DURHAM GEO SLOPE INDICATOR

Permeant Interface device

S-470

Operator's Manual

Version 1.0

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GENERAL DESCRIPTION

The Permeant lnterface Device is for use in permeability tests where a corrosive fluid is to be used as the permeant. Some important advantages of the Permeant lnterface Device include:

- Corrosive fluids are prevented from entering the pressure control panel.
- There is no air/permeant interface so problems with toxic or corrosive vapors escaping into the laboratory is eliminated.
- The problem of compressed air dissolving into the Permeant is minimized.

The Permeant lnterface Device connects in-line between the pressure control panel and the permeability cell. A schematic of the Permeant lnterface Device is shown in the last page. The Permeant lnterface Device consists of two cylindrical chambers separated by a flexible rubber membrane. When installed in a permeability test system, the top chamber is filled with water and is connected by tubing to a volume change device on a pressure control panel. The lower chamber of the Permeant lnterface Device is filled with Permeant and is connected to the permeability cell with tubing. Flow in or out of the chambers is controlled by three-way valves attached to the end caps.

The parts of the Permeant lnterface Device that contact the permeant include a stainless steel chamber wall, an end cap, a fitting and valve, a Teflon® o-ring and a membrane. Only permeants that will not attack these components are to be used in the Permeant Interface Device.

Two types of membranes have been supplied with the Permeant lnterface Device. One is made of ethylene propylene and the other is made of Viton®. A v-notch has been made in the flange of the Viton® membrane for identification. These two compounds are compatible with a wide range of corrosive and toxic fluids. Chemical compatibility charts should be consulted before starting a test to make sure that the permeant will not attack the membrane. If a compatibility problem arises, membranes of other compounds are available.

Sometimes leachates of unknown chemical composition are used as the permeant fluid, In this case, compatibility should be checked by immersing a membrane in a container of leachate for a sufficient amount of time to see if the membrane is attacked. If the membrane is attacked, it should not be used.

When highly corrosive and toxic fluids are to be used as permeants, special precautions should be taken to prevent the permeant from contacting anyone in the case of a leak or other accident. These precautions include regular inspection to check the integrity of the membrane and placing the Permeant lnterface Device and permeability cell in a container under a chemical hood to contain spills and escaping vapors.

OPERATING INSTRUCTIONS

Below are instructions which are to be used as a general guideline for operating the Permeant Interface Device. It is assumed that a Durham Geo Slope Indicator pressure control panel and a Durham Geo Slope Indicator flexible-wall permeameter are to be used with the Permeant Interface Device.

1.0 Connecting the Permeant Interface Device

All connections to the Permeant Interface Device are made to the three-way valves attached to the end caps. When the handle to the three-way valve is positioned in the center (pointing to the Permeant Interface Device), the valve is off. No flow can occur in or out of the Permeant Interface Device. When the handle is positioned so that it is pointing to one of the two ports, the valve is open and flow can occur in or out of the Permeant Interface Device through that port.

The Permeant Interface Device connects to the pressure control panel through one of the ports on top brass valve. Either 1/4" OD or 1/8" OD tubing can be used between the panel and the Permeant Interface Device. If 1/8" OD tubing is used, a reducer fitting Swagelok™ B-200-R-4) is needed for the quick connect that plugs into the pressure control panel. If 1/4" OD tubing is used, a reducer fitting Swagelok™ B-400-R-2) is needed for the port on the three-way valve.

A hose fitting should be attached to the other port on the top valve so that the vacuum line from the pressure control panel can be attached to it.

The permeability cell connects to the Permeant Interface Device through the bottom (stainless steel) valve. Connect a length of 1/8” OD Teflon® tubing between the Permeant Interface Device and one of the drainage lines on the cell. The other port on the bottom valve is used for filling and draining the Permeant Interface Device of permeant. Connect a piece of 1/8” OD tubing to this port that is long enough to reach a container of permeant.

2.0 Filling and draining

Fill the top chamber of the Permeant Interface Device with water as follows:

1. Switch the top valve to the port leading to the pressure control panel and switch the lower valve to the fill & drain port.
2. Partially fill the top chamber with water from the tank in the pressure control panel.
3. Switch the top valve to the port with the vacuum line and draw the air out of the top chamber. Removal of air bubbles can be facilitated by tapping and shaking the Permeant Interface Device.

4. When all the air bubbles have been removed, switch the valve back to the other port and fill the entire Permeant Interface Device with water.

The lower chamber of the Permeant Interface Device is filled with permeant as follows:

1. Place the length of tubing connected to the fill and drain port of the lower valve into a container filled with permeant. The lower valve should be switched to this position.
2. Place a vacuum on the tank and draw water out of the upper chamber. Permeant should be drawn into the lower chamber.
3. When the lower chamber is partially filled, remove the vacuum on the tank. Invert the Permeant Interface Device and force water to flow into the upper chamber. This should cause the air to flow out of the bottom chamber.
4. When bubbles cease to emerge from the lower chamber, drain line on the cell so that permeant can flow through and saturate the drains. Return the Permeant Interface Device to the upright position. Place a vacuum on the tank and draw permeant into the lower chamber until it is filled.

Once the Permeant Interface Device is filled and saturated, push permeant out of the Permeant Interface Device and through the line leading to the permeability cell. Open the extra drain line on the cell so that permeant can flow through and saturate the drains.

3.0 PERMEABILITY TEST

When used in a headwater line, the Permeant Interface Device is initially filled with permeant and the membrane is in the up position against the top end plate. As the test proceeds, the membrane moves downward as permeant flows out of the Permeant Interface Device and through the test specimen. Before the membrane comes to rest on the bottom end cap, the Permeant Interface Device should be refilled with permeant. Refill the Permeant Interface Device by closing the drain valve on the cell and the "accumulator out" valve on the panel board and then use the tank in the panel board as described previously.

When used in a tailwater line, the Permeant Interface Device is initially close to empty of permeant with the membrane positioned close to the bottom end cap. Normally when the Permeant Interface Device is set up in a tailwater position, the lower chamber is initially saturated with water rather than permeant. During the test, the membrane moves upward as permeant flows into the Permeant Interface Device. Before the membrane reaches the top end cap, the Permeant Interface Device should be drained and the membrane lowered close to the bottom end cap. Drain the Permeant Interface device by closing the drainage line valve at the cell and the "accumulator out" valve on the panel board. Then use the tank to push water into the Permeant Interface Device and drain it of permeant.

4.0 CLEANING

It is recommended that the Permeant Interface Device be disassembled, cleaned, and the membrane inspected between each permeability test. The Permeant Interface Device can be disassembled by first removing the top three hex nuts. Then lift off the top end cap and the two chamber walls. Be careful not to loosen the o-rings seated in the end caps. Rinse all the parts and check the membrane for any sign of deterioration and discard it if any is found.

To reassemble the Permeant Interface Device, first apply a thin coat of silicon high vacuum grease to the o-rings and place them back into the end plates. The white Teflon® o-ring belongs in the lower stainless steel end plate. Next, place one of the chamber walls on the bottom end plate. Check that the end with the rounded inside edge is up. Apply a light coat of silicon high vacuum grease to the flange of the rubber membrane and insert it into the remaining chamber wall. Insert the membrane into the end with the rounded inside edge. Next, put the upper chamber wall into position so that the flange of the membrane is captured between the two chamber walls. Lower the top end cap into place and tighten the top hex nuts finger tight. Check that the two chamber walls are lined up and tighten the top nuts evenly in 1/4 turn increments.