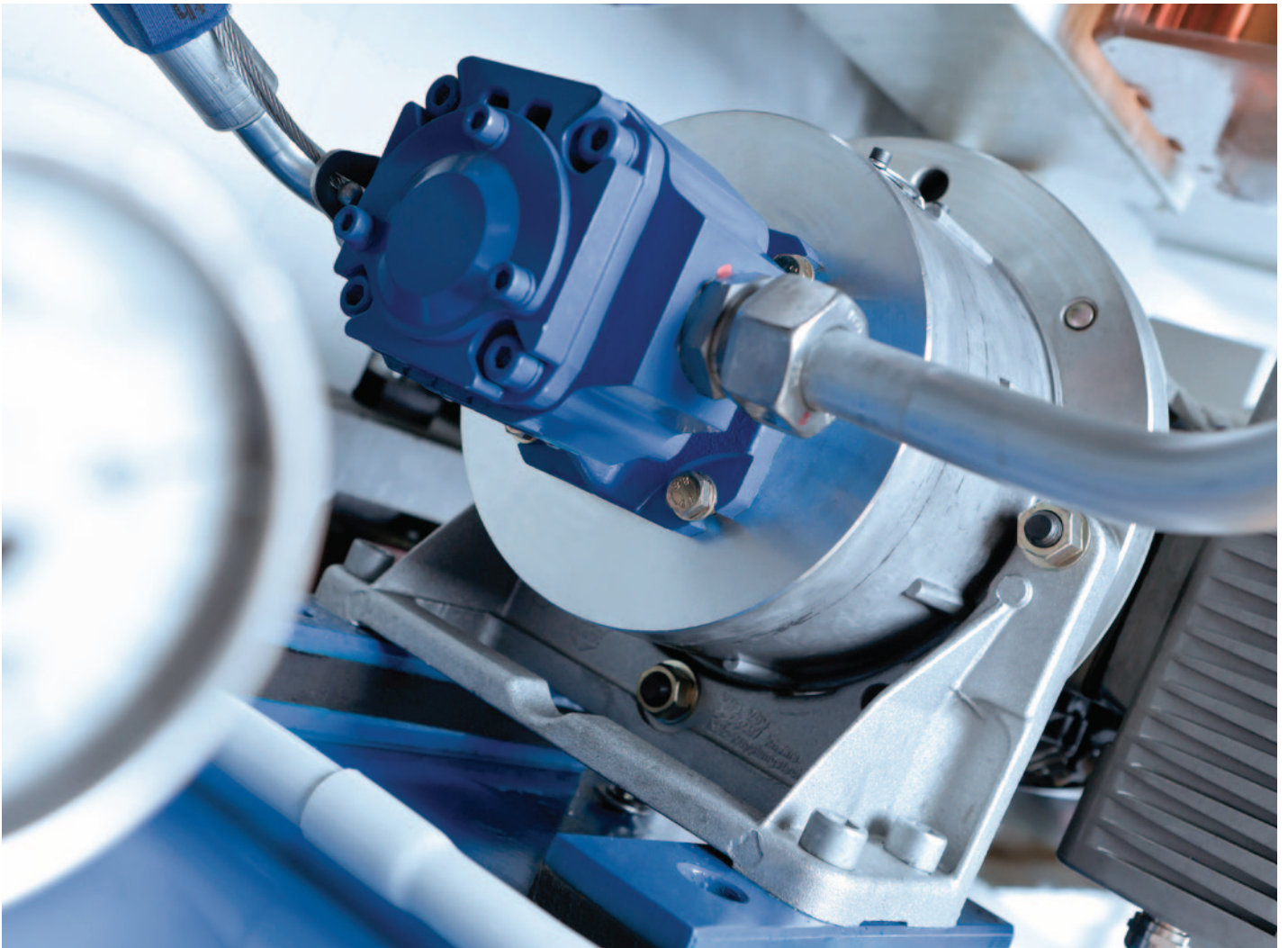


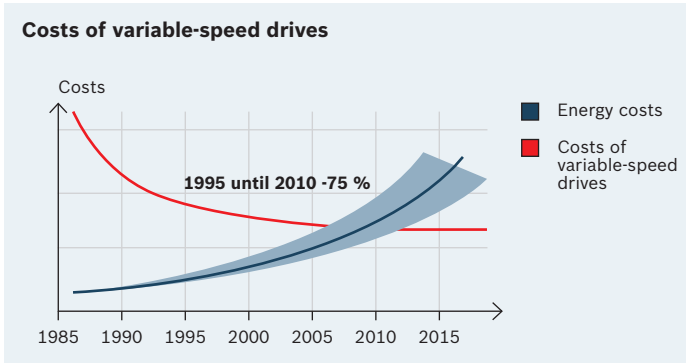
# Rexroth Sytronix – Energy-efficient Hydraulics with Variable-speed Pump Drives



