STERLCO TEMPERATURE CONTROL
SERVICE AND INSTRUCTION MANUAL

THIS MANUAL PERTAINS TO:
6016 B, D & M
6026 B, D & M

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

682-85758-00

Dear Valued Customer,

On behalf of Sterling, we would like to express our gratitude and appreciation for choosing us as your supplier. We would also like to take this opportunity to introduce you to our complete offering of quality auxiliary equipment and services available for the process industries.

STERLCO
TEMPERATURE CONTROL

Full line of water and hot oil temperature control systems available in standard and custom configurations.

STERLCO
PROCESS COOLING/ CHILLING SYSTEMS

Air- and water-cooled chillers available in portable and central styles. Cooling tower systems, with full engineering capabilities.


SCRAP RECOVERY SYSTEMS

Granulators, shredders and size reduction systems. Available with vacuum take away and special hopper configurations.

Sterltech.
AUTOMATED PARTS REMOVAL

Robotics, sprue pickers and downstream automation. Custom end of arm tooling.

STERLCO
REMANUFACTURED SYSTEMS

Quality OEM remanufacturing and updating of Sterlco water and hot oil temperature control units and components.

To obtain further information about any of these quality products, please feel free to call Sterling at either 800-783-7835 or 414-354-0970.

Sincerely,

Sterling, Inc.

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INTRODUCTION

CONGRATULATIONS !

You are the proud owner of a Sterling Temperature Control System - the finest, most dependable unit available in today's market. Your Sterlco unit represents over 40 years of proven field service. We, at Sterling, are dedicated to manufacturing a temperature control unit that is second to none. Built by skilled craftsmen with the most modern and precise machinery available today. The simplicity of design and compactness engineered into the unit result in less maintenance and less floor space.

The Sterlco High Temperature Control Unit; designed and tested over a period of many years, represents one of the most significant advances ever in the field of self-contained, closed systems - portable units for heating synthetic fluid and circulating it at controlled temperatures - through mold, rolls or jackets of processing equipment.

This owners manual is intended to provide a complete overview of the unit and to give you step-by-step guidelines for the safe operation, care and service of your unit. We recommend that you thoroughly read this manual before initial start-up of the unit. This manual covers standard single and dual zone heating, cooling and circulating, with one delivery and one return line, per zone plus a water supply line and drain line for cooling.

These standard units may have many variations of optional features added to them, relative to the customer's application or specific desires. The illustrations used are to help you identify certain parts by names and to understand our explanations, which will assist you later on in the Trouble Shooting sections.

Units are warranted against defects in materials and workmanship for one year from date of shipment. Any Sterlco unit which has been used contrary to specific operation instructions or materially altered, will not be covered by this warranty. Final determination of defects must be made at Sterling Inc.

The units can easily be moved from location to another, simply by removing the circulating connection lines. By following the instructions in this manual and treating your equipment with care and respect due any precision equipment, you will be rewarded with years of uninterrupted, trouble free service.

CAUTION! THIS EQUIPMENT MUST NOT BE USED WHILE UNATTENDED!

CUSTOMER SERVICE

Your unit was engineered and carefully assembled to give you excellent quality and years of trouble free operation. However, if an unknown condition occurs, Sterling, Inc. has a well trained customer service group to assist you. We suggest the following to request quick service:

CONTACT STERLING, INC.

The Customer Service Group is available from 7 AM to 6 PM (CST), Monday through Friday. The numbers to call are:

(800) 783-7835
(414) 354-0970
Fax #: (414) 354-6421

Before you call, be sure to do the following:

1. Refer to the "Troubleshooting" section of this manual.
2. Be sure to have this manual in front of you when you call.
3. Write down the symptoms or problem that you are experiencing.
4. Have your unit's model number and serial number available when you call.

STERLING RETURN GOODS AUTHORIZATION (RGA)

In order to better serve our customers' needs, we would ask that before returning material or equipment of any kind, for any reason, to call Sterling at 1-800-783-7835 for a return goods authorization number (RGA). This is an mandatory policy to help us identify return goods, the reason for their return and to help Sterling expedite their processing. Failure to obtain this RGA # and mark it on the goods may result in their immediate return at your cost without being processed.

We thank you for your cooperation and understanding.

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DESCRIPTION

FLUID HEATING

Heating of the fluid is accomplished through the specially designed low watt density electrical immersion heater inserted into the heater tank. The immersion heater temperature is controlled by the Indicating Thermostat mounted on the front of the control panel. A safety thermostat is installed on the electrical panel. The safety thermostat has its own sensing bulb inserted in the heater flange completely separated from the control system.

Models can be supplied with either 9, 12, 18, 24, or 36 kw low watt density immersion heaters. With the exception of the F-6016-M which is supplied with a 6 kw, 3 phase low watt density immersion heater; activated by a magnetic contactor. A 2" heater tank is used for the 6 kw immersion heater.

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

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

*6kw	20,490 BTU/hr.
12kw	40,968 BTU/hr.
18kw	61,542 BTU/hr.
24kw	81,936 BTU/hr.
36kw	122,860 BTU/hr.

*M unit only.

PUMP

10 GPM @ 30 PSI
18 GPM @ 30 PSI
24 GPM @ 30 PSI
30 GPM @ 30 PSI
36 GPM @ 30 PSI

Circulation of the fluid is controlled by a slow speed, high temperature, positive displacement pump, which is belt-driven by the electric motor. It may be supplied with a drip return pump as an option.

We can supply a field installation kit of a Drip Return Pump for units that were originally supplied with a drip pan only.

COOLING

A specially designed shell and tube type heat exchanger of copper nickel is provided as standard equipment in these units. The standard sizes offered are approximately 1.5* and 4 sq. ft. in surface area.

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FUL-FLO VALVE

The purpose of this valve is a safety device that in the event the delivery line has been obstructed and the pressure in the line exceeds the set pressure on the pressure gauge, the Ful-Flo Valve will open and divert the fluid back into the return line.

CIRCULATING CONNECTION LINES

Units are equipped with heat exchangers. A water supply line rated at 65 PSI maximum is required and a drain line is necessary. (**CAUTION!** The drain line should be directed away from personnel and flow directly into an open drain. This drain line must not have any back pressure or obstructions.)

Requirements for water connections are:

SUPPLY		DRAIN
3/4	-	3/4

Delivery and return lines of the unit are 1" female pipe threads for floe rates through 24 GPM and 1-1/2" female pipe threads for 30 or 50 GPM flow rates. These lines are located at the back of the unit.

Sterling Inc. stocks the recommended types of Flexible Metal Hoses in many lengths. Our P/N is 572-16969-00. Please state length requirements when ordering. Hoses must be adequate to withstand the maximum temperatures and pressures at which the unit is to be operated. Hoses, fittings and channel connections in the mold or other equipment being controlled should be at least 3/4" in order not to restrict the flow of fluid through the circuit; if the flow is restricted by small connecting hoses or hoses with excess bends, loops, etc., the pressure relief valve will open and the flow through the internal circulating lines will be greatly reduced.

In order to eliminate any back pressure, it would be advisable to drill holes at points 'A' and tap for 3/4" pipe. Several parallel runs are far more practical than one long serpentine run and in many cases, can make a difference between precise control and erratic operation.

CAUTION! PROLONGED OR REPEATED EXPOSURES TO VAPORS GENERATED AT HIGH TEMPERATURES OR INHALATION OF HARMFUL AMOUNTS OF MATERIAL MAY RESULT IN EYE AND RESPIRATORY TRACT IRRITATION.

GENERAL (MECHANICAL) ROOM VENTILATION IS SATISFACTORY FOR USE AT LOW TEMPERATURES. SPECIAL LOCAL VENTILATION IS RECOMMENDED AT POINTS WHERE VAPORS CAN BE EXPECTED TO ESCAPE INTO THE WORKPLACE.

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CHANGING FLUID

CAUTION! FLUID MUST BE AT ROOM TEMPERATURE PRIOR TO CHANGING.

The fluid will eventually lose its clarity and begin to darken. This change in color is a normal reaction. The fluid should last from one to three years or longer, depending upon operating temperatures. The viscosity increase (thickening) indicates an accumulation of soluble decomposition products. Prolonged use of thickened fluid will result in malfunctions of the entire system. When viscosity has increased 30 - 35 %, the fluid should be discarded and new fluid added.

Should the user choose to disregard our recommendations, we cannot assume any responsibility for the successful operation of the system or any damage or malfunction that may occur. The fluid is contained in the expansion tank which holds approximately 8 gallons. The internal piping and the heater tank require about 5 gallons of fluid. Additional fluid should be available to fill the connecting line, plus the channels, etc.

With the system purged and properly filled, only 1" to 2" should be visible in the sight gauge glass. This provides capacity in the expansion tank for expansion and for fluid when the pump is reversed and fluid is withdrawn from the system.

CAUTION! EXPANSION TANK MAY NOT HAVE ADEQUATE VOLUME TO HOLD TOTAL SYSTEM CAPACITY.

VENT CONNECTIONS

On the back of the units are a fill connection and a Vent connection. At higher temperatures where liquid may give off appreciable vapors or fumes, adequate ventilation should be provided on connection. This vent connection must not be closed at any time. If a long vent is required, it is suggested that the vent be trapped near the exit to collect moisture that can develop on the vent when the unit is cooled.

THROTTLE

The Throttle Valve is used as a control valve to regulate the amount of cold water entering the Heat Exchanger. The time lapse between heating and cooling can be regulated by this valve. If the "COOL-HEAT" indicator light switches from "COOL" to "HEAT" in rapid succession, too much cold water is entering the cooling tubes; results could damage the Heat Exchanger. Close the Throttle Valve to a point where a reasonable time element is established, depending upon the temperature of the mold.

VALVES

The Check Valve eliminates the back flow of water from the heat exchanger back into the water supply line.
The Blow-Off Valve is used in "VENTING" the unit and allows the air in the system to escape.

The Drain Valve is used to completely drain the entire unit of fluids. A hose line or a pipe can be connected to the valve and directed to a floor drain or a container. The Pressure Relief Valve is rated at 150 PSI and its function is to protect the heat exchanger. If the drain line is restricted and the pressure exceeds 150 PSI, the valve will open up to release the pressure in the line. As soon as pressure returns to normal, the valve will close.

The Throttle Valve is used as a control valve to regulate the amount of cold water entering the heat exchanger. The time lapse between heating and cooling can be regulated by this valve. If the "COOL/HEAT" indicator light switches from "COOL" to "HEAT" in rapid succession, too much cold water is entering the cooling tubes, which could result in damage to the heat exchanger. Close the Throttle valve to a point where a reasonable time element is established, depending upon the temperature of the process.

TEMPERATURE CONTROLLER

Control action of this electro-mechanical indicating temperature controller is provided through the principal of liquid change. With a variation in temperature, the liquid in the sensing bulb, which is inserted into the delivery line, expands or contracts, causing the bellows located inside the case to actuate the switching mechanism. The controller has a maximum temperature range of 400° F ("M" unit) and 550° F. Turning the control knob to the right, the indicator needle (black top) will move; this is to be set at the point of heat requirement. The black indicator needle shows the actual temperature, as it slowly advances toward the set point.

SAFETY THERMOSTAT

The adjustable Safety Thermostat is mounted in the inside electrical panel. It has its own sensing bulb that is installed in the heater tank flange bulb well, on the top of the heater tank. This Safety Thermostat is factory set and acts as a protection against overheating.

DISCONNECT SWITCH

The Disconnect Switch Lock Handle is mounted on the outside of the electrical box and controls the electrical system of the unit. If for any reason while the unit is in operation, a fast shut down is required, the Disconnect Switch Lock Handle acts as a master switch. Turning the handle from the "ON" position to the "OFF" position will disconnect the entire electrical system of the unit from the main supply.

CAUTION! THE THREE WIRES COMING FROM THE POWER SOURCE TO THE TOP OF THE SWITCH ARE STILL HOT.

The Disconnect Switch Lock can be made inoperable in the "OFF" position by pushing up on the small lever of the bottom of the handle and putting a lock through the opening. This method prevents anyone from turning the handle to the "ON" position. In order to place the handle in the "ON" position, depress the handle and turn.

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PERFORMANCE

"M" units have four basic electrical controls, plus a pressure vacuum gauge and a manual temperature controller:

START ON-OFF STOP LOCK

START

When this button is depressed, the starter is manually energized and supplies power to the motor. Voltage is applied to the transformer, which in turn applies power to the "ON-OFF" switch.

ON-OFF SWITCH

When the switch is in the "ON" position, power is applied to the temperature controller, which in turn regulates either "heating or cooling." When this switch is in the "OFF" position, the unit will neither heat nor cool, but the pump continues to circulate the fluid.

STOP

When the switch is depressed, the starter is manually de-energized cutting the voltage to the motor and transformer, de-activating the complete electrical control (115V) system.

LOCK

When the switch is in the "STOP" position, the lock can be pulled out. A padlock can be inserted in the lock to prevent anyone from starting the unit.

PRESSURE GAUGE

This compound pressure gauge has dial readings in inches of mercury vacuum and pounds per square inch pressure. The red arrow is set to indicate pressure at which the Ful-Flo Valve is fully open. The black arrow indicates the actual pressure the pump is developing.

Other units have five basic electrical controls, plus a pressure vacuum gauge, manual temperature controller and a manual disconnect switch.

On/off switch	Reverse switch	Pressure gauge
Heat indicator light	(push-button)	Temperature controller
(push-button)	Stop switch	Safety thermostat
	(push-button)	Disconnect switch

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ON/OFF SWITCH

When this switch is turned to the "ON" position, it will activate the power to the heating circuits through the "FORWARD PUSH-BUTTON."

HEAT INDICATOR LIGHT

When the switch is in the "ON" position, it will illuminate indicating that the unit is in the heating cycle, when the call is for heat. However, if the safety thermostat has tripped, this pilot may still illuminate even though no heat is being developed by the heater. The model F 6026 D unit is equipped with a heat exchanger and a solenoid valve. Therefore, in place of the ON/OFF switch and the HEAT LIGHT, as used on F 6026 B, we have:

HEAT - COOL INDICATOR LIGHT

If the unit is in the heating cycle, the right side of the indicator will illuminate "RED." However, if the safety thermostat has tripped, this pilot may still illuminate even though no heat is being developed by the heater. If the unit is in the cooling cycle, the left side of the indicator will illuminate "GREEN"

COOL - OFF - AUTO SWITCH

When the control knob is placed in the "OFF" position, the unit is neither heating nor cooling but is circulating. When the control knob is placed in the "AUTO" position, the unit is heating or cooling depending upon the temperature setting.

COOL POSITION

When the control knob is placed in the "COOL" position, the unit is in manual cooling at all times.

FORWARD PUSH BUTTON

When this switch is depressed momentarily, the motor starter is energized and the pump runs (clockwise) in forward position, as viewed from the shaft end. The circuit is held in by the motor starter interlock, which provides low voltage protection. This interlock is used to provide power at the heating circuit "ON - OFF" switch. The heating cycle will not activate until the "ON-OFF" switch is turned to the "ON" position. At this time the light will illuminate (RED).

REVERSE PUSH BUTTON

CAUTION! Never reverse pump with hot fluid. Cool fluid to room temperature PRIOR to reversing. When this button is depressed and held, the reverse motor starter is energized and the pump runs in reverse (counter clockwise) rotation (viewing shaft end). The heating circuit is inoperable. With the Return Line Valve closed and the Blow-off Valve open, fluid is drawn from the system to the expansion tank.

CAUTION! EXPANSION TANK VOLUME MAY NOT BE ADEQUATE TO HOLD TOTAL SYSTEM CAPACITY. ALWAYS ALLOW PUMP TO COME TO A COMPLETE STOP BEFORE ACTIVATING PUMP REVERSE.

STOP PUSH BUTTON

When this switch is depressed the electrical control (115V) system is deactivated.

PRESSURE GAUGE

This compound pressure gauge has dial readings in inches of mercury vacuum and pounds per square inch pressure. It is also calibrated in Kg/cm^2. The red arrow is set to indicate pressure at which the Ful-flo Valve is fully open. The black arrow indicates the actual pressure that the pump is developing.

INSTALLATION

INITIAL PROCEDURES

This unit is supplied for 3-phase operation for a selected voltage. Caution must be taken to provide a correctly sized power supply to the unit. This unit must be properly grounded.

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

ELECTRICAL

It will be necessary to drill a hole in the cabinet for a power supply line.

HEATER CAPACITY EACH CIRCUIT KW	TOTAL AMPS 3/60/220	TOTAL AMPS 3/60/230	TOTAL AMPS 3/60/440	TOTAL AMPS 3/60/460
6 KW	17		8	
12 KW		62		31
18 KW		92		46
24 KW		124		62
36 KW		194		97

FILLING THE TANK WITH FLUID

The expansion tank holds 8 gallons of fluid. The internal piping and the heater tank require 5 gallons of fluid. Additional fluid should be added to fill the connecting lines, plus the channels in the process. As the unit is operating in the heating cycle, the fluid expands. Caution must be taken to never over fill the tank. Maintain 1" to 2" of fluid visible in the sight glass. This will allow for thermal expansion of the fluid.

CIRCULATION

FLOW DIAGRAM (HEATING AND COOLING)

HEATING

With the "ON-OFF" switch in the "ON" position, power is supplied to the thermostat. If the fluid temperature is lower than the thermostat set point, the heater will come on and will be indicated by the red heat light. The fluid is drawn down to the pump by gravity feed; as the fluid is circulated through the pump, a pressure will be indicated on the pressure gauge. The fluid travels into the bottom of the heater tank where it is heated by the immersion heater to the temperature requirements set on the temperature controller. As the pressure builds up on the pressure gauge and fluid reaches the top of the tank, the heat sensor indicates the temperature on the temperature controller. The fluid is forced into the shell of the shell and tube heat exchanger and into the process delivery supply connecting line and circulated through the process.

NOTE: If the pressure in the line is greater than the set pressure on the pressure gauge, the fluid will by-pass the delivery to the process supply and will be diverted through the Ful-Flo (Safety Valve) back in the return line. As the fluid is circulated through the process, the fluid cools down slightly and is returned from the process to the return line into the pump and recirculated back into the heater tank.

CAUTION: It is very important that the sight gauge glass indicates that there is an ample supply of fluid contained in the fluid expansion tank, an inch or two visible in the sight gauge glass is sufficient after the unit is properly purged.

COOLING

If the fluid temperature is higher than the controller set point the cooling solenoid valve will open allowing cooling water to pass through the heat exchanger. This condition will be indicated by the white light. The hot fluid will flow the same way as in the heating cycle, except that the heater will be disengaged and the solenoid valve will be activated and cold water from the water supply line will flow through the strainer, solenoid valve, throttle valve and check valve into the bottom of the heat exchanger, through the cooling tubes and cooling the hot fluid circulating around the cold tubes. The circulation of water is then routed out through the drain line.

