High Temperature Aging Cell

Instruction Manual

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Fann Instrument Company

High Temperature Aging Cell Instruction Manual

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Table of Contents

List of Figures

List of Tables

1 Introduction

Some drilling fluids, especially lime-treated drilling fluids thicken or solidify when left in a deep hot hole under static conditions. This thickening impairs and sometimes prevents drilling and completion operations, such as logging and perforating. Fann's High Temperature Aging Cells are designed for use in aging tests which help predict the performance of a drilling fluid under static, high temperature conditions. Recent drilling research indicates that it is better to apply pressure before heating samples to elevated temperatures in aging tests. Fann has aging cells which can be pressurized with nitrogen or carbon dioxide to prevent boiling and vaporization before reaching the test temperature.

For temperatures up to 500°F (260°C) and pressures up to 1000 psi (6895 kPa), a 550 ml stainless steel aging cell is available. This cell can hold a 350 ml sample with adequate room for expansion. Samples aged in this cell can be analyzed in shear tests.

Cell assemblies made of Type 303 and Type 316 stainless steel and other corrosion-resistant materials can be pressurized using the Fann High Temperature, High Pressure Filter Press manifolds.

Glass liners with Teflon® lids are available for use with 260 ml or 500 ml aging cells. These liners keep the sample and the cell from touching and protect from corrosion or contamination. These glass liners are made of Pyrex® glass and can be heated. They do not form a seal. A cell containing a glass liner can be heated and pressurized. However, this cell must be kept upright and cannot be rolled.

1.1 Document Conventions

The following icons are used as necessary to distinguish elements of text.

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

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

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

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

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

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

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

2 Safety

Safe laboratory practices and procedures should be observed while operating and maintaining the High Temperature Aging Cell.

Safely operating this aging requires your understanding and practicing correct assembly and use of the aging cell, as well as the oven used to heat them.

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

Improper assembly, operation, or the use of defective parts could result in cell leakage or failure, causing serious injury and damage.

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

The following sections list some precautions for safely operating and maintaining these aging cells.

2.1 Safe Pressurization

Some aging cells are designed to be pressurized before heat is applied to prevent boiling the sample when heated.

A detailed pressurization procedure is described in Section 5. Some instructions and recommendations are listed in this section.

- Always use either nitrogen or carbon dioxide.
- Never connect the aging cell to compressed oxygen or other non-recommended or flammable 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 all safety standards.

- Carbon dioxide is usually supplied in small cartridges which contain approximately 900 psig (6205 kPa) pressure. These cartridges are primarily used in the field.

Do NOT allow the carbon dioxide 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 that they will relieve excessive pressure. Never plug or bypass these safety valves.
- When pressurizing the aging cell, always open the supply pressure first, and then adjust the regulator. Do not attempt to pressurize higher than the equipment's pressure rating or the relief valve settings.
- When de-pressurizing, shut off the supply pressure, and bleed pressure from the system. Then, turn the regulator T-screw counterclockwise (left).

2.2 Safe Heating

Hot cells if touched can cause severe burns. Wear approriate hand protection.

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

- Caution should be exercised when operating ovens to avoid accidental injury by touching the inside of the oven or the cell assembly while these are hot. The oven and cells are still dangerously hot even after the test has ended and the oven has been turned off.

- It is not recommended that the aging cells be removed from the heating chamber or oven until they have cooled to a temperature in which they can be safely handled.

- Cooling a hot aging cell under running water is very dangerous. This practice is not recommended because there is risk of getting burned. If the cell must be cooled quickly, be extremely careful and wear appropriate hand protection.

- Use extreme caution when placing a hot cell in water. Hot steam that is generated when the water contacts the hot cell can cause severe burns.

2.3 Safe Electrical Operation (oven)

Always disconnect the power cable before repairing an oven.

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

- Electrical problems in the oven wiring or heaters may not be obvious by looking at the equipment.

- If any of these situations occur, then there is a malfunction and the equipment may need electrical repair:

    - Blows fuses or trips the breaker.
    - The heating time seems too long.
    - The thermostat control does not repeat.

2.4 Safe Test Cell Maintenance

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

The aging cell assembly constitutes a pressure vessel. These safety precautions should be followed:

- The aging cell material should be compatible with the test sample.
- Aging cell bodies that show stress cracking, severe pitting, or that have damaged threads must not be used.
- Aging cell outer caps with damaged threads or set screw holes must not be used.
- Damaged set screws or low-strength, non-heat treated set screws must not be used.

3 Features and Specifications

Refer to Table 3.1 for specifications. These aging cells (Figure 3-1) are designed for numerous testing requirements and conditions:

- Volume: 260 ml or 500 ml
- Temperature Range: Ambient to 500°F (260°C)
- Material: stainless steel (303 & 316)

When heat aging at temperatures at 212°F (100°C) and greater, apply the recommended backpressure and add the volume of drilling fluid as shown in Table 3-2.

