



Torque Tool Calibration Strategies for Cost Control

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Overview

Assembly and repair operations need to keep their assembly and maintenance torque application tools calibrated. Calibrating torque application tools - torque wrenches, torque screwdrivers, and power tools - has the unavoidable consequence of expenses, both obvious and hidden.

The goal of every operation is profit, so selecting a strategy that minimizes the obvious *and* the hidden expenses is critical. This paper, and the associated spreadsheet, can help you find the optimum strategy for your individual circumstances.

This paper discusses, in some depth, the issues to be addressed in selecting a torque tool calibration strategy. It also lays out three basic strategies, and discusses the costs and benefits of each. These three options also form the building blocks for creating a customized strategy for your operation should one of the three basic approaches not quite fit.

We have a related calibration cost analysis spreadsheet we provide as a companion download. This spreadsheet gives you the ability to analyze the cost of each calibration strategy option were it to be implemented in your operation. You can use hard data from your operation to determine the effects of changes with a high degree of accuracy prior to making your decision.

In the end, you can use the spreadsheet as a tool to “What if?”, and objectively determine for yourself the most efficient and cost-effective calibration strategy for your operation.

If you have not done so already, go to our website (www.srtorque.com) and download the companion spreadsheet for this paper. The spreadsheet is indispensable in analyzing your current costs and the effects of each strategic option as applied to your operation.

You will also need to obtain tool counts and some actual cost data from your current calibration practices. Having the exact costs is optimum, but if the exact dollar costs for each part of your operation are not available, close approximations can be used. Do bear in mind that the closer the estimate is to the real costs you experience, the more accurate your projections will be.

Do NOT be surprised if you discover that you can cut your torque tool calibration costs by 50% to 80% by changing your strategy!

Discovering just how much you can save, then actually saving the money and realizing the profit, is fun! So sit down, read the paper, gather your data and perform the analysis - and start making more money!

Torque Tool Calibration Strategies and Cost Factors

There are three basic torque application tool calibration strategies in common industrial use: Factory Calibration, Calibration Service, and Internal Calibration. For each and every operation there is a strategy that can be applied to provide a high level of operational and cost-effectiveness. The challenge is to determine what strategy, or what blend of strategies, is best for your individual operation.

Each strategy has costs that are obvious and costs that are hidden. *The hidden costs for some strategies can be 50% or more of the total cost of torque tool calibration.* Because they are not apparent, perhaps because of accounting methods, perhaps because of operational factors, or even because they are assumed to be “natural overhead”, they often do not get taken into account when determining the total cost of calibration.

Cost-effective calibration is the goal, and finding, then examining all of the costs of each is paramount to successful strategy development.

Factory Calibration

Factory calibration is used by many assemblers. There appear to be several reasons for this:

1. Lack of internal expertise.
2. Lack of equipment.
3. Belief that any other method would not achieve accuracy.
4. Fear of error.
5. Inertia

Factory calibration of torque tools can be beneficial, since one can usually repose a high degree of confidence in the results, and any needed repairs can be made quickly. There is, however, a price.

For the assembler, the upsides of this strategy are several:

1. Convenience.
2. Repairs can be made immediately if needed.
3. Manufacturer is highly familiar with their own brand.
4. Certification can usually be obtained.
5. Confidence can usually be reposed in the process and output.

For the assembler, using the tool manufacturer as a calibration service provider has a high “comfort factor”; there is no skull sweat needed. The process is invisible to most personnel; the tools go away, then they come back calibrated and in good shape after a relatively short period of time.

While the convenience and comfort factors in this strategy are high, this strategy also frequently has the highest costs.

The obvious costs are:

1. Factory calibration charge.
This is the amount billed by the manufacturer for the calibration service.
2. Factory certification charge, if additional (common).
This is the amount billed by the manufacturer for a written certification.

These charges are those usually thought of when the subject of torque tool calibration comes up.

They are pretty straightforward and easy to ascertain. They are also far from the only costs associated with this strategy.

Among the hidden costs this strategy imposes are:

1. Preparation to ship.
 - A. Labor to package the tools.
 - B. Labor to fill out the shipping paperwork.
 - C. Labor to fill out the purchase requisition for the service.
 - D. Packaging materials.
2. Outbound shipping cost.
 - A. Shipping.
 - B. Insurance, if used.
3. Inbound shipping cost.
 - A. Shipping cost
 - B. Insurance if used.
4. Costs to receive the tools.
 - A. Labor to fill out receiving paperwork.
 - B. Labor to unpack the tools.
 - C. Labor to file the certification.
5. Payment costs.
 - A. Labor to receive the invoice.
 - B. Labor to process the invoice.
 - C. Labor to pay the invoice and mail the payment.
 - D. Postage
6. Backup tool costs.
 - A. Tools to use while the primary assembly tools are out for calibration.
 1. At least 1 tool for each type of torque application tool used (air, electric, manual, etc.).
 2. At least 1 tool for each tool capacity used within each tool type.
 - B. Backup tool calibration costs.

