Algas-SDI™

...Innovative liquid vaporizing and gas mixing solutions

ISO 9001 Certified

Stabilaire

Liquid LPG Pump Packages Models: BS 1 through BS 3

Operations & Maintenance Manual

151 S Michigan Street, Seattle, Washington, USA 98108
Tel: 206-789-5410 Fax: 206-789-5414 Web: www.algas-sdi.com

FILE: MANUAL PN 52631 REV 03-30-07 STABILAIRE.DOC

ECLIPSE Innovative Thermal Solutions

WARNING

Read the OPERATION MANUAL before operating this equipment.

- **NOTE: Algas-SDI reserves the right to use alternate manufacturers' components as vendor delivery applicability dictates. Literature contained in the Operation Manual has been supplied by vendors. Please check to be sure supplied data matches your configuration. Contact Algas-SDI if any questions exist.**
- **This equipment uses LPG-a flammable fuel, or NH3-a toxic gas, (depending on the model), handled under pressure. Inherent hazards exist and a thorough understanding of the equipment is required to allow safe operation and maintenance.**
- **Allow only a TRAINED and FULLY QUALIFIED PERSON to service this equipment.**
- **Any time a component must be replaced, use the same type, model, etc. DO NOT SUBSTITUTE! The consequence from such actions are unpredictable and may lead to dire consequences. When components are replaced with components not approved for use in our FM/UL listed equipment, the FM/UL listing becomes void for that unit.**

Liquid LPG Pump Data Sheet

Job Number: _____ Serial Number: _____ Year Built: _____

Model / P.N. Number: _____

Electrical Specifications:

Equipment Drawing: _____ Rev.: _____

Electrical Drawing: ___ _____ Rev.: _____

Input Electrical Power: _____Volts, _____Amps, _____Phase, _____Hz.

Starter Type:

□ Switch, Not Fused
□ Manual Starter, Overload Heater Size: _____
□ Magnetic Starter, Overload Heater Size: _____

Specifications:

Pump Type: Positive Displacement Sliding Vane
Pump Manufacturer: Blackmer

Pump Model Number:	Internal Relief Setting:	Pump Model Number:	Internal Relief Setting:
□ LGF1	105 psi	□ LGL2	150 psi
□ LGL1 ¼	150 psi	□ LGL3	150 psi
□ LGL1 ½	150 psi		

Operating Pressure Range:

BS1 – BS2	BS3	
□ 25-75 psig	□ 20-65 psig	□ Other: _____psig
□ 70-140 psig	□ 50-100 psig	
□ 130-200 psig	□ 80-170 psig	

Economy Pressure Switch Settings:

□ No Switch Installed
□ Close @ _____psig, re-opens at 10 psig Above Close Pressure.

Pump Speed:

□ 1750 rpm	□ 520 rpm
□ 1450 rpm	□ 470 rpm
□ 980 rpm	□ 420 rpm
□ 780 rpm	□ 350 rpm
□ 640 rpm	

This page intentionally left blank.

WARRANTY, COPYRIGHTS and APPROVALS

WARRANTY

Algas-SDI International, LLC (ASDI) warrants that the equipment is free of defects in materials and workmanship under normal use and service. ASDI agrees to repair or replace, at our option, without charge f.o.b. factory, any part which has proven defective to the satisfaction of Algas-SDI International, LLC within one (1) year from the date of the original installation or within 18 months from the date of shipment, whichever is earlier. Equipment, which in the opinion of ASDI, has been damaged by improper installation or operation, or has been abused or tampered with in any way, will not be accepted for return under warranty.

Algas-SDI International, LLC will not accept back charges for work performed by others upon or in conjunction with ASDI equipment, unless prior authorization is given by means of an Algas-SDI International, LLC purchase order. Algas-SDI International, LLC will not be liable by reason of shutdown, non-operation or increased expense of operation of other equipment, or any other loss or damage of any nature, whether direct or consequential, arising from any cause whatsoever.

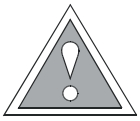
Algas-SDI International, LLC makes NO other warranty of any kind, whatsoever expressed or implied; and all warranties of merchantability and fitness for a particular purpose are hereby disclaimed by Algas-SDI International, LLC and excluded from these terms of sale. No person has any authority to bind Algas-SDI International, LLC to any representation or warranty other than this warranty.

COPYRIGHT

SYMBOLS and CONVENTIONS

Special symbols are used to denote hazardous or important information. You should familiarize yourself with their meaning and take special notice of the indicated information.

Please read the following explanations thoroughly.



GENERAL WARNING OR CAUTION

Indicates hazards or unsafe practices, which can result in damage to the equipment or cause personal injury. Use care and follow the instructions given.

FLAMMABLE GAS HAZARD

Indicates a potential hazard, which can result in severe personal injury or death. Use extreme care and follow the instructions given.

ELECTRICAL DISCONNECT REQUIRED

Indicates a potentially dangerous situation, which can result in severe personal injury or death or damage to equipment. Use great care and follow the instruction given.

ASDI CONTACT NUMBERS

If you have questions, need help with your equipment, or want information on other products, contact Algas-SDI at:

Telephone: 206.789.5410

Facsimile: 206.789.5414

Email: sales@algas-sdi.com

Internet: http://www.algas-sdi.com

TABLE of CONTENTS

1. Introduction

2. Installation

3. Startup

4. Operation

5. Maintenance

6. Troubleshooting

Appendix A: Component Information

Appendix B: Technical Information

Warranty Registration - Refer to the Rating Plate on the unit to fill out the product registration. Then photocopy and mail to address shown. Or register on line by visiting Algas-SDI web site under "Tech Support".

Introduction 1

SPECIAL PROBLEMS OF PUMPING LIQUID PETROLEUM GAS

Pump systems manufactured by Algas-SDI are designed to pump Liquid Petroleum Gas, both butane and propane, in their liquid state. Because propane and butane are pumped in an unnatural state, they are difficult to handle. The slightest drop in pressure or the smallest addition of heat will cause the LPG to boil, especially when it is going through a pipe. All necessary safety measures with LPG pump systems should be taken.

ALGAS-SDI PUMPING SYSTEMS

Algas-SDI **STABILAIRE** Liquid Pump Systems are fully packaged pumping systems designed to pump liquid petroleum gas in its liquid state. The systems are pressure stabilized and include a positive displacement sliding vane pump with an internal relief valve, explosion proof motor, bypass line, pressure relief valve, shut-off valve, check valves, and pressure gauges. The pressure relief valve provides a stable delivery pressure by returning excess pump capacity to the storage tank. The **STABILAIRE** systems are designed for continuous use and meet all Class 1, Division 1, Group D requirements. All of the electrical wiring is explosion-proof. An inlet strainer is provided for field installation. Each system is leak tested at the factory.

