



The new generation 300 l/s Turbo Pump
with Agilent Floating Suspension

AGILENT TWISTORR 304 FS

HIGH PERFORMANCE. INNOVATION. RELIABILITY.

The Measure of Confidence



Agilent Technologies

Agilent TwisTorr 304 FS

High Performance. Innovation. Reliability

Applications

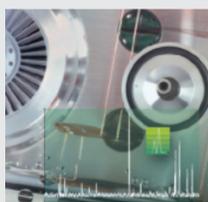
The new TwisTorr 304 FS represents a unique blend of performance and features that is perfectly suited for a wide range of applications:



Unmatched vacuum performance in its class, with TwisTorr stages optimized for H₂ compression, make it the ideal solution for demanding academic and research applications



Thanks to low vibration, low noise and high stability, the TwisTorr 304 FS meets the specific needs of Electron Microscopes



High throughput and optimized performance for light gases in routine applications meet the needs of the Instrumentation market



The TwisTorr 304 FS offers dry, clean vacuum for demanding industrial and semiconductor applications

A new category of Turbo Molecular Pumps

The TwisTorr 304 FS is a compact, reliable, energy efficient best-in-class 300 l/s Turbo drag package, with innovative, breakthrough technologies leading to outstanding performance, and designed for reliability, to meet highest quality standard



Agilent Floating Suspension

To ensure:

- Low vibration and acoustical noise
- Optimal working conditions for the bearings, extended operating life
- Exceptional stability for the very demanding SEM application



Proven best vacuum performance available,

with innovative TwisTorr stages to deliver:

- High pumping speed and compression ratios for Hydrogen and Helium
- High throughput, high foreline tolerance
- Low power consumption, low operating temperature

Features and Benefits

Feature	Advantage	User Benefit
Innovative TwisTorr technology	High compression ratio for light gases with very compact rotor design	Highest performance Minimal system footprint
High Foreline Tolerance	Small backing pump footprint	System downsizing (cost, dimensions)
Agilent Floating Suspension	Low vibration and acoustical noise Optimal bearing working conditions, extended operating life Vibration stability	Lowest noise Optimized CoO Minimum system downtime Constant performances overtime
Unique bearing & Dry lubrication concept	Maintenance Free Oil-free Any installation orientation	Hassle free operation No contamination risk User flexibility
Copper water cooling channel (optional)	No risk of corrosion Optimized heat transfer	Reduced water consumption and cost



Vacuum Technology Leadership: Agilent Vacuum, formerly Varian, is the market leader in UHV since the invention of the Ion Pump in 1957, and in turbo pumping solutions for academic and research, analytical instrumentation and electron microscopy applications



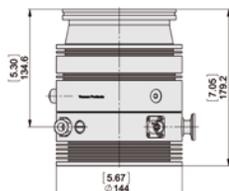
Complete Solutions

Agilent Dry Primary Scroll Pumps are the ideal combination for backing TwisTorr turbo pumps



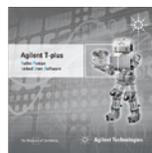
Advanced Electronics

- Complete system with Pump and Navigator on board controller
- Universal voltage rack type controller, with active gauge reading capability



Smallest Footprint

A unique solution in a smaller package than any Turbomolecular Pump available today

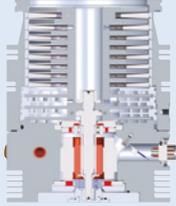


User-friendly Interface

T-Plus software for full PC/Laptop control enables easy data download and graphical display

Agilent TwisTorr

The new molecular-drag technology

2013	<ul style="list-style-type: none">● Agilent introduces the new TwisTorr 304 FS, with Agilent Floating Suspension	
2010	<ul style="list-style-type: none">● Agilent Technologies presents the new TwisTorr molecular drag technology based on its well-known hybrid Turbo Molecular Pump design, introducing a spiral drag section that achieves unmatched performance in both pumping speed and compression ratio in the most compact space available. New state-of-the-art electronics complete this industry leading Turbo Molecular Pump innovation	
2004	<ul style="list-style-type: none">● Varian develops a dedicated range of SEM products that meets the most stringent requirements of the industry	
2003	<ul style="list-style-type: none">● With the Turbo-V 2K-G Varian, now Agilent, introduces a fully integrated Turbo pumping system	
1996	<ul style="list-style-type: none">● Introduction by Varian of microprocessor-based on-board controller units: Navigator line, for computer driven plug-and-pump operation	
1991	<ul style="list-style-type: none">● Varian introduces a new hybrid type Turbo Molecular Pump: one monolithic 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	<ul style="list-style-type: none">● Varian begins collaboration with Elettrovava for turbomolecular pump technology and know-how transfer	

