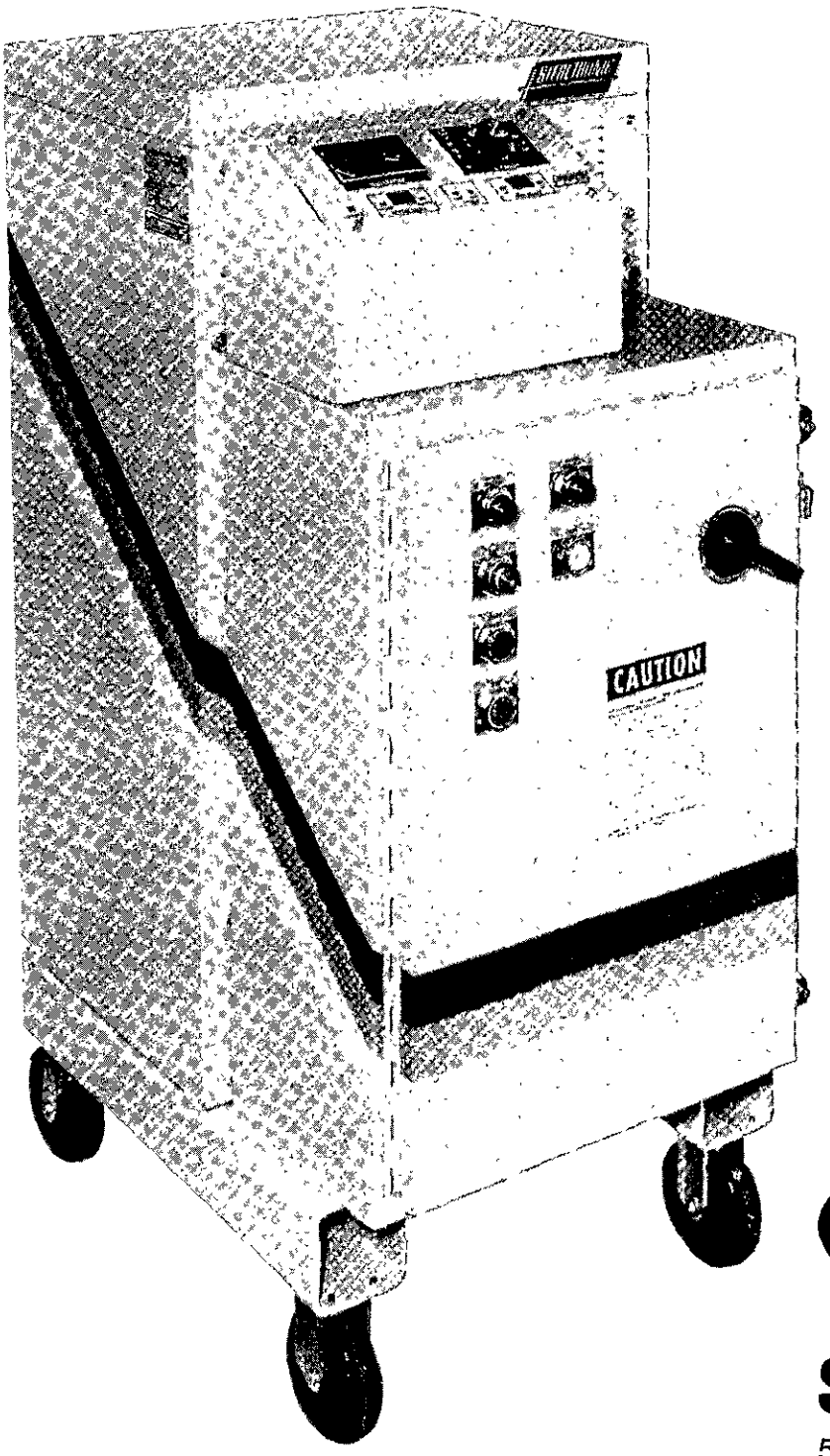
STERLCO TEMPERATURE CONTROL UNIT
SERVICE AND INSTRUCTION MANUAL

MODEL: M-8414

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

STERLCO

SINGLE ZONE TEMPERATURE CONTROL UNIT
WATER TYPE — JIC



DIGITAL AND ANALOG THERMOSTATS AVAILABLE

MODEL NUMBER:
TEMP. RANGE:
HEATERS:
PUMPS:
THERMOSTATS:
ELECTRICALS:
COOLING:

Sterling, Inc.
5200 W. Clinton Ave.
Milwaukee, WI 53223 USA
414-354-0970
Telex: 2-6805

MODEL: M-8414 or M-8424

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MODEL: M-8414 or M-8424

DESCRIPTION

The Model M-8414 or M-8424 Sterl-Tronic temperature control unit is built to comply to JIC specifications as best as they can be interpreted to apply to a portable device of this nature.

