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Permeability Plugging Tester with LCM Receiver, 6000 psi

#171-193-6K: 115 Volt

#171-193-6K-1: 230 Volt

Instruction Manual

Updated 11/3/2025

Ver. 8

OFI Testing Equipment, Inc.

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Table of Contents

Intro.....	2
Specifications	2
Components	3
Safety.....	6
Quick Start	8
Preparation	11
Cell Assembly	12
Testing	17
Data.....	20
Cell Cap Assembly	21
Piston Assembly.....	22
Maintenance.....	23
Diagrams	24
<i>Permeability Plugging Tester</i>	<i>24</i>
<i>Test Cell</i>	<i>25</i>
Warranty and Return Policy	26

Intro

The Permeability Plugging Tester (PPT) is a modification of the standard 500 mL HTHP Filter press. It may be used in the field or in a laboratory environment. The instrument is useful for performing filtration tests on plugging materials without the interference of particles settling on the filter medium during the heat up process. The PPT is very useful in predicting how a drilling fluid can form a low permeability filter cake to seal off depleted, under pressured intervals and help prevent differential sticking. Typical differential pressures are much higher than those seen in standard HTHP testing.

The pressure cell is similar to those seen in standard HTHP filtration testing, but it is inverted with the filter medium and the back pressure receiver on top of the assembly. It is pressurized with hydraulic oil and a hand pump. A floating piston separates the oil from the test fluid in the cell. The cell has a maximum pressure rating of 6,000 psi.

Specifications

- Weight: 61 lb (27.7 kg)
- Dimensions: 15" × 25" × 42" (38.1 × 63.5 × 106.7 cm)
- Shipping Weight: 90 lb (40.8 kg)
- Shipping Dimensions: 30" × 18" × 17" (76.2 × 45.7 × 43.2 cm)
- 800W Heater
- Maximum Temperature: 500°F (260°C)
- Maximum Pressure: 6,000 psi (41.4 MPa)

Components

#153-14	Graduated Cylinder, 50 mL × 1 mL, Glass
#154-20	Thermometer with Metal Dial, 8" Stem, Dual Scale: 50°–500°F / 0°–250°C
#165-44-2	Anti Seize Compound, Silver, 7g Pouch, Qty: 10
#170-04	CO ₂ Pressure Unit
#170-13-3	O-ring for Cell, Viton 75D, Qty: 16
#170-17	O-ring for Valve Stem, Viton 75 D, Qty: 22
#170-53	Ceramic Filter Disk, 15 D, 50 µm, Qty: 10
#171-00	Heating Jacket (115 Volt)
#171-01	Heating Jacket (230 Volt)
#171-10-1	Back Pressure Receiver
#171-190-057	O-ring for Valve Stem, Viton 90D, Qty: 16
#171-190-060	O-ring for Cell, Viton 90D, Green, Qty: 24
#171-190-061	O-ring for Piston, Viton 90D, Green, Qty: 12
#171-23-1	Safety Pin with Lanyard
#171-90-15	6" Crescent Adjustable Wrench
#171-99	O-ring for Piston, Viton 70D, Qty: 8
#171-193-6K-S	Test Cell, Stainless Steel
#120-910-028	O-ring for Rupture Disk, Viton 75D, Qty: 2
#130-81-040	Retaining Ring, Qty: 2
#165-44-2	Anti Seize Compound, Silver, 7g Pouch, Qty: 4
#170-13-3	O-ring for Cell, Viton 75D, Qty: 4
#170-17	O-ring for Valve Stem, Viton 75D, Qty: 4
#170-53	Ceramic Filter Disk, 50 Darcy
#171-190-020-S	Cell Body
#171-190-023	Locking Ring, Qty: 2
#171-190-024-S	Piston
#171-190-027-1	Rupture Disk, Qty: 2
#171-190-031-2S	Cell Cap, Inlet
#171-190-034-S	Cell Cap, Outlet, For Valve Stem
#171-190-037-S	Cell Cap, Outlet, For LCM Receiver
#171-190-039	Set Screw for Piston
#171-190-055	Hex Key T-Handle 9"
#171-190-056	O-ring for Piston Bleed Port, Viton 90D, Green
#171-190-057	O-ring for Valve Stem, Viton 90D, Qty: 4
#171-190-058	O-ring for Rupture Disk, Viton 90D, Green, Qty: 2
#171-190-060	O-ring for Cell, Viton 90D, Green, Qty: 4
#171-190-061	O-ring for Piston, Viton 90D, Green, Qty: 2
#171-190-064	Wrench for Cell Cap
#171-193-501	Quick Connect Fitting, Male
#171-83-1	Valve Stem Assembly
#171-90-07	Hex Nipple, ¼" NPT
#171-95	T-handle for Piston
#171-99	O-ring for Piston, Viton 70D, Qty: 2
#500-350-001	Fitting, Male VCO
#500-350-002	Fitting, VCO Nut
#500-SS-4-HCG	Hex Coupler, ¼" FNPT
#700-100-096	O-ring for Piston Bleed Port, Viton 75D

#171-193-103

#120-00-042	Fitting, Male Elbow
#120-00-043	Fitting, Union Tee
#127-52-041	Fitting, Port Connector
#130-81-014	Plug, Male, 1/4" NPT
#145-00-001	Female Tee, 1/4" NPT
#171-190-062	Gauge, 6000 psi
#171-193-502	Quick Connect Fitting, Female
#171-193-505	Pressure Relief Valve
#171-27-1	Hose, 6000 psi, 6 ft
#171-90-07	Hex Nipple
#171-96	Hand Pump
#171-96-1	Hydraulic Oil, 1 Quart
#171-98	Ball Valve for Inlet Pressure Line, 1/4"
#500-350-013	Fitting, Male, Tube Adapter

