NIKKISO Pumps America
VIP-806
API-685 Sealless Pump
Installation & Operation Manual

June 2009

www.nikkisopumpsamerica.com

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WARRANTY

NIKKISO Pumps America, Inc. warrants to Buyer for a period of twelve (12) months from the date of being placed in service (but not to exceed eighteen (18) months after the date of shipment) that the equipment at the time of shipment will be free from defects of design, material and workmanship. If any defects or malperformance occur during the warranty period, NIKKISO's sole obligation shall be limited to alteration, repair or replacement at NIKKISO's expense, F.O.B. Factory, of parts or equipment, which upon return to NIKKISO and upon NIKKISO's examination prove to be defective. Equipment and accessories not manufactured by NIKKISO are warranted only to the extent of and by the original manufacturers' warranty. NIKKISO shall not be liable for damage or wear to equipment caused by abnormal conditions, vibration, failure to properly prime or to operate equipment without flow or caused by corrosives, abrasives or foreign objects. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESSED OR IMPLIED INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. In no event shall NIKKISO Pumps America, Inc. be liable for consequential or incidental damages.

Icons Used in this Manual

The following icons (symbols) are used to indicate specific types of information.

Good ideas to use. A reminder to do something.

Equipment use alert. Unless you follow these procedures correctly, the equipment may be damaged.

Safety alert. Failure to follow these procedures can endanger the safety of you or others.

Electrical hazard. Failure to follow these procedures can endanger the safety of you or others.

NOTES:

VIP = Vertically Integrated Pump

USING THIS MANUAL:

This manual is part of the final data package for your NIKKISO VIP pump. This manual explains procedures for the NIKKISO pump, including how to: install it, maintain it, service it, troubleshoot problems and order parts. In addition to this manual, the final data package includes: drawings, NIKKISO specification sheet with test performance curves, test data, inspection data, material certificates if required, driver, and auxiliary equipment information.

All dimensions are provided in English units followed by SI units in parenthesis.

This manual contains the following sections:

i. Introduction to the NIKKISO Pump
ii. Safety Precautions
iii. Critical Startup Checklist

1. Installation
Describes how to install the pump and how to store it until you install it.

2. Operation and Control of NIKKISO Pumps
Factors that are critical to proper pump operation.

3. Start-up
Provides the procedure for starting the pump.

4. Servicing
Provides procedures for servicing the pump.

5. Disassembly and Maintenance
Provides an understanding of the process end and motor ends of the pump.

6. Inspection of Disassembled Hardware

7. Spare Parts
Contact and reference information.

8. Pump Troubleshooting
Provides a table for looking up pump problems; identifying possible causes; and finding the appropriate corrective action.

Appendix A
Pump cross section drawing complete with component item numbers.

i. Introduction to the NIKKISO Pump

The NIKKISO VIP pump has a single stage with an integral canned motor. Its purpose is to increase the pressure of a continuous flow fluid by applying centrifugal action. NIKKISO VIP Pumps are most commonly used in HPI, CPI, and Boiler Feed applications. They are also used in refineries, petrochemical plants, and power generation plants. Within these facilities, NIKKISO Pumps are used in high head, low to medium flow processes.

NIKKISO VIP Pumps offer industrial quality in a compact unit that is simple to maintain. It provides high-energy performance and competitive efficiencies. For detailed specifications of NIKKISO VIP Pumps, see the specification sheet and bill of material or consult NIKKISO Pumps America, Inc. for the primary components, reference the Pump section.

ii. Safety Precautions

⚠ *Safety Warning*

NIKKISO Pumps America, Inc. manufactures centrifugal pumps to exacting standards. Genuine parts and accessories have been specifically designed and tested for use with these products to ensure continued product quality and performance. As NIKKISO 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 affect the performance and safety features of these products. Failure to properly select, install or use authorized NIKKISO pump parts and accessories is considered misuse and damage or failure caused by misuse is not covered by NIKKISO's warranty. Additionally, modification of NIKKISO products or removal of original components may impair the safety of these products and their effective operation.

⚠ *Suggested Safety Instructions:*

During installation, maintenance, or repair operations of a NIKKISO pump, systems for safety shall be applied before the commencement of work. Failure to take responsibility for safety may lead to injury of operator or others.

Personal Protective Equipment (PPE): Safety glasses with side shields, as a minimum, shall be worn by all personnel installing or performing maintenance or repair on the equipment. If equipment is over 15 pounds (7 kg) and is to be manually lifted, or if pallet jacks or forklifts are to be used, steel-toed safety shoes shall be worn. When testing the equipment, hearing protection is highly recommended if noise levels exceed 85 dB during an eight (8.0) hour period. Chemical resistant gloves shall be used if chemical use is required. (See Chemical Use below for additional information). If chemicals have warnings regarding fumes and/or dust/mists, a dust mask respirator shall be worn as a minimum.

When selecting one piece of PPE to be used with another, consider the compatibility between them. For example, safety glasses should not interfere with the seal from hearing protection. Be sure to clean the PPE after each use.

