

Maintaining an edge

PUMPS Centrifugal pumps need to be kept in tip-top condition in order to handle harsh operating conditions in bulk liquids terminals. Rick Whidden, applications manager at Griswold Pump, offers some advice on effective maintenance

Liquids storage terminals play an integral role in the ongoing success and relevance of a wide array of industries around the world. These facilities serve as a vital hub in the storage and dispersal of numerous types of liquids, including vegetable oils and fats, oleochemicals, petroleum products and petrochemicals, all substances that are vital to the world's transport and manufacturing sectors. Any liquid that can be transported in bulk, be it by oceangoing tanker, barge, railcar, tank truck or pipeline, is at some point in its supply chain stored and transferred at a liquids terminal.

But while the range of products that may pass through a storage terminal is wide and varied, the operating conditions at most terminals are quite similar: harsh, often corrosive atmospheres that require around-the-clock equipment reliability with any downtime having a potentially hugely adverse effect on the terminal's operation and profitability.

Transfer pumps used in these conditions are under constant assault and must be able to perform reliably while coping with a number of diverse operating characteristics, such as:

- (a) changes in ambient temperature, humidity and other weather conditions;
- (b) line shock from piping that is not properly anchored;
- (c) piping systems configured with sharp bends rather than smooth curves;
- (d) changes in products being pumped;
- (e) changes in product viscosity;
- (f) high volume throughput at high flow rates – up to 4,000 gpm; and
- (g) changes in product velocity, force and head pressure.

Taking all of this into consideration, this article looks at the role of centrifugal pump technology in liquids terminal applications. It will show how proactive steps in both preventive and protective maintenance can keep the pumps running reliably in environments that put the pump's effective operation under constant threat.

The maintenance solution

Centrifugal pumps move liquids through the use of centrifugal force. The three most common styles of centrifugal pumps are:

ANSI These pumps meet centrifugal pump



Structured maintenance will help keep pumps working for longer

manufacturing criteria established by the American National Standards Institute (ANSI) in 1977. With that standard in mind, ANSI centrifugal pumps are engineered for operational flexibility and durability, and can meet the needs of virtually any fluid transfer application.

End-Suction Ideal for thin liquids and the top choice for most water-pumping applications.

Self-Priming Balanced pumping pressures prevent product recirculation, making these pumps ideal for high capacity loading and unloading operations.

No matter the operational atmosphere where these, or any, type of pump is in use, a routine maintenance programme will extend the life of the pump since well maintained equipment lasts longer and requires fewer and less expensive repairs. A detailed record of any preventive maintenance that was performed and repairs that were needed should be kept in order to help diagnose problems and eliminate, or at least minimise, any future equipment downtime.

Routine preventive and protective maintenance practices should, at a minimum, include the monitoring of:

Bearing and lubricant condition Monitor bearing temperatures, lubricant level and vibration. The lubricant should be clear with no signs of frothing, while changes in bearing temperature may indicate imminent failure.

Shaft seal condition The mechanical seals should show no signs of visible leakage. Any packing should leak at a rate of about 40 to 60

drops per minute.

Overall pump vibration Imminent bearing failure can be preceded by a change in bearing vibration. Unwanted vibration can also occur due to a change in pump alignment, the presence of cavitation or resonances between the pump, its foundation or the valving located in the suction and/or discharge lines.

Pump discharge pressure The difference between the readings on the suction and discharge gauges will provide the total developed head pressure of the pump. A gradual decrease in the developed head pressure of the pump can indicate that the impeller clearance has widened, which requires an impeller clearance adjustment to restore the pump's intended design performance.

To stay on top of these potential maintenance concerns, Griswold Pump Company, a leading manufacturer of centrifugal pumps, suggests the following basic maintenance regimen. Also worth noting is that maintenance and monitoring intervals should be shortened if the pump is used in severe service conditions, such as with highly corrosive liquids.

1. Quarterly maintenance:

- (a) check the pump's foundation and hold-down bolts for tightness;
- (b) the oil should be changed after the first 200 hours of operation for a new pump then after every three months or 2,000 operating hours, whichever comes first;
- (c) re-grease bearings every three months or

2,000 operating hours, whichever comes first; and

(d) check the shaft alignment.

2. Annual maintenance:

The pump's performance should be checked and recorded in detail at least once a year. Performance benchmarks should be established during the early stages of a pump's operation when the parts are new and the installation adjustments are correct. This benchmarking data should include:

- the pump's developed head pressure as measured at the suction and discharge gauges
- pump flow rate
- motor amp draw
- vibration signature.

When the annual assessment of a pump's performance is made, any changes in the benchmarks should be noted and used in determining the level of maintenance that may be required to get the pump back to operating at its efficient best.

Delaying failure

When considering centrifugal pump operation and maintenance requirements, one thing must be kept in mind: all pump bearings will fail eventually. However, the cause of bearing failure is more often than not a failure of the lubricating medium, not equipment fatigue. Therefore, particular attention needs to be paid to bearing lubrication in order to maximise bearing and, by extension, pump life.

