Rev. 12/2014

STEPP MFG™

ASPHALT MAINTENANCE EQUIPMENT

OPERATIONS/MAINTENANCE/PARTS MANUAL

Diesel Burner Systems

12325 River Road North Branch MN 55056 ~ Phone: 651-674-4491 ~ Fax: 651-674-4221
www.steppmfg.com

Warranty

Stepp Manufacturing Company Inc. hereby warrants to the original purchaser that products manufactured by Stepp Mfg. will be free from defects in material and workmanship for a period of one (1) year from the date of purchase.

Stepp Mfg., at its discretion, will provide for the repair or replacement of any part found upon examination by Stepp Mfg. to be defective, except as noted below. Such repair or replacement will be free of charge to the original purchaser for a period of one (1) year from the date of purchase, except as noted below.

No warranty is extended to cover:
•Product pump wear or damage caused by foreign objects.
•Routine maintenance, cleaning, and adjustments.
•Parts/components that have been altered, misused, or improperly adjusted or maintained.
•Transportation to and from the place of warranty repair.
•Removal of material from equipment.

The following items are covered solely by their manufactures warranty:
•Engines
•Hydraulic components
•Burners
•Pumps
•Tires
•Other component parts

The following items are covered by a pro-rata warranty:
•Hoses that carry heated materials.
•Heating elements for hoses and wands.

Disclaimer of further warranty:
Stepp Mfg. makes no warranty, expressed or implied, other than this warranty. The implied warranties of merchantability and fitness for particular purpose are hereby disclaimed. Repair or replacement of products or parts proving to be defective in material or workmanship shall be the exclusive remedy for breach of this warranty.
Stepp Mfg. shall not be liable for incidental or consequential damages including but not limited to: damages for inconvenience, rental or purchase of replacement equipment, for loss of profits, loss of material, or other loss resulting from breach of this warranty.
Stepp Mfg. reserves the right to incorporate any changes in design into its products without obligation to make such changes on products previously manufactured.
Please see Warranty section for more details.

Stepp Manufacturing Co., Inc.
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North Branch, MN 55056
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INTRODUCTION

OJK Stepp Oil Jacketed Kettle

Thank you for selecting *Stepp* highway maintenance equipment. We are confident you will be satisfied with the *Stepp Oil Jacketed Kettle. Stepp Manufacturing* is backed by over 70 years of experience in the design and manufacture of highway maintenance equipment. This experience along with our innovative design and unique features make the *Stepp Oil Jacketed Kettle* the fastest and most efficient kettle available.

In order to assure safe operation of this equipment, the operator must read and understand all operating procedures and safety notices contained in this manual. In addition, the operator must receive instruction on how to safely operate the *Stepp Oil Jacketed Kettle*. Contact the manufacturer if any questions arise or if you desire training for additional staff members.

Operating instructions, adjustments and periodic maintenance procedures are given so you, the operator, can keep your unit working like new and expect many years of dependable service from it. Remember, any machine, regardless of design or type, will perform only in relation to the way it is operated and the maintenance it receives.

Read this manual carefully and observe all warnings and cautions. If you have any recommendations or comments regarding this manual, please send them attention to: Stepp Manufacturing Co. Inc., 12325 River Road, North Branch MN. 55056-6225 or call 651-674-4491. All comments we receive are reviewed and may be incorporated into future manuals.

When ordering parts or making any inquiry about the *Stepp Oil Jacketed Kettle,* be sure to include the model number and serial number found on the data plate attached to the frame.

TABLE OF CONTENTS

IMPORTANT NOTICE!
This manual contains cautions and warnings that alert you to potential safety issues.

WARNING is used to inform you of conditions or operations that could cause serious injury or death.

CAUTION is used to inform you of conditions or operations that could cause damage to the equipment

NOTES is used to provide you with additional information that may be helpful or useful for a particular situation.

This manual explains the basic operations, maintenance and use of the Stepp OJK Oil Jacketed Kettle. The main objective of this equipment is to melt rubberized crack sealing and water proofing compound and apply them to road surfaces.

Before Starting or Operating this Machine

Understand and observe all the following ⚠ Warnings, ⚠ Cautions, and Notes.

⚠ WARNINGS

- This equipment contains mechanical and heating components that may cause serious injury or death if not handled or maintained properly. All personnel must be properly trained in the operation and maintenance of this equipment.
- Before refueling, shut off the burners and allow all flames in the burner and pilot light to extinguish. Shut off the engine.
- Check fuel lines, fuel line connections, and all other components for leaks. If any leaks are found, they must be repaired before using the unit.
- Know the temperature required for the material being used, and do not exceed this temperature. Avoid over heating, as this may cause equipment damage, personal injury, and/or death.
- Never load a tank with heated oil when moisture is present in the tank. Depending on the temperature of the hot oil, the moisture may instantly boil causing hot oil to foam up and out of the tank causing severe burns.
- Do not operate the tack tank burner when the amount of material in the tank is less than 4" above the flues. Allow 10 minutes cool-down time after the burner has been shut off before exposing the flues. Exposed flues will over-heat and cause an explosion and/or fire.
- The tack tank cover must be unlatched when operating the tack tank burner. This is to provide for emergency venting, in the event of a flash, to prevent the tank from exploding.

⚠ CAUTIONS

- Know the materials being used and know the proper handling, heating, application, clean-up, and storage procedures. Not all materials are compatible with each other. Many materials have a very limited shelf life. Most materials require special handling procedures to prevent personal injury and/or equipment damage. Contact your material supplier and/or manufacturer for proper handling instructions. Equipment malfunction or damage due to improper handling or use of the materials is not covered by warranty.
- Do not exceed the maximum heating temperature or storage time as recommended by the material manufacturer. This may cause emulsion type materials to separate and become difficult or impossible to remove from the machine. Consult with the material manufacturer for recommendations.
- Over-agitation or circulation may cause emulsion type materials to separate and become difficult or impossible to remove from the machine. Consult with the material manufacturer for recommendations.
- Do not mix *Anionic* and *Cationic* materials together, as the materials attach to each other and will become difficult or impossible to remove from the machine. If you are not sure consult your material supplier.

NOTES

- Become familiar with the Material Safety Data Sheet (MSDS) for the material being used in the machine and take appropriate safety precautions. Wear the proper clothing and protective gear as recommended by the MSDS and your safety director.
- DO NOT use the equipment unless it is in good condition.
- In case of skin contact with hot materials, dip into **cool**, **clean water immediately**. Do not wipe the product, as this will spread the burn.
- Consult the MSDS and contact your safety director for proper extinguishing of petroleum based fires.
- Carry a fire extinguisher(s) as recommended by your safety director.
- Notify your supervisor or the manufacturer if any questions arise concerning the operation of this equipment.

The Stepp Oil Jacketed Kettle is the perfect blend of

PERFORMANCE, DURABILITY,

and VERSATILITY

for your pothole patching needs and budget!

Quick Spec	OJK 185	OJK 275	OJK 400
Capacity	190 Gallon	280 Gallon	440 Gallon
Heat Transfer Oil Capacity	110 Gallon	118 Gallon	130 Gallon
Tires	(4) ST225/75R15	(4) 225/75R15	(4) ST235/80R16
GVWR	10,000 lbs	12,000 lbs	14,000 lbs
Empty Weight (avg.)	5,600 lbs	6,000 lbs	
Dimensions (avg.)	210”L 90”W 85”H	210”L 90”W 90”H	
Diesel Burner BTU	350,000 BTU	350,000 BTU	350,000 BTU

This Oil Jacketed Kettle (double boiler) will be used to melt rubberized crack sealing and water proofing compounds and apply them to the road surface. The machine shall be the manufacturer’s current production model, trailer mounted, and completely self contained. It shall be capable of heating, melting, and applying all grades of rubberized asphalt crack sealer, joint sealants, and waterproofing compounds without the need for additional equipment. The machine shall be capable of heating sealing material from ambient to application temperature in 60 minutes or less.

DESCRIPTION

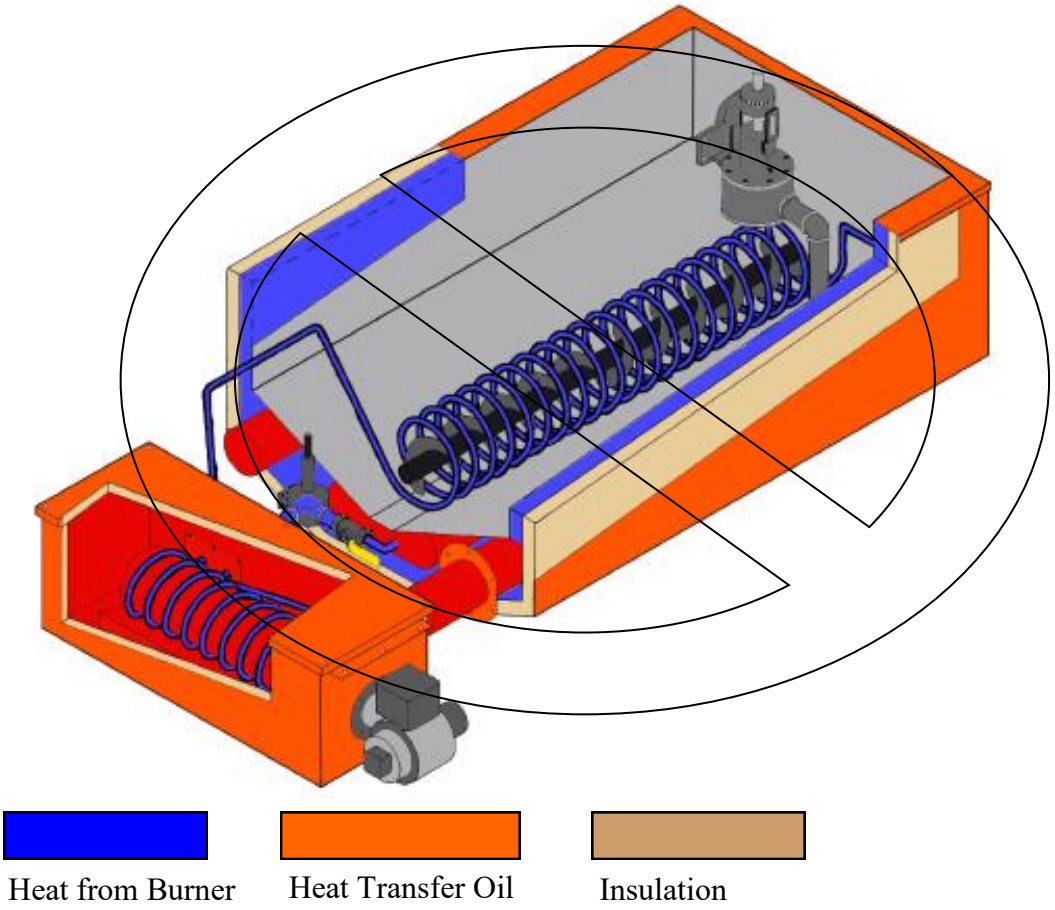
DESCRIPTION

The Stepp OJK is designed to melt and apply rubberized crack sealing compounds to fill cracks in the roadway surface.

The OJK uses a tank surrounded by an oil jacket filled with heat transfer oil. The heat transfer oil is heated by a diesel fired burner and is circulated in the oil jacket by a pump. In addition to the oil jacket there is a coil surrounding the agitating auger in the tank. Heat transfer oil is pumped through this coil to facilitate heating of the asphalt material. The temperature of the product and the heat transfer oil is automatically maintained by electronic temperature controls.

The heated asphalt is applied to the crack by an electrically heated hose and wand. The heating element in the hose and wand keep the product at working temperature thus eliminating wand "freeze up". No cleanup or flushing of the wand and hose is required.

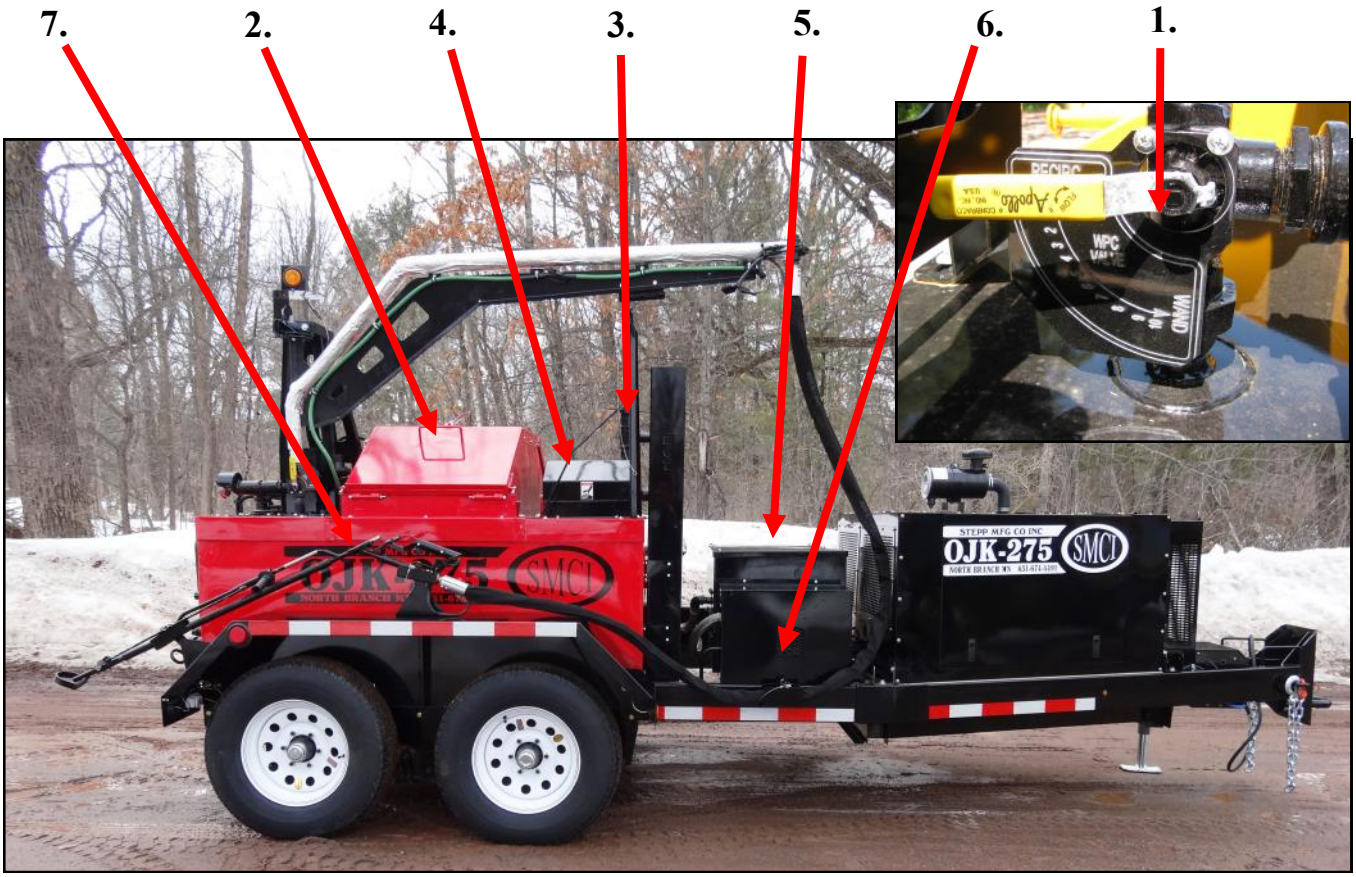
Power is supplied by a diesel engine. The engine drives a 24 volt alternator for the heated hose and wand. It also drives a hydraulic pump that powers the heat transfer oil circulation pump, product pump, agitating auger and the optional direct mounted 100 CFM rotary screw air compressor.



DESCRIPTION

Component Location

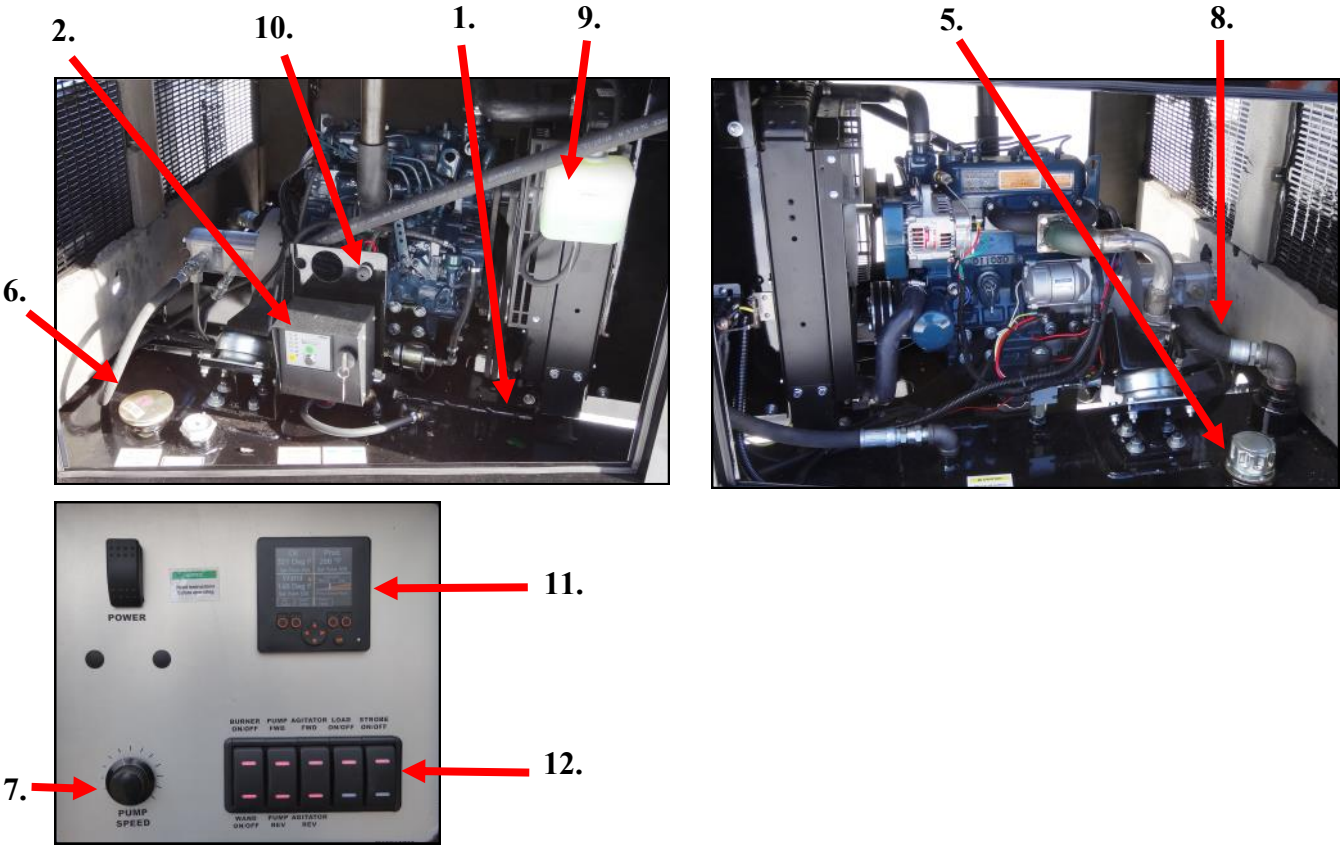
1. Wand Pressure Control (WPC) Valve — Controls the amount of pressure being applied to the hose & wand when the pump saver system is not being used. Also allows the operator to divert the flow of material back to tank for circulation, or to the wand for application to the road surface.
2. Safety Loading Chute — Provides a "splash free" way of loading product into a hot tank.
3. Dip Stick / Fill Cap — Provides a way to check and fill the heat transfer oil tank.
4. Expansion Tank — Provides room for the heat transfer oil to expand and allows the oil to cool. This creates a "cold seal" effect allowing safer operation at elevated oil temperatures.
5. Heat Exchanger Chamber — Exchanges heat from the burner to the heat transfer oil.
6. Oil Pump Drive Motor — Drives the heat transfer oil circulation pump.
7. Wand and Hose — Provides a means of applying the product to the road surface.



DESCRIPTION

Component Location

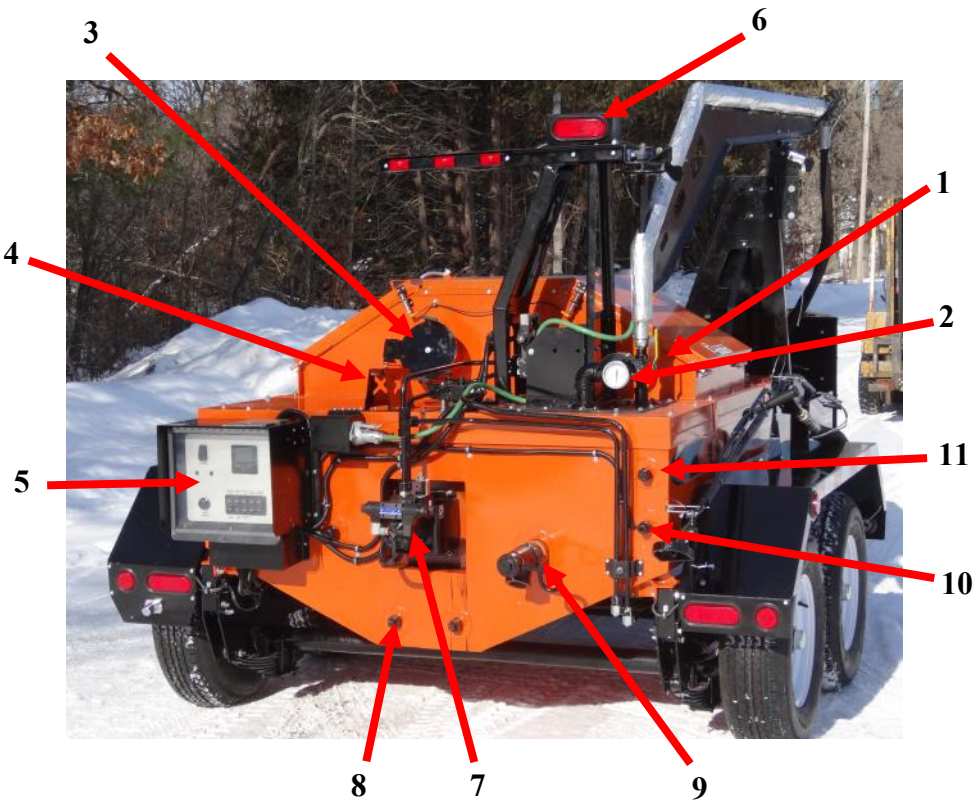
1. 24V Alternator — Provides electrical power to the wand and hose heating elements.
2. Engine Control Panel — Provides a means of controlling engine functions.
3. Engine Fuel Filter — Provides clean fuel to engine. (not shown)
4. Hydraulic Filter — Removes contaminates from the hydraulic system. (not shown)
5. Hydraulic Reservoir — Provides a 15 gallon capacity for the hydraulic system.
6. Fuel Tank and Gauge — Stores 20 gallons of diesel fuel to operate the burner and the engine.
7. Product Pump Control — Allows the operator to start, stop, or reverse the rotation and control the speed of the product pump.
8. Hydraulic Pump — Provides hydraulic power to the heat transfer oil circulation pump, auger, and the product pump.
9. Radiator Reservoir– Used to fill the radiator.
10. Hydraulic Unloader– Unloads the hydraulic load on the engine for cold starts.
11. Automatic Temperature Controls for Burner, Oil and Wand Temperatures — Controls burner and wand heating functions.
12. Operation Switches — Operates Burner On/Off, Wand On/Off, Auger Fw / Rev, Pump Fw / Rev, Autoloader On/Off, and Strobe Light On/Off



DESCRIPTION

Component Location

1. Wand Pressure Control (WPC) Valve — Controls the amount of pressure being applied to the hose & wand when the pump saver system is not being used. Also allows the operator to divert the flow of material back to tank for circulation, or to the wand for application to the road surface.
2. Thermometer — Indicates the temperature of the material as it is pumped from the tank.
3. Circulating Flange — The wand is placed into this port allowing circulation through the wand and back to tank.
4. Wand Rest — Holds the wand in position when circulating through the wand back to tank.
5. Thermostats — Digital display thermostats control the temperature of the heat transfer oil and the product temperature.
6. Controller Warning Light — Will flash in the event of a burner malfunction or if burner interlock is locked out.
7. Drive Motor — Hydraulic drive motor powers the agitating auger.
8. Electric Overnight Heaters — Maintains heat transfer oil temperature of approximately 150 to 200°F.
9. Draw off cock — Provides a means of draining tank or filling dispensing equipment.
10. Thermal Well — Contains temperature sensor for product temperature.
11. Heat Transfer Oil Level Plug — Allows easy check of oil level only when unit is cold.



Burner System:

The heating system is designed to burn diesel fuel and efficiently heat the transfer oil. The heating system is equipped with constant ignition (flame-out protection) and automatic controls to monitor the temperature of the heat transfer oil and the product temperature. Heat transfer oil must be circulated through the heat exchanger whenever the burner is on. This prevents the heat exchanger from overheating and causing damage to the equipment. Operation of the engine is required during the heating cycle to supply hydraulic pressure to the heat transfer oil pump. The pump then circulates the heat transfer oil through the heat exchanger and the hot oil coil in the product tank.

⚠ **WARNING:** *Operation of the burner without the engine running and oil circulating will cause an overheat situation resulting in severe damage to the heat exchanger. Whenever the engine is shutdown, the burner will also shutdown.*

Agitator:

This unit is equipped with a hydraulically operated agitator with forward / reverse control. Operating the agitator during the heating cycle will decrease the amount of time and energy necessary to bring the product up to working temperature. The agitator should be turned on as soon as the material melts sufficiently enough to allow the agitator to rotate usually around 275°F.

Product Pump:

The Stepp OJK is equipped with a hydraulically operated product pump with "Pump & Reverse" control. In the "Pump" position, the pump delivers product from the tank, through the hose, and to the wand for application to the road surface. In the "Reverse" position the pump draws the product out of the product pump, plumbing, and WPC (wand pressure control) valve to prevent freeze-up when the unit is shutdown. The product pump is mounted in the tank allowing it to heat to the proper temperature along with the product, thus it is not necessary to preheat the pump. The product pump should only be engaged when the product has reached a temperature that will allow the product to flow through the pump and plumbing.

Stepp AKC Advanced Kettle Controls:

The Stepp OJK shall be equipped with the Stepp AKC Advanced Kettle Control, can buss PLC control system. The AKC controller shall monitor and control all burner functions, pumping and agitation controls, kettle interlock safety systems, autoloader controls and operations, auger safety shutdown, and diagnostics for the burner control system. The AKC integrates all burner and hydraulic controls into a simple easy to use control package.

The AKC control operates the automatic spark ignition and lights the burner with the flip of a switch and includes flame-out protection to shut off the fuel supply if the flame is blown out. The AKC control has an easy-to-adjust thermostat with a setting range from 0° - 550° F. A large color display makes it easy to monitor the product temperature in the tank. Once the operator sets the desired temperature, burner operation and temperature controls are fully automated with this system. The AKC controls are to be located in a weather proof enclosure. The enclosure shall have a transparent cover so the temperatures can be monitored without the need to open the cover. The operator shall be able to read the product temperatures when standing 6 feet from the machine.

The AKC Control Features are as follows:

Pump - on / off, adjust speed control
Auger - on / off, forward / reverse
Wand and Hose Heat - on / off.
Heat Transfer Oil - actual temperature and set temperature
Material - actual temperature and set temperature
Hose - actual temperature and set temperature
Pumping System Interlock - will not allow operator to start pump or auger until product and hose have reached 275°F
Burner Control Diagnostics - turns warning light on when components fails
Burner Lock-out with Warning - warning light flashes until temperature is reached
US / Metric Conversion- user selectable US or metric temperature controls
User adjustable lock out settings
Pump speed indication

Optional Equipment:

Exact Flow Wand Control - controls pump speed from wand
Autoloader - on / off
Autoloader auto / manual - auto mode automatically dispenses a block into the kettle when one is pumped through the wand
Pump Hour Meter - totalizes pump hours with autoloader option
Block Counter - totalizes the blocks used with autoloader option
Material Dispensed - totalizes gallons used with autoloader option
Strobe light - on / off

DESCRIPTION

Wand Pressure Control Valve

⚠ **CAUTION:** *Operators must understand the proper operation of the WPC valve located on the top rear of the unit.*

The purpose of this valve is to direct the flow of product either back to the tank (during start-up to assist melting) or to the wand (during crack filling operations).

During normal operation the WPC valve will be in the “Wand” position and the flow of crack sealant will be adjusted by the “Pump Speed” control located in the operators control box.

When finished for the day, the WPC valve will be returned to the “Recirculate” position and the pump reversed to evacuate the plumbing.

Heated Hose & Wand:

The application wand and hose are equipped with an internal heating element. The element is powered by the 24 volt alternator run by the engine. This heating element prevents the product from "freezing" in the hose and wand.

The electric wand heat control should be turned on 20 to 30 minutes before trying to pump material through the hose and wand. This will allow time for the material to reliquefy in the hose.

NOTE: *It is recommended that you circulate the product back to the tank through the wand circulating flange provided in the hood. This is to assure proper flow and temperature of the material going though the wand.*

Depending upon the volume of the material going through the wand and the outside temperature, it may not be necessary to run the heated wand all the time. Once flow is established through the wand and circulating back to the tank, it is recommended that the electric heating element be used only as required to maintain flow. This will help to extend the service life of the components. If the flow is not adequate to maintain temperature in the hose and wand, freeze up may occur. If this happens, simply turn the electric heating element on and allow time for the material to remelt.

No cleanup is required with the electric wand, just shut the machine off as the product can be remelted by activating the wand heat control. No additional flushing is required.

Overnight Heater (optional):

This feature will maintain the product from 150° to 200° F., saving startup time. The system consists of two heating elements submerged in the heat transfer oil.

The heaters require 110V, 15 amp service each. The extension cords used must be the outdoor heavy duty type, grounded, and each rated for 1500 watt service.

⚠ **CAUTION:** *Make sure to plug each heater into separate circuits or it may cause the breaker to trip on your outlet.*

Digital Engine Management Controls:

The engine controls consist of a starter / glow plug button, an unloader switch to relieve the hydraulic pressure for starting purposes (the deep sea control will also stop the engine in case of low oil pressure or high coolant temperatures), and indicator lights for oil pressure, coolant temperature, hour meter and volt meter. Optional equipment includes engine gauges.

OPERATIONS

Pre-start Checks:

The burner system is equipped with a safety interlock system that prevents the burner from igniting unless the engine is running.

⚠ **WARNING:** *This safety interlock must be tested each time before the engine is started. Follow the steps below prior to engine start.*

1. With engine OFF, turn the burner power switch ON, the burner and blower motor should NOT operate. If the burner or blower motor runs there is a fault in the system, shut OFF burner switch immediately. Contact a qualified service technician and correct the problem before continuing.
2. Be sure the burner switch is in the OFF position.
3. Check the overall appearance of the unit inspecting for any obvious damage.
4. Check all fluid levels, the condition of the hot asphalt hose, and the 24 volt alternator belt (refer to the daily maintenance schedule).

Transporting:

1. Shut off the burner and the engine.
2. Securely latch the loading chute and recirculating flange.
3. Secure the wand and hose assembly in the hanger.
4. Attach the unit to the towing vehicle being certain hitch is fully engaged, connect safety chains, electrical connector, and breakaway switch (if equipped), retract the landing gear and secure in the up position.
5. Check the condition and operation of the lights, tires, brakes, hitch, and safety chains.

Loading:

It is very important that the operator know the operating temperature and flash point of the product being used. This information is available from the product manufacturer. Be sure the thermostat is set at the recommended temperature.

Prior to adding product to the tank, ensure the compatibility of the product in the tank to that being loaded. If products are not compatible the tank must be thoroughly drained and cleaned before switching products.

Loading When Hot:

1. Open loading chute and place block of product in chute, close loading chute and product will drop into tank. Open chute and repeat until product is at the desired level. Agitator will automatically shut off when cover is open. Make sure to close the cover to start the agitator and ensure that the material stays mixing.
2. Close loading chute but DO NOT latch, this will allow for emergency venting in case of a “flash”.

Engine Starting:

NOTE: *Be sure all pre-start checks are complete prior to starting engine.*

1. Fill fuel tank.
2. Turn key switch to the ON (right) position.
3. Hold yellow glow plug button down for 30-60 seconds.
4. Press and hold the unloader button (this allows the engine to start with out hydraulic load on the engine). Hold in for 1 - 3 minutes once the engine starts (in cold weather operation you may need to hold in longer to allow engine to warm up before putting under load).
5. Press green start button to start engine.
6. If engine does not start on first try, turn key switch OFF and start the starting sequence over.

5. Check to see that the heat transfer oil pump is rotating, if not investigate problem before proceeding to heating operations.
6. For units equipped with optional air compressor, an adjustable throttle is provided (shown in picture below). For units without the compressor, the engine is governed at the optimum speed for operation of the kettle and no throttle cable is provided.