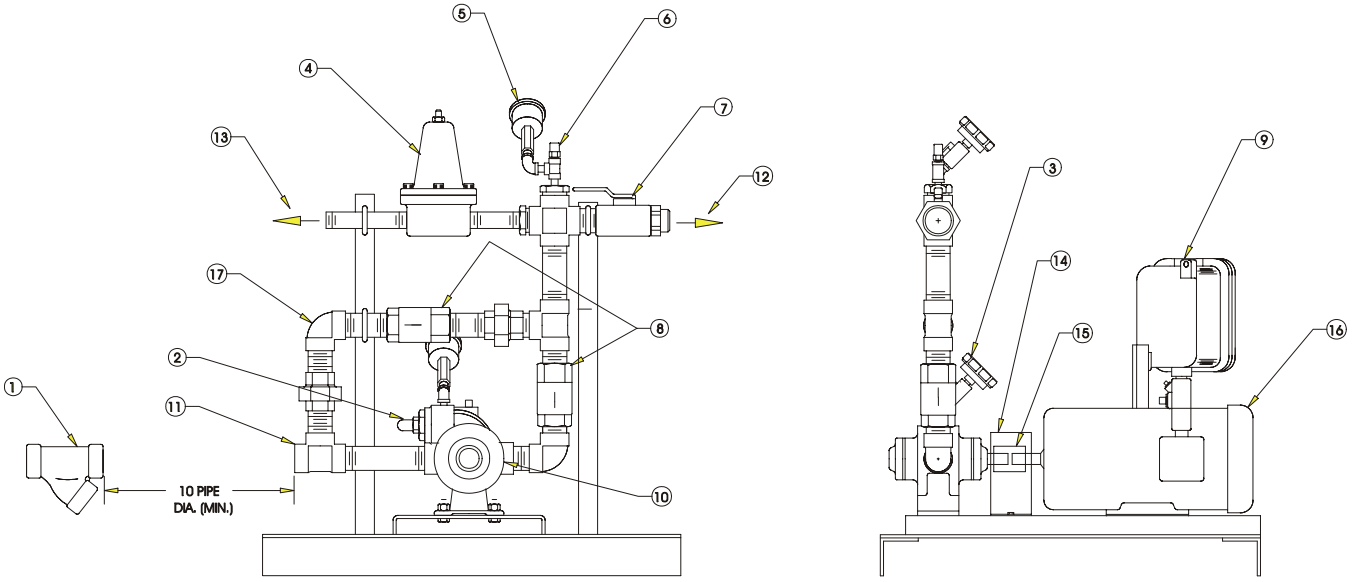
The smaller capacity pump systems, models BS1 through BS1½ are direct drive units; the pumps are either mounted directly on the face of the motor by flange or are connected to electric motors by a flexible coupling. The larger capacity pump systems, models BS2 through BS3, are driven by V-drive belts. The smaller pump systems, BS1, provide 10 to 15 gpm (38 to 57 lpm) at a differential pressure of 125 psi. (862kPa). The BS1½ have capacities from 9 to 35 gpm (34 to 132 lpm) at a differential pressure of 150 psi. Models BS2 and BS3 provide from 30 to 300 gpm (114 to 1135 lpm) at a differential pressure of 150 psi. The pumps used in the larger systems have a special cavitation liner that “cushions” the effects of collapsing vapor bubbles within the pump, reducing noise, vibration, and wear.

The pumps themselves are designed for easy maintenance and feature replaceable end disks, vanes, casing liners and seals which can be easily replaced with basic tools. The sliding vanes are self-adjusting and maintain their efficiency throughout their life.

Both direct coupled and belt driven pumps have heavy duty bolted-down safety covers surrounding their drives. All systems are supplied with industrial duty explosion-proof motors.

The pump systems feature a manual starter located near the motor. Magnetic starters featuring a Hand-Off-Auto switch are available as an option for the systems. Another option includes a pressure switch system and magnetic starter to turn on the pump when the LPG storage tank pressure is below a pre-set level.

Figure 1 – *Component Drawing – BS1 and BS1½*



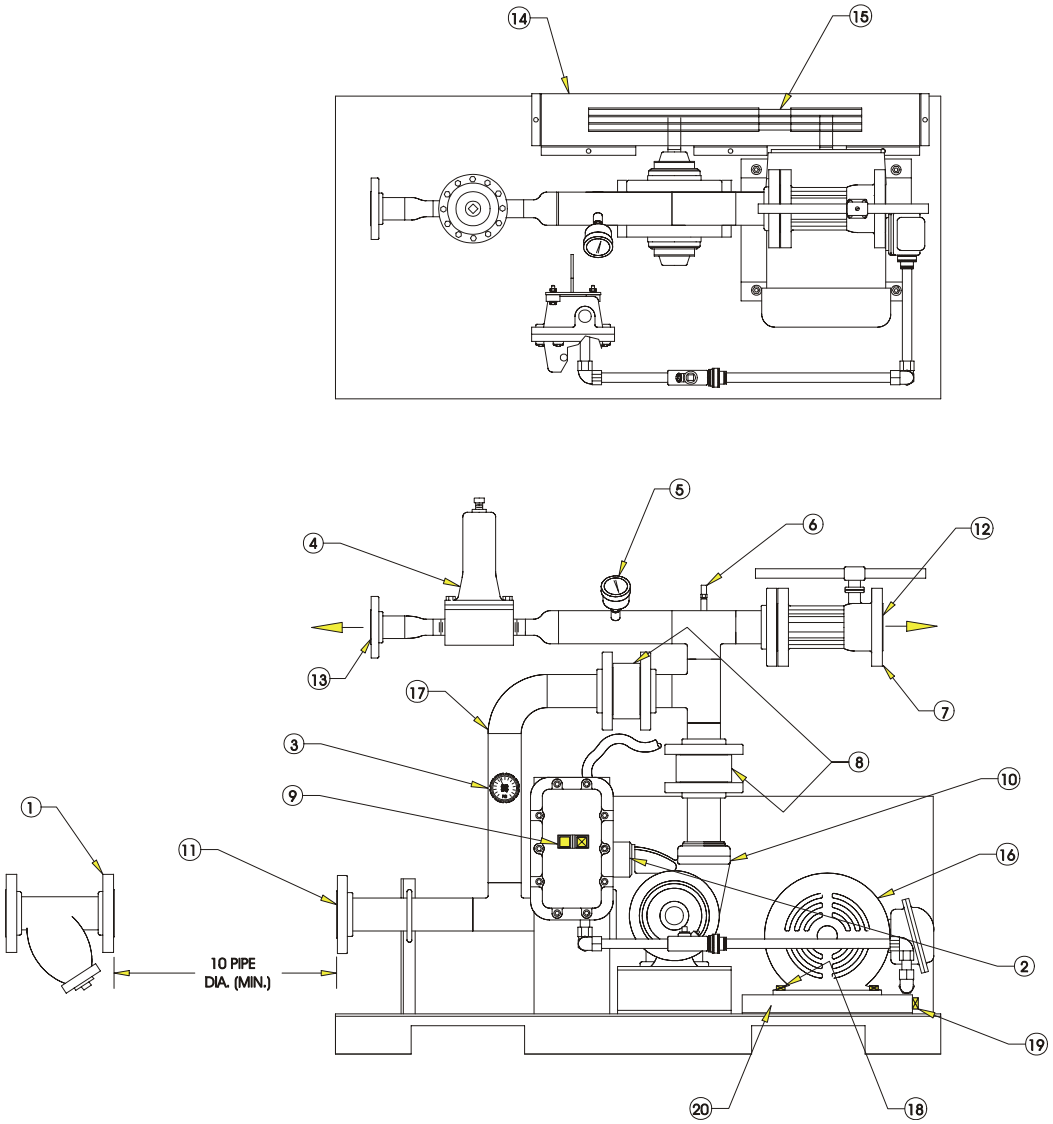
BS1 and BS1½.dxf

1. **LPG Inlet strainer**
2. **Internal relief/bypass valve**
3. **LPG inlet pressure gauge**
4. **Back pressure control valve**
5. **LPG outlet pressure gauge**
6. **Hydrostatic relief valve**
7. **Outlet isolation valve**
8. **Check valves**
9. **Starter or on/off control switch**
10. **Pump – positive displacement sliding vane type**
11. **LPG inlet**
12. **LPG outlet**
13. **LPG excess return**
14. **Coupling guard**
15. **Coupling between motor and pump**
16. **Explosion-proof electric motor**
17. **LPG bypass line**

NOTE

These systems are designed for above ground LPG tanks. A special pumping system is required for use with underground tanks.

Figure 2 – *Component Drawing – BS2 and BS3*



BS2 and BS3

1. **LPG inlet strainer**
2. **Internal relief/bypass valve**
3. **LPG inlet pressure gauge**
4. **Back pressure control valve**
5. **LPG outlet pressure gauge**
6. **Hydrostatic relief valve**
7. **Outlet isolation valve**
8. **Check valves**
9. **Starter with on/off control switch**
10. **Pump – positive displacement sliding vane type**
11. **LPG inlet**
12. **LPG outlet**
13. **LPG excess return**
14. **V-belt guard**
15. **V-belt drive**
16. **Explosion-proof electric motor**
17. **LPG bypass line**
18. **Motor mounting bolts**
19. **Motor position adjustment screw**

Basic Components of Stabilaire Pump Systems

VALVES

Back Pressure Control Valve (Item 4)

This valve adjusts downstream discharge pressure. When discharge pressure exceeds the relief valve setpoint, the LPG returns to the storage tank.

