Varian, Inc.
Vacuum Technologies

Turbo-V 2300 TwisTorr

The new molecular-drag technology

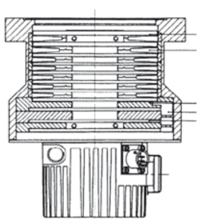
TwisTorr

NOTICE: This document contains references to Varian. Please note that Varian, Inc. is now part of Agilent Technologies. For more information, go to **www.agilent.com/chem.**

Agilent Technologies

TwisTorr
The new molecular-drag technology

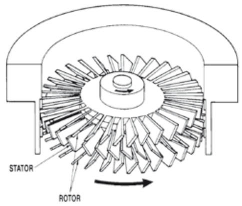
2010
- Today Varian, now a part of Agilent Technologies, presents the new TwisTorr molecular drag technology based on its well-known hybrid Turbo Molecular Pump design, and introducing a spiral drag section that achieves unmatched performance in both pumping speed and K-ratio in the most compact space available. New state-of-the-art electronics complete this industry leading Turbo Molecular Pump innovation



2003
- With the Turbo-V 2K-G Varian introduces a fully integrated Turbo pumping system

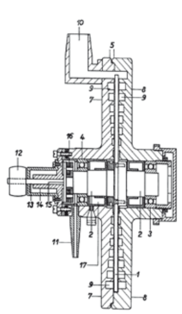
1996
- Introduction by Varian of microprocessor-based on-board controller units: Navigator line

1991
- Varian introduces a new hybrid type Turbo Molecular Pump: one monolythic rotor provides both high speed (Turbo stages) and high foreline tolerance (MacroTorr® stages)
- Use of ceramic ball bearings with life-time lubrication using a proprietary dry solid lubricant



1986
- Varian begins collaboration with Elettrorava for technology and know-how transfer

1980
- Introduction of ceramic ball bearing technology
- Compound Turbo Molecular Pumps appear, combining a Turbo section with a Drag section

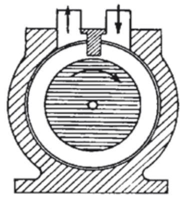


1970
- Snecma design commercialized by Elettrorava, with manufacturing based in Turin, Italy

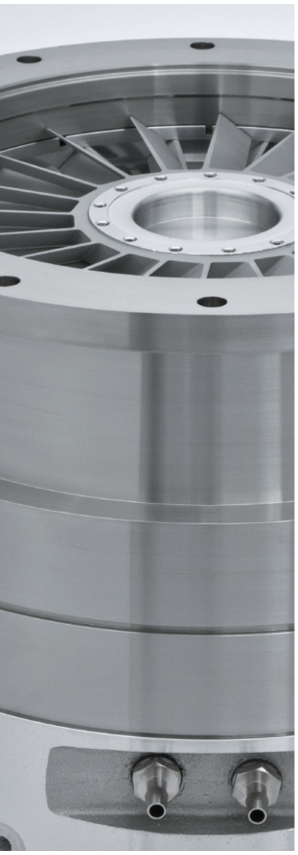
1965
- First prototype of axial flow turbo pump (Snecma), with open thin blades
- This design is the basis for modern TMP technology

1960
- Theoretical basis for the pumping mechanism of axial flow impeller (Shapiro and Kruger, MIT)

1958 First Turbo Molecular pumps developed using experimental design:
- Double-Ended design (Becker), based on a closed cell design using thick rotor and stator blades (this design was abandoned in the late '70s)
- Axial flow pumping principle, demonstrated in the high vacuum regime (Hablanian)



EARLY 1900 First Molecular Drag pumps
- 1912 W.Gaede
- 1922 F.Holweck
- 1929 M.Siegbahn

