SCAN ME

Adapters are Critical

Best measurement practice is talking to the end user and replicating via calibration, how they are using equipment.

MHFORCE

Morehouse

THE FORCE IN CALIBRATION SINCE 1925

What Morehouse does

We are a manufacturing company that produces force calibration equipment and adapters, that are used in industry, to measure force.

We have state-of-the-art force and torque calibration laboratories and offer calibrations at a very high level of accuracy.

Our Purpose

We create a safer world by helping companies improve their force and torque measurements.

Outcomes

The participant will be able to

- Know the right questions to start asking
- Know what adapters to use to best replicate use
- Know the interactions of some adapters used for force calibration

Agenda

- The Importance of Adapters for Best Force Calibration Results

Improve Your Force Measurements

Additional Material

- **Technical Paper on Adapters**
- **Technical Paper on Uncertainty Propagation**
- **Technical Paper on ASTM E74 and ISO 376**
- **Technical Paper on Common Measurement Errors in Weighing**
- **PDF version of this presentation**

- **Website link @ https://mhforce.com/documentation-tools/?_sft_support-item-tag=technical-paper**

Old Adapters Can Have Issues

- Service life of force calibration adapters depend on the several factors including design, number of load cycles, and magnitude of each load.
- Better material manufacturing and quality control processes provide more reliable strength values for design engineers than 20 years ago.

Old Adapters Can Have Issues

- It is recommended that old adapters be inspected and replaced if they have been used for more than 20 years or 100,000 load cycles (10,000 calibrations)

The Wrong Tension Adapters

- If any of these look like tension adapters in your calibration lab, there is a problem.
- Even straight threaded rod can introduce misalignment issues as they can distort the line of force in non-Morehouse machines.
- Any machine misalignment of 0.01 degrees can affect the reproducibility of some load cells. Even our spherical adapters can only overcome about 0.1 degree of misalignment.

Multi - Column Load Cell

Error associated with using a non flat base on a multi-column cell. This is an actual test result we observed on a Revere multi-column cell.

	Non-Flat Base	Flat Base
	Maximum Error	Maximum Error
Force Applied	In Rotation	In Rotation
	LBF	LBF
30000	12	4
150000	136	24
300000	342	68
	% error	% error
30000	0.040%	0.013%
150000	0.091%	0.016%
300000	0.114%	0.023%

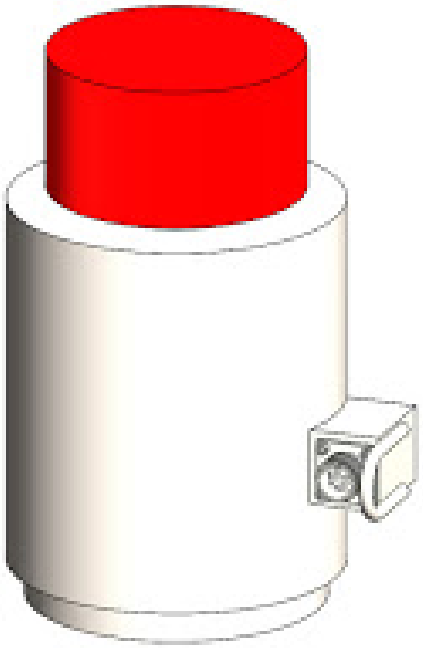
Bottom Plates

- A flat bottom plate may be needed to improve performance. It is often not recommended the practice to load against the machine surface as it could be uneven, or the base of the load cell could deform the machine surface.

- Pictured left is a Morehouse 60K rod end style load cell with spherical threaded adapter, top compression pad and load cell base plate.

Top Adapters - Hardness

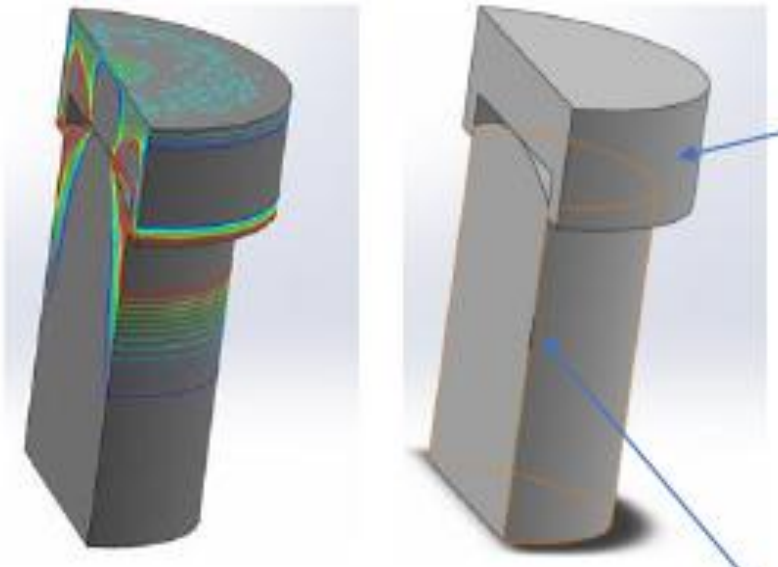
Do you have a top block that can be sent with the Force Measuring Device?



Different hardness of top adapters on column load cells can produce errors as high as 0.3 %.

6/23/2017		6/23/2017		
4340 Top Block		Hardened Top Block		Difference
0	120	0	120	
-48968	-48960	-49120	-49109	-0.307%
-244290	-244308	-244990	-244971	-0.279%
-487279	-487320	-488596	-488570	-0.263%

Top Adapters - Hardness



Materials with different hardness experience different amounts of lateral deflection under the same amount of load. Therefore, the varying hardness causes different amounts of stress between the block and the load cell. The above analysis shows steel to steel. It gets much worse if we use a softer material

Flat on Flat Loading

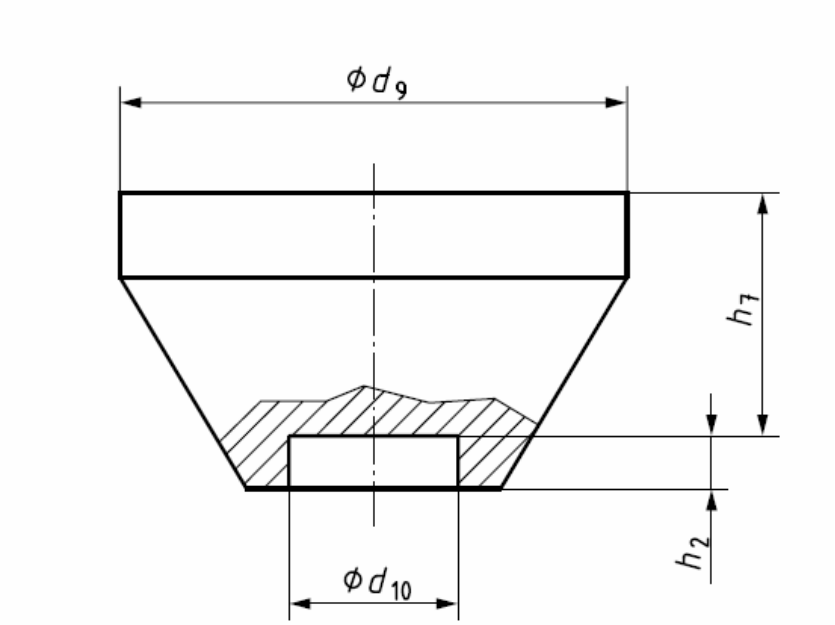
- Flat on Flat will produce additional errors as the material is never truly flat and side loading occurs.
- Flat on Flat may not direct the stresses to the gauges

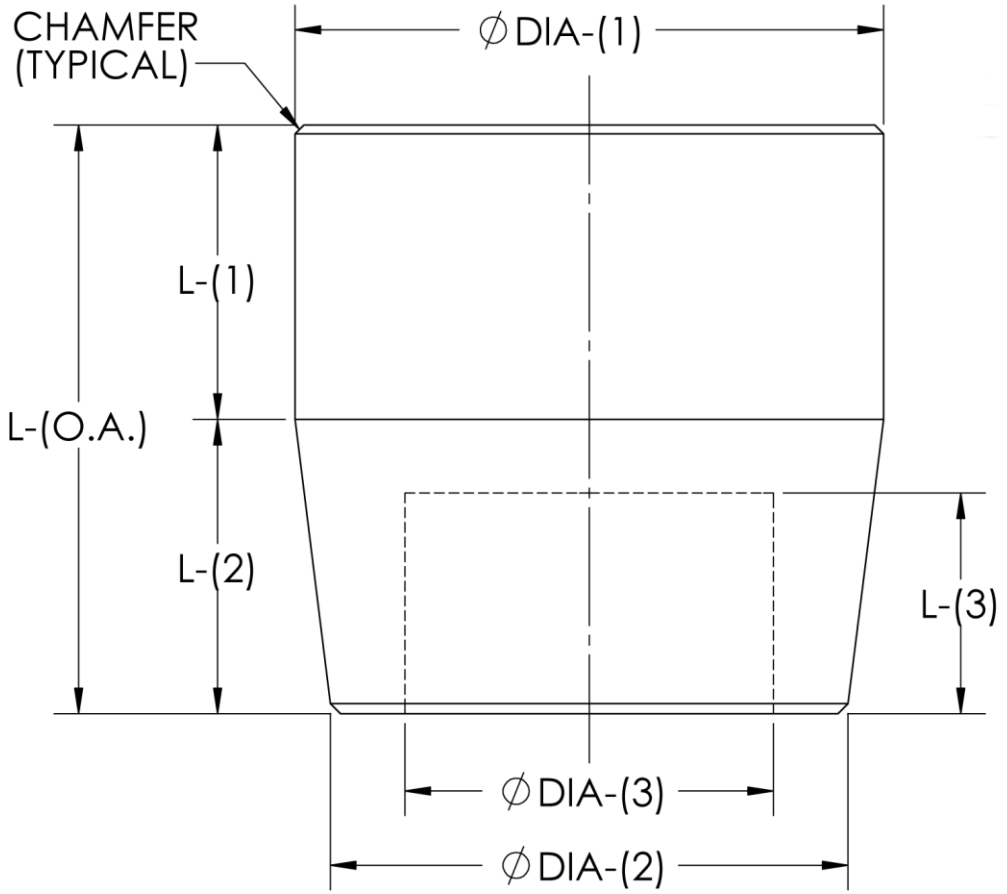
Morehouse Compression Adapters

- Pictured above is a Morehouse Concrete set with top and bottom adapters (the 600K cell which weighs 25 lbs & with top & bottom adapter weighs less than 40 lbs.

