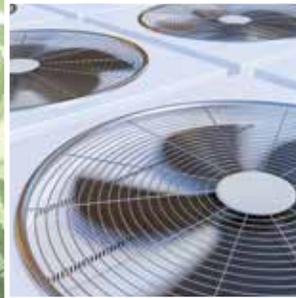




MOTOR GENERATOR TECHNOLOGY



INTRODUCING A NEW CLASS OF ULTRA EFFICIENT ELECTRIC MOTORS

MGT HYBRID DUAL ROTOR MOTORS

A NEW CATEGORY OF ELECTRIC MOTORS

MGT has introduced an entirely new and unique category of ultra-efficient electric motors. They are best described as line-operated, synchronous reluctance, PM assisted motors ("Hybrid Dual Rotor Motor" for short). They deliver ultra-high-efficiency, high-power factor, high power density and high-starting torque! MGT Dual Rotor Motors can operate directly off the AC line or via any standard variable frequency drive. They are currently producible in a range of horsepower (1/2 to 15) and in a wide range of rated speeds (450 rpm to 3600 rpm).

ABOUT MGT

Motor Generator Technology, Inc. ("MGT") is a Southern CA-based, privately held, independent company, specializing in innovative, energy-efficient, approaches to electric motor design. The Company engineers, manufactures, and assembles its product in the United States.

DIRECTLY SERVING OEMS

MGT works directly with mid to high volume OEMs - primarily fan, pump, and general industrial equipment applications. MGT collaborates with its customers, applying the capabilities of its unique technology, by designing and delivering models that optimally meet the specific demands of the application.

AC LINE OPERATION

"Line Start Permanent Magnet (LSPM) Motors" have been around for many years. Unfortunately, they have suffered from an inability to synchronize a load with high inertia (i.e. low starting torque), have a rapid, noisy "kick start" that can damage components, and power factor that drops off quickly at partial loads. These deficiencies have eliminated them from consideration in most applications. Conventional PM motors overcome many of these deficiencies, but require one-to-one application of specialized PM compatible VFDs to operate. MGT's unique Hybrid Dual Rotor design resolves all these issues, combining the best attributes of AC induction and/or synchronous reluctance motors (e.g. high starting torque, ability to operate off the AC line, cost-effectiveness) with those of conventional PM motors (e.g. ultra-high-efficiency over wide speed range and synchronous operation).

IDEAL FOR DIRECT DRIVE APPLICATIONS

MGT combines the high torque density of a rare-earth PM motor, the ability to modify pole count (2, 4, 6, 8, 10, 12, 14, and 16), and ability to operate directly off the AC line to produce rated speeds of 3600, 1800, 1200, 900, 720, 600, 514, and 450 rpm. It does so without the need for either belts/pulleys or VFDs and their associated costs and efficiency losses - making MGT motors a very attractive solution to direct drive applications.

VFD OPERATION

While one of the important advantages of MGT Dual Rotor Motor technology is its ability to achieve the ultra-energy-efficiency of a permanent magnet motor while operating directly off the AC line, It can also be operated via variable frequency drives (VFDs). Further, unlike conventional PM motors, MGT motors do not require VFDs with specific permanent magnet control algorithms (PM compatible). Rather, MGT motors are compatible with any standard off-the-shelf VFD. And, like induction motors, MGT motors can be ganged to operate with a single VFD. And, finally, unlike other PM motors, they can operate in bypass mode - either to save energy at rated speed or to continue operation in case of a VFD failure.



