The new generation Turbo Pumps
with Agilent Floating Suspension

AGILENT TWISTORR FS TURBO PUMPS

AGILENT QUALITY ASSURED

TwisTorr 304 FS

TwisTorr 84 FS

The Measure of Confidence

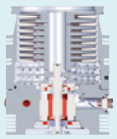
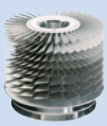
Agilent Technologies

Agilent TwisTorr FS Turbo Pumps

Agilent Quality Assured

A new category of Turbomolecular Pumps

The TwisTorr 84 FS and 304 FS are compact, reliable, energy efficient best-in-class 80 and 300 l/s Turbo drag packages, with innovative, breakthrough technologies leading to outstanding performance, and designed for reliability, to meet highest quality standard.

2015		**Agilent expands the TwisTorr family with the new 84 FS**
2013		• Agilent launches the TwisTorr 304 FS with Floating Suspension, the patented innovative, most reliable and high performing 300 L/s pump in the market
2010		• Agilent Technologies, having acquired Varian, 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 Turbomolecular Pump innovation
2004		• Varian develops a dedicated range of SEM products that meets the most stringent requirements of the industry
2003		• With the Turbo-V 2K-G Varian, now Agilent, introduces a fully integrated Turbo pumping system
1996		• Introduction by Varian of microprocessor-based on-board controller units: Navigator line, for computer driven plug-and-pump operation
1991		• Varian introduces a new hybrid type Turbomolecular 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 turbomolecular pump technology and know-how transfer

Agilent Quality and Reliability

Your Benefit

- Reduced cost of ownership and system down-time
- Improved reliability
- Proven robustness
- Agilent quality standards

84FS Features

- Agilent Floating Suspension (FS)
- Optimized thermal design
- Precise positioning of bearings and rotor

Easy System Integration

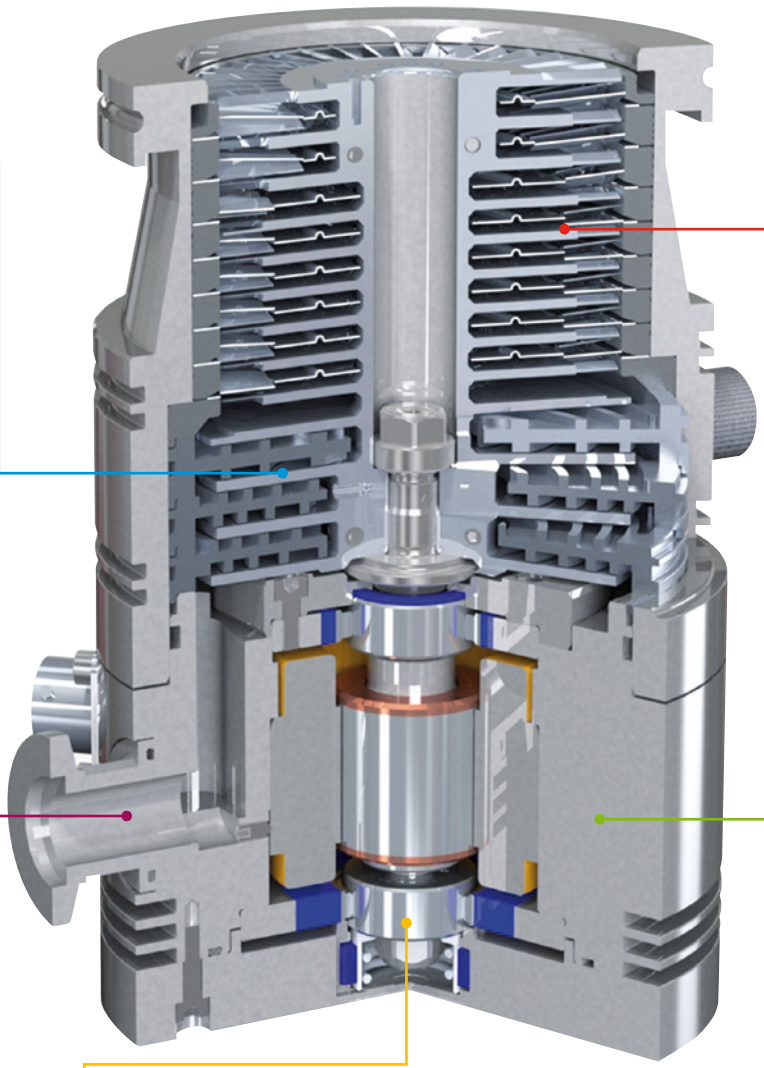
Your Benefit

- Compact design
- Plug & play
- Easy pump driving and monitoring
- Operation in any position
- Oil-free solution

