INSTALLATION
OPERATION & MAINTENANCE
INSTRUCTIONS

FOR YOUR

PENN PUMP & EQUIPMENT COMPANY, INC.
FUEL OIL TRANSFER SYSTEM

This completely assembled, tested, packaged pumping system is of the highest quality and design. To obtain optimum performance from this system, it is important that you read these instructions carefully and pay particular attention to any highlighted instructions. We are confident that you will receive many years of trouble-free service from your **Penn Pumping System**.

www.pennpump.com

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I. GENERAL DESCRIPTION

Penn Pump & Equipment Company, Inc.'s pumps are available in five sizes each, with nominal capacities ranging from 0.5 to 14 gallons per minute (1.9 to 53 liters per minute). These pumps can handle inlet pressure to 250psi (17 bar) and differential pressure to 500psi (34 bar). Differential pressure is limited to 300psi (20 bar) in models 4108. These pumps are self-priming and particularly suited to hand liquids of 35 to 1000 SSU (2 to 200 centipoises). Higher viscosities can be handled at reduced speeds. These pumps are bi-rotational and designed for direct drive at standard motor speeds, with modifications available for indirect drive. The pumps include a mechanical seal and carbon graphite idler and housing bushings.

II. THE PUMPING PRINCIPLE

Penn Pump & Equipment Company, Inc.'s cast iron pumps employ the internal gear pumping principle. There are only two moving parts. Pumping action is based on a rotor, idler gear, and crescent-shaped partition cast integral with the cover. Power applied to the rotor is transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by the crescent. As the pump starts, the teeth come out of the mesh, increasing the volume. This creates a partial vacuum, drawing the liquid into the pump through the suction port. The liquid fills the spaces between the teeth of the idler and the rotor and is carried past the crescent partition, through the pressure side of the pump. When the teeth mesh on the pressure side, the liquid is forced from the spaces and out through the discharge port.

WARNING!

Failure to follow these instructions could result in serious bodily injury or death.
Do not attempt to work on any pump installation before completing the following steps:

- Disconnect the drive so that it cannot be started while work is being performed.
- Review the Material Safety Data Sheet (MSDS) applicable to the fluid being pumped to determine its characteristics and the precautions necessary to ensure safe handling.
- Vent all pressure within the pump through the suction or discharge lines.

III. LOCATION

Most pumps are required to develop 25" mercury vacuum at 0 psi on factory test. While these pumps will develop as high as 27" of vacuum, it is sound engineering practice to avoid extreme vacuum whenever possible. Select a pipe size to reduce line friction loss to a minimum. The pump should be located as close to the source of supply as conditions permit and, if possible, below the level of the liquid in the reservoir. When necessary to locate the pump in a pit, provisions should be made to safeguard against flooding. Care must be taken to properly support the suction and discharge piping so that no strain is put on the pump due to either weight or expansion. Piping strain can result in misalignment, hot bearings, worn couplings, and vibration. It is important that the piping used be clean and free of chips and scales.

IV. PROPER INSTALLATION

Unsatisfactory pump installations are usually characterized by poor suction conditions for the specific liquid being handled. Suction conditions should be minimized to prevent vaporization of the liquid. If vacuum conditions force the liquid to vaporize, cavitation will occur, resulting in the loss of capacity, premature wear, and noisy operation. When handling high viscosity liquids, the speed of the pump must be reduced and the size of the lines increased to prevent cavitation. Consult the factory for NPSH requirements. *Note: Pipe line friction increases at a rapid rate with an increase in viscosity. For a given pump and motor, larger pipe lines are necessary to maintain the same pump pressure when changing from a thin fluid to a thick one*. Most pumps are supplied with both parts on the same plane. Pumps with this type of porting arrangement should always be installed with the ports facing upward to ensure proper priming. When pipes are installed, an inverted "U" bend should be incorporated into the suction line close to the pump for priming purposes. There is an inlet and an outlet side to the pump. There must always be at least one pipe installed on each side. Viewing the pump from the shaft end, the inlet port is on the right for clockwise rotation and on the left for counterclockwise rotation. Pumps should be filled with fluid at installation and never be allowed to run dry. Every pump installation should have a good foundation. Its structure should be sufficiently strong to hold the pump rigid and to absorb any strain or shock that may be encountered. The installation should be leveled, checked for proper piping alignment, +and then fastened securely.

