



Permeability Plugging Tester, 10 ksi

#171-84-10K - 115 Volt
#171-84-10K-1 - 230 Volt

Instruction Manual

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Ver. 7

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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 10,000 psi.

Description

All of the end caps are designed to accept the standard valve stem. The inlet, or bottom, valve stem is fitted with a quick-connect for the connection to the hydraulic pressure manifold. The standard hydraulic pressure manifolds are equipped with a 10,300 psi (71 MPa) relief valve. The outlet, or upper, valve stem assembly consists of a dual valve stem with a valve in the middle, which facilitates the opening and closing of the outlet flow.

The 100 mL back pressure receiver is mounted on top of the heating jacket and upside down, when compared to the normal HTHP filter press configuration. It attaches to the cell outlet valve stem and is secured with the safety pin (#171-23-1). The fittings on the receiver are reversed with the pressure inlet on the small end (the upper end).

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: 10,000 psi (69 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
#170-04	CO ₂ Pressure Unit
#170-17	O-ring for Valve Stem, Viton, Qty: 6
#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	Back Pressure Receiver, 100 mL (Modified)
#171-23-1	Safety Pin with Lanyard
#171-90-15	Adjustable Crescent Wrench, 6"

#171-84-10K-I

Test Cell

#120-910-028	O-ring for Rupture Disk, Viton, 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, Qty: 4
#170-17	O-ring for Valve Stem, Viton, Qty: 4
#170-53	Ceramic Filter Disk, 15 D, 50 µm
#171-190-020-I	Cell Body
#171-190-023	Locking Ring, Qty: 2
#171-190-024-S	Piston
#171-190-031-2S	Cell Cap for Mud Testing, Inlet
#171-190-034-S	Cell Cap for Ceramic Disks, Outlet
#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, -006, VW155, 90D, Green
#171-190-057	O-ring for Valve Stem, Viton 90D, Qty: 4
#171-190-058	O-ring for Rupture Disk, Viton 90D, Qty: 2
#171-190-060	O-ring for Cell, Viton 90D, Qty: 4
#171-190-061	O-Ring, -327, VW155, 90D, Green, Qty: 2
#171-193-501-1	Fitting, Quick Connect, Male
#171-193-504-1	Plug, Rupture, 10,000 psi, Qty: 2
#171-193-504-2	Plug, Rupture, 14,500 psi, Qty: 2
#171-193-6K-501	Adjustable Spanner Wrench
#171-83-2	Valve Stem Assembly, Outlet
#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, Female VCO
#500-SS-4-HCG	Hex Coupling, ¼" FNPT
#700-100-096	O-ring for Piston Bleed Port

Inlet Pressuring:

#120-50-056-2	Fitting, Adapter, F250C to 3/8" MNPT
#171-190-062-1	Gauge, 2.5", 0 - 15000 psi
#171-193-104-201	Pump Mounting Plate
#171-193-104-512	U Bolt, 3", Stainless Steel, Qty: 2
#171-193-501-1	Fitting, Quick Connect, Male
#171-193-502-1	Fitting, Quick Connect, Female
#171-193-506-1	Pressure Relief Valve, 10,300 psi
#171-193-520	Fitting, Hex Nipple, 1/4" NPT
#171-193-521	Fitting, Tee, 1/4" NPT
#171-193-522	Fitting, Adapter, 3/8" MNPT, 1/4" MNPT
#171-193-523	Fitting, Tee, 3/8" NPT
#171-193-524	Fitting, Elbow, 3/8" NPT
#171-193-525	Fitting, Nipple, 3/8" MNPT, Qty: 2
#171-27-2	Hose, 10 ksi, 1/4" Stainless Steel MNPT, 6 Feet
#171-44	Rubber Foot, Qty: 7
#171-96-1	Hydraulic Oil, 1 Quart
#171-96-5	Hand Pump
#171-98-1	Ball Valve, 1/4" FNPT

Optional:

#170-33	Cell Cap Removal Tool
#170-40	Carrying Tool for HTHP Cell
#170-91	HTHP Pressure Relief Tool
#171-06	Safety Shield

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 valve stems 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 15 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 (10,000 psi / 69 MPa) is marked on the cell body and cap. Never exceed this pressure.

