50 ml Oil and Water Retort

Instruction Manual

Manual No. 210466, Revision G

Instrument No. 210465 (115V)

Instrument No. 210463 (230V)

Authorized Canadian Dealer:

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50 ml Oil and Water Retort Instruction Manual

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1 Introduction

The 50 ml Oil and Water Retort provides a simple, direct-reading method for measuring volumes of water, oil, and solids contained in drilling fluids. Oil and water retorts can also measure water or solids in oil samples, water and oil saturation in core samples, or volume of oil in polluted sea water.

The sample is heated until the liquid vaporizes. These vapors pass through a condenser and are collected in a graduated cylinder. Oil and water volumes are read directly from the graduated cylinder. Total solids are determined by subtracting the oil and water volumes from total sample volume. For fresh-water fluids, the relative amount of barite and clay can be estimated. Corrections must be made for salt in the calculation for solids content by volume.

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

To safely operate the 50 ml Oil and Water Retort become familiar with its proper operation and potential hazards.

Also observe safe laboratory practices and procedures while operating and maintaining this instrument.

Operating the retort instrument exposes the user to steam and hot surfaces, like the condenser or metal parts of the case near the retort chamber. There is risk of getting burned if hot surfacea are touched.

These retorts are electrically heated. If the wiring becomes faulty, electrical shorts can occur and cause injury to the operator.

Retort instruments should always be used on a grounded circuit.

2.1 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.

2.2 Safe Electrical

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 6 for repair procedures.

Always disconnect the power cable before repairing his instrument.

2.3 Safe Instrument Maintenance

Clean the sample chambers (upper and lower) thoroughly after each test and replace steel wool in the upper chamber to prevent solids buildup.

Before each test, check the threads of the sample chambers.

Abnormal strain or structual weakening of threads could lead to explosive separation under normal pressure conditions.

Remove each retort from service, especially offshore operations at least once every six months and thoroughly examine and clean them.

Repairing the retort may require removing some or all insulation. If the insulation is deteriorated, wear a breathing mask when removing it.

Wear a breathing mask when diassembling the insulation and cleaning the inside of the retort case. Do NOT reuse deteriorated insulation.

3 Features and Specifications

Retorts are electrically heated and thermostatically controlled to shut off at 930°F ± 70°F (500 °C ± 40°C), as specified in API RP 13-B1. These retorts operate on either 115V, 50/60 Hz (P/N 210465) or 230V, 50/60 Hz (P/N 210463). Both retort models have 700 watts of power. See Table 3-1 for specifications.

The retort is packaged in a stainless steel carrying case. The retort is composed of a 50 ml sample chamber that contains an upper boiling chamber and distillation tube, measuring lid, steel wool and a condenser. The kit also includes these items shown in Figure 3-1:

- Graduated Cylinder, 50 ml
- Spatula
- Corkscrew
- Square Bar Retort Wrench
- Pipe Cleaners
- Steel Wool
- Drill Twist
- Brushes — wire and stainless steel
- High-Temperature Lubricant
- Wetting Agent

Table 3-1 50 ml Oil and Water Retort Specifications

Category	Specification
Stainless Steel Case Dimensions	9-1/4 x 8 x 10-7/8 inches 23.5 x 20.3 x 27.6 centimeters
Weight	25 lb (11.3 kg)
Power Requirements	P/N 210465: 115V, 50/60 Hz, 700 W
	P/N 210463: 230V, 50/60 Hz, 700 W