# Rexroth Sytronix – Powerful, Energy-efficient and Cost-cutting

Investing now into the future – as a result of rising energy costs and increasingly cost-efficient speed-controlled drives offered on the market, variable-speed solutions are on the advance.





With Sytronix variable-speed pump drives Rexroth cuts operating costs in hydraulic systems as soon as the machine cycle utilizes fluctuating flows. Using intelligent servo-drives, Rexroth Sytronics regulates the speed and thus the power consumption of electric motors in line with demand. The higher the share of part-load operation, the greater is the saving potential. In this way, the energy consumption can be reduced by up to 80%.

At the same time, noise emission is reduced by up to 20 dB (A). The expenditure for noise-reducing secondary measures is cut accordingly. The investment therefore pays off within a few years.

In many cases, it is possible to do without cooling of the power unit, because due to the reduced energy consumption the hydraulic fluid will not heat up excessively. This, in turn, allows a compacter design, which reduces complexity and acquisition costs.

In addition, since our pump drives achieve sustained noise reduction, the investment into secondary measures for personnel protection is diminished. The integration into automation requirements becomes easier and commissioning times are shortened.

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# Energy-efficiency up – Unit Costs down

Energy consumption has a significant effect on Total Cost of Ownership of plant and machinery: Even with standard machines, the energy consumption represents 20 – 30% of total costs, and with particularly energy-intensive applications, this share is remarkably higher.

With energy savings of between 30 and 80%, the investment into energy-efficient hydraulics from Bosch Rexroth quickly pays off. At the same time, the low energy consumption reduces the emission of climate-damaging CO<sub>2</sub>. In this way, we support numerous companies in significantly reducing their “Carbon Footprint“.

Sytronix variable-speed pump drives from Rexroth contribute to reducing operating costs. In addition, they lower the average noise emission of hydraulic power units by up to 20 dB (A). Complex and expensive noise insulation of the hydraulic power units is therefore no longer required.

Sytronix variable-speed pump drives are based on perfectly matched mass-produced components with high availability. The extended diagnostics options of these closed-loop controlled drives open up additional options of preventing expensive machine failures thanks to condition monitoring. A calculation that pays off: Energy-efficiency up – unit costs down.

## Advantages:



### High energy-saving potential

Significant reduction of operating costs.



### Remarkable noise reduction

Compliance with EU Directives. Fewer secondary measures.



### Clearly reduced cooling effort

Lower investment. Reduced space requirement.



### Reduced space requirement

Lower investment. Reduced space requirement.



### Hydraulic and electrical standard components

Operational reliability. High availability.



### System safety

Compliance with Machinery Directives.



### Future-oriented technology

Compliance with EU Directive.



### Ease of integration of flexible check functions

Reduction of expensive machine failures.

# Scalable in Power and Function

Sytronix variable-speed pump drives comprise a comprehensive construction kit consisting of pumps, control devices and motors as well as software, which perfectly meet a wide variety of requirements. Depending on cycle characteristics and rating, Sytronix variable-speed pump drives achieve energy savings of between 30 and 80% in many applications.

**Sytronix**

**FcP 5000**  
basic performance



basic dynamics

basic accuracy

energy efficient

**DFEn 5000**  
advanced performance



advanced dynamics

advanced accuracy

energy efficient

**SvP 7000**  
high performance



high dynamics

high accuracy

energy efficient

As early as at the engineering stage Rexroth supports machine manufacturers in dimensioning and the selection with simulation models. The fine scalability in power and function always provides optimum solutions.

Consume always only the amount of energy that is actually required by the process. In contrast to non-closed-loop controlled pump drives, the Sytronix variable-speed drives operates strictly in line with demand. In the pressure-holding mode or in part-load operation, the control device reduces speed to save energy. With the internal gear pump specifically developed for variable-speed operation with SvP 7000 and FcP 5000, speeds are reduced to significantly below 200 min<sup>-1</sup> without having to make concessions on the operating pressure.

