Spring Testing on a Budget

by:
David A. Larson
President & CEO
Larson Systems Inc.
10073 Baltimore Street, NE
Blaine, MN 55449-4425
www.larsonsystems.com

You want your test results to agree with those of your suppliers or your customers. Fortunately, accurate results shouldn’t cost you a lot of cash.

If you don’t do a lot of spring testing, it’s tempting to hold off on equipment purchases, especially in a recession like the current one. Or worse, to skimp by buying the cheapest stuff you can find. While that may save you money in the short run, it could cost you money down the road when your springs are out of spec, and your customer takes his business to a more reliable manufacturer. Fortunately, you don’t have to spend a lot of money to get highly accurate results. In fact, you can get a top-quality spring tester for approximately US$1000.

Whatever you purchase, your emphasis should be on accuracy. You want your test results to agree with those of your suppliers or your customers. If your test results vary significantly, you probably don’t have the equipment you need.

Spring Testers or Force Gages?
There are motorized, mechanical and electronic spring testers, and there are force gages that mount on a stand. For purposes of staying on a budget, we’ll discuss hand-operated testers and force gages.

The type of tester you buy depends on the type of spring you want to test. If your spring is long and tends to buckle, you’ll want a tester that has a thru-rod that will hold the spring in place while you test it and prevent it from shooting out of the tester. If you test high-rate springs such as Belleville washers, length accuracy becomes critical.

A basic hand-operated spring tester consists of a base that supports a rigid frame, a pair of compression plates, a load cell and a lever for moving the top plate up and down and applying compression to a spring. Even the simplest models have a digital display and an RS232 connection that enables the tester to communicate with a printer.

A force gage is usually hand-held; test stands are sold separately and can be used horizontally or vertically. Testing springs involves measuring force and length. These are standard operations on a spring tester. To measure length with a force gage, you’ll need a length attachment.

Load Capacity
One of the first things to look for when you buy a spring tester is load capacity. Most spring tests require you to measure a load at a specific height. One of the most common load testing problems is using a load cell that’s too big for the spring. If you produce a variety of springs with different loads, you may need to purchase a few different load cells with a variety of force capacities.

Measuring Length
When an automated spring tester measures a spring, it usually takes four measurements: the spring in its normal, uncompressed position (free length); at 20%
compression; 80% compression; and at full compression (solid height). With a hand-operated tester, you will probably measure the spring free length, a single load and solid height. You must be careful when you do this, or you could overload the cell. Look for a tester with overload stops.

**Range & Stroke**

Basically, range is the amount of room you need to get your spring into the tester. Stroke is the distance the top plate must travel to measure your spring.

On some compression testers, the range and stroke are the same. If you test extension springs, you will want a tester with a longer stroke.

**Accuracy**

The American Society for Testing Materials (ASTM) has set a minimum load accuracy of ±1% for spring testers.

**Resolution**

Resolution is the smallest change of force that a tester can measure. Smaller resolution is usually an indication of more accurate measurement capability.

**Deflection Compensation**

When springs are compressed, they push against not only the compression plates, but the frame of the tester as well, causing the frame and load cell to deflect. This deflection can cause accuracy errors, and most spring testers and force gages don’t have a means of counteracting this deflection.

To compensate, the person operating the tester has to perform calculations to take this deflection into account. A spring tester with built-in deflection compensation not only takes the headache out of the job, it shortens testing time and makes it easier to stay in compliance. And it won’t cost you anything extra. Make sure your tester has deflection compensation.

**Calibration**

Annual calibration is a must if you’re going to maintain accuracy. The master weights in the tester should be traceable to standards of the National Institute of Standards and Technology (NIST). Load cells should be checked to ensure that they are linear throughout the usable range of the tester. Length readings need to be calibrated with gage blocks.

Although there are independent calibration companies, the manufacturer of your spring tester knows your machine best and should offer calibration services. By maintaining calibration, you will maintain accuracy, your tester will last longer and you won’t have to buy another one for a long time to come.

**Spring Testers vs. Force Gages**

All spring testers and force gages are capable of compression and extension testing. The Table seen above compares spring testers and force gages.

**Conclusion**

While force gages are very flexible and may be suitable for a variety of force measurement applications, spring testers are most often the best choice to measure springs, when viewed from an acquisition cost and operating cost point of view.

The specialized features with deflection compensation make spring testers easier and more productive to use. Some spring applications, such as those that require thru-rods to support buckling springs, require the specialized features of a spring tester.

www.larsonsystems.com

---

**Company Profile...**

Larson Systems Inc. has been a leading manufacturer of spring-testing equipment since 1979. Larson Systems offers a broad line of spring-testing equipment, ranging from hand testers to high-capacity automated testing and sorting machines. The company also distributes force gages for Nidec-Shimpo.

www.larsonsystems.com

---

**Table**

<table>
<thead>
<tr>
<th></th>
<th>Hand-Operated Digital Compression Tester</th>
<th>Hand-Operated Digital Spring Tester with Extension Capability</th>
<th>Digital Force Gage with Stand, Compression Plates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>750 lb.</td>
<td>750 lbs.</td>
<td>500 lb.</td>
</tr>
<tr>
<td>Resolution-Force</td>
<td>0.5 lb.</td>
<td>0.05 lb.</td>
<td>0.1 lb.</td>
</tr>
<tr>
<td>Resolution-Length</td>
<td>0.001 in.</td>
<td>0.001 in.</td>
<td>0.001 in.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± resolution x 2</td>
<td>± resolution x 2</td>
<td>±0.2 F.S.</td>
</tr>
<tr>
<td>Sampling Rate</td>
<td>2,000/second</td>
<td>2,000/second</td>
<td>1,000/second</td>
</tr>
<tr>
<td>Range/Stroke</td>
<td>5”/5”</td>
<td>12”/6”</td>
<td>n/a</td>
</tr>
<tr>
<td>Deflection compensation</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Approximate cost</td>
<td>$1189</td>
<td>$3095</td>
<td>$2085</td>
</tr>
</tbody>
</table>

---

**Hand-Operated Digital Compression Tester**

- Capacity: 750 lb.
- Resolution-Force: 0.5 lb.
- Resolution-Length: 0.001 in.
- Accuracy: ± resolution x 2
- Sampling Rate: 2,000/second
- Range/Stroke: 5”/5”
- Deflection compensation: Yes
- Approximate cost: $1189

**Hand-Operated Digital Spring Tester with Extension Capability**

- Capacity: 750 lbs.
- Resolution-Force: 0.05 lb.
- Resolution-Length: 0.001 in.
- Accuracy: ± resolution x 2
- Sampling Rate: 2,000/second
- Range/Stroke: 12”/6”
- Deflection compensation: Yes
- Approximate cost: $3095

**Digital Force Gage with Stand, Compression Plates**

- Capacity: 500 lb.
- Resolution-Force: 0.1 lb.
- Resolution-Length: 0.001 in.
- Accuracy: ±0.2 F.S.
- Sampling Rate: 1,000/second
- Range/Stroke: n/a
- Deflection compensation: No
- Approximate cost: $2085