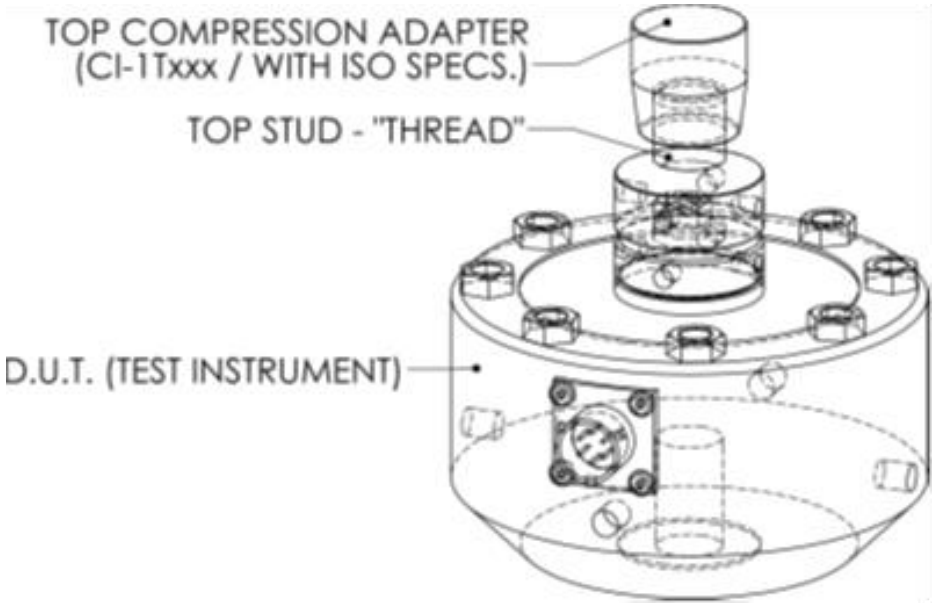
ISO 376 Compression Adapters

- Compressive force transducers should be fitted with one or two compression pads





Morehouse Compression Adapters



- Pictured above is an ISO 376 recommended compression adapters

Thread Versus Shoulder Loading

Is the force device loaded through the top shoulder or thread loaded? If thread loaded, how much engagement?

Morehouse tested the same load cell with two different types of adaptors and recorded the readings with 10,000 LBF applied.

Output was 10,001.5 LB with 1.5” of engagement vs 9942.3 LBF with 0.5” engagement.
There was a difference of 59.2 LBF on a 10,000 LBF cell.
The error on this measurement was over 0.5 % on a device expected to be better than 0.025 % (20 times expected).

Proper Adapters Shear Web cells

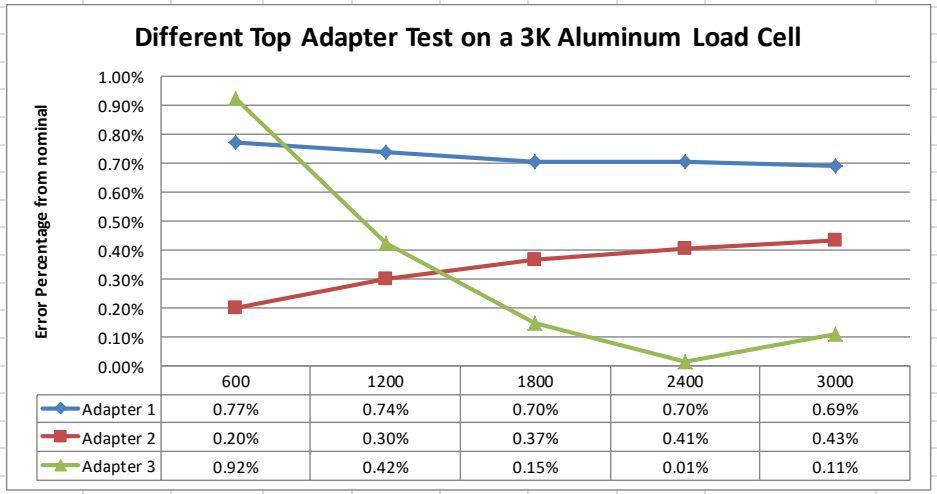
Solution – Purchase and lock in an integral adapter

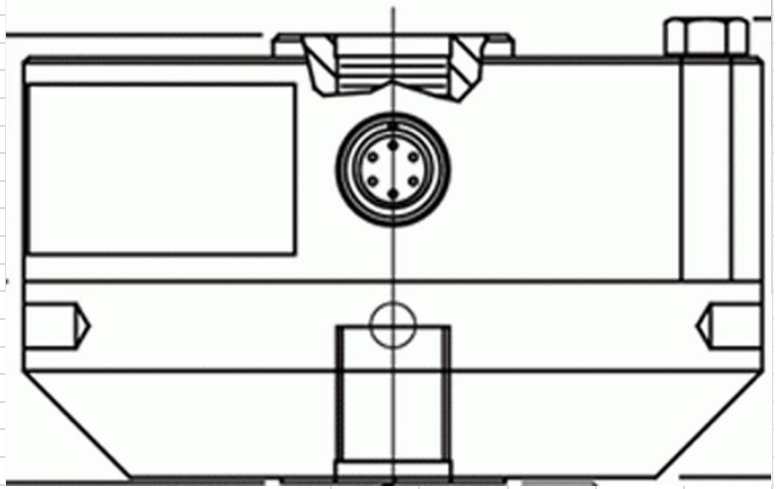
or pick a top adapter and always use and have the force measuring device calibrated with that top adapter. In this example, a spherical load button would be an excellent top adapter for this load cell.

Thread Depth – Shoulder loading Versus Thread Loading ON SHEAR WEB CELLS

Aluminum Load Cell Top Fixture Test

Force Applied	Adapter 1 Readings	Adapter 2 Readings	Adapter 3 Readings	Max Error Between Adapters	Max % Error
600	595.4	598.8	605.6	**10.2**	1.70%
1200	1191.2	1196.4	1205.1	**13.9**	1.16%
1800	1787.4	1793.4	1802.7	**15.3**	0.85%
2400	2383.2	2390.3	2399.7	**16.5**	0.69%
3000	2979.4	2987.1	2996.7	**17.3**	0.58%

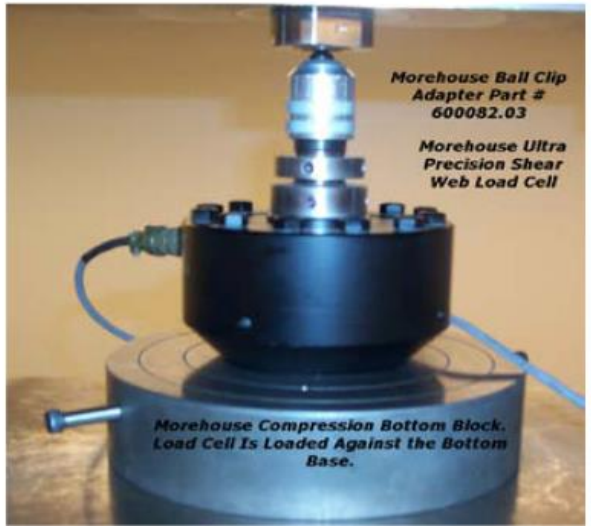




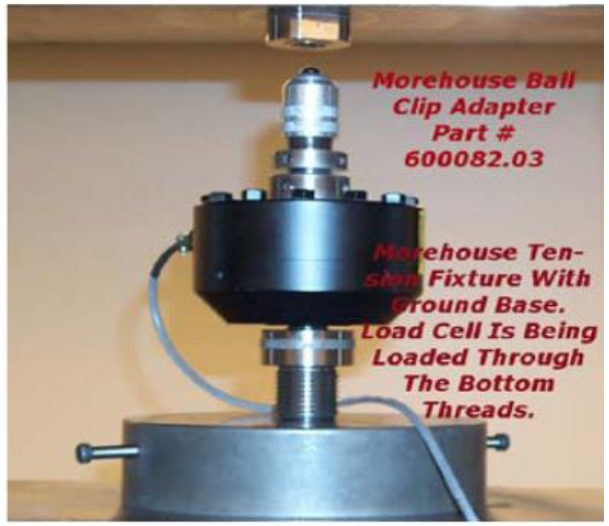
Note: This test was done on Aluminum type Shear Web Cell. Steel cells behave much differently. Aluminum cells are usually from 100 LBF - 3,000 LBF

Asking the Right Questions

Is the force device loaded through the bottom threads?



