

# Using a Vernier Caliper

*That's right...  
don't waste time trying  
to learn how to use  
all the different types of  
vernier calipers  
and micrometers.  
You don't need to know.*

**W**hile rebuilding a 4T60E transaxle, you notice the pump rotor splines are worn; you'll need to replace the rotor. That's okay: You have several good used rotors on the shelf. But they come in different thicknesses. How can you tell which one you need?

You're going to have to measure the rotors to find one that's the correct thickness. Sounds easy, doesn't it? But the thickness variations are slight; sometimes as little as a few thousandths of an inch. A tape measure just isn't

going to cut it... you're going to need a more accurate way to measure thickness; you're going to need a vernier caliper or micrometer.

Having the right tool is easy enough: Calipers and micrometers are available from just about any tool or parts store.

The hard part is reading them. There are a number of reasons for this, not least of which being that they come in many different forms and versions. In this article, we're going to look at a few different styles of vernier caliper,

and see how to use them. Next time, we'll discuss how to read the scales on the most common types.

## Don't Waste Your Time

Before you get too far into this short series, I'm going to make a simple suggestion to you: Don't bother.

That's right... don't waste time trying to learn how to use all the different types of vernier calipers and micrometers. You don't need to know. There's an easier solution:

Buy a digital caliper.



Figure 1: To provide an adequate demonstration for this series, I purchased three new calipers. Total cost: just under \$47. The digital itself was just \$9.45 plus shipping.

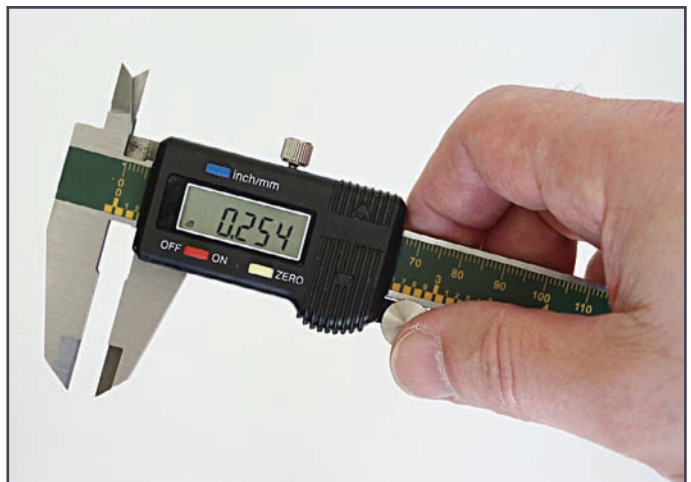


Figure 2: A digital caliper is certainly the easiest to use. The display is easy to read, and you can switch between Imperial (inches) and Metric at the touch of a button.

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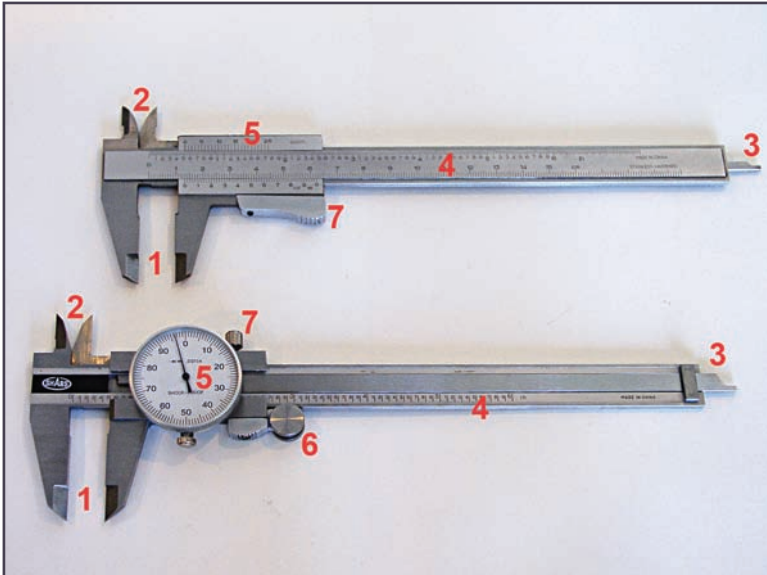


Figure 3: The parts of a typical vernier caliper.

