

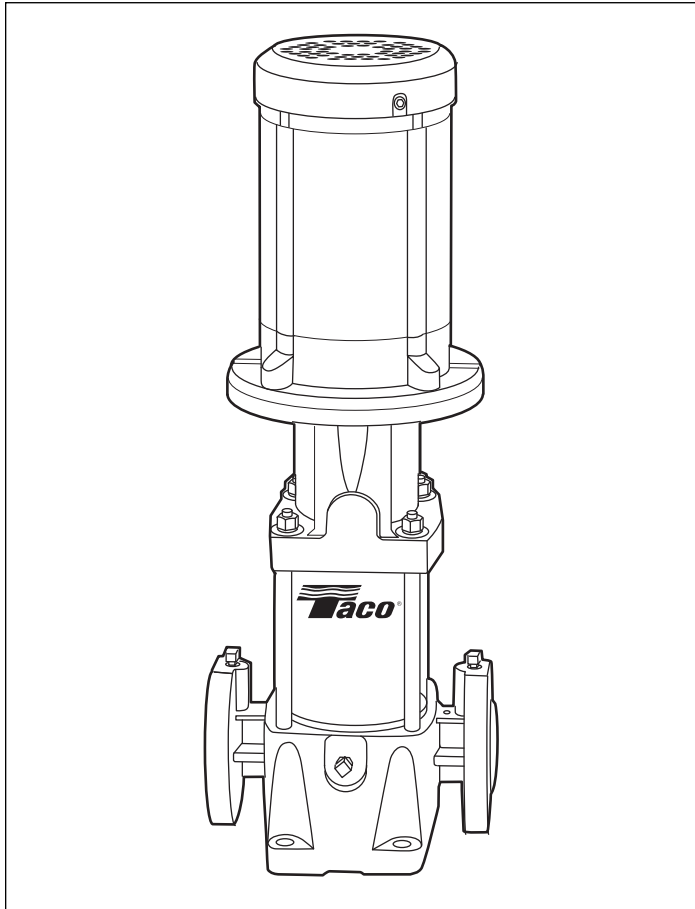


Installation & Operation Manual

Vertical Multistage Pumps

SUPERSEDES: New

EFFECTIVE: July 1, 2012



VM - Vertical Multistage Pump

1. TABLE OF CONTENTS

- Important Safety Instructions 1
- Applications and Operating Ranges 2
- Installation 2
- Electrical 4
- Operation 5
- Maintenance 6
- Troubleshooting 9
- Repair Parts 10
- Warranty 12

2. IMPORTANT SAFETY INSTRUCTIONS

2.1 Save These Instructions

This manual contains important instructions that should be followed during installation, operation, and maintenance of the product.

Save this manual for future reference.



This is the safety alert symbol. When you see this symbol on your pump or in this manual, look for one of the following signal words and be alert to the potential for personal injury!



DANGER: This indicates a hazard which, if not avoided, **will** result in death or serious injury.



WARNING: This indicates a hazard which, if not avoided, **could** result in death or serious injury.



CAUTION: This indicates a hazard which, if not avoided, **could** result in minor or moderate injury.

NOTICE addresses practices not related to personal injury.

To avoid serious or fatal personal injury and possible property damage, carefully read and follow the safety instructions.

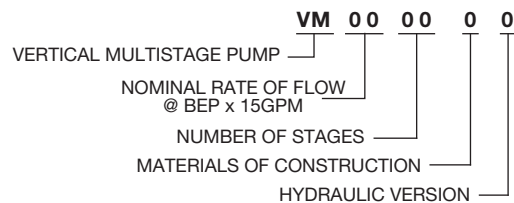
1. Install pump according to all code requirements.
2. Compare pump nameplate data with desired operating range.
3. Pump only liquids compatible with pump component materials (that is, liquids that will not attack the pump).
4. Make sure plumbing is adequate to handle system pressure.
5. Periodically perform maintenance inspection on pump and system components.
6. Wear safety glasses at all times when working on pumps.

2.2 Inspect the Shipment

The vertical multistage centrifugal inline pump has been carefully inspected and packaged to assure safe delivery. Inspect the pump and fittings and report to the carrier any items which are damaged or missing.

2.3 Model Plate Information

Confirm you have the right pump.



MATERIALS OF CONSTRUCTION CODE	
B	CI body / 304SS impellers
D	316SS body / 304SS impellers
E	304SS body / 304SS impellers

3. APPLICATIONS AND OPERATING RANGES

Taco multistage in-line centrifugal pumps are designed for liquid transfer, circulation, and pressure boosting of hot or cold clean water or other thin, non-explosive liquids, not containing solid particles or fibers, which will not chemically attack the pump materials.

Typical applications include:

- Municipal water supply and pressure boosting
- Boiler feed and condensate systems
- Cooling water systems
- Irrigation
- Fire fighting

OPERATING RANGES	
Maximum Ambient Temperature	104° F (40° C)
Liquid Temperature Range	5° F to 250° F (-15° C to +121° C)
Maximum Permissible Operating Pressure Curves	See Figure 1.
Maximum Inlet Pressure	The actual inlet pressure plus the pressure when the pump is running against a closed valve must always be lower than the Maximum Permissible Operating Pressure.
Electrical Data	See motor nameplate.
Dimensions and Port-to-Port Lengths	See Figures 2A, 2B and Table 1.

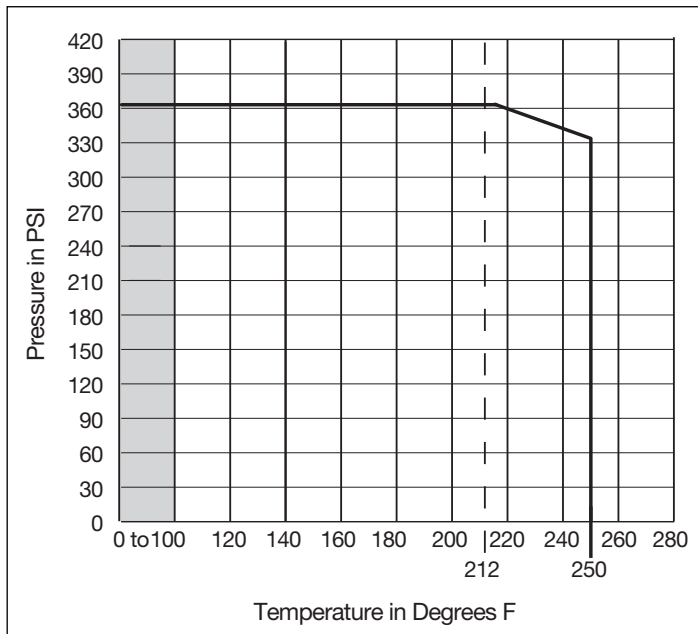


Figure 1: Maximum Permissible Operating Pressure - all VM models

4. INSTALLATION



WARNING: Hazardous voltage. Voltage can shock, burn, or cause death. Ground pump motor correctly before connecting to power supply, per article 250-80 of the National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable.

4.1 Location

Locate pump in a dry, well ventilated area, not subject to freezing or extreme variations in temperature.

Mount pump a minimum of 6" from any obstruction or hot surface. Install the pump with the motor shaft vertical. Make sure that an adequate supply of cool air reaches the motor cooling fan. Maximum ambient air temperature is 104° F (40° C).

For open systems requiring suction lift, locate the pump as close to the water source as possible.

4.2 Foundation

Foundation should be concrete or a similarly rigid foundation to provide a secure, stable mounting base for the pump. Secure pump to foundation using all bolt holes. Refer to Figures 2A and 2B for bolt plate dimensions. Be sure that all four pads on the base are properly supported.

Shim pump base to make sure that pump is level.

4.3 Piping



WARNING: Explosion and burn hazard. Do not run pump with discharge valve closed; the water in the pump may boil, with risk of explosion and steam burns to anyone near.

If there is any danger of the pump running against a closed discharge valve, install a pressure relief or by-pass valve in the discharge pipe to allow for minimum liquid flow through the pump. Minimum liquid flow through the pump is needed for cooling and lubrication of the pump (See Table 2). Run the bypass/relief valve and discharge pipe to a floor drain or a tank for collection.

