

AGILENT TWISTORR 304 FS

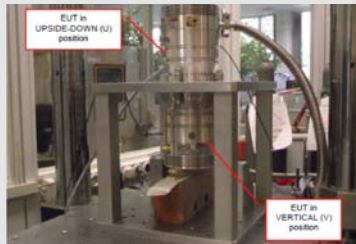
HIGH PERFORMANCE, INNOVATION, RELIABILITY.

Agilent commitment to technology leadership translates into quality, reliability and performance. Our products need to comply with strict parameters, to make sure we can meet and exceed customer expectations. The TwisTorr 304 FS represents a breakthrough in turbomolecular pump technology, based on two patented innovations, TwisTorr stages and Floating Suspension, which strongly impact performance and reliability. Development of the 304 FS included a comprehensive series of tests and analysis, performed to ensure the highest levels of pump performance and reliability. Through those tests VPD verified, step by step, that pump performance and robustness is ready to meet our customers' demanding specifications.

This rigorous test regime of product performance, reliability and durability according to Agilent standards ensures the release of a robust, high performance, system compatible product.



TwisTorr 304 FS Test Elements



Shock Test



Vibration Test



Temperature Test



Noise Test



Reliability assessment
on Agilent system



Life Tests



Vacuum Test



Humidity Test



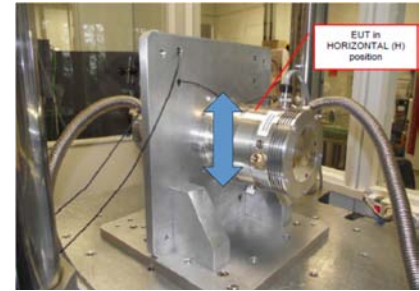
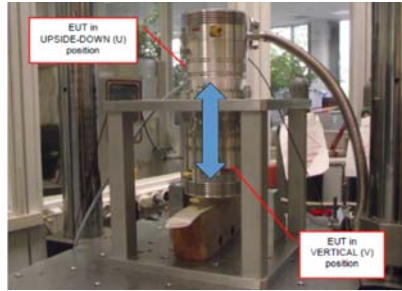
Shock Test

4 Pumps tested in each position.

Operative: Pump tested under nominal working conditions (pump ON). After the test the pump must operate as new.

Non Operative: Pump not running (pump OFF) to simulate transportation and storage. The pump after the test must operate as new.

| Pump position | Sinusoidal (Operative) | Trapezoidal (Non-Operative) |
|---------------|------------------------|-----------------------------|
| Horizontal | > 110g | > 40g |
| Vertical | > 150g | > 60g |
| Upside-down | > 150g | > 60g |



Vibration Test

4 Pumps tested in horizontal, vertical and upside position.

Operative: Pump tested under nominal working conditions (pump ON). After the test the pump must operate as new.

Non Operative: Pump not running (pump OFF) to simulate transportation and storage. The pump after the test must operate as new.

| Pump position | Operative (5-500Hz) | Non-Operative (5-500Hz) |
|---------------|---------------------|-------------------------|
| Horizontal | 0.2grms | 2grms |
| Vertical | 0.2grms | 2grms |
| Upside-down | 0.2grms | 2grms |



Temperature Test

4 Pumps tested in horizontal, vertical and upside position.

Operative: Pump tested under nominal working conditions (pump ON). After the test the pump must operate as new.

Non Operative: Pump not running (pump OFF) to simulate transportation and storage. The pump after the test must operate as new.

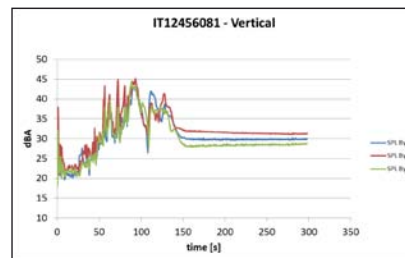
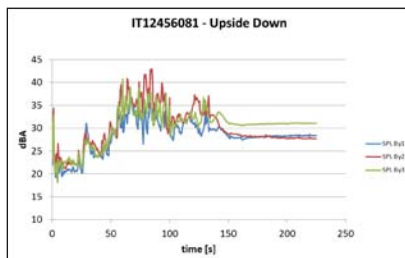
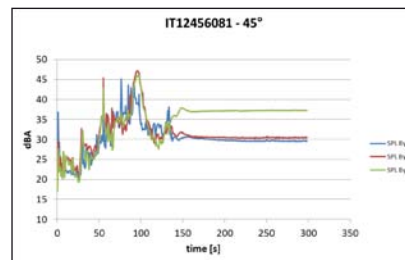
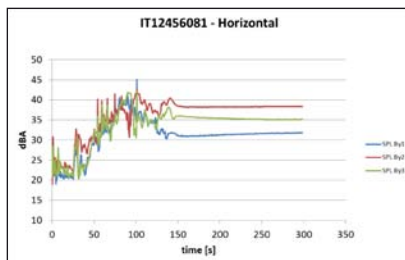
| Pump position | Operative | Non-Operative |
|---------------|---------------|------------------|
| Horizontal | 0 °C to 40 °C | -40 °C to +70 °C |
| Vertical | 0 °C to 40 °C | -40 °C to +70 °C |

Entire thermal cycle = 80 hours



Noise Test

Noise specs are measured at full speed at 1 meter from the pump (noise specs < 50dB (A)).

