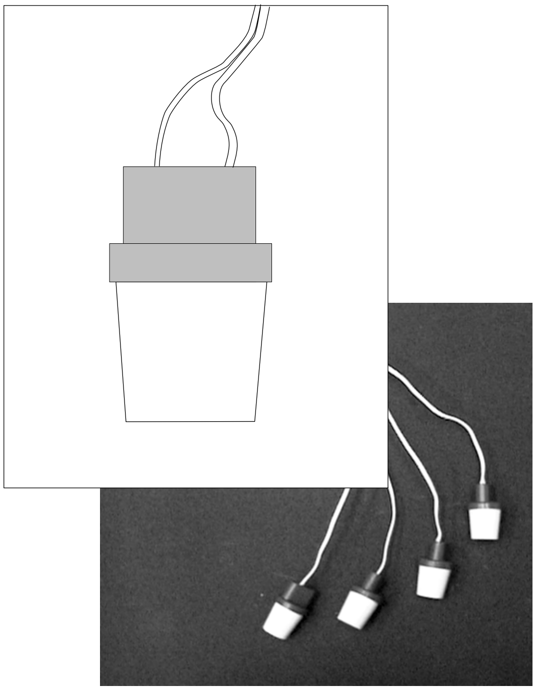
5201F1 OPERATING INSTRUCTIONS



The new Soilmoisture G-Blocks are an evolution in design. They provide quick response and true sensitivity to conditions where moisture remains relatively high. All G-Blocks are wetted and checked for speed of response and ability to maintain overall consistency from block to block prior to shipping. The new design of electrode spacing ensures a sensitive response to changing moisture conditions below 2 bars of matric suction with overall operation range to 10 bars of matric suction. The new blocks should provide significant improvements over any competitive blocks or older Soilmoisture blocks.

To properly use the new blocks, it is important that you reference the new look up tables and formulas at the end of these instructions.

How To Optimize Water Usage Using G-Blocks

Limits Method of Monitoring

There are several methods that can be used to optimize water using G-Blocks. The first, and easiest, method is the Limits Method of water management. This simple, but effective, method requires that you determine the limits to which you want water to migrate. The plant maturity rooting depth, rooting patterns, and the system of irrigation will help you to determine these limits. Older and less effective irrigation, such as flood or furrow, will have a broader range of water limits. Shallow rooting and precision applicators will have a narrower limit band. G-Blocks are placed at the minimum water level (also known as minimum refill point) and at the maximum water level (also know as maximum refill point) for irrigation cycles. Frequently, another G-block is placed at a depth past the maximum refill point to ensure irrigation water does not exceed the set minimum-maximum limits. Minimum limits may be set as shallow as 3 inches in young or sensitive shallow-rooted plants, and maximums can vary from 12 inches in young plants to 6-8 feet in mature orchards where flood irrigation is practiced. Look for the existing rooting patterns of the plant in question and use the 75% Rule for both vertical depth and lateral distances.

When using this or any other water monitoring system 75% of the rooting volume will be responsible for 95% of the plant's uptake of water and nutrients. Therefore, be careful not to place the G-Blocks at the deepest possible rooting depth, but more accurately at depths that represent 75-80% of the maximum rooting depth. Rooting volumes and uptake will develop in the areas of specific wetting associated with drippers or spitters. It is, therefore, very important to ensure that 75% of rooted volume will receive sufficient subsurface wetting necessary for its livelihood and maintenance.

