

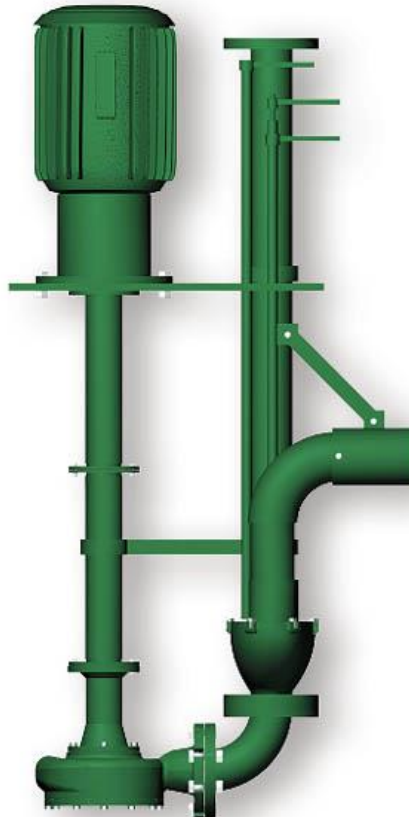


## VERTICAL WET WELL RECIRCULATOR CHOPPER PUMPS

### INSTALLATION, OPERATION & MAINTENANCE MANUAL

Pump Model \_\_\_\_\_

Serial Number \_\_\_\_\_



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## SECTION1: IMPORTANT SAFETY INFORMATION

### IMPORTANT INFORMATION FOR INSTALLERS OF THIS EQUIPMENT!

This equipment is intended for installation by technically qualified personnel. Failure to install it in compliance with national and local electrical codes, building codes and within Vaughan Co. recommendations may result in electrical shock, personal injury or death, fire hazard, unsatisfactory performance, and equipment failure. If further assistance is required contact your local representative or Vaughan Co. *Keep this manual in a safe location for future reference.*

**⚠ DANGER** Indicates a hazard, which, if not avoided, will result in death or serious injury.

**⚠ WARNING** Indicates a hazard, which, if not avoided, could result in death or serious injury.

**⚠ CAUTION** Indicates a hazard, which, if not avoided, may result in minor or moderate injury or damage to the equipment.

**NOTICE** Indicates special operation or maintenance information.

- Isolate the pump hydraulically and electrically before servicing or inspecting pump. Lock out both power source and isolation valves.
- This pump may handle dangerous or contaminated fluids. There are sharp corners, edges and pinch areas which can cause serious injury. Be careful; wear protective gloves whenever possible. If you cut yourself, seek medical help immediately to avoid serious infection.
- This pump may start automatically if wired to float switches or other equipment. Before inspecting or making adjustments disconnect electrical power and lock out circuit breakers to pump motor and associated equipment. Duplex pumps with alternating relays must both be locked out; otherwise the pump you are working on may not be isolated and could start as “the alternate”. Visually confirm that the pump has come to a complete stop before proceeding.
- Motors may be equipped with built-in thermal overloads to shut off the motors in the event the temperature gets too high (as a result of low voltage, poor ventilation, overloaded lines, etc.) These motors can restart automatically as the motor cools down. DO NOT work on the pump or motor without first disconnecting and locking out the power supply.
- Enter tanks or pits with extreme caution and only after an instrument check has been completed to verify the absence of dangerous gases and the presence of safe levels of oxygen. Never enter a tank or pit without a safety harness and lifeline, and an air pack. Never enter the pit without rescue personnel standing by. Follow all national and local requirements for confined space entry.
- Keep all pit openings covered when not in use. In addition to the injuries from falling, pits may contain poisonous gases or liquids.
- The pump is to always be lifted using adequate crane and sling capacity. All applicable safe hoisting practices should be employed. When doing so, rig the load to prevent flipping. Do not use the motor lifting eyes to lift the assembled pump. Use the motor lifting eyes to lift the detached motor only. Cast-in lifting eyes are designed for lifting individual pump components or sub-assemblies, not the entire pump. Only the lifting eyes on the deck plate may be used to lift a pump and drive assembly.
- Do not allow people under the pump assembly while it is being lifted.
- Pump components can be heavy. Proper methods of lifting must be employed to avoid physical injury and/or equipment damage. Steel toed shoes should be worn at all times.
- Do not allow liquid to be trapped in pump or piping between two closed valves. Always drain or vent the piping/pump between two closed valves. Failure to vent or drain could allow dangerous pressures to build causing rupture damage resulting in injury, death, and equipment damage.
- Never operate a pump with closed or blocked discharge valves. This will destroy the pump and could be dangerous to personnel.
- Do not operate this equipment unless safety guards or devices are in place and properly adjusted.
- Let the pump cool to ambient temperature before beginning work on it. A warm pump can contain compartments of pressurized fluid, which may vent violently during disassembly.
- Safety apparel to be worn when working on or making adjustments to pumps should include:

Heavy work gloves when handling parts with sharp edges, especially impellers.

Safety glasses (with side shields) for eye protection

Steel-toed shoes for foot protection when handling parts, heavy tools, etc.

Other personal protective equipment to protect against hazardous/toxic fluids and gases.

- Never apply heat to remove parts unless specifically directed to do so in overhaul instructions. Use of heat may cause an explosion due to trapped fluid, resulting in severe physical injury and property damage.
- As it is possible to run Vaughan Chopper and Screw pumps dry, for quality assurance or troubleshooting reasons, it is extremely important to ensure suction and discharge connections are always properly guarded to prevent anything (i.e. foreign objects or pump parts) from being thrown from the pump as a projectile. All pumps must be run with suction and discharge piping in place, or blind flanges installed on suction and discharge connections. Blind flanges should be vented to avoid pressure build-up. Note that cast rotating parts could break if metal to metal contact occurs while the pump is running dry.
- Shut pump off when adjusting fittings to avoid being sprayed with pumpage. Pumped materials may be hot, corrosive, poisonous, infectious, or otherwise dangerous to personnel.
- Pump motors are connected to high voltage. Allow only qualified electricians to service this electrical equipment only in accordance with the latest revision of the National Electrical Code and other applicable requirements.
- Make certain all personnel are clear of equipment before operating.
- This equipment may not meet explosion proof requirements for hazardous environments unless specifically ordered for this purpose. Introducing non-explosion proof equipment into a hazardous environment as defined by the National Electrical Code can cause a dangerous explosion.
- This pump uses oil which, if spilled, can cause a slipping hazard and danger to personnel.
- Keep hands, feet and clothing away from moving machinery.
- Never clean, oil, adjust, or repair machinery while in motion.
- Keep electrical control panel area clear to avoid to avoid hazard to personnel. If a person should trip and fall into an open panel enclosure, serious electrical burns can result.
- Keep electrical control panel doors closed except to make adjustments or repairs by a qualified electrician.
- Overheated pumps can cause severe burns and injury. If overheating of pump casing occurs:
  - 1) Shut down pump immediately.
  - 2) Wait for pump to cool to air temperature.
  - 3) Slowly and cautiously vent pump at drain plug.
  - 4) Troubleshoot cause of overheating.

