Materials Testing Machine / Materials Testing System / Comprehensive Materials Testing System

ME-8236 / ME-8230 / ME-8244

Introduction

The Materials Testing Machine is a device for measuring force and displacement for various materials as those materials are stretched, compressed, sheared, or bent. The machine has a built-in load cell (strain gauge transducer) able to measure up to 7100 N (1600 lb) of force, as well as an optical encoder module that measures displacement of the load bar. A crank-and-gear system raises or lowers the load bar on two leadscrews. Force data from the load cell and displacement data from the encoder module can be recorded, displayed, and analyzed by PASCO Capstone data collection software via a PASPORT interface.

NOTE: SPARKvue data collection software should not be used with this apparatus.

TIP: Do not discard the packaging in which the equipment is shipped, including the foam inserts. The packaging serves as a convenient solution for transportation and long-term storage.

Included equipment

Equipment included in the Materials Testing Machine (ME-8236):

- Materials Testing Machine
- Calibration rod and nut
- Load bar round nut
- 2× safety shields

Note that PASCO Capstone and a PASPORT interface, such as the AirLink Interface (PS-3200), are required for data collection. These components are not included with the Materials Testing Machine (ME-8236) and must be purchased separately.

Equipment included in the Materials Testing System (ME-8230):

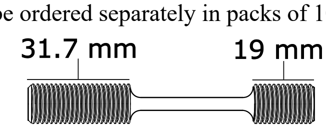
- All components included in the Materials Testing Machine
- AirLink Interface (PS-3200)
- PASCO Capstone Single User License
- 10× Aluminum Tensile Samples (ME-8231)
- 10× Brass Tensile Samples (ME-8232)
- 10× Annealed Steel Tensile Samples (ME-8233)
- 10× Acrylic Tensile Samples (ME-8235)
- 10× Steel Tensile Samples (ME-8243)

Equipment included in the Comprehensive Materials Testing System (ME-8244):

- All components included in the Materials Testing System
- Stress Strain Apparatus Coupons, Plastic (AP-8222)
- Stress Strain Apparatus Coupons, Metal (AP-8223)
- Materials System Storage Base (ME-8229)
- Bending Accessory (ME-8237)
- Flat Coupon Fixture (ME-8238)
- Shear Accessory (ME-8239)
- Photoelasticity Accessory (ME-8241)
- Structures Beam Fixture (ME-8242)
- Clevis Grip (ME-8245)
- 10-32 Adapter (ME-8246)
- Compression Accessory (ME-8247)
- Four-Point Load Anvil (ME-8249)
- Cast Beam Spares Set (ME-6983)
- Thin I-Beams (ME-7012)

Tensile sample information

Tensile samples are included with the Materials Testing System and are used for tensile strength testing. The samples include four metals (aluminum, brass, annealed steel, and steel) and two plastics (acrylic and polyethylene). All of the tensile samples have an overall length of 90 mm (3.5 in). The center section of each sample has a diameter of about 3.3 mm (0.131 in). The threaded ends are metric M12 × 1.75. The samples can also be ordered separately in packs of 10.

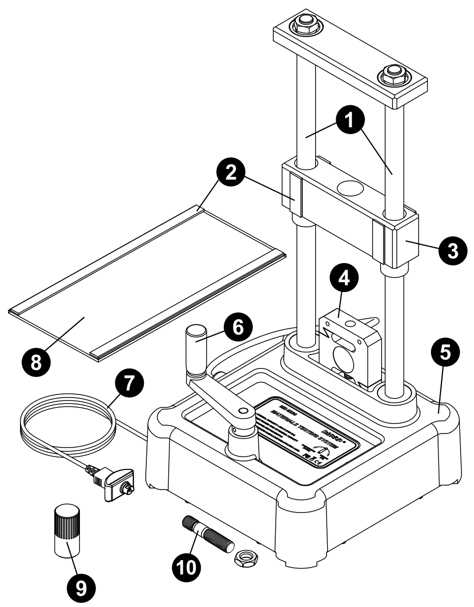


The table below shows typical values of tensile strength and Young's Modulus for the provided tensile samples.

Material	Tensile Strength (MPa)	Young's Modulus (GPa)
Aluminum	390 ± 20	60 ± 5
Brass (360)	610 ± 30	74 ± 10
Steel (1018)	700 ± 50	168 ± 15
Annealed steel (1018)	400 ± 40	180 ± 20
Polyethylene*	18 ± 2	1.3 ± 0.25
Acrylic*	70 ± 5	2.8 ± 0.5

*Tensile strength values for plastics depend on the rate at which the sample is stretched. Provided values were recorded with speeds of <5 mm/min; measured values may vary significantly at higher speeds.

Features



❶ **Leadscrews**

Rotate in response to the motion of the crankshaft.

❷ **Velcro® material**

Loop material found on the front and back of the load bar. Hook material found on safety shields. Use to secure shields in place during testing.

❸ **Load bar**

Holds the top of tensile samples and other accessories.

❹ **7100 N load cell**

Measures and records vertical force data, and holds the bottom of tensile samples and other accessories.

❺ **Base**

❻ **Crankshaft**

Turn clockwise to move the load bar upward. Turn counterclockwise to move the load bar downward.

❼ **Sensor cable**

Use to connect the apparatus to a PASPORT interface.

❽ **Safety shield**

Attach to the Velcro® loop material on the front and back of the load bar. *Always* use the shields when performing any experiment which could cause the sample to break!

❾ **Load bar round nut**

Use to connect one end of a tensile sample to the load bar, or to attach an accessory or adapter to the bottom of the bar.

❿ **Calibration rod and nut**

Use to determine how much the Materials Testing Machine itself flexes as force is applied in tension or compression experiments.

Setup

Setting up the Materials Testing System involves securing the machine to a sturdy support and setting up data collection in PASCO Capstone.