PRELIMINARY OPERATION

START-UP PROCEDURES

1. By means of hard piping or copper tubing connect a vent line from the blow off valve to the vent fitting on the reservoir tank.

2. Close the Return Line Valve.

3. Open Blow Off Valve 1/2 turn.

4. Turn the heater selector switch to "OFF".

5. Depress the "START" switch to start the pump. Check motor rotation by observing the pressure gauge. If indicating pressure, rotation is correct. If indicating vacuum, reverse two motor power connections.

6. If there is any air in the lines it will come out of the Blow Off Valve.

7. Allow the unit to run for a brief period to ensure complete circulation. Watch the flow coming out of the Blow Off Valve for bubbles or erratic flow.

8. When the fluid runs steadily, close the Blow Off Valve.

9. Open the Return Line Valve.

10. Recheck the Sight Gauge Glass for fluid level (approximately 1" in glass is sufficient when fluid is at ambient temperature).

11. Position "ON/OFF" switch to the "ON" position.

F-6016, F-6026-D

The procedures are the same as F-6016-B except that after rechecking the sight gauge glass:

1. Position the "COOL - OFF - AUTO" switch to the "AUTO" position.

2. With F-6026-D make sure that the Blow off valve is closed.

F-6026-B

1. Set the desired temperature on the temperature controller. It is strongly recommended that you "RAMP UP" slowly to the desired set point in order to minimize wear and tear on the fluid, and temperature control unit.

2. Turn the "ON-OFF" switch to the "ON" position.

3. Depress the "FORWARD" push button. The heat indicator will illuminate RED indicating that the unit is in the heating cycle.

If the fluid is cold. the black indicator needle could exceed the setting of the red indicator set point. As the fluid heats, the black indicator needle will indicate system pressure and unless severe restrictions are in the system, should indicate about 10 PSI below the red indicator. As the fluid cools down below the set point, the heater will come back on and maintain a controlled heat.

CAUTION! THIS EQUIPMENT MUST NOT BE USED WHILE UNATTENDED.

F-6026-D (heating and cooling)

1. Set the desired temperature on the temperature controller.

2. Turn "COOL - OFF - AUTO" switch to the "AUTO" position.

3. Depress the "FORWARD" push button. The heat indicator will illuminate RED indicating that the unit is in the heating cycle.
4. As the fluid heats up and the heat indicator needle rises to meet the indicator set point, the indicating needle may exceed set point slightly. When this occurs, the solenoid valve on the water supply line will open and allow cold water to enter the cooling tubes of the heat exchanger. At this moment the "COOL" indicator light will illuminate GREEN indicating that the unit is in the cooling cycle.

5. As the fluid cools down to below the set point, the solenoid will close, shutting off the water supply and the heater will take over again to bring the temperature up to a controlled even heat.

MANUAL

After the unit has been operating in the heating cycle for a length of time and a fast cool down of the fluid is required:

1. Position the "COOL - OFF - AUTO" switch to "COOL". This will over-ride the temperature controller and provide continuos cooling until the switch is reset.

2. The cool indicator will illuminate GREEN indicating that the unit is in the cooling mode.

RETURNING FLUID TO TANK

If the unit is to be moved from one process to another, the following steps must be taken:

1. Cool fluid to room temperature.

2. Close the Return Line Valve.

3. Open the Blow-off valve to allow air to enter the system.

4. Depress and HOLD the "REVERSE" push button. The pump will then run in reverse, draining the fluid from the process and into the delivery line.

5. The pump then circulates the fluid in this reverse direction into the expansion tank.

6. Watch the sight gauge glass as it fills, indicating how much fluid has returned into the expansion tank.

CAUTION! EXPANSION TANK MAY NOT HAVE ADEQUATE VOLUME TO HOLD TOTAL SYSTEM CAPACITY.

PREVENTATIVE MAINTENANCE

Periodic inspection of the following equipment must be made to maintain optimum performance of your Sterlco Temperature Control Unit.

MOTOR

1. Clean out the motor air intake grill of dust and any oil accumulation.

2. Check the bolts and nuts that hold the motor to the support.

3. Make certain that the belts are in good condition and are aligned with the pump. Replace if necessary.

PUMP

1. It is good practice to keep the pump as clean as possible. This will facilitate inspection, adjustment and repair work and help prevent omission of lubrication to fittings covered or hidden with dirt.

2. Check the bolts and nuts that hold the pump to the support.

3. Under normal operating conditions, the pump packing should allow a drop or two of oil per minute. The packing is of the finest type available for this service and it depends upon a small amount of oil flow for lubrication. When the new unit is first started, the packing should be checked periodically and tightened as the pump wears in. Do not over-tighten the packing gland to a point where the pump will not drip. This will shorten the life of the packing and will damage the shaft.

WARNING! DO NOT MAKE ADJUSTMENTS TO THE PACKING UNTIL AFTER IT HAS BEGUN TO DRIP. IT MAY TAKE SEVERAL DAYS FOR THE FLUID TO START DRIPPING FROM THE PACKING. ONCE THE DRIPPING HAS BEGUN, THE RATE NEED NOT EXCEED 1 DRIP PER MINUTE AT OPERATING TEMPERATURE. IF UNIT IS EQUIPPED WITH DRIP PUMP, INSTALL BELT AFTER DRIPPING HAS STARTED.

4. Mechanical seal pumps should not leak. Leaking on this type of pump indicates a defective seal and the seal should be replaced.

5. Grease all zerks after 500 hours of operation or after 60 days, whichever comes first. Use #2 ball bearing grease.

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VENT CONNECTION

Check to see if vent connections are open at all times.

DRAIN LINES

Check outlet of drain line for any obstructions or back pressure.

DRIP PAN

Clean any fluid, dust, or dirt accumulation from pan.

FLUID

1. Check the fluid for viscosity. Prolonged use of thickened fluid will result in malfunction of the entire system.

2. Check level of fluid in the sight glass.

3. If fluid level decreases, check all connections for leaks.

HEAT EXCHANGER

1. Keep exterior of the heat exchanger clear of dust or dirt.

2. Check water supply for correct pressure, leaks, etc.

STRAINERS

Clean out the strainer twice a year, as a minimum, depending upon usage and operating conditions.

CONNECTION LINES

Connection line, hoses and connectors should be inspected frequently to ensure that the original service rating has not been reduced by age, damage, and/or deterioration.

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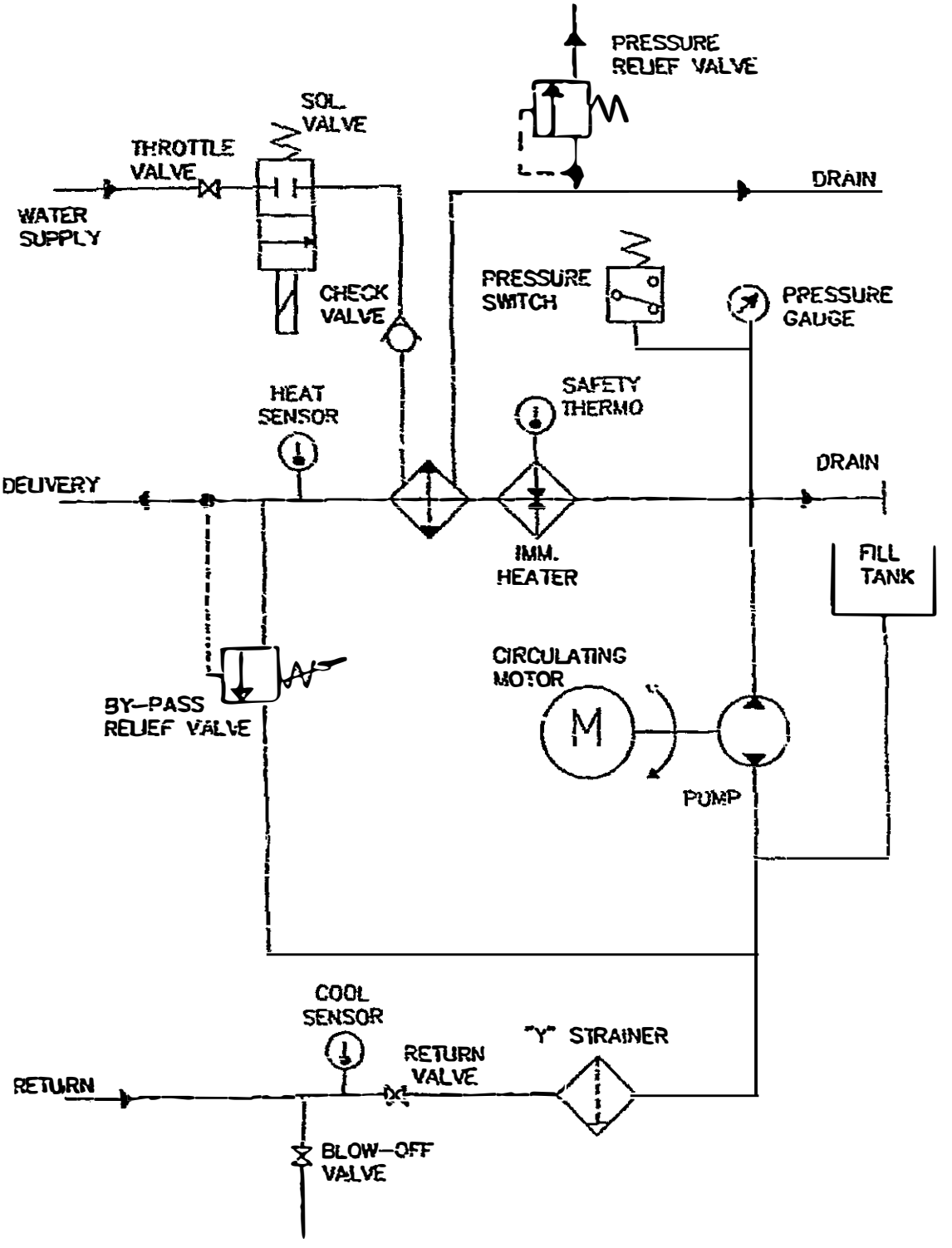
TROUBLE SHOOTING

PROBABLE CAUSE	PROBABLE REMEDY
RAPID DROP IN PRESSURE	
a. Leaks in connection lines.	a. Check all connecting lines.
b. Air in circulation lines.	b. Refer to "Start-up" procedures.
c. Low fluid.	c. Check sight gauge glass.
d. Ful-flo valve.	d. Broken spring, valve stuck open.
e. Pressure line.	e. Check for broken lines, loose connections
NO PRESSURE	
a. Water in circulating lines.	a. Refer to "Start-up" procedures for venting sequence, which should be performed at a temp. of approx. 225° F.
TEMPERATURE CONTROLLER	
a. Heat indicator needle does not match the hat of the controller.	a. Release the lock nut. Turn the "off set adjusting nut" left or right to change the °F. setting. Re tighten lock nut. See controller manual.
HEATING and COOLING	
a. Low or no water.	a. Check pressure of water supply line.
b. Throttle valve closed.	b. Adjust the valve.
c. Blow off valve in-operable.	c. Close valve tight.
d. Solenoid valve in-operable	d. Check valve for proper operation. Watch the drain line.
e. Clogged strainer.	e. Dirt from strainer entered solenoid valve.
f. Clogged drain line.	f. Disconnect and check the line.
g. Plugged heat exchanger.	g. Examine heat exchanger.
COOLING TOO FAST	
a. Throttle valve.	a. Close the valve tightly.
b. Solenoid valve dirty.	b. Check the valve for proper operation. Watch the drain line.
COOLING TOO SLOW	
a. Throttle valve	a. Open valves slightly, watch drain.



DWG. NO. A682-11276

1. Revision entered per ECN - 7-29-87

DRG. NO. A682-31276
SCALE
DATE 2-26-87
CH'K.
DR. TAB
TITLE M6016-1,-2
STERLING, INC. MILWAUKEE, WIS.

UNLESS OTHERWISE SPECIFIED USE .005" TOL FOR DECIMAL DIMENSIONS, 1/64" TOL FOR FRACTIONAL DIMENSIONS

DWG No.
A682-30792

MAIN PROTECTION						
KW	208	230	380	415	460	575
12	110	100	60	60	50	40
18	150	150	90	80	70	60
24		175	110	100	90	70
36			150	150	125	100
48					150	150
50						150
60						175

HEATER AMPS @ VOLTAGE						
KW	208	240	380	415	480	600
12	33	29	18	17	14	12
18	50	43	27	25	22	17
24		58	37	33	29	23
36			55	50	43	35
48					58	46
50						48
60						58

HEATER FUSE SIZE @ VOLTAGE						
KW	208	240	380	415	480	600
12	90	80	50	45	40	30
18	125	110	70	70	60	45
24		150	100	90	80	60
36			150	150	110	90
48					150	125
50						125
60						150

CONTROL FUSE SIZE	
TRANS. SIZE	FUSE SIZE
250 VA	2.5 AMP
350 VA	3.5 AMP
500 VA	5.0 AMP
750 VA	8.0 AMP

MOTOR AMPS @ VOLTAGE						
HP	208	230	380	415	460	575
3/4	3.2	2.8	1.7	1.5	1.4	1.1
1	4.1	3.6	2.2	2	1.8	1.4
1.5	6	5.2	3.3	2.9	2.6	2.1
2	7.8	6.8	4.3	3.7	3.4	2.7
3	11	9.6	5.8	5.3	4.8	3.9
5	16.8	15.2	9.2	8.4	7.6	6.5
7.5	24.3	22	13.3	12.2	11	8.8

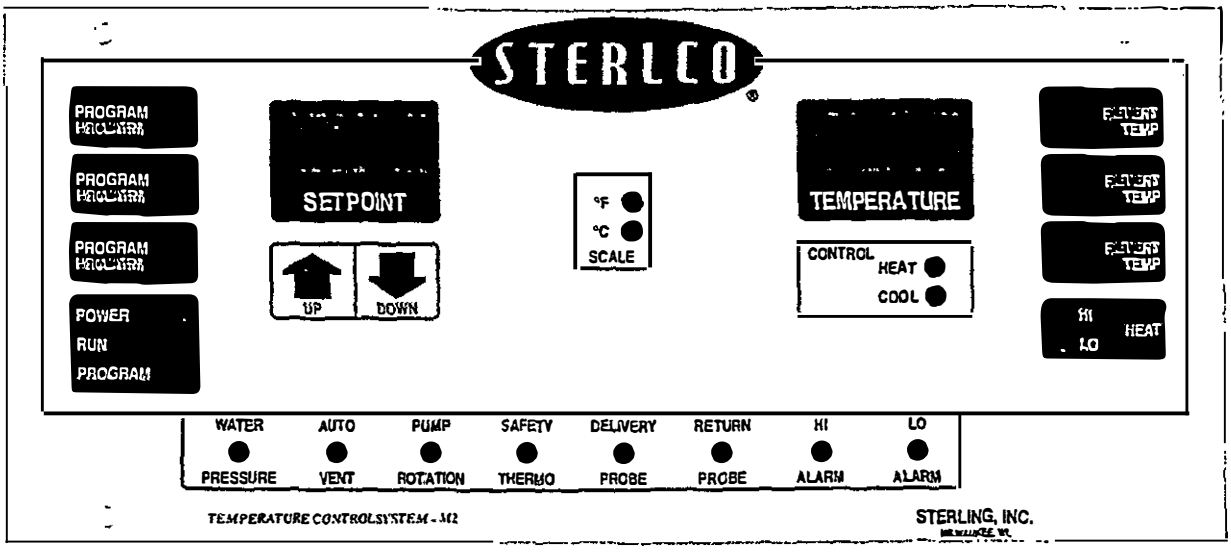
MOTOR FUSE SIZE						
HP	208	230	380	415	460	575
3/4	9	8	4.5	4.5	4	3
1	12	9	5.6	5	4.5	3.5
1.5	15	15	9	8	7	5.6
2	20	17.5	12	10	9	7
3	30	25	15	15	12	10
5	45	40	25	25	20	15
7.5	70	60	35	30	30	25

TYPE	SYM	ASYM
K5 FUSE	200,000A	
150A C/BRK.	14,000A	15,000A
225A C/BRK.	22,000A	25,000A

TRANS. PRIMARY FUSE SIZE						
VA	208	230	380	415	460	575
250	1.6	1.4	1	.8	.8	.6
350	2.25	2	1.25	1.125	1	.8
500	3	2.8	1.8	1.6	1.4	1.125
750	4.5	4.5	2.5	2.25	2	1.8

SHEET #2 OF 2 SHEETS

STERLING INC. MILWAUKEE, WI	TITLE: ELEMENTARY WIRING CHARTS	DR. JCL	DATE 2-16-90	SCALE NONE	DWG No A682-30792



M-2

The M-2 is a microprocessor based temperature controller designed for exclusive use with the Sterlco tempertature control units. The M-2 monitors and maintains the temperature of the fluid in any given process to a selected setpoint. The controller directs the system to heat or cool the fluid as required by the process.

The M-2 has LED displays for setpoint and delivery temperatures. Controller status lights are provided for the following functions: °F/°C, heat/cool, heater high/low, power, run & program, high & low alarm sets.

The controller includeds self-diagnostics to check all hardware functions. Diagnostic status lights are provided for the following functions: low pressure, pump rotation, safety thermo, delivery and return probes, high and low alarms tripped and auto vent.

BOLD- faced type designates the controller keypads, the "QUOTED" words are the controller functions.

PROGRAMMING THE M-2

Depressing any program keypad (**PROGRAM PROCESS, PROGRAM HI ALARM, PROGRAM LO ALARM**) deletes the stored value. The controller will idle and the "Program" LED will flash, allowing the limits to be reset. The following programmable features are allowed by the M-2:

- **PROGRAM PROCESS-** Depress the **PROGRAM PROCESS** keypad and the up or down arrow simultaneously to increase or decrease the setpoint display.
- **PROGRAM HI ALARM-** Depress the **PROGRAM HI ALARM** and the up or down arrow to set the alarm high limit. To disable the function, set the limit out of range.
- **PROGRAM LO ALARM-** Depress the **PROGRAM LO ALARM** and the up or down arrow to set the alarm low limit. To disable the function, set the limit out of range.

OTHER KEYPAD FUNCTIONS

- **RETURN TEMP-** Depressing the **RETURN TEMP** keypad will cause the returning fluid temperature to be displayed on the digital "temperature" LED display. The display will revert to delivery temperature when the keypad is released.
- **ΔT TEMP DIFF-** Depressing the **ΔT TEMP DIFF** keypad will cause the ΔT, or difference between delivery and return temperature, to be displayed on the digital "temperature" LED display. When the keypad is released, the display will revert to delivery temperature.

STATUS LIGHTS

- °F/°C- Indicates temperature scale being displayed on "SETPOINT" and "Temperature" LED's. Used in conjunction with optional °F/°C selector switch.

- HI-LO HEAT- Indicates automatic high or low heat selection of the M-2. When possible, the M-2 will operate in the low heat mode to minimize power consumption.

