$30.00

STERLCO®

Operation and Installation Manual

# 9016 / 9026 Series Hot Oil Temperature Control Units

***Important!*** **Read Carefully Before Attempting to Install or Operate Equipment**

**Part No. 682.85757.07** **Revision 7** **Bulletin No. SC1-625.7**

*Write down your unit serial number(s)* _____ _____

*here for future reference* _____ _____

_____ _____

_____ _____

Sterling/Sterlco is committed to a continuing program of product improvement.
Specifications, appearance, and dimensions described in this manual
are subject to change without notice.


Effective 6/14/02
Part No. 682.85757.07 Revision 7 Bulletin No. SC1-625.7

# Safety Considerations

Sterling/Sterlco 9016 / 9026 Series hot oil temperature control units are designed to provide safe and reliable operation when installed and operated within design specifications, following national and local safety codes.

To avoid possible personnel injury or equipment damage when installing, operating, or maintaining this equipment, use good judgment and follow these safe practices:

- ☑ Follow all **SAFETY CODES**.
- ☑ Wear **SAFETY GLASSES** and **WORK GLOVES**.
- ☑ Disconnect and/or lock out power before servicing or maintaining the hot oil temperature control unit.
- ☑ Use care when **LOADING**, **UNLOADING**, **RIGGING**, or **MOVING** this equipment.
- ☑ Operate this equipment within design specifications.
- ☑ **OPEN**, **TAG**, and **LOCK ALL DISCONNECTS** before working on equipment. You should remove the fuses and carry them with you.
- ☑ Make sure the hot oil temperature control unit and components are properly **GROUNDED** before you switch on power.
- ☑ Do not jump or bypass any electrical safety control.
- ☑ Do not restore power until you remove all tools, test equipment, etc., and the hot oil temperature control unit and related equipment are fully reassembled.
- ☑ Only **PROPERLY TRAINED** personnel familiar with the information in this manual should work on this equipment.

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# 1 General Information

## 1-1 Introduction

Your Sterling/Sterlco 9016/9026 Series hot oil temperature control unit is designed to circulate oil through your process and to precisely, automatically, and reliably maintain it at a specified temperature. The operating range of the standard unit is from 100°F (38ºC) to 400°F (204°C) or 550°F (288°C), optional 600°F (315°C). The unit is suited for use with a variety of commercially available heat transfer fluids. A recommended list of commercially available heat transfer fluids can be obtained through Sterling Customer Service.

Rapid recirculation of the relatively small amount of fluid provides close and uniform temperature relation between the delivery and return lines. (This depends on the configuration of your process, and any restrictions within the mold.)

This recirculation, combined with the large immersion heater and optional cooling capability, gives fast and accurate response to bring the fluid up to temperature, or to changes in the settings when needed.

Performance is assured through matching the unique Sterlco Controllers to the Sterlco High Temperature System. The two systems are properly integrated to achieve accurate control along with efficient use of water and electricity.

## 1-2 Necessary Documents

The following documents are necessary for the safe installation, operation, and maintenance of your Sterling/Sterlco 9016 / 9026 Series hot oil temperature control unit. You can obtain additional copies from Sterling, Inc. Make sure that appropriate personnel are familiar with these documents:

- ☑ This manual.
- ☑ The electrical schematic and connection diagram in the control enclosure.
- ☑ The manuals for accessories and options you've selected.
- ☑ The customer parts list in the control enclosure.

## 1-3 Models Covered

This manual lists installation, operation, and maintenance instructions for the 9016/9026 Series hot oil temperature control unit.

Model numbers are listed on the serial tag. A model number followed by **-Q** indicates a specially constructed unit, and not all information in this manual may apply. Make sure that you know the model number, serial number, and operating voltage of your unit if you contact Sterling, Inc.

## 1-4 Standard Features

- M2B microprocessor controller with fuzzy logic; includes diagnostic features with indicator and warning status lights
- Dual stage immersion heater with IEC contactors
- 550°F (288ºC) maximum operating temperature
- Branch fusing
- System status graphic display
- Pressure switch for low pump pressure shut-down
- UL listed subpanel
- To Process pressure gauge
- Independent safety thermostat
- Y strainer on From Process line
- Positive displacement pumps capable of reversing to evacuate the process
- Low level alarm for reservoir
- Easily removable panels for quick access to internal components
- Audible alarm

# 1-5 Available Options

- Drain valve
- Hour meter; measures total pump run time hours
- General fault visual alarm
- Non-fused lockable rotary disconnect
- NEMA 12 electrical enclosure
- Autovent sequence
- Low level alarm
- Manual bypass
- M2B microprocessor controller options include:
  - 4-20 mA remote set point and retransmission
  - SPI protocol, RS-485
  - General protocols, types RS-232, -485
  - Remote sensor
- Heat exchanger options of 3.9 sq. ft. (0.3627 sq. m) up to 21.0 sq. ft. (1.953 sq. m)
- Remote controller
- Lexan cover
- Optional operating voltages of 208/3/60, 230/3/60, 575/3/60, 380/3/50, and 415/3/50

# 1-6 Feature Descriptions

### Immersion Heaters

The fluid is heated by the specially designed three-phase low watt density electrical immersion heater, and regulated by the controller. The standard heater has a steel sheath for low watt density and good heat transfer.

These models can be supplied with 12, 18, 24, 36, or 48kW low watt density immersion heaters, depending upon the heating needs of the process. All of the models are built to provide "full" or "partial" heat as required by the process and determined by the controller, to provide more precise control.

## Heater Tank

The Model 9016/9026 features a patented, two pass heater tank. The tank was designed to maintain an optimum balance of fluid velocity versus watt density, with maximum turbulence for excellent heat transfer, and minimal pressure drop. The high fluid velocity will greatly prolong the life of the heater and fluid.

## Pump

The pump is a mechanical seal, positive displacement pump. It features a nearly maintenance free design, and was selected after extensive testing to provide superior performance, flexibility and low maintenance. It is well suited for use with a variety of commercially available heat transfer fluids. The pump has only two internal moving parts, and a specially designed seal to give years of trouble free service, even at high temperatures. The only routine maintenance required is the monthly greasing and occasional head space adjustment *(see Section 6-1, Page 43)*.

The pump is capable of running in either direction. Thus, the "pump reverse" feature can be used to draw fluids back from the process. It is not necessary to install a service air line to purge the lines before changing molds. Since the pump is capable of achieving extremely high pressures, it is necessary to regulate the pressure through use of a regulating by-pass line (Ful-Flo valve).

## Ful-Flo Valve

A regulating by-pass line featuring a Ful-Flo valve is standard in all units. This is a safety device to prevent excessive pressure in the event that the delivery line is obstructed. Each Ful-Flo is factory preset to limit system pressure as specified by the customer. It must not be tampered with in any way.

In the event of an obstruction in the line, the Ful-Flo will open and divert fluid to the return line. A constant flow of fluid is maintained through the heater tank to prevent damage to the heating elements and fluid.

## Cooling Optional

The Sterlco designed shell and tube heat exchanger is provided as optional equipment in this unit. The design features U-tube construction and copper-nickel tubes for durability and optimal heat transfer.

The modular construction (unique to Sterlco units) allows the tube bundle to be easily removed for periodic cleaning. Additionally, check valves are installed on the water supply and drain lines to prevent water from back flowing into the heat exchanger from a closed drain or into the water supply piping.

A water supply of 75 PSI (517.1 kPa/5.2 bars) maximum is required for connection to the heat exchanger.

NOTE: The 9016H (400° F.) utilizes a single pass, straight tube heat exchanger as a standard feature.

## Connection Lines

Process, delivery, and return lines are 1" NPT (25.4 mm) deliveries of 30 GPM or less, and 1 1/2" NPT for deliveries between 30 and 70GPM. Water connections vary based on heat exchanger size. *(See Section 3-3, Page 19.)* ***The Customer is responsible for conversions to metric standards.***

Sterling stocks many lengths of flexible metal hose to be used in connecting your unit to the process. The part number is 572-16969. State the length of hose you want when ordering.

## ⚠ WARNING

**Component failure may result in a spray of high temperature oil, causing serious injury or death to nearby persons.**

**Make sure hoses, valves, and other components installed in your process can withstand maximum temperature and pressure of the 9016/9026 unit; check unit nameplate for specific capacities.**

**All components must be carefully inspected for condition before installing. If in doubt, obtain factory components.**

## Electrical System Controls

The electrical controls of your Model 9016/9026 were specially engineered for reliability, safety and simplicity of operation. The switches are clearly labeled as to their function.

Additionally, a system status board is provided to enable the operator to evaluate the status and performance of the unit at a glance. Pilot lights are provided to indicate key unit functions.

An audible alarm is standard with your unit. The alarm will sound in the event of the following conditions:

- ♦ motor overload
- ♦ safety thermostat trip (over temperature)
- ♦ low fluid pressure

The alarm can be silenced by depressing the **ALARM SILENCE** push button. See Section 5 Page 28, Control Panel, for complete information on the functioning of the controls.

## Electrical Panel and System Components

The pump motor and immersion heater operate on three-phase, 50/60 cycle, nominal voltage with the control circuit at 115V single phase. The control circuit voltage is provided by a single phase machine tool transformer with primary fuse protection and a grounded secondary. The electrical panel is U.L. listed and complies with N.F.P.A. 79.

All components are I.E.C. rated for long life and reduced maintenance. The heater elements are branch fused, and protected from contactor welding by a separate primary voltage contactor. The pump motor is controlled by a full voltage magnetic reversing starter, with fused branch circuit overcurrent and thermal overload protection. Many additional features, including a main power disconnect, are available as options.

NEMA 1 enclosure is standard, with NEMA 12 and NEMA 4 available as options.

### Air Purge

Upon initial start-up and mold/process change out, it will be necessary to purge all air and water from the system. The 9016/9026 model is equipped with appropriate valving to ensure complete purging. Procedures are covered in Section 4.

## ⚠ WARNING

**Failure to purge the system of air before heating may result in serious injury or critical system and equipment damage.**

**Make sure you properly purge the system of air *before* starting the heater cycle.**

### Pressure Switch

A pressure switch is built into each unit to guard against heater damage. This feature prevents the heater elements from being energized unless the pump is running, and fluid is in the system. The pressure switch is preset at the factory and **must not be tampered with.**

### Safety Thermostat

The safety thermostat is a J-thermocouple sensing, adjustable, fail-safe device located in the heater tank. This is to guard against the unlikely event of "runaway" heating. If overheating does occur, the safety thermostat will shut down the heater outputs and sound an audible alarm. A red pilot light on the status board will also light up. The unit will continue to pump fluid through the system to prevent heater damage. Auxiliary factory installed alarms such as beacons and klaxons are available as options.

Resetting the alarm condition is initaited by depressing the red pump stop button. All controller functions will be locked out until the main supply power is disconnected and the thermostat reset by pushing the red button back in. The reset button is located inside the electrical enclosure, mounted on the left wall of the enclosure. It is imperative that a qualified maintenance technician determine and correct the cause of the fault before resuming operation.

## Reservoir Tank

An extra large capacity reservoir tank with sight gauge is standard. Usable capacity is 17 gallons. The tank allows for thermal expansion of the heat transfer fluid, as well as for "make-up" fluid.

