

Specific Accreditation Guidance

Calibration reference equipment table

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Calibration reference equipment table

Purpose

This document provides guidance for establishing calibration and checking intervals for reference equipment. The information presented should be read in conjunction with the guidance found in the informative annex of the *General Accreditation Criteria: Equipment assurance, in-house calibration and equipment verification.*

Facilities should also refer to the *General Accreditation Criteria: Metrological Traceability Policy*.

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Accelerometer			
Reference	5		
		24	Intercomparison
Acoustic attenuator			
	5		
		12	Check 2 ratios
Acoustic calibrator - incluc	ling pistonphone	and sound sour	ce
	1		IEC 60942
		6	Intercompare
Alignment telescope			
	6		
Analogue band pass filter	- sound & vibratio	on	
Octave and fractional	2		IEC 61260
Anemometer			
	1		Anemometers with rotating parts should be checked regularly for wear, damage and free bearing operation.
Angle gauge			
Reference	4 then 8 subsequent		

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Working	2 then 4 subsequent		
Attenuator			
	3		Frequency Response
		12	Check two ratios. Resistance and return loss.
Autocollimator	·		
	6		EURAMET cg-22
Balance			
	3		NMI Monograph 4
		12	Service.
			Where the facility can demonstrate that the balance is used in a suitable environment (e.g. dust free, chemical free) and results of user checks consistently demonstrate good performance and ability, the service may be waived.
		6	Repeatability check.
			General Accreditation Criteria: User checks and maintenance of laboratory balances
		1	One point check
			General Accreditation Criteria: User checks and maintenance of laboratory balances
		Each weighing	Zero point check
Barometer			·
Fortin	Initial		
		60	One point check with transfer instrument.
			General Accreditation Guidance: The in-situ calibration of barometers
Aneroid	1		

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Bridge - manual balance			
	5		
		12	Check against laboratory standards
Caliper			
	2		AS 1984
		On use	Zero point, correct closure of jaws
Capacitor			
	5		
		12	Intercompare
Cold reference junction - A	VCJC		
		12	Check against reference thermometer or comparison at ice point
Colorimetric integrating sp	ohere		
	1		As long as the coating is in reasonable condition then the absolute reflectance is not critical and recoating is not necessary. Annual recalibration using a reference lamp is recommended. More frequent calibration may be necessary if the sphere is new or in a dusty or humid environment or subject to lamps emitting UV radiation.
		3	Check using working standard lamp
Comparator - dimensional			
	3		
Current shunt			1
	5		See entry for shunt
DC voltage reference			
	1 to 2		Interval dependent on required uncertainty

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
		3 to 6	Intercompare
Digital signal analyser - so	ound & vibration		
	5		
		12	
Dimensional measuring m	achine		
Precision scale	5 then subsequent 10		
Geometric test	5		
Micrometer head	3		
Coordinate Measuring Machine (CMM)	2		
		6	Intermediate volumetric check (e.g. ball bar)
Dividing head and rotary t	able		
	5 then 10 subsequent	24	
Dry block calibrator			
	1		EA – 10/13, EURAMET cg-13
Electrical instrument			
Digital Multimeter (DMM) and other types of meters which measure electrical parameters such as volts, resistance, current,	1		Calibrate over all ranges and parameters of use including calibration across frequency (Hz) of use.
capacitance, power, etc			General Accreditation Guidance: Electronic measuring equipment as reference standards.
			EURAMET cg-15
		6	Compare with meters of similar resolution
Analogue meter (see above)	1		
		6	Compare with meters of similar resolution

