OFITE®

Dependable Products From People You Trust

Model 130 Benchtop Consistometer

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

Instruction Manual

Updated 7/31/2024
Ver. 8

OFI Testing Equipment, Inc.
11302 Steeplecrest Dr. · Houston, Texas · 77065 · U.S.A.
Tele: 832.320.7300 · Fax: 713.880.9886 · www.ofite.com

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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 touch-screen display controls 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. The touch-screen display graphs cement consistency and temperature as a function of time.

Features

- Maximum Pressure: 16,000 PSI (110.3 MPa)
- Maximum Temperature: 400°F (204.4°C)
- Touch screen display controls temperature and displays and graphs temperature, pressure, and consistency
- Can operate with a computer or in standalone mode
- Conditions well cement under temperature and pressure for further API testing
- Pressure generated via an air-driven hydraulic pump
- Drive table is rotated with a magnetic drive
- External cooling jacket aids cooling of the 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
- Pressure displayed in PSI/MPa; Temperature displayed in °F/°C
- Compact size and light weight make the unit suitable for the benchtop

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

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

Components

#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
#120-90-033 Air Filter
#120-90-035 Filter
#130-79-15 Serial Cable
#130-79-14-1 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	7¾" 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

Note

1. Carefully remove the instrument from the wooden crate and place it on a stable surface.

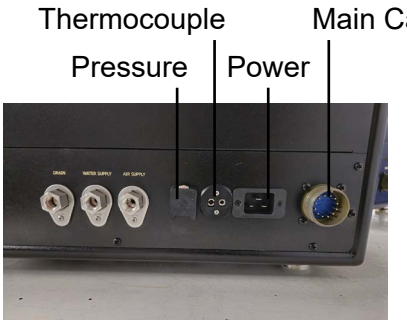
2. Connect an air or nitrogen supply (100 - 150 PSI / 690 - 1,035 kPa) to the Air Supply port on the back of the instrument.

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

3. Connect the Drain and Water 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 Main Cable, Pressure Cable, and Thermocouple Cable into the appropriate ports on the unit cabinet and connect the other ends to the ports on the back of the Control Box.



Main Cabinet

Control Box

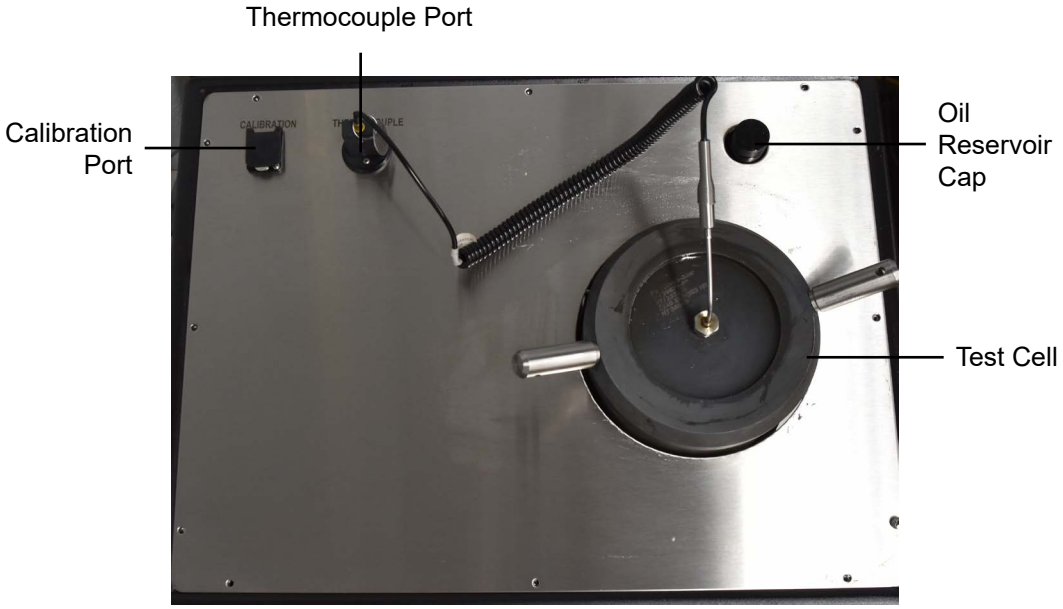
Main Cable

Pressure Cable

Thermocouple Cable

6. If you are using a computer, connect the Control Box to the computer with the supplied USB cable (#130-79-16).

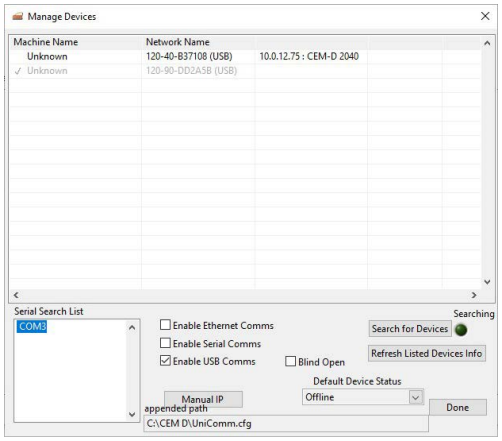
7. To fill the oil reservoir, remove the oil reservoir cap and pour mineral oil into the reservoir until it is full. Replace the cap. Make sure the seal is air tight. Use the sight glass on the side of the reservoir to check the oil level. The oil level should be about ½" from the top of the sight glass.



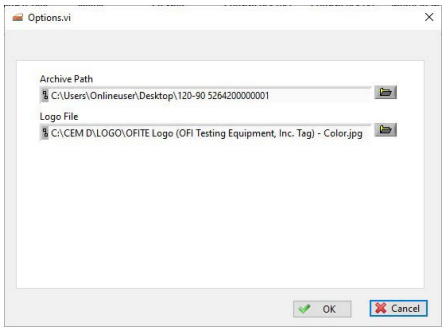
Software

Setup

1. Double-click the “CEM-D” icon on the PC desktop.
2. Right-click on the correct device and select “Default Device”.
3. Click “Done”.



4. The main screen shows the Elapsed Time, Temperature, Pressure, Consistency (in both Bc and V) and Motor RPM for the current test. It also has tabs for Info, Profile, Events & Cal Values, Chart, and Log Data.
5. Select “Options” from the “Edit” menu.
6. Choose an “Archive Path”. This is the folder where all test data will be stored.
7. Choose a “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.