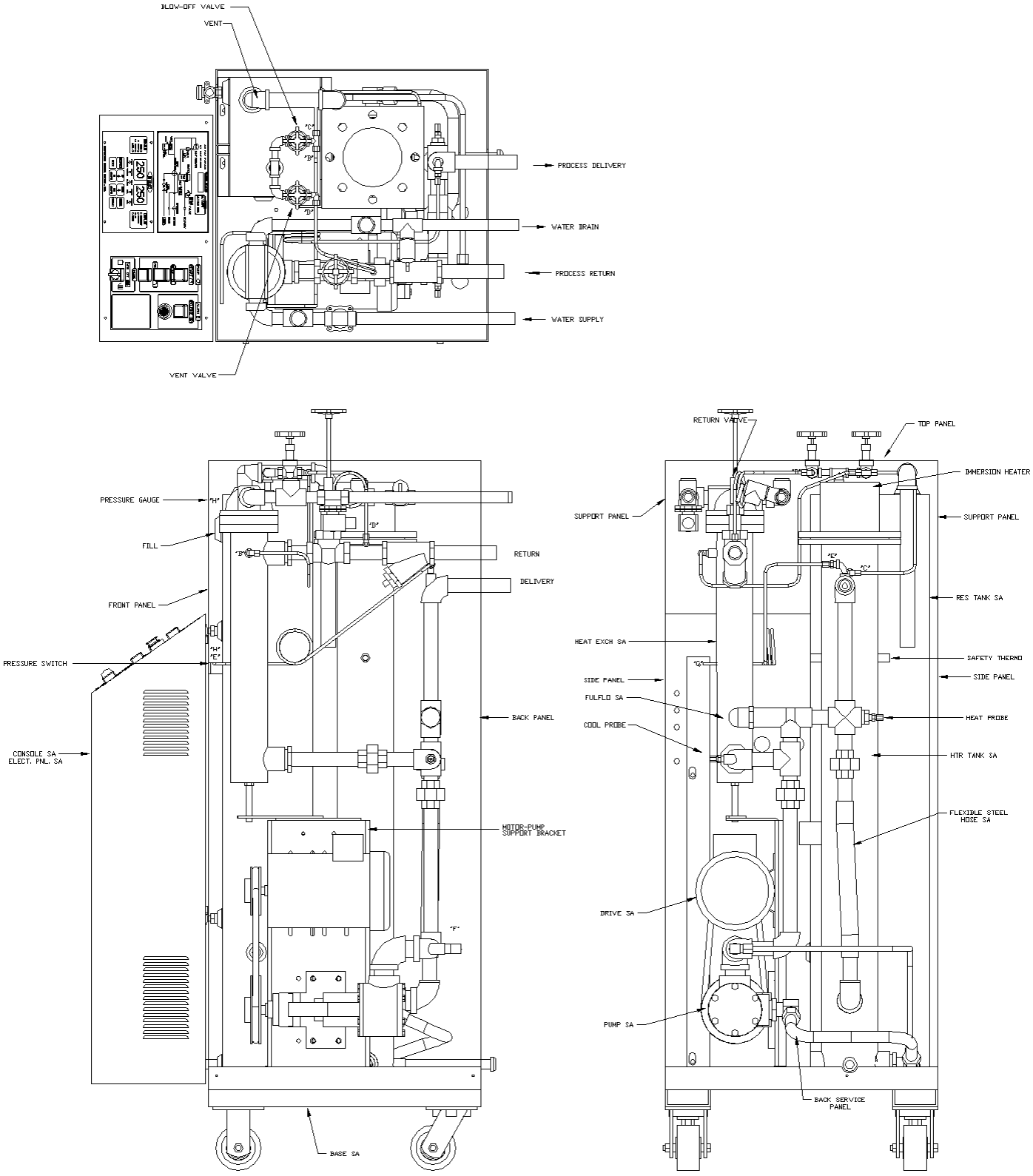
### ⚠ WARNING

**The reservoir tank may cause serious injury if it ruptures from not being properly vented.**

**Make sure that the reservoir tank is always properly vented to prevent tank rupture.**

The reservoir tank drain is extended beyond the base of the unit for ease of draining. Optional ball valves are available to further simplify draining.

Figure 1
9016/9026 Series Hot Oil Temperature Control Unit



# 2 Shipping Information

## 2-1 Unpacking and Inspection

You should inspect your Sterling/Sterlco 9016/9026 Series hot oil temperature control unit for possible shipping damage. If the container and packing materials are in re-usable condition, save them for reshipment if necessary.

Thoroughly check the equipment for any damage that might have occurred in transit, such as broken or loose wiring and components, loose hardware and mounting screws, etc. In case of breakage, damage, shortage, or incorrect shipment, refer to the following sections.

## 2-2 In the Event of Shipping Damages

**Important!**

**According to the contract terms and conditions of the Carrier, the responsibility of the Shipper ends at the time and place of shipment.**

- ☑ Notify the transportation company's local agent if you discover damage.
- ☑ Hold the damaged goods and packing material for the examining agent's inspection. **Do not return any goods to Sterling, Inc. before the transportation company inspection and authorization**.
- ☑ File a claim against the transportation company. Substantiate the claim by referring to the agent's report. A certified copy of our invoice is available upon request. The original Bill of Lading is attached to our original invoice. If the shipment was prepaid, write us for a receipted transportation bill.
- ☑ Advise Sterling, Inc. regarding your wish for assistance and to obtain an RGA (return goods authorization) number.

## 2-3 If the Shipment is Not Complete

Check the packing list. The apparent shortage may be intentional. Back-ordered items are noted on the packing list. You should have:

- ☑ 9016/9026 Series hot oil temperature control unit
- ☑ Bill of lading
- ☑ Packing list
- ☑ Operating and Installation packet
- ☑ Electrical schematic and panel layout drawings
- ☑ Component instruction manuals

Re-inspect the container and packing material to see if you missed any smaller items during unpacking. Determine that the item was not inadvertently taken from the area before you checked in the shipment. Notify Sterling, Inc. immediately of the shortage.

## 2-4 If the Shipment is Not Correct

If the shipment is not what you ordered, **contact Sterling, Inc. immediately**. For shipments in the United States and Canada, call 1 (800) 783-7835 or 1 (414) 354-0970. Include the order number and item. *Hold the items until you receive shipping instructions*.

## 2-5 Returns

**Important!**

**Do not return any damaged or incorrect items until you receive shipping instructions from Sterling, Inc.**

# Installation 3

## 3-1 Work Rules

The installation, operation, and maintenance of this equipment must be conducted in accordance with all applicable work and safety codes for the installation location. This may include, but is not limited to OSHA, NEC, CSA, and any other local, national, and international regulations.

- Read and follow these instructions when installing, operating, and maintaining this equipment. If the instructions become damaged or unreadable, obtain additional copies from Sterling/Sterlco.
- Only qualified personnel familiar with this equipment should work on or with this hot oil temperature control unit.
- Work with approved tools and devices.
- Disconnect the electricity **before** maintenance or service. If the unit is installed with a power cord that can be un-plugged, unplug it. If the unit is permanently wired to a power main, make sure that a fused power disconnect is installed to allow the disconnect to be locked in the **OFF** position. Open and lock out the disconnect installed in the control enclosure.

## 3-2 Installation Requirements

The 9016/9026 series Temperature Control Systems must have certain requirements met for proper operation.

### Installation Location Considerations

The 9016/9026 series is designed to be located as close as possible to the process for proper circulation and temperature control.

Proper care must be used in selecting a unit location. The area surrounding the unit must be free of obstructions to ensure proper ventilation of the internal components.

The ambient temperature range for storage is -40 °F (-40 °C) to 185 °F (85 °C). The ambient temperature range for operation is -4 °F (-20 °C) to 120 °F (49 °C). Preheating of

the process fluid may be necessary when performing unit start-ups at ambient temperatures below 30ºF (-1ºC).

The unit must never be operated in confined spaces. Air circulation is generally satisfactory for units operated at lower (to 500 °F) temperatures. At higher temperatures special local ventilation is recommended at points where vapors can be expected to escape from the unit (reservoir tank vent, etc.).

**⚠ CAUTION**

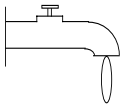
**Harmful vapors may be generated from thermal fluid during high temperature operation.**

**Prolonged or repeated exposure of these hot-generated vapors may result in eye and respiratory tract irritation.**

**Avoid contact or inhaling harmful amounts of material. Consult the Material Safety Data Sheet (MSDS) for precautions and instructions for the thermal fluid you are using.**

## 3-3 Connecting Piping

**NOTE:** Use back-up wrenches to support unit piping when making connections.



**Water**

It is recommended that the 9016/9026 series have at least 15 psi water supply pressure. A maximum 75 psi supply pressure is recommended so as not to damage the heat exchanger.

Hard or corrosive water can build layers of scale or lime within the unit, slowing down water flow and possibly causing temperature control problems. Since the corrective maintenance and downtime caused by poor water quality is costly, it is worthwhile to treat your water. In general, we have found that customers who use quality water only occasionally need to buy spare parts.

Proper inlet pipe sizing is suggested to keep restrictions to a minimum. Never install process or water supply/drain piping smaller than the outlets found on the unit. If the water supply piping is larger than indicated below, reduce the size at the unit. The table below contains the pipe sizes that are used in the unit.

**PIPE SIZES**

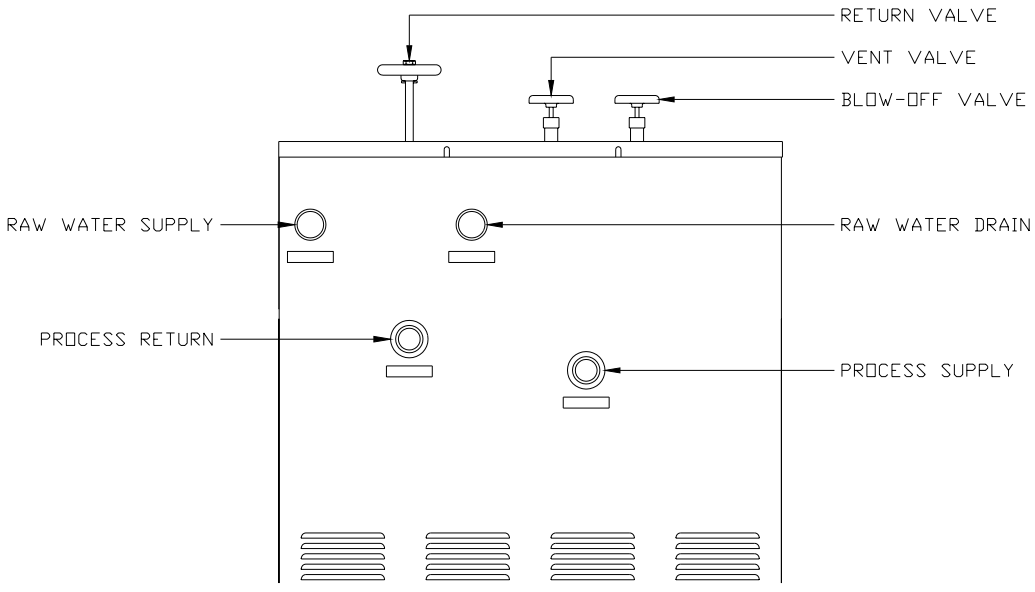
| | 18 - 30 GPM | 31 - 70 GPM | 71 - 90 GPM |
|---|---|---|---|
| Process delivery | 1" | 1 1/2" | 2" |
| Process return | 1" | 1 1/2" | 2" |
| Fill and Vent | 1" | 1" | 1" |

**PIPE SIZES**

| | 1.5 SQ FT | 3.7 SQ FT | 3.9 - 6.7 SQ FT | 13.0-21.0 SQ FT |
|---|---|---|---|---|
| Water Supply | 1/2” | 3/4” | 3/4" | 1" |
| Drain | 3/4” | 1” | 3/4” | 1" |

***Note***: The 9016/9026 is designed to operate with an open (unrestricted) drain line. Due to the rapid expansion of steam in the heat exchanger, backpressure or standing columns of water against the drain should be avoided. The resulting overpressure can cause venting of the relief valve or damage to the heat exchanger.

Figure 2
9016/9026 Series Unit Piping Setup



On the back of each unit, the connections are labeled appropriately. Connect the DELIVERY hookup to the entrance of the process and the RETURN hookup to the exit of the process. Connect the WATER SUPPLY to your plant water supply. Connect the DRAIN line to an open drain, or to the return line of your central water system. If returning to a central water system, use a condensate/return tank, if necessary, to avoid a standing column of water against the heat exchanger drain line.

**⚠ CAUTION**

**If you are routing the drain line to an open drain, make sure that the line is directed away from personnel to avoid scalding.**

**Carefully select connecting lines and connectors between the 9016/9026 unit and the process to best meet the needs and requirements of your application.**

**Make sure lines and connectors have a service rating of at least 100 psig (689.5 kPa/6.9 bars), and a temperature rating at least equal to the maximum operating temperature of your 9016/9026 unit (consult unit nameplate).**

*Note*: The 9016/9026 is supplied with an internal vent on the reservoir tank. This is to prevent falling debris from entering the tank. The external fill port on the tank should be closed off with the plug provided after filling the unit with heat transfer fluid. (See Pg. 24).