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. (120° C.) max. The unit is well suited for use with a city water supply, water from portable or central chillers, towers or with well water.

Performance is assured through the matched performance of the unique Sterlco Digital Controllers, and the Sterlco Water Circulating System. The two systems are properly integrated so as to achieve most accurate control, along with efficient use of electricity and water.

The digital controller has several important features in addition to it's primary function as a thermostat. Simultaneous digital display of set temperature and actual water temperature in large numerals will give the user the opportunity to monitor performance at a glance. The automatic purge will assure positive vent of air prior to start-up. The controller will tell you if the water supply has not been turned on and will notify you if the motor phasing (rotation) is incorrect. It provides you the opportunity to program high and low temperature limits so that you might be advised if conditions cause the water temperature to exceed those limits. The controller normally indicates the delivery (to your process) water temperature. However, you may read the return (from process) water temperature by simply touching the return temperature control. In similar fashion the difference between Delivery and Return (ΔT) can also be displayed by a touch of the control.

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. The high rate of recirculation, combined with the large immersion heater and large cooling capacity, gives the unit exceptionally fast response in bringing the process to temperature, and in making changes of settings when necessary.

These units may have many variations of optional features added to them, relative to the customer's application or specific desires.

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 and electrical supply connections.

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: M-8414 or M-8424

WATER HEATING

Heating of the water is accomplished through the specially designed 3 phase low watt density electrical immersion heater, and controlled by the main digital thermostat. The standard heater has a copper sheath for best application of heat. Stainless heaters are offered as options.

These models can be supplied with 4-1/2 KW, 9 KW, 12 KW, 18 KW, or 24 KW low watt density immersion heaters, depending upon the heating needs of your process. All are built to provide "full" or "partial" heat as required by the thermostat.

ELECTRICAL

The pump motors and the immersion heaters operate on three phase, full line voltage with the control circuit operating at 115 V. single phase. The control circuit voltage is provided by a single phase transformer wired across two legs of the three phase power supply. The 115 V. control circuit is fuse-protected. Magnetic motor starters with overload protection are used for the pump motors. If a motor overload condition should occur, the motor starter overload protection will trip. This condition will be indicated on the controller by the pump rotation light illuminating.

AUTOMATIC VENT

This feature permits quick and complete purge of air from your system before the unit is started. The "VENT" 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 pressure switch itself is set at approximately 10 PSI prior to leaving Sterling. If the pressure switch is not satisfied, the unit will not operate, and the "water pressure" pilot will light.

SAFETY THERMOSTAT

The safety thermostat is mounted on the side of the heater tank as a protection against over-heating. The safety thermostat is electrically connected to the "M-2" controller. If an over-heating condition existed, the controller would flash the safety thermo light and discontinue the control function.

MODEL: M-8414 or M-8424

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.