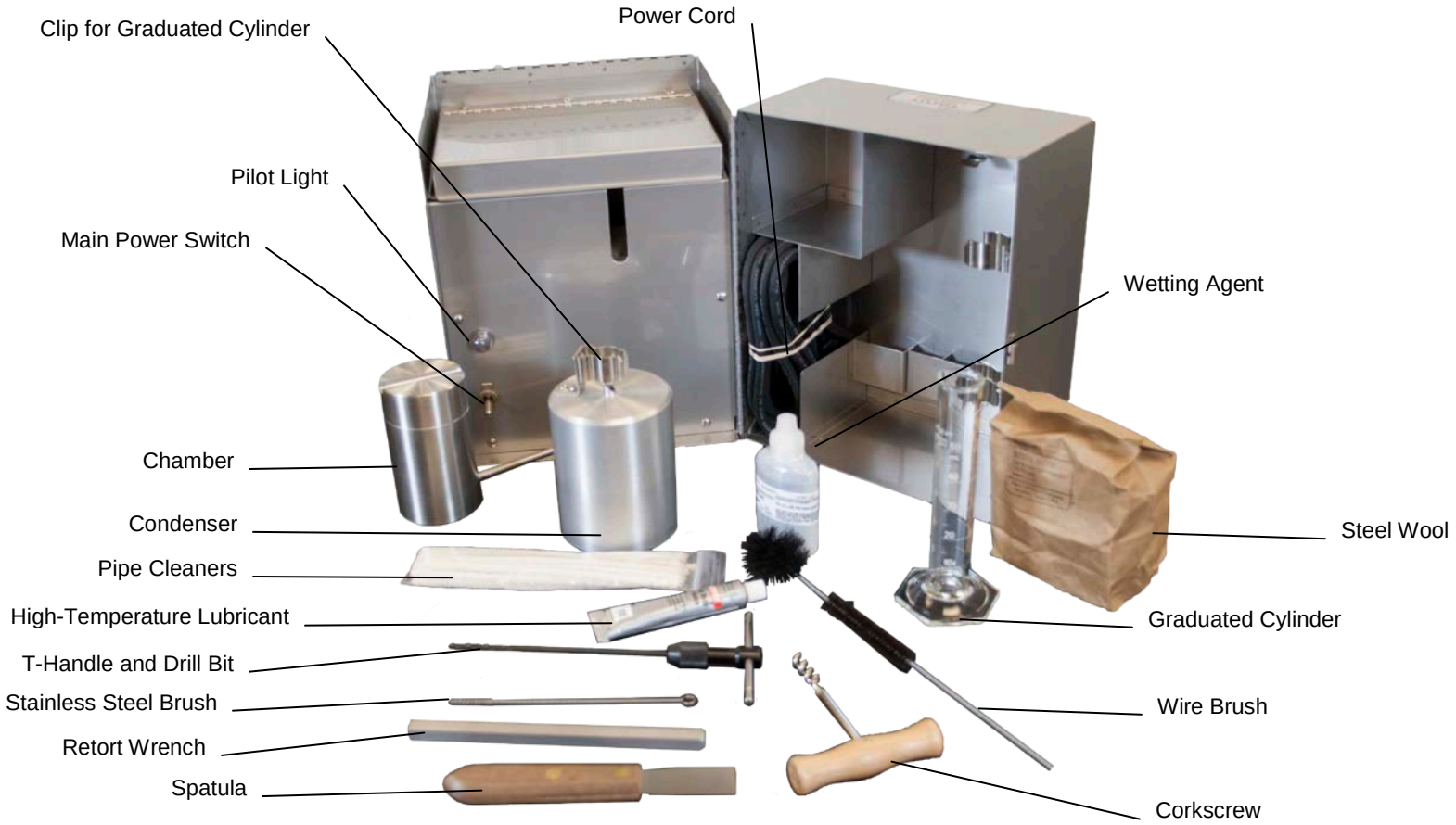

Figure 3-1 50 ml Oil and Water Retort Kit

4 Test Procedure

1. Prepare the retort for service. See Section 6.1 Equipment Care.
2. Lift the retort assembly (Figure 4-1) from the heating compartment.

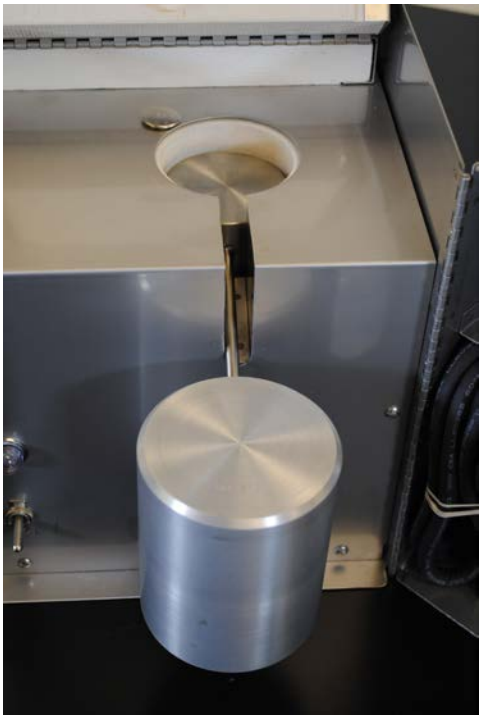

Figure 4-1 Retort Assembly in Heating Compartment

3. Using the square bar retort wrench, separate the sample chamber from the upper chamber as shown in Figure 4-2,

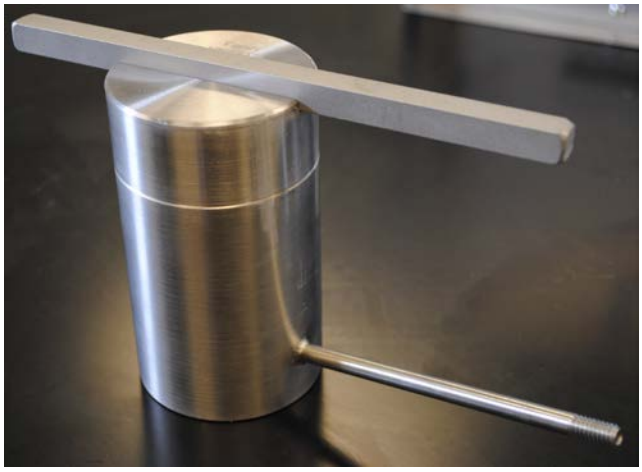

Figure 4-2 Retort Wrench to Separate Chamber Assembly

4. Pack the upper chamber with steel wool. See Figure 4-3.

5. Fill the sample chamber with the sample and replace the lid. Let excess sample flow from the lid. Wipe excess sample from the chamber and lid.

Error is often introduced when filling the sample chamber. Be sure that no air is trapped in the sample chamber. An accurate sample volume is very important.

6. Clean and lubricate retort threads with high-temperature lubricant.

7. Screw the sample chamber with lid into the upper chamber. Hand-tighten using the square bar retort wrench.

8. Place the retort assembly in the heating compartment and put the insulating cover in place.

9. Add a drop of wetting agent (P/N 209938) to the graduated cylinder (or a graduated receiver) and place the graduated cylinder under the drain port of the condenser.

