CALIBRATION OF MEASURING EQUIPMENT PROCEDURE

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1.0 PURPOSE AND SCOPE

The purpose of this procedure is to define Mansa Engineering’s responsibilities and activities in order to ensure that all inspection and test equipment used for product, service, and process verification is controlled and calibrated against nationally traceable standards at specified intervals and that such devices are available to ensure continuity of measurement capability.

This procedure applies to all inspection and test equipment required for product and process verification. There must be confidence that equipment used to inspect or measure attributes of the design is calibrated to an acceptable level of accuracy.

The HSEQ Advisor ensures that any device which does not meet this criterion is isolated from use and recalibrated before being used. Devices used to calibrate equipment are traceable to a national or international standard unit of measurement. Each measurement instrument is traceable through its calibration record which contains:

- a) Identification number;
- b) Manufacturer and model;
- c) Frequency of calibration;
- d) Reference standards used;
- e) Validation certificates and calibration findings;
- f) Details of actions taken in case of unsatisfactory results.

Procedures that may be outside of this scope but related include:

- **MP-CRP-PRO-07** Control of Documented Information Procedure
- **FP-PRJ-PRO-01** Tendering and Contracts Procedure
- **FP-PRJ-MNL-01** Project Procurement Manual
- **FP-PRJ-MNL-02** Project Management Manual
- **MP-CRP-PRO-06** Quality Risk and Assessment Procedure
- **MP-CRP-PRO-07** Control of Documented Information Procedure
- **MP-CRP-PRO-13** Service Provision Process
- **MP-CRP-PRO-16** Customer Related Process
- **MP-CRP-PRO-21** Analysis of Data Procedure
- **MP-CRP-PRO-25** Change Management Procedure

1.1 RISK-BASED THINKING

Mansa Engineering encourages Risk-Based Thinking (RBT) throughout the planning, implementation, performance evaluation, and improvement ‘process approach’ to ensure intended results are achieved, to enhance desirable effects, to prevent or reduce undesired effects, and to achieve improvement in its processes. Using RBT in conjunction with this and other company procedures, Mansa Engineering strives to continually improve customer confidence and satisfaction, to assure consistency of quality of products and services, and to establish an initiative-taking culture of prevention and improvement.

Mansa Engineering acknowledges the risk management process must start with its personnel who know the business, know the hazards, and can help determine how to identify and address risk within the organization. Personnel is encouraged to approach management for any guidance with the RBT concept.
2.0 REQUIREMENTS

In compliance with Integrated Management System (IMS) Organizational Chart (ISO Steering Committee) as maintained on the EDMS, and guided by:

ISO 9001:2015 Quality Management System

ISO 14001:2015 Environmental Management System

ISO 45001:2018 Occupational Health and Safety Management System
3.0 ACRONYMS AND DEFINITIONS

CIP     Continual Improvement Program
QMS     Quality Management System
4.0 PROCEDURE

EXISTING DEVICES

These steps are to be followed to control the calibration of existing in-house devices:

a) Remove the device from use before calibration due date;
b) Determine whether calibration is to be done in-house or by an external supplier;
c) Verify the need for maintenance and undertake maintenance where required;
d) Verify device performance and calibrate;
e) Affix new calibration label;
f) Update the Master Calibration/Verification Register;
g) Issue device for use.

4.1 UNLOADING

These steps are to be followed to control the registering and calibration verification of new devices:

a) Assign device identification/asset number;
b) Add device details to the Master Calibration/Verification Register;
c) Determine calibration frequency;
d) Determine next calibration date;
e) Verify device performance and calibrate;
f) Affix Calibration Label;
g) Update the device details to the Master Calibration/Verification Register;
h) Issue device for use.

4.2 CALIBRATION FREQUENCY

Calibration frequency is determined by comparing the performance of the measuring equipment to:

a) Equipment purpose;
b) Manufacturer’s specifications;
c) Degree of usage;
d) Equipment type;
e) Stability/reliability.

4.3 CALIBRATION DUE DATE

After the calibration frequency has been established; the specific calibration due date is established and documented:

a) Attach the calibration label to the equipment;
b) Update the Master Calibration/Verification Register;
c) Ensure equipment is re-calibrated by the due date.
4.4 IN-HOUSE CALIBRATION

Requirements for calibrations performed by company personnel:

a) Calibration Standards used to perform internal calibration shall be traceable to a National or International Standard.

b) Calibrations are to be performed per specific written procedures, describing the step-by-step method of calibrating specific instruments. See Section 7.

c) Company personnel performing calibrations must be trained to the proper procedure as evidenced in the individual’s training record.

d) The following details the steps to be followed to verify existing dimensional measuring equipment. This procedure is to be updated as and when new equipment to be calibrated in-house is obtained.

e) All equipment used must have a valid calibration certificate including rented equipment.

4.5 OUTSOURCED CALIBRATION

A commercial laboratory will be used for calibration and repair that cannot be accomplished in-house.

a) The calibration facility must comply with nationally or internationally recognized calibration standards;

b) The calibration facility will be evaluated by the Disciplined Technician (Mechanical/Electrical) or nominated designee by the Technical or General Manager

c) Calibration certificates will be required.

4.6 NON-CONFORMING EQUIPMENT

If confirmed that inspection and test equipment is out of calibration, the Disciplined Technician (Mechanical/Electrical) or nominated designee by the Technical or General Manager is required to:

a) Remove the suspect device from service;

b) Investigate the validity of measurements for which the equipment was previously used;

c) Assess the acceptance status of all affected products;

d) Select appropriate corrective actions to mitigate the subsequent non-conforming product;

e) Immediately inform the customer if the product has been shipped;

f) Re-calibrate any inspection or test equipment that appears to give inaccurate readings.