Let's face it: Fixing transmissions is critical work, but it's not rocket science. As long as you're within a thousandth of an inch — or a hundredth of a millimeter — you're probably going to be close enough. And a digital caliper will give you that level of accuracy, without forcing you to spend a lot of time learning to interpret a convoluted scale that's too tiny to be read without a magnifying glass.

Price? I just bought these three new calipers (figure 1): a standard caliper, a dial type, and a digital, from the Discount Machine Shop store on Ebay — <http://stores.ebay.com/Discount-Machine-Shop>. The total including shipping was just under \$47, and they were here in less than a week. The digital caliper alone was \$9.45 plus shipping.

Is it as accurate as the more expensive models? Hard to be sure, but it's probably more than accurate enough for your needs. I compared it to a micrometer, and the digital caliper appeared to be accurate to within 0.0005". In fact, all three calipers were within about a thousandth of an inch of one another. Accurate enough for any auto repairs I can think of.

And a digital caliper gives you a simple, digital readout, in either inches or millimeters, at the press of a button (figure 2). No trying to interpret the scratches on a scale or adding the numbers: Just read and go. At about \$20 (including shipping), it's really a smart choice.

Of course, some people just prefer to learn, even if it isn't something they're necessarily going to use. For them, we'll look at how to use all three types of caliper. We'll start by going over the basics that are common to all calipers:

## The Parts of a Vernier Caliper

There are several parts common to most vernier calipers (figure 3). You'll need to know these terms so you'll under-

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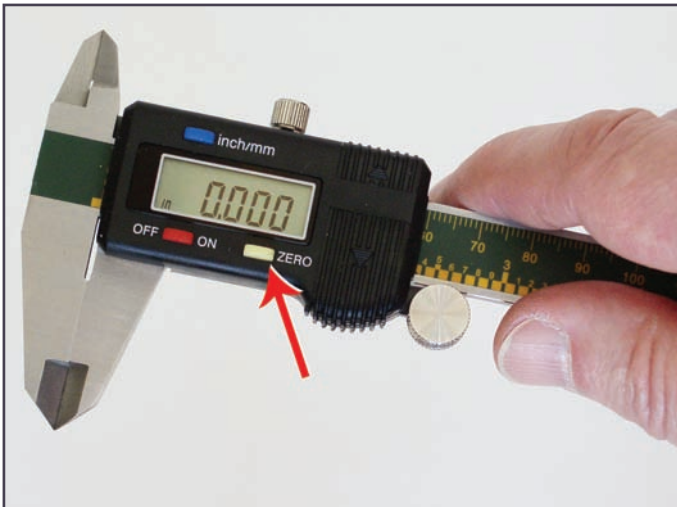


Figure 4: Zeroing a digital caliper is easy: Just press the zero button and you're ready to take your measurement.

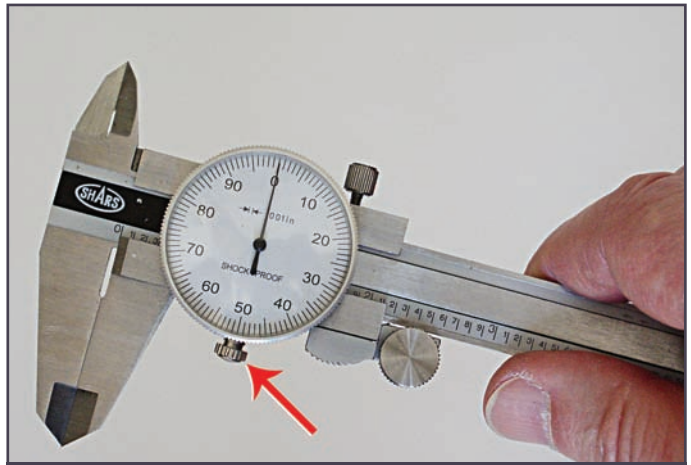


Figure 5: To zero a dial caliper, loosen the lock screw, and rotate the dial until the needle lines up with zero. Make sure you're looking straight at the dial when adjusting or reading it, to prevent parallax errors.

stand the explanations for how to use them.

1. Outside Jaws — for measuring the outer diameter of a component.
2. Inside Jaws — for measuring the inside diameter of a component.
3. Depth Probe — for measuring depth.
4. Main Scale/Fixed Scale — usually provides measurements in Imperial (inches) or Metric units.
5. Vernier Scale/Moveable Scale — slider that indicates

measured size on the scale.