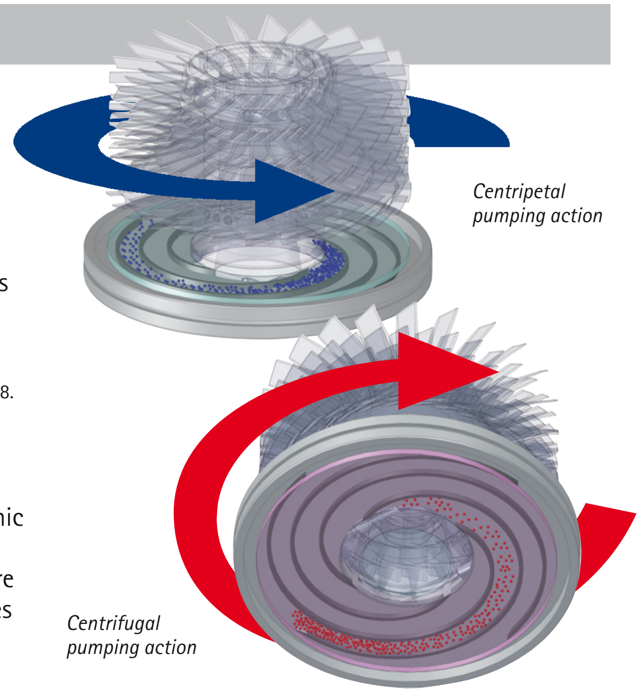


WHAT IS TWISTORR

TwisTorr Technology*

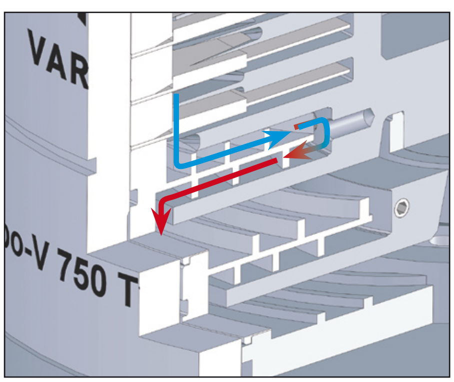
- Pumping effect is created by spinning rotor disk which transfers momentum to gas molecules.
- Gas molecules are forced to follow spiral groove design on the stator. The design of the channel ensures constant local pumping speed and avoids reverse pressure gradients, minimizing power consumption.

(*) US Patents applications 12/343961 and 12/343980, 24 Dec. 2008.



Space Saving Design

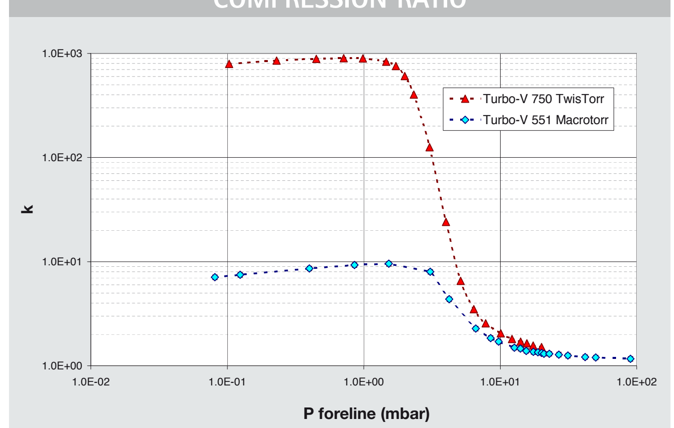
- Our rotor is based on the proven Varian monolithic rotor design which positions the TwisTorr Stator between two smooth spinning disks and therefore exploits the pumping action by both disk surfaces in series.
- The double-sided spiral groove design on the TwisTorr stators combines centripetal and centrifugal pumping actions in series, greatly reducing the size of the drag section.



Compression ratio

- Compression ratio for N_2 of a single TwisTorr stage can increase up to a factor of 100 with respect to a MacroTorr® stage of the same space and rotor speed, without reducing foreline tolerance and pumping speed.

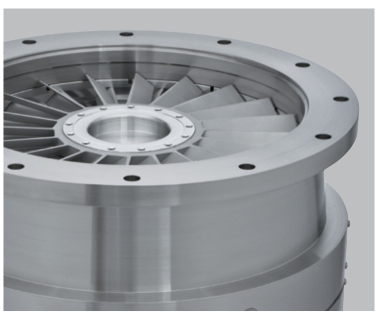
COMPRESSION RATIO



Turbo-V 2300 TwisTorr
Key features

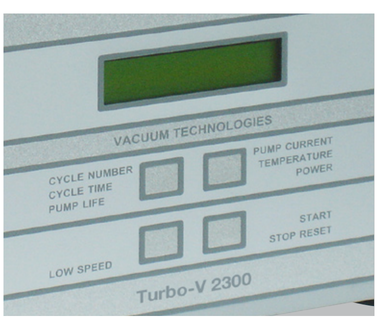
Leading edge performance

- The new Turbo-V 2300 TwisTorr offers the highest pumping speed in its class for N_2
- State of the art TwisTorr technology also creates higher compression ratios for light gases than other large Turbo Molecular Pumps
- The Turbo-V 2300 TwisTorr is designed for scientific and research applications and is operated with a dedicated full display rack controller
- TwisTorr allows for very high foreline pressure tolerance, so the pump may be backed by a smaller, cost-effective dry scroll pump like our TS600



