

Engineering Services

for

ELECTROMAGNETIC COMPONENTS

For more than 50 years, **Windings** has provided engineered electromagnetic solutions for critical applications in Aerospace, Defense, Automotive and Oil & Gas industries. As a full-service provider, Windings is a leader in the design, test, manufacture and support of custom electric motors, generators and related components including rotors, stators, lamination stacks and insulation systems.



ANALYZE

DESIGN

ENGINEERING SERVICES

Windings' Engineering Services staff is skilled both mechanically and electrically to optimize client designs, and to provide the technical documentation and tooling necessary for efficient manufacturing. With our engineering team's skills and experience, combined with Windings' 50-year history of manufacturing electric motors for critical applications, you can be assured that your project will transition smoothly and seamlessly from engineering and prototyping to pilot and full-rate production.

With Windings' engineering experience and access to the latest design tools, Windings' offers a host of professional engineering services to complement and extend your internal capabilities.

Client Objectives

- Solve challenging or complex design issues
- Accomplish more with existing internal engineering resources
- Compress new product development schedules
- Supply rapid prototypes for proof-of-concept testing
- Achieve "stretch goals" for performance, reliability or cost

Unlike our competitors, Windings offers ownership to our clients any unique intellectual property developed by Windings for their application.

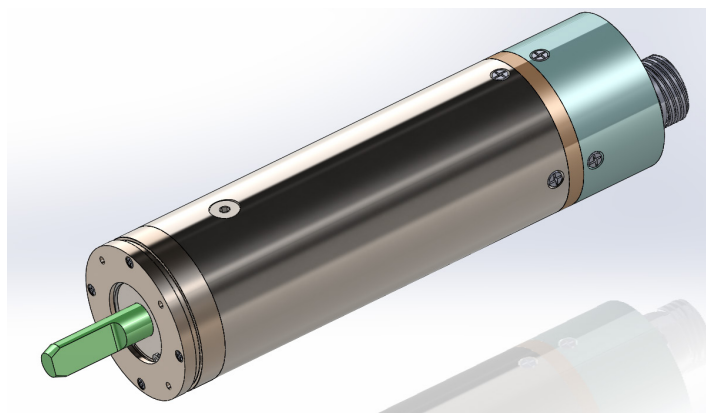
APPLICATION ANALYSIS

From basic motor sizing and performance calculations on new designs to root cause failure analysis (RCFA) of field failures on existing products, Windings engineers can analyze your application challenges and partner with you to engineer successful solutions.

Whether your challenge is aggressive performance goals, tight space constraints or survivability in a harsh environment, our engineers have the tools, experience and expertise to analyze your designs, simulate expected performance and provide recommendations for refinement to achieve optimal results.

Critical Performance Expertise

- Extreme Environments
 - Cryogenic to +260°C
 - Vacuum to 20,000 PSI pressure
 - Wet / wash down / salt spray
- Ultra-High Speed (100,000+ RPM)
- High Power / Torque Density
- High Shock / Vibration





DESIGN

OPTIMIZE

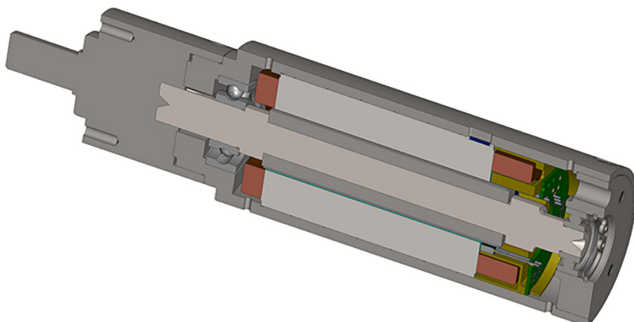
DESIGN ASSISTANCE

Not every company has the luxury of having motor design experts on staff; add to that the plethora of available motor technologies and ever-evolving manufacturing methods and the process of selecting the right motor technology, let alone developing an optimized solution, can quickly become overwhelming.

Windings' engineering team is well versed in most major motor topologies, and has extensive experience engineering solutions for a wide variety of critical applications. Leveraging Windings' engineering talent early in the definition phase of your project will result in an optimized motor solution, a significantly condensed project schedule and an overall project cost savings for your company.

Motor/Generator Topologies

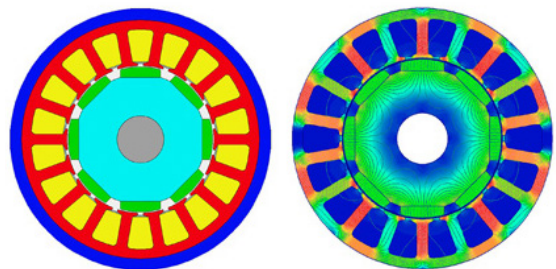
- Brushless DC
- Permanent Magnet DC
- Wound Field DC
- Single- and Three-Phase Induction
- Synchronous AC and DC
- Switched Reluctance
- Transverse Flux



