NIKKISO Pumps America, Inc.

VIP-801

S-FRAME

INSTALLATION & OPERATION MANUAL

Effective: August, 2009

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EUROPEAN UNION MACHINERY DIRECTIVE
(CE Mark System)

(where applicable)

This document incorporates information relevant to the Machinery Directive 89/392/EEC. it should be read prior to the use of any of our equipment . Individual maintenance manuals which also conform to the EU Directive should be read when dealing with specific models.

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The manual contains information on the NIKKISO VIP-801 pump. The instructions in this manual are provided to aid in the installation, operation, and servicing of the pump. The manual should be read in its entirety before any maintenance or start-up is attempted.

The pump is constructed to meet a specific application. Information that may be required regarding performance, operating limitations, optional features, and other technical details which are not included herein may be found in the specification sheet, performance curve, and drawings for each unit. This information is identified by serial number and supplied in the final data package with each pump.

WARNING

DO NOT RUN DRY
Motor and bearing heat is removed primarily by internal circulation of the pumped fluid. Overheating and internal failure will occur if the pump is run dry and may exceed safe limits when installed in Class 1, Division 2, Group C or D areas

Running the pump dry can be avoided by:

- Providing at least the NPSH required as listed on the specification sheet. Suction strainers (60 to 80 mesh) are recommended for start-up but must be monitored to assure that a blocked strainer does not result in insufficient NPSH. Factors which affect NPSH include but are not limited to:
    *Blocked strainers
    *Low suction pressure
    *Elevated suction temperature
    *Flow rate below minimum recommended on specification sheet

Monitor process conditions and confirm with levels on the specification sheet to avoid NPSH inadequacy problems.

CHECK DIRECTION OF SHAFT ROTATION

Allow sufficient space above the motor for viewing direction of shaft rotation with the end plug or bearing monitor removed prior to initial start-up. Rotation can be inspected by turning on the motor for only an instant and verifying that the shaft rotation is counterclockwise, while looking down into the pump. An optional instrument can be purchased from NIKKISO that, when held next to the stator housing, displays a green light for proper motor rotation or a red light for improper rotation by monitoring motor flux.

PROVIDE FOR SAFE DRAINING OF PUMP AND ROTOR PRIOR TO MAINTENANCE

Drain openings are shipped with pipe plugs as standard and flanged openings as an option. Provisions must be made before operation for safe draining of pumped fluid prior to maintenance.

USE PUMP ONLY FOR THE SERVICE OUTLINED ON THE SPECIFICATION SHEET

Use in another service may result in damage to the equipment.

ALLOW FOR POSSIBILITY OF PUMPED FLUID LEAKAGE

The design eliminates the use of mechanical seals which are the most common leak source in conventional pumps. Primary leak containment is provided by the stator liner and secondary containment by the outer motor shell and terminal plate. Although this design improves fluid containment, errors in maintenance assembly, operation, or unforeseen circumstances could result in leakage.

THERMOSTATS MUST BE CONNECTED

If thermostats are not connected, overheating and burnout of the motor windings may occur. This can be caused by loss of pump flow (loss of suction, blocked discharge, running backwards, etc.), locked rotor, or loss of cooling flow to the heat exchanger.

MOTOR SURFACE TEMPERATURE DEPENDS ON PUMP FLUID TEMPERATURE AND COOLING FLUID FLOW THROUGH MOTOR.

EACH PHASE OF POWER SUPPLY MUST HAVE OVERLOAD PROTECTION.

CONNECT GROUNDING WIRE TO GROUNDING TERMINAL

Pump is suitable for use in Class 1, Division 2, Group C and D areas depending on motor temperature, which in turn depends on pump fluid temperature and on cooling liquids (when required). These factors must be controlled within limits shown on the specification sheet. Overheating will also occur if the pump is run dry or below the minimum flow.

INTRODUCTION

PUMP CONSTRUCTION

The NIKKISO VIP-801 is a sealless, single stage centrifugal pump which incorporates a canned motor with a standard LMV-801 pump case and diffuser. The benefit of wet end interchangeability inherent in the traditional LMV-801 is maintained in the VIP-801. Retrofit effort is minimal to convert an existing LMV-801 into a VIP-801.

The driver is a hermetically sealed induction motor contained within welded hastalloy liners at the inner diameter of the stator and the outer diameter of the rotor. The canned motor housing provides secondary fluid containment in the event of liner rupture. Thermostats located within the stator windings monitor motor temperature to protect against overheating.

Motor heat is removed and the bearings are lubricated by process fluid or and external flush fluid continuously circulating throughout the canned motor. The circulated fluid temperature will increase but the fluid is maintained in a pressurized state to prevent vaporization. Fluid is supplied to the motor through a close clearance annulus which prevents passage of particles greater than .020" in diameter. This annulus is located in a high pressure zone behind the impeller as shown in Figure 1.

An auxiliary impeller is used to circulate the fluid through the motor. Internal vents are drilled in the rotor assembly to remove any vapor that may form in the motor cavity.

A double acting thrust design assures position and control under normal and process upset conditions. The bottom thrust bearing, located directly underneath the auxiliary impeller, is placed as low as possible to insure the bearing is wetted upon start-up. The upper thrust bearings housed in the auxiliary impeller are essentially bumpers made of PEEK which are only active during upset suction conditions.

The radial and lower thrust bearings on the VIP-801 are made of wear resistant alpha sintered silicon carbide material. The shaft sleeves and thrust runner (auxiliary impeller) are made of tungsten carbide. This application of hard bearings and sleeves assures long life and tolerance to fluid particles.

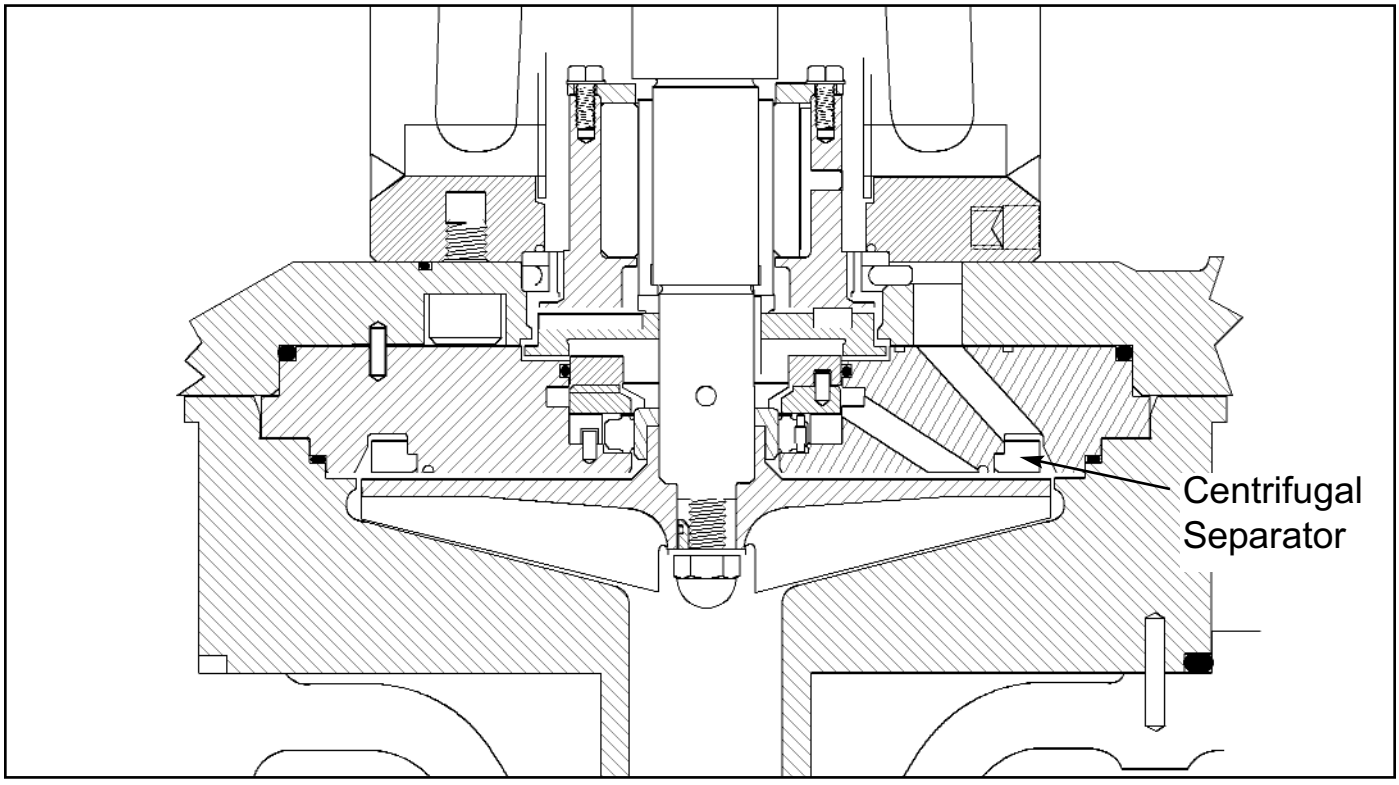


Figure 1. Fluid circulation path for the API Plans 1-S & 13-S begins at the high pressure annulus behind impeller.

1. INSTALLATION

VIP-801 Principles of Operation

1. INSPECTION

A. Inspect the shipping container for any evidence if shipping damage. If any visible evidence is seen, it should be noted. It is often helpful to photograph the damage if the extent of damage is uncertain.

B. Care should be taken when uncrating the pump.

C. Check the bill of lading to determine if any shortages exist. If any freight damage or shortage is determined, it should be noted on both the receipt and freight bill. Make any claim to the transportation company immediately.

D. Inspect the suction and discharge flange for damage. If the pump will not be installed immediately, reseal the flange to protect the pump from contamination.

