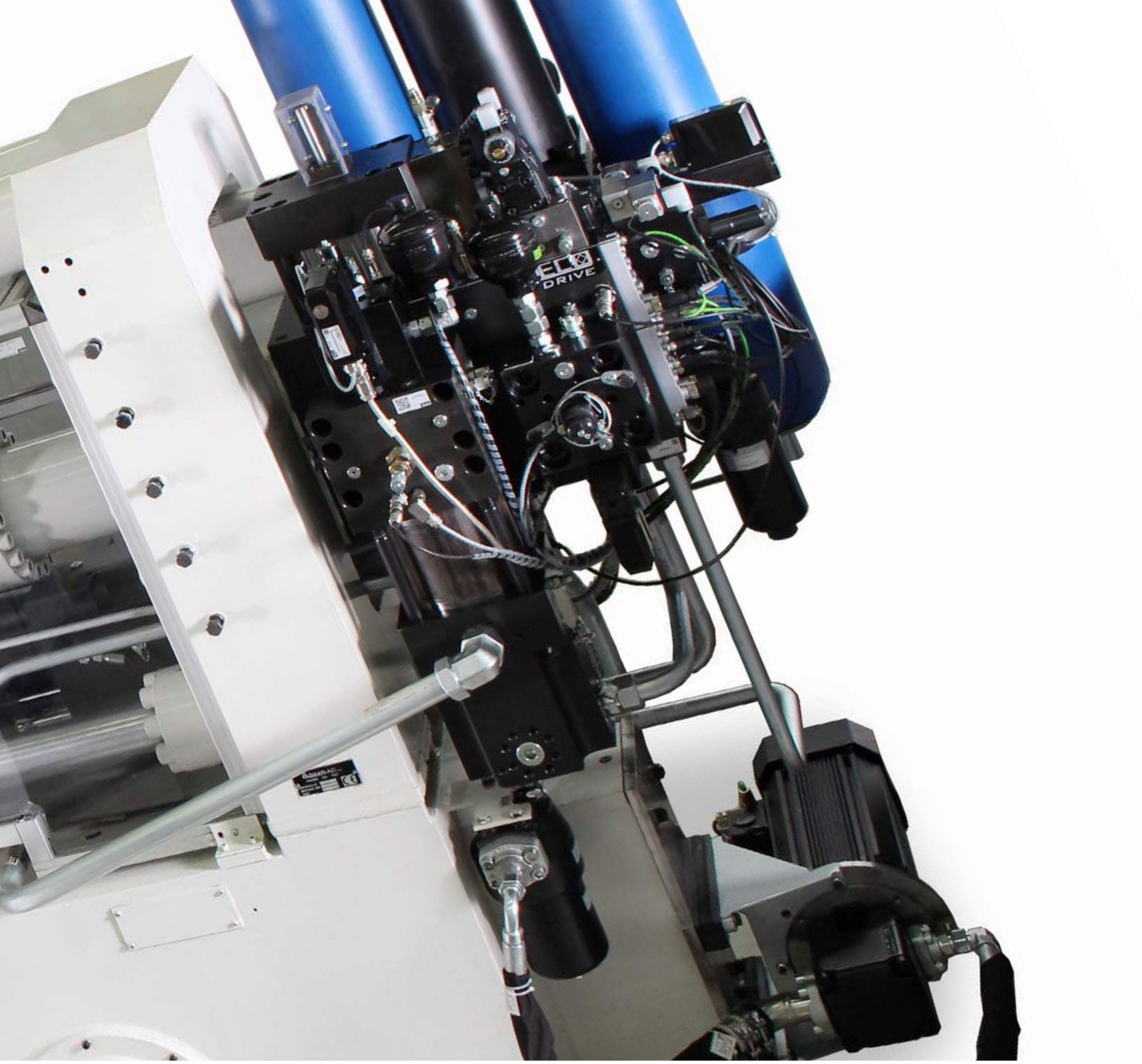


Drive Controlled Pump Solutions

Integrated Energy-Saving Hydraulic Systems
Customized to Your Application Requirements

ENGINEERING YOUR SUCCESS.

Drive Controlled Pump Solutions

Integrated Energy-Saving Hydraulic Systems Customized to Your Application Requirements

Modern industrial machinery is creating ever-increasing demands on hydraulics to provide more efficient and quieter solutions with a smaller footprint, while maintaining the benefits traditionally associated with hydraulic systems, i.e., high power density, precise control and enduring performance. But historically, these benefits have come with the high cost of inefficient energy allocation, heat generation and noise.

