HT4700 HPHT Filter Press

Instruction Manual

Manual No. D00971165, Revision A
Instrument Part Nos: 102195986,
102196306,
102197003,
102197111

DNA™ System Compatible

fann®
Fann Instrument Company

HT4700 HPHT Filter Press Instruction Manual

Houston, Texas, USA

Printed in USA.

Contact Fann Instrument Company

Phone	1-281-871-4482 1-800-347-0450
Fax	1-281-871-4358
Postal Address	Fann Instrument Company P.O. Box 4350 Houston, Texas, 77210 USA
Shipping Address	Fann Instrument Company 14851 Milner Road, Gate 5 Houston, Texas, 77032, USA
Online	www.fann.com fannmail@fann.com

Table of Contents

List of Figures

List of Tables

1 Introduction

The HT4700 HPHT Filter Press is designed for safe and efficient fluid loss testing that meets API specifications. This filter press simulates filtration against a permeable formation at high temperatures and pressures. At the desired temperature, the sample is filtered across the filter media while pressure is applied to the top of the cell. Pressurization sources include carbon dioxide cartridges, bottled nitrogen, or an in-house gas supply.

The maximum temperature for this filter press is 500°F (260°C).

This unit includes HT4700 Heating Jacket, Safe Cell, Type J thermocouple probe, pressurizing assemblies, two power cables (115V and 230V), and the necessary equipment required to perform a fluid loss test.

1.1 Safe Cell

Safe Cell is equipped with the patented CellTell™ Positive Pressure Indicator, a unique safety feature that indicates the presence or absence of pressure in the cell. After the test ends, it is critical to know that the all pressure is released before the cell is opened. The CellTell™ is durable, resistant to temperature changes, vibration, and rotation.

These cells come in two styles - single or double opening. It also has valves at the top and bottom that can be closed for heat up and cool down. With this design, the sample can be aged and agitated in a roller oven prior to filtration testing.

Filter media choices are API standard filter paper, ceramic discs of various porosities, and screens of various mesh sizes.

1.2 Document Conventions

The following icons are used as necessary in this instruction manual.

NOTE. Notes emphasize additional information that may be useful to the reader.

CAUTION. Describes a situation or practice that requires operator awareness or action in order to avoid undesirable consequences.

MANDATORY ACTION. Gives directions that, if not observed, could result in loss of data or in damage to equipment.

WARNING! Describes an unsafe condition or practice that if not corrected, could result in personal injury or threat to health.

ELECTRICITY WARNING! Alerts the operator that there is risk of electric shock.

HOT SURFACE! Alerts the operator that there is a hot surface and that there is risk of getting burned if the surface is touched.

EXPLOSION RISK! Alerts the operator that there is risk of explosion.

2 Safety

Safe laboratory practices and procedures should be observed while operating and maintaining this unit. Improper assembly, operation, or the use of defective parts may result in cell leakage or failure which could result in serious injury and damage. This filter press is electrically heated, and as with any electrical device, the wiring should be regularly checked for bad connections.

Only qualified personnel should perform repairs or maintenance.

HT4700 HPHT Filter Press and Safe Cell are rated for 500°F (260°C).

Sample volume depends on the test temperature. Fill lines are etched inside Safe Cell to guide the user:

- 130 ml — up to 350°F (177°C)
- 100 ml — 350°F (177°C) to 500°F (260°C)

Figure 2-1 illustrates the safety label that is affixed to the heating jacket (top).

Figure 2-1 Warning Label for Cell Temperature Rating

The heating jacket and sample cell are hot during operation. Be aware of hot areas and avoid contact with them.

This heating jacket should always be used on a grounded circuit.

Electrical connections to and from the heating jacket should be properly insulated and must not be compromised.

2.1 Safe Pressurization

Always use either nitrogen or carbon dioxide. Never connect the filter press to compressed air, oxygen or other non-recommended gas. If nitrogen is used, it must be supplied in an approved nitrogen gas cylinder or the nitrogen supply system must be built into the laboratory. Nitrogen cylinders must be secured to meet safety standards. Carbon dioxide is normally supplied in small cartridges that contain about 900 psi (6206 kPa) pressure. They are primarily used for field operations. Do not allow these cartridges to be heated or exposed to fire. They can explode if overheated.

Maintain pressure regulators in good condition. Never use oil on pressure regulators. Leaking pressurization systems should be repaired or replaced. Gauges, fittings and hoses should be kept in good condition and leaks should be found and corrected. Periodically test the safety relief valves on the pressurization manifolds to verify they will relieve if excessive pressure should occur. Never plug or bypass these safety valves.

When pressurizing the cell and the backpressure assemblies, always open the supply pressure first, and then adjust the regulator. Do not attempt to pressurize higher than the equipment is rated or above the relief valve settings. When de-pressurizing, shut off the supply pressure, bleed the system of pressure, and then back out the regulator tee screw.

Cell assemblies include the CellTell™ Positive Pressure Indicator on the top of the cell assembly to show when the cell is pressurized. This is a safety device that provides additional protection in case the normal pressure bleeding procedure does not operate due to plugging or other reasons. If this indicator can be depressed and will stay depressed, the cell does not have pressure in it, and it is safe to open. If the indicator cannot be depressed or will not stay depressed, the cell has pressure in it and **MUST NOT** be disassembled. The CellTell™ indicator is installed in the solid end of single-ended cells and in the top cap of double-ended cells.

2.2 Safe Heating

Caution should be exercised by all personnel working with or working in the area where HPHT Filter Presses are in operation to avoid accidental injury caused by touching the heating jacket or cell assembly while these are hot. The heating jacket can operate at a temperature that will cause burns if touched. Safeguard the equipment after the test ends long enough for it to cool. It can still cause burns even after it has been turned off.

The practice of removing the cell and cooling it under water is very dangerous and is not recommended because the user could be severely burned if the cell is touched or accidentally dropped. Hot steam generated when the water hits the hot cell can cause severe burns.

Use extreme caution when handling a hot cell. A cell removal tool (Figure 5-7) is available for handling the cell assembly and removing it from the heating jacket. Its use will reduce the chances of accidentally dropping the cell or being burned by it.

2.3 Safe Electrical Operation

1. Make sure the electrical source is fused and grounded.
2. Verify that the power cord on the Filter Press is in good condition and has the proper ground connection.

Electrical problems in the wiring or heaters may not be obvious by looking at the equipment. If a malfunction is suspected by the unit blowing fuses or tripping breakers, the heating time seems too long or the thermostat control does not repeat, electrical repair may be indicated.

Always disconnect the power cable before attempting any repair.

2.4 Safe Test Cell Maintenance

The filtration cell assembly is a pressure vessel. These safety precautions should be followed to assure safe operation:

- Cell material should be compatible with the test sample.
- Cell bodies that show signs of stress cracking, or severe pitting must not be used.

3 Features and Specifications

Each filter press is equipped with Safe Cell, single-ended or double-ended, pressurizing system, filter medium, and graduated cylinder (Figure 3-1). CellTell™ Positive Pressure Indicator is safety feature that is also included.

This filter press and Safe Cell (included) are suitable for HPHT testing up to 500°F (260°C). Refer to Table 3-1 for a complete list of specifications.

Each HT4700 HPHT Filter Press is available in various arrangements, giving the user more choices and flexibility in test set-up. The user can perform tests at pressures up to 900 psi (6205 kPa) with the compact, easily attached carbon dioxide pressuring unit that is provided. Or the user can perform tests at pressures up to 1200 psi (8274 kPa) on the cell and 750 psi (5171 kPa) on the backpressure receiver when using the nitrogen manifold along with the nitrogen regulator assembly. The nitrogen manifolds have built-in safety relief valves that are set at 1200 psi (8274 kPa) for the cell and 750 psi (5171 kPa) for the backpressure receivers. See Table3-2 for options.

Table 3-1 HT4700 HPHT Filter Press Specifications

HT4700 Heating Jacket Specifications	
Maximum Temperature	500°F (260°C)
Heating Capacity	800W
Power Requirements	115/ 230 VAC
Dimensions	12 x 12 x 17.8 in. 30.5 x 30.5 x 45 cm
Weight	34 lb (15.4 kg)
HPHT Safe Cell Specifications	
Maximum Working Pressure	1800 psig (12,410 kPa)
Sample Cell Volume	130 ml @ 350°F (177°C) 100 ml @ 500°F (260°C)
Weight	9 lb (4.1 kg)

DNA™ System Compatible

The DNA System is a proprietary hardware and software system which adds capabilities to existing Fann instruments by connecting them to a computer using Fann's exclusive Data Acquisition and Control Software. The system combines individual instruments into one integrated system.

3.1 HT4700 HPHT Filter Press Assemblies

HT4700 HPHT Filter Press is available in various configurations with Safe Cell and other included items (Figures 3-1 and 3-2). Table 3-2 provides a detailed list of items include in each configuration.

Figure 3-1 HT4700 HPHT Filter Press with CO_2 Pressure & Backpressure

Figure 3-2 Filter Press with Nitrogen Manifold and Backpressure

Table 3-2 HPHT Filter Press Assemblies

HT4700 HPHT Filter Press Assemblies				
Pressure System	**CO_2 Pressurization**		**Nitrogen Pressurization**	
Filter Press Assembly P/N	102195986	102196306	102197003	102197111
Safe Cell Configuration	Single Ended	Double Ended	Double Ended	Single Ended
Pressurization	CO_2 Assembly P/N 209471		Dual Nitrogen Assembly P/N 209545	
Backpressure Receiver	15 ml CO_2, No. 209503		15 ml Nitrogen, No. 209502	
HT4700 Heating Jacket	115/230 Volts, 400 Watts, P/N 101631160			
NOTE: *Items listed for each assembly are included. These items can also be ordered separately.* *Heating Jacket includes Type J Thermocouple Probe, 115V and 230V power cables.*				

3.2 Front Panel Controls

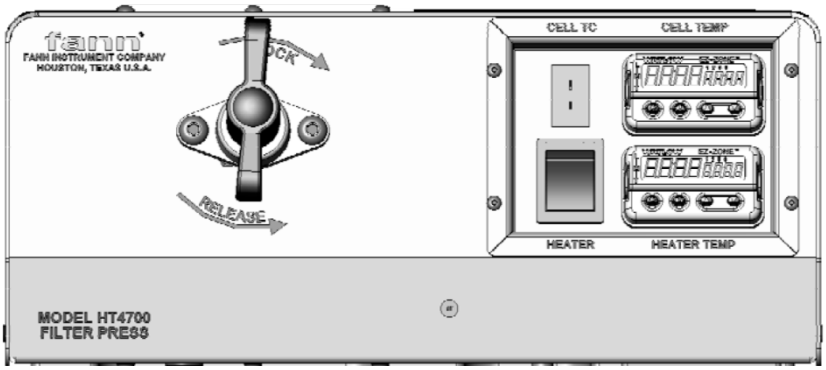

Figure 3-3 HT4700 Front Panel

- **LOCK/RELEASE**: This handle secures the cell in place, increasing heat transfer.
- **CELL TC**: Connect the cell thermocouple, which measures cell temperature.
- **CELL TEMP**: Displays cell temperature
- **HEATER**: Heater ON/OFF
- **HEATER TEMP**: Heater temperature controller

