

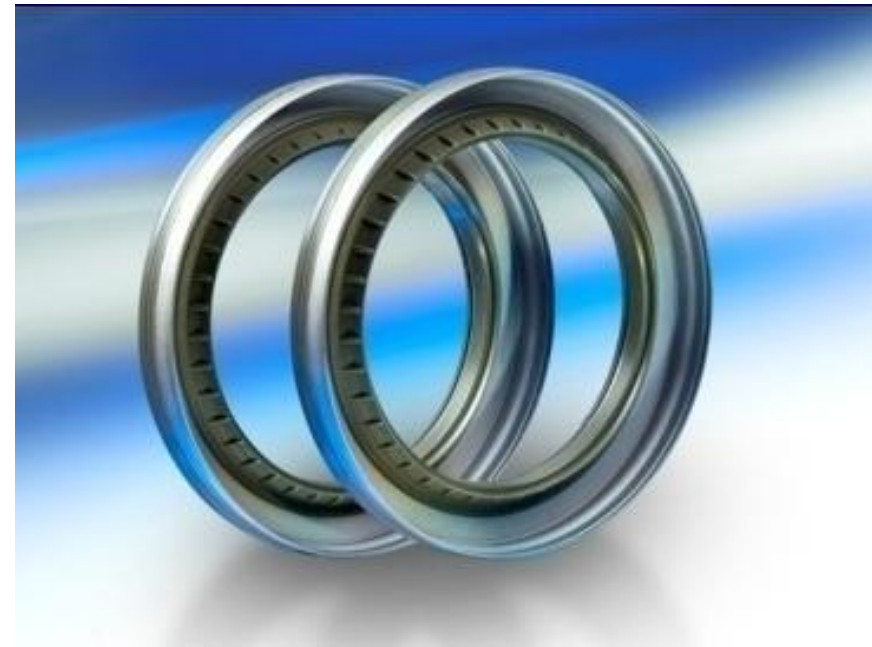
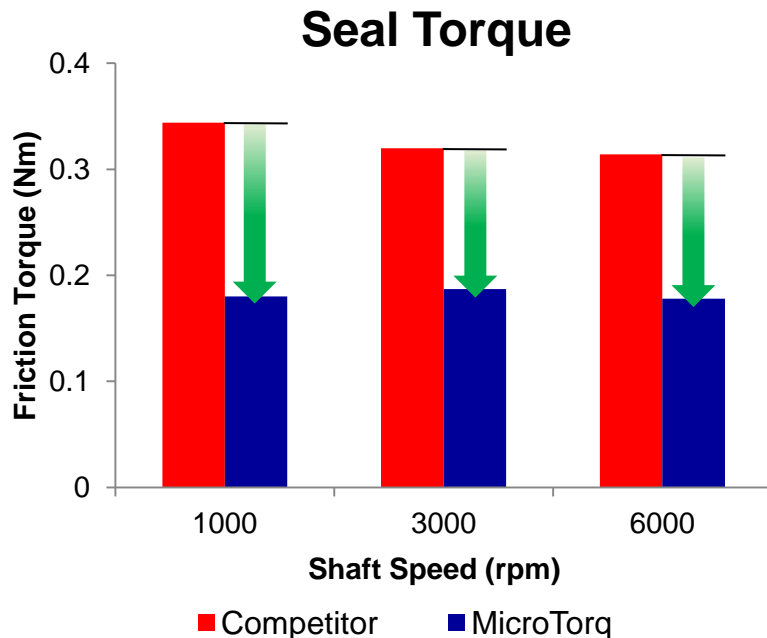
# MicroTorq<sup>®</sup> Dynamic Seal



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## New engine seal technology to directly reduce frictional losses

- 30-80% lower frictional torque than industry benchmarks
- Robust / error-free installation
- Excellent performance in vacuum environment



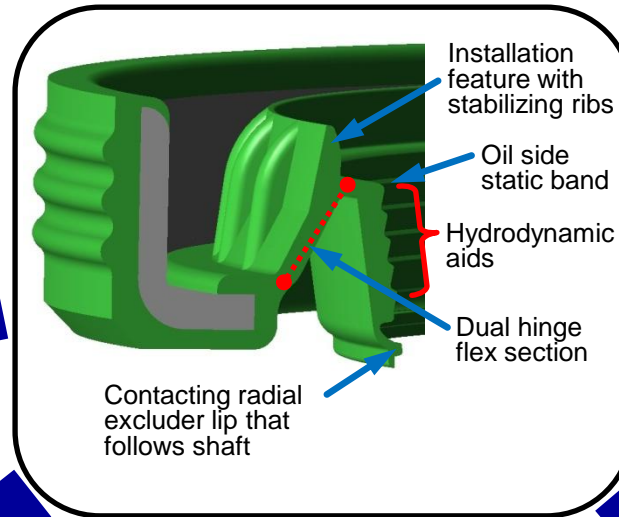
### Unique *dual hinge* design enables many seal benefits

#### Customization

Customize design features based upon individual application requirements to minimize torque.

