OHD L-44
METHOD OF TEST FOR MEASUREMENT OF WATER PERMEABILITY OF COMPACTED PAVING MIXTURES

1. SCOPE

A. This test method covers the laboratory determination of the water conductivity of a compacted asphalt paving mixture sample. The measurement provides an indication of water permeability of that sample as compared to those of other asphalt samples tested the same way.

B. The procedure uses either laboratory compacted cylindrical specimens or field core samples taken from existing pavements.

2. APPLICABLE DOCUMENTS

A. OHD L-14 Method of Test for Determining the Specific Gravity and Unit Weight of Compacted Bituminous Mixtures

B. AASHTO T 209 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

C. FM 5-565 Florida Method of Test for Measurement of Water Permeability of compacted Asphalt Paving Mixtures

D. AASHTO T 283 Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage

3. APPARATUS

A. Permeameter - This device shall meet the following requirements:

1. A calibrated cylinder of 1.25 inches ± 0.02 inches (31.75 mm ± 0.5 mm) inner diameter graduated in millimeters capable of dispensing 500 ml of water.

2. A sealing tube using a flexible latex membrane 0.025 inches (0.635 mm) thick and capable of confining asphalt concrete specimens up to 6.5 inches (165.1mm) in diameter and 7.0 inches (177.8 mm) height.

3. An upper clamp assembly for supporting the graduated cylinder and expanding an o-ring against the sealing tube. The opening in the upper cap shall have the same diameter as the inner diameter of the calibrated cylinder mentioned previously in (i). See figure on last page.

4. A lower pedestal plate for supporting the asphalt concrete specimen and expanding an o-ring against the sealing tube. The opening in the plate should have a minimum diameter of 0.71 inches (18 mm).

5. O-rings of sufficient diameter and thickness for maintaining a seal against the sealing tube.

B. Sealing Agent - Petroleum jelly.

C. Spatula - Used for applying the petroleum jelly to the sides of laboratory compacted specimens.

D. Fan - An electric fan for drying the wet cut asphalt specimen.

E. Vacuum container and vacuum pump, including manometer or vacuum gauge.

F. Calibrated Thermometer - Used for obtaining temperature of water.

G. Stopwatch - Used to obtain the time of the falling head.

4. **PREPARATION OF TEST SAMPLES**

A. Saw cut the field core specimen to a height of not less than 50 mm and not more than 115 mm. Wash the field core test sample thoroughly with water to remove any loose fine material resulting from saw cutting. The ideal nominal size for the test specimen is 75 mm. Laboratory prepared specimens should be compacted to a height of 75 mm. The diameter for all test specimens shall be 150 mm. Laboratory prepared specimens shall be compacted to 7% air voids (± 0.5%). Determine G_{mb} by method B in OHD L-14, regardless of the percent water absorption. Determine G_{mb} of roadway cores by method A in OHD L-14 if the percent water absorption is 2% or less, otherwise determine G_{mb} using OHD L-45.

B. Measure and record, to the nearest 0.5mm or better, the diameter and height of the sample at a minimum of three different equidistant locations for the diameter and four equidistant locations for the height as specified in ASTM D 3549. The three height measurements shall not vary by more than 5 mm. The diameter of the specimen shall not be less than 144 mm and not more than 153 mm.

C. During the permeability test, the sample will need to reach a saturated state. Vacuum saturate the sample to a minimum of 70%, in the manner prescribed in AASHTO T 283.

D. It is necessary to apply a thin layer of petroleum jelly on the sides of the specimen. This will fill the large void pockets around the sides of the specimen which are not representative of the level of compaction of the interior of the specimen. If the sample is wet, wipe the sides with a towel to remove any free standing water. Use a spatula or similar device and apply the petroleum jelly to the sides of the specimen only.

5. **TEST PROCEDURE**

A. Evacuate the air from the sealing tube/membrane cavity. Complete evacuation of the air is aided by pinching the membrane and slightly pulling it away from the hose barb fitting as the pump is being stroked. Also a vacuum pump, from AASHTO T 209, using a hose to connect the pump to the permeameter will quickly evacuate the air from the membrane cavity.

B. Place the specimen on top of the lower plate and center it.

C. Place the sealing tube over the specimen and lower pedestal plate making sure that the sealing tube is oriented so that the hose barb fitting will be located between the o-rings on the upper cap and lower pedestal.

D, Insert the upper cap assembly into the sealing tube and let it rest on the top of the asphalt concrete specimen. Insertion of the upper cap assembly is aided if the graduated cylinder is already inserted into the upper cap assembly. The graduated cylinder can then be used as a handle.

