# Torque Application Tool Calibration Strategies - Cost Analysis and Control

## Spreadsheet Instructions
## August, 2003

### Calibration Cost Analysis Spreadsheet and Instructions

The Calibration Cost Analysis Spreadsheet was developed to help you, the assembler with torque tools to calibrate, to find the true costs of calibrating these assembly tools.

The spreadsheet has several sheets, one for each primary strategy. Each is designed to use the same basic data on the number and types of tools, and the same basic cost data in the analysis of the effects of each strategy. This provides the ability to compare the effects of changes in strategy when the number of tools remains the same, effectively isolating strategy as a cost factor.

The spreadhseet also provides the ability to take the generic data used as an example and change it to reflect the labor rates and shipping costs and lab or manufacturer charges that you actually experience. This customization ability, combined with the ability to isolate the effects of strategy changes, is what makes the spreadsheet such a valuable tool.

The existing data in the spreadsheet is generic; it is used simply to illustrate a “typical” small assembly operation with a mix of torque tools. We recommend that after you have become familiar with the spreadsheet you alter the numbers of tools and wage rates and other hard data to match your current costs.

Conventions and Notes

In each sheet the same cost data and labor times are used in some areas. For example, the “Average Labor Rate” for the plant is the same, regardless of the calibration strategy used. Rather than have you enter this labor rate once for each sheet, the number entered for this in the front sheet, the “**Tool Mfr Cal Strategy**” sheet is automatically imported into the other sheets and used in those calculations as well as this one. This reduces the amount of data entry required to perform an analysis, and very much speeds up the “what if” analysis of proposed changes in strategy.

It is not possible to link all of the data. The shipping cost of a tool to the tool manufacturer will likely be different from the cost of shipping the same tool to a cal lab located closer to your plant. Therefore even though each strategy and each sheet has a section for the outbound and inbound shipping costs, the costs are not copied from one sheet to another.

In each sheet you will find cells surrounded by a **bold** outline. These are the cells that require entry of the data to properly calculate your costs.

All other cells contain either (1) data imported from another sheet or (2) the results of calculations or (3) titles for a row or column. These cells should not be changed, or the spreadsheet may stop working or return wrong answers.

Cells highlighted in yellow contain subtotals. Cells highlighted in turqoise contain the annual total expense for the strategy using the data provided.

Manufacturing Strategy Sheet

The first sheet in the spreadsheet addresses the strategy of using the manufacturer(s) of the torque tools as the source for calibration.

Within the sheet, the first subsection addresses the inventory of torque tools to be calibrated.

**Factory Calibration Strategy Sheet**

**Tools Data**

| | Clicker Torque Wrenches | Dial or Beam Wrenches | Torque S'drivers | Digital Torque Wrenches | Air Power Tools | Electric Power Tools |
|---|---|---|---|---|---|---|
| Number of tools | 6 | 1 | 4 | 0 | 6 | 0 |
| Calibrations Per Year | 4 | 2 | 4 | 0 | 6 | 0 |
| **Total Calibrations** | 24 | 2 | 16 | 0 | 36 | 0 |

Across the top, you can see there are six columns of tools, one for each of the most common torque tools in assembly plants. Below the column headers are three rows of data; two that come from your plant information, one that is calculated from the data provided in the other two.

The first row is "Number of tools". This is the number of torque tools in your plant that must be calibrated, by type. Take an inventory of the torque tools in the plant, and enter the number in use in the appropriate cell in the row.

In our fictional "typical" small assembly plant used throughout the spreadsheet, there are 6 clicker-type torque wrenches, 1 dial torque wrench, 4 torque screwdrivers, no digital torque wrenches, 6 air-powered tools, and no electric power tools. These inventory numbers will be used in each of the strategies to allow direct comparison. The data entered here will be entered only once - on this sheet. Any later changes to the number of tools or calibration cycles should also be entered only on this sheet.

To change the fictional inventory to your actual inventory, simply type the correct numbers into the appropriate cells.

The next row in the subsection is the "Calibrations per year". This is the number of times per year your firm has determined that each tool type should be calibrated.

(Bold Outlined Cell)

As the data from our fictional plant shows, not all tool types are calibrated at the same interval. This may be true for a number of reasons related to tool usage rate or tool history. Some plant will have identical calibration intervals across the board, some will have different intervals for different groups.

It is in this row that you enter the appropriate number of calibrations per year for each tools type: 24 for a bi-monthly calibration cycle, 12 for a monthly cycle, four for a quarterly cycle (every 3 months), 2 for a semi-annual cycle, or 1 for an annual cycle.

The third row is the "**Total Calibrations**" row. This is the product of multiply the two pieces of data just entered for each tool type; the total number of calibrations, by tool type, per year. This will be used to calculate how many calibrations are purchased or performed for each type, and is essential to the cost calculations.