E. Verify that the pump identification plate has the correct serial number and agrees with the serial number on the outline drawings sent previously .

2. STORAGE

A. If the pump is not to be installed immediately, it should be stored in a dry, clean area. Care should be taken to protect it from dust and moisture.

B. Flange covers must be securely in place.

C. Accompanying each pump will be one instruction manual, which should be properly identified and stored in a protected area.

3. SUCTION AND DISCHARGE PIPING

Consult the outline drawings and specification sheet for your pump for the size and rating of the suction and discharge flanges.

A. The pump should be mounted as near to the supply tank as possible, while allowing sufficient working area around the pump for maintenance and assembly.

B. All piping must be supported independent of the pump. The piping should always line up with the pump flanges. Never draw the piping into place by the use of force at the suction and discharge connections as this may impose excessive strains on the unit.

C. The piping, both suction and discharge, should be as short as possible. Avoid all unnecessary elbows, bends, and fittings as they increase friction losses in the piping. The size of the pipe and fittings should be selected carefully and should be of sufficient size to keep the friction losses as low as practical.

D. The use of elbows near the suction flange should be avoided. When used, elbows should have a large radius. A straight pipe run of at least ten times the pipe diameter is desirable between an elbow and the suction flange.

E. Suction pipe should never be of a smaller diameter than the pump suction inlet. Reducers, if used, should be eccentric and preferably slope up to the pump to avoid creating air pockets in the piping.

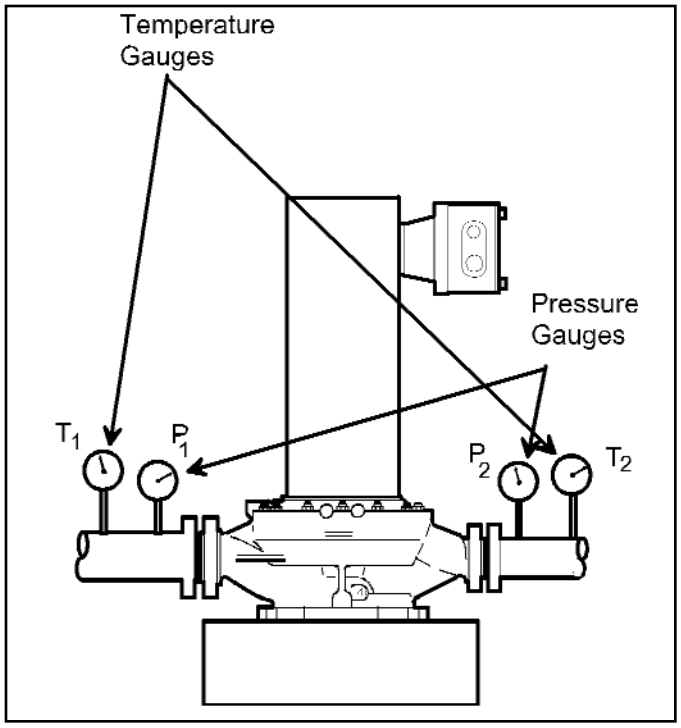
F. If reverse flow during shutdown is likely, it is recommended that a check valve be installed in the discharge line to protect the pump from possible reverse rotation.

G. On initial installation of the pump, it is recommended that a temporary suction strainer be installed in the suction piping to protect the impeller from damage by mill scale, weld slag, or other foreign particles. This strainer may be removed after confirming that no additional foreign objects exist in the system. If a condition exists where foreign objects are present continuously, the strainer should be mounted permanently, with a differential pressure gauge installed to measure the drop across the filter.

A cone shaped strainer with 1/4 inch (6.35mm) holes is preferred. For initial start-up, a screen with mesh openings of .060 inch (1.524mm) can be attached over the cone then removed alter the system is clean. Do not run the pump with a clogged strainer. The strainer should be monitored frequently and cleaned on a regular basis, depending on the condition of the pumped liquid. On initial start-up, the strainer should be checked for foreign objects soon after the system has started. Should a strainer become clogged, NPSH will be reduced, resulting in cavitation in the fluid end of the pump or at the motor bearings.

H. Provisions should be made for pressure gauges in the suction and discharge piping. The gauges should be located as shown in Figure 2. The pressure gauges can be extremely helpful during start-up and are desirable for monitoring the performance of the pump.

Figure 2. Typical Piping Arrangement



4. AUXILIARY PIPING

Depending on pumped fluid temperature and characteristics, a heat exchanger may be required and will be indicated on the outline drawing and specification sheet for the specific serial number pump. Port sizes, temperature, flow and pressure requirements are also shown when required.

5. ELECTRICAL WIRING (Recommended Electrical Circuit

Normally, direct line starting is used for the NIKKISO VIP-801 pump. If a low starting current must be maintained because of other existing electrical equipment or for some other reason, transformer starting or reactor starting may be used instead.

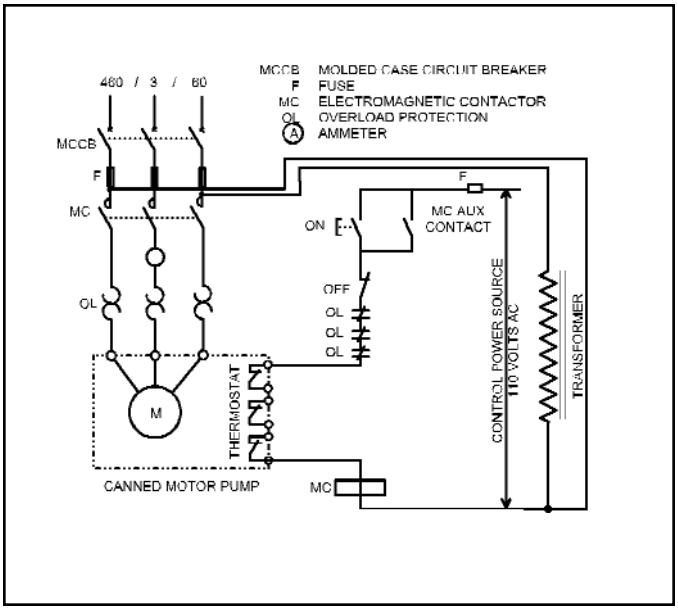
A. Starter Type

A magnetic type contact switch should be used as the main contact switch. This arrangement provides not only protection in the event of overload, but also thermal protection of the motor windings can be achieved by connecting the thermostat in series with the exciting coil of the switch. Properly sized circuit breakers and fuses must be used on all 3 phases. Motor full load amp value is shown on the specification sheet.

B. Thermal Protection Circuit

One to three thermostats are located in the stator winding at a point where the winding temperature is the highest. Their purpose is to protect the motor windings from excessive heat build-up. The thermostats are electrically connected in the stator as shown in Figure 3.

Figure 3. Recommended Circuit

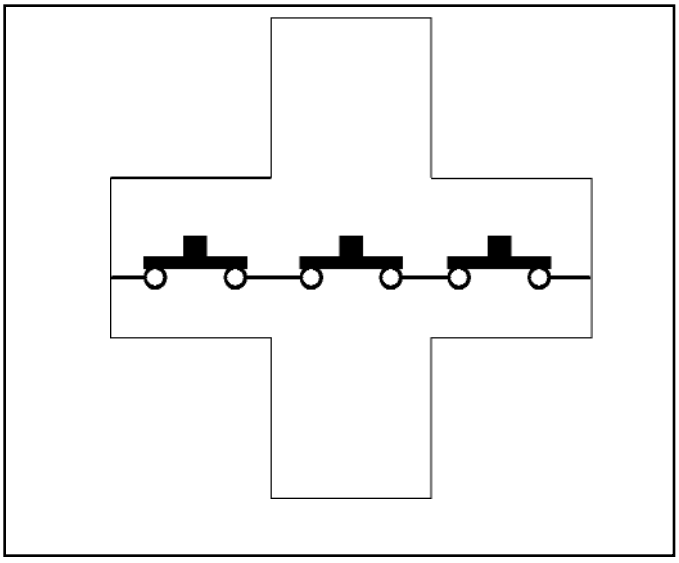


(a) The thermostats have normally closed (NC) contacts that open when the motor winding temperature reaches the rated value. Refer to specification sheet or Table 1 for thermostat operating temperatures.

Table 1. Thermostat Operating Temperature

For Power	U, V, W
For Thermostat	S1, S2
For Spare	C1, C2

Figure 4. Thermostat Contacts (NC)



(b) Maximum Thermostat Ratings: AC230V-0.5A AC 100V, 20-30 MA

DC 24V, 10-25 MA

C. The terminal box has two openings: the 3/4” NPT opening for the thermostat leads, and the larger NPT opening is for the main power leads.

D. Wiring

(a) When the phase relationship of the incoming power leads is known (i.e., R S T), make the connection as S-U, R-V, and T-W. This should provide the proper direction of rotation. The direction of the motor rotation should be verified before pump operation using the procedure described in the start-up section.

