



INSTALLATION, OPERATION &
MAINTENANCE MANUAL
FOR
SERIES 470 VM
VERTICAL MULTISTAGE PUMPS

05 MAY 2010
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SAFETY CONSIDERATIONS

The American-Marsh VM vertical multistage pumps have been designed and manufactured for safe operation. In order to ensure safe operation, it is very important that this manual be read in its entirety prior to installing or operating the pump. American-Marsh Pumps shall not be liable for physical injury, damage or delays caused by a failure to observe the instructions for installation, operation and maintenance contained in this manual.

Remember that every pump has the potential to be dangerous, because of the following factors:

- parts are rotating at high speeds
- high pressures may be present
- high temperatures may be present
- highly corrosive and/or toxic chemicals may be present

Paying constant attention to safety is always extremely important. However, there are often situations that require special attention. These situations are indicated throughout this book by the following symbols:



DANGER - Immediate hazards which WILL result in severe personal injury or death.



WARNING – Hazards or unsafe practices which COULD result in severe personal injury or death.



CAUTION – Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

Maximum Lifting Speed: 15 feet/second.

If in a climate where the fluid in the casing could freeze, never leave liquid in the pump. Drain the pump completely. During winter months and cold weather, the liquid could freeze and damage the pump.

ENGINEERED PROCESS GROUP

Do not run the equipment dry or start the pump without the proper prime (pump flooded).

Never operate the pump for more than a short interval with the discharge valve closed. The length of the interval depends on several factors including the nature of the fluid pumped and its temperature. Contact American-Marsh Engineering for additional support if required.

Never operate the pump with a closed suction valve.

Excessive pump noise or vibration may indicate a dangerous operating condition. The pump must be shut down immediately.

Do not operate the pump for an extended period of time below the recommended minimum flow. See TABLE 4, page 9.

The pump shaft MUST turn clockwise when viewed from the motor end. It is absolutely essential that the rotation of the motor be checked before installation of the coupling and starting the pump. Incorrect rotation of the pump for even a short period of time can cause severe damage.

If the liquid is hazardous, take all necessary precautions to avoid damage and injury before emptying the pump.

Residual liquid may be found in the pump. Take the necessary precautions if the liquid is hazardous, flammable, corrosive, poisonous, infected, etc.

Always lockout power to the driver before performing pump maintenance.

Never operate the pump without the coupling guard and all other safety devices correctly installed.

Do not apply heat to disassemble the pump or to remove the impeller. Entrapped liquid could cause an explosion.

If any external leaks are found while pumping hazardous product, immediately stop operations and repair.



PUMP IDENTIFICATION

MANUFACTURER

American-Marsh Pumps
185 Progress Road
Collierville, TN 38017
United States of America

TYPE OF PUMP

The American-Marsh VM vertical multistage pumps are in line, multistage centrifugal pumps.

INSTALLATION, OPERATION & MAINTENANCE MANUAL IDENTIFICATION

Prepared: May, 2010
Revision:

Edition: 01
Date of Revision:

NAMEPLATE INFORMATION

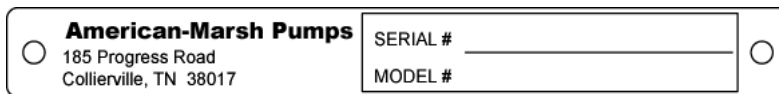


FIGURE 1 – Pump Data Plate

SERIAL NUMBER : Serial Number of pump unit (issued by Production Control).
MODEL NUMBER : Model designation of pump (VM32-8)



WARRANTY

American-Marsh Pumps guarantees that only high quality materials are used in the construction of our pumps and that machining and assembly are carried out to high standards.

The pumps are guaranteed against defective materials and/or faulty craftsmanship for a period of one year from the date of shipment unless specifically stated otherwise.

Replacement of parts or of the pump itself can only be carried out after careful examination of the pump by qualified personnel.

The warranty is not valid if third parties have tampered with the pump.

This warranty does not cover parts subject to deterioration or wear and tear (mechanical seals, pressure and vacuum gauges, rubber or plastic items, bearings, etc.) or damage caused by misuse or improper handling of the pump by the end user.

Parts replaced under warranty become the property of American-Marsh Pumps.

Contact the American-Marsh Pumps' factory:

American-Marsh Pumps
185 Progress Road
Collierville, TN 38017
United States Of America

Phone: (901) 860-2300
Fax: (901) 860-2323
www.american-marsh.com

GENERAL INSTRUCTIONS

The pump and motor unit must be examined upon arrival to ascertain any damage caused during shipment. If damaged immediately notify the carrier and/or the sender. Check that the goods correspond exactly to the description on the shipping documents and report any differences as soon as possible to the sender. Always quote the pump type and serial number stamped on the data plate.

The pumps must be used only for applications for which the manufacturers have specified:

- ❖ **The construction materials**
- ❖ **The operating conditions (flow, pressure, temperature, etc.)**
- ❖ **The field of application**

In case of doubt, contact the manufacturer.

