

New from **PASCO**

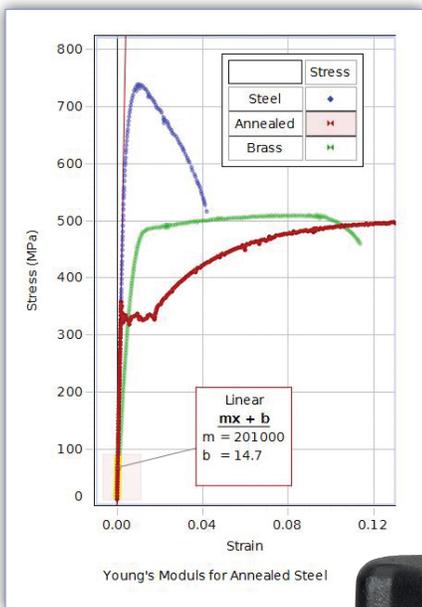


Materials Testing System

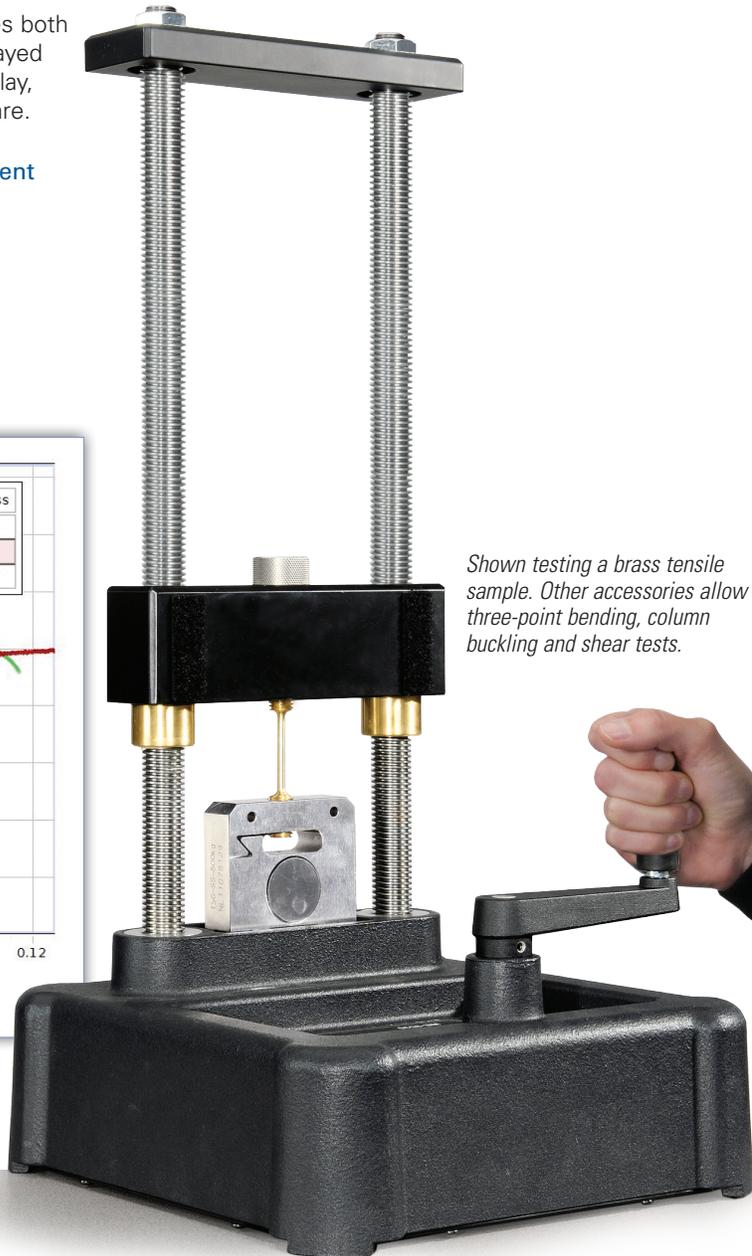
Introducing the most affordable way to teach material testing!