Use of Forklifts: All forklift drivers must have a current recognized license. If using a forklift, first ensure that the lift is in a safe operating condition.

Electrical Safety: During installation, service, or repair ensure all electrical sources are off and it is safe to work on the equipment. A recognized Lock-out/Tag-out program should be followed. Locks and/or tags should be provided warning employees that the equipment is being installed, serviced, and/or repaired. Once the work is complete, the person installing the lock and/or Tag shall remove it following your company's procedure for Lock-out/Tag-out and inform others of start-up.

Testing Equipment: Persons in the immediate area shall be warned when a test is to be performed.

Tools: Tools shall be insulated from electrical shock. Ensure all tools are clean and free of oil and the insulation is not damaged in any way.

Chemical Use: Any chemicals to be used shall be accompanied by a relevant material safety data sheet (MSDS), in accordance with your government legislation. If applicable, chemical proof gloves shall be used. An eye wash station (or equivalent) should be available in the event of injury. Should any hazardous or flammable chemicals have passed through the equipment a complete decontamination of the equipment is required.

Fall Protection: When working over six feet from the ground, fall protection is required.

Machine Guards: Guards shall remain in place on all equipment. Only during maintenance/repair can the guards be removed, and prior to start-up, the guard must be replaced.

Lock-out/Tag-out Guidelines:

Follow Your Company's Lock-Out / Tag-Out Procedure When Servicing Sundyne Pumps.

iii. Critical Startup Checklist

Know Your Machine

Before servicing and starting up the NIKKISO VIP-806 pump, carefully review the specification sheet, the outline drawings, performance curves, and this instruction manual. It is important you become familiar with the pump configuration before starting and operating the pump.

Auxiliaries

1. Check the utility connections.
2. Verify that the auxiliary piping conforms to NIKKISO's drawings.
3. Verify the connections of the switches, the instruments, and their settings.
4. Calibrate all measurement equipment (Flow meters, Current or Ampere meters, Pressure meters, etc.).

Check Driver Rotation

Rotation must be in the same direction as the arrow stamped or cast on the pump casing.

Starting Pump

Start pump with suction valve completely open while throttling discharge valve, to bring pump to design operating point.

Check

Check total head, flow rate, and power consumption against pump specification sheet. Check that specific gravity, viscosity and NPSH are in accordance with specification sheet. These conditions will significantly alter performance of the pump.

Process Conditions
Do process conditions; suction pressure, suction temperature, discharge pressure, agree with specification sheet information? Check with your NIKKISO representative if you must test or run a different fluid/specific gravity than shown on the specification sheet.

Piping Connections
Are the following bolted/threaded connections tight:
a. Pump flange bolts?
b. Cooling water connections to heat exchanger? (if applicable)
c. Pump case drain plug?

1. Installation

This section contains the following:

Introduction: Provides a brief description of the pump and how it is used.

Inspection: Important items to inspect as soon as you receive your pump.

Short-term Storage: Procedure for units installed within 6 months.

Long-term Storage: Procedure for units installed after 6 months.

Suction and Discharge Piping: Procedures to set up the suction and discharge piping.

Inspection

1. When you receive the NIKKISO VIP Pump, check for any damage. If you find any, inform the carrier and NIKKISO Pumps America, Inc. promptly.

2. Use outline drawings in the last section of final data package, and reference the bill of material to ensure that all auxiliary items are properly included.

Short-term Storage - 1 day to 6 months

1. If the pump is to be stored near strong chemicals or salt water, protect it immediately. To do this, follow steps 5 through 7 from the long-term storage procedures below.

2. Protect the unit from moisture and dust.

3. Make sure that the factory's shipping covers for the housing flanges and the seal ports are securely in place.

Long-term Storage - 6 months or more

If you store the NIKKISO VIP Pump for a long period of time, the following methods are very important. If you require further instructions, please contact NIKKISO Pumps America, Inc. at (281)-310-6747 USA and ask for the Field Service Department.

1. Be sure the storage area is indoors and has: Humidity below 65%; and temperature range from 45° to 85°F (7°C to 29°C).

2. Do not allow contact of airborne chemicals with the internal components of the unit.

3. If the unit is being stored near strong chemicals or salt water, protect it immediately.

4. Protect the unit from moisture and dust.

5. Make sure that the factory's shipping covers for housing flanges are securely in place.

6. Prevent corrosion to the components.

7. Fill unit with rust preventative oil.

8. After long-term storage, have an authorized NIKKISO service engineer inspect all components and supervise any necessary repair to be sure that they work properly. Any components not made by NIKKISO must be inspected or replaced as determined by the manufacturer's authorized personnel, at the purchaser's expense. Any Field Service work must be clearly stated at the time of purchase to validate an Extended Warranty.

   Because storage location and unknown factors at the site or storage are beyond our control, NIKKISO does not accept any liability for damage to the equipment during storage, nor do we guarantee the quality of the equipment during and after the storage period. An Extended Warranty will be null and void if the proper equipment preparation is not maintained.

Installing the Suction and Discharge Piping - Guidelines

Step 1 Clean the suction line.

