

**2202 STANDARD METHOD OF TEST FOR MEASURING THE MOISTURE  
CONTENT OF AGGREGATE BY RAPID EVAPORATION (PHOENIX  
AGGREGATE TEST METHOD)****2202.1 SCOPE**

- 1.1. This test method describes the measurement of the moisture that can be evaporated within aggregates. The moisture content can be calculated by using the mass of the aggregates before and after drying.
- 1.2. Unit – the values stated in either SI units or inch-pound units are to be regarded separately as the standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
- 1.3. The standard does not purport to address all the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before use.

**2202.2 REFERENCE DOCUMENTS**

- 2.1. ASTM C566 Test Method for Total Moisture Content of Aggregate by Drying

**2202.3 SUMMARY OF THE TEST METHOD**

- 3.1. This test method describes a way to measure the moisture content of either coarse or fine aggregate. A rigid pan and lid are used to hold the aggregate. The mass of the pan and lid are measured before, and after filling with the sample. The pan is then placed into the furnace.
- 3.2. This specimen is inserted into a furnace between 1450°F (788 °C) and 1500°F (815°C) for approximately 5 min. The mass is weighed again to ensure that the water has been evaporated. The difference in the mass of the specimen before and after the test determines the moisture content of the specimen.

**2202.4** SIGNIFICANCE AND USE

- 4.1. Aggregates are an important construction material, and the rapid measurement of the moisture content is helpful for producing concrete and compaction. Since this test can be completed quickly it will save time and also allow more rapid construction in practice.

**2202.5** APPARATUS

- 5.1. Scale – A balance or scale accurate, readable, and sensitive to within 0.1 % of the test load at any point within the range of use and within any interval equal to 10 % of the capacity of the balance or scale used to determine the mass. The load indicated shall be accurate within 0.1 % of the difference in mass. For normal-weight concrete, this requires a balance with 0.002 lb (1 g) accuracy.
- 5.2. Heat Resistant Plate – A ceramic plate that is used on the scale to isolate it from the high temperatures of the pan.
- 5.3. Furnace – A 3600-Watt (3600 Joules/s) furnace with internal dimensions of 19.75" wide x 4.5" height x 11" deep (500 mm wide x 114 mm height x 279 mm deep) that is capable of maintaining a heat of 1500°F (815°C).
- 5.4. Pan – The pan used is made of steel that can resist the temperatures and deterioration in the test. The pan should allow the concrete to be placed in a single ½" (13 mm) layer. The pan should be designed to not warp excessively to not damage the furnace during heating.
- 5.5. Lid - A mesh lid is used to contain the sample while in the furnace. It is formed and fits on the pan. It must be removable to place the sample inside the pan. This prevents the sample from losing excess mass if an aggregate is ruptured from rapid heating.
- 5.6. Gloves – Oven gloves are recommended for protection from the furnace heat. The gloves are not to be used to transport the sample by themselves but to be worn while using the steel spatula.
- 5.7. Cooling Cover – A wire mesh container that allows the heated pan, sample, and lid to cool.
- 5.8. Scoop – Aluminum scoop is used to transfer the aggregates to the pan.
- 5.9. Pan Fork – A steel fork is used to transfer the pan and sample in and out of the furnace.

**2202.6** SAMPLING, TEST SPECIMENS, AND TEST UNITS

- 6.1. Sample in accordance with applicable procedures of C 566 but use between 2000 g and 2200 g of material. Protect the sample against loss of moisture prior to determining the mass. This test can be used to determine the moisture content for fine and coarse aggregates.



**Figure 1. The empty pan and lid placed on a scale covered with heat resistant plate**



**Figure 2. Adding aggregate to the pan with a scope**



**Figure 3. Aggregate placed in the pan**

**2202.7** PROCEDURE

7.1. Preheat the furnace to a temperature between 1450 °F to 1500°F before placing the sample in the oven.

*Note: This may take at least 20 minutes.*

7.2. After preheating the furnace, the door should not remain open more than 10 seconds at any time during the test to minimize the temperature loss for the test and for safety.

7.3. Place the heat resistant plate on the scale.

7.4. Record the tare mass for the dry, empty container [CylTare].

7.5. Use a scoop to fill the pan with a sample of aggregates between 2000 g and 2200 g (Figures 1b and 1c).

7.6. Cover the aggregates filled pan with the lid and then record the mass [PWet] (Figure 2a).

- 7.7. Open the door to the furnace and place the aggregates filled pan and lid into the furnace by using the pan fork and closing the door (Figure 2b).
- 7.8. *Note: The internal temperature in the furnace will decrease when inserting the sample. Over time the furnace temperature may increase but it may not reach the set temperature.*
- 7.9. After 5 minutes; remove the sample filled pan and lid with the pan fork.
- 7.10. Remove the pan fork from the pan. Record the mass of the sample filled pan and lid [PDry<sub>0</sub>] and return to the furnace and close the door. The sample should be returned to the chamber within 45 seconds.
- 7.11. After 30 seconds; remove the sample filled pan and lid with the pan fork.
- 7.12. Remove the pan fork from the pan. Record the mass of the sample filled pan and lid [PDry<sub>1</sub>] and return to the furnace and close the door. The sample should be returned to the chamber within 45 seconds.
- 7.13. If the difference between PDry<sub>0</sub> and PDry<sub>1</sub> is less than 0.0022 lb (1 g) then record PDry<sub>1</sub> as the dry mass of the aggregates [PDry]. If the difference is larger than 0.0022 lb (1 g) then repeat steps 7.11 and 7.12 are repeated until the mass change from 30 seconds of exposure to heat is less than 0.0022 lb (1 g). This mass should be recorded as the dry mass of the aggregates [PDry].
- 7.14. The sample is then cooled and can be removed from the pan and lid. The pan and lid can be cleaned, dried, and then used for the next sample.

*Note: After the final mass is determined, it is recommended to either allow the sample to cool in the cooling cover or be quenched in a metal wheelbarrow or metal bucket full of water.*

*Note: After cleaning, the pan and wire mesh can be dried quickly by placing them on top of the furnace between tests.*



Figure 4. Sample filled pan and lid on top of the scale



Figure 5. Pan and lid being transferred to the furnace

**2202.8** CALCULATION AND REPORT

8.1. The total moisture content is calculated using the following equation:

$$\text{Moisture Content} = 100 (P_{\text{Wet}} - P_{\text{Dry}}) / (P_{\text{Dry}} - P_{\text{Tare}})$$

**2202.9** PRECISION AND BIAS

9.1. No precision and bias have been established for this test method.

**2202.10** KEYWORDS

10.1. Phoenix; Moisture Content; Fine Aggregates, Coarse Aggregates