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## Test Procedure for

# MINIMUM STANDARDS FOR ACCEPTANCE OF A LABORATORY FOR HOT MIX TESTING



TxDOT Designation: Tex-237-F

Effective Date: November 2016

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## 1. SCOPE

- 1.1 Use this procedure to determine if a laboratory meets the minimum standard for hot mix testing. In addition to requirements shown below, each piece of apparatus required to perform each test method must be available in the laboratory.
  - 1.2 The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.
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## 2. DOCUMENTATION

- 2.1 Laboratories are required to maintain calibration records for all calibrated or verified equipment in paper or electronic format or through Calibration Manager (CalMgr). Miscellaneous items such as trowels, pans, scoops, spatulas, straightedges, funnels, brushes, and containers are excluded.  
**Note 1**—The Materials and Pavements Section of the Construction Division (CST/M&P) maintains CalMgr equipment calibration worksheet templates. To request copies, contact CST/M&P at (512) 506-5821.
  - 2.1.1 Records must include the following information for each piece of equipment:
    - description of equipment,
    - serial number or other ID,
    - frequency of calibration,
    - calibrating technician,
    - date of calibration,
    - date of last calibration,
    - date of next calibration,
    - procedure used to calibrate equipment, and
    - detailed results of calibration work.
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### 3. REQUIREMENTS

#### 3.1 Moved Equipment:

3.1.1 In addition to the intervals specified below, the following equipment must be re-calibrated or verified each time it is moved prior to being used again: balances/scales, gyratory presses, compression machines, thermometers (check for broken mercury column), and ovens.

#### 3.2 Sieves:

3.2.1 The results of annual Proficiency Sample Program results for Hot Mix Asphalt are no longer acceptable in lieu of sieve dimensional measurement.

**Table 1—Tex-200-F, “Sieve Analysis of Fine and Coarse Aggregates”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 10,000 g	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 200°F (93°C), or suitable microwave oven	Verify temperature settings	Tex-927-K	12
Mechanical sieve shaker	Verify sieving thoroughness	2	12
Set of standard U.S. sieves	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>

**Table 2—Tex-201-F, “Bulk Specific Gravity and Water Absorption of Aggregate”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 10,000 g	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 200°F (93°C), hot plate, gas burner, or suitable microwave oven	Verify temperature settings	Tex-927-K	12
Mercury thermometer capable of measuring the temperature specified in the test procedure and marked in 1°F (0.5°C) divisions	Verify accuracy	3	12
Set of standard U.S. sieves	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>

**Table 3—Tex-202-F, “Apparent Specific Gravity of Material Finer than No. 50 (300 µm) Sieve”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G1, minimum capacity of 1000 g	Verify calibration records	Tex-901-K	12
Drying oven, capable of attaining a temperature of 200°F (93°C) or more	Verify temperature settings	Tex-927-K	12
Mercury thermometer, marked in 5°F (3°C) divisions or less, or digital thermometer capable of measuring the temperature in the test procedure	Verify accuracy	3	12
Aspirator or vacuum pump	Verify vacuum	7	12
Desiccator	Verify availability	---	---
Constant temperature water bath at 73°F (23°C) or other selected temperature	Verify temperature settings	1	4

**Table 4—Tex-203-F, “Sand Equivalent Test”**

Equipment	Requirements	Procedure	Interval (Months)
Set of standard U.S. sieves	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>
Drying oven, capable of maintaining 60 ± 3°C (140 ± 5°F) and 110 ± 5°C (230 ± 9°F)	Verify temperature settings	Tex-927-K	12
Agitator tube—brass, stainless steel, or copper, with 1/4 in. (6.3 mm) outside diameter and approximately 20 in. (500 mm) long, with one end closed to form a wedge-shaped tip. Two holes (drill size 60) are drilled laterally through the flat side of the wedge near the tip.	Verify hole sizes	---	---
Weighted foot assembly with a total weight of 35 ± 0.175 oz. (1000 ± 5 g)	Verify weight	4	12

**Table 5—Tex-205-F, “Laboratory Method of Mixing Bituminous Mixtures”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 10,000 g	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 325 ± 5°F (163 ± 3°C)	Verify temperature settings	Tex-927-K	12
Mercury thermometer, marked in 5°F (3°C) divisions or less, or digital thermometer capable of measuring the temperature in the test procedure	Verify accuracy	3	12

**Table 6—Tex-206-F, “Compacting Specimens Using the Texas Gyrotory Compactor (TGC)”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 10,000 g	Verify calibration records	Tex-901-K	12
Motorized gyrotory-shear molding press	Verify pressure and measure gyration angle	Tex-914-K	12
Molding assembly, consisting of gyrotory-shear mold, base plate, and wide-mouthed funnel	Check for wear and verify calibration sticker	11	4
Mercury thermometer, marked in 5°F (3°C) divisions or less, or digital thermometer capable of measuring the temperature in the test procedure	Verify accuracy	3	12
Oven, capable of attaining a temperature of at least 325 ± 5°F (163 ± 3°C)	Verify temperature settings	Tex-927-K	12