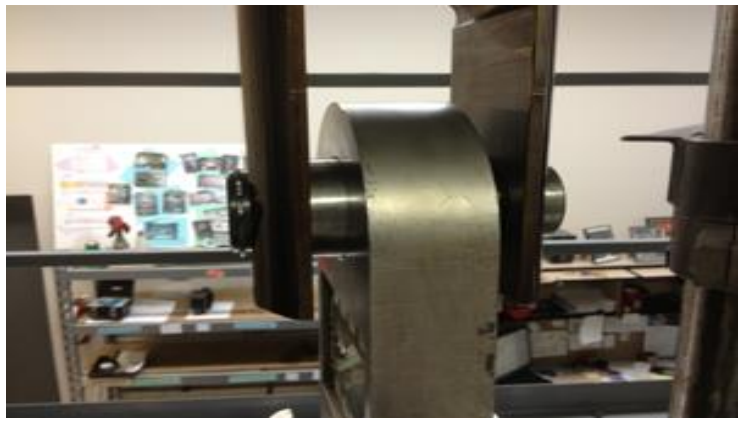
FORCE APPLIED LBF	LOAD CELL OUTPUT LOADED AGAINST BOTTOM BASE	LOAD CELL OUTPUT LOADED AGAINST BOTTOM THREADS
1000	999.0	999.0
2000	1998.0	1998.0
5000	4996.0	4996.5
7000	6995.0	6995.5
10000	9994.5	9995.0
12000	11994.0	11995.0
15000	14993.5	14995.0
17000	16993.5	16995.0
20000	19994.0	19996.0
22000	21994.0	21996.5
25000	24994.0	24997.0



The Importance of Adapters

Keeping the line of force pure (free from eccentric forces) is key to the calibration of load cells. ASTM E74 does not address the various adapter types, but ISO 376 does.

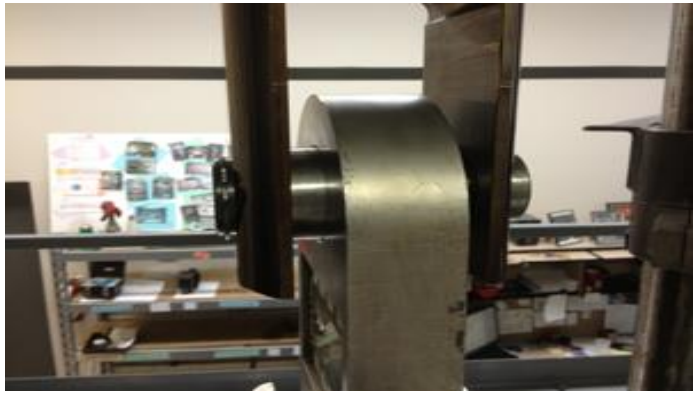
Tension Links Pin Diameter



- Does anyone think the output will vary by using different pin sizes?

Tension Links Improper Vs Proper Pin Diameter

- Loaded with the proper Pin Diameter to 50,000 LBF



Tension Links Improper Vs Proper Pin Diameter

- Loaded without the proper Pin Diameter to 50,000 LBF

Proper Adapters – Tension Links

Tension Links Improper Vs Proper Pin Diameter

Difference of 860 LBF or 1.72 % error at 50,000 LBF from not using the proper size load pins.

Out of Tolerance Versus In Tolerance

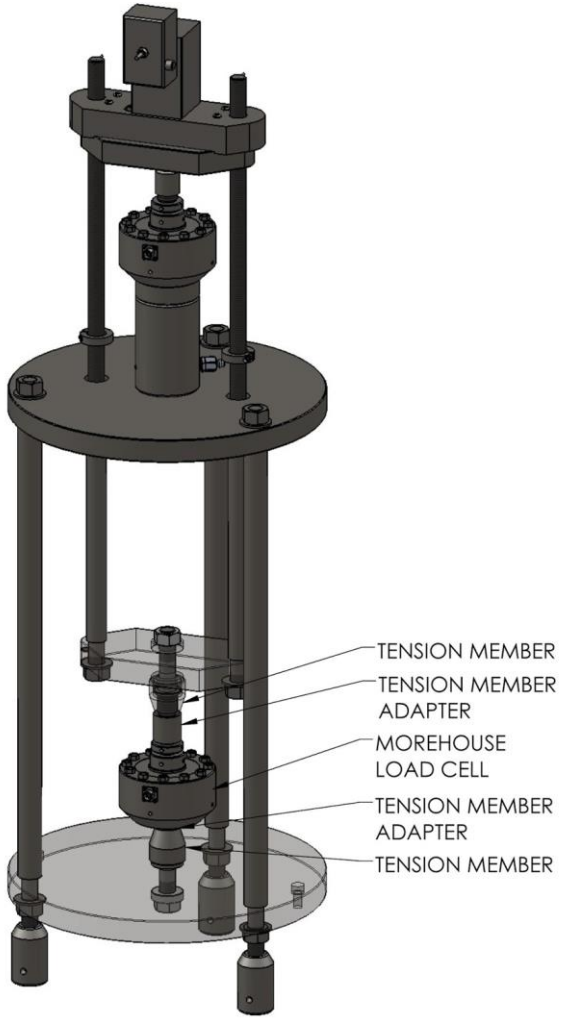
Note: Tension links of this design seem to exhibit similar problems. If you are unsure, TEST!

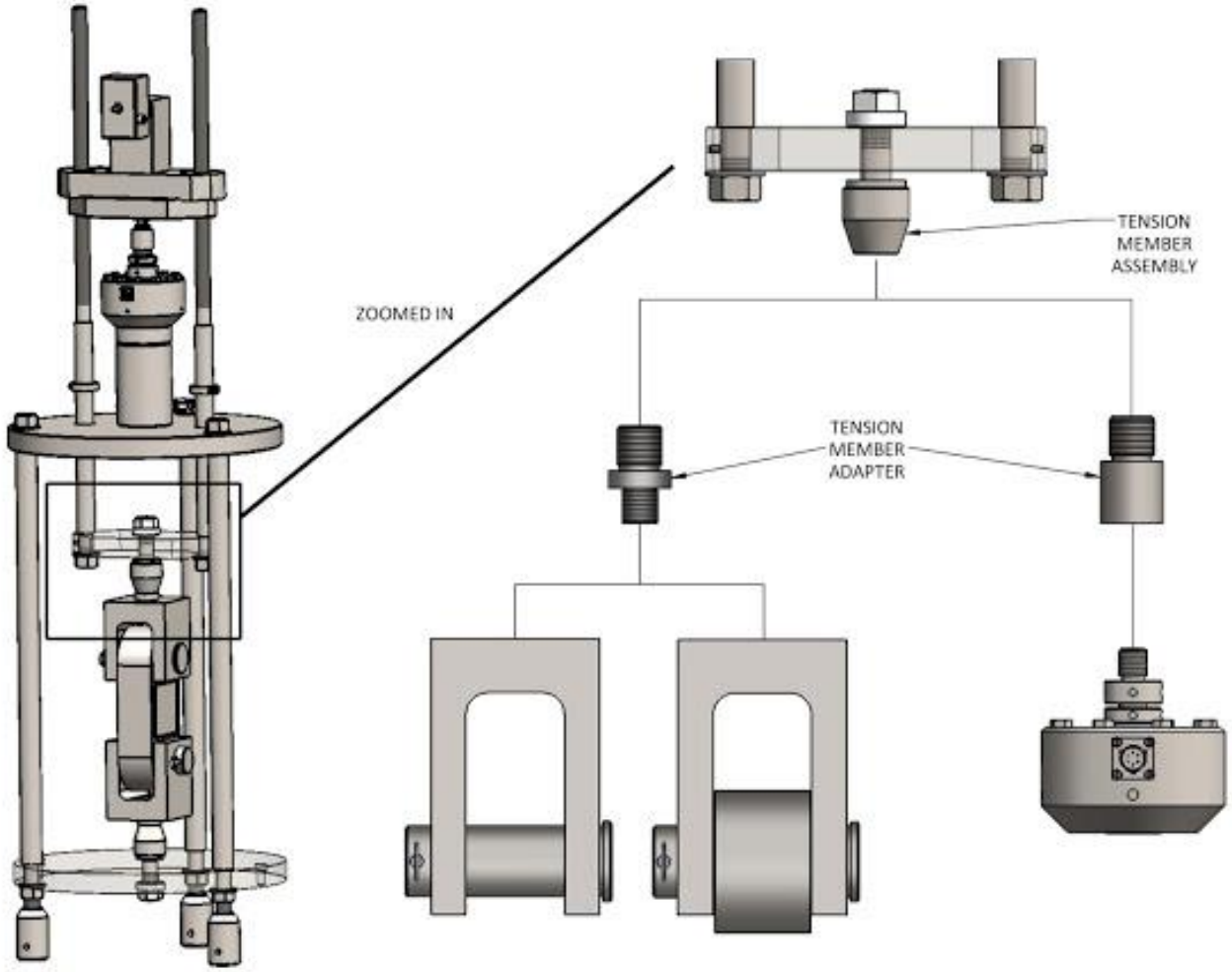
Tension Links Pin Diameter

Pin B (2.0030 to 2.0060)	Pin A (2.0005 to 2.0045)
50,070	50,010
50,050	50,020
50,040	50,010
50,070	50,020
50,090	50,020
50,060	50,030
50,080	50,010
50,070	50,030
50,090	50,020
50,090	50,070
50,080	50,060
50,100	50,070
17.81640375	22.74696117
Out of 24 tests 13 did not meet spec ± 50	

