

Colorado Procedure 43-20

Standard Method of Test for

Determining Moisture (Water) or Volatile Distillates Content of HMA

1. SCOPE

- 1.1 This procedure covers two methods for the quantitative determination of moisture in Hot Mixture Asphalt (HMA).
- 1.2 The procedures are intended for the determination of moisture content, or volatile fraction of the bitumen, in HMA.
- 1.3 The water content of a mixture is defined by this Standard as the ratio, expressed as a percentage of the mass of “pore” or “free” water in a given mass of material to the mass of the solid mixture.
- 1.4 The methods are intended to apply to samples of HMA used in verification and quality control from the points of acceptance designated in the Schedule for Minimum Materials Sampling, Testing, and Inspection.
- 1.5 This Standard may involve hazardous materials, operations, and equipment. This Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory regulations before use.
- 1.6 Unless otherwise specified in the Contract Documents, either method is acceptable for use.

2. REFERENCED DOCUMENTS

- 2.1 *Colorado Procedures:*
 - CP 41 Sampling Hot Mix Asphalt
 - CP 55 Reducing Field Samples of Hot Mix Asphalt to Testing Size
- 2.2 Manufacturer’s instruction manual.
- 2.3 CDOT Standard Special Provisions and/or Project Special Provisions for Item 620
- 2.4 CDOT M & S Standards, Item 620

3. SIGNIFICANCE AND USE

- 3.1 These test methods are used for determining either the amount of moisture or the number of volatile petroleum distillates in bituminous paving mixtures.

METHOD A

Determining Moisture or Volatile Petroleum Distillates Content of HMA by the Microwave Method

4. APPARATUS

- 4.1 *Microwave oven* - Having variable time and power controls.
- 4.2 *Pyrex dish* – (or similar microwave proof glass container) Capable of holding the entire test specimen being tested.
- 4.3 *Balance* - Having sufficient capacity and sensitivity to 0.1g.

5. TEST SPECIMEN

- 5.1 Sample the material per CP 41 and reduce it to test specimen size per CP 55.

6. SAFETY PRECAUTIONS

- 6.1 See the Manufacturer's Operator's Manual for the microwave oven.
- 6.2 Do not place any metallic containers or metallic material in any microwave oven at any time.

7. DETERMINE VARIABLE POWER SETTING

- 7.1 Set variable power control to approximately 50% power.
- 7.2 Place 550 ± 50 ml (or 550 ± 50 g) of tap water in a Pyrex (or similar microwave-proof glass) container. Record temperature of water (T1). Set the microwave oven timer for five minutes and heat the 550 ± 50 ml of water. Record the water temperature (T2). The difference between temperature T1 and T2 should be $75^{\circ}\text{F} \pm 10^{\circ}$ ($42^{\circ}\text{C} \pm 6^{\circ}$). If the difference is too low (or high) increase (or decrease) the variable power control setting then repeat 7.2. This procedure will determine the power control setting to be used in Subsection 8.2.

8. PROCEDURE

- 8.1 Place the specimen in a clean, glass, dry, tared container, and weigh to the nearest 0.1g. The weighed sample should be 550 ± 50 g for Grading S and SX mixtures. (Grading SG mixtures will require a minimum mass of 2,000 grams for testing.)
- 8.2 Dry the specimen in the microwave oven using the variable power setting determined in Subsection 7.2. Continue to dry the test specimen until the mass of the specimen does not change after further heating for 5 minutes. Care should be taken to avoid overheating the specimen. An indication of overheating is blue smoke.

9. CALCULATIONS

9.1 Determine the percent moisture to the nearest 0.01% as follows:

$$\text{Percent Moisture} = \frac{A - B}{A} \times 100$$

Where:

A = Wet weight (mass) of test specimen,
B = Dry weight (mass) of test specimen.

10. RECORD

10.1 No CDOT Form is used, record on your worksheet.

Method B

Determination Moisture of Bituminous Paving Mixtures by Convection Oven

11. APPARATUS

- 11.1 *Drying oven* - Thermostatically controlled forced draft oven meeting the requirements of Section 620 of the Standard Special Provisions.
- 11.2 *Specimen container* - Capable of holding the entire test specimen being tested.
- 11.3 *Balance* - Having sufficient capacity and sensitivity to 0.1g.
- 11.4 *Miscellaneous* - Knives, spatulas, scoops, tools, etc., as required in applicable CPs and CP-Ls.

12. TEST SPECIMEN

- 12.1 Sample the material per CP 41 and reduce it to test specimen size per CP 55.
- 12.2 The moisture content determination shall be done as soon as practicable after the original sample has been split down to test sample size.
 - 12.2.1 If determining moisture content only, determine wet weight (mass) "A" in Subsection 14.1 as soon as the sample has been split.
 - 12.2.2 If using it for moisture correction applied to the asphalt content, then determine wet weight (mass) "A" at the same time the asphalt content sample is done, i.e., during ignition oven asphalt content test.

13. PROCEDURE

- 13.1 Place the specimen in a clean, dry, tared container and weigh to the nearest 0.1g. The weighed sample mass shall not be less than 500 grams for grading S and SX mixtures. (Grading SG mixtures will require a minimum mass of 2000 grams for testing.)
- 13.2 Dry the specimen in the oven at the specified binder compaction temperature for that mixture, as per Table 43-1 for a minimum of 3 hours. Remove specimen and immediately weigh to the nearest 0.1g. No manipulation, i.e., stirring of the specimen, shall be permitted. Place specimen back in the oven and continue drying, checking mass of the specimen every ½ hour, ± 5 minutes. The specimen is considered dry when the loss in mass between two consecutive measurements is equal to 0.00%.

TABLE 43-1

Superpave Binder Grade	Lab Mixing Temp.	Lab Compaction Temp.
PG 58-28	310°F (154°C)	280°F (138°C)
PG 58-34	310°F (154°C)	280°F (138°C)
PG 64-22	325°F (163°C)	300°F (149°C)
PG 64-28	325°F (163°C)	300°F (149°C)
PG 70-28	325°F (163°C)	300°F (149°C)
PG 76-28	325°F (163°C)	300°F (149°C)

All temperatures in this table have tolerance of ± 5°F (± 2.8°C)

14. CALCULATIONS

- 14.1 Determine the percent moisture to the nearest 0.01% as follows:

$$\text{Percent Moisture} = \frac{A - B}{A} \times 100$$

Where:

A = Wet weight (mass) of test specimen,

B = Dry weight (mass) of test specimen.

15. RECORD

- 15.1 CDOT Form 106 or CDOT Form 107 is used to record the information.