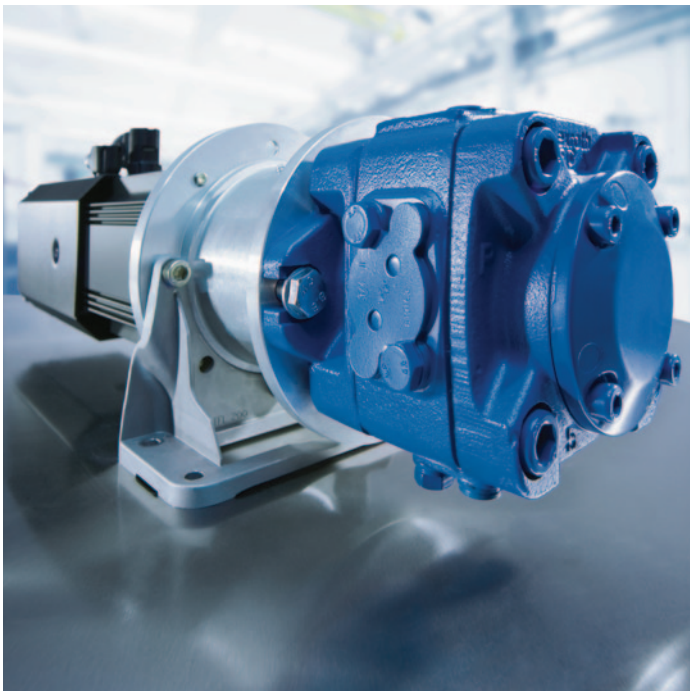
With FcP 5000, asynchronous standard motors control internal or external gear pumps. They are suitable as constant-pressure system for numerous standard power units, for example in machine tools. The system DFEn 5000 consists of a variable-displacement axial piston pump that is powered by a standard asynchronous motor with frequency converter. This combination guarantees a good price/performance ratio, especially in the case of great powers. Variable servo pump drives SvP 7000 utilize the high dynamics of synchronous motors and therefore achieve substantial energy savings, for example in plastics processing machines and presses.

# Variable-speed Pump Drives Sytronix FcP 5000 and SvP 7000

With conventional hydraulic systems, a variable displacement pump works in conjunction with an electric motor at a nominal speed of, for example,  $1500 \text{ min}^{-1}$ . The variable oil requirement of the hydraulic system is regulated via internal adjustment mechanisms of the pump. In contrast to this, with FcP 5000 and SvP 7000 the flow demand of the hydraulic system is fulfilled by means of a fixed displacement pump and speed adjustment of an electric motor.

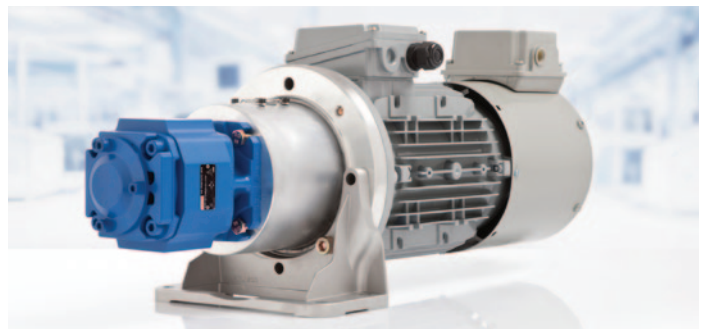
The SvP 7000 system consists of a pump that is optimized for variable-speed operation, a synchronous servo-motor, an appropriate converter plus accessories. For applications with less stringent demands on dynamics, an asynchronous standard motor is used with system FcP 5000. In both systems, an internal gear pump is powered, with the speed and the displacement of the pump providing the flow rate. A pressure transducer senses the hydraulic pressure that is controlled in a decentralized manner by special software in

the converter. Here, the pressure controller has a limiting effect on the pump speed. The internal gear pump used is specifically optimized to variable-speed operation and achieves low leakage rates while featuring high overall efficiency and low noise emission. The required command and actual values for pressure and flow can be exchanged with the higher-level machine control via analog signals (0 – 10 V) or over field bus.



◀ SvP 7000 system

▼ FcP 5000 system



# Pumps for FcP 5000 and SvP 7000

In the open circuit for standard applications, the combination of a standard motor and a frequency converter with internal and external gear pumps covers numerous applications. The pump families PGH, PGF und AZPF developed specifically for variable operation always deliver the required hydraulic power.