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Data loggers / chart recorders	1		
(see above)			
		6	Check at two points over the range
Environmentally controlled	lenclosure		
Temperature-controlled chamber	1		Spatial uniformity, IEC 60068-1; 60068-2-38; 60068-2-39 over 3 points in the temperature working range, EURAMET cg-20
		36	Spatial uniformity in the working zone over 3 points in the temperature working range
Humidity-controlled chamber	1		Humidity distribution in working zone over the operational range. EURAMET cg-20
		12	Spatial uniformity of temperature
CO ₂	On use		Monitor level
Infrared, ultraviolet and visible	1		
		On use	Check operation of the lamps
Pressure / vacuum	1		Monitor level
Extensometer calibrator			
	5		AS 2328 and AS 1545
Flowmeter			
			EURAMET cg-19
Differential pressure meter, orifice meter, venturi meter and anubar	2	6	Flow or dimensional calibration plus inspection for wear and damage. Associated transducers (temperature, pressure, density) to be calibrated in accordance with that transducer requirement.
Electronic thermal, mass flow	1		Where high temperature or corrosive gases are monitored a shorter interval is recommended
Laminar flow meter	2	6	Inspect for damage or contamination

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Orifice plate	Initial	6	Visual check for wear and damage
Sonic nozzle			
Reference 0.1%	3	6	Inspect and clean
Working 0.5%	6	6	Inspect and clean
Soap film	2		
Positive displacement meter	2		
Prover	2	6	Thermometer ice points and pressure readout checks for stability EURAMET cg-21
Rotary meter	2	6	Inspect for contamination or damage
Rotameter variable area meter	2	3	Visual inspection for damage to float edges or ball float for pitting
Turbine meter	2	6	Inspect for contamination or damage of turbine blades, and free bearing operation
Turbine meter (Pelton Wheel / Miniature)	1	6	Inspect for contamination or damage of turbine blades, and free bearing operation
Vortex shedding	2	6	Inspect for contamination of the bluff body
Wet test meter	2	Before use	Set water level before use
Gauge block			
Reference	4 then 8 subsequent		EURAMET cg-02
Glass scale - used as a re	ference for dimen	sional comparis	son
	3 then 6 subsequent		
Haze standard			
Plastic	5		
Glass	10		

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Height setting micrometer	and riser block		
	3 then 6 subsequent		
Hydrometer			
Reference	5		
Working glass	1		
Working metal	6 months		
Hygrometer			•
Electronic type (e.g. digital psychrometer)	1		
Digital psychrometer (aspirated wet and dry-bulb thermometer)	1		
		6	Check against a calibrated thermometer at ambient temperature. Check the wick for contamination and effective wetting and clean or replace if required.
Electrical impedance relative humidity sensor	1		Can be 2 yearly if used only under ambient conditions. May need more frequent calibration or checks if used in high humidity environments.
Chilled mirror dew or frost point hygrometer	2		Maintain/clean the mirror in accordance with manufacturer recommendations
Inductor			
	5		
		12	Intercompare
Instrument and ratio transf	ormer		
	10		Instrument transformers may be extended to 20 years with annual intercomparisons
Instrument transformer test set			

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
	5	12	Compare with a transformer or other known error device.
			For CT sets every second calibration may be substituted by a test using the NMI/NATA adjustable error current transformer.
Laser power / energy mete	r		
	2		
		3	Visual check
Length bar			
Reference	4 then 8 subsequent		
Working	2 then 4 subsequent		
Level - precision	·		•
	4		
		12	12 monthly single point check for electronic levels
Linear scale - precision			
	5 then 10 subsequent		
Load cell			
			EURAMET cg-04
	2		AS 2193
		On day of use	If amplification is variable perform shunt calibration check
Luminance meter and Illun	ninance meter		
Digital	1		
Analogue	2		
Manometer	•		

