PUMPS

This troubleshooting guide does not cover all possible situations, but does represent the most common problem areas, causes, and recommended corrective actions to be taken when troubleshooting this equipment. Contact McLanahan Corporation if addtional assistance is required.

NO DISCHARGE WHEN PUMP RUNS:
EXTREMELY IMPORTANT: THE PUMP MUST NOT BE ALLOWED TO RUN IF IT DOES NOT DISCHARGE!

EXTREMELY IMPORTANT: IF IT IS NOTED THAT THE PUMP HAS BEEN RUNNING WITHOUT DISCHARGE, STOP IT IMMEDIATELY!

- MAKE SURE to take EXTREME CARE when dismantling a pump after one has run without discharge, due to high temperature and pressure, which may be present in the pump casing!
- DO NOT remove the drain plug until the temperature of the fluid in the pump has dropped!

A. AIR LOCK:
- This is the most common cause of failure on a newly installed pump.
- Even if the pump is well below water level, a large bubble may remain inside the casing which will prevent the start of pumping.
- This phenomenon is:
    - Far more likely to occur in a horizontal discharge branch arrangement than any other practical configuration.
    - Least likely to occur with horizontal overshot arrangements.
- If an air lock is suspected as the cause of pump failure, start and stop the pump several times to drive the air out, one fraction at a time.
- When using the above procedure, MAKE SURE not to damage the motor starter or burn out the motor, by starting and stopping too many times in a short period of time!
- The number of permissible attempts will vary from equipment to equipment, but it is usually safe to try one start every three (3) to four (4) minutes.

B. INADEQUATE PRIME:
- A failure to pump may be caused by inadequate priming, which is usually fixed by allowing more time for priming to occur.
- When "jet priming", it is possible to have such a small amount of priming water that the pump will never prime, therefore more water will be needed.

  IMPORTANT: Usually the diameter of the priming branch should be at least one-third the diameter off the suction pipe!

  NOTE:
  a. 2" (50mm) will prime 6" (150mm).
  b. 3" (80mm) will prime 8" (200mm).
  c. Etc.

  NOTE: Minimum water required is 30% of pump capacity.

- If priming with a vacuum pump, there MUST BE a valve, or at least an air-lock, on the delivery side!
- The vacuum pump MUST BE able to "beat" the air leakage throughout the gland!

NOTE: ALWAYS attempt to prime with the gland water running, no matter what style of priming is being attempted!

C. INSTALLATION FAULTS:
- Possible causes of an installation fault are:
    - Failure to discharge.
    - Inadequate sump capacity

IMPORTANT: The result of installing a sump without adequate capacity is risking repeated air-locks of the pump!

- This can happen when the pump reduces the water level, allowing either:
  a. A vortex to form which air-locks the pump.
  b. So much air is entrained, when water is introduced into the sump, that the same effect is produced.
- Too small a sump can easily prevent any discharge from reaching the end of the pump discharge line.
- The only way to fix the above condition is to extend the sump capacity.

NOTE: Sumps of at least one minute's pumping time are the MINIMUM recommended!

NOTE: The above recommendation does not apply to feed regulating sumps in sand plants where greater capacity is required.

- Other installation faults are more obvious such as:
  - Tramp material lodged over a pump suction.
  - A kinked suction hose.

BRIEF DISCHARGE ONLY:

A. AIR LOCK:

- A pump with a suction lift and partial air lock, will often start to pump at a greatly reduced rate after each start, but then give up completely.
- At the discharge end of the pipe it will look like a brief surge followed by failure.

NOTE: This problem can only be overcome by closer attention to the priming system.

B. OBSTRUCTED SUCTION:

- If the suction line is obstructed, either by tramp material or delaminated suction hose lining, the pump may start well but when the discharge rate rises, the obstruction throttles the pump in a way that will quickly cause failure due to gross cavitation.
- Detecting the above condition is difficult, with the only way to find out for sure, is the use of a vacuum gauge immediately before the pump suction.
- An obstructed suction line will be indicated by a sudden increase in vacuum right before failure.

