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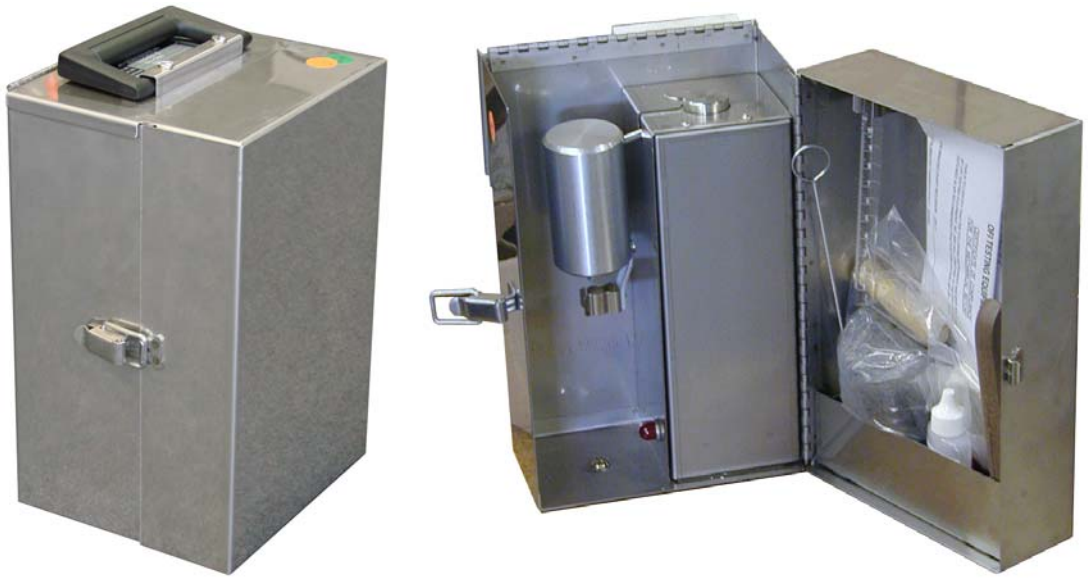

10-mL Retort Kit

165-00-1: 10-mL Retort Kit with Thermostat (115V)
165-10-1: 10-mL Retort Kit with Thermostat (230V)

Instruction Manual

Updated 5/19/2010
Ver. 2.3

OFI Testing Equipment, Inc.
11302 Steeplecrest Dr. · Houston, Texas · 77065 · U.S.A.
Tele: 832.320.7300 · Fax: 713.880.9886 · www.ofite.com

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Intro

The retort provides a means for separating and measuring the volumes of water, oil, and solids contained in a sample of drilling fluid. A known volume of sample is heated to vaporize the liquid components which are then condensed and collected in a graduated cylinder. Liquid volumes are determined from reading the oil and water phases on the graduated cylinder. The total volume of solids, both suspended and dissolved, is obtained by noting the difference of the total sample volume versus the final liquid volume collected. Calculations are necessary to determine the volume of suspended solids since any dissolved solids will be retained in the retort. Relative volumes of low-gravity solids and weight materials may also be calculated.

Equipment

Sample Cup: 10 mL capacity

Condenser: Cools the water and oil vapors below their vaporization temperature prior to leaving the condenser chamber. 464 g

Heating Element: Raises the temperature of the sample above its vaporization point within API Specifications, without causing the solids to boil over. 350 watts.

Thermostat: Limits the temperature of the retort to 930°F ± 70° F (516 ± 22°C). OFITE retorts are calibrated for heating a sample between 860° and 1000°F (760° - 538°C) per API specifications.

Any manual adjustments made to the thermostat are a safety hazard and will void the factory warranty.

Liquid Receiver: Graduated cylinder or tube, transparent and inert to oil, water, or salt solutions and temperatures of up to 90°F (32°C).

Fine Steel Wool: No. 00 Steel Wool. *Do not use liquid steel wool or coated steel wool substitutes.*

Grease: Never-Seez®. Used for a thread seal and lubricant at high temperatures.

T-handle Drill: Used for cleaning the retort chamber and condenser passage.

Pipe Cleaner: Used for cleaning the retort chamber and condenser passage.

