

# Classic Electrically Heated Stills

Series 2112

Operating Manual and Parts List LT2112X1 Rev. 0



<b>Models covered in this manual</b>		
<b>Model Number</b>	<b>Voltage</b>	<b>Size</b>
A1011-A (6768)	120V, 1PH	1 gallon
A1011-B-61 (6769)	240V, 1PH	1 gallon
A1013-C (6771)	120/208V, 3PH	2 gallon
A1013-B-61 (6786)	240V, 1PH	2 gallon
A1015-B-61 (6772)	240V, 1 PH	5 gallon
A1015-C (6773)	120/208V, 3PH	5 gallon
A1016-D (6774)	240V, 3PH	10 gallon

**MANUAL NUMBER LT2112X1 (7006769)**

0	--	7/1/10	Transfer to Marietta (was LT2112X1 3/18/10)	ccs
<b>REV</b>	<b>ECR/ECN</b>	<b>DATE</b>	<b>DESCRIPTION</b>	<b>By</b>



**Important** Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance. ▲

**Caution** All internal adjustments and maintenance must be performed by qualified service personnel. ▲

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Important operating and/or maintenance instructions. Read the accompanying text carefully.



Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.



Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.



Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.



Marking of electrical and electronic equipment, which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005.



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- ✓ Always use the proper protective equipment (clothing, gloves, goggles, etc.)
- ✓ Always dissipate extreme cold or heat and wear protective clothing.
- ✓ Always follow good hygiene practices.
- ✓ Each individual is responsible for his or her own safety.

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# Section 1 Safety Information

This manual contains important operating and safety information. The user must carefully read and understand the contents of this manual prior to the use of this equipment.

Water purification technology employs one or more of the following: chemicals, electrical devices, mercury vapor lamps, steam and heated vessels. Care should be taken when installing, operating or servicing Thermo Scientific products. The specific safety notes pertinent to the Thermo Scientific Electrically Heated Stills are listed in safety information section.

Your Classic Electrically Heated Stills has been designed with function, reliability, and safety in mind. It is the user's responsibility to install it in conformance with local electrical codes. For safe operation, pay attention to Notes, Cautions, and Warnings throughout the manual.

## Warnings

To avoid electrical shock, always:

1. Ensure that the equipment is connected to electrical service according to local and national standards. Failure to properly connect may create a fire or shock hazard.
2. Do not connect unit to electrical service until instructed to do so.
3. Disconnect from the power supply prior to maintenance and servicing.

**To avoid personal injury:**

1. Do not use in the presence of flammable or combustible materials; fire or explosion may result. This device contains components which may ignite such materials.
2. Use this device with water feed only. Sanitizing/cleaning agents must be used in compliance with the instructions in this manual. Failure to comply could result in explosion and personal injury.
3. Avoid splashing disinfecting solutions on clothing or skin.
4. Ensure all piping connections are tight to avoid leakage of chemicals.
5. Always depressurize chemical lines before disassembly.
6. Ensure adequate ventilation.
7. Follow carefully the manufacturers' safety instructions on labels of chemical containers and Material Safety Data Sheets (M.S.D.S.).
8. Caution - Hot Surface. Avoid contact.
9. Refer servicing to qualified personnel.

If this unit is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

This equipment is designed for indoor use only.

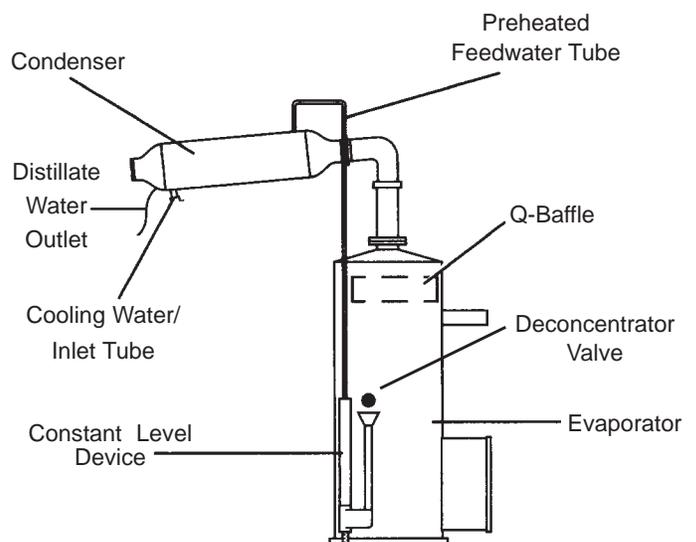
## Section 2 Introduction

Thermo Scientific electrically heated water stills are available in four sizes; 1, 2, 5 and 10 gallons per hour of distilled water. The distilled water produced by the stills contains not more than 1.0 ppm total solids, with a pH value of 5.4 to 7.2 and an electrical resistance of not less than 300,000 ohms at 25°C when the stills are operated on most potable water. The stills are designed to use not more than 9 gallons of cooling water and feedwater combined, for each gallon of distilled water produced. The still consists of: an evaporator with its heat supply, a condenser, and devices to control the water level and salt concentration in the evaporator, a Q baffle for pyrogen removal and a low water cutoff control. The operating characteristics for each size still are shown in the Installation Diagram.

### Evaporator

Still evaporators are the vertical, cylindrical double-wall type with air-insulating space. The evaporators are built sufficiently high and wide to provide ample vapor disengaging space and operation at low velocity.

The evaporator shell is of polished stainless steel. The inner shell (boiler) is fabricated of copper, brass and bronze. The evaporator cover is brass, finished in polished nickel and is provided with a Q baffle. All surfaces that contact the vapor and distillate are coated with pure tin to prevent metallic contamination. A water level sight glass is provided on all 5 and 10 gph stills.



**Figure 2-1.** Electrically Heated Stills

## Condenser

Still condensers are the horizontal type, slightly inclined and atmospherically vented for final elimination of volatiles. The condensers are fabricated of copper and brass and are finished in polished nickel. All surfaces that contact the vapor and distillate are coated with pure tin to prevent metallic contamination. A distillate delivery tube of block tin is provided to connect the distillate outlet of the condenser to a storage tank or other suitable container.

## Features Provided

All stills are equipped with a deconcentrator to continuously deconcentrate impurities from the evaporator and retard scale formation. A constant level device with hot well arrangement is provided for evaporator water level control and for primary elimination of volatile impurities. All stills are equipped with a drain valve. Cooling water discharge piping is provided between the cooling water outlet of the condenser and the constant level device. Self-resetting solid state low water cutoff controls prevent the heating elements from burning out in a low water situation.

## Electric Heat

Electrically powered, immersion type heaters are used to give complete heat transfer and maximum heating efficiency.

**Note** Heater life may be reduced when operated above maximum stated voltage. Operation of still at a voltage less than the stated voltages will cause a drop in still output. Electrically heated stills wired for 240 volts AC, 2 or 3 wire, will operate on 208 volts, 2 or 3 wire respectively with resultant 25 percent drop in distillate capacity. Special heaters for 208 volts are needed to obtain rated still output. The electric heaters will burn out if operated in air. To eliminate the possibility of heating element burnout, a solid state low water cutoff control is provided. ▲