C. LACK OF DELIVERY RESISTANCE:

- A pump that is required to pump with a suction or a fair length of pipe, with basically no resistance of the delivery side, may pump briefly before failing.
- The above condition is caused by the centrifugal pumps on open discharge needing positive pressure on the suction eye to prevent gross cavitation.
- If the installation does not provide sufficient positive pressure on the suction side, the pump will fail.

NOTE: The easiest way to overcome this situation is to artificially create resistance on the delivery side by extending the pipework or introducing a valve or other resistance, such as an orifice.

PUMPS WATER BUT NOT SOLIDS:

A. AIR LEAKS ON SUCTION SIDE:

- Poorly made joints:
  - Cause air leaks.
  - Cause air entrainment with feed into a sump.
  - Sometimes prevent a pump from pumping water satisfactorily.
  - Cause the pump to work harder when solids, especially very coarse ones, are introduced because it has to entrain the solids into the fast-moving stream in the suction pipe, because the solids are basically "dredged" into the stream.

NOTE: Even if solids are already moving in the right direction, they must be accelerated to match the water velocity, therefore, acting as a suction resistance for the pump.

- Introducing solids into an aerated system will cause failure.
- The pump can only handle a small margin of solids when pumping water alone.
- Air leaks can usually be detected because of water leaks when the pump is not running.

NOTE: Where water can get out, air can get in!

- Air entrainment with the feed can sometimes be overcome by using baffles in the sump, allowing air bubbles time to rise to the surface before being drawn down to the suction.

B. POOR SUCTION LINE:

- Several different factors may allow a pump to appear adequate when it isn't, affecting whether or not it can handle solids:
    - A long suction line.
    - A line with a considerably smaller diameter.
    - A line with a restriction, where sudden step-downs in diameter are the worst!

NOTE: Refer to previous Section A above.

NOTE: The only way to fix this situation is to rework the suction line.

- If the line increased in diameter, it should be made to match the pump inlet diameter by using a specially rolled flanged taper pipe.

NOTE: DO NOT step down the line by a mismatch!

C. ELECTRIC MOTOR WRONGLY WIRED:

- Most squirrel cage induction motors can be wired in two ways:
    - Star.
    - Delta.
- Some users start their motors in Star to reduce the current surge when the motor is brought online.
- This is done because good starting torque is given and starting current is reduced.
- After smooth starting has been achieved, mode is changed to Delta.
- Delta mode increases the speed close to synchronous speed, which is maximum, and maintains a constant speed under variations in load.

NOTE: If a motor is left to run continuously in Star, its speed will vary dramatically with load.

NOTE: If the motor is not wired correctly, the pump may appear unable to pick up solids while still pumping water, because on Star the motor speed drops when solids load comes on.

- The easiest way to detect the above fault is to check the speed of the motor shaft compared to the nameplate rating, with no more than a few RPMs difference between the nameplate rating and the actual shaft speed no matter what load the pump is pulling.

EXTREMELY IMPORTANT: The correction of the above fault **MUST BE** performed by an electrician!

OVERLOADS FOR MOTOR TRIP OUT:

A. WRONG PUMP SPEED:

- The power drawn by a centrifugal pump discharging through a given delivery system is approximately proportional to the cube of its speed.

EXAMPLE: If the speed is changed by 20% to 1.2 times the original, the expected power demand will rise by the cube of 1.2, or 1.728 which is nearly 73% above the original.

NOTE: Even if the rise in speed is 10% to 1.1 times the original, the expected power demand will rise 33% for the pump.

NOTE: The relationship is not exact, but is close enough for field calculation purposes.

- If the pump runs at the wrong speed, it can make a considerable difference to the load drawn from the motor.
- Correct pump speed calculation is based on:
  - Flow rate to be pumped.
  - Difference In height between pump and discharge points.
  - Length, diameter, and inner surface of the pipeline through which the pump must deliver.
  - Number of elbows, bends, valves, and other fittings in pipeline.
  - Equipment at end of pipeline such as hydrocyclones, pressurized distributors, jets, etc.
  - Grading, tonnage, and specific gravity of solids to be pumped.
  - Pump performance curves.
- With fault finding, the actual RPM of a pump should be compared with the RPM specified.
- Corrections to pump speed can be made with pulley changes.