  Note- The "HI-LO HEAT" also functions as a keypad to manually override controller selection of the heat function. Depressing the keypad once will lock the controller into the "high heat" selection. Depressing it again will cause the controller to revert to the automatic hi-lo heat selection.

CAUTION! Must be employed when using this feature, as manual selection of the high heat mode will prevent the controller from achieving the tightest degree of control.

DIAGNOSTIC AND ALARMS

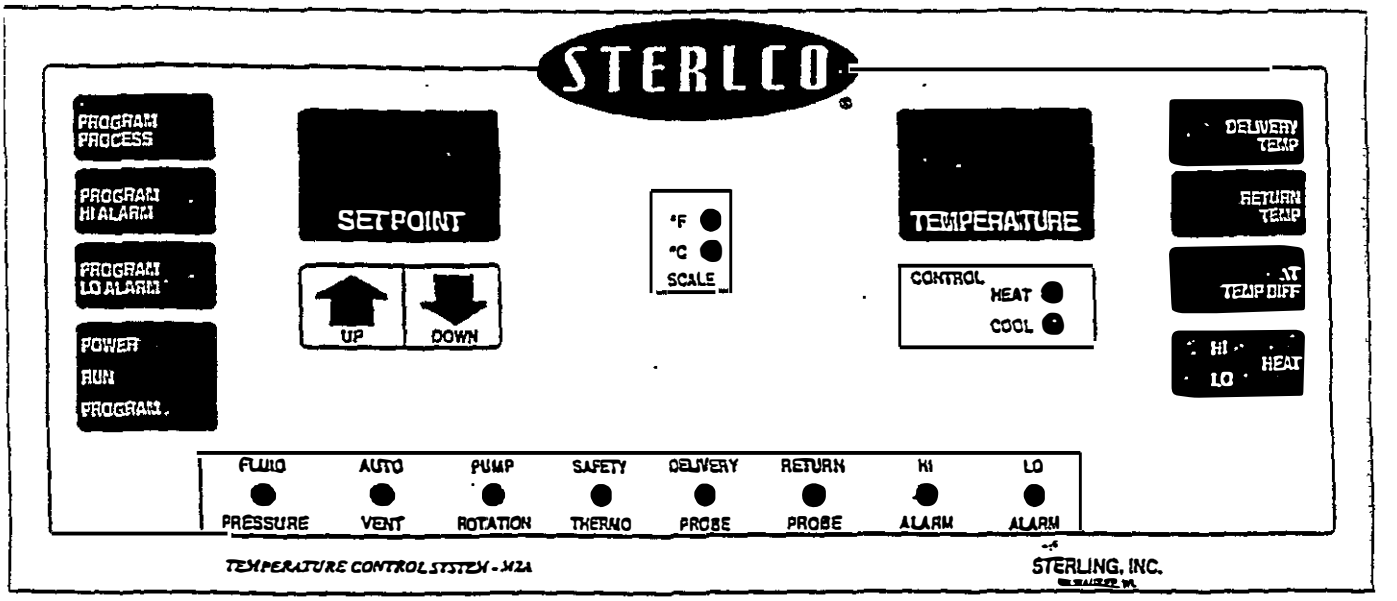
Indicates alarm conditions:

WATER PRESSURE-	Indication of low fluid pressure alarm; alarm shuts down the unit.
AUTO VENT-	Flashing light for duration of auto vent condition.
PUMP ROTATION-	Indication of improper pump rotation of pump failure.
SAFETY THERMO-	Indication of unit over temperature; heater outputs are disabled.
DELIVERY PROBE-	Indication of delivery probe failure.
RETURN PROBE-	Indication of return probe failure.

HIGH ALARM- Indication of process fluid temperature exceeding high setpoint limit.

LOW ALARM- Indication of process fluid temperature exceeding low setpoint limit.

M2A



NOTE: The M-2A must be tuned upon initial start-up.

The M-2A is a microprocessor based temperature controller designed for exclusive use with the Sterlco temperature control units. The M-2A monitors and maintains the temperature of the fluid in any given process to a selected setpoint. The controller directs the system to heat or cool the fluid as required by the process.

The M-2A employs a unique PID auto-tuning program to precisely control process temperature.

The M-2A has LED displays for setpoint and delivery temperatures. Controller status lights are provided for the following functions: °F/°C, heat/cool, heater high/low, power, run & program, high & low alarm sets.

The controller includes self-diagnostics to check all hardware functions. Diagnostic status lights are provided for the following functions: low pressure, pump rotation, safety thermo, delivery and return probes, high and low alarms and auto vent.

BOLD-faced type designates the controller keypads, the "QUOTED" words are the controller functions.

STATUS LIGHTS

- °F/°C- Indicates temperature scale being displayed on "SETPOINT" and "Temperature" LED's. Used in conjunction with optional °F/°C selector switch.

- HI-LO HEAT - Indicates high or low heat selection of the M-2A.

  Note: The "HI-LO HEAT" also functions as a keypad to manually control selection of the heat function. Depressing the keypad once will lock the controller into the "low heat" selection. Depressing it again will lock the controller into the "high heat" selection.

The M-2A default is high heat. If an autotune is completed with high heat, do not switch to low heat, unless a new autotune is initiated using low heat. Failure to comply will result in poor controllability.

DIAGNOSTIC AND ALARMS

Indicates alarm conditions:

FLUID PRESSURE - Indication of low fluid pressure alarm; alarm shuts down the unit. Unit will resume operation when pressure is restored.

AUTO VENT - Flashing light for duration of auto vent condition. The auto vent feature is deactivated on high temperature oil units.

PUMP ROTATION - Indication of improper pump rotation or pump failure. This is a fatal fault which requires disconnection of main power to reset.

SAFETY THERMO - Indication of unit over temperature; heater outputs are disabled. Pump will continue to operate and the M-2A will energize the "cool" solenoid in order to prevent damage to the heater. This is a fatal fault which requires disconnection of main power to reset.

DELIVERY PROBE - Indication of probe failure. Alarm will reset when new probe is installed.

RETURN PROBE - Indication of probe failure. Alarm will reset when new probe is installed.

PROGRAMMING THE M-2A

Depressing any program keypad (**PROGRAM PROCESS, PROGRAM HI ALARM, PROGRAM LO ALARM**) displays the stored value. The controller will idle and the "Program" LED will flash, allowing the limits to be reset. The following programmable features are allowed by the M-2A.

- **PROGRAM PROCESS -** Depress and hold the **PROGRAM PROCESS** keypad and the up or down arrow simultaneously to increase or decrease the setpoint display.

- **PROGRAM HI ALARM -** Depress and hold the **PROGRAM HI ALARM** and the up or down arrow to set the alarm high limit. To disable the function, set the limit out of range. The controller will automatically program a high alarm of 25°F over setpoint. This program feature is used only to override the alarm value programmed by the controller.

- **PROGRAM LO ALARM -** Depress and hold the **PROGRAM LO ALARM** and the up or down arrow to set the alarm low limit. To disable the function, set the limit out of range. The controller will automatically program a low alarm of 25° under setpoint. This program feature is used only to override the alarm value programmed by the controller.

OTHER KEYPAD FUNCTIONS

- **RETURN TEMP -** Depressing the **RETURN TEMP** keypad will cause the returning fluid temperature to be displayed on the digital "temperature" LED display. The display will revert to delivery temperature when the keypad is released.

- **ΔT TEMP DIFF-** Depressing the **ΔT TEMP DIFF** keypad will cause the ΔT, or difference between delivery and return temperature, to be displayed on the digital "temperature" LED display. When the keypad is released, the display will revert to delivery temperature.

- **DOWN ARROW -** Depressing the **DOWN** arrow keypad will energize the "cool" output of the controller, causing the unit to crash cool. This will cause a rapid drop in process temperature.

- **UP ARROW -** Depressing the **UP** arrow keypad will perform a lamp test of all the LED's.

- **HIGH ALARM -** Indication of process fluid temperature exceeding high alarm limit.

- **LOW ALARM -** Indication of process fluid temperature exceeding low alarm limit.

TUNING

The M-2A is capable of tuning itself to a specific process. A new controller MUST be tuned upon initial start-up. For optimum results the M-2A should be re-tuned whenever the process is changed.

To initiate the autotune feature, energize the controller and program the setpoint at which the controller will operate. After autoventing is complete, simultaneously depress **PROGRAM PROCESS** and **DELIVERY TEMP** keypads; the "RUN" LED will flash during the autotune process. The M-2A will then begin ramping up to the programmed setpoint, and tune itself to the process it is controlling. During the ramp-up, the M-2A will occasionally go into heat and cool cycling, or into a brief "standby" mode to measure ambient temperature losses. The controller will then ramp-up to the programmed setpoint with minimal overshoot. The "run" LED will stop flashing when the autotune is complete.

> Do not attempt to reprogram the M-2A or depress any keypads during the tuning process, or the process will be disrupted.

To cancel the tuning process, press and hold **PROGRAM PROCESS** for three (3) seconds. The M2A will retain its previously stored PID values.

Note the following:

- Process temperature must be stabilized at least 10°F lower than setpoint in order to achieve a proper autotune.

  If the autotune process is canceled or not initiated, the controller will re-use the parameters stored in its memory from the last tuning process.

- If the tuning parameters for the process are known (i.e., P,I,D values), they can be manually inputted to avoid having to retune. Consult factory if this feature is required.

CAUTION: If heat is applied to the process from any source other than the Sterlco temperature control unit during an autotune (e.g. induction heater, hot air, etc.) it is **MANDATORY** that the gain ratio be adjusted from the factory default value of 10. This is done via Mode 2 Set-Up (see below). More powerful external heat sources will require a LOWER gain ratio. Failure to do so may result in a runaway heating situation during the autotune "drift" cycle.

"MODE 2" SET-UP

The "set-up: programming mode can be accessed by simultaneously pressing and holding the **UP** and **DOWN** arrows while the controller is energized. Select the parameter to be programmed by pressing the keypad shown below. Once the parameter is accessed it can be changed by pressing the **UP** and **DOWN** arrows individually.

PARAMETER	KEYPAD
Cool gain ratio **"RAT"**	**HEAT HI/LO**
PID constant RATE **"D"**	**DELIVERY TEMP**
PID constant RESET **"I"**	**RETURN TEMP**
PID constant GAIN **"P"**	**ΔT TEMP DIFF**
Baud Rate **"BAU"**	**PROGRAM PROCESS**
Communications ID **"C I D"**	**PROGRAM HI ALARM**
Communications Protocol Type **"tPE"**	**PROGRAM LOW ALARM**

To exit Set-Up Mode 2, power to the M-2A must be cycled off and back on again. This will return the M-2A to the "Run" mode with the new parameters stored in memory.

SAMPLE SET-UP

1. Simultaneously press **UP** and **DOWN** arrows. Turn the controller on. M-2A will enter the "Set-UP" mode.

2. Press **PROGRAM PROCESS**. Controller displays current baud rate.

3. Press **UP** or **DOWN** arrow repeatedly until desired baud rate shows in the display.

4. Press **PROGRAM HI ALARM.** Controller displays current communications ID.

5. Press **UP** or **DOWN** arrow until desired ID shows in the display.

6. Turn controller power "off" and then back on again.

"MODE 1" SET-UP (FACTORY ACCESS ONLY)

The "set-up" programming mode can be accessed by simultaneously pressing and holding the DELIVERY, RETURN and Δ TEMPERATURE keypads while the controller is energized. Select the parameter to be programmed by pressing the keypad shown below. Once the parameter is accessed it can be changed by pressing the **UP** or **DOWN** arrows individually.

PARAMETER	KEYPAD
Safety Thermo On-Off	**DELIVERY TEMP**
Pressure Switch On-Off	**RETURN TEMP**
Auto Vent On-Off	**PROGRAM PROCESS**
Hi Setstop Limit	**PROGRAM HI ALARM**
Lo Setstop Limit	**PROGRAM LO ALARM**

To exit Set-Up Mode 1, power to the M-2A must be cycled off and back on again. This will return the M-2A to the "Run" mode with the new parameters stored in memory.

STERLCO®

SERVICE BULLETIN

NUMBER ESB-515
PAGE 1 OF 1

VIKING PUMP HOUDAILLE

VIKING PUMP DIVISION,
HOUDAILLE INDUSTRIES, INC.
CEDAR FALLS, IOWA 50613 U.S.A.

REPRINTED: 4/19/93

TO: MASTER CATALOG HOLDERS
SUBJECT: LUBRICATION

1. LUBRICATION OF VIKING PUMPS

	GREASE USED FOR ANTI-FRICTION BEARINGS, SLEEVE BEARINGS AND LANTERN RINGS*	
TEMPERATURE OF LIQUID PUMPED, °F.	GENERAL DESCRIPTION OF GREASE USED BY VIKING	VIKING SUPPLIER
Below -20	Low Temperature Lithium Base Grease, **NLGI #1	Shell; Alvania #1
-20 to +250	Multi-purpose Lithium Base Grease, **NLGI #2	Mobile; Mobilux #2
+250 and Above	High Temperature Specialty Grease With Oil and Thickener	Sunoco; Sunaplex 992-EP

*Lubricate each grease fitting every 500 hours of operation of every (6) six months, whichever occurs first. If service is severe, grease more often.

**NATIONAL LUBRICATING GREASE INSTITUTE

Reservoir on Ammonia Pumps	The series 924 ammonia pumps are shipped without oil in the reservoir. Before start-up fill the reservoir with one pint of Light Refrigeration Oil that is compatible with the Neoprene seal and with a maximum viscosity of 15,000 SSU at operating temperature. Drain and refill the reservoir after the first 200 hours of operation and every 1000 hours thereafter (Refer to Technical Service Manual TSM-420)
Pumping Chamber of Take-Apart Pumps and Stainless Pumps	All internal parts are coated with edible grease, Keystone Nevastane HT-1, after testing to avoid galling when the pump is first installed. Be sure the pump is kept full of liquid when in operation to prevent damage to the pump.

2. LUBRICATION OF VIKING REDUCERS

Viking Gear Reducers, "A", "B". and "C" sizes use SAE 30W oil above 32° F. a. 3-8 PT. (6 oz.) b. 1-2 PT. (8 oz.) c. 2 and 1/4 PT. (36 oz.)	Viking gear reducers are shipped less oil. Before startup, fill to proper levels with quantity and type of oil shown at left. After first 100 hours of operation. drain and refill with new lubricant. Check lubricant level every 2000 hours or every (6) six months and once each year. drain and refill.

3. LUBRICANT OF VIKING ASSOCIATIVE EQUIPMENT

Check any motor. coupling. gear reducer or other driven equipment for manufacturer's instructions and lubricate as recommended.

STERLCO®

TECHNICAL SERVICE MANUAL

HEAVY-DUTY BRACKET MOUNTED PUMPS
SERIES 125 and 4125
SIZES G-LL

VIKING PUMP

CONTENTS

INTRODUCTION

The illustrations used in this manual are for identification purposes only and cannot be used for ordering parts. Obtain a parts list from the factory or a Viking® representative. Always give complete name of part, part number and material with model number and serial number of pump when ordering repair parts. The *unmounted pump or pump unit* model number and serial number are on the nameplate.

In the Viking model number system, basic size letters are *combined with series number (125 and 4125)* indicating both unmounted or mounted pump unit.

Model Number Chart

UNMOUNTED PUMP		UNITS
PACKED	MECH. SEAL	Units are designated by the unmounted pump model numbers followed by a letter indicating drive style. V=V-Belt D=Direct Connected R=Viking Speed Reducer P=Commercial Speed Reducer
G125	G4125	
H125	H4125	
HL125	HL4125	
AK125	AK4125	
AL125	AL4125	
K125	K4125	
KK125	KK4125	
L125	L4125	
LQ125	LQ4125	
LL125	LL4125	

This manual deals only with Series 125 and 4125 Heavy-Duty Bracket Mounted Pumps. Refer to Figures 1 thru 19 for general configuration and nomenclature used in this manual. Pump specifications and recommendations are listed in Catalog Section 141, Series 125 and 4125 Heavy-Duty Bracket Mounted Pumps.

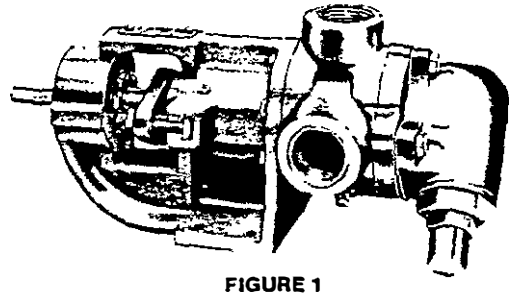


FIGURE 1
Sizes G, H, and HL

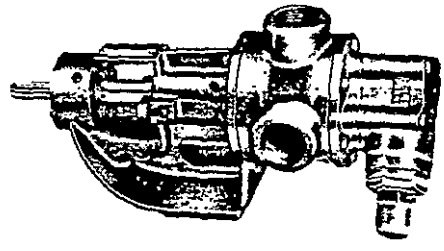


FIGURE 2
Sizes AK and AL

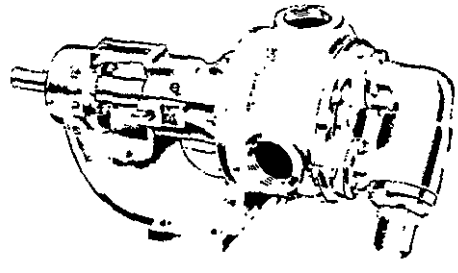


FIGURE 3
Sizes K, KK and L

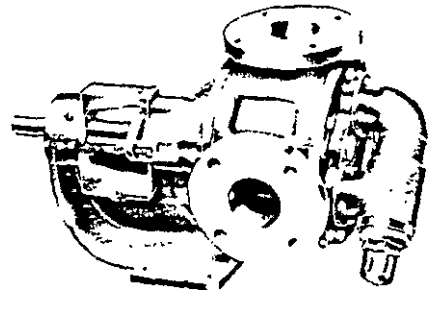


FIGURE 4
Sizes LQ and LL

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SPECIAL INFORMATION

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, JACKET, ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

ROTATION: Viking pumps operate equally well in a clockwise or counterclockwise rotation. Shaft rotation determines which port is suction and which is discharge. Port in area where pumping elements (gear teeth) come out of mesh is suction port.

PRESSURE RELIEF VALVES:

1. Pressure relief valves are standard on pumps with valve-type heads; they are not available with jacketed type heads. Jacketed relief valves are available for special applications.
2. Pumps not furnished with a relief valve must be provided with some means of pressure protection (in-line pressure relief valve, torque limiting device, etc.).
3. If pump rotation is to be reversed during normal operation, using same pump to load and unload, then pressure protection must be provided on *both* sides of pump.
4. Relief valve adjusting screw cap must *always* point towards suction side of pump. If pump rotation is reversed, remove pressure relief valve and turn end for end. Refer to Figures 1, 2, 3 and 4.
5. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure.

For additional information on pressure relief valves, refer to Technical Service Manual TSM000 and Engineering Service Bulletin ESB-31.

