

# Hydraulic System Solutions for Plastics Processing Machinery



**Your Development Partner: The Rexroth Applications Centers**



# Your Development Partner for Hydraulic Drive and Control Technology in Plastics Processing Machinery

Continuous improvement and development are part of the Rexroth corporate philosophy. This also includes the development of complex systems in close cooperation with the customer. The aims and objectives are, in particular, faster processing, maximum precision, reduced downtimes, and additional savings on the operational side.

The latest developments in Rexroth hydraulic systems and controls make plastics processing machinery even safer, cleaner, more economical, and more attractive. With our hydraulic components and control cards you receive state-of-the-art technology that can meet the challenges of the future.

## Clean seals

Hydraulic systems from Rexroth are leak-free – and remain so: Special plain compression rings and pipe connections will prevent leakage in hydraulic systems for years!

## Silent solutions

As in many other areas Rexroth is also setting standards with respect to noise emission: Effective “whispering power units” perform so quietly that they more than fulfill the wishes of the system operators.

## Plus-point precision

The heart of the system – the hydraulic cylinder – is technically a straightforward principle that can be controlled with such high precision and is so effective that no other mechanical concept can match it.

Closed loop control circuits and open loop control valves can be matched to each other without problem. The necessary positioning accuracy can be realized according to any requirement. The quality of the plastic products convincingly verifies this.

## Energy-saver

In modern hydraulic systems the pressure is application-oriented, and dependent on the actual movement involved. Drive powers can be designed to the average requirement of the system. Power peaks are easily contained by means of hydraulic accumulators, with pressure limiting valves to prevent overload.

Matching customer requirements is our challenge. The customer sets the task and Rexroth delivers the tailor-made solution.

## Less is more

Less cost and effort for higher dynamics and better economy: Hydraulic systems have the highest efficiency in power-density and require the least space.

The interaction from the compact volume, at the same time eliminating the need for costly power transmission devices like shafts, spindles, and gearboxes, maximizes the service life of the system and considerably increases maintenance intervals.





**Try it for Yourself:**

**Rexroth Simulation Technology**

Increasing demands for high dynamic response, efficiency, energy consumption, and low noise emission from hydraulic systems in plastics processing machinery require swift and accurate developments in new products and systems. Only best-in-class components can guarantee our customers a position in the market.

The simulation and construction of mathematical models for components and systems can be under-taken with the aid of a flexible and efficient virtual test stand. Systems “tested” in this way help to prevent costly development failures and manufacture of incorrect or of faulty products. They also shorten development times, reduce costs of basic tests, and lead directly to the optimum solution.

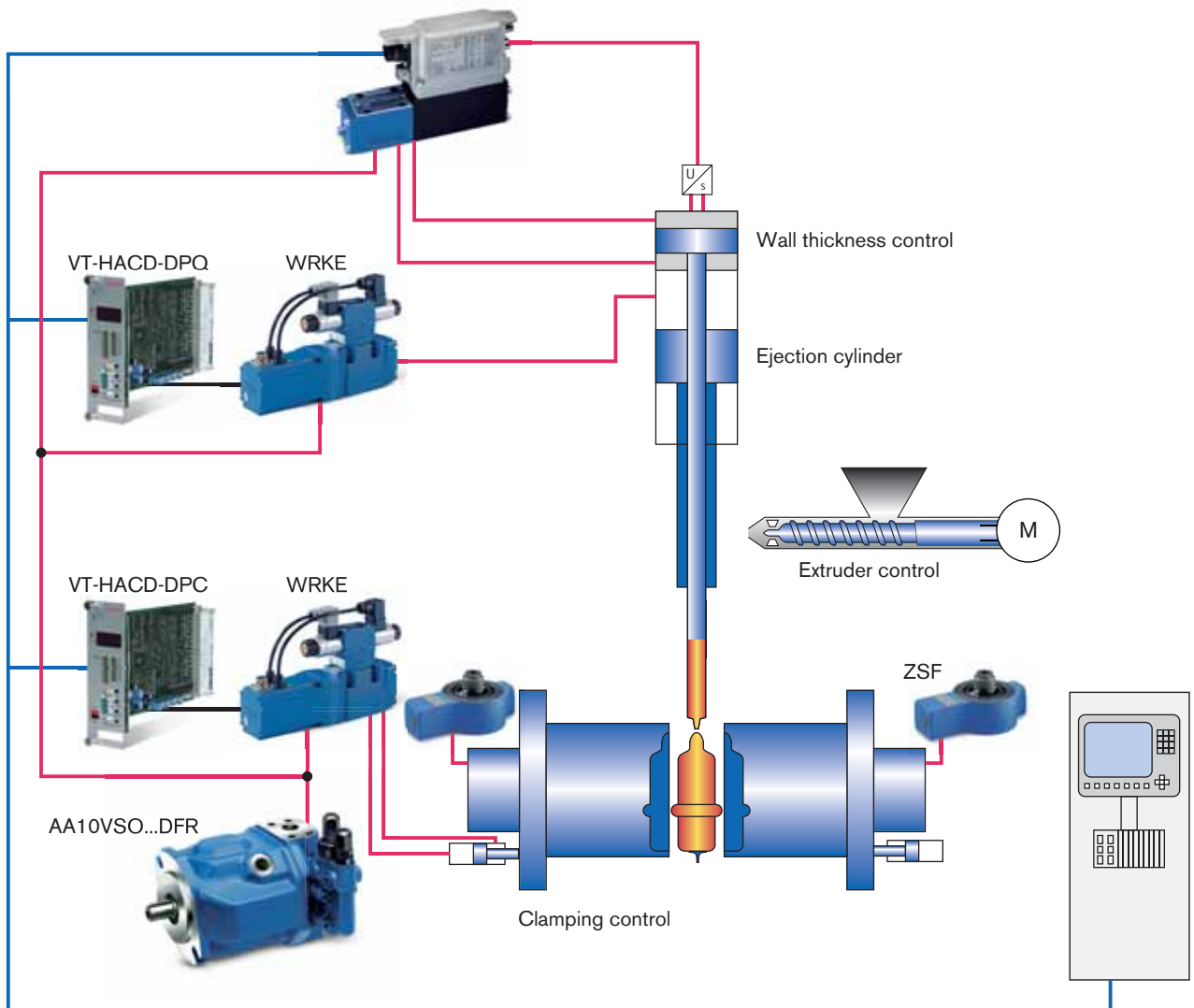
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# Rexroth Offers Universal System Solutions



