SPEED CONTROLLED PUMP SYSTEM

Energy efficiency and flexibility for high performance applications

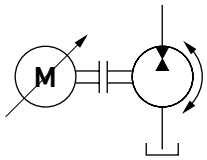
The pressure has never been greater for manufacturers of industrial machinery to achieve higher productivity, premium-quality products and maximum energy efficiency, all at less cost. Machine builders are also seeking new technologies and alternative ways to differentiate themselves in the marketplace.

Moog developed a complete integrated system using our world-class building block products that offers machine builders a new option for hydraulic motion control. The unique functionality of this system is the ability to allow users to change the speed of the motor and pump thereby controlling the fluid flow. The resulting machine has 30 % lower energy consumption or more when compared to traditional approaches and also provides optimized system performance and easier setup for operators.

Moog's Speed Controlled Pump (SCP) System can be used in various motion control applications where high energy efficiency is important. The robust components are used for small to medium nominal sizes and meet individual requirements through numerous combinations. Equipped with a suitable control option the Speed Controlled Pump System of Moog provides the right flow and pressure rate for the intended machine.

The Speed Controlled Pump System can be used in one or 2-quadrant operation. It operates in an open hydraulic circuit with an alternating direction of rotation and a defined high pressure and low pressure side.

Operational environment



ADVANTAGES

- High energy efficiency
- Robust and modular design for high reliability and performance
- Pressure holding function at speeds down to 0 rpm at high efficiency possible without external orifice
- Allows decompression operations in 2-quadrant operation
- Wide range of control options:
  - Electro-hydraulic control for analog and fieldbus operation
  - Dual displacement function
  - Variable displacement pump with diverse control options (hydro-mechanical, RKP-D)
- Low noise piston pump

APPLICATIONS

- All machinery in which pumps are used and where low energy consumption is intended (e.g. injection molding machines, wrapping and bending machines)

For an easier selection, Moog provides preselected variants of the Speed Controlled Pump System over all nominal sizes. Those variants ideally combine the single Moog components, but can be adjusted to meet individual machine requirements.

TECHNICAL DATA AND COMPONENTS FOR 280 BAR AND 210 BAR[1)]

			280 bar											
										Model number pump and motor				Drive
			$p_{nominal}$ [bar]						280		Pump	Motor		
Displacement [cm³/rev]	n_{max_Pump} [1/min][2)]	Q_{max} [l/min]	T_{max_Motor} [Nm]	$T_{0\_continuous}$ [Nm]	$T_{nominal}$ [Nm]	Factor T_{eff}	T_{eff} [Nm]	p_{eff} [bar]	$P_{nominal}$ [kW]		Model number	Cooling option: water	Model number	
19	2,700	51	116	68	85	0.65	55	182	24	D147-0001	D951-2319	JHW5	G445-1066	G392-045 Size 5
32	2,500	80	233	123	143	0.7	100	196	38	D147-0002	D952-2361	JHW6	G446-1070	G392-072 Size 5
45	2,000	90	303	160	201	0.65	131	182	5	D147-0003	D953-2219		G446-1071	G392-060 Size 5
63	2,400	151	643	328	281	0.7	197	196	71	D147-0004	D954-2355	JSS7	G447-1018	G392-110 Size 6
80	2,000	160	535	271	357	0.65	232	182	75	D147-0005	D955-2239			G392-090 Size 6

			210 bar											
										Model number pump and motor				Drive
			$p_{nominal}$ [bar]						210		Pump	Motor		
Displacement [cm³/rev]	n_{max_Pump} [1/min][2)]	Q_{max} [l/min]	T_{max_Motor} [Nm]	$T_{0\_continuous}$ [Nm]	$T_{nominal}$ [Nm]	Factor T_{eff}	T_{eff} [Nm]	p_{eff} [bar]	$P_{nominal}$ [kW]		Model number	Cooling option: convection/ water	Model number	
19	2,700	51	90	46	64	0.4	26	84	18	D147-0006	D951-2319	JHC6	G446-1067	G392-024 Size 4
			115	66		0.7	45	147		D147-0007		JHW5	G445-1065	G392-032 Size 4
32	2,500	80	168	86	107	0.4	43	84	28	D147-0008	D952-2361	JHC6	G446-1068	G392-045 Size 5
			190	100		0.7	75	147		D147-0009		JHW6	G446-1064	
45	2,000	90	223	116	151	0.4	60	84	4	D147-0010	D953-2219	JHC6	G446-1069	
			253	135		0.7	106	147		D147-0011		JHW6	G446-1065	
63	2,400	151	266	127	211	0.2	42		53	D147-0012	D954-2355	JHC6	G446-1069	G392-072 Size 4
			349	184		0.7	148	147		D147-0013		JHW6	G446-1066	G392-072 Size 5
80	2,000	160	350	127	268	0.2	54	42	56	D147-0014	D955-2239	JHC6	G446-1069	G392-072 Size 4
			434	219		0.65	174	137		D147-0015		JSS7	G447-1018	G392-072 Size 5