**Table 7—Tex-207-F, “Determining Density of Compacted Bituminous Mixtures”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 10,000 g, equipped with suitable apparatus to permit weighing specimen while suspended in water	Verify calibration records	Tex-901-K	12
Water bath for immersing specimen in water while suspended, equipped with an overflow outlet for maintaining a constant water level	Verify availability	1	---
Vacuum device	Verify pressure	7	12
Mercury thermometer, marked in 2°F (1°C) divisions or less, or digital thermometer capable of measuring the temperature in the test procedure	Verify accuracy	3	12
Drying oven, capable of attaining the temperature specified in the test procedure	Verify temperature settings	Tex-927-K	12
Nuclear density gauge, (with manufacturer's instruction manual and sample pans), able to determine the asphalt content of a sample containing between 0% and 14% asphalt cement	Verify availability	---	---
Electrical impedance (nonnuclear) density measurement gauge (optional)	Verify availability	---	---

**Table 8—Tex-208-F, “Test for Stabilometer Value of Bituminous Mixtures”**

Equipment	Requirements	Procedure	Interval (Months)
Hveem stabilometer, with adjustable stage	Verify calibration records	12	12
Compression testing machine, with a minimum capacity of 10,000 lb. (45,000 N) capable of applying a vertical load at a rate of 0.05 in. (1.27 mm) per minute	Verify calibration records	Tex-902-K	12
Oven, capable of attaining a temperature of at least 140 ± 5°F (60 ± 3°C)	Verify temperature settings	Tex-927-K	12
<b>Follower</b>	<b>Verify critical dimensions</b>	<b>18</b>	<b>12</b>
<b>Calibration cylinder</b>	<b>Verify critical dimensions</b>	<b>19</b>	<b>12</b>

**Table 9—Tex-210-F, “Determining Asphalt Content of Bituminous Mixtures by Extraction”**

Equipment	Requirements	Procedure	Interval (Months)
<b>Part I—Centrifuge Extraction Method Using Chlorinated Solvent</b>			
Balance, Class G1, <b>minimum capacity of 4000 g</b>	Verify calibration records	Tex-901-K	12
Balance, Class G2, <b>minimum capacity of 4000 g</b>	Verify calibration records	Tex-901-K	12
Drying oven, capable of attaining a temperature of at least 200°F (93°C), and vented to the outside	Verify temperature settings	Tex-927-K	12
Ventilation system for asphalt mix control laboratories	Check for compliance	5	---
Centrifugal extractor, motorized, with explosion-proof features, consisting of a bowl mounted in an assembly so that the bowl revolves at a controlled speed	Verify availability	---	---
Filter paper to fit the rim of the bowl and having a 20–25 µm retention factor	Verify retention by calling Flexible Pavements Branch or manufacturer	6	---
Extraction Solvent: 1,1,1 Trichlorethylene or methylene chloride	Verify availability	---	---
<b>Part II—Vacuum Extraction Method</b>			
Balance, Class G2, <b>minimum capacity of 4000 g</b>	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 200°F (93°C), and vented to the outside	Verify temperature settings	Tex-927-K	12
Ventilation system for asphalt mix control laboratories	Check for compliance	5	---

Equipment	Requirements	Procedure	Interval (Months)
Vacuum extractor complete with vacuum pump. A vane-type vacuum pump is recommended. An exhaust hose is required for the vacuum pump to carry fumes to immediately in front of the exhaust fan of the ventilation system.	Verify availability	7	---
Filter paper, size 13 in. (331 mm) on having a 20–25 µm retention factor	Verify retention by calling Flexible Pavements Branch or manufacturer.	6	---
Extraction Solvent: 1,1,1 Trichlorethylene or methylene chloride	Verify availability	---	---
<b>Part III—Centrifuge Extraction Method Using Non-Chlorinated Solvent</b>			
Balance, Class G1, minimum capacity of 4000 g	Verify calibration records	Tex-901-K	12
Balance, Class G2, minimum capacity of 4000 g	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 200°F (93°C), and vented to the outside	Verify temperature settings	Tex-927-K	12
Ventilation system for asphalt mix control laboratories	Check for compliance	5	---
Centrifugal extractor, motorized, with explosion-proof features, consisting of a bowl mounted in an assembly so that the bowl revolves at a controlled speed	Verify availability	---	---
Filter paper to fit the rim of the bowl and having a 20–25 µm retention factor.	Verify retention by calling Flexible Pavements Branch or manufacturer	6	---
Glass fiber filter paper, Whatman GF/F 5-in. (12.5-cm) glass micro fiber filters or equivalent	Verify retention	6	---
Buchner filter funnel, Coors porcelain Buchner funnel, 5-in. (126-mm) internal diameter	Verify availability	---	---
Vacuum pump, with an exhaust hose to carry fumes to immediately in front of the exhaust fan of the ventilation system	Verify availability	7	---
Biodegradable extraction solvent meeting the requirements of the Department’s specification for non-chlorinated extraction solvent for bituminous mixtures NOTE: See Section 5.	Verify availability	---	---
<b>Part IV—Vacuum Extraction Method Using Non-Chlorinated Solvent</b>			
Balance, Class G2, minimum capacity of 4000 g	Verify calibration records	---	12
Oven, capable of attaining a temperature of at least 200°F (93°C), and vented to the outside	Verify temperature settings	Tex-927-K	12