Ideal System Solutions for Blow Molding Machines from a Single Source

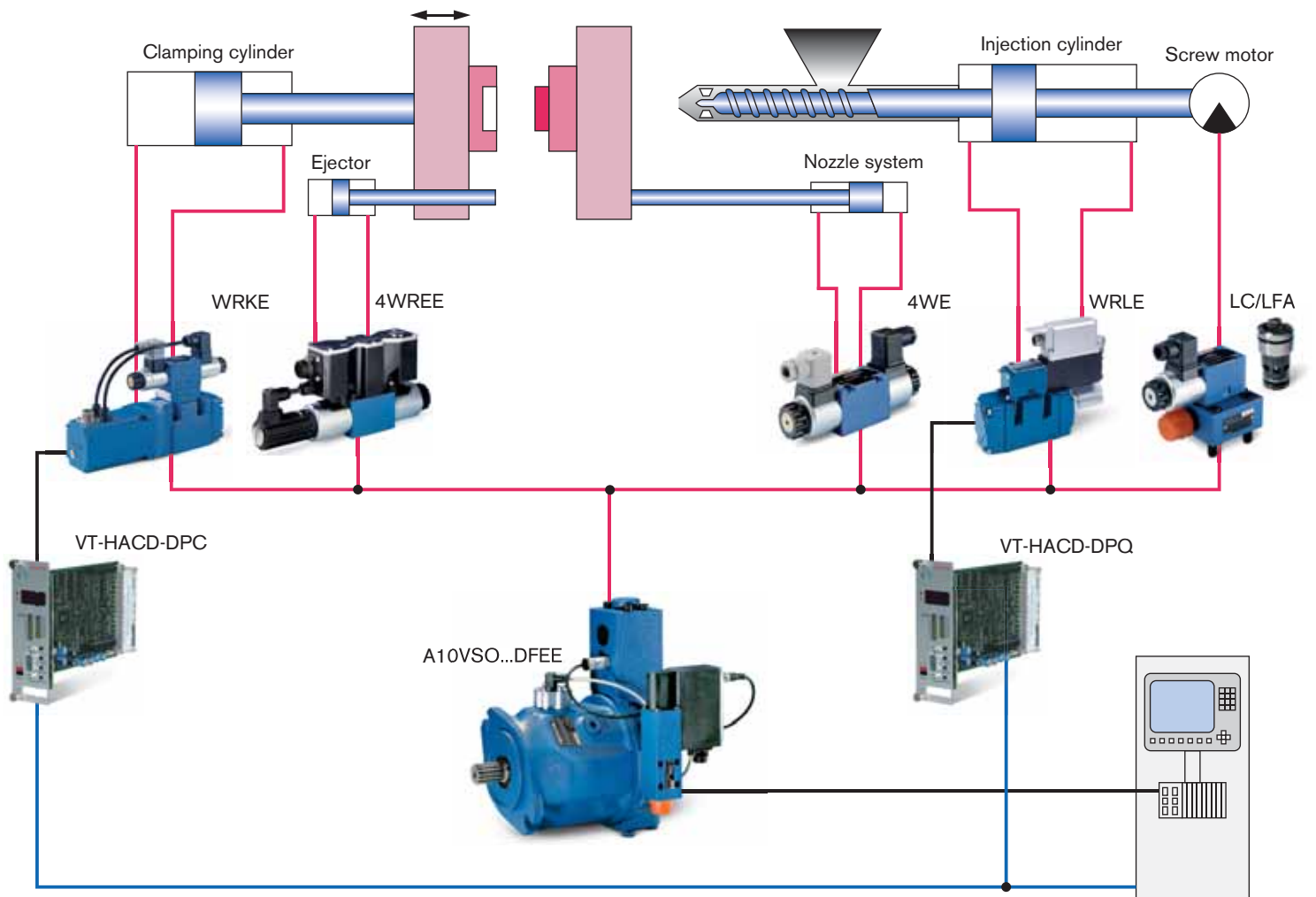
Blow molding machine



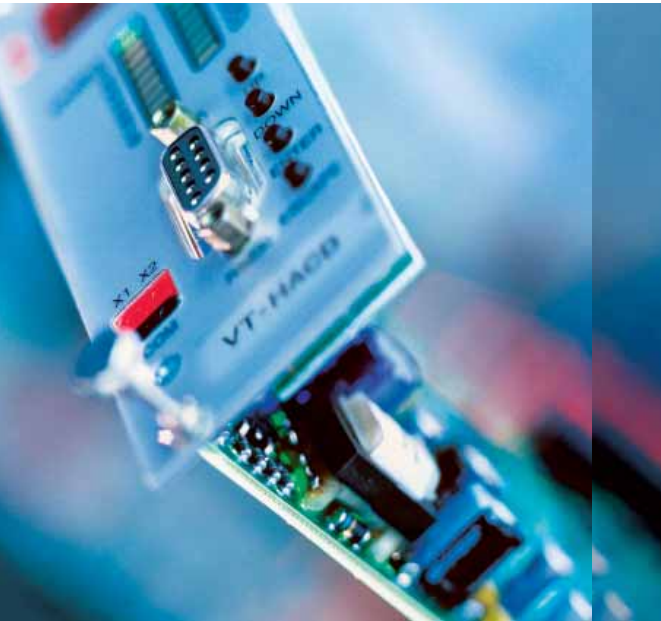


From pressure generation through to axial motion – a universal and matched concept

