

# Frequency-controlled pumps from Colfax Fluid Handling in machine tools

## Challenge

Reduce the amount of maintenance-related downtime, reduce energy consumption, and reduce total costs for coolant and cooling water pumps.

## Solution

Complete solutions consisting of Colfax Fluid Handling pumps and electronic control with frequency converters.

## Results

Significant, long-term costs reductions, longer service life of the units, significantly less maintenance, and therefore much less downtime, plus energy savings and a reduced carbon footprint.

## Requirements change fast

Pump applications for machine tools must fulfill special requirements in order to ensure efficient tooling changes. The pumps must supply each tool with cooling lubricant or cutting oil as soon as the tool has been engaged. However, fluid volume and pressure requirements vary for each tool.

In conventional systems, pumps move the fluids continuously at the maximum required pressure, ensuring that the necessary volume is always available to each tool. When tools are changed or the machine is idle, valves divert the unused oil. The upstream channel of each valve contains a filter that traps swarf-based contaminants such as turnings, filings or shavings. While this method of fluid delivery provides an overall solution, it is certainly not the most efficient solution.

## Frequency converters instead of valves = overall savings

Machine operators are increasingly choosing options that deliver cost, material and energy savings that make conventional systems obsolete. Rather than pumping excess coolants and lubricants in a loop, intelligent controllers adjust pump speeds to the precise volume and pressure. Smaller pumps and motors can be utilized, proving equipment savings as well.

Energy is saved and efficiency enhanced as the pump operates only when needed to deliver only the required amount of fluid. Installations are also more straightforward. The pump may be adjusted according to changing conditions, and safety buffers utilized in dimensioning are no longer needed.



Three pumps in this production line were converted to frequency control.

### Successful conversion by reducing downtime

The Volkswagen plant in Kassel, Germany uses this technology for mechanical processing of transmission housings and in its foundry. To optimize housing production, the company focused on minimizing failures caused by defective control valves and associated production interruptions. Filters the closed loop system regularly clogged with swarf and required cleaning, causing extended periods of downtime for the entire production line.

After eliminating control valves and switching to a Colfax Fluid Handling Allweiler EMTEC-series of frequency-controlled screw pumps, uptime increased significantly. Energy savings vary, but at times can reach up to 68 percent.



**EMTEC pumps with valve-based control before the conversion.**

The line's electronic controller needs less than a second to adjust motor speed to the pressure required by each individual tool. If a higher volume is required, speed is readjusted automatically. The new system is a package that includes the pump, frequency converter, and control logic and is optimized for use in machine tools, transfer centers, and transfer lines.

From the operator's perspective, the new system's fast reaction time is a major benefit. The optimal operating point is achieved from a starting stop in just 500 ms. The pumps require less maintenance than those of the old system, and have a longer service life because they are not operated continuously at their highest speed. The speed controller adjusts for normal wear without loss of pumping performance as it automatically increases speed, allowing for maintenance to be coordinated with the production process.

In most cases, smaller motors with significantly lower rated power are used. The pump operates only when the tool is in operation, protecting the filter preceding the pump. Downtime due to maintenance has been reduced by more

than 90% – from 100 minutes per month to just six minutes – which allows Volkswagen to produce an additional 200 transmission housings per month.

"Besides the energy savings, this is the primary benefit," according to Dipl.-Ing. Jan Wettlaufer, who is responsible for housing production.

The new process consumes approximately 9000 kWh less electrical energy each year, reducing the facility's carbon footprint by approximately 5.2 metric tons Co<sub>2</sub>.

Another advantage is the automated adaptation of pumping performance to the various workpieces and tools. Now a variety of transmissions can be processed on the same machine, reducing the need for equipment.



**Electronic control with a frequency converter in a remote switch cabinet, after conversion.**

„The electronic controllers work so flawlessly and automatically that we no longer have to keep an eye on the system,“ said Wettlaufer. „This is truly optimal for our purposes.“ Aside from the electronic controller and smaller motors, the system itself is unchanged. The absence of control valves improves overall stability; in the past, every instance of maintenance had the potential to introduce errors. Operators no longer make manual adjustments. Any changes to the system – which are minimal – are made through a direct telephone call to the vendor.

The VW plant in Kassel converted the coolant pumps in four systems from mid-2010 to mid-2012. The conversion of each machine required less than one day and the new pumps, including electronic controllers, were installed on two machines over a weekend.

Costs were approximately €15,000-€25,000 per machine, with the majority of cost residing in the switch cabinet. Full installation was preceded by a 2010 system test. Once the test system proved its effectiveness, all four systems were converted.



**Switch cabinet with frequency converter, throttle, filter, and control logic.**

### Energy savings in the foundry

The facility's foundry, which produces aluminum and magnesium die-cast structural components, will also be equipped with electronic controllers. The foundry's pumps move cooling water up to 90°C as part of pressure boosting systems for cooling casting molds.

Nine of the 65 Allweiler "NI" series centrifugal pumps have been converted to date, with the remainder scheduled for conversion.

As in the housing production area, the foundry focuses on pressure control. Similarly, control had been handled solely with valves before conversion to the electronic controller. Pumping in the foundry was also independent of current

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needs, and pressure varied widely depending on the requirements. In extreme cases, the pumps ran up against gate valves even though consumer circuits were closed. The new electronic controls installed to date create a consistent supply pressure, significantly reducing power consumption by approximately 50 percent, or about 1.2 kW per pump. Payback time per system is estimated to be 18 months. Retrofitting costs, including commissioning, were less than €2,500 per pump. The foundry and its pumps operate 20 hours per day, approximately 300 days per year. Electronic control reduces CO<sub>2</sub> output at the foundry as well by about 3.6 metric tons per pump per year. Additionally, electronic control extends pump service life and significantly extends the service life of the seals due to lower operating speeds.

As in the housing production area, the Allweiler units have also proven themselves in the foundry. Efficient, electronically controlled pumps contain numerous benefits and make an outstanding contribution to the "Think Blue. Factory." project, with which Volkswagen intends to further improve the environmental friendliness and sustainability of its production sites.

"Install and forget," summed up Dr.-Ing. Dieter Kaiser.



**"The conversion allows us to process about 200 more transmissions each month. Aside from the energy savings, this is a critical point for us," according to Dipl.-Ing. Jan Wettlaufer, technical manager in housing production. Image shows one of the electronically controlled EMTEC screw pumps.**

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