High-Pressure, High-Temperature Filter Press

Instruction Manual

Manual No. 209486, Revision N

Instrument No.
Models 175CT and 500CT

fann®
Fann Instrument Company

HPHT Filter Press Instruction Manual

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CellTell™ Positive Pressure Indicator is protected by U.S. patent number D347,799.

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1 Introduction

Fann High-Pressure, High-Temperature Filter Press is used to evaluate the filtration properties of drilling fluids, cement slurries, and fracturing fluids. Filtration behavior is affected by the quantity, type, and particle sizes, as well as temperature and pressure. Measuring filtration properties and observing filtrate and filter cake characteristics is fundamental to treatment and control.

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.

Fann High-Temperature, High-Pressure (HPHT) Filter Press is designed for safe and efficient testing that meets API specifications.

Each HPHT filter press 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. This safety feature makes it possible for the user to safely open the cell. The CellTell™ is durable, resistant to temperature changes, vibration, and rotation.

HPHT filter presses are available in various arrangements. Two sizes are available - 175 ml and 500 ml. The 175 ml cell units can be operated up to 350°F (177°C), and the 500 ml cell units can be operated up to 500°F (260°C). Both units can be pressurized to 1800 psig on the cell and 750 psig on the backpressure receiver.

The HPHT sample 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.

1.1 Document Conventions

The following icons are used as necessary in this 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.

2 Safety

Safe operation of the High-Pressure, High-Temperature Filter Press requires the operator understand and practice the correct assembly and operation of the equipment. Improper assembly, operation, or the use of defective parts may result in cell leakage or failure which could result in serious injury and damage.

Only qualified personnel should perform repairs or maintenance.

The sample cell and the heating jacket are hot during operation. The operator should be aware of these hot areas and avoid contact with them. Burns can result from touching hot parts of the equipment during normal operation.

These instruments are electrically heated, and as with any electrical device, the wiring should be regularly checked for bad connections. These instruments should always be used on a grounded circuit.

The following sections give suggestions that should be observed to assure safe operation and maintenance of the HPHT filter presses.

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. Follow the procedure as outlined in Section 5-4. When de-pressurizing, shut off the supply pressure, bleed the system of pressure, and then back out the regulator tee screw following the procedures in Section 5-6.

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, shown in Figure 5-4, 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

Always disconnect the power cable before repairing the instrument.

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.
3. 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. Refer to Sections 7.7 or 7.8 for repairing the heating jacket.

2.4 Safe Test Cell Maintenance

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

1. Cell material should be compatible with the test sample.
2. Cell bodies that show signs of stress cracking, severe pitting, or have damaged set screw holes must not be used. Refer to Section 7.1.4.
3. Cell caps showing evidence of the set screw seat being pulled or deformed must not be used. Refer to Section 7.1.2.
4. Damaged set screws must not be used. Do not attempt to substitute low strength steel or stainless steel set screws. Refer to Section 7.1.2.

To safely operate the HPHT filter press, the user must use the CellTell™ Positive Pressure Indicator and the filter press clamp.

3 Features and Specifications

The HPHT Filter Press consists of a stainless steel cell with filtering area of 3.5 in^2 (22.58 cm^2), an aluminum heating jacket, filter medium, graduated cylinder to collect filtrate and pressurization equipment. The CellTell™ Positive Pressure Indicator is safety feature that is also included.

Filter media choices are API standard filter paper, ceramic discs of various porosities, and screens of various mesh sizes. For operation above 375°F (190°C), the filter paper should be backed with a glass fiber filter. One alternative is a stainless steel filter. Another alternative is the use of a cell adapted to accept a ceramic filter disc.

HPHT filter presses are available in two cell capacity sizes, 175 ml and 500 ml, as shown in Figures 3-1 and 3-2, respectively. Both series are available with either 115 volt AC or 230 volt AC heating jackets. See Table 3-1 for features and specifications and Figures 3-1 and 3-2.

The operator has various options for achieving the desired pressure. 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.

Table 3-1 Model 175CT HPHT Filter Press

Category		Specification
Maximum Temperature		350°F (177°C)
Maximum Pressure	Cell	1800 psig (12.4 MPa)
	Backpressure	750 psig (5.17 MPa)
Sample Cell Volume		175 ml
Receiver Volume		15 ml
Filtering Area		3.5 in^2 (22.58 cm^2)
Heating Capacity		400 watts
Pressure Connection		Nitrogen or Carbon Dioxide
Power Requirement		115/230 VAC, Frequency 50/60 Hz

Table 3-2 Model 500CT HPHT Filter Press

Category		Specification
Maximum Temperature		500°F (260°C)
Maximum Pressure	Cell	1800 psig (12.4 MPa)
	Backpressure	750 psig (5.17 MPa)
Sample Cell Volume		500 ml
Receiver Volume		100 ml
Filtering Area		3.5 in^2 (22.58 cm^2)
Heating Capacity		800 watts
Pressure Connection		Nitrogen or Carbon Dioxide
Power Requirement		115/230 VAC, Frequency 50/60 Hz

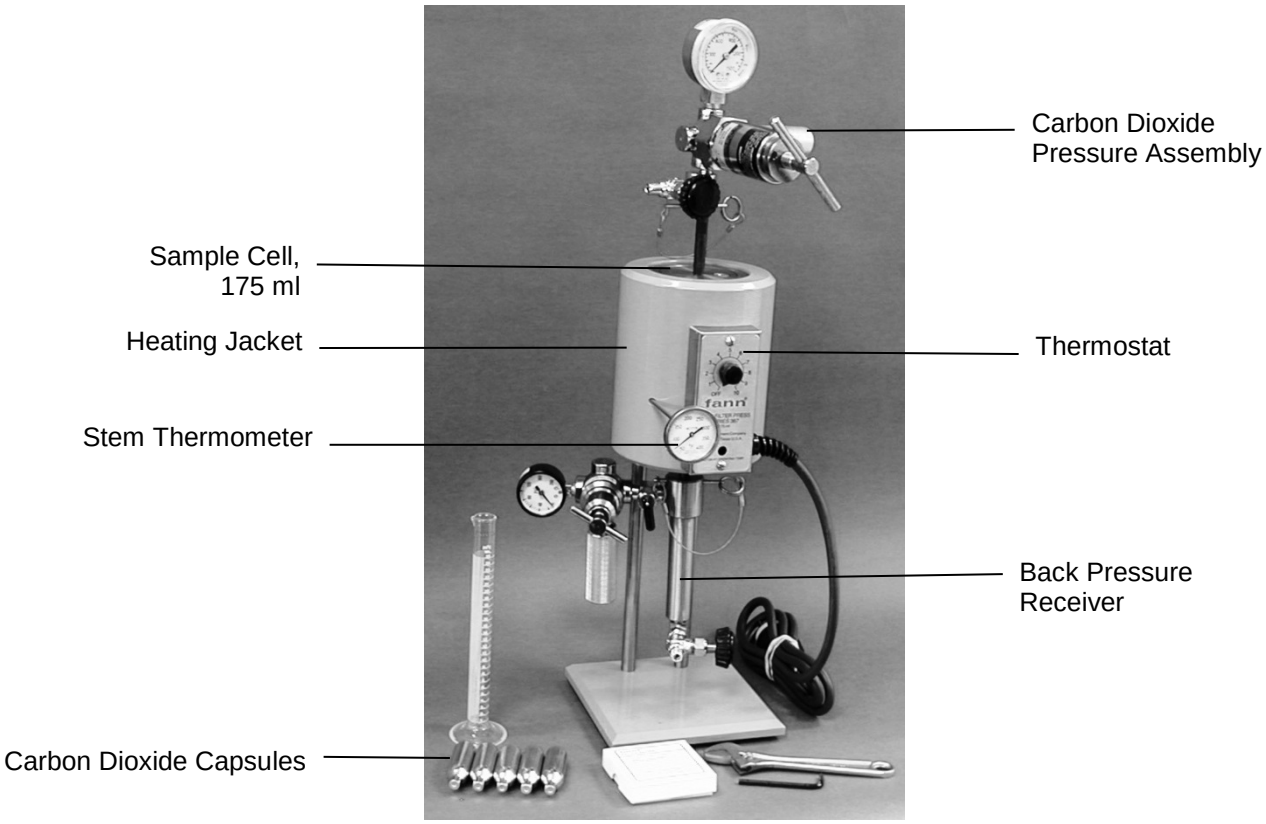

Figure 3-1 HPHT Filter Press, 175 ml

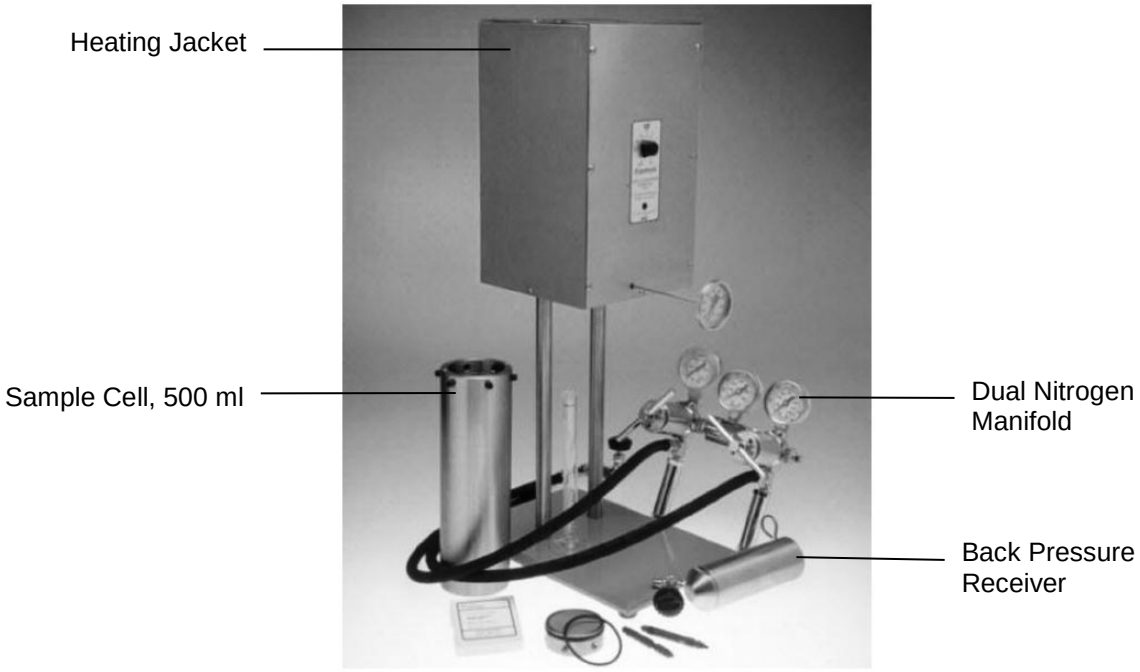

Figure 3-2 HPHT Filter Press, 500 ml

3.1 Pressure

All HPHT 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 as shown in Figures 3-1 and 3-3. 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, shown in Figure 3-4, supplies pressure to the cell only, and backpressure is optional. The backpressure receiver requires carbon dioxide. The dual nitrogen manifold, shown in Figure 3-5, 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, shown in Figure 3-6, 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. See Figures 3-1, 3-7 and 3-8. Either carbon dioxide or nitrogen can be used as the pressurizing medium. These 15 ml backpressure receivers also may be connected to the 500 ml cells when a small receiver volume is desired. However, the 500 ml cells are usually connected to the 100 ml capacity backpressure receiver shown in Figure 3-9. The nitrogen pressurized backpressure receivers can handle a maximum pressure of 750 psi (5171 kPa).

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

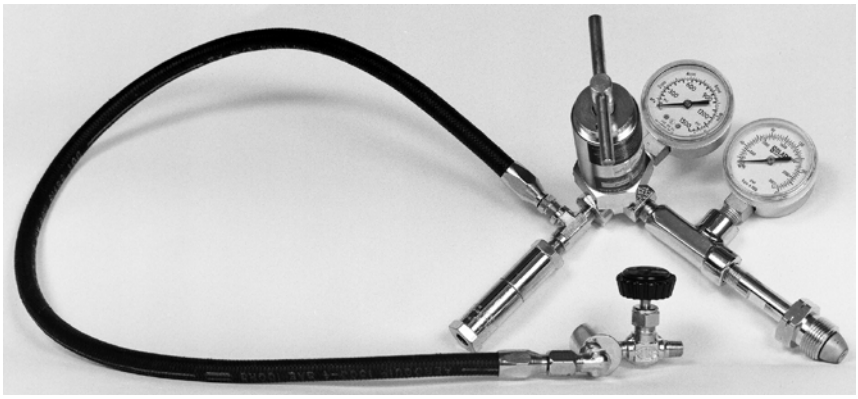

Figure 3-4 Single Nitrogen Manifold [P/N 209547]

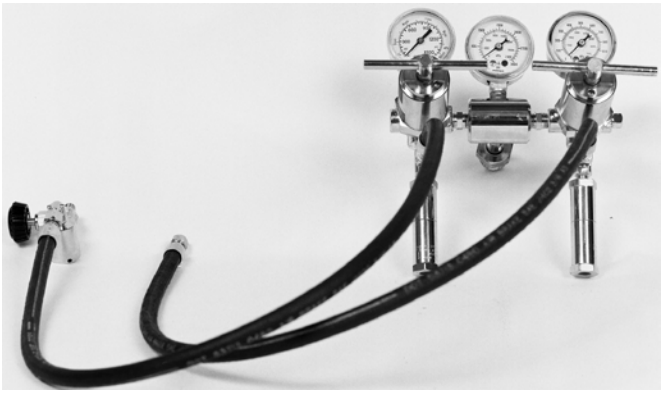

Figure 3-5 Dual Nitrogen Manifold [P/N 209545]

Figure 3-6 HP Primary & LP Secondary HPHT Manifold [P/N 209546]

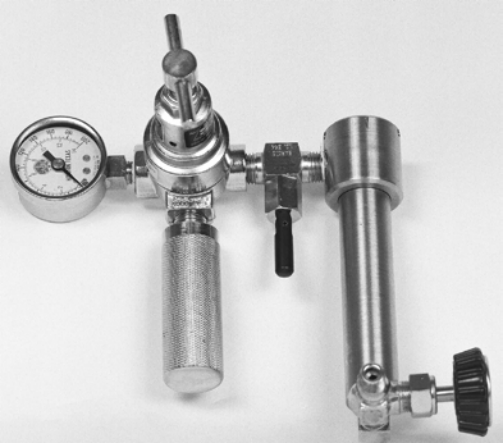

Figure 3-7 Backpressure Receiver with Carbon Dioxide, 15 ml [P/N 209503]

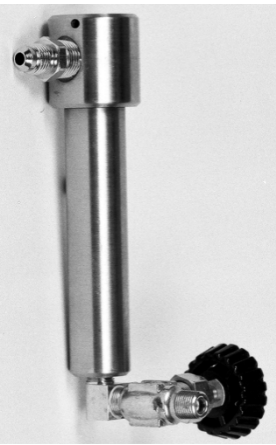

Figure 3-8 Backpressure, 15 ml [P/N 209502]

Figure 3-9 Backpressure Receiver, 100 ml [P/N 209542]

3.2 Temperature

To achieve the desired temperature, use the thermostat knob that is located on the heating jacket. To measure the actual temperature of the heating jacket and cell, insert a stem thermometer into the thermometer well in the heating jacket or the cell. The thermostat knob has a scale of from 1 to 10; take note of the scale number and the actual measured temperature for future reference. See Figures 3-1 and 3-2 for pictures of the heating jackets, both 175 ml and 500 ml.

3.3 Sample Cell

All HPHT filter presses use one of two basic cells:

- 175 ml cell (173.3 ml exact)
- 500 ml cell (493.0 ml exact)

These cells are normally made of stainless steel alloy 303. Optional materials, such as stainless steel alloy 316, Inconel® alloy 600, or Hastelloy® C-276 are also available.

The cells are available with a single end opening and with removable ends (also called dual opening or double ended).

End caps come in four designs:

- Cap with permanently installed 60 mesh screen (P/N 209532)
- Cap with removable screen (P/N 209536)
- Cap with CellTell™ Positive Pressure Indicator (P/N 209568)
- Cap with groove (P/N 209573)

Caps with the CellTell™ Positive Pressure Indicator are only used on the top of the double opening cells. The other end cap types can be used with the 175 ml or 500 ml cells and the single or double opening cells.

Several screen mesh selections are available for use with the end cap for the removable screen assembly. These screens are listed in Section 8.

Double-ended cell bodies are available for use with ceramic disc filters, where one end is used for the ceramic filter disc. The opposite end is standard and can accept either end cap. The ceramic filter disc end requires a ceramic filter disc cap. To use these cells and caps for ceramic filter discs with any of the standard filter paper and support screen assemblies, an adapter ring and O-ring must be assembled into the cell. See Table 8-1 Accessories for a list of ceramic disc filters that are available for separate purchase.

Refer to Section 9.6 Cell Assemblies for cell drawings, descriptions, and part numbers.

3.4 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 3-10). 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.

Certain tests may require that the test sample does not contact the pressurization medium. This requirement can be met by using a free floating piston. The free floating piston can be used with most cell combinations, both the 175 ml and the 500 ml sizes. These pistons are furnished with a suitable installation and removal tool. See Table 8-1 Accessories for part numbers and descriptions.

Figure 3-10 CellTell™ Positive Pressure Indicator

3.5 Filter Press Cell Clamp

During testing, sometimes the test fluid may solidify and plug the valve stems. Or the CellTell™ Positive Pressure Indicator may become plugged, giving a false, *no pressure* reading. In these high risk situations, where pressure is trapped inside the cell, it is recommended to use the filter press cell clamp (Figure 3-11).

Fann has developed a bench top cell clamp to maintain force on the lid while the set screws are removed. Once the screws are removed, the lid can be allowed to slowly rise and release any trapped pressure in a controlled manner.

The filter press cell clamp is available as a separate purchase.

Figure 3-11 Filter Press Cell Clamp [P/N 232207 or 232208]

Two filter press cell clamps are available: 1) 175 ml cell clamp, P/N 232207; 2) 500 ml cell clamp, P/N 232208.

4 Installation

The 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 consumable, such as filter paper and pressurizing cartridges.

4.1 Heating Jacket

The heating jacket is equipped with a 115V or 230V power cord, approximately 5 ft (1.5 m) long. The heating jacket should be placed no farther than this distance from an available electrical outlet that has the correct voltage for the heating jacket. Because of the diversity in types of electrical outlets throughout the world, it may be necessary to replace the power cord's plug.

Customer- installed wiring, electrical connectors, and power cords are excluded from the warranty.

Ideally, the heating jacket should be placed to the left side of the electrical outlet, rather than directly in front or to the right of it. This reduces the risk of a thermal burn when unplugging the power cord from the outlet while the heating jacket is still hot.

The power cord should be kept away from the noninsulated surface of the heating jacket while the jacket is in use and immediately afterwards.

The area immediately above the heating jacket needs sufficient clearance for the fully assembled cell with valve stems to be placed into the heating jacket from above. Additional clearance should be considered if the cell handling tool is used to remove hot cells before they have cooled to room temperature. See Figure 5-1.

The 175 ml filter press requires approximately 10 inches (25 cm) of vertical clearance and 18 ½ inches (47 cm) with the carbon dioxide pressurizing regulator installed. The cell handling tool requires 12 ½ inches (32 cm).

The total overhead clearance from the surface supporting the heating jacket should be 25 ½ inches (65 cm), 28 inches (71 cm) with the cell handling tool, and 34 inches (86 cm) with the carbon dioxide pressurizing regulator installed.

The 500 ml filter press requires approximately 15 ½ inches (39 cm) of vertical clearance and 18 ½ inches (47 cm) with the carbon dioxide pressurizing regulator installed. The cell handling tool requires 18 inches (46 cm). The total overhead clearance from the surface supporting the heating jacket should be 25 ½ inches (65 cm) and 28 inches (71 cm) with the cell handling tool.

4.2 Pressurizing System

The type of pressurizing system may also 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.

4.3 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.

4.4 Filter Press Cell Clamp

The filter press cell clamp is a safety tool that guards against the sudden release of the cell cap when the retaining screws are being removed, while pressure is trapped inside the cell. It should be in close proximity to both the heating jacket and the cell clean up area. If desired, it can be secured to the work surface through the holes provided, or otherwise clamped to prevent undesired movement.

The filter press clamp is available for separate purchase.

4.5 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.

4.6 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 Operation

Before starting the test, the High-Pressure, High-Temperature 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. Refer to Figures 3-1 and 3-2 when following these operating instructions.

