OPERATING INSTRUCTIONS

Twin-Burette Volume Change Unit

26-1892

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1 Introduction

1.1 The twin-burette volume change unit consists of two 100 ml burettes graduated at 0.2 ml intervals. The burettes are mounted within outer plastic tubes, which avoids them being subject to a net internal pressure. The unit can therefore be calibrated independent of pressure.

When the cumulative flow exceeds the burette capacity, re-arranging the valves allows reversal of flow and maintains symmetry of operation.

1.2 A by-pass system is also provided to allow for flow when volume change recording is not required but water is required at the Triaxial cell.

1.3 The fluids used in the unit are clean de-aired water and coloured kerosene, to provide a suitable fluid interface meniscus reading.

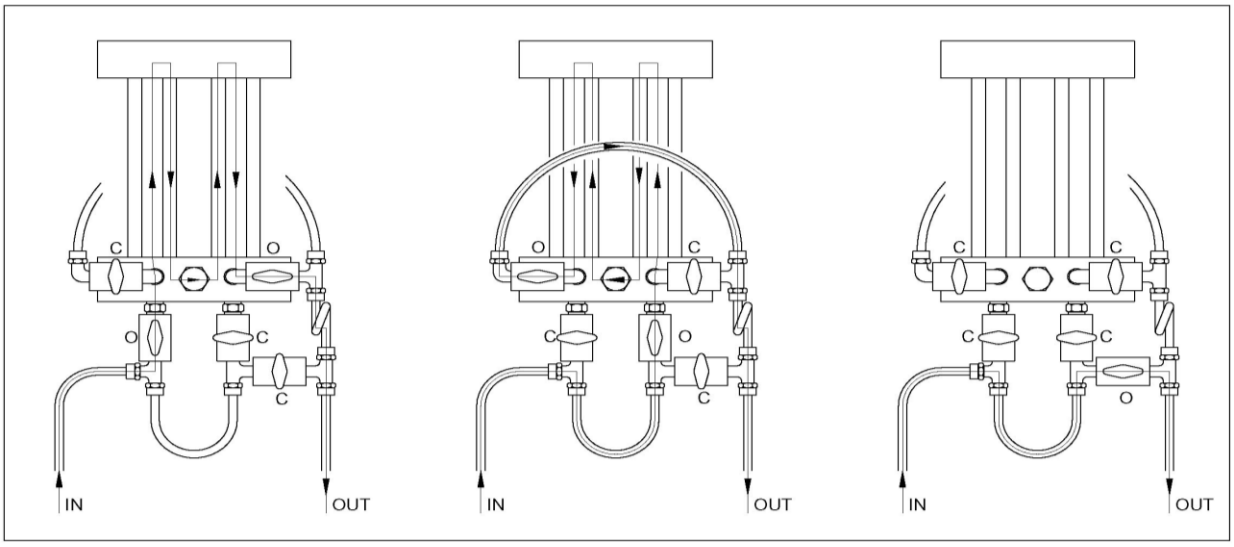
1.4 The unit is mounted on a steel frame for wall mounting.

2 Installation

2.1 It is suggested that these instructions are read carefully before starting installation work, and that before using the unit some time should be spent becoming familiar with the device in order to gain a practical understanding of how it works.

2.2 Select a wall which is adjacent to the Triaxial cell that the volume change unit will be connected to.

2.3 Position the unit on the wall about mid point to the sample height and mark or spot through the holes in the frame. Drill the holes in the wall to accept suitable fixings to safely attach the unit to the wall.



Setting 1 Setting 2 Setting 3

Figure 1

3 Priming the Panel

3.1 Close all the valves on the unit. **Note:** when taps are across the line of flow it is normally closed.

3.2 Connect the 6mm tubing from one of the back pressure outlet valves on the ELE pressure indicating panel (EL26-1880) to the IN connection (Figure 1) on the volume change unit.

3.3 Connect the 6mm pipe to the OUT connection (Figure 1) on the volume change unit. Connect the other end to the back pressure valve if back pressure volume change is to be measured, or to the cell pressure valve if volume change of cell pressure is required. For priming purposes the Triaxial cell valve should initially be closed.

3.4 Open the upper LH bleed valve and set the valves as seen in Figure 1 (setting 1).

3.5 Carefully pump de-aired water into the left-hand burette until the burette and outer tube are completely full of water. Tap the assembly to allow any trapped air bubbles to escape from the appropriate upper bleed valve.

3.6 Close the upper LH bleed valve.

3.7 Open the upper RH bleed valve and set valves to setting 2 (Figure 1).

3.8 Repeat step 3.5 for the right-hand burette with air exiting the upper RH valve.

3.9 Close the upper RH bleed valve.

3.10 Close all valves.

4 Pressure Testing

4.1 With the by-pass (setting 3, Figure 1) & cell valve open, pump de-aired water through the volume change unit until no air appears at the cell connection and all air bubbles in the pipes are expelled.

4.2 With the outlet pipeline closed at the cell and all the valves open on the volume change unit, gradually increase the pressure to the panel until the maximum working pressure is reached on the system pressure indicator (must not exceed 1700 kPa).

