

STERLCO TEMPERATURE CONTROL UNIT  
SERVICE AND INSTRUCTION MANUAL  
MODELS: S-6410-A

Engineered and manufactured by INDUSTRIAL CONTROL DIVISION  
STERLING, INC.  
5200 West Clinton Avenue, Milwaukee, Wisconsin 53223  
Manufacturers of Temperature Control Equipment Since 1916

## Please note that our address and phone information has changed. Please reference this page for updated contact information.



These manuals are obsolete and are provided only for their technical information, data and capacities. Portions of these manuals detailing procedures or precautions in the operation, inspection, maintenance and repair of the products may be inadequate, inaccurate, and/or incomplete and shouldn't be relied upon. Please contact the ACS Group for more current information about these manuals and their warnings and precautions.

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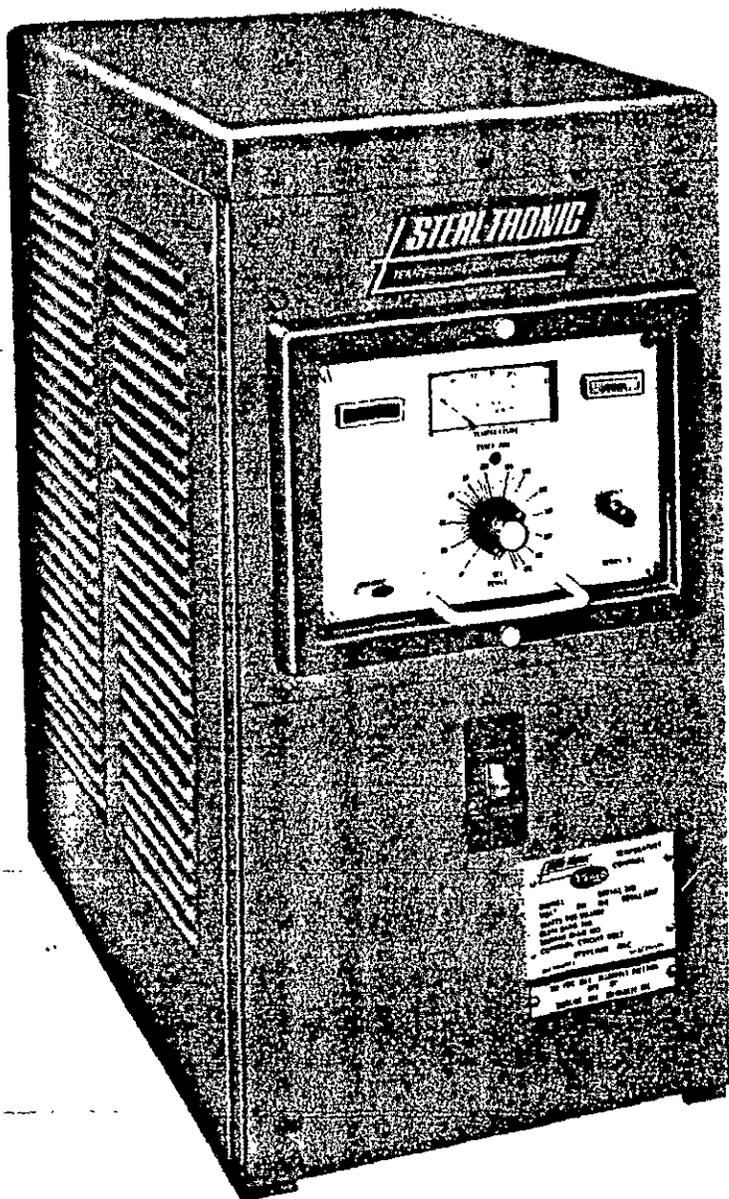
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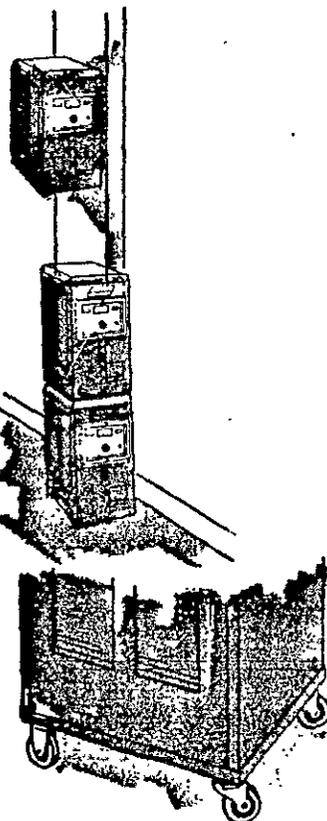


model S-6410



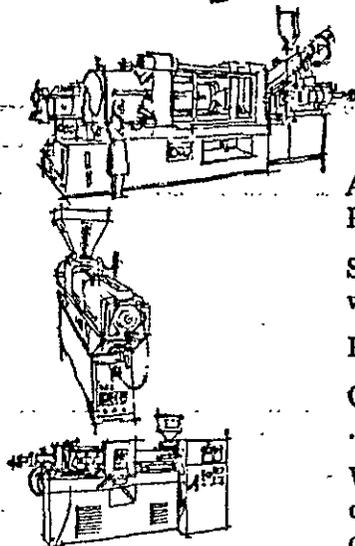
single zone  
temperature  
control unit

Easily mounted on  
post, wall or press  
... out of the way  
of aisle traffic.



Can be vertically  
stacked, two  
or three high.

Can be equipped  
with casters for  
portable use.



**ACCURATE, EFFICIENT WATER-CIRCULATING UNIT MAINTAINS PROPER PROCESS TEMPERATURE CONTROL.**

Small, compact... yet the Model S-6410 embodies all of the control features for which Sterlco units are famous.

**PILOT LIGHTS**—indicate heating or cooling.

**COMPLETE PROTECTION**—neat, compact cabinet keeps dirt and grime out ... assures protection for personnel and components.

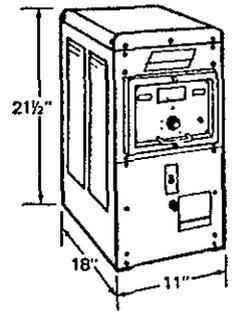
**WATER PROPORTIONING SYSTEM**—solid state control and dual sensing design assure accurate control of mold temperature ... even under adverse conditions.



# SPECIFICATIONS model S-6410

## SINGLE ZONE WATER-CIRCULATING UNIT

COMPACT CABINET PROTECTS ALL INSTRUMENTS & PARTS . . . PROVIDES EASY ACCESS TO CONTROLS . . . PERMITS INSTALLATION IN SMALL SPACES, OUT-OF-THE-WAY LOCATIONS



- Solid state thermostat with plug-in relays and adjustable dead-band.
- All controls on front panel.
- Large, easy-to-read dial and indicator.
- All pipe connections at rear for easy hook-up.
- Balanced electrical system with 3 phase heater . . . built to rigid standards.

HEATER	4500 watts—3 phase. Low watt density assures long life . . . proper heating characteristics for water. Heater is flange mounted for easy removal.
CONTROL	Outstanding solid state controller with dual probe sensing gives precise, reliable control through full 50-250°F (10-121°C) range. Calibrated in metric if desired.
PUMPING CAPACITY	15 GPM @ 20 lb. discharge pressure (57 L/M at 1.4 Kg/cm <sup>2</sup> ) . . . a true rating at inlet and outlet of unit.
PUSH BUTTON VENT	Gives positive, thorough venting of your entire installation before start-up.
ELECTRICAL	3/60/230 or 3/60/460 standard . . . other specifications available. Control circuit is 115 volt and fuse-protected.
HOSE CONNECTIONS	3/4" delivery and return connections; 1/2" water supply and drain connections . . . all at rear of unit.
PRESSURE SWITCH	Pressure switch protects components against damage through operation without water.
CABINET	Welded steel frame; side covers easily removable; properly louvered for ventilation; 11" wide, 18" deep, 21 1/2" high.
SHIPPING WEIGHT	3/60/230—135 lbs.; 3/60/460—145 lbs.

MODEL: S-6410

INTRODUCTION (Continued)

The illustrations used are to help you identify certain parts by name and to understand our explanations - which will assist you later on in the Trouble Shooting sections.

The unit is warranted against defects in materials and workmanship for one year from date of shipment.

Any Sterlco Unit which has been used contrary to specific operating instructions or materially altered, will not be covered by this warranty. Final determination of defects must be made at Sterling, Inc.

The units can easily be moved from one location to another, simply by removing the circulating connection lines.

By following the instructions in the manual and treating your equipment with care and respect due any precision equipment, you will be rewarded with years of uninterrupted, trouble free service.

MODEL: S-6410

INTRODUCTION

We are pleased to provide a Water Circulating Temperature Control Unit for your application. It is built by skilled craftsmen with the most modern and precision machines available today. The simplicity of design and compactness engineered into the unit resulted in less maintenance and less floor space.

The Sterl-Tronic High Temperature Control Unit, designed and tested over a period of many years, represents one of the most significant advances ever in the field of self-contained, direct injection type portable units for heating water and circulating it at controlled temperatures - through molds, rolls or jackets of processing equipment.

The Model S-6410 is a complete single zone heating/cooling, circulating and control unit, with one delivery and one return line, plus a water supply line and a drain line for cooling.

The Sterl-Tronic Temperature Control Unit is designed to circulate water through your process and to precisely, automatically, and reliably maintain this water at the selected temperature. The operating range of the Sterl-Tronic unit is from supply water temperature up to 250° F. maximum. The unit is well suited for use with a city water supply, water from portable or central chillers, towers or with well water.

Many new improved designed features have been incorporated into the Sterl-Tronic including the solid-state electronic thermostat with automatic mechanical proportioning of heating and cooling, dual electronic sensing probes and push button air vent.

The relatively small total amount of water, rapidly circulated by the Sterl-Tronic, provides assurances of a close and uniform temperature relationship between the delivery and return lines of the unit. This assures uniform and stable temperature control as well as a very even temperature throughout the work area. Also, the high rate of circulation, combined with the large immersion heater and high cooling rate, gives the unit exceptionally fast response in bringing the process up to temperature and in making changes of settings when necessary.

These standard units may have many variations of optional features added to them, relative to the customers application of specific desires.

DESCRIPTION (CONT.):

CIRCULATING CONNECTION LINES (CONT.)

These connection lines and connectors should be inspected frequently to insure that the original service rating has not been reduced by age and/or deterioration. If the flow is restricted by small connections, the pressure will increase and the flow through the process will be greatly reduced.

If your mold or platens have already been made with serpentine channeling, we would like to suggest modifications as shown in Dwg. A682-03844 and using a manifold, preferably of 3/4" N.P.T. pipe.

