Agilent
Trusted Answers

Agilent TwisTorr FS Turbo Pump Family

The new generation Turbo Pumps
with TwisTorr drag technology and Agilent Floating Suspension

A new category of Turbomolecular Pumps

The TwisTorr FS family: compact, reliable, energy efficient, best-in-class turbo drag packages with innovative technology, for outstanding performance.

Agilent TwisTorr FS Pump Applications

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

Academia, Government and Research

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

Surface Analysis

Thanks to low vibration, low noise and high stability, the TwisTorr FS turbo pumps meet the specific needs of electron microscopes.

Analytical Instrumentation

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

Industrial and Semiconductors

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

Agilent Quality and Reliability

Your Benefit

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

TwisTorr FS Family Features

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

Easy System Integration

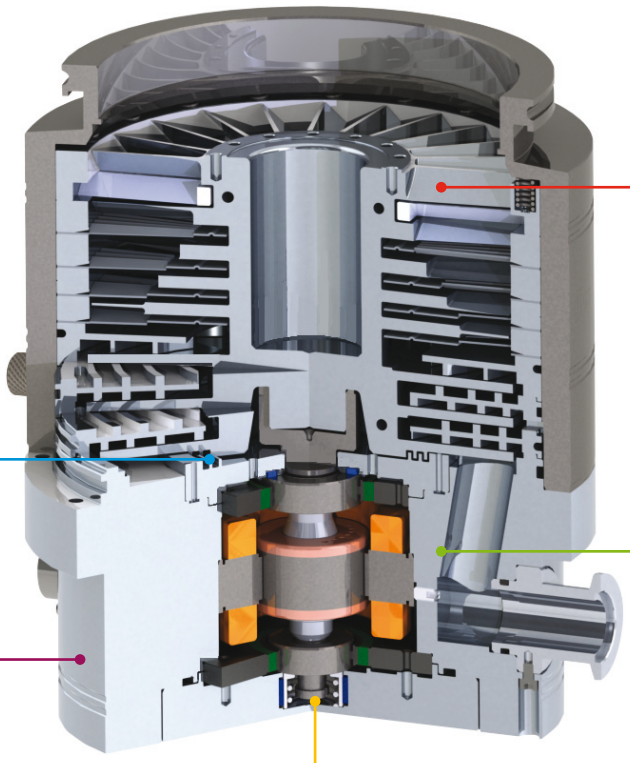
Your Benefit

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

TwisTorr FS Family Features

- Ceramic ball bearings with permanent lubrication
- PCB, onboard, rack control units with Serial and Profibus communication
- Retrofitable to any pump

Your solution for high performance, quality, and reliability



* The new TwisTorr 704 FS – Cutaway

Superior Performance

Your Benefit

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

TwisTorr FS Family 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

TwisTorr FS Family Features

- Agilent Floating Suspension

Stability Over Time

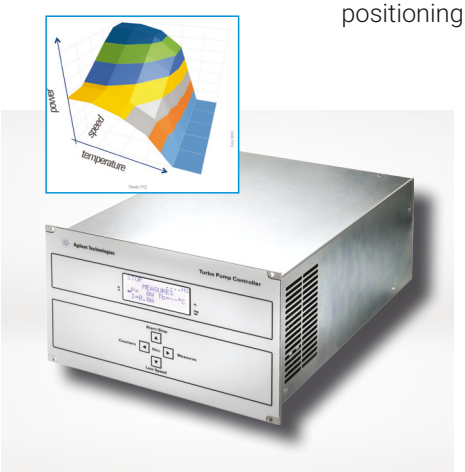
Your Benefit

- Stable noise and vibration performance over time

TwisTorr FS Family Features

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

How Quiet is a TwisTorr FS Pump?	
Noise	**dBA**
Motorcycle (8 m away)	**90**
Freight train (25 m); food blender	**80**
Cars on freeway; vacuum cleaner	**70**
Air conditioner (30 m); office noise	**60**
Rotary vane Pump	**55**
Agilent IDP-15 Scroll pump/conversation at home	**50**
Competitors' medium TMP	**50**
Agilent Medium TwisTorr pumps	**43**
Competitors' small TMP	**48**
Agilent Small TwisTorr pumps	**40**



Now Featuring

New 3D Software for Pump Control

✓ Optimized Performance, Maximum Flexibility and Extended Reliability
✓ Dynamic speed and power tuning according to inlet pressure, gas load, and temperature
✓ Always the best performance in every working point

Learn more, see pages 8-9

TwisTorr FS: Design Process, Quality, and Reliability Test Elements

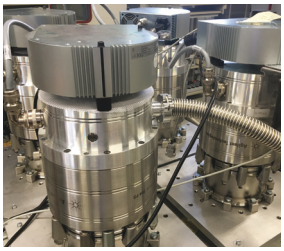
The «Product Life Cycle» method drives and tracks the design process through the six steps of proposal, investigation, lab prototype, production prototype, pilot run, and ramp to volume. Reiterated controls and tracking ensure full confidence in performance, quality, and the regulatory data published for users.

Agilent Quality and Reliability

Warranty - TwisTorr 404 FS, 704 FS, 804 FS

Agilent Warranty: Two year full coverage.
Free of charge pump quick replacement in case of pump issues in the first 24 months.

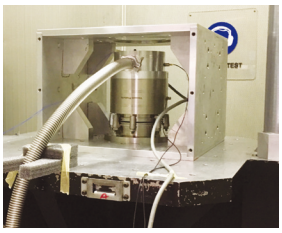
Lifetest - TwisTorr 404 FS, 704 FS, 804 FS*



Pump reliability proven through an accelerated life test on a significant number of pumps, exposed for extended time to accelerating factors.

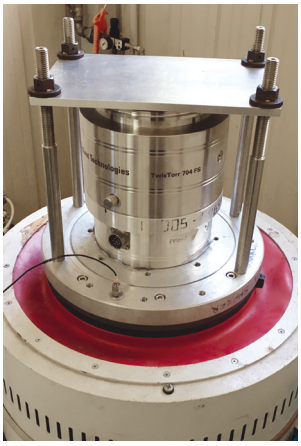
The test provided confidence in pump's hassle-free operation for an average period longer than five years.

