Dependable Products From People You Trust

Permeability Plugging Tester - P.P.T.

4,000 PSI (27,600 kPa) - 500°F (260°C)

Part No. 171-84 (115V)
Part No. 171-84-01 (230V)

Instruction Manual

Updated 1/4/2017
Ver. 3.0

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Table of Contents

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 permeable 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. The conventional cell may be operated to 2,000 PSI by using hardened steel set screws to secure the cell cap. For elevated pressure, OFITE has designed a special cell with a working pressure of up to 4,000 PSI, pressurized with the conventional hydraulic pump. The cell is pressurized with hydraulic oil and a floating piston separates the oil from the test fluid within the cell.

Description

The cell is furnished with a threaded cell inlet cap, a floating piston, and a threaded scribed outlet cap for the ceramic filter disks. The outlet end of the cell has a ¼" (6.35 mm) deeper recess than a standard cell to allow for the ceramic disk as a filter medium. The end cap used with the ¼" (6.35 mm) disk has a scribed concentric pattern rather than the conventional screen. Filter paper or other thin filter medium may be used with this cap by using the spacer ring (#170-72) to fill the extra ¼" (6.35 mm) space. Also, an extra thick end cap with a standard screen backup is furnished to use with thin filter media - paper or metal.

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 4,000 PSI (27,600 kPa) relief valve. The outlet, or upper, valve stem assembly consists of a dual valve stem with a ball valve in the middle, which facilitates the opening and closing of the outlet flow. Power consumption for the PPT heating jacket is 800 watts.

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). A flare fitting may be provided if it is desired to use the low-pressure side of a dual manifold on a nitrogen bottle instead of the standard CO_2 cartridges.

Specifications

- Weight: 61 lbs. (27.7 kg)
- Dimensions: 15" × 25" × 42" (38.1 × 63.5 × 106.7 cm)
- Shipping Weight: 90 lbs. (40.8 kg)
- Shipping Dimensions: 30" × 18" × 17" (76.2 × 45.7 × 43.2 cm)
- 800W Heater
- 316 Stainless Steel Test Cell
- Maximum Temperature: 500°F (260°C)
- Maximum Pressure: 4,000 PSI (27,600 kPa)

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
#170-19	Filter Paper, 2.5" (6.35 cm), Grade #50, Box of 100
#170-53	Ceramic Filter Disk, 15 D, 50 µm
#171-23-1	Safety Pin with Lanyard

Heating Jacket:

#164-32	Male Connector for Power Cable (230 Volt Only)
#171-00	Heating Jacket, 800 Watt (115 Volt Only)
#171-01	Heating Jacket, 800 Watt (230 Volt Only)
#171-82	Power Cord (115 Volt Only)
#171-87	Location Pin

Test Cell:

#153-55	Grease, High Vacuum, 150 g Tube
#170-72	Spacer for Filter Paper, ¼"
#171-84-03	Strap Wrench
#171-85	Cell Assembly, 500 mL, Double Cap, Complete
#171-85-002	Cell Cap, Inlet
#171-86-1	Cell Body
#171-88-1	Cell Cap, Outlet, Scribed
#171-88-2	Cell Cap with Screen, Outlet, Scribed
#171-93	Piston
#171-95	T-handle for Piston

Inlet Pressuring:

#171-27	Hose, #5000, 6 Feet
#171-41	Gauge, 5000 PSI, 2½" Face, ¼" Bottom Connection
#171-84-02	Reducing Bushing, ⅛" MNPT × ⅛" FNPT
#171-90-02	Quick Coupler, Female
#171-90-03	Quick Coupler, Male
#171-90-04	Cross, ¼" NPT
#171-90-06	Reducing Bushing, ¼" MNPT × ⅛" FNPT
#171-90-07	Hex Nipple
#171-90-08	Valve Stem, Hydraulics Entry
#171-90-11	Elbow, Female, ⅛" NPT
#171-90-12	Elbow, Male, ¼" NPT
#171-90-13	Adapter, ¼" Flare × ¼" Male NPT
#171-90-14	Adapter, ⅛" NPT × ¼" Hose Barb
#171-92-1	Relief Valve, 4000 PSI
#171-96	Handpump
#171-96-1	Hydraulic Oil, 1 Quart
#171-98	Ball Valve for Inlet Pressure Line, ¼"