This integrated system measures both force and position. Data is displayed real-time in graphs or digits display, using PASCO Capstone™ Software.

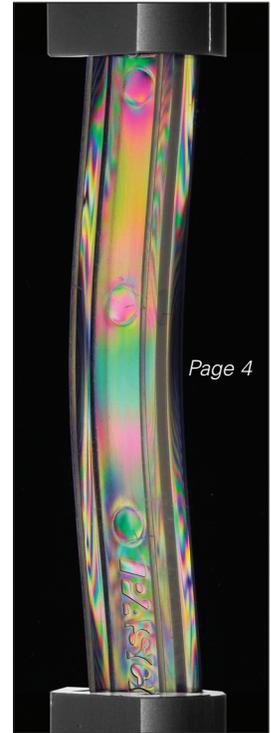
- ▶ Computer-based Measurement
- ▶ Tensile Testing
- ▶ Column Buckling
- ▶ Bending
- ▶ Shear



Investigate material properties including Young's Modulus, Tensile Strength, Yield Strength, Ductility and Modulus of Resilience.



Shown testing a brass tensile sample. Other accessories allow three-point bending, column buckling and shear tests.



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Materials Testing Machine

- ▶ Designed for students learning about material properties
- ▶ Inexpensive samples make it possible for each student to experience it first-hand
- ▶ Hand-cranked so students can feel samples break
- ▶ Utilizes PASCO Capstone software for data collection, analysis and video syncing. Unique software makes compliance calibration easy



PASCO Capstone workbooks include all instructions needed to perform the experiment:

- ▶ Set-up instructions
- ▶ Introduction and theory
- ▶ Detailed analysis and summary questions

Download FREE

www.pasco.com/MaterialsTester

Analysis

- Use Text annotations to mark the following regions of your graph.
Elastic, Uniform Plastic Deformation, Non-uniform Plastic Deformation, Strain Hardening, Tensile Strength, Necking, Geometric softening, and Fracture.
- What important quantities did you measure? How did your values compare to those listed in reference data tables for the material? How did the values found for this material compare to other materials tested.

| Material | E GPa | Yield MPa | Tensile MPa | Elongation % | Toughness MJ/m ³ |
|----------|----------|--------------|----------------|-----------------|--------------------------------|
| Steel | 200 | 400 | 750 | 7 | 42 |
| Annealed | 200 | 250 | 450 | 21 | 64 |
| Brass | 70 | 200 | 450 | 13 | 60 |
| Aluminum | 60 | 250 | 450 | 10 | 33 |

Tensile Strength

Graph Regions

display at right shows you the rate that you are raising (▲) or lowering (▼) the cross-head beam, in millimeters / minute.

- Practice turning the crank to raise the cross-head at a smooth, constant rate between 10 and 20 mm/min.

Tensile Samples

- Use calipers (or a micrometer) to measure the diameter of the machined portion of the tensile sample. Edit the value for diameter in line #3 of the calculator.
- Note that the calculator also has a value for the length of the sample. If you measure the complete machined portion, you should get about 38 mm. However, since there is a radius, the length of the thinner part that is actually stretching, is less. A good average value to use for the length is 35 ± 3 mm.
- Install the test sample as shown in Figure 3. The end of the bar with the longer threads should be screwed directly into the knurled cap nut.
- Lower the sample through the hole in the cross-head, and screw the other end of the sample into the top of the load cell, as shown in Figure 4. You will need to use the hand crank to adjust the height of the cross-head.
- When you are testing the sample, it is important that you use the plastic safety shields as shown in Figure 5. They attach with Velcro directly to the cross-head, and are easily installed and removed. Never touch the test sample when it is under load!