> ⚠ **CAUTION:** ALWAYS wear adequate eye protection when using the Materials Testing Machine or its accessories.

Securing the Materials Testing Machine

There are two holes through the base of the Materials Testing Machine that can be used to bolt the machine to a sturdy support. The two 6 mm diameter holes are 15 cm apart, with one on each side of the label, as shown in Figure 1.

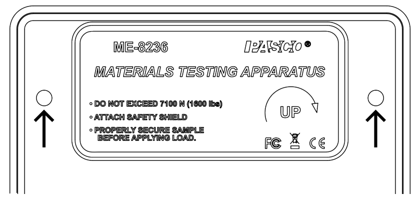


Figure 1: Position of the holes in the Materials Testing Machine's base.

Bolting the machine down will avoid the problem of the apparatus moving during a sample test. The Materials System Storage Base (ME-8229) is designed for two purposes: to provide a sturdy base to which the machine can be bolted, and to serve as a storage place for accessories, tools, and other items in the Comprehensive Materials Testing System.

The Storage Base includes two screws and two washers and has two threaded holes matching the spacing of the holes in the machine's base. To install the Storage Base:

1. Place the Materials Testing Machine onto the Storage Base, aligning the holes in the machine's base with the threaded holes in the Storage Base.
2. Place the washers onto the screws.
3. Insert one of the screws into a hole in the base of the machine and into the threaded hole in the Storage Base below.
4. Tighten the screw using your fingers.
5. Repeat Steps 3 and 4 for the other screw.
6. Use a 7/16 inch (11 mm) wrench to secure the screws in place.
7. *Recommended:* Use C-clamps (not included) to fasten the Storage Base to a sturdy bench or table.

The Materials Testing Machine and Storage Base can also be bolted directly to a table or bench, as shown in Figure 2. The Storage Base has holes at each of its corners to allow this type of connection.

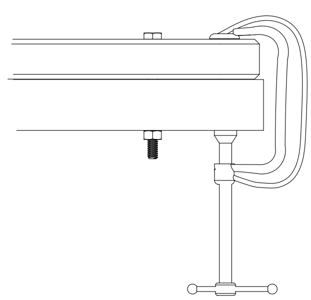


Figure 2: The Storage Base fastened to a table with a bolt and C-clamp.

Software setup

Follow the steps below to connect the Materials Testing Machine's sensors to PASCO Capstone and set up data collection.

To connect the apparatus to PASCO Capstone:

1. Turn on Capstone, then click **Hardware Setup** in the **Tools** palette.
2. Connect the AirLink (PS-3200) or another chosen PASPORT interface to Capstone. For instructions on doing this, see the interface's manual or the Capstone online help.
3. Plug the sensor cable on the apparatus into a PASPORT port on the interface. The program will automatically detect and recognize the Materials Testing Machine.

To set up data collection:

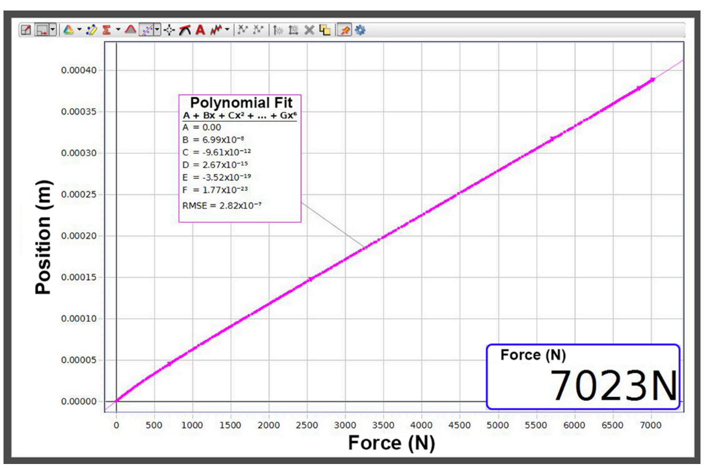
PASCO provides Capstone workbook files containing various pre-configured experiments for use with the Materials Testing System and its accessories. A list of these labs can be found at www.pasco.com/resources/lab-experiments/collection/35.

To create a new display, double-click the icon for the appropriate display type in the **Displays** palette, then click each **<Select Measurement>** box and select the desired measurement from the list.

Calibration

If the Materials Testing Machine were perfectly rigid, it would always give completely accurate measurements of force and displacement during compression and tension experiments. However, the machine is not perfectly rigid and will "flex" slightly while in use. To correct for this, we can perform a calibration procedure which will characterize the stiffness of the machine and perform a calculation to adjust the raw position data, leaving only the displacement that is due purely to the distortion of the test sample. This "compliance calibration" information can then be stored within the machine or in a Capstone file. *Compliance calibration should **always** be applied during an experiment!*

The calibration rod and nut can be used to calibrate the machine for compression or tension. The calibration rod will not change shape significantly under tension or compression. Thus, any displacement measured when using the rod is due to the flexing of the Materials Testing Machine itself. For example, the sample graph below shows that the machine flexes by 0.2 mm per 3750 N of force while the calibration rod is being stretched. When using this machine to stretch a sample, this "flex" amount of 0.2 mm per 3750 N must be subtracted to obtain accurate data.



> **NOTE:** PASCO provides a Capstone workbook file walking the user through creating a compliance calibration. To download this file, visit www.pasco.com/resources/lab-experiments/collection/35 and select **Compliance Calibration Tutorial**.

Mount the calibration rod

To mount the calibration rod for tension:

1. Screw the short threaded end of the calibration rod into the top of the load cell.
2. Lower the load bar until the top of the calibration rod's long threaded end protrudes through the hole in the bar.
3. Screw the load bar round nut onto the top of the calibration rod. (See Figure 3.)

