

Efficient pump selection for tough process conditions

Retrofitting as an economical solution

A non-functioning pump can cause massive damage and consequently result in high costs. For this reason, lastingly reliable pump performance is amongst the most important selection criteria for plant operators, together with low operating costs and a long service life of the pump used. Replacing a pump can also be worthwhile if it means that operating stoppages and repair costs are a thing of the past — as this practical example illustrates.

The pump location is an emulsion evaporator in a plant for the treatment of used cooling lubricants, washing fluids and other oil-water emulsions. The process temperature is generally approx. +90 °C. With an absolute pressure of approx. 300 mbar, the emulsion is concentrated by means of evaporating the aqueous components. A heated rotary evaporator continuously stirs the medium, mineral oil with crystalline components, i.e. solids. The delivery height for this process is approx. 25 m. Accordingly, a pump must convey up to 200 m³ of oil concentrate per hour.

This absolutely exceeds the capabilities of the pump used by the plant manufacturer. The pump cannot pass the test in practice. The centrifugal pump fitted with dual mechanical seals is also struggling to cope with other process conditions, which this disposal and treatment process naturally involves. It can neither handle the specific – and also abrasive – properties of the oil concentrate nor the fluctuating quality of the process medium.

Henrik Dorn, manager of the emulsion evaporation plant, which is operated independently of the remaining part of the process at the refinery, draws attention to a further difficulty that needs to be overcome. When cooling the emulsion, caking and the formation of hard encrustations can occur. He describes his experience as follows, „With the centrifugal pump previously used by the plant manufacturer, mechanical wear would sometimes result in severe leakages at the double-action mechanical seal within four to six weeks, leading to significant leakage of product and loss of vacuum in the process. In addition to extended and unscheduled operating stoppages, this



Product tank store and emulsion evaporation plant of Südöl Mineralöl Raffinerie GmbH in Eisingen, Germany

also repeatedly resulted in extensive repair costs.“ It was not possible to achieve any improvement when operating this pump, despite the efforts of the pump and seal manufacturer. The mechanical seal was eventually completely destroyed. The replacement parts costs alone came to almost 2000 Euro. The work required for the dismantling and renewed reinstallation would also have to be added.

„As stable and economical operation was no longer possible in the longer term, an alternative had to be found,“ explains Henrik Dorn,

who supervises all process systems at the Südöl mineral oil refinery in his capacity as operations engineer. The use of a hermetically sealed special centrifugal pump was thus indispensable. The optimum solution for these extreme conditions was consistently implemented with the use of the horizontal magnet-coupled centrifugal pump MPCH_{DryRun}.

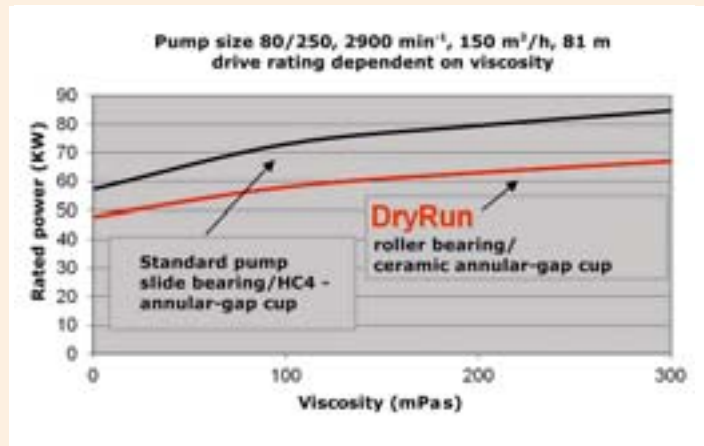
Dry-running magnetic drive

The high performance of the DryRun can be seen from its magnetic drive, which is continuously dry-running and depressurised. The rolling bearing and magnetic drive run under an atmosphere of protective gas, and are not in contact with the pumping medium. In this case, the sealing gas used is dry air. In a tailor-made response to this specific application situ-

ation, the impeller was fitted with closed blades.