## Low Water Cut-Off

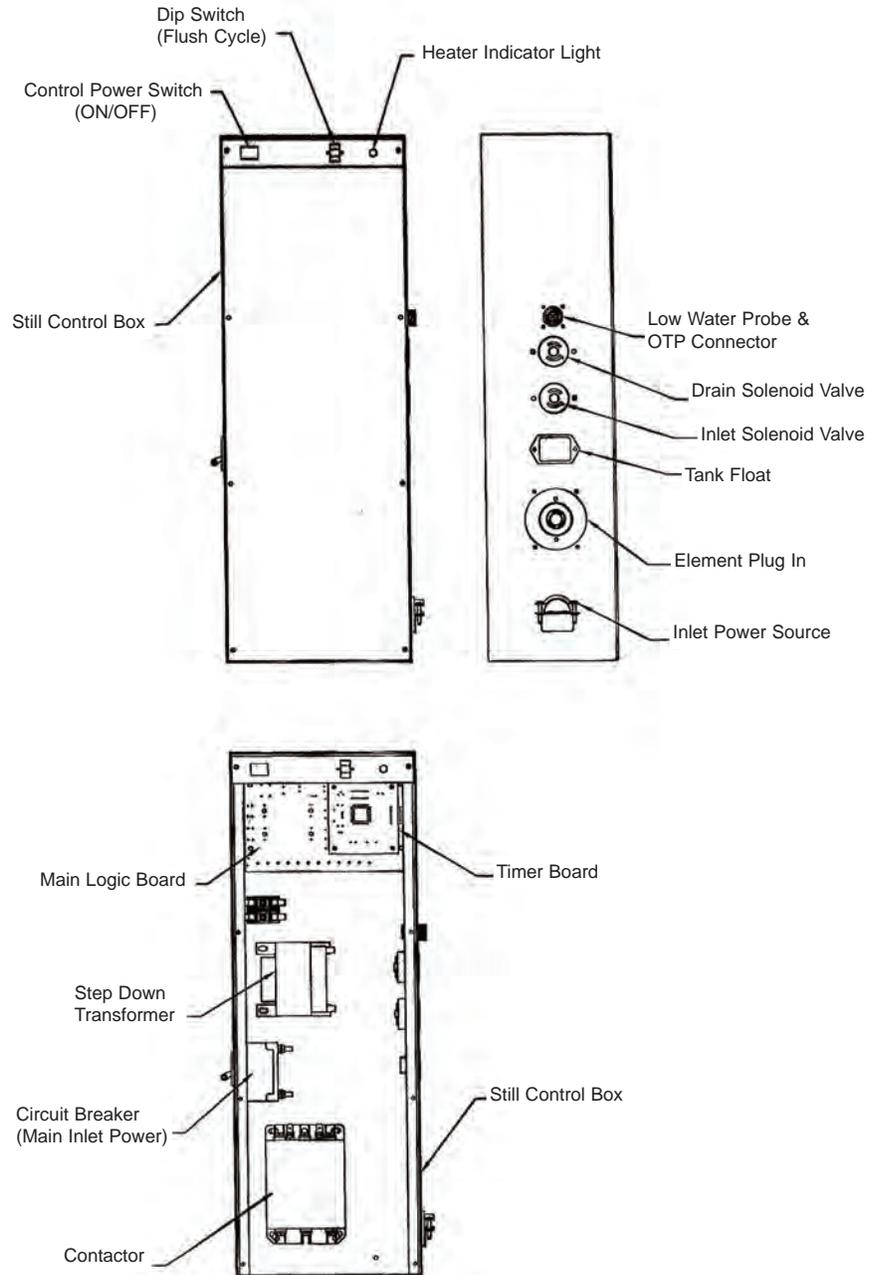
Electric current to the still heating elements is controlled by an ON/OFF switch and a self-resetting low water cutoff. The solid state low water cutoff is designed to prevent damage caused by low water conditions in the still evaporator.

When the water level is at a safe level in the still evaporator (the water level is above the immersion type heaters and makes contact with the probe), the circuit across probe terminals is completed. The completion of this circuit, after a two-second delay to prevent contactor chatter, will start the contactor to energize the contactor coil to connect the heater service to the still. Opening of the probe circuit (water no longer makes contact with the probe) will stop the contactor without delay.

The solid state low water cutoff is designed to prevent damage caused by low water conditions in the evaporator of electrically heated water stills. The low water cutoff consists of the Solid State Low Water Control, a probe assembly for installation on stills, and still heat control (contactor).

## Still Heat Control

The heat control consists of a cabinetized contactor, located in Control Box, designed for wall mounting or mount to the floor stand (Distillation unit). The contactor is provided to control the heat supply to the still heating elements, as determined by the low water cutoff controller. See Figure 2-2 for information on the contactor size required for a given size still and the available heating service. Unpack the still carefully so as not to damage any of the parts. Ensure that all parts are removed from the container before discarding the packing materials.



**Figure 2-2.** Connection Locations

## **On/Off/Control - Still Main Power**

The Control Box has an ON/OFF power circuit breaker on the side of the Control Box. This switch will control the power to the control section and the still main power (power to elements).

The Control Box has an ON/OFF control power switch that will switch the power on and off to the controls section for the Still.

## **Over Temperature Protection (OTP)**

This device will shut off the power to the heating elements of the still if the temperature in the boiler section exceeds a given preset temperature of the Over Temperature Protection Device. This will prevent the elements from running away on temperature.

## Section 3 Unpacking

Unpack the still carefully so as not to damage any of the parts. Ensure that all parts are removed from the container before discarding the packing materials.

### Package Contains:

Evaporator

Condenser

Control Cabinet and Cables

Distill Tube

Floor Stand

Evaporator Fill Tube

**Note** Once the OTP is tripped, the OTP will need to be replaced with a new OTP. Refer to Parts list in this manual. ▲



## Section 4 Installation

Move the still evaporator to the operating location and install the evaporator so that it is level and plumb.

### Accessories

All operating and convenience accessories purchased with the still should be installed after the still has been assembled on its mounting and before connecting the service lines to the still.

**Note** The floor stand (still) must be secured to the floor before mounting the still or Control Cabinet. ▲

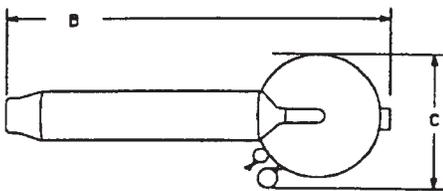
### Plumbing Connections

Ensure that all fittings are tight in the still and still accessory piping and connect the water and waste service to the still as shown in the installation diagram.

It is recommended that the plumbing lines be connected by a licensed plumber.

**Note** The still is not designed to support the service piping. Ensure that the service piping is adequately supported. If no control valves were purchased with the still, a shutoff valve and throttling valve should be installed in the cooling water supply line, just before the still. ▲

**Note** The temperature of the drain water can range between 70°C to 83°C. Make sure that the facility drain system can handle that temperature of drain water. ▲



**Figure 4-1.** Top View

Dimensions in Inches				
Electric Heat				
Still Cap (GPH)	1	2	5	10
Height	64	68	77	87
Width B	27	25	38	48
Depth C	10	11	14	14

\* Overall height includes enough clearance to facilitate condenser removal.

Service Line Sizes in Inches				
Still Capacity (GPH)	1	2	5	10
CW - Cooling Water Supply	1/4	1/4	1/4	3/8
WA - Waste	1/2	1/2	3/4	3/4

**Notes**

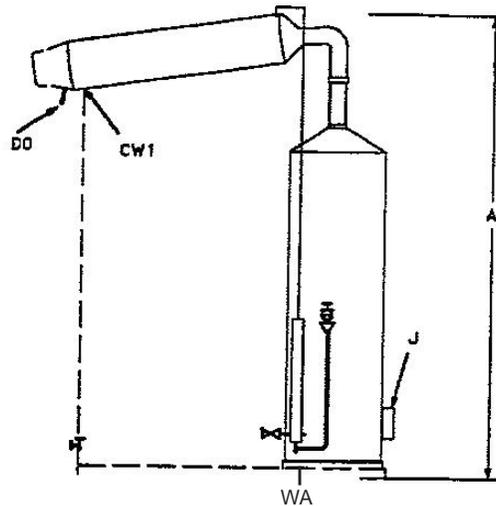
CW-1: Cooling water inlet connection 1, 2, 5 and 10

GPH stills (water supply pressure - 40 to 90 psi.)

J: Junction box for heating element connections on electrically heated stills.

DO: Distillate outlet.

WA: Waste line must be atmospherically vented and gravity flow.



