

CITY OF COLUMBUS, OHIO

**SUPPLEMENT 1043
CALIBRATION AND TEST PROCEDURES FOR
USE OF ASPHALT CONTENT NUCLEAR GAUGES**

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1043.01 Scope. This supplement specifies the following procedures for using an Asphalt Content Nuclear Gauge (AC Gauge):

1. Establishing a background count.
2. Calibration.
3. Determining the asphalt binder content of a sample of asphalt concrete.

1043.02 General. Turn on the AC Gauge for a minimum of 10 minutes prior to performing any tests.

For QC test reporting take AC Gauge readings at 16 minutes. For quick checks readings may be taken at lesser times.

Ensure the AC Gauge operator is no closer than 5 feet (1.6m) to the AC Gauge when it is performing a test.

Express asphalt binder contents as percent of total mix.

1043.03 Background Count. Establish the initial background count of the AC Gauge the first day of production. Verify this initial background count by comparing it to a second background count. Ensure these two counts are within 1.0 percent of each other to verify the initial background count. If the initial background count is verified, use it as the current background count.

Verify the current background count before each AC Gauge test. Ensure these two counts are within 1.0 percent of each other to verify the current background count. Re-establish the current

background count if the verification background count is not within 1 percent of the current background count.

1043.04 Laboratory Produced Mixtures. This section describes the procedures for making laboratory mixes of asphalt concrete to calibrate an AC Gauge.

The following equipment is required to make a laboratory mixture:

1. A mechanical mixer with a mixing bowl able to hold a minimum capacity of 12 quarts (11 liters). Ensure this mixer has a beater of flexible spring steel that makes contact with the bottom of the mixing bowl.
2. A digital scale with the capability of measuring the combined weight of the mixing bowl and sample to be mixed and reading to the nearest gram.
3. An appropriate size oven capable of maintaining a uniform temperature of
4. 350 °F (177 C).
5. Miscellaneous equipment required for measuring and mixing asphalt concrete in the Laboratory.

Mix aggregate meeting the JMF with the specified percent asphalt binder in accordance with ASTM D 1559. Prior to mixing the samples for calibration, mix a sample of the asphalt concrete, at the minimum asphalt binder content to be mixed, to prime the mixing bowl. After discarding this sample, scrape the mixing bowl and mixer beater clean and the mixing bowl shall be weighed.

Scrape the mixing bowl and mixer beater clean after mixing each batch of asphalt concrete so that the mixing bowl weighs the same before each batch is mixed. After all the batches are mixed, clean all of the mixing equipment using a solvent, so that no residue remains.

1043.05 Blank Sample. Prior to performing each calibration, prepare and weigh a blank sample to determine the weight of asphalt concrete to add to an AC Gauge pan for an AC Gauge test. Prepare a blank sample as follows:

1. Weigh an empty, clean AC Gauge pan.
2. Mix a sample of asphalt concrete, having an asphalt binder content within 0.1 percent of the design asphalt binder content, in accordance with 1043.04. Ensure this sample is of a sufficient size to completely fill an AC Gauge pan.
3. Fill an AC Gauge pan with the asphalt concrete in accordance with the first 3 steps of 1043.06.

4. Add additional asphalt concrete to just slightly over the top edge of the AC Gauge pan. Lightly press the top of the sample with a hot spoon or other instrument to settle the asphalt concrete into the edges and corners of the AC Gauge pan. Fill in any low spots with additional asphalt concrete as needed. The blank sample should be level with the top edge of the AC Gauge pan.

After the blank sample is prepared, weigh it to the nearest gram. The weight of the blank sample is the difference between this weight and the weight of the AC Gauge pan. Prepare a new blank sample for each JMF.

The blank sample may be used as a calibration sample in accordance with 1043.07.

1043.06 Filling AC Gauge Pans. Fill the AC Gauge pans with laboratory or plant mixed asphalt concrete, at a workable temperature, as follows:

1. Weigh an empty, clean AC Gauge pan that is going to be used
2. Fill the AC Gauge pan about 1/3 full with the asphalt concrete and settle the contents by dropping it 3 to 4 inches (75 to 100 mm) onto a level surface 3 times.
3. Add additional asphalt concrete until the AC Gauge pan is about 2/3 full and settle the contents by again dropping it 3 to 4 inches (75 to 100 mm) onto a level surface 3 times.
4. Place the AC Gauge pan on a balance and add additional asphalt concrete until the weight of the asphalt concrete in the AC Gauge pan equals the weight of the blank sample.
5. Lightly press the top of the sample with hot spoon or other instrument to settle the asphalt concrete into the edges and corners of the AC Gauge pan.
6. Weigh the AC Gauge pan and asphalt concrete to confirm the total weight equals the weight of the blank sample.

