fann®

Oil and Water Retort
Instruction Manual

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SECTION 1
DESCRIPTION

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 Oil and Water 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.

These retorts are electrically heated and thermostatically controlled to shut off when a predetermined temperature (930°F ±70°) (498°C ±21°) as specified by API has been reached. Three models are available to conform to the electric power available. These are: 115 volt, 230 volt, combination 115/12 volt (car battery).

These retorts are available in individual carrying cases or as a part of complete mud testing kits. The retort module (used in the kits) is also available for use where a carrying case is not necessary.

The retort shown in Fig. 1 is composed of a 10 cm^3 drilling fluid chamber (17), measuring lid (18) upper boiling chamber (19) containing steel wool (22) and distillation tube and condenser (20). The retort, shown in Fig. 2, is heated by inserting it in a heating well (7) which also contains the cartridge heat (12) and the thermostat (8). Water and oil distillate are collected in a 10 cc graduate or special collector tube resulting in the percentages read directly (0.1 cc = 1% readable to 0.5%).

A similar but larger retort is available for use where the additional accuracy of a larger sample is necessary. The model 210465 retort uses a 50 cm^3 sample and a special volumetric flask or special collector tube thus obtaining ± 0.5% accuracy. Special 10 cm^3 collectors are available for more accurate readability.