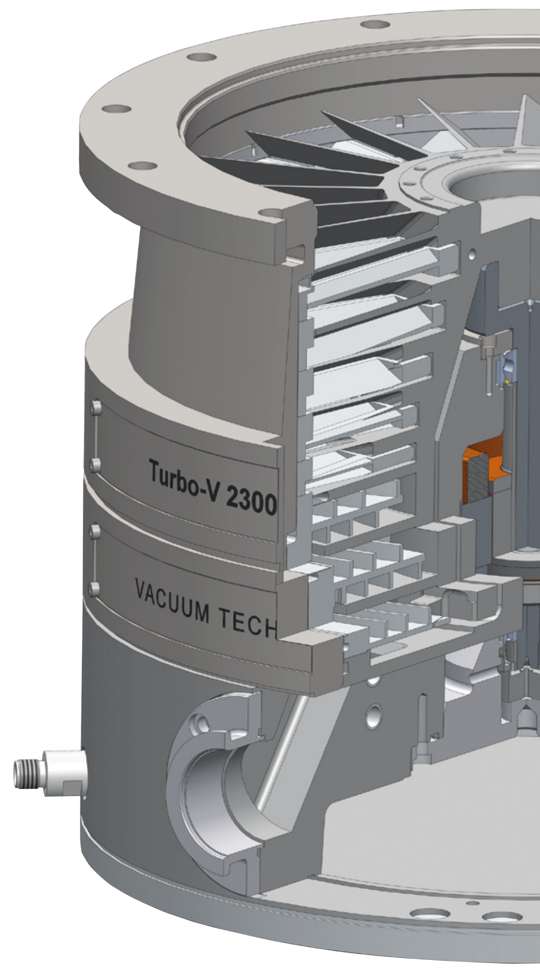
Dedicated UHV solution

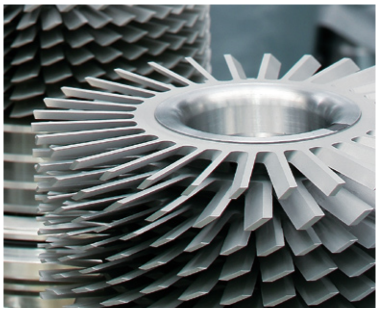
- The new high performing TwisTorr drag stages allow for a 20% reduction in the height and weight of the rotor
- High foreline pressure tolerance permits the use of a more compact dry fore pump, allowing you to downsize your system and run a fully UHV-compatible solution
- Rack electronics are ideally suited for research and laboratory environments, and because no electronics are present inside the pump, provide an excellent solution for radioactive applications as well



Advanced electronics

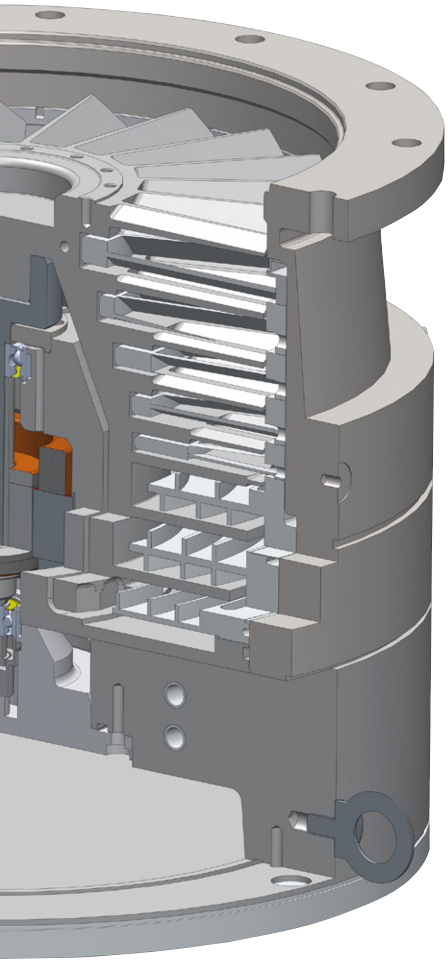
- The Turbo-V2300 solution is comprised of a stand-alone pump and a rack type display controller unit, available in two voltage versions: 110 and 220 VAC
- Remote control is available through Logical I/O and serial (RS232) connection. Profibus solutions are available on request as well
- The integrated Purge/Vent device allows for a controlled pump slow down, with a modulated vent procedure in combination with the Stop Speed Reading (SSR) function. The embedded purge gas solution protects bearings against dust and corrosive gases