In our example, we can see that the six clicker torque wrenches are calibrated four times a year (quarterly), resulting in a total of 24 calibrations for this category of tool each year. The numbers for

the other categories are derived the same way.

A few rows below this is the "Average labor rate for plant" label and data cell. In the cell to the right of the label, you will see "$12.00", which is the average labor rate (wages & benefits cost) for our example facility. This is used in all strategy cost calculations, and because labor is a component of the costs in all calibration strategies, the number is needed.

To adapt the spreadhseet to the costs reflecting the conditions in your facility, ascertain the average labor rate for your facility, and simply replace the $12.00 with that number. Again, this is the only place in the spreadsheet where this should be entered. This cell is referenced by all three sheets.

The next subsection is where the costs *per calibration* are entered for each category of torque tool.

| | Single Calibration Cost Data | | | | | |
|---|---|---|---|---|---|---|
| Labor time to pack tool for shipping in minutes | 15 | 20 | 10 | 0 | 15 | 0 |
| - Labor $ to pack tool for shipping | 3.00 | 4.00 | 2.00 | 0.00 | 3.00 | 0.00 |
| Shipping container/packaging cost in dollars | 1.50 | 2.45 | 1.25 | 0.00 | 2.65 | 0.00 |
| Outbound shipping charge in dollars | 7.45 | 7.45 | 6.25 | 0.00 | 9.50 | 0.00 |
| Calibration charge from tool manufacturer in dollars | 30.00 | 40.00 | 30.00 | 0.00 | 35.00 | 0.00 |
| Certification charge from tool manufacturer in dollars | 5.00 | 5.00 | 5.00 | 0.00 | 5.00 | 0.00 |
| Return shipping charge from tool manufacturer in dollars | 7.45 | 7.45 | 6.25 | 0.00 | 9.50 | 0.00 |
| Package receiving labor in minutes | 10 | 15 | 5 | 0 | 10 | 0 |
| - Labor to record package receipt and unpack in $ | 2.00 | 3.00 | 1.00 | 0.00 | 2.00 | 0.00 |
| Certification filing/tracking labor in minutes | 5 | 5 | 5 | 0 | 5 | 0 |
| - Labor to get and file certification from tool mfr. in $ | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Invoice receipt/processing/payment labor in minutes | 20 | 20 | 20 | 0 | 20 | 0 |
| - Invoice receipt/processing/payment labor in $ | 4.00 | 4.00 | 4.00 | 0.00 | 4.00 | 0.00 |
| **Subtotal cost per single calibration** | $61.40 | $74.35 | $56.75 | $0.00 | $71.65 | $0.00 |

The first per calibration component cost addressed is the labor to pack the tool for shipping to the manufacturer for calibration. This row is labeled "Labor time to pack tool for shipping in minutes".Since some types of torque tool differ in size and packaging requirements, each is addressed in its' own column (true throughout spreadsheet to account for differences among types).

We recommend watching whoever packages the tools for calibration while they do so, from start to finish, then entering the number of minutes it takes them to do that job into the appropriate cell in this row. Since the better the data quality is the more accurate the calculations will be, we suggest watching while they get the tool, get the packaging, pack the tool, label the container, prep the shipping documents, and put the package in the proper location. That will be the total time for this operation for the tool type. Do this for each type. The data in this row will be referenced on the Cal Service sheet, since the time to package the tool is the same regardless of the destination.

The second line, "- Labor $ to pack tool for shipping", is the result of multiplying the time to package a tool of that type, multiplied by the average hourly labor rate entered previously. In our example, the time to package a clicker-type torque wrench is 15 minutes, which led to a $3.00 labor cost to package when applied to the $12.00 per hour labor rate.

The multiplication is performed automatically and the labor cost displayed, when the time to package each category of tool is entered in the cell above.

The next row, "Shipping container/packaging cost in dollars", is the cost of the box the tool is shipped to the manufacturer in. Even if your tool has a steel or plastic case, the tool is usually put in the case then into a cardboard box for shipping. The box has a cost; some of the larger ones cost a surprising amount. In our example, costs for the boxes used vary by tool type. This is common since the tools themselves vary in size, weight, and configuration.

To adjust this for your actual costs, find the cost of the box used for each type of tool and enter the cost in the appropriate cell in this row.

Since the cost of the shipping box is the same regardless of strategy, the cost entered here will be used elswhere as the cost for the box when shipping is required.

The fourth row in this subsection, "Outbound shipping charge in dollars", is the cost to ship the tool to the manufacturer for calibration. This is the charge from the carrier for transporting the tool to the manufacturer. This will vary by tool type, and likely by tool capacity as well since carriers usually charge by weight and distance. This variation shows in the numbers entered for our example.

To adjust the charge to closely reflect the charges you experience, use the charge for most common size within each type for this data. This will result in a weighted charge, increasing the accuracy of the final calculations.