In conjunction with axial piston or external gear pumps, SvP 7000 perform 4-quadrant operation in a closed circuit and offer a multitude of electrical and electrohydraulic control features.

SvP 7000 systems are also suitable for controlling axes directly and therefore substitute valves that used to be necessary in the past.

Even for very high power ratings in the field of plant construction Rexroth offers tailored solutions for increasing energy efficiency. In cascading systems, several Sytronix systems jointly generate the required displacement in line with demand. In this way, Rexroth ensures high efficiency over the entire performance range.



# Variable-speed Pressure and Flow Control System DFEn 5000

The variable-speed pump drive DFEn 5000 is based on the proven pressure and flow control system DFE. An electrohydraulically controlled axial piston pump is controlled by a variable-speed drive. Thanks to the use of standard motors, this control system offers an excellent price/performance ratio.

The digital on-board electronics computes the optimum speed for the entire drive train. By swiveling the variable displacement pump back in the pressure holding mode, the displacement and loads acting on the motor are reduced. The optimum speed for pressure holding ranges between 300 and 400  $\text{min}^{-1}$  depending on the pressure. In cyclically operating machines, a teach-in process can be applied in order that the system is speeded up in due time before the flow demand increases.

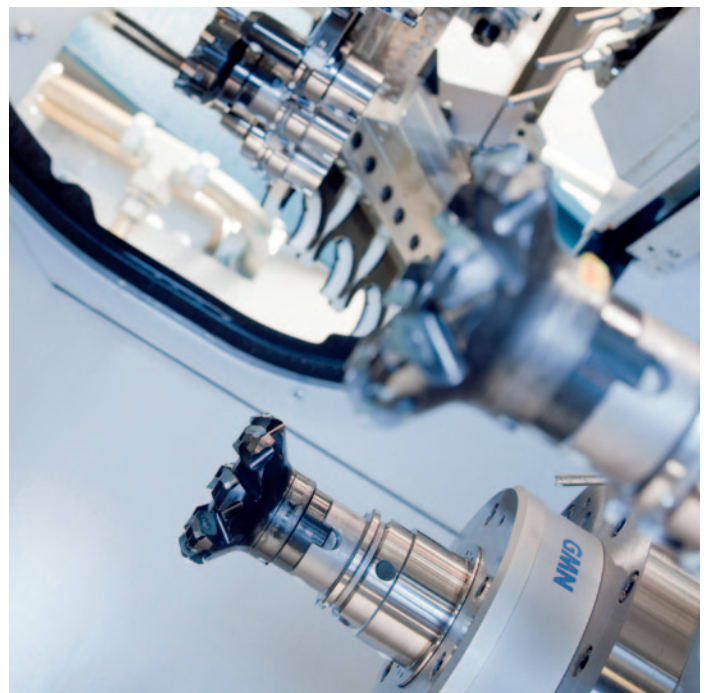
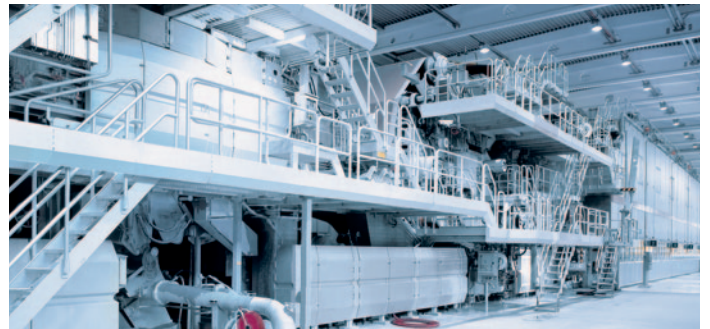
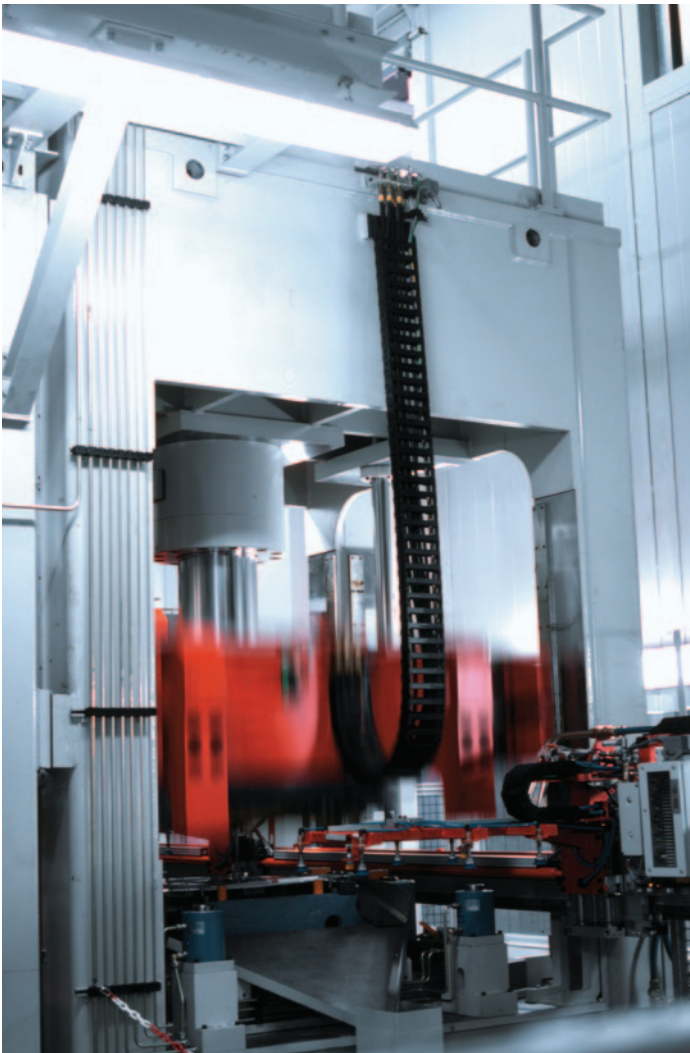
In non-cyclical machines, shortly before a greater flow is required (e.g. change of batch), a contact can be closed for accelerating to a minimum speed in order that the full dynamics of the pump is available when required. Identical, mechanical interfaces allow the DFEn 5000 to be retrofitted as substitute for a DFEE. The control system is available for pumps of the A10 family and can therefore be utilized for a wide spectrum of applications.





