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QSC Approval:	Frank L. Shetterly	Approval Date:	12/13/04

## Calibration

### 1.0 Purpose

This procedure defines the process to ensure that calibrations are conducted and records maintained for all company, employee, and customer-supplied gages used for acceptance or rejection of items.

### 2.0 Scope

This procedure includes the responsibilities, documents, environment, equipment, identification and recall method required for calibration.

### 3.0 Reference Documents

- ISO 10012, Quality Assurance Requirements for Measuring Equipment;
- ISO 17025, General Requirements for the Competence of Testing and Calibration Laboratories;
- MIL-STD-45662A – Calibration System Requirement;
- [PUR-SOP-01](#), Vendor Assessment and Control;
- [PUR-SOP-03](#), Purchase Orders;
- [QA-SOP-01](#), Nonconformance Control;
- [QA141](#), Out of Tolerance Gage Record;
- [QA-WI-010](#), Calibration;
- [QA-WI-015](#), Checking Out and Returning Gages;
- [TLG-SOP-02](#), Customer Owned Property;
- [MTM-NQM-CVR](#), ASME Nuclear Quality Assurance Manual;
- [MTM-QAM-01](#), Major Tool & Machine, Inc., Quality Assurance Manual.

### 4.0 Definitions

- **Accuracy** - the average error of successive measurements produced by an individual gage/equipment as compared to a known standard or targeted characteristic of “true value”.
- **IMTE** – Inspection, measuring and test equipment; includes all types of devices used to check materials, products, processes, or other inspection, measuring and test equipment. This includes test hardware, test software, automated test equipment (ATE) and plotters used to produce inspection media. It also includes personally-owned equipment used for product acceptance.
- **Linearity** - accuracy of a gage/equipment at various increments throughout a given operating range.
- **NIST** - National Institute of Standards and Technology.
- **PO** - Purchase Order.
- **Stability** - changes in accuracy of an individual gage/equipment over a given time period.

### 5.0 Procedural Narrative

#### 5.1 Incoming IMTE

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MTM personnel should forward inspection, measuring and test equipment (IMTE) entering MTM to the Inspection Lab for calibration and traceability to NIST standards by IMTE personnel. If no national standard exists, IMTE personnel shall work with the Quality System Committee to incorporate the basis for calibration in [QA-WI-010](#).

Gages not forwarded to IMTE personnel for calibration shall not be issued calibration stickers and are considered to be for reference use only. It is prohibited to use these gages for part acceptance or for IDC documentation purposes.

#### **5.1.1 Employee-Owned Gages**

Human Resources personnel shall ensure that the designated department manager or team leader informs new employees of MTM's gage calibration policy and notifies IMTE calibration personnel of new employee-owned gages during the new hire orientation process.

#### **5.1.2 Purchased Gages**

Receiving personnel shall forward gages purchased for MTM as well as employee purchased gages to the Inspection Lab. Receiving personnel shall notify IMTE personnel by phone or e-mail that gages have been received.

#### **5.1.3 Inspection Fixtures and Templates**

The CFT shall incorporate Manufacturing Routing operations for calibration of inspection fixtures, templates, etc., that are manufactured in-house or by sublet/subcontract vendors. IMTE personnel shall ensure that inspection fixtures, templates, etc. dedicated to specific part numbers are identified with the part number and revision specified by the CFT in the Manufacturing Routing. IMTE personnel shall complete calibration of inspection fixtures, templates, etc. per the Manufacturing Routing instructions.

#### **5.1.4 Customer Supplied Gages**

Receiving personnel shall forward customer-supplied gages to the Inspection Lab per [TLG-SOP-02](#).

### **5.2 Assignment of Gage Serial Numbers**

The designated IMTE calibration personnel shall assign each gage a unique serial number from the calibration database sequence for that type and permanently apply it to the gage. The serial number, gage description, and calibration frequency shall be entered in the electronic calibration program. Gage calibration frequency shall be per [QA-WI-010](#).

#### **5.2.1 Customer Supplied Gages**

Serial numbers used for customer-supplied gages should be those applied or issued by the customer. If not supplied by the customer, MTM shall supply a unique serial number for tracking the customer-owned equipment or tooling.