Do not Enter any Confined Manure Storage Areas Without Either:

A self-contained air breathing apparatus (SCBA) and an approved harness/lifeline.

**OR**

1. Testing the air for hydrogen sulfide, combustible gases or methane, and oxygen with dependable and reliable equipment, **AND**
2. Constant and adequate ventilation of fresh air, **AND**
3. An approved harness/lifeline on the person entering the pit with at least two people outside the pit who are capable of pulling the person out of the pit if necessary, **AND**
4. An approved pulley and tripod or other suitably strong lifting system that will make it possible to remove a limp body from the pit.

***If there are any questions regarding the safe and proper methods for operating or servicing this pump, please contact Vaughan Company for assistance.***

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## **SECTION 2: DESCRIPTION OF VAUGHAN WET-WELL CHOPPER PUMP**

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The Vaughan vertical recirculating wet-well chopper pump is specifically designed for pumping trash laden material from wet pits in industrial and municipal plants. Recirculation mixing is particularly helpful in pits where material either settles or else floats on the surface, such as sewage scum pits. The pump is supplied with a deck plate to mount the pump, automatic oil level monitor (for pump shutdown in case of seal failure), and a discharge flange above the deck plate with a pressure gauge tap. The pump also includes a 3-port valve with a recirculation nozzle located below the deck plate and attached to the pump discharge. This recirculation system allows the user to direct pump discharge back to the sump to mix liquid and debris in the pit to homogenize fluid prior to pumpout. This system also includes above-deck handles for changing valve position from recirculation to pumpout (or vice versa) and handles for aiming the recirculation nozzle. The pump can be customized to add a valve actuator for changing valve position remotely. Material is chopped up by the pump so that particle size is reduced, and downstream plugging problems are eliminated.

### **A. DESCRIPTION OF MAJOR COMPONENTS**

#### **CHOPPER IMPELLER**

The impeller on the Vaughan pump serves two purposes. It induces flow by propelling liquid material through the pump casing, and also chops solids by slicing against the cutter bar. The leading edge of each impeller blade is sloped forward to create a knife edge. As material enters the pump, it is caught and cut between the knife edges on the impeller blades and the stationary bars of the cutter bar. The standard impeller is made of cast alloy steel and is heat treated to Rockwell C60.

#### **CUTTER BAR**

The cutter bar is a patented design that serves two functions. First, it serves the function of a “suction plate”, sealing the intake of the pump. The pressure generated by the impeller is kept inside the pump by the close clearances between the cutter bar and the impeller. Second, the cutter bar includes two shear bars which span the entrance to the pump. Material is chopped by the pump impeller cutting against these stationary shear bars. The standard cutter bar is made of alloy steel and is heat treated to Rockwell C60.

#### **CUTTER NUT**

The cutter nut is a patented design that serves two purposes. First it secures the impeller to the shaft. Second the raised cutter tooth design prevents pump binding by cutting stringy materials that could otherwise wrap around the shaft and block the intake opening. The cutter nut is made of cast alloy steel heat treated to Rockwell C60. All 3-6” chopper pumps have a cutter nut.

#### **EXTERNAL CUTTER (OPTIONAL ON 3-6” PUMPS)**

The external cutter has opposing cutter wings that shear against the outside face of the cutter bar. It is used to prevent binding and buildup of stringy materials at the pump inlet. The external cutter is made of cast alloy steel, heat treated to Rockwell C60 and is standard on Chopper pumps 8” and larger.

#### **UPPER CUTTER**

The upper cutter is located behind the impeller and cuts against the pumpout vanes and the impeller hub to for the purpose of preventing stringy materials from wrapping in the mechanical seal area. The upper cutter is made of alloy steel heat treated to Rockwell C60.

#### **DISINTEGRATOR TOOL**

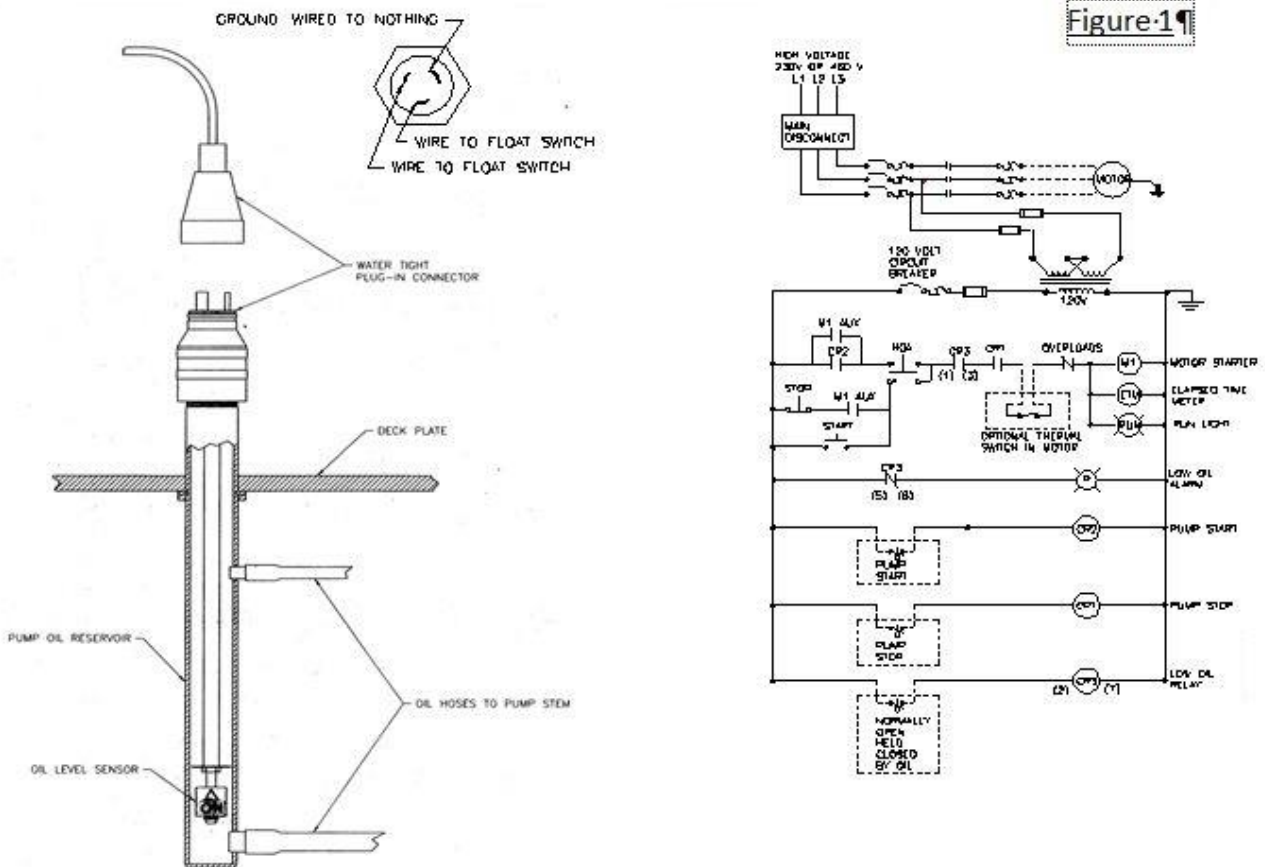
The disintegrator tool, not always used, is an auxiliary cutter located below the pump to help prevent inlet blockage. Matted material which tends to block the opening to the pump can be cut up or knocked away by this tool until flow can resume into the pump. The disintegrator tool is particularly helpful in manure and food-processing applications. However, it has the disadvantage that material which tends to wrap -- material like rags, hair, and fiber -- can ball up on the tool and eventually block flow into the intake openings of the pump. (Vaughan Co. does not recommend the use of a disintegrator tool whenever you are pumping sewage or sewage sludge.) If the pump is installed with a disintegrator tool and if suction blockage becomes a problem due to wrapping (problems usually show up as reduced flow or severe vibration), then the tool should be removed and replaced with a stainless-steel set-screw available from Vaughan Co. Note that the cutter nut holds the impeller onto the shaft, not the disintegrator tool.