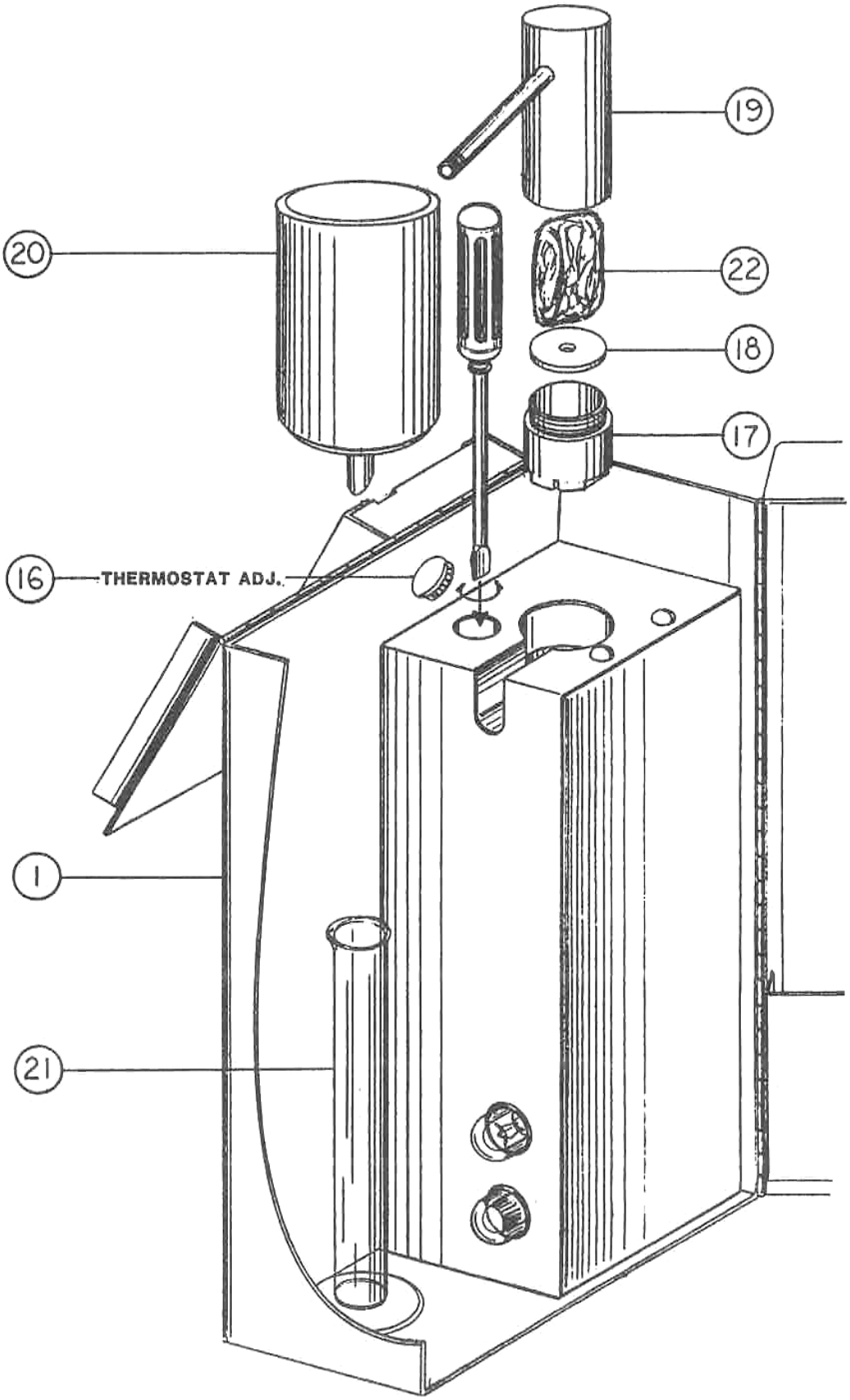


Fig. 1 – RETORT ASSEMBLY

SECTION 2
SAFETY CONSIDERATIONS

Safe operation of the Oil and Water Retorts 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 is a list of suggestions that should be observed to assure safe operation and maintenance of the Retort Kits.

1. 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. The practice of removing the retort and condenser and cooling them under water is a very dangerous procedure and is not recommended because of the danger of severe burns if touched or accidently dropped. Also use extreme caution when placing a hot retort in water. Hot steam generated when the water hits the hot retort can cause severe burns.

3. Make sure the electrical source is fused and grounded. Verify the power cord on the Oil and Water Retort Kit is in good condition and has the proper ground connection.

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

5. Clean the sample chambers (upper and lower) thoroughly after each test, especially the spout. The wire brush, 205850, can be used for spout cleaning. For hard, baked – on materials, a long #31 drill bit, 206118, with handle, 206119, should be used, ensuring that the entrance to the spout inside the sample chamber is **clean.**

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

7. 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. These symptoms are signs of abnormal strain and structural weakening of the threads and could lead to explosive separation under abnormal pressure conditions.

8. Remove from service each retort, especially for offshore operations, at least once every six months for thorough examination and cleaning.

SECTION 3
OPERATING PROCEDURE

A. Prepare the retort for service by performing steps A through D under Section 4, CARE OF EQUIPMENT.

B. Lift retort assembly, (parts 17, 18, 19, 20), out of heating compartment. (Refer to Fig. 1.) Using the spatula as a screwdriver, remove the drilling fluid chamber (17) from the retort (19).

C. Pack the upper chamber (19) with steel wool (22). Refer to Fig. 1.

D. Fill drilling fluid chamber (17) with drilling fluid and replace lid (18), 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 very essential.)

E. Clean and lubricate retort threads with high temperature lubricant.

F. Screw drilling fluid chamber (17) with lid (18) into upper chamber (19) and hand tighten.

G. Replace retort assembly in heating compartment and put insulating cover in place.

H. Add a drop of wetting agent to the graduate or collector tube and place under drain port of condenser.

I. Turn heater on by connecting power cord.

NOTE: The model 210444 combination 115/12 volt retort is provided with three power cords. If the available power is 115 volts, use the cord with the standard AC plug on one end.

If car battery power or other 12 volt source is to be used, use one of the other two cords. One is adapted to fit a car cigarette lighter outlet, the other clips directly to the battery. The retort plug and receptacle are polarized so proper connection is made with any of the three cables.