## 3-4 Making Electrical Connections

These units are designed for three-phase voltage operation. Refer to the unit nameplate for proper voltage and amperage requirements and make sure your electrical service conforms.

**Check the unit nameplate for correct voltage and amperage *before* making electrical connections!**

## ⚠ CAUTION

1. **Provide a correctly sized and protected power supply to the unit.**
2. **If an electrical supply disconnect is not installed as a factory option, the customer is responsible to properly size and install a suitable disconnect.**
3. **Refer to National Electric Code (NEC) 430-24-26 for proper feed conductor and supply disconnect sizing.**
4. **Voltages must be within plus or minus ten percent (±10%) of the nameplate rating.**
5. **Maintain a safe ground and disconnect the power supply before servicing the unit.**

**A qualified electrician should make electrical connections and disconnect the electricity when service calls are needed.**

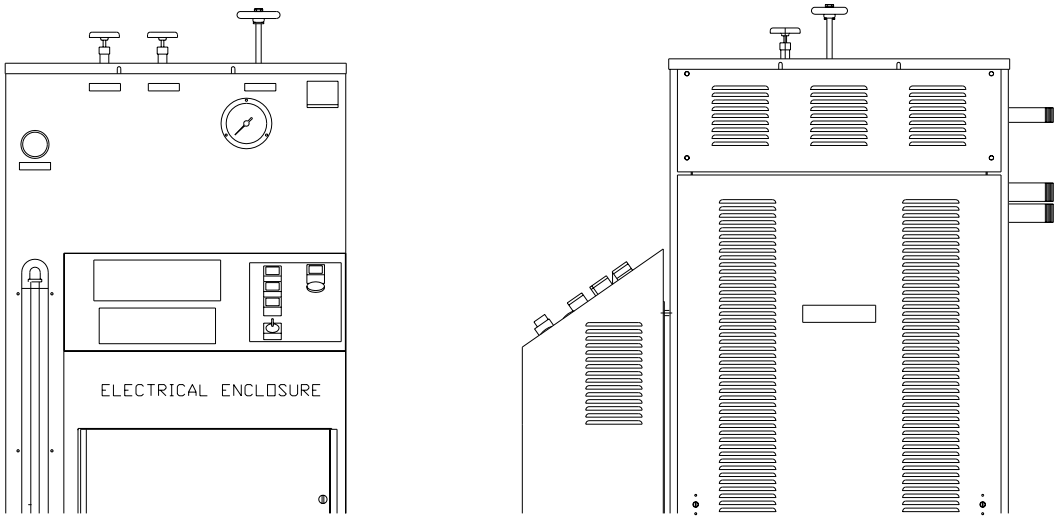
**Check the unit nameplate for correct voltage and amperage *before* making electrical connections!**

## ⚠ DANGER

***IMPROPER ELECTRICAL CONNECTIONS CAN DAMAGE THE UNIT AND CAUSE SERIOUS OPERATOR INJURY OR DEATH!***

***MAKE SURE THAT ALL ELECTRICAL CONNECTIONS ARE MADE BY A QUALIFIED ELECTRICIAN, AND THAT ALL CONNECTIONS ARE TIGHT.***

Figure 3
9016/9026 Series Electrical Panel




Electrical supply connections are made in the front of the unit. An access panel covers all of the electrical connections. Customer connections can be run to the supply terminals from either side of the unit. Be sure that all three phases are wired correctly. *If not wired properly, the pump will run backwards.*

# 4 Startup Preparations

## 4-1 Starting the Unit

### Unit Start-Up

The highly engineered controls and controller make this unit almost self operating. Before you can begin heating, it will be necessary to perform the following start up procedures. This will ensure that all air is vented from the system to prevent fluid degradation and damage to the heater.

1. Add fluid to the reservoir tank until the level is near the top of the sight glass.

2. Close the Return Valve half way.

3. Open the Blow-Off Valve.

4. Close the vent valve.

5. Depress the "Pump Start" button to start the pump. Check motor rotation by observing the pressure gauge. If the gauge indicates positive pressure, rotation is correct. If not, disconnect power and reverse the incoming power leads.

6. As fluid is drawn out of the reservoir tank to fill the process, the fluid level will fall in the tank. Continue to add fluid to maintain the level about 6 inches from the bottom of the sight glass.

7. Air will be vented through the Blow-Off Valve and into the reservoir tank.

**⚠ CAUTION**

**You must purge the system of air before the heating cycle.**
**Personal injury and system damage can occur from a pressurized system.**

**Make sure that the reservoir tank vent port *is not plugged*.**
**The reservoir tank must *never* be pressurized!**

8. After 2 minutes of running, select a set point of 100 °F and switch unit into the "Auto" mode. As the oil warms up, viscosity will decrease, and the pressure will fall. Close the Return Line Valve further to maintain a pressure of 30-50 psi.

9. Repeat step #7 as necessary, increasing setpoint to 150 and 200 °F.

10. If any water is present in the system, it must be boiled off before continuing operation. Select a setpoint of 102ºC and observe the reservoir tank vent for any signs of escaping steam. Continue to run at 215ºF until no more steam appears and pressure has stabilized.

11. When fluid level has stabilized and air and water are purged from the system, close the Blow-Off Valve, and open the Return Valve.

With the system properly purged, only 6 - 8" of fluid should be visible in the sight glass. This will allow for expansion of the fluid as it heats, as well as capacity for process fluid when the pump is reversed and fluid withdrawn from the mold.

The Model 9016/9026 is now ready for use. All that is required is to turn the **Mode** switch to the "Auto" position and select a process set point on the controller as described in the next section.

**NOTE**: If all traces of water are not removed from the system, severe cavitation may occur at elevated temperatures. Indications are a “gravely” sounding pump, fluctuating or dropping pressure, or rapidly rising fluid level in the expansion tank. Repeat Step #10 if this occurs.

## 4-2 Shutting Down the Unit

Cool the unit down by switching the **Mode** switch to the "Manual Cool" position. This will disable the heaters ( i.e. prevent the controller from turning them on) and open the cool solenoid. Fluid temperature can be monitored on the controller display during cool down. When fluid temperature is below 120ºF, depress the **PUMP STOP** button to turn the unit off.

## 4-3 Returning Fluid to the Tank

If the unit is to be moved from one process to another (i.e. mold changes, etc.), the following steps must be taken to drain the mold and process lines. Note that this is just the opposite of unit start up/air purge:

1. Cool fluid to 100 degrees °F maximum.
2. Depress the **PUMP STOP** push button.
3. Close the Return Line Valve.
4. Open the Vent Valve to allow air to enter the system.
5. Depress and hold the **PUMP REVERSE** push-button. The pump will then run in reverse, drawing fluid from the mold and lines, and into the reservoir tank.
6. Watch the sight glass to prevent overflow of the reservoir tank.

**⚠ CAUTION**

**The reservoir tank may not have adequate volume to contain the total system capacity of fluid.**

**An overflowing reservoir allows hot fluid to escape and become a potential fire and slip hazard.**

**The total capacity of the tank is 17 gallons (64.3 liters).**

If it appears the tank may overfill, simply connect a line from the **FILL** port of the reservoir tank to a **clean** auxiliary container.

*-Notes-*

# 5 Using Controls and Indicators

**FUNCTIONS OF THE CONTROL PANEL**

This section will provide a complete description of controls layout and function, as well as the description and function of the controllers available on the Model 9016/9026.

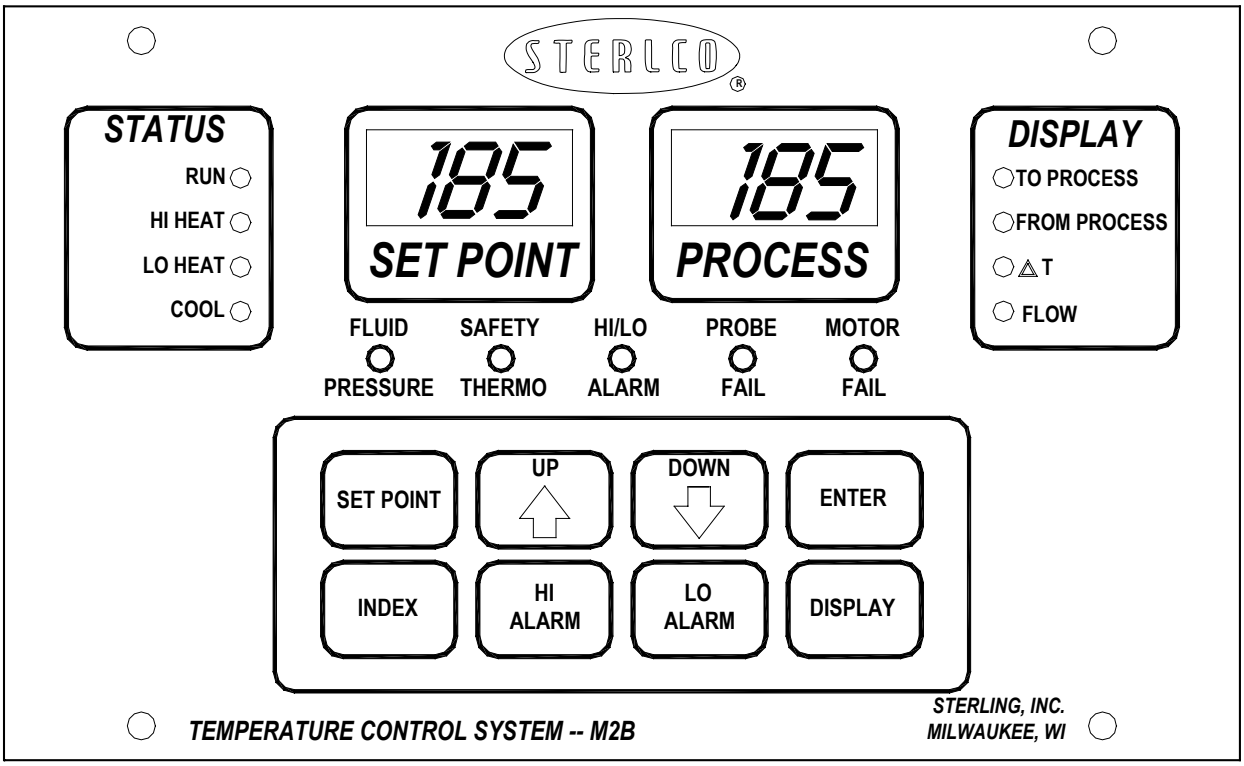
## 5-1 The Microprocessor Controller

The M2B controller is an easy-to-operate microprocessor-based PID control device. When the process reaches the set point, the PID control cycles the cooling valve and/or immersion heater to maintain the proper leaving water temperature.

The controller is fully factory tested. Set the process temperature set point you want and the controller does the rest.

Built-in range of operation on the controller is 0°F to 550°F (-18ºC to 288ºC).

Figure 4
Typical M2B Graphic and Button Control Panel

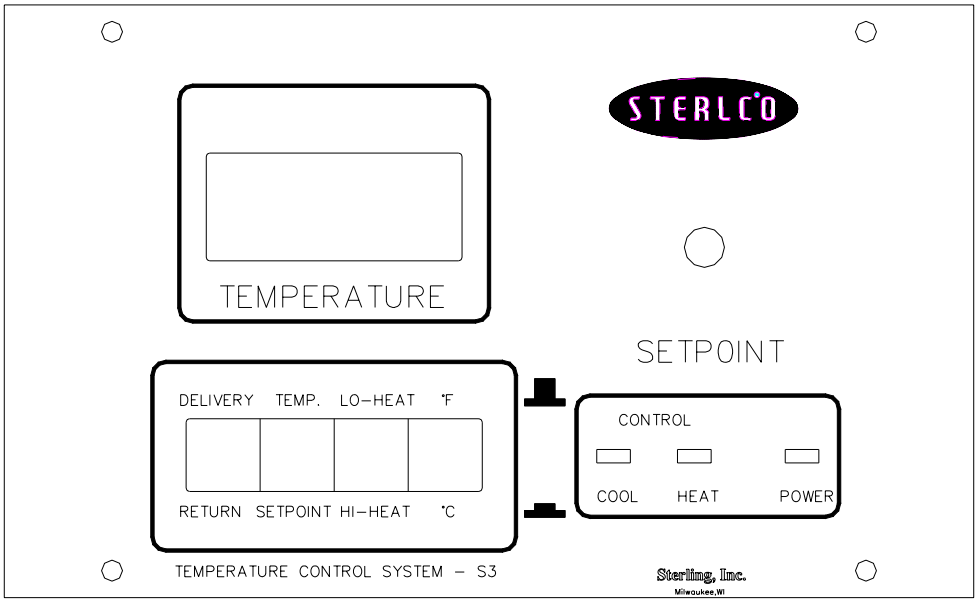


## 5-2 M2B Controller Panel Components

**Please refer to M2B Temperature Control Owners Manual, Part No. 682-86666-00 supplied with unit.**

## 5-3 S-3 Controller (If Equipped)

Figure 5
Typical S-3 Graphic & Button Control Panel




The S-3 controller is an analog based circuit temperature controller, specifically designed for use with the Sterlco Temperature Control units. The unit is extremely easy to use and the temperature readings are highly visible. The controller has been enhanced with the digital readout, completely solid state output drivers, and improved control circuitry for tighter control around the set point temperature. This controller, when used with the Sterlco Temperature Control system, regulates the temperature of the fluid in any given customer process to a selected set point. The Temperature Control system will heat or cool the fluid as required by the individual processes.