Agilent TwisTorr 304 FS

The new member of the TwisTorr Turbo Pumps family



Key Innovations

- New TwisTorr Molecular Drag Turbo pump technology
- Optimized clearances design
- Optimized thermal design, reducing rotor and bearings temperature
- New Agilent Floating Suspension
- Optimized bearings
- Noise <50 dB(A) at normal speed
- Vibration stability over time

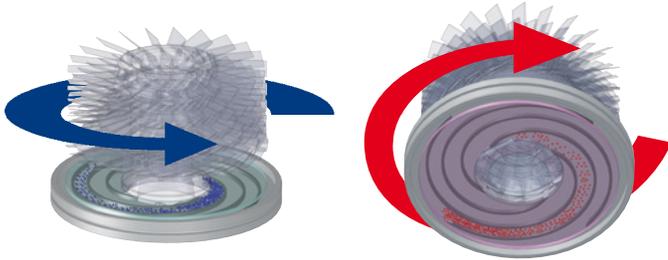


What is TwisTorr?

Agilent TwisTorr Technology*

- Pumping effect is created by a spinning rotor disk which transfers momentum to gas molecules.
- Gas molecules are forced to follow spiral groove design on the stator. The specific 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.



Centripetal pumping action

Lower surface area of rotating disk transfers momentum to gas molecules

Spiral groove design on the upper section of the TwisTorr stator causes a **centripetal** pumping action (Blue colored gas flow)

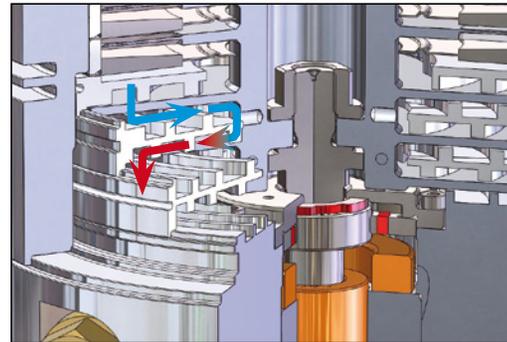
Centrifugal pumping action

Upper surface area of rotating disk transfers momentum to gas molecules

Spiral groove design on the lower section of the TwisTorr stator causes a **centrifugal** pumping action (Red colored gas flow)

Loading Edge Performance

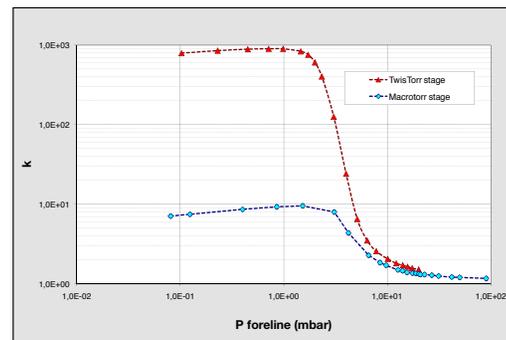
- The TwisTorr Pumps offer the highest pumping speed in their category for all gases.
- The state of the art TwisTorr technology also achieves the highest compression ratios for light gases in a commercially available Turbo Molecular Pump.
- While offering the highest performance, average power consumption by the new drag section design is reduced by at least 20% compared with previous designs.



Gas flow in centripetal and centrifugal direction through TwisTorr channels

Space Saving Design

- Our rotor is based on the proven Agilent 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 action in series, greatly reducing the size of the drag section.



Compression ratio

- Compression ratio for N₂ 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.