Shock test - TwisTorr 404 FS, 704 FS, 804 FS*



Pump resistance to shocks proven by a set of tests on a batch of pumps both in operative and inoperative conditions.
Every pump exposed to a 30 to 120 g acceleration (equivalent to a drop from 82 cm / 32" - not operative pump, and 15 cm / 6" - operative pump).
Pumps shock-tested six times in vertical, horizontal, upside-down orientation.
No issue occurred to the tested pumps after the full batch of 24 drops (No rotor mechanical contacts, No change to pumps operation).
The **pump unbalance** verified after every drop highlighted minor variations, **remaining well below acceptance threshold**: the shock test confirmed the pump robustness and reliability.

Vibration test - TwisTorr 404 FS, 704 FS, 804 FS*



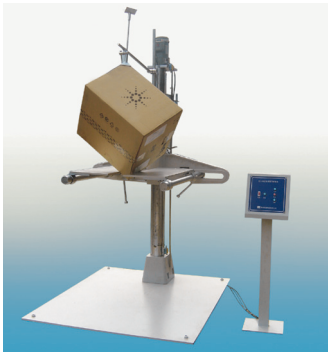
The compatibility with vibrations generated by external sources was proven through a set of tests on a batch of pumps, both in operative and inoperative conditions.
Each pump was exposed to energy levels from **0.5 to 2 g during 105 minutes'** vibration cycles in vertical, horizontal, upside-down orientation at full rotational speed and not operative.
The test confirmed pump robustness and full compatibility to vibrations as **No rotor mechanical contacts or change to pumps' operation** were highlighted and the **pump unbalance remained well below acceptance threshold**.

Packaging test - TwisTorr 404 FS, 704 FS, 804 FS*

The packaging functionality verified with test session on packed pumps, subjected to a test of **18 drops from 96 cm (37.8 inch) height.**

The test confirmed that packaging can limit the acceleration provided to the pump during a typical transportation to the 30 g.

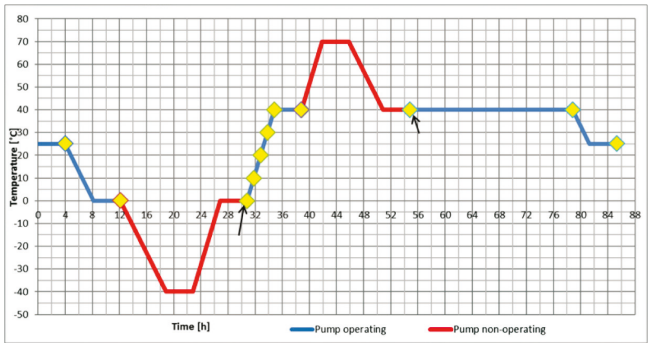
From the shock test, we know that 30 g is a **level of acceleration fully compatible with TwisTorr pump design.**



Stability Over Time

Thermal test - TwisTorr 404 FS, 704 FS, 804 FS*

Pumps were exposed **for 86 h to temperatures ranging from -40 °C to +70 °C** (not operative) and from 0° C to 40 °C (operative).



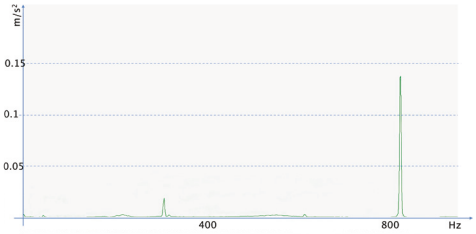
The pump unbalance and correct operation was verified 11 times on every pump finding only minor variations, well below acceptance threshold. The thermal test confirmed the pump's robustness and **full compatibility to every operative and not operative temperature condition** of applications or during storage and transport.

Quiet and Low-Vibration

Fourier analysis TwisTorr 404 FS, 704 FS, 804 FS*

The pump vibration spectrum is verified on every pump during the manufacturing process and before the pump shipment as a final test of pump's correct operation.

Average maximum vibration level at full speed: 0.4 m/s².

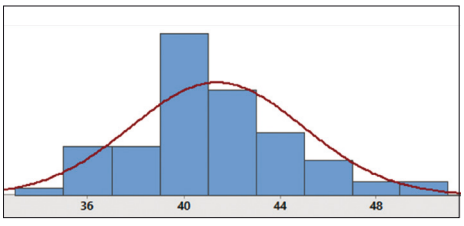


FFT Analysis - TwisTorr 404 FS, 704 FS, 804 FS

Noise test TwisTorr 404 FS, 704 FS, 804 FS*

Pump noise was verified through a set of tests on a batch of pumps in 12 different operative statuses and orientations including: vertical, horizontal, and upside-down positions; with and without gasload; high temperature and low temperature; full speed and low speed.

The average pump noise resulting from the 168 measurements was 43 dB(A) +/-3σ in normal operation.



Noise distribution cart - TwisTorr 404, 704, 804 FS

*NOTE: Test data provided are referred to TwisTorr 404 FS, 704 FS, 804 FS – similar data are available on request even for 84 FS and 304 FS.

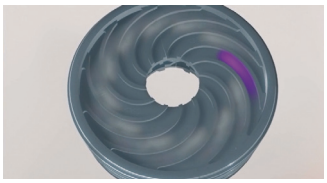
What is TwisTorr?

The new molecular-drag technology, applied to the entire family from 84FS to 804FS.

Agilent TwisTorr Technology*

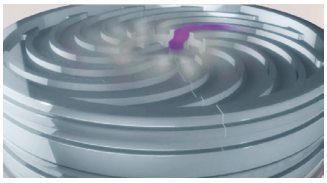
- Pumping effect is created by a spinning rotor disk, which transfers momentum to gas molecules.
- Gas molecules are forced to follow spiral groove design on the stator. The specific design of the channel ensures constant local pumping speed and avoids reverse pressure gradients, minimizing power consumption.