Relief/By-pass Valve (Item 2)

This valve is set to relieve excessive differential pressure if the back pressure control valve malfunctions.

Hydrostatic Relief Valve

The hydrostatic relieve valve protects the pipe from trapped LPG liquid. If liquid is trapped and builds up pressure higher than the factory setting it automatically discharges. It automatically reseats after discharge.

Isolation Valve

Isolation valves allow the gauges to be removed without shutting down the system and can also be used to bleed the system by removing the gauge first. Isolation valves also allow air to be bled out of the system when it is first installed.

Outlet Isolation Valve

The Outlet Isolation valve is used to close the pump discharge when setting the back pressure control valve and also to facilitate pump repair and maintenance.

Check Valves

Check valves prevent the LPG liquid from flowing backward to the pump while allowing a bypass for the LPG when the pump is not used.

INLET STRAINER

The inlet strainer traps dirt and foreign material in the system.

PUMP – POSITIVE DISPLACMENT SLIDING VANE TYPE

For maximum efficiency, the pumps use a rotor with sliding vanes. The LPG is drawn behind each vane through the inlet port and into the pumping chamber. As the rotor turns, the LPG is transferred between the vanes to the port where it is discharged as the pumping chamber narrows. Each vane pushes the LPG before it.

The Pump vanes maintain contact with the chamber by three forces: (1) centrifugal force from the rotor's rotation, (2) push rods moving between opposing vanes, and (3) liquid pressure entering through the vane grooves and acting on the rear of the vanes.

Pump efficiency is maintained as the vanes wear out. New vanes and the pump vane liner can be replaced quickly and easily without removing the pump from the system.

Rotation of the pump is always counter-clockwise when viewing the unit from the pump end. Standard assembly is with the intake to the left and discharge to the right.

EXPLOSION PROOF ELECTRIC MOTOR

The motors are sealed and the bearings do not require lubrication or maintenance of any kind.

The motors are designed for 20% overload for short periods of time. The pump motors have an overload protector and will shut off if they become overheated. Low voltage at the motor will also cause the motor to shut off.

NOTE

Explosion Proof Electric Motors are subject to moisture condensation inside when not used regularly. Moisture inside the motors can cause electrical problems and may short out the motor. To eliminate this problem, operate the motor at least once a week long enough for it to get hot.

START/STOP SWITCH

The start/stop switch is either manual or magnetic. Pumps with magnetic control systems can be operated remotely, by a computer control system or by hand. If pumps with magnetic switches are overloaded, the pump will automatically shut off.

THREE POSITION SWITCH

Pumping systems supplied with the optional magnetic starter use a 3-position switch known as a "Hand-Off-Auto" switch.

The **HAND** Position allows the pump to be started manually. The **OFF** position will stop the unit under any condition. The **AUTO** position allows the unit to be operated from a remote control source.

BY-PASS FLOW OPTION - ECONOMY SETTING

The optional by-pass feature of **STABILAIRE** Pump Systems saves energy by shutting off the pump automatically and letting incoming LPG bypass it if the tank and inlet pressure are adequate. Algas-SDI terms this "Economy Setting."

This page intentionally left blank.

Installation 2

WARNING

The equipment described in this manual is designed to operate with LP-gas, a flammable fuel under pressure. The nature of the application involves inherent hazards that could result in injury. ONLY a trained and fully qualified person should service this equipment.

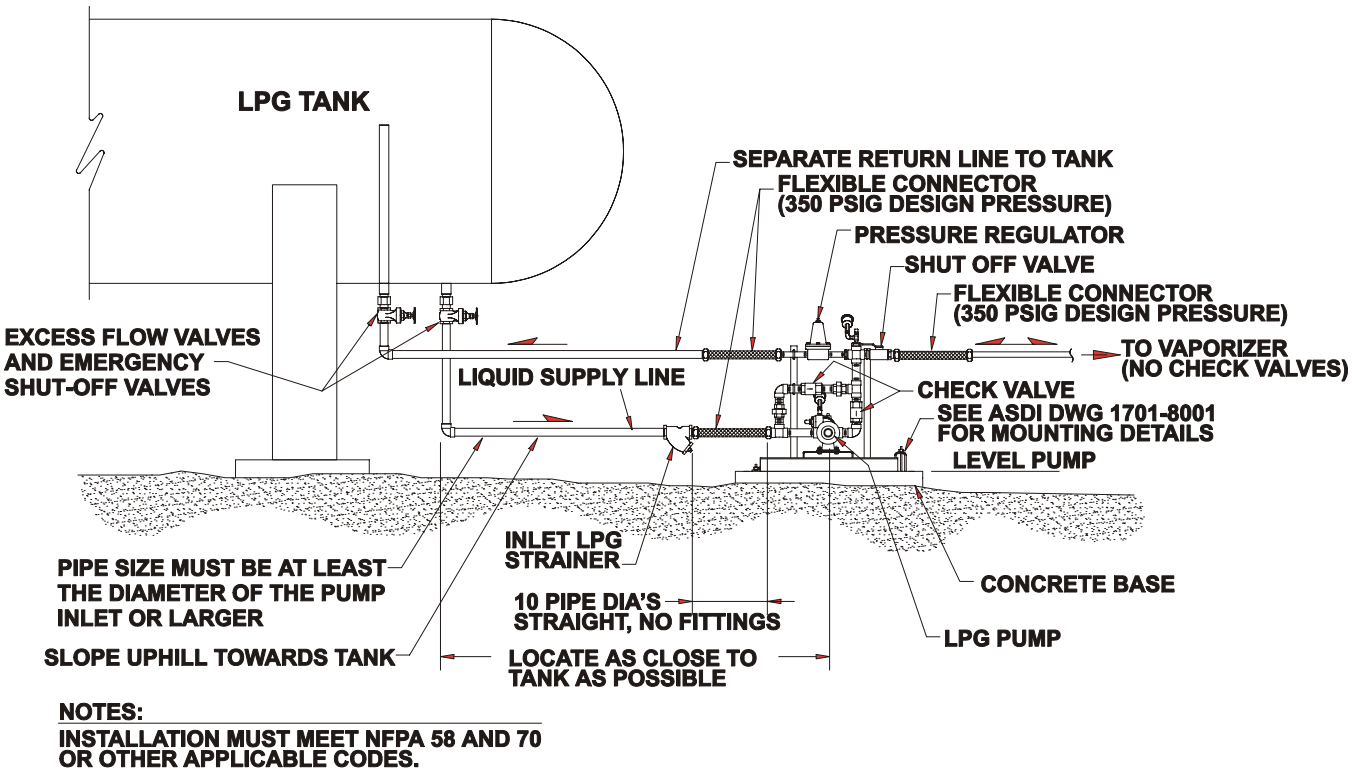
CAUTION

LPG is explosive and extremely flammable. Appropriate safety procedures must be observed when installing and operating the system.

GENERAL INSTALLTION OF STABILAIRE PUMP SYSTEMS

See Figure 3. All local codes and regulations must be determined so the installation conforms to local requirements.

Figure 3 – *Typical Installation Drawing*



Installation.wmf

PUMP BASE

The steel base of the pump unit must be installed on concrete. Pumps bolted to a concrete foundation will operate better with less vibration. The steel base must be level on the concrete. If necessary, drive metal shims under the steel base near the concrete anchor bolts to make the base level. Refer to drawing # 1701-8001 for mounting suggestions.

TYPES OF VALVES AND FITTINGS TO USE

Use gate or ball type valves, not globe valves for installation. The flow of the LPG should be as straight through as possible. ***See Figure 3***.

Do not use fittings that reduce the LPG pressure. Vaporization may occur and cause cavitation.

