

## Product Guide

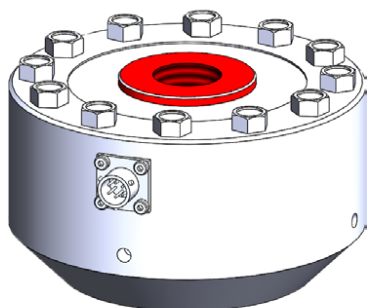
### Universal Calibrating Machine Adapters and Accessories



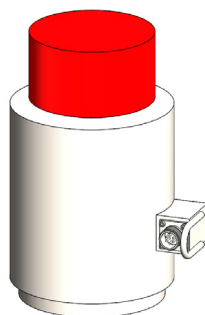
## Adapters Deliver Better Calibration Results

Morehouse has created multiple adapters and accessories for the Universal Calibrating Machine to meet specific customer application requirements. These have been designed to provide proper loading, alignment, and measurement accuracy.

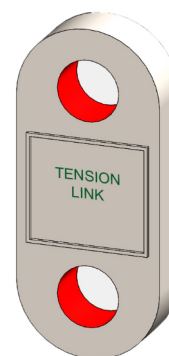
### Sources of Measurement Error



Incorrect loading condition



Varying hardness and flatness  
of top block adapters



Improper pin size

The output of a force-measuring device can be significantly impacted by adapters, which poses serious safety concerns and can impact measurement uncertainty. Risk considerations include:

- Lifespan of old adapters
- Eccentric force and side loading
- Calibration setups that do not replicate the application
- Permanent material deformation
- Not using ISO 376 recommendations for tension loading
- Introducing unwanted bending or torsion

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

Force calibration can be complex because the mechanical interactions of not using the proper adapters can produce significant errors. We welcome the opportunity to help reduce these errors by answering your questions or concerns.

For more information, read:

[Proper Adapters to Reduce Force Measurement Error](#)

## Why Adapters Matter...

A misalignment as small as 1/8 in (3.2 mm) has pushed error on a 10 000 lbf S-beam load cell to 0.75 % of full scale, nearly nine times its certified uncertainty. The right alignment adapter can reverse that, often by a factor of 2–10. The three readings below cover choosing the correct adapter, keeping the load line pure, and building a force setup that holds up under calibration.

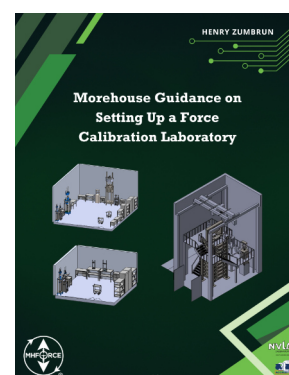
## Recommended Readings



[Morehouse eBook](#)



[Why Do Force Calibration Adapters Matter?](#)



[Setting Up a Force Calibration Laboratory](#)

A main goal at Morehouse is to change how people think about force and torque calibration, and that starts with better information. We built our reputation on measurement uncertainties 10 to 50 times lower than the industry standard, and adapters are one of the reasons why.

For more on force calibration, visit the [Morehouse blog](#) or our [documentation tools page](#), where we publish the setups, mistakes, and fixes we see in the lab every day.

If you'd like content delivered straight to your inbox, [sign up for the Metrology Mastery Series](#), our free weekly training on force and torque measurement. It's the same material we use to train new calibration technicians, distilled into a few minutes a week.

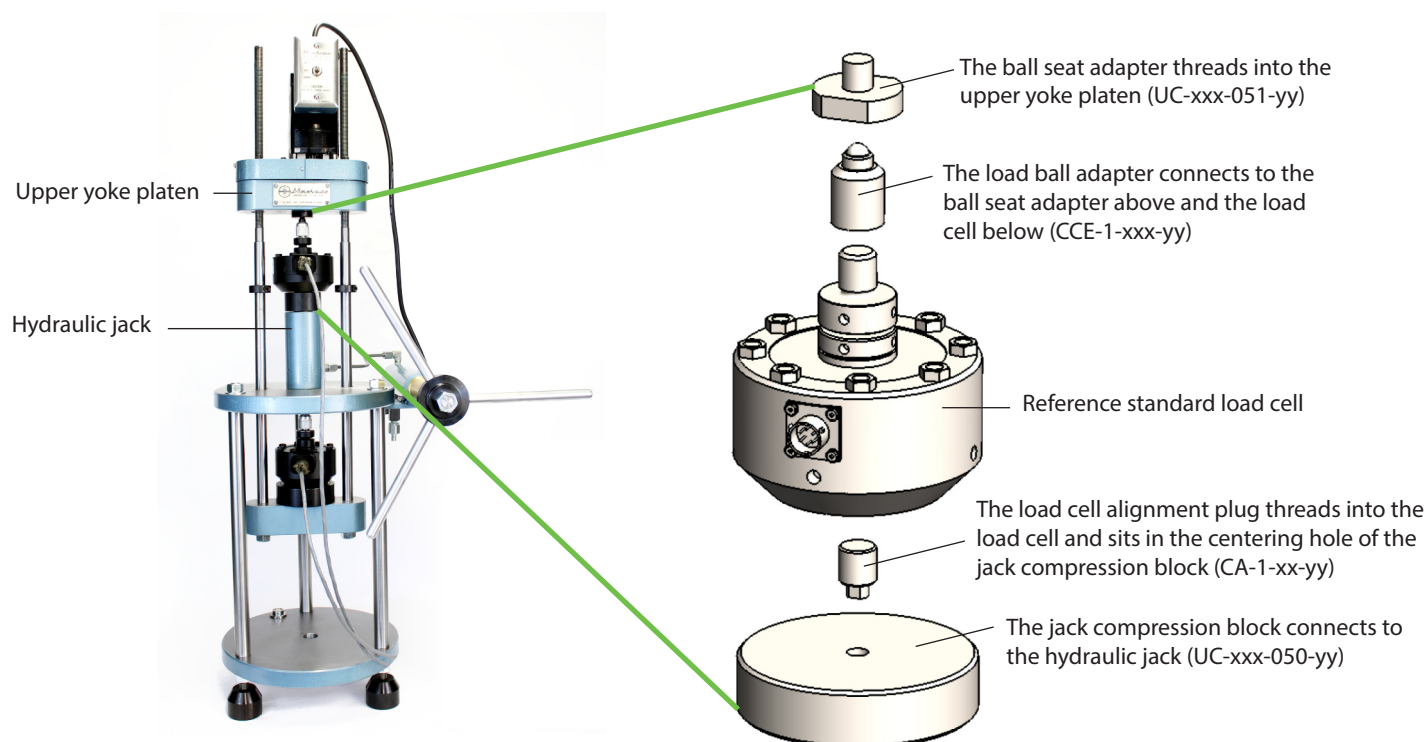
Rated capacities are shown in lbf or kN according to regional convention; the machine's maximum capacity may exceed the stated rating. For example, a machine rated 100 000 lbf in the US has a maximum capacity of 112 500 lbf. More information on UCM capacities. [More information on capacities.](#)

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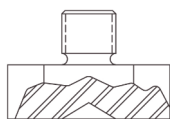
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## Reference Standard Mounting Example

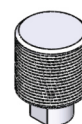
Morehouse has designed mounting kits with special adapters that align the reference standard on the center of the hydraulic jack ram to ensure balanced placement of the moveable yoke on the reference standard. This mounting kit provides uniform stress over the cross-section of the force instrument, improving accuracy and measurement uncertainty. The mounting kit is offered in two configurations for different capacities.



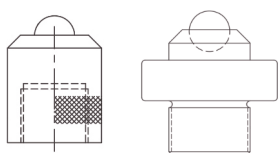
### Mounting Kit for Capacities up to 150 000 lbf (700 kN)



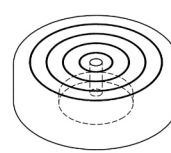
**Ball seat adapter**



**Load cell alignment plug**



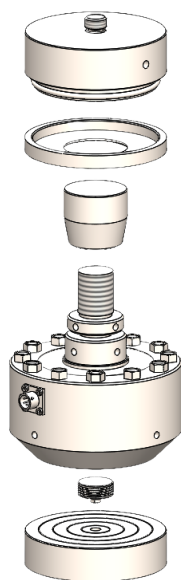
**Load ball adapter**



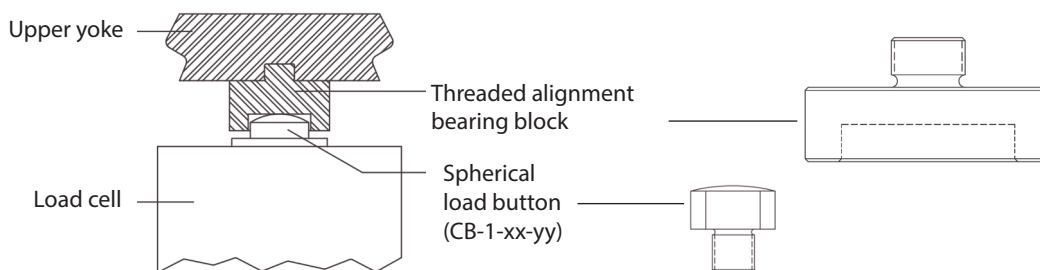
**Jack Compression Block**

## Reference Standard Mounting Example (cont.)

Either a load ball or ISO adapter may be used to align the reference standard. When a load ball is not used, a spherical load button and threaded alignment bearing block are used to align the reference standard. If the load cell will be loaded through its body, then the spherical load button is fully screwed into the load cell so its shoulder is tight against the load cell body. If the load cell will be loaded through its threads, then the spherical load button is loosened one full turn so it does not touch the load cell body.



