

Calibration vs. output checking of load cells in quick release hooks



Why calibration matters

Accurate measurement of mooring line loads is critical for both safety and operational efficiency.

Load cells integrated into Quick Release Hooks (QRHs) provide real-time insight into mooring line tension. This enables operators to maintain line forces within safe design limits, ensuring optimal mooring conditions, reducing vessel motion at berth, and supporting efficient cargo transfer. It also allows early identification of overload or slack conditions before they escalate into operational risks, helping protect both personnel and equipment.

The value of this data depends on one factor: measurement accuracy.

Without proper calibration, load cells may appear functional while providing inaccurate readings, creating false confidence in both safety and operational performance. This can result in undetected overloads, unbalanced mooring patterns, and reduced efficiency at berth.

Regular calibration of mooring load monitoring systems is mandated by SIGTTO (Society of International Gas Tanker and Terminal Operators) and OCIMF (Oil Companies International Marine Forum). In line with international best practice, calibration using applied loads at or above the Safe Working Load (SWL) ensures measurement accuracy, traceability, and dependable performance under real-world conditions.

This document outlines the critical distinction between formal calibration and simple output checking, highlighting why calibration using controlled, incremental loads up to SWL is essential to verify true performance and maintain safe, efficient mooring operations.

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Calibration vs. output checking understanding the difference

In practice, output checking is often used as a quick method to verify sensor response. While it may indicate that a load cell is functioning, it does not confirm measurement accuracy or performance across the operating range.

OUTPUT CHECKING

A basic functional verification of a load cell's signal response under informal or non-controlled conditions (e.g., manual tension, operational loading, or comparison against historical trends).

- Typically performed at only a portion of the full SWL, using assumed or opportunistic loads rather than controlled application across the measurement range.
- Does not use certified reference loads and does not provide traceable calibration data.
- Intended to confirm that the sensor is responding plausibly and has not suffered gross failure, signal loss, or obvious drift.
- Cannot verify measurement accuracy, linearity, or full-range performance, and therefore does not constitute calibration.

CALIBRATION

A structured, traceable process in which known reference loads are applied in increments (typically 0%, 25%, 50%, 75%, 100% of SWL) to evaluate and adjust the load cell's output.

- Conducted using certified calibration equipment such as calibrated hydraulic presses or deadweight testers.
- Ensures linearity, accuracy, and repeatability across the full operational range.
- Conforms to international metrology standards such as OIML R60, ISO 376, or ASTM E4.

Best practice: Load cells should be calibrated up to at least 100% of their Safe Working Load (SWL), or higher where appropriate, to confirm consistent performance under real operational conditions.

INDUSTRY GUIDELINES & GLOBAL BEST PRACTICES

Both SIGTTO and OCIMF recommend annual calibration of QRH load cells to ensure safe and effective mooring operations. However, neither organization specifies load application levels or calibration methodologies in detail.

In the absence of detailed calibration procedures from SIGTTO/OCIMF, terminal operators should follow global standards and engineering best practices.

GLOBAL CALIBRATION STANDARDS

- OIML R60 / ISO 376: Require multi-point calibration across the entire measurement range to validate linearity and hysteresis.
- DNV-ST-0378 (Offshore Lifting Appliances): Specifies test loads between 100% and 125% of SWL, depending on capacity.
- ADNOC Lifting Integrity Management: Mandates static load tests using certified weights equal to SWL, with overload protection verified between 102.5% and 110% of SWL.
- Calibrating up to or above SWL ensures that load cells behave predictably across their full operating range and can be safely relied upon during high-tension mooring events.



RISKS OF RELYING SOLELY ON OUTPUT CHECKS

Undetected overload conditions

Increased risk of line failure, snap-back incidents, personnel injury, and equipment damage

Unbalanced mooring patterns

Leads to excessive vessel surge, sway, or yaw, reducing stability at berth and impacting operational efficiency

False confidence in system performances

Sensors may appear functional despite internal drift or degradation

Delayed response to changing conditions

Reactive rather than controlled mooring management

Lack of traceability and compliance

Cannot demonstrate adherence to SWL limits, operating procedures, or international calibration standards

Inconsistent mooring practices

Reliance on operator judgement rather than measured data

WHY FULL-RANGE CALIBRATION MATTERS

Accuracy – Ensures readings reflect true mooring line tension across the full load range.

Linearity Verification – Identifies non-linear response or mechanical/electrical degradation.

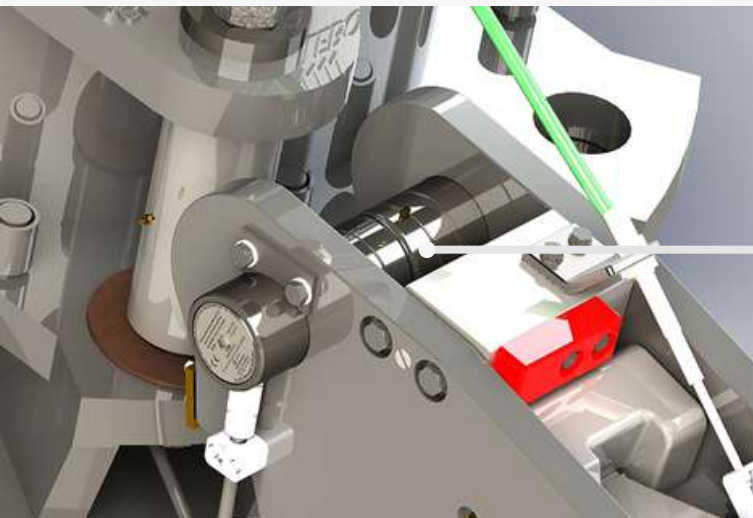
Reliability – Detects internal drift and sensor fatigue.