### Injection molding machine



## Clamping Units – Moving Large Masses Smoothly with Speed and Precision



Rexroth offers optimized digital closed loop control solutions for injection molding and blow molding machines: The VT-HACD-DPC is configured for applications where characteristics and functions are specially tailored to the demanding control of closing movements, mold protection and breakaway forces. The positioning and controller card can be integrated into the machine control system either by analog means or via fieldbus (DeviceNet™ and Profibus) interfaces.

### Reduced cycle times

- Efficient opening and closing velocity profiles speed and pressure control.
- A special controller design takes into consideration the requirements of the hydraulics and attains maximum repetitive accuracy.
- Active damping technology permits smooth and swift motion sequences even with springy, low natural frequency clamping units.

### Reduced costs

- The flexibility of the program structure allows easy adaptation to a wide range of hydraulic control concepts.
- First-class control for both old and new injection molding and blow molding machines minimizes waste and protects the mold, thanks to its smooth motion sequences and highly repeatable accuracy.
- Leakages caused by hydraulic pressure spikes and shocks are eliminated.

### Improved process control

- Versatile profile and set-up options for complete closed loop control, even of the most complex clamping applications.
- True differential force control permits application of minimum forces, thus helping to protect the mold, yet without affecting the speed setting.
- Position-dependent deceleration for repeatable, swift and smooth deceleration of toggle lever or fully-hydraulic clamping units.



#### **Greater flexibility**

- Adaptable to any machine control, PLC or PC .
- Controls the complete clamping process, including velocity and pressure.
- Configuration options simplify adaptation to customer-specific requirements.

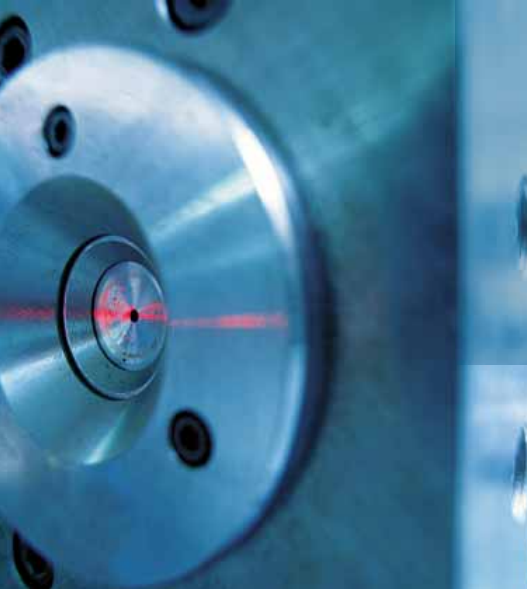
#### **Improved process monitoring**

- Fieldbus interfaces permit access to all parameters.
- Acquisition and storing of critical process data during the operating cycle for precision process monitoring and quality control.

#### **Simple set-up and adjustment of profile**

- Special closed loop control solutions for hydraulic systems are more efficient than conventional machine controls and simplify set-up.
- Stored parameters for description of Rexroth valve characteristics makes for easier commissioning.
- Powerful software tool with graphic real-time display accelerates set-up.
- Stored profiles reduce setting time when changing molds.
- Configuration options support almost any hydraulic circuit that is equipped with proportional valves.

## The Injection Process – Perfect Control with Precision Reproducibility



With the VT-HACD-DPQ the correct closed loop control electronics for the injection process are now also available from Rexroth: perfect process control, the highest repetitive accuracy for maximum economic efficiency.

The positioning and controller card VT-HACD-DPQ is easily integrated into the machine control system either by analog means or via fieldbus interfaces.

### The injection process

As soon as both halves of the mold are closed, the most important part of the process begins – the injection of the plastic.

Rexroth has applied this know-how to design critical process steps, such as the transition from velocity into pressure control (hold pressure) without variation and with repetitive accuracy.

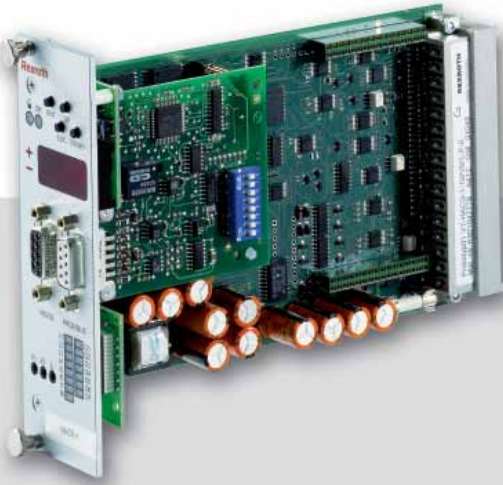
Not only the volume, but also the accurate flow rate of the extruded plastic is essential for the quality of the molded parts. Being able to define and guarantee material flow according to the design of the mold cavity, so that the resulting control of the injection speed is accurate and remains independent of all other process variables, demands the highest level of closed loop control technology.

