

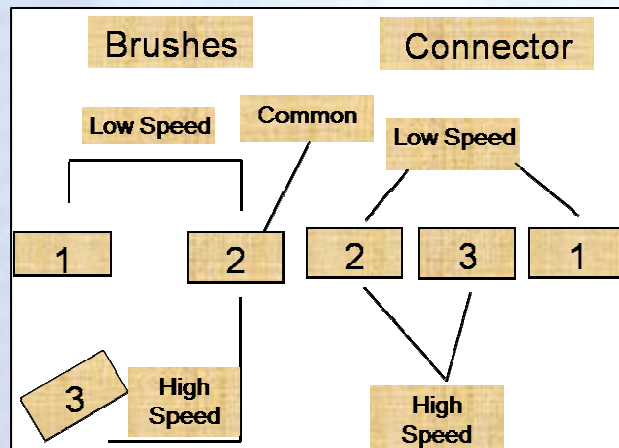
Magnequench

Motor Design
- Wiper Motor

Wiper Motor

Rationale

- Wiper motors are designed for two speed operation. The motor consists of three brushes namely; common, low speed and high Speed. Two of the brushes will be supplied for different mode of operation.



Mode	Supply to the Brushes	Angle between the Brushes
Low Speed	Common-Low Speed	180° elect.
High Speed	Common-High Speed	<180° elect.

- Reduction in size
 - Increase the amount of useable space

Benchmark Ferrite Wiper Motor

Winding Details

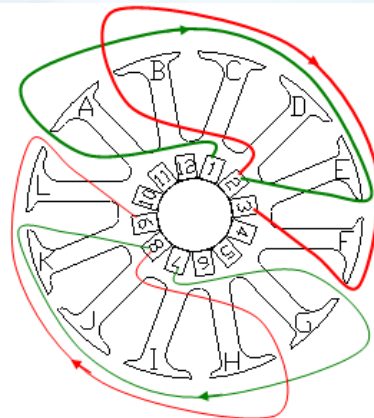


Figure #1

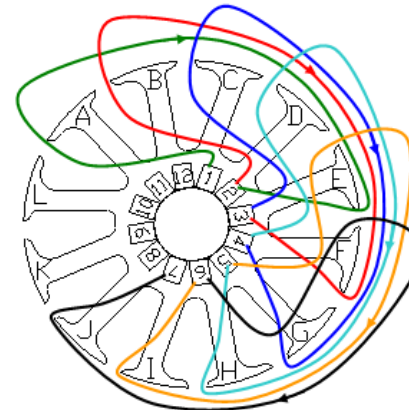


Figure #2

The copper unwinding direction (thick green line) at pole A-E (Figure #1 & #2) starts from commutator # 1 and ends at commutator #2 and so on to clockwise direction down to commutator # 6 and #7 at pole F-J (thick black line).

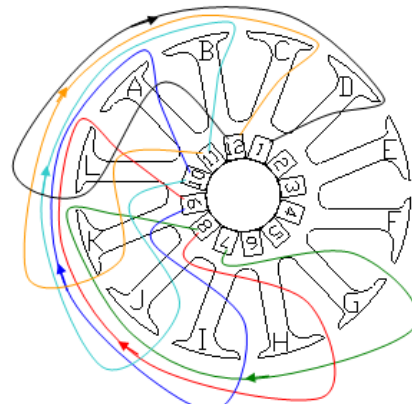
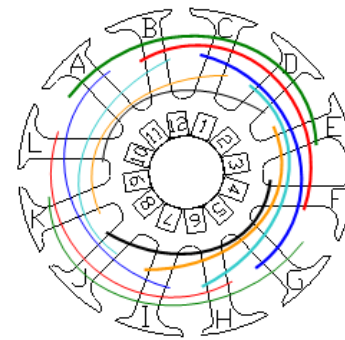


Figure #3

On the other half (Figure #1 & #3), the copper unwinding direction (thin green line) at pole G-K starts from commutator # 7 and ends at commutator # 8 and so on to clockwise direction down to commutator # 12 and #1 at pole L-D (thin black line).



