

Early Pump Cavitation Detection for Effective Operations and Maintenance

BASF Schwarzheide GmbH

Location: Schwarzheide, Germany
Order date: 2021
Completion: 2021
Industry: Specialty & Fine Chemical

Executive Summary

Customer profile

BASF Schwarzheide GmbH has been part of the BASF group since 1990. More than 2,000 employees produce specialized chemicals at the production site in Lusatia. The product portfolio ranges from polyurethane-based products and systems, crop-protection agents and water-based coatings to engineering plastics, foams, dispersions, Laromer brands and from 2022 also battery materials. With these high-quality products that contribute to a more sustainable future, BASF Schwarzheide GmbH helps its customers to be successful.

BASF Schwarzheide GmbH assumes social responsibilities in the region, contributing to various areas from vocational training to co-siting activities. A dozen companies have already become co-siting partners with BASF, thereby benefiting from the multifaceted synergies of working together with an innovative chemical company and the experience and expertise BASF has to offer. For more information, please visit www.basf-schwarzheide.de.

Outline of the project

BASF Schwarzheide GmbH worked closely with Yokogawa to evaluate Yokogawa's Cavitation Detection System. They assessed that the system is high reliable and accurate and is able to detect cavitation at an early stage, track cavitation occurrence time and rate, and measure low to high levels of cavitation. As such, they concluded that it clearly surpasses the capabilities of conventional vibration sensor solutions.

The Challenges and the Solutions

The Challenges: Effective operation and maintenance

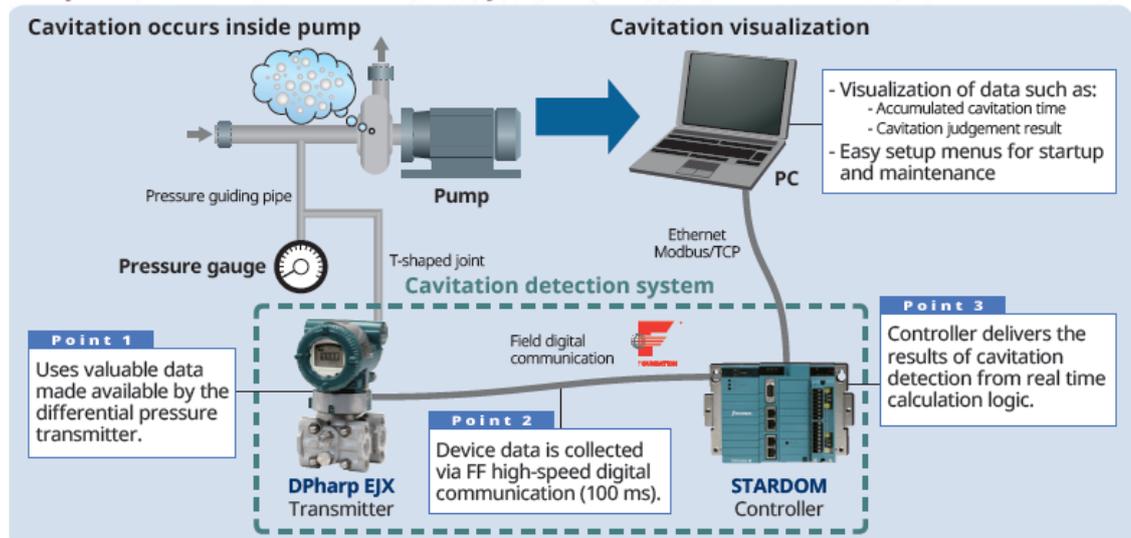
Cavitation is the sudden implosion of vapor-filled bubbles that form in hydraulic machines under certain pressure and temperature conditions. Avoiding this is a major challenge for plant operators, especially in the manufacturing industry and with centrifugal pumps. This occurrence can lead to damage of plant components and, under certain circumstances, to failures, but is difficult to detect and sometimes remains completely unnoticed. In order to prevent this phenomenon and its consequences, it is essential to recognize them as they arise and to take measures to prevent them from occurring. BASF Schwarzheide GmbH is looking for innovative ways to counteract this problem and thus improve its production in the long term. For this reason, they decided to test Yokogawa's Cavitation Detection System as it is a novel and promising approach.

The Setup: Yokogawa's Cavitation Detection System

The Yokogawa Cavitation Detection System, which consists of a pressure transmitter and a STARDOM controller providing high speed measurement and real time evaluation, detects the first signs of cavitation by detecting an increase in pressure fluctuations caused by the implosion of vapor-bubbles. Within process environment, this implosion is commonly detected by supervising vibration. As it is measured on the pump housings the bubbles need to have a certain size to be measurable as vibration whereas the pressure transmitter is in direct contact with the medium and therefore can already detect changes when first small bubble appear.