Pump Assembly:**#171-193-101**

#170-16	Valve Stem
#170-32	Needle Valve, Male
#171-190-057	O-ring for Valve Stem, Viton 90D, Qty: 2
#171-84-010	Receiver Body
#171-84-011	Bottom Cap
#171-84-012	Top Cap
#171-84-014	Filter
#171-84-015	O-ring for Receiver Cap, Viton 75D, Qty: 2
#171-90-11	Female Elbow, 1/8" NPT
#171-90-14	Hose Barb, 1/8" NPT x 1/4"
#500-350-003	Fitting, Female VCO
#500-350-004	Fitting, VCO Plug

LCM Receiver

Optional:

#170-33 Cell Cap Removal Tool
#170-40 Carrying Tool for HTHP Cell
#171-06 Safety Shield

#171-193-6K-SP Part Part Kit
#130-81-040 Retaining Ring, Qty: 2
#143-02-13 O-ring for Puncture Pin Holder, Qty: 2
#143-02-14 O-ring for Puncture Pin Holder, Qty: 2
#143-05 *CO2 Bulbs, Box of 10, UN2037, Qty: 30
#153-12 Graduated Cylinder, 100 mL × 1 mL, Qty: 2
#153-14 Graduated Cylinder, 50 mL × 1 mL
#154-20 Thermometer with Metal Dial, 8" Stem, Dual Scale: 50° - 500°F / 0° - 250°C
#165-44-2 Anti Seize Compound, Silver, 7g Pouch, Qty: 2
#170-10 Thermostat Pilot Light
#170-11 Heating Element, Qty: 2
#170-13-3 O-ring for Test Cell, Viton® 75D, Qty: 50
#170-16 Valve Stem, 3.25"
#170-17 O-ring for Valve Stem, Viton® 75D, Qty: 100
#170-19 Filter Paper, 2.5" Diameter, Qty: 10
#170-53 Ceramic Filter Disk, 50 Micron, Qty: 10
#171-190-057 O-ring for Valve Stem, Viton® 90D, Qty: 50
#171-190-060 O-ring for Test Cell, Viton® 90D, Qty: 50
#171-190-061 O-ring for Piston, Viton® 90D, Qty: 24
#171-193-504 Rupture Plug, 6500 psi, Qty: 2
#171-23-1 Safety Pin with Lanyard, Qty: 2
#171-71 Thermostat
#171-84-014 Filter Disk for LCM Receiver, Qty: 10
#171-84-015 O-ring for LCM Receiver, Qty: 10
#171-99 O-ring for Piston, Viton® 75D, Qty: 24
#500-350-004 Fitting, VCO Male Nut for LCM Receiver

Safety

Read this manual carefully before attempting to use the equipment. Improper use can result in injury or damage to the equipment.

Temperature

The heating jacket, test cell, and pressure assemblies will be very hot during testing. Handle these components with care. Never touch hot components without wearing protective clothing.

At elevated temperatures, the fluid in the test cell will expand. Never fill the test cell completely with fluid. Always leave some void space to allow for thermal expansion. Refer to page 17 for recommended fill volumes.

Pressure

Always pressurize with either Carbon Dioxide or Nitrogen. Do not use Nitrous Oxide (NO₂), Oxygen (O₂), or compressed air. These gasses are dangerous at elevated temperatures.

The maximum working pressure of the test cell (6,000 psi / 41.2 MPa) is marked on the cell body and cap. Never exceed this pressure.

Equipment

Inspect all o-rings before every test. Discard any that show signs of damage or wear. Look for nicks, cuts, or brittle o-rings. Two sets of o-rings are included with the Filter Press. The first set is made from Viton 75D. These o-rings should be used for tests up to 400°F only. The second set is made from Viton 90D. These o-rings should be used for tests up to 500°F.

Cell Corrosion

Test fluids under high temperature and pressure can corrode the cell body and caps. Carefully inspect the cell body and caps for corrosion before and after each test.

Some materials are more susceptible to corrosion than others. Also, some fluids and additives are more corrosive than others. OFITE offers a variety of cell materials for different levels of corrosion resistance and cost.

Pump

For safe operation of the Hydraulic Pump Pressurization system, make sure the pressure has been released and the gauge on the pump reads zero before:

1. Attempting to disconnect the pressure hose from the cell at the quick-connect.
2. Attempting to remove the cell from the heating jacket.
3. Reallocating or moving the PPT in the laboratory.
4. Refilling the hydraulic pump.
5. Performing any maintenance including tightening leaking fittings on the pump, hydraulic fittings, or cell assembly.

When refilling or repairing the hydraulic system, make sure any spilled oil is cleaned. Oil on the floor is very slippery and can cause falls and injury. Oil spills on the bench can accumulate and become a fire hazard.

