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Automated Gas Permeameter

Part No. 127-80

Instruction Manual

Updated 3/8/2017

Ver. 1.0

OFI Testing Equipment, Inc.

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Intro

Permeability is a measure of the ability of a fluid to flow through a porous media when subjected to a differential pressure and is mathematically equated by Darcy's Law.

The permeability of a petroleum reservoir is one of the most influential factors governing the production capabilities of a producing formation.

The Automated Gas Permeameter measures the steady state permeability of rock core specimens 1" or 1.5" in diameter and up to 4" in length. The specimen is placed into a sleeve inside the test cell. A gas at a constant differential pressure is forced through the core and the flow rate is measured. Differential pressure (measured by a transducer), flow rate (measured by a flow meter), and the viscosity of the gas are incorporated into Darcy's law to calculate the permeability of the sample.

Description

Specifications

- Confining Pressure: 10,000 psi (69 MPa)
- Gas Inlet Pressure: up to 145 psi (1 MPa)
- Flowrate Range: 0 - 500 sccm (dual scale)
- Core Diameter: 1.5" (4 cm) - other sizes available
- Core Length: up to 4"
- Size: 27" x 21" x 21" (69 x 53 x 53 cm)
- Weight: approximately 180 lb (81.6 kg)

Requirements

- Gas: Helium or Nitrogen - up to 145 psi (1 MPa)
- Air: up to 140 psi (965 kPa)
- Electrical: 115/230 VAC, 50/60 Hz

Components

#120-104	Rupture Disk (18,200psi)
#120-910-066	Quick Connect Body, ¼" MNPT
#127-20-021	Solenoid Valve, 400 PSI, 24 VDC
#127-80-027-8	Sleeve and Seal Kit, 1"
#127-80-027-9	Sleeve and Seal Kit, 1.5"
#127-80-029-2	Gas Flow Meter, 0 - 10 SCCM
#127-80-029-3	Gas Flow Meter, 0 - 500 SCCM
#127-80-030	Pressure Controller, 0 - 100 psi
#127-80-055	Valve, 2 Way
#127-80-033	Gauge, 15,000 psi, 3.5"
#127-80-034	Differential Pressure Transducer
#127-80-035	Pressure Transducer, 10 ksi
#127-80-036	Pressure Transducer, 100 psi
#127-80-057	Quick Connect Stem with Valve
#127-80-062	In-Line Filter, ½"
#127-80-078	Analog Input Module
#127-80-079	Digital Output Module
#127-80-122	Miniature Regulator
#130-77-033	Safety Head
#130-77-040	Maximator Pump
#150-80-074	Quick Connect Body

Quick Start

1. Connect a gas supply and compressed air supply to the back of the Permeameter.
2. Connect the instrument to the computer with an Ethernet cable.
3. Plug the instrument and the computer into electrical outlets.
4. Turn on the computer and the Permeameter.
5. Open the software.
6. Create a test (see page 13).
7. Load the core sample (see page 9).
8. Purge the air from the cell (see page 12).
9. Set confining pressure.
10. Start the test.
11. Release confining pressure.
12. Remove the core sample from the cell and start again.

Setup

Hardware



Note

1. Connect the Automated Gas Permeameter to the computer with an Ethernet cable.
2. Connect a regulated Nitrogen or Helium supply to the gas inlet port. Set the pressure to 110 psi (758 kPa).
3. Connect a compressed air source to the air inlet port. Set the pressure to 120 psi (827 kPa)
4. Plug the computer and the Automated Gas Permeameter into electrical outlets and turn them both on.
5. Make sure the inlet (upper) tubing connectors are connected to the Upstream ports on the instrument cabinet. Make sure the outlet (lower) tubing connectors are connected to the Downstream ports on the instrument cabinet.

There are two Upstream ports and two Downstream ports. The two ports

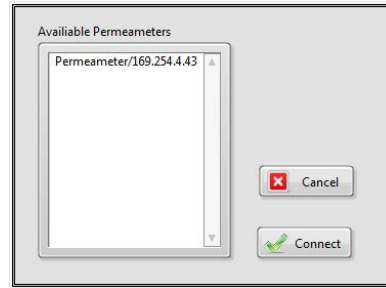


within each group are interchangeable.

