

INTERPRETATION OF CALIBRATION CERTIFICATE

Presented by:

Patrick Kizito

Head Pressure Laboratory-UNBS

INTRODUCTION:

Our calibration certificate in NML contains imperative evidence of the integrity of test/calibration equipment and the validity of the calibration itself.

This is despite the fact that the need to calibrate equipment is been perceived by some to be simply a 'necessary evil" to attain quality. Industries and factories worldwide spend millions of dollars annually to calibrate their instrumentation yet the tangible evidence of what has been obtained in return for this investment generally receives scant attention.

SO WHAT IS CALIBRATION?

Calibration is defined as a performance comparison against a standard of known accuracy.

PURPOSE OF CALIBRATION:

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

WHY IS CALIBRATION NECESSARY?

As components age and equipment undergoes changes in temperature or sustains mechanical stress, critical performance gradually degrades. This is called drift and when it happens, test results obtained using measurement equipment become unreliable and both design and production quality suffers.

In a nutshell, calibration:

- Increase production yields ,
- Assures consistency,
- Optimizes resources,
- Is fundamental to compliance with international, regulatory or industrial-sector specific standards that require measurements to be traceable to national standards and in doing so,
- Ensures measurement (and perhaps products) are compatible with those made elsewhere.

TRACEABILITY: RELATING YOUR MEASUREMENTS TO OTHERS

Results of measurements are most useful if they relate to similar measurements, perhaps made at different time, in 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

TRACEABILITY Ctd...

The calibration record must include the following:

- Identification of specific standards used (which must be within their assigned calibration interval)
- Means of knowing the method used and other test conditions.

When these records are examined, it should be possible to demonstrate an unbroken chain of comparisons that ends at National Metrology Laboratories (NML). This demonstrable linkage to national standards, with known accuracy, represents traceability.

UNCERTAINTY:

How accurate are your measurements?

Ultimately all measurements are used to help make decision, and poor quality measurements result un 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 quality of measurement and provides the means to assess and minimize the risk and possible consequences of poor decisions.

RELIABILITY

Can I trust the instrument?

Reliability is judged primarily by the absence of any behavior that would indicate that the instrument is or may be faulty. A calibration certificate will be issued only if the instrument is found to be reliable, and will satisfy its intended purpose.

To make a traceable measurement three elements are required:

- **An appropriate and recognized definition of how the quantity should be measured.**
- **A calibrated measuring instrument**
- **Competent staff who are 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.

CALCULATING THE UNCERTAINTY IN YOUR MEASUREMENTS

The uncertainty statement on your certificate should say something like:

The uncertainty stated is the expanded uncertainty of measurement obtained by multiplying the standard uncertainty by coverage factor $k=2$. It has been determined in accordance with the "Guide to the Expression of Uncertainty in Measurement" (ISO, 1995). The value of the measured lie with a probability of 95% within the interval of values stated. The expanded uncertainty does not, however, contain any long term-stability.

calculating the uncertainty in your measurements Ctd...

When calculating uncertainty two main aspects are considered:

- *Calculating uncertainty due to each of the factors affecting the measurements*
- *Combining these uncertainties to find the total uncertainty in measurement.*

Various uncertainties that may be considered in measurement fall into one of several categories:

- *Uncertainty associated with the instrument (i.e. uncertainty reported on certificate)*

- *Uncertainty associated with your measurement processes i.e. departures from method used in the calibration*
- *Uncertainty associated with environmental factors including temperature, pressure and humidity.*
- *Uncertainty associated with the drift of the instrument with time.*
- *Therefore, the expanded uncertainty in the measurement is given by:*

$$U_{combined} = k \times \sqrt{\left(U_{cert}^2 + U_{meas}^2 + U_{env}^2 + U_{drift}^2 \right)}$$

ADJUSTMENT

Calibration does not usually involve the adjustment of an instrument so that it reads 'true'. Indeed adjustments made as part of calibration often detract from the reliability of an instrument because they may destroy or weaken the instrument's history of stability.

It is recommended that a calibration report be issued with both the 'as received' and 'after adjustment' values.

THE CALIBRATION CERTIFICATE!!



TEST/ CALIBRATION CERTIFICATE

CLIENT : SHELL (U) LTD
 ADDRESS : P.O BOX 7082 KAMPALA
 MODEL/ TYPE : BS5 9HU
 SERIAL NUMBER : 055662
 MANUFACTURER : SAUNDERS AND WEEKS (BRISTOL) LTD
 DATE : 2009-03-31
 CERTIFICATE NO. : 04 09 014

1. Test Instrument : Fine pressure gauge with Bourdon tube
 Range of measurement : 0bar up to 25bar
 Resolution : 0.1bar
 Manufacturer accuracy : -
 Class : 0.25

2. Standard : Pressure balance
 Uncertainty : 0,005 % of the reading, but not smaller than 0,7 mbar
 Calibration marking : 0031 PTB 05

3. Calibration procedure
 DKD-guide DKD-R-6-1 (March 2002), " Calibration of Pressure Gauges "; sequence B.
 The readings of standard were directly compared to the readings of the test instrument.