## MECHANICAL SEAL DESIGN

Standard Vaughan wet-well pumps use a high quality Vaughan-designed cartridge mechanical seal to isolate and protect the oil-bath ball bearing system from contamination from the pumpage. The seal is located immediately above the pump impeller on the pump shaft. Mechanical seal faces are made of solid silicon carbide for long life in abrasives. The best indication of any problems with the mechanical seal system is either a loss of oil from the pump stem (or column) or, in unusual cases, overflowing of the oil reservoir. The pump impeller pumpout vanes are designed to pull oil out of the pump stem if a seal failure occurs and as long as pump discharge pressure is not too high. (If the pump is operating near shutoff head, it's possible to push material up into the reservoir.)

## AUTO OIL MONITOR SYSTEM

Vaughan Co. uses an automatic oil monitor system to monitor oil level and to give immediate indication of a problem if and when it occurs. Oil is monitored by a reed switch float in the oil reservoir located at the deck plate. Electrical connection to this oil switch is through a watertight Woodhead connector mounted above the deck plate. Since the oil switch has only a 30 watt capacity, shutdown of pump motor (i.e., interruption of motor starter operation) is generally accomplished with a standard 110 volt control relay, which Vaughan supplies with the pump. If an explosion proof motor is supplied with this pump, then an intrinsically safe relay will be supplied so that there is no chance of having a spark in the reed switch in a hazardous environment. A schematic showing a possible controls setup for the auto oil system is shown below. Also shown is a cross-section of the oil reservoir and float switch.

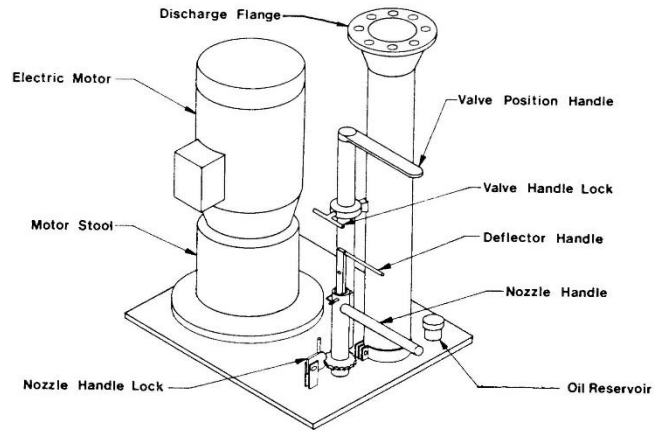


## RECIRCULATION SYSTEM:

The recirculation system consists of a 3-port cast ductile iron valve body, a steel valve cover, stainless steel valve disc, a rotatable nozzle, a stainless-steel nozzle deflector, and reach-rod handles that allow the user to change valve disc position, rotate the nozzle and aim the flow deflector up or down from above the deck plate.

## MOTOR MOUNTING

Vaughan wet-well pumps can be belt-driven (call Vaughan Co. for an exploded parts assembly drawing showing this configuration), but most pumps are directly driven by an induction type AC electric motor. Direct-drive pumps use a C-Face (or metric B5) flange-mounted motor bolted to a machined and piloted motor stool, which in turn is mounted to the deck plate. The pump is driven by the motor through an elastomeric (TB Woods "Sure-Flex or equal) coupling. The motor and motor stool are aligned to the shaft and pump column by machined, rabbeted fits so that motor and pump shaft alignment is automatically assured.



DECK PLATE ARRANGEMENT

## B. PROPER APPLICATIONS FOR VAUGHAN CHOPPER PUMPS

Vaughan Chopper Pumps are used for pumping liquid slurries contaminated with debris which can be chopped and mixed into the slurry. The benefits of chopping the pumpage are that a more homogenous slurry is pumped, making some slurries pumpable that would normally not be, and eliminating downstream plugging in piping and other equipment. Screens located upstream of the pump may often be able to be eliminated, which will cut labor costs. Vaughan pumps are routinely used to pump the following slurries:

- Sewage and sewage sludge
- Fish waste.
- Vegetable waste.
- Mill scale.
- Aluminum chips from machining operations.
- Lead oxide and plastics in battery plants.
- Oil sludges in oil refineries.
- Wood chips and paper waste.
- Animal manures (dairy cow, pigs, and chicken).
- Feathers mixed with blood and water in poultry plants.
- Animal fat in rendering and hide processing plants.
- Plastic debris.
- Coal slurry.

## C. USES OF VAUGHAN PUMPS THAT MAY CAUSE TROUBLE

If the system is not designed correctly for proper handling of your material, or if the pump is incorrectly chosen for your system, the pump may not work to your satisfaction or the pump may experience early failures of seals or bearings due to cavitation and the resulting vibration. Vibration will damage mechanical seals and bearings fairly quickly. Common rules of thumb include:

- A pump must be operated in the safe portion of its pump performance curve. Operation in the dashed lines indicates vibration areas. Curves are available from Vaughan Co. or from [www.chopperpumps.com](http://www.chopperpumps.com)
- Operating a pump against very low backpressure damages pumps
- Operating a pump against too much backpressure damages pumps.
- Chopper pump impellers with the largest number of blades are the most efficient, but they also provide the poorest solids handling. Added impeller blades block the inlet and cause increased binding on fiber during chopping. When pumping sewage and similar slurries, choose impellers with the *least* number of blades.

