

# MOVING YOUR WORLD

IDEAS IN MOTION CONTROL FROM MOOG INDUSTRIAL

APRIL 2006

ISSUE 11

MOOG

## FEATURE

### THE NEW GENERATION RADIAL PISTON PUMP OFFERS MANY ADVANTAGES TO INJECTION MOLDING APPLICATIONS

By Dirk Becher, Engineering Manager Pumps, Moog Germany



Moog has recently introduced a new generation of the proven Radial Piston Pump called RKP-II that has a significant reduction in noise and a longer lifespan. This new version has important design changes and improvements such as completely reengineered housing with an increased number of pistons and a sliding stroke ring. RKP-II models can be equipped with a proportional valve with digital on-board control electronics for volume flow and pressure control.

#### RKP-II Meets the Requirements of the Plastics Industry

Well-known in the industrial market for its reliability, suitability with special fluids, and low noise emission, the RKP has been an ideal solution for demanding applications such as plastics and die casting machinery for many years. The new design of RKP-II pumps in the sizes 63, 80 and 100 cc per revolution offers even in greater durability and quieter performance.

With an electro-hydraulic digital p/Q control system, the pump is well suited for a variety of pressure and volumetric flow control applications. Hence it was adopted early on as a flexible solution in applications with sequential motion such as injection molding machines. It can achieve more dynamic and more precise control as well as a higher repeatability of machine operations. The ability to make "on-the-fly" changes of parameter sets makes possible performance optimization during the sequential machine processes with different actuators. The RKP-II, combined with an electro-hydraulic digital p/Q control, gives injection molding machine builders a competitive advantage through longer service life, lower noise emission, improved control options, expanded functionality, and easy commissioning.

#### New Stroke Ring Increases Stability and Lifetime

The RKP-II incorporates a flattened, sliding ring instead of a round stroke ring. The outer face of the new ring has a nearly rectangular surface, which supports the ring in the housing. This reduces the wear and tear on the entire actuator system. Machine stability and lifecycle are thus increased, even under demanding operating conditions.



Round stroke ring design



Sliding stroke ring design



7 Pistons



9 Pistons

#### Reduced Noise Emission

Moog has implemented important design changes to reduce the primary and secondary noise levels produced by the RKP-II. The number of pistons was increased from 7 to 9 for sizes 63 and 80 cc per revolution, enabling a reduction in piston diameter. This

*continued on page 2*

has reduced the dynamic alternating forces affecting the housing and noticeably decreased the circulatory and pressure pulsation on the high-pressure side.

Dead volume in the pistons has been reduced to a minimum due to the cup design of the working pistons. The pulsation amplitude of the RKP-II is thus significantly lower than the values exhibited by comparable piston pumps with external pre-compression volume. This is a contributing factor towards reducing the noise emitted by the system or machine. Noise emissions are further improved by the optimized flow design of the suction path. Pressure pulsation on the intake side is significantly less due to reduced hydraulic inductance.

### **Compliance with the European Union's Noise Emission Guideline**

The overall result of these design changes is that the noise pressure level of RKP-II models of size 63 and 80 cc per revolution does not generally exceed the 70-decibel mark even in demanding operating conditions. Thus, the Moog RKP-II actively supports machine and equipment manufacturers in implementing the European Unions noise emission guideline (2003/10/EG).



Standard Version 3000 psi  
SAE 1 1/4" (RKP63/80)  
SAE 1 1/2" (RKP100)



Standard Version 3000 psi  
SAE 2"

### **Optimized Suction Path**

Another improvement in the standard design of the RKP-II is a larger intake connection (SAE 2" standard series, 3000 psi). The solution offers more robust suction behavior, optimum intake, and less pressure loss along the suction path. The optimized intake channel in the housing and control journal has reduced the incidence of cavitation in the housing, control journal and drive.

