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HTHP Filter Press for Ceramic Disks

with 175-mL, Double-Capped Test Cell and CO_2 Pressuring Assemblies

#170-00-7: (115 V)
#170-01-6: (230 V)

Instruction Manual

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Ver. 1.2

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Intro

The OFI Testing Equipment (OFITE) High Temperature High Pressure (HTHP) Filter Press is designed to evaluate drilling fluids, cement slurries, fracturing and completion fluids under elevated temperatures and pressures. Evaluating fluids under HTHP conditions similar to the downhole environment is of paramount importance. Fluid properties must be monitored while under high temperatures and pressures as filtration behavior and wall cake building characteristics of permeable formations change with changing environments. These characteristics are affected by the shape, type and quantities of solids present in the fluid and their physical and electro-chemical interactions, all of which are affected by changing temperatures and pressures.

OFITE manufactures and provides HTHP filtration units in two basic sizes, 175 mL and 500 mL capacities. Both are used extensively throughout the world and in all environments, but in general the 175 mL units is designed for field portability, while the larger 500 mL units are designed for laboratory usage at higher temperatures and pressures. All OFITE Filtration devices fully conform to American Petroleum Institute (API) specifications.

A complete HTHP Filter Press consists of a controlled pressure source, usually Nitrogen pressurization or Carbon Dioxide bulbs for the 175 mL units. Top and bottom pressure manifolds are provided to simulate the differential pressures found in a down-hole environment, and to prevent evaporation of the base fluid if exceeding the boiling point of that fluid. The test cells are provided in a variety of assemblies, depending upon the type of fluid tested, the filter media, and the temperatures and pressures desired. The test cells are encased inside a heating jacket which is adjustable.

A variety of filter media are available, the most common being the standard API filter paper, cement screens and ceramic filters, which may be obtained to match the pore throat or permeability of the formation. Natural formation cores may also be used of differing sizes. Different screens may be used, or slotted disks of varying sizes are frequently used for lost circulation materials studies

Both the 175 mL and the 500 mL heating jackets are capable of reaching 400°F (204°C), but lower fluid volumes due to fluid expansion at higher temperatures, limit the 175 mL units to a useful working temperature of 300°F (149°C) for water based fluids and 350°F (176°C) for non aqueous fluids. Anyone running tests above 350°F (177°C) must substitute a complete set of o-rings after each and every test.

Specifications

Size:	7.5" × 11" × 23.5" (19.1 × 27.9 × 59.7 cm)
Weight:	27 lbs. (12.3 kg)
Shipping Size:	20" × 13" × 13" (51 × 33 × 33 cm)
Shipping Weight:	33 lbs. (15 kg)
Maximum Temperature:	400°F (204°C)
Maximum Pressure (Cell):	1,500 PSI (10,343 kPa)
Maximum Pressure (Receiver):	750 PSI (5.1 MPa)
Pressure Source:	Two CO_2 Pressuring Assemblies
Test Cell Capacity:	175 mL
Power Requirement:	#170-00-7: 115V; #170-01-6: 230V, 50/60 Hz
Heater:	400 Watt

Components

#153-14 Graduated Cylinder, 50 mL × 1 mL
#154-10 Dual-Scale Thermometer with Dial, 5" Stem, 50° - 500°F (0° - 250°C)
#170-19 Filter Paper; 2½" (6.35 cm); Specially Hardened for Filter Presses
#170-35 6" Adjustable Wrench

#170-04 CO_2 Pressurize Unit:
- #143-02-10 CO_2 Puncture Head Assembly
- #143-02-12 Puncture Pin
- #143-02-13 O-ring
- #143-02-14 O-ring
- #143-03 Barrel for CO_2 Cartridge
- #170-08 Regulator
- #170-20 Manifold Block
- #170-32 ⅛" × ⅛" NPT Male Needle Valve
- #171-23-1 Safety Pin with Lanyard
- #171-34 1,500-PSI Gauge; 2"; ¼" NPT Bottom

#170-06 Back Pressure Receiver; 15-mL Stainless Steel Tube for CO_2
- #143-00 Regulator, Low Pressure
- #143-01 200-PSI Gauge; ⅛" Bottom Connection
- #143-02-10 CO_2 Puncture Head Assembly
- #143-02-12 Puncture Pin
- #143-02-13 O-ring
- #143-02-14 O-ring
- #143-03 Barrel for CO_2 Cartridge
- #143-06 Safety Bleeder Valve
- #144-11 ⅛" 90 Street Ell
- #170-07 O-ring
- #170-28 Receiver Body
- #170-32 ⅛" × ⅛" NPT Male Needle Valve
- #171-23-1 Safety Pin with Lanyard