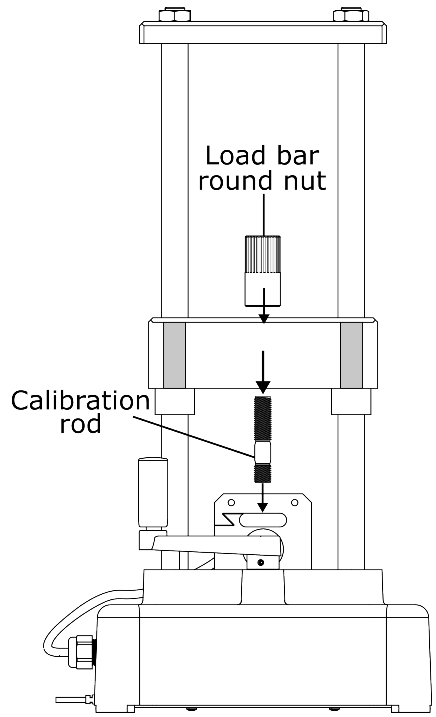


Figure 3: Mounting the calibration rod for tension experiments.

4. Attach the Velcro® hook material on the two safety shields to the loop material on the front and back of the load bar. Adjust the shields' position so that they will block any fragments of the calibration rod if it accidentally breaks.

To mount the calibration rod for compression:

1. Screw the short threaded end of the calibration rod into the top of the load cell.
2. Screw the calibration nut onto the long threaded end of the calibration rod until the nut is at the bottom of the threaded section.
3. Lower the load bar until the bottom of the bar rests on the top of the calibration nut.
4. Attach the Velcro® hook material on the two safety shields to the loop material on the front and back of the load bar. Adjust the shields' position so that they will block any fragments of the calibration rod if it accidentally breaks.

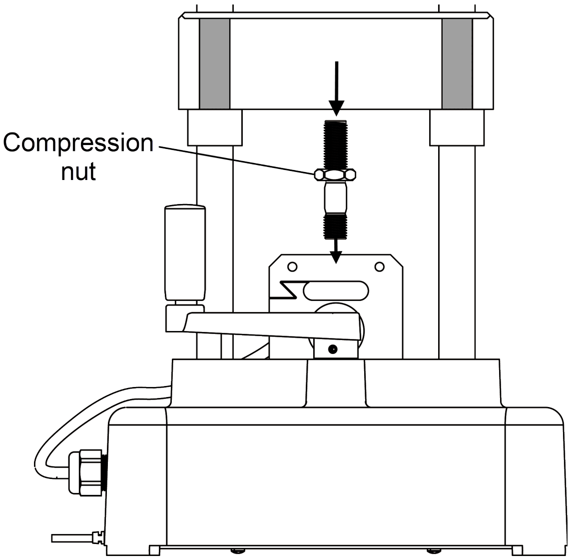


Figure 4: Mounting the calibration rod for compression experiments.

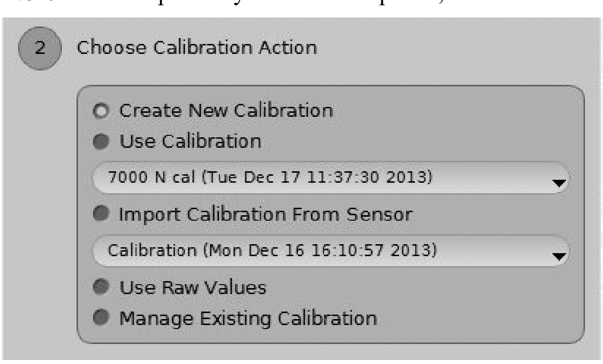
Optional: Change the sign

By default, the Materials Testing Machine treats the force and position values recorded during tension force experiments as negative. While it is possible to use the machine with these negative values for force and position, it is more convenient to change the sign convention to be positive before calibrating the sensor for tension experiments.

1. Select **Hardware Setup** from the **Tools** palette.
2. Click the **Properties** icon next to the sensor's name.
3. The "Change Sign" box in the Properties window is unchecked by default. This means that position and force will both be positive as the load bar is moving down, as in a *compression* experiment. For *tension* experiments, check this box to enable sign changing.
4. Click **OK** to exit the Properties window.

Calibration options

To access the calibration options, select **Calibration** from the **Tools** palette. Ensure that **Materials Testing System: Compliance Calibration** is selected as the measurement type to be calibrated, then click **Next**. This will present you with five options, as shown below.

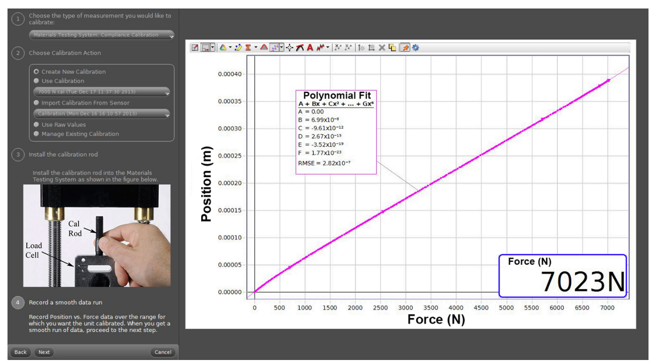


- **Create New Calibration:** Create and save a new compliance calibration.
- **Use Calibration:** Enable a compliance calibration loaded into the Capstone file. If the dropdown menu is blank and inaccessible, there are no saved calibrations in the file.
- **Import Calibration From Sensor:** Import a compliance calibration stored on the sensor to the current Capstone file.
- **Use Raw Values:** Temporarily disable compliance calibration for the experiment.
- **Manage Existing Calibration:** Rename or delete a compliance calibration stored in the file, or upload it to the sensor.

The following sections will explain some key uses of these functions.