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Reference and working, liquid (mercury based)	10		Periodically check the cleanliness of the fluid and the cleanliness, shape and freedom of movement of the Hg meniscus. Changes in the shape of the meniscus. as it moves, indicates dirty mercury or glass.
		36	Check the cleanliness of the fluid
Reference and working, liquid (liquid other than mercury)	3		Periodically check the cleanliness of the fluid and the cleanliness, shape and freedom of movement of the meniscus
		18	Check the cleanliness of the fluid
Electronic	1		
Mass			
Reference (integral stainless steel or nickel chromium alloy)	3 then 6 subsequent		Verifying Authorities request 3 then 5 subsequent
Working (stainless steel, nickel chromium alloy)	3		
Working (other alloy and iron Class III)	2		
Mass comparator			
		6	Repeatability checks at full, half and minimum scale
Metal - temperature referer	ice		
Freezing fixed point	5		
Micrometer	1	1	
	5		
		1	Zero, one point (against gauge block) and condition of anvils
Micrometer setting gauge			
	3 then 6 subsequent		

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Microphone - measuring			
	2		
		3	Check frequency response and sensitivity
Microphone amplifier			
		12	Check frequency response and meter accuracy
Noise analyser			
Integrated in firmware	Initial		Initial calibration is not necessary where the analyser has already been type approved. Where the instrument has not been type approved, or where firmware changes are made, initial calibration is necessary.
Optical flat			
	3 then 6 subsequent		
Optical parallel			
	3 then 6 subsequent		
Optical projector			
	5		
Orifice plate			
	Initial	6	Visual check for wear and damage
Oscilloscope			
		24	Time base and voltage scale accuracy
Photodetector			
Silicon cell	3		Linearity and spectral
Other	5		Calibrate more frequently when the filter transmittances change significantly

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
		12	Check spectral response with colour filters
		6	Check linearity of response
Photometric integrating sp	here		
	1		As long as the coating is in reasonable condition then the absolute reflectance is not critical and recoating is not necessary. Annual recalibration using a reference lamp is recommended. More frequent calibration may be required if the sphere is new or in a dusty or humid environment or subject to lamps emitting UV radiation.
		3	Check using working standard lamp
Photometric test plate for I	uminance		
All		36	Visual inspection
Ceramic or enamel	10		
Other	5		
Pitch diameter reference d	isc		
	4 then 8 subsequent		
Polygon - precision			
	5 then 10 subsequent		
Verification plate for plate	reader		
	10		See photometric test plates
Polilight or light source us	ed with specific v	wavelength filter	rs
		On use	Checked against reference material
Process instrument calibra	itor		
	1		Initial calibration should include an ACJC check at typical field use ambient temperatures

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Pressure balance			
			EURAMET cg-03
Dead weight tester with accuracy < 0.01%	3		
		12	Spin time and fall rate
Dead weight tester with accuracy > 0.01%	5		
		12	Spin time and fall rate
Pressure equipment			
Mechanical gauge	1		Metrology Society of Australia (MSA), Test Method 2 - 2008, Calibration of Pressure Gauges
Digital pressure gauge	1		Metrology Society of Australia (MSA), Test Method 1 - 2008, Calibration of Pressure Calibrators, Indicators and Transducers
Pressure transducers	1		Metrology Society of Australia (MSA), Test Method 1 - 2008, Calibration of Pressure Calibrators, Indicators and Transducers
Pressure transmitter	1		Metrology Society of Australia (MSA), Test Method 1 - 2008, Calibration of Pressure Calibrators, Indicators and Transducers
Calibrator	1		Metrology Society of Australia (MSA), Test Method 1 - 2008, Calibration of Pressure Calibrators, Indicators and Transducers
Pyrgeometer			
	3		
Pyrheliometer			·
Reference	3		
Working		6	Check against reference
Pyrometer - disappearing	filament		
	3		