- When pumping materials that float or settle in a pit, mixing and chopping with the pump may be required before pit pumpout. If you have trouble starting the pump because it's jammed in too much debris, it means you are not mixing material in the pit well enough prior to pumpout.
- Do not operate the recirculation pump for prolonged periods of time with the nozzle above liquid level as this aerates the fluid and causes pump cavitation.
- A slurry that is too hot cannot be pumped from an open pit. A reasonable limit at 1170 RPM is about 180°F (82°C); at 1750 RPM it's about 160°F (71°C).
- A reliable and properly sized electrical supply must be installed for the pump to work properly. If there is too much voltage drop because of an undersized cable or transformer, the motor will not be able to provide full power to the pump and it will stall during chopping of debris. If a VFD (variable frequency drive) is used, be sure that the set points are adjusted to provide maximum possible overload capability to the motor or nuisance VFD shutdown may occur during chopping. If nuisance tripping occurs in your control panel, verify that your motor overloads are properly sized, generally for 110% of motor full load amperage rating. The circuit breaker should never trip on motor overload, as this device is supposed to provide short circuit protection, not overload protection. If your circuit breaker trips during pump chopping, it may need to be replaced with a larger unit if it cannot be adjusted to a less sensitive setting
- Wet-well level control can be troublesome in solids handling applications. Some users simply allow the pump to run continuously, with the pump snoring a combination of air and liquid at low pit levels. This mode of operation can lead to seal and bearing failures and is not recommended. Vaughan Co. has available a low-current shut-off system that eliminates the need for a low-level float switch. Do not use a throttle valve to operate a pump at or near shutoff head at low pit levels, as this can lead to seal failures and broken shafts.
- For pumping suspended solids, maintain at least 3-5 fps. velocity in horizontal runs, and 8-10 fps in vertical runs. Otherwise, material can settle and plug the discharge line, particularly at downstream elbows. Pumping over separation screens can cause plugging at elbows unless these guidelines are followed. Always use a check valve when pumping uphill to avoid shutdown backflow through the pump, which can plug the pump and loosen the impeller.

#### **D. EXPECTED BENEFITS OF VAUGHAN PUMPS**

Most customers who install a Vaughan pump see several advantages:

- Minimal pump attention is required.
- Chances of pump plugging or binding on tough solids or fibers are minimized.
- Minimal plugging problems downstream, because the material is preconditioned.
- Elimination of ancillary grinders or comminutors upstream of the pump.
- Long and reliable life of the Vaughan pump.
- Wet-well pumps use standard T-frame AC electric motors, which are cost-effective and relatively easy to replace compared to special-purpose submersible motors used on submersible pumps.
- Wet-well pumps eliminate suction piping and damage to submerged wires typical of submersible pumps.

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### **SECTION 3: INSTALLATION INSTRUCTIONS**

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#### **A. RECEIPT INSPECTION**

Prior to shipment Vaughan pumps are carefully crated and inspected to ensure arrival at your site in good condition. On receiving your pump, examine it carefully to assure that no damaged or broken parts have resulted from shipping or handling. Look for signs that the pump has been dropped, such as damaged crating, missing paint, dented-in flanges, cracked housings, or leaking oil. Turn the pump shaft by hand and verify that it turns over smoothly. If the shaft binds, look for debris or paint between impeller and cutter bar. Otherwise, shaft binding could indicate damage. If damage has occurred, report to your carrier immediately, and consult your local Vaughan representative or call Vaughan Co. for advice.



## B. STORAGE CONSIDERATIONS

If equipment is to be stored for longer than two weeks, take the following action:

1. Coat exposed steel with a light layer of grease or Cosmoline to protect the equipment from corrosion.
2. Rotate the motor 1-1/4 turn once each month to keep the bearings from sitting in one position for extended periods of time.
3. Avoid storing rotating equipment near other vibrating equipment. The vibrations can damage the bearings and result in premature failure once the equipment is started up.
4. Store rotating equipment in a clean, dry, heated area away from areas where it could be damaged from impact, smoke, dirt, vibration, corrosive fumes or liquids, or from condensation inside the motor or pump. It may be helpful to cover equipment with plastic.
5. The pump column and bearing housing are assembled as an oil-filled assembly so that the seal and lower bearings are covered in oil. To avoid bearing corrosion these housings should be kept filled with ISO 46 hydraulic oil to normal levels. (Note that the top bearing is grease lubricated. An air gap should be left below the top two bearings. Do not over fill.)

## C. PUMP MOUNTING

The Vaughan wet-well pump is heavy and will require a crane to lift it into position over your pit. Lifting the pump by the lifting eyes on the deck plate is the only recommended method for lifting. If the pump is long, it's advisable to support the center of the pump column during lifting to avoid bending any of the stem sections. *Do not lift by the motor lift eye.*

### WARNING

The pump is to always be lifted using adequate crane and sling capacity. All applicable safe hoisting practices should be employed. When doing so, rig the load to prevent flipping. Do not use the motor lifting eye to lift the assembled pump. Use the motor lifting eye to lift the detached motor only. Only the lifting eyes on the deck plate may be used to lift a pump and drive assembly. Do not allow people under Vaughan equipment during hoisting operations. Consult the Vaughan Co. shipping department for weight of your equipment if you are in doubt.

When locating the pump in the pit, position the pump so that the lower pump casing (or volute) is located at least 12" away from the nearest vertical wall in the pit. Pump length should have been chosen so that the pump inlet is located about 12" above the pit floor. Smaller 3" and 4" pumps may be located no closer than 6" from the floor as a minimum. Mounting the pump intake too close to the pit floor can cause vibrations and keep material from getting into the pump.

The pump deck plate should be bolted or clamped to the upper deck or floor to minimize operational vibrations. Expansion-type, cast-in place J-bolts, bolts mounted in sleeves, and epoxy anchoring systems are all acceptable anchoring means.

The exact details of your pump, (i.e., parts breakdown, outline dimensions, and weight) are available from Vaughan Co. The illustration at right shows a typical wet-well pump installation

## D. PIPING

As a general rule in piping layout, avoid frictional losses by minimizing fittings and abrupt changes in direction and by choosing piping size carefully. Remember that when pumping sludges that this material has significantly higher friction losses than water, so larger diameter piping is often required. If you are going uphill or going into a force main, or if there is more than one pump pumping into a common header, a check valve and isolation valve will be required on the discharge of each pump. Note that there is a pressure tap above the deck plate and just below the discharge flange for installation of pressure gauge for testing purposes, particularly important at pump startup.

Also, if you are ever required to do any troubleshooting, a pressure gauge will also be required.