The analog based solid state circuit design provides for quick response to system demands.

The display is readable at a glance, using the latest in LCD backlit technology. The controller constantly displays the Delivery temperature and with a push of a button, the Return temperature or the Set point temperature is displayed. The heating/cooling mode is continuously displayed, depending on the operating condition.

The temperature can be displayed in either °F or °C with a push of a button. The controller offers manual control for the selection of half or full heat for better process heating.

The front panel shows the system status as well as the selections for High or Low heat, Setpoint Temperature, Return and Delivery temperatures. The controller indicates when the unit is in a heating mode (red), or a cooling mode (yellow). The controller has a green indicator when there is power applied to the controller.

## S-3 Controller Setup

The set-up for the S-3 controller requires three basic settings for operation.

### Set Point Temperature

The first is the selection of the set point temperature. This is accomplished by pressing and holding the set point button (this is a momentary switch and must be held while changing the set point in order to read the temperature on the display) on the front panel and adjusting the set point knob to the desired temperature. This knob is a 16-turn potentiometer that changes the temperature approximately 13.6 °F (9.3 °C) per revolution.

### High or Low Heat

The second is the selection of High or Low heat. The High heat shows on the button as black lettering on an orange background. The Low heat shows on the button as white lettering on a black background.

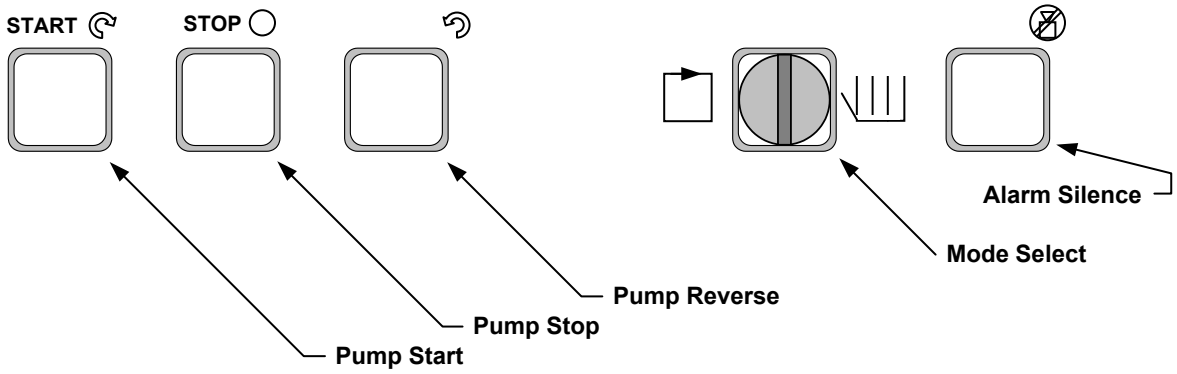
### Temperature Display

The third setting is the scale that the temperature is displayed. Degrees Fahrenheit is shown as white lettering on a black background, and degrees Celsius is shown as black lettering on an orange background.

# 5-4 Identifying Control Panel Switches

This section lists the descriptions and functions of the control panel switches. These switches control the operation of the unit.

Figure 6
Control Panel Switches




### Pump Start

Press the **START** button to start the pump in the normal forward direction.

### Pump Stop

Press the **STOP** button to stop the pump and de-energize the controller.

**⚠ CAUTION**

**Always press the Pump Stop button and allow the pump to come to a complete stop before pressing the Pump Reverse button.**

**Failure to let the pump stop before reversing may damage the pump and drive.**

### Pump Reverse

Press the **REVERSE** button to run the pump in reverse. Use this feature to draw transfer fluid from the mold.

### Mode Select

With the pump running, you can select the **AUTO** position or the **MAN. COOL** (manual cooling) position with the **Mode Select** switch. Select **AUTO** mode to energize the controller, permitting it to monitor and control the process. The switch automatically returns to the **Center Default** position when in **AUTO** mode. The switch stays in the **Maintained** position in **Manual Cooling** mode.

**⚠ CAUTION**

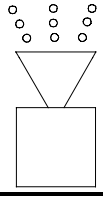
**Always let the pump run for at least one (1) minute before switching to AUTO mode.**

***Never* switch to AUTO mode when filling or venting the unit, except as described in the Unit Startup chapter. Improper switching can seriously damage the heater, as it could become energized with air in the system.**

### Alarm Silence

Press the **ALARM SILENCE** button to silence the audible alarm on the console.

**⚠ CAUTION**

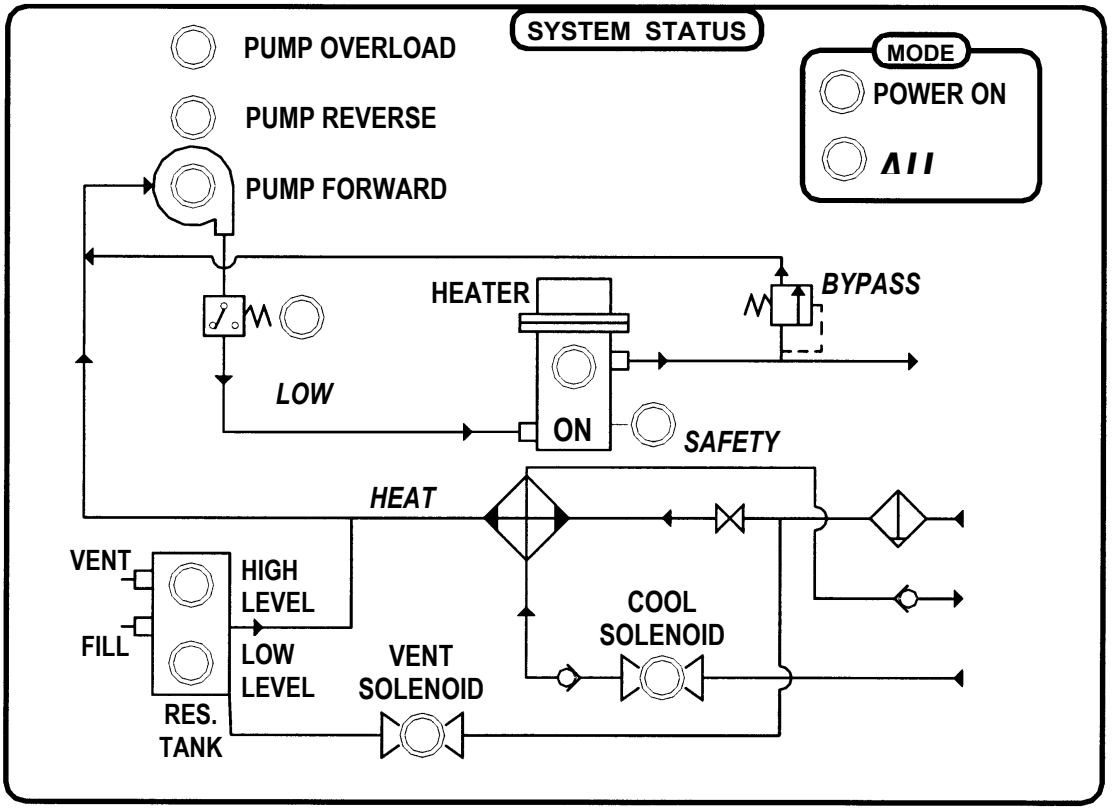


**After you silence the alarm, make sure you *locate and correct* the alarm condition before continuing with unit operation.**

# 5-5 Identifying System Status Board Indicators

The system status board is located next to the controller panel. It displays indicator lights to show current operation status, letting you analyze system performance.

Figure 7
System Status Board Indicators




Use the status board to optimize unit performance. For example, if you observe a rapid cycling of the **Heater** and **Cool Solenoid** indicators, the unit is operating with a process inefficiency; see the Troubleshooting chapter for more information.

What follows is a description of system status board indicators.

# Status Indicator Lights

### Pump Reverse Indicator Light

The **Pump Reverse** indicator light illuminates when the unit pump runs in reverse.

### Pump Forward Indicator Light

The **Pump Forward** indicator light illuminates when the unit pump runs in the normal forward direction. This indicator typically illuminates continuously during normal operation.

### Heater On Indicator Light

The **Heater On** indicator illuminates when the heater energizes.

### Cool Solenoid Indicator Light

The **Cool Solenoid** indicator illuminates when the cooling solenoid energizes. It is used only on the optional heat exchanger.

### Vent Solenoid Indicator Light

When the unit is equipped with the Autovent option, the **Vent Solenoid** indicator illuminates when the venting solenoid energizes during venting sequences.

# Mode Indicator Lights

Select the unit operating mode by using the **selection switch**.

### Power On Mode Indicator Light

The **Power On** mode indicator light illuminates to indicate that the control circuit is energized in the unit.

### Auto Mode Indicator Light

The **Auto** mode indicator light indicates that the Auto mode is active and the controller is monitoring the system and controlling the process.

If the **Auto** light is off and the **Cool Solenoid** indicator light is illuminated, the controller is disabled and the cooling solenoid is open, permitting maximum cooling.

If the **Auto** and **Cool Solenoid** indicator lights are off, the unit is in standby.

# Fault Indicator Lights

## Pump Overload Indicator Light

The **Pump Overload** indicator light illuminates when the pump is overloaded. ***This is an alarm condition***, so the audible alarm activates to notify you of the pump overload fault, and the unit shuts down.

**Always correct the alarm condition before returning to normal operation!**

## Low Pressure Indicator Light

The **Low Pressure** indicator light illuminates when the unit has low heat transfer fluid pressure. ***This is an alarm condition***, so the audible alarm activates to notify you of the low pressure fault, and disables controller outputs, permitting the pump to continue to circulate fluid to avoid damage. If low pressure continues past five minutes, the pump shuts off.

**Always correct the alarm condition before returning to normal operation!**

## Safety Thermo Indicator Light

The **Safety Thermo** indicator light illuminates when the unit is overheating. ***This is an alarm condition***, so the audible alarm activates to notify you of the safety thermo fault, and disables controller outputs, permitting the pump to continue to circulate fluid to avoid damage.

**Always correct this alarm condition before returning to normal operation!**

## High Level Indicator Light

The **High Level** indicator light illuminates when the heat transfer fluid level in the reservoir tank is **too high**. Carefully remove just enough fluid so this indicator light shuts off.

## Low Level Indicator Light

The **Low Level** indicator light illuminates when the heat transfer fluid level in the system is too low. ***This is an alarm condition***, so the audible alarm activates to notify you of the low fluid level fault, and the controller outputs are disabled.

**Always correct the alarm condition before returning to normal operation!**

*-Notes-*

## ⚠ WARNING

**Make sure that your maintenance technicians comply with lock-out/tag-out procedures during any servicing or maintenance of this unit and related equipment, per OSHA article ART 1910.147.**

***Before you begin servicing this unit*, disconnect all power to the unit, let the unit cool down *completely*, and turn off the water.**

**Failure to follow these directives can result in serious injury or *death!***

# 6-1 Periodic Checks

### Making Daily Checks

- Check fluid level; *add fluid as needed*.
- Check all connecting lines, hoses, and connectors for wear or damage.

