



Reference equipment - calibration and checks

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Reference equipment - calibration and checks

For NATA's policies on metrological traceability and equipment please refer to NATA Policy 11 Policy on Metrological Traceability and Policy Circular 12 NATA Policy on equipment assurance, in-house calibration and equipment verification.

The recommended calibration and checking intervals as presented in this table is to be used in conjunction with the guidance on establishing an equipment assurance program as found in the informative annex of Policy Circular 12.

General equipment table for reference use

Item of equipment	Calibration interval (years)	Checking interval (months)	General comments and example reference standards
Accelerometers			
Reference	5		
		24	Intercomparison.
Acoustic calibrators including Pistonphones and sound sources	1		AS/IEC 60942
		6	Intercompare
Acoustic attenuators	5		
		12	Check 2 ratios
Alignment telescopes	6		
Anemometers	1		
Angle gauges			
Reference	4 then 8 subsequent		
Working	2 then 4 subsequent		
Attenuators	3		Frequency Response
		12	Check two ratios. Resistance and return loss
Autocollimators	6		
Balances	3		<i>The Calibration of Weights and Balances</i> EC Morris and KMK Fen
		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, this requirement may be waived.
		6	Repeatability check. NATA Technical Note 13.
		1	One point check. NATA Technical Note 13.
		Each weighing	Zero point check.
Analogue band pass filters (sound & vibration)			
Octave and fractional	2		AS/NZA 4476, IEC 1260.
Barometers			
Fortin	Initial		

		60	One point check with transfer instrument. NATA Technical Note 8.
Aneroid	1		
Bridges - manual balance	5		
		12	Check against laboratory standards.
Callipers	2		AS 1984
		On use	Zero point, correct closure of jaws.
Capacitors	5		
		12	Intercompare
Colorimetric Integrating spheres	when reflectivity < 0.85		When reflectivity falls below 0.85 or 10 years which ever occurs first, replace paint or coating.
Comparators (dimensional)	3		
Cold reference junctions (ACJC)		12	Check against reference thermometer or comparison at ice point.
Current shunts	5		
DC Voltage references	1 to 2		Interval dependent on required uncertainty.
		3 to 6	Intercompare
Dimensional Measuring Machines			
Precision scales	10		
Geometric tests	5		
Micrometer heads	3		
Coordinate Measuring Machines (CMMs)	2		
		6	Intermediate volumetric check (e.g. ball bar).
Dividing Heads and rotary tables	5 then 10 subsequent		
Extensometer calibrators	5		AS 2328 and AS 1545
Electrical instruments			
Digital multimeters (DMM), and other types of meters which measure electrical parameters such as volts, resistance, current, capacitance, power, etc...	1		Calibrate over all ranges and parameters of use including calibration across frequency (Hz) of use.
		6	Compare with meters of similar resolution.
Analogue meters (see above)	1		

		6	Compare with meters of similar resolution.
Data loggers/chart recorders (see above)	1		
		6	Check at two points over the range.
Environmentally controlled enclosures including Incubators, Ovens, Furnaces, Conditioning enclosures (ageing), Refrigerators and freezers, water baths			
Temperature	1		Spatial uniformity, IEC 60068-1; 60068-2-38; 60068-2-39; AS 2853 over 3 points in the working range
	On use		Monitor temperature at at least one point
		36	Temperature distribution in the working zone at 3 temperatures over the operational range.
Humidity	1		
		12	Spatial uniformity of temperature
CO ₂	On use		Monitor level
Infra Red, Ultraviolet and Visible	1		
		On use	Check operation of the lamps
Pressure / Vacuum	1		Monitor level
Extensometer calibrators	5		
Digital signal analysers (sound & vibration)	5		
		12	
Flowmeters			
Differential Pressure meters, orifice meters, venturi meters and Anubar	2	6	Flow or dimensional calibration plus inspection for wear and damage. Pressure to be calibrated as appropriate.
Electronic Thermal, Mass Flow	1		Where high temperature or corrosive gases are monitored a shorter interval is recommended.
Laminar flow meters	2	6	Inspect for damage or contamination
Sonic Nozzle			
Reference 0.1%	3	6	Inspect and clean