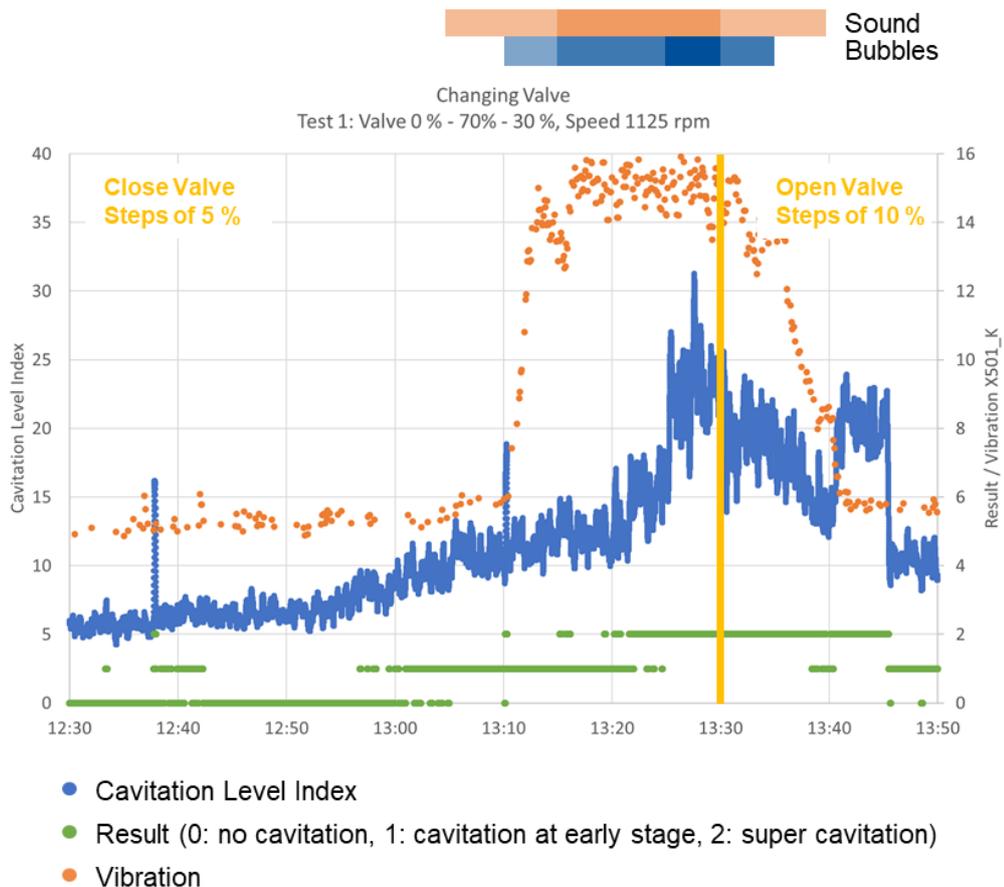
To evaluate the accuracy of the Yokogawa Cavitation Detection System, BASF Schwarzheide GmbH therefore integrated it into its test facility and compared the results of extensive cavitation tests with those of the conventional measurement methods like vibration.

