

CALIBRATION OF MEASURING AND TEST EQUIPMENT

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One of the most frequent reasons for failing to obtain ISO certification in Pakistan is the absence of an adequate calibration system. There are few resources in Pakistan for this sort of activity. The calibration process is not understood by businessmen and business leadership is unaware of the principles of calibration.

This article sets out in some detail, how the subject should be handled. It does not however tell you how, to calibrate individual instruments, because there are far too many of them.

Each company must tackle this issue individually with guidance, and assistance provided by professionals. It is hoped that this article will help the reader to develop a clear understanding of how to develop a viable calibration scheme for his company which would satisfy the requirements of, for example, ISO 9001/2

A measuring or testing activity is useful only if the results of the measurements are reliable i.e; they are sufficiently accurate with a known degree of uncertainty. The accuracy

refers to how close an experimental observation lies to the true or standard value. It should not be mixed up with precision. Precision refers to how close is the observed and true value of the same quantity.

Measuring and test equipment must have the desired level of accuracy and consistency under conditions of actual use. Clause 4.11 of ISO 9001 covers the calibration of all instruments and devices used for product verification at all stages during the production cycle.

TYPES OF STANDARDS.

International:

These are standard definitions on the basis of which primary standards are developed.

Primary: These are the most precise and accurate physical standards, which are derived from international standards. They specify the most stringent conditions and are used only at rare intervals for comparison with secondary standards. These standards are not portable.

Secondary: These are derived from primary standards. They are portable and are often used as national standards. They are less precise than primary standards but are still very precise. They are used at rare intervals to calibrate tertiary and working standards.

Tertiary: These are used in laboratories as reference standards. They are used to calibrate equipment.

Working Standards:

This is a less expensive working version of the tertiary standards. They are usually used in calibration laboratories.

Establishing a Calibration System.

1.Selection of Equipment:

Select equipment, which is suitable for the task. The following points should be covered.

The nature of measurement to be carried out, (physical dimensions, such as mass, temperature, pressure and flow).

The range of measurement.

The equipment's accuracy and degree of precision.

The precision required.

Estimated time required for each measurement and the number of measurements to be taken per day on the basis of daily average, quantities of output being produced.

Any special requirements stipulated by the purchaser.

2. Identification:

Identify each piece of equipment with a unique number in order to ensure traceability of the equipment.

3. Frequency of Calibration:

Define the calibration interval for each piece of equipment on the basis of its usage. Equipment is used in various locations and the frequency of usage might be different in each location. If necessary, the frequency of calibration may have to be adjusted depending upon the results of the calibration. For example, if adjustment is not necessary, when performing calibration, then the frequency of calibration could be extended.

4. Calibration:

Where possible, calibrate equipment in your own laboratory. For this purpose your standards should be traceable to national or international standards and possess calibration certificates. For example, for calibration of your master equipment, the agency should have standards traceable link to national or international standards. On calibration, the relevant calibrating agency will also provide a calibration certificate for your master equipment, which should be carefully stored.

5. Calibration Status:

There must be calibration status stickers on all equipment, which are calibrated. The stickers should contain the calibration date, expiry date, signature and stamp of the authorized person, who performed the calibration, and any specific restrictions on the use of the equipment.

The absence of such a sticker indicates that calibration has not been performed. All equipment not requiring calibration must be identified with a “CNR” sticker.

6. Calibration Procedures:

Document the detailed calibration procedure, if you are doing an in house calibration. If the calibration is performed by an external agency, this must be noted.

7. Training of Personnel:

Train personnel performing the calibrations. Also train all persons doing inspection and using measuring and test equipment. Keep all training records.

8. Maintenance of Calibration Records:

Maintain a calibration record for each equipment. This is called a quality record. The record must be traceable to national or international standards.

The calibration record should show the following.

Description, identification on the equipment and location
Date on which calibration was performed and next calibration's due date.
Results of the calibration.
Planned calibration interval.
Permissible limits of error.
Reference to calibration procedures.
Reference to standards on which calibration is based.
Environmental conditions during calibration.
Details of any maintenance, modification, adjustments carried out on the equipment.
Limitations of use, if any.

9. Action When the Equipment is Out of Calibration:

It may not be possible to pinpoint exactly when a specific equipment went out of calibration. The accuracy of all measurements carried out by the equipment, since its earlier calibration would then be doubtful. In such a case, the following steps should be taken.

Where possible, check with similar calibrated equipment the parameters, which were measured by the equipment, which went out of calibration. If any parameter falls beyond the specified limits, immediate action should be taken to isolate all non-confirming products.

Assess the possible effects of the nonconformity on the final quality of the product. Reappraise the frequency of calibration for this particular piece of equipment. Keep records of the event. Proper maintenance of identification and tractability in production records, as required by ISO 9001. Clause 4.8 will greatly facilitate tracking products whose parameters were measured by the equipment, which is out of calibration. A record of all revalidation should be maintained for future reference.

10. Handle and Preserve the Equipment Properly:

Handle equipment carefully during inspection and transportation. All equipment must be properly stored. Performance of equipment may be impaired by careless use and storage, exposure to extremes of humidity, temperature, vibration, dust etc. These factors should be kept in mind when developing procedures.

Summary

Formalize a list of all equipment used in the organization.

Define a suitable identification scheme. For example:

QC-01, where QC shows the location and 01 is the serial number.

H-001 where H stands for the name of the manufacturing or using company and 001 is the serial number.

Identify all equipment with a suitable indicator, such as a sticker, engraving, permanent ink, etc. Identify all those items of equipment which do not require calibration (for this purpose one can use a sticker **CNR**). Calibrate equipment against traceable national/international standards, either from an outside calibration agency or on the basis of house calibration.

In case of an in house calibration, develop calibration procedures and calibration data card for each piece of equipment.

Paste calibration status stickers on the equipment after calibrating the equipment.

Train staff to use equipment. In the case of in-house calibration, provide training to all personnel who are calibrating the equipment. Take necessary action when equipment shows error at the time of calibration. Check previously inspected product, if possible.

Further Reading

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