Working 0.5%	6	6	Inspect and clean
Soap Film	2		
Positive Displacement Meters	2		
Provers	2	6	Thermometer ice points and pressure readout checks for stability
Rotary meter	2	6	Inspect for contamination or damage
Rotameters Variable area meters	2	3	Visual inspection for damage to float edges or ball float for pitting
Turbine meters	2	6	Inspect for contamination or damage of turbine blades
Turbine meters (Pelton Wheel/Miniature)	1		
Vortex shedding	2	6	Inspect for contamination of the bluff body
Wet test meters	2	Before use	Set water level before use
Gauge blocks			
Reference	4 then 8 subsequent		AS 1457
Haze standards			
Plastic	5		
Glass	10		
Height setting micrometers and riser blocks	3 then 6 subsequent		
Hydrometers			
Reference	5		AS 2026
Working glass	1		
Working metal	6 months		
Hygrometers			
(Assmann and sling psychrometers)	5		
		6	Compare thermometers at room temperature with wick dry. AS 2001.1 Appendix C
Thermohygrographs (hair)	1		
		Weekly	Check against a calibrated psychrometer.
Electronic types (e.g. digital psychrometer)	1		
Digital psychrometers (not electrical impedance sensors)	3		

		6	Check against a calibrated thermometer at ambient temperature.
Electrical impedance humidity probes	1		Can be 2 yearly if used only under ambient conditions.
Dew or frost point hygrometers	2		
Impedance matching networks (Acoustics)	5		
		12	
Inductors	5		
		12	Intercompare
Instrument and ratio transformers	10		Instrument transformers may be extended to 20 years with annual intercomparisons
Instrument transformer test sets	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 meters	2		
		3	Visual check
Length bars			
Reference	4 then 8 subsequent		AS 1457
Working	2 then 4 subsequent		AS 1457
Levels (precision)	4		
		12	12 monthly single point check for electronic levels
Linear scales (precision)	5 then 10 subsequent		
Load cells			
	2		AS 2193
		On day of use	If amplification is variable perform shunt calibration check.
Luminance meters and Illuminance meters			
Digital	1		
Analogue	2		
Manometers			
Reference and Working, liquid (mercury based)	10		
		36	Check the cleanliness of the fluid.

Reference and Working, liquid (liquid other than mercury)	3		
		18	Check the cleanliness of the fluid.
Electronic	1		
Masses			
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 comparators		6	Repeatability checks at full, half and minimum scale
Metals – Temperature reference			
Freezing fixed point	5		Calibration every 5 years.
Micrometers	5		AS 2102
		1	Zero, one point (against gauge block) and condition of anvils.
Micrometer setting gauges	3 then 6 subsequent		
Microphones (measuring)	2		Or whenever a 1 dB change is detected
		3	Check frequency response and sensitivity
Microphone amplifiers		12	Check frequency response and meter accuracy
Network Analysers	1		
Neutral density filters	10		
Noise analysers			
Integrated in firmware	Initial		No requirement where the analyser has already been type approved. Initial calibration required where instrument has not been type approved, or where firmware changes are made.
Optical flats	3 then 6 subsequent		
Optical parallels	3 then 6 subsequent		
Optical projectors	5		
Orifice plates	Initial	6	Visual check for wear and damage
Oscilloscopes		24	Time base and voltage scale accuracy.

