

Powerful, compact and cost-effective

The next stage in the

evolution of servo-hydraulic axes

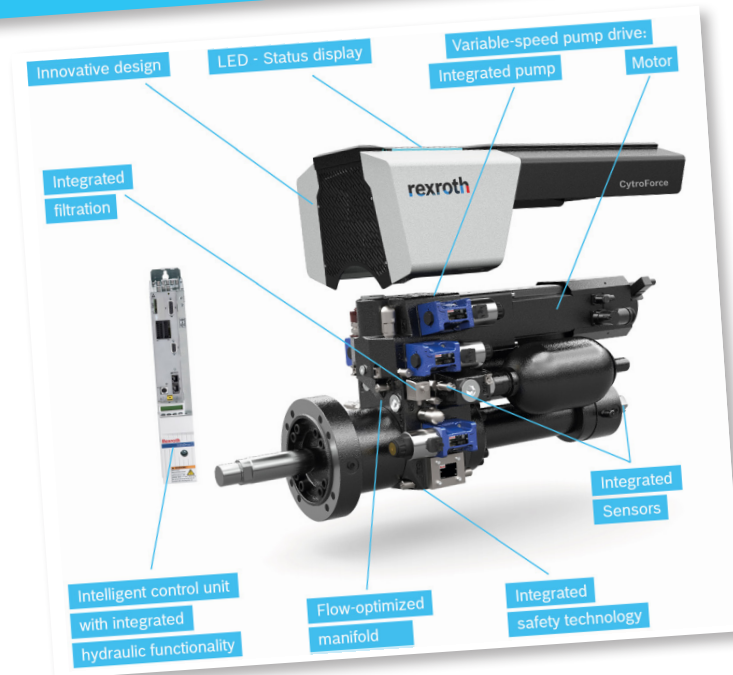


Linear axes for power, movement and positioning tasks should be effective and reliable but also efficient, ideally throughout their entire life cycle: from engineering to maintenance and service. Bosch Rexroth's modular plug-and-produce solution CytroForce proves that servo-hydraulic axes can be easily configurable, useful and low-maintenance out-of-the-box products. What new fields of application and potential areas for making savings are opening up as a result?

Many machine manufacturers have a preconceived opinion that hydraulic linear axes are too complicated, too cumbersome and not smart enough. On the other hand, their key strong points include impressive power density, dynamics and service life. How can these benefits be properly utilized without any hydraulics expertise and will experienced hydraulics users be impressed with new performance classes?

PRE-CONFIGURED COMPACT AXES FOR PLUG & PRODUCE

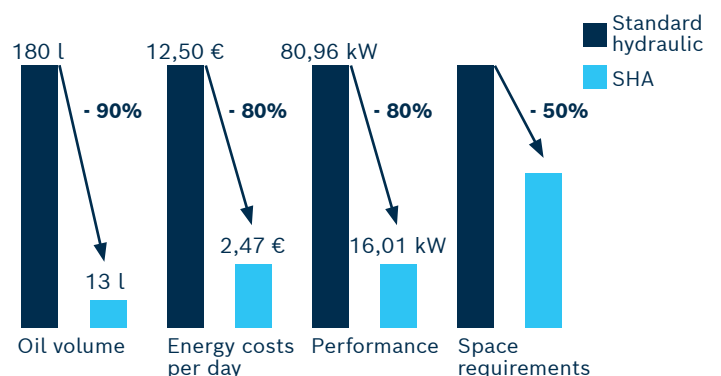
The industrial hydraulics experts at Bosch Rexroth have completely redesigned electro-hydraulic axes and developed a groundbreaking new solution called CytroForce: following a short configuration process carried out jointly with the customer, the experts in Lohr am Main document the linear axes, get them produced, and deliver them pre-configured and ready to be installed all within a 12-week window. Once commissioned in line with the plug & produce concept, the linear axes are virtually maintenance-free. How is it possible? The stand-alone servo-hydraulic axes (SHAs) in the CytroForce range are composed of a flow-optimized and space-optimized combination of servodrive, hydraulic pump, manifold and hydraulic cylinder. Together with the tank, safety valves and sensors they form a closed fluid circuit. Other standard components form the integrated control system, PFC standard software and open communication interfaces. Software-supported parameterization via the engineering software IndraWorks removes the need for labor-intensive programming as previously required. As such, even subsequent cycle adjustments required further down the line can be made quickly and easily. What's more, the software supports other simulation, engineering and commissioning tools.



