REVISION HISTORY			
Rev	**Description of Change**	**Author**	**Effective Date**
0	Initial Release	T. Spalding	11/24/99
1	Clarifications based on F00.0009 Internal Audit see (DCR # 00-011)	T. Spalding	4/25/00
2	Changed section 5.1, fifth bullet, added section 5.2 and deleted ARC Form 755 from section 9 (DCR 01-005)	T.Spalding	9/6/01
3	Based on CAR ARC-00951, Deleted form CLF-002, Out of Tolerance Notice, (DCR 02-008)	J. Weller	4/17/02

REFERENCE DOCUMENTS	
Document Number	**Document Title**
53.ARC.0000	Ames Research Center Quality Manual
53.ARC.0011	Control of Inspection, Measuring, and Test Equipment
53.ARC.0016	Quality Records
ANSI/ASQC Q9001	Quality Systems—Model for Quality Assurance in Design, Development, Installation, and Servicing

Documents referenced in this procedure are applicable to the extent specified herein.

1. Purpose

This work instruction provides instructions for using the Ames Calibration Laboratory (ACL) to assist in complying with the requirements of 53.ARC.0011.

2. Scope

This work instruction applies to individuals and organizations at Ames Research Center (ARC) who use the ACL to calibrate Inspection, Measuring, and Test Equipment (IM&TE) that make measurements to demonstrate the conformance of

product to specified requirements.

3. Definitions and Acronyms

3.1.	ACL	Ames Calibration Laboratory
3.2.	Calibration	Set of operations which established, under specified conditions, the relationship between values indicated by a measuring instrument or measuring system and the corresponding standard or known values derived from the standard
3.3.	Calibration Interval	Designated period of time between calibrations; IM&TE can be calibrated before each use if specified in lower-level procedures
3.4.	Calibration Label	Label affixed to a measuring instrument to show its calibration status
3.5.	Calibration Procedure	Detailed processes used in the calibration of IM&TE against certified calibration standards which include the check method, acceptance criteria, equipment identification and type, and actions required when results are unsatisfactory
3.6.	Calibration Records	Records of IM&TE calibration status as-found, date calibrated or date due for calibration, and other pertinent information
3.7.	Calibration Standards	Standards used in the calibration process, traceable to NIST
3.8.	Equipment Control Number (ECN)	Refers generically to the decals issued by NEMS for all equipment meeting the requirements for control and to NASA calibration decals applied by the calibration lab
3.9.	IM&TE User	On-site personnel or organizations using IM&TE
3.10.	In-situ	Calibrations done in-place when equipment cannot or should not be moved
3.11.	Inspection, Measuring, and Test Equipment (IM&TE)	Measuring instruments, measurement standards, test software, comparative references, and auxiliary apparatus necessary to verify that a product or process conforms to requirements

3.12.	Measurement	Set of operations that determine the value of a measurand
3.13.	Metrology	The science and technology of measurement
3.14.	NASA Equipment Management System (NEMS)	Asset management system used to maintain the inventory of controlled or reportable capital equipment
3.15.	National Institute of Standards and Technology (NIST)	Government agency responsible for all United States national measurement standards
3.16.	Performing Laboratories	On-site or off-site calibration/repair facilities approved by the ACL
3.17.	Recall Program	System of tracking, documenting, and recalling for re-calibration all IM&TE submitted to the ACL
3.18.	Traceability	Property of a result of a measurement whereby the measurement can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons

4. Flowchart

There is no flowchart applicable to this procedure

5. Responsibilities

5.1. **The ACL** shall:

- Calibrate IM&TE to ensure compliance of calibration activity to the requirements of 53.ARC.0000.
- Attach Appropriate Control Label to IM&TE (see Appendix B)
- Maintain calibration records, calibration standards, the recall program database, and calibration procedures.
- Coordinate with user for calibration intervals on IM&TE and issue monthly calibration recall listings to each user of record.
- Provide directorate management a monthly listing of past due recalled IM&TE.

5.2. Directorate Management shall:

- Deal with users of delinquent recalled IM&TE in their organizations as appropriate.

5.3. **IM&TE User** shall:

- Evaluate the need for calibrated IM&TE (see Appendix A).
- Respond to the monthly calibration recall listings by either submitting recalled equipment for calibration, arranging with the ACL for in-situ calibration, or changing unneeded IM&TE to non-recall status.
- Prepare an Equipment Service Tag (see Appendix C) for each unit of IM&TE submitted or prepare a printed list of IM&TE submitted (contact the ACL for details). Note on the tag or list any failure modes or special calibration requirements. The equipment's ECN or white “NASA Calibration” Mylar bar code decal (see Appendix B) shall be used as the identification when communicating with the ACL about a particular item. Indicate whether IM&TE is to be listed as “recall” or “non-recall.”
- Either contact the ACL to arrange for IM&TE pickup or drop off the IM&TE in building 213, room 103C. Submit a Service Request when priority service is needed (call Lab Manager for details).
- Submit a Service Request for repairs when repair parts and/or labor exceeds $50 per unit (the ACL shall call with an estimate).
- Review and correct calibration recall listings.