Figure 3. Installing Sample

Figure 4. Center Threads

Figure 5. Always use Shields

Download PASCO Capstone Trial Version at www.pasco.com/capstone

Specifications

- Sample rate:** 1 Hz to 500 Hz
- Force Range:** ± 7100 N
- Force Resolution:** 1 N @ 5 Hz
- Force Accuracy:** 10 N
- Cross-head displacement:** 27 cm
- Displacement Resolution:** 0.001 mm
- Machine weight:** 20 lbs (9 kg)
- Sturdy base:** cast aluminum
- Mounting holes:** for bolting to table
- Footprint:** 24 cm wide x 25 cm deep x 52 cm height

Materials Testing Machine (ME-8236) Includes: Machine, compliance calibration rod, and safety shields (requires Capstone software and a USB Link or other PASCO interface)



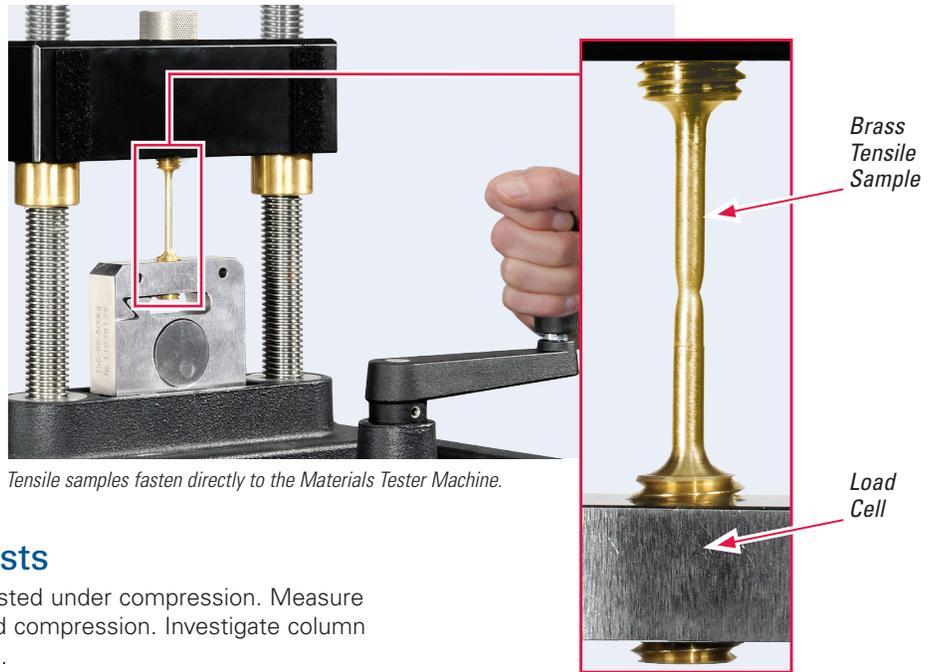
Order Information

| | |
|---------------------------------|----------|
| Materials Testing Machine | ME-8236 |
| PASCO Capstone Software | |
| Single User License | UI-5401 |
| Site License | UI-5400 |
| USB Link | PS-2100A |

Tensile Samples

Investigate material properties including

- ▶ Young's Modulus
- ▶ Tensile Strength
- ▶ Yield Strength
- ▶ Ductility
- ▶ Modulus of Resilience



Tensile samples fasten directly to the Materials Tester Machine.

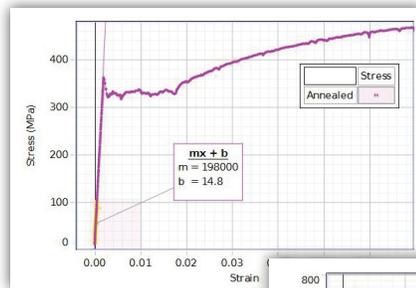
Perform compression tests

These "Tensile" samples can also be tested under compression. Measure the elastic modulus for both tension and compression. Investigate column buckling and the Euler Column Equation.