Photodetectors			
Silicon cells	3		Linearity and and spectral
Others	5		Or when filter transmittances change significantly.
		12	Check spectral response with colour filters.
		6	Check linearity of response.
Photometric Integrating spheres	when reflectivity < 0.75		When reflectivity falls below 0.75 or 10 years which ever occurs first, replace paint or coating. Annual check of reflectivity.
Photometric test plate for luminance			
Ceramic or enamel	10		
Others	5		
All		36	Visual inspection
Pitch diameter reference discs	4 then 8 subsequent		
Polygons (precision)	5 then 10 subsequent		
Verification plates for plate readers	10		See photometric test plates.
Polilight (Or light source used with specific wavelength filters)		On use	Checked against reference material.
Potentiometers			
Laboratory type	5		
		12	Check standard cell.
Process Instrument Calibrators	1		Initial calibration should include an ACJC check at typical field use ambient temperatures
Pressure balances			
Dead weight testers with accuracy < 0.01%	3		
		12	Spin-rate
Dead weight testers with accuracy > 0.01%	5		
		12	Spin-rate
Pressure equipment			
			In addition to AS 1349, facilities may also use methods detailed in the Metrology Society of Australia publications MSA 1 and MSA 2
Test gauges used for calibration of industrial gauges	1		AS 1349 for Bourdon tube types

Industrial gauges not subject to shock loading	1		AS 1349 for Bourdon tube types
Industrial gauges subject to shock loading.	6 months		AS 1349 for Bourdon tube types
Digital pressure gauges	1		
Pressure transducers	1		
Pressure transmitters	1		
Calibrators	1		
Quartz control plates	Initial		
Disappearing filament pyrometers	3		
Radiation thermometers including visible and infrared pyrometers	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 sources	2		Either calibration of the measured radiance temperature in a specified waveband, or, calibration of the monitor sensor together with blackbody cavity uniformity assessment.
Pyrgeometers	3		
Pyrheliometers			
Reference	3		
Working		6	Check against reference.
Quartz control plates	Initial		Visual check before use.
Radioactive reference material			
Neutron, X-rays, Gamma	5	12	
Radioactive reference material			
Neutron, X-rays, Gamma	5	12	
Radiometers (Thermal)	2 or after 100 tests		
		3	Against know radiant heat source
Reference ballasts Lighting tests	5		
Refractometers		On use	Check against distilled water.
Reference glass filters, spectrophotometry, colourimetry, luminous transmittance, neutral density,	10		
Reference tiles			

Plastic and PTFE	3		
Ceramic	10		
Gloss - glass, ceramic	10		
Reference Haze standards			
Plastic	5		
Glass	10		
Refractive index standards			
Liquid	5		
		Before use	Check for contamination.
Solid	Initial		
		Before use	Visual examination.
Resistors	5		
		12	Intercompare
RF power meters	3		
		6	Intercompare
			Check VSWR
RF thermister mounts and thermal converters	3		
		6	Intercompare
Rollers and balls	4 then 8 subsequent		
Roughness standards			
Metal	4		
		12	Microscopic inspection
Glass	Initial		
		12	Microscopic inspection
Roundness standards	5 then 10 subsequent		
Screw check plugs for ring gauges	3 then 6 subsequent		
Screw pitch reference standards	3 then 6 subsequent		
Screw thread measurement cylinders and vee pieces	Initial		
		12	Visual inspection
Secondary standard dosimeters (Ionising Radiation)	3	Before use	
Setting cylinders	3 then 6 subsequent		

Setting rings	3 then 6 subsequent		
Shunts	5		
		12	Intercompare
Sine bars, centres and tables	3 then 6 subsequent		
Squareness testers	3 then 5 subsequent		
Squares			
Try squares	2 then 5 subsequent		
Block squares	4 then 8 subsequent		
Straightedges, steel/cast iron	3 then 6 subsequent		
Granite	4 then 8 subsequent		
Standard lamps			
Luminous flux, Luminous intensity, Illuminance	5		Or after each 20 hours burning period, whichever comes first.
Spectral radiance, irradiance, relative measurements	10		Or after 50 hours burning period, whichever comes first.
Spectral radiance, irradiance, absolute measurements	5		Or after 20 hours burning period, whichever comes first.
Distribution temperature	10		Or after 50 hours burning period, whichever comes first.
Surface plates			
Cast iron	3 then 6 subsequent		
Granite	4 then 8 subsequent		
Signal generators	1		When used in isolation to provide reference signals.
Sound level meter and Noise dosimeters	2		.
		On use	Check against acoustic calibrator or pistonphone.
Sound power source	5		
Spectrophotometers and Spectroradiometers		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 must be checked.

