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LIST OF ILLUSTRATIONS

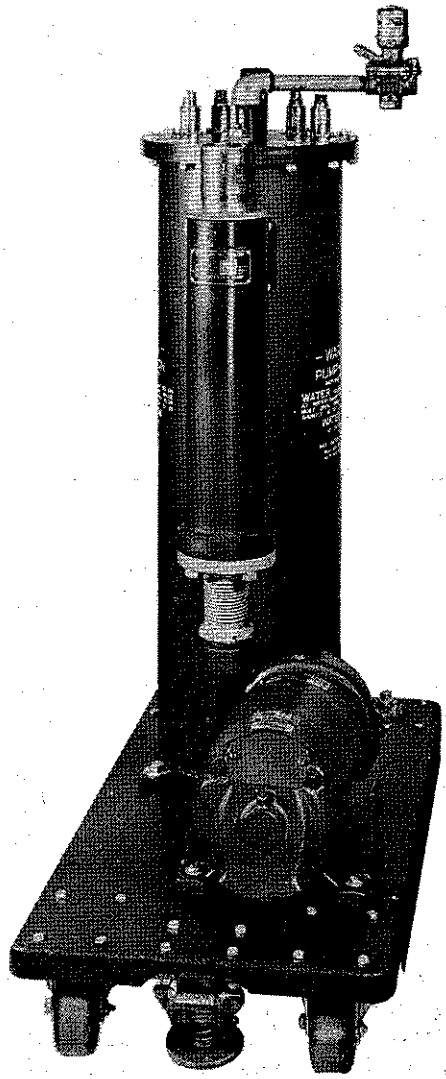

Figure 1. Model 502-H R-F Load

TECHNICAL SUMMARY

ELECTRICAL SPECIFICATIONS

Power Rating (Average) . . . . . 25 kw (5000 feet max. elevation)
R-F Input Impedance . . . . . 51.5 ohms (3-1/8 inch coaxial line)
Frequency Range . . . . . 108 - 216 mc
A-C Power Input . . . . . 60-cycle, one-phase, 1.125 kw
Ambient Air Temperature
Maximum . . . . . 45 degrees C
Minimum . . . . . 15 degrees C

MECHANICAL SPECIFICATIONS

Mounting . . . . . floor (fixed or portable)
Water Required . . . . . 10 gpm (30 degrees C max.)
Water Connections
Inlet . . . . . 3/4-inch std. pipe
Outlet . . . . . 1-1/4-inch std. pipe
Dielectric Cooling Fluid Capacity - Dowtherm A . . . . . 18 gallons
Weight . . . . . 750 pounds
Dimensions . . . . . See Figure 2
Width Clearance . . . . . 24 inches
Vent Plug . . . . . Fully disengage thread before operating unit
Thermoswitches . . . . . 5 amp. max. in-rush at 220 volts

EQUIPMENT

The components of the Model 502-H Radio Frequency Load are listed in the following tabulation:

Quantity	Description
1	Heat Exchanger
1	R-F Load Unit Assembly
1	Coupling
1	Water Saver Valve

DESCRIPTION

The Bird Electronic Model 502-H 25-KW R-F Load, Figure 1, is a termination-type unit and is supplied for operation in the 108 to 216 mc frequency range.

A special film resistor, arranged as the center conductor of a tapered coaxial line to give an almost reflectionless termination, is used as the load resistance. The r-f power is converted to heat and dissipated through a water cooling system.

The R-F Load consists of the load resistor, an intermediate coolant, a heat exchanger (cooling coil), and a motor-driven pump assembly which are mounted on a wheeled truck.

Two upright steel cylinders, which are joined at the top through a conduit and at the bottom through a motor-driven centrifugal pump, house the load resistor, the intermediate coolant, and the cooling coil. See Figure 3, Installation Schematic. The smaller cylinder contains the load resistor surrounded by the coolant and the larger cylinder contains the cooling coil which is also immersed in the circulating coolant.

Housed in the lower end of a length of transmission line which projects through a teflon seal located at the top of the smaller steel cylinder is the load resistor. The outer conductor of the transmission line is exponentially tapered down about the resistor to provide a reduction of surge impedance directly proportional to distance. Thus at the high end of the resistor the characteristic impedance is 51.5 ohms. Halfway down the resistor, the impedance is 25.75 ohms to compensate for the resistance already passed over. At the low end of the resistor, the transmission line outer conductor joins the inner. The teflon seal at the top of the cylinder provides both mechanical support for the transmission line inner conductor and a seal against coolant leakage.

