Digital Retort

Instruction Manual

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Digital Retort Instruction Manual

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Houston, Texas, USA

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1 Introduction

Oil and water retorts provide a simple, easy, accurate, and direct-reading method of determining the percentages of water, oil, and solids which make up drilling fluids. The retort can also be used to determine the amount of water or solids in oil samples, or the water and oil saturation in core samples.

The Fann Digital Retort is a next generation offering of oil and water retorts featuring a digital temperature controller, providing upgraded benefits.

- The digital retort provides exceptional temperature control, ensuring accurate and stable test temperatures every time.
- The digital temperature controller displays a visual indication of the heated condition of the retort, allowing the operator to verify the safe condition of the retort assembly before handling.
- The integrated over-temperature protection adds a redundant level of safety to prevent thermal runaway.

Figure 1-1 Digital Retort Temperature Control

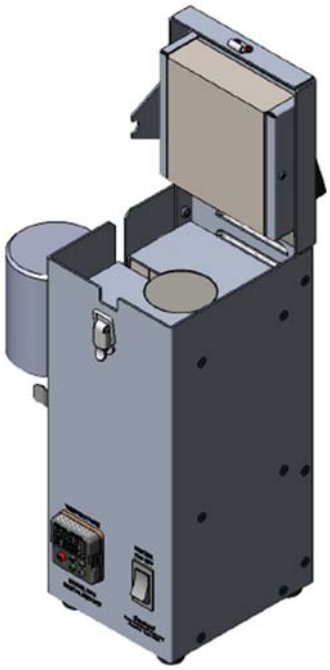

Figure 1-2 Digital Retort Assembly

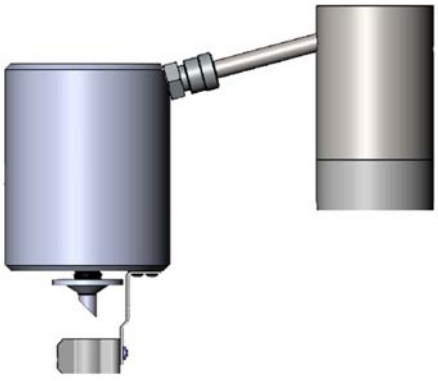

Figure 1-3 Cell and Condenser Detail

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

Safe operation of the retort requires that the laboratory technician be familiar with the proper operation and potential hazards associated with this equipment. Retorting the sample poses the potential hazards of the exposed retort stem and condenser getting hot enough to cause burns and serious injury.

Burns can result from touching the hot metal parts of the case near the retort chamber during normal operation. The operator should be aware of these hot areas and avoid contact with them.

These retorts are electrically heated, and as with any electrical device if the wiring is allowed to become faulty electrical shorts can occur, causing injury to the operator. These instruments should always be used on a grounded circuit.

Following are suggestions that should be observed to assure safe operation and maintenance of the retort kits.

2.1 General Safety

Caution should be exercised by all personnel when an Oil and Water Retort Kit is in operation to avoid injury by touching the case near the heating jacket or the retort and condenser assembly while these are hot.

Parts of the case can operate at a temperature where it may cause burns if touched. Safeguard the retort after the test ends long enough for it to cool. It can still cause burns even after it has been turned off

2.2 Safe Heating Operation

Exercise caution when operating a retort to avoid injury by touching the case near the heating jacket or the retort condenser while they are hot. The temperature in certain parts of the case may be hot enough to burn if touched. Safeguard the retort instrument after the test ends; allow time for the retort to cool. After it is turned off, its surface and parts can still be hot enough to burn.

Removing the retort and condenser while they are hot and placing them under running water is dangerous. This practice is not recommended.

2.3 Electrical Safety

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

Electrical problems in the wiring or heaters may not be obvious by external observation. If the retort repeatedly blows a fuse, trips a circuit breaker or heats too slowly or erratically, electrical repairs are required. Refer to Section 7 for repair procedures.

Always disconnect the power cable before repairing this instrument.

