Troubleshooting for:

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Pay attention to possible faults.
Study the instructions carefully.

4.2 Fault finding

NOTE!
Study the maintenance instructions carefully before replacing worn parts. - See section 5.1 General maintenance

Problem	Cause/result	Remedy
Overloaded motor	- Pumping of viscous liquids - Pumping of liquids with high density - Low outlet pressure (counter pressure) - Lamination of precipitates from the liquid	- Larger motor or smaller impeller - Higher counter pressure (throttling) - Frequent cleaning
Cavitation: - Damage - Pressure reduction (sometimes to zero) - Increasing of the noise level	- Low inlet pressure - High liquid temperature	- Increase the inlet pressure - Reduce the liquid temperature - Reduce the pressure drop before the pump - Reduce speed
Leaking shaft seal	- Dry run (See 4.1 Operation/Control)	Replace: All wearing parts (See 5.1 General maintenance)
	- Incorrect rubber grade	If necessary: - Change rubber grade
	- Abrasive particles in the liquid	- Select stationary and rotating seal ring in Silicon Carbide/Silicon Carbide
Leaking seals	Incorrect rubber grade	Replace with seals of a different rubber grade

Troubleshooting for:

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14.0 TROUBLESHOOTING

Pump Does Not Deliver Liquid

- Pump not primed
- Pump suction pipe not completely filled with liquid
- Insufficient available NPSH
- Air pocket in suction line
- Inlet of suction pipe insufficiently submerged
- Pump operated with closed or partially closed suction valve
- Clogged suction strainer
- Obstruction in suction line
- Clogged impeller
- Speed of pump too low
- Wrong direction of rotation
- Impeller diameter smaller than specified
- Static head higher than shut-off head
- Total head of system higher than design of pump
- Parallel operation of pumps unsuitable for this purpose
- Viscosity of liquid differs from design conditions

Insufficient Capacity Delivered

- Pump suction pipe not completely filled with liquid
- Insufficient available NPSH
- Excessive amount of air or gas in liquid
- Air pocket in suction line
- Air leaks into suction line
- Air leaks into pump through mechanical seal
- Inlet of suction pipe insufficiently submerged
- Vortex formation at suction
- Pump operated with closed or partially closed suction valve
- Clogged suction strainer
- Obstruction in suction line
- Excessive friction losses in suction line
- Clogged impeller
- Two elbows in suction piping at 90° to each other, creating swirl and prerotation
- Speed of pump too low
- Wrong direction of rotation
- Uncalibrated instruments
- Impeller diameter smaller than specified
- Friction losses in discharge higher than calculated
- Total head of system higher than design of pump
- Viscosity of liquid differs from design conditions
- Foreign matter in impellers

Insufficient Pressure Developed

- Excessive amount of air or gas in liquid
- Air leaks into suction line
- Air leaks into pump through mechanical seal
- Inlet of suction pipe insufficiently submerged
- Vortex formation at suction
- Pump operated with closed or partially closed suction valve
- Clogged suction strainer
- Obstruction in suction line
- Excessive friction losses in suction line
- Clogged impeller
- Two elbows in suction piping at 90° to each other, creating swirl and pre-rotation
- Speed of pump too low
- Wrong direction of rotation
- Uncalibrated instruments
- Impeller diameter smaller than specified
- Specific gravity of liquid differs from design conditions
- Viscosity of liquid differs from design conditions
- Foreign matter in impellers

Pump Loses Prime After Starting

- Pump suction pipe not completely filled with liquid
- Excessive amount of air or gas in liquid
- Air leaks into suction line
- Air leaks into pump through mechanical seal
- Source of sealing liquid has air in it
- Inlet of suction pipe insufficiently submerged
- Vortex formation at suction

Excessive Power Consumption

- Pump speed too high
- Impeller diameter larger than specified
- Binding rotating element
- Impeller rubbing the casing or backcover
- Bent shaft
- The mechanical seal binding
- Specific gravity higher than anticipated
- Viscosity higher than anticipated
- Solids concentration higher than anticipated (Vortex only)
- The pump and driver shafts misaligned
- Wrong direction of rotation
- Uncalibrated instruments
- Total head of system higher than design of pump
- Total head of system lower than design of pump
- Running pump at too high a flow
- Foreign matter in propeller
- Misalignment

Cavitation

- Insufficient suction head available (NPSHA)
- Operating at a higher capacity than specified
- Excessive air or gas entrainment
- Vortexing in the pump suction or intake system
- Liquid temperature higher than the vapor temperature
- Air leak in the pump or suction line
- Partially plugged suction
- Elbow too close to the pump suction
- Temperature too low, thereby increasing liquid viscosity

Vibration

NOTE: The major frequency of the vibration can help to pinpoint the source

- Pump cavitatiion
- Worn ball bearings
- Impeller rubbing the casing bowl or backcover
- Shaft binding
- Bent shaft
- Impeller out of dynamic balance
- Pump and driver shafts severely out of alignment
- Insufficient bearing lubrication
- Worn motor bearings
- Pump improperly assembled
- A worn or defective discharge valve that may be fluttering
- Pump suction pipe not completely filled with liquid
- Clogged impeller
- Transients at suction source (imbalance between pressure at surface of liquid and vapor pressure at suction flange)
- Foundations insufficiently rigid
- Loose foundation bolts
- Loose pump or motor bolts
- Inadequate grouting of baseplate
- Excessive forces and moments from piping on pump nozzles
- Improperly mounted expansion joints
- Resonance between operating speed and natural frequency of foundation of baseplate or of piping
- Lack of lubrication of certain couplings
- Excessive grease or oil in anti-friction bearing housings
- Moisture contamination of lubricant

Pump Vibrates or is Noisy at High Flows

- Pump suction pipe not completely filled with liquid
- Insufficient available NPSH
- Vortex formation at suction
- Pump operated with closed or partially closed suction valve
- Clogged suction strainer
- Obstruction in suction line
- Excessive friction losses in suction line
- Clogged impeller
- Two elbows in suction piping at 90° to each other, creating swirl and pre-rotation
- Total head of system lower than design of pump
- Running pump at too high a flow (for low specific speed pumps)
- Excessive wear at internal running clearances

Pump Vibrates or is Noisy at Low Flows

- Pump suction pipe not completely filled with liquid
- Insufficient available NPSH
- Selection of pump with too high a suction specific speed
- Running the pump against a closed discharge valve without opening a by-pass
- Operating pump below recommended minimum flow
- Running pump at too low a flow (for high specific speed pumps)
- Parallel operation of pumps unsuitable for this purpose
- Excessive radial thrust in single-volute pumps

Premature Bearing Failure

- See Items under “Vibration”
- Frequency of lubrication is too low (grease), or the quantity of lubrication is insufficient
- Wrong type of oil or grease for the pump load, speed and temperature involved
- Inadequate water or air cooling to the bearing housing, cooling jacket, or heat exchanger
- Lubricant has undergone viscosity breakdown
- Lubricant contamination
- Bearing replacements that do not conform to the pump manufacturer’s specifications. See section 9.0
- Bearings improperly installed
- Pump cavitation. See items under “Cavitation”
- Belts on the belt drive too tight, causing excessive loading (Belt drive units only)
- Shaft diameter under the bearing inner race does not conform to the manufacturer’s specifications. See section 10.0.
- Bearing mounting diameter not conforming to the pump manufacturer’s specifications. See section 10.0.
- Excessive pipe stress
- Shaft misalignment with the driver causing excessive loading

Checks that can be made while the Pump is Inoperative

Partial or complete disassembly may be required

- Impeller Clearance
- Coupling Alignment
- Impeller Size
- System Obstructions (Check Valve)
- Pipe Stress
- Bearing Fits
- Mechanical Seal Condition
- Shaft Run-Out
- Wet End Inspection
- Condition of Lubricant
- Oil Level

Checks that can be made while the Pump is in Operation

- Rotation
- Foundation Condition
- Suction Pressure
- Discharge Pressure
- Speed
- Oil Temperature
- Amperage Draw
- Flow
- Vibration
- Listen for Unusual Noises
- Loose Fasteners
- Drive Noise

Troubleshooting for:

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Troubleshooting

If problems are encountered during start-up or pump operation, refer to the folowing table for likely causes:

Problem	Likely Cause	Remedy
No liquid delivered	Pump not primed	Re-prime pump, check that suction line is full of liquid
	Suction line obstructed	Remove obstruction
	Impeller clogged	Remove obstruction
	Wrong direction of rotation ***Note - Possible severe damage!***	Check rotation, change if necessary
	Foot valve or suction pipe has inadequate submergence	Check suction source for vortexing, correct as necessary
	Suction lift too high	Review/revise level on suction
Pump does not produce rated flow or head	Air leak through gasket	Replace gasket, tighten connections
	Air leak through stuffing box	Inspect packing/mechanical seal, add pressurized flush if necessary
	Impeller partially clogged	Remove obstruction
	Excessive impeller clearance	Adjust impeller clearance
	Inadequate suction head	Review/revise design
	Worn or damaged impeller	Inspect/replace as necessary
Pump starts then stops pumping	Pump improperly primed	Re-prime pump
	Air or vapor in suction line	Review/revise suction piping to eliminate air pockets
	Air leak in suction line	Check gaskets, repair leak
Bearings run hot	Improper alignment	Re-align pump and driver
	Improper lubrication	Check lubricant for applicability and level/quantity
	Bearing cooling not working	Check cooling water line(s)
Pump is noisy or vibrates	Improper alignment	Re-align pump and driver
	Partial impeller clog/imbalance	Remove obstruction
	Broken or bent impeller or shaft	Replace as necessary
	Foundation not rigid	Tighten hold-down bolts of base, pump and motor. Recheck alignment.
	Worn bearings	Replace as necessary
	Suction and/or discharge piping not anchored correctly	Review design, modify as necessary
	Pump cavitation	Review suction system, correct problem(s)
Excessive stuffing box leakage	Packing gland improperly adjusted	Tighten gland nuts
	Stuffing box not packed properly	Check, re-pack as necessary
	Shaft sleeve scored, ridged	Replace as necessary
	Worn mechanical seal	Replace as necessary
Excessive power required	Actual head lower than design	Throttle discharge valve slightly, trim impeller. Review design
	Liquid heavier than expected	Review design
	Stuffing box packing too tight	Re-pack pump
	Rotating parts binding	Check pump internals

Troubleshooting for:

HMD Kontro SEALLESS PUMPS

Sundyne Corporation

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SECTION 11

- FAULT FINDING -

11.01 This section is intended to highlight possible pump problems caused by system design inadequacies or incorrect operation.

11.02 The Sealless pump has all the characteristics of the conventional centrifugal pump but without the problems associated with the mechanical seals or packed glands.

11.03 Because the Sealless pump impeller is not coupled directly to the electric motor, it is inherently quiet so that any increase in noise is a good indication that there are problems.

11.04 Should it be necessary to dismantle a pump, please read through the disassembly instructions carefully.

11.05 No special tools[1] are required to dismantle an HMD/Kontro pump and no special skills are required as the pump is simple in design and robust in construction.

11.06 Refurbishing is by replacement and no attempt should be made to repair pump components by welding and re-machining.

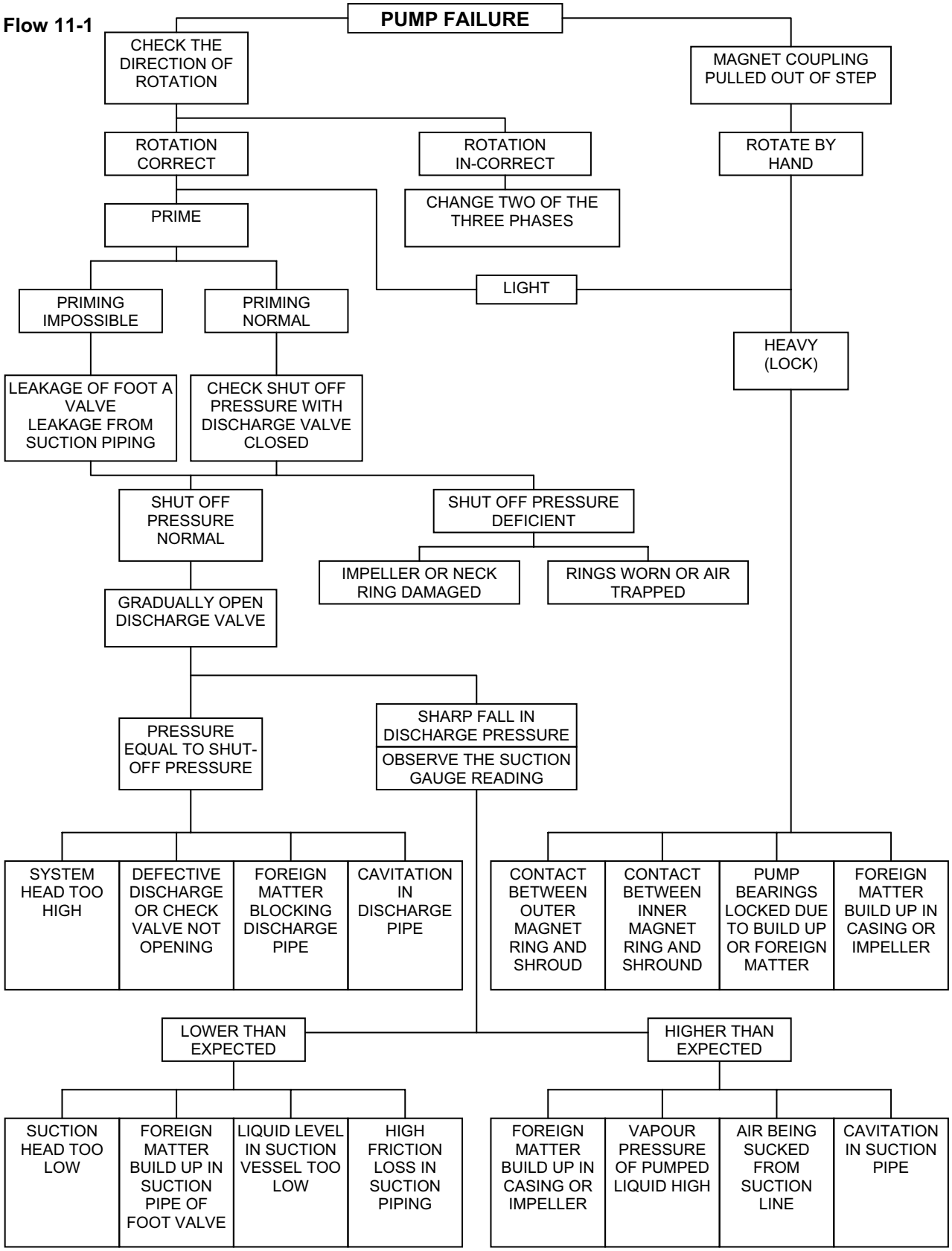
11.07 Clearances between the rotating components in the pump are comparatively large, so care must be taken not to scrap components before checking with the Maintenance Manual that the clearances are excessive.

11.08 Should circumstances cause the magnetic coupling to pull out of step, then **the motor must be stopped IMMEDIATELY** since continuous running out of step will damage the magnets.

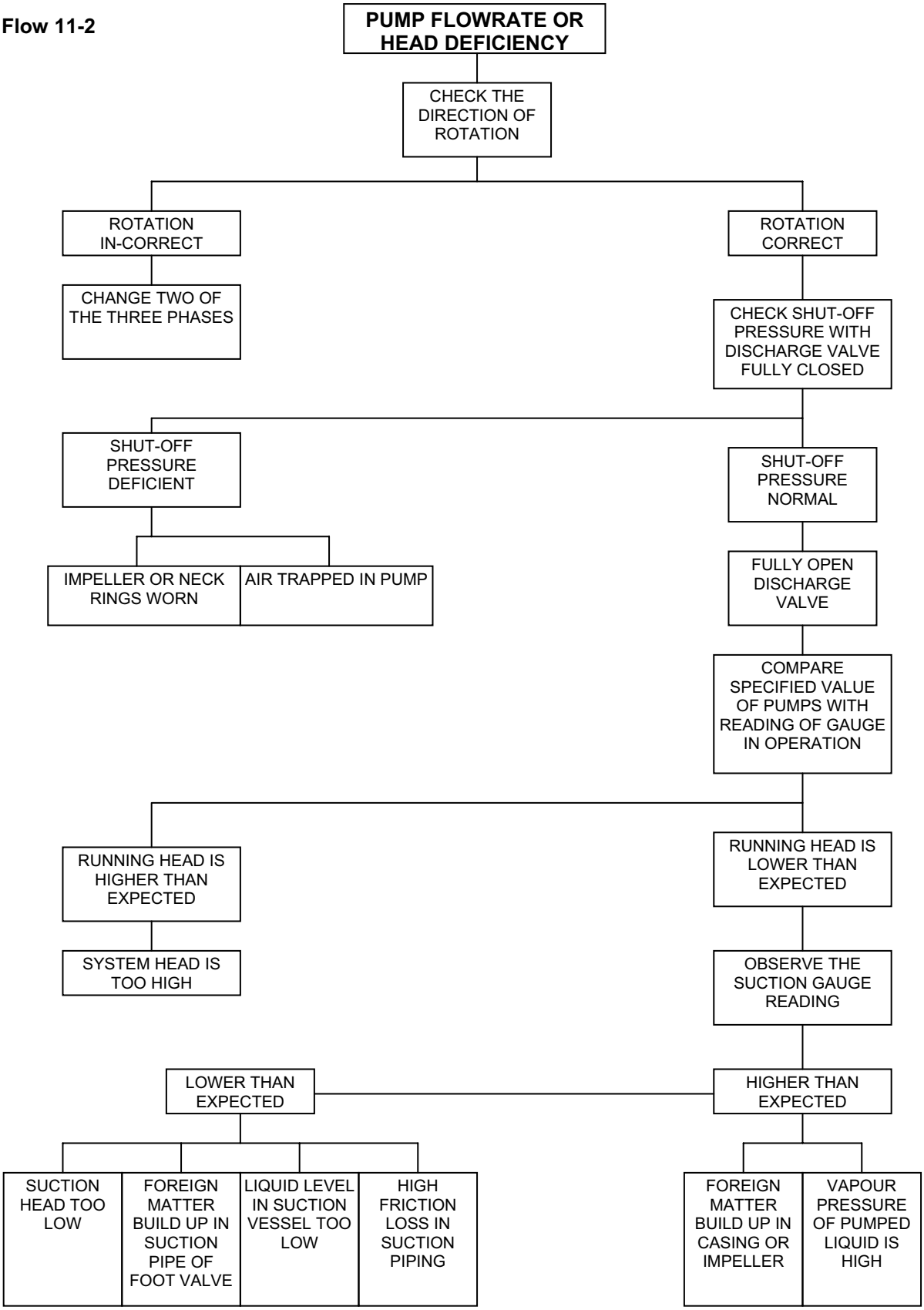
Refer to the Fault Finding Chart for symptoms, causes and remedies.

