Morehouse Instrument Company
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How to order a Morehouse custom load cell

A specification and ordering guide

This guide explains when a custom load cell is the right choice, how the Morehouse ordering process works, and exactly what to tell us so we can design, build, and calibrate a sensor for your application. Work through the specification checklist before you request a quote, and you will get a faster, tighter proposal.

When a custom load cell is the right choice

A standard catalog load cell is usually the better choice when it fits, because common capacities are in stock and ship quickly. We stock standard cells from 25 lbf (111 N) up to 1 125 000 lbf (5 000 kN), and we can supply standard cells below 25 lbf as well. Because the physical weight of a single cell exceeds 45 kg (100 lb) at roughly 110 000 lbf (489 kN), we use multi-column designs at higher capacities. Even within this range, a custom cell is sometimes the better choice when you are tight on space or have a tension application that a standard cell cannot serve.

Choose a custom load cell when one or more of the following is true:

- Geometry, space, or interface: you are tight on installation space, you have a tension application a standard cell cannot serve, or you need a specific envelope, body length or diameter, left-hand or ACME threads, a flange, a through-hole or donut shape, custom rod ends, or a particular connector type and orientation.
- Capacity beyond stock: above 1 125 000 lbf (5 000 kN), or a multi-cell tandem system reaching into the millions of lbf.
- Axis configuration: bi-axial or multi-axis force and torque measurement, or load pins where the force direction varies.
- Environment: hermetic sealing for marine, subsea, or underwater service; cryogenic or high-temperature use; corrosive media; non-magnetic construction; or a hazardous area requiring ATEX or NEC Class I, Division certification.
- System-level performance: your calibration must replicate the in-use mounting and load path to control error.

Two myths are worth retiring. A custom cell is not necessarily more expensive, since the fixtures to adapt a standard cell often cost several times the cell itself. A custom cell is also not less reliable, because a custom design typically receives extra scrutiny and testing before it ships.

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Figure 1. A dual-bridge custom load cell with left-handed threads, built to match a specific test interface.

The ordering process, step by step

Ordering a custom load cell is a short engineering project, not an off-the-shelf purchase. The process runs in eight stages.

Figure 2. The Morehouse custom load cell ordering process, from inquiry to recalibration.

1. Inquiry and quote. Call us, email us, or request a quote and describe your application.
2. Requirements capture. Our engineers work directly with your team to turn your requirements into a sound measuring principle. Use the checklist in the next section.
3. Design and analysis. We shape the elastic element, select the material, place the strain gauges, and then use our analysis and expertise to identify high-strain regions and confirm structural integrity.

4. Drawing and/or specification approval. We provide drawings, specifications, and can provide STEP files (additional charges may apply) for your approval, so your engineering team can verify fit, interfaces, and integration before any metal is cut.
5. Manufacture. We machine, gauge, seal, and assemble the cell in-house.
6. System-level calibration. We calibrate the entire measurement chain using adapters that replicate your load path and report the applied measurement uncertainty.
7. Delivery and documentation. You receive the hardware, an ISO/IEC 17025 accredited calibration certificate with an uncertainty appendix, and the approved drawings, specifications, and STEP file for the design.
8. Recalibration. Most repeat calibrations are completed within 7 to 10 business days, minimizing downtime and ensuring a highly reliable calibration window.

Figure 3. Trimming the gauging on a custom load cell in-house. Adjusting the gauging is one step we use that can drastically improve reproducibility.

What to tell us: the specification checklist

Define as much of the following as you can before you request a quote. At a minimum, give us capacity, load direction, axis count, your accuracy or uncertainty target, the mechanical and mounting constraints, the environment, and the calibration standard you must meet.

Force and measurement requirements

- Rated capacity and direction (tension, compression, or both). For multi-axis, give the capacity per axis.

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- Number of axes: uniaxial, bi-axial, or multi-axis force and torque.
- Accuracy or uncertainty target, with nonlinearity, hysteresis, nonrepeatability, creep, and resolution as needed.
- Overload and safe-load tolerance and the required safety factors. We have built to a 5:1 safety factor for nuclear work.

Mechanical and interface

- Mounting: male or female threads, flange, through-hole or donut, or load washer, including thread form and hand (ACME and left-hand are available).
- Envelope constraints: body length, diameter, height, and any weight limit.
- Rod ends, loading fixtures, and adapters. For shear-web cells, we strongly recommend keeping the integral threaded adapter.
- Deflection, stiffness, and natural-frequency requirements for dynamic use.

Electrical and signal

- Bridge configuration (single or dual bridge), number of gauges, and bridge resistance.
- Rated output in mV/V and excitation voltage.
- Connector type and orientation, cable length, and four- or six-wire sensing.
- Options: wireless transmitter, amplifier or signal conditioner, TEDS, and indicator selection.