Burner & Pump Operations:

1. Turn the main power switch to the ON position.
2. Turn the burner switch ON and the burner will ignite.
3. Set product thermostat to the product manufacturers recommended temperature. Thermostat will display the set point and the actual temperature of the product.
4. Set heating oil thermostat 25 to 50° F above the asphalt product manufacturers recommended temperature. Thermostat will display the set point and the actual temperature of the product.
5. Turn the wand switch to the ON position. This will start to heat the heating elements in the hose, wand, and overhead boom.
6. Turn on the agitator to the “Forward” position. The agitator or pumping system will not function until the material temperatures in the tank and hose reach the factory set 275°F interlock. Once material is up to temperature, the agitator and pump will function. The interlock is designed to prevent damage to the machine and pumping system by not letting the operator engage the pump until material is able to flow.
7. Once product is up to temperature and the agitator is spinning freely you can engage the pumping system.
8. Put the WPC valve in the “Recirculate” position.
9. Select “Pump Forward” on the pump switch. The pump still will not turn until you pull the trigger on the wand. When the trigger is pulled this will engage the pump to turn and recirculate the material back to the tank. You will see the temperature start to climb on the analog thermometer located next to the WPC valve.
10. Once flow is established insert the wand into the recirculate flange located in the back of the safety loading chute. Make sure that the sliding valve on the end of the wand is open.
11. Slowly move the WPC valve towards the wand position to redirect the flow to the hose and wand. If no product flows out of the wand, allow additional time for the electric heating elements to melt the product in the hose and wand.
12. Adjust the pump speed control located in the control box to the desired application rate.

NOTE: *The pump will not operate unless the trigger is pulled on the wand.*

13. When the product is flowing freely and temperatures are stabilized, the product is ready to apply to the road surface. Proceed to "Application Operations".

Standard Application Operations:

NOTE: *For units equipped with pump saver option installed, the pump will only function when the trigger is pulled on the wand.*

Application Operations with "Pump Saver":

1. Position the WPC valve fully to the "Wand" position.
2. Close the wand flow control valve (located on the wand handle) and remove wand from the recirculating flange.
3. Open the wand flow control valve and pull trigger to apply product to the road surface.
4. Adjust the pump speed as necessary for the desired flow.
6. Monitor the level in the tank and add product as necessary.

⚠ **CAUTION:** *Do not engage wand heat unless there is product in the hose.*

⚠ **CAUTION:** *Positioning of the pump speed all the way to the "max flow" position may cause excess pressure in the wand which may cause damage to the wand hose or system. The pump speed should not be positioned fully to the "max flow" unless the wand flow control valve located on the wand is open and product is flowing freely, or the pump saver is in operation. Observing unusual flexing in the wand hose should signal to the operator that excess pressure is being applied to the wand hose and the pump speed should be adjusted accordingly.*

Standard Shutdown Procedures:

NOTE: *If pump saver option is installed, refer to shutdown procedures at bottom of page.*

1. Turn OFF the wand heat control switch.
2. Move the WPC valve to the "Recirculate" position.
3. Press and hold the product pump switch to activate the pumping system in reverse. Allow the pump to stay in the "Reverse" position for 2 minutes then press the pump switch to turn OFF the pump. This will draw the product out of the pump, plumbing, and WPC valve. Leave sealant in the hose and wand.
4. Turn both thermostats to their lowest setting.
5. Turn OFF the burner power switch.
6. Place the agitator switch to the OFF position.
7. Securely latch all covers.
8. Turn key to OFF position to shutdown the engine.

⚠ **CAUTION:** *The Stepp OJK requires special shutdown procedures that must be followed to maximize safety and equipment performance. These procedures will assure that the hose and wand always have product in them to avoid an overheated element. (DO NOT suck the product back out of the wand and hose assembly). No hose cleanup is necessary as the product in the hose is remelted at the next startup with the wand and hose heating element.*

⚠ **CAUTION:** *DO NOT reverse the pump with the WPC valve in the "Wand" position as this would suck the product out of the wand and hose assembly. The hose and wand must contain product to absorb the heat from the heating elements to avoid equipment damage. Only reverse the pump when the WPC valve is in the "Recirculate" position. No hose cleanup is necessary with this system.*

Helpful Hints

1. It is recommended that the product level be drawn down to ¼ capacity or less prior to shutdown if the machine is not going to be used for two days or more. This will decrease the startup time next time the machine is used. However, if the equipment will be used the next day leave the unit ½ full or more, then plug in the optional overnight heaters (if available). This will help retain heat for a faster startup the following day.
2. Overnight heating elements normally should not be used for more than 48 hours at a time. Check your product manufacturers specifications for recommended "pot" life.
3. DO NOT heat or reheat any product for a length of time more than that recommended by the product manufacturer. The result of excessive heating time is the material hardening and possibly becoming difficult or impossible to remove from the machine.
4. The flow control valve at the end of the wand is not heated by the heating element. Although heat transfer from the wand will normally be enough, by inserting the wand into the recirculating flange, additional heat from the kettle will aid in heating the valve.
5. If the engine quits for any reason, move the WPC valve to the recirculate position then attempt to resolve the problem and restart the engine as soon as possible. The proper shutdown procedures must be followed before the product hardens in the plumbing between the WPC valve and the top of the kettle. If the product hardens between the WPC valve and the top of the kettle, use heat to reliquefy the product to reestablish flow.

Optional Air Compressor:

100 CFM rotary screw compressor, direct coupled to the Kubota engine.

1. Start the engine (refer to engine start).
2. Set throttle to adjust the desired air flow using the supplied pressure gauge.
3. Connect the air hose to the quick connector and open the supply valve.

Optional Autoloader:

The optional autoloader will automatically add blocks of sealant to the kettle as you apply material from the wand. You can also operate the autoloader manually with the supplied tether.

1. Turn the load switch to the ON position.
2. Load blocks onto the loading conveyor.
3. Unlatch the loading chute hatch located on the front of the loading hatch.
4. Select between manual or auto-mode.
5. When finished turn the load switch to the OFF position.

NOTE: *The loader operates by calculating the amount of material that you have pumped. Operators still need to monitor the material height in the product tank. Autoloader also has a totalizing option to tell you how many gallons of sealant are pumped. This also includes any material pumped back into the tank.*

MAINTENANCE

OJK MAINTENANCE SCHEDULE

ITEM	OPERATION TO PERFORM	HOURS	AS NEEDED	DAILY	EVERY 3MO	EVERY 12 MO	EVERY 24MO
ENGINE	Refer to the engine manufacturers manual insert.						
OIL	Check engine oil level, add oil as needed.			X			
OIL	Change engine oil and filter.	100					
COOLANT	Check coolant level.			X			
COOLANT	Flush cooling system and replace coolant.						X
RADIATOR	Clean radiator fins of dirt and dust with garden hose.		X				
AIR FILTER	Clean air filter.		X				
AIR FILTER	Replace air filter.	100				X	
FUEL FILTER	Replace fuel filter.					X	
FAN BELT	Check condition and tension.			X			
HYDRAULICS							
HYD. OIL	Check hydraulic oil level, add oil as necessary.			X			
HYD. OIL	Change hydraulic oil.						X
FILTER	Change hydraulic filter.	200				X	
STRAINER	Clean strainer screen.					X	
DRIVE LINE							
ALT. BELTS	Check condition and tension of 24V alternator belts.			X			

OJK MAINTENANCE SCHEDULE

ITEM	OPERATION TO PERFORM	HOURS	AS NEEDED	DAILY	EVERY 3MO	EVERY 12 MO	EVERY 24MO
BURNER							
ELECTRODES	Check electrodes for wear and proper adjustment.					**X**	
NOZZLE	Replace fuel nozzle with same size and style.					**X**	
FILTER	Replace burner fuel filter.	**400**				**X**	
F-HEAD	Check condition of F-head on burner.					**X**	
HOT PUMP							
CLEARANCE	Check and adjust end clearances of heat transfer oil pump.						**X**
PACKING	Adjust shaft seal packing of heat transfer oil pump.		**X**				
COUPLING	Check pump to hydraulic motor coupling for proper alignment and excess wear.					**X**	
PRODUCT PUMP							
CLEARANCE	Adjust end clearances of product pump.		**X**				
PACKING	Adjust shaft seal packing of pump.		**X**				
COUPLING	Check pump to hydraulic motor coupling for proper alignment and excess wear.					**X**	
HEAT TRANSFER OIL							
OIL	Check heat transfer oil level.			**X**			
OIL	Change heat transfer oil.	**1000**					**X**

OJK MAINTENANCE SCHEDULE

ITEM	OPERATION TO PERFORM	HOURS	AS NEEDED	DAILY	EVERY 3MO	EVERY 12 MO	EVERY 24MO
HEATED HOSE							
JACKET	Check condition of hose safety jacket. Replace if damaged.			X			
HOSE	Check condition of hose. Replace if damaged.				X		
HOSE	Replace hose.					X	
CONNECTION	Check condition of tightness of hose and wire connections.			X			
BOOM	Check boom, boom support, and lock pin for cracks or damage.				X		
PRODUCT TANK							
TANK	Clean and inspect interior for leaks or damage.					X	
PACKING	Adjust packing seal on auger shaft.		X				
COUPLING	Check auger to hydraulic motor coupling for proper alignment and excess wear.					X	
BEARINGS	Check auger bearing mounts for looseness and excessive wear.					X	
HEAT COIL	Check heating coil for damage or leaks.					X	
HEAT COIL	Check for leaks and tighten fittings on each end of the heating coil.					X	

OJK MAINTENANCE SCHEDULE

ITEM	OPERATION TO PERFORM	HOURS	AS NEEDED	DAILY	EVERY 3MO	EVERY 12 MO	EVERY 24MO
CHASIS							
TIRES	Check tire condition and pressure.			X			
BRAKES	Check brake operation.			X			
BRAKES	Inspect and adjust brake shoes, drums, and components.				X		
LUG NUTS	Check lug nuts for proper torque.				X		
BEARINGS	Inspect wheel bearings and repack with grease.					X	
SUSPENSION	Inspect all suspension components for wear, breaks, or damage				X		
LIGHTS	Check that all lights function properly.			X			
FRAME	Inspect frame for cracks or damage.					X	
HITCH	Inspect hitch for wear, damage, and proper adjustment.			X			
Air Compressor							
	Air Filter Replacement	**500**				X	
	Oil Filter	**2000**				X	
	Separator Filter	**2000**				X	
	Oil	**2000**				X	

OJK MAINTENANCE RECORD

DATE	MAINTENANCE PERFORMED	HOUR METER	SERVICED BY

All maintenance items must be performed according to the maintenance schedules and documented for warranty coverage to be effective.

OJK MAINTENANCE RECORD

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OJK MAINTENANCE RECORD

DATE	MAINTENANCE PERFORMED	HOUR METER	SERVICED BY

All maintenance items must be performed according to the maintenance schedules and documented for warranty coverage to be effective.

Oil & Filter Change:

1. Run engine until operating temperature is reached, then shut OFF engine.
2. Place drain pan under oil drain hose.
3. Open oil drain valve and drain oil from the engine.
4. Close the oil drain valve.
5. Place drain pan under engine oil filter and remove filter.
6. Coat gasket of new oil filter with engine oil and install, hand tighten only.
7. Add 5 quarts SAE 10 W 40 oil.
8. Run engine and check for leaks.
9. Return used oil to a recycling center.

Air Cleaner Service:

1. Remove wing nut in center of air cleaner.
2. Remove filter.
3. Clean element following instructions on air cleaner housing. Element may be cleaned up to six times before replacement.
4. Reinstall element in housing and tighten wing nut.

Fuel Filter Change:

1. Position drain pan under fuel filter.
2. Remove fuel filter.
3. Fill new filter with clean diesel fuel.
4. Lubricate gasket with fuel and install filter, hand tighten.
5. Loosen the air vent plug on the injection pump where the fuel line is attached.
6. Pump the lever on the fuel pump until no air bubbles are present, tighten air vent plug.

Cooling System Service:

1. Allow engine to cool to ambient temperature.
2. Open radiator petcock and drain coolant into a suitable container.
3. Open petcock on left side of engine block and drain into a suitable container.
4. Open radiator cap and remove lower radiator hose.
5. Flush clean water through radiator until the water comes out clear.
6. Remove the thermostat then flush clean water through the engine block until the water comes out clear.
7. Install new thermostat and gasket.
8. Install radiator hose and close all petcocks.
9. Refill system with fresh anti-freeze in a 50/50 mix.
10. Run engine and check for leaks, then recheck coolant level after engine has cooled.

Filter Change:

1. Position drain pan under filter.
2. Remove oil filter.
3. Lubricate gasket of new filter with hydraulic oil.
4. Install new filter, hand tighten.
5. Start unit and check for leaks.
6. Shutdown unit then check hydraulic oil level.

Hydraulic Oil Change:

1. Position drain pan under the hydraulic reservoir (reservoir capacity exceeds 15 gallons, be sure drain pans have adequate capacity).
2. Remove drain plug from bottom of reservoir and drain oil.
3. Return used oil to a recycling center.
4. Replace drain plug using pipe sealer on threads.
5. Fill reservoir with hydraulic oil to about 3 to 4 inches from the top of the tank (approx. 15 gallons).

Strainer Screen Service:

1. Position drain pan under the hydraulic reservoir (reservoir capacity exceeds 15 gallons, be sure drain pans have adequate capacity).
2. Remove drain plug from bottom of reservoir to drain oil.
3. Replace drain plug using pipe sealer on threads.
4. Remove hose clamps and 1¼" suction hose from nipple on hydraulic reservoir tank.
5. Unscrew king nipple from street-el.
6. Unscrew strainer from tank and clean in solvent.
7. Apply pipe sealer to threads and reinstall strainer and king nipple.
8. Attach 1¼" suction hose to king nipple and tighten clamps.
9. Refill hydraulic reservoir with hydraulic oil.
10. Check for leaks.

Level Check:

1. Remove oil fill cap on top of expansion tank.
2. Cold oil level should be at the lower notch and the hot level at the upper notch in the dipstick. The cold level may also be checked by removing the cold oil level plug located to the lower left of the control panel on the rear of the machine.
3. Allow unit to cool, then add heat transfer oil as necessary. Use heat transfer oil with a minimum flash point of 475° F. C.O.C. (ISO 68)
4. Replace oil fill cap.

Oil Change:

1. Allow unit to cool to ambient temperature.
2. Approximate oil capacities are 110 gal (OJK185), and 118 gal (OJK275). Have suitable containers ready to contain oil.
3. Remove the drain plug from lower rear of unit and drain oil into drain pan(s).

NOTE: *If optional overnight heater is installed, remove to allow the oil to drain.*

4. Replace drain plug and return oil to a recycling center.
5. Remove oil fill cap and add oil to the cold fill mark on the dipstick, or until oil flows from the cold oil level plug on the rear of the machine. Use heat transfer oil with a minimum flash point of 475° F. C.O.C. (ISO 68)
6. Heat unit to normal operating temperature and verify oil is half full in the expansion tank.

Packing Adjustment, Hot Oil Pump:

NOTE: *The packing gland requires a small amount of leakage (one drop every couple minutes) for lubrication, if leakage becomes excessive, adjust only enough to stop the excessive leakage.*

1. Stop engine.
2. Tighten two nuts on adjusting plate equally to control leakage (DO NOT over tighten).
3. Start machine and check amount of leakage.
4. Readjust as necessary.

WARNING: *The proper heat transfer oil level is critical to the safe operation of this equipment. The most accurate way to check the oil level is when the unit is at operating temperature, however, extreme caution must be used since the dipstick and the oil are very hot and will cause severe burns. Wear leather gloves, eye and face protection, and other appropriate safety gear when checking the oil level.*

WARNING: *It is important that the oil level (when hot) be approximately half full in the expansion tank. Allow the unit to cool before adding oil. DO NOT allow any water or moisture to be introduced into the system.*

NOTE: *The heat transfer oil will expand approximately 10 to 15% when heated from 60°F to 400°F. Make allowance for this when adding oil to a cold system.*

NOTE: *The unit is shipped with LUBE-TECH Ace Heat Transfer Oil 68. Use this or an equivalent heat transfer oil.*

Fuel Filter Replacement:

1. Close fuel shutoff valve located at the fuel tank.
2. Remove the nut securing the canister to the fuel filter body.
3. Remove the canister and the filter element.
4. Replace the element with a new one.
5. Reinstall the canister and turn on the fuel valve.
6. Attach a clear hose to the fuel pump bleeder screw on the burner and direct the hose into a suitable container.
7. Start engine, set thermostats, then turn on the burner power switch. This will allow the fuel pump in the burner to run so the fuel system can be bled of air.
8. Loosen the bleeder screw and observe the flow of fuel through the clear hose, when all air is purged from the system close the bleeder screw.
9. Check entire fuel system for leaks.
10. Set the thermostats to the desired level and the burner will ignite.

Combustion Chamber Inspection:

1. Allow unit to cool to ambient temperature.
2. Remove six nuts and washers securing combustion chamber cover and remove cover.
3. Inspect heat transfer tubes for any signs of leaks, cracks, or deformation.
4. Using a pick or similar tool, probe the heat transfer tubes for any sign of flaking, scaling, distortion, thin metal or other deterioration.
5. Inspect insulation support clips for damage.
6. Inspect end diffuser plate for cracking or warping.
7. Inspect liner for cracks, excessive deformation, or other signs of deterioration.
8. Inspect entire combustion chamber area for any other signs of leakage, damage or fatigue.
9. Reinstall cover if no damage is found.

NOTE: *If any damage is found it must repaired before returning the unit to service. Contact Stepp Mfg. (651) 674-4491 for replacement parts.*

Combustion Chamber Liner and Heat Transfer Tube Replacement:

1. Allow unit to cool to ambient temperature.
2. Remove six nuts and washers securing combustion chamber cover and remove cover.
3. Remove the bolt that locks the hot-oil valve in the open position and close the valve.
4. Remove the heat transfer oil hose connections at the inlet and outlet of the heat exchanger. Cap the inlet and outlet ports to prevent oil spillage in the combustion chamber when the tubes are removed.
5. Remove the six bolts securing the heat transfer tubes to the combustion chamber housing.
6. Remove fuel lines and electrical connections from burner.
7. Remove four bolts from burner flange and remove burner.
8. Lift heat transfer tubes and liner from combustion chamber housing.
9. Replace any insulation that is damaged or soaked with fuel or oil. Be sure to replace only with the same type insulation. Contact Stepp Mfg. for the proper insulation.
10. Install liner into heat transfer tubes.
11. Install liner and tube assembly into the combustion chamber housing.
12. Install the six bolts securing the heat transfer tubes to the combustion chamber housing.

Liner and Heat Transfer Tube Replacement (continued)

13. Slide the liner to the end of the housing where the burner is mounted, then install the retaining clip over a tube and weld to the liner.

NOTE: *DO NOT weld on the heat transfer tubes.*

14. Install the burner on the flange and install the four bolts.
15. Reconnect the fuel lines and electrical connections to the burner.
16. Reconnect the heat transfer oil hose connections at the inlet and outlet of the heat exchanger.
17. Open the hot oil valve and lock (bolt) in the open position.

NOTE: *Operation of the burner with the valve closed will result in severe damage to the heat exchanger assembly.*

18. Reinstall the combustion chamber cover with six nuts and washers.
19. Check the heat transfer oil level and add as necessary.
20. Start the engine and allow to run for ten (10) minutes prior to igniting the burner. This will purge any air out of the heat transfer tubes before subjecting them to the heat from the burner.

Hot Asphalt Hose Replacement

⚠ **WARNING:** *Use proper PPE while perfomaning repair. Hot melted sealant is present in hose. Protect exposed skin with leather gloves, long pants, long sleeved shirt with non-melting material, and face shield*

Hose Removal:

1. Disconnect all electrical connections from hose.
2. Separate the hose from the wand at the quick coupling.
3. Remove the quick coupling from the hose and save for reuse on the new hose.
4. Unscrew the hose from the cross fitting at the end of the boom assembly.

Hose Installation:

1. Screw the hose fitting into the cross fitting at the end of the boom assembly and tighten securely.
2. Screw the quick coupling to the other end of the hose and tighten securely.
3. Reconnect all electrical connections to hose.
5. Gently heat the end of the wand with a propane torch. This will soften the material in the wand for easy insertion of the protruding hose heating element (see next step).
6. Connect the hose to the wand at the quick coupling. Use gentle pressure to insert the protruding hose heating element into the wand.

⚠ **CAUTION:** *Do not apply power to the hose heating element in an empty hose or damage to the hose will result*.

7. Bring material in tank up to operating temperature (refer to operating instructions).
8. Verify hose heating element is disconnected.
9. Activate wand and boom heat for 20 minutes or longer if needed.
10. Pump material through wand until flowing freely (refer to operating instructions).
11. Stop pump. Connect hose heating element connector. The hose is now full of material and the unit can be returned to service.

Hose Heating Element Replacement
(Functioning Element)

Hose Heating Element Removal:

These instructions assume the heating element is functioning properly. If the heating element does not function, refer to the instructions on the following pages.

NOTE: *If the hose is damaged, skip steps 1 through 3, activate wand heat for 15 minutes, then begin at step 4.*

1. Start the engine and the burner and allow the product to reach operating temperature. Activate wand heat switch. Begin circulation of material through the wand into the recirculating flange when temperatures permit. When product is circulating freely proceed to step two.
2. Turn OFF the electric wand heat. Then with wand valve open, and the wand pressure control valve in the "Wand" position, reverse the pump for two minutes to clear the hose, wand, and boom of material.
3. Shut OFF the burner and the engine.
4. Disconnect the hose heating element connector at the end of the boom.

NOTE: *The following steps must be completed with all components warm.*

5. Remove the compression fitting that holds the hose heating element at the top of the cross fitting on the end of the boom.
6. Gently pull the heating element from the cross fitting and the hose.

⚠ **WARNING**: *The heating element will be HOT, wear protective clothing, leather welding gloves, and safety gear.*

⚠ **CAUTION**: *Do not pull on the wires to remove the heating element or damage to the element may result.*

Hose Heating Element Replacement
(Functioning Element)

Hose Heating Element Installation:

1. Remove wand from hose at quick coupling.
2. Lay the hose out as straight as possible.
3. Install new compression fitting into cross fitting.

NOTE: *If hose DOES NOT contain material proceed with step 4. If hose CONTAINS material, replace step 4 with steps A & B listed below.*

4. Insert heating element into compression fitting and hose. (The heating element will protrude about 10" from the end of the hose). Tighten compression fitting.
5. Insert protruding element into wand and reattach wand to hose at quick coupling. Gently heat wand with propane torch to ease installation if needed.
6. Reconnect all electrical connections.

CAUTION: *Do not apply power the hose heating element in an empty hose or damage to the hose will result.*

7. Bring material in tank up to operating temperature (refer to operating instructions) and activate wand heat.
8. Pump material through wand until it is flowing freely (refer to operating instructions). The hose is now full of material and the unit can be returned to service.

Steps A & B

A. Connect one lead of the heating element to the large terminal of the 24V alternator, and the other lead to a good chassis ground. Use 10 gauge (minimum) jumper wires.

B. Start the engine. As the heating element heats, insert it into the hose. Start and stop the engine, or disconnect the jumper wires, as needed to regulate the heat of the element. Use only enough heat to soften the material and allow the element to be pushed into the hose. (The heating element will protrude about 10” from the end of the hose.) Tighten compression fitting.

Proceed to step 5 above.

WARNING: *The heating element will be HOT; wear protective clothing, leather welding gloves, and safety gear.*

Hose Heating Element Replacement
(Non-Functioning Element)

Hose Heating Element Removal and Installation:

These instructions assume the heating element is damaged and NOT functioning. If the heating element functions properly, refer to the instructions on the previous page. The element may be damaged during removal, rendering it useless.

A functioning hose heating element is slid into the hose alongside the non-functioning element. As the material in the hose is heated with the new element, the old element can be pulled from the hose.

1. Remove wand from hose at quick coupling. (The heating element will protrude about 10” from the end of the hose.) Gently heat wand with propane torch to ease separation if needed.
2. Disconnect the hose heating element connector at the end of the boom.
3. Remove the compression fitting nut that holds the hose heating element at the top of the cross fitting on the end of the boom. Then, remove the complete compression fitting.
4. Pull the element out and to the side far enough to allow a new element to be slid in alongside the old element.
5. Connect one lead of the new element to the large terminal of the 24V alternator, and the other lead to a good chassis ground. Use 10 gauge (minimum) jumper wires.
6. Start the engine. As the heating element heats, insert it into the hose along side the old element. Start and stop the engine, or disconnect the jumper wires, as needed to regulate the heat of the element. Use only enough heat to soften the material and allow the element to be pushed into the hose.
7. Pull the old heating element from the cross fitting and the hose.
8. Secure new heating element in compression fitting, then reconnect electrical connector.
9. Insert protruding hose element into wand and reattach wand to hose at quick coupling. Gently heat wand with propane torch to ease installation if needed.

WARNING: *The heating element will be HOT, wear protective clothing, leather welding gloves, and safety gear.*

Wand & Boom Heating Element Replacement

Wand & Boom Heating Element Removal and Installation:

These instructions assume the heating element is damaged and not functioning. The element may be damaged during removal rendering it useless.

A functioning heating element is slid into the wand or boom along side the non-functioning element. As the material is heated with the new element, the old element can be pulled from the wand or boom.

1. Remove wand from hose at quick coupling. About 10" of the hose heating element protrudes out the hose and into the wand. Gently heat wand with propane torch to ease separation if needed.
2. Remove the compression fitting nut that holds the heating element in the wand or boom, then remove the complete compression fitting.
3. Pull the element out and to the side far enough to allow a new element to be slid in along side the old element.
4. Connect one lead of the new element to the large terminal of the 24V alternator, and the other lead to a good chassis ground. Use 10 gage (minimum) jumper wires.
5. Start the engine, as the heating element heats, insert it along side the old element. Start and stop the engine, or disconnect the jumper wires, as needed to regulate the heat of the element. Use only enough heat to soften the material and allow the element to be pushed into the wand or boom.
6. Pull the old heating element from the wand or boom.
7. Secure new heating element in compression fitting, then reconnect electrical connector.

WARNING: *The heating element will be HOT, wear protective clothing, leather welding gloves, and safety gear.*

NOTE: *An alternate method is to remove all insulation from the wand or boom., then heat as needed with a torch to soften the material allowing removal and installation of the heating element.*

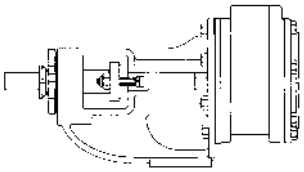
TROUBLESHOOTING

	POSSIBLE CAUSE	*Items to Check /Service*
LACK OF PERFORMANCE	Plugged Strainer Screen	Service strainer screen
	Hydraulic Filter Plugged	Replace hydraulic oil filter
	Collapsed Suction Hose	Replace suction hose and service strainer screen
	Air Leak in Suction Hose	Replace hose
	Low Fluid Level	Fill reservoir to proper level
	Overheated Hydraulic Fluid	Clean oil cooler fins with pressurized water
	Worn Pump or Hydraulic Motor	Adjust, rebuild, or replace as necessary
	Crushed Hydraulic Lines	Replace line
	“Brand” valve relief out of adjustment	Adjust relief on “Brand” valves to 1000 lbs.
HYDRAULIC MOTORS DO NOT TURN OR TURN SLOWLY	Product in Tank not Melted	Allow for more time for product to melt
	Foreign Material Jamming Agitator	Remove foreign material from agitator
	Foreign Material Jamming Product Pump	Remove foreign material from product pump
	Also see “Lack of Performance”	
UNUSUAL NOISES	Low Hydraulic Fluid	Fill reservoir to proper level
	Air Leak in Suction Hose	Replace hose
	Damaged Pump or Hydraulic Motors	Repair or replace as necessary
EXCESSIVE OIL LEAKS FROM PUMP OR HYDRAULIC MOTOR SHAFT	Bad Shaft or Shaft Seal	Replace as necessary

	POSSIBLE CAUSE	*Items to Check /Service*
PRODUCT PUMP DOES NOT TURN	Product in Tank not Melted	Allow more time for product to melt
	Safety Interlock	Allow material to reach 275° on product and hose thermostat
	Pump Motor not Functioning	Refer to "Hydraulic System" troubleshooting
LACK OF FLOW FROM WAND	Product Temperature too Cold.	Heat product to manufacturers recommended temperature
	Product "Froze" in Wand & Hose	Allow additional time for heating element to melt product in hose
	Non-functioning Heat Element in Hose	Refer to "Electric Wand & Hose" troubleshooting
	WPC Valve not Positioned Correctly	Refer to operating instructions for WPC Valve position
	WPC Valve and External Plumbing "Froze"	Heat to remelt product
	Worn Product Pump	Adjust or repair product pump as necessary

TROUBLE SHOOTING

Product Pump



Lack of flow from wand.

Check for rotation of product pump.

No Rotation → **Engage pump control and observe engine RPM.**

Little or no change in RPM → **Refer to hydraulic system trouble Shooting.**

Rotation → **Check that the pump control is in the "Pump" position and not "Reverse".**

Definite RPM drop → **Check that the product is at working Temperature.**

CAUTION: *Product repeatedly heated beyond manufacturer's recommended heating cycles will harden and be difficult or impossible to remove from machine.*

Electric wand & hose heat on. Allow 30 to 40 minutes to heat.

Little or no heat in wand or hose → **Refer to electric wand & hose troubleshooting.**

Wand & hose hot → **Position WPC valve toward "Wand" position and observe engine RPM's.**

Little or no change in RPM → **Check for loose pump pick-up tube and that tube is in product**

Definite RPM drop → **Indicates a plugged/ frozen wand or hose; allow addi- tional time for heat- ing elements to work. Also check for a plugged valve or nozzle at the end of the wand, or fro- zen plumbing next to WPC valve. Heat if necessary.**

Check pump packing for excessive leakage.

Excessive Leakage → **Adjust packing per Mfg. instructions.**

No Excessive Leakage → **Adjust pump end clear- ance per Mfg. instructions.**

Lack of flow from wand → **Rebuild or replace as necessary.**

Normal flow from wand → **System functioning properly; return unit to service.**

Normal flow from wand → **System functioning properly; return unit to service.**

No heat, or low heat in wand or hose.

With engine OFF, Check for loose pulleys and loose or missing belts on 24 volt alternator.

Start engine, with wand switch OFF check voltage at battery terminal of 24 volt alternator.

9 volts or less → Check for a dead battery, then check for an open resister or open wires from battery to alternator, or a shorted wire between the alternator and control panel switch and alternator and battery

24 to 28 volts

12 to 14 volts → Repair or replace alternator

With engine running, turn wand switch ON, check voltage at battery terminal of 24 volt alternator.

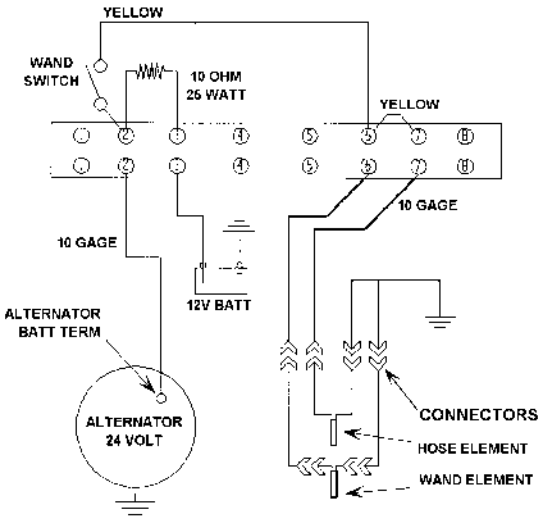
9 volts or less → Check for "short" between switch and heating elements. Alternately disconnect the wires to the hose and wand heating elements, when the voltage goes to 24 - 28 volts you have located the "shorted" circuit.
Check element resistance as follows:

15' hose element: .4 to 1.0 W.
20' hose element: .5 to 1.2 W.
Wand element: .9 to 1.6 W.

Repair or replace as necessary.