Outlet Pressuring:

#170-04	CO_2 Pressurize Unit
#171-10	Back Pressure Receiver, 100 mL (Modified)
#171-11	O-ring for Back Pressure Receiver, 100 mL
#171-23-1	Safety Pin with Lanyard
#171-90-09	Valve Stem, Filtrate Outlet
#171-90-10	Valve Stem, Receiver Entry
#171-97	Ball Valve for Outlet Pressure, ⅛"

O-rings:

#170-13-3	O-ring for Cell
#170-17	O-ring for Valve Stem
#170-77	O-ring for Spacer
#171-99	O-ring for Piston

Tools:

#171-90-15	6" Crescent Adjustable Wrench
#171-85-05	Spanner Wrench

#171-84-SP One Year Spare Parts for #171-84:

#143-00-1	Diaphragm for Airco Regulator
#143-02-13	O-ring for Puncture Pin Holder Assembly, CO_2 Cartridge, Qty: 2
#143-02-14	O-ring for Puncture Pin Assembly, Qty: 2
#143-05	*CO_2 Bulbs EZ Puncture, PKG/10, UN# 1013, Qty: 30
#143-07	Repair Kit for Regulator
#153-14	Graduated Cylinder, 50 mL × 1 mL, Glass, Qty: 2
#154-20	Thermometer with Metal Dial, 8" Stem, Dual Scale: 50° - 500°F / 0° - 250°C
#165-44-1	High-Temperature Thread Lubricant, 1 oz Tube, Qty: 2
#170-13-2	O-ring for Cell, Qty: 50
#170-17	O-ring For Valve Stem, Qty: 24
#170-19	Filter Paper, 2.5" (6.35 cm), Grade #50, Box of 100, Qty: 5
#170-32	Needle Valve, Male, ⅛" × ⅛" NPT
#171-11	O-ring for Back Pressure Receiver, Qty: 4
#171-23-1	Safety Pin with Lanyard, Qty: 2
#171-90-08	Valve Stem, Hydraulics Entry
#171-90-09	Valve Stem, Filtrate Outlet
#171-90-10	Valve Stem, Receiver Entry, Qty: 2
#171-96-1	Hydraulic Oil, 1 Quart, Qty: 2
#171-99	O-ring for Piston, Qty: 12

Safety

1. 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.

2. 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.

3. Always use either **nitrogen or carbon dioxide** to pressurize the back pressure receiver. Never connect it to compressed air, oxygen, or other non-recommended gas. If nitrogen is used it must be supplied in an approved nitrogen gas cylinder and it must be secured to meet safety standards. CO_2 is normally supplied in small bulbs, which contain about 900 PSI, and are frequently used for field operations. Do not allow these bulbs to be heated or exposed to fire as they can explode if overheated.

4. When pressurizing the back pressure receiver always open the supply pressure first, then adjust the regulator. When de-pressurizing, shut off the supply pressure first by backing out the regulator T-screw (counter-clockwise), then bleed the system of pressure by opening the bleeder valve.

5. Cooling the hot cell under water is very dangerous. Be very careful to avoid touching or accidentally dropping the cell. Steam generated when the cell contacts water can cause severe burns.

6. Make sure the electrical source is fused and grounded. Verify the power cord on the heating jacket is in good condition and has the proper ground connection.