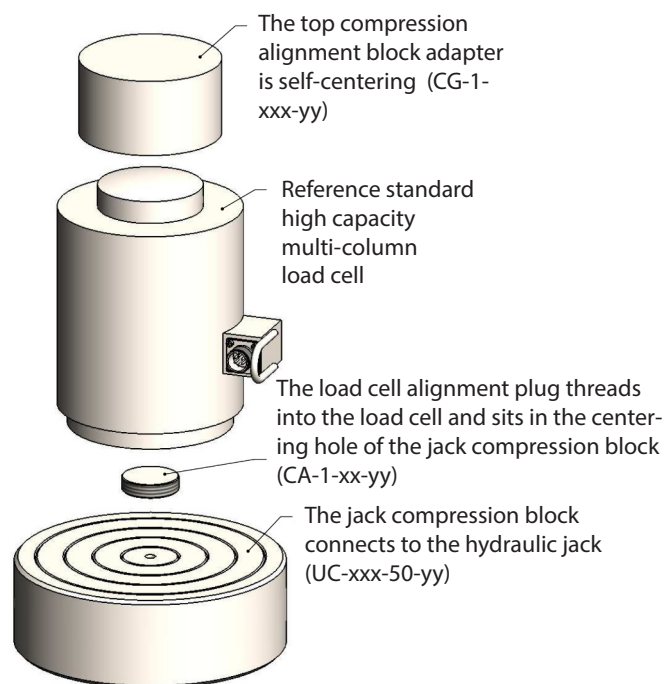
**ISO 376 Setup**



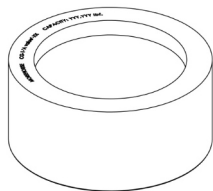
**Alternative Setup with Load Button**

## Reference Standard Mounting Example (cont.)

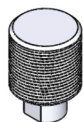
For most capacities 200 000 lbf (1000 kN) and higher if the load cell will be loaded through its body, then the top block compression adapter and load cell alignment plug are screwed into the load cell so the shoulders are tight against the load cell body. If the load cell will be loaded through its threads, then the top block compression adapter and load cell alignment plug are loosened one full turn so they do not touch the load cell body.



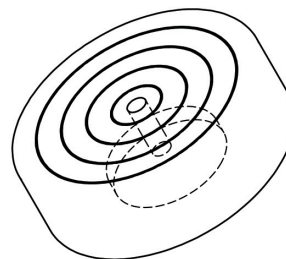
### Mounting Kit for Capacities 200 000 lbf (1000 kN) and Higher



**Top compression alignment block**



**Load cell alignment plug**

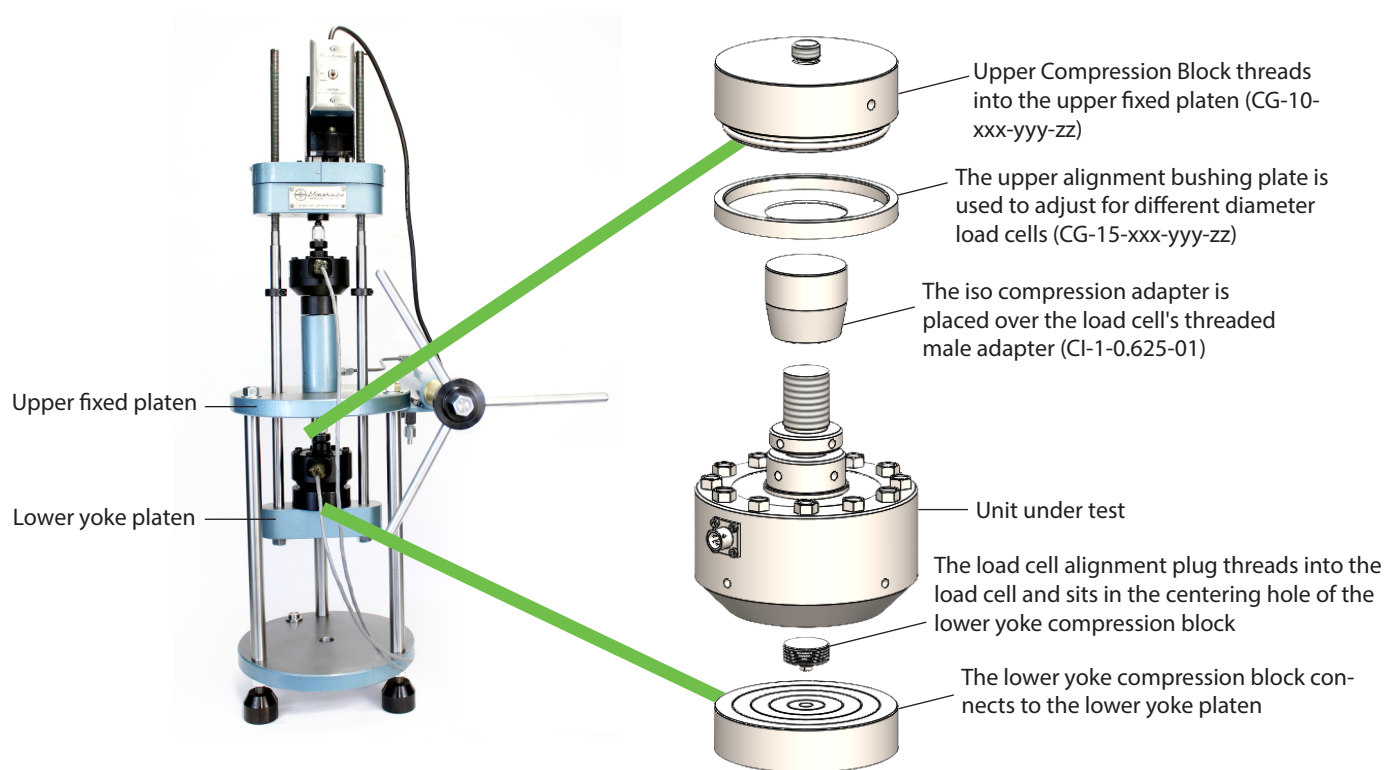


**Jack compression block**

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

## ISO 376 Compression Adapter Setup

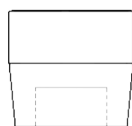
Centering a load cell is critical to obtaining the correct line of force and reducing calibration errors. Misalignment errors can be a magnitude of ten times what is expected. Morehouse has designed special adapters that align the unit under test to the machine and load line applied to the reference standard. This provides uniform stress over the cross-section of the force instrument, improving accuracy and decreasing errors. The ISO 376 compression adapter system is a commonly used system.



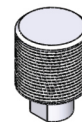
### ISO 376 Compression Adapter System



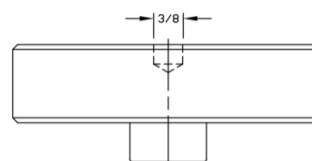
**Upper Compression Block and Upper Alignment Bushing Plate**



