STANDARD OPERATING PROCEDURE

Calibration, De-Airing & Field Servicing of Soil Tensiometers & Pressure Transducers

DOCUMENT TITLE:	**Soil Tensiometer SOP**	**DOC NUMBER:**	SOP-TEN-001
TARGET HARDWARE:	Jet Fill / Irrometer / TensioMark / Piezoresistive Transducer	**REVISION / DATE:**	Rev 1.0 / Sep 16, 2026
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1. Purpose & Scope

This Standard Operating Procedure (SOP) defines de-airing, vacuum purging, and 2-point pressure transducer calibration procedures for field soil tensiometers. Tensiometers measure soil water matric suction (ψ_m) directly across the 0 to -85 kPa range. Maintaining air-free porous ceramic cups and accurate transducer zeroing is critical for irrigation scheduling and vadose zone hydrology.

2. Required Equipment & Standard Reagents

- **De-Aired Distilled Water:** Boiled and vacuum-degassed deionized water ($<0.5\text{ mg/L}$ dissolved O_2).
- **Vacuum Hand Pump:** Service pump with vacuum gauge ($0\text{ to }-100\text{ kPa}$ range, accuracy $\pm 0.5\text{ kPa}$).
- **Digital Pressure Calibrator:** Reference pressure standard (Druck DPI 610 or NIST-traceable digital gauge).
- **Porous Ceramic Cup Conditioning Fluid:** $0.01\text{ M } CaCl_2$ solution to prevent clay dispersion.
- **Servicing Syringe & Reservoir Cap:** Rubber septum cap and Luer-lock degassing syringe.

3. Step-by-Step Calibration & Maintenance Procedure

3.1 Ceramic Cup Inspection & Saturation Conditioning

1. Inspect porous ceramic cup for hairline cracks or organic fouling. Replace cup if bubbling pressure is $<100\text{ kPa}$.
2. Submerge ceramic cup in $0.01\text{ M } CaCl_2$ solution under a -80 kPa vacuum for 2 hours to fully saturate ceramic pores.

3.2 Water Reservoir De-Airing & Bubble Elimination

1. Fill tensiometer body tube with de-aired distilled water.
2. Attach vacuum hand pump to the top reservoir port. Pull a vacuum of -80 kPa for 3 minutes while tapping the tube side to dislodge entrained air bubbles.
3. Refill reservoir to top brim and seal with rubber septum cap.

3.3 2-Point Pressure Transducer Calibration

1. **Zero Point Check (Atmospheric):** Leave ceramic cup submerged in a shallow water bath at same level as transducer diaphragm. Record output voltage V_0. Verify zero offset reads $0.0 \pm 0.3\text{ kPa}$.
2. **Vacuum Span Check (-50 kPa):** Connect vacuum hand pump and reference digital gauge to top port. Apply -50.0 kPa suction. Record transducer output V_{-50}. Calculate sensitivity $S = (V_{-50} - V_0) / (-50.0\text{ kPa})$. Verify linearity error $\le 0.5\%\text{ FS}$.

4. Field Installation & Quality Control

Auger soil installation hole using a matching diameter core tool. Pour a thick silica flour slurry (100-mesh) into hole bottom to ensure intimate soil-ceramic cup contact. Insert tensiometer firmly. Verify response time: matric suction reading should stabilize within 15 minutes of soil contact.