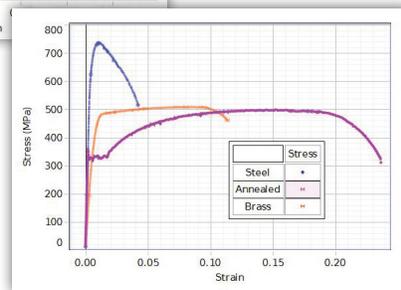


Measure the critical load needed to buckle the sample.

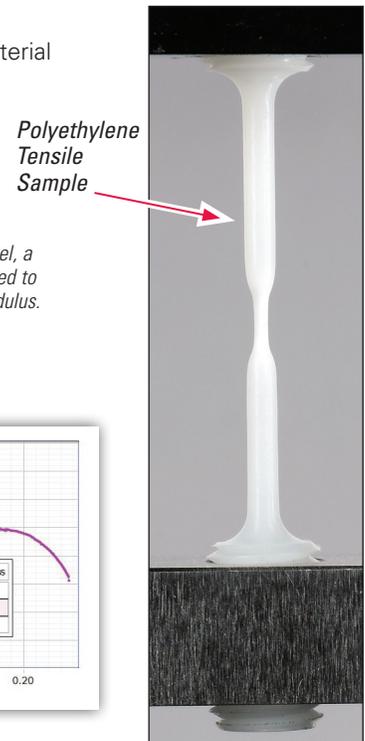
Detailed graphs allow students to investigate the material properties of various samples, and measure Young's Modulus as well as the Tensile Strength and Yield Strength for the material.



For annealed steel, a linear fit is applied to find Young's Modulus.



Tensile stress versus strain is plotted in Capstone software for steel, annealed steel, and brass.



Tensile Samples (set of 10 each)

Order Information

| | |
|--|---------|
| Tensile Sample Aluminum (10) | ME-8231 |
| Tensile Sample Brass (10)..... | ME-8232 |
| Tensile Sample Annealed Steel (10) | ME-8233 |
| Tensile Sample Steel (10) | ME-8243 |
| Tensile Sample Acrylic (10) | ME-8234 |
| Tensile Sample Polyethylene (10) | ME-8235 |

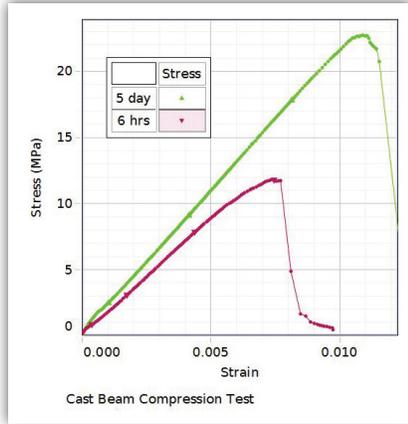
Structures Beam Fixture

Test beams from the PASCO Structures System under tension or compression

When a compressive force is applied to a long straight column, it will elastically compress until a critical force is reached, and at this point the column will suddenly buckle. The relationship between this critical load and the column material and geometry is called the Euler Column Equation, and it predicts the maximum compression force applied to a column before it buckles.

Cast Beams

Plaster of Paris is a brittle solid with fracture properties similar to cement, and can be used to model the load behavior of concrete beams. The cast beam shown here is tested to destruction under compression. Quantities measured include Young's Modulus and the Compressive Strength for the material.



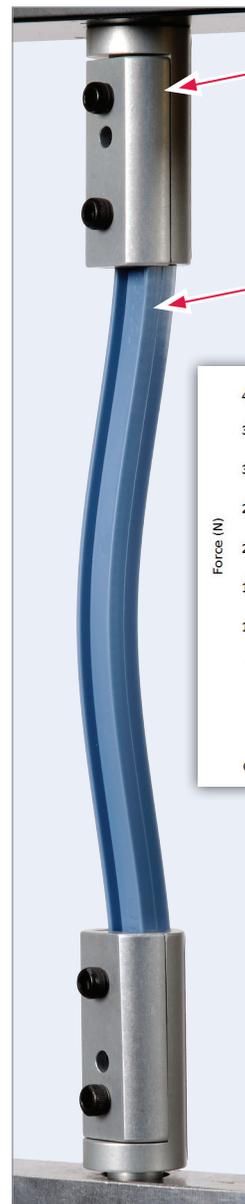
Graph shows that strength of Plaster of Paris increases with cure time.



