

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

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

MODEL: M-6410

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MODEL: M-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 M-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.

MODEL: M-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

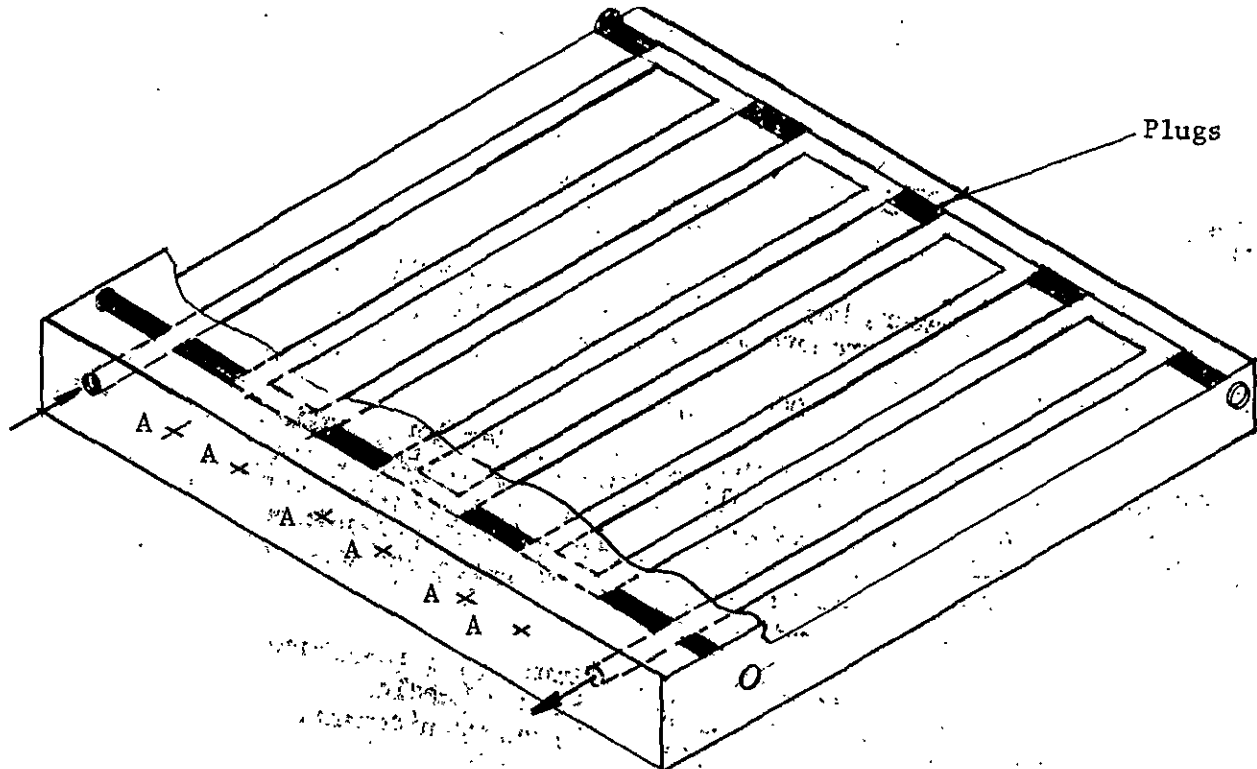
15,368 BTU/hr.

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.



