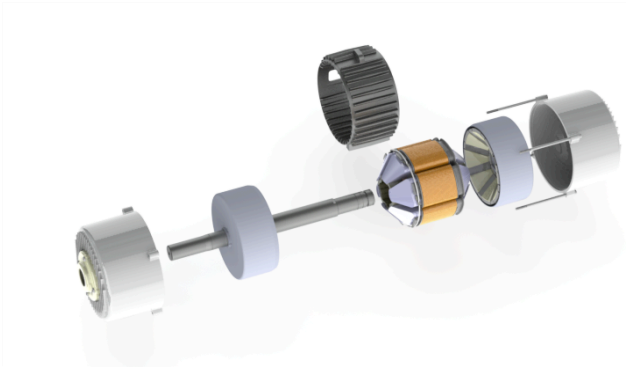
# Technology Description

The innovative and unique features implemented in the NovaTorque™ Electronically Commutated Permanent Magnet (ECPM) motor design create a superior, better performing, and more efficient motor. The NovaTorque motor uses low-cost ferrite magnets and less material, making it cost-competitive with induction motors.

The unique design begins with the stator and rotor hub geometry. The field poles used in the stator have conical end-surfaces, instead of the conventional perpendicular flat cross-section. The rotor hubs have conical shapes that match the end-surfaces of the field poles. This approach maximizes the surface area available for magnetic flux transmission, while minimizing the volume of materials.



A typical NovaTorque motor design has a rotor/stator surface area interface that is twice the perpendicular cross-sectional area of the stator field pole. The increased surface area at the rotor/stator interface concentrates the magnetic flux density. This allows NovaTorque to use lower cost ferrite magnets to achieve motor efficiency and performance that equals or exceeds much more expensive motors that use rare- earth (neodymium) magnets.

With an axial flux path, the NovaTorque motor flux flows straight (parallel to the shaft) through the axially-oriented field poles of the stator. Grain-oriented transformer grade steel can be used in this orientation, which lowers eddy current losses and results in improved efficiency. In a radial flux path, the flux travels in a circular fashion, which prohibits the use of grain- oriented steel.

The axial orientation of the NovaTorque motor stator field poles allows the use of bobbin-wound coils. This type of coil is easier to wind and requires less conductor material than the coils that are wound in the slots of a radially- oriented induction motor. This coil arrangement also creates a better thermal path, as one face of the coils is next to the external motor case, instead of being inside the lamination stack as is found in an induction motor.

The rotor in the NovaTorque motor design consists of a pair of conical hubs mounted on opposite ends of the motor shaft. The rotor hubs use an interior permanent magnet (IPM) arrangement that provides another source of flux concentration. An IPM design has both mechanical and adhesive magnet retention, which allows for higher speed motor operation than a surface permanent magnet design. Another benefit of an IPM design, due to its saliency, is better sensorless motor control.

The NovaTorque motor is more reliable by design. A major factor in motor failure is thermal breakdown. Since the NovaTorque motor is more efficient, it generates less heat and runs cooler than comparable motors. With a superior internal thermal path and heat dissipating aluminum case, the heat that is generated is rapidly transferred out of the motor.

For applications where variable speed is a must, and high efficiency is critical over the entire operating range, NovaTorque motors paired with select Variable Frequency Drives are the answer. Plus, the unique NovaTorque design offers a smaller package than conventional motors, allowing the motor to be used in a wide variety of applications.