Step 2 Install a strainer to protect the impeller from damage by mill scale, welding slag, or other foreign particles.

Step 3 Make sure that the piping is aligned with the pump flanges.

Step 4 Support all piping independently of the pump.

Step 5 When you move the piping into place, never use excessive force at the flanged suction and discharge connections. This could strain the unit.

Step 6 Use suction pipe that has a diameter at least as large as the diameter of the suction inlet of the pump.

Step 7 Make sure that the suction and discharge piping do not have unnecessary elbows, bends, and fittings. These increase the losses caused by friction. Also, be sure that all piping and fittings are large enough to minimize losses caused by friction.

Step 8 Before you connect the piping to the pump, tighten the pump base plate hold down-bolts on the pump.

Step 9 Do not use elbow parts near the suction flange.

Step 10 Use block valves and pressure bleeds on both suction and discharge pipes to isolate the pump during shutdown, minimize process leakage, and reduce the likelihood of back-flow through the pump, which can cause reverse rotation. A check valve should also be located downstream from the pump discharge.

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. The VIP may be applied in Group B areas with the addition of an inert gas purge in the terminal box.

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
- FIow 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

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. With liquid in the pump, if the discharge pressure at rated flow is less than 70% of design pressure, the motor is probably running in the wrong direction. Stop operation immediately, lock out electrical power, switch two power leads, and restart the pump.

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-806 is a sealless, single stage centrifugal pump that incorporates a canned motor with a standard Sundyne LMV-806 pump case and diffuser. The benefit of wet end interchangeability inherent in the traditional LMV-806 is maintained in the VIP-806. Retrofit effort is minimal to convert an existing LMV-806 into a VIP-806.

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 are 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, when required, an 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 which are only active during upset suction conditions.

The radial and lower thrust bearings on the VIP-806 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.

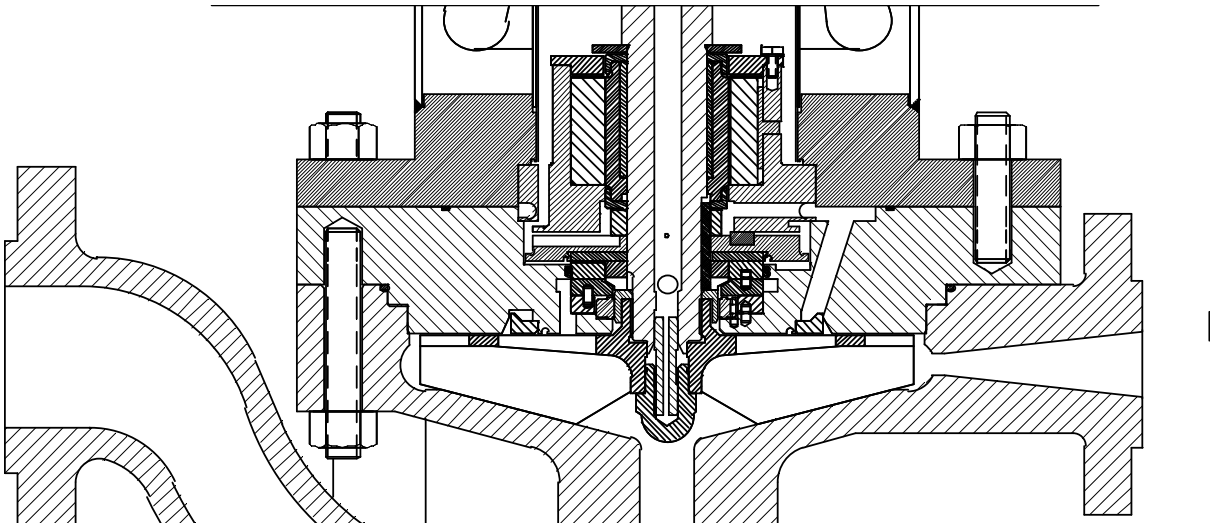


Figure 1. Fluid circulation paths for the API Plans 1-S & 13-S begin at the high pressure annulus behind impeller.

1. INSTALLATION

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.

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.

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. Both suction and discharge piping 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. 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 after 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.

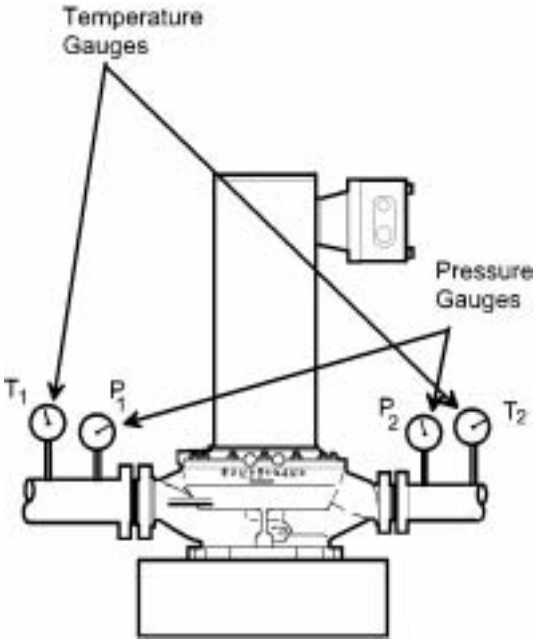


Figure 2. Typical Piping Arrangement

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-806 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 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.