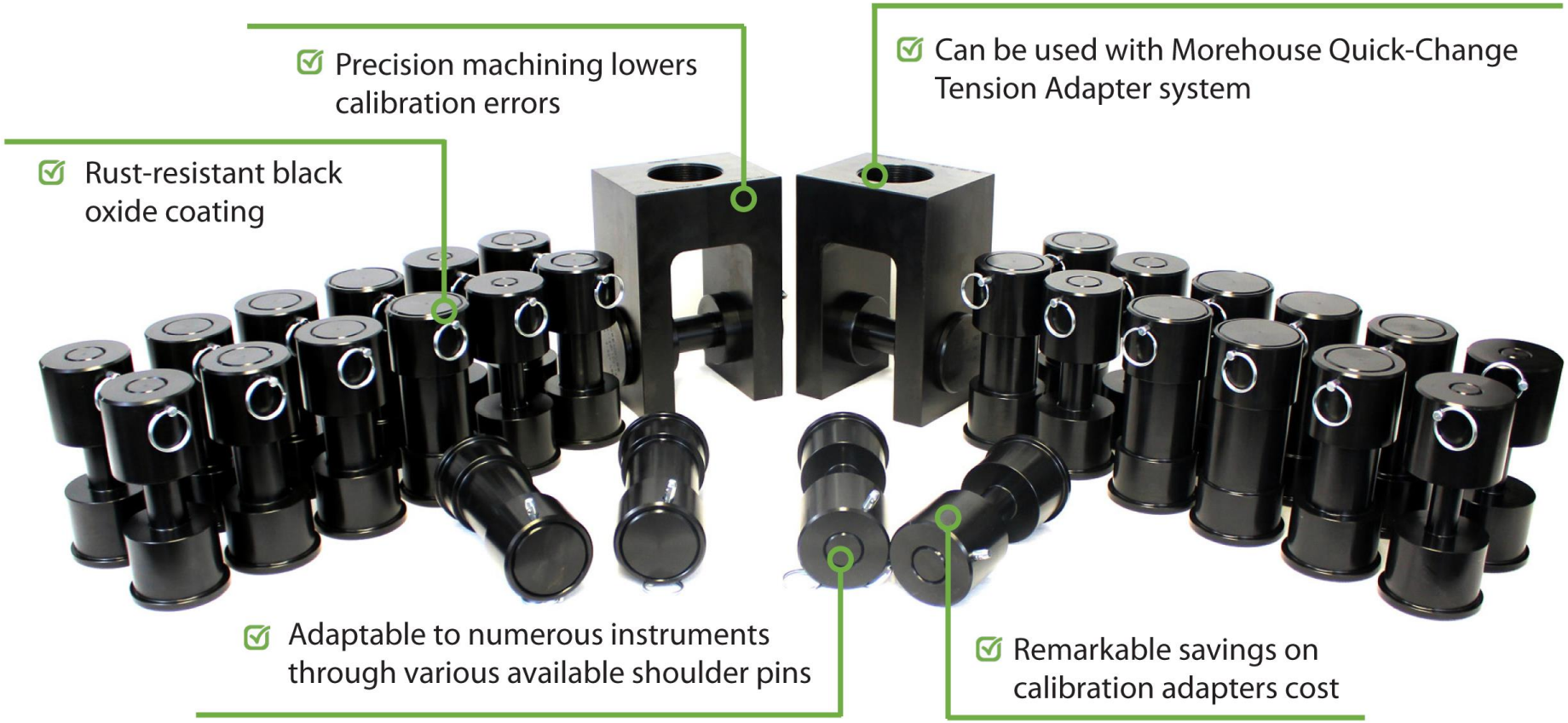
	PIN A		PIN B	
	Q1 to Q3	Q2 to Q4	Q1 to Q3	Q2 to Q4
Diameter	2.0005	2.0045	2.0060	2.0030

Proper Adapters





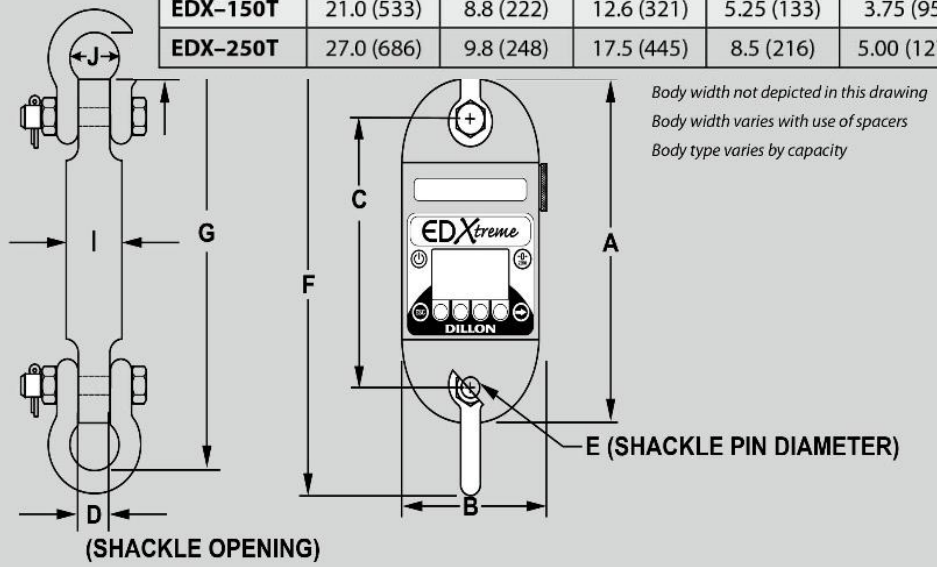
Proper Adapters for Tension Links (U.S. Patent No 11,078,052)



Proper Adapters for Tension Links

Dimensions inches (mm)

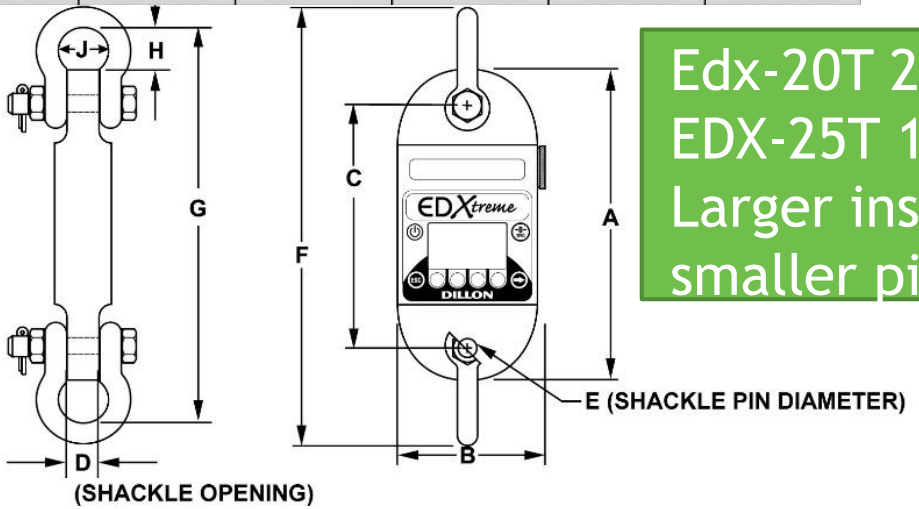
Model	A	B	C	D	E
EDX–1T	10.6 (269)	5.0 (127)	7.8 (198)	1.06 (26)	0.75 (19)
EDX–2T	10.6 (269)	5.0 (127)	7.8 (198)	1.06 (26)	0.75 (19)
EDX–5T	11.4 (289)	5.3 (135)	8.1 (206)	1.38 (35)	1.00 (25)
EDX–10T	11.5 (291)	5.3 (133)	7.9 (201)	1.97 (50)	1.38 (35)
EDX–25T	13.7 (348)	6.0 (152)	9.0 (229)	2.75 (70)	1.97 (50)
EDX–50T	15.8 (400)	6.8 (172)	10.3 (262)	3.88 (99)	2.75 (70)
EDX–75T	16.5 (419)	7.8 (197)	10.3 (262)	3.88 (99)	2.75 (70)
EDX–100T	18.0 (457)	7.8 (197)	11.0 (280)	5.00 (127)	3.25 (83)
EDX–150T	21.0 (533)	8.8 (222)	12.6 (321)	5.25 (133)	3.75 (95)
EDX–250T	27.0 (686)	9.8 (248)	17.5 (445)	8.5 (216)	5.00 (127)



Body width not depicted in this drawing
Body width varies with use of spacers
Body type varies by capacity

Dimensions inches (mm)

Model	A	B	C	D	E	G	H	J
EDx–1T	10.6 (269)	5.0 (127)	7.8 (198)	1.06 (26)	0.75 (19)	13.4 (340)	1.36 (34)	1.69 (43)
EDx–2T	10.6 (269)	5.0 (127)	7.8 (198)	1.06 (26)	0.75 (19)	13.4 (340)	1.36 (34)	1.69 (43)
EDx–5T	11.4 (289)	5.3 (135)	8.1 (206)	1.38 (35)	1.00 (25)	15.8 (402)	2.17 (56)	2.28 (58)
EDx–10T	11.5 (291)	5.3 (133)	7.9 (201)	1.97 (50)	1.38 (35)	18.8 (478)	3.67 (93)	3.25 (83)
EDx–20T	13.7 (348)	6.0 (152)	9.0 (229)	2.75 (70)	2.0 (51)	25.2 (640)	5.7 (146)	5.0 (127)
EDx–50T	15.8 (400)	6.8 (172)	10.3 (262)	3.88 (99)	2.75 (70)	34.3 (870)	9.3 (235)	7.3 (184)
EDx–75T	16.5 (419)	7.8 (197)	10.3 (262)	3.88 (99)	2.75 (70)	34.3 (870)	8.9 (225)	7.3 (184)
EDx–100T	18.0 (457)	7.8 (197)	11.0 (280)	5.00 (127)	3.25 (83)	40.5 (1027)	11.2 (284)	7.8 (200)
EDx–150T	21.0 (533)	8.8 (222)	12.6 (321)	5.25 (133)	3.75 (95)	45.6 (1159)	12.3 (313)	9.0 (229)
EDx–250T	27.0 (686)	9.8 (248)	17.5 (445)	8.5 (216)	5.00 (127)	62.8 (1595)	17.9 (454)	13.0 (330)



Edx-20T 2.0-inch pin
EDX-25T 1.97-inch pin
Larger instrument takes smaller pin!

