



Morehouse
THE FORCE IN CALIBRATION SINCE 1925

PG-5201
Rev. 4/2022

ISO/IEC 17025 / ANSI/NCSLI Z540.3 Accredited

Product Guide

Universal Calibrating Machine (UCM)



Morehouse Instrument Company, Inc.
1742 Sixth Ave., York, PA 17403-2675 USA



P: (717) 843-0081
F: (717) 846-4193



info@mhforce.com
www.mhforce.com

Morehouse Universal Calibrating Machine ... Force Calibration Simplified!



Assumptions on your
calibration accuracy



Problematic setups



Missed revenue opportunities

Imagine Fewer Calibration Headaches!



Time-consuming rework



Costly reference standard
dual-mode calibrations



Unidentified errors

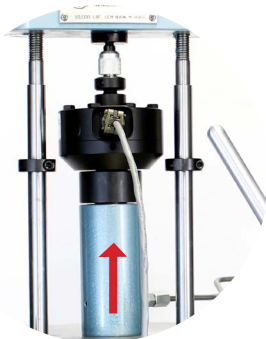
Morehouse Universal Calibrating Machine ... Force Calibration Simplified!

Improve measurement accuracy

The key to accurate force calibration is keeping everything straight. The universal calibrating machine is designed to provide uniform stress over the cross-section of the force instrument, improving accuracy and decreasing errors.

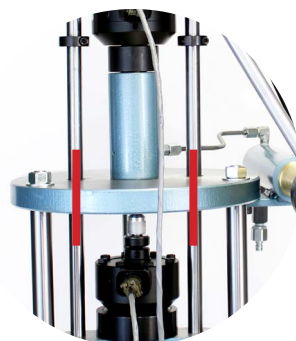
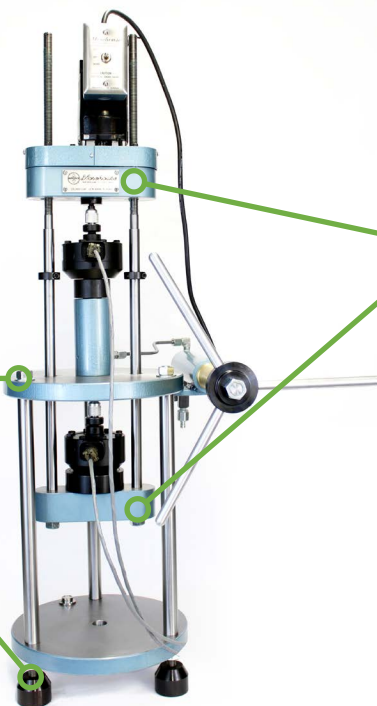
Reduce errors from misalignment

The machine's rigid platen, square frame, and adjustable feet minimize off-center loading, bending, and torsion.



Save money and time

Your reference standard only needs a compression calibration, eliminating the need for tension calibration which saves on annual calibration costs.



Make it easy

The simple yoke movement and fine adjustment control remove operation headaches. Operators can quickly learn the machine and enjoy easy calibrations.



Grow your business

Calibrate a wide range of force instruments with one machine, lowering overhead cost and performing more calibrations.

Say goodbye to rework

Customized adapters and accessories allow for easy setup. Low friction between the reference standard and test instrument reduces costly rework.

Force Calibration Simplified

The Universal Calibrating Machine (UCM) is a versatile, easy-to-use hydraulic-force calibration system. The machine is designed for ultimate accuracy and reliability. Capabilities include:

- Available in capacities from 10,000 to 2,250,000 lbf (50 to 10 000 kN)
- Calibrates both tension and compression force instruments
- Calibrates a wide range of force instruments
- Customizable features and dimensions based on the user's specifications and needs
- Able to calibrate instruments in accordance with ASTM E74, ISO 376, and other force standards

