

Discipline		NEBB Instrument Master List (Effective January 1, 2020)															BET	BSC	CPT	PII	RCx	Sound	Tab	Vibration	Notes	Calibration Requirements
Function		RANGE				ACCURACY				RESOLUTION																
Air	Air Pressure	0	in wg	to	10	in wg	±	2%	of reading	±	0.001	in wg	0.001	in wg	<	1	in wg									12 Months
													0.01	in wg	>	1	in wg	x	x	x	x	x				
		0	Pa	to	2500	Pa	±	2%	of reading	±	0.25	Pa	0.10	Pa	<	250	Pa									
														1.0	Pa	>	250	Pa								
Air	Air Velocity Instrument	100	fpm	to	3500	fpm	±	5%	of reading	±	7	fpm	1	fpm											12 Months	
		0.50	m/s	to	20	m/s	±	5%	of reading	±	0.04	m/s	0.01	m/s												
	FHT Air Velocity	25	fpm	to	2500	fpm	±	3%	of reading	±	3	fpm	1	fpm											12 Months	
		0.10	m/s	to	12.7	m/s	±	3%	of reading	±	0.02	m/s	0.01	m/s												
Digital Direct Reading Hood	Digital Direct Reading Hood	100	cfm	to	2000	cfm	±	5%	of reading	±	7	cfm	1	cfm											12 Months	
		50	l/s	to	1000	l/s	±	5%	of reading	±	4	l/s	1	l/s												
Temperature	Air Meter with probe	0	°F	to	200	°F	±	0.5%	of reading	±	2.0	°F	0.1	°F											12 Months	
		-20	°C	to	100	°C	±	0.5%	of reading	±	1.0	°C	0.1	°C												
	Immersion Meter with probe	0	°F	to	200	°F	±	0.5%	of reading	±	2.0	°F	0.1	°F											12 Months	
		-20	°C	to	100	°C	±	0.5%	of reading	±	1.0	°C	0.1	°C												
Humidity	Humidity Meter (w/Probe, if req'd)	10	% RH	to	90	% RH	±	3%	of reading				1%												12 Months	
Electrical	Amperage Measurement	0.1	AC Ampere	to	100	AC Amperes	±	2%	of reading	±	5	digits	0.1	AC Ampere											12 Months	
	Voltage Meter - True RMS	1	VAC	to	600	VAC	±	2%	of reading	±	5	digits	1	Volt											12 Months	
Rotation	Rotation Measurement	60	rpm	to	5000	rpm	±	2%	of reading	±	2	rpm	1	rpm											12 Months	
Hydronic	Pressure Measurement	0.4	psi	to	200	psi	±	2%	of reading	±	1	psi	0.1	psi											12 Months	
		3	kPa	to	1400	kPa	±	2%	of reading	±	7	kPa	1.0	kPa												
	Δ Pressure measurement	0.4	psi	to	75	psi	±	2%	of reading	±	0.5	psi	0.01	psi											12 Months	
		3	kPa	to	500	kPa	±	2%	of reading	±	3.5	kPa	0.1	kPa												
RCx Instruments	Receptacle Circuit Tester	125	VAC						Not Applicable			Not Applicable													Not Required	
	Voltage Detector	50	VAC	to	1000	VAC			Not Applicable			Not Applicable													Not Required	
	Light Level Measurement	0	FC	to	4000	FC	±	3%		+	5%	full scale	0.1	FC											Per Manufacturer's Requirements	
0		lx	to	40000	lx	±	3%		+	5%	full scale	1.0	lx													
BET / RCx Instruments	Temp Documentation Thermal Camera	-4	°F	to	450	°F	±	2%		or	3.6	°F	0.1 @ 86 °F & 160 x 120												Per Manufacturer's Requirements	
		-20	°C	to	232	°C	±	2%		or	-15.7	°C	0.1 @ 30 °C & 160 x 120			x										