**Figure 4-2.** Front View

Electric Heat Requirements						
Model Number	Still Capacity	KW	Amps at 120V, 2 Wire, 1 Phase	Amps at 240V, 3 Wire, 1 Phase	Amps at 208V, 4 Wire, 3 Phase	Amps at 240V, 3 Wire, 3 Phase
A1011	1 GPH	2.3	23	12	NA	NA
A1013	2 GPH	6	NA	26	17	NA
A1015	5 GPH	13	NA	57	36	NA
A1016	10 GPH	26	NA	NA	NA	66

<b>Cooling Water and Inlet Pressure Requirement</b>				
Still Capacity	1 GPH	2 GPH	5 GPH	10 GPH
Cooling Water Requirement	30 L/hr, 8 GPH	61 L/hr, 16 GPH	151 L/hr, 40 GPH	303 L/hr, 80 GPH
Inlet Water Pressure	40-90 psi, 2.8-6.3 kg/cm <sup>2</sup>			

## **Electrical Connections**

Connect the electrical inlet power source to the Still Control Box. Customer must supply adequate on-off control for electrical heating service. Recommended to use a licensed electrician.

1. Connect the low water cutoff probe cable to the Still Control box.
2. Connect the electrical service to the Still Control box. The heater electrical service requirements will be indicated on the nameplate decal at the base of the still evaporator.

## **Optional FAC Controls**

1. Connect Drain and Inlet Solenoid Valve cable to Still Control Box.
2. Connect Tank Level Monitor to Still Control Box.



## Section 5 Operation

### Stills Without FAC Controls

The first time that the still is started, or after cleaning, operate the still as follows:

1. Close the drain valve.
2. Open the deconcentrator valve slightly.
3. Open the cooling water inlet valve.
4. Open the cooling water throttling valve about 1/2 turn.
5. When water begins to issue steadily from the deconcentrator valve, turn On the still heat supply circuit breaker on side of Still Control Box, then the control ON/OFF switch.
6. When the still begins to produce distilled water, close the deconcentrator valve and adjust the cooling water throttling valve until a puff of steam issues from the condenser vent. Discard the first two hours production of distillate to allow the still to clean itself out.
7. Adjust the deconcentrator as described below.

**Warning** A fire hazard may result if the still is used with a flammable liquid. “Caution: Hot Surface. Avoid Contact.” ▲

**Note** During the procedures listed below, check all connections for leaks and tighten as required. ▲

**Note** The cooling water inlet and throttling valves are shown in dotted lines. If these were not purchased with the still, they must be installed in the cooling water inlet line by the customer to ensure proper operation. ▲

**Caution** Ensure that the water level in the evaporator is above the heating elements before turning on the still. The heaters are the immersion type and will burn out if operated in air. The water level should be safe when water issues steadily from the deconcentrator valve. ▲

**Note** Ideally, the temperature of the steam and gases escaping the vent should be 70°C or higher. To measure the vent temperature, use a thermocouple probe, such as the Thermo Scientific PM20700 Digital Pyrometer, inserted into the vent. ▲

**Note** Circuit breaker on side of Control Cabinet will shut down power to the control section and still power. ▲

## Initial Operation

The first time the still is operated, or after cleaning, set the Still Control Box “ON/OFF” switch to ON position, open the manual drain valve and operate the still according to the basic still operating instructions. The lighted switch will remain lit as long as the switch is in the ON position. The “Still On” (amber) lamp will light when the water in the evaporator makes contact with the probe. The still is started and stopped with the “ON/OFF” control switch.

## Deconcentrator Adjustment

The function of the deconcentrator is to maintain a minimum concentration of dissolved impurities in the evaporator, thus reducing scale formation and tendency to foam to a minimum. The deconcentrator is adjusted as follows:

1. **Permanent Hard Water or Softened Water** (Softened feed is not recommended). The deconcentrator valve should be left open at all times to bleed water from the evaporator at approximately 1½ times the capacity of the still. This valve should be left open permanently at the required setting. Care should be exercised to see that it is never clogged. The valve should be inspected periodically and if required, disassembled and cleaned with a brush or scraper.
2. **Temporary Hard Water.** If the feedwater to the evaporator is high in temporary hardness, i.e., high in bicarbonates, the deconcentrator valve should be closed. The reason for this is that bicarbonates in solution tend to precipitate out at temperatures exceeding 150°F. With the deconcentrator valve opened, a larger quantity of feedwater passes through the evaporator, precipitating out bicarbonates, increasing the amount of scale formed. Keeping the temperature to 150° and deconcentrator valve closed will result in an increased concentration of solids in the evaporator as time goes on, thus creating a tendency to foam. This condition is corrected by draining the still through the drain valve at frequent intervals.
3. **Demineralized Water.** When demineralized water is used as feedwater, the deconcentrator valve may be kept closed.

## Stills with Optional FAC Controls

**Starting** - Start the still as follows:

1. Open the drain valve.
2. Open the deconcentrator valve slightly, if not adjusted.
3. Open the cooling water inlet valve (one full turn).
4. Turn on the circuit breaker and control ON/OFF switch. As long as the control "ON/OFF" switch is in the ON position, the still will start and stop automatically, depending on the stored distilled water distribution requirements and the operating cycle of the interval drain timer. To stop the still, set the control "ON/OFF" switch to the OFF position. When this is done, the inlet water will stop and the still will drain automatically.
5. If necessary, adjust the cooling water throttling valve until a puff of steam issues from the condenser vent.

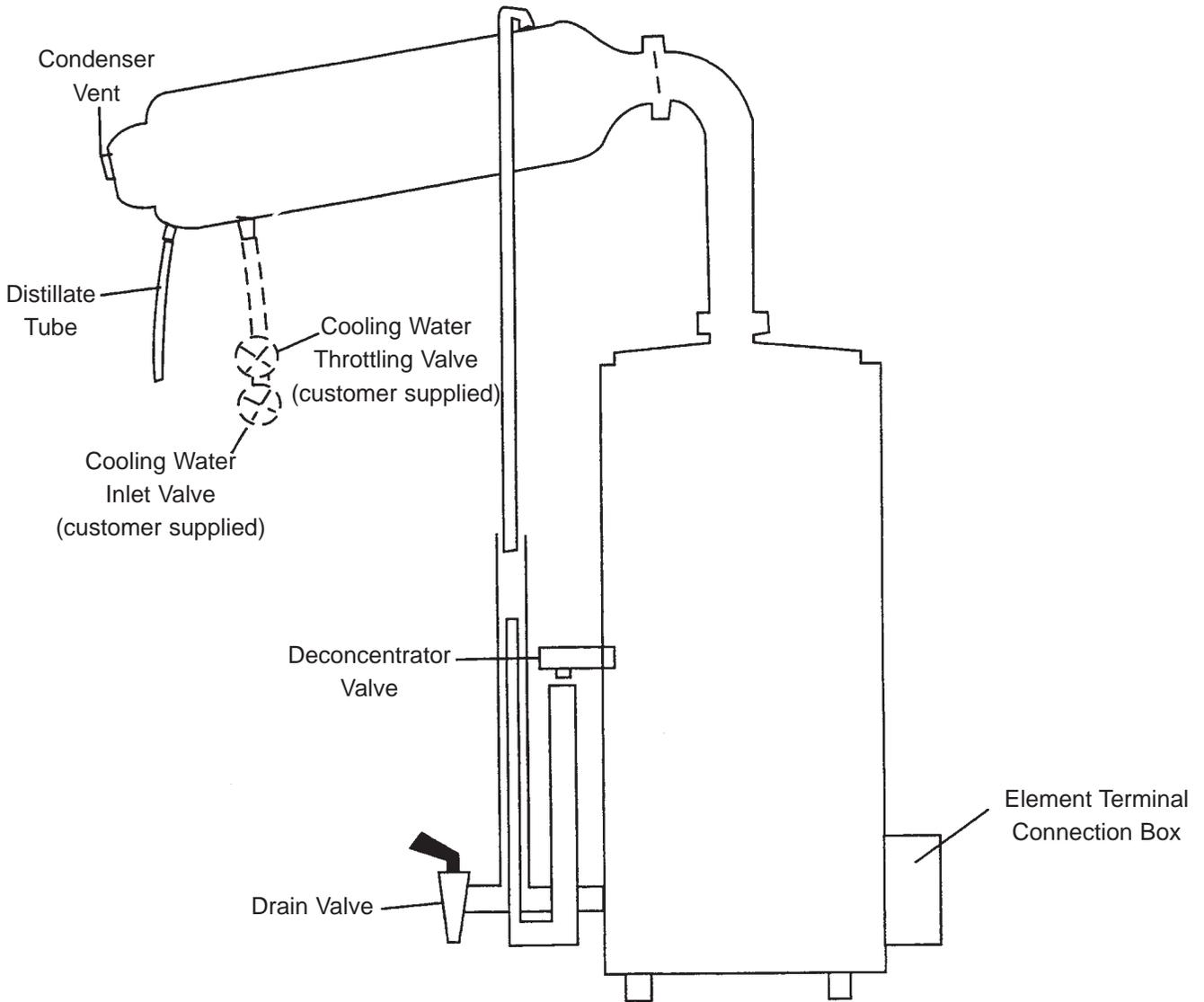
**Stopping** - Stop the still as follows:

1. Shut off the control ON/OFF switch to the OFF position.
2. The cooling water inlet valve will close.
3. The drain valve will open and let the still (boiler) drain completely.

**Note** Ideally, the temperature of the steam and gases escaping the vent should be 70°C or higher. To measure the vent temperature, use a thermocouple probe, such as the Thermo Scientific PM20700 Digital Pyrometer, inserted into the vent. ▲

**Note** Do not change the setting of the cooling water throttling valve and deconcentrator valve. ▲

## Still Diagram without FAC Controls



**Figure 5-1.** Operating Controls

**Note** Valves shown in dotted lines must be supplied and installed by customer. Available as optional equipment, (FAC Controls). ▲

## Section 6 Maintenance and Servicing

Cleaning requirements fall into two classes, scale removal and biological cleaning. Scale removal may be accomplished chemically or mechanically. Biological cleaning is accomplished with an isopropyl alcohol solution. For best results, all solutions and water should be heated. But you do not want to bring water to boil. The various methods of cleaning are described below:

**Soft Scale Removal.** Soft scale may be removed with a stiff bristle brush. After cleaning, all scale particles should be flushed out with water.

**Hard Scale Removal.** Hard scale may be removed by using a 10% solution of inhibited HCl. This acid cleaner is available commercially or may be prepared using 20 parts water and 6 parts 30% HCl. When using the acid, do not allow the acid to remain in contact with the part for more than 20 minutes. Flush the part thoroughly after using the acid cleaner. A 5% Sodium Bicarbonate solution may be used to remove any acid left on the part.

**Note** If desired, 10% solutions of sulfamic or acetic acids may be used instead of the HCl. Sulfamic and acetic acids have an advantage over hydrochloric acid in that they will not corrode the metal parts being cleaned. Under no circumstances should any concentrated acid be allowed to come in contact with tinned surfaces. ▲

**Warning** Always wear protective clothing and eye shields when handling acid. Disconnect from the power supply prior to maintenance and servicing. Refer servicing to qualified personnel. ▲

**Organic Scale and Sludge Removal.** If the scale has a dark brown or black color, it may be formed from organic impurities present in the feedwater. This type of scale may be removed with a strong detergent solution. The detergent solution should be allowed to be in contact with the scale or sludge for 24 hours. Rinse off the parts with water after cleaning.

**Silica Scale Removal.** Silica scale is usually clear and shiny and hard to detect visually. It is very hard and cannot be removed with an acid solution. Silica scale formation can be reduced by controlling the quality of the feedwater by routing it through a mixed bed deionizer. It is best removed with a blunt instrument.

**Biological Cleaning.** Biological cleaning is used on the parts that come in contact with the distillate (such as, the distilled water side of the condenser, or the distilled water transmission tubing) to remove any biological contamination from the affected part. This may be accomplished as follows:

1. Immerse the part in an isopropyl alcohol or a mild detergent (not containing bleach) solution overnight. Do not rinse the part with water after cleaning. Drain parts before reassembly.
2. After the still is reassembled and has operated for 30 minutes to flush, reduce the cooling water flow rate with the cooling water throttling valve until steam issues from the condenser vent at least 12 inches. Operate the still in this manner for 30-60 minutes. Ventilate the room during this operation.

**Warning** Avoid splashing the isopropyl alcohol solution on open cuts. ▲

**Caution** Do not use chlorine bleach for biological cleaning. The chlorine will interact with and damage the tinned surfaces. ▲

## Disassembly for Cleaning

The frequency of cleaning will depend upon the purity of the water being used. For example, the evaporator should require infrequent cleaning if it is fed partially purified water; however, the cooling water side of the condenser will have to be cleaned at more frequent intervals due to the fact that raw water is flowing through it and it will scale up sooner. The still should be inspected at frequent intervals until cleaning intervals are determined. Disassemble, inspect, and clean the still as follows:

1. Shut off Main Power switch and drain the still.
2. Shut off the water supply to the still.
3. Remove the condenser from the still. Inspect the cooling water side of the condenser for scale and clean as required. If required, clean the distilled water side of the condenser as described under "Biological Cleaning."
4. Disassemble until the interior of the evaporator is visible. The evaporator cover, high purity chamber and QBaffle may be removed as a unit and the interior of the evaporator will be visible. Inspect the interior of the evaporator for scale. Remove as much scale as possible manually.

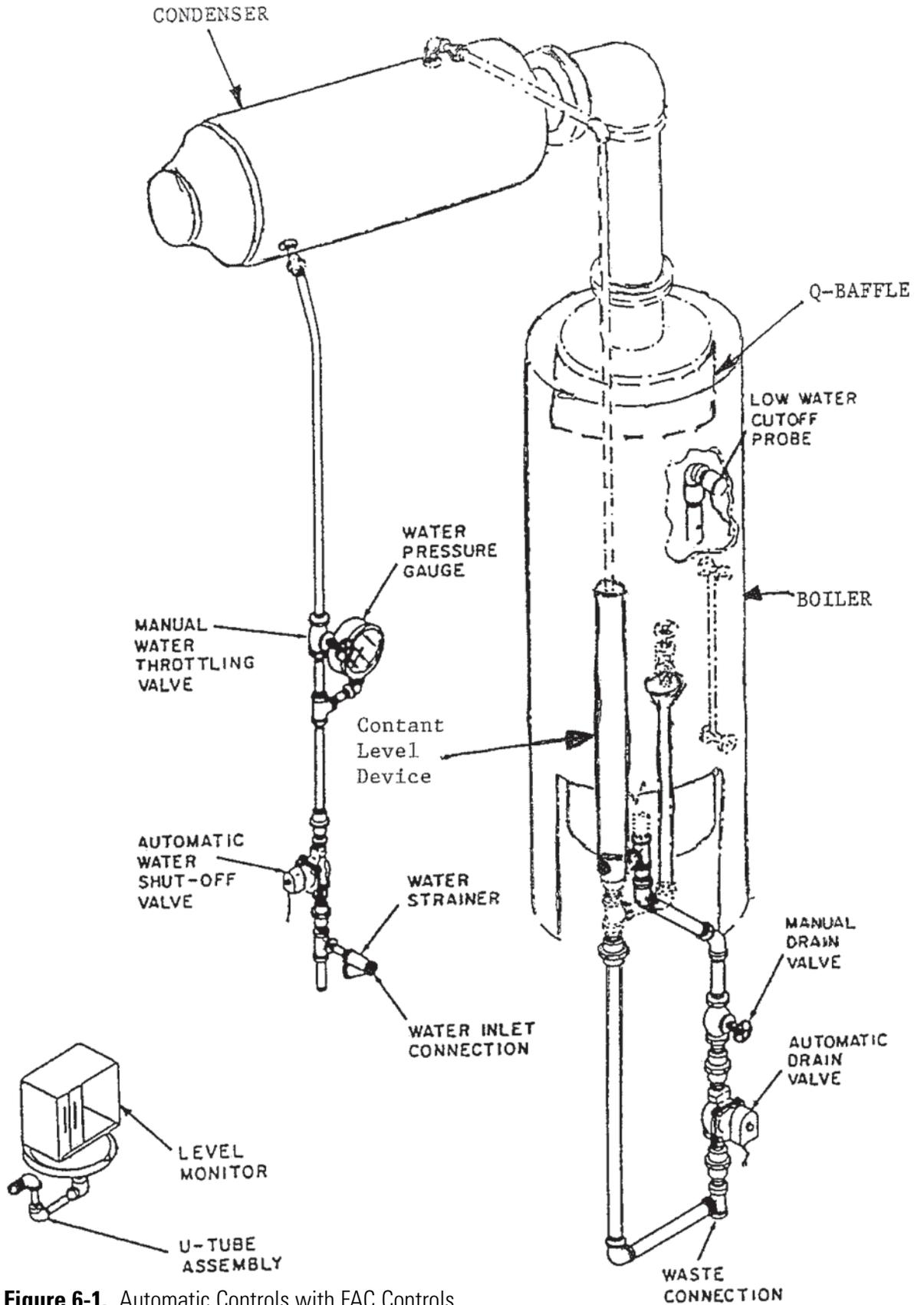
**Note** Stills equipped with a high purity chamber or preheater should not be cleaned with acid unless the high purity chamber can be removed. The fumes given off by the acid may damage the tin coating used in these accessories. ▲