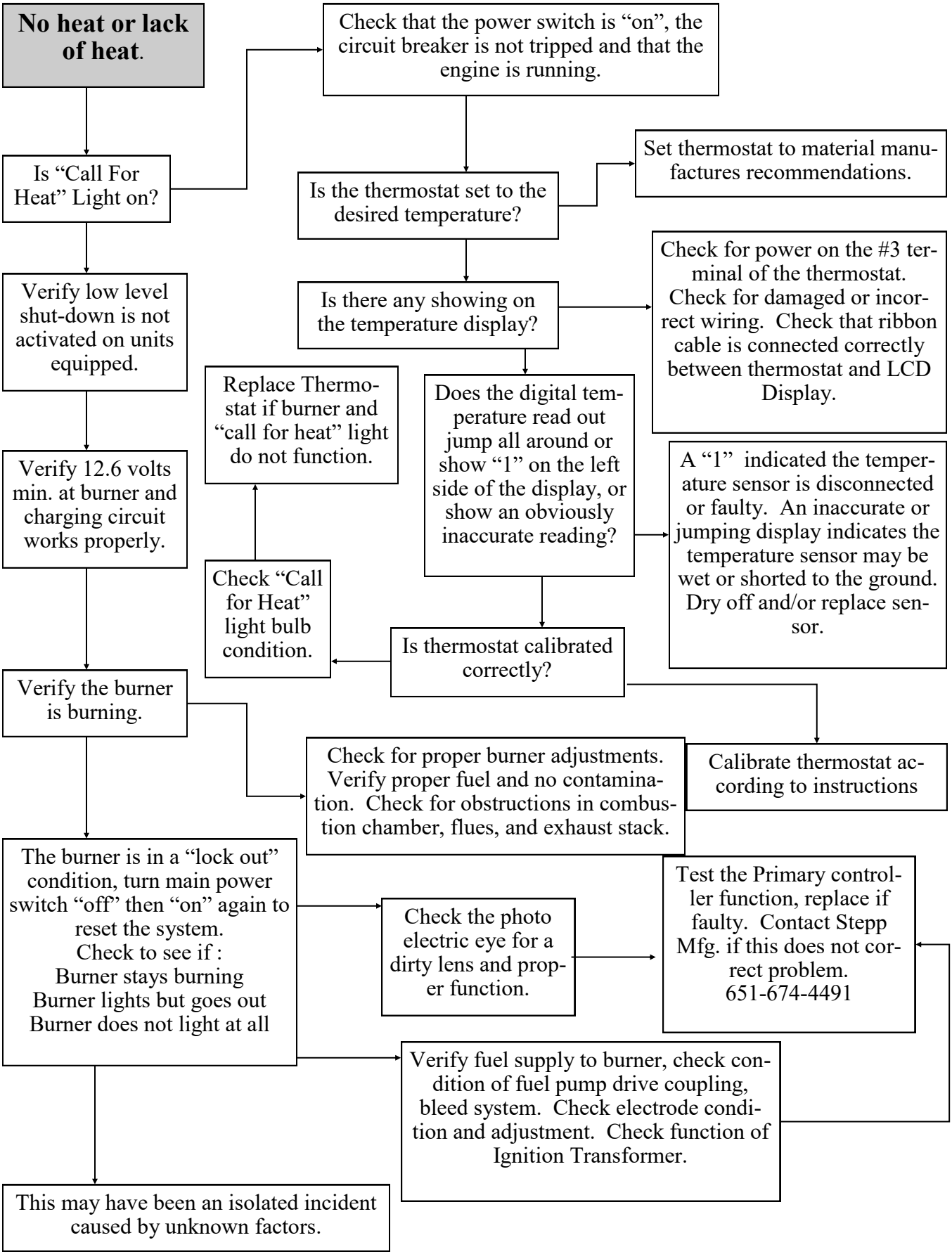
24 to 28 volts

Check heating elements for an "open" condition. Check for faulty switch. Check for broken wires or loose connections from alternator to switch, and switch to heating elements.

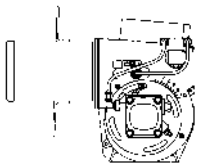


TROUBLE SHOOTING

Diesel Burner



Primary Controller Burner MTD/Hard Wired



NOTE: *The primary controller can be bench tested for proper operation using an automotive type, 12 volt battery as a power source. Refer to the wiring schematics for wire identification.*

1. Remove controller from burner. Mark all wires for proper reassembly.
2. Using two test lights, or volt meters, connect one to the blue wire, and one to the white/orange wire of the controller. Connect the black leads of your test instruments to the negative (-) terminal of the battery.
3. Connect the black wire from the controller to the negative (-) terminal of the battery.
4. Connect the red, white/red, and the white wires together, then connect these three wires to battery (+) terminal. Both test instruments should show voltage for approximately 15 seconds. After 15 seconds, the controller should "lock out" and no voltage will be present.
5. Repeat step #4, only this time connect the two yellow wires from the controller together three seconds after applying power to the three wires of the controller. (This simulates the controller receiving a "flame" signal from the photo electric eye). The white/orange wire should show voltage as long as the controller is hooked to the battery. The blue wire should only show voltage for about 15 seconds. Replace the controller if it fails any of these tests.

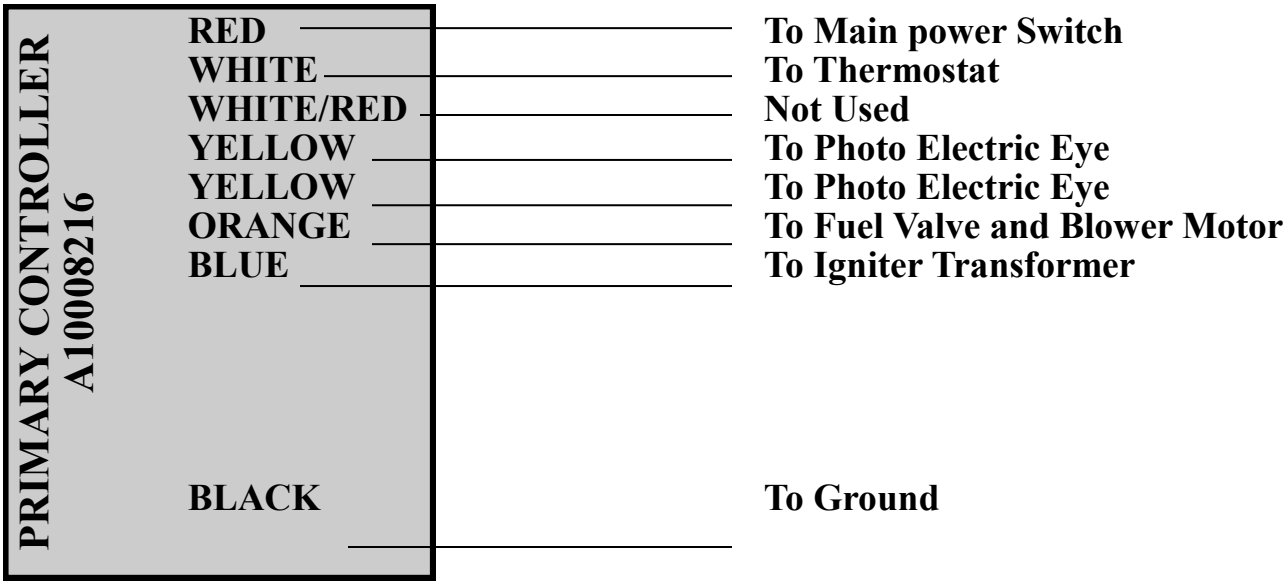
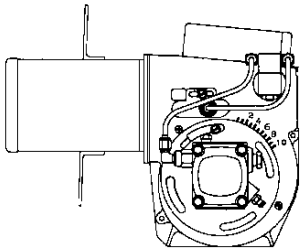


Photo Electric Eye



NOTE: *The Photo Electric Eye can be bench tested for proper operation using an ohm meter. Assure the lens of the Photo Electric Eye is clean prior to testing.*

1. Block off all light to the Photo Electric Eye. Test across the leads with your ohm meter; you should get an infinite resistance reading (a lot of resistance).
2. Point the Photo Electric Eye at a light source, the brighter the light, the less resistance your ohm meter will show. **CAUTION:** *Replace the Photo Electric Eye if it does not respond in this way.*

Fuel Valve

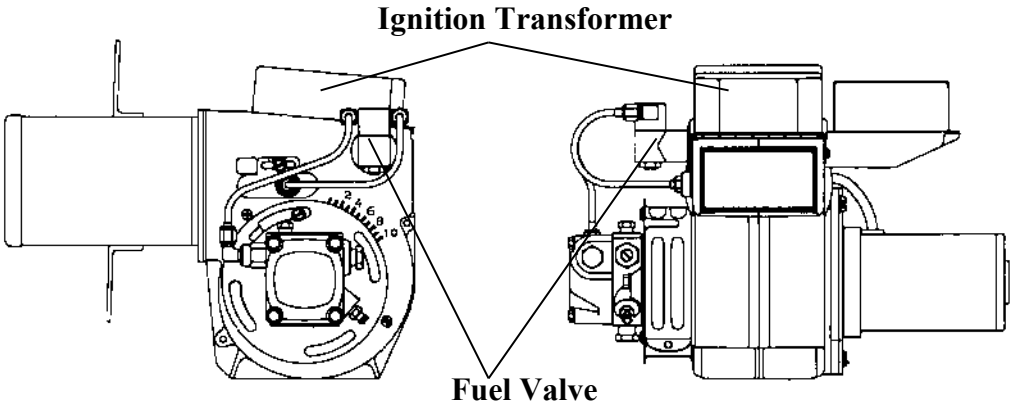
NOTE: *The Fuel Valve can be bench tested for proper operation using an automotive type 12 volt battery as a power source.*

1. Disconnect the two leads and remove the fuel lines from the fuel valve.
2. The valve should be closed when no power is available.
3. Apply 12 volts to the two leads and the valve should open. **CAUTION:** *Replace the fuel valve if it does not respond in this way.*

Ignition Transformer

WARNING: *Shock hazard, high voltage up to 20,000 volts.*

1. Assure that 12 volts is being supplied to the transformer during the ignition cycle. (Refer to the Primary Controller tests.)
2. Check electrode condition and adjustment. Replace or adjust as necessary. **CAUTION:** *Replace ignition transformer if unit won't produce sparks.*



VIKING PUMP

Symptoms Of Internal Gear Pump Failure And Items To Check

CAUSE		SYMPTOM	Hydraulic:					Mechanical:					
			Pump turns, but no flow	Low capacity	Pump will not develop sufficient pressure	Pump develops too much pressure	Pump no longer self-priming	Pump won't turn / motor stalls	Pump runs noisy / excessive vibration	Pump runs hot	Frequent seal failures	Packing has short life	Excessive wear of the pump internals
SYSTEM	NPSHa not sufficient		x	x					x		x		x
	Air leaks into pump		x	x	x		x		x		x		x
	Pump has run dry		x	x	x		x		x		x	x	x
	Liquid temperature higher than expected			x	x			x		x	x		
	Viscosity higher than expected					x	x	x	x	x	x		
	Pump running too fast for application			x		x		x	x	x	x	x	x
	Abrasives present/parts not hardened			x			x				x	x	x
	Suction or differential pressure too high										x		x
	Suction valve not open		x						x				
	Suction valve partially open			x	x				x				
	Discharge valve not open		x			x		x					
	Clogged strainer		x	x	x				x				
	Supply tank empty		x								x		x
PUMP	Incorrect rotation		x										
	Incorrect head placement		x	x	x								
	Wrong clearance setting for application		x	x	x		x	x		x			x
	Worn pump internals		x	x	x		x	x	x			x	
	Packing gland too tight/skewed							x		x		x	x
	Improper seal installation										x		
	Inadequate lubrication									x	x	x	x
	Relief valve improperly set			x	x	x				x			
	Relief reversed					x							
	Material compatibility problems										x		x
	Incorrect speed (lower speed)		x	x									
	Bad bearings (thrust bearing)								x		x		
DRIVE	Drive misalignment							x	x	x	x	x	x
	Base or equipment not secured								x				
	Drive incorrectly sized for h.p. requirement				x			x					

Causes Of Internal Gear Pump Failure In Detail

NPSHa Not Sufficient - Pump cavitating due to inadequate suction side pressure. Buildup in suction lines, partially closed inlet valves, dirty strainers, or an increase in liquid viscosity are all potential causes.

Air Leaks Into Pump - Pump pulling in air through a loose fitting or in a vortexing tank. Causes a cavitation-like noise.

Pump Has Run Dry - Gear pumps that are frequently run dry will exhibit increased wear and seal problems.

Liquid Temperature Higher Than Expected - Increases in temperature much beyond what the pump was specified to handle can fail seal elastomers, cause pins and bushings to lose their interference fits, or seize the pump.

Viscosity Higher Than Expected - Rotor and shaft materials, seals, and clearances are viscosity limited and may cause failures if not checked and adjusted. Viscosity increases can also cause NPSH problems (watch for cold startups).

Pump Running Too Fast - Increases in speed increase the pump's NPSH requirement and line losses on both sides of the pump. This will also increase the HP requirement.

Abrasives - Abrasive applications need to be run with slow pumps with hardened parts.

Incorrect Rotation - Usually causes no damage, but can blow out lipseals in the 75 series models.

Incorrect Head Place - In relation to the crescent, can cause no flow or only partial flow. Easy to check, but often overlooked.

Wrong Clearance - Tight clearances raise the HP requirement, but boost the pump's capacity. Make sure that they are set properly for the viscosity and the temperature. High temperatures can seize incorrectly set pumps.

Worn Internals - Worn parts cause the pump to lose capacity. Wear in one area can cause wear in others.

Tight Packing Gland - Over-tightened packing can wear the shaft causing increased weeping. This in turn can cause a customer to further tighten the gland perpetuating this problem. Packing requires some weeping for lubrication. Without this lubrication the pump will run hot and the HP requirement will increase.

Improper Seal Installation - Often seal failures can be linked to improper installation. The stationary face should be checked for eccentric or uneven wear patterns.

Inadequate Lubrication - Causes increased wear and frictional heat.

Relief Valve Setting - Valve needs to be set to full-bypass pressure. A valve that is consistently bypassing will cause lower than expected capacity and a heat rise over time.

Relief Valve Reversed - Needs to be checked twice. A reversed RV seems to work fine until overpressure occurs. The valve cap should face toward the suction port.

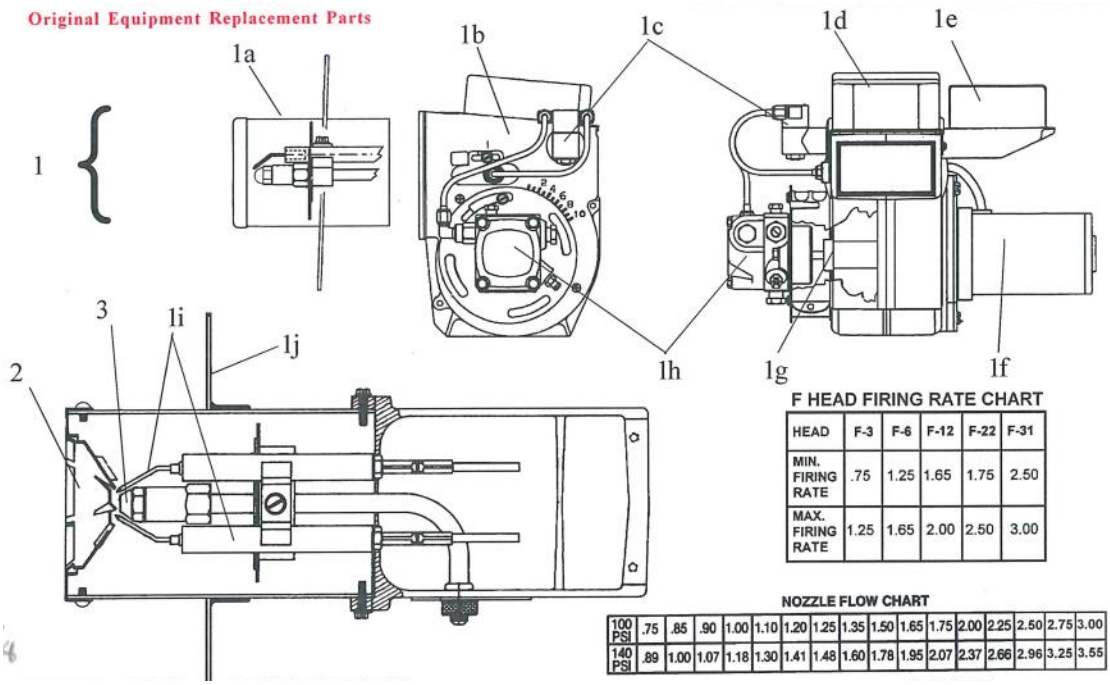
Material Corrosion - Causes pitting type wear or seal leaking due to incompatible elastomers.

Drive Problems - Just as critical as pump and system problems and easy to check. Make sure that V-belt driven units are not too tight and have adequate shaft support.

Vacuum and Pressure Gauges - Installing a vacuum gauge in the suction port and a pressure gauge in the discharge port can be the fastest way to diagnose system problems. The readings will give a clue where to start looking for the trouble. Refer to TSM000 for additional information.

 Printed in U.S.A. 10/2008 **Form No. 576**

REPLACEMENT PARTS



F HEAD FIRING RATE CHART

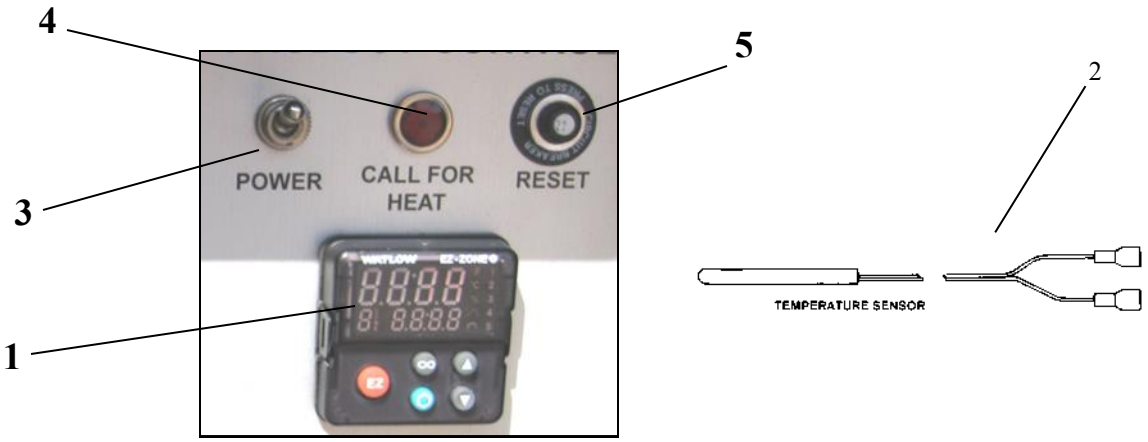
HEAD	F-3	F-6	F-12	F-22	F-31
MIN. FIRING RATE	.75	1.25	1.65	1.75	2.50
MAX. FIRING RATE	1.25	1.65	2.00	2.50	3.00

NOZZLE FLOW CHART

100 PSI	.75	.85	.90	1.00	1.10	1.20	1.25	1.35	1.50	1.65	1.75	2.00	2.25	2.50	2.75	3.00
140 PSI	.89	1.00	1.07	1.18	1.30	1.41	1.48	1.60	1.78	1.95	2.07	2.37	2.66	2.96	3.25	3.55

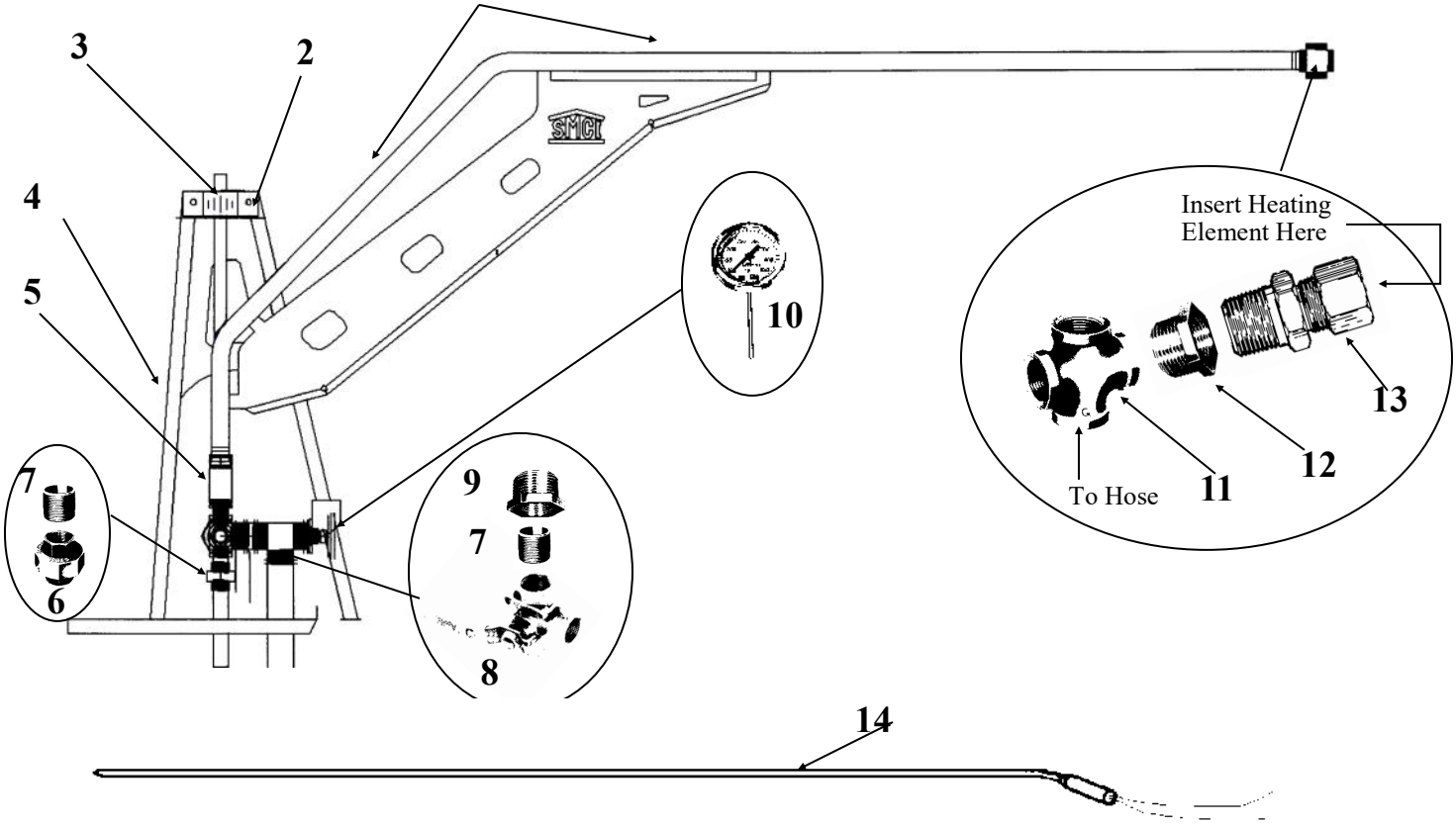
ITEM	QTY	DESCRIPTION	PART#
1	1	Burner assembly w/ Primary Control (less fuel retention head and nozzle)	A10008215
1	1	Burner assembly, complete w/ fuel retention head and nozzle	A10008105
1a	1	Air Tube	509070
1b	1	Photo electric eye (under ignition transformer)	
		-With Connectors	A10007678
		-Without Connectors	P10007720
1c	1	Valve, fuel control	509091
1d	1	Ignition Transformer	509087
1e	1	Primary Controller	P10001034
		-Weather Pack/Weather Pack	A10007216
		-Weather Pack/CPC New Style	A10008216
1f	1	Motor, blower	509092
1g	1	Coupling, pump to motor	509086
1h	1	Pump, burner fuel	509094
**	1	Pump, burner fuel– Internal Fuel Shut-off Valve	509109
1i	1	Electrode, igniter set	509089
1j	1	Mounting Flange	509071
**	1	Blower Fan Wheel	509069
2	1	Fuel retention head, F31 (for 2.5 to 3.0 gph)	P10005133
**	1	Fuel Filter Element	509078

** Not Shown
Note: Indented item numbers with letter suffix are included with preceding item number.
Nozzle GPH rated at 100 psi. Match nozzle and fuel retention head with that installed.



ITEM	QTY PART#	DESCRIPTION	
1	-	Thermostat, Watlow 0-550°, EZ 12V	EZ-ZONE– P10003540
2	-	Sensor, RTD Watlow 0-550°	A10001017
3	-	Switch– SPST Toggle ON/OFF	P10000180
**	-	Switch– ON/OFF/ON	P10002877
4	-	Light– Call For Heat 12V	P10000181
**	-	Hour Meter	P10002722
5	-	20 Amp Breaker	P10000179

** Not Shown



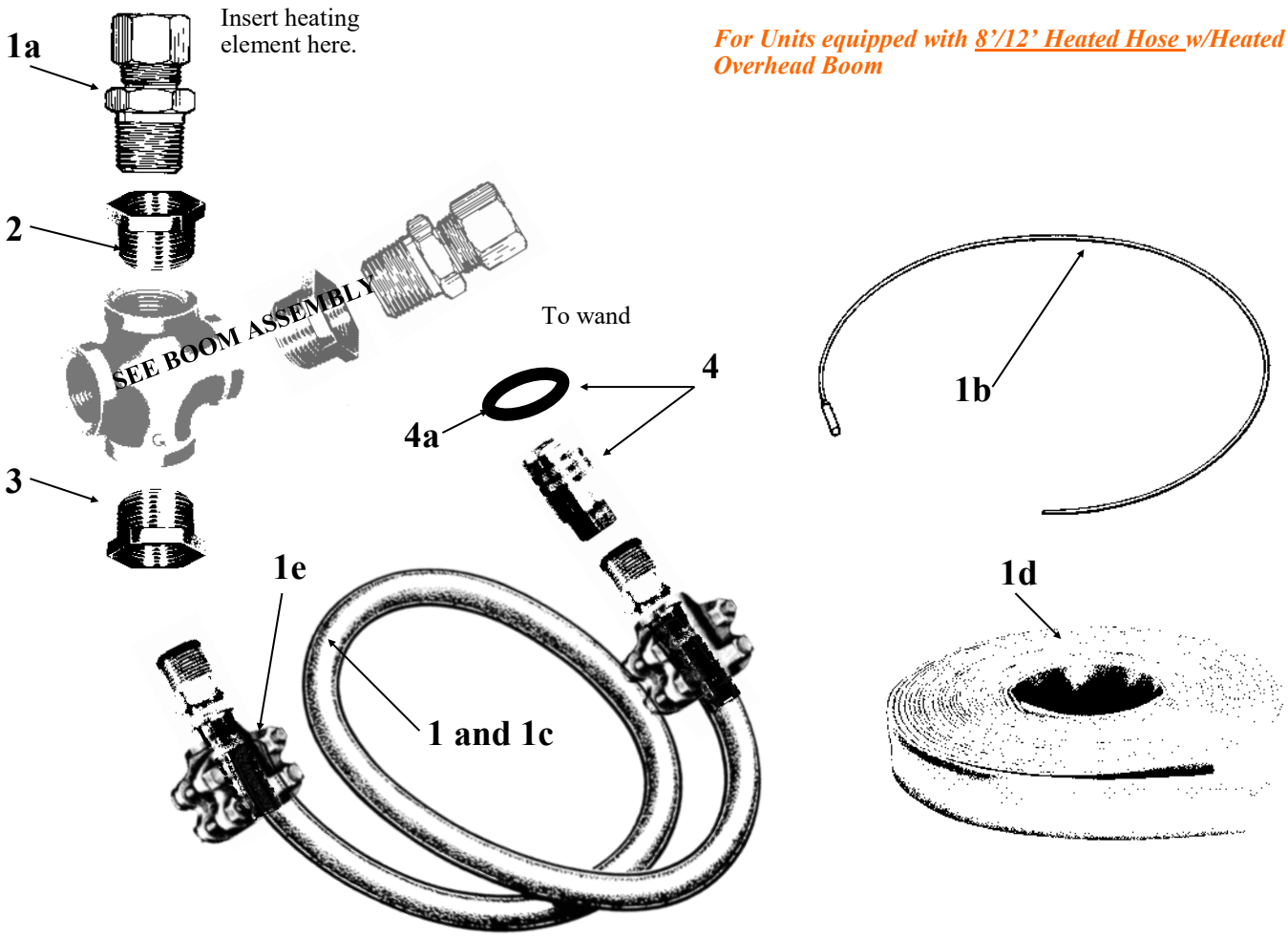
ITEM	QTY	DESCRIPTION	PART #
1	1	Boom	901280
2	1	Latch, boom transport and safety	901283
3	1	Support bearing	502006
4	1	Boom support (OJK 75 & 120)	901281
5	1	Boom swivel	520007
6	1	Union, 3/4"	513202
7	2	Nipple, 3/4" close	513211
8	1	Valve, 3-port WPC, 3/4"	517022
9	1	Bushing, reducing 1" x 3/4"	513706
10	1	Thermometer, 550 F. with 6" stem	516001
11	1	Cross Fitting	513254
12	1	Bushing, reducing 1" x 3/8"	513709
13	1	Compression Fitting 3/8"	520232
14	1	Heating Element, boom, includes *pre-wired connector	526112
*	9 ft.	Inner Insulating for boom (specify length, priced per foot)	511007
*	8 sq. ft.	Outer Alumagard wrap for boom (specify length, priced per sq. foot)	511008
*	1	Wire Harness, boom	526115

* - Not Shown

Note: Illustrations are for parts identification only. Illustrations may not represent actual parts.

REPLACEMENT PARTS

8’ / 12’ Heated Hose



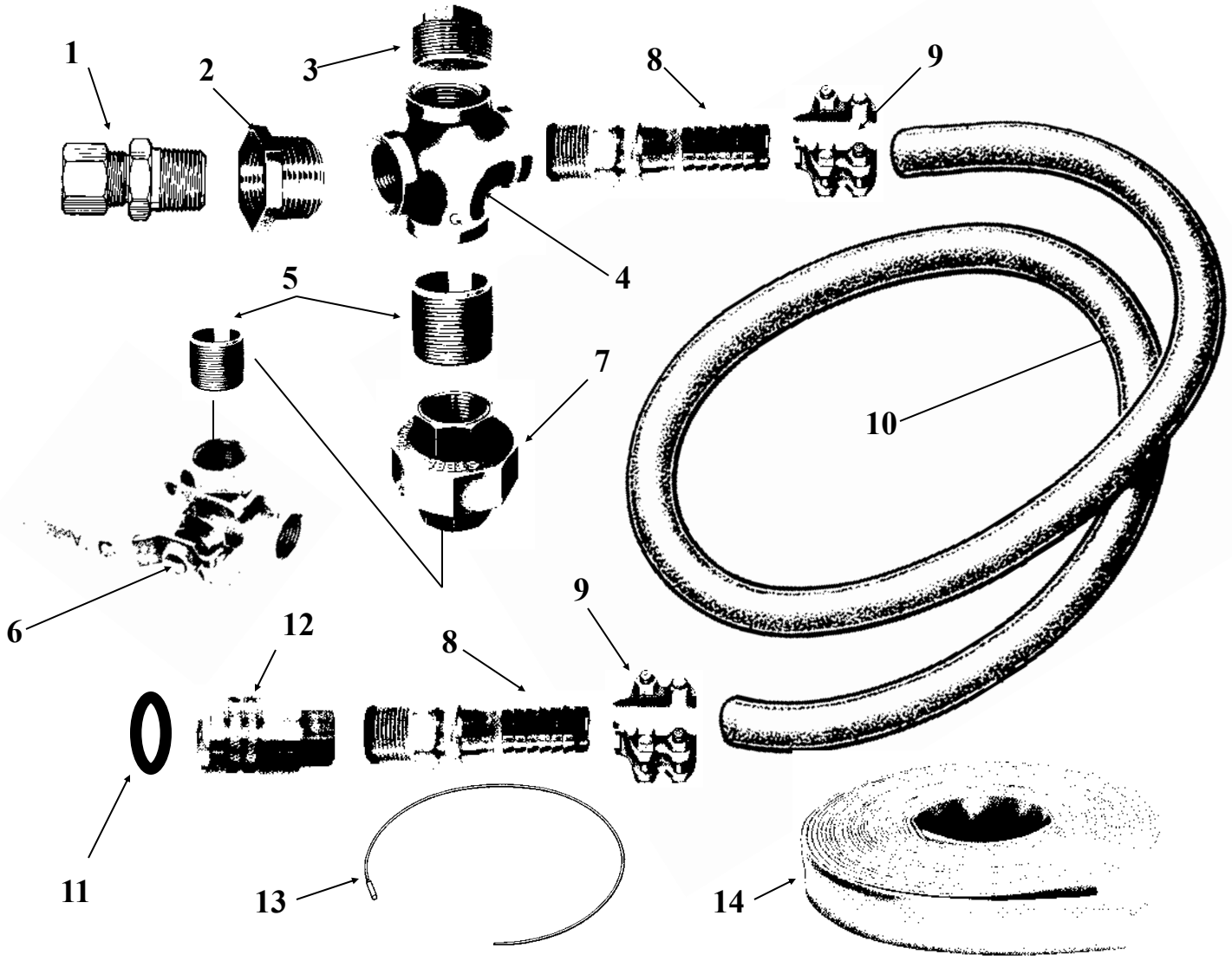
For Units equipped with 8’/12’ Heated Hose w/Heated Overhead Boom

ITEM	QTY	DESCRIPTION	PART #
1	1	8' Hose Assembly with heating element	523089
	1	12' Hose Assembly with heating element	523093
1a	1	Compression Fitting 3/8"	520232
1b	1	8' Heating element, for hose, includes **connector	526112
	1	12' Heating element, for hose, includes **connector	526120
1c	1	8' Hose Assembly, less heating element	523088
	1	12' Hose Assembly, less heating element	523092
1d	AR	Safety Jacket, specify length	523080
1e	2	Clamp assembly (torque bolts to 21 ft. lbs.)	523087
**	1	Wire Harness & Connectors (in hose jacket)	Call
2	1	Bushing, reducing	513709
3	1	Bushing, reducing	513706
4	1	Quick Coupling, female	510003
4a	1	Seal, quick coupling	509999

** - Not Shown

REPLACEMENT PARTS

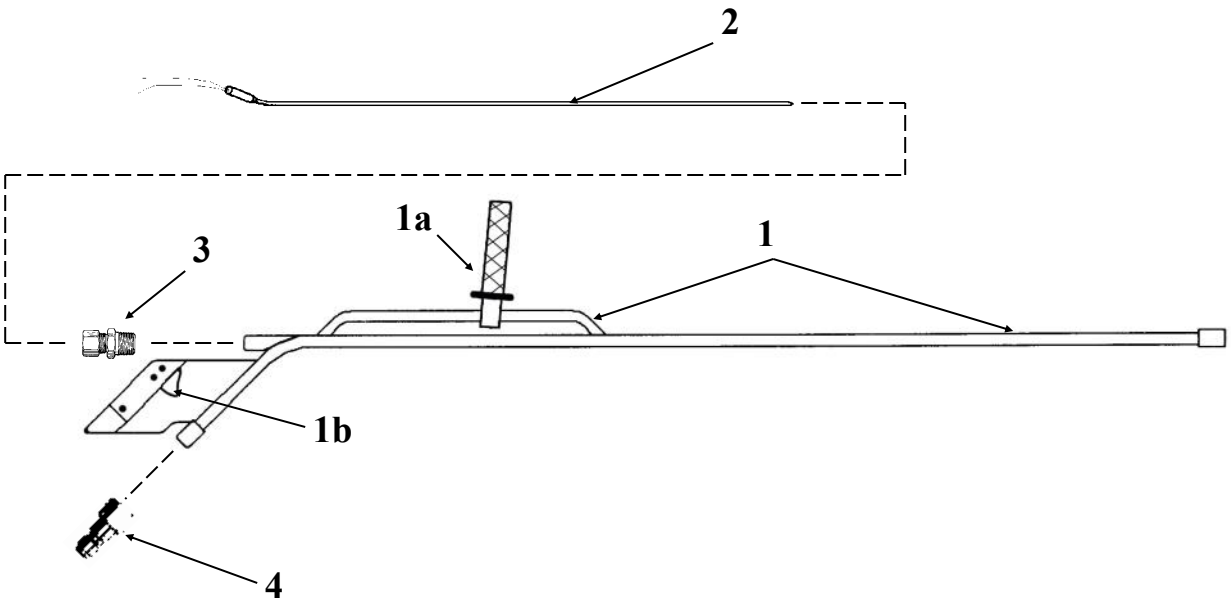
15' / 20' HEATED HOSE



ITEM	QTY	DESCRIPTION	PART #
1	1	Compression Fitting assembly	523260
2	1	Bushing, reducing	513701
3	1	Plug	513208
4	1	Cross Fitting	513203
5	2	Nipple, close	513211
6	1	Valve, 3-port WPC	517022
7	1	Union	513202
8	2	Hose End	523084
9	2	Clamp assembly	523087
10	-	Hose only, specify 15 or 20 ft.	523083
11	1	Seal, quick coupling	509999
12	1	Quick Coupling, female	510003
13	1	Heating element, 15 ft.	526072
		Heating element, 20 ft.	526073
14	-	Safety Jacket, specify 15 or 20 ft.	523080
**	1	Hose Assembly Complete, 15 ft. (includes items 1-5, 7-10, 13-14)	523085
**	1	Hose Assembly Complete, 20 ft. (includes items 1-5, 7-10, 13-14)	523086
**	1	Hose Assembly, 15 ft. (less heating element, includes items 8-10, 14)	523081
**	1	Hose Assembly, 20 ft. (less heating element, includes items 8-10, 14)	523082

** - Not Shown. Specify with or with out pump saver option.

Note: Illustrations are for parts identification only. Illustrations may not represent actual parts.