6. Adjustment Roller — allows for easy movement of the jaws; not all calipers have this.
7. Locking Screw/Lever — locks the caliper jaws in place to make it easier to read the measurement.

### Zero the Caliper

Before you begin a measurement with any type of caliper or micrometer, your first step is to zero it. This is an important



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step to assure accuracy, and should be repeated before each measurement.

**TIP:** You can also use the zeroing feature to measure the difference between two components. With the jaws measuring the first component, zero the caliper. Then measure the second. The measurement on your caliper is the difference between the two components.

Here's how to zero your caliper:

- Open the caliper.
- Slide it gently back to the fully closed position. You may have to do this a couple times to be sure it's closed all the way.
- Check the measurement on the scale.

With the jaws fully closed, the scale should read zero.

- To zero a digital caliper, just press the "zero" button (figure 4).
- To zero a dial caliper, loosen the locking screw, and rotate the dial until the needle is pointing to zero (figure 5).

**CAUTION:** Dials such as these are subject to *parallax errors*; that is, slight errors created when you view the dial from different angles. To avoid parallax errors, always keep the dial squarely in front of you when reading the measurement; never read it from an angle.

- To zero a standard caliper... well, you can't; at least, not for any I've ever seen. All you can do is compensate for the inaccuracy. Check how much it's off, then subtract that amount from (or add it to) your final measurement to get an accurate reading.

## Measuring with a Vernier Caliper

Once you have your caliper zeroed, you're ready to begin your measurement. Vernier calipers are capable of making four main kinds of measurements:

- Outer Diameter
- Inner Diameter
- Depth
- Step Height

Let's look at each of these measurements:

**Outer Diameter** — This is probably the most familiar use for a caliper. You use the outside jaws to measure the distance across the outside edges of a component.

For this demonstration, we're going to measure the outer diameter of a copper pipe fitting; here's how:

1. Zero your caliper.
2. Open the jaws, and then close them gently around the outside of the component (figure 6). Not too tight: You don't want to distort



Figure 6: To measure the outer diameter of a component, apply the outside jaws gently around the widest part of the component. Not too tight! You don't want to crush anything, or screw up your measurement.

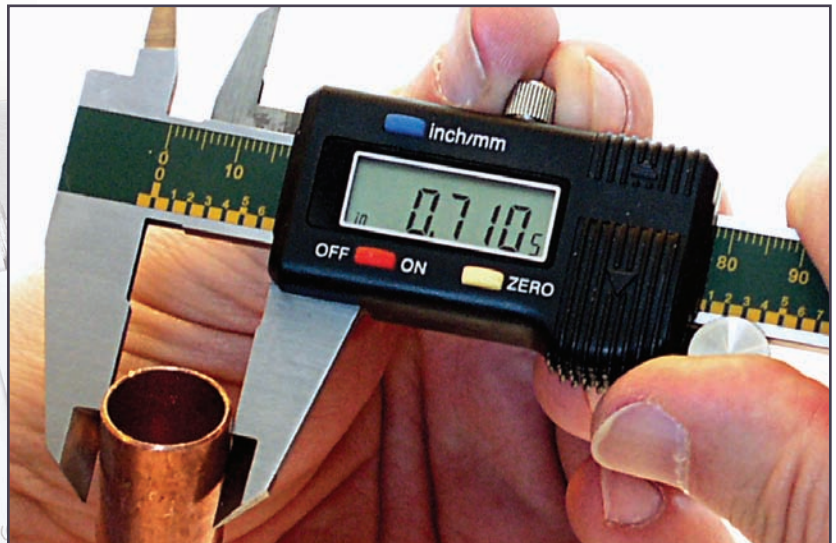


Figure 7: Once you have the component centered and the jaws in place, tighten the lock screw to hold your measurement steady.

