STERLCO TEMPERATURE CONTROL UNIT
SERVICE AND INSTRUCTION MANUAL
MODEL: S-9210

Engineered and Manufactured by INDUSTRIAL CONTROL DIVISION
STERLING, INC.
5200 West Clinton Avenue, P.O. Box 23435, Milwaukee, Wisconsin 53223-0435
Manufacturers of Temperature Control Equipment Since 1916

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MODEL S-7210

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, closed systems - portable units for heating water and circulating it at controlled temperatures - through molds, rolls or jackets of processing equipment.

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. Among them are: solid-state electronic thermostat, automatic mechanical proportioning of heating and cooling, dual electronic sensing probes, and pushbutton air vent.

The relatively small total amount of water, rapidly recirculated 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 recirculation, combined with the high cooling rate, gives the unit exceptionally fast response.

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

Any Sterlco unit which has been used contrary to specific operation 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.

DESCRIPTION

SYSTEM TEMPERATURES

The system temperatures are easily read on the meter which is part of the thermostat. Its long thin needle with close calibration permits the detection of small temperature variations.

ELECTRICAL

The pump motors operate on three phase, full line voltage with the control circuit operating at 115V single phase. The control circuit voltage is provided by a single phase transformer wired across two legs of the three phase power supply. Magnetic motor starters with overload and high/low voltage protection are used for the pump motors. The 115V control circuit is fused.

NOTE:

ALL PUMP MOTORS ARE THREE (3) PHASE AND PUMP ROTATION MUST BE CHECKED TO INSURE PROPER OPERATION OF YOUR UNIT.

VENT PUSHBUTTON

This pushbutton permits a quick and complete purge of air from the operators 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 PS prior to leaving Sterling.

CIRCULATION

PUMP

The pump is a 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 as stated below.

NOTE:

ALL PUMP MOTORS ARE THREE (3) PHASE AND PUMP ROTATION MUST BE CHECKED TO INSURE PROPER OPERATION OF YOUR UNIT.

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. For pump (only) ratings, please refer to page 4 of Bulletin #844. The following table is a listing of true unit capacities.

1/2 H.P.	15 GPM @ 20 PSI
3/4 H.P.	20 GPM @ 20 PSI
1 H.P.	30 GPM @ 25 PSI
1-1/2 H.P.	40 GPM @ 30 PSI
2 H.P.	50 GPM @ 30 PSI
3 H.P.	45 GPM @ 40 PSI
5 H.P.	60 GPM @ 50 PSI

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.

WATER SUPPLY

It is very important that the water supply to the unit meets certain requirements. We recommend a full sized hose, equal to the pipe size of our water supply connection and without restricting fittings. Usable pressure should be in excess of 20 PSI (1.4 KG/CM^2) and preferably 25 PSI (1.75 KG/CM^2) at the unit, if the unit is expected to operate at temperatures 200°F. (93°C.). This minimum pressure is necessary to keep the process water from flashing to steam at the pump inlet, where pressure is the lowest in the system. The pressure switch inside the unit will keep the unit from running until the unit has been subjected to a minimum water supply pressure.

Water Supply – Continued

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^2) 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 valve 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. Also, bad water can build layers of scale or lime on the surfaces of the unit, slowing down water flow and causing control problems and eventual damage to the equipment. Since the corrective maintenance and downtime often caused by bad water are costly, it is well worthwhile to treat that water. In general, we have 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.

PROCESS CONNECTIONS:

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.

These connection lines and connectors should be inspected frequently to ensure that the original service rating has not been reduced by age and/or deterioration.

OPERATION

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.

After the water supply has been connected up to the "WATER SUPPLY LINE", (the pressure must be in excess of 20 PSI and preferably over 25 PSI, but not to exceed 50 PSI) press the "VENT" button and hold for at least one minute. The solenoid valve opens electrically.

As the water comes in on the water supply line, and as the check valve is closed, the water must enter the pump, go down through the bottom of the tank, up through the tank and out through the "DELIVERY LINE"; through the process, back through the "RETURN LINE", and through the open solenoid valve and out the "DRAIN LINE".

At this time, 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.

"START-STOP" SWITCH

"Start Position"

When the switch is in the "START" 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".

NOTE: ALL PUMP MOTORS ARE THREE (3) PHASE AND PUMP ROTATION MUST BE CHECKED TO INSURE PROPER OPERATION OF YOUR UNIT.

