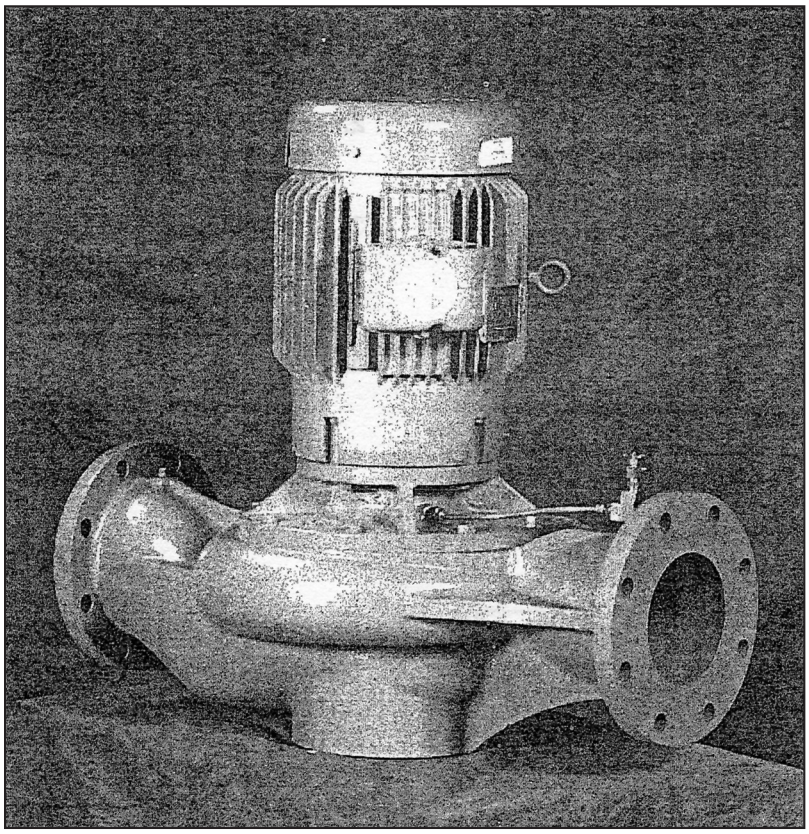
302-006

"VI" Vertical In-Line Pump

Installation, Operation & Maintenance Manual

Supersedes: April 1, 1987

Effective: June 1, 1999



VI Vertical
In-Line Pump

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., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3 Telephone: (905) 564-9422 Fax: (905) 564-9436

Visit our website at: www.taco-hvac.com

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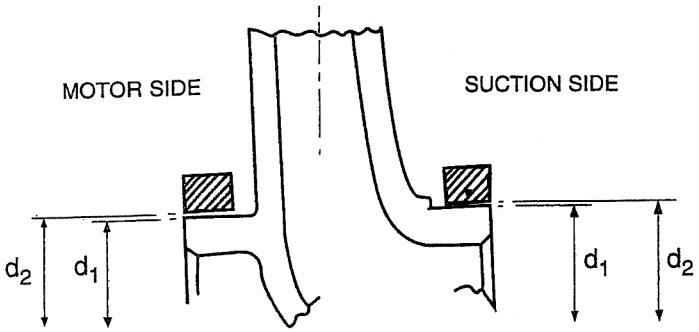
APPLICATION

1. Working Pressure: 175 psig
   Optional Working Pressure: 300 psig for models VI3013, VI4013, VI6009, VI6011, VI6013, VI8011, VI8013
2. Temperature: 250°F Standard
   300°F Hi Temperature

CASING/IMPELLER WEAR RING CLEARANCES



VI CASING/IMPELLER WEAR RING CLEARANCE

PUMP SIZE	WEAR RING-SUCTION SIDE				CLEARANCE	
	DIA d_1		DIA d_2			
	MAX	MIN	MAX	MIN	MAX	MIN
1506	2.744	2.740	2.759	2.757	.019	.012
1507	2.744	2.740	2.759	2.757	.019	.012
2006	3.138	3.134	3.153	3.151	.019	.012
2007	3.138	3.134	3.153	3.151	.019	.012
2008	3.138	3.134	3.153	3.151	.019	.012
2506	3.728	3.724	3.744	3.742	.020	.012
2507	3.728	3.724	3.744	3.742	.020	.012
2508	3.728	3.724	3.744	3.742	.020	.012
2510	4.516	4.512	4.531	4.529	.019	.012
3006	4.516	4.512	4.531	4.529	.019	.012
3007	4.516	4.512	4.531	4.529	.019	.012
3008	4.516	4.512	4.531	4.529	.019	.012
3010	4.516	4.512	4.531	4.529	.019	.012
3013*	3.738	3.736	3.752	3.750	.016	.012
4007	5.102	5.098	5.122	5.120	.024	.018
4013*	4.613	4.611	4.627	4.625	.016	.012
5008	6.283	6.281	6.303	6.301	.022	.018
6009*	5.861	5.859	5.877	5.875	.018	.014
6011*	5.861	5.859	5.877	5.875	.018	.014
6013*	5.861	5.859	5.877	5.875	.018	.014
8011*	7.234	7.232	7.252	7.250	.020	.016
8013*	7.734	7.732	7.752	7.750	.020	.016

*Use front and back wear ring.