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

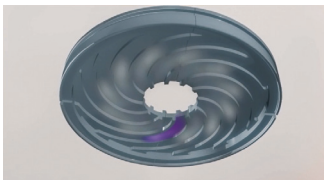


Centripetal pumping action

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

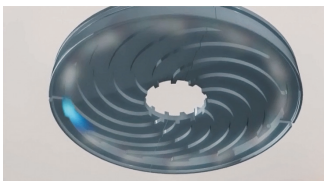


Spiral groove design on the upper section of the TwisTorr stator causes a **centripetal** pumping action).



Centrifugal pumping action

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

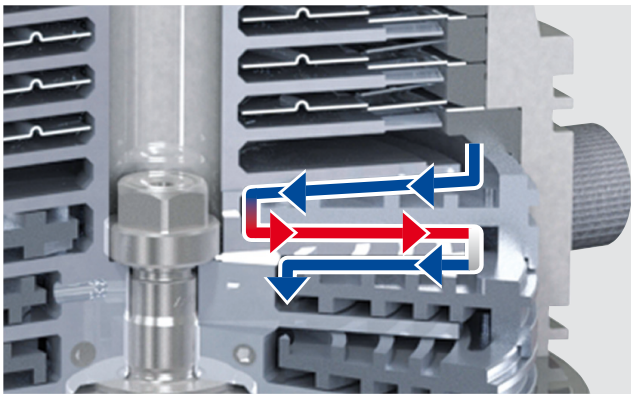


Spiral groove design on the lower section of the TwisTorr stator causes a **centrifugal** pumping action.

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

Leading Edge Performance

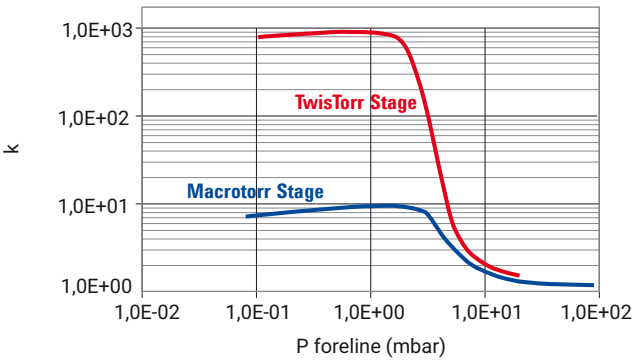
- The TwisTorr pumps offer the highest pumping speed in their category for all gases.
- The state of the art TwisTorr technology also achieves the highest compression ratios for light gases in a commercially available turbomolecular pump.
- While offering the highest performance, average power consumption by the new drag section design is reduced by a factor of four, 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.

What is Agilent Floating Suspension?

Innovative solutions for low vibration and stability over time.