2.4 Maintenance Safety

Clean the sample chambers (upper and lower) thoroughly after each test, especially the distillation tube. The wire brush, 205850, can be used for retort distillation tube cleaning. For hard, baked – on materials, a long #31 drill bit, 206118, with handle, 206119, should be used, ensuring that the entrance to the distillation tube inside the sample chamber is clean. After each test, replace the steel wool in the upper chamber to prevent solids buildup.

Inspect the threads on the sample chambers (upper and lower) before each test. Check for signs of "belling" of the threads or for movement (rattling) when the threads are being engaged.

The symptoms described above are signs of abnormal strain and structural weakening of the threads and could lead to explosive separation under normal pressure conditions. If these indications are observed, discard the damaged retort chamber and replace with a new chamber

Remove each retort from service at least once every six months for thorough examination and cleaning.

Wear a dust mask/respirator when disassembling the insulation and cleaning the inside of the retort case. Do NOT reuse deteriorated insulation.

3 Features and Specifications

- Digital temperature control (no mechanical switch)
- Independent over temperature circuit
- Air circulation
- Expanded diameter of chamber outlet, which minimizes risk of plugging and overpressure
- UL/CE compliant
- Circuit breaker

Table 3-1 Digital Retort Specifications

Category	Specification
Temperature	930°F (± 2°F)
Sample Volumes	10, 20, 50mL using accessory lids
Dimensions (W x D x H)	6in x 7in x 15in
Weight	30lb (13.61kg)

4 Operation

Safe operation of oil and water retorts requires that the laboratory technician to be familiar with these practices.

Prepare the retort for service by performing steps A through I below:

A. Turn the power on to the retort by flipping the power switch on the back. Before removing the retort assembly, verify that the unit is not hot by reading the heater temperature on the temperature controller. The heater switch on the front of the retort should be in the "off" position.
B. Lift retort assembly, out of heating compartment. Using the spatula as a screwdriver, remove the drilling fluid chamber from the retort.
C. Pack the upper chamber with steel wool.
D. Fill drilling fluid chamber with drilling fluid and replace lid, allowing excess drilling fluid to escape. Wipe drilling fluid chamber and outside of lid clean of drilling fluid.

This is a point where error is often introduced. Be sure that no air is trapped in the chamber. An accurate charge of drilling fluid is essential.

E. Clean and lubricate retort threads with high temperature lubricant.
F. Screw drilling fluid chamber with lid into upper chamber and hand tighten.
G. Screw condenser onto distillation tube.
H. Replace retort assembly in heating compartment and put insulating cover in place.
I. Add a drop of wetting agent to the graduate or collector tube and place under drain port of condenser.
J. Turn heater on by flipping the heater switch on the front of the retort.
K. Allow the retort to heat until the temperature controller reaches the desired test temperature. The distillation should be complete in approximately 20–30 minutes. After completion of test, turn off the heater switch.

If the heater switch is not turned off the retort will continuously cycle and heat the chamber.

L. Read the volume of oil and water. (A drop of wetting agent at this time will often improve the meniscus for easier reading.)

Nearly 100% recovery of refined oil will be obtained with this retort. If the drilling fluid is made up with crude oil, calibration runs should be made on a drilling fluid containing a known percentage of the crude used. Recovery on some crude may be as low as 60%. However, allowing the retort to remain at maximum temperature for a longer period should improve recovery on paraffin or asphaltic oil. The correction factor to be used in Section 5, as obtained from this test will be as follows:

$$\text{FACTOR} = \frac{\text{\% oil in known sample mud}}{\text{\% of oil recovered}}$$

5 Equipment Care

Cleaning and lubricating the retort threads with high temperature lubricants is required to prevent seizing of the threads.

A. Use the spatula and scrape the dried drilling fluid from the chamber and lid to assure correct drilling fluid measurement.
B. Remove steel wool using the corkscrew, and clean chamber with spatula. Replace any steel wool caked with drilling fluid with new steel wool.
C. Clean the retort distillation tube and condenser with a pipe cleaner.
D. Clean and lubricate the retort threads with high temperature lubricant.
E. Inspect the threads on the sample chambers (upper and lower) before each test. Check for belling of threads or movement (rattling) when the threads are being engaged.