Close-up of beam after destruction showing plastic "rebar".



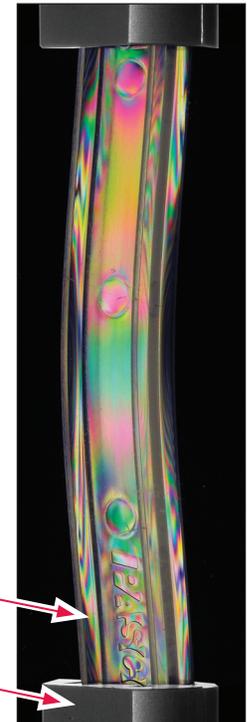
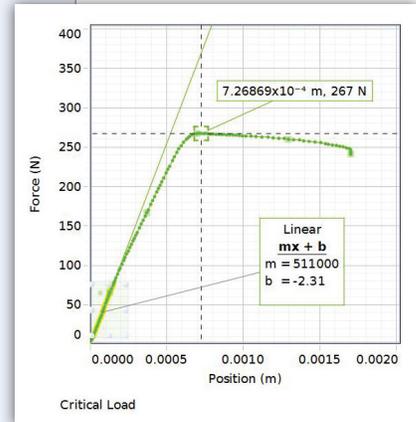
Structures Beam Fixture



Structures Beam Fixture

Plastic I-beam

Find the critical load that causes the beam to buckle.



Visualize the stress lines as the clear photoelastic beam is compressed and buckles.

Clear Plastic Photoelastic I-beam

Structures Beam Fixture

Order Information

Structures Beam Fixture..... ME-8242

Shown in use with:

Thin I-beams..... ME-7012

Cast Beams Spares..... ME-6983

(includes 30 rebar members, 10 cast beam molds)

Photoelastic I-beams Set..... ME-7011

Bending Accessory

Perform three-point bending tests of various materials, including beams from the PASCO Structures System. Support anvils have adjustable separation up to 10 cm.

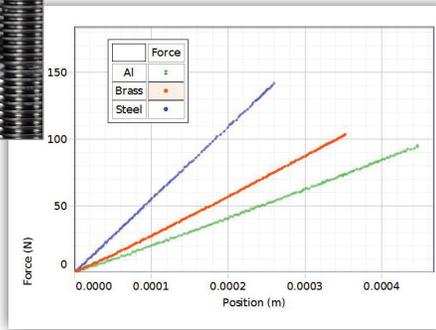


A Three-Point Bend test is performed on a brass rod from the ME-8240 Shear Samples. The support anvils have adjustable separation up to 10 cm.



Perform a Three-Point Bend Test on the ME-6983 Cast Beams from the PASCO Structures System. Quantities measured include the Flexural Elastic Modulus and the Modulus of Rupture for the material.

This Force vs. Position graph shows bending for aluminum, brass, and steel samples, all with the same anvil spacing. From this graph, the flexural elastic modulus for each material is measured.



Bending Accessory includes base with adjustable support anvil and load anvil.