### **5.3 Determine Gage Calibration Requirements**

Each month IMTE calibration personnel shall print and review a list of gages where calibration is due or past due from the electronic calibration program. This list may be used to notify department managers, team leaders, or employees, as required, to retrieve the required gages for calibration. IMTE personnel shall ensure that all gages due for calibration are retrieved from

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Manufacturing or Quality personnel. Under manpower shortages or heavy workload schedules, IMTE calibration personnel may extend the calibration due date by a maximum of four weeks.

#### **5.4 Determine Calibration Facility**

IMTE calibration personnel shall determine the facility where the gage(s) are to be calibrated using [QA-WI-010](#). Gages may be calibrated internally by MTM or by a gage calibration vendor approved per [PUR-SOP-01](#). The facility where the calibration is performed is logged on the electronic calibration program. The electronic calibration program shall include the calibration method when MTM is the facility.

##### **5.4.1 Purchasing Vendor Calibration Services**

If gage calibration is to be performed by a vendor, IMTE calibration personnel shall complete a purchase requisition per [PUR-SOP-03](#). The purchase requisition shall specify the following:

- Gage calibration is to be performed in accordance with ISO 10012, MIL-STD-45662A, or other applicable standard;
- Certification/results required;
- The lab should be A2LA and ISO17025 certified;
- Description of service;
- Calibration tolerance;
- Statement of as-received gage condition;
- Right of access;
- Calibration cert requirements;
- Nonconformances;
- Sub-tier vendor requirements.

#### **5.5 MTM Gage Calibration**

IMTE calibration personnel shall calibrate gages per the MTM method identified in [QA-WI-010](#) using standards or other gages that are calibrated and traceable to the NIST. The accuracy error of the NIST traceable standard shall not exceed 25% of the acceptable accuracy error limits of the gage being calibrated. Serial number(s) of the standard(s)/gage(s) are entered in the electronic calibration program.

IMTE personnel shall ensure that current calibration records (reports, certs or Calibration Program) for standards are maintained in the Quality Department and are readily available with actual results or sizes.

##### **5.5.1 Environmental Controls**

IMTE calibration personnel shall perform calibration in a clean environment with the temperature at 70° F +/- 2° (or compensation factors must be used). Soak time for gages forwarded from the shop to the inspection lab should be 24 hours. A temperature log shall be maintained by IMTE calibration personnel for calibration in the inspection lab. Entries and sign-offs signify the temperature was acceptable for the duration of the calibration period. The temperature at the time of calibration shall be recorded on the electronic gage calibration record for each gage.

##### **5.5.2 Scope of Calibration**

IMTE calibration personnel shall inspect gages for cleanliness, wear, loose parts and legibility. All measuring features shall be calibrated (e.g., dial calipers -- OD jaws, ID jaws, step face, and depth stem). Linearity shall be checked for variable gages by taking one measurement near each

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end of the range and one at midrange. The acceptable accuracy error limits shall be equal to or less than the lowest graduation or per industry/manufacture's specification.

#### **5.5.3 Gage Adjustment**

When gage wear causes the gage reading to approach the acceptable accuracy error limits, IMTE calibration personnel shall adjust the gage and/or increase the calibration frequency per [QA-WI-010](#) to ensure reliable accuracy until the next due date. If the gage cannot maintain stability on a three-month cycle, IMTE calibration personnel shall remove the gage from service or specify calibration prior to each use.

#### **5.5.4 Adjustment of Calibration Interval**

IMTE calibration personnel may decrease calibration frequency for a specific gage after stability is maintained for two consecutive intervals without adjustments.

#### **5.5.5 Out of Tolerance Gages**

If results are found outside the acceptable accuracy error limits, IMTE calibration personnel shall initiate a nonconformance report per [QA-SOP-01](#). The nonconformance report shall be forwarded to the Quality Manager for investigation of the possibility that the gage was used to accept defective product. If it is found that defective product was accepted with the out of tolerance gage, the Quality Manager shall notify the VP Quality and initiate additional nonconformance reports if necessary per [QA-SOP-01](#). If suspect product has been shipped, the VP Quality shall notify the customer.