Lower AFS

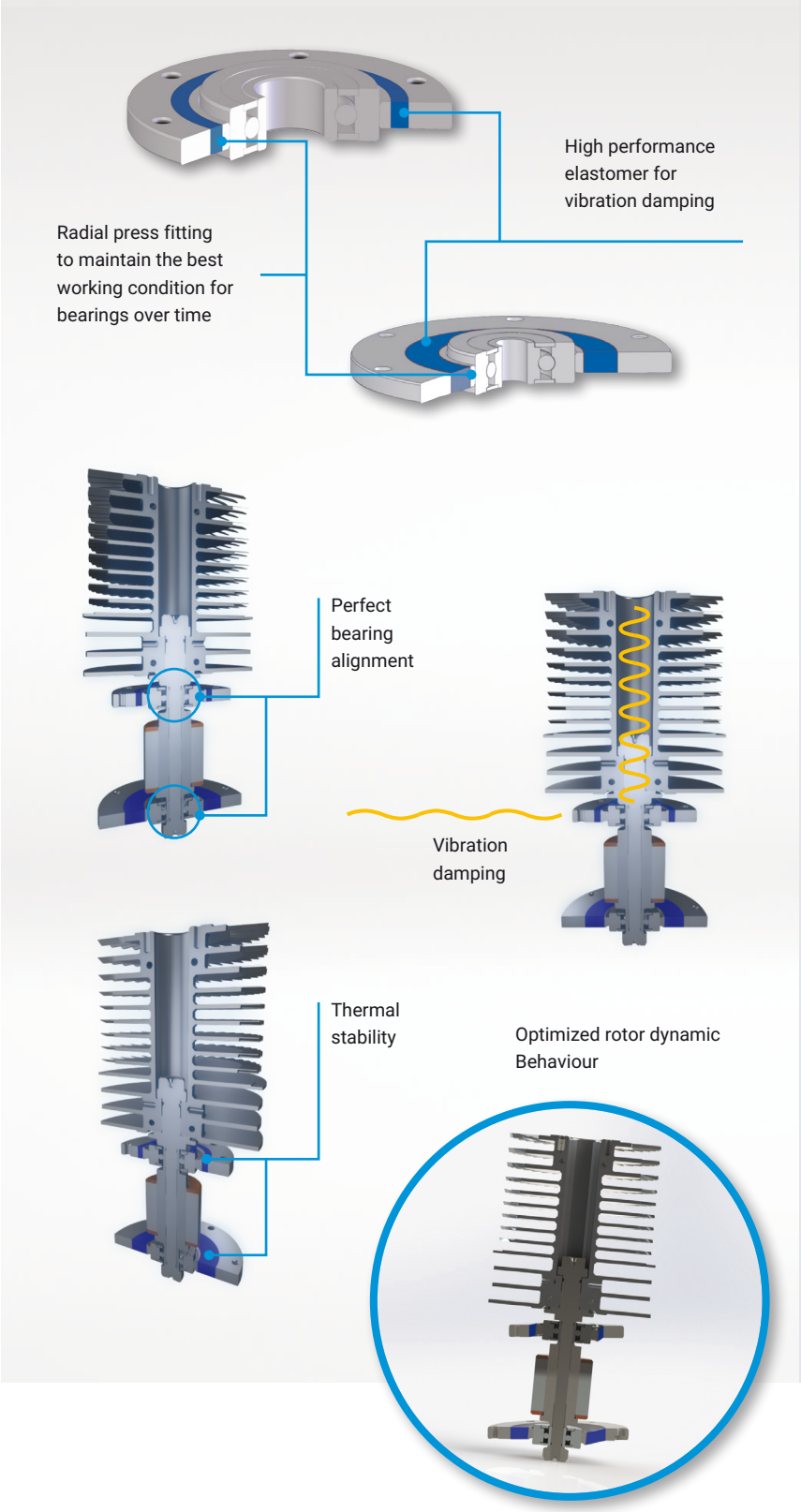
Upper AFS

To ensure

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

TwisTorr rotor, floating suspension, and electrical motor

- 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



The new TwisTorr medium TMP Controllers.

Rack or onboard, available for 404 FS, 704 FS, 804 FS pumps with 3D firmware for performance optimization

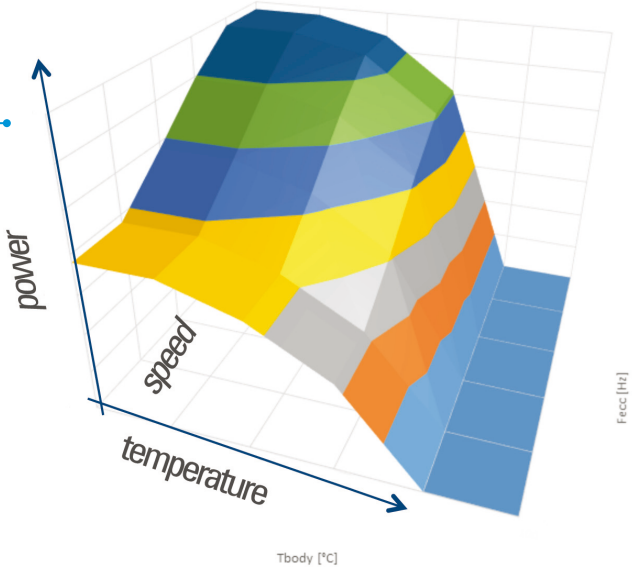
Steering towards flexibility, speed of execution, and simplicity, TwisTorr 404 FS, 704 FS, and 804 FS are now introducing a new Agilent innovative footstep - 3D pump control software.
The innovative pump driving function provides maximum flexibility, speed, and simplicity: Always the best possible throughput performance according to the pump operative conditions.

A unique vacuum system is able to quickly and automatically ensure the entire spectrum of customers' application needs, from UHV to high gas-load, on a single turbo pump.
An automatic routine manages the pump's rotational frequency and power according to the required inlet pressure and gas-load, at the specific application's temperature point.

Maximum flexibility, speed, and simplicity, thanks to a unique smart vacuum system:

Dynamic speed and power tuning according to inlet pressure, gas load, and temperature.

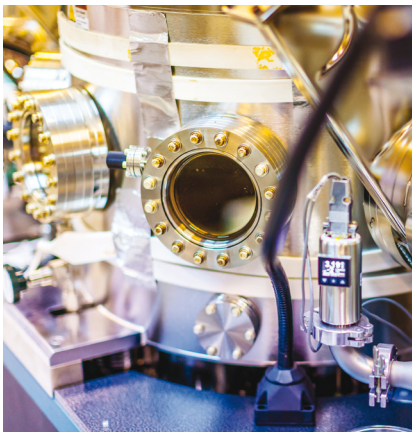
Always the best performance in every working point.

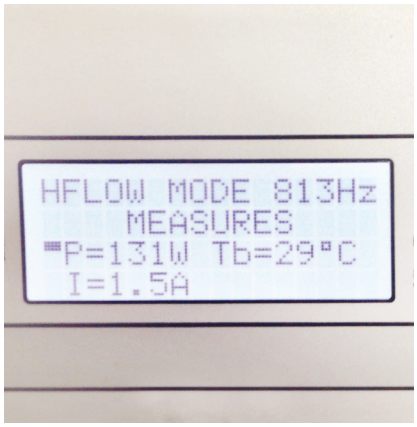


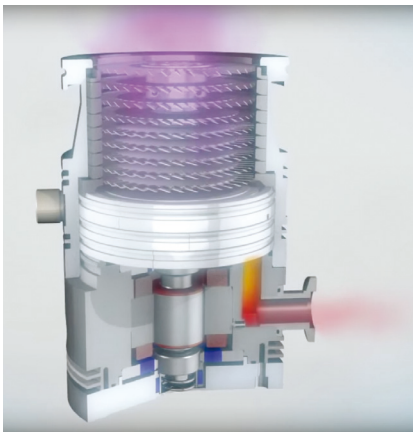
3D Firmware benefits:

- Immediate auto detection of changing requirements in the application.
- Dynamic TMP performance adapting to application conditions for customer's process stabilization and speeding-up.
- Always the best «tuning» for TMP pumping technology taking the complete advantage of TwisTorr technology potential.
- Pump components' minimized stress by means of continuous TMP parameters tuning for extended reliability.

«3D» software drives the pump







Application requirements auto detection

High Gas Flow →
High Vacuum →

Pump parameters dynamic setting/tuning

- Rotational speed →
- Power →
- Temperature

TwisTorr Technology Output/Performance

High Throughput
High Compression

Vacuum Solutions for a better Service

The power of over 60 years of expertise in vacuum service applied to our most innovative turbo pump family. Learn about our TwisTorr turbo pump support strategy

Exchange

Advance Exchange – In a fast moving world we keep your business ahead.
Our Premium Advance Exchange Program maximizes your uptime and enables you to focus on what you do best – your business. We take care about the rest.