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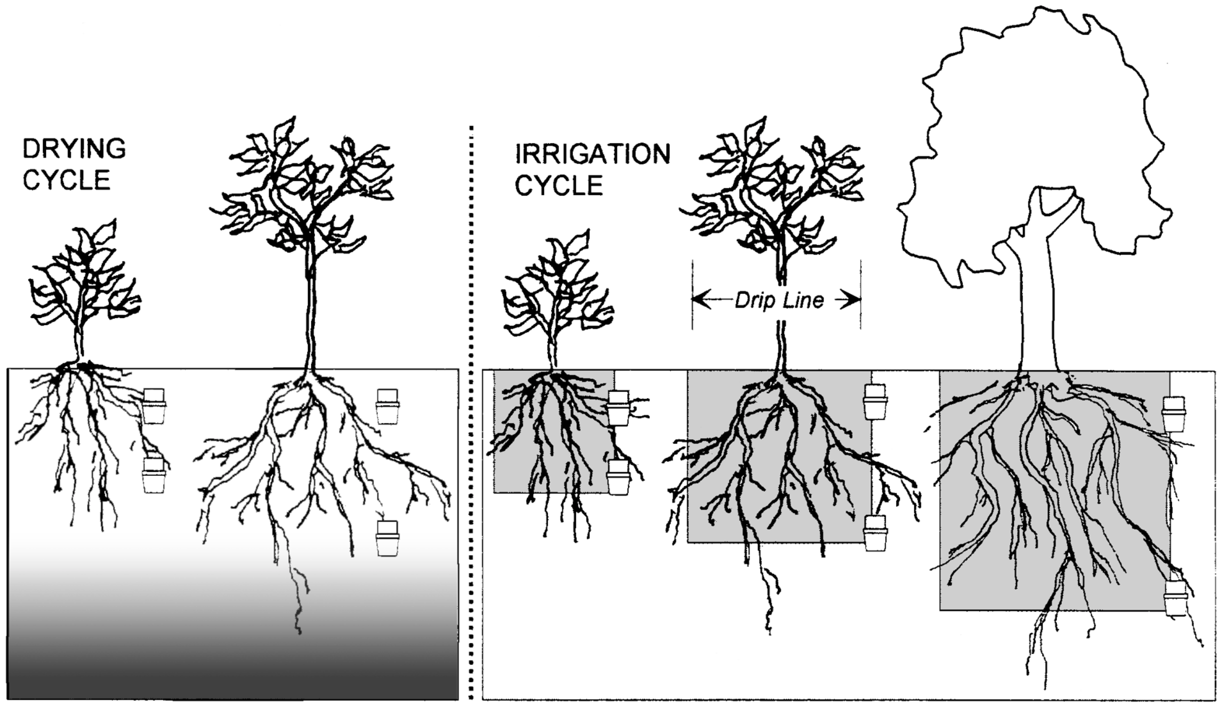
How to Optimize Water Usage Using G-Blocks



The first illustration shows the depletion of water from the soil profile due to root uptake and evaporation at the soil surface. This would be typical of drying, accelerated or depressed due to day time temperatures, soil surface conditions, winds, rain, etc. The second illustration shows wetting fronts as they progress from younger to older rooting patterns. Water moving as a wetting front from the surface to some vertical depth is consistent with the time interval that water is applied in the irrigation cycle.

As you can see in the above illustrations, placement of the G-Blocks is important in achieving best overall results. Not only do you want to place blocks to provide the 75% depth requirement, but you must also consider the lateral extent of rooting. Rule of thumb is that roots commonly do not extend laterally beyond the drip line of the tree or shrub. The drip line is a theoretical maximum diameter equivalent to the largest leaf area from which rain will drip from the overhead leaf canopy of the plant. Once the blocks are in place, you can monitor the wetting front as it passes the limit blocks. Irrigation practices are optimized as you limit timing and, therefore, areas watered to rooting areas only. You will also want to consider modifying less effective irrigation practices such as furrow to drip. You will irrigate based on what the conditions are at near surface and at deepest rooting depths. If, for instance, minimum level blocks show a low moisture content and maximum level blocks show continuing wet conditions, you wouldn't need to irrigate to full depth. You would only need to irrigate to the minimum level depth, or slightly beyond, to refill moisture in upper regions, which means running shorter irrigation cycles. Determination of the time needed to fully refill the profile to minimum level refill point is an important tool in overall water management. The goal is to keep plants within tolerable limits of stress (matric suction), by providing water to most roots (not all) in a scheduled program of full recharge of the soil profile as determined by the limit blocks; and partial recharge of the soil profile to replace shallow drying and root uptake effects.