#### Friction Reduction

The reduction of radial load is possible because of the dual hinge's ability to make the design less sensitive to shaft eccentricities. This translates into reduced operating frictional torque.



#### Ease of Installation

The dual hinge installation features ensure that the lip does not invert while being installed over the shaft.

#### Vacuum Performance

The dual hinge stabilizes the lip so that it is resistant to deformation or change in contact due to crankcase pressure variations.

#### Durability Enhancement

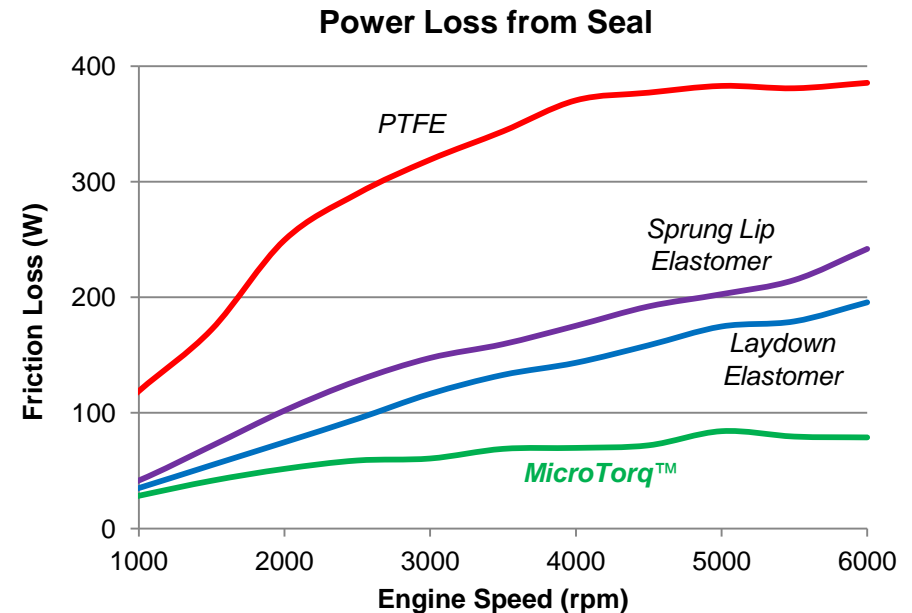
The dual hinge allows the seal to perform under wider application conditions and compensate for varying environments, thus expanding the durability of the design.

Strategies to reduce seal frictional torque losses are in the opposite direction of robust sealing

- Minimize load
- Reduce coefficient of friction
- Eliminate contact between features with relative motion

- MicroTorq achieves low friction loss without impacting sealing performance**
- Lower parasitic friction losses of MicroTorq equate to 0.31% efficiency improvement**

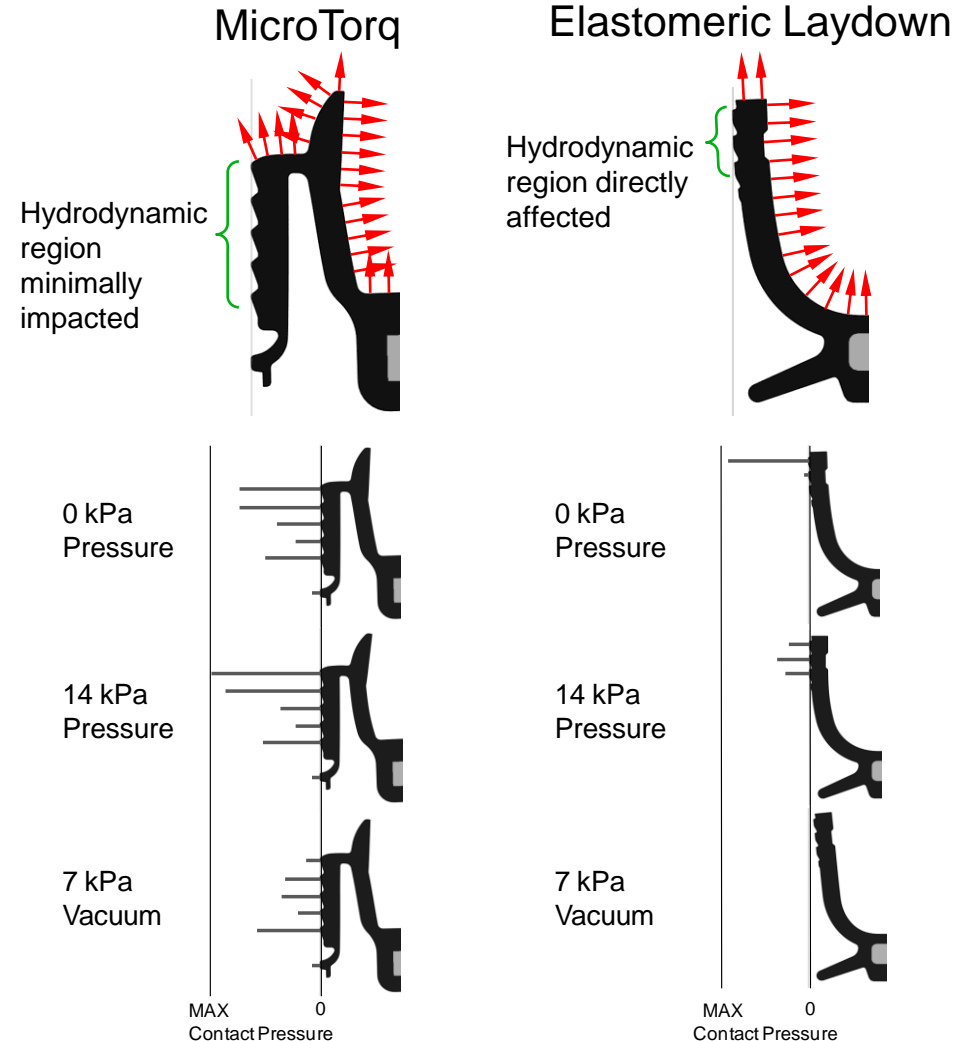
(Based on savings of 125W, GTDI 2.0L engine at 2000rpm)