Pressure control with repetitive accuracy within the range of fractions of a percent, is necessary to maintain the dimensional stability of the injected part as well as the mechanical integrity of the machine. The VT-HACD-DPQ from Rexroth, now the most comprehensive control package in the field of plastics processing machinery, possesses this capability.

The know-how in the development, design and application of control axes is based on decades of experience working on hydraulic axis controllers.

Rexroth offers a complete system, consisting of easy-to-integrate hydraulic components and matched electronics for the highest quality closed loop process control.





#### Reduced cycle time

- Efficient control of injection velocity and pressure.
- Special controller design for highly repeatable accuracy.

#### Reduced costs

- Controls the overall injection process.
- High efficiency both for old and new molding machines minimizes waste thanks to repetitively accurate motion sequences.
- Leakages caused by hydraulic pressure spikes and shocks are eliminated.

#### Improved process control

- Versatile profile and set-up options permit complete closed loop control of complex motion sequences.
- Repeatable transition from injection-velocity profile to pressure profile based on cylinder position, pressure, mold pressure or external event.

- Multiple steps for mold fill, hold, and back pressure profiles.
- Control of recovery volume and screw decompression.

#### Increased flexibility

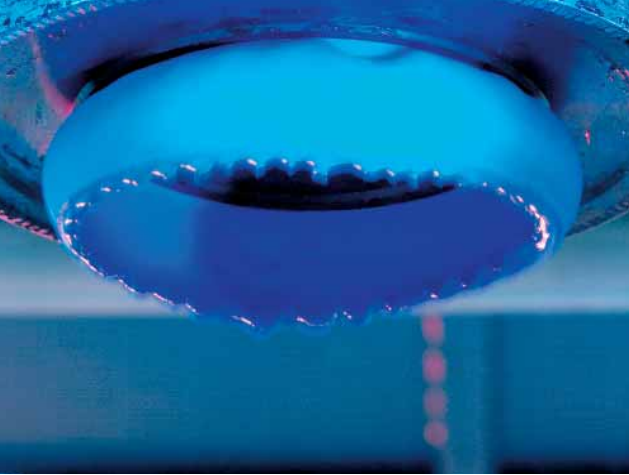
- Adaptable to any machine control, PLC or PC.
- Configuration options support every type of proportionally controlled hydraulic circuit.
- Control the process using either an analog command profile, or store a complete injection profile "on board" and trigger individual sequences via either discrete signals or fieldbus.
- Stored profiles greatly reduce part to part change-over time.
- Control the injection process for up to six different parts in sequence from a single injection unit and a single material.

#### Improved process monitoring

- Fieldbus interfaces permit access to all parameters.
- Acquisition and storing of critical process data during the operating cycle improves process monitoring.

#### Simple set-up and adjustment of profile

- Special closed loop control solutions for hydraulic systems are more efficient than conventional machine controls and simplify set-up.
- Stored parameters for description of Rexroth valve characteristics makes for easier commissioning.
- Powerful software tool with graphic real-time display accelerates set-up.

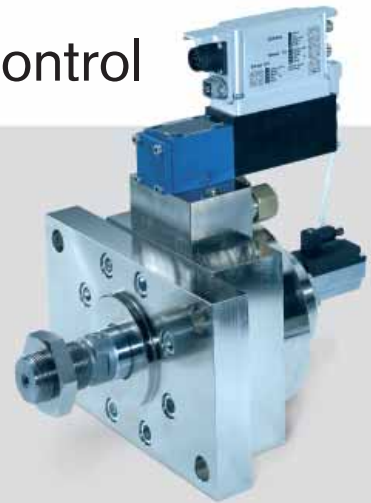


## Wall Thickness Control

One particular challenge to the perfect interaction between hydraulic and electronic components can be demonstrated by the control of wall thickness in blow molding machines. The innovative system solution from Rexroth fulfils all the requirements.  
**Modular Wall Thickness (MWT)**

offers the correct process whether operation is continuous (time-dependent profile) or intermittent (path-dependent profile). It is easy to integrate into any machine control system.

The MWT System is available with a range of control options and different sizes.

