Case Study: JBJ Techniques and the BLOODHOUND SSC Project

Photo courtesy of Flock and Siemens

The Challenge

Specialist power transmission supplier JBJ Techniques Limited, of Redhill, Surrey, England were recently contacted by the staff of Bloodhound SSC R&D engineering team to solve a problem on the fuel pump test rig. JBJ Techniques had worked with various team members in the past and this previous experience made JBJ an easy choice to assist with this project. The scope of supply was to produce a suitable drive coupling with a maximum diameter of 160 mm, capable of transmitting 550 Nm @ 10,000 rpm, with as short an assembly as possible, and at the same time be able to accept misalignment within the drivetrain.

The Solution

JBJ proposed a Sier Bath coupling from their principles — RL Hydraulics, in Germany, a wholly owned subsidiary of U.S.-based Lovejoy Inc. The high-torque capacity of the coupling meant that, when assembled, it fit perfectly within the existing adaptor arrangement, and the crown tooth gear form on the coupling allows for relatively high misalignment without transferring loads between the shafts. JBJ had the blank parts in stock, having a comprehensive inventory of power transmission couplings of many types and designs, thus helping to keep customer downtime to an absolute minimum.

JBJ Techniques's proposed solution required a special driveshaft that, when connected to the output flange of an automotive gearbox, enabled easy assembly of the Sier Bath unit. 3D models were then supplied and approved by the Bloodhound team, and after manufacture, the complete assembly was dynamically balanced to ensure that the coupling operated without generating any additional forces.

The fuel pump is, in effect, the pump for the rocket; it's an end-suction centrifugal pump driven by a Jaguar 'F'- type V8 engine. Its role is to pump the oxidizing agent (hydrogen peroxide) into the rocket engine that contains the actual (solid) fuel (rubber). The other engine is a jet and does not require a separate pump.

The end-suction centrifugal pump (Fig. 1) is basically an impeller mounted within a volute housing; the impeller is mounted on a shaft supported on two bearings. One is mounted close behind the impeller with a pressurized, double-mechanical seal to prevent leakage. A bearing housing accommodates the length of the shaft and ensures a suitable gap between the bearings sufficient to support the rotating parts. The photo shows it standing on its suction inlet flange with the outlet (dis-

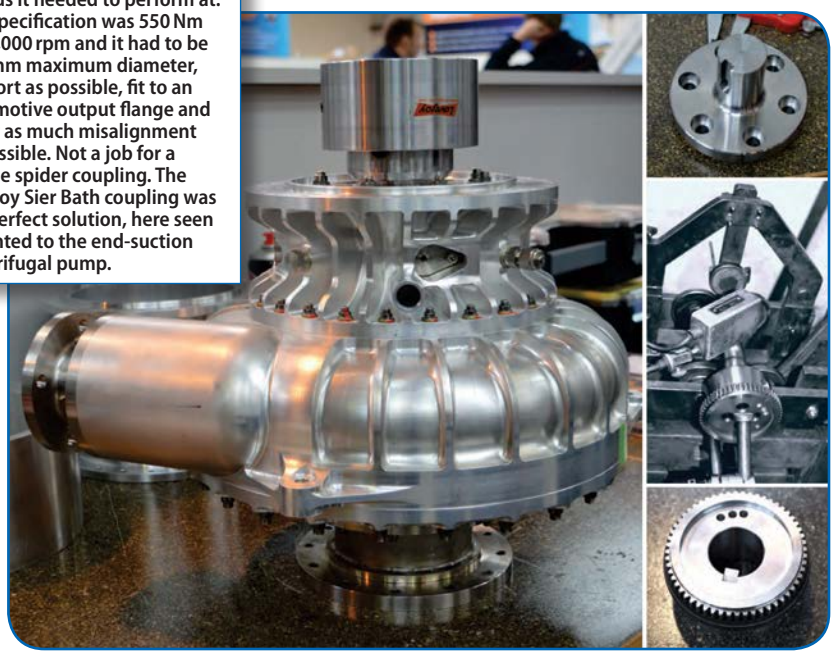

Figure 1 The coupling underwent dynamic balancing before delivery because of the high speeds it needed to perform at. The specification was 550 Nm at 10,000 rpm and it had to be 160 mm maximum diameter, as short as possible, fit to an automotive output flange and allow as much misalignment as possible. Not a job for a simple spider coupling. The Lovejoy Sier Bath coupling was the perfect solution, here seen mounted to the end-suction centrifugal pump.

charge) pointing left, and the coupling at top mounted on the end of the shaft.

The company takes pride in the fact that the coupling specified and supplied by JBJ Techniques performed exactly as designed. The research and development process has only added to the knowledge base needed to help Bloodhound SSC succeed in its mission of breaking the land speed record and, most importantly of all, to help inspire the young to be the future engineers that shape the world we all live in. We are all eager to see Bloodhound SSC "flying" across Hakskeen Pan in South Africa — driven by Wing Commander Andy D. Green — the British Royal Air Force fighter pilot and new World Land Speed Record holder. **PTE**

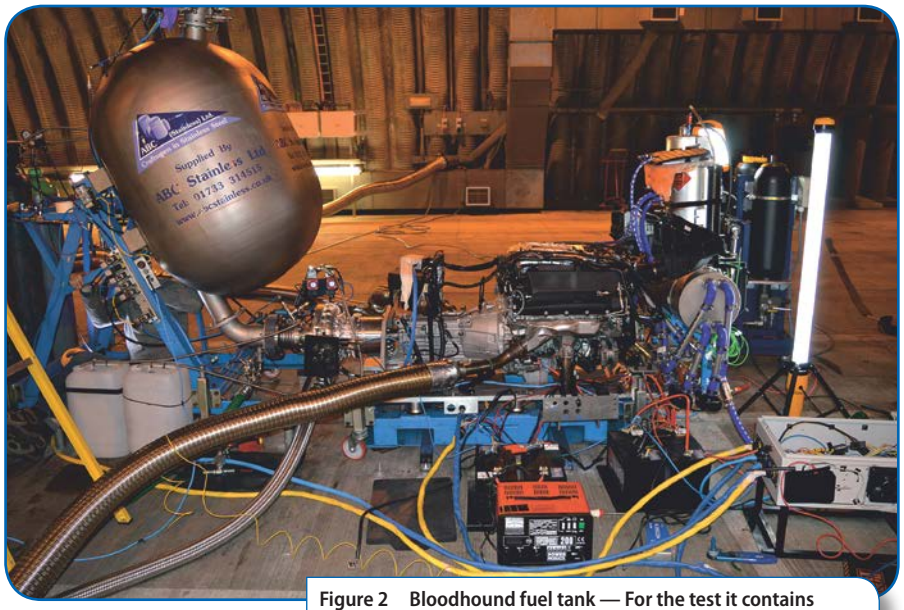

Figure 2 Bloodhound fuel tank — For the test it contains water to be pumped through at the same speed and pressure that fuel will be pumped during the actual land speed record attempt.

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