Taha Kimia Tajhiz Co.

Ofite Co.

Volumetric Cement Expansion Device

Datasheet

Cement Testing / Compressive Strength Equipment

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Volumetric Cement Expansion Device

Patent Pending

Part No. 120-54

Instruction Manual

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Intro

The OFITE Volumetric Cement Expansion Device (VCED) is an accessory component to the Ultrasonic Cement Analyzer (UCA). This system continuously measures the expansion or contraction of a cement sample while simultaneously running a standard UCA test to measure compressive strength.

Description

The VCED attaches to the UCA test cell during testing. A bi-directional pump pressurizes the cell and continuously monitors the volume of fluid inside. As the cement sample expands or contracts, the software records the change in volume, as well as the temperature, transit time, compressive strength, and acoustic impedance.

As conventional cement begins to set, it experiences a period of chemical shrinkage. If the cement is permeable and in contact with water, then water is able to flow into the cement matrix pore spaces to counteract the chemical shrinkage. This results in little to no net volume change.

Once the cement becomes relatively impermeable due to cement hydration, water is no longer able flow into the pore spaces. At this point a conventionally designed cement will begin to experience bulk shrinkage. If the cement has been designed with expanding additives, it will begin to experience bulk expansion when it becomes impermeable.

The VCED will accurately measure the amount of water that flows into the cement matrix while the cement is permeable. Once the cement is impermeable, it will continue to measure bulk shrinkage. If the cement begins to expand, the VCED will measure bulk expansion as a percentage.

Specifications

- Size:
  UCA: 15" × 24" × 18" (38 × 61 × 45.8 cm)
  VCED: 30" × 18" × 43" (76 × 46 × 109 cm)

- Weight:
  UCA: 85 lbs (39 kg)
  VCED: ~95 lbs (43 kg)

- Air Supply - 100 PSI (690 kPa) Recommended; 150 PSI (1,035 kPa) Maximum; ¼" NPT Connector (For standard UCA tests only)

- Water Supply - Tap water; ¼" NPT Connector. Both the UCA and VCED units will require a water supply.

- 120V/220 V, 50/60 Hz Power

Components

UCA (#120-50 or #120-52):

#120-50-TR	Transducer, Set of 2
#120-50-018	Fill Gauge
#120-50-021	Cell Assembly
#120-50-039	Box-End Wrench, ½"
#120-50-040	Box-End Wrench, ⅝"
#120-50-041	Strap Wrench, 18"
#120-50-047	Spring for Transducer
#120-50-053	Heater
#120-50-090	Wrench for UCA Cell
#120-90-033	Air Filter
#122-004	Thermocouple Assembly
#122-053	Rupture Disk, 22,500 PSI
#123-024	Acoustic Couplant (0°–600°F)
#130-75-27	Allen Key, T-handle, 3/16"

Replacement Parts for VCED:

#130-77-030	Valve
#120-106-001	High-pressure Filter Element
#120-90-035-1	Low-pressure Filter Element

Optional:

#120-50-SP Spare Parts for Single-Cell UCA

#120-50-053	Heater
#122-004	Thermocouple Assembly
#122-053	Rupture Disk, 22,500 PSI, Qty: 2
#122-073	Fuse, 2-Amp, 5 mm × 20 mm, Qty: 4
#122-077	Fuse, 10-Amp, 5 mm × 20 mm, Qty: 4
#123-011	O-ring for Test Cell, Qty: 80
#123-024	Acoustic Couplant (0°–600°F), Qty: 2

#120-52-SP Spare Parts for Dual-Cell UCA:

#120-50-053	Heater, Qty: 2
#122-004	Thermocouple Assembly, Qty: 2
#122-053	Rupture Disk, 22,500 PSI, Qty: 4
#122-073	Fuse, 2-Amp, 5 mm × 20 mm, Qty: 8
#122-077	Fuse, 10-Amp, 5 mm × 20 mm, Qty: 8
#123-011	O-ring for Test Cell, Qty: 160
#123-024	Acoustic Couplant (0°–600°F), Qty: 2

#120-54-SP Spare Parts for VCED:

#120-54-001-SP	Spare Parts for Bi-directional Pump
#120-104	Rupture Disk, 17,500 PSI, Qty: 2
#120-106-001	High Pressure Filter Element, Qty: 3

Setup

Installation

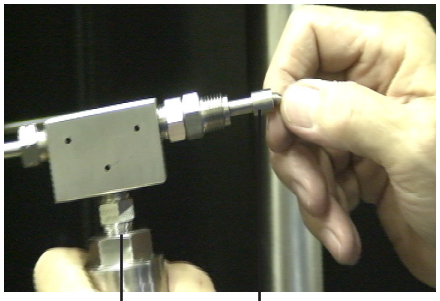
The VCED is an add-on component for the OFITE Ultrasonic Cement Analyzer (UCA). The two units work together to provide both compressive strength and expansion data on the same graph.

The VCED bypasses the standard UCA plumbing. When the VCED unit is connected to the UCA, the gauge, regulators, and valves on the UCA are not operational.

DO NOT REFER TO THE GAUGE ON THE UCA TO READ PRESSURE INSIDE THE TEST CELL. THIS GAUGE IS NOT OPERATIONAL WHEN THE VCED IS CONNECTED. FOR AN ACCURATE PRESSURE READING, REFER TO THE SYRINGE PUMP INSIDE THE VCED CABINET OR THE VCED SOFTWARE.

1. Place the VCED unit next to the UCA unit on the left-hand side.
2. On the UCA, make sure all switches are off and all pressure knobs are turned completely counterclockwise.
3. Connect the **WATER** and **DRAIN** connectors on the back of the UCA unit to their appropriate source and plug in the power cord.
4. Turn on the “Main” switch on the UCA.
5. Carefully remove the syringe pump from its crate.
6. Place the pump into the VCED cabinet. The flat platform on the front of the pump should face the front of the cabinet.
7. Remove the screws on the base of the pump and use them to secure the mounting brackets to the base of the pump. The brackets are marked “Front” and “Rear”. The “Front” bracket should be closest to the door.
8. Position the pump inside the cabinet to align the brackets with the holes in the base of the cabinet.
9. Secure the mounting brackets to the base using 10-32 screws.
10. Plug the power cord into the pump.
11. Place the controller on the platform on top of the pump.
12. Connect the 25-pin cable to the port labeled “Pump A” on the back of the controller.
13. Connect the data cable to the “RS-232” port on the back of the controller.