Be cautious of abnormal strain or structural weakening.

The digital temperature controller eliminates the requirement for thermostat adjustment and will easily maintain the correct temperature set points. In the event of a heating malfunction the retort is equipped with an over-temperature device that will remove power from the heaters if the temperature exceeds 1030°F. In the event that this occurs, the power must be cycled to return power to the heaters. If overheating persists, the retort will require maintenance to the heating system.

6 Calculations

Calculate the volume percentages of water, oil and solids as follows:

A. % Oil by volume = mL oil* X 10
B. % Water by volume = mL water X 10
C. % Solids by volume = 100 - (mL oil + mL water) X 10

Calculate weight percentages of the water and oil and the specific gravity of the solids as follows:

D. Grams Oil = mL oil* X 0.84
E. Grams water = mL water
F. Grams Drilling Fluid = lb/gal drilling fluid weight x 1.2
G. Grams solids = F - (D + E)
H. mL solids = 10 - (mL oil* + mL water)
I. Average specific gravity of solids = $\frac{G}{H}$

J. Solids % by weight = $\frac{G}{F}$ x 100

K. High gravity (4.3) solids % by volume = (1 - 2.5) x 55.6
L. Low gravity (2.6) solids % by volume = 100 - K

* CORRECTION FACTOR = $\frac{\text{\% oil in known sample}}{\text{\% oil recovered}}$

The correction factor may need to be applied to the mL oil in these calculations. See Note in Section 4 for further explanation of the correction factor.

Average specific gravity of solids must fall between 2.6 and 4.3. If it is out of this range, an error has been made in test or calculations. An approximation of the relative proportion of clay and barite can be obtained from Table 6-1.

Table 6-1: Approximations of Relative Proportions of Clay and Barite

SP.GR SOLIDS	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.3
% BY WT. BARITE	0	18	34	48	60	71	81	89	100
% BY WT. CLAY	100	82	66	52	40	29	19	11	0

7 Troubleshooting and Maintenance

Failure of the retort to properly heat is usually caused by failure of the cartridge heater or the thermostat. Contact Fann Service for assistance with disassembly, replacement, and or reassembly of component parts.

Table 7-1 Troubleshooting Guide

Problem or Symptom	Possible Cause	Corrective Action
Not powering up	No power connection	Check power connection and source.
Not heating up	Heater switch not on	Check the switch
	Over-temperature switch tripped (if switch is turned to “on” position but not lit, there has been a trip)	Wait to reach lower temperature if needed
		Cycle power
	Temperature set point not set	Contact a Fann representative.
	Temperature controller output not turned on	Push red EZ button

8 Accessories

Table 8-1 102620463 Digital Retort Accessories Kit

Part Number	Description
101512999	BRUSH SS WIRE 1/2W X 1-1/2 X 7-1/4 IN PLASTIC HANDLE
209938	WETTING AGENT 1oz
210439	CORKSCREW
210435	HIGH TEMPERATURE LUBRICANT (NEVER-SEEZ) 1 OUNCE TUBE
210433	SPATULA RETORT
210440	STEEL WOOL 1/4 POUND PACKAGE
208776	CYLINDER GRADUATED GLASS 50ml TC
206119	WRENCH TAP T-HANDLE
102620717	EXTENDED REACH DRILL BIT, SIZE C, 0.243 DIAMETER
102620728	0.5 OZ TUBE SUPER LUBER HIGH TEMP O-RING GREASE
102620735	HAND-HELD LOW SCRATCH TUBE BRUSH, 5/16 IN DIAMETER FOR CLEANING 0.25 IN TUBE ON CELL. NYLON BRISTLES.