[1] Some custom engineered products may require the use of a (HMD/Kontro supplied) special tool.

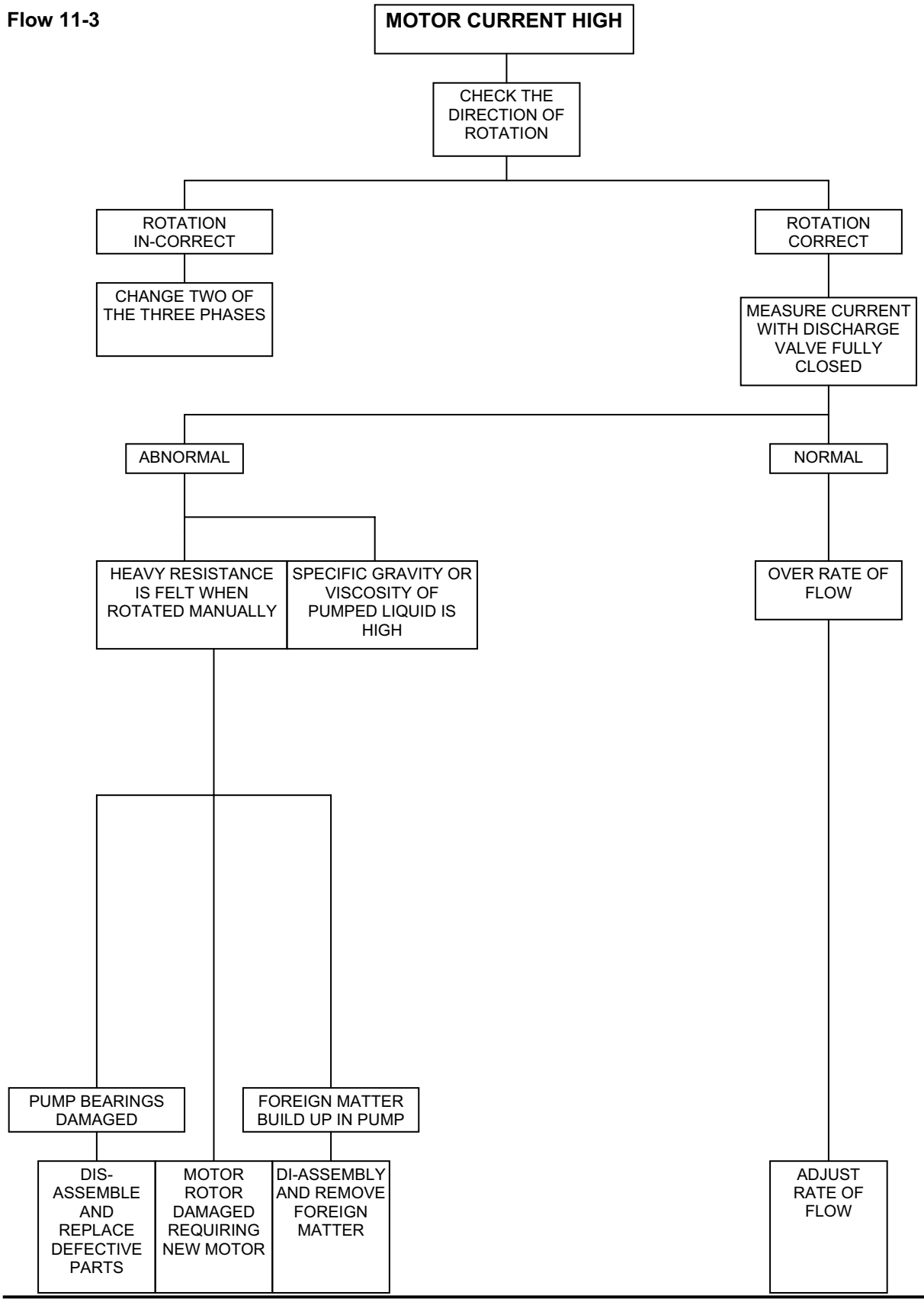
Flow 11-1


PUMP FAILURE
CHECK THE DIRECTION OF ROTATION
MAGNET COUPLING PULLED OUT OF STEP
ROTATION CORRECT
ROTATION IN-CORRECT
ROTATE BY HAND
CHANGE TWO OF THE THREE PHASES
PRIME
LIGHT
PRIMING IMPOSSIBLE
PRIMING NORMAL
HEAVY (LOCK)
LEAKAGE OF FOOT A VALVE LEAKAGE FROM SUCTION PIPING
CHECK SHUT OFF PRESSURE WITH DISCHARGE VALVE CLOSED
SHUT OFF PRESSURE NORMAL
SHUT OFF PRESSURE DEFICIENT
IMPELLER OR NECK RING DAMAGED
RINGS WORN OR AIR TRAPPED
GRADUALLY OPEN DISCHARGE VALVE
PRESSURE EQUAL TO SHUT-OFF PRESSURE
SHARP FALL IN DISCHARGE PRESSURE
OBSERVE THE SUCTION GAUGE READING
SYSTEM HEAD TOO HIGH
DEFECTIVE DISCHARGE OR CHECK VALVE NOT OPENING
FOREIGN MATTER BLOCKING DISCHARGE PIPE
CAVITATION IN DISCHARGE PIPE
CONTACT BETWEEN OUTER MAGNET RING AND SHROUD
CONTACT BETWEEN INNER MAGNET RING AND SHROUND
PUMP BEARINGS LOCKED DUE TO BUILD UP OR FOREIGN MATTER
FOREIGN MATTER BUILD UP IN CASING OR IMPELLER
LOWER THAN EXPECTED
HIGHER THAN EXPECTED
SUCTION HEAD TOO LOW
FOREIGN MATTER BUILD UP IN SUCTION PIPE OF FOOT VALVE
LIQUID LEVEL IN SUCTION VESSEL TOO LOW
HIGH FRICTION LOSS IN SUCTION PIPING
FOREIGN MATTER BUILD UP IN CASING OR IMPELLER
VAPOUR PRESSURE OF PUMPED LIQUID HIGH
AIR BEING SUCKED FROM SUCTION LINE
CAVITATION IN SUCTION PIPE