Matrix/Segmental Method of Monitoring

The Matrix/Segmental Method of monitoring is simply an extension of the Limits concept. By adding additional G-Blocks between the minimum-maximum limits, you are able to more accurately monitor subsurface moisture due to root uptake, evaporation, and the water release characteristics of different soil types. This added information can be used to more accurately determine the precise level required for partial recharges. Besides the incremental measuring at different depths, you extend a pattern of monitoring points horizontally in a matrix to capture the lateral extent of wetting fronts and to access root withdrawal areas. Placement of G-Blocks in a matrix of points at defined depth segments can be very useful in optimizing water application systems, such as drip and subsurface emitters, for maximum efficiency.

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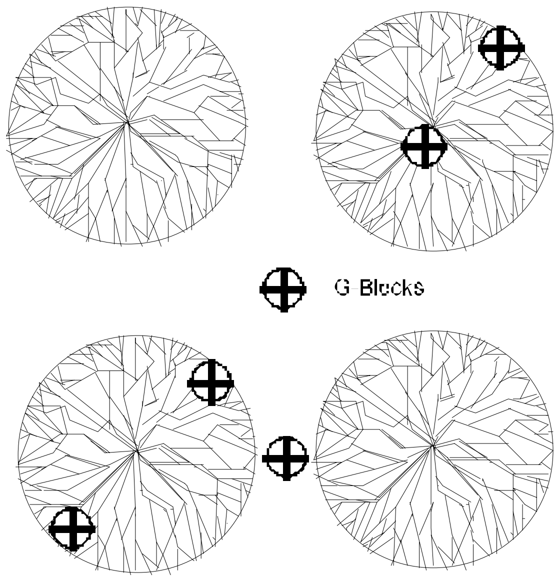
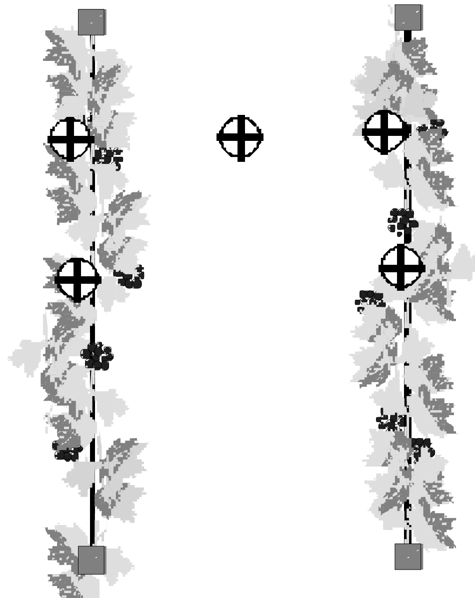