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		RANGE					ACCURACY					RESOLUTION														
Function																										
Data Loggers	Carbon Dioxide CO ₂	0	ppm	to	2500	ppm	±	5	ppm				1	ppm							Qty = 1	Per Manufacturer's Requirements				
	Carbon Monoxide CO	0	ppm	to	1000	ppm	±	5	ppm				1	ppm							Qty = 1	Per Manufacturer's Requirements				
	Lighting Levels	0	FC	to	3000	FC	±	10	FC				2	FC								Qty = 1	See Note 5			
		0	lx	to	30000	lx	±	100	lx				0	lx												
	Electrical	0	VAC	to	600	VAC		2%	of reading			VAC	1.0	VAC								Qty = 2	See Note 5			
		0	Amperes	to	100	Amperes		4%	of reading			Ampere	0.1	Ampere												
	Static Pressure - Low	0	in wc	to	0.25	in wc	±	1%	full scale				0.01	in wc	<	1	in wc						Qty = 1	See Note 5		
													0.1	in wc	>	1	in wc									
		0	Pa	to	60	Pa	±	1%	full scale				2.5	Pa	<	250	Pa									
	Static Pressure - High	0	in wc	to	6.00	in wc	±	1%	full scale				0.01	in wc	<	1	in wc						Qty = 1	See Note 5		
												0.1	in wc	>	1	in wc										
0		pa	to	1500	Pa	±	1%	full scale				2.5	Pa	<	250	Pa										
Water Pressure	0	psi	to	100	psi	±	1%	of reading	psi			1.0	psi									Qty = 1	See Note 5			
	0	kPa	to	700	kPa	±	1%	of reading	kPa			0.1	kPa													
Temperature	-4	°F	to	150	°F	±	0.63	°F	@	32-122	°F	0.05	°F	@	77	°F						Qty = 8	See Note 5			
	-20	°C	to	65	°C	±	0.35	°C	@	0-50	°C	0.03	°C	@	25	°C										
Humidity	10	% RH	to	90	% RH		2.5%	RH				1%	RH									Qty = 8	See Note 5			
Event	Not Applicable					Not Applicable					Not Applicable											Qty = 2	Not required			
RCx Instruments	Thermal Infrared Thermometer	-4	°F	to	500	°F	±	2%	of reading	±	4	°F	0.5	°F									Per Manufacturer's Requirements			
		-20	°C	to	260	°C	±	2%	of reading	±	2	°C	0.2	°C												
	TDS Meter	0	μ	to	1000	μ	±	2%	full scale				1.0%										Per Manufacturer's Requirements			
0		ppm	to	1000	ppm	±	2%	full scale																		
Capacitance Moisture Meter	0%		to	100%		±	5%					0.75	inches			Penetration						Per Manufacturer's Requirements				
CPT Instruments	Particle Counter	A light scattering instrument with display or recording means to count and size discrete particles in air, as defined by ASTM F50-07. Instruments of this type shall provide for a minimum sampling flow rate of 28.3 L/min (1.0 cfm) and a threshold size discrimination of a minimum of 0.3 micrometer in size.																								12 Months