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

TEMPERATURE	< 200°F (93°C), No backpressure required.
	200°F - 300°F (93°C -149°C), Backpressure at 100 psi (689 kPa).
	300°F - 500°F (149°C- 260°C), Backpressure according to Table 5-3 and special test notes.
PRESSURE	< 200°F (93°C), 500 psi (3447 kPa)
	200°F - 300°F (93°C - 149°C), 100 psi (689 kPa) during heating and 600 psi (4137 kPa) with 100 psi (689 kPa) backpressure during test
SAMPLE PREPARATION	Stir for 10 minutes with high speed mixer
EXPANSION ALLOWANCE	1/2 inches (12.7 mm), < 300°F (149°C)
	1-1/2 inches (38.1 mm), 300°F- 500°F (149°C - 260°C)
SAMPLE VOLUME	175 ml cell: 130 - 145 ml, < 300°F (149°C)
	500 ml cell: 455 - 470 ml, < 300°F (149°C)
	500 ml cell: 390 - 405 ml, 300°F - 500°F (149°C - 260°C)
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 - less than 1 hour
	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.

NOTE: This table is based on API Recommended Practice for Field Testing Water Based Drilling Fluids, API RP 13B-1 and API Recommended Practice for Field Testing Oil Based Drilling Fluids, API RP 13B-2.

Table 5-2 Fann HPHT Cement Test Outline

TEMPERATURE	< 200°F (93°C), No backpressure required.
	200°F - 300°F (93°C -149°C), Backpressure at 100 psi (689 kPa).
	300°F - 500°F (149°C- 260°C), Backpressure according to Table 5-3 and special test notes.
PRESSURE	< 200°F (93°C), 500 psi (3447 kPa)
	200°F - 300°F (93°C - 149°C), 100 psi (689 kPa) during heating and 600 psi (4137 kPa) with 100 psi (689 kPa) backpressure during test
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)
	1-1/2 inches (38.1 mm), 300°F- 500°F (149°C - 260°C)
SAMPLE VOLUME	175 ml cell: 130 - 145 ml, < 300°F (149°C)
	500 ml cell: 455 - 470 ml, < 300°F (149°C)
	500 ml cell: 390 - 405 ml, 300°F - 500°F (149°C - 260°C)
FILTER	No. 325 (45 micrometer) U S Sieve with 60 mesh backing screen, stainless steel, Part No. 209534
TIME	Sample Heating - 15 minutes from time pressure is applied 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

NOTE: This table is based on API Recommended Practice for Testing Field Cements, API RP 10B-2.

5.1 Preheating the Heating Jacket

1. Connect the power cord to the proper line voltage as indicated on the nameplate.
2. Turn the thermostat to near mid-scale.
3. Place a metal stem dial thermometer in the thermometer well of the heating jacket.
4. The pilot light will turn on when the heating jacket temperature has reached the thermostat setting.
5. Readjust the thermostat setting as necessary to obtain the desired test temperature.

The time required to heat the sample to the test temperature will be between one half and one hour, depending on the desired test temperature. The temperature of the cell should be checked by placing a metal stem dial thermometer in the thermometer well of the cell.

5.2 Loading the Filtration Cell

The filtration cell assembly constitutes a pressure vessel. Follow the safety precautions listed in Section 2 to assure safe operation.

Cell material should be compatible with the test sample.

Cell bodies that have stress cracking or severe pitting, or damaged set screw holes must not be used. Refer to Section 7.1.4 Cell Corrosion.

Cell caps that have pulled or deformed set screw seats must not be used. Refer to Section 7.1.2 Set Screws.

Damaged set screws must not be used. Do not attempt to substitute low strength steel or stainless steel set screws. Refer to Section 7.1.2 Set Screws.

1. Loosen the six socket head set screws, and remove the cell end cap by pulling it straight out of the cell, using the valve stem as a handle. If the O-rings are stuck, screw the cell cap removal tool into the cap valve stem hole then press downward on the handle to pull the cap out. See Figure 5-1. If the cap removal tool is not available, grasp the valve stem, slightly rocking the end cap.
2. Unscrew the valve stem out of the cap.
3. Inspect the O-rings on the valve stems, cell body and cap, and replace any damaged or brittle O-rings. It is recommended that O-rings are replaced after each test run at temperatures above 350°F (177°C).
4. If using a double-ended cell, reassemble the end cap and valve stem that will be the non-filter end. Make sure the six socket set screws are securely tightened and the valve stem is tight.
5. For a single-ended cell, assemble and tighten the valve stem into the cell body.
6. With the filter end of the cell up, carefully fill the cell with the sample to be tested.
   - For 175 ml cells, allow 1/2 to 3/4 inches (12.7 to 19 mm) from the top.
   - For 500 ml cells, if the test temperature is 300°F (149°C) or less, allow 1/2 to 3/4 inches (12.7 to 9 mm) from the top.
   - For 500 ml cells, if the test temperature is 300°F to 500°F (149°C to 260°C), leave 1 ½ to 1 ¾ inches (38 to 44.5 mm) from the top.

Figure 5-1 Cell Cap Removal Tool [P/N 209508]

5.3 Inserting the Filter

1. Follow the instructions for the filter media that you are using:
   a. If using a permanently attached screen cap and standard filter paper, place a filter paper disc on the O-ring in the cell body.
   b. If the test temperature is 400°F (205°C) or greater, place a fiberglass backing disc on top of the filter paper.
   c. If using one of the removable screens, install it directly into the cell, coarse side up.
   d. If using a ceramic filter, install it directly into the cell, omitting the filter paper and screens.
2. Install the end cap, making sure the set screw seats in the cap are aligned with the set screws in the body. Tighten set screws firmly, then install and tighten the valve stem. (Refer to Section 9.6 for compatibility of end caps).
3. Invert the assembled filtration cell (turn it 180 degrees) and lower it into the heating jacket (filter end down). Then rotate the cell assembly so that the pin in the bottom of the heating jacket engages the hole in the bottom of the cell. This prevents the cell rotating when the valve stems are opened or closed.

5.4 Pressurizing the Filtration Cell

5.4.1 Pressurizing with Carbon Dioxide

1. Install the pressure unit on the inlet (top) valve stem and insert the locking pin. Refer to Figure 5-2.
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.

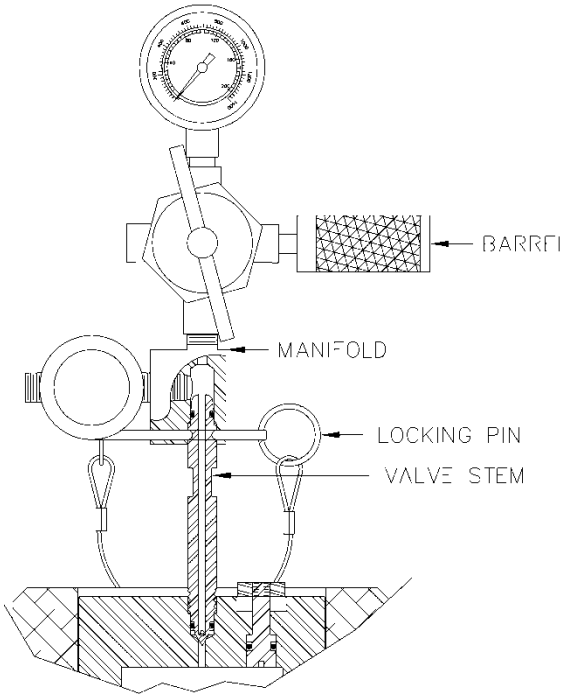

Figure 5-2 CO_2 Pressure Unit

5.4.2 Pressurizing with Nitrogen

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

- The dual nitrogen manifold (P/N 209545) is normally provided. See Figure 3-5.
- The other dual nitrogen manifold (P/N 209546) can be used if the tests will be conducted with 150 psi (1034 kPa) or less backpressure. See Figure 3-6.
- The single nitrogen manifold (P/N 209547) can be used without a backpressure receiver or with the CO_2 backpressure receiver. See Figure 3-4.

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. If applicable, install the correct backpressure receiver on the bottom stem (filter paper end) to capture the expected filtrate volume. One of four backpressure receivers can be used. Refer to Figure 5-3.
7. 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.
8. 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.
9. 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 3-6.

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

10. Turn the T-screw on the left-hand regulator clockwise until the desired cell pressure is registered on the gauge. Refer to Table 5-3.
11. Turn the T-screw on the right-hand regulator clockwise until the desired back pressure is registered on the gauge. Refer to Table 5-3.
12. If using a CO_2 backpressure receiver, load a CO_2 cartridge in it as previously described.
13. Adjust the T-screw on the backpressure receiver regulator clockwise to the desired backpressure. See Figure 3-7 and Table 5-3.

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

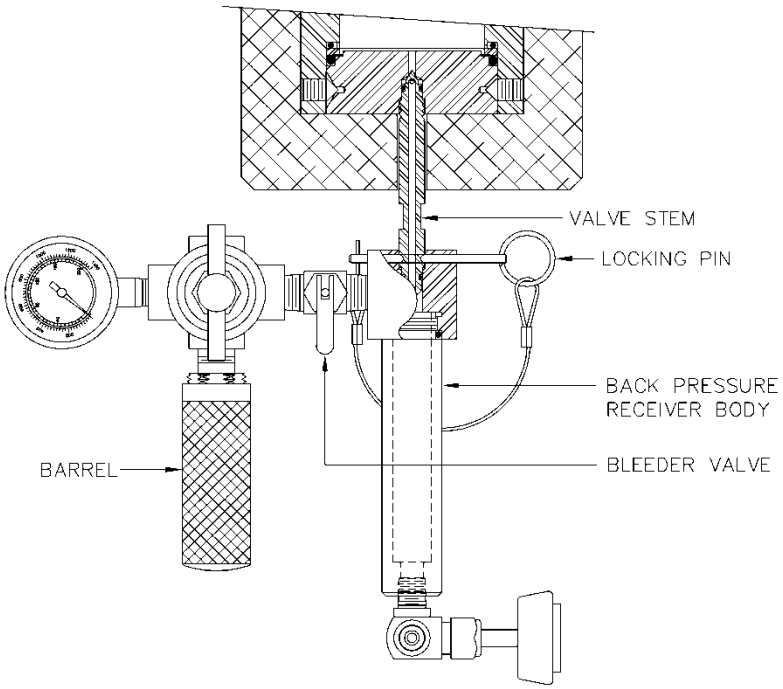

Figure 5-3 CO_2 Backpressure Unit

5.5 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.

The time required to heat the sample to the test temperature will be between one half and one hour, depending on the desired test temperature. The temperature of the cell should be checked by placing a metal stem dial thermometer in the thermometer well of the cell. As soon as the desired temperature is reached, the test may be started.

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.

5.6 Ending the Test and Disassembling

1. Disconnect the filter press heating jacket from the power source.

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

3. 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.

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

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

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

7. 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.

8. The pressurized cell assembly may be left in the heating jacket or it may be removed to another location for air cooling. A cell handling tool shown in Figure 5-4 is available for removing a hot cell from the heating jacket. Attach it to the top valve stem using the valve stem locking pin.

Figure 5-4 Cell Handling Tool [P/N 209497]

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 remove the cell cap if any pressure remains in the cell. Removing an unrestrained cell cap while the cell is pressurized could result in serious injury.

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

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

10. Make sure the open end of the valve stem is pointed away. Then, using the adjustable wrench, open the top valve stem (the one on the opposite end of the cell from the filter) about a 1/2 turn and allow the pressure to bleed off.

11. Make sure that all pressure has bled off. Press the CellTell™ safety indicator toward the cell. It should depress to be flush with the cell or cap surface if no pressure exists.

12. If you suspect that the cell may still contain pressure, do not attempt further disassembly until the lid can be fully contained by a clamp, specifically designed for this purpose. Refer to Figure 3-11.

13. Insert the cell into the cell clamp, and tighten the top plate of the clamp against the cell cap.

14. Once all the pressure has been released, loosen the six socket set screws in the end cap.

15. Slowly undo the top nut on each of the threaded bolts of the cell clamp.

If pressure is trapped in the cell, fluid will vent from the cell and the clamp will prevent the end cap from being blown off.

16. Remove the cell from clamp when you are sure the cell is depressurized.

17. Use the valve stem as a handle to pull the end cap out of the cell. If the cell caps O-rings are stuck, screw the end cap removal tool into the valve stem hole in the end cap, and press down on the handle to pull the cap out (Figure 5-1). If

the removal tool is not available, a rocking motion of the valve stem will help break them loose.

18. The sample may now be emptied and examined as desired.

19. If a double-ended cell is being used, remove the second cap as described above.

20. The filter cake may now be removed and examined as desired.

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 Set Screws

Use only Part No. 209501 set screws. These are special set screws for the HTHP cell. Do not attempt to substitute low strength steel or stainless steel set screws.

Cells are assembled using six set screws to retain the cell cap (12 screws for double ended cells). For safe operation, the threads of these set screws must be properly maintained.

Lubricate the threads with a high temperature lubricant, such as Never-Seez®. Inspect the threads and taper points of these screws for damage. Replace any screws that have damaged threads or flattened cone points.

Inspect the set screw seats in the end cap to make sure the metal is not deformed. Deformed screw seats require replacement of the cap.

7.1.3 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.

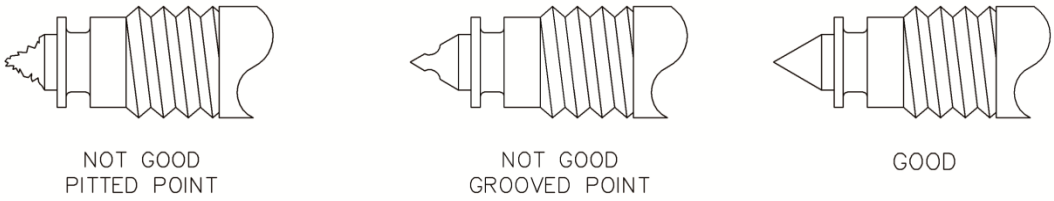

Figure 7-1 Valve Stem Points

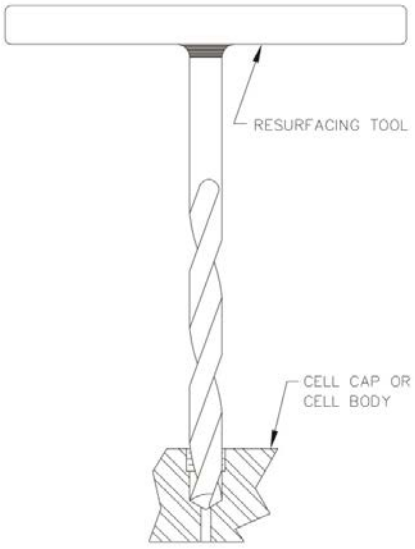

Figure 7-2 Resurfacing Tool

7.1.4 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.

7.2 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

7.3 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.

7.4 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.

7.5 Faulty Regulator Systems

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

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

7.6 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.

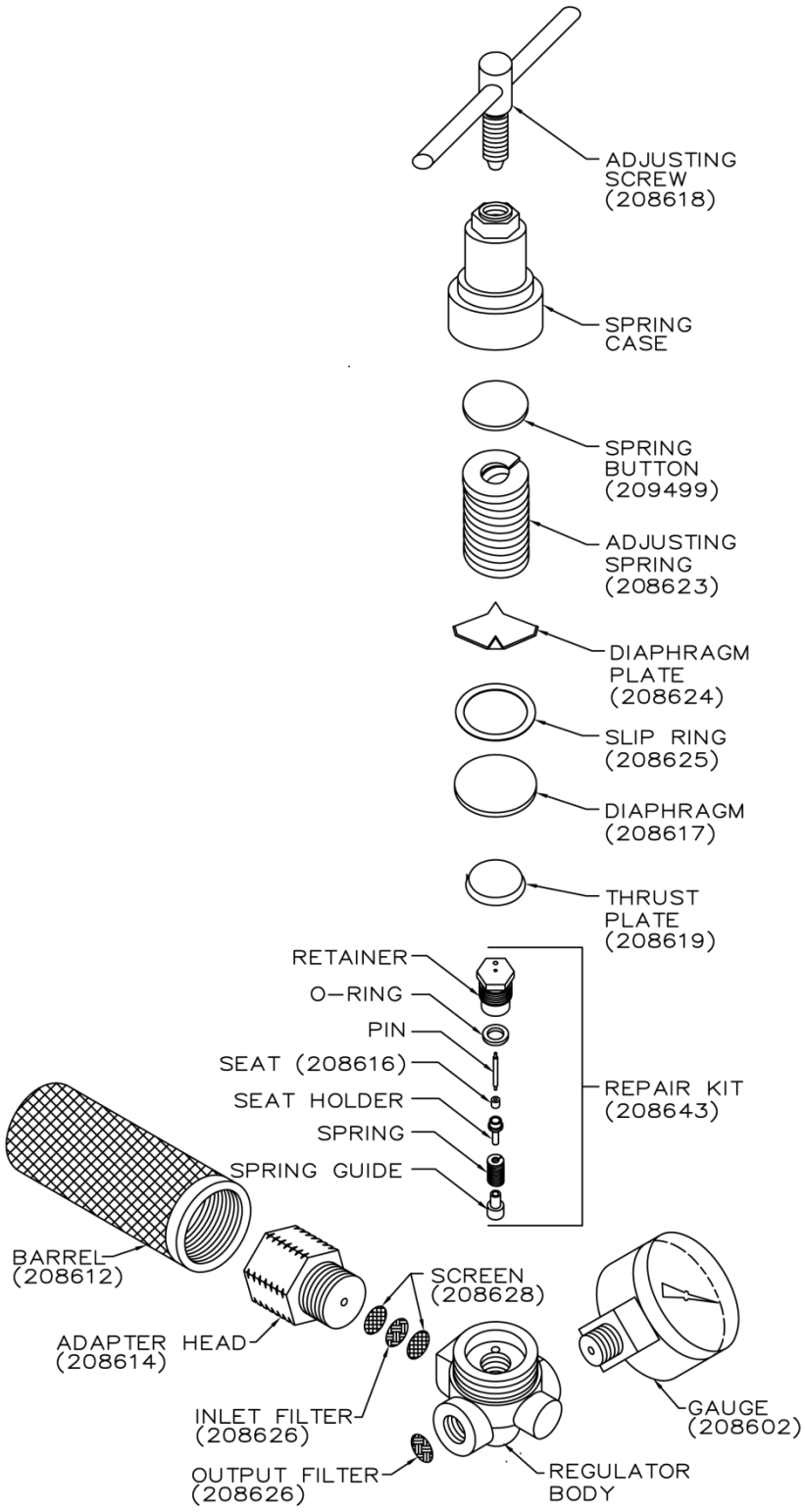

Figure 7-3 CO_2 Pressure Assembly, P/N 208647

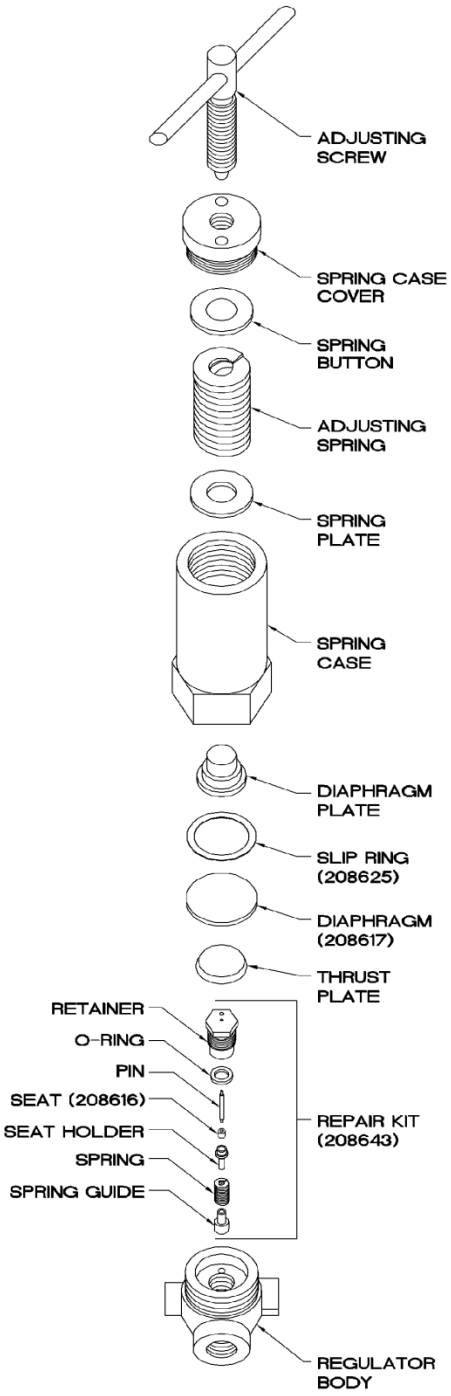

Figure 7-4 Nitrogen Regulator, P/N 209470

7.7 Heating Jacket Assembly for 175 ml Cells

The stand and heating jacket contain the thermostat, cartridge heaters, and power cord used to heat the cell. Most problems are caused by burned or broken wiring, misadjusted or defective thermostat, or burned out heaters.

Always disconnect the power cable and allow the heating jacket to cool before attempting any repair.

7.7.1 Disassemble

Refer to Figure 7-5.