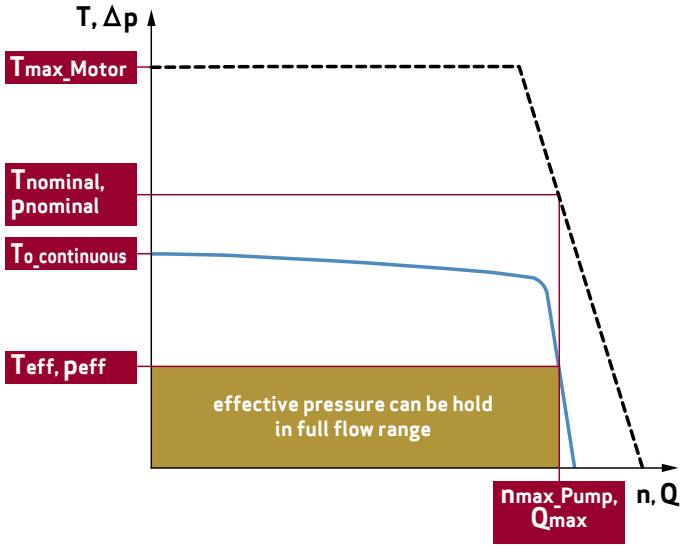
1) Theoretical and rounded values without efficiencies and tolerances

2) @ minimum inlet pressure = 0.8 bar (12 psi) abs.

SPEED CONTROLLED PUMP SELECTION CHART

Moog offers extensive support for the selection of the right system variants. Experienced experts identify the required pressure and flow rates according to the cycle data of the individual machine and come up with a complete solution that is individual, ready to use and from one single supplier.

T_{max_Motor}	Maximum motor torque: Attention, observe maximum pump pressure
$T_{nominal}$, $p_{nominal}$	Rated pressure, e.g. 280 bar, short-term[1)]
$T_{o\_continuous}$	Maximum continuous torque: Decreases with increasing speed
T_{eff}, p_{eff}	Effective pressure that can be held continuously with maximum flow during one cycle
n_{max_Pump}, Q_{max}	Maximum permissible speed (at p_{Tabs} = 0.8 bar) resulting in maximum flow



1) The motors are sized as follows: p_{nom} can be held for 1 sec.

REDUCED ENERGY CONSUMPTION

The primary advantage of the Speed Controlled Pump System is the impressive energy saving that is not typically available with the traditional hydraulic technology. The overall energy efficiency of the Moog Speed Controlled Pump is significantly higher than traditional hydraulic systems for a few key reasons. In a normal hydraulic application, the machine experiences, medium and full loads as part of the cycles. In tests conducted by Moog with customers, the efficiency of the SCP with a medium load has reached 20 to 30 % higher when compared to the conventional system. If a machine is running without load, or in a standby mode, energy consumption can be 90 % less. Under full load conditions, the performance compared to the traditional system is nearly identical. This offers the user the opportunity to optimize the energy efficiency based on the needs of the application, but without losing performance.

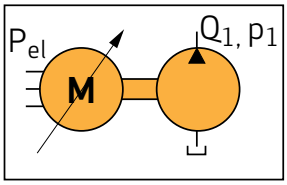
MODULAR SYSTEM FOR OPTIMIZED PERFORMANCE AND EASIER SETUP

The configuration of the Speed Controlled Pump System is flexible to meet unique customer requirements. As Moog has the control over the design and manufacture of the key products in the system, the offering is based on a modular concept that allows a wide variety of performance parameters.