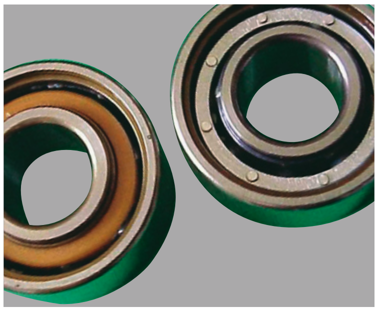




Design for Reliability

- VACUUM PERFORMANCE
  Advanced rotor design in combination with TwisTorr technology has allowed us to reduce the number of pumping stages by 20% compared to conventional designs. The result is a more compact, lighter rotor with improved overall vacuum performance. This compact rotor design also leads to an improved dynamic stability of the rotor and a reduced mechanical load on the suspension.
- ADVANCED ROTOR GEOMETRY
  Our unique monolithic rotor is fully automatically machined out of one single piece of advanced high strength aluminum alloy according to our proprietary design. This highly precise process reduces material stress and relaxes the required assembly tolerances compared with a traditional stacked rotor design, in which individual rotor stages are assembled on a shaft. Our proprietary new inverted shaft fitting process reduces stress by 60% compared to traditional fitting.
- OPERATING EFFICIENCY
  State of the art rotor design with improved motor efficiency allows delivery of higher vacuum performance with lower heat dissipation inside the pump. A further improvement to average lower running temperatures comes from our improved water cooling system, which uses a double loop stainless steel cooling channel casted inside our pump body.





Clean maintenance-free vacuum

- Modern research and scientific applications require the cleanest vacuum solution. For these applications we offer our unique UHV compatible Turbo Molecular Pump design. In our Turbo Molecular Pumps no suspension components are exposed to the UHV side of the system and there are no permanent magnetic bearings that could disturb the experimental chamber.
- Our high-precision ceramic ball bearings are both installed on the fore vacuum side of the pump and permanently lubricated with our unique proprietary solid lubricant characterized by an extremely low vapor pressure. This solution is absolutely maintenance free and allows for installation of the pump in any orientation.
- Our Turbo Molecular Pumps contain no free oil for bearing lubrication, thereby eliminating the need for refills and eliminating the risk of vacuum chamber contamination.

Turbo-V 2300 TwisTorr Rack

TECHNICAL SPECIFICATIONS

Vacuum Performances	
Pumping speed for N_2 (*)	2050 l/s
Pumping speed for He (*)	1800 L/s
Pumping speed for H_2 (*)	1500 L/s
Compression ratio for N_2	>8 x 10^8
Compression ratio for He	8 x 10^5
Compression ratio for H_2	4 x 10^4
Base pressure* (with recommended forepump)	10^{-10} mbar (7.5 x 10^{-11} Torr) (**)
Inlet Flange	ISO 250F, CFF 12" O.D.
Foreline flange	KF 40 NW

Other	
Nominal rotational speed	33300 rpm
Start-up time without gas load and with the recommended forepump	< 6 minutes
Minimum recommended forepump	TriScroll 600
Operational position	Any
Operating ambient temperature	+5 °C to +35 °C
Bakeout temperature	120°C (CFF), 80°C (ISO)
Max rotor temperature	120 °C
Vibration level (displacement)	< 0.01 µm at inlet flange
Lubricant	Permanent lubrication
Cooling requirements	Water
Coolant water	Recommended flow: 200 l/h Temperature: +15 °C to +30 °C Pressure: 3 to 5 bar (45 to 75 psi)
Noise level	<60 dB(A) at 1 meter
Storage temperature	-20° C to +70° C
Environment protection	IP54
Weight kg (lbs)	ISO 250: 54.2 (119.5) CF 12": 55.3 (121.9)