8. When finished, click “OK”.

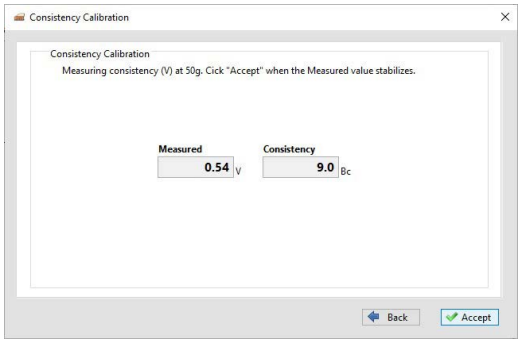
Software

Calibration - Consistency

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 Utilities → Calibrate → Consistency.
2. Prepare the potentiometer for calibration as described on page 35.
3. Set the “15 VDC” switch to AUTO.
4. Place the weight hanger (with no weights) on the end of the string. The weight hanger is 50 g.
5. Wait for the value on the screen to stabilize and then click “Accept”.
6. The software will prompt you to add weight to the hanger. After adding the weight, wait for the value to stabilize, then click “Accept”.

   At any time you can click the “Back” button to re-enter a calibration point.
7. At the end of the sequence, the software will show you the Slope, r^2 Value, and the y-intercept.
8. Click “Save” to save the calibration data.

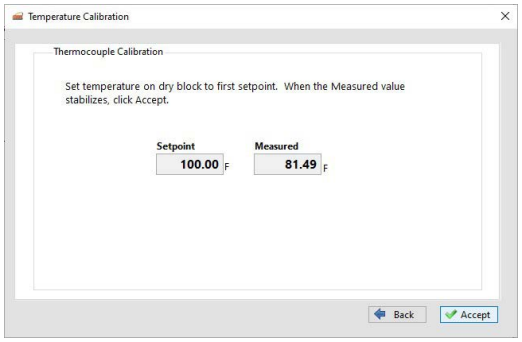


Software

Calibration - Thermocouple

The temperature should not need to be calibrated unless the thermocouple is replaced or the software on the PC is reinstalled.

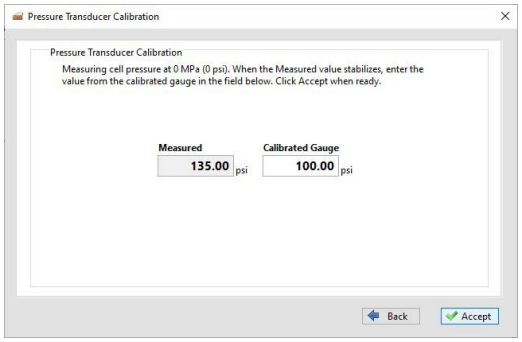
1. Select Utilities → Calibrate → Thermocouple.
2. Insert the thermocouple into a dry block calibrator and set the “PUMP” switch to OFF.
3. Click “Accept”.
4. Follow the onscreen instructions. Set the dry block to the first setpoint. When the Measured value stabilizes, click “Accept”.
5. Repeat step 4 for all setpoints in the sequence.
6. At the end of the sequence, the software will show you the Slope, r^2 Value, and the y-intercept.
7. Click “Save” to save the calibration data.



Software

Calibration - Pressure Transducer

1. Connect a calibrated gauge to the thermocouple port in the cell cap.
2. Close the Pressure Release valve.
3. Follow the onscreen instructions. When the Measured value stabilizes, enter the value from the calibrated gauge into the field and click “Accept”.
4. Repeat step 3 for each setpoint in the sequence.
5. At the end of the sequence, the software will show you the Slope, r^2 Value, and the y-intercept.
6. Click “Save” to save the calibration data.



Software

Operation

1. If you have not already built a test, refer to page 13 for instructions.

2. Select “Test” from the “Edit” menu.

3. On the Information tab, enter the necessary information. The following fields do not affect your test. This information will print on the report when the test is complete:

   - Test Name
   - Test ID
   - Rig Name
   - Customer
   - Well Name
   - Lab Technician
   - Pad Name
   - Cement Manufacturer
   - Cement Class
   - Cement Density
   - Job Type
   - Bottom Hole Circulating Temperature (BHCT)
   - Bottom Hole Staic Temperature (BHST)
   - Blend
   - Additives
   - Comments

4. On the “Configuration” tab, set the following options:

   - Stop at End: When this option is “No”, the test will run until you click the “Stop Test” button. The final temperature setpoint and motor setting will be maintained indefinitely. If this option is “Yes”, the test will end when all steps in the Test Profile are complete.
   - DAQ Rate: Determines how often test data is saved to file
   - Temp Unit: choose F or C
   - Press Unit: choose psi or MPa

5. On the “Profile” tab, choose a test profile from the list. To create a new profile, click the “Open Builder” button. See page 13 for more information.

6. Click “Save” to save the test settings.

7. To start a test, click the “Start Test” button in the bottom left-hand corner of the screen.

Software

Test Builder

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

1. Select “Test” from the “Edit” menu. On the “Profile” tab, click “Open Builder”.

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.

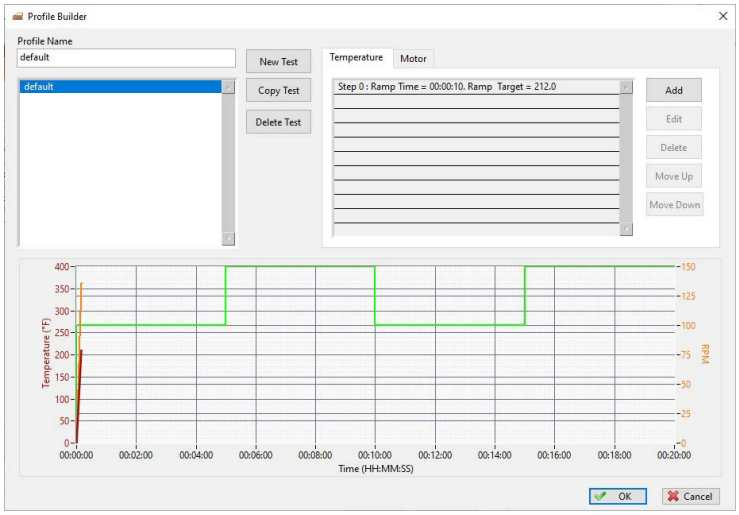
   - Hold: Maintain the current setpoint for the specified period of time. You will be asked for a time period (minutes).

5. On the Motor tab, click the “Add” button to add a step.

   - You can choose either “Motor On” or “Motor Off”. You will be asked for a time period (hh:mm:ss).