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		Function		RANGE		ACCURACY		RESOLUTION		BET	BSC			CPT	FHT	RCX	Sound	Tab	Vibration									
CPT Option 1	Aerosol Photometer	CHOOSE ONLY 1 OF THE 2 OPTIONS	The instrument shall have a threshold sensitivity of 10 ⁻³ micrograms/liter of challenge aerosol particles and be capable of measuring concentrations over a range of 105 times the threshold sensitivity. Sample flow rate shall be 28.3 L/min (1 cfm). Readout shall be either linear with an accuracy of 1% of full scale of the selected range. ± 2% of reading ± 0.1 psi 0.04 psi (US)										x														12 Months or 400 operating hours	
	Pneumatic Aerosol Generator		A device that can aerosolize oil medium to serve as an artificial challenge for filter integrity testing of systems under 3,000 cfm, typically Laskin nozzle(s) type, thermal generator, atomizer, etc.										x															Not Required
	Thermal Aerosol Generator		A device that can aerosolize oil medium to serve as an artificial challenge for filter integrity testing of systems of 3,000 to 60,000 cfm										x															Not Required
CPT Option 2	Optical Particle Counter for Scan Test		A particle counter should have a 1.0 cfm flow rate with a threshold sensitivity of at least 0.3µm. The counter must have an audible alarm for every particle that is counted. The particle counter shall have a continuous counting mode or a sample time that exceeds the time required to completely scan the area of the filter under test. This counter may also be used for Cleanliness Classification above.										x														12 Months	
	Diluter		A device used with the scanning particle counter to sample the aerosol challenge upstream of a filter under test. The dilution ratio shall be between 300 – 1,000:1. The resulting counts after dilution should not exceed 100,000 particles.										x														12 Months	
	Aerosol Generator		A device that can aerosolize oil or microsphere medium to serve as an artificial challenge for filter integrity testing. A low output (defined as one which supplies of < 5 x 10 ⁹ particles /min of ≥ 0.3 um in size) or a normal output generator may be used.										x														Not Required	
FHT Instruments	Tracer gas Detector				Minimum detection range: 0.01 PPM Minimum response time: 1 second The units shall be configured to measure sulfur hexafluoride (SF6), or other approved tracer gas, and display in concentration measurement units (PPM)		±	10%	of reading	or	0.025	ppm	0.01	ppm														12 Months
	Detection Calibrator				Device used to calibrate the detection instrument in accordance with the manufacturer's specifications.		Not Applicable		Not Applicable		Not Applicable		Not Applicable															12 Months When Required
	Local Challenge Source				Device that can generate a small relatively neutrally buoyant smoke, discharging with minimal velocity.		Not Applicable		Not Applicable		Not Applicable		Not Applicable															Not Required
	Large Challenge Source				Device that can generate a large relatively neutrally buoyant smoke, discharging with minimal velocity.		Not Applicable		Not Applicable		Not Applicable		Not Applicable															
	Ejector w/critical orifice			Shall conform to the requirements as indicated in the current edition of NEBB FHT PS. See appendix D for instrument specifications		Not Applicable		Not Applicable		Not Applicable		Not Applicable																Not Required
	Orifice Calibrator	Flow Meter	0	l/m	to	10	l/m	±	3%				0.1	l/m														Not Required
		Mechanical Device	0	l/m	to	15	l/m	±	0.1	l/m			0.1	l/m														12 Months
	Tracer Gas			Sulfur Hexafluoride Commercial grade (Minimum purity of 99%) or approved replacement gas		Not Applicable		Not Applicable		Not Applicable		Not Applicable																SDS Required
Mannequin			A three dimensional mannequin (torso) with arms and shall be of reasonable human proportions and be clothed with a lab coat. The height must be adjustable to meet the height requirements of the various hood configurations; i.e. standard bench hood, ADA height, floor mounted, etc. Probe shall be placed in the normal breathing zone based on the various heights.		Not Applicable		Not Applicable		Not Applicable		Not Applicable																Not Required	
BET Instruments	Digital pressure flow measurement system			Not Applicable		±	4%	of reading			0.1 Pa (0.0004 inwc, 0.002 psf)			x													Per Manufacturer's Requirements	