CE

List of Instruments to Calibrate

Instruments which can be calibrated with the Adaptable Clevis Kits and corresponding part numbers

Common Clevis Part Number: TU-120-001						
Manufacturer	Model	Capacity (lbf)	Pin Needed for Calibration through Instrument Holes	Pin Needed for Calibration through Shackles	Basic Kit (v.1)	Premium Kit (v.1)
Dillon	EDx-20T	50000	TUZ-120-001-11	TP-120-001-01X	✓	✓
Dillon	EDx-25T	55000	TUZ-120-001-24	TP-120-001-01X		✓
Dillon	EDx-50T	100000	TUZ-120-001-10	TP-120-001-01X	✓	✓
Dillon	ED2000 (50000 lbf)	50000	TUZ-120-001-11	TP-120-001-01X	✓	✓
Dillon	ED2000 (100000 lbf)	100000	TUZ-120-001-14	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh; MSI-4260	20000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Port-A-Weigh; MSI-4260	30000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Port-A-Weigh; MSI-4260	50000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh; MSI-4260	70000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh; MSI-4260	100000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-4300	20000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-4300	30000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-4300	50000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-4300	70000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-4300	100000	-	TP-120-001-01X	✓	✓
Rice Lake	Trans-Weigh; MSI-6260CS	20000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Trans-Weigh; MSI-6260CS	30000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Trans-Weigh; MSI-6260CS	50000	-	TP-120-001-01X	✓	✓
Rice Lake	Trans-Weigh; MSI-6260CS	70000	-	TP-120-001-01X	✓	✓
Rice Lake	Trans-Weigh; MSI-6260CS	100000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-9300	20000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-9300	30000	-	TUZ-120-001-11X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-9300	50000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-9300	70000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-9300	100000	-	TP-120-001-01X	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-9300HT †	70000	TUZ-120-001-11 †	TP-120-001-01X †	✓	✓
Rice Lake	Port-A-Weigh Plus; MSI-9300HT †	120000	TUZ-120-001-13 †	TP-120-001-01X †		✓
Rice Lake	Dyna-Link 2; MSI-7300	25000	TUZ-120-001-25	TP-120-001-01X		✓
Rice Lake	Dyna-Link 2; MSI-7300	50000	TUZ-120-001-11	TP-120-001-01X	✓	✓
Rice Lake	Dyna-Link 2; MSI-7300	120000	TUZ-120-001-13	TP-120-001-01X		✓

† Instrument has two different hole sizes. Thus, two pins with two different diameters are required; one for instrument hole and one for shackle.

Morehouse THE FORCE IN CALIBRATION SINCE 1925
Adaptable Clevis Kits
120 klbf Capacity Datasheet
(PD-5907)

Common Clevis Part Number: TU-120-001						
Manufacturer	Model	Capacity (lbf)	Pin Needed for Calibration through Instrument Holes	Pin Needed for Calibration through Shackles	Basic Kit (v.1)	Premium Kit (v.1)
Rice Lake	Dyna-Link 2; MSI-7200	25000	TUZ-120-001-25	TP-120-001-01X		✓
Rice Lake	Dyna-Link 2; MSI-7200	50000	TUZ-120-001-11	TP-120-001-01X	✓	✓
Rice Lake	Dyna-Link 2; MSI-7200	100000	TUZ-120-001-12	TP-120-001-01X		✓
Straightpoint	RLP25T	55000	TUZ-120-001-11	TP-120-001-01X		✓
Straightpoint	RLP35T	77000	TUZ-120-001-12	-		✓
Straightpoint	RLP50T	110000	TUZ-120-001-12	-		✓
Straightpoint	WLP35T	77000	TUZ-120-001-12	-		✓
Straightpoint	WLP50T	110000	TUZ-120-001-12	-		✓
IMES	LE35T	77000	TUZ-120-001-15	-		✓
IMES	LE50T	110000	TUZ-120-001-16	-		✓
Canflex	JCM-25LC	55000	TUZ-120-001-17	-		✓
Canflex	JCM-35LC	77000	TUZ-120-001-18	-		✓
Intercomp	TL8000	25000	TUZ-120-001-25	TP-120-001-01X		✓
Intercomp	TL8000	50000	TUZ-120-001-11	TP-120-001-01X	✓	✓
Intercomp	TL8000	100000	TUZ-120-001-14	TP-120-001-01X	✓	✓
Intercomp	TL8500	25000	TUZ-120-001-25	TP-120-001-01X		✓
Intercomp	TL8500	50000	TUZ-120-001-11	TP-120-001-01X	✓	✓
Intercomp	TL8500	100000	TUZ-120-001-14	-	✓	✓
LSI (Trimble)	GC060	60000	TUZ-120-001-19	-		✓
LSI (Trimble)	GC100	100000	TP-120-001-01	-	✓	✓
Tractel	LLZ2	44000	TUZ-120-001-24	-		✓
Tractel	LLXh	55000	TUZ-120-001-24	-		✓
Tractel	LLXh	110000	TUZ-120-001-20	-		✓
Sensy	5200R (500 kN)	112000	TUZ-120-001-23	-		✓
Sensy	5200-5205 (500 kN)	112000	TUZ-120-001-23	-		✓
Eilon	RON 2300 SHACKLE (80000 lbf)	80000	TUZ-120-001-12	-		✓
Eilon	RON 2300 SHACKLE (100000 lbf)	100000	TUZ-120-001-12	-		✓
Eilon	RON 2501 (80000 lbf)	80000	TUZ-120-001-12	-		✓
Eilon	RON 2501 (100000 lbf)	100000	TUZ-120-001-12	-		✓
Eilon	RON 2000 (80000 lbf)	80000	TUZ-120-001-12	-		✓
Eilon	RON 2000 (100000 lbf)	100000	TUZ-120-001-12	-		✓
Eilon	RON 2125 (80000 lbf)	80000	TUZ-120-001-12	-		✓
Eilon	RON 2125 (100000 lbf)	100000	TUZ-120-001-12	-		✓
Strainsert	STL-40 SSX	80000	TUZ-120-001-21	-		✓
Strainsert	STL-50 SSX	100000	TUZ-120-001-22	-		✓

Morehouse THE FORCE IN CALIBRATION SINCE 1925

Common Clevis Part Number: TU-120-001						
Manufacturer	Model	Capacity (lbf)	Pin Needed for Calibration through Instrument Holes	Pin Needed for Calibration through Shackles	Basic Kit (v.1)	Premium Kit (v.1)
CAS	Caston III	30000	-	TUZ-120-001-11X	✓	✓
CAS	Caston III	40000	-	TUZ-120-001-11X	✓	✓
CAS	Caston III	60000	-	TP-120-001-01X	✓	✓
CAS	Caston III	100000	-	TP-120-001-01X	✓	✓
CAS	Caston III(B)-15THD	33000	-	TUZ-120-001-11X	✓	✓
CAS	Caston III(B)-20THD	44000	-	TUZ-120-001-11X	✓	✓
CAS	Caston III(B)-30THD	66000	-	TP-120-001-01X	✓	✓
CAS	Caston III(B)-50THD	110000	-	TP-120-001-01X	✓	✓
CAS	Caston III(BT)	30000	-	TUZ-120-001-11X	✓	✓
CAS	Caston III(BT)	40000	-	TUZ-120-001-11X	✓	✓
CAS	Caston III(BT)	60000	-	TP-120-001-01X	✓	✓
CAS	Caston III(BT)	100000	-	TP-120-001-01X	✓	✓

*Parts are designed and manufactured to each instrument's specifications as reported by its manufacturers. For any changes to the standard specifications sheet, the calibration clevis and pins may need to be redesigned.