Due to the high pressures involved in this test, we recommend using a safety shield (#171-06) to protect people and equipment during testing.



Tip

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.

The Safety Pin includes an attached lanyard. The lanyard secures the pin and prevents it from accidentally disengaging from the valve stem and pressure assembly. Always secure the pin with the lanyard.



Retainer Pin with Lanyard



Safety Retainer Pin with Lanyard
(# 171-23-1)

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:

- a. Attempting to disconnect the pressure hose from the cell at the quick-connect.
- b. Attempting to remove the cell from the heating jacket.
- c. Reallocating or moving the PPT in the laboratory.
- d. Refilling the hydraulic pump.
- e. 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.

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.

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. Soak a ceramic disk in base fluid for at least 10 minutes before testing.
4. Inspect all o-rings. Replace any that show signs of damage or wear.
5. Make sure all threads are clean and free of debris.
6. Apply grease to all o-rings.
7. Assemble both cell caps and the piston. Place o-rings in the grooves around the cap and piston.
8. Place an o-ring on the shoulder inside the cell on the end marked "IN".
9. Apply anti seize compound (#165-44-2) to the threads of the cell locking rings and valve stems.
10. Screw the inlet cell cap into the cell body and tighten it completely.
11. Push in the red knob on the heating jacket. Place the cell in the heating jacket with the inlet side pointing down.
12. Screw the inlet pressure assembly into the inlet cell cap.
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. Open the inlet valve stem assembly by turning it one half turn counterclockwise.
18. Stroke the pump until the t-handle rises about 1.5" (3.8 cm).
19. Unscrew the t-handle from the piston.
20. Pour the test fluid into the cell all the way up to the o-ring shoulder.
21. Place an o-ring on the shoulder inside the cell body.

22. Place a ceramic disk on top of the o-ring.
23. Screw the outlet cell cap into the cell body.
24. Screw the outlet valve stem assembly into the outlet cell cap and tighten it completely. Then loosen it $\frac{1}{4}$ turn.
25. Fill the outlet valve stem assembly with base fluid.
26. Pull out the red knob on the heating jacket and lower the cell. Rotate the cell until it seats.
27. Move the thermometer to the cell body.
28. Place the back pressure receiver onto the outlet valve stem assembly and lock it in place with the safety pin.
29. Attach the CO₂ pressure assembly to the valve stem on the back pressure receiver and secure it in place with the safety pin.
30. Place a CO₂ bulb in the CO₂ pressure assembly. Set the pressure to the appropriate back pressure for your test.
31. Stroke the pump to apply the same pressure to the cell.
32. When the cell has reached the test temperature, stroke the pump to apply the working test pressure to the cell.
33. Open the outlet ball valve to initiate filtration.
34. Collect filtrate by opening the needle valve on the back pressure receiver.
35. At the end of the test, turn off the heating jacket.
36. Allow the cell to cool.
37. Open the pressure release valve on the pump to release pressure inside the cell.
38. Open the outlet port on the receiver to collect any remaining filtrate.
39. Close the regulator on the CO₂ pressure assembly.
40. Remove the CO₂ pressure assembly from the receiver.
41. Remove the receiver from the outlet cell cap.
42. Remove the outlet cell cap assembly.