The fifth row is "Calibration charge from manufacturer in dollars". This is the amount charged by the manufacturer for the actual calibration, as shown on their invoice. In our example, this varied by tool type. The amount used in each cell in this rowwas the charge for the most common tool capacity for the tool type; a fairly good estimate of the charge overall for the category. If you are not currently using a manufacturer calibration strategy, or not using it on all of your torque tools, a call to the tool manufacturer(s) for those tools you are not using it on can obtain answers for this and the next cost item (row of cells).

We suggest obtaining a recent invoice from the manufacturer for the calibration of the most common tool capacity for each tool type, and entering that amount in the appropriate cell in the row.

The sixth line, "Certification charge from the manufacturer in dollars", is where this charge is entered if the manufacturer is one who has a separate line item on their invoice for this. Some manufacturers include the charge for a certification in the calibration charge, some have it as a separate line item.

In our example, the manufacturers in each category of tools had a separate line item for the certification, and the dollar amount was entered in the appropriate cell for each.

In changing this row to reflect your actual charges, use the amount shown on the invoice for the most common tool type in each category; it will usually be a flat fee across the board regardless of tool capacity when it is charged separately. If one or more of the manufacturers does not charge for this, enter zero in the appropriate cell(s) in the row.

The following row, "Return shipping charge from tool manufacturer in dollars", will most likely be the same as the outbound shipping charge for each category of tools as shown a few rows above, with the exception of rush or priority shipments. In our example, the numbers are the same.

Again, the costs may be ascertained directly from invoices (if you are using this strategy), or by simply copying the outbound shipping costs directly (again, if you are using this strategy). If you are not using this strategy, you can go to the UPS website and calculate about what the shipping costs would be for use here (via UPS), or you can go to the USPS website to see what it would cost to mail the tools to and from the manufacturer.

The eighth row, "Package receiving labor in minutes", is the time it takes to receive the tool off the truck delivering it, enter it into the system as received, unpack it, dispose of the packaging, and notify the recipient of its' return. In our example, the labor time for this was slightly less than the labor time required to ship the same tool type out.

To adjust this to fit your facility, we suggest watching the process while timing it on your watch. This will let you get a time to use for each tool type that should be quite accurate. Again, enter the correct time in minutes into the cell for the tool type once the actual time for your facility has been determined.

This time will be used on other sheets where appropriate, and should only be entered here.

The ninth row, "Labor to record package receipt and unpack in $" is a calculated number. The labor cost is derived by multiplying the time in minutes in the row above by the average labor rate for the plant entered in the first subsection. There is no need to do anything with this row; the formula has already been entered and the result will be displayed immediately upon entry of the time in the eighth row.

The tenth row, "Certification filing/tracking labor in minutes", is the time it takes for the party responsible for the tool and tool records to get the tool from the receiving area, read and file the certification, and deliver the tool to the storage or use area, whichever is appropriate.

In our example, this was a small amount of time, due to a uniform process. To customize the data to your plant and reflect your costs, we suggest timing this process from start to finish. If the process for all the torque tools is the same, the timed data can be used for each tool type with no significant loss of accuracy in the overall estimate. If there are different processes for different tool types, then it would be wise to time the various processes. Again, enter the measured time in minutes into the appropriate cell for each type of tool in this row.

In each strategy, the time entered here will be used for the same process in that strategy. This time should only be entered or changed here.

The eleventh row, "Labor to get and file tool certification from mfr. in $", is a calculated row. Again, this is a dollar cost calculated from the time entered in the row above (time for the process) and the average labor rate entered in the first subsection. No data entry is needed; the formula has already been entered.

The twelfth row, "Invoice receipt/processing/payment time in minutes", is the time it takes to perform all of the checking and paperwork necessary to convert an invoice arriving in the mail (e- or snail) into a check in an envelope in the hands of the Post Office.

This time can be difficult to ascertain accurately, but the accounting department may be able to give you a reasonable ballpark time number to work with. In our example, the time was that provided by the accounting department for a relatively simple invoce for which the paperwork was complete. Since each calibration of each type of tool generated a relatively simple invoice, the invoices for each tool type were treated as taking the same amount of time to process from start to finish.

To customize this for your operation, we recommend asking the accounting department for their best estimate of the actual time it takes to process an invoice completely, generate the check to pay it, and send it off. Enter this number in each cell in the row for which you have torque tools.

This number will be used as the labor time in each strategy where an invoice must be processed. It should only be entered once, here.

The thirteenth row,"Invoice receipt/processing/payment labor in $", is a calculated dollar amount based upon the data in the row above (time for this operation sequence) and the average hourly labor rate entered in the first subsection of this sheet. There is no need to do anything in this row; the calculations take place automatically as the data upon which they are based is entered.