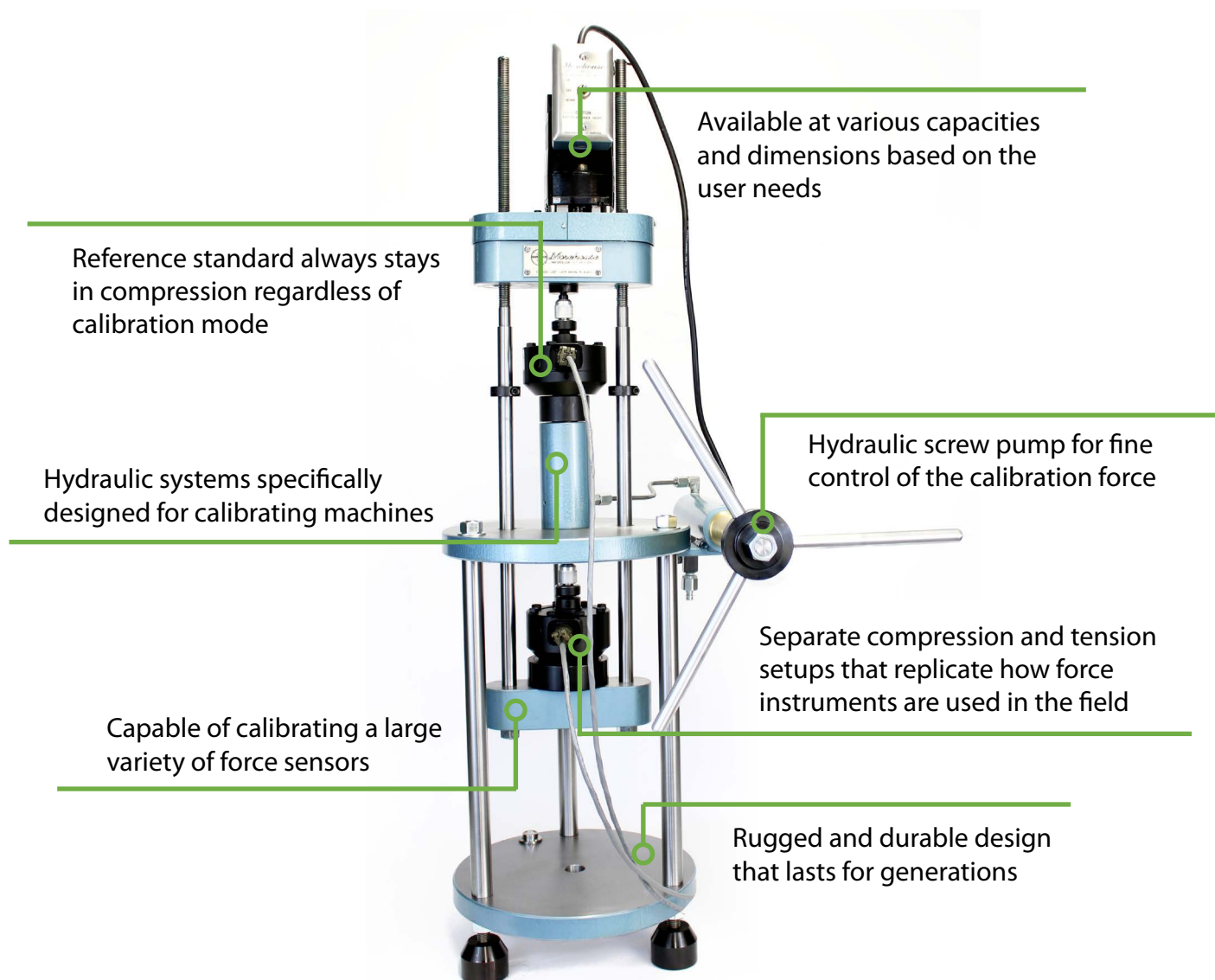


Figure 1: Morehouse Universal Calibrating Machine (UCM)

Improve Measurement Accuracy

Morehouse provides long-term support for the UCM with calibration of the machine's reference standard to the highest accuracies available in the commercial industry.

- A reference standard up to 120,000 lbf is calibrated using primary deadweight force standards with Calibration and Measurement Capability (CMC) better than 0.002 % of applied force.
- A reference standard higher than 120,000 lbf is calibrated using high accuracy secondary standards directly calibrated by the National Institute of Standards and Technology (NIST) with Calibration and Measurement Capability (CMC) better than 0.01 % of applied force. If better than 0.01 % of applied force is required, Morehouse can arrange for calibration by NIST, generating forces typically known to within 0.02 - 0.05 % of applied force.