The category of backup tools is one often overlooked. It is necessary to keep production flowing, even when the primary tools are out for calibration, ergo backup tools are usually purchased. To sustain quality while the primary tool is out it is imperative that the backup tool be equally as accurate, and preferably as productive, as the primary tool.

The hidden costs are very real; they are actual cash paid for actual work performed. Although many of the costs are each small, the total can be startling, and is directly attributable to the factory calibration strategy.

Calibration Services

Outside calibration services or laboratories are another commonly-used strategy for assuring the accuracy of torque application tools. The firms engaged in providing these services often offer a host of calibration services, with differing service levels and pricing for each. The customer using them chooses what they need “a la cart” from the menu, with each customer selecting only those services they need.

One of the advantages of this approach is that the calibration services can often calibrate a wide

variety of equipment types. It is not uncommon for a single cal lab to be able to calibrate optical devices (such as optical comparators), linear measurement devices (such as calipers or micrometers), and some force instruments (pressure or torque). In addition, most of these services can offer calibration and/or repair on multiple brands of equipment within an equipment type.

This versatility is enhanced by some labs through the provision of on-site calibration; they come to your facility and calibrate the equipment there instead of you sending it out. This may be offered for some types of measurement equipment but not others. Even services that come to you frequently cannot bring all of the instruments and working standards needed to calibrate the entire range of test and measurement equipment you have in stock.

Calibration service firms vary in quality, both from firm to firm and within a firm. Some cal labs have a high degree of expertise and attention to detail, some are less quality oriented. Within a given lab or service, the level of expertise may vary from one type of measurement or calibration to another. All cal labs face the same problems other businesses face in terms of staffing, training, employee turnover, and varying workload. This means that even the best of them will have difficult times, just as other industries face.

For the assembler using the external calibration service, the advantages of this strategy can be notable:

1. One can purchase only the services needed.
2. A variety of equipment can be serviced from a single service supplier.
3. Repairs of some types/brands of equipment can be rapidly accomplished.
4. Certification can usually be obtained.
5. Minimal additional labor is needed.
6. Confidence can frequently be reposed in the output.
7. Service is usually rapid, minimizing the time the equipment is out of service.
8. The rates charged are frequently reasonable.
9. The service may be registered to an international standard, enhancing acceptance.

The convenience factor for this strategy can be very high. Yet as with every calibration strategy, there are both obvious and hidden costs. The costs associated with the strategy vary greatly, depending upon the services offered, where they are offered, and which ones are chosen. The obvious costs include:

1. Laboratory calibration service charge.
This is the amount billed by the lab for the calibration service.
2. Laboratory Certification charge, if additional (common).
This is the amount billed by the lab for a written certification.
3. Travel Charge
This is a line item for some labs that perform on-site calibration.

These are the costs usually considered when torque tool calibration is the subject. The less obvious costs may include essentially the same cost categories that are incurred when a factory calibration strategy is used. When the tools are shipped to the lab, the same processes are used, but the number for the actual shipping charges may be lower if the lab is closer to the assembly plant. These categories of costs may be negated when the calibration service provides on-site calibration, but that is somewhat offset by either a travel charge or higher calibration charges.

Internal Calibration

Internal calibration of torque tools usually has the lowest total cost, whether all torque tools are calibrated internally or whether internal calibration is used as part of a blended strategy.

Internal calibration has been a mainstay for large plants and assembly operations. Large operations are frequently those best able to afford the expertise required to obtain the operational and financial benefits that accrue to the strategy. The inability to afford or even obtain the required expertise has been an impediment to smaller firms, inhibiting their ability to obtain the same cost-efficiencies that contributes to growth.

Much of that has changed with the advent of digital torque testers, particularly as the costs of the testers themselves has declined while their capabilities expanded. The expanded capabilities eliminated much of the guesswork that was involved. It also simplified the process so that it became well within the ability of most assembly or internal lab employees to learn. At the same time, the purchase price of the expanded capabilities dropped, following the normal pattern of digital equipment and products.

What was once the distant realm of specialist experts became the normal landscape for many large companies.

By 2002, the simplicity of an internal calibration strategy for most torque tools had become not merely viable for the small to mid-size assembly operation, it had become cost-effective.

The advantages of internal calibration include:

1. The fastest calibration time with the lowest out-of-service time.
2. Fewest total labor hours to execute.
3. Simplicity of control over the calibration process.
4. Highest level of control over the calibration process.
5. Immediate availability in event of question about a tool.
6. Fewer tools needed in inventory; replacement tool inventory drops markedly.
7. Easiest integration into the internal quality system of the assembler.
8. Ability to assure new tools are accurate.
9. Ability to compare brands and models internally prior to purchase.
10. Computerized record keeping with less paperwork.

The costs of an internal calibration strategy include acquisition costs, direct costs, and relatively few hidden costs.

Acquisition costs vary according to the type and quantity of torque tools to be calibrated, and the variation is significant. Digital torque testers of +/- 1% I.V. accuracy that are suitable for testing clicker type torque wrenches, torque screwdrivers, stall and clutch-type power tools, and pulse tools, can be had for less than \$2,000. On the other end of the spectrum, the very highest end of computer-driven automated torque tool testers that offer the ultimate in testing may cost as much as \$60,000.