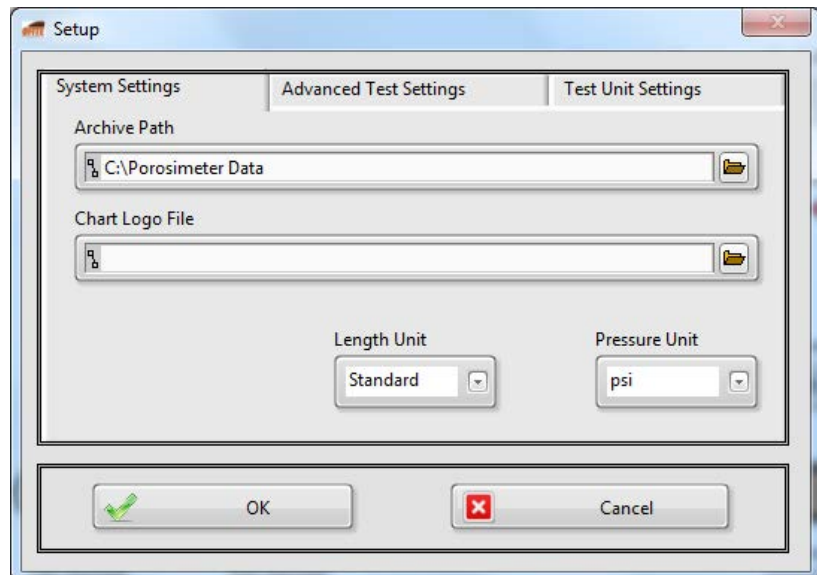
6. Place a cup or jar underneath the Purge Outlet to catch any oil that is purged from the cell.

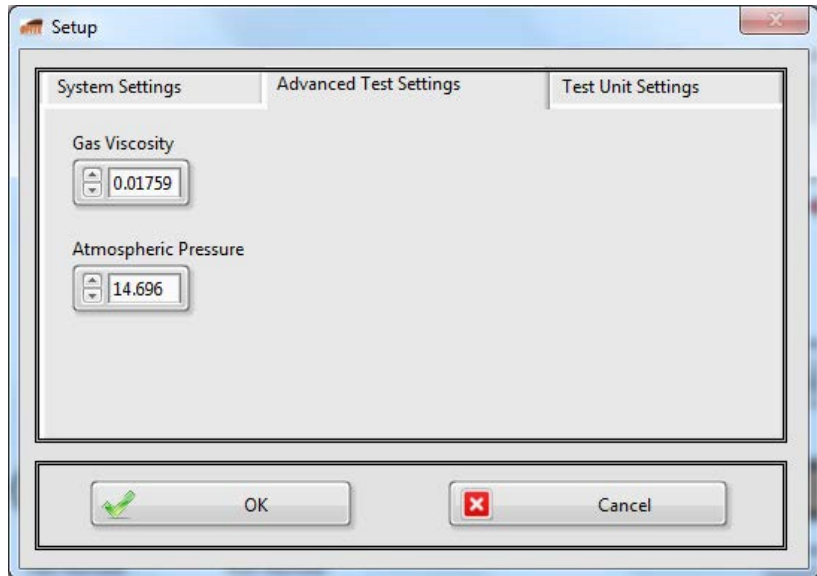
Setup Software

1. Open the software.
2. When the Connection Manager opens, choose from the list the Permeameter you want to control.

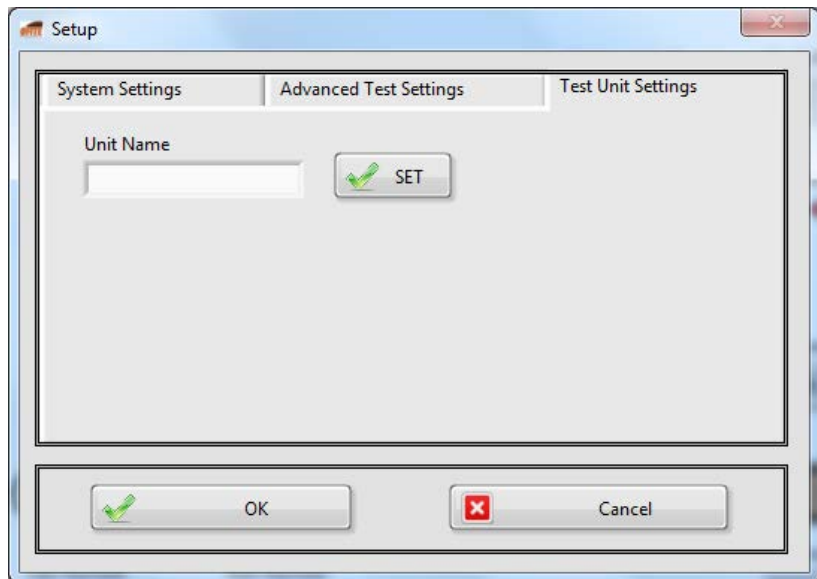


3. Select Setup from the Utilities menu.
 - Archive Path: Choose a location to save the test data.
 - Chart Logo File: Choose a logo file to print on the chart at the end of the test.
 - Length Unit: Standard or Metric
 - Pressure Unit: psi or MPa