J. Allow the retort to heat until the pilot lamp (10) goes out. Refer to Fig. 2. This will indicate that the retort has reached the temperature for distillation to be completed. 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 20 minutes if rated 115 or 230 voltage is available. A lower voltage may take 25-30 minutes, while at a higher voltage the distillation may be completed in 15 minutes. Distillation using 12 volt power will take longer, 35 to 45 minutes. After completion of test, disconnect power cord.

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

NOTE: 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:

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

SECTION 4
CARE OF EQUIPMENT

A. Use the spatula and scrape the dried drilling fluid from the chamber (17) and lid (18) to assure correct drilling fluid measurement. Refer to Fig. 1.

B. Remove steel wool using the corkscrew, and clean chamber with spatula. Replace any steel wool caked with drilling fluid with new steel wool (22).

C. Clean the retort drain tube (19) and condenser (20) with a pipe cleaner.

D. Clean and lubricate the retort threads with high temperature lubricant. This is extremely important to prevent seizing of the threads.

E. The thermostat should allow the retort to reach a dull red heat (approx. 930°F)(498°C) ±70°F (21°C). If adjustment must be made on thermostat, remove plug (16) in top of heating assembly and turn thermostat shaft clockwise with screwdriver to lower temperature or counterclockwise to raise temperature. Adjustments are made most easily by starting below the cutoff point and raising the temperature in small steps (approximately 1/8 turn) until the proper setting is reached. The retort setting should not be higher than the 970°F (521°C).

SECTION 5
CALCULATIONS

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

A. % Oil by volume = cm^3 oil* X 10

B. % Water by volume = cm^3 water X 10

C. % Solids by volume = 100 - (cm^3 oil + cm^3 water) X 10

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

D. Grams Oil = cm^3 oil* X 0.84

E. Grams water = cm^3 water

F. Grams Drilling Fluid = lb/gal drilling fluid weight X 1.2

G. Grams solids = F - (D + E)

H. cm^3 solids = 10 - (cm^3 oil* + cm^3 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

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

THE CORRECTION FACTOR MAY NEED TO BE APPLIED TO THE CM^3 OIL IN THESE CALCULATIONS. SEE NOTE IN SECTION 3 FOR EXPLANATION OF CORRECTION FACTOR.

CAUTION

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 1.

TABLE 1

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

SECTION 6
SPECIFICATIONS

TYPE & SIZE

Part No.	Style	Size in. (cm)	WT-LB (kg)
210442	Stainless Steel Case	6-1/4 x 7-1/8 x 10-7/8 (15.9 x 18.1 x 27.6)	10 (4.55)
210443	Stainless Steel Case	6-1/4 x 7-1/8 x 10-7/8 (15.9 x 18.1 x 27.6)	10 (4.55)
210444	Stainless Steel Case	6-1/4 x 7-1/8 x 10-7/8 (15.9 x 18.1 x 27.6)	10 (4.55)
210398	Removable Retort (From Mud Lab Kits) (Stainless Steel Case)	4 x 3-3/4 x 10-7/8 (10.2 x 9.5 x 27.6)	6.5 (2.95)
210465	Stainless Steel Case	9-1/4 x 8 x 10-7/8 (23.5 x 20.3 x 27.6)	25 (11.36)

POWER REQUIREMENTS

Part No.	Voltage	Watts
210442	115 V AC/DC	350 @ 115 V
210443	230 V AC	350 @ 230 V
210444	115/12 V AC/DC	350 @ 115 V, 200 @ 12 V
210398	115/12 V AC/DC	350 @ 115 V, 200 @ 12 V
210465	115 V AC	700 @ 115 V
210463	230 V AC	700 @ 230 V