4.7 REVIEW

All monitoring and measurement equipment performance data is reviewed by the Project Engineer or nominated designee by the Technical or General Manager.
4.8 IN-HOUSE CALIBRATION PROCEDURE (MEASURING TAPE CALIBRATION)

The following equipment is required:

a) Granite plate
b) Master Gauge Block Set

Procedure:

Measuring Tape Calibration Record Sheet must be used

Clean the Measuring Tape's measuring surfaces, the granite surface, and the gauge blocks to be used

**Step 1:**

Measure the ambient temperature and record it.

**Step 2:**

Test Characteristic: Visual inspection of the tape
Test Method: Slide out one foot of the measuring tape. Inspect the body of the tape measure, the tape itself, and the tabbed metal clip on the end of the tape for damage, visibility of scale and marks, and looseness
Acceptable Limit: Should have a smooth movement along its whole length and markings should be clearly visible

**Step 3:**

Test Characteristic: Inside scale measurement
Test Method: Using gauge blocks, measure and record 5 different lengths. Join multiple gauge blocks for checking longer measurements
Acceptable Limit: +/- 0.05” (1/16”) or 1mm

**Step 4:**

Test Characteristic: Outside scale measurement
Test Method: Put the gauge blocks vertically on a granite surface and hold them in place using a height gauge. Put the metal clip on the measuring tape against the granite surface measure and record 5 different lengths. Join multiple gauge blocks for longer measurements
Acceptable Limit: +/- 0.05” (1/16”) or 1mm
4.8.1 **Vernier Caliper Calibration**

The following equipment is required:

a) Granite plate
b) Master gauge block set
c) Calibrated micrometer of similar range as an instrument

**Procedure**

vernier calliper Calibration Record Sheet must be used

Clean the vernier calliper’s measuring surfaces, the granite surface, and the gauge blocks to be used

**NOTE:**

a) Digital vernier callipers only need one scale to be verified
b) Zero the vernier calliper at the start and adjust as required by the manufacturers’ specifications. If you cannot zero it then mark it as a failure
c) When testing the vernier calliper, one of the points must be near the lower limit that the instrument can measure, another somewhere in the middle, and the third near the upper limit

**Step 1:**
Measure the ambient temperature and record it.

**Step 2:**
Test Characteristic: Inspect the inside and outside Jaws, Depth Gauge, and sliding jaw for smooth movement
Test Method: Visual, Touch
Acceptable Limit: No damage, nicks, or burrs. Should have straight and parallel faces with no free play over the whole length

**Step 3:**
Test Characteristic: Outside Jaws
Test Method: Using gauge blocks, measure and record 5 different lengths
Acceptable Limit: +/- 0.002” or 0.05 mm

**Step 4**
Test Characteristic: Inside Jaws
Test Method: Use a calibrated micrometer to measure gauge blocks of appropriate length, lock the micrometer at that length then measure between the micrometer anvils using the inside jaw of the instrument and record the data
Acceptable Limit: +/- 0.002” or 0.05 mm

**Step 5**
Test Characteristic: Depth Gauge
Test Method: Make 2 equal stacks of gauge blocks on the granite surface to a height in the mid-range of the instrument, measure and record the height with the rod between the two stacks and the flat part of the instrument flush against the top of each of the two stacks
Acceptable Limit: +/- 0.002” or 0.05 mm
4.8.2 Outside Micrometer Calibration

The following equipment is required:
Master gauge block set

Procedure

Outside Micrometer Calibration Record Sheet must be used.

a) Clean the outside micrometer’s measuring surfaces and the gauge blocks to be used. NOTE: Digital
outside micrometers only need one scale to be verified.

b) Zero the Outside micrometer at the start and adjust as required by the manufacturers’ specifications.
   If you cannot zero it then use a gauge block and adjust the micrometer to that value.

c) When testing the outside micrometer, one of the points must be near the lower limit that the
   instrument can measure, another somewhere in the middle, and the third near the upper limit.

Step 1:
Measure the ambient temperature and record it.

Step 2
Test Characteristic: Anvils and Thimble
Test Method: Visual, Touch
Acceptable Limit: No damage, nicks, or burrs. Should have straight and parallel faces with no free play over the
whole length

Step 3
Test Characteristic: Ratchet
Test Method: Turn the ratchet with the instrument locked, to ensure it is functional
Acceptable Limit: Good working order

Step 4
Test Characteristic: Measuring Scale
Test Method: Using gauge blocks and the smallest anvil, measure and record 5 different lengths. For
micrometers with more than one anvil, make a separate measurement with each anvil
Acceptable Limit: +/- 0.0002” or 0.005 mm

Step 5
Test Characteristic: Rod Inserts
Test Method: For micrometers with a large measuring range, and different rod inserts, make one measurement
for each rod individually.
Acceptable Limit: +/- 0.0002” or 0.005mm
5.0 RECORDS

All relevant documents and records referenced in the procedure are kept according to the Records Lifecycle requirements in the Control of Documented Information procedure MP-CRP-PRO-07.

6.0 REFERENCES

- **FF-PRJ-FRM-33** Calibration Record Sheet
- **FP-PRJ-PRO-01** Tendering and Contracts Procedure
- **FP-PRJ-MNL-01** Project Procurement Manual
- **FP-PRJ-MNL-02** Project Management Manual
- **MP-CRP-PRO-06** Quality Risk and Assessment Procedure
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7.0 REVISION LOG

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