Table 3-1 Aging Cell Specifications

Part No.	Material	Volume	Maximum Working Pressure		Maximum Temperature	
		(ml)	psig	kPa	°F	°C
210285	303 Stainless Steel	500	2500	17237	500	260
210286	316 Stainless Steel	500	2500	17237	500	260
210288[2]	303 Stainless Steel	260	2500	17237	350[1]	177
210289	303 Stainless Steel	260	2500	17237	350[1]	177
210290[2]	303 Stainless Steel	500	2500	17237	500	260
210291	316 Stainless Steel	260	2500	17237	350[1]	177
210292[2]	316 Stainless Steel	260	2500	17237	350[1]	177
210294[3]	303 Stainless Steel	500	2500	17237	500	260
210316[2]	316 Stainless Steel	500	2500	17237	500	260

1. These cells are rated at 350°F (177°C) since the allowable sample size becomes less than 200 ml at higher temperatures.
2. These cells cannot be pressurized.
3. The corrosion coupon holder and gas injection tube are mounted to the inner cap.

The maximum temperature specifications are based on the cell's gasket (material).

Figure 3-1 Aging Cell

Table 3-2 Drilling Fluids Volume and Pressure for High Temperature Aging

Desired Aging Temperature		Absolute Water Vapor Pressure		Desired Total Cell Absolute Pressure	Initial Sample Volume (V_1)	Water Density	Water Volume	Total Sample Volume	Gas Volume	Applied Initial Pressure (P_1)	Calculated Final Pressure (P_2)
°F	°C	psia	kPa	psia	ml	1b/ft^3	ml	ml	ml	psig	psig
212	100	15	101	215	350	59.87	364	364	186	25	53
250	121	30	206	230	350	58.86	370	370	180	50	110
300	149	67	462	267	350	57.36	380	380	170	100	243
350	177	135	928	335	350	55.65	391	391	159	150	433
400	204	247	1705	447	350	53.72	406	406	144	200	709
450	232	422	2912	622	350	51.53	423	423	127	250	1113
500	260	681	4692	881	350	49.03	444	444	106	300	1731
520	271	812	5599	1012	350	47.92	455	455	95	250	1811
540	282	962	6634	1162	350	46.74	466	466	84	150	1679
560	293	1133	7810	1333	350	45.46	479	479	71	100	1734
580	304	1325	9138	1525	350	44.08	494	494	56	50	1760
600	316	1542	10635	1742	350	42.58	512	512	38	25	1937

4 Unpressurized Test Procedure

Refer to Figure 4-1.

1. Determine the safe sample volume (350 ml or 500 ml) and the aging temperature (Table 3-2). Pour the drilling fluid into the aging cell.

Do NOT overfill the aging cell.

2. Make sure the sealing edge of the cell is clean. Place the inner cap onto the cell. (The gasket should be installed in the groove of the inner cap).

3. Screw the outer cap onto the cell. Use the 5/16-in Allen wrench to tighten the center set screw (in the middle of the outer cap). If the cell will be rolled, install one O-ring (P/N 205662) into the groove on the outer cap and one O-ring on the flange near the bottom of the cell.

4. Place the cell in a Fann roller oven or aging oven, and set the aging temperature.

A hot air oven may also be used if it can maintain a constant, uniform temperature like the Fann roller ovens.

5. After the desired aging time has elapsed, remove the cell and cool it to less than 130°F (54°C).

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

Do NOT handle hot cells with bare hands. If the cell temperature is greater than 130°F (54°C), there is danger of being burned.

6. To open the cell, loosen the set screw, unscrew the outer cap, and then remove the inner cap.

7. Examine the aged drilling fluid and report its condition: gelled, plastic, or hard.

For shear strength testing, see Section 6.