"Stop Position"

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

Set the "SET-POINT" on the temperature controller to the desired temperature.

If the heat of the water travels above the set point, the unit will automatically switch to the cooling cycle and the COOL INDICATOR LIGHT will illuminate.

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 a long time, or if 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.

PREVENTIVE MAINTENANCE:

EVERY SIX (6) MONTHS:

Inspect all electrical connections for secure attachment and for safe and secure ground connections. Inspect the power cable, especially at entrance point to the unit.

MODEL S-7210

ALL ELECTRICAL TROUBLESHOOTING MUST BE DONE BY A QUALIFIED ELECTRICIAN

TROUBLESHOOTING

TEMPERATURE FLUCTUATIONS Alternate Overheating and Overcooling.

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

1. Small connectors or small water passages. Slow water flow will create a long reaction time which causes overheating and overcooling.

2. Very long connecting lines 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.

UNABLE TO COOL

In order to cool, the unit must pass water to the drain directly, or through the heat exchanger if the unit has a heat exchanger. Therefore, if your unit does not provide cooling, the following steps should be taken to help locate the cause.

1. Check to see that the water supply is open at all times while the unit is in operation.

2. Check to see if water flows to the drain when the unit calls for cooling.

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.

4. If the solenoid valve is operating properly, a "no flow" condition could be the result of a plugged heat exchanger, which could reduce or stop the cooling water flow on those units which contain heat exchangers.

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.

PUMPS AND SEALS

Before leaving our factory, each unit is operated for a considerable period of time and calibrated. After this test, the unit is drained and blown out the warm air to remove most of the water from the piping systems. If the unit is allowed to stand idle for a longtime 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 tighten the pump screws to stop a leaking condition.

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, but 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 the pump and free the seal by hand. It is seldom necessary to install a replacement seal in a new unit unless the seal has been damaged because 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 presence of certain chemicals in the water. Our pump seal assembly has been developed to resist abrasive particles 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 wear 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 downtime 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-E1 when overhauling the pumps. Careful attention to these instruction will help assure a proper installation and mimimum downtime.

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.

NOTE:

IF THE PUMP MOTOR IS UNWIRED FOR REMOVAL FROM THE UNIT, IT IS VERY IMPORTANT THAT YOU CHECK THE ACTUAL DIRECTION OF ROTATION WHEN THE MOTOR IS REWIRED INTO THE UNIT.

S SERIES CONTROLLER
TROUBLE SHOOTING

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 metal 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 set 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).

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 through 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 or 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 through 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 - COOLING 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.

VI. 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. HEATING 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.

VIII. 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.

IX. DEAD BAND ADJUSTMENT: (see Dwg. B681-00031 or C681-00013)

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"

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.
   b. Too High - Turn the potentiometer on top of meter board clockwise to correct temperature.

CALIBRATIONS

The following sequence of steps should be followed to properly and effectively calibrate your Sterlco Temperature Control Unit.

A. Be certain that the unit is connected to allow for good water flow. If necessary, use an extra jumper hose, or at least use large diameter hose to allow for good flow of water through the system.

B. Turn the pump off and "Zero" the temperature indicator as shown by drawing B681-00031 of this manual.

C. Check the sensor wires at terminals 1, 2, and 3 of the solid state control to make sure that they are very securely attached. If they are somewhat loose or oxidized, a false thermostat reading will be given. We recommend that these connectors be soldered to the solid state board at terminals 1, 2 and 3.

D. Check the dead-band span by turning the front set-knob up scale and down slowly to determine the amount of span between heating and cooling. Next, refer to drawing B681-00031 of this manual for the location of the dead-band adjustment. That adjustment should be rotated gently a few times clockwise and counter clockwise to clean its internal surfaces. Then, the dead-band should be properly set for a total span of 3^{o} to 4^{o} or whatever is required by your process. A wide span will put the whole instrument out of proper calibration.

E. Re-adjust the temperature meter to agree with the dial setting of the thermostat (see drawing B681-00031 for location of meter adjustment).

F. We recommend that every 3 or 4 months you check the dead-band span to be certain that atmospheric conditions haven't corroded the surfaces to where the span has become too wide for proper operation. As mentioned above, wide span will also cause the temperature meter to provide a false reading.