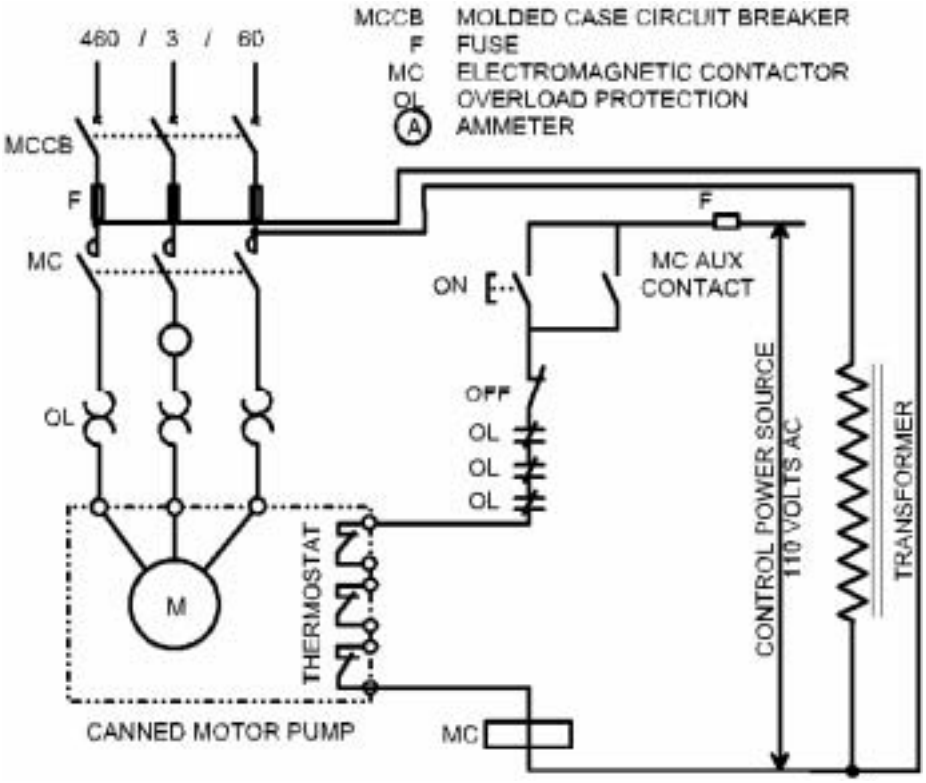


Figure 3. Recommended Circuit

(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.

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

Table 1. Thermostat Operating Temperature

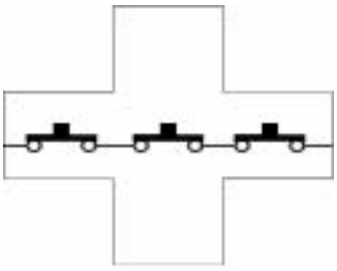


Figure 4. Thermostat Contacts (NC)

(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 3” 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.

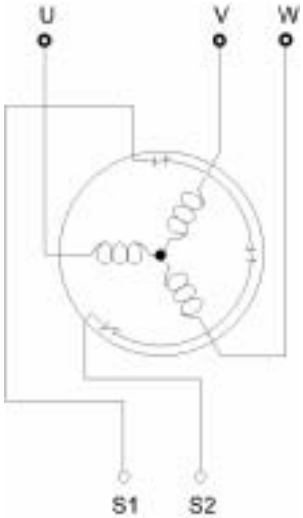


Figure 5. Standard VIP-806 motor winding and thermostat connection diagram

(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.

(c) Inside the terminal box is a ground terminal. The terminal should always be used to ground the pump.

(d) O-rings are used to seal the terminal posts and terminal plate. Fluid may leak into the stator cavity if the stator liner is ruptured. 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.

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.

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

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.

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

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

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

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. 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.

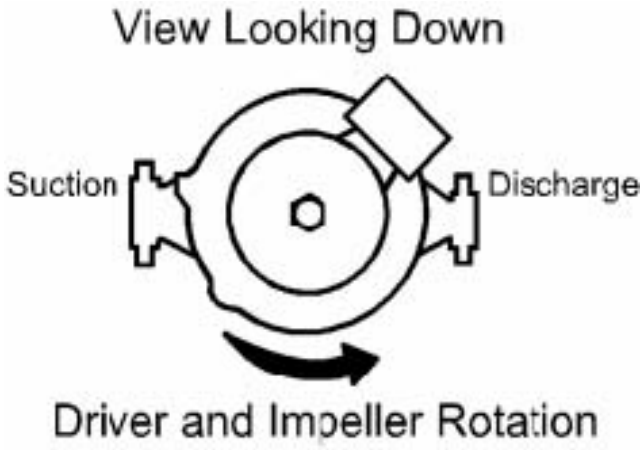


Figure 10. Direction of motor rotation

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. 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 NIKKISO VIP-806 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 corresponding 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.