The intermediate coolant, which has been chosen for chemical inactivity to prevent damage to the resistor, carries heat away from the resistor and provides a uniform dielectric constant for the transmission line. With r-f power applied, the coolant is heated by the resistor. The motor-driven circulating pump causes the coolant to rise past the resistor and enter the heat exchanger through the conduit. At the same time, the lower temperature coolant in the heat exchanger is forced to the bottom of the larger cylinder, into the pump, and up past the resistor.

The cooling coil is a helix of finned copper tubing. The cooling water is made to flow through the helix where it picks up and carries off heat from the intermediate coolant.

A 115/230-volt a-c motor with a self-contained thermal overload switch is used to drive the circulating pump. The Model 502-H is equipped with a 60-cycle motor.

As mentioned previously, water carries off the heat from the r-f energy flowing into the load. The lower the inlet temperature of the water, the more heat it can dissipate. As the power and water temperature inputs to the load vary, the actual water requirement of the load varies.

The water saver valve will minimize water flow into the cooling coil. It is controlled by the water saver thermoswitch which is located at the top of the large steel cylinder. In this manner, the water will flow only when the intermediate coolant temperature reaches a certain maximum limit. Thus, the water flow is automatically cut off when the load is not in operation. Power for the water saver valve should be available when the power is on at the transmitter.

In operation, the water saver valve solenoid is energized when the water saver thermoswitch closes. The solenoid opens a small pilot valve which admits full line water pressure to a spring-loaded diaphragm. The pressure exerted on the diaphragm actuates the main valve allowing water to flow into the load. Upon de-energization of the coil, the pilot valve closes, the pressure over the diaphragm dissipates into the low pressure (outlet) water line, and the spring closes the main valve stopping the flow of water into the load.

In addition to the water saver thermoswitch, an over temperature thermoswitch and an under temperature thermoswitch are also located at the top of the larger steel cylinder. Both of these switches should be connected in series with the transmitter interlock circuit, or if desired, to an auxiliary aural alarm system. The latter method will prevent the disablement of the transmitter during actual operation on the air in cases where the r-f load is stored in a location that is cool enough to cause the under temperature thermoswitch to open.

The over temperature switch, when properly connected, will prevent an excessive rise of the intermediate coolant temperature and thereby preclude any damage to the resistor element.

The under temperature thermoswitch, which should be connected in a manner similar to the over temperature switch, will prevent the application of r-f power if the coolant temperature is below 15 degrees C (59 degrees F). Since the coolant possesses the property of a high boiling point, it also has a correspondingly high freezing temperature. If the coolant were congealed, circulation of the coolant would not be possible and heat would not be carried away from the load resistor.

An additional heater control thermoswitch is located at the top of the larger steel cylinder. This control is intended for use in conjunction with an external heating element, and will close if the temperature of the coolant should drop below 19 degrees C (69 degrees F); thus permitting a circuit hookup which will prevent freezing of the intermediate coolant. However, a heater element should not be installed unless abnormally low ambient temperatures are anticipated.

INSTALLATION

The unit may be used in both fixed and portable applications. For use as a portable unit, a truck lock is mounted on the underside of the transport to keep the unit fixed while connected in the transmission system. Holes, 5/8-inch in diameter, are provided in the transport for fixed floor mounting.

Refer to the outline drawing Figure 2 and the installation schematic Figure 3 and proceed as follows:

1. Place the unit in the proper location.

2. Connect the water drain pipe to a convenient drainage. Use 1-1/4-inch standard pipe or hose.

3. Connect the water saver valve to the horizontal pipe on top of the heat exchanger. Make this connection on the outlet side of the water saver valve (side in direction of arrow head on valve body). To screw the valve on the pipe, use a wrench on the valve ends. Do not use the solenoid cover as a lever. The valve should be installed in a vertical position with the solenoid cover uppermost.

4. Connect the water inlet pipe to a water source capable of delivering 10 gallons per minute. Use 3/4-inch standard pipe or hose to make this connection.

If the required source of water flow is not available from local water lines, a closed circuit system utilizing a water tank and an external circulating pump can be employed. For calculating purposes, the water pressure drop through the load at a water flow rate of 10 gallons per minute is 0.2 pound.