6. Once you add a step, you can then go back and edit, delete, or move it up or down in the step list.

7. Click “OK” to save the test. The new test will now be available on the “Edit Test” screen.



Software

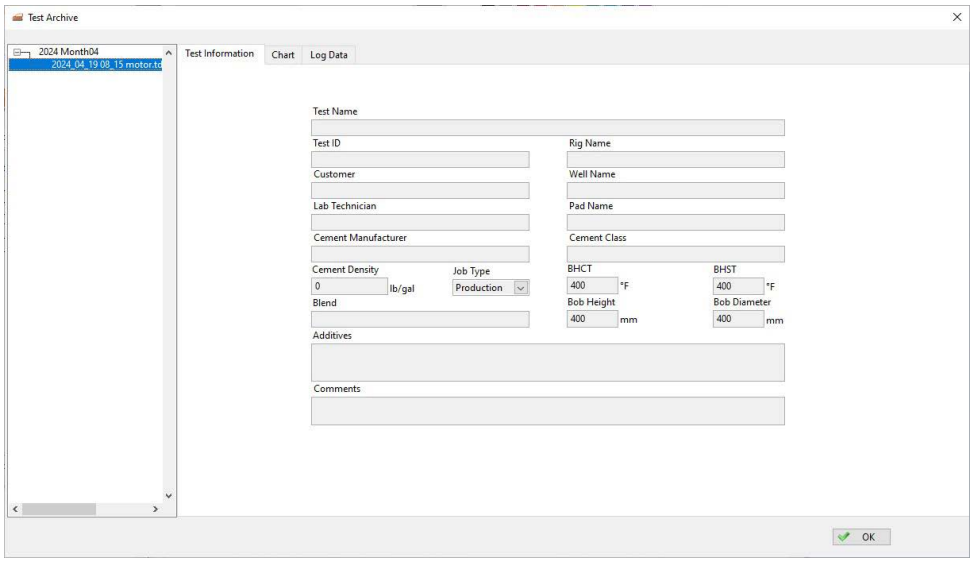
Test Data

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 “Test Archive” or “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 to File” 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.

   b. “Export” - This will export the current test data to a file in the archive folder.

Software

Events

Events are triggered based on conditions in the test. When an Event is triggered, it can send an alert, end the test, or both.

To manage Events, choose Test from the Edit menu. Then go to the Configuration tab and then the Events tab.

1. Choose a Signal: Time, Temperature, Pressure, BC.

2. Enter the Value you want to test for. For example, if your Signal is Temperature, then a Value of 100 represents 100°.

3. Enter the time (in seconds) you want the Signal to be at the specified Value before triggering the event.

4. Choose a Condition.

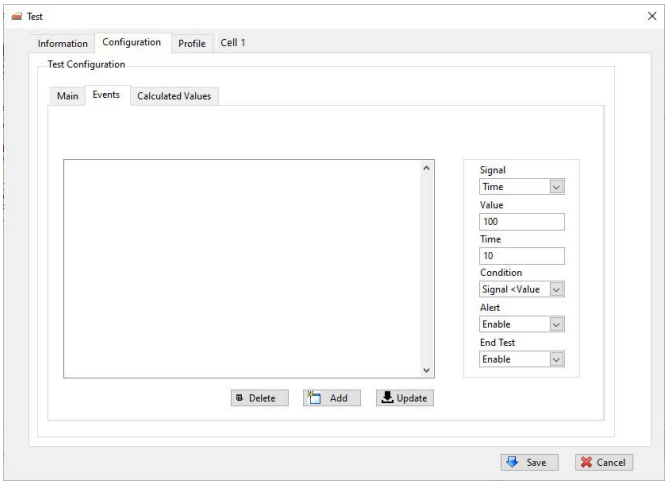
5. If you want to be alerted when the conditions are met, select Enable under Alert.

6. If you want the test to end when the conditions are met, select Enable under End Test.

7. Click the Add button to add the Event.

8. To modify an Alert, select it in the list, make your changes, and then click the Update button.

9. Click Save.



Software

Calculated Values

Calculated Values are triggered by conditions in the test. They are printed on the chart at the end of the test.

To manage Calculated Values, choose Test from the Edit menu. Then go to the Configuration tab and then the Calculated Values tab.

1. Choose a Signal: Time, Temperature, Pressure, BC.

2. Choose a Calculation:

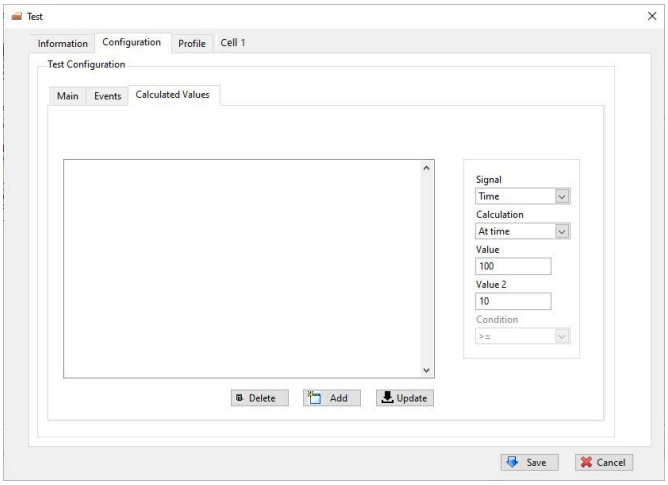
   - **At Time:** Calculate the value of the Signal at a specific test time
   - **Time When:** Calculate the time when the Signal reaches a specified value
   - **Signal Min:** Calculate the minimum Signal value for the test
   - **Signal Max:** Calculate the maximum Signal value for the test
   - **Transition Time:** Calculate the time it takes the Signal to change from one value to another

3. Fill in the remaining fields. These fields will change depending on which Calculation you choose.

4. Click the Add button to add the Calculated Value.

5. To modify a Calculated Value, select it in the list, make your changes, and then click the Update button.

6. Click Save.



Onboard Display

The Benchtop Consistometer features an onboard display. It provides access to basic test configuration and control and makes it possible to run the instrument without an external computer. The display can be operated either as a touch screen or with the control wheel.