1. Loosen set screw and remove thermostat knob (P/N 205777).
2. Remove the two 8-32 x 7/8 long screws holding the thermostat cover (P/N 209487) and tag (P/N 204566), and remove the cover.
3. Remove one 6-32 x 1/4 long screw from the thermostat terminal connection board (P/N 209491), and then remove one wire from each heater and the white power wire.
4. Remove the two terminal nuts and washers from the thermostat (P/N 205801), and then remove the pilot light assembly (P/N 209488), the black power wire, the second heater wire from each heater, and the terminal board.
5. Remove two 6-32 x 1/4 screws holding the thermostat and the green ground wire; remove the thermostat.
6. If the heaters are to be replaced, refer to Section 7.7.2.

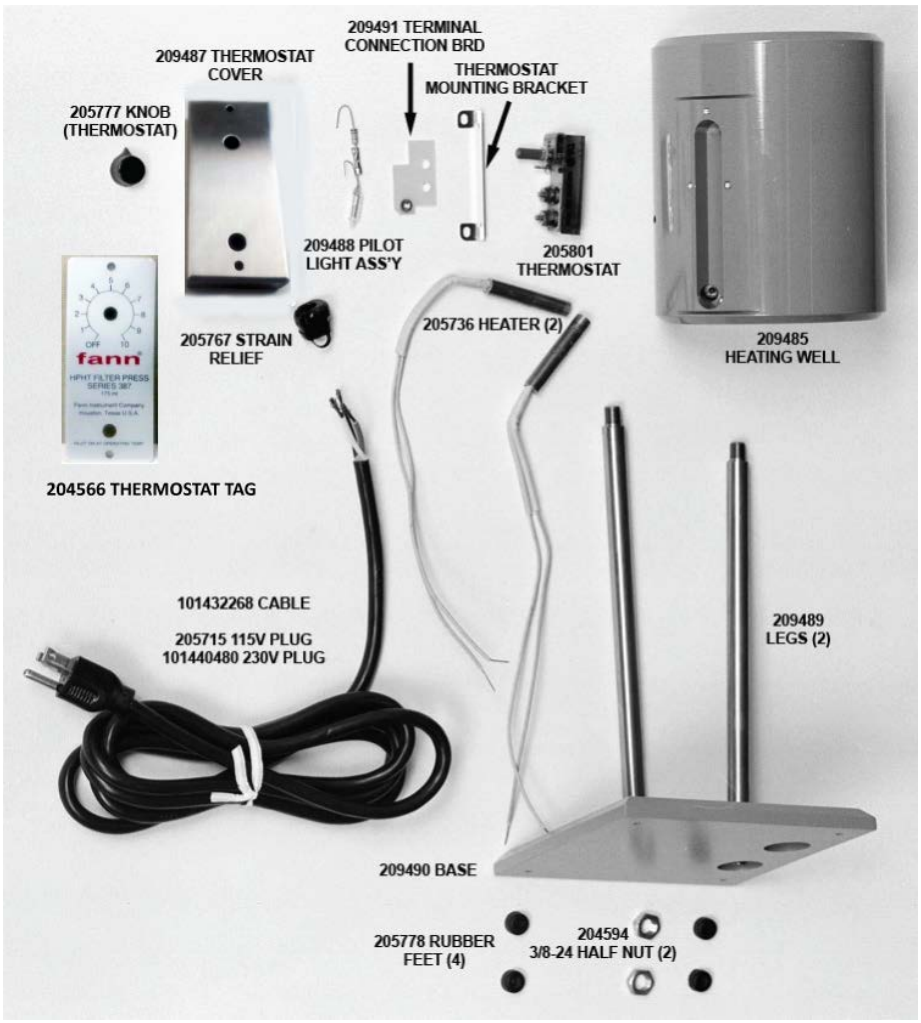

Figure 7-5 Heating Jacket Assembly, 175 ml, Exploded View

7.7.2 Repair

Refer to Section 9-3 for wiring diagrams 38700-W1 for 115 volt (Figure 9-5) or 38740-W1 for 230 volt (Figure 9-9).

1. After disassembly, inspect all components and replace any burned or broken wires.
2. Determine if the thermostat is faulty by connecting an ohmmeter or continuity tester across the two screw terminals and noting whether connection is made, and then broken by the rotation of the stem. If rotation of the stem does not result in a change on the meter or tester, replace the thermostat.
3. Using an ohmmeter, test the heaters one at a time. An open circuit between the leads indicates a faulty heater. A shorted heater will show continuity (no resistance) between the leads.
4. Also, test from each lead to the heater sheath or the heating jacket for ground. If

the meter shows other than open on this test, the heater is defective. Good heaters will show about 60-70 ohms resistance.

5. Remove and replace any defective heater. If the heater tests *good*, do not attempt to remove it. If the heater tests *defective*, remove it by pulling it out of the heating jacket by its leads. It may be necessary to soak the surface between the heater and the heating jacket with penetrating oil or similar product.

7.7.3 Reassemble

Reassemble the heating jacket in the reverse order of disassembly, considering the following:

1. If new heaters were installed, the leads should be cut to the proper length to fit neatly onto the thermostat. New high temperature wire lugs must be crimped onto the heater lead wires after fitting the length. Refer to Section 9-3 for wiring diagrams 209492 for 115 volt or 230 volt 209506 for positioning the wire terminals on the thermostat and terminal connection board.
2. When reinstalling the pilot light assembly, make sure the bulb is directly inside the hole in the thermostat cover.
3. Make sure that all screws and nuts around the thermostat are tight and all wires are properly routed before replacing the thermostat cover.
4. Make sure that the insulating paper lining inside the thermostat cover is in good condition and covers the entire inside front surface of the thermostat cover. If the lining is torn or missing, replace it. Use an adhesive to attach the lining to the metal cover.
5. If the thermostat was replaced, check to see that the stop is properly set. The stop is the washer-shaped part with a tang on it that fits over the grooved stem of the thermostat. At room temperature and with the stem turned completely counterclockwise, the thermostat should show the heaters turned on when the heating jacket is plugged into power. As the heating jacket heats, the thermostat should stop the heating. The farther clockwise the stem is set, the hotter the jacket will become. With the tang turned as far as possible clockwise, the temperature should be approximately 350°F (177°C). Should the thermostat stop require resetting, remove it from the stem and rotate it one or two grooves, and then reinstall and retest.
6. Install the thermostat cover and knob.

7.8 Heating Jacket Assembly for 500 ml Cells

The stand and heating jacket assembly contain the thermostat, cartridge heaters, power cord, and insulated cover used to heat the cell. Most problems are caused by burned or broken wiring, misadjusted or defective thermostat or burned-out heaters.

Always disconnect the power cable and allow the heating jacket to cool before repairing.

7.8.1 Disassemble

Refer to Figure 7-6.

2. Loosen set screw and remove the thermostat knob (205777).
2. Turn heating jacket and stand on its side and remove the two 1/2 inch thin nuts (P/N 206593) from the bottom of the base and remove the base (P/N 209553).
3. Unscrew the two legs (P/N 209554) from the heating jacket.
4. Remove six screws on front and five screws on top holding front and top sheet metal to the rest of the case (P/N 209556) and remove the front /top sheet metal.
5. Remove insulation from between case and heating jacket, then slide heating jacket (P/N 209555) out through front of case.
6. Remove one 6-32 x 1/4 long screw from the thermostat terminal connection board (P/N 209491), and then remove one wire from each heater and the power wire.
7. Remove the two terminal nuts and washers from the thermostat (P/N 205801), and then remove the pilot light assembly (P/N 209488), the power wire, the second heater wire from each heater, and the terminal board.
8. Remove two 6-32 x 1/4 screws holding the thermostat and the green ground wire, and then remove the thermostat.
9. Determine the condition of the heaters. Refer to Section 7.8.2. If they need replacing, remove them by pushing the two bottom heaters out through the bottom of the heating jacket and then pulling the two top heaters down past the wiring groove and out the bottom of the heating jacket by their leads. It may be necessary to soak them with penetrating oil or similar product to aid in loosening the cartridge heater housings from aluminum heating jacket.

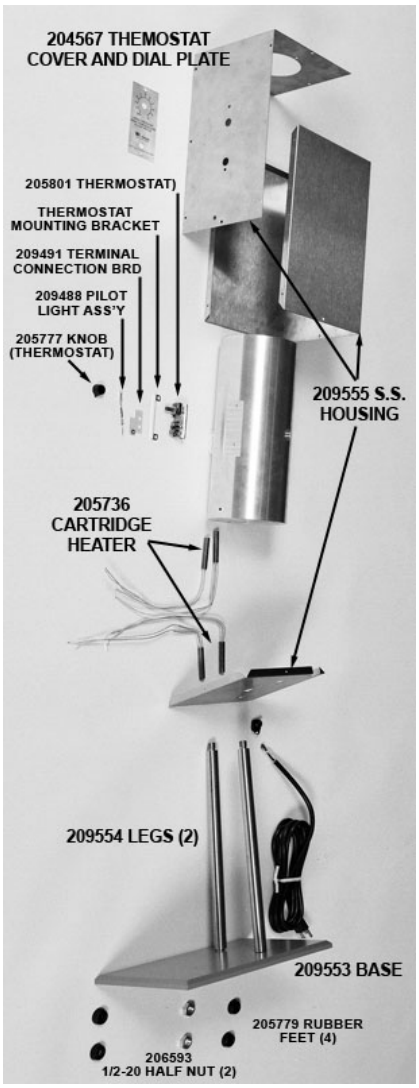

Figure 7-6 Heating Jacket Assembly, 500 ml, Exploded View

7.8.2 Repair

Refer to the repair instructions for the 175 ml cell heating jackets. See the wiring schematics 38770-W1 for 115 volt and 38771-W1 for 230 volt for troubleshooting. See the wiring diagram 38770-W3 for 115 volt and 38771-W3 for 230 volt for positioning of the wire terminals on the thermostat and the terminal connection board. Wiring diagrams and schematics are located in Section 9.3.

7.8.3 Reassemble

Reassemble the heating jacket in the reverse order of disassembly, considering the following instructions:

1. When installing new heaters, assemble the top heaters (two) from the bottom with the leads down. After the heaters are in place, pull the leads into the wiring groove.
2. Next, assemble the two bottom heaters with the leads in first. Pull the leads into the wiring groove as the heater is inserted into the jacket.
3. The leads should be cut in order to fit neatly into the wiring groove and around the thermostat.
4. New high temperature wire lugs must be crimped onto the heater lead wires after fitting them to the proper length.
5. When reinstalling the pilot light assembly, make sure the bulb is directly inside the hole in the thermostat cover. This may require temporarily placing the heating jacket in its cover and positioning the front/top sheet metal in place to determine the position of the pilot light hole.
6. Make sure all screws and nuts around the thermostat are tight and that all wires are properly routed before installing the heating jacket into its case. Refer to wiring layouts in Section 9-3: 38770-W3 for 115 volt, and 38771-W3 for 230 volt.
7. Reinstall the insulation between the heating jacket and the case. Add new insulation if the old insulation is deteriorated or burned.
8. Make sure the electrical insulating paper inside the front metal cover is in good condition. If it is torn, loose, or missing, repair or replace it. Use adhesive to reattach this paper or a new piece of paper.
9. If the thermostat was replaced, make sure that the stop is properly set. The stop is the washer-shaped part with a tang on it that fits over the grooved stem of the thermostat. At room temperature, and with the stem turned completely counterclockwise, the thermostat should show the heaters on when the heating jacket is plugged into power. As the heating jacket heats, the thermostat should stop the heating. The farther clockwise the stem is set, the hotter the heating jacket will become. With the tang turned as far as possible clockwise, the temperature should be approximately 500°F (260°C). If the thermostat stop requires resetting, remove it from the stem and rotate it one or two grooves. Then, reinstall and retest the thermostat.
10. Install the legs and base and tighten securely.
11. Install the thermostat knob.

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
209561	Adapter for using Standard Screens and End Caps with Single Ended Cells Modified for 1/4-in. Ceramic Disc Filters.
209507	Adapter, Piston Removal
209509	Case, Stainless Steel
232207	Cell Clamp for 175 ml HPHT Filter Press Cell
232208	Cell Clamp for 500 ml HPHT Filter Press Cell
209512	Core Holder for 1-in. Diameter Core, Compression Type
205868	Cylinder, Graduated Glass, 25 ml, TC
209571	Holder, HPHT cell assemblies
209513	Packer for 1-in. Diameter Core Holder, Compression Type
209443	Piston Floating for Double Ended 500 ml
209518	Ring, Core Seal for 1-in. Diameter Core
209517	Ring, Core Seal for 1-3/4-in. Diameter Core
209520	Spacer Ring for Filter Press Cell with Core Holder
209521	Spacer Sleeve for 500 ml Filter Press Cell with Core Holder
209519	Support Core for Filter Press Cell with Core Holder
206976	Temperature Controller, 115 Volt
206980	Temperature Controller, 230 Volt
205177	Thermocouple for Temperature Controller
206038	Thermometer, 5-in. Stem, Dial Range 50-350°F
206039	Thermometer, 8-in. Stem, Dial Range 50-500°F
209508	Tool, Cell Cap Removal
209497	Tool, Cell Handling
209500	Tool, Valve Stem Seat Resurfacing
209493	Wrench, Hex Key 5/32 Cell Cap Set Screws

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

Fann HPHT Filter Press units are available in various component configurations to allow for greater flexibility in choosing the system and option that suite the user. Pressurization is available through carbon dioxide cartridges, bottle nitrogen, or your in-house source. Single or double opening cells are available. The filter media includes API Standard filter paper, ceramic discs (various porosities), and mesh screens.

9.1 HPHT Filter Press, 175ml

These units fit the 175 ml HPHT cell, have a built-in heating jacket, and can be pressurized with carbon dioxide or nitrogen.

See Figure 9-1.

The 175 ml HPHT Filter Press assembly parts lists are organized as follows:

- Table 9-1 - 115 volts heating jacket, dual opening cell, CO_2 cartridge
- Table 9-2 - 115 volts heating jacket, single opening cell, CO_2, cartridge
- Table 9-3 - 230 volts heating jacket, dual opening cell, CO_2, cartridge
- Table 9-4 - 230 volts heating jacket, single opening cell, CO_2 cartridge
- Table 9-5 - 115 volts heating jacket, dual opening cell, N_2
- Table 9-6 - 115 volts heating jacket, single opening cell, N_2
- Table 9-7 - 230 volts heating jacket, dual opening cell, N_2
- Table 9-8 - 230 volts heating jacket, single opening cell, N_2

The heating jacket assembly parts are listed separately as follows:

- Table 9-9 - 115V Heating Jacket, P/N 209492
- Table 9-10 - 230V Heating Jacket, P/N 209506

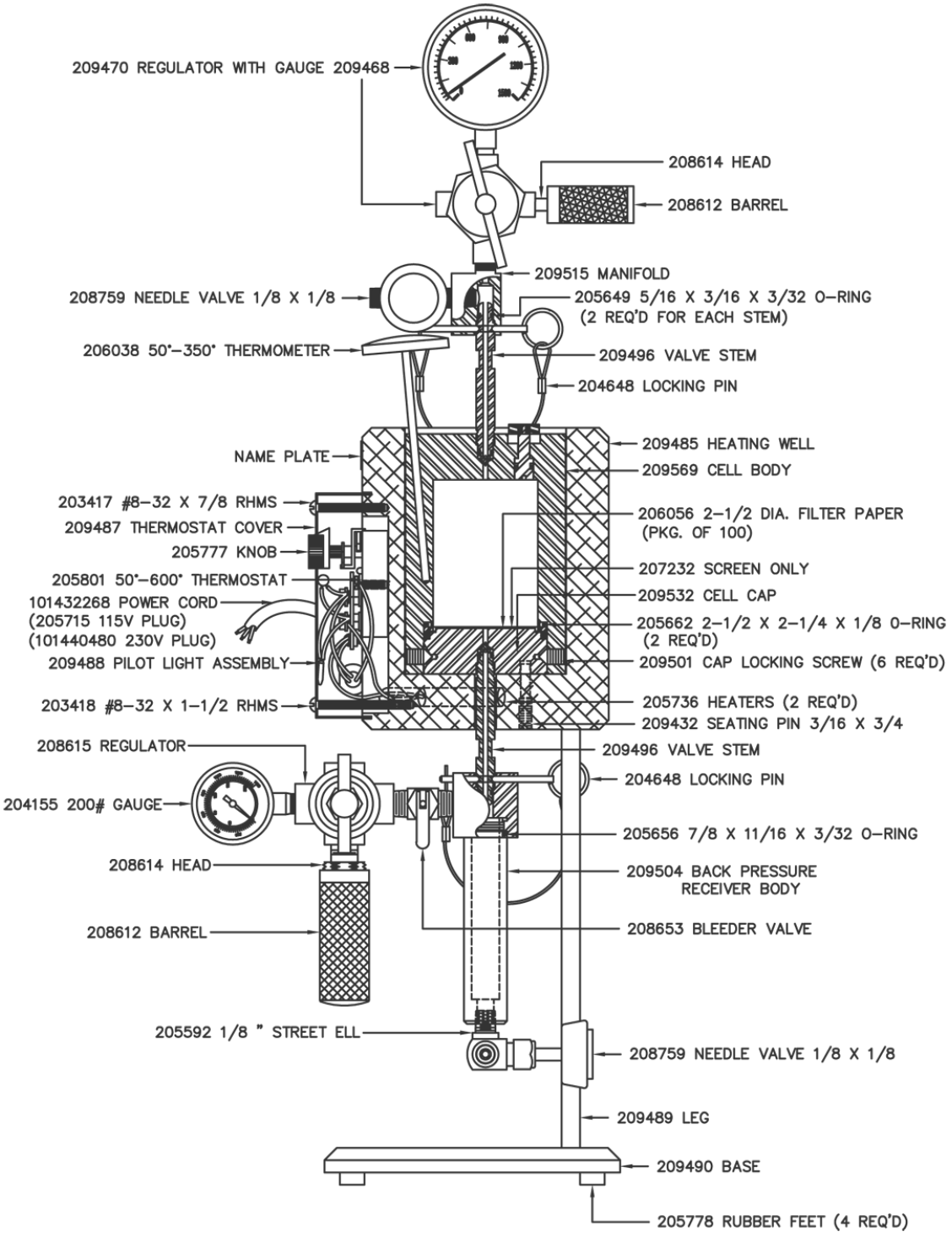

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Figure 9-1 HPHT Filter Press, 175 ml, CO_2 Pressurization

Table 9-1 HPHT FP, 175 ml, Dual Opening, 115V, CO_2, P/N 101571371, Rev D

Item No.	Part No.	Quantity	Description
0003	209471	1	PRESSURING UNIT CO_2
0004	209492	1	HEATING JACKET, 175 ml HPHT FILTER PRESS, 400 Watts, 115 Volts, Maximum Temp. Rating 350°F
0005	209503	1	BACKPRESSURE RECEIVER ASSEMBLY, 15ml CO_2
0006	209585	1	HPHT FILTER PRESS CELL, 175ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F, Double Ended Cell, Two Openings, One End Cap with Detachable Screen, 325 Mesh/60 Mesh Back-Up, One End Cap with CellTell™ Positive Pressure Indicator
0010	205649	1	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0011	205662	3	O-RING, 2-1/4 X 1/8 NITRILE
0012	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0013	206038	1	THERMOMETER DIAL 50°F -350°F
0014	206056	1	FILTER PAPER 2.5 IN. DIA (6.35 CM)
0015	208654	1	WRENCH ADJUSTABLE
0016	209486	1	INSTRUCTION MANUAL
0021	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-2 HPHT FP, 175 ml, 115V, Single Opening, CO_2, P/N 101571372, Rev D

Item No.	Part No.	Quantity	Description
0004	209471	1	PRESSURING UNIT CO_2
0005	209492	1	HEATING JACKET 175ml HPHT FILTER PRESS, 400 Watts, 115 Volts, Maximum Temp. Rating 350°F
0006	209503	1	BACKPRESSURE RECEIVER ASSEMBLY, 15ml, CO_2
0007	209584	1	HPHT FILTER PRESS CELL 175ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F, CellTell™ Positive Pressure Indicator built into Cell, One End Cap with 60 Mesh Screen installed
0010	205649	12	O-RING, 0.176 ID X 0.070 W, NO. 2-008,75 DURO VITON®
0011	205662	3	O-RING 2-1/4 X 1/8 NITRILE
0012	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0013	206038	1	THERMOMETER DIAL, 50 °F -350°F
0014	206056	1	FILTER PAPER, 2.5 IN. DIA (6.35 CM)
0015	208654	1	WRENCH ADJUSTABLE
0016	209486	1	INSTRUCTION MANUAL
0021	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-3 HPHT FP, 175 ml, Dual Opening, 230V, CO_2, P/N 101571373, Rev D

Item No.	Part No.	Quantity	Description
0002	209471	1	PRESSURING UNIT CO_2
0003	209503	1	BACKPRESSURE RECEIVER ASSEMBLY, 15ml CO_2
0004	209506	1	HEATING JACKET, 175ml HPHT Filter Press, 400 Watts, 230 Volts, Maximum Temp. Rating 350°F
0005	209585	1	HPHT FILTER PRESS CELL, 175ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F Double Ended Cell, Two Openings, One End Cap with Detachable Screen, 325 Mesh/60 Mesh Back-Up, One End Cap with CellTell™ Positive Pressure Indicator
0010	205649	12	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0011	205662	3	O-RING, 2-1/4 X 1/8, NITRILE
0012	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0013	206038	1	THERMOMETER DIAL, 50°F -350°F
0014	206056	1	FILTER PAPER 2.5in DIA (6.35cm)
0015	208654	1	WRENCH ADJUSTABLE
0016	209486	1	INSTRUCTION MANUAL
0021	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-4 HPHT F P, 175 ml, Single Opening, 230V, CO_2, P/N 101571374, Rev D