### Making Monthly Checks

- Check for leaks developing at the pump seal, gaskets, and other similar locations.
- Check the pump drive V-belt for any wear.
- Check the reservoir tank vent for any obstructions.

### Making Quarterly Checks

- Check the heat transfer fluid for deterioration. If the fluid is noticeably darker, or it seems significantly thicker, drain the system and replace the fluid with fresh, new recommended heat transfer fluid.

Do a routine check of the fluid every 1,000 hours of operation or every three (3) months, whichever comes first. Contact Sterling, Inc. Service for information on fluid testing.

### Making Six-Month Checks

- Inspect electrical connections for secure, tight electrical terminations and ground connections. Inspect the power cable, especially at the entrance point to the electrical enclosure. Have a qualified electrician perform this inspection.
- Check the mounting bolts on the pump, the motor, and the heater flange for tightness.
- Remove the heat exchanger tube bundle and check it for lime and mineral deposits. Carefully clean the bundle as needed.

## 6-2 Routine Servicing

Your hot oil temperature control unit requires little in preventive maintenance and servicing. To keep it in good, reliable working order, make sure you follow the following scheduled preventive maintenance procedures.

Keep surfaces clean and free of any excessive accumulations of dirt, oil, or debris. This is especially true for the pump. It relies on free air circulation for proper cooling.

Check the motor air intake screen for any accumulation of dirt; clean it as needed.

### Servicing the Unit Monthly or Every 500 Hours

- **Lubricate the pump** at the grease fittings with a high-quality lithium grease rated at 400ºF or higher. Use only Dow-Corning #44 or a high temperature grease rated at 400ºF or higher that is compatible with Dow-Corning #44.
- **Adjust** the pump drive **belt tension**. Make sure that the motor pulley is properly aligned with the pump pulley; use a straightedge to check. Tighten motor mounting bolts after realignment.
- Inspect the screen in the Y strainer for accumulations of debris. Clean as needed.

### Servicing the Unit Every Three Months

Remove and clean the screen in the Y-strainer. Replace the screen if it is damaged.

## 6-3 Draining the Unit for Storage

You should thoroughly flush and drain the 9016/9026 unit if you need to take it out of service for a long time, or if you expect it to become exposed to freezing temperatures. Sterling, Inc. recommends SterlFlush™ flushing fluid or equivalent for flushing your 9016/9026 unit; follow unit flushing instructions that comes with SterlFlush™ flushing fluid.

Drain plugs are provided at the base of the heater tank, reservoir tank, and on the pump. You should also remove, drain, and reinstall the heat exchanger tube bundle before storage.

## 6-4 Corrective Maintenance

### Pumps and Seals

Each 9016/9026 unit is completely tested and calibrated before leaving the factory. The unit is then cooled, drained, and packed for shipment.

If the unit stands idle for a long time before being installed in your factory, gaskets can dry out and possibly leak when you start the unit. In most cases, these gaskets soon swell and form a tight seal. If not, **you may need to tighten the bolts to stop the leak.**

Similarly, rough handling in shipping may sometimes cause minor leaks upon startup; **you may need to re-tighten bolts or fittings to stop the leak.**

You should expect to periodically replace the pump seal. If the pump is properly lubricated and used at moderate temperatures, the seal should last several years. The following section describes the proper procedures for replacing the seal. Periodic replacement of the pump drive V-belt is also to be expected.

***Note:*** If the pump motor wiring is disconnected for removal from the unit, **you must check the actual direction of rotation** when the motor is rewired to the unit. Consult Elementary Diagram provided in unit for more information.

## 6-5 Maintaining the Pump

**Disassembly**

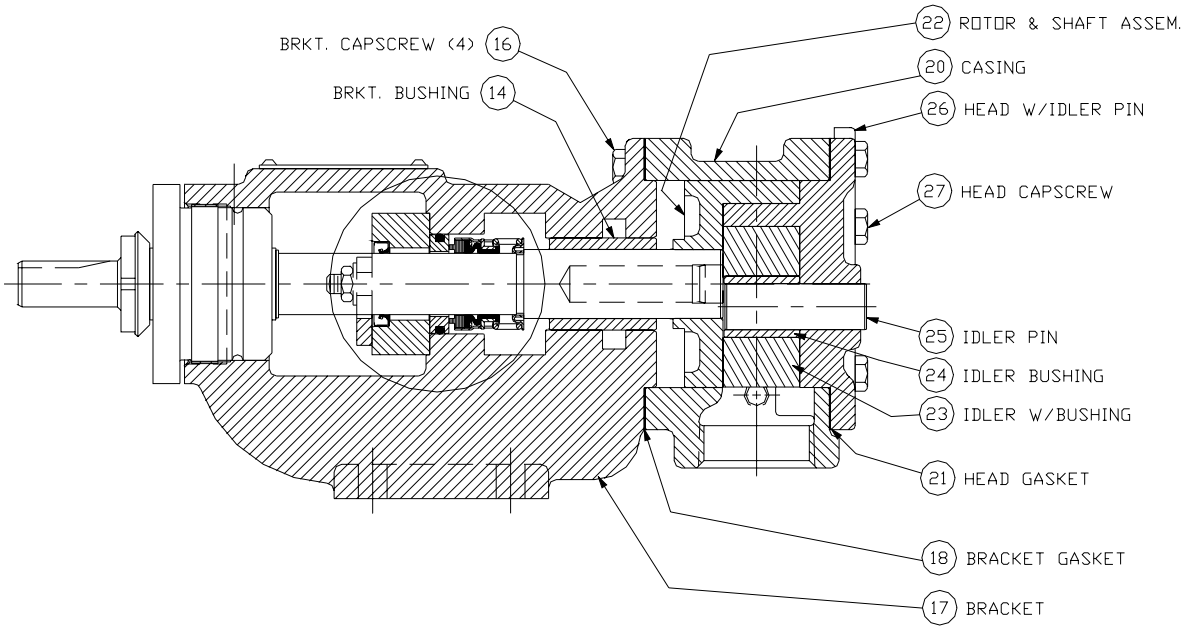
**⚠ WARNING**

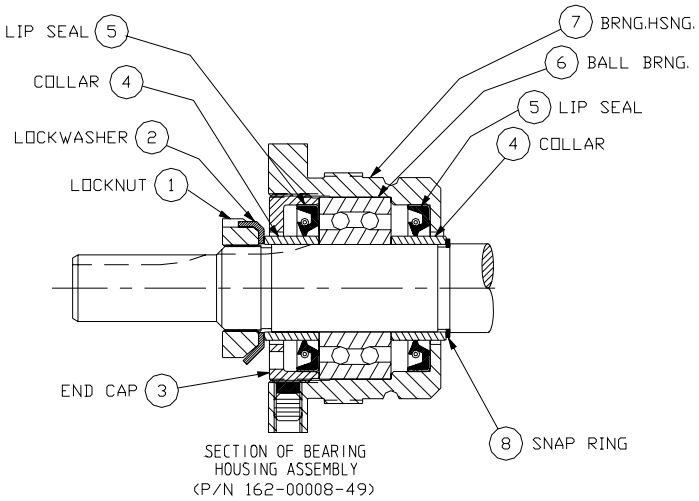
***Before* opening the pump chamber:**

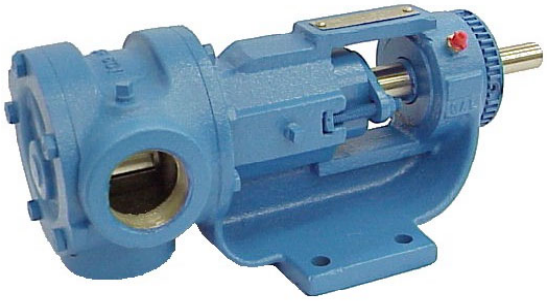
- **Make sure that any pressure in the chamber has been *completely vented!***
- **Make sure that the motor cannot be inadvertently started while you work on the pump!**

