# Appendix B. Recognition Parameter Summary

State legal metrology laboratories providing calibrations under a recognized measurement scope have evaluated and declared measurement capabilities in terms of uncertainties for each nominal value and each type of procedure. A participant laboratory specifies the nominal ranges requested in the annual *Recognition Application*. The approved recognition Scope is documented on the *Certificate of Metrological Traceability*.

**Other Areas.** In addition to the recognized measurement areas that have been described in the Annexes, many State legal metrology laboratories perform measurements for which the NIST Office of Weights and Measures has either not developed specific technical criteria or not established guidelines for recognition. State legal metrology laboratories are recognized for these areas in a limited number of cases, where validated and verified procedures are available. These areas include tuning forks used in testing radar speed devices, testing of wheel-load weighers used in testing large trucks for road weight restrictions, and the testing of hydrometers for testing sugar content of syrup. Areas without established recognition criteria include the calibration of dial gauges used to test polyethylene sheeting (an extension of dimensional measurements), lottery balls for State lottery programs (which may be recognized for mass and/or dimensional measurements), or entire programs, such as grain moisture and petroleum quality testing.

Table 3. Typical Legal Metrology Recognition Parameters

| Parameter | Typical Recognition  Scope Range | Class/Application and Documentary Standard | Typical Expanded Uncertainty |
| --- | --- | --- | --- |
| Mass Echelon I (Extra Fine Accuracy) | 30 kg to 1 mg  50 lb to 0.001 lb  8 oz to 0.03125 oz | OIML Class E1, E2  ASTM Class 000, 00, 0, 1 | OIML R111  ASTM E617  Require compliance to specifications and maximum permissible errors (m.p.e.); uncertainty must be less than 1/3 m.p.e.. |
| **Mass Echelon II**  (Fine Accuracy) | 1200 kg to 1 mg  2500 lb to 0.001 lb  8 oz to 0.0125625 oz | OIML Class F1, F2  ASTM Class 2, 3 |
| **Mass Echelon III**  (Medium Accuracy) | 2500 kg to 1 mg  2500 lb to 0.001 lb  8 oz to 0.0125625 oz | NIST Handbook 105-1, Class F (1990) Legal/regulatory enforcement)  OIML Class M1, M1-2, M2, M2-3, M3  ASTM Class 4, 5, 6, 7 |
| **Mass Echelon III**  **Weight Cart** | ≤ 10 000 lb | NIST Handbook 105-8 |
| **Mass Echelon III**  **Wheel-Load Weigher**  **Railroad Test Car** | ≤ 40 000 lb  ≤ 115 000 lb | NIST Handbook 44  ASTM E74 |
| **Volume**  **Echelon I** Gravimetric | 500 L to 100 mL  1 mL to 1 μL  100 gal to 1 gal | Syringe, micropipette, glassware, slicker, and metal prover  ASTM Standards  OIML Standards  NIST Handbook 105-2 | 0.000 10 mL/L |
| **Volume**  **Echelon II**  **Volume Transfer** | 5000 L to 100 mL  2000 gal to 1 gal  1 qt to 1 gill | Prover and glassware  NIST Handbook 105-2  NIST Handbook 105-3 | < 0.001 mL/L |
| **Volume**  **Echelon II**  **Volume Transfer**  **LPG** | 2000 L to 100 L  500 gal to 25 gal | Prover  NIST Handbook 105-4 | < 0.001 mL/L |
| LengthTape, Bench Method | Up to 30 m  Up to 200 ft | Up to 25 m (100 ft) | 0.0001 m to  0.000 14 m |
| **Length**  **Tape, Tape Method** | Up to 30 m  Up to 200 ft | Up to 25 m (100 ft) | 0.000 15 m to 0.000 25 m |
| **Length**  **Rule, Direct Comparison** | Up to 1 m  Up to 24 in | Up to 0.5 cm (18 in) | < 0.000 05 m |
| TemperatureEchelon I | 230 °C to - 30 °C  450 °F to - 25 °F | Standard Platinum Resistance Thermometer (SPRT) | ≤ ± 0.005 °C |
| Temperature Echelon II | 230 °C to - 30 °C  450 °F to - 25 °F | Thermistor and thermocouple  NIST Handbook 105-6 | > ± 0.005 °C to  ≤ ± 0.05 °C |
| Temperature Echelon III | 230 °C to - 30 °C  450 °F to - 25 °F | Liquid-in-glass thermometer  NIST Handbook 105-6 | > ± 0.05 °C to  ≤ ± 0.20 °C |
| Temperature Echelon IV | 230 °C to - 30 °C  450 °F to - 25 °F | Liquid-in-glass, dial type, and pyrometer  NIST Handbook 105-6 | > ± 0.20 °C to  ≤ ± 1.0 °C |
| Temperature Echelon V | 230 °C to - 30 °C  450 °F to - 25 °F | Infrared sensor and thermograph | > ± 1.0 °C to  ≤ ± 5.0 °C |
| **Frequency** | 10 kHz to 1 kHz | Tuning fork used for law enforcement | Estimate based on interlaboratory comparison |
| Time | ≤ 24 h | Stopwatch used for law enforcement  NIST Handbook 105-5  NIST Handbook 44 | Significantly less than tolerances. Estimated at 2 s for a 24 h test |
| Hydrometer | Degree Baumé  Degree Brix | Sugar, syrup, and petroleum | Estimates from control chart measurement assurance |
| NOTE 1 – See Annexes in this Program Handbook for detailed technical criteria used for evaluation of traceability and competency. Mass Echelon I, II, and III correspond directly related to OIML R111:2004 weight classes. Echelon I: E1 and E2. Echelon II: F1 and F2. Echelon III: M1, M2, M3 (etc.). The ASTM E617:2018 classes correspond to those of OIML R111. NIST Handbook 105-1, Class F weights correspond to Echelon III. Volume Echelon I is related to gravimetric volume calibration measurement procedures. Volume Echelon II is related to volume transfer calibration procedures. | | | |
| NOTE 2 – Typical Uncertainties are not the sole limiting factor for assigning Recognition for Echelons listed in this table. See additional technical criteria published in the Annexes as requirements. | | | |