LOCATION AND PIPING - GENERAL INFORMATION

If the LPG liquid boils in the intake line the system may fail. Boiling may be caused by heat from sunshine, heat from the earth on underground piping, heat from the atmosphere when the air is warmer than the liquid in the pipes, friction from the liquid in the pipe and restrictions in the pipe. Vapor in the pipe may reduce the flow of LPG liquid to the pump, causing damage to the pump.

Locate the pump within five feet (1.5 meters) of the LPG storage tanks to reduce the friction of the LPG through the pipe.

Whenever possible, locate the pump directly under the supply tank so the piping will be short to keep friction loss minimal and where vapors will rise into the tank.

Never locate the pump more than 50 piping feet (15 meters) from the LPG tanks.

Where the pipes are connected horizontally to the pump, slope the piping downward to the pump at least one inch per 10 feet (2.5 centimeters per 3 meters) so vapors will go back to the tanks. Whenever possible, the pipe should drop straight down from the manifold at least 12 inches (30 centimeters) to the pump.

The inlet pipe should have a length ten times that of its diameter between the pump inlet and the strainer.

Do not bury the intake lines underground. Do not route the intake piping upward at any point because vapor will accumulate. In cold weather when vaporizers are needed most, pump cavitation from vapors is much worse because bubbles from boiling are much larger because vapor pressure is low.

Flexible connectors are recommended for the intake and discharge piping because they will result in much quieter pump operation and help eliminate vaporization problems. The recommended flexible connectors should be rated at least 350 psi (24.5 KG/CM2) ***See NFPA 58***.

When installing the system, check to make sure that the pipes are properly supported so there is no pipe strain on the pump. Always flush the piping before installing the pump to remove all debris and welding slag.

DETERMINING CORRECT PUMP CAPACITY

The delivery rate of LPG at the system operating pressure should be 2 to 3 times the maximum system consumption. For example, a 1,000 GPH system requires a pump with a capacity of 2,000 to 3,000 GPH at the desired pressure.

All vaporizers have a cycling type of operation and have changes in load during operation. In the cycling process, the flow rate of LPG liquid from the pump to the vaporizer is much larger than a calculated steady flow rate. For example, in the case of a vaporizer supplying LPG vapor to a blender that has only one venturi, the off period is zero flow and the on period is maximum flow.

When the system starts and the vaporizer begins operating, the liquid chamber is empty of LPG and must be filled rapidly to avoid a low pressure condition. This requires extra pump capacity.

Maximum flow rates are always used in determining the sizing of propane equipment. The piping from the pump to the vaporizer should be sized for the maximum capacity of the vaporizer. In determining the pump capacity, the pressure drop through the vaporizer output pressure must be determined by calculating the total pressure drop in the system.

The built-in relief valve on the pump is factory set to prevent re-circulation, which would cause vapor binding. Never connect the back pressure control valve discharge pipe into the pump intake piping.

PUMP MOTORS

The lead wires to the motor starter should be run through rigid threaded metal conduit, explosion-proof joints and explosion proof condulets. Adequate size wire must be used from the power source to the motor starter.

Motor rotation should always be the same as the direction arrow on the pump body. If the motor rotation is incorrect, check the wiring with the wiring diagram on the motor.

NOTE

3 phase motors may be reversed in direction by changing the position of any two of the three lead wires.

CAUTION

Do not reverse the pump rotation to reverse the direction of the flow. This will not work! Reverse rotation would make the pump unsafe and work poorly.

An overload protector will cut off power to the motor if it overheats. The motor temperature depends on the load and the air temperature. Shading the motor from direct sunlight will help reduce its operating temperature.

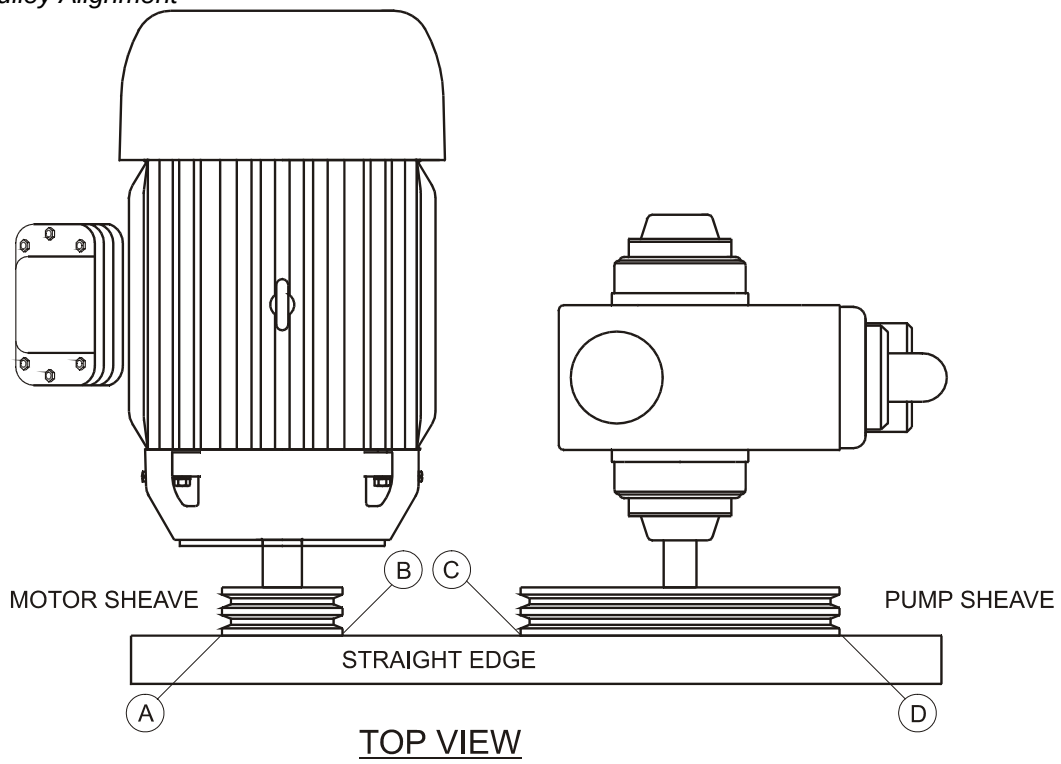
V-BELT DRIVE PUMPS

***See Figure 2*.** Loose belts will cause noise and excessive wear. Follow these directions for installation or replacement of V-belts.

V-Belt Installation Guide

1. Remove V-Belt guard, ***Fig.2 Item 14***, unscrew the bolts holding it down and lift it up and out of the way.
2. Check for proper rotation, by applying power to motor. Check pump rotation direction indicated on pump. Motor rotation **MUST** match that of pump.
3. After proper rotation has been verified, disconnect power to motor.
4. Loosen, but do not remove, the four mounting bolts, ***Fig. 2, Item 18***.
5. Loosen motor position adjustment bolt(s), ***Fig. 2. Item 19***, until approximately 1" to 1 ½" of the motor position bolt(s) are visible. This will allow the motor to be moved towards the pump for easier installation of the V-Belt(s) onto pulleys.
6. Install V-Belt(s) over both pulleys.
7. Check for proper installation of pulleys with a straight edge. Place the straight edge against the outside face of both pulleys. The straight edge **MUST** be able to lay up against both edges of both pulleys at the same time. The pulleys are aligned when the straight edge is flush at points A through D. ***See Figure 4***.