10. Connect the power cord. Move the power switch up to the ON position.

11. Let the retort heat until the pilot lamp goes out, indicating the temperature has been reached.

The thermostat will automatically turn off the power to the retort heater at the correct temperature regardless of the voltage available.

The distillation should be complete in approximately 45 to 60 minutes if the power is 115 or 230 volts. At a lower voltage, the distillation may take longer. At a higher voltage, the distillation may complete sooner.

12. After the test ends, move the power switch down to the OFF position.

13. Read the volumes of oil and water. Adding another drop of wetting agent will make it easier to read the meniscus.

Nearly 100% recovery of refined oil will be obtained with this retort. If the drilling fluid contains crude oil, a calibration test should be performed using the drilling fluid with a known percentage of crude oil. See Section 5 for calculating percent oil.

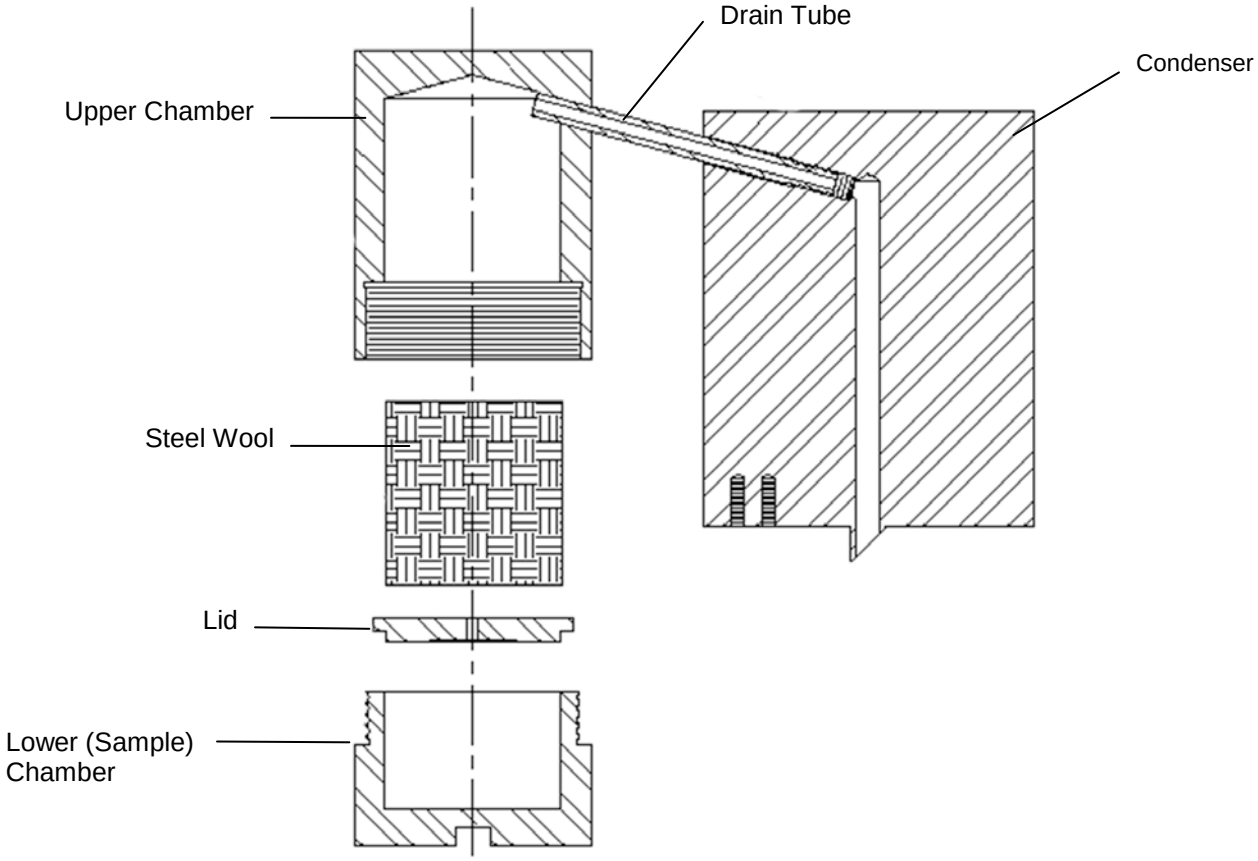

Figure 4-3 Retort Assembly

4.1 Equipment Cleanup

Clean the sample chambers (upper and lower), thoroughly after each test, especially the spout.

Use the wire brush (P/N 205850) to clean the spout. For hard, baked-on materials, use a long #131 drill bit (P/N 206118) with handle (P/N 206119) to remove this material from the entrance to the spout inside the sample chamber.

After each test, replace the steel wool in the upper chamber to prevent solids buildup.

5 Calculations

The reference for retort testing is API Recommended Practice for Field Testing Water Based Drilling Fluids, API RP 13B-1.

The basic equation for calculating volume percentage is as follows:

$$\%\text{Volume} = 100 \times \frac{\text{V(ml) of recovered oil or water}}{\text{V(ml) of drilling fluid}}$$

This retort test will obtain approximately 100% recovery of refined oil. If the drilling fluid contains crude oil, calibration is required using a drilling fluid containing a known amount of crude. Crude oil recovery could be 60%. However, keeping the retort at maximum temperature for longer time should improve recovery of paraffin or asphaltic oil.