Quick Start

1. Place the thermometer in the heating jacket.
2. Preheat the heating jacket to 10°F (6°C) above the test temperature. The pilot light will turn on at the target temperature.
3. For PPT testing, soak a ceramic disk in base fluid for at least 10 minutes.
4. Inspect all o-rings. Replace any that show signs of damage or wear.
5. Apply grease to all o-rings.
6. Assembly both cell caps and the piston. Place o-rings in the grooves around the cap and piston.
7. Place an o-ring on the shoulder inside the cell on the end marked "IN".
8. Apply anti-seize compound to the threads of the cell caps.
9. Screw the inlet cell cap assembly into the cell body and tighten it completely.
10. Push in the red knob on the heating jacket. Place the cell in the heating jacket with the inlet side pointing down.
11. Pull out the red knob on the heating jacket and lower the cell. Rotate the cell until it seats.
12. Screw the inlet pressure assembly into the inlet cell cap and tighten it completely.
13. Screw the t-handle into the piston.
14. Push the piston inside the cell against the inlet cell cap. Tighten the set screw on the piston bleed valve.
15. Connect the inlet pressure manifold to the inlet pressure assembly.
16. Open the ball valve on the manifold and close the pressure release valve on the pump.
17. For LCM testing:
 - a. Fill the cell with no more than 250 mL of test fluid.
 - b. Stroke the pump until the top of the fluid is level with the o-ring shoulder.

18. For PPT testing:

- a. Stroke the pump until the t-handle rises about 1.5" (3.8 cm).
- b. Pour the test fluid into the cell all the way up to the o-ring shoulder.

19. Unscrew the t-handle from the piston.

20. Place an o-ring on the shoulder inside the cell body.

21. Place a ceramic disk or slotted disk on top of the o-ring.

22. Screw the outlet cell cap assembly into the cell body and tighten it completely.

23. For LCM testing:

- a. Connect the LCM bottom cap assembly to the outlet cell cap assembly.
- b. Make sure the filter is in place inside the receiver bottom cap.
- c. Pour water into the hole in the receiver bottom cap.
- d. Open the outlet valve to allow excess water to drain, then close the outlet valve.
- e. Apply grease to the receiver cap o-rings and place one around each cap.
- f. Screw the receiver top cap onto one end of the receiver body.
- g. Screw the receiver body onto the bottom receiver cap.
- h. Screw the valve stem into the port on the receiver top cap.
- i. Attach the CO₂ Pressure Assembly to the top valve stem and secure it with a safety pin.

24. For PPT testing:

- a. Fill the outlet valve stem assembly with base fluid.
- b. Screw the outlet valve stem assembly into the outlet cell cap. Unscrew it one half turn.
- c. Place the back pressure receiver onto the outlet valve stem assembly and lock it in place with the safety pin.
- d. Attach the CO₂ pressure assembly to the valve stem on the back pressure receiver and secure it in place with the safety pin.

25. Move the thermometer to the cell body.

26. Place a CO₂ bulb in the CO₂ pressure assembly. Set the pressure to the appropriate back pressure for your test.

27. For LCM tests, open the valve stem on the receiver top cap ¼ turn.
28. Stroke the pump to apply the same pressure to the cell.
29. When the cell has reached the test temperature, stroke the pump to apply the working test pressure to the cell.
30. For PPT tests, open the outlet ball valve to initiate filtration.
31. Collect filtrate by opening the needle valve on the receiver.
32. At the end of the test, turn off the heating jacket.
33. Allow the cell to cool
34. Open the pressure release valve on the pump to release pressure inside the cell.
35. Open the outlet port on the receiver to collect any remaining filtrate.
36. Close the regulator on the CO₂ pressure assembly.
37. Close the valve stem on the outlet LCM cap.
38. Remove the CO₂ pressure assembly from the receiver.
39. Remove the receiver from the outlet cell cap.
40. Remove the outlet cell cap assembly.
41. Remove the filter medium and save the filter cake for later analysis.
42. Screw the t-handle into the piston and push the piston to the bottom of the cell.
43. Close the pressure release valve on the pump and the ball valve on the pressure manifold.
44. Disconnect the inlet pressure manifold from the inlet pressure assembly.
45. Remove the cell from the heating jacket.
46. Discard any remaining test fluid.
47. Remove the inlet pressure assembly, inlet cell cap assembly, and piston.
48. Clean and dry the entire cell assembly and receiver.

Preparation

1. Plug the heating jacket into an appropriate power source. Place a thermometer (#154-20) into the heating well and preheat to 10°F (6°C) above the test temperature. A pilot light will turn on when the heating jacket reaches the temperature set by the control knob.
2. LCM tests typically use slotted filter disks for the filter medium. These disks are made from 316 stainless steel and include either 1 or 3 slots.

3 Slots

#170-53-46	5000 Micron
#170-53-43	4000 Micron
#170-53-42	3000 Micron
#170-53-47	2000 Micron
#170-53-48	1500 Micron
#170-53-49	1250 Micron
#170-53-50	1000 Micron
#170-53-57	800 Micron
#170-53-51	600 Micron
#170-53-52	500 Micron
#170-53-56	400 Micron
#170-53-53	300 Micron
#170-53-54	200 Micron
#170-53-55	100 Micron

Single Slot

#170-53-60-200	200 Micron
#170-53-60-300	300 Micron
#170-53-60-400	400 Micron
#170-53-60-500	500 Micron
#170-53-60-600	600 Micron
#170-53-60-750	750 Micron
#170-53-60-800	800 Micron
#170-53-60-1000	1000 Micron
#170-53-60-1250	1250 Micron
#170-53-60-2000	2000 Micron
#170-53-60-3000	3000 Micron
#170-53-60-4000	4000 Micron
#170-53-60-5000	5000 Micron

3. PPT tests typically use ceramic filter disks for the filter medium. Before using the ceramic disk, soak it for at least 10 minutes in base fluid.