- Quick and hassle free turnaround
- Refurbished to "As New" specifications
- Full one year warranty

Quality Repair

When uncompromised quality at the right price is of essence You need a trusted partner to deliver it. Specialized Repair Centers around the globe bring Agilent quality standards closer to you. When your TwisTorr turbo pump needs attention, we have the right know how and the experience to deal with it. Your trusted solution:

- Certified process and workmanship
- Genuine Agilent parts

Dedicated Solutions

Your work is important to us.
Our technology refresh programs and tailored service plans are designed to protect and secure your investment.
Customized service contracts and a comprehensive upgrade program are designed around your business needs and make us the natural choice as your vacuum service partner.
Your advantage:

- Stay up to date with the technology
- Close to your business
- Personalized coverage

Agilent TwisTorr 704 FS

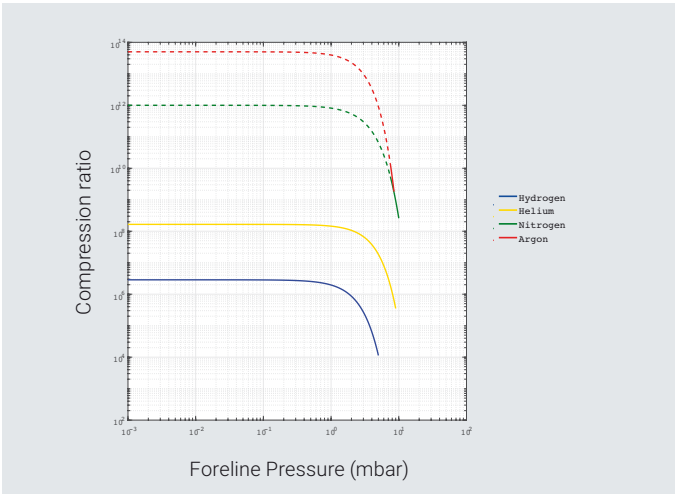
Technical Specifications

Technical Specifications		
Pumping speed	ISO 160 / CF 8"	
N_2 He H_2 Ar	660 L/s 640 L/s 480 L/s 625 L/s	
Gas throughput at full rotational speed (with recomm. forepump)*	Ambient Temp. (25 °C)	Water Temp. (25 °C, 50 L/h)
He	7.9 mbarL/s 467 SCCM	10.4 mbarL/s 615 SCCM
N_2	4.3 mbarL/s 255 SCCM	6.2 mbarL/s 367 SCCM
Ar	1.5 mbarL/s 89 SCCM	3.3 mbarL/s 195 SCCM
(*) Backing pump 11.6 m3/hr		
Compression ratio and foreline tolerance*		
N_2 He H_2 Ar	> 1 x 10^{11} 2 x 10^{8} 3 x 10^{6} > 1 x 10^{11}	10 mbar 10 mbar >4 mbar 8.5 mbar
(*) Foreline Tolerance defined as the pressure at which the turbopump still produces a compression of 100 and estimated in water cooling mode		
Base pressure with recomm. forepump	< 1 x 10^{-10} mbar (< 1 x 10^{-10} Torr)	
Inlet flange	ISO 160K, ISO 160F, CFF 8"	
Foreline flange	NW25 (NW40 as option)	
Rotational speed	Auto setting from 40'800 RPM to 49'500 RPM	
Start-up time	< 5 minutes	

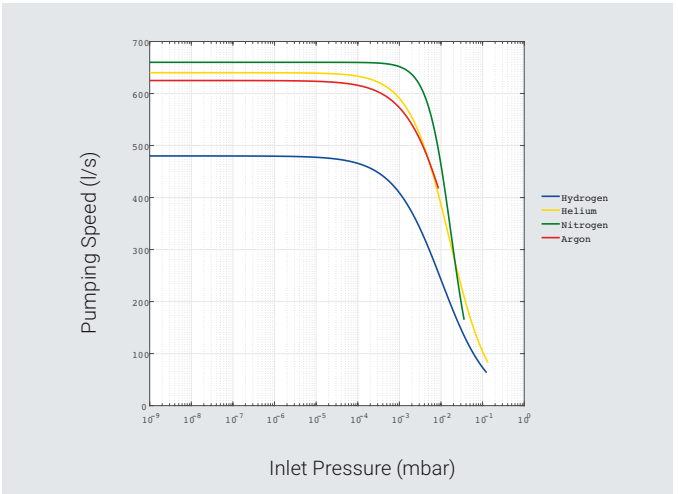
Technical Specifications		
Recommended forepump	DS302 IDP-10 IDP-15	
Operating position	Any	
Oper. ambient temp.	+5 °C to +35 °C	
Rel. humidity of air	0 - 90 % (not condensing)	
Bakeout temp.	ISO pump: 80 °C at inlet flange CFF pump: 120 °C at inlet flange	
Lubricant	Permanent grease lubrication	
Cooling requirements		
Air cooling	Air temperature from +5°C to 35°C	
Water cooling	Water temperature from +15°C to +25°C Water flow min. 100L/h	
Noise Pressure Level (at 1m at full speed)	43dB(A)	
Storage temp.	-40°C to +70°C	
Max altitude	3000 m	
Weight kg (lbs)	ISO160K ISO160F CFF 8"	20.6 Kg / 45.3 lbs. 22.6 Kg / 49.7 lbs. 22 Kg / 48.4 lbs.