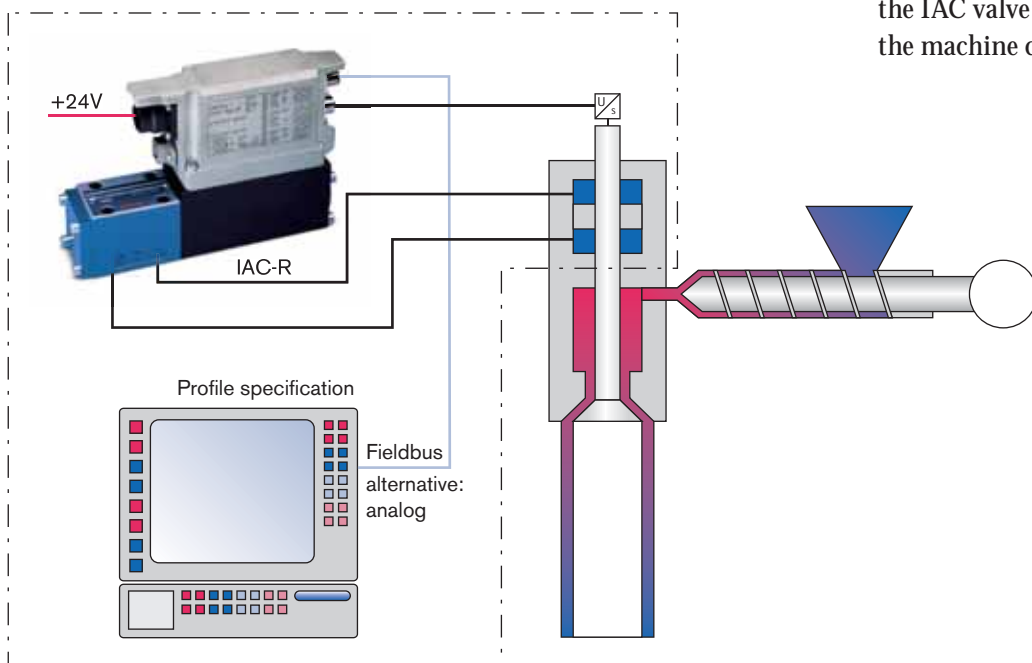


The different types of wall thickness cylinders range from standard cylinder diameters of 60/80/100/125/150, through to special sizes built to customer specifications. The wall thickness cylinder is driven by an IAC control valve size 6/10.

The valve and cylinder positioning circuit can be operated in closed loop mode with the help of the integrated axis controller in the IAC control valve.

Control of the wall thickness profile may be implemented using an analog interface or with the aid of the fieldbus interface.

When using the fieldbus interface the wall thickness profile can be stored internally and processed in the IAC valve to lighten the load of the machine control system.



## Dosing Unit for PU Foaming Machines

Accurate mixing according to requirement – high-pressure axial piston pumps with adjustable displacement (volume) are used for measuring and delivery of polyurethane components.



Closed loop electronic control for clamp and lance systems provides advanced, precise control plus greater flexibility and reduced set-up time.

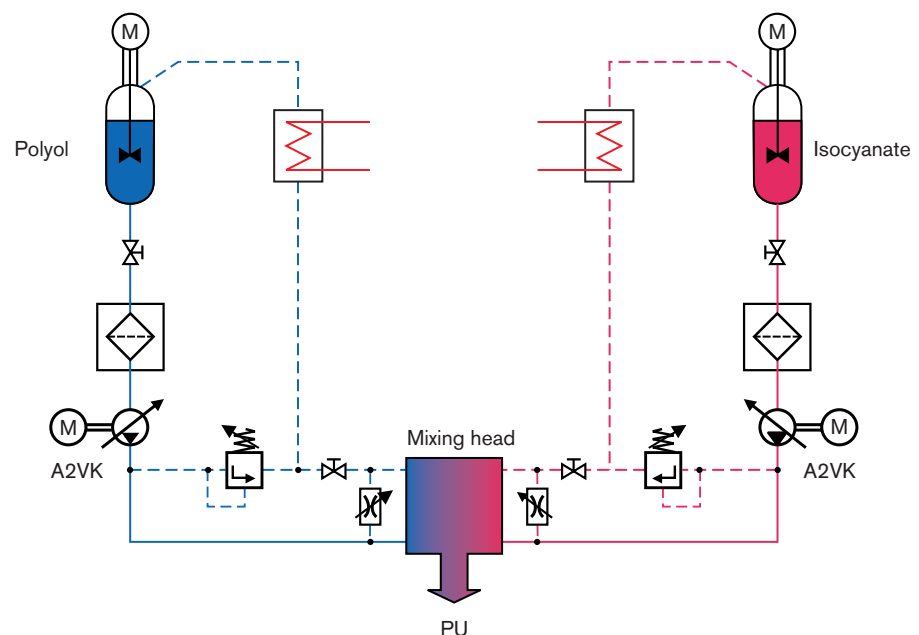
The A2VK and A27VK variable displacement pump is optimally suited to this task. It guarantees maximum, reproducible measuring accuracy using precision adjustment of the flow. It has proven itself over decades of use in this application.

Adjustment can either be manual by means of a hand wheel with integral precision measuring scale or by connecting a rod for remote control. Either hydraulic or pneumatic adjusting cylinders can be built on and connected to the rod for remote control.

