

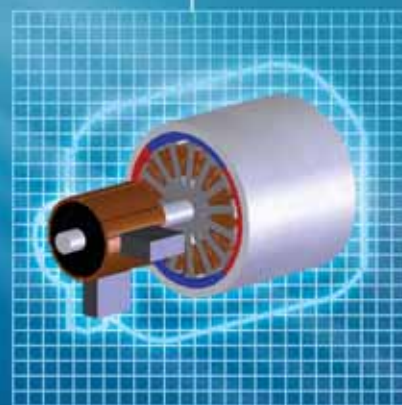
# Magnequench®

A Division of Neo Material Technologies Inc.

Leading Magnet Innovation™

## Virtual Prototyping

# BONDED NEO FOR ENERGY-EFFICIENT AUTOMOTIVE ACCESSORY MOTORS



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Environmentally  
Engineered

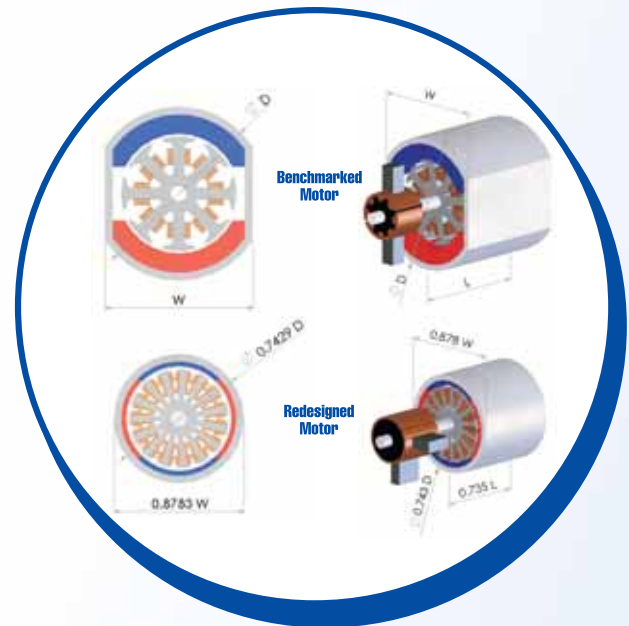
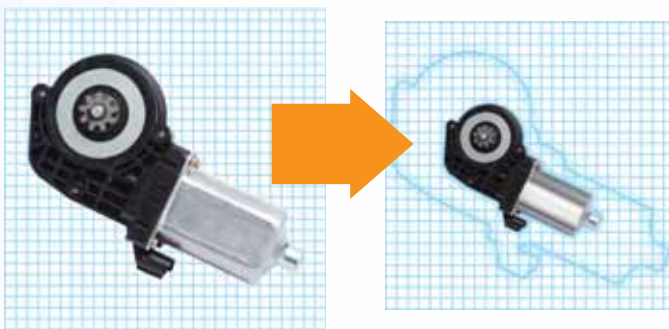
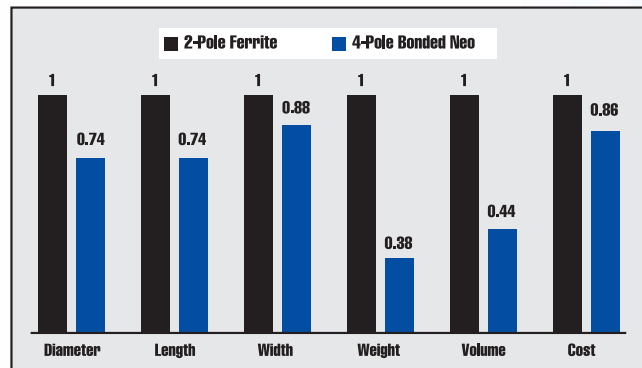
# Bonded Solution 1 - Weight and Size reduced by more than 60%