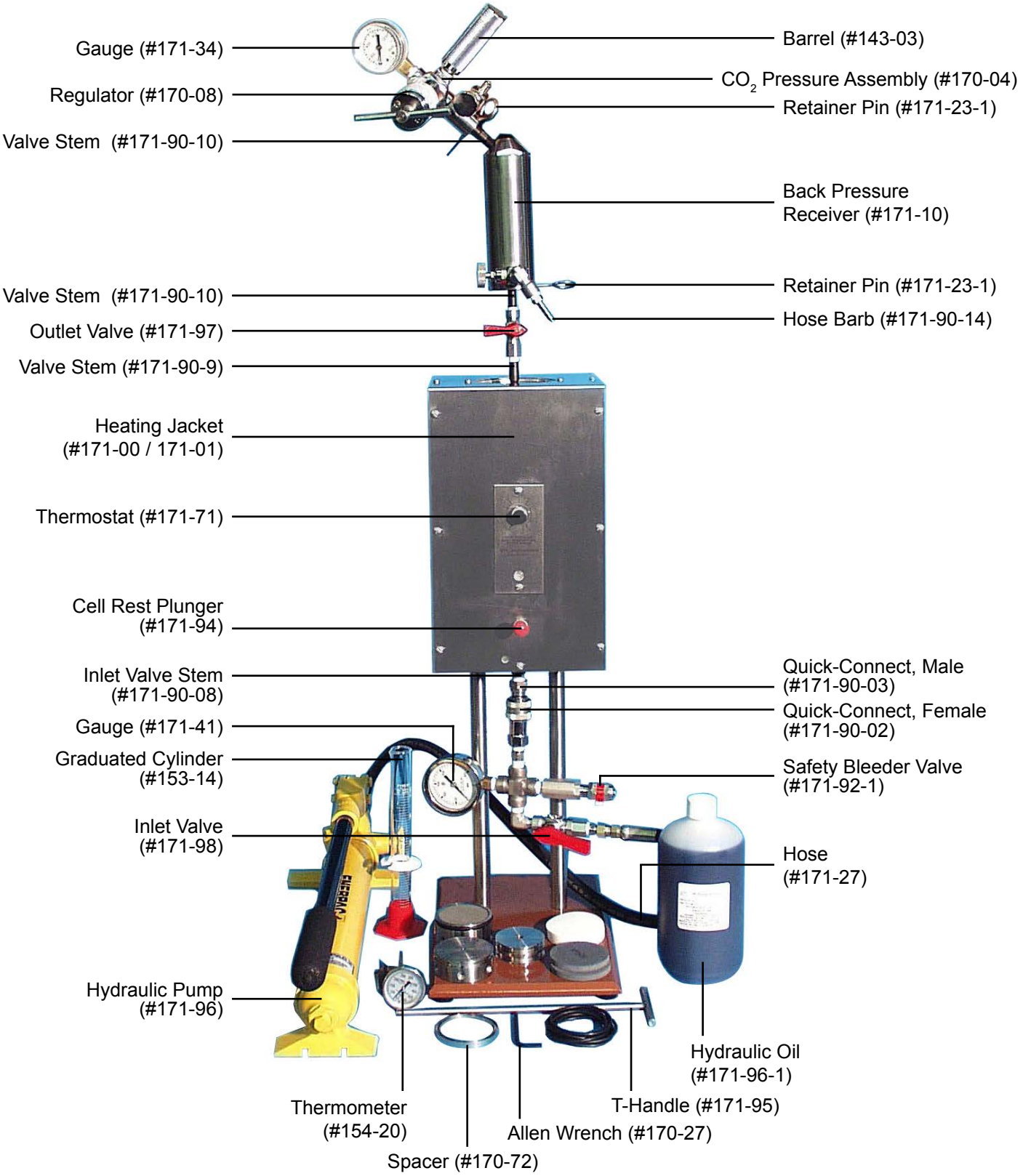
7. Electrical problems in the wiring or the heaters may not be obvious by looking at the equipment. A malfunction is indicated if the unit starts blowing fuses or tripping breakers, the heating time seems too long, or the thermostat control does not repeat. These conditions indicate an electrical repair job may be required. Always disconnect the power cables before attempting any repair.

8. The filtration cell assembly is a pressure vessel and these safety precautions should be followed:

    a. Cell bodies that show signs of stress cracking, severe pitting or have damaged threads must not be used.

    b. Cell caps showing evidence of damaged or deformed threads must not be used.

    It is strongly recommended the instruction manual be attached to the apparatus and read completely prior to the initial operation by anyone unfamiliar with the equipment.


Gauge (#171-34)
Regulator (#170-08)
Valve Stem (#171-90-10)
Valve Stem (#171-90-10)
Outlet Valve (#171-97)
Valve Stem (#171-90-9)
Heating Jacket (#171-00 / 171-01)
Thermostat (#171-71)
Cell Rest Plunger (#171-94)
Inlet Valve Stem (#171-90-08)
Gauge (#171-41)
Graduated Cylinder (#153-14)
Inlet Valve (#171-98)
Hydraulic Pump (#171-96)
Barrel (#143-03)
CO_2 Pressure Assembly (#170-04)
Retainer Pin (#171-23-1)
Back Pressure Receiver (#171-10)
Retainer Pin (#171-23-1)
Hose Barb (#171-90-14)
Quick-Connect, Male (#171-90-03)
Quick-Connect, Female (#171-90-02)
Safety Bleeder Valve (#171-92-1)
Hose (#171-27)
Hydraulic Oil (#171-96-1)
T-Handle (#171-95)
Allen Wrench (#170-27)
Thermometer (#154-20)
Spacer (#170-72)

Operation

Preparation

1. Before starting a test, close all valves and ensure that all regulators are rotated fully counterclockwise.

2. Connect the heating well to a 110V or 220V AC power source as specified on the nameplate. The heating jacket requires an 800W power supply.

