Methods to measure flow efficiency and maintenance savings at paper mills

DAN C. WILLIAMS

Like the terms "tooth extraction," "flight delayed," and "overdue notice," the words "bearing failure" produce thoughts of pain, frustration, and missed opportunity among paper mill operators. Equally discouraging, the term is generally accompanied by the unfortunate realities of downtime and considerable expense.

Lubrication, the lifeblood of any paper machine, acts as the main artery and primary preventive measure against bearing failure. Its role assumed added importance with production demands pushing machinery to new production levels. Put simply, increased production demands put added stress on bearings, increasing the possibility of failures and making monitoring all the more important.

Bearing studies show that bearings starved for lubrication suffer failures due to excessive heat buildup. Over-lubricated bearings, on the other hand, also suffer from poor heat transfer and create undue stress on bearing seals, increasing the possibility of oil leakage and shaft misalignment. Moderation and consistency are the goals of proper lubrication, and those attributes are best achieved through efficient flow monitoring.

Lubrication monitoring methods have been developed to enable careful monitoring of multiline oil recirculation system flows, making certain that each and every bearing receives adequate, consistent lubrication. The systems, though not a cure-all device, greatly reduce the prospects for bearing failures and instances of downtime at paper mills. They assure adequate flow, avoiding the consequences of too much or too little lubrication.

How do these systems function at today's paper mills? What are their benefits and cost advantages? The current evidence is convincing.

Basic operation

The purpose of these systems is basic—to assure an accurate and continuous flow of lubrication oil to each bearing. The design of a monitoring system can be as complex and extensive as the paper machine it services. For instance, a single monitoring system at one plant has kept careful check of as many as 500 bearings on each of four paper machines. And while the paper machines are massive, the centralized control areas for flow monitoring enable fast, efficient checking. The outcome has been a monitoring procedure accomplished in minutes, instead of an elaborate program that previously occupied up to two hours of a skilled technician's daily routine.

As an operational measurement, flow monitoring must be more than a simple gauge. For example, on one monitoring system, the primary measurement of flow rate is provided by a piston-type variable area flow indicator located in the main viewing section of the transparent flow tube. A secondary spinner-type indicator in the upper inlet of the flow tube provides a highly animated, easily visible check of flow.

Not only does flow monitoring enable consistency, but quick, easy flow-rate adjustments in individual lube lines also allow for more effective operation. For instance, during the start-up stage, paper production machine rollers generally run at lower speeds and dryer sections operate at cooler temperatures. As a result, oil should circulate at lower rates to avoid the prospects of messy oil spills due to over-flooded bearings.

At normal, full-production speeds, the demand for precisely controlled flows becomes critical. For instance, in dryer section applications the circulating oil is also the primary heat transfer media used to dissipate heat from the bearing area. Thus, inadequate oil flow to the bearings can create a sudden rise in operating temperatures, resulting in rapid deterioration of oil lubricating. Efficient flow monitoring systems signal the arrival of these conditions and enable fast, effective adjustments to maintain high-speed paper products.

Predictable benefits

By definition, effective flow monitoring systems prevent potential problems and enable predictable paper machine output. Just as the oil flows they monitor, the benefits they offer can also be computed and measured. The primary benefits are easy to determine. Savings, too, are easy to compute. Benefits include:

- Lubricating consistency—Bearing analyses show that, while bearing failures can stem from a variety of factors, by far the most common contributor is inadequate lubrication. The operating efficiency and longevity of bearings are directly influenced by lubrication. Put simply, a properly lubricated bearing will outlive the one lacking consistent lubricity.

- Fast, accurate readings—On older machines, checking a sight glass system can be an arduous task, as well as an inexact science. Monitoring "rounds," conducted several times a day, take time. Plus, in systems where leaks exist, sight tubes need to be wiped off before rates can be determined. If flow rates are inaccurate, lubrication becomes inconsistent and bearing problems recur.
- Not only are readings more accurate, they are also easier to obtain. Some systems are appreciably smaller than a sight glass system, meaning less ground needs to be covered to obtain readings. At one paper mill, a new monitoring system has approximately 10 tubes every 14 in. The predecessor occupied 3–4 ft of space for the 10 tubes.
- Production efficiency—Naturally, paper machines must be maintained to achieve maximum reduction rates. Saying that downtime is disruptive is like the proverbial coach's lament that his team must stay healthy and injury-free to have a successful season. Adequate lubrication, properly monitored, is the preventive measure through which paper mills both accentuate the positive and eliminate the negative.

Measurable results

Just like the flow rates they monitor, the new systems also provide clear signs on the operational savings they provide. These can be felt and measured through:

- Reductions in downtime—A typical bearing failure can cost a company up to US$ 10,000 an hour to rectify. Parts, labor and lost production time all must be factored into the equation. Of the three lost ingredients, the production logjam is by far the most critical, especially for mills with round-the-clock operations. In these instances the lost time cannot be made up after hours. Equally damaging and disturbing are the real but often incalculable losses in customer confidence.
- Reduced oil consumption—Precise control of lube oil flow rates, over-flooded bearings, and oil leaks can positively reduce waste. Savings of nearly 30% and annual costs of US$ 50,000 have been realized.
- Reduced manpower—As previously noted, the more compact the monitoring area, the faster and more accurate the visual checking process becomes. This not only improves operator response time to make needed adjustments; it also frees maintenance personnel for other assignments. The previously mentioned instance of one paper mill's experience resulted in the saving of 9–10 hours per week. Applying this time to other projects can potentially broaden a department's scope of activity or reduce staffing requirements.

Like good dental care, lubrication monitoring is an industrial form of hygiene that pays off. The dividends come both in the form of smoother operations and the reduction or elimination of the unpleasant outcomes of misuse—damage, downtime, and expensive repairs. TJ

Williams is Lube View sales manager, Hedland Co., 2200 South St., Racine, WI 53404.