2100F

OPERATING INSTRUCTIONS

2100F SOILMOISTURE PROBE Oct 2009

(Figure 1) - 2100F Soilmoisture Probe Kit

The Model 2100F Soilmoisture Probe is a specialized unit designed for investigation of soil suction in such small regimes. Ideal for laboratory work such as measuring soil suction values at various levels in soil columns, and for getting measurements near surface conditions with minimal disturbance or in places where the readout must be remotely located.

The basic components of Model 2100F Soilmoisture Probe include a porous ceramic cup tube assembly, a vent tube, a plastic body tube, and a vacuum gauge. The ceramic cup is placed in good hydraulic contact with the soil and allows transfer of water into and out of the vent and body tubes according to the tension in the soil. The vacuum inside the body tube equilibrates with the soil water tension, and the dial gauge provides a direct readout of the tension.

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UNPACKING

The Model No. 2100F Soilmoisture Probe shipped to you has been thoroughly tested before shipment. When packed, it was in perfect order. Unpack with care being sure to remove all packing material. Follow the instructions carefully in order to assure long, trouble-free service.

Handle the nylon tubes with care to avoid any "kinking" which will weaken the tubes under vacuum and may cause a restriction to flow of water.

NOTICE: ANY DAMAGE FOUND UPON RECEIPT, SHOULD BE REPORTED IMMEDIATELY TO THE TRANSPORT CARRIER FOR CLAIM. IT IS IMPORTANT THAT YOU SAVE THE SHIPPING CONTAINER AND ALL EVIDENCE TO SUPPORT YOUR CLAIM.

Be sure to read all operating instructions thoroughly before operating the unit.

CAUTIONS & WARNINGS

Be sure to protect the porous ceramic cup from any oil, grease or other materials that will clog pores.

Handle the nylon tubes with care to avoid any "kinking" which will weaken the tubes under vacuum and may cause a restriction to flow of water.

When Soilmoisture Probes are not in use, empty the unit of all water. Do not permit prolonged evaporation from the cup surface. Evaporation deposits on the cup surface can be removed by sanding the surface of the cup with medium grade sandpaper.

Avoid exposing Soilmoisture Probes to freezing conditions.

The Vacuum Dial Gauge (2060FG3) is hermetically sealed for maximum gauge life. It is well protected against weathering conditions and can be submerged in water for a limited period without damage. It should be kept in mind, however, that it is a delicate instrument and it should be protected against rough handling and particularly against sharp blows which can damage the integral mechanism.

WARRANTY & LIABILITY

Soilmoisture Equipment Corp. (SEC) warrants all products manufactured by SEC to be free from defects in materials and workmanship under normal use and service for twelve (12) months from the date of invoice provided the section below has been met.

Soilmoisture Equipment Corp. (SEC) is not liable for any damages, actual or inferred, caused by misuse or improper handling of its products. SEC products are designed to be used solely as described in these product operating instructions by a prudent individual under normal operating conditions in applications intended for use by this product.

THEORY OF OPERATION

The Model 2100F Soilmoisture Probe measures the force with which water is held in the soil by the soil particles. This force, referred to as soil suction, tension, or potential, indicates how tightly the water is bound in the soil, and how much energy must be exerted by plant roots to remove and use the water.