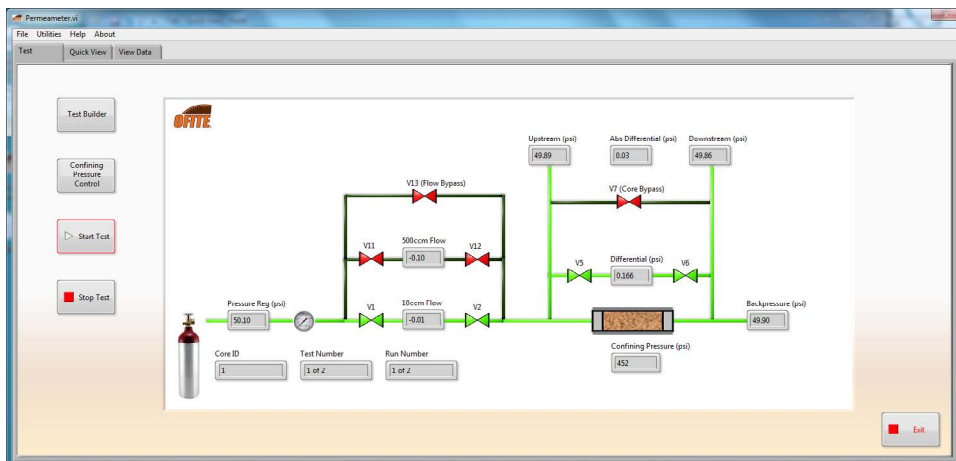
- Gas Viscosity: Enter the viscosity of the gas you are using to test.
- Atmospheric Pressure: Enter the current atmospheric pressure.



- Unit Name: Choose a name and click "SET". This will help identify the unit on the network when multiple Automated Permeameters are in use.

Operation

1. Prepare the instrument for use as described on page 4.
2. Prepare the software for use as described on page 5.
3. In the software, click the Test Builder button.



4. To load a test, click the Open button and choose the correct test. To build a new test, refer to page 13.
5. Once the correct test has been loaded, click the “Accept” button.
6. You will be prompted to load the core sample into the cell. See page 9 for details.
7. Now you will be prompted to purge the confining pressure of air. See page 12 for details.
8. Make sure the value in the Confining Pressure Setpoint field is correct and click Accept. If it is not, click Cancel and update the test configuration.

Confining Pressure Control

<p>To Purge the Confining Pressure</p> <p>This must also be performed after changing the core sample.</p> <ol style="list-style-type: none"> 1. Open the Pressure Lock-In Valve by turning the handle fully counter-clockwise. 2. Close the Pressure Release Valve by turning the handle fully clockwise. 3. Open the Purge Valve by turning the handle fully counter-clockwise. 4. Click the "Purge" button below and let the pump run until confining fluid begins to flow out. 5. Click the "Purge" button again to turn off the pump and close the Purge valve by turning the handle fully clockwise. <p style="text-align: center;"> Purge</p>	<p>To set the Confining Pressure</p> <ol style="list-style-type: none"> 1. Verify the Confining Pressure is purged of air by following the "To Purge the Confining Pressure" procedure. 2. Once the system is purged open the Pressure Lock-In Valve by turning the handle fully counter-clockwise. 3. Close the Pressure Release Valve by turning the handle fully clockwise. 4. Close the Purge Valve by turning the handle fully clockwise. 5. Click "Accept". The Permeometer will pressurize the Core Holder to the pressure setpoint. <p>Confining Pressure Setpoint (psi)</p> <p style="text-align: center;"><input style="width: 100%;" type="text" value="500.00"/></p> <p style="text-align: center;"> <input type="button" value="Accept"/> <input type="button" value="Cancel"/> </p>
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9. The software will now set the confining pressure and return you to the main screen. Click Start Test to begin the test.
10. When the test is complete, slowly open the Pressure Release valve to release the confining pressure. You can now open the cell and install a new core sample.