## INCREASED SPACE IN

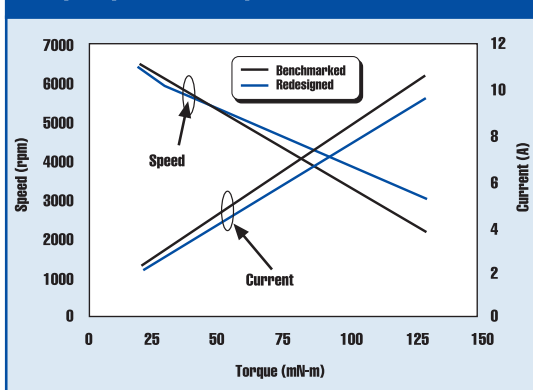
Significantly smaller and lighter motors are possible by employing bonded Neo magnets. The weight savings will help automotive companies reduce the total weight of their cars in order to meet fuel efficiency and performance goals.

### Application Example : Power Window Lift Motor (Toyota)

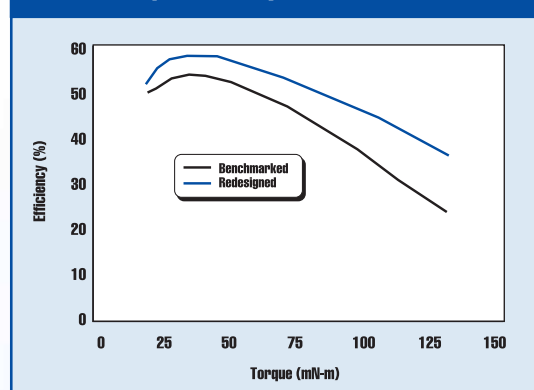
Parameter	Benchmark PMDC Motor	4-Pole PMDC motor with Bonded Neo Magnets
Type of Magnet	Ferrite	Compression Molded (B+)
Total motor weight (gm)	182.00	69.30
Length of the motor (mm)	29.90	22.00
Overall diameter (mm)	35.00	26.00
Total copper weight (gm)	20.81	14.20
Total magnet weight (gm)	31.83	9.00
Length of air gap (mm)	0.50	0.50
Current at 50 mN-m (A)	4.42	4.08
Current at 100 mN-m (A)	8.22	7.53
Efficiency at 50 mN-m (%)	52.40	57.27
Efficiency at 100 mN-m (%)	36.22	45.57



#### Torque-Speed and Torque-Current Characteristics



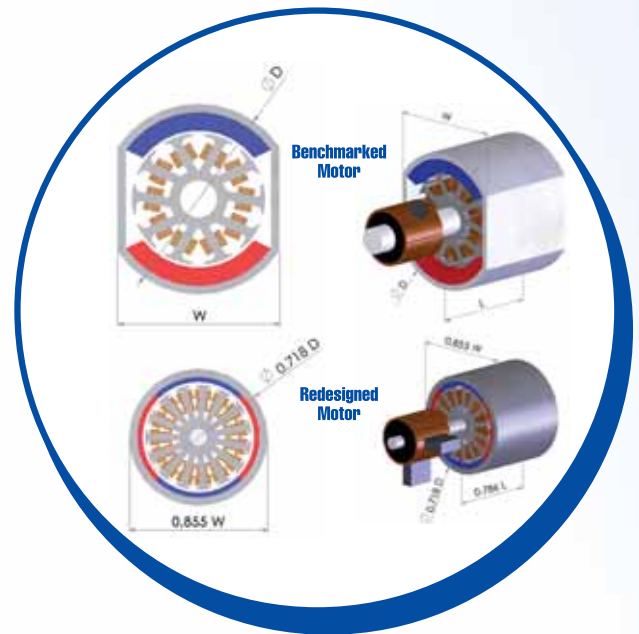
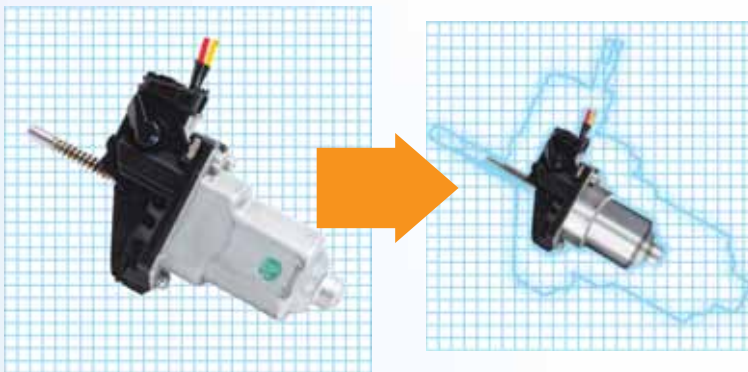
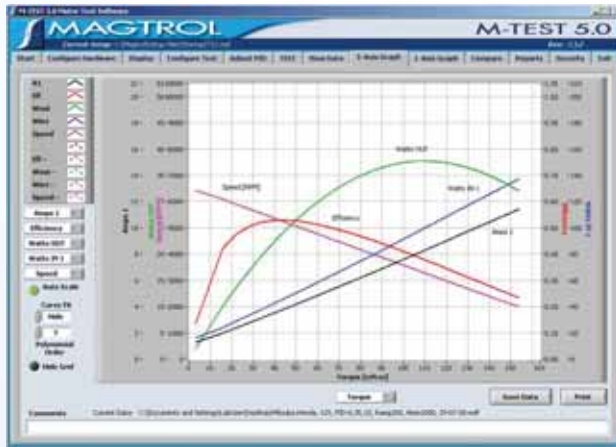
#### Torque-Efficiency Characteristics