Modification of Platen  
For Manifold

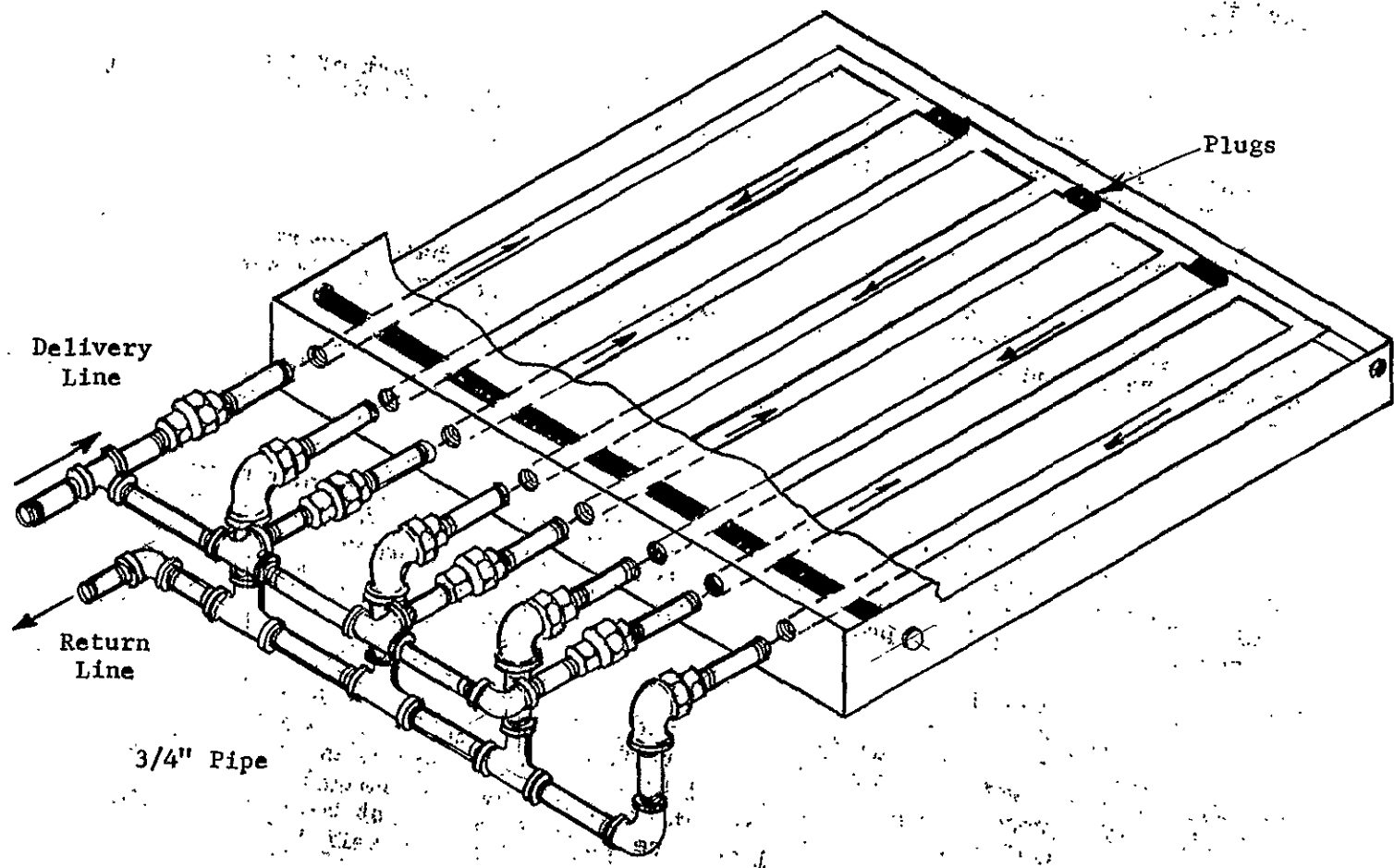


Fig. 1

MODEL: M-6410

PERFORMANCE:

The Model M-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 one 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: M-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.

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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.



MODEL: M-6410 . .

PREVENTIVE MAINTENANCE:

EVERY 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.

EVERY 4 MONTHS:

Check to be sure that all removable panels are in place and securely attached especially those which enclose the electricals. Check the calibration of the thermostat, particularly the "span" between "Heat & Cool" - correct as required per the "Calibration" section of this manual.

## STERL-TRONIC

Series 6300 & 6400

### 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.

#### 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.

## TROUBLESHOOTING

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.

### 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.

## TROUBLESHOOTING

### 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 startup.
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 with warm air to remove most of the water from the piping systems. If the unit is allowed to stand idle 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 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.

## TROUBLESHOOTING

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 instructions will help assure a 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.

M-1 SOLID STATE DIGITAL CONTROLLER: (cont.)

- 5.) Self-diagnostic capabilities - when a problem is detected by the computer circuits, such as a loose probe wire, the controller automatically turns off all heating and cooling functions, then flashes the temperature display to indicate immediate attention is required.
- 6.) Microprocessor design - Each M-1 is a miniature computer turning our analog world into digital pulses. Problems of guessing at temperature or set point are eliminated. Customer requested options and specialties are easier to produce.
- 7.) Temperature and set point are continuously displayed and large enough to be read from a distance.
- 8.) Various colored lights to indicate the heat and cool functions along with a red colored lamp to indicate power to the controller and the Sterl-Tronic pump.
- 9.) Manual "VENT" push button switch to aid you in purging all air from your system prior to start-up.
- 10.) Extremely tight deadband control-under normal operation the M-1 has a deadband of  $\pm 1^{\circ}$  F. For example, if your set point is  $150^{\circ}$ , heating and cooling functions are kept in the "OFF" state only if the process temperature is  $149^{\circ}$ ,  $150^{\circ}$ , or  $151^{\circ}$ . A more lenient deadband of  $\pm 3^{\circ}$  is obtainable by operating the deadband toggle switch. This switch is inside the access hole located on the right side of the controller cover.
- 11.) Available in Fahrenheit or Centigrade calibrations as well as maximum temperatures of  $250^{\circ}$  F.