84FS Features

- Ceramic ball bearings with permanent lubrication
- PCB, Onboard, Rack Control Units with Serial and Profibus communication
- Retrofitable to any pump of similar size

Your solution for high performance, quality, and reliability



Superior Performance

Your Benefit

- Low ultimate pressure
- Fast pumpdown
- Smaller/less expensive backing pump
- Suitable for high gas load applications
- Lower power consumption

84FS Features

TwisTorr Drag Stages allow for:

- Superior compression ratio
- High foreline pressure tolerance
- Best-in-class pumping speed

Quiet and Low-Vibration

Your Benefit

- Excellent vibration level (damping effect)
- Quiet pump during operation

84FS Features

- Agilent Floating Suspention

How Quiet is the TwisTorr 84 FS?	
Noise	**dBA**
Chainsaw; thunder clap	**120**
Car horn (1m); live rock music	**110**
Lawn mower; airplane take off (1km)	**100**
Motorcycle (8m away)	**90**
Freight train (25m); food blender	**80**
Cars on freeway; vacuum cleaner	**70**
Air conditioner (30m); office noise	**60**
Rotary Vane Pump	**55**
IDP-15, or conversation at home	**50**
Competitor's Pump	**48**
Library or **TWISTORR 84 FS**	**40**

Stability Over Time

Your Benefit

- Stable noise and vibration performance over time.

84FS Features

- Agilent Floating Suspention
- Bearings and rotor stable/constant positioning over time

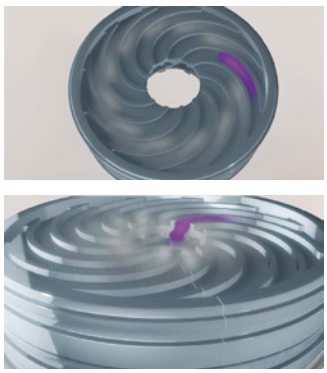
What is TwisTorr?

The new molecular-drag technology

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.

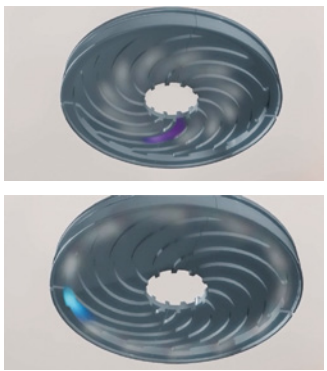
(*) US Patents applications 12/343961 and 12/343980, 24 Dec. 2008.



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).



Centrifugal pumping action

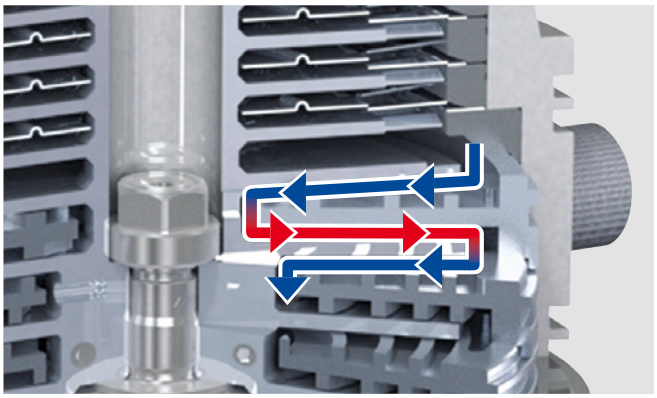
Upper surface area of rotating disk transfers momentum to gas molecules.

Spiral groove design on the lower section of the TwisTorr stator causes a **centrifugal** pumping action.

The pumping effect is repeated for each of the pump's Twistorr stages

Leading Edge Performance

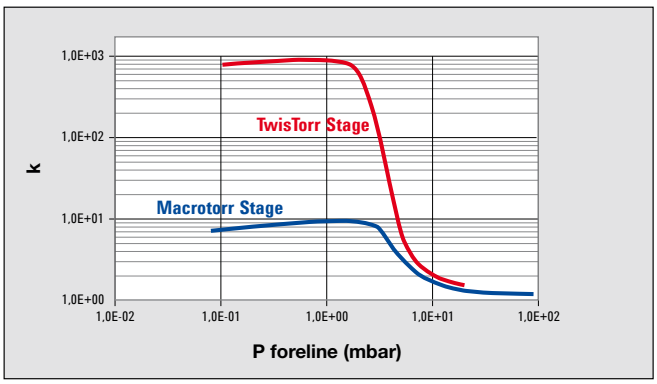
- The TwisTorr Pumps offer the highest pumping speed in their category for all gases.
- The state of the art TwisTorr technology also achieves the highest compression ratios for light gases in a commercially available Turbo Molecular Pump.
- While offering the highest performance, average power consumption by the new drag section design is reduced by a factor of x4, compared to 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