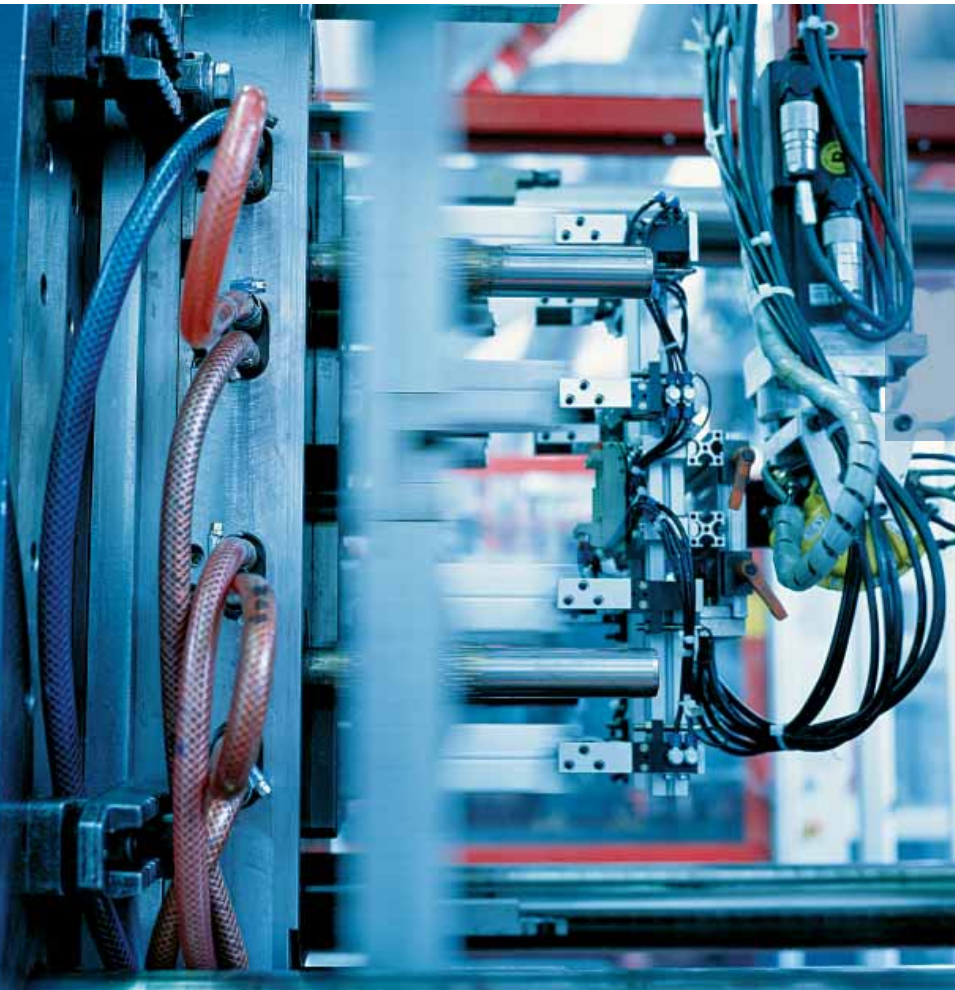
Particular material combinations and special sealing elements permit reliable operation with specific media such as polyol or isocyanate.

The variable displacement pump features low-noise and low-pulsation operation with an operating pressure rating of up to 250 bar, as well as high volumetric efficiency. It also permits a low inlet pressure, even for highly viscous fluids.

Principle of a PU foaming machine



## The Auxiliary Functions – Decisive Technology in Use



The complete system is only as good as its individual components. This is why Rexroth works constantly on every detail to assure maximum potential for improvement.

### **Ejector**

Pressure control to protect the mold component, positioning accuracy to support robots when removing the components, and speed control for synchronous ejection are all examples of the stringent requirements placed on precision in modern injection molding machines.

Valves used for pressure or force control support the ejection process. Two such examples are the new IAC valve with integrated axis control for closed loop position or pressure control and the VT-HACD from Rexroth. Valves with special flow characteristics permit control both of the ejection movement and of the pressure with a single valve.

It therefore reduces the number of components and the complexity, and increases not only the dynamics but also the precision in pressure control.



With these solutions not only do we simplify the system, we also improve the precision of pressure control by a considerable degree.

#### **Core pull**

Core pull is in essence a simple function. The real challenge is the speed control of the cores. As these cores are normally part of the mold, they often have no position feedback. So how can we control the movement of something that we are unable to measure?

The solution is a flow-control function using a proportional throttle valve with built in load sense. The new Type IAC axis controller valve from Rexroth unites these functions in a single valve to make your system simpler, yet at the same time, more efficient.

#### **Nozzle system**

The nozzle system controls movement of injection unit during the injection process with force control against the fixed half of the mold, in order to achieve a seal between these two units. This pressure has to be reduced before the mold opens.

The traditional method comprises a combination of a directional control and a pressure control valve. Thanks to the latest technology these two components can be replaced by a single valve (also with IAC integrated axis controller).

#### **Screw rotation**

Screw rotation takes place by means of hydraulic motors. The selection of motor model here is decisive for the efficiency of the movement. As this function makes up a large part of the machine cycle appropriate care should be taken.

Selecting the correct solution will depend on the demands on the machine and its cycle.

For a hydraulic solution the highest degree of efficiency can be achieved by driving the screw motor directly from a variable displacement pump with electro-proportional DFE adjustment (see Page 14). For machines with mechanical variable displacement pump, however, the flow for controlling the screw speed is effected via a throttle valve (with system-dependent throttle losses).

## Consistent Optimum Control of Pressure-Flow and Force

SYHDFEE with analog OBE



Efficiency and reliability – these are the features of Rexroth pump technology for plastics applications. It has improved itself in a large number of machines manufactured worldwide.

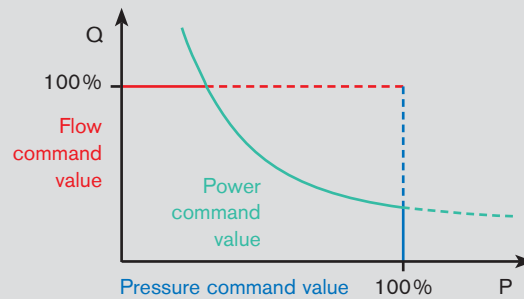


To meet the high demands placed on hydraulic systems for injection molding machines, pumps of the Type A10VSO/A4VSO with DFEE proportional control are usually selected, as they generate accurate flow and pressure that is required for machine functions. The DFE pump electronically controls both flow and pressure, swiftly and with precision, just as with all subsequent machine cycles, and without requiring any other proportional technologies. Flow control without any throttling pressure loss makes injection molding machines fitted with a DFE pump the optimum solution with respect to hydraulic efficiency.

The pressure-compensated version of the A10VSO/A4VSO pump comes as part of the standard equipment that most machine manufacturers use for conventional, proportional valve-controlled injection molding and blow molding machines. A wide range of control options makes the A10VSO/ A4VSO pump flexible enough for every casting and molding application.