Table 2: Minimum Pumping Rates

Type	Liquid Temperature +5°F to +250°F
VM01	1 GPM
VM02	2 GPM
VM04	4 GPM
VM06	8 GPM

Suction pipe should be adequately sized (See Table 3) and run as straight and as short as possible to keep friction losses to a minimum. Pipes, valves, and fittings must have a pressure rating equal to or greater than the maximum system pressure.

Table 3: Minimum Suction Pump Sizes

Type	Pipe Size
VM01	1¼" Nominal Diameter, Schedule 40 Pipe
VM02	1¼" Nominal Diameter, Schedule 40 Pipe
VM04	2" Nominal Diameter, Schedule 40 Pipe
VM06	2" Nominal Diameter, Schedule 40 Pipe

Pressure check the discharge piping as required by codes or local regulations.

"Inlet" and "Outlet" are marked on the pump base to show the direction of the liquid flow through the pump.

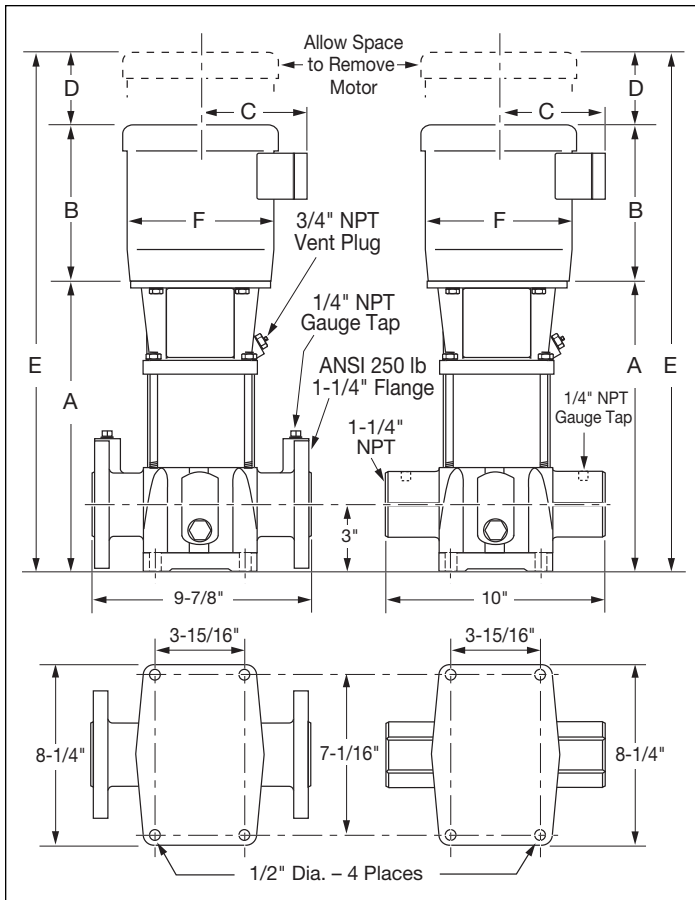


Figure 2A: Height, Width and Baseplate Dimensions for VM01 and VM02 Series Pumps

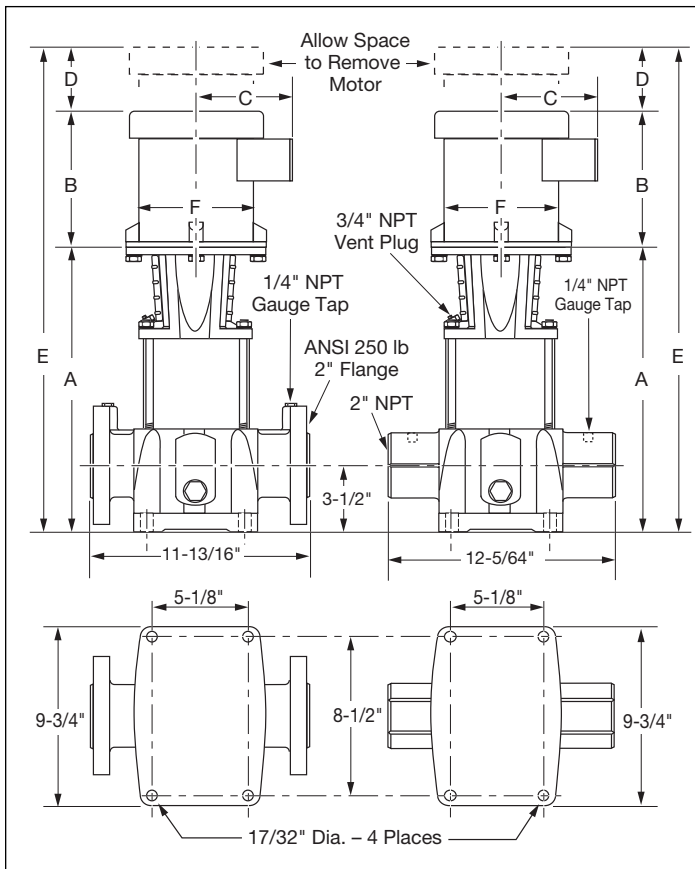


Figure 2B: Height, Width and Baseplate Dimensions for VM04 and VM06 Series Pumps

Table 1: Maximum Height and Width Dimensions *						
Model Number	Dimensions in Inches					
	A	B	C	D	E	F
VM0102	11 ³ / ₈	9 ¹ / ₄	4 ⁷ / ₈	2	22 ⁵ / ₈	6
VM0103	11 ³ / ₈	9 ⁷ / ₈	4 ⁷ / ₈	2	23 ¹ / ₄	6
VM0104	12	11 ¹ / ₈	5 ¹ / ₄	2	25 ¹ / ₄	7 ¹ / ₈
VM0105	12 ³ / ₄	11 ¹ / ₈	5 ³ / ₄	2 ¹ / ₈	26	7 ¹ / ₄
VM0106	13 ¹ / ₂	11 ¹ / ₈	5 ³ / ₄	2 ¹ / ₈	26 ⁵ / ₈	7 ¹ / ₄
VM0107	14 ¹ / ₈	12 ¹ / ₈	5 ³ / ₄	2 ¹ / ₈	28 ¹ / ₄	7 ¹ / ₄
VM0108	14 ⁷ / ₈	12 ¹ / ₈	5 ³ / ₄	2 ¹ / ₈	29	7 ¹ / ₄
VM0110	16 ⁵ / ₈	13 ⁵ / ₈	2 ⁷ / ₈	2 ⁷ / ₈	33 ¹ / ₄	8 ¹ / ₂
VM0112	18 ¹ / ₈	13 ⁵ / ₈	6 ⁷ / ₈	2 ⁷ / ₈	34 ⁵ / ₈	8 ¹ / ₂
VM0115	20 ¹ / ₄	15 ¹ / ₄	8	3 ³ / ₈	38 ⁷ / ₈	10 ⁵ / ₈
VM0118	22 ³ / ₈	15 ¹ / ₄	8	3 ³ / ₈	41	10 ⁵ / ₈
VM0201	11 ³ / ₈	9 ¹ / ₄	4 ⁷ / ₈	2	22 ⁵ / ₈	6
VM0202	11 ³ / ₈	9 ⁷ / ₈	4 ⁷ / ₈	2	23 ¹ / ₄	6
VM0203	12 ³ / ₈	11 ¹ / ₈	5 ¹ / ₄	2	25 ⁵ / ₈	7 ¹ / ₈
VM0204	13 ¹ / ₂	11 ¹ / ₈	5 ³ / ₄	2 ¹ / ₈	26 ⁵ / ₈	7 ¹ / ₄
VM0205	14 ¹ / ₂	12	5 ³ / ₄	2 ¹ / ₈	25 ⁵ / ₈	7 ¹ / ₄
VM0206	16	13 ⁵ / ₈	6 ⁷ / ₈	2 ⁷ / ₈	32 ¹ / ₂	8 ¹ / ₂
VM0207	18 ¹ / ₈	13 ⁵ / ₈	6 ⁷ / ₈	2 ⁷ / ₈	34 ⁵ / ₈	8 ¹ / ₂
VM0208	18 ¹ / ₈	13 ⁵ / ₈	6 ⁷ / ₈	2 ⁷ / ₈	34 ⁵ / ₈	8 ¹ / ₂
VM0210	20 ¹ / ₄	15 ¹ / ₄	8	3 ³ / ₈	38 ⁷ / ₈	10 ⁵ / ₈
VM0212	22 ³ / ₈	15 ¹ / ₄	8	3 ³ / ₈	41	10 ⁵ / ₈
VM0214	24 ¹ / ₂	15 ¹ / ₄	8	3 ³ / ₈	43 ¹ / ₈	10 ⁵ / ₈
VM0216	26 ⁵ / ₈	15 ¹ / ₄	8	3 ³ / ₈	45 ¹ / ₄	10 ⁵ / ₈
VM0401	13 ¹³ / ₁₆	9 ⁷ / ₈	4 ⁷ / ₈	2	25 ¹³ / ₁₆	6
VM0402	13 ¹³ / ₁₆	11 ¹ / ₈	5 ³ / ₄	2 ¹ / ₈	27 ¹ / ₁₆	7 ¹ / ₄
VM0403	16 ⁹ / ₁₆	13 ⁵ / ₈	6 ⁷ / ₈	2 ⁷ / ₈	33 ¹ / ₁₆	8 ¹ / ₂
VM0404	17 ¹ / ₁₆	13 ⁵ / ₈	6 ⁷ / ₈	2 ⁷ / ₈	34 ⁵ / ₁₆	8 ¹ / ₂
VM0405	18 ¹⁵ / ₁₆	15 ¹ / ₄	8	3 ³ / ₈	37 ⁹ / ₁₆	10 ⁵ / ₈
VM0406	20 ¹ / ₁₆	15 ¹ / ₄	8	3 ³ / ₈	38 ¹³ / ₁₆	10 ⁵ / ₈
