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INSTRUCTIONS

HIGH TEMP. - HIGH PRESS. (HTHP) FILTER PRESS
4 - UNIT ASSEMBLY, 175 ML CAPACITY
PART No. 170-00-4

For Temperatures up to 350°F (177°C)

The unitized HTHP Filter Press assembly , manufactured by OFI Testing Equipment is designed for testing drilling fluids and cement under elevated temperatures and pressures. This simulates various downhole conditions and provides a reliable method for determining the effectiveness of the material being tested. The complete assembly consists of four standard 175 ml filter press mounted in a convenient installation for regular laboratory or drilling rig usage. All filter press units are complete and ready for use after the assembly has been connected to a source (bottle) of compressed nitrogen. The 4 unit assembly includes a dual nitrogen manifold for supplying up to 1250 psi pressure to the cell and up to 750 psi to the back pressure assemblies.

Although all four units are supplied nitrogen at the same pressures, both the high pressure to the cell (right regulator) and the back pressure (right regulator) can be controlled ON-OFF individually by valves mounted at the front of the work table base. The red knobs control the high pressure flow of nitrogen to the cells and the black knobs control the flow to the back-pressure receivers. The pressure for each line is indicated by the gauge above each regulator and both high pressure lines contain a check valve to prevent any accidental reverse flow of fluid.

The connection at the back of the dual manifold assembly has a standard 1/4 inch pipe thread (NPT) with a 1/4 inch tubing fitting so that the connection to the nitrogen bottle can be made with 1/4 inch .035 or .049 inch wall stainless steel tubing or with a high pressure hose. Any system that is used must be rated at 3000 psi or more working pressure. If the nitrogen bottle is to be mounted adjacent to the filter press assembly, a standard #171-26 high pressure 3000 psi hose that is 3 foot long probably can be used. A longer length hose may be provided on a special order basis.

The OFI HTHP Filter Press Multi-unit is available with a number of different options. It is also available as a two or six unit assembly, and 500 ml cell capacities or the "MB" style filter press may by used in place of the standard 175 ml assemblies.

CAUTION: NEVER USE OXYGEN AS THE PRESSURE SOURCE

Principle Components:

#153-14 Cylinder, Graduated, 50 ml x 1 ml, glass
#154-10 Thermometer, metal, 5 inch, 50 - 500°F
#170-35 Wrench, Adjustable, 6 inch

#170-00-1 Heating Jacket & Stand, 115 Volt Components:
#170-01-1 Heating Jacket & Stand, 230 Volt Components:

#164-32 Connector, male, for 230 volt power cable
#170-05 Thermostat, 50 - 500°F
#170-09 Insulation Board
#170-10 Pilot Light, for Thermostat
#170-11 Heating Element, 115 Volt, 200 Watt (2 each)
#170-15 Base
#170-21 Support Rod, for Heating Jacket
#170-25 Aluminum Well, Heating Jacket
#170-29 Power Cord, with make plug
#170-30 Thermostat Cover, stainless steel
#170-44 Foot, Rubber, 1/2 inch
#171-32 Knob, Midget

#170-12-1 Cell Assembly Components:

#170-12 Cell Body, 1500 psi
#170-13 O-Ring for Cell, Buna N
#170-14 Cell Cap, with screen, 1500 psi
#170-16 Valve Stem, for Cell
#170-17 O-Ring for Valve Stem, Viton®
#170-19 Filter Paper, 2 1/2 inch, 100/pkg
#170-26 Cap Locking Screw, stainless steel
#170-27 Wrench, Allen, 5/32 inch, for Cap Locking Screw

#171-24 Nitrogen Manifold, Dual 750/1350 psi

#170-08 Regulator, Concoa® (Airco)
#170-20 Manifold Block
#170-32 Needle Valve, 1/8" NPT
#171-22 Retainer Pin
#171-25 Relief Valve, 750 or 1350 psi
#171-26 Hose, high pressure, 3000 psi
#171-28 Manifold body, dual
#171-38 Gauge, 1000 psi, 2.5" face, 1/4" conn.
#171-40 Gauge, 1500 psi, 2.5" face, 1/4"conn.
#171-42 Gauge, 3000 psi, 2.5" face, 1/4"conn.

#170-06 Back Pressure Receiver Assembly

#170-07 O-Ring, for Receiver
#170-28 Receiver Body, 15 ml stainless steel
#170-32 Needle Valve male, 1/8" NPT
#171-22 Retainer Pin

Procedure:

(The operating procedure is essentially the same for running individual HTHP Filter Press units)

1. Connect the heating well power cord to a 3-wire outlet which will provide 1600 watts - about 14 amperes on 115 volts or about 7 amperes on 230 volts. Each filter press heating well is connected through a separate receptacle switch at the back of the assembly. This allows any number of the four units to be heated individually. Place a dial-type metal thermometer into the well in the heating jacket and preheat to 10°F (6°C) above the desired test temperature. A pilot light will come on when the heating jacket is at the desired temperature as selected by the thermostat control knob.

