



Acme Penetrometer

Introduction

Hydraulic reaction-type apparatus for determining the setting time of concrete with slump greater than zero by testing mortar sieved from the concrete mixture. It also determines the effects of variables such as temperature, cement, mixture proportions, additions and admixtures upon the time of setting and hardening of concrete. The penetrometer's design makes it easy to operate, being more efficient, with a longer gear rack. All needles are one length so settings may remain the same. Loads are applied hydraulically with pressures read on a 200 lbf (890N) capacity gauge graduated in 2 lbf divisions. Set of six needles allows multiplication to a maximum reading of 8000 lbf. The Acme penetrometer features cast aluminum base and set of stainless steel penetration needles in a wooden block (bearing area: 1, 1/2, 1/4, 1/10, 1/20 and 1/40 sq. in., (645, 323, 161, 65, 32 and 16mm²). Includes 100 laboratory test data reporting forms. Meets ASTM C403; AASHTO T197. Shipping wt. 60 lbs. (27kg)

Preparation of Mortar Specimens

From the concrete mixture under test, select a representative sample of concrete of sufficient volume to provide enough mortar to fill the test container(s) to a depth of at least 5-1/2 inches (140 mm).

Remove essentially all of the mortar from the sample of concrete by sieving it through a No. 4 (4.75 mm) sieve onto a non-absorptive surface.

Thoroughly remix the mortar by hand method on the non-absorptive surface and place it in the container(s) and compact by rodding. Rod the specimen by means of the tamping rod held so as to penetrate the mortar with the round end. Rod the mortar once for each 1 in² (6.5 cm²) of top surface area of the specimen and distribute the strokes uniformly over the cross section of the specimen. After completion of the rodding, tap the sides of the containers lightly with the tamping rod to close voids left by the tamping rod and to further level the surface of the specimen. Upon completion of specimen preparation, the mortar surface shall be 1/2 inch (13 mm) below the top edge of the container to provide space for the collection and removal of bleeding water and to avoid contact between the mortar surface and the protective covering such as damp burlap or a tight fitting water impermeable cover.

Storage of Mortar Specimen

Store and maintain the specimens at the desired temperature of test. To prevent excessive evaporation of moisture, keep the specimens covered with a suitable material such as damp burlap or a tight fitting, water impermeable cover for the duration of the test, except when bleeding water is being removed or penetration tests are being made. The specimens shall be shielded from the sun.

Number of Specimens

Prepare at least three separate batches for each test condition. One rate of hardening test shall be made on each batch. An equal number of batches for each condition shall be made on any given day. When it is impossible to make at least one test for each variable on a given day, the mixing of the entire series of batches shall be completed in a few days as possible and one of the mixtures shall be repeated each day as a standard of comparison.

Penetration Test

Remove bleeding water from the surface of the mortar specimens just prior to making a penetration test by means of a pipette or suitable instrument. To facilitate collection of bleeding water, tilt the specimen carefully to an angle of about 12 degrees from the horizontal by placing a block under one side 2 minutes prior to removal of the bleeding water.

Insert a needle of appropriate size, depending upon the state of hardening of the mortar, in the penetration resistance apparatus and bring the bearing surface of the needle into contact with the mortar surface. Gradually and uniformly apply a vertical force downward on the apparatus until the needle penetrates the mortar to a depth of 1 inch (25 mm) as indicated by the scribe mark and take the maximum reading (lbs) indicated on the gauge. The time required to penetrate to the 1 inch depth shall be approximately 10 seconds. Record the force required and the time of application, measured as elapsed time after initial contact of cement and water. In subsequent penetration tests take care to avoid areas where the mortar has been disturbed by previous tests. The clear distance between needle impressions shall be at least two diameters of the needle being used, but not less than 1/2 inch (13 mm). The clear distance between any needle impression and the side of the container shall be not less than 1 inch.