Using a reference standard calibrated to these high accuracies, the Universal Calibrating Machine is capable of:

- Generating forces to better than 0.01 - 0.05 % of applied force
- Calibrating secondary and working standards to ASTM Class A and ISO 376 Class 0.5
 - Secondary standards can be used as reference standards in other force calibrating machines
 - Working standards can be used to calibrate force testing machines in the field according to field level calibration procedures such as ASTM E4 Standard

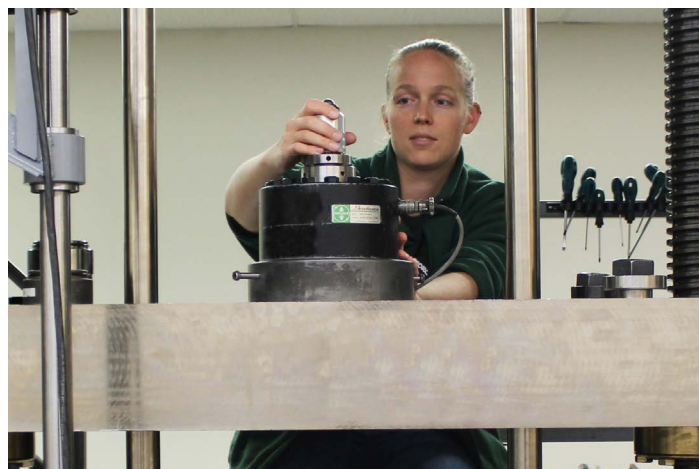


Figure 2: Reference Standard Calibration with Morehouse Primary Deadweight



Figure 3: Reference Standard Calibration with Morehouse Secondary Standard

Operation Made Easy

The UCM operates by simultaneously applying force to a reference standard and the force instrument to be calibrated. Force is produced by a hydraulic jack, which is activated by a manually operated pump. The adjustable yoke opening allows for different size instruments to be calibrated and does not change the position of the reference standard. Prior to calibration, the opening of the yoke is adjusted by a motor until a gap of less than 0.25 inches exists between the UCM and the unit under test. Instruments to be calibrated in tension can be attached with studs or tension members to holes in the lower platen and lower yoke.