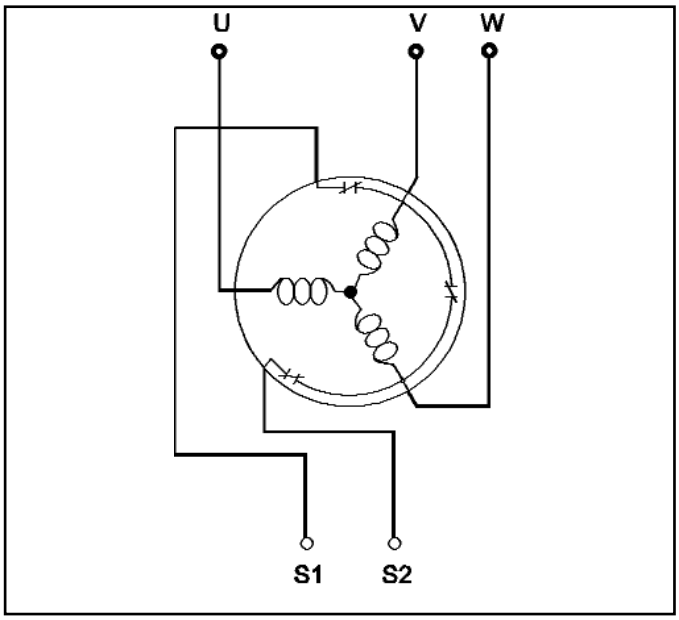


Figure 5. Standard VIP-801 motor winding and thermostat connection diagram

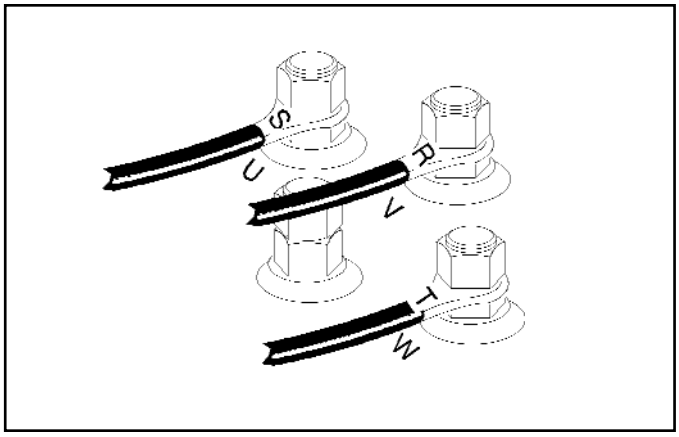


Figure 6. Main power connection

(b) Thermostats are embedded in the stator windings. Make connections to S1 and S2 terminals to establish the protective circuit. Proper terminal connections are shown in Table 2. If thermostats are not connected, over-heating and burnout of windings may occur as a result of loss of pump flow, loss of suction, blocked discharge, running backwards, locked rotor, and loss of cooling flow to heat exchangers.

Class of Insulation	Thermostat at Operating Temp.
N	392 ± 18°F

Table 2. Terminal Leads

WARNING

DO NOT USE OR LOOSEN THE NUTS ON TERMINALS (C1 AND C2)

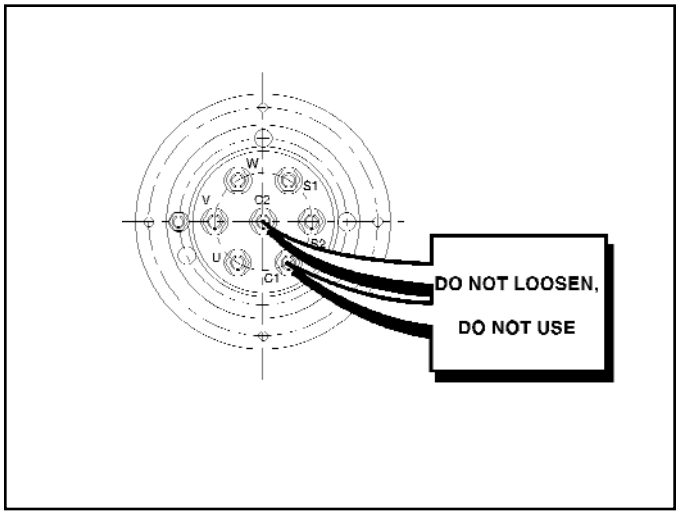


Figure 7. Terminal plate

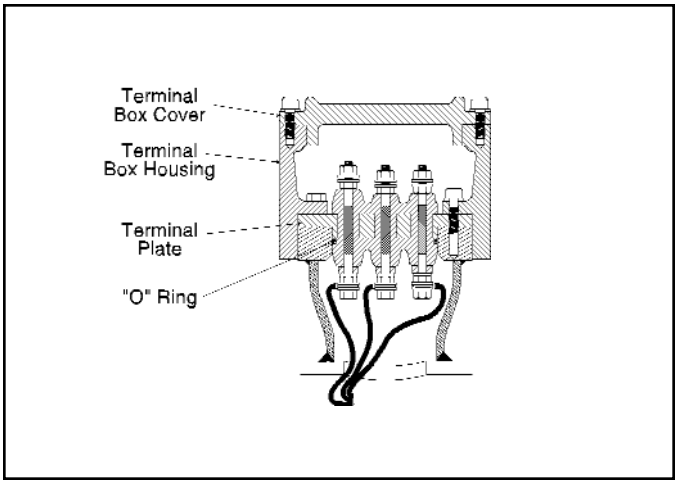


Figure 8. Terminal box cross section

(c) Inside the terminal box is a ground terminal. The terminal should always be used to ground the pump. Ground terminal is also provided on the base.

Reference Figure 9.

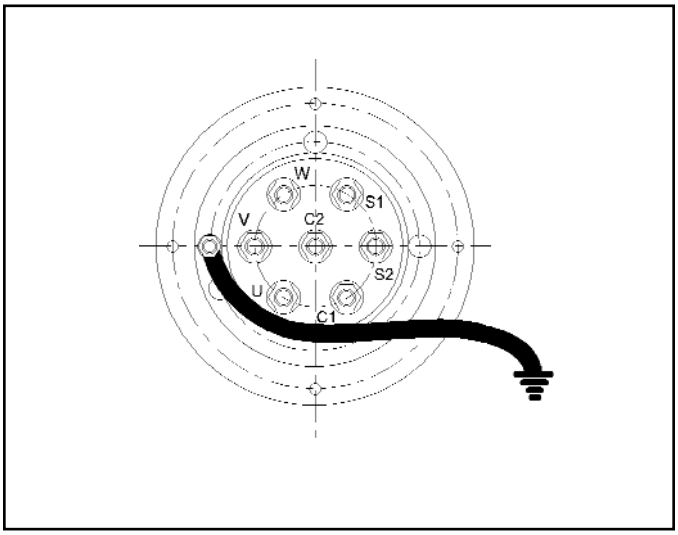


Figure 9. Terminal Box Grounding

(d) O-rings are used to seal the terminal posts and terminal plate. Fluid may leak into the stator cavity in event of rupture of the stator liner. The terminal plate O-rings provide an additional seal to prevent fluid leakage to the junction box. If pumped fluid is hazardous an adequate trap should be used in connecting cables and conduit to prevent leakage to the power source and additional damage .

E. Checking Insulation Resistance

After wiring has been completed, measure insulation resistance of the various circuits with a megger having a range of more than 500V.

(a) Points at which insulation resistance is to be measured: - Between the stator windings and ground. - Between the thermostat and ground. - Between the thermostat and stator windings.

NOTE

The thermostats must be electrically disconnected during insulation and resistance measurement if common power is used for the stator windings and thermostat circuits.

(b) In all cases, the insulation resistance must be more than 2 M ohm.

NOTE

At time of shipment, insulation resistance is more than 100 M ohm.

WARNING

Operation of the pump must not be attempted until the section on OPERATION has been read and thoroughly understood.

If the overload relay or the thermostat trips during operation, inspect and determine the real cause before restarting the pump. Correct the problem and then measure the resistance of the motor stator windings

If the difference in resistance between any of the three stator windings Is more than 5%, the motor stator is defective and must be replaced.

WARNING

Do not apply power to a motor that has been determined defective, as serious Injury may result.

WARNING

When the pump is Installed outdoors, the terminal box and the electrical leads to the terminal box must be sealed so that water cannot enter the terminal box.

2. OPERATION

WARNING

Do not operate pump when dry for more than one second

Do not operate under the following conditions -

- **Blocked discharge and suction lines**
- **Below minimum flow rate**
- **Insufficient NPSH (clogged suction strainer, low tank level, flow too high, low pressure and excessive temperature)**
- **Inadequate flow of cooling water to exchanger (if one is Installed)**
- **"reverse" rotation**

1. PREPARATORY PROCEDURES

WARNING

Do not attempt to operate the pump until the following checks have been performed

A. Motor Rotation - The correct direction is counterclockwise as viewed from the top looking down on the pump. Rotation direction is checked by removing the end plug or bearing monitor and observing the direction of shaft rotation when power is turned on for an instant.

WARNING

Before removing the end plug, be sure that there is no liquid or vapor In the pump.

Remove the end plug or bearing monitor from the top of the motor. Verify the direction of rotation by directing a beam of light from a flashlight into the hole and watching the end nut. Apply power to the motor for an instant and visually check shaft rotation. See Figure 10.

NOTE

If there is liquid in the pump the direction of rotation can be confirmed by checking the pumping action for a few seconds. If the discharge pressure gauge indicates less than 70 percent of the design head at design flow, the motor is rotating in the wrong direction. If this is the indication, stop operation immediately, lock out electrical power, and switch any two power leads. Pressure developed in reverse rotation may not be sufficient to push flow through the discharge system and cause zero flow with heat buildup, loss of bearing cooling, and eventual failure.

B. Verify piping, valve location and position, electrical wiring, and auxiliary piping.

C. Verify that the correct suction strainer is installed.

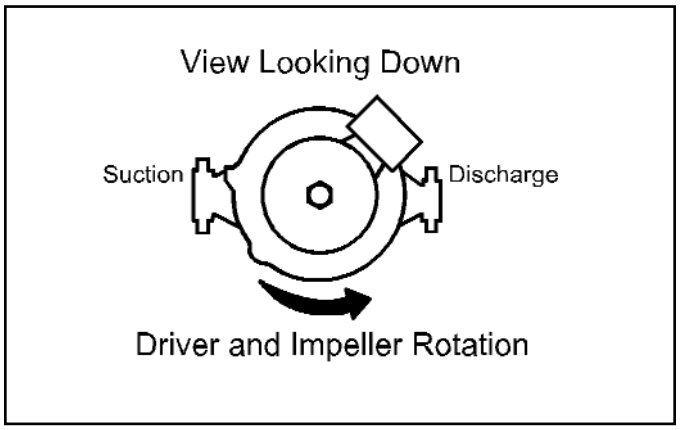


Figure 10. Direction of motor rotation

2. PREPARATION FOR STARTING

A. Verify that the suction and discharge valves are closed.

B. If a cooling system is used, turn on water, brine, or heating fluid to the heat exchanger. Flow should conform to specification sheet requirements.