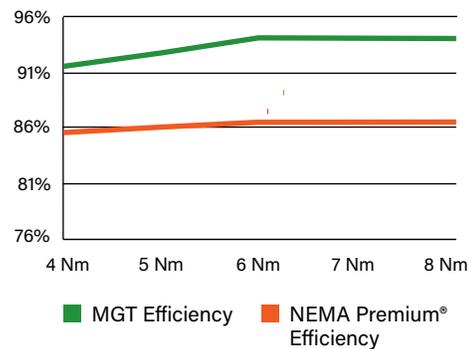
MGT HYBRID DUAL ROTOR MOTORS

FEATURES	BENEFITS
MGT motors are a hybrid combination of AC induction and permanent magnet motor. The Hybrid Dual Rotor design initiates rotation as an asynchronous induction motor and then, as rated speed is achieved, operates as a synchronous reluctance, permanent magnet assisted, motor. Utilization of permanent magnets reduces losses and increases efficiency when compared to AC induction motors. MGT Hybrid Dual Rotor motors all exceed proposed IE5 efficiency standards.	Reduced energy expense for the life of the motor providing rapid payback.
Ability to operate directly off the AC line.	Unlike conventional PM motors, MGT motors do not require a VFD to operate. For many applications this eliminates the cost and efficiency losses of the VFD while still providing PM motor-like efficiency performance. This also allows for bypass operation at rated speeds eliminating need for back up VFD in variable speed applications when codes require.
High starting torque and smooth acceleration	Unlike convention line start PM motors, MGT Dual Rotor Motors easily overcome high inertia loads. The also eliminates initial "kick" torque associated with LSPM motors that can damage and/or reduce life of equipment.
Available in 2 (3600 rpm), 4 (1800 rpm), 6 (1200 rpm), 8 (900 rpm), 10 (720 rpm), 12 (600 rpm), 14 (514 rpm) , and 16 (450 rpm) pole versions	Ability to match motor rated speed to desired application speed for direct drive applications without the need for gearing with belts and pulleys, hence reducing system costs, complexity, and maintenance, while maintaining very high levels of efficiency.
High Power Factor (98%)	Eliminates power factor surcharges and lowers demand charges by the electric utility. Eliminates need and costs of power factor correction by VFD or capacitors.
Compatibility with all standard VFDs	For those applications truly requiring variable speed, MGT motors are compatible with standard VFDs and do not require special PM compatible models. Further multiple motors can be controlled by a single VFD.
High torque density	Lowers the weight and reduces the length of the motor. Allows meeting/exceeding efficiency standards without requiring redesign of the equipment in those cases where the equipment was originally designed around EPACK/IE2 motors. Less material mitigates the additional cost of the permanent magnets.
Very low audible noise	Well suited to noise sensitive applications such as HVAC equipment. No VFD switching frequency noise when operated off the AC power line.
Totally enclosed, non-ventilated	Suitable for outdoor applications
UL, CE, CSA approvals available	Meets local codes
Wide range of configurations producible. (horsepowers, pole counts, voltages, single or three phase, frame sizes, foot or face mount, special shafts...)	MGT partners directly with OEMs to produce models that provide optimum performance and value for their specific application.

COMPARING EFFICIENCY

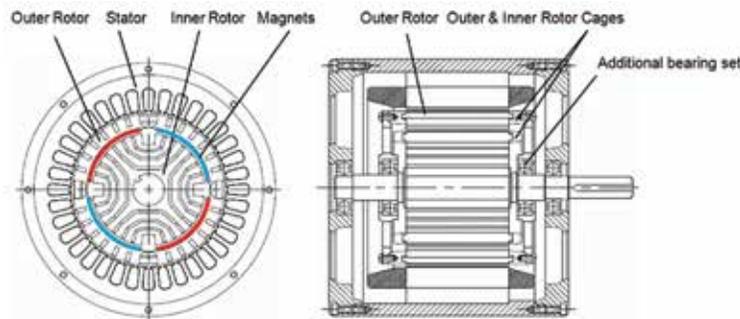
The graph to the right compares a 1.5 hp 1800 rpm MGT Hybrid Dual Rotor Motor with a NEMA Premium (IE3) 1.5 hp 1750 rpm induction motor at various torque loads. It is representative of the efficiency gains achievable by applying MGT motors. And, while the efficiency point gap will narrow some as horsepower is increased, the power saving will also increase. In all cases MGT efficiency levels will meet or exceed proposed IE5 standards.

1.5 HP Motor Efficiency Comparison



MGT'S HYBRID DUAL ROTOR MOTOR DESIGN

The revolutionary dual rotor line start motor overcomes the starting and synchronization problems of traditional LSPM technology. The inner rotor is mechanically coupled to the motor shaft. Its magnetic design with slots cause it to operate in a similar manner to that of a synchronous reluctance motor. The secondary outer rotor is not mechanically coupled to the motor shaft. Rather it rotates around the inner rotor on a set of additional bearings. The outer rotor is a squirrel cage design but contains rare earth permanent magnets on its inner surface. The outer rotor acts like a magnetic torque converter transferring the rotating magnetic stator flux smoothly to the inner rotor producing both extremely high PM efficiency with near design D starting torque. Similar in construction of a traditional induction motor, the Hybrid Dual Rotor motor now offers the user a robust ultra-efficient and cost-effective motor solution for a wide range of industrial and commercial applications. Its unique design, ultra-efficiency, and ability to operate with or without an inverter places the revolutionary Hybrid Dual Rotor motor in a class all its own.



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