Create a new calibration

1. From the calibration options, select **Create New Calibration** and click **Next**. A graph display tracking Position versus Force will automatically be created.
2. If you have not already done so, set up the apparatus for calibration, following the appropriate instructions from **Mounting the calibration rod**. Ensure the bar is at a position where it is not yet exerting a force on the rod.
3. Click **Next**.
4. When you are ready to begin collecting calibration data, click **Record**. The program will automatically begin recording position and force data from the apparatus.
5. Rotate the crank to begin causing the load bar to exert a force on the calibration rod. For tension tests, rotate clockwise to move the bar up. For compression tests, rotate counterclockwise to move the bar down.
6. Once your calibration has covered the full range of force values which you expect to use in your experiment, click **Stop** to end data recording. The graph display will automatically plot a best fit curve of the collected data.



7. Click **Next**.
8. The program will now display the Curve Fit Editor, allowing you to adjust the best fit curve for the data. If desired, you can change the number of terms, enter an "Initial Guess" for each coefficient, and lock or unlock a coefficient value.

> **NOTE:** If the curve fit was not successful, use trial and error in the Curve Fit Editor to adjust the coefficients until the curve fit is successful. Click **Update Fit** to view the impact of each new coefficient.

9. Once you receive a message saying "Curve fit was successful", click **Next**.
10. Name your compliance calibration, then click **Finish**.

Once a new compliance calibration has been created, you can apply it at any time from the calibration options by choosing **Use Calibration**, selecting the name of the calibration from the dropdown list, and clicking **Finish**.

Store a calibration on the sensor

After creating a new calibration, you can store this calibration on the sensor using the following steps.

1. From the calibration options, select **Manage Existing Calibration**, then click **Next**.
2. Ensure that the calibration you wish to upload is selected in the new dropdown box.
3. Select **Save Calibration In Sensor** and click **Next**.
4. Using the new dropdown box, select which calibration slot you wish to overwrite with the new calibration.
5. Click **Finish**.

The sensor can store up to four compliance calibrations at a time. Any "slots" not containing calibration data will be listed as "Empty Calibration" followed by a number from 0 to 3.

Import an existing calibration

1. From the calibration options, select **Import Calibration From Sensor**.
2. Open the dropdown list and select the name of a compliance calibration stored on the sensor.
3. Click **Finish** to import the selected calibration to the current Capstone file.

Tension force data collection

Once you have a successful compliance calibration, you may begin collecting data using the Materials Testing System. One of the simplest and most accessible experiments that can be done with the machine is tensile strength testing, which only requires the machine itself, a tensile sample, and the load bar round nut.

Mount a tensile sample

1. Select a tensile sample, then place the shorter threaded section of the sample into the threaded hole in the top of the load cell.
2. Screw the sample into place until the top edge of the short threaded section is flush with the top of the load cell.
3. Using the crank handle, lower the bar until the longer threaded section of the sample protrudes through the hole in the center of the bar.
4. While holding the tensile sample so it does not turn, screw the round nut onto the longer threaded section until the sample is held tightly in place.
5. Attach the two safety shields to the front and back of the load bar. Adjust the shields' position so that they will block any fragments that may come from the sample.
6. Turn the crank handle clockwise to raise the load bar until you begin to feel resistance, then turn it back counterclockwise by about a quarter turn.

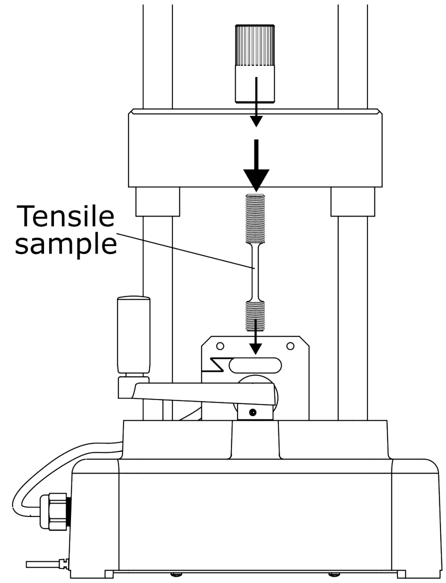


Figure 5: Mounting a tensile sample in the machine.

Seat the sample and set a pre-load

In order to obtain the best possible data, a test sample should be slightly stretched and relaxed to properly "seat" the sample and remove any slack, and a pre-load should be set.

1. In Capstone, create a graph display of Position versus Force, as well as a digits display of Force.
2. With the sample mounted, ensure the load bar round nut is slightly loose and not applying a force on the sample.
3. Click **Record**.

> **NOTE:** If the position and force data on the graph do not start at zero, check the sensor properties by opening the **Hardware Setup** tool and clicking the **Properties** icon next to the sensor's name. Make sure the check box for **Zero Sensor Measurement at Start** is checked.

4. Slowly turn the crank clockwise until the force reading is approximately 100 N. Note the position and force data being plotted on the graph display.
5. With data still being recorded, slowly turn the crank back counterclockwise, carefully watching the digits display. Continue turning the crank until the force is between 10 and 20 N, then stop. *Do NOT* let the force go back to 0 N.
6. Turn the crank clockwise again to increase the force to the same level as before. Take note of how the second plot of data looks on the graph compared to the first.
7. If the second plot of data "tracks" on top of the first plot, the sample is properly seated. If not, repeat the process of applying and unloading force until two consecutive plots of data track on top of each other. (This may take several repetitions.)
8. Return the crank to a position where 100 N of force are on the sample, then click **Stop**. Since the Materials Testing Machine is set to automatically zero itself the next time you begin recording data, this puts a pre-load of 100 N on the sample, which will improve data quality.

Apply a tension force

1. If you have not already done so, create a display in Capstone to measure your desired quantities.
2. Click **Record** to begin collecting data.
3. Turn the crank in a clockwise direction to move the load bar upward, applying a tension force to the tensile sample. Observe the data as it is collected.
4. When the sample breaks, or when the maximum force covered by the compliance calibration is reached, stop recording data.

