

Why Calibrate?

The following is an article written by John Marks, previously one of our IANZ Approved Signatories who retired after over 40 years with *Homersham's*.

1. The Need for Calibrations

In our physical world, all things eventually wear out. Instrumentation devices are constructed of materials, which resist that tendency, but eventually entropy has its way and the accuracy of the instrument suffers. Manufacturers calibrate instruments before they are shipped, but mishandling can cause strains in sensitive instrument elements, and often require adjustment when they reach the customer. Local laboratories have the function of maintaining the accuracies of instruments within manufacturers' specifications.

2. Intervals between Calibrations

International Standards Associations over the years have gathered information on the typical performance characteristics of instrumentation, including recommended intervals between calibrations. Individual classes of instruments retain their required accuracies over individual lengths of time. For example, the typical pressure gauge, when operated in a reasonable fashion, tends to retain its required accuracy of calibration for at least 12 months. Pressure gauges therefore are recommended to be calibrated at least once within a 12-month period. Dead-weight testers are typically laboratory-based equipment and normally require a 5-year calibration interval. However, those intervals are maxima, and should be shortened, should subsequent testing prove any individual instrument to be drifting out of calibration more quickly. The interval should be halved in that situation and the laboratory should advise the end-user of the tendency, with a recommendation that the process connected to the instrument be inspected to ensure that the process is not causing undue harsh effects on the instrument. (Instruments can be protected from harsh environments by the use of, for instance, restrictors in pressure gauge lines to dampen pressure pulsations.)

3. Available Standards Publications

Various standards publications are available which identify important elements of instrumentation design and calibration. However, the Standards relating to pressure gauge use are quite unique in instrumentation, in specifying strict standards for pressure gauge calibrations. Other forms of instrumentation make more general recommendations on required accuracy's, in which case the instrument's accuracy must match that required by the process involved. (For instance, the instrument required for measuring and maintaining the temperature of a hatching egg in an incubator, with a tolerance of only 1 or 2 degrees C, must have a smaller degree of uncertainty than a less-demanding application, such as washing machine water temperature.)

Standard publications in the pressure gauge field include the British Standard and Australian Standard Specifications BS1780 and AS1349, both of which are renewed periodically (the most recent of which is 1985 and 1986 respectively). The "bible" for temperature calibrations in New Zealand is the book, "Traceable Temperatures", written by John Nicholas/Rod White, of the Industrial Research Department based in Lower Hutt.

4. Traceability of Calibration

Instruments used for testing other instruments' calibrations must themselves periodically be calibrated using instruments of smaller levels of calibration uncertainty. There should be a clearly defined chain of such traceability from any instrument back to the National Standards (which, in New Zealand, are maintained at the Industrial Research Department at Lower Hutt). Their Standards in turn periodically are compared with the International Standards. Two factors of calibration reporting are important for a full appreciation of an instrument's calibration: (a) its accuracy of indication and the associated corrections which need to be applied to reach an accurate result, and (b) the level of uncertainty of those values. As no data can ever be absolute but is relative to something else (and is therefore uncertain to that extent), so that extent of uncertainty must be reported in calibration results. (For example, a temperature instrument that is accurate at 30 degrees C, but with an uncertainty of measurement of ± 10 degrees C, would be unsuitable for measuring egg incubator temperatures.) The uncertainty of measurement of an instrument includes many factors, such as the readability of its scale, the uncertainties of the instrument used to test it in turn, variability's of repeatability, instrument stiction, etc.

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Temperature
Pressure

Why Calibrate? - Continued

5. International Authorities for Quality Management of Instrument Laboratories

In recognition of the need for accuracy in industry, various national and international bodies have been commissioned whose task is to set suitable quality standards for laboratories, which calibrate instruments. New Zealand's internationally recognised body for the inspection and audit of instrument laboratories is IANZ (International Accreditation New Zealand). That body was formerly TELARC NZ, but IANZ was formed out of the TELARC organisation, in response to the need to have TELARC's product/services suppliers' audits conducted distinctly separately from IANZ's laboratory audits, and thereby remove a possible conflict of interests. Some areas of industry, (especially where life is at risk, such as scuba tank testing), require strict guidelines of calibrations for maintaining quality of equipment, and IANZ-endorsed certificates are a mandatory requirement. Accordingly, various calibration laboratories (including that at *Homersham's*) are accredited by IANZ for testing of instrumentation. Such laboratories undergo a rigorous annual audit of their quality management systems, to ensure that quality of testing is being maintained to the customers.

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