1043.07 Calibration. Calibrate the AC Gauge using a minimum of 3 separate calibration samples mixed in accordance with 1043.04 by the Contractor. Ensure these samples have asphalt binder contents within 0.1 percent of the following asphalt binder contents:

1. Design asphalt binder content.
2. 1.0 percent above the design asphalt binder content.
3. 1.0 percent below the design asphalt binder content.

These asphalt binder content ranges may be adjusted by the Laboratory.

Perform the calibration of the AC Gauge in accordance with the AC Gauge manufacturer's instructions. Calibrate the AC Gauge such that the Fit Coefficient is 0.995 or above. If the Fit Coefficient is less than 0.995, calibrate the AC Gauge again.

For final verification of the calibration, mix a new sample of asphalt concrete, having an asphalt binder content within 0.1 percent of the design asphalt binder content, in accordance with 1043.04. Determine the asphalt binder content of this sample by the AC Gauge in accordance with 1043.08. The AC Gauge will be considered calibrated if the asphalt binder content determined by the AC Gauge is within 0.14 percent of the actual asphalt binder content of the sample.

Store the calibration in the AC Gauge or recorded so that it may be retrieved whenever a sample of asphalt concrete with the same design is to be tested for asphalt binder content.

Print out the following information for each calibration:

1. Date
2. Contractor's name
3. AC Gauge serial number
4. Calibration number
5. Type of asphalt concrete
6. Background count
7. Blank sample weight
8. Fit coefficient
9. Calibration constants
10. Programmed asphalt binder contents, corresponding measure counts and percent differences

Submit the printouts from the calibration and verification sample, along with the City's "Calibration Inspection Form", to the Laboratory. The Calibration Number is assigned by the Laboratory.

The Contractor may offset the AC Gauge calibration based on the asphalt binder content of plant mixed asphalt concrete. Establish the calibration offset in accordance with procedures in the Sampling and Testing Manual. Enter the offset calibration into the AC Gauge in accordance with the manufacturer's instructions.

1043.08 Determining Asphalt Binder Content. Determine the asphalt binder content of a sample of asphalt concrete as follows:

1. Set the AC Gauge for the calibration that corresponds with the design of the asphalt concrete which is to be tested.
2. Place the AC Gauge pan with the sample of asphalt concrete shall be placed in the AC Gauge and tested in accordance with the manufacturer's instructions.

3. Determine the moisture content of a 3.31-pound (1500-gram) split sample shall be determined in accordance with 1043.10 and recorded with each AC Gauge and test.
4. Print out the following information shall be printed out for each AC Gauge test:
 - a. Date
 - b. Time
 - c. Contractor's name
 - d. AC Gauge serial number
 - e. Calibration Number
 - f. Measure count
 - g. Background count
 - h. Percent asphalt binder to the nearest 0.01 percent

1043.09 AC Gauge Pan Cleaning. Remove the sample of asphalt concrete from the AC Gauge pan by heating the AC Gauge pan in an oven so the sample of asphalt concrete can be dumped out. The AC Gauge pan may be tapped to help loosen the sample as long as the tapping does not dent the AC Gauge pan. Clean the AC Gauge pan using a solvent so that no residue remains.

1043.10 Determining Moisture Content. Determine the moisture content of a sample of asphalt concrete as follows:

1. Determine and record the combined weight of the empty sample pan and stirrer to the nearest 0.004 ounce (0.1 gram).
2. Place the sample of asphalt concrete and stirrer in the sample pan. Determine and record the weight of the filled sample pan to the nearest 0.1 gram (initial weight).
3. Place the filled sample pan in an oven for a minimum of 2 hours. Ensure the oven temperature is 355 + 20 °F (180 +/- 11 °C).
4. Remove the filled sample pan from the oven. Determine and record the weight of the filled pan to the nearest 0.1 gram. Stir the sample and place the filled sample pan back in the oven.
5. Repeat Step #4 every 15 minutes until the total weight loss between 2 consecutive 15 minute readings is less than 0.1 percent. The last 15 minute reading is the final weight.
6. Calculate the moisture content (expressed as a percent) as follows:

$$\text{Moisture content} = \frac{(\text{initial weight} - \text{final weight})}{\text{Final weight}} \times 100$$

7. Subtract the percent moisture content from the asphalt binder content as determined by the AC Gauge to determine the corrected asphalt binder content.