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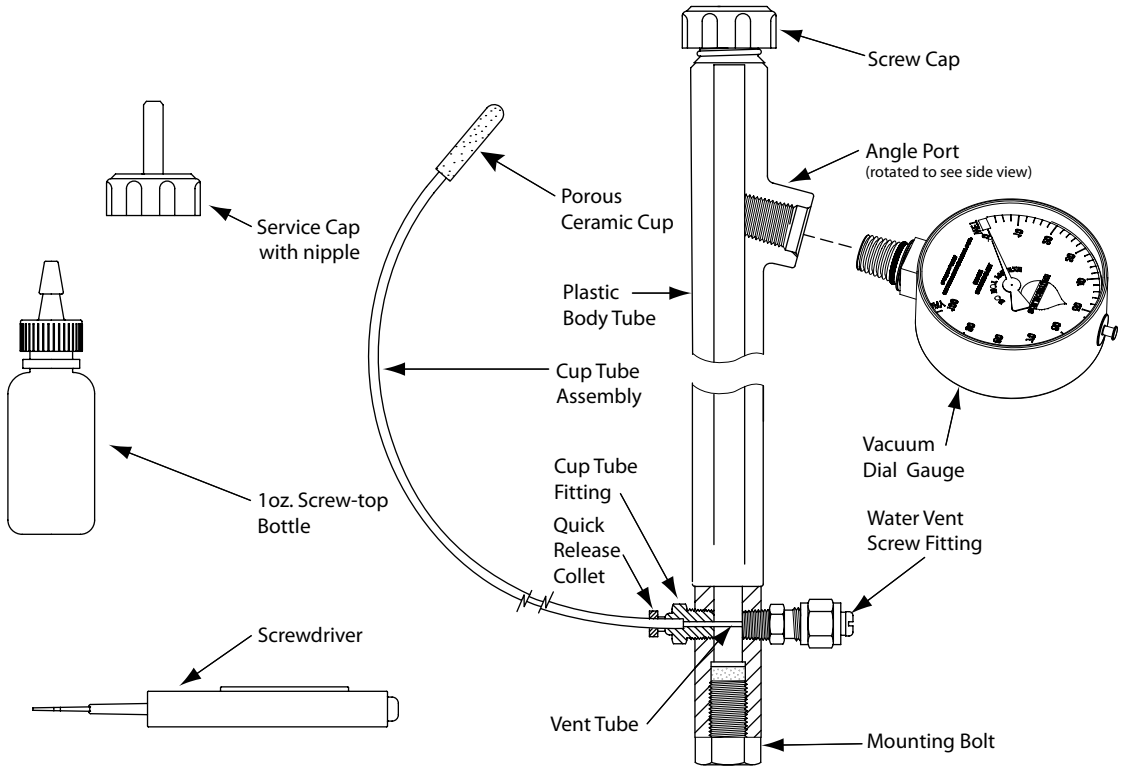
AQUAINT YOURSELF WITH THE PARTS



(Figure 2) - 2100F Soilmoisture Probe Parts

The Cup Tube Assembly (Z2100F-200CR) is composed of a nylon vent tube and the porous ceramic cup (2100-201). The ceramic cup is made from our 1 Bar Porous Ceramic which has a bubbling pressure of 20-30 psi.

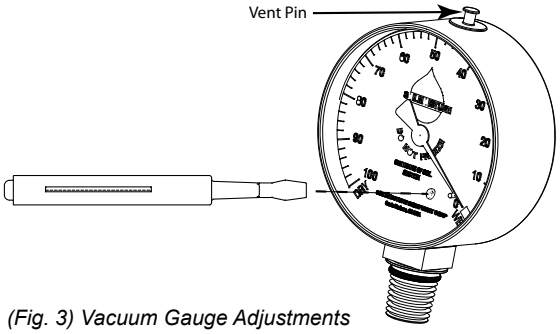
The plastic body tube (Z2100F-100) is made of rigid plastic to withstand years of weather abuse.

The mounting bolt (Q2820SCH12) is 1/2"-20 X 3/4" long hex head bolt and is used to mount unit in a vertical position.

The Screw Cap covers the filler end of the Plastic Body Tube and is used to seal the unit.

The vacuum dial gauge (2060FG-3) is a "Bourdon Tube" type gauge and measures the vacuum in the unit. It is graduated from 0-100 centibars (or 1 Bar of soil suction). It has an accuracy of +/- 1.5% full scale. *Please see following instructions on how to vent the dial gauge prior to use (Fig. 3).*

PREPARING THE SOILMOISTURE PROBE FOR USE



(Fig. 3) Vacuum Gauge Adjustments

ADJUSTING THE POINTER ON THE DIAL GAUGE

The tensiometer dial gauge is hermetically sealed at the factory at sea level. If you live at a higher elevation, the pointer on the dial gauge may read higher than zero when you unpack it. This is due to the lower atmospheric pressure at your elevation.

First, simply press the vent pin located, at the top of the gauge, to release any collected air.

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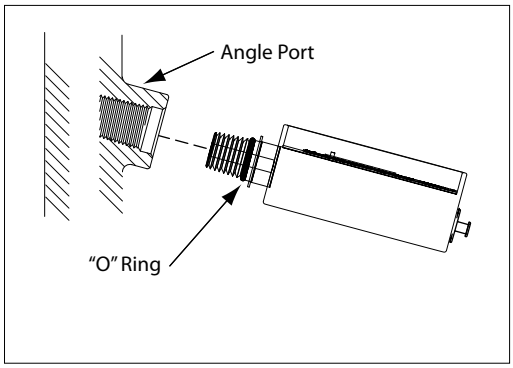
PREPARING THE SOILMOISTURE PROBE FOR USE

Located on the face of the gauge is an insertion point for a small flathead screwdriver. If the gauge is reading high, turn the screwdriver clockwise an estimated amount to correct the error. If the gauge reads low, turn the screwdriver counterclockwise an estimated amount to correct the error. Repeat the process if necessary until the pointer is on zero. Tap the gauge to help settle the needle.



