Agilent TwisTorr FS Turbo Pump Family

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

NEW! TwisTorr 804 FS
NEW! TwisTorr 704 FS
NEW! TwisTorr 404 FS
TwisTorr 84 FS
TwisTorr 304 FS
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

**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

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**How Quiet is a TwisTorr FS Pump?**

<table>
<thead>
<tr>
<th>Noise</th>
<th>dBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorcycle (8 m away)</td>
<td>90</td>
</tr>
<tr>
<td>Freight train (25 m); food blender</td>
<td>80</td>
</tr>
<tr>
<td>Cars on freeway; vacuum cleaner</td>
<td>70</td>
</tr>
<tr>
<td>Air conditioner (30 m); office noise</td>
<td>60</td>
</tr>
<tr>
<td>Rotary vane Pump</td>
<td>55</td>
</tr>
<tr>
<td>Agilent IDP-15 Scroll pump/conversation at home</td>
<td>50</td>
</tr>
<tr>
<td>Competitors’ medium TMP</td>
<td>50</td>
</tr>
<tr>
<td>Agilent Medium TwisTorr pumps</td>
<td>43</td>
</tr>
<tr>
<td>Competitors’ small TMP</td>
<td>48</td>
</tr>
<tr>
<td>Agilent Small TwisTorr pumps</td>
<td>40</td>
</tr>
</tbody>
</table>

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**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.

**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.**
**Stability Over Time**

**Quiet and Low-Vibration**

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**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.

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**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.

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**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.

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**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.

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*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 84 FS to 804 FS

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.


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

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.

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.

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.
What is Agilent Floating Suspension?
Innovative solutions for low vibration and stability over time

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.

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**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
### Technical Specifications

#### Pumping speed

<table>
<thead>
<tr>
<th>Gas</th>
<th>ISO 160 / CF 8&quot;</th>
<th>N₂</th>
<th>He</th>
<th>H₂</th>
<th>Ar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumping speed L/s</td>
<td>660</td>
<td>640</td>
<td>480</td>
<td>625</td>
<td></td>
</tr>
</tbody>
</table>

#### Max Gas Throughput (*)

<table>
<thead>
<tr>
<th>Gas</th>
<th>Air Cooling (25°C ambient temperature)</th>
<th>Water Cooling (15°C water temp., 25°C ambient temp.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂</td>
<td>4.3 mbar L/s 255 SCCM</td>
<td>6.2 mbar L/s 367 SCCM</td>
</tr>
<tr>
<td>He</td>
<td>7.9 mbar L/s 467 SCCM</td>
<td>10.4 mbar L/s 615 SCCM</td>
</tr>
<tr>
<td>Ar</td>
<td>1.5 mbar L/s 89 SCCM</td>
<td>3.3 mbar L/s 195 SCCM</td>
</tr>
</tbody>
</table>

(*) Backing pump 11.6 m³/hr

#### Compression ratio and foreline tolerance (**)

<table>
<thead>
<tr>
<th>Gas</th>
<th>Compression ratio</th>
<th>Foreline Tolerance</th>
<th>Foreline Pressure (mbar)</th>
<th>Inlet Pressure (mbar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂</td>
<td>&gt; 1 x 10⁻¹¹ mbar</td>
<td>10 mbar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>He</td>
<td>2 x 10⁻¹ mbar</td>
<td>10 mbar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ar</td>
<td>&gt; 1 x 10⁻¹¹ mbar</td>
<td>8.5 mbar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(**) 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 recom. forepump

- ISO 160K, ISO 160F, CFF 8"
- NW25 (NW40 as option)

#### Start-up time

- < 5 minutes

#### Recommended forepump

- Agilent DS302 Rotary Vane Pump
- Agilent IDP-10 Dry Scroll Pump
- Agilent IDP-15 Dry Scroll Pump

#### 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 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: 20.6 kg (45.3)
- ISO160F: 22.6 kg (49.7)
- CFF 8": 22 kg (48.4)

#### Conformity to norms

- EMC (Control Units): 61326-1
- Safety (CE/CSA): 61010-1
- Low Voltage Directive: DIR 2014/30/EU
- EMC Directive (Control Units): DIR 2011/65/EU
- ROHS: 61326-1