Operation

Loading the Core

1. Release all confining pressure by opening the Pressure Release valve (counterclockwise).
2. Close the Pressure Lock-In valve (clockwise).
3. Open the Purge valve (counterclockwise).



4. Pull up on the inlet plunger tubing.

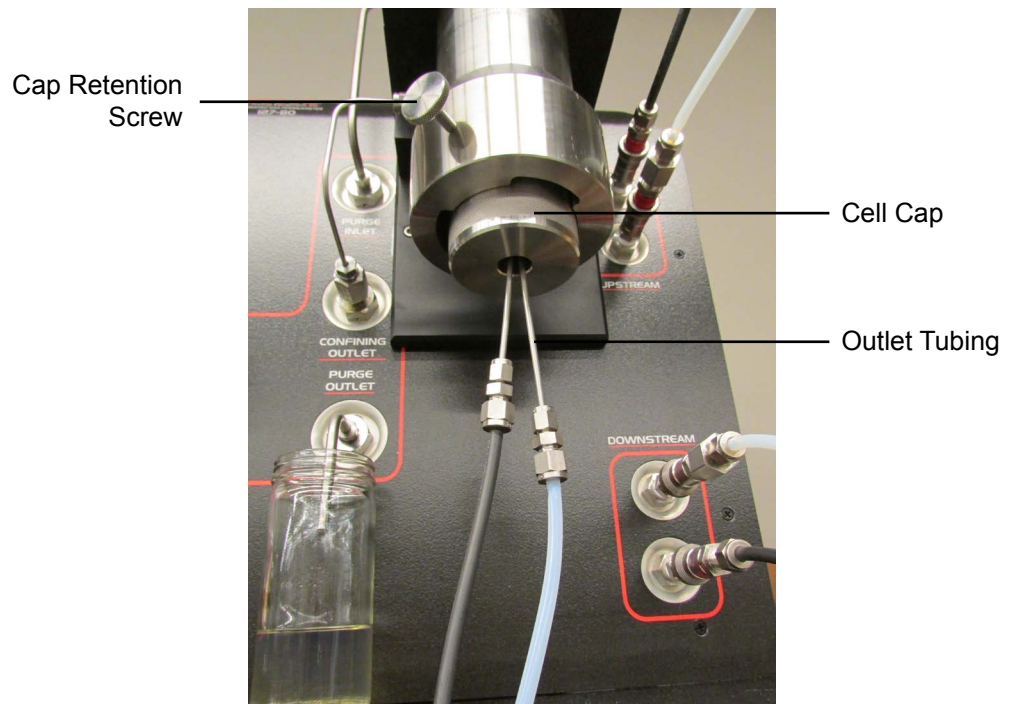
Be sure to pull up on the metal tubing, not the rubber sleeve.

5. Loosen the cap retention screw to loosen the cell cap.



6. Rotate the cap to disengage it from the cell body.

7. Remove the cap and core sample (if any) from the cell.



8. Insert a new core sample and the cap into the cell body.



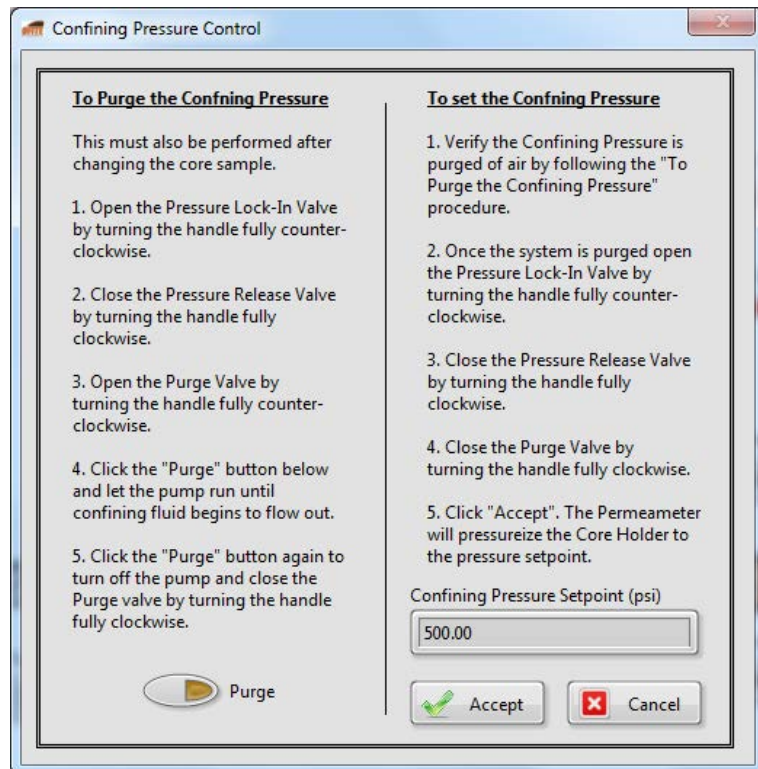
9. Rotate the cap so that it engages with the cell body. You should hear and feel it click into place.
10. Tighten the cap retention screw to lock the cap in place.
11. Push the inlet plunger tubing down until you feel the plunger contact the core sample. Be sure to push on the rubber sleeve and not the metal tubing.
12. Open the Pressure Lock-In valve.
13. Close the Pressure Release valve.