Table 8-2 102620464 Digital Retort Spares Kit

Part Number	Description
102619986	AS-205 SIZE O-RING, VITON
102619990	EASY INSTALL STAINLESS STEEL SPIRAL RETAINING RING FOR 3/8 IN DIAMETER SHAFT
102620891	O-RING, VITON, DASH 012, 3/8 ID X 1/2 OD DUROMETER 75

9 Parts List

Table 9-1 Parts List, 102620462 Digital Retort Kit

Item No.	Part No.	Quantity	Description
0001	102615226	1	DIGITAL RETORT, MODEL DR3, 115/230VAC
0002	102620439	1	FOAM INSERT FOR B1010 CASE FOR MODEL DR3 DIGITAL RETORT
0003	203622	1	CASE BLANK PLASTIC 6.8 X 12.7 UNDERWATER KINETICS MODEL 718 PART NUMBER C1523-7 INSIDE DIMENSIONS 6.8 X 12.7 x17.7 COLOR-GREY OUTSIDE DIMS 8 x 15 x 19
0004	204572	1	LABEL FANN B1010 CASE
0005	102620463	1	ACCESSORIES KIT FOR THE MODEL DR3 DIGITAL RETORT
0006	102620464	1	SPARE PARTS KIT FOR THE MODEL DR3 INCLUDING EXTRA O-RINGS AND RETAINING RINGS FOR THE CONDENSER AND O-RINGS FOR THE VACCUUM FITTING ON THE CONDENSER

Table 9-2 Parts List, 102615226 Digital Retort

Item No.	Part No.	Quantity	Description
0001	102570447	1	CASE DIGITAL RETORT
0002	102570448	1	INSULATION BLOCK SET
0003	101743906	1	HANDLE PLASTIC BLACK WITH BRACKET
0004	101752942	1	CIRCUIT BREAKER, 10 AMP, PUSH BUTTON, 125-250 VAC/32 VDC
0005	101959461	1	CIRCUIT BREAKER, 5 AMP, PUSH BUTTON, 125-250 VAC/32 VDC
0006	101984629	1	SWITCH DPDT, POWER AND SELECT, SLIDE, 10.1A AT 125 VAC, 4A AT 28VCD, 5A AT 250VAC
0007	102662414	1	WATLOW TEMPERATURE CONTROLLER PROGRAMMED FOR DIGITAL RETORT
0008	205128	1	SWITCH POWER 15 AMP LIGHTED
0009	102575624	1	INLET AC, WITH ON/OFF SWITCH, SNAP-IN FRONT 1.5MM 12A
0010	203863	1	CONNECTOR RJ45 JACK 8-CON IDC
0011	102412972	2	HEATER CARTRIDGE, 120V, 350W, 5/8 OD, 2.25 LONG, UL/CE RATED
0012	102570450	1	WASHER FOR CONDENSER TO PREVENT THE ESCAPE OF VAPORS FROM THE GRADUATED CYLINDER.
0013	102592397	1	THERMOCOUPLE K TYPE, DUPLEX CONDUCTOR, DIA .125 INCH SHEATH, 1 INCH OD FLANGE. 12 IN WIRE LEADS.
0014	102595107	1	OVERTEMP CIRCUIT, K THERMOCOUPLE.