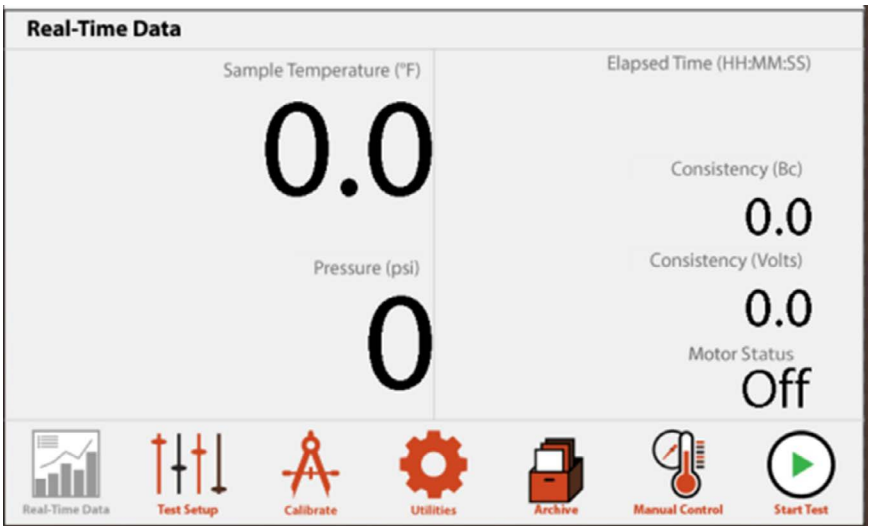
To operate the display with the Control Wheel:

1. Turn the Control Wheel to scroll through the available parameters.
2. Press the Control Wheel to select a parameter.
3. Turn the Control Wheel to scroll through available values for the parameter.
4. Press the Control Wheel to select a value.

Onboard Display

Real-Time Data

The Real-Time Data screen is the default screen. When the display has been idle for more than 2 minutes, it will automatically revert to this screen. Here you can see the current test parameters. This screen does not accept any inputs.



Real-Time Data

Onboard Display

Test Setup - Profile

On the Profile tab of the Test Setup screen, you can create a Test Profile for your test.

1. Choose a Parameter (Temperature or Motor).

2. Choose a Step Type:

   Temperature

   Ramp: This will increase the temperature up to the target in a set number of minutes. Enter the ramp time and target.

   Step: This will increase the temperature up to the target as fast as possible. Enter the target temperature.

   Dwell: This will hold the current temperature for a set number of minutes. Enter the time.

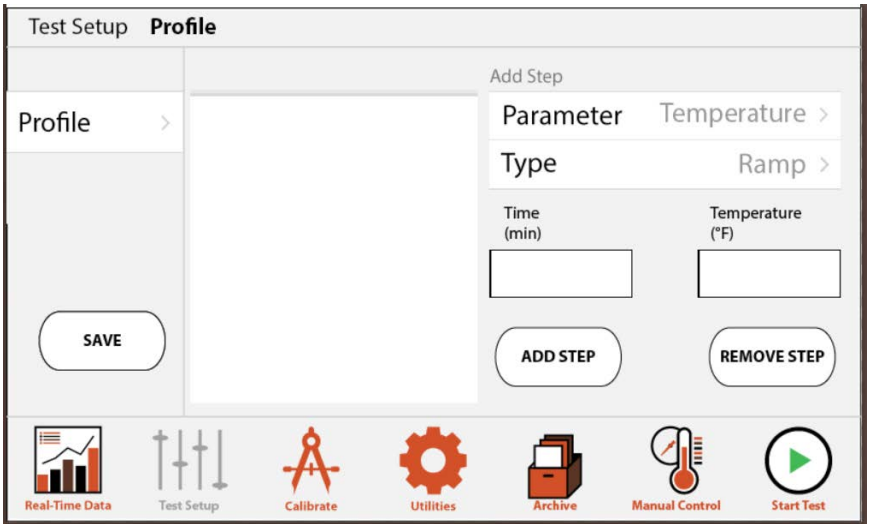
   Motor: On or Off

3. Enter the parameters for the step (ramp time, target temperature, motor on/off, etc).

4. Select the “ADD STEP” button.

5. To remove a step, select it in the list and select the “REMOVE STEP” button.

6. When you are finished adding steps, select the “SAVE” button.



Onboard Display

Calibrate

On the Calibrate screen, the onboard display can calibrate the pressure transducer, thermocouple, and potentiometer.

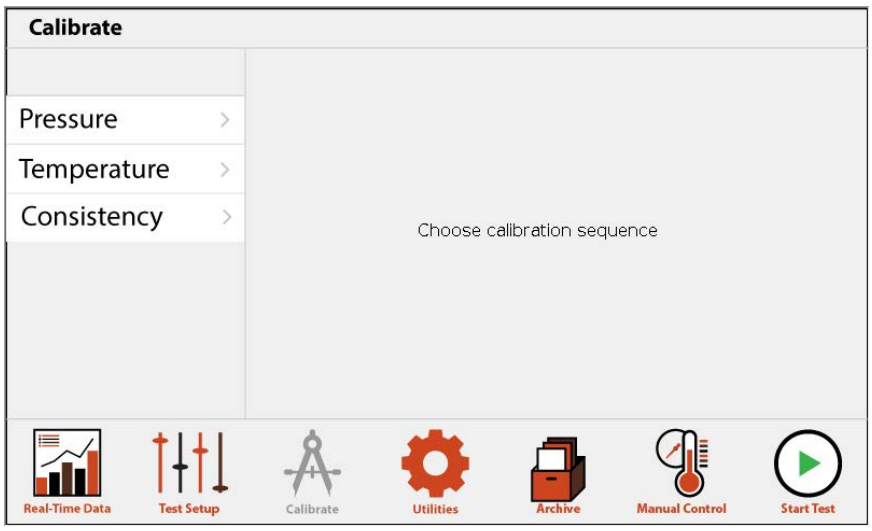
1. Select the system (Pressure, Temperature, Consistency) to calibrate.

2. Follow the onscreen instructions.

   Pressure: Attach a calibrated pressure gauge to the thermocouple port in the cell cap.

   Temperature: Plug the thermocouple into the Thermocouple Port on the top of the Main Unit. Place the thermocouple into a dry block calibrator.

   Consistency: See page 35.



Onboard Display

Utilities

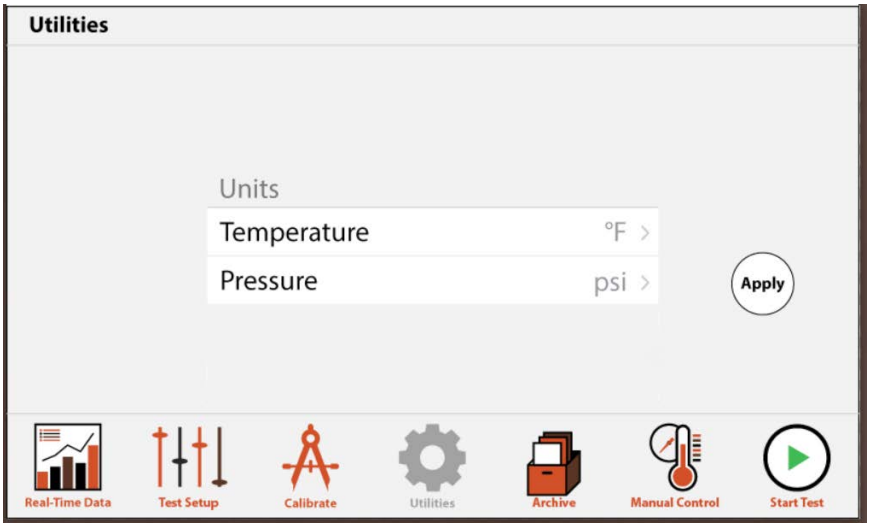
The Utilities screen sets general parameters.