In order to eliminate excessive back pressure - it would be advisable to drill holes at points "A" and tap for 3/4" pipe.

Several parallel runs are far more practical than one long serpentine run and in many cases, can make a difference between uniform control and erratic operation.

WATER SUPPLY:

It is very important that the water supply to the unit meet certain requirements. We recommend a full sized connection, equal to the pipe size of our water supply connection and without restriction fittings. Usable supply pressure should be in excess of 20 PSI (1.4 kg/cm<sup>2</sup>) and preferably over 25 PSI (1.7 kg/cm<sup>2</sup>) at the unit, if the unit is expected to operate at temperatures over 200° F. (93° C.). This minimum pressure is necessary to keep the process water from flashing to steam at the pump inlet where water pressure is the lowest in the system. The pressure switch inside the unit will not allow the unit to run until the unit has been subjected to a minimum water supply pressure.

The water supply line should be open to the unit whenever the unit is running. While a certain minimum supply pressure is necessary as stated above, supply pressures over 75 PSI (5.27 kg/cm<sup>2</sup>) while serving no useful purpose may indeed cause damage to the unit and shorten its life. If your water pressure is excessively high it is recommended that a pressure regulator be installed in the supply line with a relief downstream from the regulator and set slightly higher than the regulator. Hard or corrosive water can be damaging to the unit and your equipment, especially since the temperatures at which the system operates, tend to accelerate deposits or corrosion. This build up on the surfaces of the unit can reduce the water flow and cause control problems and eventual damage to equipment. Since the corrective maintenance and downtime often caused by bad water are costly, it is worthwhile to analyze and treat your water.

In general, we found that people with good water seldom buy parts. Industrial water treatment to neutralize these conditions is relatively inexpensive and in many cases is truly a wise investment.

300° F. UNITS:

If the unit is expected to operate at temperatures of 290° F. (143° C.), usable water supply pressure should be in excess of 45 PSIG (3.2 kg/cm<sup>2</sup>) and preferably 50 PSIG (3.4 kg/cm<sup>2</sup>).

MODEL: S-6410

DESCRIPTION:

WATER HEATING:

Heating of the water is accomplished through the specially designed low watt density electric immersion heater inserted into the heater tank; the immersion heater temperature is controlled by the manual indicating thermostat mounted on the front of the control panel.

These Models are supplied with 4-1/2 KW low watt density immersion heaters. 2" heater tanks are used for 4-1/2 KW.

KW ratings of the immersion heaters are rated at the following standard voltages:

208V, 240V, 380V, 415V, 480V, 600V

4-1/2 KW

15,368 BTU/hr.

PUMP:

The pump is a 1/2 H.P. straight centrifugal type, bronze-fitted. It has a high output capacity with good discharge pressure and is well suited for the conditions under which the unit is designed to operate. The circulating capacity available to the user, outside the unit is 15 GPM @ 20 PSI. A special seal-flush system in the pump helps keep the seal clean thereby extending seal life. The seal itself is the finest type available for this type of service and provides an excellent combination of long wearing ability, high abrasion resistance and heat resistance.

COOLING:

Cooling is accomplished by automatic release of the required amount of warm water from the system to the drain. This permits an equal amount of cool water to enter the system from the plant water supply. Naturally, the plant water supply temperature will govern the minimum operating temperature of the unit. The cool water enters the system immediately ahead of the pump which blends it with system water.

CIRCULATING CONNECTION LINES:

On the Model S-6410, the water supply and drain line are 1/2" N.P.T. The Return and Delivery Lines are 3/4" N.P.T.

Connection lines and connectors between the Temperature Control Unit and the process should be selected by the customer to suit the needs and requirements of the application.

- 1) If your unit has a maximum operating temperature of 250° F. the connection lines and connectors should have a service rating of at least 250° F. and 150 PSIG.
- 2) If your unit has a maximum operating temperature of 300° F. the connection lines and connectors should have a service rating of at least 300° F. and 150 PSIG.

MODEL: S-6410

DESCRIPTION: (cont.)

HEATER:

The Heater is a three phase immersion heater, 4-1/2 KW capacity of low watt density construction to minimize fouling and to promote longer heater life.

SERIES S1 CONTROLLER:

Thermostatic control of the system is maintained by a newly developed solid-state electronic controller with heating and cooling relay output. Two stable, wire-wound temperature sensors, one sensing the need for heating and the other sensing the need for cooling, monitor process temperatures and relay readings back to the controller. The solid-state design of these components assures exceptionally precise and trouble-free operation.

The controller has a maximum set temperature of 250° F.

SYSTEM TEMPERATURES:

The System Temperatures are easily read on the meter which is part of the thermostat. It's long thin needle with close calibration permits the detection of small temperature variations.

ELECTRICAL:

The control circuit and pump operate on 115 volt, single phase current. A single phase transformer provides 115 volt single phase current for the control circuit and motor. A manual starting switch with an electrical overload protects the motor.

VENT PUSH BUTTON:

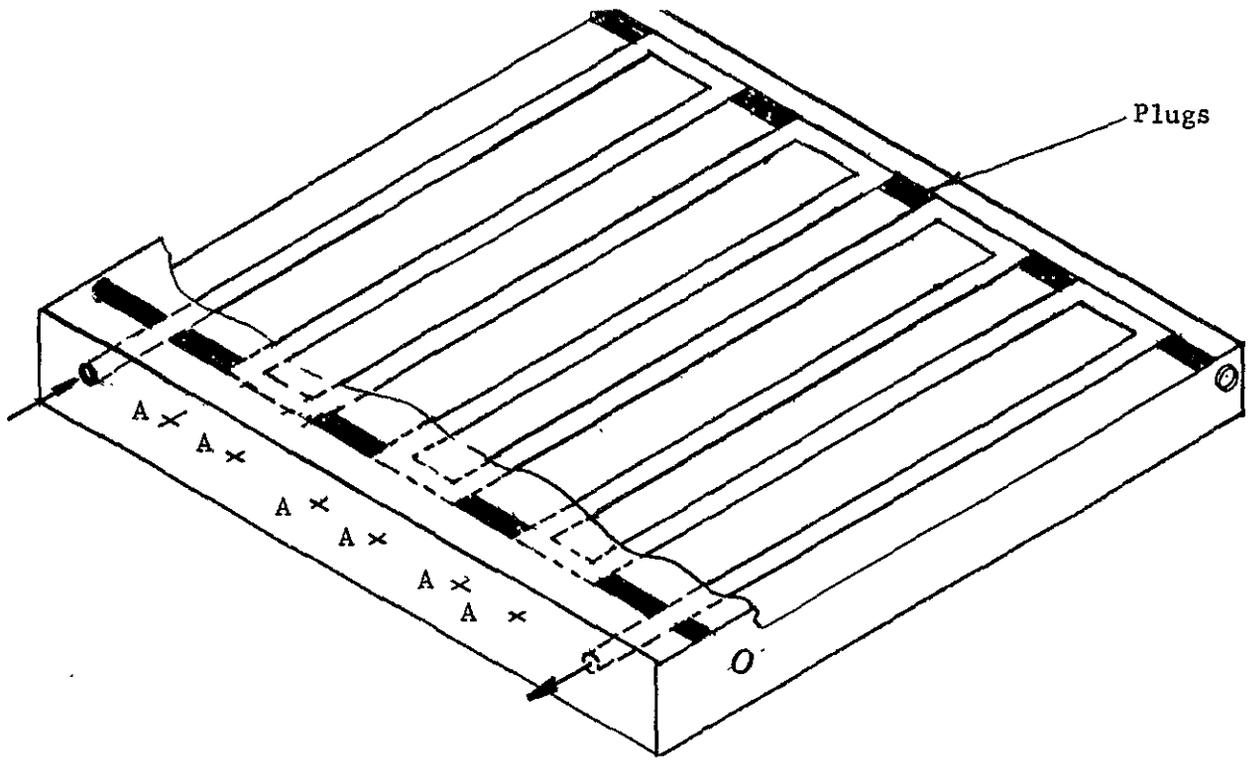
This pushbutton permits quick and complete purge of air from the operator's panel, before the unit is started. The "VENT" pushbutton actuates the solenoid valve which permits the flow of trapped air and water out through the drain, insuring that the unit is properly filled and primed prior to start-up.

PRESSURE SWITCH:

The Pressure Switch is built into each unit to insure that the unit will not start until the water supply has been turned "ON" and the unit subjected to water supply pressure. This is intended to provide a strong measure of protection for the pump seal and the heater so that they will not be damaged through operation without water. The final measure of protection must come from the operator in venting before start-up. The pressure switch itself is set at approximately 10 PSI prior to leaving Sterling.

300° F. UNITS

The pressure switch itself is set at approximately 45 PSIG prior to leaving Sterling.



