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 1. 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 E_1, E_2 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 F_1, F_2 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 M_1, M_{1-2}, M_2, M_{2-3}, M_3 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	

Parameter	Typical Recognition Scope Range	Class/Application and Documentary Standard	Typical Expanded Uncertainty
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
Length Tape, 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
Temperature Echelon 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

Parameter	Typical Recognition Scope Range	Class/Application and Documentary Standard	Typical Expanded Uncertainty
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: E_1 and E_2. Echelon II: F_1 and F_2. Echelon III: M_1, M_2, M_3 (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] 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 (E_1)	18 to 23	0.5 °C / 12 h	0.3	0.10	40 to 60	5 % / 4 h	66.5
Mass, I (E_2)	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]	23	NS	0.2	NS	NS	NS	NS
Force[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]	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.
[2] NVLAP Annex D1, 2019.
[3] Unpublished SOP from Pennsylvania Laboratory, specifies conditions for Mass III
[4] NVLAP Handbook 150-2A, Section 2.13, Watthour Meters, 2004.