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Rig Laboratory

#144-20 - Basic
#144-22 - With Dead Weight Hydraulic Assembly
#144-30 - With Sink

Instruction Manual

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Ver. 2.0

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Intro

Included in the Rig Laboratory are a mud balance, marsh funnel, measuring cup, filter press, Sand Content Kit, timer, and all the reagents and labware for performing chloride ion analysis. An air hose and connections are included to run the filter press from rig air. A model with a small sink with hook-ups for rig water (#144-30) is also available.

Components

#110-10	Marsh Funnel Viscometer, Plastic
#110-20	Measuring Cup, 1,000 mL, Plastic
#115-01	Mud Balance with Machined Arm, Metal
#140-10	Wall Mount Filter Press
#140-55	Filter Paper, Whatman #50, 3.5” (9 cm), Box of 100
#141-13	Air Hose, Low Pressure, 15”
#141-19	Air Hose Adapter
#152-84	Drive Clutch, Rubber

Sand Content Kit

#167-10	Sieve, 200-Mesh
#167-20	Funnel
#167-30	Tube

Labware

#147-50	pH Paper, Hydrion Dispenser, pH 2 - 10, 1 - 11
#147-70	pH Paper, Hydrion Dispenser, pH 10 - 12, 12.5 - 14
#153-01	Bottle Brush, 3" × 12"
#153-03	Brush, Graduate, ½" × 8"
#153-18	Graduated Cylinder, 10 mL × .2 mL, Glass
#153-26	Titration Dish, Polyethylene
#153-28	Stirring Rod, 4", Polyethylene
#153-34	Pipette, 1 mL × .01 mL, Glass
#153-40	Pipette, 10 mL × .1 mL, Glass
#154-10	Thermometer with Metal Dial, 5" Stem, Dual-Scale: 50° - 500°F (0° - 250°C)
#155-20	Timer, 60 Minutes Interval
#155-25	Stopwatch, Digital

Reagents

#206-01	Deionized Water, 8 oz
#215-00	Potassium Chromate Solution, 2 oz
#265-00	Silver Nitrate Solution, .001 g, 0.0282 N, 8 oz
#265-06	Silver Nitrate Solution, .01 g, 0.282 N, 8 oz

Case

#141-17	Clip for Graduated Cylinder
#144-21	Cabinet, Stainless Steel
#163-26	Clip, Small
#163-27	Clip, Medium
#163-28	Clip, Large
#144-25	Air Manifold

Optional

#143-05	*CO_2 Bulbs, Box of 10, UN2037
#140-70	Dead Weight Hydraulic Assembly

#144-20-SP Spare Parts Kit

#100-56	Steel Shot for Mud Balance, 25 g
#115-06	Lid for Mud Balance
#140-55	Filter Paper, Whatman #50, 3.5” (9 cm), Box of 100, Qty: 3
#140-60-01	O-ring for Bleeder Valve, Qty: 2
#141-04	Screen for API Filter Press, Qty: 2
#141-05	Gasket for API Filter Press, Qty: 12
#141-22	Filter, Felt, Qty: 4
#143-00-1	Diaphragm for Airco Regulator
#143-02-13	O-ring for Puncture Head Assembly, Qty: 4
#143-02-14	O-ring for Puncture Pin Holder, Qty: 4
#143-05	*CO_2 Bulbs, Box of 10, UN2037, Qty: 30
#143-07	Repair Kit for Regulator
#147-50	pH Paper, Hydrion Dispenser, pH 2 - 10, 1 - 11, Qty: 2
#147-70	pH Paper, Hydrion Dispenser, pH 10 - 12, 12.5 - 14, Qty: 2
#153-16	Graduated Cylinder, 25 mL × .2 mL, Glass, Qty: 2
#153-18	Graduated Cylinder, 10 mL × .2 mL, Glass, Qty: 2
#153-26	Titration Dish
#153-28	Stirring Rod, 4", Polyethylene
#153-34	Pipette, 1 mL × .01 mL, Glass, Qty: 4
#153-40	Pipette, 10 mL × .1 mL, Glass, Qty: 4
#154-10	Thermometer with Metal Dial, 5” Stem, Dual-Scale: 50° - 500°F (0° - 250°C)
#167-10	Sieve, 200 Mesh
#167-30	Sand Content Tube, Qty: 2
#206-01	Deionized Water, 8 oz, Qty: 6
#215-00	Potassium Chromate Solution, 2 oz, Qty: 4
#265-00	Silver Nitrate Solution, .001 g, 0.0282 N, 8 oz, Qty: 6
#265-06	Silver Nitrate Solution, .01 g, 0.282 N, 8 oz, Qty: 3

Marsh Funnel Viscometer

Viscosity and gel strength are measurements that relate to various flow properties of fluids. The study of the deformation and flow characteristics of matter is called rheology.