C. Open the suction valve allowing the suction piping

and pump to fill with liquid. The liquid will also enter the rotor chamber of the pump, displacing a portion of the entrapped air.

3. START-UP PROCEDURE

A. Vent motor prior to start-up. A vent port exists at the top of the motor (located on the side of the upper bearing or bearing monitor housing). This vent is necessary to remove any entrapped vapor from the unit and to insure proper liquid circulation throughout the motor. Failure to vent the unit may result in the motor overheating and damage to the bearings.

B. With the discharge valve at design position, start motor and check to be sure that discharge pressure is approximately the value shown on the specification sheet. Also check for any unusual noise or vibration.

C. Verify the differential pressure across the suction strainer. If a large differential pressure exists, the strainer is clogged. The pump must be shut down immediately and the strainer cleared.

D. The operation of the VIP-801 pump is quiet and smooth, and it is sometimes difficult to determine if the pump is running.

During initial operation, verify the following:

(a) Compare flow rate, differential pressure and electrical current to the design specification.

(b) Occasionally the motor selected does not provide full curve protection. Therefore, the discharge control valve opening should be adjusted to maintain a flow rate so that current draw is below full load amperage value listed on the specification sheet.

(c) Check the pump for any abnormal noise.

(d) Open the discharge control valve gradually up to maximum required operating flow and listen for any increase in noise or vibration level. If an abnormal noise or vibration is detected as the discharge valve is opened further, without an according increase in flow rate, cavitation is occurring in the pump. Operation of the pump under these conditions can cause severe damage
to the internal parts of the pump.

WARNING

Never operate the pump under cavitation conditions.

Discharge throat cavitation may be heard when operating the pump at a flow rate beyond the end of its curve. It is recommended that the pump flow be reduced below the onset of noise. Pump
flow is reduced by gradually closing the discharge control valve. Closing the control valve completely will result in unstable surge conditions and will damage the pump.

If the pump is equipped with a heat exchanger, check the difference in temperatures at the inlet and outlet piping.

When abnormal conditions occur, stop the pump and investigate.

4. ROUTINE INSPECTION DURING OPERATION

The following items should be checked on a routine schedule to verify normal pump operation.

A. Check discharge pressure against the original design specification.

B. Check ammeter readings compared to the initial start-up readings.

C. Check for abnormal noise and increase in vibration levels.

D. Check the cooling water “in” and “out” line for a temperature differential.

5. MINIMUM FLOW RATE

The pump should not be operated below the minimum continuous flow rate as defined on the pump specification sheet. Operating below minimum flow rate will result in unstable surge conditions and excessive down thrust.

6. EMERGENCY STOPPING

If the motor is wired correctly and the protective devices are in a serviceable condition, the pump will stop automatically if the temperature of the motor windings exceeds the thermostat setting. If this occurs, the cause could be as follows:

• Abnormally high temperature of the pumped fluid.

• Failure of the cooling system.

• Motor overload.

The pump may also stop because the overload relay has tripped. This may indicate incorrect operating conditions such as excessive flow or specific gravity. It may also indicate a short circuit within the motor, or evidence that the stator liner has ruptured. If the overload relay has tripped, the suction and discharge

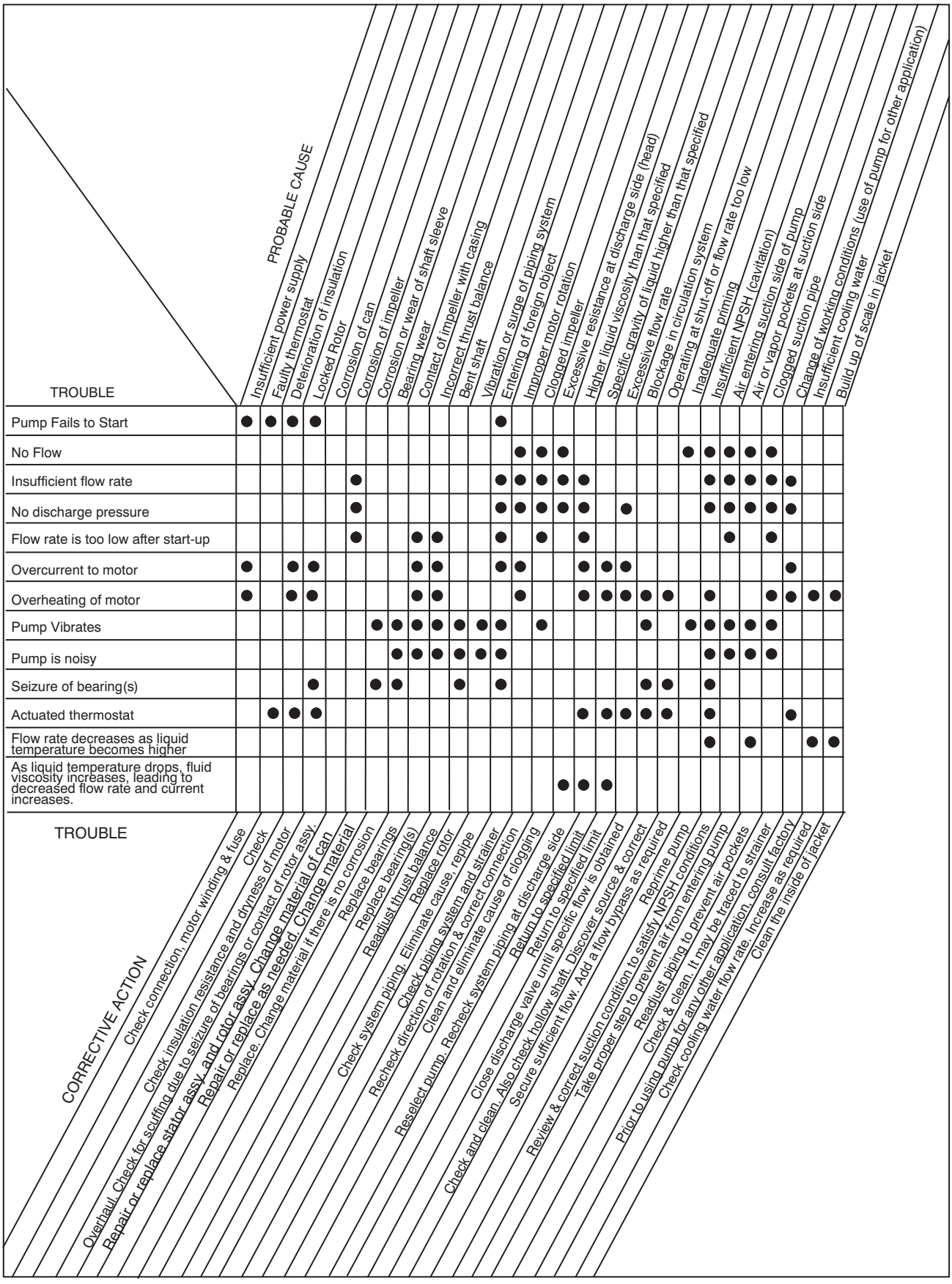
valves should be closed and the cause of the problem determined.

Determine the cause, perform corrective action, and restart the pump.

WARNING

Never restart motor until the cause is corrected.
Measurement of the winding resistance value, described on Page 6 should be done prior to determining whether stator windings have been damaged. Restarting should be done only if winding check is satisfactory.

3. TROUBLESHOOTING



1. PERIODIC CHECK

It is recommended that the pump be checked periodically following initial start-up and then on a less frequent basis as satisfactory pump and system performance indicates. Monthly checks are usually sufficient after the system operation is stable. Check of the following points is recommended.

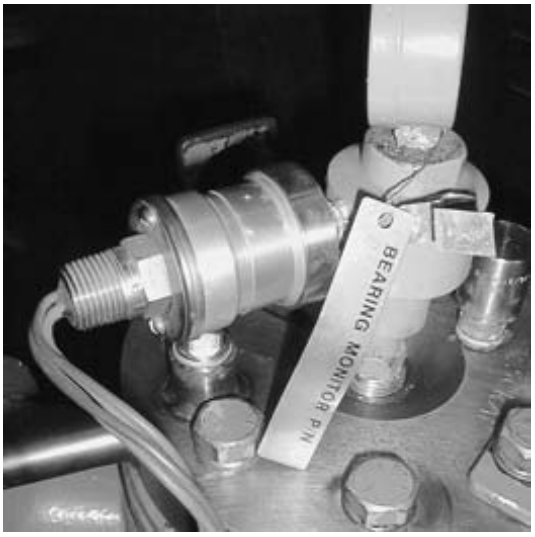
-PUMP PERFORMANCE
Pump differential pressure, flow, and amperage draw should be near specification sheet values.

-CONDITION OF SUCTION STRAINER
should be verified to assure that NPSH is not being reduced.

-UNUSUAL NOISE OR VIBRATION
May indicate internal wear or cavitation due to insufficient NPSH.

-ELECTRICAL—CHECK
should be made yearly to assure that insulation resistance is over 100M ohms with 500 V megger and that unbalance of resistance between phases is within 5%.

5. DISASSEMBLY & RE-ASSEMBLE PROCEDURE



WARNING

Before any work is performed on the pump, it must be depressurized, drained, electrically disconnected, and made safe from both environmental and physical hazards.