14. Install the high-pressure line (with the pressure transducer) from the pump to the “Pump” valve. Make sure the ferrule is turned back enough for two or three threads to show. This will allow the threads to seat properly. Tighten both ends with a ⅝" wrench.



15. Connect the cable from the transducer to the back of the pump (DB-9 connector).

16. Install the other set of plumbing from the pump to the “Fill” valve. Be sure to check the ferrules as described in step 14.

17. Tighten both ends with a ⅝" wrench.

18. Connect the “Water” and “Drain” connectors on the back of the VCED unit to their appropriate source and plug in the power cord.

Note

Always connect the pump to a source of clean, fresh water.

19. Connect the VCED unit to the PC with one of the supplied serial cables. The PC has two serial ports labeled “UCA” and “Pump”.

20. The VCED unit has two valves on the front. The “Fill” valve, when open, allows water to flow into the pump to fill the piston. The “Pump” valve, when open, allows the pressure from the pump into the test cell.

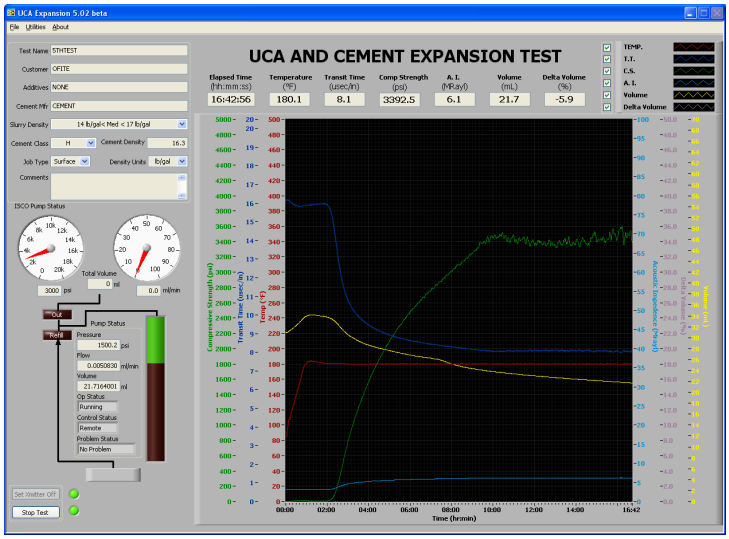
Setup

Software

Before you begin your test, you must prepare the PC to record the data.

1. Open the VCED software by double-clicking the icon on the desktop.

2. The main screen of the software shows a graph of the temperature, transit time, compressive strength, acoustic impedance, volume, and delta volume with respect to time. Above the graph, the current value for each of these variables is displayed. To the left of the graph is the user-defined information about the test and the current status of the pump.



Elapsed Time: The elapsed time since the beginning of the test.

Temperature: The temperature of the cement slurry.

Transit Time: The time it takes the acoustic signal to travel through the cement.

Comp Strength: The compressive strength of the cement. This value is calculated based on the transit time.

A.I.: The calculated acoustic impedance of the cement. This is mostly used for well logging.

Volume: The current volume in the pump.

Delta Volume: The change in volume of the cement. The software will not begin calculating the change in volume until after the slurry temperature has stabilized. Until then, this field will read “NaN”.

3. From the “Utilities” menu, select “Setup”.

UCA COM Port: select the COM port the UCA is connected to

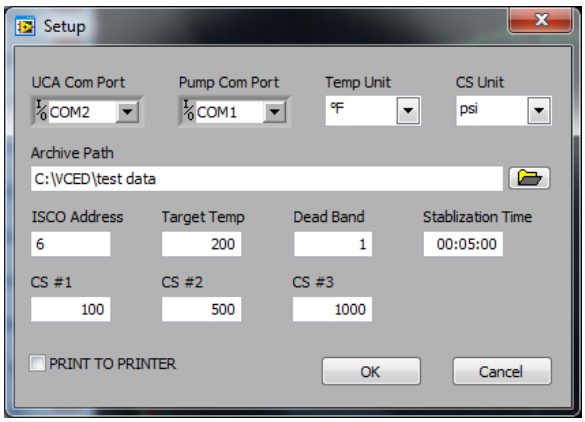
Pump COM Port: select the COM port the pump is connected to

Temp Unit: Select either °F or °C

CS Unit: Select either PSI or kPa for pressure units

Archive Path: Choose a location to save test results

ISCO Address: This field will be set to 6 by default. It should not be changed unless the pump is reconfigured to reflect the new address also.



Target Temp: Enter the Target Temperature for the test. The software will not record volume data until the sample reaches this temperature.

Dead Band: The Dead Band specifies a range above and below the Target Temp. If the temperature is within this range, it is considered stable. The recommended setting is 2.

Stabilization Time: The software will wait until the slurry temperature is stable for this amount of time before recording volume data. The recommended setting is 15 minutes.

As the slurry sample heats up, its volume will increase due to thermal expansion. This expansion should be excluded from the final test results. To do this, the software waits until the test temperature reaches the Target Temp and stays within the Dead Band for the length of time entered in Stabilization Time.

CS #1, CS #2, CS #3: Enter a compressive strength in each of these fields. When the cement sample reaches these values, the software will record the elapsed time and make a note on the graph at the end of the test. These settings are optional.

Print to Printer: If this box is checked, a report will automatically be sent to the printer when a test is complete.