(Fig. 4) Attaching the dial gauge

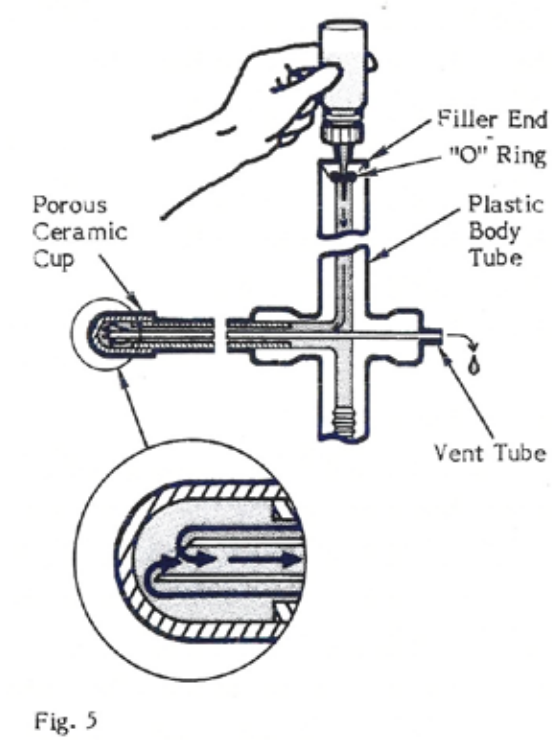
ATTACHING THE DIAL GAUGE

Grease "O" ring with MFTO12PK INC in 2790K1. Next, screw the dial gauge into the threaded angle port in the side of the body tube. Be sure that the threads on the dial gauge stem line up properly with the threads of the angle port on the probe body. Screw the dial gauge in until the backup washer on the stem touches the body tube and then unscrew dial gauge slightly until the face of the dial gauge is facing up and in the desired position for easy reading. Do no over tighten the dial gauge. The “O” ring on the stem of the dial gauge makes the vacuum seal, not the threads *(see Fig. 4)*.

INITIAL FILLING

Since the unit is shipped dry, there is a considerable amount of air retained in the walls of the porous ceramic cup and adsorbed on the interior walls of the unit. If this air is removed before placement of the unit in the soil, it will have maximum sensitivity with minimum maintenance right from the start.

For the initial filling, it is desirable to use air-free water. This is obtained by boiling a quantity of water for several minutes and allowing it to cool. It should be used within an hour after cooling. If air-free water is not used it will merely require a longer time for the Soilmoisture Probe to react with maximum sensitivity.



(Fig. 5) Filling the Soilmoisture Probe

The first step is to immerse the Porous Ceramic Cup in water and to leave it under water for one hour or more to fill the pores with water.

To fill the Soilmoisture Probe with water, use the plastic applicator bottle which is provided. After filling the bottle with air free water, unscrew the Service Cap on the unit and insert the applicator loosely into the filler end, (*see Fig. 5)*.

By squeezing the plastic bottle, direct a fine stream of water toward the inner wall of the Plastic Body Tube. Fill the unit slowly so that the water runs down the inside wall. By filling slowly you prevent entrapment of large volumes of air in the tube which requires suction to remove.

Now remove the Water Vent Screw, insert the stem of the applicator bottle firmly into the filler end so that it makes a seal at the "0" ring, *(see fig 6)*. Squeeze the bottle to force water through the outer nylon tube, to the porous ceramic cup and back through the Vent Tube and out the vent, thus purging air from the system. Continue until a clear flow of water, without air bubbles, comes out the vent. Replace the Water Vent Screw.

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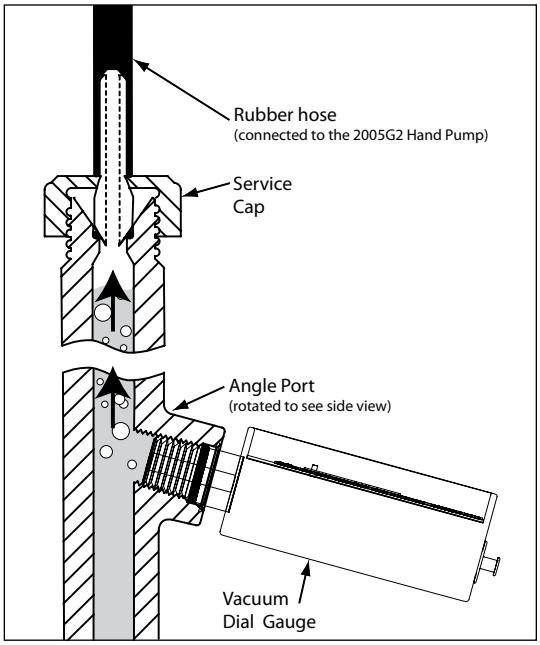


(Fig. 6) Removing the air from the probe with the 2005G2 Vaccum Pump

It is now necessary to apply suction at the filler end to remove air from the bourdon tube in the Vacuum Dial Gauge.