Vaughan Co. does not recommend the use of an expansion joint on the pump discharge as this can impose large forces onto the pump and can also cause pump and piping vibrations by making the discharge piping system too flexible.

### NOTICE

Never use force to draw piping to pump flange. Excess forces on the pump will reduce seal and bearing life. Be sure all piping connections are tightened and properly supported before operation.

## E. MOTOR AND CONTROLS

Most motors provided on Vaughan pumps are TEFC C-Face and are not designed for hazardous environments or rated as explosion proof. However, some applications require explosion-proof motors. If your pump is in a hazardous location, be sure you ordered and received your pump with an explosion-proof motor and that you use an electrician experienced in hazardous environment wiring and controls.

Vaughan Chopper Pumps, because they cut and condition the material they pump, require motor protection with correctly sized breakers, starters, and overload protection. A Chopper Pump can jam and stall on material too tough to chop, such as steel rebar. Therefore, carefully chosen overload protection for your expensive motor is critical to avoid motor burnout. Note that nuisance tripping during chopping can occur if you do not have an adequately sized circuit breaker. The circuit breaker should never open during chopping, only during a short circuit. High current trip settings for Starters and VFD's should be set at 110% of motor nameplate full load current to prevent the current spikes from tripping out those devices while chopping.

Selecting a motor with a base speed at the upper end of your operating range and slowing it down to hit the low range results in lowest available torque and may not be recommended. Note, when slowing a motor down below nameplate speed with a VFD it is very important to remember that available horsepower drops in direct proportion to speed reduction, so a 100 HP motor running at 30 Hz can only make 50 HP max at 30 Hz.

Selecting a motor with a base speed at the lower end of your operating range and speeding it up to hit the high range results in the highest available torque and is generally preferred for chopper pump applications. When speeding a motor up above nameplate speed, available horsepower = nameplate horsepower.

Severe duty applications like septage receiving, screenings, beef processing, or any application with an external cutter often require oversizing the motor to get sufficient torque. Oversizing the motor has the added benefit of increasing rotational inertia to help carry the impeller through each chop.

When driving chopper pump motors with a VFD, it is important that Constant Torque type VFD's be specified. Constant torque VFD's allow for maximum chopping torque at all speeds. (Variable Torque units have reduced torque and horsepower at reduced speeds.)

## F. AUTOMATIC OIL LEVEL MONITOR

The Vaughan Automatic Oil Level Monitor (OLM) System constantly monitors oil level in the pump column and bearing housing below the deck plate level. The auto OLM system is designed to shut the pump down whenever oil level drops below a preset level, but to make this system work, your electrician must connect the OLM to your controls. If desired, your controls can be set up to actuate an alarm on low oil level to alert the operators of a problem in the mechanical seal system.

The OLM system is composed of a small liquid level switch, mounted in the oil reservoir, and of a control relay, mounted in the control panel with the motor controls. Vaughan Co. supplies both the pump-mounted oil monitor/oil reservoir with connectors, and the control relay with 8-pin base for mounting in the customer's panel. The Auto OLM system allows the pump to operate normally as long as the oil level is at an acceptable level in the reservoir. However, on loss of oil, usually due to seal damage, the oil level drops, the oil switch then opens, the control relay in the panel becomes de-energized, and the control relay contacts wired in series with the pump motor starter open up and interrupt voltage to the starter.

This sequence of events shuts down the pump. The schematic presented earlier in this manual (Figure 1) illustrates how Vaughan Co. intends this system to work.

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## SECTION 4 STARTUP INSTRUCTIONS

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**⚠CAUTION**

Never operate a pump with closed or blocked discharge valves. This will destroy the pump and could be dangerous to personnel.

### NOTES:

- 1) Vaughan pumps are designed and built for automatic alignment of motor and pump shafts during assembly. No further alignment is necessary.
  
- 2) The pump is shipped from the factory with oil, but once the pump is installed in your pit, it will need additional oil to make sure the oil monitor float switch is covered. Do not completely fill the pump column with oil. Fill only until the float switch is covered with oil plus one additional inch. The pump requires some air space at the top of the pump column to avoid getting oil into the upper bearings during heat-up of the oil. The upper bearings are grease lubricated so over-filling will wash out the grease. Oil capacity of 3"-6" pumps is 1.8 quarts per foot and 5 quarts per foot for 8" and larger pumps.  
Vaughan Co. uses Chevron Rando HD-46 Hydraulic Oil in the pump column. Other equivalent oils are: Shell Turbo 46, Texaco Regal 46, Gulf Harmony 46 and Exxon Teresstic 46. Note also that most ISO grade 46 hydraulic and turbine oils should be compatible with the Rando HD-46 but only a few brands have the rust inhibitors we recommend for optimum pump life.
  
- 3) When performing the pump rotation check to ensure that the pump is turning Clockwise (as viewed from the motor end). At the control panel, push the "ON" button, then the "OFF" button as fast as possible in sequence to merely "jog" or "bump" the motor. If the motor turns clockwise, then you are ready to start the pump. If the motor turns counter-clockwise, (wrong direction), then have your electrician open the circuit breakers to the motor panel using your plant's normal safety precautions for locking and tagging out breakers, and then reverse any two leads to the motor starter in the control panel. Then re-close the breakers to the panel, and recheck the motor direction to be sure it's correct. If the pump can run backwards for any significant length of time, the disintegrator tool or the cutter nut can unwind, and then the impeller will come loose on the shaft and damage the pump.
  
- 4) When the STARTUP AND CERTIFICATION CHECKLIST is completed satisfactorily, open the discharge valve, and then start the pump. Please send a copy of the completed STARTUP AND CERTIFICATION CHECKLIST to Vaughan Engineering. We will review your installation to make sure the pump is properly matched to your system to protect your investment.



DATE: \_\_\_\_\_

Project Name: \_\_\_\_\_ Location: \_\_\_\_\_

Pump S/N: \_\_\_\_\_ Equipment ID/Tag#: \_\_\_\_\_

Startup Performed By: \_\_\_\_\_

Customer Contact Info \_\_\_\_\_

Contractor Contact Info \_\_\_\_\_

Engineer Contact Info \_\_\_\_\_

### PRE-STARTUP CHECKLIST

- Was rotating equipment stored in a clean, dry heated area away from areas where it could be damaged from impact, smoke, dirt vibration, corrosive fumes, or liquids, or from condensation inside the motor or pump?

Yes \_\_\_\_\_ No \_\_\_\_\_

- If no, are you aware of any damage the equipment may have sustained?

- Was the shaft rotated 1-1/4 turn once each week? Yes \_\_\_\_\_ No \_\_\_\_\_

- If no, how often was the shaft rotated?