3.3 Back Panel Functions

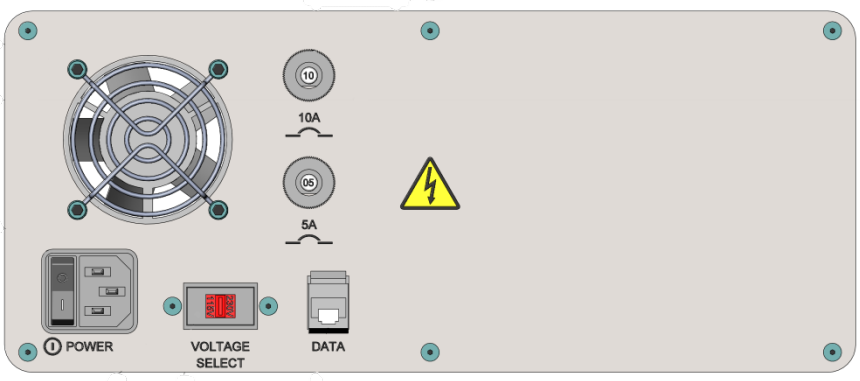

Figure 3-4 HT4700 Back Panel

- **POWER**: Main Power Inlet and ON/OFF switch
- **Circuit Breakers, 5A and 10A**: Press either button to reset.

- **VOLTAGE SELECT**: Choose 115 VAC or 230 VAC.
- **DATA**: The port for connecting a data logger (not included).

A data logger measures various electrical signals, converts them to digital data, and stores data in its internal memory for later download to a computer. With a temperature data logger, real-time temperature data can be collected at a set logging rate and start time.

DNA™ System Compatible

3.4 Pressure Sources

These filter presses should be pressurized with either nitrogen or carbon dioxide. Self-contained and convenient carbon dioxide capsules are used with the 175 ml cells and the 15 ml backpressure receivers (Figure 3-1). The carbon dioxide capsules have a maximum pressure of approximately 900 psi (6205 kPa). If the test requires a higher pressure, then use one of the three available nitrogen pressurization systems.

Nitrogen pressurization is usually preferred for use with the 500 ml cells because this cell requires a greater volume of gas. Three nitrogen systems are available: 1) single nitrogen manifold; 2) dual nitrogen manifold; 3) HP primary and LP secondary HPHT manifold. The single nitrogen manifold (Figure 3-6) supplies pressure to the cell only and backpressure is optional. The backpressure receiver requires carbon dioxide. The dual nitrogen manifold (Figure 3-7) is usually furnished and has capacity to supply maximum pressures of 1200 psi (8274 kPa) to the cell and 750 psi (5171 kPa) to the backpressure receiver. The HP primary and LP secondary HPHT manifold (Figure 3-8) allows pressurization of the cell to 1200 psi (8274 kPa), but supplies a lower backpressure of 170 psi (1172 kPa) maximum.

For temperatures greater than 200°F (93°C), a backpressure receiver must be used to prevent boiling of the filtrate. The standard backpressure receiver has a separate carbon dioxide pressuring source to provide the standard 100 psi (689 kPa) backpressure. Larger volume and/or higher backpressure receivers also may be used. These are connected to the nitrogen manifold allowing for pressurizing up to 750 psi (5171 kPa) backpressure. (If an ion analysis of the filtrate is required, nitrogen should be used for the backpressure.)

A backpressure receiver of 15 ml capacity is normally used with the 175 ml cells (Figures 3-9 and 3-10). Either carbon dioxide or nitrogen can be used as the pressurizing medium. The nitrogen pressurized backpressure receivers can handle a maximum pressure of 750 psi (5171 kPa).

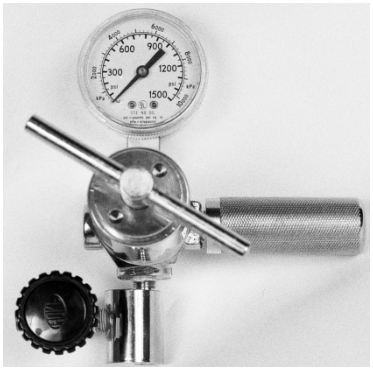

Figure 3-5 Carbon Dioxide Pressurizing Unit [P/N 209471]

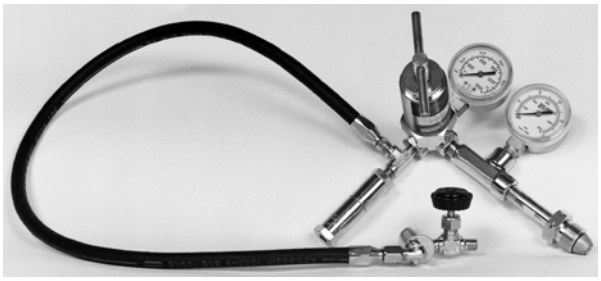

Figure 3-6 Single Nitrogen Manifold [P/N 209547]

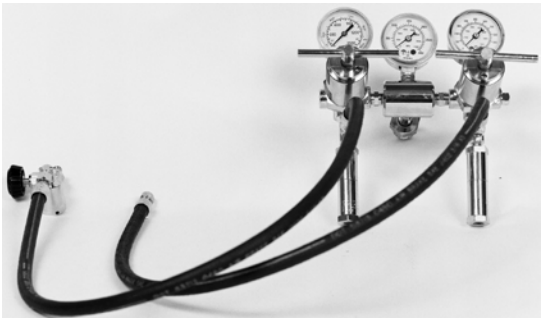

Figure 3-7 Dual Nitrogen Manifold [P/N 209545]

Figure 3-8 HP Primary & LP Secondary HPHT Manifold [P/N 209546]

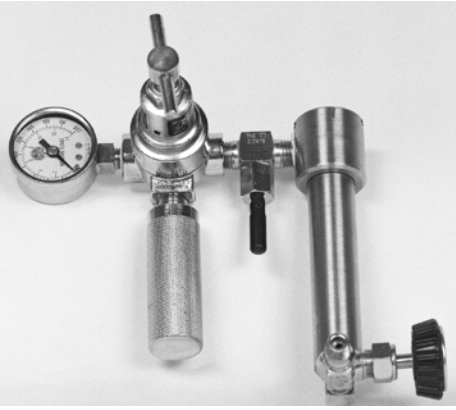

Figure 3-9 Backpressure Receiver with Carbon Dioxide, 15 ml [P/N 209503]

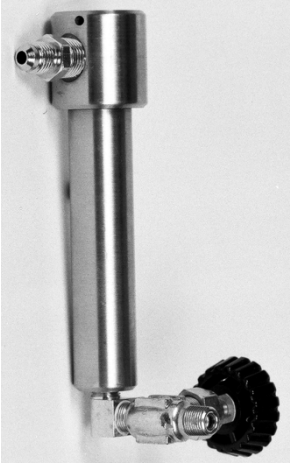

Figure 3-10 Backpressure, 15 ml [P/N 209502]

Figure 3-11 Backpressure Receiver, 100 ml [P/N 209542]

3.5 CellTell™ Positive Pressure Indicator

If the CellTell™ indicator cannot be depressed or will not stay depressed, the cell has pressure in it and **MUST NOT** be disassembled.

The cell assemblies have the CellTell™ Positive Pressure Indicator on the top of the cell assembly to show that the cell is pressurized (Figure 3-12). This safety device indicates whether or not all pressure was reduced through the normal pressure bleeding procedure. If this indicator can be depressed and will stay depressed, there is no pressure in the cell. If it cannot be depressed, or will not stay depressed, the cell has pressure in it and it **MUST NOT** be disassembled. This device is installed in the top end of single-ended cells and in the top cap of double ended cells. A screen is not used with the top cap when the top cap has this safety device present.

Figure 3-12 CellTell™ Positive Pressure Indicator

4 Installation

This filter press can generally be arranged to suit the available space and the desires of the lab personnel, consistent with any established work processes. Some environments encourage a right-to-left flow, while others a left-to-right flow.

Consideration should be given to the location where samples are prepared and the cells are cleaned following test completion. The type of pressurizing system may also dictate installation specific requirements, such as having a large compressed gas cylinder secured nearby. There should be sufficient storage area nearby for commonly used tools, as well as consumables, such as filter paper and pressurizing cartridges.

4.1 Pressurizing System

The type of pressurizing system may dictate installation requirements, such as having a large compressed gas cylinder secured nearby. When an external pressurizing manifold is used, the compressed gas cylinder should be located within reach of the hoses that are attached to the pressure manifold, typically 3 feet (1 m). It is possible to extend these hoses to 6 feet (2 m) or more by purchasing additional hoses and proper fittings.

4.2 Backpressure Receiver

The backpressure receiver attaches to the lower cell valve stem and sits directly beneath the heating jacket. No special installation considerations are indicated.

4.3 Tools

Storage space near the cell preparation area should be provided for the hex wrench that is used to install, tighten and loosen the cell retaining screws. A small adjustable wrench that is used to tighten and loosen the valve stems needs to be kept near the heating jacket, especially when a test is being performed. Similarly, the cell handling tool should be kept near the heating jacket. The cell cap removal tool can be kept near the cell clean up area, or near the filter press cell clamp.

4.4 Consumables

Consumables, such as filter paper and replacement O-rings, should be near the cell preparation area. The filter paper should be protected from exposure to water, grease, oils, and other fluids that could alter the filter characteristics.

5 Basic Operation

EXPLOSION RISK! Do NOT heat the heating jacket above the temperature rating of the test cell.

Refer to Fann Safe Cell Instruction Manual (Part No. D00850888) for properly operating, assembling, and cleaning the cell.

Follow API Recommended Practice for drilling fluids testing.

Before starting the test, the filter press must be disassembled; the pressure source and backpressure assembly must be disconnected, and the filtration cell assembly must be removed from the heating jacket.

The test procedure is outlined in Tables 5-1 and 5-2 for drilling fluid and cement, respectively.

Table 5-1 Fann HPHT Mud Test Outline

SAMPLE PREPARATION	Stir for 10 minutes with high speed mixer
EXPANSION ALLOWANCE	1/2 inches (12.7 mm), < 300°F (149°C); Cells are marked
	1-1/2 inches (38.1 mm), 300°F- 500°F (149°C - 260°C); Cells are marked
SAMPLE VOLUME	130 ml up to 350°F (177°C) (cells are marked)
	100 ml @ 350°F (177°C) to 500°F (260°C) (cells are marked)
FILTER	Filter Paper, Part No. 206056
	Glass Fiber, Part No. 206057 For > 375°F (190°C), back the filter paper with a disc of glass fiber.
TIME	Sample heating – 15 minutes to reach 350°F (177°C)
	Duration of test - 30 minutes
FILTRATE COLLECTOR	25 ml or 50 ml TC Graduated Cylinder [< 200°F (93°C)]
	Backpressure Receiver [300°F - 500°F (149°C- 260°C)] Bleed into graduated cylinder during and at end of test.