B. CHANGED PIPELINE SYSTEM:

- It's not uncommon to calculate a pump's speed based on the intended pipeline system at the time of purchase, only to put into service with a different pipeline system.

NOTE: A customer may say that their application does not have such a high lift so the pump doesn't have to work as hard, which is not true!

NOTE: At a given speed, a pump will pump a larger amount through a shorter pipeline, or a shorter vertical height, but will take more power, not less!

NOTE: BEFORE making a pulley change, calculate the correct head and RPM. The affinity rule can be used or the drive can be recalculated.

C. LOW VOLTAGE:

- The power consumed by an electric motor is the product of the voltage, amperage, and power factor for it.
- If a pump demands a certain power from the motor, the motor will demand corresponding amperage from the electrical supply system.
- However, if the voltage of the electrical supply system is lower than normal, the motor will draw extra amps to meet the demand of the pump.
- By doing so, the power consumed by the motor, the product of the voltage, amperage, and the power factor, remains unchanged.
- Circumstances where lower than standard voltages might be encountered:
  - When power supply is from a generator set.
  - At the end of a long trailing cable.
  - At the end of an electric supply system remote from the nearest transformer substation.
  - In an area where very heavy start-up loads can occur like near large crusher stations or long conveyor installations.
- Low voltage can readily cause a motor overload by drawing higher than expected amps, but is in no way related to the pump itself.

NOTE: If low voltage is suspected as the cause of motor overload, a qualified electrician should be called!

D. WRONGLY SET OVERLOAD PROTECTION:

- All motor starting equipment has some form of overload protection built in so that a burnt out, or locked-rotor, motor does not cause more extensive damage.
- If a motor repeatedly drops out on overload for no apparent reason, the electrical overload protection equipment should be checked out.

E. MECHANICAL FAULT IN PUMP:

- The pump shaft should turn freely by hand by removing the v-belts and checking the pump shaft for rotational freedom.
- If there is no resistance to turning the shaft, the fault must be with the motor.

- If a jarring or resistance can be felt when trying to turn the pump shaft, remove the suction pipe and check the clearance between the Impeller and the suction plate as well as checking for blockages.
- If no issues are seen, remove the suction bush and look for marks on the surface of the Impeller that might be an indication of rubbing.
- Either way, rotate the shaft again to see if any resistance is still present, and if so, remove the Impeller and check the gland side liner.
- If there is still no evidence of rubbing, rotate the shaft once more to see if any resistance is still present, and if so, remove the gland sleeve.
- If there is still resistance when rotating the shaft then the bearings need addressed.

NOTE: The remedies to fix the above faults revealed by the above step-by-step approach are:

1. Impeller rubs on suction bush:
   a. Release the bearing housing, set the Impeller to suction bush clearance by adjusting the position of the bearing housing until the impeller runs freely, then tighten the bearing housing, replace the suction pipe, and realign the belt drive.
2. Impeller rubs on the gland half lining:
   a. Reset the suction bush clearance, the check for movement of the casing liner.
3. Seizure in the gland area:
   a. Strip and inspect.
4. Shaft is tight in bearings:
   a. There is no simple field fix for this as the rotating assembly must be removed and stripped for inspection of the bearings and grease seals.

F. AIR ENTRAINMENT:

- In sump-fed pump systems, the following sequence of events can produce air entrainment with the pump feed, producing periodic overloads on the motor:
  - Air entrainment with feed gives the pump a "spongy" pulp which reduces the pump throughput and power.
  - Flow through the sump is reduced allowing air in the feed to escape to the surface, with solids obviously reaching the pump suction.
  - The pump now has a largely de-aired pulp with a much higher percentage of solids than intended, and the power demand rises, causing the pump to potentially choke.

  NOTE: This is a dangerous condition!

  - The pump entrains accumulated solids into the suction pipeline and begins to pump normally again, which increases throughput through the sump.
  - Air entrainment begins to reach the pump suction again, and the sequence repeats.
  - Air entrainment can permanently reduce slurry throughput and make it appear as if the pump is not working.

NOTE: In small installations, the above surge may be repeated at three (3) minute intervals.

NOTE: In large installations, the above surge may take as long as five (5) minutes for the full cycle to complete.

EXTREMELY IMPORTANT: If the cycle terminates at stage three, the pump may explode if it is left to run while blocked!