**Contact Morehouse Sales team for calibrating any instruments which might not be mentioned in the list above.

Included in the Kits

Basic 120K Adaptable Clevis Kit (v.1)		
Part Number	Qty.	Description
TU-120-001	2	Clevis
TP-120-001-01X	2	Straight Pin with Roller
TUZ-120-001-10	2	Shoulder Pin
TUZ-120-001-11X	2	Shoulder Pin with Roller
TUZ-120-001-14	2	Shoulder Pin

Premium 120K Adaptable Clevis Kit (v.1)		
Part Number	Qty.	Description
TU-120-001	2	Clevis
TP-120-001-01X	2	Straight Pin with Roller
TUZ-120-001-10	2	Shoulder Pin
TUZ-120-001-11X	2	Shoulder Pin with Roller
TUZ-120-001-12	2	Shoulder Pin
TUZ-120-001-13	2	Shoulder Pin
TUZ-120-001-14	2	Shoulder Pin
TUZ-120-001-15	2	Shoulder Pin
TUZ-120-001-16	2	Shoulder Pin
TUZ-120-001-17	2	Shoulder Pin
TUZ-120-001-18	2	Shoulder Pin
TUZ-120-001-19	2	Shoulder Pin
TUZ-120-001-20	2	Shoulder Pin
TUZ-120-001-21	2	Shoulder Pin
TUZ-120-001-22	2	Shoulder Pin
TUZ-120-001-23	2	Shoulder Pin
TUZ-120-001-24	2	Shoulder Pin
TUZ-120-001-25	2	Shoulder Pin

Tension Link Calibration

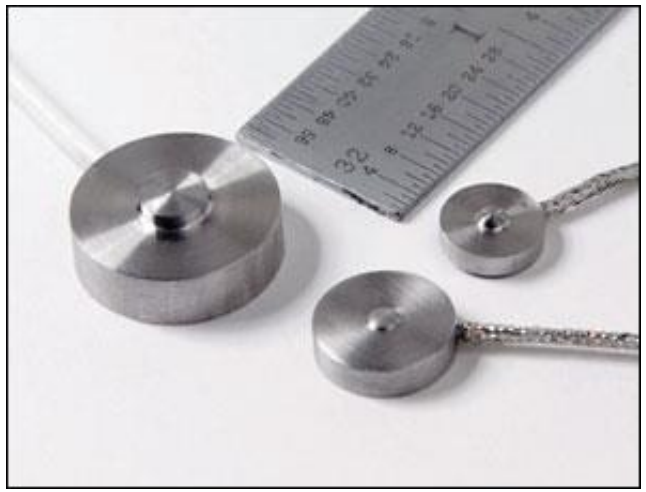
Anyone think this is a safe adapter?

What do you think was the cause of this?

[Force Safety Blog]

Button Load Cell Calibration

Does this setup look familiar?

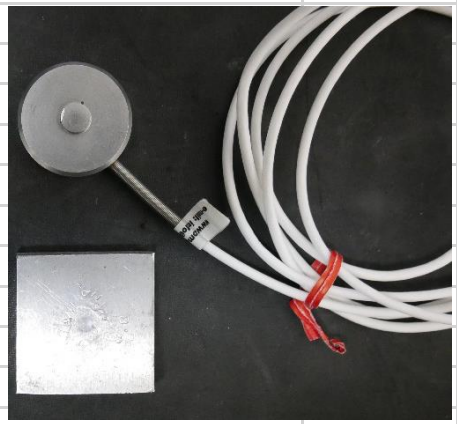


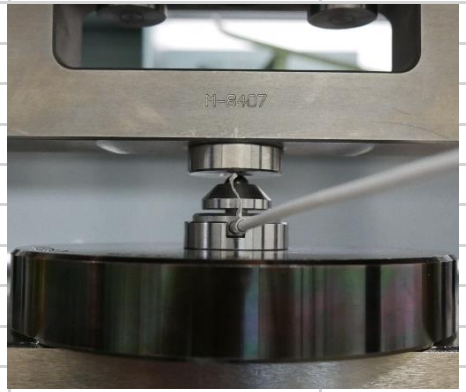
Manually Aligned	Data
0 degree	2011
120 degree	1997
240 degree	2018
Average	2008.66667
Standard Deviation	10.6926766
Max Deviation	21
% Error	1.045%

Button Load Cell Calibration

Button Load Cell Adapters that better aligned the load cell improved the measurement result by 525 %

Standard Setup versus Morehouse Adapters in Morehouse Deadweight





Manually Aligned	Data
0 degree	2011
120 degree	1997
240 degree	2018
Average	2008.66667
Standard Deviation	10.6926766
Max Deviation	21
% Error	1.045%

Aligned with Adapter	Data
0 degree	2008
120 degree	2006
240 degree	2010
Average	2008
Standard Deviation	2
Max Deviation	4
% Error	0.199%

Button and Washer Load Cell

- Above are pictures of button and washer load cell adapters which improve alignment and yield better calibration results

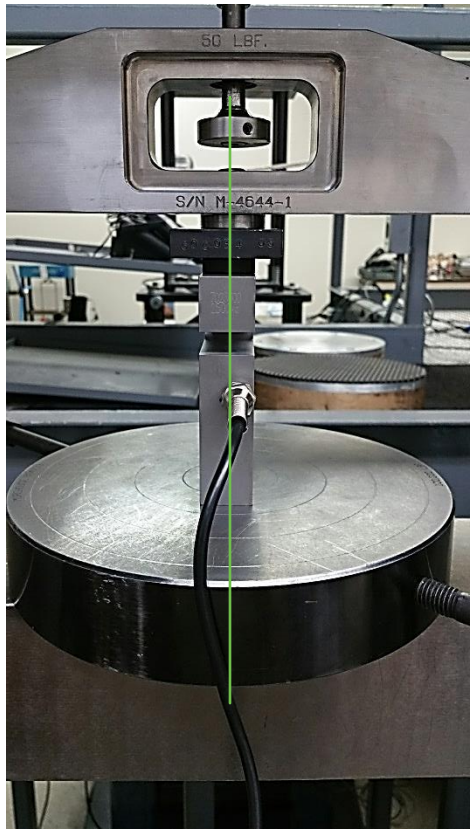
S-beam

Does anything look different when comparing these two pictures?

Misalignment S-Beam

Misalignment Demonstrating 0.752 % error

Output in mV/V
Aligned in machine
-1.96732 mV/V



Output in mV/V
Slightly misaligned in machine
-1.98211 mV/V

Misalignment S-Beam

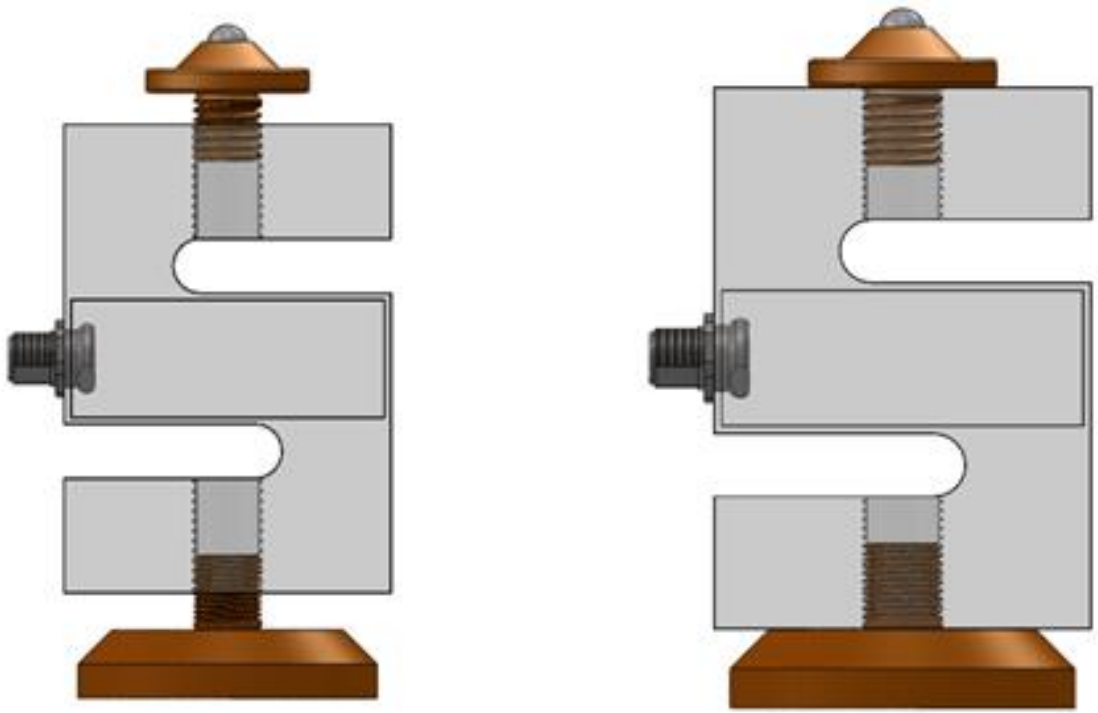
S-BEAM WITH 0.75 % MISALIGNMNET ERROR

S-BEAM	10000	LBF	SERIAL NO	EXAMPLE
%	Force Applied	COMBINED UNCERTAINTY FOR K=2		
2.00%	200	0.89076%	1.782	LBF
10.00%	1000	0.86705%	8.671	LBF
20.00%	2000	0.86630%	17.326	LBF
30.00%	3000	0.86616%	25.985	LBF
40.00%	4000	0.86612%	34.645	LBF
50.00%	5000	0.86609%	43.305	LBF
60.00%	6000	0.86608%	51.965	LBF
70.00%	7000	0.86607%	60.625	LBF
80.00%	8000	0.86607%	69.286	LBF
90.00%	9000	0.86607%	77.946	LBF
100.00%	10000	0.86606%	86.606	LBF

40

Overall Uncertainty went from about 10 lbf to 86.6 lbf with slight misalignment

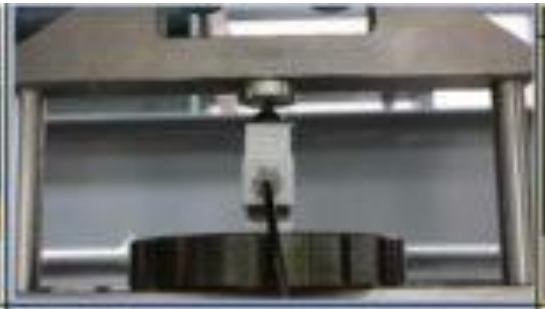
S-beam Loading



S-beam Load Cell with Different Loading Conditions

S-beam Loading






Instrument Reading Thread Loading Loose Both Ends Output in mV/V	Instrument Reading Thread Loading Tight Both Ends Output in mV/V	Instrument Reading Thread Loaded on Top / Flat Base Output in mV/V	Instrument Reading Flat on Flat Output in mV/V
1.50136	1.50241	1.50182	1.50721
3.00381	3.00581	3.00459	3.01326

Maximum Difference mV/V	Maximum Difference lbf	Maximum % Difference	Smallest % Difference
0.00585	4.618066191	0.369%	0.029%
0.00945	7.459953077	0.298%	0.025%

S-Beam example where loading through the threads versus against the base produces up to a 0.369 % difference in output.

