

**▶ MARK INTEGRITY PROGRAM**

# UL Calibration Requirements: Equipment Used for UL/C-UL/ULC Mark Follow-Up Services

UL defines minimum requirements for calibration of inspection, measuring and test equipment (IMTE) required as part of its Follow-Up Services Procedures. These requirements also include IMTE supplied by customers and used by UL field representatives during inspection activities at the inspection location. Standards used to calibrate such inspection, measuring and testing equipment are also covered by these requirements.

This document applies to all customers of UL's product certification services for the U.S. and Canadian markets, i.e., UL/C-UL/ULC Mark certifications. Calibration is a requirement of UL certification as noted in the **United States and Canadian testing and certification service terms and conditions located at [www.ul.com/contracts](http://www.ul.com/contracts)**.

**Why this requirement is important**

A key element in determining compliance with UL requirements is the validity and accuracy of inspection, measurement and test results. Equipment used to perform these activities must be calibrated to provide the necessary level of confidence in the results of the inspections, measurements and tests being conducted. Calibration of IMTE – as well as the standards for calibration – must be traceable to the National Institute of Standards and Technology or another national metrology institution. It is recommended that providers of calibration services should be accredited under ISO/IEC 17025. See page 3 of this document for calibration certificate requirements for calibrations performed by a non-accredited laboratory or performed in-house by the manufacturer.

**REQUIREMENTS****Equipment requiring calibration**

All IMTE required as part of a UL Follow-Up Services Procedure including any Appendices, Follow-Up Inspection Instructions or Standard Appendix Pages or equipment that is used by UL field representatives while conducting inspection activities at the factory must be calibrated.

Customers must ensure that the IMTE selected for each measurement is capable of meeting measurement tolerances specified in UL Follow-Up Services Procedures or related documentation, i.e., customers must select and use the right tool for the job.

When inspection, measuring and test equipment with low precision capability, such as tape measures, steel rules, protractors, radius gauges, etc., are used as the final means of verifying compliance with UL requirements, customers have the following options:



## Option 1

At a minimum, customers will have an appropriate accuracy statement from the manufacturer of a measuring device to certify or attest to a device's stated precision and accuracy capabilities. This information is important in demonstrating that equipment accuracy is capable of meeting required measurement tolerances. In addition, tape measures and similar low-precision inspection, measuring and test equipment shall undergo in-service checks. During an in-service check, the measuring device is validated prior to use to ensure it is capable of achieving the required measurement accuracy. Customers must specify the criteria, frequency and methods used to conduct these in-service checks, as well as the process for handling non-conformances.

## Option 2

Customers may choose to include tape measures and similar low-precision IMTE in their calibration system. This equipment will be calibrated or validated at regularly defined intervals, according to requirements defined in this document.

Instruments and gauges that are an integral part of equipment used in manufacturing products are not generally subject to calibration requirements, unless specifically identified in the Follow-Up Services Procedure. Typically, these are gauges and instruments used to monitor process characteristics, e.g., speed, pressure, etc., not product characteristics.

### Frequency of calibration

All IMTE described in a UL Follow-Up Services Procedure as well as Appendices, Follow-Up Inspection Instructions or Standard Appendix Pages or used by UL field representatives in activities at a manufacturing location must be calibrated at least annually for their intended function and use. If a UL Follow-Up Services Procedure specifies more frequent calibration frequency, then that frequency is to be followed.

### Measurement standards

Measurement standards used in the calibration of IMTE must also be calibrated and are to be used for calibration purposes only.

Weights and gauge blocks standards must be calibrated by a competent body – preferably by an ISO/IEC 17025 accredited calibration service provider – every **three years** or whenever the measurement standard has been subject to some form of abuse that may affect the measurement standard's fitness for use. Other measurement standards, e.g., voltmeters, master gauges used to calibrate other gauges, etc., shall be calibrated by a competent body – preferably by an ISO/IEC 17025 accredited calibration service provider – either **annually** or in accordance with the equipment manufacturer's specifications, or whenever the standard has been subject to some form of abuse that may affect the fitness of a standard.

Standards, including any related software, shall be protected from damage or deterioration and must be maintained according to the original equipment manufacturer's recommendations.

### Calibration identification and status

All IMTE being calibrated – as well as measurement standards used for calibrations – shall include evidence of calibration status, e.g., a label or other marking indicating the next calibration due date. If size limitations or usage environment prevents the use of a calibration label, alternate identification methods are acceptable, providing that the identification and calibration status can be readily determined. Each piece of calibrated IMTE must have a unique, unambiguous identifier such as manufacturer name and model number, serial number, identification number, asset number, etc.