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Quartz control plate			
	Initial		Visual check before use
Radiation thermometer - ir	cluding visible a	nd infrared pyro	meters
	2		Initial test of target size dependence should be performed.
			Initial calibration should include sufficient points to confirm linearity.
		12	Check at one point in range or at ice point
Black body source	2		Either calibration of the measured radiance temperature in a specified waveband, or calibration of the monitor sensor together with blackbody cavity uniformity assessment.
Radioactive reference mat	erial		
Neutron, X-rays, gamma	5	12	
Radiometers - thermal			
	2 or after 100 tests		
		3	Against know radiant heat source
Reference ballast			
Lighting test	5		
Refractometer			
		On use	Check against distilled water
Reference glass filter			
Spectrophotometry, colourimetry, luminous transmittance, neutral density	10		
Reference haze standard			
Plastic	5		
Glass	10		

Calibration interval (years)	Checking interval (months)	General comments and example reference standards
5		
	Before use	Check for contamination
Initial		
	Before use	Visual examination
3		
10		
10		
5		
	12	Intercompare
3		
	6	Intercompare
		Check VSWR
nermal converter		
3		
	6	Intercompare
4 then 8 subsequent		
4		
	12	Microscopic inspection
Initial		
	interval (years) 5 Initial 3 10 10 10 10 5 5 3 a a a a a a a a a a a a a a a a a	interval (years)interval (months)5Before useInitialBefore use3310101010512363610610611611101211364 then 8 subsequent6412

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
		12	Microscopic inspection
Roundness standard			
	5 then 10 subsequent		
Screw check plug for ring	gauge		
	3 then 6 subsequent		EURAMET cg-10
Screw pitch reference stan	dards		
	3 then 6 subsequent		EURAMET cg-10
Screw thread measuremen	t cylinder and ve	e piece	
	Initial		EURAMET cg-10
		12	Visual inspection
Secondary standard dosim	neter - ionising ra	diation	
	3	Before use	
Setting cylinder			
	3 then 6 subsequent		EURAMET cg-06
Setting ring			
	3 then 6 subsequent		
Shunt			
	5		
		12	Intercompare
Signal generator			
	1		When used in isolation to provide reference signals
Sine bar, centre and table			
	3 then 6 subsequent		

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Sound level meter and noi	se dosimeter		
	2		
		On use	Check against acoustic calibrator or pistonphone
Sound power source			-
	5		
Spectrophotometer		I	
		6	Wavelength accuracy, bandpass, absorbance, stray light error, linearity of response, repeatability and matching of cells
		On use	A blank and at least 2 points on the calibration curve to be checked
Spectroradiometer			-
All		On use	If not calibrating prior to use, a check on a working standard lamp is recommended. Additional checks may be required if the input geometry has been changed.
Array	Initial		Wavelength accuracy, bandpass, stray light error, spectral responsivity, linearity of response, repeatability
		6	Wavelength accuracy, spectral responsivity, linearity of response, repeatability
Scanning		6	Wavelength accuracy, bandpass, stray light error, linearity of response, repeatability
Spectrum and harmonic a	nalyser		
	1		Parameters to be calibrated dependant on use
Squareness tester			
	3 then 5 subsequent		
Square			·

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Try square	2 then 5 subsequent		
Block square	4 then 8 subsequent		
Straightedge - steel cast iron	3 then 6 subsequent		
Granite	4 then 8 subsequent		
Standard lamp - incandesc	ent		
Luminous flux, Luminous intensity, Illuminance	5		Or calibrate after each 20 hours burning period, whichever comes first
Spectral radiance, irradiance, relative measurements	10		Or calibrate after 50 hours burning period, whichever comes first
Spectral radiance, irradiance, absolute measurements	5		Or calibrate after 20 hours burning period, whichever comes first
Distribution temperature	10		Or calibrate after 50 hours burning period, whichever comes first
Standard lamp - LED	•		
Luminous flux, luminous intensity, illuminance	1		Calibration interval may be increased based on stability after several repeat calibrations
Surface plate			
Cast iron	3 then 6 subsequent		
Granite	4 then 8 subsequent		
Thermocouple			
			EURAMET cg-08
'Base metal' type, sheathed	2		For use up to 400°C. It is not recommended to recalibrate thermocouples used above 400°C
'Base metal' type, wire	2		For use up to 300°C. Replace if used above 300°C