Equipment	Requirements	Procedure	Interval (Months)
Ventilation system for asphalt mix control laboratories	Check for compliance	5	---
Vacuum extractor complete with vacuum pump. A vane-type vacuum pump is recommended. An exhaust hose is required for the vacuum pump to carry fumes to immediately in front of the exhaust fan of the ventilation system.	Verify availability	7	---
Filter paper, size 13 in. (33 mm), 20–25 µm retention factor.	Verify retention, by calling CST/M&P’s Flexible Pavements Branch or manufacturer	6	---
Diatomaceous silica filtering aid (Celite 110 or equivalent) (Optional)	Verify availability	---	---
Biodegradable extraction solvent meeting the requirements of the Department’s specification for non-chlorinated extraction solvent for bituminous mixtures NOTE: See Section 5.	Verify availability	---	---

**Table 10—Tex-211-F, “Recovery of Asphalt from Bituminous Mixtures by the Abson Process”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2	Verify calibration records	Tex-901-K	12
Centrifuge, capable of handling two 8-oz. (237-mL) wide-mouth bottles at 770 times gravity at approximately 2200 rpm	Verify speed	13	12
Distillation assembly, heating mantle on ring stands, three-neck distillation flasks with 17 oz. (500 mL) capacity, glass boiling flask with 101 oz. (3000 mL) capacity, and tin cans with 3 oz. (89 mL) capacity	Verify availability	---	---
Condenser, glass-tube type, having a condenser jacket approximately 16 in. (400 mm) long	Verify availability	---	---
Mercury thermometer marked in 1°F (0.5°C) divisions, or digital thermometer, capable of measuring the temperature in the test procedure	Verify accuracy	3	12
Aeration tube assembly for primary and final distillation to insert Carbon Dioxide Gas for the test procedure	Verify availability	---	---
Gas flow meter capable of indicating a gas flow up to 34 oz. (1000 mL) per minute	Verify flow	14	12

Equipment	Requirements	Procedure	Interval (Months)
A system of tubing for passing water continuously through condenser	Verify availability	---	---

**Table 11—Tex-212-F, “Determining Moisture Content of Bituminous Mixtures**

Equipment	Requirements	Procedure	Interval (Months)
<b>Part I—Moisture Content by Distillation</b>			
Balance, Class G2	Verify calibration record	Tex-901-K	12
Metal still, consisting of a vertical cylindrical container approximately 5 in. (127 mm) in diameter and 6 in. (152 mm) deep, with removable lid, fiber gasket or O-ring, and clamping system. There must be two holes in the lid, each approximately 1 in. (25 mm) in diameter, to provide for entrance of the water trap-condenser assembly and a safety valve.	Verify availability	---	---
Moisture trap, 0.85 oz. (25 mL) capacity, graduated in 0.0034-fl. oz. (0.1-mL) divisions and equipped with cork or rubber stoppers	Verify availability	---	---
Condenser, Liebig glass-tube type, with a condenser jacket approximately 16 in. (400 mm) long	Verify availability	---	---
System of tubing for passing water continuously through condenser	Verify availability	---	---
<b>Part II—Moisture Content by Drying Oven</b>			
Balance, Class G2	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 200°F (93°C) or more, or suitable microwave oven	Verify temperature setting	Tex-927-K	12

**Table 12—Tex-213-F, “Determining Hydrocarbon-Volatile Content of Bituminous Mixtures**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2	Verify calibration records	Tex-901-K	12
Metal still, consisting of a vertical cylindrical container approximately 5 in. (127 mm) in diameter and 16 in. (52 mm) deep, with removable lid, fiber gasket, or O-ring, and clamping system. There must be two holes in the lid, each	Verify availability	---	---