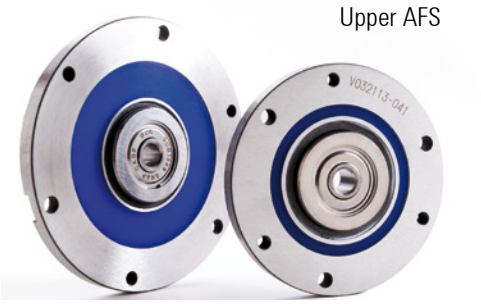
- Compression ratio for N_2 of a single TwisTorr stage can increase up to a factor of 100 with respect to a MacroTorr stage of the same space and rotor speed, without reducing foreline tolerance and pumping speed.

Agilent Floating Suspension

Innovative solutions for low vibration and stability over time

Lower AFS

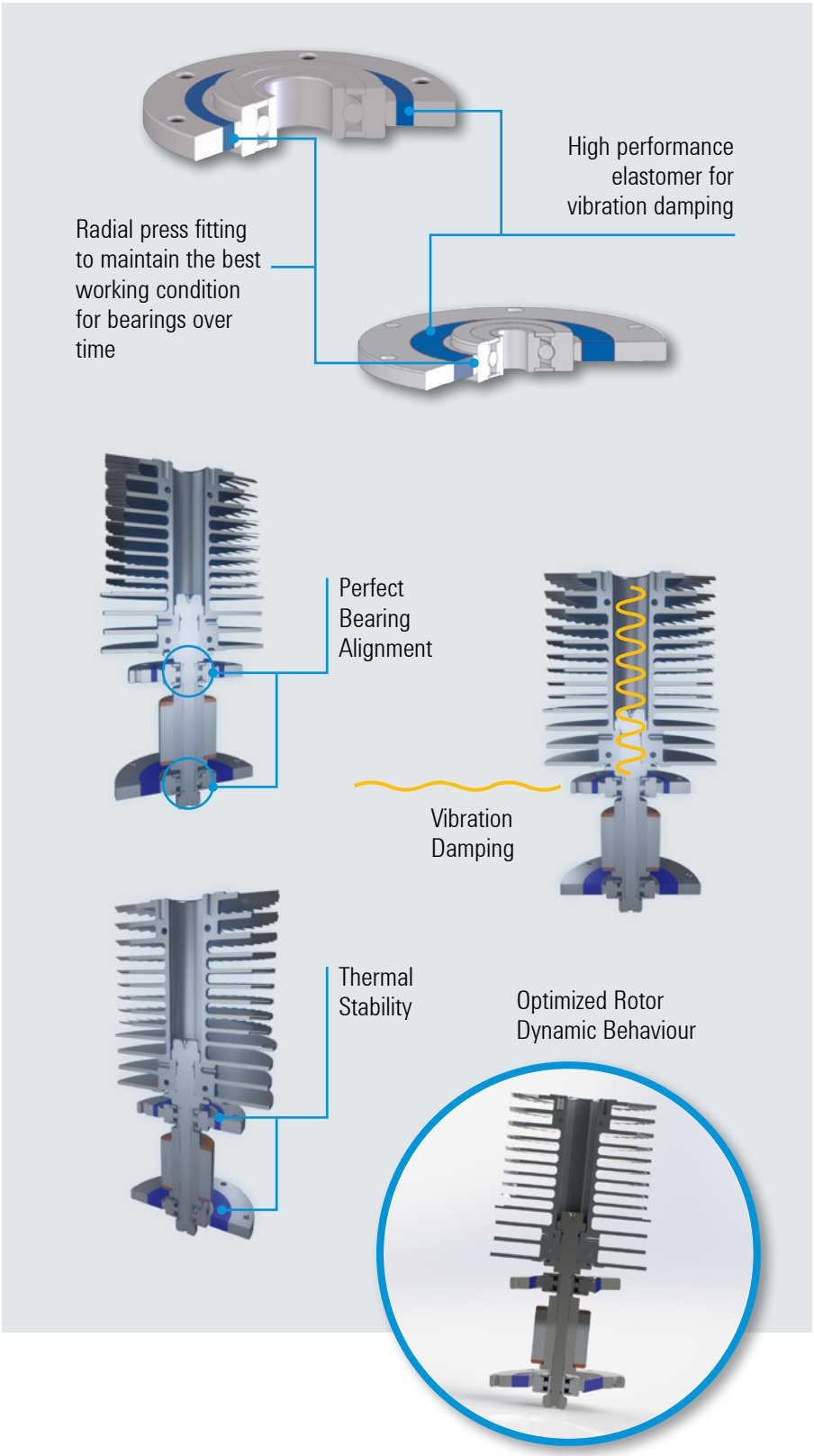
Upper AFS



To ensure

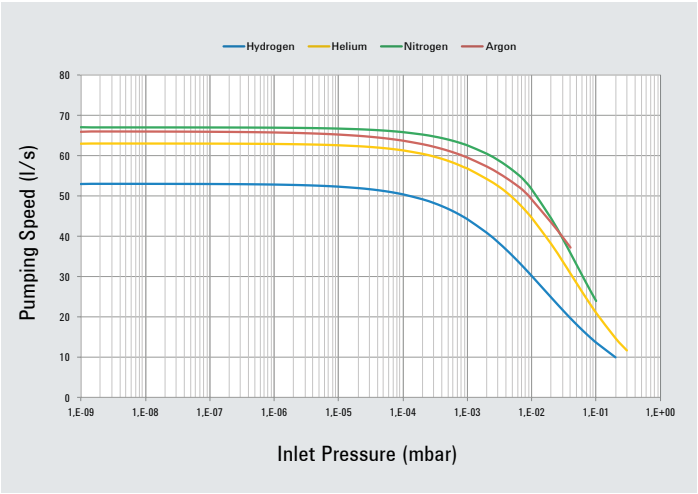
- Low vibration and acoustical noise
- Optimal working conditions for the bearings, extended operating life
- Exceptional stability for the very demanding SEM application