ENGINEERED PROCESS GROUP

HANDLING AND TRANSPORT

METHOD OF TRANSPORT

The pump must be transported in the horizontal position

INSTALLATION

During installation and maintenance, all components must be handled and transported securely by using suitable slings. Handling must be carried out by specialized personnel to avoid damage to the pump and persons. The lifting rings attached to various components should be used exclusively to lift the components for which they have been supplied.

! CAUTION

Maximum lifting speed: 15 feet/second

STORAGE

SHORT-TERM STORAGE

Normal packaging is designed to protect the pump during shipment and for dry, indoor storage for up to two months or less. The procedure followed for this short-term storage is summarized below:

Standard Protection for Shipment :

- a. Loose unmounted items are packaged in a water proof plastic bag and placed on the skid. Larger items are cartoned and metal banded to the skid.
- b. After a performance test, if required, the pump is tipped on the suction flange for drainage (some residual water may remain in the pump). Internal surfaces are sprayed with Calgon Vestal Labs RP-743m, or equal. Exposed shafts are taped with Polywrap.
- c. Flange faces are protected with plastic covers secured with plastic drive bolts. 3/16 in (7.8 mm) steel or 1/4 in (6.3 mm) wood covers with rubber gaskets, steel bolts, and nuts are available at extra cost.
- d. All assemblies are bolted to a wood skid which confines the assembly within the perimeter of the skid.
- e. Assemblies with special paint are protected with a plastic wrap.

LONG-TERM STORAGE

Long-term storage is defined as more than two months, but less than 12 months. The procedure American-Marsh follows for long-term storage of pumps are



Every three months, the shaft should be rotated approximately 10 revolutions.

CONFIRMING PROPER APPLICATION

Confirm that the application the pump is planned to be installed in matches the requirements of the pump performance curve and the operating conditions in the following section.

OPERATING CONDITIONS

Fluids pumped need to be thin, clean, non-flammable and non-explosive liquid containing no solids or fibers. Normal fluid temperatures need to range from -4 to 158°F (-15 to 70°C).

Hot water application temperatures need to range from -158 to 248°F (70 to 120°C).

MINIMUM INLET PRESSURES

The minimum inlet pressure is NPSHr + 2 feet.

MAXIMUM INLET PRESSURES

The maximum inlet pressure is shown in table 1 below. But the actual inlet pressure plus the valve close pressure of the pump shall be lower than the maximum allowable working pressure.

TABLE 1. Maximum Inlet Pressures

Model	50 Hz Stages	60 Hz Stages	Max psi / bar
VM1	2 to 8 9 to 36	2 to 6 7 to 25	87 / 6 145 / 10
VM2	2 3 to 11 13 to 26	2 3 to 7 9 to 18	87 / 6 145 / 10 217 / 15
VM3	2 to 5 6 to 29 31 to 36	2 to 5 6 to 19 20 to 25	87 / 6 145 / 10 217 / 15
VM4	2 3 to 10 12 to 22	2 3 to 8 10 to 16	87 / 6 145 / 10 217 / 15
VM8	2A to 6 8 to 20	2A to 5 6 to 14	87 / 6 145 / 10
VM12	2 to 4 5 to 18	2A to 4 5 to 14	87 / 6 145 / 10
VM16	2 to 3 4 to 16	2A to 2 3 to 10	87 / 6 145 / 10
VM20	1 to 3 4 to 17	1 to 2 3 to 10	87 / 6 145 / 10
VM32	1A to 4 5B to 10 11B to 14	1A to 3B 3 to 7 8B to 10B	58 / 4 145 / 10 217 / 15
VM42	1A to 2 3B to 5 6B to 13B	1A to 2B 2 to 4B 4 to 7	58 / 4 145 / 10 217 / 15
VM65	1A to 2B 2A to 3 4B to 8A	1A to 2B 2 to 3B 3 to 5B	58 / 4 145 / 10 217 / 15
VM85	1A to 1 2B to 3B 3A to 6	1A to 1 2B to 2 3B to 4B	58 / 4 145 / 10 217 / 15

MAXIMUM ALLOWABLE WORKING PRESSURE

The maximum allowable working pressure is shown in table 2 below.

TABLE 2. Maximum Allowable Working Pressures

Model	50 Hz Stages	60 Hz Stages	Max psi / bar
VM1	2 to 23 25 to 36	2 to 17 19 to 25	232 / 16 305 / 21
VM2	2 to 15 18 to 26	2 to 11 13 to 18	232 / 16 305 / 21
VM3	2 to 23 25 to 36	2 to 15 17 to 25	232 / 16 305 / 21
VM4	2 to 16 19 to 22	2 to 10 12 to 16	232 / 16 305 / 21
VM8	2A to 12 14 to 20	2A to 8 10 to 14	232 / 16 333 / 23
VM12	2 to 10 12 to 18	2A to 7 8 to 14	232 / 16 333 / 23
VM16	2 to 8 10 to 16	2 to 6 7 to 10	232 / 16 333 / 23
VM20	1 to 8 10 to 17	1 to 4 5 to 10	232 / 16 333 / 23
VM32	1A to 7 8B to 12 13 to 14	1A to 5B 5 to 9B 9 to 10B	232 / 16 362 / 25 435 / 30
VM42	1A to 6 7B to 9 10B to 13B	1A to 3 4B to 6 7B to 7	232 / 16 362 / 25 435 / 30
VM65	1A to 5 6B to 8A	1A to 3 4B to 5B	232 / 16 362 / 25
VM85	1A to 5B 5 to 6	1A to 3 4B	232 / 16 362 / 25

INSTALLATION

WARNING

Do not energize pump until properly installed

PUMP LOCATION

The pump location should be in a well-ventilated, dry area that is not subject to freeze or be exposed to extreme variation of temperature.

