2825K1

OPERATING INSTRUCTIONS

2825K1 Tension Infiltrometer

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(Figure 1) - Guelph Permeameter Reservoir Assembly

(Figure 2) - Infiltometer Foot Assembly and Marriot Bubbler Assembly

The Tension Infiltrometer (TI) Attachments for the Guelph Permeameter (GP), consist of three major components:

1. Guelph Permeameter Reservoir Assembly
2. Infiltrometer Foot Assembly
3. Marriot Bubbler Assembly

SOILMOISTURE EQUIPMENT CORP.
P.O. Box 30025, Santa Barbara, CA 93105 U.S.A.
Telephone 805-964-3525 - Fax No. 805-683-2189
Email: sales@soilmoisture.com - Website: http://www.soilmoisture.com

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ASSEMBLY

Assemble the unit as shown in Figure 1. Refer to the GP operating instructions for complete and detailed information regarding the components of the Reservoir Assembly.

Insert the short support tube (14-cm) into the reservoir base. Insert the double “O” ring portion of the support tube into the foot assembly. The Reservoir Assembly should contain the air tube with the air tip and air tube connectors firmly attached. The well head scale is not required for reference elevation determination when making measurements using the TI attachments. The air tube must be plugged with a rubber seal during TI measurements as shown in Figure 1.

The TI Foot comes completely assembled and can be attached immediately to the double “O” ring portion of the support tube/reservoir assembly. The TI foot cover has two accessory port plugs. Use the port plug located nearest the anodized aluminum support ring (farthest from the central support tube port) for attaching the Marriot Bubbler Assembly as shown in Figure 1.

The Marriot Bubbler comes completely assembled and should have a rubber seal plugged in the Bubbler top cap. The drainage tube must be plugged or clamped prior to filling the Bubbler reservoir. Once the Marriot Bubbler, the Guelph Reservoir and the TI Foot are assembled, the Tension Infiltrometer can be filled with water.

PREPRARATION PROIR TO USE / FILLING THE GUELPH TENSION INFILTROMETER

FILLING THE GUELPH RESERVOIR ASSEMBLY

When you fill the GP Reservoir, use the vacuum hand pump (supplied with the GP Kit) to draw water into the Reservoir through the porous disk in the foot assembly. Connect the vacuum hand pump to the Neoprene tube attached to the Reservoir top cap. Plug the Marriot Bubbler port, the accessory port, the air tube, and the fill port. Place the assembled TI in a shallow pail of water. Lift the air tube (air inlet tip) from the air inlet tip seat and open the reservoir valve to the outer reservoir (the 12:00 o'clock position) to permit water to flow into the Reservoir. Draw a vacuum with the hand pump, filling the Reservoir to the desired level. Seat the air tip in the air tip seat when filling is complete.

FILLING THE MARRIOT BUBBLER

Place a pinch clamp (or clamping ring) on the drainage tube and remove the Bubbler top cap assembly. Totally fill the Bubbler reservoir and replace the top cap assembly. Adjust the head height () 20 mm to –250 mm) by opening both the Bubbler rubber seal and the drainage tube. Release water through the drainage tube until the desired level is attained. If the desired level is exceeded, simply repeat the procedure.

HOW TO OPERATE THE GUELPH TENSION INFILTROMETER

These instructions are helpful for operating the Guelph TI. Making measurements using the GP reservoir assembly and using the inner and outer reservoirs are described in the GP operating instructions.

Before operating the TI, all entrapped air and air bubbles must be removed from the foot assembly and Marriot Bubbler. Do this by filling the reservoir through the porous disk (described above) or soaking the porous disk in water. It is also helpful to use the air tube/air inlet tip assembly as a plunger (use a stroking up and down motion) to dislodge accumulated air bubbles from the foot and reservoir assemblies.