Spectrum and harmonic analysers	1		Parameters to be calibrated dependant on use.
Thermocouples			
'Base metal' type, sheathed	2		For use up to 400°C. For use from 400°C to 1300 °C the same immersion depth must always be used (or a greater depth of immersion). Homogeneity must be assessed as part of their recalibration.
'Base metal' type, wire	2		For use up to 300° C. Replace if used above 300° C.
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.
Dry block calibrators	1		EA – 10/13
Thermometers			
Reference, liquid-in-glass	10		
		Before use	Before use check at ice point. NATA Technical Note 19.
Liquid-in-glass	5		
		6	Check at ice point. NATA Technical Note 19 OR against reference thermometer at 1 point in range
Resistance			Calibrate to Handbook of Temperature Measurement Vol 2.
-40°C to 250°C	5		
		6	Check at ice point.
<-40°C and >250°C	2		
		6	Check resistance at ice point.
Measuring instrument AC Bridge type, Reference and Working	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.
		6	Check at ice point.
Working Digital indicating systems, with or without a temperature sensor, hand held or bench type, single and multichannel. (Includes temperature loggers)	2		
		6	Check against a reference device at the temperature of use. If used at more than one temperature, choose the most critical temperature. Check at ice point if the facility does not have a reference device. (For data loggers the reference device can not be another data logger of the same type).
Time interval and frequency standards			
Caesium and Rubidium			Calibration regime dependent on type and accuracy required. This may be as frequently as daily if needed.
Other oscillators			Calibration regime dependent on type and accuracy required.
Counters	1		
GPS receivers			See Calibration Application Document for GPS policy.
Torque			
Standards – beams and masses	4 then 8 subsequent		
Transducers	1		
		6	In house cross check of overlapping ranges
Transfer standards AC-DC			
	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
Tricolorimeters		12	Check against calibrated colour filters or surfaces.
Vibration calibrators	2		
Velocity transducers	3		
		24	Check frequency response and sensitivity
Vibration calibrators	2		
Voltage dividers	5		
Volt ratio boxes	5		
		12	Intercompare
Viscometers			
Ultraviolet lamps		During use	Monitor irradiance level.
U-tube			
Reference	Initial	120	Against reference oils. ASTM D2162
Working	Initial		Using quality oils against reference tubes or using reference oils.
		24	ASTM D2162/D445; IP 71
Others			
Brookfield	Initial, then every 2		Against reference oils. Note: As well as the spindle number, laboratories need to report the temperature of the test and the revolution per minute.
		1	Against quality (ie. manufacturers') oils.
Ferranti	Initial	3	Against reference oils.
Zahn	Initial	12	Against reference oils.
Watt-hour and VAR-hour references			
Electro-mechanical	2		
		3	Intercompare
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 1457	Geometrical Product Specifications (GPS) - Length standards - Gauge blocks
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 2026	Laboratory glassware - Density hydrometers
AS 2102	Micrometer callipers for external measurement
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 2853	Enclosures - Temperature-controlled - Performance testing and grading
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;

- 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

- NATA Policy Circular 11 Policy on Metrological Traceability
NATA Policy Circular 12 NATA Policy on equipment assurance, in-house calibration and equipment verification
NATA Technical Note 8 The in-situ calibration of Barometers
NATA Technical Note 13 User Checks of Balance Calibration
NATA Technical Note 19 Liquid-in-Glass Thermometers – Selection, Use and Calibration Checks

Other Publications

- The Calibration of Weights and Balances* EC Morris and KMK Fen
Calibration of Pressure Calibrators, Indicators and Transducers Metrology Society of Australia MSA Test Method 1 - 2008
Calibration of Pressure Gauges Metrology Society of Australia MSA Test Method 2 - 2008

Amendment Table

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

Section or Clause	Amendment
Forward	Updated in accordance with Policy Circular 12