#170-55	775 milli-darcy, 10 micron
#170-53-2	850 milli-darcy, 12 micron
#170-53-3	3 darcy, 20 micron
#170-51	8 darcy, 40 micron
#170-53	15 darcy, 50 micron
#170-53-1	20 darcy, 55 micron
#170-53-4	40 darcy, 120 micron

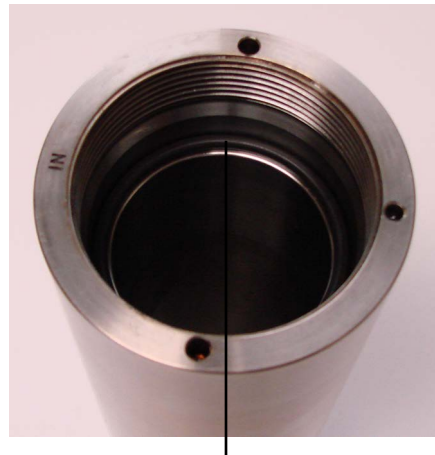
Cell Assembly



Note

1. Carefully inspect all o-rings. Replace any that show signs of damage or wear.
2. Place a thin film of grease on all o-rings.

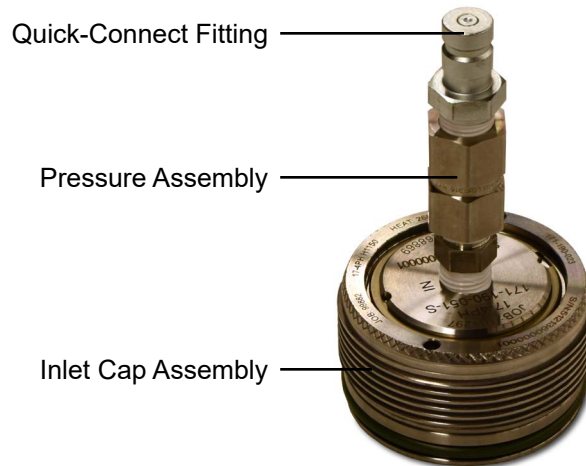
Replace all o-rings after any test above 350°F (176.6°C).
3. If the cell caps are not already assembled, refer to page 21 for assembly instructions.
4. Set the cell body on the stand with the end marked "IN" pointing up. Place an o-ring (#170-13-3) on the shoulder inside the cell body and one in the groove around the cell cap.



O-ring

5. Apply anti seize compound to the threads of the cell caps.
6. Screw the inlet cell cap assembly into the cell body.
7. Push in the red knob on the heating jacket. This moves the cell rest plunger into position to support the cell.
8. Place the cell into the heating jacket with the inlet side pointing down.
9. Pull out the red knob on the heating jacket and carefully lower the cell. Rotate the cell until it seats.
10. Move the thermometer to the cell body.

11. Screw the inlet pressure assembly into the inlet cap and tighten it completely.

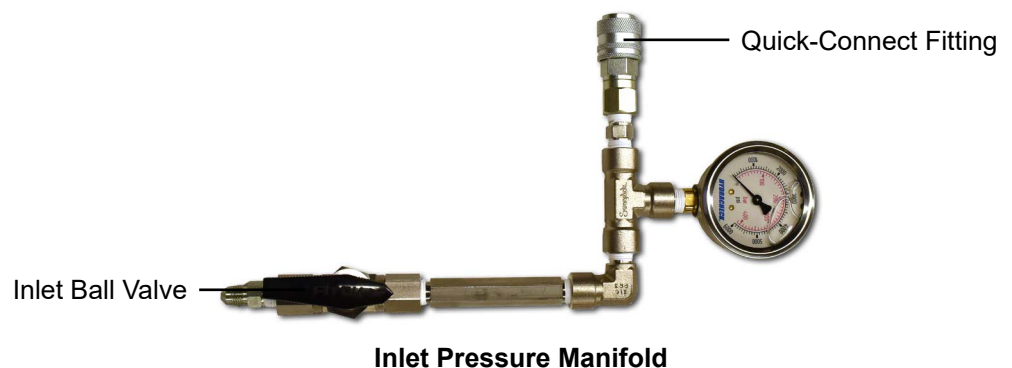


12. If the piston is not already assembled, refer to page 22 for assembly instructions. The set screw on the piston bleeder valve should be loose.
13. Place two o-rings (#171-99) into the grooves around the piston.
14. Screw the T-handle into the piston.
15. Push the piston inside the cell against the inlet cell cap.
16. Tighten the set screw on the piston bleeder valve completely.
17. Connect the inlet pressure manifold to the inlet pressure assembly.



Note

Make sure the quick-connect fittings are completely engaged. Pull down hard on the ring on the female fitting until it clicks into place.



18. Open the inlet ball valve.
19. Close the pressure release valve on the pump by tightening it clockwise.
20. Prepare the test fluid.
21. For LCM testing:
 - a. Carefully pour no more than 250 mL of test fluid into the test cell.
 - b. Stroke the pump until the top of the fluid is level with the o-ring shoulder.
22. For PPT testing:
 - a. Stroke the pump until the T-handle on the piston rises approximately 1½" (3.8 cm).

It may be helpful to set a ruler on the o-ring shoulder inside the cell. This will help you see how far the T-handle has risen.
 - b. Carefully pour the test fluid into the cell. The fluid level should be just below the o-ring shoulder.
23. Be careful not to get fluid on the o-ring shoulder.
24. Unscrew the T-handle from the piston.
25. Place an o-ring on the shoulder inside the cell body.
26. Place a ceramic disk or slotted filter disk on top of the o-ring.
27. Screw the outlet cell cap assembly into the cell body and tighten it completely.