VM0408	22 ⁷ / ₁₆	15 ¹ / ₄	8	3 ³ / ₈	41 ¹ / ₁₆	10 ⁵ / ₈
VM0410	24 ¹³ / ₁₆	15 ¹ / ₄	8	3 ³ / ₈	43 ⁷ / ₁₆	10 ⁵ / ₈
VM0412	27 ³ / ₁₆	16 ¹ / ₂	8 ³ / ₄	3 ³ / ₈	47 ¹ / ₁₆	10 ⁵ / ₈
VM0414	29 ⁹ / ₁₆	16 ³ / ₈	8 ³ / ₄	3 ³ / ₈	49 ⁵ / ₁₆	10 ⁵ / ₈
VM0416	32 ⁷ / ₁₆	19 ⁵ / ₈	9 ¹ / ₂	4 ¹ / ₄	56 ⁵ / ₁₆	13
VM0602	17 ³ / ₄	15 ¹ / ₄	8	3 ³ / ₈	36 ¹ / ₂	10 ⁵ / ₈
VM0603	17 ³ / ₄	15 ¹ / ₄	8	3 ³ / ₈	36 ¹ / ₂	10 ⁵ / ₈
VM0604	19 ⁵ / ₈	15 ¹ / ₄	8	3 ³ / ₈	38 ¹ / ₄	10 ⁵ / ₈
VM0605	21 ¹ / ₈	16 ³ / ₈	8 ³ / ₄	3 ³ / ₈	41 ¹ / ₈	10 ⁵ / ₈
VM0606	23 ³ / ₈	19 ⁵ / ₈	9 ¹ / ₂	4 ¹ / ₄	47 ¹ / ₂	13
VM0607	25 ³ / ₈	19 ⁵ / ₈	9 ¹ / ₂	4 ¹ / ₄	49 ¹ / ₄	13
VM0608	27 ¹ / ₈	19 ⁵ / ₈	9 ¹ / ₂	4 ¹ / ₄	51 ¹ / ₈	13
VM0610	30 ¹ / ₄	21 ¹ / ₄	9 ⁵ / ₈	4	56	11 ¹ / ₂
VM0612	33 ³ / ₈	21 ¹ / ₄	9 ¹ / ₂	3 ¹ / ₄	58 ⁵ / ₈	13

* Measurements represent the largest number possible for each model.

Install anti-vibration mountings on either side of the pump if a minimum noise level is desired.

Install isolation valves in both inlet and outlet pipes near the pump (see Figure 3). This allows for removal of pump for service without draining the system and isolation of the pump in case of a flooded suction condition.

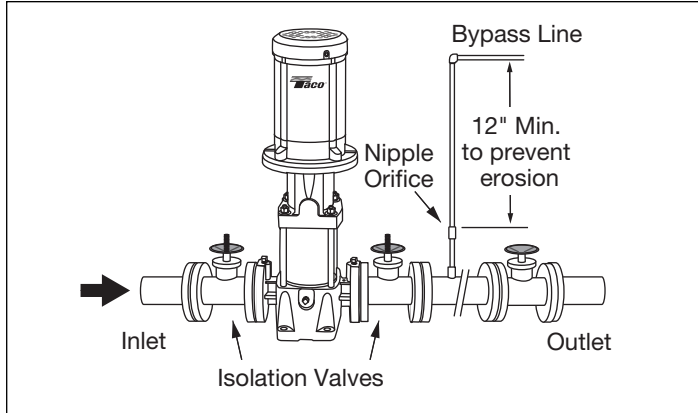


Figure 3: Bypass required if pump might operate with discharge valve closed. See Table 3 for minimum required flow through pump to prevent overheating and to ensure lubrication.

If the system pressure is greater than the pump's maximum inlet pressure the limits of the pump can be exceeded if the discharge pressure backs up to the inlet side of the pump. Installation of a check valve in the discharge pipe is recommended to prevent this condition.

Make sure, especially on the inlet side of the pump, that there are no airlocks in the system. See Figure 4 for correct pipe work to avoid airlocks. The suction pipe should be level or slightly rising.

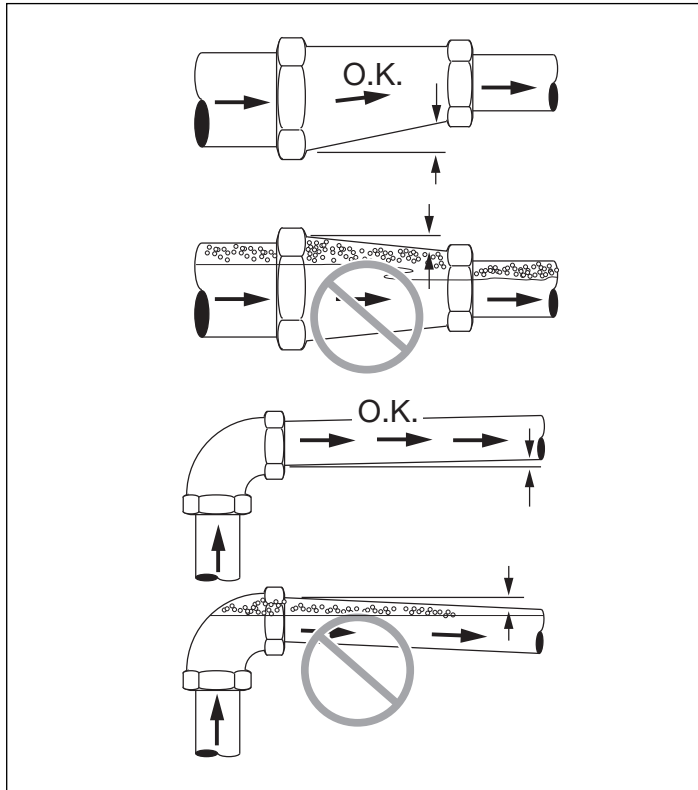


Figure 4: Install Pipe Correctly to Prevent Air Locks

Support all piping independently of the pump so the weight of the piping system does not strain the pump case. Make sure that the

expansion and contraction of the piping system from temperature variations cannot put a strain on the pump.

If the system or pump must be drained periodically (especially if the discharge pipe is horizontal or slopes downward away from the pump), install a loop and vacuum valve as shown in Figure 5 to protect the pump against running dry. The highest point of the loop should be at least as high as the lowest point of the motor. This loop/valve combination will allow the pump and the system to be drained independently of one another.