The last row, "**Subtotal cost per single calibration**" is the sum of the dollar amounts from each of the cost factors in this subsection. It is a close approximation (assuming accuracy of the data entered) of your actual costs every time you send a tool out to the manufacturer for calibration.

This money is what you spend each time you send a tool out under this strategy. In our example, you will see that the actual calibration charge from the manufacturer is only about half of what is really spent for this strategy. Depending upon the systems involved, the average labor rate in your facility, and the actual charges from the manufacturer, the amount of overhead can be a surprising addition to the cost. There are some facilities and operations where the actual calibration charge can be as low as 20% of the total cost per tool!

The last subsection multiplies the actual costs per calibration by the total calibrations per year for each tool type, then sums the results for each type to obtain the total annual cost for using this calibration strategy.

| | Annualized Calibration Costs | | | | | |
|---|---|---|---|---|---|---|
| Total Calibrations x Cost Per Single Calibration | $1,473.60 | $148.70 | $908.00 | $0.00 | $2,579.40 | $0.00 |
| Total Annual Manufacturer Calibration Strategy Cost | $5,109.70 | | | | | |

In our example, the plant is spending $5,109 per year to calibrate the 17 torque tools it has on a relatively modest calibration schedule. Of this, only about 50% is actual calibration cost; the other 50% is overhead.

There is no data entry required for either the row showing the total cost per year by tool type, or for the total cost for the strategy. The numbers displayed are calculated using the hard data and estimated costs you entered above.

**This strategy is often the most expensive calibration strategy of the three primary strategies, and markedly more expensive than almost any optimized strategy.**

**The only strategy consistently more expensive than this one is not calibrating the tools at all.**

## Calibration Service Strategy Sheet

This sheet is very similar to the Manufacturer Strategy Sheet. It uses the same basic tiems to measure, with the exception of having an additional and alternative area for calculations if the service comes to the plant and performs the calibrations instead of you sending the tools to them. If the service is delivered on-site instead of the tools being shipped out, the cost of travel may be built into the basic rate the service uses or it may be billed separately. This spreadsheet has both options built in, so the applicable one can be used.

The first subsection is the same as the first subsection in the Manufacturing Strategy sheet, addressing tool count, calibration cycle, total calibrations per year, and the average labor cost for the facility. The data is automatically imported for you from the tool manufacturer strategy sheet. Nothing should be entered in any of these cells.

| | Tools Data | | | | | |
|---|---|---|---|---|---|---|
| | Clicker Torque Wrenches | Dial or Beam Wrenches | Torque S'drivers | Digital Torque Wrenches | Air Power Tools | Electric Power Tools |
| Number of tools | 6 | 1 | 4 | 0 | 6 | 0 |
| Calibrations Per Year | 4 | 2 | 4 | 0 | 6 | 0 |
| **Total Calibrations** | 24 | 2 | 16 | 0 | 36 | 0 |
| | | | | | | |
| Average labor rate for plant | $12.00 | | | | | |

In the second subsection of this sheet, the data for analyzing the costs associated with sending tools out to a calibration service is analyzed. There are only a few rows where data needs to be entered, and they have a bold outline.

| | Single Calibration Cost Data | | | | | |
|---|---|---|---|---|---|---|
| Labor time to pack tool for shipping in minutes (if sent to lab) | 15 | 20 | 10 | 0 | 15 | 0 |
| - Labor $ to pack tool for shipping (if sent to lab) | 3.00 | 4.00 | 2.00 | 0.00 | 3.00 | 0.00 |
| Shipping container/packaging cost in dollars (if sent to lab) | 1.50 | 2.45 | 1.25 | 0.00 | 2.65 | 0.00 |
| Outbound shipping charge in dollars (if sent to lab) | 5.45 | 5.45 | 4.25 | 0.00 | 7.50 | 0.00 |
| Calibration charge from calibration service in dollars | 25.00 | 35.00 | 25.00 | 0.00 | 30.00 | 0.00 |
| Certification charge from calibration service in dollars | 5.00 | 5.00 | 5.00 | 0.00 | 5.00 | 0.00 |
| Return shipping charge from calibration service in dollars (if sent to lab) | 5.45 | 5.45 | 4.25 | 0.00 | 7.50 | 0.00 |
| Package receiving labor in minutes (if sent to lab) | 10 | 15 | 5 | 0 | 10 | 0 |
| - Labor to record package receipt and unpack in $ (if sent to lab) | 2.00 | 3.00 | 1.00 | 0.00 | 2.00 | 0.00 |
| Certification filing/tracking labor in minutes | 5 | 5 | 5 | 0 | 5 | 0 |
| - Labor to get and file certification from tool mfr. in $ | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Invoice receipt/processing/payment labor in minutes | 20 | 20 | 20 | 0 | 20 | 0 |
| - Invoice receipt/processing/payment labor in $ | 4.00 | 4.00 | 4.00 | 0.00 | 4.00 | 0.00 |
| **Subtotal cost per single calibration** | $52.40 | $65.35 | $47.75 | $0.00 | $62.65 | $0.00 |

The first row to be changed, "Outbound shipping charge in dollars (if sent to lab)", is the actual shipping charge from the carrier to take the tool to the calibration service. In our example, the calibration lab is closer to our facility than any of the tool manufacturers, resulting in lower shipping charges across the span of tool types. If you have not used this strategy, a close approximation of the charge can usually be obtained form the carrier via their website or a phone call. If you are using this strategy, the number to use is the charge for that shipment on the carrier's invoice. Once the number for each type of tool has been obtained, enter it in the appropriate cell in this row.