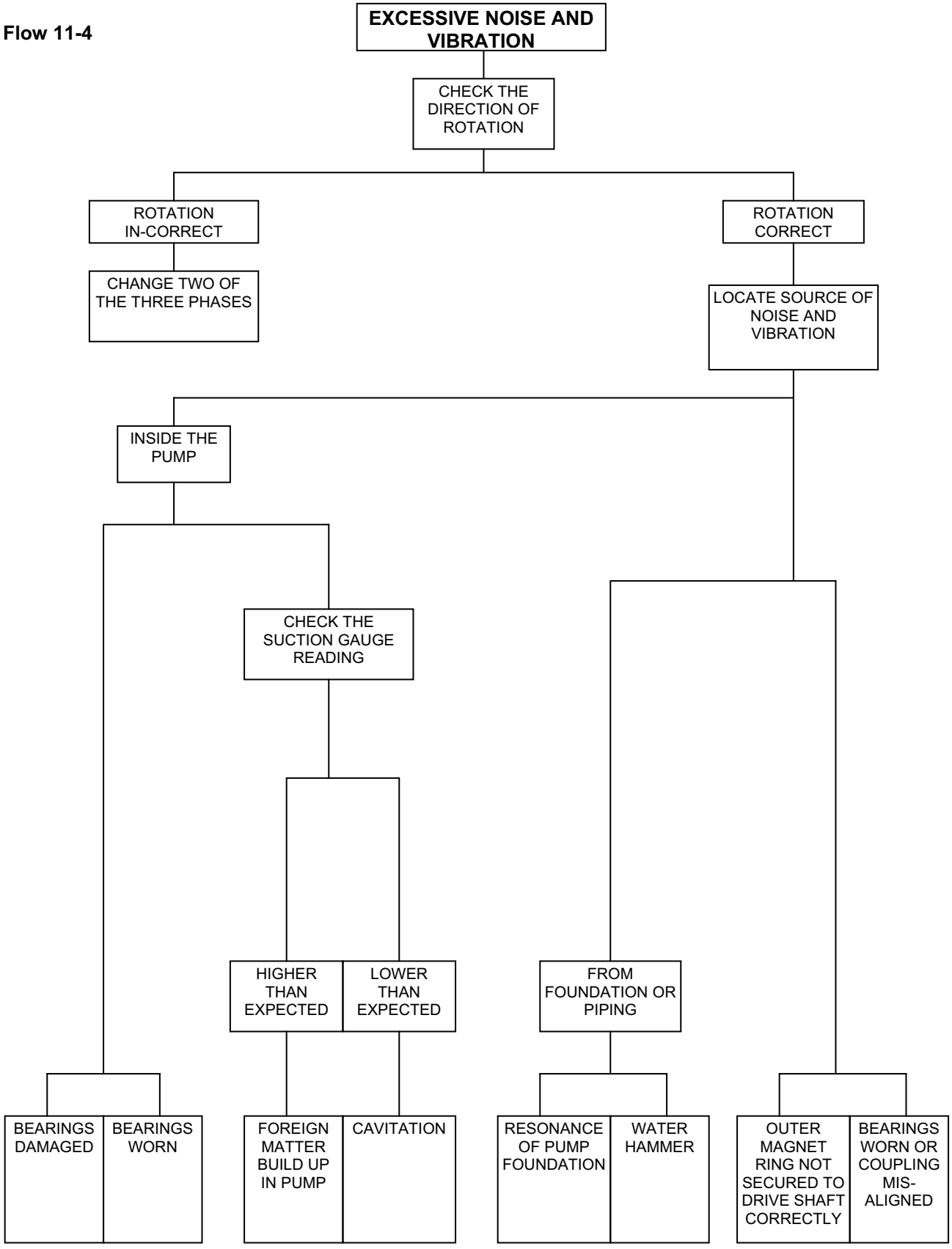
Flow 11-2


PUMP FLOWRATE OR HEAD DEFICIENCY
CHECK THE DIRECTION OF ROTATION
ROTATION IN-CORRECT
CHANGE TWO OF THE THREE PHASES
ROTATION CORRECT
CHECK SHUT-OFF PRESSURE WITH DISCHARGE VALVE FULLY CLOSED
SHUT-OFF PRESSURE DEFICIENT
IMPELLER OR NECK RINGS WORN
AIR TRAPPED IN PUMP
SHUT-OFF PRESSURE NORMAL
FULLY OPEN DISCHARGE VALVE
COMPARE SPECIFIED VALUE OF PUMPS WITH READING OF GAUGE IN OPERATION
RUNNING HEAD IS HIGHER THAN EXPECTED
SYSTEM HEAD IS TOO HIGH
RUNNING HEAD IS LOWER THAN EXPECTED
OBSERVE THE SUCTION GAUGE READING
LOWER THAN EXPECTED
HIGHER THAN EXPECTED
SUCTION HEAD TOO LOW
FOREIGN MATTER BUILD UP IN SUCTION PIPE OF FOOT VALVE
LIQUID LEVEL IN SUCTION VESSEL TOO LOW
HIGH FRICTION LOSS IN SUCTION PIPING
FOREIGN MATTER BUILD UP IN CASING OR IMPELLER
VAPOUR PRESSURE OF PUMPED LIQUID IS HIGH

Flow 11-3


MOTOR CURRENT HIGH
CHECK THE DIRECTION OF ROTATION
ROTATION IN-CORRECT
ROTATION CORRECT
CHANGE TWO OF THE THREE PHASES
MEASURE CURRENT WITH DISCHARGE VALVE FULLY CLOSED
ABNORMAL
NORMAL
HEAVY RESISTANCE IS FELT WHEN ROTATED MANUALLY
SPECIFIC GRAVITY OR VISCOSITY OF PUMPED LIQUID IS HIGH
OVER RATE OF FLOW
PUMP BEARINGS DAMAGED
FOREIGN MATTER BUILD UP IN PUMP
DIS-ASSEMBLE AND REPLACE DEFECTIVE PARTS
MOTOR ROTOR DAMAGED REQUIRING NEW MOTOR
DI-ASSEMBLY AND REMOVE FOREIGN MATTER
ADJUST RATE OF FLOW

Flow 11-4


EXCESSIVE NOISE AND VIBRATION
CHECK THE DIRECTION OF ROTATION
ROTATION IN-CORRECT
CHANGE TWO OF THE THREE PHASES
ROTATION CORRECT
LOCATE SOURCE OF NOISE AND VIBRATION
INSIDE THE PUMP
CHECK THE SUCTION GAUGE READING
HIGHER THAN EXPECTED
LOWER THAN EXPECTED
FROM FOUNDATION OR PIPING
BEARINGS DAMAGED
BEARINGS WORN
FOREIGN MATTER BUILD UP IN PUMP
CAVITATION
RESONANCE OF PUMP FOUNDATION
WATER HAMMER
OUTER MAGNET RING NOT SECURED TO DRIVE SHAFT CORRECTLY
BEARINGS WORN OR COUPLING MIS-ALIGNED

Troubleshooting for:

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Problem	Symptoms	Cause	Remedy
Liquid is not being pumped	No suction or discharge pressure. Pump power usage is very low.	Pump not primed	Re-prime pump and verify that suction pipe is full of liquid. Check the suction pipe for high points that can trap air.
	Suction gauge reads much lower than normal.	Suction pipe clogged	Confirm that any suction valves or control valves are not stuck shut. Inspect suction pipe for blockage.
	Suction gauge reads normal. Pump generates full discharge pressure but no flow.	Discharge pipe clogged	Confirm that any discharge valves or control valves are not stuck shut. Inspect discharge pipe for blockage.
	Discharge pressure is only slightly higher than suction pressure.	Clogged impeller	Open pump and clear blockage from impeller.
	No discharge pressure. Pump makes a loud buzzing noise. Increased vibration	De-coupled impeller	Shut off pump. Verify that the motor spins smoothly by hand. If motor will not spin by hand, open pump for inspection. If motor spins by hand, confirm that the impeller is sized for operating conditions and liquid specific gravity. Verify the viscosity of the liquid is not too high. Impeller or outer magnet may be weakened if overheated.
	Pump generates full discharge pressure but no flow. Pump casing and pipes immediately before and after pump heat up.	Head requirement higher than anticipated / Undersized impeller	Confirm than discharge line is not blocked or valve is not stuck shut. Pump may require a larger impeller to overcome system head.
Pump not delivering desired head or flow	Suction pressure is negative. (Gauge pressure) Discharge pressure is lower than normal.	Air leak in suction line	Locate and seal the air leak.
	Discharge pressure is lower than normal. Flow rate is decreased. Pump is noisy. Increased vibration.	Insufficient NPSH	Check liquid level in suction tank. Check suction piping for restrictions, or obstructions. Verify vapor pressure and temperature of process liquid. Pump should be located as close to the source as possible.
	Discharge pressure is lower than normal. Flow is reduced.	Backwards rotation	Verify motor rotation and correct if necessary.
	Pump does not reach desired flow rate.	Head requirement higher than anticipated / Undersized impeller	Increase impeller size or motor speed
	Suction gauge is very low.	Strainer device is full / clogged (if equipped).	Clean / empty strainer basket.
Pump starts, then stops pumping	Discharge pressure rises then falls. Pump power usage is very low after pressure drops.	Pump not properly primed	Re-prime pump and verify that suction pipe is full of liquid. Verify there are no high points in suction pipe that can trap air.
	Discharge pressure rises then falls. Pump makes a loud buzzing noise. Increased vibration	De-coupled impeller	Confirm that the impeller is sized for operating conditions and liquid specific gravity. Verify the viscosity of the liquid is not too high. Impeller assembly or outer magnet may be weakened if overheated.
	Pump operated normally but stops pumping & loses prime. Pump will not run until priming chamber is re-filled.	Suction pipe volume too large for priming chamber	Calculate volume of the suction pipe. It is recommended that the priming chamber volume should be 3 times the suction pipe volume. Decrease suction pipe volume. Move pump closer to source

Problem	Symptoms	Cause	Remedy
Pump uses excessive power	Burning smell coming from back of pump	Outer magnet installed improperly	Confirm that the groove on the outer drive lines up with the edge of the adapter and is properly tightened.
	Decreased flow. High power consumption. High vibration. Noisy operation	Damaged or broken wear rings	Inspect the pump and replace damaged components.
	Pump delivers the required flow and head but power consumption is high. High discharge pressure.	Specific Gravity or viscosity higher than expected.	Determine liquid viscosity and specific gravity. Verify the actual power consumption is correct.
	Pump delivers the required head, operates normally. Discharge pressure will be lower if head requirement is lower than anticipated.	Flow is higher than expected. Required head is lower than rated head.	Verify flow with instrumentation or batch cycle time and adjust as needed.
	Pump will produce the rated flow. Discharge head may be decreased. Power will be higher.	Clogged thrust balancing passages in impeller	Open pump and clean blockage from groves in between the impeller and bushings.
Pump is noisy or vibrates	No discharge pressure. Pump makes a loud buzzing noise. Increased vibration	De-coupled impeller	Shut off pump. Verify that the motor spins smoothly by hand. If motor will not spin by hand, open pump for inspection. If motor spins by hand, confirm that the impeller is sized for operating conditions and liquid specific gravity. Verify the viscosity of the liquid is not too high. Impeller or outer magnet may be weakened if overheated.
	Flow and head are normal, Pump or pipes vibrate	Piping or pump not properly anchored	Tighten mounting bolts on pump feet and base plate. Confirm that the suction and discharge pipes are properly supported per Hydraulic Institute recommendations.
	Discharge pressure is lower than normal. Flow rate is decreased. Pump is noisy. Increased vibration.	Insufficient NPSH / pump is cavitating	Check liquid level in suction tank. Check suction piping for restrictions, or obstructions. Verify vapor pressure and temperature of process liquid. Pump should be located as close to the source as possible.
	Discharge pressure may be lower than normal. Flow rate may be decreased. Increased vibration.	Partially clogged impeller is unbalanced	Open pump and clear blockage from impeller.

