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# Model 130 Benchtop Consistometer

**#120-90 - Standard**

**#120-90-DAS - With Computer for Data Acquisition and Control**

## Instruction Manual

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Ver. 6.0

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## ***Intro***

During cementing operations, the time required for a cement slurry to set is of primary concern. Under an ideal situation, minimal time would be required to successfully pump the slurry, which immediately upon placement, begins to develop compressive strength. However, if insufficient time is allowed to fully pump the cement, it will be necessary to drill the cement remaining in the casing string. Remedial operations such as this are very costly. Conversely, cements that are successfully placed, but require considerable time to cure, consume valuable rig time, which is also quite costly. Laboratory tests should be conducted under simulated reservoir conditions to examine the actual thickening time of the slurry. The OFITE Benchtop Consistometer was specifically engineered to determine the thickening time of well cements under simulated downhole pressures and temperatures.

## ***Description***

A cement is mixed and poured into the slurry cup assembly. The slurry cup is placed into the test vessel and pressure is increased via an air-driven hydraulic pump. A PID temperature controller governs an internal heater, which maintains the necessary temperature profile, while a magnetic drive mechanism rotates the slurry cup assembly at 150 RPM. A potentiometer controls an output voltage, which is directly proportional to the amount of torque the cement exerts upon an API-approved paddle. A chart recorder registers cement consistency and temperature as a function of time. Temperature and consistency are digitally displayed via LED indicators.

## ***Features***

- Maximum Pressure: 16,000 PSI (110.3 MPa)
- Maximum Temperature: 400°F (204.4°C)
- Pressure generated via an air-driven hydraulic pump
- Drive table is rotated with a magnetic drive
- External cooling jacket aids cooling of test cell
- Electronic timer with alarm, elapsed 0.1 minute resolution
- Deadweight calibration unit included
- Temperature and consistency alarms provide automatic shutdown
- Safety head with rupture disk are provided
- Unit is fully capable of testing cements in strict accordance to the guidelines as stated in API Specification 10

## ***Requirements***

- Air/Nitrogen Supply (100 - 150 PSI / 690 - 1,035 kPa)
- Water Supply for Cooling (40 PSI / 276 kPa)
- Water Drain
- 220 Volt, 50/60 Hz, 25 Amp electrical power supply

# Specifications

<b>Size</b>	25 × 16 × 20 inches (63.5 × 40.6 × 50.8 cm)
<b>Weight</b>	215 lb (94.6 kg)
<b>Crated Size</b>	30 × 20 × 24 inches (76.2 × 50.8 × 61 cm)
<b>Crated Weight</b>	255 lb (115.8 kg)
<b>Temperature Controller</b>	Digital PID, 1° Resolution
<b>Internal Heater</b>	2,500 Watt (5,000 Watt Available)
<b>Slurry Cup</b>	150 RPM Rotational Speed; 316 Stainless Steel; Expansion Chamber
<b>Maximum Temperature</b>	400°F (204.4°C)
<b>Maximum Pressure</b>	16,000 PSI (110.3 MPa)

# Components

- #120-00-026-1 Timer
- #120-00-028 Consistency Indicator, Eurotherm 2408i
- #120-001 Mineral Oil, 1 Gallon, Qty: 3
- #120-104 Rupture Disk, 17,500 PSI
- #120-208-1 Slurry Cup Thermocouple
- #120-519 Slurry Cup Assembly, No Expansion Cap
- #120-502 Molded Diaphragm
- #120-503 Paddle Pin
- #120-506 Paddle
- #120-90-5 Chart Recorder, Eurotherm 6100A
- #120-90-033 Air Filter
- #120-90-035 Filter
- #120-90-63 Temperature Controller, Eurotherm 3504
- #130-79-15 Serial Cable
- #130-76-16 USB Cable
- #152-38 Power Cable
- #120-628 Potentiometer Assembly:**
  - #120-602 Calibration Spring
  - #120-603 Potentiometer Body
  - #120-604 Potentiometer Resistor
  - #120-605 Contact Spring
  - #120-606 Potentiometer Contact Arm
  - #120-607 Contact Strip
  - #120-608 Grounding Cable Retaining Screw
  - #120-609 Grounding Contact Spring
  - #120-75-10 Slotted Weight Set
  - #120-75-9 Weight Hanger

**#120-90-00 Cell Assembly:**

120-90-049 Cell Cap Backup Ring  
120-146 Mag Drive O-ring  
120-147 Mag Drive  
120-148 Retaining Ring  
120-149 Test Cell O-ring  
120-206 2,500 Watt Heater  
120-257 Drain Plug O-ring  
503-258V90 O-Ring, Qty: 2

**#120-91 Spare Parts for #120-90:**

#120-001 Mineral Oil, 1 Gallon, Qty: 2  
#120-104 Rupture Disk, 17,500 PSI, Qty: 3  
#120-105 High-Pressure Check Valve  
#120-146 Mag Drive O-ring, Qty: 12  
#120-148 Cell Cap Backup Ring, Qty: 2  
#120-149 Test Cell O-ring, Qty: 12  
#120-204 Heater Gasket, Qty: 2  
#120-208-1 Slurry Cup Thermocouple, Qty: 2  
#120-257 Drain Plug O-ring, Qty: 12  
#120-501 Slurry Cup Sleeve, Qty: 2  
#120-502 Molded Diaphragm, Qty: 25  
#120-503 Paddle Pin, Qty: 24  
#120-504 Pivot Bearing, Qty: 10  
#120-505 Pivot Bearing Gasket, Qty: 5  
#120-506 Paddle, Qty: 6  
#120-507 7<sup>3</sup>/<sub>4</sub>" Paddle Shaft, Qty: 10  
#120-508 Diaphragm Retaining Ring, Qty: 6  
#120-509 Drive Disc  
#120-510 Drive Bar  
#120-511 Slurry Cup Shear Pin, Qty: 24  
#120-512 Slurry Cup Drive Pin, Qty: 12  
#120-513 Slurry Cup Gasket, Qty: 12  
#120-519 Slurry Cup Assembly, No Expansion Cap  
#120-602 Calibration Spring, Qty: 6  
#120-604 Potentiometer Resistor, Qty: 6  
#120-606 Potentiometer Contact Arm, Qty: 6  
#120-607 Contact Strip, Qty: 6  
#120-628 Potentiometer Assembly

# Setup

## Consistometer

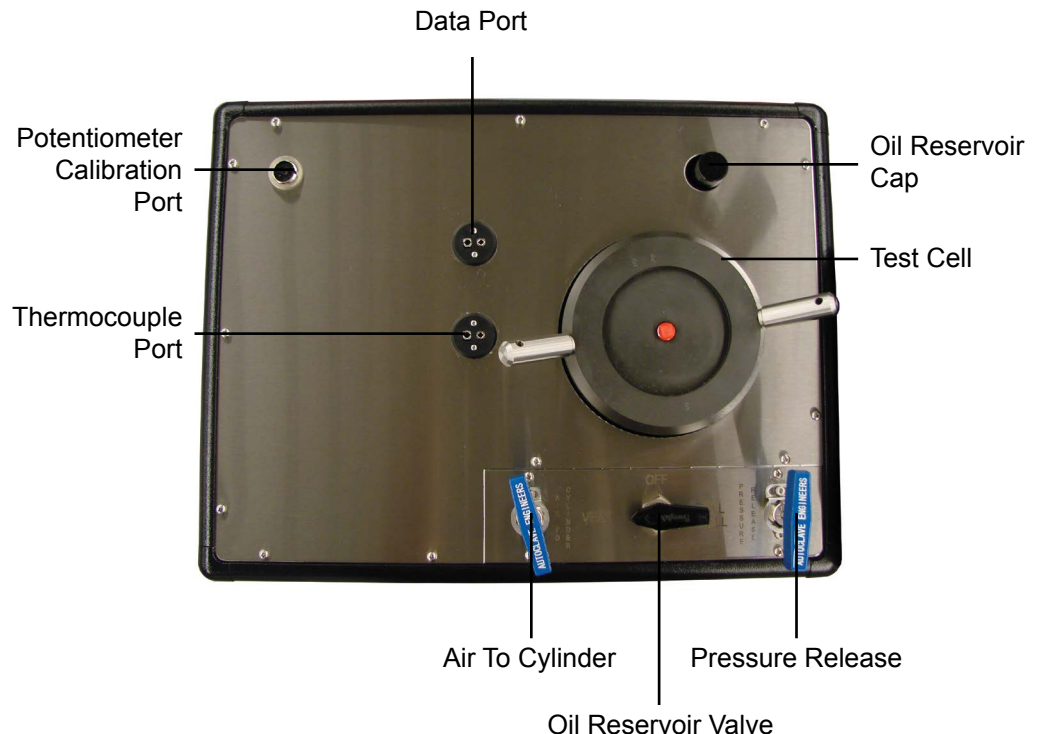


Note

1. Carefully remove the instrument from the wooden crate and place it on a stable surface.
2. Connect an air or nitrogen (100 – 150 PSI/690 – 1,035 kPa) supply to the air supply on the back of the instrument.

