# AEROSPACE PROCEDURE
# FOR
# CONTROL OF INSPECTION TEST EQUIPMENT

## 1.0 PURPOSE

The purpose of this procedure is to provide for a system and instructions, and to assign responsibilities for calibration, identification and maintenance of measuring and test equipment.

## 2.0 SCOPE

This procedure applies to the measuring of all test equipment to comparative references, such as gages, templates, and meters.

## 3.0 DEPARTMENTS RESPONSIBLE FOR IMPLEMENTATION

- Quality Assurance
- Quality Control
- Metrology Department
- Manufacturing

## 4.0 REFERENCE DOCUMENTS

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|---|---|
| AP0416 | Control of Quality Records |
| AP0422 | Control of Inspection, Measuring and Test Equipment (Subcontractor) |
| WI691 | Calibrating Kavlico Mexico Facility Equipment |
| ANSI/NCSL Z540.3-2006 | Requirements for the Calibration of Measuring and Test Equipment. |
| NIST HANDBOOK 143 | Weights and Measures Laboratories Program Handbook |

## 5.0 PROCEDURE

5.1 Definitions:

5.1.1 “Primary Standards" shall be those standards that are either directly calibrated by the U. S. National Institute of Standards and Technology (NIST), or are calibrated by instruments which have been directly calibrated by (NIST).

5.1.2 “Secondary Standards" shall be those standards which are calibrated by Primary Standards.

5.1.3 “Gages" - The term applies to all types of mechanical measuring tools that compare the physical characteristics of an item to specific dimensional requirements.

5.1.4 “Measuring Equipment" - The term applies to calibrated hydraulic, mechanical, electronic and optical measuring devices used to measure variances.

5.1.5 “Certification" as referenced in this procedure is "the act of designating that standards and measuring equipment have been calibrated and meet all established requirements.

5.2 General Calibration:

5.2.1 Kavlico Calibration Standards shall be stored, and utilized in a controlled environment equal to those specified in Para. 5.6.

5.2.2 All measurement standards used to calibrate measuring and test equipment shall have a test accuracy ratio of 4:1 greater than the equipment being calibrated when state of the art permits.

5.2.3 When a minimum 4:1 test accuracy ratio is not achieved or stated differently, or when the collective uncertainty of the measurement standards exceeds 25% (NASA Measuring and Test Equipment shall not exceed 10%) of the acceptable tolerance of the characteristic being calibrated, the technician shall document such deviations and demonstrate how the adequacy of the calibration is not degraded.

5.2.4 All measuring and test equipment shall be calibrated against calibration standards that are traceable to the U. S. National Institute of Standards and Technology (NIST). Items not calibrated to their full

capability or which have other limitations of use, labeled or otherwise identified as to the limitation.

5.2.5 Prior to each equipment calibration, Metrology/Gage Lab Personnel shall review the calibration records for trends and equipment known to have been exposed to rough handling, extreme usage, etc., detrimental to the capabilities of the equipment must be considered questionable. Calibration intervals may be shortened or lengthened when results of previous calibration indicate that such action is appropriate to maintain acceptable reliability. Reliability is defined as the probability that the M&TE and measuring standard will remain in tolerance throughout the established interval. The reason for any change to the calibration cycle shall be documented and filed in the Metrology/Gage Lab. When equipment exhibits wear and/or damage, the extent of such wear and/or damage shall be evaluated by Metrology personnel and appropriate repairs shall be made prior to calibration. When repairs are required the calibration technician shall document the wear, damage and required repairs using AF163 and notify the supervisor or Quality Manager so that an assessment of previous inspection and test results can be made.

5.2.6 Equipment requiring Calibration shall be calibrated or verified at periodic intervals established and maintained to assure acceptable reliability, where reliability is defined as the probability that the Equipment will remain in-tolerance throughout the interval. Intervals shall be established for all Equipment requiring calibration unless the equipment is regularly monitored through the use of check standards in a documented measurement assurance process. Check standards must closely represent the item parameters normally tested in the process and the check standard must be verified periodically. Where intervals are used to ensure reliability, the interval setting system must be systematically applied and shall have stated reliability goals and a method of verifying that the goals are being attained. Intervals may be based on usage or time since last calibration or verification. All exemptions from periodic calibration or verification shall be documented. The recall system may provide for the temporary extension of the calibration due date for limited periods of time under specified conditions that do not unreasonably impair the satisfaction of the customer's requirements.