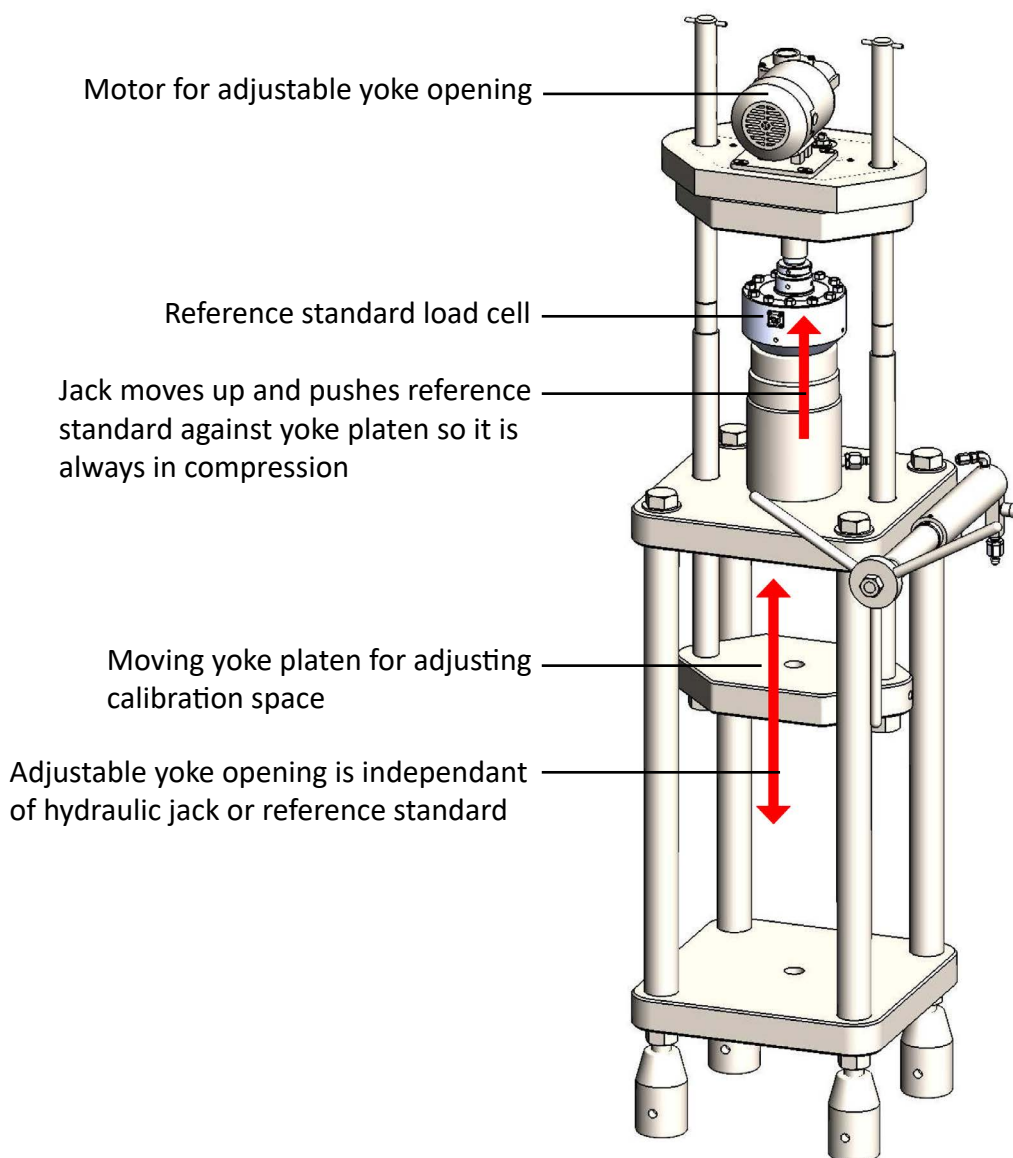


Figure 4: Easy Operation of the Universal Calibrating Machine (UCM)

Tension and Compression Calibration

Compression calibration

- Reference standard is positioned between the jack and upper yoke
- Unit under test is placed between the upper machine platen and lower yoke

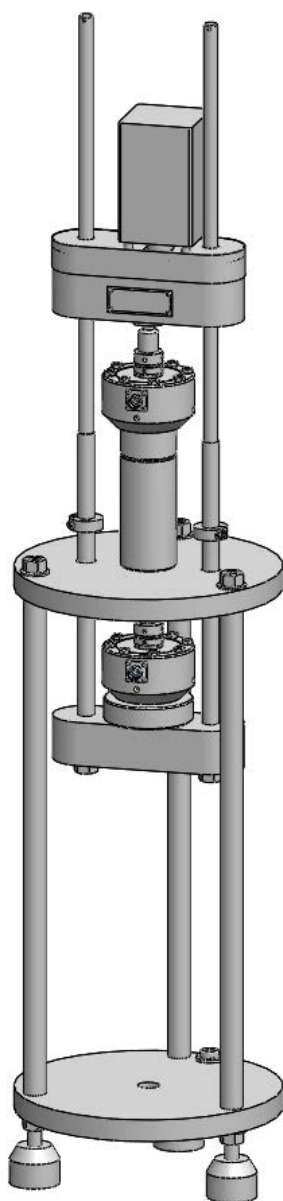


Figure 5: Typical Compression Setup

Tension calibration

- Reference standard is positioned between the jack and upper yoke
- Unit under test is connected by tension members between the lower yoke and lower platen