43. Remove the ceramic disk and save the filter cake for later analysis.
44. Screw the t-handle into the piston and push the piston to the bottom of the cell.
45. Close the pressure release valve on the pump and the ball valve on the pressure manifold.
46. Disconnect the inlet pressure manifold from the inlet pressure assembly.
47. Remove the cell from the heating jacket.
48. Discard any remaining test fluid.
49. Remove the inlet pressure assembly, inlet cell cap assembly, and piston.
50. 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 come on when the heating jacket reaches the temperature set by the control knob.
2. Before using the ceramic disk, soak it for at least 10 minutes in base fluid. Use water for freshwater-based fluids, brine for saltwater-based fluids, diesel for oil-based fluids, and a synthetic base for synthetic-based fluids. Never reuse a disk except for return permeability studies. Below is a list of ceramic disks available:

#170-55	Ceramic Filter Disk, 775 milli-darcy, 10 micron, 2½" × ¼"
#170-53-2	Ceramic Filter Disk, 850 milli-darcy, 12 micron, 2½" × ¼"
#170-53-3	Ceramic Filter Disk, 3 darcy, 20 micron, 2½" × ¼"
#170-51	Ceramic Filter Disk, 8 darcy, 40 micron, 2½" × ¼"
#170-53	Ceramic Filter Disk, 15 darcy, 50 micron, 2½" × ¼"
#170-53-1	Ceramic Filter Disk, 20 darcy, 55 micron, 2½" × ¼"
#170-53-4	Ceramic Filter Disk, 40 darcy, 120 micron, 2½" × ¼"

Cell Assembly



Note

1. Carefully inspect all o-rings. Replace any that show signs of damage or wear.
2. Place a thin film of silicone 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 19 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. Make sure all threads are clean and free of debris.
6. Apply anti seize compound (#165-44-2) to the threads of the cell caps and valve stems.
7. Screw the inlet cell cap into the cell body.



Note

The cell cap should turn smoothly in the threads and not require any tools for complete tightening. If you encounter resistance, carefully unscrew the cap and start over. Make sure the threads are properly seated before tightening completely.

8. Push in the red knob on the heating jacket. This moves the cell rest plunger into position to support the cell.
9. Place the cell into the heating jacket with the inlet side pointing down.
10. Pull out the red knob on the heating jacket and carefully lower the cell. Rotate the cell until it seats.
11. Move the thermometer to the cell body.

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

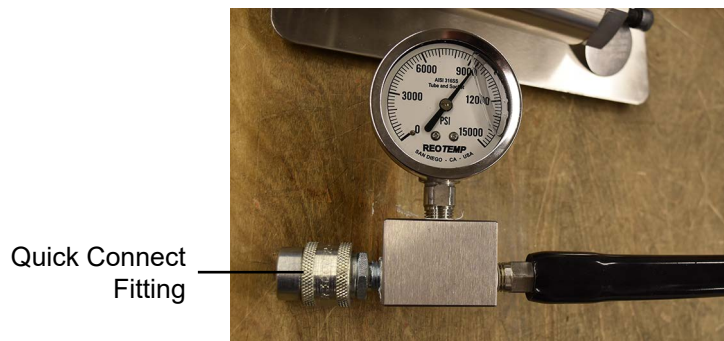


13. If the piston is not already assembled, refer to page 20 for assembly instructions. The set screw on the piston bleeder valve should be loose.
14. Place two o-rings (#171-99) into the grooves around the piston.
15. Screw the T-handle into the piston.
16. Push the piston inside the cell against the inlet cell cap.
17. Tighten the set screw on the piston bleeder valve completely.
18. 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.



Inlet Pressure Manifold

19. Open the inlet ball valve.
20. Close the pressure release valve on the pump by tightening it clockwise.



Tip

21. 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.

22. Unscrew the T-handle from the piston.

23. Prepare the test fluid.

24. Carefully pour the test fluid into the cell. The fluid level should be just below the o-ring shoulder.

Be careful not to get fluid on the o-ring shoulder.

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

26. Place a ceramic disk on top of the o-ring.

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

28. Screw the outlet valve stem assembly into the outlet cap and tighten it completely. Then loosen it ¼ turn.

29. 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.