Setup

Temperature Controller

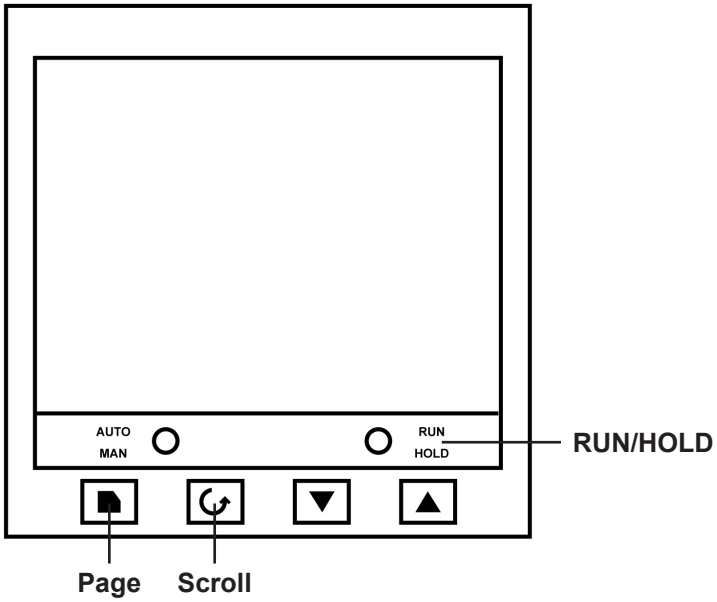
The Eurotherm temperature controller allows you to program a temperature profile for your test. This profile will be divided into at least two segments. Each segment represents either a change in temperature or a period of time to hold the current temperature.

The four buttons along the bottom of the display provide access to the temperature controller settings. Begin by pressing the “PAGE” button three times. The display will read “Prog List”. Now, press the “SCROLL” key repeatedly until the setting you wish to change is shown on the display. Then press either arrow key until the appropriate value is displayed. Once you’ve chosen a value, press the “SCROLL” key again to select a new setting.

For more information, refer to the Eurotherm instruction manual.

For cement expansion tests, we recommend using a simple temperature profile that ramps to a target temperature and holds it until the test stops.

Temperature Controller



The first group of settings should read as follows:

Setting	Value
Prg1	1
Hb	OFF
Hb.u	0.0
Rmp.u	min
Dwl.u	min
Cyc.n	1

Important

These settings will be the same for every test. Do not change them.

1. Begin by defining the first segment of the test.

    b. Press the “SCROLL” key repeatedly until “Seg” appears on the display.

    c. Press either arrow key repeatedly until “1” appears on the display. You are now editing segment 1.

2. The first setting is “Type”.

    a. Press the “SCROLL” key until the word “Type” appears on the display.

    b. The available options are “rmp.r”, “rmp.t”, or “dwell”. Press either arrow key until the appropriate value appears on the display.

    Rmp.r programs the controller to steadily increase the temperature by a specified rate (degrees per minute). If you choose this value, your next option will be “Tgt”, which is your target temperature and then “Rate” which is the rate you want the temperature to increase.

    Rmp.t increases the temperature over a specified time interval (minutes). If you choose this value, your next option will be “Tgt” (target temperature) and then “Dur” (duration in minutes).

    Dwell holds the temperature at its current setting for a specified length of time. If you choose this value, your next option will be “Dur” (duration in minutes).

3. Now define the second segment.

    a. Press the “SCROLL” key until “Seg” appears on the display.

    b. Press either arrow key until “2” appears on the display. You are now editing segment 2.

4. Continue this process with each segment in the test.

5. When you reach the last segment, set the “Type” to “end”. The next setting will be “End.t”.

    If you choose “sop”, the heat will be turned off and the test ended.

    If you choose “dwell”, the heat will be held at the current temperature indefinitely.

Example 1:
Heat the sample at 2.5° per minute and stop at 150°. Hold at 150° for 180 minutes and then stop the heat.

Setting	Value	Description
Prg	1	
Hb	OFF	
Hb.u	0.0	
Rmp.u	min	
Dwl.u	min	
Cyc.n	1	
Seg	1	Segment 1
Type	rmp.r	Increase temperature at a specified rate
Tgt	150	Heat to 150°
Rate	2.5	Increase temperature at 2.5° per minute
Seg	2	Segment 2
Type	dwell	Hold on the current temperature
Dur	180	Hold for 180 minutes
Seg	3	Segment 3
Type	end	This is the last segment
End.t	sop	Stop the heat

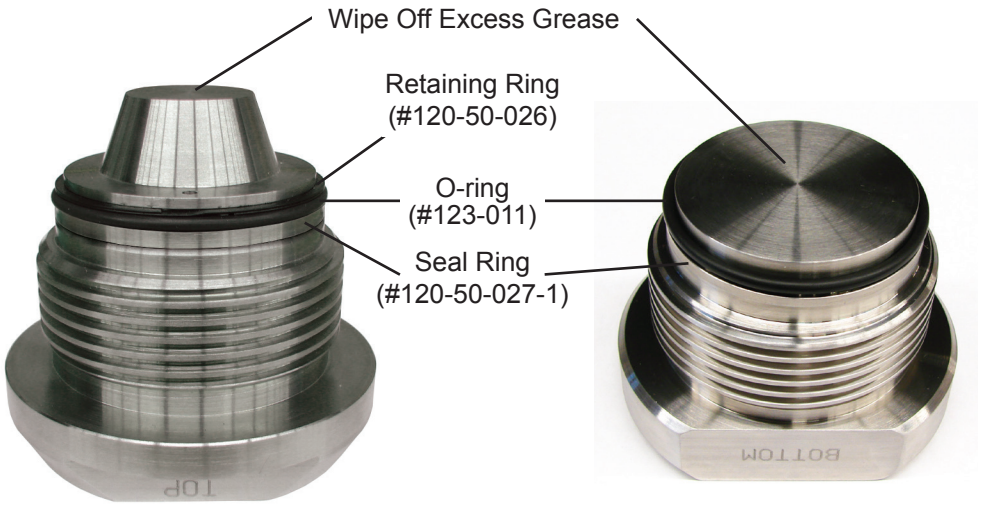
Example 2:
Heat the sample to 200° over a period of 90 minutes. Then increase the temperature to 300° at a rate of 3° per minute. Hold that temperature until the unit is turned off.