The variety of discreet components constituting each hydraulic system has complicated the challenge. No two systems are identical, and effective integrations require a deep understanding of hydraulic systems, hydraulic pump and electric motor technologies, and control algorithms – and how these interact with each other.

Conventional hydraulic power units require oversized pumps and motors to ensure performance during a system's highest duty-cycle demands. When energy costs were predictable and environmental regulations less stringent, the wasted energy and high CO_2 emissions were not seen as problematic. In today's eco-conscious and globally competitive economic environment, a transition to systems in which power is precisely modulated to the requirements of specific tasks within highly complex hydraulic systems is essential.

Drive Controlled Pump technology provides a synergistic approach in which electronic drives, electric motors and hydraulic pumps are successfully integrated to meet each local load demand within a hydraulic system. Specifically, variable frequency (variable speed) drives manage the electric motor's operating torque and speed, producing the precise, variable pressure and flow required at any given point in the machine or duty cycle. Drive control is directed through the use of field-tested control algorithms (modes) designed to provide standardized and customizable hydraulic functions.

Metal Forming

Reduces the energy, noise and component-size required by taking advantage of the extended speed range of the electric motor

Automotive

Reduces noise, energy and cooling requirements during cycles with lower power demands

Rubber

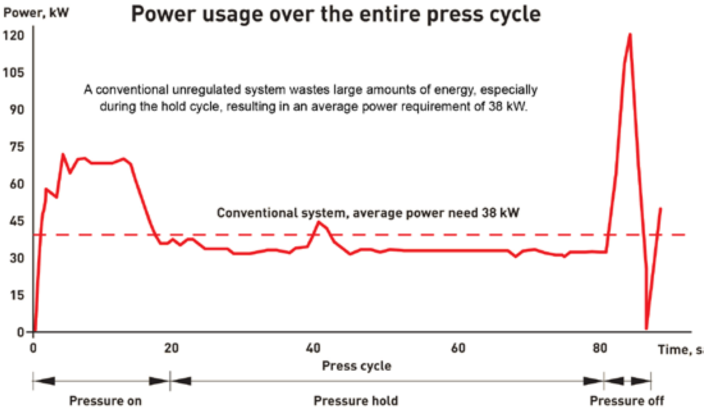
Ensures precise flow in high-power cycles and improves pump efficiency in the curing cycle

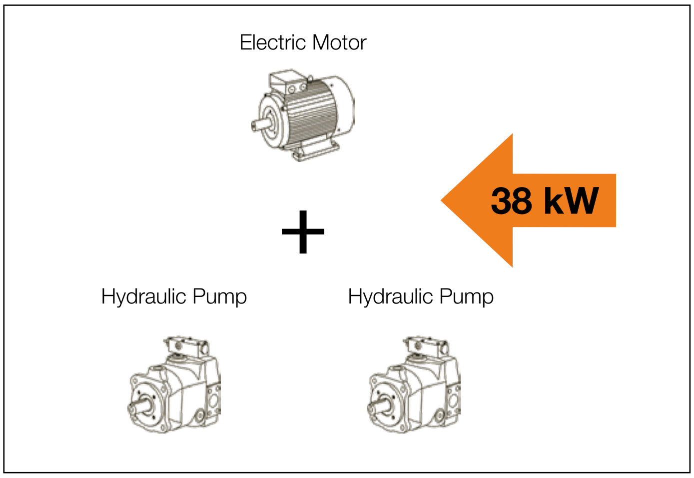
Marine

Optimized for battery operation, the keys are energy-efficient solutions with low noise levels based on marine approved components.

The shift towards greener marine vessels can be attributed to the confluence of several contributory factors. Energy costs have become more of an issue, and environmental regulations have become more stringent, the wasted energy and high CO_2 emissions have become increasingly problematic in marine applications. This has required a transition to more efficient systems where power is precisely modulated to the requirements of specific tasks.