- a. Open the ball valve on the outlet valve stem assembly.
- b. Using a syringe, inject base fluid into the outlet valve stem assembly. Make sure the assembly is completely filled.
- c. Close the ball valve.



Important



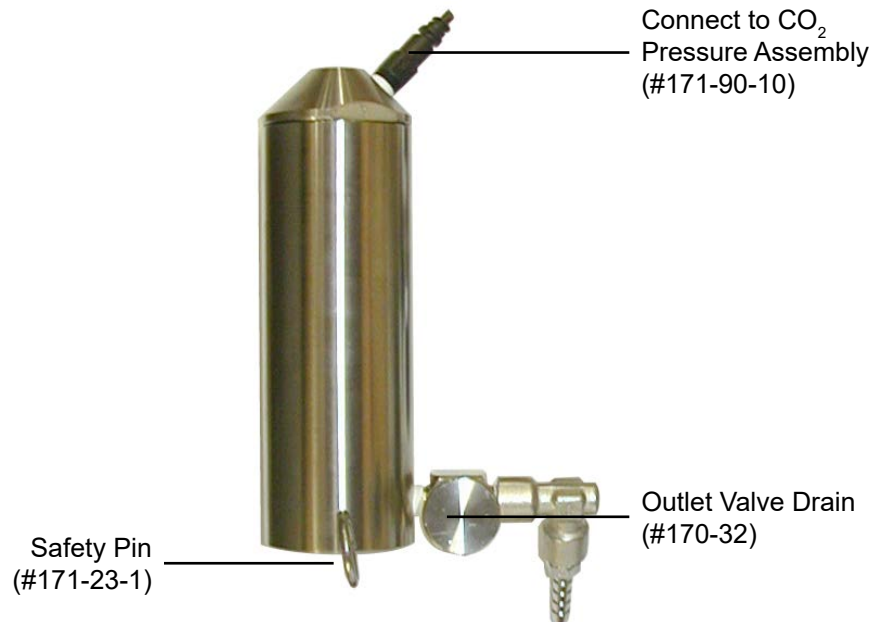
**Outlet Valve Stem Assembly
(#171-83-2)**



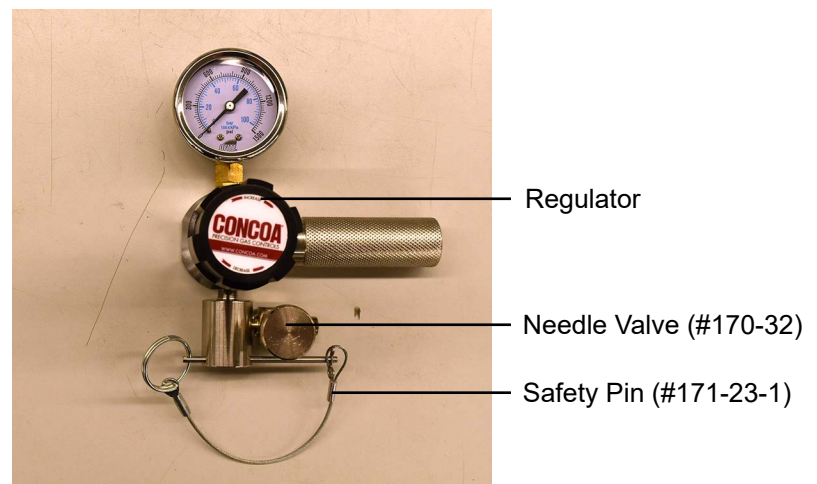
30. Place the back pressure receiver onto the outlet valve stem assembly and lock it in place with the safety pin and lanyard. The outlet drain valve on the receiver should be closed (clockwise).

Be careful to not rotate the valve assembly.

31. Attach the CO₂ pressure assembly to the valve stem on top of the back pressure receiver and lock it in place with the safety pin and lanyard.



Back Pressure Receiver



CO₂ Pressure Assembly

Testing

Starting a Test

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. Stroke the pump to apply the same pressure to the cell.



