Pressurized Sag Cup

Instruction Manual

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Fann Instrument Company

Pressurized Sag Cup Instruction Manual

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Table of Contents

List of Figures

List of Tables

1 Introduction

Fann Pressurized Sag Cup is the test equipment used for measuring static sag of a fluid sample.

Sag, commonly referred to as barite sag, happens when solid weighting material separates from the liquid in drilling fluid and settles to the bottom. The result is fluctuating densities, which can cause drilling and wellbore problems.

1.1 Document Conventions

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

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

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

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

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

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

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

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

2 Safety

Hazardous Chemicals

Some chemicals used in this procedure may be hazardous under certain conditions.

- Always work in a well-ventilated area while using aerosol sprays.
- Always wear protective eyewear when working with aerosol spray solvents.
- Never use aerosol sprays near open flames or objects at high temperatures.
- Use protective gloves to avoid prolonged contact between skin and solvents.
- Wash hands thoroughly before eating, drinking, smoking, or using the restroom.

Protective Equipment

- Wear appropriate hand and foot protection when working with the equipment used in this procedure.
- Wear protective eyewear when performing any operation that has the potential of creating flying debris.

Wear appropriate heat-resistant gloves when exposed to high temperature.

Sharp Edges

Sharp edges can create a cut hazard. Avoid direct contact with sharp edges.

Material Safety Information

Material Safety Data Sheet (MSDS) information should be reviewed before using any hazardous chemical or solvent.

Waste Disposal

- Always follow your waste management procedures.
- Segregate all trash and waste by placing in properly labeled containers.
- Do **not** pour chemicals down any drains.
- Do **not** wash tools, instruments or containers over sinks or drains.
- Always provide your environmental contact with details when new products, chemicals or processes are introduced into work environment.
- Immediately contain and report any spills or releases of chemicals, products or contaminated materials or wastes to the HSE Department.

3 Test Equipment

- Pressurized Sag Cup (included)
- Aging Cell, 500 ml
- Hamilton Beach® Mixer or Multi-Mixer
- Mixing Cup, Stainless Steel
- Oven
- Syringes
- Graduated Cylinders
- Spatula (metal)
- Laboratory Top Loading Balance
- Digital Timer

Figure 3-1 Pressurized Sag Cup

4 Operation

This procedure describes how to measure static sag and calculate the sag factor. Sag factor is a measurement that helps predict whether or not sag will occur.

Use proper hand protection when handling hot cells.

Review the procedures on pressurizing and depressurizing the sag cup before starting the test. Refer to Section 4.3 Pressurizing Plunger Instructions

4.1 Sample Preparation

1. Mix the fluid for 10 minutes using a Hamilton Beach® Mixer or a Multi-Mixer. This test requires 350 ml.
2. Measure the density using a mud balance or follow the steps in Section 4.2, and summarized here:
   a. Weigh the Sag cup.
   b. Determine the Sag cup volume (water).
   c. Weigh the test fluid in the Sag cup.
   d. Calculate the mud density (ppg) : (Fluid Mass ⁄ Sag Cup Volume) x 8.3454
3. Transfer this fluid, 350 ml, to an aging cell.
4. Close the aging cell properly. Pressurize with nitrogen to a pressure appropriate for the test temperature and check for leaks.
5. Static age at specified temperature and angle for specified time.
6. Remove the aging cell and let it to cool to approximately 100°F (37.7°C).
7. Release pressure from cell by opening the valve stem slowly.

8. After pressure is completely released, open the cell. Let the sample to sit for 15 minutes, allowing residual gas to escape from the fluid.

9. If trapped gas remains, lightly tap the cell to help release it.

4.2 Sag Test

1. Measure the mass of the clean, dry Pressurized Sag Cup (fully assembled with lid and ring), using a laboratory top loading balance.

2. Remove the ring and lid and add water to fill the cup to a level slightly below the upper edge of the cup (~1/4 in.).

3. Replace the lid on the cup with the attached check valve in the down position (open). Push the lid down until surface contact is made between the outer edge of the lid and the cup edge.

If the O-ring on the lid makes it difficult to push the lid onto the cup, do not force it. Forcing the lid can cause fluid to exit from the check valve opening and possibly spray the person in the face.

4. Place the ring over the lid and screw it into place. This placement forces the lid against the cup and allows excess fluid to slowly flow from the check valve opening, preventing a sudden spray of fluid. If necessary place a rag over the opening. If fluid does not flow out, remove the lid and pour more fluid into the cup.

Fluid could spray from the connection. Take precautions to avoid fluid contact with face or eyes.