6. Procedure

6.1. IM&TE user shall determine if calibration and/or repair of IM&TE is required.

6.2. IM&TE user shall contact the ACL to arrange for service. If priority service is required, IM&TE user shall notify the ACL of that requirement and issue a Service Request.

7. Metrics

There are no metrics required for this document.

8. Quality Records

The following Quality Records shall be generated and managed in accordance with 53.ARC.0016 (See Table 1):

Required Record	Custodian
Calibration Report (ARC 190)	ACL Quality Supervisor

9. Form(s)

Forms required for this document:

Form Number	Title
ARC 73	Service Request
ARC 190	Calibration Report
ARC 518	Equipment Service Tag
ARC 523	Equipment Usage Suspension Tag

Appendix A: Guidelines for Determining Need for Calibration

The purpose of instrument calibration is to ensure that IM&TE performs to the manufacturer or user's specifications. Regular calibration establishes measurement traceability and increases confidence that IM&TE measurements are accurate, reliable, and reproducible.

As a rule, calibrate any device used in the performance of a measurement where the quality or accuracy of a process is critical or in applications designed to ensure the safety of personnel or equipment.

Note: While it is important to calibrate equipment that ensures safety, it should be noted that safety related activity and systems are not part of the Quality System, however safety issues will be handled in an effective manner.

- Per ANSI/ASQC Q9001, section 4.11.1: IM&TE used to demonstrate the conformance of product to specified requirements shall be calibrated.
- Calibrate all test and measuring equipment and safety instruments used to perform measurements associated with the following functions:
  A. Acceptance testing of new instrumentation
  B. Inspection, maintenance, calibration, and/or qualification of flight hardware
  C. Measurement of processes where test equipment accuracy is essential for the safety of personnel
  D. Telecommunication, transmission, and test equipment where exact signal interfaces and circuit confirmations are essential to mission success
  E. Development, testing, and special application where the specifications, end products, or data are accuracy sensitive

  Instruments used for purposes other than those described in the preceding paragraphs shall be limited to applications where substantiated accuracy is not required or for 'indication only' purposes in non-hazardous, non-critical applications.

III. Typical Measuring Equipment Calibrated

Equipment such as recorders, signal generators, counters, oscilloscopes, balances, scales, transducers, gauges, calipers, wrenches, meters, sensors, etc., designed to perform measurements of mass, dimension, torque, force, pressure, vacuum, voltage, resistance, current, flow, waveforms, gas analysis, temperature, humidity, etc.

Appendix B: Labels Used to Control IM&TE at Ames Research Center

1. Equipment Identification

Used for unique identification for each unit of IM&TE. There are two types of decals: one is an aluminized bar code decal applied by property managers to NEMS-controlled NASA property.

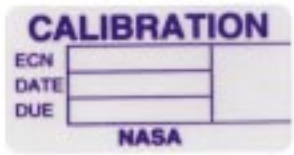
Second, for equipment not controlled by NEMS, a white Mylar bar code decal with black lettering stating "NASA Calibration" is applied by the ACL. On small items, the "NASA Calibration" decal may be trimmed to fit available space or may be replaced by a tiny, silver Mylar label with a handwritten identification number. All ACL records on IM&TE reference these tag numbers, which are both referred to as the ECN.

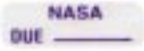
2. Calibration Laboratory Labels

All equipment serviced in the ACL receives a label indicative of the service(s) performed in order to show the IM&TE user the condition or level of permissible use.

Wherever possible, labels are applied to the control surface of IM&TE to clearly indicate its calibration status. The largest appropriate label shall be applied. For items too small for even the smallest label, the label may be applied to the unit's storage container or to a cardboard, plastic, or metal tag attached to the IM&TE. Alternatively, labels may be cut to fit if that does not interfere with the recognition of the label or with equipment operation. Items such as lead weights may have calibration dates, due dates, and ECNs handwritten on the weight in indelible ink.

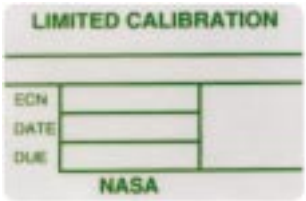
a. Calibration (blue lettering on gray background)





The “Calibration” label is applied to fully calibrated equipment by the calibrating technician or other lab employee. Equipment size determines the size of the label. The MCD (Metrology Control Number), date of calibration, and next calibration due date are recorded along with the technician's initials (label size permitting). The presence of this label indicates that the instrument to which it is attached meets all of the manufacturer's published specifications. These labels are to be provided and installed solely by the ACL.

b. Limited Calibration (green on gray)



The “Limited Calibration” label is attached to any instrument that has not been completely calibrated to manufacturer’s specifications. Where equipment cannot be made to meet all specifications, where certain functions have not been calibrated or have not been calibrated to full specification, or where the manufacturer's specifications are unknown, a “Limited Use” label is applied. In addition to the ECN, date of calibration, date due, and technician initials, a brief description of calibration limitations is recorded.