## Disassembly for Cleaning (continued)

5. Disassemble the drain line and clean as required. Ensure that the drain line is clear (including the drain opening in the evaporator) before using detergent or acid cleaners. Reassemble the drain line.
6. Soft scale may be removed as described under “Soft Scale Removal.” Silica scale may be removed as described under “Silica Scale Removal.” To remove hard scale or organic scale, fill the evaporator with concentrated acid (see “Hard Scale Removal”) or detergent solution (see “Organic Scale and Sludge Removal”) or detergent solution (see “Organic Scale and Sludge Removal”) as required.
7. Inspect the constant level device and drain line. Clean as required.
8. If the still is equipped with a gauge glass, remove and clean the gauge glass cocks and gauge glass:
  - a. Unscrew the nuts that hold the gauge glass in place.
  - b. Lift the gauge glass up into the top gauge glass cock about 1/2 inch.
  - c. After the bottom of the gauge glass is clear of the bottom gauge glass cock, move it away from the still and remove it from the upper gauge glass cock.
  - d. Remove and clean the gauge glass cocks and clean the gauge glass.
9. Reassemble the still. Assembly is essentially the reverse of disassembly.
10. Connect the water, waste and distillate lines.
11. Start the still as described under “Initial Startup.”
12. Lower the cooling water flow rate (with the cooling water throttling valve) until steam spouts out of the condenser vent at least 12 inches. Operate in this manner for 30-60 minutes to sterilize and clean out the still.

**Caution** Ventilate the room during this operation. ▲

13. Adjust the still as described in “Initial Operation.”



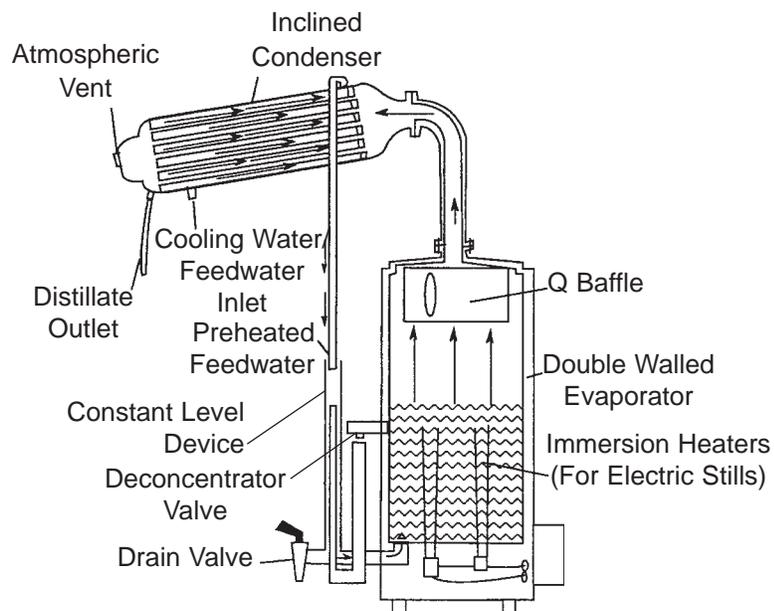
**Figure 6-1.** Automatic Controls with FAC Controls

## Section 7 Theory of Operation

The still consists primarily of a boiler or evaporator which holds the water during the evaporation process; electric heating elements of the immersion type inserted in the evaporator to boil the water; and a condenser which condenses the steam from the boiler to form the distillate.

The water to be purified enters the condenser where it is heated by the steam passing through the evaporator. The preheated water is fed to the evaporator as required by the constant level device which maintains the proper water level in the evaporator. An overflow connected to the drain is provided for the excess cooling water.

Water in the evaporator is vaporized by the electric heating elements. The steam passes up through the vapor pipe into the condenser where it is condensed to distilled water. The condenser is vented to atmosphere to eliminate the gaseous impurities. All stills are equipped with a deconcentrator and an extra high evaporator to permit operating a still from hard water supplies. The deconcentrator automatically maintains a minimum concentration of dissolved impurities in the evaporator, thus reducing to a minimum the scale formation and tendency to foam.



**Figure 7-1.** Component Locations



## Section 8 Troubleshooting

This section contains troubleshooting, testing and repair instructions. A troubleshooting chart is included to help the repair specialist find the difficulty quickly.

### Tests for Condenser Leaks

**Visual Test** - A simple test for condenser leaks may be performed as follows:

1. Shut off Main Power switch to the still heating elements.
2. Let the cooling water flow through the condenser until the condenser is cold.
3. Note whether there is a flow, even in drop quantities, from the distillate outlet. If there is a continuous flow, it is possible that there is a leak from the cooling water side to the distillate side. If this is the case, the condenser must be replaced.

**Pressure Test.** If a more positive test is required, proceed as follows:

1. Remove the condenser from the still.
2. Remove the cooling water discharge tubing. Plug the discharge connection on the condenser with a plug or stopper.
3. Attach a hose to the cooling water inlet connection on the condenser and apply about 5 PSI air pressure to condenser. Ensure that the plugs used to seal the condenser do not leak air.
4. Submerge the entire condenser in a tank of water.
5. If any air bubbles come from the condenser, replacement is necessary.

## Condenser Test for Scale

**Note** The condenser cannot be repaired and must be replaced as a unit. ▲

Test the cooling water side of the condenser for scale as follows:

1. Adjust the cooling water throttling valve so that just a puff of steam issues from the condenser vent.
  - a. In extreme cases of scale, steam will always blow from the condenser vent, even when the cooling water throttling valve is wide open.
  - b. Ensure that a minimum cooling water pressure of 30 psi is maintained. A drop in cooling water pressure will cause steam to blow from the condenser because of inadequate cooling.
2. Remove the condenser if the discharge pipe is cool enough to hold. Inspect the interior of the condenser for scale. If scale is present, pour the acid cleaning solution (see “Hard Scale Removal”) into the condenser through one of the cooling water connections.