ITEM	QTY	DESCRIPTION	PART #
1	1	Wand assembly , LONG Trigger Style	204056
	1	Wand assembly, SHORT Trigger Style	204058
1a	1	Handle, Adjustable Slide	520022
1b	1	Switch, Trigger	526116
**		Wire Harness, Ultra-Lite Wand	Call
2	1	Heating Element, LONG Style	526113
	1	Heating Element, SHORT Style	526118
3	1	Compression Fitting, LONG Style 1/2”	523260
	1	Compression Fitting, SHORT Style 3/8”	520232
4	1	Quick coupling, Male Half	510002
**	1	Ball Valve w/Handle 1/2” , SHORT Style only	517047

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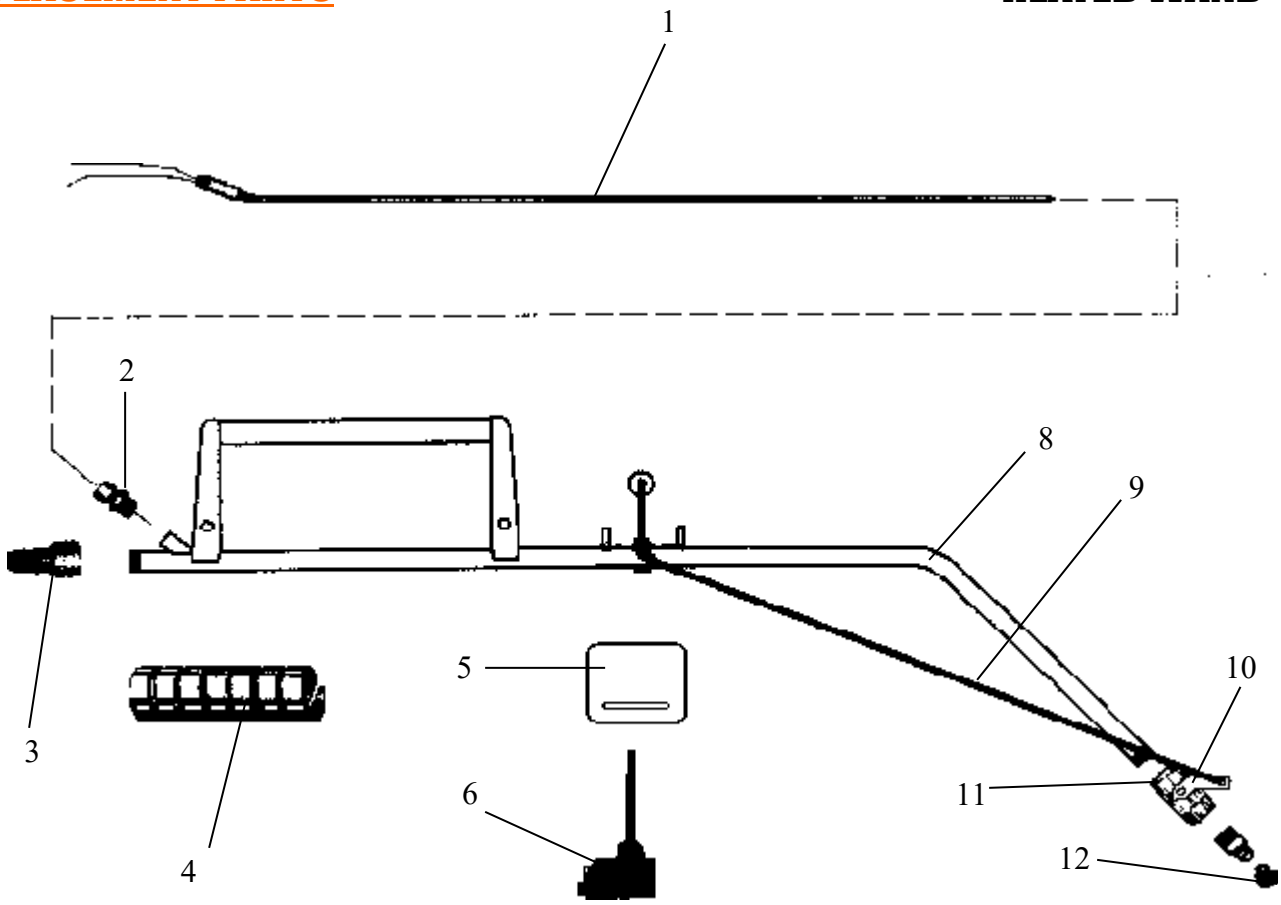
HEATED WAND



ITEM	QTY	DESCRIPTION	PART #
1	1	Heating Element	526074
2	1	Compression Fitting	523260
3	1	Quick Coupling, male	510002
4	10 ft.	Insulating Wrap, wand	520114
5	1	Mounting Bracket, switch (pump saver option only)	Call
6	1	Switch, pump saver (pump saver option only)	526057
7	1	Control Handle, for steel wand	Call
	1	Control Handle with bushing, for aluminum wand	Call
8	1	Steel Spray Wand Assembly (includes items 4, 7-9)	Call
	1	Aluminum Wand, light weight, optional (includes items 4, 7-9)	Call
9	1	Actuating Rod	Call
10	1	Lever, valve	Call
11	1	Valve	517006
12	1	Spray Nozzle, ¼U9508	520060

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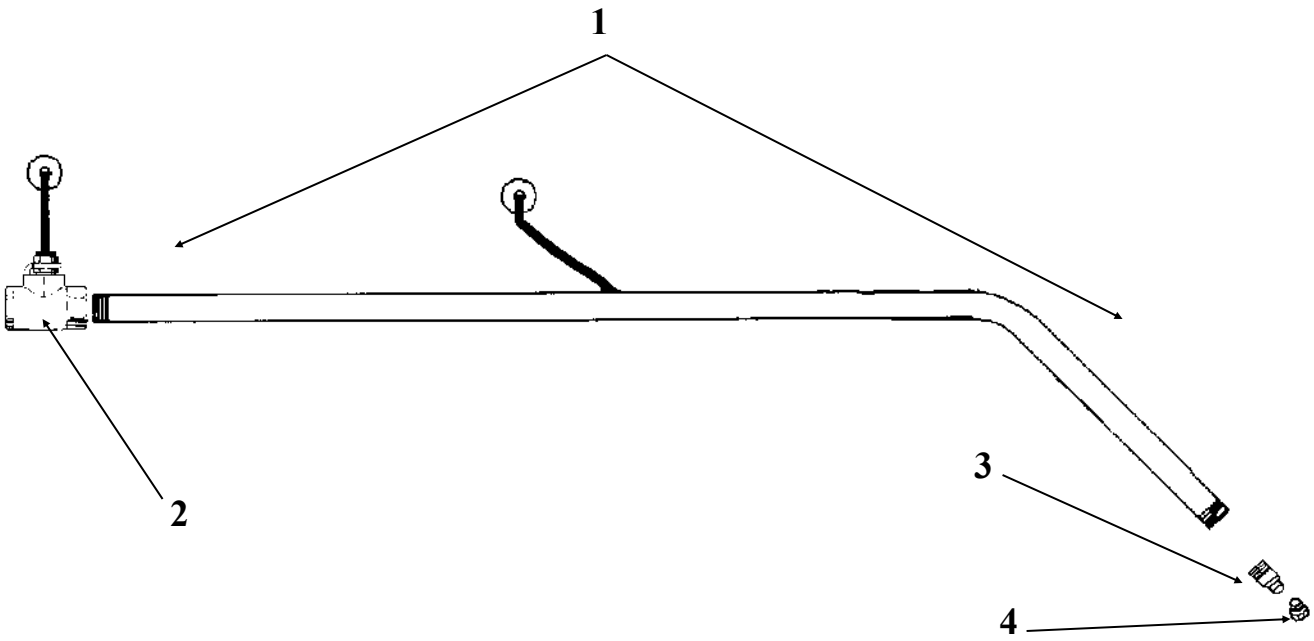

ITEM	QTY	DESCRIPTION	PART #
1	1	Wand assembly complete, steel (Includes items 1 - 4)	204004
	1	Wand assembly complete, light weight aluminum (Includes items 1 - 4)	204026
2	1	Valve	517006
3	1	Coupling	513809
4	1	Spray Nozzle, 9508	520060

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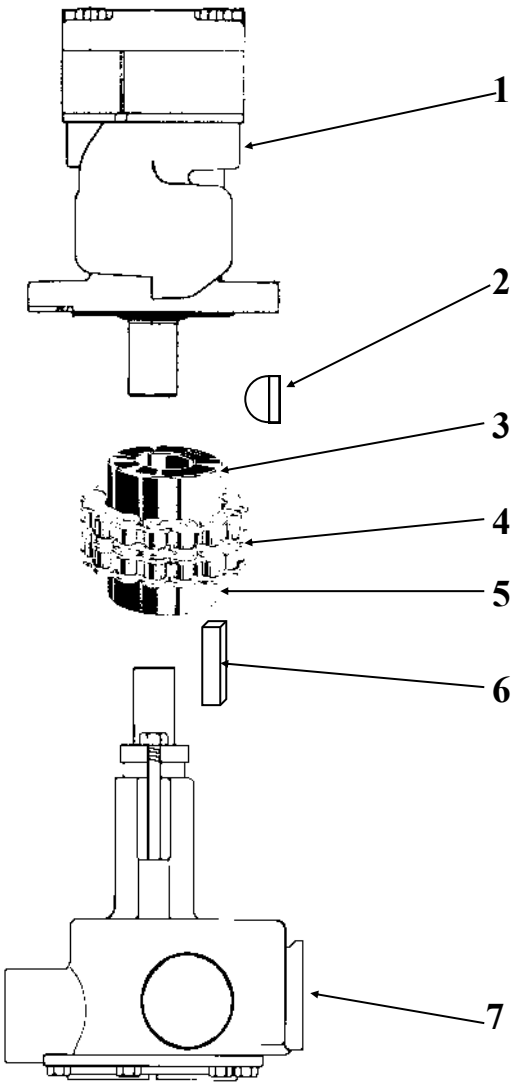
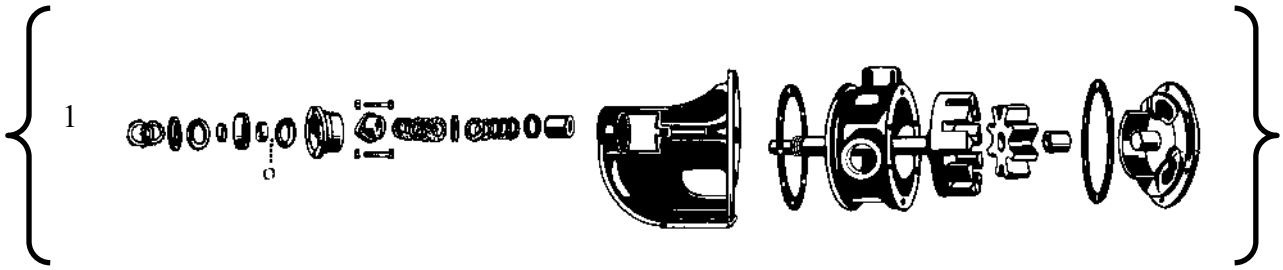


ITEM	QTY	DESCRIPTION	PART #
1	1	Motor, Hydraulic	Call
2	1	Woodruff Key, ¼" × 1"R	522048
3	1	Chain Coupling Half, 1" bore	P10004555-004
4	1	Coupling Chain, 4016	P10004556
5	1	Chain Coupling Half, 1 1/8" bore	P1000455-005
6	2	Drive Key, 1/4x1/4	P10002019
7	1	Product Pump K124A L/RV	515081

Note: Illustrations are for parts identification only. Illustrations may not represent actual parts.



ITEM	QTY	DESCRIPTION	PART#
1	1	Oil Pump, K124A Less RV	515081

Call for Pump break down on parts.

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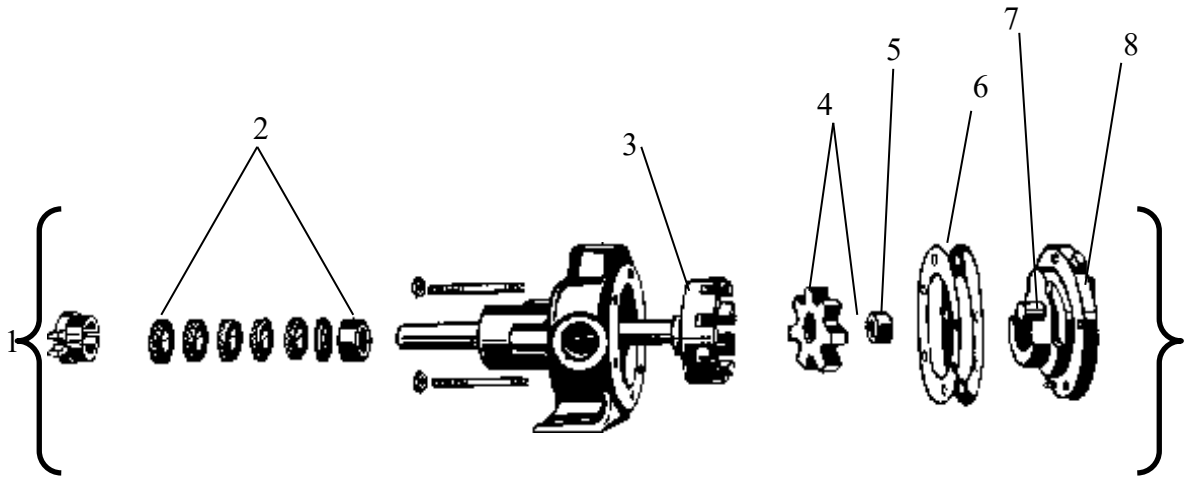

ITEM	QTY	DESCRIPTION	PART#
1	1	Oil Pump, complete	515063
2	5	Packing seal, shaft	515019
3	1	Rotor and Shaft	515031
4	1	Idler with bushing	515015
5	1	Bushing	515053
6	1	Gasket set, head - (for setting end clearance)	515016
7	1	Idler Pin	515052
8	1	Head (includes # 6)	515028

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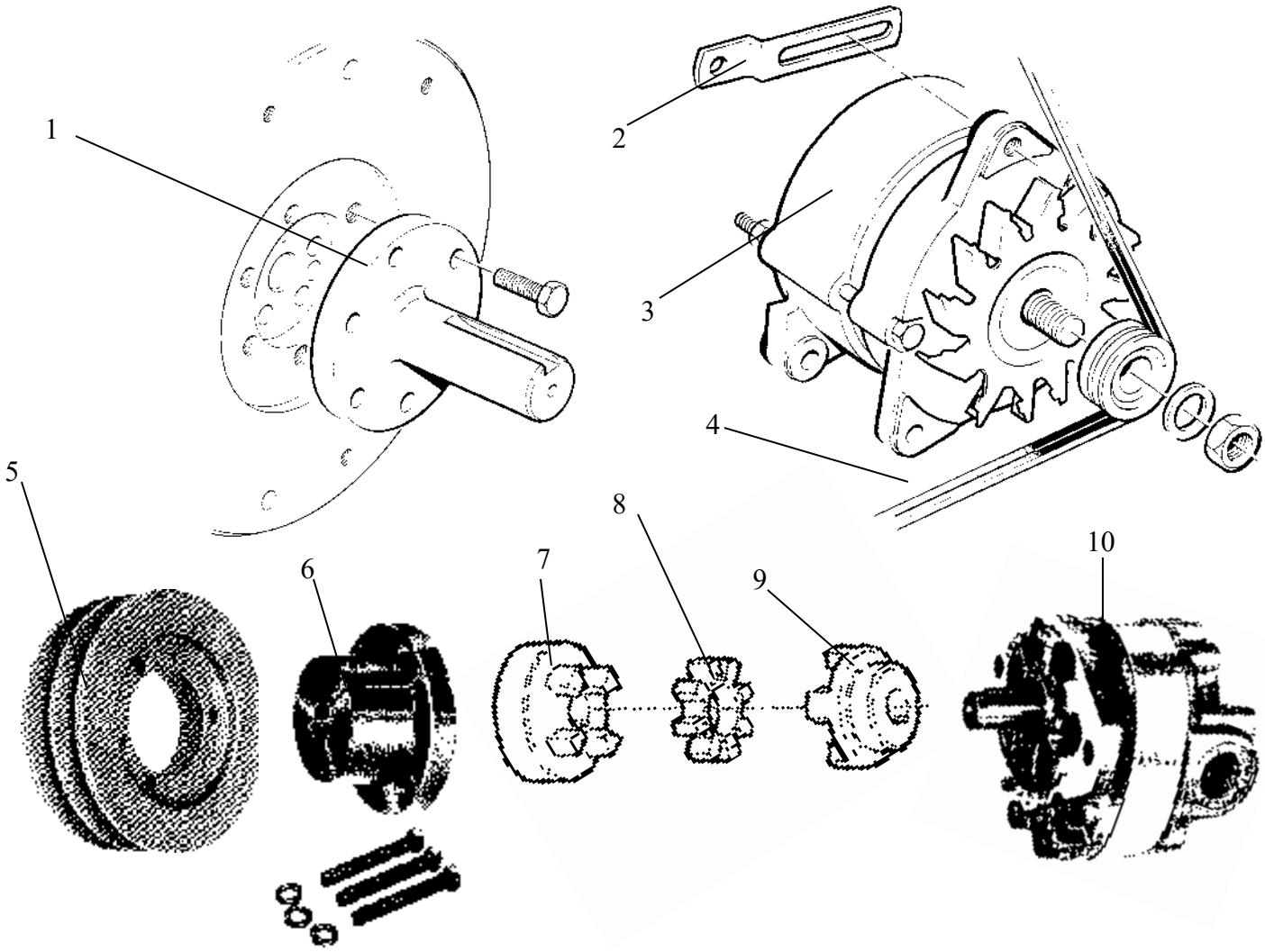
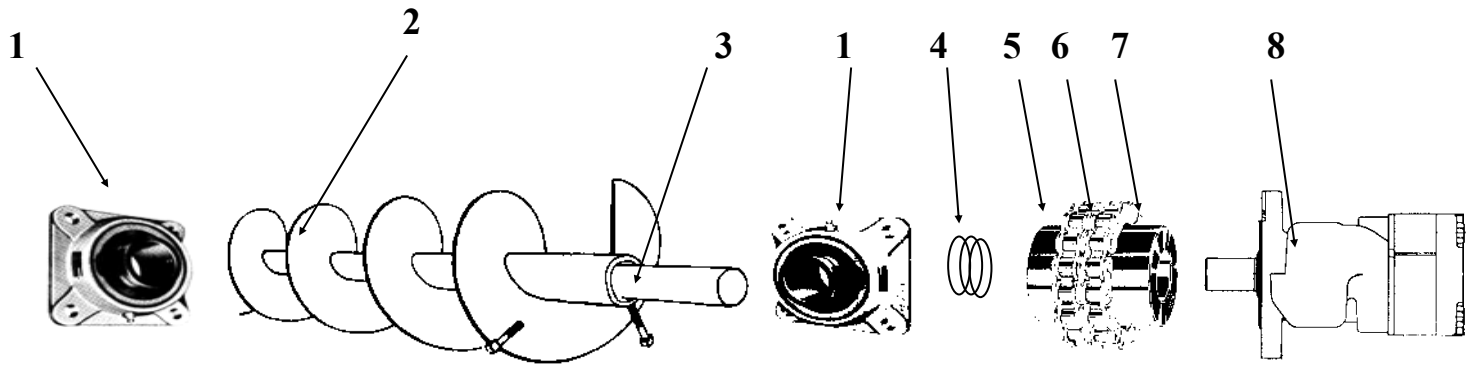
ALTERNATOR / HYDRAULIC PUMP DRIVE

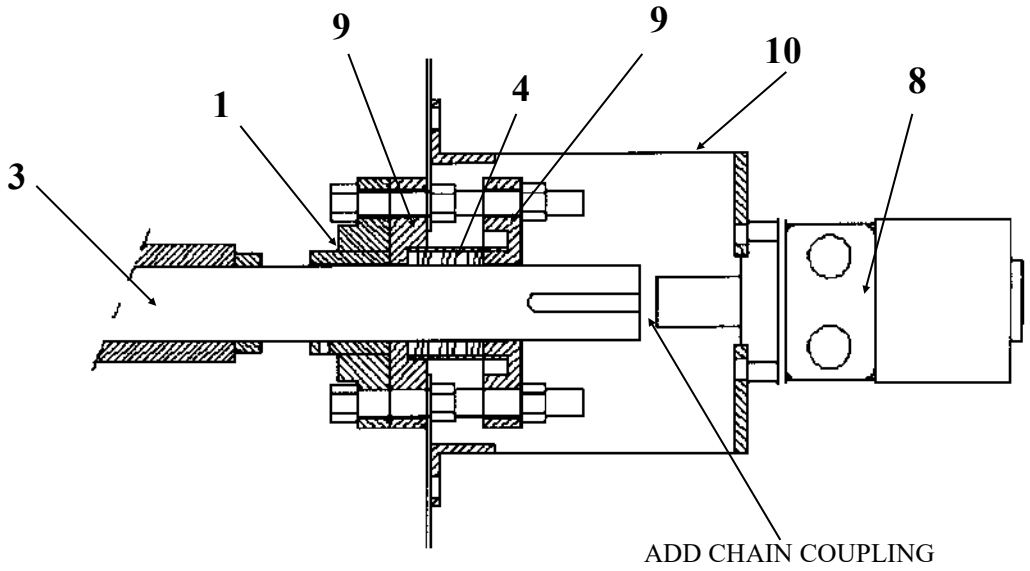


ITEM	QTY	DESCRIPTION	PART #
1	1	Stub Shaft, diesel engine only	901230
2	1	Adjusting Bracket, alternator, for diesel engine only	Call
3	1	Alternator, 24 volt	526058
4	2	V-Belt, alternator, diesel engine	514013
	2	V-Belt, alternator, gas engine	514011
5	1	Pulley	514020
6	1	Bushing, Pulley (includes bolts)	514022
7	1	Coupling Half, 1" bore	507063
8	1	Spider	507067
9	1	Coupling Half, 5/8" bore, used with diesel engine	507064
	1	Coupling Half, 9/16" bore, used with gas engine	507066
10	1	Pump, Hydraulic, used with diesel engine	510073
	1	Pump, Hydraulic, used with gas engine	510064

Note: Illustrations are for parts identification only. Illustrations may not represent actual parts.



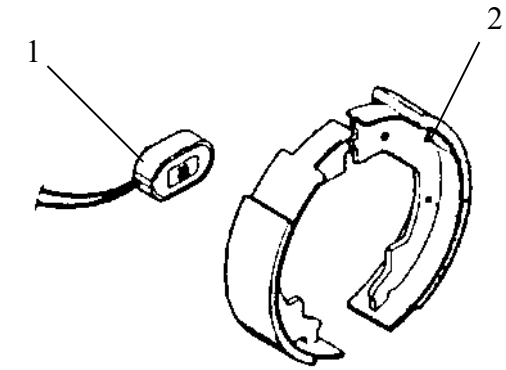
ASSEMBLY DETAIL

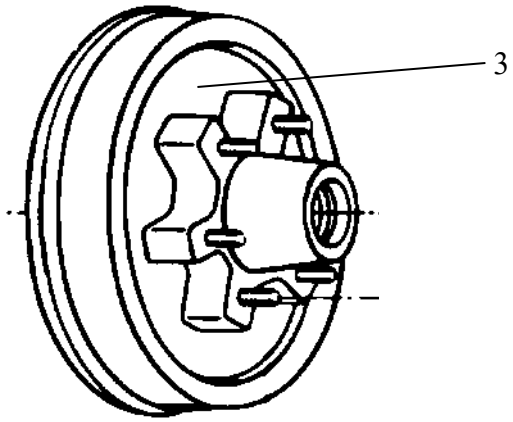


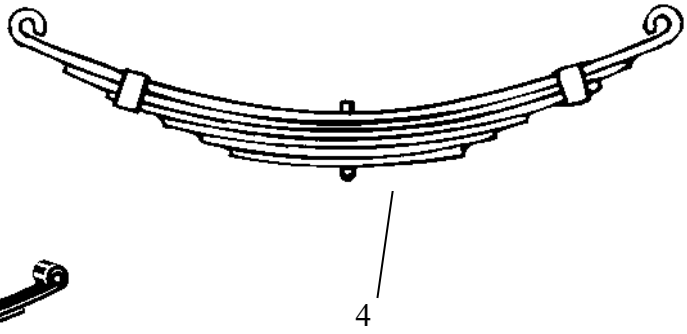
ITEM	QTY	DESCRIPTION	PART #
1	2	Bearing, Auger	502019
2	1	Auger	Give VIN
3	1	Shaft, Auger	Give VIN
4	3 ft.	Seal Packing	515042
5	1	Chain Coupling Half, 1 1/2” bore	507009
6	1	Coupling Chain, 5016	507022
7	1	Chain Coupling Half, 1” bore	507008
8	1	Hydraulic Motor	510054
9	1	Packing Gland and Seat Assembly (includes items, 4, 9 and bolts)	901028
10	1	Mount for Hydraulic Motor	Give VIN

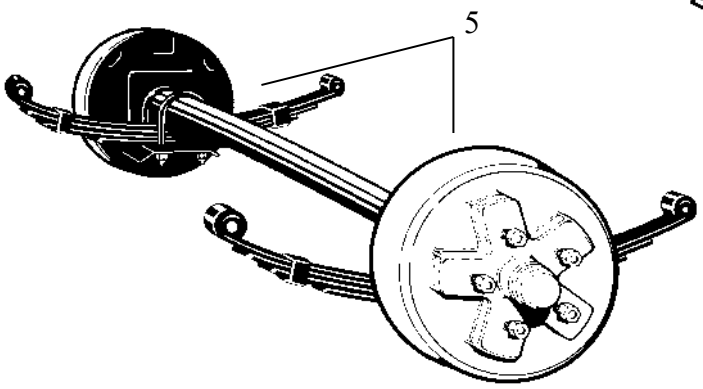
Note: Illustrations are for parts identification only. Illustrations may not represent actual parts. Part description and unit serial number are required to place orders for parts without numbers.