Make penetration tests at hourly intervals for normal mixtures and normal temperatures, the initial test being made after an elapsed time of 3 to 4 hours. For accelerated mixtures or high temperatures, it maybe advisable to make the initial test after an elapsed time of 1 or 2 hours and subsequent tests at 1/2 hour intervals. For low-temperature conditions or retarded concrete mixtures, the initial penetration test maybe deferred for an elapsed time of 4 to 6 hours and perhaps longer. Subsequent tests maybe made at intervals of 1 hour unless the rate of increase in penetration resistance indicates that shorter intervals are desirable.

Not less than six penetration resistance determinations shall be made in each rate of hardening test. And the time intervals between penetration resistance determinations shall be such as to give a satisfactory rate of hardening curve, as indicated by equally spaced points. Continue the test until one penetration resistance of at least 4000 psi (27.6 MN/m²) is reached.

Calculations

The gauge reading in each penetration test divided by the area of the bearing face of the needle gives the penetration resistance corresponding to the gauge reading in each test.

Report

The report shall include the following:

Data on Concrete Mixture

- Type and proportions of cement, fine aggregate, coarse aggregate (including maximum size and grading of aggregates) and the ratio of net water content to cement content.
- Name, nature and percentage of active ingredients by weight of cement, of any addition or admixture used.
- Air content of fresh concrete and method of determination.
- Consistency of concrete as determined by the slump or other test for consistency.
- Temperature of mortar after sieving.
- Date and ambient temperature during the test period.

Curves

For each variable and condition of concrete as specified in the Number of Specimens section, the results from each of three or more rate of hardening tests shall be plotted separately, showing penetration resistance in pounds per square inch or (mega-Newton's per square meter) as the ordinate and elapsed time in hours and minutes as the abscissa, where 500 psi (3.5 MN/m²) and 1 hour are represented by not less than 1/2 inch (13 mm).

Time of Setting Results

The following informations are required in the report on the time of setting tests:

- A graph or plot of penetration resistance versus elapsed time for each time of setting test.
- The times of initial and final setting for each test, reported in hours and minutes to the nearest minute.
- The average times of initial and final setting for each test condition, reported in hours and minutes to the nearest 5 minutes.

Gauge Adjustment

The gauge on this instrument may not go to the zero setting. This is caused by either one or both of the following:

- The zero is offset to compensate for the weight of the plunger assembly.
- To calibrate this system accurately in the range from 20 to 180 lbs., the zero may shift to a positive number.

Note: The gauge and cylinder assembly has been vacuumed and filled with hydraulic oil and thus becomes a closed system. If this integrity is not preserved, any air will void the calibration.

Calibration

- Obtain a force-measuring gauge appropriate for measuring compressive force from 20 to 200 lbf and acceptable as reference standard.
- If the measurement standard will not fit under the Penetrometer's needle adapter, remove the breather plug, H-4133.8.4 from the cylinder, and the needle adapter, H-4133.8.9, from the piston stem.
- Remove the gauge & cylinder assembly, H-4133.7A, by taking off the lock nut, H-4133.8.5.
- Install the cylinder assembly into the measurement standard test frame and secure with the lock nut and check in 20 lbf steps from 20 to 200 lbf.
- Apply force and check in 20 lbf steps from 20 to 200lbf.
- If the readings depart from the standard more the ± 2 lbf return the gauge & cylinder assembly to the factory for service.

Maintenance

Keep the units clean at all times. If re-lubrication is necessary, use Teflon based grease to avoid particulate accumulations.

Warranty

Humboldt Mfg. Co. warrants its products to be free from defects in material or workmanship. The exclusive remedy for this warranty is Humboldt Mfg. Co., factory replacement of any part or parts of such product, for the warranty of this product please refer to Humboldt Mfg. Co. catalog on Terms and Conditions of Sale. The purchaser is responsible for the transportation charges. Humboldt Mfg. Co. shall not be responsible under this warranty if the goods have been improperly maintained, installed, operated or the goods have been altered or modified so as to adversely affect the operation, use performance or durability or so as to change their intended use. The Humboldt Mfg. Co. liability under the warranty contained in this clause is limited to the repair or replacement of defective goods and making good, defective workmanship.

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Testing Equipment for



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