SPECIAL MECHANICAL SEALS can be installed either next to rotor hub or in an altered stuffing box.

Extra care must be taken in repair of pumps with mechanical seals. Read and follow all special information supplied with pump.

MAINTENANCE

Series 125 and 4125 pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of maintenance. The points listed below will help provide long service life.

LUBRICATION: External lubrication must be applied slowly with a hand gun to all lubrication fittings every 500 hours of operation with multi-purpose grease, NLGI #2. Do not over-grease. Applications involving very high or low temperatures will require other types of lubrication. Refer to Engineering Service Bulletin ESB-515. Consult factory with specific lubrication questions.

PACKING ADJUSTEMENT: New packed pumps require initial packing adjustment to control leakage as packing "runs in". Make initial adjustments carefully and do not over-tighten packing gland. After initial adjustment, inspection will reveal need for packing gland adjustment or packing replacement. Refer to instructions under Disassembly, page 4, and Assembly, page 4, regarding repacking pump.

CLEANING PUMP: Keep pump as clean as possible. This will facilitate inspection, adjustment and repair work and help prevent overlooking a dirt covered grease fitting.

STORAGE: If pump is to be stored, or not used for six months or more, pump must be drained and a light coat of non-detergent SAE 30 weight oil must be applied to all internal pump parts. Lubricate fittings and apply grease to pump shaft extension. Viking suggests rotating pump shaft by hand one complete revolution every 30 days to circulate the oil.

SUGGESTED REPAIR TOOLS: The following tools must be available to properly repair Series 125 and 4125 pumps. These tools are in addition to standard mechanics' tools such as open end wrenches, pliers, screw drivers, etc. Most of the items can be obtained from an industrial supply house.

1. Lead hammer
2. Allen wrenches (some mechanical seals and set collars)
3. Packing hooks, flexible (packed pumps)
   Small for 1/4 inch and 5/16 inch cross section packing
   Large for 3/8 inch and up cross section packing
4. Mechanical seal installation sleeve
   2-751-001-900 for 3/4 inch seal; G4125
   2-751-002-900 for 1 1/8 inch seal; H & HL4125
   2-751-003-900 for 1 7/16 inch seal; AK - LL4125
5. Bearing locknut spanner wrench
   (Source: #471 J. H. Williams & Co. or equal)
6. Spanner wrench, adjustable pin type for use on double end caps
   (Source: #482 J. H Williams & Co. or equal)
7. Brass bar
8. Arbor press

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PACKED PUMPS

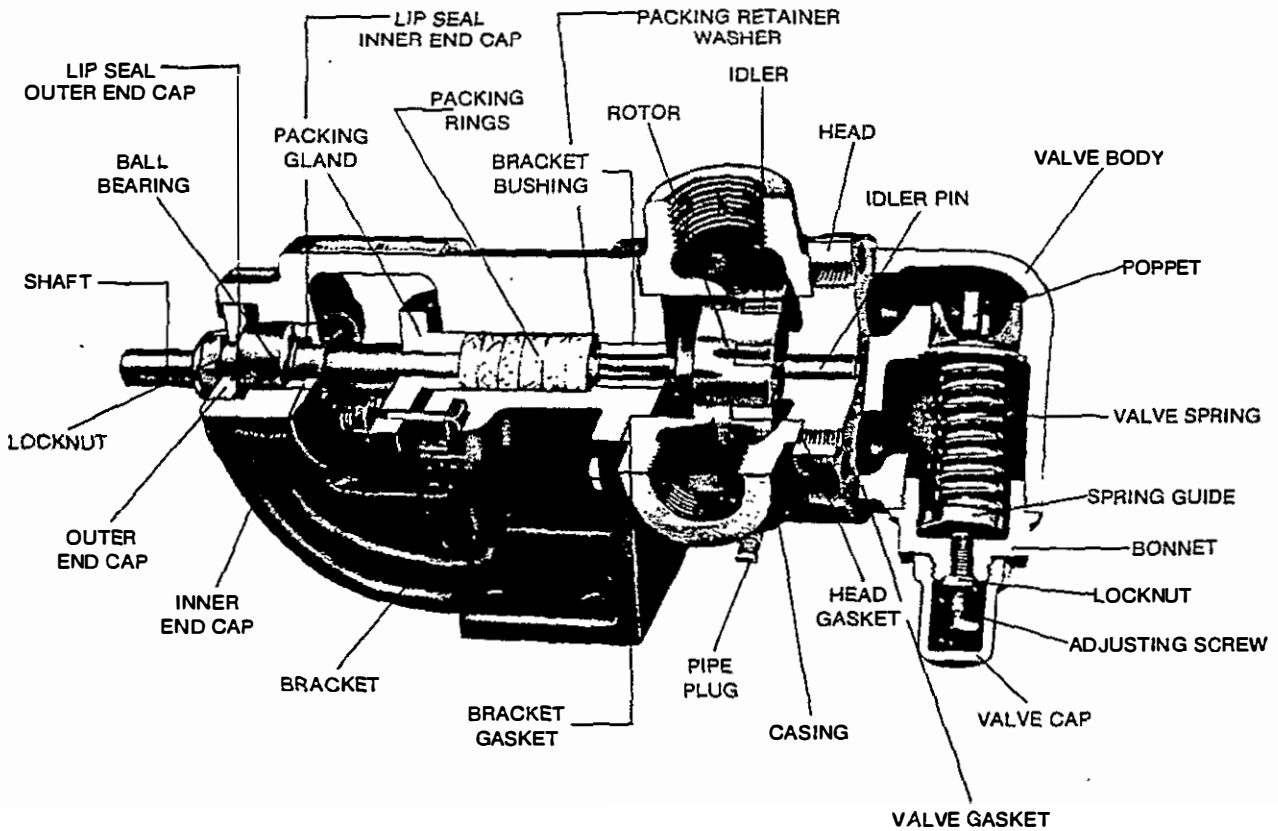
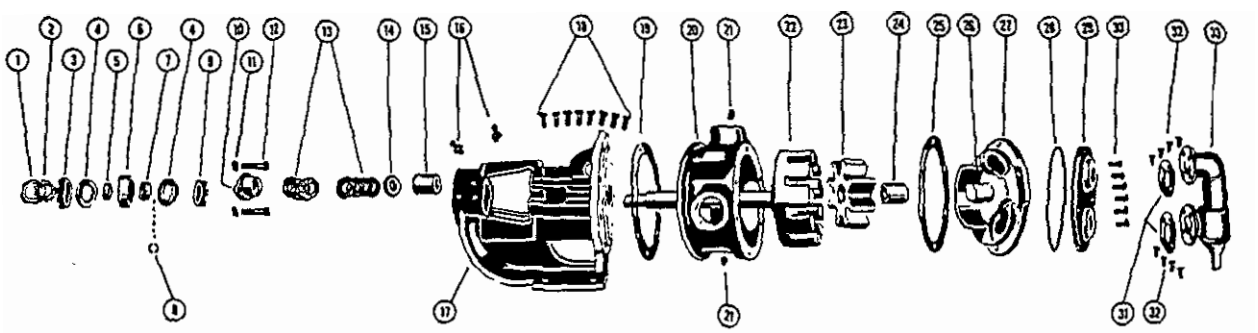


FIGURE 5
Cutaway View of G125 with Callouts

Exploded View for Models G125, H125, HL125, AK125, AL125, K125, KK125, L125, LQ125 and LL125 (Model KK125 shown)



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	10	Packing Gland	19	Bracket Gasket	28	Gasket for Jacketed Head Plate
2	Lockwasher (Not G)	11	Packing Gland Nut	20	Casing	29	Jacketed Head Plate
3	End Cap (outer)	12	Packing Gland Capscrew	21	Pipe Plug	30	Capscrew for Head
4	Lip Seal for End Cap	13	Packing	22	Rotor and Shaft	31	Relief Valve Gasket
5	Bearing Spacer Collar (outer)	14	Packing Retainer Washer	23	Idler and Bushing	32	Capscrew for Valve
6	Ball Bearing	15	Bracket Bushing	24	Idler Bushing	33	Internal Relief Valve
7	Bearing Spacer Collar (inner)	16	Grease Fitting	25	Head Gasket		
8	Ring, Half Round (Not G,H,HL)	17	Bracket and Bushing	26	Idler Pin		
9	End Cap (inner)	18	Capscrew for Bracket	27	Head and Idler Pin		

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DISASSEMBLY

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, JACKET, ETC.) BE SURE:

1. **THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.**
2. **THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.**

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

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. If pump is furnished with pressure relief valve, it need not be removed from head or disassembled at this point. Refer to Pressure Relief Valve Instructions, page 14.

   If pump has jacketed headplate, it will separate from head when it is removed. The gasket between head and jacket head plate must be totally removed. Use new gasket when assembling pump.

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. There is no lockwasher on G size pump.
4. Remove packing gland nuts.
5. Tap shaft forward approximately ½ inch and remove pair of half round rings under inner bearing spacer collar. There is no pair of half round rings on G, H and HL size pumps.
6. Carefully remove rotor and shaft to avoid damaging bracket bushing.
7. Remove packing gland from side of bracket.
8. Loosen setscrews. Two on G, H and HL size pumps, four on all other sizes. With a spanner wrench, remove both end caps with lip seals. Remove ball bearing and spacer collars. Refer to Figure 6.

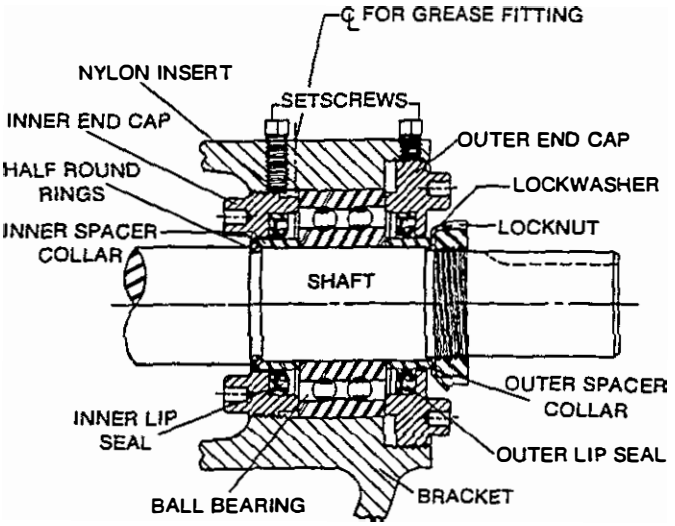

FIGURE 6

9. Remove packing and packing retainer washer.
10. 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.

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

ASSEMBLY

1. Install bracket bushing. 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 13.
2. Coat shaft of rotor shaft assembly with non-detergent SAE 30 weight oil. Start end of shaft in bracket bushing turning from right to left, slowly pushing rotor in casing.

3. Place packing retainer washer in bottom of packing chamber and pack pump with new packing. Use packing suitable for liquid being pumped. Install packing, staggering the joints from one side of shaft to other. Lubricate packing rings with oil, grease or graphite to aid assembly. A length of pipe will help to seat each packing ring.

4. Install packing gland, capscrews and nuts. Back rotor and shaft out of casing just far enough to insert packing gland through side opening of bracket over end of shaft. Make sure gland is installed square and nuts are tightened evenly. Tighten nuts wrench tight then back off until gland is slightly loose.

5. 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 13.

6. 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.

   If pump is equipped with jacketed head plate, install at this time along with new gasket.

   Tighten head capscrews evenly.

7. Slide inner spacer collar over shaft with recessed end facing rotor. G, H and HL size bearing spacer collars are not recessed.

   Place pair of half round rings on shaft and slide inner bearing spacer collar over half round rings to lock them in place. There is no pair of half round rings on G, H and HL size pumps. Refer to Figure 6, page 4.

8. Press lip seal, lip facing end of shaft, in inner end cap and insert end cap through shaft end of bracket. Turn end cap clockwise, looking at shaft end, until it engages threads. End cap spanner wrench holes must be facing rotor. Turn end cap with spanner wrench until it projects slightly from opening on side of bracket. End cap must not be turned so far that lip seal drops off end of spacer collar on shaft or end cap becomes disengaged from threads. Refer to Figure 6, page 4.

   If this happens, remove inner spacer collar, half round rings and end cap and start over at Step 7.

9. Pack ball bearing with multi-purpose grease, NLGI #2. Place on shaft and push or gently drive in place in bracket.

10. Press lip seal, lip facing end of shaft, in outer end cap and insert end cap in bracket. Turn end cap in bracket until it is tight against bearing. Refer to Figure 6, page 4.

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 and bend one tang of lockwasher into slot of locknut. There is no lockwasher on G size pumps.

12. Adjust pump end clearance. Refer to Thrust Bearing Adjustment, page 13.

13. Lubricate all grease fittings with multi-purpose grease, NLGI #2.

DANGER

BEFORE STARTING PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

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MECHANICAL SEAL PUMPS

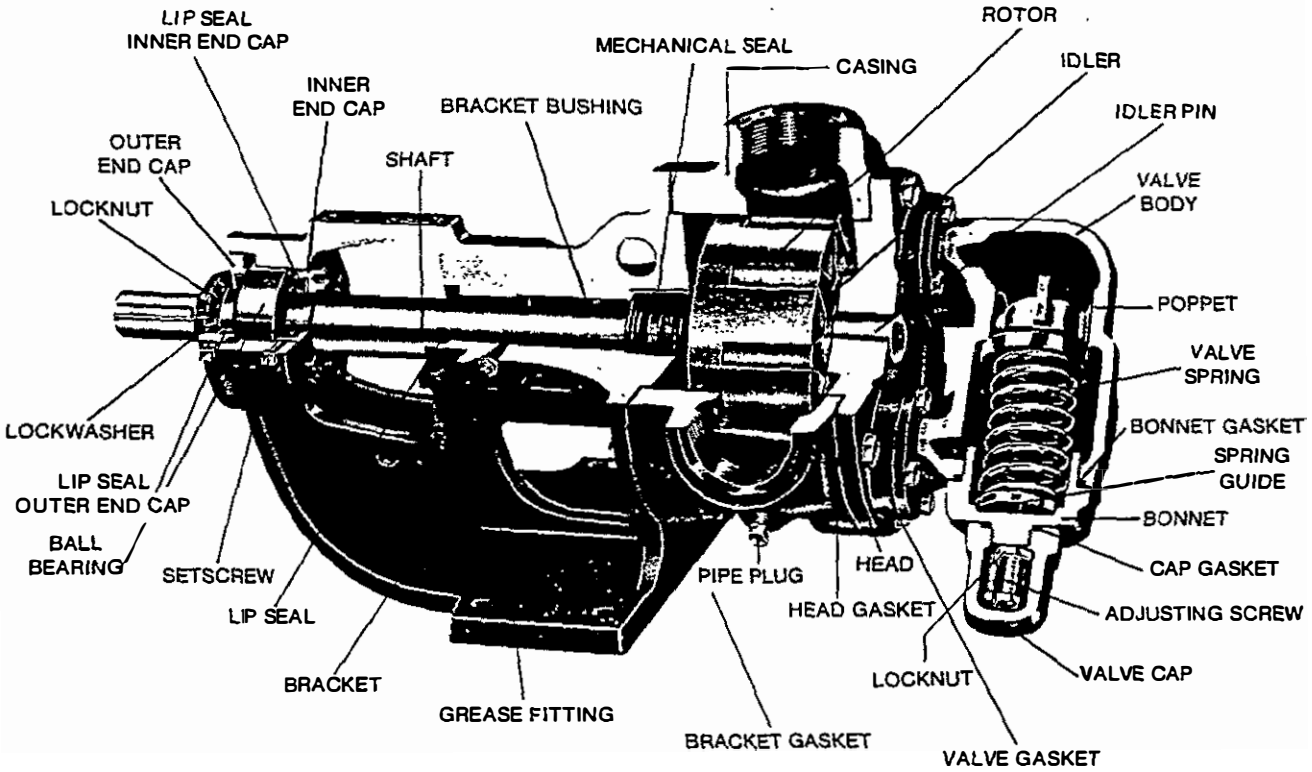
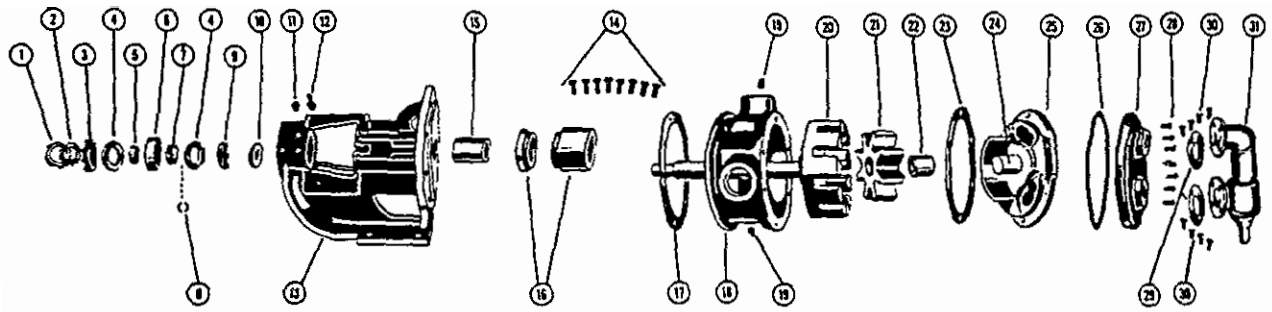


FIGURE 7
Cutaway View of KK 4125 with Callouts

Exploded View for Models G4125, H4125, HL4125, K4125, KK4125, L4125, LQ4125 and LL4125 (Model KK4125 shown)



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	9	End Cap (inner)	17	Bracket Gasket	25	Head and Idler Pin
2	Lockwasher (Not G)	10	Lip Seal for Seal Chamber	18	Casing	26	Gasket for Jacketed Head Plate
3	End Cap (outer)	11	Pressure Relief Plug	19	Pipe Plug	27	Jacketed Head Plate
4	Lip Seal for End Cap	12	Grease Fitting	20	Rotor and Shaft	28	Capscrew for Head
5	Bearing Spacer Collar (outer)	13	Bracket and Bushing	21	Idler and Bushing	29	Relief Valve Gasket
6	Ball Bearing	14	Capscrew for Bracket	22	Idler Bushing	30	Capscrew for Valve
7	Bearing Spacer Collar (inner)	15	Bracket Bushing	23	Head Gasket	31	Internal Relief Valve
8	Ring, Half Round (Not G,H,HL)	16	Mechanical Seal	24	Idler Pin		

For Disassembly and Assembly of AK 4125 and AL 4125
see page 11.