# Branch-oriented System Advantages

Sytronix variable-speed drives change the boundary conditions for hydraulic systems and open up new design options for efficient solutions. An important factor here is perfectly matched components and an in-depth physical understanding of hydraulics.



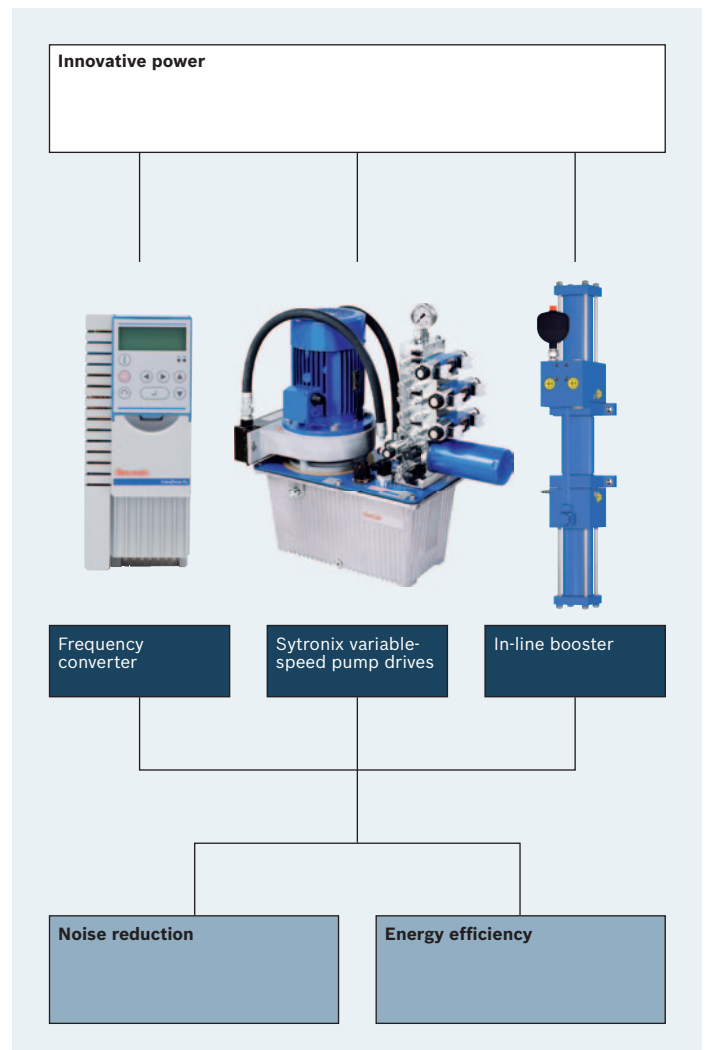
## Example of Machine Tools: Efficient Energy-savers

Providing power only when it is needed by the process: The generation of pressure as required with variable-speed pump drives reduces the energy requirement of hydraulics in machine tools by up to 70%. But even more, the KST booster developed exclusively by Rexroth transfers these advantages to the high-pressure cooling lubricant supply.