Environmental

- Operating temperature range, including high-temperature or cryogenic service.
- Sealing and IP rating. We recommend hermetic sealing for outdoor, marine, or underwater use.
- Pressure compensation or subsea service, corrosive or chemical media, non-magnetic requirements, and vibration, shock, or fatigue life.

Material and safety

- Material selection (tool steel, stainless steel such as 17-4PH or 440C, aluminum, or some more exotic material, if required). 17-4PH balances strength, corrosion resistance, and machinability; an overaged condition is preferred where corrosion cracking is a concern. 440C offers higher wear resistance but lower corrosion resistance.
- Hazardous-area certification: ATEX marking (for example II 1 G Ex ia) or North American Class I, Division 1 or 2 per NFPA 70, Article 501. Intrinsically safe designs need an associated barrier and a control drawing.

Calibration and compliance

- Required standard, units, and force points. Common references are ASTM E74-18, Standard Practices for Calibration and Verification for Force-Measuring Instruments, and ISO 376:2011,

Metallic materials: Calibration of force-proving instruments used for the verification of uniaxial testing machines.

- Decision rule and guard banding for any statement of conformity, per ISO/IEC 17025:2017, Clause 7.8.6, and ILAC-G8:09/2019.
- Quality-program flow-downs, such as nuclear 10 CFR 50 Appendix B and 10 CFR Part 21, or an aerospace quality management system.

Capability reference

The figures below summarize our current custom and calibration capability. Capacities above the maximum demonstrated are quoted on a project basis, so confirm exact values with us at quote time.

Capability	Specification
Standard load cell range	25 lbf (111 N) to 1 125 000 lbf (5 000 kN); cells below 25 lbf also available; made to order above 5 000 kN
Highest demonstrated custom system	6 000 000 lbf (26.7 MN) compression, oil and gas
Compression manufacture and calibration capability	Up to 10 000 000 lbf (44.5 MN) with multiple load cells
Accredited calibration, compression	Up to 2 250 000 lbf (10 MN), CMC typically better than 0.01 % of applied force
Accredited calibration, tension	Up to 1 000 000 lbf (4.45 MN), CMC typically better than 0.01 % of applied force
Deadweight primary standards	0.049 N to 533.787 kN (5 gf to 120 000 lbf), CMC typically better than 0.002 % of applied force
Multi-column single-axis reference cells	To 2 250 000 lbf (10 MN), better than 0.0125 % of full scale
Axis configurations	Single, bi-axial, and multi-axis force and torque; single and multi-axis load pins
Recalibration turnaround	7 to 10 business days

Calibration and measurement uncertainty

Our advantage is uncertainty, not just traceability. We calibrate against deadweight primary standards up to 120 000 lbf (534 kN) and maintain calibration and measurement capabilities that are often 10 to 50 times lower in uncertainty than those of typical commercial laboratories. Because your calibrated load cell absorbs the uncertainty of the reference standard used to calibrate it, a lower reference uncertainty directly improves the device you put into service.

Be precise about two terms. Error is the difference between a measured value and the reference value. Measurement uncertainty is the quantified doubt about the result. They are not the same quantity. We report expanded uncertainty completely, stating the coverage factor and coverage probability, for example, $k = 2$ at approximately 95 % confidence, following ISO/IEC 17025:2017, the GUM (JCGM 100:2008), and NIST SP 811, Guide for the Use of the International System of Units (SI).

System-level calibration is what makes the number meaningful. Laboratory performance does not translate directly to the field, so we calibrate the entire chain using adapters that replicate your load path and build an applied measurement uncertainty model for your setup. Lower uncertainty also produces narrower guard bands and broader acceptance limits, which allow us to make more pass statements of conformity under ISO/IEC 17025:2017, Clause 7.8.6, and reduce the risk of false accept and false reject.

Figure 4. A Morehouse custom load cell was installed in a structural load test.

What you receive

- The custom load cell or load cell system, with adapters and connector protection.
- An ISO/IEC 17025 accredited calibration certificate with an uncertainty appendix, traceable to SI through an NMI such as NIST.
- The approved drawings, specifications, and STEP file or CAD model used for design approval.
- An applied measurement uncertainty model for real-world field performance.
- Decision-rule and guard-banding documentation and statements of conformity on request.
- Recalibration support with a 7 to 10 business-day turnaround.

How to get started

Send us a description of your application and as much of the checklist as you can, along with any existing drawings or STEP files. We will tell you exactly what is achievable within your constraints.

Morehouse Instrument Company is ISO/IEC 17025 / ANSI/NCSLI Z540.3 Accredited.

Contact

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