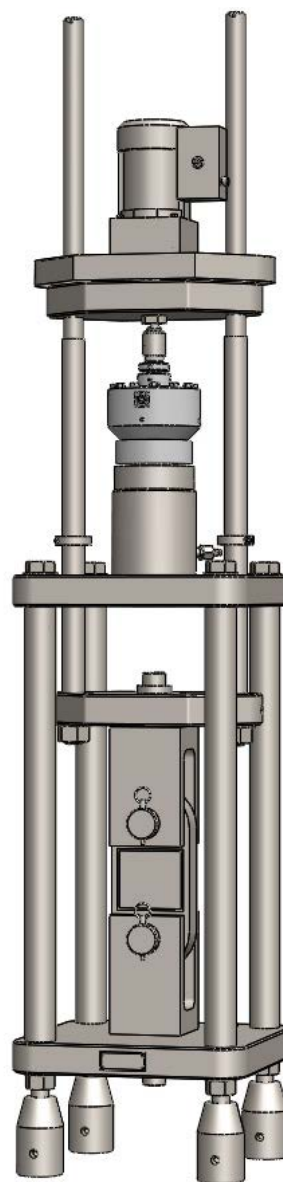


Figure 6: Typical Tension Setup

Technical Specifications

- Machine consists of three major parts: stationary frame, movable frame or yoke, and hydraulic jack
- Available in capacities from 10,000 to 2,250,000 lbf (50 to 10 000 kN)
- Two height options (01 and 02) available for smaller capacity machines (10,000 to 100,000 lbf; 50 to 500 kN)
- Calibration is in accordance with ASTM E74, ISO 376 and other internationally recognized force standards
- Calibrates a variety of difference force instruments such as load cells (general purpose, button, washer, universal, low capacity, multi-axis, miniature, S-beam, strain gage), force gauges (general purpose, digital, hand-held), proving rings, force transducers, dynamometers, crane scales, load links, and more
- Machines under 200,000 lbf (1 000 kN) capacity are supplied with a ball seat adapter
- A variety of reference standards are available to achieve the desired accuracy, quoted separately

Mechanical	
Capacities	10,000 to 2,250,000 lbf (50 to 10 000 kN) ¹
Calibration Mode	Both compression and tension
Maximum Misalignment	1/16th in. (1.6mm) over max yoke length
Unit Under Test Area	Adjustable (see dimensions)
Maximum Jack Stroke	1.0 in. (25.4 mm)
Maximum Hydraulic Pressure	5,000 psi (34 473.79 kPa)
Yoke Adjustment Speed	Approx. 2 in/min. (50.8 mm/min.)

Standard Power Requirements		
lbf Capacities	kN Capacities	Power
10,000 - 600,000	50 - 3 000	115 or 220 VAC, single phase
1,000,000	5 000	230 or 460 VAC, three phase

¹ Contact Sales for more information on capacities above 1,000,00 lbf (5 000 kN)

Table 1: UCM Specifications

Don't see what you need? Not a problem.

We make custom machines with features and dimensions to meet your requirements.