- Was the exposed steel covered with a light layer of grease or Cosmoline to protect the equipment from corrosion? Yes \_\_\_\_\_ No \_\_\_\_\_

- Was the bearing housing kept filled with ISO Grade 46 hydraulic oil? Yes \_\_\_\_\_ No \_\_\_\_\_

Yes \_\_\_\_\_ No \_\_\_\_\_

**VERTICAL WET-WELL CHOPPER PUMP  
STARTUP AND CERTIFICATION CHECKLIST**

- |  |           |          |
|--|-----------|----------|
| Pump Shaft turns freely by hand?   | Yes _____ | No _____ |
| All guards are in place?   | Yes _____ | No _____ |
| Pump is turning CW as viewed from motor end?   | Yes _____ | No _____ |
| Is pump properly filled with oil?  | Yes _____ | No _____ |
| Is Auto Oil Level monitor properly connected and functioning?                              | Yes _____ | No _____ |
| All piping attached to pump is being independently supported? (not by the pump)            | Yes _____ | No _____ |
| Flexible joint is connected to pump discharge?   | Yes _____ | No _____ |
| If yes, is piping anchored between expansion joint and pump discharge, per H.I. Standards? | Yes _____ | No _____ |
| All piping joints are leak tight?  | Yes _____ | No _____ |
| Are discharge valves open?   | Yes _____ | No _____ |
| Has wet well been cleared of all construction debris?                                      | Yes _____ | No _____ |
| Does Inflow splash down into sump?   | Yes _____ | No _____ |

**ELECTRICAL DATA**

Motor Manufacturer: \_\_\_\_\_ Motor Serial Number: \_\_\_\_\_  
 Motor HP \_\_\_\_\_ Motor RPM: \_\_\_\_\_  
 Nameplate voltage: \_\_\_\_\_ Nameplate F.L. Amperage: \_\_\_\_\_  
 Operating Voltage: L1 – L2: \_\_\_\_\_ L2 – L3: \_\_\_\_\_ L1 – L3: \_\_\_\_\_  
 Operating Amperage: L1: \_\_\_\_\_ L2 \_\_\_\_\_ L3: \_\_\_\_\_

**SYSTEM DATA**

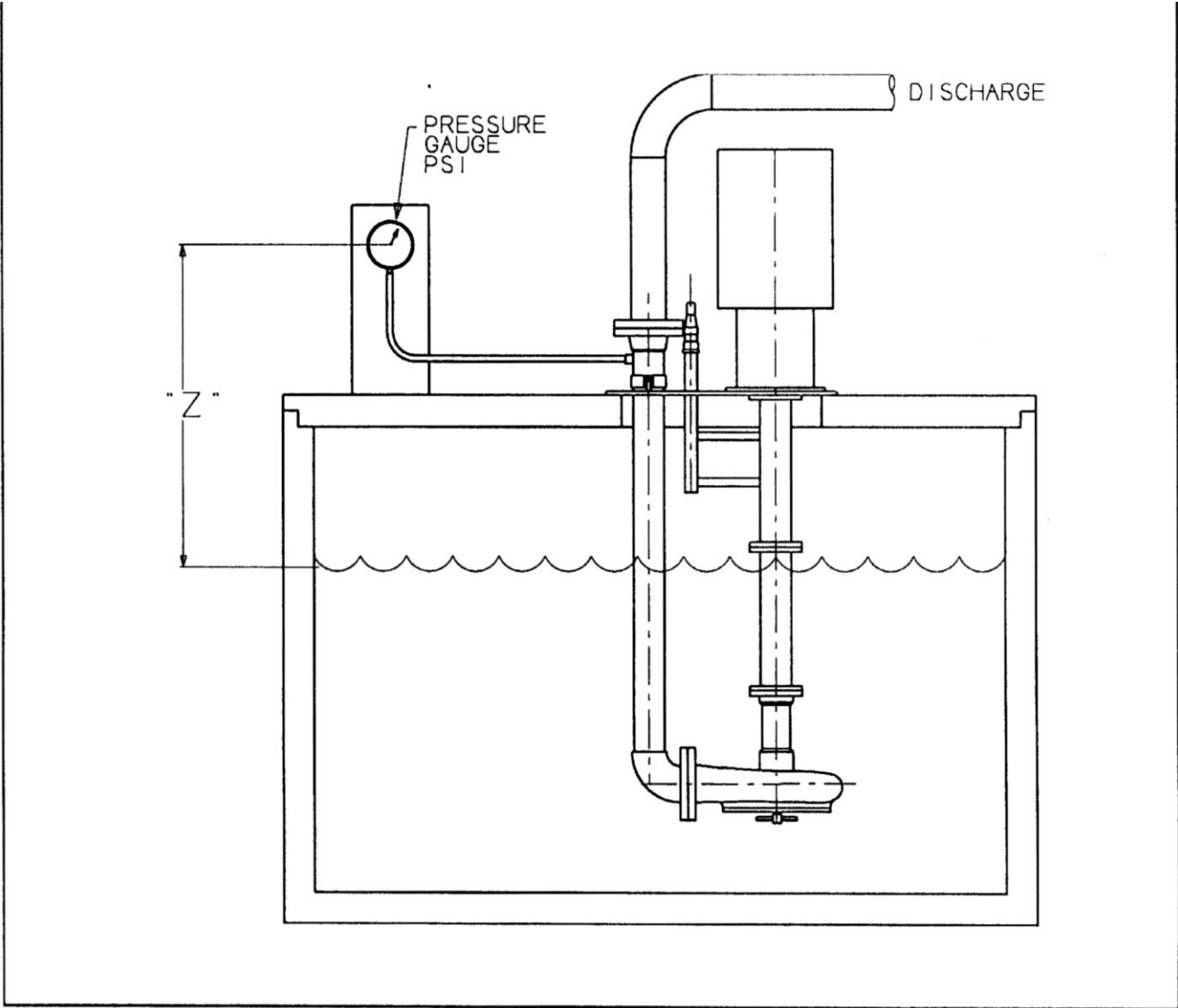
What type of material are you pumping? \_\_\_\_\_  
 Temperature (°F): \_\_\_\_\_ Specific Gravity: \_\_\_\_\_ %Solids: \_\_\_\_\_  
 Pipe Size (in): \_\_\_\_\_ Total equivalent length of pipe (Ft): \_\_\_\_\_  
 Elevation change from water level to discharge point (Ft): \_\_\_\_\_  
 Estimated Total Head (Ft): \_\_\_\_\_ Design flow (GPM): \_\_\_\_\_

**PUMP OPERATING DATA**

Pump Model: \_\_\_\_\_  
 Impeller Diameter: \_\_\_\_\_  
 Discharge Pressure (psi): **Pump Off (psi):** \_\_\_\_\_ **Pump On (psi):** \_\_\_\_\_  
 DIM "Z" (distance from liquid level to pressure gauge-Ft): \_\_\_\_\_  
 Observed Pump Flow (GPM): \_\_\_\_\_  
 Is pump running quietly? \_\_\_\_\_ Noisily? \_\_\_\_\_ Very Noisily? \_\_\_\_\_

*NOTE: If pump is not running quietly, please contact us immediately for help. Severe vibration can damage the pump very quickly.*

VERTICAL WET-WELL IMAGE



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## SECTION 5 NORMAL OPERATION

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### NOTICE

Pump speeds and operating conditions must fall within the acceptable limits of the performance curve of the pump. Do not operate in the dashed portions of the curve

#### A. NOISE

Vaughan pumps which operate at either 1750 RPM or 1170 RPM are normally quiet running (<85 dbA), and the major source of noise is the electric motor. Higher head pumps operating at 3510 RPM, however, will be noisier due to the nature of the pump design. Typically, noise level will be around 90-93 dbA in this pump. (However, mechanical vibrations should be minimal.) Note that chopping operations may be noisy.