Tip



Important



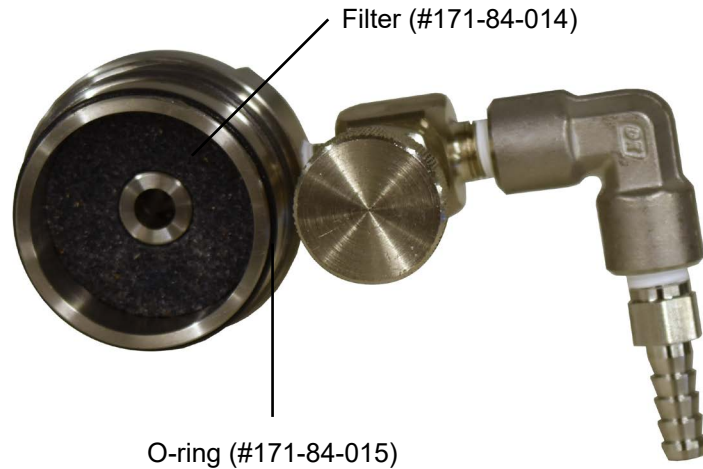
**Outlet Cap for
PPT Receiver**



Outlet Cap for LCM Receiver

28. For LCM tests:

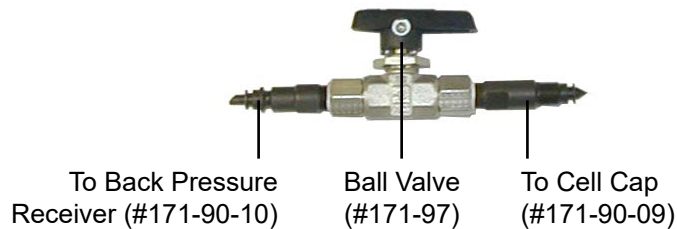
- a. Connect the LCM Receiver bottom cap assembly to the outlet cell cap assembly. Make sure the filter is in place inside the receiver bottom cap.



- b. The space between the filter media and the receiver bottom cap should be filled with water to ensure that the volume of filtrate passing through the filter will displace an equal volume of filtrate into the receiver.
 - i. Pour enough water into the hole in the LCM Receiver bottom cap to fill the void space.
 - ii. Open the needle valve and allow the excess water to drain.
 - iii. Close the need valve.
- c. Apply a thin coat of grease to the receiver cap o-rings (#171-84-015).
- d. Place one o-ring around each receiver cap.
- e. Screw the top cap into one end of the cell body (the ends of the body are interchangeable).
- f. Screw the receiver body onto the bottom receiver cap.
- g. Screw a valve stem into the port in the top receiver cap.
- h. Attached the CO₂ Pressure Assembly (#170-04) to the top valve stem and secure it with the safety pin (#171-23-1).

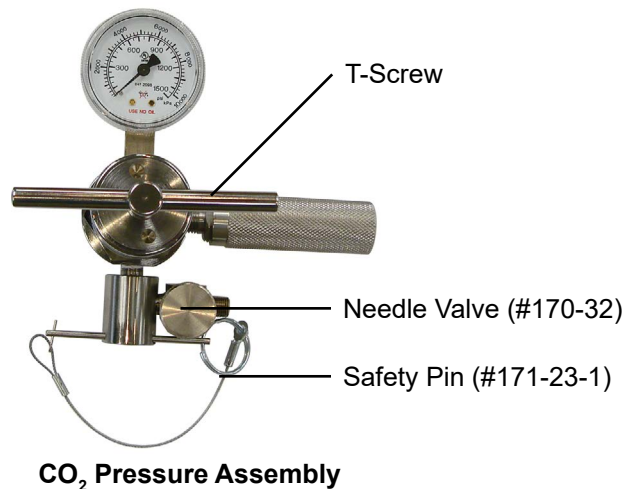
29. For PPT tests:

- a. The space between the filter medium and the ball valve on the outlet valve stem assembly should be filled with base fluid prior to starting the test. This will ensure that the volume of filtrate passing through the filter will displace an equal volume of filtrate into the receiver.
 - i. Close the ball valve on the outlet valve stem assembly.
 - ii. Using a syringe, inject base fluid into the valve stem that connects to the cell cap. Make sure the valve stem is completely filled.
- b. Screw the outlet valve stem assembly into the outlet cap and tighten it completely. Then loosen it ¼ turn. Make sure the ball valve is closed.



**Outlet Valve Stem Assembly
(#171-83-1)**

- c. Place the back pressure receiver onto the outlet valve stem assembly and lock it in place with the safety pin.
- d. Attach the CO₂ pressure assembly to the valve stem on the back pressure receiver and secure it in place with the safety pin.



Testing

Starting a Test



Note

1. Unscrew the T-screw on the CO₂ pressure assembly to make sure the regulator is completely closed.
2. Place a CO₂ bulb in the barrel and screw it onto the pressure assembly. This will puncture the CO₂ bulb.
3. Turn the T-screw clockwise to set the back pressure. Refer to the chart below to determine the minimum recommended back pressure for your test temperature.
4. Unscrew on the LCM top cap ¼ turn.
5. Stroke the pump to apply the same pressure to the cell.

Make sure the pressure release valve on the pump is closed and the ball valve on the inlet manifold is open.



Note

If the LCM fails to plug the filter media, it is unlikely the pressure in the cell will build. If the cell pressure has not increased after approximately 20 strokes of the pump, stop the test and record the results as "Total Fluid Loss".

Throughout the test, use the pump to maintain the pressure differential.

Recommended Minimum Back Pressure

Test Temperature		Vapor Pressure		Minimum Back Pressure	
°F	°C	psi	kPa	psi	kPa
200-299	95-149	12.1-67	84-462	100	700
300-374	150-189	67-184	462-1269	200	1400
375-399	190-199	184-247	1269-1704	275	1900
400-424*	200-219	247-326	1704-2245	350	2500
425-450*	220-230	326-422	2245-2912	450	3100

*For tests above 400°F, use Viton 90D o-rings.

