CONTINUOUS MONITORING OF PUMPS IN HEAT TRANSFER SYSTEMS

Numerous production processes depend on pumps for the movement of heat-transfer oils. When selecting a pump, operator safety and system stability are the top considerations, followed closely by maximum uptime and low operating costs.

THE CHALLENGE

DEMANDING REQUIREMENTS IN HEAT TRANSFER APPLICATIONS

Heat-transfer pumps must operate safely and reliably in order to ensure a high level of quality in production processes. Not only are such pumps frequently subject to high loads, but in addition their failure can have serious consequences, especially if hot oil is allowed to escape. For these reasons, operators of heat-transfer systems are very sensitive to any leaks. While hot water normally escapes through the seal in the form of steam – and usually does not cause major damage – any escaping heat-transfer oil rapidly disperses across a wide area and has a high potential for serious damage. Any leaks from thermal oil pumps represent a precarious situation that requires a rapid and effective response. Elevated liquid temperature makes this a challenging task. The solution to this problem is to monitor the rate of leakage in order to detect the early stages of seal wear. That way, pump operators know as soon as a leak starts.

Pumps used in heat-transfer systems are subject to high loads induced by elevated temperatures and large temperature differentials. What's more, chemical decomposition reactions often occur in the pumped liquid whenever the heat carrier is under high thermal loads. In particular, the chain-like hydrocarbons decompose over time into „low boilers" and „high boilers". When the proportion of low boilers becomes too high, there is a risk of pump cavitation. High boilers, on the other hand, accelerate pump wear and occur in numerous forms, from a bituminous-like consistency to highly carbonized products. Both represent a threat to the bearing and shaft seal of the pump. The use of synthetic heat-transfer oil reduces the appearance of low and high boilers, but the low viscosity and lubricity of these materials has other drawbacks. The tribological loads working on the sliding components of mechanical seals is extremely high.

UNIFORM HEAT

German company Odenwald Faserplattenwerk GmbH (OWA) has been manufacturing acoustic panels since 1948. OWA uses heat-transfer pumps to move mineral oil at temperatures of approximately 270 °C.

The most important elements of any dryer are the heating register and the heating coils. They impinge heat onto the mineral fiber panels in a highly uniform manner. Doing so requires pumps that move the heat carrier (petroleum-based or synthetic thermal oil) to the dryer both uniformly and reliably. Maintaining the temperatures required of the process is essential both for achieving high product quality as well as to ensure reliable and continuous functionality.

THE SOLUTION

THE BENEFITS OF CONTINUOUS MONITORING

As part of OWA's in-house engineering, the pumps are in continuous operation in the heat-transfer systems. "We often think of the provision of heat to our production lines as a self-evident fact. Our employees in the production area are focused each day on maintaining the premium quality of our ceiling panels. The special challenge they face is to have a system that is extremely reliable and allows for preventative maintenance and a sufficient level of digitization," according to Jan Herrschaft of the Technology and Process Engineering department at OWA. In the past, OWA relied on leak detectors in the collection pans of the thermal oil pumps. Unfortunately, this method detected leaks only once they were already very advanced. Preventative maintenance options were also very limited. But in 2017 they made the decision to deploy their first Allweiler IN-1000 condition monitoring system from CIRCOR. Based on their positive experiences, they added additional systems near the end of 2018.

The IN-1000 monitors the functionality of the mechanical seal, the temperature of the bearing, and oscillations in the pump. If one of the monitored parameters exceeds the primary or secondary thresholds, IN-1000 reacts with the appropriate warning or alarm messages. The status of each of the pumps can be read directly from the display on the IN-1000 master unit, giving maintenance personnel the opportunity to respond quickly to disturbances. The signal can also be optionally transmitted across an Ethernet to a control panel or sent wirelessly to mobile devices. A green light indicates normal operation. In most cases, a yellow light draws attention to the need for pump maintenance. Once the light switches to red, immediate intervention is usually required. In some cases, production must be stopped.

If significant leaks or high bearing temperatures are detected, IN-1000 indicates that the seal is worn or that the bearing must be replaced. Large oscillations indicate that the pump is out of alignment or the coupling is damaged. When the appearance of such irregular operating conditions is monitored comprehensively, the operator has the opportunity to plan for replacement or repair in a timely manner on scheduled maintenance days, thereby avoiding unanticipated production downtime. Early detection of disturbances and wear saves money by minimizing service and repair costs.

"For us, disturbance-free operation is the most important aspect and the greatest advantage of monitoring our systems with IN-1000. In addition, we can detect upcoming wear early and plan for countermeasures," according to Jan Herrschaft.

MODULAR DESIGN

The IN-1000 condition monitoring system is modularly constructed. This makes it possible to adapt the IN-1000 module to the system being monitored. The master/satellite combination of the IN-1000 fulfills a variety of monitoring requirements, from straightforward monitoring of a single condition to complex situations involving multiple pumps. The master module is equipped with a web server that enables remote access to the master module through a web browser or the application-specific interface of an existing process monitoring system via ethernet connection. At OWA, IN-1000 is integrated into a larger control system so that pump conditions can be retrieved directly. Seamless implementation into existing IT structures is therefore another benefit of this monitoring system.

IN-1000 fulfills the requirements of the IP 54 protection class and is designed to withstand environmental influences.

THE RESULTS

CONTINUOUS MONITORING YIELDS POSITIVE RESULTS

Users of IN-1000 report uniformly positive experiences because it allows them to optimize their pumps from the time of installation onward. Therefore, an investment in IN-1000 can quickly pay for itself. For example, when existing installations were monitored with IN-1000 it was discovered that up to 75% of the pumps were not properly aligned, which would have resulted in high oscillations and ultimately bearing damage and premature failure. These cases alone can avoid damages costing several thousand euros.

But IN-1000's integrated data recording has other benefits as well by enabling precise, daily determination of pump performance. This functionality gives users additional ways to optimize their pumps, such as speed control or hydraulic optimization.

LONG-TERM SAVINGS

Another significant advantage of continuous monitoring is more long-term in nature. Since IN-1000 reliably detects critical levels of seal wear, the need for preventative maintenance is reduced substantially. This allows operators to fully exploit the long service life of high-quality pumps. As a result, typical maintenance costs for pumps in heat transfer systems are reduced by up to 50%. IN-1000 pays for itself within a short period and simultaneously gives operators of heat-transfer systems the peace of mind that comes with knowing that everything is under control.

IN-1000 can be installed on new pumps or retrofitted onto existing installations at any time.

The Allweiler IN-1000 system from CIRCOR is the perfect addition to ALLHEAT and NTT pumps from Allweiler. But it can also be added to compatible pumps from other manufacturers as long as they are equipped with standardized sensors (analog and digital).

Warnings and alarms for disturbances and irregular operating conditions can be retrieved wirelessly on mobile devices.

FOR ADDITIONAL INFORMATION VISIT:
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