



EQUIPMENT CALIBRATION AND VERIFICATION

Equipment and apparatus used in testing materials must be calibrated or verified for accuracy on a regular basis to assure the equipment is giving reliable results.

Materials Group, Quality Assurance Section, has developed a listing of requirements, frequency, and the applicable test methods for the calibration and verification of various types of equipment. The listing provided is not intended to address the calibration or verification of all equipment. Appendix A3 contains the following figures:

Figure Number	Figure Title
1	General Laboratory Testing Equipment
2	Aggregates Testing Equipment
3	Asphalt Binder/Cutback Asphalt/Emulsified Asphalt Testing Equipment
4	Asphalt Mixtures Testing Equipment
5	Soils Testing Equipment
6	Soils Testing Equipment (Continued)
7	Portland Cement Concrete Testing Equipment
8	Metal Testing Equipment
9	Equipment Maintenance

Test methods and standards referenced in the figures contained in Appendix A3 are identified as follows:

AZ	Arizona Test Methods
T, M, and R	AASHTO Test Methods and Standards
C, D, and E	ASTM Test Methods and Standards

Related information on the calibration and verification of apparatus can be found in AASHTO R 18, "Establishing and Implementing a Quality System for Construction Materials Testing Laboratories".

Maximum frequency intervals shown in the following figures may be reduced based on specific laboratory conditions, deterioration of equipment, frequency of use, and other contributing factors.

Equipment and apparatus that may be affected by movement must be recalibrated after relocation.

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GENERAL LABORATORY TESTING EQUIPMENT

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)
Mechanical Shakers	Check Sieving Thoroughness.	12
Ovens	Standardize Thermometric Device.	12
Sieves	Fine Sieves (openings < No.4) Check Physical Condition	12
	Coarse Sieves (openings ≥ No.4) Check Physical Condition and Dimensions of Openings.	
Specimen Molds	Check Critical Dimensions.	12
General Purpose Balances and Masses	Standardize	12
Thermometers, including Digital Thermistors	Standardize	12
Analytical Balances and Masses	Calibrate	12
Calipers	Standardize	12
Vacuum/Pressure Measurement Devices (Bourdon Gauges, Pressure Manometer, and Electronic Pressure Transducers)	Standardize	12
Length Measurement Devices (Dial Indicators, LDT's, LVDT's, and Extensometers)	Standardize	12
Compression, Loading, or Tensile Testing Devices	Standardize	12
Constant Temperature Baths	Check Temperature Settings.	12

FIGURE 1

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AGGREGATES TESTING EQUIPMENT

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)	TEST METHOD
Unit Weight Apparatus	Standardize	12	T 19, C 29
Sulfate Oven	Check Rate of Evaporation.	12	T 104, C 88
Sulfate Soundness Sample Containers	Check Physical Condition.	12	T 104, C 88
L.A. Abrasion Machine	Check RPM and Critical Dimensions.	24	T 96, C 131
Steel Balls for Abrasion Machine	Check Individual Weight and Charge Weight.	24	T 96, C 731
Conical Mold and Tamper	Check Critical Dimensions.	24	AZ 211, T 84, C 128

FIGURE 2

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ASPHALT BINDER/CUTBACK ASPHALT/EMULSIFIED ASPHALT TESTING EQUIPMENT

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)	TEST METHOD
Saybolt Viscometer	Standardize	36	T 59, D 244, T 72
Timing Devices	Standardize	12	T 49, D 5
Penetrometer Needle	Check Condition and Critical Dimensions.	12	T 49, D 5
Penetrometer	Standardize for Penetration Depth.	12	T 49, D 5
Ductility Apparatus	Check Speed of Travel.	12	T 51, D 113
Elastic Recovery Apparatus	Check Speed of Travel.	12	T 301, D 6084
RTFO Carriage	Check Rotation Speed.	12	T 240, D 2872
Brass Rings and Assembly	Check Critical Dimensions.	12	T 53, D 36
Pycnometers	Check Physical Condition and Standardize Volume.	12	T 228, D 70
Collars and Floats	Check Critical Dimensions.	12	T 50, D 139
Pressurized Aging Vessel	Standardize Temperature and Pressure.	6	R 28, D 6521
Rotational Viscometer	Standardize with Reference Fluid.	6	T 316, D 4402
Dynamic Shear Rheometer (DSR)	Standardize with Reference Fluid.	6	T 315, D 7175
Bending Beam Rheometer (BBR)	Calibrate Masses.	12	T 313, D 6648
Kinematic Viscometer Tubes	Calibrate with Reference Fluid.	36	T 201, D 2170

FIGURE 3

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ASPHALT MIXTURES TESTING EQUIPMENT

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)	TEST METHOD
Mechanical Compaction Hammers, Breaking Heads	Check Critical Dimensions, Check Mass of Hammer.	12	AZ 410, AZ 815, T 245, T 283, D 4867, D 6926, D 6927
	Monitor Through Proficiency Sample Program.	Per proficiency sample frequency.	
Manual Compaction Hammers, Breaking Heads	Check Critical Dimensions, Check Mass of Hammer.	12	AZ 410, AZ 815, T 245, T 283, D 4867, D 6926, D 6927
Marshall Stability/Flow Testing Machine	Check Speed of Travel, Verify Load Cell.	12	AZ 410, AZ 422, AZ 815, T 245, T 283, D 4867, D 5581, D 6926, D 6927
Plungers	Check Critical Dimensions.	12	AZ 802, T 165, T 176, D 1074
Gyratory Compactor	Standardize Ram Pressure, Frequency of Gyration, LVDT.	12	T 312, D 6925
Gyratory Compactor	Standardize External or Internal Angle of Gyration.	12	T 312, D 6925
Ram Face, Base Plate Face	Check Critical Dimensions.	12	T 312, D 7115
Ignition Oven Internal Balance	Standardize	12	AZ 427, T 308, D 6307
Rice Flasks	Calibrate Volume.	12	AZ 417, AZ 806, T 209
Nuclear Asphalt Content Gauge	Check Variability using 3 - Point Calibration.	12	AZ 421

