



National Association for Proficiency Testing

A Non-Profit Organization Dedicated to Excellence in Metrology & Test Measurement

THE VALUE OF PROFICIENCY TESTING

-Gain Financial Return On Your ISO17025 Investment-

Why Participate in Proficiency Testing

Simply put, a quality system needs to have provisions to “assure the quality of test and calibration results”. ISO 17025 *General Requirements for the Competence of Testing and Calibration Laboratories* gives five suggestions for monitoring the validity of results and detecting trends using planned and structured methods.

These suggestions are as follows:

- 1) Regular use of certified reference materials and/or internal quality control using secondary reference materials
- 2) Participation in interlaboratory comparison or proficiency testing programs
- 3) Replicate tests or calibrations using the same or different methods
- 4) Retesting or recalibration of retained items
- 5) Correlation of results for different characteristics of an item

This paper will focus on the use of proficiency testing as a means to assure quality. A sound proficiency test will test the effectiveness of every element in your quality system and provide an unbiased, non-threatening assessment.

Interpreting the Results of PT

Several different methodologies are used to evaluate and report the results of a proficiency test. ISO Standard 17043, NCSLI Recommended Practice, *Guide for Interlaboratory Comparisons*, is another excellent source of information. The most widely accepted method compares the measured data against established reference values. The result is the En (called E sub n) number. When the En is between +1 and -1 no corrective action is required. A second method for evaluating and reporting proficiency test results centers around determining the inclusion and/or overlap of a participant’s measured values and associated uncertainties with that of the artifact’s reported reference values and uncertainties. This evaluation is simply given as “Within”, “In” and “Out”. Both of these evaluations can be displayed using charts/graphs, making a relatively simple comparison. Besides being compared in the reference values, a report is also prepared showing the data from all participants. With this information it is relatively easy to note individual performance compared to that of peers within the industry.

Language of Metrology

One thing is certainly clear; of the changes that have been introduced in the calibration business over the last few years, laboratory accreditation has created a universal language. In the past as they were discussed, the definitions of terms such as “NIST numbers,” “traceability,” and “accuracy ratio’s,” could vary greatly. While these varying interpretations have not been eliminated, a great deal of clarification and mainstreaming



National Association for Proficiency Testing

A Non-Profit Organization Dedicated to Excellence in Metrology & Test Measurement

of these terms has occurred in a short time. Within the industrial world, the term “calibration” prompts a set of expectations that are widely understood. ISO 17025 and its predecessor, ISO Guide 25 has become a language that is used in day-to-day conversation. Terms including “accreditation,” “measurement uncertainty,” and “technical competence,” are commonplace. In the process, proficiency testing has taken on new meaning. Historically, this concept conjured up images of re-calibration and comparison of these results. Now, proficiency testing brings to mind concepts of data integrity, measurement confidence, and risk assessment. Successfully enrolling in proficiency testing provides the opportunity to witness the effectiveness of quality systems currently in place. Essentially, every facet within a given quality system comes into light during the successful participation in a proficiency test. Accreditation requires thorough examination of operations such as validated procedures, qualification of staff, uncertainty analysis capabilities, and corrective action system maintenance, just to name a few. Laboratories must understand and apply this terminology and these ideals if they are to be recognized for accreditation.

Measurement Uncertainty Analysis

The single most difficult change within the realm of calibration and testing has been measurement uncertainty analysis. Major progress continues to be made, but work still remains. With the requirement for calibration certificates to include statements of uncertainty contribution, and scope of accreditation documents being readily available, it is easier now than ever to gauge how a laboratory measures up. Many items are sent to outside locations for calibration due limited measurement capability in many laboratories. A quick indicator of the gap can be recognized by comparing the uncertainty on the certificate to a laboratory’s best measurement capability. Reviewing scopes is much easier with the information now posted on the web sites of A2LA and L-A-B. Examining laboratories with similar capabilities is a common practice by laboratories that would like to investigate individual laboratory quality positioning as compared to like laboratories within their industry.