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

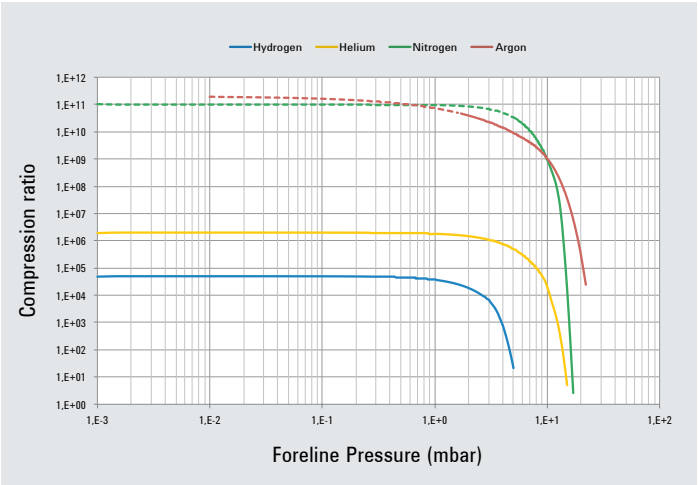


Agilent TwisTorr 84 FS

Pumping Speed



Compression Ratio



Technical Specifications

Pumping speed		KF40	CFF 2.75"	ISO 63	CFF 4.5"
Ar	l/s	44	57	66	66
N_2	l/s	49	56	67	67
He	l/s	38	46	63	63
H_2	l/s	36	40	53	53

Gas throughput at full rotational speed (with recommended forepump)	Air cooling (35°C)	Water Cooling (25°C, 65 l/h)
N_2	100 sccm	100 sccm
Ar	70 sccm	70 sccm

Compression ratio & Foreline Tolerance		
Ar	> 1.0 x 10^{11}	>14 mbar
N_2	≥ 1.0 x 10^{11}	>14 mbar
He	2.0 x 10^{6}	>12 mbar
H_2	5.0 x 10^{4}	>4 mbar