This unit uses ¼" NPT female connectors for all supply lines.

3. Connect the drain and coolant supply lines, also on the back of the unit.
4. Make sure all electrical switches are turned off and the unit is grounded. Make the necessary electrical connections in accordance with local codes.
5. Plug the cable into the top port on the unit cabinet and connect the other end to the port on the back of the Control Box.
6. If you are using a computer, connect the Control Box to the computer with the supplied cable. Newer units connect via a USB cable (#130-79-16). Older units use an RS-232 (serial) cable (#130-79-15).
7. To fill the oil reservoir, remove the oil reservoir cap and pour mineral oil into the reservoir until it is full. Replace the cap. Make sure the seal is air tight. Use the sight glass on the side of the reservoir to check the oil level. The oil level should be about ½" from the top of the sight glass.



# Setup

## Chart Recorder

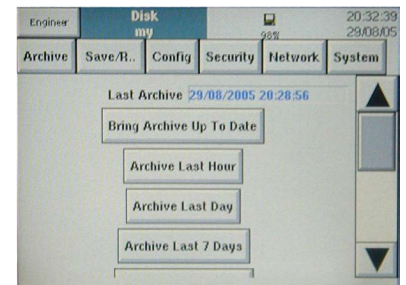
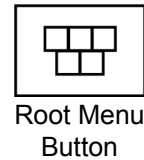
The OFITE Benchtop Consistometer includes a Eurotherm Chessell 6100A chart recorder for displaying and recording test data. It features a removable drive for easily transferring test data to a PC for processing. The unit is setup to automatically record data onto the disk during the test. However, for this feature to work, you must have the disk inserted into the drive when the unit is powered on. Otherwise, the data must be manually archived at the end of the test.



**It is strongly recommended that you carefully study the Eurotherm Chessell 6100A instruction manual before using this equipment.**

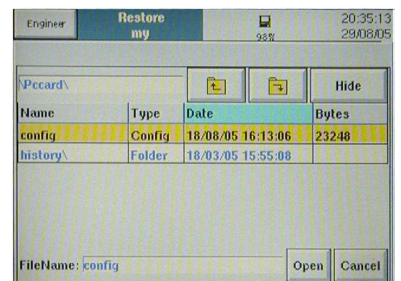
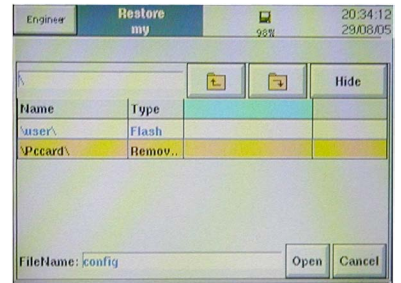
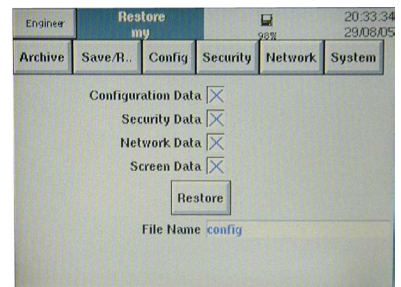
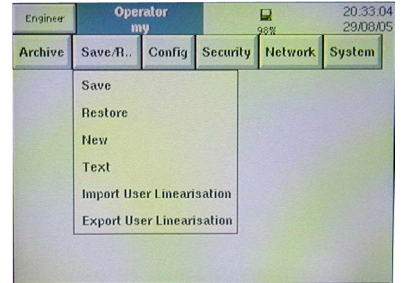
To manually archive test data:

1. Press the “Root Menu” button.
2. Press “Operator” from the root menu.
3. At the top of the screen, choose “Archive” and then choose “Disk”.



The chart recorder is shipped to you with a pre-programmed configuration file. It is highly recommended that you do not change any of these settings. However, in case of emergency, it is possible to restore your configuration from the disk that is shipped with the unit.

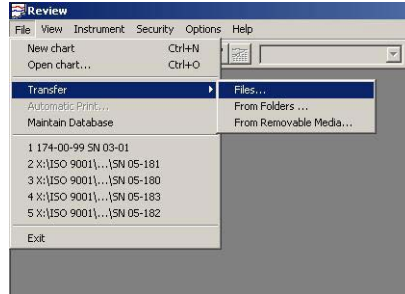
1. At the top of the screen, press “Save/Restore” and choose “Restore”.
2. Make sure all four options are selected, then touch the “File Name” field.
3. Press the up arrow to access the root directory.
4. Select “Removable” and press the down arrow to access the disk.
5. Choose the file titled “Config” and press “Open”.
6. When the progress bar at the top of the screen stops, the restore process is complete.





To transfer the test data to a PC:

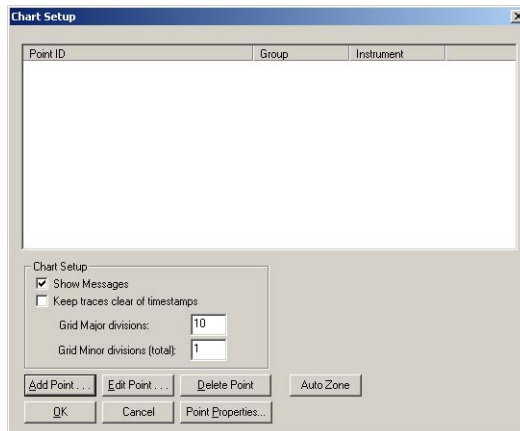
1. Remove the disk from the chart recorder and insert it into the appropriate drive on the PC.
2. From the Start Menu, select “Programs” then “Eurotherm” and then click “Review”. This will open the Eurotherm Review software application.
3. From the “File” menu, select “Transfer” and then click “Files”.



4. Click the “Browse” button, then choose the appropriate drive for your removable media. Open the “History” folder and select the files you wish to transfer.
5. Type a name in the “Name” field and click “OK”.

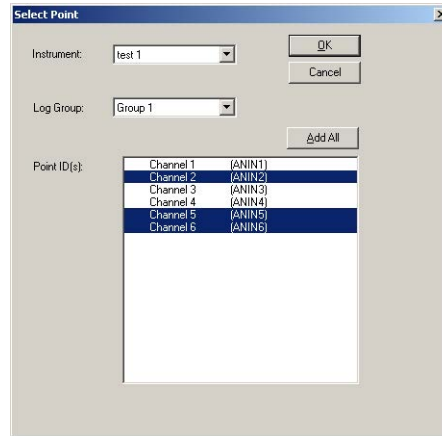
At this point you will receive a warning message. Click “OK” again.

6. When the file transfer is complete, go to the “File” menu and click “New Chart”.
7. Click “Add Point”.

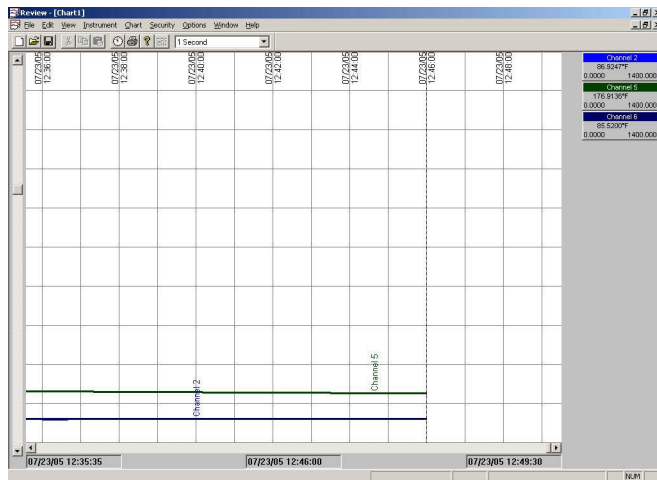


8. From the “Instrument” drop-down menu, choose the name you selected in step 5.
9. Choose “Group 1” from the “Log Group” menu.

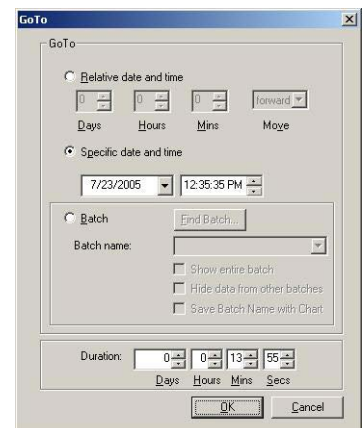
10. Now, select the Point IDs you wish to display on the chart. Hold down the “CTRL” button to select more than one. Click “OK”.