### Calibration certificates: ISO/IEC 17025 accredited calibration service providers

UL recommends using calibration service providers that are accredited to ISO/IEC 17025 through authorized signatories of an international accreditation body. See page 4 for more information on accreditation endorsements. Using an accredited calibration service provider expedites review of calibration records during a UL inspection visit: the calibration information that UL field representatives need to verify is limited due to calibrations being performed in accordance with a calibration service provider's accreditation requirements.



During UL inspection visits, UL field representatives will evaluate calibration records. Each calibration certificate from an accredited calibration service provider shall include at least the following information:

- Unambiguous identification of the calibrated item. Some examples are manufacturer name and model number, serial number, identification number, etc.
- Date(s) calibration was performed to determine that the IMTE has been calibrated within required frequency
- A valid accreditation body endorsement for the calibration performed. Please refer to page 4 for a sample list of accreditation endorsements

During UL inspection visits, UL field representatives will confirm that the inspection, measuring and testing equipment is within the defined calibration period. Additionally, UL field representatives will review calibration data to verify that inspection, measuring and test equipment has been calibrated for the measurements for which it will be used.

If the above information is unavailable or cannot be verified, UL representatives will evaluate compliance with the requirements specified for non-ISO/IEC 17025 accredited calibration service providers or calibrations performed in-house.

### **Calibration certificates: non-ISO/IEC 17025 accredited calibration service providers or calibrations performed in-house**

Certificates for calibrations performed by non-ISO/IEC 17025 accredited calibration service providers must include the following information:

1. Title, e.g., Calibration Certificate, Calibration Report, etc., or equivalent
2. Name and address of the calibration service provider
3. Location where the calibration was conducted, if different from the service provider address

4. Unambiguous identification of the specific piece of IMTE calibrated such as manufacturer name and model number, serial number, identification number, etc.
5. Unique identifier of the calibration record such as a serial number and the capability to match it to a specific piece of calibrated IMTE
6. Description of the condition of the item calibrated, i.e., the as-received condition, e.g., out of tolerance, in tolerance, damaged, etc.
7. Date(s) calibration was performed
8. Quantitative measured value(s) of the calibration results **when** out of calibration conditions are identified, i.e., when stated calibration tolerances have been exceeded
9. For IMTE capable of measuring multiple parameters, calibration records must include an attestation or statement confirming that the equipment's as found conditions and calibration results encompass all parameters for which it is being used. Examples of this type of equipment include digital multi-meters measuring voltage, amperage and resistance as well as 6" calipers measuring ID, OD and depth attributes
10. The name(s), functions(s) and signature(s) or equivalent identification of person(s) authorizing the calibration certificate. Note: Electronic signature/authorization is acceptable
11. Evidence that the measurements are traceable (to national or international standards). Note:
  - There should be **no** alteration to the calibration data/results without evidence of appropriate authorization, e.g., names, titles, dates, nature of alteration, etc.
  - When the certificate or report contains results of calibrations performed by subcontractors, these results shall be clearly identified



For calibrations performed in-house by customers, calibration results may be reported in a simplified manner. However, any information outlined in this section that is not included on the calibration certificate or report shall be *readily available* for review at the manufacturing location.

### Out of calibration conditions

When IMTE (before any adjustments are made) is found to be outside of required calibration tolerances, i.e., OEM accuracy specification, customers shall perform an analysis to determine if the out of calibration condition could have adversely affected inspection results. Similarly, this same analysis must be performed if equipment is determined to be non-operational, if it is discovered to be defective or if other conditions exist that would raise questions about the validity of previous measurements/test results.

The equipment in question must be removed from service by segregating or prominently labeling it. The customers shall:

- Evaluate **and** document the effects of the equipment on previous inspections or tests
- Evaluate if the condition of the equipment could have significantly affected previous inspections or test results and take corrective action, as appropriate. Customers **must** take action to correct product that does not comply with UL requirements

Corrective actions taken by customers should include a robust root cause analysis, containment actions, and long-term corrective actions to ensure that any nonconformance is not likely to recur.

### Traceability

All calibrated IMTE is to be calibrated using measurement standards traceable to a national metrological institute, e.g., National Institute of Standards and Technology in the United States or an officially recognized national metrology institute participating in Bureau International des Poids et Mesures (BIPM), either directly or through a regional group.

Note: Citation of a NIST test number, certification of the calibration lab to ISO 9001, or a simple statement of traceability to NIST or other international body by the calibration service provider are **not**

acceptable as evidence of traceability. The calibration certificate and related records must provide evidence that a calibration service provider utilized calibration standards that are traceable to national standards.

### Measurement uncertainty

While not required, UL recommends that calibration certificates or reports include the uncertainty of measurement values associated with the calibration data. Uncertainty calculations are recommended for all calibrations. These calculations may be performed in accordance with ISO 5725-2, Guide to the Expression of Uncertainty in Measurement Accuracy of Measurement Methods and Results – Part 2, also known as GUM (trueness and precision), or in accordance with ANSI/NCCL Z540-2, General Requirements for Calibration Laboratories and Test Equipment.