Between the rear side of the impeller and the shaft bearing, there is a product-free labyrinth area through which the sealing gas flows. This separation and the structural design produce a high temperature gradient and hence a low bearing temperature.

„The new pump, the MPCH_{DryRun}, was commissioned on 30 August 2012 in cooperation with a technician from the pump manufacturer Bungartz. From the initial contact onwards,



Uncomplicated: retrofitting to the horizontal magnet-coupled MPCH_{DryRun} centrifugal pump manufactured by Bungartz

The standard pump requires around 9.5 kW more power at a density and viscosity of 1. Compared to a pump with a metallic annular-gap cup, approx. 7,600 Euros/year can be saved under conditions of continuous operation.

there was excellent communication with Bungartz. All questions relating to the process were thoroughly discussed. This allowed the pump and its sealing gas system to be optimally designed," says Henrik Dorn, who was able to successfully eliminate a cause of continuous problems and cost-drivers through this decisive retrofitting measure. „Since the new pump was installed, there have been no further problems, interruptions or leakages in this area. The MPCH_{DryRun} runs completely smoothly and inconspicuously.“

A control system continuously monitors the bearing temperature at the magnetic drive, as well as the minimum flow rate in the sealing gas system. Südöl confirms that the values are always within the green range. The analysis of bearing vibrations after commissioning was performed as a reference measurement, in order to identify potential bearing damage at an early stage through yearly repeated measurements.

The retrofitting process also went smoothly and without the need for any major conversion work. Due to the structural length of the magnetic drive in the horizontal centrifugal pump, it was merely necessary to lengthen the concrete foundation slightly before the installation. The pump casing of the DryRun, dimensioned in accordance with the DIN standard, is no different from that of the pump used previously; and the performance data of the 45 kW/1500 min⁻¹ motor are likewise identical.

Optimised use of energy

The economy with which the MPCH_{DryRun} operates can be seen from the use of rolling bearings and a ceramic annular-gap cup. And the

special centrifugal pump from Bungartz also scores points in terms of energy efficiency, low energy consumption, and no heating of the medium. No hydraulic or vortex losses occur, neither in the coupling nor in the bearing.

The very long maintenance intervals of the DryRun are also convincing, which at three years can be described as very long given the performance of the pump. Together with the long service life of the bearing, at more than 32,000 hours, the DryRun definitely has a rigid construction.

The retrofitting is definitely profitable, despite the investment, particularly since, taking into consideration the previous replacement parts costs, the procurement costs will have been amortised within 18 to 24 months at the latest. Given that there are no more stoppages in production, and taking into consideration all the repair costs previously incurred, this amortisation period will even be substantially shorter, not to mention all the annoyance and time expenditure in the past. When one considers the usual cost ratio of 30:70 – purchase and installation (30%) to operating costs e.g. power and maintenance (70%) – it is no longer remarkable that the chemical and petrochemical industries, environmental protection, and power plant engineering prefer to use this efficient pump solution.

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The author:



Annette van Dorp
Freelance journalist

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Advantages at a glance

- The special centrifugal pump MPCH_{DryRun} is fitted with a continuously dry-running and depressurised magnetic drive.
- The sealing and bearing technology works independently of the pumping medium, and is hence entirely free of wear and tear.
- The product-free labyrinth area between the rear side of the impeller and the shaft bearing, through which sealing gas flows, ensures a heat barrier with high temperature gradients, and hence ensures that the bearing remains at a low temperature.
- The pump scores points with low installation and maintenance costs, low power consumption, and fast availability in all standard dimensions.
- The very high standard of safety and reliability results from the triple-seal design, and is based on the low pressurisation of the annular-gap cup, which runs in a gas atmosphere without any contact to the product.
- A high level of operating safety and reliability – even where the flow of medium is interrupted – rounds off the safety concept.

The features of the pump are shown in the web at <http://bungartz-dryrun.de/english/animation.html>.