Spatula: Shaped to fit the inside dimensions of the sample cup

Components

#141-17 Clip for Graduated Cylinder; Qty: 2
#153-03 Graduate Brush; ½" x 8"
#153-18 Graduated Cylinder; 10 mL x 2/10 mL; Qty: 2
#164-10 Top Insulator Block
#164-11 Bottom Insulator Block
#164-12 Cover (Lid) Insulator Block
#164-19 Retort Adapter for 10-mL Retort (115V & 230V)
#165-25 Stainless Steel Case for Retort Kit
#165-31 10-mL Retort Chamber with Lid
#165-32 Condenser
#165-34 Spatula
#165-38 Thermostat
#165-41 Corkscrew
#165-42 Steel Wool; Grade 00. Fine; Package of 4 Pads
#165-43 Pipe Cleaner
#165-44 High-Temperature Thread Lubricant; 1-oz. Tube
#280-00 Wetting Agent; 1 oz

For 115V Only (#165-00-1):

#165-35 350-Watt Heating Element (115V)
#165-40 Power Cable (115V)

For 230V Only (#165-10-1):

#165-36 350-Watt Heating Element (230V)
#165-40-1 230V Power Cable

Optional:

#165-00-1-SP Spare Parts for One Year for #165-00-1:

#153-03 Brush; Graduate ½" x 8"
#153-18 Graduated Cylinder; 10 mL x 2/10 mL
#165-05 10-mL Receiver Tube; Special for Oil Mud; 0-100%, with Certificate; Qty: 2
#165-33 Lid for 10-mL Sample Cup
#165-34 Spatula
#165-41 Corkscrew
#165-42 Steel Wool; Grade 00. Fine; Package of 4 Pads; Qty: 16
#165-43 Pipe Cleaner; Qty: 6
#165-44 High-Temperature Thread Lubricant; 1-oz. Tube; Qty: 2
#280-00 Wetting Agent; 1 oz

#165-10-1-SP	**Spare Parts for One Year for #165-10-1:**
#153-03	Brush; Graduate ½" x 8"
#153-18	Graduated Cylinder; 10 mL x 2/10 mL
#165-05	10-mL Receiver Tube; Special for Oil Mud; 0-100%, with Certificate, Qty: 2
#165-33	Lid for 10-mL Sample Cup
#165-34	Spatula
#165-36	350-Watt Heating Element (230V)
#165-41	Corkscrew
#165-42	Steel Wool; Grade 00. Fine; Package of 4 Pads; Qty: 16
#165-43	Pipe Cleaner; Qty: 6
#165-44	High-Temperature Thread Lubricant; 1-oz. Tube; Qty: 2
#280-00	Wetting Agent; 1 oz

Safety

The following guidelines should be followed to ensure safe operation of retorts.

1. Clean and dry the retort chamber and condenser, especially the inside of the mud sample cup, lid, and the condenser passage (spout). Clean the sample cup threads with a wire brush. The spatula, corkscrew tip, or a knife may be used to dislodge solids inside the sample cup. The T-handle drill and pipe cleaners should be used to scrape and drill out any residue out of the spout.

   Make sure the spout and the hole in the lid of the mud sample chamber are absolutely free of obstructions.

2. The assembly should be cooled to below 100°F (37.8°C) from any previous usage.

3. Visually inspect the threads on the retort for any sign on damage before use.

4. Change out the steel wool after every test to prevent solids from building up.

5. Retorts used offshore should be changed out every 6 months for examination and cleaning.

6. **Never attempt to manually adjust the thermostat. This creates a safety hazard and can cause significant damage to the equipment. Any attempt to manually adjust the thermostat will void the factory warranty.**

Operation

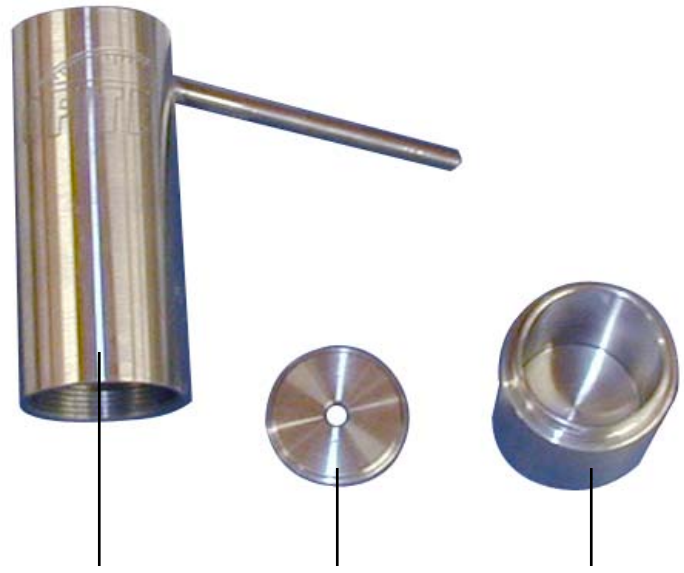
1. Collect a representative sample of drilling fluid and pour it through a marsh funnel screen to remove any lost circulation material, large cuttings, or debris.

2. Record the sample temperature. It should be within 10°F (5.5°C) of the temperature at which mud density was determined.

