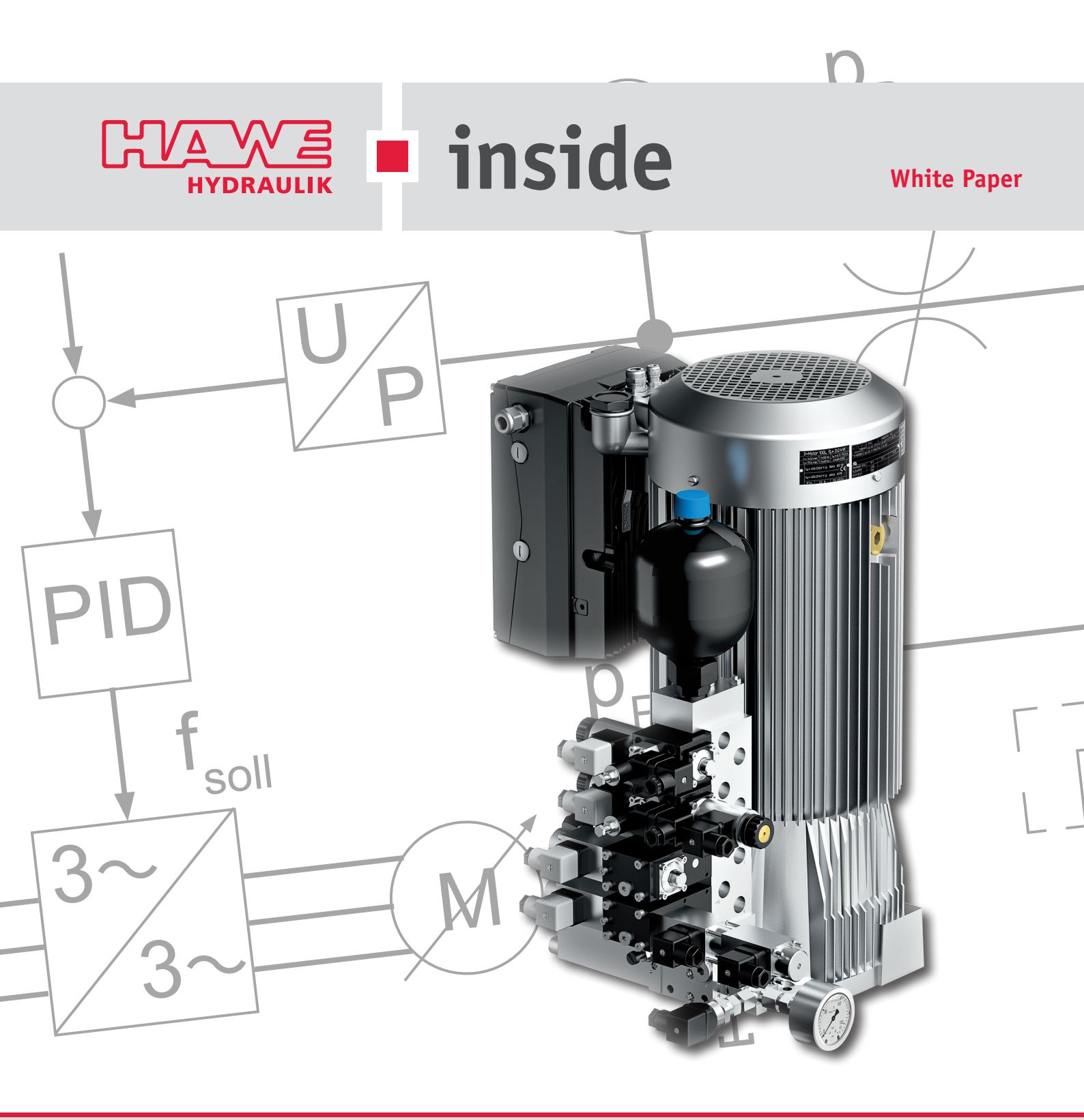
HAWE HYDRAULIK

inside

White Paper



Speed controls in compact power units

For high operating ratios and efficient hydraulics

With a speed-controlled motor, the efficiency of a hydraulic drive in the lathe can almost be doubled. The supply of the functions is tailored to the needs and thus as efficient as possible. But other applications also benefit from this type of drive, for example, by a very precise speed control.

Solutions for a World under Pressure

HAWE HYDRAULIK

Hydraulic power packs with speed controls open up many new options for the supply of hydraulic systems. In applications such as lathes with constant flow rate requirements, speed controls supply the hydraulic consumers according to demand.

In applications requiring exact control of the hydraulic cylinders' power, such as test facilities, they finely adjust the pressure via the speed. The appeal of speed controlled hydraulic power packs is not limited to their technical refinement, however. They also increase the energy efficiency of the machines in which they are deployed and so save hard cash during production.

What is the specific saving potential in lathes?