The next row of data to be entered is "Certification charge from calibration service in dollars". This is the actual charge from the calibration service for calibrating the tools, and is specific to each tool type. In our fictional example plant, this charge from the calibration service was less for each tool type than the charge from the manufacturer. If you are using this strategy, the required number for each tool type is the charge for the calibration for that type on their invoice. If you have not used this strategy, a call to a calibration service you might use can get you their rates.

The third row in this section, "Certification charge from calibration service in dollars", is the charge for a written certification of the calibration results, if the lab charges it as a separate line item. This will most likely be a flat charge across tool types if it is charged. That common practice is what was used in our example. If you are using this strategy and the service does have a separate certification charge, enter the amount shown on their invoice for it in each cell. If you are contemplating the use of this strategy, contact a likely source to find out whether they charge separately for the certification and what the amount is, then enter that charge. If the calibration service you are currently using or contemplate using does not charge additional for a written certification, enter zero in the cells in this row.

The fourth and last row of data to be entered in this section is "Return shipping charge from calibration service in dollars (if sent to lab)". Again, this charge will probably be the same as the charge for getting the tool to the lab, as shown in our example. The source for the data for each tool type is the same as in the outbound shipment - actual invoice from the carrier if you are already using this strategy or the charge quoted by the carrier for the transport of the package.

When these four lines of data have been entered, the cost for each tool calibration will appear in the summary line (yellow highlight) for each tool type.

The next section calculates the total costs for using a calibration service strategy if the tools are sent out to the calibration service.

| | | Annualized Calibration Costs | | | | |
|---|---|---|---|---|---|---|
| Total Calibrations x Cost Per Single Calibration | $1,257.60 | $130.70 | $764.00 | $0.00 | $2,255.40 | $0.00 |
| Total Annual Calibration Service Cost if tools shipped out | $4,407.70 | | | | | |

In our example plant this cost is nocieably less than the cost of sending each tool back to its' msanufacturer for calibration. The change is primarily the result of a lower charge for the service and lower carrier charges. While the change in charges was small in each area, the quantity of calibrations each year on which the savings was obtained multiplied the total effect to result in a noticeable savings.

There is also the possibility that the calibration service will come to your plant and perform the calibrations. Some services offer this in defined geographic areas, and where this is available, the option should be investigated.

A look at the summary above shows a gray bar running across the cells. Below this gray bar is another subsection that performs this function. Scroll down until you see that subsection, as shown below.

| | Cal Service In-House Data | | | | | |
|---|---|---|---|---|---|---|
| Calibration charge from calibration service in $ (if comes to plant) | 25.00 | 35.00 | 25.00 | 0.00 | 30.00 | 0.00 |
| Certification charge from calibration service in $ (if charged) | 5.00 | 5.00 | 5.00 | 0.00 | 5.00 | 0.00 |
| Certification filing/tracking labor in minutes | 5 | 5 | 5 | 0 | 5 | 0 |
| - Labor to get and file certification from lab in $ | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| Invoice receipt/processing/payment labor in minutes | 20 | 20 | 20 | 0 | 20 | 0 |
| - Invoice receipt/processing/payment labor in $ | 4.00 | 4.00 | 4.00 | 0.00 | 4.00 | 0.00 |
| **Subtotal for per-calibration costs** | 35.00 | 45.00 | 35.00 | 0.00 | 40.00 | 0.00 |

In this option the charges pertinent to shipping and receiving the tools no longer exist. That does not eliminate transportation costs, it shifts them to the calibration service who must recover them.

The travel costs may be recouped by the service in either of two ways. The calibration service may add increase the price of the service when it is perfomed on-site instead of in their facility, or a "per trip" charge may be added to the invoice.

In this subsection the first row, "Calibration charge from calibration service in $ (if comes to plant)". is where the charge for the calibration is entered when on-site calibration is performed. In our sample plant, the calibration charge is the same whether the service is performed on-site or in the calibration service facility, so the same number is used in both places for each tool type. To customize this to your facility, ask the calibration service (existing or potential supplier, as appropriate) what they charge for the actual calibration of each tool type when it is performed on-site. Enter their quoted amounts in the appropriate cells in this row.