STEP 1

Remove the bearing monitor (38). Note the nut has left hand threads. It will be necessary to tilt the bearing monitor to remove it from the eccentric portion of the bearing monitor nut. Remove and replace the bearing monitor o-ring (936EE).

STEP 2

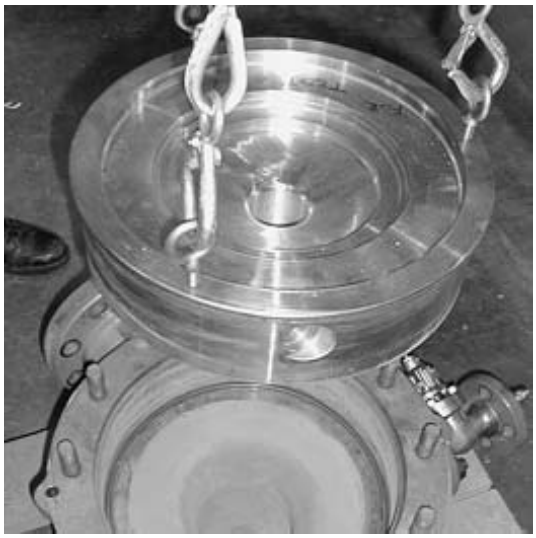
Remove the twelve (12) hex nuts (914A) using a 1-1/4 wrench and separate the adapter housing and motor from the pump case. Exercise care not to damage the smooth finish of the diffuser bowl, and the impeller (2) and inducer (9), if one is installed.

STEP 3

Using a certified lift, remove the upper stator assembly from the pump housing.

Lower the upper stator assembly onto a work bench. Two hoists or some manual assistance should be used to lay the motor section flat on the work bench with the adapter plate (30) overhanging the bench.

CAUTION!
The out stator band of the motor must be protected from damage.



To remove the diffuser, install 5/16 -18 UNC eyebolts (customer furnished) into the tapped holes on the top rim of the diffuser and gently lift diffuser out of pump casing.

Two spiral pins (14A) are located within the pump case to correctly align the diffuser when reinserting it. The spiral pins are clocked slightly so that the diffuser can be inserted in one way only.

NOTE: All “O”-rings should be replaced, regardless of their condition, when the pump is being reassembled.

STEP 4

Prevent impeller (2) from turning and remove impeller nut (3). ..or hold impeller (2) and remove inducer (9) and inducer stud (10). Note that the impeller nut has a left hand thread.

WARNING

A single impeller blade will bend if excessive force is used while removing the impeller nut. If the impeller nut is not easily loosened, secure a strap wrench around the impeller outer diameter so that force is uniformly distributed among the blades before applying torque to the nut (3).

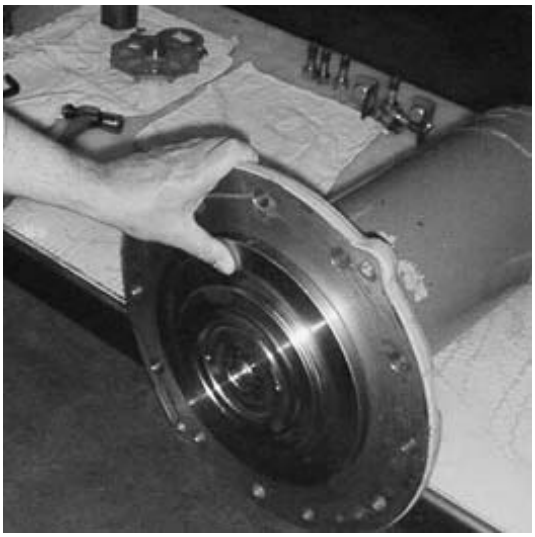
STEP 4 (cont.)

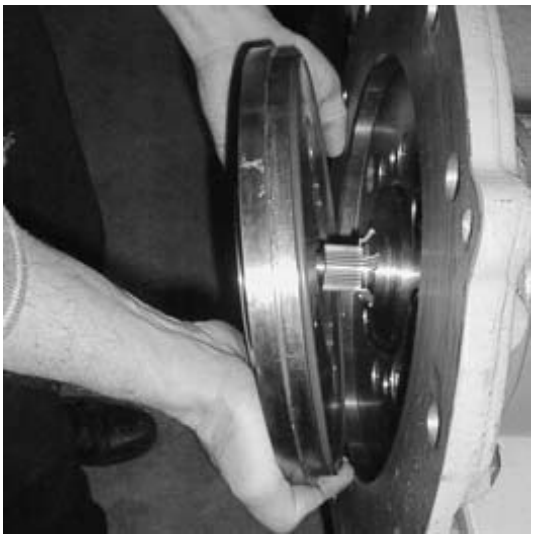
Pry impeller (item 2) from rotor and remove. Note that the impeller is a spline fit to the shaft.

CAUTION !
Hold or clamp the diffuser cover (15) in place until prepared to remove it. It is heavy and if not properly supported could drop and cause damage to the shaft or sleeves.

STEP 5

To avoid damage to thrust bearing, remove the throttle bushing sleeve (250A) from the rotor before removing the diffuser cover (15).





STEP 6

Next remove the diffuser cover (15). Support it carefully to avoid damage to the shaft.

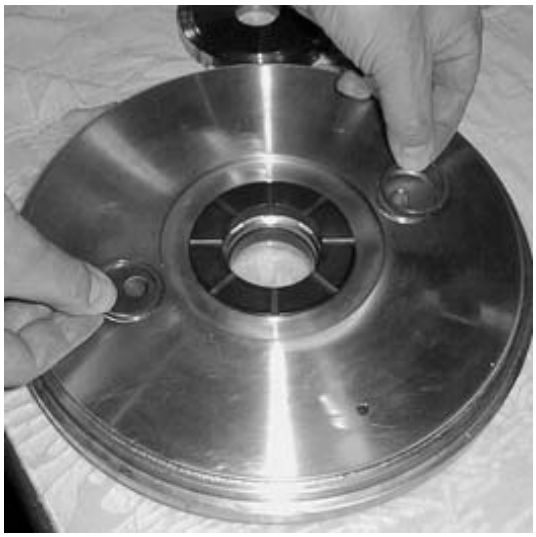
Next remove the thrust bearing sleeve (250B) from the rotor assembly.

NOTE
The slotted sleeve locates the key to shaft orientation.

STEP 7

Remove the auxiliary impeller (202). If necessary, gently pry it from the shaft. Upon re-assembly, position the auxiliary impeller on the shaft as square as possible, aligning the slot in the impeller with the key in the shaft.

Note the eight upper thrust bearing buttons (155B) mounted in the auxiliary impeller. They should extend 0.045" from the auxiliary impeller. If they are worn to less than 0.035", they must be replaced.



STEP 8

From the diffuser cover, remove the two port O-rings (936V). Note these are only applicable to the API 1-S and 13-S circulation systems.

STEP 8 (cont.)

Remove the lower thrust bearing (155A). The lower thrust bearing has 2 holes that align it to the pins of the bearing support plate (156). Check the bearing for damage or wear.

STEP 8 (cont.)

Next remove O-ring (936EA).

With the O-ring removed, the bearing support plate (133B) is now removed. This plate has four pins. Two pins (14G) are installed on the thrust bearing (155A) side. Two more pins are installed on the tilt washer (22) side for alignment in tilt washer holes.

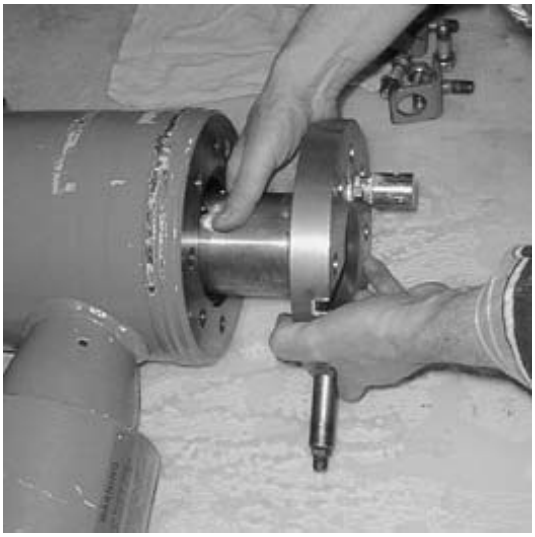
Now remove the tilt washer (22) which aligns on two (14D) pins installed in the diffuser cover.

The last part to remove from the cover is the throttle bushing (21). One roll pin (14C) is installed in the cover to align the throttle bushing upon re-assembly.

Inspect the flow ports on the bottom side of the diffuser cover (15) to insure that no blockage exists.
The number of ports can vary with the application.

STEP 9

Moving to the other end of the motor, remove the four (4), or eight (8) upper bearing housing bolts (905A/B).

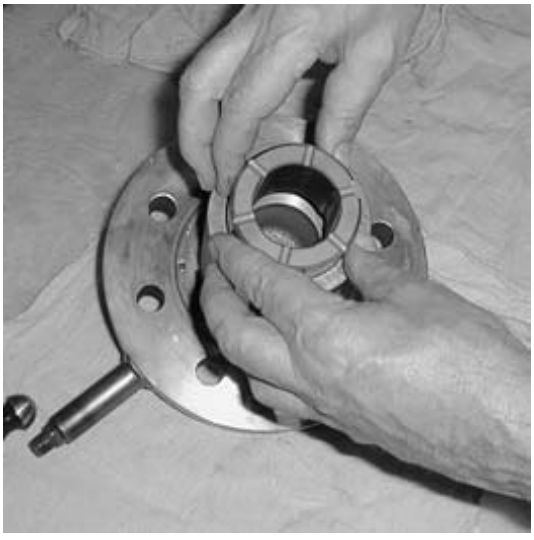


Carefully remove the bearing housing (118B).