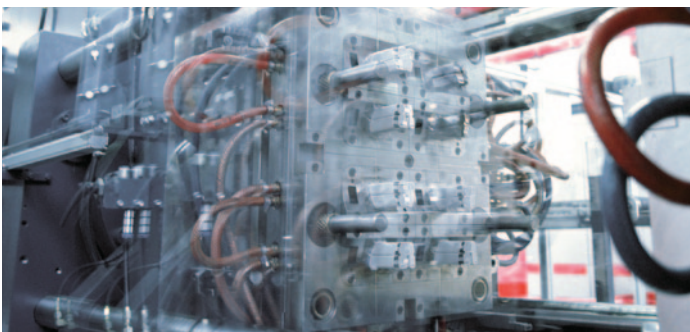
Especially for clamping functions, hydraulics offers a unique advantage, for it does not need additional power for the pressure holding function. In this phase, Sytronix variable-speed pump drives significantly reduce the energy requirement. FcP 5000 consisting of the combination of a standard motor and a frequency converter are a particularly efficient solution to reduce the energy consumption of hydraulics by 30 to 70% depending on the cycle characteristics. At the same time, with an unchanged displacement, pumps with a smaller swept volume and reduced cooling capacity are sufficient.

Moreover, the combination of a KST booster from Rexroth for the high-pressure cooling lubricant supply in line with demand trims down the energy requirement of this function by almost 90%. In this case, the Sytronix variable-speed pump drive generates the flow for the cooling lubricant high-pressure circuit by means of an additional cylinder pump. The common screw pump plus electric motor are therefore no longer necessary.



# Example of Plastics Processing Machines: Higher Dynamics with Reduced Energy Consumption

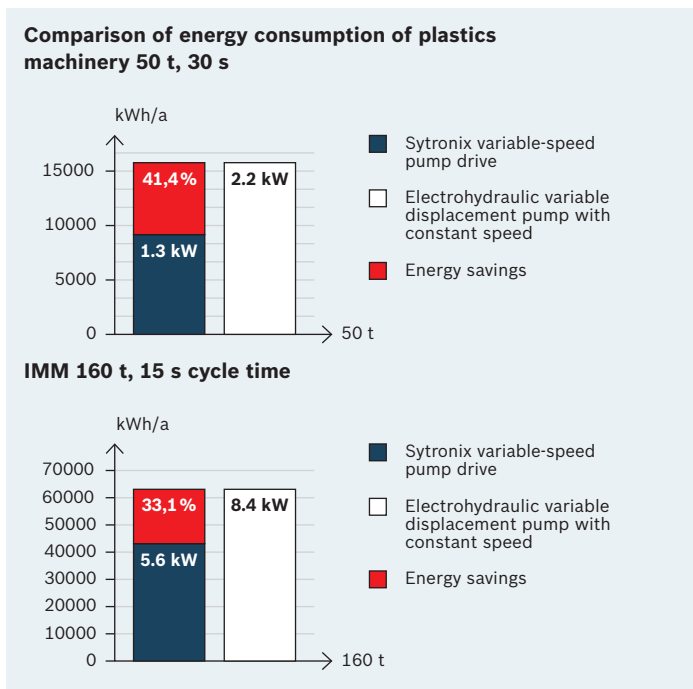
Consistent automation, higher dynamics and high accuracy: Variable servo-pump drives combine highest efficiency with remarkably lower energy consumption and noise emission in plastics processing machines. The DFEn 5000 is based on the proven control system DFE and reduces losses in pressure holding during pauses and in part-load operation.