### **Available control options**

In addition to the wide range of hydro-mechanical control options (e.g., pressure compensator, combined pressure and flow compensator [load sensing controller], constant horse power control), the electro-hydraulic digital p/Q control is a new option for the RKP-II. The addition of a new proportional solenoid pilot valve with digital on-board electronics to the pump enables local loop closure, tuning and diagnostics. This digital p/Q control was the result of extensive research and development work, which led to performance and system optimizations never before possible with a servo pump. Among the other important improvements is the possibility to implement servo control in multi-pump arrangements in a master-slave version. With the master-slave solution, key parameters can be easily adjusted "on the fly", while real-time diagnostic data remains available via the man-machine interface (MMI) of the machine or via a laptop pc interface. This version of the RKP-II is one of the most advanced solutions in the market-place today.



### **About the Author:**

*Dirk Becher has been Engineering Manager for radial piston pumps at Moog since October 2004. He has a doctorate in engineering sciences and was previously involved in the development of axial piston pumps at Eaton Fluid Power GmbH.*

## DID YOU KNOW

### MANUFACTURING IMPROVEMENTS IN INTEGRATED HYDRAULIC MANIFOLDS TO IMPROVE LEAD TIMES

By Markus Paule, Production Engineer, Moog Luxembourg



Press Manifold System



Servo Cartridge Valve DSHR

Moog's facility in Luxembourg is the Center of Product Responsibility for producing integrated hydraulic manifold systems and hydraulic components such as cartridge valve technology, servocartridges and pilot valves. In January 2006, all Moog Luxembourg moved to the new facility near Bettembourg, a small town in the south of Luxembourg with easy highway access near the French and German border. Moog used state-of-the-art lean tools to design the production and engineering facilities. The goal is to improve the lead times for customers from design to finished products.

#### Benefits of the New Facility

The previous facility had many operation challenges due to three different buildings separated from a parking zone. Now the facility is an optimised 3,720 m<sup>2</sup> (40,000 square foot) production surface and 1,360 m<sup>2</sup> (14,500 square foot) office area designed to run the business with more productivity, better quality, and higher flexibility.

In 2003, the new facility was designed using Lean tools such as process mapping and value stream analysis. The goal was to create a straight material flow from goods receiving through to shipping. Now a new basis is created for continuous improvements with the short term goal of a big gain in productivity due to better layouts, improved processes and simplified material flows.

As a part of Moog's industrial business, it was also important to plan for growth, flexibility, and future expansion.

#### Investments

Moog made capital investments in two new hydraulic test aggregates for a total of 10 test benches with an increased flow-capacity up to 1,200 l/min (320 gpm) enabling more throughput in production. Two new multi-axis CNC machining centres will allow us to develop better customised system solutions and our wide range of cartridge and pilot valve technology.

Other features of the facility include:

- A new air-conditioning and heating system that will provide a 2/3 reduction in energy costs.
- A focus on waste management for Moog and its suppliers and customers. The goal is to reach the Luxembourg "green" waste label.
- Different safety protection systems like a sprinkler system in all production zones to ensure business continuity.



Servo Cartridge Valve DSHR

#### Conclusion:

The new facility will be a big step forward to meet our customers requested leadtimes with the best prices and highest quality. It also will help create the best possible working environment for the Moog team in Luxembourg.

#### About the Author:

Markus Paule was one of the project leaders responsible for designing and building the new facility. He works in production engineering and is responsible for production planning as well as Lean and value stream management. In 1997, he started as a hydraulic engineer at Moog and supported different customers as well as the production in Luxembourg. In 2003, he participated in the Lean facilitator training, Markus studied mechanical engineering with a speciality in Hydraulics at Fachhochschule Niederrhein in Krefeld.

## PRODUCT SPOTLIGHT

### 4 CHANNEL 400 POINT MODULAR PARISON CONTROLLER FOR BLOW MOLDING MACHINES



Moog recently introduced its latest solution for blow molding called the 4 Channel 400 Point Modular Parison Controller with an advanced software platform. The new controller allows blow molding machine manufacturers to control multiple heads and more points with less material consumption and reduced scrap. It is flexible enough to use on electric, hydraulic, continuous extrusion, or accumulator machines.