While the electric-hydraulic operating ratio of conventional systems comes to around 35%, speed-controlled power packs achieve efficiency ratios of over 55%. This means that a power pack with a rated output of 3 kW will cut the average power consumption by around 1 kW. For two shift operations over 240 working days and at energy costs of EUR 0.15/kWh, the annual savings accumulate to almost EUR 600.00 for each machine! This recoups any additional one-off costs for the speed-control in a few months.

In lathes the crucial point is the leakage at the rotary transmission for the hydraulic clamping chuck. While the clamping chuck rotates at 5,000 or more revolutions per minute, the leakage at the rotary transmission equals two to six liters per minute. These losses must be balanced out by a constant flow rate. In addition, the hydraulic actuators (clamping chucks, tailstock, steady rest, tool changer, etc.) trigger strong fluctuations in the volume flow requirements. The recommendation for machine manufacturers therefore is to deploy a hydraulic system capable of balancing out these system-inherent fluctuations with minimum loss of energy.

Which components do I need for the control circuit?

Speed-controlled power packs are the solution. They adjust the hydraulic power pack's flow rate to the actual demand, while the motor keeps operating at a good efficiency ratio. Usually the control will be so fine-tuned that the flow rate taken off by the hydraulic consumers is balanced out and the pressure level is maintained.

Such a control circuit necessitates a number of components. These include a pressure sensor to meter system pressure and a PID-controller that calculates the reference speed from the reference pressure and system pressure. A frequency converter in the motor applies the reference speed and the pump finally converts the speed into flow rate. Special attention must be given to the fact that the power pack has to accelerate quickly to balance out any sudden flow rate demand of a consumer. Depending on the size of the motor and the pump it takes about 0.2 seconds until the nominal speed is attained. For this phase an additional hydraulic accumulator is required to offset loss of pressure. Generally, an accumulator's volume of 500 cm³ is adequate.

HAWE Hydraulik's compact power unit type HK, with frequency converter was fine-tuned for deployment in lathes.

Speed-controlled power packs with improved operating ratios reduce the hydraulics system's cooling needs. However, the heat cannot be dissipated with a conventional heat exchanger, as the exchanger needs constant and unpressurized flow rate. The compact power units of HAWE Hydraulik dissipates the heat via the housing by their cooling fan and the finned design of the housing.

To deploy power packs with frequency converter usefully, special attention should be given to the control. Once the exact pressure and flow rate requirements of individual consumers are known, the control can ensure „pinpointed" supply. Thus, no additional valves are needed, for example, to traverse the tailstock at the lath into the clamping position via rapid and creep speed and set the load there via the pressure control.

The control becomes „smarter", if the system pressure is lowered to the required minimum. Where the preset clamping pressure is 20 bar, for example, and in case no further consumer is active, the system pressure can be lowered to around 25 bar. Compared with a constant system pressure of 50 bar this allows for an additional 50% in energy savings.

Both approaches require additional small programmable valve controller, which is fine-tuned to the control of hydraulic systems.

Which other applications can be optimized by speed cotrolled drive?

The combination of speed-controlled power packs and a programmable logic valve control makes sense for many other fields of application as well.

Highly precise power controls can be realized, if pressure serves as set point. This is of particular interest for test applications.

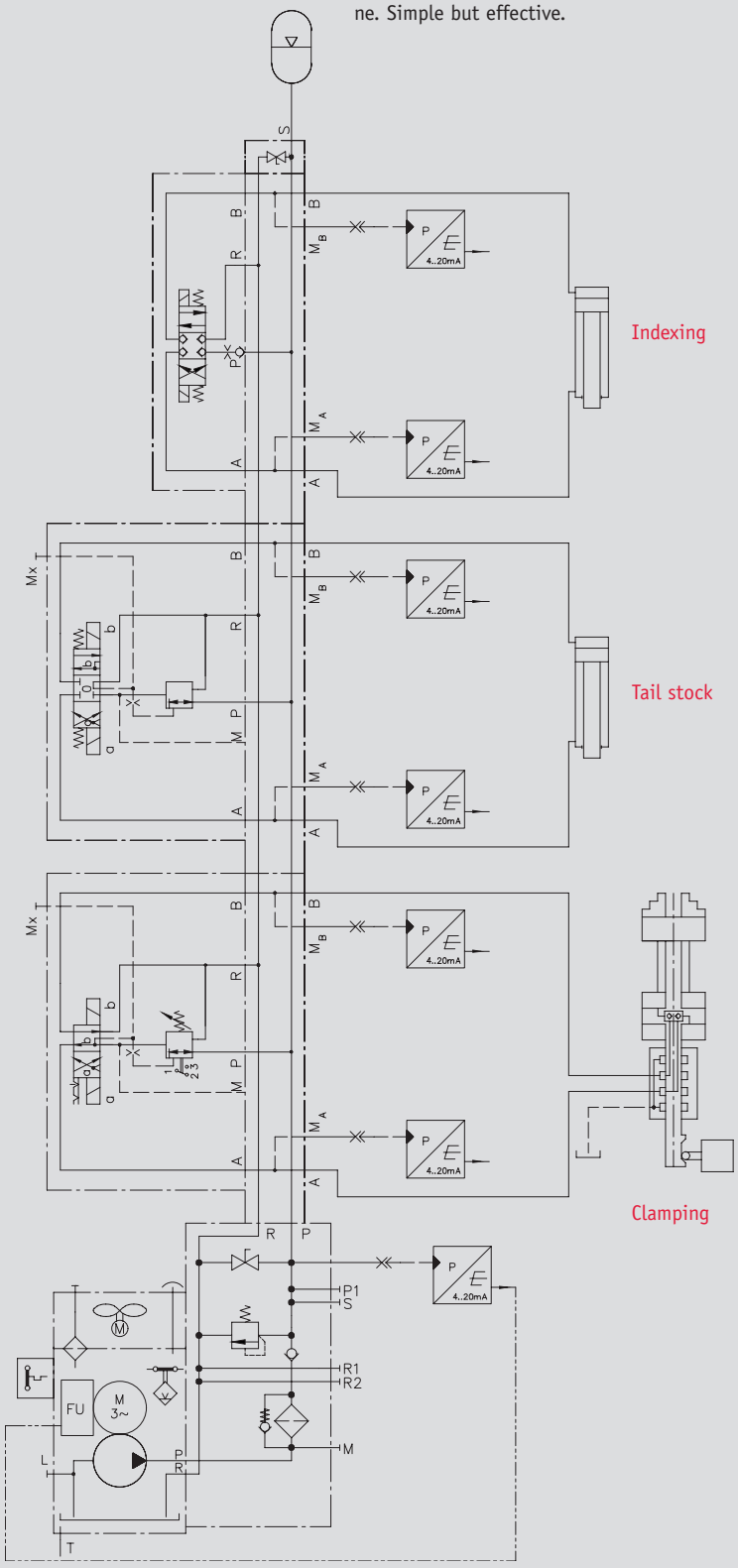
Can I even realize predefined velocity sequences?