Modification of Platen  
For Manifold

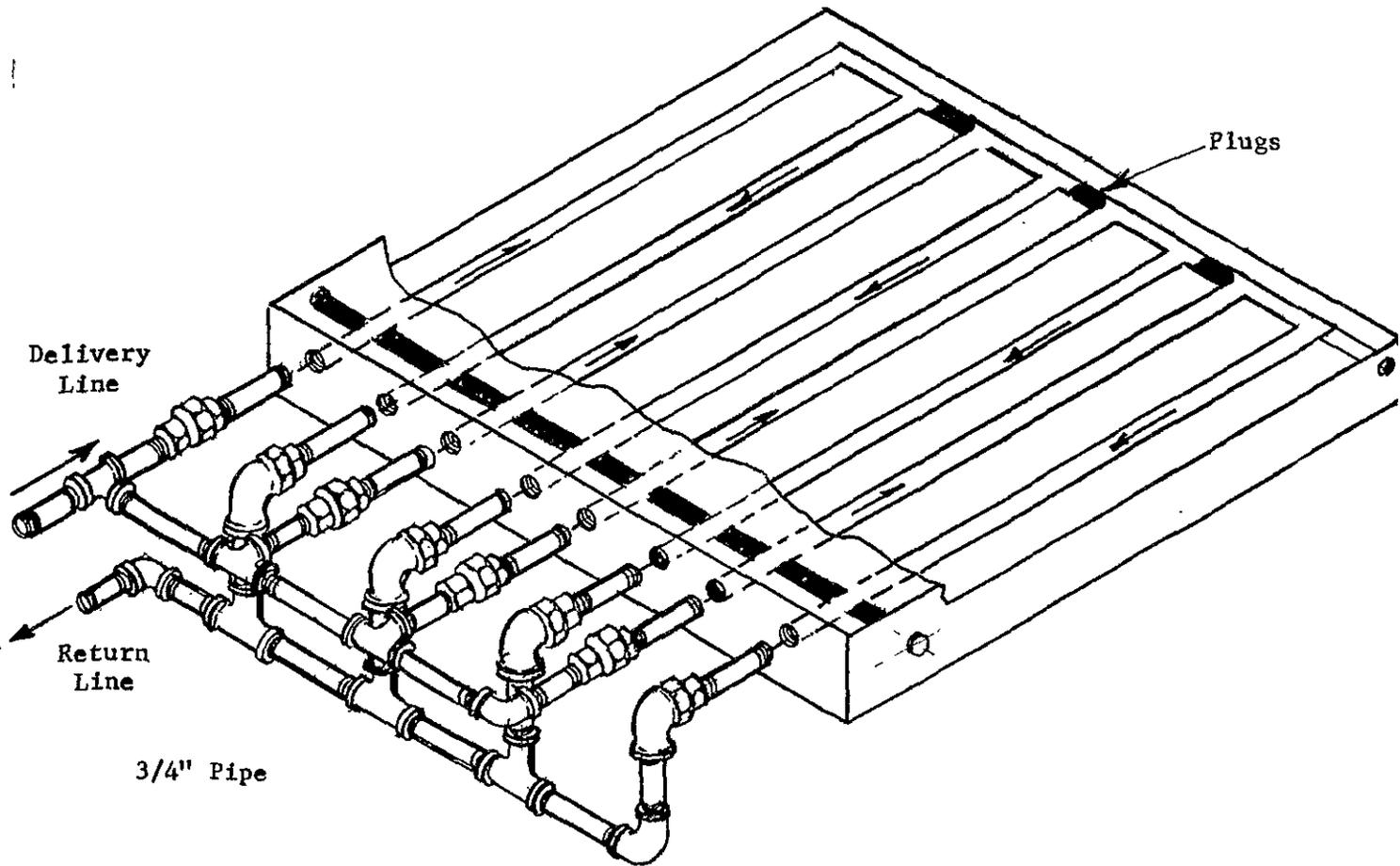


Fig.1

MODEL: S-6410

PERFORMANCE:

The Model S-6410-A is an easy unit to operate. The simplicity of design and the highly engineered controller make these units almost self-operated.

The "ON-OFF" control, the "VENT" button and the "TEMPERATURE CONTROLLER" are all that is required to operate these units.

Connect the water supply to the "WATER SUPPLY LINE" and check to insure that the pressure is in excess of 20 PSI and preferably over 25 PSI, but does not exceed 50 PSI.

When the "VENT" button is depressed and held, the solenoid valve opens electrically, and should be held in this position for at least on minute.

The water comes in the water supply line and enters the pump, passing thru the heater tank and out the "DELIVERY LINE", to the process, back to the "RETURN LINE".

With the "VENT" button depressed, the solenoid valve is open allowing a flow of water to the drain, and by watching the drain for bubbles or erratic flow will indicate whether or not the system has been properly "purged". If a steady stream flows from the drain line, it is certain that all the air is out of the system.

"ON-OFF" SWITCH:

"ON" POSITION:

When the switch is in the "ON" position, the starter is manually energized and supplies the power to the motor and the temperature controller, which in turn regulates either "heating" or "cooling".

"OFF" POSITION:

When the switch is in the "OFF" position, the starter is de-energized, cutting the voltage to the motor and the temperature controller.

MODEL: S-6410

INSTALLATION:

INITIAL PROCEDURE:

These units are supplied for three phase operation for a selected voltage. Caution must be taken to provide a correctly sized power supply to the unit. These units must be correctly grounded.

All connections must be secure and should be checked before starting.

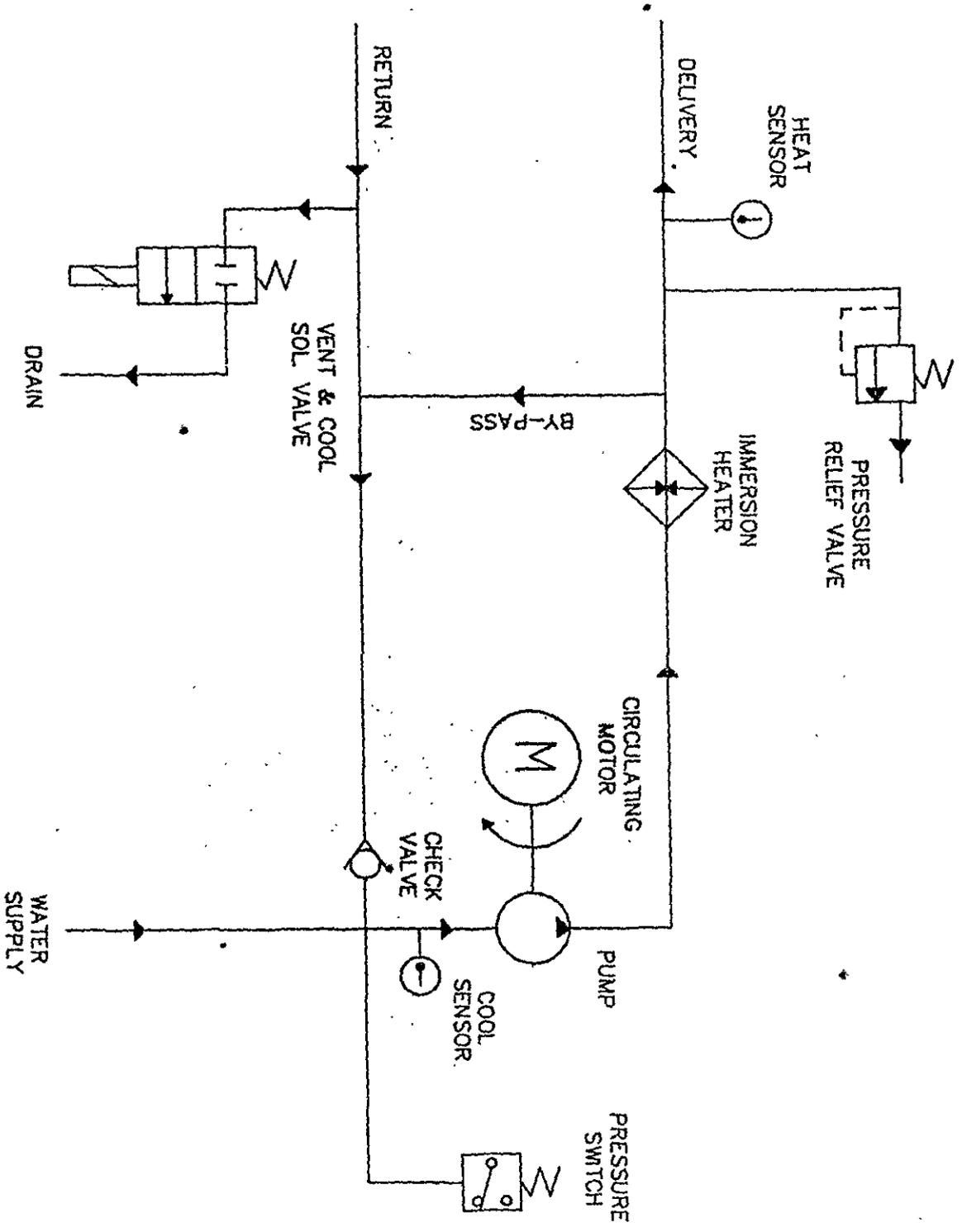
ELECTRICAL:

It will be necessary to drill a hole in the cabinet for a power supply line. (Ref. Wiring Diagram B682-01727).

<u>HEATER CAP.</u> <u>EACH CIRCUIT KW</u>	<u>TOTAL AMPS</u> <u>3/60/208</u>	<u>TOTAL AMPS</u> <u>3/60/230</u>	<u>TOTAL AMPS</u> <u>3/60/460</u>	<u>TOTAL AMPS</u> <u>3/60/575</u>
4-1/2 KW	18 AMPS	16 AMPS	8 AMPS	7 AMPS

DWG. NO. A682-00407  
 EQM # 87-2337  
 6-11-87DK

UNLESS OTHERWISE SPECIFIED USE: ±.005" TOL. FOR DECIMAL DIMENSIONS; ±1/64" TOL. FOR FRACTIONAL DIMENSIONS



STERLING, INC.  
 MILWAUKEE, WIS.

TITLE  
 FLOOD SCHEMATIC

USED ON: 56412-A THRU G

DR.	CHK.	DATE	SCALE	DRG. NO.
DK		6-10-87	NONE	A682-00407

8898

MODEL: S-6410

CIRCULATION:

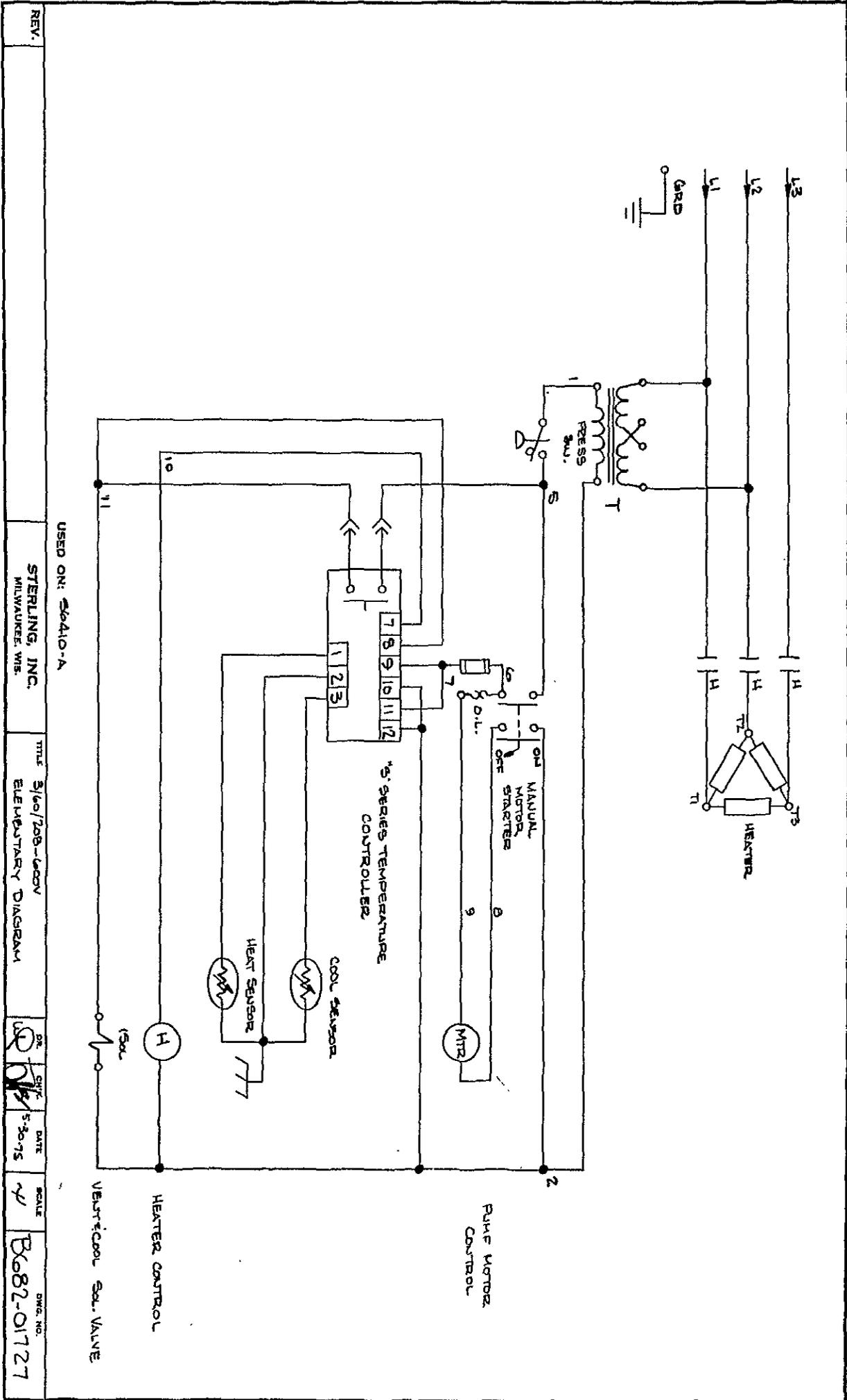
FLOW DIAGRAM: (See Dwg. C682-03930)