Equipment	Requirements	Procedure	Interval (Months)
approximately 1 in. (25 mm) in diameter, to provide for entrance of the water trap-condenser assembly and a safety valve.			
Volatile trap, 0.2 oz. (5 mL) capacity, graduated in 0.0034-fl. oz. (0.1-mL) divisions and equipped with cork or rubber stoppers	Verify availability	---	---
Condenser, Liebig glass-tube type, having a condenser jacket approximately 16 in. (400 mm) long	Verify availability	---	---
System of tubing for passing water continuously through condenser	Verify availability	---	---

**Table 13—Tex-215-F, “Determining Asphalt Content of Rock Asphalt by Hot Solvent Extraction”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2	Verify calibration records	Tex-901-K	12
Oven, capable of maintaining 140–230°F (60–110°C)	Verify temperature setting	Tex-927-K	12

**Table 14—Tex-216-F, “Aggregate Retention Test”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2	Verify calibration records	Tex-901-K	12
Oven, capable of maintaining 140–230°F (60–110°C)	Verify temperature setting	Tex-927-K	12

**Table 15—Tex-217-F, “Determining Deleterious Material and Decantation Test for Coarse Aggregates (Bituminous Mixtures)”**

Equipment	Requirements	Procedure	Interval (Months)
<b>Part I—Determining Deleterious Material in Coarse Aggregates</b>			
Balance, Class G2, minimum capacity of 4000 g	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 200 ± 5°F (93 ± 3°C)	Verify temperature setting	Tex-927-K	12
Set of standard U.S. sieves	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>

Equipment	Requirements	Procedure	Interval (Months)
<b>Part II—Decantation Test for Coarse Aggregates</b>			
Balance, Class G2, minimum capacity of 4000 g	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 200 ± 5°F (93 ± 3°C)	Verify temperature setting	Tex-927-K	12
Mechanical sieve shaker	Verify sieving thoroughness	2	12
Set of standard U.S. sieves meeting the requirements of Tex-907-K	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>
<b>Part III—Determining Deleterious Material in Recycled Asphalt Shingles (RAS)</b>			
Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 5000 g	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature of at least 140 ± 5°F (60 ± 3°C)	Verify temperature setting	Tex-927-K	12
Mechanical sieve shaker	Verify sieving thoroughness	2	12
Set of standard U.S. sieves	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>

**Table 16—Tex-220-F, “Determining Percentages of White Rock Contained in Native Rock Asphalt”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2	Verify calibration records	Tex-901-K	12
Oven, capable of attaining a temperature range of of 105–230°F (40–100°C)	Verify temperature setting	Tex-927-K	12

**Table 17—Tex-224-F, “Determining Flakiness Index”**

Equipment	Requirements	Procedure	Interval (Months)
Oven, capable of attaining a temperature of at least 100°F (38°C)	Verify temperature setting	Tex-927-K	12
Set of standard U.S. sieves	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>
Metal Thickness Gauge, made of 12 gauge carbon steel sheet, with three sized slots cut into it	Verify physical condition	15	12

**Table 18—Tex-226-F, “Indirect Tensile Strength Test”**

Equipment	Requirements	Procedure	Interval (Months)
Loading press capable of applying compressive load at a controlled deformation rate of 2 in. (51 mm) per minute	Verify calibration records	Tex-901-K	12
Loading strips consisting of 0.75 × 0.75 in. (19 × 19 mm) square steel bars. Machine the surface in contact with the specimen to the curvature of the test sample.	Verify conformity of loading strips	---	---

**Table 19—Tex-227-F, “Theoretical Maximum Specific Gravity of Bituminous Mixtures”**

Equipment	Requirements	Procedure	Interval (Months)
<b>Part I—Using Hand-Held Glass Pycnometer</b>			
Balance, Class G2, minimum capacity of 2500 g	Verify calibration records	Tex-901-K	12
Mercury thermometer, marked in 2°F (1°C) divisions or less, or digital thermometer capable of measuring the temperature used in the test procedure	Verify calibration records	3	12
Vacuum pump or water aspirator, to evacuate air from the assembly, able to reduce residual pressure to 2.0 in. (50 mm) Hg or less before completion of the evacuation process of the procedure. This equates to a vacuum gauge reading of 27.9 in. Hg or more at normal sea level atmospheric pressure.	Verify vacuum	7	12
Manometer or vacuum gauge, able to determine the level of pressure (vacuum) within the assembly.	Verify gauge reading	9	12
Vacuum hose, connections, tapered stoppers, and valves, suitable to apply and control the specified vacuum level within the assembly	Verify setup	8	---
Heavy-walled glass pycnometer. A 1/2 gal. (2 L) fruit jar (recommended) or 68 fl. oz. (2000 mL) side-arm flask, the strength and seals to withstand an essentially complete vacuum. A 135 oz. (4000 mL) side-arm flask may be used to handle large samples.	Verify availability	---	---
<b>Part II—Using a Metal Vibratory Pycnometer</b>			
Balance, Class G2, minimum capacity of 2500 g	Verify calibration records	Tex-901-K	12