**Caution** Do not add the acid cleaning solution rapidly for if any bicarbonate scale is present, gas will be released in considerable amounts. Do not use the acid cleaning solution on the tinned (Distilled Water) side of the condenser. ▲

3. Let the solution remain in the condenser for 15-20 minutes, then drain. Repeat if necessary until scale is removed.
4. Wash the interior of the condenser thoroughly after using acid solution.
5. Install the condenser on the still.

## Heating Element Test and Replacement

**Warning** To avoid electrical shock, this product must be disconnected from the power supply prior to performing the following maintenance and servicing. ▲

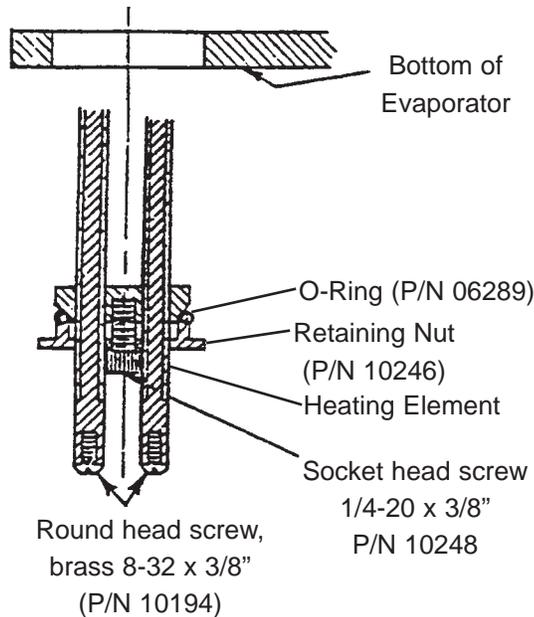
Whenever a heating element is suspected of not operating properly, test and if necessary, replace the heating element as follows:

1. Shut off Main Power switch to the still. Close the water supply valves to the still. Open the drain valve and let the still drain completely.
2. Disconnect the electrical supply to the still control box.
3. Remove the bottom plate from the still evaporator. Disconnect the electrical leads and bus bars from the heating element terminals. Tag the leads to facilitate reassembly.
4. To test each heating element for open circuit, disconnect one lead to each element, one element at a time. Use a ohm meter to test the resistance of each element. If you register resistance (approx. 10-20 ohm) the element is good. If you show no resistance value at all, the element is defective in series with the applied current. If the test light does not light, the heating element is burned out. Mark all damaged heating elements.
5. To test each heating element for short circuit, connect one test lead to the boiler bottom and the other to each terminal (one at a time). If the heating element is short circuited, the ohm meter will show resistance. Mark all damaged heating elements.
6. Remove the evaporator cover from the still and inspect the heating elements from the inside of the evaporator. Warped or split elements should be replaced.
7. To remove an inoperative or damaged heater, loosen the screw under the heater and push out the heater. If the heater is badly scaled, remove the retaining nut and rock the heater back and forth (from inside the evaporator) to break the scale.
8. Install a new heater in place of the old heater. Tighten the screw only enough to hold the heater in place. This will allow you to rotate the heater when installing the bus bars.
9. Install the bus bars and wiring between heater terminals. Retighten the heater retaining screws to eliminate the possibility of leakage.
10. Add water to the evaporator and ensure that none of the heating elements are leaking.
11. Reassemble the still and connect the electrical service.

# Heating Elements

Listed below are the heating elements available. The heating elements now have compression nuts. These are directly interchangeable with the older threaded types. Heating elements are shipped complete as shown in Figure 8-1.

Still Catalog No. (Capacity)	Heater Catalog No.	Heater Wattage	Heater Type	Qty Required
A1011 (1 GPH)	07031	650	U	4
A1013 (2 GPH)	07033	1000	Y	6
A1015 (5 GPH)	07029	2160	P	6
A1016 (10 GPH)	07028	2160	O	12



**Figure 8-1.** Heating Element Replacement

**Note** Heater replacement data stamped inside still junction box cover. ▲

**Note** Replacement heating elements are furnished with O-ring, retaining nut, socket head screw and two round head screws. These parts are listed in the event that only these parts need replacement. ▲

Tee handle wrench (P/N 06287) available for removing socket head screw. May be ordered with replacement heating elements.

Symptom	Probable Cause	Test and Remedy
Drop in purity.	Dirty still.	Inspect evaporator for scale, clean as required.
	Volatile impurities in feedwater.	Test distillate for CO <sub>2</sub> , NH <sub>3</sub> , etc. Reduce cooling water flow to help eliminate volatiles from condenser.
Pyrogenic or organic contamination of distillate.	Dirty still.	Inspect evaporator for excess scale, clean as required.
	Leak in condenser.	Test condenser for leaks or replace as required.
Drop in distillate capacity.	Bacteriological growth in distilled water.	Inspect the suspected parts. Clean with alcohol if required. (See "Biological Cleaning.")
	Excess scale on heating unit.	Inspect and clean as required.
	Low voltage.	Check voltage. If less than specified in wiring diagram, notify electrician.
	Leak in drain valve.	Ensure drain valve is closed and not leaking.
	Damaged inoperative heaters.	Check wiring, connections, etc. Test heaters and replace if necessary.
Steam blowing from condenser.	Low cooling water flow rate.	Readjust throttling valve.
	Low cooling water pressure.	Check cooling water pressure. Should be at least 30 psi.
	Excess scale in condenser.	Inspect condenser for scale.
	High voltage.	Check voltage. If over the rated voltage, shut down still immediately. Notify electrician.
Water blowing from condenser.	Condenser leak.	Test condenser for leaks. Repair or replace as required.
	Trapped distillate line.	Inspect distillate lines for any restrictions or trapping.
	High concentration of solids in evaporator.	Ensure deconcentrator is adjusted properly and drain still more often.
Still starts but will not produce distillate.	No electrical power to heater circuit.	Check power to control box.
		Check contactor points and replace if badly burned.
		Check that low water cutoff probe is properly installed in accordance with instructions.
		Check thermal cutoff.