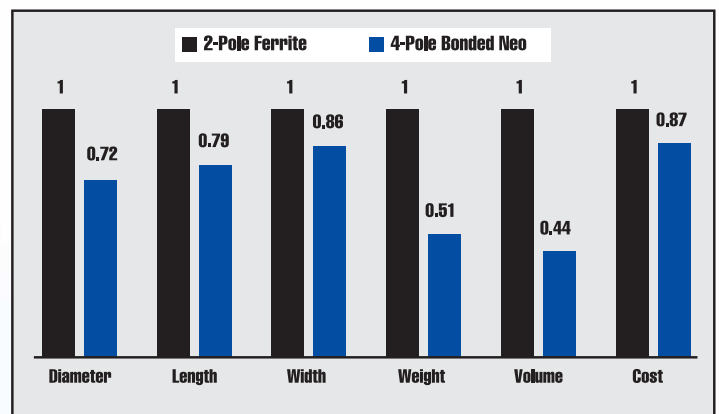
# PASSENGER COMPARTMENTS

The reduced size of the motors will enable automotive companies to increase the amount of useable space within the passenger compartment. Larger ferrite based motors need additional space inside the car door, but bonded Neo offers a solution to considerably shrink the space required.

## Application Example : Power Window Lift Motor (Honda)



Parameter	Benchmark PMDC Motor	4-Pole PMDC motor with Bonded Neo Magnets
Type of Magnet	Ferrite	Compression Molded (B+)
Total motor weight (gm)	133.60	67.70
Length of the motor (mm)	28.00	22.00
Overall diameter (mm)	36.20	26.00
Overall Width (mm)	30.40	26.00
Total copper weight (gm)	30.75	12.60
Total magnet weight (gm)	26.46	9.00
Length of air gap (mm)	0.50	0.50
Current at 60 mN-m (A)	4.842	4.870
Current at 105 mN-m (A)	7.924	7.910
Efficiency at 60 mN-m (%)	51.10	51.57
Efficiency at 105 mN-m (%)	39.41	39.67

