ALLWEILER PUMPS

IN EXHAUST GAS TREATMENT SYSTEMS

REQUIREMENTS

Short-term delivery of individually configured pumps for pulsation-free pumping of urea in catalytic waste gas treatment systems.

SOLUTION

Allweiler progressing cavity pumps.

RESULT

Turnkey systems equipped with Allweiler pumps are ready for delivery within eight to ten weeks.

RESPECTING ENVIRONMENTAL REGULATIONS

As environmental regulations become more stringent, waste gas treatment systems are growing in importance. H+H Umwelt- und Industrietechnik GmbH of central Germany has been using Allweiler progressing cavity pumps as a core component of these systems since 2003. The company has been manufacturing catalytic waste gas treatment systems since 1998. Originally they focused on applications in block heating stations and industrial plants. But stricter environmental regulations introduced in Scandinavia and in the Baltic Sea in 2004 have boosted demand for shipborne systems. Introduction of a NOx tax in Norway has further increased demand. NOx-reduction systems are used on ships for the propulsion system's heavy oil motor and for auxiliary equipment like power generators. The first of these systems produced by H+H was commissioned in 2005. Since 2004, the company has been the global market leader for maritime Selective Catalytic Reduction systems (SCR) with a market share of approximately 80%. Currently about 600 of these single systems, known by the name “EcoMarin”, are operational on 160 ships.

TURNKEY SYSTEMS

According to the company's founders, Alexander Hommen and Michael Heck, the success of H+H is based on four factors. First is their global service. Approximately 20 agents and service centers ensure rapid reactions regardless of where a ship is currently located. Second, the company delivers fully assembled, fully tested systems that are ready for immediate deployment. "We provide turnkey systems, including a complete maintenance package, such as a catalyst replacement plan,” according to M. Heck. And H+H is fast – the third factor in its success. "We design every system ourselves, configure it for the specific ship it will be used in, and assemble the whole thing here." The company's years of experience with catalytic processes are the foundation of their strategy. Even before the company was founded, three of the four managing directors were active in this area. Fourth, fast and reliable suppliers are essential to making this approach work.

SELECTIVE CATALYTIC REDUCTION (SCR)

Treatment of exhaust gas through selective catalytic reduction (SCR) performed by an integrated SCR system is essential for achieving significant and sustainable reduction of NOx values. The principle behind SCR is based on a reaction between NOx and urea-based ammonia (NH_3) in the exhaust gas. This reaction takes places on the surface of the catalyst. A urea solution is injected into the exhaust pipe after the turbocharger. The NOx is thereby converted to harmless nitrogen (N_2) and water vapor. Each SCR system is individually configured for optimal cleansing. The proper catalyst type is determined by the proportion of dust in the exhaust gas and the temperature after the turbocharger and before the SCR system. Required output and collector efficiency as well as motor power and mass flow of the exhaust gas determine the volume and back pressure of the catalyst. Additionally, fuel quality and sulfur content determine the SCR system's running time and minimum operating pressure.

The SCR process requires a relatively high temperature level (270 to 510 °C). For this reason, the SCR reactor must be installed in front of a boiler. After cold-starting the motor, a "warm-up" period of approximately 15 minutes is required before the SCR system can inject the urea solution. The mixing and injection unit is installed in either a vertical or horizontal section of the exhaust gas line. The system doses the proper quantity of urea solution according to the motor load signal. In addition, the output of the SCR system can be monitored with a continuous monitoring system (CEM, NOx analyzer) and integrated into the ship's management system by way of a BUS system. The PLC control cabinet operates fully automatically.

PULSATION-FREE PUMPING

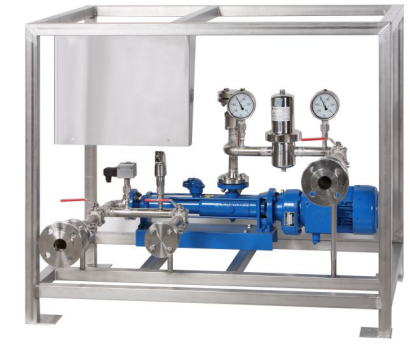
Progressing cavity pumps from Allweiler AG, a Colfax business unit, play a major role in the finished products. These pumps feed urea to the SCR system's dosing panels. The urea is heated to a high temperature in the waste gas. The resulting ammonia serves as a reducing agent in the system. Due to the difficulty of storing ammonia, it is not possible to simply keep the material onboard the ship in ready-to-use" form. Allweiler pumps continuously circulate urea in a closed loop; excessive amounts of the material are fed back into the tank. A major advantage of these pumps is their pulsation-free pumping characteristics. Even when starting, they do not produce pressure surges that could damage the system.

RAPID DELIVERY

Allweiler's tremendous flexibility and ability to react quickly to individual requirements were key factors in H+H's decision to use Allweiler for these critical components. Speed and flexibility are particularly important for shipborne systems. For example, power supplies on ships can vary between 230 and 690 V, so having the right pump motor is very important. In many cases, H+H has only eight to ten weeks from the time an order is placed until the system is delivered, so fast reactions and direct contact with the supplier are essential.

The pumped liquids (32% to 40% urea and 12% to 24% ammonia water) are very demanding on the pump materials. Allweiler manufactures its own stators and can choose the best possible combination from 20 different materials. Other parts that contact the pumped liquid directly, such as the joint collar, are also made of specially adapted materials to give them an extended service life. Pump casings are made of stainless steel. These configurations allow the pumps to achieve continuous operating times of 8000 hours or more.

The pumps operate continuously instead of being controlled by frequency converters. Frequency converter controls have proven to be too sensitive and complex for practical applications. They also influence the ship's power supply network. In this configuration and installation, the systems and pumps even meet the high requirements of military applications and have already been installed in several naval vessels.



Allweiler progressing cavity pumps of the "ANBP" and "AEB" series in block design are used in the pump stations. These pumps are equipped with dry running protection. Capacity of the pumps is between 600 and 4000 liters/hour with pressure up to 9 bar. The pumps draw urea from the tank up to 4 m away.

Managing Director Michael Heck displays a model of an anchor-handling supply ship equipped with an H+H waste gas treatment system. To the right of the model are examples of honeycomb catalysts like those used in these systems.