Never operate the NIKKISO 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.

ALLOWABLE STARTS: 2 HOT & 1 COLD PER HOUR.

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 amp meter 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 mechanical or thermal flow rate as defined on the pump specification sheet. Operating below minimum flow rate will result in unstable surge conditions and excessive down thrust.

B. EMERGENCY STOPPING

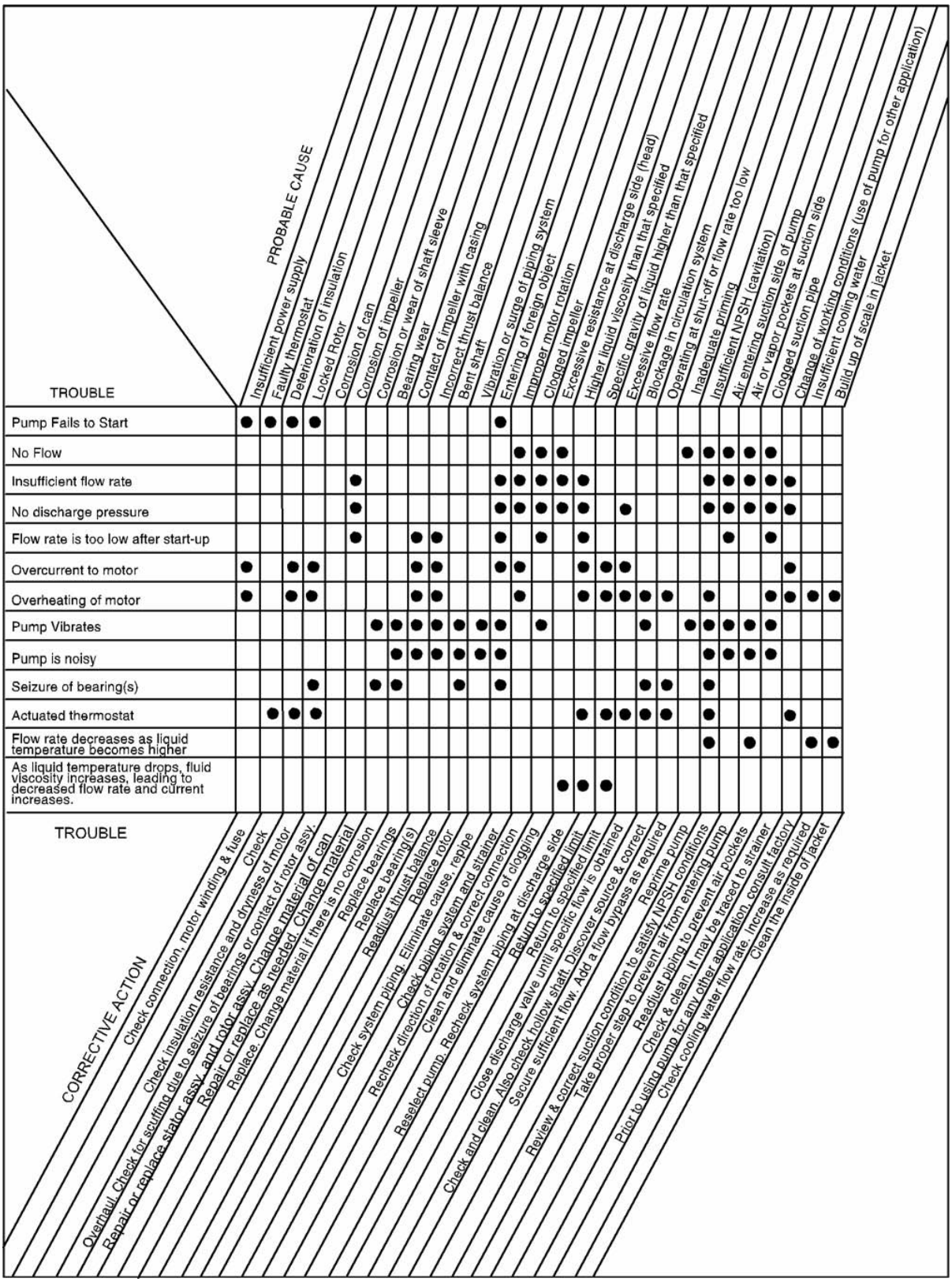
If the motor is wired correctly and the protective devices are in a serviceable condition, the pump will stop automatically if the temperature of the motor windings exceeds the thermostat setting. If this occurs, the cause could be as follows:

- 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.

2. TROUBLESHOOTING



4. MAINTENANCE

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

Before any work is performed on the pump it must be depressurized, drained, electrically disconnected, and made safe from both environmental and physical hazards. The pump/motor are very heavy. Be sure the hoist capacity is greater than 1200 pounds.

STEP 1
Remove the twelve (12) hex nuts (914A). Using a hoist, 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). Upon re-assembly, torque nuts to 200-220 ft-lbs.

STEP 2
Lower the upper assembly onto a workbench. Two hoists should be used to lay the motor section flat on the workbench with the adapter plate (30) overhanging the bench.