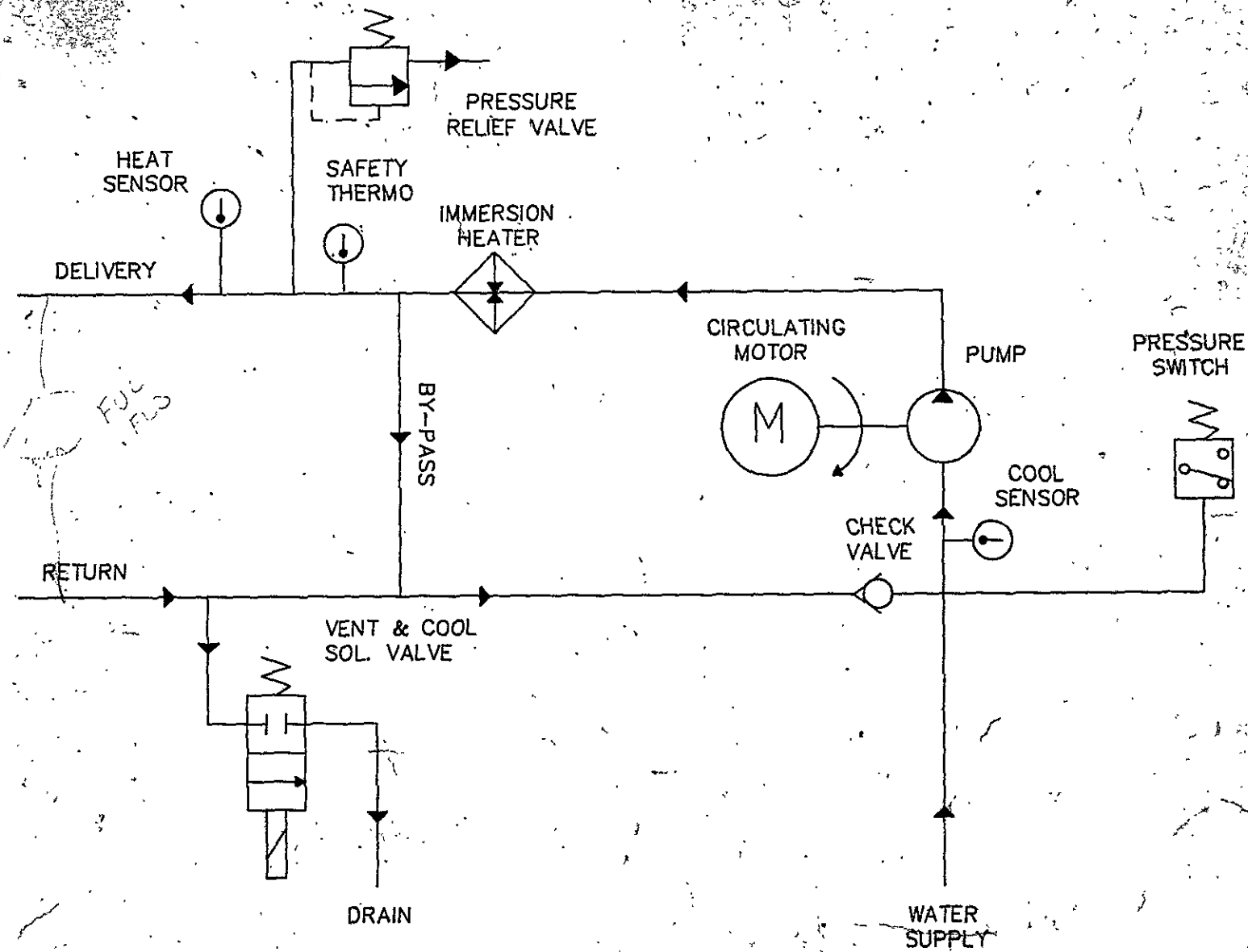
A special seal-flush system in the pump helps keep the seal clean, thereby extending seal life. The seal itself is the finest type available for this type of service and provides an excellent combination of long wearing ability, high abrasion resistance and heat resistance. For pump (only) ratings, please refer to page 4 of Bulletin #841. 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 @ 35 PSI
2 H.P.	50 GPM @ 30 PSI
3 H.P.	45 GPM @ 40 PSI
5 H.P.	90 GPM @ 30 PSI

COOLING

Cooling is accomplished by automatic release of the required amount of warm water from the system. 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.

DWG. NO. AG82-3154G



USED ON: M8412-A THRU G & S8412-A THRU G

STERLING, INC. MILWAUKEE, WIS.	TITLE: FLOW SCHEMATIC	DR. DK	CH'K	DATE 6-10-87	SCALE NONE	DRG. NO. AG82-3154G

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

MODEL: M-8414 or M-8424

INSTALLATION

ELECTRICAL:

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. Refer to unit nameplate for proper voltage and amperage requirements. These units must be securely grounded.

WATER SUPPLY

It is very important that the water supply to the unit meet 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 up to 250° F. 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.

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) will serve no useful purpose and may tend to shorten the life of the unit. If your water pressure is excessively high, it is recommended that a combination regulator/relief be installed in the supply line with the relief valve downstream from the regulator and set slightly higher than the regulator. Hard or corrosive 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 caused by bad water are costly, it is very 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.