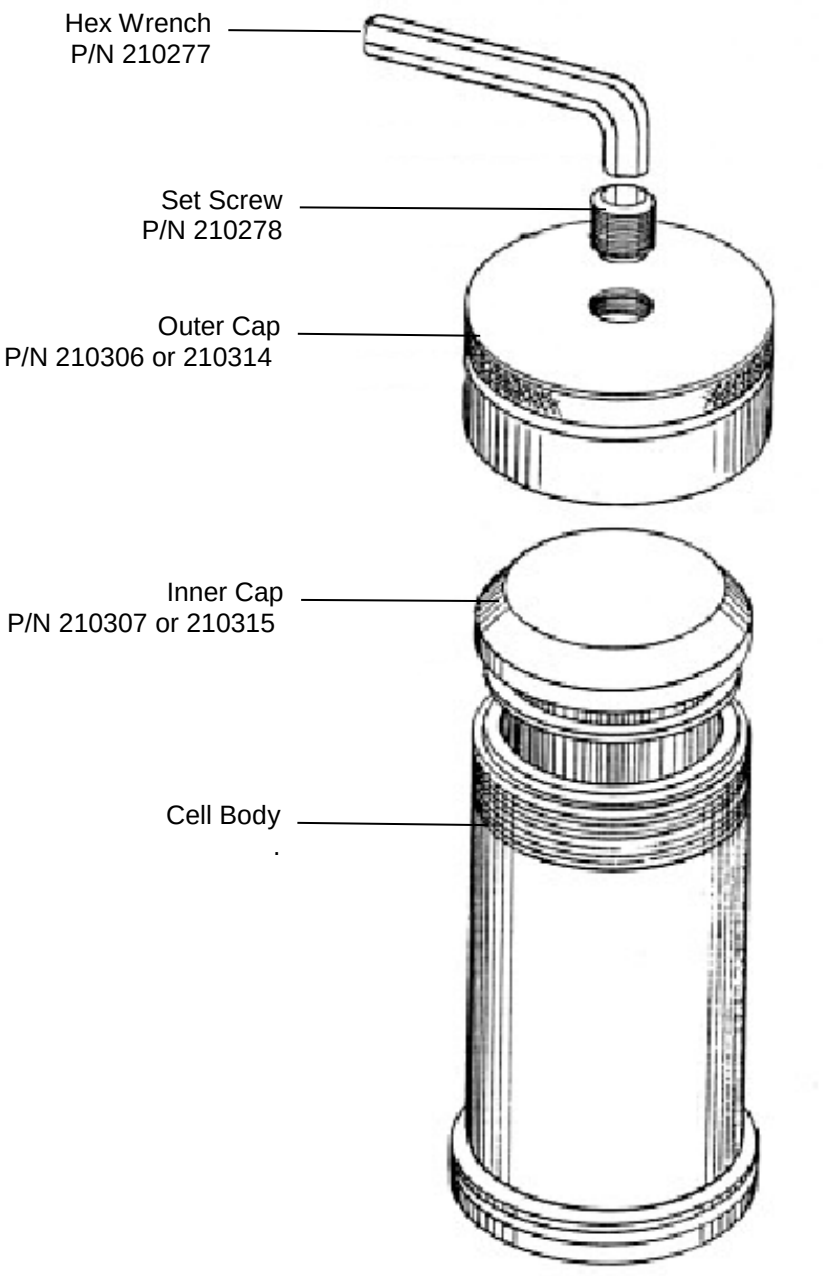

Figure 4-1 Unpressurized Cell Assembly

Refer to Parts List for part numbers not shown.

5 Pressurized Test Procedure

Refer to Figure 5-1 Pressurized Cell Assembly.

Pressuring manifolds are shown in Figure 5-2 Carbon Dioxide and Figure 5-3 Nitrogen.

1. Determine the safe sample volume (350 ml or 500 ml) and the aging temperature. Refer to Table 3-2. Pour the drilling fluid into the aging cell.

Do NOT overfill the aging cell.

2. Make sure that the sealing edge of the cell is clean.
3. Install the gasket in the groove of the inner cap. Place the inner cap onto the cell.
4. Place the pressure plate (or washer) over the neck of the inner cap.
5. Screw the outer cap onto the cell. Use the 3/16-in. set screw wrench to tighten the three set screws in the outer cap. If the cell will be rolled, install one O-ring (P/N 205661) in the groove on the outer cap and one O-ring on the flange near the bottom of the cell.
6. Check the condition of O-ring in the lower groove, and replace it if necessary. Next, put the valve stem (cone end) into the inner cap and twist it fully in place. Then, loosen it one-half turn.
7. Attach the pressurizing assembly— carbon, nitrogen, or air. Apply the pressure that will prevent vaporization (Table 3-2). See Figure 5-2 and Figure 5-3.

The carbon dioxide manifold for the HPHT filter press is usually used for pressuring aging cells (Figure 5-2). Its manifold block (adapter) fits onto the valve stem.

8. After pressuring the cell, close the valve stem by turning it until seated.
9. Shut off the supply pressure, and bleed pressure from the system. Then, turn the regulator T-screw counterclockwise (left).

10. Open the valve to bleed pressure, and then pull the locking pin to disconnect the pressuring assembly.

11. Place the cell into the heating chamber and heat at the test temperature for the desired time.

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

Use proper hand protection when handling hot cells.

12. Remove the cell and let it cool until the temperature reduces to 130°F (54°C) or less. The cell may be cooled with or without water.

13. Examine the aged drilling fluid and report its condition: gelled, plastic, or hard.

For shear strength testing, see Section 6.