Prg	1	
Hb	OFF	
Hb.u	0.0	
Rmp.u	min	
Dwl.u	min	
Cyc.n	1	
Seg	1	Segment 1
Type	rmp.t	Increase temperature for a specified time
Tgt	200	Heat to 200°
Dur	90	Increase temperature for 90 minutes
Seg	2	Segment 2
Type	rmp.r	Increase temperature at a specified rate
Tgt	300	Heat to 300°
Rate	3	Increase temperature at 3° per minute
Seg	3	Segment 3
Type	end	This is the last segment
End.t	dwell	Hold at the current temperature indefinitely

Setup

Cell Cap Assembly

1. Apply a thin layer of high-temperature grease to the inside surfaces of the two cell caps. Wipe off any excess grease.



Top Cell Cap
(#120-50-021C)

Top Cell Cap
(#120-50-021B)

2. Apply high-temperature grease to both cell cap o-rings.

3. Place a metal seal ring onto the bottom cell cap with an o-ring on top of it. The narrow side of the metal seal ring (see diagram of cross-section) should point away from the o-ring.

4. Place an o-ring on the top cell cap between the metal seal ring and the retaining ring.

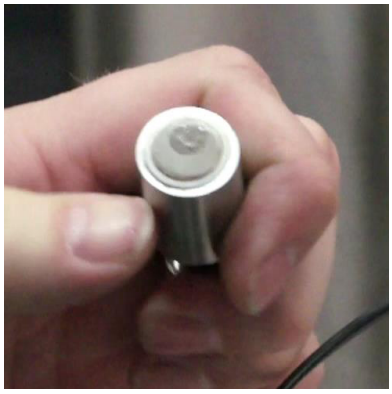
   You should not need to remove the retaining ring and metal seal ring from the top cell cap. However, if you do, be sure to place the metal seal ring back in the same orientation. The narrow end should point toward the handles at the top of the test cell.

Metal Seal Ring
(Cross Section)

5. Make sure the transducers and the transducer holes in the cell caps are clean and free of debris. If they are not, they can be cleaned with a rag or paper towel. You can also use alcohol if further cleaning is necessary.

6. Apply a thin coat of an ultrasonic couplant to the two transducers.

   When applying the couplant, apply only the smallest amount necessary to allow for the couplant to be spread out in a very thin layer, evenly over the face of the transducer. Applying too much couplant can interfere with the integrity of the signal that is either transmitted or received by the transducers.



7. Place the top transducer into the hole in the top cell cap. Compress the spring and place the spring holder over it. Tighten the screw with a 3⁄16" allen wrench to secure the spring holder in place.

Operation

Preparing the Test Cell

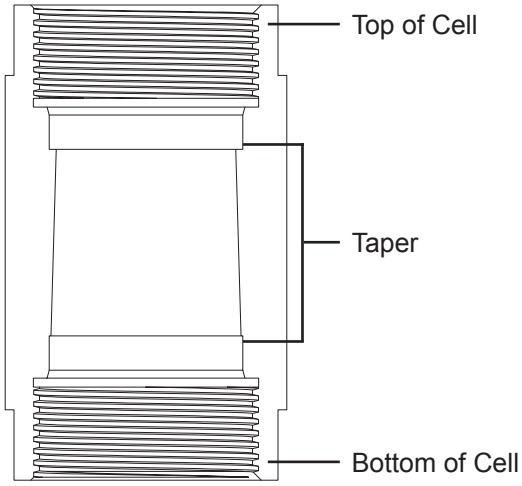
The cell body and both cell caps were manufactured and pressure tested together. All three pieces are serialized. Before assembling the test cell, make sure all three pieces have the same serial number.

For a complete diagram of the UCA test cell, refer to page 28.

1. The test cell is labeled to indicate which end is the top and which is the bottom. Additionally, you can identify the bottom of the cell by removing both caps and examining the grooves beneath the threads. The end with the smaller groove is the bottom of the cell.

   Note

   The interior of the cell has a taper with the narrow end at the top and the wide end at the bottom. A hardened cement plug can only be pushed out of the cell from the top.



2. Apply a thin layer of high-temperature grease to any surface that will be in contact with cement. This will make cleaning easier when the test is complete.

3. Carefully screw the bottom cell cap onto the test cell.

   The cell cap should turn smoothly in the test cell threads. If you encounter resistance, stop turning and unscrew the cap slightly. Then continue turning until the cap is completely tightened.

4. Once the cap is completely tightened, unscrew it one quarter turn. This will facilitate disassembly later.

5. Turn the test cell over and begin filling with the cement slurry. Place the fill gauge on top of the test cell. Fill the cell until the cement touches the bottom of the fill gauge.

Fill Gauge
(#120-52-021)

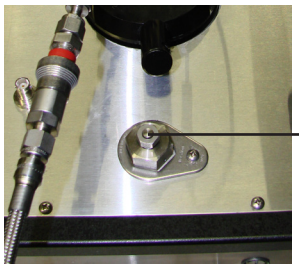
6. Carefully screw the top cell cap into the test cell, just as you did with the bottom cell cap.

Operation

Starting a Test

1. Close the Pump and Fill valves on the VCED unit.

2. Plug the water bulkhead on the UCA cabinet with the supplied plug (#120-51-024-1) and gland (#120-51-024).



Water Bulkhead with Plug and Gland

3. Program the temperature controller as described on page 9.

4. Select “Load Cell Infos” from the “Utilities” menu. Enter the necessary information and click “OK”.

   Most of these fields are optional. The information in them will display in the data file at the end of the test.

   The following fields are required:

   Test Name - Each test must have a unique test name. The software uses this field to name the data file.

   Slurry Density - The software uses this field to calculate the correct compressive strength.

   Cement Density - The software uses this field to calculate the acoustic impedance.

5. Prepare the test cell as described on page 12.

6. Carefully place the cell into the heating jacket. Make sure the bottom transducer is inside the hole in the cell cap before lowering the cell.