Agilent TwisTorr 304 FS

Technology and Innovation



Aluminum rotor with EDM bladed stages



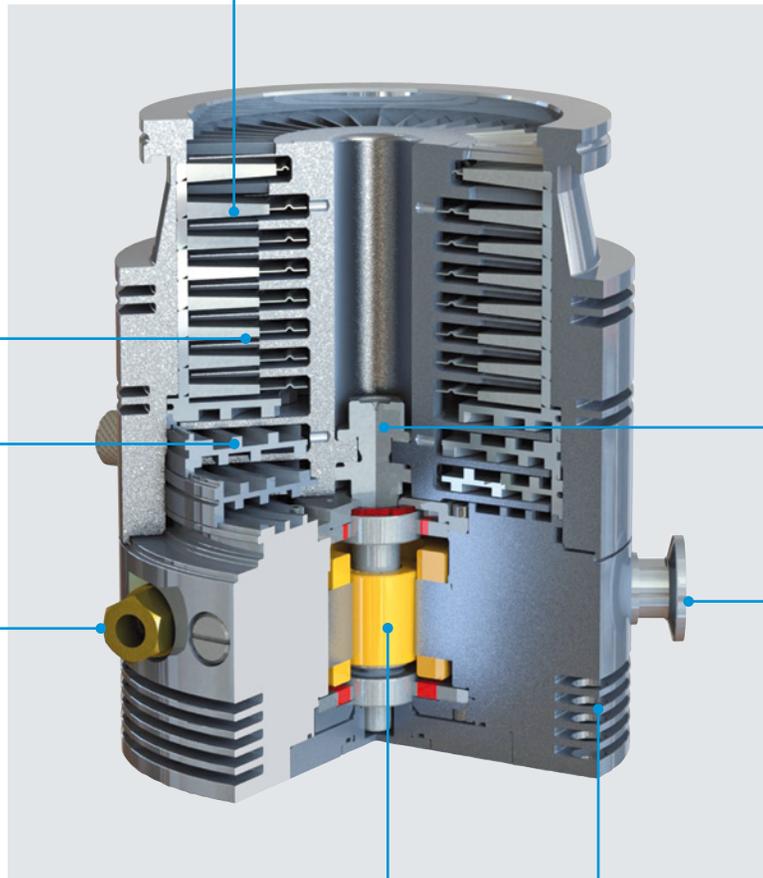
8 stamped SST turbo stators

Turbo section:

8 EDM turbo stages (rotor) designed to optimize pumping speed for light gases

Drag section:

New TwisTorr technology
3 TwisTorr drag stages (spiral channels) designed for high compression ratio performances



SST shaft, screwed on Aluminum rotor

Foreline flange
Replaceable

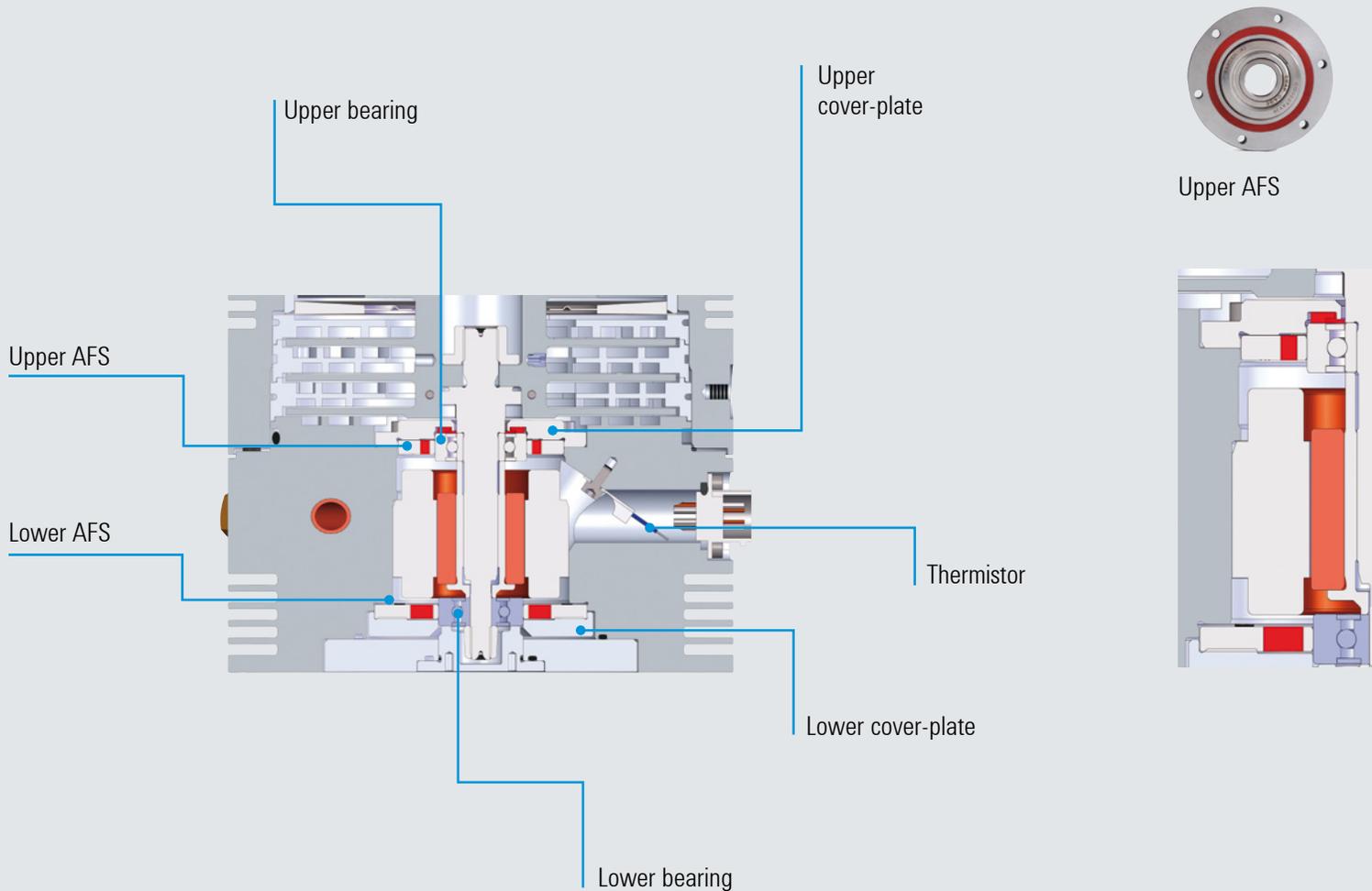
New water channel:
mandrel-fitted copper pipe