Table 5-2 Fann HPHT Cement Test Outline

SAMPLE PREPARATION	Mix cement per API RP10B, Section 5 Process sample in Consistometer See API RP10B, Section 10 Static Fluid Loss Test for filtrate times
EXPANSION ALLOWANCE	1/2 inches (12.7 mm), < 300°F (149°C); Cells are marked.
	1-1/2 inches (38.1 mm), 300°F- 500°F (149°C - 260°C); Cells are marked.
SAMPLE VOLUME	130 ml up to 350°F (177°C) (cells are marked)
	100 ml @ 350°F (177°C) to 500°F (260°C) (cells are marked)
FILTER	No. 325 (45 micrometer) U S Sieve with 60 mesh backing screen, stainless steel, Part No. 209534
TIME	Sample Heating - 15 minutes to reach 350°F (177°C) Duration of test - 30 minutes Take filtrate volume readings 1/4, 1/2, 1, 2, and 5 minutes after test starts, then every 5 minutes. (Backpressure not being used)
FILTRATE COLLECTOR	25 ml or 50 ml graduated cylinder and backpressure receiver

5.1 Preparing the Safe Cell

1. Check O-rings on the valve stems, cell, and cell cap. Lubricate the O-rings. It is recommended that O-rings are replaced after each test at temperatures above 350°F (177°C).

2. Place O-ring into groove in the cell body (Figure 5-1).

3. Add sample, approximately 130 ml to the top fill line for tests at 350°F (177°C) or 100 ml for tests at 500°F (260°C) (Figure -).

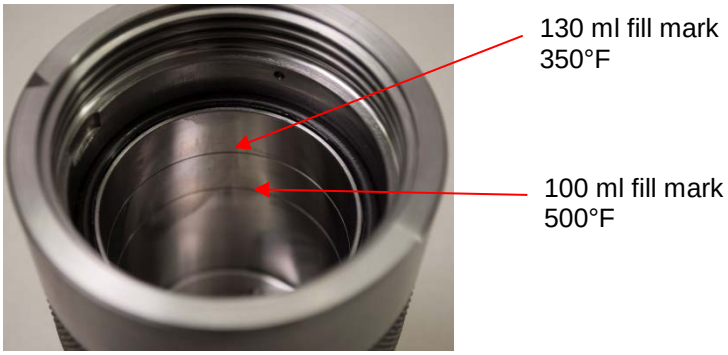

Figure 5-1 Cell showing fill marks inside

4. Place filter paper on the O-ring in the cell body.

5. Put the screen on the filter paper (Figure 5-3).

6. Add the O-ring.

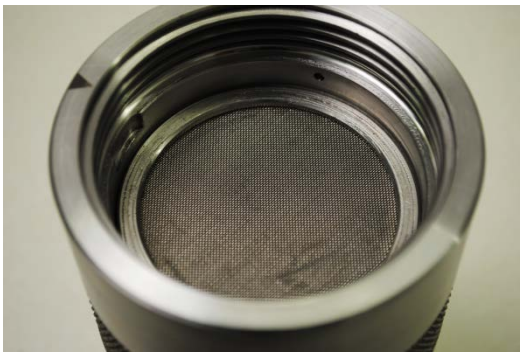

Figure 5-2 Screen in cell

7. Install the cap retainer, making sure its alignment pin is aligned with the arrow on the cell body (Figure 5-3).

8. Install the cell cap and turn until hand-tight (Figure 5-4).

The cell will not pressurize if it is not properly sealed.

Figure 5-3 Cap Retainer installed

Figure 5-4 Cell Cap installed

9. Install and tighten the valve stems.

10. Invert the assembled cell (Figure 5-5) and put it into the heating jacket (filter end down).

Figure 5-5 Safe Cell, fully assembled

5.2 Pressurizing the Filtration Cell

This section contains instructions for pressurizing with carbon dioxide and nitrogen. Refer to Table 5-3 for appropriate backpressures.

Table 5-3 Recommended Backpressures for Fann HPHT Filter Press

TEMPERATURE RANGE		MINIMUM BACKPRESSURE	
°F	°C	psi	kPa
Less than 200	93	0	0
200 - 300	93 - 149	100	689
301 - 350	150 - 177	150	1034
351 - 375	178 - 190	200	1379
376 - 400	191 - 205	250	1724
401 - 425	206 - 218	350	2413
426 - 450	219 - 232	450	3103
451 - 475	233 - 246	550	3792
476 - 500	247 - 260	700	4826

5.2.1 Pressurizing with Carbon Dioxide

1. Install the pressure unit on the inlet (top) valve stem and insert the locking pin. Refer to Figure 5-6.
2. Make sure that the regulator T-screw is backed out (counterclockwise) to release the pressure on the diaphragm. After all pressure has been released, the T- screw will turn more freely.
3. Remove the barrel from the pressure unit and insert one CO_2 cartridge into the barrel, blunt end first. Screw the barrel onto the pressure unit, and tighten the barrel using hand force only to puncture the CO_2 cartridge. Do not adjust the regulator T-screw at this time.
4. If using a backpressure receiver, install it on the lower stem (filter paper end) to capture the filtrate. Make sure that the drain valve and bleeder valve on the backpressure receiver are closed. Insert the locking pin. Insert a CO_2 cartridge as described in step 3.
5. Turn the T-screw on the top regulator clockwise until the desired pressure is registered on the gauge.

6. Turn the T-screw on the backpressure regulator clockwise until the desired cell pressure is registered on the gauge. See Table 5-3 to find the recommended minimum backpressure.

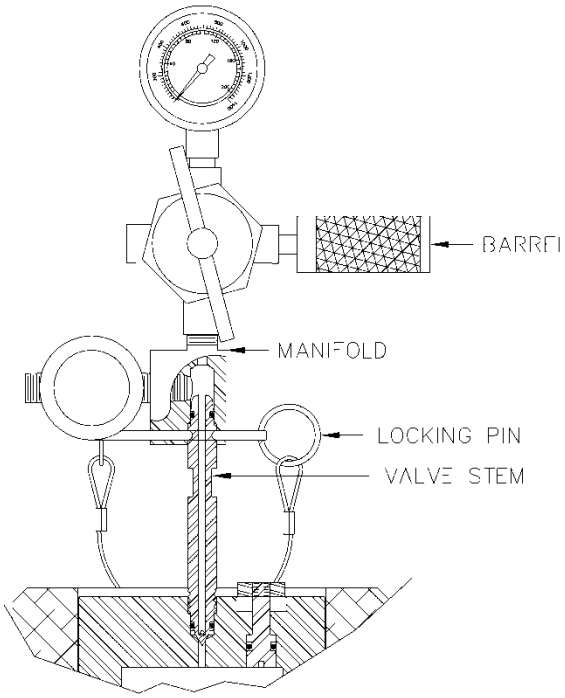

Figure 5-6 CO_2 Pressure Unit

5.2.2 Pressurizing with Nitrogen

One of these three optional manifolds is assembled onto a nitrogen cylinder:

- Dual nitrogen manifold (P/N 209545) is normally provided (Figure 3-7).
- Dual nitrogen manifold (P/N 209546) can be used if the tests will be conducted with 150 psi (1034 kPa) or less backpressure (Figure 3-8).
- Single nitrogen manifold (P/N 209547) can be used without a backpressure receiver or with the CO_2 backpressure receiver (Figure 3-6).

1. Screw the gland nut into the cylinder valve and position the manifold with the gauges right side up; then, tighten the nut securely.

High pressure connections are capable of causing injury if not properly assembled.

2. Attach the opposite end of the high pressure hose that is connected to the 1500 psi (10,342 kPa) gauge side (or left side) of the manifold to the top cell valve stem. Slip the stem adapter manifold (located on the end of the hose) over the valve stem. Secure it by inserting the locking pin.
3. Close the bleeder valve on the valve stem adapter manifold.
4. Check that the T-screws on the pressure regulators are unscrewed (counterclockwise) and no pressure will be applied.
5. Open the valve on the nitrogen bottle slowly and carefully. The bottle pressure will be registered on the middle manifold gauge.
6. Install the backpressure receiver onto the filter cell's lower valve stem, and insert the locking pin. Make sure that the drain valve on the backpressure receiver is closed.
7. Attach the high pressure hose that is connected to the 1000 psi (6895 kPa) gauge side (right side) of the manifold to the inlet of the backpressure receiver, and tighten securely.
8. If operating at 150 psi (1034 kPa) maximum backpressure, the HP & LP manifold (P/N 209546) is recommended; it has a 200 psi (1379 kPa) gauge on the right side. Refer to Figure 3-8.

Although the dual nitrogen manifold, P/N 209545, can be used, it is difficult to accurately read the backpressure.

9. Turn the T-screw on the left-hand regulator clockwise until the desired cell pressure is registered on the gauge.
10. Turn the T-screw on the right-hand regulator clockwise until the desired back pressure is registered on the gauge.
11. If using a CO_2 backpressure receiver, load a CO_2 cartridge in it as previously described.
12. Adjust the T-screw on the backpressure receiver regulator clockwise to the desired backpressure. See Figure 3-9.

5.3 Operating the HT4700 Filter Press

The basic operating instructions for the HT4700 filter press are provided in this section.

1. Set the Voltage Selector to proper voltage, and then connect the HT4700 power cord to power outlet (back panel shown in Figure 3-4).
2. Turn on the Main Power Switch (back panel).
3. Connect the thermocouple probe (front panel).
4. On the heater temperature controller, use the up or down buttons to set the desired temperature. The current temperature will be displayed in larger digits on the display. The setpoint temperature will be displayed in the lower right corner (smaller digits).
5. Move the Heater Switch to the **ON** position.

The heater temperature will rise to the setpoint temperature and remain constant.

During operation, the heating jacket's top and bottom surfaces near the cell will be hot. There is risk of getting burned if these surfaces or the cell are touched.

6. Insert the thermocouple into the cell to monitor the cell temperature.

You may need to increase the heater setpoint temperature to get the desired cell temperature.

7. When the test ends, turn **OFF** the Heater Switch to begin cooling the filter press. Also, set the temperature to below ambient temperature by using the up/down buttons on the heater temperature controller.
8. To shut off the power, both the Heater Switch and Main Power Switch must be in the **OFF** position.

5.4 Conducting the Filtration Test

Filtration tests at temperatures below 200°F (93°C) may be performed without the use of a backpressure receiver.