Common Low Force Calibration Problems – Hand-Held Force Gauge

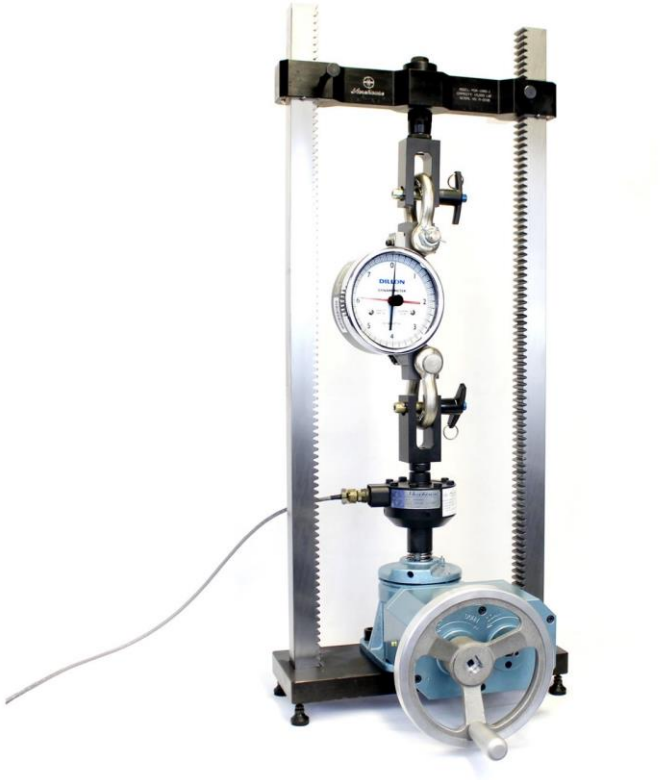
Stacking Weights Issues

- Slow and dangerous
- Ergonomic issue
- Often not corrected for force (corrections for force must include correcting for gravity, air density, and material density)

Common Low Force Calibration Problems – Hand-Held Force Gauge

Not Correcting Mass Weights To Force

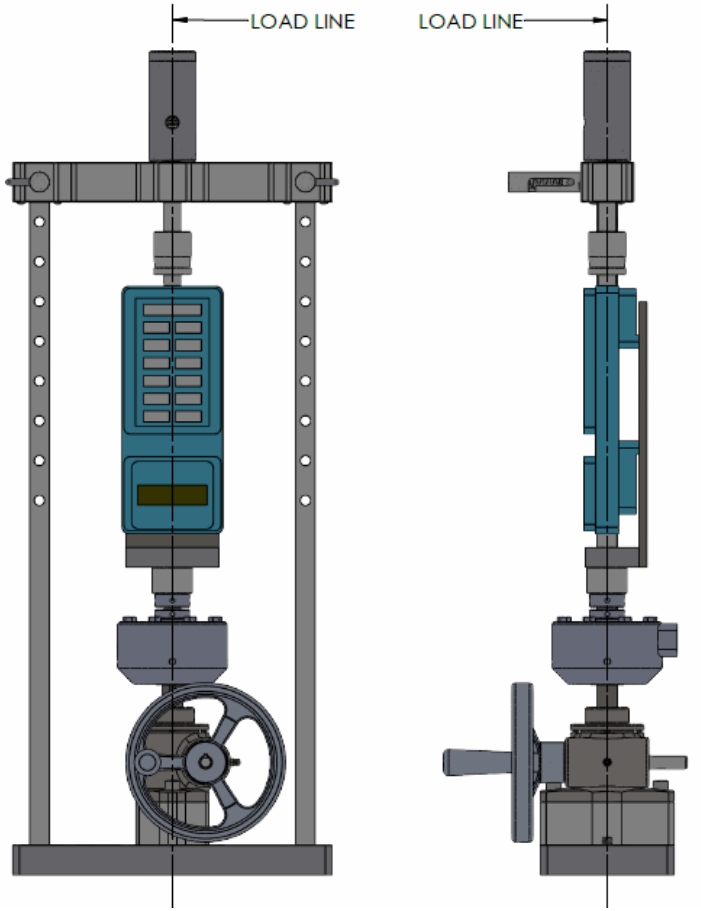
- Morehouse Blog on Using Mass Weights
- Blog shows these errors to be from 0.05 % up to 0.185 %



Common Low Force Calibration Problems – Hand-Held Force Gauge

Off Center Loading Issues

- Most hand-held force gauges require different centering fixtures for alignment - If the line of force is not pure, a large measurement error should be expected



Adapters for hand-held force gauges

Morehouse L-Bracket kits are available for tension and compression calibration of handheld force gauges. These kits simplify setup and reduce errors with stacking weights. This kit can be used on both the Mechanical Tensiometer and PCM.

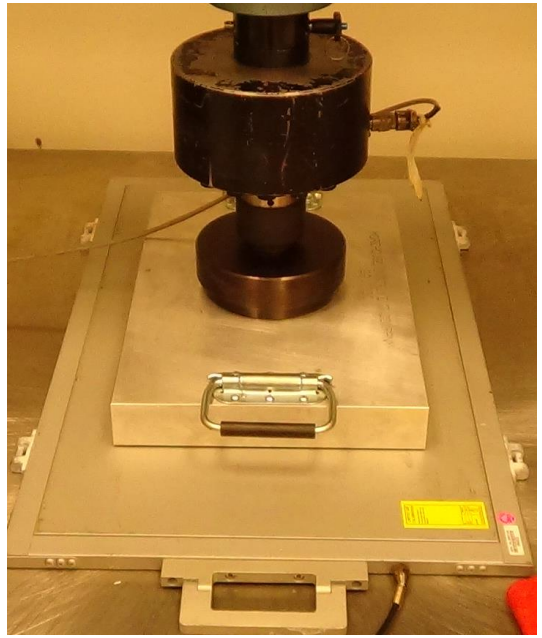
Link to Hand-Held Force Gauge Kit

Aircraft and Truck Scale Adapters

Truck and Aircraft Scales are typically used to weigh trucks and airplanes with the tires sitting on several scales. Any adapter used during calibration should be composed of the same type of rubber and should have the same footprint as the tire to ensure accurate results.

Aircraft and Truck Scale Adapters

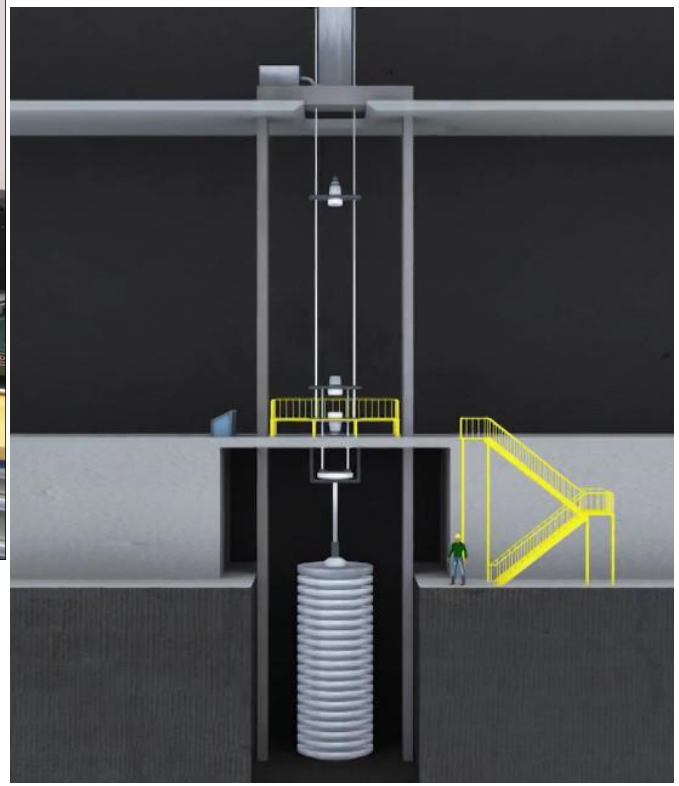
Morehouse has test truck and aircraft scales and there is a large difference in using different size plates