Conformity to norms	
EMC (Control Units)	61326-1
Safety (CE/CSA)	61010-1
Machinery Directive	DIR 2006/42/CE
Low Voltage Directive	DIR 2014/35/EU
EMC Directive (Control Units)	DIR 2014/30/EU
ROHS	DIR 2011/65/EU

Compression Ratio



Pumping Speed



Agilent TwisTorr 804 FS

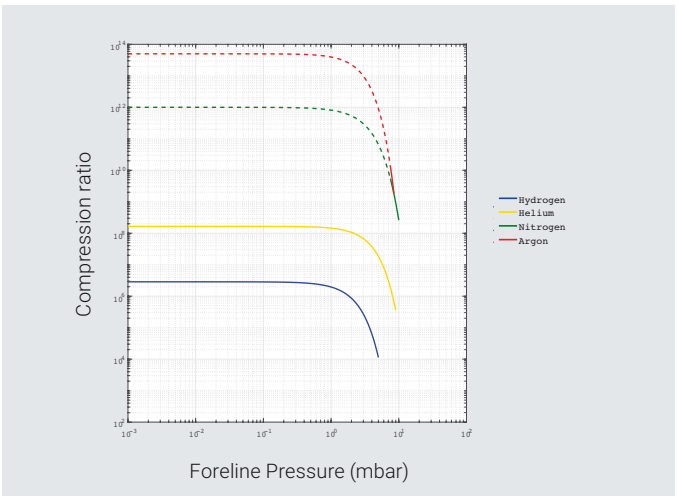
Technical Specifications

Technical Specifications			
Pumping speed	ISO200K-F	ISO250K-F	CFF10
N_2 He H_2 Ar	720 L/s 660 L/s 485 L/s 690 L/s		
Max Gas Throughput*	Air Cooling (25°C Air temperature)	Water Cooling (15°C Water temp. / 25°C room temp.)	
N_2	4.3 mbar L/s 255 SCCM	6.1 mbar L/s 367 SCCM	
He	7.9 mbar L/s 467 SCCM	10.4 mbar L/s 615 SCCM	
Ar	1.5 mbar L/s 89 SCCM	3.3 mbar L/s 195 SCCM	
(*) Backing pump 11.6 m3/hr			
Compression ratio and foreline tolerance*			
N_2 He H_2 Ar	> 1 x 10^{11} 2 x 10^{8} 3 x 10^{6} > 1 x 10^{11}	10 mbar 10 mbar >4 mbar 8.5 mbar	
(*) Foreline Tolerance defined as the pressure at which the turbopump still produces a compression of 100 and estimated in water cooling mode			
Base pressure with recomm. forepump	< 1 x 10^{-10} mbar (< 1 x 10^{-10} Torr)		
Inlet flange	ISO 200K, ISO 200F, ISO 250K, ISO 250F, CFF 10"		
Foreline flange	NW25 or NW40		
Rotational speed	Auto setting from 40'800 RPM to 49'500 RPM		
Start-up time	< 5 minutes		

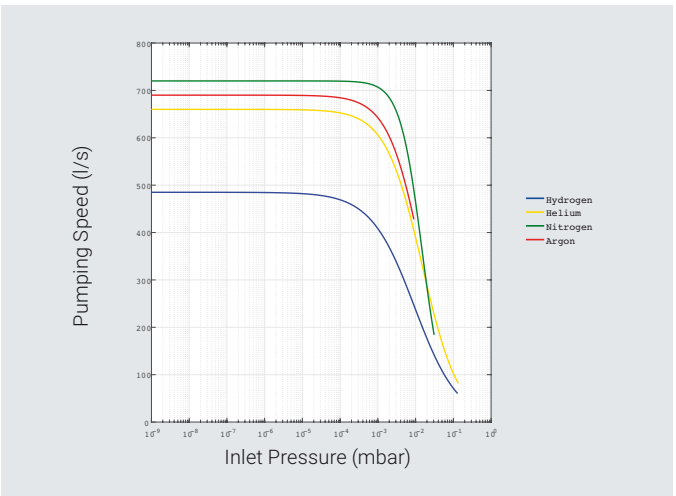
Technical Specifications		
Recommended forepump	DS302 IDP10 IDP-15	
Operating position	Any	
Oper. ambient temp.	+5 °C to +35 °C	
Rel. humidity of air	0 to 90% (not condensing)	
Bakeout temp.	ISO pump: 80°C at inlet flange CFF pump: 120°C at inlet flange	
Lubricant	Permanent grease lubrication	
Cooling requirements		
Air cooling	Air temperature from +5°C to 35°C	
Water cooling	Water temperature from +15°C to +25°C Water flow min. 100L/h	
Noise Pressure Level (at 1m at full speed)	43dB(A)	
Storage temp.	-40 °C to +70 °C	
Max altitude	3000 m	
Weight kg (lbs)	ISO200K ISO200F ISO250K ISO250F CFF 10"	20.7 Kg / 45.5 lbs. 23.6 Kg / 51.9 lbs. 23.3 Kg / 51.2 lbs. 27.6 Kg / 60.9 lbs. 22.1 Kg / 48.6 lbs.

Conformity to norms	
EMC (Control Units)	61326-1
Safety (CE/CSA)	61010-1
Machinery Directive	DIR 2006/42/CE
Low Voltage Directive	DIR 2014/35/EU
EMC Directive (Control Units)	DIR 2014/30/EU
ROHS	DIR 2011/65/EU

Compression Ratio



Pumping Speed



Agilent TwisTorr 404 FS

Coming soon

Technical Specifications

Technical Specifications		
Pumping speed	ISO100K-F	CFF6
N_2 He H_2 Ar	355 L/s 470 L/s 445 L/s 320 L/s	
Max Gas Throughput(*)	Air Cooling (25°C Air temp.)	Water Cooling (15°C Water temp. / 25°C room temp.)
N_2	"4.3 mbarL/s 255 SCCM"	"6.2 mbarL/s 367 SCCM"
He	"7.9 mbarL/s 467 SCCM"	"10.4 mbarL/s 615 SCCM"
Ar	"1.5 mbarL/s 89 SCCM"	"3.3 mbarL/s 195 SCCM"
Compression ratio and foreline tolerance		
N_2 He H_2 Ar	> 1 x 10^{11} 2 x 10^{8} 3 x 10^{6} > 1 x 10^{11}	>10 mbar >10 mbar >4 mbar >8.5 mbar
(*) Foreline Tolerance defined as the pressure at which the turbopump still produces a compression of 100 and estimated in water cooling mode		
Inlet flange	ISO 100K, ISO 100F, CFF 6"	
Foreline flange	NW25 (NW16 as optional accessory)	
Rotational speed	Auto setting from 40'800 RPM to 49'500 RPM	
Start-up time	< 5 minutes	
Recommended forepump	DS302 IDP-10	
Operating position	Any	
Oper. ambient temp.	+5 °C to +35 °C	
Rel. humidity of air	0 to 90% (not condensing)	
Bakeout temp.	ISO pump: 80°C at inlet flange CFF pump: 120°C at inlet flange	
Lubricant	Permanent grease lubrication	
Cooling requirements		
Air cooling	Air temperature from +5°C to 35°C	
Water cooling	Water temperature from +15°C to +25°C Water flow min. 100L/h	
Noise Pressure Level (at 1m at full speed)	43dB(A)	
Storage temperature	-40 °C to +70 °C	
Max altitude	3000 m	
Weight kg (lbs)	ISO100K ISO100F CFF 6"	20.6 Kg / 45.3 lbs. 22.1 Kg / 48.6 lbs. 22 Kg / 48.4 lbs.