Filtration tests at temperatures above 200°F (93°C) require the use of a backpressure receiver. The cell and the backpressure receiver should both be pressurized to the backpressure value before the cell is heated.

1. Place a graduated cylinder under the cell lower valve stem.
2. With an adjustable wrench, open the inlet valve stem 1/2 turn. If the pressure on the cell pressure gauge (left gauge) of nitrogen manifold or gauge on CO_2 pressuring assembly has changed from the desired setting, readjust the regulator. If the adjustment is to lower the pressure, momentarily open the bleed valve to reduce the pressure.
3. If a CO_2 backpressure regulator is being used, adjust the regulator to the desired backpressure. This will pressurize the backpressure receiver. If a dual nitrogen manifold is being used, adjust the right-hand regulator.
4. Allow the cell to heat until the cell is at the test temperature.
5. Readjust the cell pressure regulator to the test pressure. The test is now ready to be started.

The differential filtration pressure is the cell pressure less the backpressure.

6. Set a timer for 30 minutes, or other desired filtration test time. Accurate test time is especially important when the test temperature is above 300°F (149°C).
7. To start the test (timed period during which the filtrate is collected), use an adjustable wrench to open the lower valve stem on the bottom of the filtration cell a 1/2 turn.

8. Periodically during the test, bleed filtrate from the drain valve on the backpressure receiver into a graduated cylinder. Use care in collecting the filtrate; do not collect all of it while pressure is still applied. This prevents the gas pressure from blowing the filtrate out of the graduated cylinder.

5.5 Ending the Filtration Test

1. Turn **OFF** the Heater Switch to begin cooling the filter press. Also, set the temperature to below ambient temperature by using the up/down buttons on the heater temperature controller.

2. To shut off the power, both the Heater Switch and Main Power Switch must be in the **OFF** position.

3. Close the filtration cell (upper) valve stem and backpressure (lower) valve stem.

4. Release the T-screws (turn counterclockwise) of both the test filtration and the backpressure regulators. This applies to either the nitrogen or CO_2 regulators.

5. Open the bleed valve on the test cell manifold and on the backpressure receiver to de-pressurize the system.

6. The drain valve on the backpressure receiver now may be opened and the filtrate collected.

7. Remove the upper valve stem locking pin and remove the adapter manifold or the CO_2 pressuring assembly from the top valve stem.

8. Remove the lower valve stem locking pin and remove the backpressure receiver.

The temperature of the sample in the cell must be reduced to less than 200°F (93°C) before the cell can safely be opened.

Be extremely careful in removing a hot cell from the heating jacket. It can cause severe burns if accidentally touched.

9. The pressurized cell assembly may be left in the filter press or it may be removed to another location for air cooling. A cell handling tool is available for removing a hot cell from the heating jacket. Attach it to the top valve stem using the valve stem locking pin.

Immersing the hot cell in water to cool it is very dangerous. The steam created when the water touches the cell can burn. This practice is not recommended.

Do not open the cell if the CellTell™ indicator will not depress and stay depressed.

10. Wait for the cell to cool. After the cell and the sample in the cell are cool, the cell may be opened.

5.6 Safe Cell Disassembly

Hot cells can cause severe burns. Wear proper hand protection when handling hot cells.

Cells can be removed from the heating jacket after cooling to a temperature at which they can be safely handled.

1. Slowly open the valve stems and allow pressure to release.
2. Make sure all pressure has been released. Press the CellTell™ safety indicator. It should depress and stay depressed if all pressure has been released.

If pressure is present, you will not be able to loosen the cell cap.

3. Twist the cell cap (right turn) to remove it. Also remove the retainer cap, O-rings, and screen.
4. If using a double-ended cell, remove the second cap.
5. Remove and examine the filter cake.

5.7 Cleaning and Inspecting the Equipment

1. Clean all parts, including the cell, cell caps, CellTell™ safety indicator, and valve stems with water. You may need to force water through the parts to dislodge any material, such as lost circulation material (LCM) or test sample residue.

2. Use compressed air to dry the valve stems and CellTell™.

3. Inspect all parts for damage.

   a. If a screen was used, examine it under a light source. Shadowed areas indicate plugging; the screen needs cleaning.

   b. Screens with scratches or holes must be replaced.

   c. O-rings that are brittle, torn, or cracked must be replaced. Do not store O-rings between tests with grease applied to them. Stopcock grease should only be applied to the O-rings immediately before using them.

   d. If the cone point of the valve stem is damaged, it must be replaced.

See Section 7 Troubleshooting and Maintenance for detailed instructions.

6 Test Analysis

6.1 References

- API Recommended Practice for Field Testing Water Based Drilling Fluids, API RP 13B-1
- API Recommended Practice for Field Testing Oil Based Drilling Fluids, API RP 13B-2
- API Recommended Practice Testing Field Cements, API RP 10B-2

6.2 Results

Measurement of the filtration behavior and wall cake building characteristics of a drilling fluid (mud) is fundamental to drilling fluid control and treatment. The characteristics of the filtrate, such as oil, water, or emulsion content are also important.

These characteristics are affected by the types and quantities of solids in the fluid, and their physical and chemical interactions. Temperature and pressure affect all these characteristics. Therefore, tests are often run at both low pressure and temperature, and elevated pressure and temperature; different equipment and techniques are required.

The fundamental filtration measurements include the filtrate volume and filter cake thickness.

6.3 Filtrate Volume

The volume of liquid filtrate collected after 30 minutes is reported in milliliters (ml), to the nearest 0.1 ml. The test temperature at which the filtrate was produces is also recorded on the appropriate Drilling Mud Report. The filtrate volume is calculated by the formula:

Filtrate volume (ml) = 2 x (volume collected in 30 minutes, ml) x (10)

6.4 Filter Cake Thickness

The thickness of the resulting filter cake is measured at its center, and reported to the nearest 1/32 inch (0.8 mm).

7 Troubleshooting and Maintenance

Apply standard laboratory procedures when cleaning Fann HPHT Filter Press assemblies and backpressure receivers. After each test, thoroughly clean and dry the cell and backpressure receiver, paying attention to the O-rings and O-ring grooves.

Wash and dry screens, or end caps with attached screens.

Wipe spilled sample or other debris from the heating jacket and stand. Some sample materials may damage the finish of these parts if allowed to remain on them for a long period of time.

7.1 Cell Maintenance

7.1.1 O-rings

While cleaning, inspect all O-rings for cuts or nicks. If the O-rings have been subjected to over 300°F (149°C), check for hardening or brittleness.

Replace any damaged O-rings.

Lubricate O-rings before installing them. For most applications, laboratory stop cock grease is satisfactory; however, since some O-rings come into contact with the sample, the lubricant must be compatible with the sample.

O-rings furnished with the instrument are suitable for testing up to 300°F (149°C). They may be used for one test up to 400°F (205°C). Special Viton® O-rings can be used for repeated testing up to 400°F (205°C), and one test up to 500°F (260°C).

7.1.2 Valve Stems

A metal- to-metal pressure tight seal is made between the valve stem and its seat. Leaks can occur if either the valve stem or seat is damaged.

Inspect the cone point of the valve stem by removing the valve stem from the cap or body. If the point is damaged, replace the valve stem. For examples of damaged and undamaged valve stem points, see Figure 7-1.

If the point is in good condition, then check the seat in the cell or cap. If the seat is rough, use a 5/16-inch drill bit to resurface it. A resurfacing tool, composed of a 5/16 drill and handle (Part No. 209500), may be used. See Figure 7-2.

Regularly inspect valve stems for possible plugging with dried sample. Use a small drill or wire remove dried sample from the cross bore and the main passage openings.

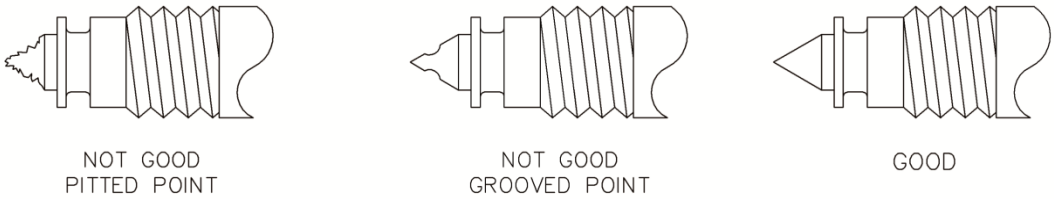

Figure 7-1 Valve Stem Points

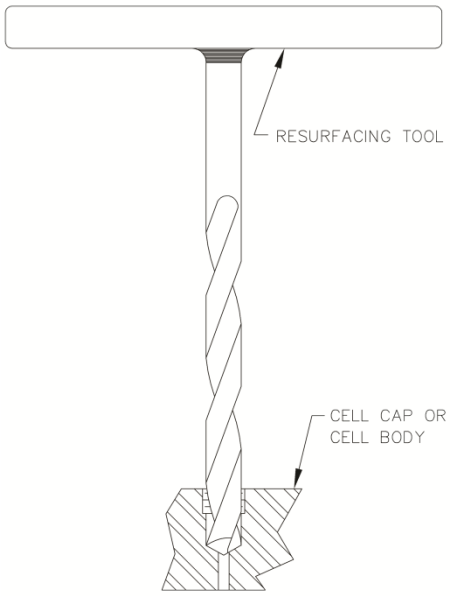

Figure 7-2 Resurfacing Tool

7.1.3 Cell Corrosion

Corrosion, pitting, and cracking can cause rupture of cells.

Sample fluids under high-temperature and high-pressure conditions can, at times, cause corrosion of the test cells and caps. Standard cells are made of Type 303 or Type 316 stainless steel. Cells are available in other materials for use where the stainless steels are not suitable because of potential corrosion.

Periodically inspect the inside of the cell for corrosion. Use 320- grit (or finer) sandpaper, wet or dry, to remove light corrosion. Deep corrosion pitting may be removed by sand blasting the corroded area. Severe corrosion will require re-machining or re-surfacing the inside of the cell. If machining to 0.020-in. (0.5 mm) oversize does not remove all corrosion, replacing the cell is recommended. If corrosion cracks are evident, the cell should be replaced.

7.1.4 CellTell™ Maintenance

Thoroughly clean the CellTell™ Positive Pressure Indicator with water, making sure that any test sample residue, lost circulation material (LCM), or other material is washed away.

Inspect the safety indicator for damage and worn or damaged O-rings.

Follow these steps to replace the CellTell™ indicator O-rings:

1. Use a set of locking pliers to hold the red button of the indicator. Take care not to score the button.

2. While holding the red button with the pliers, use a flat-head screwdriver to unscrew the stem from the red bottom.

3. Using a small screwdriver or pick, remove the existing O-ring from the stem and discard.

4. Replace it with the new O-ring. Carefully using a small screwdriver or pick, place the O-ring into the slot.

5. Insert the stem back into the cap.

6. Use a small amount of Loctite®242 on the threads.

7. Screw the red button back on until the stem is flush with the top of the red button.

8. Allow the Loctite®242 to dry

7.2 Pressurization Systems

Improper handling of compressed gas cylinders can result in adverse physical or health effects. Read and follow all safety procedures for handling high pressure gas cylinders.