Out of tolerance gages shall have the following information recorded on form [QA141](#) by IMTE calibration personnel:

- Gage number;
- Date received;
- Nonconformance report number.

IMTE calibration personnel shall ensure that one of the following actions is taken for out of tolerance gages:

- Adjust the gage;
- Send the gage out for repair;
- Remove the gage from service.

#### **5.5.6 Customer Supplied Gages**

The CFT shall submit calibration methods and frequencies used for customer-supplied IMTE for approval when required by contract.

#### **5.5.7 Equipment on Hold**

IMTE calibration personnel shall segregate past due or unacceptable gages to prevent inadvertent use. Segregation may be accomplished by locking the gages in the Out-Of-Use Cabinet or by red-tagging the gages.

#### **5.5.8 Gage Repeatability and Reproducibility Studies**

The Quality Manager may consider gage repeatability and reproducibility studies for use when practical and advantageous.

### **5.6 Calibration Documentation**

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#### **5.6.1 Documenting Internally Performed Calibration**

IMTE calibration personnel shall record the following in the electronic calibration program:

- Measured results;
- Any adjustments;
- Calibration date;
- Next due date;
- Clock number or full name.

#### **5.6.2 Documenting Vendor Supplied Calibration**

When equipment/gages have been calibrated and returned by a vendor, IMTE calibration personnel shall update the electronic calibration program and file the vendor calibration certificate/report.

### **5.7 Apply Calibration Sticker**

Upon completion of gage calibration by a vendor or MTM, IMTE calibration personnel shall review the results. If the gage calibration is acceptable, IMTE calibration personnel shall apply a calibration sticker to the gage. If the sticker will not fit on the gage, it may be applied to the gage's case. For personal gages, IMTE calibration personnel may place calibration stickers on an index card to be kept by the employee.

IMTE calibration personnel shall record the following on calibration stickers:

- Calibration date;
- Due date;
- Serial number;
- Clock number.

If the equipment has limitations, IMTE calibration personnel shall identify the equipment/gage with a "reference only" or "calibrate at each use" tag or sticker and enter the limitation in the electronic calibration program.

### **5.8 Issuance and Return of Gages**

Quality and/or Stores personnel issue and log the return of gages using the Gage Control program per [QA-WI-015](#). When the work order is completed, the person who had the gage checked out shall ensure that it is returned to the location it was checked out from to be entered back into the Gage Control program.

IMTE calibration personnel may issue gages to specific work centers at their discretion when the gage is required for a long period of time or when repeated use is required.

IMTE calibration personnel may audit the gages checked out using the Gage Control program.

### **5.9 Use of Gages**

Prior to use, Manufacturing or Quality Assurance personnel shall verify the calibration sticker and condition (e.g. damage, corrosion or seals) of the gage. The gage should be checked against a standard or gage blocks before use. If any questions arise about condition, accuracy, or status, the Manufacturing or Quality Assurance personnel shall not use the gage. The gage(s) in question shall be returned to IMTE calibration personnel for review.

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#### **5.9.1 Proper Handling and Storage**

Manufacturing or Quality Assurance personnel shall ensure that gages are handled and stored to maintain the accuracy and condition of the equipment/gage.

#### **5.9.2 Maintaining Employee Gage Information**

If ownership of personal tools changes, the Team Leader and employee shall be responsible to notify IMTE calibration personnel.

If the employee is no longer employed by MTM, IMTE calibration personnel shall be notified by Payroll to update the electronic calibration program.

#### **5.10 Removal from Service**

Gages may be removed from service for reasons such as:

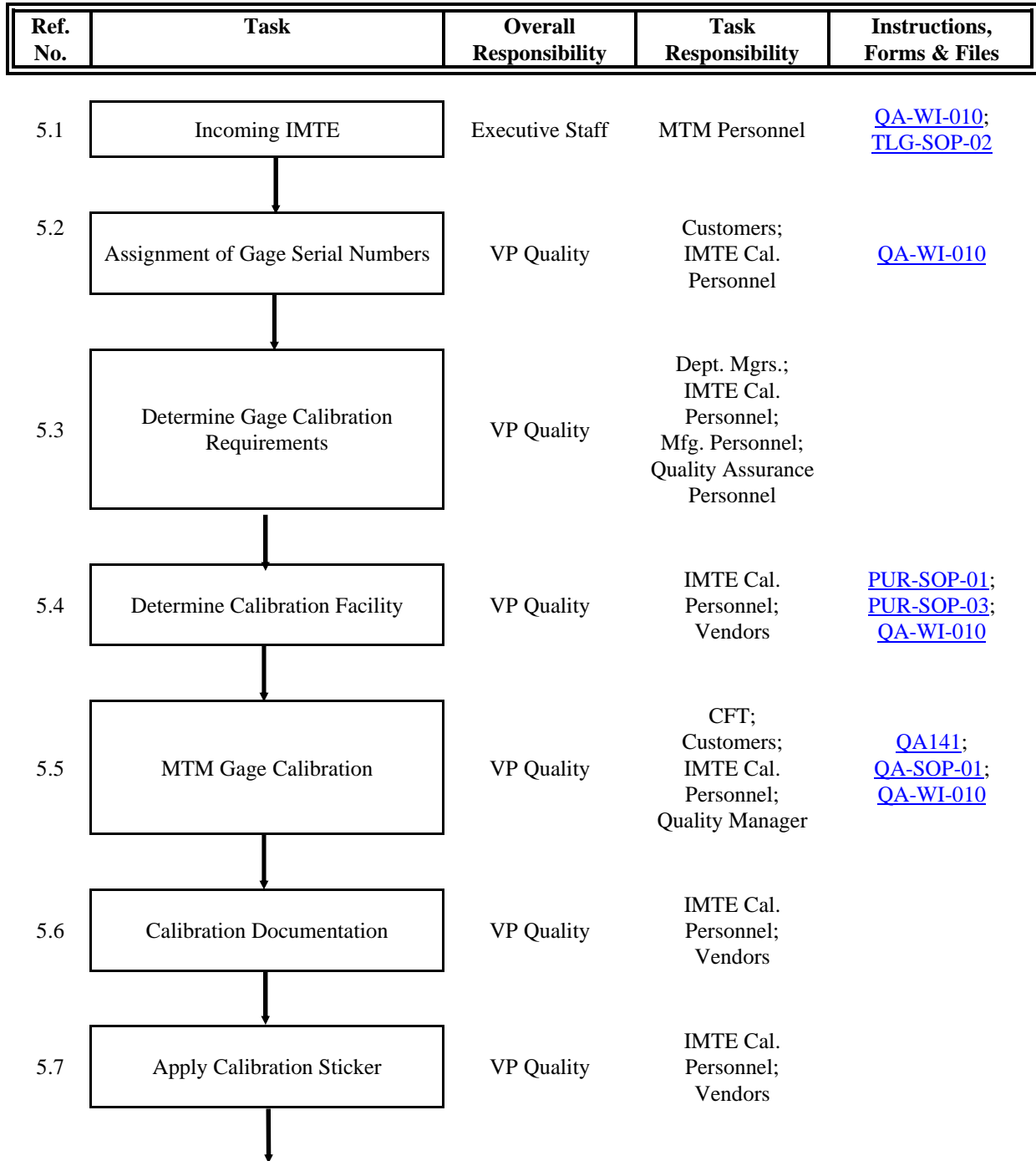
- Inactivating or returning a gage to a customer;
- Employees taking a gage home;
- Gage cannot be calibrated.

In these cases, IMTE calibration personnel should perform a final calibration check to ensure the last product measurements taken with the gage are valid. Justification for not performing this function (for reasons such as lost gage, or employee termination) shall be documented, and records maintained.

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## 6.0 Procedural Flowchart



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Ref. No.	Task	Overall Responsibility	Task Responsibility	Instructions, Forms & Files
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5.8	Issuance and Return of Gages	VP Quality; VP Manufacturing	IMTE Cal. Personnel; Quality Assurance Personnel; Stores Personnel	<a href="#">QA-WI-015</a>
	↓			
5.9	Use of Gages	VP Manufacturing	IMTE Cal. Personnel; Mfg. Personnel; Quality Assurance Personnel	
	↓			
5.10	Removal from Service	VP Quality	IMTE Cal. Personnel; Mfg. Personnel; Quality Assurance Personnel	