The second row, "Certification charge from calibration service in $ (if charged)", is where the charge for a written certification is entered if there is a separate charge for it. In our example, there is a flat charge for written certifications, regardless of tool type. As before, the line item on the invoice from the calibration service is used if you are currently doing this, a quote from the potential supplier of the service is used if you are not using one, and if there is no additional charge for a written certification the number to enter is zero.

The other cost factors in this subsection have already been entered into the sheet and calculated, so here they are repeated, then used for the tool type annual cost summary. These cells should not be changed.

In the next subsection the sheet addresses "per trip" charges and the number of trips per year. It then calculates the total for any such charges and the total strategy cost for on-site calibration be a calibration service. This is shown immediately below.

| | | Annualized Calibration Costs | | | | |
|---|---|---|---|---|---|---|
| **Total Calibrations x Cost Per Single Calibration** | **$840.00** | **$90.00** | **$560.00** | **$0.00** | **$1,440.00** | **$0.00** |
| Subtotal single Calibration Costs,Annual Amount | $2,930.00 | | | | | |
| Travel charge from cal service per trip (if charged separately, not built in) | 50.00 | | | | | |
| Number of cal service trips to plant per year | 4 | | | | | |
| **Total Travel Charges** | $200.00 | | | | | |
| **Total Annual Strategy Cost with on-site service** | **$3,130.00** | | | | | |

As the bold outline shows, there are only two cells where data must be entered to customize this sheet. The first is the "Travel charge from cal service per trip (if charged separately, not built in)". In our example, the cal service has a charge for the trip, so that number was entered in the cell. To customize this for your plant, enter the charge your cal service (current or potential) would have for this if charged. If there is no separate per trip charge, enter zero.

The second and last question is the number of trips they would make per year under your system. In our example, the number is four. To customize this, enter the appropriate number in that cell.

The total for the calibration service strategy when the service is performed on-site is automatically calculated, and the result displayed in the turquoise box.

In our example plant, the "on-site" option saved money by eliminating the costs of sending the tools out, even though a charge was made by the service for their travel. The increased convenience was accompanied by a lower cost, making this a less expensive option.

## Internal Calibration Strategy

The costs of the third basic strategy, performing torque tool calibration in-house, is analyzed on the third sheet of the spreadsheet.

The first subsection is the same data on the number of tools and calibration cycles used on the sheets for the other two strategies. Since we are performing a direct cross-comparison, this is essential.

| | Tools Data | | | | | |
|---|---|---|---|---|---|---|
| | Clicker Torque Wrenches | Dial or Beam Wrenches | Torque S'drivers | Digital Torque Wrenches | Air Power Tools | Electric Power Tools |
| Number of tools | 6 | 1 | 4 | 0 | 6 | 0 |
| Calibrations Per Year | 4 | 2 | 4 | 0 | 6 | 0 |
| **Total Calibrations** | 24 | 2 | 16 | 0 | 36 | 0 |
| | | | | | | |
| Average labor rate for plant | $12.00 | | | | | |

There is no need to enter anything in the first subsection; indeed, doing so would only complicate any later comparisons.

The second subsection, where the data to compute the cost of calibrating a tool of each type is analyzed, is the next area to review and customize. Only the three bolded rows should be addressed.

| | Single Calibration Cost Data | | | | | |
|---|---|---|---|---|---|---|
| Labor time to calibrate tool in minutes | 20 | 30 | 25 | 0 | 30 | 0 |
| - Labor to calibrate tool in $ | 4.00 | 6.00 | 5.00 | 0.00 | 6.00 | 0.00 |
| Labor time to certify tool in minutes | 3 | 3 | 3 | 0 | 3 | 0 |
| - Labor time to certify tool in $ | 0.60 | 0.60 | 0.60 | 0.00 | 0.60 | 0.00 |
| Setup/collect & return tools/filing time in minutes | 5 | 5 | 5 | 0 | 5 | 0 |
| - Setup/collect & return tools/filing time in $ | 1.00 | 1.00 | 1.00 | 0.00 | 1.00 | 0.00 |
| **Subtotal cost per single calibration** | 5.60 | 7.60 | 6.60 | 0.00 | 7.60 | 0.00 |

The first line to be addressed, "Labor time to calibrate tool in minutes", is one that it can be challenging to quantify if you have no experience in calibration. In spite of the challenge, obtaining reasonably accurate data is important; erroneous data impedes your ability to rely on the results obtained.

If you have no data inside the plant from which to work, we suggest talking to your counterparts in firms that do perform internal calibration on the same categories of tools. Your QA Manager may know others in the profesion and be able to obtain information from them. A rough approximation of the required time can even be obtained for any tool by just taking your watch and miming the steps in the written procedure for calibrating the tool - as provided by the tool manufacturer - and checking the elapsed time. The tool manufacturer may simply tell you what to expect for time if you simply ask their representative or customer service personnel. If at all possible, go to the tool manufacturer's facility or some other facility where torque calibration is performed and observe the procedure, preferably on the same types and brands of tools you own.