The following equation is the correction factor that must be used to adjust the volume of oil recovered:

$$\text{Factor} = \frac{\%\ \text{Oil in known sample}}{\%\text{Oil recovered}}$$

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

A % Oil = Volume oil recovered x Factor x 2

B % Water = Volume Water x 2

C % Solids = 100 – (Volume oil + Volume water) x 2

Where

Factor is the calculated correction for a sample containing crude

[2] is the result of [100 x (1/50 ml drilling fluid)]; for 10 ml, this value would be [10]

Calculate weight, weight percentage, and specific gravity as follows:

D Grams Oil = Volume Oil x 0.84

Where 0.84 is the specific gravity of oil; if the oil in the drilling fluid is known, use its specific gravity.

E Grams Water = Volume Water

Where the specific gravity of water is 1; if the drilling fluid has high salinity, perform a low pressure filter test and measure the specific gravity of the filtrate.

F Grams Drilling Fluid = Density (lb/gal) x 6.0

Where [6.0] is the value used for 50 ml drilling fluid; use [1.2] for 10 ml drilling fluid

G Gram Solids = F – (D + E)

H Volume Solids = 50 – (Volume Oil + Volume Water)

Where [50] is the volume (ml) of drilling fluid; Use [50] for 50 ml retort and [10] for 10 ml retort

I Average Specific Gravity of Solids = $\frac{G}{H}$

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

K High Gravity Solids (SG 4.3) % by Volume = (I – 2.6) x 58.8

Where

[58.8] is the result of [(4.3 – 2.5) x 100]; the assumption is that specific gravity for high gravity solids is 4.3 and 2.6 for low gravity solids; recalculate if the specific gravities are not 4.3 or 2.6.

L Low Gravity (SG 2.6) Solids % by Volume = 100 – K

The average specific gravity of solids must be in the range of 2.6 to 4.3. If the calculated specific gravity is outside this range, then an error has been made in the test or calculations. The relative proportion of clay and barite is estimated in Table 5-1.

Table 5-1 Clay and Barite Proportions

SG 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

6 Troubleshooting and Maintenance

Troubleshooting and regular maintenance procedures are described in this section. If more extensive maintenance or service of the instrument is required, contact Fann Instrument Company.

Remove each retort from service, especially offshore operations at least once every six months and thoroughly examine and clean them.

Remove each retort from service, especially offshore operations at least once every six months and thoroughly examine and clean them.

Wear a breathing mask when diassembling the insulation and cleaning the inside of the retort case. Do NOT reuse deteriorated insulation.

6.1 Equipment Care

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

- Use the spatula to scrape dried sample from the chamber and lid, assuring correct sample measurement.
- Remove steel wool using the corkscrew, and clean the chamber using the spatula.
- Replace any steel wool that is caked with dried sample.
- Clean the retort drain tube and condenser with a pipe cleaner.
- 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.

Abnormal strain or structual weakening of threads could lead to explosive separation under normal pressure conditions.

- Clean and lubricate the retort threads with high-temperature lubricant.

6.2 Retort Repair

Disconnect the power cord before repairing the retort.

If the retort fails to properly heat, the cause is one or more of the following:

- Cartridge Heater
- Thermostat
- Thermostat Switch
- Main Switch
- Burned or broken wires or wire connections

To replace these parts, you must disassemble the retort. Replacement wire must have high-temperature insulation. Fann Instrument Company offers an 18 AWG wire (P/N 205772) that meets this requirement.

Refer to Figure 7-1 for mechanical disassembly and reassembly. Refer to Figure 7-2 and 7-3 for electrical wiring.

6.3 Retort Disassembly

1. Unplug the retort power cable from the power outlet.

2. Open the case cover and remove the retort and condenser assembly.

3. Remove three 6-32 x 1-1/2-in. screws. Then remove the retort sheet metal cover and the 1-in. thick insulation, including the insulating strip on the back.

4. Remove five 6-32 x 1/4 -in. screws from the front and bottom edge of the front/top panel. Lay the panel forward.

5. Refer to Figure 7-2 or 7-3. Disconnect these wires:

- Two wires from the ON-OFF switch that come from male receptacle (screw terminals).
- Two wires each terminal, one from each heater, from both top terminals of terminal strip.
- Two wires one terminal (pilot light and thermostat switch) and other terminal (pilot light and power switch) from the bottom two terminals of the terminal strip
- Ground wire at the mounting screw of the power receptacle screw and nut terminal (230V model) or center screw terminal (115V model).

Wear a NIOSH approved, N-95 rated, filtering face-piece respirator (dust mask) when diassembling the insulation. Loose insulation in the retort may give off dust when handled.

6. Remove two sheet metal screws, holding the two top pieces of insulation together. Remove the top piece over the heater block.
7. Remove the heater wires from the groove in the insulation, and straighten them. Then remove the second piece of insulation.
8. Heaters that are not stuck in the adapter block can be removed and replaced without further disassembly. If the heaters are stuck, the adapter block must be removed. Refer to Section 6.6 Adapter Block Assembly, step3.
9. Carefully remove the loose insulation from the retort adapter.

Do NOT reuse dusty or deteriorated insulation.

10. Remove the side support insulation block.
11. Lift the heater block, heaters, lower insulation, and thermostat as an assembly from the case.

6.4 Inspection

While the retort is disassembled, repair or replace other items before reassembly. Also, inspect, repair, or replace the following:

- Cracked or broken insulation blocks.
- Burned or bare wires. Replace these wires with high-temperature wires and high-temperature lugs. Crimp the lug tightly onto the wire.