Technical Specifications

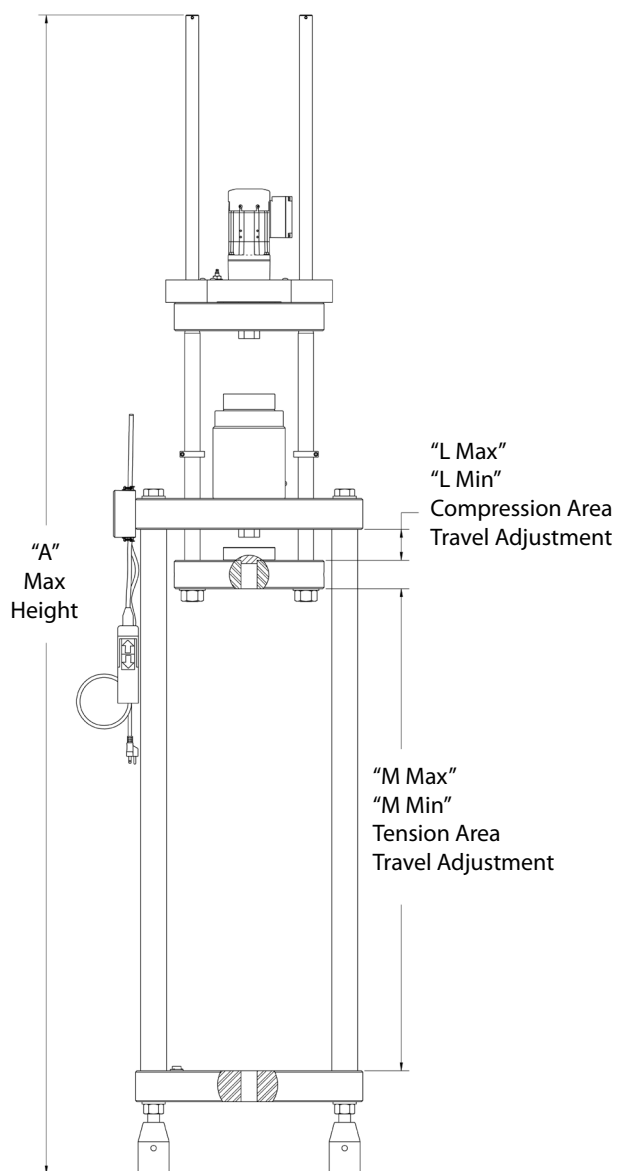


Figure 7: UCM Dimensions



Technical Specifications

Capacity required (lbf)	Order code	Max capacity (lbf)	A	L Max ¹	L Min ¹	M Max ¹	M Min ¹
10,000	UCM-10K STD	11,500	TBD	TBD	TBD	TBD	TBD
30,000	UCM-30K STD	30,000	96.0	22.0	3.0	43.5	24.5
60,000	UCM-60K STD	60,000	105.0	22.5	3.0	46.0	26.5
100,000	UCM-100K STD	112,500	112.5	24.0	3.0	46.5	25.5
200,000	UCM-200K STD	225,000	120.0	28.5	7.0	36.5	14.5
300,000	UCM-300K STD	338,000	132.0	29.5	8.0	41.5	19.5
500,000	UCM-500K STD	675,000	158.0	34.5	10.0	50.5	26.0
600,000	UCM-600K STD	675,000	158.0	34.5	10.0	50.5	26.0
1,000,000	UCM-1000K STD	1,125,000	192.5	40.0	11.0	54.0	25.0

Table 2: UCM lbf Dimensions (inches)

Capacity required (kN)	Order code	Max capacity (kN)	A	L Max ¹	L Min ¹	M Max ¹	M Min ¹
50	UCM-50 kN STD	50	TBD	TBD	TBD	TBD	TBD
100	UCM-100 kN STD	133	2 438	559	76	1 105	622
250	UCM-250 kN STD	266	2 667	572	76	1 168	673
500	UCM-500 kN STD	500	2 858	610	76	1 181	648
1 000	UCM-1000 kN STD	1 000	3 048	724	178	927	368
1 500	UCM-1500 kN STD	1 500	3 353	749	203	1 054	495
3 000	UCM-3000 kN STD	3 000	4 013	876	254	1 283	660
5 000	UCM-5000 kN STD	5 000	4 013	876	254	1 283	660

Table 3: UCM kN Dimensions (mm)

¹ Referenced dimensions are configured with the use of Morehouse load cells as the standards.

Options for Easy Setup and Operation

Morehouse has created multiple options for the UCM to meet specific customer application requirements. The options below have been designed to provide proper loading, alignment, and measurement accuracy. For more information on these options please refer to [UCM Adapters and Accessories PG-5202](#).

Size Options

- Standard size 01 model: These models are designed wide and tall to accommodate tension calibration of large instruments.
- Compact size 02 model: These models are a compact design for smaller load cell applications.

Reference Standard with Indicator

A reference standard such as a load cell or proving ring is needed to measure the applied force of the unit under test. It is not supplied with the machine and is necessary for the machine to function. The reference standard must be a secondary force standard that is calibrated to accurate standards such as primary deadweight standards to minimize measurement errors, maintain a better than 4:1 test uncertainty ratio, and lower measurement uncertainty of future calibrations. Therefore, Morehouse recommends a high accuracy load cell with a high accuracy, stable indicator for most users.

- For up to 100,000 lbf (500 kN) capacities, a Morehouse Ultra-Precision or Precision Shear-Web load cell is recommended.
- For capacities 200,000 lbf (1 100 kN) and higher, a Morehouse High-Capacity Multi-Column load cell is recommended.
- The Morehouse PSD, HADI, and 4215 indicators can be paired with the reference standard to read the output and determine applied forces.