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Agilent TwisTorr 804 FS

Technical Specifications

<table>
<thead>
<tr>
<th>Pumping speed</th>
<th>ISO200K-F</th>
<th>ISO250K-F</th>
<th>CFF10</th>
</tr>
</thead>
<tbody>
<tr>
<td>N&lt;sub&gt;2&lt;/sub&gt;</td>
<td>720 L/s</td>
<td>660 L/s</td>
<td>540 L/s</td>
</tr>
<tr>
<td>He</td>
<td>485 L/s</td>
<td>425 L/s</td>
<td>360 L/s</td>
</tr>
<tr>
<td>H&lt;sub&gt;2&lt;/sub&gt;</td>
<td>690 L/s</td>
<td>630 L/s</td>
<td>570 L/s</td>
</tr>
<tr>
<td>Ar</td>
<td>720 L/s</td>
<td>660 L/s</td>
<td>540 L/s</td>
</tr>
</tbody>
</table>

Max Gas Throughput (*)

- **Air Cooling (25°C ambient temperature)**
  - N<sub>2</sub>: 4.3 mbar L/s
  - He: 7.9 mbar L/s
  - Ar: 1.5 mbar L/s

- **Water Cooling (15°C water temp. / 25°C ambient temp.):**
  - N<sub>2</sub>: 6.2 mbar L/s
  - He: 10.4 mbar L/s
  - Ar: 3.3 mbar L/s

(*) Backing pump 11.6 m<sup>3</sup>/hr

Compression ratio and foreline tolerance**

- N<sub>2</sub>: > 1 x 10<sup>-11</sup> mbar
- He: 2 x 10<sup>-10</sup> mbar
- H<sub>2</sub>: 3 x 10<sup>-10</sup> mbar
- Ar: > 1 x 10<sup>-10</sup> mbar

Base pressure with recomm. forepump

- < 1 x 10<sup>-1</sup> mbar (1 x 10<sup>-13</sup> Torr)

Inlet flange


Foreline flange

- NW25 or NW40

Rotational speed

- Auto setting from 40'800 RPM to 49'500 RPM

Start-up time

- < 5 minutes

Recommended forepump

- Agilent DS302 Rotary Vane Pump
- Agilent IDP-10 Dry Scroll Pump
- Agilent IDP-15 Dry Scroll Pump

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 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: 20.7 kg (45.5)
- ISO200F: 23.6 kg (51.9)
- ISO250K: 23.3 kg (51.2)
- ISO250F: 27.6 kg (60.9)
- CFF 10": 22.1 kg (48.6)

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: 2011/65/EU
Technical Specifications

<table>
<thead>
<tr>
<th>Pumping speed</th>
<th>ISO 100K / ISO 100F / CFF 6&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂</td>
<td>380 L/s</td>
</tr>
<tr>
<td>He</td>
<td>505 L/s</td>
</tr>
<tr>
<td>H₂</td>
<td>415 L/s</td>
</tr>
<tr>
<td>Ar</td>
<td>340 L/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max Gas Throughput (*)</th>
<th>Air Cooling (25°C ambient temperature)</th>
<th>Water Cooling (15°C water temp. / 25°C ambient temp.)</th>
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<tr>
<td>N₂</td>
<td>4.3 mbar L/s 255 SCCM</td>
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<td>He</td>
<td>7.9 mbar L/s 467 SCCM</td>
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<td>Ar</td>
<td>1.5 mbar L/s 89 SCCM</td>
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(*) Backing pump 11.6 m³/h

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<td>N₂</td>
</tr>
<tr>
<td>He</td>
</tr>
<tr>
<td>H₂</td>
</tr>
<tr>
<td>Ar</td>
</tr>
</tbody>
</table>

(**) Foreline Tolerance defined as the pressure at which the turbopump still produce a compression of 100 and estimated in water cooling mode

- Base pressure with recomm. forepump: < 1 x 10⁻¹ mbar (≤ 1 x 10⁻¹⁰ Torr)
- Inlet flange: ISO 100K, ISO 100F, CFF 6"
- Foreline flange: NW25 (NW16 as optional accessory)
- Rotational speed: Auto setting from 40800 RPM to 49500 RPM
- Start-up time: < 5 minutes

Recommended forepump:
- Agilent DS302 Rotary Vane Pump
- Agilent IDP-10 Dry Scroll Pump
- Agilent IDP-15 Dry Scroll Pump

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 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):
  - ISO100K: 22.6 kg (49.8)
  - ISO100F: 23.7 kg (52.3)
  - CFF 6": 23.5 kg (51.8)

