Interface Inc. Gold Standard® Calibration System

Load Cell Calibration 101

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A load cell is a transducer that converts a force into an electrical signal. Most load cells use well proven strain gage technology in which strain gages are precisely positioned and wired into a Wheatstone bridge configuration along a flexing element. The load cell outputs electrical signals corresponding to changes in resistance caused by the amount of applied force. Instrumentation can be connected to the load cell, interpreting these electrical signals to provide readings in units of measurement such as pounds-force, newtons, etc.

While there are many types of load cells, including bending beam, column, shear beam, and low profile/shear web (to name a few), they all require calibration to characterize performance. Calibration verifies that the load cell meets designed performance parameters for non-linearity, hysteresis, and static error band among other specifications. In some industries, calibration is also important for traceability and quality system requirements.

Load cell calibration, simply explained, consists of applying a series of known forces and recording the output from the load cell. The two most common methods of applying a known force are to use calibrated dead weights, or a reference standard load cell coupled with some means of applying a force (such as a hydraulic actuator). There are pros and cons to either method; dead weight results in lower uncertainties but may be more impractical or expensive as the level of force increases, while using a reference standard may have a higher uncertainty but can offer more efficient calibration and be more practical at higher force levels.

The reference standard method of load cell calibration typically involves two or three load cells mounted inline in a load frame. Three load cells are often used in an automated load frame setup, where one sensor is used for force control and the other two being the reference standard load cell and unit under test (UUT). The reference standard load cell is a load cell that has been calibrated by primary standards; it can also be configured with a second bridge (additional output) to serve as the control channel for the load frame and eliminating the need for a separate control load cell. The control load cell or bridge confirms the force applied, which may be used to control the actuator or determine the force required to meet the desired calibration set points. Readings from the reference standard and UUT load cells are collected manually or through instrumentation software. After collecting readings from the calibration points within the UUT's rated capacity, the readings are compared and differences analyzed to determine the load cells performance.

Load cell manufacturers such as Interface, Inc. calibrate their load cells at the factory. Interface uses its Gold Standard® Calibration Load Frame System, which includes a rigid four-post hydraulic load frame, Gold Standard® reference standard load cell, and proprietary software, to calibrate every load cell manufactured before it is shipped to the customer.

"The key to good calibration is to keep the applied force as concentric as possible," said Ken Bishop, Senior Applications Engineer at Interface. "A rigid four-post load frame minimizes chances of off-axis loading. Also, using a moment-compensated load cell as the control or reference standard further reduces error since any off-axis loading will be mechanically compensated for."

Calibration systems use a variety of means to apply loads, including hydraulic or electric actuators, or dead weights. Since, in many cases, the dead weight method requires a change in setup for tension and compression readings, an actuator system that can apply tension and compression in the same setup can save valuable time

during calibration and reduce uncertainty due to setup changes between tension and compression runs. Software can also make a difference. For example, Interface's Gold Standard® Calibration Software, which is used by more than 300 metrology labs around the world, can compile up to eight calibration runs into a single curve-fit analysis for even greater accuracy. The software also prevents the overshoot of any calibration points. "Once the system is set up, an automated tension and compression calibration run typically finishes in less than five minutes including exercising the load cell," says Brian Shaw, Production Engineering Manager at Interface. "Between software automation and the load frame allowing back to back tension and compression runs without changing setup, Interface's Gold Standard® Calibration System reduces calibration time by 50 to 90 percent."

After a load cell leaves the factory, it typically requires recalibration following a certain period of use. If following *ASTM E74* guidelines, new load cells should be recalibrated within a year to determine stability. Subsequent calibration intervals can then be adjusted based on the observed stability per *ASTM E74*. Interface offers recalibration services for their own load cells as well as from other manufacturers. Interface offers calibration and repair services for a wide range of load cells with various options, including internally and externally amplified load cells, load cells with indicators, and TEDS (transducer electronic data sheet) load cells. Load cells with amplifiers can be tested in-rig to provide a single traceable calibration certificate for the load cell and amplifier combination, and a similar setup can be used to provide a calibration certificate for a load cell and indicator combination. Custom calibrations for specific customer requirements can also be accommodated.

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