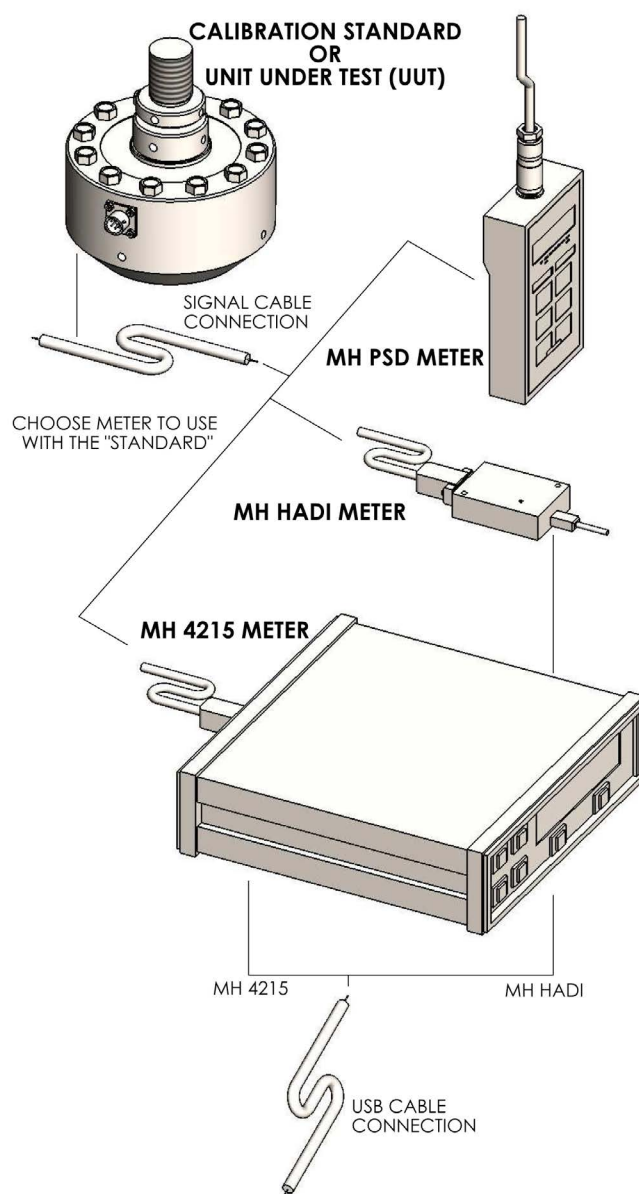


Figure 8: Morehouse Load Cell with Indicator

Options for Easy Setup and Operation

Reference Standard Mounting Kit

Morehouse has designed mounting kits with special adapters that align the reference standard at the center of the jack ram or in the lower yoke platen to ensure axial alignment of the reference standard or the unit under test. This provides uniform stress over the cross-section of the force instrument, improving accuracy and decreasing errors. The mounting kit is offered in two configurations for different capacities.

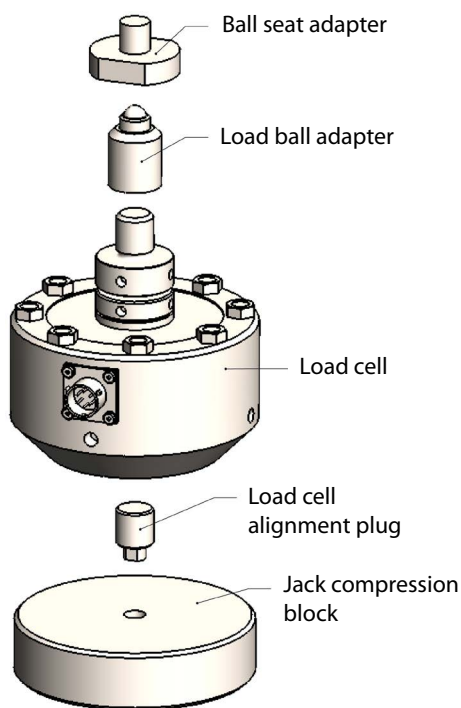


Figure 9: Mounting Kit for Capacities up to 100,000 lbf (500 kN)

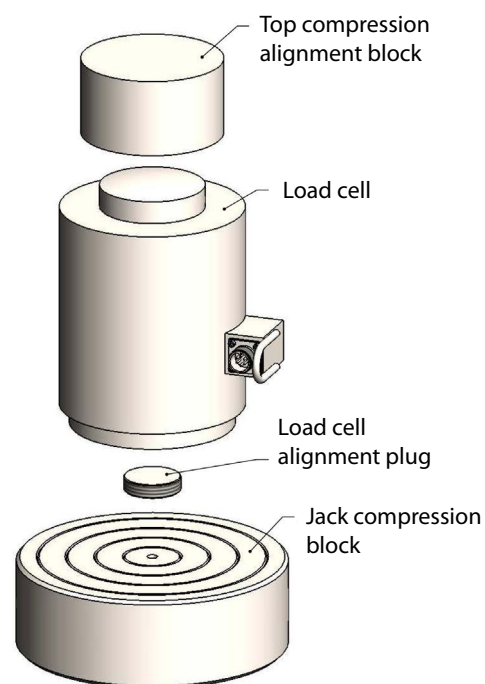


Figure 10: Mounting Kit for Capacities 200,000 lbf (1 100 kN) and Higher

Options for Easy Setup and Operation

Clevis Assemblies

A set of two clevises and several pins will accurately calibrate numerous instruments such as dynamometers, crane scales, tension links and other weighing devices. This versatile solution eliminates the need for acquiring several clevises and yields significant savings in equipment cost.