Components of cavitation detection system



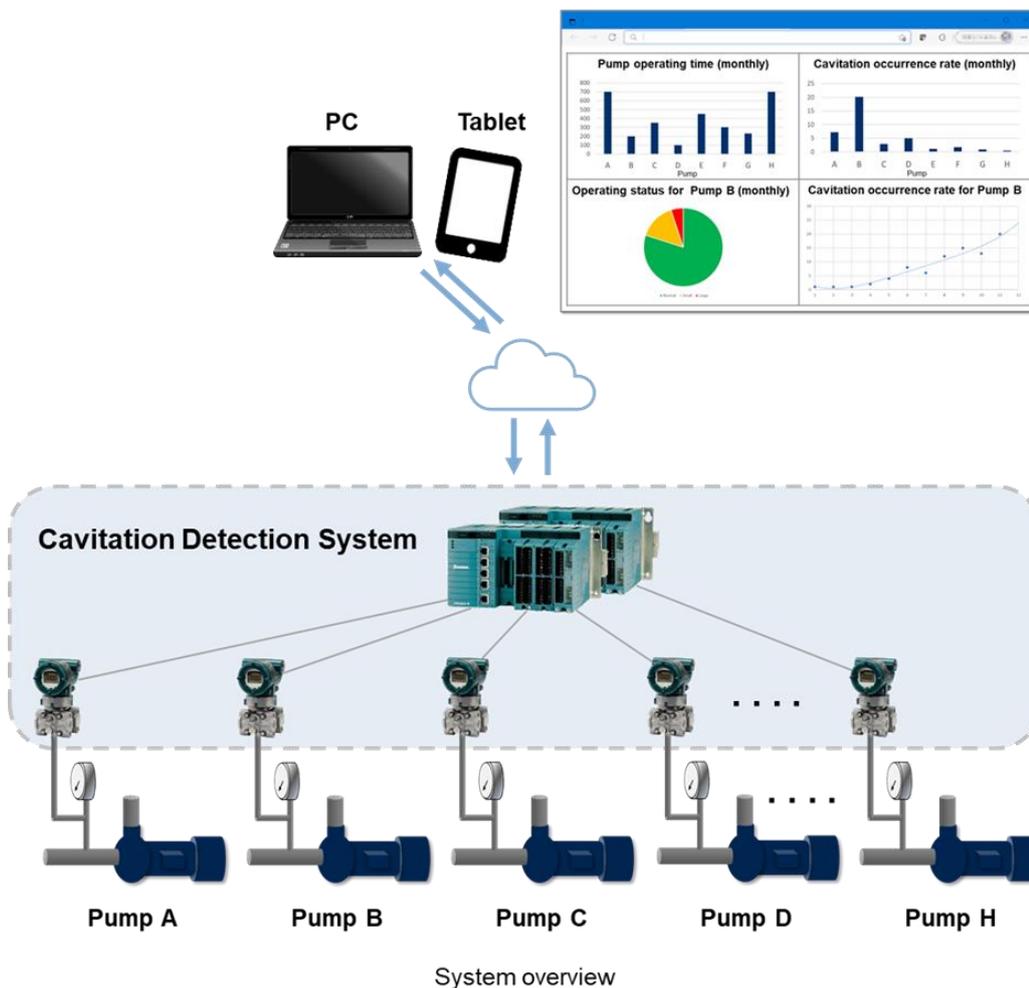
The Results

The Yokogawa Cavitation Detection System outputs the degree of cavitation in form of a Cavitation Level Index whereby automatically generated thresholds divide the levels of early cavitation and super cavitation. BASF Schwarzheide GmbH verified that it was possible to clearly differentiate between normal operation, early cavitation, and super cavitation. Compared to the other measurements, particularly vibration they confirmed that the Cavitation Detection System was able to detect cavitation at an earlier stage. The results were reproducible and showed a close relationship to manually recorded sound values and visual confirmation of the appearance of bubbles.



Expectations for the Future

Yokogawa anticipates that this Cavitation Detection System will make an effective contribution in improving operations and maintenance. By aiding in the visualization of pump status, this system will contribute to operational excellence and enable an effective maintenance strategy.



Customer Satisfaction

BASF Schwarzheide GmbH was very satisfied with the following results:

- The Cavitation Detection System catches minute pressure fluctuations generated by low cavitation; problems are recognized before vibration occurs.
- The Cavitation Level Index that is continuously generated is a highly precise health index that is suitable for use in intelligent early detection systems.

It is expected to utilize the Cavitation Level Index for process control, allowing countermeasures to be taken at an early stage, before the process is significantly affected. By outputting total pump running time and total occurrence time for high/low cavitation, the controller gives an accurate picture of pump status and enables a predictive maintenance approach. This is one step on the way to Industry 4.0.

Statements by BASF Schwarzheide GmbH staff

Yokogawa's Cavitation Detection System was tested as part of a series of experiments and with the help of BASF Schwarzheide GmbH's own test facility. It turned out that the system provides very accurate results regarding the detection of cavitation. Particularly noteworthy is the fact that even minor cavitation was detected and indicated for the installed pump, which conventional methods (e.g. vibration monitoring) did not allow.

The cooperation with Yokogawa was also perceived as very positive, as a competent contact person was always available for the implementation as well as for problems or questions.

The use of the system made it clear that it can help to identify weaknesses in running processes for the right use case. It can help to counteract these and thus extend the service life of pumps.

For more Information and Contact

[Predictive Maintenance of Pump Cavitation \(Cavitation Detection System\)](#)

Yokogawa Deutschland GmbH

Broichhofstr. 7-11, 40880 Ratingen, Germany

<https://www.yokogawa.com/de/>

Yokogawa Europe Solutions B.V.

Euroweg 2 , 3825 HD Amersfoort, The Netherlands

<https://www.yokogawa.com/nl/>

Yokogawa Electric Corporation**YOKOGAWA ELECTRIC CORPORATION****World Headquarters**

9-32 Nakacyo 2-chome, Musashino-shi, Tokyo 180-8750, Japan

<https://www.yokogawa.com/>

Subject to change without notice

All Rights Reserved, Copyright © 2022, by Yokogawa Electric Corporation