Order Information

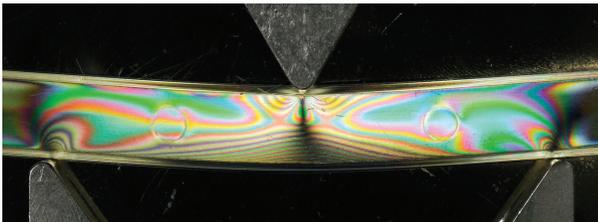
Bending Accessory.....ME-8237

Shown in use with:

Shear Samples (Set of 9).....ME-8240
Thin I-beams.....ME-7012
Cast Beams Spares.....ME-6983
(includes 30 rebar members, 10 cast beam molds)

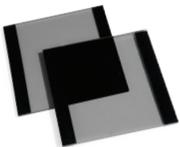
Photoelasticity Accessory

See stress lines by bending a clear, colorless photoelastic I-beam between two polarizing sheets. As the beam is bent, areas of greater stress show up as patterns of colored lines.



Illuminated using a standard compact fluorescent lamp (not included).

Photoelasticity Accessory consists of two crossed polarizing sheets which are placed in front of and behind the clear beam. When illuminated from behind by a bright white light, fringes due to the stress lines become visible.



Photoelasticity Accessory includes two polarizing sheets, 5 3/8" x 5 3/8" x 1/8" and one Photoelastic I-Beams Set (ME-7011)

Order Information

Photoelasticity AccessoryME-8241
Photoelastic I-beams Set (Set of 48)ME-7011

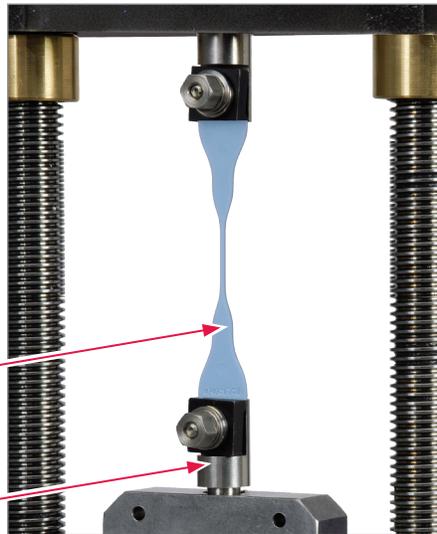
Flat Coupon Fixture

Tensile test any thin, flat material, such as paper, foil, or even a leaf! Designed to be used with the AP-8222, and AP-8223 flat coupons.

Shown using the Flat Plastic Test Coupons (AP-8222).

Flat, plastic coupon

Flat Coupon Fixture



Flat Coupon Fixture (ME-8238) includes:
Two clamps and a wrench

Shown using the flat brass coupon from the AP-8223 Metal Set.

Flat, brass coupon



Plastic set (AP-8222)



Metal set (AP-8223)

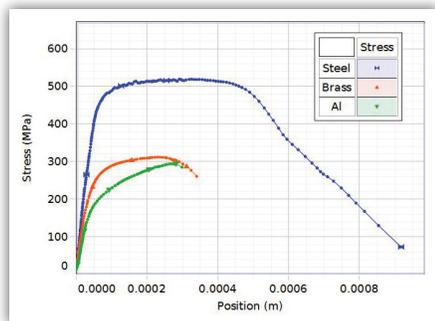
Order Information

| | |
|---|---------|
| Flat Coupon Fixture | ME-8238 |
| Plastic Test Coupons (40 coupons) | AP-8222 |
| Metal Test Coupons (50 coupons) | AP-8223 |

Materials Shear Accessory

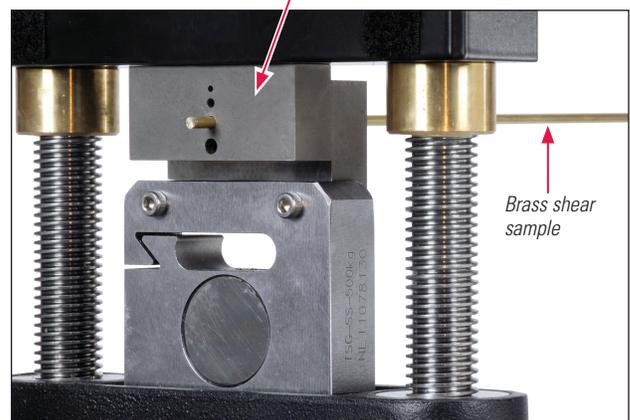
Perform shear tests for a variety of wires.