The pump must be installed at least 6 inches (150 mm) from any obstruction or hot source.

Pumps installed in an open system requiring suction lift should be as close to the water source as possible to reduce piping losses.



FOUNDATION

The foundation should be concrete or a similar foundation material should provide a secure, stable mounting base for the pump.

The pump should be secured to the foundation using all four bolts and shim pump base to assure the pump is vertical and all four pads on the base are properly supported (uneven surfaces can result in pump base breakage when mounting bolts are tightened).

Arrows are provided on the pump base to show the direction of flow of liquid through the pump.

To minimize possible noise from the pump, it is advisable to fit expansion joints on either side of the pump and anti-vibration mounting between the foundation and the pump.

Note: The pump should be positioned so that the vent plug is located in the uppermost position.

Isolation valves are recommended on either side of the pump to avoid draining the system if the pump needs to be cleaned, repaired or replaced.

PIPING CONNECTION – SUCTION & DISCHARGE

TABLE 3. Recommended installation torques

Model	Recommended foundation torque (ft-lbs)	Recommended flange torque (ft-lbs)
VM1, 2, 3, and 4	30	37 – 44
VM8, 12, 16, and 20	37	44 – 52
VM32, 42, 65, and 85	52	52 – 59

All piping must be independently supported, accurately aligned and preferably connected to the pump by a short length of flexible piping. The pump should not have to support the weight of the pipe or compensate for misalignment. It should be possible to install suction and discharge bolts through mating flanges without pulling or prying either of the flanges. All piping must be tight. Pumps may air-bind if air is allowed to leak into the piping. If the pump flange(s) have tapped holes, select flange fasteners with thread engagement at least equal to the fastener diameter but that do not bottom out in the tapped holes before the joint is tight.

! WARNING

Piping Forces: Take care during installation and operation to minimize pipe forces and/or moments on the pump casing.

SUCTION PIPING

To avoid NPSH and suction problems, suction pipe sizes must be at least as large as the pump suction connection. High fluid temperatures may require larger diameter pipe to reduce friction and improve NPSHa.

Never use pipe or fittings on the suction that are smaller in diameter than the pump suction size. Figure 2 and 3 illustrate the ideal piping configuration with a minimum of 10 pipe diameters between the source and the pump suction. In most cases, horizontal reducers should be eccentric and mounted with the flat side up as shown in figure 6 with a maximum of one pipe size reduction. Never mount eccentric reducers with the flat side down. Horizontally mounted concentric reducers should not be used if there is any possibility of entrained air in the process fluid. Vertically mounted concentric reducers are acceptable. In applications where the fluid is completely deaerated and free of any vapor or suspended solids, concentric reducers are preferable to eccentric reducers.

Avoid the use of throttling valves and strainers in the suction line. Start up strainers must be removed shortly after start up. When the pump is installed below the source of supply, a valve should be installed in the suction line to isolate the pump and to permit pump inspection and maintenance. However, never place a valve directly on the suction nozzle of the pump.

Refer to the American-Marsh Pump Engineering Manual and the Centrifugal Pump IOM Section of the Hydraulic Institute Standards for additional recommendations on suction piping.

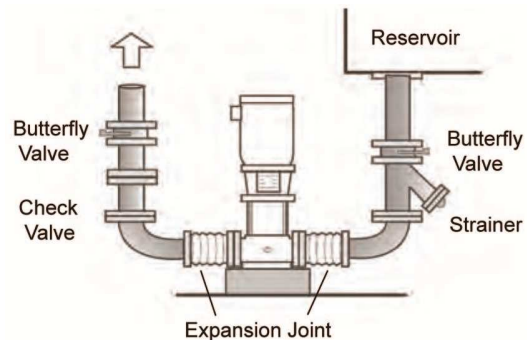


FIGURE 2 – Good Piping Practices for Flooded Suction

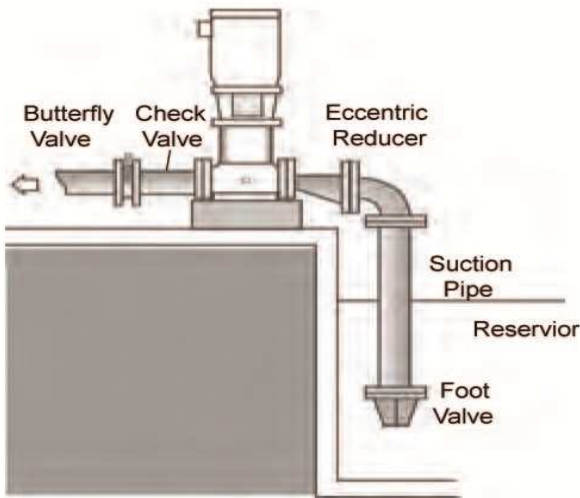


FIGURE 3 – Good Piping Practices for Suction Lift

DISCHARGE PIPING

Install a check valve and isolation valve in the discharge line. This isolation valve is required for regulating flow and/or to isolate the pump for inspection and maintenance. Pipe sizes must be at least as large as the pump discharge connection.