Note and mark the upper bearing housing alignment for re-assembly.

Remove O-ring (936ED) from the bearing housing.

Remove the bearing retainer screws (905D) and tab washers (152B) and upper bearing retainer (112B).



Last, remove and inspect the upper bearing (151B).

STEP 9 (cont.)

Remove articulating anti-rotation key (14H).

STEP 10

Carefully lift and remove rotor assembly without damaging rotor or stator.

WARNING

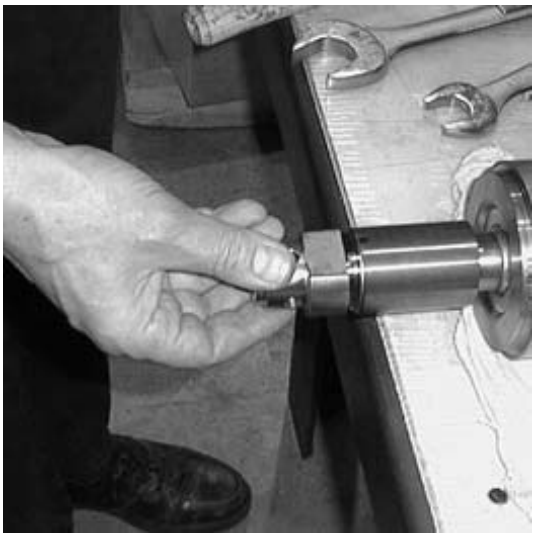
The rotor assembly must be disassembled and reassembled on a clean, padded work bench. To prevent damage to the motor can, the rotor must never be placed In a vise or other clamping mechanism.

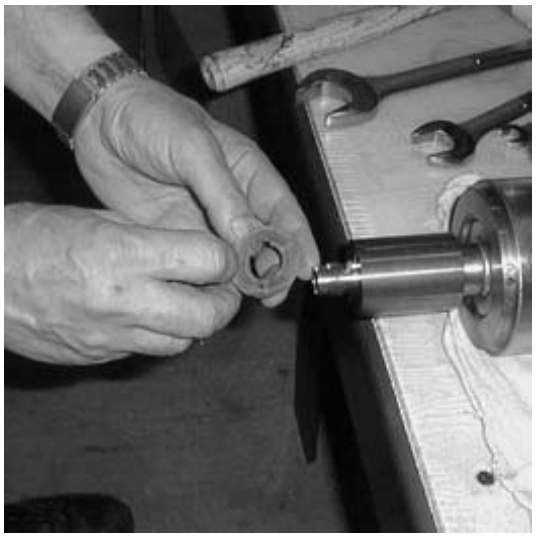
Straighten the bearing monitor nut tab washer (152A).

In order to hold the rotor while loosening the bearing monitor nut (915), slide the impeller back onto the rotor.

NOTE
Right hand threads on bearing monitor nut.

Remove bearing monitor nut (915)





Remove tab washer (152A)

Remove key (920B).

Remove upper shaft sleeve (250D).

STEP 11

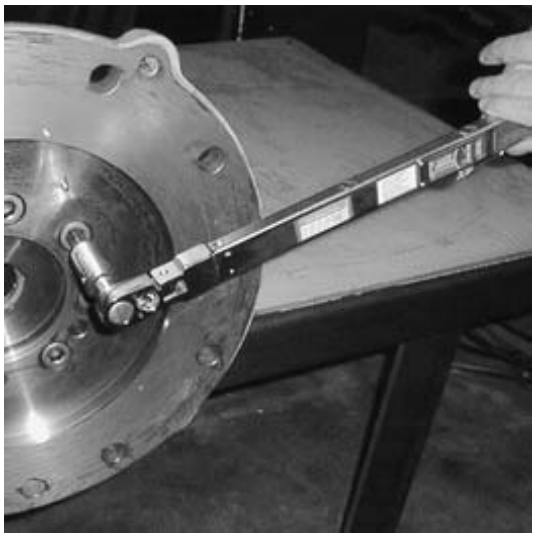
From the opposite end of the rotor, remove the auxiliary impeller key (203A).

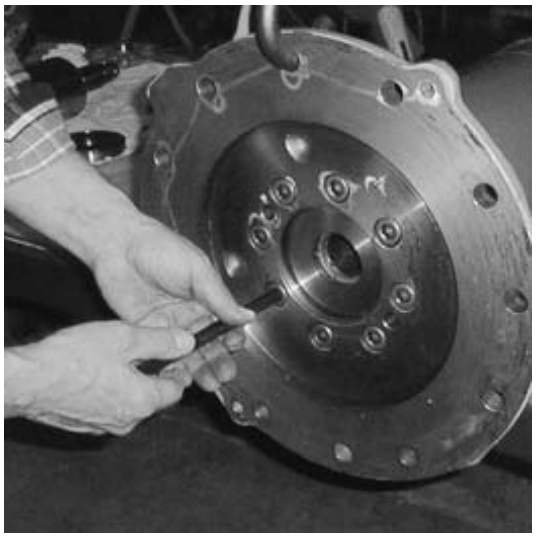
Remove the lower shaft sleeve (250C).

STEP 12

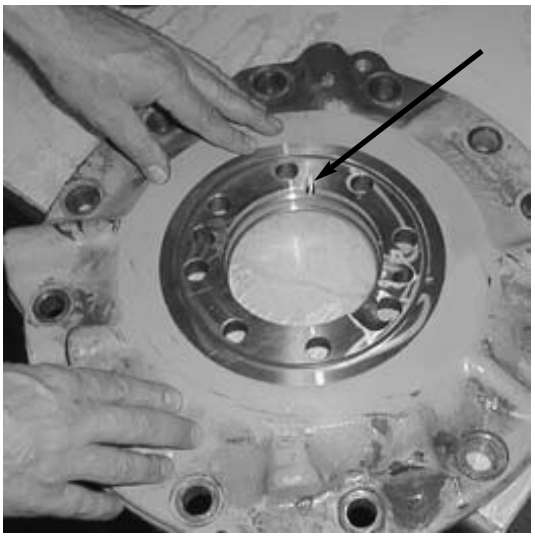
The illustration indicates diffuser cover alignment pin (14B) in the adapter housing (30). The purpose of this pin is to correctly align the two parts upon re-assembly.

Loosen the four or eight socket screws (906A) that attach the adapter housing to the stator assembly (A201).

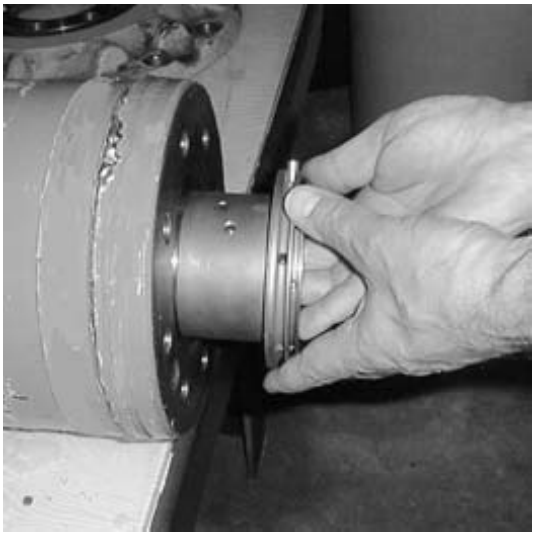




Support the adapter housing while removing screws to avoid damage to parts and/or personal injury.



Remove O-ring (936EC) from adapter. The illustration indicates a slot in the adapter and a pin (14F) in the bearing housing for alignment upon re-assembly.



STEP 13

Remove the lower bearing housing (118A) from the stator. Note the alignment pin for re-assembly.

Note:
Bearing housing pin to adaptor plate slot orientation.

Remove tab washers (152C) bearing retainer screws (905C) and lower bearing retainer (112A).

The lower bearing (151A) can now be removed and inspected.

The articulating anti-rotation key(14H) can now be removed from the bearing housing.

Check the pin portion of the anti-rotation key (14H) for wear.

Note:
The clocking, anti-rotation pin (14E) of the lower bearing housing.

STEP 14

Examine all parts for wear or damage, and replace as necessary. Check all motor cooling passages for blockage.