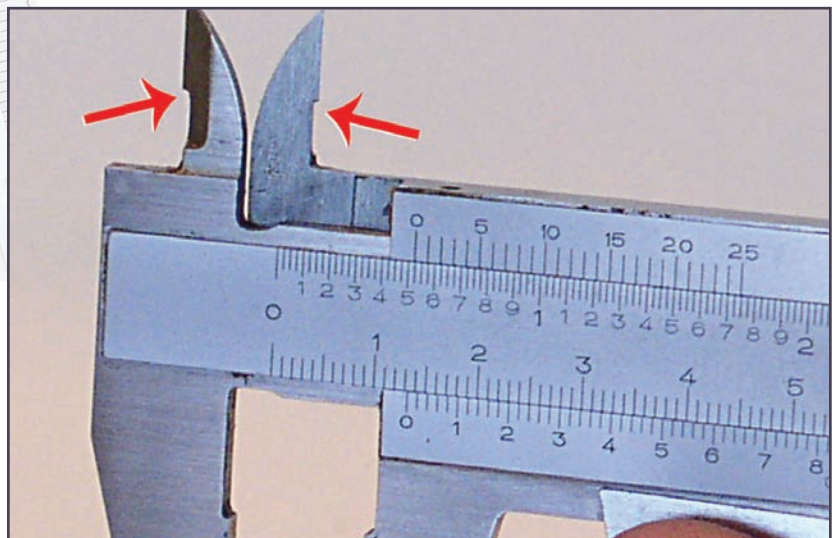


Figure 8: The small cutout on the back edge of the inside jaws allows you to measure without worrying about the ridge along the edge of the opening.



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the component or your caliper. In most cases, you should just about be able to move the component, while feeling it drag firmly against the jaws.

3. Wiggle the component or your caliper slightly as you slide the jaws around it, to make sure you're measuring at the widest spot, and it's sitting squarely between the jaws.
4. Once you have the jaws securely in place, lock them with the screw or lever (figure 7).
5. Read the measurement on the scale.

**Inner Diameter** — The inside jaws allow you to measure the inner diameter of most openings to a depth of about a half inch.

Notice the small cutout on the inside edge of the jaws (figure 8). This allows for a slight ridge, such as the remnants from a pipe cutter. The cutout avoids the ridge, allowing you to measure the unmarred area of the opening.

To measure the inner diameter:

1. Zero the caliper.
2. Slip the inside jaws into the opening.
3. Open the jaws until they contact the sides of the opening (figure 9). Not too tight: You don't want to distort the component or your caliper. In most cases, you should just about be able to move the component, while feeling it drag firmly against the jaws.
4. Wiggle the component or your caliper slightly as you slide the jaws around the opening, to make sure you're measuring at the widest spot, and the jaws are sitting squarely on the sides.
5. Once you have the jaws securely in place, lock them with the screw or lever.
6. Read the measurement on the scale.

**Depth** — The depth probe on the opposite end of the caliper makes it easy to measure opening depth.

When measuring depth, always zero the caliper using the depth probe. That is, open the caliper, and then gently press the depth probe down against a completely flat surface, until your caliper bottoms out (figure 10). Then zero the scale.

The reason for this special zeroing procedure is simple: There may be a slight variation between the jaws and the depth probe. Zeroing against the depth probe eliminates that error.

To measure depth:

1. Zero the caliper.
2. Hold the caliper on the flat surface you're measuring against (figure 11).
3. Open the caliper until it rises away from the surface, and is sitting on only the depth

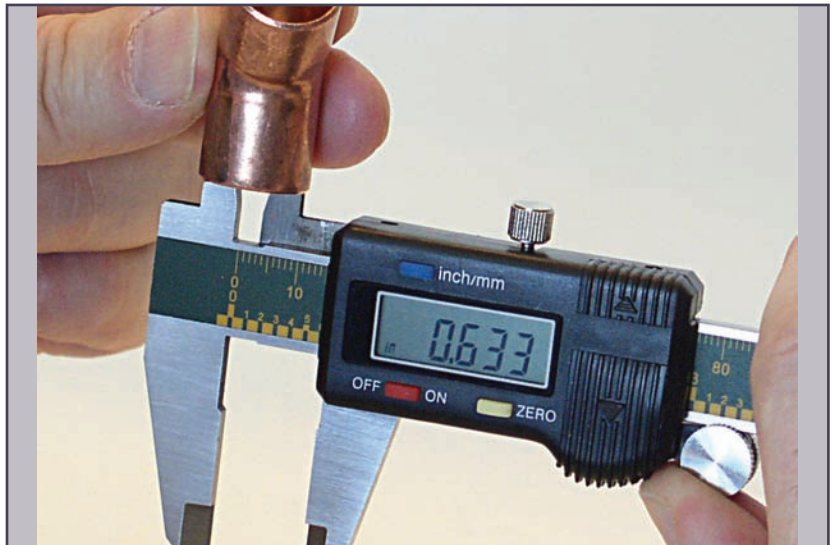


Figure 9: Slide the inside jaws into the opening, and open the caliper until the jaws contact the surface. Wiggle the component and your caliper to make sure you're measuring at the exact widest point in the opening.