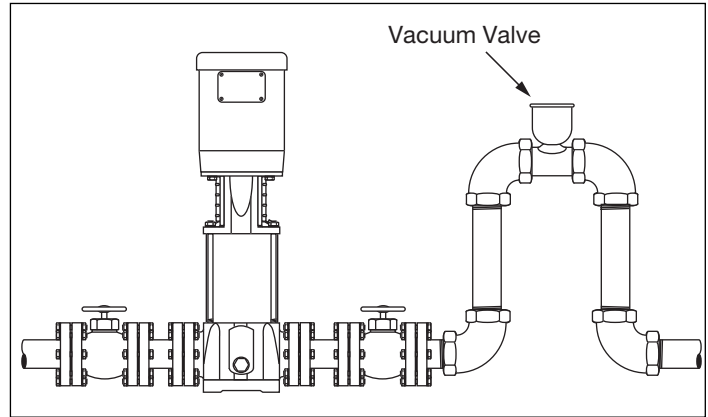


Figure 5: Loop and Vacuum Valve Installation

5. ELECTRICAL



WARNING: Hazardous voltage. Can shock, burn or cause death. All electrical work should be performed by a qualified electrician in accordance with the National Electrical Code and all local codes and regulations.

Make sure that the motor voltage, phase, and frequency match the incoming electrical supply. The proper operating voltage and other electrical information can be found on the motor nameplate. These motors are designed to run up to $\pm 10\%$ of the nameplate-rated voltage. The wiring connection diagram can be found on either a plate attached to the motor or on a diagram inside the terminal box cover.

- If voltage variations are greater than $\pm 10\%$ do not operate the pump.
- Incorrect voltage can cause fire or serious damage to the motor and voids warranty.
- Ground the pump motor correctly before connecting it to the power supply.
- Follow the wiring instructions when connecting the motor to the power lines.

5.1 Position of Terminal Box

To turn the motor so that the terminal box faces the right direction, proceed as follows:

1. Disconnect the power to the pump motor.
2. Remove the coupling guards (use a screwdriver).
3. Remove the couplings.
4. Remove the bolts that fasten the motor to the pump.
5. Turn the motor to the required position (in quarterturn increments).
6. Follow steps 10 - 20 under Motor Replacement.

5.2 Field Wiring

All wiring connections and wiring sizes must meet National Electrical Code and local requirements.

5.3 Motor Protection

See the motor nameplate for electrical connection/wiring diagram.

Taco pumps must be used with the proper size and type of motor starter to ensure protection against damage from low voltage, phase failure, current imbalances, and overloads. The overload should be sized to trip at the full-load current rating of the motor.

6. OPERATION

6.1 Priming



WARNING: Hazardous pressure. Do not run the pump with the discharge valve closed; the water in the pump may boil, causing risk of explosion and steam burns to anyone nearby.



WARNING: Hazardous voltage. Disconnect all power to the pump before servicing or working on the pump. Make sure that the power is locked out and that the pump cannot be accidentally started.

NOTICE: Under no circumstances should the pump be operated without flow through the pump. Never operate the pump dry.

6.1.1 Operation of closed systems or open systems with the liquid level above the pump priming plug:

1. Close the discharge isolating valve and loosen the needle valve located in the assembly in the pump head (Figure 6). Do not remove the needle valve.



WARNING: Risk of water damage and injury. Watch the direction of the priming plug and make sure that the liquid escaping from it does not injure persons nearby or damage the motor or other components. In hot water installations, pay particular attention to the risk of injury from scalding hot water.

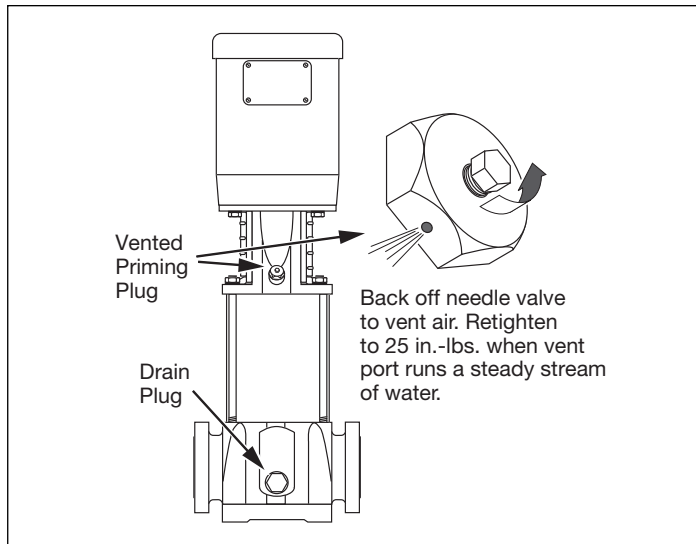


Figure 6: Priming and Drain Plugs

2. Slowly open the isolation valve in the suction pipe until a steady stream of liquid runs out the vent in the priming port.
3. Tighten needle valve to 25 inch-pounds. Completely open isolation valves.

NOTICE: Please turn to **Section 6.3 Starting** before proceeding any further.

6.1.2 Operation of open systems with the liquid level below the top of the pump:

NOTICE: The suction pipe requires a check valve or isolation valve.

1. Close the discharge isolation valve.
2. Remove the vented priming plug.
3. Pour liquid through the priming port until the suction pipe and the pump are completely filled with liquid.
4. Replace the vented priming plug and tighten it securely.
5. Repeat steps 1-4 until the pump is primed.

NOTICE: Please turn to **Section 6.3 Starting** before proceeding any further.

6.2 Checking Direction of Rotation

NOTICE: Do not disconnect the motor from the shaft to check the direction of rotation. If you remove the coupling, then you must adjust the shaft position when you reinstall it. This must be done before starting the pump.

Arrows on the pump head show the correct direction of rotation. When seen from the motor fan, the pump should rotate counter-clockwise (↺). For pump motors without a fan remove one of the coupling guards and look at the coupling to determine the direction of rotation. Turn off the pump and replace coupling guard.

NOTICE: Do not check the direction of rotation until the pump has been filled with liquid. See "Priming", at left and above.

1. Switch power off.
2. Remove the coupling guard and rotate the pump shaft to be certain it can turn freely. Replace the coupling guard.
3. Verify that the electrical connections are in accordance with the wiring diagram on the motor.
4. If the fan is visible, turn on and off to verify rotation.
5. To reverse the direction of rotation, first switch **OFF** the power supply.
6. On three-phase motors, switch 2 of the 3 power leads on the load side of the starter. On single-phase motors, see the connection diagram on the motor nameplate. Change the wiring as indicated.



WARNING: Hazardous voltage. Voltage can shock, burn or cause death. Ground the pump motor correctly before connecting to power supply per article 250-80 of National Electrical Code (NEC) in the U.S., or the Canadian Electrical Code (CEC), as applicable.

7. Switch on the power supply and recheck the direction of motor rotation.

6.3 Starting

1. If a suction line isolation valve has been installed, check to be sure that it is completely opened.
2. For initial starting, the isolation valve in the discharge pipe should be almost closed.
3. Start the pump.
4. When the piping system has been filled with liquid, slowly open the discharge isolation valve until it is completely open. Opening the valve too fast may result in water hammer in the discharge pipe. If the pump or system start to rattle, the pump is cavitating. To avoid damage to the pump, reduce the flow through the discharge isolation valve until the rattling stops. If this does not give adequate flow for your installation, call your installer or system designer.
5. Record the voltage and amperage of the motor. Adjust the motor overloads if required.
6. If pressure gauges have been installed, check and record operating pressures.
7. Check all controls for proper operation.

6.4 Motor Bearings

For the greasing schedule and greasing procedure of the motor bearings follow the motor manufacturer's recommendations.