Copper windings sequence.

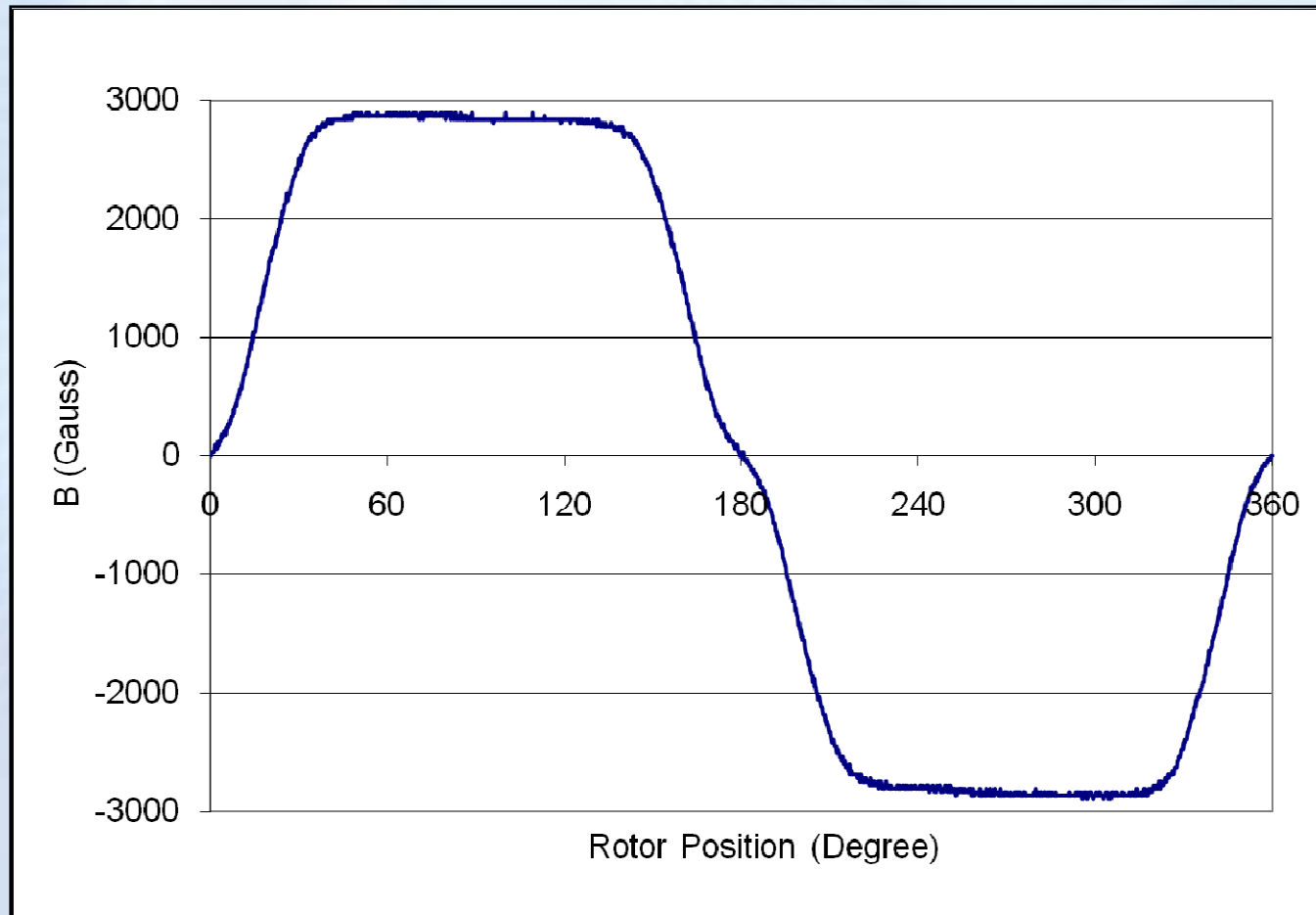
No. of copper turns: 17
Copper wire size, mm: 0.64 (AWG 23)

