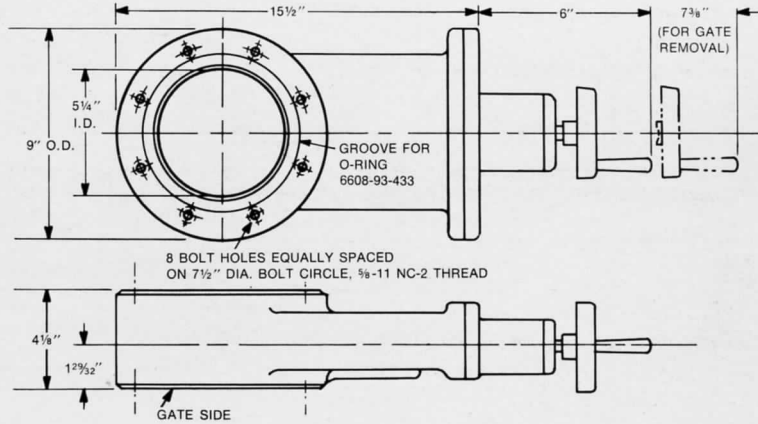
M-4 DIFFUSION PUMP (M-4 Series)



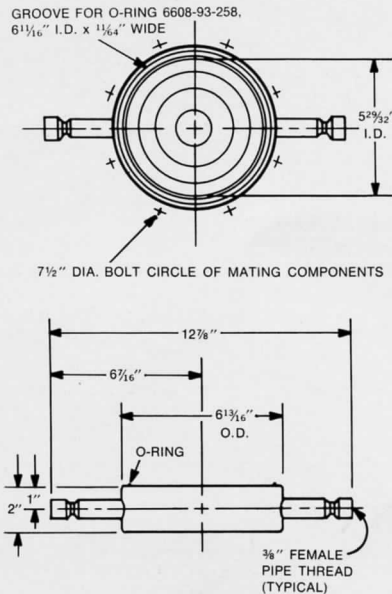
NRC 316-4 CRYOTRAP (M-4 Series)



NRC 326-4 LONG-LIFE CRYOTRAP (M-4 Series)



NRC 1293S-4 SLIDE VALVE (M-4 Series)



NRC 334 LOW-PROFILE WATER-COOLED BAFFLE (M-4 Series)