Troubleshooting for:

Liquiflo
Chemical Processing Pumps

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Appendix 5: Troubleshooting Guide

Problem	Possible Cause	Corrective Action
No discharge	Pump not primed	Verify suction pipe is submerged. Increase suction pressure. Open suction valve.
	Wrong direction of rotation	Reverse motor leads.
	Valves closed	Open all suction and discharge valves.
	Bypass valve open	Close bypass valve.
	Air leak in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Clogged strainer	Clean strainer.
	Clogged impeller	Disassemble and remove blockage.
	Impeller greatly worn or damaged	Disassemble and replace impeller.
Insufficient discharge	Suction pressure too low	Increase suction pressure. Verify suction piping is not too long. Fully open any suction valves.
	Bypass valve open	Close bypass valve.
	Partly clogged strainer	Clean strainer.
	Partly clogged impeller	Disassemble and remove blockage.
	Speed too low	Increase driver speed, if possible. Use larger size pump, if required.
	Impeller worn or damaged	Disassemble and replace impeller.
Loss of suction after satisfactory operation	Pump not properly primed	Reprime pump.
	Air leaks in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Air or vapor pockets in suction line	Rearrange piping as necessary.
	Increase in fluid viscosity	Heat fluid to reduce viscosity. Reduce pump speed.
Excessive power consumption	Fluid viscosity higher than specified	Heat fluid to reduce viscosity. Reduce pump speed. Increase driver horsepower.
	Liquid specific gravity higher than expected	Reduce pump speed. Increase driver horsepower.
	Total head greater than specified	Increase pipe diameter. Decrease pipe run.
	Total head lower than specified, pumping higher flow than expected	Install throttle valve.
	Total head higher than rating with flow at rating	Install impeller with correct diameter.
	Rotating parts binding or severely worn	Disassemble and replace worn parts.

Appendix 5: Troubleshooting Guide (Continued)

Problem	Possible Cause	Corrective Action
Rapid pump wear	Abrasives in fluid	Install suction strainer. Limit solids concentration. Reduce pump speed or use larger pump running at lower speed.
	Corrosion wear	Use materials of construction that are acceptable for fluid being pumped.
	Extended dry running	Install power sensor to stop pump.
	Discharge pressure too high	Increase pipe diameter. Decrease pipe run.
Excessive noise and vibration	Partly clogged impeller causing imbalance	Disassemble and remove blockage.
	Damaged impeller and/or shaft	Disassemble and replace damaged parts.
	Suction and/or discharge piping not anchored or properly supported	Anchor per Hydraulic Institute Standards.
	Base not rigid enough	Tighten hold-down bolts on pump and motor or adjust stilts. Inspect grout and regrout if necessary.
	Worn motor bearings	Replace bearings or motor.
	Pump cavitation	Increase NPSH available.
Excessive product leakage	Static seal failure caused by chemical incompatibility or thermal breakdown	Use O-rings or gaskets made of material compatible with fluid and temperature of the application.
	Static seal failure caused by improper installation	Install O-rings or gaskets without twisting or bending. Use star-pattern torque sequence on housing bolts during assembly. Allow Teflon O-rings to cold flow and seat during tightening. Torque bolts to specification.
	Mechanical seal worn or damaged	Disassemble and replace mechanical seal. Prime pump and avoid dry running.
	Pump port connections not properly sealed	Use Teflon tape or other suitable sealant. Use gaskets compatible with fluid and temperature of the application.
	Crevice corrosion of pump housing material	Only pump chemical fluids that are compatible with the pump housing material. Decrease temperature to reduce corrosion rate to acceptable value. Flush idle pumps that are used to pump corrosive chemicals, such as acids and caustics. Eliminate contaminants in the fluid that can accelerate corrosion wear.

Appendix 4: Troubleshooting Guide

Problem	Possible Cause	Corrective Action
No discharge	Pump not primed	Verify suction pipe is submerged. Increase suction pressure. Open suction valve.
	Wrong direction of rotation	Reverse motor leads.
	Valves closed	Open all suction and discharge valves.
	Bypass valve open	Close bypass valve.
	Air leak in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Clogged strainer	Clean strainer.
	Clogged impeller	Disassemble and remove blockage.
	Impeller greatly worn or damaged	Disassemble and replace impeller.
	Magnetic coupling has decoupled	Stop driver and check temperature and viscosity of fluid. Stronger magnetic coupling may be needed.
Insufficient discharge	Suction pressure too low	Increase suction pressure. Verify suction piping is not too long. Fully open any suction valves.
	Bypass valve open	Close bypass valve.
	Partly clogged strainer	Clean strainer.
	Partly clogged impeller	Disassemble and remove blockage.
	Speed too low	Increase driver speed, if possible. Use larger size pump, if required.
	Impeller worn or damaged	Disassemble and replace impeller.
Loss of suction after satisfactory operation	Pump not properly primed	Reprime pump.
	Air leaks in suction line	Tighten connections. Apply sealant to all threads. Verify suction pipe is submerged.
	Air or vapor pockets in suction line	Rearrange piping as necessary.
	Increase in fluid viscosity	Heat fluid to reduce viscosity. Reduce pump speed.
Excessive power consumption	Fluid viscosity higher than specified	Heat fluid to reduce viscosity. Reduce pump speed. Increase driver horsepower.
	Liquid specific gravity higher than expected	Reduce pump speed. Increase driver horsepower.
	Total head greater than specified	Increase pipe diameter. Decrease pipe run.
	Total head lower than specified, pumping higher flow than expected	Install throttle valve.
	Total head higher than rating with flow at rating	Install impeller with correct diameter.
	Rotating parts binding or severely worn	Disassemble and replace worn parts.

Appendix 4: Troubleshooting Guide (Continued)

Problem	Possible Cause	Corrective Action
Rapid pump wear	Abrasives in fluid	Install suction strainer. Limit solids concentration. Reduce pump speed or use larger pump running at lower speed.
	Corrosion wear	Use materials of construction that are acceptable for fluid being pumped.
	Extended dry running	Install power sensor to stop pump.
	Discharge pressure too high	Increase pipe diameter. Decrease pipe run.
Excessive noise and vibration	Partly clogged impeller causing imbalance	Disassemble and remove blockage.
	Damaged impeller and/or shaft	Disassemble and replace damaged parts.
	Suction and/or discharge piping not anchored or properly supported	Anchor per Hydraulic Institute Standards.
	Base not rigid enough	Tighten hold-down bolts on pump and motor or adjust stilts. Inspect grout and regrout if necessary.
	Worn pump bearings	Replace bearings.
	Worn motor bearings	Replace bearings or motor.
	Pump cavitation	Increase NPSH available.
Excessive product leakage	Static seal failure caused by chemical incompatibility or thermal breakdown	Use O-rings or gaskets made of material compatible with fluid and temperature of the application.
	Static seal failure caused by improper installation	Install O-rings or gaskets without twisting or bending. Use star-pattern torque sequence on housing bolts during assembly. Allow Teflon O-rings to cold flow and seat during tightening. Torque bolts to specification.
	Pump port connections not properly sealed	Use Teflon tape or other suitable sealant. Use gaskets compatible with fluid and temperature of the application.
	Crevice corrosion of pump housing material	Only pump chemical fluids that are compatible with the pump housing material. Decrease temperature to reduce corrosion rate to acceptable value. Flush idle pumps that are used to pump corrosive chemicals, such as acids and caustics. Eliminate contaminants in the fluid that can accelerate corrosion wear.

Troubleshooting for:

NIKKISO

115 Hilton Street West • Easton, PA 18042 USA • (800)854-0539 • fax: (800)926-9508 • http://www.ProcessFlo.com

5 Troubleshooting

5.1 Troubleshooting

Table 5-1 summarizes various indications of pump problems, their probable causes, and remedies. In general, problems are the result of multiple interacting causes, making it difficult to isolate the specific cause(s). Use this table as a reference. If you cannot isolate the problem, contact NIKKISO.