5.2.7 Laboratory calibration of instrumentation may be conducted according to manufacturer, Government and/or Kavlico Calibration Procedures

when the Supervision of Metrology approves such calibration procedures.

5.2.8 When no in-house calibration capability exists, it shall be the responsibility of the Metrology/Gage Lab Supervision to utilize only approved outside calibration facilities having standards traceable to NIST. Kavlico Mexico Facility shall follow WI691 when calibrating its equipment thru CST de México. No in-house procedures are required for contracted calibration. (See AP0422)

5.2.9 Calibration purchase orders, when issued to an approved outside Calibration Lab, shall state the calibration process in the form of Quality Clauses / Requirements. For equipment belonging to any NDT process, conforming to NADCAP requirements, the flow down shall include items such as standards, calibration frequency, number of points to be checked and the specific range of use, as defined in KPS6044.

5.2.10 All certifications will be maintained and filed by the Kavlico Metrology/Gage Lab subject to customer review at all times. Valid calibration certification must be in the possession of Kavlico Metrology prior to release of calibrated equipment for use.

5.2.11 Calibration frequencies shall start at time of first issue date/or date of calibration.

5.2.12 All calibrations shall be performed to established specifications and tolerances, which are documented (either electronically and/or in manufacturer's manuals) and referenced in the calibration tracking system.

5.2.13 All calibration results shall be compared to these specifications (see 5.2.12 above) and verified as compliant, prior to releasing items back to production. Evidence of this review shall be the calibration technicians stamp on the certification.

5.2.14 All calibrations performed will be verified as documented in the calibration tracking system by comparing the end of day recall list to all calibrations performed that day.

5.3 Specific Calibration Requirements:

5.3.1 Thread Plug Gauges / Gages:
At the time of initial release of this document, Kavlico does not perform in-house metrology services for Thread Gauges / Gages. Monitoring of passes/usage and/or time will determine calibration intervals. Intervals shall not exceed one year following date of issue.

5.3.2 Thread Ring Gauges / Gages:
At the time of initial release of this document, Kavlico does not perform in-house metrology services for Thread Gauges / Gages. Monitoring of passes/usage and/or time will determine calibration intervals.

5.3.3 Inspection Fixtures (other than balance beam fixtures):
At the time of initial release of this document Kavlico does not perform in-house metrology services for Mechanical Inspection Fixtures.

5.3.4 Inspection Fixtures (Balance Beam Inspection Fixtures):
Balance Beam Inspection Fixtures are calibrated IAW Kavlico Process Specification(s) 1983 & 3566 unless otherwise specified by the fixture print.

5.3.5 Personal Owned Inspection Equipment:
Personal owned inspection equipment used for acceptance criteria shall be subject to the same requirements as company owned inspection equipment.

5.3.6 New Equipment Calibration:
Upon receipt, new equipment used to verify and/or set up a production process and equipment shall be submitted for calibration and shall be inspected for visual damage and cleanliness. If a manufacture's certificate, traceable to NIST, accompanies the new equipment, then calibration is waived for one calibration cycle at this time.

5.4 Calibration Due Date Recall and Past Due Procedure:

5.4.1 Department supervisors and/or operators shall be responsible for the withdrawal of equipment from service prior to the expiration of the designated calibration due date. Thereafter the Equipment shall be identified as "NOT TO BE USED UNTIL CALIBRATED" using any method deemed appropriate by the tool owner (labelled storage locations, tags, or locally generated labels)

5.4.2 It is the tool owners' responsibility to alert the Metrology Lab of any equipment being taken out of service in order to maintain an accurate recall list.

5.4.3 A computer printout with the list all equipment due for calibration and all equipment past due for calibration shall be distributed to Supervisors of the "user" departments and cognizant Quality Control Department Supervision at a minimum of twice a month by the calibration technician.. .

5.4.4 If the department Supervisors and/or Operators fail to bring in their equipment that have the calibration due date approaching and/or past due equipment, then the calibration technician shall provide a list of all the equipment that have not been brought in to the calibration lab along with the departments that own each equipment to his/her supervisor or the Quality Assurance Manager. The supervisor or the Quality Assurance Manager will then notify the Managers of the departments that failed to bring in their equipment for calibration and inform them that it is their responsibility to have all past due and/or soon to be due calibration equipment brought to the calibration lab.

5.4.5 Equipment specified for withdraw will be removed from service and delivered to the Metrology/Gage Lab by the "user department".