(*): WITHOUT INLET SCREEN

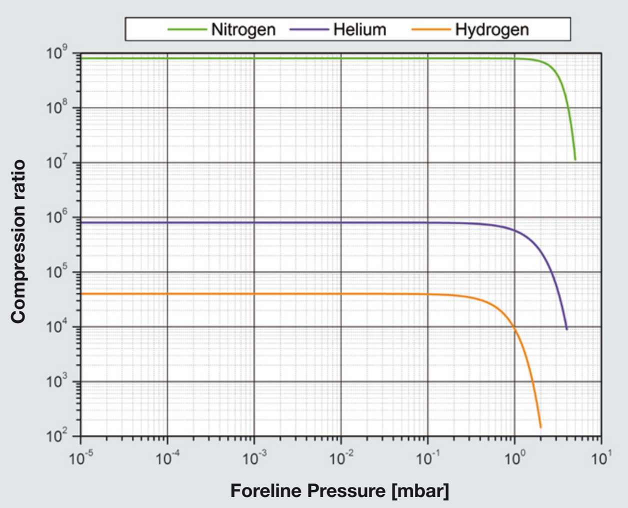
(*): According to standard DIN 28 428, the base pressure is that measured in a leak-free test dome, 48 hours after the completion of test dome bake-out, with a Turbopump fitted with a CFF flange and using the recommended pre-vacuum pump

Controller Specifications	
Motor control mode	Field Oriented Control (FOC)
Input voltage	100 - 240 Vac (± 10%)
Input frequency	50 - 60 Hz
Maximum input power	450 VA
Maximum output power	320 W (pump ramp-up) 300 W (water cooling) 200 W (forced air cooling) (up to 120 W cable power loss with 40 m cable length)
Interface	Navigator standard remote I/O RS 232, RS 485 serial Can accept internal Profibus board
Protection category	IP 20
Data Logger	Standard
Stop speed reading	Standard
Active stop	Standard
Automated Purge/Vent device control	Standard
External gauge readout	2 ports compatible with all Agilent gauges
Primary pump control	Pilot 2 external configurable relays (48 Vdc (± 10%) - 250 mA MAX)

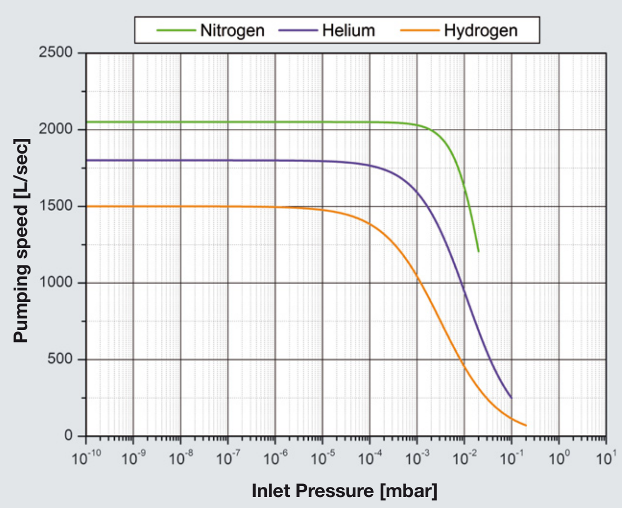
ORDERING INFORMATION

Pump	
969-6000	Turbo-V 2300 TwisTorr ISO250F
969-6001	Turbo-V 2300 TwisTorr CFF12" OD
Electronics	
969-9539	Turbo-V 2300 Rack Controller 120V
969-9540	Turbo-V 2300 Rack Controller 220 V
969-9962	Turbo-V 2300 Pump-Controller Cable kit, 5mt
Accessories	
969-9145	TV 2300 Purge/Vent KIT
969-9958	Mains cable NEMA Plug, 3m long
969-9957	Mains cable European Plug, 3m long
969-9144	Center-ring ISO250
969-9350	Inlet screen DIN ISO 250 // CFF12" AISI
969-9348	Water cooling kit for 6x8 (IDxOD) flexible tube
969-9338	Water cooling kit for 3/8 in. ID flexible tube