## RECORDS

### Certificates and other records

Customers must maintain records of calibration for at least one year. For equipment calibrated less frequently, e.g., every three years, calibration records shall be maintained at least for the current calibration cycle.

The content of the records must comply with the requirements defined in this document.

Records of analysis of out-of-calibration conditions shall also be maintained. The duration of records retention should be defined and documented by customers. UL also recommends that customers maintain records of in-service checks for low-precision equipment such as tape measures.

### Accreditation endorsements

The following information is provided to assist customers; it is not intended to be all-inclusive.

Since calibration certificates from accredited laboratories that conduct work within their scope of accreditation can bear an endorsement of accreditation, attention to verifying a suitable endorsement with the unique identifier is necessary. This satisfies the need to substantiate that a certificate was provided by an accredited calibration laboratory.



The following are acceptable accreditor endorsements:

- International Laboratory Accreditation Cooperation MRA signatories – a full listing of ILAC MRA signatories can be found at [www.ilac.org/membersbycategory.html](http://www.ilac.org/membersbycategory.html). The category “Full Members” includes a listing of the signatories to the ILAC MRA.
- Asian Pacific Laboratory Accreditation Council MRA signatories – a full listing of APLAC MRA signatories can be found at [www.aplac.org/membership\\_by\\_category.html](http://www.aplac.org/membership_by_category.html).
- European Accreditation Cooperation MRA signatories – a full listing of EAC MRA signatories can be found at [www.european-accreditation.org/content/mla/scopes.htm](http://www.european-accreditation.org/content/mla/scopes.htm).

#### Sample calibration certificate

The calibration certificate/record shown on pages 6-7 is a representative example that contains the required elements defined previously in this document. These required elements include the following:

1. Title, e.g., Calibration Certificate, Calibration Report, etc., or equivalent
2. Name and address of the calibration service provider
3. Location where the calibration was conducted, if different from the service provider address
4. Unambiguous identification of the specific piece of IMTE calibrated such as manufacturer name and model number, serial number, identification number, etc.
5. Unique identifier of the calibration record such as a serial number and the capability to match it to a specific piece of calibrated IMTE
6. Description of the condition of the item calibrated, i.e., the “as received” condition, e.g., out of tolerance, in tolerance, damaged, etc.

7. Date(s) calibration was performed
8. Quantitative measured value(s) of the calibration results when out of calibration conditions are identified, i.e., **when** stated calibration tolerances have been exceeded
9. For IMTE capable of measuring multiple parameters, calibration records must include an attestation or statement confirming that the equipment’s as-found conditions and calibration results encompass all parameters for which it is being used. Examples of this type of equipment include digital multi-meters measuring voltage, amperage and resistance as well as 6" calipers measuring ID, OD and depth attributes
10. The name(s), functions(s) and signature(s) or equivalent identification of person(s) authorizing the calibration certificate. Note: Electronic signature / authorization is acceptable
11. Evidence that the measurements are traceable (to national or international standards)

#### Important notes

- UL does not endorse any vendors or products referenced herein.
- For more information, please contact your local UL Field Representative.



# Calibration Certificate

Certificate Number ABC-123

## "Calibration Service Name"

123 Main Street  
Chicago IL, 60601

Accreditation  
Endorsement Logo  
Certificate No. XYZ-789

## "Equipment Owner Name"

987 Washington Street  
Asbury Park, NJ 07712  
Att'n: J. Doe

Manufacturer	FLUKE	Calibration Date	6/18/2007
Model	8062A	Recommended Due	6/18/2008
Description	Digital Multi-meter	Calibration Location	ONSITE
Size / Range	all checked	As Received	OUT OF TOLERANCE
Serial Number	3990313	As Returned	IN TOLERANCE
Asset Number	MM0027	Procedure	SOP-CAL-DMM-04
ID #	MM0027	Environment	22 DEG C 33% RH
Accessories	None received	P.O. Release	007-777777

This instrument has been processed and calibrated in accordance with "Calibration Service Name" Quality Assurance Manual and is traceable to the National Institute of Standards and Technology (NIST). The "Calibration Service Name" quality system is registered to ISO 9001:2000, A2LA - accredited to ISO / IEC 17025 - 2005 & ANSI / NCSL Z540-1-1994, and compliant with ISO 10012-1, 10 CFR 50 App. B, 10 CFR 21, NQA-1 and MIL-STD-45662A. This report may not be reproduced, except in full, without the written approval of "Calibration Service Name". Unless stated otherwise, the expanded measurement uncertainty of the measurement process does not exceed 15% of the tolerance allowed for the individual characteristics measured, the measurement uncertainties for this calibration are based upon 95% (2 sigma) confidence limits. No sampling plan or other process was used for this calibration. The results reported herein apply only to the calibration of the item described above and no limitations of use apply to the calibrated unit. Although the item calibrated meets the specifications and performance at the time of calibration, due to any number of factors the recommended due date of the item calibrated does not imply continuing conformance to specifications during the recommended interval.