Equipment	Requirements	Procedure	Interval (Months)
Mercury thermometer, marked in 2°F (1°C) divisions or less, or a digital thermometer capable of measuring the temperature used in the test procedure	Verify calibration records	3	12
Vacuum pump or water aspirator to evacuate air from the assembly, able to reduce residual pressure to 2.0 in. Hg or less before completion of the evacuation process of the procedure. This equates to a vacuum gauge reading of 27.9 in. Hg or more at normal sea level atmospheric pressure.	Verify vacuum	7	12
Manometer or vacuum gauge, able to determine the level of pressure (vacuum) within the assembly	Verify gauge reading	9	12
Vacuum hose, connections, tapered stoppers, and valves, suitable to apply and control the specified vacuum level within the assembly	Verify setup	8	---
Metal vacuum pycnometer, 150 fl. oz. (4500 mL), with a clear poly (methyl methacrylate) (PMMA) lid for applying vacuum, (Humbolt H-1750, Gilson SG-16A, or equal)	Verify availability	---	---
Vibrating table, Humbolt H-1755, Gilson SGA-5RT, or equal	Verify availability	---	---
Water bath, for calibration of metal pycnometer and for immersing the metal pycnometer and sample in water, while suspended, and equipped with an overflow outlet for maintaining a constant water level	Verify availability	---	---
<b>Part III—Using a Wide-Mouth Hand-Held Glass Pycnometer</b>			
Heavy-walled, wide-mouthed glass pycnometer. A 1/2 gal. (2 L) fruit jar (recommended) or 68 fl. oz. (2000 mL) side-arm flask, with the strength and seals to withstand an essentially complete vacuum.	Verify availability	---	---
Vacuum hose, connections, tapered stoppers, and valves, suitable to apply and control the specified vacuum level within the assembly	Verify setup	8	---
Manometer or vacuum gauge, able to determine the level of pressure (vacuum) within the assembly.	Verify gauge reading	9	12
Vacuum pump or water aspirator, to evacuate air from the assembly, able to reduce residual pressure to 2.0 in. Hg or less before completion of the evacuation process of the procedure. This equates to a vacuum gauge reading of 27.9 in. Hg or more at normal sea level atmospheric pressure.	Verify vacuum	7	12

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 2500 g	Verify calibration records	Tex-901-K	12
Mercury thermometer, marked in 2°F (1°C) divisions, or digital thermometer capable of measuring the temperature used in the test procedure	Verify calibration records	3	12
Water bath, for calibration of metal pycnometer and for immersing the metal pycnometer and sample in water, while suspended. Bath should be equipped with an overflow outlet for maintaining a constant water level.	Verify availability	---	---

**Table 20—Tex-228-F, “Determining Asphalt Content of Bituminous Mixtures by the Nuclear Method**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, capable of weighing 44 lb. (20 kg)	Verify calibration records	Tex-901-K	12
Oven, capable of heating to at least 350 ± 5°F (177 ± 3°C)	Verify temperature setting	Tex-927-K	12
Thermometer capable of measuring 10–300°C (50–500°F)	Verify calibration records	3	12
Nuclear testing gauge (with manufacturer's instruction manual and sample pans), able to determine the asphalt content of a sample containing between 0% and 14% asphalt cement	Verify availability	---	---
Plywood, 0.75 in. (19 mm) or thicker, or metal plate, 0.375 in. (9.55 mm) or thicker, with an area slightly larger than the top of the gauge sample pans	Verify availability	---	---

**Table 21—Tex-229-F, “Combined Bituminous Mixture Cold-Belt Sampling and Testing Procedure”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 10,000 g	Verify calibration records	Tex-901-K	12
Oven capable of heating to at least 350 ± 5°F (177 ± 3°C), or microwave oven	Verify temperature setting	Tex-927-K	12
Mechanical sieve shaker	Verify sieving thoroughness	2	---
Set of standard U.S. sieves	<ul style="list-style-type: none"> <li>▪ Check physical condition</li> <li>▪ Check accuracy</li> </ul>	Tex-907-K	<ul style="list-style-type: none"> <li>▪ 12</li> <li>▪ 12</li> </ul>
Sample template	Verify availability	---	---

Equipment	Requirements	Procedure	Interval (Months)
Source of potable water, with pressurized (minimum 20 psi [137.9 kPa]) spray attachment. Example—standard sink with spray head attachment	Verify availability	---	---

**Table 22—Tex-235-F, “Determining Draindown Characteristics in Bituminous Materials”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2	Verify calibration records	Tex-901-K	12
Oven, capable of heating to at least 100–302°F (38–150°C)	Verify temperature setting	Tex-927-K	12
Wire basket assembly, constructed with 0.25 in. (6.3 mm) sieve cloth	Verify availability	---	---