Table 5-1 Troubleshooting (for all types)

Symptom	Probable cause		Remedy
1. Bearing wears out prematurely (short bearing life).	1.1 Process liquid contains foreign matter (pipe rust, sludge, etc.).		a Install a strainer (60-80 mesh) in the pump suction piping.
	1.2 Insufficient lubrication	(1) Insufficient air venting of the pump and motor chamber	a. Vent air completely, as described in this manual.
		(2) Cavitation of the main impeller	a. Check NPSH Available. (Measure suction pressure and temperature.)
			b. Attach an inducer.
			c. Replace impeller and/or inducer if visible signs of deterioration over time can be observed.
		(3) Cavitation of the auxiliary impeller (in the case of high-temperature type or slurry-separation type)	a. Prevent cavitation of the main impeller. (Check NPSH Available.)
			b. Check the back-flushing liquid pressure.
		(4) Entrainment of gas (2-phase flow liquid, etc.).	a. Check the pump suction conditions (NPSH Available) and prevent entry of gas.
		(5) Decrease in circulation flow	a. Clean the inside of circulation piping.
			b. Clean the internal filter.
			c. Replace auxiliary impeller if its performance has degraded (due to corrosion and erosion).
		(6) Improper liquid properties (low viscosity, low specific heat, etc.)	a. Change the bearing and/or shaft sleeve material.
			b. Change the pump configuration. (Change to reverse-circulation type, slurry-handling type, etc. may be necessary. Contact NIKKISO.)

Symptom	Probable cause		Remedy
1. Bearing wears out prematurely (short bearing life).(Cont.)	1.3 Excessive contact pressure	(1) Excessive radial load	a. Check that operating flow is within the proper range. (Check that flow is neither excessive nor less than the minimum)
			b. Check rotating parts (impeller, inducer, rotor, etc.) for dynamic balance. Make corrections as necessary.
		(2) Excessive thrust load	a. Adjust back-flushing pressure to the value in the specifications (for the slurry-handling type).
			b. Adjust reverse flow and pressure to the values in the specifications (for the reverse-circulation type).
			c. Replace impeller and/or casing if visible signs of deterioration over time can be observed.
			d. At the time of a periodical inspection or the like, return pump to NIKKISO for thrust balance adjustment.
	1.4 Liquid properties	(1) Foreign matter (polymers, deposits, etc.) sticking to bearing and/or shaft sleeve	a. Improve liquid properties (temperature condition, etc.).
			b. Change pump configuration (contact NIKKISO).
		(2) Corrosion of bearing, shaft sleeve, thrust washer, etc.	a. Change the materials used.
2. Increase in motor current	2.1 Increased liquid load	(1) Changes in liquid properties (large specific gravity, high viscosity)	a. Check liquid properties.
			b. Size up the motor.
		(2) Increase of pump flow (process flow, pump internal circulation flow)	a. Check process operating conditions.
			b. Disassemble pump and check internal parts.
		(3) Increase in pump internal fluid resistance (roughening of internal surfaces due to corrosion, erosion, and/or adhesion of foreign matter).	a. Disassemble pump and check casing and impeller. (If surfaces have become rough, refine with sandpaper or by machining. If badly damaged, replace with new part.)

Symptom	Probable cause			Remedy
2. Increase in motor current (Continued)	2.2 Increased mechanical loss	2.2.1 Motor side	(1) Abnormal symptoms on the bearing sliding surface (wear, adhesion of foreign matter, corrosion)	a. Replace bearing, shaft sleeve, thrust washer, etc.
				b. Remove cause of bearing wear.
			(2) Loosening of the bearing retaining section	a. Tighten bolts.
			(3) Contact of rotor with stator	a. Check rotor and stator can surfaces. (Check for abnormal symptoms such as swelling, etc.)
				b. Remove cause of bearing wear. Refer to Section 4.3, "Inspecting the Bearing."
		2.2.2 Pump side	(1) Contact of impeller with casing	a. Check shaft for bending. (If bent, correct or replace.)
			(2) Adhesion of foreign matter	a. Remove pump casing and check for presence of foreign matter inside the pump.
	2.3 Abnormal symptoms in motor section	2.3.1 Stator	(1) Decrease in insulation resistance (due to moisture absorption) (2) Unbalance of resistance between windings (3) Lack of phase (short-circuit)	a. Measure insulation resistance and winding resistance.
				b. Dry by blowing N2 gas into the stator (or by other means).
				c. If insulation resistance and winding resistance cannot be corrected, replace stator.
			(4) Attachment of metal onto the stator can surfaces	a. Disassemble and check the motor section. Clean and remove any attached metal.
		2.3.2 Rotor	(1) Attachment of metal onto the rotor can surfaces	
			(2) Breakdown of rotor bars	a. Replace rotor.
		(1) Loosening of terminal bolt connections		a. Check tightness of connections in the terminal box, and tighten if loose.
	2.4 Electric wires	(1) Voltage fluctuation (2) Frequency fluctuation (3) Voltage unbalance between phases		a. Check electric wires.
	2.5 Instruments	(1) Ammeter defective		a. Check ammeter. (Replace ammeter.)

Symptom	Probable cause		Remedy
3. Locked rotor (Rotor does not turn.)	3.1 Locking of casing and impeller (inducer)	(1) Adhesion of foreign matter (of relatively large size)	a. Disassemble pump and remove foreign matter.
			b. Install a suction strainer.
		(2) Bearing wear	a. Replace bearing (shaft sleeve).
			b. Remove cause of bearing wear. Refer to Section 4.3, "Inspecting the Bearing."
			c. Check the bearing monitor periodically.
		(3) Bending of shaft (more than 10/100 mm)	a. Correct the bend. (Or replace shaft.)
		(4) Decreased eccentricity of rotating parts (impeller, inducer) and stationary parts (casing)	a. Measure eccentricity; if abnormal, replace parts.
	3.2 Locking of stator liner and rotor sleeve	(1) Adhesion of foreign matter (foreign matter sticking to the can)	a. Install a suction strainer.
			b. Check liquid properties.
		(2) Swelling and deformation of stator can (due to high temperature)	a. Check liquid temperature.
			b. Check jacket or heat exchanger cooling water flow.
		(3) Swelling of rotor can (corrosion, weld pinhole)	a. Check the welds using a liquid penetrant.
			b. In the case of corrosion, change the can material.

Symptom	Probable cause		Remedy
3. Locked rotor (Rotor does not turn.) (Continued)	3.3 Locking of bearing and shaft sleeve	(1) Abnormal wear (sticking) of bearing	a. Remove cause of bearing wear. Refer to Section 4.3, "Inspecting the Bearing."
		(2) Adhesion of foreign matter	a. Install a suction strainer. Check liquid properties.
		(3) Deposition and sticking of foreign matter	
		(4) Improper bearing clearance (due to difference of thermal expansion)	a. Change material and dimensions of bearing (shaft sleeve).
	3.4 Others	(1) Motor burn-out	a. Replace stator.
		(2) Rotor bar breakage	b. Replace rotor.
		(3) Insufficient motor starting torque	c. Check motor starting characteristics and load characteristics.
		(4) Voltage drop in power source	d. Check power source.
4. Thermostat operates frequently.	(1) Motor overload		a. Check operating flow rate.
			b. Check liquid specific gravity and viscosity.
	(2) Motor cooling insufficient (motor overheat)		a. Check cooling water flow of jacket or heat exchanger.
			b. Check liquid temperature.
			c. Clean inside the circulation pipe.
			d. Clean inside the jacket or heat exchanger.
	(3) Thermostat value deviation (under high-temperature conditions)		a. Switch to another thermostat (if two units are mounted).
	(4) Defective thermostat		b. Replace stator.

Symptom	Probable cause	Remedy
5. Strong (or increasing) vibration	(1) Bearing wear	a. Remove cause of bearing wear. Refer to Section 4.3, "Inspecting the Bearing."
	(2) Contact between casing and impeller (inducer)	a. Check part dimensions.
		b. Correct bending of shaft.
	(3) Loosening of base mounting bolts	a. Tighten bolts.
	(4) Generation of cavitation	a. Check NPSH Available.
	(5) Inappropriate operating flow (too large, too small)	a. Check operating conditions.
	(6) Inappropriate direction of rotation (reverse rotation)	a. Change connections of 2 of 3 phases for a normal direction of rotation.
	(7) Resonance with piping systems	a. Reinforce piping support.
	(8) Improper dynamic balance of rotating system (rotor impeller)	a. Check dynamic balance and adjust if lost.
6. Loud noise (abnormal noise)	(1) Inadequate air venting	a. Conduct thorough air venting.
	(2) Incorrect direction of rotation (reverse rotation)	a. Change connections for normal direction of rotation.
	(3) Inappropriate operating flow (too large, too small)	a. Check operating conditions.
	(4) Generation of cavitation	a. Check NPSH Available.
	(5) Adhesion of foreign matter (anything hard)	a. Install a strainer.
	(6) Water sound in casing (especially in the case of open impeller)	a. This sound is made by the fluid and does not indicate a problem.
		b. Check operating flow (too much flow).
	(7) Fluid sound in the circulation tube	a. This sound is made by the fluid and does not indicate a problem.
	(8) Contact between casing and impeller (inducer)	a. If the bearing wears out, replace bearing (shaft sleeve).
		b. Correct bending of shaft.
		c. Correctly finish the contacting parts of the casing and impeller (if contact damage is serious).
	(9) Loosening of internal bolts	a. Disassemble pump and check bolts. Tighten if loose.