To make a measurement with the Guelph TI, the porous disk must make very good hydraulic contact with the soil surface. Either prepare the surface by removing any occasional coarse fragments (>2 mm particle) from the site or locate a 20 cm diameter area free of coarse fragments. Sites with considerable quantities of coarse fragments or vertisols with large cracks require special techniques and are not discussed in these instructions. It is helpful to make a test run near the site you wish to measure. This allows you to inspect the foot assembly for air leaks due to insufficient wetting and provides an estimate of infiltration at the site. Rinse any soil adhering to the porous disk before conducting further measurements at other sites.

To start a measurement, raise the air inlet tip 2 to 3 cm allowing water to flow from the reservoir. Remove the Bubbler rubber seal from the Bubbler top cap. Measurements can be made when sufficient vacuum develops in the upper reservoir to draw an air bubble from the Marriot Bubbler at a predetermined head. The developing unsaturated wetting front pulls water from the GP reservoir creating a vacuum. To verify that infiltration is occurring, inspect the Bubbler air tube. The water level in the tube should be decreasing until all the water is removed. At this time air bubbles will release through the foot assembly and migrate to the

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GP reservoir.

Sites that have rapid infiltration can be measured with the outer reservoir (reservoir valve notch in the 12:00 o'clock position). On slow infiltration sites, the inner reservoir (notch in the 6:00 o'clock position) should be used for better resolution.

When you make measurements of very slow infiltration rate (<10-6 cm/s) it can be difficult to obtain steady state values. This is due in part to:

1. The length of time necessary to obtain steady state (many hours in the worst cases)
2. The dynamic physics of the ambient environment
3. The physics of the instrument construction:

If the infiltration rate is approximately 1.0 cm/min or less, the TI is in a warming environment (i.e., air temperature increases in the bright sun),
and an air gap exists above the water level in the reservoir, a pressure increase in the GP Reservoir can be expected in the GP Reservoir.

Under these conditions, gases above the Reservoir water level expand (causing pressure) at a rate that exceeds the rate of infiltration into the soil.

In such cases, there is no steady state condition, and measurements are meaningless.

To avoid this problem, use the following methods:

1. Maintain as much water in the Reservoir as possible to minimize the air space.
2. Shield the Upper Reservoir from direct sun light.

CALCULATIONS

Decide on an appropriate technique to use when making a measurement with the TI. Options are:

1. Transient flow (early time) measurements
2. Steady flow techniques.

Using Steady Flow Techniques, values can be obtained using single head or multiple head approaches.

In the multiple head approach, two or more water potentials are sequentially applied. Appropriate hydraulic conductivity (Kt) and flux potential (Ot) are solved by using either simultaneous equations (2 heads applied sequentially), or least squares regression (2 or more heads applied sequentially).

For a complete discussion of appropriate techniques and calculations, review pertinent literature by D. E. Elrick and/or W. E. Reynolds and others. A short list of review articles is included in References section.

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When making multiple head measurements, it is important to apply successively larger (more positive) heads rather than decreasing heads. Decreasing soil moisture tension is less trouble then increasing soil moisture tension.

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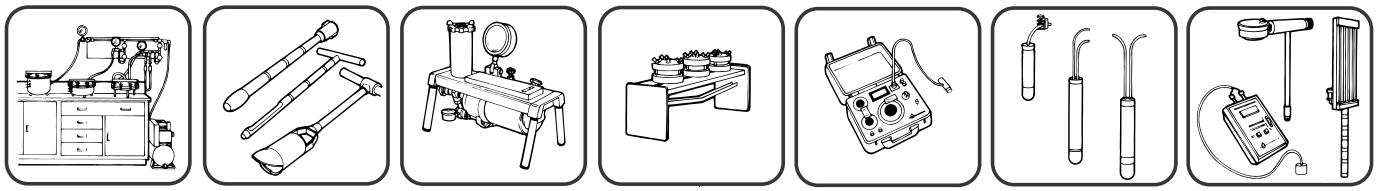

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