11. The software will now create the chart based on the data collected from the test.



12. To jump directly to a specific data point, click the “Go To” button at the top of the screen. Choose the data point you wish to view and click “OK”.



# Setup

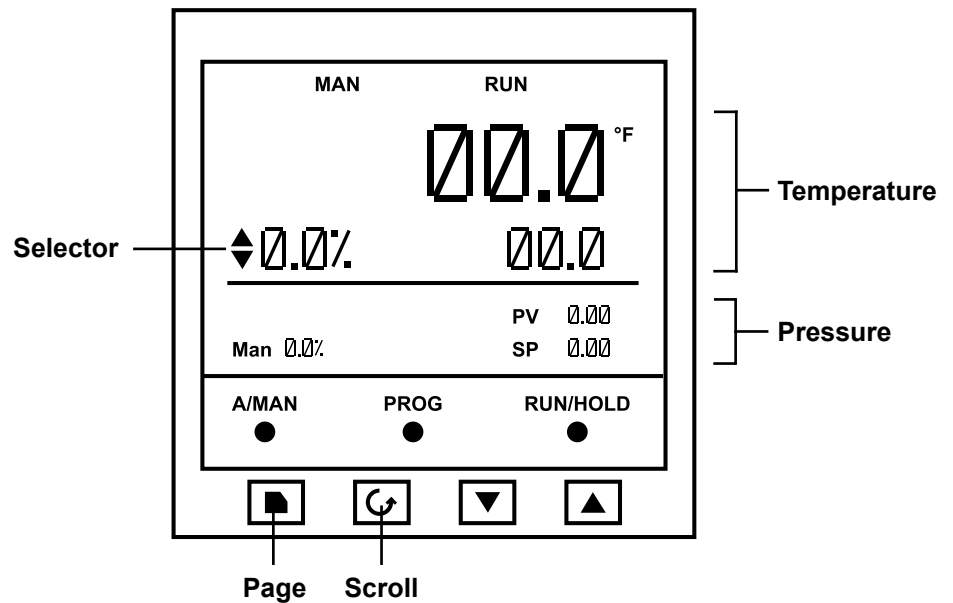
## Eurotherm

The Eurotherm Model 3504 controls the temperature and displays the pressure. When running a test with the computer, the software automatically programs the controller. However, when running a test without the computer, the controller must be programmed manually. It is strongly recommended that operators carefully study the Model 3504 instruction manual before attempting to program the controller.

When running a test without the computer, always build the program prior to mixing the slurry and loading the slurry cup.

The Eurotherm 3504 can store up to eight custom programs. Each program consists of multiple segments. In a segment, the temperature setpoint can be changed or held for a certain amount of time.

Each program also can consist of two channels; one for temperature and one for pressure. Since the Benchtop Consistometer does not offer automatic pressure control, only Channel 1 should be programmed.



To edit a program:

1. Press the "Page" button until the display reads "Program Edit".
2. Use the up and down arrows to select the program you want to edit.
3. Press the "Scroll" button to move to the Channel parameter.
4. Use the up and down arrows to select Channel 1.

Programming Channel 2 is not supported on the Benchtop Consistometer.

5. Set the parameters for the test:

Press the “Scroll” button to select a parameter to edit. Then use the up and down arrows to modify the value of that parameter.

- a. Set the following parameters for each test:
  - Ramp Units: Seconds, Minutes, Hours
  - Cycles: The number of times to repeat the test.
- b. You must choose a Segment Type for each segment in the test. The Segment Type will determine the parameters available for that segment:

**Rate:** Increase the setpoint by a certain rate (Ramp Rate)

- Target SP: The end temperature for the segment
- Ramp Rate: The rate of increase for the setpoint. For example, if Ramp Units is set to minutes, and Ramp Rate is set to 5, the temperature setpoint will increase by 5° per minute.

**Time:** Increase the setpoint over a certain time (Ramp Time)

- Target SP: The end temperature for the segment
- Duration: The amount of time it will take to increase the setpoint to the target.

**Dwell:** Hold the current setpoint.

- Duration: The amount of time to hold the current setpoint.

**Step:** Increase the setpoint immediately. No ramp is involved.

- Target SP: The end temperature for the segment.

**End:** The final segment in every test must be End.

- End Type: Dwell is recommended. This will hold the current setpoint until the test is stopped.

The display is split into two areas. The top area shows the temperature channel while the bottom shows the pressure channel. Before starting a manual test, the temperature channel must be in auto mode and the pressure channel must be in manual mode:

1. Press the “Scroll” button to move the selector around the screen. When the selector is above the dividing line, the temperature channel is selected. When it is below the dividing line, the pressure channel is selected.
2. Press the “A/MAN” button to toggle the selected channel between auto and manual mode.

In the temperature channel, the word “MAN” will appear at the top of the display to indicate manual mode. This word will disappear in auto mode.

# Setup

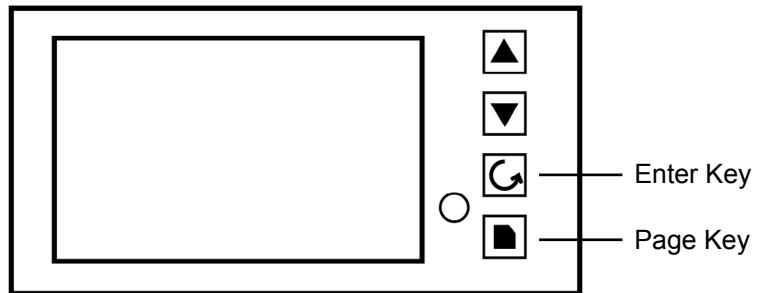
## Potentiometer Indicator

The Benchtop Consistometer includes a built-in Eurotherm 2408i 15V Potentiometer Indicator. As the slurry cup rotates within the unit, the potentiometer creates a small voltage charge, which is displayed on the indicator. This charge increases as the strength of the slurry increases.

The potentiometer indicator features a high-voltage alarm. When the charge reaches the specified level, an alarm condition is triggered and the heater, pump, and motor are automatically shut off.

To change the alarm setting, perform the following steps:

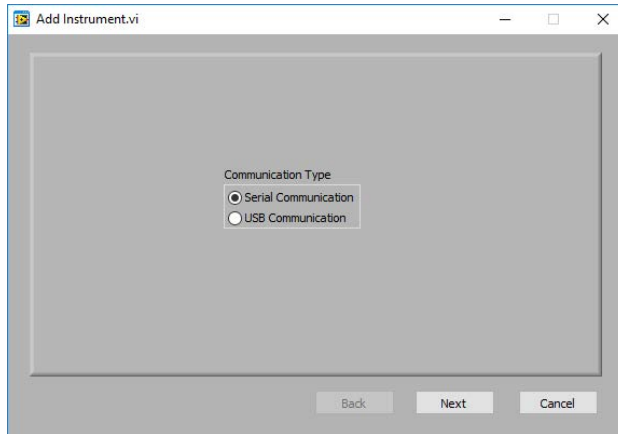
1. Push the “Page” key twice. The display will read “AL”.
2. Push the “Enter” key. The display will read “IFSH”.
3. Push the up arrow key once to read the current setting.
4. Push the up or down arrow keys to change the setting.
5. After choosing the appropriate setting, press the “Page” key three times to return to the original display.



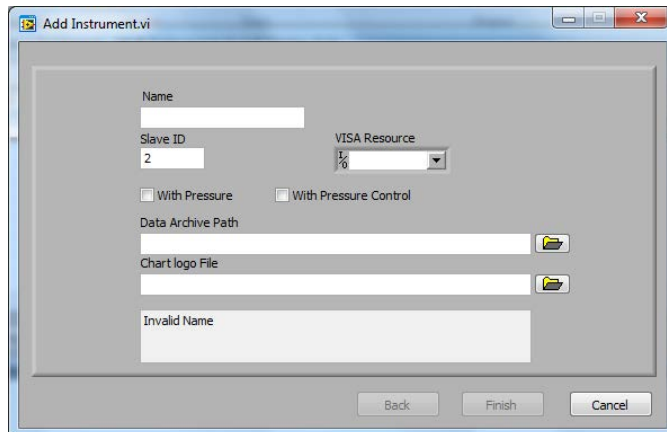
# Software

## Setup

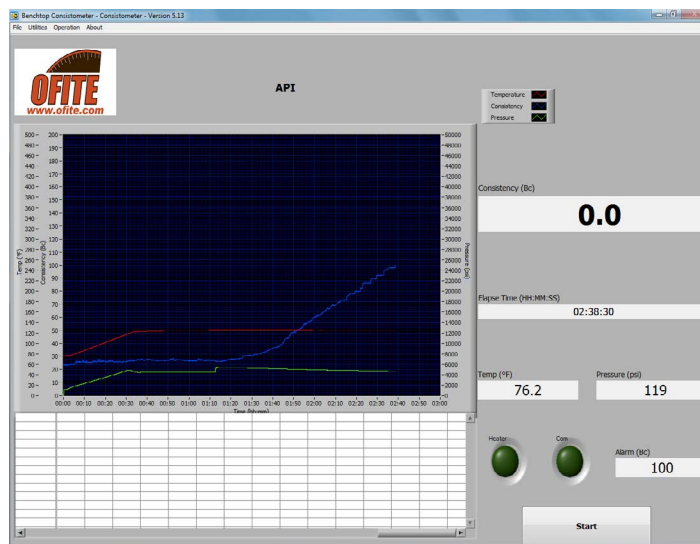
1. Double-click the “Multi Consistometer” icon on the PC desktop.
2. To add a new unit, click “Add New”.
3. Select “Consistometer” from the list.
4. Choose a Communication Type: Serial or USB. Newer units connect to the computer via a USB cable. Older units use an RS-232 (serial) cable.