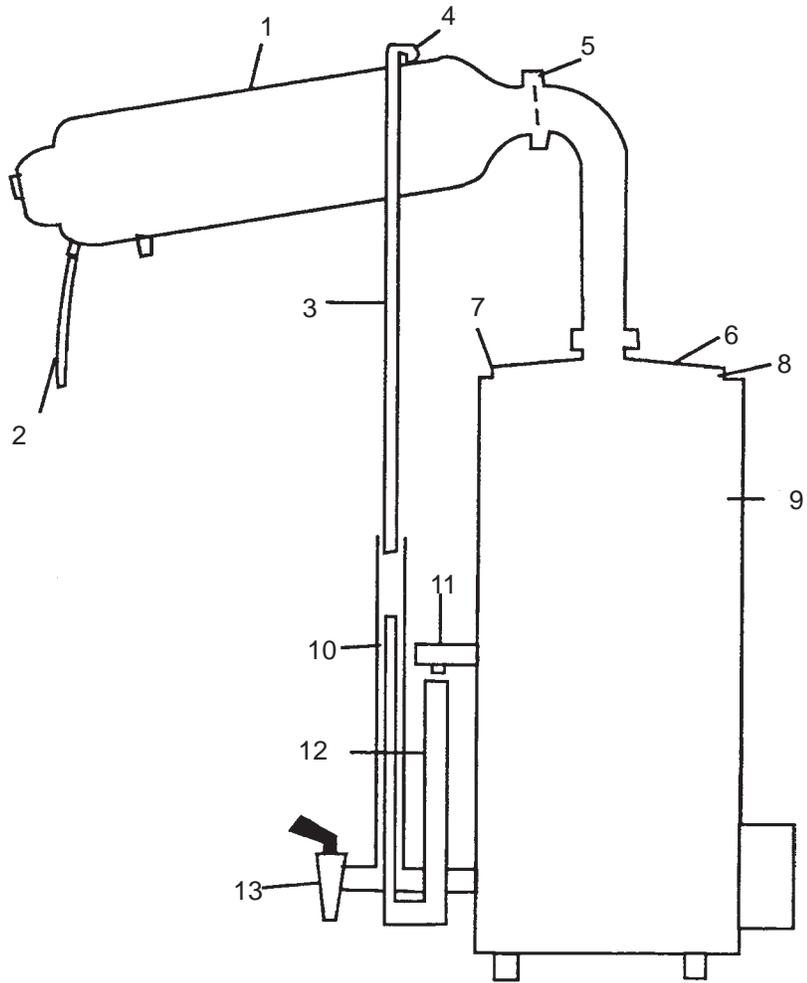


## Section 9 Parts List

Index No.	Description	A1011 (1 GPH)	A1013 (2 GPH)	A1015 (5 GPH)	A1016 (10 GPH)
1	Condenser	21058	21060	21062	21064BI
2	Distillate Delivery Tube	20622	20624	20624	21904BI (36")
	48" Distillate Delivery Tube W/O Adapter	20631	20633	20633	-----
	Distillate Tube Adapter (End) - Not Shown	01449	01450	01450	-----
3	Cooling Water Discharge Tube	21881	21882	21883	-----
4	Cooling Water Discharge Elbow	03702-DB	03702-DB	03426BI	03411
5	Vapor Pipe Gasket (A1016-X003 only)		-----	-----	21152
6	Evaporator Cover	21195	21197	21199	21535
7	Knurled Nut	03719BI	03719BI	03469-DB	03469-DB
8	Evaporator Cover Gasket	06271	06271	06272	06272
9	Evaporator	21123	21127	21131BI	21300
10	Constant Level Device	21320	21321	21167	21301
11	Deconcentrator Valve	21272	21272	21043	21043
12	Deconcentrator Funnel	21281	21282	21041	21619
13	Drain Valve	02096	02096	02096	03506BI
	Heating Elements (See Note 1) (Not Shown)	07031	07033	07029	07028
	Q Baffle (Not Shown)	G1650	G1650	G1651	G1651
	Thermal fuse	FZ2112X1	FZ2112X1	FZ2112X1	FZ2112X1

\* Refer to Figure 9-1

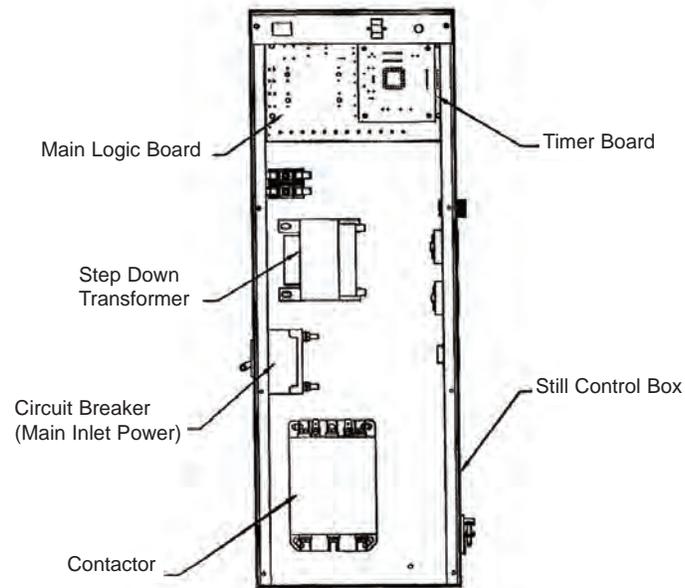
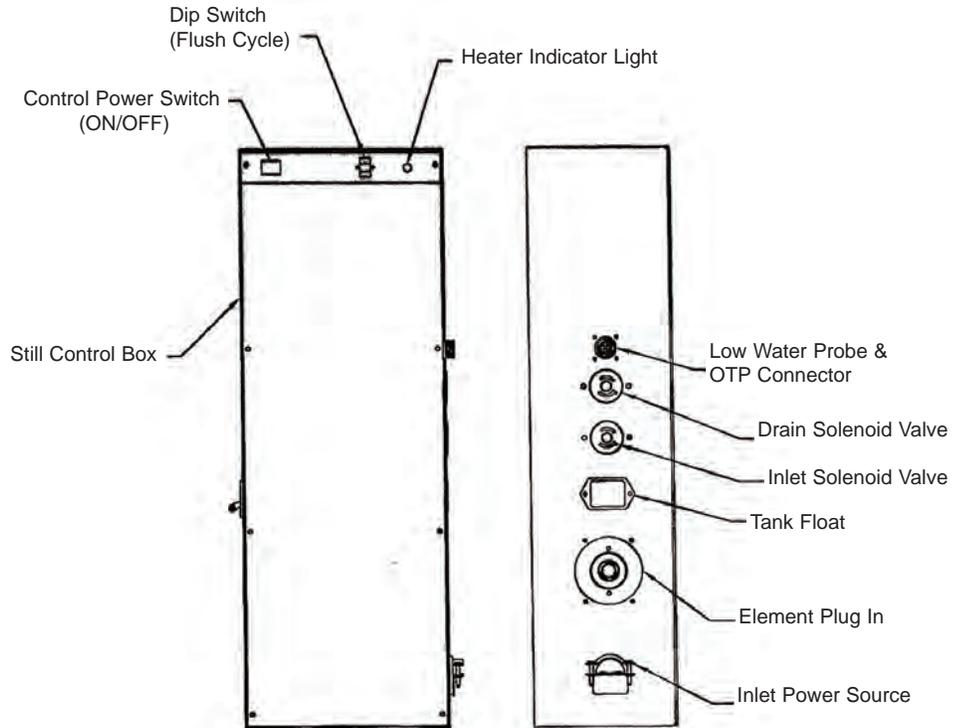
**Section 9**  
Parts List



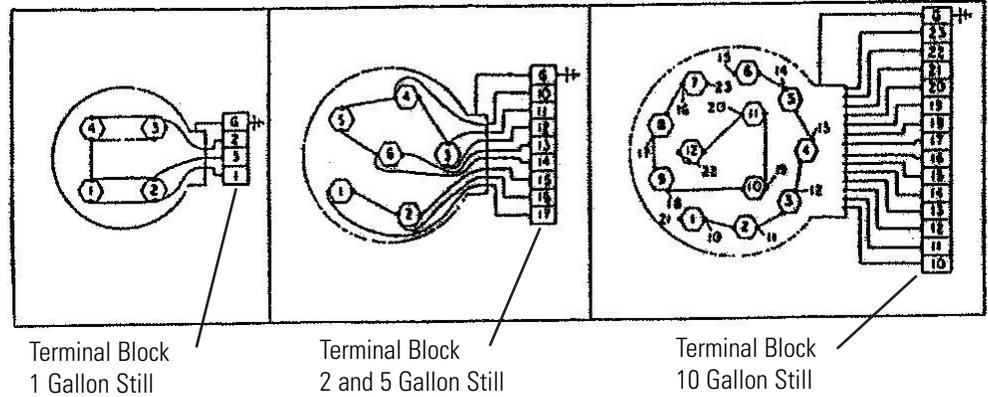
**Figure 9-1.** Heating Element Replacement

**Note** For more details on heating elements, refer to “Heating Element Replacement”. ▲

Other Parts Not Illustrated	Part No.	
	(1-2 GPH)	(5-10 GPH)
Gauge Glass Cocks	-----	02002
Gauge Glass	-----	06038
O-Rings (Gauge Glass)	-----	06041



**Figure 9-2.** Still Box Connection Locations



**Figure 9-3.** Terminal Block Connections

Catalog No.	Qty. & Type of Element	Voltage	Wattage	Total Watts
A1011	4 Type U	120	650	2600
A1013	6 Type Y	120	1000	6000
A1015	6 Type P	120	2160	13000
A1016	12 Type O	120	2160	26000

**Notes**

1. Heater life may be reduced when operated above maximum stated voltage. Operation of still at a voltage less than the above stated voltages will cause a drop in still output.
2. Customer external connections and circuit protection must be capable of carrying the full load current in accordance with the national electrical code and local practice.
3. Still evaporator must be grounded.
4. O denotes terminal in junction box.
5. At 208 volts, the output is reduced by 25% of rated capacity. Special heaters for 208 volts are needed to obtain rated still output.
6. This nonstandard voltage will cause a 16% drop in still output capacity in a standard still. Special heaters may be ordered as an option to achieve rated capacity.

