PROCEDURES FOR THE CALIBRATION OF SOIL TEST MOLDS AASHTO T 99, T 134, T 180 AND UNIT WEIGHT MEASURES

A. PURPOSE

This method provides instruction for the calibration of soil test molds and unit weight measures.

B. APPARATUS REQUIRED

Liquid Method

1. Calibrated balance capable of weighing the empty mold, water required to fill the mold and the plate glass
2. Plate glass 1/4 inch thick and at least one (1) inch larger than the diameter of the mold or measure
3. Wax Pot (for soil mold only)
4. Calibrated thermometer readable to 0.1 °F or 0.1 °C

Linear Measurement Method

1. Calibrated Caliper capable of measuring inside height and inside diameter and with a range of 0-8 inches and readable to at least 0.001 inches

C. PROCEDURE

Liquid Method

1. Determine and record the empty weight of measure or mold and plate glass in grams.

   Note: For molds used for soil testing, a light coat of wax or other substance that prevents leaks should be applied around the base of the mold before weighing to prevent loss of water.

2. Fill measure or mold with water at room temperature and cover with plate glass in a way to eliminate air bubbles and excess water.

   Note: Wipe excess water away before weighing.

3. Determine the weight of measure or mold with water and glass. Record weight in grams.
4. Determine the temperature of water to the nearest 0.1 °C or 0.1 °F and record.
5. Subtract weight of empty measure or mold and glass from total weight to determine the weight of water in the measure.
6. Determine unit weight of water at test temperature from chart given and record.

Calculations:

1. Wt. of Mold, Glass and Water in grams – Wt. of Mold and Glass in grams = Wt. of Water in grams

2. $$\text{Volume} = \frac{\text{Wt. of Water in grams}}{\text{Unit Wt. of Water at Specific Temperature in g/ft}^3}.$$

3. $$\text{Mold Factor} = \frac{1}{\text{Volume}}.$$

4. $$\text{Correction Factor Conversion} = \frac{\text{Mold Factor}}{453.6}.$$

Linear Measurement Method

1. Measure the inside diameter of the mold to the nearest 0.001 inches with calibrated calipers 6 times evenly spaced around the top of the mold and 6 times evenly spaced around the bottom of the mold and record each measurement and average all 12 measurements and record the average inside diameter.

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2. Measure the inside height of the mold to the nearest 0.001 inches with calibrated calipers 6 times evenly spaced around the mold and record each measurement and average all 6 measurements and record the average inside height.

Calculations:

1. $$\text{Volume} = \left[K * \frac{3.14159 * \text{Avg Height} * (\text{Avg Diameter})^2}{4} \right] \div 28317$$

K = 16.387 = Constant to convert measurements made in inches
28317 = Factor to convert volume to cubic feet

2. $$\text{Mold Factor} = \frac{1}{\text{Volume}}.$$

3. $$\text{Correction Factor Conversion} = \frac{\text{Mold Factor}}{453.6}.$$

D. TOLERANCE

Any unit weight measure or soil test mold whose critical dimensions specified in the application test method exceeds more than 1 1/2 times the allowable amount shall not be calibrated using these methods and should be replaced.

EQUIPMENT CALIBRATION RECORD
LIQUID METHOD

Calibrated By: _____ Date: _____

Equipment: Soil Test Molds and Unit Weight Measures Location (Lab): _____

Identification No.: _____ Verification Frequency: 12 months

Previous Verification Date: _____ Next Due Date: _____

Calibration Equipment Used: Calibrated balance (capacity greater than the mold plus water), SN: _____

Calibrated thermometer (graduated in increments of 1.0 °F or °C. and having a range that includes the temperature to be checked), SN: _____ Plate Glass Wax Pot, ID No. _____

Calibration Procedure: (In-house) OMR-CVP-7A

Note: All calibration equipment meets the requirements of section B of OMR-CVP-7A

Dimensions of Measures, U.S. Customary System

Capacity Cubic ft.	Inside Diameter	Inside Height	Minimum Thickness of Metal Bottom	Wall	Band at top
1/30 cu. ft.	3.976-4.024 in.	4.577-4.592 in.	N/A	N/A	N/A
1/13.33 cu. ft.	5.961-6.039 in.	4.577-4.592 in.	N/A	N/A	N/A
1/8.73 cu. ft.	5.974-6.026 in.	6.982-7.018 in.	N/A	N/A	N/A
1/10 cu. ft.	5.9-6.1 in.	6.0-6.2 in.	0.20 in.	0.10 in.	.10
1/3 cu. ft.	7.9-8.1 in.	11.4-11.6 in.	0.20 in.	0.10 in.	.10
½ cu. ft.	9.9-10.1 in.	10.9-11.1 in.	0.20 in.	0.12 in.	.20
1.0 cu. ft.	13.9-14.1 in.	11.1-11.3 in.	0.20 in.	0.12 in.	.20

Inside diameter or measure or mold: _____ in.
Inside height of measure or mold: _____ in.
Bottom thickness of measure: _____ in.
Wall thickness of measure: _____ in.