6. Periodically check the thermometer in the test cell and adjust the thermostat as needed.

While the cell is heating, the pressure inside will rise due to thermal expansion. Use the pressure release valve on the pump to prevent over-pressurization. Maintain the pressure on the fluid until the temperature has stabilized. The heating time of the sample should **never exceed one hour**.

7. When the cell has been heating for one full hour, stroke the pump to apply the working test pressure to the cell. For PPT tests, open the ball valve in the outlet valve stem assembly to initiate filtration.



Important



Tip

8. To collect filtrate, hold a graduated cylinder up to the outlet port on the receiver and slowly open the needle valve. Close the valve as soon as you have collected the filtrate.

Collect filtrate 15 seconds after initiating filtration to ensure there is filtration control.

Continue collecting filtrate throughout the test. At a minimum, filtrate should be collected at 15 seconds, 7.5 minutes, and 30 minutes.

If the back pressure rises during the test, collect some filtrate and leave the valve open long enough to reduce the pressure.

Ending a Test

1. After 30 minutes, close the outlet port on the receiver and turn off the heating jacket.
2. Allow the cell to cool to room temperature before disassembling it.
3. After the cell has cooled, slowly open the pressure release valve on the pump. This will release pressure in the cell and allow hydraulic oil to flow back into the pump.
4. Open the outlet port on the receiver to collect any remaining filtrate.
5. Close the regulator on the CO₂ pressure assembly and release any remaining pressure by opening the safety bleeder valve.
6. Close the valve stem on the LCM top cap.
7. Remove the CO₂ pressure assembly from the receiver.
8. Remove the receiver from the outlet cell cap.
9. Unscrew and remove the outlet cell cap assembly.
10. Remove the ceramic disk or slotted disk and save the filter cake for analysis. Discard any remaining test fluid.

If the ceramic disk does not easily come out of the cell:

- a. Close the pressure relief valve on the pump.
- b. Stroke the pump until the pressure pushes the ceramic disk out of the cell.
- c. Then re-open the pressure relief valve on the pump.



11. Screw the T-handle into the piston on the outlet side.
12. Manually push the piston to the bottom of the cell. This will force any remaining hydraulic fluid back into the pump.
13. Disconnect the inlet pressure manifold from the inlet pressure assembly (quick connect fitting).

A small amount of hydraulic oil may be released.
14. Remove the cell from the heating jacket and discard any remaining test fluid.
15. Remove the inlet pressure assembly, cell cap assembly, and piston. Be aware that some hydraulic fluid will remain in the cell.
16. Clean and dry the entire cell and receiver assemblies. Pay close attention to the threads. Also make sure to clean the outlet valve assembly. Inspect all o-rings and replace any that show signs of damage or wear.

Data

Filtrate Volume

The HTHP filter press has a filtration area of 3.55 in² (22.9 cm²). This is half the area of a standard filtration test, which is 7.1 in² (45.8 cm²). To compare the results of this test to a standard filtration test, double the total filtrate volume collected.

$$V_F = 2 (V_{30})$$

Where:

V_F = Standard Filtrate Volume (mL)

$V_{7.5}$ = Filtrate volume collected after 7.5 minutes

Spurt Loss (Optional):

Spurt Loss is the amount of filtrate collected before the filter cake has had a chance to form and is expressed in millimeters. To calculate the spurt loss, use the following equation:

$$V_1 = 2 [V_{7.5} - (V_{30} - V_{7.5})] = 2 (2V_{7.5} - V_{30}) = 4V_{7.5} - 2V_{30}$$

Where:

V_1 = Spurt Loss

$V_{7.5}$ = Filtrate volume collected after 7.5 minutes

V_{30} = Filtrate volume collected after 30 minutes

Filter Cake

Wash the filter cake on the paper with a gentle stream of water. Measure and report the thickness of the filter cake to the nearest 1/32 in (0.8 mm). A ruler with the "zero mark" at the very edge of the ruler is useful here. Cake descriptions may be subjective and such notations such as hard, soft, rubbery, and fine, etc. convey adequate information on cake quality.

Cell Cap Assembly

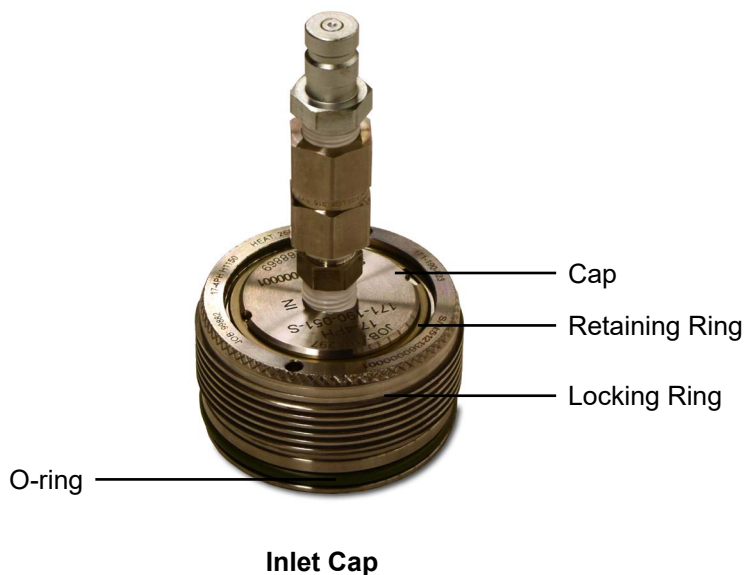


Tip

This Permeability Plugging Tester is supplied with three cell caps.