CASING WEAR RING FITTED TO SUCTION SIDE ONLY

INSTALLATION

A. Receiving Pump

1. Inspect for shipping damage. If a shortage or damage occurs, contact carrier immediately.

B. Location

1. Install vertically with motor up. Consult factory for horizontal mounting.
2. Pump should be accessible for inspection and repair work, head room must be provided for the use of hoist or tackle as necessary.
3. Lift pump by slinging through motor eye bolts and securing through pump adapter.
4. **In no case should any part of motor be covered with insulation.**

C. Foundation

1. The pump must always be supported.
2. Pumps with smaller motors may be suspended in the piping, provided the piping is supported adjacent to the pump.
3. For pumps with larger motors, the pump should be attached to a support utilizing the tapped hole or holes in the bottom of the pump casing. **Note: Piping loads shall not be applied to the pump.**
4. Pump must be allowed to move with piping movement. Expansion of piping must be taken into account when piping and suitable devices should be employed.

OPERATION

A. Before operating for the first time check the following:

1. Is motor correctly wired for voltage available.
2. Has pump been primed. Pump should never be run dry. **Extra effort may be required to get the air out of the seal chamber.**

Caution: Make sure power supply to pump motor is locked out before touching motor shaft.

3. All rotating parts turn freely.

B. Starting pump

1. Jog pump to check proper rotation.
2. Start pump with discharge valve closed. **DANGER: MAKE SURE SUCTION VALVE IS OPEN!!**
3. When correct pressure has been reached, open discharge valve slowly.
4. **Do not operate pump for prolonged periods with discharge valve closed, so as to avoid overheating and potential damaging loads.**

5. Pump should be stopped if any of the following occur:
   a. No discharge.
   b. Insufficient discharge.
   c. Insufficient pressure.
   d. Loss of suction.
   e. Excessive power consumption.
   f. Vibration.

   Check problem analysis further in the manual for help in troubleshooting.

MAINTENANCE

A. Routine Inspections

Routine inspections should be made on a regular basis. Inspections made while pump is running should reveal potential failures.

1. Inspect motor bearings for any sign of temperature rise. Temperature should not exceed 160°F. Temperature rise may indicate the early stages of bearing problems.
2. Listen for any unusual noise.
   a. Air trapped in pump
   b. Hydraulic noise.
   c. Mechanical noise in motor and/or pump.
3. Check suction gauge reading and confirm that it is normal.
4. Check discharge gauge reading and confirm that it is normal.
   a. If gauge readings are abnormal find out why.

Note: Suction and discharge gauges should read the same with pump stopped.

B. Close Coupled Pumps

The pump section is attached directly to the motor shaft and does not contain bearings.

C. Close Coupled Motors

The motor must be lubricated in accordance with the manufacturer's recommendations. **Do not over lubricate the motor bearings as this could cause premature bearing failure.**

D. Mechanical Seal

The mechanical seal is the "John Crane" Type 21 General Purpose Seal for the 175 psig pressure rating.
A "John Crane" Type 2 General Purpose Seal is used for the 300 psig pressure rating.

DIS-ASSEMBLY AND RE-ASSEMBLY

A. General

If the pump has been maintained and serviced properly, breakdowns which necessitate the pump being dis-assembled should not occur often.

1. If a problem occurs, the cause should be determined, if possible, before dis-assembling. (See "Problem Analysis")
2. If the pump is being dis-assembled, all parts must be carefully handled, avoid heavy blows and shocks.
3. All parts must be carefully cleaned and inspected for wear. Recondition or replace parts where necessary.

B. Dis-Assembly

1. Drain liquid from casing by removing drain plug.

Caution: Allow pump to cool and secure suction and discharge valves before working on pump!!

2. Remove re-circulation line.
3. Remove bolts holding cover/adapter to casing, pry cover/adapter and motor assembly from casing.
4. Remove impeller bolt in a counterclockwise direction. Remove impeller and key.
5. In all cases of mechanical seal arrangement, after removing the sleeve and its seal assembly, the seal rotating element may be drawn off the shaft sleeve. Note: apply silicone grease on the OD of the sleeve in the area between the seal and the end of the sleeve. This will help removal of the old seal. The stationary element is to be removed from the cover.
6. All parts must be cleaned and inspected for wear. Replace parts where necessary.

C. Re-Assembly

1. Be certain that all parts to be replaced are free from burrs, with screw threads and connecting faces clear and free from damage.
2. Insert stationary element of seal into cover-adapter, slip cover-adapter over shaft and engage rabbit of motor. **Note: Do not touch the seal surfaces because this may result in leakage. Do not contaminate seal faces with fingerprints.**
3. Lubricate smaller OD of shaft sleeve with silicone grease. **Do not use petroleum oil or grease.**
4. Place spring on shaft sleeve to abut against sleeve shoulder. Slide rotary seal on sleeve until it contacts spring.
5. Slide the shaft sleeve on the shaft, larger bore first. Be certain the O-ring is correctly seated in the groove.
6. Assemble impeller key and impeller on shaft. Refit with new impeller washer on impeller bolt and tighten carefully. Be certain that the impeller rotates freely by hand.
7. Apply a few spots of gasket adhesive to gasket surface of cover. Place a new casing gasket against gasket surface and press against adhesive.
8. Assemble cover-adapter complete with motor into casing. Insure that gasket is seated correctly. Install hex-headed cap screws into casing tapings and tighten uniformly.
8. Reconnect re-circulation line and drain plug.