3. Turn the thermostat to about mid-scale to begin heating and place a metal dial thermometer in the thermometer well.

   Tip

   The pilot light will turn on when the heating well is at the temperature setpoint. The temperature should read 10°F (6°C) above the desired test temperature. If it is not, adjust the thermostat.

4. 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"

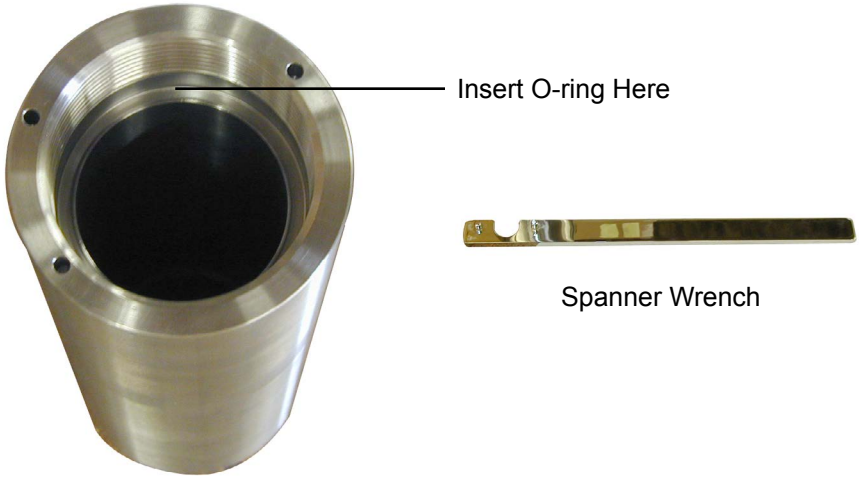
Operation

Loading the Cell

1. Open the cell and check all of the o-rings. Replace any that appear worn or damaged. New o-rings are normally required after each test above 300°F (149°C).

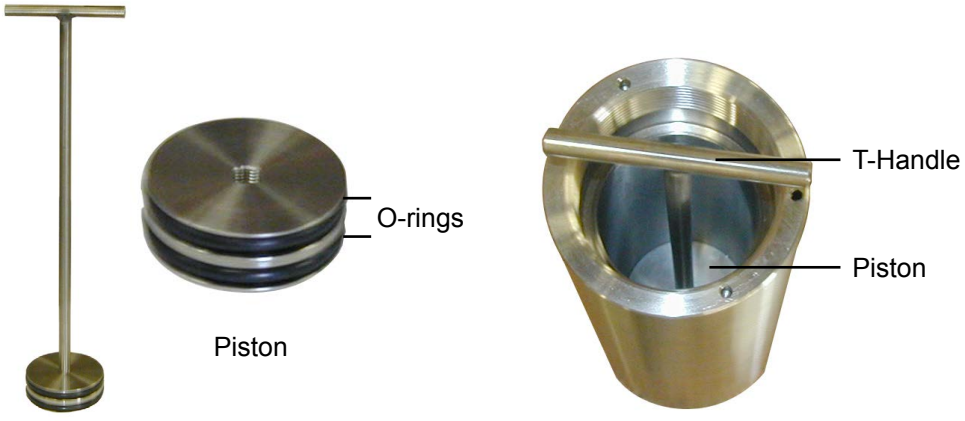
2. Apply a thin coat of silicone grease around the o-rings used on the piston, valve stems, and the cell caps. Also apply a thin coat of Never-Seez® Stopcock Grease to the threads on the cell caps.

3. Position the cell upright with the inlet, or shallow, recess facing upwards. Check the o-ring recess to make sure it is clean. Carefully insert an o-ring (#170-13-3) inside the cell recess and cell caps.