Other test applications require a load-independent build-up of force with predefined velocity sequences. A speed-controlled power pack is once again capable of solving this task. As the velocity of a hydraulic cylinder depends immediately on the flow rate supplied, and as this velocity increases with rotational speed, it is actually an application that is particularly easy to realize. If a highly precise speed control is required, feedback via a position sensor system is recommended.

Power packs with frequency converters offer another feature that was hardly utilized so far. The converter provides output signals on the current rotational speed and the uptake of electric power. There is a direct connection between power and pressure as well as rotational speed and flow rate. The evaluation of signal deviations can therefore be used to detect disruptions in the system, such as pump wear or failure. Thus, it enables system diagnosis without additional sensors.

The expertise for selecting the optimal system components lies in the right dimensioning. This in turn depends on the individual actuators requirements for pressure, processing velocity and activation frequency. The optimal design of the hydraulic system becomes feasible once such information and suitable simulation software is available. The specialists of HAWE Hydraulik will find the suitable solution for many different requirements, given their extensive portfolio of compact power packs, valve controls, proportional and seated valves as well their expertise in system design.

A typical hydraulic solution for a lathe machine. Simple but effective.



HAWE Hydraulik SE is a responsible development partner with application expertise and experience in more than 70 branches of mechanical engineering. The product range includes hydraulic power units, fixed and variable displacement pumps, valves, sensors and accessories. Electronic components that are exactly attuned to the hydraulic components provide an easy initial operation, precise control and condition monitoring. The intelligent system solutions reduce energy consumption and operating costs. Compact drives save space and allow an innovative machine design. Around 1,950 employees in 16 countries and more than 30 distributors worldwide support the customers locally, professionally and personally.

Certified according ISO 9001, ISO 14001, ISO 50001, OHSAS 18001.

■ Subsidiaries and service offices

■ Australia ■ Austria ■ China ■ Finland ■ France ■ Germany ■ India ■ Italy ■ Japan ■ Korea ■ Russia ■ Slovenia ■ Spain ■ Sweden ■ Switzerland ■ USA

● Sales partners:

● Argentina ● Belgium ● Brazil ● Bulgaria ● Canada ● Chile ● Czech Republic ● Denmark ● Egypt ● Ecuador ● Great Britain ● Greece ● Hongkong ● Hungary ● Israel ● Luxembourg ● Malaysia ● Morocco ● Netherlands ● Norway ● Panama ● Peru ● Poland ● Portugal ● Romania ● Saudi Arabia ● Singapore ● Slovakia ● South Africa ● Taiwan ● Thailand ● Turkey ● Ukraine ● Vietnam

WP Speed controlled EN HAWE NA 08/2017

HAWE - Charlotte
9009-K Perimeter Woods Dr. | Charlotte, NC | 28216
Tel 704-509-1599 | info@hawehydraulics.com | www.hawe.com

HAWE - Portland
12990 S.E. Hwy 212 | Clackamas, OR | 97015
Tel 503-222-3295 | info@hawehydraulics.com | www.hawe.com

HAWE - Houston
10920 West Sam Houston Pkwy N. | Suite 700 | Houston, TX | 77064
Tel 713-300-3260 | info@hawehydraulics.com | www.hawe.com