CALIBRATION OF A SOILS COMPACTION HAMMER

1. SCOPE

This method describes the procedure for determining the critical dimensions of a standard or modified compaction hammer, which may be manually or mechanically operated. The tolerances are based on AS1289 5.l.1 and 5.2.1.

2. APPARATUS

(a) Balance—at least 5 kg capacity, with a limit of performance of not exceeding ± 1g.

(b) Vernier caliper accurate to 0.05 mm

(c) Steel rule accurate to 0.5 mm

(d) Masking tape, felt tip pen, Loctite medium strength thread locking compound

(e) Bevel protractor-graduated to 5 minutes

(f) 105 mm diameter cylindrical mould as described in AS 1289 5.1.1.

(g) A sample of low plasticity soil to fill the compaction mould

3. FULL CALIBRATION OF A MANUAL HAMMER

Clean the hammer thoroughly and check to ensure that it falls freely within 2 to 4 mm of the edge of a 105 mm diameter mould.

(a) Record the laboratory identification of the hammer, the date of calibration and the identification of the measuring devices used for the calibration.

(b) Invert the hammer and allow the top of the foot to rest against the washer which will be resting on the frame.

(c) Use a steel rule to measure the distance between the face of the foot and the open end of the frame at three positions, each adjacent to the frame, and at about 120 degree intervals. If the drop height is outside the specification limits, the washer may need replacement.

(d) Remove the foot from the handle.

Note: As the foot is secured to the handle with thread locking compound it may be necessary to apply considerable heat to the hammer to weaken the bond to allow the foot to be unscrewed.

(f) Withdraw the handle from the frame and add or delete washers to ensure compliance with drop height specification requirements.

(g) Weigh the foot plus handle plus washer/s. If necessary, add or remove mass to meet specification requirements. Record the combined mass.

(h) Measure and record the diameter of the foot about 3 mm from the compaction face at each of four positions around the circumference, about 45° apart. Calculate the mean diameter and record.

NOTE: One way of locating the plane of measurement is to place a steel rule across the compaction face of the hammer, rest a vernier caliper which has jaws 3mm thick against the ruler. (If the caliper jaws are bevelled then ensure that the bevel is towards the rule.)

(i) Reassemble the hammer using medium grade thread locking compound.

(j) Remeasure the drop height as described in (c) and record.

4. PARTIAL CALIBRATION OF A MANUAL HAMMER

Clean the hammer, check its operation and measure and record the drop height and diameter of foot as described in paragraphs 3 (b), (c) and (h).

5. CALIBRATION OF A MECHANICAL HAMMER

(a) Remove the hammer from the machine and clean. Weigh the shaft, compaction foot and attachment bolt, if used, to the nearest 1g, and record.

(b) Measure and record the diameter of the round foot as in 3(h) or the area of the sector foot (as applicable).

AREA OF SECTOR RAMMER

(i) Using the protractor measure the included angle (ϕ) of the foot, to the nearest 5 minutes and record. Convert (ϕ) from degrees and minutes to (ϕ_s) in decimal degrees.

(ii) Measure the radius of the sector (r_s) 3 mm from the face to the nearest 0.05 mm and record.

(iii) Calculate the area of the sector foot (A_s) from the formula below and record.

$$A_s = \pi \frac{\phi_s}{360}$$

(iv) If the point of the sector foot is slightly rounded or truncated due to wear, measure the chord length (C) 3 mm from the face and angle and calculate the area of the sector from:

$$A_s = \pi \left(\frac{C}{2 \sin \left(\frac{\phi_s}{2} \right)} \right)^2 \left(\frac{\phi_s}{360} \right)$$

(c) Replace the hammer and check that it falls freely and within 2 to 4 mm of the edge of a 105 mm diameter mould and adjust if necessary (see Note 1).

(d) Place a compaction mould in the machine and place sufficient material in it to bring the hammer within its normal operating range.

(e) Apply a strip of masking tape down one side of the hammer shaft for its full length and parallel to its axis.

(f) Rest the hammer on the material in the mould.

(g) Using a felt tipped pen or soft lead pencil resting lightly against the masking tape and held firmly against the machine frame as a reference, operate the machine to raise the hammer the full height and allow it to drop once. The pen should mark the height of lift on the tape and should be removed when the hammer starts to fall.

(h) After the hammer has stopped bouncing, reposition the pen on a clear portion of the tape and repeat (d) to (g) a further four times to give five traces of the lifting height.

(i) Before removing the tape from the rammer measure the overall length of each lift to the nearest mm using a steel rule . Take the error due to the width of the pen trace into account by subtracting the width of the trace from the measured overall length.

(j) Calculate the average of the five lift height measurements and record as the drop height.

6. RECORDS

Record the following:

(a) Mass of hammer

(b) Drop height

(c) Dimensions of the foot

(d) Compliance, or otherwise, with dimensions and tolerances as shown in AS 1289.5.1.1.

Note 1

For a Pav Pac compactor:

(a) before determining the drop height:

(i) ensure that the air pressure is set to the correct value;

(ii) ensure that the air line lubrication is functioning correctly;

(iii) Ensure that the speed of operation is approximatley 60 blows/minutes for the test using Standard compactive effort.

(b) determine the lift (or drop) height in accordance with the procedure described in the instruction manual instead of Steps (e) to (j). Two methods for determining drop height are included in different editions of the instruction manual. It is recommended that the split plastic sleeve method be used.