

METHOD OF CALIBRATION OF MECHANICAL LABORATORY SOIL COMPACTOR

1. SCOPE

1.1 This method for the calibration of mechanical laboratory soil compactors is for use in checking and adjusting mechanical devices to be used in compacting soil specimens for MTO Method LS-706, Test of Moisture-Density Relationship of Soils Using 2.5 kg Rammer and 305 mm Drop, and MTO Method LS-707, Test for Moisture-Density Relationship of Soils Using 4.5 kg Rammer and 460 mm Drop. Calibration is based on the deformation of a standard lead cylinder.

2. RELEVANT DOCUMENTS

2.1 ASTM D 2168

Note 1: Figures 1 through 4 refer to illustrations detailed in ASTM D 2168.

3. APPARATUS

3.1 LEAD DEFORMATION APPARATUS: Consisting of an anvil, guide collar and striking pin, as shown in Figure 1.

3.2 DIAL COMPARATOR: For measuring the deformation of the lead cylinders, as shown in Figure 2. An outside micrometer caliper reading to 0.025 mm may be used to measure the initial and final lengths of the lead cylinders to secure the deformation values.

3.3 GUIDE SLEEVE PEDESTAL: For use with guide sleeves used to control the height of drop of the rammers required in MTO Methods LS-706 and LS-707. A satisfactory pedestal design is shown in Figure 3.

3.4 CONCRETE BASE: A cylinder or cube of Portland cement concrete weighing not less than 90 kg. In the case of the cylinder, its height shall be at least equal to its diameter. The surface on which the mold is placed and its opposite face shall be plane surfaces and shall be parallel to each other.

3.5 LEAD CYLINDERS: A supply of 38-caliber lead alloy cores, each weighing 8.70 to 8.76 g (145 to 146 grains), and having a length of 17.27 ± 0.13 mm, manufactured for swaging into 9.48 g (158 grains) bullets. A minimum of 10 is required for the calibration of one mechanical compactor.

4. TEST PROCEDURE

4.1 DEFORMATION BY THE MANUAL METHOD: Secure the deformation value for the manual method as follows:

4.1.1 Check the mass of the manual rammer. The mass is required to be within 1 % of the specified mass. Check the sleeve control device for controlling the height of drop of the manual

rammer. The height of drop of the manual rammer is required to be within 1 % of the specified height.

4.1.2 Select a set of lead cylinders from the same lot or shipment. Minimum of ten is needed for the calibration of a mechanical compactor. Remove any burrs from the ends of the leads cylinders using a fine grade of emery cloth.

Note 2: Deformation of the lead cylinders is affected by changes in temperature. Precautions must be taken to maintain the cylinders at a constant temperature during the calibration of a mechanical compactor, including the securing of the values for the manual method.

4.1.3 Assemble the lead deformation apparatus with a lead cylinder in place as shown in Figure 4.

4.1.4 Place the assembled deformation apparatus on the base of the dial comparator with the top centre of the striking pin directly under the tip of the dial stem. This places the dial stem on top of the 6.4 mm steel ball. Rotate the striking pin rapidly several turns in one direction while rotating the guide sleeve rapidly several turns in the opposite direction. Read and record the dial reading.

4.1.5 Place the base plate of the compaction mold on the 90 kg cylinder or cube of concrete; place the deformation apparatus on the base plate; place the guide sleeve pedestal in position on the base plate, mount the rammer and guide sleeve on the guide sleeve pedestal, and apply one drop of the manual rammer.

4.1.6 Return the deformation apparatus to the dial comparator and secure and record the dial reading. The difference between the dial readings secured in 4.1.4 and in this step is the deformation value.

4.1.7 Repeat steps 4.1.3 to 4.1.6 using a fresh lead cylinder for each determination, until five deformation values are secured that do not vary more than 2 % from the average. The deformation value for the manual method shall be taken as this average value.

4.2 DEFORMATION BY THE MECHANICAL COMPACTOR: Clean and adjust the mechanical compactor in accordance with the manufacturer's instructions. Operate the compactor for a period of time to cause friction in the parts to become constant, allowing the rammer to fall on soil or other soft material. Check the height of drop of the rammer. This should be within 1 % of the specified height. Place the assembled lead deformation apparatus on the base of the mechanical compactor at such location that the striking pin will be centered on the face of the rammer at the moment of contact of the two. Secure the deformation value of the mechanical compactor using the procedure specified in 4.1.

4.3 ADJUSTMENT OF THE MECHANICAL COMPACTOR: If the deformation produced by the manual rammer is greater than that produced by the mechanical compactor, add mass to the rammer on the mechanical compactor in an amount necessary to produce the same deformation value as produced by the manual method. The deformation values shall be considered to be the same if the average value for the mechanical compactor does not vary more than 2 % from the

average value by the manual method. If the deformation produced by the manual rammer is smaller than that produced by the mechanical compactor, remove mass from the rammer on the mechanical compactor in an amount necessary to produce the same value as produced by the manual method. If the mass required to be added or removed from the rammer of the mechanical compactor is greater than 0.5 kg, the mechanical compactor shall not be used.

Note 3: As a final means for checking the adjusted mechanical compactor with the manual method, it is recommended that a compaction test be carried out on each using a moderately lean clay soil. If a moderately lean clay soil is not available, a silt soil may be used but the results will not be positive. Sands should not be used. The maximum dry density value should not vary from the value for the manual method value; optimum moisture content for the mechanical compactor should not vary from the value from the manual method by more than 0.5 %. For example, if the value of the manual method is 16.0 %, the value for the mechanical compactor should not be less than 15.5 % nor more than 16.5 %.

5. GENERAL NOTES

5.1 When the deformation of the lead-calibrating cylinder produced by a mechanical compactor is not the same as that produced by the manual method of compaction, the mass of the rammer on the mechanical compactor is adjusted to produce the same deformation as produced by the manual method. This method is for use only in the calibration of mechanical compactors equipped with rammers striking the surface of the soil directly. Mechanical compactors to be used in both MTO Method LS-706 and LS-707 must be calibrated using rammers with masses and heights of drop as specified in both methods. Calibration for use in one method does not qualify the equipment for use with the other.