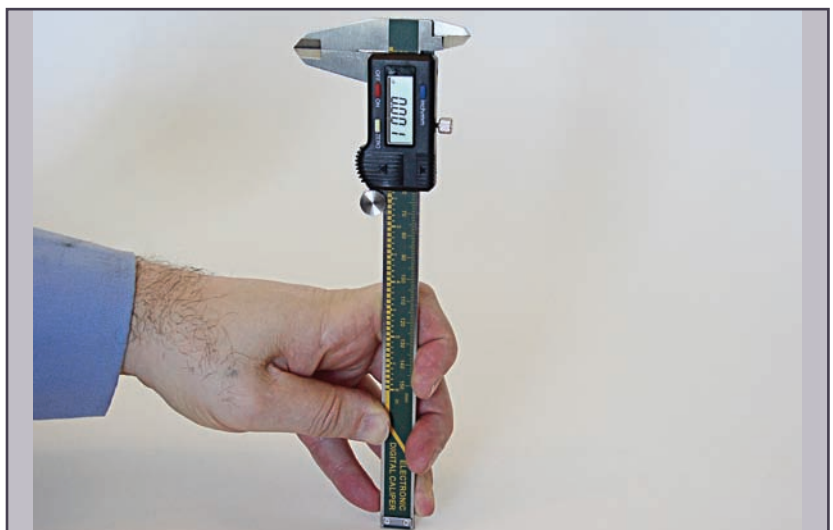


Figure 10: When measuring depth, always zero against your depth probe. There could be a slight variation between the depth probe and the regular jaws.

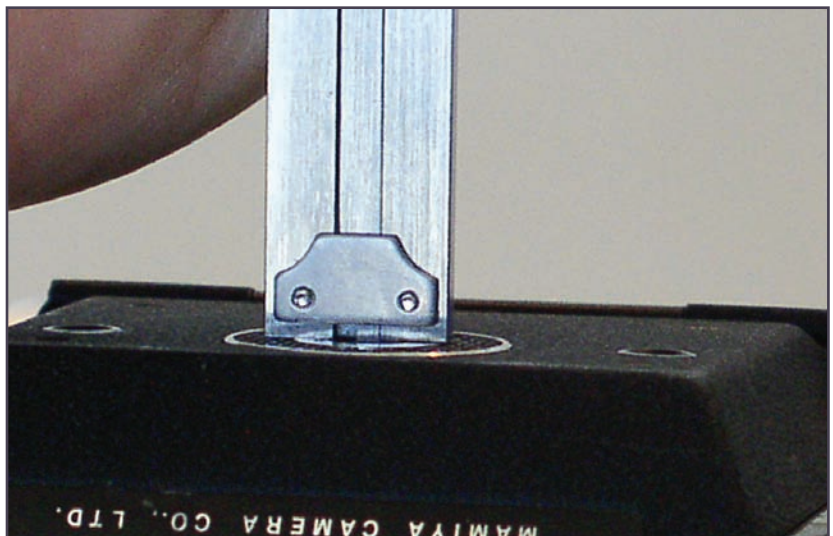


Figure 11: To measure a depth, hold the end of the caliper against the object you're measuring.

- probe (figure 12).
4. Gently press down against the depth probe until the caliper just bottoms again (figure 13).
  5. Lock the caliper in place with the screw or lever.
  6. Read the measurement on the scale.

**Step Height** — This is the one measurement you might be completely unfamiliar with. But there are times when it could come in handy. Here's what the step height measurement is:

With the jaws closed, the top of the fixed jaw and the moveable jaw are aligned. So, if you place the caliper against one flat surface, the measurement will display the height to the top of the moveable jaw (figure 14).

While not a particularly common procedure for the automotive repair industry, there may be times when this could come in handy.

That's all for this time. Next time, we'll look at how to read the scales on the different types of calipers.