The Marsh funnel is a simple device used for routine quick measurements of fluid viscosity. It is an excellent indicator of changes in drilling fluid properties. The marsh funnel is conical in shape, 6" (152 mm) in diameter at the top and 12" (305 mm) long with a capacity of 1,500 cm^3. A 12-mesh screen covers half of the top and is designed to remove any foreign matter and drilled cuttings from the fluid. The fluid runs through a fixed orifice at the end of the funnel and is 2" (50.8 mm) by 3/16" (4.7 mm) in size.

Procedure

1. Hold the funnel in an upright position with the index finger over the outlet.

2. Pour a freshly obtained sample of the fluid to be tested through the screen until the fluid level reaches the bottom of the screen.

3. Remove the finger from the outlet and start the stopwatch. Using the measuring cup, measure the time for the fluid to fill to the one-quart (946-milli liter) mark of the cup.

4. Measure the temperature of the fluid in °F or °C.

5. Report the time to the nearest second as Marsh funnel viscosity and record the temperature of the fluid.

Precautions

1. Check the calibration of the Marsh funnel with fresh water. One quart (946 mL) of fresh water at a temperature of 70 ± 5°F (21 ± 3°C) should out-flow the orifice in 26 ± 0.5 seconds.

2. Clean and dry the funnel and cup thoroughly after each use.

3. Do not bend or flatten the brass orifice in the bottom of the funnel.

Mud Balance

The density or weight of a given volume of liquid is determined by using a mud balance. The arm is graduated and permits accurate measurements to within ±0.1 pounds per gallon. The balance is constructed so that the fixed volume cup at one end of the beam is balanced by a fixed counterweight at the opposite end, with a sliding weight rider free to move along the graduated scale. A level bubble mounted on the beam indicates when the system is in balance.

Mud weight may be read directly off the scales and expressed as:

- 6.5 - 23 pounds per gallon (ppg)
- 0.79 - 2.72 specific gravity, gm/cm
- 49 - 172 pounds/ft^3
- 80 - 2720 kg/m^3

Procedure

1. Place the mud balance base (preferably in carrying case) on a flat level surface.

2. Measure the temperature of the fluid and record on the appropriate mud report form.

3. Fill the clean, dry cup to the top with the freshly obtained mud sample to be weighed.

4. Place the lid on the cup and set it with a gentle twisting motion. Be sure that some mud is expelled through the hole in the cap as this will ensure the cup is full and also will free any trapped air or gas.

5. Cover the hole in the lid with a finger and wash all mud from the outside of the cup and arm. Then thoroughly dry the entire balance.

6. Place the balance on the knife edge and move the rider along the outside of the arm until the cup and arm are balanced as indicated by the bubble.

7. Read mud weight at the edge of the rider toward the mud cup.

8. Clean and dry the mud balance after each use.

9. Report the mud weight to the nearest 0.1 pound per gallon, 0.5 pound per cubic foot, 0.01 gram per cubic centimeter or 10 kilograms per cubic meter.

API Filter Press

Measurements of filtration behavior and wall cake-building characteristics of a drilling fluid are fundamental to control and treatment of drillings fluids, as are various characteristics of the filtrate such as oil, water or emulsion content. These factors are affected by the types and quantities of the solids in the fluid and their physical and chemical interactions, which in turn are affected by changing temperatures and pressures.

The pressure cell is designed so that a 3 ½ inch (9 cm) sheet of filter paper can be placed in the bottom of the chamber to remove particles from the fluid. The filtration area is 7.1 ± 0.1 in^3 (4,580 ± 60 mm^3). The filter press gasket is the determining factor of the filtration area. Pressure may be applied with any non hazardous fluid medium, either gas or liquid. Some models are equipped with pressure regulators and may be pressurized with portable pressure cylinders, midget pressure cartridges or by utilizing hydraulic pressure.

Procedure

1. Be sure each part of the cell is clean and dry, particularly the screen, and that the gaskets are not distorted or worn. The screen should be free of sharp edges, burrs or tears.

2. Assemble the cell as follows: base cap, rubber gasket, screen, filter paper, rubber gasket, and cell body.

3. Pour the freshly stirred sample of fluid into the cell to within 0.5" (13 mm) to the top in order to minimize CO_2 contamination of the filtrate. Check the top cap to insure the rubber gasket is in place and seated all the way around and complete the assemble. Place the cell assembly into the frame and secure with the T-screw.