REASSEMBLE PUMP IN REVERSE ORDER

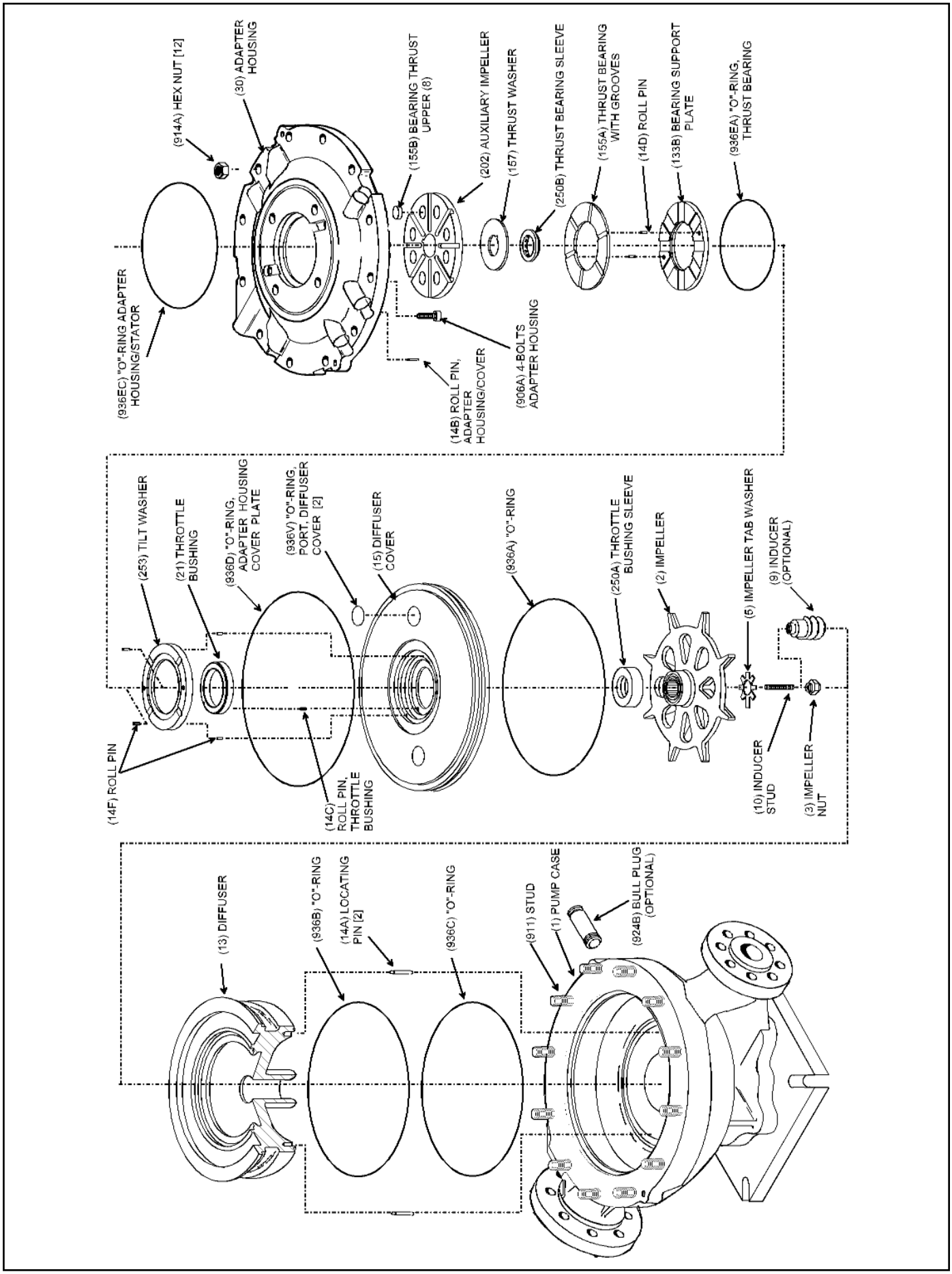


Figure 11. Pump Exploded View

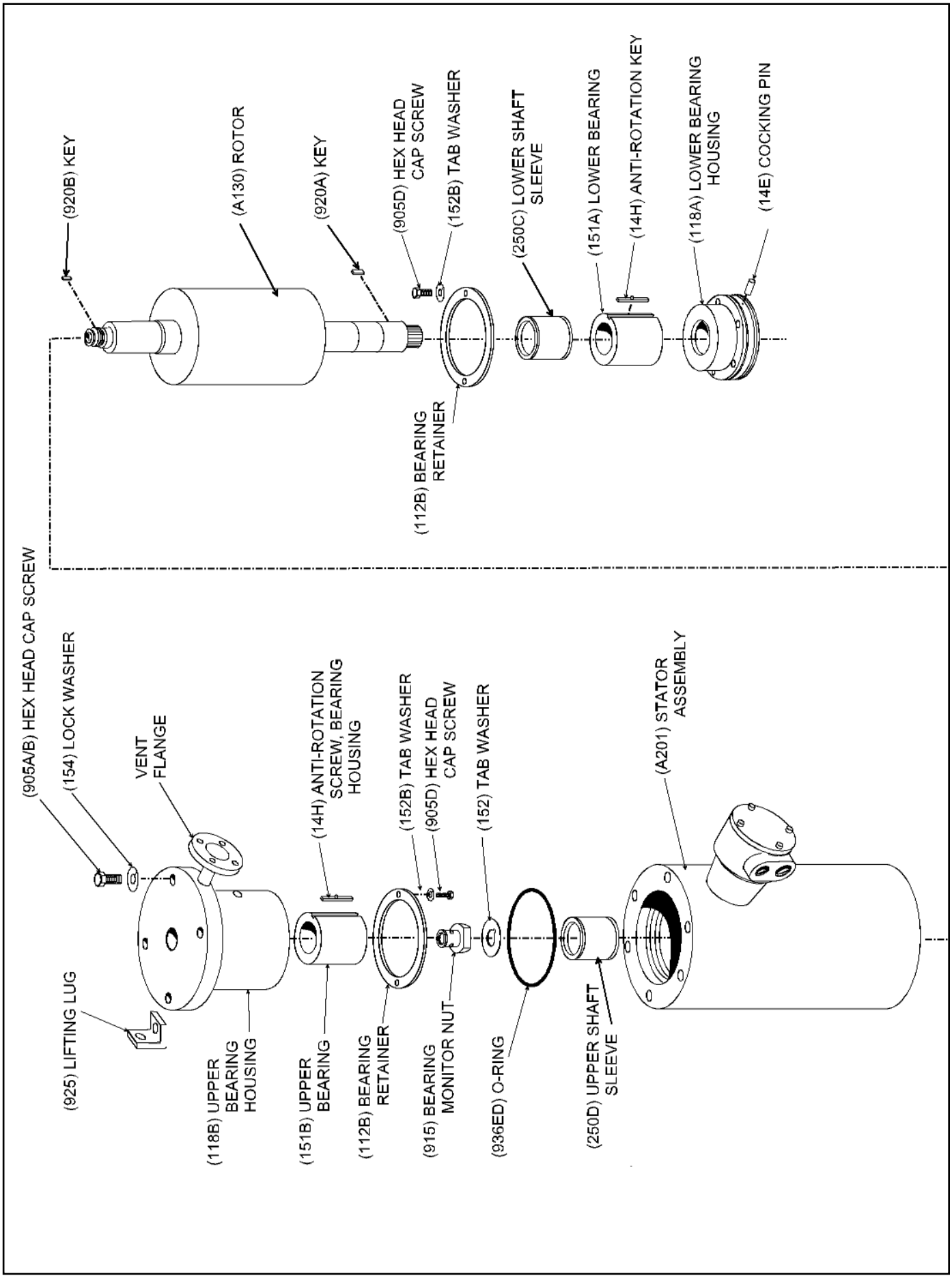


Figure 12. Motor Exploded View

6. RECOMMENDED SPARE PARTS

ITEM	DESCRIPTION	CLASS 1 QTY	CLASS 2 QTY	CLASS 3 QTY
5	Washer, Tab, Inducer	1	1	2
151A	Bearing, Lower	1	1	2
151B	Bearing, Upper	1	1	2
155A	Bearing, Thrust, Lower	1	1	2
155B	Bearing, Thrust, Upper	8	8	16
21	Bushing, Throttle	1	1	2
250A	Sleeve, Throttle Bushing	1	1	2
250C	Sleeve, Shaft, Lower	1	1	2
250D	Sleeve, Shaft, Upper	1	1	2
152A	Washer, Tab, Bearing Monitor Nut	1	1	2
202	Impeller, Auxiliary	-	-	1
250B	Sleeve, Thrust Bearing	-	-	1
133A	Washer, Thrust (Auxiliary Impeller)	1	1	2
152B/C	Washer, Tab	4	4	8
936A	O-Ring	2	4	4
936B	O-Ring	2	4	4
936C	O-Ring	2	4	4
936V	O-Ring, Port, Cover Plate	4	8	8
936EA	O-Ring, Thrust Bearing	2	4	4
936ED	O-Ring, Brg. Hsg/Stator	2	4	4
936D	O-Ring, Adaptor HSG/Cover Plt.	2	4	4
936EC	O-Ring, Adaptor HSG/Stator	2	4	4
936EE	O-Ring, Bearing Monitor	2	4	4

NOTES:

CLASS 1 - Minimum recommended spare parts necessary to perform a start-up and inspection of a new unit.

