

## High Performance Alloys

### *Hitachi Construction Machinery switches to ToughMet<sup>®</sup> alloy for kingpin bushings.*

The properties of Materion's high-strength, copper-nickel-tin ToughMet 2 and ToughMet 3 alloys provide significant performance advantages for demanding applications operating in harsh environments. ToughMet alloys resist galling, corrosion and wear, and when used for bushings and bearings, last longer and carry more load than those made of other materials.

**PROFILE:** Hitachi Construction Machinery

Hitachi Construction Machinery is deployed around the world for on-site civil engineering, construction work and mine development operations.



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### CHALLENGE

Bigger than a house, weighing over 200 tons and able to carry a payload of more than 300 tons, rigid-body haul trucks are some of the world's largest mobile machinery. The engineered components must be extremely rugged to withstand the heavy loads and harsh work environments. Understandably, maintenance is a tough task on such large equipment and downtime is extremely costly. As a result, reliability and long service intervals are paramount to productivity and the customer's bottom line. Longer service intervals also reduce the inherent safety risks associated with maintenance on any large pieces of equipment.

An area of dump truck design that traditionally has been problematic is plain bearings in the steering assembly. These can wear, leading to slackness in the steering and damage to other components. Extreme temperatures and running on very soft or abrasive terrain will accelerate the wear.

Initially, Hitachi Construction Machinery used a lubricated steel bushing on a steel kingpin, but if the lubrication became marginal the resulting steel-on-steel arrangement soon started galling. A change to the aluminum bronze overcame the galling problems, but then the bushings suffered from high wear rates.

### SOLUTION

Materion's ToughMet material was proposed as a solution because its advanced properties could provide the performance needed. The grade of ToughMet alloy specified was 3 CX 105, a cast spinodal copper-based alloy with 15% nickel and 8% tin and a yield strength of 105,000 psi (724 MPa). This unique material has the strength of steel and the low-friction and lubricity that would normally be associated with leaded bronzes. As a result, compact bushing arrangements can be designed and the bushings will continue to function even with little lubricant. Unlike bronzes, ToughMet alloy is not susceptible to damage by contaminants, should these find their way into the bushing.



# Case Study continued

## RESULTS

Remarkably, tests showed that ToughMet alloy exhibited only one-third the wear rate of aluminum bronze, which translated to a five-fold increase in the service interval. Hitachi Construction Machinery was also able to reduce the large inventory of replacement bushings they previously kept on hand.