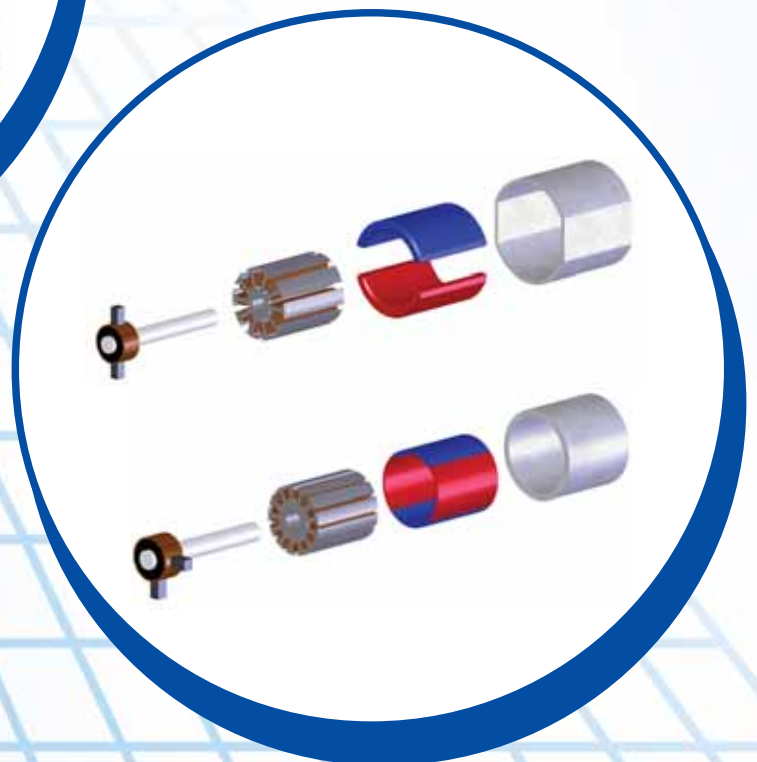
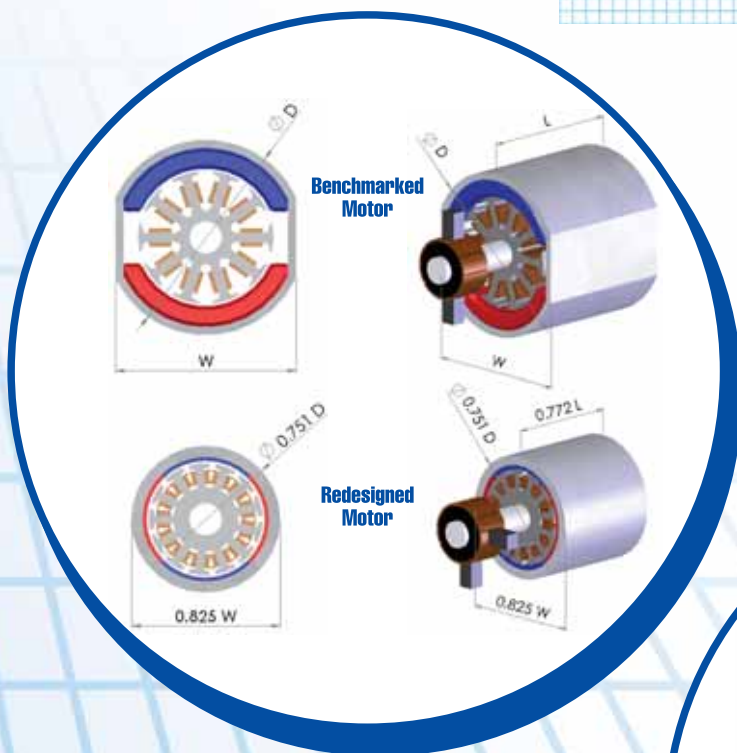
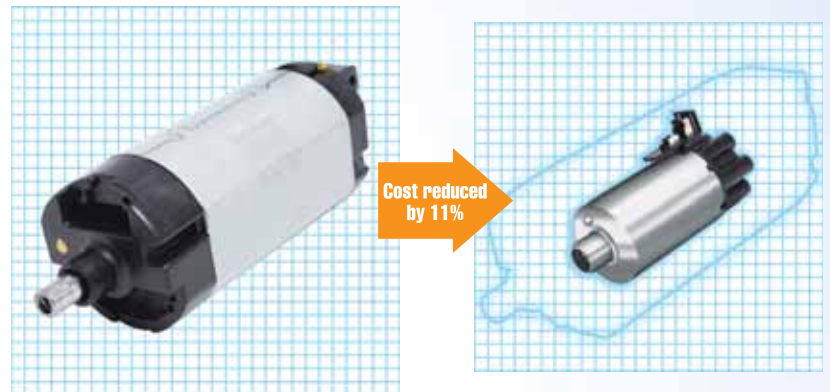