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Flux Scan

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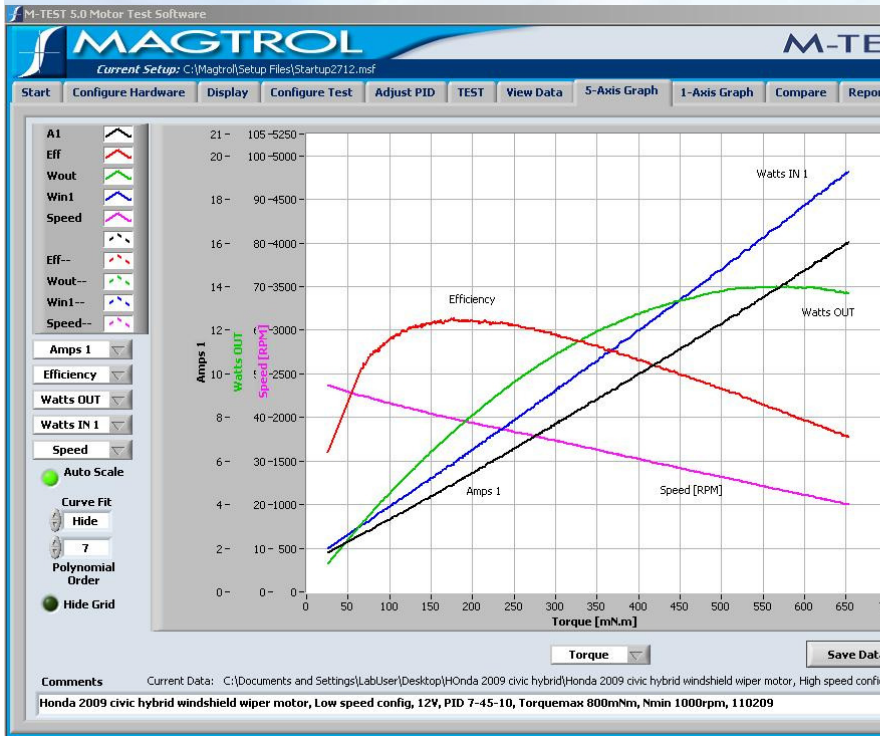


Air gap flux for the magnetic circuit with solid iron piece replacing the armature of the motor

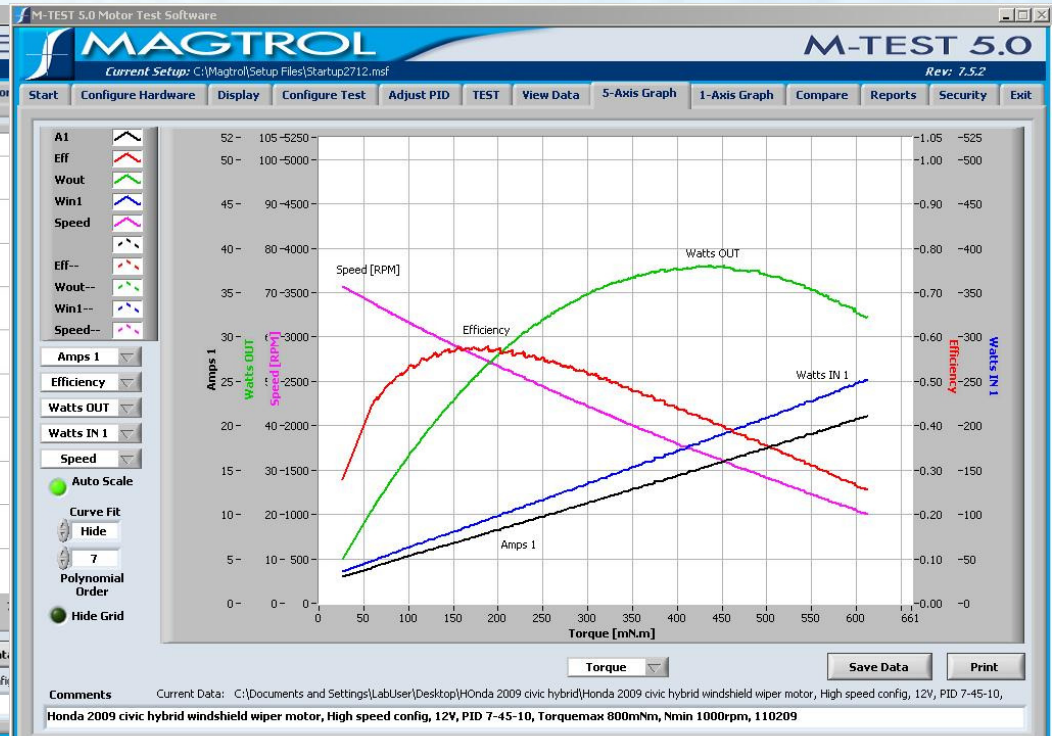
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Dyno Test