Note

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

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 Teflon o-rings.					

5. 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. If the pressure rises above the back pressure for the test, use the pressure release valve on the pump to relieve pressure. Maintain the pressure on the fluid until the temperature has stabilized. The heating time of the sample should **never exceed one hour**.

6. When the cell has been heating for one full hour, stroke the pump to apply the working test pressure to the cell.



Important



7. Open the outlet ball valve to initiate filtration.

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

8. To collect filtrate, hold a graduated cylinder up to the outlet port on the back pressure 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 ball valve 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.

Do not release pressure until the cell has cooled to room temperature.

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. Remove the CO₂ pressure assembly from the receiver.
7. Remove the receiver from the outlet cell cap.
8. Unscrew and remove the outlet cell cap assembly.
9. Remove the ceramic 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.
10. Screw the T-handle into the piston on the outlet side.
 11. Manually push the piston to the bottom of the cell. This will force any remaining hydraulic fluid back into the pump.
 12. Disconnect the inlet pressure manifold from the inlet pressure assembly (quick connect fitting).

A small amount of hydraulic oil may be released.
 13. Remove the cell from the heating jacket and discard any remaining test fluid.
 14. Remove the inlet pressure assembly, cell cap assembly, and piston. Be aware that some hydraulic fluid will remain in the cell.
 15. 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

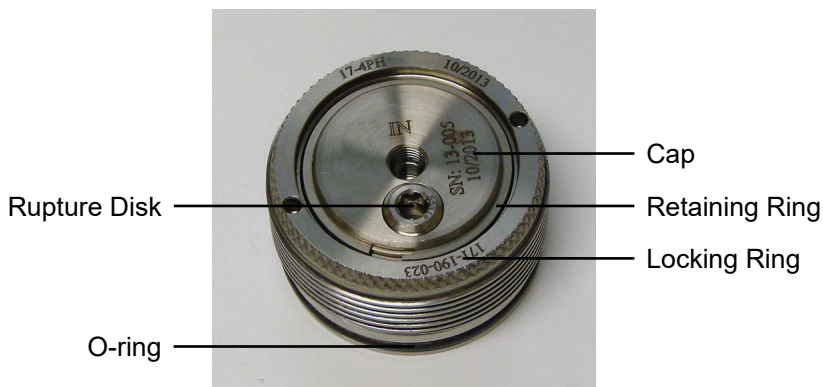
Wash the filter cake on the paper with a gentle stream of water. Measure and report the thickness of the filter cake to the nearest 1/32 in (0.8 mm). A ruler with the "zero mark" at the very edge of the ruler is useful here. Cake descriptions may be subjective and such notations such as hard, soft, rubbery,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

Cell Cap Assembly



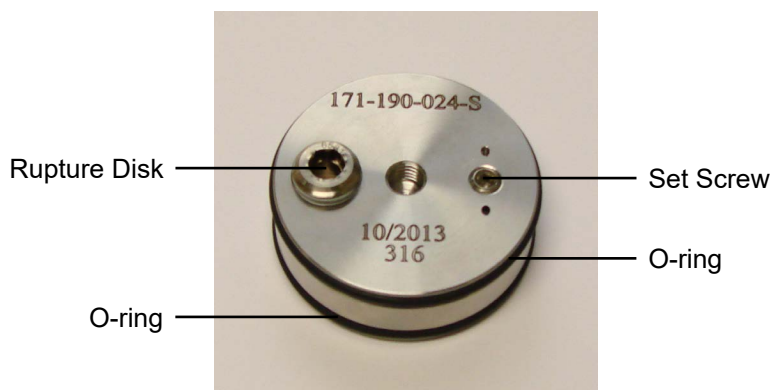
Tip

1. Choose the appropriate cap for your test:
 - 171-190-030-S - Outlet, for Filter Paper
 - 171-190-031-S - Inlet, for Mud
 - 171-190-032-S - Outlet, for Cement
 - 171-190-033-S - Inlet, for Cement
 - 171-190-034-S - Outlet, for Ceramic Disks
 - 171-190-037-S - Outlet, for LCM Receiver
 2. Place the locking ring (#171-190-023) around the cap.
 3. 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.
4. Place an o-ring in the port in the cap. Wrap a rupture disk (#171-193-504-2) with nickel anti-seize tape (#171-190-040) and screw it into the port.