The 4 Channel 400 Point Modular Parison Controller can be used on most models of blow molding machines without having to modify its software, making it easy for operators to configure a machine in minutes. The fully featured menu and the VGA resolution color LCD allow the software to be readily used by any operator. It has a rotary control knob for a rapid and accurate set-up of functions and easy navigation with a limited number of keys. The operator also has access to LEDs to continuously monitor the main states of the machine.

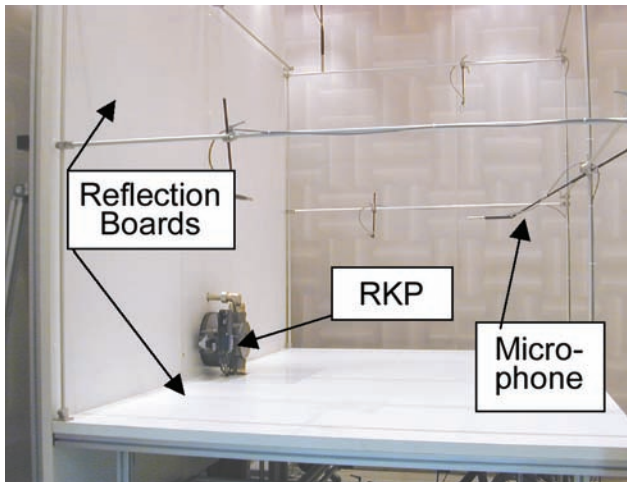
In addition to the well-known features of Moog's proven Parison Controllers, the 4 Channel 400 Point Modular Parison Controller offers the following improvements:

- 4 Independent Channels
- From 10 points up to 400 points parison profile
- The number of analog and digital markers equal to the profile points
- Modular structure allows the operator to easily add other features such as connectivity, additional I/O, and others
- Customizable software and hardware architectures
- Ability to easily add open-loop control for hydraulic and electric blow pin velocity and positioning, and temperature
- Next generation equipment with TFT color LCD for an easy data type identification
- Removable memory for recipes (calibration and process data)
- Multilanguage support (Asian and European languages)

## ASK THE EXPERT

### MOOG USES ANECHOIC CHAMBER TO DESIGN ITS NEXT GENERATION RKP PUMP

By Daniel Flach, Design Engineer



An important European Union Directive concerning noise is encouraging machine builders to reduce the sound level of their products and systems in order to protect the health of operators. In the development of our new Second Generation Radial Piston Pump, our designers worked closely with customers to find ways to reduce noise from one common source in hydraulic systems: the hydrostatic pump. The noise is caused by the physical phenomenon that within 2-5 ms the pressure level in the piston chamber changes between the tank (0 bar) and high pressure (up to 350 bar, (5,000 psi)) and vice versa. The result is a dynamic load acting on the inner parts and the housing that leads to vibration and sound emission from the pump.

To accurately measure the sound emission of pumps an anechoic chamber is necessary. This chamber enables the sound level of the pump to be measured free of any influence of other sound sources (e.g. electrical motor, HPU). Moog invested in an anechoic chamber in our Böblingen, Germany facility that was designed and built according to the demands of the European Norm for sound (DIN45635 part 26) and which enables a measurement of sound levels with a tolerance of 1dB(A).

The anechoic chamber is a room, equipped with absorbers of 65-centimeter (25.59 in.) in thickness at the walls and a soundproof floor. These absorbers enable the anechoic measuring of frequencies higher than 125 Hz. The acoustic conditions are then similar to a free field. The measurement of sound levels is performed according to the so called "Quarter Method" (DIN45635 part 26). That means all sound waves emitted by the pump, are led to two reflection boards (horizontal and vertical). The six microphones have defined positions in relation to the pump surface and it frames a virtual box around the pump. With mathematical equations and the size of this predefined box it is possible to calculate the total emitted sound level of the RKP.