3. If the sample contains gas or air bubbles, add 2 to 3 drops of a defoaming agent for every 300 mL of sample fluid. Stir slowly for 2 to 3 minutes to release any entrained gasses. Air or gas entrapment will result in erroneously high retort solids content due to the initial reduced liquid sample volume.

4. Pack a wad of no. 00 steel wool into the chamber to approximately 3/16 in (4.76 mm) above the threads. As determined from experience, use only enough steel wool to prevent a boiling over of solids into the liquid receiver.

5. Using a clean syringe, fill the retort cup slowly with the non-aerated sample in order to avoid air entrapment. Lightly tap the side of the cup to expel any air and place the lid onto the cup. Rotate the lid to obtain a proper fit and be sure a small excess of fluid flows out the hole in the lid. Wipe away any excess mud and clear any solids that may have accumulated in the hole in the lid.



6. Lubricate the threads on the sample cup with a light coat of Never-Seez®. This will prevent vapor loss through the threads and will also facilitate disassembly of the equipment at the end of the test.

7. Carefully hand tighten the retort cup onto the retort chamber and connect the assembly to the condenser. Thread the chamber arm into the condenser. Be careful not to over-tighten and strip out the threads in the condenser. Place the chamber into the heating jacket and close the insulating lid.

8. Place a clean, dry liquid receiver under the condenser discharge tube. The length of this receiver may require that it be angled out from the retort or supported off the edge of the worktable.

9. Connect the retort to an electrical outlet to turn it on. Observe the liquid exiting the condenser. Continue heating for ten minutes beyond the time that no more condensate is being collected. If whole mud boils over into the receiver tube, the test must be rerun. Pack the retort body with a larger amount of steel wool and rerun the test. Allow it to run a minimum of 45 minutes.

10. Remove the liquid receiver and allow it to cool. After it has cooled to ambient temperature, read and record the volumes (or volume percentage) of the following:

    a. total liquid volume
    b. oil volume
    c. water volume

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Tip

If an emulsion interface is present between the oil and water phases, heating the interface may break the emulsion. One way to do this is to remove the retort assembly from the heating jacket by grasping the condenser. Carefully heat the receiver along the emulsion band by gently touching the receiver for short intervals with the hot retort chamber. Avoid boiling the liquid. After the emulsion interface is broken, allow the receiver to cool and read the water volume at the lowest point of the meniscus.

11. Turn off the retort and allow it to cool prior to cleaning. Do not use cold water to try to rapidly cool down the chamber.

Calculations

The measured volumes (mL) of oil and water are converted into volume percents based on the volume of whole mud in the retort cup.

$$\text{Volume Percent (\%) Oil} = V_O = \frac{100\ (\text{Oil Volume Collected, mL})}{\text{Sample Volume, mL}}$$

$$\text{Volume Percent (\%) Water} = V_W = \frac{100\ (\text{Water Volume Collected, mL})}{\text{Sample Volume, mL}}$$

$$\text{Volume Percent (\%) Solids} = V_S = 100 - (V_O + V_W)$$

Note

The volume percent solids include both suspended solids (weight material, etc.) and dissolved materials (for example salts). This volume percent will represent total suspended solids only if the mud is an untreated, freshwater mud.

To find the volume percent (%) of suspended solids and relate them to the relative volumes of low-gravity solids and weighting materials, an accurate mud weight and Chloride concentration must be known.

$$V_{SS} = V_S - V_W \frac{\text{Chloride Concentration, mg/L}}{1{,}680{,}000 - 1.21\ (C_S)}$$

Where:

V_{SS} = Volume Percent (%) Suspended Solids
C_S = Chloride Concentration, mg/L

Volume percent (%) Low-Gravity solids, V_{lg}, are calculated as follows:

$$V_{lg} = \frac{1}{P_b - P_{lg}} [100\ P_f + (P_b - P_f)V_{SS} - 12\ W_m - (P_f - P_O)\ V_O\ ]$$

Where:

V_{lg} = Volume percent (%) low-gravity solids.
W_m = Mud Weight, pounds per gallon
P_f = Density of filtrate, grams per cubic meter
P_b = Density of weighting material, grams per cubic meter
P_{lg} = Density of low gravity solids, grams per cubic meter (use 2.6 if unknown)
P_o = Density of oil, grams per cubic meter (use 0.84 if unknown)

Volume percent (%) weighting material (Vb) is calculated as follows:

$$V_b = V_{SS} - V_{lg}$$

Concentrations of low gravity solids, weighting material and suspended solids may be calculated as:

$C_{lg} = 3.49 (P_{lg}) \times (V_{lg})$
$C_b = 3.49 (P_b) \times (V_b)$
$C_{SS} = C_{lg} + C_b$

Where:

C_{lg} = Low gravity concentration, pounds per barrel
C_b = Weighting material concentration, pounds per barrel
C_{SS} = Suspended solids concentration, pounds per barrel