E. Install the two clamp assemblies onto the permeameter frame and evenly tighten each one, applying a moderate pressure to the upper cap assembly. This action seals the o-rings against the membrane and sealing tube.

F. Inflate the membrane, using the hand pump, to 10 psi (68.9 kPa) ± 0.5 psi (3.4 kPa). Maintain this pressure throughout the test.

G. Fill the graduated cylinder with water approximately halfway and rock the permeameter back, forth, and sideways enough to dislodge any trapped air from the upper cavity.

H. Adjust the water inflow so that it equals the outflow. Allow the water to run in this manner for five to ten minutes.

I. Fill the graduated cylinder to a level above the initial timing mark (65). Start the timing device when the bottom of the meniscus of the water reaches the initial timing mark. Stop the timing device when the bottom of the meniscus reaches the lower timing mark. Record the time to the nearest 0.1s. Perform this test three times and use the lowest time recorded. If the test time is approaching thirty minutes during the first test run without the water level reaching the lower timing mark, then the tester may mark the water level at thirty minutes and record this mark and time. Run the test one more time and record the mark and time. Use the mark and time which will result in the highest permeability value.

J. Take a sample of water in a beaker or other suitable container and determine the temperature to the nearest 0.2°F (0.1°C).

K. After the test is complete, release the pressure from the container and evacuate the sealing tube/membrane cavity. Remove the clamp assemblies, upper cap, and specimen. Wipe off any excess petroleum jelly left on the latex membrane.

6. CALCULATIONS

The coefficient of permeability, k, is determined using the following equation:

$$k = \frac{a\ L}{A\ t} \ln\left(\frac{h1}{h2}\right) C$$

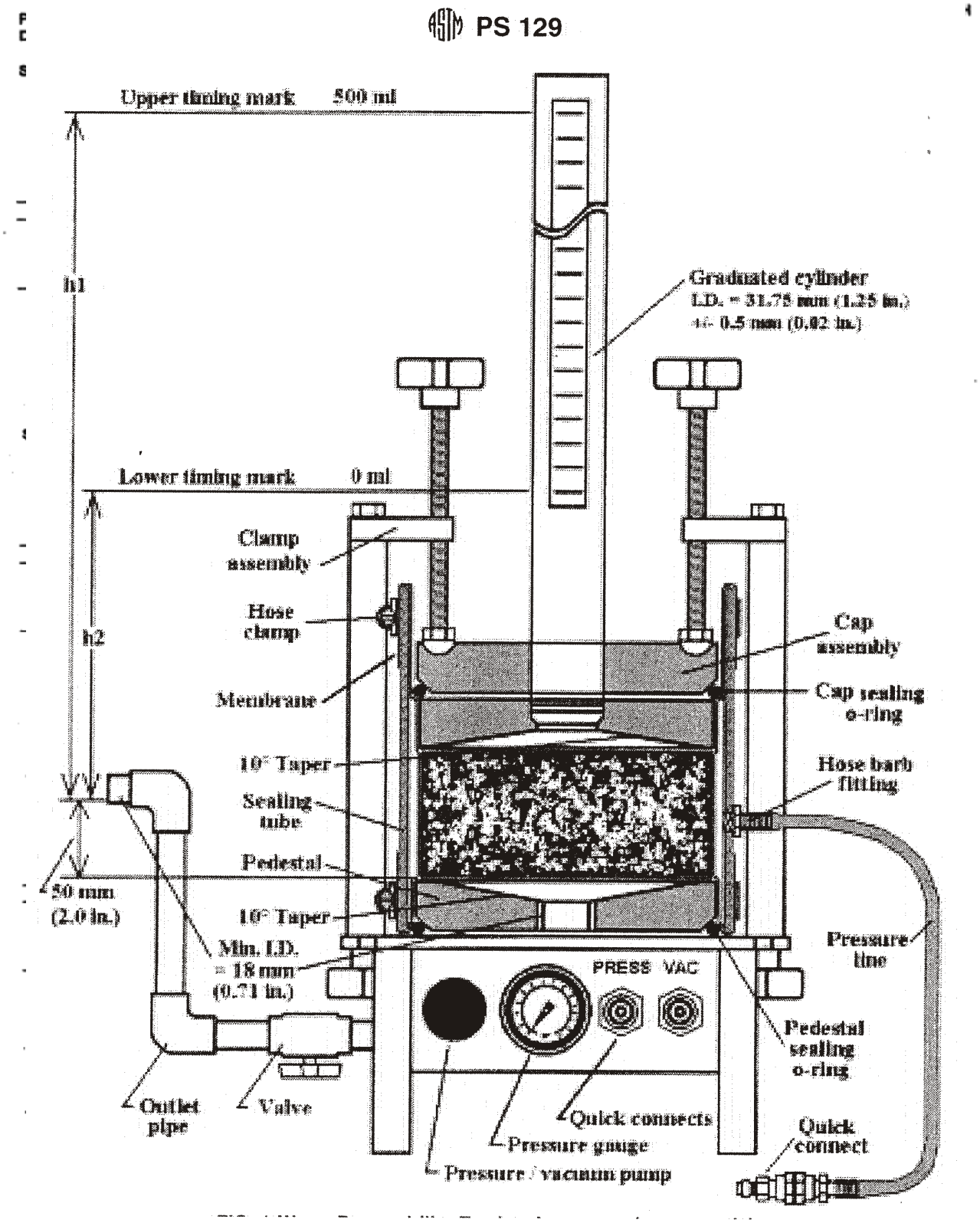
Where:

k = coefficient of permeability, cm/s
a = inside cross-sectional area of the buret, cm^2
L = average thickness of the test specimen, cm
A = average cross-sectional area of the test specimen, cm^2
t = elapsed time between h1 and h2, s
$h1$ = initial head across the test specimen, cm
$h2$ = final head across the test specimen, cm
C = temperature correction for viscosity of water; see Table 1. A temperature of 68°F (20°C) is used as the standard.
$\ln$ = Natural Logarithm

Table 1 - Temperature Correction for Viscosity of Water, Celsius

°C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
10	1.30	1.30	1.29	1.29	1.29	1.28	1.28	1.27	1.27	1.27
11	1.26	1.26	1.26	1.25	1.25	1.25	1.24	1.24	1.24	1.23
12	1.23	1.23	1.22	1.22	1.22	1.21	1.21	1.21	1.20	1.20
13	1.20	1.19	1.19	1.19	1.18	1.18	1.18	1.17	1.17	1.17
14	1.16	1.16	1.16	1.15	1.15	1.15	1.15	1.14	1.14	1.14
15	1.13	1.13	1.13	1.13	1.12	1.12	1.12	1.11	1.11	1.11
16	1.10	1.10	1.10	1.10	1.09	1.09	1.09	1.09	1.08	1.08
17	1.08	1.07	1.07	1.07	1.07	1.07	1.06	1.06	1.06	1.06
18	1.05	1.05	1.05	1.04	1.04	1.04	1.03	1.03	1.03	1.03
19	1.02	1.02	1.02	1.02	1.01	1.01	1.01	1.01	1.00	1.00
20	1.00	1.00	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98
21	0.98	0.97	0.97	0.97	0.97	0.97	0.96	0.96	0.96	0.96
22	0.96	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.93
23	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.91	0.91
24	0.91	0.91	0.91	0.90	0.90	0.90	0.90	0.90	0.89	0.89
25	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88	0.87	0.87
26	0.87	0.87	0.87	0.87	0.86	0.85	0.85	0.85	0.85	0.85
27	0.85	0.85	0.85	0.85	0.84	0.84	0.84	0.84	0.84	0.84
28	0.83	0.83	0.83	0.83	0.83	0.83	0.82	0.82	0.82	0.82
29	0.82	0.81	0.81	0.81	0.81	0.81	0.81	0.80	0.80	0.80
30	0.80	0.80	0.80	0.79	0.79	0.79	0.79	0.79	0.79	0.78
31	0.78	0.78	0.78	0.78	0.78	0.78	0.77	0.77	0.77	0.77
32	0.77	0.77	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.75
33	0.75	0.75	0.75	0.75	0.75	0.74	0.74	0.74	0.74	0.74
34	0.74	0.74	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.72

Example Worksheet:



Karol-Warner Flexible Wall Permeameter

Revision Date	Revision Description
9/21/04	Added in “APPLICABLE DOCUMENTS “ section a reference to AASHTO T 283 Changed in “APPARATUS” section, part E., from five gallon bucket to vacuum container and vacuum pump, including manometer or vacuum gauge “PREPARATION OF TEST SAMPLES” section: Part A.: Moved part B. into part A. Changed ideal height from 3 in. (76.2 mm) to 75 mm Added requirement for 7% air voids and specified how they are to be determined Part B.: Added requirement that height of specimen measurements shall not vary by more than 5 mm Part C.: Changed method of saturation Added in “TEST PROCEDURE” section step H., a requirement to adjust the water flow so that inflow equals outflow before beginning timed test. Removed “KNOWN SOURCES OF APPARATUS AND SUPPLIES” section due to increased availability of equipment from different sources.