

ASTM C187

Standard Test Method for Amount of Water Required
for Normal Consistency of Hydraulic Cement Paste

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

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Outline

- ▶ Objectives
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- ▶ Scope/Significance and Use
- ▶ Apparatus
- ▶ Temperature and Humidity Requirements
- ▶ Procedure Molding Specimen
- ▶ Procedure Determining Normal Consistency
- ▶ Calculation Water Content
- ▶ Understand Limitations of Procedure

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Objectives

- ▶ Define Key Terminology
- ▶ Identify Necessary Equipment
- ▶ Understand Sources of Errors
- ▶ Understand Limitations of Procedure

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Related Procedures

- ▶ ASTM C219 – Terminology Relating to Hydraulic Cement
- ▶ ASTM C305 – Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- ▶ ASTM C511 – Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

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Related Procedures

- ▶ ASTM C1005 – Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements
- ▶ ASTM D1193 – Specification for Reagent Water
- ▶ ASTM E177 – Practice for Use of the Terms Precision and Bias in ASTM Test Methods

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Significance of ASTM C187 – Consistency

- ▶ Determine amount of water required to achieve a standard consistency
- ▶ Two Procedures for Determining Consistency:
 - Flow (C1437)
 - Normal Consistency (C187)
- ▶ Measures consistency through penetration resistance
- ▶ Required for:
 - Vicat (C191) and Autoclave (C151)

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Scope/Significance and Use

- ▶ **Scope:** This test method covers the determination of the normal consistency of hydraulic cement
- ▶ **Significance and Use:** This test method is intended to be used to determine the amount of water required to prepare hydraulic cement pastes with normal consistency, as required for certain standard tests.



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Key Terminology

- ▶ Normal Consistency - a degree of plasticity of a hydraulic cement paste that is appropriate for testing as measured by a stipulated method.
- ▶ Discussion —The result of tests for normal consistency is reported as the mass of water required to achieve this plasticity divided by the mass of hydraulic cement, expressed as a percentage.

Source: ASTM C219

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Apparatus

- ▶ Reference Masses
- ▶ Devices for Determining Mass
- ▶ Glass Graduates
- ▶ Vicat Apparatus
- ▶ Flat Trowel

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Apparatus: Reference Masses and Devices for Determining Mass

- ▶ Conforming to the requirements of Specification C1005.
- ▶ Devices for determining mass shall be evaluated for precision and bias at a total load of 1000 g.



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Apparatus: Glass Graduates

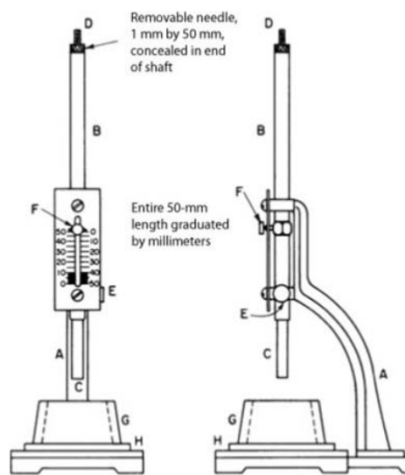
- ▶ 200 or 250-mL capacity, and conforming to the requirements of Specification C1005.



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Apparatus: Vicat Apparatus



Source: ASTM C187

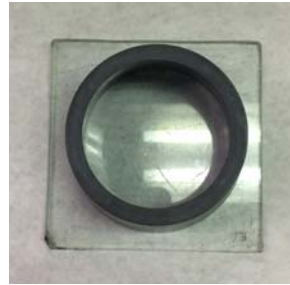
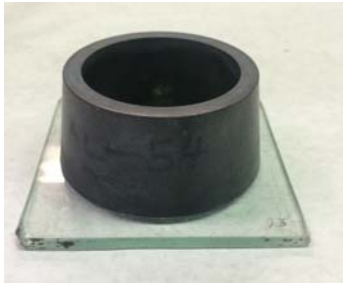


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Apparatus: Ring

- ▶ Inside diameter of ring at bottom 70 ± 3 mm
- ▶ Inside diameter of ring at top 60 ± 3 mm
- ▶ Height of ring 40 ± 1 mm



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Apparatus: Flat Trowel

- ▶ Having a sharpened straight-edged steel blade 100 to 150 mm in length.