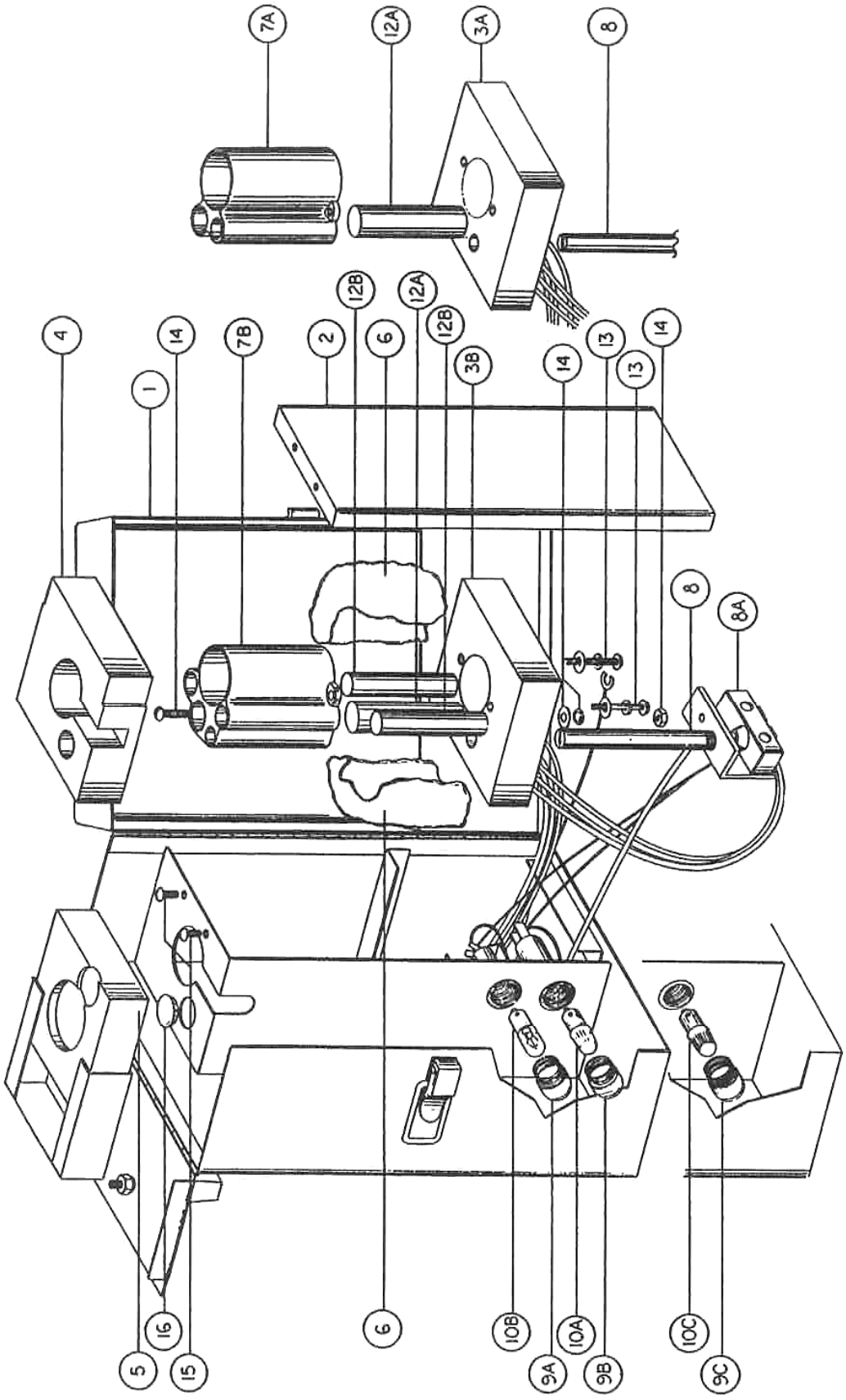


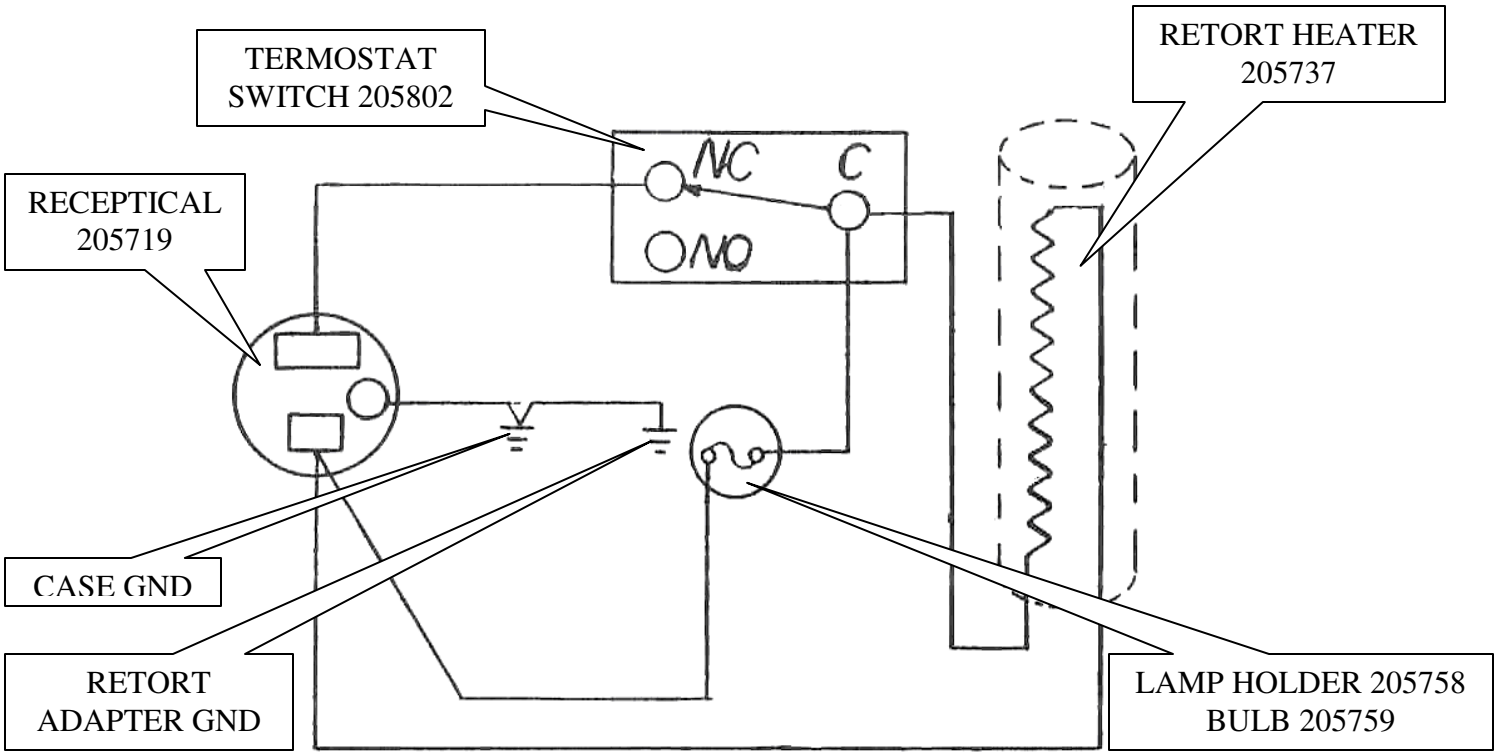
Fig. 2 - RETORT KIT ASSEMBLY

SECTION 7
RETORT REPAIR

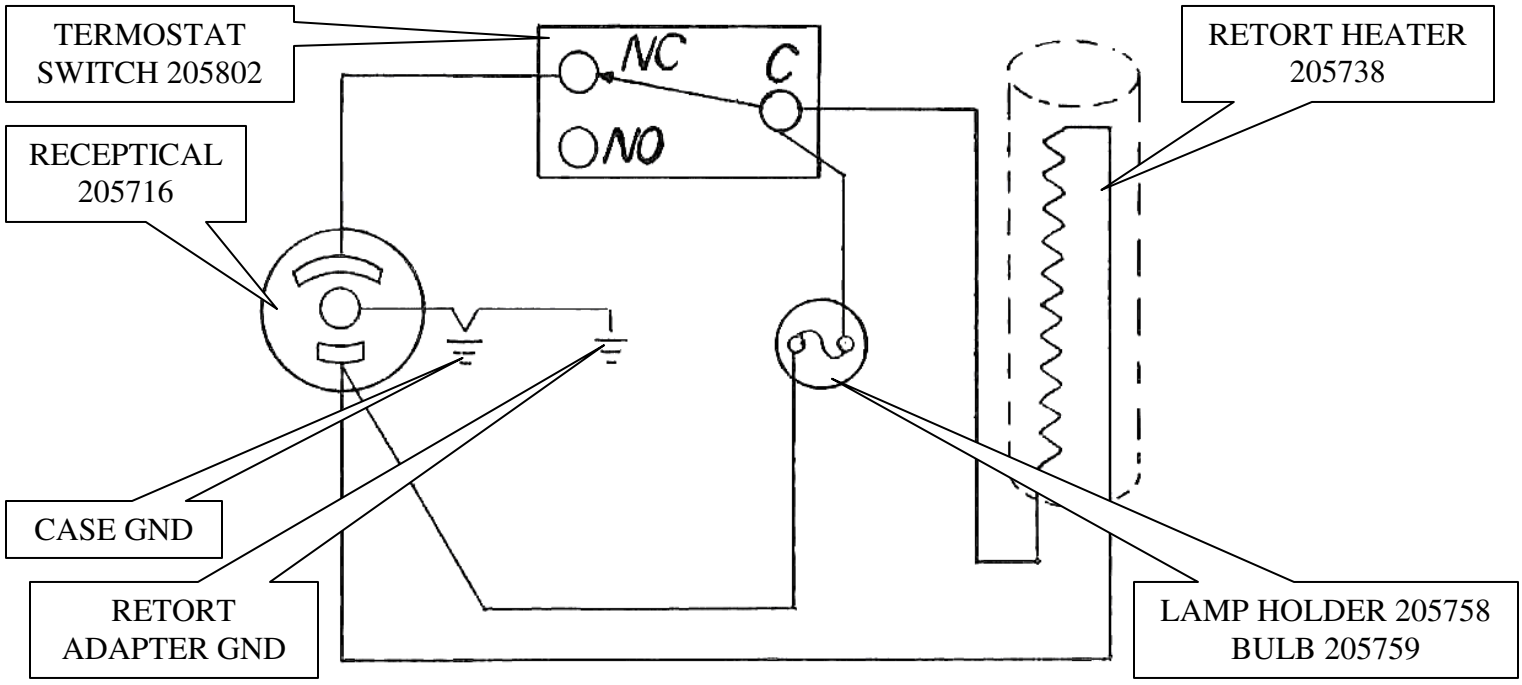
Failure of the retort to properly heat is usually caused by failure of the cartridge heater or the thermostat. Replacement procedure for either is covered below: Refer to Fig. 2. Figures 3 and 4 illustrate the electrical wiring. **CAUTION: DISCONNECT THE POWER CORD BEFORE BEGINNING REPAIR.**

A. Disassembly

1. Remove two screws (15)
2. Remove cover (2) by pulling top outward to clear top of case, then upward.
3. Carefully remove insulation (6) from around retort adapter. Save if to be re-used.
4. Remove retort adjustment cover(16)
5. Slide out top insulator block (4)
6. Slide out retort assembly consisting of items (3), (7), (8), and (12).
7. Loosen nut then unscrew thermostat mounting screw (14).
8. Remove wires from thermostat switch, (8A) then slide thermostat (8) downward out of retort adapter (7) and lower insulator (3). The thermostat switch (8A) or the complete thermostat (8) may be replaced at this time.
9. Remove the two retort adapter mounting screws (13) and remove the adapter and heaters from the shelf insulator block (3).
10. Remove heaters from retort adapter. If these are stuck, drive them out from the top with a suitable punch and hammer. If heaters are to be replaced the leads must be unsoldered from the power receptacle.