# MicroTorq®

## Vacuum Resistance

- Crankcase vacuum is becoming standard in engines as a way to control emissions.
- In other elastomeric lay down seal designs, crankcase environment conditions directly effect the sealing interface.
- The MicroTorq dual hinge isolates the functional area of the main lip from the pressure and vacuum effects of the operating environment.

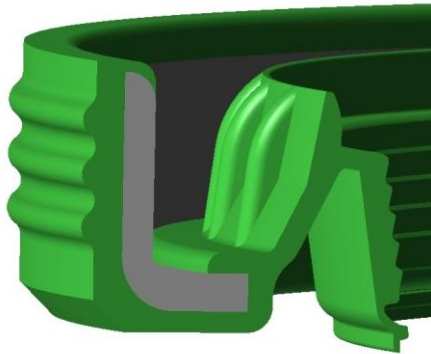


# MicroTorq®

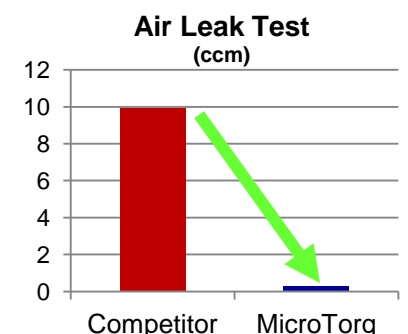
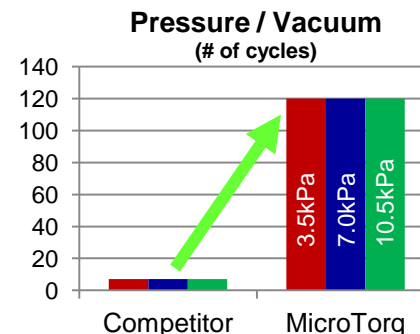
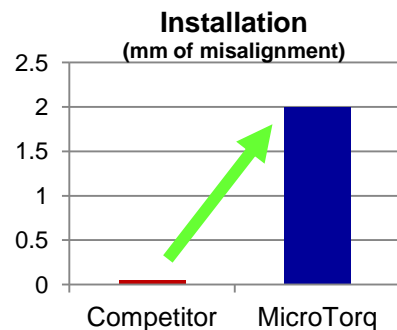
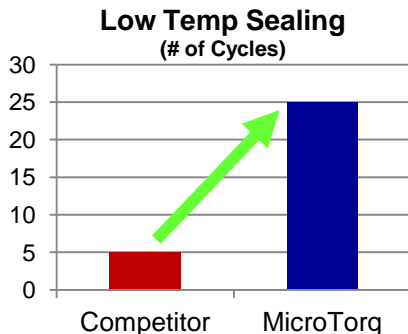
## Functional Performance / Durability



MicroTorq meets or beats competitive benchmarks in performance



Life Durability Tests	A	B	C	D	E
Max speed (rpm)	6000	7000	8000	3000	6000
Geometry – DRO/STBM (mm)	0.25 / 0.64	0.2 / 0.5	0.2 / 0.2	0.2 / 0.2	0.2 / 0.2
Max temperature (°C)	150	130	150	100	150
Special requirements	Dry running	Cold cycle (-18°C)	–	Used oil	Dry running
Durability requirement (hr)	1500	2416	1700	1700	2500
MicroTorq performance	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>



# MicroTorq<sup>®</sup> Dynamic Seal

Innovative sealing technology sets the benchmark for low friction and outstanding sealing performance

- Reduced CO<sub>2</sub> emissions via lower frictional torque losses
- Capable of handling over 70kPa pressure
- Capable of handling up to 15kPa vacuum
- Smaller package size
- Robust installation