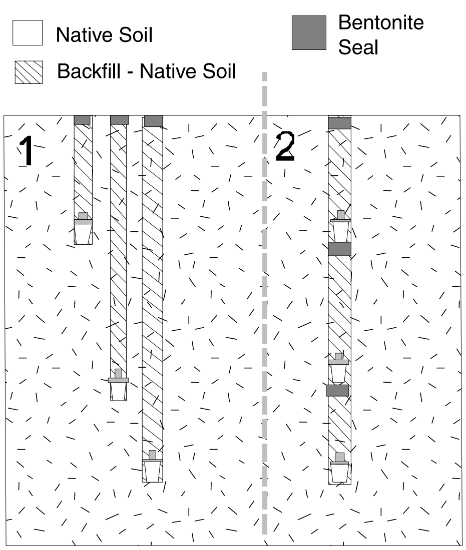
Mature Orchard



Vineyard

In the illustrations above are two typical installations shown in overhead view. In the first case, an orchard with mature trees using spitters, one would want to provide a defined lateral spacing of sensors consistent with spitter spacing, tree spacing, and canopy size. Each sensor spot measures sequential depths of 1 foot, 3 feet, and 6 feet. The matrix pattern of sensors in both vertical and horizontal aspects is used to monitor uniformity of water distribution under the tree, to check for shadow effects from wind, trunk obstructions, or pressure differentials. You will notice that sensing between the trees addresses precise determination of water migration in the subsurface areas beyond the drip line and to assess the residual water content from rain or snow. The second illustration shows sensor placement in a vineyard with the first set of sensors situated along the row at a drip emitter and half way between drippers. Sensors are placed in vertical profile at each location to ensure that a wetting ball is established at drippers and that there is adequate subsurface water migration for all rooted areas. A sensor placed in between rows is used to monitor residual moisture due to rain and/or snow. G-Blocks used in this prescribed manner can provide a wealth of information, improving irrigation practices, and saving on water and energy costs.