PART OPTIMIZATION

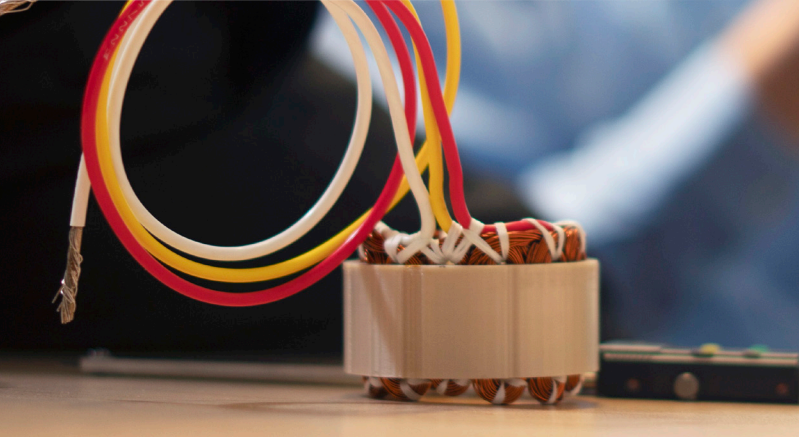
Windings' engineers specialize in design analysis and simulation of custom electric motors. With access to the latest analysis and simulation tools, Windings' engineering team can be an efficient resource to supplement your motor design efforts.

In addition to analyzing part design, the engineering team can utilize DFMA Analysis to analyze your manufacturing process, including jigs, fixtures, tooling and assembly methods to identify additional opportunities for improvement.



Engineering & Analysis Tools

- SolidWorks 3D modeling software
- Mechanical design & 3D modeling
 - Simulation (structural and thermal analysis)
 - Composer (technical communication and work instructions)
 - Inspection module (inspection and first article reports)
- SPEED – Electromagnetic design and analysis software
- MotorCAD – Thermal analysis software
- Basic Circuit Design Tool – Magnetic FEA software



PROTOTYPE

RAPID PROTOTYPING

At Windings' prototyping is a core competency and is one of the reasons why we are a valued partner to our clients. Prototyping ranges from 3D-printed components to test for fit, to a fully functioning motor assembly for testing actual verses predicted performance.

During prototyping, numerous design iterations can be quickly and easily tested to ensure the best possible outcome. Unfortunately, most companies don't have the internal resources necessary to build and test prototype motors and most motor manufacturers are not interested in low volume "custom" jobs.

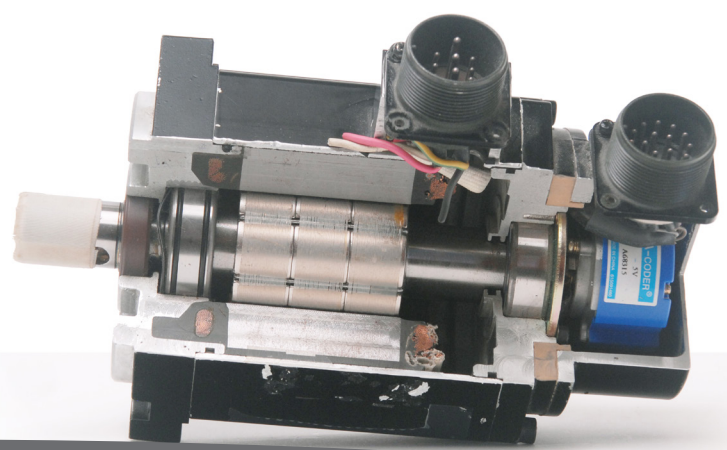
As the pressure to condense project schedules increases, so does the interest in rapid prototyping. Cutting days or even weeks out of a project schedule can have a tremendously positive impact on a project's outcome. Winding's willingness and ability to quickly build and test motors "from scratch" in low quantity can be a tremendous asset to our clients during the development phase of a project.

Lead Time (Material Dependent)

- 4-8 weeks typical

Prototyping Capabilities

- 3D printing
- Test fit of mating components
- Simulate manufacturing steps
- Develop / refine production tooling
- Hand winding of stator coils
- Custom magnet machining and grinding
- Custom machining of rotors and other miscellaneous components
- Dynamometer test stands
- Speed-torque testing
- Thermal stress testing



PROLONG

REVERSE ENGINEERING

Nothing lasts forever, and sometimes things come to an end before you're ready. Windings can deconstruct an existing part sample to re-engineer a design solution and create the necessary manufacturing prints and documents to support future part production. At the client's discretion, Windings can also provide recommendations for design enhancements to improve performance and / or manufacturability, and update material specifications to lower cost or replace components that have been discontinued or are otherwise no longer available.

Past Project Examples

- Resurrect obsolete designs
- Extending the life of legacy designs
- Transition production to a new supplier
- Analyze competitive designs
- Generate missing or non-existent manufacturing documentation



For further information, please contact us!

🌐 www.windings.com

📞 1-800-795-8533

@ sales@windings.com

📍 15 Somsen Street
New Ulm, MN 56073