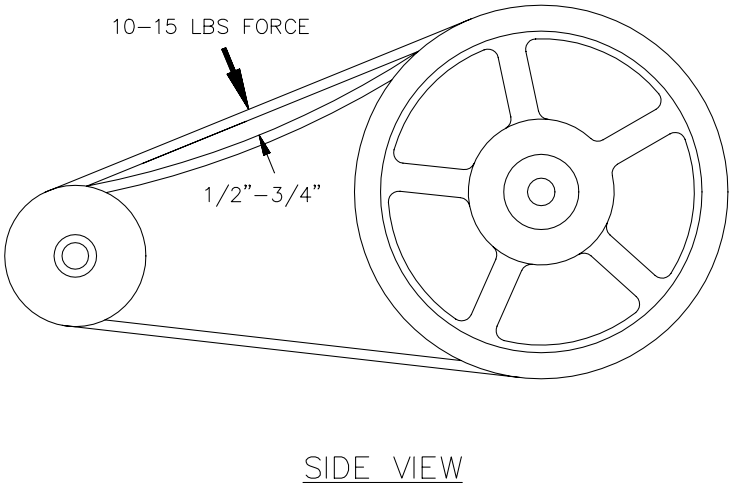
Figure 4 – *Pulley Alignment*



Pulley Alignment.dxf

8. Tighten motor position adjustment bolt(s) until proper belt tension is achieved. Proper belt tension is the lowest tension at which the belt(s) will not slip under peak load conditions. A general rule for ASDI's application of V-Belts: a 10 to 15 (4 to 7 kg) lb. pressure applied at the center point on the belt between the pump and motor pulleys should deflect the belt ½" to ¾" (1 cm to 2 cm). ***See Figure 5***.

Figure 5 – *Proper Belt Tension*



Belt Tension.dxf

9. After proper tension has been achieved, re-check for proper pulley alignment with a straight edge. Place the straight edge against the outside face of both pulleys. The straight edge MUST be able to lay up against both edges of both pulleys, at the same time. The pulleys are aligned when the straight edge is flush at points A through D. ***See figure 4***. If belt tension adjustment has mis-aligned the pulleys, the motor adjustment bolts must be loosened and the procedure repeated.

10. Tighten the four (4) motor mounting bolts (item 18) securely.

11. Before replacing the V-Belt guard (14), momentarily apply power to motor to double-check tension, alignment and rotation.

12. Replace the V-Belt guard and tighten all bolts securely.

DIRECT COUPLED PUMPS (REFER TO *FIGURE 1*)

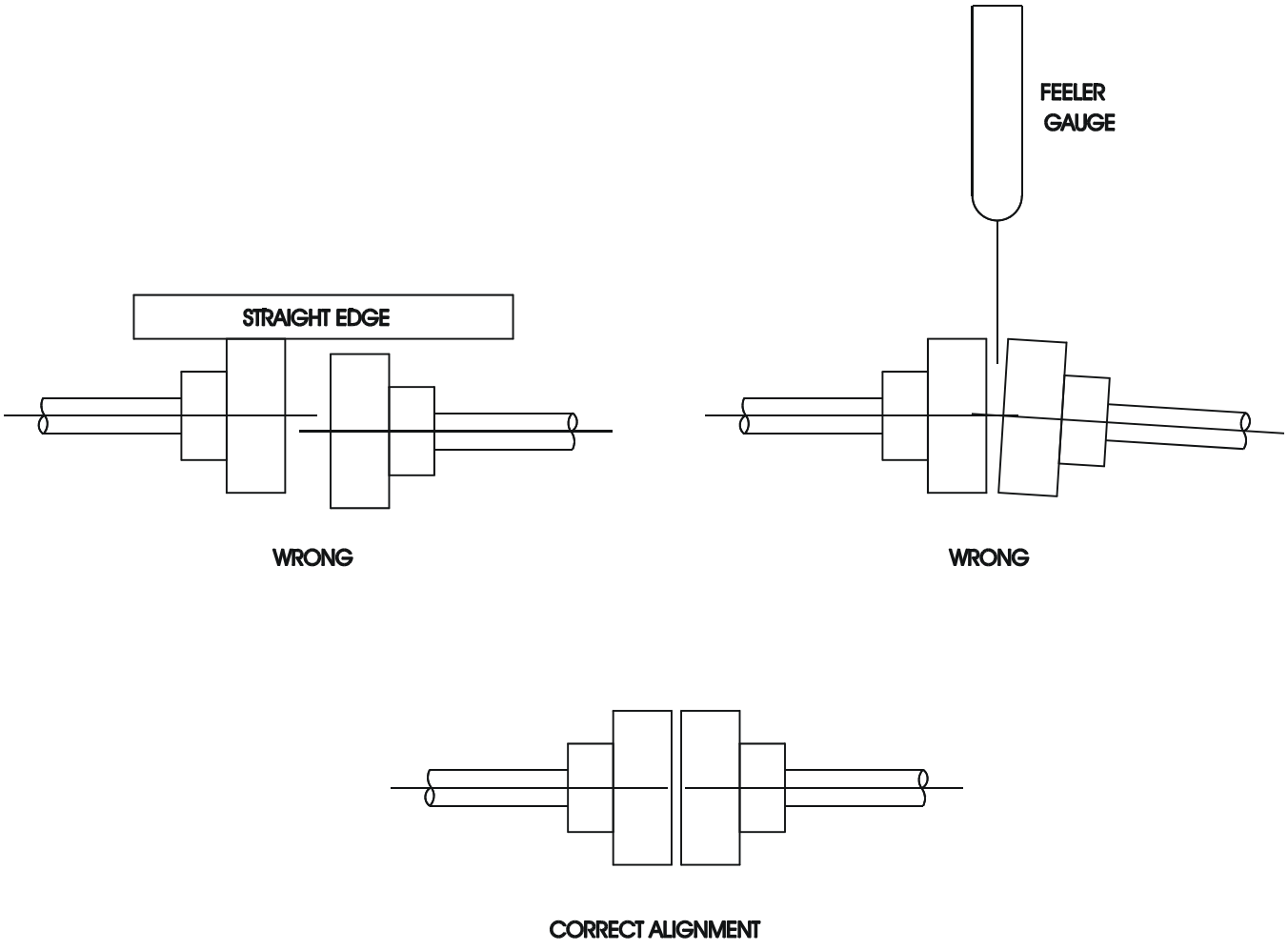
The coupling alignment must be near perfect to give quiet, long-life to the pump and driver. The pump and driver shafts are carefully aligned at the factory, but the alignment should always be checked after the pump is installed and before initial operation.

After the power to the pump motor is disconnected and the coupling guard is removed, use either of the methods on the following pages to align the pump coupling.

ALIGNMENT VERIFICATION GUIDELINES FOR DIRECT COUPLED PUMPS

1. Disconnect power to pump motor.
2. Remove coupling guard.
3. Inspect flexible coupling insert for wear.
4. Two methods can be used to check alignment of couplings. One requires the use of a small straight edge. The other requires the use of a feeler gauge.

Figure 6 – *Direct Coupled Pump Alignment*



Direct Coupled Pump Alignment.dxf

Startup 3

CAUTION

LPG is explosive and extremely dangerous. Take all necessary safety precautions in operation of the system. No open flames or sources of electrical sparks should be in the operating facility.

NOTE

All piping of the system, both incoming and outgoing, should be thoroughly cleaned and tested before starting.

WARNING

No smoking throughout the entire facility! Even smoking in an adjacent room next to the facility or close by outdoors is dangerous.

OPERATION CHECK

Thoroughly check the entire LPG facility for safe operation and function before starting up the process. The check must include the condition and operation of the storage tanks, pipes, electrical wiring, and appropriate valves all the way to the outlet and transfer pipes.

TAKE ALL SAFTEY PRECAUTIONS!

VERIFY THAT THE PUMP SYSTEM HAS BEEN INSTALLED CORRECTLY

1. Check the pump system for correct installation of all components. All bolts should be tight, secure, and the V-belts should be correctly adjusted. *See the maintenance section for correct tightening of belts if necessary*.

2. Check the wiring, make sure there are no broken or frayed wires and that all wiring is properly installed. Check all electrical conduits for correct installation and ensure that all fittings are tight.

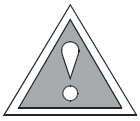
3. Measure the incoming voltage with a voltmeter to check if it is the correct voltage for the system.

4. All piping should be clean, free of moisture and have no leaks. Even a small leak anywhere in the entire facility is unacceptable!

PUMP SETTINGS AND ADJUSTMENT PROCEDURES (REFER TO *FIGURES 1 OR 2*)

Perform these procedures on initial startup of the system, if the pump is restarted after being idle, or if the delivery pressure or tank pressure changes.