Conformity to norms	
EMC (Control Units)	61326-1
Safety (CE/CSA)	61010-1
Machinery Directive	DIR 2006/42/CE
Low Voltage Directive	DIR 2014/35/EU
EMC Directive (Control Units)	DIR 2014/30/EU
ROHS	DIR 2011/65/EU

Agilent TwisTorr 304 FS

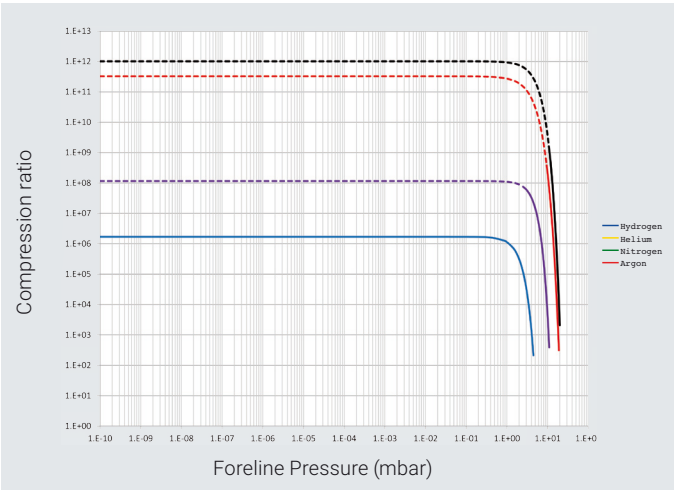
Technical Specifications

Technical Specifications		
Pumping speed	ISO 100 / CF 6”	ISO 160 / CF 8”
N_2 He H_2 Ar	250 L/s 255 L/s 220 L/s 250 L/s	250 L/s 255 L/s 220 L/s 250 L/s
Gas throughput at full rotational speed (with recomm. 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 and foreline tolerance		
N_2 He H_2 Ar	> 1 x 10^{11} > 1 x 10^{8} 1.5 x 10^{6} > 1 x 10^{11}	>10 mbar >10 mbar >4 mbar >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” od ISO 160 CFF 6” od ISO 100	
Foreline flange	KF16 NW (KF25 - optional)	
Rotational speed	60000 rpm (1010 Hz driving frequency)	
Start-up time	< 3 minutes	

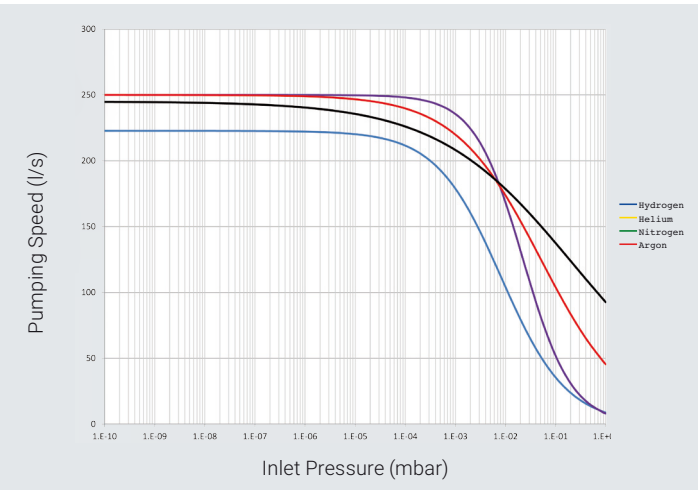
Technical Specifications		
Recommended forepump	mechanical: Agilent DS 102 dry pump: Agilent IDP-7	
Operating position	Any	
Oper. ambient temperature	+5 °C to +35 °C	
Rel. humidity of air	0 to 90 % (not condensing)	
Bakeout temp.	80 °C at inlet flange max (ISO flange) 120 °C at inlet flange max (CFF flange)	
Lubricant	Permanent lubrication	
Cooling requirements	Forced air (5- 35 °C ambient temperature) Water (mandatory if ambient temp. > 35 °C) Water temperature from +15°C to +25°C Water flow min. 100L/h	
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 temp.	-40°C to +70°C	
Max altitude	3000 m	
Weight kg (lbs)	Pump ISO 100 Pump CFF 6” Pump ISO 160 Pump CFF 8”	5.5 kg (12.3) 7.5 kg (16.5) 5.7 kg (12.6) 9.7 kg (20.9)

Conformity to norms	
EMC (Control Units)	61326-1
Safety (CE/CSA)	DIR 2006/42/CE
ROHS	DIR 2011/65/EU