The DFE proportional pump control technology is also available with fieldbus control as a DFEC. By modifying parameters via the fieldbus the pressure control can be optimally matched to each motion axis in the system.

The Rexroth SYDFE is an electrohydraulic closed loop control system based on an axial piston variable displacement pump used for the control of pressure, flow and power without throttle losses in the energy train.



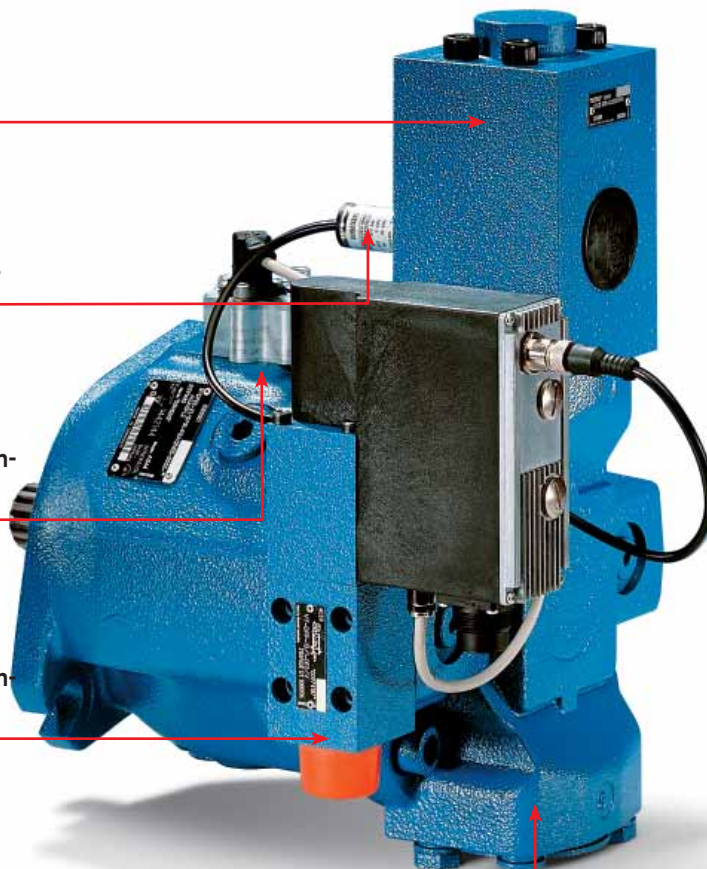
SYDZ Preload valve

HM16  
Pressure transducer

VT-SWA Swivel  
angle transducer  
with integral electron-  
ics

VT-DFPE  
Pilot valve  
with integral electron-  
ics

A10VSO  
Axial piston pump



#### System benefits

- Pressure and flow control with high dynamic response
- Energy savings by elimination of throttle losses
- Easy system installation through reduction of components
- High-precision infinite control through electronic closed loop operation

#### Available sizes

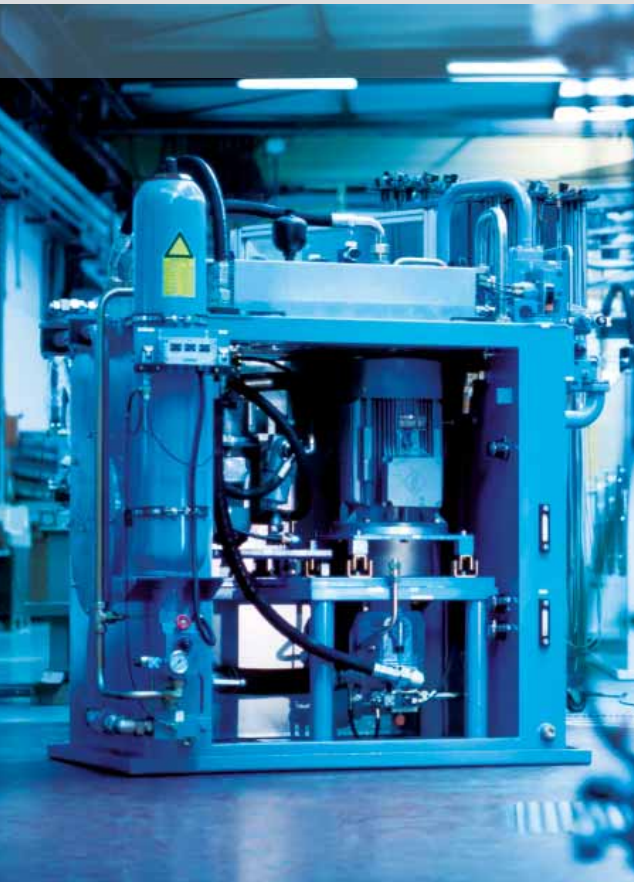
- SYDFEx with medium pressure pump A10VSO from Size 18 to Size 140
- SYHDFEx with high pressure pump A4VSO from Size 71 to Size 355

#### Application areas

- Plastic injection molding machines
- Blow molding machines
- Rubber injection presses
- Diecasting machines
- Different types of presses
- Oil supply for test stands
- and many others

# The Drive Unit for Your Plastics Processing Machines

The heart of your machines is the power unit with its best-in-class components and the correct design – the “whispering power unit”.



Rexroth experience in design and construction promotes the continuous improvement and innovation of low-noise power units for plastics processing machinery and other applications.

## Design

The tank is a U-shape design, inside of which the motor-pump assembly is mounted with vibration-damping. Good decoupling of structure-borne noise using precision-matched tubes, insulating mountings, and damping material results in a system that can operate at an extremely low noise level. Specially designed noise-damping top and side covers also contribute to the unusually low noise values.

