Double-Ring Infiltrometer Measurement instructions

Basic Checklist

1. Drive double ring infiltrometer 6-8 in. into the soil. Be sure the rings are level
2. Add water to a desired depth in both rings.
3. Measure the amount of water infiltrated after every 15 min in the first hour, 30 minutes for the second hour, and 60 minutes for the remaining time (at least 6 hours). Higher permeable soils may require more frequent measurements.
4. Carefully remove the double ring infiltrometer.

(If you want a shorter infiltration test you can measure every minute or so for about an hour… It may not be as accurate, especially if you don't reach soil saturation. You just need to identify the relationship of infiltration over time, and then extrapolate from your data.)

Taken from an excerpt of:
A Field Method for Measurement of Infiltration: Geologic Survey Water-Supply Paper 1544-F. A.I. Johnson. *General Groundwater Techniques*. USGS 1963. Revised 1991.

If a double-ring infiltrometer is desired, a small ring is installed, centered inside a larger ring. The 12- and 24-inch rings are suggested for a double-ring infiltrometer installation. The sides of the infiltrometer rings should be kept vertical, and undue disturbance of the soil surface from driving of the ring or from excessive trampling over the surface should be avoided. The infiltrometer rings should be driven 6 to 8 inches into the soil. Where the infiltration rate for a shallow subsurface layer is desired, a pit should be excavated to the desired depth before tin rings are installed. An infiltration ring is driven by means of a driving cap (1/2-in.-thick plate), which has been centered on the ring and on the edge of which has been placed a heavy wood block (2X4 or 4X4 in., 2 or 3 ft. long). Blows of the heavy sledge on the block should be of medium force to prevent undue fracturing of the soil surface. The wood block should be moved around the edge of the driving cap every one or two blows, so the cylinder will penetrate the soil surface uniformly, without the tilting back and forth that results in a disturbance of the soil. If a double-ring infiltrometer is used, both rings are installed to the same depth. The rings may be jacked into the soil surface if a truck and heavy jack are readily available. The jack should be centered upon a wood block that has been centered across the driving cap of the ring:. The top of the jack then can be placed under the end of the truck body and force applied to the jack. In heavy-textured soils it may be necessary to add additional weight to the truck in order to obtain sufficient force.

After the driving is completed and the rings are level, the disturbed soil adjacent to the ring on the inside should be tamped firm by means of the metal tamp (lin. wide X 1/4 in. thick X 20 in. long). If the soil is disturbed more than one-eighth of an inch from the wall of its ring, an attempt should be made to reset the infiltrometer ring with less disturbance of the surface. Some type of depth gage should be installed on the infiltrometer ring (fig. 3), or on both rings if a double-ring infiltrometer is used, to assist the investigator visually in maintaining a given water level (head). A staff gage is satisfactory if the infiltration rate is high, but a more accurate device should be used for low rates. A hook gage may be used, or a simple point gage may be constructed. The latter consists merely of a length of heavy wire, pointed on both ends, inserted into the soil and left at a height above the soil surface equivalent to the desired depth of water. All these gages, except the staff gage (which is installed on the ring wall), should be installed near the center of the center ring and in the middle of the annular space between the two rings. The water is at the proper depth when the point of the wire or hook barely makes a small pimple on the surface of the water. A minimum water level of 1 inch and a maximum of 6 inches is usually maintained.

A Mariotte tube can be utilized for maintaining the water level and for measuring the quantity of water. (See fig. 3.) The small quantities of water required for low infiltration rates may require measurement by small-diameter Mariotte tubes, or merely graduated cylinders. For higher rates or longer test runs, the water level may be held constant by means of a float valve connected to the ring and supplied from a large water-storage tank or trailer. (See fig. 4.) A recording level gage may be installed on the supply tank to record the amount of water used for the test.

To dissipate the force of the applied water and to prevent disturbance of the soil, the soil surface within the infiltrometer rings should be covered with a splash guard (pieces of burlap or rubber sheet). The initial amount of water poured into the rings need not be measured, but any water added to maintain the desired depth of water, after the start of the timing interval, should be recorded. This process is followed for both rings in a double-ring infiltrometer. For comparison, infiltration rate is usually calculated for the outer as well as inner ring.

The water level should be maintained as near the desired depth as possible. For average materials the amount of water used should be recorded at intervals of 15 minutes for the first hour, 30 minutes for the second hour, and 60 minutes during the remainder of a period of at least 6 hours. Permeable materials may require more frequent early readings. A longer test may be desirable if the soil has a low permeability or if a long-range infiltration rate is more applicable to the problem being studied. To prevent evaporation, the driving cap or some other type of covering should be placed on the infiltrometer rings during the time intervals between water measurements. A small hole should be drilled in the center of the driving cap to permit air to enter.

Upon completion of the infiltration test, the infiltrometer rings are removed from the soil by light hammering on the sides, (the rings should be hammered only with a rubber hammer to prevent denting), by moving the ring back and forth, and by lifting. A trench then should be dug. One wall of the trench should pass along the centerline of the former location of the infiltrometer rings and be so oriented that it will be illuminated by the rays of the sun. If feasible, the trench should be large enough to include all the moist area. If the soil was moist before the start of the infiltration test, the use of dyes may assist in delineating the newly moistened areas (Tamm and Troedsson, 1957). If the soil is sandy, sodium fluorescein or indigo carmine may be used, but a portable black-light lamp will be needed to detect the fluorescein dye. The use of dyes in clay soils commonly is unsatisfactory because the clay may absorb the dye. If preferred, an auger (the Orchard barrel-type auger is suggested) may be used to determine the approximate outline of the moist area. Determination of the moisture content of samples obtained from different locations in the moist area commonly provides useful information in interpreting the movement of water through any particular soil profile. The moist area should be plotted on the cross-section part of the report form. Contours of different moisture contents also may be plotted.

The volume of water used during each measured time interval should be converted into depth of water per unit of time (inches per hour or centimeters per hour). If the Mariotte tube is used, these calculations may be made by use of tables 2 and 3. For double-ring infiltrometers, these calculations usually are made for the inner ring, the outer ring, and both rings combined.