Pipe, valves, and fittings must have a pressure rating equal to or greater than the maximum system pressure.

When fluid velocity in the pipe is high, for example, 10 ft/s (3 m/s) or higher, a rapidly closing discharge valve can cause a damaging pressure surge. A dampening arrangement should be provided in the piping.

American-Marsh Pumps recommends the system be thoroughly cleaned and flushed of all foreign materials and sediment prior to pump installation. The pump should never be installed at the lowest point of the system due to the natural accumulation of dirt and sediment. If there is excessive sediment or suspended particles present, it is advised a strainer or filter be used. American-Marsh Pumps recommends that pressure gauges be installed on both the suction and discharge flanges to check pump and system performance.

BYPASS ORIFICE

If there is any possibility the pump may operate against a closed valve in the discharge line a bypass should be installed in the discharge pipe. To ensure adequate cooling and lubrication of the pump it is required that the minimum flow shown on TABLE 4 flows through the pump.

Elbows should be a minimum of 12" from the orifice discharge to prevent erosion.

TABLE 4. Minimum Continuous Duty Flow Rates

Model	Min to 176°F (Min to 80°C)	At 210°F (at 99°C)	At 248°F (at 120°C)
VM1	0.9	1.3	2.3
VM2	0.9	1.3	2.3
VM3	1.6	2.4	4.0
VM4	3.0	4.5	7.5
VM8	4	6	10
VM12	7	10	17
VM16	8	12	20
VM20	11	17	28
VM32	14	21	35
VM42	22	33	55
VM65	34	51	85
VM85	44	66	110

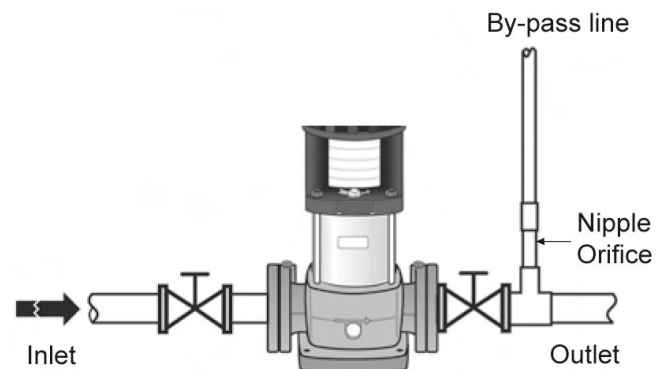


FIGURE 4 – Recommended Bypass

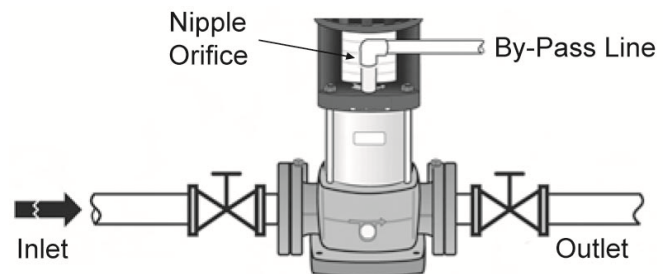


FIGURE 5 – Optional Bypass

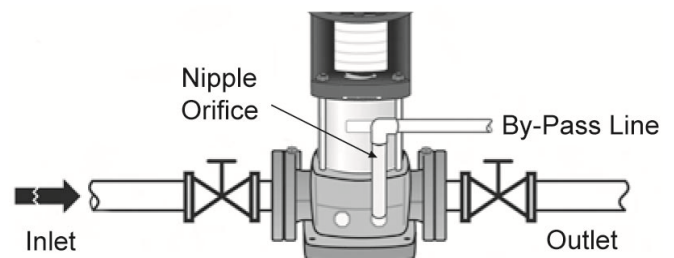


FIGURE 6 – Optional Bypass for VM32, 42, 65, and 85



TEMPERATURE RISE

Sometimes it may be necessary to stop the flow of fluid through the pump during operation. When the pump runs at shut-off the power to the pump is transferred to the pumping fluid as head. This will generate excess heat and may cause damage to the pump. The risk of damage depends on the temperature of the fluid and how long the pump operates without flow. The following TABLE 5 shows the temperature rise of the fluid.

TABLE 5. Temperature Rise

Model	Time for temperature Rise of 18°F (10°C)	
	Seconds	Minutes
VM1, 2, 3	210	3.5
VM4	240	4.0
VM8, 12	210	3.5
VM16	150	2.5
VM20	120	2.0
VM32, 42, 65, 85	60	1.0

The listed times are subject to the following:

- No exchange of heat with the surroundings
- The pump is pumping water
- Pump parts have the same thermal capacity as water
- The water in the base and pump head are not included.

The maximum temperature must not exceed the rated maximum pump temperature.