Comprehensive Materials Testing System components

The following sections outline the use of various components included in the Comprehensive Materials Testing System (ME-8244). Note that these products can also be individually ordered separately from the apparatus. For information on collecting data using these components, see the experiment library for the Comprehensive Materials Testing System at www.pasco.com/resources/lab-experiments/collection/35.

Bending Accessory (ME-8237)

The Bending Accessory includes a plunger, a base with two adjustable support anvils, a small hex key, and two mounting screws. The plunger can be mounted on the bottom of the load bar using the load bar round nut. The base for the adjustable anvils can be screwed onto the top of the load cell.

1. The spacing between the support anvils can be adjusted if desired. To do so, use the hex key to loosen the screws holding the anvils, slide them to the desired distance from each other, and tighten the screws securely.
2. Insert the threaded rod attached to the plunger into the bottom of the hole in the load bar, as shown in Figure 6. Hold the plunger in place.
3. Use the round nut to secure the plunger in place on the load bar.
4. Remove the screws from the anvil base, then position the base on top of the load cell.
5. Align the threaded holes in the base with the threaded holes near the top of the load cell. Insert the screws into these holes and tighten them with the hex key to secure the base in place.
6. Place a sample for testing on the two support anvils, as shown in Figure 6.
7. Attach the two safety shields to the front and back of the load bar. Adjust the position of the shields if needed.
8. Turn the crank counterclockwise to lower the load bar and apply a force to the sample via the plunger.

The full setup of the Bending Accessory on the Materials Testing Machine is shown in Figure 6.

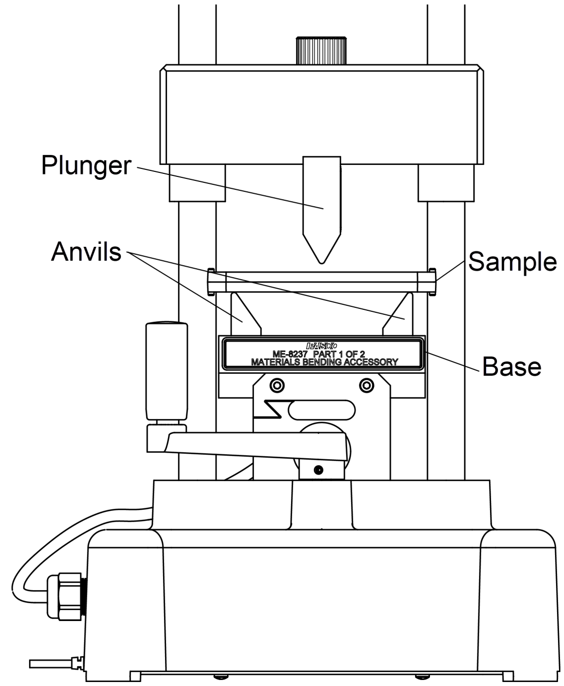
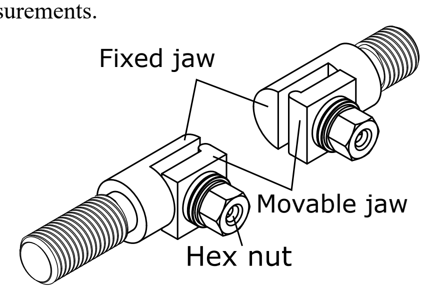


Figure 6: Mounting the Bending Accessory onto the apparatus.

Flat Coupon Fixture (ME-8238)

The Flat Coupon Fixture includes two coupon clamps and a "tee-handle" wrench with a 3/8" socket. One of the clamps fits into the load cell, and the other fits into the load bar. These clamps can be used to mount a Stress Strain Apparatus Coupon, either plastic (AP-8222) or metal (AP-8223), onto the Materials Testing Machine for tensile strength measurements.



1. Loosen, but do not remove, the hex nut on each clamp. The jaws of the clamp are spring-loaded, so the moveable jaws will separate from the fixed jaws.
2. Screw the clamp with the shorter threaded section into the load cell.
3. Raise the threaded section of the other clamp up through the hole in the load bar, then use the round nut to hold this upper clamp in place. Do NOT completely tighten the round nut yet.
4. Carefully place one end of a coupon between the jaws of the bottom clamp.
5. While holding the moveable jaw to keep it aligned with the fixed jaw, use the wrench and socket to tighten the hex nut.

> **IMPORTANT:** Each coupon is fragile. Do NOT let the moveable jaw twist out of alignment with the fixed jaw, as this might bend the coupon.

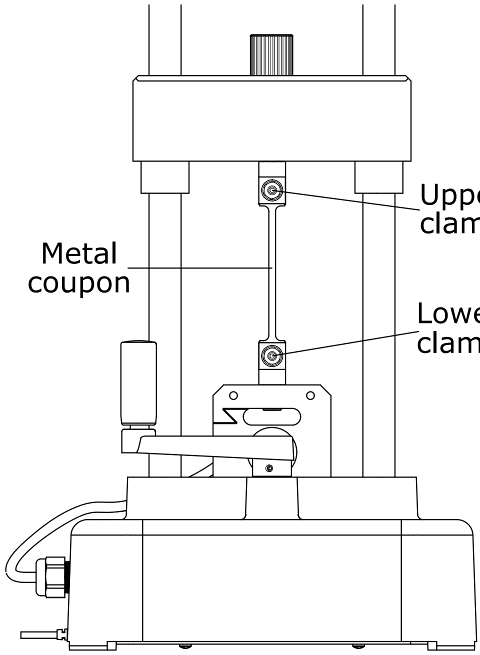


Figure 7: Mounting a metal coupon with the Flat Coupon Fixture. Note that a plastic coupon can be attached in the same way.