Some manufacturers will provide calibration training on their tools at little or no cost, and this presents a great ability to obtain hard data and to learn the procedures.

In our example plant we have entered the times for each category, based upon our experience. When you have determined reasonable estimates of the time required to calibrate each tool type you have, simply enter the time into the appropriate cell for each tool type.

The second data row to be addressed, "Labor time to certify tool in minutes", is the time to create, save, and (if desired) print a certification of the calibration. Digital torque testers frequently have serial ports and software packages that permit immediate recording, analysis, storage, and printing of the results of the calibration. As a result, the longest time needed to perform this function is simply waiting for the printer to finish printing the cert.

in the case of our example plant, the torque tester has been tied to the computer and the computer is running calibration and certification software. One mouse click stores the results and prints a certification that accompanies the tool at all times, so there are a couple of minutes in this process.

If you anticipate using computerized recordkeeping direct from the tester, you may wish to leave the times as they are. If you anticipate using a manual system, increase the time to what you believe what it will take using the process you envision. The time in this process should be the same for almost all torque tools. Simply enter the time into the appropriate cells in this row to customize the calculations.

The last cost category in this subsection in which customization is needed, "Setup/collect & return tools/filing time in minutes", is the time it takes to obtain the tool, take it to where calibration will be performed, prepare the tester for testing, return the tool after calibration is completed, and file the paperwork if such is generated. This is the bulk of the time overhead associated with the calibration of each individual tool.

In our example plant the plant is small, so obtaining and returning the tool takes only a little time. Since the paperwork stays with the tool, there is no significant filing time. The use of digital test equipment makes setup a matter of pushing a couple of buttons and maybe attaching an adapter to either the tester or the tool.

To customize this for your facility, look at the location that would be used for internal calibration, the distance it is from the location(s) where the tools will be used, and the paperwork procedure you would like;y use. Estimate the total time that would be involved for this and enter that number in the appropriate cell in the row.

When the data entry for these three rows has been completed, the cost per calibration will be displayed in the yellow cells at the bottom of each category.

The next subsection requires no data entry; it is the calculation of the annual cost of calibrating your torque tools, and is calculated from the data you entered.

| | | Annualized Tool Calibration Costs | | | | |
|---|---|---|---|---|---|---|
| Total Calibrations x Cost Per Single Calibration | $134.40 | $15.20 | $105.60 | $0.00 | $273.60 | $0.00 |
| Total Annual Tool Calibration Cost | $528.80 | | | | | |

This cost is usually markedly lower than the similar costs in both of the other primary strategies. The overhead costs associated with repeated tool shipment and with processing many invoices simply go away.

That said, this IS only a sub-total of the actual cost. It is necessary to calibrate the tester (or testers or transducers if more than one is needed) on some reasonable basis. The next subsection of the spreadsheet addresses the costs associated with the calibration of the tester(s).

| Torque Transducer Calibration Costs | |
|---|---|
| Number of Single-Transducer Testers | 0 |
| Number of Multi-Transducer Testers | 1 |
| - Number of Transducers for Multi-Transducer Testers | 2 |
| **Total Number of Transducers to Calibrate** | 2 |
| | |
| Labor to pack transducer for shipping in minutes | 10 |
| - Labor to pack transducer for shipping in $ | 2.00 |
| Shipping container/packaging cost in $ | 5.00 |
| Outbound shipping charge | 25.00 |
| Calibration charge per transducer from manufacturer ($) | 350.00 |
| Certification charge per transducer from manufacturer ($) | 5.00 |
| Return shipping charge | 25.00 |
| Package receiving labor in minutes | 10 |
| - Package receiving labor in $ | 2.00 |
| Certification filing/tracking labor in minutes | 5 |
| - Certification filing/tracking labor in $ | 1.00 |
| Invoice receipt/processing/payment labor in minutes | 20 |
| - Invoice receipt/processing/payment labor in $ | 4.00 |
| **Subtotal cost per transducer calibration** | 419.00 |
| | |
| Transducer calibrations per year | 2 |
| **Total transducer calibrations per year** | 4 |
| | |
| **Total Annual Transducer Calibration Cost** | $1,676.00 |

Many of the categories of costs and calculations associated with tester or transducer calibration are the same as those for the torque tools themselves, leaving only a limited amount of data to be entered.

The first question that must be answered in this section is “How many testers or transducers must be calibrated?” Torque testers come in two basic types; testers with a single transducer integral to the unit, and testers which accept multiple transducers. Single-transducer testers require sending the unit out for calibration, and a count of the testers is sufficient to determine the cost. Multi-transducer testers may or may not need to be sent out for calibration, but each of the transducers that connect to the tester must be. Therefore, for these, the important number is the number of transducers to be calibrated.