**Table 4. Summary of Environmental Facility Limits Specified in NISTIR[[1]](#footnote-1) Standard Operating Procedures (2019) or NVLAP Handbook 150-2 Technical Annexes**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter, Echelon | Temperature Range (Limits, choose a set point)  (°C) | Temp variability from set point  (± °C / h) | Max change per calibration (°C / h) | Temp uncertainty  (± °C) | Relative Humidity (RH) % Range  (Limits, choose a set point) | RH variability from set point (± % RH / h) | Pressure uncertainty  (± Pa) |
| Mass, I (E1) | 18 to 23 | 0.5 °C / 12 h | 0.3 | 0.10 | 40 to 60 | 5 % / 4 h | 66.5 |
| Mass, I (E2) | 18 to 23 | 1.0 °C / 12 h | 0.7 | 0.10 | 40 to 60 | 5 % / 4 h | 66.5 |
| Mass, II | 18 to 23 | 2 °C / 12 h | 1.5 | 0.10 | 40 to 60 | 10 % / 4 h | 66.5 |
| Mass, III | 18 to 27 | 5 °C / 12 h | 3.0 | 0.10 | 40 to 60 | 20 % / 4 h | 66.5 |
| Force[[2]](#footnote-2) | 23 | NS | 0.2 | NS | NS | NS | NS |
| Force[[3]](#footnote-3) | 18 to 27 | 5 °C / 12 h | 3.0 | 0.10 | 40 to 60 | 20 % / 4 h | 66.5 |
| Volume, I Gravimetric | 18 to 23 | NS | 1.0 | 0.10 (water)  0.50 (air) | 40 to 60 | 10 % / 4 h | 135 |
| Volume, II  Transfer | 18 to 27 | NS | 2.0 | 0.10 (water) | 35 to 65 | 20 % / 4 h | NS |
| Dimensional | 18 to 22 (20) | 1 °C / 24 h | 0.5 | 0.5 | 40 to 60 | 10 % / 4 h | NS |
| Time | General laboratory conditions; record conditions with laboratory data. | | | | | | |
| Tuning Forks | 18 to 25 | NS | NS | NS | 40 to 60 | NS | NS |
| Thermometry | NS | 2 °C / 24 h | NS | NS | 40 to 60 | 10 % / 4 h | NS |
| Hydrometers | Stable | NS | NS | 0.01 (liquid) | NS | NS | NS |
| Watthour Meters[[4]](#footnote-4) | 23 | NS | 1.0 | NS | 30 to 50 | NS | NS |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

NS = Not Specified.

1. NISTIR 6969, 2019, Selected Laboratory and Measurement Practices, and Procedures to Support Basic Mass Calibrations.

   NISTIR 5672, 2019, Advanced Mass Calibrations and Measurements Assurance Program for the State Calibration Laboratories.

   NISTIR 7383, 2019, Selected Procedures for Volumetric Calibrations.

   NISTIR 8028, 2014, Selected Laboratory and Measurement Practices and Procedures for Length Calibrations.

   NISTIR 8250, 2019, Calibration Procedures for Weights and Measures Laboratories. [↑](#footnote-ref-1)
2. NVLAP Annex D1, 2019. [↑](#footnote-ref-2)
3. Unpublished SOP from Pennsylvania Laboratory, specifies conditions for Mass III [↑](#footnote-ref-3)
4. NVLAP Handbook 150-2A, Section 2.13, Watthour Meters, 2004. [↑](#footnote-ref-4)