Frequently Asked Questions

Technical and Operational Considerations in Torque Tester Selection

Once the optimum torque tool calibration strategy has been determined for a given operation, the next step is to choose the testers and support equipment to execute the strategy. This page provides technical and operational information pertinent to the selection, and allows comparison of varying offerings, both for torque tool calibration and for interim checks.

Relationship of Calibrated Tool to Tester

To perform an accurate, reliable and valid calibration of a torque tool, the tester used for calibration must be at least four times as accurate as the tool to be calibrated. This simple rule is the first to consider when you are selecting a tester to calibrate your torque tools.

The table below gives a rough guide to tool accuracy and the tester accuracy required to calibrate that tool type.

Tool Type	Common Accuracy	Required Calibration Tester Accuracy (Min.)
Beam Torque Wrench	+/- 2% I.V.	+/- 0.5% I. V.
Dial Torque Wrench	+/- 3% I.V.	+/- 0.5% I. V.
Clicker Torque Wrench	+/- 4% I. V.	+/- 1.0% I. V.
Digital Torque Wrench	+/- 1% I. V.	+/- 0.25% I. V.
Torque Screwdriver	+/- 6% I. V.	+/- 1.5% I. V.

When a tool has a better accuracy than the norm for that tool type, the tester used to calibrate it must have a proportionally better accuracy. When a tool has a lesser accuracy (such as the same percentage but of Full Scale instead of Indicated Value), use a tester of the accuracy in the chart above.

Interim Checks

The above rule is applicable to calibration only; it need not be adhered to for interim checks, where the tool is merely being checked for any gross departure from accuracy. For interim checks the accuracy of the tester must be equal to or greater than the accuracy of the tool being checked. See the Education section of our site for an extended discussion of the differences between calibration and interim checks, and what they mean to your operation.

S/R Testers and Tester System Accuracies

The table below gives the accuracy for each S/R tester or tester system, along with the number of transducers supported and mechanical loader compatibility.

Tester or Tester System	I.V. Accuracy (1)	Single or Multi Transducer	Power Tool Compatible (2)	Mech. Loader Compatible	Notes (3)
System 5	+/- 0.25%	Multi	Yes	Yes	Excellent for calibrating every torque tool.
System 4	+/- 0.5%	Multi	Yes	Yes	Excellent except for digital tool calibration.
System 6	+/- 0.5%	Multi	Yes	No	Excellent for power tools in lab or at line.
Torq-Tronics®	+/- 1%	Single	Yes	No	Excellent for calibrating power and clicker tools.
VeriTorq®	+/- 1%	Single	No	No	Excellent for calibrating clicker tools and for interim torque checks.

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1. All testers and systems are accurate to stated value from 10% to 100% of capacity for the transducer.
2. The power tools referred to are non-impacting power tools; impact wrenches are specifically excluded.
3. This is purely an overview. For details on each tester or system, follow the link to the pages pertinent to that product.
4. System 6 uses rotary transducers, and can test tools while in use on the joint to be assembled.

Single- and Multi-Transducer Testers - Test Range Considerations

When calibration of torque tools is contemplated, the range of torque that will be tested is as critical a consideration as the accuracy of the tester. ASME standards for the calibration of torque wrenches require that they be chaecked at 20%, 60% and 100% of tool capacity - at a minimum.

When all of the tools to be tested are of the same capacity, often only one tester or transducer is needed. If the tools are of multiple capacities, more testers or more transducers may be needed to have the range of required torque test levels covered.

Analysis of your operating and testing requirements is required to determine whether you need one or two single-transducer testers or will be better served by a multi-transducer tester.

Single-transducer torque testers, such as Torq-Tronics® and VeriTorq®, have a single transducer installed and calibrated into the tester. Single transducer testers are normally quite easy to install, learn to use and use well. They lend themselves readily to calibrating the tools they have the accuracy and range to handle, and to performing interim torque checks. They are usually less expensive than their multi-transducer counterparts, and sometimes even two of them may be a better fit for the operation than a single multi-transducer torque tester.

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Multi-transducer torque testers, such as System 4 and System 5, permit connection to and use of multiple transducers of varying types and ranges. They have a greater level of accuracy than the single-transducer testers, hence are capable of testing more types of tools. They can be used with mechanical loaders to assure that the greatest possible accuracy of the tester is taken advantage of and to reduce technician fatigue when many tools must be calibrated. They work with calibration software that can help error-proof the process and reduce the clerical costs associated with tool calibration. When there is a wide range of test torque levels that must be addressed, multi-transducer testers are usually the best choice.

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Mechanical Loaders and Accuracy

Mechanical loaders are designed to fulfill several purposes in torque tool testing, and they fulfill each very well.

