MSNST APPLICATIONS SOLUTION
METALS PROCESSING

ISO 9001:2015 REGISTERED FIRM US1742

Measurement Specialists Inc, dba National Scale Technology (MSNST), recently manufactured several custom load pins designed to measure the clamping forces created by hold-down bolts for an existing tundish weighing system. Featuring a steel super-alloy, we developed and tested a fully hermetically-sealed load pin for mold oscillating units that provided accuracies easily surpassing 0.50% throughout the measurement range.

Photo of a tundish-rest system commonly utilized throughout steel mills, like that of our Midwestern client.

The Problem

A steel processing plant needed to effectively monitor tension forces in hold down bolts for their tundish in real-time. Ultimately, this force feedback would serve two purposes: First, to ensure the mold is properly clamped to the oscillator; and second to provide a measure of the friction force of the product on the mold itself. The data was to be used to evaluate various oscillation forces and frequencies as well as mold lubricants so the casting process could be optimized.

The first challenge was the form factor of the pre-existing link pins; their small size did not lend itself to making drop-in replacement load pins capable of handling the anticipated forces. Without modifying the existing equipment, the load pins needed to be 1.960” in diameter and handle 150,000lb in a cyclic, fatigue-load environment.

The second challenge was survivability in a hot, steamy environment while still providing accurate readings.

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Our Solution

Measurement Specialists' engineering team identified several material candidates with an attractive combination of yield strength, tensile strength, fracture toughness, machinability, hardness and modulus to test out as load cells. We identified an existing load pin design, made from the typical load cell material. Because MSNST maintains run data on for every load cell we've ever manufactured, we could build a load pin of the same design from the new candidate materials and compare performance against a known quanitity. This way, we could divorce the effects of design from the effects of material choice; and use that understanding to design a new load pin from a new material – and get it to work right on the first try.

To meet objectives of fatigue resistance and safety/overload capacity, MSNST needed nearly the full cross-section of the 1.960" diameter load pin, thus we were not able to gage the pin internally as we often do for hermetically sealed applications. This forced us to install strain gages into shallow pockets on the outside of the load cell which created a sealing challenge. MSNST designers and welding specialists met several times to arrange a welded-lid seal that was feasible to perform and would meet the hermetic requirement.

Ultimately, we designed and delivered a very compact load cell with capacity of 150,000 LBS with a 5:1 factor of safety. Together with a signal conditioner suitable to provide the clients PLC with load cell readings, our load cell solved the customer's need.

Interestingly, we recently designed and built another set of very specialized load pins for a different customer trying to monitor the forces and instantaneous acceleration of steelmaking mold oscillator arms. Turns out the second set of pins will be commissioned at the first customer's steelmaking facility, and the data from the two different sets of pins will be combined and used to deduce frictional forces between the mold and the steel itself. Watch for a white paper on this topic soon!

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