Symptom	Probable cause	Remedy
7. Required flow (discharge pressure) not achieved	(1) Reverse rotation of motor	a. Check direction of rotation, and change connections as necessary.
	(2) Generation of cavitation (insufficient NPSH, air intake)	a. Check NPSH Available (measurement of suction pressure, cleaning of strainer, check of piping loss, etc.)
		b. Tighten suction piping connections (flange, piping parts).
	(3) Liquid properties mismatch	a. Check liquid specific gravity, viscosity, etc. to the specification.
	(4) Incorrect measurements	a. Check measuring instruments (flow meter, pressure gauge).
		b. Check flow to bypass piping.
8. Rampant change in E-MONITOR LEDs.	(1) Defective capacitor	a. Replace E-MONITOR amplifier.
	(2) Fluctuations in power supply voltage	a. Check power supply voltage.
	(3) Overloaded operation	a. Adjust flow rate to rated value.
		b. Check liquid specific gravity, viscosity, and other values against the values in the specifications.
	(4) Use of inverter power supply	a. Use three-phase AC power supply.
	(5) Use of inverter in the vicinity	a. If any inverter is used on the same power line, provide a noise filter for that inverter, or use separate power lines.
9. E-MONITOR red LEDs light frequently.	(1) Fluctuations in power supply voltage	a. Observe specifications indicated on the nameplate.
	(2) Variations in flow rate	a. Set flow rate to specified value.
	(3) Worn bearing	a. Replace bearing.
	(4) RB housing installed unevenly	a. Tighten each bolt evenly after having loosened bolt once.
10. E-MONITOR reverse rotation indicator is lit.	(1) During jogging only	a. E-MONITOR may not function normally when motor is only powered momentarily. Check indicator status during continuous operation.

Troubleshooting for:

PRICE® PUMP CO.

115 Hilton Street West • Easton, PA 18042 USA • (800)854-0539 • fax: (800)926-9508 • http://www.ProcessFlo.com

TROUBLESHOOTING

1. Pump fails to build pressure:

Check for:

a. Pump not primed.
b. Incorrect rotation.
c. Driver speed too low.
d. Suction line restricted.
e. Driver failure.
f. Plugged or damaged impeller.
g. Pump or impeller undersized.
h. Pump cavitation.
i. Improper impeller clearance.

2. Pump fails to provide enough flow.

Check for:

a. System resistance too high.
b. Pump undersized.
c. Pump not primed.
d. Driver speed too low.
e. Poor suction conditions.
f. Improper impeller clearance.

3. Excessive noise or vibration during operation.

Check for:

a. Motor bearing failing.
b. Pump cavitating.
c. Improper impeller clearance.

4. Leaking mechanical seal.

Check for:

a. Improper assembly.
b. Worn or cracked seal faces.
c. Abrasive material in fluid.
d. Liquid flashing at seal faces (fluid temperature too high).
e. Seal pressure rating too low for the service.
f. Chemical attack of seal parts.
g. Seal operated dry or with a liquid having poor lubricating properties.

5. Pump gradually loses pressure and head.

Check for:

a. Increasing temperature causing cavitation or liquid vaporization.
b. Driver failure.
c. Suction lift too high.
d. Air entering suction line.

6. Motor/pump overheating.

Check for:

a. Excessive flow and amp draw (Throttle discharge).
b. Low voltage or frequency.
c. Flow too low with resulting heat rise.
d. Bearing failure.
e. System temperature too high.

If all else fails, call your distributor or Price Pump @ (707) 938-8441

Troubleshooting for:

Sundyne

SUNFLO®

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TROUBLESHOOTING

Gearbox and Pump Diagnostics

Several system factors may affect the performance of the pump. These factors are:

- Temperature
- Specific gravity
- Suction pressure
- Driver speed
- Flow rate and control characteristic

These factors as well as internal problems must be considered when analyzing pump system performance. The following table gives diagnostic information that can be useful when analyzing gearbox and pump performance problems.

Table 3. Gearbox and Pump Diagnostics

Situation/Symptom	Possible Cause	Investigative / Corrective Action
No flow, no pressure at startup.	Pump not completely primed.	Bleed all vapors and gases from system. Also bleed vapor or air from the seal flush port.
		Allow more cool-down time if pumping a low temperature fluid.
		Verify that pump and suction line are full of liquid.
	NPSH available actually lower than requirement specified on specification sheet.	Suction line blocked. Check suction strainer and valves.
		Excessive pressure drop through suction piping.
		Flow restricted by vapor pockets in high points of suction and discharge piping.
		Inability to vent past a check valve in the discharge piping.
		Suction tank level or pressure too low.
		Entrained air or gas in pumped liquid.
		NPSH reduced by a more volatile process liquid.
	Failure of drive component such as missing drive gear key, sheared or missing impeller key, or failed high-speed shaft bearing.	Replace as necessary with Genuine Sundyne Parts.
	Wrong direction of rotation on motor.	Direction of driver shaft rotation is as shown by arrow on gearbox housing. Note: Impeller and driver rotate in opposite directions. Rotation can be checked by viewing driver fan or input shaft on frame-mounted units. Reverse any 2 leads on motor to change direction of rotation.
Pump starts and then stops pumping.	Improperly primed pump.	Attempt to prime pump. If priming is not possible, inspect suction piping for obstructions.
		Determine if there is a check valve on the discharge. If so, determine if the vapors between the pump and the check valve are being vented.
	Suction screen plugged.	Suction line blocked. Check suction strainer and valves.
	Air or vapor pockets in suction line.	Vent suction piping at the highest point. Determine if the piping must be redesigned to eliminate the formation of air or vapor pockets.

Table 3. Gearbox and Pump Diagnostics

Situation/Symptom	Possible Cause	Investigative / Corrective Action
Insufficient flow or head rise	Flow rate is higher than pump design allows.	Check head rise and flow rate against performance curve.
	Wrong direction of driver shaft rotation.	Direction of driver shaft rotation must be as shown by arrow on gearbox housing. Note: Impeller and driver rotate in opposite directions. Rotation can be checked by viewing driver fan or input shaft on frame-mounted units. Reverse any 2 leads on motor to change direction of rotation.
	Air trapped in pump or pumping entrained vapors or gases.	Check shutoff pressure. If deficient, vent pump.
		Determine if there is a check valve on the discharge. If so, determine if the vapors between the pump and the check valve are being vented.
	Available NPSH actually lower than required NPSH listed on pump specification sheet.	Refer to solutions provided under “No flow, no pressure at startup”.
	Flow too low causing overheating of fluid and loss of NPSH after a short period of satisfactory operation.	Increase pump flow rate.
		Increase bypass flow rate or use seal cavity bypass to continuously increase inlet flow rate. Vent to the highest point of the pump.
		Install bypass to recirculate part of pump discharge back to the supply tank.
	Impeller damage by passage of solid particles.	Inspect impeller for nicked, bent, or worn blades. Replace impeller if damaged.
	Process fluid specific gravity or viscosity different from what was specified.	Check actual viscosity and specific gravity at the operating temperature. A viscosity higher than 5 centipoise will cause reduced head and flow and increased power consumption. A specific gravity higher than what was specified will cause increased power consumption.
	Driver speed too low.	Check driver speed against specification sheet. Check phase current for maximum of 3% variance between phases. Consult authorized motor repair shop.
	Pressure gauges or flow meters in error.	Remove and replace with calibrated instrument.
	Corrosion pitting on pump casing.	Minor pitting may be polished with emery cloth. Major pitting indicates a failed part and should be replaced.
		Inspect remainder of pump to determine if other areas of pump are damaged from corrosion. Replace damaged parts.
		Establish corrosion mechanism. Determine if process conditions can be changed. Consult your authorized Sunflo sales representative for assistance on different pump materials of construction.

Table 3. Pump and Gearbox Diagnostics

Situation/Symptom	Possible Cause	Investigative / Corrective Action
Insufficient flow or pressure. (cont)	Corrosion and/or erosion of diffuser throat (may also be accompanied by corrosion and/or erosion of diffuser surface adjacent to the impeller).	If edge of throat has opened in size, head-rise may be reduced. Opening of the throat will result in higher flow rate and horsepower consumption. Corrosion and/or erosion of the diffuser and cover surfaces will also result in a significant increase in horsepower consumption.
	Pump discharge throat partially plugged.	Disassemble pump and inspect pump casing for any obstructions. Replace hardware with Genuine Sundyne Parts if necessary.
Driver overloaded.	Fluid specific gravity or viscosity is higher than what the pump was initially designed for.	Decrease specific gravity and/or viscosity, or pump flow must be reduced to level that will compensate for the higher specific gravity and/or viscosity.
		Reduce pump flow to the level that will reduce driver power consumption to an acceptable level.
	Electrical failure in driver.	Check circuit breaker heater size and setting.
		Check motor voltage.
		Check motor current in each phase. The current should be balanced within 3 percent.
	Mechanical failure in driver, gearbox, or pump.	Remove casing and check for impeller rub on cover plate and pump casing.
		Rotate high-speed shaft assembly and check for ease of rotation.
		Inspect all bearings. Replace failed parts with Genuine Sundyne Parts.
	Pump operating beyond design flow.	Check actual pump flow and head against the values provided on the pump specification sheet.
	Corrosion pitting on surface of diffuser adjacent to impeller blades.	Minor pitting may be polished with emery cloth. Major pitting indicates a failed part and must be replaced. Disassemble pump and inspect. Rough or pitted surfaces can cause additional friction losses which will significantly increase driver horsepower consumption. Clean these areas of all obstructions and use emery cloth to restore all surfaces to a smooth, polished finish. Check the diffuser throat. Erosion and corrosion will cause roughness that will increase horsepower consumption. Note: A larger than designed diffuser throat will allow for a higher flow and horsepower consumption for a given head rise.
Excessive discharge pressure pulsation (may be associated with a “hammering” sound or may sound like “gravel” being pumped).	Flow rate too low	Increase flow rate through pump. Add bypass if required.