Figure 11: Adaptable Clevis Value Kit

Compression and Tension Adapters

Our hundreds of compression and tension adapters are designed to ensure axial force application, prevent misalignment, simplify setups, prevent damage to the machine, and minimize measurement errors. Common options include:

- Quick change tension adapters
- High-capacity tension adapters
- Compression load pad system
- Soft steel load pad and hardened steel bearing plates
- Load ball adapters for UCM and for load cells
- Load cell ball clip adapters and load cell alignment plugs and adapter plate
- Proving ring adapter plate
- Spherical load buttons and alignment bearing block
- Load ball adapter for Universal Calibrating Machine and load cell ball adapter
- Ball retainer clips for Morehouse proving rings and load balls
- Morehouse proving ring alignment block
- Threaded alignment bearing block
- Proving ring alignment bushing
- Load cell locating plugs and load cell alignment adapter



Figure 12: Quick-Change Tension Adapters

Options for Easy Setup and Operation

Custom Multi-Axis Load Cell Adapters

To calibrate a multi-axis load cell, proper adapters must be designed to meet the configuration and capacity. Morehouse can design and manufacture a multi-axis load cell adapter to minimize off-center loading, lower crosstalk between channels to negligible amounts, and improve safety.

Hydraulic Pressure Systems

The UCM is powered by a hydraulic jack, which is activated by a hydraulic hand pump that does not need any source of electric power to operate. There are two options for other hydraulic pressure control systems:

- **Auxiliary screw pump:** This option is a secondary hydraulic pressure control system that provides better control of the calibration force in the UCM. It is added to the main power source and will accurately achieve targeted calibration forces.
- **Universal hydraulic pump (UHP):** The UHP is an electronically powered system that is an upgraded replacement to the hand pump. Morehouse recommends this upgrade for UCMs with capacities above 100,000 lbf (500 kN) because it provides a higher flow rate and power. The auxiliary screw pump is included with the universal hydraulic pump.

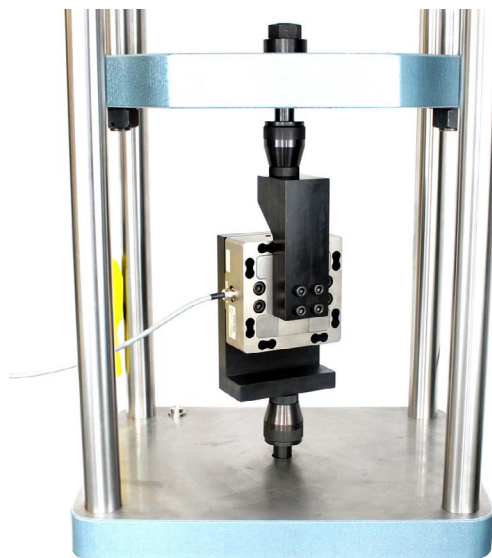


Figure 13: Multi-axis Adapter



Figure 14: Universal Hydraulic Pump with Auxiliary Screw Pump

Morehouse Universal Calibrating Machine ... Force Calibration Simplified!

The Morehouse Universal Calibrating Machine simplifies force calibration by reducing rework, errors from misalignment, and problematic setups. The machine ranks among the most versatile and cost-effective solutions to calibrate all types of force instruments. The operator can replicate how the force instruments are used in the field by using different setups for tension and compression, and proper adapters recommended by several standards, including ISO 376. The UCM will help you improve measurement accuracy and grow your business.

Force calibration can be difficult. We welcome the opportunity to answer your questions or concerns. Our technical experts are here to help.

Contact us:

(717) 843-0081

sales@mhforce.com

www.mhforce.com

Learn more:

[Universal Calibrating Machines versus Universal Testing Machines - These machines are different](#)
[Recommended Compression and Tension Adapters for Force Calibration](#)