Vacuum Hand Pump (Model No. 2005G2) and Service cap (Z2710-001) may be used for this purpose. Insert the stem of the Vacuum Hand Pump into the filler end of the plastic body tube. Use the 2 foot rubber hose to connect the hand pump to the service cap. *(see Fig. 6)*.

Now pull out on the Vacuum Hand Pump handle and the vacuum created will cause the Vacuum Dial Gauge reading to rise, and air will be seen to bubble out of the Vacuum Dial Gauge connection inside the unit.

Release the stem of the Vacuum Hand Pump slowly from the rubber tube so that the dial gauge reading drops to zero. Add water to keep level above dial gauge connection. Repeat the process several times to remove as much air as possible from the Vacuum Dial Gauge.

Now, loosen Water Vent Screw, purge water through the nylon tubes again and tighten Water Vent Screw. Be sure the Plastic Body Tube is full of water, and then screw Screw Cap on snugly. Excess moisture on the porous ceramic cup surface should be removed with absorbent tissue or a clean cloth. Support the plastic body tube in a vertical position and arrange so that moisture is free to evaporate from porous ceramic cup.

PREPARING THE SOILMOISTURE PROBE FOR USE

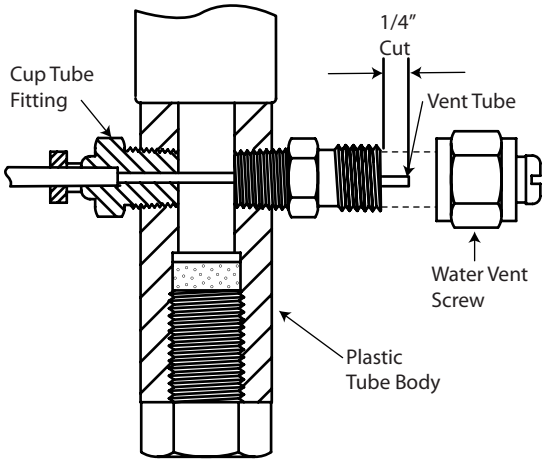
As water is evaporated from the cup surface, the dial gauge reading will rise as the vacuum inside the unit increases. As this occurs entrapped air will form in bubbles. After an hour or two, or longer depending on local drying conditions, the dial gauge reading will rise to 60 or more on the scale and there will be considerable accumulation of air in the nylon tubes and in the plastic body tube. This is air which has been adsorbed on the inner surfaces of the unit and trapped in the pores of the porous cup. The process of releasing this trapped air is known as outgasing and is characteristic of all vacuum systems. Once this trapped air is removed, it will remain quite free of air and will be very sensitive to changes in soil suction values.

To remove the accumulated air, first tap the plastic body tube to release as many of the air bubbles as possible that cling to the inner wall, then remove the Screw Cap. Now, completely remove the Water Vent Screw and flush air-free water through the system as done previously. When the Water Vent Screw is removed the Vent Tube will spring out a substantial distance from the end of the vent fitting. This is due to the expansion of the Vent Tube that has taken place as it absorbed water from the system.

This inner nylon tube should now be trimmed so that it projects no more than 1/4" beyond the vent fitting *(see Fig. 7)*. A sharp knife or razor blade is used for this operation. After this has been completed, replace and tighten the Water Vent Screw. Add water as required to fill the unit and replace the Service Cap.

The Soilmoisture Probe is now ready for field installation. If installation is to be delayed for any reason be sure to leave the probe sealed with the porous cup immersed in water to prevent continuing evaporation.

Long term evaporation from the porous ceramic cup should be avoided, since it results in evaporation deposits on the surface of the cup which reduces the sensitivity.