4. Place a clean dry graduated cylinder under the filtrate exit tube.

5. Close the relief valve and adjust the regulator so that a pressure of 100 ± 5 psi (690 ± 35 kPa) is applied in 30 seconds or less. The test period begins at the time of initial pressurization.

6. At the end of 30 minutes, measure the volume of filtrate collected. Shut off the air flow through the pressure regulator and open the relief valve carefully.

7. Report the volume of filtrate collected in cubic centimeters to the nearest .1 cm^3 as "API Filtrate". Report the time interval and the mud temperature in °F (°C) at the start of the test. Save the filtrate for running chemical analysis.

8. Check to see that all pressure has been removed from the cell, and then remove the cell from the frame. Disassemble the cell, discard any remaining mud and using extreme care save the filter paper and deposited cake with a minimum of disturbance to the cake. Wash the filter cake on the paper with a gentle stream of water or with diesel oil if oil mud is being tested.

9. Measure and report the thickness of the filter cake to the nearest 1/32" (0.8 mm). A cake thickness less than 2/32" is usually considered acceptable. Observations as to the quality of the cake should be noted. Notations such as hardness, softness, toughness, slickness, rubberiness, firmness, flexibility and sponginess are appropriate descriptions.

Sand Content

It is desirable to know the sand content of drilling muds because excessive sand may result in the deposition of a thick filter cake on the wall of the hole, or may settle in the hole about the tool when circulation is stopped, thus interfering with successful operation of drilling tools or setting of casings. High sand content also may cause excessive abrasion of pump parts and pipe connections. Sand sized particles are defined as anything larger that 74 micron. This test can be performed on low solids muds as well as on weighted muds.

Test Procedure

1. Fill the sand content tube to the indicated mark with mud. Add water to the next mark. Close the mouth of the tube and shake vigorously.

   When testing oil based mud, use diesel instead of water.

2. Pour the mixture onto the clean, wet screen. Discard the liquid passing through the screen. Add more water (or diesel) to the tube, shake, and again pour onto the screen. Repeat until the fluid passes through clear. Wash the sand remained on the screen to free it of any remaining mud.

3. Fit the funnel upside down over the top of the screen. Slowly invert the assembly and insert the tip of the funnel into the mouth of the tube. Wash the sand into the tube by spraying a fine spray of water (or diesel) through the screen (tapping on the side of the screen with a spatula handle may facilitate the process). Allow the sand to settle, from the graduate on the tube, read the volume percent of sand.

4. Report the sand content of the mud in volume percent. Report the source of the mud sample (above shaker, suction, pit). Coarse solids other than sand will be retained on the screen (lost circulation material, coarse barite, coarse lignite, etc.) and the presence of such solids should be noted.

Chloride Ion Determination

This test measures the soluble chloride Ion concentration in the mud filtrate. The Chloride can come from sodium chloride, calcium chloride or potassium chloride. Also, for the titration to work correctly the pH of the filtrate needs to be only weakly basic (pH = 8.3). This is the reason for the first step in the procedure. There are two chemical reactions taking place simultaneously during the titration:

1. $Ag^{+} + Cl = AgCL$
2. $2\ Ag^{+} + CrO_4 = Ag_2CrO_4$

The first reaction, the formation of silver chloride, accounts for the appearance of the white specs or milky appearance during the titration. The formation of the silver chromate, which is red, will not start until all the chloride Ions are tied up as silver chloride. The silver nitrate will then react with the chromate from the potassium chromate indicator to form silver chromate. So, for the above two reactions to occur, the filtrate needs to be weakly basic (pH = 8.3). High pH will precipitate silver oxide.

Procedure

1. Pipette 1.0 mL of filtrate or sample to be tested into titration dish.
2. Add 2 - 3 drops of phenolphtahalein indicator to the filtrate.
3. If a pink color appears, titrate with N/50 sulfuric acid until the color changes from pink to that of the original sample. If no pink color appears, the test can be continued.
4. If needed, add 25 - 50 mL of distilled water. This serves to dilute the dark color of a deeply colored filtrate.
5. Add 10 - 15 drops of potassium chromate indicator to give the filtrate a bright yellow color.
6. Add silver nitrate from a pipette dropwise, stirring continuously with a stirring rod, until the sample just turns from yellow to an orange-red.