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 (#171-99) in the o-ring grooves around the outside of the piston.



Maintenance



Note

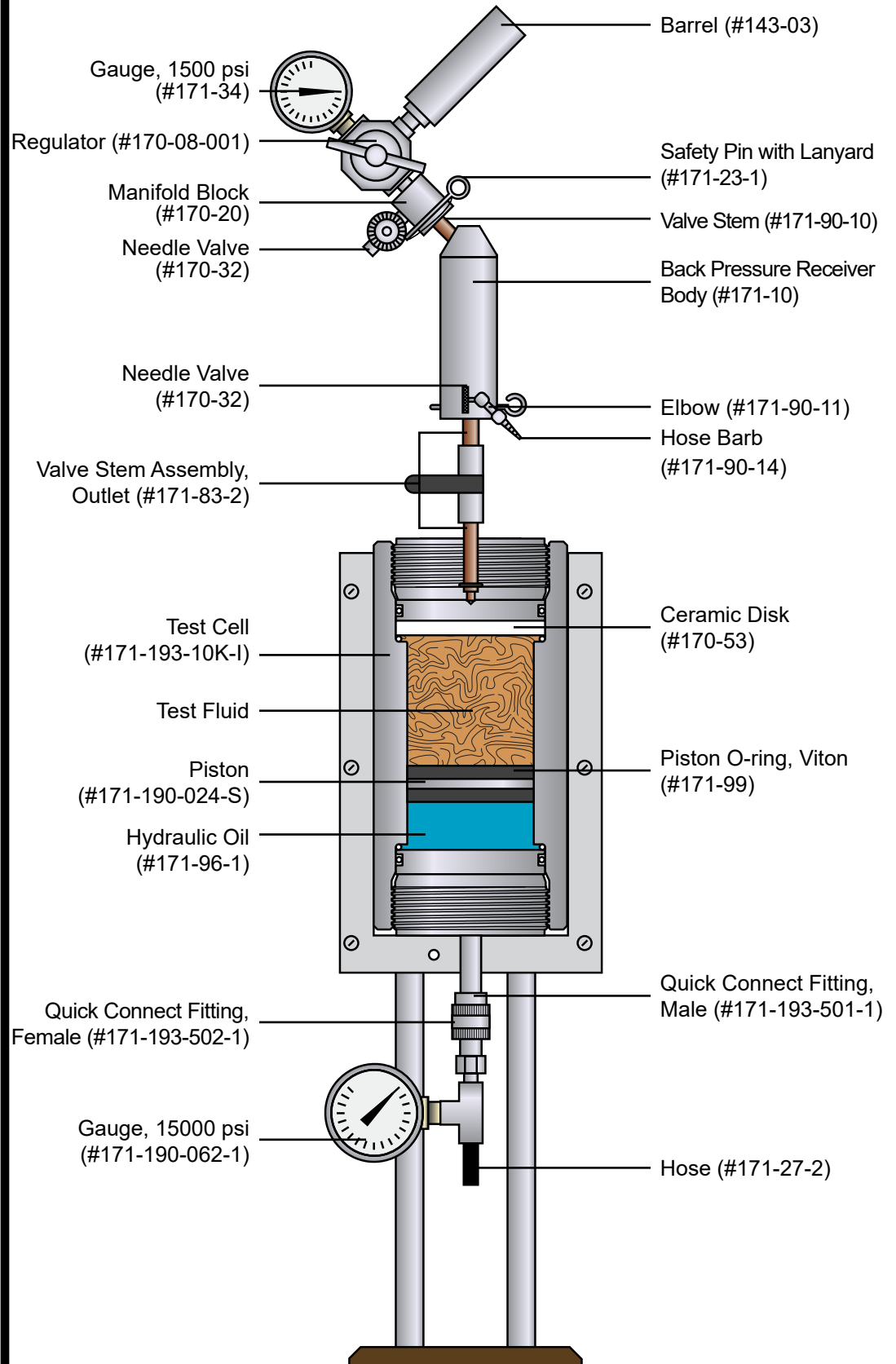
1. Thoroughly clean and dry all components with water and soap (or appropriate solvent).
 2. Periodically check the cell assembly for leaks. Pressurize the cell and immerse it in water. Look for bubbles.
 3. Power Cord
 - a. Check the power cord for insulation wear and loose connections near the heating jacket and plug.
 - b. Place the heating jacket no farther from the heating jacket 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: Repair the regulator
Outlet pressure increases while downstream valves are closed	Seat leak or *creep: Repair the regulator
Gas leak from the spring housing case	Diaphragm failure: Repair the regulator
Excess drop in outlet pressure with the regulator flow open	Blocked seat assembly or inlet filter: Repair 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: Repair the regulator
Inconsistent repeat readings	Seat sticking: Repair 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.	