CAUTION



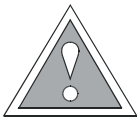
Before performing this procedure, follow all safety procedures for LPG. Make sure there are no open flames or electrical sparks, wear gloves and appropriate clothing.

ADJUSTING OUTPUT SETPOINT

1. Determine the required pump discharge pressure.
2. Slowly open shut-off valves in the storage tank for pump section line and return lines. Open all shut-off valves between storage tank and pump.
3. Verify tank pressure reading and gauge reading on LPG pump inlet. Both should correspond with each other. If not, refer to step #2.
4. Close shut-off valve at pump outlet.
5. Loosen lock nut on adjustment bolt for the control valve, ***Fig. 2, Item 4***. Turn adjustment bolt out until it is loose. **DO NOT** remove completely.
6. Turn pump on. You may notice a slight pressure increase at the outlet pressure gauge.
7. Slowly start to turn adjustment bolt “in” on the control relief valve, ***Fig. 2, Item 4***, until the desired outlet pressure is attained. Stop the adjustment when the pressure is obtained.
8. Tighten lock nut, making sure adjustment bolt does not turn while tightening.

INTERNAL PUMP RELIEF VALVE ADJUSTMENT

CAUTION

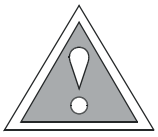


Only try this test briefly. If the relief valve doesn’t open during the test, open the outlet valve. The internal bypass valve of the pump is designed for emergency protection only. It may be damaged if this procedure is done for any length of time.

1. To test pump bypass valve (***Fig. 2, Item 2***) for proper operation, with pump outlet closed and pump on, momentarily close manual shut-off valve in the control relief valve return line to the tank. The pressure increase should be slightly higher than the normal discharge pressure.

   For example: if the outlet pressure is normally 80 psi, the outlet pressure should now be 90 to 100 psi.
2. Adjust the valve as required using a hex wrench and an open end wrench.
3. Open manual shut-off valve in the control relief valve return line to the tank.
4. Open pump outlet shut-off valve (***Fig.2, Item 7***). Pump is now ready for operation.

Operation 4



WARNING

The equipment described in this manual is designed to operate with LP-gas, a flammable fuel under pressure. The nature of the application involves inherent hazards that could result in injury. ONLY a trained and fully qualified person should service this equipment.

Startup

1. Check the system thoroughly before putting it into operation. Any problem with the system: leak, faulty valve, loose bolt or connection is unacceptable! Repairs must be made immediately.

   The wiring should be examined for correct connections, voltage and proper rotation.

2. Open all valves in the lines to the pump.

3. Turn on the power to the pump

4. Turn on the pump.

If it is in correct operating order, the motor should start quickly, the pressure will come up immediately, the pump will run at normal operating speed and the pressure gauge on the discharge side of the pump will indicate the correct operating pressure. Refer to the troubleshooting guides if there is pump noise, vibration, leakage, overheating, or low pressure.

To check pump operation separately, start it manually. (In systems with magnetic starters, put the Hand-Off-Auto Switch in the **HAND** position).

Normal Operation

OPERATING PRECAUTIONS

- Do not run the pump dry.
- Do not allow LPG liquid to cavitate in the pump as this will also damage it.
- Correct piping minimizes vaporization of the LPG liquid into the pump. Excessive vaporization in the intake line causes pump noise and excessive wear. Restrictive intake piping, globe valves, or some types of tank outlet valves can cause cavitation. Circulation of LPG liquid through the built-in relief valve causes cavitation inside the pump. The relief valve is an emergency protection device only.
- Check the inlet and outlet pressure at regular intervals.
- Check the bearing seal at the shaft end of the pump for leaks.
- Pump drives should operate satisfactorily with a minimum of vibration.
- If direct coupled pumps vibrate excessively they should be checked for alignment as noted in the maintenance section.

INLET PRESSURE

If the inlet pressure differs or fluctuates from the setpoint the system should be shut down, lines bled to zero pressure, purged and source of difficulty determined. (Changes in climate will also cause changes in inlet pressure.)

OUTLET PRESSURE

If the outlet pressure and all other parts of the pump system are functioning normally, the control valve must be reset. *See Adjusting the Output Setpoint procedure in the initial startup section*.

BACK PRESSURE RELIEF VALVE

The back pressure relief valve may need to be adjusted as climatic conditions change causing a change in the storage tank pressure.

To adjust the back pressure relief valve perform the following:

1. Turn off the pump.
2. Loosen the adjusting nut on the relief valve and screw out the pusher post all of the way.
3. Start the pump, make sure the pump is operating normally.
4. Slowly screw in the pusher post until the output pressure is the desired setting.
5. Tighten the adjusting nut.

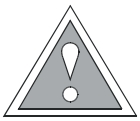
STRAINER

Inspect and clean the strainer periodically. A dirty strainer screen can cause vaporization, cavitation, lower the pump capacity and increase pump wear.

On new installations, inspect the strainer frequently until the initial accumulation of dirt and other material is flushed from the system.

To clean the strainer, shut down the system, remove the cap and remove the screen.

A plugged strainer basket or a very fine strainer may also cause cavitation and noise.



CAUTION

System pressure must be zero before the strainer basket can be removed and cleaned.

CAUTION

Strainer contents may be flammable. Observe all safety rules in handling flammable material.

LUBRICATION

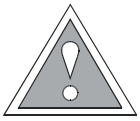
The pump bearings should be lubricated every six months with number 2 lithium-base type of grease. Apply the grease slowly with a grease gun to the grease fittings on each bearing cover until excess grease begins to come from the relief fitting. It is normal for some grease to escape from the tell-tale holes under the bearing covers for a short period after lubrication.

For operation in very low temperatures, lubricate the pump with a low temperature grease.

NOTE

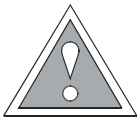
If excessive grease leaks from the holes under the bearing covers, then mechanical seal may be damaged or liquified gas may be leaking past the seal and gradually washing grease out of the bearing chamber. Remove the bearing head and examine the mechanical seal for wear or damage. If gas is escaping from the tell-tale holes, the entire mechanical seal must be replaced.

Pump overhaul and repair



CAUTION

Before performing any work on the pump, follow all safety procedures for LPG gas. Make sure there are no open flames or electrical sparks, and wear appropriate clothing.



CAUTION

Do not open the pump until the pressure is bled off. On systems with meters, the differential valve will keep LPG under pressure in the pump, meter, and piping even when the hose is emptied.

TOOLS REQUIRED

Worn or defective parts can be replaced using the following tools:

1. small blade screwdriver
2. small hammer
3. two pairs of vise-grip pliers
4. long handle wrenches
5. one half of the drive coupling and key

DISASSEMBLY

Lock nuts are secured by a lock washer tang. This tang must be pried out of one slot, in the lock nut, with a small blade screwdriver. After removing both lock nuts and lock washers, remove the four (4) head cap screws. While holding the cylinder, tap the drive end of the rotor shaft and the pump will pop apart. Use caution to avoid getting dirt into the bearing grease and to not damage the mechanical seals. Remove the combination bypass and relief valve.

Observe all parts and check them for wear and physical damage. Replace all defective parts. A groove around the cylinder bore or back wall makes that part unusable. These same conditions apply to the head wall. Parts with such grooves should be replaced.

ASSEMBLY

NOTE

The rotor and shaft is used as an assembly pilot guide to get alignment between the cylinder and the head.