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Low Speed Characteristics



High Speed Characteristics

Comparison

Benchmark Ferrite Wiper Motor Vs Bonded Neo

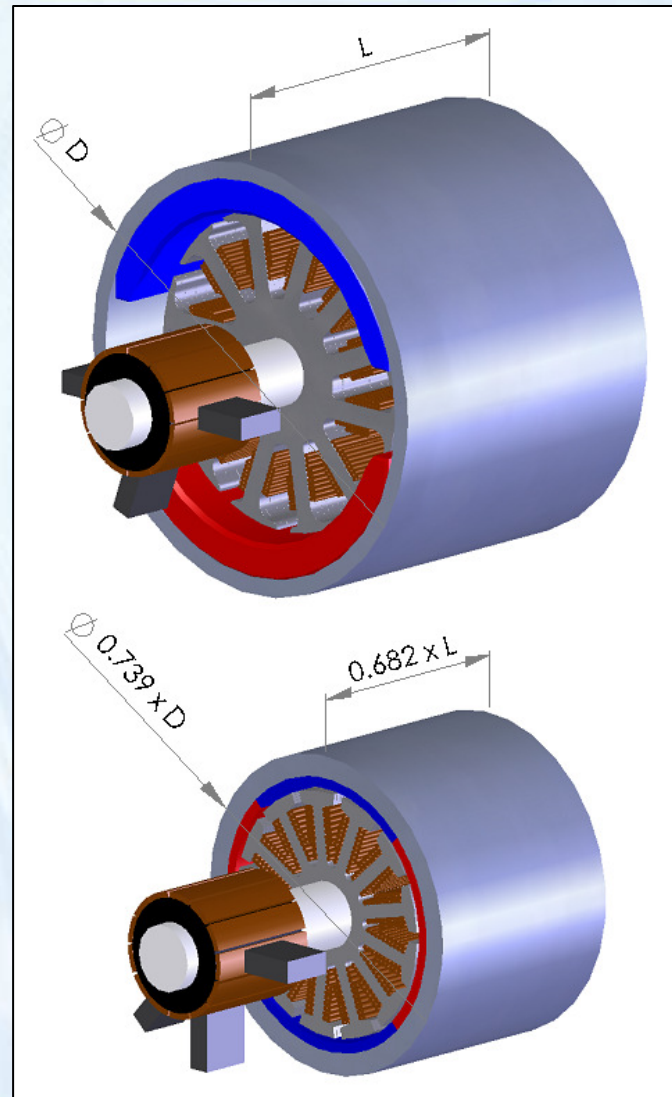
Parameter	Benchmark PMDC Motor	4-Pole PMDC motor with Bonded Neo Magnets
Type of Magnet	Ferrite	Compression Molded (B+-20056-070)
Total motor weight (gm)	526.14	274.25
Length of the motor* (mm)	44.00	30.00
Overall diameter**(mm)	58.00	42.86
Total copper weight (gm)	84.82	70.00
Total magnet weight (gm)	118.00	27.65
Length of Air gap (mm)	0.53	0.53
Current at 149 mN-m (A) (Low Speed)	4.38	4.46
Current at 150 mN-m (A)	6.77	6.51
Efficiency at 149 mN-m (%) (Low Speed)	61.30	65.85
Efficiency at 150 mN-m (%) (High speed)	56.70	56.34