**Table 23—Tex-236-F, “Determining Asphalt Content from Asphalt Paving Mixtures by the Ignition Method”**

Equipment	Requirements	Procedure	Interval (Months)
Ignition furnace with internal balance	Verify calibration records for balance	Tex-901-K	12
Tempered stainless steel perforated basket assembly and catch pan	Verify physical condition	---	--
Balance, Class G2, minimum capacity of 17.6 lb. (8 kg)	Verify calibration records	Tex-901-K	12
Oven, capable of heating to at least 325 ± 5°F (163 ± 3°C)	Verify temperature setting	Tex-927-K	12

**Table 24—Tex-241-F, “Superpave Gyrotory Compacting of Test Specimens of Bituminous Mixtures”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 10,000 g	Verify calibration records	Tex-901-K	12
Oven, capable of heating to at least 325 ± 5°F (163 ± 3°C)	Verify temperature setting	Tex-927-K	12
Mercury thermometer, marked in 5°F (3°C) divisions or less, or digital thermometer capable of measuring the temperature in the test procedure	Verify calibration records	3	12

Equipment	Requirements	Procedure	Interval (Months)
Superpave gyratory compactor, able to maintain a ram pressure of $87 \pm 2$ psi ( $600 \pm 18$ kPa) at an internal angle of $1.16 \pm 0.02^\circ$ , and with molds that have an inside diameter of 149.90–150.20 mm (reference 2011 AASHTO Specification T 312-2, 4.2)	Check for wear and verify calibration records	16	12

**Table 25—Tex-242-F, “Hamburg Wheel-Tracking Test”**

Equipment	Requirements	Procedure	Interval (Months)
Wheel Tracking device and stainless steel sample tray assemblies	Verify physical condition	--	--
Steel wheels, with an applied load of $158 \pm 5$ lb. ( $705 \pm 22$ N)	Verify calibration records	--	12
Linear Variable Differential Transducer (LVDT) device, capable of measuring the rut depth induced by the steel wheel within 0.0004 in. (0.01 mm), over a range of 0.8 in. (20 mm)	Verify calibration records	--	12
Maximum wheel speed of 1.1 ft./sec. (0.305 m/s)	Verify speed	17	12
Circulating water bath, capable of controlling the test temperature within $\pm 4^\circ\text{F}$ ( $2^\circ\text{C}$ ) over a range of $77\text{--}158^\circ\text{F}$ ( $25\text{--}70^\circ\text{C}$ )	Verify temperature settings	1	4

**Table 26—Tex-248-F, “Overlay Test”**

Equipment	Requirements	Procedure	Interval (Months)
Overlay tester device	Verify calibration records	--	12
Base plates and mounting jig	Verify physical condition	--	12

**Table 27—Tex-280-F, “Determining Flat and Elongated Particles”**

Equipment	Requirements	Procedure	Interval (Months)
Proportional caliper device	Verify ratios using machined block, micrometer	--	12
Balance, Class G2, minimum capacity of 2000 g	Verify calibration records	Tex-901-K	12
Machined blocks, micrometer	Verify dimensions to meet 2:1, 3:1, 4:1, 5:1 ratio requirements	--	12

**Table 28—Tex-530-C, “Effect of Water on Bituminous Paving Mixtures”**

Equipment	Requirements	Procedure	Interval (Months)
Balance, Class G2, minimum capacity of 2000 g	Verify calibration records	Tex-901-K	12
Oven, capable of heating to at least 300°F (150°C)	Verify temperature settings	Tex-927-K	12
Mercury thermometer capable of measuring the temperature in the test procedure	Verify calibration records	3	12
Hot oil bath, controllable at 350°F (177°C) and sized to allow a 68-fl. oz. (2000-mL) beaker to be supported at a minimum of 0.25 in. (0.6 cm) from the bottom when submerged to 2/3 of its depth	Verify temperature settings	10	4
Beaker, 68 fl. oz. (2000 mL), preferably stainless steel	Verify availability	--	--
USP mineral oil for bath, minimum flash point of 420°F (215°C)	Verify availability	--	--

#### 4. PROCEDURES

##### 4.1 Procedure 1—Water Baths:

4.1.1 Place a calibrated thermometer in the center of the water bath for 1 hour to verify temperature setting.

**Note 2**—Check setting at which the water bath is used.

##### 4.2 Procedure 2—Mechanical Shakers:

4.2.1 Match the sieve and aggregate such that a minimum of 10% of the total sample weight is retained on each sieve. After sieving on the mechanical shaker for a given time, check the thoroughness of sieving by shaking each sieve by hand with a lateral and vertical motion, accompanied by a jarring action, to keep the material moving continuously over the surface of the sieve.