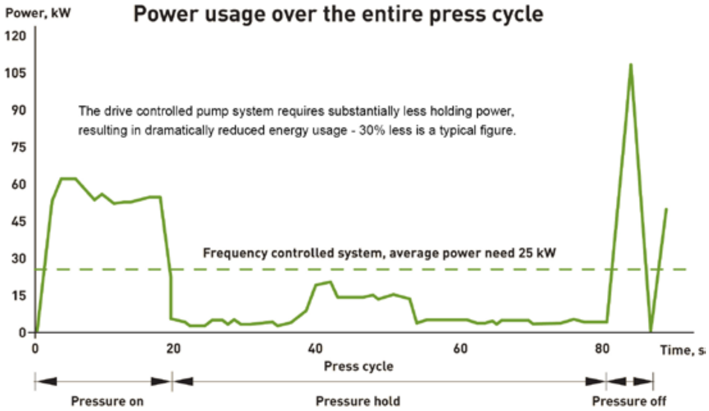
Traditional Hydraulic Technology

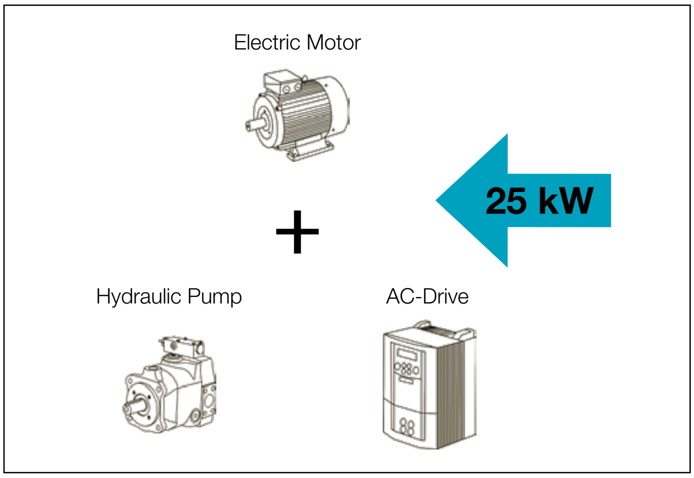




= 38 kW x 7200 h x € 0.10/kWh **€ 27,360/Year**

Drive Controlled Pump Technology





= 25 kW x 7200 h x € 0.10/kWh **€ 18,000/Year**

Total annual energy saving = € 9,360/Year

The Versatility to Meet a Multitude of System Requirements

During fixed displacement hydraulic pump applications, hydraulic power unit efficiency approaches zero percent during pressure-holding (deadhead) conditions. By lowering the pump speed using the Q (flow) control function, Drive Controlled Pump systems can reduce inefficiency by as much as 90 percent. In these applications, the Drive Controlled Pump solution performs well with variable axial piston pumps.

When used with variable displacement pumps, which are typically controlled using a variety of hydraulically operated pilot controls, lowering the pump speed can reduce inefficiency by as much as 50 percent in low-flow or deadhead conditions.

Drive Controlled Pump technology uses the PQ control function (P mode with Q-limit) to extend system capabilities, regulating the operation of fixed and variable displacement pumps/motors through the closed loop pressure control by using the pressure feedback signal.

In addition to these most commonly used functions, Drive Controlled Pump technology enables hydraulic system design engineers to deploy a wide range of application-specific customized and standardized control functions, including but not limited to the applications in Table 1.

Device Modes	Description
Q (flow) Control	This mode controls the flow of pump as the demand changes, and can eliminate use of flow control valves and proportional valves in many applications.
P (pressure) Control	This mode controls the pump's pressure in a closed loop mode using the pressure signal feedback, mimicking the variable displacement pump's compensated pressure and flow characteristics. Electronic power limiting and load sense can be added to this function.
PQ Control	This mode operates the pump in P mode with a Q-Limit mimicking a variable displacement pump with electronic swash plate control. This mode is suited for position, speed, and force control.
ACU - Accumulator Control	This mode is an addition to other modes, allowing for hydraulic accumulator charging control. This mode shuts down the hydraulic pump/motor of the HPU for further energy reduction when accumulator is fully charged. This eliminates the need for a pump unloading circuit.
Extended Speed Control	This function takes advantage of the AC induction motor's tapered torque range (constant power operation), when the electric motor operates beyond its base speed. This function will allow the system to generate additional flow at reduced pressure, enhancing the pump's High/ Low function.
Energy Saver Control	For variable displacement pumps. By simply lowering the hydraulically controlled pump's rotational speed during deadhead periods, the pump's efficiency can be improved. This function senses when the pump is deadheading and it reduces the pump's speed to its most efficient range. The result is energy savings and reduced heat generation. The function can also detect changes in flow demand and increases the pump speed to meet the application's variable load demands.