ITEM	QTY	DESCRIPTION	PART#
00	1	Main burner power switch	526039
00	1	Red 12v heat light	526038
00	1	20 amp circuit breaker	526094
00	1	Charging Resistor	526059
00	1	Fuel Pump, electric	Call
00	1	Oil drain valve, engine	508050
00	1	Fuel Gauge	509080
00	1	Cap Assembly, fuel tank	513414
00	1	Cap, hydraulic tank	513522
00	1	Warning Label and Decal Kit	Call
00	-	LUBE-TECH Heat Transfer Oil 460, 55 gallon drum.	603017
00	-	LUBE-TECH Heat Transfer Oil 460, 5 gallon pail.	603019
		(Used in oil jacketed equipment *without* oil circulation pumps)	
		(Refer to maintenance manual for oil capacities)	





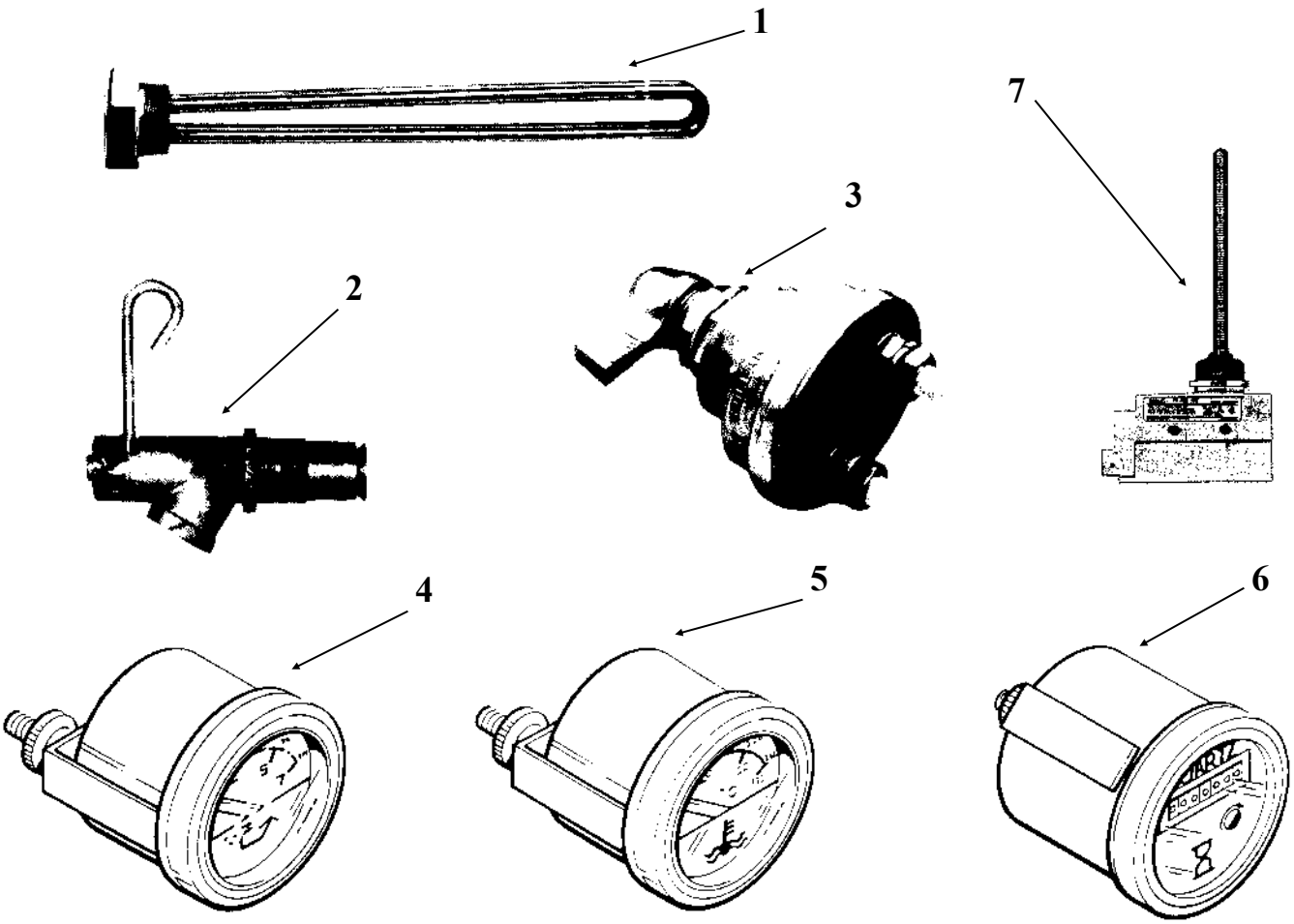




ITEM	QTY	DESCRIPTION	PART#
1	1	Magnet, electric brake (1 required for each wheel)	Give Serial #
2	1	Brake Shoe Set (1 set required for each wheel)	Give Serial #
3	1	Brake Drum and Hub assembly (1 required for each wheel)	Give Serial #
4	1	Leaf Spring assembly (1 required for each wheel)	Give Serial #
Complete replacement axle assemblies are available and include brakes, hubs, and springs.			
5	1	Axle assembly, complete, call for ordering information	Give Serial #
*	4	Wheel, call for ordering information	Give Serial #

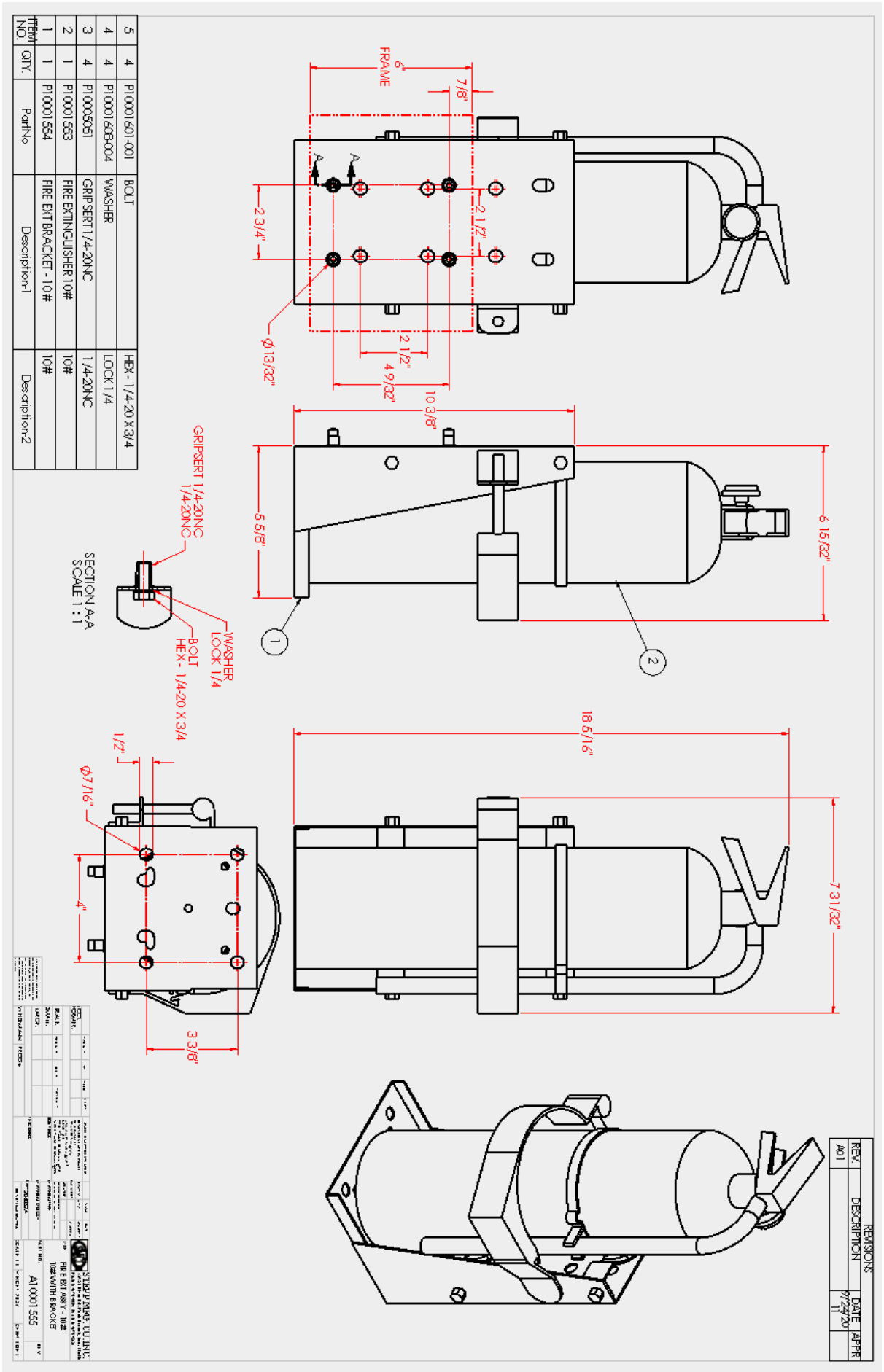
* - Not Shown
Note: Illustrations are for parts identification only. Illustrations may not represent actual parts.

ORDERING INFORMATION:
Orders for suspension parts must include the equipment serial number.
Orders for brake parts must include the equipment serial number and brake drum dimensions. (diameter and width) Also specify electric or hydraulic brake system.



ITEM	QTY	DESCRIPTION	PART#
1	1	Over night heater, electric (optional)	520097
2	1	2.5" doc, draw-off valve	107006
3	1	Switch, heated hose and wand	526080
4	1	Oil Pressure Gauge	Call
5	1	Water Temperature Gauge	Call
6	1	Hour Meter	508038
7	2	Switch, pump saver & safety loading	526057

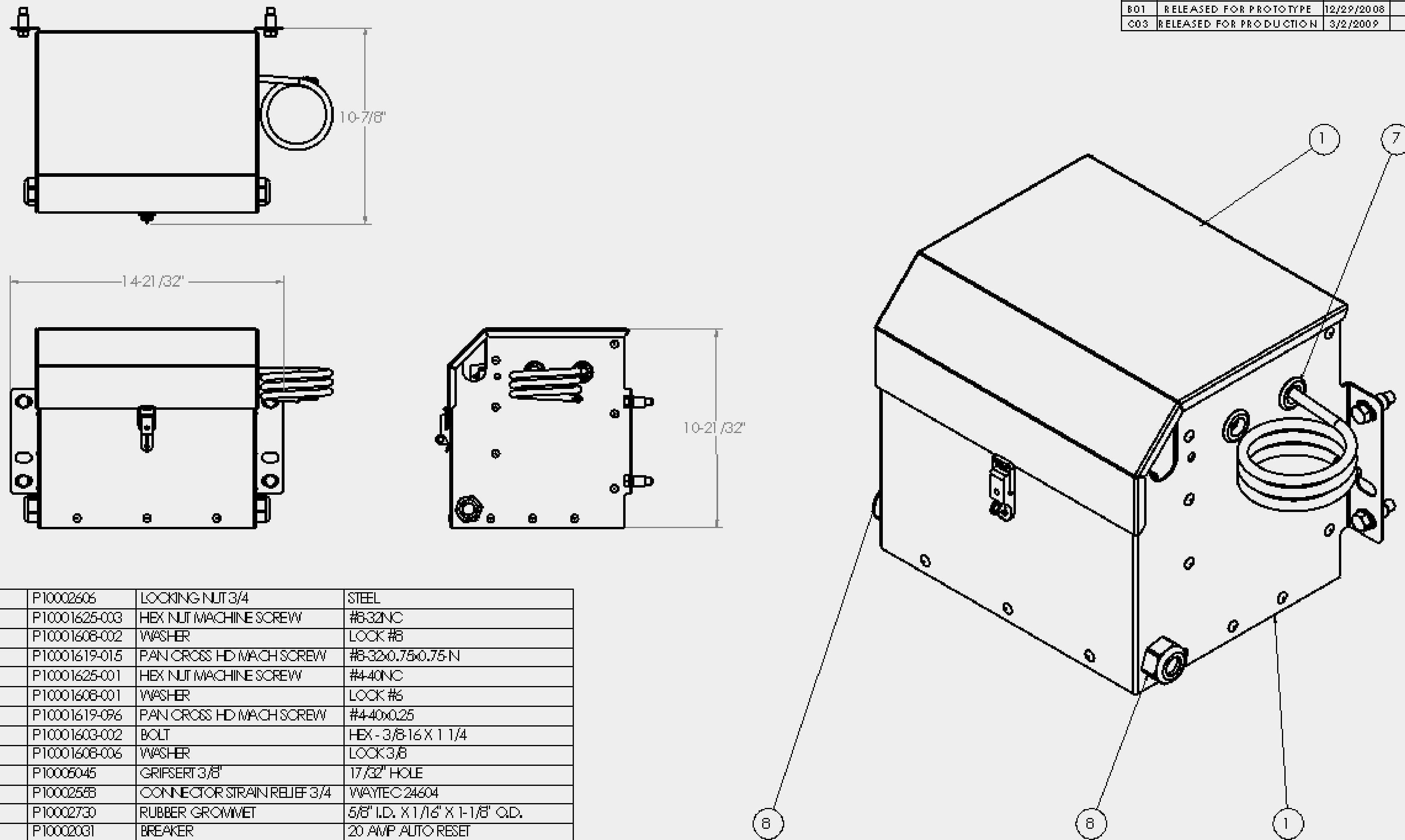
Note: Illustrations are for parts identification only. Illustrations may not represent actual parts.



ITEM NO.	QTY.	Part No	Description1	Description2
5	4	P10001601-001	BOLT	HEX - 1/4-20 X 3/4
4	4	P10001608-004	WASHER	LOCK 1/4
3	4	P10005051	GRIPSERT 1/4-20NC	1/4-20NC
2	1	P10001553	FIRE EXTINGUISHER 10#	10#
1	1	P10001554	FIRE EXT BRACKET - 10#	10#

REVISIONS

REV.	DESCRIPTION	DATE	APPR
B01	RELEASED FOR PROTOTYPE	12/29/2008	
C03	RELEASED FOR PRODUCTION	3/2/2009	



ITEM NO.	-002/QTY.	PartNb	Description-1	Description2
18	2	P10002606	LOCKING NUT 3/4	STEEL
17	2	P10001625-003	HEX NUT MACHINE SCREW	#8-32NC
16	2	P10001608-002	WASHER	LOCK #8
15	2	P10001619-015	PAN CROSS HD MACH SCREW	#8-32x0.75x0.75-N
14	2	P10001625-001	HEX NUT MACHINE SCREW	#4-40NC
13	2	P10001608-001	WASHER	LOCK #6
12	2	P10001619-096	PAN CROSS HD MACH SCREW	#4-40x0.25
11	4	P10001603-002	BOLT	HEX - 3/8-16 X 1 1/4
10	4	P10001608-006	WASHER	LOCK 3/8
9	4	P10005045	GRIPSERT 3/8"	17/32" HOLE
8	2	P10002553	CONNECTOR STRAIN RELIEF 3/4	WAYTEC 24604
7	4	P10002730	RUBBER GROMMET	5/8" I.D. X 1/16" X 1-1/8" O.D.
6	1	P10002031	BREAKER	20 AMP AUTO RESET
5	1	P10005107	GROUND CABLE 24"	24" BATTERY CABLE 6 GA TOP POST
4	1	P10000187	TERMINAL STRIP	8 X 30 AMP
3	1	P10001037	BATTERY	12 VOLT
2	1	M10005486	BATTERY TERMINAL ID	BOLT ON BATTERY BOX
1	1	A10003290	BATTERY BOX ASSY	POP RIVET STYLE

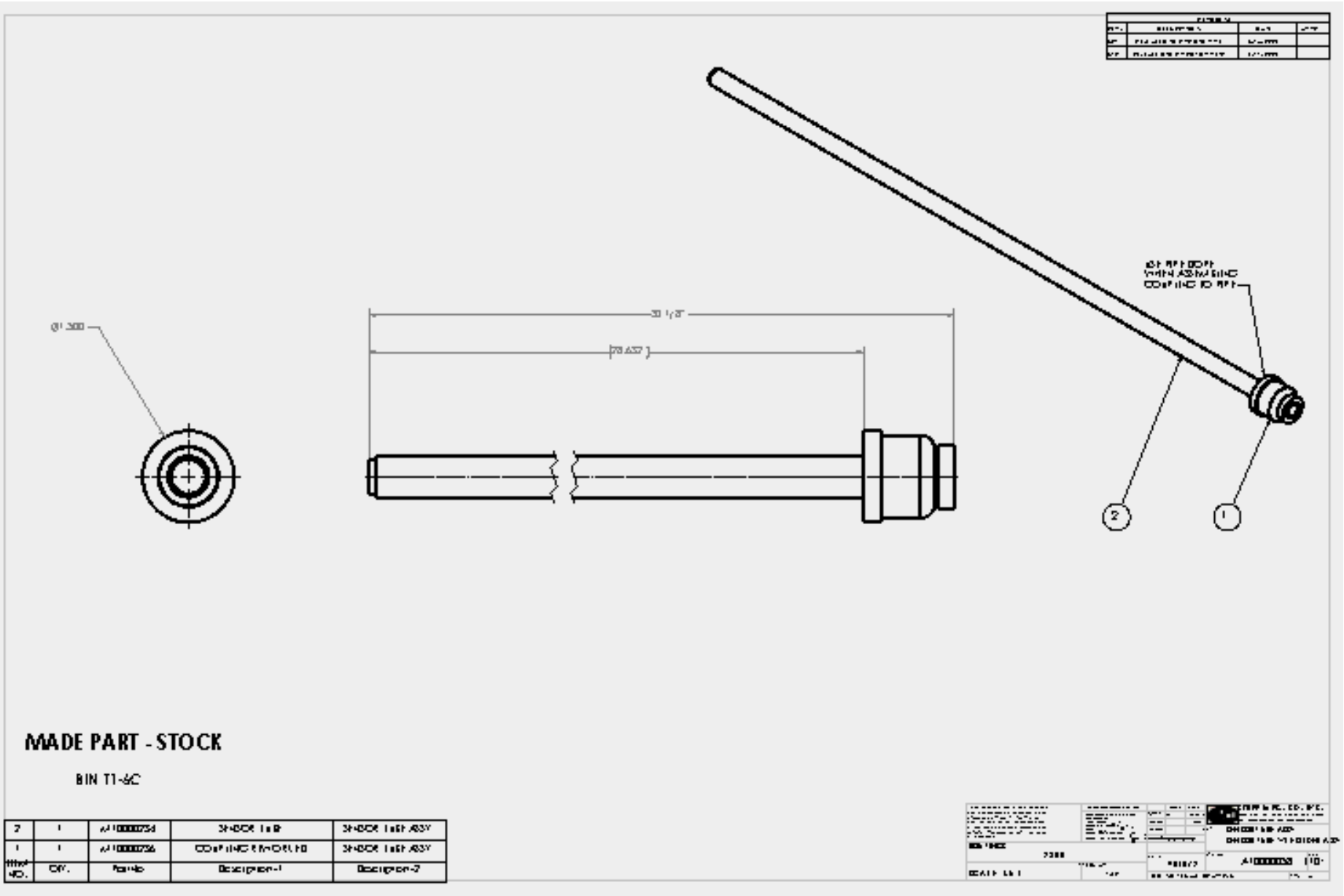
STEPP MFG. CO. INC.

2500-2500

SCALE: 1:4

A10005104-002 C03+

DO NOT SCALE DRAWING



MADE PART - STOCK

BIN T1-6C

ITEM NO.	QTY.	PART NO.	DESCRIPTION-1	DESCRIPTION-2
2	1	A10000754	SHOCK TUBE	SHOCK TUBE ASSY
1	1	A10000756	COUPLING SHOCK TUBE	SHOCK TUBE ASSY

NHTSA

NHTSA Reporting Safety Defects

If you believe that your vehicle has a defect in which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying STEPP MANUFACTURING CO., INC..

If NHTSA receives similar complaints, it may open an investigation and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or STEPP MANUFACTURING CO., INC..

To Contact NHTSA, you may either call the Auto Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153); go to http://www.safecar.gov; or Write to: NHTSA, US Department of Transportation, 1200 New Jersey Ave., S.E., Washington DC 20590. You can also obtain information about your motor vehicle safety from http://www.safecar.gov.

STEPP MFG™

ASPHALT MAINTENANCE EQUIPMENT

Consumer Warranty Guide

12325 River Road, North Branch, MN 55056~ Phone: 651-674-4491~ Fax: 651-674-4221 www.steppmfg.com

Introduction

Congratulations on your purchase of equipment built by Stepp Manufacturing for your asphalt maintenance needs. Your equipment has been designed and constructed to give you the most in performance, ease of use, and reliability. It is our desire that you will find operating the equipment both productive and profitable.

Warranty Procedures Through A Dealer

If your equipment requires repair, or needs parts for repair, please contact your area dealer. For repairs, the unit must be brought to the dealer for warranty. The dealer will require purchase date information, where the machine was purchased, and the Vehicle Identification Number (VIN) of the equipment. This information is needed so the dealer can submit a warranty claim. The dealer will repair your equipment, once warranty is approved, at no charge to you under the provisions of the warranty policy.

Warranty Procedures Direct Through The Factory *(when no servicing dealer is available in your area)*

Contact Stepp Manufacturing's Customer Service Department at (651) 674-4491.

In this situation, it may be advantageous for you to repair the machine and be reimbursed direct from the factory for warranty repairs. If you do not have the facilities, or the technicians, to perform the repair, the unit can be brought to a local repair facility. In either case, Stepp Manufacturing ***MUST*** be contacted and authorize the warranty repair ***PRIOR*** to any work being performed. If work is done prior to authorization, the warranty will not be honored.

If parts are required for the warranty repair, contact Customer Service at Stepp Manufacturing for replacements. When warranty replacement parts are shipped to you, a Warranty Authorization Number will be issued. If asked to return the defective parts, "tag" the defective parts with the Warranty Authorization Number, then package them in the same box the new parts were shipped in. Ten (10) business days will be allowed for return of the defective parts. If the defective part is not received back at the factory within this allotted time, the warranty will not be honored.

You will be billed for all parts shipped that require returning of defective parts. However, when the defective parts are returned and evaluated, you will receive credit for the cost of the part only. Thus, it is important that all defective parts are turned to Stepp Manufacturing in the allotted ten (10) day period.

Engine Warranty Claims

When a warranty issue develops with the engine, bring the unit to the engine manufacturer nearest authorized service center for repair. Be prepared to supply them with proof of purchase information with purchase dates.

Stepp Manufacturing cannot process engine warranty claims. However, we will be happy to offer assistance in locating the nearest service center.

Equipment Owner Responsibilities

As the equipment owner, you are responsible for:

- Using the equipment in accordance with the correct operating procedures as shown in the operators manual.
- Assuring all maintenance items are completed in accordance with the operators/maintenance manuals.
- Transporting the equipment to the place where warranty repairs can be completed.
- Supplying purchase date and VIN information to establish warranty coverage.

General Warranty Statement

Stepp Manufacturing's One (1) Year Limited Warranty

Stepp Manufacturing Co., Inc. hereby warrants, to the original purchaser of new equipment, that products manufactured by Stepp Manufacturing will be free from defects in material and workmanship for a period of one (1) year from the date of purchase from Stepp Manufacturing.

Stepp Manufacturing, at is discretion, will provide for the repair or replacement of any part found, upon examination by Stepp Manufacturing, to be defective, except as noted below. Such repair or replacement shall be free of charge to the original purchaser of new equipment for a period of one (1) year from the date of purchase, except as noted below.

No warranty is extended to cover:

- Product pump wear or damage caused by foreign objects.
- Routine maintenance, cleaning, and adjustments.
- Parts or components that have been altered, misused, improperly adjusted, or improperly maintained.
- Transportation to and from the place of warranty repair.
- Removal of materials from equipment.

The following items are covered solely by their manufacturer's warranty:

- Engines
- Hydraulic components
- Burners
- Pumps
- Axles
- Tires
- Other component parts not solely manufactured by Stepp Manufacturing

The following items are covered by a pro-rata warranty:

- Hoses that carry heated materials
- Heating elements for material hoses and wands

Disclaimer of further warranty:

Stepp Manufacturing makes no warranty, expressed or implied, other than this warranty. The implied warranties of merchantability and fitness for a particular purpose are hereby disclaimed. Repair or replacement of products or parts proving to be defective in material or workmanship shall be the exclusive remedy for breach of this warranty.

Stepp Manufacturing shall not be liable for incidental or consequential damages. Including, but not limited to, damages for inconvenience, rental or purchase of replacement equipment, loss of profits, or other loss resulting from breach of this warranty.

Stepp Manufacturing reserves the right to incorporate any changes in design into its products without obligation to make such changes on products previously manufactured.

Twelve (12) Month Pro-Rata Limited Warranty
Heated Asphalt Hose and Heating Elements
Effective for Equipment Delivered After 5/1/2012

Stepp Manufacturing Co., Inc. hereby warrants to the original purchaser, on a pro-rated basis, that the heated asphalt hose and heating elements installed on NEW Stepp Manufacturing's equipment shall be free from defects in material and workmanship for period of twelve (12) months for the heated asphalt hose and six (6) months for the heating element.

In the event that a heated asphalt material hose or a heating element fails under normal use during the warranty period, Stepp Manufacturing will supply a replacement heated asphalt hose or heating element, along with one-half (0.5) hour for installation labor on a pro-rated adjustment basis.

- If the failure occurs under normal use within the first three (3) months from date of purchase, Stepp Manufacturing will supply a replacement, and provide for one-half (0.5) hour installation labor at no charge to the customer.
- If the failure occurs under normal use within the fourth (4th) through twelfth (12th) months, Stepp Manufacturing will supply a replacement, and provide for one-half (0.5) hour installation labor on a pro-rata basis.

The pro-rated adjustment is based on the total number of months elapsed since the purchase date of the new equipment from Stepp Manufacturing. This rate is then applied to the one-half (0.5) hour labor rate and the current suggested retail price of the proper replacement heated asphalt hose or heating element supplied by Stepp Manufacturing. This is the amount the customer will have to pay. Freight will not be included in the reimbursement. If a new heated asphalt hose or heating element is needed prior to warranty inspection, you will be billed for all parts shipped that require returning of defective parts. However, when the defective parts are returned and evaluated, you will receive credit for the cost of the part only. **Thus, it is important that all defective parts are turned in to Stepp Manufacturing in the allotted ten (10) day period, or warranty will be denied.**

In no case will the warranty coverage extend beyond the six (6) month period for the heating element or the twelve (12) month period for the heated asphalt hose, from the original purchase date of the new equipment from Stepp Manufacturing. *Physical damage is not covered by this warranty*. Physical damage may include, but is not limited to:

- Broken heating element (typically caused by repeated bending to less than a one (1) foot radius).
- Heated asphalt hoses burnt from the inside (typically caused by operating the heating element in an empty hose).
- External cuts or abrasions on the heated asphalt hose (typically caused by dragging on the ground).

The chart below shows the pro-rated amount, by percentage, that will be allowed by warranty, pending examination of the heated asphalt hose or heating element.

Heated Asphalt Hose		
Failure Date	**Warranty's Responsibility**	**Customer's Responsibility**
0-3 Months *0-90 Days*	100%	0%
3-6 Months *91-180 Days*	70%	30%
6-7 Months *181-211 Days*	60%	40%
7-8 Months *212-242 Days*	50%	50%
8-9 Months *243-273 Days*	40%	60%
9-10 Months *274-304 Days*	30%	70%
10-11 Months *305-335 Days*	20%	80%
11-12 Months *336-365 Days*	10%	90%
After 12 Months	0%	100%

Heating Element		
Failure Date	**Warranty's Responsibility**	**Customer's Responsibility**
0-3 Months *0-90 Days*	100%	0%
3-4 Months *91-121 Days*	60%	40%
4-5 Months *122-152 Days*	40%	60%
5-6 Months *153-180 Days*	20%	80%
After 6 Months	0%	100%

STEPP MFG™
ASPHALT MAINTENANCE EQUIPMENT

Warranty Claim Authorization Number: _____
Call Customer Service at 651-674-4491 to obtain prior approval or warranty will be denied.
Date of Authorization Request _____

Equipment Owner		Warranty to be Performed by	
Customer Name		Company Name	
Street Address		Address	
City/State/Zip		City/State/Zip	
Equipment Model #		Contact Name	
Equipment VIN		Contact Phone #	
Hour Meter Read			
Purchase Date		Date of Malfunction	
Dealer Purchased Form		Date of Repair	

Warranty Authorization		Signature for Authorization
Date of Malfunction		X
Date of Repair		

Symptoms / Diagnostics / Action

Symptoms	Diagnostics	Action
Describe the symptoms in detail, be as specific as possible. Ex: Burner ignites and runs for 35 seconds, then goes out.	*Describe issues found, be as specific as possible. Ex: Part failed due to loose connection, resulting in misalignment and premature wear.*	*Describe action taken, be as specific as possible. Ex: Removed damaged section of wire harness, soldered new leads in place, and insulated splices w/ heat shrink tubing.*

Parts and Labor

Labor Time to Correct Problem (reimbursed at $55/hour)		Parts Used to Correct Problem		
Labor Time (in hours)	Repair Made	Part Number	Description	Qty

Parts Return

All parts returned must be tagged with the warranty authorization number and a copy of this claim. Retain all parts until credit is received from the factory. When requested, return the parts, along with this claim, to:

Stepp Manufacturing Co., Inc.
Attn: Warranty Department
12325 River Road
North Branch MN 55056

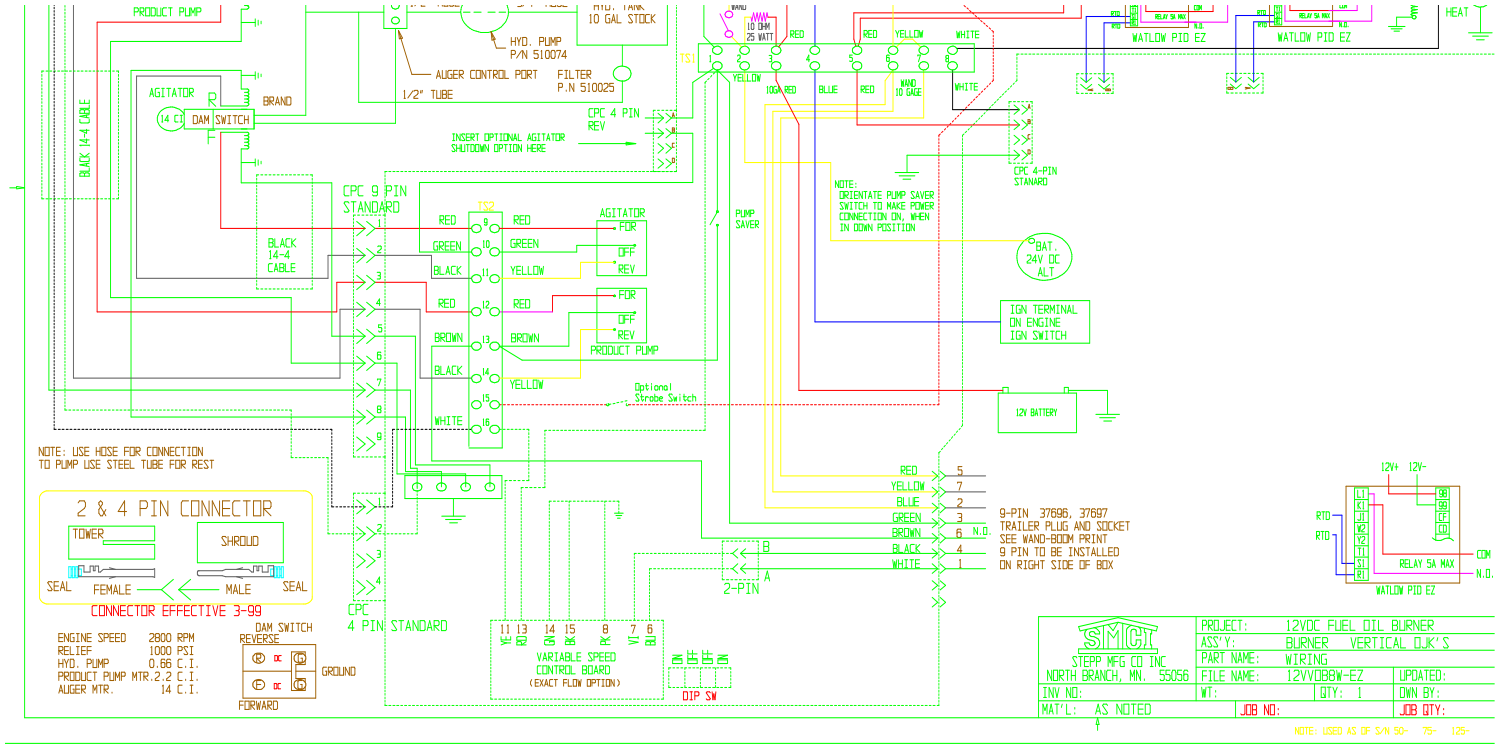
***Note**: If defective parts are not returned within 10 days, or this warranty claim does not accompany the returned parts, the claim will be denied.