With the "ON-OFF" switch in the "ON" position and the temperature controller set to the required heat, the water is drawn into the pump - past the cooling sensor, into the bottom of the tank.

As the water is circulated up through the tank, it is heated by the immersion heater, where it passes the heating sensor, which is recorded on the temperature controller and out to the delivery line.

After it is routed through the process supply, the heated water, which has cooled down a bit, comes back into the return line for recirculation, through the pump and back into the tank, where it is reheated.

The by-pass line is a safety feature in the event there is a malfunction in the system, external of the unit proper. The by-pass line allows a small amount of water to recirculate internally to the unit.



USED ON: 50410-A

STERLING, INC.  
MILWAUKEE, WIS.

TYPE 5160/208-600V  
ELEMENTARY DIAGRAM

DATE 5-30-75

SCALE 1/2"  
DWG. NO. B082-01727

REV. 40-108 1M-3-71

MODEL: S-6410

OPERATION:

Vent the unit as described on page 4, position the "ON-OFF" switch to the "ON" position.

Set the control knob on the temperature controller to the desired set point.

When the unit is in the heating cycle, the Heat Indicator Light will illuminate "AMBER". If the temperature of the water is above the set point, the unit will automatically switch to the cooling cycle and the Cooling Indicator Light will illuminate "WHITE".

SHUTDOWN:

Prior to shutdown, the water supply to the unit should be shut off.

Depress the "VENT" button for a few seconds to relieve the internal pressure. Water supply and drain lines, delivery and return lines and the electrical supply may then be disconnected.

DRAINING:

If your Sterl-Tronic is to be taken out of service for long time or it will be exposed to freezing, it should be thoroughly drained. Drain plugs are provided at the base of the heater tank and water supply and drain lines.

TROUBLE SHOOTING:

TEMPERATURE FLUCTUATIONS: Alternate Overheating and Overcooling

While the user might be inclined to believe the trouble to be in the thermostat, this fluctuation can most always be traced to poor water flow, resulting from one or more of the following conditions.

- 1.) Small hose and fitting or small water passages. Slow water flow will create a long reaction time which causes overheating and overcooling.
- 2.) Very long lengths of hose or long serpentine flow of water in and out of the mold in series rather than in parallel. Refer to the page on installation.
- 3.) Blocked water line in the mold. New molds sometimes contain metal chips or other foreign particles inside the water lines. Old molds sometimes contain lime or rust accumulations.
- 4.) Quick disconnect fitting with check valves. (A source of very serious obstruction). The check valves should be removed.
- 5.) Lime buildup in the piping or fittings.

NOTE: The unit itself can be checked out for normal control by the use of a short line of 3/4" or 1/2" hose connected directly from the delivery to the return line. This will provide a condition of very good flow and will establish whether the blockage is in the unit or the piping.

RAPID CYCLING FROM HEAT TO COOL:

This condition is traceable to the same causes as the temperature fluctuations indicated above.

SET TEMPERATURE NOT SAME AS "INDICATED" TEMPERATURE:

Through rough handling in transit, the "set" calibration of the potentiometer may be shifted slightly. This will cause the unit to control at an indicated temperature slightly different than the "set". The thermostat knob may be loosened and reset to agree with the temperature being maintained on the thermometer. This should only be done with a condition of good water flow and preferably near mid-range of the thermostat.

TROUBLE SHOOTING: (Continued)

UNABLE TO HEAT PROPERLY:

When the temperature will not rise above a certain temperature, the cause will generally be traced to continuous loss of water from the system (allowing cooling water to enter). This can be checked by observing the drain. Under some conditions, it is possible to have the solenoid valve closed on a particle of grit which, of course, will allow the valve to continuously leak. This solenoid valve can be flushed out easily by having the operator push the vent button several times to open and close the solenoid. If it continues to leak, the unit should be stopped and the electric power and water turned off and the solenoid valve should be taken apart and cleaned or replaced as required.

Another cause would be traceable to a leaking hose or fitting somewhere in the system. It is also possible that the immersion heater might be inoperative or defective. Most any qualified electrician can check this out readily. Heater terminals are readily accessible for checking.

NO HEAT AT ALL:

Check to be sure that the contactor goes "in" and "out" in response to signals from the thermostat. This can be done by turning the thermostat up and down the scale. The contactors should be made to go in and out as the dial passes unit temperature. If it does not function, the thermostat may be faulty and the section of this manual dealing with thermostat diagnosis should be studied and followed. If the contactor does function, but if no heat is produced, the problem is likely within the heater itself, assuming, of course, that the steps listed under "Unable to Properly Heat" have been followed first.

UNABLE TO COOL:

In order to cool, the unit must discharge water to the drain and simultaneously allow tap water to enter. Therefore, if your unit does not provide cooling, the following steps should be taken to help locate the cause.

- 1.) Check to see if water flows to the drain when the unit calls for cooling.
- 2.) Check to see that the water supply is open at all times while the unit is in operation.
- 3.) Check the solenoid valve for proper operation - observe the drain. Water should flow to drain in response to solenoid action. If the drain cannot be seen, a simple method of check is by "feel" of the drain piping at the unit, with the solenoid alternately open and closed.

MODELS: S-6410-A

TROUBLE SHOOTING: (Continued)

- 4.) Perhaps it might be well to check the water supply pressure. If the water supply pressure drops below the setting of the pressure switch, the unit will stop.
- 5.) High back pressure from the drain could easily cause a limited ability to cool, since the unit depends upon the pressure differential between the water supply and drain for the amount of cooling which it can provide.

HEATER BURN-OUT:

A direct visual indication of heater burn-out is the presence of scorched or discolored paint on the heater tank. In most cases, the water level inside the tank at the time of burn-out can be determined because the paint on the exterior of the tank below the water level will not be scorched. Causes of heater burn-out are generally traceable to:

- 1.) The unit not being filled with water and purged of air prior to start-up.
- 2.) A faulty heater (tank discoloration not always present)
- 3.) A plugged system or badly obstructed flow.

PUMPS AND SEALS:

Before leaving our factory, each unit is operated for some considerable period of time and calibrated. After this test the unit is drained and blown out with warm air to remove most of the water from the piping systems. If the unit is allowed to sit for a long time before being installed in your factory, the housing gasket at the pump can dry out and will possibly leak when the unit is started. In many cases these gaskets will soon swell and form a tight seal, while in other cases, it may be necessary for you to make a partial turn of the pump screws to stop a leaking condition.

In some cases, it is possible to have the pump seal surface separate slightly because of rough handling or considerable vibration during transit from our plant to yours. This, of course, would cause a leak at the pump seal when the pump is started, and in most cases the surface will mate again after the pump is allowed to run for short periods of time. If they do not mate, you might find it necessary to open up the pump and free the seal by hand. It is seldom necessary to install a replacement seal in a new unit unless the unit has been started without water.

Our pump seals should give a long period of service life. There are conditions, of course, which tend to shorten the seal life - such as presence of grit, operation of the unit without water, sustained high water temperatures or the

MODELS: 6410-A

TROUBLE SHOOTING: (Continued)

presence of certain chemicals in the water. Our pump seal assembly has been developed to resist abrasive tendencies which we find present in many water systems. It is also fitted with high temperature flexible components for a maximum amount of heat resistance. These same components remain flexible even at low temperatures. Thus, the standard seal has a fine combination of heat resistance and abrasion resistance.

After the unit has been in service for a period of years, where abrasive conditions are present, you may find that the pump casting, which is designated as our "bracket" can be eroded away in the area around the seat of the rotary seal. This area should provide a straight, smooth surface against which the O-ring of the seal seat should bear. Should your casting show signs of erosion in this area, we would strongly recommend that the casting be replaced, since the replacement cost of the casting is a very modest investment when compared with down-time and maintenance cost for replacing a seal which has been installed in a worn out pump. A small puddle underneath the unit is a sign of rotary seal wear and if your investigation confirms the pump as the source of the leak, we would recommend that the seal be replaced as soon as practical. If allowed to leak, the water will eventually find its way to the lower motor bearing and cause further damage. The water slinger is intended to provide temporary protection against this possibility, but a continued and substantial leak will undoubtedly ruin the motor bearing.

Even though your maintenance people may have had many years of experience in dealing with pumps in general, we would strongly suggest that they follow our form I-4100-EI when over-hauling the pumps. Careful attention to these instructions will help assure a proper installation and minimum down-time.

Under some conditions users find that the pump will not start. After turning off the power supply it would be well to check the motor shaft to be certain that it is free to turn. By removing the drip cover atop the motor, access is provided to the end of the shaft, which has been slotted so that it might be turned with a screwdriver. If the shaft is found free to turn, we would suggest that the power supply to the unit be checked on all legs to be certain that the power is available to the motor. If these two items have been checked, we would then recommend that a competent electrician be called upon to check the motor and its circuit.