Electric motor

Air coolign fins

Agilent Floating Suspension

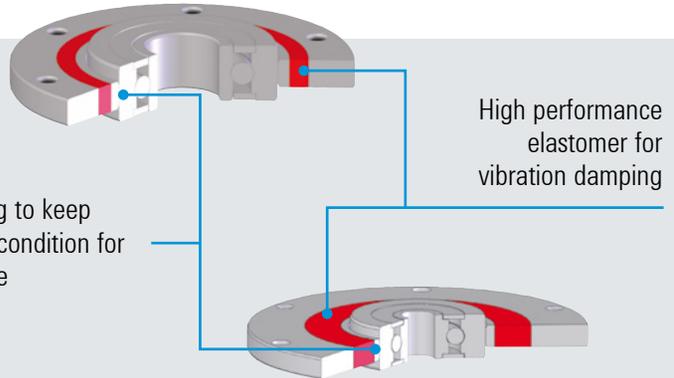


Mechanical Design

SST shaft screwed on Al rotor to provide rotor stability (bending effect, behaviour under external shock loads)

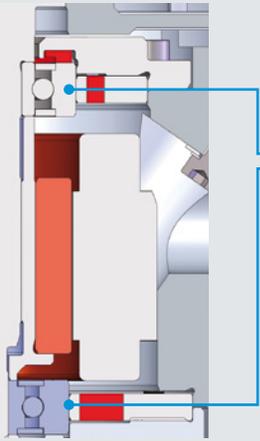
Agilent Floating Suspensions (AFS)

- AFS geometrical precision to guarantee bearing alignment
- Designed radial stillness to optimize rotor dynamic behaviour and acoustic noise
- Lower AFS acts as an axial spring to provide bearing's constant preload and rotor axial positioning
- Thermal stability
- Vibration stability over time



Radial press fitting to keep the best working condition for bearings over time

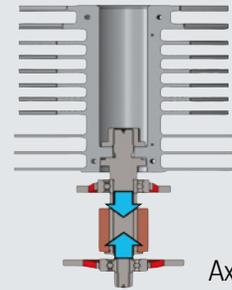
High performance elastomer for vibration damping



- AFS geometrical precision guarantees perfect bearings alignment
- Designed radial and axial stiffness, optimized rotor dynamic behaviour and acoustic noise
- Lower AFS acts as an axial spring providing bearing's preload and rotor axial positioning
- Thermal stability