4. Condition of Measurement

Temperature of Test Instrument : (19.4± 1.0) °C
 Pressure medium : Sebacat
 Pressure reference : pressure connecting area
 Accuracy of height measurement : ± 5 mm
 Position : Vertical

5. Ambient Condition

Room temperature : (20.5 ± 1.0) °C
 Atmospheric pressure : (881.3 ± 1) mbar

This certificate is valid up to **March, 2010**

Calibrated by: Date:

Checked by: Date:

Approved by: Date:

Executive Director

Test/Calibration certificate without signature and official stamp is not valid. This certificate has been issued without any alteration and may not be reproduced other than in full except with the approval of the Executive Director Uganda National Bureau of Standards.

Postal Address	Office Address	Telephone	+256-414-286123	Telefax	+256-414-286123
P.O. Box 6329	Plot M217 Nakawa	Executive Director	+256-414-505995	Telex	
KAMPALA	Industrial Area	General Line	+256-312 279474	Telegram	
		Metrology		Website	www.unbs.go.ug
		E-mail Address:	unbs@infocom.co.ug		



UGANDA NATIONAL BUREAU OF STANDARDS

TEST/ CALIBRATION CERTIFICATE

6. Results of Measurement

The Calculation of the Gauge Pressure is given by:

$$p_g = [\text{Reading} * (p_{max} - p_{min}) / (U_{max} - U_{min})] + p_{min}$$

Pressure unit is bar and 1 bar = 1.01972kg/cm²

The results below are based on the above Conditions:

Standard pressure at reference height (bar)	Average Gauge pressure reading (bar)	Deviation (bar)	Uncertainty U (k=2) (bar)
0.00	0.00	0.00	0.01
2.48	2.64	0.15	0.04
4.99	5.14	0.15	0.04
7.49	7.65	0.16	0.01
9.98	10.15	0.17	0.01
12.48	12.65	0.17	0.01
14.99	15.15	0.16	0.01
17.49	17.67	0.18	0.02
19.98	20.15	0.17	0.01
22.48	22.65	0.17	0.01
24.84	25.00	0.16	0.01

7. Expanded uncertainty of measurements

The expanded uncertainty U (see table) is calculated after correcting the value of the gauge reading with the deviation (see table) in the range of gauge pressure 0bar up to 25bar

The uncertainty stated is the expanded uncertainty of measurement obtained by multiplying the standard uncertainty by coverage factor k=2. It has been determined in accordance with the "Guide to the Expression of Uncertainty in Measurement" (ISO, 1995). The value of the measurand lie with a probability of 95% with in the interval of values stated. The expanded uncertainty does not, however, contain any long term-stability.

8. Marking

One adhesive label with the official mark has been put at the back of the test instrument.

Test/Calibration certificate without signature and official stamp is not valid. This certificate has been issued without any alteration and may not be reproduced other than in full except with the approval of the Executive Director Uganda National Bureau of Standards.

Postal Address	Office Address	Telephone	Telefax	+256-414-286123
----------------	----------------	-----------	---------	-----------------

Features of the Certificate!!

The Title: The calibration certificates establish what the document claims to be.

➤ *Name and address of calibration laboratory:*

The user and laboratory can trace all work relating to the calibration and the use of an instrument.

➤ *Each page should be numbered and the total number of pages given.*

➤ *Unambiguous identification of the instrument, including make, model and serial number: With this information, you will know that this is an authentic calibration relating to that particular instrument.*

Features of the Certificate Ctd...

Date of calibration

- **Identification of calibration method used or unambiguous description of any non-standard method used, and/or departures from standard method**
- **Conditions under which the calibration is carried out e.g. ambient temperature, pressure, etc**
- **Measurements and derived results**
- **A statement of the estimated uncertainty of calibration results**
- **A signature and title of person (s) accepting responsibility for the report contents**
- **A statement that the certificate shall not be reproduced other than in full, except with the approval of the executive director Uganda National Bureau of Standards**

ENSURING THAT YOUR CALIBRATION REMAINS USEFUL

The Calibration Certificate provides the user with an assurance that the instrument is reliable. This assurance is based on the calibration laboratory's knowledge and expertise on the behavior of similar instruments, but is conditional upon reasonable care and use of the instrument .

CARE OF THE INSTRUMENT

It is a requirement that a log for the instrument that contains procedures for use, records for calibration and checks, records for repair and servicing and most importantly, restrictions on use of the instruments to approved staff are put in place.

RECALIBRATION

Placing the burden of proof of validity of the certificate with the user clarifies the question of recalibration. Recalibration is required as soon as you no longer have confidence in the results because you are unable to demonstrate that the measurements are traceable.

THANK YOU FOR LISTENING!!!

ANY QUESTIONS???