Use lug crimping pliers. Do not use solder.

- Burned or damaged wiring. Wiring connections are shown in Figure 7-2 and 7-3. Use only high-temperature wire (P/N 205772) and nickel lugs (P/N204289). Crimp the lug tightly onto the wire.
- Defective thermostat switch. Replace the switch or thermostat.
- Burned or loose ground wire or lug. Make sure the ground wire lug is connected to the heater block.

6.5 Assembly

Reassemble in opposite order of disassembly, noting the following:

1. Place the heater block assembly into the bottom of the stainless steel case.
2. Install the side insulation.
3. Make sure the loose insulating material is in good condition and completely fills the space on all sides of the heater block. If the insulation is deteriorating, replace it.
4. If installing new heaters, insert them into the holes in the adapter block. Make sure the new heaters have the correct voltage, 115V or 230V. The new heaters must have new terminal lugs crimped onto them.
5. Install the grooved top insulation block. The heater leads must be properly routed in the grooves of the top insulation and must not be pinched or kinked.

6. Install the second top insulation, and secure it to the grooved insulation board with the two sheet metal screws.

7. Make sure all wiring connections are tight and all crimp connections are properly made using crimping pliers as follows:

   - Ground wire from heater adapter block mounting screw to receptacle mount screw in the receptacle.

   - Terminal Strip
   - Wire of each heater to left top
   - Second wire of each heater to right top
   - Wire from thermostat switch and wire from pilot light to left bottom
   - Wire from power switch and wire from pilot light to right bottom
   - Wire from thermostat to power switch

8. Install the following:

   - Panel/Top Assembly, 5 screws
   - Lid Assembly, 3 screws
   - Retort Assembly
   - Power Cable

9. When reassembly is complete, test the retort and adjust the thermostat. See Section 6.10 Thermostat Test and Adjustment.

6.6 Adapter Block Assembly

The adapter block assembly must be disassembled in order to repair or replace the following:

- Heaters, if the old heater is stuck in the adapter block
- Thermostat switch or thermostat

1. Remove the fish paper glued to the bottom of the lower insulation, and then remove the thermostat assembly (on older models). On new models, remove the screw holding the thermostat mounting bracket to the insulation block.

2. Remove two 3-in. screws holding the lower insulation and the ground wire to the adapter block.

3. If the heaters are stuck in the adapter block, pull the heaters out by their leads. If the leads break off, either the heater can be drilled out using a 5/8-in. drill bit or a smaller hole, approximately 1/4 inches, can be drilled from the opposite side. Then a punch can be used to drive out the heater.

4. Place the thermostat in the adapter block. Follow the procedure described in Section 6.7 Thermostat Removal and Replacement, steps 3, 4, and 5 or Section 6.8 Thermostat Switch Replacement, steps 4, 5, and 6.

5. Install the three insulation boards to the adaptor block using two 8/32 x 3–in. screws. Some units use one screw and 8/32 all thread and nuts. Make sure the lug of the ground wire is attached by one screw or two the all thread.

6.7 Thermostat Removal and Replacement

1. Remove the fish paper covering the thermostat (on older models). On new models, remove the screw holding the thermostat mounting bracket to the insulation block.

2. Pull the thermostat assembly from the heater block, and disconnect the two wires.

3. Connect the two wires to the thermostat switch. Make sure to transfer the capacitor (230V model) to the new thermostat. Make sure the wires are installed on the common (C) and normally open (NO) terminals.

4. Assemble the new thermostat in the heater block.

5. Attach new fish paper to the insulation covering the thermostat (old models only). For new models, reinstall the screw holding the thermostat mounting bracket to the insulation block.

6. Adjust the new thermostat to shut off when the temperature reaches 930°F±70°F (499°C±21°C). See Section 6.10.

6.8 Thermostat Switch Replacement

1. Remove the thermostat from the heater block. Refer to Section 6.6 Adapter Block Assembly, step 1.

2. Remove the wires from the thermostat switch.

3. Remove the two 6-32 screws holding the switch to the ell bracket.

4. Transfer the wires and capacitors (if used) to the new switch. Make sure the wires are installed on the common (C) and normally open (NO) terminals.

5. Mount the new switch to the ell bracket with the two 6-32 screws (step 3). Press the switch away from the ell while tightening the screws.

6. Replace the fish paper. Glue new fish paper to the insulation covering the thermostat.

7. Adjust the new thermostat switch to shut off when the thermostat reaches 930°F±70°F (499°C±21°C). See Section 6.10 Thermostat Test and Adjustment.

6.9 Thermostat Check

The thermostat should allow the retort temperature to reach 930°F±70°F (499°C±21°C). The thermostat will shut off and the pilot light will go out when the temperature is reached. If these events do not occur, then adjust the thermostat.

6.10 Thermostat Test and Adjustment

To perform this test, use a digital thermometer capable of reaching 999°F (537°C) and equipped with a1/16-in. (1.6 mm) diameter thermocouple.

1. Remove the condenser from the retort assembly.

2. Disassemble the retort and remove the steel wool and the lid.

3. Feed the thermocouple through the drain tube and the top section of the retort. Position the thermocouple end to touch the sample chamber bottom. Screw the retort back together.