INSTALLATION

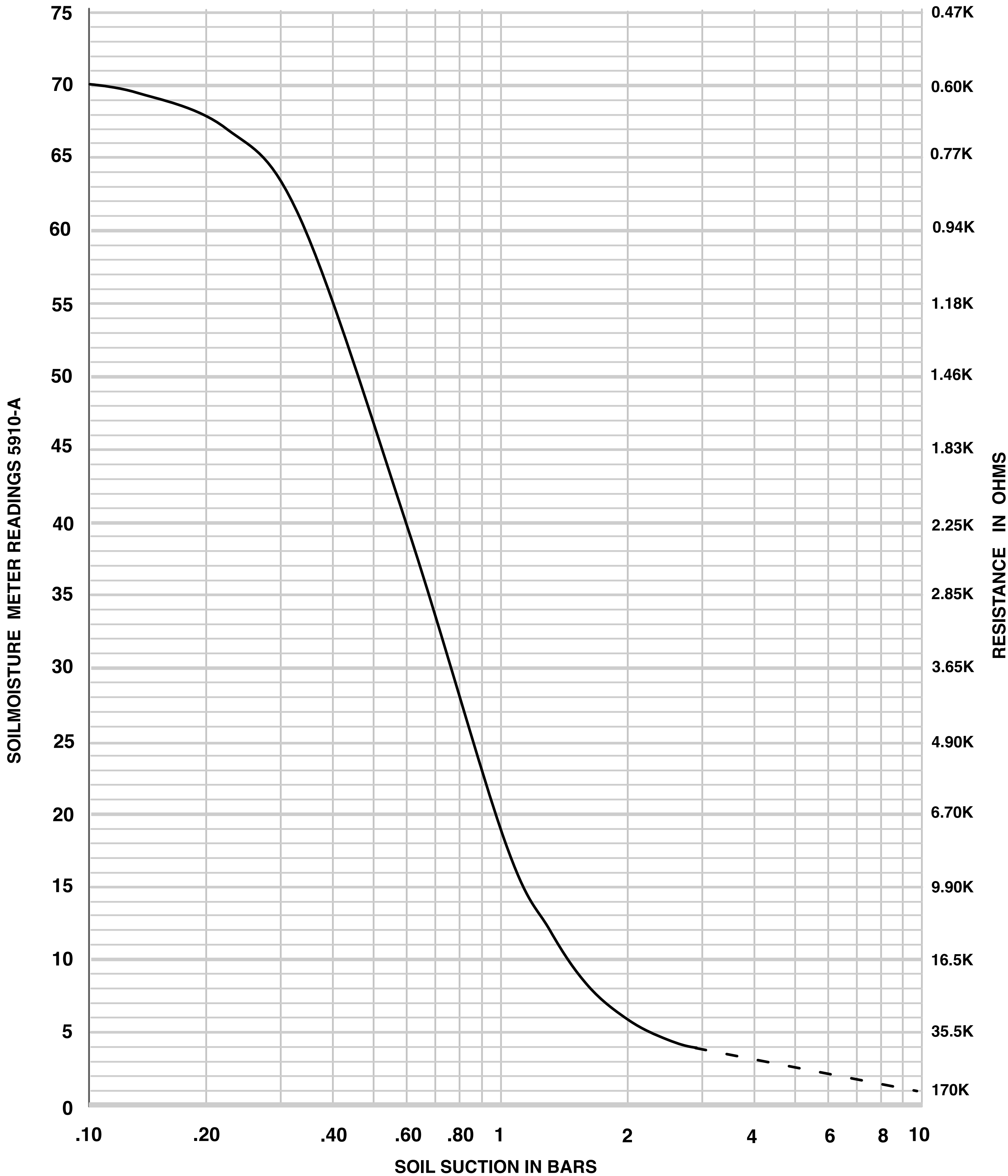


In the illustration to the left there are two approaches to installing G-Blocks. First, there is the school of thought that blocks cannot be situated in the same hole and only placed in separate holes that are close in proximity, best represents the surrounding native soil conditions. The other school of thought is to make a slightly larger hole and that stacking blocks is acceptable, provided a bentonite (swelling clay) cap or heavy compacted clay “seals” each hole.