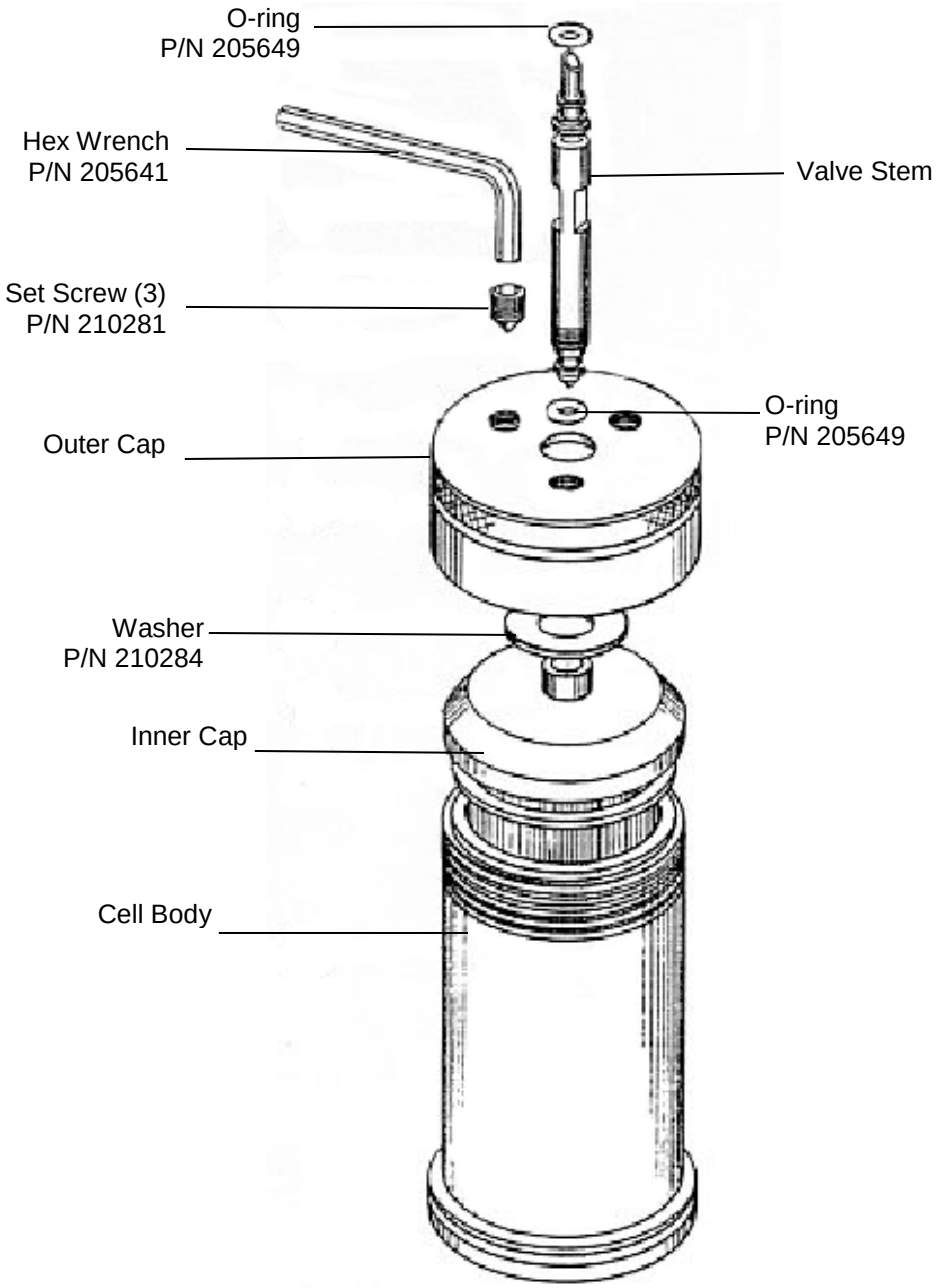

Figure 5-1 Pressurized Cell Assembly

Refer to Parts List for part numbers not shown.

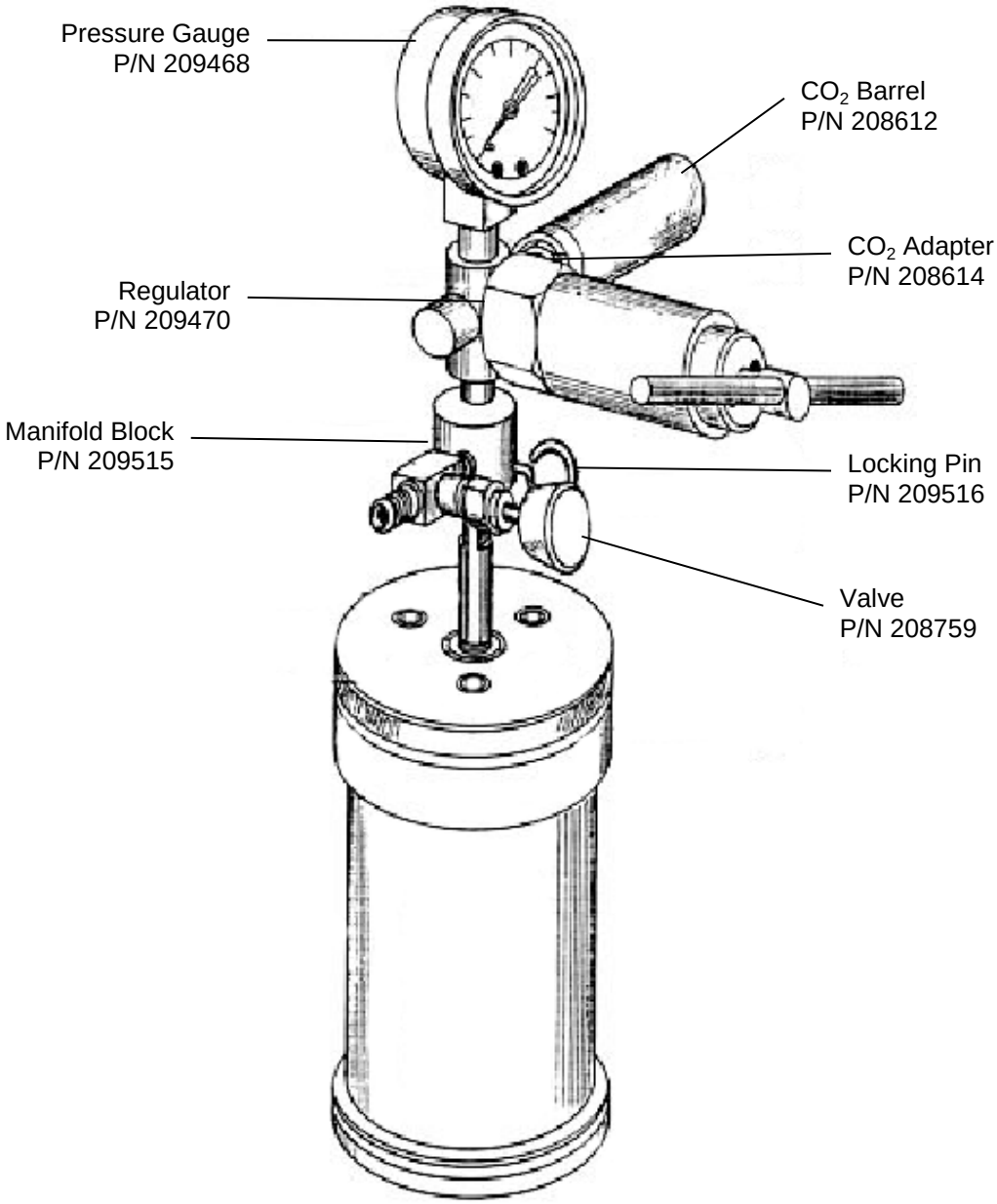

Figure 5-2 Carbon Dioxide Pressurizing Manifold

Refer to Parts List for part numbers not shown.