Item No.	Part No.	Quantity	Description
0005	209471	1	PRESSURING UNIT CO_2
0006	209503	1	BACKPRESSURE RECEIVER ASSEMBLY, 15ml CO_2
0007	209506	1	HEATING JACKET, 175 ml HPHT FILTER PRESS, 400 Watts, 230 Volts, Maximum Temp. Rating 350°F
0008	209584	1	HPHT FILTER PRESS CELL, 175 ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F, CellTell™ Positive Pressure Indicator built into Cell, One End Cap with 60 Mesh Screen installed
0010	205649	12	O-RING, 0.176 ID X 0.070 W NO. 2-008, 75 DURO VITON®
0011	205662	3	O-RING, 2-1/4 X 1/8 NITRILE
0012	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0013	206038	1	THERMOMETER DIAL 50°F -350°F
0014	206056	1	FILTER PAPER 2.5 IN. DIA (6.35 CM)
0015	208654	1	WRENCH ADJUSTABLE
0016	209486	1	INSTRUCTION MANUAL
0021	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-5 HPHT FP, 175 ml, Dual Opening, 115V, N_2, P/N 101565554, Rev C

Item No.	Part No.	Quantity	Description
0003	209492	1	HEATING JACKET, 175ml HPHT FILTER PRESS, 400 Watts, 115 Volts, Maximum Temp. Rating 350°F
0004	209502	1	BACKPRESSURE RECEIVER ASSEMBLY, 15ml N_2
0005	209585	1	HPHT FILTER PRESS Cell, 175ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F, Double Ended Cell, Two Openings, One End Cap with Detachable Screen, 325 Mesh/60 Mesh Back-Up, One End Cap with CellTell™ Positive Pressure Indicator
0006	209545	1	DUAL MANIFOLD
0010	205649	12	O-RING 0.176 ID X 0.070 W NO. 2-008,75 DURO VITON®
0011	205662	3	O-RING 2-1/4 X 1/8 NITRILE
0012	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0013	206038	1	THERMOMETER DIAL, 50 °F-350°F
0014	206056	1	FILTER PAPER 2.5 IN. DIA (6.35CM)
0015	208654	1	WRENCH ADJUSTABLE
0016	209486	1	INSTRUCTION MANUAL
0026	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-6 HPHT FP, 175 ml, Single Opening, 230V, N_2, P/N 101565556, Rev C

Item No.	Part No.	Quantity	Description
0003	209492	1	HEATING JACKET, 175ml HPHT FILTER PRESS, 400 Watts, 115 Volts Maximum Temp. Rating 350°F
0004	209502	1	BACKPRESSURE RECEIVER ASSEMBLY,15ml N_2
0005	209584	1	HPHT FILTER PRESS 101565556 CELL, 175ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F, CellTell™ Positive Pressure Indicator built into Cell, One End Cap with 60 Mesh Screen installed
0006	209545	1	DUAL MANIFOLD
0010	205649	12	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0011	205662	3	O-RING, 2-1/4 X 1/8 NITRILE
0012	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0013	206038	1	THERMOMETER DIAL, 50°F-350°F
0014	206056	1	FILTER PAPER, 2.5 IN. DIA (6.35 CM)
0015	208654	1	WRENCH ADJUSTABLE
0016	209486	1	INSTRUCTION MANUAL
0026	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-7 HPHT FP, 175 ml, Dual Opening, 230V, N_2, P/N 101565558, Rev C

Item No.	Part No.	Quantity	Description
0003	209502	1	BACKPRESSURE RECEIVER ASSEMBLY 15ML N_2
0004	209506	1	HEATING JACKET, 175ml HPHT FILTER PRESS, 400 Watts, 230 Volts, Maximum Temp. Rating 350°F
0005	209585	1	HPHT FILTER PRESS CELL,175ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F, Double Ended Cell, Two Openings, One End Cap with Detachable Screen, 325 Mesh/60 Mesh Back-Up, One End Cap with CellTell™ Positive Pressure Indicator
0006	209545	1	DUAL MANIFOLD
0010	205649	12	O-RING, 0.176 ID X 0.070 W, NO. 2-008,75 DURO VITON®
0011	205662	3	O-RING, 2-1/4 X 1/8, NITRILE
0012	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0013	206038	1	THERMOMETER DIAL, 50°F -350°F
0014	206056	1	FILTER PAPER 2.5 IN. DIA (6.35 CM)
0015	208654	1	WRENCH ADJUSTABLE
0016	209486	1	INSTRUCTION MANUAL
0026	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-8 HPHT FP, 175 ml, Single Opening, 230V, N_2, P/N 101565560, Rev C

Item No.	Part No.	Quantity	Description
0003	209502	1	BACKPRESSURE RECEIVER ASSEMBLY, 15ML N_2
0004	209506	1	HEATING JACKET, 175ml HPHT FILTER PRESS, 400 Watts, 230 Volts, Maximum Temp. Rating 350°F
0005	209584	1	HPHT FILTER PRESS CELL, 175ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 350°F , CellTell™ Positive Pressure Indicator built into Cell, One End Cap with 60 Mesh Screen installed
0006	209545	1	DUAL MANIFOLD
0007	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0008	206038	1	THERMOMETER DIAL 50°F -350°F
0009	206056	1	FILTER PAPER 2.5 IN. DIA (6.35 CM)
0010	208654	1	WRENCH ADJUSTABLE
0011	205649	12	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0012	205662	3	O-RING, 2-1/4 X 1/8, NITRILE
0026	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-9 Heating Jacket, 175 ml HPHT FP, 115V, P/N 209492, Rev H

Item No.	Part No.	Quantity	Description
0001	203392	5	6-32 X 1/4 RHMS SS
0002	203417	1	8-32 X 7/8 RHMS SS
0003	203418	1	8-32 X 1-1/2 RHMS
0005	101409270	1	TERMINAL, RING, HIGH TEMP, NO. 8-10 STUD, WIRE 22-18 GA.
0006	204290	8 in.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F
0007	101409263	6	TERMINAL, RING, HIGH TEMP, NO. 4-6 STUD, WIRE 22-18 GA.
0009	204566	1	TAG THERMOSTAT
0010	204594	2	NUT 3/8-24 HEX JAM SS
0014	205736	2	HEATER ROD HPHT JACKET 200 WATT 115 VOLT, 3/8 X 2 INCONEL® SHEATH, 12 IN. HIGH TEMP FIBERGLASS LEADS
0015	101440482	1	STRAIN RELIEF, CORD
0016	205777	1	KNOB ROUND BLACK w/BRASS BUSHING
0017	205778	4	RUBBER FEET 1/2 IN.
0018	205801	1	THERMOSTAT 50°F -600°F
0022	207759	2	8-32 X 1/4 BHMS SS
0023	207895	2	WASHER, FLAT 8
0025	209432	1	SCREW PIN LOCATOR HEATING WELL
0026	209485	1	WELL, ALUMINUM HPHT FILTERPRESS
0028	209487	1	COVER THERMOSTAT
0029	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0030	209489	2	LEG, HPHT FILTER PRESS
0031	209490	1	BASE MODEL, HPHT FILTER PRESS
0032	209491	1	PLATE THERMOSTAT MOUNT
0033	101432268	5	CABLE 18 AWG 3
0034	205715	1	PLUG AC RUBBER INSULATED

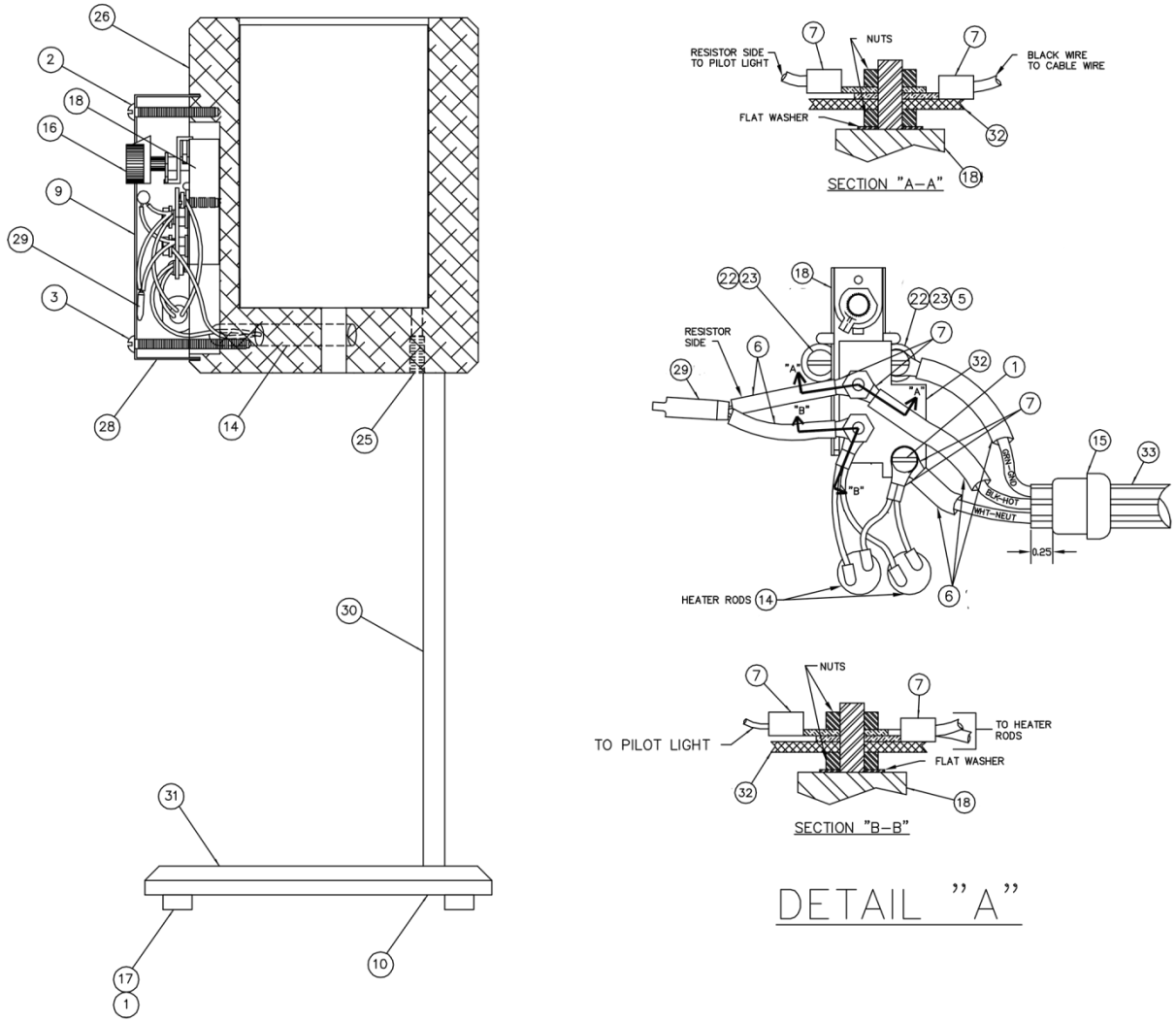

Figure 9-2 Heating Jacket Assembly, 175 ml, 115V

Table 9-10 Heating Jacket, 175 ml HPHT FP, 230 V, P/N 209506, Rev. K

Item No.	Part No.	Quantity	Description
0001	203392	5	6-32 X 1/4 RHMS SS
0002	203417	1	8-32 X 7/8 RHMS SS
0003	203418	1	8-32 X 1-1/2 RHMS
0005	204290	8 in.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F 0.166 ID 125 FT PER PACKAGE
0006	101409263	8	TERMINAL, RING, HIGH TEMP NO. 4-6 STUD, WIRE 22-18 GA.
0007	204297	2	BUTT SPLICE HI-TEMP NON-INSULATED NICKEL PLATED
0009	204566	1	TAG THERMOSTAT
0010	204594	2	NUT 3/8-24 HEX JAM SS
0014	205706	1	RESISTOR 5 OHM 1W
0015	205736	2	HEATER ROD HPHT JACKET 200 WATT 115 VOLT, 3/8 X 2 INCONEL® SHEATH, 12 IN. HIGH TEMP FIBERGLASS LEADS
0016	101440482	1	STRAIN RELIEF, CORD HOLDING , PIGTAIL
0017	205777	1	KNOB ROUND BLACK w/BRASS BUSHING
0018	205778	4	RUBBER FEET 1/2 IN.
0019	205801	1	THERMOSTAT 50°F -600°F
0023	207759	2	8-32 X 1/4 BHMS SS
0024	208658	2	WASHER FLAT 6 SS
0027	209432	1	SCREW PIN LOCATOR HEATING WELL
0028	209485	1	WELL ALUMINUM
0030	209487	1	COVER THERMOSTAT
0031	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0032	209489	2	LEG, HPHT FILTER PRESS
0033	209490	1	BASE MODEL, HPHT FILTER PRESS
0034	209491	1	PLATE THERMOSTAT MOUNT
0035	209523	1	CAPACITOR 10,000PF 1000V CERAMIC DISK
0036	101440480	1	PLUG RUBBER
0037	101432268	5	CABLE 18 AWG
0038	101409270	1	TERMINAL RING, HIGH TEMP, NO. 8-10 STUD, WIRE 22-18 GA.

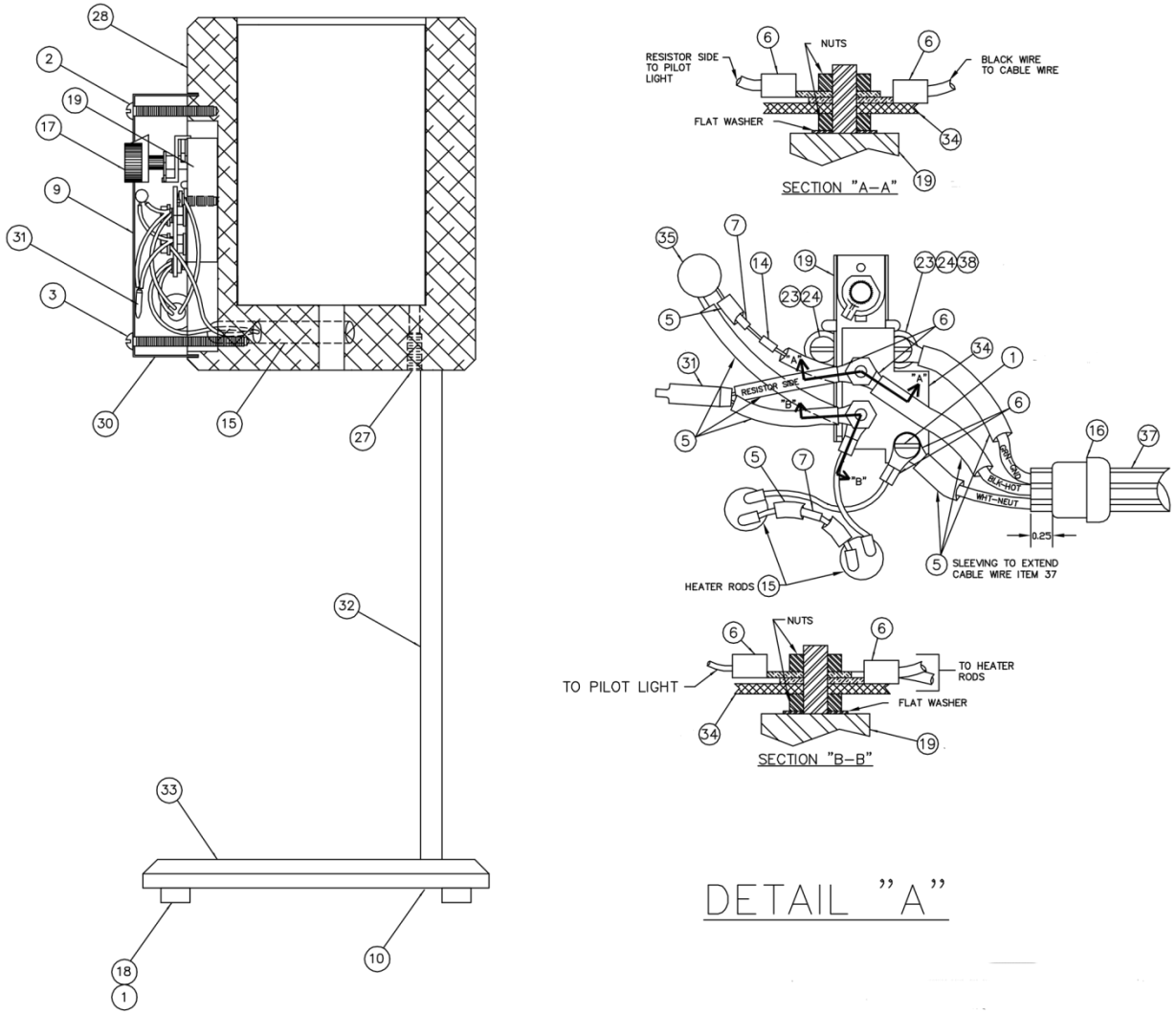

Figure 9-3 Heating Jacket Assembly, 230 V, 175 ml

9.2 HPHT Filter Press, 500 ml

These units fit the 500 ml HPHT cell, have a built-in heating jacket, and can be pressurized with nitrogen.

See Figure 9-4.

The 500 ml HPHT Filter Press assembly parts lists are organized as follows:

- Table 9-11 - 115V heating jacket, dual opening cell
- Table 9-12 - 115V heating jacket, single opening cell
- Table 9-13 – 230V heating jacket, dual opening cell
- Table 9-14 – 230V heating jacket, single opening cell

The heating jacket parts are also listed separately in each of these tables:

- Table 9-15 - 115V Heating Jacket, P/N 209540
- Table 9-16 - 230V Heating Jacket, P/N 209541