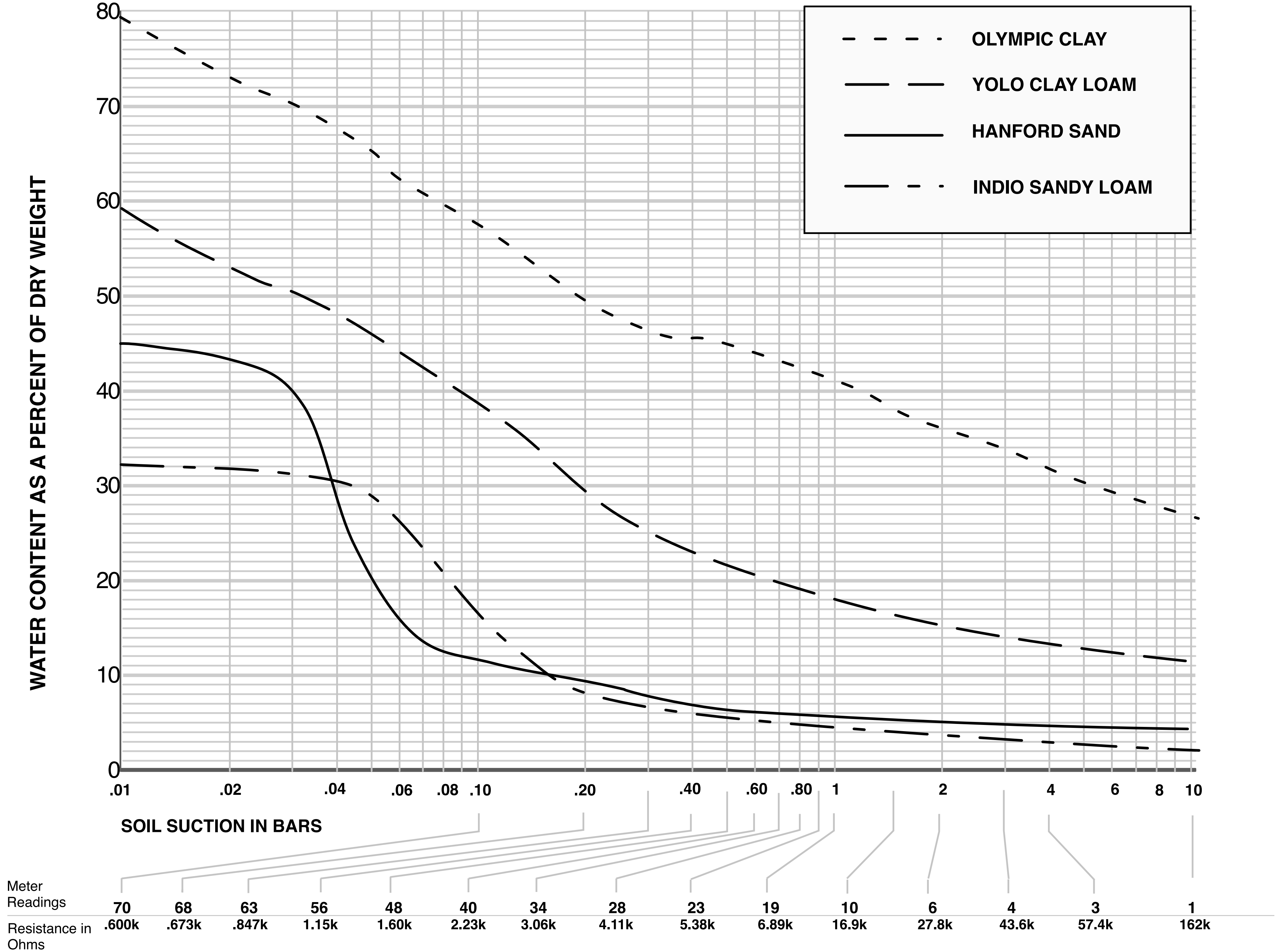
<u>Steps</u>

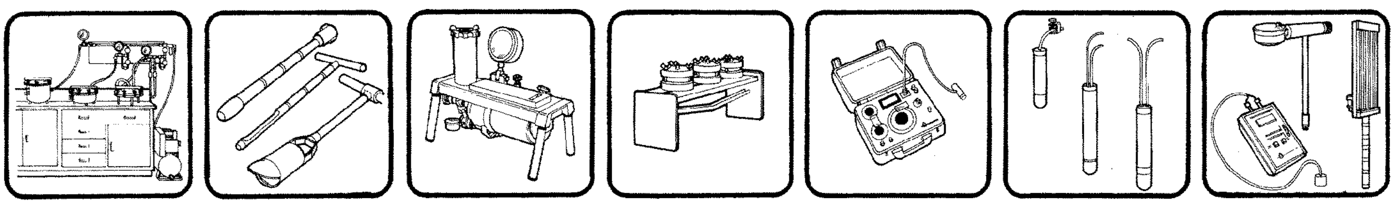
a. Auger a hole slightly larger than the G-Blocks to be ins talled.
b. Soak Blocks prior to installation for at least ten minutes.
c. Prepare a small slurry of native soil and water.
d. Pour slurry into hole.
e. Using a broom handle or long pole gently push Blocks into the slurry at the bottom of the hole.
f. Cover Blocks with native soil backfill tamping lightly as you refill hole.
g. Cap hole with a Bentonite seal or other highly compacted clay plug.
h. Four to six hours later the hole will be ready for the first reading.

NEW 5201F1 G-BLOCK RELATIONSHIPS



The relationship between Soilmoisture Meter readings and impedance in Ohms is based on a 350 mV step pulse having a frequency of approximately 60 cycles/second. The impedance values in Ohms, as shown, represent a signal/response relationship and that may vary with alternative sources of signal excitation.


OLYMPIC CLAY
YOLO CLAY LOAM
HANFORD SAND
INDIO SANDY LOAM
WATER CONTENT AS A PERCENT OF DRY WEIGHT
80
70
60
50
40
30
20
10
0
.01
.02
.04
.06
.08
.10
.20
.40
.60
.80
1
2
4
6
8
10
SOIL SUCTION IN BARS
Meter Readings
70
68
63
56
48
40
34
28
23
19
10
6
4
3
1
Resistance in Ohms
.600k
.673k
.847k
1.15k
1.60k
2.23k
3.06k
4.11k
5.38k
6.89k
16.9k
27.8k
43.6k
57.4k
162k



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