Item No.	Part No.	Quantity	Description
0015	102046995	2	COMPACT CONNECTOR 5-CONDUCTOR TERMINAL BLOCK WITH LEVERS MAX. CONTINUOUS USAGE TEMPERATURE 85 C
0016	102046994	2	COMPACT CONNECTOR 3-CONDUCTOR TERMINAL BLOCK WITH LEVERS MAX. CONTINUOUS USAGE TEMPERATURE 85 C
0017	102615615	1	TERM BLOCK PLUG 4POS STR 5.08MM
0018	102615616	1	TERM BLOCK PLUG 4POS STR 5.08MM
0019	101983226	1	MALE CONNECTOR,10 PIN, SPACING 2.5 MM / 0.098 IN 100% PROTECTED AGAINST MISMATING
0020	101983225	1	FEMALE CONNECTOR, 10 PIN, SPACING 2.5 MM / 0.098 IN 100% PROTECTED AGAINST MISMATING
0021	102613062	1	CONN RECEPT VERT 14POS 22AWG MTA100
0022	102615782	1	CONN RECEPT 8POS 24AWG MTA100
0023	102615788	1	FAN AXIAL 40X28MM 12VDC WIRE
0024	102618742	1	FANN FILTER ASSEMBLY, 40MM.
0025	102620032	1	HEATER BLOCK FOR THE DIGITAL RETORT MODEL DR3
0026	102570453	1	CHAMBER SET FOR DIGITAL RETORT
0027	102570454	1	CONDENSER DIGITAL RETORT
0028	102570452	1	ULTRA-TORR QUICK DISCONNECT FITTING CONNECTING RETORT CELL AND CONDENSER.
0030	102619986	1	AS-205 SIZE O-RING, VITON
0031	102619990	1	EASY INSTALL STAINLESS STEEL SPIRAL RETAINING RING FOR 3/8 IN DIAMETER SHAFT
0032	102620017	3	ALUMINUM FEMALE THREADED HEX STANDOFF, 1/4 HEX SIZE, 5/16 LENGTH, 6-32 THREAD SIZE
0033	102620021	2	SHCS 10-32 X 6.5 IN ZINC OXIDE COATED
0034	207489	1	6-32 X 1/2 BHMS STAINLESS
0035	203428	2	6-32 X 2 RHMS STAINLESS
0036	101652778	2	6-32 LOCK NUT STAINLESS
0037	101902820	6	SCREW, 6-32 X 1/4 BHCS, SST 18-8
0038	101487377	6	SCR 6-32 X 3/16 IN LG BUTTON HEAD SHCS 18-8 SST
0039	204289	1	TERMINAL RING NO.8 SCREW 16-14 AWG HIGH TEMP 1200 F
0040	207634	4	NUT 4-40 HEX REGULAR STAINLESS
0041	207900	6	WASHER SPLIT 4 STAINLESS STEEL
0042	206203	4	WASHER FLAT 4 STAINLESS STEEL
0043	102093563	1	8-32 X 1/4, 18-8 SS, BUTTON SOCKET CAP SCREW
0044	207639	1	WASHER EXTERNAL TOOTH 8 STAINLESS
0045	102620038	4	SCREW, FLAT HEAT SCS, M3 X 40MM
0046	102620039	4	FLAT WASHER, M3, STAINLESS
0047	102436084	4	WASHER, LOCK, SIZE 3, 6.2mm OD, .7mm THK, 18-8 SS
0048	102620041	4	HEX NUT, M3, STAINLESS
0049	102620040	2	SHCS, 8-32 X 1.125 IN ZINC OXIDE COATED
0050	206218	60	WIRE 20 AWG PVC STRANDED WHITE
0051	102620194	60	WIRE 20 AWG PVC STRANDED BROWN

Item No.	Part No.	Quantity	Description
0052	101476559	4	TERMINAL, FEMALE QUICK-SLIDE, NICKEL PLATED ALLOY STEEL, HIGH TEMP (900 DEG F CONTINUOUS, 1200 DEG F INTERMITTENT), WIRE RANGE 18-14GA, 0.25 X .023 TAB. MFG P/N 3M NO. MU14-250DFHTX, 16-14 AWG. DISTRIBUTOR P/N GAUMER NO. QSFL 1814.
0053	204299	9	TERMINAL FEMALE Q.C .25X.032 1
0054	204350	6	TUBE HEAT SHRINK 1/8 DIA BLK
0055	205728	1	CLIP LARGE
0056	101262158	4	SCREW, THREADED, BUTTON HEAD SCS (US) - NO. 4 -40 UNC x 0.375 - 18-8 SS
0057	101652740	2	4-40 x 1/4 SHCS STAINLESS
0058	208658	1	WASHER FLAT 6 STAINLESS CC-BLUE
0059	208452	1	CABLE POWER 115V 18 AWG M&F PLUG
0060	204359	6	TERMINAL, DISCONNECT, 16-14AWG, FULLY INSULATED FEMALE FOR .187X.020 BLADE
0061	102101327	3	NYLON INSUL RIGHT ANGLE FEMALE 0.205/0.187 x 0.020 16-14 AWG

10 Warranty and Returns

10.1 Warranty

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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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