(Fig. 7) Trim the vent tube

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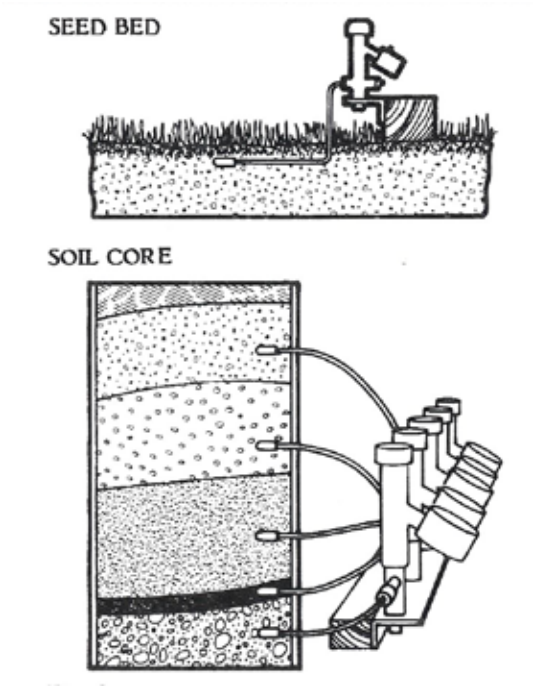

(Fig. 8) 2100F Mounted for field and column studies

The bottom end of the Plastic Body Tube is threaded with a 1/2"-20 screw thread and a 1/2"-20 by 3/4" long machine bolt is provided with the unit for mounting purposes. The Plastic Body Tube should be mounted in a reasonably vertical position in order to facilitate servicing of the unit. When mounting in confined areas, one should provide adequate clearance for loosening of the Water Vent Screw during a servicing operation *(see Fig.8)*.

In handling the nylon probe tubes, care should be taken that they are not bent sharply so as to kink them. Kinking will weaken the tubes under vacuum and may cause a restriction to flow of water.

The porous ceramic cup must be mounted in the region where soil suction values are required and the cup must be in good contact with the soil. A thin wall 1/4" 0.0. tube can be used to core a hole in the soil to accept the porous cup.

After installation is completed the Soilmoisture Probe should be flushed with air free water; water added to completely fill the Plastic Body Tube; and Screw Cap screwed on securely.

If the cup and gauge are not at the same vertical level, the gauge needs to be adjusted for the manometer effect. This effect is about 3 centibars per foot +/-, depends on above or below the gauge. Best have the cup wet and zero for the difference.

The unit will now come to equilibrium with the soil and the soil suction in centibars will be read directly on the dial gauge. After an initial installation it requires approximately 24 hours for the Soilmoisture Probe to come to true equilibrium with the soil. The range of operation of the unit is 0-85 centibars. If the porous ceramic cup is exposed to soil suction values much higher than this for an extended time, local drying of the cup will occur and air will enter the cup wall and the dial gauge reading will drop to zero. When this occurs it is necessary to flush the air from the Soilmoisture Probe to make it operative again.

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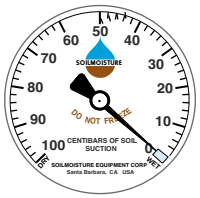
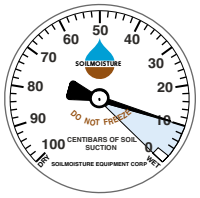
IRRIGATION SCHEDUALING / GAUGE READINGS



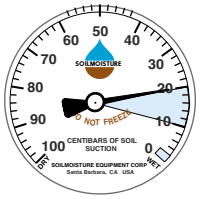
ZERO:

A gauge reading of zero means the surrounding soil is completely saturated with water, regardless of the type of soil. Zero readings can be expected after a heavy rain or deep irrigation. If the zero reading persists after a long period of time, there will be oxygen starvation to plant roots and development of diseases. A persistent zero reading after irrigation indicates poor drainage conditions which should be investigated and corrected.



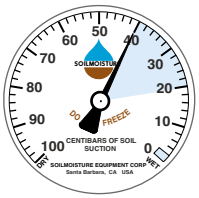
0-10 CENTIBARS:

Gauge readings in the range of 0-10cb indicated a surplus of water for plant growth. Water held by the soil in this range drains off within a few days. Persistent readings in this range indicate poor drainage conditions which should be corrected to obtain healthy plant growth.



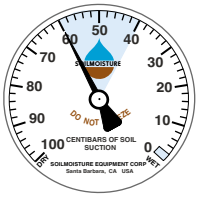
10-20 CENTIBARS:

Gauge readings in the range of 10-20cb indicate that there is ample moisture and also air in the soil for healthy plant growth in all types of soils. This range is often referred to as the “field capacity” range for soils, which means that the soil has reached its “capacity” and cannot hold anymore water for future plant growth. When soils are at “field capacity”, any additional water that is added drains out of the root zone within a day or two—before it can be used by the growing plant. If irrigation has been in process, it should be stopped when gauge drops to this level, since any further additional water will be quickly drained from the root zone and wasted, carrying with it valuable fertilizer.