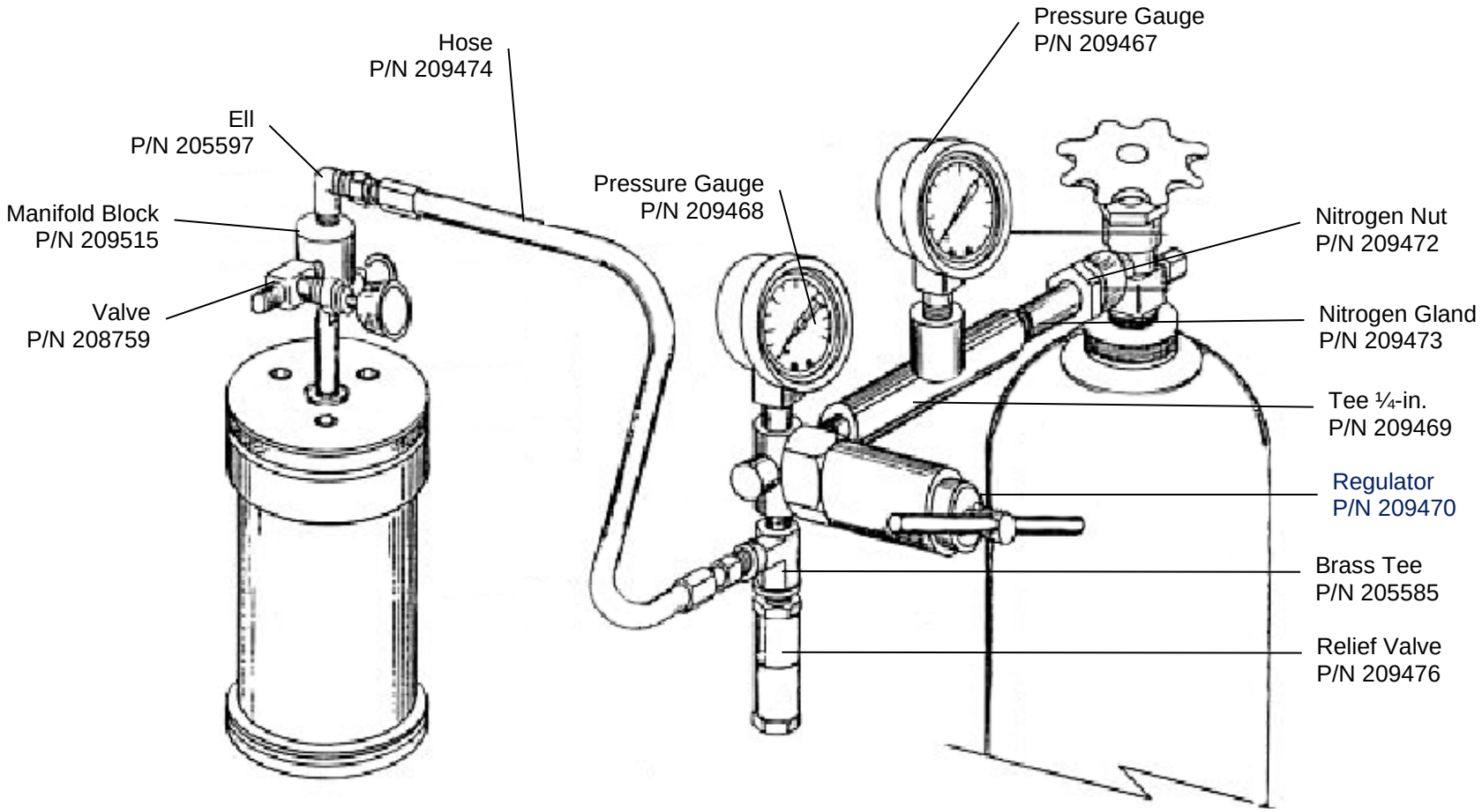

Figure 5-3 Nitrogen Cell Pressurizing Manifold

6 Shear Strength Test Procedure

The references for this procedure are as follows:

- 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

Refer to Figure 6-1.

1. Place the stainless steel shear tube on the surface of the sample.
2. Place the stainless steel weight platform on top of the shear tube. This platform weighs 20 grams.
3. Add gram weights (small gram weights first) until the shear tube starts to sink into the sample. The shear tube will stop sinking when the shear strength of the gelled sample against the surface of the tube is sufficient to support the applied weight.
4. Measure the length of the tube exposed above the sample surface.
5. Calculate the length of the tube below the sample, X, as follows:

   3.5 in – X = Length of tube above sample surface (in)

6. Calculate the shear strength as follows:

$$S = \frac{3.61W}{X} - 0.256U$$

where

S is shear strength in lb/100ft^2

W is the total shear weight in grams

U is the fluid density in lb/gal

X is the submerged length of shear tube in inches

7. For a 16 lb/gal sample, you can use the nomograph shown in Figure 6-2.

   Use the total shear weight and the length of the tube above sample surface to find the shear strength (lb/100ft^2) on the nomograph.