115 VOLTS RETORT WIRING (210442)



230 VOLTS RETORT WIRING (210443)

Fig. 3 – RETORT WIRING, 115 VOLTS AND 230 VOLTS

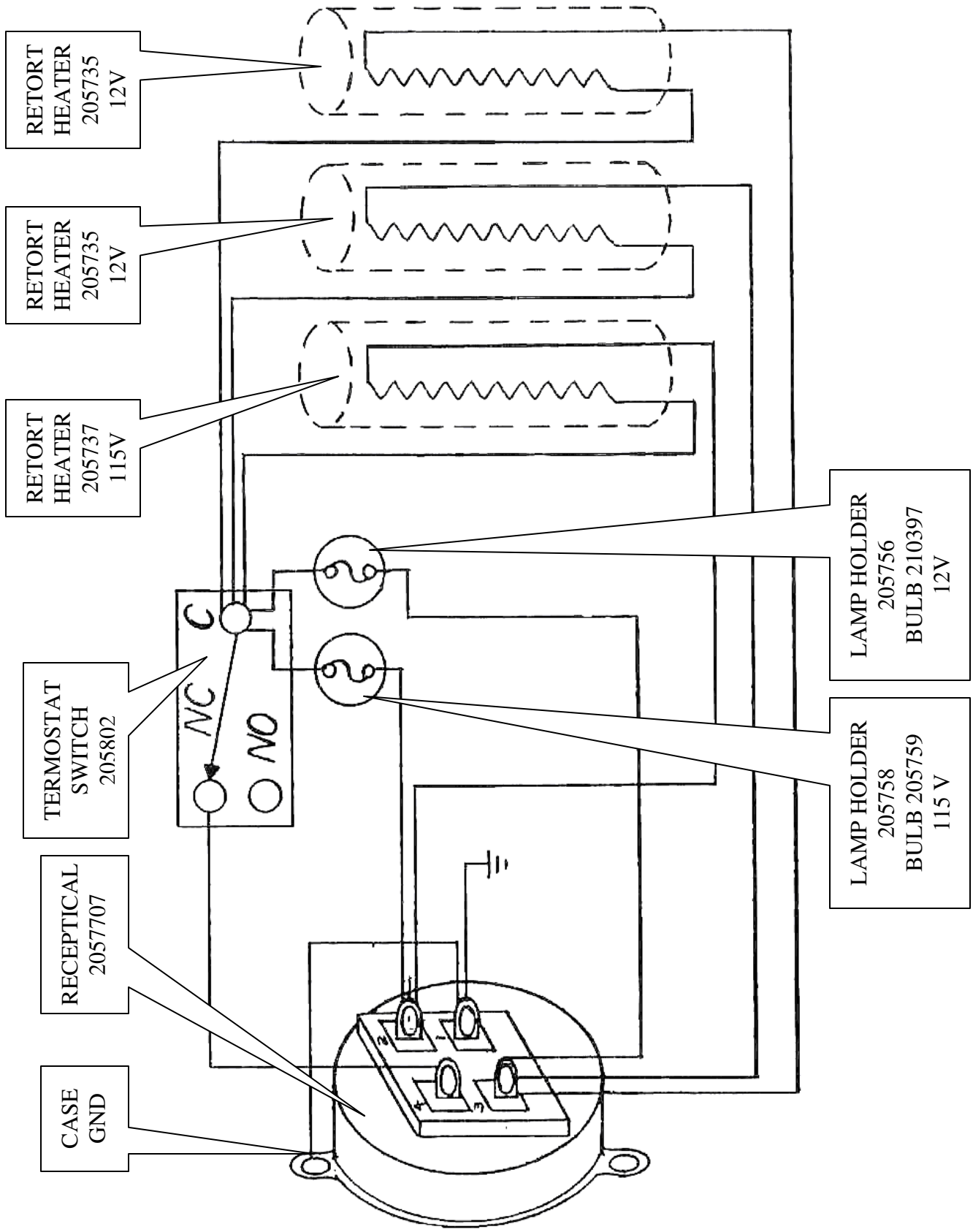


Fig. 4 - RETORT WIRING, COMBINATION 12/115 VOLT

B. Inspection

While the retort is disassembled it should be checked for cracked or broken insulator blocks, burned or bare wires, and defective thermostat switch. Replace all burned or damaged parts. Wiring connections are shown in Fig. 3 and 4. Replacement wire must have high temperature insulation such as 205772 18 gauge appliance wire.

C. Re-assembly

Re-assemble in the opposite order of disassembly noting the following:

1. Make sure all wiring connections are proper (good solder connections, tight terminals). Do not use solder connections near heaters or in any "hot" area.

2. Make sure ground wire is connected to retort adapter mounting screw.

   NOTE: Use only rosin core solder.

3. When retort adapter assembly is slid into case make sure no wires are pinched or kinked.

4. Position insulating material (6) on all sides of retort adapter.

5. When re-assembly is complete test retort and adjust thermostat as described in Section 4-E.

D. Pilot Light Replacement

1. Remove lens (9) then bulb (10) by pressing inward and turning.

2. Replace with new bulb and re-assemble lens.

SECTION 8
PARTS LIST

Part No.	Description	Part No.	Description
205240	Receiver, Retort, 10 cm^3	210450	Adapter, Retort (7A) (7C)