#170-46 Double-Ended Test Cell for Ceramic Disks; 2000-PSI
- #170-13-3 O-ring for Test Cell, Viton®/Fluorocarbon (FKM); Qty. 4
- #170-16 Valve Stem; Qty. 2
- #170-17 Valve Stem O-ring; Qty. 4
- #170-26-1 Hardened Locking Screw; Qty. 12
- #170-27 5/32" Allen Wrench
- #170-47 Cell Body for Ceramic Disks, 175 mL, Double-Capped
- #170-69 End Cap for Ceramic Disks, Scribed, 2,500 PSI
- #170-72 Spacer for Filter Paper, ¼", 316 Stainless Steel
- #170-77-1 O-ring, 140 Viton 75D, for Spacer; Qty. 2
- #171-21 Cell Cap with 60-mesh Screen, 2,000 PSI

#170-00-1 Heating Jacket (115V) -OR-
#170-01-1 Heating Jacket (230V):

#164-32	Male Connector for Power Cable (230 Volt)
#165-40-3	Power Cable, (For 170-01-1 230V Only)
#170-05	Thermostat
#170-10	Thermostat Pilot Light
#170-11	Heating Element; 115V; 200W
#170-15	Base
#170-21	Stand Support Rod
#170-25	Aluminum Well
#170-30	Stainless Steel Thermostat Cover
#170-44	Rubber Foot ½"; Qty: 4
#171-32	Midget Knob
#171-82	8' Power Cord with Male Plug 8; 16/3 SJ; Round (For 170-00-1 115V Only)

Optional:

#143-05:	EZ Puncture CO_2 Bulbs; 8-Gram; UN #1013; Package of 10
#152-00	Hamilton Beach Mixer, With Container
#152-01	Armature For Model 936 H.B. Mixer, 115 Volt
#155-20	Timer; 60 Min. Interval
#170-03:	Stainless Steel Carrying Case
#170-13	O-ring for Test Cell, Buna, For tests below 300°F
#170-13-5	O-ring for Test Cell, Ethylene propylene, For temperatures up to 400°F (204.4°C), Water-based fluids only
#170-33:	HTHP Cell Cap Puller
#170-40:	Test Cell Removal and Carrying Tool
#170-91	HTHP Pressure Relief Tool
#170-92	Safety Clamp for HTHP Fluid Loss Cells

Optional:
#170-00-SP Spare parts for 170-00, 175 mL HTHP Filter Press

Part Number	Description	Quantity
#140-60-01	O-ring for Bleeder Valve	2
#143-00-1	Diaphragm for Concoa Regulator	1
#143-01	Gauge. 200 psi, ⅛" Bottom Connection	1
#143-02-13	O-ring for Puncture Pin Holder	2
#143-02-14	O-ring for Puncture Pin Holder (rear)	2
#143-05	CO_2 Bulbs, 8 gram, 10 per pkg, UN1013	60
#143-07	Repair Kit for Concoa Regulator	1
#153-14	Graduated Cylinder, 50 mL × 1 mL	2
#154-10	Dial Thermometer, 5" stem, 5-500°F & 0-250°C	1
#170-13-3	O-ring for test cell and cap, Viton 75D	50
#170-16	Valve Stem, for cell pressure and de-pressurization	4
#170-17	O-ring, for Valve Stem, Viton 75D	48
#170-19	Filter Paper, 2 ½" (6.35 cm), hardened for Filter Press, 100/box	5
#170-26-1	Locking Cap Screw, Hardened Alloy Steel	12
#170-27	Allen Wrench, 5/32"	1
#171-23-1	Safety Pin with Lanyard	1


Note

Spare parts listings are intended to be used as a reference for future purchases. Everyone's consumable requirements will be different, and replacement quantities needed will depend upon the number of test performed on a daily and/or weekly basis.