5. Then fully pressurize with water, using the pressurization pump. (Refer to Section 4.3.1 Pressurizing the Sag Cup)

6. Dry the outside completely and weigh the water-filled cup. Determine the volume of the cup as follows:

   Sag Cup with water (g) − Sag Cup, empty (g) = Sag Cup Volume (ml)

7. Depressurize the cup and wipe it dry. See Section 4.3.2 Releasing Pressure from the Sag Cup.

8. Use a syringe to carefully remove any top oil from the sample in the aging cell. See Figure 4-1. Measure this top oil in a graduated cylinder and record the volume.

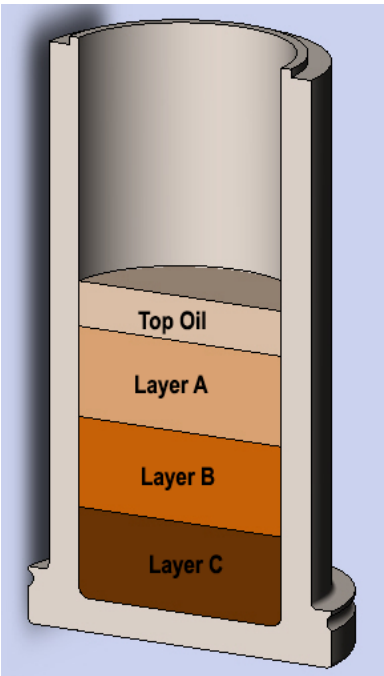

Figure 4-1 Aged Fluid showing layers

9. Using a syringe, remove layer A and store in a separate container.
10. With a spatula, stir layer B without disturbing layer C in the aging cell.
11. Carefully remove layer B with a syringe.
12. Stir the remaining layer C of sample and pour into a separate container.
13. Fill the sag cup with layer A as follows:

This sag cup holds approximately 75 ml of fluid.

a. Place the lid on the cup with the attached check valve in the down position (open). Push down until surface contact is made between the outer edge of the lid and the cup edge.

If the O-ring on the lid makes it difficult to push the lid onto the cup, do not force it. Forcing the lid can cause fluid to exit from the check valve opening and possibly spray the person in the face

b. Place the ring over the lid and screw it into place. This placement forces the lid against the cup and allows excess fluid to slowly flow from the check valve opening, preventing a sudden spray of fluid. If necessary place a rag over the opening. If fluid does not flow out, remove the lid and pour more fluid into the cup.

Fluid could spray from the connection. Take precautions to avoid fluid contact with face or eyes.

c. Pressurize with the same fluid, using the pressurization pump. See Section 4.3.1 Pressurizing the Sag Cup.

14. Clean the cup of any fluid and measure the mass of the Pressurized Sag Cup on the top loading balance.

15. Determine the density of Layer A as follows:

    a. Take the mass of the cup with the fluid and subtract the original mass of the clean dry cup.

    b. Divide this calculated mass by the cup volume (Step 6). This value is the specific gravity of the mud.

    c. Multiply that number by 8.3454 to obtain the weight of the mud in lb/gal.

16. Carefully depressurize the cup. Refer to Section 4.3.2 for depressurizing instructions.

17. Repeat steps 13 thru 16 with Layer C.

18. To report the change in mud weight,

This method only uses Layer C and the original mud weight.

a. Subtract Layer C Mud Weight from the Original Mud Weight.

b. Report this number as Δ (delta), the change in mud weight, in lb/gal.

19. To report the sag factor, use the equation below:

$$Sag\ Factor = \frac{Density, Layer\ C}{(Density, Layer\ C + Density, Layer\ A)}$$

4.3 Pressurizing Plunger Instructions

4.3.1 Pressurizing the Sag Cup

1. The pressurizing plunger is similar to a syringe. Fill the plunger by submerging the nose of the plunger into the fluid (Figure 4-2). Then, pull the piston rod upward to fill the plunger.

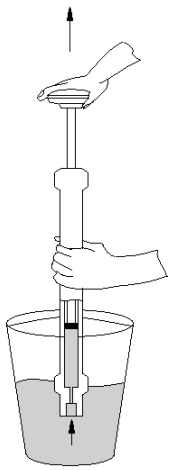

Figure 4-2 Filling the plunger

2. Push the nose of the plunger onto the check valve (Figure 4-3). To pressurize the Sag cup, forcefully hold the cylinder to keep the check valve down (open); and simultaneously, apply and maintain approximately 50 lb of force on the piston rod.

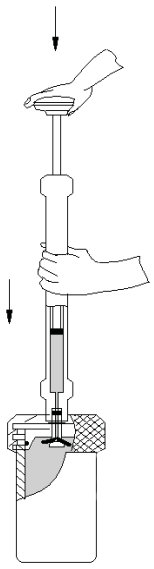

Figure 4-3 Pressurizing the cup

3. The check valve is pressure actuated. When pressure is applied within the cup, this same pressure pushes the valve upward into the closed position. Therefore, the valve is closed gradually.

4. While maintaining the same force on the plunger, decrease the force on the cylinder by lessening your grip. This process allows the check valve to move upward slightly (Figure 4-4).