**Failure to follow these precautions may result in serious injury or *death!***

Figure 8
18-24 GPM Pump Construction 075-00370-02

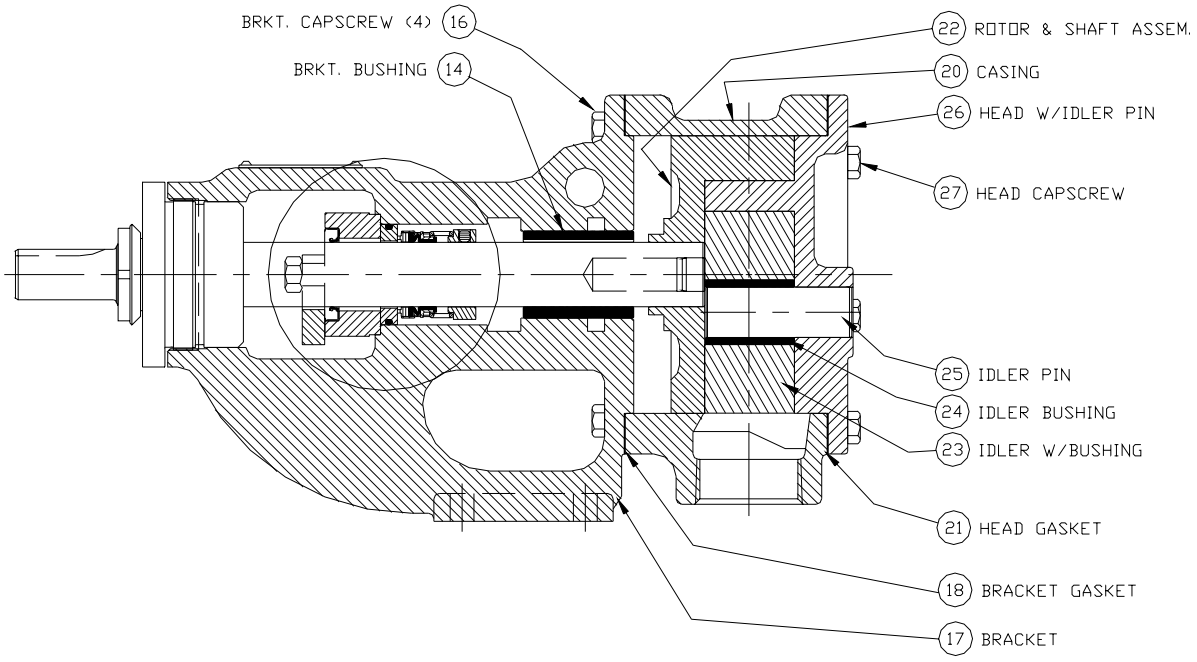


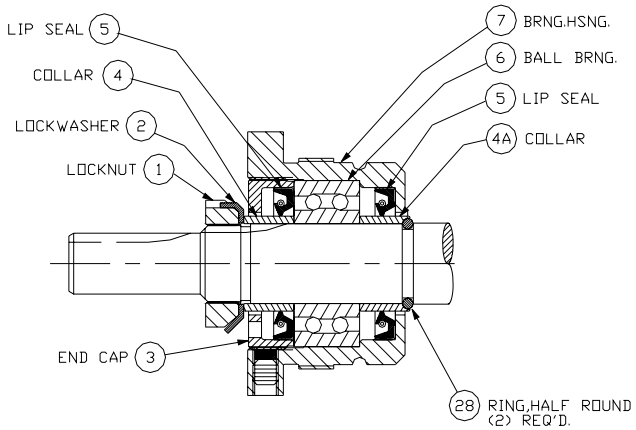



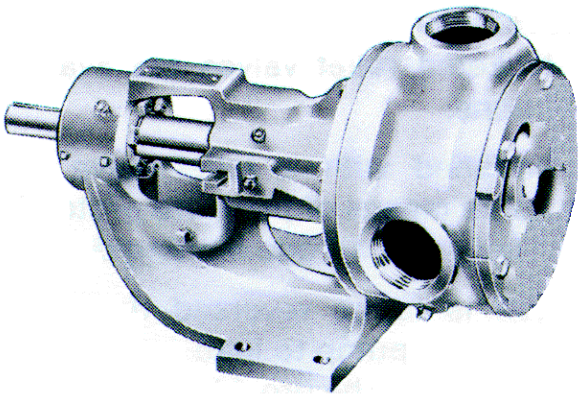
| ITEM | QTY | DESCRIPTION | PART NUMBER |
|---|---|---|---|
| | 1 | BEARING HOUSING ASSEMBLY | 162-00008-49 |
| 1 | 1 | LOCKNUT | 162-00008-35 |
| 2 | 1 | LOCKWASHER | 162-00008-40 |
| 3 | 1 | CAP,END,BRG | 162-00008-17 |
| 4 | 1 | COL,SPCR,SET OF 2 | 162-00008-19 |
| 5 | 2 | CLSR,BRG,HSG | 162-00008-20 |
| 6 | 1 | BRG,BALL | 162-00008-14 |
| 7 | 1 | HSG,BRG | 162-00008-24 |
| 8 | 1 | RING,SNAP | 162-00030-108 |
| 9 | 1 | BOLT,SEAL,HLDR | 162-00030-160 |
| 10 | 1 | SEAL,HLDR,FOR,VIKING,PMP | 162-00030-159 |
| 11 | 1 | SEAL,LIP | 162-00030-153 |
| 12 | 1 | PL,SEAL | 162-00030-154 |
| 13 | 1 | SL,MECH,HI,TEMP | 162-00030-144 |
| 14 | 1 | BUSH,BRKT | 162-00008-98 |
| 15 | – | – | – |
| 16 | 1 | CPSC,PRESS,RLF,VLV,SET OF 4 | 162-00008-18 |
| 17 | 1 | BRKT&BUSH | 162-00030-155 |
| 18 | 1 | GSKT,FLNG,BACK | 162-00008-09 |
| 19 | 3 | PLUG,PIPE,STL,SQ,HD,SOLD,1/8 | 012-00001-00 |
| 20 | 1 | CASING,HL,PMP | 162-00008-47 |
| 21 | 1 | GSKT,HEAD | 162-00008-08 |
| 22 | 1 | RTR&SFT,ASSY | 162-00030-156 |
| 23 | 1 | IDL&BUSH | 162-00030-56 |
| 24 | 1 | BUSH,IDL,GRAPHITE | 162-00030-02 |
| 25 | 1 | PIN,IDL | 162-00008-36 |
| 26 | 1 | PIN,HEAD&IDL | 162-00030-92 |
| 27 | 1 | CPSC,PRESS,RLF,VLV,SET OF 4 | 162-00008-18 |
| 28 | 1 | NUT,PACK,GL,SET OF 2 | 162-00008-43 |

Figure 9
50-70 GPM Pump Construction 075-00421-02




SECTION OF BEARING HOUSING ASSEMBLY NOT TO SCALE



| ITEM | QTY | DESCRIPTION | PART NUMBER |
|---|---|---|---|
| 1 | 1 | LOCKNUT | 162-00008-75 |
| 2 | 1 | LOCKWASHER | 162-00008-67 |
| 3 | 1 | CAP,END,BRG | 162-00008-76 |
| 4 | 1 | COL,BRG,SPCR,OUTER | 162-00008-78 |
| 4A | 1 | COL,SPCR | 162-00008-74 |
| 5 | 2 | CLSR,BRG,HSG | 162-00008-77 |
| 6 | 1 | BRG,BALL | 162-00008-68 |
| 7 | 1 | HSG,BRG | 162-00008-80 |
| 8 | 2 | NUT,PACK,GL | 162-00008-69 |
| 9 | 2 | BOLT,SEAL,HLDR | 162-00008-71 |
| 10 | 1 | SEAL,HLDR,FOR,VIKING,PMP | 162-00030-162 |
| 11 | 1 | SEAL,LIP | 162-00030-164 |
| 12 | 1 | PL,SEAL | 162-00030-163 |
| 13 | 1 | SL,MECH,HI,TEMP | 162-00030-161 |
| 13A | 1 | SET,COL,&,SCRW | 162-00030-167 |
| 14 | 1 | BUSH,BRKT | 162-00008-71 |
| 15 | – | – | – |
| 16 | 4 | CPSC | 162-00008-71 |
| 17 | 1 | BRKT&BUSH | 162-00030-166 |
| 18 | 1 | GSKT,FLNG,BACK | 162-00008-54 |
| 19 | 3 | PLUG,PIPE,STL,SQ,HD,SOLD,1/8 | 012-00002-00 |
| 20 | 1 | CASING,KK,PMP | 162-00030-60 |
| 21 | 1 | GSKT,HEAD | 162-00008-53 |
| 22 | 1 | RTR&SFT,ASSY | 162-00030-168 |
| 23 | 1 | IDL&BUSH | 162-00030-123 |
| 24 | 1 | BUSH,IDL,GRAPHITE | 162-00008-58 |
| 25 | 1 | PIN,IDL | 162-00030-169 |
| 26 | 1 | PIN,HEAD&IDL | 162-00008-42 |
| 27 | 4 | CPSC | 162-00008-71 |
| 28 | 2 | RING,HALF-ROUND | 162-00008-79 |

## Disassembling the Pump

1. Mark head and casing before disassembly to insure proper reassembly. The idler pin, which is offset in pump head, must be positioned toward and equal distance between port connections to allow for proper flow of liquid through pump.

   Remove head from pump. Do not allow idler to fall from idler pin. Tilt top of head back when removing to prevent this. Avoid damaging head gasket.

2. Remove idler and bushing assembly.

3. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Bend up tang of lockwasher and with a spanner wrench remove locknut and lockwasher from shaft.

4. Loosen Allen head setscrews in the face of the thrust bearing assembly. Remove the thrust bearing assembly by threading out of the bracket.

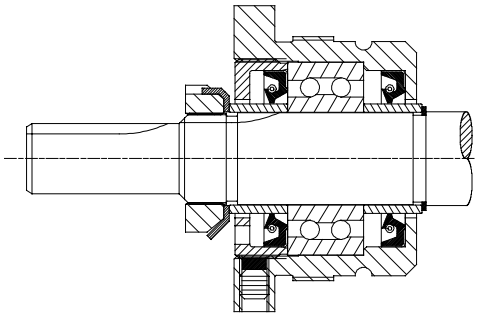


Figure 10
Thrust Bearing Assembly

5. Loosen the radial setscrews in the thrust bearing assembly and remove the end cap using the spanner wrench.

6. Remove the bearing spacer collars and the ball bearing.

7. Using snap ring pliers, remove snap ring from shaft.

8. Remove two nuts holding seal gland plate and seal gland in place. Slide seal gland off of shaft being careful not to damage the lip seal.

9. Using a soft headed hammer, gently tap on the end of the rotor shaft until the rotor and shaft assembly can be completely removed from the pump. Note the mechanical seal may stick to the shaft causing initial resistance when the shaft is removed.

10. Remove the mechanical seal parts from the bracket.

11. Clean all parts thoroughly and examine for wear and damage. Check lip seals, ball bearing, bushings and idler pin and replace if necessary. Check all other parts for nicks, burrs, excessive wear and replace if necessary.

    Wash bearings in clean solvent. Blow out bearings with compressed air. Do not allow bearings to spin; turn them slowly by hand. Spinning bearings will damage race and balls. Make sure bearings are clean, then lubricate with non-detergent SAE 30 weight oil and check for roughness. Roughness can be determined by turning outer race by hand.

12. Casing can be checked for wear or damage while mounted on bracket.

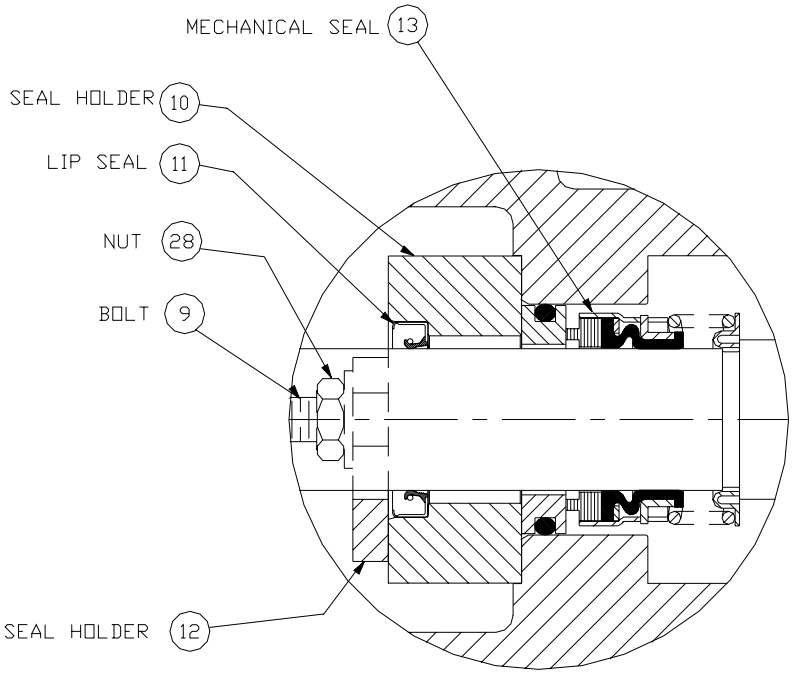
## Pump Assembly

The seal used in this pump is simple to install. If you take care during installation, good performance will result.

The principle of the mechanical seal is to make contact between the rotary and stationary members. These parts are lapped to a high finish, and their sealing effectiveness depends on complete contact. When requesting special seal information, make sure that you give the pump model number and serial number.

1. Install bracket bushing if required. If bracket bushing has a lubrication groove, install bushing with groove at 6:00 o'clock position in bracket. If carbon graphite, **Refer to Installation of Carbon Graphite Bushings,** page 48.

2. Coat shaft of rotor shaft assembly with non-detergent P80 oil. Start end of shaft in bracket bushing turning from right to left, slowly pushing rotor in casing.




3. Coat idler pin with non-detergent SAE 30 weight oil and place idler and bushing on idler pin in head. If replacing with carbon graphite bushing, **Refer to Installation of Carbon Graphite Bushings,** page 48.

4. Using a .010 to .015 inch head gasket, install head and idler assembly on pump. Pump head and casing were marked before disassembly to insure proper reassembly. If not, be sure idler pin, which is offset in pump head, is positioned toward and equal distance between port connections to allow for proper flow of liquid through pump. Tighten head capscrews evenly.

5. Place the mechanical seal installation tapered half rings over the shaft and apply P-80 oil supplied with the replacement seal, **grease is not recommended** on the sleeve and rotor shaft. Slide the rotating portion of the mechanical seal on the

shaft until it bottoms on the shaft step. See FIGURE 8. Remove the seal installation tapered half rings. It is important when using the rings to make sure the thin edge is facing the direction of the shaft end, and that the thick end is facing the rotor.

6. Apply lubricant to the seal seat o-ring and push it in the bracket. Note the shinny side of the seat goes towards the carbon graphite seal face.

7. Apply Dow Corning #44 high temperature silicon grease to the lip seal area in the seal gland and install on the shaft. Install the seal gland plate and secure with two nuts.

8. Pack ball bearing with Dow Corning #44 high temperature silicon grease and install in the thrust bearing housing. Place bearing spacer collars inside the lip seals. Thread the end cap into the bearing housing and tighten with a spanner wrench. Tighten the radial set screws that lock the end cap in place.

9. Using the snap ring pliers, install the snap ring onto the shaft.

10 Thread the thrust bearing assembly into the bracket. Turn in until hand tight. This forces the rotor against the head.

11. Put lockwasher and locknut on shaft. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Tighten locknut to 50 – 70 ft.-lbs. torque and bend one tang of lockwasher into slot.

12. Adjust pump end clearance. Refer to Thrust Bearing Adjustment below.

13. Lubricate all grease fittings with Dow Corning #44 high temperature silicon grease.

**Thrust Bearing Adjustment**

1. Loosen axial setscrews in face of end cap on the thrust bearing assembly. If rotor shaft cannot be turned by hand, back off the thrust bearing assembly until there is a noticeable drag of the shaft. Note mechanical seal will provide some drag and this is a normal condition. The thrust bearing assembly must be turned in until it can just be turned over by hand. This ensures the rotor is against the head and a zero end clearance condition exists.