It is desirable to maintain the temperature of the water in the tank at 15 to 20 degrees centigrade as the water flow requirement decreases with lower water inlet temperatures. For example, a 15-kw power dissipation requires approximately 67 degree centigrade gallons per minute. For a water inlet temperature of 35 degrees C (permitting a 10-degree temperature rise since the water saver valve opens at 45 degrees C), a water flow of 6.7 gallons per minute is required whereas with a water inlet temperature of 25 degrees C (permitting a 20-degree temperature rise), a water flow of 3.3 gallons per minute is required. The temperature-differential and water-flow figure given in this paragraph includes a safety factor of approximately 15 percent.

The information in the preceding paragraph was computed using the following formula:

$$P = 0.263 (T_1 - T_2) F$$

where P = Power in load in kilowatts
T_1 = Outlet water temperature
T_2 = Inlet water temperature
F = Water flow in gallons per minute

Note: When computing the temperature-differential water-flow figure, multiply known value of input power to load by 1.15 to obtain 15 percent safety factor.

5. Make the electrical connections to the unit.

   a. The over temperature and under temperature switches should be connected in series with the transmitter interlock circuit.

   b. Connect one terminal of the water saver switch to one side of a 115-volt 60-cycle line. The other terminal on the switch should be connected to one of the water saver solenoid leads. The other solenoid lead should then be connected to the other side of the 115-volt line. The 115-volt line should be energized whenever the transmitter filament circuits are energized.

      If only a 230-volt supply is available, a 115-volt source to operate the water saver may be obtained from the yellow and black (red tracer) leads in the pump motor.

c. Connect the pump motor to a 115/230-volt 60-cycle power supply in such a manner as to insure pump operation prior to the application of r-f power. Follow the instructions on the motor nameplate.

6. Make the transmission line connection to the unit. Transmission line input is 3-1/8", 51.5 ohms VHF Swivel Flange (Communication Products Co. Cat. #100-506, or Equivalent).

7. Remove the vent plug (painted red) from the top of the dissipating unit. The unit is now ready for operation.

OPERATION

To place the unit in operation, the following procedure is recommended:

1. Make certain water pressure is on at the water saver valve.

2. Check the dielectric coolant level by removing the filler plug located on top of the power dissipating section. The coolant level must be within five inches of the filler-plug opening.

3. Ascertain that the coolant vent plug has been removed. This will allow the coolant to expand as the temperature increases.

4. Operate the pump switch to ON.

5. Apply r-f power. The water saver valve should open shortly after r-f power is applied to allow water to flow through the load. The valve will operate intermittently; the interval between each "on" period will depend on inlet water temperature and r-f power input to the load.

MAINTENANCE

The R-F Load will require little in the way of maintenance. Components located inside the dissipating unit are not subject to field maintenance.

The outside surfaces of the instrument should be wiped free of dust when necessary.

Keep the jacks and connector plugs clean to avoid inaccurate readings due to poor electrical contact.

The most likely source of damage to the equipment will be careless handling.

Accurate measurement of the d-c resistance between the inner and outer conductors of the line coupling section will provide a good check of the condition of the load resistor. For this measurement, use a resistance bridge with an accuracy of one percent or better at 50 ohms. When the load unit is at room temperature, the measured resistance should be within one ohm of the value stamped on the name plate.

Check the coolant level periodically. Replenish if necessary. Use only the coolant referenced in the parts list.

If the water saver valve should become inoperative and need cleaning, remove the bonnet from the valve, clean the passages with a wire, clean the strainer, and re-assemble.

If water hammer is noted as the water saver valve closes, remove the acorn nut protruding from the side of the valve body, loosen the check nut and tighten the leak-off stud until the hammer is eliminated. The check nut and leak-off stud are located under the acorn nut. Retighten the check nut and replace the acorn nut.

Lubricate the pump-motor bearings periodically by placing a small amount of grease in the grease cups on the motor. See tag attached to motor for type of lubricant required. Do not use oil to lubricate the motor and be careful not to overlubricate the motor.

REPLACEMENT PARTS

Service parts for this equipment should be obtained from:

Bird Electronic Corporation
1800 East 38 Street
Cleveland 14, Ohio

When ordering replacement parts, please give description and part number of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment.