4. Install the retort and the thermocouple into the heating well; connect the thermocouple to its thermometer.

5. Heat the retort using the normal procedure. Observe the thermometer reading when the pilot light goes out and comes on again. Record the highest and lowest readings for at least three cycles. The difference between the highest and lowest readings should be less than 80°F (27°C); the average reading should be 930°F±70°F (499°C±21°C).

6. If the thermostat needs adjusting, remove the plug (top of the heating assembly) and turn the thermostat shaft using a screwdriver — rotate right to decrease the temperature or rotate left to increase the temperature.

7. Begin adjusting the thermostat at temperature below the cutoff and gradually increase the temperature (approximately 1/8 turns) until the proper setting is reached. The retort temperature should not be more than 970°F (521°C).

8. After the thermostat is properly adjusted, let the retort assembly cool. Remove the thermocouple and reassemble the retort.

6.11 Pilot Light Replacement

1. Remove the lens.
2. Remove the bulb by pressing and turning.
3. Install new bulb.
4. Reassemble the lens.

6.12 Switch Replacement

1. Disassemble the retort as described in Section 6.3 Retort Disassembly, steps 1 through 4.
2. Remove wires and capacitor (if used) on terminals of the old switch. Make note of terminal location and switch position. Remove old switch from panel.
3. Mount new switch in panel, and replace wires and capacitor (if used) on terminals. Refer to retort wiring diagrams (Figure 7-2 or 7-3).
4. Reassemble the retort in reverse order.

7 Parts List

Two models are available:

- P/N 210465, Oil & Water Retort, 50 ml, 115V, 700W
- P/N 210463, Oil & Water Retort, 50 ml, 230V, 700W

Table 7-1 Oil & Water Retort Kit, 50 ml

Item No.	Part No.	Quantity	Description
0001	210467	1	CASE 50ml RETORT STAINLESS STEEL
0002	205719	1	RECEPTACLE RECESSED MALE 2 PRO
0003	205728	3	CLIP LARGE
0004	205726	2	CLIP MEDIUM
0009	205737	2	HEATER ROD 350 WATT 120 VOLT
0010	205802	1	THERMOSTAT
0012	204289	1	TERMINAL RING NO.8 SCREW 16-14 AWG
0013	205772	5	WIRE 18 AWG HIGH TEMP
0014	209938	1	WETTING AGENT 1oz
0015	210440	1	STEEL WOOL 1/4 POUND
0016	210435	1	HIGH TEMPERATURE LUBRICANT
0017	210441	1	CLEANER PIPE 5mm 20/PKG
0018	210433	1	SPATULA
0019	210439	1	CORKSCREW
0020	205743	1	SWITCH TOGGLE DPST
0021	205147	1	TERMINAL STRIP
0026	210459	20	INSULATION BULK
0028	210474	1	HEATER BLOCK RETORT 50ml 115/230 V
0032	205855	1	BRUSH, TEST TUBE
0033	205758	1	HOLDER LAMP
0034	205759	1	LAMP NEON
0035	205757	1	LENS, CLEAR
0038	208776	1	CYLINDER GRADUATED GLASS 50ml TC
0062	204295	1	CLOSURE SNAP 5/8
0065	213469	4	6-32 X 1 1/2 THMS STAINLESS
0066	203392	9	6-32 X 1/4 RHMS STAINLESS
0080	210468	1	MACHINE PARTS SET (SEE TABLE 7-2)
0085	205769	1	CABLE 115VAC
0090	205850	1	BRUSH WIRE-ALL STAINLESS STEEL 1/8 DIA
0100	206118	1	DRILL TWIST (31) 6 IN. LENGTH
0110	206119	1	WRENCH TAP T-HANDLE

Table 7-2 Machine Parts Set, P/N 210468, Rev. K

Part No.	Description
210470	CHAMBER, COMPLETE
210471	INSULATION BLOCK SET
210472	CONDENSER
210473	WRENCH, 3/8-IN. SQUARE BAR RETORT
210480	INSULATION BLOCK, LID
210482	INSULATION BLOCK, SIDE
210483	INSULATION BLOCK, TOP
210484	INSULATION BLOCK, BOTTOM
101834947	CHAMBER LID