Table 1

The Right Time to Increase Operational Efficiency

Drive Controlled Pump technology represents a new approach to hydraulic system design in which precisely controlled, variable-speed-pump modes are custom-configured to meet the functional requirements of each process within a complex hydraulic system. It provides the most rapid return on investment with conservatively designed hydraulic systems using oversized components engineered to meet maximum flow and pressure requirements.

Simply put, if cooling is required for your hydraulic system, it is operating at less-than-optimum efficiency. A preliminary assessment of probable energy savings will take into consideration the voltage of your power source, electric motor horse power, the number and types of pumps used, the length and frequency of deadhead conditions, whether or not a pump unloads during idle, pressure control requirements, both oil and ambient system pressures, HPU cooling requirements and your desired level of noise control. But only a comprehensive energy audit can accurately predict real-world savings.

Due to the rapidity of return on investment, the use of variable speed drives to manage hydraulic power allocation is expected to more than double by 2019. Trouble-free adoption of the Drive Controlled Pump solution is best achieved through a customized process in which a multi-disciplinary team of drive and motion system, fluid power and control technologies engineers:

- Conduct energy audits, including predictive analysis of energy savings
- Evaluate and replace individual components, as appropriate, with more compact, less energy-wasting alternatives
- Integrate variable speed drives that modulate speed and torque to meet specific flow and pressure requirements through the use of customized modes
- Initialize the system and monitor performance to validate ROI

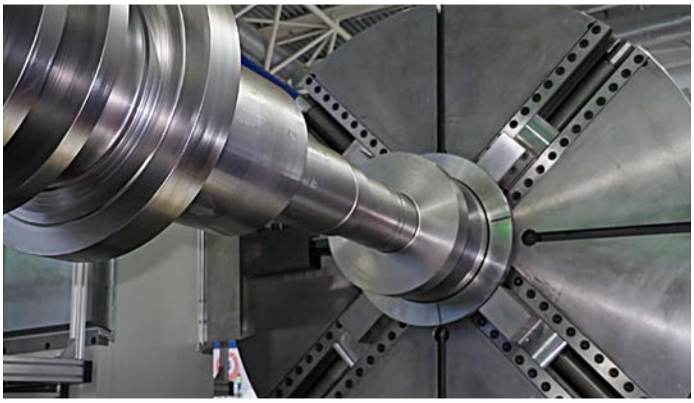
An energy audit is the best next-step for determining whether this technology is right for your hydraulic application.

General Industrial

Reduces hydraulic system footprint, noise and energy use while extending component service life

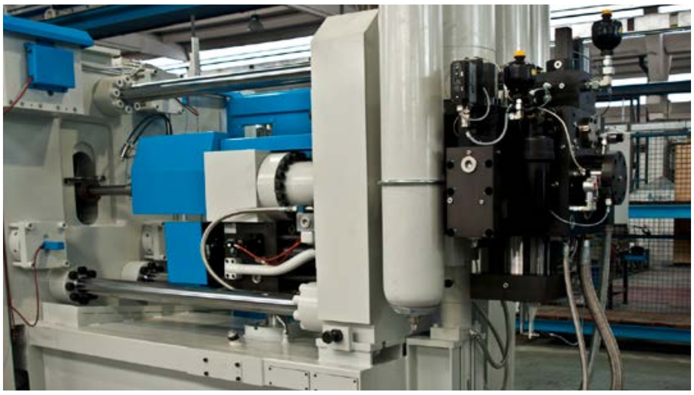
Machine Tools

Reduces energy required during main movement, while enabling energy delivery for quick clamping actions and auxiliary movements, thereby optimizing pump sizing



Die Casting

Adjusts flow and pressure to meet the highly varying requirements of closing and injection slides, enabling a variety of pump combinations while reducing motor size requirements



Plastics

Provides the highest dynamics with size-optimized components for overall reductions in operating cost

Retrofit Designs

Reuses as many of your existing components as possible, reducing initial investment and accelerating ROI

Test Stands

Reduces costs related to intensive energy use, while actually producing energy for potential reuse

About the Author

Michael Gundlach is a Product Manager for Parker. He uses his electrical and fluid power background to create custom Drive Controlled Pump solutions. Prior to joining Parker 22 years ago, he worked as project engineer at the IFAS institute in Aachen. He holds a graduate engineering degree from the RWTH Aachen University.

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