



Purpose of a calibration

There are three main reasons for having instruments calibrated:

1. To ensure readings from an instrument are consistent with other measurements.
2. To determine the accuracy of the instrument readings.
3. To establish the reliability of the instrument i.e. that it can be trusted.

Traceability: relating your measurements to others

The results of measurements are most useful if they relate to similar measurements, perhaps made at a different time, a different place, by a different person with a different instrument. Such measurements allow manufacturing processes to be kept in control from one day to the next and from one factory to another. Manufacturers and exporters require such measurements to know that they will satisfy their clients' specifications.

Most countries have a system of accreditation for calibration laboratories. Accreditation is the recognition by an official accreditation body of a laboratory's competence to calibrate, test, or measure an instrument or product. The assessment is made against criteria laid down by international standards. Accreditation ensures that the links back to the national standard are based on sound procedures.

For measurements to be compared they must share a common measurement system.

Uncertainty: how accurate are your measurements?

Ultimately all measurements are used to help make decisions, and poor quality measurements result in poor quality decisions. The uncertainty in a measurement is a numerical estimate of the spread of values that could reasonably be attributed to the quantity. It is a measure of the quality of a measurement and provides the means to assess and minimize the risk and possible consequences of poor decisions.

For example we may want to determine whether the diameter of a lawn mower shaft is too big, too small or just right. Our aim is to balance the cost of rejecting good shafts and of customer complaints if we were to accept faulty shafts, against the cost of an accurate but over engineered measurement system. When making these decisions the uncertainty in the measurement is as important as the measurement itself. The uncertainty reported on your certificate is information necessary for you to calculate the uncertainty in your measurements.

A measurement with a stated uncertainty can be compared to others

Reliability: can I trust the instrument?

Many measuring instruments read directly in terms of the SI units, and have a specified accuracy greater than needed for most tasks. With such an instrument, where corrections and uncertainties are negligible, the user simply wants to know that the instrument is reliable. Unfortunately a large number of instruments are not. Approximately one in six of all of the instruments sent to MSL for calibration are judged to be unreliable or unfit for purpose in some way. This

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failure rate is typical of that experienced by most calibration laboratories and is not related to the cost or complexity of the instrument.

Reliability is judged primarily by the absence of any behavior that would indicate that the instrument is or may be faulty.

Achieving Traceability in your measurements

Many quantities of practical interest such as color, loudness and comfort are difficult to define because they relate to human attributes. Others such as viscosity, flammability, and thermal conductivity are sensitive to the conditions under which the measurement is made, and it may not be possible to trace these measurements to the SI units. For these reasons the international measurement community establishes documentary standards (procedures) that define how such quantities are to be measured so as to provide the means for comparing the quality of goods or ensuring that safety and health requirements are satisfied.

To make a traceable measurement three elements are required:

1. An appropriate and recognized definition of how the quantity should be measured,
2. A calibrated measuring instrument, and
3. Competent staff able to interpret the standard or procedure, and use the instrument.

Traceability is ensured only if these three factors are present in the measurement process

For those who buy their measurement services from other companies it pays to purchase from a laboratory that has been independently assessed as being technically competent to provide the measurement services.

Adjustment: what a calibration is not

Calibration does not usually involve the adjustment of an instrument so that it reads 'true'. Indeed adjustments made as a part of a calibration often detract from the reliability of an instrument because they may destroy or weaken the instrument's history of stability. The adjustment may also prevent the calibration from being used retrospectively. When MSL adjusts an instrument it normally issues a calibration report with both the 'as received' and 'after adjustment' values.

Adjustments may completely invalidate an earlier calibration

What a calibration certificate contains

Your calibration certificate must contain certain information if it is to fulfil its purpose of supporting traceable measurements. This information can be divided into several categories:

- it establishes the identity and credibility of the calibrating laboratory;
- it uniquely identifies the instrument and its owner;
- it identifies the measurements made; and
- it is an unambiguous statement of the results, including an uncertainty statement.

In some cases the information contained in your certificate might seem obvious but ISO Guide 25 grew out of the experience that stating the obvious is the only reliable policy.

Calibration overview provided by the Measurement Standards Laboratory