**ISO Compression Adapter**



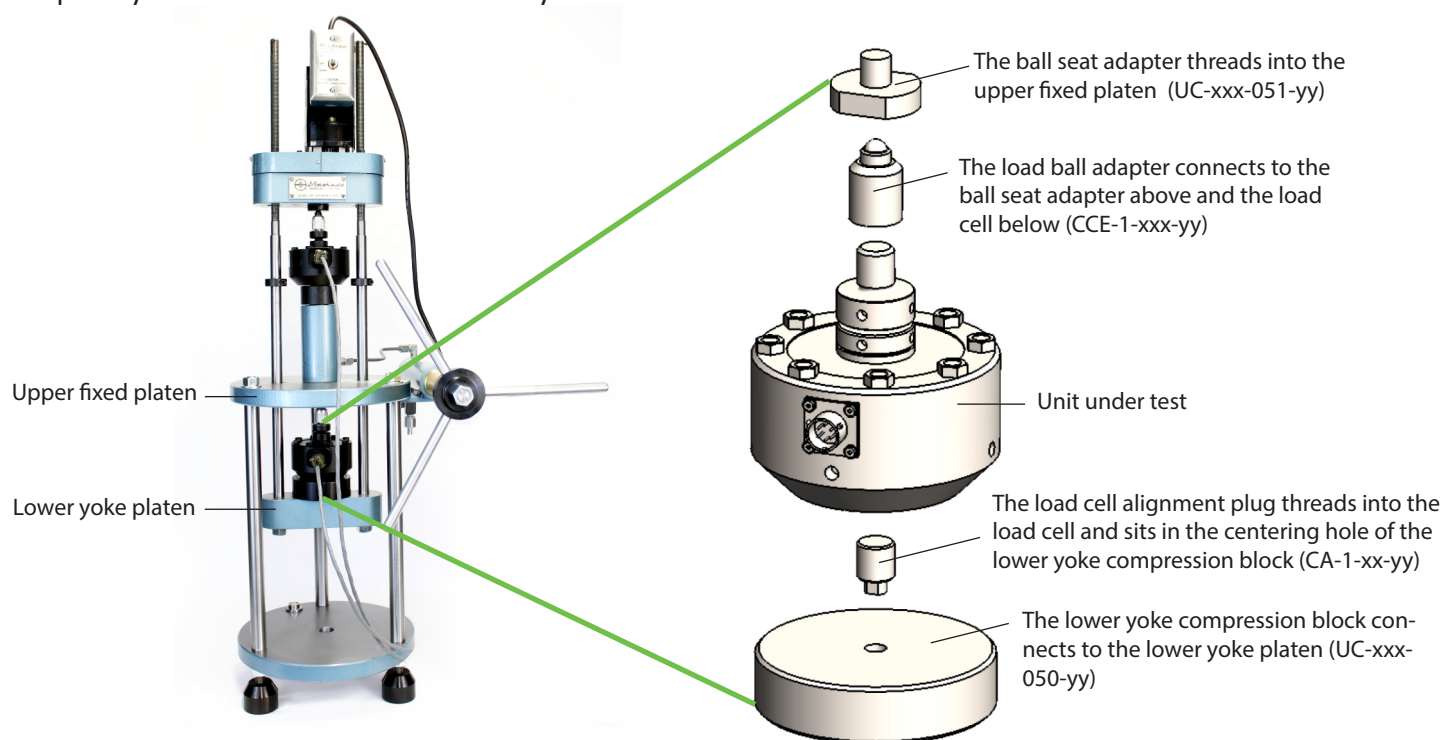
**Load cell alignment plug**



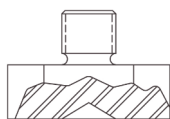
**Lower Yoke Compression Block**

## Compression Adapter Alternate Setup

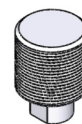
Morehouse recommends an ISO 376 setup, though this setup can work as well. Centering a load cell is critical to obtaining the correct line of force and reducing calibration errors. Misalignment errors can be a magnitude of ten times or more of what is expected. Morehouse has designed special adapters that align the unit under test to the machine and load line applied to the reference standard. This provides uniform stress over the cross-section of the force instrument, improving accuracy and decreasing errors. The load ball compression adapter system is one of the most used systems.



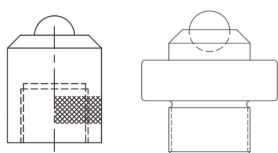
### Load Ball Compression Adapter System



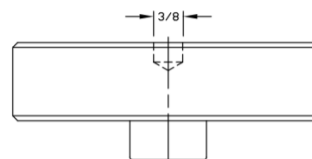
**Ball seat adapter**



**Load cell alignment plug**



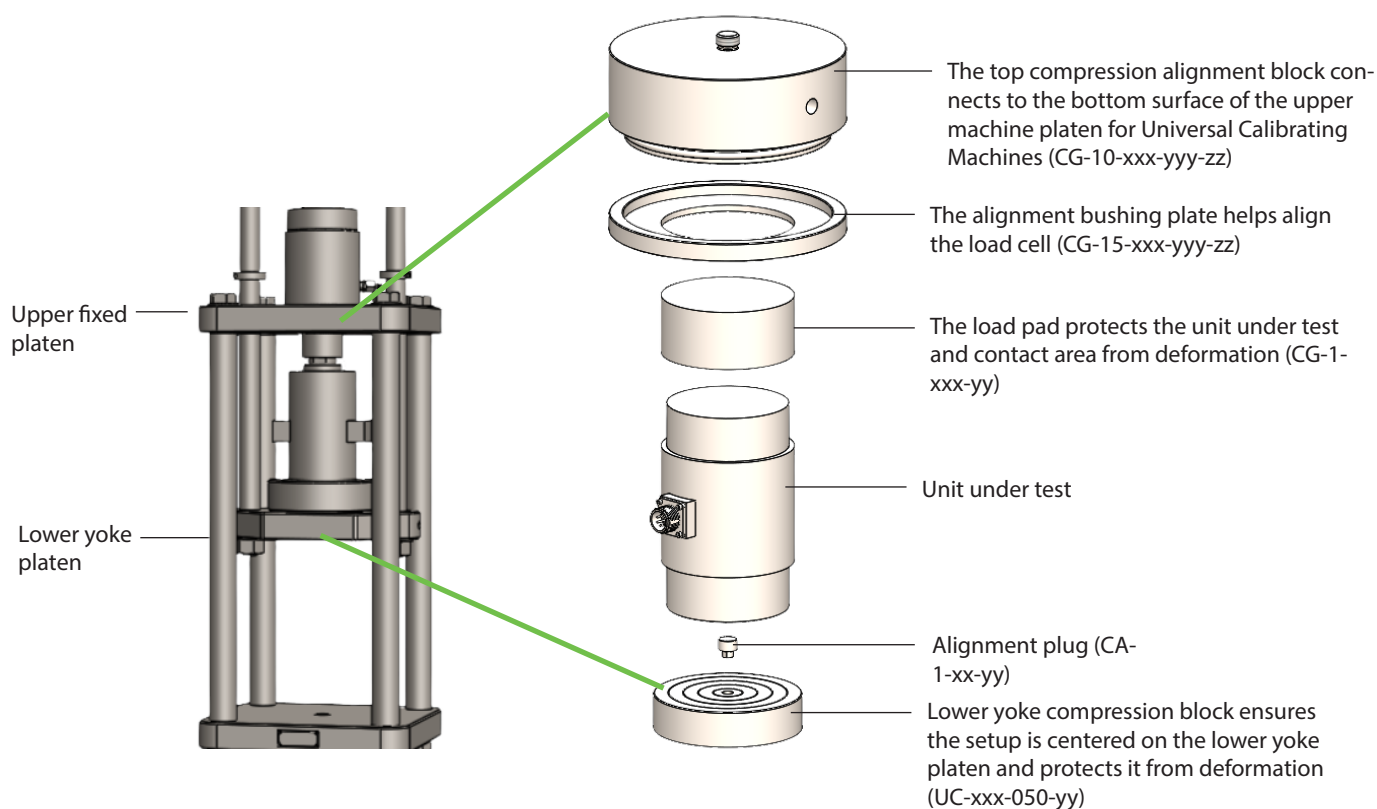
**Load ball adapter**



**Lower Yoke Compression Block**

## Compression Adapter System Large Capacity

The compression load pad system is used with higher-capacity load cells >150 000 lbf, which are typically made with a spherical top section.