   - Total Shear Weight

     W (g) = 20 g + gram weights (weight applied to the shear tube)

   - Length of shear tube above sample surface (in)

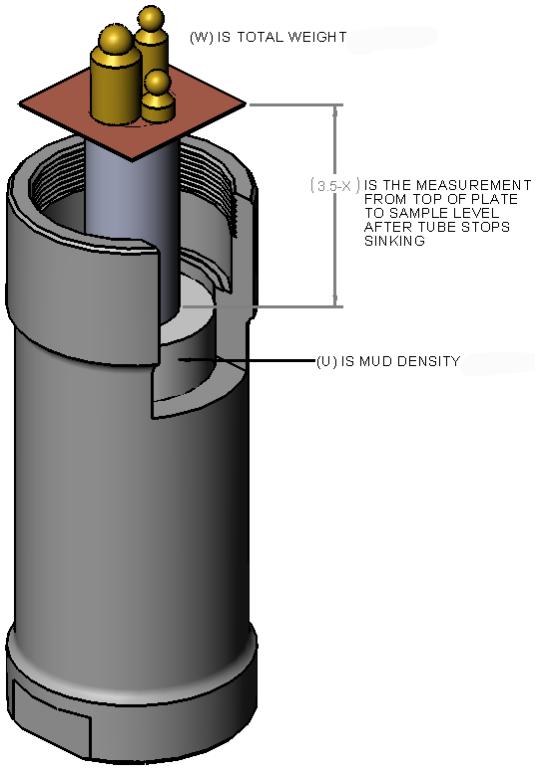

Figure 6-1 Shear Tube on Sample

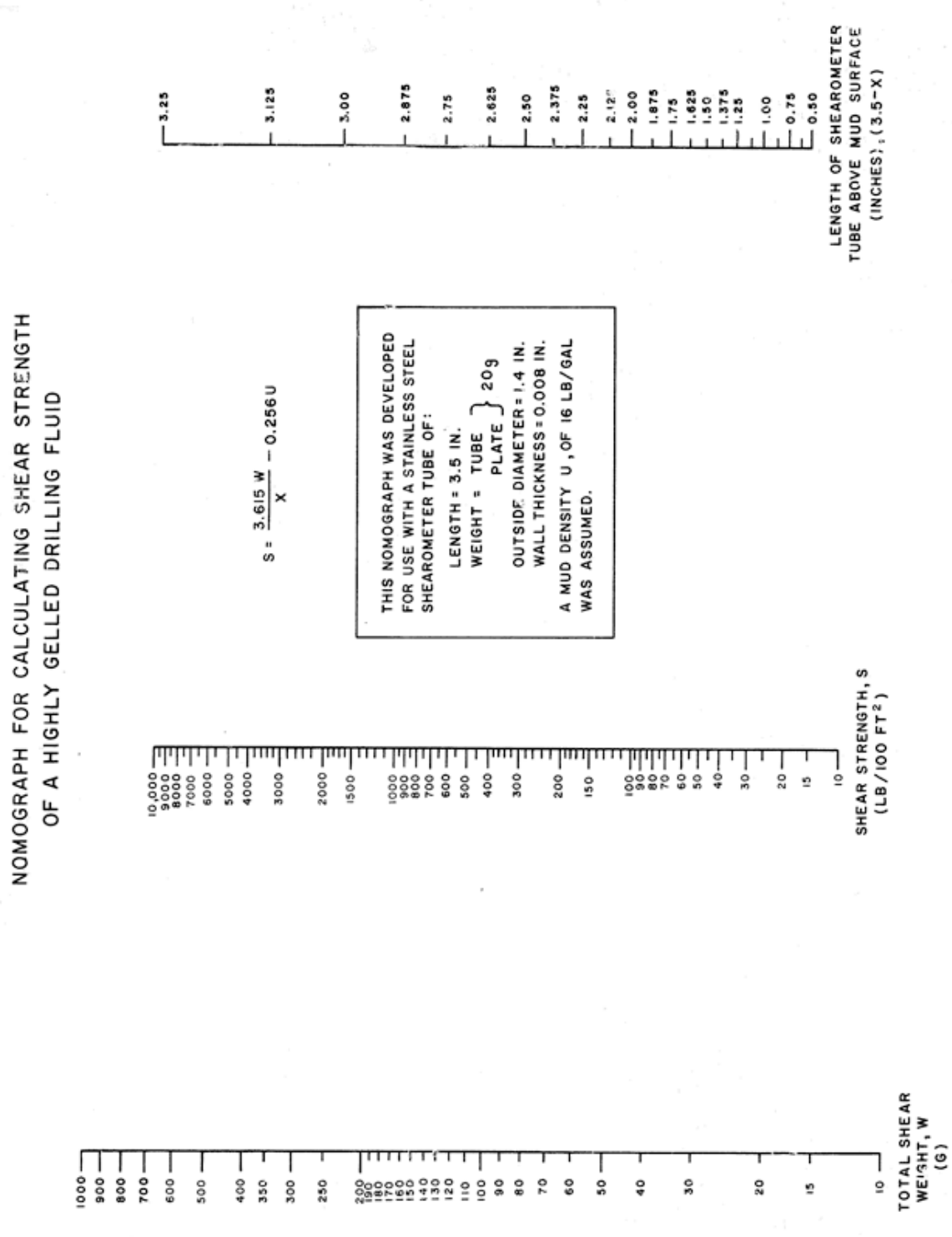

Figure 6-2 Nomograph for Calculating Shear Strength

7 Maintenance of Aging Cells

After each test, completely disassemble and thoroughly clean the aging cell.

