ANSI/ASABE S633 MAY2020
Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies

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Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies

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Keywords: Bypass switches, Controllers, Irrigation, Landscape, Smart water application technologies, SMS, Soil moisture sensors, SWAT, Turf

1 Scope

This standard defines a procedure to test a soil moisture sensor and interface device's response to changes in soil moisture conditions in a media that simulates soil. The test procedure covers soil water content (volumetric) and soil water tension (matric potential) sensors. The standard provides a method, using two different media, two water salinities, and three different water depletion levels, to determine if the sensor and associated interface device will enable/disable an irrigation event at preset or selected soil water values.

2 Normative References

The following referenced documents (resources) are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM D6913 Standard test methods for particle size distribution of soils using sieve analysis.

Glossary of Soil Science Terms. Soil Science Society of America, Madison, WI.
https://www.soils.org/publications/soils-glossary

3 Definitions

Several terms in this Section have been adapted from the Glossary of Soil Science Terms from the Soil Science Society of America.

3.1 interface device: Portion of the soil water sensor controller that either enables/disables irrigation events, and/or transmits soil water information to a control system for irrigation decision-making. The interface device may be integrated into the sensor, be separate, or be part of the irrigation controller.

3.2 irrigation enabled/disabled threshold: For sensors and associated interface devices with an option to enable or disable irrigation events based on SO, Man Ngok-defined soil moisture values, the value at which the control system changes state to enable or disable irrigation.

3.3 irrigation event: Landscape watering beginning at a pre-determined start time(s) and run time(s) for one or more watering zones.

3.4 sensor mechanism: The portion of the device that contacts the soil and measures physical properties that are related to water content or potential.

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3.5 soil moisture-based control technology: A sensor mechanism and interface device that enables or disables an irrigation event at pre-set or selected soil water values.

3.6 soil water content: The water lost from the soil upon drying to a constant mass at 105°C (221°F); expressed either as the mass of water per unit mass of dry soil or as the volume of water per unit bulk volume of soil.

3.7 soil water content sensor controller: A sensor mechanism and interface device that measures a property of the soil (e.g. electrical) that is related to soil water content in a way that allows the measurement to be used to output soil moisture. The soil water content for a saturated soil will vary by soil type. These devices are often referred to as soil moisture sensors and may express soil water content as a relative term or percent by volume (volume of water/total sample volume).

3.8 soil water potential: The amount of work that must be done per unit of a specified quantity of pure water in order to transport reversibly and isothermally an infinitesimal quantity of water from a specified source to a specified destination. If the specified quantity is volume, the potential is referred to as pressure (Pa). If the specified quantity is weight, the potential is referred to as head (m). If the specified quantity is mass, the potential is the term used (J kg^{-1}).

3.9 soil water potential sensor controller: A sensor mechanism and interface device that measures a property of the soil (e.g. electrical) that is related to soil water potential in a way that allows the measurement to be used to output soil water potential. The soil water potential for a saturated soil will be near zero kPa (bars or atmospheres). These devices are often referred to as soil moisture sensors and may express soil water potential as a relative term or pressure value.

3.10 zone of influence: The volume of soil surrounding the sensing mechanism that impacts the sensor reading. This shall be the volume as specified by the manufacturer.

4 Testing Equipment and Materials

4.1 Test media. The tests shall use two different mediums. Each test medium shall be developed by the test lab from component materials:

(a) The salinity level of the test medium shall be measured prior to adding water by using a saturated paste extract electrical conductivity (EC) at 25°C (77°F) After water is added to make the various depletion levels, the test medium shall be measured again by using a saturated paste extract electrical conductivity (EC) at 25°C (77°F) The salinity shall not exceed a total of 3.0 deciSiemens/meter (dS/m) when saline water is added.[1]

(b) The pH of the test media shall be between 6 and 9.

(c) Test media shall be dried and processed as described in Section 4.1.3.

(d) Materials used shall comply with ASTM D6913.

4.1.1 Moderately coarse media (6:2:2).

Test media shall be constructed from three component materials. The following materials shall be mixed from air-dry source materials in proportions by weight as follows:

- 6 parts 60F fine silica sand
- 2 parts 325 mesh silica flour
- 2 parts 200 mesh sodium bentonite powder-without any additives
- Bulk density of 1.4 g/cc
- Field capacity = 20% by volume (reference determined by the SPAW model's Soil Water Characteristics program).[2]

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