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DISASSEMBLY

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, JACKET, ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

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. If pump is furnished with pressure relief valve, it need not be removed from head or disassembled at this point. Refer to Pressure Relief Valve Instructions, page

   If pump has jacketed head plate, it will separate from head when it is removed. The gasket between head and jacket head plate must be totally removed. Use new gasket when assembling pump.
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. There is no lockwasher on G size pump.
4. Tap shaft forward approximately ½ inch and remove pair of half round rings under inner spacer collar. There is no pair of half round rings on G, H and HL size pumps.
5. Carefully remove rotor and shaft to avoid damaging bracket bushing.
6. Remove rotary member of seal from shaft and stationary seal seat from bracket.
7. Loosen setscrews. Two for G, H and HL size pumps, four for all other sizes. With spanner wrench remove both end caps and lip seals. Remove ball bearing and spacer collars. Refer to Figure 6, page 4.
8. Examine seal chamber lip seal and remove if it shows wear or damage. Lip seal must be removed if bracket bushing needs to be replaced.
9. Clean all parts thoroughly and examine for wear or damage. Check lip seals, ball bearing, bushing 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.

   Be sure shaft is free from nicks, burrs and foreign particles that might damage bracket bushing. Scratches on shaft in seal area will provide leakage paths under mechanical seal.
10. Casing can be checked for wear or damage while mounted on bracket.

ASSEMBLY

Standard Mechanical Seal
(Synthetic Rubber Bellows Type)

The seal used in this pump is simple to install and good performance will result if care is taken during installation.

The principle of the mechanical seal is contact between the rotary and stationary members. These parts are lapped to a high finish and their sealing effectiveness depends on complete contact.

Viking furnishes a number of heavy-duty pumps with special mechanical seals installed in the packing end of the pump. These special seals are not discussed in TSM141.1. Information is available by contacting the factory. When requesting special seal information, be sure to give pump model number and serial number.

1. Install bracket bushing. 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 13.
2. Install lip seal in bracket. Refer to Figure 8.

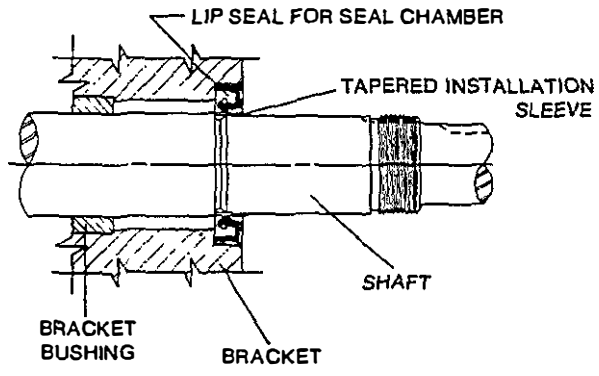


FIGURE 8

Prior to installing rotating portion of mechanical seal, prepare and organize rotor shaft, head and idler assemblies and appropriate gaskets for quick assembly.

Once rotating portion of mechanical seal is installed on rotor shaft, it is necessary to assemble parts as quickly as possible to insure that seal does not stick to shaft in wrong axial position. The seal should be expected to stick to the shaft after several minutes setting time.

Never touch sealing faces with anything except clean hands or clean cloth. Minute particles can scratch the seal faces and cause leakage.

3. Coat idler pin with non-detergent SAE 30 weight oil and place idler and bushing on idler pin in head. If replacing a carbon graphite bushing, refer to Installation of Carbon Graphite Bushings, page 13.
4. Clean rotor hub and bracket seal housing bore. Make sure both are free from dirt and grit. Coat outer diameter of seal seat and inner diameter of seal housing bore with non-detergent SAE 30 weight oil.
5. Start seal seat in seal housing bore, refer to Figure 9. If force is necessary, protect seal face with a clean cardboard disc and gently tap it in place with a piece of wood.

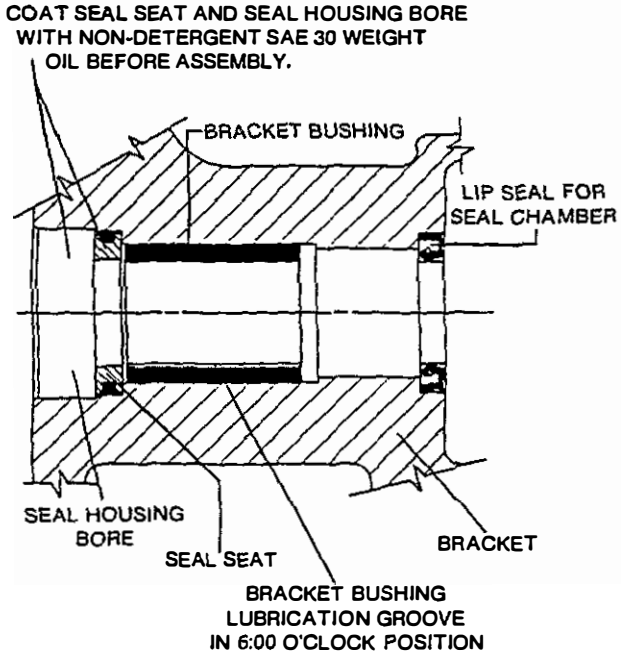


FIGURE 9

6. Place tapered installation sleeve on shaft, refer to Figure 10. Sleeve is furnished with H, HL, K, KK, L, LQ and LL size replacement mechanical seals. Coat rotor shaft, tapered installation sleeve and inner diameter of mechanical seal rotary member with a generous amount of non-detergent SAE 30 weight oil. Petrolatum may be used but grease is not recommended.

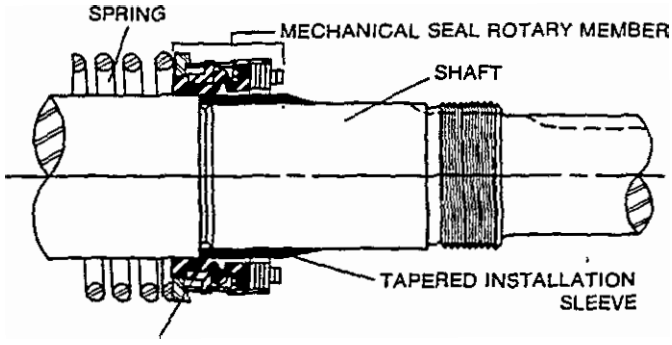


FIGURE 10

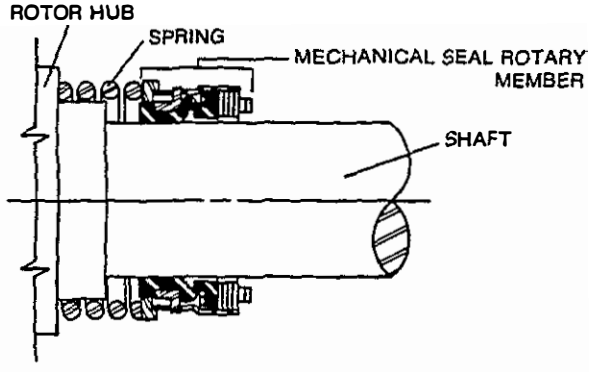


FIGURE 11

7. Place seal spring on shaft against rotor hub. Refer to Figure 11.
8. Slide rotary member, lapped contact surface facing away from spring, over installation sleeve on shaft until it is against spring.

   Do not compress spring.
9. Coat rotor shaft with non-detergent SAE 30 weight oil. Start end of shaft in bracket bushing and turn from right to left, slowly pushing until the ends of the rotor teeth are just below the face of the casing.

   Leave the rotor in this position. Withdrawal of rotor and shaft may displace the carbon seal rotating face and result in damage to the seal.
10. 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.

If pump is equipped with jacketed head plate, install at this time along with new gasket.

Tighten head capscrews evenly.

Remove tapered installation sleeve from the shaft.

11. Slide inner spacer collar over shaft with recessed end facing rotor. G, H and HL size bearing spacer collars are not recessed.

    Place pair of half round rings on shaft and slide inner bearing spacer collar over half round rings to lock them in place. There is no pair of half round rings on G, H and HL size pumps. Refer to Figure 6, page 4.

12. Press lip seal, lip facing end of shaft, in inner end cap and insert end cap through shaft end of bracket. Turn end cap clockwise, looking at shaft end, until it engages threads. End cap spanner wrench holes must be facing rotor. Turn end cap with spanner wrench until it projects slightly from opening on side of bracket. End cap must not be turned so far that lip seal drops off end of spacer collar on shaft or end cap becomes disengaged from threads. Refer to Figure 6, page 4.

    If this happens, remove inner spacer collar, half round rings and end cap and start over at Step 11.

13. Pack ball bearing with multi-purpose grease, NLGI #2. Place on shaft and push or gently drive in place in bracket.

14. Press lip seal, lip facing end of shaft, in outer end cap and insert end cap in bracket. Turn end cap in bracket until it is tight against bearing. Refer to Figure 6, page 4.

15. 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 and bend one tang of lockwasher into slot of locknut. There is no lockwasher on G size pump.

16. Adjust pump end clearance. Refer to Thrust Bearing Adjustment, page 13.

17. Lubricate the grease fitting over the seal chamber with petroleum jelly, petrolatum (Vasoline) or other similar low melting point lubricant. Lubricate all other grease fittings with multi-purpose grease, NLGI #2.

DANGER

BEFORE STARTING PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

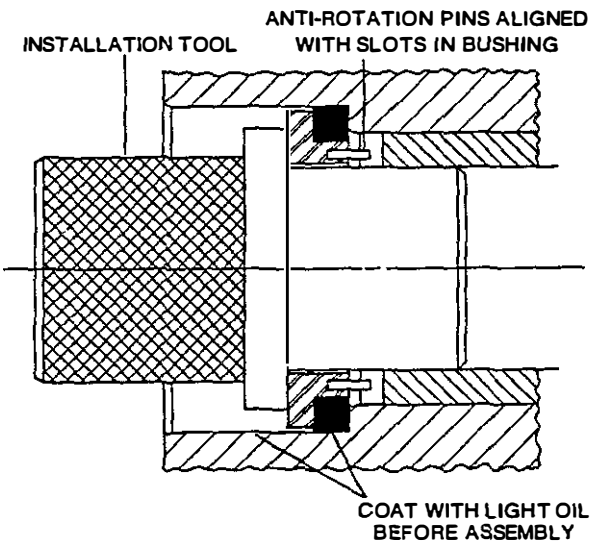
FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

ASSEMBLY

Optional Mechanical Seal (Teflon Fitted Type)

The seal type shown in Figures 12, 13 and 14 can be installed as an alternate to the standard mechanical seal (synthetic rubber bellows type). These seals are setscrew driven and the stationary seats have anti-rotation pins which mate with slots in the end of the bracket bushing.

1. Install bracket bushing. 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 13.
2. Install lip seal in bracket.
3. Clean rotor hub and bracket seal housing bore. Refer to Figure 12. Make sure both are free from dirt and grit. Coat outer diameter of seal seat gasket and inner diameter of seal housing bore with non-detergent SAE 30 weight oil.



BRACKET SEAL HOUSING BORE WITH SEAL SEAT INSTALLED. NOTE SPECIAL INSTALLATION TOOL USED FOR FACTORY ASSEMBLY.

FIGURE 12

4. Start seal seat in seal housing bore. Make sure seat anti-rotation pins are aligned to engage slots in end of bracket bushing. Refer to Figure 12.
5. Using a cardboard disc to protect lapped face of seal seat, press seal seat assembly to bottom of seal housing bore using a piece of wood. An arbor press can also be used to install the seal seat. Seal seat must be started square and carefully pressed to bottom of seal housing bore.

   K size pumps require a 1/4 inch spacer between seal and rotor hub to properly position seal on shaft.

6. Place tapered installation sleeve (furnished with H, HL, K, KK, L, LQ and LL size replacement mechanical seals) on shaft. Refer to Figure 13. Coat inner diameter of seal rotary member, tapered installation sleeve and the shaft with a generous quantity of non-detergent SAE 30 weight oil. Place rotary member on shaft over sleeve and against hub of rotor. Refer to Figure 14.

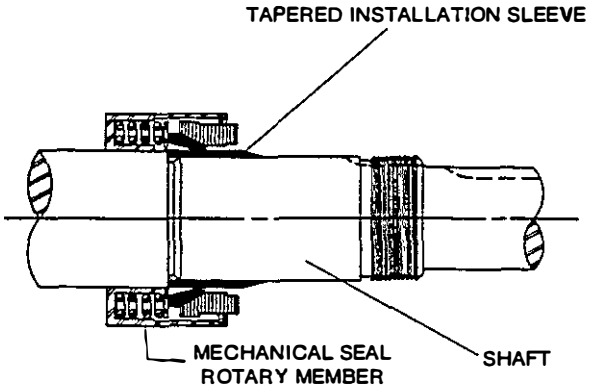


FIGURE 13

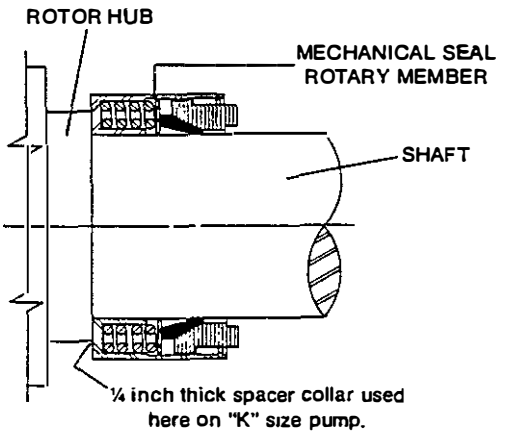


FIGURE 14

Some Teflon seals are equipped with holding clips which compress the seal springs. Remove holding clips to release springs after seal is installed on shaft. Tighten all drive setscrews securely to shaft.

AT THIS POINT, FINISH ASSEMBLY PROCEDURES STARTING AT STEP 9, PAGE 8 (STANDARD MECHANICAL SEAL).

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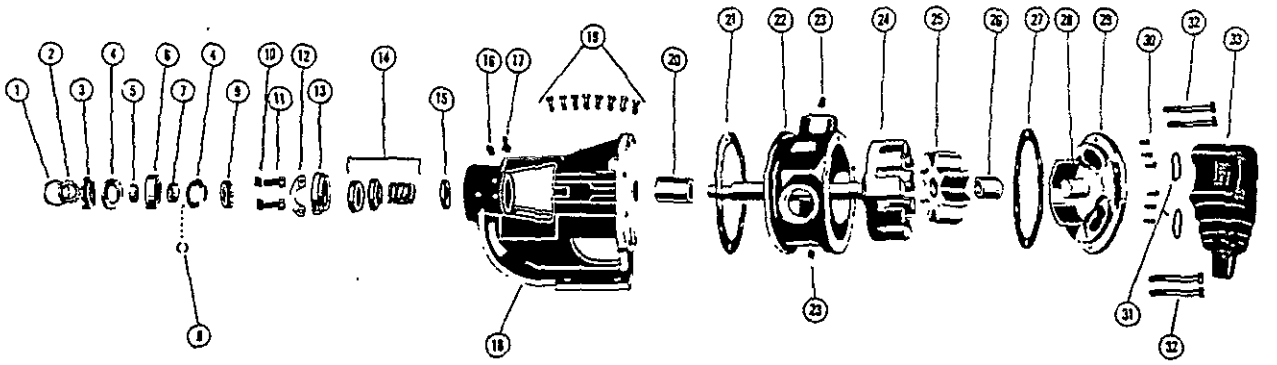
Exploded View for Models AK4125 and AL4125 (Model AK4125 shown)



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	10	Seal Holder Nut	19	Capscrew for Bracket	28	Idler Pin
2	Lockwasher	11	Seal Holder Capscrew	20	Bracket Bushing	29	Head and Idler Pin
3	End Cap (outer)	12	Seal Plate	21	Bracket Gasket	30	Capscrew for Head
4	Lip Seal for End Cap	13	Seal Holder	22	Casing	31	Relief Valve Gasket
5	Bearing Spacer Collar (outer)	14	Mechanical Seal	23	Pipe Plug	32	Capscrew for Relief Valve
6	Ball Bearing	15	Set Collar with Setscrews	24	Rotor and Shaft	33	Internal Relief Valve
7	Bearing Spacer Collar (inner)	16	Pipe Plug	25	Idler and Bushing		
8	Ring, Half Round	17	Grease Fitting	26	Idler Bushing		
9	End Cap (inner)	18	Bracket and Bushing	27	Head Basket		

DISASSEMBLY

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, JACKET, ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

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. If pump is furnished with pressure relief valve, it need not be removed from head or disassembled at this point. Refer to Pressure Relief Valve Instructions, page 14.

   If pump has jacketed head plate, it will separate from head when it is removed. The gasket between head and jacket head plate must be totally removed. Use new gasket when assembling pump.

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. Rotate shaft so that the two setscrews for set collar can be seen through the seal access hole on left side of pump (viewed from shaft end). These two setscrews must be loosened before shaft can be removed from pump. *Refer to Figure 15.*
5. Remove seal holder nuts., seal holder plate and capscrews.
6. Seal holder cannot be removed until shaft is removed.
7. Tap shaft forward approximately ½ inch and remove pair of half round rings under inner spacer collar.
8. Carefully remove rotor and shaft to avoid damaging bracket bushing.
9. Remove seal holder, seal seat and rotary member of seal from side opening in bracket.
10. Loosen the four setscrews over outer and inner end caps. With spanner wrench remove both end caps and lip seals. Remove ball bearing and spacer collars. Refer to Figure 6, page 4.

11. Clean all parts thoroughly and examine for wear or 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 roughness. Roughness may be determined by turning outer race by hand.

    Be sure shaft is free from nicks, burrs and foreign particles that might damage bracket bushing. Scratches on shaft in seal area will provide leakage paths under mechancial seal.

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

ASSEMBLY

Standard Mechanical Seal
(Synthetic Rubber Bellows Type)
Models AK4125 and AL4125

The seal used in this pump is simple to install and good performance will result if care is taken during installation.

The principle of the mechanical seal is contact between the rotary and stationary members. There parts are lapped to a high finish and their sealing effectiveness depends on complete contact.

1. Install bracket bushing. 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 13.
2. Coat shaft of rotor shaft assembly with non-detergent SAE 30 weight 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 carbon graphite bushing, refer to Installation of Carbon Graphite Bushings, page 13.
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.

    If pump is equipped with jacketed head plate, install at this time with new gasket.

    Tighten head capscrews evenly.

5. Examine set collar to be sure there are no burrs or scratches and that setscrews are withdrawn so shaft will not be scratched when set collar is installed.
6. Place seal set collar on shaft, push into seal chamber so centerline of setscrew coincides with centerline of access hole on left side of bracket (viewed from shaft end.) Refer to Figure 15. Tighten setscrews to secure set collar to shaft.
7. Slide spring over shaft into seal chamber on set collar pilot. Place tapered installation sleeve on shaft. Refer to Figure 10.