TROUBLE SHOOTING: (Continued)

THERMOSTAT:

The following is a general outline for diagnosing possible problems in the temperature control system. By following the checkout procedure given below, one should be able to determine what the problem is and what steps to take to correct it.

I. PROBLEM - NO HEAT OR COOL:

- 1.) Loss of Power
  - (a) Check control circuit voltage between terminals #9 and #12 on solid state unit. Correct voltage is shown on brass nameplate of the unit.
- 2.) No connection on terminal #5 or broken wire from set pot wiper (red wire)
- 3.) Faulty contactor and solenoid on output of solid state unit
  - (a) Rotate set pot to its maximum clockwise position and check for proper control circuit voltage across terminals #7 and #12.
  - (b) If voltage is present but contactor does not energize, coil is open and should be replaced.
  - (c) If no voltage appears across these terminals, visually, check the heat relay on the solid state controller for operation by rotating the set pot above and below the indicated temperature. If relay operates but no voltage appears across the contactor coil, the contacts on the relay are probably burned and should be cleaned with very fine sandpaper. This applies to the solid state unit with open type relay. If the unit has plastic covered plug-in type relays, simply remove the faulty one and replace with new. If relay does not operate, return defective solid state unit to Sterling for repair.
  - (d) Repeat step 1-3 for solenoid valve operation by rotating set pot counter, clockwise and checking voltage across terminals #8 and #12.

II. PROBLEM - COOLING STAYS ON, HEATING STAYS OFF REGARDLESS OF SETTING:

- 1.) No connection to terminal #2 on solid state unit.
- 2.) No connection to terminal #4 on solid state unit or broken wire from set pot (white wire).

TROUBLE SHOOTING: (Continued)

THERMOSTAT:

- 3.) Faulty probes - If both probes are open-circuited, the cooling will stay on and heating will be off.  
Short out terminals #1 and #2 - If heat comes on, the heat probe is faulty.  
Short out terminals #2 and #3 - If cool turns off, the cool probe is faulty.

If problem persists after checking 1 thru 3 above, return solid state unit to Sterling, Inc. for repair.

III. - HEATING STAYS ON, COOLING STAYS OFF REGARDLESS OF SETTING:

- 1.) No connection to terminal #6 of broken wire from set pot (black wire).
- 2.) Short between terminals 4 and 5 indicating faulty set pot. Remove wire #5 - if heating goes off - set pot is defective or connecting wires are shorted.
- 3.) Shorted probes on both the heating and cooling. Disconnect probe wires from terminals 1 and 2 and 3, the cooling should turn on and heating turn off.

If problem persists after checking 1 thru 3 above, return solid state unit to Sterling, Inc.

IV. - COOLING STAYS OFF - HEAT REACTS NORMALLY  
TURN SET POT TO LOWEST SETTING:

- 1.) Short circuit between terminals 2 and 3 indicating faulty probe; disconnect wires 2 and 3, if cooling turns on, the probe should be replaced.
- 2.) Check output circuit as in (I-3d) above.

V. - HEATING STAYS ON - COOL REACTS NORMALLY  
TURN SET POT TO LOWEST SETTING:

- 1.) Short circuit between terminals 1 and 2 indicating faulty probe. Disconnect wires from 1 and 2 if heating turns off, the probe should be replaced.
- 2.) Check output "heat" relay of solid state unit for welded contacts.

IV. - COOLING STAYS ON - HEAT REACTS NORMALLY:

- 1.) Open circuit between 2 and 3. Short terminals 2 and 3; if cooling turns off - probe should be replaced.
- 2.) Check output "cool" relay of solid state unit for welded contacts.

VII. - HEAT STAYS OFF - COOL REACTS NORMALLY:

- 1.) Open circuit between terminals 1 and 2. Short terminals 1 and 2 if heating turns on, replace faulty probe.
- 2.) Check output circuits as in (I - 3a,b,c) above.

TROUBLE SHOOTING: (Continued)

THERMOSTAT: (Continued)

VIII. - HEAT AND COOL CONTROL BUT AT A HIGHER TEMPERATURE THAN INDICATED ON POT DIAL:

- 1.) First check to determine that knob has not slipped on potentiometer shaft, by turning pot to both ends of scale. If stop point is near end of scale at each end, proceed to "2" below. If stop is not near end of scale, loosen screw holding knob in shaft and remove knob. Turn shaft to a setting above mid-range. When unit has stabilized at temperature as shown on the thermometer.
- 2.) Short between terminals 5 and 6 on solid state unit indicating faulty probe.

IX. - OUTPUT RELAY CHATTER:

- 1.) Check for loose connections on terminals 1 through 6 on solid state unit.
- 2.) Broken or intermittent connection on pot or probe wires.

X. - DEAD BAND ADJUSTMENT: (See Dwg. B681-00031)

The Dead Band Adjustment is used to vary the span between Heat "off" and Cooling "on". The Adjustment only affects the cool output, thereby, not changing the set point temperature. In the lower left corner of the black plastic cover of the solid state board is a small hole which provides access to the dead band adjustment. Adjustments should be made slowly and in small amounts. Do not force the adjustment beyond its stops.

NOTE: The "TROUBLE SHOOTING" guide applies to the thermostat board only. The trouble shooting for the temperature meter board attached to the main board is as follows: In the event of disagreement between the potentiometer and the temperature meter, adjust the meter first.

TEMPERATURE METER "TROUBLE SHOOTING":

- 1.) Turn off all electrical power to the unit.
- 2.) Remove two (2) hold-down screws from top of panel and remove controller top panel leaving all wires connected. Caution is urged in this, especially on right side of controller which is the power side. Exercise great care to avoid shorting this side of controller.

After removal of controller, the following steps should be followed in locating the difficulty:

- 3.) Check power supply to main board terminals #9 and #12. Should be 115 volt.
- 4.) Meter does not read -
  - (a) Remove meter and shunt wire - if there is one in place.
  - (b) Check for tight connections to terminals #3 and #6 on meter board.
  - (c) Check positive (+) terminal on main board and terminal #2 on meter board for tight connections.

TEMPERATURE METER "TROUBLE SHOOTING" (Continued)

If all wires are correct and secure, check voltage between terminals #1 and #6 on meter board (+15 volt D.C.) and between #2 and #6 on meter board (+15 volts). Also voltage between #4 and #6 (2.5 volts A.C.). If, at this point there is no voltage the problem is in the main board. If voltage is present the meter is faulty.

5.) Meter check off scale (high end)

- (a) Check (VAC) terminal on main board and terminal #4 on meter board for tight connection.
- (b) Check for tight connection to terminal #1 on main board.
- (c) Check negative (-) terminal on main board and terminal #1 on meter board all for tight connection.
- (d) Check terminals #1 and #2 on main board for tight connection.

If all wires are correct and secure the heat sensing probe is faulty.

6.) Meter reading does not correspond to known temperatures.

- (a) Too Low - Turn potentiometer on top of meter board counter clockwise to correct temperature. This potentiometer is long and rectangular, with the adjusting screw at one end.

MODEL S-6410

<u>PART NO.</u>	<u>DESCRIPTION</u>
081-00024	Rotary Seal Assembly
545-00001	Housing Gasket
615-13341-01	Bracket E - Per Form I-4100-EI
615-14921	Volute A - Per Form I-4100-EI
695-18400	Pump Impeller
542-10404	Water Slinger
001-06850	Impeller Screw
720-09159	Motor, 1/2 HP
605-00030-01	Complete Pump & Motor Assembly, 1/2 HP
695-00007-01	Motor, Impeller, Seal Assembly, 1/2 HP
601-00002-07	Complete Solid State Tray (0-250° F) <i>"OBSOLETE" see Factory</i>
691-00044-01	Solid State Thermostat (0-250° F)
601-00019-06	Complete Solid State Tray (0-300° F, -20 to 150° C)
691-00044-05	Solid State Thermostat (0-300° F, -20 to 150° C)
691-00046-01	Pilot Light "Cool"
691-00045-01	Pilot Light "Heat"
691-00048-01	Vent Button
691-00003-09	Sensing Probe (Heat & Cool)
691-00007-02	Potentiometer Assembly
147-00002	Pointer for Thermostat
714-00002	Plug-in Relay
722-00044-07	Heater, 4.5 KW, 3 PH., 230V
722-00044-08	Heater, 4.5 KW, 3 PH., 460V
542-00007-06	Heater Gasket (Flange)
729-00045	Contactator
632-02858	Pressure Switch
726-00030	Pump Start Switch (Less Element)
731-00232	Heater Element for Start Switch (Specify Heater Amp Rating)
732-00024	Solenoid Valve - 1/4" (5/32" Orifice)
732-00007	Solanoid Valve - 1/4" (9/32" Orifice)
162-00001-18	Solenoid Valve Coil - 1/4"
044-00138	Pressure Relief Valve 3/4"
704-00051	Transformer
725-00626	Fuse Control
725-00512	Fuse, Control (MDL-1A)
717-04003	Toggle Switch (Quick Cool Down Option)

REV.

STERLING, INC.  
MILWAUKEE, WIS.

TITLE

S I CONTROLLER

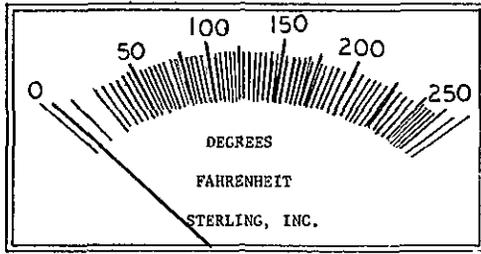
DN.  
BjM

CHK.