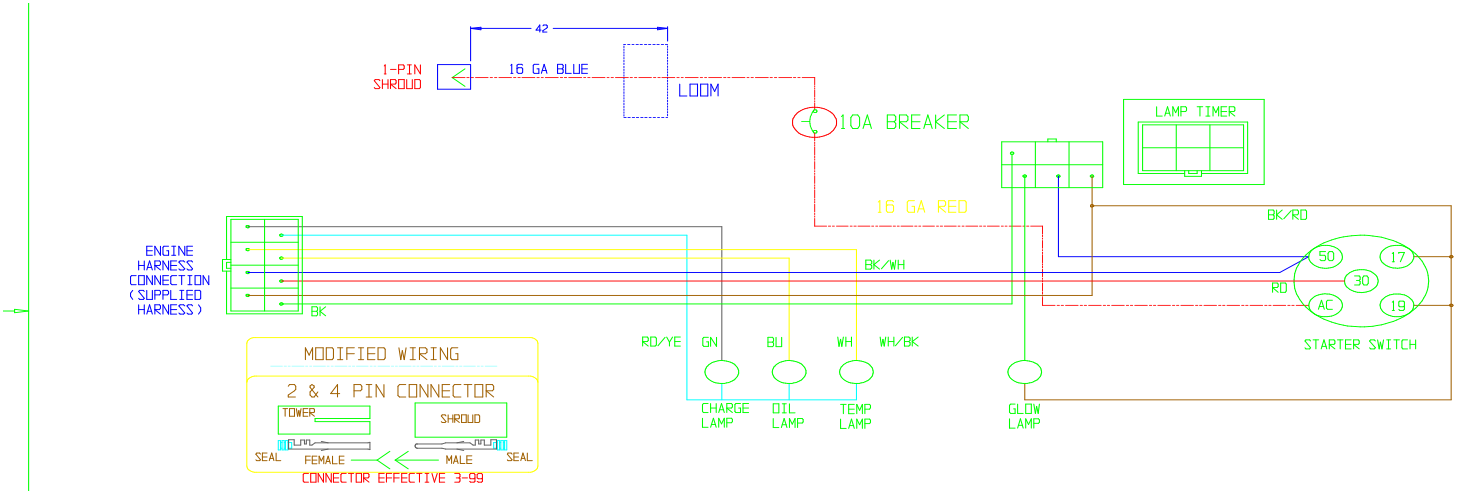
Office Use Only

Date Claim/Parts Received?		Is this a warrantable claim?	Yes	No
Claim Reviewed By:		Original Invoice # for Parts		
Date of Review:				

Warranty Totals

SCHEMATICS


PRODUCT PUMP
HYD. TANK 10 GAL STOCK
HYD. PUMP P/N 510074
AUGER CONTROL PORT
1/2" TUBE
FILTER P.N 510025
AGITATOR
BRAND
DAM SWITCH
BLACK 14-4 CABLE
INSERT OPTIONAL AGITATOR SHUTDOWN OPTION HERE
CPC 4 PIN REV
CPC 9 PIN STANDARD
BLACK 14-4 CABLE
TS2
AGITATOR
FOR
OFF
REV
PRODUCT PUMP
Optional Strobe Switch
NOTE: USE HOSE FOR CONNECTION TO PUMP USE STEEL TUBE FOR REST
2 & 4 PIN CONNECTOR
TOWER
SHROUD
SEAL
FEMALE
MALE
SEAL
CONNECTOR EFFECTIVE 3-99
ENGINE SPEED 2800 RPM
RELIEF 1000 PSI
HYD. PUMP 0.66 C.I.
PRODUCT PUMP MTR. 2.2 C.I.
AUGER MTR. 14 C.I.
DAM SWITCH
REVERSE
FORWARD
GROUND
CPC 4 PIN STANDARD
VARIABLE SPEED CONTROL BOARD (EXACT FLOW OPTION)
DIP SW
2-PIN
PUMP SAVER
NOTE: ORIENTATE PUMP SAVER SWITCH TO MAKE POWER CONNECTION ON, WHEN IN DOWN POSITION
CPC 4-PIN STANARD
BAT. 24V DC ALT
IGN TERMINAL ON ENGINE IGN SWITCH
12V BATTERY
9-PIN 37696, 37697 TRAILER PLUG AND SOCKET SEE WAND-BOOM PRINT 9 PIN TO BE INSTALLED ON RIGHT SIDE OF BOX
WATLOW PID EZ
WATLOW PID EZ
HEAT
12V+ 12V-
RTD
RTD
RELAY 5A MAX
COM
N.O.
WATLOW PID EZ
STEPP MFG CO INC
NORTH BRANCH, MN. 55056
PROJECT: 12VDC FUEL OIL BURNER
ASS'Y: BURNER VERTICAL DJK'S
PART NAME: WIRING
FILE NAME: 12VVDB8W-EZ
UPDATED:
INV NO:
WT:
QTY: 1
DWN BY:
MAT'L: AS NOTED
JOB NO:
JOB QTY:
NOTE: USED AS OF S/N 50- 75- 125-



SHOP NOTES	MACHINE CODE				
STANDARD SHOP TOLERANCE UNLESS OTHERWISE NOTED: ±1/16" & ±1°	LOCK FORMER:	STEPP MFG CO INC NORTH BRANCH, MN. 55056	ROUTING:	PROJECT:	KABOTA 482 DIESEL ENGINE
	WIEDEMANN:		CAGE CODE: 06447	ASS'Y:	ENGINE COVER HARNESS
	LARGE BRAKE:		DWN: 6/03 DWN BY: SGS	PART NAME:	FINAL DETAIL
			REV:	FILE NAME:	K482-MSL1
			INV NO:	INV AMT EA:	QTY: 1
			MAT'L: AS NOTED	JOB NO:	JOB QTY:

HEAT TRANSFER OIL MSDS

MATERIAL SAFETY DATA SHEET

SECTION 1	PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: EXXON TERESSTIC 100
Product Description: Base Oil and Additives
Product Code: 16013
Intended Use: Circulating oil

COMPANY IDENTIFICATION

Supplier: **Canada Imperial Oil Limited, An Affiliate of Exxon Mobil Corporation**
P.O. Box 2480, Station M
Calgary, ALBERTA. T2P 3M9 Canada

24 Hour Health Emergency	519-339-2145
Transportation Emergency Phone	519-339-2145
Supplier General Contact	1-800-567-3776

SECTION 2	COMPOSITION / INFORMATION ON INGREDIENTS

No Reportable Hazardous Substance(s) or Complex Substance(s).

SECTION 3	HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation.

NFPA Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0
HMIS Hazard ID:	Health: 0	Flammability: 1	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4	FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5	FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Hazardous Combustion Products: Sulfur oxides, Aldehydes, Smoke, Fume, Oxides of carbon, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: 220C (428F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Auto ignition Temperature: 330°C (626°F)

SECTION 6	ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material;

however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7	HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabeled containers.

SECTION 8	EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly affect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid
Color: Yellow
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.83
Flash Point [Method]: 220C (428F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Auto ignition Temperature: 330°C (626°F)
Boiling Point / Range: N/D
Vapor Density (Air = 1): N/D
Vapor Pressure: [N/D at 20 °C] | < 1 kPa (7.5 mm Hg) at 38C
Evaporation Rate (n-butyl acetate = 1): < 1
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5
Solubility in Water: Negligible
Viscosity: 100 cSt (100 mm2/sec) at 40 C
Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -12°C (10°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt.

SECTION 10	STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11	TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/m3	Minimally Toxic. Based on test data for structurally similar materials.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on test data for structurally similar materials.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on test data for structurally similar materials.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12	ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bio accumulate, however metabolism or physical properties may reduce the bio concentration or limit bioavailability.

SECTION 13	DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14	TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15	REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: DSL, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below:

Chemical Name	CAS Number	List Citations
DIPHENYLAMINE	122-39-4	5, 9
XYLENES	1330-20-7	5, 9

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16	OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Revision Changes:
Section 13: Empty Container Warning was modified.
Section 08: Hand Protection was modified.
Section 01: Company Mailing Address was modified.
Section 15: List Citation Table - Header was modified.
Section 06: Notification Procedures was modified.
Section 15: TSCA Class 2 Statement was deleted.

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MHC: 0, 0, 0, 0, 0, 0 PPEC: A

DGN: 5014320 (1012313)

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HYDRAULIC OIL MSDS

MATERIAL SAFETY DATA SHEET

SECTION 1	PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **UNIVIS N 32**
Product Description: Base Oil and Additives
Product Code: 8259
Intended Use: Hydraulic fluid

COMPANY IDENTIFICATION

Supplier: **Canada Imperial Oil Limited, An Affiliate of Exxon Mobil Corporation**
P.O. Box 4029, Station A
Calgary, ALBERTA. T2P 3M9 Canada

24 Hour Health Emergency	519-339-2145
Transportation Emergency Phone	519-339-2145
Supplier General Contact	1-800-567-3776

SECTION 2	COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	64742-53-6	20 - 30%

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

SECTION 3	HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID:	Health:	0	Flammability:	1	Reactivity: 0
HMIS Hazard ID:	Health:	0	Flammability:	1	Reactivity: 0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4	FIRST AID MEASURES

INHALATION

Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT

Wash contact areas with soap and water. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5	FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Pressurized mists may form a flammable mixture.

Hazardous Combustion Products: Smoke, Fume, Sulfur oxides, Aldehydes, Oxides of carbon, Incomplete combustion products

FLAMMABILITY PROPERTIES

Flash Point [Method]: 165C (329F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Auto ignition Temperature: N/D

SECTION 6	ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. U.S. regulations require reporting releases of this material to the environment which exceed the reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do it without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dike far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7	HANDLING AND STORAGE

HANDLING

Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is a static accumulator.

STORAGE

Do not store in open or unlabeled containers.

SECTION 8	EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure limits/standards for materials that can be formed when handling this product: When mists / aerosols can occur, the following are recommended: 5 mg/m³ - ACGIH TLV, 10 mg/m³ - ACGIH STEL, 5 mg/m³ - OSHA PEL.

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Work conditions can greatly effect glove durability; inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

No protection is ordinarily required under normal conditions of use.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

No skin protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid skin contact.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9	PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Liquid
Color: Yellow
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.87
Flash Point [Method]: 165C (329F) [ASTM D-93]
Flammable Limits (Approximate volume % in air): LEL: 0.9 UEL: 7.0
Auto ignition Temperature: N/D
Boiling Point / Range: 229C (444F) - 512C (954F)
Vapor Density (Air = 1): N/D
Vapor Pressure: [N/D at 40 °C] | < 1 kPa (7.5 mm Hg) at 38C
Evaporation Rate (n-butyl acetate = 1): < 0.1
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5
Solubility in Water: Negligible
Viscosity: 32 cSt (32 mm2/sec) at 40 C
Oxidizing Properties: See Sections 3, 15, 16.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -48°C (-54°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt.

SECTION 10	STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11	TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity (Rat): LC50 > 5000 mg/ m3	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Skin	
Toxicity (Rabbit): LD50 > 2000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Negligible irritation to skin at ambient temperatures. Based on assessment of the components.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12	ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bio accumulate, however metabolism or physical properties may reduce the bio concentration or limit bioavailability.

SECTION 13	DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrosivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning PRECAUTIONARY LABEL TEXT: Empty containers may retain residue and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to refill or clean container since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

SECTION 14	TRANSPORT INFORMATION

LAND (DOT) : Not Regulated for Land Transport

LAND (TDG) : Not Regulated for Land Transport

SEA (IMDG) : Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA) : Not Regulated for Air Transport

SECTION 15	REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

NATIONAL CHEMICAL INVENTORY LISTING: DSL, TSCA

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: Delayed Health.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The Following Ingredients are Cited on the Lists Below:*

Chemical Name	CAS Number	List Citations
HYDROTREATED LIGHT NAPHTHENIC DISTILLATE (PETROLEUM)	64742-53-6	13, 17, 18
PHOSPHORODITHOIC ACID, O,O-DI C1-14-ALKYL ESTERS, ZINC SALTS (2:1) (ZDDP)	68649-42-3	15

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive
* EPA recently added new chemical substances to its TSCA Section 4 test rules. Please contact the supplier to confirm whether the ingredients in this product currently appear on a TSCA 4 or TSCA 12b list.

SECTION 16	OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
No revision information is available.

The information and recommendations contained herein are, to the best of ExxonMobil's knowledge and belief, accurate and reliable as of the date issued. You can contact ExxonMobil to insure that this document is the most current available from ExxonMobil. The information and recommendations are offered for the user's consideration and examination. It is the user's responsibility to satisfy itself that the product is suitable for the intended use. If buyer repackages this product, it is the user's responsibility to insure proper health, safety and other necessary information is included with and/or on the container. Appropriate warnings and safe-handling procedures should be provided to handlers and users. Alteration of this document is strictly prohibited. Except to the extent required by law, re-publication or retransmission of this document, in whole or in part, is not permitted. The term, "ExxonMobil" is used for convenience, and may include any one or more of ExxonMobil Chemical Company, Exxon Mobil Corporation, or any affiliates in which they directly or indirectly hold any interest.

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DGN: 5007202 (1012936)

VIKING PUMP

TECHNICAL SERVICE MANUAL

UNIVERSAL SEAL HEAVY DUTY PUMPS
SERIES 124A, 4124A, 124AE, 4124AE, AND 4124B CAST IRON
SERIES 126A AND 4126A DUCTILE IRON
SERIES 123A AND 4123A STEEL
SERIES 127A AND 4127A STAINLESS STEEL
SIZES H, HL, K, KK, L, LQ, LL

SECTION	TSM 630
PAGE	1 OF 12
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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 a complete name of part, part number and material with the 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 (124A, 4124A, 124AE, 4124B, 126A, 4126A, 123A, 4123A, 127A) indicating basic pump construction material.

UNMOUNTED PUMP		UNITS
PACKED	MECH. SEAL	
H124A	H4124A	A = Universal Seal Pump
	H4124B	B = Universal Seal Pump with mechanical seal behind the rotor
H126A	H4126A	AE = Universal Seal Pump with larger rotor shaft
H123A	H4123A	
H127A	H4127A	Units are designated by the unmounted pump model numbers followed by a letter indicating drive style.
HL124A	HL4124A	
	HL4124B	V = V-Belt
HL126A	HL4126A	D = Direct Connected
HL123A	HL4123A	R = Viking Speed Reducer
HL127A	HL4127A	P = Commercial Speed Reducer
K124A	K4124A	
	K4124B	
K126A	K4126A	
K123A	K4123A	
K127A	K4127A	
KK124A	KK4124A	
	KK4124B	
KK126A	KK4126A	
KK123A	KK4123A	
KK127A	KK4127A	
L124A	L4124A	
L124AE	L4124AE	
	L4124B	
L126A	L4126A	
LQ124A	LQ4124A	
LQ124AE	LQ4124AE	
	LQ4124B	
LQ126A	LQ4126A	
LQ123A	LQ4123A	
LQ127A	LQ4127A	
LL124A	LL4124A	
LL124AE	LL4124AE	
	LL4124B	
LL126A	LL4126A	
LL123A	LL4123A	
LL127A	LL4127A	

FIGURE 1 - SIZES H AND HL

FIGURE 2 - SIZES K, KK AND L

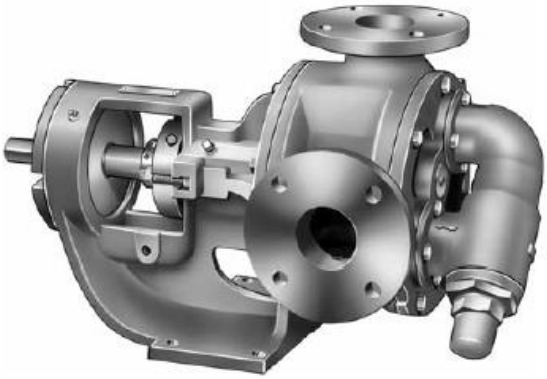


FIGURE 3 - SIZES LQ AND LL

SAFETY INFORMATION AND INSTRUCTIONS

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. VIKING'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

Symbol Legend :

⚠ **Danger** - Failure to follow the indicated instruction may result in serious injury or death.

WARNING **Warning** - In addition to possible serious injury or death, failure to follow the indicated instruction may cause damage to pump and/or other equipment.

⚠ **BEFORE** opening any liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure that :

- Any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
- The pump drive system means (motor, turbine, engine, etc.) has been "locked out" or otherwise been made non-operational so that it cannot be started while work is being done on the pump.
- You know what material the pump has been handling, have obtained a material safety data sheet (MSDS) for the material, and understand and follow all precautions appropriate for the safe handling of the material.

⚠ **BEFORE** operating the pump, be sure all drive guards are in place.

⚠ DO **NOT** operate pump if the suction or discharge piping is not connected.

⚠ DO **NOT** place fingers into the pumping chamber or its connection ports or into any part of the drive train if there is **any possibility** of the pump shafts being rotated.

⚠ WARNING DO **NOT** exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those the pump was originally supplied, without confirming its suitability for the new service.

⚠ WARNING **BEFORE** operating the pump, be sure that:

- It is clean and free from debris
- all valves in the suction and discharge pipelines are fully opened.
- All piping connected to the pump is fully supported and correctly aligned with the pump.
- Pump rotation is correct for the desired direction of flow.

WARNING **INSTALL** pressure gauges/sensors next to the pump suction and discharge connections to monitor pressures.

⚠ WARNING **USE** extreme caution when lifting the pump. Suitable lifting devices should be used when appropriate. Lifting eyes installed on the pump must be used **only** to lift the pump, **not** the pump with drive and/or base plate. If the pump is mounted on a base plate, the base plate must be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached. For weight of the pump alone (which does not include the drive and/or base plate) refer to the Viking Pump product catalog.

⚠ DO **NOT** attempt to dismantle a pressure relief valve that has not had the spring pressure relieved or is mounted on a pump that is operating.

⚠ **AVOID** contact with hot areas of the pump and/or drive. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc.), improper installation, improper operation, and improper maintenance can all cause high temperatures on the pump and/or drive.

⚠ WARNING **THE PUMP** must be provided with pressure protection. This may be provided through a relief valve mounted directly on the pump, an in-line pressure relief valve, a torque limiting device, or a rupture disk. If pump rotation may be reversed during operation, pressure protection must be provided on ***both*** sides of pump. Relief valve adjusting screw caps must always point towards suction side of the pump. If pump rotation is reversed, position of the relief valve must be changed. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure. For additional information, refer to Viking Pump's Technical Service Manual TSM 000 and Engineering Service Bulletin ESB-31.

⚠ WARNING **THE PUMP** must be installed in a matter that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

This manual deals only with Series 124A, 4124A, 124AE, 4124AE, 4124B, 126A, 4126A, 123A, 4123A, 127A, and 4127A Heavy Duty Bracket Mounted Pumps. **Refer to Figures 1 through 13** for general configuration and nomenclature used in this manual. Pump specifications and recommendations are listed in Catalogue Section 630, Heavy Duty Bracket Mounted Pumps, with Universal Seal Type Bracket.

SPECIAL INFORMATION

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the 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.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

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. Viking pumps are positive displacement pumps and must be provided with some sort of pressure protection. This may be a relief valve mounted directly on the pump, an inline pressure relief valve, a torque limiting device or a rupture disk.
2. There are relief valve options available on those pump models designed to accept a relief valve. Options may include a return to tank relief valve and a jacketed relief valve. Pumps equipped with a jacketed head plate are generally not available with a relief valve.
3. If pump rotation is reversed during operation, 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.
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:

Extra care should be taken in repair of these pumps. Be sure to read and follow all special instructions supplied with your pump.

MAINTENANCE

Series 124A, 4124A, 126A, 4126A, 123A, 4123A, 127A, and 4127A 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 ADJUSTMENT*:** 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 and Assembly, page 7,** 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.

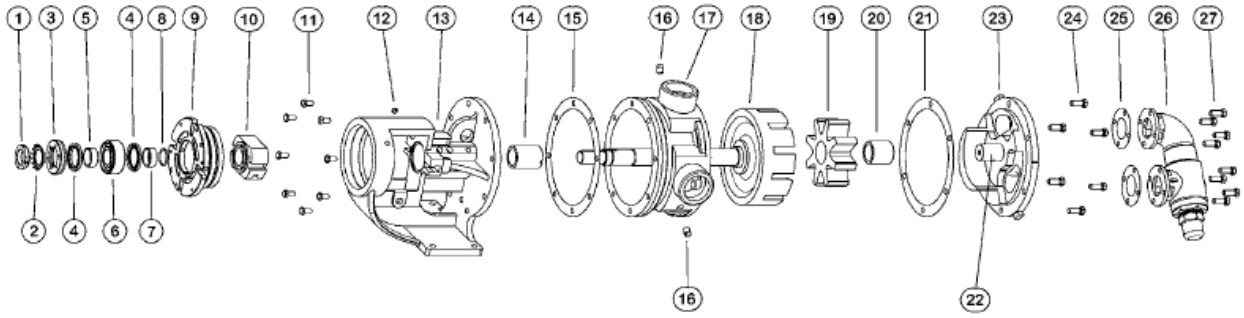
***STORAGE*:** If pump is to be stored, or not used for six months or more, pump must be drained and a light coat of light oil must be applied to all internal pump parts.

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. Tighten all pump assembly bolts before putting pump in service after being stored.

SUGGESTED REPAIR TOOLS: The following tools must be available to properly repair series 124A, 4124A, 126A, 4126A, 123A, 4123A, 127A, and 4127A pumps. These tools are in addition to standard mechanics' tools such as open-end wrenches, pliers, screwdrivers, etc. Most of the items can be obtained from an industrial supply house.

1. Soft Headed hammer
2. Allen wrenches (some mechanical seals and set collars)
3. Packing hooks, flexible (packed pumps)
4. Mechanical seal installation sleeve
   2-751-002-900 for 1.125 inch seal; H-HL pumps.
   2-751-003-900 for 1.4375 inch seal; K-LL pumps.
5. Bearing locknut spanner wrench
   (Source: #471 J. H. Williams & Co. or equal)
6. Spanner wrench, adjustable pin type for use on bearing housing (Source: #482 J. H. Williams & Co. or equal)
7. Brass bar
8. Arbor press

REPAIR: MODELS H, HL, K, KK, L, LQ AND LL CARTRIDGE MECHANICAL SEAL PUMPS



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	10	Cartridge Seal	19	Idler and Bushing Assembly
2	Lockwasher	11	Capscrew for Bracket	20	Idler Bushing
3	End Cap	12	Grease Fitting	21	Head Gasket
4	Lip Seal	13	Bracket and Bushing Assembly	22	Idler Pin
5	Bearing Spacer Collar (Outer)	14	Bracket Bushing	23	Head and Idler Pin Assembly
6	Ball Bearing	15	Bracket Gasket	24	Capscrew for Head
7	Bearing Spacer Collar (Inner)	16	Pipe Plug	25	Relief Valve Gasket
8	Ring, Half Round (Not H, HL)	17	Casing (Tapped or Flanged)	26	Internal Relief Valve
9	Bearing Housing	18	Rotor and Shaft Assembly	27	Capscrew for Valve

FIGURE 4 - EXPLODED VIEW SERIES 4123A, 4124A, 4124AE, 4126A, AND 4127A MODELS

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the 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.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

Failure to follow above listed precautionary measures may result in serious injury or death.

CARTRIDGE MECHANICAL SEAL REPLACEMENT

MODELS:

H, HL, K, KK, L ,LQ, LL4124A AND LL4124AE CAST IRON
H, HL, K, KK, L, LQ, AND LL4126A DUCTILE IRON
H, HL, K, KK, LQ, AND LL4123A STEEL
H, HL, K, KK, LQ, AND LL4127A STAINLESS STEEL

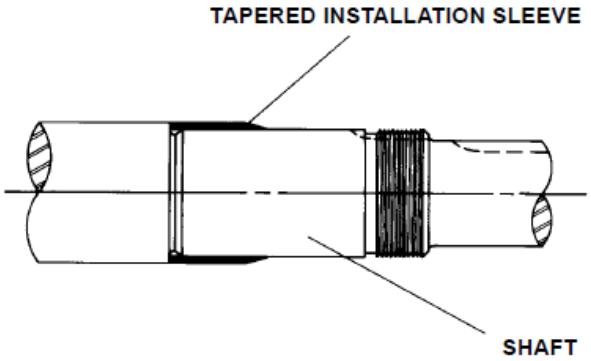
For complete pump disassembly and assembly see pages 7 and 8.

CARTRIDGE MECHANICAL SEAL REMOVAL

1. Bend up tang of lockwasher and with a spanner wrench, remove locknut and lockwasher from shaft.
2. Loosen two set screws in the face of the bearing housing and remove the bearing housing assembly from the bracket.
3. Remove the pair of half round rings under the inner spacer collar from the shaft. There are no half round rings on the "H" and "HL" size pumps.
4. If flush or barrier fluid tubes are connected to the seal gland, disconnect before removing seal. Loosen the set screws on the cartridge seal collar to free the cartridge seal from the shaft. Remove the two gland capscrews and slide cartridge seal out through bearing housing opening.

CARTRIDGE MECHANICAL SEAL INSTALLATION

1. **NOTE:** Burrs left on shaft can damage O-ring on seal sleeve during installation. Inspect shaft for burrs and remove any found with a fine grade of emery cloth.
2. Clean rotor shaft and face of seal chamber.
3. Place tapered installation sleeve on shaft. Coat rotor shaft, tapered installation sleeve, and O-ring in the inside diameter of cartridge seal sleeve with a generous amount of light oil. **Refer to figure 5.**



COAT ROTOR SHAFT, TAPERED INSTALLATION SLEEVE AND INNER DIAMETER OF MECHANICAL SEAL WITH LIGHT OIL BEFORE ASSEMBLY.

FIGURE 5

4. Slide cartridge seal over installation sleeve on shaft until it contacts the seal chamber face. Remove tapered installation sleeve from shaft.
5. Place pair of half round rings in groove on shaft and turn bearing housing assembly into bracket. There are no half round rings on the "H" and "HL" size pumps.
6. Put lockwasher and locknut on shaft. Tighten locknut and bend one tang of lockwasher into slot of locknut.
7. Adjust pump end clearance as in **Thrust Bearing Adjustment page 10.**
8. Insert gland capscrews and secure gland to bracket face. **NOTE:** turn shaft several turns while gland is loose to center seal; then tighten gland tight enough to compress gasket. Tighten only enough to contain leakage and not to distort gland.
9. Lock cartridge seal drive collar to shaft and remove or turn centering clips out of the way so as to clear the drive collar.
10. Turn shaft by hand or jog motor to check drive collar for runout.
11. Connect flush line or vent stuffing box seals without flush line until liquid is present on start up.

    NOTE: For maximum seal life, flush line should be used.

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

MODELS:

H, HL, K, KK, L, LQ, AND LL4124A CAST IRON
L, LQ AND LL 4124AE CAST IRON
H, HL, K, KK, L, LQ, AND LL4126A DUCTILE IRON
H, HL, K, KK, LQ, AND LL4123A STEEL EXTERNALS
H, HL, K, KK, LQ AND LL4127A STAINLESS STEEL

This seal type can be installed as an alternate to the cartridge mechanical seal. The seal is setscrew driven, is simple to install and good performance will result if care is taken during installation.

For complete pump disassembly and assembly **see pages 7 and 8.** For Step 6, disassembly, remove the appropriate nuts, capscrews, seal holder and seal seat. Remove the pipe plug in the bracket and loosen the setscrews holding the mechanical seal rotary member to the shaft. This must be done before the rotor is removed to avoid damage to the seal and the rotor shaft.

The following steps are for mechanical seal assembly.

1. Clean rotor shaft and seal housing bore. Make sure they are free of dirt, grit and scratches. Gently radius leading edge of the shaft diameter over which seal is to be placed.

   Never touch mechanical seal faces with anything except clean hands or clean cloth. Minute particles can scratch the seal faces and cause leakage.
2. Place tapered installation sleeve on the shaft. Coat tapered sleeve and inside of the rotary member with a generous quantity of light oil. Grease is not recommended. Start rotary member on shaft and over tapered sleeve. **Refer to Figure 6.**

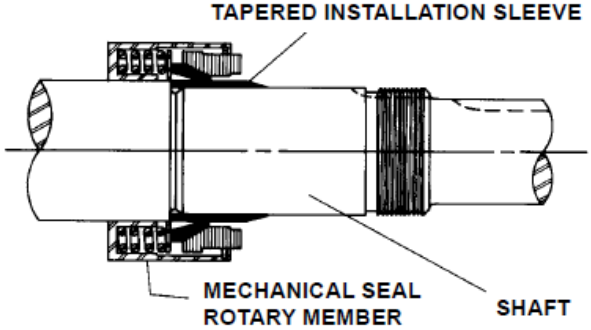


FIGURE 6

3. Move rotary member so setscrews are directly below seal access holes on side of bracket. Tighten all setscrews securely to shaft. Some seals are equipped with holding clips which compress the seal springs. Remove holding clips to release springs after seal is installed on shaft.

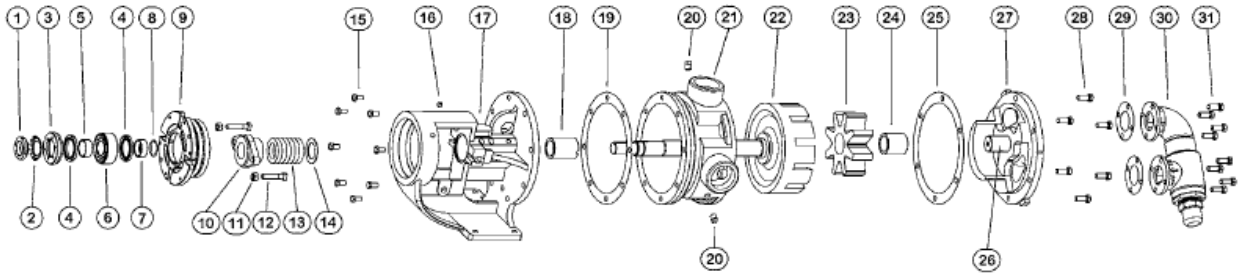
4. ***FOR "O-RING" GASKET TYPE MECHANICAL SEAL SEAT:*** Lubricate outer diameter of O-Ring seal gasket with oil. Flush sealing faces of both rotary member and seal seat with oil and press seal seat in to bore until back, unlapped face, is flush with bore. Install

FOR "CLAMPED-IN" TYPE MECHANICAL SEAL SEAT: Flush sealing faces of both rotary member and seal seat with oil and install seal seat and seat gasket over end of shaft against machined bracket face. Install other seal gasket, seal holder, capscrews, and nuts and tighten securely. Remove tapered installation sleeve.

5. Connect flush line or vent stuffing box for seals without flush line until liquid is present on start up.

NOTE: For maximum seal life, flush line should be used.

REPAIR: MODELS H, HL, K, KK, L, LQ AND LL PACKED PUMPS



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

FIGURE 7 - EXPLODED VIEW SERIES 123A, 126A, 124A AND 4127A MODELS

DISASSEMBLY

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the 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.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

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 the 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 11.**

   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. Loosen two setscrews in the face of the bearing housing and remove the bearing housing assembly from the bracket. **Refer to Figure 8.**
5. Remove pair of half round rings under the inner spacer collar from the shaft. There are no half round rings on the "H" and "HL" size pumps.

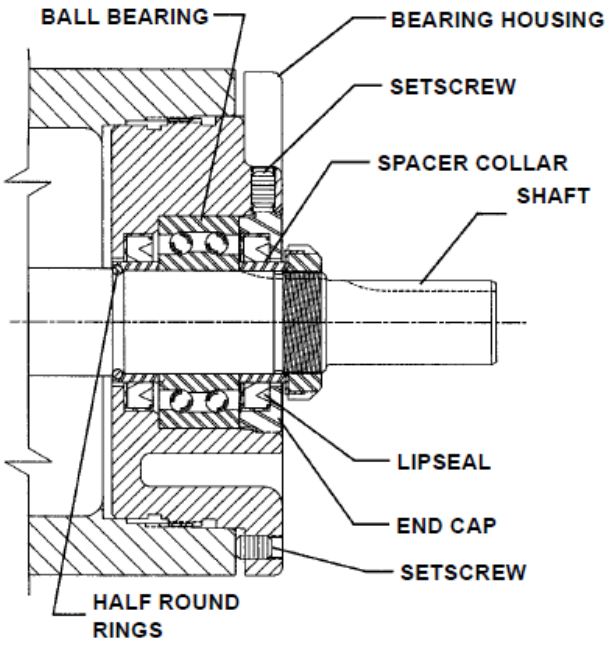


FIGURE 8

6. Remove packing gland capscrews, slide packing gland out of stuffing box, and remove packing.

   NOTE: Reference cartridge seal replacement beginning on page 3 when disassembling seal pump.
7. Carefully remove rotor and shaft to avoid damaging bracket bushing.
8. Loosen two radial setscrews in flange of bearing housing and with a spanner wrench remove the outer end cap with closure and outer bearing spacer collar.
9. Remove the double row ball bearing, closure and inner bearing spacer collar from the bearing housing.
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 light 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 11.**
2. Coat shaft of rotor shaft assembly with light oil. Start end of shaft in bracket bushing turning from right to left, slowly pushing rotor in casing.

3. Coat idler pin with light 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 11.**

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 the equal distance between port connections to allow for proper flow of liquid through pump. If pump is equipped with jacketed headplate, install at this time along with new gasket.

   Tighten head capscrews evenly.

5. When assembling packed pump, 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. Install packing gland, capscrews, and nuts. Make sure gland is installed square and nuts are tightened evenly. Tighten nuts until packing gland is snug against packing.

6. Slide inner spacer collar over shaft with recessed end facing rotor. 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 the H and HL size pumps.

7. Install the lip seal (lip toward end of shaft) in the bearing housing and turn the bearing housing into the bracket.

8. Pack the ball bearing with grease, place on the shaft and push or drive into place in housing.

9. Install the lipseal (with lip toward end of shaft) and bearing spacer collar in the outer end cap and turn the end cap into the bearing housing until tight against the bearing. Lock in place with two set screws in the flange of the bearing housing.

10. Put lockwasher and locknut on shaft. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Tighten locknut to 50-70 ft.– lbs. Torque (H, HL) or 100-130 ft. – lbs. Torque (K, KK, L, LQ, LL) . Bend one tang of lockwasher into slot of locknut. If tang does not line up with slot, tighten locknut until it does. Failure to tighten locknut or engage lockwasher tang could result in early bearing failure and cause damage to pump.

    Remove length of hardwood or brass from port opening.

11. Adjust pump end clearance as in **Thrust Bearing Adjustment page 10.**

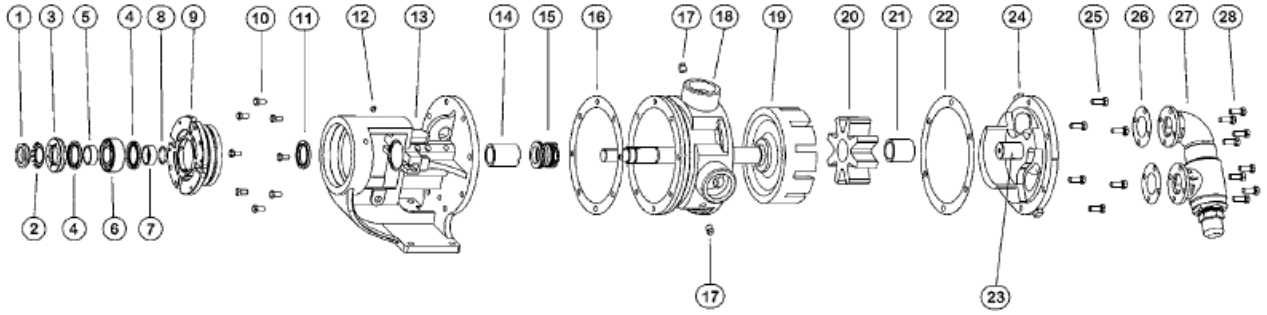
12. Lubricate all grease fittings with multi-purpose grease, NLGI #2.

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.