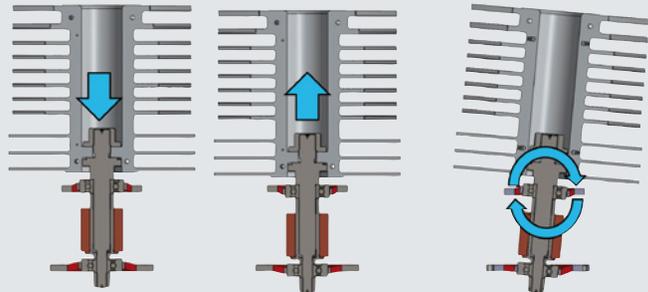


Lower AFS



Axial bearings pre-load

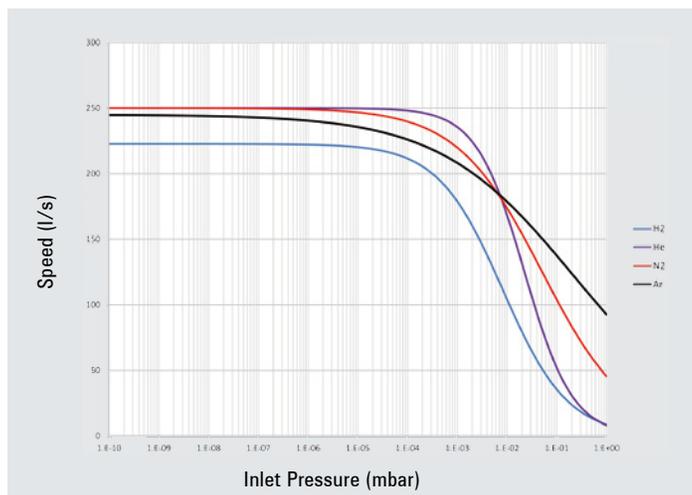
Floating rotor to improve vibration damping and control



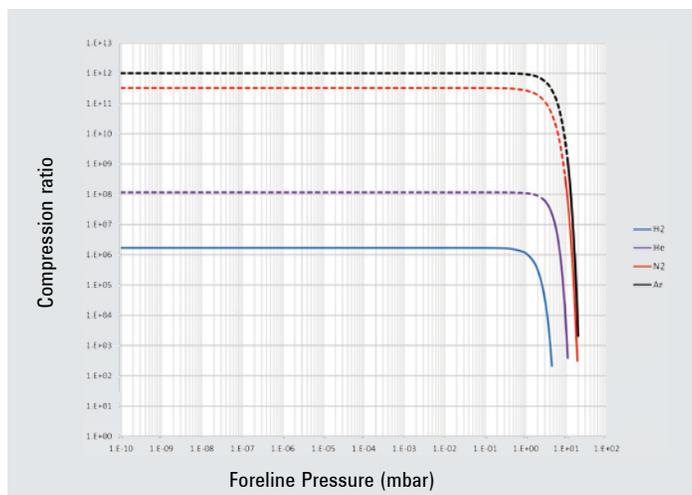
Agilent TwisTorr 304 FS



Pumping Speed



Compression Ratio



Technical Specifications

Pumping speed	ISO 100 / CF 6"	ISO 160 / CF 8"
N ₂	250 l/s	250 l/s
He	255 l/s	255 l/s
H ₂	220 l/s	220 l/s
Ar	250 l/s	250 l/s

Gas throughput at full rotational speed (with recommended forepump)	Ambient Temp. (25°C)	Water Temp. (25°C, 50 l/h)
N ₂	170 sccm	170 sccm
Ar	110 sccm	110 sccm

Compression ratio & Foreline Tolerance		
N ₂	> 1 x 10 ¹¹	>10 mbar
He	> 1 x 10 ⁸	>10 mbar
H ₂	1.5 x 10 ⁶	>4 mbar
Ar	> 1 x 10 ¹¹	>10 mbar

Base pressure with recommended forepump (5 m ³ /h)	
	< 1 x 10 ⁻¹⁰ mbar (< 1 x 10 ⁻¹⁰ Torr)

Inlet flange	
	CFF 8" O.D. ISO 160 CFF 6" O.D. ISO 100

Foreline flange	
	KF16 NW (KF25 - optional)