## M-1 SOLID STATE DIGITAL CONTROLLER: (Cont.)

Whenever power is applied to the motor pump, power is also connected to the digital thermostat. At this time a red light will be activated on the controller labeled "pump" and the controller will begin to execute temperature control procedures. The customer will dial in through the directional push button set-point switch the temperature at which he desires to operate. The temperature of the delivery line or in other words at the point of the heat probe, will be displayed in degrees Fahrenheit on the digital thermometer.

### THERMOSTAT DIAGNOSTICS:

The M-1 digital controller does have built-in probe sensing diagnostics. Should you encounter a defective probe whereby the sensor either shorts out or is mechanically disconnected from the temperature controller, the display will start to flash a "1" for a defective heat probe or a "2" for a defective cool probe, indicating that immediate action is required. When a defective probe is detected, heating and cooling functions are disabled. Normal operation is resumed when the probe defect is corrected. If a problem occurs such that the controller seems to be operating properly, however, the indication of the heating and cooling lights appear both to be on, this would be an indication that there is a mechanical disconnection of electrical power between the controller and the solenoid or heater contactor. If, in fact, these connections are good and both heater contactor and solenoid are operating properly, a problem would exist internally in the controller and the controller should be returned to Sterling, Inc. for immediate repair.

If the customer applies power to the pump motor, and notices a red light on the controller but no heating or cooling functions and no display in the digital thermometer, the customer should attempt to restart the pump motor. If this fails, the digital controller is defective and should be returned for immediate repair. The loss of the display on the digital thermometer at anytime during normal operation would also dictate turning the unit off and then turning power back on to give automatic reset. If the display heating and cooling functions are not returned, again the controller is defective and should be returned.

## M-1 SOLID STATE DIGITAL CONTROLLER

### AUTO VENT MODE FEATURE

If desired a customer may select a M-1 controller with auto venting. The controller faceplate will then be equipped with a small push button switch on the faceplate.

1. When the customer turns on the pump switch and presses the small auto vent push button switch on the faceplate simultaneously, the controller automatically goes into an auto vent sequence.
2. The seven-segment display will indicate a zero.
3. During automatic venting all other operations of the controller are disabled. The venting solenoid in an indirect cooling system or the cooling solenoid in a direct cooling system is activated for 60 seconds.
4. An attempt to depress the auto vent push button again or a drop in control voltage will not send the controller into an automatic venting cycle again should the customers process be up to temperature which might result in a spoiled product.



STERLING, INC.  
 PARTS LIST (B-G)  
 STERLCO PUMP 1 to 3 HP

<u>ITEM</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
O	001-05915	Motor Screw, (4) req'd
P	542-10404	Water Slinger
Q	B-615-00001	Bracket
R	081-00024	Rotary Seal Assembly
S		Impeller - specify part no. and dia. (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) req'd
X-B	001-05915	Pump Screw for pump w/tank suction (6) req'd
X-B	001-05923	Pump Screw for pump w/tank suction (7) req'd
		(Above parts illustrated on Form MP-1)
	M-160-00005	Motor Drip Cover (**)
	N-720-09003	Electric Motor 1 HP - 3/60/230-460 V open (#)
	N-720-09009	Electric Motor 1 HP - 3/60/230-460V TEFC (#ç)
	N-720-09004	Electric Motor 1-1/2 HP - 3/60/230-460V open (#)
	N-720-09010	Electric Motor 1-1/2 HP - 3/60/230-460V TEFC (#ç)
	N-720-09005	Electric Motor 2 HP - 3/60/230-460 V open (#)
	N-720-09011	Electric Motor 2 HP -3/60/230-460V TEFC (#ç)
	N-720-09285	Electric Motor 3 HP - 3/60/230-460V open (#)
	N-720-09012	Electric Motor 3 HP - 3/60/230-460V TEFC (#ç)

\*\* Used only on drip proof motors

\* State Motor Manufacturer

# State Motor Manufacturer if preferred

ç 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.

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Telex: 2-6805

P.O. Box 23435

MODEL M-6410

<u>PART NO.</u>	<u>DESCRIPTION</u>
729-00045	Contactora, Imm. Heater
601-00185-05	Controller, Thermostat
725-00626	Fuse, Control #MDA-15, 15 amp
725-00512	Fuse, Control #MDL-1, 1 amp
725-00694	Fuse, Control #AGC-3, 3 amp
722-00044-08	Immersion Heater 4-1/2 KW @ 480V
720-09159	Motor, 1/2 HP
720-09168	Motor, 3/4 HP
691-00003-15	Probe, Sensing Temp.
695-00007-01	Pump & Motor Assembly
695-00030-03	Pump & Motor Assembly
721-00104	Push Button, Start & Stop
726-00005	Starter, Motor
726-00030	Starter, Motor
632-02858	Switch, Pressure
704-00015	Transformer
704-00051	Transformer
044-00138	Valve, Safety
732-00024	Solenoid Valve 1/4"
736-00005	Alarm

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