REPAIR: MODELS H, HL, K, KK, L, LQ AND LL BEHIND THE ROTOR COMPONENT MECHANICAL SEAL PUMPS



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

FIGURE 9 - EXPLODED VIEW SERIES 4124B MODELS

DISASSEMBLY

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the 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.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

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 the 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 11.**

   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. Loosen two setscrews in the face of the bearing housing and remove the bearing housing assembly from the bracket. **Refer to Figure 10.**
5. Remove pair of half round rings under the inner spacer collar from the shaft. There are no half round rings on the "H" and "HL" size pumps.
6. Carefully remove rotor and shaft to avoid damaging bracket bushing.

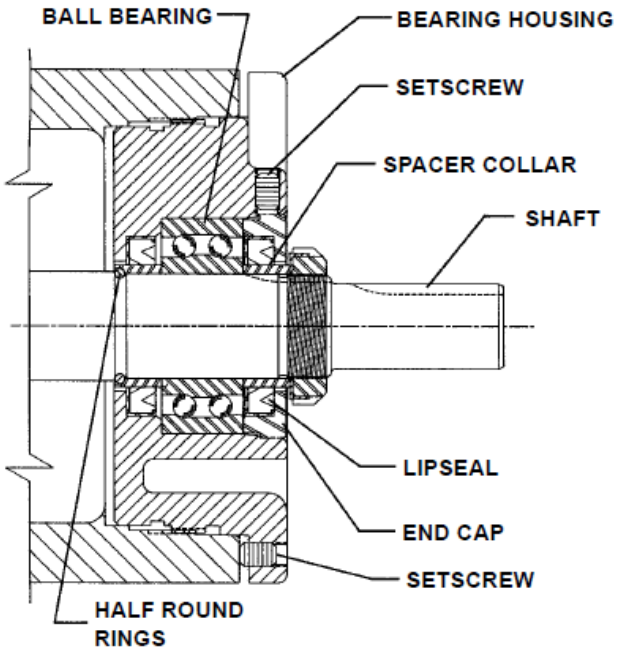


FIGURE 10

7. Loosen two radial setscrews in flange of bearing housing and with a spanner wrench remove the outer end cap with closure and outer bearing spacer collar.
8. Remove the double row ball bearing, closure and inner bearing spacer collar from the bearing housing.
9. Remove the rotary member of the mechanical seal from the rotor shaft. Remove the seal seat from the bracket.
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 light 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 11.** Make sure slots in the face of the bushing are towards rotor end of the bracket.
2. Clean rotor shaft and seal housing bore. Make sure they are free of dirt, grit and scratches. Gently radius leading edge of shaft diameter over which seal is to be placed.

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

3. Place tapered installation sleeve on the shaft. Coat tapered sleeve and inside of the rotary member with a generous quantity of light oil. Grease is not recommended. Start rotary member on shaft and over tapered sleeve. **Refer to Figure 11.**

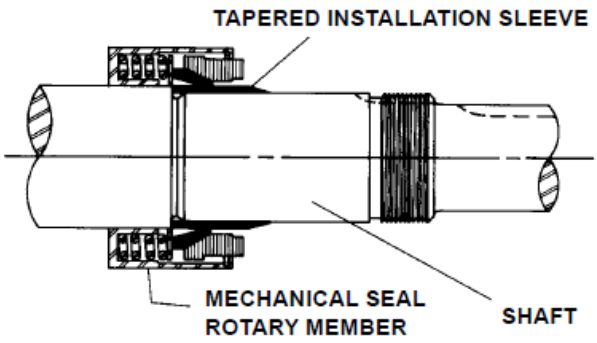


FIGURE 11

4. Move rotary member all the way on the rotor shaft until it is against the rotor hub. If the seal uses setscrews to secure the seal to the shaft, tighten the setsecrews once the seal is in place. Some PTFE seals are equipped with holding clips which compress the seal springs. Remove holding clips to release springs after seal is installed on shaft.
5. Lubricate outer diameter of seal seat gasket with oil. Press seal seat into bore until back, unlapped face bottoms in bore. Make sure the seat anti-rotation pins are aligned with slots in the bracket bushing.
6. Coat rotor shaft and face of mechanical seal with light oil. Start end of shaft in bracket bushing turning from right to left, slowly pushing rotor in casing.
7. Coat idler pin with light 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 11.**
8. 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 the equal distance between port connections to allow for proper flow of liquid through pump. If pump is equipped with jacketed headplate, install at this time along with new gasket.
9. Tighten head capscrews evenly.
10. Slide inner spacer collar over shaft with recessed end facing rotor. 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 the H and HL size pumps.
11. Install the lip seal (lip toward end of shaft) in the bearing housing and turn the bearing housing into the bracket.
12. Pack the ball bearing with grease, place on the shaft and push or drive into place in housing.
13. Install the lipseal (with lip toward end of shaft) and bearing spacer collar in the outer end cap and turn the end cap into the bearing housing until tight against the bearing. Lock in place with two set screws in the flange of the bearing housing.
14. Put lockwasher and locknut on shaft. Insert length of hardwood or brass through port opening between rotor teeth to keep shaft from turning. Tighten locknut to 50-70 ft.– lbs. Torque (H, HL) or 100-130 ft. – lbs. Torque (K, KK, L, LQ, LL) . Bend one tang of lockwasher into slot of locknut. If tang does not line up with slot, tighten locknut until it does. Failure to tighten locknut or engage lockwasher tang could result in early bearing failure and cause damage to pump.

    Remove length of hardwood or brass from port opening.

THRUST BEARING ADJUSTMENT SIZE H, HL, K, KK, L, LQ, LL PUMPS

1. Loosen the two set screws in the outer face of the bearing housing and turn this thrust bearing assembly clockwise until it can no longer be turned by hand. Back off counter-clockwise until the rotor shaft can be turned by hand with a slight noticeable drag.
2. For standard end clearance, back off the thrust bearing assembly the required length measured on the outside diameter of the bearing housing. **See Table 1.**
3. Tighten the two self-locking type “Allen” set screws, in the outboard face of the bearing housing, with equal force against the bracket. Your pump is now set with standard end clearances and locked.

   NOTE: Be sure the shaft can rotate freely. If not, back off additional length on outside diameter and check again.

PUMP SIZE	MODEL	STANDARD END CLEARANCE (Inch)	TURN BRG. HOUSING C.C.W. LENGTH ON O.D. (Inch)	ADDITIONAL LENGTH ON O.D. BRG. HOUSING FOR .001” END CL. (Inch)
H HL	124A 4124A 4124B 126A 4126A 123A 4123A	0.003	.75	.22
	127A 4127A	0.005	1.125	
K,KK L,LQ LL	124A 4124A 124AE 4124AE 4124B 126A 4126A 123A 4123A	0.005	1.25	.25
	127A 4127A	0.008	2	

TABLE 1

4. High viscosity liquids required additional end clearances. The amount of extra end clearance depends on the viscosity of the liquid pumped. For specific recommendations, consult the factory. Each additional ¼" turn on the outside diameter of the bearing housing is equivalent to an extra end clearance of .001".

INSTALLATION OF CARBON GRAPHITE BUSHINGS

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

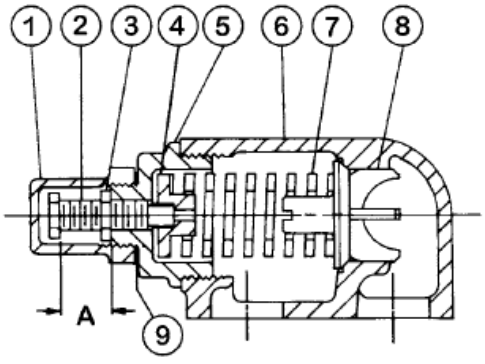
1. A press must be used for installation.
2. Be certain bushing is started straight.
3. Do not stop pressing operation until bushing is in proper position. Starting and stopping will result in a cracked bushing.
4. Check bushing for cracks after installation.

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

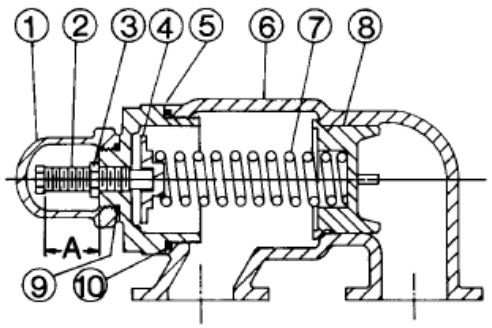
1. Heat bracket for idler to 750°F.
2. Install cool bushing with a press.
3. If facilities are not available to reach 750°F. temperature, it is possible to install with 450°F. temperature; however the lower the temperature the greater the possibility of cracking the bushing.

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

PRESSURE RELIEF VALVE INSTRUCTIONS



VALVE - 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		



VALVE - 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

FIGURE 13
SIZES K, KK, L, LQ AND LL

DISASSEMBLY

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the 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.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

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 Figure 12 and Figure 13.**
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 if 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.

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 adjusting operation.
3. Turn adjusting screw in to increase pressure and out to decrease pressure.
4. With discharge line closed at 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 CORPORATION

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. The warranty period for Universal Seal series pumps ONLY, shipped after July 1, 2001 (Universal Seal models listed below) is three (3) years from date of startup, provided that in no event shall this warranty extend more than forty-two (42) 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, FOB. 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.

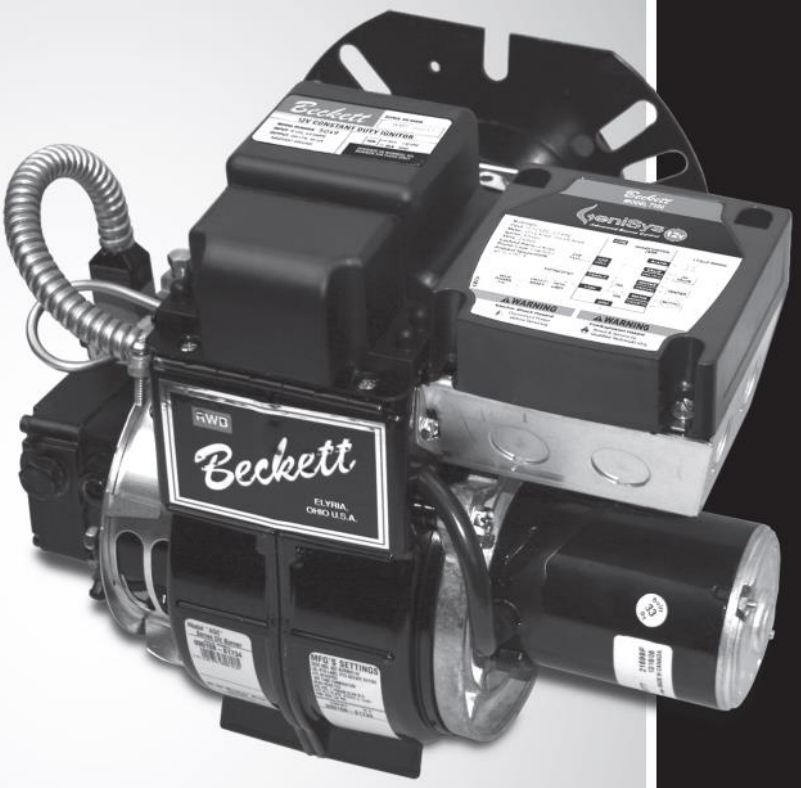
THIS IS VIKING'S SOLE WARRANTY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, WHICH ARE HEREBY EXCLUDED, INCLUDING IN PARTICULAR ALL WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. No officer or employee of IDEX Corporation or Viking Pump, Inc. is authorized to alter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

Universal Seal Pump Models: Sizes H, HL , K, KK, L, LQ, LL, LS, Q, QS, N and R in Series 124A, 4124A, 4124AE, 4124B, 224A, 4224A, 4224AE, 4224B, 324A, 4324A, 126A, 4126A, 226A, 4226A, 123A, 4123A, 223A, 4223A, 323A, 4323A, 127A, 4127A, 227A, 4227A, 327A and 4327A.

ADC

Oil Burner Manual

Beckett™
CORPORATION



⚠ WARNING **Potential for Fire, Smoke and Asphyxiation Hazards**

Incorrect installation, adjustment, or misuse of this burner could result in death, severe personal injury, or substantial property damage.

To the Homeowner or Equipment Owner:

- Please read and carefully follow all instructions provided in this manual regarding your responsibilities in caring for your heating equipment.
- Contact a professional, qualified service agency for installation, start-up or service work.
- READ THESE INSTRUCTIONS AND SAVE FOR REFERENCE.

To the Professional, Qualified Installer or Service Agency:

- Please read and carefully follow all manual instructions and any supplements provided, before installing, starting, or servicing this burner or heating system.
- The Installation must be made in accordance with all state and local codes having jurisdiction.

Contents

Prepare Before Installing

Hazard Definitions

DANGER Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

Within the boundaries of the hazard warning, there will be information presented describing consequences if the warning is not heeded and instructions on how to avoid the hazard.

NOTICE Intended to bring special attention to information, but not related to personal injury or property damage.

WARNING **Owner's Responsibility**

Incorrect installation, adjustment, and use of this burner could result in severe personal injury, death, or substantial property damage from fire, carbon monoxide poisoning, soot or explosion.

Contact a professional, qualified service agency for the installation, adjustment and service of your oil heating system. This work requires technical training, trade experience, licensing or certification in some states and the proper use of special combustion test instruments.

Please carefully read and comply with the following instructions:

- Never store or use gasoline or other flammable liquids or vapors near this burner or appliance.
- Never attempt to burn garbage or refuse in this appliance.
- Never attempt to light the burner/appliance by throwing burning material into the appliance.
- Never attempt to burn any fuel not specified and approved for use in this burner.
- Never restrict the air inlet openings to the burner or the combustion air ventilation openings in the room.

Specifications

Capacity	*'F' Head* Firing rate: 0.75 – 2.50 GPH Input: 105,000 - 350,000 Btu/h
Fuels	*USA:* No. 1 or No. 2 diesel fuel or kerosene; No.1 or No. 2 heating oil (ASTM D396) **CAUTION** **DO NOT USE GASOLINE, CRANKCASE OIL, OR ANY OIL CONTAINING GASOLINE.**
Electrical	*Power supply:* 13.5 VDC *Operating load:* 15 Amps w/ igniter on, 8-10 Amps w/ igniter turned off *Motor:* 13.5 VDC, 1/6 hp, 3450 rpm,10 Amps (max.), NEMA "M" flange, rotation CCW when facing shaft end. *Ignition Secondary:* 20KVpk 30mA Interrupted duty OR optional continuous duty
Pump	*Outlet pressure:* Note 1
Air tube	*ATC code:* See ***Table 1***.
Dimensions	*Height (maximum):* 11 ½ inches *Width (maximum):* 14 3/8 inches *Depth (chassis only):* 6 9/16 inches *Air tube diameter:* 4 inches
Ambient Operating Temperature	+32° F. (0° C.) Minimum +115° F. (+46° C.) Maximum (See Warning on Impaired Burner Performance and Fire Hazard.)

Note 1. See equipment manufacturer's burner specifications for recommended outlet pressure. Pressure is 100 psig unless otherwise noted.

WARNING **Impaired Burner Performance and Fire Hazard.**

Do NOT operate the burner beyond specifications outlined in the following Table.

- For applications beyond these limits, consult Beckett Technical Service at 1-800-645-2876.
- NOTE: Some packaged appliances with burners may be agency listed as a unit to operate beyond these limits. Consult the appliance manufacturer's specifications and agency approvals for verification.

Notice Special Requirements

NOTICE If you discover damage to the burner or controls during unpacking, notify the carrier at once and file the appropriate claim.

NOTICE When contacting Beckett for service information — Please record the burner serial number (and have available when calling or writing). You will find the serial number on the silver label located on the left rear of the burner. See ***Figure 1***.

⚠ WARNING **Adequate Voltage Required**

A low or erratic power supply could result in impaired burner operation, severe delayed ignition or an explosion inside the heat exchanger resulting in a burn and/or asphyxiation hazard.

- The Model ADC requires a continuous supply of 11 to 16 volts DC at 15 amps measured at the burner during operation.
- An automotive or small engine charging system that is capable of supplying the required continuous voltage/amperage is recommended with certain road equipment, such as asphalt hot patchers and similar applications.
- This is especially true while maintaining nominal load temperatures during idle periods.

⚠ WARNING **Adequate Combustion and Ventilation Air Supply Required**

Failure to provide adequate air supply could seriously affect the burner performance and result in damage to the equipment, asphyxiation, explosion or fire hazards.

- The burner cannot properly burn the fuel if it is not supplied with a reliable combustion air source.
- Follow the guidelines in the latest editions of the NFPA 31 and CSA-B139 regarding providing adequate air for combustion and ventilation.

Table 1. Air Tube Combination (ATC) Codes

Firing Rate GPH	Head	Static Plate Size	ATC Codes for Usable Air Tube Lengths: ('A' in inches see Fig. 2)			
min-max		inches	4-1/2	5	5-3/8	6-5/8
0.40-0.75	F0	3-3/8U	AF44XR	-	AF53XR	AF65XR
0.75-1.25	F3	2-3/4	AF44XN	-	AF53XN	AF65XN
0.85-1.35	F4	2-3/4	AF44WH	-	AF53WH	AF65WH
0.85-1.65	F6	2-3/4	AF44YB	-	AF53YB	AF65YB
1.10-2.00	F12	2-3/4	AF44XO	-	AF53XO	AF65XO
1.65-2.50	F22	2-3/4	AF44XP	-	AF53XP	AF56XP

General Information

Your burner was designed, installed and adjusted at the factory prior to shipment and should not require additional adjustments. Refer to the Troubleshooting section of this manual when experiencing a possible fault condition.

A. Equipment Located in Confined Space

The confined space should have two permanent openings: one near the top of the enclosure and one near the bottom of the enclosure. Each opening shall have a free area of not less then one square inch per 1,000 BTU's per hour of the total input rating of all equipment within the enclosure. The openings shall have free access to the building interior, which should have adequate infiltration from the outside.

B. Exhaust Fans and Other Air-Using Devices.

Size air openings large enough to allow for all air using devices in addition to the minimum area required for combustion air. If there is any possibility of the equipment room developing negative pressure (because of exhaust fans, for example), either pipe combustion directly to the burner or provide a sealed enclosure for the burner and provide it with its own combustion air supply.

C. Clearances to Burner and Equipment

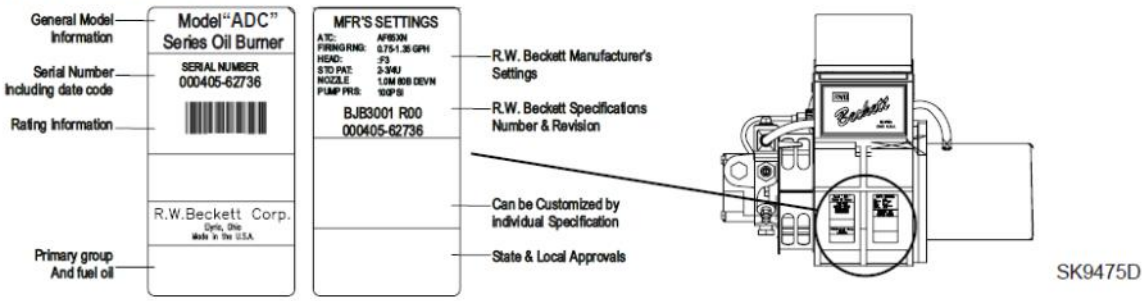
Provide space around burner and equipment for easy service and maintenance. Check minimum clearances against those shown by the equipment manufacturer and by applicable codes.

D. Exhausting Hazardous Fumes

See warning on this page. Also be conscious of any fumes produced by the materials that are being heated. Always ensure adequate ventilation to exhaust all fumes.

Head Type	Low Firing Rate Baffle (if specified)
F0	up to 0.65 gph
F3	up to 0.85 gph
F4 or F6	up to 0.90gph

Figure 1. Typical Burner Nameplate



E. Low Firing Rate Baffle.

The low firing rate baffle (See LFRB in Replacement Parts) reduces the air flow and pressure. The LFRB is sometimes used for firing rates under 1.00gph as listed in the table on this page. Refer to the equipment manufacturer's instructions. Do not omit the LFRB when specified. Omitting the baffle when specified or installing the baffle when not specified could result in poor burner performance.

Nozzle Assembly Maintenance

⚠ WARNING **Correct Nozzle and Flow Rate Required**

Incorrect nozzles and flow rates could result in impaired combustion, under-firing, over-firing, sooting, puff-back of hot gases, smoke and potential fire or asphyxiation hazards.

Use only nozzles having the brand, flow rate (gph), spray angle and pattern specified by the appliance manufacturer.

Follow the appliance manufacturer's specifications for the required pump outlet pressure for the nozzle, since this affects the flow rate.

- Nozzle manufacturers calibrate nozzle flow rates at 100 psig.
- When pump pressures are higher than 100 psig, the actual nozzle flow rate will be greater than the gph stamped on the nozzle body. (Example: A 1.00 gph nozzle at 140 psig = 1.18 gph)

Securely tighten the nozzle (90 torque inch pounds). For typical nozzle flow rates at various pressures refer to ***Table 2***.

A. Replace the Burner Nozzle.

1. If applicable, remove the plastic plug protecting the nozzle adapter threads.
2. Place a 3/4" open-end wrench on the nozzle adapter. Insert the nozzle into the adapter and finger tighten. Finish tightening with a 5/8" open-end wrench.
3. If the nozzle is already installed, remove the nozzle line assembly to verify that the nozzle size and spray pattern are correct for the application (per equipment manufacturer's information). Verify that the electrode tip settings comply with ***Figure 3***.

⚠ CAUTION **Use care when removing or installing an oil nozzle**

A damaged nozzle could cause impaired combustion, sooting, puffback of hot gases, oil leakage and potential fire or asphyxiation hazards.

- Inspect the nozzle adapter to insure that the sealing surface is not grooved or scratched.
- To insure that the nozzle functions properly, check the orifice and strainer for dirt, scratches or other damage before installation.
- Do NOT attempt to install or remove a nozzle without securing the adapter to prevent seriously damaging the alignment.
- Use care when handling the nozzle line assembly to prevent changing the electrode tip settings or damaging the ceramic electrode insulators.
- Insure that the electrode setting match the values shown in ***Figure 3***.

Figure 3. Electrode Tip Setting

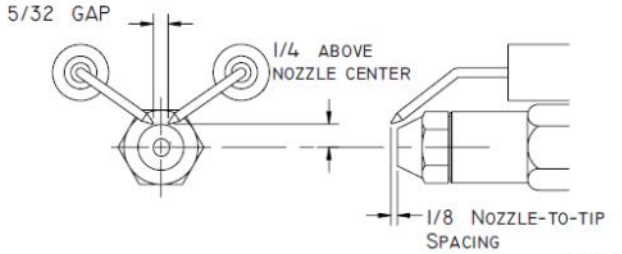


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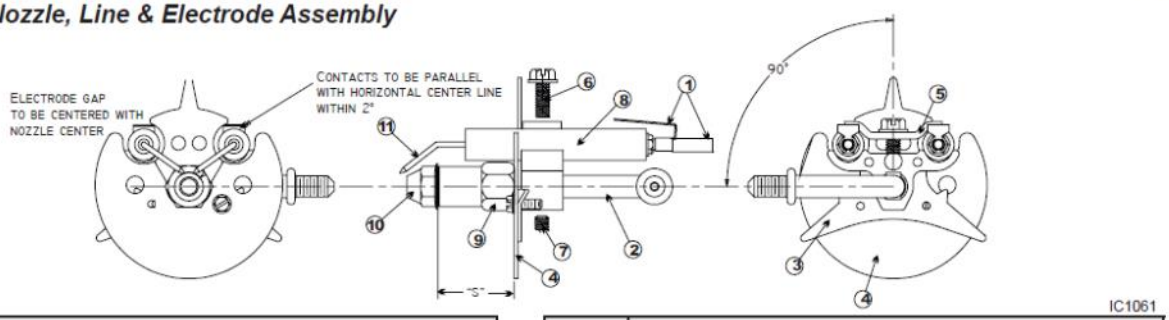
Figure 2. Nozzle, Line & Electrode Assembly



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Item #	Description
1	Electrode Contact (3" ATC or extension over 3")
2	Nozzle Line
3	Spider spacer assembly
4	Static Plate
5	Electrode clamp
6	Electrode clamp retaining screws

Item #	Description
7	Nozzle line setscrew
8	Electrode Insulator
9	Nozzle adapter
10	Nozzle tip
11	Electrode tip

B. Check/Adjust Electrodes

Check the electrode tip settings. Adjust if necessary to comply with the dimensions shown in Figure 3. To adjust, loosen the electrode clamp screw and slide/rotate electrodes as necessary. Securely tighten the clamp screw when finished.

C. Igniter Maintenance

The igniter assembly does not require any adjustments beyond making sure the springs and the burner electrode rods make solid contact when the igniter is in the closed position. The sealing surfaces of the gaskets should be checked and replaced at the first signs of any damage or deterioration. Clean any dirt or residue from the porcelain bushings, springs, and baseplate.

The simplest way to check igniter operation is by supplying voltage to the input and checking to see whether an arc is produced. Check by either looking or listening to see if there is an arc across the electrodes while the burner is running and the igniter is energized.

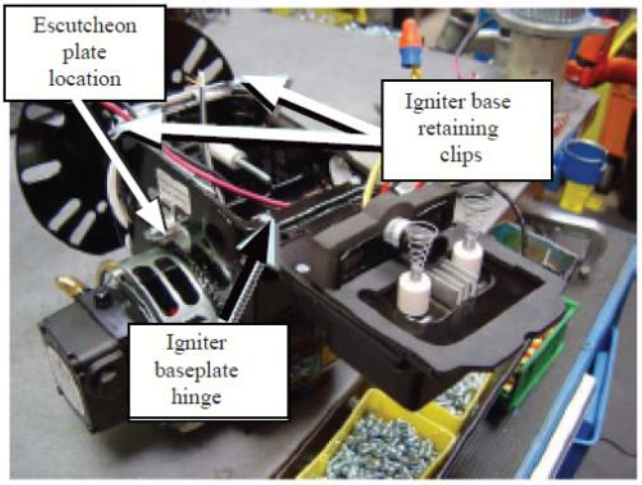
The igniter must be grounded to the burner before checking the following. To check the igniter, insure that the burner is off and use an ohmmeter to check the resistance between one of the springs and the exposed metal on the burner (ex. housing bolt). The meter should read less than 2000 ohms when measuring the spring-to-ground resistance at either spring.

The igniter should be replaced if the meter indicates an open circuit, the difference between the two spring-to-ground resistance readings is greater than 20% or the spring-to-spring resistance does not read approximately twice the spring-to-ground reading.

D. Servicing Nozzle Line Assembly

Before proceeding, turn off power to the burner.

Figure 4. Igniter Hinge & Retainer Clips



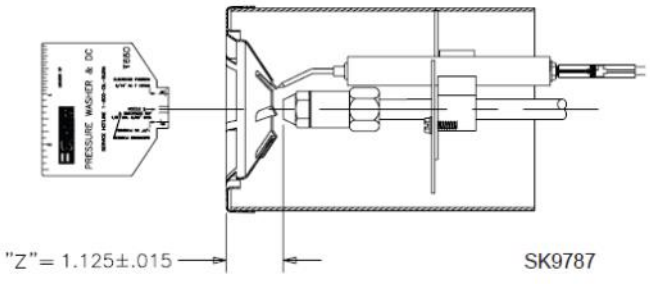
1. Disconnect the oil connector tube from the nozzle line.
2. Referring to Figure 4, loosen the two screws securing the igniter retaining clips and rotate both clips to release the igniter baseplate. Then tilt the igniter back on its hinge.
3. Remove the splined nut.
4. Remove the nozzle line assembly from the burner, being careful not to damage the electrodes or insulators while handling. To ease removal of short assemblies, it may be necessary to loosen the escutcheon plate. Reset to the edge of the label.
5. To replace the nozzle line assembly, reverse the above steps.

E. Check/Adjust "Z" Dimension

Refer to Figure 5. The critical "Z" dimension is the distance from the face of the nozzle to the flat face of the head. This distance for F heads is 1-1/8". The "Z" dimension is factory set for burners shipped with the air tube installed but should always be verified during service and installation. If the "Z" dimension is out of adjustment, perform the following steps.
Before proceeding, turn off power to the burner.

1. Disconnect the oil connector tube from the nozzle line.
2. Referring to Figure 2, loosen the splined nut from the nozzle line. Loosen the hex head screw securing the escutcheon plate to the burner housing.
3. A Beckett T650 gauge should be used to set the Z dimension.
4. Place the end of a ruler at the face of the nozzle and, using a straight edge across the head, measure the distance to the face of the head.
5. Slide the nozzle line forward or back until this dimension for F heads is 1-1/8".
6. Tighten the hex head screw to secure the escutcheon plate to the burner chassis. Then tighten the splined nut and attach the oil connector tube.

Figure 5. 'Z' Dimensions Using Gauge



7. Recheck the "Z" dimension periodically when servicing to ensure the escutcheon plate has not shifted. You will need to reset the "Z" dimension if you replace the air tube or nozzle line assembly.

NOTICE The Beckett Z gauge (part number Z-2000) is available to permit checking the F head "Z" dimension without removing the burner.

Fuel Supply

A. Connect Fuel Lines

⚠ WARNING **Do Not Install Bypass Plug with 1-Pipe System**

Failure to comply could cause Immediate pump seal failure, pressurized oil leakage and the potential for a fire and injury hazard.

- The burner is shipped without the by-pass plug installed.
- Install the bypass plug in two-pipe oil supply systems ONLY.

For oil supply system specifications for tanks not mounted on machines, carefully follow the pump manufacturer's literature and the latest edition of the National Fire Protection Association (NFPA) 31 standard.

NOTICE Pumps with automatic bypass do not require a bypass plug. Verify by referring to the pump manufacturer's instructions.

B. Fuel Supply Level with or Above Burner

The burner may be equipped with a single stage pump. If a one-pipe system is installed, insure that a bypass plug is not installed in the pump, then connect the fuel supply to the burner with a single supply line Note that manual bleeding of the pump is required on initial start-up or when the equipment runs out of fuel. When connecting a two-pipe fuel system, install the pump by-pass plug.

⚠ CAUTION **Oil Supply Pressure Control Required**

Damage to the filter or pump seals could cause oil leakage and a fire hazard.

- The oil supply inlet pressure to the burner ***cannot exceed 3 psig***.
- Insure that a pressure limiting device is installed in accordance with the latest edition of NFPA 31.
- **Do NOT install valves in the return line.** (NFPA 31, Chapter 8.)
- **Gravity Feed Systems:** Always install an anti-siphon valve in the oil supply line or a solenoid valve (RWB Part # 21441U) in the pump/nozzle discharge tubing to provide backup oil flow cut-off protection.

C. Fuel Supply Below Level of Burner

When the fuel supply is more than eight feet below the level of the burner, a two-pipe fuel supply system is required. Depending on the fuel line diameter and the horizontal and vertical length, the installation may also require a two-stage pump. Consult the fuel unit manufacturer's literature for lift and vacuum capability.

D. Fuel Line Replacement (Remote Tank Only)

When replacing fuel lines, continuous lengths of heavy wall copper tubing is recommended. To ensure a tight seal, always use flare fittings. Never use compression fittings. Always install fittings in an accessible location. To avoid vibration noise, fuel lines should not run against the appliance or the ceiling joists.

E. Fuel Line Valve and Filter

⚠ CAUTION **Do Not Use Teflon Tape**

Damage to the pump could cause impaired burner operation, oil leakage and appliance soot-up.

- Never use Teflon tape on fuel oil fittings.
- Tape fragments can lodge in fuel line components and fuel unit, damaging the equipment and preventing proper operation.
- Use oil-resistant pipe sealant compounds.

Shutoff valves should be located in the oil supply line. Do not install valves in the return line.

Burner Wiring

A. Burner installed on equipment

Refer to appliance manufacturer's wiring diagram for electrical connections.

⚠ WARNING **Electrical Shock Hazard**

Electrical shock can cause severe personal injury or death.