PUMP OPERATION

ROTATION CHECK

CAUTION

It is absolutely essential that the rotation of the motor be checked before connecting the shaft coupling. Incorrect rotation of the pump, for even a short time, can dislodge and damage the impeller, casing, shaft and shaft seal.

All VM pumps turn left to right (**counter-clockwise**) as viewed from the motor end.

PRE START-UP CHECKS

Prior to starting the pump it is essential that the following checks are made. These checks are all described in detail in the Maintenance Section of this booklet.

- Pump and Motor properly secured to the foundation
- All fasteners tightened to the correct torques
- Coupling guard in place and not rubbing

- Rotation check, see above
THIS IS ABSOLUTELY ESSENTIAL.
- Shaft seal properly installed
- Impeller clearances properly set
- Pump instrumentation is operational
- Pump is primed
- Rotation of shaft by hand

As a final step in preparation for operation, it is important to rotate the shaft by hand to be certain that all rotating parts move freely, and that there are no foreign objects in the pump.

ENSURING PROPER NPSH_A

Net Positive Suction Head – Available (NPSH_A) is the measure of the energy in a liquid above the vapor pressure. It is used to determine the likelihood that a fluid will vaporize in the pump. It is critical because a centrifugal pump is designed to pump a liquid, not a vapor. Vaporization in a pump will result in damage to the pump, deterioration of the Total Differential Head (TDH), and possibly a complete stopping of pumping. Net Positive Suction Head – Required (NPSH_R) is the decrease of fluid energy between the inlet of the pump, and the point of lowest pressure in the pump. This decrease occurs because of friction losses and fluid accelerations in the inlet region of the pump, and particularly accelerations as the fluid enters the impeller vanes. The value for NPSH_R for the specific pump purchased is given in the pump data sheet, and on the pump performance curve.

For a pump to operate properly the NPSH_A must be greater than the NPSH_R. Good practice dictates that this margin should be at least 5 ft (1.5 m) or 20%, whichever is greater.

CAUTION

Ensuring that NPSH_A is larger than NPSH_R by the suggested margin will greatly enhance pump performance and reliability. It will also reduce the likelihood of cavitation, which can severely damage the pump.

PRIMING

To prime the pump in a flooded suction application, close the isolation valves and open the priming vent plug on the pump head. Gradually open the isolation valve on the suction side until a stream of airless water runs out the priming port. Close the plug and securely tighten. Then completely open the isolation valves.



To prime the pump in a suction lift application, the suction pipe and pump must be filled with water and vented of air before starting the pump. Close the discharge isolation valve and remove the priming plug. Pour water into the pump through the priming hole until the suction piping and pump are completely filled with water. Replace the priming plug and securely tighten.

MINIMUM FLOW

Minimum continuous stable flow is the lowest flow at which the pump can operate and still conform to the bearing life, shaft deflection and pump vibration limits. Pumps may be operated at lower flows, but it must be recognized that the pump may not conform to one or more of these limits. For example, vibration may exceed the limit set by the ASME standard. The size of the pump, the energy absorbed, and the liquid pumped are some of the considerations in determining the minimum flow.

CAUTION

Do not operate the pump below Minimum Thermal Flow, as this could cause an excessive temperature rise. Contact an American-Marsh Sales Engineer for determination of Minimum Thermal flow.

LUBRICATION

VM multistage pumps are water-lubricated and do not require any external lubrication or inspection. The motor may require periodic lubrication per motor manufacture requirements.

OPERATION IN SUB-FREEZING CONDITIONS

When using the pump in sub-freezing conditions where the pump is periodically idle, the pump should be properly drained or protected with thermal devices which will keep the liquid in the pump from freezing.

SHUTDOWN CONSIDERATIONS

When the pump is being shutdown, the procedure should be the reverse of the start-up procedure. First, slowly close the discharge valve, shutdown the driver, then close the suction valve. Remember, closing the suction valve while the pump is running is a safety hazard and could seriously damage the pump and other equipment.

TROUBLESHOOTING

The following is a guide to troubleshooting problems with American-Marsh pumps. Common problems are

analyzed and solutions are offered. Obviously, it is impossible to cover every possible scenario. If a problem exists that is not covered by one of the examples, then contact a local American-Marsh Sales Engineer or Distributor/Representative for assistance.



PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Problem #1 Pump not reaching design flow rate.	1.1 Insufficient NPSH _A . (Noise may not be present)	Recalculate NPSH available. It must be greater than the NPSH required by pump at desired flow. If not, redesign suction piping, holding number of elbows and number of planes to a minimum to avoid adverse flow rotation as it approaches the impeller.
	1.2 System head greater than anticipated.	Reduce system head by increasing pipe size and/ than or reducing number of fittings.
	1.3 Entrained air. Air leak from atmosphere on suction side.	1. Check suction line gaskets and threads for tightness. 2. If vortex formation is observed in suction tank, install vortex breaker.
	1.4 Entrained gas from process.	Process generated gases may require larger pumps.
	1.5 Speed too low.	Check motor speed against design speed.
	1.6 Direction of rotation wrong.	After confirming wrong rotation, reverse any two of three leads on a three phase motor. The pump should be disassembled and inspected before it is restarted.
	1.8 Plugged impeller, suction line or casing which may be due to a product or large solids.	1. Reduce length of fiber when possible. 2. Reduce solids in the process fluid when possible. 3. Consider larger pump.
	1.9 Wet end parts (casing cover, impeller) worn, corroded or missing.	Replace part or parts.
	2.1 Refer to possible causes under Problem #1.0.	Refer to remedies listed under Problem #1.0 and #3.0.
Problem #2.0 Pump not reaching design head (TDH).	3.1 Not properly primed.	Repeat priming operation, recheck instructions. If pump has run dry, disassemble and inspect the pump before operation.
Problem #3.0 No discharge or flow	3.2 Direction of rotation wrong.	After confirming wrong rotation, reverse any two of three leads on a three phase motor. The pump should be disassembled and inspected before operation.



PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Cont. Problem #3.0 No discharge or flow	3.3 Entrained air. Air leak from atmosphere on suction side.	Refer to recommended remedy under Problem #1.0, Item #1.3.
	3.4 Plugged impeller, suction line or casing which may be due to a fibrous product or large solids.	Refer to recommended remedy under Problem #1.0, Item #1.8.
	3.5 Damaged pump shaft, impeller.	Replace damaged parts.
Problem #4.0 Pump operates for short period, then loses prime.	4.1 Insufficient NPSH.	Refer to recommended remedy under Problem #1.0, Item #1.1.
	4.2 Entrained air. Air leak from atmosphere on suction side.	Refer to recommended remedy under Problem #1.0, Item #1.3.
Problem #5.0 Excessive noise.	5.1 Cavitation - insufficient NPSH available.	Refer to recommended remedy under Problem #1.0, Item #1.1.
	5.2 Abnormal fluid rotation due to complex suction piping.	Redesign suction piping, holder number of elbows and number of planes to a minimum to avoid adverse fluid rotation as it approaches the impeller.
	5.3 Impeller rubbing.	Reset impeller clearance.
Problem #6.0 Pump cycles too much	6.1 Pump is oversized	Install pressure gauges on suction and discharge flanges. Start and run pump under normal conditions, record gauge readings. Refer to the specific pump curve for that model, ensure that total head is sufficient to limit pump delivery within its design flow range. Throttle pump discharge flow if necessary.
	6.2 Tank is too small	Check tank size and air volume in tank. Tank volume should be approximately 10 gallons for each gpm of pump capacity. The normal air volume is 2/3 of the total tank volume at the pump cut-in pressure. Replace tank with one of correct size.
	6.3 Insufficient air charging of leaking tank or piping	Pump air into tank or diaphragm chamber. Check diaphragm for leak. Check tank and piping for leaks with soap and water solution. Check air to water volume. Repair as necessary.
	6.4 Level control is not properly adjusted or is defective	Check setting and operation. Readjust setting (refer to level control manufacturer's data). Replace if defective.
	6.5 Pressure switch is not properly adjusted or is defective	Check pressure setting on switch and operation. Check voltage across closed contacts. Readjust switch or replace if defective.



MAINTENANCE

PREVENTIVE MAINTENANCE

The following sections of this manual give instructions on how to perform a complete maintenance overhaul. However, it is also important to periodically repeat the "Pre start-up checks" listed on page 13. These checks will help extend pump life as well as the length of time between major overhauls.

The following checks should be made on regular intervals depending on the conditions and time of operation:

1. Pump performance meets requirements
2. Pump operates smoothly and quietly
3. There are no leaks, particularly at the shaft seal
4. The motor is not overheating
5. Remove and clean all strainers or filters in the system
6. Check the operation of all controls
7. If the pump does not operate for long periods, the unit should be maintained in accordance with these instructions. In addition, if the pump is not drained, the pump shaft should be manually rotated or run for short periods of time at monthly intervals.
8. To extend the pump life in severe duty applications, consider performing one of the following actions:
 - Drain the pump after each use
 - Flush the pump, through system, with water or other fluid that is compatible with the pump materials and process fluid
 - Disassemble the pump fluid components and thoroughly rinse or wash them with water or other fluid that is compatible with the pump materials and process fluid.

NEED FOR MAINTENANCE RECORDS

A procedure for keeping accurate maintenance records is a critical part of any program to improve pump reliability. There are many variables that can contribute to pump failures. Often long term and repetitive problems can only be solved by analyzing these variables through pump maintenance records.

NEED FOR CLEANLINESS

One of the major causes of pump failure is the presence of contaminants in the bearing housing. This contamination can be in the form of moisture, dust, dirt and other solid particles such as metal chips.

Contamination can also be harmful to the mechanical

seal (especially the seal faces) as well as other parts of the pumps. For example, dirt in the impeller threads could cause the impeller to not be seated properly against the shaft. This, in turn, could cause a series of other problems. For these reasons, it is very important that proper cleanliness be maintained. Some guidelines are listed below.

DISASSEMBLY

1. Turn off and lock out power supply. Safely disconnect power supply wiring from the motor wiring.
2. Loosen the cap screws in the coupling. Completely remove coupling halves. The shaft pin can be left in the pump shaft if applicable.
3. Loosen and remove the bolts that hold the motor to the pump end.
4. Lift the motor straight up until the shaft has cleared the motor stool.