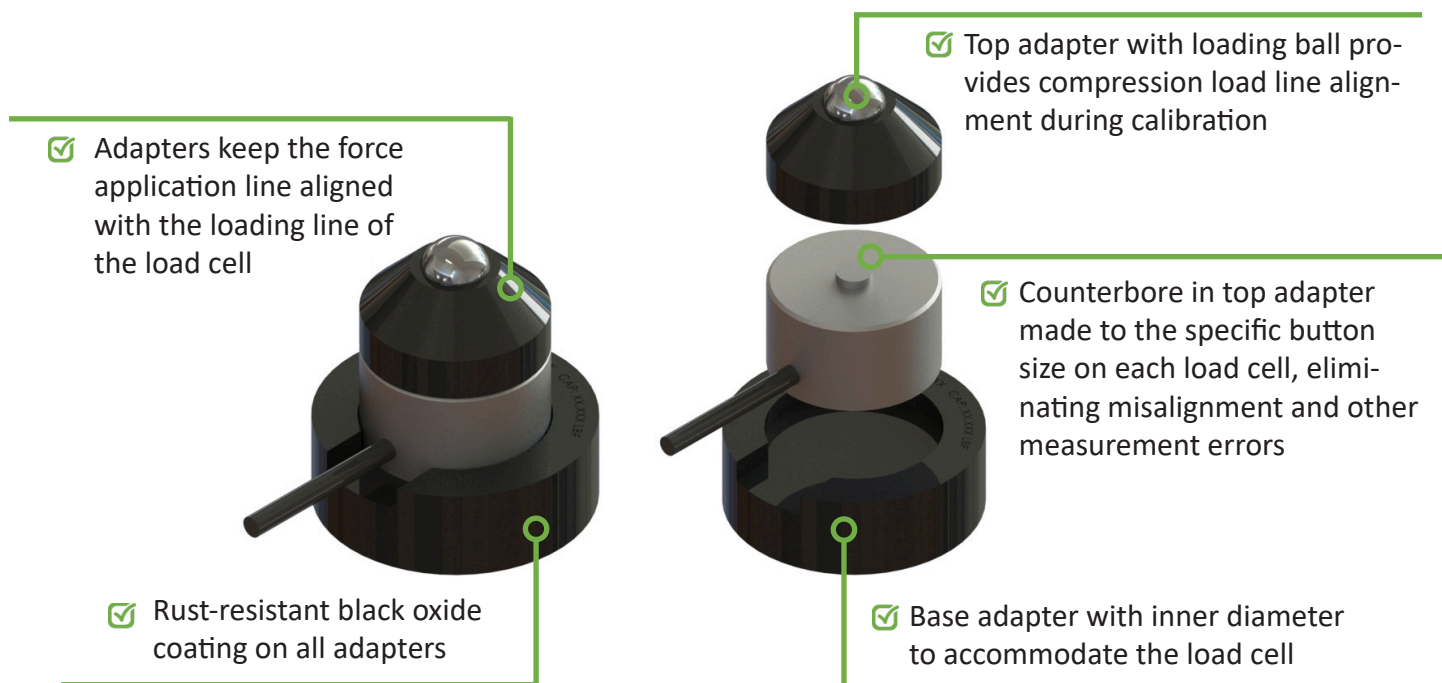


### Compression Load Pad System

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

## Miniature Button Load Cell Adapters

Button load cells are sensitive to rotation and any misalignment will produce large errors that impact measurement uncertainty. Our button load cell adapters improve the alignment and stability of the setup during calibration. They provide more accurate and repeatable calibration results, save on calibration time, and facilitate easy setups.



Each set includes a base adapter, top adapter, and an optional alignment plug for the base adapter. The optional alignment plug can also be used with the base adapter to keep the setup aligned with the calibrating machine.

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

## Miniature Washer Load Cell Adapters

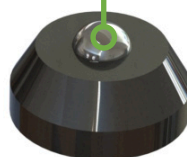
Washer load cells are sensitive to rotation and any misalignment will produce large errors that impact measurement uncertainty. Our washer load cell adapters improve the alignment and stability of the setup during calibration. They provide more accurate and repeatable calibration results, save on calibration time, and facilitate easy setups.

✓ Adapters keep the force application line aligned with the loading line of the load cell

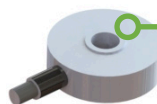
✓ Rust-resistant black oxide coating on all adapters



✓ Top adapter with loading ball provides compression load line alignment during calibration



✓ The top and base adapters are designed to the inner and outer diameter of each washer load cell, eliminating misalignment and other measurement errors



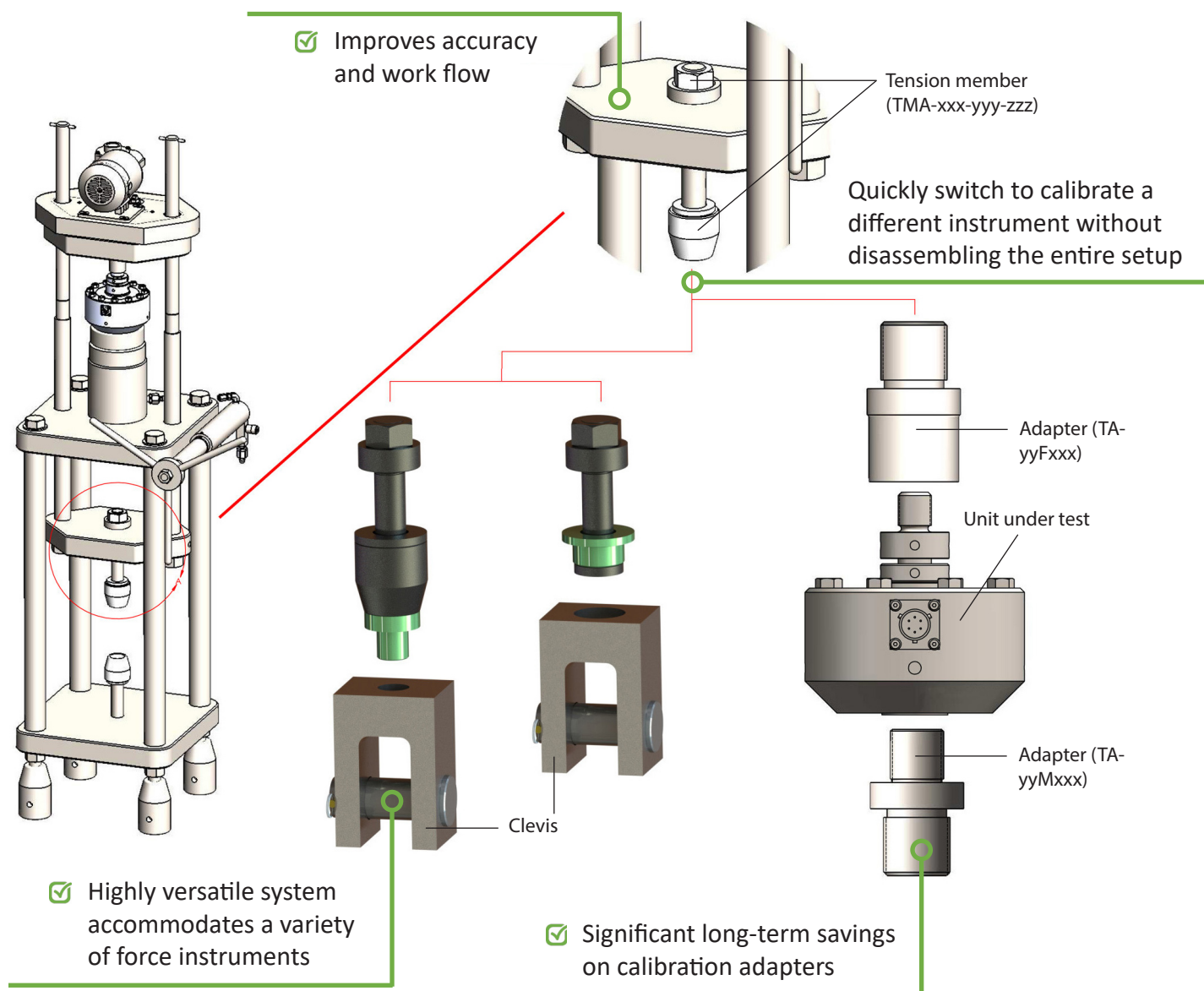
✓ Base adapter with inner diameter to accommodate the load cell

Each set includes a base adapter, top adapter, and an optional alignment plug for the base adapter. The optional alignment plug can also be used with the base adapter to keep the setup aligned with the calibrating machine.

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

## Tension Quick Change Setup

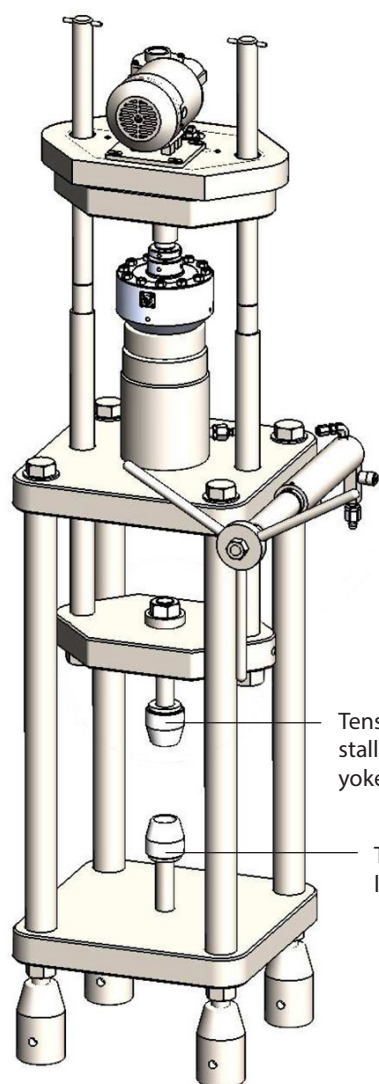
The quick-change tension adapter system is designed to perform tension calibration on a variety of force instruments. It reduces changeover and cycle time, improves measurement repeatability, and yields significant savings. The system eliminates factors that can be significant contributors to measurement uncertainty.