4.3 Should the application of pressure release trapped air bubbles, lower the pressure to 50 kPa and gently loosen the top two bleed valves through which the air is required to escape or the Triaxial cell valve. Top up with de-aired water and close the upper bleed valves and the cell valve.

4.4 Re-pressurise the panel to a maximum pressure of 1700 kPa or maximum required working pressure.

4.5 Check that no leakage is evident under pressure at the various connections and valves. Any leakages must be rectified for correct operation.

Note: There will be a certain amount of ‘settling down’ of a new panel when first commissioned. Maintain pressure by ‘topping up’ as necessary.

4.6 Maintain maximum pressure for a period of up to 24 hours. Any leakage will be indicated by a continuous fall of the pressure gauge. Leakages should be rectified and pressure testing continued.

4.7 Once the pressure test is complete, lower the pressure in the panel by slowly reducing the supply pressure to zero and close all the valves. Do not drain.

5 Setting the Kerosene Interface

5.1 Open the upper LH bleed valve. To aid correct movement of meniscus place **1 drop** of clear liquid soap in the upper bleed valve. (**NOTE:** Keep the cell valve closed.)

5.2 Open the lower LH valve and by-pass valve and place a suitable drainage container at the outlet of the cell, then open the cell valve. Water will now drain from the left-hand burette.

5.3 Allow the burette to drain until the water level in the inner burette reaches the 100 ml position. Close the upper LH bleed valve and the lower LH valve.

5.4 Open the upper RH bleed valve and lower RH valve. Water will now drain from the right-hand burette. Again, place **1 drop** of clear liquid soap in the upper bleed valve.

5.5 Allow to drain again until the water reaches the 100 ml position, and close all valves.

Note: Only a few grains of dye should be used to colour the kerosene, too much will make it dark and difficult to read. Test a small amount of kerosene first.

5.6 Open the upper LH bleed valve and, using a small funnel, add high grade kerosene which has been treated with the red dye into the upper LH valve. The kerosene will enter the left hand burette. Fill completely to the top, ensuring that no air is trapped, and then close the upper LH bleed valve.

5.7 Open the upper RH bleed valve, fill the right-hand burette with kerosene until no air is present, and then close the upper RH valve.

5.8 Open the lower LH valve and, using a spanner, open the lower centre brass bleed valve.

5.9 Slowly pump water into the left-hand burette, displacing kerosene into the outer tube. The excess water will bleed off from the lower centre bleed valve into a suitable container.

5.10 When the fluid interface in the left-hand inner burette reaches zero ml, close both the lower LH valve and the lower centre brass bleed valve.

5.11 The volume change unit should now have the water/kerosene interface at zero in the left hand burette and at 100 ml in the right hand burette.

5.12 The volume change unit is now ready for use.

5.13 Should water be required to flush the system at the Triaxial cell use setting 3 (Figure 1).

5.14 For volume change measurement use setting 1 or 2 (Figure 1) as required depending on initial movement of interfaces.

5.15 During the test select setting 1 or 2 (Figure 1) to change the direction of the water/kerosene interface, and also as the two interfaces get near to zero and 100 ml during a test. At no time must kerosene travel to the Triaxial cell or pressure system.

5.16 NOTE! Never allow the kerosene to escape from the confines of the burettes and outer tubes and migrate to the Triaxial cell or pressure systems. If this happens the volume change may require draining and refilling.

6 Maintenance

6.1 After initial settling down and pressure testing, the unit should require little or no attention for some time other than general cleaning.

6.2 Draining the system for repair or cleaning

6.2.1 Make sure all the valves are closed. Remove the lower loop of piping. Open the upper LH and RH bleed valves. Place a container under the lower pipe outlets and open the lower LH and RH valves.

6.2.2 Both burettes should drain together.

6.2.3 With a suitable container in place, open the lower centre brass bleed screw and drain the outer tubes of any remaining water and kerosene. (The kerosene can be used again if clean.)

6.2.4 The unit is now ready to be removed from the wall and dismantled.

6.3 Take the unit, having detached all pipe connections, and lay it down on a workbench. Remove the nuts at the top of each of the four tie rods.

6.4 Carefully turn the unit over and remove the two upper bolts holding the upper block to the back plate.

6.5 Taking care to support the tie rods, upper block and burettes, turn the unit so the burettes are upright. Support the burettes and carefully draw the upper block off of the burettes and tie rods.

6.6 Remove the outer tube from the lower block, taking care not to disturb the inner glass burette.

6.7 Very carefully twist and remove the now exposed glass burette from the lower block.

6.8 When cleaning, use soap and water only. Never use scourers or caustic detergents. Rinse well with clean water and carefully dry.

6.9 Inspect all seals and replace as necessary.

6.10 Re-assemble in reverse order the complete volume change unit.

Note: To assist in re-fitting the burettes, the 'O' rings may be coated in a very small smear of vacuum grease. The four tie rods must be tightened evenly in order to achieve a good seal.

Note: A set distance of 63 cm must be measured between the lower face of the upper block and the upper face of the lower block during re-assembly of the tie rods.

6.11 Replace lower pipe loop.

6.12 Prime, pressure test and add kerosene as previously described.

7 Spares

Order separately:

26-1900 Red Dye
Kerosene soluble, 25g. Used to colour kerosene in volume change unit.