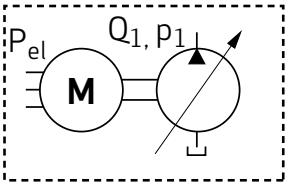
If required, the pump can also feature a dual displacement, capable of intelligently switching from one to the other displacement. This functionality enables the motor to run more efficiently and save energy. For example, during the pressure holding phase in an injection molding machine, low flow but high pressure is required, making real energy savings of up to 90 % possible.

The Speed Controlled Pump System not only has advantages over traditional hydraulic systems but it also delivers lower maintenance and investment costs when compared to an all-electric motion system. Electromechanical devices on an all-electric machine are generally built into the framework of the machinery. When a machine needs to be rebuilt as part of routine maintenance, the electro-mechanical infrastructure needs to be totally disassembled and re-assembled. The cost of rebuilding a hydraulic machine with Moog's Speed Controlled Pump System is much lower because it is an integrated modular unit with all of the parts easily accessible for maintenance and upgrades.

Comparison of efficiency

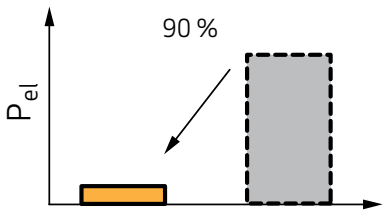


Speed controlled drive



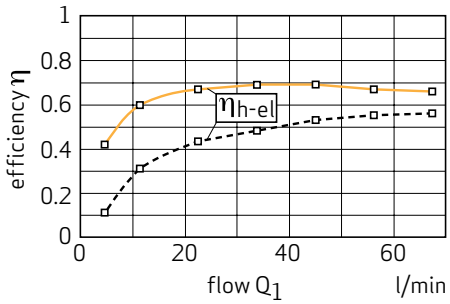
Pump controlled drive

Without load
Flow Q_1 = 0 l/min
Load pressure p_1 = 0 bar



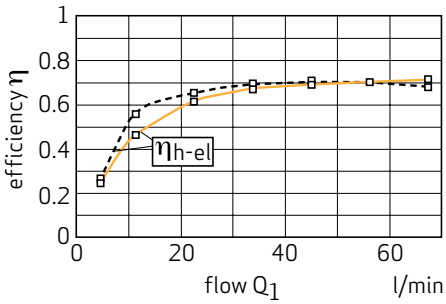
Medium load

Load pressure p_1 = 40 bar



Full load

Load pressure p_1 = 200 bar



Source: TU Dresden

SYSTEM BASED ON WORLD-CLASS MOOG PRODUCTS

The Moog Speed Controlled Pump System includes several high performance building block products in the integrated design: Fixed displacement Radial Piston Pump (RKP), the Maximum Dynamic Brushless Servo Motor (MD Series) and the Modular Multi-Axis Servo Drive System (MSD).

MOOG RADIAL PISTON PUMP

Moog's Radial Piston Pumps, also known as RKP, are high-performance variable, dual or constant displacement pumps designed for demanding applications requiring robust performance, low noise and unsurpassed reliability. This product is available in various sizes, single and multiple configurations, and a wide array of control options as well as mounting flanges. Thus, the product offers rapid response time and high volumetric efficiencies.

MOOG MAXIMUM DYNAMIC BRUSHLESS SERVO MOTOR

Moog's Maximum Dynamic Brushless Servo Motor, also known as MD Series, is ideal for highly demanding applications. These motors are built to provide the exact torque, speed and power requirements for your application. Available in different sizes and with cooling options, they provide rapid acceleration and deceleration. The wide range of configurations allows our customers to define and realize the best design of their machines.

MOOG MODULAR MULTI-AXIS SERVO DRIVE SYSTEM

Moog's Modular Multi-Axis Servo Drive System, also known as MSD, provides the highest levels of dynamic response, smooth performance and application versatility. The MSD system includes modular Servo Drives powered by a shared power supply and a motion controller to coordinate motion across multiple axes to reduce cycle times and provide precise motion control for higher accuracy. It provides intelligent pressure and flow functionality for the system due to unique control algorithms. Depending on pressure and flow demand values, the MSD controls the speed setting requirements for torque and speed. Pump and servo motor characteristics are stored in the servo drive, creating an intelligent system that can communicate with external systems over a fieldbus.

Moog has offices around the world. For more information or the office nearest you, contact us online.

info@moog.com

www.moog.com/industrial

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This technical data is based on current available information and is subject to change at any time. Specifications for specific systems or applications may vary.

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