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		Function	RANGE		ACCURACY	RESOLUTION											
Sound Instruments	Sound Level Meter, Real Time Analyzer, & Octave Band Analyzer	Sound Level Meters (SLM's) and Real Time Analyzers	Sound Level Meters (SLM's) and Real Time Analyzers	which conforms Appendix A of the NEBB Instrument List													
		Real Time Analyzers	As listed in Tables 3-1.2.1, 3-1.2.2 and 3-1.2.3	which conforms Appendix A of the NEBB Instrument List								x				#3	12 Months
		Full Octave Filters	As listed in Table 3-1.2.3	which conforms Appendix A of the NEBB Instrument List													
	Acoustic Calibrator	Sound Pressure Calibrator. Shall meet the requirements specified in Appendix A of the NEBB Instrument List.										x			#3	12 Months	
Vibration Instruments	Vibration Analyzer / Meter, Real Time Analyzer & Spectrum Analyzer	Shall meet the minimum requirements as specified below:															
		Displacement – 0.1 to 100 mils (0.0001 to 0.1 inches)															
Velocity – 0.0005 to 10 in/sec																	
Acceleration – 0.0001 to 30 G's																	
Frequency Range – 1 to 1000 Hz (60 to 60,000 RPM)																	
Frequency Resolution (bandwidth) – at least 1.25 Hz (1 / 75 RPM) Minimum														x	*4	12 Months	
Lines of resolution ≥ 800																	
Detection - Peak, Peak-to-Peak, RMS																	
FFT Windowing- Hanning at least																	
Averaging – exponential or time and selectable to at least four averages																	
Accelerometers / Transducer		Shall have the following minimum specifications:															
		Sensitivity (± 10%) ≥ 100 mV/G typical															
		Measurement Range = ± 20 G peak															
		Frequency Range = 2 to 3000 Hz at ± 5%													x	*4	12 Months
NOTES																	
*1		CPT Option - choose only Option 1 OR Option 2 - along with required instrument for CPT certification (All instruments in any of the chosen is required)															
*2		FHT Orifice Calibrator - Choose only one															
*3		Refer to Appendix A for complete instrumentation requirements for Sound Measurement (SM)															
*4		Firms may own or rent vibration equipment instrumentation for vibration certification															
*5		Calibration Requirement: Data logger calibration may be verified from a calibrated instrument with an associated calibration form showing calibration readings from both the calibrated instrument and the data logger. If a data logger is out of calibration and cannot be adjusted, the logger must be sent back to the factory for re-calibration or be replaced															
*6		Accuracy of an instrument is either stated as a percentage of full scale or as a percentage of the reading. NEBB has chosen percentage of reading due to it being a more accurate reading. Since a % of reading error becomes smaller as you read near the lowest part of the scale the instrument resolution and accuracy must be very small to maintain the accuracy of the reading. To overcome this the manufactures add a standard offset to the % of reading to maintain a reasonable accuracy at all locations on the scale. Normally for TAB readings we are never operating at the extreme ends of the scale so this has no impact on our work.															
General Note:		Some local jurisdictions require qualified electrician for any electrical readings															
Calibration Requirement:		Instruments require NIST Traceable calibration or National Metrology Institutes (NMI) which exist in many countries maintaining primary measurements of standards; such as NPL in the UK, PTB in Germany and many others which are approved for those regions.															

NEBB Required Instrumentation (Effective January 1, 2020)

Appendix A - NEBB Sound Level Meter and Acoustic Calibrator Instrumentation Minimum Calibration Data

1.0 Introduction:

NEBB allows for ANSI S1.4 Type 1 or Type 2 meters; which, minimally have full octave band filters sets. There are two general configurations of SLM and filter set instruments used by NEBB firms; an older SLM with an external filter set which attaches to the SLM and more modern SLM / Real Time Analyzer, which has the filters built into the instrument. Most NEBB firms use modern instruments, SLM / Real Time Analyzer.

The amplitude tolerances for Type 1 and 2 meters are different in each octave band. Therefore, there are two sets of compliance tables; one set for Type 1 / Class 1 instruments and one set for Type 2 / Class 2 instruments. The two sets cannot be combined, since, some NEBB firms have Type 1 instruments which are required for government work.

Additionally, many of the newer Real Time Analyzers have both full and third octave band filter sets. The NEBB S&V certification is to measure and report sound levels, which are in the form of overall A-weighted levels (overall dBA) or data input to Noise Criteria (NC) and /or Room Criteria (RC) curves. Both of which only use full octave band data. Therefore, the minimum calibration information is for full octave bands only.

As a matter of procedure for calibration of SLM / Real Time Analyzers, the information listed below is the minimum number of calibration check test points which must be on a calibration certificate.