205735	Heater, 100 Watt, 12 Volt, Cartridge (12B)	210451	Insulator Block, Lid (5) for 210442, 210443, 210444
205737	Heater, 350 Watt, 115 Volt, Cartridge (12A)	210452	Insulator Block, Top (4) for 210442, 210443, 210444
205738	Heater, 350 Watt, 230 Volt Cartridge (12C)	210445	Instructions, Retort
205755	Switch for Thermostat (8A)	210453	Insulator Block, Shelf (3) for 210442, 210443
205757	Lens, Clear (9)	210455	Insulator Block, Shelf (3)for 210444
205759	Lamp, Neon, NE51, 115 Volt (10A)	210456	Adapter, Retort (7B)
205766	Power Cable, Retort, 230 Volt for 210443	210458	Insulation, Retort, 1 pound (6)
205769	Power Cable, 115 Volt for 210442	210461	Insulator Block, Shelf for 210398
205772	Appliance wire, 18 gauge	210440	Steel Wool, 1/4 pound (22)
205802	Thermostat (8)	210441	Pipe Cleaner
205854	Brush, Test Tube	210439	Corkscrew, Steel Wool Remover
205869	Graduated Cylinder, 10 ml (21)	210437	Condenser (20)
210420	Tube, Centrifuge, 10 ml	210436	Lid, Retort Mud Chamber (18)
209938	Wetting Agent, 1 oz. Dropper Bottle	210435	Thread Lubricant, 1 oz.
210272	Power Cable, 12 Volt Battery Clip	210434	Retort, 10 ml (17) (18) (19)
210273	Power Cable, 115 Volt for 210398	210433	Spatula
210389	Insulator Block, Lid (5) for 210398	210397	Lamp, GE 1816, 12 Volt (10B)
210390	Insulator Block, Top (4) for 210398	210391	Insulator Block, Shelf (3) for 210398
210460	Insulator Block, Top for 210398		

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