5. When the check valve closes, pressure releases from the plunger and the cylinder disconnects from the check valve.

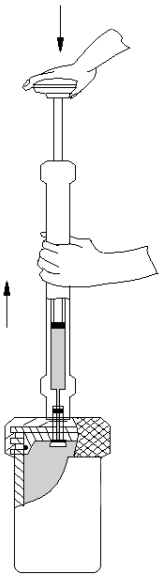

Figure 4-4 Removing the plunger

Observe how far the check valve moves. It should move 3/8 inches. Make sure the check valve and cylinder are moving up. If the cylinder moves up without the valve moving up, the plunger can disconnect from the check valve and spray fluid. If the plunger housing is raised more than approximately 1/4 inches while pressure is held on the plunger, the connection will be lost and fluid will spray onto the operator and others nearby.

4.3.2 Releasing Pressure from the Sag Cup

1. Reconnect the empty plunger and push down on the cylinder to release pressure (Figure 4-5).

Do not press downward on the check valve if the plunger assembly is not connected. Pressing downward without the plunger assembly connected will allow the pressurized fluid to spray from the check valve opening.

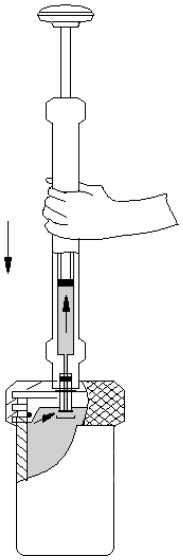

Figure 4-5 Releasing pressure from the cup

2. Empty the Sag cup and thoroughly cleanse all components with water. Pull water into the plunger and expel it several times until clear water flows from the plunger.

For best operation, the O-ring should occasionally be lightly greased with waterproof grease.

3. Verify that the check valve works properly by pushing and pulling on it. If it does not move easily, remove the retaining ring (in the groove above the lid) and the sliding check valve.

4. Inspect the O-ring on the sliding check and replace if damaged.

5. Lightly grease the sliding check valve, reinstall it into the lid, and attach the retaining ring.

5 Troubleshooting and Maintenance

- Thoroughly wash and dry the Pressurized Sag Cup after each measurement.
- Check and replace damaged, cracked or worn O-rings on the lid and check valve.
- Test the check valve for proper operation by pushing and pulling it. If it does not move easily, the retaining ring (on the groove above the lid) and the sliding check valve should be removed and inspected. Lightly grease the sliding check valve.
- Be sure to move the check valve in and out in the lid when cleaning it to remove any cement or drilling fluid.
- The O-rings and sliding portion of the check valve and large O-ring on the lid may be lightly coated with grease to allow it to move easier during a test.

6 Parts List

Table 6-1 Pressurized Sag Cup, P/N 102432866

Item No.	Part No.	Quantity	Description
0001	102418736	1	CUP, SAMPLE
0002	100003571	1	CUP LID RING
0003	100003573	1	CUP LID
0004	100003574	1	VALVE, CHECK
0005	100003566	1	PLUNGER ASSEMBLY
0006	100002151	1	RETAINING RING, EXTERNAL
0007	100001880	4	O-RING, 70 DURO, 1/2 X 3/8 X 1/16
0008	100001884	3	O-RING, 70 DURO, 2 3/16 X 2 X 3/32
0009	100001941	3	O-RING, NITRILE 90 DURO, 3/8 X 1/4 X 1/16

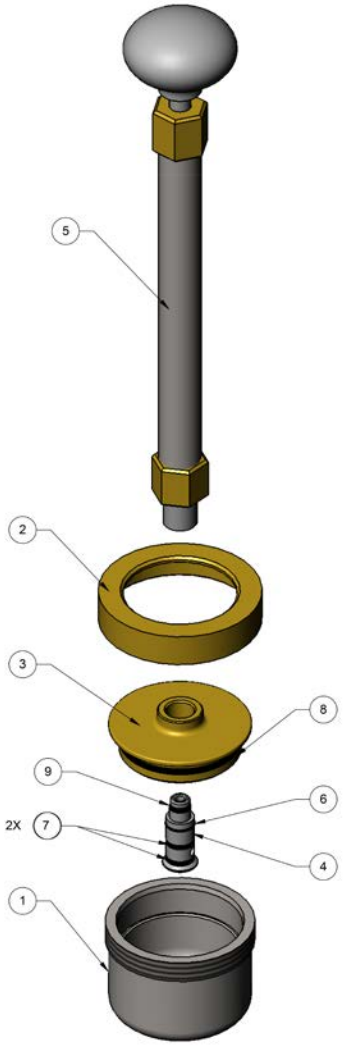

Figure 6-1 Pressurized Sag Cup Parts

7 Warranty and Returns

7.1 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.

7.2 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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