4.2.2 If hand shaking shows more than 1% passing any given sieve, increase shaking time and repeat the check until all screens show less than 1% by weight passing a given sieve.

##### 4.3 Procedure 3—Thermometers:

4.3.1 Examine documentation for each thermometer used. Examine documentation for the standard used.

4.3.2 The documentation on thermometers used should include:

- temperature read at each calibration point
- true temperature read at each calibration point
- serial or identification number of each thermometer

- date calibrated or checked
- signature of person who read calibration.

4.3.3 The documentation on standard used should include:

- serial or identification of standard used
- dated standard used
- signature of person who ran calibration on standard.

4.4 *Procedure 4—Sand Equivalents:*

4.4.1 The weighted foot assembly must weigh  $1000 \pm 5$  g. The cap to fit the top of the cylinder, centering the weighted foot assembly, is not considered part of the total weight of the assembly.

4.4.2 Verify that the two drill holes, drilled laterally through the flat side of the wedge near the tip, are drill size 60.

4.5 *Procedure 5—Ventilation System for Asphalt Mix Control Laboratories:*

4.5.1 Ventilation required by current specifications for asphalt mix control laboratories applies, unless tests show that the alternate system lowers solvent vapor to safe levels throughout the testing process.

4.5.2 Refer to Section 5 for a description of ventilation systems and information on electrical equipment.

4.6 *Procedure 6—Filters:*

4.6.1 Check for size to fit extractor (both centrifuge and vacuum) and retention factor. On the Buchner funnel filter, a Whatman GF/F 12.5 cm glass microfiber filter or equivalent is needed.

4.7 *Procedure 7—Vacuum Pumps:*

4.7.1 Using a manometer or an analog vacuum verification gauge, verify that the vacuum pump or water aspirator is evacuating the air from the assembly.

4.7.2 The vacuum pump or water aspirator must be able to reduce residual pressure to 2 in. Hg or less. This equates to 27.9 in. Hg or more at normal sea level atmospheric pressure.

4.8 *Procedure 8—Vacuum Setup:*

4.8.1 Check the vacuum setup to comply with Tex-227-F, Figure 1.

4.9 *Procedure 9—Vacuum Gauge:*

4.9.1 Use a manometer or a vacuum verification gauge to verify the gauge reading.

4.9.1.1 Connect a manometer to the vacuum pump with vacuum gauge in line.

- 4.9.1.2 Place the analog vacuum verification gauge inside of the pycnometer bucket.
- 4.9.2 Close the bleed valve very slowly.
- 4.9.3 Take pressure readings with one of the two pressure reading devices.
- 4.9.3.1 Take readings on the two sides of the manometer, subtract the difference between the two readings from 760 mm Hg, and record the result.

EXAMPLE:

$$760 \text{ mm Hg} - (53 \text{ difference between two readings}) = 707 \text{ mm Hg}$$

Since 1.0 in. Hg = 25.4 mm Hg or absolute, divide the result by 25.4 mm/in. to determine what the vacuum pump is pulling.

EXAMPLE:

$$\frac{707 \text{ mm Hg}}{25.4 \text{ mm / in.}} = 27.83 \text{ in. Hg}$$

- 4.9.3.2 Take a reading from the analog vacuum verification gauge by looking through the lid of the pycnometer bucket. Since 1 torr = 1 mm Hg, subtract the reading from 760 mm Hg, and record the result. Next, divide this result by 25.4 to determine what the vacuum pump is pulling. Follow the example from Section 4.9.3.1.
- 4.9.4 Check the resulting number against the gauge reading. They must be relatively close.
- 4.10 *Procedure 10—Hot Oil Baths:*
- 4.10.1 Use a calibrated mercury or digital thermometer with a range of approximately 32–572°F (0–300°C). Place the thermometer in the center of the oil bath about 1 in. (25 mm) off the bottom.
- 4.10.2 After 5 minutes, check the thermometer reading.
- 4.10.3 Verify that the temperature setting is within 5% of the calibrated thermometer reading.
- 4.11 *Procedure 11—Molding Assembly – Texas Gyrotory Compactor:*
- 4.11.1 Replace worn or damaged mold ring, base plate, or compression rams.
- 4.11.2 Measure the distance the ram head travels with one stroke of the pump handle.
- 4.11.2.1 Place a dial gauge between the ram and the platen. The gauge must have a minimum travel of 0.2 in. (5 mm) and must be capable of measuring to 0.001 in. (0.023 mm).
- 4.11.2.2 Lower the ram until it depresses the tip of the dial gauge slightly and the distance between the ram and the platen is  $4 \pm 0.1$  in. ( $102 \pm 2$  mm).