### Force Calibration Setup with Quick Change Tension Members

## Quick Change Tension Members

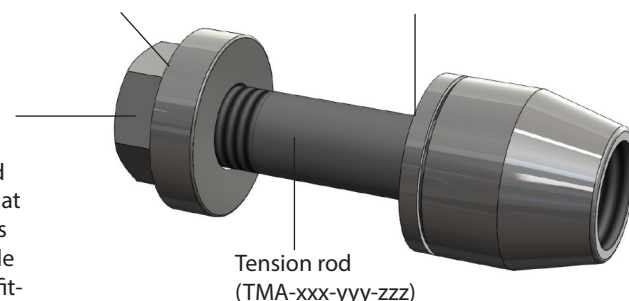
For machines with 112 500 lbf (500 kN) capacity and less, to calibrate an instrument in tension two tension members must be installed.



Tension member is designed according to ISO 376 Annex A.4.1 "Loading fittings should be designed in such a way that the line of force application is not distorted. As a rule, tensile force transducers should be fitted with two ball nuts, two ball cups."

Contact point between the spherical nut and alignment bushing acts as a joint, which centers itself and aligns the tension rod with the force line

Contact point between the retaining ring and tension rod aligns the instrument under test with the tension rod



Tension rod  
(TMA-xxx-yyy-zzz)

### Tension Member

✓ Rust-resistant black oxide coating



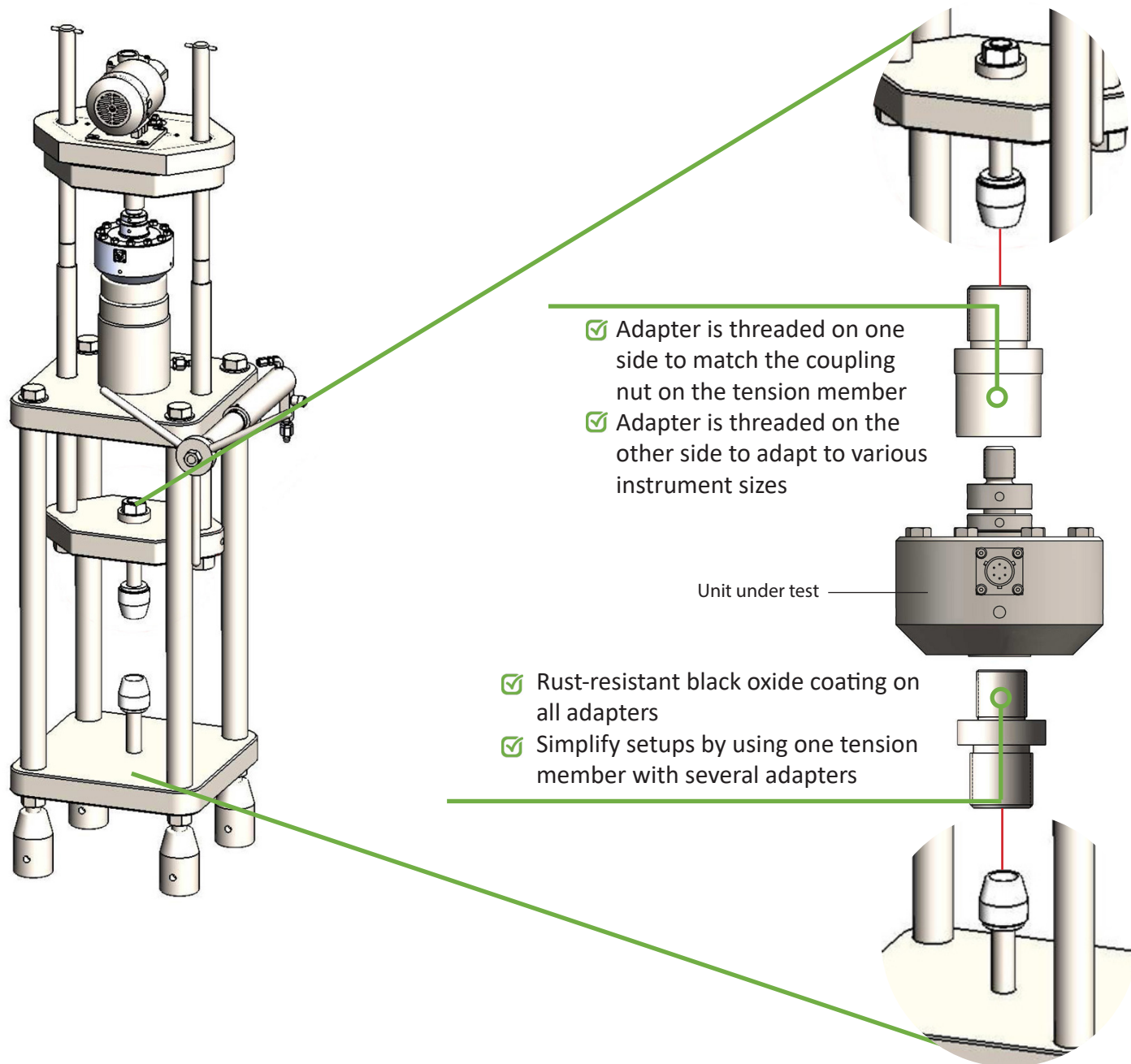
- ✓ Common thread allows the tension thread size to be changed in less than 1 minute
- ✓ Eliminates the need to reach under the machine to change tension setups

### Two Tension Members for UCMs 112 500 lbf (500 kN) capacity and less



## Quick Change Tension Member Adapters

Intermediate adapters are threaded onto the tension members to mount multiple types of instruments for tension calibration.



**Tension Members with Adapters for UCMs 100 000 lbf (500 kN) capacity and less**

## Quick Change Tension Adapter Value Kit

The quick-change tension adapter value kit includes two tension members and common adapter sizes to calibrate most force instruments available on the market. Kits are available for machines up to 100 000 lbf (500 kN) capacity.

These adapters were developed with Lean principles in mind. They can be stored near the machine so a technician can easily make the appropriate tension setups without wasting time hunting for adapters.

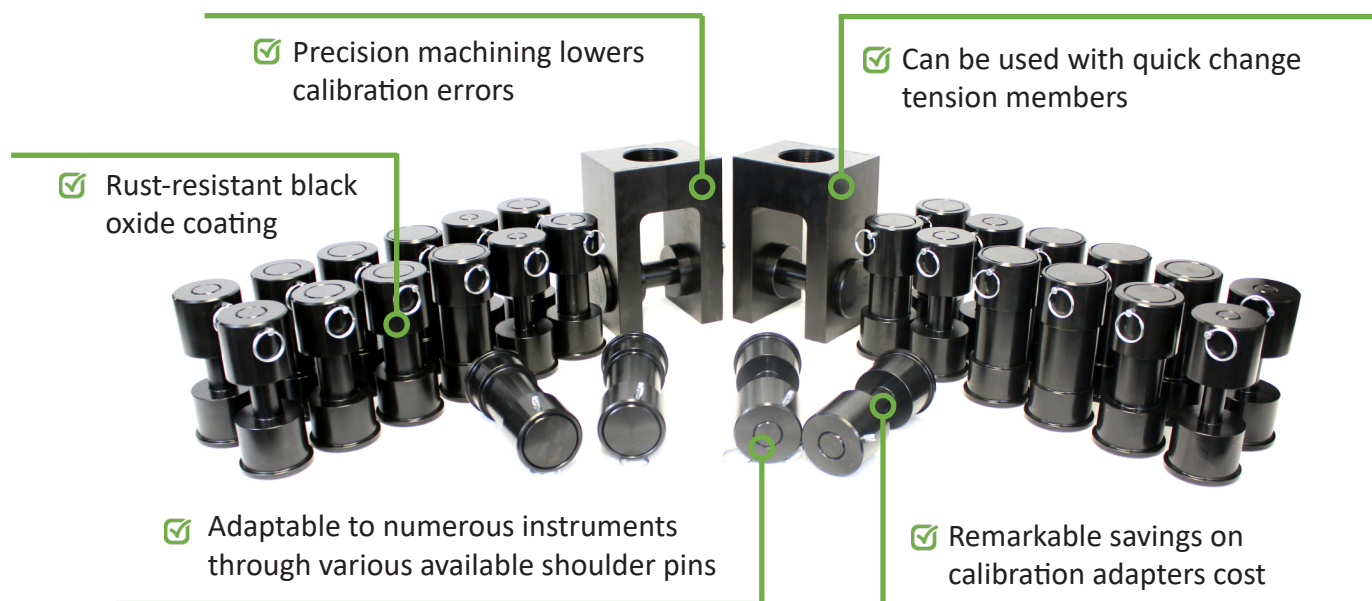


### Kit for UCMs 100 000 lbf (500 kN) capacity and less

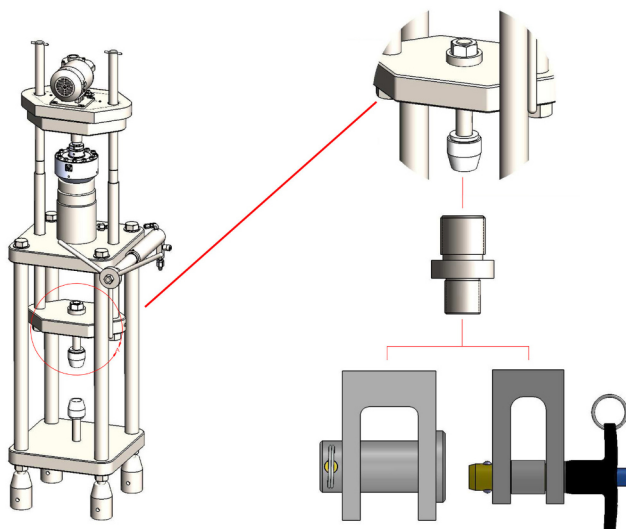
Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

## Adaptable Clevis Value Kit (U.S. Patent No. 11,078,052)

A set of two clevises and several pins is a versatile solution that eliminates the need for acquiring several clevises and yields significant savings in equipment costs. Finding the right pin size can be challenging, and using the wrong pin size can significantly increase bias. Additional pin sizes can be ordered for new instruments.