Temp. F	g/ft^3		Temp. F	g/ft^3
56	28298.3		71	28256.4
57	28296.0		72	28252.5
58	28293.8		73	28248.8
59	28291.5		74	28245.2
60	28289.2		75	28241.6
61	28286.5		76	28237.5
62	28283.8		77	28233.4
63	28281.1		78	28229.3
64	28278.3		79	28225.3
65	28275.6		80	28221.2
66	28272.4		81	28216.6
67	28269.3		82	28212.1
68	28266.1		83	28207.6
69	28262.9		84	28203.0
70	28259.7		85	28198.5

MOLD OR MEASURE CALIBRATION

Scale Weights should be expressed to nearest 0.1g

Measure Weight:	Test 1	Test 2
Weight of measure or mold, glass and water A:	A1. _____ g	A2. _____ g
Weight of measure or mold and glass B:	B1. _____ g	B2. _____ g
Weight of water C: (A-B)	C1. _____ g	C2. _____ g
Temperature of water D:	D1. _____	D2. _____
Unit weight of water from chart for Temp E:	E1. _____	E2. _____

Volume F: = (C / E) Expressed to nearest .00001 F1. _____ F2. _____

Avg. Volume G: = (F1 + F2) / 2 Expressed to nearest .00001 G. _____

Mold Factor H: = (1 / Volume) Expressed to nearest .00001 H. _____

Correction Factor Conversion I: = H / 453.6 Expressed to nearest .00001 I. _____

EQUIPMENT CALIBRATION RECORD
LINEAR MEASUREMENT METHOD

Calibrated By: _____ Date: _____

Equipment: Soil Test Molds and Unit Weight Measures Location (Lab): _____

Identification No.: _____ Verification Frequency: 12 months

Previous Verification Date: _____ Next Due Date: _____

Calibration Equipment Used: Calibrated calipers with range of 0-8 inches and readable to at least 0.00l SN: _____

Calibration Procedure: (In-house) OMR-CVP-7A

Note: All calibration equipment meets the requirements of section B of OMR-CVP-7A

Dimensions of Measures, U.S. Customary System

Capacity Cubic ft.	Inside Diameter	Inside Height	Minimum Thickness of Metal Bottom	Wall	Band at top
1/30 cu. ft.	3.976-4.024 in.	4.577-4.592 in.	N/A	N/A	N/A
1/13.33 cu. ft.	5.961-6.039 in.	4.577-4.592 in.	N/A	N/A	N/A
1/8.73 cu. ft.	5.974-6.026 in.	6.982-7.018 in.	N/A	N/A	N/A
1/10 cu. ft.	5.9-6.1 in.	6.0-6.2 in.	0.20 in.	0.10 in.	.10
1/3 cu. ft.	7.9-8.1 in.	11.4-11.6 in.	0.20 in.	0.10 in.	.10
½ cu. ft.	9.9-10.1 in.	10.9-11.1 in.	0.20 in.	0.12 in.	.20
1.0 cu. ft.	13.9-14.1 in.	11.1-11.3 in.	0.20 in.	0.12 in.	.20

MOLD OR MEASURE CALIBRATION

Top Inside Diameter Measurement to nearest 0.001

1. _____inches
2. _____inches
3. _____inches
4. _____inches
5. _____inches
6. _____inches

Bottom Inside Diameter Measurement to nearest 0.001

7. _____inches
8. _____inches
9. _____inches
10. _____inches
11. _____inches
12. _____inches

Avg. Inside Diameter A: (Avg. of all 12 Measurements) A. _____ Expressed to nearest 0.001

Inside Height Measurement to nearest 0.001

1. _____inches
2. _____inches
3. _____inches
4. _____inches
5. _____inches
6. _____inches

Avg. Inside Height B: (Avg. of all 6 Measurements) B. _____ Expressed to nearest 0.001

$$\text{Volume C:} = \left[K * \frac{3.14159 * A * (B)^2}{4} \right] \div 28317$$

C. _____ Expressed to nearest 0.00001

K = 16.387 = Constant to convert measurements made in inches 28317 = Factor to convert volume to inches

Mold Factor D: = (1 / Volume) D. _____ Expressed to nearest 0.00001

Correction Factor Conversion E: = H / 453.6 E. _____ Expressed to nearest 0.00001