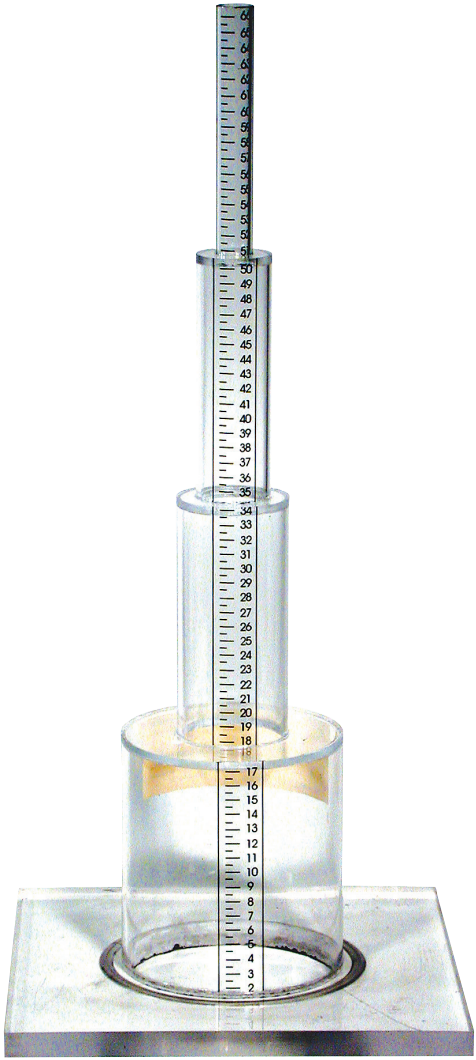
# HM-9113 & HM-9113.1



## NCAT Field Permeameter Kit

## Introduction

The preliminary instrument design and test protocol for in-situ testing of asphalt permeability was developed by the National Center for Asphalt Technology (NCAT). The HM-9113 Permeameter is based upon the NCAT design. The test is based on the falling head principle of permeability. The coefficient of permeability is calculated as follows:

$K = (a\ L / At)\ \ln (h_1/h_2)$

Where:

K = coefficient of permeability.

a = inside cross-sectional area of standpipe, $cm^2$ (Varies depending on tier used for testing; see listed values in Calculation section.)

L = length of the sample, cm (thickness of the asphalt mat).

A = cross-sectional area of permeameter through which water can penetrate the pavement (test area), $cm^2$.

t = Elapsed time between $h_1$ and $h_2$.

$h_1$ = Initial head, cm.

$h_2$ = Final head, cm.

## Operating Instructions

The Permeameter assembly consists of up to four segments, or "tiers" of clear plastic in two sections. Two different top sections are included and are designed to increase the versatility and range of the unit. The standard top section consists of one 3/4" (19mm) ID tube and one 1-3/4" (44.5mm) ID tube. The alternate top section is comprised of one long 1-3/4" (44.5mm) ID tube to allow extended test times in moderately permeable pavements. Using this section also allows faster filling of the permeameter when testing open-graded pavements, which may be very permeable.

Seat the Permeameter on the prepared test site using the Moldable Sealant, fill with water to a beginning mark, and start recording time. Rate of outflow may be observed as water level drops past graduated marks on the side of the tiers. To keep equation parameter "a" constant, the operator must select one of the four different tier diameters listed under "calculation". The choice of tier depends upon the rate at which the head is falling after the apparatus is filled with water. Very permeable pavements will necessitate selection of one of the larger diameter tiers because the head will fall too quickly for accurate observation in the smaller diameter tiers.

**A. Test Sequence:**

Select an area of unsealed asphalt approximately 1ft square of known thickness (equation value "L"). Brush the area clean of loose stone, dust and debris to enable a watertight seal between the HM-9113 base, Moldable Sealant and asphalt surface.

Invert and secure the Permeameter vessel for placement of the Moldable Sealant. The bottom of the base plate must be clean to promote a watertight seal. A rubber gasket on the bottom of the base plate insures a well-defined area for the permeability test. Replacements Permeability Vessel Gaskets may be ordered. The Moldable Sealant must be placed around the outside diameter of this gasket.