- #171-190-031-2S: Inlet Cap
 - #171-190-034-S: Outlet Cap with pressure port for standard valve stem
 - #171-190-034-S: Outlet Cap with larger port for LCM Receiver
1. Place the locking ring (#171-190-023) around the cap.
 2. Place the retaining ring (#130-81-040) into the groove around the outside of the cap. Make sure it engages completely around the circle.

The cap should turn freely inside the locking ring.



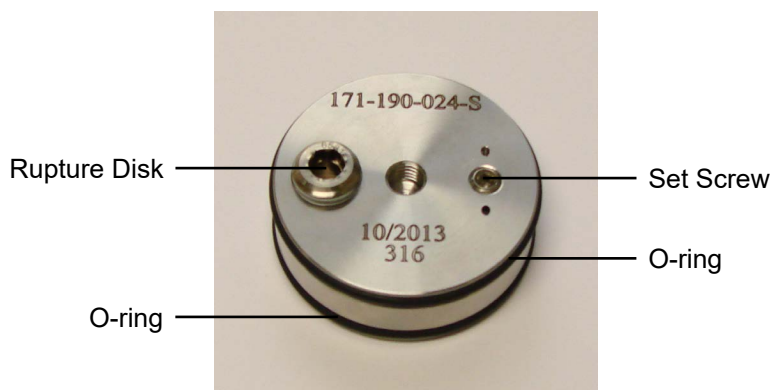
**Outlet Cap for
PPT Receiver**



Outlet Cap for LCM Receiver

Piston Assembly

1. Place a rupture disk o-ring (#120-910-028) into the rupture disk port.
2. Screw the rupture disk into the port.
3. Place an o-ring (#700-100-096) into the bleed port.
4. Screw the set screw (#171-190-039) into the bleed port. Unscrew it one full turn.
5. Place two o-rings (#171-900-025) in the o-ring grooves around the outside of the piston.



Maintenance



Note

1. Thoroughly clean and dry all components with water and soap (or appropriate solvent).
2. Periodically check the cell assembly for leaks. Pressurize the cell and immerse it in water. Look for bubbles.
3. Power Cord
 - a. Check the power cord for insulation wear and loose connections near the heating jacket and plug.
 - b. Place the heating jacket no farther from the electrical outlet than the length of the power cord.
 - c. Keep the power cord away from the hot surface of the heating jacket.

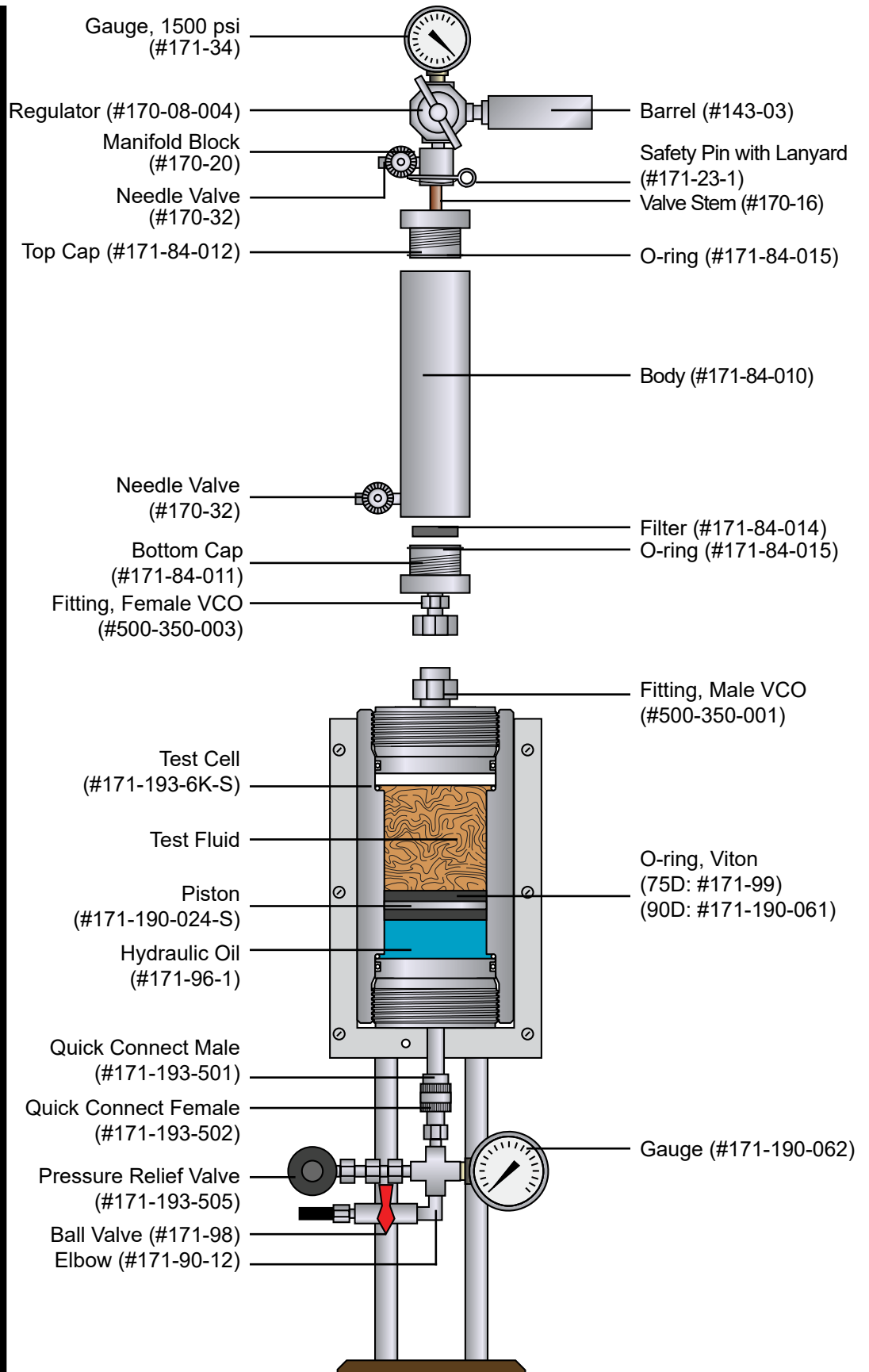
Installing wiring, power cords, or electrical connectors will void the warranty.