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Temperature and Humidity Requirements

- ▶ The temperature of the air and mixing water shall conform to the requirements of Specification C511.
 - Air – Temp. $23.0 \pm 4.0^{\circ}\text{C}$
 - Mixing Water - shall be $23.0 \pm 2.0^{\circ}\text{C}$
- ▶ The relative humidity of the laboratory shall conform to the requirements of Specification C511.
 - Relative Humidity - not less than 50 %

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Procedure: Mixing

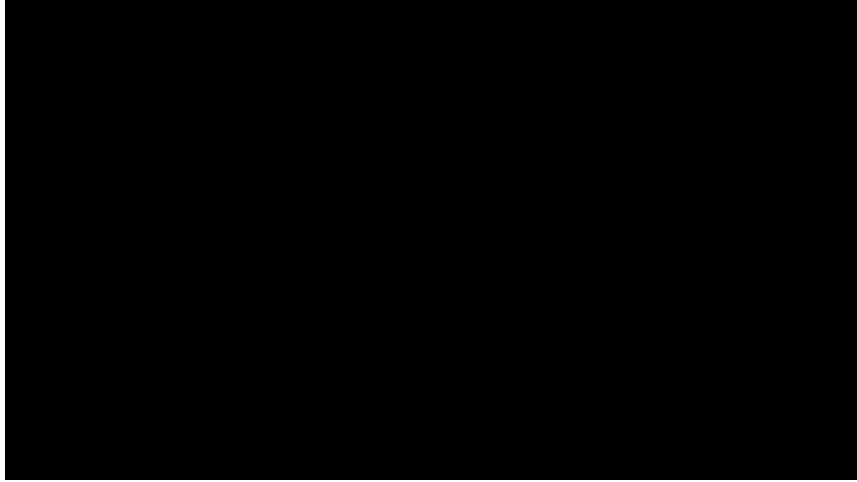
- ▶ Mix 650 g of cement with a measured quantity of water following the procedure prescribed in the Procedure for Mixing Pastes and Practice C305.
- ▶ The water shall conform to the numerical limits of Specification D1193 for Type III or Type IV grade of reagent water.



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Procedure: Molding Test Specimens



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Procedure: Molding Test Specimens (1/2)



1. Mix per ASTM C305



2. Toss 6 Times



3. Press Ball in Larger End of Conical Ring

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Procedure: Molding Test Specimens (2/2)



4. Place Conical Ring on Base Plate

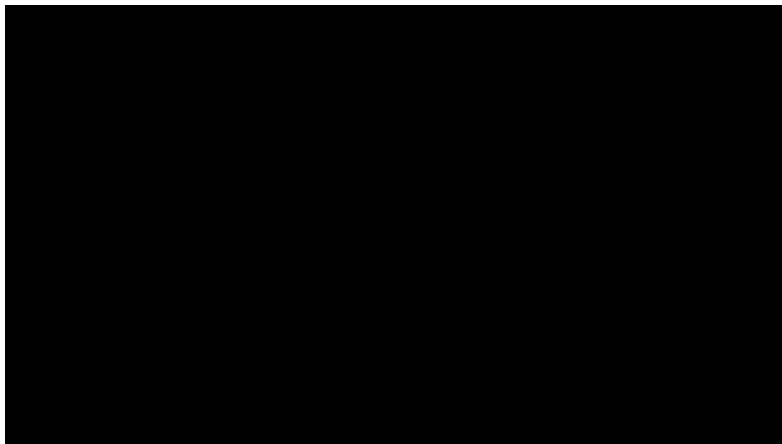


5. Slice Off Excessive Paste

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Procedure: Consistency Determination



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Procedure: Consistency Determination



1. Center Ring and Base Plate under Rod



2. Place Plunger in Contact with Paste and Zero Reading



3. Release the Plunger. Time not Exceeding 30s after Mixing.

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Calculation

- ▶ Calculate the amount of water required for normal consistency as the mass of water divided by the mass of dry cement, expressed as a percentage.
- ▶ Calculate the mass ratio to the nearest 0.1% and report the mass ratio to the nearest 0.5%.

$$P = \frac{\text{Quantity Water (g)}}{\text{Quantity Cement (g)}} \times 100$$

P = Percentage of Water(%)

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Limitations and Errors

- ▶ Gauging time should be strictly observed.
- ▶ Room temperature should be well maintained as per test requirement.
- ▶ All apparatus used should be clean.
- ▶ The experiment should be performed away from vibrations and other disturbances.
- ▶ Do not compress paste in conical ring.
- ▶ Mixtures containing SCMs (especially Silica Fume) normal consistency are very sensitive to water.

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Questions & Answers