Follow these instructions for maintaining the aging cells or other equipment used in the tests:

- Replace the gasket (inner cap) when it becomes distorted. The life of this gasket is greatly reduced after heating at 500°F (260°C). Replacing the gasket is recommended.
- Examine the O-rings and valve stem. Replace them if they are cut or brittle.

After performing tests at 400°F to 500°F (205°C to 260°C), replace the O-rings.

- Remove, clean, and lubricate the set screws (outer cap). Lubricate them with high-quality, high-temperature lubricant suitable for 500°F (260°C) (e.g., an anti-seize lubricant).
- Clean and lubricate the outer cap and cell thread.
- Thoroughly clean the inside of the cell and the inner cap. Make sure the rounded corner between the wall and the bottom of the cell is clean and not corroded. Minor corrosion may be removed by sandblasting.

Cell corrosion can result in corrosion stress cracking, which impairs the safety of the cell. Do NOT pressure or heat a cell showing stress cracks.

- For maintaining regulators and pressurizing assemblies, see the instructions for regulators.
- Shearometer parts should be cleaned and dried after use.

8 Accessories

Table 8-1 Accessories

Part Number	Description
205661	O-ring (cell outside), 3-5/8 ID x 3/16 Viton®
208608	CO_2 Cartridges, 10/box
208654	Wrench, 6-in Adjustable (valve stem)
209497	Cell Lifting Tool (pressurized cells only)
209500	Valve Seat Refinishing Tool (pressurized inner caps)

9 Parts List

Each aging cell assembly includes this instruction manual (P/N 210287).

9.1 Pressurized Aging Cell Assemblies

Table 9-1 Aging Cell, 303 SS, Pressurized, 500 ml, P/N 210285

Part No.	Quantity	Description
205641	1	WRENCH, HEX KEY, 3/16 SHORT ARM
205649	2	O-RING (VALVE STEM)
210276	1	GASKET , TEFLON®
210281	3	SCREW SET 3/8-16 X 5/8 LONG
210282	1	VALVE STEM
210283	1	INNER CAP, 303 SS
210284	1	FLAT WASHER
210309	1	CELL BODY, 500 ml, 303 SS
210311	1	OUTER CAP, 303 SS

Table 9-2 Aging Cell, 316 SS, Pressurized, 500 ml, P/N 210286

Part No.	Quantity	Description
205641	1	WRENCH, HEX KEY, 3/16 SHORT ARM
205649	2	O-RING (VALVE STEM)
210276	1	GASKET, TEFLON®
210281	3	SCREW SET 3/8-16 X 5/8 LONG
210282	1	VALVE STEM
210284	1	FLAT WASHER
210310	1	CELL BODY, 500ml, 316 SS
210312	1	OUTER CAP, 316 SS
210313	1	INNER CAP, 316 SS

Table 9-3 Aging Cell, 303 SS, Pressurized, 260 ml, P/N 210289

Part No.	Quantity	Description
205641	1	WRENCH, HEX KEY, 3/16 SHORT ARM
205649	2	O-RING (VALVE STEM)
210276	1	GASKET, TEFLON®
210281	3	SCREW SET 3/8-16 X 5/8 LONG
210282	1	VALVE STEM
210283	1	INNER CAP, 303 SS
210284	1	FLAT WASHER
210308	1	CELL BODY, 260ml, 303 SS
210311	1	OUTER CAP, 303 SS

Table 9-4 Aging Cell, 316 SS, Pressurized, 260 ml, P/N 210291

Part No.	Quantity	Description
205641	1	WRENCH, HEX KEY, 3/16 SHORT ARM
205649	2	O-RING (VALVE STEM)
210276	1	GASKET, TEFLON®
210281	3	SCREW SET 3/8-16 X 5/8 LONG
210282	1	VALVE STEM
210284	1	FLAT WASHER
210305	1	CELL BODY, 260ml, 316 SS
210312	1	OUTER CAP, 316 SS
210313	1	INNER CAP, 316 SS

Table 9-5 Aging Cell, Corrosion Test, 303 SS, Pressurized, 500 ml, P/N 210294

Part No.	Quantity	Description
205641	1	WRENCH, HEX KEY, 3/16 SHORT ARM
205649	2	O-RING (VALVE STEM)
210276	1	GASKET, TEFLON®
210281	3	SCREW SET 3/8-16 X 5/8 LONG
210282	1	VALVE STEM
210284	1	FLAT WASHER
210086	10/PKG	GROMMETS & SCREWS (COUPON HOLDER)
210293	1	INNER CAP, 303 SS
210309	1	CELL BODY, 500ml, 303 SS
210311	1	OUTER CAP, 303 SS

9.2 Pressurizing Assemblies

Refer to Figure 5-2 Carbon Dioxide Pressurizing Manifold and Figure 5-3 Nitrogen Pressurizing Manifold.