2.0 Acoustic Calibrators (ANSI S1.40)

Acoustic calibrators typically have one or two sound amplitude levels and one or two frequencies. That is amplitudes 94 or 114 dB, and frequency 250 or 1000 Hz. These combinations cover 99% of all sound level (acoustic) calibrators. The tolerances are,

Parameter	Type / Class 1	Type / Class 2
Amplitude	±0.55 dB	±0.95 dB
Frequency	±1.3%	±2.3%

3.0 Sound Level Meters / Real Time Analyzers

3.1 Calibration Tolerances and Minimum Data (ANSI S1.4)

The data listed in Tables 3.1.1 and 3.1.2 are minimum performance checks on a sound level meter, with the meter set in the overall sound level mode. The data in Tables 3.1.1 and 3.1.2 is **not** to be used to assess compliance of filter sets. Tolerance parameters for filter sets (analog or digital) is presented in Section 3.2

Table 3.1.1: Overall Meter Performance Tolerances

Acoustical Parameter Check	Type 1	Type 2
Overall SPL Accuracy	±0.7 dB	±1.0 dB
Fast Response	-1 ±1.0 dB	-1, (+1, -2) dB
Slow Response	-4.1 ±1.0 dB	-4.1 ±2.0 dB
Linearity	±0.4 dB	±0.6 dB
Noise Floor	Note 1	Note 1

Note 1: 5 dB below manufacturers minimum published level.

Table 3.1.2: Overall Meter Frequency Response.

Frequency (Hz)	A-weighted Relative Response Level dB	Tolerance Limit dB	C-weighted Relative Response Level dB	Tolerance Limit dB	Z-weighted Relative Response Level dB	Tolerance Limit dB
31.5	-39.4	± 1.5	-3.0	+/-1.5	0.0	+/-1.5
63	-26.2	± 1	-0.8	+/-1	0.0	+/-1
125	-16.1	± 1	-0.2	+/-1	0.0	+/-1
250	-8.6	± 1	0.0	+/-1	0.0	+/-1
500	-3.2	± 1	0.0	+/-1	0.0	+/-1
1K	0	± 1	0.0	+/-1	0.0	+/-1
2K	1.2	± 1	-0.2	+/-1	0.0	+/-1
4K	1.0	± 1	-0.8	+/-1	0.0	+/-1
8K	-1.1	± 1.5/-3	-3.0	+1.5/-3	0.0	+1.5/-3

3.2 Filter Set Requirements

(ANSI S1.11)

Table 3.2.1 Octave Band Filter Roll-Off Response

Octaveband Center Freq. Hz	Lower Octaveband Edge Limit, Hz	Band edge Roll-off Limits dB		Upper Octaveband Edge Limit< Hz	Band edge Roll-off Limits dB	
		Type 1	Type 2		Type 1	Type 2
31.5	22.4	-2.0 to -5.0	-1.6 to -5.5	44.7	-2.0 to -5.0	-1.6 to -5.5
63	44.7	-2.0 to -5.0	-1.6 to -5.5	89.1	-2.0 to -5.0	-1.6 to -5.5
125	89.1	-2.0 to -5.0	-1.6 to -5.5	178	-2.0 to -5.0	-1.6 to -5.5
250	178	-2.0 to -5.0	-1.6 to -5.5	355	-2.0 to -5.0	-1.6 to -5.5
500	355	-2.0 to -5.0	-1.6 to -5.5	708	-2.0 to -5.0	-1.6 to -5.5
1,000	708	-2.0 to -5.0	-1.6 to -5.5	1413	-2.0 to -5.0	-1.6 to -5.5
2,000	1413	-2.0 to -5.0	-1.6 to -5.5	2,818	-2.0 to -5.0	-1.6 to -5.5
4,000	2818	-2.0 to -5.0	-1.6 to -5.5	5623	-2.0 to -5.0	-1.6 to -5.5
8,000	5623	-2.0 to -5.0	-1.6 to -5.5	11220	-2.0 to -5.0	-1.6 to -5.5
16,000	11220	-2.0 to -5.0	-1.6 to -5.5	22390	-2.0 to -5.0	-1.6 to -5.5

3.3 Other Information Required to be on Calibration Certificate

Laboratory Conditions during Calibration:

1. Atmospheric Pressure,
2. Temperature, and
3. Humidity