Accessory accepts diameters of 1/16", 3/32", 1/8", and 5/32". The Shear Accessory includes the ME-8240 Shear Samples, three each of 1/8" diameter, 12" long, aluminum, brass and mild steel.



The graph shows shearing of steel, brass, and aluminum rods, all having an 1/8" diameter. The shear strength of each material is measured.

Materials Shear Accessory



Brass shear sample

Shown shearing a brass wire..



Materials Shear Accessory (ME-8238) includes:
Shearing Block and Shear Samples (ME-8240)



Shear Samples include, 3 each of three types of wire.

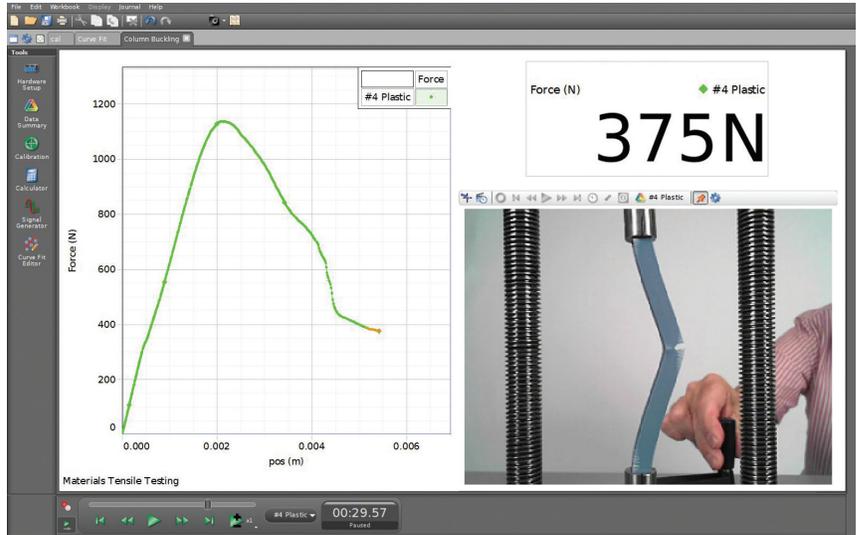
Order Information

| | |
|---------------------------------|---------|
| Materials Shear Accessory | ME-8239 |
| Shear Samples (set of 9) | ME-8240 |

PASCO Capstone Software

Combining video with simultaneous data graphs is a very powerful tool.

- ▶ PASCO Capstone is data collection and analysis software which has a special built-in compliance calibration routine for the Materials Tester.
- ▶ It is shown here plotting a graph and recording a video, synced together, in real time. Data analysis tools such as curve fits and area under the curve are available.
- ▶ With the USB Link or any of PASCO's other USB interfaces, you can take advantage of the power of Capstone by using some of the other 70+ sensors from PASCO.



Enhance student understanding of the behavior of materials. PASCO Capstone software has the ability to embed live video from a webcam and sync the Materials Tester data to the recorded video. Then you can play back the video along with the data on the graph, stepping through one frame at a time to see the exact breaking point.

Order Information

| | |
|--------------------------|---------|
| PASCO Capstone Software | |
| Single User License..... | UI-5401 |
| Site License | UI-5400 |

Download PASCO Capstone Trial Version at www.pasco.com/capstone

USB Camera Microscope

- ▶ Use as a web camera
- ▶ Optical zoom from 1x to 60x
- ▶ Built-in LED lights



This versatile USB Microscope Camera can take pictures and video just like a digital camera, but it can also magnify like a microscope when it's up close to a specimen. And you can use it to take pictures showing lab setups, and document what materials look like before and after an experiment has been performed.