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

STEP 3

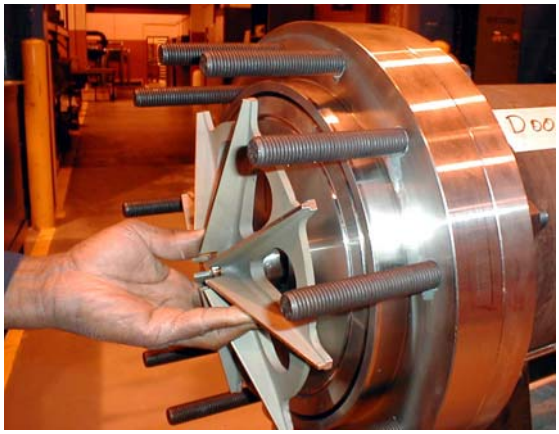
Prevent impeller (2) from turning and remove impeller nut (3), or hold impeller (2) and remove inducer (9) and inducer stud (10).

Note that the impeller nut has a left hand thread.

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 torquing the nut.

STEP 4

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



STEP 5

To avoid damage to thrust bearing, remove the bushing sleeve (250A) from the rotor before removing the adaptor (30).

STEP 6

Remove the eight (8) adaptor nuts (914B) and remove adaptor (30).

STEP 6 (continued)

Place adaptor on flat surface prior to removing bearing components.

STEP 7

Remove the lower thrust bearing (155A). The lower thrust bearing has 2 holes that align it to the pins of the bearing support plate (133). Check the bearing for damage or wear.

STEP 7 (continued)

Next remove o-ring (936EA).

STEP 7 (continued)

With the o-ring removed, the bearing support plate (133) is now removed. This plate has four pins. Two pins 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.

STEP 7 (continued)

Remove the throttle bushing (21) from the adaptor. One roll pin (14C) is installed in the cover to align the throttle bushing upon reassembly.

Check the flow ports on adaptor to insure no blockage exists.

STEP 7 (continued)

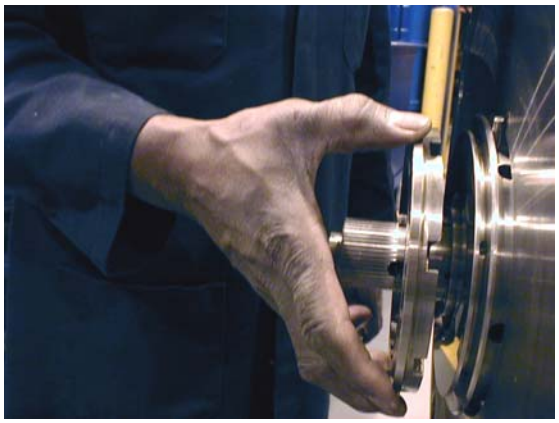
Remove the tilt washer (22) which aligns on two pins installed in the diffuser cover..

STEP 8

Remove sleeve (250B).

STEP 8 (continued)

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



STEP 9

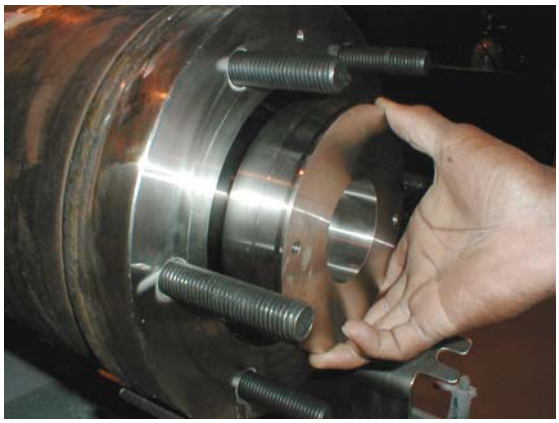
Moving to the other end of the motor, remove the six (6) upper housing nuts (914C) and the two (2) lifting eye nuts (925). Upon reassembly, torque nuts to 200 ft-lbs. (271 N.m).

STEP 10

Carefully remove the housing (230).

STEP 11

Carefully remove upper (118B) and lower (118A) bearing housing. Note position of anti-rotation clocking pin. Upon reassembly assure pin is aligned with notch in adapter (30).



STEP 12

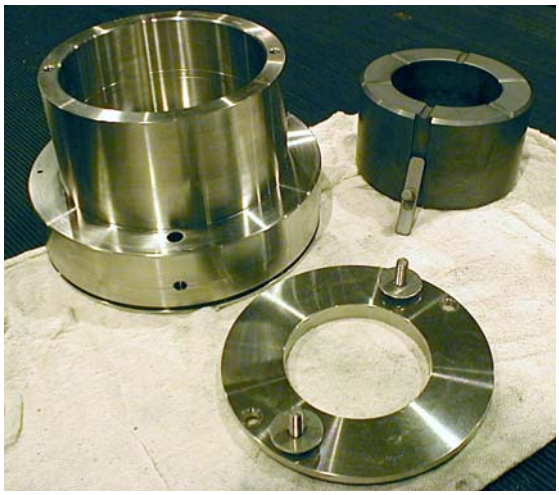
Straighten tab washers (152A & B) and remove bearing retainer screws (905C &D). Upon reassembly, torque screws to 95-102 in-lbs. (10-11.5 N.m)

STEP 13

Remove lower bearing retainer (112A & B).