DATE  
6/13/78

SCALE

DWG. NO.  
B-681 - 00031

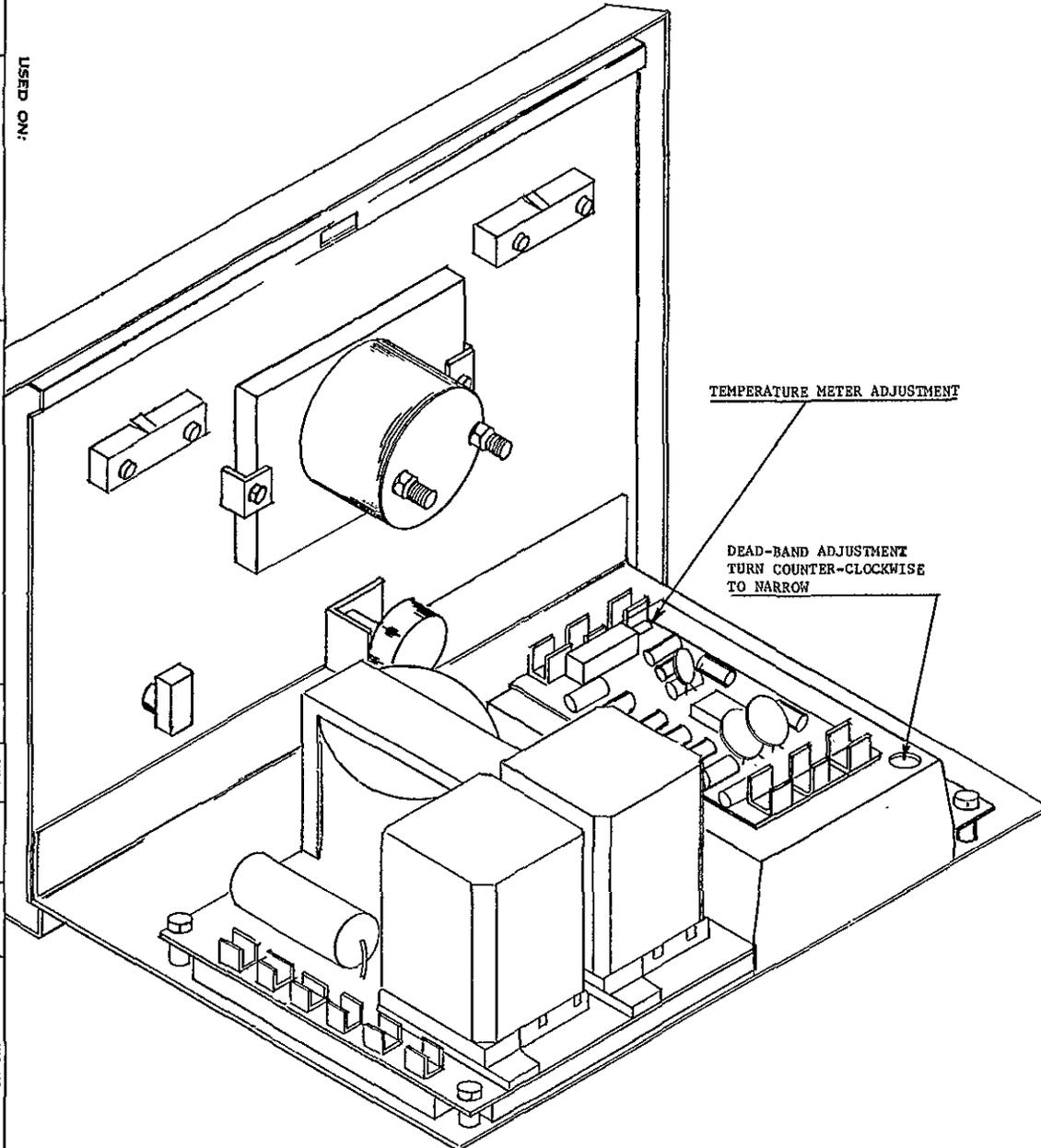


TEMPERATURE  
ZERO ADJ.



WITH THE UNIT STOPPED, THE TEMPERATURE INDICATOR SHOULD POINT TO ZERO. IF IT DOES NOT, THE "ZERO ADJUSTMENT" SHOULD BE USED TO BRING THE INDICATOR TO "ZERO". IF THE CORRECT TEMPERATURE IS NOT SHOWN WHEN THE UNIT IS OPERATED, PLEASE MAKE ADJUSTMENT FOR CORRECT TEMPERATURE ON THE POTENTIOMETER OF THE SOLID STATE BOARD, AS SHOWN BELOW

USED ON:



DWG. NO. 4289

NO.

CHANGE

DATE

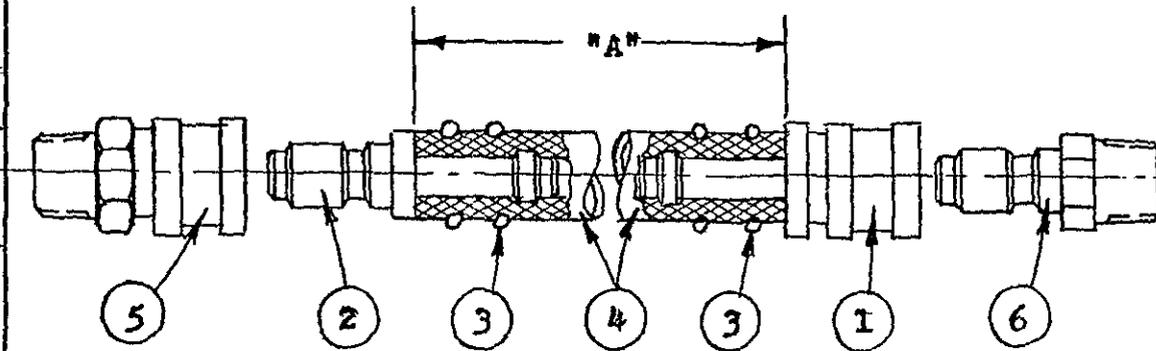
BY NO.

CHANGE

DATE

BY

USED ON



UNLESS OTHERWISE SPECIFIED USE  
 ± .005" TOLERANCE ON DECIMAL DIMENSIONS.  
 ± .010" TOLERANCE ON FRACTIONAL DIMENSIONS.

Item No.	No. Parts Req.	Purch. Part No.	Name	Material
1	1	J-91-C	Socket	Hansen #4-S27, Type ST, Brass, 1/2" Hose Con.
2	1	J-91-B	Plug	Hansen #4-T27, Type ST, Steel, 1/2" Hose Con.
3	2	J-91-E	Hose Clamp	Wedgon Or Staput, Narrow Width, to Fit 27/32" O.D. Hose.
4	See Chart	J-91-F	Hose	Ortac 1/2" I.D. X 27/32" O.D. 1 Braid, (200°)
5	1	J-91-A	Socket	Hansen #4-S25, Type ST, Brass, 1/2" M.P.T. Con.
6	1	J-91-D	Plug	Hansen #4-T25, Type ST, Steel, 1/2" M.P.T. Con.

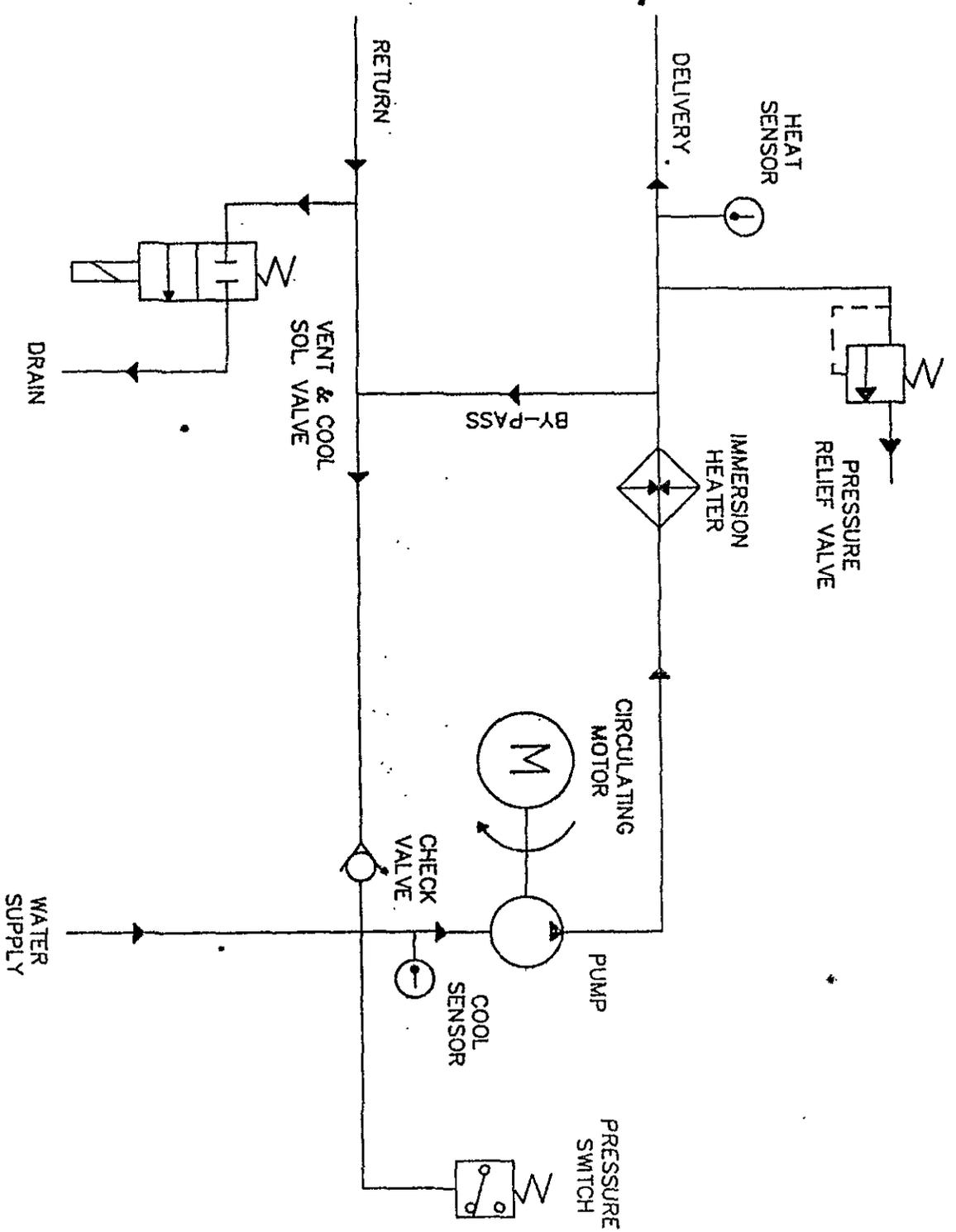
Sub. Assembly Part No.	"A" Hose Length
14289-1	17" Lg.
14289-5	5' 0" Lg.
14289-10	10' 0" Lg.
14289-15	15' 0" Lg.

MATERIAL FINISH

STERLING, INC. MILWAUKEE, WIS.  
 TITLE 1/2" Hose S.A. For Temp. Control Units  
 DR. HWS  
 CH'K. HWS  
 DATE 1-25-56  
 SCALE None  
 ISSUE 3  
 DRG. NO. 14289

DWG. NO. A682-00407  
 EQN # 87-2337  
 6-11-87DK

UNLESS OTHERWISE SPECIFIED USE: ±.005" TOL. FOR DECIMAL DIMENSIONS; ±1/64" TOL. FOR FRACTIONAL DIMENSIONS



USED ON: 56412-A THRO G

STERLING, INC.  
 MILWAUKEE, WIS.