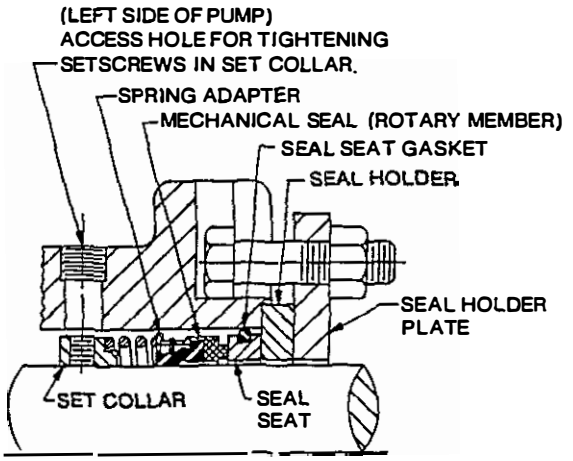


FIGURE 15

8. Apply generous amount of non-detergent SAE 30 weight oil to large diameter of shaft, tapered installation sleeve and inner diameter of mechanical seal rubber parts.
9. Slide rotary member, lapped contact surface facing away from spring, over installation sleeve on shaft until it is against spring.

    Do not compress spring.

10. Lubricate outer diameter of mechanical seal o-ring seat gasket and flush lapped seal faces with non-detergent SAE 30 weight oil.
11. Press stationary seal seat in bore until back, unlapped face, is just inside bore. Position stationary seal seat by installing seal holder and secure seal holder to machined face of bracket with seal holder plate.
12. Tighten nuts securing seal holder plate evenly so seal holder will not be distorted.
13. Remove tapered installation sleeve.
14. Slide inner bearing spacer collar over shaft with recessed end facing rotor.

    Place pair of half round rings on shaft and slide inner bearing spacer collar over half round rings to lock them in place. Refer to Figure 6, page 4.

15. Press lip seal, lip facing end of shaft, in inner end cap and insert end cap through shaft end of bracket. Turn end cap clockwise, looking at shaft end, until it engages threads. End cap spanner wrench holes must be facing rotor. Turn end cap with spanner wrench until it projects slightly from opening on side of bracket.

End cap must not be turned so far that lip seal drops off end of spacer collar on shaft or end cap becomes disengaged from threads. Refer to Figure 6, page 4.

If this happens, remove inner spacer collar, half round rings and end cap and start over at Step 15.

16. Pack ball bearing with multi-purpose grease, NLGI #2. Place on shaft and push or gently drive in place in bracket.
17. Press lip seal, lip facing end of shaft, in outer end cap and insert end cap in bracket. Turn end cap in bracket until it is tight against bearing. Refer to Figure 6, page 4.
18. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Put lockwasher and locknut on shaft, tighten and bend one tang of lockwasher into slot of locknut.
19. Adjust pump end clearance. Refer to Thrust Bearing Adjustment, below.
20. Lubricate all grease fittings with multi-purpose grease, NLGI #2.

DANGER

BEFORE STARTING PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

THRUST BEARING ADJUSTMENT

1. Loosen setscrews over outer and inner end caps. Two for G, H and HL size pumps, four for all other sizes.
2. Turn inner end cap clockwise, viewed from shaft end, until it projects slightly from bracket exposing approximately three threads.
3. Turn outer end cap clockwise until rotor is tight against head and rotor shaft cannot be turned.
4. Make a reference mark on bracket end, opposite a notch on outer end cap. There are no notches on G size pump. Back off outer end cap required number of notches. Refer to Figure 16.

   Each ¼ inch travel on circumference of end cap is equivalent to approximately .002 inch end clearance for G size pump and .0015 inch for all other sizes.
5. End clearances set per Step 4 are adequate for viscosities up to 750 SSU (SAE20 lube oil at room temperature). Higher viscosity liquids require additional end clearances.

   As a general guideline, for viscosities between 750 and 7500 SSU (heavier lube oils) double the amount of end clearance indicated in Step 4; for viscosities between 7500 and 75,000 SSU (e.g., resins) triple the amount and for viscosities greater than 75,000 SSU (e.g., black strap molasses) use 4 times the amount.

   For specific recommendations for end clearances for viscosity or for operating temperatures above 225°F, check with your Viking representative or consult the factory.
6. Tighten inner end cap with a spanner wrench. Tap spanner wrench lightly but DO NOT OVER TIGHTEN as it will only damage the threads.
7. Tighten all setscrews that hold inner and outer end caps to prevent their turning in bracket.
8. Rotor and shaft should turn smoothly by hand one complete revolution. If rotor and shaft doesn't turn smoothly, go back and repeat Thrust Bearing Adjustment Steps 1 thru 8.

Pump Size	Turn Outer End Cap C.C.W.	
	No. of Notches *	or Length on O.D., Inches
G	-	3/8"
H - HL	3	1/2"
AK - LL	5	21/32"

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

FIGURE 16

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 intallation.

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.

Consult factory with specific questions on high temperature applications. Refer to Engineering Service Bulletin ESB-3.

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PRESSURE RELIEF VALVE INSTRUCTIONS

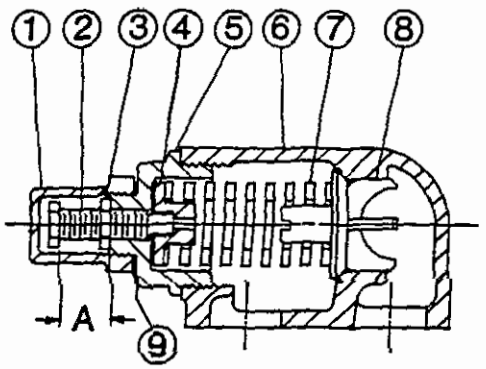

FIGURE 17
Size G, H and HL

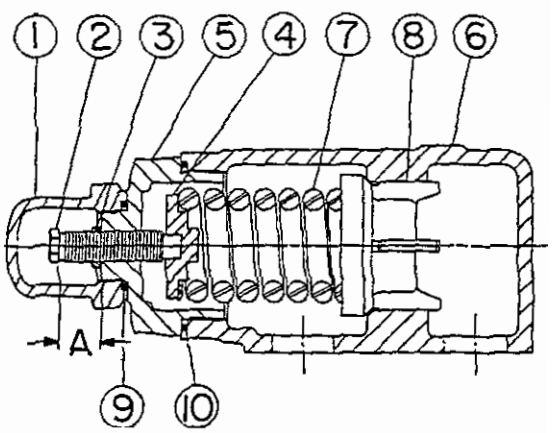

FIGURE 18
Size AK and AL

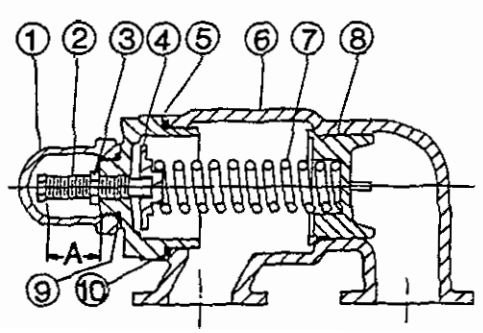

FIGURE 19
Size K, KK, L, LQ and LL

LIST OF PARTS	
1. Valve Cap	6 Valve Body
2. Adjusting Screw	7 Valve Spring
3. Lock Nut	8 Poppet
4. Spring Guide	9 Cap Gasket
5. Bonnet	10 Bonnet Gasket

DISASSEMBLY

DANGER

BEFORE OPENING ANY VIKING PUMP LIQUID CHAMBER (PUMPING CHAMBER, RESERVOIR, JACKET, ETC.) BE SURE:

1. THAT ANY PRESSURE IN CHAMBER HAS BEEN COMPLETELY VENTED THROUGH SUCTION OR DISCHARGE LINES OR OTHER APPROPRIATE OPENINGS OR CONNECTIONS.
2. THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.

FAILURE TO FOLLOW ABOVE LISTED PRECAUTIONARY MEASURES MAY RESULT IN SERIOUS INJURY OR DEATH.

Mark valve and head before disassembly to insure proper reassembly.

1. Remove valve cap.
2. Measure and record length of extension of adjusting screw. Refer to "A" on Figures 17, 18 and 19.
3. Loosen locknut and back out adjusting screw until spring pressure is released.
4. Remove bonnet, spring guide, spring and poppet from valve body. Clean and inspect all parts for wear or damage and replace as necessary.

ASSEMBLY

Reverse procedures outlined under Disassembly. If valve is removed for repairs, be sure to replace in same position. Relief valve adjusting screw cap must *always* point towards suction side of pump. If pump rotation is reversed, remove relief valve and turn end for end. Refer to Figures 1, 2, 3 and 4, page 1.

DANGER

BEFORE STARTING PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

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PRESSURE ADJUSTMENT

If a new spring is installed or if pressure setting of pressure relief valve is to be changed from that which the factory has set, the following instructions must be carefully followed.

1. Carefully remove valve cap which covers adjusting screw.

   Loosen locknut which locks adjusting screw so pressure setting will not change during operation of pump.

2. Install a pressure gauge in discharge line for actual adjustment operation.
3. Turn adjusting screw in to increase pressure and out to decrease pressure.
4. With discharge line closed at a point beyond pressure gauge, gauge will show maximum pressure valve will allow while pump is in operation.

IMPORTANT

In ordering parts for pressure relief valve, always give model number and serial number of pump as it appears on nameplate and name of part wanted. When ordering springs, be sure to give pressure setting desired.

VIKING PUMP IDEX

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, F.O.B. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.

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TECHNICAL SERVICE MANUAL

SECTION TSM141.1
PAGE 16
ISSUE B

HEAVY-DUTY BRACKET MOUNTED PUMPS
SERIES 125 and 4125
SIZES G-LL

VIKING PUMP

VIKING PUMP, INC • A Unit of IDEX Corporation • Cedar Falls Iowa 50613 U S A
Printed in U S A

STERLCO

TECHNICAL SERVICE MANUAL

VIKING PUMP

INSTALLATION, START UP, TROUBLESHOOTING, PREVENTATIVE MAINTENANCE, DO'S & DON'TS

Suggested Reference: Hydraulic Institute Handbook, 14th Edition.

INSTALLATION

General

Before installation is started a few items of a general nature should be considered.

1. *Location* — always locate the pump as close as possible to the supply of liquid to be pumped. Locate it below the liquid supply if at all practical. Viking pumps are self priming but the better the suction conditions the better the performance.
2. *Accessibility* — the pump should be located where it is accessible for inspection, maintenance, and repair. For large pumps, allow room to remove the rotor and shaft without removing the pump from the base.
3. *Port Arrangement* — since the pumps have different port arrangements depending on the model, port location should be checked before starting the installation. The ports may be upright, opposite or at right angles to each other, see Figure 1. The right angle ports are normally right-hand, see Figure 2; some models are available with left-hand arrangements; still other models are available with the right angle ports located in any one of eight positions including right-hand and left-hand.

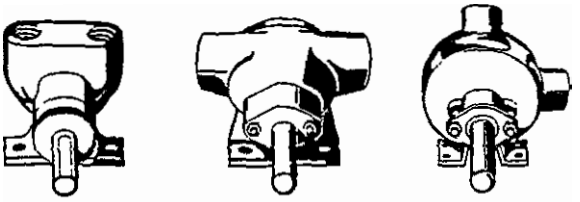


FIGURE 1

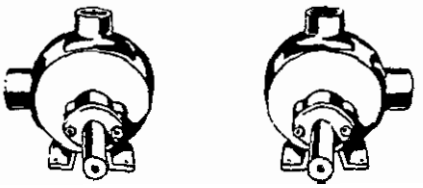


FIGURE 2

4. *Suction/Discharge* — shaft rotation will determine which port is suction and which discharge. A look at Figure 3 will show how rotation determines which port is which; as the pumping elements (gears) come out of mesh, point "A" on Figure 3, liquid is drawn into the suction port; as the gears come into mesh, point "B", the liquid is forced out the discharge port. Reversing the rotation reverses the flow through the pump. When determining shaft rotation, always look from the shaft end of the pump. Unless otherwise specified, rotation is assumed to be clockwise (CW), which makes the suction port on the right side of the pump. The idler pin, which is offset in the pump head, should be properly positioned toward and an equal distance between the port connections.

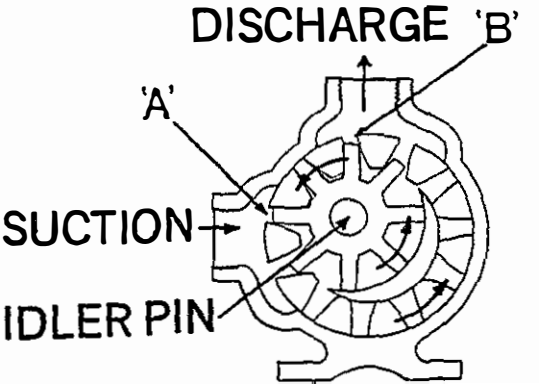
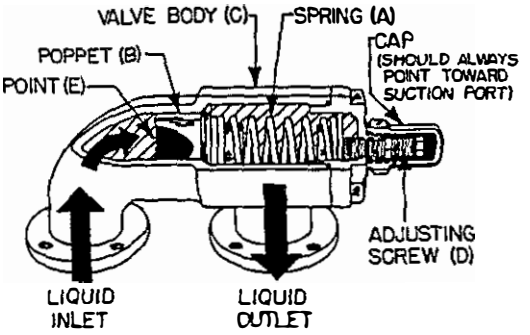


FIGURE 3

5. *Pressure Relief Valve* — the Viking pump is a positive displacement pump. This means that when the pump is rotated, liquid will be delivered to the discharge side of the pump. If there is no place for this liquid to go — discharge line is blocked or closed — the pressure will build up until the motor stalls, the drive equipment fails, a pump part breaks or ruptures, or the piping bursts. To prevent the possibility of any one or more of these things happening in case of unintentional closing of the discharge line, the use of a pressure relief valve is recommended. A pressure relief valve will relieve the pressure at a predetermined value, thus protecting the entire system.



CUT-AWAY OF VIKING INTERNAL PRESSURE RELIEF VALVE
FIGURE 4

The pressure relief valve mounted on Viking pumps and most in-line valves are of the spring loaded poppet design. See Figure 4. The spring (A) holds poppet (B) against the seat in the valve body (C) with a given force determined by the spring size and by how tightly it is compressed by the

adjusting screw (D). The pump discharge pressure pushes against the under side of the poppet at point (E). When the force exerted by the liquid under the poppet exceeds that exerted by the spring, the poppet lifts and liquid starts to flow through the valve. As the discharge pressure builds up, more and more of the liquid flows through until a pressure is reached at which all of the liquid being pumped is going through the valve. This pressure is the relief valve setting.

CAUTION:

THE INTERNAL TYPE PRESSURE RELIEF VALVE MOUNTED ON THE VIKING PUMP SHOULD ALWAYS HAVE THE CAP OR BONNET POINTED TOWARD THE SUCTION SIDE OF THE PUMP. THE RETURN-TO-TANK TYPE PRESSURE RELIEF VALVE SHOULD ALWAYS BE MOUNTED ON THE DISCHARGE SIDE OF THE PUMP. IF PUMP ROTATION IS PERMANENTLY REVERSED CHANGE THE RELIEF VALVE. TURN THE INTERNAL TYPE END FOR END; MOVE THE RETURN-TO-TANK TYPE TO THE OTHER PORT. IF, ON A PARTICULAR INSTALLATION IT IS THE INTENT TO REVERSE THE PUMP ROTATION FREQUENTLY, *e.g., USING ONE PUMP TO FILL A TANK AND THEN BY USE OF A REVERSING SWITCH OR OTHER MEANS CHANGING ROTATION TO PERMIT THE SAME PUMP TO CIRCULATE THE LIQUID THROUGH A HEATER OR TO LOAD OUT)* THEN OVER PRESSURE PROTECTION MUST BE PROVIDED FOR *BOTH* SIDES OF THE PUMP OR FOR BOTH ROTATIONS. USE AN INTERNAL PRESSURE RELIEF VALVE TO PROTECT ONE SIDE AND AN IN-LINE PRESSURE RELIEF VALVE TO PROTECT THE OTHER; USE AN IN-LINE PRESSURE RELIEF VALVE ON EACH SIDE OF THE PUMP OR USE SOME MEANS OF LIMITING TORQUE THAT IS FUNCTIONAL IN BOTH DIRECTIONS OF ROTATION.

PUMPS OR SYSTEMS WITHOUT PRESSURE RELIEF VALVES SHOULD HAVE SOME FORM OF OVER PRESSURE PROTECTION, e.g., TORQUE LIMITING DEVICES, RUPTURE DISCS, ETC.

Viking pumps can be furnished with either an internal pressure relief valve — one which directs the flow from the valve back to the suction side of the pump — or a return-to-tank valve which directs the flow through piping back to the supply tank. See Figure 5. An inline pressure relief valve mounted in the discharge piping also directs the flow back to the supply tank. This type of valve should be mounted close to the pump so that the pressure drop through the piping between the pump and the valve is at a minimum. Be sure there are no shutoff valves between the pump and relief valve. Piping from a return-to-tank or an in-line valve to the supply tank should also be as short and large as possible.

The spring loaded poppet-type valve is strictly a differential valve, sensing only those pressures on each side of the poppet. It should not be used as a *pressure or flow control* device. **It is intended strictly as a pressure relief valve.**

The pressure at which either the return-to-tank or internal pressure *relief valve* bypasses can be changed by turning the adjusting screw. Do not back the adjusting screw all the way out.

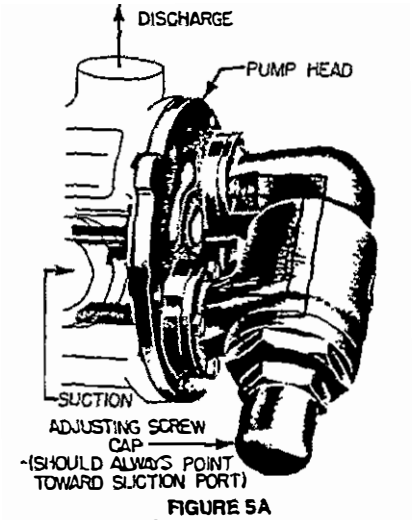


FIGURE 5A
INTERNAL PRESSURE RELIEF VALVE

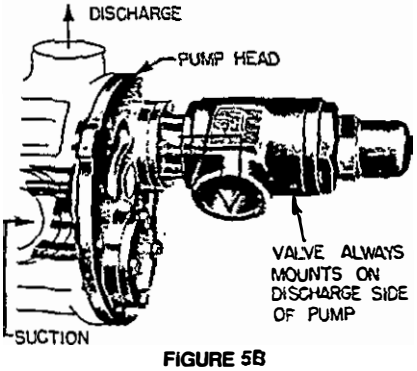


FIGURE 5B
RETURN-TO-TANK PRESSURE RELIEF VALVE

NOTE: on some models the pressure relief valve is mounted on the pump casing instead of the pump head.

Stop when spring tension is off the screw (the screw starts to turn easily).

For details on maintenance of the relief valve see Technical Service Manual covering your model series.

6. *Motor* — follow local electrical codes when hooking up motors.

Foundation

Every pump should have a good foundation. It may be any structure sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered.