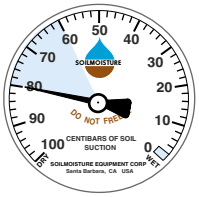
20-40 CENTIBARS:

Available moisture and aeration good for plant growth.
HEAVY CLAY SOILS: No irrigation required.
MEDIUM TEXTURED SOILS: No irrigation required.
SANDY SOILS: Irrigation started for coarser sandy soils in the 20-30 cb range. For finer sandy soils in the 30-40 cb range.



40-60 CENTIBARS:

Available moisture and aeration are good for plant growth in finer textured soils.
HEAVY CLAY SOILS: No irrigation required.
MEDIUM TEXTURED SOILS: Irrigation started in this range. The finer the texture the higher the reading before start of irrigation.
SANDY SOILS: Too dry. Hot windy conditions can force soil suction to high reading quickly and damage plants.



60-80 CENTIBARS :

Readily available moisture scarce, except in heavy clay soils.
HEAVY CLAY SOILS: Start of irrigation desirable as soil suction values reach 70-80 cb.
MEDIUM TEXTURED SOILS: Too dry. Hot, windy conditions can force soil suction to high reading quickly and damage plants.
SANDY SOILS: Too dry. Damage to plants will occur before irrigation can be applied.

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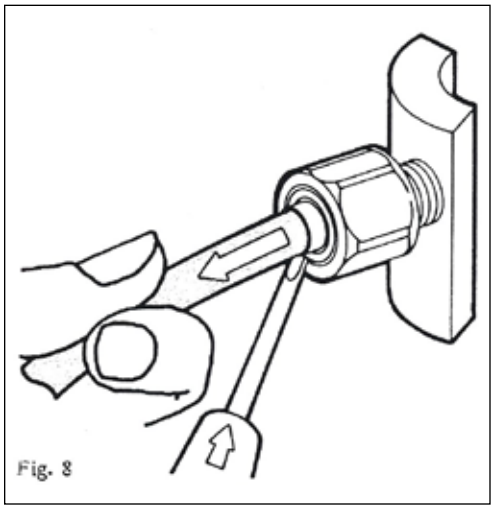
REMOVING ACCUMULATED AIR WHILE INSTALLED

Each time soil suction values fall, such as in response to an irrigation, small amounts of air-filled water from the soil enter the soilmoisture probe through the porous ceramic cup. Over a period of time, this air collects and should be removed. A small accumulation of air does not effect the accuracy of the reading, it simply makes the response of the unit somewhat slower.

To remove accumulated air, unscrew Screw Cap and fill plastic body tube using plastic applicator bottle. Loosen Water Vent Screw, insert stem of applicator bottle into filler end so that it makes a seal at the "0" ring, squeeze bottle to force water through nylon tubes to purge air out through water vent. Tighten Water Vent Screw and add water as required to fill the unit and replace Service Cap making sure that there are no soil particles around sealing area.



(Fig. 9) Replacing the cup tube

TO REPLACE OR SHORTEN THE CUP TUBE ASSEMBLY

To replace the porous ceramic cup assembly or to shorten the outer nylon tube, the following steps are taken:

Unscrew the Water Vent Screw Retaining Nut completely. This will expose the Vent Tube "0" Ring Retainer and "0" Ring Seal. On the Cup Tube Fitting, push in the release collet and at the same time, pull the outer nylon tube straight out, *(see Fig. 9)*.

When the outer nylon tube has been pulled free of the Cup Tube Fitting, the Vent Tube can then be pulled out. When the Vent Tube is removed the "0" Ring Seal and "0" Ring Retainer can then be removed.
Be careful not to loose this small "0" Ring Seal or retainer.

To shorten the outer nylon tube, first remove the Vent Tube by pulling it out of the outer nylon tube. Cut the outer nylon tube to the desired length, making sure the end of the outer tube is cut square, with a sharp knife or razor blade. Reinsert the Vent Tube into the outer nylon tube making sure it reaches the bottom of the porous ceramic cup. Then insert Vent Tube into the Cup Tube Fitting thru the Plastic Body Tube and out thru the Water Vent Screw Fitting. Insert the outer nylon tube into the Cup Tube Fitting by pushing straight in until the outer nylon tube bottoms out.