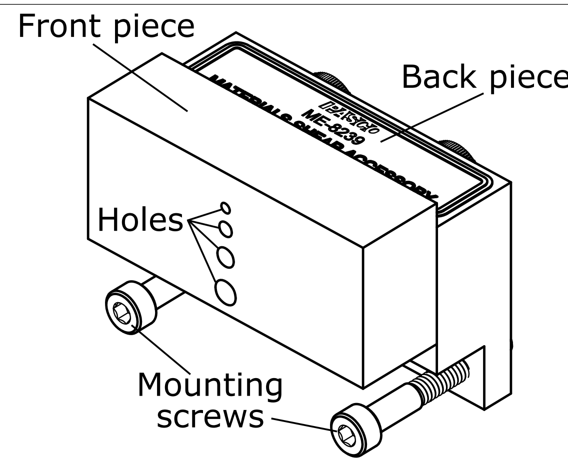
6. Rotate the upper clamp so that it is aligned with the lower clamp.
7. Adjust the position of the load bar until you have room to carefully place the free end of the coupon between the jaws of the upper clamp.
8. While keeping the moveable jaw aligned with the fixed jaw, tighten the upper clamp's hex nut with the wrench and socket.
9. While holding the upper clamp so it remains parallel to the lower clamp, tighten the round nut slightly to remove any slack in the coupon.
10. Attach the two safety shields to the front and back of the load bar. Adjust the position of the shields if needed.

With the coupon installed, you can now conduct tension experiments similar to those done with the tensile samples in previous sections.

Shear Accessory (ME-8239)

The Shear Accessory consists of two pieces of hardened steel, a front piece and a back piece, held together by two permanent screws. A package of Shear Samples (ME-8240) and a pair of mounting screws are also included. The front piece can slide vertically relative to the back piece, which is designed to be mounted on the load cell using an included hex key. The two pieces have pairs of matching holes with four different diameters to fit a variety of test samples. The hole diameters, from top to bottom, are about 0.067 in (1.7 mm), 0.099 in (2.5 mm), 0.130 in (3.3 mm), and 0.161 in (4.1 mm). These holes are designed to accommodate rods with diameters of 1/16 in, 3/32 in, 1/8 in, and 5/32 in respectively. The Shear Samples include three 1/8 in diameter rods each of aluminum, brass, and mild steel.

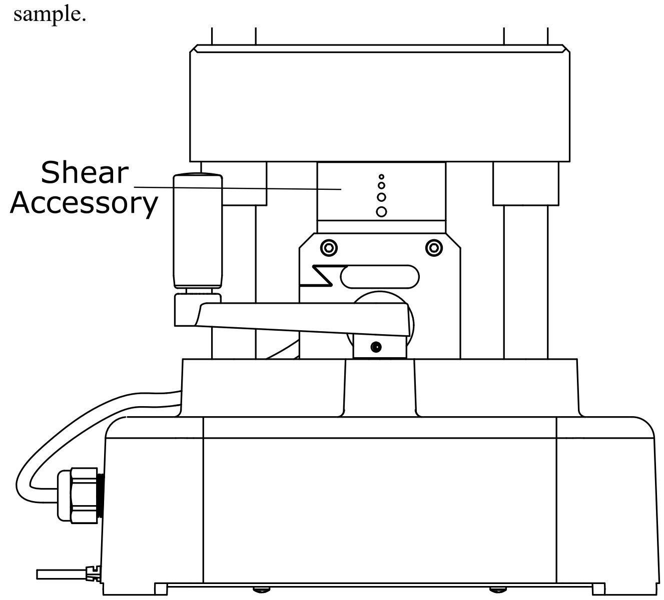
> **IMPORTANT:** Do NOT use any samples with a hardness greater than mild steel, as doing so may damage the Shear Accessory!



1. Using the two mounting screws, attach the back piece of the Shear Accessory to the top of the load cell. Tighten the screws using the included hex key.
2. Raise the front piece by hand as far as it will go. When doing this, the holes in the front piece align with the matching holes in the back piece.
3. Insert the test sample through the pair of holes that best matches the diameter of the sample.

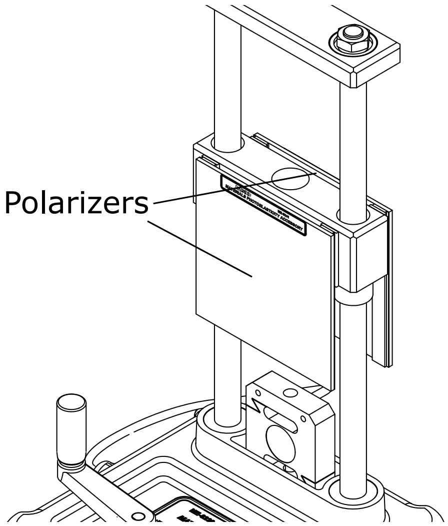
> **TIP:** Use a sample long enough to extend about a quarter inch (~6 mm) beyond the front *and* back pieces. This makes it easier to remove the sample remnants from the accessory after the test while not obstructing the shield.

4. Adjust the position of the load bar so that it rests on the top surface of the front piece.
5. Attach the two safety shields to the front and back of the load bar. Adjust the position if needed.
6. When you are ready, turn the crank handle counterclockwise to move the load bar downward, applying a shearing force to the sample.



Photoelasticity Accessory (ME-8241)

The Photoelasticity Accessory is designed to demonstrate the photoelastic phenomenon in clear plastic samples. Viewing these samples through crossed polarizers reveals patterns of different colors, which show stress distribution in the sample. The accessory includes two rectangles of polarizer material that can be attached to the Velcro® loop material on the Materials Testing Machine's load bar, as shown below. For best results, place a light source so that it shines through the polarizers from behind.