V. METHOD OF DRIVE

Direct drive through a traditional, flexible coupling is recommended. However, do not expect the flexible coupling to compensate for misalignment. Contact the coupling manufacturer to determine the maximum amount of misalignment to which the coupling can be subjected. The pumps can be driven in either direction of rotation. The seal chamber communicates with the neutral zone; therefore, the seal is subjected to approximately one half of the discharge pressure. All pump and motor units must be properly aligned during assembly and periodically checked, since misalignment may occur later due to abuse or other conditions. Pipe strain can force the pump and motor shafts out of alignment. Therefore, all piping to the pump must be properly supported. Do not allow the pump to act as a pipe support.

VI. EXTERNAL RELIEF VALVE PROTECTION

All models are positive displacements pumps. As the pump rotates, liquid is positively delivered to the discharge side of the pump. If the discharge line is closed off, pressure will increase until the drive stalls and/or fails, the pump breaks or ruptures, or the piping bursts. To prevent this from happening, the use of an external pressure relief valve is required. A relief valve that directs the flow back to the supply tank is recommended. <u>The relief valve is designed for overpressure protection only. It is not intended as a flow/pressure control device or for any similar use.</u> Continuous operation of the relief valve will result in excessive heat buildup within the pump cavity, which could cause serious internal damage. Make certain the adjusting screw of the relief valve is set properly for the application.

VII. STRAINER PROTECTION

Strainers are used to remove contaminated particles from the fluid system and extend pump life. Every pump should be protected from these particles by a strainer in the suction line. Strainer size and mesh of screen are determined by the rate of flow and viscosity of the fluid. Consult the strainer manufacturer for recommendations. Install the strainer according to the designated direction of flow, locating it so that it is accessible for servicing. Use a duplex type strainer when shutdown during service is not possible. Provide a vacuum gauge in the suction line for determining when the strainer requires cleaning. Make certain the strainer baskets are properly reinforced so as not to collapse under 30" Hg. Vacuum.

WARNING!

All of Penn Pump & Equipment Company, Inc.'s pumps contain residual hydraulic oil from the factory test. Determine if this is compatible with the fluid you are pumping. If the fluid is incompatible, consult the factory. Do not run the pump dry as this could cause severe damage to the seal, bushings, and/or metal parts.

VIII. STARTUP

Prior to starting the pump, double check the following:

- Pressure and vacuum gauges should be installed as close as possible to the pump.
- Rotate the pump shaft to ensure it turns freely without binding.
- Recheck the alignment and ensure all guards are in place.
- Make sure the piping is independently supported and no strain is being transmitted to the pump.
- Make sure the safety relief valve is installed correctly.
- Check the pump rotation.
- Open the suction and discharge gate valves.
- Check for any leaks once the valves are open.

After completing these checks, the pump can be started.

CAUTION!

The pump should not be run dry. If, after approximately 60 seconds, there is no discharge of liquid, stop the pump and investigate the possible cause. Failure to comply with this could cause severe damage to the internal seals, bushings and/or metal parts.

IX. SERVICE

WARNING!

Failure to follow these instructions could result in serious bodily injury or death.

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- Vent all pressure within the pump through the suction or discharge lines.

X. TROUBLESHOOTING

Symptom: No fluid is delivered.

What to look for:

- Power is not on.
- Net positive suction head available (NPSHA) is lower than required for the inlet conditions and the vapor pressure of the liquid pumped. Calculate NPSHA and redesign piping if necessary.
- Leaks in suction line or port passages. These can be detected by submerging the pressure line from the discharge side of the pump into a pail of liquid where the air will be seen in the form of bubbles.
- Direction of the shaft rotation is incorrect.
- Pump shaft is not rotating. The coupling is defective or the tongue and groove are not engaged.
- The relief valve setting is too low. Liquid is discharging through the bypass port.