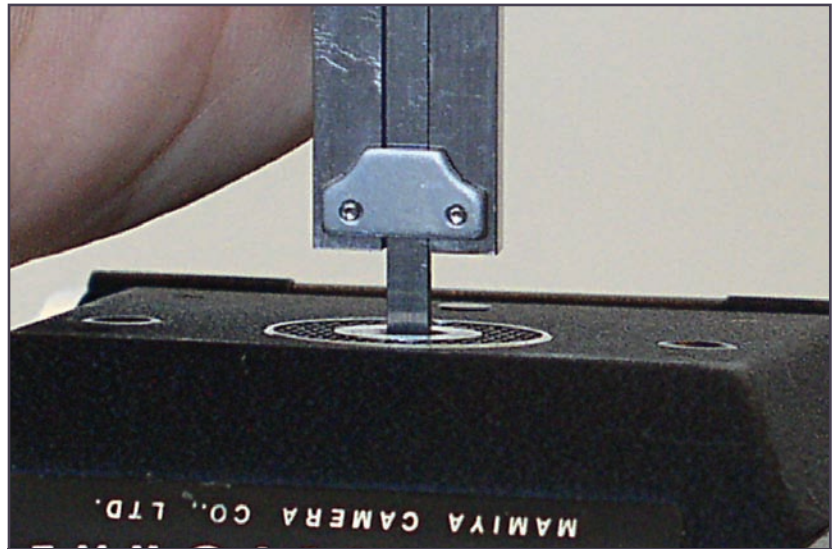


Figure 12: Open the caliper until it rises away from the component onto the end of the depth probe.

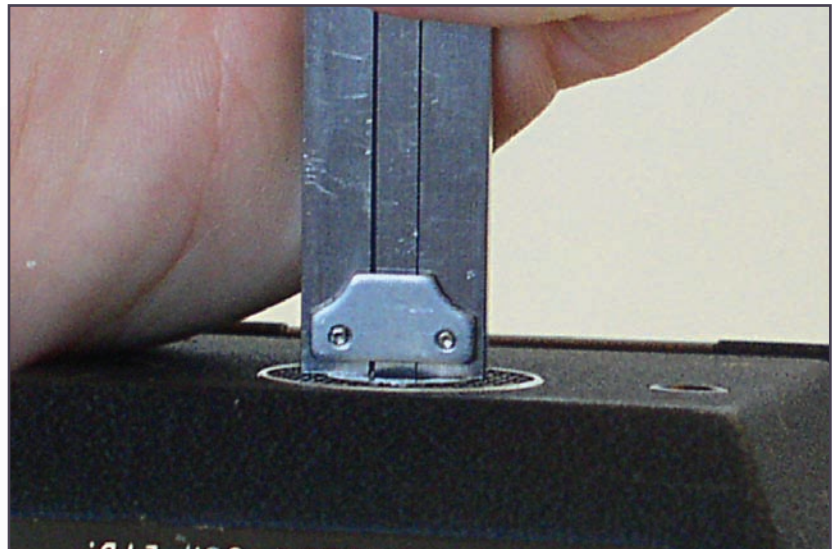


Figure 13: Gently press down against the depth probe, until the caliper just contacts the component again.

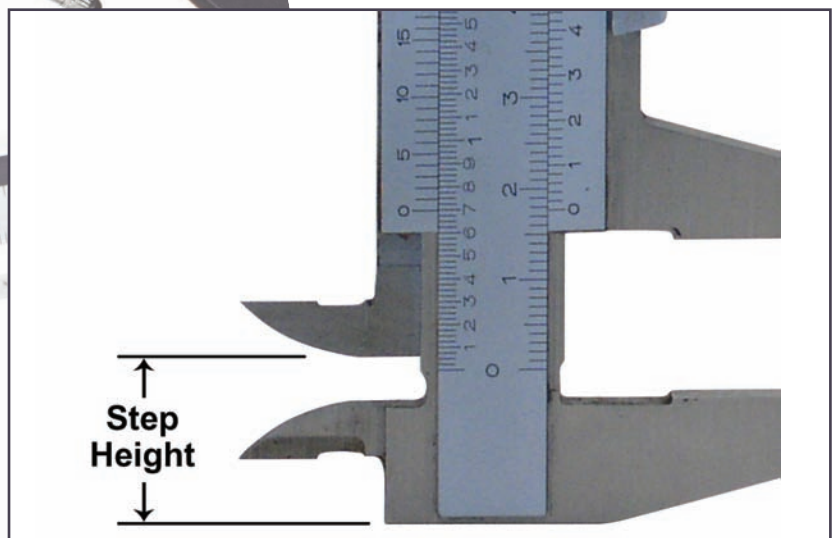


Figure 14: The ends of the fixed and moveable jaws align when the caliper is closed, so you can use the caliper to measure step height, too.