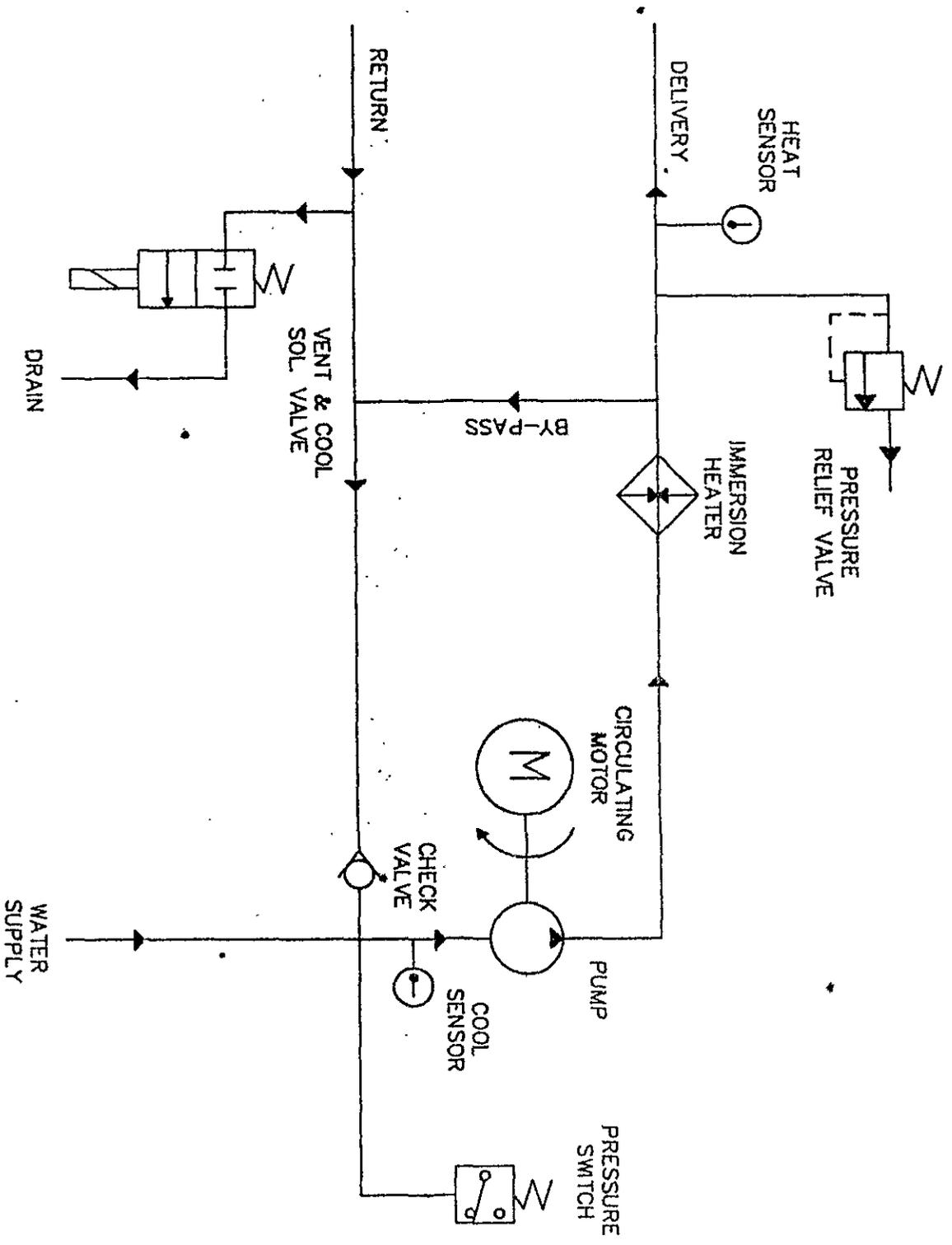
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 FLOW SCHEMATIC

DR.	CH.K.	DATE	SCALE	DRG. NO.
DK		6-10-87	NONE	A682-00407

85995

DWG. NO. A682-00407  
 ③ Rev # 87-2337  
 6-11-87DK

UNLESS OTHERWISE SPECIFIED USE: ±.005" TOL. FOR DECIMAL DIMENSIONS; ±1/64" TOL. FOR FRACTIONAL DIMENSIONS



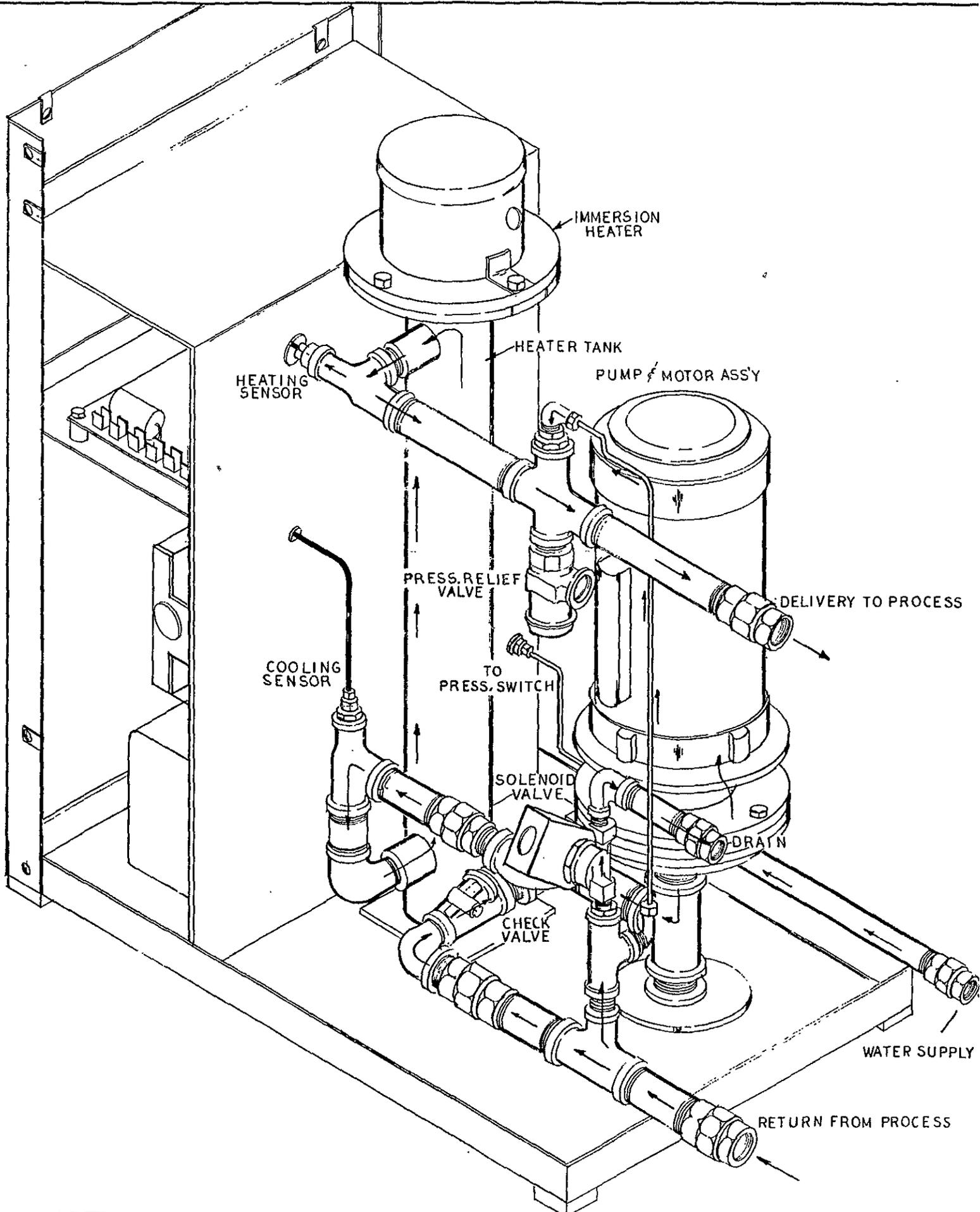
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STERLING, INC.  
 MILWAUKEE, WIS.

TITLE  
 FLOOD SCHEMATIC

DR.	CHK.	DATE	SCALE	DRG. NO.
DK		6-10-87	NONE	A682-00407

85998



STERLING, INC.  
MILWAUKEE, WIS.

TITLE  
R-6410-A & S-6410-A

DR.  
B J M

CH'K.