2. Stir the sample for 10 minutes with a high speed mixer. Be sure all of the o-rings on the valve stems are in good working condition (pliable with no nicks or cuts, etc.), and are not damaged during the assembly procedures. Place a thin film of silicone grease on all o-rings. Tighten the inlet valve stem to seal the cell and carefully pour the mud into the cell. Do not fill the cell closer than 0.5 inch (13 millimeters) from the o-ring groove to allow for heat expansion of the fluid, and do not spill fluid on the o-ring groove inside the cell.

3. Install an o-ring in the cell and another in the cell cap recess. Place a circle of filter paper on top of the cell o-ring and slowly push the cell cap into the cell, ensuring that the cap locking screw seats match thescrews in the cell body. *Note: If the cap locking screw seats are oval shaped and no longer round, there is a possibility of stress failure and the cap should be replaced.*

4. Tighten the cap locking screws, close (tighten) both valve stems and place the cell in the heating jacket with the outlet or filter side of the cell properly oriented down. Rotate the cell in the heating jacket so that the pin in the bottom of the heating well will seat into a hole in the bottom of the cell. This will anchor the cell inside the well and prevent the cell from rotating as the valve stems are opened and closed. Transfer the thermometer from the heating jacket to the thermometer well within the cell.

5. Connect the high pressure hose assembly to the top valve stem and lock it in place with the retainer pin. Place the back pressure receiver on the bottom valve assembly and lock it in place with the retainer pin.

6. Keeping the valves closed, adjust the knobs so the top and bottom pressure is equal to 100 pounds per square inch (690 kilopascals). Open (loosen) the top valve stem 1/2 turn and apply 100 psi (690 kilopascals) to the fluid sample inside the cell. Maintain this pressure on the fluid until the desired temperature is stabilized, as indicated by the thermometer. The heating time of the sample should never exceed one hour.

7. When the fluid sample reaches the desired test temperature, increase the pressure on the top pressure unit to 600 psi (4140 kilopascals). Open (loosen) the bottom valve stem 1/2 turn to initiate filtration.

8. Collect the filtrate for 30 minutes maintaining the selected test temperature within ±5°F (±3°C). If back pressure rises above 100 psi (690 kPa) during the test, cautiously reduce the pressure by opening the valve on the receiver and drawing off some of the filtrate into the graduate cylinder.

9. At the end of the test, close (tighten) the top and bottom valve stems to seal off the cell. Turn the regulator knob counter-clockwise to close off the flow of pressurized gas. Open the receiver outlet valve to collect all filtrate in the graduated cylinder. Release the pressure from the top and bottom pressuring units by opening the needle and/or bleeder valves.

10. Remove the top and bottom valve stem locking pin, and remove the top pressure and the back pressure assemblies. Drain any residual filtrate collected in the receiver into the graduate cylinder. Remove the cell from the heating jacket after once again checking that the cell valve stems are tightly closed. Allow it to cool to room temperature or quick cool the cell by immersion in cool water.

    Caution: ***Pressure inside the sample cell will still be approximately 500 psi (3450 kPa). Keep the cell upright and cool it to room temperature before disassembling. The cell must be cool for at least one hour at room temperature or at least 10 minutes in cool water before loosening the cap locking screws and removing the cell cap.***

11. Correct the total filtrate volume collected to a standard filtration test area of 7.1 square inches (45.8 cm^2) by doubling the filtrate volume collected in 30 minutes. Record this total filtrate volume (doubled), and the temperature, pressure and time.

12. Using extreme care to save the filter paper and deposited cake, place the cooled cell upright with the outlet (cap side) or filter side down. Open (loosen) the inlet valve stem to bleed off pressure from the cell body. *Pressure cannot be removed from the cell by opening the outlet valve stem as the filter cake will seal off the cell.* It is a good idea to open the valve stem with the cell inside a sink, or with a rag over the valve stem in order to catch any liquid that might be ejected. Loosen, but do not remove, the six cap locking screws, and separate the cap from the cell with a slight rocking motion. Discard the fluid inside the cell unless it is required for further testing, and retrieve the filter cake.

13. 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 inch (0.8 millimeter).

14. Clean and dry the apparatus thoroughly after each use. Inspect and replace if necessary all o-rings.

Remarks:

1. The upper and lower limits of the test pressure differential are determined by the test temperature. As this temperature exceeds 212°F (100°C), the back pressure must be increased in order to prevent vaporization of the filtrate. The 500 psi differential pressure must be maintained, so the top pressure will have to be increased accordingly. The table below shows the pressures recommended for various test temperatures.

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	1104

2. Due to the high temperatures and pressures involved in this test, EXTREME CARE must be exercised at all times. All safety precautions must be met, especially in the cell breakdown procedure after the filtration procedure has been complete.

CAUTION:

Nitrous oxide cartridges should not be used as pressure sources for high temperature, high pressure (HTHP) filtration. Under temperature and pressure, nitrous oxide can detonate in the presence of grease, oil or carbonaceous materials. Nitrous oxide (N_20) cartridges are to be used only for Garrett Gas Train Carbonate Analysis. Carbon dioxide and Nitrous oxide cartridges are pressurized to approximately 900 psi at 1 atmosphere (sea level). Therefore they should never be placed on airplanes, without proper packaging, due to the possibility of cabin de-pressurizing which may result in an explosion.