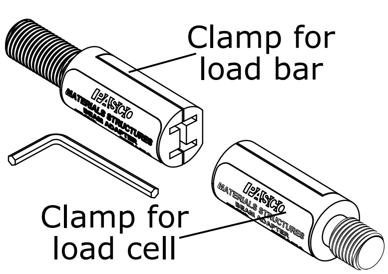


The Photoelasticity Accessory also includes a Photoelastic I-Beam Set (ME-7011), including 24 #3 beams and 24 #4 beams. These beams are similar to the I-beams that are supplied in the Comprehensive Materials Structures System, as well as various PASCO Structures Systems, such as the Truss Set (ME-6990). However, the Photoelastic I-beams are made of a clear polycarbonate plastic and do not have holes in the web area of the beam. These beams can be mounted on the Materials Testing Machine using the Structures Beam Adapter (ME-8242). By viewing the beams through the polarizers, the distribution of stress in these beams can be studied. The #3 I-beam is 11.5 cm long, and the #4 I-beam is 17 cm long.

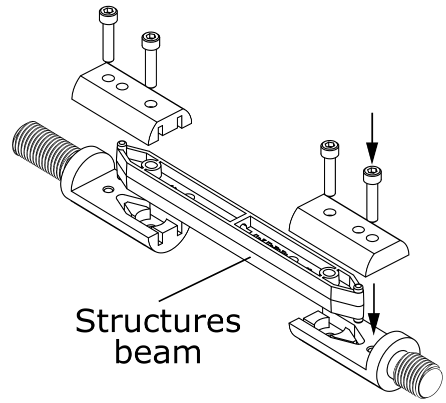
Structures Beam Adapter (ME-8242)

PASCO offers a variety of beams that can be used with the Materials Testing Machine. These beams include models of I-beams and other structure elements. The Structures Beam Adapter is designed to hold a structures beam so it can be tested under tension and compression.

The Structures Beam Adapter consists of two clamps and a hex key, as shown below. Each clamp has two jaws, one of which can be removed so that one end of a structures beam can be put in the clamp. The threaded ends of the clamps fit into the load bar and load cell of the Materials Testing Machine.



1. Using the included hex key, remove the screws that hold the two parts of each clamp together.
2. Put one end of a structures beam, such as a #3 I-beam, into one half of the load bar clamp (the clamp with the longer threaded section).
3. Use the screws to reattach the other part of the load bar clamp.
4. Repeat Steps 2 and 3 to attach the load cell clamp, which has the shorter threaded section, to the other end of the beam, as shown below.



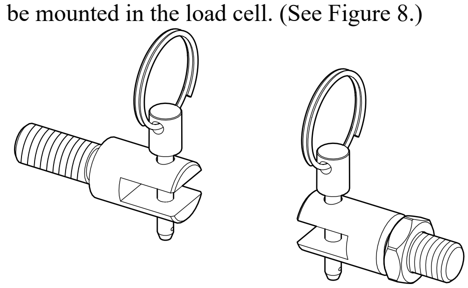
5. Screw the threaded end of the load cell clamp into the hole in the top of the load cell.
6. Using the crank handle, lower the load bar until the threaded end of the load bar clamp extends through the hole in the bar.
7. Use the round nut to secure the load bar clamp in place.
8. Attach the two safety shields to the front and back of the load bar. Adjust their position if necessary.

The mounted structures beam can now be subjected to compression or tension forces.

Clevis Grip (ME-8245)

The Clevis Grip is designed to allow tensile testing of samples which have hooked ends or through holes. Each grip includes a pin which can be inserted into a hole in the grip, securing the sample in place. The diameter of each clevis pin is 0.187 in (0.47 cm). Each pin contains a pair of small, spring-loaded spheres near its end, which keeps the pin from slipping out of the clip.

The grip with the longer threaded section is designed to be mounted in the load bar of the Materials Testing Machine and secured in place with the round nut. The grip with the smaller threaded section and hex nut is designed to be mounted in the load cell. (See Figure 8.)



NOTE: As with all other tests, remember to use the safety shields when performing experiments!

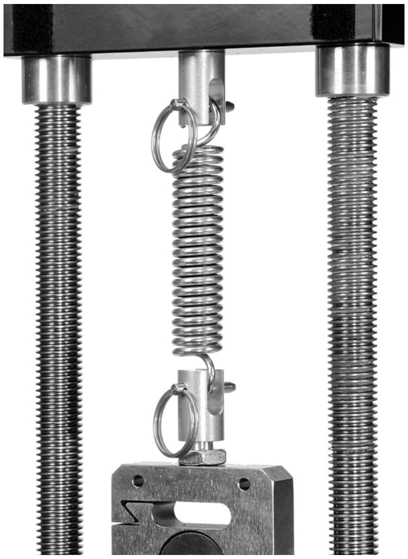
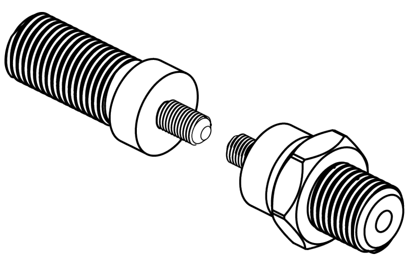


Figure 8: A spring secured in place using the Clevis Grip.

10-32 Adapter (ME-8238)

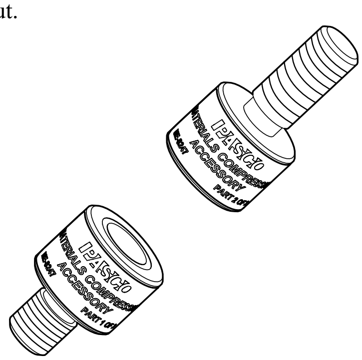
Several devices used to hold materials in place during materials testing have a 10-32 hole designed for mounting devices on a materials tester. The 10-32 Adapter is designed to connect these devices to the load bar and load cell of the Materials Testing Machine.

The adapter includes two components, as shown before. The adapter with the longer larger-diameter threaded section is designed to be mounted in the load bar of the Materials Testing Machine. The adapter with the shorter larger-diameter threaded section and hex nut is designed to be mounted in the top of the load cell.