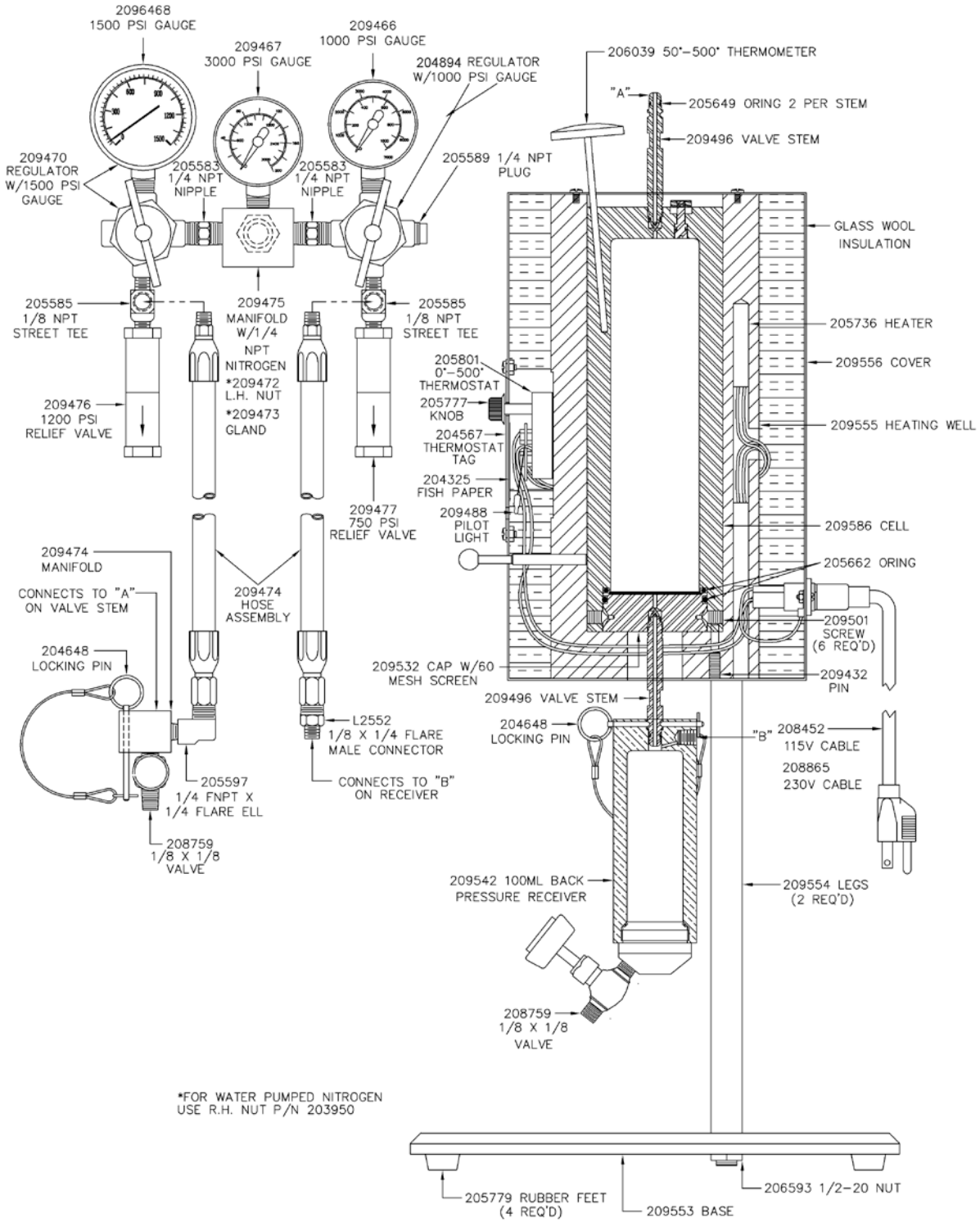

Figure 9-4 HPHT Filter Press, 500 ml

Table 9-11 HPHT FP, 500 ml, Dual Opening, 115V, N_2, P/N 101565561, Rev F

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 50°F-600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5 ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0005	101476559	3	TERMINAL
0006	203392	3	6-32 X 1/4 RHMS SS
0008	204290	6 in.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F
0009	101409263	6	TERMINAL, RING, HIGH TEMP, NO. 4-6 STUD, WIRE 22-18 GA.
0010	208438	1	PLUG INTL ELECT CODE TYPE
0020	203391	2	4-40 X 1/2 RHMS SS
0040	204291	4	TERMINAL RING 6 SM-14-16AWG H
0050	204325	N/A	FISH PAPER 0.02 THICK
0070	204567	1	TAG THERMOSTAT
0080	205595	1	UNION HALF 1/4 X 1/8 PLATED
0090	205649	24	O-RING 0.176 ID X 0.070 W NO. 2-008 VITON® 75 DURO
0100	205662	24	O-RING 2-1/4 X 1/8 NITRILE
0110	205668	6	O-RING 1-3/8 X 1/16 NITRILE
0120	205736	4	HEATER ROD HPHT JACKET 200 WATT 115 VOLT
0130	205777	1	KNOB ROUND BLACK w/BRASS BUSHING
0140	205779	4	FEET RUBBER 3/4 IN.
0150	205868	1	GRADUATED GLASS CYLINDER 25ML TC
0160	206039	1	THERMOMETER DIAL, DUAL SCALE 50°F -500°F
0170	206056	1	FILTER PAPER 2.5IN. DIA (6.35CM), 100/BOX
0180	206058	1	FILTER DYNALLOY X-5 2.5in DIA (6.35 CM) X 0.012 THK
0190	206593	2	NUT 1/2-20 JAM HEX SS
0200	207632	4	NUT 6-32 HEX REGULAR SS
0210	207634	1	NUT 4-40 HEX REGULAR SS
0220	207766	4	8-32 X 1/2 RHMS SS
0230	207842	4	6-32 X 1/4 THMS SS
0240	208452	1	CABLE POWER 115V 18 AWG
0250	208654	1	WRENCH ADJUSTABLE 6 CHROME PLATED
0260	209432	1	SCREW PIN LOCATOR HEATING WELL
0270	209486	1	INSTRUCTION MANUAL
0290	209542	1	BACK PRESSURE RECEIVER ASSEMBLY 100 ML, N_2
0300	209587	1	HPHT FILTER PRESS CELL, 493ml Capacity 303 Stainless Steel Pressure Rating: 1800 psig @ 500°F, Double Ended Cell, Two Openings, One End Cap with Detachable Screen, 325 Mesh/60 Mesh Back-Up, One Cap with CellTell™ Pressure Indicator
0310	209545	1	MANIFOLD DUAL
0320	209553	1	BASE MODEL, HPHT FILTER PRESS
0330	209554	2	LEG, HPHT FILTER PRESS
0340	209555	1	WELL, HPHT FILTER PRESS
0350	209556	1	COVER, HPHT FILTER PRESS
0360	210459	24	INSULATION BULK
0370	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-12 HPHT FP, 500 ml, Single Opening, 115V, N_2, P/N 101565562, Rev D

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 50°F -600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0005	101476559	3	TERMINAL
0006	203392	3	6-32 X 1/4 RHMS SS
0008	204290	6 in.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F
0009	101409263	11	TERMINAL RING, HIGH TEMP, NO. 4-6 STUD, WIRE 22-18 GA
0010	208438	1	PLUG INTL ELECT CODE TYPE
0020	203391	2	4-40 X 1/2 RHMS SS
0040	204291	1	TERMINAL RING 6 SM-14-16AWG H
0050	204325	N/A	FISH PAPER 0.02 THICK
0070	204567	1	TAG THERMOSTAT
0080	205595	1	UNION HALF 1/4 X 1/8 PLATED
0090	205649	24	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0100	205662	24	O-RING, 2-1/4 X 1/8 NITRILE
0110	205668	6	O-RING, 1-3/8 X 1/16 NITRILE
0120	205736	4	HEATER ROD HPHT JACKET 200 WATT 115 VOLT
0130	205777	1	KNOB ROUND BLACK w/BRASS BUSHING
0140	205779	4	RUBBER FEET 3/4 IN.
0150	205868	1	GRADUATED GLASS CYLINDER, 25ml TC
0160	206039	1	THERMOMETER DIAL, DUAL SCALE 50°F -500°F
0170	206056	1	FILTER PAPER 2.5 IN. DIA (6.35CM), 100/Box
0180	206058	1	FILTER DYNALLOY X-5 2.5IN. DIA (6.35 CM) X 0.012 THK
0190	206593	2	NUT 1/2-20 JAM HEX SS
0200	207632	4	NUT 6-32 HEX REGULAR SS
0210	207634	1	NUT 4-40 HEX REGULAR SS
0220	207766	4	8-32 X 1/2 RHMS SS
0230	207842	4	6-32 X 1/4 THMS SS
0240	208452	1	CABLE POWER 115V 18 AWG
0250	208654	1	WRENCH ADJUSTABLE 6 CHROME PLATED
0260	209432	1	SCREW PIN LOCATOR HEATING WELL
0270	209486	1	INSTRUCTION MANUAL
0290	209542	1	BACKPRESSURE RECEIVER ASSEMBLY, 100ML, N_2
0300	209586	1	HPHT FILTER PRESS CELL, 493ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 500 °F, CellTell™ Positive Pressure Indicator built into Cell, One End Cap with built-in 60 Mesh Screen
0310	209545	1	DUAL MANIFOLD
0320	209553	1	BASE MODEL, HPHT FILTER PRESS
0330	209554	2	LEG, HPHT FILTER PRESS
0340	209555	1	WELL, HPHT FILTER PRESS
0350	209556	1	COVER, HPHT FILTER PRESS
0360	210459	24	BULK INSULATION
0370	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-13 HPHT FP, 500 ml, Dual Opening, 230V, N_2, P/N 101565563, Rev E

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 50°F -600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5 ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0005	207842	4	6-32 X 1/4 THMS SS
0006	203392	3	6-32 X 1/4 RHMS SS
0007	101476559	3	TERMINAL
0008	208438	1	PLUG INTL ELECT CODE TYPE
0009	101409263	9	TERMINAL, RING, HIGH TEMP, NO. 4-6 STUD, WIRE 22-18 GA.
0010	209523	1	CAPACITOR 10,000PF 1000V CERAMIC DISK
0011	204297	2	BUTT SPLICE HI-TEMP NON-INSULATED NICKEL PLATED
0012	205706	1	RESISTOR 5 OHM 1W
0013	204290	12 in.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F
0020	203391	2	4-40 X 1/2 RHMS SS
0040	204291	1	TERMINAL RING 6 SM-14-16AWG H
0050	204325	N/A	FISH PAPER 0.02 THICK
0070	204567	1	TAG THERMOSTAT
0080	205393	1	INSULATION HEATER 1/32 THK
0090	205595	1	UNION HALF 1/4 X 1/8 PLATED
0100	205649	24	O-RING 0.176 ID X 0.070 W NO. 2-008 VITON® 75 DURO
0110	205662	24	O-RING 2-1/4 X 1/8 NITRILE
0120	205668	6	O-RING 1-3/8 X 1/16 NITRILE
0130	205736	4	HEATER ROD HPHT JACKET 200 WATT 115 VOLT
0140	205777	1	KNOB ROUND BLACK w/BRASS BUSHING
0150	205779	4	RUBBER FEET 3/4 IN.
0160	205868	1	GRADUATED GLASS CYLINDER 25ML TC
0170	206039	1	THERMOMETER DIAL, DUAL SCALE 50°F -500°F, 10°C -260°C
0180	206056	1	FILTER PAPER 2.5 IN. DIA (6.35CM)
0190	206058	1	FILTER DYNALLOY X-5 2.5 IN. DIA (6.35 CM) X 0.012 THK
0200	206593	2	NUT 1/2-20 JAM HEX SS
0210	207632	4	NUT 6-32 HEX REGULAR SS
0220	207634	1	NUT 4-40 HEX REGULAR SS
0230	207766	4	8-32 X 1/2 RHMS SS
0240	208654	1	WRENCH ADJUSTABLE 6 CHROME PLATED
0250	208865	1	CABLE POWER 230V 18 AWG
0260	209432	1	SCREW PIN LOCATOR HEATING WELL
0270	209486	1	INSTRUCTION MANUAL
0280	209542	1	BACKPRESSURE RECEIVER ASSEMBLY 100 ML, N_2
0290	209587	1	HPHT FILTER PRESS CELL, 493ml Capacity 303 Stainless Steel Pressure Rating: 1800 psig @ 500°F, Double Ended Cell, Two Openings, One End Cap with Detachable Screen, 325 Mesh/ 60 Mesh Back-Up, One Cap with CellTell™ Pressure Indicator
0300	209545	1	MANIFOLD DUAL
0310	209553	1	BASE MODEL
0320	209554	2	LEG, HPHT FILTER PRESS
0330	209555	1	WELL, HPHT FILTER PRESS
0340	209556	1	COVER, HPHT FILTER PRESS
0350	210459	24	BULK INSULATION
0410	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-14 HPHT FP, 500 ml, Single Opening, 230V, N_2, P/N 101565564, Rev D

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 500°F-600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5 ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP, NEON HPHT FP & CUP-HEATER
0005	207842	4	6-32 X 1/4 THMS SS
0006	203392	3	6-32 X 1/4 RHMS SS
0007	101476559	3	TERMINAL
0008	208438	1	PLUG INTL ELECT CODE TYPE
0009	101409263	9	TERMINAL, RING, HIGH TEMP
0010	209523	1	CAPACITOR 10,000PF 1000V CERAMIC DISK
0011	204297	2	BUTT SPLICE HI-TEMP NON-INSULATED NICKEL PLATED
0012	205706	1	RESISTOR 5 OHM 1W
0013	204290	12 in.	SLEEVING, FIBERGLASS SIZE 6 CLASS R GRADE A 1200F
0020	203391	2	4-40 X 1/2 RHMS SS
0040	204291	1	TERMINAL RING 6 SM-14-16AWG H
0050	204325	N/A	FISH PAPER 0.02 THICK
0070	204567	1	TAG THERMOSTAT
0080	205393	1	INSULATION HEATER 1/32 THK
0090	205595	1	UNION HALF 1/4 X 1/8 PLATED
0100	205649	24	O-RING 0.176 ID X 0.070 W NO. 2-008 VITON® 75 DURO
0110	205662	24	O-RING 2-1/4 X 1/8 NITRILE
0120	205668	6	O-RING 1-3/8 X 1/16 NITRILE
0130	205736	4	HEATER ROD HPHT JACKET 200 WATT 115 VOLT
0140	205777	1	KNOB, ROUND BLACK w/BRASS BUSHING
0150	205779	4	RUBBER FEET 3/4 IN.
0160	205868	1	GRADUATED GLASS CYLINDER, 25ML TC
0170	206039	1	THERMOMETER DIAL, DUAL SCALE 50°F-500 °F, 10°C-260°C
0180	206056	1	FILTER PAPER 2.5 IN. DIA (6.35 CM), 100/BOX
0190	206058	1	FILTER DYNALLOY X-5 2.5 IN. DIA (6.35 CM) X 0.012 THK
0200	206593	2	NUT 1/2-20 JAM HEX SS
0210	207632	4	NUT 6-32 HEX REGULAR SS
0220	207634	1	NUT 4-40 HEX REGULAR SS
0230	207766	4	8-32 X 1/2 RHMS SS
0240	208654	1	WRENCH, ADJUSTABLE
0250	208865	1	CABLE POWER 230V 18 AWG
0260	209432	1	SCREW PIN LOCATOR HEATING WELL
0270	209486	1	INSTRUCTION MANUAL
0280	209542	1	BACKPRESSURE RECEIVER ASSEMBLY, 100 ML, N_2
0290	209586	1	HPHT Filter Press Cell, 493ml Capacity, 303 Stainless Steel, Pressure Rating: 1800 psig @ 500°F CellTell™ Positive Pressure Indicator built into Cell, One End Cap with built-in 60 Mesh Screen
0300	209545	1	DUAL MANIFOLD
0310	209553	1	BASE MODEL, HPHT FILTER PRESS
0320	209554	2	LEG, HPHT FILTER PRESS
0330	209555	1	WELL, HPHT FILTER PRESS
0340	209556	1	COVER, HPHT FILTER PRESS
0350	210459	24	BULK INSULATION
0410	101983293	1	FILTER CAKE THICKNESS RULER

Table 9-15 Heating Jacket, 500 ml HPHT FP, 115V, P/N 209540, Rev H

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 50°F-600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5 ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0005	101476559	3	TERMINAL
0006	203392	3	6-32 X 1/4 RHMS SS
0007	208658	2	WASHER FLAT 6 STAINLESS CC-BLUE
0008	204290	6 in.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F
0009	204293	11	TERMINAL RING NO. 6 SCREW 16-14AWG
0010	208438	1	PLUG INTL ELECT CODE TYPE
0020	203391	2	4-40 X 1/2 RHMS SS
0030	204291	1	TERMINAL RING 6 SM-14-16AWG H
0040	204325	N/A	FISH PAPER 0.02 THICK
0060	204567	1	TAG THERMOSTAT
0070	205393	1	INSULATION HEATER 1/32 THK
0080	205736	4	HEATER ROD HPHT JACKET 200 WATT 115 VOLT
0090	205777	1	KNOB ROUND BLACK w/BRASS BUSHING
0100	205779	4	RUBBER FEET 3/4IN.
0110	206593	2	NUT 1/2-20 JAM HEX SS
0120	207632	4	NUT 6-32 HEX REGULAR SS
0130	207634	1	NUT 4-40 HEX REGULAR SS
0140	207766	4	8-32 X 1/2 RHMS SS
0150	207842	4	6-32 X 1/4 THMS SS
0160	208452	1	CABLE POWER 115V 18 AWG
0170	209432	1	SCREW PIN LOCATOR HEATING WELL
0180	209553	1	BASE MODEL
0190	209554	2	LEG, HPHT FILTER PRESS
0200	209555	1	WELL, HPHT FILTER PRESS
0210	209556	1	COVER, HPHT FILTER PRESS
0220	210459	24	BULK INSULATION

Table 9-16 Heating Jacket, 500 ml HPHT FP, 230V, P/N 209541, Rev I

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 50°F -600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5 ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0005	101476559	3	TERMINAL
0006	203392	3	6-32 X 1/4 RHMS SS
0007	208658	2	WASHER FLAT 6 STAINLESS
0008	208438	1	PLUG INTL ELECT CODE TYPE
0009	204293	9	TERMINAL RING NO. 6 SCREW 16-14AWG
0010	209523	1	CAPACITOR 10,000PF 1000V CERAMIC DISK
0011	204297	2	BUTT SPLICE HI-TEMP NON-INSULATED NICKEL PLATED
0012	205706	1	RESISTOR 5 OHM 1W
0013	204290	12	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F
0020	203391	2	4-40 X 1/2 RHMS SS
0030	204291	1	TERMINAL RING 6 SM-14-16AWG H
0040	204325	N/A	FISH PAPER, 0.02 THICK
0060	204567	1	TAG THERMOSTAT
0070	205393	1	INSULATION HEATER 1/32 THK
0080	205736	4	HEATER ROD HPHT JACKET 200 WATT 115 VOLT
0090	205777	1	KNOB ROUND BLACK w/BRASS BUSHING
0100	205779	4	RUBBER FEET 3/4IN.
0110	206593	2	NUT 1/2-20 JAM HEX SS
0120	207632	4	NUT 6-32 HEX REGULAR SS
0130	207634	1	NUT 4-40 HEX REGULAR SS
0140	207766	4	8-32 X 1/2 RHMS SS
0150	207842	4	6-32 X 1/4 THMS SS
0160	208865	1	CABLE POWER 230V 18 AWG
0170	209432	1	SCREW PIN LOCATOR HEATING WELL
0180	209553	1	BASE MODEL, HPHT FILTER PRESS
0190	209554	2	LEG, HPHT FILTER PRESS
0200	209555	1	WELL, HPHT FILTER PRESS
0210	209556	1	COVER, HPHT FILTER PRESS
0220	210459	24	BULK INSULATION

9.3 Heating Jacket Wiring

The heating jacket wiring schematics and heating well diagrams are included in this section.

The heating jacket wiring drawings are matched with their respective HPHT models as follows:

HPHT Model	Voltage	Drawing Type	Figure No.
175 ml	115V	Wiring Schematic, 38700-W1	Figure 9-5
		Thermostatic Wiring Assembly, 209492 Detail A	Figure 9-6
500 ml	115V	Wiring Schematic, 38770-W1	Figure 9-7
		Thermostatic Wiring Assembly, 38770-W3	Figure 9-8
175 ml	230V	Wiring Schematic, 38740-W1	Figure 9-9
		Thermostatic Wiring Assembly, 209506 Detail A	Figure 9-10
500 ml	230V	Wiring Schematic, 38771-W1	Figure 9-11
		Thermostatic Wiring Assembly, 38771-W3	Figure 9-12