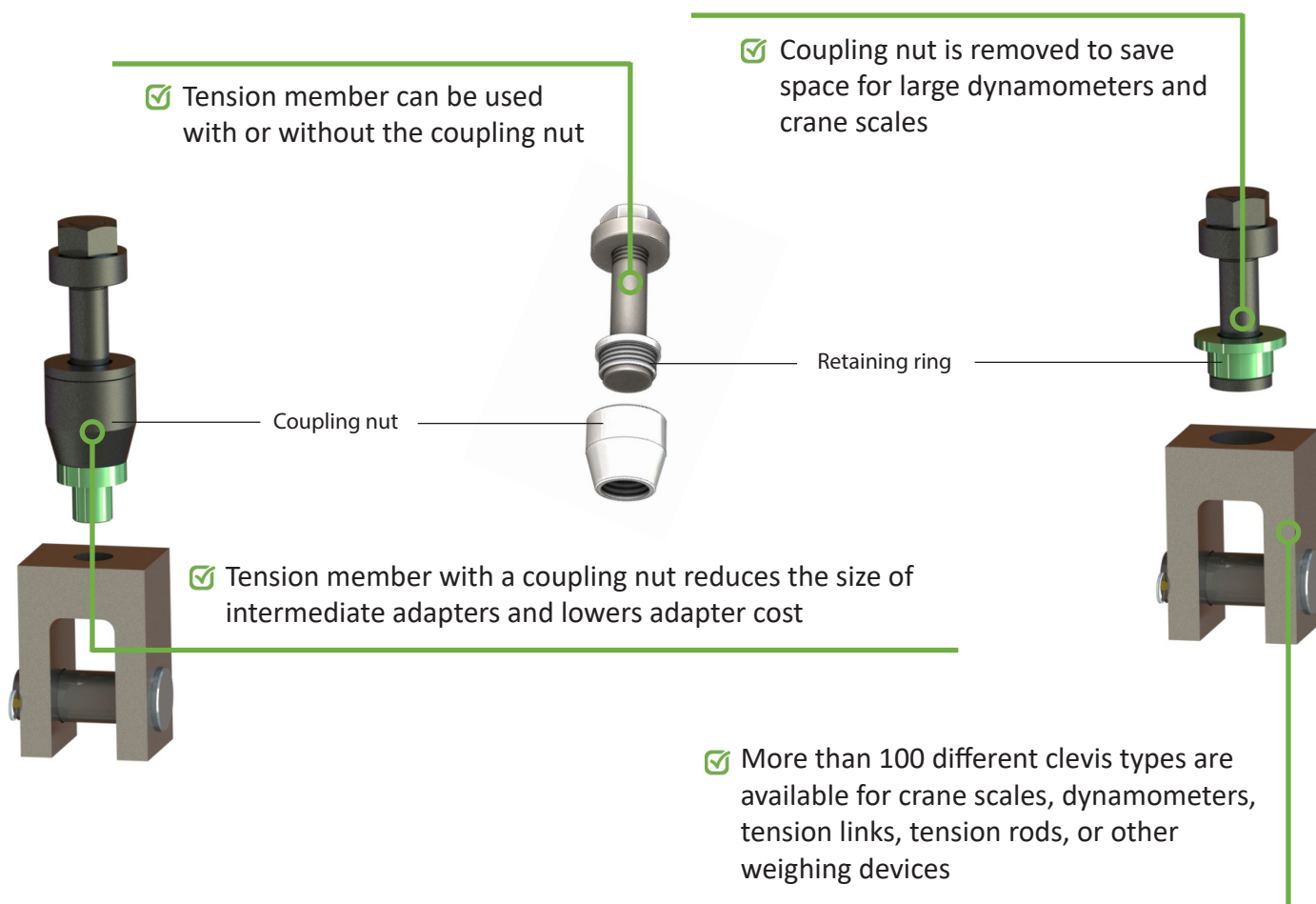
### Kit with Two Clevises and Several Pins



### UCM with Tension Member, Adapter, and Clevises

## Clevis Diagram

A clevis is often used to calibrate dynamometers, load links, tension rods, crane scales, or other weighing devices. The clevis is mounted to the tension member through a common thread on the coupling nut or retaining ring.



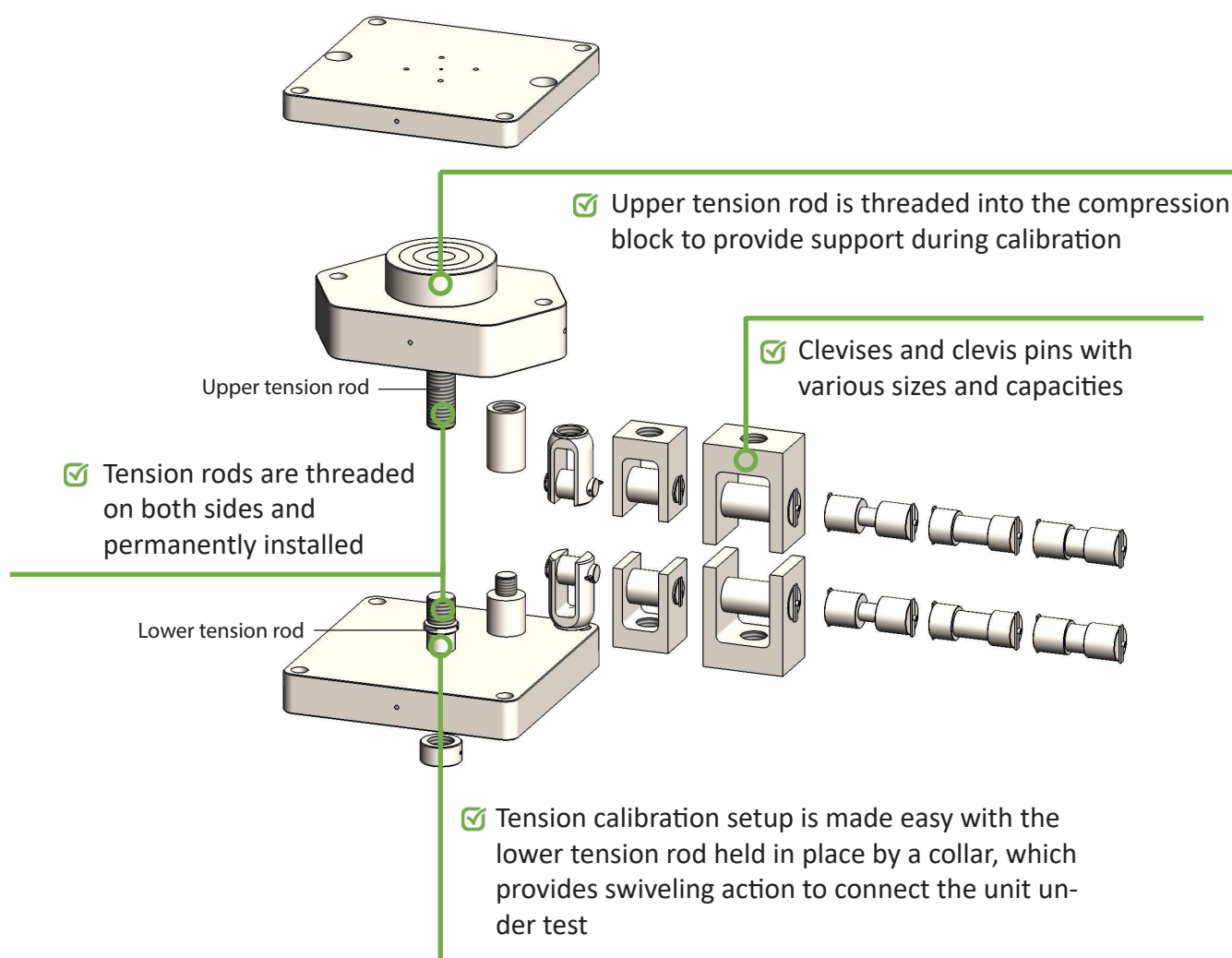
### Clevis with Tension Member

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.