#### B. VIBRATION

Vibration, like noise, should be minimal in the pump unless the pump is doing heavy chopping. If a particularly tough rag, or nylon pantyhose gets caught in the pump, temporary dynamic imbalance and some flow blockage will occur until the rag is chopped up and cleared. These conditions will create vibration that is undesirable. But this condition is generally only temporary, and the chopping action of the pump normally clears the obstruction with time unless the pump is worn out.

Please note that every effort has been made at the factory to ensure that this pump operates smoothly and within Hydraulic Institute Standard vibration limits. All impellers are dynamically balanced after machining and heat treat to the ISO 1940/1 G6.3 balance standard. Component alignment from top to bottom is assured by the machining methods we use, and the pump shaft is very tightly held by bearings so that there is virtually no shaft movement.

#### C. MOTOR OVERLOADS

A motor overload is not part of normal operation, but can happen more often in a chopper pump than in other types of "non-clog" pumps because of unpredictable chopping demands. If you find that the motor has tripped out on overload, when you restart the motor, have an electrician check operating amps. Make sure that the motor is not pulling more than the maximum allowable full load amps as indicated by the motor nameplate. *Note especially that repeatedly resetting the motor overload devices and restarting the motor when it trips out again will burn out the motor!* Please pull the pump up out of the pit and see if something not choppable is stuck in the pump.

#### D. OIL USAGE

All seals must leak some small amount of oil out or water in to provide cooling and lubrication to the seal faces. Normally, with the seal in good condition, this will be a very small amount, perhaps one or two ounces per year. If the pump uses large amounts of oil or if the oil is contaminated, mechanical seal damage may have occurred. (Verify that the pump has not been flooded from the top.) If the seal is leaking, the unit should be repaired immediately to avoid more expensive repairs later. Call Vaughan Co. immediately for advice. Vaughan Co. can send out a bearing and seal system sub-assembly or a new seal overnight, if necessary, to support your operations. Should repair be necessary, please carefully follow the instructions of the Wet-Well Overhaul Manual. Because the Vaughan pump has a unique bearing and seal design, it is extremely difficult to repair the pump properly if you do not have detailed directions to follow.

In unusual circumstances, the oil in the reservoir will become very slightly "milky" in appearance. Generally, this happens because condensation occurs inside the pump column or reservoir as temperature and weather change. If the oil is only slightly milky, it will not present any problems for the pump. Obviously, if too much water gets into the oil, the oil (or the seal) must be changed.

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## SECTION 6 SHUTDOWN INSTRUCTIONS

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### A. MANUAL SHUTDOWN

In the manual mode of operation, a Vaughan pump is shut down by hitting the "OFF" button or turning the auto/man/off switch on the front panel of your control panel to the "OFF" position. If any repair or maintenance work is to be done on the pump, be sure to follow all the warnings at the beginning of this manual. Be sure to turn off electrical power by opening the breaker at the control panel and by following all plant safety procedures!

### B. AUTOMATIC SHUTDOWN

Automatic operation normally shuts the pump down for you, usually on low pit level. If the pump does not shut down when the pit is pumped out, the pump may be shut down manually, but do troubleshoot your level control system. If you are going to do any maintenance, adjustment or inspection on this pump or motor, be sure to follow all warnings at the beginning of this manual. Be sure to turn off electrical power by opening the main panel breaker and by following all plant safety procedures, since in the automatic mode, the pump could start automatically if not isolated!

### C. EMERGENCY SHUTDOWN

In any kind of emergency when the pump needs to be shutdown, hit the manual "OFF" switch or pushbutton on the front of the pump control panel. If any work has to be done on the pump or motor, open the main breaker on the pump control panel so that the pump cannot automatically restart when personnel are near the pump or motor.

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## SECTION 7 MAINTENANCE

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### A. ROUTINE MAINTENANCE

#### WARNING

Isolate the pump hydraulically and electrically before servicing or inspecting the pump. Lock out both power source and isolation valves. Never clean oil, adjust, or repair machinery while in motion.

#### MONTHLY

1. Check amperage draw to the pump motor and compare to that measured at startup. Make sure power draw does not exceed the full load amperage on the motor nameplate.

#### QUARTERLY

1. Inspect electric motor. Make sure that casing drain is not plugged to ensure that motor cannot fill up with water. Clean cooling fins so that dirt buildup will not affect cooling ability of motor. Check for loose hardware and damaged wiring or conduit.
2. Inspect pump for loose hardware. Disconnect power to the Auto OLM and check the oil to ensure that it is clean and at the proper level. Make sure that pump is operating smoothly and without vibration.

#### SEMI-ANNUALLY

1. Grease motor bearings.
2. Grease the top bearing of models V8M, V8N, V8P, V10R, V12W, V16W, and all other direct driven pumps ordered with upper bearing protection. The grease zerk is accessed through the pump motor stool. In addition to the models listed above, all belt driven pumps 25 HP or greater will have a grease zerk mounted in the deck plate.
3. Perform quarterly inspections.



## **ANNUALLY**

Remove pump from the pit and inspect for wear or damaged parts. Check impeller clearance from cutter bar. It should be no greater than 0.025" max. Shim cutter bar closer to pump casing, or replace impeller and cutter bar as required. Check for smooth shaft rotation by rotating the pump shaft by hand. Be especially alert to rough spots on the bearings. Make sure there is no axial play in the pump shaft and that no oil is leaking across the seal faces into the pump bowl. Inspect pump bowl for wear and replace as necessary. Check for loose hardware, and tighten and replace as necessary.

## **B. CORRECTIVE MAINTENANCE**

Because overhaul of a Vaughan pump is a major undertaking, the Overhaul Instruction is a separate procedure. Please do not try to overhaul or repair the pump without this important procedure and without the exploded assembly parts breakdown. The overhaul manual was sent to you by mail when your order for the pump was placed at the factory. If you do not have a copy of this manual, please call Vaughan Co. Engineering; we will make sure you get proper instructions.