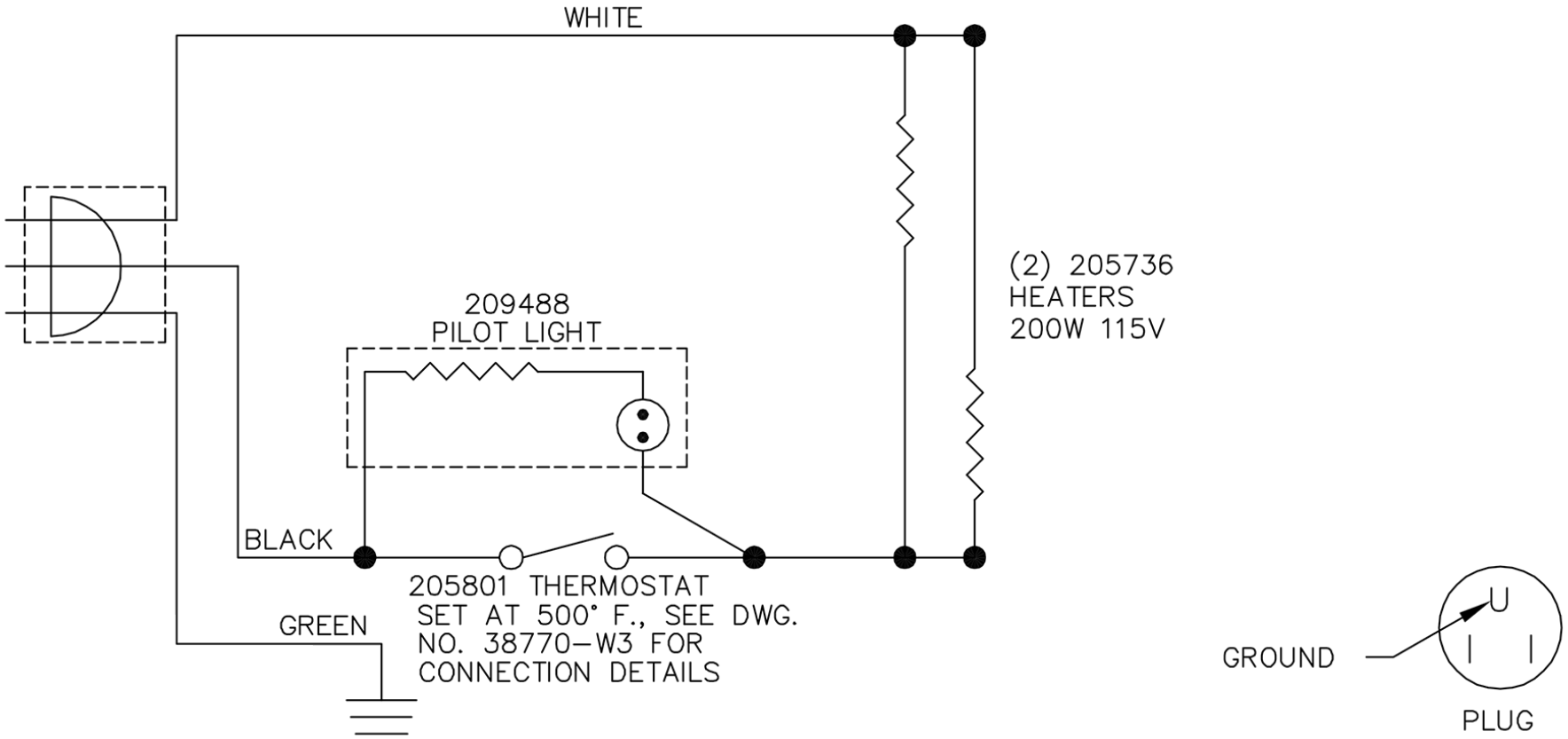

Figure 9-5 Wiring Schematic, 175 ml, 115 V

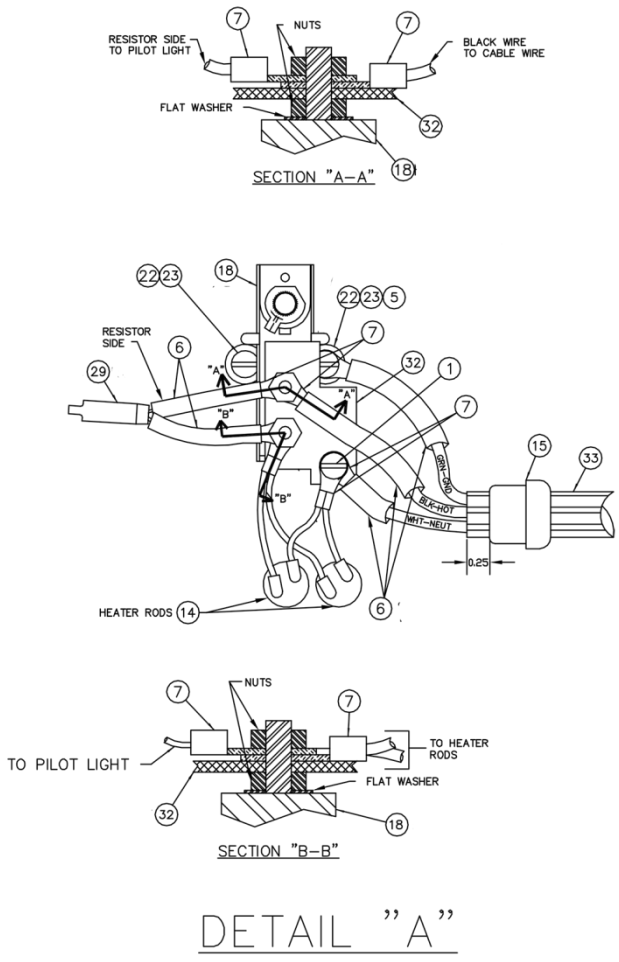

Figure 9-6 Thermostat Wiring Assembly, 175 ml, 115V

Thermostat Wiring Assembly, 175 ml, 115V*

Item No.	Part No.	Quantity	Description
0001	203392	5	6-32 X ¼ RHMS SS
0005	101409270	1	TERMINAL, RING, HIGH TEMP, NO. 8-10 STUD, WIRE 22-18 GA.
0006	204290	8 in.	SLEEVING FIBERGLASS
0007	101409263	6	TERMINAL, RING, HIGH TEMP, NO. 4-6 STUD, WIRE 22-18 GA.
0014	205736	2	HEATER ROD
0015	101440482	1	STRAIN RELIEF, CORD
0018	205801	1	THERMOSTAT 50°F -600°F
0022	207759	2	8-32 X ¼ BHMS SS
0023	207895	2	WASHER, FLAT 8
0029	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0032	209491	1	PLATE THERMOSTAT MOUNT
0033	101432268	5	CABLE 18 AWG 3

*Reference: Table 9-9 Heating Jacket, 175 ml HPHT FP, 115V, P/N 209492, Rev H

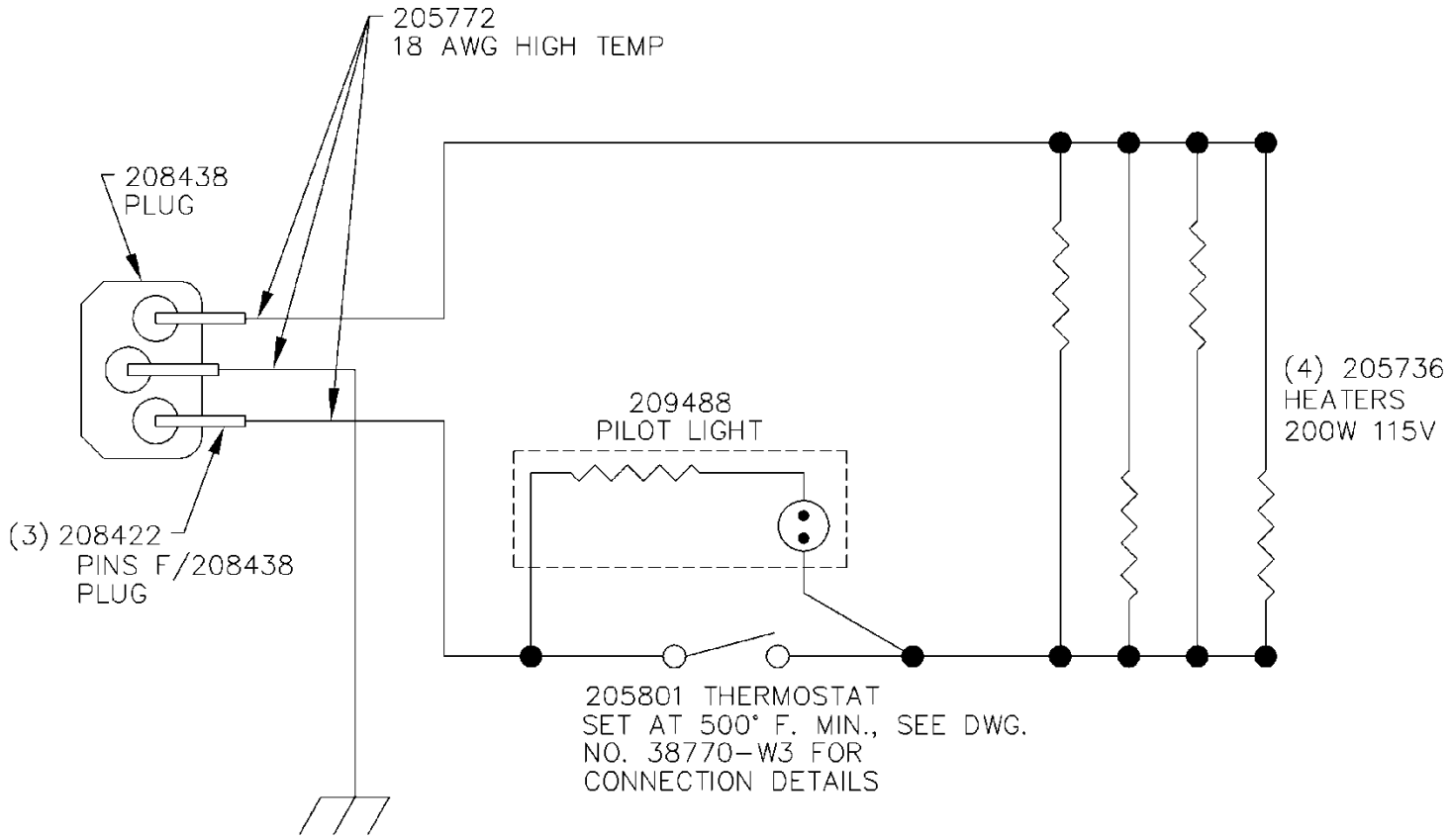

Figure 9-7 Wiring Schematic, 500 ml, 115V

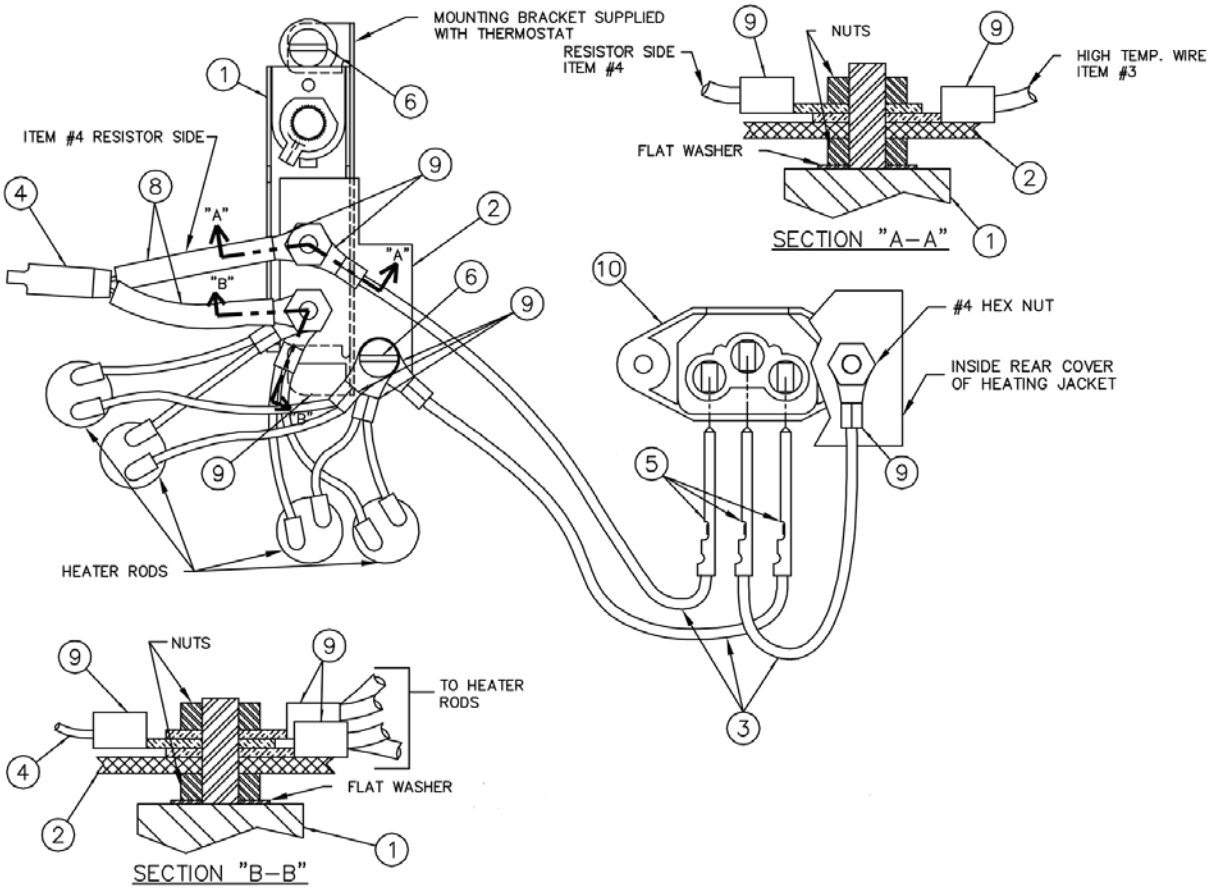

Figure 9-8 Thermostat Wiring Assembly, 500 ml, 115V

Thermostat Wiring Assembly, 500 ml, 115V*

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 50°F-600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5 ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0005	101476559	3	TERMINAL
0006	203392	3	6-32 X 1/4 RHMS STAINLESS STEEL
0008	204290	6 in.	SLEEVING FIBERGLASS
0009	204293	11	TERMINAL RING NO. 6 SCREW 16-14AWG
0010	208438	1	PLUG INTL ELECT CODE TYPE

*Reference: Table 9-15 Heating Jacket, 500 ml HPHT FP, 115V, P/N 209540, Rev H

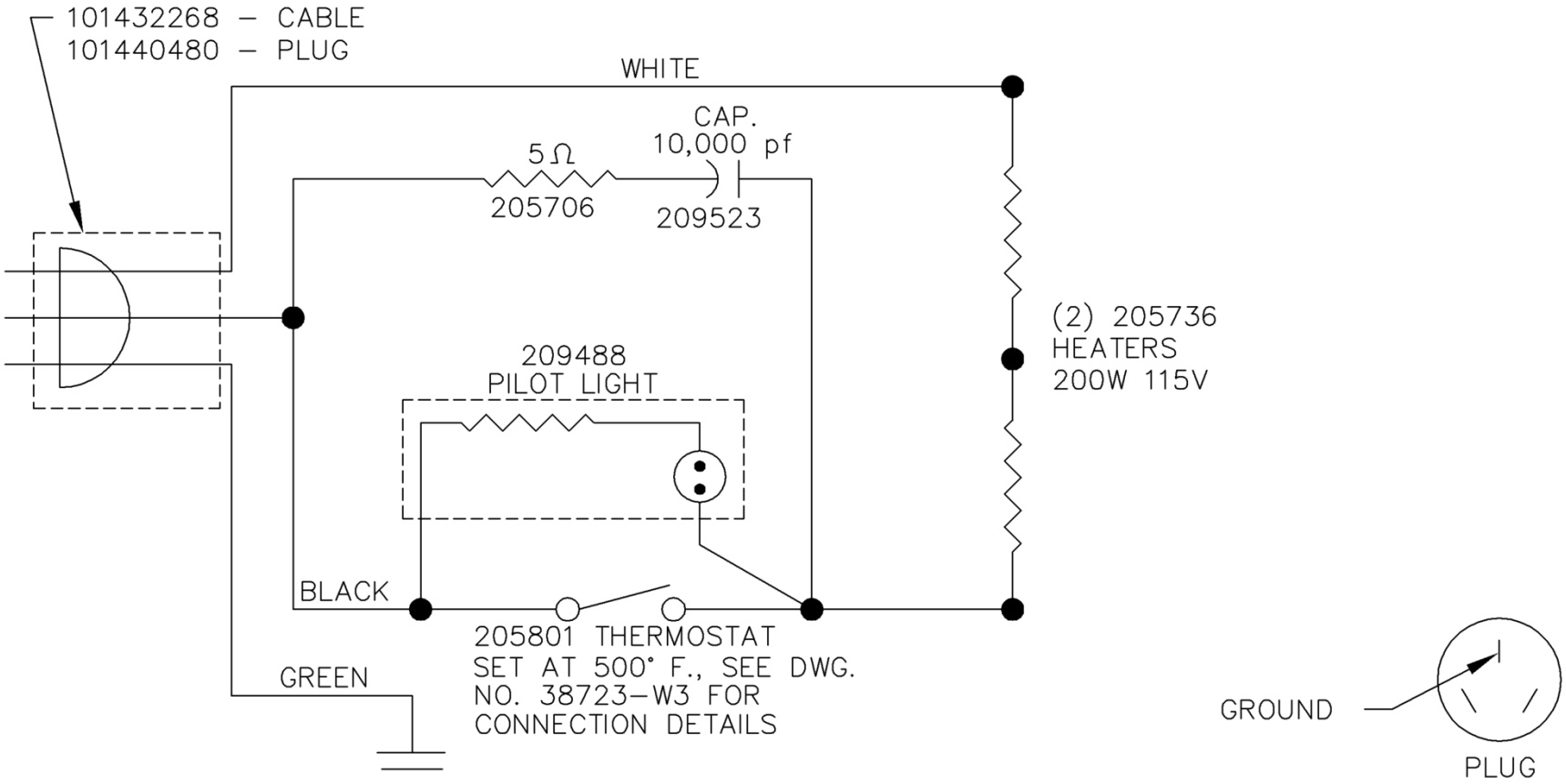

Figure 9-9 Wiring Schematic, 175 ml, 230V

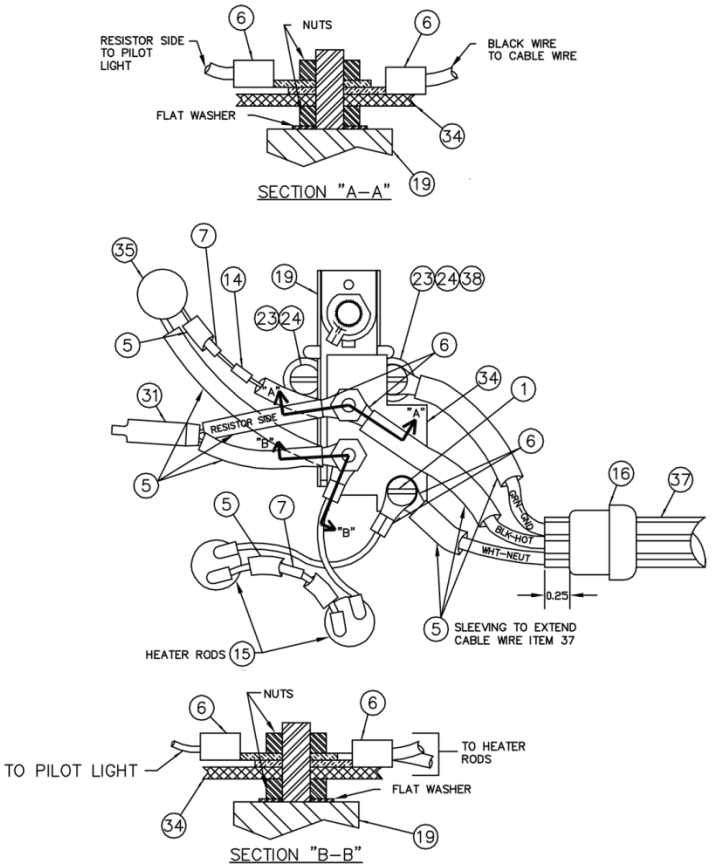

Figure 9-10 Thermostat Wiring Assembly, 175 ml, 230V

Thermostat Wiring Assembly, 175 ml, 230V*

Item No.	Part No.	Quantity	Description
0001	203392	5	6-32 X 1/4 RHMS SS
0005	204290	8 in.	SLEEVING FIBERGLASS
0006	101409263	8	TERMINAL, RING, HIGH TEMP NO. 4-6 STUD, WIRE 22-18 GA.
0007	204297	2	BUTT SPLICE HI-TEMP NON-INSULATED NICKEL PLATED
0014	205706	1	RESISTOR 5 OHM 1W
0015	205736	2	HEATER ROD
0016	101440482	1	STRAIN RELIEF, CORD HOLDING , PIGTAIL
0019	205801	1	THERMOSTAT 50°F -600°F
0023	207759	2	8-32 X 1/4 BHMS SS
0024	208658	2	WASHER FLAT 6 SS
0031	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0034	209491	1	PLATE THERMOSTAT MOUNT
0035	209523	1	CAPACITOR 10,000PF 1000V CERAMIC DISK
0037	101432268	5	CABLE 18 AWG
0038	101409270	1	TERMINAL RING, HIGH TEMP, NO. 8-10 STUD, WIRE 22-18 GA.