Base pressure with recommended forepump (5 m^3/h)	< 8 E-10 mbar (< 6.0 x 10^{-10} Torr)	
Inlet flange	CFF 4.5" O.D.	ISO 63
	CFF 2.75" O.D.	KF 40
Foreline flange	KF16 NW	
Rotational speed	81000 rpm (1350 Hz driving frequency)	
Start-up time	< 2 minutes	
Recommended forepump	mechanical:	Agilent DS 42 / DS 102
	dry pump:	Agilent SH 110 / IDP-3
Operating position	Any	
Operating ambient temperature	+5 °C to +35 °C	
Relative humidity of air	0 - 90 % (not condensing)	
Bakeout temperature	80°C for ISO (120°C for CFF) at inlet flange	
Lubricant	Permanent lubrication	
Cooling requirements		
- **Air Cooling**	Air flow temperature +5°C to +35 °C	
- **Water Cooling**	Cooling water temperature: +15 °C to +25 °C	
	Minimum flow: 65 l/h (0.30 GPM)	
	Pressure: 2 to 4 bar (45 to 75 psi)	
Noise Pressure Level (at 1 mt at full speed)		
	40 dB(A) *	
Storage temperature	-40° C to +70° C	
Max altitude	3000 m	
Certifications	CE, C-CSA-US, RoHS compliant as per 2011/65/UE	
Weight kg (lbs)	Pump ISO 63	kg 2.05
	Pump CFF 4.5"	kg 3.50
	Pump CFF 2.75"	kg 3.34
	Pump KF 40"	kg 2.37

*average value ± 4 dB(A) std deviation

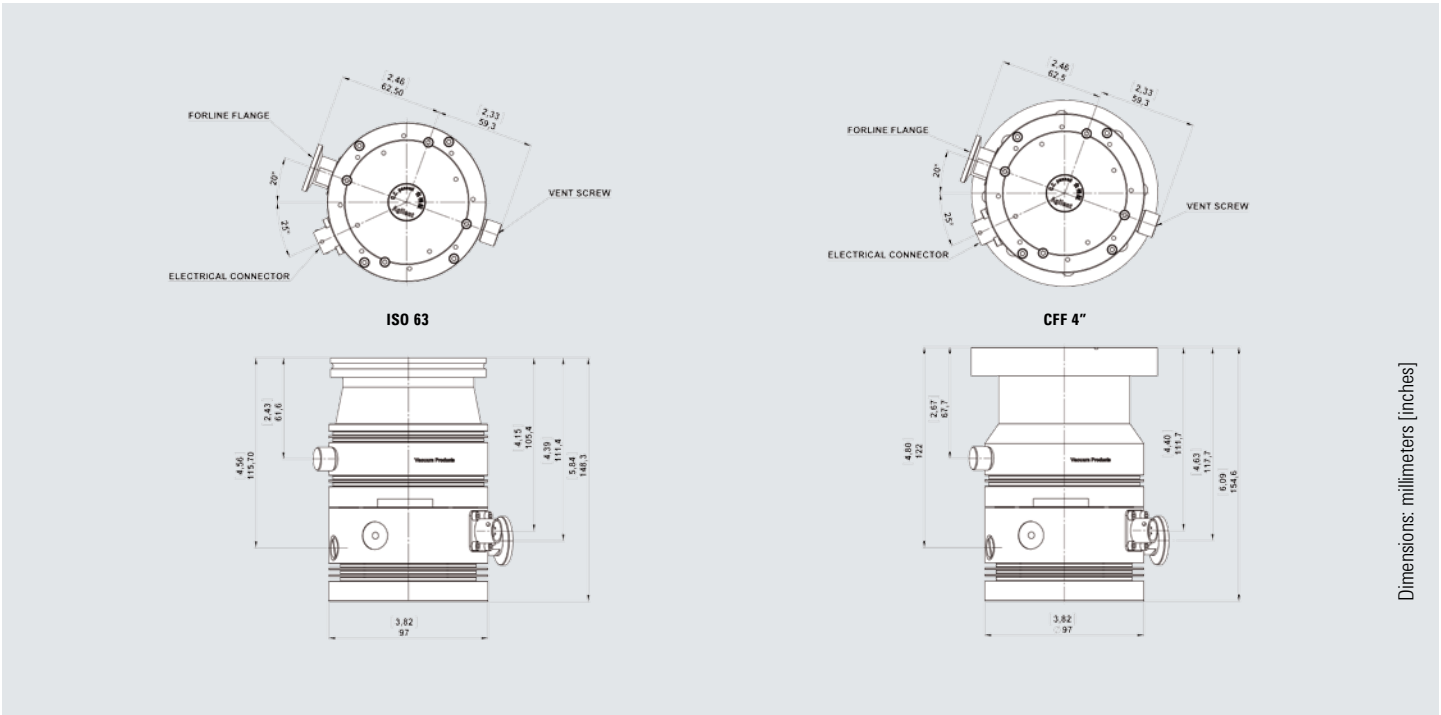
Ordering Information

Pumps	Part Numbers
TwisTorr 84FS ISO63	X3502-64000
TwisTorr 84FS KF40	X3502-64001
TwisTorr 84FS CFF4.5	X3502-64002
TwisTorr 84FS CFF2.75	X3502-64003