The Moldable Sealant should be placed approximately 3" (75mm) around the outside circumference of the Rubber Gasket and about 3/8 - 1/2" (9.5—12.5mm) uniform thickness. This takes approximately 1-1/4lb (0.6kg) of sealant to form. The sealant is easily worked with the hands and will conform to the asphalt surface when seated. Some care should be taken in forming it uniformly against the outside edge of the Rubber Gasket. Extra Moldable sealant may be added, if needed, by simply molding It Into place with the fingers.

Once the Moldable Sealant is installed, turn the Permeameter right side up and place on the clean, prepared test area. Use gentle, uniform foot pressure around the perimeter of the base to seat the Permeameter Vessel. Gently step on opposite corners of the base plate, repeat on the remaining corners. Slowly and gently, step around the perimeter of the base without twisting it to force the sealant into the asphalt mat. Observe the area inside the Rubber Gasket to see that sealant material has not been forced into the test area. Place a 5lb (2.3kg) weight on each side of the Permeameter base. This compensates for the head pressure exerted by the water column. Without these weights, water pressure may break the seal.

After the Permeameter is sealed to the pavement, place a thin layer of Moldable Sealant on the bottom rim of the selected Standard or Alternate Top Section, and seat it onto the Base Section.

Insert the filling tube assembly into the assembled vessel all the way to the bottom. Fill the Vessel completely with water at a steady rate. As the water level nears the top, continue filling while the tube is being withdrawn. Careful filling insures a minimum of bubbles and entrapped air in the water column. The Permeameter Vessel holds about a gallon (3.9L) of water in the standard configuration.

Observe the rate at which the water level in the Permeameter Vessel drops. Select a tier for recording rate of flow where the rate of fall is slow enough for accurate observation, but fast enough for timely completion of the test. Test times vary greatly depending on mix gradation and

density, but should generally not exceed five minutes. Make note of a starting time and a starting height for the falling head. The elapsed time is the value of "t" in the equation. The starting and ending head height are the equation values "$h_1$" and "$h_2$" respectively.

Upon completion of the test, gently lift one corner of the base plate to break the seal and allow the water to drain away.

**WARNING**

**DO NOT apply force to the side of the Vessel to break the seal. The Permeameter Vessel will break.**

The Moldable Sealant can be reused, but Its sealing effectiveness may be diminished over time. Debris must be carefully cleaned out and excess water removed from the material before reuse.

**B. Calculation:**

Use the test values obtained to calculate the equation for coefficient of permeability as shown previously.

Area Values of "a" for each Tier:

Tier 1 (Top) = area "a" = 2.85$cm_2$

Tier 2 = area "a" = 15.52cm2*

Tier 3 = area "a" = 38.32cm2

Tier 4 (Bottom) = area "a" = 167.53cm2

Pavement Test Area (value "A" in equation) = 167.53cm2

*This value also applies to the 1-3/4" (44.5mm) ID alternate top section.

**NOTE:** Values given are typical tier areas and are suitable for most determinations. If desired, the inside diameter of the tiers can be Individually measured and the areas calculated.

**General Notes**

A. Cleaning:

The Permeameter Vessel may be gently cleaned with water and conventional dish-washing detergents. Over time, the Vessel material may become scratched or clouded, but should remain viable for use as long as the water level can be accurately observed.

B. Temperature:

At low temperatures, the Moldable Sealant will become less pliable and may not form a watertight seal. This should be taken into account for air and test surface temperatures below room temperature. Warming of the test surface or sealant may allow sealing at lower temperatures.

In most cases, it is fairly easy to obtain a good seal for the Permeameter Vessel on finished surfaces of asphalt pavement. Problems can occur if there is insufficient area or thickness of the Moldable Sealant, if the asphalt surface is unusually rough, or if the test time is unusually long. Some open-graded mixes can be particularly difficult to seal. Selecting a different test site and using extra care in the seating process often overcomes these problems, although there is no guarantee that every attempted test will be successful.

A stream of water coming from the base is a leak, which affects the permeability test results. The test should be redone if a leak occurs. During unusually long test periods, condensate can form on the bottom of the base plate. This condensate comes from water vapor permeating outward through the asphalt and is not a sealant leak.

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