Comparison

Benchmark Ferrite Wiper Motor Vs Bonded Neo

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Benchmarked Motor

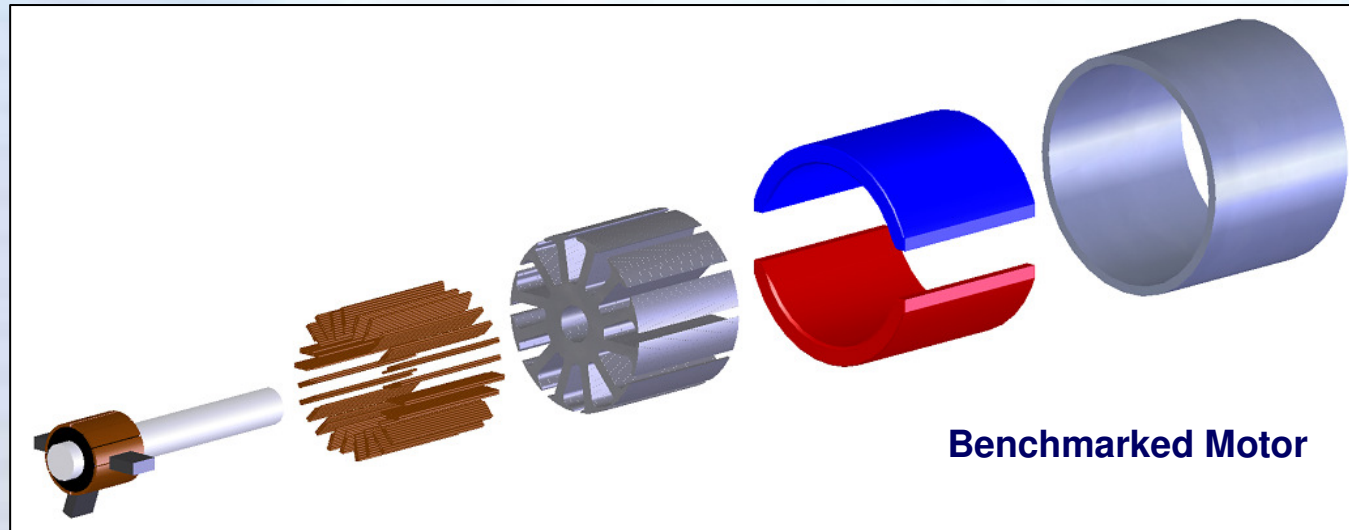


Redesigned Motor

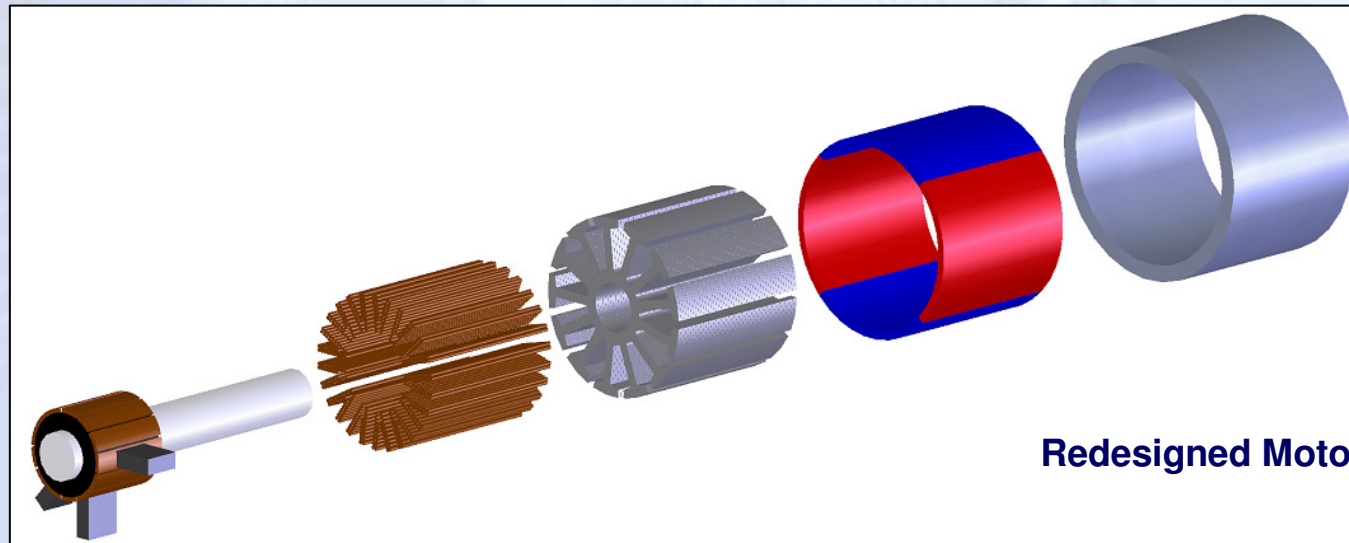
Comparison

Benchmark Ferrite Wiper Motor Vs Bonded Neo

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**Exploded View of
the Motor**