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## **SECTION 8, TROUBLESHOOTING**

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The Vaughan Vertical Wet Well pump may be susceptible to some system problems because it can be used in a wide range of applications and systems.

Because troubles can erupt, attached to this section is a wet-well trouble shooting chart that will help you get some idea of what symptoms could indicate what problems.

If you would like help, please call Vaughan Co. Engineering for troubleshooting help. We will be glad to offer assistance.

## TROUBLE SHOOTING CHART

		SYMPTOM							
		Low flow.	Low discharge pressure.	Excessive power required.	High vibration	Short bearing or seal life.	Contamination or loss of oil.	Cavitation noise	Pump binding or plugging.
POSSIBLE PROBLEM									
<b>SYSTEM PROBLEMS</b>	Suction or discharge blocked.	✓	✓		✓			✓	
	Gas or air binding.	✓	✓		✓	✓		✓	
	Pump too near wall or floor.	✓	✓		✓	✓		✓	✓
	Fluid too hot to pump.	✓	✓		✓	✓		✓	
	Pump speed too low.	✓	✓						
	Impeller diameter too small.	✓	✓						
	Pump speed too high.			✓	✓	✓		✓	
	Impeller diameter too large.			✓	✓	✓		✓	
	Fluid too viscous.	✓		✓	✓				
	System head too low.			✓	✓	✓		✓	
	System head too high.	✓			✓			✓	
	Specific gravity too high.			✓					
	Incorrect parallel operation.	✓			✓	✓		✓	
	Incorrect series operation.			✓	✓	✓		✓	
	Deck plate foundation too flexible.				✓	✓			
	Excessive strain or weight on pump flange.				✓	✓			
	Pumped fluid abrasive.					✓			
Flooding of pump.					✓	✓			
<b>ELECTRIC PROBLEM</b>	Loss of phase.			✓					✓
	Low voltage.			✓					✓
	Phase to ground leakage.			✓					
<b>PUMP PROBLEMS</b>	Wrong direction of rotation.	✓	✓	✓	✓	✓		✓	✓
	Improper repair.				✓	✓	✓		✓
	Impeller/Cutter bar binding.	✓		✓	✓				
	Worn cutter bar or impeller.	✓	✓	✓					✓
	Disintegrator tool wrapped with rags.	✓			✓	✓		✓	
	Bent shaft.				✓	✓			
	Stationary seal member spinning in gland.					✓	✓		
	Rotating seal member spinning on sleeve.					✓	✓		
	Oil leakage from stem or hose.						✓		
	Overfilling stem with oil.					✓	✓		
	Mechanical seal failure.						✓		
	Worn shaft or bearings.			✓	✓	✓	✓		
	Shaft sleeve worn or scored.					✓	✓		
	Impeller loose on shaft.				✓	✓			

## VAUGHAN CO., INC. PRODUCT WARRANTY

Vaughan Company, Inc. (Vaughan Co.) warrants to the original purchaser/end user (Purchaser) all pumps and pump parts manufactured by Vaughan Co. to be free from defects in workmanship or material for a period of one (1) year from date of startup or eighteen (18) months from the date of shipment from Vaughan Co., whichever occurs sooner. Startup data must be submitted to Vaughan Co. within 30 days of startup. If Purchaser fails to submit startup data within 30 days of startup, then Vaughan, in its sole discretion, may elect to void this warranty at any time. Purchaser must contact Vaughan Co. prior to commencing any repair attempts, or removing pump or parts from service. If Purchaser fails to contact Vaughan Co. prior to commencing any repair attempts or removing pumps or parts from service, then Vaughan, in its sole discretion, may elect to void this warranty at any time.

If during said warranty period, any pump or pump parts manufactured by Vaughan Co. prove to be defective in workmanship or material under normal use and service, and if such pump or pump parts are returned to Vaughan Co.'s factory at Montesano, WA, or to a Vaughan authorized Service Facility, as directed by Vaughan Co., transportation charges prepaid, and if the pump or pump parts are found to be defective in workmanship or material, they will be replaced or repaired by Vaughan Co. free of charge. Products repaired or replaced from the Vaughan Co. factory or a Vaughan authorized Service Facility under this warranty will be returned freight prepaid. Vaughan Co. shall not be responsible for the cost of pump or part removal and/or re-installation.

All warranty claims must be submitted in writing to Vaughan Co. not later than thirty (30) days after warranty breach occurrence. The original warranty length shall not be extended with respect to pumps or parts repaired or replaced by Vaughan Co. under this Warranty. This Warranty is voided as to pumps or parts repaired/replaced by other than Vaughan Co. or its duly authorized representatives.

Vaughan Co. shall not be liable for consequential damages of any kind, including, but not limited to, claims for property damage, personal injury, attorneys' fees, lost profits, loss of use, liability of Purchaser to customers, loss of goodwill, interest on money withheld by customers, damages related to third party claims, travel expenses, rented equipment, third party contractor's fees, or unauthorized repair service or parts. The Purchaser, by acceptance of delivery, assumes all liability for the consequences of the use or misuse of Vaughan Co. products by the Purchaser, its employees or others.

Equipment and accessories purchased by Vaughan Co. from outside sources which are incorporated into any Vaughan pump or any pump part are warranted only to the extent of and by the original manufacturer's warranty or guarantee, if any, which warranty, if appropriate, will be assigned by Vaughan Co. to the Purchaser. It is Purchaser's responsibility to consult the applicable product documentation for specific warranty information. Specific product documentation is available upon request. Any warranty shall be void if the total contract amount is not paid in full.

Vaughan Co. neither assumes, nor authorizes any person or company to assume for it, any other obligation in connection with the sale of its equipment with the exception of a valid Vaughan "Performance Guarantee" or "Extended Warranty," if applicable. Any other enlargement or modification of this warranty by a representative or other selling agent shall not be legally binding on Vaughan Co.

Warranty eligibility determination is at Vaughan Co.'s sole discretion.

### Warranty Limitations:

This warranty shall not apply to any pump or pump part which has been subjected to or been damaged by any of the following non-exclusive list of causes:

- Misuse
- Abuse
- Accident
- Negligence
- Operated in the dashed portion of the published pump curves
- Used in a manner contrary to Vaughan's printed instructions
- Defective power supply
- Improper electrical protection
- Faulty installation, maintenance, or repair
- Wear caused by pumping abrasive or corrosive fluids or by cavitation
- Dissatisfaction due to buyer's remorse
- Damages incurred during transportation
- Damages incurred during installation or maintenance

***THIS IS VAUGHAN CO.'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.***

REV NUMBERS AND DATE:

REV 5, ECN 4735 Warranty Updated

10/16/20 SJM

REV. 6, ECN #4831, Added Pre-Startup Procedures and Manual punctuation edits. 4/20/21 LMN.