For the typical assembler with some clicker-type torque wrenches and some power or pulse tools, the \$1,800 - \$4,000 range is quite common as a total acquisition cost. The torque range of the assembly tools to be calibrated is one of the larger factors in determining where the assembler will fall within that common range. The broader the range, the more likely multiple transducers will be needed to cover it and the higher the associated costs.

In addition to the equipment acquisition cost, there are a few other acquisition-related costs to consider. They include:

1. Initial training.

This is the cost of the initial training of the employees who will conduct and supervise the process. Usually a single employee and the QA manager or the employees' supervisor are those trained. Many manufacturers and distributors are willing to perform the initial training on a low- or no-cost basis as part of their value-added approach. This means that the primary training cost will consist of the time to learn to use the tester and adjust the tool(s) to bring them into calibration.

2. Additional training costs

- A. Learning curve on testing.

The individual performing the calibration will not be as productive at first as they are once a few months of experience has been acquired. This is essentially a one-time startup cost related to the initial training.

- B. Learning curve on tool adjustment.

One of the large paybacks of internal calibration is the ability to make rapid adjustments when a tool goes out of calibration. Most torque wrench manufacturers include calibration instructions with the tool or make it immediately available to their customers. Learning to adjust the tools to bring them back into calibration does require a short learning curve for each type and brand of tool calibrated. The length of this curve has a great deal to do with the variety of types and brands within each type that are present in the facility. Most tool types do not take long to learn to adjust, and most brands do not take long to learn to adjust, but the total time can be long if there are six tool types and multiple brands within each type. Again, this is essentially an up-front cost related to acquisition. There can be a small recurrence if the number of types or brands expands.

- C. Inventory

Some tool brands within some tool types require separate parts in order to adjust the torque output of the tool. This can necessitate keeping a small but varied inventory of these parts on hand. It should be noted that this only applies to some brands within some tool types; it is not applicable universally. There are tool makers whose designs allow for adjustment to bring the tool back into calibration without parts change.

The costs above are variables, but are variables within the control of the assembler. Narrowing the number of brands of tools used in the facility can markedly decrease some of the above costs and effectively eliminate others. This is readily achievable simply by making it part of the tool replacement selection process as old tools wear out. Replace hard-to-adjust tools with easily-adjusted counterparts as the old tools come up for replacement.

There are some ongoing costs when using an internal calibration strategy. The more obvious among them are:

1. Direct labor to calibrate the torque tools.
2. Direct labor for recordkeeping.
3. Supervisory labor (as needed).
4. Calibration charges for the torque tester itself.

The less obvious or hidden costs are similar to those encountered in sending the torque tools themselves out for calibration by the manufacturer or by a calibration lab. The primary difference lies in the frequency. A single torque tester is sent out for calibration in lieu of sending out many tools. In addition, the frequency with which the tester needs to be calibrated is far lower than the frequency at which the tools need to be sent out. This results in the costs being incurred at a far lower rate, often

1% or less the rate incurred by sending out the tools themselves. The savings in the hidden costs with this approach are highly noticeable.

Blended Strategies

Blending the three basic strategies in a manner that fits the assembler's operational needs, capital resources, and human resources is quite often the approach that will result in a strategy optimized for any given firm or facility.

Perhaps you have digital torque wrenches, clicker torque wrenches, and pulse tools, and do not work in a broad range of torques. Two of the three tool types can be calibrated with an inexpensive and easy-to-operate +/- 1% I.V. digital torque tester, but the digital tools require a +/- 0.25% I.V. tester for accurate and reliable calibration. They also require a mechanical loader, and may require other devices that would add to the purchase cost.

By blending an in-house and cal lab approach or in-house and manufacturer approach, you may be able to cut your ongoing expenses in half by performing in-house calibration of the clickers and pulse tools, but sending the digital torque wrenches out. Many firms find this may be accomplished with the expenditure of less than \$2,500, and have a payback measured in months instead of years.

Dividing the calibrations along required accuracy or required investment lines permits accommodating capital restrictions and internal operating constraints while obtaining some or most of the cost reductions that typically accompany the shift to internal tool calibration.

The savings can be used to bank for expansion of the internal calibration strategy, or for such other purposes the firm desires. Regardless of the purpose to which the savings are put, the fact is the savings are achieved.

Blended strategies are frequently the single most operationally efficient and cost effective means of addressing torque tool calibration for the small to mid-size assembly operation. Firms with as few as a dozen torque wrenches or power tools can benefit, and those with more tools save even more.

We urge you to download the associated spreadsheet and study the example plant it examines. When you understand the workings of it, take the time to obtain your own costs (current and associated with other strategies), and customize the spreadsheet to see what the effects of a strategy change would be for you.

It is entirely likely that you will discover that there are many dollars flowing out the door that could instead be going to your bottom line. If you discover that is the case in your facility, don't hesitate! Pick up the phone and contact us to become more profitable - now!