Operation

Purging the Cell

Before running a test, you must purge the confining pressure within the cell of air.

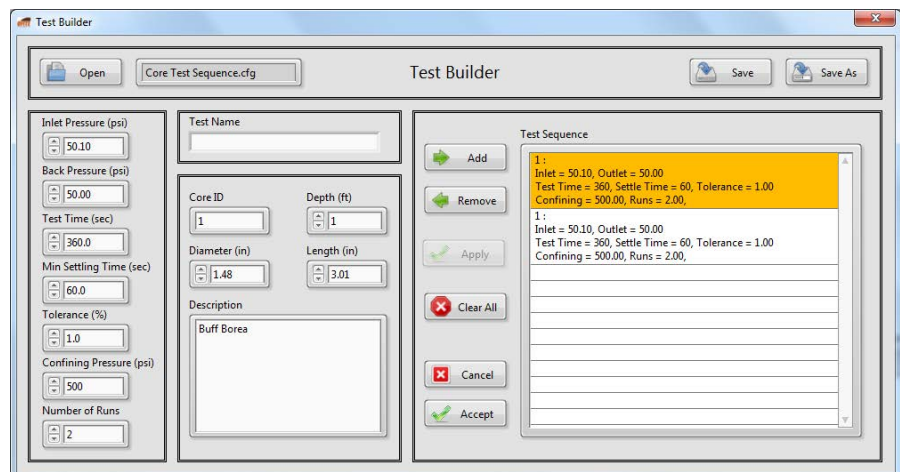
1. In the software, click the Confining Pressure Control button.
2. Open the Pressure Lock-In valve (counterclockwise).
3. Close the Pressure Release valve (clockwise).
4. Open the Purge valve (counterclockwise).
5. Click the "Purge" button.
6. Let the pump run until oil flows out of the Purge Outlet with no air bubbles.
7. Click the "Purge" button again to stop the pump.
8. Close the Purge valve (clockwise). The cell has now been purged of air.
9. Click the Cancel button to return to the main screen.