1. Enter the values for each parameter:

   Temperature: Choose either °F (Fahrenheit) or °C (Celsius)

   Pressure: Choose units for cell pressure (psi or MPa).

2. Select “Apply” when done.



Onboard Display

Archive

On the Archive screen, saved calibrations and tests can be exported to a USB drive.

1. Place a USB drive in the Data Export port on the Control Box.

   The port has an indicator light to show the status of the inserted drive:

   a. Green: The drive is inserted and supported.

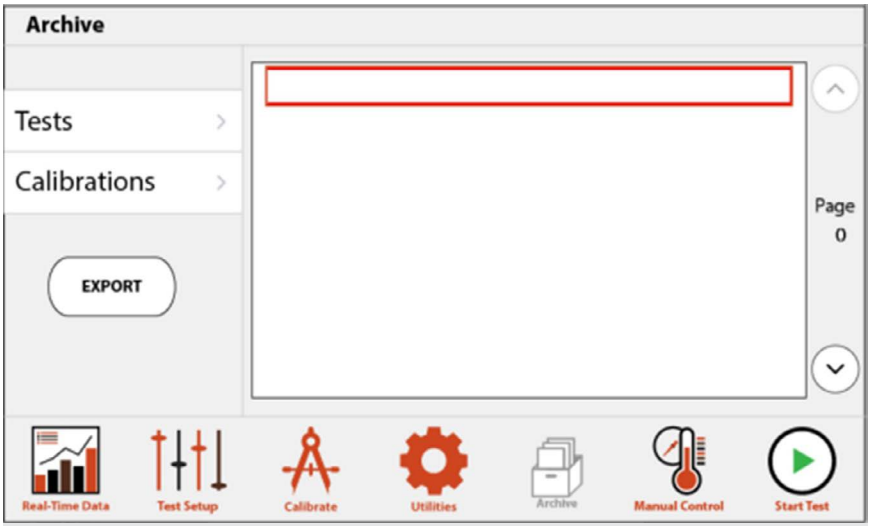
   b. Amber: The drive is inserted and supported, but low on free space.

   c. Red: The drive is inserted but not supported. Make sure the drive is formated in the FAT32 file system.

2. On the left-hand side of the screen, choose either Tests or Calibrations. The list of available tests or calibrations will populate on the right.

3. Choose the item to export.

4. Select “Export”. The file will be saved to the USB drive.



Onboard Display

Manual Control

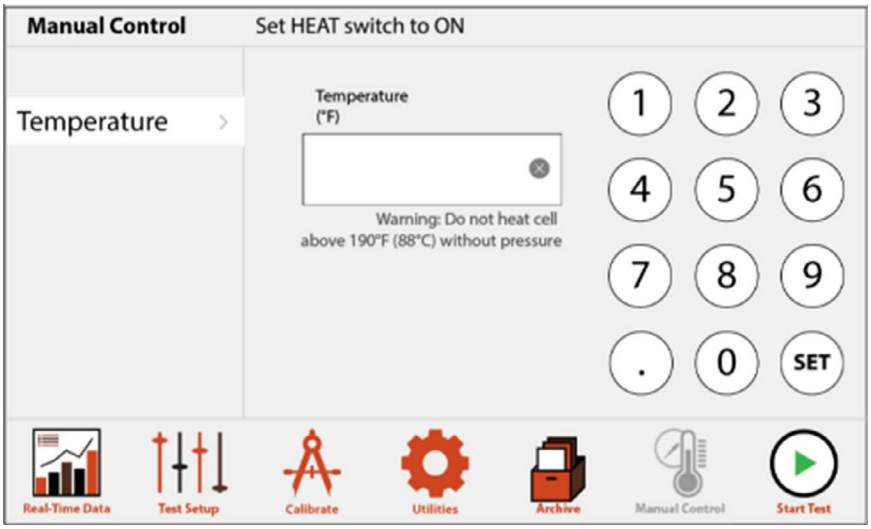
Note

The Manual Control screen can be used to set the temperature when a test is not running. The Heat switch must be set to AUTO.

1. Enter the setpoint in the box.

2. Select “SET” when done.

   When setting the temperature with Manual Control, a thermocouple must be connected to the port on the bulkhead to prevent alarms.



Onboard Display

Start Test

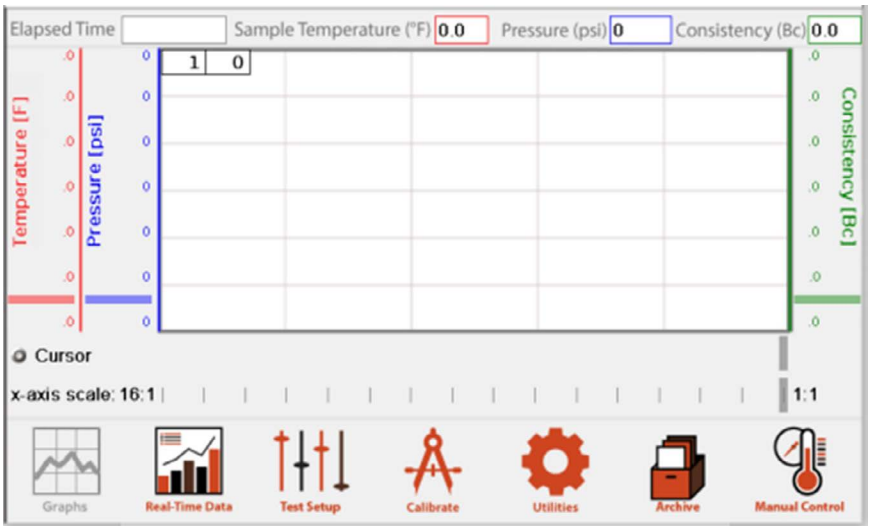
The Start Test button starts a test using the parameters that are currently saved to the internal board. Before pressing the Start Test button, be sure to configure your test parameters on the Test Setup screen (see page 19) or in the PC software (see page 13).

Also note, when saving settings in the onboard display, the settings displayed on the screen will be saved to the board, but other settings that were previously set in the software will be replaced by defaults.