DATE  
6/30/78

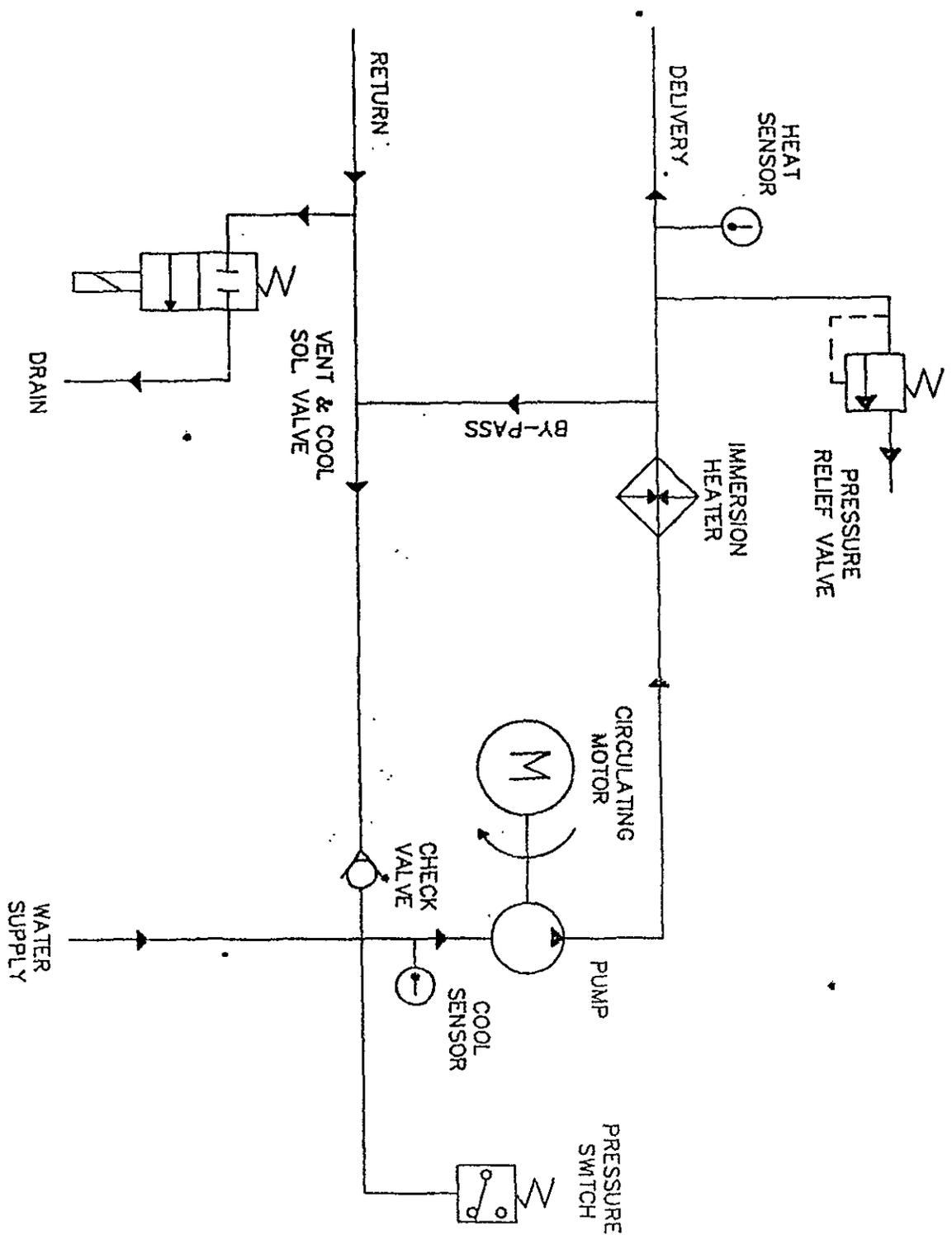
SCALE

DWG NO  
C-682-03930

DWG. NO. A682-00407

ECM # 87-2337  
6-11-87DK

UNLESS OTHERWISE SPECIFIED USE: ±.005" TOL. FOR DECIMAL DIMENSIONS; ±1/64" TOL. FOR FRACTIONAL DIMENSIONS



USED ON: 56412-A THRU G

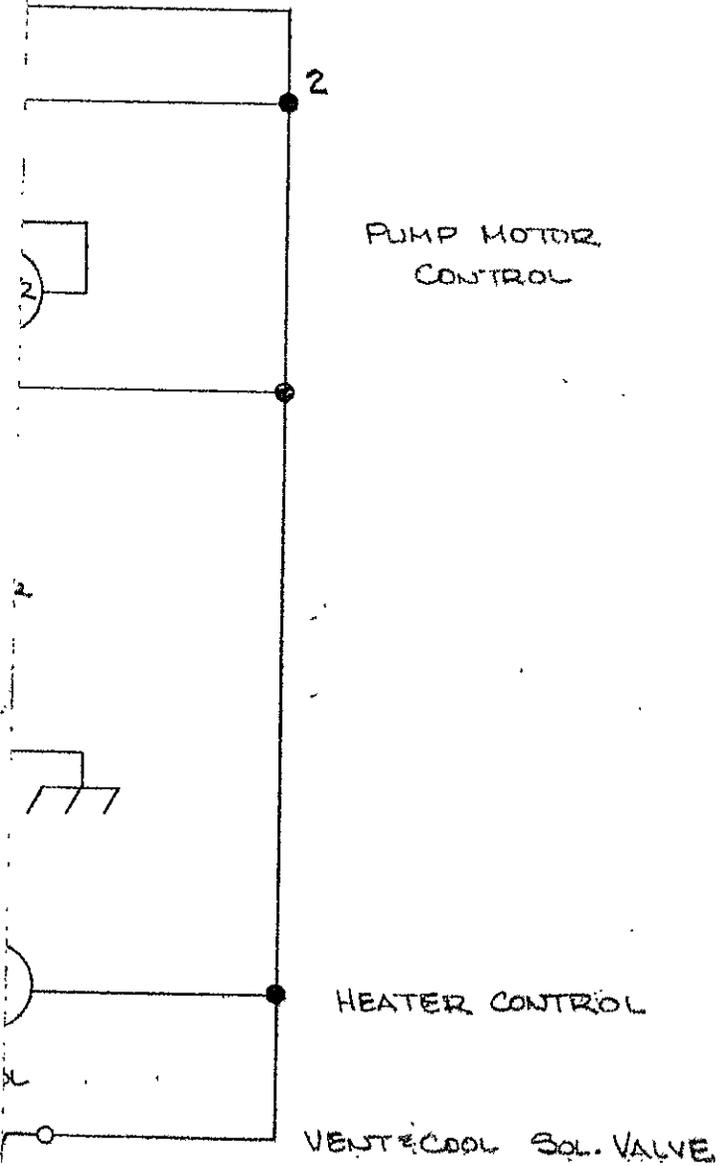
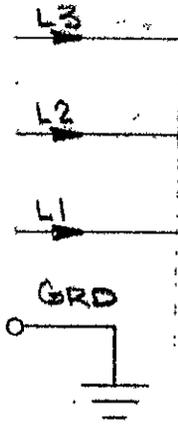
STERLING, INC.  
MILWAUKEE, WIS.

TITLE  
FLOOD SCHEMATIC

DR.	CHK.	DATE	SCALE	DRG. NO.
DK		6-10-87	NONE	A682-00407

85986

UNLESS OTHERWISE SPECIFIED USE: ± .003 TOL. FOR DECIMAL DIMENSIONS: ± .008" TOL. FOR FRACTIONAL DIMENSIONS



REV.

CHK.

DATE

SCALE

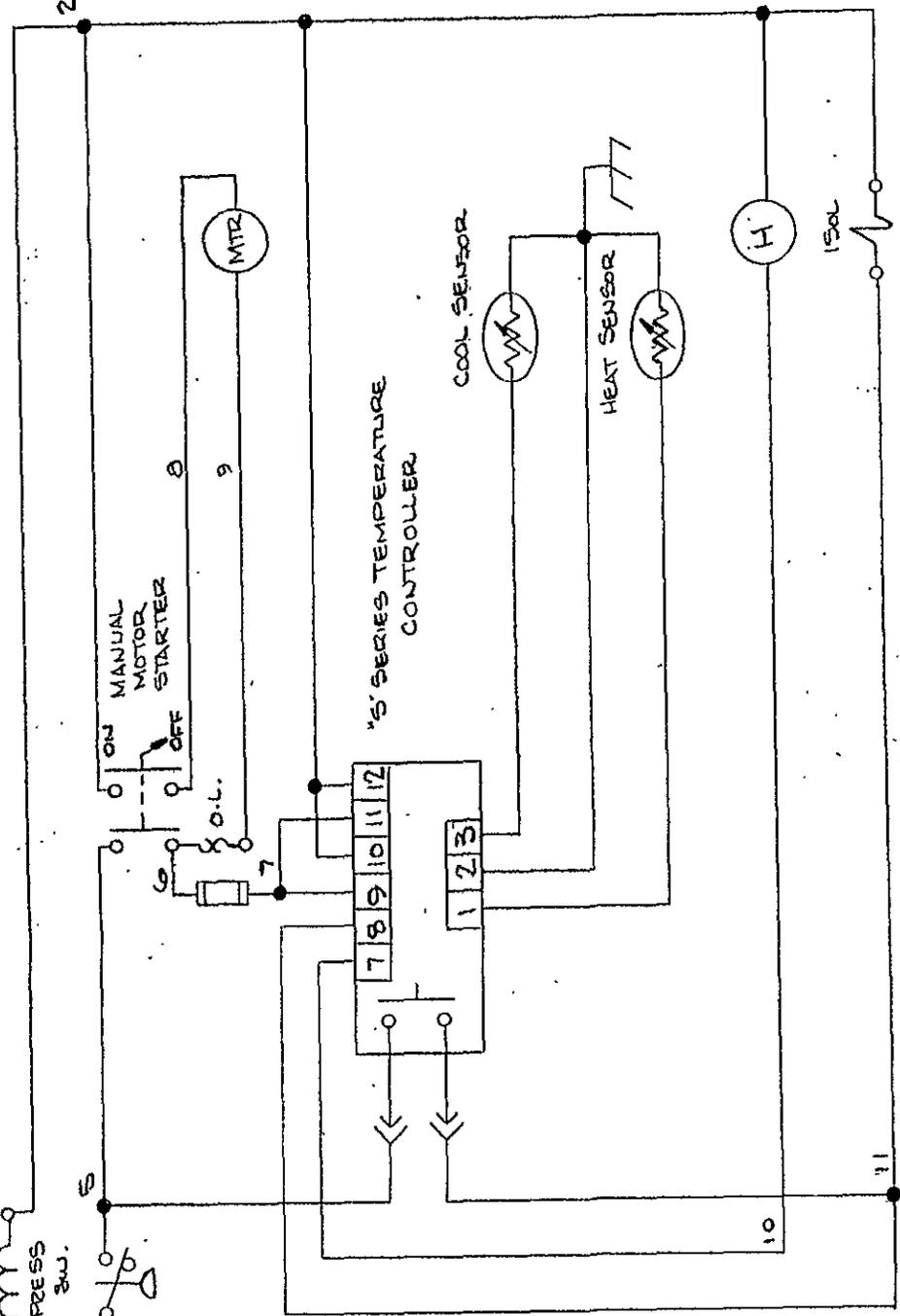
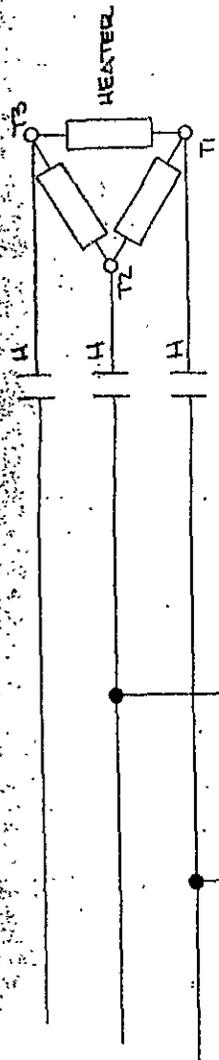
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*[Signature]*

5-30-75

4

B682-01727



PUMP MOTOR CONTROL

HEATER CONTROL

VEHT-COOL SOL. VALVE

USED ON: 56410-A

STERLING, INC.  
MILWAUKEE, WIS.

TITLE: 3/66/208-600V  
TYPE: WYE  
DATE: 5-30-75

DR. [Signature]  
CHK. [Signature]

SCALE: 1/4"

DWG. NO. BX 2-01727