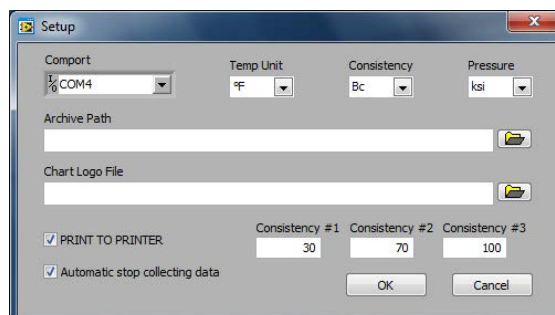
5. Enter a name. The name must be different from all other Consistometers connected to this PC.
6. Enter a slave ID. The slave ID must be different from all other Consistometers connected to this PC.
7. Choose the COM port the new Consistometer is connected to.
8. Chose a folder to save the test data. It is recommended that each Consistometer have its own data archive folder.
9. Choose a logo file (.jpg) to display on the printed chart.



10. Make sure “With Pressure” is selected and “With Pressure Control” is not. Pressure monitoring is available on the Benchtop Consistometer, but pressure control is not.
  11. Click “Finish” then “Save”.
  12. The main screen shows all units added to the PC. For each one it shows the type of equipment, name, slave ID, COM port, and data archive path. Units with “[R]” after their name are currently running a test.
- Right-click on a unit and select “Launch” from the menu.



13. Select “Setup” from the “Options” menu.
14. Select units for Temperature (°F or °C), Consistency (Voltage or Bc), and Pressure (PSI, KSI, or kPa).
15. Choose an “Archive Path”. This is the folder where all test data will be stored.
16. Choose a “Chart Logo File”. This is the logo that will print on the report at the end of a test. This file must be in .jpg format.



17. Select "Print to Printer" if you want a chart to automatically print when you stop a test. Select "Print to File" if you want a .jpg file to be create automatically when you stop a test.

Both of these options can be enabled at the same time. It is recommended that "Print to File" always be enabled.

18. Choose values for the "Consistency #1", "Consistency #2" and "Consistency #3" fields.

These values tell the software to record the test time when the consistency reaches each point. A note will be made on the chart when the test is finished.

Make sure that if you select "Bc" for consistency units that you also use Bc for these two fields. Likewise, if you chose "V" for consistency units, you must use voltage for these two fields.

19. Select "Automatic stop collecting data" if you want the Consistometer to stop collecting data during an alarm condition.

During an alarm condition, the motor, heaters, and pump all stop. By default, when the alarm condition is resolved, everything restarts. However, if the "Automatic stop collecting data" box is checked data collection is also stopped, and only the motor and pump restart. The heaters remain off and no more data is collected.

20. When finished, click "OK".

21. Select "Set Alarm" from the "Utilities" menu.

22. Enter a value in Bc. If the sample reaches this consistency, the unit will enter alarm condition.





# Software

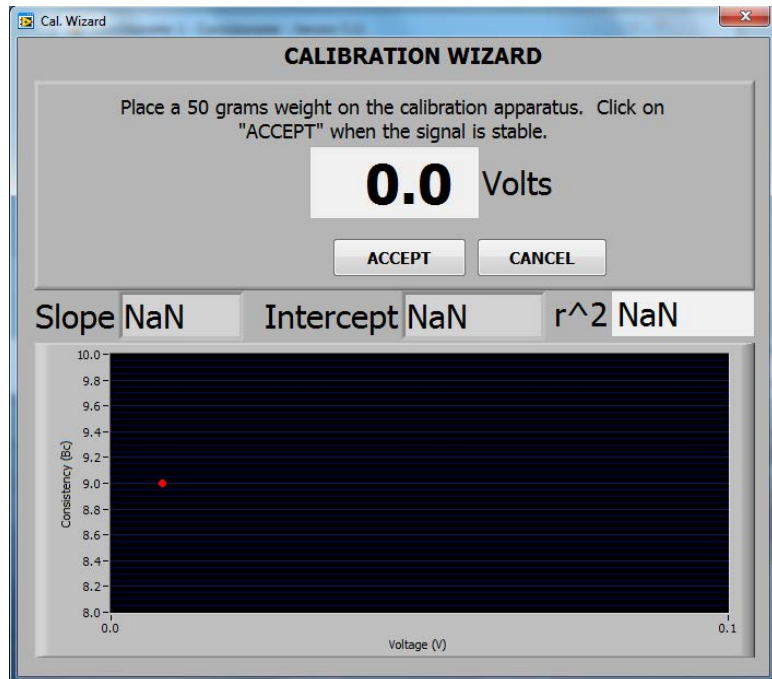
## Calibration

A calibration should be performed periodically to make sure the unit is still providing accurate information. Also, be sure to calibrate any time the potentiometer is changed. **Always calibrate with the same potentiometer that will be used during the test.**

1. Select "Calibration" from the "Operations" menu.
2. Prepare the potentiometer for calibration as described on page 29.
3. Place the weight hanger (with no weights) on the end of the string. The weight hanger is 50 g.
4. Wait for the value on the screen to stabilize and then click "Accept".
5. The software will prompt you to add weight to the hanger. After adding the weight, wait for the value to stabilize, then click "Accept".

The software will graph the calibration points as you enter them. At any time you can click the "Back" button to re-enter a calibration point.

6. Click "Save" to save the calibration data.



# Software

## Operation

1. Click “Start Test”.
2. Enter the necessary information. The following fields do not affect your test. The information will print on the report when the test is complete:
  - Customer Info
  - Additives
  - Cement Mfr.
  - Test Name
  - Cement Density
  - Cement Class
  - Density Units
  - Job Type

The following fields do affect your test:

- DAQ Time (mm:ss): determines how often test data is saved to file
  - Alarm: sets the consistency alarm. Be sure to use the same consistency units set in the “Setup” screen.
3. Select a “Test Profile”. Test profiles are built in the Test Builder. Refer to page 18 for instructions.
  4. Click “OK” to start the test.



If the computer is disconnected from the Consistometer or loses power, the test will not stop. Be sure to stop it manually. Refer to page 25 for instructions on stopping a test manually.

5. When the test is complete, click “Stop”.

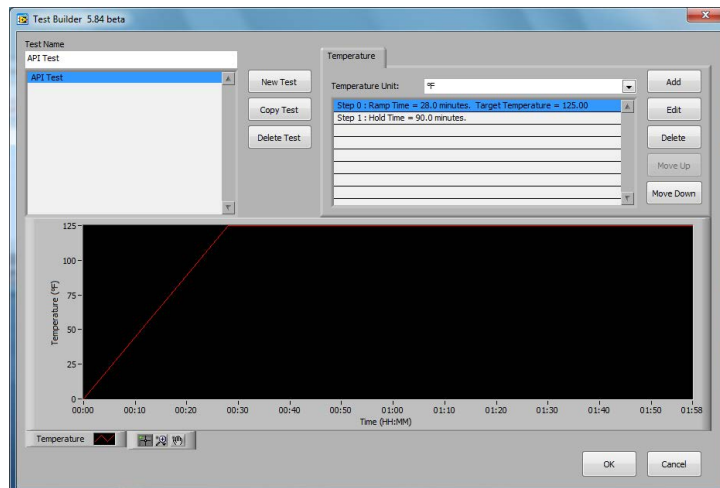
Customer Info	OFITE
Additives	
Cement Mfr.	
Test Name	Final Cement Test Cell 1
Cement Density	0.0
Cement Class	H
DAQ Time (mm:ss)	01:00
Density Units	lbs/gal
Job Type	SURFACE
Alarm	100.0
Test Profile	API Schedule 5

# Software

## Test Builder

The Consistometer Software can control the temperature during a test. Tests are programmed in the Test Builder.