**Torque, efficiency and current of re-designed motor is matched against benchmarked Honda motor.**

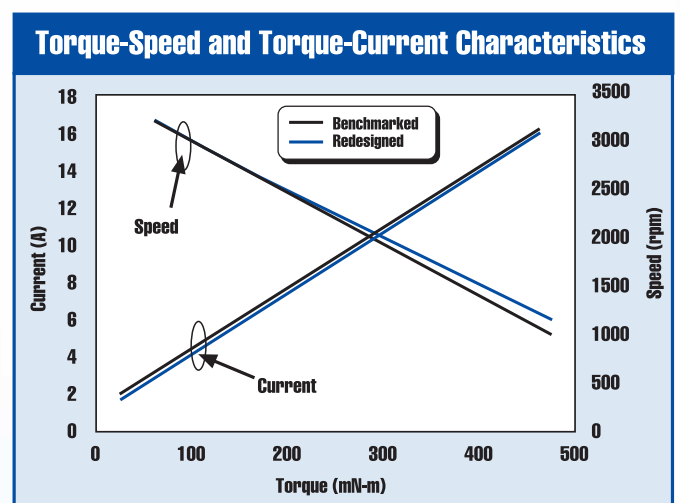
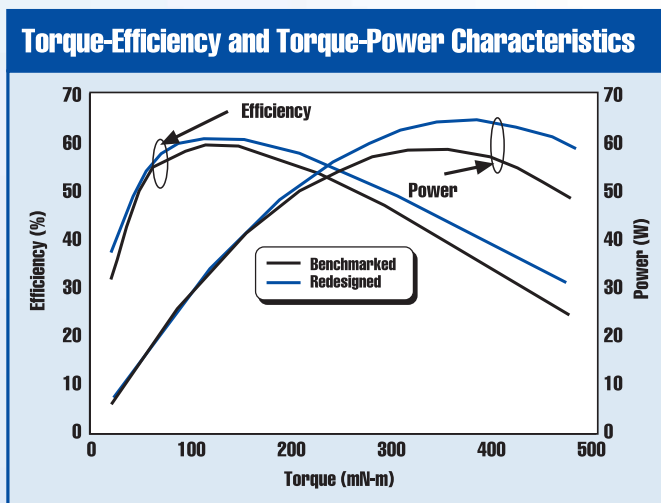
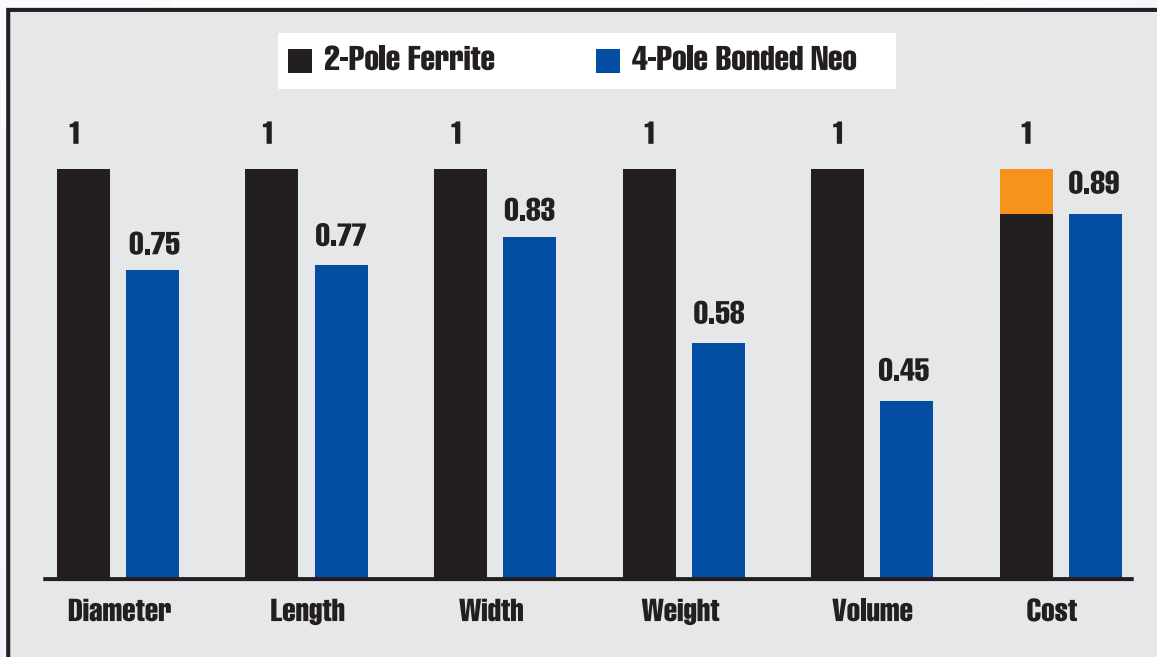
# Bonded Solution 2 - Cost reduced by more than 10%