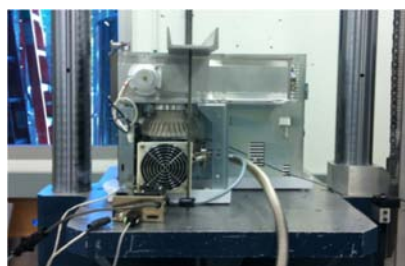


Reliability assessment on Agilent GCMS

Non-operational shock test: system drop with pump not running, after each drop pump is switched on and

after stabilization unbalance, Fourier spectra, power adsorption and bearing temperature are acquired.

| # shock | 1 | 2 | 3 | 4 |
|------------------|------|------|------|------|
| TV301 IT12186116 | pass | pass | pass | pass |
| TV301 IT12196067 | pass | pass | pass | pass |
| TV301 IT12166229 | pass | pass | pass | fail |
| 304 - LP 13 | pass | pass | pass | pass |
| 304 - LP 15 | pass | pass | pass | pass |
| 304 - LP 16 | pass | pass | pass | pass |
| 304 - LP 14 | pass | pass | pass | pass |



Operational shock test: system drop with pump running, after each drop unbalance, Fourier spectra, power adsorption and bearing temperature are acquired.



| # shock | Increasing drop height | | | | | | | | | | | | | | | | | | | | |
|------------------|------------------------|---|------|------|-------|---|---|---|---|----|-----|-----|-----|-----|-----|-----|----|-------|-----|----|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | ... | 25 | |
| Height (inches) | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3.1 | 3.2 | 3.3 | 3.4 | 3.6 | 3.8 | 4 | 4.3 | ... | 10 | |
| TV301 IT12186116 | crash | | | | | | | | | | | | | | | | | | | | |
| TV301 IT12196067 | crash | | | | | | | | | | | | | | | | | | | | |
| TV301 IT12166229 | crash | | | | | | | | | | | | | | | | | | | | |
| 304 - LP 13 | pass | pass | pass | pass | crash | | | | | | | | | | | | | | | | |
| 304 - LP 15 | pass | crash | | | | | | | | | | | | | | | | | | | |
| 304 - LP 16 | pass | Pump perfectly working but unbalance above baseline | | | | | | | | | | | | | | | | | | | |
| 304 - LP 14 | pass | Pump perfectly working but unbalance above baseline | | | | | | | | | | | | | | | | crash | | | |

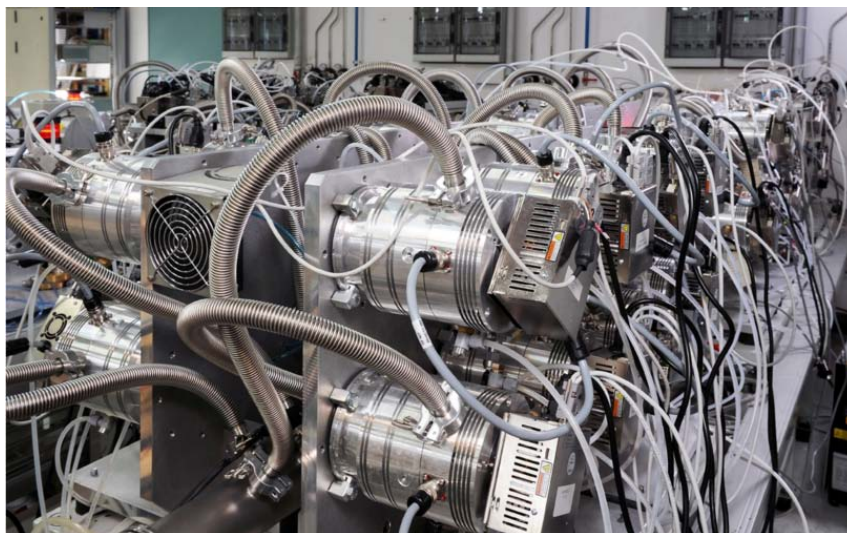
Pass = Unbalance within baseline value

Continuous Life Tests

20 pumps in accelerated life test since September 2012.

- Pumps operating 24/7 at 55 °C under argon gas load
- Ambient temperature 25 °C
- Power > 100 W
- Pumps stopped once per day for 45 minutes: resonance frequencies normally stable.

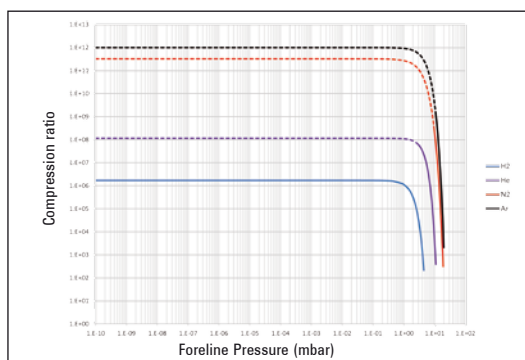
All pumps still working
as of today
(end of April 2013)



Vacuum Test

6 Pumps measured for each test type.
4 gases measured: Hydrogen, Helium, Nitrogen, Argon.

- Compression Ratio
- Pumping Speed with Fischer Mommsen
- Pumping Speed at high pressure
- Throughput curves
- Isopower - Isoflow curves
- Maximum flows
- Thermal behavior



Agilent Technologies

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Learn more:

www.agilent.com/chem/TwisTorr304FS

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Published May, 2013