PUMP HANDLES ONLY A LIMITED PERCENTAGE OF SOLIDS:

A. PUMP SPEED INCORRECT:

- Three major factors will limit the percentage of solids handled by a pumping system with increasing solids feed:
  - Friction resistance increases, leaving less pressure on the delivery side to maintain the velocity in the pipeline.
  - Critical (settling) velocity for the pulp in the pipeline increases.

    - Pump performance drops so that the total head generated by the pump diminishes.
- Therefore, if the pump speed has been calculated for water only and increasing tonnages of solids are fed into the system, the above combination of factors may soon produce a situation where the pipeline velocity is too low to maintain movement off the solids.

B. AIR ENTRAINMENT:
- The above Sub-Section explains how a pump can handle water, but because of air entrainment, fails when solids are introduced into the system.
- The same fault can sometimes explain why a pump appears to perform well on pulp up to a certain percentage of solids, then gives up when this is passed.

C. POOR SUCTION LINE:
- A suction line layout as described in the PUMPS WATER BUT NOT SOLIDS Sub-Section is far worse as the percentage of solids is increased and can become completely blocked.

D. CAVITATION:
- A pump may suffer from cavitation if it is expected to draw relatively coarse solids from a sump below the pump centerline, depending on the pump speed and its capacity in relation to the flow rate being handled.
- When the above condition happens, and the onset of it is often quite sudden and sharp, the total head generated by the pump diminishes dramatically.
- Reduced delivery pressure, for maintaining flow, combined with increased requirement for velocity in the pipeline create the conditions for blocking a line.
- Usually if cavitation is the source of trouble there is plenty of evidence, with an audible “rattle” in the pump or from the bearings, a sudden reduction in power demand, the gland leaks or draws air, as well as a dramatic drop in delivery pressure.

NOTE: To solve the above problem, arrangements made to the suction must be made as smooth as possible without restrictions, as well as to arrange for the feed to come gradually up to load without sudden surges of solids.

NOTE: If these measures do not overcome the problem it may be necessary to change the suction line to a size larger, and fit a flat-topped taper-piece to the pump suction.

NOTE: If troubles persist, a larger pump will have to be installed.

EXTREMELY IMPORTANT: Something effective MUST BE done as the situation is potentially dangerous!

GLAND WILL NOT SEAL ADEQUATELY:
A. POOR ADJUSTMENT:
- The outer seal of a hydrostatic gland assembly MUST BE allowed to rub lightly on the gland sleeve for an effective seal to be maintained!
- If the gland adjuster is pushed too far the seal will be lifted off the sleeve and the gland will leak profusely.
- When a leaking gland is seen, most people immediately want to tighten it, but with a hydrostatic gland, the gland adjuster MUST BE moved outward to reduce leakage!

NOTE: Type D and P glands should be tightened for reduction of leakage, just like standard packed glands are tightened in all water pumps.
NOTE: DO NOT over tighten glands, especially D glands, because a drip is ALWAYS necessary for lubrication of the rubber face seal!

B. DRY RUNNING:
- Although glands will not be damaged by running the pump for a few seconds without lubrication and cooling water, running either gland for a length of time without water in the pump will increase the danger of melting the rubber seals!

- If a Type D gland is correctly adjusted, the danger of damage is very remote because without hydraulic pressure to force the rubber seal against the gland seat, the seal should run without touching the gland seat.

IMPORTANT: DO NOT run a pump in dry conditions because of the danger of damaging the gland seals; because once the seals have been damaged they MUST BE replaced!

C. TOO MUCH SEALING PRESSURE:
- Too much water pressure in either type of gland can make them almost impossible to seal reliably.
- To correct this problem on hydrostatic glands is to insert a pressure control in the gland water line.
- With Type D glands, the problem usually arises only with pumps being run in series or as booster pumps.
- Either way, the only solution is to convert the pump over too an H or P gland and provide suitably pressurized gland water.

D. INADEQUATE PRIME:
- The "snore" condition for pump operation is very difficult to seal without unacceptable leakage.
- Under this condition, a pump continuously receives a good proportion of air drawn in with the pulp from the sump, where the level is too low or the sump has inadequate capacity, or both.