By drastically reducing the amount of various raw materials – such as copper and steel – a motor utilizing higher performing bonded Neo may cost less than heavier and larger ferrite based motors.

## Application Example : Seat Motor



Parameter	Benchmark PMDC Motor	4-Pole PMDC motor with Bonded Neo Magnets
Type of Magnet	Ferrite	Compression Molded (B+)
Total motor weight (gm)	368.64	214.84
Length of the motor (mm)	43.00	33.20
Overall diameter (mm)	48.60	36.52
Overall Width (mm)	44.25	36.52
Total copper weight (gm)	59.73	34.50
Total magnet weight (gm)	101.86	18.44
Length of air gap (mm)	0.51	0.51
Current at 150 mN-m (A)	5.78	5.75
Current at 300 mN-m (A)	10.60	10.58
Efficiency at 150 mN-m (%)	60.25	61.82
Efficiency at 300 mN-m (%)	46.50	50.16



# Bonded Solution 3 - Improved Efficiency and Performance

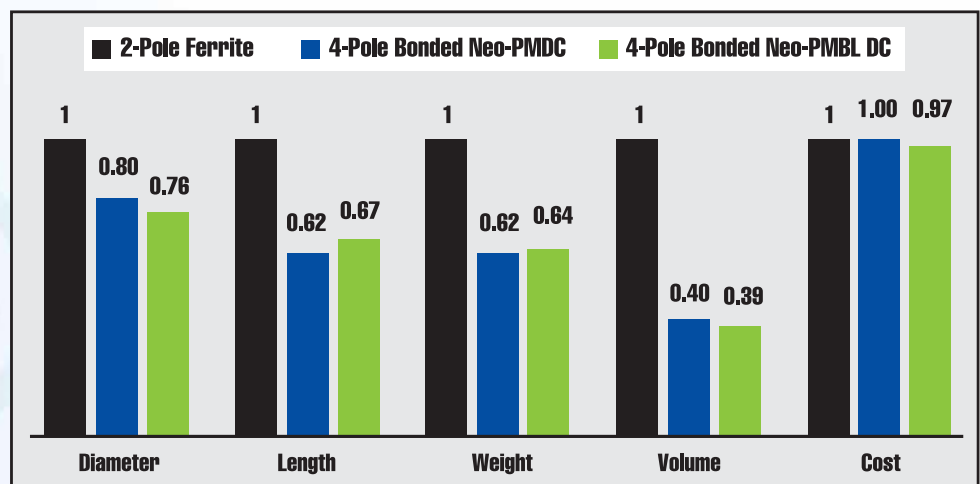
## FERRITE REPLACEMENT FOR LARGER SIZED MOTORS

Many smaller (<60mm) motors in automobiles, office products, and consumer electronic products switched from ferrite magnets to bonded Neo magnets years ago. However, an emerging trend is to now replace larger motors, as automotive companies look at all opportunities to improve the environmental performance of their cars.