Rotational speed	
	60000 rpm (1010 Hz driving frequency)

Start-up time	
	< 3 minutes

Recommended forepump	mechanical:	Agilent DS 102
	dry pump:	Agilent SH 110

Operating position	
	Any

Operating ambient temperature	
	+5 °C to +35 °C

Relative humidity of air	
	0 - 90 % (not condensing)

Bakeout temperature	
	80 °C at inlet flange max (ISO flange) 120 °C at inlet flange max (CFF flange)

Lubricant	
	Permanent lubrication

Cooling requirements	
	Forced air (5- 35 °C ambient temperature) Water (mandatory if ambient temperature > 35 °C)

Coolant water	
	Minimum flow: 50 l/h (0.89 GPM) Temperature: +15 °C to +30 °C Pressure: 3 to 5 bar (45 to 75 psi)

Noise Pressure level	
	< 50 dB(A) at 1 meter

Storage temperature	
	-40° C to +70° C

Max altitude	
	3000 m

Weight kg (lbs)	Pump ISO 100	5.5 kg (12.3)
	Pump CFF 6"	7.5 kg (16.5)
	Pump ISO 160	5.7 kg (12.6)
	Pump CFF 8"	9.7 kg (20.9)

Conformity to norms

EMC	61326-1
Safety (CE/CSA) Regulatory	DIR 2006/42/CE
ROHS	DIR 2011/65/EU

Ordering Information

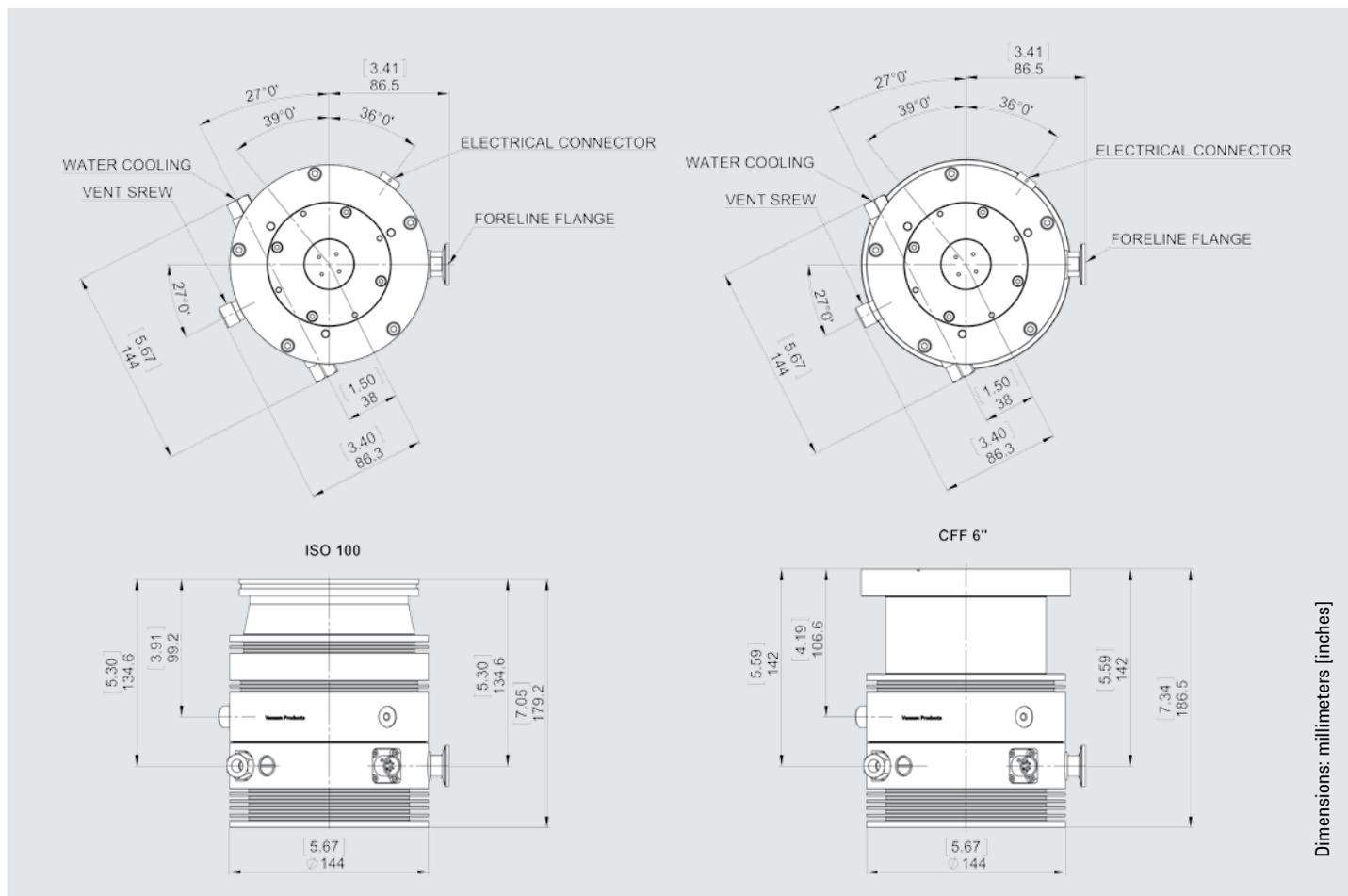
Pumps		Configuration Options
TwisTorr 304 FS ISO100	w/ water cooling	X3500#11#20
TwisTorr 304 FS CF6"	w/ water cooling	X3500#11#21
TwisTorr 304 FS ISO160	w/ water cooling	X3500#11#22
TwisTorr 304 FS CF8"	w/ water cooling	X3500#11#23
TwisTorr 304 FS ISO100	w/o water cooling	X3500#10#20
TwisTorr 304 SF CF6"	w/o water cooling	X3500#10#21
TwisTorr 304 FS ISO160	w/o water cooling	X3500#10#22
TwisTorr 304 FS CF8"	w/o water cooling	X3500#10#23
TwisTorr 304 FS ISO100 SF	w/ water cooling	X3500#11#24