FIGURE 4

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SOILS TESTING EQUIPMENT

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)	TEST METHOD
Mechanical Compactor	Check Rammer Face Diameter and Height of Drop.	12	AZ 225, AZ 226, AZ 232, AZ 245, AZ 246, T 99, T 134, T 135, T 180, D 558, D 559, D 698, D 1557
	Monitor Through Proficiency Sample Program.	Per proficiency sample frequency.	
Manual Hammer	Check Critical Dimensions.	12	AZ 225, AZ 226, AZ 232, AZ 245, AZ 246, T 99, T 134, T 135, T 180, D 558, D 559, D 698, D 1557
Liquid Limit Device	Check Wear and Critical Dimensions.	12	T 89, D 4318
Grooving Tool	Check Critical Dimensions.	12	T 89, D 4318
Hydrometers	Check Critical Dimensions.	24	T 88, D 422
Straightedge	Check Dimensions and Planeness of Edge.	12	AZ 225, AZ 245, T 99, T 134, T 135, T 136, T 180, D 558, D 559, D 560, D 698, D 1557
Weighted Foot Assembly	Check Mass.	12	AZ 242, T 176, D 2419
CA Kneading Compactor	Standardize	24	T 190, D 2844
Standard Metal Specimen	Check Outside Diameter.	12	T 190, D 2844
Metal Follower	Check Diameter.	12	T 190, D 2844

FIGURE 5

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SOILS TESTING EQUIPMENT (CONTINUED)

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)	TEST METHOD
Vertical Load	Standardize	12	AZ 249, T 216, T 236, D 2435, D 3080, D 4829
Uncompacted Void Content Apparatus	Check Critical Dimensions and Calibrate Volume.	12	AZ 247, C 1252
Resistivity Apparatus	Check Resistivity.	12	AZ 236
pH Meter	Standardize	12	AZ 236, AZ 237
Flat and Elongated Proportional Caliper Device	Check Critical Dimensions.	12	D 4791
Flakiness Index Slotted Sieves	Check Critical Dimensions.	12	AZ 233
Fine Aggregate Specific Gravity Flask	Calibrate Volume.	12	AZ 211, T 84, C 128
Coarse Aggregate Specific Gravity Apparatus	Check Wire Diameter, Basket Type, and Water Tank.	12	AZ 210, T 85, C 127
Speedie Moisture Tester	Verify Scale and Gauge.	6	T 217
Standard Sand	Check Each New Shipment for Conformance to C 778.	---	C 778
Sand Cone Density Apparatus	Standardize	12	AZ 229, AZ 230

FIGURE 6

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PORTLAND CEMENT CONCRETE TESTING EQUIPMENT

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)	TEST METHOD
Unit Weight Measures	Standardize	12	T 121, C 138
Air Meters (Pressure Type)	Standardize	3 (See Note)	T 152, C 231
Air Meters (Volumetric Type)	Standardize	12 (See Note)	C 173
Note: The individual test methods specify conditions that require restandardization, such as changes in elevation and rough handling.			
Capping Material	Check Strength.	3	T 231, C 617
Slump Cones and Rods	Check Critical Dimensions.	12	T 119, C 143
Single-Use Concrete Cylinder Molds	Check Critical Dimensions of each Shipment.	- - -	T 22, T 23, C 31, C 39
Cylinder Capping Plates	Check Critical Dimensions.	12	T 231, C 617
Recording Thermometer	Standardize	6	C 31, C 39
Autoclave Apparatus	Check Critical Dimensions, Calibrate Valve and Gauge.	12	T 107, M 210, C 151
Rebound Hammer (Swiss Hammer)	Standardize	6	C 805
Moist Room (Fog Room)	Verify Temperature and Humidity with Recording Thermometer.	6	M 201, C 511
Cube Molds and Tampers	Check Critical Dimensions and Physical Condition	30	T 106, C 109

FIGURE 7

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METAL TESTING EQUIPMENT

EQUIPMENT	REQUIREMENT	MAX. INTERVAL (Months)	TEST METHOD
Rockwell Hardness Tester	Standardize	12	E 18

FIGURE 8

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EQUIPMENT MAINTENANCE

EQUIPMENT	MAX. INTERVAL (Months)	TEST METHOD
Performance-Graded Binder Equipment	12	R 58, T 240, T 313, T 314, T 315, D 2872, D 6521, D 6648, D 6723, D 7175
Ductilometers	12	T 51, T 300, T 301, D 113, D 6084
Mechanical Marshall Compactors	12	T 245
California Kneading Compactors	12	T 247, T 190, D 1561, D 2844
Gyratory Compactors	12	T 312, D 6925
Mechanical Compactors	12	T 99, T 180, D 698, D 1557
Mechanical Shakers	12	Where Applicable.
NOTE: There may be more items added to the laboratory's list of equipment that require maintenance. Maintenance activities will typically involve lubricating, tightening fittings, cleaning, replacing fluids, checking and replacing damaged or worn parts, etc. These activities will vary based on the type of equipment, how often the equipment is used, the manufacturer's recommendations, etc.		

FIGURE 9