Regulator Maintenance and Troubleshooting

Symptoms	Cause: Resolution
Gas leak at the regulator outlet when the adjusting screw is loosened fully counterclockwise	Seat leak or *creep: Replace the regulator
Outlet pressure increases while downstream valves are closed	Seat leak or *creep: Replace the regulator
Gas leak from the spring housing case	Diaphragm failure: Replace the regulator
Excess drop in outlet pressure with the regulator flow open	Blocked seat assembly or inlet filter: Replace the regulator
Gas leak from any pipe thread joint	Loose fitting: Remove the connection. Clean the affected surfaces. Reapply Teflon tape and tighten.
Gas leak from relief valve	Faulty relief valve: replace the valve. Seat leak or *creep: Replace the regulator
Inconsistent repeat readings	Seat sticking: Replace the regulator. Bad pressure gauge: Replace the gauge.
Gauge does not return to zero with no pressure applied to the regulator.	Gauge has physical damage: Replace the gauge.
*Creep is an increase in outlet pressure that occurs when pressure escapes even when the valve is closed. Regulator seats can be compromised by particles in the process stream which can cause minor imperfections in the sealing surface. The high flow and small orifice created during pressure regulation combine to turn a very small particle into a fast projectile. This projectile can nick the sealing surface of the seat and cause leaks. Filtering particulates from the process stream should be a high priority, and a small filter can reduce the potential for creep and increase the life expectancy and accuracy of the regulator.	

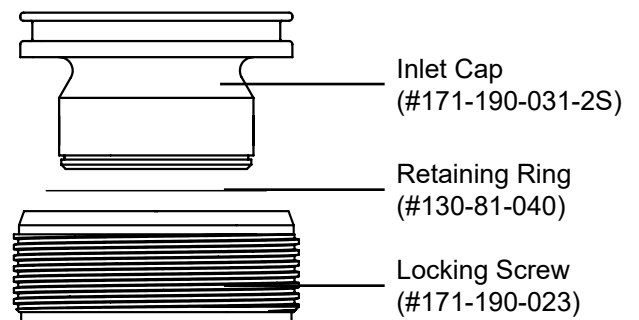
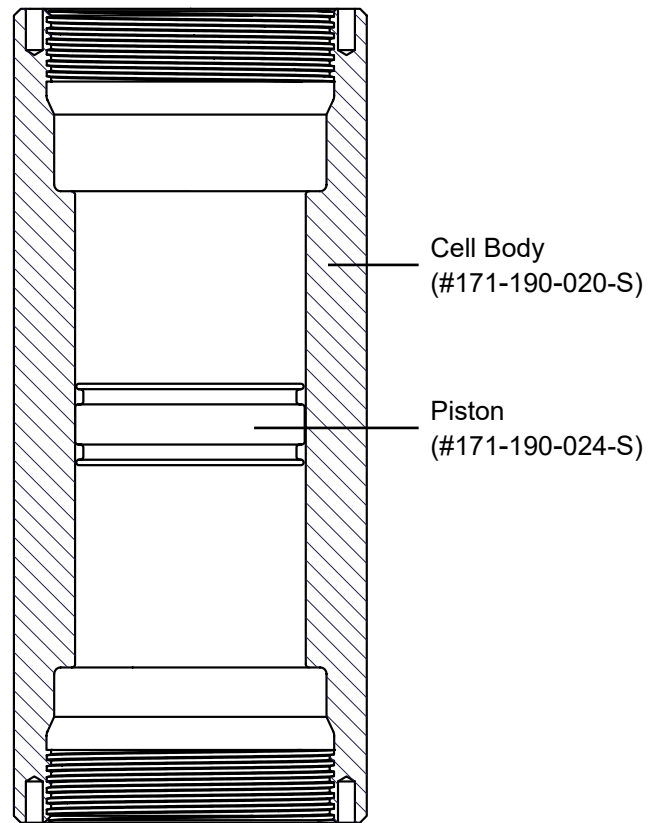
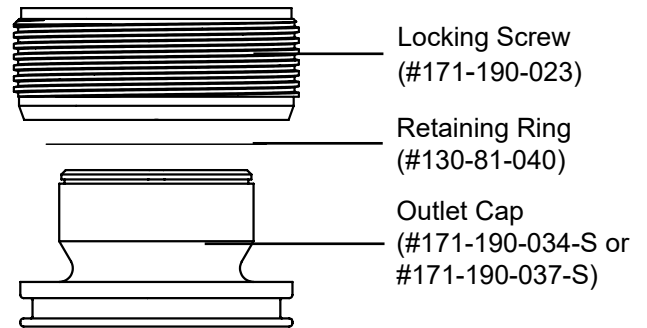
Diagrams

Permeability Plugging Tester



Diagrams

Test Cell



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.