Lever Length

Most torque wrenches have a designed load point; a place on the tool where the distance from the center of the drive to that point is a tightly-controlled known. This point is usually close to the center of the grip on digital and clicker-type torque wrenches and is at the mounting point for beam torque wrenches. When the tool is calibrated the force should be concentrated at this point.

Human hands simply cannot concentrate the force at this point; they are wide and they redistribute the force across the width of the hand as the technician applies it. This changes the "distance" portion of the "force times distance" equation. Pulling on torque wrenches by hand is, for most tools, simply a means of inducing needless variation into the test. This can cause the testing to be inaccurate, and result in needless tool adjustments, excessive calibration time, or even result in certifying a tool as accurate that is in fact inaccurate - nullifying the purpose of the calibration.

A properly designed and manufactured mechanical loader eliminates this source of test result variation. We use them in our laboratories, and will not even consider calibrating a torque tool without them.

Load Perpendicularity

A core premise in torque application, both by a tool to the fastener and on the tool during calibration, is that the force is applied perpendicular to the torque output.

When this perpendicularity (in two axes) is not maintained, a new source of variation in the torque is induced. The variation in output is not due to the tool, but to the method in which it is used or tested. During calibration, lack of perpendicularity can result in needless adjustments to the tool, reduced calibration productivity, and even certifying a tool as accurate that is not.

A properly-designed mechanical loader will have a tool support to maintain perpendicularity in one axis, and will assure that load application remains at 90 degrees in the axis of rotation at all times during tool loading. Any mechanical loader that does not perform both functions invites problems in this area, just as applying the force by hand during calibration does.

Productivity

Every human being slows down and becomes more error-prone when fatigued. Pulling on torque wrenches repeatedly during the performance of calibrations is a fatiguing activity, and over the course of hours the fatigue can adversely affect productivity. This occurs even with low-capacity torque wrenches; when calibrating tools of higher torque output the fatigue sets in more quickly.

It is not merely pulling on a tool that induces fatigue. For direct-reading torque wrenches (digital, dial, beam) the tool must be held at a specified torque value while the reading is taken. This requires the continuous application of a steady force; an exercise in care with low capacity tools and a challenging exercise with high capacity tools. Performed repeatedly this effort can rapidly fatigue a technician.

A mechanical loader gives serious mechanical advantage to the technician. Instead of applying a high amount of force for a very brief or more extended period of time with each reading, the technician applies a few ounces of force and the loader multiplies it to the needed level. With S/R mechanical loaders even the force to test a tool at 600 foot-pounds can be applied with two fingers

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- easily. The result is lower technician fatigue and higher technician productivity - every day.

We strongly urge using a mechanical loader when performing torque wrench calibration, particularly of direct reading tools.

Software

There are three components in the torque calibration process where software that integrates a computer, the tester, and the technician make a positive difference: control of the process, documenting the results and creating the certificate of calibration.

Control of the Process

Predictable and reliable testing is the result of doing the same thing the same way every time. Variation in the procedure can induce errors that are avoidable in terms of results, time, effort and money. Calibration can and should be a cost-effective process and good software can help assure that the process is and remains that way.

Good calibration software can and should communicate directly with the torque tester and technician during the setup for the test and the conduct of it. The best software will semi-automate the setup, assuring that the inputs from the operator (what is being tested, who is performing the test and similar data) are integrated with data from the tester itself (transducer, tester, current tester calibration status) and stored process information (test points, number of tests at each, test point sequence, etc.) in a manner that supports the technician through communication and error prevention.

The software should also monitor the process and communicate with the technician and tester through every step of the test procedure, and assure that the standardized and stored procedure is used every time.

Documenting the Results

Good calibration software must have bidirectional communication with the tester, controlling the tester settings and capturing the results directly from the tester. It should preclude data error induced by human interaction, and flag/communicate any questionable results immediately. The results must be stored in association with all other relevant information pertinent to each test, both for reference and for further use.

Calibration Certificate Generation

Creating and printing the certificate of calibration for each tool should be a process that can be performed immediately or later or both, with the decision made by the humans in charge of the process. The data should be complete and the format in compliance with applicable standards in all respects.

These are three areas are where good calibration software can help achieve the goals of the calibration program. Excellent calibration software starts with these core requirements and builds on them with additional features that enhance ease of use and ROI.

We urge all of our customers to look carefully at using our software with their testers so that the maximum benefit is obtained from the investment made.

Selecting the right equipment to execute your torque tool calibration strategy is complex and critical to your mission and your bottom line. If you need or wish assistance in this, you are cordially invited to contact us. We will be happy to help you select the right products for your individual needs, whether simple or complex.