4. Find the cell cap labeled “IN”. Using the spanner wrench, carefully screw the cell cap into the cell body.

5. Screw the T-handle into the piston and place it inside the cell, working it up and down to ensure free movement. Position the piston with the T-handle so that it comes into contact with the inlet cell cap.



Piston with T-Handle

Piston

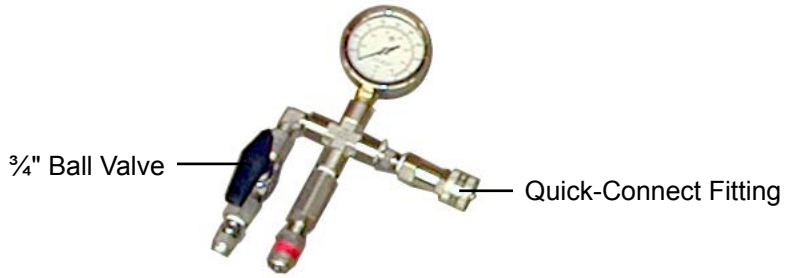
6. Push in the red knob located just below the thermostat control on the heating jacket. This moves the stop plunger into position to support the cell while it is being filled with fluid and facilitates installing the outlet cell cap. Invert the cell and place it inside the heating jacket with the inlet cap facing downward.

7. Screw the inlet valve stem (with the Quick-Connect fitting) into the inlet cell cap and tighten it completely. Then, open the valve stem by turning it clockwise ½ to 1 complete turn. When connected, the Quick-Connect end of the valve stem should be pointed down.

Inlet Valve Stem (#171-90-08)

Quick-Connect Fitting (#171-90-03)

8. Connect the hydraulic pump pressurizing hose with the ¾" (2.0 cm) ball valve and quick-connect fitting to the inlet valve stem assembly. Make sure the quick-connect fittings are completely attached. Pull down hard on the ring on the femal fitting.



9. Open the inlet ball valve. Turn the pressure release knob on the hydraulic pump clockwise to close the pressure release valve. Stroke the hydraulic pump to add approximately 1½" (3.81 cm) of hydraulic fluid volume into the cell inlet.

Tip

The best way to determine the volume hydraulic fluid in the cell is to observe the T-handle. When it has risen 1½" (3.81 cm), stop adding fluid. Place a small ruler in the o-ring groove to measure the distance.

10. Close the inlet ball valve by turning it 90° to the direction of flow.

11. Remove the T-handle from the piston and cell.

12. Prepare the test fluid according to API Specifications.

13. Add approximately 320 mL of test fluid to the cell. Be careful not to pour any fluid on the o-ring recess. **The fluid level inside the cell should be flush with the bottom of the o-ring recess.**

14. Place the cell o-ring (#170-13-3) in the o-ring groove and place the prepared ceramic disk on top.

15. Find the cell cap with the scribed flow lines in the surface. Screw the cell cap into the outlet end of the test cell. Coating the o-ring with a thin coat of high-temperature silicone grease will help.

Tip

Use a spanner wrench or strap wrench to prevent cell body rotation while installing the “outlet” end cap.

Note

If you are using filter paper instead of a ceramic disk, use the provided screened cell cap to prevent tearing. The screened cap is 2½" thicker to account for the missing disk.

Screened Cell Cap

Scribed Cell Cap

16. The space between the filter medium and the ball valve 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 filterate into the receiver.

    a. Close the outlet ball valve.

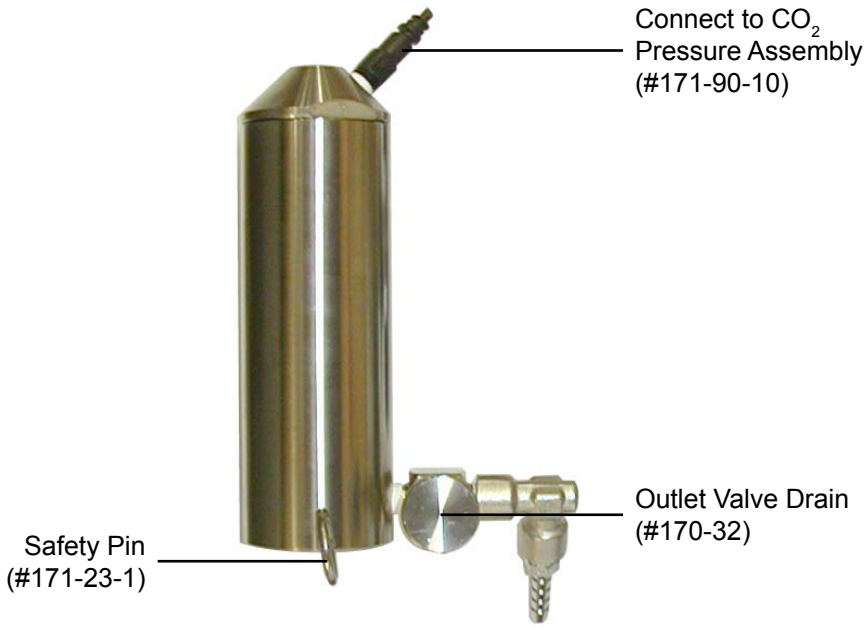
    b. Using a syringe, inject base fluid into the valve stem that connects to the cell cap. Make sure the valve stem is completely filled.