The Vent Tube can then be trimmed as in Fig. 7. CAUTION: Make sure the Vent Tube still reaches the bottom of the porous ceramic cup, before trimming. After trimming the Vent Tube, install the "0" Ring Seal, pushing it as far back as you can, then insert the "0" Ring Retainer before you screw on the Water Vent Screw Retaining Nut making sure the Vent Tube goes into the "0" Ring Retainer, see Fig. 4. Tighten the Water Vent Screw Retaining Nut finger tight. A wrench is not required.

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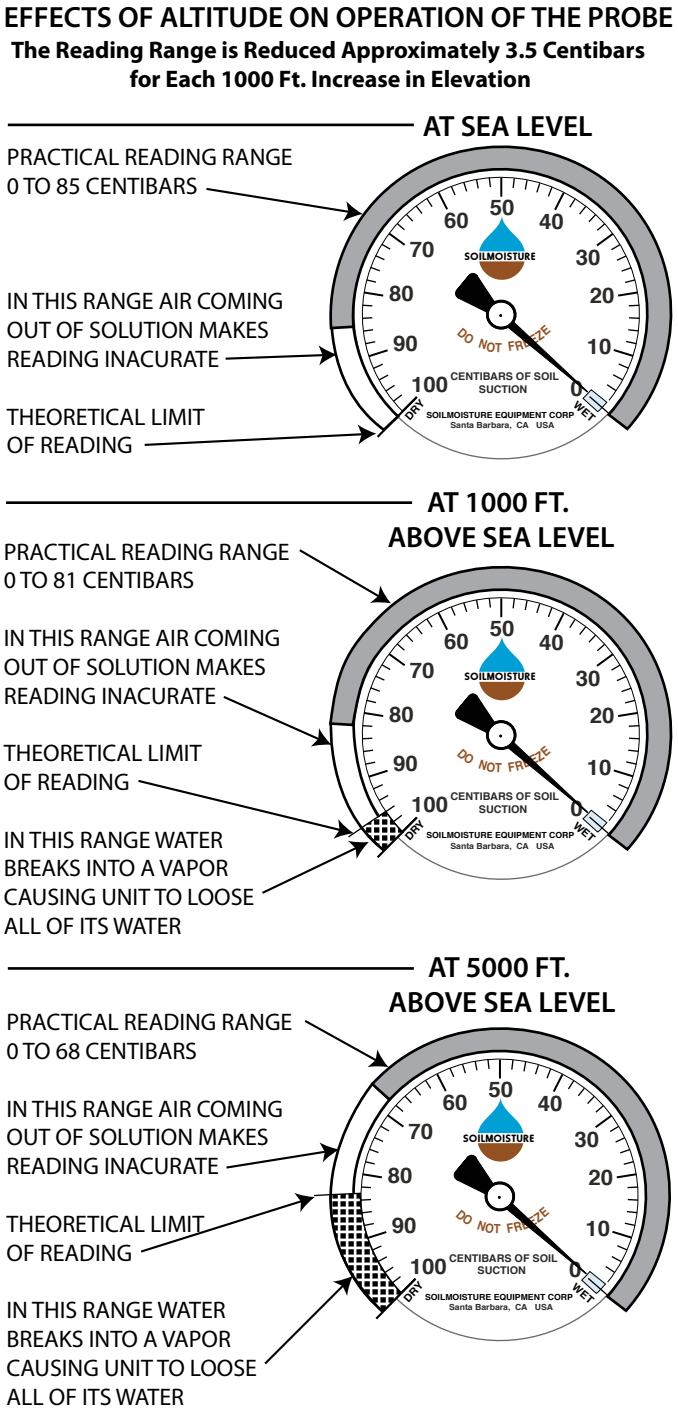

(Fig. 10)