Table 7-3 Chamber, Complete, P/N 210470

Part No.	Description
N/A	SAMPLE CHAMBER
N/A	UPPER CHAMBER W/DRAIN TUBE
101834947	CHAMBER LID FOR SAMPLE CHAMBER

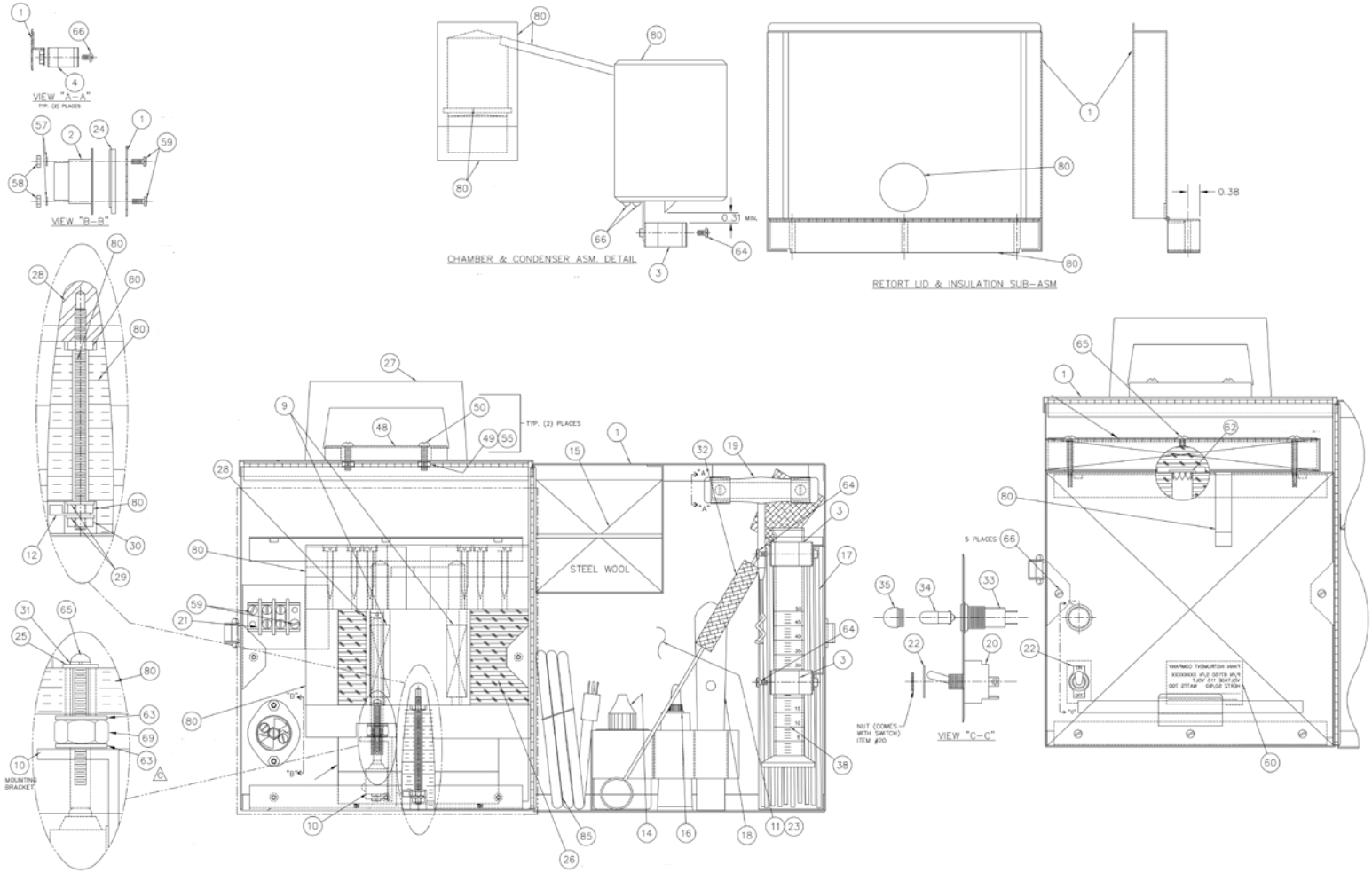

Figure 7-1 Retort Kit Assembly, 50 ml

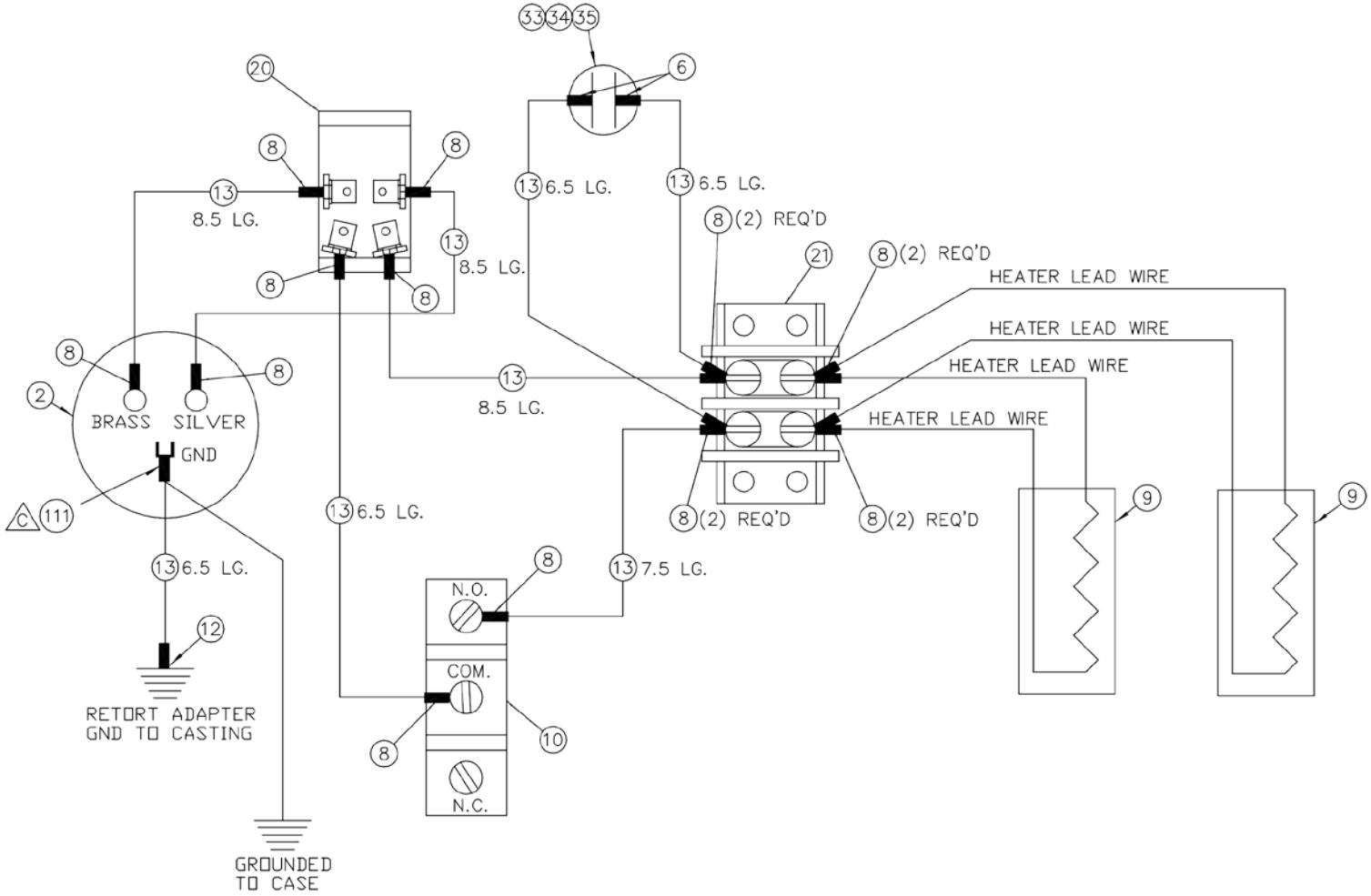

Figure 7-2 Retort Wiring, 115V

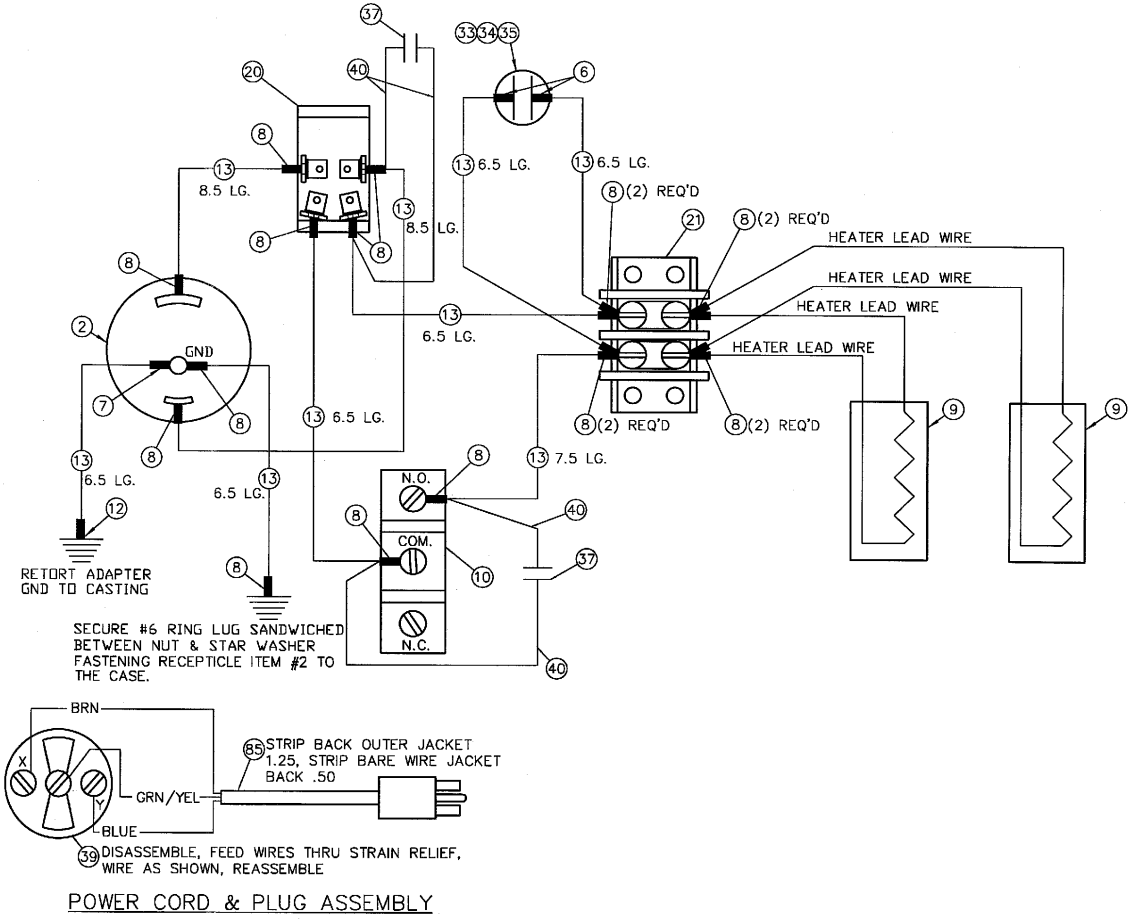

Figure 7-3 Retort Wiring, 230V

8 Warranty and Returns

8.1 Warranty

Fann Instrument Company warrants its products to be free from defects in material and workmanship for a period of 12 months from the time of shipment. If repair or adjustment is necessary, and has not been the result of abuse or misuse within the twelve-month period, please return, freight prepaid, and correction of the defect will be made without charge.

Out of warranty products will be repaired for a nominal charge.

Please refer to the accompanying warranty statement enclosed with the product.

8.2 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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FAX: 281-871-4446

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