***Reference: Table 9-10 Heating Jacket, 175 ml HPHT FP, 230 V, P/N 209506, Rev. K

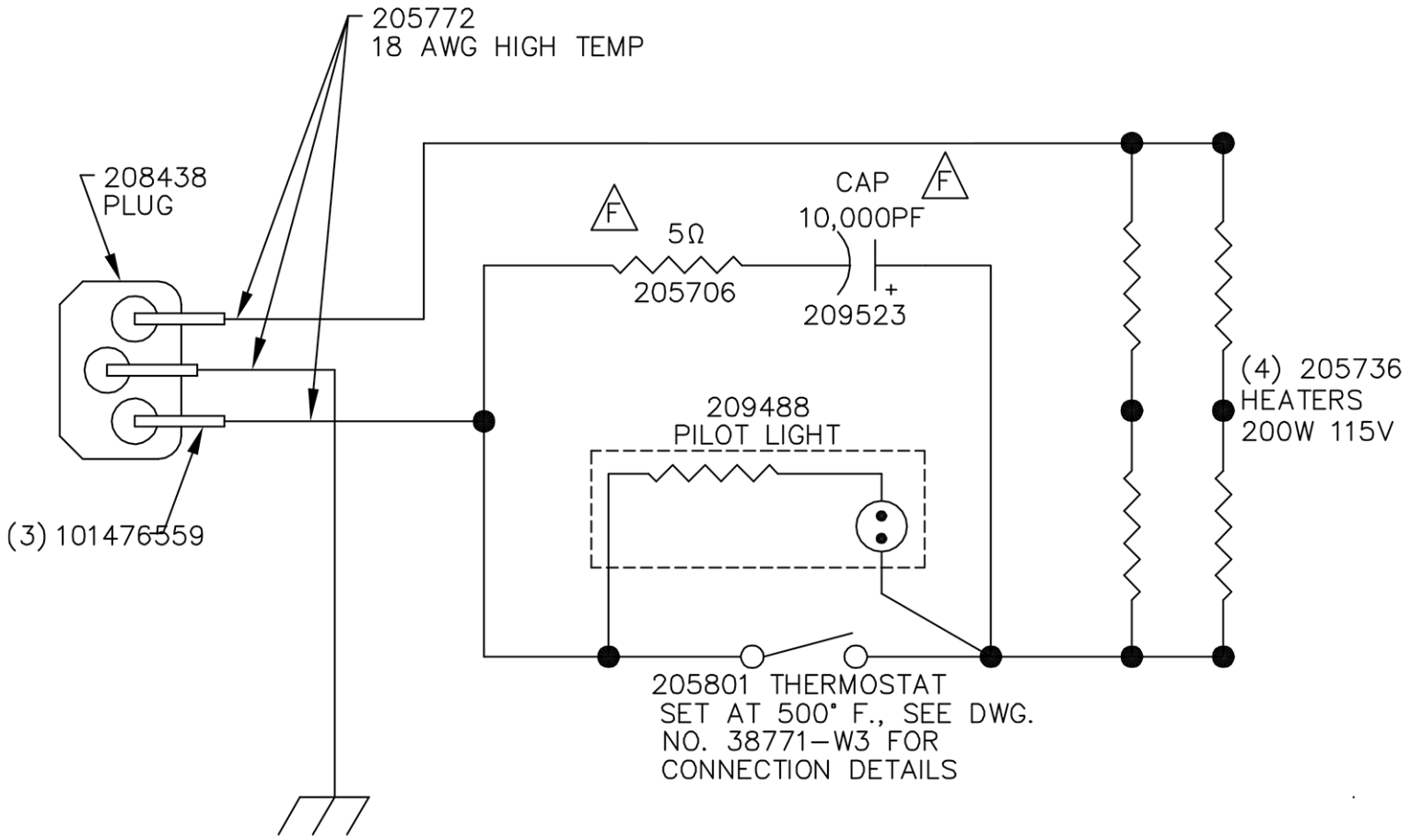

Figure 9-11 Wiring Schematic, 500 ml, 230V

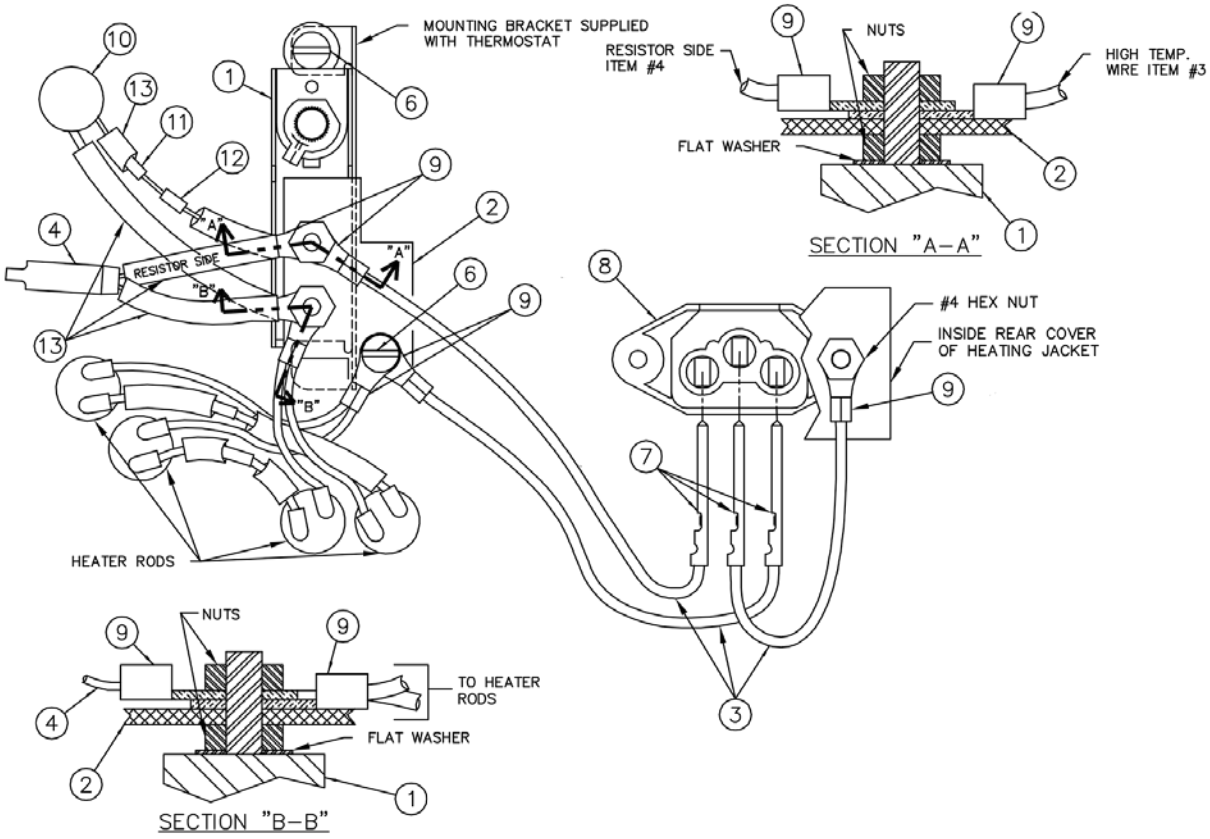

Figure 9-12 Thermostat Wiring Assembly, 500 ml, 230V

Thermostat Wiring Assembly, 500 ml, 230V*

Item No.	Part No.	Quantity	Description
0001	205801	1	THERMOSTAT 50°F -600°F
0002	209491	1	PLATE THERMOSTAT MOUNT
0003	205772	2.5 ft	WIRE 18 AWG HIGH TEMP, 600V, 450°F
0004	209488	1	LAMP NEON HPHT FP & CUP-HEATER
0006	203392	3	6-32 X 1/4 RHMS SS
0007	101476559	3	TERMINAL
0008	208438	1	PLUG INTL ELECT CODE TYPE
0009	101409263	9	TERMINAL, RING, HIGH TEMP, NO. 4-6 STUD, WIRE 22-18 GA.
0010	209523	1	CAPACITOR 10,000PF 1000V CERAMIC DISK
0011	204297	2	BUTT SPLICE HI-TEMP NON-INSULATED NICKEL PLATED
0012	205706	1	RESISTOR 5 OHM 1W
0013	204290	12 in.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F

*Reference: Table 9-13 HPHT FP, 500 ml, Dual Opening, 230V, N_2, P/N 101565563, Rev E; Table 9-14 HPHT FP, 500 ml, Single Opening, 230V, N_2, P/N 101565564, Rev D

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 175 ml cell and the 15 ml backpressure receiver. It can also be used with the 500 ml cell for low pressure and temperature tests. See Figure 9-13.

Table 9-17 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
0007	205279	1	BAG PLASTIC, 9in. X 12in.

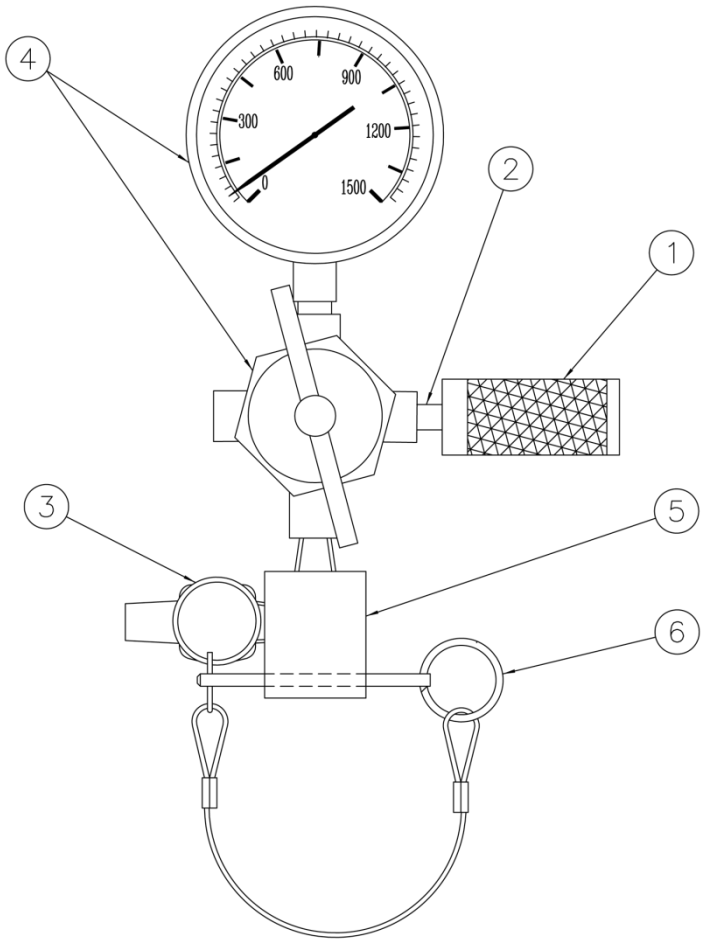

Figure 9-13 Carbon Dioxide Pressuring Unit

The dual nitrogen manifold can be used with 175 ml or 500 ml cells and at cell pressures up to 1200 psi (8274 kPa) and backpressures up to 750 psi (5171 kPa). See Figure 9-14.

Table 9-18 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

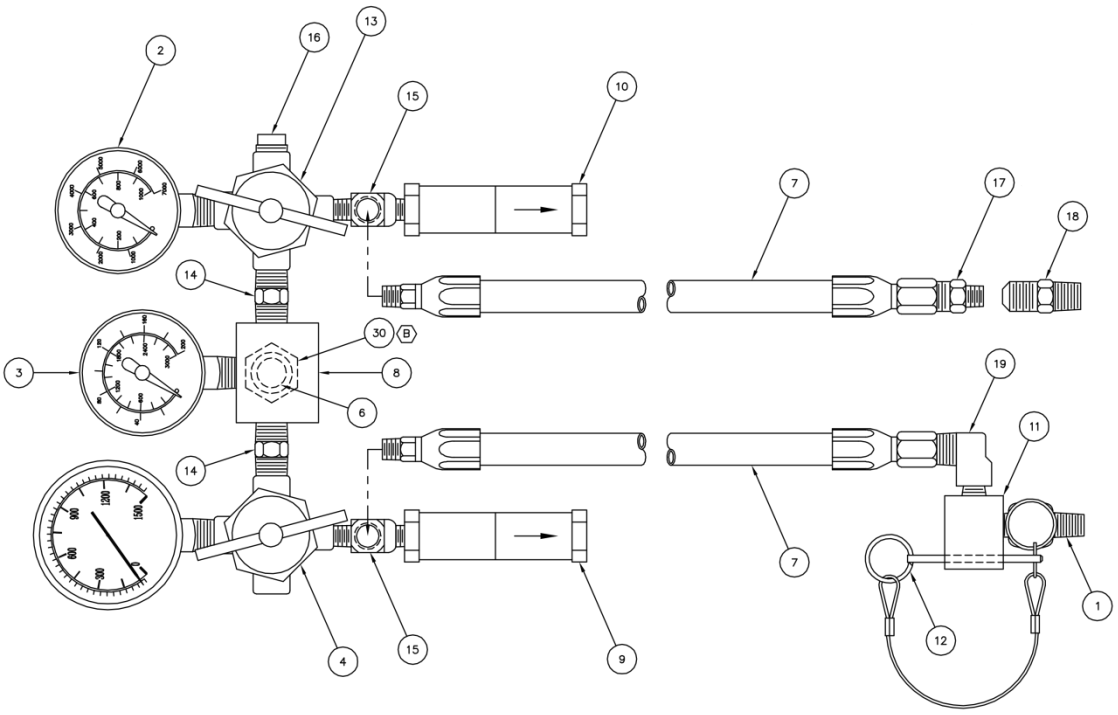

Figure 9-14 Dual Nitrogen Manifold

The dual nitrogen manifold, the HP Primary/LP Secondary Manifold, is used with any 175 ml or 500 ml cell at maximum cell pressure of 1200 psi (8274 kPa) and maximum backpressure of 170 psi (1172 kPa). See Figure 9-15.

Table 9-19 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

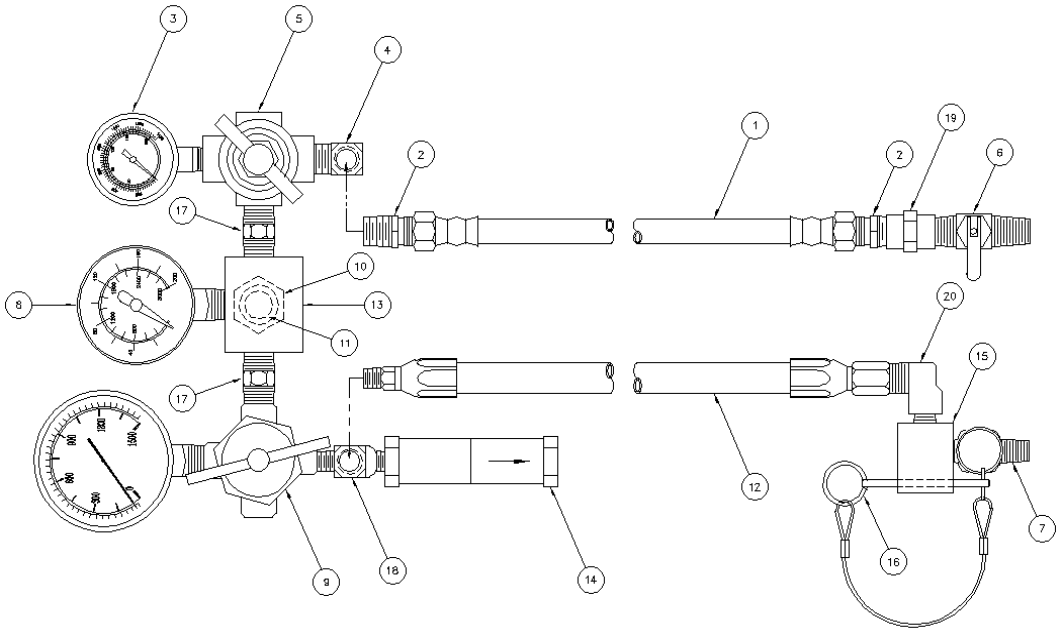

Figure 9-15 HP & LP Nitrogen Manifold

The single nitrogen manifold is used with any 175 ml or 500 ml cell at maximum cell pressure of 1200 psi (8274 kPa). See Figure 9-16.

Table 9-20 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

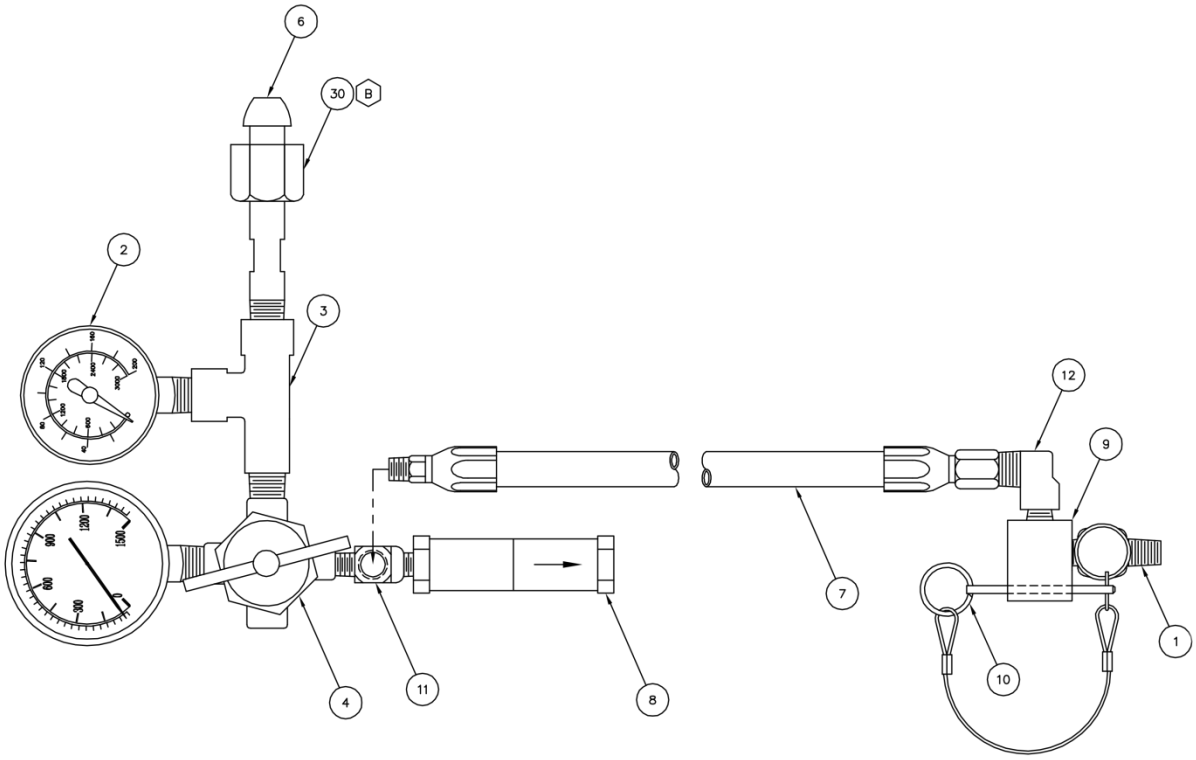

Figure 9-16 Single Nitrogen Manifold

The four unit manifold connects up to four HPHT filter presses from a single nitrogen source for cell pressure and backpressure. See Figure 9-17.

Table 9-21 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

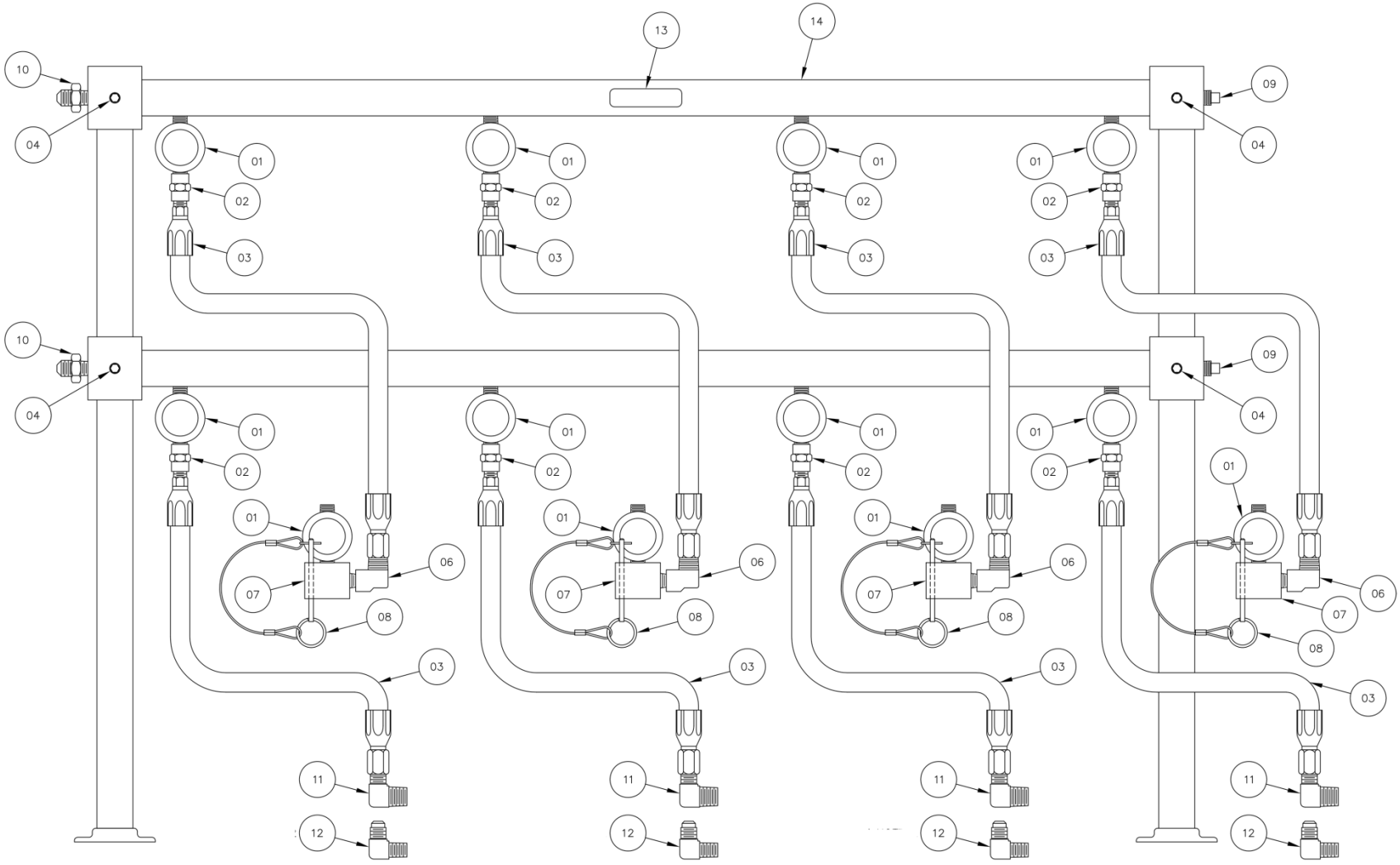

Figure 9-17 Four Unit Nitrogen Manifold

9.5 Backpressure Receivers

The 15 ml nitrogen backpressure receiver can be used with the dual nitrogen manifold (P/N 209545) or HP Primary/LP Secondary Nitrogen Manifold (P/N 209546). This backpressure unit can be used with 175 ml cells or 500 ml cells (low volume filtration). See Figure 9-18.