Calibration Accuracy MANUFACTURER'S SPECIFICATIONS

Conditions / Analysis DUE CALIBRATION / CALIBRATED WITH DATA ONSITE

### Standards Used

ID Number	Model Number	Calibration Date	Due Date	Traceability Number
1690RC	5700A	7/27/2006	8/27/2007	1700128656
1002138	3325A	5/30/2007	5/30/2008	1700144363
5113-81	SS-32	7/31/2006	7/31/2007	1700128975

Certified By Technician: C. Clemmons Inspected By Auditor: S. Van Zandt

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4  
 2 "Calibration Service Name"  
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Manufacturer FLUKE  
 Model 8062A  
 Description Digital Multi-meter  
 Procedure SOP-CAL-DMM-04

Certificate Number ABC-123  
 Calibration Date 6/18/2007  
 Serial Number 3990313  
 ID # MM0077

Function / Range	Nominal Value	As Found	Result	As Left	Result	Min	Max
<b>DC Voltage</b>							
200 mV	190.00	189.99	Pass	Same	Pass	189.89	190.11
	-190.00	-190.04	Pass	Same	Pass	-190.11	-189.89
2 V	1.9000	1.9002	Pass	Same	Pass	1.8989	1.9011
20 V	19.000	19.003	Pass	Same	Pass	18.985	19.015
200 V	190.00	190.03	Pass	Same	Pass	189.85	190.15
1000 V	1000.0	1000.0	Pass	Same	Pass	999.1	1000.9
<b>AC Voltage</b>							
100mV @ 200 Hz	100.00	100.07	Pass	Same	Pass	99.40	100.60
20 kHz	100.00	100.12	Pass	Same	Pass	98.60	101.40
1 V @ 20 Hz	1.0000	1.0002	Pass	Same	Pass	0.9890	1.0110
200 Hz	1.0000	1.0012	Pass	Same	Pass	0.9940	1.0060
1 kHz	1.0000	1.0002	Pass	Same	Pass	0.9930	1.0070
10 kHz	1.0000	1.0033	Pass	Same	Pass	0.9930	1.0070
30 kHz	1.0000	1.0046	Pass	Same	Pass	0.9860	1.0140
0.1 V @ 200 Hz	0.1000	0.1000	Pass	Same	Pass	0.0985	0.1015
30 kHz	0.1000	0.1041	Pass	Same	Pass	0.0950	0.1050
10 V @ 200 Hz	10.000	10.125	Fail	Same	Pass	9.940	10.060
10 kHz	10.000	10.734	Fail	Same	Pass	9.480	10.520
30 kHz	10.000	10.787	Fail	Same	Pass	9.460	10.540
100 V @ 200 Hz	100.00	100.26	Pass	Same	Pass	99.40	100.60
10 kHz	100.00	100.46	Pass	Same	Pass	94.80	105.20
30 kHz	100.00	100.44	Pass	Same	Pass	94.60	105.40
750 V @ 400 Hz	750.0	752.60	Pass	Same	Pass	734.0	766.0
750 V @ 1000 Hz	750.0	754.5	Pass	Same	Pass	734.0	766.0
<b>DC Current</b>							
200 uA	190.00	190.05	Pass	Same	Pass	189.41	190.59
	-190.00	-190.06	Pass	Same	Pass	-190.59	-189.41
2 mA	1.9000	1.9007	Pass	Same	Pass	1.8941	1.9059
20 mA	19.000	19.011	Pass	Same	Pass	18.941	19.059
200 mA	190.00	190.49	Pass	Same	Pass	188.65	191.35
2000 mA	1900.0	1900.2	Pass	Same	Pass	1886.5	1913.5
	-1900.0	-1900.2	Pass	Same	Pass	-1913.5	-1886.5
<b>AC Current @ 1kHz</b>							
20 mA	19.000	19.053	Pass	Same	Pass	18.847	19.153
<b>Resistance in Ohms</b>							
200	100.0	10.06	Pass	Same	Pass	99.86	100.14
2 k	1.0000	0.9998	Pass	Same	Pass	0.9986	1.0012
20 k	10.000	9.997	Pass	Same	Pass	9.986	10.012
200 k	100.00	99.97	Pass	Same	Pass	99.86	100.12
2 M	1.000	0.9999	Pass	Same	Pass	0.9978	1.0022
20 M	10.000	10.000	Pass	Same	Pass	9.95	10.05

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