The red-lettered “Limited Use” label is used where there is room on the instrument to apply it and when additional detail of interest to the equipment user should be supplied.

c. Certification Void Labels (circular label, blue on white)

“Certification Void Labels” are applied to panels or over case screws of calibrated IM&TE as an indicator of unauthorized tampering.

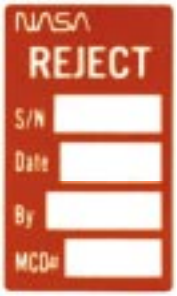
d. NASA Working Standard (black on yellow)

The “NASA Working Standard” label is applied to all equipment in the ACL that is used to calibrate submitted IM&TE.

e. Functional (purple on gray)

For items that cannot or need not be calibrated but require repair or regular maintenance, the servicing technician shall apply a properly completed “Functional” label. An item with this label applied is not considered calibrated and may be used for indication only purposes.

f. Reject (white on red)



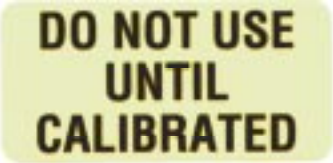
The “Reject” label is applied to any IM&TE submitted for service and found to be Beyond Economical Repair (BER) or to IM&TE that the user is unable or unwilling to repair. (A “Limited Use” label is often applied when the item still has usable functions that can be calibrated.) Additionally, a red reject string tag shall be attached to the equipment to further detail failure modes.

3. Labels for IM&TE Users

a. Calibration Not Required (red on gray background)

The “Calibration Not Required” label is used on IM&TE used in applications where accuracy is of no importance. For example, a multimeter used to detect the presence of voltage or to perform a continuity check need not be calibrated. The authority may be the initials of the responsible individual or may reference a memo, instruction, or procedure. These labels are available from the ACL.

b. Do Not Use Until Calibrated (black on yellow)



Equipment displaying this label is considered to be inactive and shall be submitted for calibration prior to next use. “Do Not Use Until Calibrated” labels are to be applied by the instrument's organization's IM&TE coordinator or user. These labels can be obtained from the ACL.

c. Calibrated by User (green on gray)

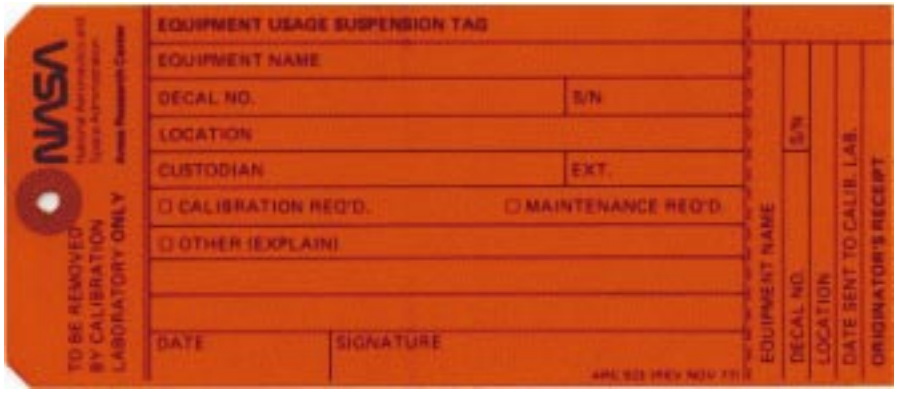
For those IM&TE users who assume technical and documentary responsibility (see 53.ARC.0011, section 6.4) for calibrating their own equipment, “Calibrated by User” label may be applied. Small quantities of these labels may be obtained from the ACL.

Appendix C: String Tags Used by the ACL

1. ARC 518 Equipment Service Tag (black on yellow)

The ARC 518, Equipment Service Tag, is completed by the IM&TE user and attached to each instrument submitted for service.

2. ARC 523 Equipment Usage Suspension Tag (black on red)



The calibration laboratory shall complete and attach this tag whenever the submitted IM&TE has been rejected due to conditions of Beyond Economical Repair (BER) or where the equipment is unserviceable and recommended repairs have been deferred by the user.

Table 1

Quality Records

Identification	Collection	Indexing	Accessing	Filing	Minimum Retention
Calibration Report (ARC 190)	Quality Supervisor	Certificate Number	ACL Employees	Quality Supervisor	5 years

Maintenance: These Quality Records are maintained in an office environment.

Disposition: These Quality Records are discarded at the end of the retention time.

Storage: Not applicable