Optional Items for HTHP Filtration Testing:

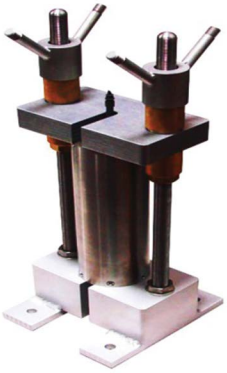
The items listed below are not included in the HTHP Filter Press, but they are items that will enable the technician to perform a more uniform and reproducible test while maintaining a high degree of safety. As optional items, the usage is not compulsory, but consideration should be given to these items when running tests at elevated temperatures and pressures. Some of the items will be used only on cell assemblies using set screws as fasteners, while others should be implemented when operating all filtration equipment.

Interval Timer, 60 minute
(#155-20)

Cell Cap Removal Tool
(#170-33)
(Set Screw Cell Assemblies Only)

Cell Carrying Tool (#170-40)

HTHP Pressure Relief Tool
(#170-91)
(To release trapped pressure)

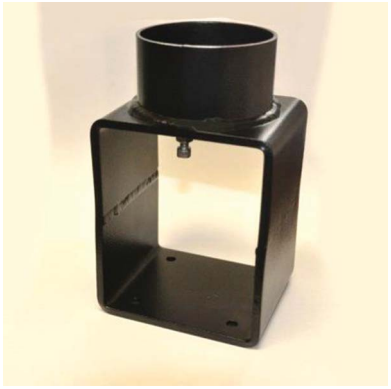


Safety Clamp (#170-92)
(Set Screw Cell Assemblies Only)

Safety Shield (#171-06)

High Pressure Nitrogen Assy.
(#171-31)

Thermocouple Assembly
(#171-45-1)
(Direct temperature measurement
Of the fluid Inside the Cell)



Stand for HTHP Cell Assembly
(#171-190-028)

Ceramic Disk Filters

Porous ceramic filters have many applications, but in the oil field they are used as a replacement for filter paper in the HTHP Filter Press. Available in a range of pore throat sizes and permeabilities, ceramic filters enable the operator to perform filtration tests under conditions similar to the formations being drilled. This is a big advantage over the standard paper filters. Also ceramic filters, unlike paper, have depth (usually ¼") so core analysis, invasion and return permeability studies may all be performed. Bridging characteristics of drilling and drill-in fluids may be analyzed.

Porous ceramics consists of closely-sized particles bonded together which result in a uniform permeable material that forms a tortuous path for fluid flow. The most common materials are Alumina and Silica, but there is an almost unlimited variety of materials and shapes available. HTHP filtration cell bodies must be recessed and extra ½" on the outlet side of the cell body in order to accommodate the ceramic disk. A ¼" spacer is provided for usage of filter paper if desired. Different sized ceramic disks to simulate cores and an assortment of other pore throat porosities/permeabilities are available on a special order bases.

These ceramic filters are classified by mean pore throat sizes and/or units of permeability. Mean pore throat is the average minimum pore diameter through the disk and it is measured in microns, or thousandths of a millimeter. Permeability is measure of the volume flow of fluids through a porous or semi porous media when subjected to a differential pressure. It is mathematically equated by Darcy's Permeability Law.

Previously mean pore throat size and permeability were roughly determined using air permeameter technology. Recent research funded by the American Petroleum Institute (API) used the latest Mercury Injection Capillary pressure technology to determine these characteristics. This new procedure found that the manufacturing process does not allow for absolute consistency between ceramic batches, but after numerous tests over several years, the final results was statistically pretty close. Even though the ceramic filters are the same filters that have been provided for years, the new API method for determining mean pore throat size and permeability have resulted in new and improved

specifications as outlined in the chart. All results and all orders should be based upon the information under the “New Mercury” column in the chart.

Important

All ceramic disks must be soaked in the base fluid being tested for at least 30 minutes prior to usage. Failure to do so will result in premature and excessive plugging of the pores within the disks, giving erroneous results. Laboratories often will perpetually soak disks in the base fluid.

Mean Pore Throat (µm*)			Mean Permeability (Darcy)	
Part Number	**New (Mercury, Hg)**	**Old Data (Air)**	**New (Mercury, Hg)**	**Old Data (Air)**
#170-55	10	3	775 mD	400 mD
#170-53-2	12	5	850 mD	750 mD
#170-53-3	20	10	3 D	2 D
#170-51	40	20	8 D	5 D
#170-53	50	35	15 D	10 D
#170-53-1	55	60	20 D	20 D
#170-53-4	120	90	40 D	100 D
#170-53-5	--	150	--	180 D
#170-53-6	--	190	--	--

*1 Micron (µm) = 1/1,000 mm or 1/25,400 inch