Safe operation of pressurized equipment requires properly maintaining the pressurizing systems. Follow these procedures for the safe use of pressure regulators:

1. Never subject a regulator to inlet pressure greater than its rated inlet pressure, as shown on the regulator body.
2. Never use the regulator for gases other than those for which it is intended.
3. All connections to the regulator must be clean. Remove oil, grease, or other contaminants from external surfaces of the regulator and metal connecting parts.
4. Before attaching the regulator to the cylinder, remove any dirt or foreign matter that may be in the cylinder valve outlet by wiping with a clean, lint free cloth.

The valve on the cylinder may be opened momentarily to blow the outlet clean. Make sure the cylinder opening is pointed away from personnel.

5. Never pressurize a regulator that has loose or damaged parts or is in questionable condition.
6. Never loosen or attempt to tighten a connection or a part until the gas pressure has been relieved. Under pressure, gas can dangerously propel a loose part.
7. Before transporting a gas cylinder, remove the regulator and recap the cylinder.
8. Keep cylinder hand wheel or wrench on open cylinder valve at all times for prompt emergency cutoff.
9. Check regulator and all connections for leaks immediately after installation, periodically afterward, and following any service in which parts or connections were disconnected and reconnected.
10. To check for leaks, use a soap solution around fittings to find small leaks. Bubbles will indicate a leak.

7.3 Pressurization System Troubleshooting

Two types of pressure systems are used on the HPHT filter presses: carbon dioxide (CO_2) system and nitrogen (N_2) system. Leaking fittings, dirt in the regulators, or faulty pins and seats in the regulator are the primary causes of pressurization system problems. Rarely does a diaphragm rupture.

If a regulator will not hold pressure, proceed as follows:

1. Check for leakage around fittings.
    a. Pressure the system and look for escaping gas in the form of bubbles. This can be done by applying soap suds to possible leak areas. The regulator assembly, except for the gauge, may be submerged in water.
    b. Repair fitting leaks by disassembling, cleaning the threads, and then applying a good thread sealant or Teflon® tape thread sealant before re-installing fitting.
2. Check for a faulty regulator.
    a. Check for a faulty pin and seat; leakage through the regulator to the downstream side (not external leakage) is a sign of a faulty in and seat.
    b. Check for bubbles coming out of the regulator when the tee screw is backed out (screwed counterclockwise until the spring pressure is completely released).
3. Check for dirt or sample contamination in the regulator.

7.4 Faulty Regulator Systems

One or more of the following conditions are signs that a regulator is faulty:

- Gas leaks at the regulator outlet when the adjusting screw is completely released.
- With no flow through the system (downstream valves closed and adjusting screw in), working pressure increases steadily above set pressure.
- Gas leaks from spring case (adjusting screw end of regulator).
- Excessive drop in working pressure with the regulator flow open.
- Gas leaks from the relief valve.

7.5 Regulator Repair

A faulty regulator must be disassembled, cleaned, and repaired. For disassembly and reassembly, refer to Figure 7-3 for the carbon dioxide regulator (P/N 208615) and Figure 7-4 for the nitrogen regulator (P/N 209470).

1. Using a wrench on the hex of the spring cap, unscrew the spring case. All parts, including the diaphragm will remain in the spring case.
2. Remove the thrust plate, and then unscrew the retainer, and remove the seat with the pin.
3. Thoroughly clean all parts. Make sure that small orifices are open.
4. Inspect the regulator parts. Make sure that the diaphragm, gaskets, O-rings and other non-metal parts are not brittle, cracked or misshaped. Replace these parts as necessary.
5. Do not use any oil on the internal parts of the regulator.
6. Replace the seat and pin by installing the retrofit kit.
7. Reassemble the regulator. Refer to Figures 7-3 and 7-4. Replacement part numbers are in parentheses.
8. Pressure test the regulator. Use the list of symptoms above as a check list.
9. Assemble required fittings, relief valve and gauges onto regulator. Use a good thread sealant on all pipe threaded fittings as they are assembled.

Replacement part numbers for Figures 7-3 and 7-4 are in parentheses.

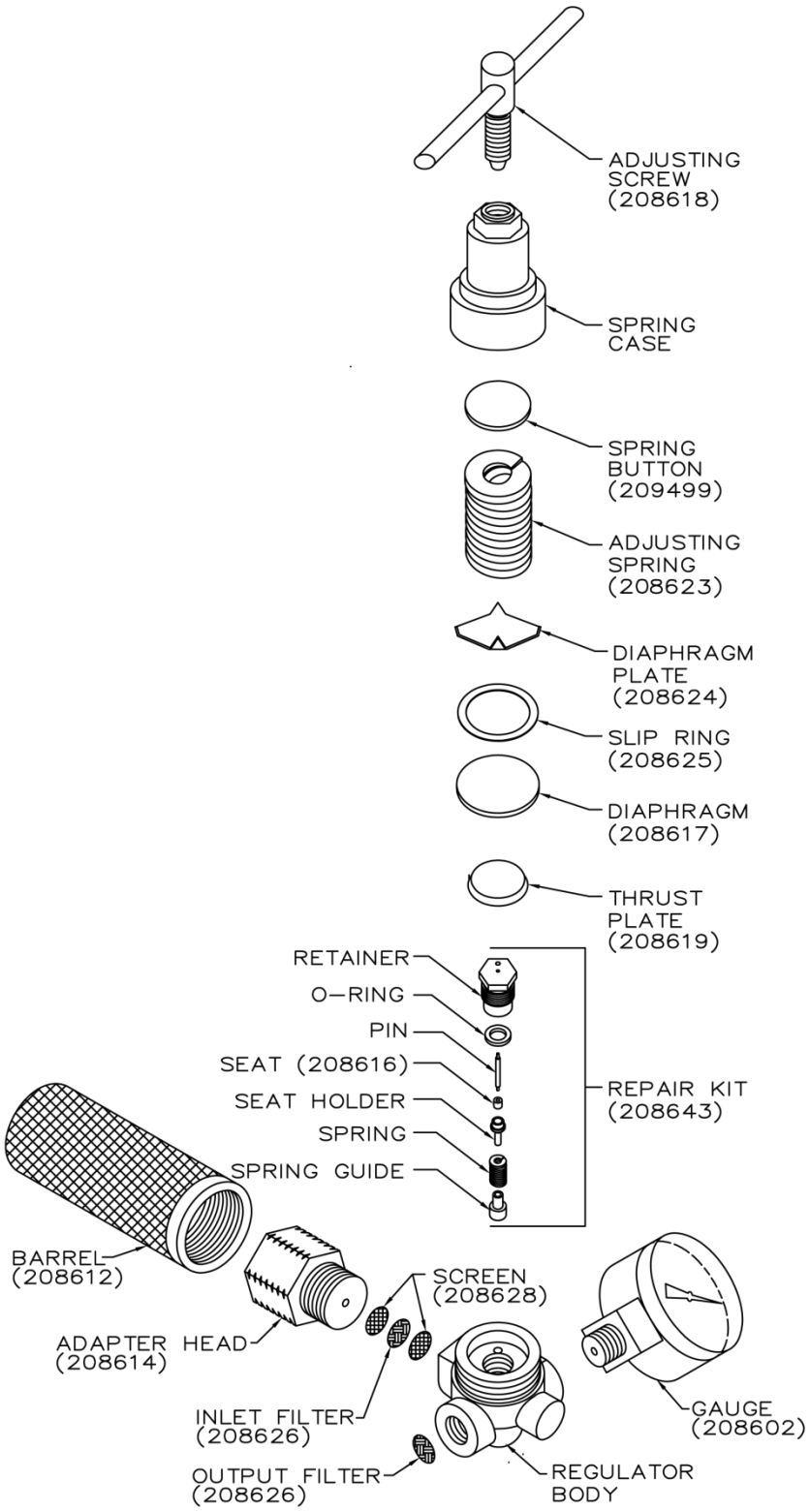

Figure 7-3 CO_2 Pressure Assembly, P/N 208647

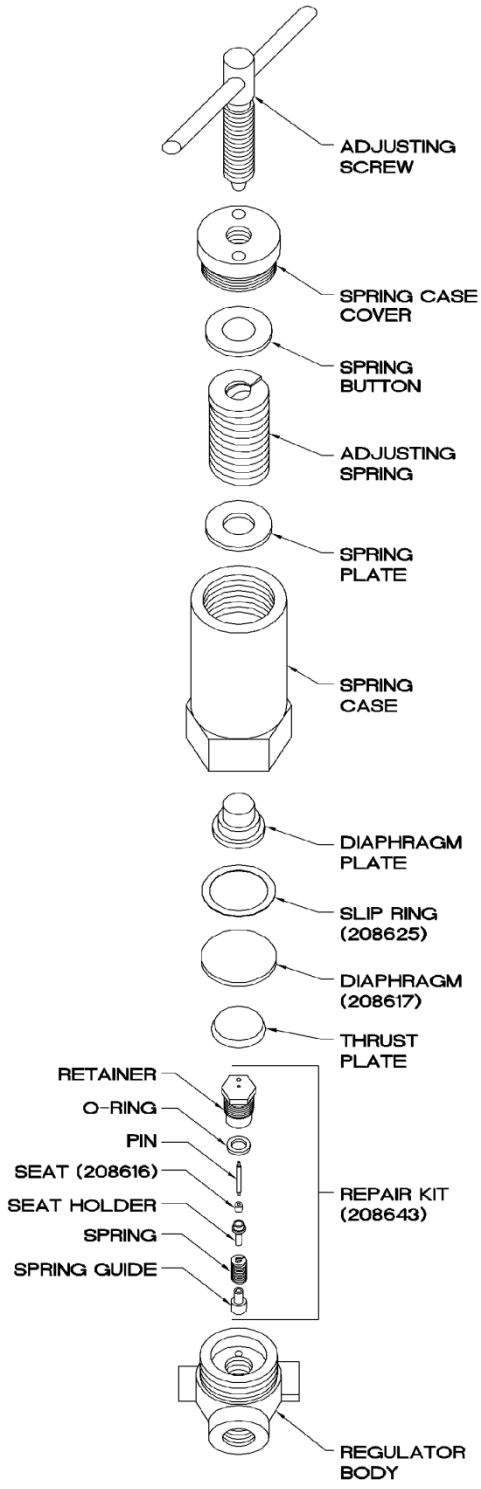

Figure 7-4 Nitrogen Regulator, P/N 209470

8 Accessories

Accessories listed in Table 8-1 consist of various special purpose parts that are not normally furnished with the filter presses, but are designed for use with them. Special tools are also in this listing

The supplies listed in Table 8-2 consist of the items consumed in the normal operation of the filter presses.