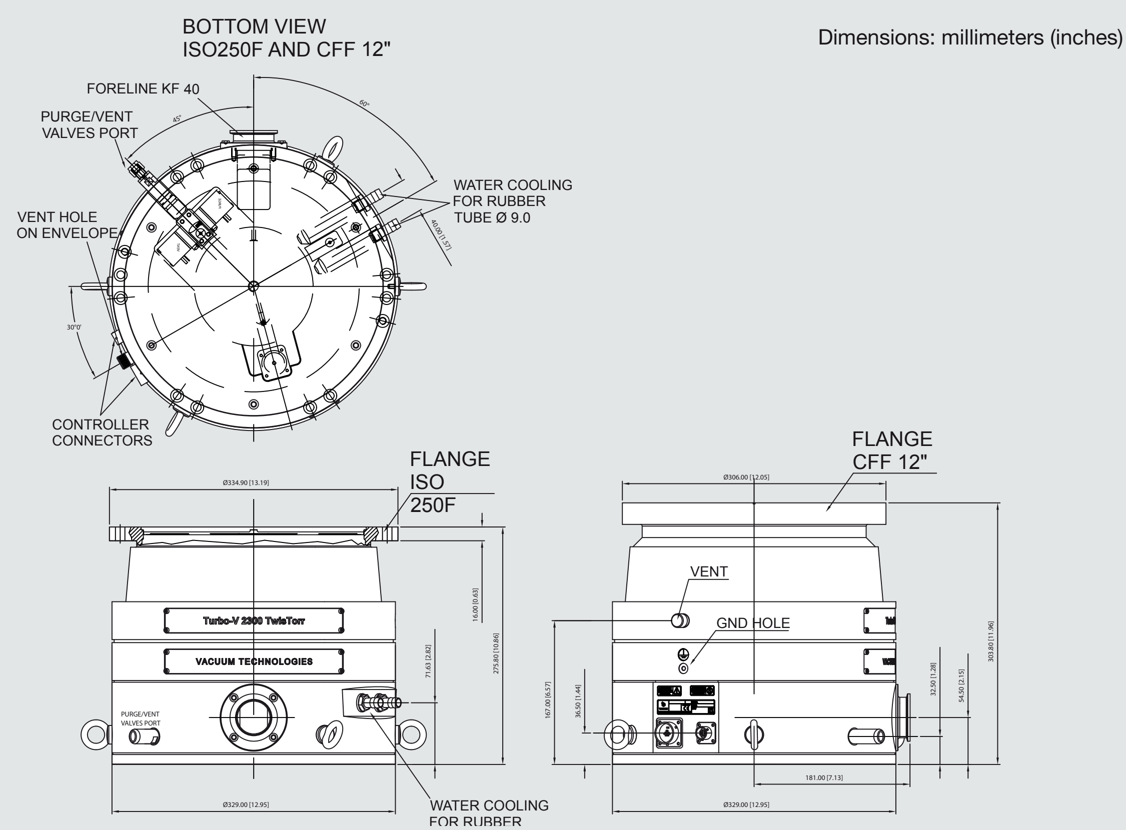
COMPRESSION RATIO vs FORELINE PRESSURE



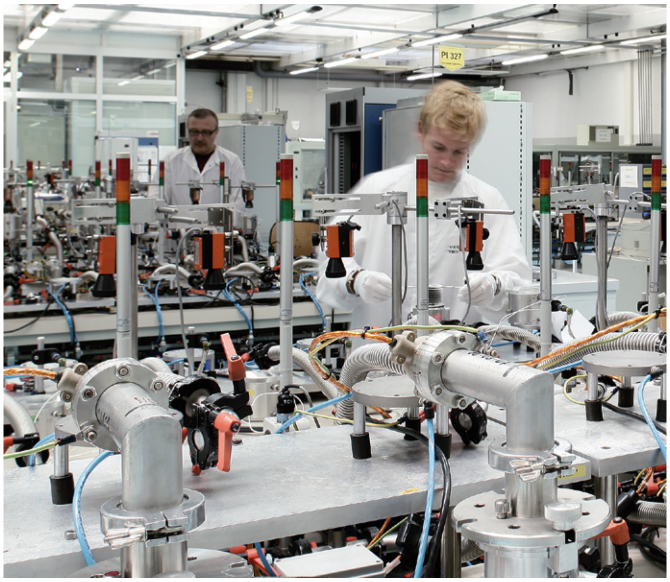
PUMPING SPEED



OUTLINE DRAWING



SERVICE & SUPPORT



ADVANCE EXCHANGE

To maximize uptime, and for those occasions where you cannot afford stopping your process, Varian offers exchange units for advanced shipment, with pumps which are rebuilt to as-new specs and latest revision level. As soon as requested, your order can be processed within 24 hours.

REPAIR

Varian products offer unmatched reliability, performance and cleanliness. Production requirements, however, inevitably create, over time, the need for maintenance and repair. Timely repair at Varian will keep your products performing at an outstanding level all the time.

UPGRADE

Designed for customers who want replace a Varian unit with a newest technology product. We rebuild these products to as-new specifications, with a full 12-month warranty.level all the time.

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ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001 CERTIFIED

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