Symptom: Capacity is too low.

What to look for:

- There are leaks in the suction line.
- Suction losses are too high. The suction life is too great or the suction line too small or too long. This can be detected by installing a vacuum gauge directly at the pump suction. The maximum vacuum at the pump suction should never exceed 15" of mercury. Vaporization caused by higher vacuums will generally result in capacity drop-off. Suction conditions must be redesigned.
- Pump speed is too slow.
- The strainer is too small or obstructed.
- The suction port or pipe is not immersed deeply enough in the liquid.

- Piping is improperly installed, permitting an air pocket to form in the pump.
- Increased clearances or wear in the pump will sometimes cause the pump to deliver an insufficient supply of fluid. This can generally be corrected by reducing the thickness of the cover gaskets. A folded gasket or a slight amount of dirt can exaggerate the problem and cause leakage.

Symptom: Pump works spasmodically.

What to look for:

- Leaky suction line.
- Varying suction conditions.
- Air or vapor in the fluid.

Symptom: Excessive power draw.

What to look for:

- Pressure is too high.
- Liquid is more viscous than originally expected.
- Suction or discharge lines are obstructed.
- Insufficient horsepower.
- Drive shaft and pump are misaligned.
- Pump binding due to insufficient end clearance.
- Pump shaft is bent.
- Misalignment within the pump due to bad piping or poor installation, which causes strain or distortion.

Symptom: Pump is noisy.

What to look for:

- Pump is cavitating due to inadequate suction conditions.
- Misalignment of coupling.
- Coupling is set too close to the pump.
- Vibration of the pump due to a worn or bent shaft.
- Air leaks on the suction side of the pump or air entrainment in the fluid.

Symptom: Pump leaks.

What to look for:

- Cover bolts need tightening or cover gasket is defective.
- Worn or defective seal.

WARRANTY

The components of each Penn Pump Fuel Oil Transfer system, when purchased as regular factory selections, are warrantied against failure due to defects in design, material, or construction, from date of factory shipment within the periods and under the conditions noted below:

PUMPS

All Penn Pump pumping assemblies are warrantied against mechanical failure for a period of One (1) year. If any component of the pumping assembly fails within this period, Penn Pump & Equipment Company, Inc., will, at its option, repair or replace the pump assembly on a no-charge exchange basis FOB factory, Hatfield, Pennsylvania.

MOTORS

Motors, when equipped with standard Penn Pump overload protection systems and maintained according to factory instructions, are warrantied for One (1) year. Penn Pump & Equipment Company, Inc., will make, at its option, a no-charge repair or replacement at the factory or at the authorized motor service station.

VALVES

Valves are warrantied for One (1) year. If any mechanical component of the valve fails within this period, Penn Pump & Equipment Company, Inc. will, at its option, repair or replace the valve component parts on a no-charge exchange basis FOB factory.

COMPLETE SYSTEM

The complete Penn Pump system as a whole, including all accessories and components not mentioned above, is warrantied functionally and mechanically for a period of One (1) year, when installed, operated, and maintained in accordance with the Company's recommendations.

Penn Pump & Equipment Company, Inc., is responsible only for repairing or replacing its products in accordance with the terms and conditions set forth above. The are no warranties, either expressed or implied, extending beyond those stated on the face hereof, and Penn Pump & Equipment Company, Inc. expressly disclaims all other warranties, including any implied warranties of mechanical ability or fitness for a particular purpose. Penn Pump & Equipment Company, Inc. also disclaims any liability whatsoever for incidental or consequential damages, including damages to property, damages for loss of use, loss of time, loss of profits, loss of income, or any other incidental or consequential damages. Penn Pump & Equipment Company, Inc. neither assumes nor authorizes any other person to furnish any warranties, or assume for it any liability in connections with the sale of its products.

This warranty does not include mechanical seals, gauges, transportation, or labor costs for exchange or installation or repaired or replaced material. Final determination of warranty shall be made only by the factory upon return and inspection of returned material. No material is to be returned without a return of materials authority (RMA) tag, which may be obtained by calling or writing the factory, advising what will be shipped and the reason for the return.