If an oil is being used for bearing lubrication it must be non-foaming and non-detergent. The proper oil level is at the mid-point of the bull's-eye sight glass on the side of the bearing frame. It is important to avoid over-lubrication as it can be just as damaging as under-lubrication since excess oil will cause a slightly higher horsepower draw and generate additional heat, which can cause frothing of the oil. When checking the condition of the lubricating oil, if any cloudiness is observed it can be indication that a water content of greater than 2,000 ppm is present. This is often the result of condensation. If this is the case, the oil needs to be changed immediately.

If the pump is equipped with re-greaseable bearings, greases of differing consistencies or types should never be mixed. Also note that the shields must be located toward the interior of the bearing frame. When re-greasing, ensure that the bearing fittings are absolutely clean as any contamination will decrease bearing life. Overgreasing must also be avoided as this can cause localised high temperatures in the bearing races and create caked solids. After re-greasing the bearings may run at a slightly higher temperature for a period of one to two hours.

When a terminal operator needs to replace a part, or parts, on a malfunctioning pump, it offers an opportunity to examine the pump's other parts for signs of fatigue, excessive wear and cracks. At this time, any worn parts should be replaced if they do not meet the following part-specific tolerance standards:

Bearing frame and foot Visually inspect for cracks, roughness, rust or scale. Check machined surfaces for pitting or erosion.

Bearing frame Inspect tapped connections for dirt. Clean and chase threads as necessary. Remove all loose or foreign material. Inspect lubrication passages to be sure that they are open.

Shaft and sleeve Visually inspect for grooves or pitting. Check bearing fits and shaft runout and replace the shaft and sleeve if worn or if the tolerances are greater than 0.002 inches.

Casing Visually inspect for signs of wear, corrosion or pitting. The casing should be replaced if wear exceeds 1/8-inch deep. Check gasket surfaces for signs or irregularities.

Impeller Visually inspect the impeller for wear, erosion or corrosion damage. If the vanes are worn more than 1/8-inch deep, or if they are bent, the impeller should be replaced.

Frame adapter Visually inspect for cracks, warping or corrosion damage and replace if any of these conditions are present.

Bearing housing Visually inspect for signs of wear, corrosion, cracks or pits. Replace housings if worn or out of tolerance.

Seal chamber/stuffing box cover Visually check for cracks, pitting, erosion or corrosion, paying special attention to any wear, scoring or grooves that might be on the chamber face. Replace if worn more than 1/8-inch deep.

Shaft Check the shaft for any evidence of corrosion or wear. Check the shaft for straightness, noting that the maximum total indicator reading (TIR) at the sleeve journal and coupling journal cannot exceed 0.002 inches.

Implementing all of these maintenance recommendations may seem daunting, but it is only through a routine such as this that a fluid-handling operation can maximise the service life of the equipment while enhancing the safety of plant personnel and the environment.

Conclusion

As mentioned, the harsh, difficult operating conditions at liquid terminals can put a great deal of stress on the pumping equipment that is used to keep them running 24/7/365. The best way to ensure that instances of equipment failure that lead to costly downtime and potential safety hazards do not occur is to be proactive in your maintenance routine. This means establishing a maintenance schedule for every pump and documenting every maintenance

occurrence, whether planned or unplanned. Liquid-terminal operators who stay ahead of the maintenance curve will reap the benefits of a facility that operates without encountering the breakdowns and out-of-service situations that can set an operation back.

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In a pinch

A comprehensive preventive and protective maintenance regime will work wonders for the life cycle of industrial pumps that are used in fluid handling applications in bulk liquids terminals. What a maintenance regime cannot do, no matter how strict it is, is halt the ravages of time. Simply put, any pump and its component parts, no matter the style or brand, will eventually reach the end of their useful life.

Whenever that happens - usually, it seems, at the most inopportune time - the terminal operator has to be able to rely on his supplier to get a new pump, or the appropriate replacement parts, into his hands as quickly as time allows.

Recognising the importance of supplying replacement equipment in a timely manner, Griswold Pump Company has established a worldwide network of stocking distributors that can ensure that emergency equipment needs are met with the utmost urgency without the facility operator incurring premium delivery or replacement charges. Since Griswold pumps and parts are also interchangeable, the components fit a wide variety of pumps styles, making part replacement even easier and more efficient.

"There is nothing worse for a facility operator than that 2 a.m. call saying that a pump has gone down and needs to be replaced," says Bob Mattox, operations director at Griswold Pump Co. "With that in mind, quick turnaround is very important to us, and our worldwide distribution network allows us to meet the strict standards we have developed for timely delivery of replacement equipment and parts. This, we believe, offers increased peace of mind for facility operators and lets them know that we stand firmly behind them and our equipment."