5.5 Extended Service Condition:

5.5.1 Equipment deemed critical to ongoing programs shall be recorded on the Recall List Record and conspicuously identified that the Calibration has been extended. The equipment will receive Extended Calibration, by the Metrology/Gage Lab personnel and allowed to remain on station for a maximum of (30) working days. Such actions shall have the Metrology/Gage Lab Supervisor's approval. For items which are on a NASA Contract, a deviation must be submitted to and approved by the buyer.

Equipment on extended service shall be conspicuously identified showing the new due date (extended) and stamped with the "EXTENDED" in the calibration date block of the sticker. The Metrology technician shall affix his stamp to the sticker.

5.6 Environmental Controls:

**Note:** At the time of initial release of this document Kavlico Aerospace Operations does not perform any Metrology Calibrations requiring controlled environments. Critical Calibrations are performed through the services of accredited Metrology Laboratories IAW AP0422. Certain equipment is calibrated at Kavlico per equipment list.

5.6.1 All environmental conditions for an on-site calibration laboratory shall be controlled, monitored and recorded.

5.6.2 An on-site calibration laboratory should be clean and free of dust.

5.6.3 An on-site calibration laboratory temperature shall be maintained between 68°F and 72°F, 24 hours, 7 days a week.

5.6.4 The relative humidity shall be no more than 65%.

5.6.5 Light at workbench level shall be 80-foot candles.

5.6.6 Laboratory vibration level shall not be detrimental to the calibration readings, i.e. the reading of an analog meter (needle type) will not be affected.

5.6.7 NOTE: On-site calibration of non-moveable equipment to be calibrated at the ambient temperature and humidity of the user location and recorded.

5.7 Discrepant Equipment:

5.7.1 When attribute indicating gages are reported as having out-of-tolerance “As Found” data or variables indicating equipment is reported as having significantly out of tolerance (4 times the allowable gage tolerance), the calibration technician shall document the failure using form AF163 and notify his/her supervisor or the Quality Assurance Manager so that an assessment of previous inspection results can be made. If such results indicate that the non-conforming product has been shipped, the customer will be notified. Note: This may necessitate a need for the adjustment in calibration intervals at the discretion of Quality Management.

5.7.2 Any equipment failing calibration shall be identified by a rejection tag and/or secured in such a way as to prevent its use until such time as it is repaired or replaced.

5.8 Inactive Equipment:

5.8.1 Equipment placed on "Inactive Status" shall not require calibration until placement on an "Active status". The equipment shall be conspicuously identified "NOT TO BE USED UNTIL CALIBRATED". Calibration Decals, stickers shall be affixed to inactive equipment and/or storage shelves confined within the Metrology/Gage Lab where inactive equipment is stored.

Equipment reactivated from an "Inactive Status" shall comply with all calibration provisions of this procedure prior to reissue.

5.9 No Calibration Required Equipment:

5.9.1 "No Calibration Required" (NCR) or "Indication Only" (IO) stickers may be applied to an instrument or device that is not used to measure compliance to specifications and/or drawings. The Metrology/Gage Lab Supervisor or the Quality Assurance Engineering Manager shall approve the usage Calibration Decals.

5.10 Temporary Storage of Gauges and / or Meters:

5.10.1 Equipment that is past due for calibration shall be identified Per paragraph 5.4.1 of this procedure.

5.10.2 Specific instrumentation delegated to specialized use, i.e., test benches, test rigs, etc. (ganged instruments) having simultaneous calibration due dates may be controlled as follows.

5.10.3 Multiple (ganged instrumentation) may be removed from service at specified due dates, be recalibrated and replaced in their respective locations less "calibration due date", provided test bench or rig is idle (not productively active).

5.10.4 Prior to startup of the test bench, Metrology/Gauge Lab shall be notified for initiating a "calibration due date" cycle on attached instrumentation.

5.10.5 When gauges and/or meters are placed in temporary storage, the Metrology/Gage Lab shall log such status on the appropriate lab report/history computer database for each of those instruments placed in temporary storage. Conversely, when meters and gauges are activated, the Metrology/Gage Lab report shall be annotated.

5.10.6 Hanging or otherwise affixing a placard indicating “Temporary Storage”, “Notify Metrology/Gage Department Prior to Use”, shall identify equipment in temporary storage.

5.11 Interim Storage, In-Service Items:

Interim storage of test and measuring equipment shall be in a protected area. Metrology/Gage Lab shall utilize provisions for minimum deterioration to the calibration, finish, stability, or accuracy of the equipment in determining methods for storage.