A look at the potential torque tester supplier website will let you compare their tester offerings against the range (various torque capacities) of torque tools you have. Comparing your tool inventory with the testers available to test them will let you figure out what tester(s) you need, and whether you are better off with single transducer testers or multi-transducer testers. If you are having difficulty figuring out your needs, a call to the manufacturer’s Sales or Customer Service operation will usually provide the answers you seek.

Once you have determined your needs, you can customize the spreadsheet to project the likely costs for comparison. You will notice the categories of costs, and the data required to calculate them, are the same for sending out the transducers for calibration as sending out the torque wrenches.

The first cell needing customization, “Number of Single-Transducer Testers”, is zero in our example plant. If you and your supplier determined that this was the option to investigate, enter the number of single transducer testers that it would take to achieve your internal calibration goals. If you determined that you will not need any single transducer testers, leave the zero in place.

The second possible customization cell, “ - Number of Transducers for Multi-Transducer Testers” is two in our example plant that uses a multi-transducer tester. If you have determined that you will

use only single transducer testers, or that you will be using a multi-transducer tester with a different number of transducers, change this number to reflect the decision.

The third cell to customize is "Labor to pack transducer for shipping in minutes". Transducers are precision instruments, and when they will be shipped out for calibration, they should be packed carefully. In our example plant, it took 10 minutesto properly package the transducer for shipment. If you believe the time in your plant will be different, change the number in this cell to refliect your best estimate of the time required for this operation.

The fourth cell to be addressed in this subsection, "Shipping container/packaging cost in $", is the cost of the packaging materials that would be used to send the transducer out for calibration, whether it is to the manufacturer or a calibration service. Since transducers require careful packaging, the packaging cost is higher in our example facility. Enter the cost, in dollars, of the packaging you believe would be required in your facility for this.

The fifth cell in this subsection, "Outbound shipping charge", is the charge from the carrier to take the package to the calibration facility. In our example plant this cost was higher than sending out a wrench. You can use quotes from the likely carrier to get a close estimate of this charge, and use the quoted amount in this cell.

The sixth cell, "Calibration charge per transducer from manufacturer ($)", is the amount the manufacturer of the transducer (or calibration service) tells you they would charge to calibrate a transducer such as you would have. In our example the manufacturer is the source of calibration and they quoted the amount shown. Change this to what you are quoted from the source you would most likely use.

The seventh cell in this sequence, "Certification charge per transducer from manufacturer ($)" is the amount the transducer calibration source charges for a written certification of the transducer. This applies only if charged in addition to the calibration cost in the cell above. In our example, there was a modest cost and it was entered into the cell. Change this cell to reflect the actual dollars your likely calibration source would charge for this if they would.

The eighth cell for consideration in this subsection, "Return shipping charge", is the charge from the carrier for bringing the transducer back to the facility from the calibration provider. Again, this charge can be obtained from the likely carrier, and is most likely the same as the outbound charge, as in our example. Change the contents of this cell to the number quoted for it from the carrier.

All of the other cells in this subsection have been automatically filled out using the data provided in the other strategy sheets. When the eighth cell has been changed, the cost of each transducer calibration will be calculated and displayed in the yellow cell to the right of "**Subtotal cost per transducer calibration**".

This amount is typically a significant multiple of the cost of calibrating an individual torque tool. The process used to calibrate a transducer to the high level of accuracy required is slow and labor intensive, leading to higher costs and charges.

There is only one more cell to be customized to allow the spreadhseet to reflect the costs you will experience. That is "Transducer calibrations per year". in our example plant, each transducer will be sent out twice a year for calibration, so the number entered is "2". The manufacturer of the torque tester and transducers can help you estimate the number of times per year you might want to cali-

brate the transducers, based upon your usage rate and the environment in which they will be used. Use the suggested frequency in changing the contents of this cell.

Once the above customizations are complete, the spreadsheet will display your cost per individual transducer calibration, the annual cost of calibrating the transducer(s) or tester(s), and the projected total cost for applying an internal calibration strategy to your plant.


Our example plant found an internal calibration strategy to have the lowest ongoing costs of the three strategies. Only the use of a calibration service located nearby and providing in-house calibration of the torque tools came anywhere near saving the money internal calibration would, and even then it was 50% more expensive overall.

**This is not uncommon.**

In fact, only a blended strategy - one combining elements of more than one strategy - can usually improve the savings further.

We cordially invite you to call us and discuss the various strategies as they apply to your operation. Only by careful analysis can the optimum strategy for any given facility be derived, and it takes good planning and diligent execution to assure the initial cost is held within your budget and the desired savings are achieved.

You will be delighted at how much we can help, and how well the improved profit looks on your bottom line!