A certified print of the pumping unit should be used in preparing the foundation. As for one. If a separate foundation is provided, make it at least four inches wider and longer than the base of the unit.

When the unit is placed on the foundation it should be leveled and checked for position against the piping layout and then fastened down.

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Alignment

CHECK ALIGNMENT AFTER MOUNTING

For detailed coupling alignment procedures see Viking service bulletin ESB-61.

The pump, drive, and motor were properly aligned at the time they were assembled. During shipping and mounting the alignment is often disturbed. **CHECK IT!**

1. Check pump ports to be sure they are square and in proper position; shim or move pump as required.
2. If the pump is driven by a flexible coupling(s) either direct connected to the motor or through a reducer, remove any coupling guards or covers and check alignment of the coupling halves. A straightedge (a piece of key stock works nicely) across the coupling must rest evenly on both rims at the top, bottom, and sides. See Figure 6.
3. If the pump is driven by V-belts, check the alignment by using a long straightedge or tightly drawn string across the face of the sheaves. See Figure 6A.
4. Make a final check on alignment after piping is hooked up.

   See item 13 under "Installation — Piping".
   Figures 7, 8, and 9 show typical units— direct, gear reducer and V-belt drive.
5. For high temperature applications (those above 300°F) allow pump to reach operating temperature, then recheck alignment.

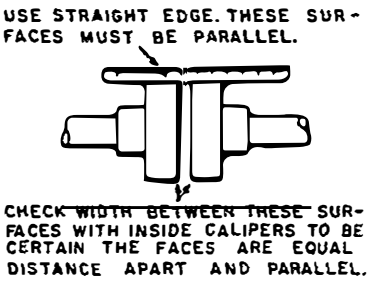
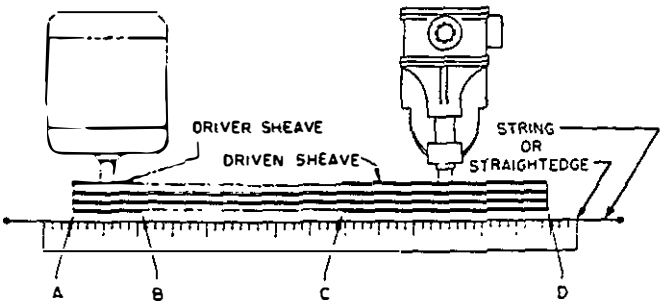


FIGURE 6



WHEN SHEAVES PROPERLY ALIGNED ALL POINTS A B C D WILL TOUCH STRING OR STRAIGHTEDGE

FIGURE 6A

Piping

The cause of many pumping problems can be traced to suction piping. It should always be as large and short as practical. For help in selecting the proper size piping, both suction and discharge, refer to Viking General Catalog Section 510.

Before starting layout and installation of your piping system, consider the following points:

1. Never use piping smaller than the pump port connections.
2. Be sure the inside of the pipe is clean before hooking it up.
3. *Foot valve* — When pumping a light liquid with a suction lift, a foot valve at the end of the suction piping or a check valve in the first horizontal run will hold the liquid in the line and make it easier for the pump to prime. Be sure the foot or check valve is big enough so that it doesn't cause excessive line loss.

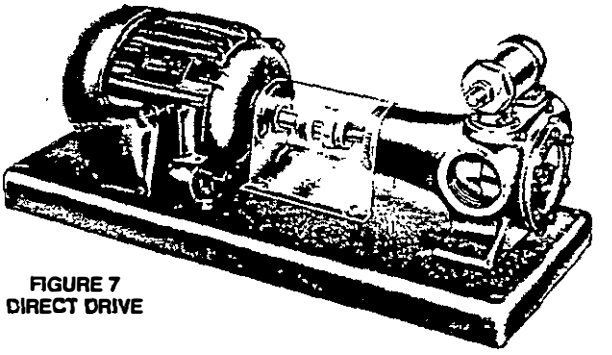


FIGURE 7
DIRECT DRIVE

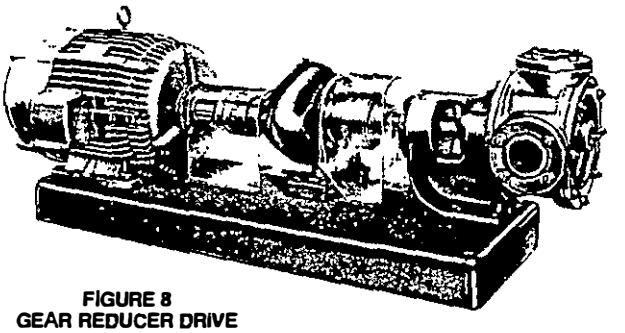


FIGURE 8
GEAR REDUCER DRIVE

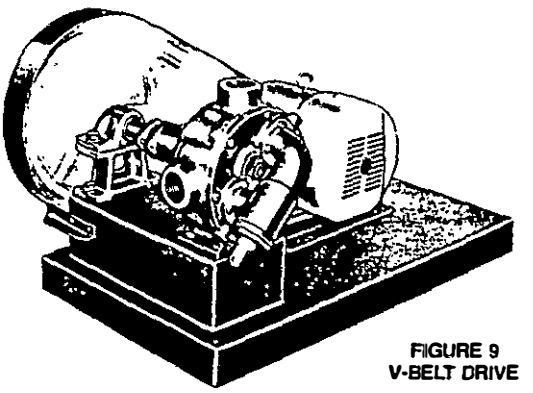


FIGURE 9
V-BELT DRIVE

4. When approaching an obstacle in the suction or discharge line, go around the obstacle instead of over it. Going over it creates an air pocket. See Figure 10.

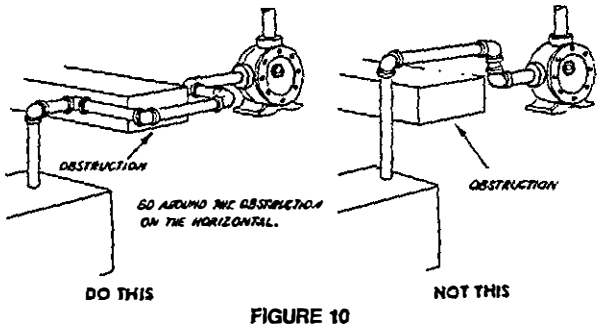


FIGURE 10

5. Where practical, slope the piping so no air or liquid pockets will be formed. Air pockets in the suction line make it hard for the pump to prime.

6. For a suction line with a long horizontal run keep the horizontal portion below the liquid level if possible. This keeps the pipe full so the pump does not have to remove so much air when starting; this is most helpful when there is no foot valve. See Figure 11.

7. When piping a hot or cold system (liquid being handled is at a temperature different from the air surrounding the pump), be sure allowance is made for expansion and contraction of the piping. Loops, expansion joints, or unsecured (this does not mean unsupported) runs should be used so the pump casing is not distorted or put into a bind.

8. **STRAINER** — It is always good practice to consider a strainer on the suction side of a positive displacement pump. The strainer will keep foreign objects from going into the pump; without a strainer some would go through; others would cause a jammed pump, a broken part, or a torn up drive. The strainer basket mesh or perforation size should be big enough so that it does not cause excessive pressure drop, but it should be find enough to protect the pump. When in doubt as to the proper size, check with the manufacturer, giving him pipe size, flow rate, and viscosity involved. Provision should be made for cleaning the strainer. If the pump operates continuously, a bypass should be built around the strainer or two strainers should be put in parallel with proper valving so they can be isolated for cleaning. Use of a strainer is particularly important at start up to help clean the system of weld beads, pipe scale, and other foreign objects. For additional information, refer to TSM640.

9. If the pump is not equipped with a pressure relief valve, consideration should be given to mounting one in the discharge line. See discussion on pressure relief valves under START UP.

10. The pump should not be used to support the piping. The weight of the pipe should be carried by hangers, supports, stands, etc.

11. When fastening the piping to the pump it should not be necessary to impose any strain on the pump casing. "Springing" or "drawing" the piping up to the pump will cause distortion, possible misalignment, and probable rapid wear of the pump. Do not use the pump to correct errors in piping layout or assembly.

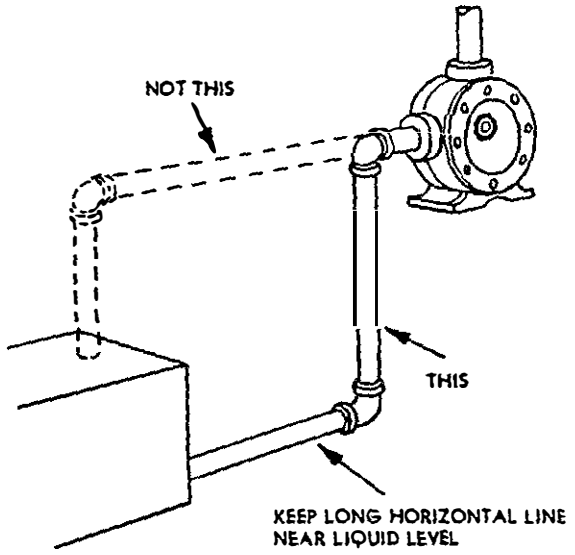


FIGURE 11

12. All joints of the piping system should be tight; pipe sealer or teflon tape will help assure leak-free threaded joints. Leaks in the suction line permitting air to be drawn in may cause a noisy pump, or a reduction in capacity.

13. **ALIGNMENT** — Check the alignment of the drive after the piping is hooked up. As a final check on pump alignment remove the head of the pump and with a feeler gauge determine if there is clearance all the way around between the rotor and casing. Because of manufacturing tolerances, bushing clearances, etc., the rotor may not be centered in the casing, but it should not drag; dragging would indicate unit misalignment or casing distortion from piping strain. Making this check is most desirable on installations involving Q, M and N size standard duty pumps.

14. The auxiliary piping hooked to jackets, glands, etc. for heating, cooling, quenching, or for other purposes should receive the same attention as the piping handling the liquid pumped.

15. Provide a pressure relief device in any part of a pump and piping system that can be valved off and, thus, completely isolated. This is particularly important:
    1. When handling a cold liquid such as refrigeration ammonia that can warm up to ambient temperatures when the pump is shut off or
    2. When handling a liquid such as asphalt or molasses that has to be heated before it can be pumped. The rise in temperature causes the liquid to expand; if there is no provision for pressure relief in the closed off section, there is a chance that the pump or piping will rupture.

START UP

Before pushing the "start" button, check the following:

1. Are there vacuum and pressure gauges on or near the pump? These gauges are the quickest and most accurate way of finding out what is happening in the pump.

2. Check alignment — See suggestions under "Installation — Alignment" in this manual.
3. Check piping to be sure there is no strain on the pump casing.
4. Rotate the pump shaft by hand to be sure it turns freely.
5. Jog motor to be sure it is turning in the right direction; see discussion on pump rotation under "Installation — General" item 4 in this manual.
6. Check any pressure relief valve to be sure it is installed correctly. See discussion on pressure relief valve under "Installation — General".
7. Check suction piping to be sure (a) it is all connected and tight, (b) valves are open, and (c) end of pipe is below liquid level.
8. Check discharge piping to be sure (a) it is connected and tight, (b) valves are open, and (c) there is a place for the liquid to go.
9. Lubricate any grease fitting on the pump using a good, general purpose #2 ball bearing grease. Check any gear reducer, motor, coupling, etc. for instructions and lubricate as recommended. See Engineering Service Bulletin ESB-515.
10. For packed pumps, loosen packing gland nuts so gland can be moved slightly by hand. Adjust gland to reduce leakage only after pump has run long enough to reach constant temperature. Packing should weep a little to keep it cool and lubricated.
11. Do **not** use the Viking pump to flush, pressure test or prove the system with water. Either remove the pump or run piping around it while flushing or testing. Pumping water, dirty or otherwise, can do more damage in a few minutes than months of normal service.
12. Check to be sure all guards are in place.
13. Now you are ready to push the "start" button — gently.

If the pump begins to deliver liquid within 60 seconds, you're in business. If it does not, push the "stop" button. Do **not** run the pump longer than one minute without liquid in it; you will ruin it. Review the steps just outlined, consider what the suction and discharge gauges indicate, see page 6; if everything appears to be in order, put some liquid in the pump, a lubricating liquid is best. This will help it prime.

Push the "start" button again. If nothing is flowing within two minutes, stop the pump. The pump is not a compressor, it will not build up much air pressure; it may be necessary to vent the discharge line until liquid begins to flow.

If the pump still does not deliver, the cause may be one or more of the following:

1. Suction line air leaks; vacuum gauge reading should help determine if this is the problem.
2. End of suction pipe not submerged deep enough in liquid.
3. Suction lift is too great or the suction piping is too small.
4. Liquid is vaporizing in the suction line before it gets to the pump.

If after consideration of these points it still does not pump, suggest you review again all points given under START UP; read through Troubleshooting in this manual and try again. If it still does not pump, contact your Viking representative.

TROUBLESHOOTING

A Viking pump which is properly installed and maintained will give long and satisfactory performance.
NOTE: Before making any pump adjustment or opening the pump liquid chamber in any manner, make sure that:

1) any pressure in the pumping chamber has been vented through the suction or discharge lines or other openings provided for this purpose, 2) the driver has been "locked out" so that it cannot inadvertently be started while work is being done on the pump and 3) the pump has been allowed to cool down to the point where there is no chance of anyone being burned.

If trouble does develop, one of the first steps toward finding the difficulty is to install a vacuum gauge in the suction port and a pressure gauge in the discharge port. Readings on these gauges often will give a clue as to where to start looking for the trouble.

Vacuum Gauge — Suction Port

1. High reading would indicate —
   a. Suction line blocked — foot valve stuck, gate valve closed, strainer plugged.
   b. Liquid too viscous to flow through the piping.
   c. Lift too high.
   d. Line too small.
2. Low reading would indicate —
   a. Air leak in suction line.
   b. End of pipe not in liquid.
   c. Pump is worn.
   d. Pump is dry — should be primed.
3. Fluttering, jumping, or erratic reading —
   a. Liquid vaporizing.
   b. Liquid coming to pump in slugs, possibly an air leak or insufficient liquid above the end of the suction pipe.
   c. Vibrating from cavitation, misalignment, or damaged parts.

Pressure Gauge — Discharge Port

1. High reading would indicate —
   a. High viscosity and small and/or long discharge line.
   b. Gate valve partially closed.
   c. Filter plugged.
   d. Vertical head did not consider a high specific gravity liquid.
   e. Line partially plugged from build up on inside of pipe.
   f. Liquid in pipe not up to temperature.
   g. Liquid in pipe has undergone a chemical reaction and has solidified.
   h. Relief valve set too high.
2. Low reading would indicate —
   a. Relief valve set too low

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b. Relief valve poppet not seating properly.
c. Bypass around the pump partially open.
d. Too much extra clearance.
e. Pump worn.

3. Fluttering, jumping, or erratic reading —
a. Cavitation.
b. Liquid coming to pump in slugs.
c. Air leak in suction line.
d. Vibrating from misalignment or mechanical problems.

Some of the following may also help pinpoint the problem:

A. Pump does not pump.
1. Lost its prime — air leak, low level in tank, foot valve stuck.
2. Suction lift too high.
3. Rotating in wrong direction.
4. Motor does not come up to speed.
5. Suction and discharge valves not open.
6. Strainer clogged.
7. Bypass valve open, relief valve set too low, relief valve poppet stuck open.
8. Pump worn out.
9. Any changes in the liquid system, or operation that would help explain the trouble. e.g. new source of supply, added more lines, inexperienced operators, etc.
10. Tighten end clearance.
11. Head position incorrect. See Fig. 3.

B. Pump starts, then loses its prime.
1. Supply tank empty.
2. Liquid vaporizing in the suction line.
3. Air leaks or air pockets in the suction line; leaking air through packing or mechanical seal.
4. Worn out.

C. Pump is noisy.
1. Pump is being starved (heavy liquid cannot get to pump fast enough). Increase suction pipe size or reduce length.
2. Pump is cavitating (liquid vaporizing in the suction line). Increase suction pipe size or reduce length; if pump is above the liquid, raise the liquid level closer to the pump; if the liquid is above the pump, increase the head of liquid.
3. Check alignment.
4. May have a bent shaft or rotor tooth. Straighten or replace.
5. Relief valve chatter; increase pressure setting.
6. May have to anchor base or piping to eliminate or reduce vibration.
7. May be a foreign object trying to get into the pump through the suction port.

D. Pump not up to capacity.
1. Starving or cavitating — increase suction pipe size or reduce length.
2. Strainer partially clogged.
3. Air leak in suction piping or along pump shaft.
4. Running too slowly; is motor the correct speed and is it wired up correctly.
5. Bypass line around pump partially open.
6. Relief valve set too low or stuck open.
7. Pump worn out.
8. Tighten end clearance.
9. Head position incorrect. See Fig. 3.

E. Pump takes too much power.
1. Running too fast — is correct motor speed, reducer ratio, sheave size, etc. being used.
2. Is liquid more viscous than unit sized to handle; heat the liquid, increase the pipe size, slow the pump down, or get a bigger motor.
3. Discharge pressure higher than calculated, check with pressure gauge. Increase size or reduce length of pipe, reduce speed (capacity), or get bigger motor.
4. Packing gland drawn down too tight.
5. Pump misaligned.
6. Extra clearance on pumping elements may not be sufficient for operating conditions. Check parts for evidence of drag or contact in pump and increase clearance where necessary.

F. Rapid Wear.
On most applications the pump will operate for many months or years before it gradually loses its ability to deliver capacity or pressure. Examination of such a pump would show a smooth wear pattern on all parts. Rapid wear, occurring in a few minutes, hours or days, shows up as heavy grooving, galling, twisting, breaking or similar severe signs of trouble.
SEE CHART PAGE 7.

PREVENTATIVE MAINTENANCE

Performing a few preventative maintenance procedures will extend the life of your pump and reduce the cost per gallon pumped.

A. Lubrication — Grease all zerks after every 500 hours of operation or after 60 days, whichever occurs first. If service is severe, grease more often. Do it gently with a hand gun. Use a #2 ball bearing grease for normal applications. For hot or cold applications use appropriate grease. See Engineering Service Bulletin ESB-515.

B. Packing Adjustment—Occasional packing adjustment may be required to keep leakage to a slight weep; if impossible to reduce leakage by gentle tightening, replace packing or use different type. See Technical Service Manual on particular model series for details on repacking.

C. End Clearance Adjustment— After long service the running clearance between the end of the rotor teeth and the head may have increased through wear to the point where the pump is losing capacity or pressure. Resetting end clearance will normally improve pump performance. See TSM on particular model series for procedure on adjusting end clearance for pump involved.

D. Examine Internal Parts — Periodically remove the head, examine idler and bushing and head and pin for wear. Replacing a relatively inexpensive idler bushing and idler pin after only moderate wear will eliminate the need to replace more expensive parts at a later date. See TSM on particular model series for procedure in removing head of the pump. Be sure idler does not slide off idler pin as head is removed and drop and hurt someone or damage the part.