## High Capacity Tension Adapters

For machines with 200 000 lbf (1000 kN) capacity and higher, to calibrate an instrument in tension, high-capacity tension adapters must be installed.



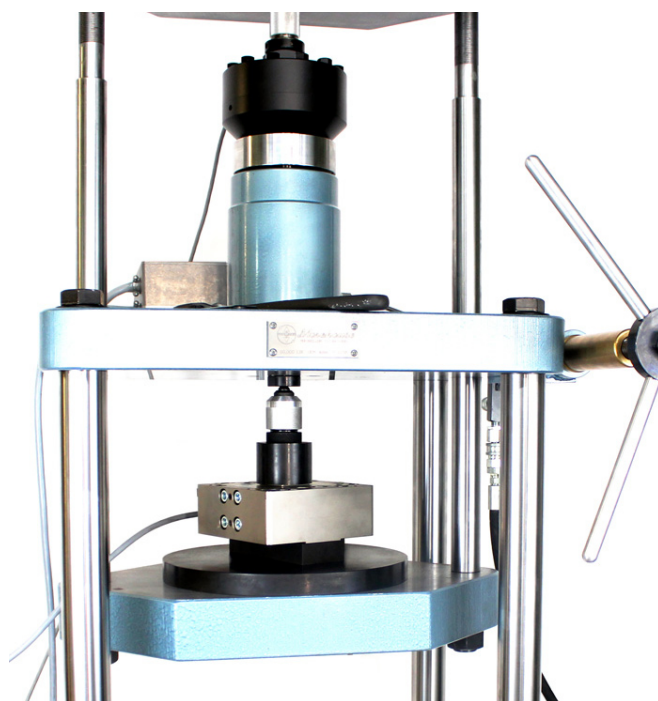
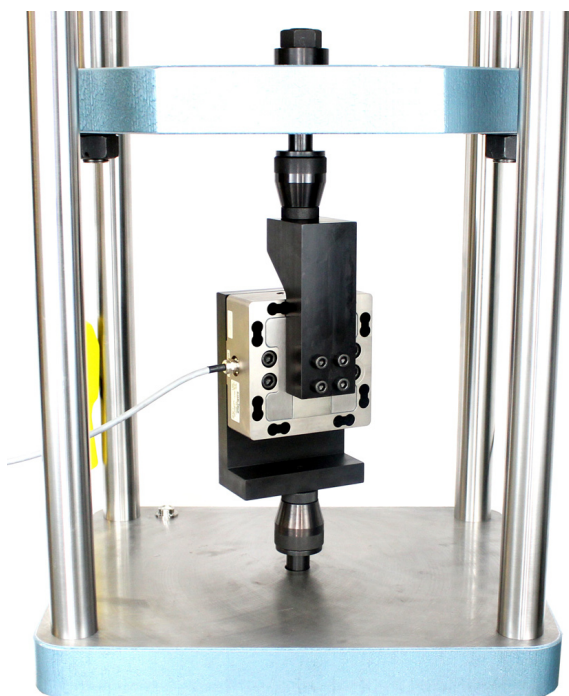
### Tension setup with High Capacity Tension Adapters for UCMs 200 000 lbf (1000 kN) capacity and higher

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

## Custom Multi-Axis Load Cell Adapters

To calibrate a multi-axis load cell in a universal calibrating machine, 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, isolate the system from erroneous lateral forces, lower crosstalk between channels to negligible amounts, and improve safety.

[Contact Morehouse](#) for a consultation to ensure the right type and size adapters are manufactured for each specific requirement. Morehouse has provided calibration adapters for several multi-axis load cell models available on the market. These adapters have a proven record of good performance and lowering the crosstalk between channels to negligible amounts.



**Adapter Design for 3-Axis Load Cell with Calibration of X and Y Axes (left) and Z Axis (right)**

Most adapters shown in this document can be used with other machines. Please [contact us](#) to find out if these can work for your application.

## Hydraulic Hand Pump

The Universal Calibrating Machine is actuated by hydraulic pressure. A hydraulic power system is required to supply, maintain, and adjust the hydraulic pressure in the hydraulic jack, which accommodates various calibration loads. The standard system for generating the hydraulic pressure is the hydraulic hand pump, which does not need any source of electric power to operate.

The hydraulic hand pump has two speeds of operation to control the applied force to the force standard and unit under test.

1 - Handle for coarse adjustment of pressure. The pump advances the ram quickly until a pressure of about 750 psi is reached.

2 - Vernier screw piston for fine adjustment of pressure. The pump advances the ram slowly until the desired load is achieved.

Hydraulic jack

Quick-connect valve  
The hand pump easily disconnects from the UCM for maintenance or other operations on the machine.

Hydraulic jack

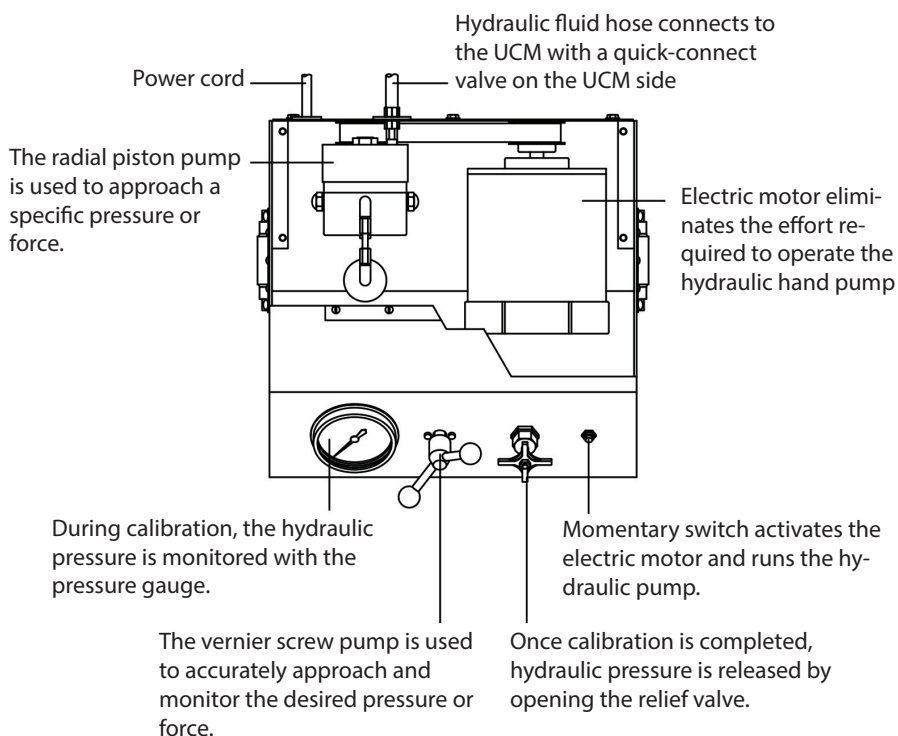
Hydraulic hand pump

**Hydraulic hand pump**

**The UCM is pictured with legacy hydraulic hand pump**

## Universal Hydraulic Pump (UHP)

An upgraded replacement to the hydraulic hand pump, the universal hydraulic pump (UHP) is an electrically powered system that provides a higher flow rate and power to the Universal Calibrating Machine. With a UHP, the operator can easily control the forces and speed up the calibration. For Universal Calibrating Machines with capacities of 100 000 lbf (500 kN) and higher, Morehouse recommends the automated force calibration system upgrade or the universal hydraulic pump. It is available for use with machine capacities of 60 000 lbf (250 kN) and higher. The operator uses the momentary switch in front of the unit to activate the electric motor and run the hydraulic pump.



## Universal Hydraulic Pump

**Upgrading to the Automated Force Calibration System Replaces the Need for the Universal Hydraulic Pump**

## Auxiliary Screw Pump

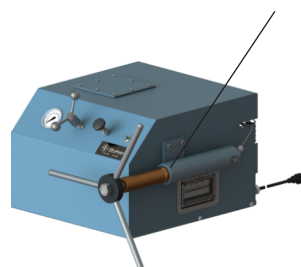
The auxiliary screw pump is a manually powered system specifically designed to adjust and maintain the Universal Calibrating Machine's calibration force at a very fine level. It gives the operator exceptional control over the calibration force. It enables accurate calibration at any desired force, improving the repeatability of the measurement, thus decreasing the expanded measurement uncertainty, resulting in less rework and the ability to "Pass" more instrumentation.

The auxiliary screw pump is included with the universal hydraulic pump and is mounted on the body for easy handling. It is an optional add-on with the hydraulic hand pump and is installed on the machine's frame directly.



**Auxiliary Screw Pump used with a Hydraulic Hand Pump**

Mounted on the body of the universal hydraulic pump for easy handling



**Auxiliary Screw Pump used with a Universal Hydraulic Pump**

**Upgrading to the Automated Force Calibration System Replaces the Need for the Hydraulic Hand Pump, Auxiliary Screw Pump, and the Universal Hydraulic Pump.**

## Upgrade Kit for Momentary Pendant Switch

An upgrade kit is available to change a stationary toggle switch to a momentary pendant switch. [Contact Morehouse](#) to order an upgrade kit with instructions on wiring the new system.



