CASE STUDY

A 2015 Grand Prize Winner in the Hardware & Appliances category.

Planetary Gearset for Lighting-Control System

Process:
Conventional powder metallurgy

End Use and Function

The planetary gearset for lighting-control systems is composed of five conventional powder metallurgy components. The parts—input flange, output flange, planet gear, sun gear, and ring gear—go into a self-contained single-stage gearset used in a high-end lighting-control applications.

Fabrication

The input and output flanges are made of nickel steel, the planet and sun gears of a low-alloy hybrid steel, and the ring gear of a sinter-hardened steel. The assembly is completed using a washer, spacers, and dowel pins, easily producible or off-the-shelf items whose use was a specific objective of the gearset design. Both flanges are produced net shape, requiring no secondary operations. Handling requirements were key to maintaining the high-quality requirements. The sun gear is actually designed as a compound gear, with the second gear serving as a spline for the mandrel. It and the planet gears are heat treated to increase their strength. The lower hardness requirement on the ring gear allows it to be made of a sinter-hardened powder. The properties of the parts include density of 6.9 g/cm^3 (flanges) and 6.8 g/cm^3 (gears); ultimate tensile strength of 340 MPa for the flanges, 620 MPa for the ring gear, and 900 MPa for the sun and planet gears; and apparent hardness of 59 HRB (flanges), 30 HRC (ring gear), and 32 HRC (sun and planet gears). Tight tolerancing is essential for the gearset's virtually noiseless operation.

Results

While the previous iteration of this part did include powder metallurgy gears, the flanges and spacers were designed used a die cast process. The redesign resulted in:

- 20% cost savings
- Quality improvements
- Reduced gear noises
- Tight tolerances