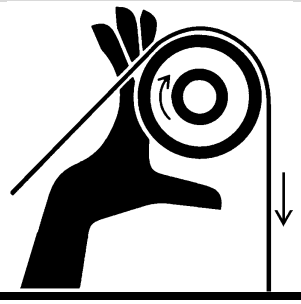
2. Make a mark on the OD of the bearing housing and a corresponding mark on the bracket. Back off thrust bearing housing the required number of marks or distance on the OD as shown in FIGURE 9.

3. Tighten the axial setscrews in the face of the thrust bearing assembly. Make sure the rotor shaft turns freely. If it does not, repeat steps 1. and 2.

| PUMP SIZE | Turn Outer End Cap C.C.W. | |
|---|---|---|
| | No. of Notches* | or Length on O.D., Inches |
| G | - | 0.75" |
| HL, HV | 6 | 1" |
| KK | 10 | 1.38" |

*Each small notch on outer end cap represents .001 inch end clearance

**⚠ WARNING**



***Before* starting the pump, make sure that all drive equipment guards are in place!**

**Failure to properly install the guards may result in serious injury or *death!***

## Installation Of Carbon Graphite Bushings

When installing carbon graphite bushings, extreme care must be taken to prevent breaking. Carbon graphite is a brittle material and easily cracked. If cracked, the bushing will quickly disintegrate. Using a lubricant and adding a chamfer on the bushing and the mating part will help in installation. The additional precautions listed below must be followed for proper installation:

1. A press must be used for installation.

2. Be certain bushing is started straight.

3. Do not stop pressing operation until bushing is in proper position. Starting and stopping will result in a cracked bushing.

4. Check bushing for cracks after installation.

Carbon graphite bushings with extra interference fits are frequently furnished for high temperature operation. These bushings must be installed by a shrink fit.

1. Heat bracket or idler to **750** ˚F.

2. Install cool bushings with a press.

3. If facilities are not available to reach **750** ˚F. temperature, it is possible to install with **450** ˚F. temperature; however, the lower the temperature, the greater the possibility of cracking bushing.

## Preventative Pump Maintenance

You can extend the life of your pump and reduce the cost per gallon pumped if you perform a few preventive maintenance procedures.

## Lubricating the Pump

Using Dow Corning #44 grease and a hand-operated grease gun, gently lubricate all grease fittings **after every 500 hours** of operation **or after 60 days**, whichever comes first. If pump service occurs in severe conditions, lubricate more frequently. Use an appropriate type of grease for hot or cold applications.

## Adjusting End Clearance

After long periods of service, the running clearance between the end of the rotor teeth and head may be increased from wear. The pump may lose some capacity of pressure as a result. If you reset the end clearance, pump performance should improve.

## Examining Internal Parts

Remove the head occasionally and examine the idler, bushing, head and pin for wear. Replace the idler bushing and idler pin after moderate wear to avoid replacing more expensive parts later.

***Note:*** Make sure the idler doesn't slide off the idler pin during head removal to avoid damage and personal injury.

## Cleaning the Pump

A clean pump is easier to inspect, lubricate, and adjust; it runs better and *looks better!*

## Storing Your 9016/9026 Unit

If you anticipate that your unit will be out of service or stored for a long time, flush and drain the pump and circulating system to protect it from freeze-ups or rusting. See Section 6-3 on Page 39 for more information.

## How to increase Belt Life

**Keep sheaves and belts clean.**
Abrasive dust, rust, oil and acids reduce service life.

**Give drives elbow room.**
Never let belts run against belt guards or other obstructions.

**Use large diameter sheaves and fewer belts.**
You save money and increase drive life.


**Never force belts.**
Move motor on adjustable base so belts can go on easily.

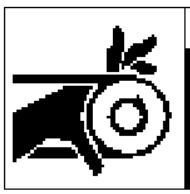
**Eliminate slack.**
Adjust motor and tighten belts in position. Slack belts wear excessively, cause slippage and deliver less power.

**Use matched belts.**
Matched belts run smoother and last longer because the load is evenly distributed. Never replace just part of a set of belts.

**Avoid belt idlers.**
Belt idlers decrease belt life! Always maintain proper tension through motor adjustment.

**Mount belts straight.**
Shafts must be parallel and sheave grooves in alignment to prevent unnecessary belt wear.

**Don't overload.**
An overloaded belt drive is like a one-ton truck with a two-ton load — both are sure to break down. Always use ample capacity.



**⚠WARNING**
**Operating drives without guards in place can result in severe injury or death.**

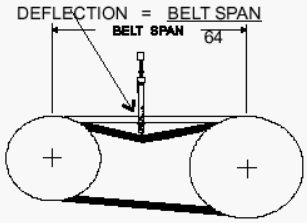


## Browning® BELT TENSIONING INSTRUCTIONS

**⚠WARNING**
**Disconnect power before installation and maintenance. Failure to do so can result in severe injury or death.**

1. Measure the belt span.
2. Calculate deflection
3. See tables below for correct deflection force.
4. Apply force at right angles to the center of the span (see diagram below). The BROWNING® belt tension checker, shown at left, is ideal for this procedure.
5. Check the tension at least twice during the first day of operation, and periodically thereafter.

**Be sure — use the inexpensive BROWNING® Belt Tension Checker See Form 5453 for more detail.**




The capacity of the BROWNING® belt tension checker is 35 lbs. Other means of applying force must be used if force requirement is greater than this.

**SHEAVE DIAM - INCHES**
**DEFLECTION FORCE - LBS.**

| Belt Cross Section | Smallest Sheave Diameter Range | RPM Range | Belt Deflection Force | | | |
|---|---|---|---|---|---|---|
| | | | Super Gripbelts and Unnotched Gripbands | | Gripnotch Belts and Notched Gripbands | |
| | | | Used Belt | New Belt | Used Belt | New Belt |
| A,AX | 3.0 - 3.6 | 1000-2500<br>2501-4000 | 3.7<br>2.8 | 5.5<br>4.2 | 4.1<br>3.4 | 6.1<br>5.0 |
| | 3.8 - 4.8 | 1000-2500<br>2501-4000 | 4.5<br>3.8 | 6.8<br>5.7 | 5.0<br>4.3 | 7.4<br>6.4 |
| | 5.0 - 7.0 | 1000-2500<br>2501-4000 | 5.4<br>4.7 | 8.0<br>7.0 | 5.7<br>5.1 | 8.4<br>7.6 |
| B,BX | 3.4 - 4.2 | 860-2500<br>2501-4000 | -<br>- | -<br>- | 4.9<br>4.2 | 7.2<br>6.2 |
| | 4.4 - 5.6 | 860-2500<br>2501-4000 | 5.3<br>4.5 | 7.9<br>6.7 | 7.1<br>6.1 | 10.5<br>9.1 |
| | 5.8 - 8.6 | 860-2500<br>2501-4000 | 6.3<br>6.0 | 9.4<br>8.9 | 8.5<br>7.3 | 12.6<br>10.9 |
| C,CX | 7.0 - 9.0 | 500-1740<br>1741-3000 | 11.5<br>9.4 | 17.0<br>13.8 | 14.7<br>11.9 | 21.8<br>17.5 |
| | 9.5 - 16.0 | 500-1740<br>1741-3000 | 14.1<br>12.5 | 21.0<br>18.5 | 15.9<br>14.6 | 23.5<br>21.6 |
| D | 12.0 - 16.0 | 200-850<br>851-1500 | 24.9<br>21.2 | 37.0<br>31.3 | -<br>- | -<br>- |
| | 18.0 - 20.0 | 200-850<br>851-1500 | 30.4<br>25.6 | 45.2<br>38.0 | -<br>- | -<br>- |
| 3V,3VX | 2.2 - 2.4 | 1000-2500<br>2501-4000 | -<br>- | -<br>- | 3.3<br>2.9 | 4.9<br>4.3 |
| | 2.65 - 3.65 | 1000-2500<br>2501-4000 | 3.6<br>3.0 | 5.1<br>4.4 | 4.2<br>3.8 | 6.2<br>5.6 |
| | 4.12 - 6.90 | 1000-2500<br>2501-4000 | 4.9<br>4.4 | 7.3<br>6.6 | 5.3<br>4.9 | 7.9<br>7.3 |
| 5V,5VX | 4.4 - 6.7 | 500-1749<br>1750-3000<br>3001-4000 | -<br>-<br>- | -<br>-<br>- | 10.2<br>8.8<br>5.6 | 15.2<br>13.2<br>8.5 |
| | 7.1 - 10.9 | 500-1740<br>1741-3000 | 12.7<br>11.2 | 18.9<br>16.7 | 14.8<br>13.7 | 22.1<br>20.1 |
| | 11.8 - 16.0 | 500-1740<br>1741-3000 | 15.5<br>14.6 | 23.4<br>21.8 | 17.1<br>16.8 | 25.5<br>25.0 |
| 8V | 12.5 - 17.0 | 200-850<br>851-1500 | 33.0<br>26.8 | 49.3<br>39.9 | -<br>- | -<br>- |
| | 18.0 - 22.4 | 200-850<br>851-1500 | 39.6<br>35.3 | 59.2<br>52.7 | -<br>- | -<br>- |

# 6-6 NEMA 12 Enclosure Maintenance (If Equipped)

## Maintenance for Air Screen Filters
### Location: Electrical Enclosure

*Note:* **DISCONNECT MAIN POWER TO THE UNIT BEFORE SERVICING.**

Periodic cleaning of the air screen filter is required on an as needed basis. This will ensure proper air flow and heat dissipation. Due to the variability of operating environments, it is the responsibility of the customer to determine the frequency of cleanings. A minimum of one (1) time per month is recommended.

To clean filters, simply remove them from the enclosure, wash with warm soapy water, dry, and re-apply the filter adhesive. This spray is applied as a secondary measure for trapping and absorbing dust, dirt and other impurities found in an industrial environment. We recommend: #A-FLTAD, available from The Hoffman Company as a suitable filter adhesive.

After allowing the adhesive time to dry, re-install the filters in their original locations.

Figure 11
Customer-Recommended Spare Parts

## Immersion Heaters

| Part Number Availability | | Description | |
|---|---|---|---|
| **9016J 550ºF** | **9016H 400ºF** | | |
| NA | 722-00043-07 | 208V | 6kW |
| 722-82124-01 | 722-00138-07 | 208V | 12kW |
| 722-82124-02 | NA | 208V | 18kW |
| 722-82124-03 | NA | 208V | 24kW |
| NA | 722-00043-01 | 230V | 6kW |
| 722-82124-04 | 722-00138-08 | 230V | 12kW |
| 722-82124-05 | NA | 230V | 18kW |
| 722-82124-06 | NA | 230V | 24kW |
| NA | 722-00043-17 | 380V | 6kW |
| 722-82124-07 | 722-00138-09 | 380V | 12kW |
| 722-82124-08 | NA | 380V | 18kW |
| 722-82124-09 | NA | 380V | 24kW |
| NA | 722-00043-10 | 415V | 6kW |
| 722-82124-10 | 722-00138-10 | 415V | 12kW |
| 722-82124-11 | NA | 415V | 18kW |
| 722-82124-12 | NA | 415V | 24kW |
| NA | 722-00043-02 | 460V | 6kW |
| 722-82124-13 | 722-00138-11 | 460V | 12kW |
| 722-82124-14 | NA | 460V | 18kW |
| 722-82124-15 | NA | 460V | 24kW |
| NA | 722-00043-05 | 575V | 6kW |
| 722-82124-16 | 722-00138-12 | 575V | 12kW |
| 722-82124-17 | NA | 575V | 18kW |
| 722-82124-18 | NA | 575V | 24kW |

## Heater Gasket

| Part Number Availability | | Description |
|---|---|---|
| **9016J 550ºF** | **9016H 400ºF** | |
| NA | 542-00007-06 | 6kW |
| NA | 542-00007-08 | 12kW |
| 542-86013-00 | NA | ALL |

## Heater Tank

| Part Number Availability | | Description |
|---|---|---|
| **9016J 550ºF (2 Pass)** | **9016H 400ºF (1 Pass)** | |
| NA | 572-82482-00 | 6 kW |
| NA | 572-82767-00 | 12 kW |
| 572-82139-00 | NA | 12 - 24 kW |

