

Appendix B - Calibration Chamber Test Procedure and Checklist

Pre-Test Checks

- Make sure that patch on top plate from previous test has been removed and replaced. Use cinder block for weight.
- Make sure U_1 and U_2 filters, element membranes, etc. are on hand.
- Confirm that all necessary equipment is in the lab.

Pluviation

- Start with jacket in chamber and fittings inside membrane tightened at bottom.
- Place collar over chamber and inside jacket. Align collar slot with jacket pin. Be careful not to hang collar on jacket hinge. Vacuum any sand out of the collar rim.
- Place membrane inside collar and fasten with clips at top. Outer membrane first, followed by inner membrane. When membranes are up and tight and have a minimum of creases, stuff rags in collar rim and remove clips.
- Check membrane all around for cuts or holes and patch as needed. Cover patches with duct tape. Pay special attention to top of jacket where membrane tends to get pinched when chamber is sealed.
- Duct tape top of membrane to collar to keep sand from getting outside the membrane.
- Place geotextile (without hole) at bottom of chamber.
- Bring pluviator over and place on chamber, using 4-8 guide pins.
- Check inside pluviator to make sure it is clean. Sprinkle small amounts of moist sand in holes of the shutter plate. Duct tape the two lifting holes at the top of the pluviator.
- Set up multimeter, power supply (10 V), and load cell.
- Bring hopper over and align diagonally with bobcat access. Fill hopper with dry sand. Brush off excess. Place load cell between crane and lift bar and raise to get weight. Record weight in millivolts on specimen data preparation sheet. Remove load cell and lift hopper above pluviator to empty. Bang on sides of hopper to get all sand out.
- Repeat until pluviator is as full as possible (approx. 3.5 - 4.0 hoppers for loose and medium dense samples). Be sure to record any excess in last hopper.
- Use crane to lift guide wires for screen. Align crane so guide wires are vertical. Make sure wires are on pulleys inside and outside the pluviator. Remove bars

from beneath screen. Lower screen to vacuum off any debris. Continue lowering to start position (2 ft from bottom of chamber).

- Close all doors to limit wind currents.
- Provide air pressure to shutter plate mechanism (approx. 80 psi). Make sure switch is off (marks not aligned) and unplugged. When completely ready to lift, plug in switch. Simultaneously open shutter plate (align 'ON' marks on switch) and raise screen on slow setting. Use burst of fast hoist every 5 seconds or so to inhibit binding of screen.
- Sweep remaining sand through shutter plate.
- Close plate, turn down pressure, and disconnect switch, air pressure, and guide wires.
- Place bars under screen (large diameter on bottom) and remove pluviator.
- Remove tape, rags, and lift off collar.
- Level sand and record measurement from top of jacket to sand. Not top of forming jacket is 1.5m above base plate of sample.

Saturation

- Close off white tube to chamber.
- Open CO₂ canister with both main valve and T-valve. Set CO₂ flow at about 30-35 psi and connect to black line into chamber on NE side. Allow 60-90 minutes for CO₂ saturation. Continue until smell of CO₂ is detected at the top of the sample.
- Disconnect CO₂ and close valve.
- Place geotextile (with hole) on top of sample.
- Run hoses from outside water faucet to chamber. Set flow at 1 to 1.5 gal/min. Record rate.
- Place pump on top of sand along the west sample edge, recessed approx. 1-2 inches in sand (but on top of geotextile) to allow for a pool of water to trigger pump.
- Connect drain hose to pump, and clamp hose and pump cord to side of chamber. Put up vibration warning signs as well as sign for outside water valve. If you leave, make sure pump is plugged in!
- When water comes to the top of sample, take another measurement of the height of sand. Verify that pump is operating. Circulate a minimum of 1000 gallons of water through the sample.

Test Preparation

- Fill small PVC chamber with glycerin/water solution. Place at least 2 pore pressure elements in saturation chamber, seal and connect to vacuum pump.
- Place cone in bucket of water to bring the cone to the same temperature as the water.
- Turn off water to chamber and close all flow valves to prevent drainage.
- Check seals on patch on top plate. Align holes with jacket pin as well as mark on side of chamber. Lower and fit plate inside membrane and jacket rim. This will require some prying with two of the prybars. Extreme care should be taken to avoid tearing the membrane.
- Vacuum off any water on top plate and dry with air pressure. Duct tape top of membrane to plate, minimizing folds in the membrane. Make sure holes in plate are clear and there are no folds present along the top plate gasket location.
- Place outer O-ring in chamber lip. Place chamber lid, aligning jacket pin in the designated hole. Move the lid until plate connecting holes are aligned. Bolt top plate to lid using long connecting bolts first, if necessary. Replace with shorter bolts and use crane to manipulate both top plate and lid into alignment with the lid bolt holes. Care should be taken to avoid bending the jacket pin. Lower the assembled top plate and lid over the designated bolt holes and tighten cover with ratchet and breaker bar.
- Attach dial gauge at jacket pin and connect 689 kPa pressure transducer to 10V power supply and multimeter.
- Connect vertical and cell pressure gauges to hoses on SW side of chamber (yellow-black; black-red).
- Connect chamber water line to back pressure tank with hose including two valves with dial gauge between. Fill 207 kPa pressure transducer with water and connect to dial gauge and power supply.
- Bring push frame over with crane and mount with 24mm bolts. Make sure underlying bolts have already been tightened. Turn on hydraulic system and set rate at 2cm/sec (full travel in 81 sec.).
- Set up DACN data acquisition system:
 - Power supply to multimeter (8 pin connection)
 - LVDT box to multimeter (male-female red and black connections)
 - Multimeter to computer (parallel port at back of meter and computer)
 - LVDT on push frame to LVDT box
- With power supply ON, thread cable from power supply through cone rod, connecting coupling and connect to cone. Verify that tip reading (Ch5 on

multimeter) reads approx. 11mV and that pore pressure readings change when pressed. Assemble cone and rod.

- Attach PVC funnel to cone and pour in de-aired glycerin solution. Under water, assemble pore pressure elements and cone tip. Use syringe to push water into pore pressure ports at the u_1 and u_2 locations. Place water-filled membrane over cone tip, remove funnel, and return cone to bucket of water.
- Record zero values from each of the channels on the multimeter

Leak Test and Membrane Installation

- Remove jacket from chamber and set up on 6-8" of sand on ground. Duct tape any protrusions in the jacket that could tear membrane, especially the location of the pin. Reinforce openings in lower portion of the jacket with duct tape.
- Put up membrane inside jacket with clips.
- Check membrane all around for any tears or holes. Patch as needed and cover with duct tape.
- Start filling membrane with water. Examine outside of membrane and underlying sand for visible water. If a leak is detected, lower water level below leak and patch. If leak is too far down, mark location and patch later.
- When membrane is full (approx. 4 hrs), detach hose at the outside faucet and allow gravity drainage. Also, lower submersible pump with attached hose to pump water outside.
- After all holes have been patched, disassemble and reinstall jacket in chamber. Duct tape over any protrusions (lifting holes, pin location, water line openings, etc) that could tear the membrane.
- Install fittings with caps and connect tubing outside chamber to pressurized water line. Check for leaks. Remove fittings.
- Use silicon adhesive to apply patches to bottom of membrane for a layer of protection where fittings will be installed. Use cinder blocks for weight and allow time to dry. Duct tape around the patches.
- Cut holes in patches and install fittings with washers. Tighten, and seal around washers and fittings with additional silicon.
- Make sure that patch on top plate from previous test has been removed and replaced. Use cinder block for weight.