1. Select “Test Builder” from the “Utilities” menu.
2. Click the “New Test” button to start a new test. Or click the “Copy Test” button to start with an existing test.
3. On the Temperature tab click the “Add” button to add a step.
4. Choose a Step Type:
  - Ramp: The software will increase the setpoint up to the target over a specified time period. You will be asked for a time period (minutes) and a target temperature.
  - Step: The software will increase the setpoint to the target immediately. You will be asked for a target temperature.
  - Hold: Maintain the current setpoint for the specified period of time. You will be asked for a time period (minutes).
5. Once you add a step, you can then go back and edit, delete, or move it up or down in the step list.
6. Click “OK” to save the test. The new test will now be available in the “Start Test” dialog box.



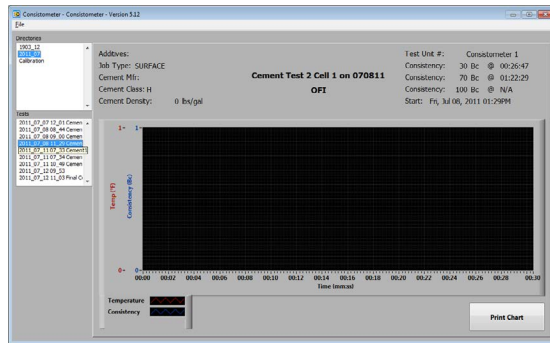
# Software

## Test Data

At the end of each test, all test data is saved in the “Data Archive Folder” that was selected in the “Setup” screen. There you can find an image showing the chart for each test as well as a data file that can be opened in MS Excel.

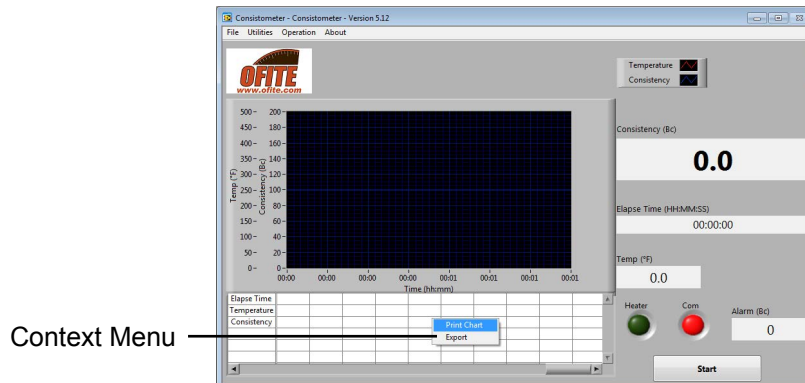
Archived tests and calibrations can also be viewed in the software:

1. Select “Open Data Archive” or “Open Calibration Archive” from the “File” menu.
2. On the left-hand side of the screen, choose a test or calibration to view. The graph will be displayed in the chart area.
3. To print the chart, click the “Print Chart” button.



You can also print a chart or export test data during a test. Simply right-click on the table at the bottom of the main screen. From the context menu, select either “Print Chart” or “Export”.

- a. “Print Chart” - This will print the current chart. If you have selected “Print to Printer” in the options screen, the chart will print to the default printer. If you have selected “Print to File”, a .jpg file will be created. See page 13 for more information about setting options.
- b. “Export” - This will export the current test data to a file in the archive folder. Refer to item 1 above for information about where to find this file.



# Operation

## Filling the Slurry Cup

1. With the slurry cup disassembled, examine the threads on the inside of the cylinder. The end with the larger set of threads is the top.
2. Coat the surface of the paddle and the inside of the slurry cup with a high-temperature grease to facilitate cement removal.
3. Insert the paddle assembly all the way into the top of the cylinder.



Cylinder



Paddle

4. Slide the slurry cup lock ring on top of the paddle assembly with the two notches facing upward. Tighten the locking ring completely using the provided slurry cup tool.



Bottom Cell Cap



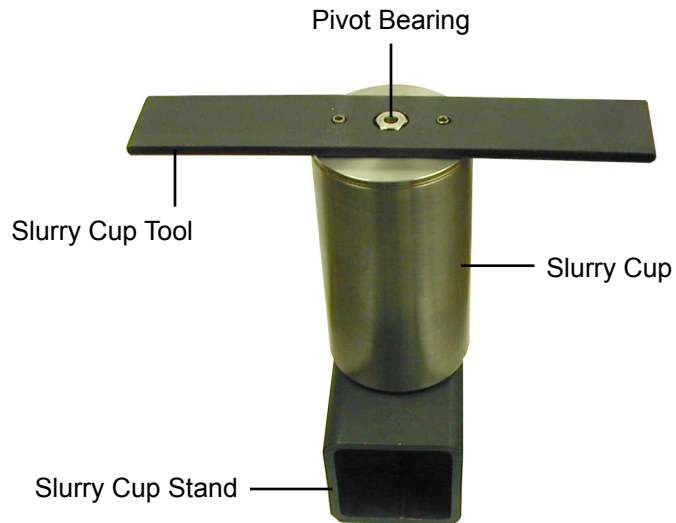
Locking Ring

5. Prepare the cement slurry as stated in API Specification 10.
6. Pour the cement into the slurry cup through the open bottom of the cylinder.
7. Place the gasket around the threads of the bottom cap. Apply high-temperature grease to the gasket and cap surface. Screw the cap onto the cup and tighten with the slurry cup tool.



The slurry cup should contain enough cement slurry that it leaks out of the hole in the center of the cap. If it does not, remove the cap and refill the slurry cup. Do not add cement through the hole in the cap.

8. Screw the pivot bearing into the hole in the center of the cap and tighten.
9. Wipe the entire slurry cup clean to ensure that no cement remains on the outside.



# Operation

## Loading the Test Cell



Tip

Before attempting to load the test cell, ensure that the “Air To Cylinder” and “Pressure Release” valves are completely closed (turned clockwise). Also, make sure the “Motor”, “Pump”, and “Heat” switches are turned off.

1. Lower the slurry cup into the test cell ensuring that the slurry cup drive pins engage the drive holes at the bottom of the test cell.

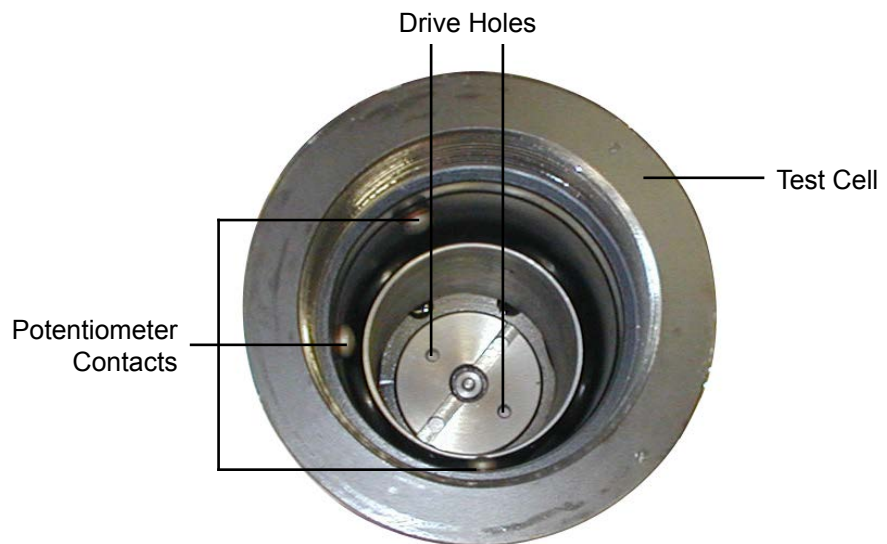
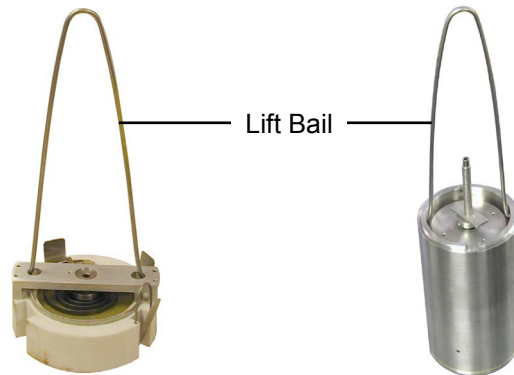
It may be necessary to start the motor briefly to confirm that the slurry cup is properly aligned inside the test cell.

2. Lower the potentiometer mechanism into the test cell ensuring that the contact springs of the potentiometer are in alignment with the test cell contacts.