17. Screw the outlet valve stem assembly into the cell cap. Loosen it one half turn.

18. Hold the outlet valve assembly with one hand and pull the stop on the heating jacket out of the way to lower the cell fully inside the heating jacket. Rotate the cell until it locks in place over the alignment pin in the bottom of the heating jacket.

19. Close the outlet valve by turning the lever 90° to the direction of flow. Place a metal dial thermometer (#154-20) in the top of the cell in the small hole.

20. Place the back pressure receiver onto the top of the valve stem assembly. Be careful to not rotate the valve assembly. Lock the receiver in place with the safety pin and lanyard. Be sure that the pin is all the way in. The outlet drain valve on the receiver should be in the closed position.



21. Attach the CO_2 pressure assembly to the valve stem on top of the back pressure receiver and make sure the safety pin is all the way in and locked in place with the lanyard.

22. Turn the T-handle on the air regulator counterclockwise until approximately 6 threads are exposed. Puncture the CO_2 bulb and apply the appropriate amount of back pressure to the receiver for the desired test temperature.

23. While the cell is heating up to the desired temperature, open the inlet ball valve and apply the amount of pressure indicated in the “Recommended Minimum Back Pressure” table.

Recommended Minimum Back Pressure					
Test Temperature		Vapor Pressure		Minimum Back Pressure	
°F	°C	PSI	kPa	PSI	kPa
212	100	14.7	101	100	690
250	121	30	207	100	690
300	149	67	462	100	690
350	177	135	932	160	1,104
400*	204	247	1,704	275	1,898
450*	232	422	2,912	450	3,105
500*	260	680	4,692	700	4,830
**For tests above 400°F, use Teflon o-rings.*					


Tip

While the cell is heating, the pressure inside will rise due to the thermal expansion. Use the pump to release hydraulic oil and prevent over-pressurization. Maintain the pressure on the fluid until the desired temperature is stabilized, as indicated by the thermometer. Use the hydraulic pump’s pressure release valve to regulate and maintain the pressure. The heating time of the sample should **never exceed one hour.**


Important

When working with heated pressurized vessels, always wear protective safety glasses.

Excessive pressure puts stress on four main areas of the cell:

1. End cap bending - may be observed either by eye or by measurement
2. End cap compression - may be observed as deformed or bent threads
3. Cylinder shear - elevated areas along the end of the cell bodies
4. Cylinder stress - stress cracking or severe pitting will appear on the cell body

Operation

Test Procedure

Important

1. Once the cell has reached the required temperature, close the valve on the hydraulic pump and open the outlet valve. Operate the pump to increase the pressure in the cell to the desired test pressure to initiate filtration. Using the pump, maintain the desired differential pressure in the cell. The differential pressure is the cell pressure less the amount of back pressure.

   Do not exceed 4,000 PSI as the primary or inlet pressure.

2. Set a timer for the desired test times. Filtrate should be collected at a minimum of 7.5 and 30 minute intervals. Collect and record the total amount of filtrate and/or mud for 30 minutes. Be sure to maintain the selected differential pressure and test temperature within ± 5°F (3°C).

3. During filtration collection, the pressure in the cell will tend to decrease, so it will be necessary to apply additional hydraulic pressure to maintain a constant pressure.