Calculation

1. Parts per million (ppm) chloride = mL of silver nitrate used × 1,000 (If 0.0282N Silver Nitrate, 1 mL = 1,000 ppm Cl is used)
2. Parts per million (ppm) chloride = mL of silver nitrate used × 10,000 (If 0.28N Silver Nitrate, 1 mL = 10,000 ppm Cl is used)
3. ppm (NaCl) = ppm Chloride × 1.65

Remarks

1. The chloride test may be run on the same samples used in the P_f determination if the M_f test was not performed. Avoid contact with silver nitrate. Wash immediately with water if silver nitrate gets on skin or clothing.
2. The end point of the reaction is when the silver chromate is first formed. It is reddish in color. When using the weak silver nitrate, the end point is ap-

proached very gradually. Therefore, the formation of the silver nitrate can be seen by a color change from yellow to orange-red. If the strong silver nitrate is used, the end point is approached much more rapidly. Hence the early formation of the silver chromate and its orange-red color may be missed due to the larger amounts of silver nitrate being added. So the color change will go from yellow to red, as soon as the red color is seen, the titration is complete.

3. White lumps of silver chloride form when titrating high concentrations of salt. This should not be taken for the end point.

4. If the chloride Ion concentration is less than about 10,000 ppm, the weak silver nitrate solution should be used. If it is greater than 10,000, the strong silver nitrate solution should be used.

Warranty and Return Policy

Warranty:

OFI Testing Equipment, Inc. (OFITE) warrants that the products shall be free from liens and defects in title, and shall conform in all respects to the terms of the sales order and the specifications applicable to the products. All products shall be furnished subject to OFITE's standard manufacturing variations and practices. Unless the warranty period is otherwise extended in writing, the following warranty shall apply: if, at any time prior to twelve (12) months from the date of invoice, the products, or any part thereof, do not conform to these warranties or to the specifications applicable thereto, and OFITE is so notified in writing upon discovery, OFITE shall promptly repair or replace the defective products. Notwithstanding the foregoing, OFITE's warranty obligations shall not extend to any use by the buyer of the products in conditions more severe than OFITE's recommendations, nor to any defects which were visually observable by the buyer but which are not promptly brought to OFITE's attention.

In the event that the buyer has purchased installation and commissioning services on applicable products, the above warranty shall extend for an additional period of twelve (12) months from the date of the original warranty expiration for such products.

In the event that OFITE is requested to provide customized research and development for the buyer, OFITE shall use its best efforts but makes no guarantees to the buyer that any products will be provided.

OFITE makes no other warranties or guarantees to the buyer, either express or implied, and the warranties provided in this clause shall be exclusive of any other warranties including ANY IMPLIED OR STATUTORY WARRANTIES OF FITNESS FOR PURPOSE, MERCHANTABILITY, AND OTHER STATUTORY REMEDIES WHICH ARE WAIVED.

This limited warranty does not cover any losses or damages that occur as a result of:

- Improper installation or maintenance of the products
- Misuse
- Neglect
- Adjustment by non-authorized sources
- Improper environment
- Excessive or inadequate heating or air conditioning or electrical power failures, surges, or other irregularities
- Equipment, products, or material not manufactured by OFITE
- Firmware or hardware that have been modified or altered by a third party
- Consumable parts (bearings, accessories, etc.)

Returns and Repairs:

Items being returned must be carefully packaged to prevent damage in shipment and insured against possible damage or loss. OFITE will not be responsible for equipment damaged due to insufficient packaging.

Any non-defective items returned to OFITE within ninety (90) days of invoice are subject to a 15% restocking fee. Items returned must be received by OFITE in original condition for it to be accepted. Reagents and special order items will not be accepted for return or refund.

OFITE employs experienced personnel to service and repair equipment manufactured by us, as well as other companies. To help expedite the repair process, please include a repair form with all equipment sent to OFITE for repair. Be sure to include your name, company name, phone number, email address, detailed description of work to be done, purchase order number, and a shipping address for returning the equipment. All repairs performed as "repair as needed" are subject to the ninety (90) day limited warranty. All "Certified Repairs" are subject to the twelve (12) month limited warranty.

Returns and potential warranty repairs require a Return Material Authorization (RMA) number. An RMA form is available from your sales or service representative.

Please ship all equipment (with the RMA number for returns or warranty repairs) to the following address:

OFI Testing Equipment, Inc.
Attn: Repair Department
11302 Steeplecrest Dr.
Houston, TX 77065
USA

OFITE also offers competitive service contracts for repairing and/or maintaining your lab equipment, including equipment from other manufacturers. For more information about our technical support and repair services, please contact techservice@ofite.com.