With the help of the anechoic chamber it is easily possible to determine the influence of design modifications on the sound emission of the pump. This tool helped Moog engineers to design one of the quietest piston pumps available on the market. The result is that the RKP Second Generation models do not generally exceed 70-decibels, even in demanding conditions.

#### **About the Author:**

*Daniel Flach works as a designer and specialist of noise investigations in the Radial Piston Pump engineering department. He studied mechanical engineering at the Technical University Zwickau.*

## HOT WEBSITES

### The Society of the Plastics Industry, Inc.

[www.plasticsindustry.org](http://www.plasticsindustry.org)



The official site of The Society of the Plastics Industry, Inc. which is a trade association representing the plastics industry in the US.

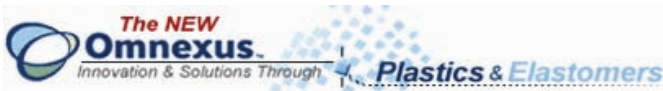
The US plastics industry employs 1.3 million workers and provides more than USD 345 B in annual shipments. Features on the site include News and Publications, Outreach and Education and Business Development.

### Euromap [www.euromap.org](http://www.euromap.org)



Euromap is the website for the national associations of plastics and rubber machinery manufacturers in a majority of EU countries. Euromap represents a total of about 3,900 companies, which together have an annual turnover of almost EUR 16 B and more than 100,000 employees. Look to the following sections on this site to be updated on Technical Issues, Environmental Issues and Market topics including economic surveys, world market directories and trend surveys.

### Plastics and Polymers [www.omnexus.com](http://www.omnexus.com)



This site presents a wealth of information as a service provider who gives "Innovations and Solutions through Plastics and Elastomers". They have two main sections: "News and Innovations Services that include Trend Reports, Innovation Briefs, R&D Highlights and a Global News Service. And a "Design and Solution Center offering a Polymers Selector, a Polymer Center, Performance Centers and Web Seminars.

## MOOG

Moog Inc., Industrial  
[www.moog.com/industrial](http://www.moog.com/industrial)

USA: +1-716-652-2000  
Germany: +49-7031-622-0  
Japan: +81-463-55-3615

For the location nearest you, visit:  
[www.moog.com/worldwide](http://www.moog.com/worldwide)

## LEARN MORE

### Press Releases:

New Radial Piston Pumps from Moog: A Quieter and More Durable Second Generation Design

[www.moog.com/Industrial/News](http://www.moog.com/Industrial/News)

### Tradeshows:

Chinaplas

26-29 April 2006

Shanghai New International Expo Centre, Hall E2  
Pudong, Shanghai, China

See Us at Booth #F11

[www.2456.com/chinaplas/](http://www.2456.com/chinaplas/)

ITEC 2006: Defence, Training, Simulation, Education

16-18 May 2006

ExCel Centre

London, United Kingdom

See Us at Booth #304

[www.itec.co.uk](http://www.itec.co.uk)

NPE 2006 : The International Plastics Showcase

19-23 June 2006

McCormick Place

Chicago, Illinois, United States of America

See Us at Booth #2149

[www.npe.org/](http://www.npe.org/)

### Published Articles:

*Plant Services*, March 2006

"Conflict in Motion: Electrics Challenge  
Hydraulics and Pneumatics"

Moog and several other motion control solutions providers discuss the advantages and disadvantages of these technologies.

[www.moog.com/Industrial/Articles](http://www.moog.com/Industrial/Articles)

### Moog Training Sessions:

Software training: Introduction to MACS / IEC 61131  
Programming (2.5 days)

9-11 May 2006: German Language Session

16-18 May 2006: English Language Session

MSC - Moog Servo Controller Hardware and  
Extension Modules Training (1.5 days)

11-12 May 2006: German Language Session

18-19 May 2006: English Language Session

[www.moog.com/Industrial/Training](http://www.moog.com/Industrial/Training)