Onboard Display

Graphs

The Graphs screen shows a graph of the current test with lines for Temperature, Pressure, and Consistency with respect to Time.



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.

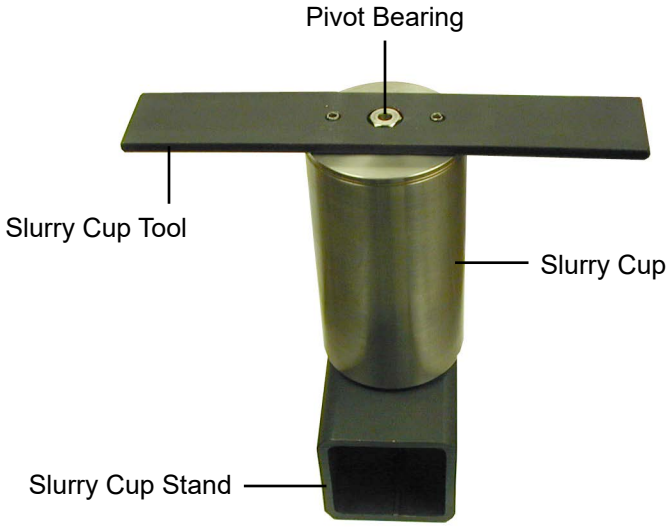
7. Place the gasket around the threads of the bottom cap. Apply high-temperature grease to the gasket and cap surface. Screw the cap onto the cup and tighten with the slurry cup tool.

Note

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

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.

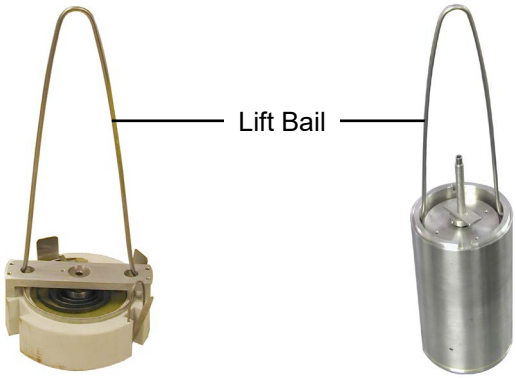
   ☑ **Tip**

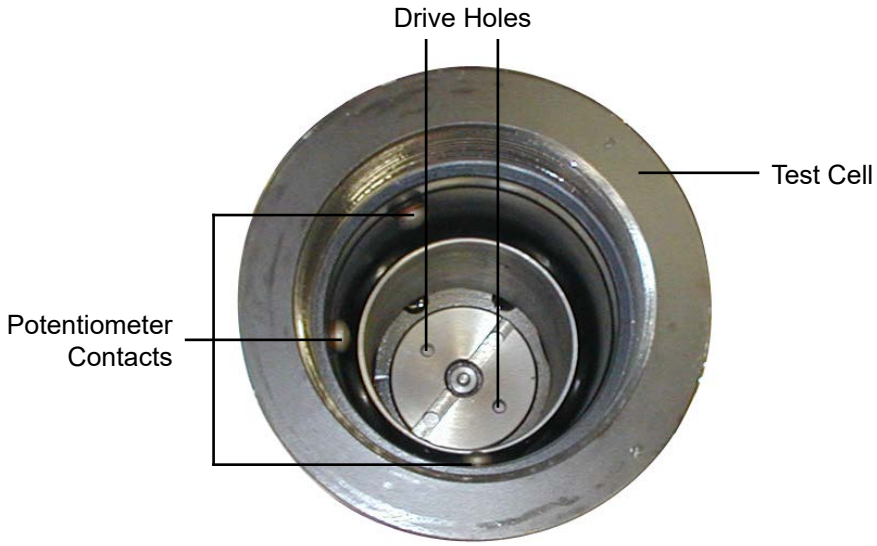
   It may be necessary to start the motor briefly to confirm that the slurry cup is properly aligned inside the test cell.

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.





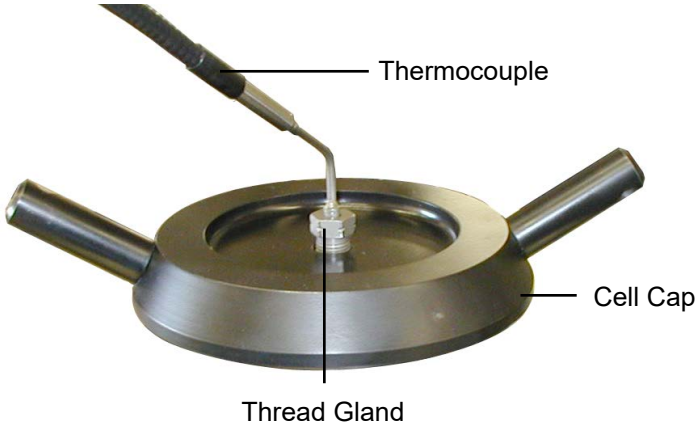
Note

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 ⅛ of a turn.

6. With a ⅝" 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 display 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 (counterclockwise) 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 12 for more information). If you are not using the software, touch the “Start Test” button on the display.

10. 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

Operation

Completing the Test

1. If you are using the Benchtop Consistometer software, click “Stop Test”. If not, touch the “Stop Test” button on the display.

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 (counterclockwise) all the way.

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

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 (counterclockwise). 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.

Oil Filter Fixture

Fixture Filter

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.

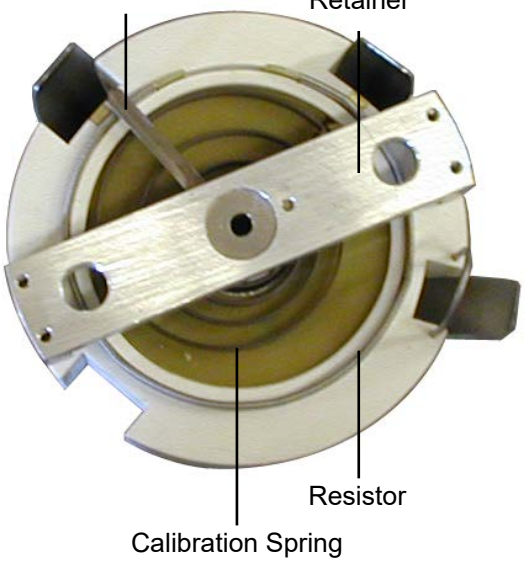
d. Install a new contact arm and make adjustments as necessary to obtain consistent contact with the resistor.