Operational Assurance – Helps prevent system failures during peak loading by testing the full capacity.

Mooring stability
Supports balanced load distribution and reduced vessel motion at berth

Safety – Validates that QRHs function safely and predictably under operational loads.

Limiting calibration to partial ranges can leave critical faults undetected. Calibrating up to SWL confirms operational readiness under real-world mooring conditions.



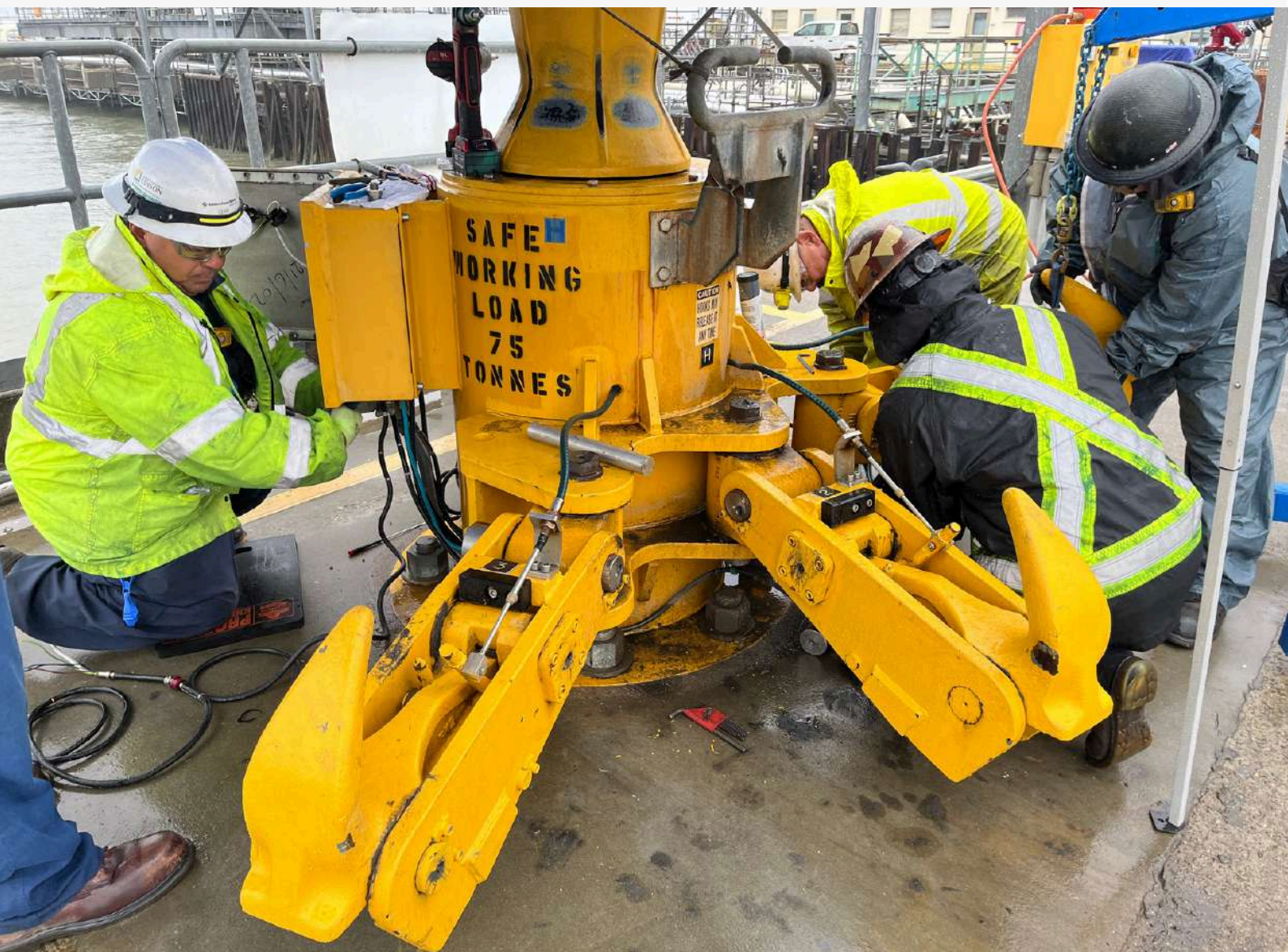
Conclusion

While output checking can provide a basic indication of sensor response, it should not be considered a substitute for calibration, particularly in safety-critical systems such as Quick Release Hooks.

Adhering to these practices supports compliance, reduces operational risk, and ensures the long-term integrity of the mooring system.

To ensure reliable mooring operations, terminal operators should:

- Follow SIGTTO/OCIMF guidelines for regular calibration
- Conduct calibration in line with internationally recognised standards
- Use calibrated reference equipment
- Apply controlled, incremental loads up to at least 100% of SWL



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This brochure supersedes the information provided in all previous editions. If in doubt, please check with Trelleborg Marine and Infrastructure.

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