Thanks to its acceleration, which is twice as fast compared with variable-displacement pumps, the SvP 7000 enhances the dynamics of plastics processing machines, thus shortening cycle times for higher productivity. The digital speed control ensures high repeatability and a stable zero point. Pressure-related leakage losses are compensated for. With closed-loop pressure control very short pressure change times are possible. High dynamics and the sophisticated controller concept allow the implementation of very precise controls, which minimize under- or overshoots. Moreover, a special function prevents cavitation when changing over to low pressures.

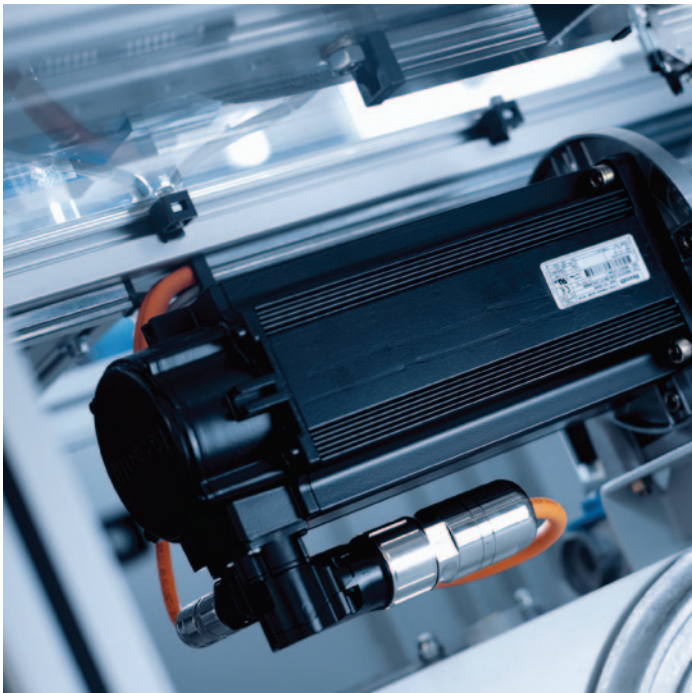
Apart from the SvP 7000, a DFEn 5000 may also be used for plastics processing machines with medium demands on dynamics. It offers a good price/performance ratio, especially for higher power ratings and long pressure holding times. The SvP 7000 and DFEn 5000 are ideal as energy-saving option for machines equipped with DFEE.

In addition, they reduce the introduction of heat into the oil and significantly lower the average noise emission. This minimizes the design effort for secondary noise insulation. In view of energy savings of up to 70% and higher productivity, Sytronix variable-speed pump drives quickly amortize.



## Example of Diecasting Machines: 80 % More Energy-efficient

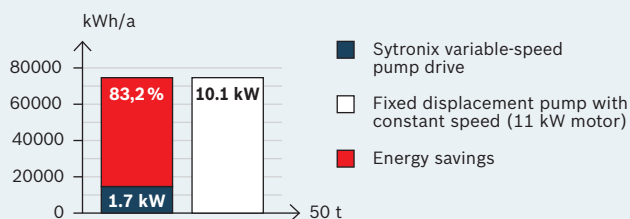
Variable servo-pump drives open up extremely high energy-saving potentials also in hot chamber diecasting machines and, at the same time, simplify the hydraulic circuit.



Robust hydraulics with its high power density and load-holding capacity has proven successful under the harsh ambient conditions of diecasting machines. Practical experience gained with series machines shows: The use of SvP 7000 with synchronous servo-motor, intelligent servo-drive, internal gear pump as well all the required software functionalities cuts the energy consumption of hydraulics in hot chamber diecasting machines by more than 80 %.

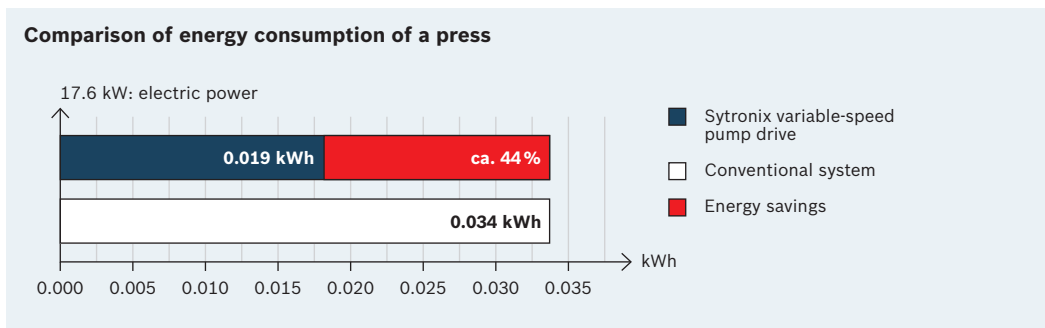
In a closed control loop, the SvP 7000 compares command values with actual values for pressure and speed and corrects any deviations. Moreover, the associated software provides further hydraulics-specific functionalities such as offset calibration of the pressure sensor, leakage compensation and options for multiple pump systems. In addition, in modern diecasting machines, SvP 7000 additionally simplify the hydraulic circuits when compared with predecessor versions. In the past, two non-closed-loop-controlled pumps for high and for low pressure were required, whereas now one SvP 7000 system is sufficient, which, thanks to its functionality, can even replace some high-response valves and, in addition, supplies an accumulator charging circuit for the shot cylinder.