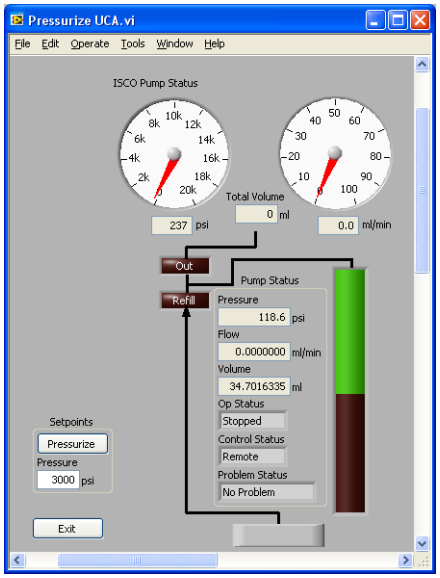
7. Insert the thermocouple into the test cell through the hole in the cap and hand tighten.

8. Plug the transducer cable into the receptacle on the unit.

9. Connect the supplied plumbing fixture to the side of the VCED cabinet and to the test cell. Use the quick-connect fittings and hose to connect the safety valve to the VCED cabinet.

10. Select “Pressurize Cell” from the “Utilities” menu.

    The pump Volume should be approximately 30 mL before the test starts. If it is less than that, the software will automatically fill it. If the volume is greater than 30 mL, it must be purged manually. Refer to page 25 for instructions.



11. Enter the target pressure and click the “Pressurize” button.

    The software will prompt you to do the following:

    a. Open the “Pump” and “Fill” valves.

    b. Loosen the thermocouple nut.

    c. Water will begin filling the test cell. When the cell is full, water will leak out of the thermocouple fitting. When you see this, tighten the thermocouple to seal the cell.

    d. Close the “Fill” valve.

    e. Click OK to continue pressurization.

    The software will automatically refill the pump if it is less than half full.

DO NOT REFER TO THE GAUGE ON THE UCA TO READ PRESSURE INSIDE THE TEST CELL. THIS GAUGE IS NOT OPERATIONAL WHEN THE VCED IS CONNECTED. FOR AN ACCURATE PRESSURE READING, REFER TO THE SYRINGE PUMP INSIDE THE VCED CABINET OR THE VCED SOFTWARE.

12. When the target pressure is reached, click the “Exit” button.

13. Turn the “Heat” switch on.

14. Press and hold the “Run/Hold” button on the temperature controller to start the temperature program.

15. Click the “Start Test” button on the main screen. You will have one last opportunity to enter test information. When finished, click “OK”.

When the cell has maintained the test temperature for the Stabilization Time (see page 8), the software will record the initial volume in the cell. Once the initial volume is set, it will begin calculating the expansion or contraction.

1. When the test is complete, click the “End Test” button in the software. The data file will be automatically saved in the folder specified on the “Setup” screen.

2. Press and hold the “Run/Hold” button on the Eurotherm temperature controller to stop the automatic program.

3. Turn the “Heat” switch off.

4. Use the down arrow to set the temperature to 32°F.

5. Turn the “Cool” switch on and allow the test cell to cool completely.

6. When the cell has cooled, turn the “Cool” switch off.

7. From the “Utilities” menu select “ISCO Manual Control”.

8. Set the pressure to 0 PSI and click the “Set Press” button.

9. When all the pressure has been released, click the “Stop” button on the ISCO Manual Control screen. Click the “Done” button to return to the main screen.

10. Remove the thermocouple, plumbing fixture, and transducer from the test cell. Leave the thermocouple plugged into the receptacle on the UCA unit.

11. Lift the cell out of the heating jacket.

    When removing the test cell, pay special attention to the transducer and make sure it doesn’t pull off of the end of the transducer cable with the cell.

Maintenance

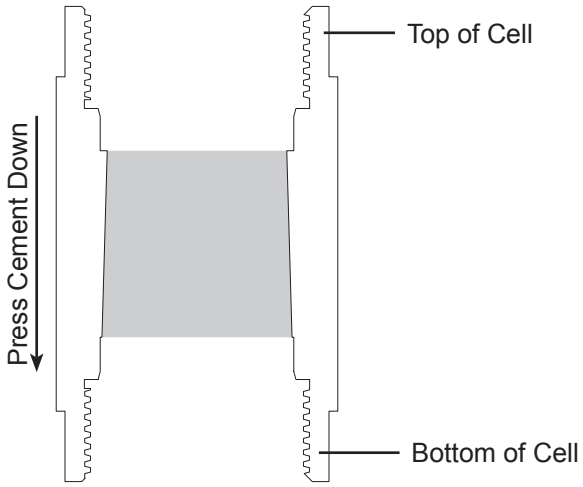
Cleaning the Test Cell

The test cell must be cleaned immediately after every test. Any cement left in the test cell will harden and could damage the equipment. Clean all surfaces of the test cell with soap and water.

The cement in the cell will be solid. It may be necessary to press the cement block out. Follow the procedure below:

1. Remove both cell caps and pour off any excess water.

   If the cell caps on the test cell will not turn, use a rubber mallet and strike the top and bottom of the test cell.



2. Remove the cement plug from the cell by pressing from the top down.

3. The test cell must be cleaned of all cement residue. Any cement left in the test cell will harden and could damage the equipment. Clean all surfaces of the test cell with soap and water.

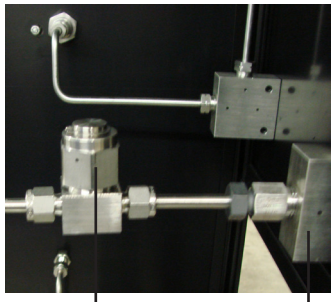
   Remove all o-rings and seal rings and clean them individually. Carefully inspect them and discard any that show damage or wear.

Tip

Maintenance

Filters

The VCED unit has two filters to protect the pump from contaminants. The low-pressure filter is inside the unit cabinet between the “Fill” valve and the pump. The high-pressure filter is outside the unit cabinet between the “Pump” valve and the test cell. These filters may accumulate solid material and require cleaning.