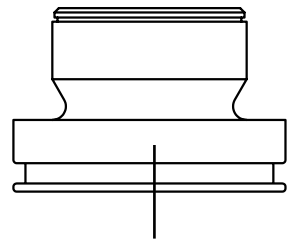
Diagrams

Permeability Plugging Tester

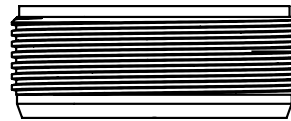


Diagrams

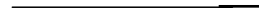
Test Cell



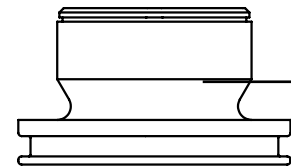
Outlet Cap for Filter Paper
(#171-190-030-S)



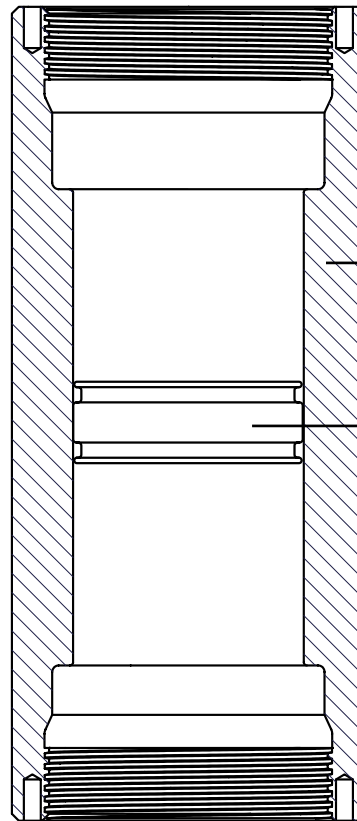
Locking Screw
(#171-190-023)



Retaining Ring
(#130-81-040)

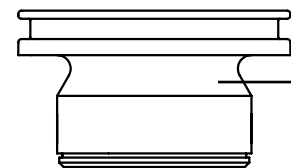


Outlet Cap
(#171-190-034-S or
#171-190-037-S)

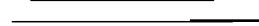


Cell Body
(#171-190-020-I)

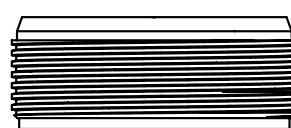
Piston
(#171-190-024-S)



Inlet Cap for Mud
(#171-190-031-2S)



Retaining Ring
(#130-81-040)



Locking Screw
(#171-190-023)

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.