Controllers	Part Numbers
TwisTorr 84FS AG Rack controller RS232/485	X3508-64001
TwisTorr 84FS AG Rack controller Profibus	X3508-64002
TwisTorr 84FS on-board controller 110/220V	X3509-64000
TwisTorr 84FS on-board controller 24V	X3509-64001
TwisTorr 84FS PCB Controller	X3510-64000

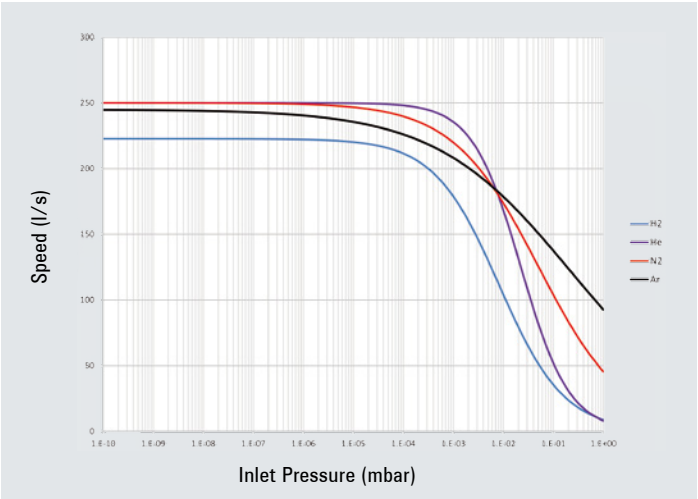
Accessories	Part Numbers
Cables	
Mains cable NEMA plug, 3 m long	969-9958
Mains cable European plug, 3 m long	969-9957
Serial cable and T-plus software	969-9883
PCB cable	969-9869
Pump extension cable (3 m)	969-9942
Extension cable 5 m	969-9942M007
Extension cable 10 m	969-9942M006
Extension cable 15 m	969-9942M005
Extension cable 20 m	969-9942M004
Inlet screen	
Inlet screen ISO63	X3502-68001
Inlet screen CFF4.5"	X3502-68000
Inlet screen, KF40	969-9309
Inlet screen CFF 2.75"	969-9328
Cooling	
Metal Water Cooling Kit	X3502-68002
Plastic Water cooling kit	X3502-68003
Air cooling kit (0,5 m cable)	969-9290
Air cooling kit extension cable (5 m)	969-9940
Vibration isolator	
Vibration isolator ISO 63	969-9375
Vibration isolator CFF 4.5"	969-9376
Venting	
Vent Valve N.O. 0,5 mm orifice (0,5 m cable)	969-9844
Vent Valve extension cable (5 m)	969-9941
Vent Valve extension cable (10 m)	969-9941M003
Vent Valve extension cable (15 m)	969-9941M001
Vent Valve extension cable (20 m)	969-9941M005
Vent Screw M5	X3502-68005
Vent Adapter kit M5-M8	X1699-64039
Purge	
Purge Screw	X3502-68004
Purge valve 10 SCCM NW16KF - M12	969-9239
Purge valve 10 SCCM ¼ Swagelok - M12	969-9240
Purge valve 20 SCCM NW16KF - M12	969-9241
Purge valve 20 SCCM ¼ Swagelok - M12	969-9242
Purge valve 10 SCCM ¼ Swagelok - ¼ Swagelok	969-9232
Purge valve 20 SCCM ¼ Swagelok - ¼ Swagelok	969-9236
Mounting	
Controller side mounting bracket	X3502-68006
CFF4.5 Mounting kit	X3502-68007
Metric screws kit	X3502-68008
American screws kit	X3502-68009
Active Gauges	
FRG 700 Full Range Gauge	Ask Agilent for details
PVG 500 Pirani Vacuum Gauge	Ask Agilent for details
PCG 750 Pirani Capacitance Gauge	Ask Agilent for details
CDG-500 Capacitance Diaphragm Gauge	Ask Agilent for details