Table 3. Pump and Gearbox Diagnostics

Situation/Symptom	Possible Cause	Investigative / Corrective Action
Excessive discharge pressure pulsation (may be associated with a "hammering" sound or may sound like "gravel" being pumped). (cont)	Insufficient NPSH	Refer to solution for insufficient NPSH under "No flow, no pressure at startup".
	Defective flow control valve.	Repair or replace valve.
Change of gearbox oil from normal color to milky pink or yellow.	Gearbox lubricant is contaminated with water or process fluid.	Check for excessive pump or seal leakage. Change gearbox oil and replace all worn or damaged parts with Genuine Sundyne Parts.
		Inspect shaft sleeve o-rings. Replace if necessary.
		Check for restricted seal drain port. Change gearbox oil and remove restriction.
Shaft sleeve rubs on inside diameter of seal.	Gearbox bearing failure.	Inspect and replaced damaged hardware with Genuine Sundyne Parts.
Excessive gearbox oil consumption.	Damaged gearbox seal.	Check for fluid leakage from drain port. Disassemble and replace worn or damaged hardware.
Excessive oil foaming.	High oil level.	Check oil level. If too high, shut down the unit and drain the oil to the correct level.
		Incorrect lubricant.
Excessive noise and vibration.	Rotation incorrect.	Direction of driver shaft rotation is as shown by arrow on gearbox housing. Note: Impeller and driver rotate in different directions. Rotation can be checked by viewing driver fan or input shaft on frame-mounted units. Reverse any 2 leads on motor to change direction of rotation.
	Worn or damaged bearings.	Disassemble pump and replace damaged components with Genuine Sundyne Parts.
	Insufficient NPSH	Refer to solution for insufficient NPSH under "No flow, no pressure at startup".
	Damaged impeller or shaft.	Replace as required with Genuine Sundyne Parts.
	Partially clogged impeller causing imbalance.	Back-flush pump to clean impeller. Determine cause of clogging.
	Foundation not rigid.	Tighten down hold-down bolts of pump and motor.
	Suction or discharge piping not anchored or properly supported.	Anchor piping per the Hydraulic Institute Standards Manual recommendations.
	Damaged drive or pinion gear.	Disassemble pump and replace damaged gear with Genuine Sundyne Parts.
	Improper pump & driver alignment.	Align pump and driver shafts.
	Resonance of pump foundation.	Perform vibration testing to determine if there is a natural frequency of the installation close to that of the driver. Modify installation to dampen the natural frequency.
	Improper location of discharge control valve.	Install discharge control valve within 5 feet of the pump discharge.

Pump Mechanical Seal Diagnostics

The following table contains diagnostic information that is applicable to single seal and double seal equipped units.

Table 4. Pump Mechanical Seal Diagnostics

Situation/Symptom	Possible Cause	Investigative/Corrective Action
Sudden Increase in Seal Leakage	Severe cavitation or loss of suction pressure causing vibration and bouncing of seal face.	Correct pump suction condition causing cavitation. Bleed vapor from seal cavity and restart pump. Install double seal system if loss of suction cannot be prevented.
		Replace seal and rotating face with Genuine Sundyne Parts if either part is shown to be worn or damaged.
	Solid particles in seal cavity or seal spring area.	Replace seal and rotating face.
		Supply clean, external seal flush or install double seal system if particles cannot be removed by a separator or filter.
	Seal stationary spring action is rough and sticky.	If parts are corroded, check for material compatibility.
		Check for the accumulation of solids in the seal retainer area. If solids are found, consider the installation of a double seal system.
	Worn or damaged seal.	Disassemble high-speed shaft assembly and replace worn or damaged components with Genuine Sundyne Parts.
	Wear pattern on seal rotating faces not uniform in the circular direction.	Inspect shaft sleeve and impeller hub for high spots. Replace if necessary. Install new seal and rotating face.
		Shaft sleeve not parallel causing rotating face to be cocked. Dirt or debris caught between sleeve, rotating face, or adjacent parts.
	Wear pattern on stationary face of seal is smooth but not uniform.	Replace seal and rotating face.
	Edges of stationary face chipped and seal face is worn. (Usually caused by vapor formation in the seal cavity)	Prevent loss of pump suction. Install double seal system if loss of suction cannot be prevented.
		Supply cool seal flush. Consult with your authorized Sunflo sales representative to see if a heat exchanger is required.

Table 4. Pump Mechanical Seal Diagnostics

Situation/Symptom	Possible Cause	Investigative/Corrective Action
Sudden increase in seal leakage (cont)	Seal rotating face is cracked or broken. This may be caused by damage during assembly or by thermal shock from running the seal dry.	Prevent loss of pump suction. Install double seal system if loss of suction cannot be prevented.
		Supply cool seal flush. Consult with your authorized Sunflo sales representative to see if a heat exchanger is required.
	Seal icing on low temperature pumps or icing when handling fluids which have high vapor pressures at a temperature of less than 32°F (0°C).	Use purge of dry nitrogen gas into seal drain area. Install double seal system and use a compatible, non aqueous, non volatile external seal flush.
		Install a double seal system.
	Chemical attack of seal faces, seal parts, or o-rings (P25-18 and P25-28).	Investigate process fluid properties and change seal and o-ring materials if needed.

Troubleshooting for:

T-MAG
MAG DRIVE PUMPS

115 Hilton Street West • Easton, PA 18042 USA • (800)854-0539 • fax: (800)926-9508 • http://www.ProcessFlo.com

TROUBLESHOOTING

Motor will not rotate when system is turned on.

1. Ensure that motor is connected to power supply and that supply switch is installed properly.
2. Inspect motor to ensure that is it is operating condition and does not require service.
3. Ensure that the power lines have been properly connected for the supply voltage and Hz.
4. Ensure that no debris is lodged within the motor assembly.

Motor is turning but no fluid is moving.

1. Check to make sure that all fluid port plugs were removed before connection to the system.
2. Check alignment of the outer magnet to the inner magnet to ensure proper engagement.
3. Check positioning of the pump with regard to the source fluid. Check to make sure that the pump is capable of drawing in process fluid and readjust pump placement if necessary.
4. Check to make sure that inlet and outlet isolation and system valves are in the full open position.
5. Confirm that the pump impeller has been trimmed to the proper diameter for the viscosity and specific gravity of the fluid being pumped.
6. Ensure that no debris has been lodged in the pump impeller.
7. Inspect the shaft, bushing and impeller for damage and alignment.
8. Inspect the pump rotation to insure the pump has been wired correctly.
9. Recheck the process fluid characteristics for viscosity, specific gravity, temperature and solids. Check that pump has not de-coupled due to high specific gravity or viscosity.

Process fluid is leaking from the pump head.

1. Immediately turn off the pump.
2. Inspect the pump housing, o-rings, flanges and impeller housing for damage or wear. Replace as necessary.
3. Confirm the fasteners have been torqued to the correct specifications.
4. Confirm that the process fluid is compatible with the pump liquid end components and make changes as necessary.

Flow rate is ABOVE the specified flow for the application.

1. Confirm the system total dynamic head conditions have not changed from the specified values.
2. Confirm the process fluid is the same temperature, viscosity and specific gravity as the system specified.
3. Confirm that the pump horsepower meets the system conditions.
4. Confirm that the Hz rating for the motor is correct (50 Hz will turn at a slower RPM than 60 Hz)
5. Confirm that the system valves have been positioned correctly for desired flow conditions.

Flow rate is BELOW the specified flow for the application.

1. Confirm the system total dynamic head conditions have not changed from the specified values.
2. Confirm the process fluid is the same temperature, viscosity and specific gravity as the system specified.
3. Confirm that the pump impeller has been trimmed to the proper dimension as required for the application.
4. Confirm that the pump horsepower meets the system conditions.
5. Confirm that the Hz rating for the motor is correct (50 Hz will turn at a slower RPM than 60 Hz)
6. Confirm that the system valves have been positioned correctly for desired flow conditions.

The pump continually cavitates, causing vibration and/or pump damage.

1. Inspect the inlet line to ensure it fits within the NPSH requirements for the specified operating conditions.
2. Confirm that the process fluid viscosity matches the process specifications.
3. Ensure that the pump impeller has been trimmed to the correct diameter for the process specifications.