**Comparison of energy consumption of diecasting machines**  
Dieasting machine 50 t, 7.5 s cycle time



# Example of Presses: Always the Most Effective Solution

Be it for the energy-efficient generation of pressure or as control element in two- or four-quadrant operation: Our scalable systems provide significantly increased energy efficiency and consistent press automation.



Thanks to open interfaces to all common field buses and real-time Ethernet protocols, Sytronix variable-speed pump drives seamlessly fit into the press automation concept. In the simplest variant, a FcP 5000 generates the required flow efficiently and as required. Nevertheless, this variant features all proven hydraulic safety circuits. In the medium extension stage, the pump drive additionally performs intelligent axis functions. In the highest extension stage, the SvP 7000 achieves extremely high dynamics and precision.

The innovative drive concept combines the positive properties of electric and hydraulic drive technology. Due to the functional integration of dynamic flow and pressure control as well as controlling of dynamic processes, positions and pressures, it opens up a higher degree of freedom for flexible and effective solutions.

In addition to achieving energy savings through speed control, Sytronix variable-speed pump drives improve the efficiency, since throttling losses across control lands are a thing of the past, the required oil flow can be precisely metered, and the electric motor is switched off, when the press does not require a flow or a pressure function. Especially in the case of retrofitting of existing presses, the use of Sytronix can clearly improve the utilization of the machine's capacity, while remarkably reducing energy costs and the noise level.

# Example of Woodworking and Papermaking Machines: Flexibly Adjusted to the Task at Hand

From the fully automated sawing line through to rolling up the ready paper web:  
Sytronix variable-speed pump drives are also suitable for harsh ambient conditions  
and continuous processes.

Especially for the continuous processes of papermaking, Sytronix variable-speed pump drives offer particularly great advantages with regard to energy efficiency. For example, for rolling up, pressure-holding functions are prevailing. Here, an intelligently reduced speed directly saves up to 60% electricity compared with power units with non-regulated fixed displacement motors. At the same time, Sytronix variable-speed pump drives achieve higher speeds with a smaller constructive size and reduce demands on the cooling capacity. The result: Significantly reduced operating costs and smaller space requirement in the hall.

Also in non-cyclical processing in woodworking applications, the user can achieve clear savings: Example of sawing operations: No tree is like the other, and a multitude of drives in the fully automated lines flexibly adapt to the individual dimensions. With unchanged pressure, the process requires a constantly changing flow that the Sytronix variable-speed drives can flexibly provide. During production breaks, integrated software reduces the speed down to zero stroke, without affecting the operating pressure. Sytronix maintains the robustness and power density of hydraulics and combines it with the flexibility of electric drives.



## Example of Retrofit: Fast Increase in Efficiency in Production

The high modularity of hydraulics also opens up economic options on existing plant and machinery by substituting fixed displacement power units by Sytronix variable-speed pump drives with little effort.



Reducing the energy consumption in production swiftly and lastingly without having to invest directly into new machines. Sytronix variable-speed pump drives, which are finely scalable in function and power, allow energy-efficient solutions to be retrofitted with little effort, for existing hydraulic circuits can remain unchanged in many cases.

Rexroth supports machine operators during the entire retrofit process. Specifically developed simulation programs determine possible savings for the concrete application in advance. After planning on the basis of comprehensive application experience, specialists of the worldwide Service network carry out installation and commissioning

on site. Open interfaces to all common field buses and Ethernet protocols simplify the integration.

But even more, beyond tailored and planned retrofitting, Rexroth joined forces with a worldwide leading machine manufacturer to develop a standardized retrofit kit for series machines. This reduces the effort additionally and ensures fast increases in efficiency in production.

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