CASE STUDY

A 2013 Grand Prize Winner in the Hardware & Appliances category.

Claw Pole Motor Core Stators

Process:
Conventional powder metallurgy

Density:
7.4–7.5 g/cm^3

Tensile Strength:
7,000 psi

End Use and Function
Claw pole motor core stators are used to generate a magnetic flux that interacts with a rotor and permanent magnets to produce torque in a high-efficiency brushless DC motor in an electric ceiling fan.

Fabrication
Both halves of the motor core are produced using one set of tools: heated fixed-fill shelf die, core rod, single upper punch, and six thin-walled lower fill punches. Formed from a high-compressibility inorganically insulated iron powder, the parts are compacted with pressures exceeding 67 tsi to a density range of 7.4–7.5 g/cm^3, typical ultimate tensile strength of 7,000 psi, and 19,000 psi transverse rupture strength. The parts are compacted to net shape and require no secondary operations. They belong to a new generation of DC motors using soft magnetic composite powder metallurgy (PM) materials to enable greater design freedom for designers of electric machines.

Results
Designing this part with powder metallurgy resulted in:

- A 60% energy efficiency increase
- A part design that uses 70% less copper
- The elimination of 26 parts resulting in a simplified motor assembly