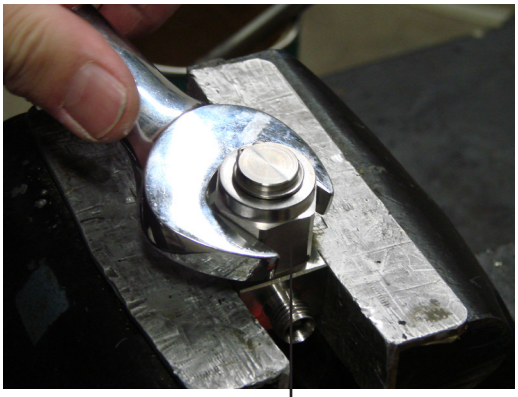


Low-Pressure Filter

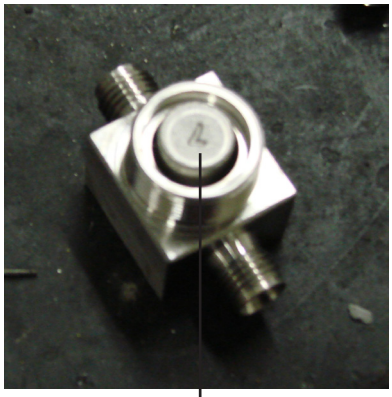
“Fill” Valve

To clean the filter:

1. Remove the filter from the plumbing before attempting to open it.
2. Place the filter assembly into a vise to secure it in place.
3. Unscrew the filter housing and remove the filter element.



Filter Assembly



Filter Element

4. Clean the filter with acetone, CLR, or other appropriate solvent.
5. Use compressed air to dislodge any remaining solid material.
6. Return the filter element to the filter housing.
7. Screw the filter housing back together. Make sure the seal is tight.
8. Re-install the filter assembly into the plumbing.

Maintenance

Changing a Fuse

If one of the main systems on the UCA (main power, fan, heater, pump, and cooling solenoid) is not working, then you may need to check the fuses.

1. Removing the back panel on the UCA and inspect the terminal block which holds the fuses. They are labeled as follows:

2. If a fuse for a particular system is blown, a red LED light will come on below the blown fuse's housing.

3. Unplug the power cord leading to the UCA.

4. Depressing the tab on the bottom of the fuse housing should allow you to flip the housing up.

5. Open the door on the side of the fuse housing.

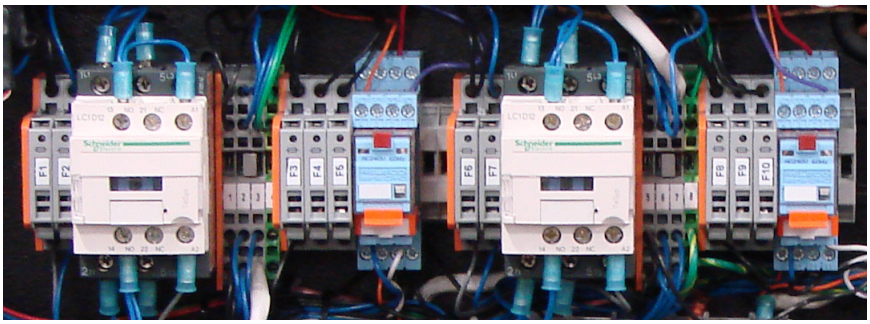
6. Replace the blown fuse.

7. Close the door on the fuse housing and push the housing down back into place.

8. Plug the power cord back into the UCA.

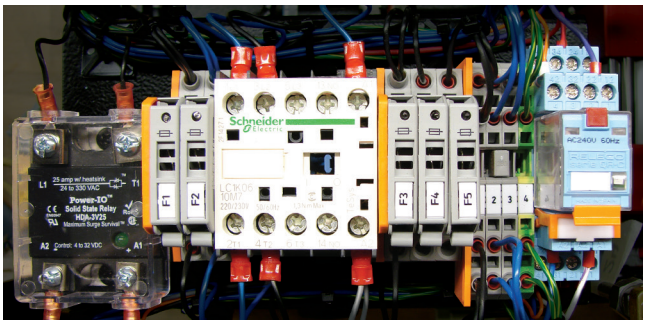
9. Check to ensure the system is working again.

Dual Cell UCA (#120-52)				
		System	**Fuse Type**	**Part#**
Unit 1				
Fuse 1	F1	Main Power	10 Amp	#122-077
Fuse 2	F2	Main Power	10 Amp	#122-077
Fuse 3	F3	Fan	2 Amp	#122-073
Fuse 4	F4	Heater	6 Amp	#122-075-2
Fuse 5	F5	Pump and Cooling Solenoid	2 Amp	#122-073
Unit 2				
Fuse 1	F6	Main Power	10 Amp	#122-077
Fuse 2	F7	Main Power	10 Amp	#122-077
Fuse 3	F8	Fan	2 Amp	#122-073
Fuse 4	F9	Heater	6 Amp	#122-075-2
Fuse 5	F10	Pump and Cooling Solenoid	2 Amp	#122-073



Fuses - Dual Cell UCA (#120-52)

Single Cell UCA (#120-50)				
		System	**Fuse Type**	**Part#**
Fuse 1	F1	Main Power	10 Amp	#122-077
Fuse 2	F2	Main Power	10 Amp	#122-077
Fuse 3	F3	Fan	2 Amp	#122-073
Fuse 4	F4	Heater	6 Amp	#122-075-2
Fuse 5	F5	Pump and Cooling Solenoid	2 Amp	#122-073



Fuses - Single Cell UCA (#120-50)

Appendix

UCA Calibration

Note

The UCA unit should be calibrated initially upon install. It should then be calibrated whenever any part of the test cell, transducers, control card or software are changed.

1. Begin by filling the test cell with distilled water and placing it in the unit as described in the “Preparing the Test Cell” section on page 14.

2. Wait for the sample temperature to reach 70° ± 2°F (21.1° ± 1.1°C).

   If the sample temperature is outside this range, transit time may be different than expected.