Table 8-1 Accessories

Part Number	Description
205868	Cylinder, Graduated Glass, 25 ml, TC
209571	Holder, HPHT cell assemblies
209497	Tool, Cell Handling
209500	Tool, Valve Stem Seat Resurfacing

Table 8-2 Supplies

Part Number	Description
208608	Cartridges, Carbon Dioxide (CO_2), 10/box
206056	Filter Paper, API 2.5-in. (6.3cm) Diameter, 100.box
206057	Filter, Glass Fiber, 2.5-in. (6.3cm) Diameter, 50/box
206058	Filter, Dynalloy-X5, 2.5-in. (6.3cm) Diameter
210536	Filter Disc, API designation 10, Ceramic, 10/box
210537	Filter Disc, API designation 12, 10/box
210538	Filter Disc, API designation 20, 10/box
210539	Filter Disc, API designation 40, 10/box
210540	Filter Disc, API designation 50, 10/box
210541	Filter Disc, API designation 55, 10/box
210542	Filter Disc, API designation 120, 10/box
210543	Filter, Ceramic Disc, 150 Micron, 10/box
210544	Filter, Ceramic Disc, 190 Micron, 10/box
204611	O-ring, 1-15/16 x 2-1/8 x 3/32, Nitrile B-46
205656	O-ring, 11/16 x 7/8 x 3/32, Nitrile B-46
204612	O-ring, 1-3/4 x 2 x 1/8, Nitrile B-46
205662	O-ring, 2-1/4 x 2-1/2 x 1/8, Nitrile B-46
205649	O-ring, 3/16 x 5/16 x 1/16, #2-008, Viton® 75 Duro
205668	O-ring, 1-3/8 x 1-1/2 x 1/16, Nitrile B-46

9 Parts List

For service and repair, contact Fann Instrument Company.

9.1 HT4700 HPHT Filter Press Parts

Table 6-1 lists the HT4700 HPHT Filter Press assemblies, which include the HT4700 Heating Jacket, Safe Cell, pressurizing systems and necessary equipment.

Table 9-1 HT4700 HPHT Filter Press Assemblies

Part No.	Cell	Pressurizing Assembly
102195986	SINGLE ENDED SAFE CELL	CO_2 PRESSURIZING ASSEMBLY 15 ML BACKPRESSURE ASSEMBLY
102196306	DOUBLE ENDED SAFE CELL	CO_2 PRESSURIZING ASSEMBLY 15 ML BACKPRESSURE ASSEMBLY
102197003	DOUBLE ENDED SAFE CELL	DUAL NITROGEN MANIFOLD 15 ML BACKPRESSURE ASSEMBLY
102197111	SINGLE ENDED SAFE CELL	DUAL NITROGEN MANIFOLD 15 ML BACKPRESSURE ASSEMBLY

CO_2 cartridges are not included with the CO_2 pressurizing assemblies.

HT4700 Heating Jacket and Safe Cell can also be ordered individually (Section 6.2).

9.2 HT4700 Heating Jacket, P/N 101631160

Table 9-2 HT4700 Heating Jacket Included Parts

Part No.	Description
208452	POWER CABLE, 115V
208865	POWER CABLE, 230V
102067614	TYPE J THERMOCOUPLE

9.3 Safe Cell Parts, P/N 102312548

Table 9-3 Safe Cell Included Parts

Item No.	Part No.	Quantity	Description
1	102313351	1	CELL CAP, THREADED
2	102313352	1	CAP RETAINER, THREADED
3	102313350	1	CELL BODY,THREADED, W/ CELLTELL™
4a	102081076	1	SCREEN, 60 MESH
4b	209534	1	SCREEN, 325 MESH W/ 60 MESH BACK-UP
5	209496	2	VALVE STEM
6	205649	9	O-RING, 0.176 ID x 0.0707 W, VITON
7	102365275	4	O-RING, 2.25 x 2.5, VITON

Figure 9-1 Safe Cell Assembly

9.4 Pressurization Systems

The carbon dioxide cartridge is rated at 900 psi (6,200 kPa) maximum. This unit is used at a maximum cell pressure of 600 psi (4316 kPa) with the 130 ml cell and the 15 ml backpressure receiver. See Figure 9-2.

Table 9-4 Carbon Dioxide Pressurizing Unit, P/N 209471

Item No.	Part No.	Quantity	Description
0001	208612	1	BARREL CO_2 CARTRIDGE
0002	208614	1	ADAPTER HEAD CO_2 CARTRIDGE
0003	208759	1	VALVE NEEDLE 1/8 X 1/8 CHROME
0004	209470	1	REGULATOR 1500 PSI
0005	209515	1	BLOCK MANIFOLD HPHT FILTER PRESS
0006	204648	1	PIN COX SAFETY LOCKING

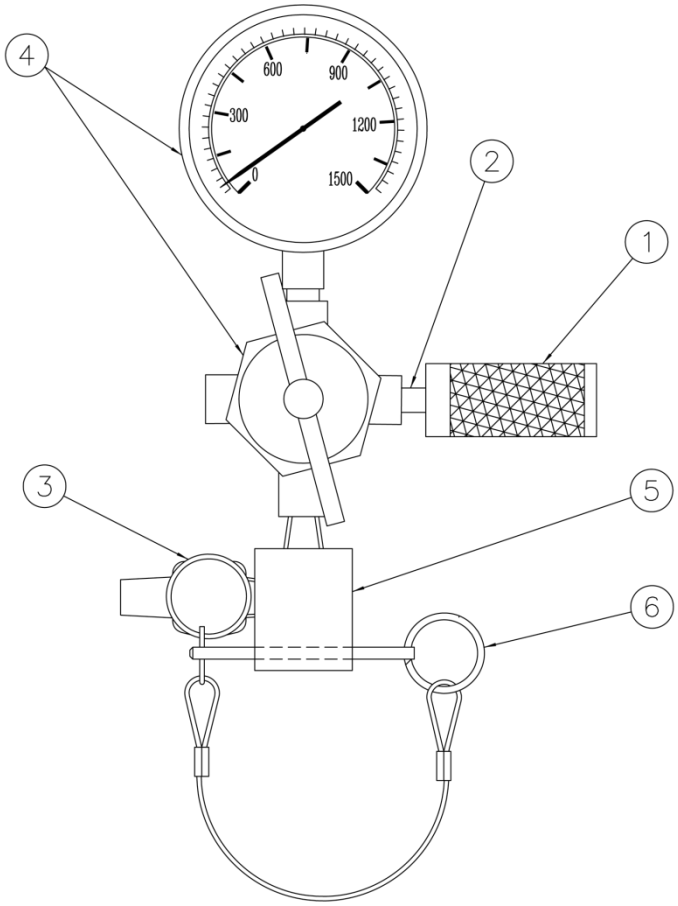

Figure 9-2 Carbon Dioxide Pressuring Unit

The dual nitrogen manifold (Figure 9-3) can be used with 130 ml cells and at pressures up to 1200 psi (8274 kPa) and backpressures up to 750 psi (5171 kPa).

Table 9-5 Dual Manifold, P/N 209545

Item No.	Part No.	Quantity	Description
0001	208759	1	VALVE NEEDLE 1/8 X 1/8 CHROME
0002	209466	1	GAUGE 1000 PSI 2in. DIAL 1/4 BOTTOM CONN
0003	209467	1	GAUGE 3000 PSI 2in. DIAL 1/4 BOTTOM CONN
0004	209470	1	REGULATOR 1500 PSI
0005	203950	1	NUT, REGULATOR, RIGHT HAND MALE
0006	209473	1	GLAND LONG NITROGEN SERVICE
0007	209474	2	HOSE 3000 PSI 3 FT X 3/16in.
0008	209475	1	BODY DUAL MANIFOLD
0009	209476	1	VALVE RELIEF 1/8in. 1200 PSI
0010	209477	1	VALVE RELIEF 1/8in. 750 PSI
0011	209515	1	BLOCK MANIFOLD HPHT FILTER PRESS
0012	204648	1	PIN COX SAFETY LOCKING
0013	204894	1	REGULATOR MODIFIED
0014	205583	2	NIPPLE 1/4 NPT HEX SS
0015	205585	2	TEE STREET 1/8 SS SWAGELOK
0016	205589	1	PLUG PIPE 1/4 NPT BRASS
0017	205595	1	UNION HALF 1/4 X 1/8 PLATED
0018	205596	1	CONNECTOR MALE 1/4 MNPT X 1/4 M JIC SS, 37 DEG, 6000PSI
0019	205597	1	ELL 1/8FNPT X 1/4 37D FLARE SS
0030	209472	1	NUT LEFT HAND GLAND

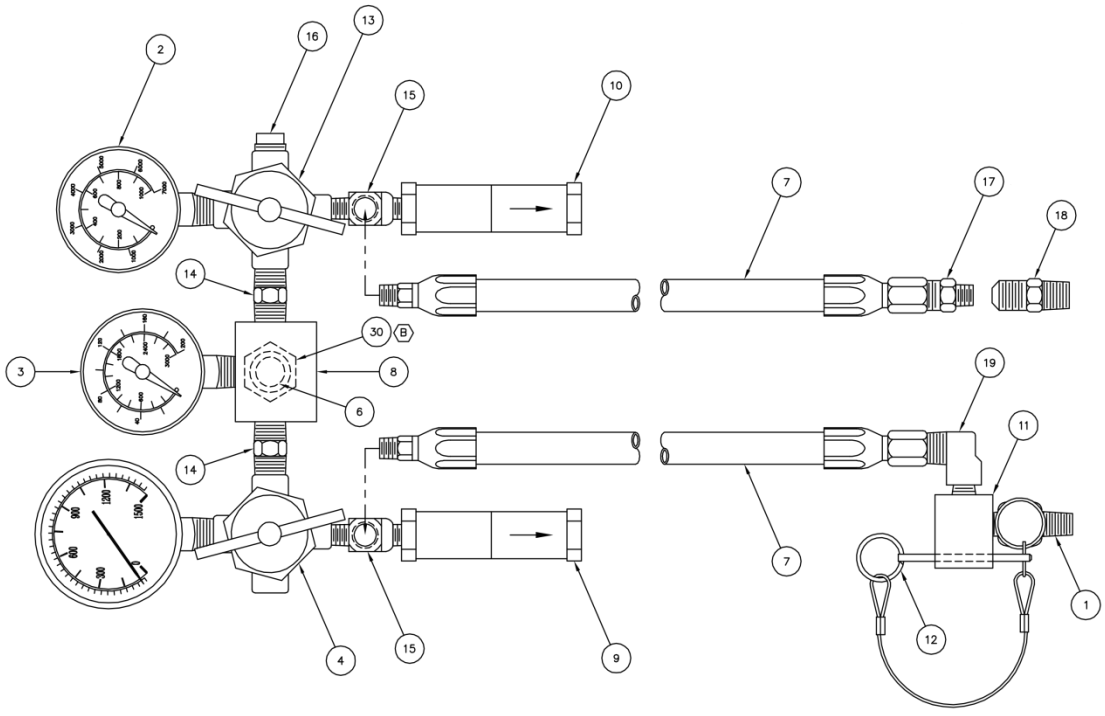

Figure 9-3 Dual Nitrogen Manifold

The HP Primary/LP Secondary Manifold (Figure 9-4), another dual nitrogen manifold, is used with 130 ml cells at maximum of 1200 psi (8274 kPa) and maximum backpressure of 170 psi (1172 kPa).