Access to Technical Expertise

The **most important** factor in proficiency test participation is behind the scenes, so to speak. Specifically, this involves the roll played by industry experts. Most laboratories making measurements everyday occasionally encounter situations that prove frustrating. As a result, even the most experienced technician may not know where to turn for assistance. These moments can lead to some messy, at times even disastrous, results. To employ an example, perhaps the scenario is that calibration results show a significant, but unexplained, data shift. After reviewing everything that could have impacted the results, the solution continues to prove elusive. Access to someone who could look at the results with a different set of eyes, someone who specializes in the particular measurement in question, is an infinitely valuable tool when circumstances become taxing. One of the most important requirements for a proficiency test provider is identifying and utilizing the skills and knowledge of Technical Advisors who are recognized as industry experts while establishing a test. At NAPT, these Technical Advisors additionally ‘stay with the product’ and provide on-going support for the particular proficiency test they are involved with. From providing assistance in the development and performance of the proficiency test, through the careful interpretation and analysis of participant results, they provide their continuing assistance, guidance, and expertise. These key individuals are representatives of premier calibration laboratories and have direct access to the reference laboratories. Reference laboratories are responsible for characterizing the test artifact and establishing the



National Association for Proficiency Testing

A Non-Profit Organization Dedicated to Excellence in Metrology & Test Measurement

basis for comparison. Any laboratory enrolling in a proficiency test with NAPT can be assured of the established credibility of the reference values to which their data is being compared.

Effectiveness of Training

One area that has grown in emphasis due to ISO certification and accreditation, is the training and qualification of proficiency testing staff. Technical courses are now available in just about every measurement discipline. The cost of this training compacted with increased travel costs make it difficult for laboratories to send more than one technician. As a result, the single technician is generally expected to return and pass on their newly acquired training to any additional technicians. By incorporating proficiency testing during this cross training, laboratories are provided immediate feedback on the training's effectiveness. In the instance of training centered around a new measurement capability, procedure, or method for the laboratory, it should be relatively easy to have multiple technicians calibrate the same artifact using the new knowledge gained. By comparing the results of this calibration along with the consistency of the data, it quickly becomes apparent how effective the training was. Furthermore, it becomes documented evidence of the training itself. This works exceptionally well with training on new calibration equipment. By incorporating tests before, during, and after the training, laboratories are provided immediate, conclusive results concerning the readiness to incorporate widespread use of any new measurement capability.

Promotion of Inter-Staff Communication

Calibration laboratories have key individuals who have a great deal of experience and knowledge within their given field. It has taken many years to hone these unique and very valuable skills. At times, such individuals may feel threatened by the prospect of the sharing of their knowledge with others. Giving these key individuals the opportunity to initiate and participate in an interlaboratory comparison allows them to begin sharing this knowledge with others in a non-threatening way. With skilled metrologists at a premium, this can potentially provide motivation to assist in cross training others and utilize their in-depth uncertainty analysis of key calibration processes. This brings other technicians into a focused discussion of how work and procedures are actually performed. Many laboratories have multiple measurement disciplines with little sharing of common learning. Using this approach as a way to initiate dialogue creates a team oriented dynamic and improves overall camaraderie. Improving inter-staff communication promotes the continued flow of shared information, knowledge, and skills. Identifying the errors that contribute to measurement uncertainty is determined in the same way regardless of the measurement discipline. To reiterate, it comes down to this new language, its development as well as the necessity to learn and know it. Teamwork and improved overall operations are the result.