1. Apply a light coating of grease or oil to the “O” rings and insert the mechanical seal assembly into the cylinder. Insert ball bearings (shield side inboard).
2. Insert the drive end of the rotor shaft through the mechanical seal and bearing. Push the rotor into the cylinder and rotate to engage the seal drive tangs.
3. Install the tang lock washer and lock nut. Using vice-grip pliers, tighten the lock nut to pull the rotor down tight against the cylinder back wall.
4. Cover the shaft with cloth to protect it, then tighten the drive end of the rotor shaft in a vise. Insert the four (4) vanes.
5. Insert the head “O” ring, mechanical seal assembly, and bearing (shield side inboard) in the head. Place this assembly over the outboard end of the rotor shaft.
6. Press down and rotate the head to engage the seal drive tangs, then just start the four (4) head cap screws.
7. Install the tanged lock washer and start the lock nut. Grasp and clamp the lock nut in the vise-grip pliers. With the vice-grip pliers clamped on to the lock nut, pull the head down very tight. Wiggle the head while tightening the lock nut.
8. Tighten the four (4) head cap screws before loosening the outboard lock hut, then loosen both lock nuts three more turns.
9. Using a keyed coupling half, check that the rotor turns free, only the seal should cause any drag. It should turn easily by hand. If the rotor does not run free, tear down the pump and correct the problem.
10. Tighten the drive end lock nut with vise-grip pliers until a moderate rotor drag is felt when turning the rotor shaft with the coupling half.
11. Locate the closest lock washer tang and lock nut slot. Align that slot and tang and stake the tang into the slot.
12. Clamp the coupling half and the outboard lock nut firmly in vise-grip pliers. Tighten the outboard lock nut approximately one-eighth (⅛) of a turn past the point where rotor drag disappears.
13. Remove both vise-grips, turn the rotor shaft with the coupling half and check for free turning (no metal-to-metal rotor drag). Align the closest slot and tang and stake the tang into the slot.
14. Install the bearing cover and bracket, then lubricate both inboard and outboard bearings.

15. Install the bypass/relief valve, making certain the valve slides freely and the disc is properly located in the valve. Insert the valve spring and install the valve cover.

NOTE

Vanes installed backwards will cause vibration and low pump pressure.

Improper adjustment of the bearing lock nuts will cause worn or scored disks and rotor ends. If the lock nuts are not drawn up evenly, the rotor and disk will wear.

Table 1 - *Pump Troubleshooting*

PROBLEM	CAUSE	SOLUTION
Electric motor will not run.	Power is not connected.	Connect power.
	Blown fuse.	Replace fuse.
	Switch on starter is not in correct position.	Reset switch.
	Switch in panel is not in correct position.	Reset switch.
	Pump switch not reset.	To restart pump, first turn off the pump switch, press the reset button, then turn on the pump switch.
	Burnt or defective electric motor.	Replace motor.
	Loose wires.	Reconnect wires.
Pump will run – low output pressure.	Restricted excess flow valve in tank.	Replace excess flow valve 1.
	Restricted valve in inlet pie line.	Open shut-off valves.
	Low tank pressure.	Check tank pressure.
	Worn pumps or vanes sticking.	Rebuild pump.
	Pump speed too low.	On pumps with V-belts, check the belt tension.
	Low voltage supply.	Supply correct voltage to motors.
	Bypass valve stuck or set too low.	Check capacity with bypass line closed with manual valve. Readjust, repair, or replace valve.
	Clogged strainer.	Clean strainer.
	Poor suction.	Increase intake and vapor pipe sizes.
Pump will run – high output pressure.	Restricted valve in pump return lines.	Check all valves.
	Relief control valve set to high.	Check setting.
	High tank pressure.	Check tank pressure.
	Failed control valve.	Repair or replace.
Pump runs for short time, then stops.	Load too high for motor.	Check pump and drive mechanism.
	Improper inlet power.	Check and restore incoming voltage.
	Overload heaters too small.	Check overload size.
Excessive vibration and/or noise when pump is running.	Loose mounting bolts.	Tighten all mounting bolts.
	Relief control valve line too small.	Check Data Sheet.
	Pump and motor out of alignment.	Re-align pump and motor.
	Worn belts.	Check V-belt installation guidelines.
	Restricted valve in pump piping.	Open all valves in pump piping.
	Cavitation from poor suction.	Increase size of intake and vapor pipes.
	Very high differential pressure.	Check for restriction in discharge line.

PROBLEM	CAUSE	SOLUTION
Pump runs but no LPG delivered.	Closed valve in line.	Open proper valve.
	Closed excess flow valve at tank outlet.	Open excess flow valve.
	Vapor binding or boiling LPG at intake line.	Check inlet pipes and valves for proper installation.
	Wrong type of valves installed.	Install correct valves.
	Restriction in suction line L.	Locate pump as close as possible to supply tank.
	Broken pump shaft.	Disassemble pump and repair.
Pump leaks.	Leakage at drain holes on the bottom of the pump cylinder and the head.	Replace mechanical seals.
	Leakage between pump cylinder and head.	Replace the head “O” ring (head must be removed).
Pump will not turn.	Foreign matter in pump.	Clean out the pump – check the strainer and clean it.
	Broken pump blades.	Disassemble pump and replace blades.
	Bearing seized.	Clean or replace pump bearings.
Unstable outlet pressure.	Damaged back pressure control valve.	Repair or replace back pressure control valve.
	Cavitation at pump.	Open all valves to pump.
		Poor installation – correct piping to pump.
		Clean strainer.
	Worn pump.	Rebuilt pump.

APPENDIX A

COMPONENT INFORMATION

This page intentionally left blank.

APPENDIX B

TECHNICAL INFORMATION

This page intentionally left blank.

Figure 7 – *Electrical schematic for pump with on/off switch*

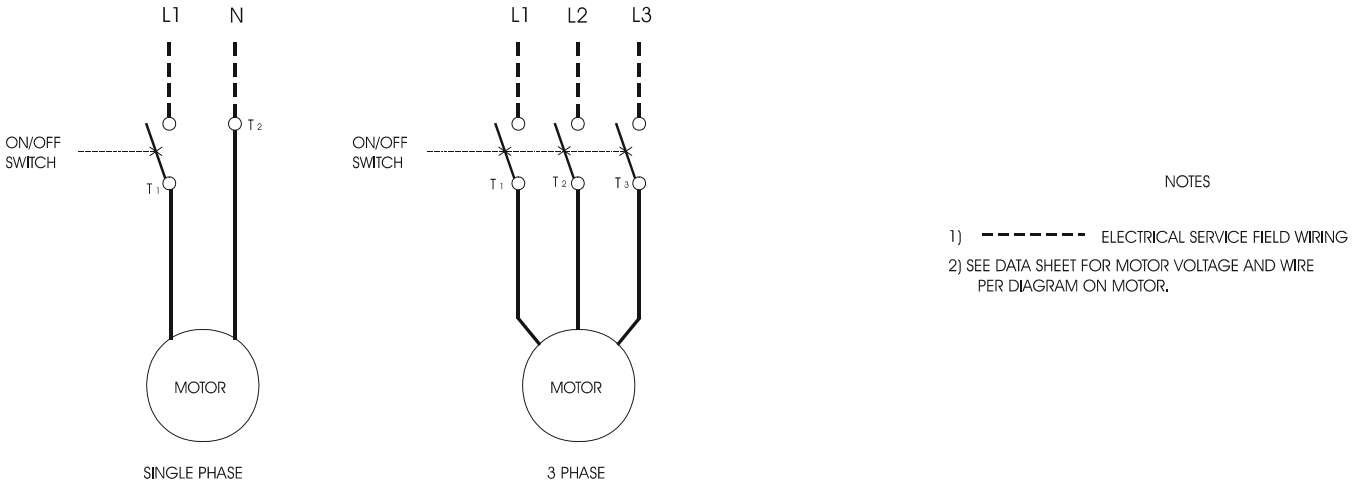
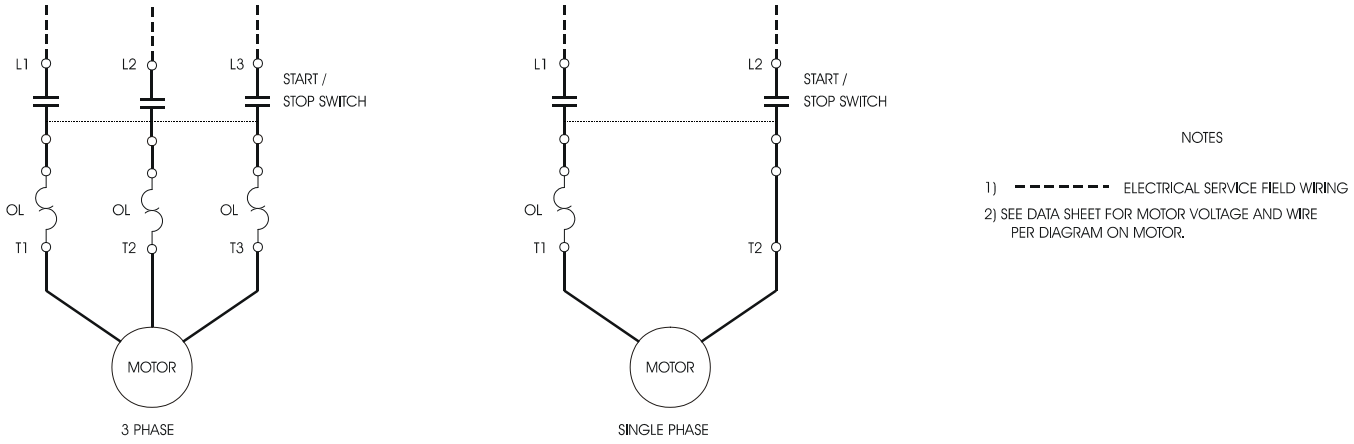