Table 9-6 HP Primary & LP Secondary Manifold, P/N 209546

Item No.	Part No.	Quantity	Description
0001	207929	1	HOSE LOW PRESSURE AIR 3 FT
0002	208059	2	HEX NIPPLE 1/4 NPT SS WITH 30 DEGREE TAPER
0003	204155	1	GAUGE PRESSURE, 200 PSI, 1.5in. DIAL, 1/8 MNPT
0004	208607	1	STREET ELL 1/4 SS-4-SE SWAGELOK
0005	208615	1	REGULATOR CO_2
0006	208653	1	VALVE BLEEDER 1/4in. NPT CHROME PLATED
0007	208759	1	VALVE NEEDLE 1/8 X 1/8 CHROME
0008	209467	1	GAUGE 3000 PSI 2in. DIAL 1/4 BOTTOM CONN
0009	209470	1	REGULATOR 1500 PSI
0010	203950	1	NUT, REGULATOR, RIGHT HAND MALE
0011	209473	1	GLAND LONG NITROGEN SERVICE
0012	209474	1	HOSE 3000 PSI 3 FT X 3/16in.
0013	209475	1	BODY DUAL MANIFOLD
0014	209476	1	VALVE RELIEF 1/8in. 1200 PSI
0015	209515	1	BLOCK MANIFOLD HPHT FILTER PRESS
0016	204648	1	PIN, SAFETY LOCKING
0017	205583	2	NIPPLE 1/4 NPT HEX STAINLESS
0018	205585	1	TEE STREET 1/8 SS SWAGELOK
0019	205587	1	COUPLING HEX 1/4 FNPT SS
0020	205597	1	ELL 1/8FNPT X 1/4 37D FLARE SS
0030	209472	1	NUT LEFT HAND

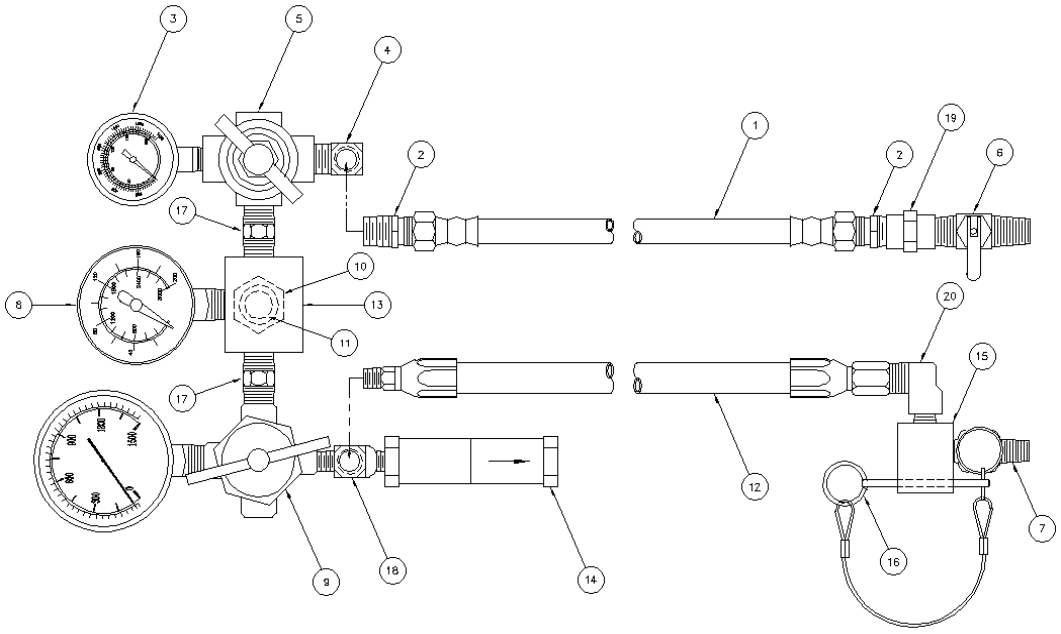

Figure 9-4 HP& LP Nitrogen Manifold

The single nitrogen manifold (Figure 9-5) is used with 130 ml cells at maximum pressure of 1200 psi (8274 kPa).

Table 9-7 Single Nitrogen Manifold, P/N 209547

Item No.	Part No.	Quantity	Description
0001	208759	1	VALVE NEEDLE 1/8 X 1/8 CHROME
0002	209467	1	GAUGE 3000 PSI 2in. DIAL 1/4 BOTTOM CONN
0003	209469	1	TEE 1/4in. HIGH PRESSURE w/SS FILTER
0004	209470	1	REGULATOR 1500 PSI
0005	203950	1	NUT, REGULATOR, RIGHT HAND MALE
0006	209473	1	GLAND LONG NITROGEN SERVICE
0007	209474	1	HOSE 3000 PSI 3 FT X 3/16in.
0008	209476	1	VALVE RELIEF 1/8in. 1200 PSI
0009	209515	1	BLOCK MANIFOLD
0010	204648	1	PIN COX SAFETY LOCKING
0011	205585	1	TEE STREET 1/8 SS SWAGELOK
0012	205597	1	ELL 1/8FNPT X 1/4 37D FLARE SS
0030	209472	1	NUT LH GLAND OIL PUMPED NITROGEN CGA

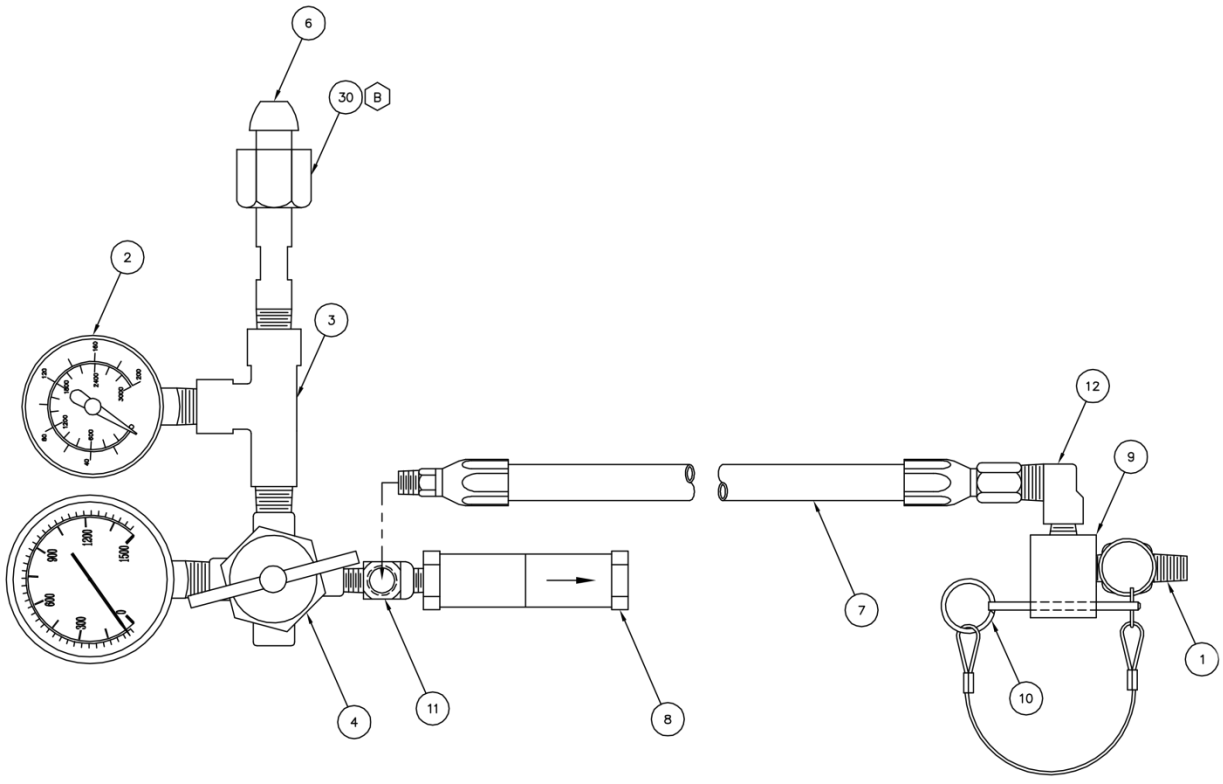

Figure 9-5 Single Nitrogen Manifold

The four unit manifold (Figure 9-6) connects up to four HPHT filter presses from a single nitrogen source for cell pressure and backpressure.

Table 9-8 Four Unit Nitrogen Manifold, P/N 209548

Item No.	Part No.	Quantity	Description
0001	208759	12	VALVE NEEDLE 1/8 X 1/8 CHROME
0002	205586	8	COUPLING 1/8in. 316SS
0003	209474	8	HOSE 3000 PSI 3 FT X 3/16in.
0004	207850	4	1/4-20 X 1/4 HSSS SS
0006	205597	4	ELL 1/8FNPT X 1/4 37D FLARE SS
0007	209515	4	BLOCK MANIFOLD HPHT FILTER PRESS
0008	204648	4	PIN COX SAFETY LOCKING
0009	205590	2	PLUG PIPE 1/8 NPT PLATED BRASS
0010	205595	2	UNION HALF 1/4 X 1/8 PLATED
0011	204004	4	ELL M 45D 37D FLARE 1/4TX1/4MP
0012	204005	4	ELL M 45D 37D FLARE 1/4TX1/8MP
0014	209549	1	MANIFOLD BARE 4 UNIT