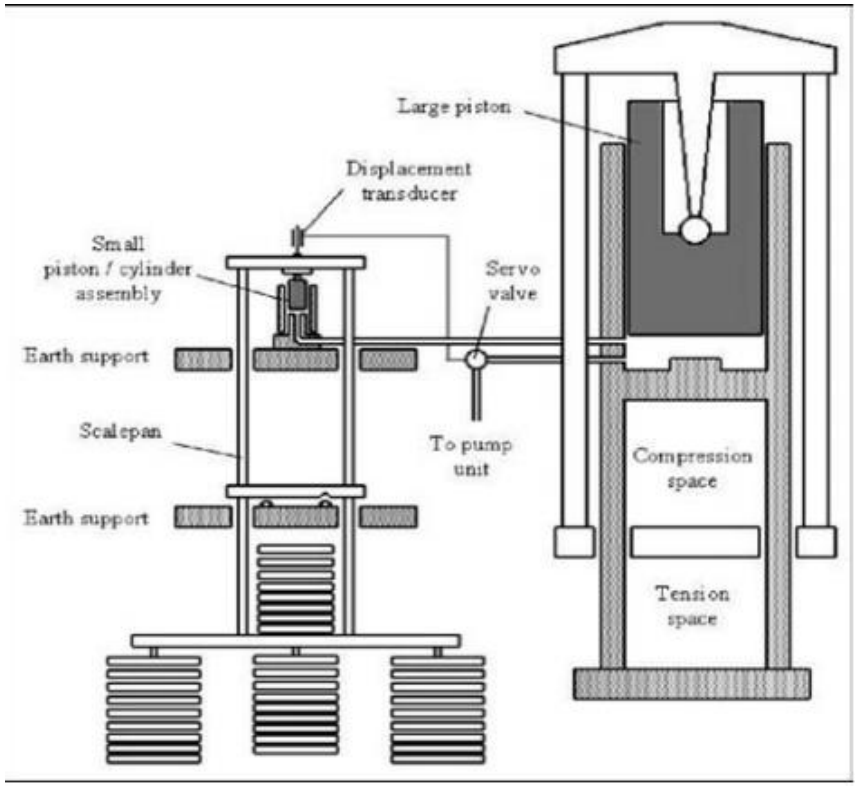


Force Applied lbf	Scale Reading w/ Large pad	Scale Reading w/ Small pad		
0	0	0	**Diff in lbf**	**%**
4000	3950	3980	-30	-0.759%
8000	7980	8030	-50	-0.627%
12000	11990	12020	-30	-0.250%
16000	15980	16090	-110	-0.688%
20000	19980	20140	-160	-0.801%
24000	23990	24210	-220	-0.917%
28000	27990	28270	-280	-1.000%
32000	31990	32350	-360	-1.125%
36000	35990	36460	-470	-1.306%
40000	40010	meter saturated		

The Right Equipment

Replicates Field Use





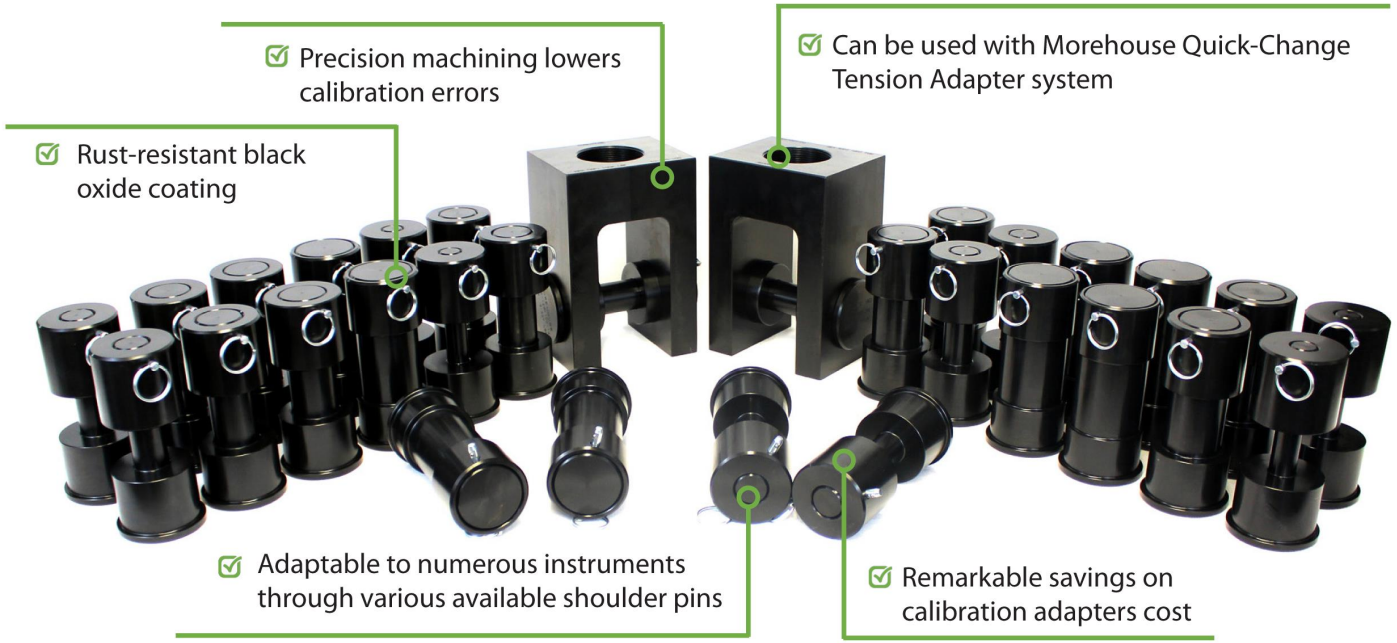
The Right Equipment

Replicates Field Use

To Replicate Field Use for ASTM E4 & ISO 7500 Calibrations in These Types of Machines

- The Calibration Laboratory Should Not Perform Compression and Tension Calibration in the Same Setup (Common Practice as it is much quicker)
- They Should use the Customer's Top Blocks and make Separate Compression Setups
- In Compression, they Should Require a Baseplate to Load Against if that is how the load cell is being used.
- For Tension Calibration if the End-User is Calibrating per ISO 7500, They Should Use Adapters Recommended Per the ISO Annex, which would be different than what is shown here

Summary of Morehouse Common Adapters



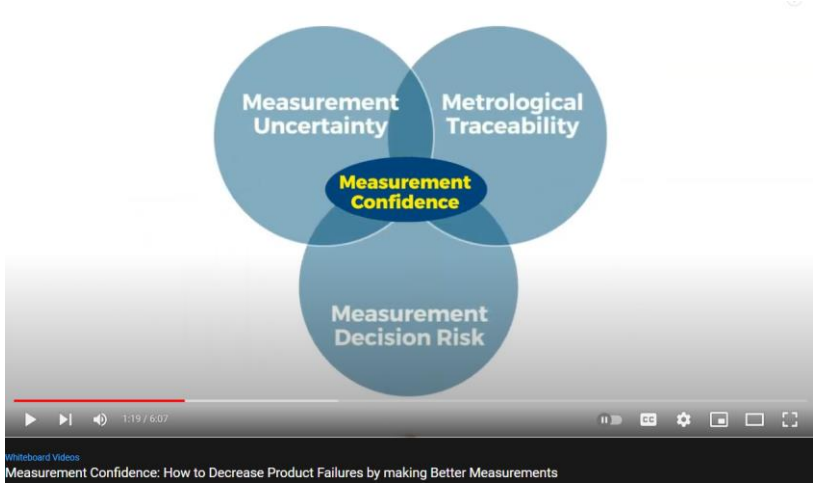
The Right Calibration Provider

Morehouse has reference force standards with calibration and measurement capabilities of better than 0.002 % to conduct many tests on adapters and provide solutions that improve measurements for our customer base.

- The frightening part of this is that not everyone in the industry realize they have these errors.
- Can you imagine the company making critical measurements using a machine that is not plumb, level, square, rigid, free of torsion, and does not replicate end-use conditions?
- How about weighing something like a ton of uranium with the wrong pin size using a tension link?

These measurements matter and the errors can be significant!

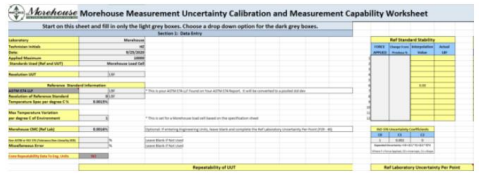
Want More Information?



[Morehouse YouTube Videos]

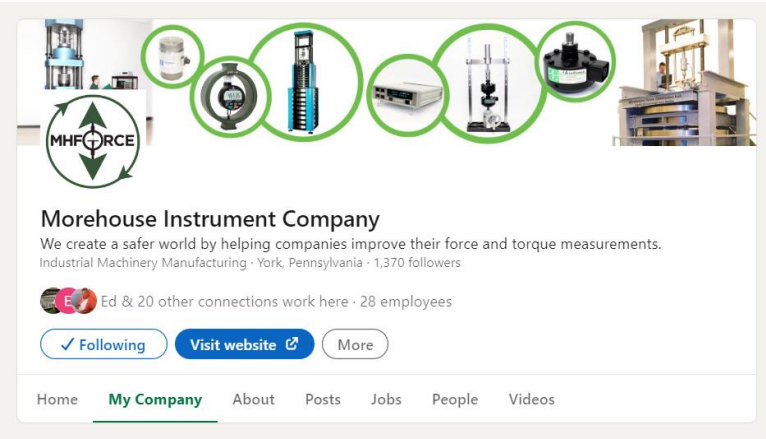
#1 CMC Calculation Made Easy Tool for Force Uncertainty

Are you having problems figuring out all of the requirements to calculate a CMC for force uncertainty or torque uncertainty? This excel sheet provides a template to calculate CMCs (force uncertainty) with explanations of everything required to pass an ISO/IEC 17025 audit.



Morehouse Free Force Uncertainty Spreadsheet to Calculate Calibration and Measurement Capability Uncertainty

[Morehouse Free Downloads]



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