- 4.11.2.3 Stop the ram movement and zero the dial gauge. For mechanical dial gauges, zeroing is usually achieved by turning the scale with the outer knurled edge.
- 4.11.2.4 Raise the pump handle up as far as it will go, then make one full, smooth, downward stroke in approximately one second.
- 4.11.2.5 Record the reading. Make the reading the instant the handle hits the bottom.  
**Note 3**—Some drift in the dial reading will usually occur due to the weight of the ram head and air in the hydraulic system. The dial gauge can be mounted to a rectangular metal block with large springs mounted on opposite sides; the springs will support the ram and eliminate the drift problem.
- 4.11.2.6 Repeat Sections 4.11.2.2–4.11.2.5 to obtain three readings. Average the results of the three readings and record.
- 4.11.2.7 If the stroke is not within tolerance, adjust the set screw near the pump handle until the ram travel is  $0.023 \pm 0.001$  in. ( $0.58 \pm 0.03$  mm).
- 4.12 *Procedure 12—Hveem Stabilometer with Adjustable Stage:*
- 4.12.1 Check for wear on inner rubber diaphragm.
- 4.12.2 Check Stabilometer for the current calibration records.
- 4.12.3 Calibrate every 12 months.
- 4.13 *Procedure 13—Centrifuge:*
- 4.13.1 Check speed for approximately 2200 rpm.
- 4.14 *Procedure 14—Gas Flow Meter:*
- 4.14.1 Check gas flow for 34 oz. (1000 mL) per minute with a gas flow metering instrument.
- 4.15 *Procedure 15—Metal Thickness Gauge:*
- 4.15.1 Verify that gauge is made of 12 gauge carbon steel sheet  $0.105 \pm 0.002$  in. ( $2.66 \pm 0.05$  mm) with three slots cut at  $5/32$  in. (4 mm),  $1/4$  in. (6.3 mm), and  $3/8$  in. (9.5 mm).
- 4.16 *Procedure 16—Molding Assembly for Superpave Gyrotory Compactor:*
- 4.16.1 Verify the load, angle, and height with calibration kit provided with gyrotory compactor.
- 4.16.2 If the mold ring, base plate, top plate, or compression rams show wear, rough or worn edges, or warped surfaces, replace them.
- 4.17 *Procedure 17—Hamburg Wheel Tracking Speed:*
- 4.17.1 Check speed of wheel passes with a stopwatch.

- 4.18 **Procedure 18—Hveem Follower Dimensions:**
- 4.18.1 Measure and record the height ( $139.70 \pm 6.35$  mm) and the diameter ( $101.219 \pm 0.127$  mm) of the follower using a digital caliper.
- 4.19 **Procedure 19—Hveem Calibration Cylinder Dimensions:**
- 4.19.1 Measure and record the outside diameter ( $101.6 \pm 0.13$  mm) and the height ( $140.0 \pm 6.4$  mm) of the calibration cylinder using a digital caliper.
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## 5. SAFETY CONSIDERATIONS

- 5.1 Bulk storage inside the laboratory building must not exceed 5 gal. (19 L), plus up to 5 gal. (19 L) of used solvent.
- 5.2 Solvent in storage must be kept in closed containers and must not be located under or adjacent to an oven or other heating device.
- 5.3 The storage location must drain away from any known source of ignition.
- 5.4 Means must be available to clean solvent spills.
- 5.5 A portable fire extinguisher for burning liquids is required (outside the room in close proximity) where solvents are stored and used.
- 5.6 The vent fan must have at least a 1,000 CFM (30 cu. m/min.) rating and be able to adequately remove fumes. The fan outlet must be located even with or below the height at which solvents will be poured or used. It is preferable that fans be located beneath a workbench constructed of expanded metal top and enclosed front and sides. The front of the workbench must have a sliding panel, which, when opened, in conjunction with covering the expanded metal top, will cause the exhaust to be pulled through the front opening. This design accommodates both centrifuge and vacuum extraction equipment while providing for exhausting fumes from floor spills. The fan must have an explosion proof (sealed) motor, or the motor must be located so that the solvent vapors are not drawn directly over it. The vent fan and extraction equipment must be wired to a single switch so the vent fan will always be on during extraction. Means for cutting power to the extraction equipment while the ventilation fan is operating is also required.
- 5.7 Ordinary electrical equipment, including switches, may be used in the room where solvents are transferred or used, except in the immediate hazardous area, which must be kept in negative pressure with respect to the rest of the room by a vent fan. The immediate hazardous area is the space immediately above and below the centrifuge extractor, and the air flow space between the centrifuge and the outside exhaust.
- 5.8 Sources of open flame (pilot lights, smoking, Bunsen burners, etc.) will not be permitted in the room where solvents are stored or handled.

**6. ARCHIVED VERSIONS**

6.1 Archived versions are available.