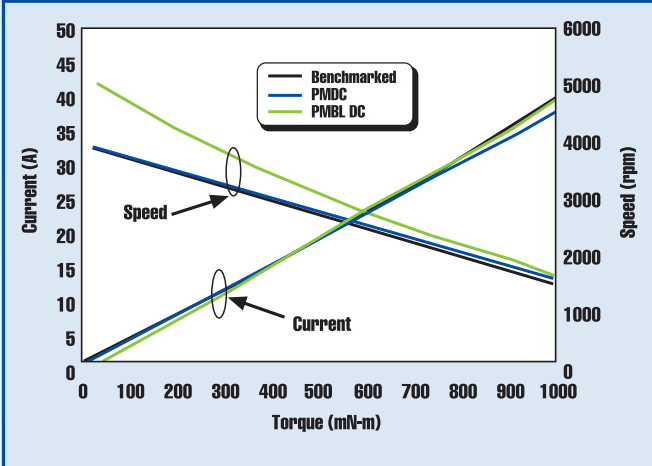
## Application Example : HVAC Motor



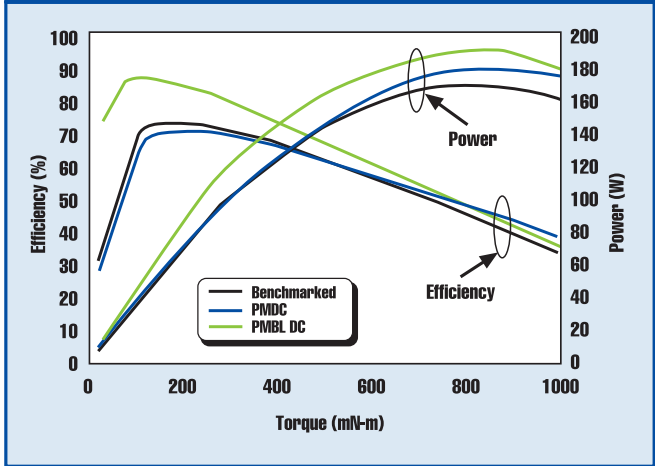
Parameter	Benchmark PMDC Motor	4-Pole Motor with Bonded Neo Magnets	4-Pole Motor with Bonded Neo Magnets
		PMDC Motor	PMBL DC Motor
Type of Magnet	Ferrite	Compression Molded (B+)	Compression Molded (B+)
Total motor weight (gm)	697.51	422.23	446.5
Length of the motor (mm)	37.20	23.00	25.00
Overall diameter (mm)	81.80	65.50	62.00
Total copper weight (gm)	81.94	73.70	67.90
Total magnet weight (gm)	257.20	37.13	32.60
Length of air gap (mm)	1.25	1.25	1.25
Current at 400 mN-m (A)	15.53	15.85	15.94
Current at 700 mN-m (A)	27.00	26.78	28.00
Efficiency at 400 mN-m (%)	66.84	66.70	73.00
Efficiency at 700 mN-m (%)	51.39	53.71	54.00



