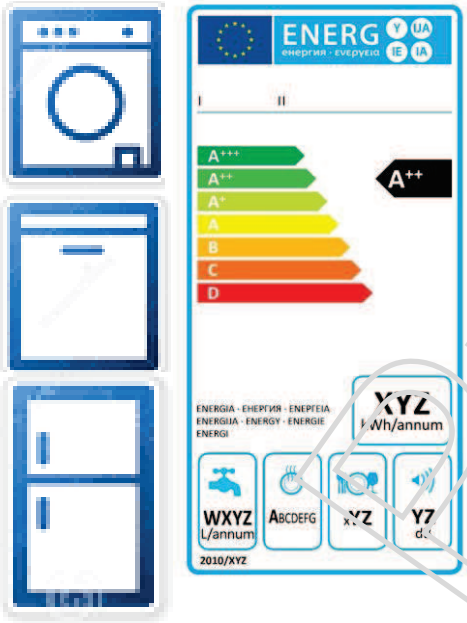
Smart Motion in Appliance

Permanent Magnet Motor Solutions

- *Drum drive motor for washing machine*
- *Circulation pump motor for diswasher*
- *Drain pump motor for washer and dishwasher*
- *Drive motor for tumble dryer*
- *Compressor motor for refrigerator*
- *Fan motor for range hood and oven*
- *Fan motor for air condition*

Most efficienct solutions



High efficiency motor design meets EU requirements

Motor design meets EN60335-1 requirements

Vector control (FOC or DTC)

Design with low vibration and noise

Constant torque and power control

Compact dimensions

High speed design up to 60.000rpm

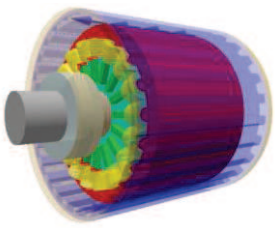
Continues variable speed control without sensor

Sinusoidal EMF and current

Low cost solution

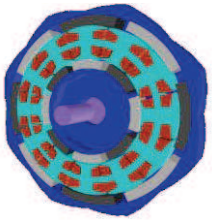
Integration of motor and application in all in one concept

Low cogging and torque ripple design

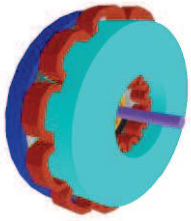


Inner rotor
Radial Flux

Outer rotor
Radial Flux



Inner&outer rotor
Radial Flux



Axial Flux

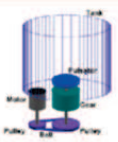
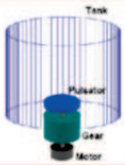
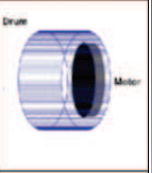
High Efficiency Motors For Home Appliance

Permanent Magnet Motor

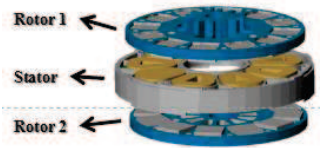
PROMOTE
ARAŞTIRMA VE TEKNOLOJİ GELİŞTİRME

Wahing Machine Drive Motor

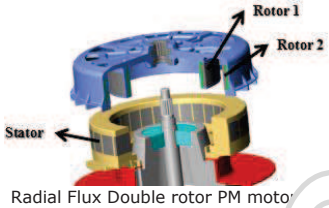
Front loader washing machine has two type of drive method, belt and direct drive. For both method, permanent magnet motor technology is the most efficient solution with a careful design. Belt drive method with a PM motor desing is the most efficient solution. It is also possible to reach lowest vibration and sound level with careful PM motor design for belt drive system. Radial and tangential forces in airgap of motor must be well optimized so that noise and vibration related with motor can be eliminated in the washing machine.

Drive method	Belt&Gear Drive	Gear Drive	Belt Drive	Direct Drive
Structure				
Pulley ratio	1:1.5	-	1:10 - 1:18	-
Gear ratio	1:6	1:6	-	-
Motor	Induction Motor	PM Motor	PM Motor	PM Motor
Vibration	middle	low	high	low
Noise	middle	low	high	low
Torque	low	middle	low	high
Motor speed	low	high	low	lowest
Efficiency	low	highest	low	high
Cost	low	middle	low	high

Different PM motor types can be adopted to washing machine to reach more efficiency and low noise level.



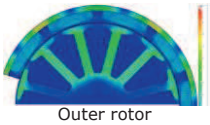
Axil Flux Double rotor PM motor



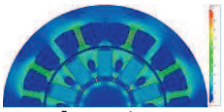
Radial Flux Double rotor PM motor

Compressor Motor for Refrigerator

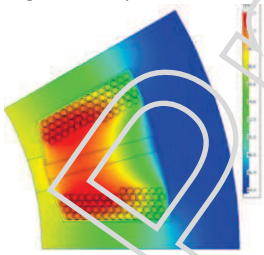
Refrigirator runs all day. So, energy consumption is so important and energy class on the label is a marketing key. One of the most important part of it is compressor motor for energy consumption level. New magnet motor technology is best solution to reach high motor efficiency. Outer and inner type rotor PM motor can be designed to get high efficiency and low vibration level.