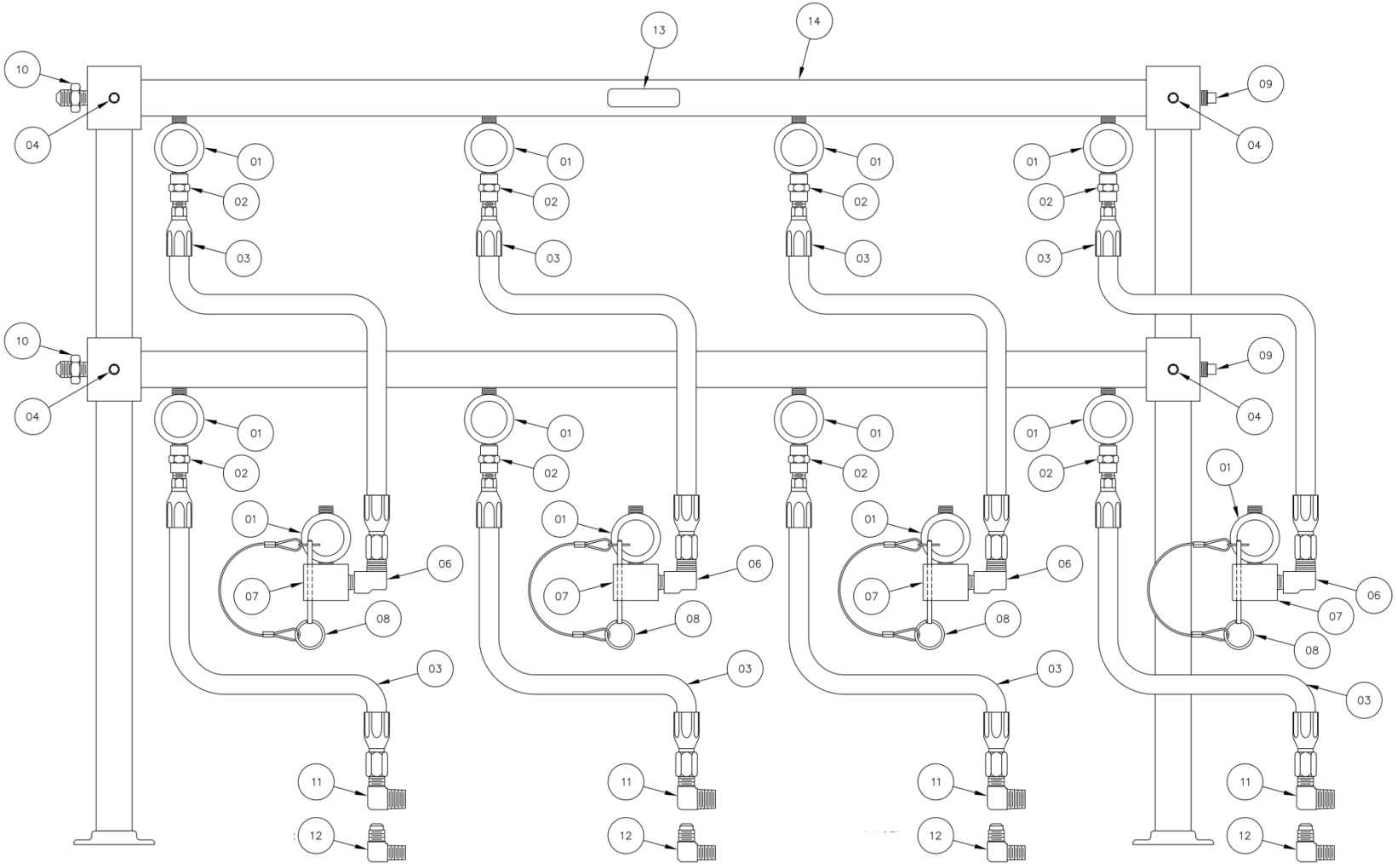

Figure 9-6 Four Unit Nitrogen Manifold

9.5 Backpressure Receivers

The 15 ml nitrogen backpressure receiver (Figure 9-7) can be used with the dual nitrogen manifold (P/N 209545) or HP Primary/LP Secondary Nitrogen Manifold (P/N 209546).

Table 9-9 Backpressure Receiver, Nitrogen, 15 ml, P/N 209502

Item No.	Part No.	Quantity	Description
0001	208759	1	VALVE NEEDLE 1/8 X 1/8 CHROME
0002	209504	1	BODY RECEIVER 15ml
0003	204648	1	PIN COX SAFETY LOCKING
0004	205592	1	ELL STREET 1/8 NPT SS
0005	205656	1	O-RING, 11/16 X 3/32, NITRILE

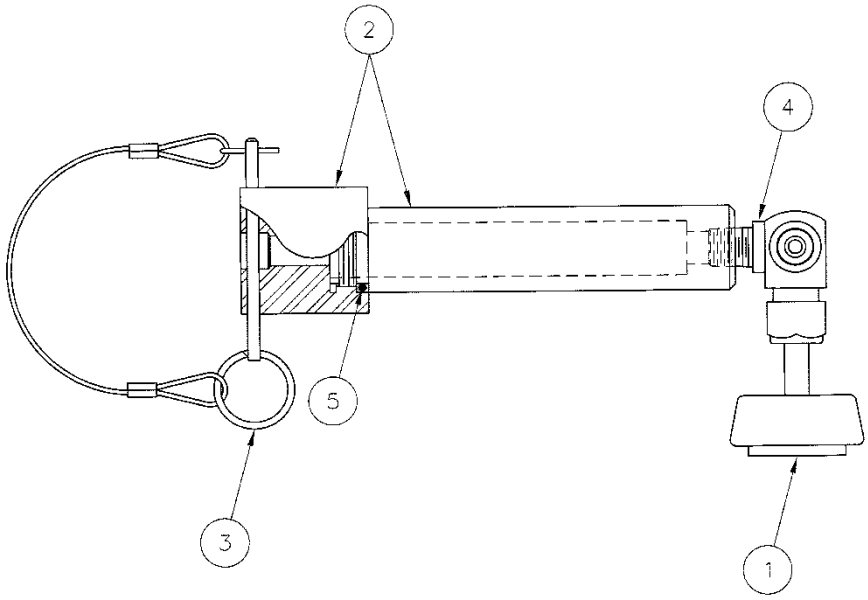

Figure 9-7 Backpressure Receiver Assembly, 15 ml, Nitrogen

Table 9-10 Backpressure Receiver, 15 ml, Carbon Dioxide, P/N 209503

Item No.	Part No.	Quantity	Description
0001	204155	1	PRESSURE GAUGE, 200 PSI, 1.5in. DIAL, 1/8 MNPT BOTTOM
0002	208612	1	BARREL CO_2 CARTRIDGE
0003	208614	1	ADAPTER HEAD CO_2 CARTRIDGE
0004	208615	1	REGULATOR CO_2 1/4 NPT FITTINGS
0005	208653	1	VALVE BLEEDER 1/4in. NPT CHROME PLATED
0006	208759	1	VALVE NEEDLE 1/8 X 1/8 CHROME
0007	209504	1	BODY RECEIVER, 15ml
0008	204648	1	PIN COX SAFETY LOCKING
0009	205279	1	BAG PLASTIC, 9in. X 12in.
0010	205592	1	ELL STREET 1/8 NPT SS
0011	205656	1	O-RING, 11/16 X 3/32, NITRILE

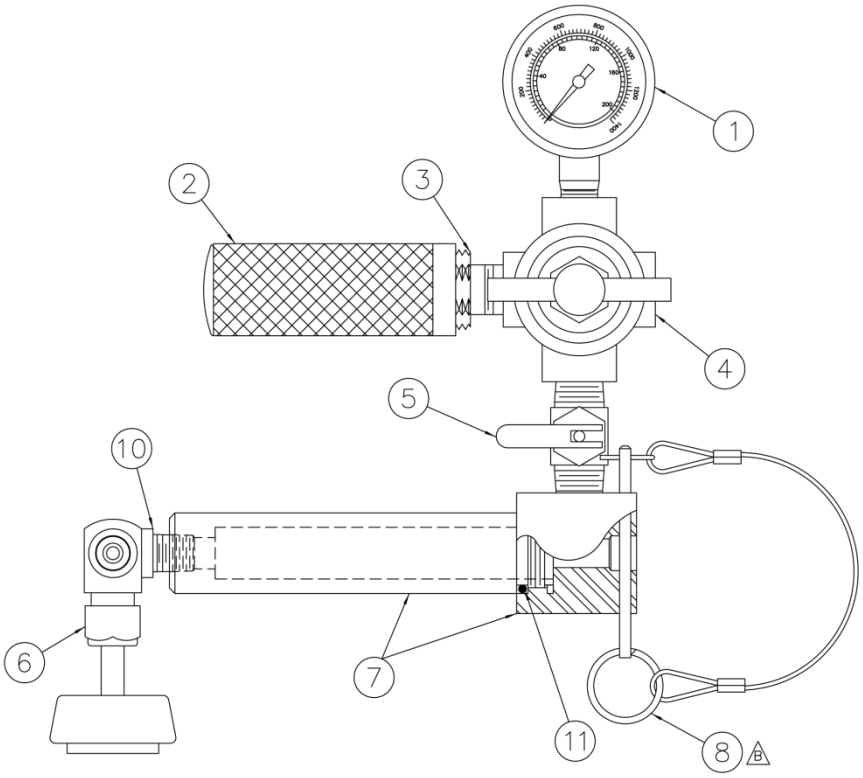

Figure 9-8 Backpressure Receiver, 15 ml, Carbon Dioxide

9.6 Cell Screens

If screens need to be replaced, choose from the following selection:

- P/N 102081076, 60 mesh, stainless steel screen
- P/N 209534, 325 mesh with 60 mesh backing, stainless steel

10 Warranty and Returns

10.1 Warranty

Fann Instrument Company warrants only title to the equipment, products and materials supplied and that the same are free from defects in workmanship and materials for one year from date of delivery. THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED OF MERCHANTABILITY, FITNESS OR OTHERWISE BEYOND THOSE STATED IN THE IMMEDIATELY PRECEDING SENTENCE. Fann's sole liability and Customer's exclusive remedy in any cause of action (whether in contract, tort, breach of warranty or otherwise) arising out of the sale, lease or use of any equipment, products or materials is expressly limited to the replacement of such on their return to Fann or, at Fann's option, to the allowance to Customer of credit for the cost of such items. In no event shall Fann be liable for special, incidental, indirect, consequential or punitive damages. Notwithstanding any specification or description in its catalogs, literature or brochures of materials used in the manufacture of its products, Fann reserves the right to substitute other materials without notice. Fann does not warrant in any way equipment, products, and material not manufactured by Fann, and such will be sold only with the warranties, if any, that are given by the manufacturer thereof. Fann will only pass through to Customer the warranty granted to it by the manufacturer of such items.

10.2 Returns

For your protection, items being returned must be carefully packed to prevent damage in shipment and insured against possible damage or loss. Fann will not be responsible for damage resulting from careless or insufficient packing.

Before returning items for any reason, authorization must be obtained from Fann Instrument Company. When applying for authorization, please include information regarding the reason the items are to be returned.

Our correspondence address:

Fann Instrument Company
P.O. Box 4350
Houston, Texas USA 77210

Telephone: 281-871-4482
Toll Free: 800-347-0450
FAX: 281-871-4446

Email fannmail@fann.com

Our shipping address:

Fann Instrument Company
14851 Milner Road, Gate 5
Houston, Texas USA 77032