Promotion of Staff-Management Communication

The authors of ISO 17025 obviously anticipated a crucial need for the active role of management in day-to-day operations within calibration and/or testing laboratories. The technical staff can readily handle the technical requirements of ISO 17025, but a proper balance must be provided. Management must ensure that the necessary level of support is provided to meet ever-growing customer expectations. The results of proficiency testing can provide valuable answers. When several technicians participate in the same test, it



National Association for Proficiency Testing

A Non-Profit Organization Dedicated to Excellence in Metrology & Test Measurement

outlines the measurement variability of the laboratory. This information is very valuable when used to identify weak processes that require further investigation and validation. It is also a powerful tool when used to create dialog and open lines of communication. Many calibration and testing laboratories participate in proficiency testing to satisfy accreditation requirements. When this is the approach, the already most proficient staff member is the only participant with the intent to pass the test. While this is not necessarily wrong, incorporating several technicians in the participation provides much more overall value from the investment made. In this way, accreditation requirements are still met, but laboratories are provided a much better indicator of day-to-day calibration/test process capabilities. In turn, the value is returned by the ability to raise the standards for the laboratory overall, as opposed to maintaining the token technician trusted to perform the proficiency testing. In an industry which continues to grow more and more competitive and quality-based, many laboratories are deciding that every technician should be as good as their best.

Effort Reduction in Subcontractor Qualification

Selecting and approving providers of calibration services has always been a difficult process. To assure data integrity and minimize risk, extensive efforts are undertaken to qualify these providers. Even with on-site assessments of quality systems, it can be difficult to focus on specific calibration services needed. As requirements for laboratory accreditation became more prevalent, this became much easier. By reviewing the scope of accreditation for potential suppliers, it is now easier to determine if their measurement capability meets specific criteria. For example, if pressure calibration up to 10,000 psi. is the particular criteria in question, reviewing a laboratory's stated 'best measurement capability' can provide a good feeling about their technical ability. In this case, the measurement uncertainty needed for the pressure calibration is $\pm 0.01\%$ capacity (95%CL @ K=2). Due to this documentation, the ability of the laboratory to satisfy these specific calibration needs becomes evident. For further evidence, completed proficiency tests within said measurement discipline can be requested to provide further documentation. In reviewing proficiency test results, an unbiased opinion can be formed in relation to the tests that were performed, their results, and how well they compare to their peers. This key information may be the deciding factor in final supplier approval. Continuing to use this approach to routinely assess ability to satisfy criteria provides the assurance needed to qualify a sub-contractor with confidence.

New Process Development

Calibration methods are always in development, either in being written or in being revised. Due to the detail-oriented discipline in the metrology lab, editing is never complete. The best indicator of the adequacy and correctness of a calibration procedure is to actually put it into action. To determine the consistency of a new process, an intra-laboratory proficiency test is initiated with multiple technicians. The results of this test are then evaluated based on the same criteria as a formal interlaboratory proficiency test. The results should show consistency from technician to technician. The steps in the calibration procedure should have been followed as prescribed. Process uncertainty can be calculated by each technician individually and then compared. Based on the study of this, the effectiveness of the new process is evident and decisions can be soundly made concerning further process development. The primary purpose of having a written procedure is to assure consistency. This method of testing is good proof of consistency.



National Association for Proficiency Testing

A Non-Profit Organization Dedicated to Excellence in Metrology & Test Measurement

Investment Potential

Many individuals understand the frustration of having put together a strong case for capital investment, only to fall short in proving financial return. In the calibration laboratory, this has always been a dilemma. A formal proficiency test can now provide the return evidence necessary. The results of the proficiency test will substantiate the difficulty in making this specific measurement. Instead of generalities, factual data is provided comparing actual results to scopes of accreditation. This data is what may have been missing and a key factor in justifying need. The need to support measurement based on customer requirements is obvious. Looking around, it is also clear that other laboratories have made investments and can meet customer requirements. Knowing the capital investment necessary and the potential loss of revenue, it becomes more of a convincing argument for making investments. Once this new investment of test and measuring equipment is fully commissioned, participation in another round of proficiency tests will show process improvement and alignment with industry or possibly even highlight a new competitive advantage. This success story will go a long way in illustrating to management the ability of an individual to identify needed capital and have the tools in place to measure the return on investment.