Table 9-22 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

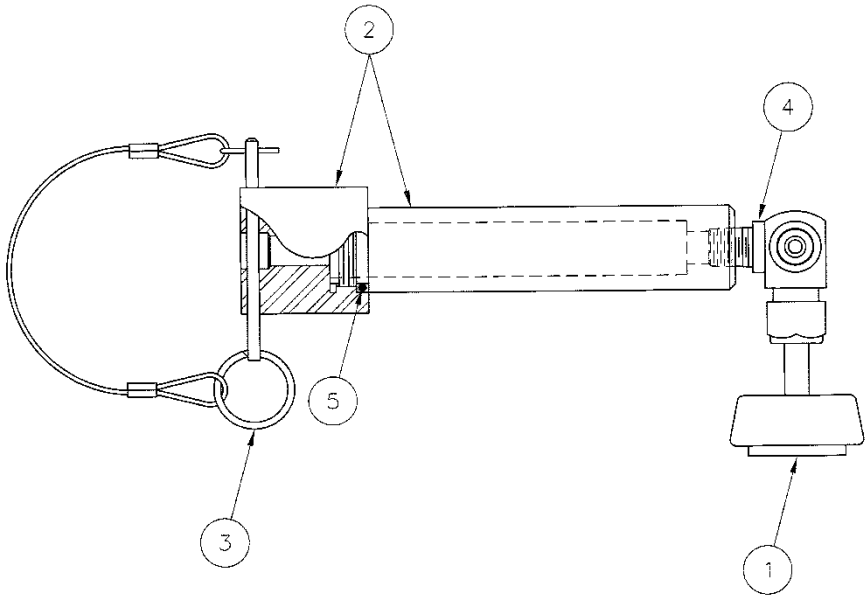

Figure 9-18 Backpressure Receiver Assembly, 15 ml, Nitrogen

The 15 ml carbon dioxide pressure receiver can be used with 175 ml cells or 500 ml cells (low volume filtration). See Figure 9-19.

Table 9-23 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

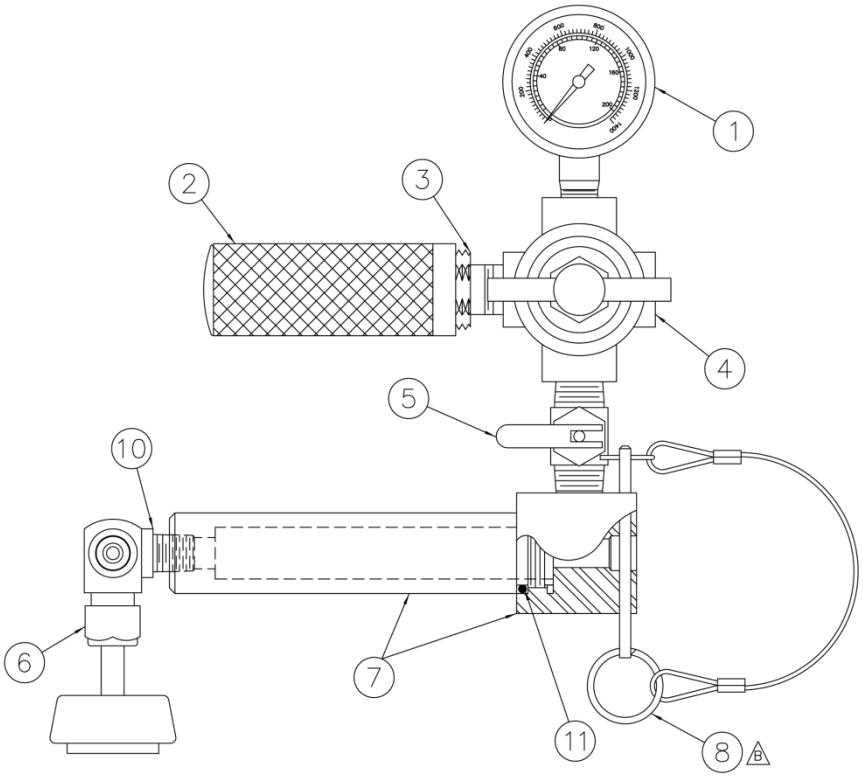

Figure 9-19 Backpressure Receiver, 15 ml

A 100 ml backpressure receiver can be used with the nitrogen manifolds (P/N 209545 and 209546). It can be used with any 500 ml cell. See Figure 9-20.

This backpressure receiver can also be used when a high filtrate volume is expected.

Table 9-24 Backpressure Receiver, 100 ml, P/N 209542

Item No.	Part No.	Quantity	Description
0001	204648	1	PIN COX SAFETY LOCKING
0002	205668	1	O-RING, 1-3/8 X 1/16, NITRILE
0003	208759	1	VALVE NEEDLE, 1/8 X 1/8 CHROME

Figure 9-20 Backpressure Receiver, 100 ml

9.6 Cell Assemblies

Table 9-25 HPHT Cell Assembly, 175 ml, Single Opening, P/N 209584

Item No.	Part No.	Quantity	Description
0001	209569	1	CELL BODY, 175ml, 303SS, PRESSURE INDICATOR
0002	209501	8	SCREW CAP LOCKING, 5/16-18 X 1/2
0003	209532	1	HPHT CAP, 1800 PSIG w/60 MESH SCREEN
0004	209496	2	VALVE STEM
0005	205649	8	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0006	205662	2	O-RING, 2-1/4 X 1/8, NITRILE
0008	209493	1	WRENCH, HEX KEY, 5/32 SHORT ARM

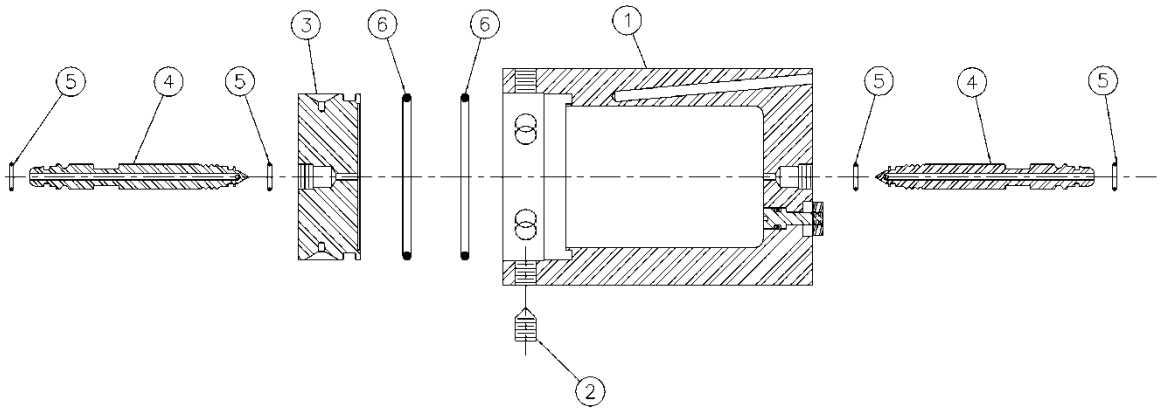

Figure 9-21 HPHT Cell Assembly, 175 ml, Single Opening

Table 9-26 HPHT Cell Assembly, 175 ml, Double Opening, P/N 209585

Item No.	Part No.	Quantity	Description
0001	203946	1	CELL BODY, 1800 PSI, DOUBLE END, 175 ml
0002	209501	14	SCREW CAP LOCKING 5/16-18 X 1/2
0003	209536	1	HPHT CAP, 1800 PSIG, DETACHABLE SCREEN
0004	209496	2	VALVE STEM
0005	205649	8	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0006	205662	4	O-RING, 2-1/4 X 1/8, NITRILE B46 228
0007	209534	1	SCREEN 325 w/60 MESH BACK
0009	209493	1	WRENCH, HEX KEY, 5/32 SHORT ARM
0010	209568	1	HPHT CAP, 1800 PSIG PRESSURE INDICATOR

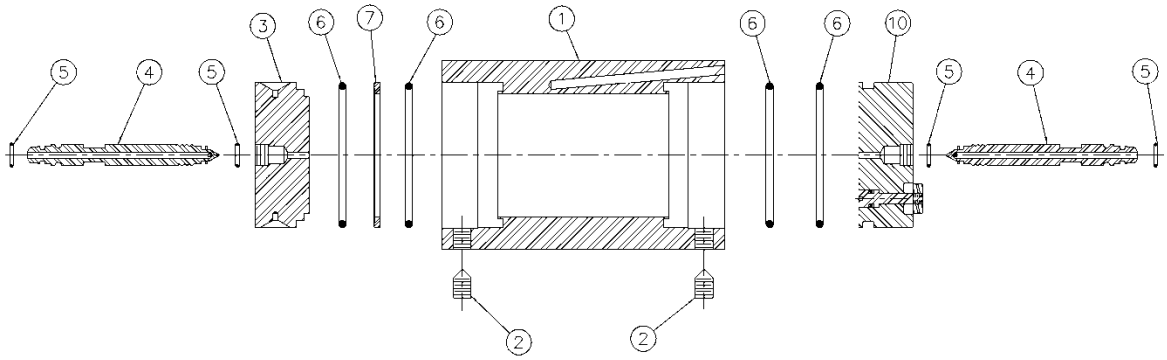

Figure 9-22 HPHT Cell Assembly, 175 ml, Double Opening

Table 9-27 HPHT Cell Assembly, 500 ml, Single Opening, P/N 209586

Item No.	Part No.	Quantity	Description
0001	209570	1	CELL BODY, 500ml, 303SS, PRESSURE INDICATOR
0002	209501	8	SCREW CAP LOCKING, 5/16-18 X 1/2
0003	209532	1	HPHT CAP, 1800 PSIG, w/60 MESH SCREEN
0004	209496	2	VALVE STEM
0005	205649	8	O-RING, 0.176 ID X 0.070 W, NO. 2-008 75 DURO VITON®
0006	205662	2	O-RING, 2-1/4 X 1/8, NITRILE
0008	209493	1	WRENCH, HEX KEY, 5/32 SHORT ARM

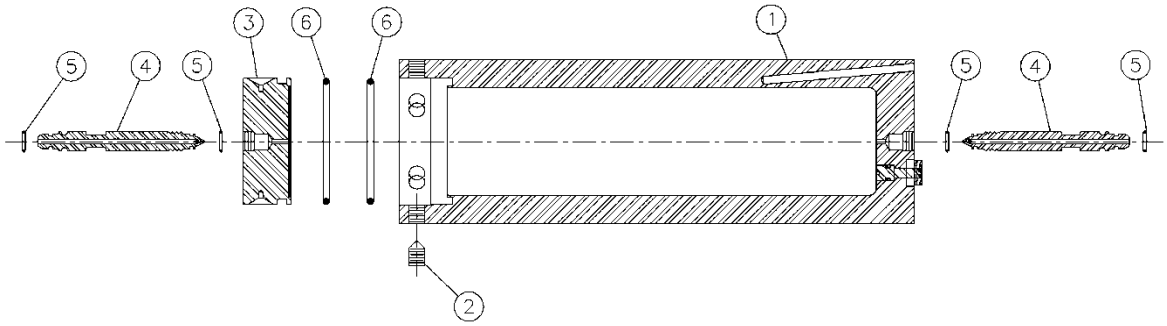

Figure 9-23 HPHT Cell Assembly, 500 ml, Single Opening

Table 9-28 HPHT Cell Assembly, 500 ml, Double Opening, P/N 209587

Item No.	Part No.	Quantity	Description
0001	203949	1	CELL BODY, 1800 PSI, DBL END, 10in., 500 ml
0002	209501	14	SCREW CAP LOCKING, 5/16-18 X 1/2
0003	209536	1	HPHT CAP, 1800 PSIG, DETACHABLE SCREEN
0004	209496	2	VALVE STEM
0005	205649	8	O-RING, 0.176 ID X 0.070 W, NO. 2-008 75 DURO VITON®
0006	205662	4	O-RING, 2-1/4 X 1/8, NITRILE B46 228
0007	209534	1	SCREEN 325 w/60 MESH BACK HPHT
0009	209493	1	WRENCH HEX KEY 5/32 SHORT ARM
0010	209568	1	HPHT CAP, 1800 PSIG PRESSURE INDICATOR

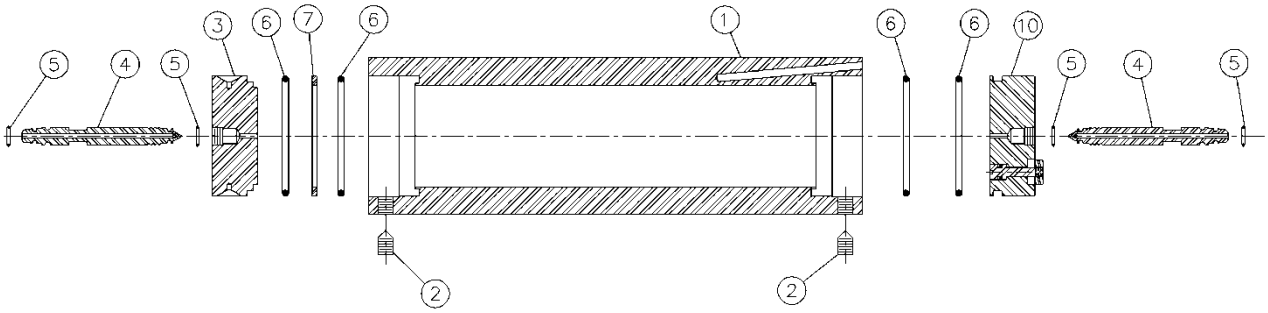

Figure 9-24 HPHT Cell Assembly, 500 ml Double Opening

Table 9-29 HPHT Cell Assembly, 175 ml, Single Opening, Removable Screen, P/N 209531

Item No.	Part No.	Quantity	Description
0001	209569	1	CELL BODY, 175ml, SINGLE END, 303SS, PRESSURE INDICATOR
0002	209501	8	SCREW CAP LOCKING, 5/16-18 X 1/2
0003	209536	1	HPHT CAP, 1800 PSIG, DETACHABLE SCREEN
0004	209496	2	VALVE STEM
0005	205649	8	O-RING, 0.176 ID X 0.070 W, NO. 2-008,75 DURO VITON®
0006	205662	2	O-RING, 2-1/4 X 1/8, NITRILE
0007	209534	1	SCREEN 325 w/60 MESH BACK
0009	209493	1	WRENCH, HEX KEY, 5/32 SHORT ARM

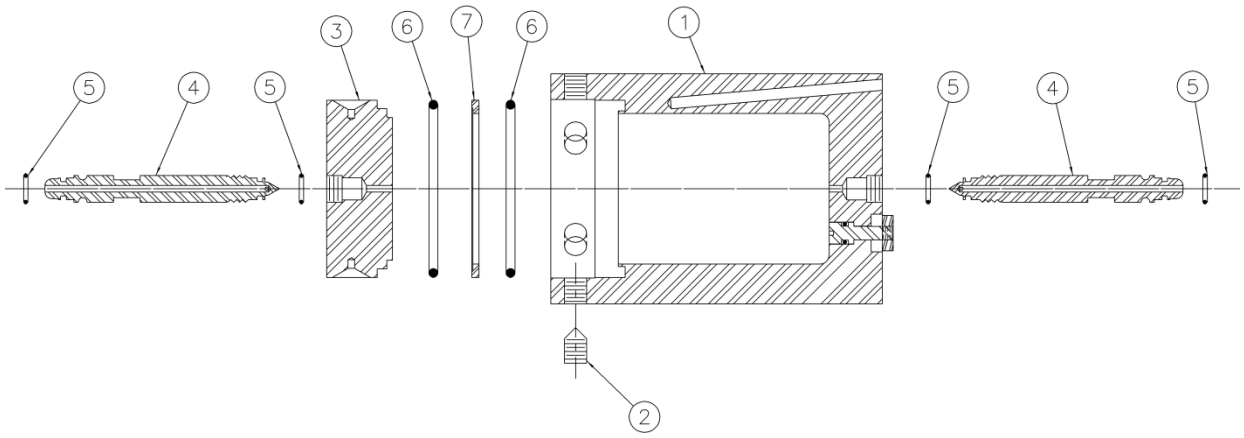

Figure 9-25 HPHT Cell Assembly, 175 ml, Single Opening, Removable Screen

Table 9-30 HPHT Cell Assembly, 175 ml, Double Opening, Ceramic Filter, P/N 209582

Item No.	Part No.	Quantity	Description
0001	209583	1	CELL BODY, 175ml, DBL END, 1/4 CERAMIC FILTER DISC
0002	209501	14	SCREW CAP LOCKING 5/16-18 X 1/2
0003	209568	1	HPHT CAP, 1800 PSIG, PRESSURE INDICATOR
0004	209496	2	VALVE STEM
0005	205649	8	O-RING, 0.176 ID X 0.070 W, NO. 2-008, 75 DURO VITON®
0006	205662	4	O-RING, 2-1/4 X 1/8, NITRILE
0008	209573	1	HPHT CAP, 1800 PSIG w/0.062 GROOVE
0009	210540	1	FILTER DISC, API DESIGNATION 50,CERAMIC, 10/BOX
0011	209493	1	WRENCH, HEX KEY, 5/32 SHORT ARM

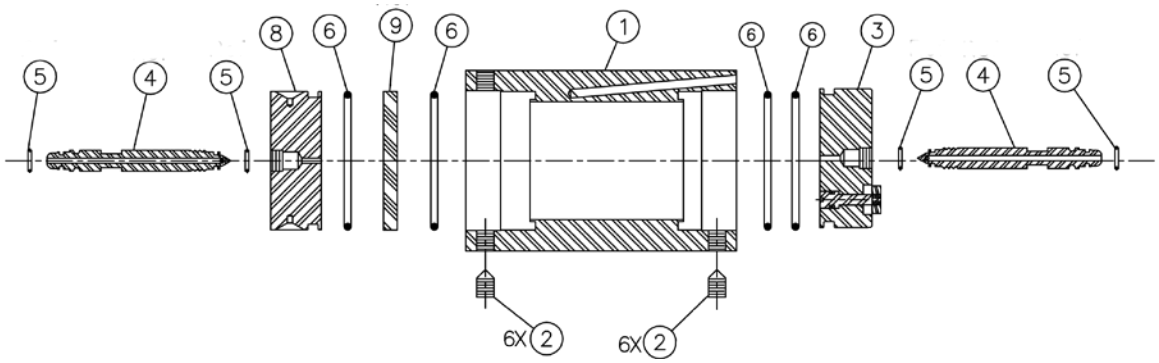

Figure 9-26 HPHT Cell Assembly, 175 ml, Double Opening, Ceramic Filter

Table 9-31 HPHT Cell Assembly, 500 ml, Double Opening, Ceramic Filter, P/N 209559

Item No.	Part No.	Quantity	Description
0001	209539	1	CELL BODY, 500ml, DBL END w/DISC
0002	209501	14	SCREW, CAP LOCKING 5/16-18 X 1/2
0003	209568	1	HPHT CAP, 1800 PSIG PRESSURE INDICATOR
0004	209496	2	VALVE STEM
0005	205649	8	O-RING, 0.176 ID X 0.070 W, NO. 2-008 75 DURO VITON®
0006	205662	4	O-RING, 2-1/4 X 1/8, NITRILE
0008	209573	1	HPHT CAP, 1800 PSIG, w/.062 GROOVE
0009	210540	1	FILTER DISC API DESIGNATION 50, CERAMIC 10/BOX
0011	209493	1	WRENCH, HEX KEY, 5/32 SHORT ARM

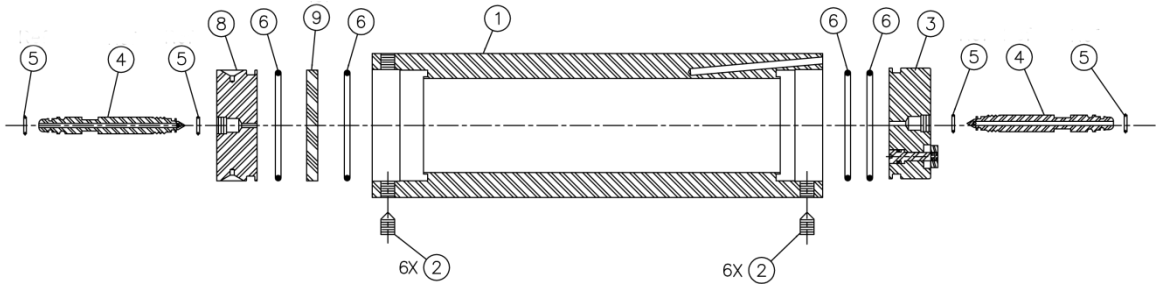

Figure 9-27 HPHT Cell Assembly, 500 ml, Double Opening, Ceramic Filter

9.7 Cell Screens

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

- For 209532 end cap - P/N 207232, 60 mesh, stainless steel screen
- For 209536 end cap and cement testing - 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.

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