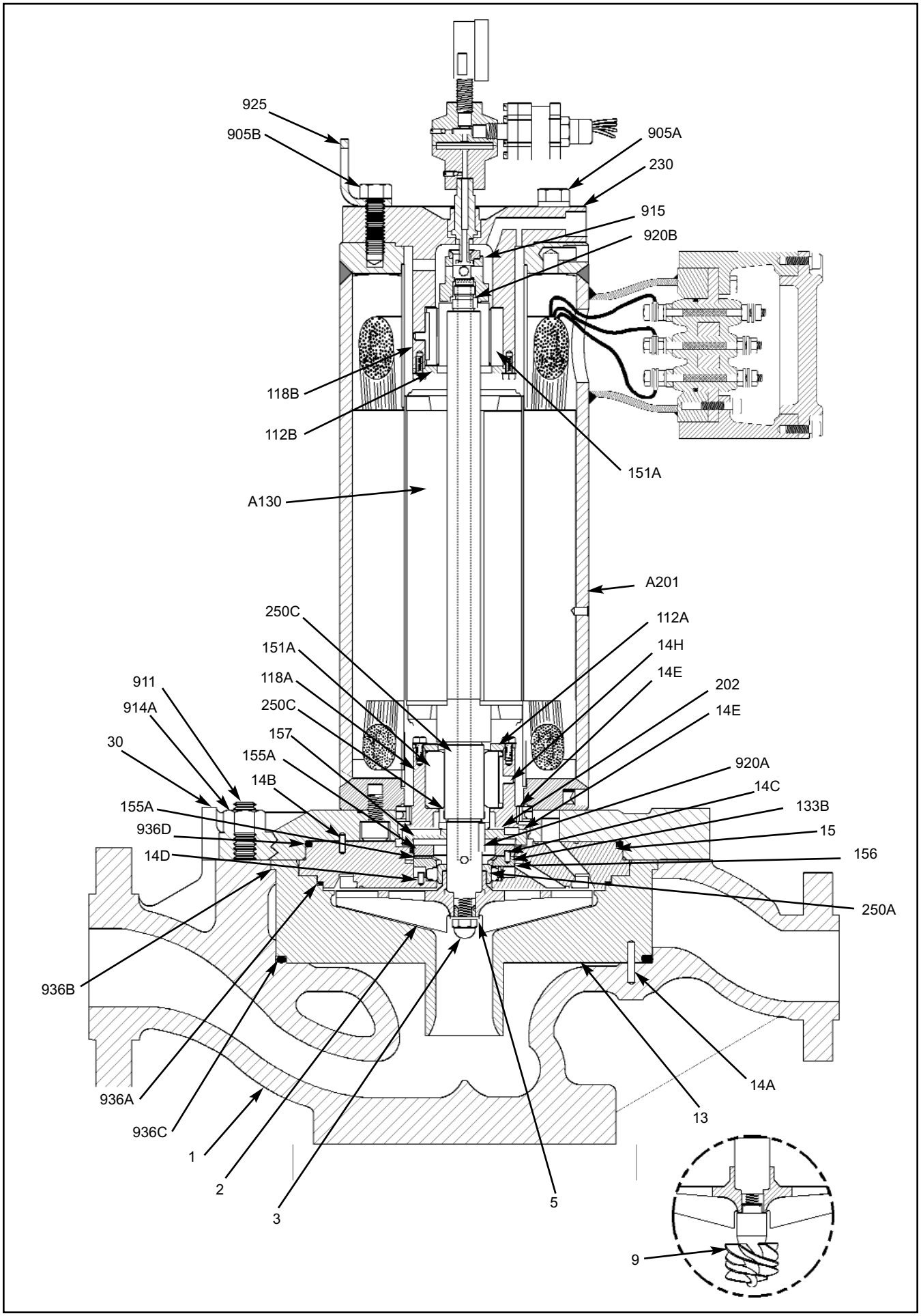
CLASS 2 - Minimum recommended spare parts necessary to cover 1 - 2 years of normal service.

CLASS 3 - Minimum recommended spare parts necessary for critical service or units that will be installed in remote locations.

7. BILL OF MATERIALS

ITEM	PART NAME	QTY
1	Pump Housing	1
2	Impeller	1
3	Impeller Nut	1
5	Impeller Tab Washer	1
9	Inducer	1
10	Inducer Stud	1
13	Diffuser	1
14A	Spirol Pin, Case/Diffuser	1
14B	Pin, Cover/Adapter	1
14C	Pin, Throttle Bushing	1
14D	Pin, Thrust Bearing	4
14E	Pin, Anti-Rotation	2
14F	Pin, Tilt Washer	1
14G	Pins Alignment	1
14H	Pin - Key, Bearing Ani-Rotation	2
15	Diffuser Cover	1
21	Throttle Bushing	1
22	Tilt Washer, Lower	1
30	Adapter Housing	1
112A	Lower Bearing Retainer	1
112B	Upper Bearing Retainer	1
118A	Lower Bearing Housing	1
118B	Upper Bearing Housing	1
A130	Electric Rotor Assembly	1
151A	Upper Journal Bearing	1
151B	Lower Journal Bearing	1
152B&C	Tab Washer	1
155A	Thrust Bearing with Grooves	1
155B	Thrust Bearing	8
133B	Thrust Bearing Support Plate Assy.	1
157	Thrust Washer	1
A201	Stator Assembly	1
202	Auxiliary Impeller	1

ITEM	PART NAME	QTY
920B	Key, Upper Shaft	1
920A	Key, Auxiliary Impeller	1
250A	Throttle Bushing Sleeve	1
250B	Thrust Bearing Sleeve	1
250C	Lower Shaft Sleeve Assembly	1
250D	Upper Shaft Sleeve Assembly	1
291	End Plug	1
905A	Upper Bearing Housing Screw, Hex Head Cap	4
905B	Lifting Lug Screw, Hex Head Cap	2
906A	Adapter Screw, Socket Cap	4
911	Pump Case Stud, Full Thread	12
914A	Pump Case Nut, Hex Head	12
915	Bearing Monitor Nut	1
925	Lifting Lug	2
936A	O-Ring, Diffuser/Cover	1
936B	O-Ring, Diffuser/Case Upper	1
936C	O-Ring, Diffuser/Case Lower	1
936D	O-Ring, Adapter Hsg/Cover Plt	1
936V	O-Ring, Cover Plate Port	1
936EA	O-Ring, Thrust Bearing	1
936EB	O-Ring, Thrust Bearing	1
936EC	O-Ring, Adapter Hsg/Stator	1
936ED	O-Ring, Upper Bearing Housing	1
936EE	O-Ring, End Plug	1


925
905B
905A
230
915
920B
118B
112B
151A
A130
A201
250C
112A
151A
14H
118A
14E
911
250C
202
914A
157
14E
30
155A
920A
14B
14C
155A
133B
936D
15
14D
156
250A
936B
14A
936A
13
936C
1
2
3
5
9

8. TORQUE VALUES REQUIRED FOR REASSEMBLY

BOLT SIZE	BOLT MATERIAL CODE	
mm (in.)	BB, DG & HD	DA, DB, HB & HC
6 (,24)	10 ft. - lbs.	8 ft. - lbs.
8 (.32)	25 ft. - lbs.	20 ft. - lbs.
10 (.49)	40 ft. - lbs.	30 ft. - lbs.
12 (.48)	60 ft. - lbs.	50 ft. - lbs.
16 (.64)	100 ft. - lbs.	75 ft. - lbs.

BOLT SIZE	BOLT MATERIAL CODE	
in. (mm)	BB & DG & HD	DB & HB
3/8 (16)	35 ft. - lbs.	18 ft. - lbs.
7/16 (14)	50 ft. - lbs.	25 ft. - lbs.
1/2 (13)	80 ft. - lbs.	40 ft. - lbs.
5/8 (11)	120 ft. - lbs.	60 ft. - lbs.
3/4 (10)	200 ft. - lbs.	100 ft. - lbs.
7/8 (9)	250 ft. - lbs.	150 ft. - lbs.

MANUFACTURERS WARRANTY

The Manufacturer warrants that its pumps are not defective in material or workmanship and that, when properly installed and operated, they will perform in accordance with the Manufacturers written proposal, if any. Subject to the preceding sentence and except as otherwise expressly stated herein, THE MANUFACTURER MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO THE GOODS. The Manufacturer shall not be liable for any damages except as set forth herein.

Parts returned to the manufacturer and determined by the Manufacturer, in its sole discretion, to be defective in material or workmanship within one year of start-up (or within six months of start-up in the case of two or three shift operation) or within 18 months of delivery to Customer, whichever occurs first, will, at the Manufacturers sole option, be repaired or replaced free of charge, f.o.b. Houston, Texas. Replaced parts are the property of the Manufacturer. Equipment and accessories not manufactured by the Manufacturer are warranted only to the extent of and by the original manufacturers warranty.

Any such repair or replacement will be performed by the Manufacturer within a reasonable time of the pumps return. This warranty is voided by repairs made by the Customer, except in cases of emergency where operational safety requires such emergency repairs and the Customer promptly notifies the Manufacturer of such emergency repairs.

Manufacturer assumes no responsibility for damage resulting from improper installation, improper operation, normal wear and tear, operation under improper conditions, operation with unsuitable liquid, corrosion due to improper metal combination, electrical or electrochemical effects, or improper process design.

Manufacturer shall not be liable for consequential or incidental damages of any kind, which are hereby expressly excluded. The Customer assumes responsibility for all personal injury and property damage resulting from the handling, possession or use of the pumps by the Customer and the Customer waives and agrees not to sue upon, and releases the Manufacturer from any and all liability for the Manufacturers negligence, breach of contract other than as provided herein, breach of warranty other than as provided herein, strict liability in tort, and for other tort.

PARTS & ACCESSORIES SAFETY WARNING

NIKKISO Pumps America, Inc. manufactures pumps and compressors to exacting quality standards.
Genuine NIKKISO Parts and accessories have been specially designed and tested for the use with these products to ensure continued product quality and performance. As NIKISSO Pumps America, Inc. cannot test all parts and accessories sourced from other vendors, incorrect design and/or fabrication of such parts and accessories may adversely effect the performance and safety features of these products. FAILURE TO PROPERLY SELECT, INSTALL OR USE AUTHORIZED NIKKISO Pumps America, Inc. PARTS AND ACCESSORIES IS CONSIDERED MISUSE, AND DAMAGE OR FAILURE CAUSED BY MISUSE IS NOT COVERED BY NIKKISO Pumps America, Inc. WARRANTY.

Additionally, modification of NIKKISO Pumps America, Inc. products or removal of original components may impair the safety of these products and their effective operation.

CRITICAL - STARTUP CHECKLIST

KNOW YOUR MACHINE

Prior to start-up of the NIKKISO VIP-801 pump, carefully review the specification sheet, outline drawing, performance curves, and instruction manual. It is important that you become familiar with the pump configuration before starting and operating the pump.

MOTOR INSTRUCTIONS

Follow installation and starting instructions

CHECK MOTOR ROTATION

Rotation must be counterclockwise looking down on pump.

PREPARATION FOR STARTING

Read and understand section **"2 OPERATION**" before start-up.

CHECK

Be sure that process conditions conform to values listed on the specification sheet. Check head rise, flow rate, and power consumption against pump specification sheet. Check that specific gravity, viscosity and NPSH are in accordance with the specification sheet. These conditions will significantly alter performance of the pump and could damage the pump if different than values listed on the specification sheet.

NIKKISO Pumps America, Inc. • 600 Kenrick Drive, Suite C-1• Houston, TX 77060, USA
Phone:281-310-6747 • FAX: 281-310-6771 • www.nikkisopumpsamerica.com