

DATA ACCEPTANCE PROGRAM

Equipment Accuracy / Selection



Revision 7.0: Updated Document Approvers.

For Client Labs

| | |
|---|---|
| Purpose | <ul style="list-style-type: none">Provides information on accuracies for equipment that is used in UL testing. |
| Why this requirement is important. | <ul style="list-style-type: none">Accuracies of test instruments have a direct effect on test data quality and the repeatability of tests. |
| Requirements/ Procedures | |
| Selection of equipment (Hierarchy of order for accuracy selection of equipment) | <ol style="list-style-type: none">Requirements in the written test standard or test protocol;Use of the default accuracy tables provided in Appendix A;Contact UL to determine accuracies of similar equipment used by UL;Use of stated tolerances by the equipment manufacturer or calibration certificate. |
| Validation of the selection | <ul style="list-style-type: none"><u>Before the visit</u>, UL may request technical specifications and calibration certificates for any equipment owned by the client lab that may be used in testing to determine if equipment meets required accuracies.<u>During the visit</u>, the required accuracy of equipment will be confirmed by examination of equipment records. Non-conforming equipment cannot be used for data acquisition and testing may be halted until appropriate equipment is obtained. |

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Records

Certificates, Approval Forms, and Other Documentation

- Calibration certificates and other related records documentation associated with each instrument used in testing are to be available for review prior testing.

For WTDP -

- UL staff may perform a review of records prior to the performance of tests.

For other DAP programs (CTDP, TCP, TPTDP, and, PPP)

- Clients are to index and retain equipment documentation for equipment used in testing (for audit confirmation).
 - In lieu of storage of paper copies of the documentation, these may be stored electronically.
 - Retention time for the records is to be retained for 5 years from the date of the signature of the authorized signatory on the data package.
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APPENDIX A

M & T E Default Tolerances

The following accuracy requirements are to be used to insure the quality of data acquired during tests and insure the repeatability of test results. These shall be used when M & T E specifications are not specifically detailed by the published standard or document in use.

Required accuracy does not necessarily need to be as precise as what might be given in the M & T E manufacturer's specifications.

Normally the required accuracy will be represented by one of the following:

- Maximum tolerances as specified in the Instrument Tolerances tables, taken from CTL provisional decision sheet **CTL DSH 251E** where indicated;
- Default value of + or - 0.1 percent of full scale for equipment not covered by the tables or;
- The manufacturer's specification for equipment not covered by the tables.

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Voltage (From CTL DSH 251E)

| <u>Range</u> | <u>Frequency</u> | <u>Full scale tolerance</u> |
|---------------|------------------|-----------------------------|
| Up to 1KV | DC to 1KHz | ± 1.5% |
| | >1KHz to 5KHz | ± 2% |
| | >5KHz to 20KHz | ± 3% |
| | >20KHz and above | ± 5% |
| 1KV and above | DC to 20KHz | ± 3% |
| | >20KHz and above | ± 5% |

Current (From CTL DSH 251E)

| <u>Range</u> | <u>Frequency</u> | <u>Full scale tolerance</u> |
|---------------|------------------|-----------------------------|
| Up to 5A | DC to 60Hz | ± 1.5% |
| | >60Hz to 5KHz | ± 2.5% |
| | >5KHz to 20KHz | ± 3.5% |
| | >20KHz and above | ± 5% |
| >5A and above | DC to 5KHz | ± 2.5% |
| | 5KHz to 20KHz | ± 3.5% |
| | 20KHz and above | ± 5% |

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Leakage Current (From CTL DSH 251E)

| <u>Range</u> | <u>Frequency</u> | <u>Full scale tolerance</u> |
|--------------|------------------|-----------------------------|
| | 50/ 60Hz | ± 3.5% |
| | >60Hz to 5KHz | ± 5% |
| | >5KHz to100KHz | ± 10% |

Power (From CTL DSH 251E)

| <u>Range</u> | <u>Frequency</u> | <u>Full scale tolerance</u> |
|----------------|------------------|-----------------------------|
| Up to 1W | 50/ 60Hz | ± 3% |
| 1W to 3KW | 50/ 60Hz | ± 3% |
| >3KW and above | 50/ 60Hz | ± 5% |

Power Factor (From CTL DSH 251E)

| <u>Range</u> | <u>Frequency</u> | <u>Full scale tolerance</u> |
|--------------|------------------|-----------------------------|
| All | 50/ 60Hz | ± 0.05 |

Frequency (From CTL DSH 251E)

| <u>Range</u> | <u>Full scale tolerance</u> |
|--------------|-----------------------------|
| Up to 10KHz | ± 0.2% |

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Resistance (From **CTL DSH 251E**)

| Range | <u>Full scale tolerance</u> |
|--------------|-----------------------------|
| Below 1mΩ | ± 3% |
| 1mΩ to 100mΩ | ± 5% |
| 100mΩ to 1MΩ | ± 3% |
| 1MΩ to 1TΩ | ± 5% |
| Above 1TΩ | ± 10% |

Temperature Measurement (From **CTL DSH 251E**) See Notes below table

| <u>Equipment Type</u> | <u>Max Temperature Range</u> | <u>Tolerance</u> |
|-----------------------|------------------------------|------------------|
| All | Less than 100°C | ± 2°C |
| | 100°C to 500°C | ± 3% |
| | -35°C down to -50°C | ± 3°C |

Flame Temperature Measurement (UL specifications)

| <u>Equipment Type</u> | <u>Max Temperature Range</u> | <u>Tolerance</u> |
|----------------------------|------------------------------|----------------------|
| Digital Indicators | 1093C (2000F) | ± 3°C+/- 2.6C (4.7F) |
| Hand-held, bench top units | 1315C (2400F) | +/- 1.0C (1.8F) |
| Chart Recorders/Loggers | -73.3C to 0C (-100F to +32F) | +/- 0.75C (1.35F) |
| | 300C (572F) | +/- 2.0C (3.6F) |
| | 1204C (2200F) | +/- 4.9C (8.8F) |
| | 1316C (2400F) | +/- 6.0C (10.8F) |
| Data loggers | As specified by Mfg | +/- 1.5C (2.7F) |

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Notes on Temperature measuring equipment:

Temperature measuring equipment (digital and analog) using the thermocouple method shall indicate temperatures in accordance with the appropriate thermoelectric voltage table specified by NIST accepted International Temperature Scales.