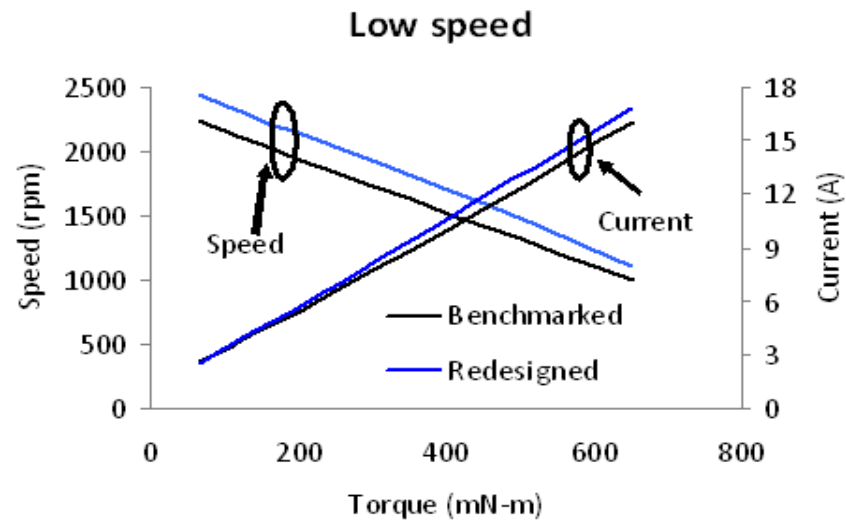


Comparison at Low Speed

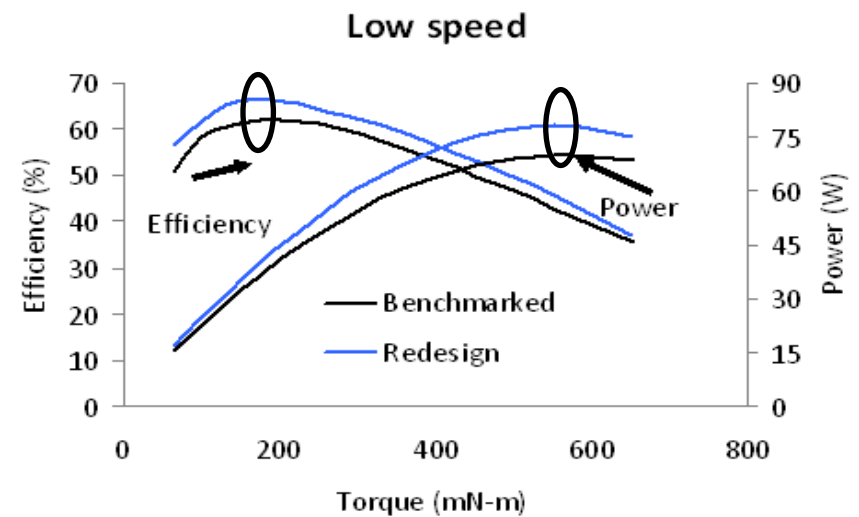
Benchmark Ferrite Wiper Motor Vs Bonded Neo

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Torque-Speed and Torque-Current Characteristics



Torque-Efficiency Characteristics