MODEL: M-8414 or M-8424

OPERATION

With M-2 Controller

After the electrical and water connections have been made, the following steps should be taken to place the unit into operation.

1. Open the water supply line to allow your cold water to enter the unit and circulating system. The "drain" line should be open so that venting and cooling can take place.

2. Push and hold the start pushbutton until the pump starts. The unit will go into the automatic vent sequence for a short while to expell all entrapped air. During the venting sequence, the pump will start automatically and the pump run light will illimunate.

3. If the electric power supply is incorrectly phased, the motor will momentarilly run backward and the "Pump Rotation" light will show. The controller will not operate with incorrect rotation. Correct phasing of your electric power supply should be made at this time, if required.

4. If your system is unusually large, you may wish to conduct additional venting. This can be accomplished by turning off the unit shortly before the end of the one (1) minute vent cycle. Turn the unit back on and the unit will repeat the vent cycle. When the vent cycle is complete, the controller will not repeat the vent cycle unless it has been turned off for 10 minutes. A thorough purge of air is essential in giving the pump a good prime and of assuring best flow and best temperature control.

5. To set for your desired temperature, press and hold the "Program Process" panel which is in the upper left corner of the controller. The pilot light should illuminate. While holding this panel, the up or down arrow panels should be touched as necessary to bring your setting into the "Set Point" display. The display will advance slowly at first and then increase. As you near the desired set point, release the arrow panel and then repress to reach desired set point. The unit is now programmed to achieve your desired temperature, and will heat or cool as necessary to achieve that temperature. Actual water temperature will show in the "Temperature" display window.

6. The type of cooling required is selectable by a switch located above the OFF/ON switch.

"PULSE" cooling is intended to be used as follows:

a. When the process is mainly heating.

b. When it is desired to have a light cooling cycle.

"FULL" cooling is intended to be used as follows:

a. Large volume systems.

b. Heavy cooling loads.

c. Controlling at low temperatures - Typical (80° F.)

7. If the cooling select switch is in pulse cool mode, the controller will automatically select the proper HI/LO heat requirement. If the cooling select switch is in full cool mode, heat selection is switched to manual control and you may select high or low heat by touching the "HEAT" panel in the lower right of the controller.

8. If you wish to program high and low temperature alarms, the method is much the same as used to program the control temperature. By touching and holding the "PROGRAM HI ALARM" you can use the up and down arrows to bring your maximum temperature to display in the "Set Temperature" window. Touching and holding the "PROGRAM LOW ALARM" will allow you to program the low alarm in the same manner.

If you do not wish to use the alarms, we would suggest that you set the high alarm for approximately 250° F. (121° C.) and the low alarm for approximately 50° F. (10° C.) to avoid nuisance flashing of the alarm pilot lights.

With the alarms programmed for your acceptable span of water temperature, you will be notified by means of a flashing pilot if the actual water temperature deviates outside these limits. Our pilots can be connected by the user to additional alarm signals such as horns or large flashers, as long as the power drawn on 115 volts is 250 watts or less.

9. If you wish to know the return temperature, press and hold the "RETURN TEMPERATURE" panel. As long as the panel is held, the return water temperature will show in the temperature window.

10. If you wish to know the temperature difference (△T) between the Delivery and Return Water Temperatures, press and hold the (△T) Temperature Difference panel. The temperature difference will show in the temperature window.

11. If you wish to cool the unit down quickly without changing your set-point, press and hold the down arrow panel. For direct mix units (8400) this procedure may also be used for additional venting.

DRAINING

If your Sterl-Tronic is to be taken out of service for a 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.

OPERATION OF ONE ZONE ONLY OF A DUAL ZONE UNIT:

When one zone of a dual or triple zone unit is to be operated while the other remains idle, it is necessary to run a by-pass line from the delivery to the return line of the idle zone.

PREVENTATIVE MAINTENANCE:

EVERY 6 MONTHS: DISCONNECT ALL POWER PRIOR TO SERVICING

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: M-8414 or M-8424

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 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.

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 close 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 adjust the "set point" up and down scale 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 controller. This can be done by adjusting the controller up and down the scale. The contactors should be made to go in and out as the setting passes unit temperature. If it does not function, the controller may be faulty and the section of this manual dealing with controller 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. The heater can be quickly checked by using an ammeter. If all 3 legs draw equal current, the heater is okay.