NOTE: The sump should contain one (1) minute's pumping time!

EXCESSIVE HEAT IN DRIVE:
A. SLACK V-BELTS:
- Lack of v-belt tension on a newly installed pump is the most common cause of generation of heat in the drive.
- All v-belts MUST BE tensioned periodically, but newly commissioned drives MUST BE re-tensioned one (1) hour or so after start-up!
- This condition is very easy to detect as pulleys are the hottest part of a drive where the v-belts have been slipping.

B. HOT PUMP BEARINGS:
- It should be noted that on high speed duties the bearings will run hotter than on low speed duties.
- If the shaft is free to be spun by hand, the heat generated while running under power is probably immaterial.
- At 150°F (65°C) the bearing assembly will be uncomfortable to the hand for more than a second or two, but is not unduly hot for the bearing assemblies.

NOTE: If the bearing is failing, the shaft WILL NOT run freely!

C. INADEQUATE LUBRICATION OF PUMP BEARINGS:
- Upon receipt, the bearings will have been factory-lubricated with grease. Refer to the LUBRICATION Section for additional detailed information.

NOTE: Adding additional grease should only be tried if the bearings become very hot or noisy!

NOTE: Avoid excessive greasing of the bearings!

D. MOTOR RUNS HOT:
IMPORTANT: Motors are intended to run hot!
- Continuous maximum rated motors experience surprising temperature rises and the design of them, and the selection of the insulation, allows for it.
- For the most part, heat from a motor can be safely ignored, if the amperage draw is lower than or equal to the nameplate rating
- Many motors are fitted with thermistors in their windings which sense the temperature rise and are wired to operate a cut-out relay if that temperature rise exceeds a safe limit.
- MAKE SURE that the motor protection will trip out the supply if a pump is choked when the motor starts!
- Trouble with bearings is usually indicated by noise and heat and can sometimes be detected by using a long-stemmed screwdriver.
- Push the blade of the screwdriver against the bearing cover and put your ear up to the handle, and with a little experience you can detect bearing "rumble" quite easily.

SUDDEN REDUCTION IN DISCHARGE:

A. CHANGE IN FEED CONDITIONS:

EXTREMELY IMPORTANT: Remember, a pump is only one part of a complete system, and any change to that system will affect all parts of it!

EXAMPLE:

a. A screen rejecting plus 1/4" (6mm) material is considered worn when it passes 1" (25mm) stones, thereby affecting pump performance.
b. The suction resistance of the larger stones will cause the suction pressure to reduce and less head will be available for
pushing the pulp through the delivery system.
c. The larger stones will make a significant difference to the pump performance by decreasing its flow and potentially causing damage to the impeller and linings.
d. In the pipeline the larger stones will probably progress by leaping along the bottom of the pipe, called "saltation".
e. Fully suspended pulp will have to flow past these slow-moving obstacles which increases resistance which further reduces the flow.

EXTREMELY IMPORTANT: A simple thing as a screen cloth with a hole in it can cause a sudden reduction in discharge, and if that causes the pipeline to block, the resulting condition is potentially dangerous!

- Other changes in feed conditions that MUST BE investigated are:
  - Increased tonnage of solids.
  - Change of grading of solids.
  - Change in the way solids are introduced into the pump system.

EXAMPLE: A bin-fed, via a vibrating feeder, plant started up in summer will perform differently in winter when the wetter feed "hangs up" in the feed bin, where the feed will then collapse down onto the feeder intermittently in larger dollops.

B. AIR LEAKS ON THE SUCTION PIPE:

- Remember, a pipe may break through to the open air near a welded flange area at the bottom of it from the constant wear from material running through it.
- Remember, a breakthrough of the pipe surface will result in all the resulting problems described elsewhere.
- Usually a pinhole leak will not allow enough air to enter the pump for any of the other five (5) listed faults to become critical.

NOTE: We, as humans, usually put off repairing or replacing worn pipe until it is too late, then we experience problems usually occurring on nightshift, resulting in a blocked pipeline!

C. SUCTION BLOCKAGE:

- When dredging, there is always the danger that the pump suction will suddenly be submerged in collapsed solids from the surrounding pit contours.
- The same thing can occur when pumping from a sump and the solids clinging precariously to the steel sides of it subside and momentarily block the pump suction.