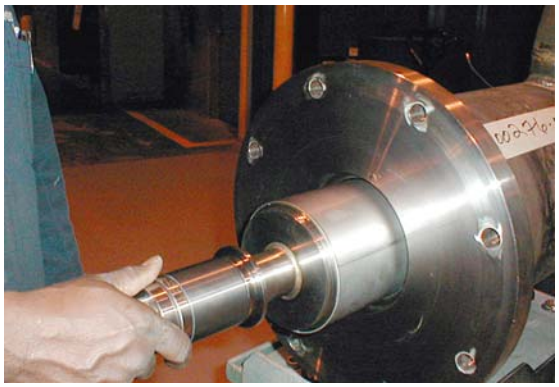
Remove and inspect the lower bearing (151A & B).

Remove and inspect the articulating anti-rotation key (14H).



STEP 14

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



The rotor assembly must be disassembled and reassembled on a clean, padded workbench. To prevent damage to the rotor can, the rotor must never be paced in a vise or other clamping mechanism.

STEP 14 (continued)

Remove rotor spacer sleeve (258B).

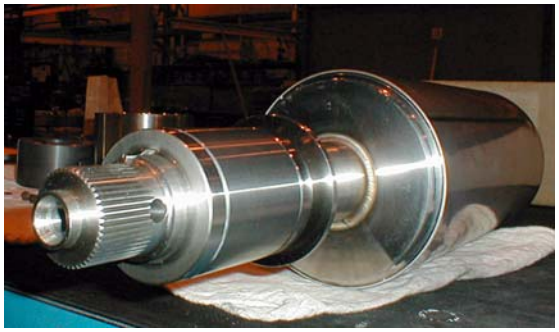
STEP 15

Remove auxiliary impeller key (920A).

Note that the key fits into the lower bearing sleeve (250C). Make sure key is fully inserted to assure proper fit later.

STEP 16

Remove lower bearing sleeve (250C) and sleeve spacer (258E).



STEP 17

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

Right hand threads on shaft end nut.

Upon reassembly, torque to 50 ft-lbs. (67 N.m).

Remove the end nut (915).

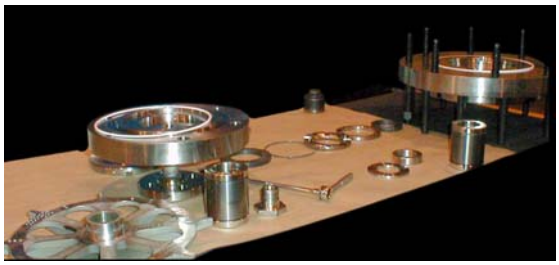
STEP 18

Remove upper bearing sleeve key (920B) and upper bearing sleeve (250D).

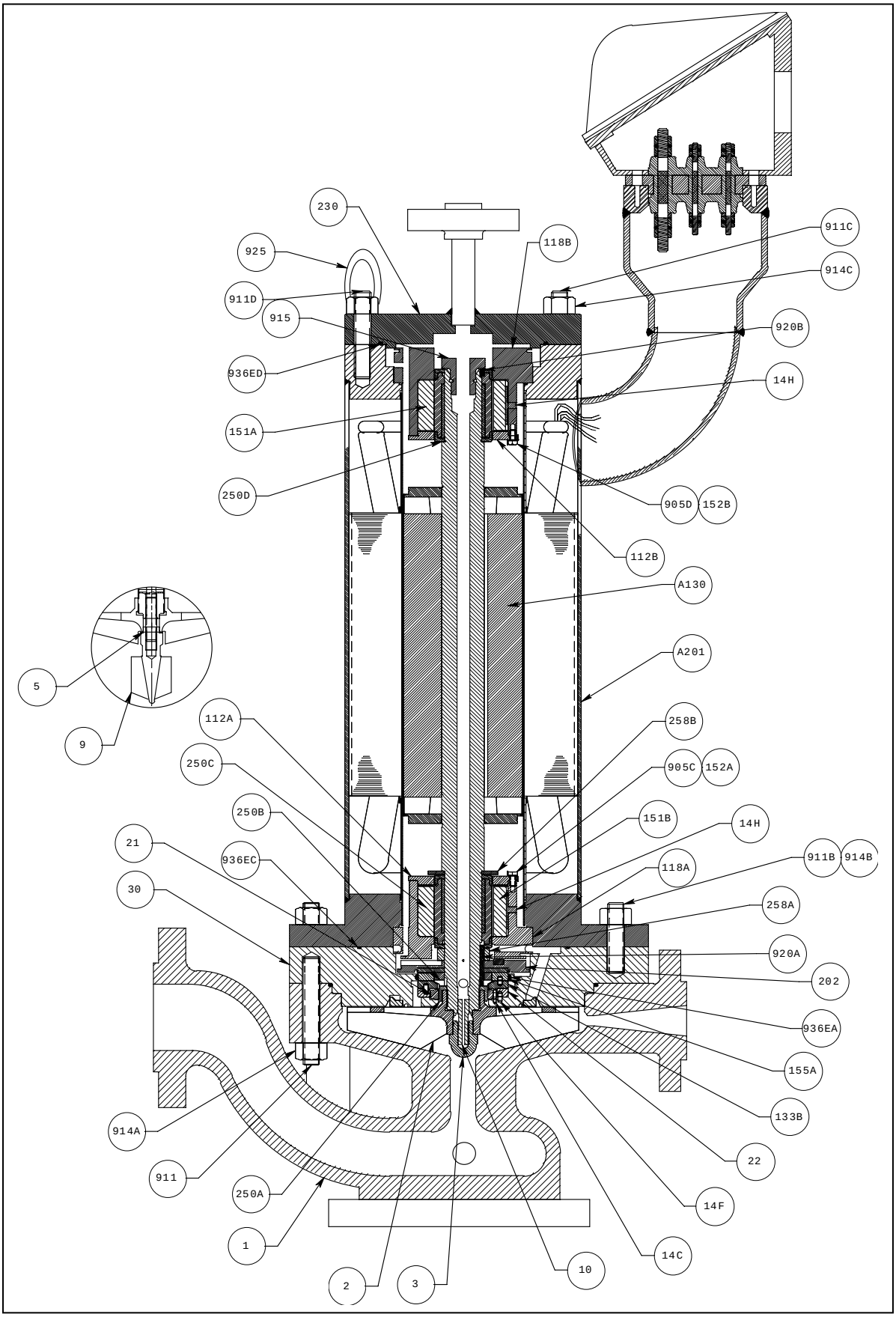
Note: Upon reassembly, make sure key aligns the notch in the bearing sleeve with the groove in the rotor shaft.