Tip

The slurry cup and potentiometer both have two holes near the top for the lift bail (provided). Use the lift bail to easily lower the slurry cup and potentiometer into the test cell.



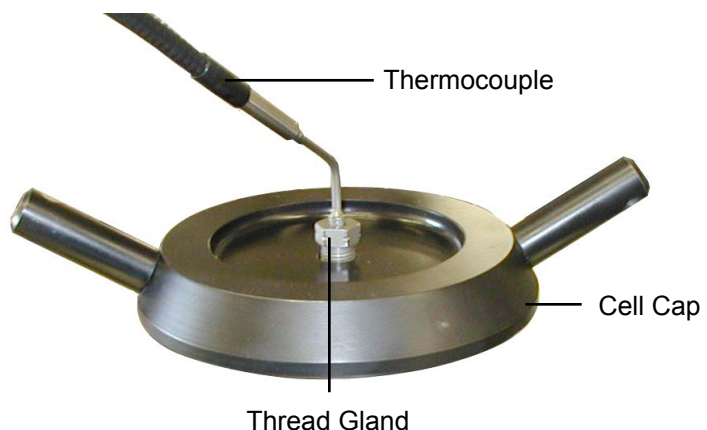


Note

3. To engage the drive bar of the slurry cup into the potentiometer, rotate the cup with the motor for a few seconds while applying slight pressure to the potentiometer. Note that if the unit is in an alarm condition the motor will not engage.
4. Place the metal seal ring, the o-ring, and the retaining ring onto the cell cap as shown below. Place the cell cap onto the cell and hand tighten.



5. Plug the thermocouple into the port on the unit cabinet. Insert the thermocouple into the hole in the top of the cell cap and tighten the thread gland finger tight. Then loosen it  $\frac{1}{8}$  of a turn.
6. With a  $\frac{5}{8}$ " wrench handy, turn the "Oil Reservoir Valve" to "Fill Cell". The test cell will begin to fill with mineral oil from the reservoir. Carefully watch the top of the test cell. When oil begins leaking out of the thermocouple hole, tighten the thread gland with the wrench. This will ensure that no air remains within the test cell.







Tip

7. Turn on the “Motor” and “15 VDC” switches.

**The “15 VDC” switch MUST be on in order to read the cell pressure on the Eurotherm or in the software. Leave the “15 VDC” switch on any time there is pressure on the test cell.**

8. Turn on the pump. Adjust the pressure to the desired level by turning the regulator clockwise.

If the pressure rises too high, open (counter clockwise) the “Pressure Release” valve very slowly. Close the valve immediately to prevent all of the pressure from leaking.

9. Turn the “Heat” switch on. If you are using the Benchtop Consistometer software, click the “Start Test” button (refer to page 17 for more information). If you are not using the software, push the “Run” button on the temperature controller.

10. Turn the “Timer” switch on and press the F1/RST button to start timing.

The timer displays elapsed time during a test. If an alarm condition occurs, the timer will stop. This is a troubleshooting measure that shows you the point during the test at which the alarm occurred. When the alarm condition is resolved, the timer will automatically resume counting from where it left off.

The “Timer” switch provides power to the timer. When the timer is first turned on, it will read 0. To start the timer, press the F1/RST button. To reset the timer to 0, turn the “Timer” switch off and then back on.

11. If the “Alarm” switch is not already on, turn it on now. If the “Alarm” switch is left off, the unit can still enter into an alarm condition, but there will be no visual or audio signal to notify the operator



Tip

# Operation

## Completing the Test



1. If you are using the Benchtop Consistometer software, click “Stop Test”. If not, press and hold the “RUN/HOLD” button on the temperature controller until the “Run” and “Hold” lights are both off.
2. Turn off the “Heat” and “Pump” switches and turn on the “Cool” switch. Make sure the water supply is turned on.
3. As the test cell cools, watch the pressure carefully. As long as the temperature is over 180°F (82.2°C), make sure the pressure is at least 1,000 PSI (6,900 kPa).
4. Once the test cell has cooled, turn off the “Cool” and “Motor” switches.
5. Open the Pressure Release valve (counter-clockwise) all the way.

**Always release the pressure very slowly to avoid pulling cement into the plumbing.**



Tip

6. Once the cell pressure reaches 0, turn the “15 VDC” switch off.
7. Slowly turn the “Oil Reservoir Valve” to “Vent”.
8. Open the “Air To Cylinder” valve (counter-clockwise). Air pressure will force the oil back into the reservoir. You will hear a hissing sound as air is released. When the hissing sound stops, close the valve (clockwise).
9. Carefully unscrew and remove the thermocouple.  
  
Keep a rag or paper towel handy in case extra oil leaks from the cell.
10. Unscrew and remove the cell cap. Remove the potentiometer and slurry cup.
11. Return the cell cap to the test cell to prevent dust and other material from entering the cell. Close all valves and turn off all switches.

# Maintenance

## Slurry Cup

After every test, immediately disassemble the slurry cup and clean it thoroughly with soap and water. Be sure to remove any residual cement before it hardens. Hardened cement on any of the parts can cause irreparable damage.

## Test Cell

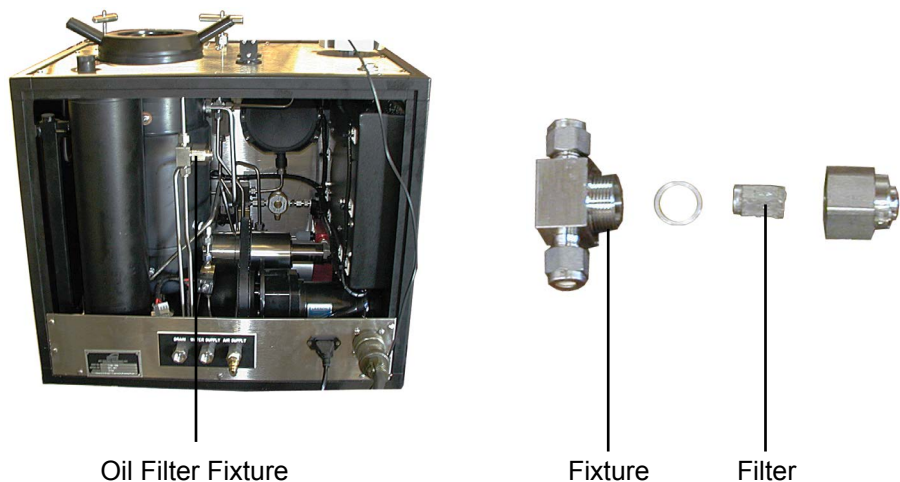
After every test, examine the inside of the test cell for any cement or other debris. If necessary, wipe the inside of the cell with a rag or paper towel.

## Oil Filter

If oil is not flowing from the oil reservoir to the pump, it may be necessary to replace the oil filter.

1. Open the back panel of the main unit cabinet and locate the oil filter fixture.
2. Open the fixture, remove the filter, and replace it with a new one.

To reduce the risk of damaging the piping around the fixture, you can completely remove the entire fixture from the unit. Once you have replaced the filter, be sure to re-install the fixture with the oil flow directed downward. An arrow printed on the side of the fixture shows the direction of the oil flow.