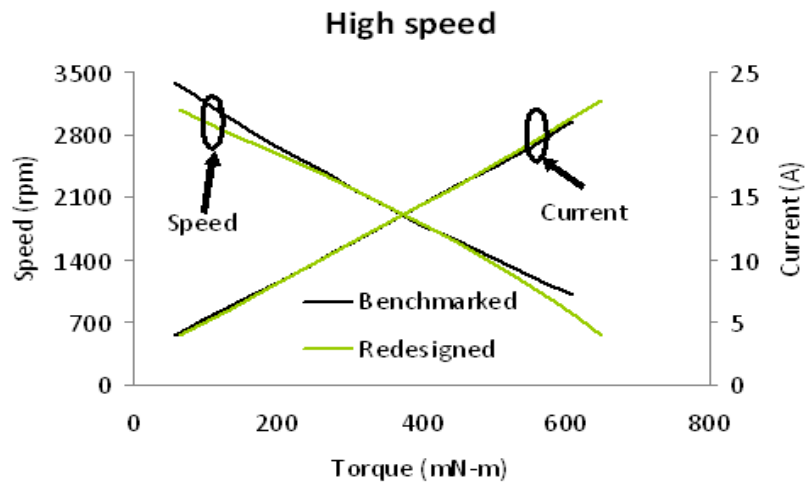


Comparison at High Speed

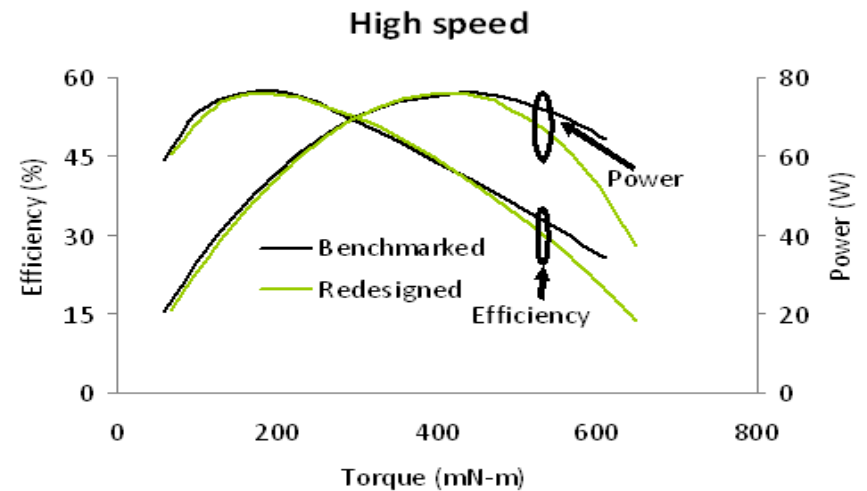
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Torque-Speed and Torque-Current Characteristics



Torque-Efficiency Characteristics



Comparison of Physical Parameter and Cost