Table 9-6 CO_2 Pressurizing Assembly, P/N 209471

Part No.	Description
208612	BARREL CO_2
208614	ADAPTER, CO_2
208759	VALVE, 1/8 IN.
209468	GAUGE, PRESSURE, 1500 PSIG(10340 KPA) 2 IN. (5.08CM) DIA.
209470	REGULATOR W/1500 PSIG GAUGE (INCLUDES 209468)
209515	MANIFOLD BLOCK
209516	LOCKING PIN

Table 9-7 Nitrogen Pressurizing Assembly, P/N 209547

Part No.	Description
205585	1/8 BRASS ST. TEE
205597	1/8 IN. FNPT X ¼ IN. FLARE ELL
208759	VALVE, 1/8 IN.
209467	GAUGE, PRESSURE 3000 PSIG(20682 KPA) 2 IN. (5.08 CM) DIA.
209468	GAUGE, PRESSURE, 1500 PSIG(10340 KPA) 2 IN. (5.08CM) DIA.
209470	REGULATOR W/1500 PSIG GAUGE (INCLUDES 209468)
209469	TEE ¼ IN., 3000 PSIG
209472	NUT, GLAND, LEFT HAND, OIL PUMPED NITROGEN
209473	GLAND, NITROGEN, OIL PUMPED
203950	NUT, GLAND, RIGHT HAND, OIL PUMPED NITROGEN
209474	HOSE, 3000 PSIG, 3/16 IN. X 3 FT. (.48 X 91 CM)
209476	RELIEF VALVE, 1200 PSIG
209515	MANIFOLD BLOCK
209516	LOCKING PIN

9.3 Unpressurized Aging Cell Assemblies

Table 9-8 Aging Cell, 303 SS, Unpressurized, 500 ml, P/N 210288

Part No.	Description
210276	GASKET, TEFLON®
210277	WRENCH, HEX KEY, 5/16 SHORT ARM
210278	SCREW SET 5/8-18 x 5/8 LONG
210306	OUTER CAP , 303 SS
210307	INNER CAP , 303 SS
210308	CELL BODY, 260ml, 303 SS

Table 9-9 Aging Cell, 303 SS, Unpressurized, 500 ml, P/N 210290

Part No.	Description
210276	GASKET, TEFLON®
210277	WRENCH, HEX KEY, 5/16 SHORT ARM
210278	SCREW SET 5/8-18 x 5/8 LONG
210306	OUTER CAP, 303 SS
210307	INNER CAP, 303 SS
210309	CELL BODY, 500ml, 303 SS

Table 9-10 Aging Cell, 316 SS, Unpressurized, 260ml, P/N 210292

Part No.	Description
210276	GASKET, TEFLON®
210277	WRENCH, HEX KEY, 5/16 SHORT ARM
210278	SCREW SET 5/8-18 x 5/8 LONG
210305	CELL BODY, 260ml, 316 SS
210314	OUTER CAP, 316 SS
210315	INNER CAP, 316 SS

Table 9-11 Aging Cell, 316 SS, Unpressurized, 500 ml, P/N 210316

Part No.	Description
210276	GASKET, TEFLON®
210277	WRENCH, HEX KEY, 5/16 SHORT ARM
210278	SCREW SET, 5/8-18 x 5/8 LONG
210310	CELL BODY, 500ml, 316 SS
210314	OUTER CAP, 316 SS
210315	INNER CAP, 316 SS

9.4 Aging Cell Reference and Shearometer Test Parts

Table 9-12 Aging Cell Body

Part No.	Description
210276	GASKET, TEFLON®
210305	CELL BODY, 316 SS, 260 ML
210308	CELL BODY, 303 SS, 260 ML
210309	CELL BODY, 303 SS, 500 ML
210310	CELL BODY, 316 SS, 500 ML

Table 9-13 Unpressurized Aging Cell Parts

Part No.	Description
210277	WRENCH, HEX KEY, 5/16 SHORT ARM
210278	SET SCREW 5/8-18 x 5/8 LONG
210306	OUTER CAP, 303 SS
210307	INNER CAP, 303 SS
210314	OUTER CAP, 316 SS
210315	INNER CAP, 316 SS

Table 9-14 Pressurized Aging Cell Parts

Part No.	Description
210283	INNER CAP, 303 SS
210293	INNER CAP (FOR CORROSION TEST CELL), 303 SS
210313	INNER CAP, 316 SS
210311	OUTER CAP, 303 SS
210312	OUTER CAP, 316 SS
205641	WRENCH, HEX KEY, 3/16 SHORT ARM
205649	O-RING (VALVE STEM)
210281	SET SCREW, 3/8-16 X 5/8 LONG
210284	FLAT WASHER
210282	VALVE STEM, 416 SS, HARDENED

Table 9-15 Shearometer Test Parts

Part No.	Description
206958	SHEAROMETER TUBE, 20 GRAM W/ PLATFORM
206956	SHEAROMETER TUBE, 5 GRAM
206967	WEIGHT SET, 1 TO 200 GRAM

10 Warranty and Returns

10.1 Warranty

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

10.2 Returns

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

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

Our correspondence address:

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

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

Email fannmail@fann.com

Our shipping address:

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