ADVANTAGES OVER CONVENTIONAL HYDRAULICS

The electrical and hydraulic components of CytroForce compact axes together form a modular system through which power and functions can be scaled up and down. Since Bosch Rexroth has standardized the physical interfaces between pump, manifold and cylinder, an extremely broad range of different combinations and models can be achieved without having to abandon the integrated design with a closed fluid circuit. However, the design concept is not only flexible but also thoroughly flow-optimized: the compact manifolds were designed using 3D CAD software and then cast in molds with the help of 3D sand cores. This not only saves on resources but also allows the axis to operate much more quietly on average, and reduces energy consumption by up to 80%. The main reason for this is the efficient pipe layout, which minimizes throttling

losses and creates optimum flow conditions. Compared to the previous generation of SHAs, the installation space and weight of the manifold have been reduced, which therefore makes them easier to integrate.

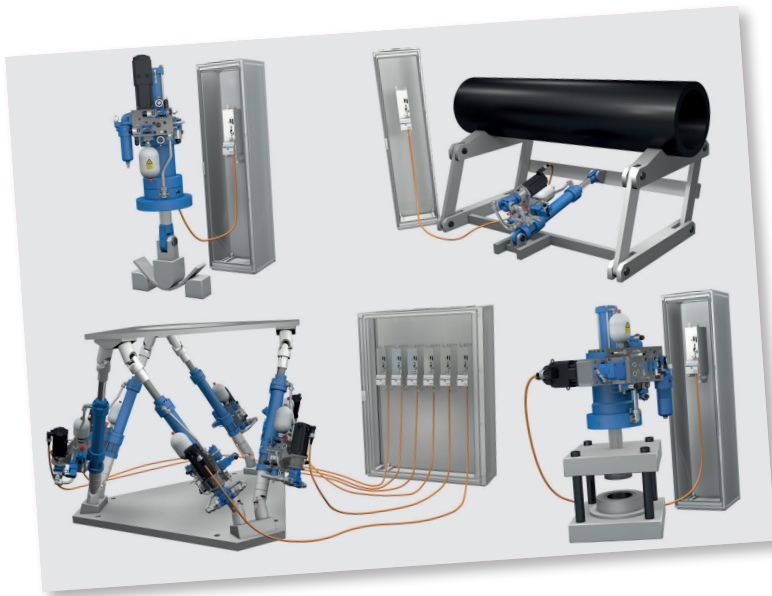


▲ 01 CytroForce: savings compared to a standard hydraulic solution

FLEXIBLE STANDARD COMPONENTS

On account of its modular design using standardized physical and logical interfaces and modular, proven software components, CytroForce is able to open up a wide range of potential applications.

Here is an example of a new use case: three different versions can be achieved with the new standard interface between the manifold and the cylinder without an additional flange: differential cylinder, tandem cylinder und synchronizing cylinder (from 2021). The flow-optimized standard interface between hydraulic manifold and pump reduces the noise level and hence contributes to the noise control of the overall construction. Since the fluid tank is also connected via a standard interface, different oscillating volumes can be achieved with one or two physically flexibly orientable accumulators. In order to achieve the desired functions, the manifold is in turn equipped with valves and blind plates, etc. at standard interfaces.



FOUR AREAS OF POTENTIAL BENEFITS

Machine manufacturers and users who rely on compact axes which are delivered ready to be installed can benefit fourfold:

01 Simple engineering

One of the key goals of CytroForce is to enable people to take advantage of the specific benefits of servo-hydraulic axes even if they don't possess any hydraulic expertise and to considerably lighten the engineering load of machine manufacturers. The process is simple: a Bosch Rexroth salesperson guides the customer through the configuration processes during a face-to-face or virtual meeting. With the help of product-specific design tools, forces, speeds and paths, etc. are entered, the cycle is defined and the installation space is checked. During the configuration meeting, the customized axis is prepared "on the fly" ready for production, meaning that it can be delivered within 12 weeks of the order being placed. The quote and the technical documents are sent on the following working day at the latest in PDF format.