Controllers	Part Numbers
TwisTorr 304 FS on board controller 24 Vdc	X3507-64002
TwisTorr 304 FS on board controller 100-240 Vac	X3507-64003
TwisTorr 304 FS AG rack controller with RS232/485	X3506-64002
TwisTorr 304 FS AG rack controller with Profibus	X3506-64003

Accessories	Part Numbers
Mains cable NEMA plug, 3 m long	9699958
Mains cable European plug, 3 m long	9699957
Serial cable and T-plus Software	9699883
Inlet Screen ISO100	X3500-68000
Inlet Screen CFF 6"	9699302
Inlet Screen ISO160	X3500-68001
Inlet Screen CFF 8"	9699304
Water cooling kit	9699337

Accessories	Part Numbers
Plastic water cooling kit	9699347
Air cooling kit for On board controller	X3500-68010
Fan extension cable for On board controller	9699949
Air cooling kit for rack AG controller	X3500-68011
Fan extension cable for rack AG controller	9699940
Bracket for On board controller side mounting	X3500-68012
Vibration isolator ISO 100	9699344
Vibration isolator CF 6"	9699334
Vibration isolator ISO 160	9699345
Vibration isolator CF 8"	9699335
Vibration isolator ISO 100 IDX	9699396
Vent flange, NW 10 KF / M8	9699108
Delay vent valve 1.2 mm orifice	X3505-68000
Delay vent valve 0.5 mm orifice	X3505-68001
Vent valve N.O. for rack AG controller (0.5 mm)	9699844
Vent valve for on-board controller (1.2 mm)	9699834
Vent valve for on-board controller (0.5 mm)	9699834M006
Purge valve 10 SCCM NW16KF - M12	9699239
Purge valve 10 SCCM ¼ Swagelok - M12	9699240
Purge valve 20 SCCM NW16KF - M12	9699241
Purge valve 20 SCCM ¼ Swagelok - M12	9699242
Purge valve 10 SCCM ¼ Swagelok - ¼ Swagelok	9699232
Purge valve 20 SCCM ¼ Swagelok - ¼ Swagelok	9699236
Foreline flange KF25 ¼ gas	9699130
Active Gauges	Ask Agilent for details

Outline Drawing



Agilent TwisTorr 304 FS

Service & Support



ADVANCE EXCHANGE

To maximize uptime, and for those occasions where you cannot afford stopping your process, Agilent 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

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

UPGRADE

Designed for customers who want replace a 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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