ASSEMBLY

1. Remove key from the motor shaft, if present, and discard.
2. Thoroughly clean the surfaces of the motor and pump end mounting flange. The motor and shaft must be clean of all oil/grease and other contaminants where the coupling attaches. Set the motor on the pump end.
3. Place the terminal box in the desired position by rotating the motor.
4. Insert the mounting bolts, then diagonally and evenly tighten:
 - ½ to 2 hp motor (3/8" bolts), torque to 17ft-lb
 - 3 to 40 hp motor (1/2" bolts), torque to 30ft-lb
 - 50 to 100hp motor (5/8" bolts), torque to 59ft-lb

For Models VM1, 2, 3, 4, 8, 12, 16, and 20

5. Install coupling halves. Make sure the shaft pin is located in the pump shaft. Put the cap screws loosely back into the coupling halves. Using a large screwdriver, raise the pump shaft by placing the tip of the screwdriver under the coupling and carefully elevating the coupling to its highest point. The shaft can only lifted approx. 0.20 in (5 mm).
6. Lower the shaft halfway back down and tighten the coupling screws (finger tight) while keeping the coupling separation equal on both sides.
7. Check that the gaps on either side of the coupling are even, and that the motor shaft keyway is centered in the coupling half as shown in FIGURE 8.
8. When the screws are tight enough to keep the coupling in place then torque the screws evenly in a cross-pattern per torque specifications in TABLE 6.

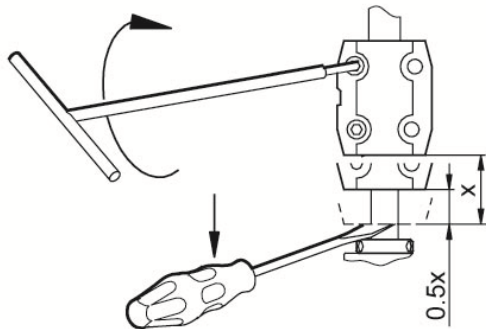


FIGURE 7. Coupling Adjustment

9. Be certain the pump shaft can be rotated by hand. If it cannot disassemble and check for misalignment.
10. Prime the pump
11. Wire the motor per the motor manufactures requirements.
12. Check for correct rotation. Rotation must be left to right (counter-clockwise) when looking directly at the coupling.
13. Shut-off power and reinstall the coupling guards. After the guards have been installed the power can be turned back on.

8. Apply anti-seize to the coupling screws. Tighten the screws (finger tight) while keeping the coupling separation equal on both sides and the motor shaft keyway centered in the coupling half as shown in FIGURE 8.
9. When the screws are tight enough to keep the coupling in place then torque the screws evenly in a cross-pattern. Torque screws to 62 ft-lbs (75 and 100hp motors to 74 ft-lbs).
10. Remove the adjustment fork from under the seal collar and store in a safe location.
11. Check to see that the gaps between the coupling halves are equal. If not loosen and readjust.
12. Be certain the pump shaft can be rotated by hand. If it cannot disassemble and check for misalignment.
13. Prime the pump
14. Wire the motor per the motor manufactures requirements.
15. Check for correct rotation. Rotation must be left to right (counter-clockwise) when looking directly at the coupling.
16. Shut-off power and reinstall the coupling guards. After the guards have been installed the power can be turned back on.

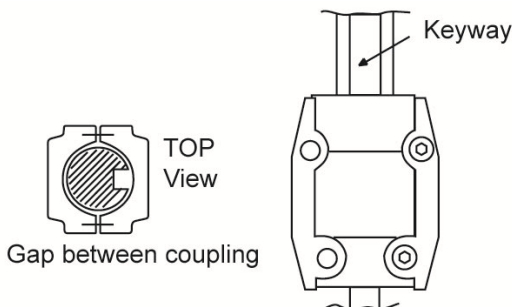


FIGURE 8. Coupling Installation

TABLE 6. Torque Specifications

Models VM1, 2, 3, 4, 8, 12, 16, and 20	
Coupling Bolt Size	Minimum Torque
M6	10 ft-lb
M8	23 ft-lb
M10	46 ft-lb

For Models VM32, 42, 65, 85

5. Make sure the shaft is all the way down. Tighten the set screws on the mechanical seal.
6. Place the plastic adjustment fork under the cartridge seal collar
7. Fit the coupling on the shaft so that the top of the pump shaft is flush with the bottom of the clearance chamber in the coupling. To avoid damaging the coupling halves, ensure that no portion of the keyway on the motor shaft lies within the gap between the coupling halves.

PUMP REINSTALLATION

The pump is now ready to be returned to service. It should be reinstalled as described in the installation section.

SPARE PARTS

RECOMMENDED SPARE PARTS – STANDARD VM PUMP

American-Marsh Pumps recommends that a seal and gasket kit be purchased as spare parts to any VM vertical multistage pump.