Figure 11
Customer-Recommended Spare Parts *Cont'd.*

Safety Thermostat (Manual Reset)

| Part Number | Description |
|---|---|
| 724-00041-00 | 200º-550ºF |
| 724-00034-00 | 200º-400ºF |

Safety Thermostat (Electronic)

| Part Number | Description |
|---|---|
| 692-84262-03 | 550ºF |
| 692-84262-02 | 400ºF |

Pressure Gauge (Delivery & Return)

| Part Number | Description |
|---|---|
| 037-00119-00 | 0 - 100 PSI |

Heat Exchangers (Optional)

| Ass'y. part no. | Tube Bundle Only Part No. | Description |
|---|---|---|
| 106-00167-00 | 162-00047-10 | 3.9 SQ. FT. 9016J 550ºF |
| 106-00168-00 | 162-00047-11 | 6.7 SQ. FT. 9016J 550ºF |
| 106-00169-00 | 162-00047-12 | 13.0 SQ. FT. 9016J 550ºF |
| 106-00170-00 | 162-00047-13 | 21.0 SQ. FT. 9016J 550ºF |
| 106-00024-00 | NA | 1.5 SQ. FT. 9016J 400ºF |
| 106-00027-00 | NA | 3.7 SQ. FT. 9016J 400ºF |

Pilot Lights

| Part Number | Description |
|---|---|
| 715-10049-00 | NEON LIGHT, LESS COLORED LENS |
| 581-88170-00 | LED, PCB, BOARD |

Casters

| Part Number | | Description |
|---|---|---|
| 9016 | 9026 | |
| 042-00058-00 | 042-00058-00 | SWIVEL |
| 042-00070-00 | NA | STATIONARY |

Sight Glass Assembly

| Part Number | Description |
|---|---|
| 037-00114-00 | ALL UNITS |

Figure 11
Customer-Recommended Spare Parts *Cont'd.*

## Controllers (Thermostats)

| Part Number | Description |
|---|---|
| 601-00497-01 | "S-3" SOLID STATE DIGITAL (400ºF) |
| 601-00497-02 | "S-3" SOLID STATE DIGITAL (550° F) |
| 601-00512-05 | M-2A MICROPROCESSOR BASED DIGITAL (400° F) |
| 601-00512-06 | M-2A MICROPROCESSOR BASED DIGITAL (550° F) |
| 601-00521-05 | M-2B MICROPROCESSOR BASED DIGITAL (400° F) |
| 601-00521-06 | M-2B MICROPROCESSOR BASED DIGITAL (550° F) |

## Selector Switches and Push Buttons

| Part Number | Description |
|---|---|
| 721-01028-00 | PUMP STOP |
| 721-01027-00 | PUMP START |
| 721-01026-00 | ALARM SILENCE |
| 717-01016-00 | MODE SELECT |
| 721-01029-00 | PUMP REVERSE |
| 717-10055-00 | HALF - FULL HEAT , LOCAL - REMOTE (OPTIONAL) |

## Pressure Switches

| Part Number | Description |
|---|---|
| 733-00029-00 | SWITCH, PRESSURE |

## Pump

| Part Number | Description |
|---|---|
| 075-00370-02 | MECH. SEAL, VIKING HL4125 (0-30 GPM) |
| 075-00421-02 | MECH. SEAL, VIKING KK4125 (31-70 GPM) |

## Motors

| Part Number | Description |
|---|---|
| 720-09217-00 | ¾ HP 3/60/208,230,460V |
| 720-09240-00 | 1 HP 3/60/208,230,460V |
| 720-09242-00 | 1-1/2 HP 3/60/208,230,460V |
| 720-09218-00 | 2 HP 3/60/208,230,460V |
| 720-09231-00 | 3 HP 3/60/208,230,460V |

## Solenoid Valves

| Part Number | Description |
|---|---|
| 732-00012-00 | 1/2" VALVE, 115V COIL (0-125 PSI, 300°F) |
| 732-00073-00 | 3/4" VALVE, 115V COIL (0-125 PSI, 300°F) |
| 732-00091-00 | 1" VALVE, 115V COIL (0-125 PSI, 300°F) |

Figure 11
Customer-Recommended Spare Parts *Cont'd.*

Sensing Probe Equipment

| Part Number | Description |
|---|---|
| 692-07369-03 | HEAT & COOL, M-2A |
| 692-07369-05 | HEAT & COOL, S-3 & M2B |
| 701-00003-00 | TYPE 'J' T/C |

Disconnect Switches

| Part Number | Description |
|---|---|
| 728-00119-00 | SWITCH, DISCONNECT, 25 AMP |
| 728-00121-00 | SWITCH, DISCONNECT, 40 AMP |
| 728-00122-00 | SWITCH, DISCONNECT, 63 AMP |
| 728-00123-00 | SWITCH, DISCONNECT, 100 AMP |
| 727-00104-00 | 125 AMP CIRCUIT BREAKER |
| 727-00105-00 | 150 AMP CIRCUIT BREAKER |
| 727-01030-00 | CIRCUIT BREAKER HANDLE ASSEMBLY |
| 728-00173-00 | ABB HANDLE, YELLOW/RED |
| 728-00174-00 | ABB DISCONNECT SHAFT |
| 728-00172-00 | 40 AMP, ABB |
| 728-00177-00 | 100 AMP, ABB |

Heater Tank Insulation

| Part Number | Description |
|---|---|
| 542-82146-02 | 6kW, 9016H 400ºF |
| 542-82146-01 | 12kW, 9016H 400ºF |
| 542-82146-00 | 12 - 24 kW, 9016J 550ºF |

Ful-Flo Relief Valves

| Part Number | Description |
|---|---|
| 044-00239-00 | 1", 0-30 GPM |
| 044-00164-00 | 1-1/2", 30-70 GPM |

Breather Cap

| Part Number | Description |
|---|---|
| 161-00072-00 | 1" |

***Note*:** Electrical panel component part numbers can be found in packet supplied with unit. ( ELECTRICAL PANEL LAYOUT)

Please give model & serial numbers when ordering parts.
**PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.**
**Net 30 Days. F.O.B. Milwaukee, Wisconsin.**

| Condition | Possible Cause | Solution |
|---|---|---|
| Temperature fluctuations/rapid cycling from hot to cold. | Undersized connectors/lines. | Increase size of connectors/ water lines. |
| | Long connecting lines between unit and mold. | Move the unit closer to the mold and shorten connecting lines. |
| | Serpentine flow through mold. | Connect lines for parallel flow instead of series flow. |
| | Blocked line in mold. | Check mold for metal chips or deposits. Clean mold. |
| | Quick disconnect fitting with check valve. | Remove and replace fitting or valve. |
| | Carbon build-up in unit piping or fittings. | Clean or replace affected piping. Replace fluid. |
| | Return Valve closed. | Open Return Valve. |
| | Faulty Sterlco TCU. | Check unit by connecting line directly from delivery to determine if TCU controls the set point temperature. |
| | Reversed Probes. | Switch Return and Delivery Probes. |
| Unit does not heat properly/ cannot achieve setpoint. | Loss of fluid in process. | Check all lines/connections/ fittings. |
| | Blow-off valve open. | Close blow-off valve. |
| | Faulty/dirty solenoid valve; Usually detected when there is a steady stream or trickle of water out of the drain line. | Switch to "Manual Cool" several times to flush valve. If the leak continues, disconnect the power to the unit, turn off the water supply, and clean or replace the solenoid. |
| | Degraded fluid. | Drain and replace fluid. |
| Unit will not heat. | Defective heater contactor. | Visual inspection of coil and contacts. Repair/replace defective contactors. |
| | Defective immersion heater. | Check resistance on all 3 legs of heater with an ohm meter. If not all equal, contact factory for replacement heater. |
| | Heater burnout. | Check heater tank for scorched/discolored paint. Check resistance on all 3 legs of heater with an ohmmeter. Replace heater as required. |
| | Controller heater output open | Check the heater output with an ohmmeter to ground. It should read in the mega-ohm range. Infinite or zero readings indicate a defective output. |
| | Return valve closed, clogged strainer | Open return valve. Clean strainer. |

| Condition | Possible Cause | Solution |
|---|---|---|
| Unit overheats/unable to cool. | Water supply to unit is turned **OFF**. | Open water supply. |
| | Drain is plugged or excessive back pressure in drain line. | Clear drain line or eliminate back pressure condition. |
| | Heat exchanger tubes plugged by lime deposits. | Remove tube bundles. Clean/replace as required. |
| | Faulty solenoid valve. | Test solenoid valve by switching to "Manual Cool" and listen for valve operation. Replace if faulty. |
| Rapid drop in pressure/no pressure | Leaks in connecting lines. | Inspect/replace faulty line or connection. |
| | Air in circulating lines. | Perform venting sequence. (Refer to Chapter 3, Unit Start-Up). |
| | Low fluid. | Check fluid level in sight glass. Add fluid if required. |
| | Defective Ful-Flo Valve. | (Refer to Chapter 3, Unit Start-Up). |
| | Water in fluid. | Drain water from low point in piping, (See Chapter 3, Start-up), or boil water off. |
| | Blow-off valve open. | Close blow-off valve. |
| | Pump running in reverse. | Check motor. Rewire if necessary. (Consult elementary.) |
| | Pump repair/adjustment needed. | Adjust head spacing or replace worn pump components. |
| | V-Belt broken/worn. | Replace as required. |
| Unit will not heat. | Return valve closed, clogged strainer. | Open return valve. Clean strainer. |
| Noisy Pump. | Water in fluid. | Drain water from low point in piping, (See Chapter 3, Start-up), or boil water off. |
| | Severely degraded fluid. | Drain and flush system. Replace fluid. |

*-Notes-*

# DIAGRAMS

**FLOW &**
**ELEMENTARY ELECTRICAL**

## Please refer to Electrical Drawings Provided in Packet with Unit

# *Service Notes*

# *Service Notes*

# *Service Notes*

# *Service Notes*

# *Service Notes*

# Index I

## *Parts Department*

Call toll-free 7am–6pm CST [800] 783-7835 or call [414] 354-0970

The Sterling/Sterlco Parts Department at Sterling, Inc. is ready to provide the parts to keep your systems up and running. Sterling/Sterlco replacement parts ensure operation at design specifications. Please have the model and serial number of your equipment when you call. Consult the Customer Parts List included in your information packet for replacement part numbers.

## *Service Department*

Call toll-free 8am–5pm CST [800] 783-7835 or call [414] 354-0970

Sterling/Sterlco has a qualified service department ready to help. Service contracts are available for most Sterling/ Sterlco products.

## *Sales Department*

Call [414] 354-0970 Monday–Friday, 8am–5pm CST

Sterling/Sterlco products are sold by a network of independent sales representatives. Contact our Sales Department for the name of the sales representative nearest you.

# Sterling, Inc.

Sterling/Sterlco
5200 West Clinton Avenue
Milwaukee, WI 53224-9518
[414] 354-0970 • Fax [414] 354-6421

# Warranty

**Sterling, Inc.** warrants all equipment manufactured by it to be free from defects in workmanship and material when used under recommended conditions. The Company's obligation is limited to repair or replace FOB the factory any parts that are returned prepaid within one year of equipment shipment to the original purchaser, and which in the Company's opinion, are defective. Each part, excluding the compressor and controller, comes with a standard 1 year warranty. Any replacement part assumes the unused portion of this warranty. In addition, this unit comes standard with a 1 year warranty on the compressor and 5 year limited warranty on the controller.

This warranty does not apply to any equipment which, in the Company's opinion, has been subjected to misuse, negligence, or operation in excess of recommended limits, including freezing or which has been repaired or altered without the Company's express authorization. If the serial number has been defaced or removed from the component, the warranty on that component is void. Defective parts become the property of the warrantor and are to be returned.

The Company is not liable for any incidental, consequential, or special damages or expenses. The Company's obligation for parts not furnished as components of its manufactured equipment is limited to the warranty of the manufacturers of said parts.

Any sales, use, excise, or other tax incident to the replacement of parts under this warranty is the responsibility of the purchaser.

The company neither assumes nor authorizes any other persons to assume for it any liability in connection with the sale of its equipment not expressed in this warranty.

Many types of Sterling, Inc. equipment carry an additional one-year service policy. Consult your Sterling/Sterlco sales representative for specific details.

**Sterling, Inc.**

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