

CASE STUDY



A 2017 Grand-Prize winner in the Automotive—Engine category

Sinter-Brazed Planetary Carrier

Process:

Conventional powder metallurgy

Hardness:

Spider: 80 HRB

Guide Plate: 90 HRB

Materials:

Modified FC0208 and modified FX1008

Density:

Spider: 7.0 g/cm³

Guide Plate: 7.5 g/cm³

End Use and Function

This lightweight powder metallurgy (PM) component—composed of a guide plate and spider—is the first sinter-brazed powder metal planetary carrier in a ZF automatic transmission. Four segments of spline are formed through the guide plate by four independent tooling elements, which made the dimensional control for a net-formed spline one of the biggest manufacturing challenges for this component through the compacting, sintering, and induction-hardening operations.

Fabrication

Manufacturing this component involved the use of four compaction presses and nearly 40 precision PM forming tooling components. The spider is made of a modified FC-0208 using one level of top tooling, two levels of bottom tooling, and two separate core rod sets. The guide plate, made of modified FX-1008, is compacted using one level of upper tooling, two levels of lower tooling, and three separate core rods; the four segments of spline are formed by four independent tooling elements. The dimensional control of the net-formed splines was one of the toughest challenges of

the product through the compacting, sintering, and induction-hardening operations. A fully automated operation was custom developed for unconventional induction hardening coil design and process with error proofing and detection. Due to close cooperation between the fabricator and the end user, compacting and tooling processes were developed to provide uniform density throughout the varying sections such as those between the functional holes and the center hole. While CNC equipment was used, there was minimal machining involved.

Results

Through thorough cooperation between fabricator and end user, this lightweight PM design planetary carrier contains optimized design features that exceed material specifications and properties. The PM design solution for this lightweight carrier met all of the customer's design and durability requirements, helping the transmission provide a 12%–16% fuel economy improvement, all the while delivering an estimated 20%–30% cost savings over alternative manufacturing technologies.



PickPM is a resource created by the Metal Powder Industries Federation, a trade association for the metal powder industry, for the benefit of the metal powder industry. To learn more about powder metallurgy, or to find a part fabricator, visit us at PickPM.com