Equipment withdrawn from interim storage, which has not previously undergone the requirements of Para. 5.2 shall be validated for accuracy prior to reissue.

5.12 Unused Equipment:

Unused equipment that has been calibrated and sealed in such a manner that usage would destroy such sealing methods, shall be reviewed at time of calibration due date. If no usage is evident, the gage shall be re-stickered with a calibration date only. The calibration "due date" shall be entered on the calibration sticker at such time gage is used or issued.

5.12.1 Calibrated, but unused/un-issued plug and ring gauges under the control of the Metrology Lab shall be sealed in such a manner to prevent usage.

5.13 Tamper-Resistant Seals:

5.13.1 Equipment, which could be adjusted affecting the calibration by unauthorized personnel, shall contain tamper-resistant stickers or be suitably sealed to prevent unauthorized adjustment. The sticker, or Calibration Decals, shall be placed over a portion of the adjustment feature or access interface, which would require destruction of the seal to adjust.

5.13.2 Sealing stickers/wax for use as tamper resistant seals shall be governed by the physical nature of the gage. The Metrology/Gauge Lab Supervisor shall determine the “need” for such stickers/wax.

5.13.3 If the seals are found to be broken, the calibration is deemed void and shall be returned to the Metrology/Gage Lab for recalibration.

5.14 Identification / Evidence of Calibration:

5.14.1 Serial numbers shall be assigned to all gages and measuring equipment. Serial numbers assigned shall be specifically traceable to their specific calibration record.

5.14.2 Company owned equipment shall have a permanent means of applying serial numbers i.e., electro-etch, vibro-etch, steel stamping, serial number plates, or any other method approved by the Metrology/Gage Lab Supervisor.

5.14.3 Employee owned equipment shall receive a specific assigned serial number sticker.

5.14.4 Primary Standards, (Gauge Lab) shall be identified with a distinct serial number GXXXXXP not to be issued as inspection equipment and is restricted to use by Gage Lab personnel only.

5.14.5 Secondary Standards, (Gauge Lab) shall be identified with a distinct serial number GXXXXXXS which denotes that the gage is not to be issued as inspection equipment and is restricted to use by Gage Lab personnel only.

5.14.6 Primary Standards (Metrology Lab) shall be identified with a distinct serial number XXXP not to be issued as inspection equipment and is restricted to use by Metrology Lab personnel only.

5.14.7 Secondary Standards (Metrology Lab) shall be identified with a serial number XXXS not to be issued as inspection equipment and is restricted to use by Metrology Lab personnel only.

5.14.8 Equipment that is controlled by a calibration frequency shall at time of issue have a calibration sticker affixed. Exceptions are made for gauges due to size, geometry or where the sticker would interfere with its intended use. In these cases, the particular gauge must have a container or equivalent to which the sticker can be applied / affixed.

5.14.9 When an instrument is determined to be within calibration tolerance, a Calibration sticker shall be placed on the instrument showing Instrument number, calibration due date and the technician's stamp. Calibration frequencies shall start at time of issue date/or calibration date.

5.14.10 These stickers shall take precedence over all outside laboratory identification.

5.14.11 A Test Bench calibration sticker may be affixed to an entire test console depicting instrument numbers, calibration and due dates.

**NOTE:** All devices recorded on this sticker shall simultaneously become due for calibration on the date noted.

5.14.12 Equipment that is to be set or adjusted before each use, such as air amplifiers, shall be identified with a sticker stating: "Set prior to use"/" Adjust prior to use".

5.14.13 Measuring equipment when issued for Production use only shall be identified with a sticker stating, "Production Use Only".

5.15 Missing Equipment:

5.15.1 The equipment users Department Supervisor is responsible for the withdrawal of equipment from service prior to the expiration of the designated calibration due date. Item's which cannot be located shall be reported to the calibration lab as missing.

5.15.2 Missing items will be indicated as such in the Calibration Database and will appear on the next recall list as "Missing". All department supervisors shall review their area's in an attempt to locate missing items, regardless if the item is assigned to them or another department.

5.15.3 Items still not accounted for after 30 days shall be reported as lost. Any item reported as lost that is subsequently found will not be placed back into service without a written explanation detailing where it was located and any potential impact on production hardware.

## 6.0 RECORDS

6.1 Records shall be maintained IAW AP0416 Control of Quality Records.