NOTE: When the pump is feeding a long length of delivery piping it will not be possible to have the column of pulp to come to rest instantly when the suction gets blocked.

EXAMPLE: Pulp in a 1000 ft. (300m) long 8" (200mm) diameter pipe moving at 10ft/sec (3 m/sec) will have considerable momentum and cannot be stopped dead in the same amount of time it takes to block the suction!

NOTE: The result of the condition described above will result in a massive reduction in pressure throughout the system which can cause a massive "water hammer" with surges that can split the pump casing as well as valves and piping!

NOTE: Hoses can also collapse, both delivery and suction, which almost always leads to a great gulp of air being sucked through the pump gland, sufficiently air-locking the pump!

NOTE: When an operator hears the resulting "hiss" of air entering the gland, resulting in air-lock, there is an automatic assumption that the gland is at fault when the trouble generally begins at the end of the suction pipe with the gland collapsing afterward!

NOTE: When dredging, MAKE SURE to have better control over pit development!

NOTE: In sump-fed systems, the feed pulp can sometimes be directed to flush away any build-up of solids on the sides or valleys of the sump, but when that is not possible then a larger take-off box at the base of the sump may improve the situation.

EXTREMELY IMPORTANT: A blocked pipeline situation is ALWAYS potentially dangerous!

D. TRAMP MATERIAL:
NEVER overlook even the simplest explanations of a fault!

EXAMPLE: If there is a sudden reduction in discharge, drain the sump, then examine the take-off box at the base of the sump before removing any pipework or dismantling the pump in any way!

SUDDEN INCREASES IN POWER DEMAND:
A. DAMAGE INSIDE PUMP:
- Remember, pumps wear with each use.
- An increase in power demand resulting from abrasion is listed below in the order of frequency of occurrence:
  - Excessive gap between Impeller and the suction bush.
  - Cut or ripped rubber in the suction bush or the casing gland rubbing against the impeller.
  - Worn out cutwater.
  - Worn out or broken casing liners.
  - Impeller worn through back shroud.
  - Impeller passages worn significantly wider than intended.

B. CHANGE IN PIPELINE SYSTEM:
- DO NOT alter a pipeline system by shortening or changing the layout as this will cause larger amounts to be pumped taking more power!

C. LOW VOLTAGE:
- A new installation near the pump site will make a significant difference in the amount of voltage available, depending on the electrical distribution system in the area.
- Lower volts, means higher current is required for the same power output of the motor.

D. CHANGED PUMP SPEED:
- MAKE SURE that after dismounted pump and motor pulleys are reassembled that they ARE NOT interchanged, as electricians have done in the past!
- REPEAT! MAKE SURE the above DOES NOT happen!

E. AIR ENTRAINMENT:
- In sump-fed systems, air entrainment can produce a cyclic pump overload, which is caused by a change to the amount or direction in which a sump is fed.
- A casual change to the feed type baffle arrangement in the sump can also cause a cyclic pump overload.

RAPID COMPONENT WEAR:
A. AIR ENTRAINMENT:

NOTE: Sand can move around easier in froth than it can in water without air bubbles which escalates the rate of abrasion.

EXAMPLE:
1. Place some sand in a bottle and fill the bottle to the very top with water.
2. Place the palm of one hand over the top of the bottle and shake it.
3. You will notice how hard it is to move the sand around vigorously against the hand.

4. Pour out roughly a third of the water and repeat Step 2.
5. Undoubtedly you will feel the sand in the air-water froth hitting the palm of the hand.

IMPORTANT: Again, sand can move around easier in froth than it can in water without air bubbles, therefore any leaks in the suction side will accelerate the rate of abrasion!

IMPORTANT: If air entrainment is severe enough to produce an air lock in the presence of solids and water, the rate of abrasion is escalated!

- Air entrainment can also cause severe abrasion indirectly, from cyclic changes in pulp density due to air, causing the pump to potentially handle far denser pulp than intended.

IMPORTANT: The above condition is an abrasion accelerator!

B. PROPERTIES OF THE SOLIDS:
- If possible, ALWAYS reduce the pump speed when confronted with a rapid abrasion problem caused by coarse or sharp-edged particles!