Promoting Higher Standards in All Measurement Disciplines

This is an important factor for calibration laboratories that provide internal support to corporations. The calibration activities support many other areas of the company. Corporations use the equipment their laboratories calibrate for making measurements in production and product development. Knowledge in calibration benefits the technical work performed. One of the most influential factors in measurement uncertainty is the operator. If multiple technicians perform proficiency tests, it should be apparent how this would impact the results. The same can be said for the departments who use the calibrated equipment. It is relatively easy to set up an ILC/PT in the production area and have all operators participate. By analyzing the results, production management will have a good sense of actual measurement capability. These results can be used for identifying areas for training, environmental influences, and marginal test and measuring equipment. This is an excellent opportunity for the calibration laboratory to use these measurement assurance techniques to directly benefit internal customers.

Expansion beyond the Technical

By now, a general understanding of the processes to manage the technical portion of the business has been outlined. Additionally and equally, an opportunity exists for the enhancement of non-technical processes. Marketing and selling are a good example of this. In measuring the effectiveness of these tools and techniques, it is helpful to examine the degree to which customers understand the terminology that is used. The administrative or financial parts of businesses are excellent study candidates. Process improvements can be made to strengthen these facets within businesses. While no organized proficiency test has been established to study administrative processes, the concept is the key. Development of a test to assess the



National Association for Proficiency Testing

A Non-Profit Organization Dedicated to Excellence in Metrology & Test Measurement

effectiveness of billing, invoicing and accounts receivable processes can prove to be time well spent. Any process improvement in all areas will not only streamline operations, but also improve cash flow.

Business Growth

A marketing study completed by *Quality Magazine* in December 2000 stated that corporations in the USA were planning to spend \$350M for calibration services in 2001. This represents 9 cents for every dollar budgeted for all quality initiatives. The central states lead with \$176M planned expenses, followed by the East coast at \$104M. Companies on the West coast anticipated spending \$70M on calibration services. It is important to really examine how business investments made can provide the opportunity to take advantage of this situation and further increase the amount financially being generated. Gaining accreditation status has its rewards.

A laboratory's technical capability is described on their Scope of Accreditation. It shows their Best Measurement Capability. Put another way, it also describes their limitations. Market share can be lost due to limited measurement capability or due to process uncertainties that are based on antiquated test and measuring equipment. There are opportunities to expand capability in a measurement discipline and increase market share. Major customers may be forced to go elsewhere in circumstances when there are calibration services that cannot be supported. The Scope of Accreditation becomes a marketing tool in identifying what type of equipment can be serviced and what level of uncertainty can be provided. By adding additional test and measuring equipment, it is possible to attract additional business from your current customers. In studying the feasibility of expanding calibration testing to new measurement areas, progress becomes almost inevitable. More and more, consumers are seeking out companies that can suit all of their needs, a one-stop shop. When reviewing a Scope of Accreditation for new opportunities, it is valuable to watch for calibrations at ranges or at uncertainty levels that others cannot achieve. By making customers aware of unique capabilities, their level of consciousness and appreciation for individual laboratories is raised. This is important to be aware of.

Conclusion

When the race has been prepared for, all contributing parts of the operation have been tested as a unit and as an integrated system, critical communication paths have been tested and scrutinized in all conceivable situations, competent staff has been selected and trained, and race day is fast approaching, it is important to make sure all efforts have paid off. To do this, one must actually move. It may begin slowly at first, to ensure everything is functioning as a system. Minor details come up and are corrected, but should not slow energy and drive. When finally up to speed with the competition and still feeling more to offer, the assurance comes of having a fine tuned "system" supported by the ultimate team of technically competent members. It shows in the "smiles" and "high fives" as a team competes head on. There is visible pride in every move which comes with the confidence of being the best possible. This is to be part of a team. The end result, the pride that completes the cycle, is technical competence.