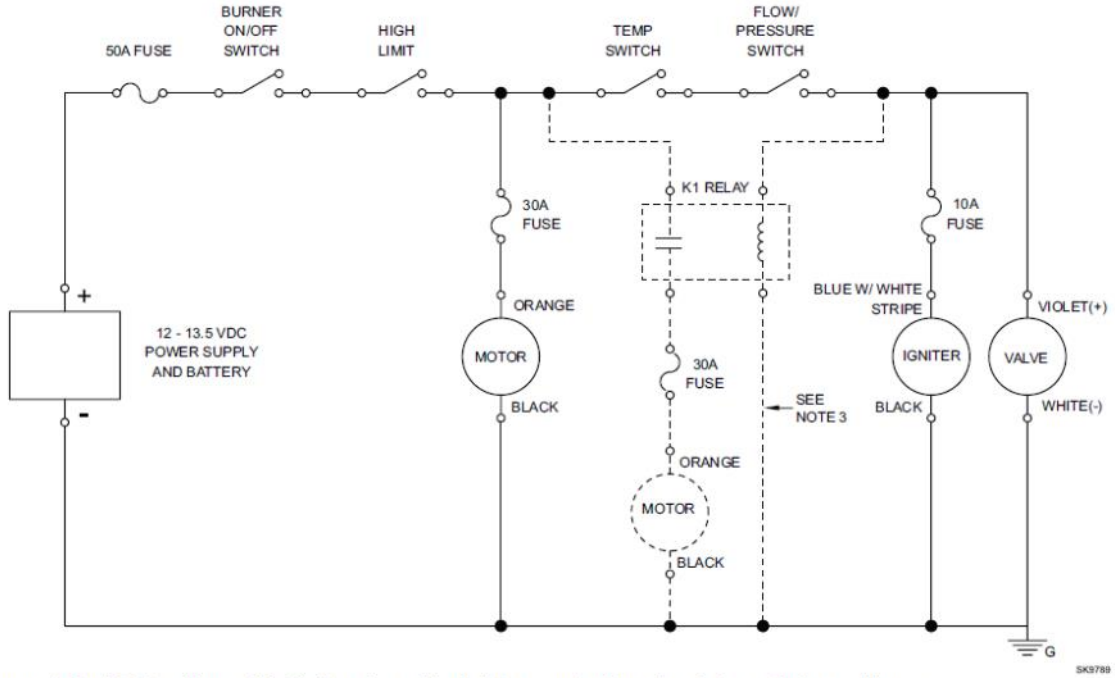
- Disconnect electrical power before installing or servicing the burner.
- Provide ground wiring to the burner, metal control enclosures and accessories. (This may also be required to aid proper control system operation.)

B. Burner Replacement

Burner wiring may vary, depending on the actual primary control and furnished options. Refer to Figure 6 for typical burner wiring, showing cad cell primary controls. Note that the relay and control, shown in the wiring diagram are optional features.

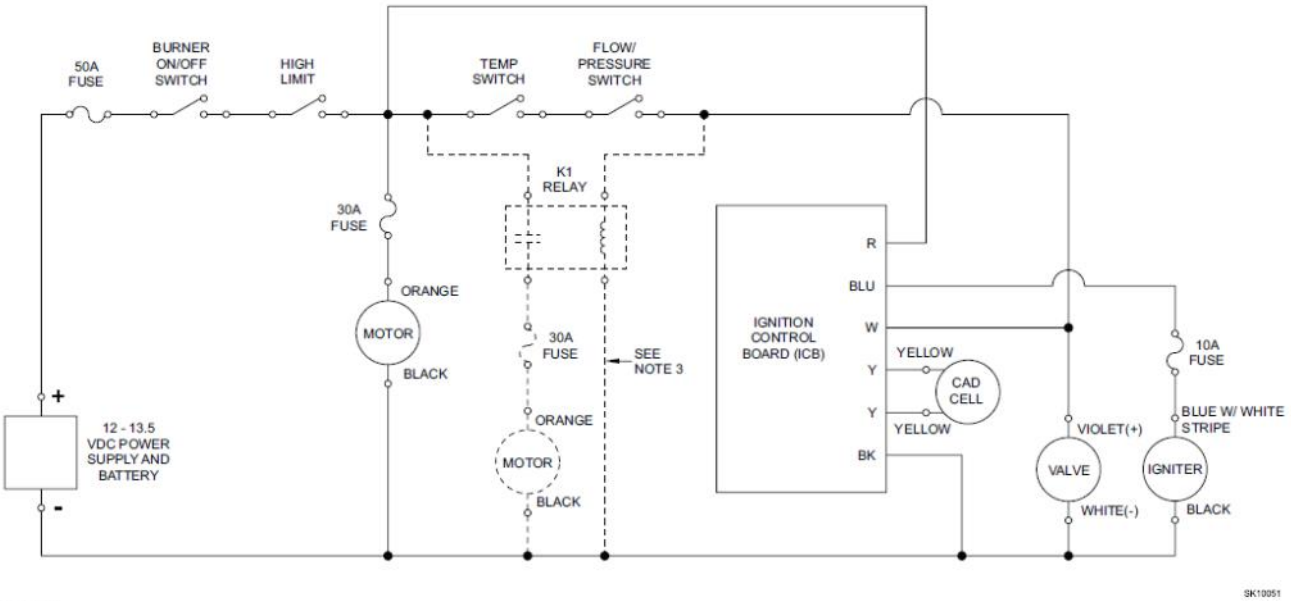
NOTICE The wiring diagrams in this manual are for general reference only. Refer to the equipment manufacturer's literature or the diagrams supplied with the equipment.

Figure 6A. Recommended Field Wiring



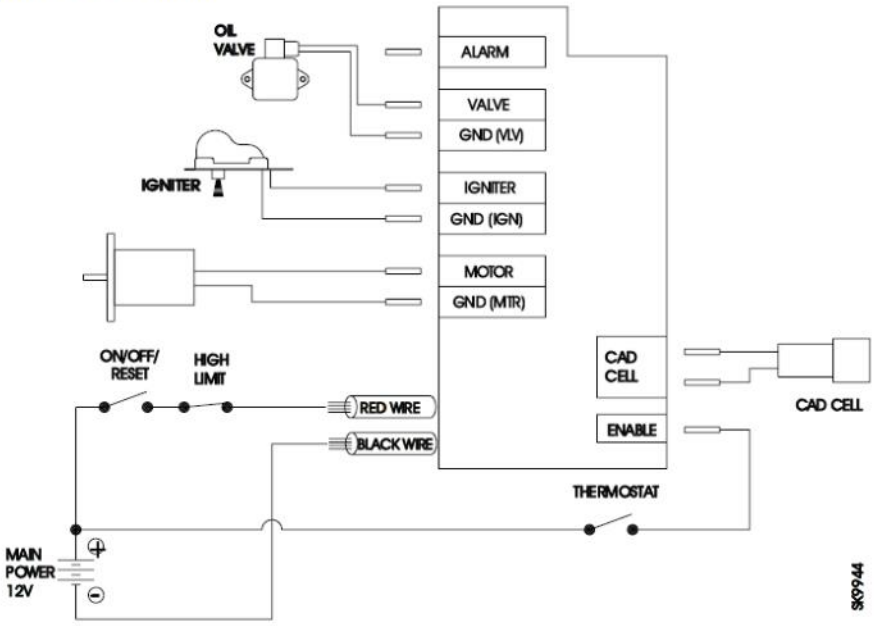
Notes:
1. *All wires are to be 14 GA. minimum (18 GA. for valve and igniter) to prevent voltage drop between battery and burner.*
2. *Motor runs continuously in normal configuration.*
3. *Optional motor configuration (shown in dashed lines) cycles motor with trigger. K1 relay to be S.P.S.T., N.O. contacts with 25A minimum current rating (100A inrush) @ 12 VDC.*
4. *Hard-wire burner ground to battery. DO NOT USE CHASSIS GROUND SYSTEM.*

Figure 6B. Wiring with ICB



Notes:
1. *All wires are to be 14 GA. minimum (18 GA. for valve and igniter) to prevent voltage drop between battery and burner.*
2. *Alternate wiring: white wire of ICB may be wired to red wire of ICB, and positive valve wire may be wired to Flow/Pressure Switch.*
3. *Hard-wire burner ground to battery. DO NOT USE CHASSIS GROUND SYSTEM.*

Figure 6C. Wiring with 7556 Control



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Notes:

1. *Wires are to be sized to prevent a voltage drop between the battery and the burner with the burner running at full load.*
2. *Fuse Sizes(inside control): Motor = 30 Amp, Igniter, Control, Valve, & Alarm = 10 Amp*
3. *Hard-wire burner ground to battery. Do NOT use chassis ground system.*
4. *Input power to the control's +12 volt wire must be provided from a fused service switch, rated at 50 amps or less.*
5. *Motor-off delay on a 7556P will be disabled if the safety and operating limits as shown in Figure 6C interrupt power to the control's red +12 volt wire.*
6. *Do not wire power directly to the burner motor. Only wire the motor as shown in Figure 6C. If instant burner heat is required by the application, purchase or program a control with a long motor-off delay time, which will ensure instant heat if a new call for heat is received within the motor-off delay time.*

Drive Component Maintenance

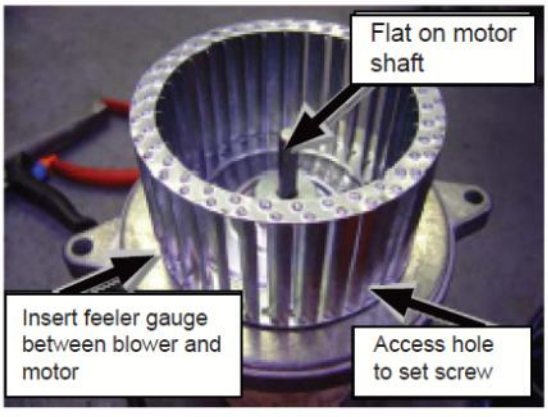
A. Motor, Blower Wheel, and Coupling Replacement

The motor will require replacement if the proper voltage is measured at the motor input, and the motor will either not run, or the current draw with a free running pump exceeds 10% of the rated current.

To replace the burner motor, coupling and/or blower wheel perform the following steps.

1. Before servicing, turn off and/or disconnect all power to the burner.
2. Disconnect the burner motor wires.
3. Remove the bolts securing the motor to the burner housing.
4. Remove the motor, coupling, and blower wheel.
5. Loosen the set screw on the blower wheel to slide the existing wheel off the shaft.
6. Slide the new blower wheel onto the old shaft (after thoroughly cleaning housing) and/or slide the old blower wheel onto the new motor shaft.
7. Place a .030" (1/32" ± 1/64") feeler gauge between the blower wheel and the motor housing.
8. Slide the blower wheel toward the motor until it contacts the feeler gauge.
9. Rotate the blower wheel until the setscrew is centered on the flat of the motor shaft. Tighten the setscrew to secure the wheel.
10. Slide the motor coupling on the motor shaft then install the motor on the burner housing. Insure that the motor coupling fits between the motor shaft and the pump shaft inside the housing. Tighten the motor retaining screws. Reconnect the wires.
11. Restore power, start the burner and perform the combustion test described previously in this manual.

Figure 7. – Blower Wheel



B. Pump Maintenance

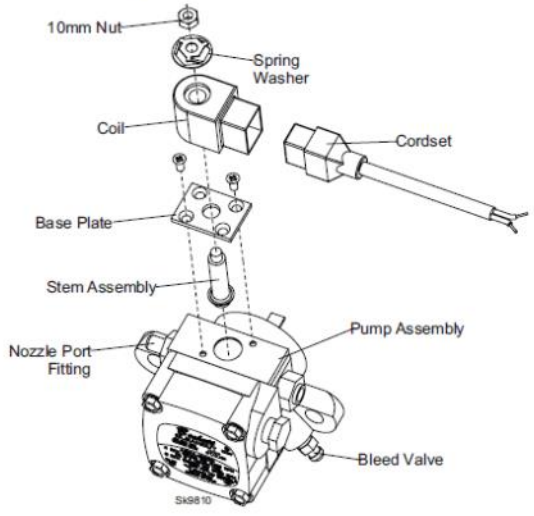
General Pump Information
Important information - Long or oversized inlet lines may require the pump to operate dry during initial bleeding period. In such cases, the priming may be assisted by injecting fuel oil in the pump gear set. Under lift conditions, lines and fittings must be air tight. To assure this, "Pipe Dope" may be applied to both the used and unused inlet and return fittings. **Do NOT use Teflon tape or compression fittings**
Mounting Position - Beckett CleanCut pump may be mounted in any position (except upside-down in a single pipe installation).
Vacuum Check - A Vacuum Gauge may be installed in either of the 1/4" NPT inlet ports.
Pressure Check- When a pressure check is made use the nozzle port. If the bleed port is used, the reading on the gauge should be approximately 5 psig higher than the pressure reading on the nozzle port. See Figure 9.
Cutoff Check - To check cutoff pressure dead head a pressure gauge in the nozzle port. Run the burner for a short period of time. Shut the burner off. The pressure will drop and hold above zero. Pressurized or gravity feed installations must not exceed 3 psi on inlet line or return line at the pump per NFPA 31. A pressure greater than 10 psi may cause damage to the shaft seal.

C. Valve Coil and Stem Replacement

To determine if the valve coil requires replacement perform the following steps.

1. Remove the cord set from the valve.
2. Place the leads from an ohmmeter across the coil.
3. A 12 volt coil should measure between 15 and 25 ohms.
4. If the meter indicates an open circuit, replace the coil.

Figure 8. – Pump and Valve Assemblies



To check pump operation perform the following.

1. Check the operating pressure by removing the copper tubing from the nozzle line and installing a pressure gauge in the line. With the motor running and the coil energized, check the gauge. The pressure should read 100 psig unless otherwise stated.
2. To check the cutoff function, deadhead the pressure gauge onto the copper connector tube attached to the nozzle port. Run the burner for a short period of time. Shut the burner off; the pressure should drop and hold.

To replace the coil and/or pump assembly perform the following steps.

1. Before servicing, turn off and/or disconnect all power to the burner.
2. Remove the copper tube assembly when replacing the pump or when removing the coil and the tube blocks the coil.
3. Using a flat tip screwdriver, press the flat tip into the spring washer to prevent it from rotating.
4. Using a 10mm wrench or adjustable wrench, remove the nut and spring washer.
5. Remove the coil by lifting it straight up.
6. Remove the two base plate screws, then the base plate by lifting straight up.
7. Remove valve stem assembly by pulling straight up.
8. To install the new stem and coil assemblies, follow the above steps in reverse order, tightening each part as you go.
9. Restore power, start the burner and perform the combustion test described previously in this manual.

Start Up Burner & Set Combustion

A. Basic Burner Operation

Standard Configuration - On the Beckett ADC oil burner standard configuration, the motor and igniter operate continuously while the valve that controls oil flow is cycled by the switches on the power washer. The motor is used to drive the blower and pump. The rotational speed of the motor is determined by the voltage supplied and the load placed on the motor. Pump pressure and air settings are the main factors affecting the motor load. The igniter converts battery DC voltage into a high voltage spark to ignite the oil. The igniter is capable of running continuously as long as the blower wheel is circulating air across the igniter base. The pump and solenoid valve are used to control the flow of oil from the reservoir to the nozzle.

With Igniter Control Board - An optional control circuit can be supplied to reduce current draw on the charging system by turning the igniter off after a flame has been established. This option controls igniter operation based on a signal from a light sensing cad cell. When light hits the cell the control will sense a decrease in resistance across the sensor. A few seconds delay will occur prior to the igniter switching off. As long as sufficient light is reaching the cell eye, the igniter will remain off. If light is removed from the sensor, the igniter will turn on until light is again sensed by the cad cell.

With 7556 Control - The 7556 control provides the same benefits as the ignition control board as described above as well as added safety, convenience, and performance features. It adds a valve on delay and motor-off delay to the burner's operation sequence that promote clean burner operation. It has a lock-out function that shuts the burner down if it is not operating properly. The control adds fusing at the burner to protect against component failures. The control also has redundant motor relays that are checked for proper operation every heat cycle.

Variations to the burner circuits may occur due to optional temperature, pressure, and vacuum switches that control burner operation. Note that when external switches are used to control motor operation they must be sized correctly for the rated current or a relay should be installed to isolate the switches from the motor's full load current.

B. Combustion Set-up

⚠ WARNING **Explosion and Fire Hazard**

Failure to follow these instructions could lead to equipment malfunction and result in heavy smoke emission, soot-up, hot gas puff-back, fire and asphyxiation hazards.

- Do not attempt to start the burner when excess oil has accumulated in the appliance, the appliance is full of vapor, or when the combustion chamber is very hot.
- Do not attempt to re-establish flame with the burner running if the flame becomes extinguished during start-up, venting, or adjustment.
- **Vapor-Filled Appliance:** Allow the unit to cool off and all vapors to dissipate before attempting another start.
- **Oil-Flooded Appliance:** Shut off the electrical power and the oil supply to the burner and then clear all accumulated oil before continuing.
- If the condition still appears unsafe, contact the Fire Department. Carefully follow their directions.
- Keep a fire extinguisher nearby and ready for use.

As soon as burner motor starts rotating bleed all the air from the pump. (Required with single-pipe systems.)

To bleed the pump, attach a clear plastic hose over the vent fitting. Loosen the fitting and catch the oil in an empty container. Tighten the fitting when all air has been purged from the supply system. Note: If the burner stops after a flame is established, the unit probably requires additional bleeding. Continue to bleed the system until the pump is primed and a flame is established when the bleed valve is closed.

C. Set Combustion with Instruments

1. Allow the burner to run for approximately 5 to 10 minutes.
2. Follow these four steps to properly adjust the burner:

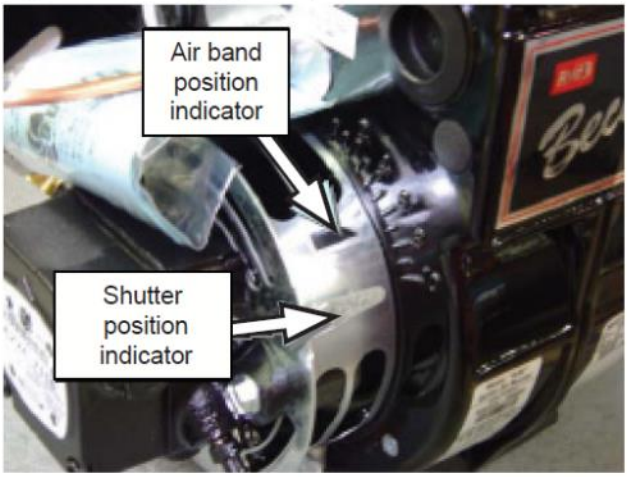
   Step 1: Adjust the air until a trace smoke level is achieved..

   Step 2: At the trace of smoke level, measure the CO_2 (or O_2). This is the vital reference point for further adjustments.

   Step 3: Increase the air to reduce CO_2 by 1 percentage point (O_2 will be increased by approximately 1.4 percentage points).

   Step 4: Recheck the smoke level. It should be zero.
3. This procedure provides a margin of reserve air to accommodate variable conditions.
4. Once the combustion level is set, tighten the fasteners on the air band and air shutter.
5. Start and stop the burner several times to ensure satisfactory operation.
6. Test the equipment safety controls to verify that they function according to the manufacturer's specifications.

Figure 9. – Air supply components



Maintain & Service Burner

A. Owner's Information

⚠ WARNING **Professional Service Required**

Incorrect installation, adjustment, and use of this burner could result in severe personal injury, death, or substantial property damage from fire, carbon monoxide poisoning, soot or explosion.

Please read and understand the manual supplied with this equipment. This equipment must be installed, adjusted and put into operation only by a qualified individual or service agency that is:

- Licensed or certified to install and provide technical service to oil heating systems.
- Experienced with all applicable codes, standards and ordinances.
- Responsible for the correct installation and commission of this equipment.
- Skilled in the adjustment of oil burners using combustion test instruments.

The installation must strictly comply with all applicable codes, authorities having jurisdiction and the latest revision of the National Fire Protection Association Standard for the installation of Oil-burning Equipment, NFPA 31 (or CSA-B139 and CSA-B140 in Canada). Regulation by these authorities take precedence over the general instructions provided in this installation manual.

Have your equipment inspected at regular intervals by a qualified service agency to assure continued proper operation. The burner should be adjusted using dedicated combustion test equipment. Failure to properly set the burner could result in inefficient operation, and/or conditions that could potentially cause severe personal injury, death or substantial property damage.

B. Owner Service and Maintenance

Properly installed and maintained, your ADC burner will provide years of efficient, trouble-free operation. Please take care of your equipment by following the warnings provided and by immediately contacting your qualified service agency if your burner is not operating properly. This equipment should be serviced only by a qualified service agency. The appropriate test instruments must be used.

Daily

Check the area around your burner/equipment to make sure:

- nothing is blocking the burner inlet air openings
- air ventilation openings are clean and unobstructed and the exhaust is not crusted
- no combustible materials are stored near the equipment
- there are no signs of oil or water leakage around the burner or equipment.

Extended Down Time

If the equipment will be stored for an extended period of time, insure that the fuel tank is full and add a fuel stabilizer to the tank.

Regular Service/Maintenance

Have your burner, serviced annually by your qualified service agency. The following components/assemblies should be checked/adjusted/replaced on a regular basis. Refer to the Replacement Parts exploded view for part locations.

- ☐ Replace the oil supply line filter if applicable. The line filter cartridge must be replaced to avoid contamination of the pump and nozzle.
- ☐ Inspect the oil supply system. All fittings should be leak-tight. The supply lines should be free of water, sludge and other restrictions.
- ☐ Remove and clean the pump strainer.
- ☐ Verify the nozzle is the one originally specified by the appliance manufacturer and replace the nozzle with one having the exact specifications from the same manufacturer.
- ☐ Clean and inspect the electrodes for damage, replacing any that are cracked or chipped.
- ☐ Check electrode tip settings. Replace electrodes if tips are rounded.
- ☐ Inspect the igniter spring contacts. Clean or replace if corroded.

- ⊔ Clean the cad cell, if applicable.
- ⊔ Make sure Low Firing Rate Baffle is in place, if required, for the burner application. Omitting the baffle can result in unacceptable burner combustion.
- ⊔ Inspect all gasket including the igniter base plate gasket. Replace any that are damaged or missing.
- ⊔ Clean the blower wheel, air inlet, air guide, retention head and static plate of any dirt, asphalt or other material.
- ⊔ Check motor current. The amp draw should not exceed the nameplate rating. Check all wiring for loose connections or damaged insulation.
- ⊔ Check the pump pressure and cutoff function.
- ⊔ Check primary control safety lockout timing if applicable. Refer to the information supplied by the control manufacturer for procedures.
- ⊔ Check ignition system for proper operation.
- ⊔ Inspect the exhaust system for soot accumulation or other restriction.
- ⊔ Clean the equipment thoroughly according to the manufacturer's recommendations.
- ⊔ Check the burner performance using test instruments.
- ⊔ It is good practice to make a record of the service performed and the combustion test results.

Troubleshooting

Oil burners that are designed for use in pressure washers are built to take temperature extremes, vibration, and rough handling. When performing the following troubleshooting steps, we assume that the oil burner motor and ignition transformer operate continuously and the oil solenoid valve, which controls oil flow, is cycled by the trigger in the wand. We also assume that there is power to the burner and fuel in the tank.

In addition to normal mechanics tools, it is recommended to have the following equipment on hand.

- o Meter capable of measuring volts, ohms and amps,
- o ignition transformer tester,
- o smoke pump tester,
- o combustion analyzer, and
- o 0 to 200 psi pressure gauge.

See ***Table 3*** on following page for troubleshooting steps.

Table 2. Nozzle Flow Rate by Size

Nozzle flow rate U. S. gallons per hour of No. 2 fuel oil when pump pressure (psig) is:					
Nozzle Size (rated at 100 psig)	**125 psi**	**140 psi**	**150 psi**	**175 psi**	**200 psi**
0.40	0.45	0.47	0.49	0.53	0.56
0.50	0.56	0.59	0.61	0.66	0.71
0.60	0.67	0.71	0.74	0.79	0.85
0.65	0.73	0.77	0.80	0.86	0.92
0.75	0.84	0.89	0.92	0.99	1.06
0.85	0.95	1.01	1.04	1.13	1.20
0.90	1.01	1.07	1.10	1.19	1.27
1.00	1.12	1.18	1.23	1.32	1.41
1.10	1.23	1.30	1.35	1.46	1.56
1.20	1.34	1.42	1.47	1.59	1.70
1.25	1.39	1.48	1.53	1.65	1.77
1.35	1.51	1.60	1.65	1.79	1.91
1.50	1.68	1.77	1.84	1.98	2.12
1.65	1.84	1.95	2.02	2.18	2.33
1.75	1.96	2.07	2.14	2.32	2.48
2.00	2.24	2.37	2.45	2.65	2.83
2.25	2.52	-	-	-	-

Table 3. Troubleshooting Chart

Symptom	Possible Cause
Oil Not Igniting	**If the burner is not igniting, the burner motor, drive coupling, and oil pump are operating and oil is flowing to the nozzle through the solenoid valve, check the following possibilities.** 1. Check the air shutter adjustment. If the air shutter is opened too far, the flow of air may prevent the arc from reaching the oil spray. This may appear as a white vapor exhaust from the heater. [Refer to section *"Start up burner and set combustion"*] 2. The ignition system may have failed to supply an adequate arc to ignite the oil. Check the battery and charging system to insure a continuous supply of 11 to 16 volts DC (15 amps). [Refer to section *"Nozzle Assembly Maintenance"*] 3. Check the electrodes for wear and damage. Insure that the electrodes are adjusted properly. [Refer to section *"Nozzle Assembly Maintenance"*]
No Flame	**If there is no flame, the burner motor and igniter operate continuously and the oil solenoid valve is functional, check the following possibilities.** 1. Check for a plugged oil nozzle. [Refer to section 3] 2. If the coil on the solenoid valve is actuating, insure that the valve is opening or closing properly. [Refer to section *"Fuel Supply"*] 3. Check for sufficient fuel pressure. Pressure is 100 psig with valve energized, unless otherwise noted. [Refer to section *"Drive Component Maintenance"*] 4. Check the pump pressure. Check for air in fuel lines. 5. Check burner for broken motor coupling. If the coupling is broken check pump rotation prior to replacing the coupling. [Refer to section *"Drive Component Maintenance"*] 6. Check for contaminated fuel and/or partially plugged fuel filter. [Refer to section *"Fuel Supply"*]
Motor Not Operating	**If the blower motor is not operating, check the following possibilities.** 1. Check voltage at the motor to insure that switches and relays, in line with the motor, are operating properly. [Refer to section *"Burner Wiring"*] 2. Check pump and motor shaft operation. They should work freely without binding. [Refer to section *"Drive Component Maintenance"*]
No Oil Spray	**If the blower motor is operating, there is fuel in the tank, but oil does not spray out the end of the nozzle, check the following possibilities.** 1. Check for a broken or stripped coupling between the pump and the motor. [Refer to section *"Drive Component Maintenance"*] 2. Check the pump output for oil. [Refer to section *"Drive Component Maintenance"*] 3. Check operation of the oil valve. [Refer to section *"Drive Component Maintenance"*] 4. Check for a plugged nozzle. [Refer to section *"Nozzle Assembly Maintenance"*] 5. Check for air in the oil line. [Refer to section *"Nozzle Assembly Maintenance"*] 6. Check for fuel contamination or plugged filter. [Refer to section *"Nozzle Assembly Maintenance"*]
Fluctuating or No Pump Pressure	**If the pump pressure, as determined by a pressure gauge, is erratic or does not exist, check the following possibilities.** 1. Check motor rotational speed. Low rpm can cause erratic or no pump pressure. [Refer to section *"Drive Component Maintenance"*] 2. Check for a broken or worn motor coupling. [Refer to section *"Drive Component Maintenance"*] 3. Check that the pump turns freely. [Refer to section *"Drive Component Maintenance"*] 4. Check for air leaks in the lines. [Refer to section *"Fuel Supply"*] 5. Check for oil froth at the bleed point. [Refer to section *"Fuel Supply"*] 6. Check voltage at the motor. [Refer to section voltage rating on nameplate] 7. Check for fuel contamination or partially plugged filter.
Slow Motor Rotation	**If the blower motor is not operating at the rpm's listed on the nameplate, check the following.** 1. Check the supply voltage to the motor. [Refer to section voltage rating on nameplate] 2. Check for free operation of the motor shaft and pump assembly. [Refer to section *"Drive Component Maintenance"*]

Replacement Parts

For best performance specify genuine *Beckett* replacement parts

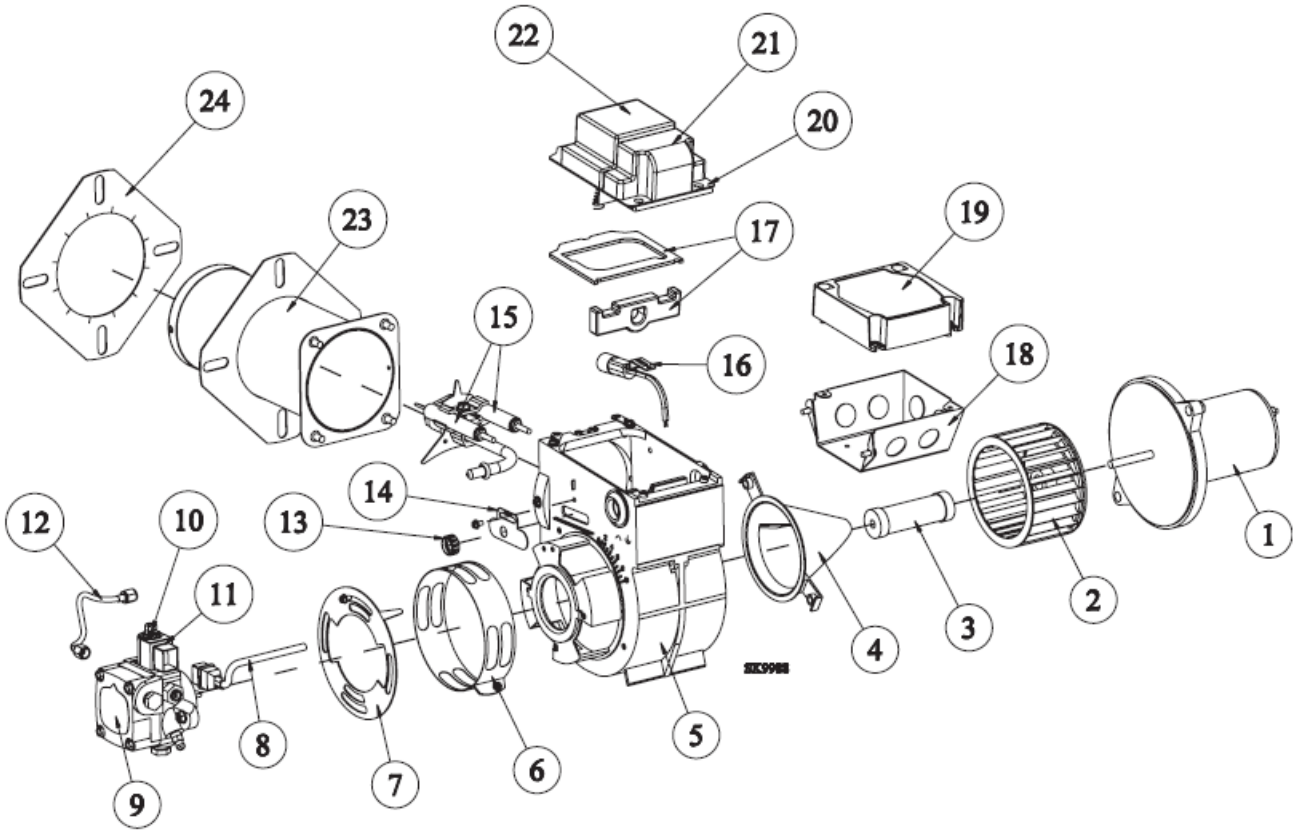


Illustration #	Description	Part#
1	DC Motor	22243U
2	Blower Wheel	2999AU
3	Coupling	2140501
4	Air Guide	31231U
5	Burner Housing - Black	55874BKU
6	Air Band	5151501
7	Air Shutter - 4 Slot Air Shutter - 8 Slot	3709 3494
8	Cord set	21807
9	Pump (CleanCut)	2184402U
10	Tube Assembly	21877U
11	12 volt Coil	21754U
12	8" Copper Tubing	5394
13	Escutcheon Plate Spline Nut	3666

Illustration #	Description	Part#
14	Escutcheon Plate	3493
15	Electrode Kit over 3-5/8"	570731
16	Cad Cell Detector	7492/7006U
17	Igniter Gasket Kit	51411
18	4X4 Wiring Box Kit	5770
19	Control Kit	7556x-xxxxU*
20	Igniter Ass'y w ICB Igniter w/o ICB	51776TU 51777TU
21	ICB Kit	51663
22	Igniter only	7435U
23	Air Tube Ass'y	Specify
24	Flange Mounting Gasket	Specify
Not Shown	Tune-up Kit for 30 & 35 Air Tube Lengths	578730

* '**X**'s *indicate timing options. Contact Beckett for available part numbers.*

Limited Warranty Information

The R. W. BECKETT CORPORATION ("Beckett") warrants to persons who purchase its "Products" from Beckett for resale, or for incorporation into a product for resale ("Customers"), that its equipment is free from defects in material and workmanship. To qualify for warranty benefits, products must be installed by a qualified service agency in full compliance with all codes and authorities having jurisdiction, and used within the tolerances of Beckett's defined product specifications.

To review the complete warranty policy and duration of coverage for a specific product, or obtain a written copy of warranty form 61545, please choose one of the following options:

1. Visit our website at: www.beckettcorp.com/warranty
2. Email your request to: rwb-customer-service@beckettcorp.com
3. Write to: R. W. Beckett Corporation, P. O. Box 1289, Elyria, OH 44036

NOTE: Beckett is not responsible for any labor cost for removal and replacement of equipment.

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TIRE INFORMATION