6.5 Calculating Minimum Inlet Pressure:

Minimum inlet pressure is required to avoid cavitation in the pump and is calculated as follows:

$$H = P_b - \text{NPSHR} - H_f - H_v - H_s$$

H = Minimum Inlet Pressure in Feet of Head

P_b = Barometric Pressure in Feet

1 Bar = 29.53 Inches of Mercury (Hg)

1 PSI = 2.31 Feet of Head

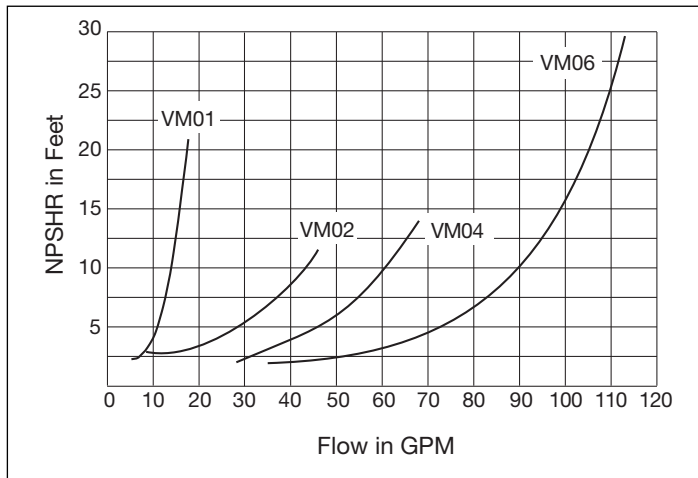
1 Bar = 33.5 Feet of Head

NPSHR = Net positive suction head required. To be read from the NPSHR curve, Figure 7, at the highest flow the pump will be delivering.

H_f = Friction loss in suction pipe in Feet of Head

H_v = Vapor pressure in Feet of Head (See Table 4)

H_s = A safety margin of 1.64 Feet of Head



**Figure 7: VM01 through VM06
Net Positive Suction Head Requirement (NPSHR)**

Table 4: Vapor Pressure of Water

Temperature in °F (°C)	Vapor Pressure in PSIA (kPa)	Absolute Pressure in Feet (M) of Water
32 (0)	0.089 (0.61)	0.205 (0.062)
40 (4.4)	0.122 (0.84)	0.281 (0.086)
60 (15.6)	0.256 (1.77)	0.592 (0.180)
80 (26.7)	0.507 (3.50)	1.172 (0.358)
100 (37.8)	0.950 (6.55)	2.195 (0.669)
120 (48.9)	1.695 (11.69)	3.914 (1.193)
140 (60.0)	2.892 (19.94)	6.681 (2.036)
160 (71.1)	4.745 (32.72)	10.961 (3.341)
180 (82.2)	7.515 (51.84)	17.360 (5.291)
200 (93.3)	11.529 (79.49)	26.632 (8.117)
210 (98.9)	14.125 (97.39)	32.629 (9.945)
212 (100)	14.698 (101.34)	33.952 (10.349)
220 (104.4)	17.188 (118.51)	39.704 (12.102)
230 (110.0)	20.780 (143.28)	48.002 (14.631)
240 (115.6)	24.970 (172.17)	57.681 (17.581)
248 (120.0)	28.790 (188.51)	66.505 (20.271)

6.5.1 Example for VM04

If: Flow = 60 GPM

P_b = 1 Bar = 29.53 Inches of Mercury *

(Convert from Bar to Feet of Head)

1 Inch of mercury = 1.13' Feet of Water

T = 100° F

NPSHR = 10' (See Figure 7)

H_f = 10' of 2" Steel Pipe @ 11.9' of loss per 100' of Pipe (H_f = 11.9'/100' = 1.19')

H_v = 2.195' (from Table 4)

H_s = 1.64' (safety factor from above)

Then: H = 33.5' - NPSHR - H_f - H_v - H_s

H = 33.5' - 10' - 1.19' - 2.195' - 1.64' = 18.475'

H = 18.475' = Minimum Inlet Pressure

* 1 Bar = 14.5 PSI x 2.31 Feet of Head = 33.5'

7. MAINTENANCE

7.1 Motor Replacement

For Reference Numbers [shown as (3) or (5)], refer to the Exploded View, Figure 12, for VM01 and VM02 Series Models and Exploded View, Figure 13, for VM04 and VM06 Series Models.



WARNING: Hazardous voltage. Disconnect all power to the pump before servicing or working on pump. Make sure that power is locked out and that pump cannot be accidentally started.

1. Disconnect the power to the pump motor.
2. Close the nearest suction and discharge valves.
3. Remove the coupling guards (4) by prying them loose with a screw driver.
4. Remove the socket head screws (3) and the coupling halves (2) from the shaft (16A). For additional reference, see Figure 8.

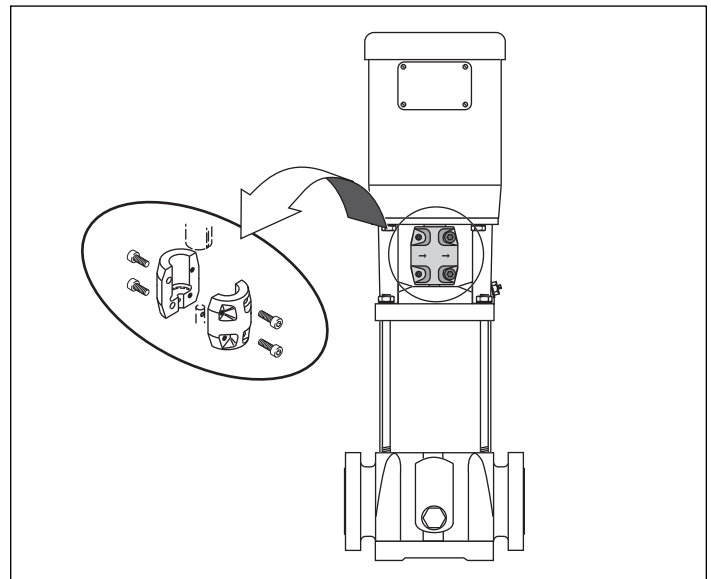


Figure 8: Remove the Socket Head Screws and the Coupling Halves

NOTICE: Socket head screws are metric. See Table 6 for specific metric driver sizes.

5. Remove the shaft pin (5).

NOTICE: Pin has been discontinued and if present does not need to be reinstalled.

6. Remove the capscrews (13), flatwashers (11), and lockwashers (12) that hold the motor (1) and the motor bracket (6) together.
 7. Pull the old motor up and off of the motor bracket.
- NOTICE:** Note the location of the conduit box on the motor.
8. Thoroughly clean the surfaces of the mounting flanges on the new motor and the pump end.
 9. Install the new motor on the pump with the conduit box in the desired position.
 10. Lubricate the capscrews (13) with oil.
 11. Reinstall the lockwashers, flatwashers, and capscrews that hold the motor and the motor bracket together, then tighten evenly and diagonally. See Table 6 for torque specifications.

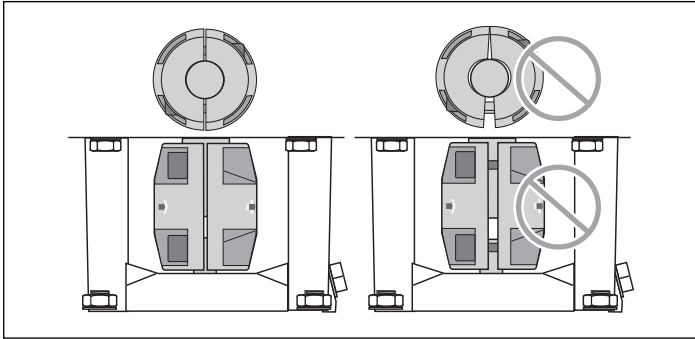


Figure 9A: Make Sure that the Coupling Halves are Evenly Tightened

12. Install the collar (13B) onto the shaft. With the collar resting on the motor bracket, tighten the collar bolt.
13. Raise the height of the pump shaft by inserting the stack height adjustment tool (see Figure 9B) below the collar.