# Flow Automatic Controls

Allows for completely unattended 24-hour operation when still is attached to tank. Adjustable drain timer/cycler 2-, 4-, 8- or 16- hour drain allows reduced still cleaning frequency.

Model No.	Where Use
G2100	1 and 2 GPH, 1 phase still
G2101	2 GPH, 3 phase still
G2110	5 GPH, 1 and 3 phase still
G2125	10 GPH, 3 phase still

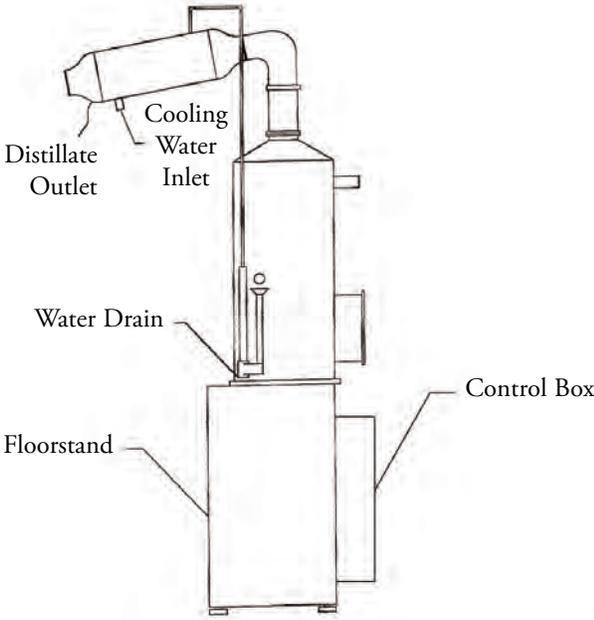


Figure 9-4. Steam Still on Floor Stand

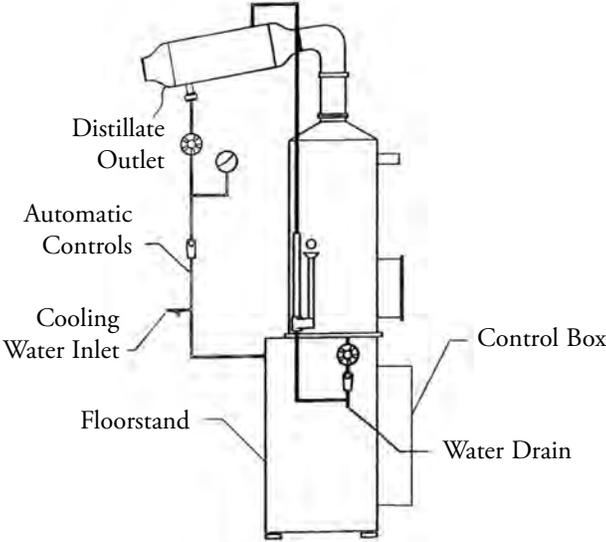
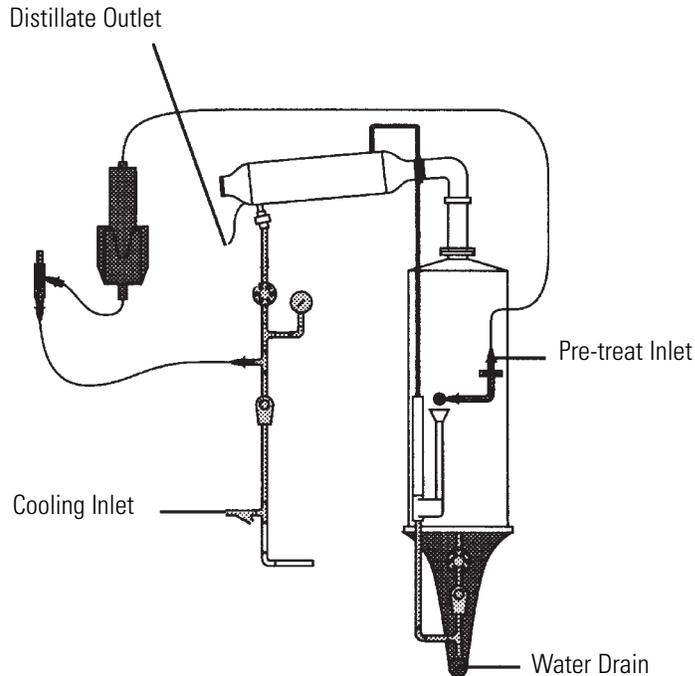


Figure 9-5. Steam Still with Automatic Controls mounted on Floor Stand

## Cartridge Pretreatment Kit



**Figure 9-6.** Pre-treated Cartridge Kit for 1 and 2 GPH Electric Stills with Automatic Controls, Mounted on Wall Bracket

**Note** Recommend sending in a water sample before you purchase this optional Pretreatment Kit, in order to check the quality of the inlet water, to determine cartridge life. ▲

The pretreatment kit removes scale-forming impurities from the feedwater to the still evaporator (boiler) while improving the distillate purity. Each pretreatment kit has a scale eliminator cartridge, Cat. No. D8921, containing ion-exchange resin to remove scale-forming impurities and activated carbon to remove chlorine and volatile organic impurities. The capacity of the cartridge is 750 grains as NaCl.

Model No.	Description
G3628	Cartridge Pre-treatment Kit for 1 and 2 GPH Stills (Includes 1 cartridge)
D8921	Extra Pre-treatment Cartridge

Enclosed in this package: Holder for wall mounting the cartridge, a flow meter for regulating the water flow through the cartridge, and the necessary piping and tubing to connect the scale eliminator cartridge to the still. For use with 1 and 2 GPH Classic Stills only.

## Section 10 Accessories for Electric Stills

Accessory	A1011	A1013	A1015	A1016
Pretreatment Kit	G3628	G3628		
	D8921	D8921		
Fully Automatic Control	G2100	G2100	G2110	G2125

### Tin-Coated Vertical Cyl. Storage Tanks

Accessory	A1011	A1013	A1015	A1016
10 Gallon Cylindrical Storage Tank	B3043	B3043	B3043	B3043
Floorstand	H1000	H1000	H1000	H1000
25 Gallon Cylindrical Storage Tank	B3045	B3045	B3045	B3045
Floorstand	H1001	H1001	H1001	H1001
50 Gallon Cylindrical Storage Tank	B3046	B3046	B3046	B3046
Floorstand	H1002	H1002	H1002	H1002
100 Gallon Cylindrical Storage Tank	B3047	B3047	B3047	B3047
Floorstand	H1003	H1003	H1003	H1003
200 Gallon Cylindrical Storage Tank	B3049	B3049	B3049	B3049
Floorstand	H3230	H3230	H3230	H3230

### Accessories Cylinder Storage Tanks

Accessory	A1011	A1013	A1015	A1016
Ventgard	H3120	H3120	H3120	H3120
Water Seal	H3130	H3130	H3130	H3130
Ventgard and Water Seal	H3111	H3111	H3111	H3111
Replacement Filter for Ventgard	25001-DB	25001-DB	25001-DB	25001-DB
Ultraviolet Lamp	H4005	H4005	H4005	H4005
Replacement UV for Lamp	04141	04141	04141	04141

## Section 10

Accessories for Electric Stills

# Ordering Procedures

Refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

All parts listed herein may be ordered from the Thermo Scientific dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed, check first with your dealer. If the dealer cannot process your request, then contact our Technical Services Department.

Prior to returning any materials, contact our Technical Services Department for a "Return Materials Authorization" number (RMA). Material returned without an RMA number will be refused.

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