In 2003, Bombardier Transportation was getting ready to introduce a new train that would break speed records for its customer Talgo while carrying 800 passengers in Spain in up to 13 coaches.

Safety was the primary concern, says Marcus Pauels, Timken’s manager for European sales and marketing rail. Not far behind was a serious concern for low-temperature operation. The trains were slated to run between Madrid and Barcelona, where the temperature in the summer can easily exceed 100°F.

Bombardier set out to find a bearing manufacturer with extensive experience in high-speed environments. Pauels says that temperature and track conditions are the main environmental factors affecting bearing life, since the average axle load is not an issue in passenger trains.

“The general design of a high-speed bearing has to reflect the optimal combination of metal, heat treatment, raceway quality, cage design, cage material, quantity and size of rollers and grease performance,” he says. “Only if all these components have been checked and combined in the best way, can the bearing system run at that speed, which is 210 miles per hour in our case, with the lowest temperature. On top of this is the factor of the environmental conditions in Spain with its high temperatures.”

Of equal importance, says Pauels, is the track condition. Even if the high-speed train has fewer curves and wider angles, the bearings have to withstand rigorous radial forces at constant high speeds. The trip between Barcelona and Madrid is approximately 510 miles, with one stop in Zaragossa.
Therefore, the trains run for two hours and 45 minutes, with only one stop in the middle. Bearing all this in mind, Bombardier and Timken were looking for a tapered roller design, instead of cylindrical roller bearings.

Bombardier knew that Timken had more than a century of experience in tapered roller design and contacted them to quote on the project.

“Bombardier needed a solution that exceeded performance specifications of what is generally available on the market,” says Mat Happach, Timken’s vice president–rail. “They turned to us because they knew our knowledge of friction management and sensor technology could overcome the challenge. We were able to use our engineering expertise to provide our customer and the railway with a fully integrated system that will provide lasting benefits in the demanding environment of everyday operation.”

Timken also supplied 480 high-tech axle-bearing assemblies to Bombardier for use in the locomotives of the next 30 trains that RENFE—the Spanish state railway—ordered from Talgo in Spain.

The Timken components include axle bearings, aluminum housings and a sensor assembly that continuously measures the temperature throughout the entire bearing system. All the bearing assemblies are networked with the control unit in the locomotive, and data are visible to the driver.

Bombardier in turn supplied 60 high-speed locomotives—two for each Talgo 350 train—equipped with Timken’s advanced sensor technology to monitor bearing temperature.

Bombardier used Timken bearings and housings for its first order from Talgo in 2003. As each train set needs two locomotives, Bombardier received the order for approximately 32 locomotives. This order required 64 trucks, including 128 axles and 256 bearings plus housings. Trains on RENFE’s Madrid-Barcelona line travel at speeds up to 205 mph. In 2006, RENFE ordered an additional 30 train sets from Talgo. This translates into 60 Bombardier locomotives using 120 trucks running on 240 axles, which are equipped with 480 Timken bearing/housing sets.

Pauels says, “Timken received the order in the end after 14 months of prototype testing, together with the competition’s bearings because of the fact that Timken’s bearings were running almost 6° cooler than the product of any other manufacturer.”

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