3. Click the “Set Xmitter On” button on the “UCA Info” tab in the software. Wait 10 seconds.

4. Click Utilities → Calibrate UCA.

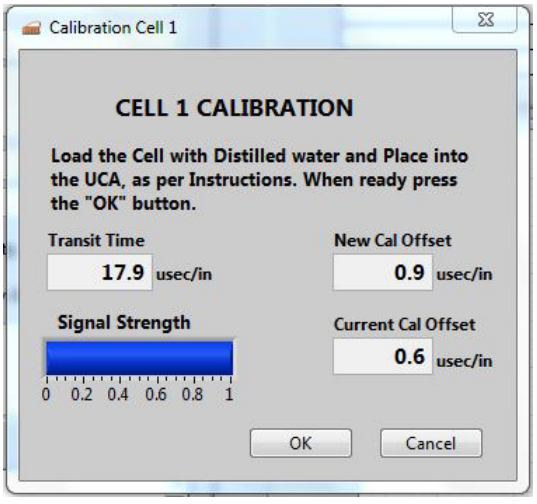
5. The transit time should be 17.0 ± 0.5 µsec (at 70° ± 2°F). If the transit time is within the acceptable range, click “OK” to save the calibration and continue.

   If the transit time is not within this range, it could be an indication that the transducers are failing or the transducer cables are damaged. Inspect and clean the transducers as well as the transducer cables and connections. Check the transducer springs for weakening or wear. If the transit time is still out of range, then you may need to get replacement parts for the transducers, cables, or springs.

   If you notice signal strength declining over time, this is an indication that the transducers are wearing out and should be replaced. A weak signal may have an adverse effect on test results.

   If the software displays an error message, contact OFITE for support.

6. Click the “Set Xmitter Off” button to turn off the transmitter.



Appendix

Purging the Pump

The VCED calculates expansion or contraction of the cement sample by measuring the amount of water that enters or leaves the pump during a test. If the pump is too empty at the beginning of a test, there won't be enough water to maintain pressure as the cement contracts. However, if the pump is too full, there won't be enough room in the pump to receive the excess water as the cement expands.

To accurately measure the expansion or contraction of the cement, the pump volume should be approximately 30 mL at the beginning of the test. This will ensure there is enough water to maintain pressure if the cement contracts, and enough room to receive excess water if the cement expands.

The software will automatically fill the pump to 30 mL if the volume is too low when the test starts. However, if the pump somehow gets too full, the excess water must be purged manually. To do this:

1. Close the "Pump" valve and open the "Fill" valve. This will allow water from the pump to run out through the drain without applying pressure to the test cell.

2. From the "Utilities" menu select "ISCO Manual Control".

3. Enter a 500 in the "Pressure" field and click the "Set Press" button.

4. Click the "Run" button. The Volume indicator will show that water is being purged from the pump.

5. When the Volume reaches 30 mL, click the "Stop" button.

Note

If the volume accidentally gets too low, don't try to refill it. The software will do it when the test starts.

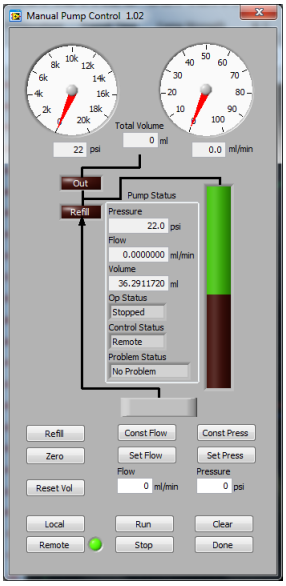
6. Click the "Done" button to return to the main screen.

Appendix

ISCO Manual Control

The VCED software includes the ability to manually control the features of the ISCO pump. To access these controls, select “ISCO Manual Control” from the “Utilities” menu.

At the top of the screen is a conceptual diagram of the pump along with several fields showing the status and current values. The three fields at the top show the current pressure, total volume to leave the pump, and current flow rate, respectively.



Under “Pump Status” you will see the following fields:

Pressure - The current pressure being applied by the pump.

Flow - The current flow rate being applied by the pump.

Volume - The volume remaining in the pump.

Op Status - The current status of the pump.

Control Status - Shows whether the pump is being controller by the onboard keypad or the VCED software.

Problem Status - Shows any problems reported by the pump.

To set a constant pressure or constant flow:

1. Click either the “Constant Pressure” or “Constant Flow” button.

2. Enter a value in the “Pressure” or “Flow” field.

3. Click the “Set Pressure” or “Set Flow” button. If the pump is already running, this will change the setting immediately. However, if the pump is stopped, click the “Run” button to start it.

4. When you are finished, click the “Stop” button.

Buttons:

Refill - Refill the pump with water.

Zero - Zero the pressure reading.

Reset Vol - Set the Total Volume value to 0.

Local - Sets to pump to “Local” mode. In this mode it can only be controller via the onboard control panel.

Remote - Sets the pump to “Remote” mode. In this mode it can only be controlled by the VCED software.

