

Monitoring vibrations, mechanical seals, and bearings for safety and performance

With more than 70 years of experience in plastics processing, Switzerland-based Quadrant Group is a leading expert in a wide range of polymer materials and technologies for polymer conversion. Its product range covers everything from polyamides (PA), polyacetal (POM), and ultra-high-molecular-weight polyethylene (UHMW-PE) to high-performance materials like fluoroplastics and polybenzimidazole (PBI). Quadrant also manufactures thermoplastic composites from polypropylene and glass fiber mat (GMT, GMTex), mixed fiber fleeces made of SymalITE reinforced fibers, and MultiQ panels. High-performance ALLHEAT pumps from ALLWEILER are essential for moving heat transfer oils in many of their production processes. Top priorities in selecting a pump are the safety of employees and systems, system availability, and a low total cost of ownership.

High pump requirements

In order to maintain a high level of quality in the production process, Quadrant's heat-transfer pumps must work safely and reliably. These pumps are commonly subjected to high loads. At the same time, failure of a pump can have serious consequences, especially if hot oil escapes. This makes operators of heat-transfer systems very sensitive to leakage. Consequently, engineers walk a fine line when designing shaft seals in heat-transfer pumps. While it is normal for water (mostly in vapor form) to escape through the sealing clearance, any escaping heat transfer oil will be readily visible. Therefore, although leakage must be kept low, it is critical to avoid overloading the seal. The high loads on the pump are the result of high temperatures and large temperature differentials as well as decomposition reactions that may occur when the heat transfer liquid is subjected to excessive thermal loads. In particular, chain-like hydrocarbons decompose over time into "low boilers" and "high boilers". If the proportion of low boilers is too high, the pump may cavitate. High boilers accelerate wear on the pump and appear in many forms, from bitumen-like consistency to extremely hard carbonized products. Both threaten the pumps' bearings and shaft seals. Using synthetic heat-transfer oils reduces formation of low and high boilers, but the low viscosity and low lubricity of these materials means that they have

disadvantages as well. Tribological loads on the gliding components of mechanical seals are particularly high.

The benefits of continuous monitoring

Manufacturing processes at Quadrant's production site in Vreden, Germany use special ALLWEILER heat-transfer pumps to move oil at about 250 °C. Pumps of the ALLHEAT series are in service in the main train 24 hours per day, seven days per week.

Additionally, the "ALLMIND" condition monitoring platform from ALLWEILER monitors the mechanical seal, the temperature of the bearing, pump vibration, and oscillations at the motor. If any of the monitored parameters reach predefined initial or secondary thresholds, ALLMIND is designed to react with appropriate warning or alarm messages. Status is indicated directly at the pump in the form of a "traffic light" to enable pump operators to react quickly. "Green" indicates normal operation; in most cases, "yellow" simply means that service must be planned for the pump. Excessive leakage or high temperature at the bearing indicate that the seal has begun to wear out or that the pump bearing requires replacement. A high level of vibration indicates faulty alignment or damage to the coupling. This advance warning should give the operator an opportunity to plan ahead for replacement or repair and avoid unanticipated interruptions to production. However, if the traffic light turns "red", immediate intervention is required, causing production to stop.

In total, eleven pumps have been integrated into Quadrant's monitoring chain using ALLMIND masters and satellites. In some cases, environmental conditions are very harsh. Some of the pumps (and ALLMIND) are even located outdoors, but this poses little problem thanks to the IP 54 protection class and robust design of ALLMIND.

Positive experiences

Quadrant has been using ALLMIND with heat-transfer pumps in its primary and secondary loops since June of 2011. They are pleased with the results: "From the very beginning, ALLMIND has given us an effective way to optimize our pump units," according to Alfred Epping, who is responsible for maintenance, service, and operational planning of the pump systems. In his experience, investment in ALLMIND quickly pays for itself. For example, monitoring with ALLMIND revealed that 75% of their pumps were improperly aligned. Improper alignment results in extreme vibration, which causes long-term damage to the pump bearing and premature failure. "This alone has saved us several thousand euros in damages," according to Mr. Epping.

Quadrant's next step is to accurately determine how their pumps are used on a daily basis and then dimension the pumps accordingly. The integrated data logging function of ALLMIND should provide valuable data for this project. They can then find other ways to optimize their pumps, such as speed control or pump replacement. "ALLWEILER has given us excellent advice. And the integrated speed control function of ALLMIND provides the technological foundation for minimizing the operating expenses of our pump systems," according to Mr. Epping's description of the successful collaboration.

Long-term savings

Another benefit of using ALLMIND should be noticed over the next few years. Since it reliably detects when the seal has actually worn to a critical level, there is now much less need for preventive maintenance. ALLMIND is designed to give operators the ability 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%. For this reason alone, this simple yet effective system should pay for itself within a short period of time and give operator of heat transfer systems the security of knowing that they have everything relating the ALLWEILER pumps under control at all times.

ALLMIND is compatible with all ALLWEILER heat-transfer pumps of the NTT series as well as ALLHEAT NTWH and CTWH. This monitoring device can be mounted on new pumps or retrofitted to older pumps at any time.

Challenge

Safe and reliable operation of thermal-oil pumps, early indication of wear, avoidance of downtime caused by excessive precautionary maintenance.

Solution

Equip ALLWEILER heat-transfer pumps with the ALLMIND automatic monitoring system.

Expected Results

Significant and long-term savings, optimized planning of maintenance times.



Typical configuration of a heat-transfer pump with ALLMIND



Heat-transfer units with ALLMIND installation



Up to 15 expansion modules/slaves can communicate with one Master unit



Traffic light on expansion module communicates status quickly. Details may be retrieved from the Master unit.

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