ITEM NO.	DESCRIPTION	BIRD ELECTRONIC PART NUMBER
1	Pump, Motor Driven: 60-cycle; furnished with one load-flange gasket (Item 7), and one pump-flange gasket (Item 8)	502202
3	Pipe Assembly: flexible	502044
4	Seal Assembly, Pump-Shaft: includes seal, shaft, and seal-cap gasket	502047
5	Bearings, Motor: set of 2	502046
6	Brushes, Motor: set of 4	502048
7	Gasket, Load-Flange	502049
8	Gasket, Pump-Flange	502050
9	Caster, Fixed	502052
10	Caster, Swivel	502053
11	Truck Lock	502054
13	Assembly, Housing and Resistor; includes "O"-ring seal	502064
14	Assembly, Resistor only	502078
15	D-C Meter Cord only: 12 feet long	502203
16	Thermoswitch, Water Saver	502115
17	Thermoswitch, Under Temperature	502116
18	Thermoswitch, Over Temperature	502117
19	Thermoswitch, Heater Control	502118
20	Thermoswitch-Cover Assembly	502062
21	Coolant: one-gallon cans	502123
22	Filler and Vent-Plug Assembly	502100
23	Plug, Access	502103
24	Valve, Water Saver	502119

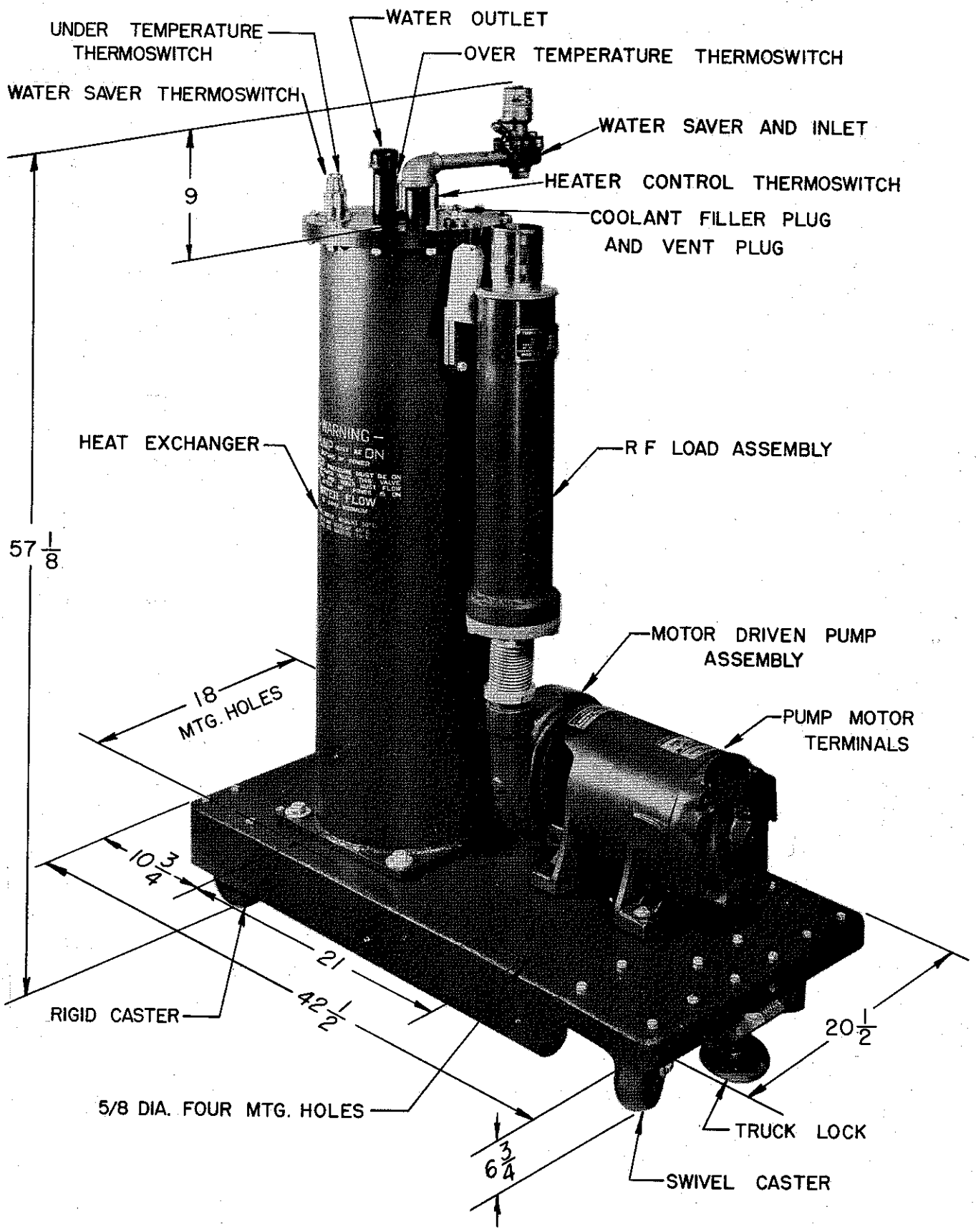

Figure 2. Outline Drawing, Model 502-H

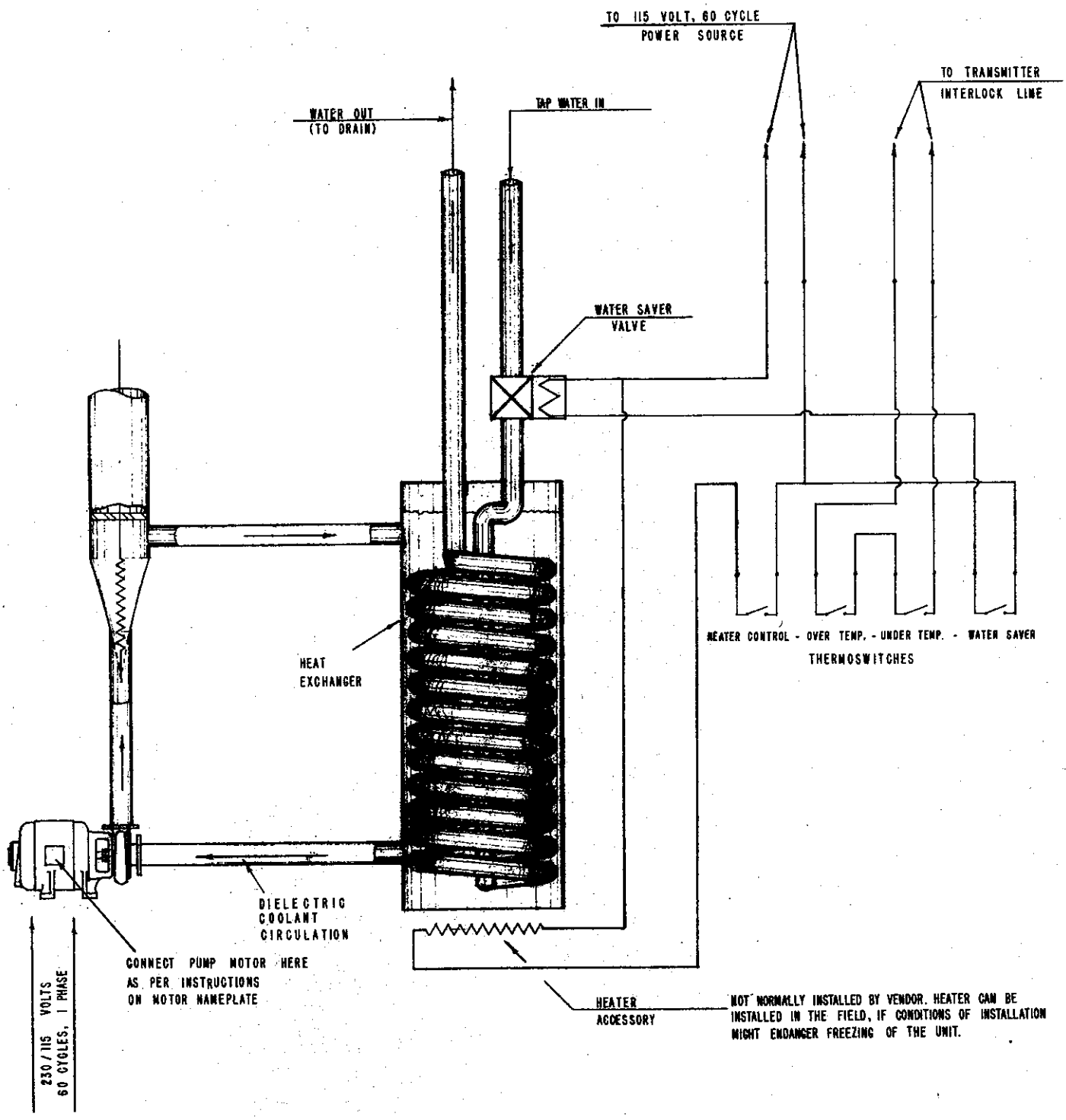

Figure 3. Installation Schematic, Model 502-H