ASTM C1437

Standard Test Method for Flow of Hydraulic Cement Mortar

Understanding ASTM International Test Procedures
for Cement and Concrete - Staying Up to Standard

Anthony F. Bentivegna, Ph.D., P.E.

May 9, 2016

CTLGROUP

Outline

▶ Objectives

▶ Related Procedures

▶ Scope/Significance and Use

▶ Key Terminology

▶ Apparatus

▶ Temperature and Humidity Requirements

▶ Procedure Molding Specimen

▶ Procedure Determining Flow

▶ Understand Limitations of Procedure

www.CTLGroup.com

CTLGROUP

Objectives

▸ Define Key Terminology

▸ Identify Necessary Equipment

▸ Understand Sources of Errors

▸ Understand Limitations of Procedure

www.CTLGroup.com

CTLGROUP

Significance of ASTM C1437 - Flow

▸ Determine consistency (flow behavior) of a fresh mixture

▸ Consistency depends on:
  · Fineness, flocculation of cement and cement with aggregates, and setting times

▸ Consistency is used for:
  · Strength (C109), air content (C185) and Sulfate Expansion (C1038) [Optional]
  · Consistency used instead of w/cm to ensure quality samples.

www.CTLGroup.com

CTLGROUP

Related Procedures

▸ ASTM C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

▸ ASTM C185 – Test Method for Air Content of Hydraulic Cement Mortar

▸ ASTM C230 – Specification for Flow Table for Use in Tests of Hydraulic Cement

▸ ASTM C511 - Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

www.CTLGroup.com

CTLGROUP

Scope/Significance and Use

▸ ***Scope:*** This test method covers the determination of flow of hydraulic cement mortars.

▸ ***Significance and Use:*** This test method is intended to be used to determine the flow of hydraulic cement mortars, and of mortars containing cementitious materials other than hydraulic cements.

▸ While flow is not usually included in hydraulic cement specifications, it is commonly used in standard tests that require the mortar to have a water content that provides a specified flow level.

www.CTLGroup.com

CTLGROUP

Key Terminology

▸ Hydraulic Cement - a <u>binding material</u> that <u>sets</u> and <u>hardens</u> by chemical reaction with water and is capable of doing so <u>underwater</u>. For example, <u>portland cement</u> and <u>slag cement</u> are hydraulic cements

▸ Mortar - a mixture of <u>cement paste</u> and <u>fine aggregate</u>.

▸ Flow – a measure of the <u>consistency</u> of freshly mixed <u>mortar</u>, or <u>cement paste</u> expressed in terms of the increase in diameter of a molded truncated cone specimen after jigging a specified number of times.

Source: American Concrete Institute CT-13: ACI
Concrete Terminology

www.CTLGroup.com

CTLGROUP

Apparatus: Flow Table, Flow Mold, and Caliper (1/2)

▸ Flow Table

Diameter: 255 ± 2.5 mm

Raised Height: 12.7 ± 0.13 mm

www.CTLGroup.com

CTLGROUP

Apparatus: Flow Table, Flow Mold, and Caliper (2/2)

▸ Conical Mold and Caliper

Diameter Top: 70 ± 0.5 mm
Diameter Bottom: 100 ± 0.5 mm
Height: 50 ± 0.5 mm

Distance to Zero: 100 ± 0.25 mm

www.CTLGroup.com

Apparatus: Other

▸ **Tamper:** conforming to the requirements of Test Method C109. The tamping face of the tamper shall be flat and at right angles to the length of the tamper.

▸ **Steel Straightedge:** not less than 200 mm long and not less than 1.5 mm nor more than 3.5 mm in thickness.

▸ **Trowel:** steel blade 100 to 150 mm long

www.CTLGroup.com

5

Temperature and Humidity Requirements

▸ The temperature of the air and mixing water shall conform to the requirements of Specification C511.

  ・ Air – Temp. 23.0 ± 4.0°C

  ・ Mixing Water - shall be 23.0 ± 2.0 °C

▸ The relative humidity of the laboratory shall conform to the requirements of Specification C511.

  ・ Relative Humidity - not less than 50 %

www.CTLGroup.com

CTLGROUP

Procedure: Determination of Flow
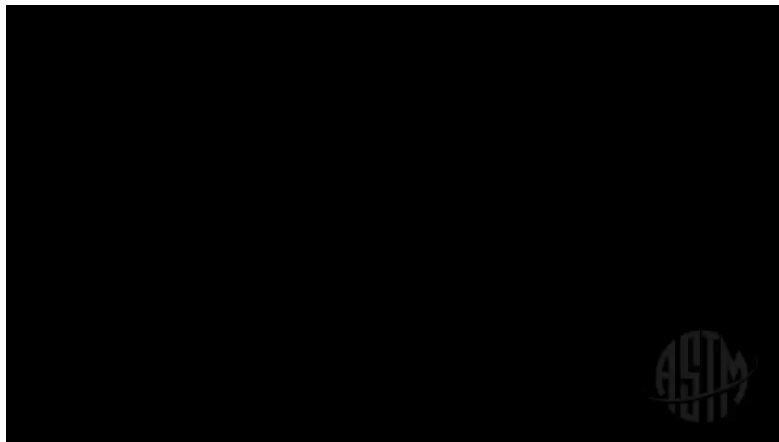
www.CTLGroup.com

CTLGROUP

Procedure: Determination of Flow (1/3)

1. Place 25 mm Layer

2. Tamp 20 Times. Incline Tamper when Near Perimeter.
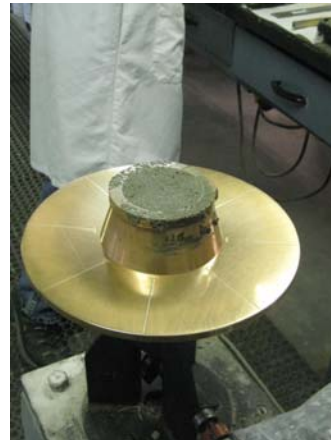
3. Fill Mold and Tamp as Specified.

www.CTLGroup.com

CTLGROUP

Procedure: Determination of Flow (2/3)

4. Cut off Mortar Plane with Sawing Motion with Straightedge or Trowel.

5. Wipe off Table Top.

www.CTLGroup.com

CTLGROUP

Procedure: Determination of Flow (3/3)

6. Lift Mold 1 Minute after Mixing.

7. Immediately Drop the Table 25 times in 15s.

8. Measure the Diameter Across Four Scribed Lines.

www.CTLGroup.com

CTLGROUP

Procedure: Calculation

▸ <u>Flow</u> is the resulting <u>increase</u> in average <u>base</u> <u>diameter</u> of the mortar mass, expressed as a <u>percentage</u> of the <u>original</u> <u>base</u>.

▸ Using ASTM C230 Caliper, <u>add</u> the <u>four readings</u>, and <u>record the total</u>. This gives the flow in percent.

www.CTLGroup.com

CTLGROUP

8

Limitations and Errors

▸ Gauging time should be <u>strictly</u> observed.

▸ Room temperature should be well maintained as per test requirement.

▸ All apparatus used should be clean.

▸ Uniformly compress and fill conical mold.

▸ Over-tamping causes water to extrude towards bottom of molds and causes increased (erroneous) flow.

www.CTLGroup.com

CTL GROUP

Questions & Answers