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Stored reels	10		Reel of wire – 4 samples of wire from end points and middle of reel
'Rare metal' type	3		3 years or after 100 hours above 500°C whichever is sooner
Thermometer			
Reference, liquid-in-glass	10		
		Before use	Before use check at ice point General Accreditation Guidance: Liquid-in-glass thermometers - selection, use and calibration checks
Liquid-in-glass	5		
		6	Check at ice point General Accreditation Guidance: Liquid-in-glass thermometers - selection, use and calibration checks or against reference thermometer at 1 point in range
Resistance			NMI Monograph 11
-40°C to 250°C	5		
		6	Check resistance at ice point
<-40°C and >250°C	2		
		6	Check resistance at ice point
Measuring instrument AC bridge type	5		
Measuring instrument DC bridge type	2		
		6	Check at ice point
Reference, digital indicating systems, with or without a temperature/humidity sensor, hand held or bench type, single and multichannel	Initial		Calibrate against a reference temperature measuring system. For thermocouple type devices, check efficacy of automatic cold junction compensation with the temperature sensor at ice point.
	1		Calibrate against a reference measuring system

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
		6	Check at ice point
Time interval and frequenc	y standard		
Caesium and rubidium			Calibration program dependent on type and accuracy required. This may be as frequently as daily if needed.
Counter	1		
GPS receivers			Refer to Specific Accreditation Criteria: ISO/IEC 17025 Application Document, Calibration - Annex, Electrical metrology
Other oscillator			Calibration program dependent on type and accuracy required
Torque			
			ISO 6789-2 EURAMET cg-14
Standard (beam and mass)	4 then 8 subsequent		
Transducer	1		
		6	In house cross check of overlapping ranges
Transfer AC-DC standard			
	1 to 5		If only one is available. Interval dependent on established history and required uncertainty.
		6 to 12	Intercompare with appropriate level digital instruments, compare adjacent ranges and self-check
	4 to 8		If two are available. Interval dependent on established history and required uncertainty.
		12	Intercompare
Tricolorimeter	1	1	
		12	Check against calibrated colour filters or surfaces

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Velocity transducer			
	2		
		12	Check frequency response and sensitivity
Vibration calibrator			
	2		
Volt ratio box		I	
Refer to resistive voltage dividers (RVDs)			
Voltage dividers			
Inductive voltage dividers (IVDs)	10		Refer to instrument transformers and instrument transformer test sets
Resistive voltage dividers (RVDs)	1	6	
Ultraviolet lamp	·		
		During use	Monitor irradiance level
Viscometer	•		
U-tube viscometer - Reference	Initial	120	Against reference oils ASTM D2162
U-tube viscometer - Working	Initial		Using quality oils against reference tubes or using reference oils
		24	ASTM D2162/D445; IP 71
Brookfield	Initial, then every 2		Against reference oils. As well as the spindle number, the temperature of the test and the revolution per minute need to be reported.
		1	Against quality (i.e. manufacturers') oils.
Ferranti	Initial	3	Against reference oils
Zahn	Initial	12	Against reference oils

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Watthour and VAR-hour ret	ference		
Electronic	1 to 2		Interval dependant on required uncertainties and instrument history.
		3	Intercompare

References

This section lists publications referenced in this document. The year of publication is not included as it is expected that only current versions of the references shall be used.