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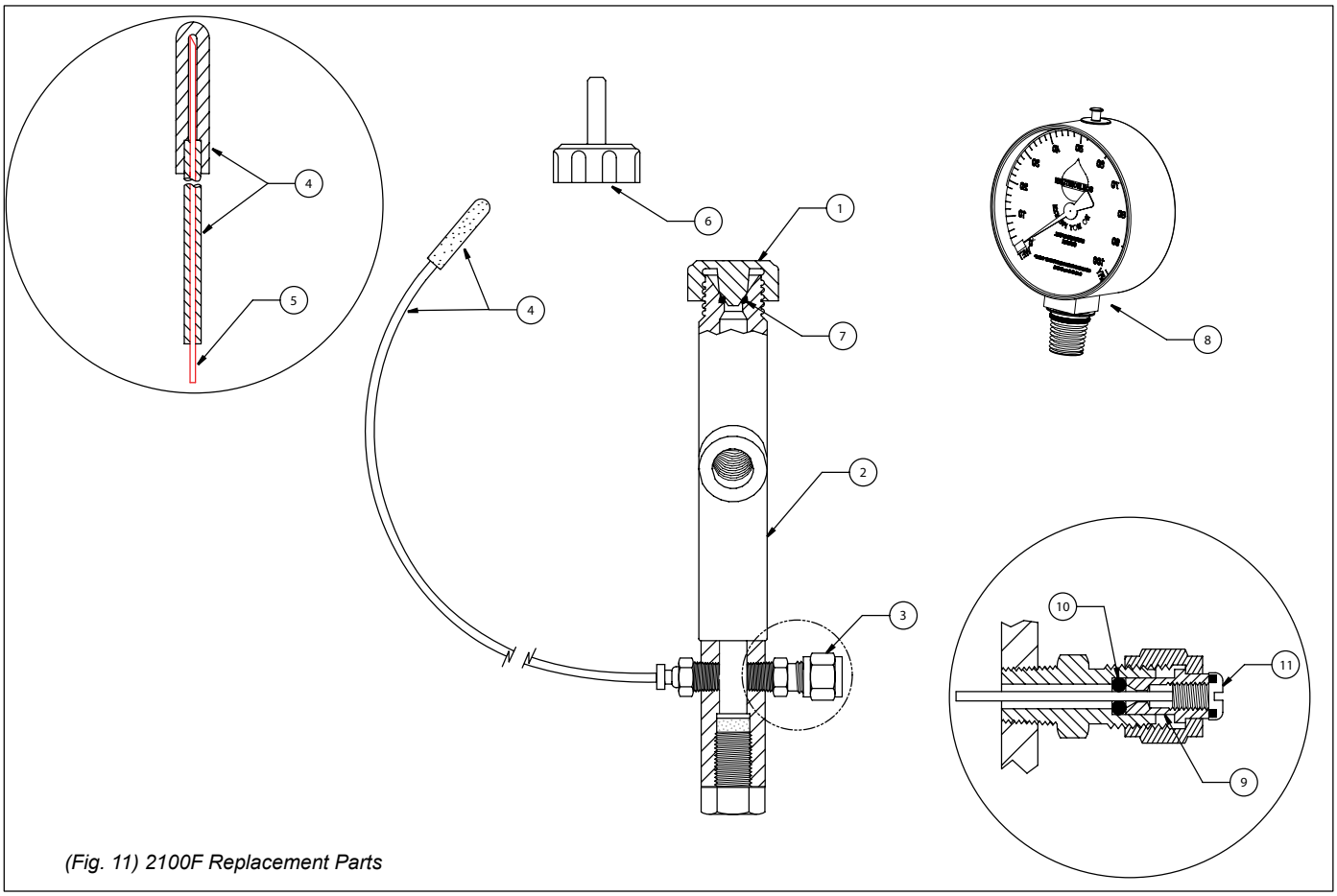
REPLACEMENT PARTS



(Fig. 11) 2100F Replacement Parts

	ITEM PART #	DESCRIPTION
1.	Z2079	Service Cap
2.	2100F-100	Body Assembly
3.	Z2100F-002	Vent Screw Fitting
4.	Z2100-200CR	Cup Tube Assembly
5.	MYT009L10	Vent Tube (10 feet)
6.	Z2710-001	Service Cap w/Nipple
7.	M802X010PKG05	O-Ring
8.	2060FG3	Vacuum Dial Gauge
9.	Z2100F-001	Brass
10.	M802X102PKG05	O-Ring
11.	Q2820SCH12	1/2-20 x 3/4 steel zinc plated cap screw

OTHER USEFUL ITEMS	
2005G2	Vacuum Hand Pump
MFJ012PK	1/4 ounce silicon grease kit

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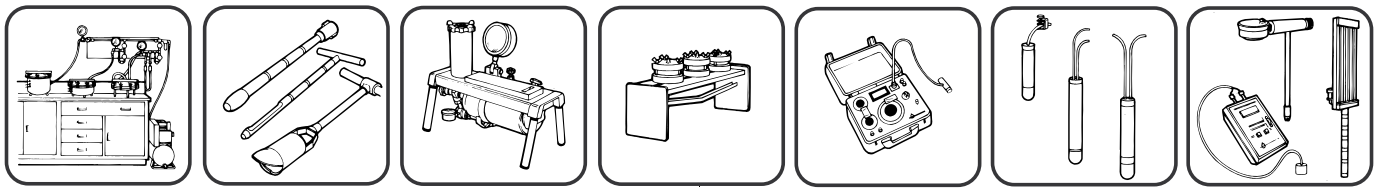

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