PROBLEM ANALYSIS

A. No Discharge
1. Pump not primed.
2. Speed too low.
3. System head too high.
4. Suction lift higher than pump is designed.
5. Impeller completely clogged.
6. Incorrect direction of rotation.
7. Air leak in suction line.

B. Insufficient Discharge Flow
1. Air leak in suction line.
2. Speed too low.
3. System head higher than anticipated.
4. Insufficient NPSH: Suction lift too high. Check gauges, also check for clogged suction line or screen.
5. Impeller partially plugged.
6. Mechanical defects.
   a. Worn wear rings
   b. Impeller damaged.
   c. Incorrect direction of rotation.

C. Insufficient Discharge Pressure
1. Speed too low.
2. System head less than anticipated.
3. Air in system.
4. Mechanical defects.
   a. Worn wear rings.
   b. Impeller damaged.
   c. Impeller diameter too small.
   d. Incorrect direction of rotation.

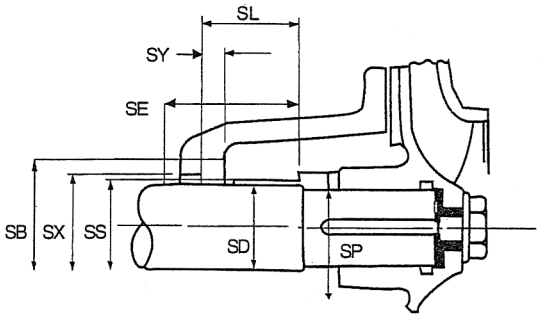
D. Loss of Suction
1. Leak in suction line.
2. Suction lift too high.
3. Insufficient NPSH.
4. Air in system.
5. Casing gasket defective.

E. Excessive Power Consumption
1. Speed too high.
2. System head lower than rating.
3. Specific gravity of liquid too high.
4. Mechanical defects.
   a. Shaft bent.
   b. Rotating elements bind.
   c. Worn wear ring.

F. Vibration
1. Air leak in suction line.
2. Air in system.
3. Impeller partially plugged.
4. Foundation not rigid.
5. Mechanical defects.
   a. Damaged impeller.
   b. Motor bearings worn.
   c. Rotor out of balance.
   d. Shaft bent.

G. Motor Runs Hot
1. Speed too high.
2. Specific gravity of liquid too high.
3. Mechanical defects.
   a. Shaft bent.
   b. Rotating elements bind.
   c. Defective motor.
   d. Voltage lower than rating.

MECHANICAL SEAL DIMENSIONS



MOTOR SIZE	SS	SB	SD	SE	SL	SP	SX	SY
143/145 JM	1.125 ± 0.002	1.750 ± 0.001	1.000	1.813	1.500	1.625	1.187	0.375
143/145 JP	1.125 ± 0.002	1.750 ± 0.001	1.000	1.984	1.500	1.375	1.312	0.375
182/184 JM	1.125 ± 0.002	1.750 ± 0.001	1.000	1.813	1.500	1.625	1.187	0.375
182/184 JP	1.125 ± 0.002	1.750 ± 0.001	1.000	1.984	1.500	1.375	1.312	0.375
213/215 JM	1.125 ± 0.002	1.750 ± 0.001	1.000	1.813	1.500	1.625	1.187	0.375
213/215 JP	1.500 ± 0.002	2.125 ± 0.001	1.375	1.963	1.563	1.750	1.688	0.375
254/256 JM	1.500 +0.003, -0.002	2.125 ± 0.001	1.375	1.990	1.563	2.000	1.562	0.375
254/256 JP	1.500 ± 0.002	2.125 ± 0.001	1.375	1.963	1.563	1.750	1.688	0.375
284/286 JM	1.500 +0.003, -0.002	2.125 ± 0.001	1.375	1.990	1.563	2.000	1.562	0.375
284/286 JP	1.500 + 0.002	2.125 ± 0.001	1.375	1.963	1.563	1.750	1.688	0.375
324/326 JM	1.500 +0.003, -0.002	2.125 ± 0.001	1.375	1.990	1.563	2.000	1.562	0.375
324/326 JP	1.500 ± 0.002	2.125 ± 0.001	1.375	1.963	1.563	1.750	1.688	0.375
364/365 JM	1.500 +0.003, -0.002	2.125 ± 0.001	1.375	1.990	1.563	2.000	1.562	0.375

All dimensions are in inches. Mechanical seal pumps have "John Crane" Type 21 seals as standard. For 300 psig casing rating " John Crane" type 2 seals are standard.