Operation

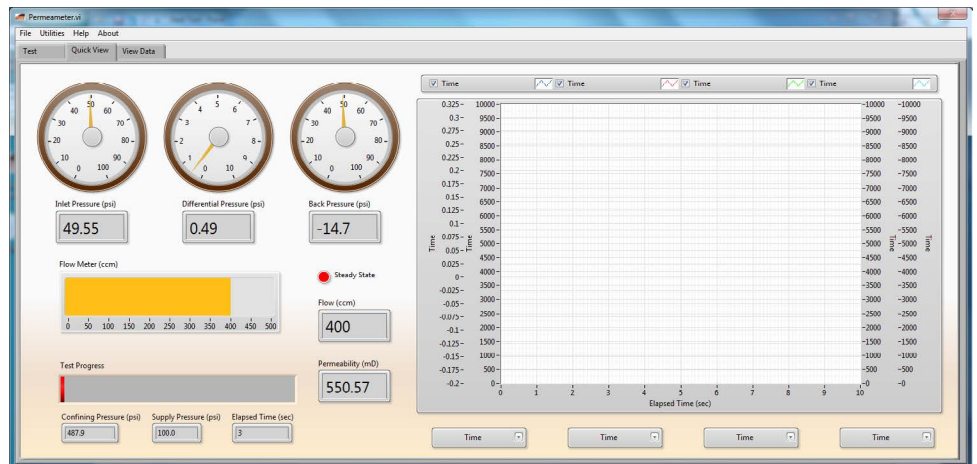
Creating a Test

1. Click the Test Builder button.
2. To modify an existing test, click the Open button and choose a test file. To create a new test, enter a name in the Test Name field.
3. Enter header information for the test:
 - Core ID: a label to identify the core sample
 - Depth: the depth from which the core was taken
 - Diameter: diameter of the core sample
 - Length: length of the core sample
 - Description: a brief description of the core sample and test parameters
4. Enter the parameter values for each step of the test:
 - Inlet Pressure: pressure on the inlet side of the core
 - Back Pressure: pressure on the outlet side of the core
 - Test Time: total duration of this step of the test
 - Min Settling Time: amount of time to allow the system to settle after the test gas is introduced to the system
 - Tolerance (%): acceptable amount of pressure variance to determine if the gas in the system has settled
 - Confining Pressure: amount of pressure around the core sample
 - Number of Runs: how many times the software will repeat this step
5. Click the Add button to add the step.
6. When all steps have been added, click the Apply button to apply the steps to the test. To save the test for later use, click the Save button.
7. Click the Accept button to make this the active test.



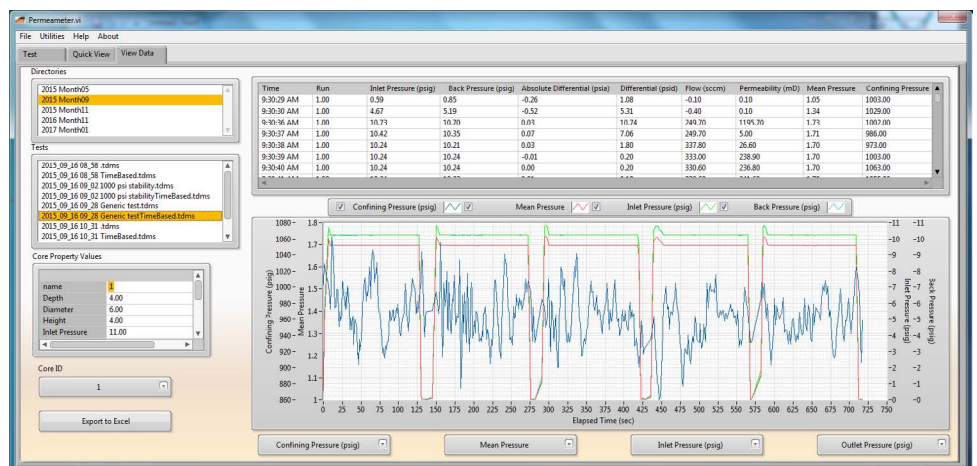
Test Data

During a test, the Quick View tab will show you the data from the current test.



In the software, the View Data tab shows the data from previous tests. This data is available even when a test is currently running.

1. In the Directories list, choose the year and month the test was run.
2. In the Tests list, choose the test file you want to view.



Maintenance

Replace the hydraulic oil if it ever becomes cloudy or dirty.

1. In the software, click the Confining Pressure Control button.
2. Open the Pressure Lock-In valve (counterclockwise).
3. Close the Pressure Release valve (clockwise).
4. Open the Purge valve (counterclockwise).
5. Click the “Purge” button.
6. Let the pump run until all of the oil flows out of the Purge Outlet. Make sure you have a receptacle large enough to hold all of the oil.
7. Click the “Purge” button again to stop the pump.
8. Pour new mineral oil into the reservoir through the opening on top of the unit cabinet.
9. Click the “Purge” button again to refill the cell.
10. Let the pump run until oil flows out of the Purge Outlet.
11. Close the Purge valve (clockwise).

Troubleshooting

Problem	Solution
Test cell is very difficult to open.	Verify there is no confining pressure in the system. Verify the cap retention screw is loosened.
Software does not find the Permeameter.	Verify that the Ethernet cable is connected between the Permeameter and PC. Verify that Windows Firewall or Anti-Virus programs are not blocking the connection.
Permeameter appears non-responsive to software commands.	Restart the software. If the connection manager appears and there are no Permeameter Units listed, close the software and turn the power off to the Permeameter machine. Wait ten seconds before turning the power back on. Start the software 30 seconds after the power was turned back on to the Permeameter. If the software still does not connect, check that Windows Firewall or Anti-Virus programs are not blocking the connection.

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, 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.