## Specification

- Customer-supplied connections end at a flexible pipe fitting with shut off valves.
- An enlarged tank surface supports good de-airation of the hydraulic fluid.
- Good access, easy operation and maintenance of all components are guaranteed.

## Characteristics

- Soldered plate heat exchangers, more compact and powerful than conventional shell and tube heat exchangers
- Water-saving control valves for reduction of water consumption
- Accumulator subassembly and safety and shut-off block (if required)
- Pressure filter
- Recirculation filter for best oil quality
- Customized designs

# Freedom: No Leakage – Guaranteed

The latest design processes and techniques have put an end to all discussions on the risk of fluid leakage – a requirement, which is particularly applicable to plastics processing machinery used the medical and food industries.

The use of profile support rings and plain compression rings in valve flange connections means that voids can no longer occur on the non-pressure side in Rexroth systems. Hydrodynamic “pumping” caused by a rise and drop in pressure in these non-pressure voids is a thing of the past – even with extreme pressure pulsations of the operating medium.

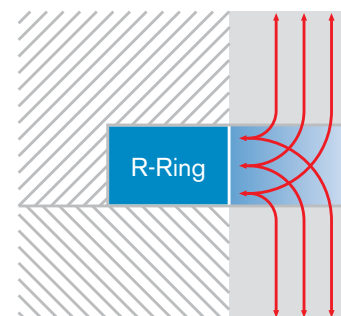
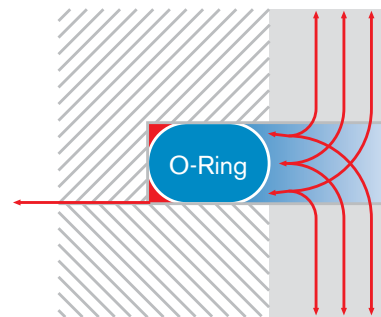
O-ring gap extrusions are also prevented and the service life correspondingly extended, as there is no longer radial movement of the sealing ring.

For a high level of leakage prevention from pipe fittings Rexroth systems now use profile fittings in addition to compression rings with soft seals.

In comparison with conventional wear-prone compression ring fittings and the costly welded fittings and flared joints, this process offers decisive advantages:

- Consistent separation of retaining and sealing functions
- Additional soft seal
- Easy machine conversion to DIN specification
- Guarantee of sustained high quality seal

Plain compression rings in the flange connection provide long-term protection against fluid leakage.



# Fieldbus Technology – Decentralized Intelligence for More Flexibility in Modular Machine Systems



Fieldbus technology – components with fieldbus communication offer high flexibility in modern systems

## Pump

The DFEC offers all the advantages of DFE control plus the benefits of digital electronics and fieldbus technology. With the CANopen communication protocol all control information shown below on the machine or PLC is accessible. The result is improved axis control and greater flexibility.

## Valves

The IAC valve family from Rexroth offers extensive control functionalities in a very confined space, specially optimized for hydraulic axes. The directly connected sensors (analog/digital) also reduce cabling in the machine.

## Pump and valve functionalities

- Parameter sets are available for individual optimization of the individual axes:
    - Optimization of each axis
    - Greater accuracy
    - And thus faster and more accurate transitions
    - Shorter cycle times
  - Selection of available parameter sets in real-time
  - Power limiters can be switched on or off.
  - Leakage compensation can be switched on or off.
  - Simplified switching of master-slave pump systems
  - Switching between multiple pressure transducers for improved control quality
- Easy transmission of settings to other systems
  - Auto-calibration function
    - Offset of pressure transducers
    - Valve zero point
    - Swivel angle zero point
    - Swivel angle gain
  - Real-time diagnostics
    - Diagnostics of pump/valve status
    - Changes in system behavior can be diagnosed and rectified
  - Improved monitoring
    - CAN communication
    - Controller error
    - Cable break in valve, swivel angle transducer, pressure transducer
    - Temperature
    - Supply voltage

# Intelligent Hydraulics in New Dimensions

Wherever forces need to be utilized economically, the advantages of industrial hydraulics are obvious – whether it is required to lift and lower loads smoothly, perform linear or rotary movements, achieve constant acceleration, maintain given speeds, approach positions exactly, transmit powers or interlink sequences.

Rexroth is the technology and market leader in industrial hydraulics with a comprehensive product range and distinct application expertise.

At Rexroth you can select from the worlds' largest standard product range in the field of hydraulics, application and customer-specific

system solutions of high quality. With advanced micro-electronics Rexroth has made hydraulics even more powerful.

For you, Rexroth is the ideal partner for developing highly efficient machines and production facilities – from the first point of contact to commissioning and throughout the entire life cycle. Teams that operate worldwide carry out the complete engineering of your systems and, if requested, up to the hand-over of turnkey systems and beyond – service included.

Thanks to the use of hydraulic drive and control technology from Rexroth you will be more competitive than ever.

## The Drive & Control Company

Rexroth offers a unique and comprehensive range of products and services across technologies in its six fields of technology and service areas – strong in high-quality individual technologies, combined with highest application-specific competence in system packages with integrated complete solutions.

Electric  
Drives and  
Controls

Hydraulics

Linear  
Motion and  
Assembly  
Technologies

Pneumatics

Service



## Rely on service across technologies

Rexroth integrates all services for the entire product spectrum in the field of factory and industrial automation into a single organization: from immediate support, spare parts service, field and repair service, retrofit/modernization through to training.

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