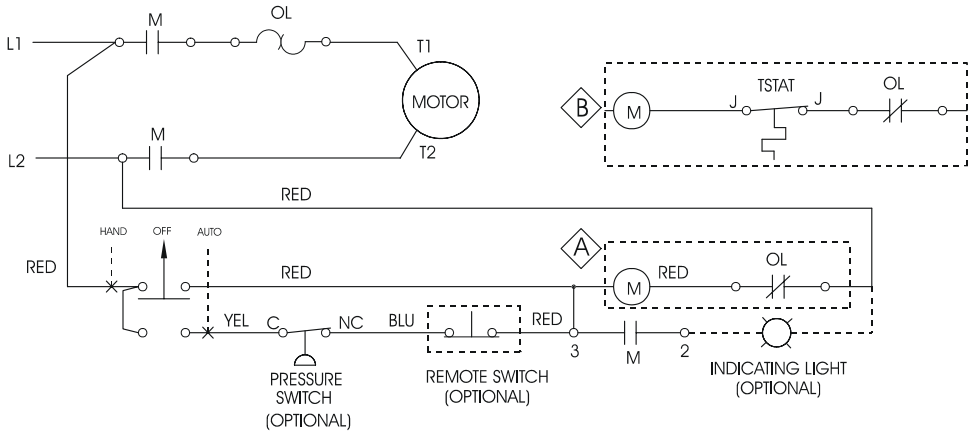
Figure 8 – *Electrical schematic for pump with manual starter.*



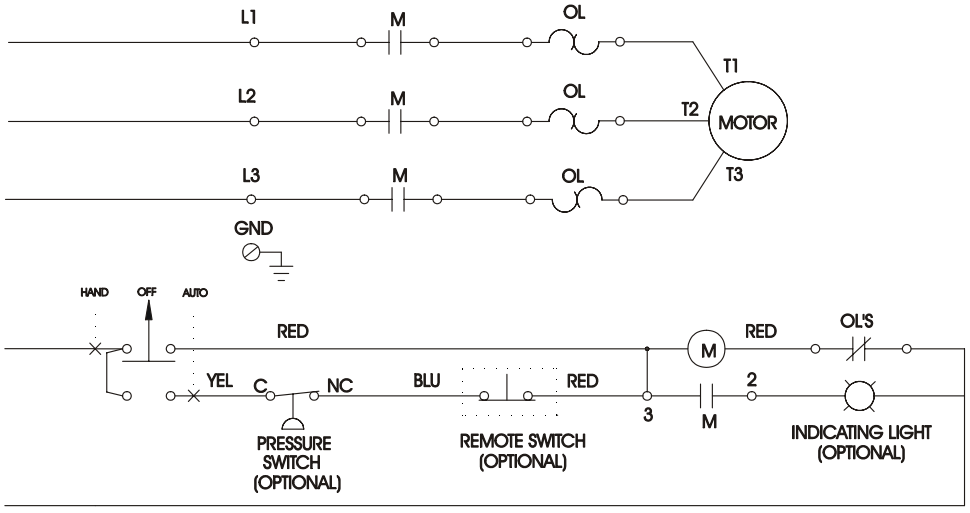
NOTE

For all Pumps see Data Sheet for voltage and wire per diagram on motor.

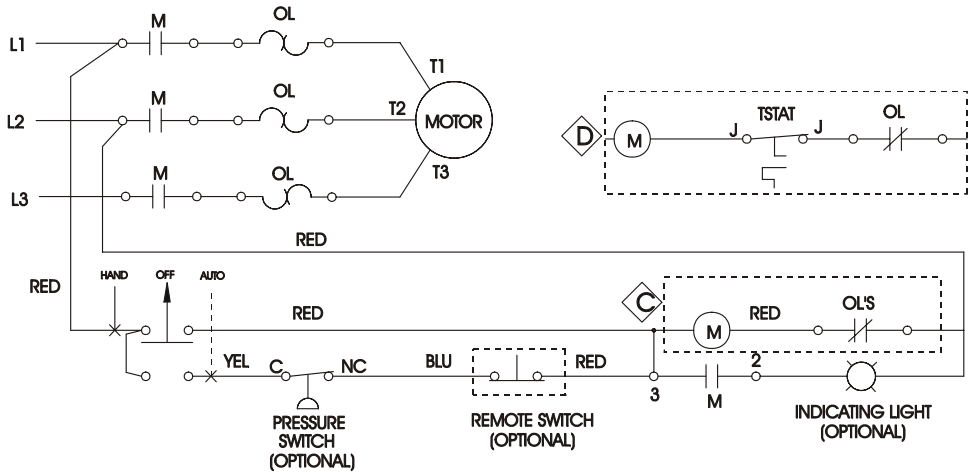
Figure 9 – *Electrical schematic for pumps with magnetic starters.*



SINGLE PHASE SCHEMATIC



THREE SCHEMATIC DIAGRAM W/SEPARATE CONTROL VOLTAGE



THREE PHASE SCHEMATIC

This page intentionally left blank.

Algas-SDI™

ISO 9001 Certified

Innovative Liquid Vaporizing and Gas Mixing Solutions

WARRANTY REGISTRATION

Type of Equipment: _____ Serial Number: _____

ASDI Sales Order #: _____ Order Date: _____

Purchased By: _____

_____

_____

To help us give you better service, please fill out this warranty registration form and return it to ASDI to register your purchase and for follow up on the performance of ASDI equipment. We are dedicated to producing a quality product and if a problem occurs, ASDI wants to know about it. Please help us with a small amount of information about your company and how the equipment will be used. When contacting ASDI, please have the type of equipment and the serial number handy so we can give you accurate information. If you have had any kind of problem with this equipment, or you have any comments, please attach a separate sheet to this form. Keep a copy for your records.

End Customer/Company Name: _____

Address: _____ Tel: _____

City: _____ Fax: _____

State: _____ Zip: _____

Name of individual to contact for follow up information: _____

Title: _____

Usage - Circle one: Base Load Standby System Peak Shaving

Other: _____

In what application is the equipment being used? _____

When was the equipment put in service? ____/____/____

Note: If you have more than one piece of ASDI equipment, fill out one warranty sheet and staple the others to it, ASDI will do the rest.

151 S Michigan Street, Tel: 206.789..5410 E-mail: sales@algas-sdi.com

Seattle, Washing ton, 98108, USA Fax: 206.789.5414 Internet: www.algas-sdi.com

Algas-SDI International, LLC
151 S Michigan Street
Seattle, Washington 98108
USA

Ph.: 1.206.789.5410
Fax.: 1.206.789.5414

www.algas-sdi.com