MSNST APPLICATIONS SOLUTION
ROLL FORCE & STRIP TENSION MEASUREMENT

ISO 9001:2015 REGISTERED FIRM US1742

Measurement Specialists Inc, dba National Scale Technology, (MSNST) identified a number of shortcomings in typical existing rolling mill load cell designs – namely, mediocre accuracy and repeatability, as well as difficulties in reliably sealing the unit from its harsh operating environment. MSNST units are interchangeable with existing designs, while decreasing response time and peak stress by 20%, increasing signal magnitude by 20%, and improving non-linearity by over 100%.

The Problem

Numerous steel manufacturers wish to monitor and control the rolls' forces during production. This allows them to maximize efficiency and product quality, while minimizing risks to valuable rolls equipment.

Multiple work-around approaches have been implemented, such as fitting the frame of the rolls' equipment with an extensometer or similar, the most reliable and accurate force readings come from a load cell directly carrying the load. These usually come in the form of a giant "load washer" or "ring cell", consisting of a steel ring between 18" and 36" outer diameter, with a section thickness and overall height of several inches. The ring cell is fitted onto the lead-screws of the rolls frame, and a captive nut prevents any axial motion of the ring cell while operating the rolling mill.

While this is a proven arrangement that provides good readings, some of the inherent design features of the rolls arrangement makes it challenging to follow typical "best practice" approaches to load cell design. This manifests itself in decreased accuracy and response. Ultimately it comes down to precisely funneling compressive stress into the load cell's sensing area in a consistent way – which is difficult to achieve given the broad loading surface mandated by the massive forces at play (often well in excess of 2,000,000 LBS). This can be mitigated to some extent by very tightly controlling the surface finish and overall flatness of the load cell and adding conformal shim plates, but even still, typical error is often 1–2%.

A secondary issue is proper sealing of the load cell, which must reliably operate in a harsh, oily environment. In most cases, significant downtime and effort is required to remove and install the load cell – which makes it particularly important to minimize risk of moisture intrusion that will cause premature failure of the load cell.

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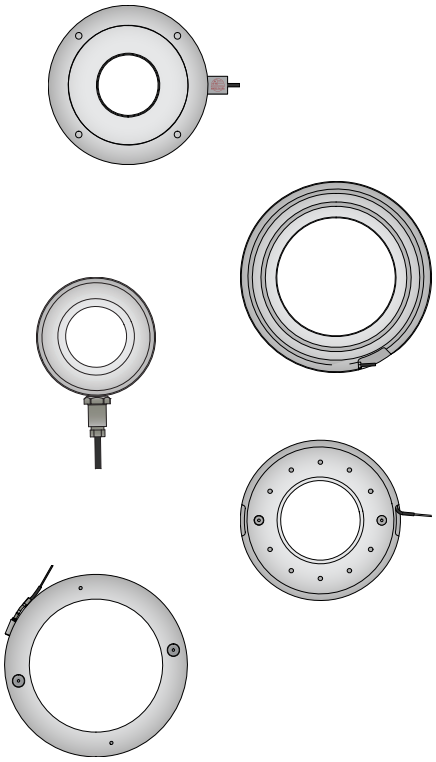
Our Solution

After decades of building and repairing traditionally engineered rolling mill load cells, MSNST developed a new design addressing the shortcomings they'd seen with other approaches. Totally interchangeable with existing designs, MSNST rolling mill load cells measure shear-strain, rather than the typical compressive-strain, which provides more signal output without increasing the overall amount of stress in the load cell element and actually decreasing the overall amount of compliance and deflection of the load cell itself.



High capacity, heat-resistant annular load cells for rolling mills designed and manufactured by MSNST in Huntsville, Alabama

The element has strategic geometry that consistently and precisely directs the forces into the strain sensitive zones of the load cell which improves non-linearity from 1–2% to 0.2–0.5%.

The shear design also greatly decreases the amount of covering required to seal sensitive electrical components from the harsh environment outside, which minimizes potential points of entry for moisture, oil or debris.

After extensive testing of various potting and sealing compounds, MSNST was not able to identify any that could reliably and consistently provide a leakproof seal for the cable exit. Instead of relying on a questionable sealant, MSNST chose to use simple hydraulic fittings and hoses to prevent hot oil or moisture from entering the load cell.

These fittings are suitable for temperatures and pressures exceeding 200°F and 3000psi -both far beyond the conditions a rolling mill load cell will need to endure.

Finally, the MSNST design is fully capable of being paired with any signal conditioning device including internal 4-20mA or 0-10V amplifiers, external amplifiers, device net, profiBus, etc.

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