STEP 19

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



REASSEMBLE PUMP IN REVERSE ORDER


230
925
911D
915
936ED
151A
250D
118B
911C
914C
920B
14H
905D
152B
112B
A130
A201
258B
905C
152A
151B
14H
911B
914B
118A
258A
920A
202
936EA
155A
133B
22
14F
14C
10
3
2
1
250A
911
914A
30
21
936EC
250B
250C
112A
9
5

Parts List					
Module Item No.	**Description**	**Qty/ Unit**	**Recommended Spares**		
			Class		
905C	Screw, Ret. Lower Brg.	2			
905D	Screw, Ret. Lower Brg.	2			
914C	Nut, Upper Hsg.	6			
914B	Nut, Adaptor/Stator	8			
914A	Nut, Case Stud	10			
14D	Pin, TH Plate	2			
14F	Pin, Tilt Washer	2			
936A	O-Ring	1			
936EA	O-Ring	1			
936ED	O-Ring	1			
936EC	O-Ring	1			
925	Eye, Lifting	2			
30	Housing, Adaptor	1			
155A	Thrust, Brg, Lower	1			
151A	Brg , Jnl, Upper	1			
151B	Brg, Jnl, Lower	1			
21	Bush, Thtl, Impeller	1			
0	Guard, Heat Shield	1			
1	Housing, Pump Case	1			
118B	Housing, Brg, Upper	1			
118A	Housing, Brg, Lower	1			
230	Housing, Upper	1			
2	Impeller	1			
202	Impeller, Assy, Aux.	1			
9	Inducer	1			
920A	Key, Aux. Impeller	1			
920B	Key, Brg. Slv, Upper	1			
915	Nut, Shaft End	1			
14C	Pin, TH Bushing	1			
14H	Pin, Brg, Anti-Rotation	2			
14E	Pin, Clocking	1			
133B	Plate, Assy, Thr Brg.	1			
0	Plate, Ident	1			
0	Plate, Ident.	1			
112B	Retainer, Brg, Upper	1			
112A	Retainer, Brg, Lower	1			
A130	Rotor Assy	1			
250D	Sleeve, Brg, Upper	1			
250C	Sleeve, Brg, Lower	1			
250A	Sleeve, Thtl, Bush	1			
250B	Sleeve, Thst, Brg.	1			
258B	Spacer, Sleeve, Rotor	1			
258A	Spacer, Sleeve, Aux. Impeller	1			
911B	Stud, Adaptor/Stator	8			
911C	Stud, Upper Hsg.	4			
911D	Stud, Upper Hsg, Lift Lug	2			

Parts List					
Module Item No.	**Description**	**Qty/ Unit**	**Recommended Spares**		
			Class		
911	Stud, Case	10			
010	Stud, Inducer	1			
A201	Stator, Assembly	1			
0	Tag, Ident.	1			
22	Washer, Tilt	1			
152C	Washer, Tab, Brg Ret	2			
152B	Washer, Tab, Brg Ret.	2			
005	Washer, Tab, Inducer	1			

CRITICAL - STARTUP CHECKLIST

KNOW YOUR MACHINE

Prior to start-up of the NIKKISO VIP-806 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 the values listed on the specification sheet.

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