4. If the back pressure rises during the test, cautiously reduce the pressure by opening the drain valve on the receiver and drawing off some of the filtrate into the graduated cylinder. The filtrate will be at or near the test temperature and slowly opening the drain valve will minimize any spattering of the fluid and any potential contact with hands and fingers. Bleed only enough to reduce the back pressure to its initial setting.

5. After the 30 minute time period, close the outlet valve. Open the receiver drain valve and allow it to blow dry to remove any filtrate and/or mud from the receiver. Record the total amount of liquid recovered, including the spurt loss.

6. Turn the T-handle on the air regulator clockwise to stop adding pressure to the back pressure receiver.

Disassembly

1. Close the outlet ball valve by turning it 90° to the direction of flow. Close the inlet valve stem by tightening it completely. This will seal the pressure inside the cell.

2. Make sure the regulator on the CO_2 pressuring assembly is backed off completely (counterclockwise). Release any remaining pressure by opening the bleeder valve. Remove the CO_2 pressuring assembly from the back pressure receiver.

3. Remove the back pressure receiver from the outlet valve assembly. Pour any remaining filtrate into the graduated cylinder.

4. Release the pressure on the hydraulic pump by turning the release valve on the pump counterclockwise until the pressure gauge reads 0 PSI (at least four complete turns).

5. Remove the quick-connect from the inlet valve assembly. Leave the inlet valve assembly connected to the cell.

6. Allow the cell to cool in the heating jacket.

The temperature of the sample in the cell must be less than 100° F (46.5° C) before the cell can be safely opened.

7. Once the cell has cooled, remove it from the heating jacket.

8. Reconnect the pump to the inlet valve assembly. Make sure the pressure release valve on the pump is open.

9. Slowly open the inlet valve stem one quarter turn. This will allow the pressure in the cell to vent into the pump.

10. Hold the cell so that the inlet and outlet valves are pointing away from people and equipment. Slowly open the outlet ball valve.

11. Remove the outlet valve assembly and cell cap.

12. Remove the ceramic disk and discard any remaining test fluid. Save the ceramic disk for analysis. See page 18 for more information.

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.

13. Screw the t-handle into the piston on the outlet side.

14. Manually push the piston to the bottom of the cell. This will force any remaining hydraulic fluid back into the pump.

15. Close the pressure relief valve on the pump and close the inlet ball valve.

16. Disconnect the pump from the inlet valve assembly.

17. Remove the inlet valve assembly, cell cap, and piston. Be aware that some hydraulic fluid will remain in the cell.

18. Clean and dry the entire cell assembly. Pay close attention to the threads on the cell body and cell caps. Also make sure to clean the outlet valve assembly. Inspect all o-rings and replace any that show signs of damage or wear.

Reporting Data

1. The filtrate volume collected should be corrected to a filter area of 7.1 in^2 (4580 mm^2) so the amount collected will have to be doubled.

2. The spurt loss is defined as the amount of mud and/or filtrate recovered from the collector immediately after the differential pressure is applied until the flow of fluid through the permeable disc stops and gas from the receiver blows out freely. The presence of whole mud in the spurt indicates that there was not an immediate seal of the mud when it passed through the filter. In most cases, the goal is to eliminate or minimize the amount of whole mud in the spurt and in the 30 minute test.

3. After the test is complete, remove the ceramic disk from the test cell and wash it very lightly with base fluid. Measure the filter cake thickness to the nearest 1/32" (0.8 mm). Although cake descriptions are subjective, such notations such as hard, soft, tough, rubbery, firm, etc. may convey important information of cake quality.

Calculations

Permeability Plugging Test Volume

$V_{PPT} = 2 \times V_{30}$

Where:

V_{PPT} = Permeability Plugging Test Volume

V_{30} = Filtrate volume after 30 minutes

Spurt Loss

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

Where:

V_1 = Spurt Loss

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

Static Filtration Rate

$V_{SF} = 2 (V_{30} - V_{7.5}) / 2.739$

Where:

V_{SF} = Static Filtration Rate (velocity of flow)

Maintenance

1. Clean the test cell, cell caps, valve stems, and all fittings thoroughly after each test. Make sure all threads are clean and free of debris. Blow air through all valve stems and fittings to clean out any remaining material.

2. Before each test, lubricate all o-rings with high-temperature grease to ensure a proper fit and increased life.

3. Periodically inspect valve stems for damage or wear. Replace any that no longer have a sharp point on the end.

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

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