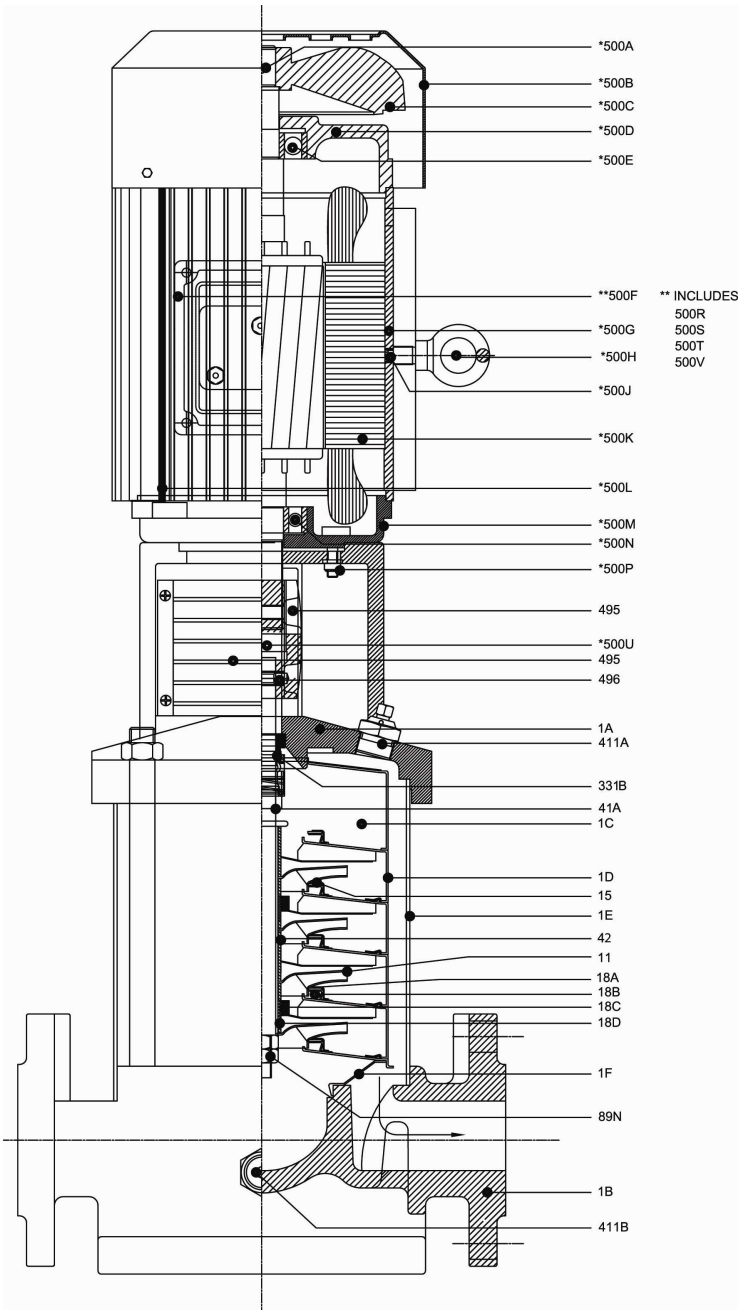
HOW TO ORDER SPARE PARTS

Spare parts can be ordered from the local American-Marsh Sales Engineer, or from the American-Marsh Distributor or Representative. The pump size and type can be found on the name plate. See Figure 1. Please provide the item number, description, and alloy for the part(s) to be ordered.

To make parts ordering easy, American-Marsh has created a catalog titled "American-Marsh Pump Parts Catalog." A copy of this book can be obtained from the local American-Marsh Sales Engineer or Distributor/Representative.



FIGURE 9 – VM Sectional Drawing



Item Number	Item Description	Num. Req.
1A	Top Pump Bracket	1
1B	Bottom Pump Bracket	1
1C	Pump Casing	1
1D	Casing Stage	Varies
1E	Pump Outer Shell	1
1F	Suction Casing	1
11	Impeller	Varies
15	Case Wear Ring	Varies
18A	Upper Guide Bearing	Varies
18B	Lower Guide Bearing	Varies
18C	Casing Bearing	Varies
18D	Guide Bearing	1
41A	Shaft	1
42	Shaft Sleeve	1
89N	Locknut	1
331B	Mechanical Seal	1
411A	Vent Plug	1
411B	Drain Plug	1
490	Split Coupling	1
495	Coupling Guard	1
496	Coupling Split Pin	1
*500A	Motor Cooling Fan Split Pin	1
*500B	Motor Cooling Fan Cover	1
*500C	Motor Cooling Fan	1
*500D	Motor Outboard Cover	1
*500E	Motor Outboard Bearing	1
*500F	Motor Terminal Box	1
*500G	Motor Frame	1
*500H	Motor Lifting Eye	
*500J	Motor Eye Bolt Set Screw	1
*500K	Motor Stator Windings	1
*500L	Motor Tie Rod With Nut	4
*500M	Motor Front Cover	1
*500N	Motor Inboard Bearing	1
*500P	Motor Stud	4
*500R	Motor Capacitor	1
*500S	Motor Top Cover	1
*500T	Motor Bottom Cover	1
*500U	Motor Shaft & Rotor	1
*500V	Motor Terminal Board	1

*American-Marsh motor item.
Recommended spare parts are in BOLD.