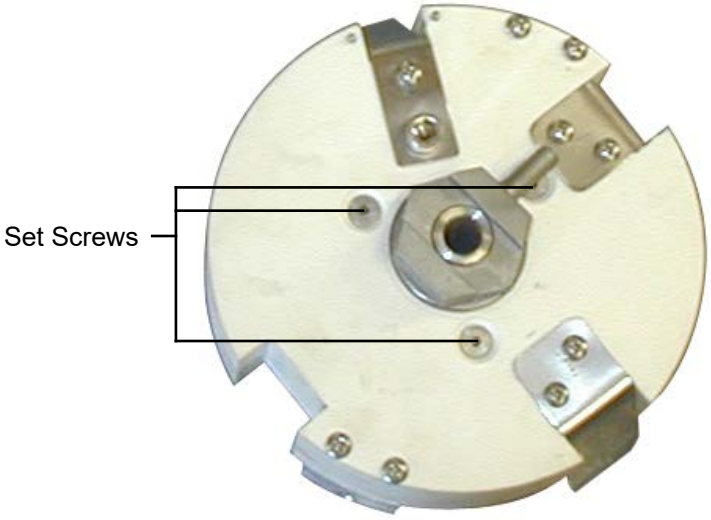
e. Loosen the three adjustment screws on the underside of the potentiometer assembly and rotate the spring adjuster until the spring rests at a relaxed state.

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 CEM-D software or the onboard display, 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 top 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.

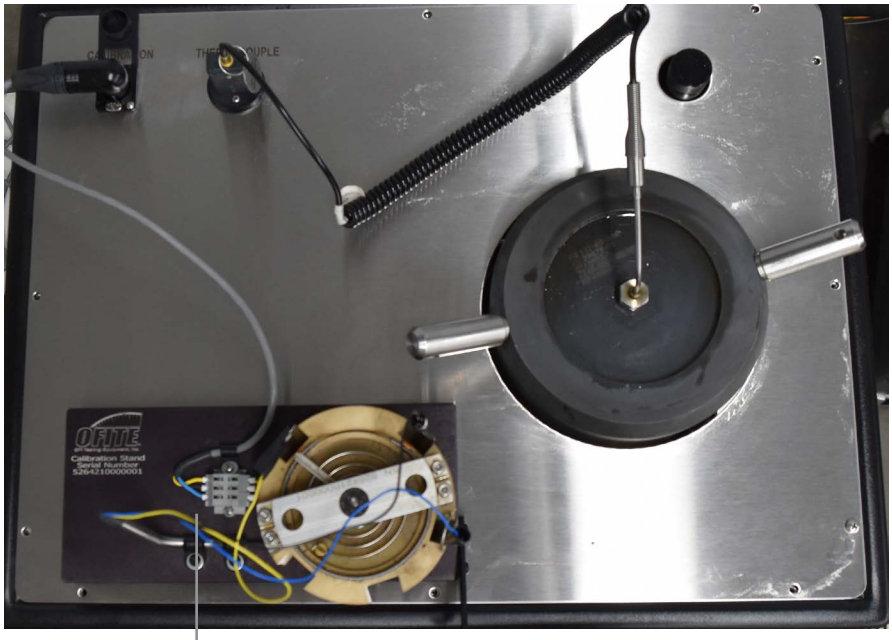
5. Attach the hook to the cord.

6. Apply the weights to the hook according to the chart below. Steady the cord to minimize the amount of swinging.

   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



Calibration Stand

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.

Note

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.

Mass (grams)	Approximate Voltage
100	2.5
200	5.5
300	8.2
400	10.75

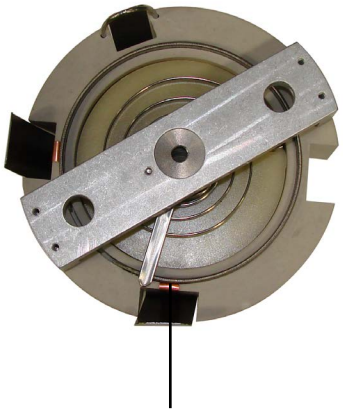
Appendix

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.

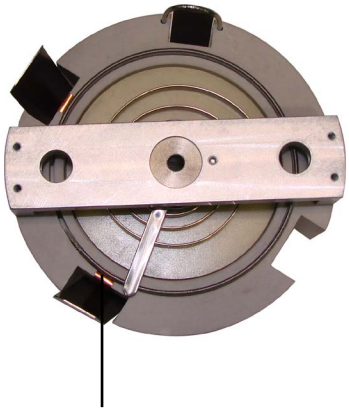
1. Remove the potentiometer from the consistometer.
2. Loosen the three set screws on the bottom of the potentiometer.
3. Locate the spring holder on the top of the potentiometer. It may be positioned beneath the shaft bearing retainer. Push the spring holder to rotate the spring within the body of the 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