E. Cleaning the Pump — A clean pump is easier to inspect, lubricate, adjust, and runs cooler; plus, it looks better.

F. Storage — If a pump is to be out of service or stored for a long time, drain it and protect it from rusting inside and out.

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RAPID WEAR

CAUSE	EVIDENCE	POSSIBLE SOLUTION
1. *Abrasives*	*Gouges or* marks made by large, hard particles; a rapid weanng away of bushings from very small abrasives similar to pumice; or *anything in* belween.	Flush the system with the pump removed. Install strainer in suction line. Oftentimes after a system has run for a few cycles or a few days the dirt is pretty well cleaned out and if the pump is rebuilt into good condition it will then last for a long time.
2. Corrosion	Rust, general overall aggressive attack or sloughing off a metal.	Check the Viking General Catalog Liquid List for materials of construction recommendation. Consider whether all of the materials used in pump construction were attacked; consider other materials used in the system to determine how they resisted the liquid. Check to see whether or not the liquid has been contaminated to make it more corrosive than anticipated.
3. Exceeding operating limits	Noisy operation, broken bushings, twisted shaft, parts show evidence of high heat.	Review General Catalog for operating limits on particular *model involved.*
4. Insufficient extra clearance	Pump may stall. Evidence of heavy contact between *end of rotor teeth and head or other* parts.	Increase end clearance and/or contact your distributor or the factory with details of the application so that information regarding proper extra clearance may be provided.
5. Lack of lubrication	Noisy bearings, localized heating at bearings or lip seal, smoke, rapid bushing wear.	Be sure all zerks are greased before starting and instructions for lubrication of drive equipment are followed; consider use of auxiliary lubricating equipment.
6. Misalignment	Wear on only one part of a surface, e.g., one side of the casing, one side of the packing gland, only a portion of the face of the head.	Double check alignment of drive equipment and piping. Check the alignment under conditions as close to operating conditions as possible.
7. Run dry	Pump stalls because parts have uneven expansion caused by frictional heat; galling between surfaces having relative motion; seal seats and idler pins changing color because of high heat.	*Be sure there is liquid in* the system at the time of start up. Provide some kind of automatic alarm or shut-off if supply tank runs dry.

DO'S AND DON'TS

Do's and Don'ts for installation, operation, and maintenance of Viking pumps to assure safe, long, trouble-free operation.

Installation —

1. Do install pump as close to supply tank as possible.
2. Do leave working space around the pumping unit.
3. Do use large, short, and straight suction piping.
4. Do install a strainer in the suction line.
5. Do double check alignment after the unit is mounted and piping is hooked up.
6. Do provide a pressure relief valve for the discharge side of the pump.
7. Do cut out the center of gaskets used as port covers on flanged port pumps.
8. Do record pump model number and serial number and file for future reference.

Operation—

1. Don't run pump at speeds faster than shown in the catalog for your model.
2. Don't require pump to develop pressures higher than those shown in the catalog for your model.
3. Don't operate pumps at temperatures above or below limits shown in the catalog for your pump.
4. Don't operate pumps without all guards being in place.
5. Don't operate pump without a pressure relief valve on the pump or in the discharge piping; be sure valve is mounted and set correctly.
6. Don't exceed catalog limits for temperature and pressures of fluids in jacketed areas of pump.

7. Don't use the pump in a system which includes a steam blow or an air or vapor blow or purge **without** provision for overspeed shutdown in case the pump starts to act as a turbine and overspeeds the drive.

8. Don't operate the pump with all of the liquid bypassing through a pump mounted internal type pressure relief valve or without any flow of liquid going through the pump for more than a couple of minutes. Operation under either of these conditions may result in a heat buildup in the pump which could cause hazardous conditions or happenings.

9. Do have spare parts, pumps or standby units available, particularly if the pump is an essential part of a key operation or process.

Maintenance —

1. Do make sure any pump that has residual system pressure in it or that has handled high vapor pressure liquids, e.g., LP-gas, ammonia, Freons, etc. has been vented through the suction or discharge lines or other openings provided for this purpose.

2. Do make sure that if the pump is still hooked to the driver while maintenance is being performed that the driver has been "locked out" so that it cannot be inadvertently started while work is being done on the pump.

3. Do make sure any pump that has handled a corrosive, flammable, hot, or toxic liquid has been drained, flushed, vented and/or cooled before it is disassembled.

4. Don't drop parts during disassembly, e.g., idler can slip from the pin as the head is removed from the pump; it may drop on your foot, plus, it may get nicked or gouged.

5. Don't stick fingers in the ports of a pump! The close running parts may trim more than your fingernails if the pump is rotated.

6. Don't spin the idler on the idler pin! Fingers may be jammed between teeth and crescent.

7. Do remember that a few simple preventative maintenance procedures such as periodic lubrication, adjustment of end clearance, examination of internal parts, etc., will extend the service life of your pump.

8. Do obtain, read and keep maintenance instructions furnished with your pump.

VIKING PUMP IDEX

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. If, during said warranty period, any products sold by Viking prove to be defective in workmanship or material under normal use and service, and if such products are returned to Viking's factory at Cedar Falls, Iowa, transportation charges prepaid, and if the products are found by Viking to be defective in workmanship or material, they will be replaced or repaired free of charge, F.O.B. Cedar Falls, Iowa.

Viking assumes no liability for consequential damages of any kind and the purchaser by acceptance of delivery assumes all liability for the consequences of the use or misuse of Viking products by the purchaser, his employees or others. Viking will assume no field expense for service or parts unless authorized by it in advance.

Equipment and accessories purchased by Viking from outside sources which are incorporated into any Viking product are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any.

THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter this warranty.

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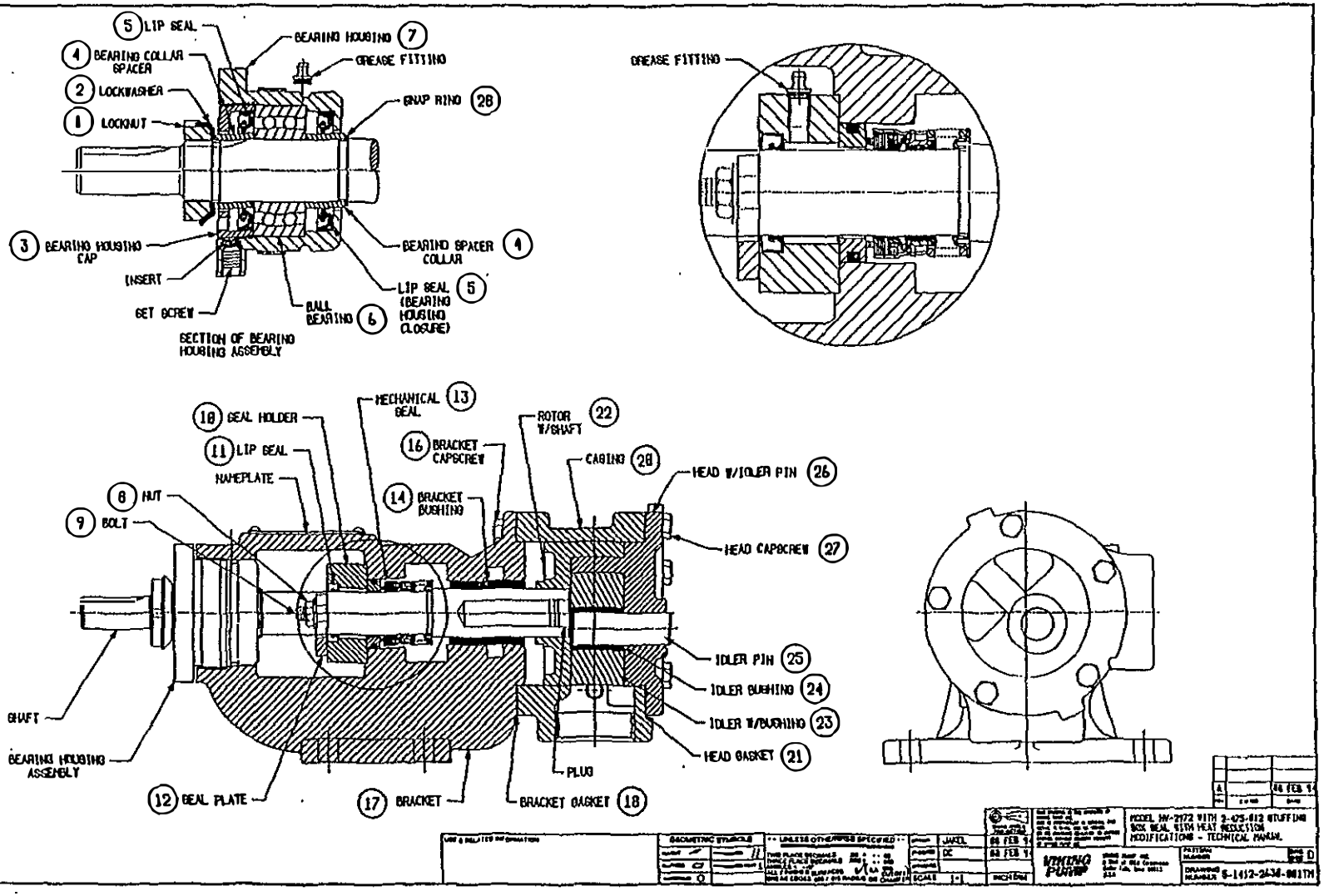
5 LIP SEAL
BEARING HOUSING 7
4 BEARING COLLAR SPACER
GREASE FITTING
2 LOCKWASHER
SNAP RING 28
1 LOCKNUT
3 BEARING HOUSING CAP
BEARING SPACER 4 COLLAR
INSERT
LIP SEAL 5 (BEARING HOUSING CLOSURE)
SET SCREW
BALL BEARING 6
SECTION OF BEARING HOUSING ASSEMBLY
GREASE FITTING
10 SEAL HOLDER
MECHANICAL 13 SEAL
ROTOR W/SHAFT 22
11 LIP SEAL
16 BRACKET CAPSCREW
CASING 28
HEAD W/IDLER PIN 26
NAMEPLATE
8 NUT
14 BRACKET BUSHING
9 BOLT
HEAD CAPSCREW 27
IDLER PIN 25
IDLER BUSHING 24
IDLER W/BUSHING 23
SHAFT
HEAD GASKET 21
BEARING HOUSING ASSEMBLY
PLUG
12 SEAL PLATE
17 BRACKET
BRACKET GASKET 18
MODEL HV-2172 WITH 2-475-812 STUFFING BOX SEAL, WITH HEAT REDUCTION MODIFICATIONS - TECHNICAL MANUAL.
DRAWING NUMBER S-1412-2434-001TM

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VIKING HL 124 PLAN HEAD STD. FIT CARBON GRAPHITE BUSHED

ITEM	PART NO.	NAME OF PART	STERLING PART #
1	2-507-003-675	Locknut	162-00008-35
2	2-807-003-375	Lockwasher	162-00008-40
3	2-140-001-781	End cap for bearing house	162-00008-17
4	2-288-003-210	Bearing space collar (2)	162-00008-19
5	2-283-007-378	Bearing housing closure (2)	162-00008-20
6	2-055-012-375	Ball bearing	162-00008-14
7	3-060-034-922	Bearing housing w/ setscrews	162-00008-24
8	2-505-004-375	Nut	162-00008-43
9	2-066-005-375	Bolt	162-00030-160
10	2-487-245-260	Seal holder	162-00030-159
11	2-283-105-381	Lip seal	162-00030-153
12	2-527-002-271	Seal plate	162-00030-154
13	2-475-012-999	Mechanical seal	162-00030-144
14	2-109-003-880-02	Bracket bushing	162-00008-98
16	2-150-004-255	Bracket capscrew (8)	162-00008-18
17	3-075-303-080	Bracket and bushing	162-00030-155
18	2-313-001-806-15C	Back flange gasket	162-00008-09
19	2-542-001-376	Pipe plug (3)	012-00001-00
20	2-194-801-100	Casing	162-00008-47
21	2-309-001-806-15C	Head gasket	162-00008-08
22	3-566-55H-012	Rotor and shaft assy.	162-00030-156
23	3-418-403-105-42	Idler and bushing	162-00030-56
24	2-095-011-880-02	Idler bushing	162-00030-02
25	2-433-004-291	Idler pin	162-00030-157
26	3-370-401-088	Head and idler	162-00030-158
27	2-150-004-255	Head cap screw	162-00008-18
28	2-556-006-375	Snap ring	162-00030-108

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PARTS LIST

PART NO.	DESCRIPTION
075-00277	Pump - (HL-125) (W/O Pressure Relief Valve)
075-00043	Drip Pump
720-09217	Motor - 3/4 H.P. 3/60/230-460V
720-09215	Motor - 1 H.P. 3/60/230-460V
720-09171	Motor - 1-1/2 H.P. 3/60/230-460V
100-00025	"V" Belt (5L360) 1-1/2 H.P. Drive
100-00255	"V" Belt (4L370) 1/2 H.P. Drive
100-00033	"V" Belt (4L360) 1 H.P. Drive
729-00084	Contactor - 35 AMP
729-00089	Contactor - 60 AMP
726-00033.02	Starter - Motor - Size "O" (G.E.) Manual
726-00005 .02	Starter - Motor - Size "OO" Magnetic
704-00052	Transformer (150VA - 460/230V-115/50-60 Hz.)
704-00054	Transformer (150VA - 550/660V)
725-00557	Fuse - Main - #FRS-20
725-00560	Fuse - Main - #FRS-10
725-00600	Fuse - Control - #FNM-1.6
	(230 Volt Power Supply)
725-00621	Fuse - Motor - #FRS-3.5 @ 600V (1/2 HP)
725-00567	Fuse - Motor - #FRS-2.8 @ 600V (1-1/2 HP)
725-00633	Fuse - Motor - #FRS-4 @ 600V (1-1/2 HP)
	(460 Volt Power Supply)
725-00574	Fuse - Motor - #FRS-1.8@ 600V (1/2 HP)
725-00619	Fuse - Motor - #FRS-2.8 @ 600V (1 HP)
725-00566	Fuse - Motor - #FRS-4 @ 600V (1-1/2 HP)
681-00012	Thermostat - Safety w/Stop at 450°
724-00009	Controller - Dual Circuit
037-00011	Gauge - Pressure Vacuum 100 PSIG
037-00049	Gauge - Pressure Vacuum 150 PSIG
715-10019	Pilot Light Receptacle (White)
715-10020	Pilot Light Receptacle (Red)

100-00039	Pulley - .617" O.D. 1/4" Bore
100-00040	Pulley - 4.564" O.D. 3/8" Bore
100-00043	"V" Belt XL 37
717-04006	Switch - Heater Control
542-00003-00	Insulation - Tank
542-00007-06	Gasket - Heater Tank
722-00043-01	Immersion Heater - 2" 6 KW - 240V
722-00043-10	Immersion Heater - 2" 6 KW - 415V
722-00043-02	Immersion Heater - 2" 6 KW - 480V
722-00043-05	Immersion Heater - 2" 6 KW - 600V
732-00012	Valve - Solenoid 1/2" - 115V
732-00013	Valve - Solenoid 3/4" - 115V
044-00013	Valve - Check, 1/2"
044-00138	Valve - Pressure Relief
044-00145	Ful-Flo Valve
106-00024	Heat Exchanger, 1.5 sq. ft.
106-00027	Heat Exchanger, 3.7 sq. ft.
573-00004	Screen - "Y" Strainer - 1/2"
573-00003-01	Screen - "Y" Strainer - 1"
162-00017-01	Sight Gauge Glass
037-00046	Gauge Glass Assembly

FLEXIBLE METAL HOSES

572-16969-05	1/2" x 6'
572-16969-03	1/2" x 8'
572-16969-10	1/2" x 10'
572-16969-02	3/4" x 6'
572-16969-06	3/4" x 8'
572-16969-12	3/4" x 10'
572-16969-07	1" x 6'
572-16969-04	1" x 8'
572-16969-08	1" x 10'

NOTE: PLEASE GIVE MODEL AND SERIAL NUMBERS WHEN ORDERING PARTS. PART NUMBERS ARE LISTED AS A GUIDE, BUT MANY UNITS HAVE SPECIAL PARTS OR FEATURES NOT COVERED BY THIS LIST. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. NET 30 DAYS, F.O.B. MILWAUKEE, WISCONSIN

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THE STERLCO EDGE

CUSTOMER SATISFACTION WARRANTY PROGRAM
for 6016 Series Temperature Control Systems

For more than seven decades, Sterlco Temperature Control Systems have built an enviable reputation for PRECISION, RELIABILITY AND DEPENDABILITY. Our commitment to total quality in manufacturing and support service has one primary goal; We want you to be completely satisfied with our products so we back them with an unmatched temperature control system warranty program.

RISK FREE WARRANTY

With the purchase of a new 6016 Temperature Control System, you receive a one years, risk free warranty program. If for any reason the unit does not perform as designed, we will repair it or replace it with another unit of equal or greater value - NO QUESTIONS ASKED, for a period of twelve months from ship date.

DOWN TIME ELIMINATORS

To help keep your operation running smoothly and efficiently, we provide back-up service and sup[port, including:

- NEXT DAY PARTS SERVICE - To get you up and running, we provide, by request, overnight shipment of replacement parts for standard units. (NOTE: Orders must be received by 1:00 P.M. CST.)

- TEMPERATURE CONTROL SYSTEM LOANER PROGRAM - Should your unit require service at the Sterling factory, we can supply, free of charge, a loaner unit (if available when requested). Loaner units are limited to standard, non custom systems from our loaner supply stock. Customers are responsible for freight.

- TELEPHONE CONSULTATION - Because many problems can be diagnosed and resolved quickly and efficiently over the telephone, our sales engineering staff is trained and prepared to provide free and immediate consultation.

STERLING, INC.

P.O. Box 23435 • 5200 W. Clinton Avenue • Milwaukee, WI 53223-0435 • 414-354-0970 • (FAX) 414-354-6421

WARRANTY DETAILS

Sterling, Inc. warrants the 6016 Series Temperature Control Systems manufactured by it to be free from defects in workmanship and material when used under conditions recommended by it. The company's obligation under this warranty is limited to make good at its factory, any parts which shall within the time frames previously stated and after delivery of equipment of its manufacture to the original purchaser, to be returned to it with transportation pre-paid, and which its examination shall disclose to its satisfaction to have been defective. The Company neither assumes nor authorizes any other persons to assume for it any liability in connection with the sale of its equipment except under the conditions of this warranty.

This warranty does not cover any labor charges for replacement of parts, adjustment or repair or any other work done. Normal or routine maintenance items, which by design, wear with time and are affected by water quality, and are not considered defects and, therefore, are not covered under this warranty. This warranty shall not apply to any apparatus which in its opinion has been subjected to misuse, negligence or temperatures or pressures in excess of limits recommended by the Company or have been repaired or altered outside the Company's factory.

Replacement of defective material will be F.O.B. our factory.

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