NOTE: A larger pump with a larger diameter Impeller will rotate slower at the suction eye for a given head than a smaller one will, therefore if wear on the leading edge of the vanes occurs, a larger pump would help.

C. CHANGE IN FEED CONDITIONS:
- The rate of wear on a pump is affected by the following:
    - A change in feed conditions.
    - Extra tonnage.
    - Coarser grading.
    - Higher proportion of crushed material.

EXAMPLE: Deposits from a river are notoriously variable as the proportion of crushed sand in relation to natural sand can vary widely:
- To most operators, sand is sand.
- If the pump is now handling 80% crushed material where three (3) months ago it was 60% natural sand may not appear significant.
- If there is a permanent change in feed conditions, which will make component life unsatisfactory, consider modifying the pump.

NOTE: A two-stage pump set will allow each pump to run at 70% of the speed of a single pump, significantly changing the abrasion rate.

D. SHAFT MISALIGNMENT:
- After several years of wear and tear, the saddles on the pedestal occasionally wear out, which allows the shaft to point downward.
- If the eccentricity of the shaft through the gland is severe enough, the gland WILL NOT seal properly!
- Misalignment between the eye of the Impeller and the suction bush will occur which will detract from pump performance.
- To correct a worn pedestal condition, purchasing a new one, will be the most cost-effective time saving solution.
- A temporary fix would be to pack the saddles with shims, which would inevitably get lost during Impeller adjustment.

MECHANICAL FAILURE:
A. BROKEN SHAFT:
- Typically, the only broken shafts on McLanahan pumps are from:
    - Tramp material in the feed.
    - A seized bearing.
    - Slurry that has worn through the gland sleeve.

NOTE: Wear from the slurry WILL of course weaken the shaft!

B. BROKEN PEDESTAL OR CASING:
• Even though the front bracket of the pump pedestal appears massive, it can be broken from the box section of the pedestal simply from starting the pump backwards!

• Starting a pump backwards results in the following chain of events:

1. The impeller will begin to unscrew from the shaft.
2. While in motion, the Impeller will strike the suction bush which is fixed in place by the flange of the suction pipework.
3. Since something has to give, occasionally with older shafts, the thread in the shaft is stripped instead of the pedestal breaking.

NOTE: Again, the most cost-effective time saving fix for a broken pedestal is to replace it because realigning one is quite difficult!

EXTREMELY IMPORTANT: A pump running backwards is an electrical problem that is overcome easily, but SHOULD NOT happen in the first place!

NOTE: Electricians are required to verify the direction of motor rotation BEFORE fitting the v-belts onto the pulleys!

C. PUMP EXPLODES:

- A centrifugal pump, McLanahan or any other, can potentially explode by:
    - Running it with pulp in the casing and no discharge.
    - Running it with water in the casing and no discharge.
- Either condition can occur in a pump that is drawing pulp from a sump and pumping it to a cyclone through a rising pipeline.
- If the pump receives a sudden surge of solids, that blocks off suction, flow WILL cease!
- In the delivery line:
    - Solids will settle in the rising pipe, but will be unable to enter the casing because the Impeller will still be spinning.
    - That allows the pump to continue absorbing power.
    - The increased power raises the fluid temperature.
    - The water will eventually boil and the pressure may be enough to destroy the rubber, or cause the pump head to explode.

EXTREMELY IMPORTANT: IF A PUMP HEAD FEELS UNUSUALLY WARM, AND IS NOT DISCHARGING, TURN THE POWER OFF IMMEDIATELY!

EXTREMELY IMPORTANT: DO NOT APPROACH AN UNUSUALLY WARM PUMP UNTIL IT HAS BEEN RELIEVED OF PRESSURE!

- The preferred method of relieving pressure is through the suction or discharge pipework, is by flushing away the solids plugs.

EXTREMELY IMPORTANT: A sign that a pump may explode will be a considerable amount of steam leaking from the gland!

EXTREMELY IMPORTANT: Even if a pump DOES NOT feel hot, use extreme caution when dismantling it, as the pump may be full of scalding water! DO NOT remove the drain plug until MAKING SURE the fluid temperature