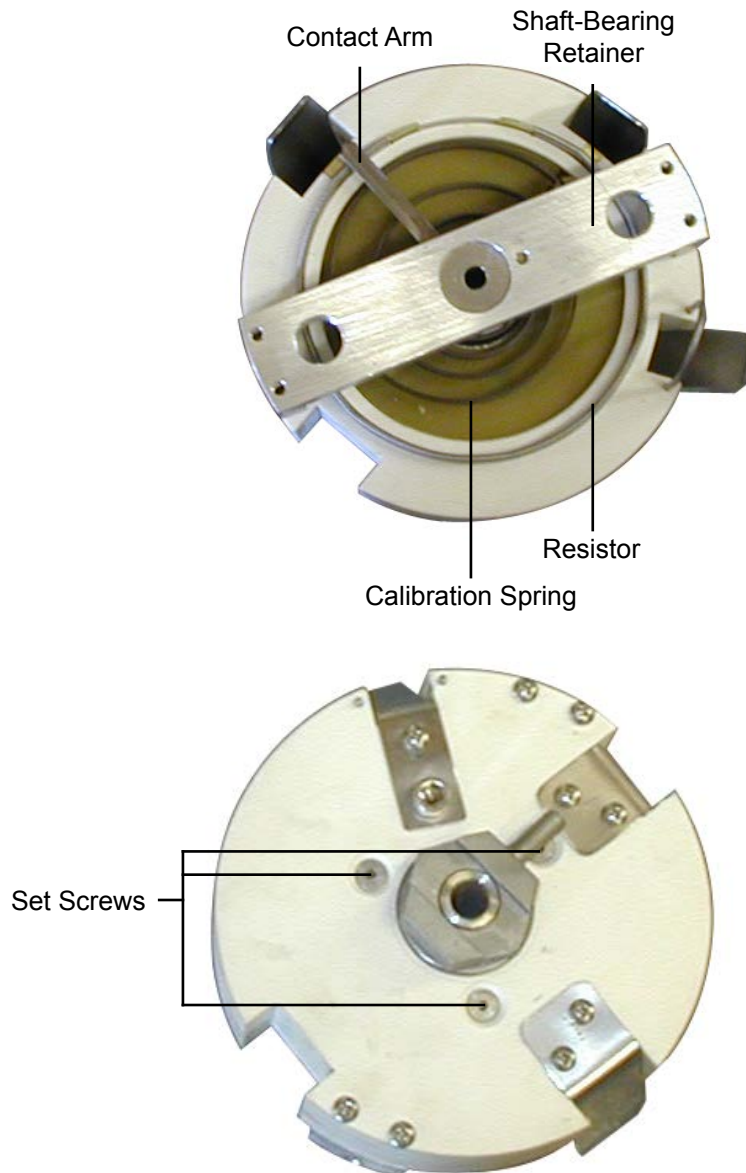


# Maintenance

## Potentiometer

1. The potentiometer should be kept as clean as possible. Periodically submerge the unit in solvent to remove cement and other materials.
2. Troubleshooting potential problems:
  - a. If consistency (voltage) readings fluctuate, examine the resistor and verify that the top is smooth and consistent. If necessary, re-insert the resistor and lightly smooth the resistor wire with emery cloth.
  - b. If the consistency (voltage) reading is zero, the resistor and contact arm may have lost contact. Adjust the contact arm either up or down. If this does not correct the problem, the resistor may have insufficient space between the windings to prohibit conductance. If this is the case, replace the resistor.
  - c. If the potentiometer will not hold a calibration, the spring is probably either damaged or worn by corrosion. Replace the spring.
3. To install a new resistor:
  - a. Remove the four small screws holding the shaft-bearing retainer to the potentiometer assembly.
  - b. Remove the contact arm.
  - c. Carefully lift the damaged resistor away from the potentiometer. Clear the resistor groove of any foreign material.
  - d. Carefully place the new resistor into the groove and ensure that it is centered between the two terminating contacts.
  - e. Push the resistor completely into the groove with either a mallet or a piece of wood. It is very important to ensure that the resistor is completely inserted into the groove and that the upper surface is level.
  - f. Install a new contact arm and if necessary, bend the arm either up or down to obtain consistent contact with the resistor.
  - g. Re-install the shaft-bearing retainer and calibrate the potentiometer before use.
4. To install a new calibration spring:
  - a. Remove the contact arm and the shaft-bearing retainer.
  - b. Carefully lift the calibration spring from the potentiometer assembly.
  - c. Install the new spring. When properly installed, it should tighten when the center shaft is rotated counter-clockwise.

- d. Install a new contact arm and make adjustments as necessary to obtain consistent contact with the resistor.
- e. Loosen the three adjustment screws on the underside of the potentiometer assembly and rotate the spring adjuster until the spring rests at a relaxed state.
- f. Ensure that the contact arm aligns with the contact strip and tighten the three set screws.
- g. Rotate the center shaft to ensure that the spring does not bind or rub the potentiometer housing.
- h. Replace the shaft-bearing retainer and calibrate the potentiometer.



# Appendix

## Potentiometer Calibration

The potentiometer should be calibrated once a month to ensure accurate readings. If you are using the Consistometer software, use the built-in calibration procedure. Otherwise, follow these steps:

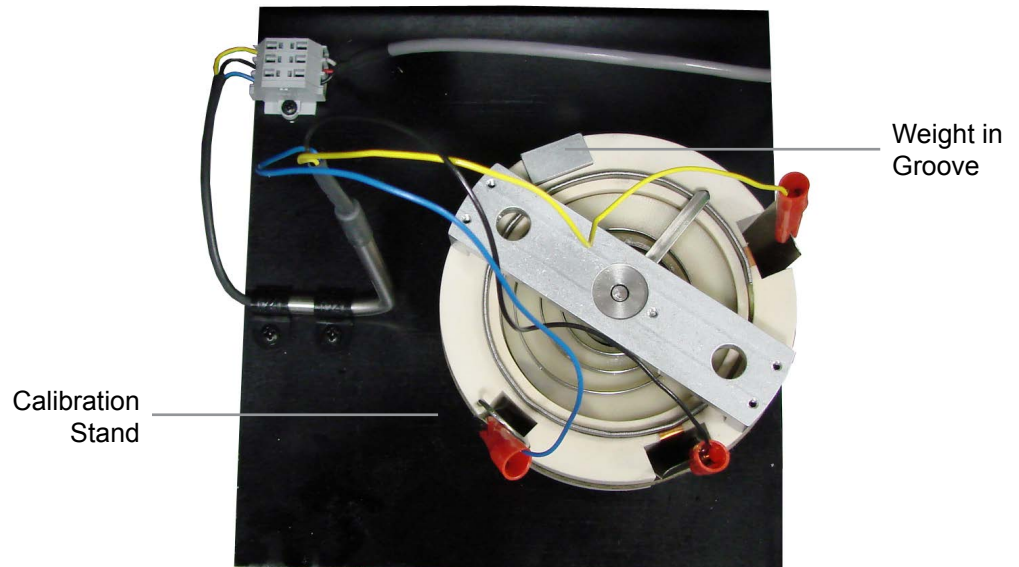
1. Place the potentiometer on the calibration stand. Place the stand on the edge of the Consistometer and plug it into the port on the side of the unit.
2. Connect the wire clamps to the contacts. From the groove going clockwise around the unit, connect yellow, then black, then blue.
3. Slide the weight into the groove and wrap the cord clockwise around the unit one full turn.
4. Let the cord hang over the wheel and off the table.
5. Attach the hook to the cord.
6. Apply the weights to the hook according to the chart below. Steady the cord to minimize the amount of swinging.



**Note**

When adding weights, remember that the hook weighs 50 grams. Therefore, to test the potentiometer at 200g, you only need to add 150g to the hook.

7. Firmly tap the surface of the calibration stand with a pen or the blunt end of a screwdriver to settle the weights and stabilize the potentiometer.





**Note**

8. Lift the weight about two inches directly upward and release it. Allow it to fall straight down. Observe the reading on the Potentiometer Indicator.
9. Record the reading and repeat steps 6 through 8 with each weight listed in the chart below.

The voltage values in this chart are only examples. Every potentiometer is different and will, therefore produce different voltages. The calibration process will help you interpret the potentiometer readings provided by the Consistometer.

<b>Mass (grams)</b>	<b>Approximate Voltage</b>
100	2.5
200	5.5
300	8.2
400	10.75

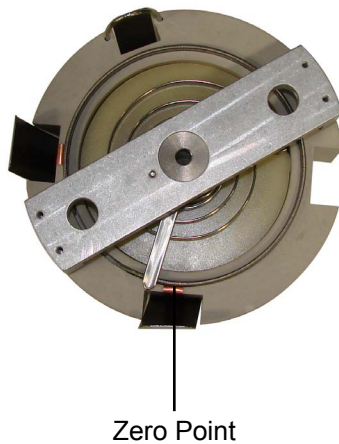
# Appendix

## Potentiometer Adjustment

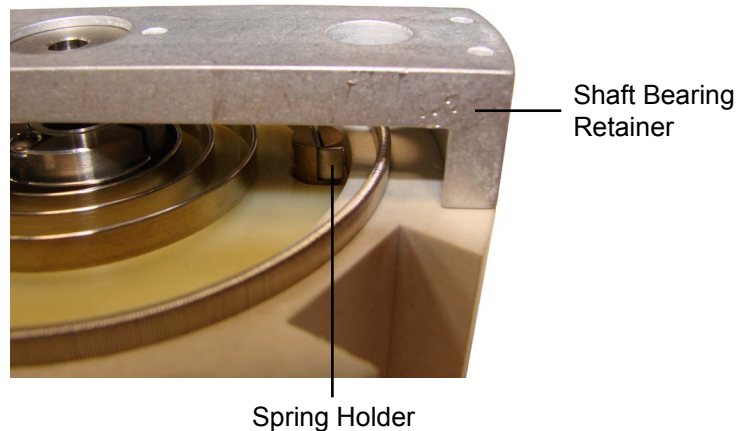
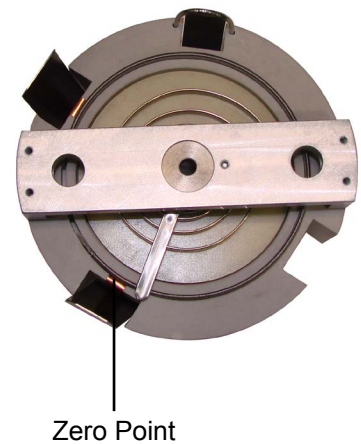
The calibration spring has a zero point. If the contact arm is behind the zero point, the potentiometer will register a negative reading. If the contact arm drifts behind the zero point, it will be necessary to adjust the position of the spring.