Resistance Temperature Detectors (RTD's) used in temperature measurement shall conform to resistance versus temperature tables specified in DIN43760, IEC751 or BS 1904.

Practices outlined in DIN43760, IEC 751 or BS 1904 concerning the application of RTD's shall be followed to ensure the quality of test data.

Practices outlined in CTL OP 0108 or equivalent, concerning the application of thermocouples shall be followed to ensure the quality of test data. <http://www.iecee.org/ctl/operational/ctl-op-108-ed1.pdf>

Thermocouple wire used in the assembly of thermocouples shall conform to special tolerance limits. Validation of the thermocouple wire is to be made in accordance with CTL OP -0109 or equivalent <http://www.iecee.org/ctl/operational/ctl-op-109-ed1.pdf>

Temperature measuring equipment shall conform to the accuracy requirements as determined by the basic application of the Measurement and Test Equipment. Thermocouple calibration errors are not included with the tolerances listed herein.

Temperature measuring equipment not accuracy in not for measurements related to relative humidity.

| Time (From CTL DSH 251E) | Range | Tolerance |
|---------------------------------|------------------|------------------|
| All | 10mS up to 200mS | ± 5% |
| | 200mS up to 1S | ± 10mS |
| | 1S and above | ± 1% |

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| Linear Dimensions (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
|--|-----------------|------------------|
| All | Up to 1mm | ± 0.05mm |
| | >1mm – 25mm | ± 0.1mm |
| | >25mm and above | ± 0.5% |

Weight Measuring Equipment (See Notes)

| Mass (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
|---------------------------------|---------------|------------------|
| All | 10g to 100g | ± 1% |
| | 100g to 5Kg | ± 2% |
| | 5Kg and above | ± 5% |

| Force (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
|----------------------------------|--------------|------------------|
| All | All | ± 6% |

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Notes on Weight Measuring Equipment:

- Stainless steel is the preferred material for the construction of test weights.
- Test weights less than 0.01 lb (4.54 grams) shall be constructed of stainless steel, tantalum, nickel-chromium alloy or other material sufficiently resistant to corrosion and oxidation such that the surface need not be protected or coated.
- Test weights smaller than 10 lb (4.54kg), but greater than 0.01 lb (4.54 grams) shall be constructed using materials and methods that will prevent calibration errors during the calibration cycle and subsequent recall of test data due to corrosion or chipping.
- Test weights larger than 10 lb (4.54kg) - Corrosion-resistant materials are the preferred in the construction. Materials susceptible to corrosion or tarnishing shall have a protective surface coating. A light coat of flat aluminum paint is highly recommended. Epoxy paint, lacquer, enamel paint or plated surfaces are not recommended where chipping could cause calibration errors and subsequent recall of test data.
- Weights which use loose fill material (sand, lead shot, etc.) are to be sealed such that the fill material cannot be separated from the weight without breaking the calibration seal or causing visible damage to the weight.
- Test weights shall not be constructed of exposed lead or exposed lead products that may come into contact with personnel handling the weight. Paint is not to be considered a means of enclosure for lead products.
- Test weights and weighted probes shall be marked with an identification code that cannot be obscured through normal use.

Exception: Where marking or attachment of labels is impractical due to size or function, procedures are to be provided to assure adherence to calibration schedules and trace back requirements (determining impact of equipment found to be out of calibration).

- Where necessary, weights assembled for temporary use shall be verified with a calibrated scale or balance prior to use. The scale or balance shall be used in an appropriate manner to ensure the required accuracy of the weight assembly.
- Weighted test probes shall comply with the above tolerance and requirements when this information is not stated in the published standard.

Mechanical Energy (From CTL DSH 251E) Range Tolerance

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| | | |
|--|------------------------|------------------|
| All | All | ± 10% |
| Torque (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
| All | All | ± 10% |
| Angles (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
| All | All | ± 1 degree |
| Relative Humidity (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
| All | 30% to 95%RH | ± 6%RH |
| Barometric air pressure (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
| All | All | ± 0.01MPa |
| Gas or Fluid pressure (From CTL DSH 251E) | <u>Range</u> | <u>Tolerance</u> |
| All | For static measurement | ± 5% |

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Gases, when used as a Measurement Standard, shall meet the following minimum requirements

| <u>Component mixture range</u> | <u>Maximum preparation tolerance</u> |
|--------------------------------|--------------------------------------|
| 5% to >50% | +/- 1% of component |
| 500ppm to <5% | +/- 2% of component |
| 1ppm to <500ppm | +/- 5% of component |

Gases, when used in the conduct of tests, shall meet the following minimum requirements

| <u>Component mixture range</u> | <u>Maximum preparation tolerance</u> |
|--------------------------------|--------------------------------------|
| 10% to >50% | +/- 5% of component gas |
| 50ppm to <10% | +/- 10% of component gas |
| 5ppm to <50ppm | +/- 20% of component gas |
| <5ppm | 1ppm to <5ppm of component gas |

END

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