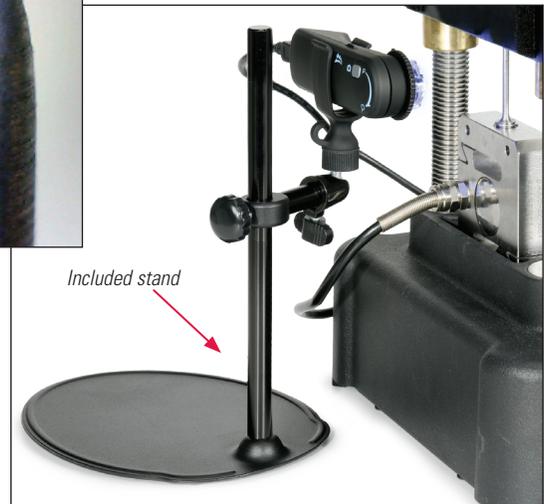
How It Works

Used with the video and image capture features in PASCO Capstone. Magnification of specimens can be changed by adjusting the dial located on the front of the camera.



Image of broken steel tensile sample taken with the microscope.

As the tensile sample is being stretched, the force versus time data is graphed in sync with the movie.



Included stand

Order Information

| | |
|---|---------|
| USB Camera Microscope | PS-2343 |
| <i>(Includes Camera, Microscope, and stand)</i> | |



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Dystrybutor PASCO w Polsce:



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Zapraszamy na strony: www.pasco.com.pl, www.pasco.com

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Profesjonalną i odpowiedzialną współpracą z nauczycielami wspieramy rozwój uczniów i studentów w współczesnym świecie.

Product Information

| ITEM | PART # | INCLUDES | SPECIFICATIONS |
|----------------------------|----------|---|--|
| Materials Testing Machine | ME-8236 | Machine only (requires Capstone software) | Load cell capacity: 7100 N (1600 lbs) Machine weight: 20 lbs (9 kg) Footprint: 24 wide x 25 depth x 52 cm height |
| Test Samples (10 ea.) | | | |
| Acrylic | ME-8234 | | Threaded: M12 x 1.75, Diameter 3.3 mm Total length: 8.9 cm, Working Length 3.5 cm |
| Aluminum | ME-8231 | 2024 - T3 aluminum | |
| Annealed Steel | ME-8233 | Annealed 1018 steel | |
| Brass | ME-8232 | 360 brass | |
| Polyethylene | ME-8235 | | |
| Steel | ME-8243 | 1018 steel | |
| Flat Coupon Fixture | ME-8238 | 2 Clamps and a Wrench | |
| Flat Test Coupons (10 ea.) | | | |
| Full Set | AP-8217A | AP-8222 and AP-8223 | |
| Plastic | AP-8222 | High impact polystyrene, nylon, ABS, polypropylene | |
| Metal | AP-8223 | Aluminum, annealed steel, steel, 2 thicknesses of brass | |
| Shear Accessory | ME-8239 | | 4 diameters: 1/16", 3/32", 1/8", 5/32" |
| Shear Samples | ME-8240 | 2024 - T4 aluminum, 360 brass, 1018 steel, (3 ea.) | 1/8" diameter, 12" long |
| Bending Accessory | ME-8237 | See "includes", on page 5 | Max separation: 10 cm |
| Photoelasticity Accessory | ME-8241 | Two polarizing sheets, one Photoelastic I-Beams Set (ME-7011) | Sheet size: 5 3/8" x 5 3/8" x 1/8" |
| Photoelastic I-Beams Set | ME-7011 | I-Beam #3 and #4, (24 ea. size) | 11.5 and 17 cm |
| Structures Beam Fixture | ME-8242 | 2 Clamps | |
| Thin I-Beams | ME-7012 | 24 #4 thin I-beams 17 cm long, and 24 #3 11.5 cm long | |
| Cast Beam Spares Set | ME-6983 | 30 rebar members, 10 cast beam molds | |