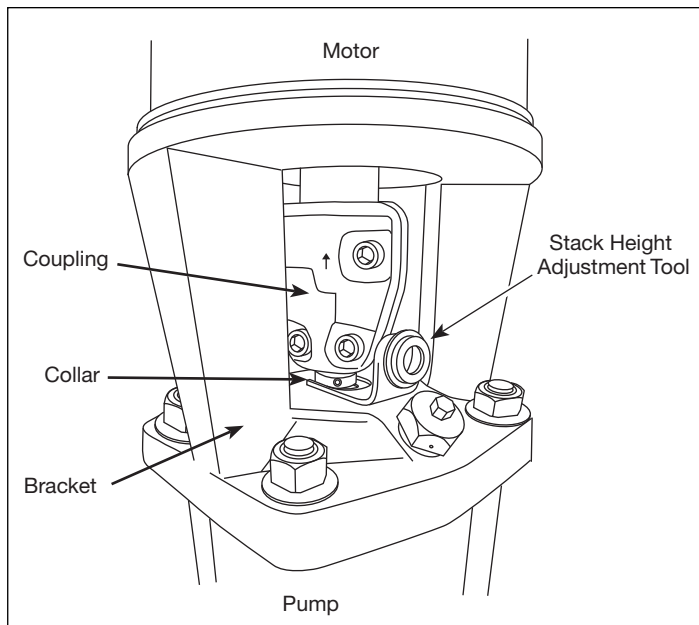


Figure 9B: Using the Stack Height Adjusting Tool

14. Reinstall the coupling halves (2) on the pump and motor shaft.
 15. Snug the socket head cap screws (3).
- NOTICE:** Torque settings are critical to prevent coupling movement. Refer to Table 6 for torque specifications.
16. Remove the stack height adjustment tool and secure it to the top of a staybolt.
 17. Rotate the shaft to make sure that there is no interference. After assembly there should be a small gap between the collar and the bracket. If rubbing is noted, repeat steps 13, 14, and 15 to readjust pump shaft height.

18. Reinstall the coupling guards by snapping them into place.
- NOTICE:** The guards should be in place before the unit is run.
19. Open the suction and discharge valves. Turn the power back on.

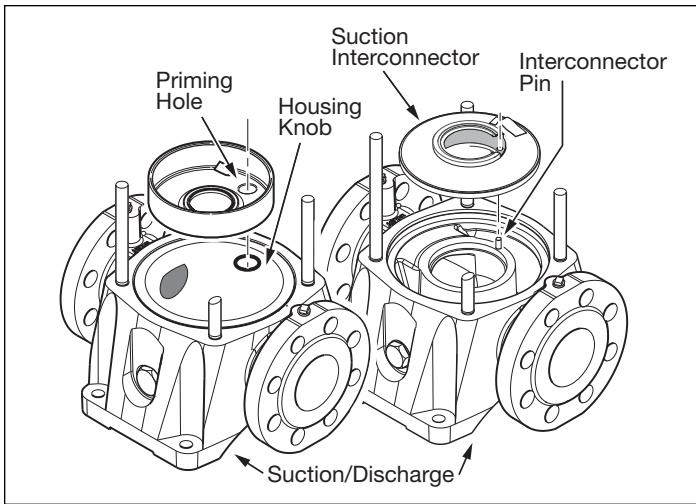
7.2 Replacing Pump Stack

For Reference Numbers [shown as (3) or (5)], refer to the Exploded View, Figure 12, for VM01 and VM02 Series Models and Exploded View, Figure 13, for VM04 and VM06 Series Models.



WARNING: Hazardous pressure. Do not run pump with discharge valve closed; the water in the pump may boil, causing risk of explosion and steam burns to anyone nearby.

1. Follow steps 1-8 under **7.1 Motor Replacement**, then proceed with step 2 below.
 2. Remove the four staybolt nuts, flatwashers, and lockwashers (7, 8, and 9) from the staybolts (19).
- NOTICE:** It is not necessary to remove the staybolts when replacing the stack.
3. Lift the motor bracket (6) off of the pump body.
- NOTICE:** Note the position of the priming plug. The priming plug must be returned to its original position during reassembly.
4. Remove and discard upper sleeve O-ring (17) or, on some older models, a paper gasket.
 5. Clean gasket seat.
 6. Remove and replace round spring ring (VM01 and VM02) or conic spring (VM04 and VM06) (14).
 7. Pull the old stack (16A through 16L) out of the stainless steel sleeve (18) by pulling straight up on the pump shaft (16A).
 8. Remove the stainless steel sleeve (18).
 9. Remove and discard the bottom sleeve O-ring (17) or, on some older models, a paper gasket.
 10. Clean the O-ring seat.
 11. Remove and discard the O-Ring (21A) or, on some older models, a paper gasket from the suction/discharge (21 - VM01 and VM02 only).
 12. Cast Iron Models Only: Clean the O-Ring seat and install a new O-Ring (21A).
 13. Install a new lower sleeve O-ring or, on some older models, a paper gasket.
 14. Install the new stack without the stainless steel sleeve.
- NOTICE:** Be sure to align either the small priming hole or the suction interconnector pin hole (located on the bottom stage of the stack) properly in the base of the Suction/Discharge (21). See Figure 10.
- NOTICE:** If the pump was originally built with a splined shaft and is being replaced with a dual flat shaft, there is a special adapter bowl included in the Replacement Stack kit that is to be installed above the suction interconnector and below the replacement stack. If not needed, this adapter bowl may be discarded.
15. Use a rubber mallet to tap the stainless steel sleeve (18) into place.
 16. Install a new mechanical shaft seal (15A and 15B). Refer to **7.3 Mechanical Seal Disassembly** and **7.4 Mechanical Seal Reassembly**.
 17. Install a new upper sleeve O-ring (17) or, on some older models, a paper gasket.
 18. Install a new round spring ring or conic spring (14).
 19. Reinstall the motor bracket (6) on the pump body. Align the priming plug (10) to its original position.
 20. Oil the threads on the staybolts (19).
 21. Replace the lockwashers, flatwashers, and staybolt nuts (7, 8 and 9) and cross-torque the staybolts. See Table 6 for torque specifications.



**Figure 10: VM01, VM02 – Align Small Priming Port
VM04, VM06 – Align Interconnector Pin**

22. Reinstall the motor (1) on the motor bracket (6) and turn the motor to the desired terminal box position.
23. Follow steps 10 - 21 under **7.1 Motor Replacement**. You have now finished changing out the impeller stack.

7.3 Mechanical Seal Disassembly

See Figure 11 for Seal Reference Numbers.

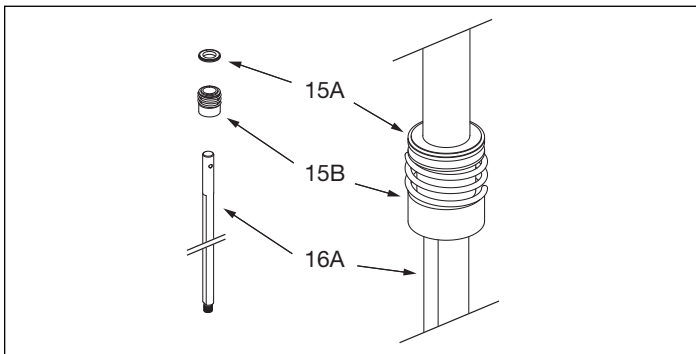


Figure 11: Seal Reference Numbers

See Figures 12 and 13 for Pump Reference Numbers.



WARNING: Hazardous voltage. Can Shock, burn or cause death. Disconnect power to pump before disassembly.

1. Follow Steps 1-8 under Motor Replacement and proceed with step 2 below.
2. Remove the four nuts, lockwashers, and washers (7, 8, and 9) from the staybolts (19).
3. The shaft seal consists of a stationary seat (15A) and a rotating assembly (15B). Turn the pump head upside down and remove the stationary part of the seal from the seal seat in the motor bracket (6). Discard the old seal.

NOTICE: Use care to not chip or scratch the seal seat during disassembly and assembly.

4. Clean the seal seat with a wet cloth.
5. If replacing only the seal, remove the rotating parts of the seal from the shaft by twisting and pulling up on them. Discard the old seal components.

7.4 Mechanical Seal Reassembly

NOTICE: Before assembly check and clean all sealing and gasket surfaces with a clean wet cloth. Replace all seals, gaskets, and O-Rings.

1. Turn the motor bracket (6) upside down.
2. Moisten the seal seat (in the motor bracket) with a small amount of water.
3. Press the stationary half of the seal (15A) into the seal seat in the motor bracket (6). Use finger pressure only. If a tool is used, protect the seal face from tools with a clean, soft cloth.
4. Install the rotating half of the mechanical seal (15B) onto the shaft with the rubber bellows extension towards the stack.