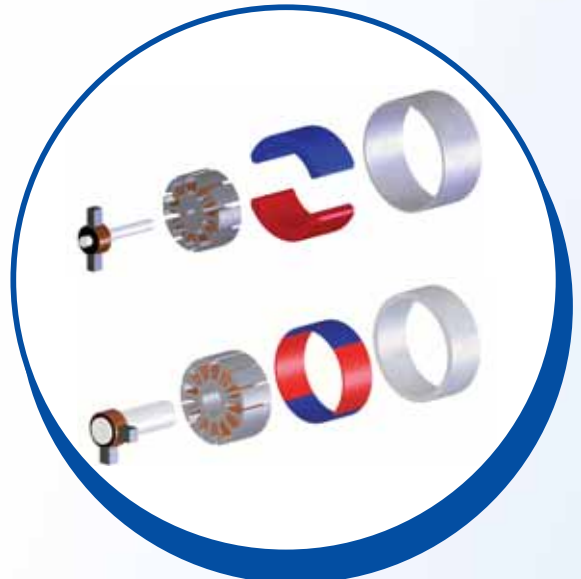
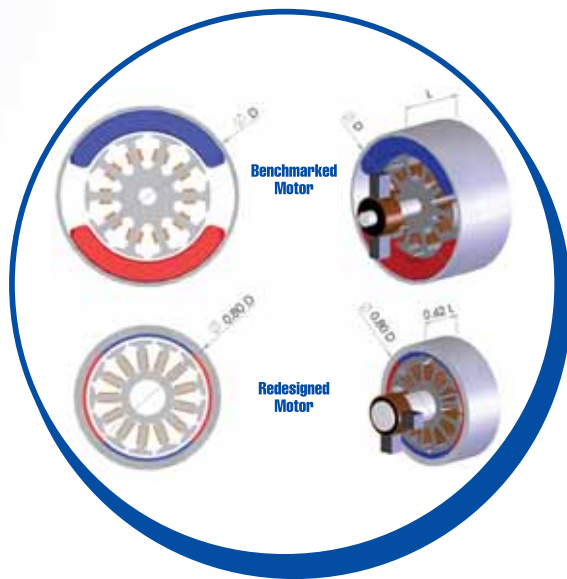
### Torque-Speed and Torque-Current Characteristics



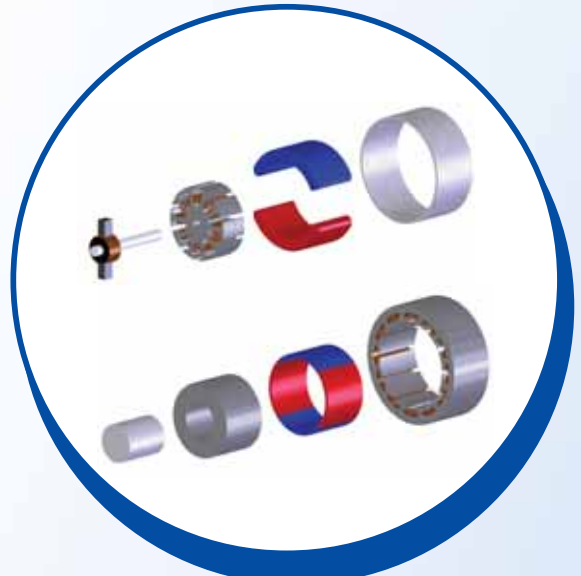
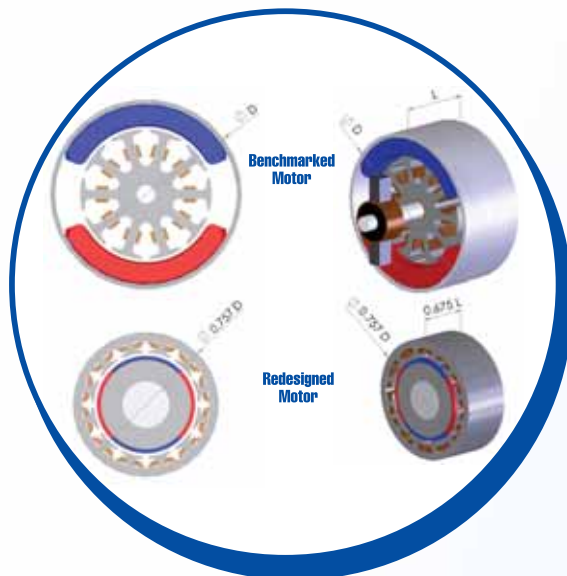
### Torque-Efficiency and Torque-Power Characteristics



**PMDC**



**PMBL DC**



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