Outer rotor



Inner rotor

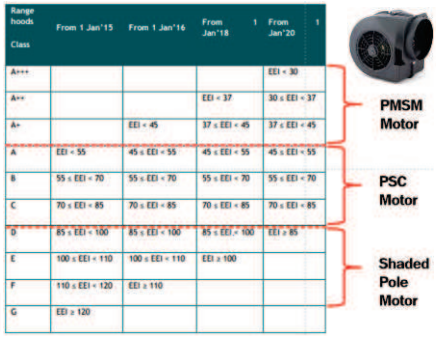


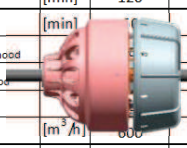
Heating management during design phase of compressor motor must be considered for low cost and reliability.

Fan Motor for Range Hood and Oven

The new eco-design and energy efficiency requirements for ranges and range hoods came into effect beginning in January 2015. Overall fan efficiency in range hoods is depending on motor technology. PM motor technology can provide manufacturer of range hood best highest efficiency level with continues variable speed control. We can provide different PM motor drvie technologies for range hood applicaiton for high efficiency with low cost.

Parameters	Unit	IM	PMS M
W_{BEP}	[W]	160	95
W_L	[W]	10	10
t_L	[min]	120	120
t_H	[min]	[illegible]	60
SAE C_{hood}		[illegible]	73.1
AE C_{hood}		[illegible]	[illegible].9
f		[illegible]	0.42
Q_{BEP}	[m^3/h]	600	600
P_{BEP}	[Pa]	250	250
FDE $_{hood}$		26.0	43.9
EE I_{hood}		63.7	30.0

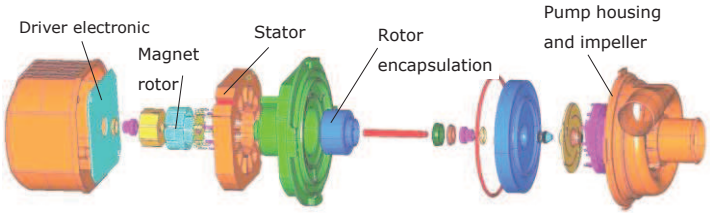




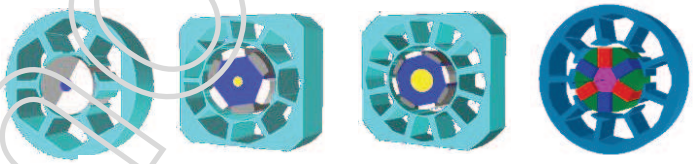
50% decrease in EEI by replacing IM with PM motor

Diswasher Machine Main Circulation Pump Motor

Dishwasher motor use mainly two types motor, split phase induction and permanent magnet motor. Induction motor is used for dry run and PM motor is used for wet run. For wet rotor run PM motor, driver electronic, pump and water heater are integrated to each other to get low cost and compactness.



The system efficiency of circulating pump drive includes driver electronic, motor and pump. The motor and pump efficiencies are dominant for drive system efficiency. Typical efficiency of new technology PM motor is between 80-90%. Pump efficiency is so important to increase system efficiency. Typical system efficiency is between 30-40%. With our spoke type flux concentrated flux technology wet rotor and pump design with decreased leakage ratio and 3D impeller, the system efficiency can be increased up to %50.

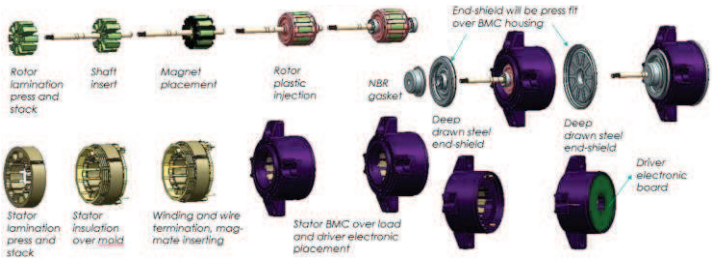


Different PM motor types for wet rotor pump application

Fan Motor for Split Air Conditioner

New magnet motor technology for fan motor design for outdoor and indoor units of air conditioner decrease energy consumption of AC by the means of high motor efficiency and continues variable speed control.

Sensorless PM AC (vector control with sinusoidal current) motor can decrease also cost and increase reliability.



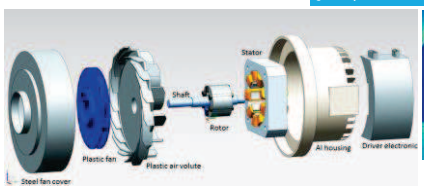
Vacuum Cleaner Motor

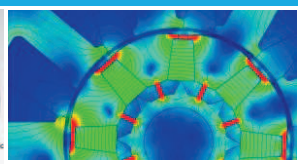
Since 1st September 2014, the new EU ECODESIGN directive requires manufacturers of vacuum cleaners to fulfil new standards in terms of energy economy and efficiency. The European Commission now requires all manufacturers to make significant reductions in the electricity consumption of their appliances, whilst at the same time improving suction and filtration efficiency.

In addition, the power of vacuum cleaners will now be limited to 1,600 W (900 W by 2017) and the noise level clearly shown.

Rated from A to G on LABEL

- Energy efficiency
- Electricity consumption
- Dust pick-up performance on carpets and smooth floors
- Quality of filtration





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