7.5 Frequency of Starts and Stops

Check pump cycling frequency and make sure that the pump is not starting more frequently than as specified in Table 5.

Cycles	Motor HP Rating
20 times per hour	1/2 – 5 HP motors
15 times per hour	7 1/2 – 15 HP motors
10 times per hour	20 and 25 HP motors

7.6 Frost Protection

1. If you do not use your pump during seasons of frost, drain it and add a glycol based antifreeze (50/50 mixture) to avoid damage.



WARNING: Risk of water damage and injury. Watch the direction of the priming plug and make sure that liquid escaping from it does not injure persons nearby or damage the motor or other components. In hot water installations, pay particular attention to the risk of injury from scalding hot water.

2. Upon restart dispose of spent antifreeze properly.
3. Do not replace the drain plug or tighten the priming plug until you put the pump back in service again.

7.7 Regular Maintenance Checks

The following checks should be made at regular intervals:

1. The pump meets required performance and is operating smoothly and quietly.
2. There are no leaks.
3. The motor is not overheating.
4. Remove and clean all strainers and filters in the system.
5. Verify amp draw – check motor amperage.
6. Pump wear rings and shaft require no regular maintenance.

Table 6: Torque Specifications (foot-lbs.) for Cast Iron and Stainless Steel Models

Pump Model Number	Coupling (Socket Head Screw)			Motor (Hex Head Capscrew)		Staybolt (Hex Nut)		Stack Nut (Hex Nut)	
	M6 x 20	M8 x 25	M10 x 25	3/8 x 1 1/2	1/2 x 1 1/2	1/2 - 13	5/8 - 11	M8	M12
VM01 Series	15	20	—	30	35	40	—	10	—
VM02 Series	15	20	—	30	35	40	—	10	—
VM04 Series	15	20	45	30	35	—	45	—	30
VM06 Series	—	20	45	—	35	—	45	—	30

8. TROUBLESHOOTING

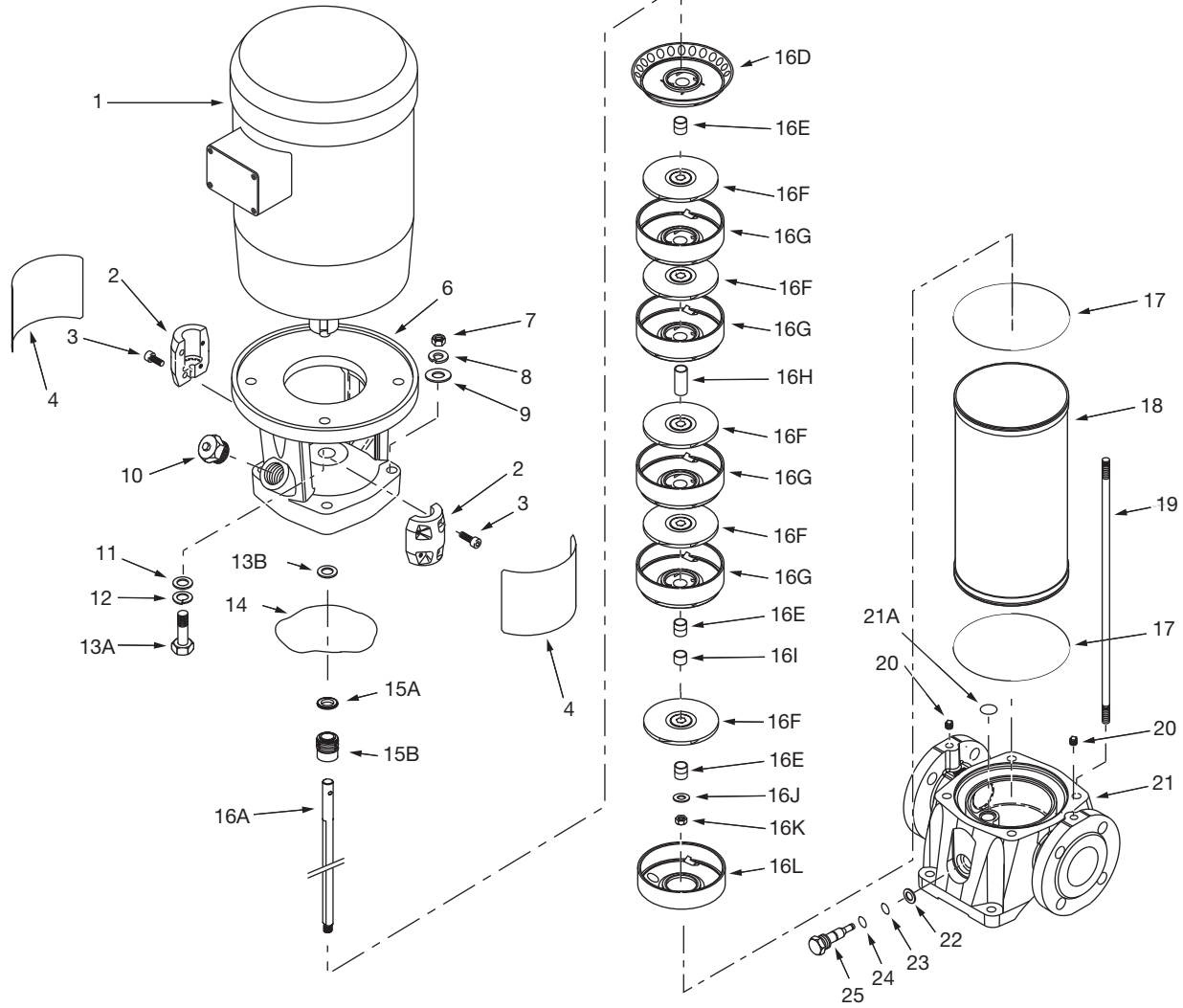


WARNING: Hazardous voltage and risk of sudden starts. Disconnect all power to the pump before servicing or working on pump. Make sure that power is locked out and that pump cannot be accidentally started.

PROBLEM	CAUSE
1. Motor does not run when started	(A) Power failure
	(B) Fuses blown
	(C) Motor starter overload has tripped out
	(D) Main contacts in motor starter are not making contact or the coil is faulty
	(E) Control circuit fuses are defective
	(F) Motor is defective
2. Motor starter overload trips out immediately when power supply is switched on	(A) One fuse has blown
	(B) Contacts in motor overload relay are faulty
	(C) Cable connections are loose or faulty
	(D) Motor winding is defective
	(E) Pump mechanically blocked
	(F) Overload setting is too low
3. Motor starter overload trips out occasionally	(A) Overload setting is too low
	(B) Low voltage at peak times
4. Motor starter has not tripped out but the motor does not run	(A) Check 1 (A), (B), (D) and (E)
5. Pump capacity is not constant	(A) Pump inlet pressure is too low
	(B) Suction pipe/pump partly blocked
	(C) Pump is sucking air
6. Pump runs but gives no water	(A) Suction pipe/pump blocked
	(B) Foot or non-return valve is blocked in closed position
	(C) Leakage in suction pipe
	(D) Air in suction pipe or pump
	(E) Motor rotates in the wrong direction
7. Pump runs backwards when switched off	(A) Leakage in suction pipe
	(B) Foot or non-return valve is defective
	(C) Foot valve is blocked in open or partly open position
	(D) Non return valve leaks or is blocked in open or partly open position
	(E) Discharge valve is defective
8. Leakage from shaft seal	(A) Pump shaft position is incorrect
	(B) Shaft seal is defective
9. Noise	(A) Cavitation is occurring in the pump
	(B) Pump does not rotate freely (that is, there is increased frictional resistance) because of incorrect shaft position