IMPRESSIVE POWER DENSITY FOR A WIDE RANGE OF APPLICATIONS

Thanks to the increased efficiency and power density, the medium-sized CytroForce-M covers forces of up to 1,200 kN. A cylinder stroke of up to 1.0 m and travel speeds in rapid traverse of up to 0.8 m/s can be achieved depending on the configuration. The positioning accuracy is 10 µm and the repetition accuracy is 5 µm. However, CytroForce also boasts impressive credentials as a compact plug-and-produce axis in the lower performance segment – for example as an alternative to electromechanics or additionally as part of hybrid concepts with a standardized engineering, control and drive concept.

As such, users can easily benefit from specific strengths, such as demand-based power output of a hydrostatic transmission system or intermediate storage and return of energy as part of an energy management system. The standardized design also allows for an optional cooling structure in order to additionally increase performance and operating time.





▲ **00 Maintenance using the service kit: closed hydraulic systems such as CytroForce and the other servo-hydraulic axes from Bosch Rexroth minimize service costs.**

02 Lower overall costs

Compared to the conventional hydraulic solution, CytroForce reduces energy costs by 80% over the life cycle and depending on the application. Further savings are also achieved through the up to 97% reduction in oil volume, the corresponding insurance costs and the 50% reduction in the space required as the conventional hydraulic power unit is no longer required. The simplified commissioning process via the plug-and-produce system with standardized interfaces also represents another positive cost factor. Since the pre-configured SHA can be treated like an electric drive at the control level, only electrics and a higher-level control system need to be connected. Maintenance requirements are minimal due to the closed system.

03 Greater productivity

Impressive performance figures, shorter cycle times and low overall costs mean a sustainable increase in productivity. Only half the installation space of that of non-integrated linear axes is required, and the energy consumption of the variable-speed drive is 80% lower than that of conventional hydraulic systems. The lower oil volume required compared to open systems is also economically and ecologically advantageous. For example, a standard axis including tank and power unit requires between 100 and 250 liters of oil, whilst a CytroForce axis can manage with as little as 3 to 15 liters. That is a reduction of up to 97%.

04 Increased availability

The closed and low-maintenance hydraulic system has a positive effect on availability. Unlike with the conventional hydraulic axis, no dirt can get into the system, meaning that the filter very rarely needs to be changed. Downtime can also be reduced through condition monitoring. Thanks to integrated sensors and open interfaces, authorized entities can read and analyze data which are critical in terms of malfunctions and failures. Predictive analytics can even be conducted by means of the ODin service. A machine health index for the entire axis and for every failure-relevant individual component generates indicators for process improvements and predictive maintenance.



CONCLUSION

With its evolutionary CytroForce concept, Bosch Rexroth has created a whole new attractive side to electro-hydraulic linear axes – for presses and machine tools but also an extremely wide range of industrial applications involving various different power and movement tasks. Machine manufacturers and users can benefit from this new flexible yet standardized solution. The former will be able to obtain specific designs that are easy to configure and are available in next to no time with minimal engineering effort required. The latter will benefit from a smaller footprint, lower noise emissions and reduced operating and maintenance costs. Not to mention how user-friendly the solution is.

Straightforward maintenance with the service kit

Stand-alone servo-hydraulic linear axes from the CytroForce, SHA and EMAH series boast straightforward maintenance. The few work steps involved can be carried out thanks to a special service kit and, overall, take less time than, for example, regularly lubricating mechanical axes.

Bosch Rexroth's service kit is kept in a handy case. It contains, for example, a fluid analysis set for taking fluid samples and a refilling device. Corresponding fluid kits with a conditioned, i.e. cleaned and degassed, fluid are available as accessories. As such, a trained employee without any specific hydraulic expertise can carry out all the specified service work:

01 Fluid sampling (three times during the first year, and once a year thereafter): using the fluid kit, a sample is taken and then sent off for analysis.

02 Refilling: following the fluid analysis, hydraulic oil specific to the axis is refilled using a pump device. The pump flow will stop automatically once the optimum fill level has been reached.

The benefits at a glance

- ▶ Do it yourself: all maintenance work on the closed hydraulics can be carried out in-house.
- ▶ Easy to use: tools required for servicing work are neatly stowed in a compact case. New fluid for refilling is kept in a cartridge in consumption-based quantities.
- ▶ Smooth operations: A wide range of experience in diverse, industrial applications, as well as extensive tests and validations in the laboratory and pilot plants, led to a suitable fluid selection, which for example prevents cavitation and is designed for a long service life - even under high loads.

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