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

Pumping Speed

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Technical Specifications

<table>
<thead>
<tr>
<th>Pumping speed</th>
<th>ISO 100 / CF 6&quot;</th>
<th>ISO 160 / CF 8&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂</td>
<td>250 L/s</td>
<td>250 L/s</td>
</tr>
<tr>
<td>He</td>
<td>255 L/s</td>
<td>255 L/s</td>
</tr>
<tr>
<td>H₂</td>
<td>220 L/s</td>
<td>220 L/s</td>
</tr>
<tr>
<td>Ar</td>
<td>250 L/s</td>
<td>250 L/s</td>
</tr>
</tbody>
</table>

Max Gas Throughput (*):

<table>
<thead>
<tr>
<th>Gas</th>
<th>Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂</td>
<td>170 SCCM</td>
</tr>
<tr>
<td>Ar</td>
<td>110 SCCM</td>
</tr>
</tbody>
</table>

(*) Backing pump 11.6 m³/h

Compression ratio and foreline tolerance (**):

<table>
<thead>
<tr>
<th>Gas</th>
<th>Compression ratio</th>
<th>Foreline Pressure (mbar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N₂</td>
<td>&gt; 1 x 10¹¹</td>
<td>&gt;10 mbar</td>
</tr>
<tr>
<td>He</td>
<td>&gt; 1 x 10⁹</td>
<td>&gt;10 mbar</td>
</tr>
<tr>
<td>H₂</td>
<td>1.5 x 10⁶</td>
<td>&gt;4 mbar</td>
</tr>
<tr>
<td>Ar</td>
<td>&gt; 1 x 10⁷</td>
<td>&gt;10 mbar</td>
</tr>
</tbody>
</table>

(**) Foreline Tolerance defined as the pressure at which the turbopump still produce a compression of 100 and estimated in water cooling mode

Base pressure with recomm. forepump:

< 1 x 10⁻¹⁵ mbar  (< 1 x 10⁻¹⁵ Torr)

Inlet flange:

ISO 100, CFF 6", ISO 160, CFF 8"

Foreline flange:

KF16 NW (KF25 - optional)

Rotational speed:

60000 rpm  (1010 Hz driving frequency)

Start-up time:

< 3 minutes

Recommended forepump:

Agilent DS102 Rotary Vane Pump
Agilent IDP-7 Dry Scroll Pump

Technical Specifications

<table>
<thead>
<tr>
<th>Operating position</th>
<th>Any</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oper. ambient temperate</td>
<td>+5 °C to +35 °C</td>
</tr>
<tr>
<td>Rel. humidity of air</td>
<td>0 to 90 % (not condensing)</td>
</tr>
<tr>
<td>Bakeout temp.</td>
<td>80 °C at inlet flange max (ISO flange) 120 °C at inlet flange max (CFF flange)</td>
</tr>
<tr>
<td>Lubricant</td>
<td>Permanent lubrication</td>
</tr>
<tr>
<td>Cooling requirements</td>
<td></td>
</tr>
<tr>
<td>Air cooling</td>
<td>Air temperature from +5°C to 35°C</td>
</tr>
<tr>
<td>Water cooling</td>
<td>Water temperature from +15°C to +25°C Water flow min. 50 L/h</td>
</tr>
<tr>
<td>Noise Pressure Level</td>
<td>&lt; 50 dB(A)</td>
</tr>
<tr>
<td>Storage temp.</td>
<td>-40°C to +70°C</td>
</tr>
<tr>
<td>Max altitude</td>
<td>3000 m</td>
</tr>
<tr>
<td>Weight kg (lbs)</td>
<td>ISO 100 5.5 kg (12.3)</td>
</tr>
<tr>
<td></td>
<td>CFF 6&quot; 7.5 kg (16.5)</td>
</tr>
<tr>
<td></td>
<td>ISO 160 5.7 kg (12.6)</td>
</tr>
<tr>
<td></td>
<td>CFF 8&quot; 9.7 kg (20.9)</td>
</tr>
</tbody>
</table>

Conformity to norms:

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

14 Agilent TwisTorr FS Turbo Pumps
Agilent TwisTorr 84 FS

Technical Specifications

<table>
<thead>
<tr>
<th>Technical Specifications</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Pumping speed</strong></td>
<td><strong>Recommended forepump</strong></td>
</tr>
<tr>
<td>KF40</td>
<td>Agilent DS 40M / DS 102 Rotary Vane Pump</td>
</tr>
<tr>
<td>ISO 63</td>
<td>Agilent IDP-3/IDP-7 Dry Scroll Pump</td>
</tr>
<tr>
<td>CFF 2.75”</td>
<td></td>
</tr>
<tr>
<td>CFF 4.5”</td>
<td></td>
</tr>
<tr>
<td>N₂</td>
<td>49 L/s 56 L/s 67 L/s 67 L/s</td>
</tr>
<tr>
<td>He</td>
<td>38 L/s 46 L/s 63 L/s 63 L/s</td>
</tr>
<tr>
<td>H₂</td>
<td>36 L/s 40 L/s 53 L/s 53 L/s</td>
</tr>
<tr>
<td>Ar</td>
<td>44 L/s 57 L/s 66 L/s 66 L/s</td>
</tr>
<tr>
<td>Max Gas Throughput (*)</td>
<td></td>
</tr>
<tr>
<td>Air Cooling (25°C ambient temperature)</td>
<td>Water Cooling 15°C water temp. / 55°C ambient temp.</td>
</tr>
<tr>
<td>N₂</td>
<td>100 SCCM 100 SCCM</td>
</tr>
<tr>
<td>Ar</td>
<td>70 SCCM 70 SCCM</td>
</tr>
<tr>
<td>(*) Backing pump 11.6 m³/h</td>
<td></td>
</tr>
<tr>
<td>Compression ratio and foreline tolerance (**)</td>
<td></td>
</tr>
<tr>
<td>N₂</td>
<td>≥ 1.0 x 10¹¹ &gt;14 mbar</td>
</tr>
<tr>
<td>He</td>
<td>2.0 x 10¹⁰ &gt;12 mbar</td>
</tr>
<tr>
<td>H₂</td>
<td>5.0 x 10⁹ &gt;4 mbar</td>
</tr>
<tr>
<td>Ar</td>
<td>&gt; 1.0 x 10¹⁰ &gt;14 mbar</td>
</tr>
<tr>
<td>Base pressure with recomm. forepump</td>
<td></td>
</tr>
<tr>
<td>KF40, ISO 63, CFF 4.5”, CFF 2.75”</td>
<td>≤ 5 x 10⁻⁹ mbar (+ 3.75 x 10⁻⁹ Torr)</td>
</tr>
<tr>
<td>Inlet flange</td>
<td></td>
</tr>
<tr>
<td>KF 40, ISO 63, CFF 4.5”, CFF 2.75”</td>
<td></td>
</tr>
<tr>
<td>Foreline flange</td>
<td>KF16 NW</td>
</tr>
<tr>
<td>Rotational speed</td>
<td>81000 rpm (1350 Hz driving frequency)</td>
</tr>
<tr>
<td>Start-up time</td>
<td>&lt; 2 minutes</td>
</tr>
</tbody>
</table>

Compliance:
- CE, CSA-US, RoHS
- compliant as per 2011/65/UE

(*) Backing pump 11.6 m³/h  
(**) Foreline Tolerance defined as the pressure at which the turbopump still produces a compression of 100 and estimated in water cooling mode.

Recommended forepump:
- Agilent DS 40M / DS 102 Rotary Vane Pump
- Agilent IDP-3/IDP-7 Dry Scroll Pump

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:
- Air cooling: Forced air (5-35 °C ambient temp.)
  - Air flow temperature +5°C to +35°C
- Water cooling: Water temperature from +15°C to +25°C
  - Water flow min. 65m³/h

Noise Pressure level (at 1 m at full speed):
- 40 dB(A)

Storage temp.:
- -40 °C to +70 °C

Max altitude:
- 3000 m

Weight kg (lbs):
- ISO 63:
  - 2.05 kg (4.5)
  - 3.50 kg (7.7)
- CFF 4.5”:
  - 3.34 kg (7.35)
- CFF 2.75”:
  - 2.37 kg (5.22)

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

![Graphs of Compression Ratio and Pumping Speed](www.agilent.com/chem/TwisTorrFSfamily)
Agilent TwisTorr FS Turbo Pump Family

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

Agilent Technologies

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
<th>Contact Information</th>
</tr>
</thead>
<tbody>
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<td>Shenzhen, 518048</td>
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