Outline Drawing

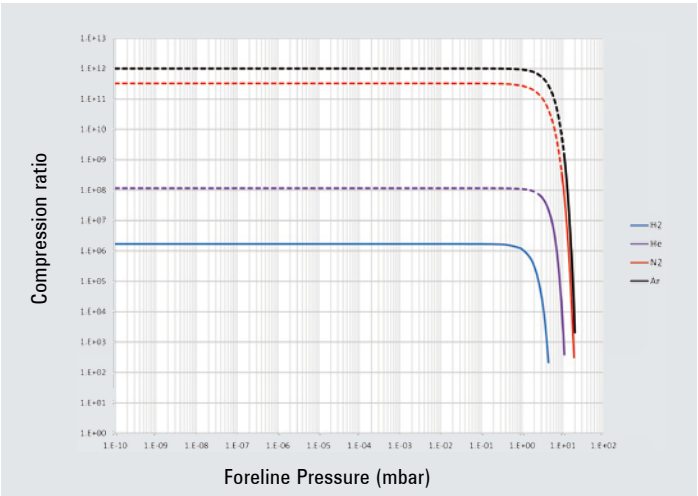


Agilent TwisTorr 304 FS

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

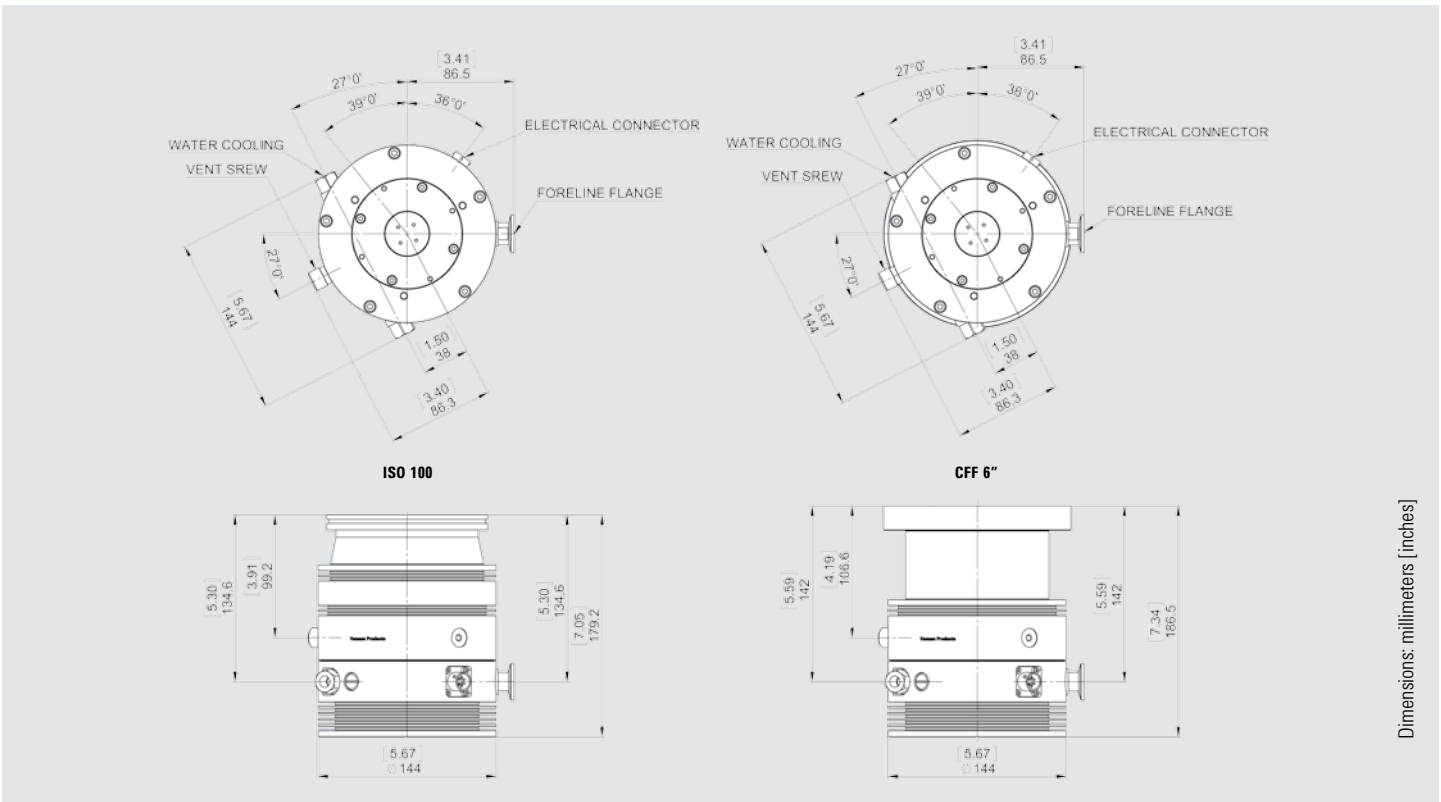
Ordering Information

Pumps	Configuration Options
TwisTorr 304 FS ISO100 water cooling	X3500-64000
TwisTorr 304 FS CFF 6" water cooling	X3500-64001
TwisTorr 304 FS ISO160 water cooling	X3500-64002
TwisTorr 304 FS CFF 8" water cooling	X3500-64003
TwisTorr 304 FS ISO100 air cooling	X3500-64004
TwisTorr 304 FS CFF 6" air cooling	X3500-64005
TwisTorr 304 FS ISO160 air cooling	X3500-64006
TwisTorr 304 FS CFF 8" air cooling	X3500-64007
TwisTorr 304 FS ISO100 SF water cooling	X3500-64010

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

Accessories	Part Numbers
Cables	
Mains cable NEMA plug, 3 m long	9699958
Mains cable European plug, 3 m long	9699957
Serial cable and T-plus Software	9699883
Extension cable 5 m	969-9942M007
Extension cable 10 m	969-9942M006
Extension cable 15 m	969-9942M005
Extension cable 20 m	969-9942M004
Inlet Screen	
Inlet Screen ISO100	X3500-68000
Inlet Screen CFF 6"	9699302
Inlet Screen ISO160	X3500-68001
Inlet Screen CFF 8"	9699304
Cooling	
Water cooling kit	9699337
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
Vibration isolator	
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
Venting	
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	
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
Mounting	
Bracket for On board controller side mounting	X3500-68012
Foreline flange KF25	X3500-68002
Active Gauges	
FRG 700 Full Range Gauge	Ask Agilent for details
PVG 500 Pirani Vacuum Gauge	Ask Agilent for details
PCG 750 Pirani Capacitance Gauge	Ask Agilent for details
CDG-500 Capacitance Diaphragm Gauge	Ask Agilent for details

Outline Drawing



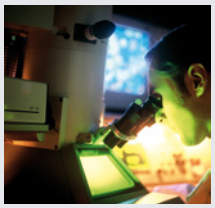
Agilent TwisTorr 84 FS and 304 FS

The new generation Turbo Pump platform:
your solution for high performance, quality and reliability

Applications

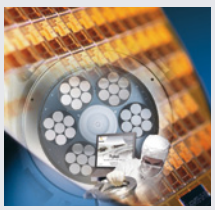
The new TwisTorr FS technology represents a unique blend of performance and features that is perfectly suited for a wide range of applications:

Unmatched vacuum performance in its class, with TwisTorr stages optimized for H_2 compression, make it the ideal solution for demanding academic and research applications



Thanks to low vibration, low noise and high stability, the TwisTorr FS turbo pumps meet the specific needs of Electron Microscopes

High throughput and optimized performance for light gases in routine applications are suited perfectly to use in analytical instruments



The TwisTorr FS turbo pumps offer dry, clean vacuum for demanding industrial and semiconductor applications

Key Innovations

- TwisTorr Molecular Drag Turbo pump technology
- Optimized clearances design (radial and axial)
- Optimized thermal design
- Agilent Floating Suspension
- Optimized bearings size
- Noise <40 dB(A) at normal speed (TwisTorr 84 FS)
- Vibration stability over time
- Precise positioning of bearings and rotor

Service & Support

To keep you up and running

Advance Exchange

Premium Advance Exchange reduces your downtime and allows you to focus on your business success, while we take care of all the rest.

To maximize uptime and for time critical situations, Agilent offers Exchange units that are available for immediate shipment. These units are refurbished pumps and fully rebuilt to the same strict standards as new products with 24hrs response, rapid delivery and minimal downtime.

Upgrade Program

Designed for customers who want to replace an Agilent product, at the end of its service life with a model of the latest available technology.

Within the upgrade program products rebuilt to as-new specifications are offered with a full 12-month warranty.

Return to Agilent for Repair

With this service, you can ship your instrument to the nearest Agilent Service Center, where it is expertly repaired and then returned to you. Timely repair by Agilent will keep your product performance at an outstanding level all the time. Our specialized repair centers bring Agilent Quality Standards closer to you with fast turnaround time, Original parts and Certified Workmanship.

Three Progressive Levels of Support

Agilent offers three convenient Service Programs to help you maximize your full stop at end.

Agilent TwisTorr FS Turbo Pumps

Agilent Quality Assured

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