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. 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 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 proper installation and minimum 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.

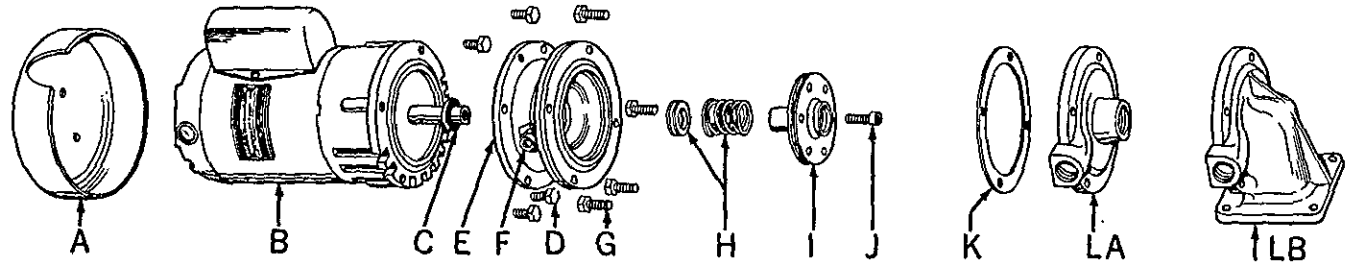
NOTE:

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. The phase sensor used to detect proper rotation may not indicate properly if the motor wire leads are reversed at reinstallation.

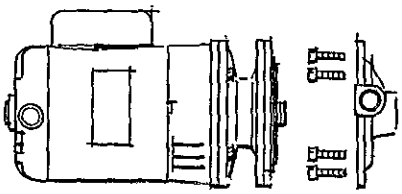
REPLACING ROTARY SEAL ASSEMBLY ON STERLCO PUMP AND MOTOR

PARTS

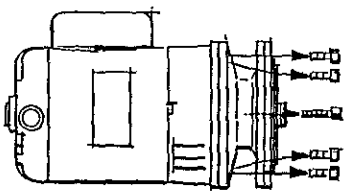
A. Drip Cover
B. Motor
C. Water Slinger
D. Motor Screws
E. Bracket
F. Prime Cock
G. Pump Screws
H. Rotary Seal Assembly
I. Impeller
J. Impeller Screw
K. Housing Gasket
L. Volute - A or B



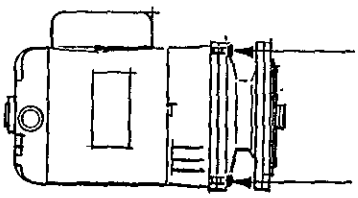
Step No. 1 — Dis-assembling (Removal of old seal assembly)



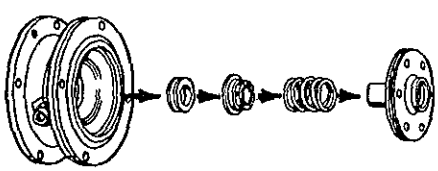
a) Remove volute from motor bracket and impeller assembly by removing pump screws.



b) Remove impeller screw and motor screws. (Note: opposite end of motor shaft is fitted with screw driver slot to hold shaft securely while impeller screw is being removed. Drip cover must be removed to get at screwdriver slot).



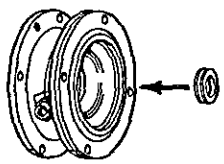
c) Insert two of the pump screws into the two threaded holes in the bracket. Tighten them slowly and evenly to force the impeller and bracket off the shaft. **Do not pry the impeller or bracket!**



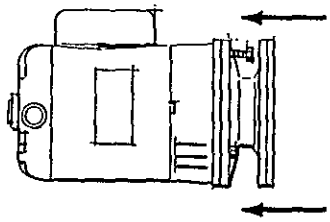
d) Remove old seal parts from impeller hub and bracket. Be sure water slinger is in place.

e) Clean impeller hub thoroughly . . . remove all loose particles of dirt, grease, etc. Use fine emery cloth if necessary. Also clean the recess in the bracket so the new seat will fit perfectly. Remove all particles and dirt on gasket surfaces of the two castings.