Compression Ratio



Pumping Speed



Agilent TwisTorr 84 FS

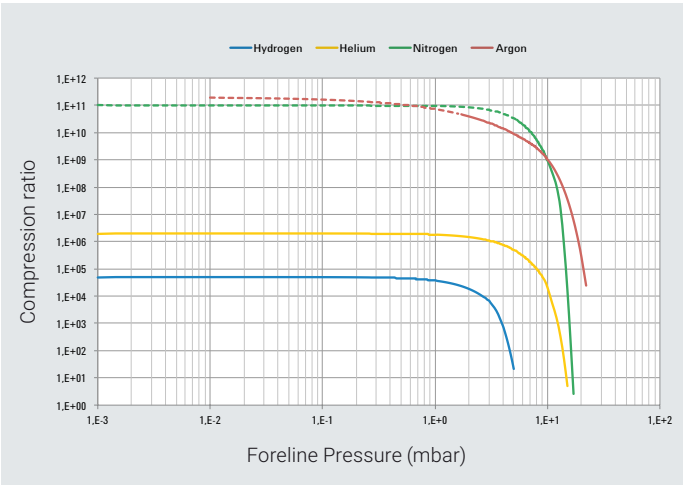
Technical Specifications

Technical Specifications				
Pumping speed	KF40	CFF 2.75"	ISO 63	CFF 4.5"
N_2	49 L/s	56 L/s	67 L/s	67 L/s
He	38 L/s	46 L/s	63 L/s	63 L/s
H_2	36 L/s	40 L/s	53 L/s	53 L/s
Ar	44 L/s	57 L/s	66 L/s	66 L/s
Gas throughput at full rotational speed (with recomm. forepump)	Air cooling (35 °C)		Water cooling (25 °C, 65 L/h)	
N_2 Ar	100 sccm 70 sccm		100 sccm 70 sccm	
Compression ratio and foreline tolerance				
N_2 He H_2 Ar	≥ 1.0 x 10^{11} 2.0 x 10^{6} 5.0 x 10^{4} > 1.0 x 10^{11}		>14 mbar >12 mbar >4 mbar >14 mbar	
Base pressure with recommended forepump (5 m^3/h)	< 5 x 10^{-10} mbar (< 3.75 x 10^{-10} Torr)			
Inlet flange	CFF 4.5" od CFF 2.75" od		ISO 63 KF 40	
Foreline flange	KF16 NW			
Rotational speed	81000 rpm (1350 Hz driving frequency)			
Start-up time	< 2 minutes			

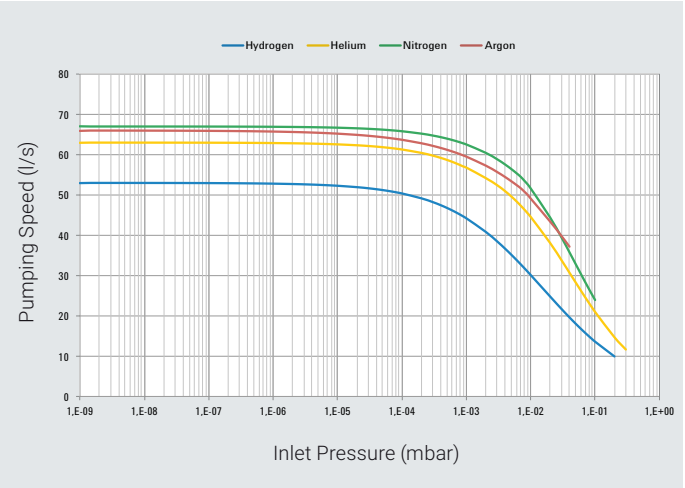
Technical Specifications	
Recommended forepump	mechanical: Agilent DS 40M / DS 102 dry pump: Agilent IDP-3 / IDP-7
Operating position	Any
Oper. ambient temp.	+5 °C to +35 °C
Rel. humidity of air	0 - 90 % (not condensing)
Bakeout temp.	80 °C for ISO (120 °C for CFF) at inlet flange
Lubricant	Permanent lubrication
Cooling requirements	Forced air (5- 35 °C ambient temp.)
Air cooling	Air flow temperature +5° C to +35 °C
Water cooling	Cooling water temp.: +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 temp.	-40 °C to +70 °C
Max altitude	3000 m
Weight kg (lbs)	Pump ISO 63 kg / 2.05 (4.5) lbs. Pump CFF 4.5" kg / 3.50 (7.7) lbs. Pump CFF 2.75" kg / 3.34 (7.35) lbs. Pump KF 40" kg / 2.37 (5.22) lbs.

Conformity to norms
CE, C-CSA-US, RoHS compliant as per 2011/65/UE

Compression Ratio



Pumping Speed



Agilent TwisTorr FS Turbo Pump Family

The new generation Turbo Pumps with TwisTorr drag technology and Agilent Floating Suspension

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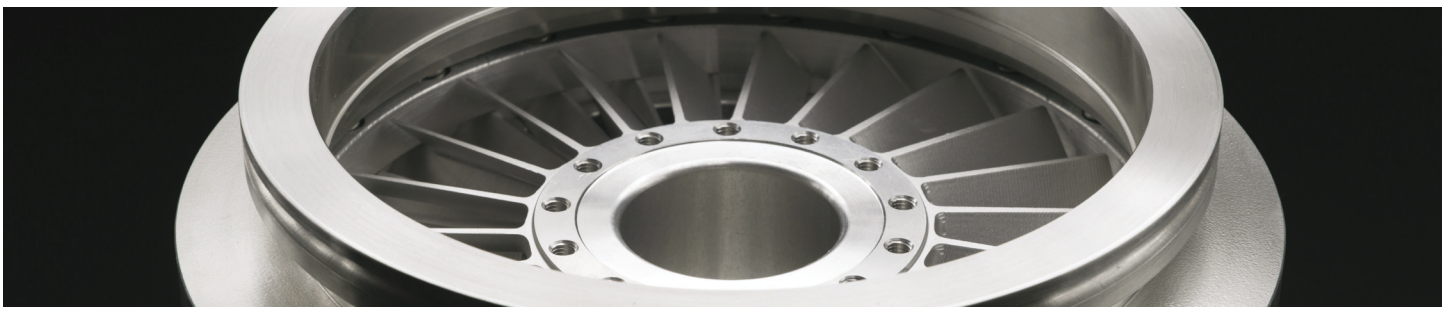

QUALITY SYSTEM ISO 9001 CERTIFIED

ENVIRONMENTAL MANAGEMENT SYSTEM ISO 14001 CERTIFIED

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