1. Remove the potentiometer from the consistometer.
2. Loosen the three set screws on the bottom of the potentiometer.
3. Locate the spring holder on the top of the potentiometer. It may be positioned beneath the shaft bearing retainer. Push the spring holder to rotate the spring within the body of the potentiometer.
4. When the contact arm is again in front of the zero point, tighten the set screws to secure it in place.
5. The contact arm may drift while tightening the set screws. Recheck the position of the contact arm before using the potentiometer.

**Negative Reading**



**Positive Reading**

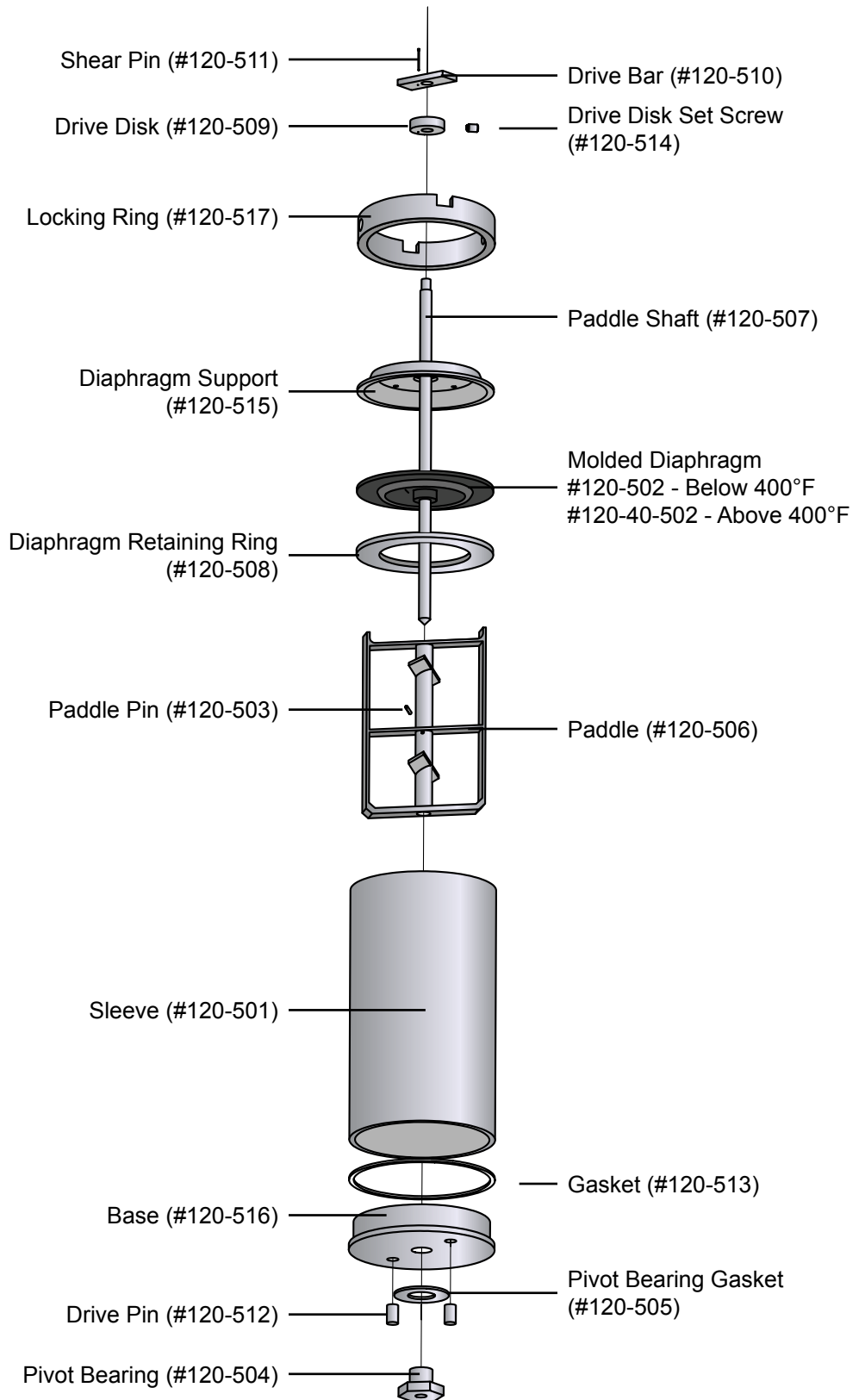




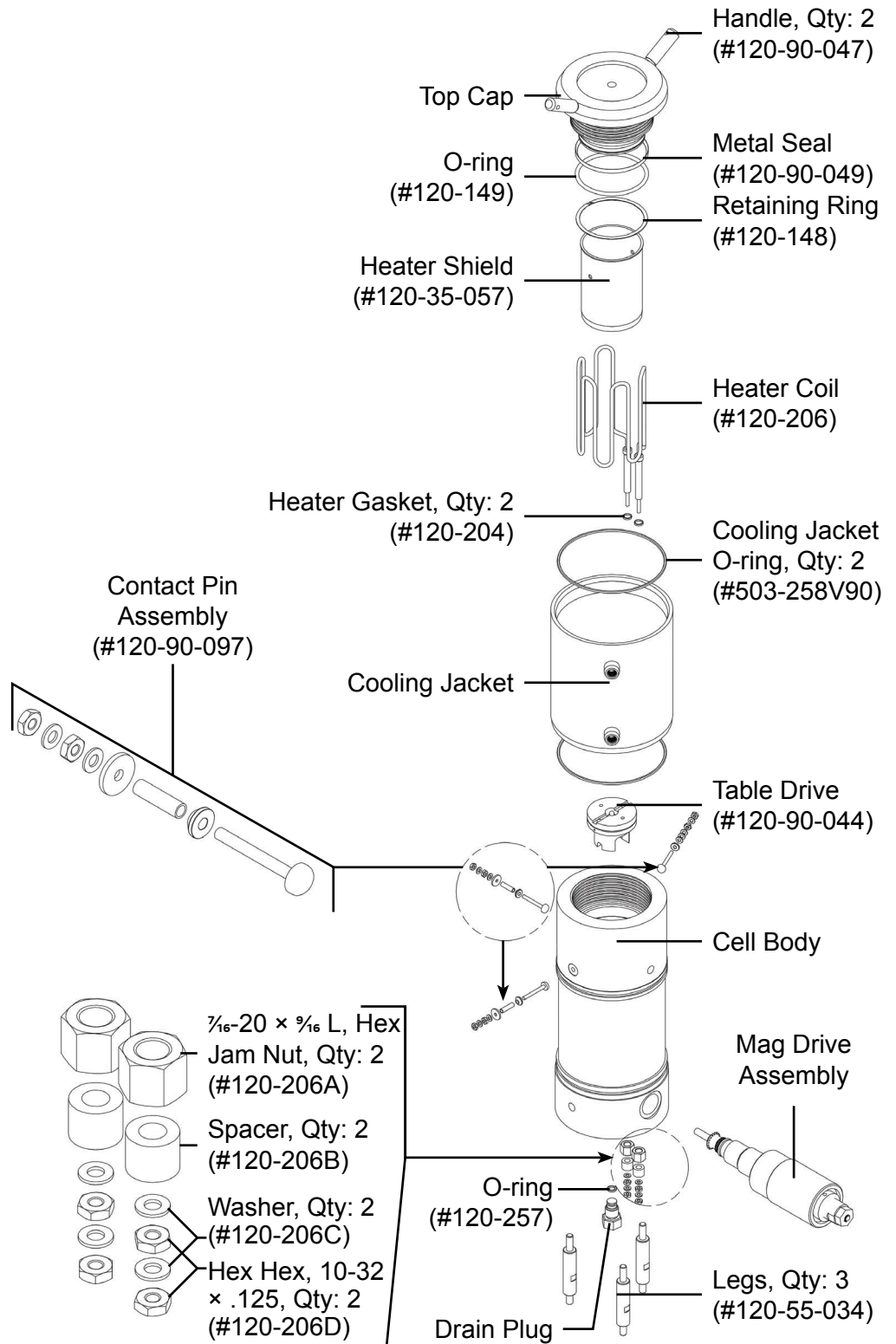
# Appendix

## Diagrams

### #120-519 Slurry Cup Assembly



## #120-90-00 Cell Assembly



# 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 PURP

OSE, 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, email 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](mailto:techservice@ofite.com).