9. REPAIR PARTS

Repair Parts
VM01 & VM02

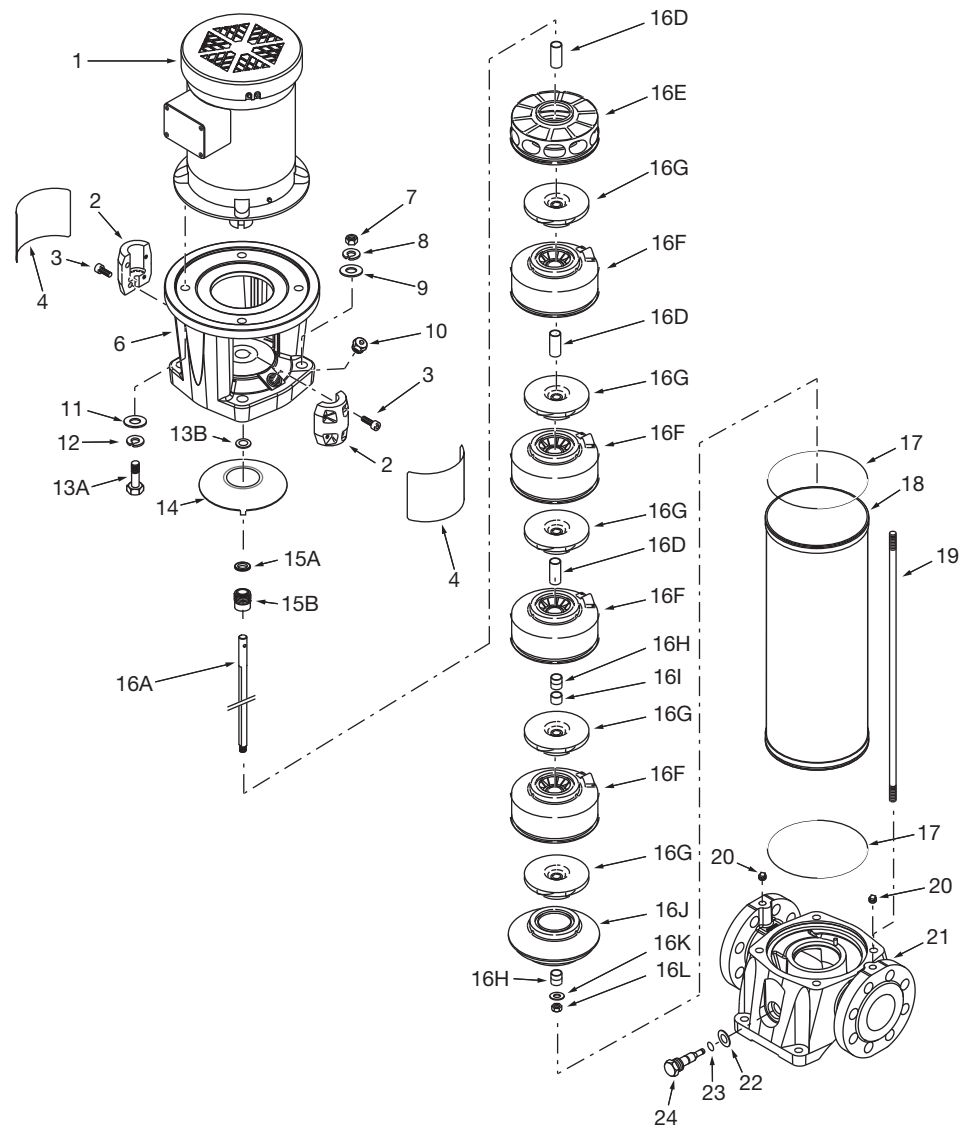


Ref.	Description
1	Motor
2	Coupling Half
3	Socket Head Screw
4	Coupling Guard
6	Motor Bracket
7	Staybolt Nut
8	Staybolt Lockwasher
9	Staybolt Flat Washer
10	Vented Priming Plug
11	Flatwasher
12	Lockwasher
13A	Capscrew
13B	Collar
14	Spring Ring
15A	Stationary Half of Mechanical Seal
15B	Rotating Half of Mechanical Seal
16	Replacement Stack Kit (Incl. Key Nos. 16A thru 16L)
16A	Shaft

Ref.	Description
16D	Top Diffuser
16E	Spacer
16F	Impeller
16G	Diffuser
16H	Spacer
16I	Bearing
16J	Shaft Washer
16K	Nut
16L	Suction Chamber
17	Sleeve O-Ring (Gasket on older models)
18	Stainless Steel Sleeve
19	Staybolt
20	Pipe Plug
21	Suction/Discharge
21A	O-Ring (Bottom Chamber)
22	Drain Plug Gasket
23	O-Ring
24	O-Ring
25	Drain Plug

Figure 12: Exploded View VM01, VM02

Repair Parts VM04 & VM06



Ref.	Description
1	Motor
2	Coupling Half
3	Socket Head Screw
4	Coupling Guard
6	Motor Bracket
7	Staybolt Nut
8	Staybolt Lockwasher
9	Staybolt Flat Washer
10	Vented Priming Plug
11	Flat Washer
12	Lock Washer
13A	Capscrew
13B	Collar
14	Conic Spring
15A	Stationary Half of Mechanical Seal
15B	Rotating Half of Mechanical Seal
16	Replacement Stack Kit (Incl.16A thru 16L)
16A	Shaft

Ref.	Description
16D	Spacer
16E	Upper Intermediate Chamber
16F	Diffuser
16G	Impeller
16H	Spacer
16I	Bearing
16J	Suction Chamber
16K	Shaft Washer
16L	Nut
17	Sleeve O-Ring (Gasket on older models)
18	Stainless Steel Sleeve
19	Staybolt
20	Pipe Plug
21	Suction/Discharge
22	Drain Plug Gasket
23	O-Ring
24	Drain Plug

Figure 13: Exploded View VM04, VM06

LIMITED WARRANTY STATEMENT

Taco, Inc. will repair or replace without charge (at the company's option) any commercial pump product or part which is proven defective under normal use within one (1) year from the date of start-up or one (1) year and six (6) months from date of shipment (whichever occurs first).

Motors provided on commercial pumps are not covered by this warranty, and are warranted by the motor manufacturer. For complete details on motor warranty returns, the purchaser should contact the motor manufacturer's local service repair center or contact the motor manufacturer directly.

Seals provided on commercial pumps are not covered by this warranty.

In order to obtain service under this warranty, it is the responsibility of the purchaser to promptly notify the local Taco stocking distributor or Taco in writing and promptly deliver the subject product or part, delivery prepaid, to the stocking distributor. For assistance on warranty returns, the purchaser may either contact the local Taco stocking distributor or Taco. If the subject prod-

uct or part contains no defect as covered in this warranty, the purchaser will be billed for parts and labor charges in effect at time of factory examination and repair.

Any Taco product or part not installed or operated in conformity with Taco instructions or which has been subject to misuse, misapplication, the addition of petroleum-based fluids or certain chemical additives to the systems, or other abuse, will not be covered by this warranty.

If in doubt as to whether a particular substance is suitable for use with a Taco product or part, or for any application restrictions, consult the applicable Taco instruction sheets or contact Taco at [401-942-8000].

Taco reserves the right to provide replacement products and parts which are substantially similar in design and functionally equivalent to the defective product or part. Taco reserves the right to make changes in details of design, construction, or arrangement of materials of its products without notification.

TACO OFFERS THIS WARRANTY IN LIEU OF

ALL OTHER EXPRESS WARRANTIES. ANY WARRANTY IMPLIED BY LAW INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS IS IN EFFECT ONLY FOR THE DURATION OF THE EXPRESS WARRANTY SET FORTH IN THE FIRST PARAGRAPH ABOVE.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR STATUTORY, OR ANY OTHER WARRANTY OBLIGATION ON THE PART OF TACO.

TACO WILL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF ITS PRODUCTS OR ANY INCIDENTAL COSTS OF REMOVING OR REPLACING DEFECTIVE PRODUCTS.

This warranty gives the purchaser specific rights, and the purchaser may have other rights which vary from state to state. Some states do not allow limitations on how long an implied warranty lasts or on the exclusion of incidental or consequential damages, so these limitations or exclusions may not apply to you.

Do it Once. Do it Right.®

TACO, INC., 1160 Cranston Street, Cranston, RI 02920 Telephone: (401) 942-8000 FAX: (401) 942-2360.
TACO (Canada), Ltd., 8450 Lawson Road, Unit #3, Milton, Ontario L9T 0J8. Telephone: 905/564-9422. FAX: 905/564-9436.

Visit our web site at: <http://www.taco-hvac.com>

Printed in USA
Copyright 2012
TACO, Inc.