Compression Accessory (ME-8247)

The Compression Accessory is designed to work with the Materials Testing Machine to compress samples. The accessory consists of two one inch (2.54 cm) diameter platforms that provide a sturdy base for compression samples. The platform with the shorter threaded end should be mounted into the load cell, and the platform with the longer threaded end should be mounted into the load bar and secured in place with the round nut.

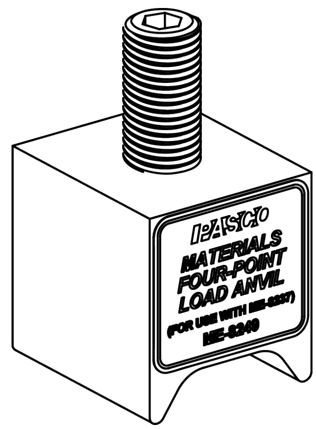


The Compression Accessory also includes a set of twenty Compression Samples (ME-8248). These polyethylene cylinders are approximately 0.5 in (1.3 cm) in diameter and 0.75 in (2 cm) in length.

> **NOTE:** As with all other tests, remember to use the safety shields when performing experiments!

Four-Point Load Anvil (ME-8249)

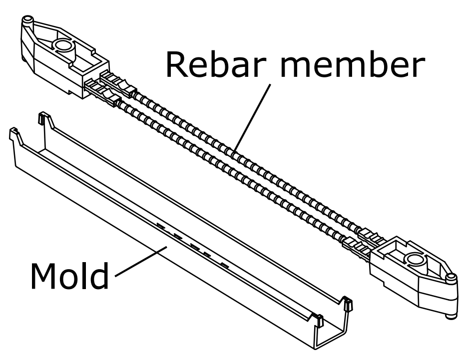
The Four-Point Load Anvil extends the capabilities of the Bending Accessory. When used with the Bending Accessory and the Materials Testing Machine, the anvil can be used to measure, record, and analyze data on the tested sample's flexural plastic modulus and modulus of rupture.



To use the accessory, simply replace the plunger from the Bending Accessory with the Four-Point Load Anvil and follow the instructions as normal.

Cast Beam Spares Set (ME-6983)

The Cast Beam Spares Set includes 30 "Rebar" members and 10 "molds". A Cast Beam consists of a beam that is a model of the reinforcement bars ("rebar") used in construction and a mold that is used to produce a model of a beam made of reinforced or prestressed "concrete". After the rebar member is aligned with the mold, a mixture of fine sand, plaster, and water is poured into the assembled rebar beam and mold.



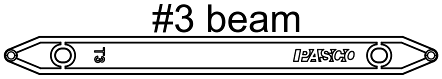
After the mixture hardens and the mold is removed, the beam can be used as a #4 beam in any PASCO Structures Set or tested on the Materials Testing Machine, as shown in Figure 9.

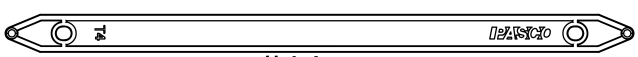
Figure 9: Testing a Cast Beam using the Bending Accessory and Four-Point Load Anvil.

Thin I-Beams (ME-7012)

The Thin I-Beams set consists of 48 thin I-beams, including 24 each of two sizes: #3 beams and #4 beams. These beams are like those found in PASCO Structures Systems, but with no holes in the web area. Therefore, when used with the Materials Testing Machine, the test results are more like those that would be obtained for the metal I-beams used in real construction.

#3 beam





#4 beam

Maintenance

The apparatus requires minimal regular maintenance. The leadscrews must be kept clean and may need to be re-lubricated at some point. Use a food grade anti-seize grease containing PTFE (polytetrafluoroethylene, commonly known as Teflon®) to lubricate the leadscrews.

If problems arise with the Materials Testing Machine, contact PASCO scientific for technical support. Attempting to fix the equipment yourself is not recommended.

Software help

The PASCO Capstone Help provides information on how to use this product with the software. You can access the help from within the software or online.

Software: Help > PASCO Capstone Help

Online: help.pasco.com/capstone

Specifications and accessories

Visit the product page at pasco.com/product/ME-8244 to view the specifications and explore accessories. You can also download experiment files and support documents from the product page.

Experiment files

Download one of several student-ready activities from the PASCO Experiment Library. Experiments include editable student handouts and teacher notes. Visit pasco.com/resources/lab-experiments/collection/35.

Technical support

Need more help? Our knowledgeable and friendly Technical Support staff is ready to answer your questions or walk you through any issues.

Chat	pasco.com
Phone	1-800-772-8700 x1004 (USA) +1 916 462 8384 (outside USA)
Email	support@pasco.com

Limited warranty

For a description of the product warranty, see the Warranty and Returns page at www.pasco.com/legal.

Copyright

This document is copyrighted with all rights reserved. Permission is granted to non-profit educational institutions for reproduction of any part of this manual, providing the reproductions are used only in their laboratories and classrooms, and are not sold for profit. Reproduction under any other circumstances, without the written consent of PASCO scientific, is prohibited.

Trademarks

PASCO and PASCO scientific are trademarks or registered trademarks of PASCO scientific, in the United States and in other countries. All other brands, products, or service names are or may be trademarks or service marks of, and are used to identify, products or services of, their respective owners. For more information visit www.pasco.com/legal.

Product end-of-life disposal

This electronic product is subject to disposal and recycling regulations that vary by country and region. It is your responsibility to recycle your electronic equipment per your local environmental laws and regulations to ensure that it will be recycled in a manner that protects human health and the environment. To find out where you can drop off your waste equipment for recycling, please contact your local waste recycle or disposal service, or the place where you purchased the product. The European Union WEEE (Waste Electronic and Electrical Equipment) symbol on the product or its packaging indicates that this product must not be disposed of in a standard waste container.

CE statement

This device has been tested and found to comply with the essential requirements and other relevant provisions of the applicable EU Directives.

FCC statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.