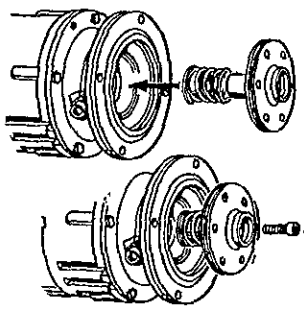
Step No. 2 — Re-assembly (Installation of new seal assembly)



f) Coat outside edge of new seat with 3% detergent solution and slip it into the bracket. Press into bracket with thumbs or wooden dowel. Handle seat carefully so seating surfaces are not scratched or chipped . . . be sure it is squarely seated.

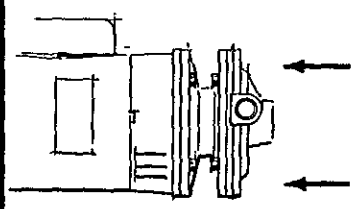


g) Remount bracket on motor.



h) Lubricate impeller hub. 3% detergent solution . . . slip new bellows and spring onto impeller hub. Be sure bellows slides freely on impeller hub.

i) Replace impeller on motor shaft extension and secure with impeller screw. Hold shaft with screw driver slot while tightening screw.



j) Replace volute onto bracket, using new housing gasket. Use one gasket for condensate pump and for temperature control units. Secure with pump screws. Be certain gasket is seated properly.

NOTE: When ordering parts please indicate pump model number and serial number.

STERLING, INC. 5200 W. Clinton Ave., Milwaukee, Wisconsin 53223

Form I-4100-E1

Litho in U.S.A. 6/62

STERLING, INC.
PARTS LIST (D-G)
STERLCO PUMP 1 TO 3 HP

ITEM	PART NO.	DESCRIPTION
O	001-05915	Motor Screw, (4) Required
P	542-10404	Water Slinger
O	615-00001	Bracket
R	081-00024	Rotary Seal Assembly
S		Impeller-specify part no. and diagram (See pump nameplate)
T	525-00001	Lock Washer
U	535-00001	Impeller Nut
V	545-00002	Housing Gasket
W-A	615-00003	Threaded Inlet Casting
W-B	615-00002	Tank Inlet Casting
X-A	001-05915	Pump Screw for pump w/threaded suction (8) required
X-B	001-05915	Pump Screw for pump w/tank suction (6) required
X-B	001-05923	Pump Screw for pump w/tank suction (2) required
		(Above parts illustrated on Form MP-1)
	M-160-00005	Motor Drip Cover (**)
	M-720-09003	Electric Motor 1 HP - 3/60/230-460V Open (#)
	M-720-09009	Electric Motor 1 HP - 3/60/230-460V TEFC (#¢)
	M-720-09004	Electric Motor 1-1/2 HP - 3/60/230-460V Open (#)
	M-720-09010	Electric Motor 1-1/2 HP - 3/60/230-460V TEFC (#¢)
	M-720-09005	Electric Motor 2 HP - 3/60/230-460V Open (#)
	M-720-09011	Electric Motor 2 HP - 3/60/230-460V TEFC (#¢)
	M-720-09006	Electric Motor 3 HP - 3/60/230-460V Open (#)
	M-720-09012	Electric Motor 3 HP - 3/60/230-460V TEFC (#¢)

**Used only on drip proof motors
* State Motor Manufacturer
# State Motor Manufacturer if preferred
¢ State special specification (i.e. 7EQ-Spec., 7E-Spec., etc.)

Sterling part numbers apply to non-special motors. Consult Parts List in your unit manual for specific motor requirements.

STERLING, INC., 5200 West Clinton Avenue, Milwaukee, Wisconsin 53223-0435
Phone: (414) 354-0970 Telex: 2-6805 P.O. Box 23435

STERLING, INC.
PARTS LIST (D-G)
STERLCO PUMP 1 TO 3 HP

COMPLETE PUMP & MOTOR ASSEMBLY

Open Drip Proof 3450 RPM, 3/60/230-460V

605-00083-11	1 HP
605-00084-07	1-1/2 HP
605-00065-03	2 HP
605-00086-01	3 HP

*TEFC 3450 RPM, 3/60/230-460V

605-00083-01	1 HP
605-00084-02	1-1/2 HP
605-00065-09	2 HP
605-00086-03	3 HP

*7EQ and Explosion Proof Not Included

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