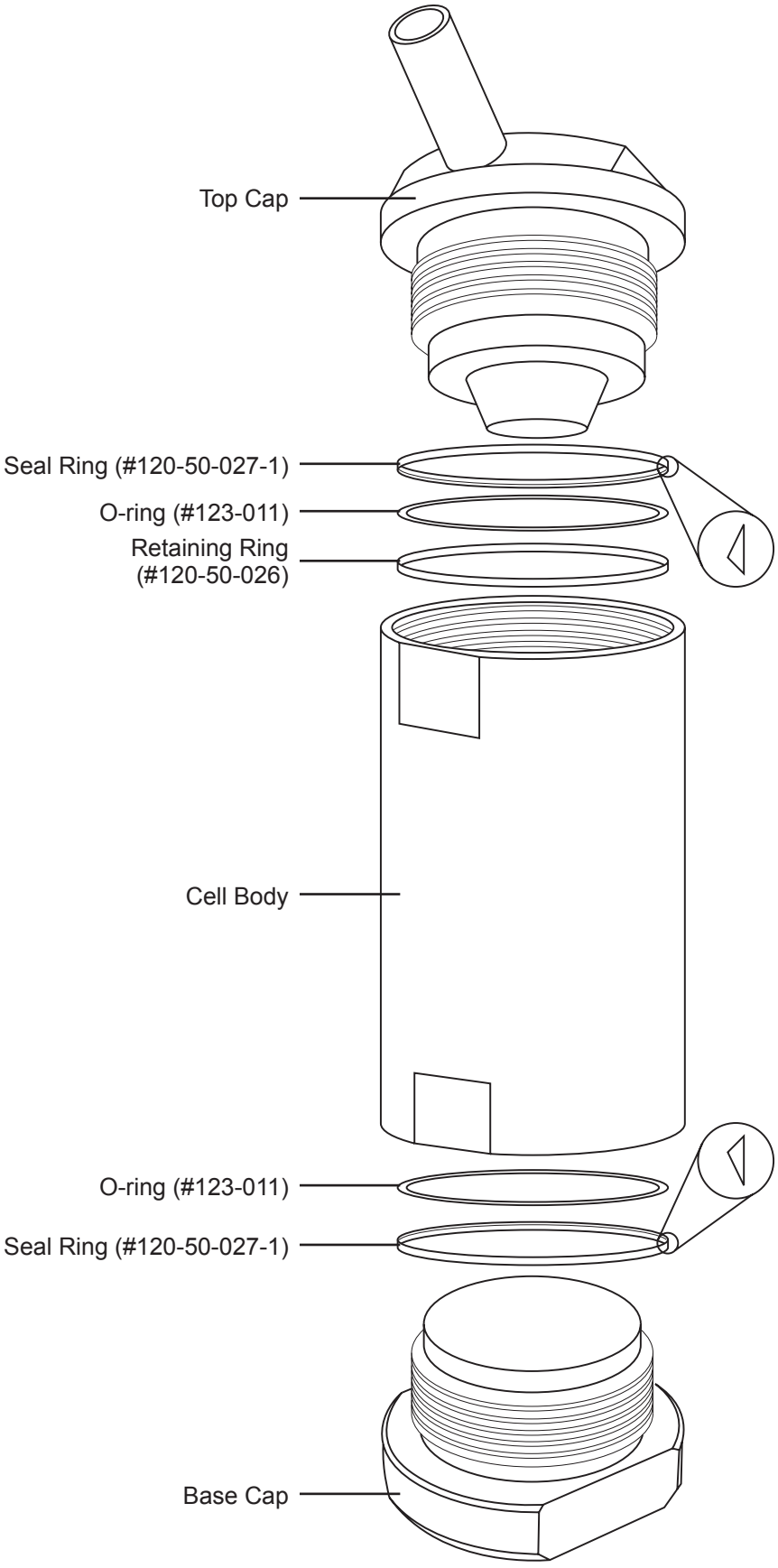
Run - Start running the pump.

Stop - Stop running the pump.

Clear - Clear the memory buffer on the pump.

Appendix

Diagram



Warranty and Return Policy

Warranty:

OFI Testing Equipment, Inc. (OFITE) warrants that the products shall be free from liens and defects in title, and shall conform in all respects to the terms of the sales order and the specifications applicable to the products. All products shall be furnished subject to OFITE's standard manufacturing variations and practices. Unless the warranty period is otherwise extended in writing, the following warranty shall apply: if, at any time prior to twelve (12) months from the date of invoice, the products, or any part thereof, do not conform to these warranties or to the specifications applicable thereto, and OFITE is so notified in writing upon discovery, OFITE shall promptly repair or replace the defective products. Notwithstanding the foregoing, OFITE's warranty obligations shall not extend to any use by the buyer of the products in conditions more severe than OFITE's recommendations, nor to any defects which were visually observable by the buyer but which are not promptly brought to OFITE's attention.

In the event that the buyer has purchased installation and commissioning services on applicable products, the above warranty shall extend for an additional period of twelve (12) months from the date of the original warranty expiration for such products.

In the event that OFITE is requested to provide customized research and development for the buyer, OFITE shall use its best efforts but makes no guarantees to the buyer that any products will be provided.

OFITE makes no other warranties or guarantees to the buyer, either express or implied, and the warranties provided in this clause shall be exclusive of any other warranties including ANY IMPLIED OR STATUTORY WARRANTIES OF FITNESS FOR PURPOSE, MERCHANTABILITY, AND OTHER STATUTORY REMEDIES WHICH ARE WAIVED.

This limited warranty does not cover any losses or damages that occur as a result of:

- Improper installation or maintenance of the products
- Misuse
- Neglect
- Adjustment by non-authorized sources
- Improper environment
- Excessive or inadequate heating or air conditioning or electrical power failures, surges, or other irregularities
- Equipment, products, or material not manufactured by OFITE
- Firmware or hardware that have been modified or altered by a third party
- Consumable parts (bearings, accessories, etc.)

Returns and Repairs:

Items being returned must be carefully packaged to prevent damage in shipment and insured against possible damage or loss. OFITE will not be responsible for equipment damaged due to insufficient packaging.

Any non-defective items returned to OFITE within ninety (90) days of invoice are subject to a 15% restocking fee. Items returned must be received by OFITE in original condition for it to be accepted. Reagents and special order items will not be accepted for return or refund.

OFITE employs experienced personnel to service and repair equipment manufactured by us, as well as other companies. To help expedite the repair process, please include a repair form with all equipment sent to OFITE for repair. Be sure to include your name, company name, phone number, e-mail address, detailed description of work to be done, purchase order number, and a shipping address for returning the equipment. All repairs performed as "repair as needed" are subject to the ninety (90) day limited warranty. All "Certified Repairs" are subject to the twelve (12) month limited warranty.

Returns and potential warranty repairs require a Return Material Authorization (RMA) number. An RMA form is available from your sales or service representative.

Please ship all equipment (with the RMA number for returns or warranty repairs) to the following address:

OFI Testing Equipment, Inc.
Attn: Repair Department
11302 Steeplecrest Dr.
Houston, TX 77065
USA

OFITE also offers competitive service contracts for repairing and/or maintaining your lab equipment, including equipment from other manufacturers. For more information about our technical support and repair services, please contact techservice@ofite.com.