Australian Standards

AS 1349	Bourdon tube pressure and vacuum gauges
AS 1545	Methods for the calibration and grading of extensometers
AS 1984	Vernier callipers (metric series)
AS 2001.1	Methods of test for textiles - Conditioning procedures
AS 2193	Calibration and classification of force-measuring systems
AS 2328	Micrometer heads - Metric series
AS 2360.1.5	Measurement of fluid flow in closed conduits - Pressure differential methods - Measurement using orifice plates, nozzles or Venturi meters - Pulsating flow, in particular sinusoidal or square wave intermittent periodic-type fluctuations
AS 4476	Acoustics—Octave-band and fractional-octave-band filters
AS IEC 60942	Electroacoustics - Sound calibrators
AS IEC 61672.1	Electroacoustics - Sound level meters - Specifications
AS IEC 61672.2	Electroacoustics - Sound level meters - Pattern evaluation tests
Other Standards	
ASTM D445	Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
ASTM D2162	Standard Practice for Basic Calibration of Master Viscometers and Viscosity Oil Standards
EA-10/13	EA Guidelines on the Calibration of Temperature Block Calibrators
IEC 1260	Electroacoustics - Octave Band and Fractional Octave Band
IEC 60068-1	Environmental testing. Part 1: General and guidance

IEC 60068-2-38	Environmental testing - Part 2-38: Tests - Test Z/AD: Composite temperature/humidity cyclic test
IEC 60068-2-39	Environmental testing - Part 2: Tests. Test Z/AMD: Combined sequential cold, low air pressure, and damp heat test
ISO 6789	Assembly tools for screws and nuts Hand torque tools Part 2: Requirements for calibration and determination of measurement uncertainty
IP 71:	Kinematic Viscosity of Transparent & Opaque Liquids
ISO/IEC Guide 99	International vocabulary of metrology - Basic and general concepts and associated terms (VIM)
ISO/IEC 17025	General Requirements for the competence of calibration and testing laboratories

NATA Publications

General Accreditation Criteria

Metrological traceability policy;

Equipment assurance, in-house calibration and equipment verification

General Accreditation Guidance

The in-situ calibration of barometers;

User checks of balance calibration;

Liquid-in-glass thermometers – selection, use and calibration checks;

Electronic measuring equipment as reference standards

Specific Accreditation Criteria

ISO/IEC 17025 Application Document, Calibration - Annex, Electrical metrology

Other Publications

NMI Monograph 11 Platinum Resistance Thermometry

NMI Monograph 4 The Calibration of Weights and Balances EC Morris and KMK Fen

Calibration of Pressure Calibrators, Indicators and Transducers, Test Method 1 - 2008, Metrology Society of Australia (MSA)

Calibration of Pressure Gauges, Test Method 2 - 2008, Metrology Society of Australia (MSA)

EURAMET calibration guides

EURAMET cg-15	Guidelines on the Calibration of Digital Multimeters
EURAMET cg-19	Guidelines on the Determination of Uncertainty in Gravimetric Volume Calibration
EURAMET cg-21	Guidelines on the Calibration of Standard Capacity Measures using the Volumetric Method

EURAMET cg-02	Calibration of Gauge Block Comparators
EURAMET cg-06	Extent of Calibration for Cylindrical Diameter Standards
EURAMET cg-10	Determination of Pitch Diameter of Parallel Thread Gauges by Mechanical Probing
EURAMET cg-22	Guidelines on the Calibration of Autocollimators
EURAMET cg-23	Guidelines on the Calibration of Angular Encoders
EURAMET cg-03	Calibration of Pressure Balances
EURAMET cg-04	Uncertainty of Force Measurements
EURAMET cg-14	Guidelines on the Calibration of Static Torque Measuring Devices
EURAMET cg-08	Calibration of Thermocouples
EURAMET cg-11	Guidelines on the Calibration of Temperature Indicators and Simulators by Electrical Simulation and Measurement
EURAMET cg-13	Guidelines on the Calibration of Temperature Block Calibrators
EURAMET cg-20	Guidelines on the Calibration of Temperature and / or Humidity Controlled Enclosures

Amendment table

The table below provides a summary of changes made to the document with this issue.

Section or Clause	Amendment
Acoustics and Velocity	Update of referenced Standards and harmonisation of recommended intervals for similar items.
Voltage dividers	 Distinction between inductive versus resistive voltage dividers added.