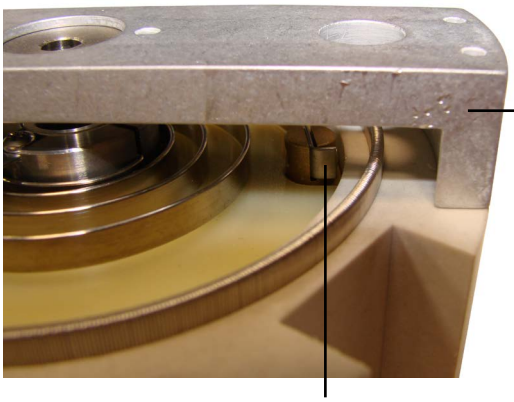


Zero Point

Positive Reading



Zero Point



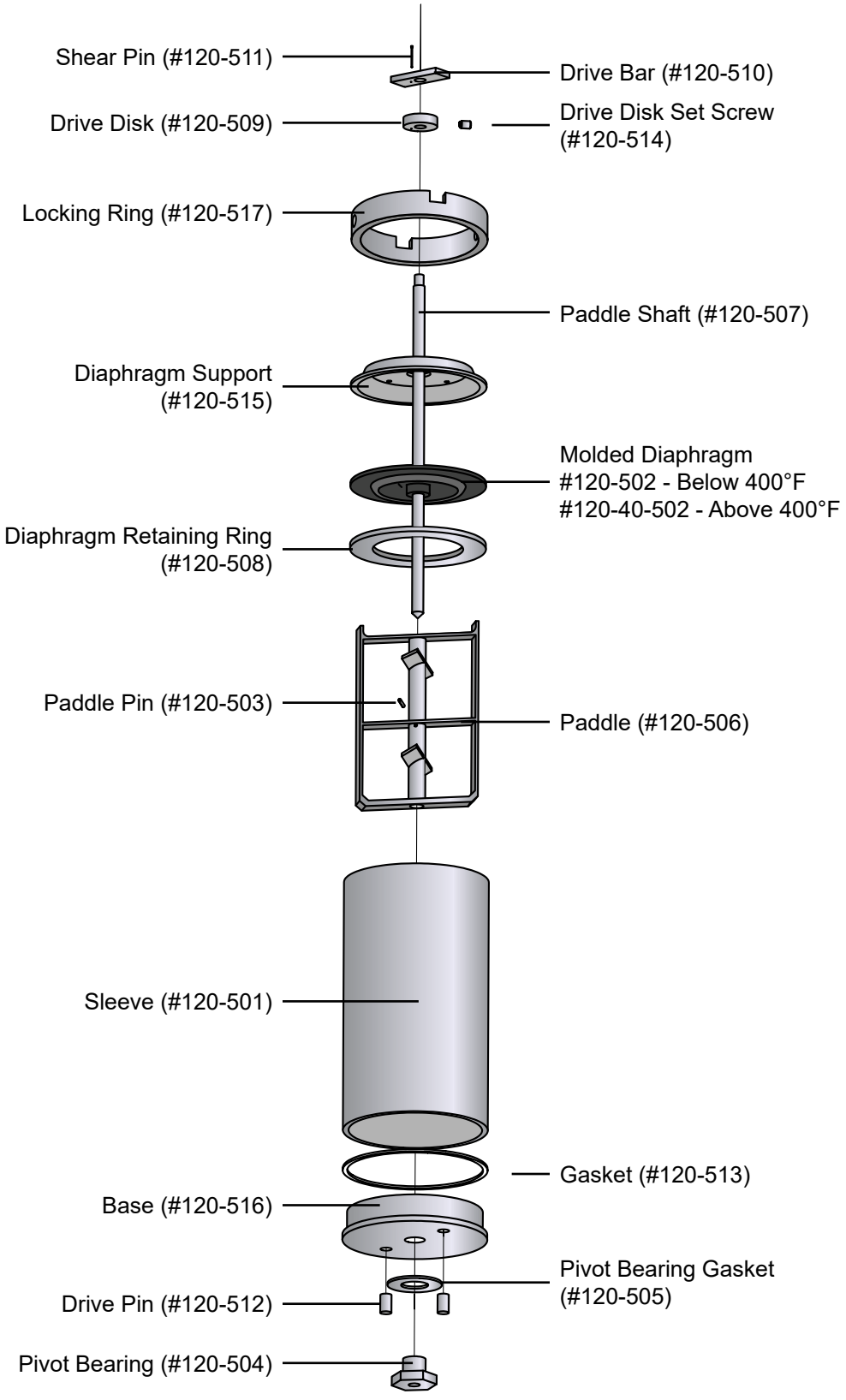
Shaft Bearing Retainer

Spring Holder

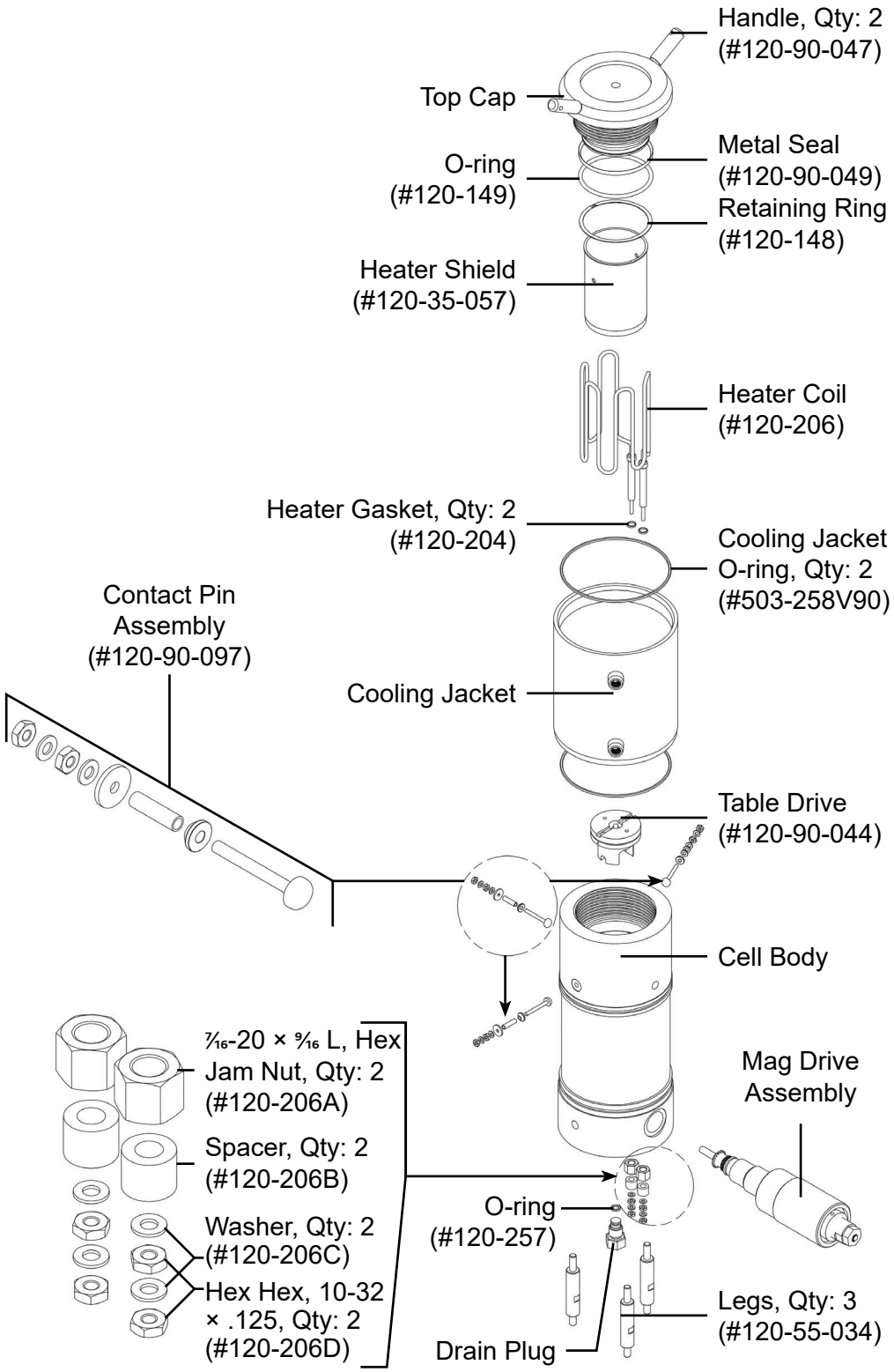
Appendix

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

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