Older models of the universal calibrating machine were manufactured with a stationary toggle switch for yoke adjustment. These switches were fixed on a part of the machine based on the size.

Upgrade

All new models of the universal calibrating machine with capacities of 60 000 lbf (250 kN) or higher are built with a momentary pendant switch for yoke adjustment. This system provides better access to the operator while adjusting the calibration space in compression or tension.

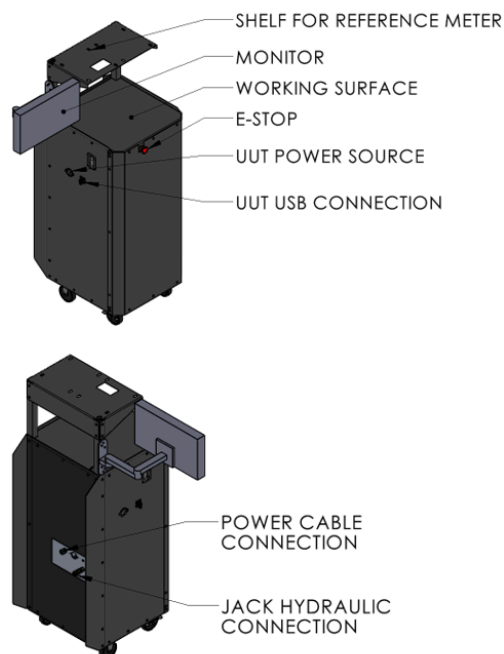


**Upgrade the Stationary Toggle Switch to a Momentary Pendant Switch**

## Automated Force Calibration System Upgrade

An automation upgrade is available for existing Morehouse Universal Calibrating Machines and Scale Calibration Presses. [Contact Morehouse](#) to order the upgrade kit and receive instructions for installing the automated control system.

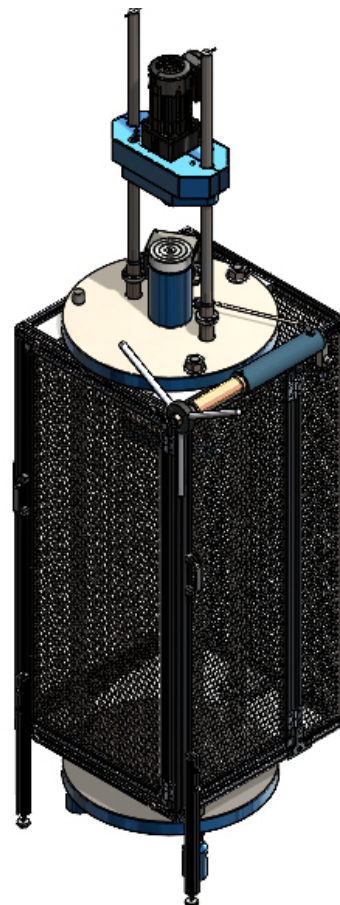
The Automated Force Calibration System connects to the hydraulic ram on an existing Morehouse UCM or SCM, handling pressures up to 4 500 psi. It runs on a standard 120 VAC outlet, so no additional wiring is needed. The system captures calibration points in milliseconds, supporting the dwell times required by ISO 376, and stores all original observation data per ISO/IEC 17025:2017 §7.5.1. Labs typically see a 25 % to 75 % increase in throughput with the upgrade.



## Safety Cages

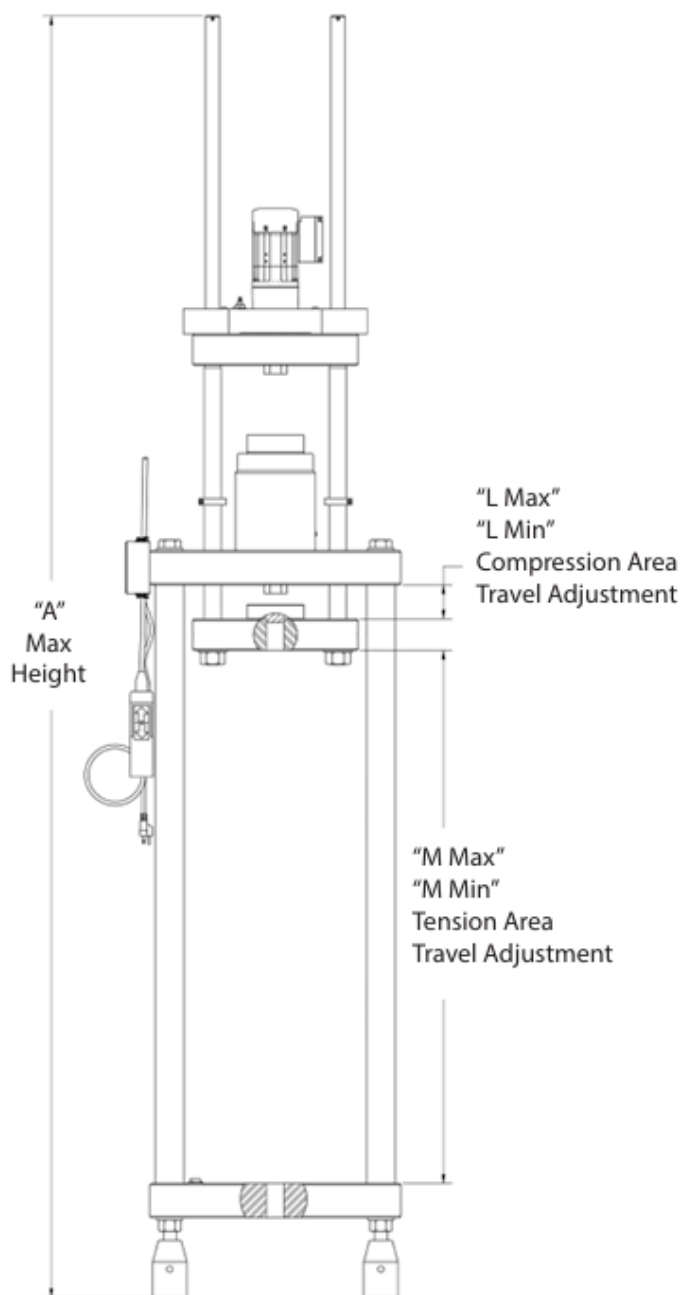
A safety cage upgrade is available for existing Morehouse Universal Calibration Machines. [Contact Morehouse](#) to order a safety cage kit and receive instructions for installation.

The Morehouse Safety Cage integrates with a UCM's existing frame and footprint, providing a physical barrier between personnel and force application without interfering with calibration accuracy or workflow. Installation does not affect machine capacity or accuracy, and full access to loading fixtures, adapters, and instrumentation is maintained. Cages are available for 30 000 lbf (100 kN), 60 000 lbf (250 kN) and 100 000 lbf (500 kN) capacity machines and work with both manual and automated calibration systems.





## UCM Technical Specifications



### UCM Dimensions Guide

## UCM Technical Specifications

For forces up to 50 kN or 10 000 lbf, the recommended machine is the 30 000 lbf UCM, which covers either range with capacity to spare.

| Capacity required (lbf) | Order Code    | Max capacity (lbf) | A     | L Max <sup>1</sup> | L Min <sup>1</sup> | M Max <sup>1</sup> | M Min <sup>1</sup> |
|-------------------------|---------------|--------------------|-------|--------------------|--------------------|--------------------|--------------------|
| 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            | 163.5 | 34.5               | 10.0               | 50.5               | 26.0               |
| 600 000                 | UCM-600K STD  | 675 000            | 163.5 | 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               |

## UCM lbf Dimensions (inches)

| Capacity required (kN) | Order Code      | Max capacity (kN) | A     | L Max <sup>1</sup> | L Min <sup>1</sup> | M Max <sup>1</sup> | M Min <sup>1</sup> |
|------------------------|-----------------|-------------------|-------|--------------------|--------------------|--------------------|--------------------|
| 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             | 4 150 | 876                | 254                | 1 283              | 660                |
| 5 000                  | UCM-5000 kN STD | 5 000             | 4 150 | 876                | 254                | 1 283              | 660                |

## UCM kN Dimensions (mm)

## Confidence in Every Reading Begins with Morehouse Universal Calibrating Machines

Force calibration can be complex because the mechanical interactions of not using the proper adapters can produce significant errors. The Morehouse Universal Calibrating Machine with the right adapters simplifies force calibration by reducing rework, errors from misalignment, and problematic setups.

We welcome the opportunity to help reduce these errors by answering your questions or concerns.

Contact us:

(717) 843-0081

[sales@mhforce.com](mailto:sales@mhforce.com)

[www.mhforce.com](http://www.mhforce.com)

Learn more:

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

