



Hydraulics 4.0

The CytroBox: The future of hydraulics has started

The digital transformation is revolutionizing processes throughout the entire value chain. The secure exchange of information and the networking of machines are the major challenges for machinery and system manufacturers, such as press machine manufacturers. In particular, forming technology could become more cost-efficient, faster and more intuitive by means of IoT technologies. The new CytroBox hydraulic power unit from Bosch Rexroth optimizes production with its intelligent and energy-efficient modular design, allowing press manufacturers to operate much more economically.

New ways of thinking and new design approaches are what make hydraulic power units the key components in the efficient and intelligent factory of the future. Already today, the latest power units boost the efficiency in production with their energy-efficient operation, innovative design and intelligent networking.

Efficient power package with sophisticated energy management

The new CytroBox raises the level of production to the next higher plane. This newest generation of hydraulic power units for medium-range performance from 7.5 kW to 30 kW impresses with its intelligent combination of speed variability, synchronous motor and axial piston pump, which make the power unit even more efficient than comparable components. This is thanks to the ideal harmonization of servo motor and pump, as well as the needs-based energy consumption. Preset controllers in the variable-speed pump drives adjust the energy requirements of the machine to match the respective conditions. Consequently, the speed is reduced under partial or no load to save energy, and conversely increased under full load with a highly dynamic response. This speed control leads to energy savings of up to 80 percent in comparison to constantly driven power units.

Flow-optimized manifold block thanks to additive manufacturing

The high degree of efficiency of the manifold block, manufactured using the 3D sand core printing method, also contributes to efficient operation. The real item is cast from the virtual, optimized model.

With this additive manufacturing method, a manifold block was created that is up to 40 percent more compact and has improved flow channels. The oil flow is improved through the flow optimization, the pressure loss is reduced, and the areas of leakage minimized due to fewer plug screws.

In addition to the energy savings in the hydraulic power unit itself, press machine manufacturers can also use the CytroBox for their own energy management within their company. Because the hydraulics, motor, and drive controllers are water-cooled, the entire waste heat of the power unit can be used for further climate control purposes within the company; for example for hot water, absorption refrigerators, or the heating of office buildings. The increased energy efficiency of the unit sustainably leads to a lower total cost-of-ownership, a smaller footprint, and reduced costs for air conditioning.

Less noise emission for more work comfort

In addition to more energy-efficient production, press manufacturers should also take low-noise equipment and procedures into consideration. In accordance with the German Noise and Vibration Work Safety Ordinance (LärmVibrationsArbSchV), the daytime sound pressure level should not exceed an average of 80 to 85 dB (A) or a peak of 135 dB. The new hydraulic power unit clearly falls below these limits. The airborne sound is absorbed completely by the compact arrangement of all the components in one unitary housing and the built-in sound insulating mats. This way no sound is emitted to the outside. In order to reduce noise emission stemming from structure-borne noise, the motor pump group is rigidly affixed to a polymer-concrete foundation. The damping bearings, which typically transmit the noise to the tank, are completely eliminated. Instead, the compound polymer-concrete



foundation increases the inertial mass, whereby the center of gravity of the power unit is located deeper. Any vibrations which arise are absorbed efficiently. Consequently, the noise emission of the CytroBox is less than 75 dB (A) – even at full load. Comparable units have an average noise level of 85 dB (A). This low level of noise pollution reduces the need for additional measures and ensuing costs for noise reduction, and also makes working quite pleasant, even in direct proximity of the hydraulic power unit.

Full performance in the smallest installation space

If press machine manufacturers want to make their production fit for the future, they need new and intelligent machines and hydraulic drives which can be flexibly installed in a space-saving way. Which is why the CytroBox combines everything in a single housing. The all-in-one power unit combines a small base area with a novel and compact design. This innovative design concept also includes a tank with optimized degassing and flow. Thanks to a CFD simulation, the oil volume is reduced by 75 percent – from 600 liters to a mere 150 liters. The use of synchronous technology also has a space-saving effect. Powerful synchronous motors, with a length of only 400 mm and a diameter of 200 mm, are up to 90 percent smaller than comparable asynchronous motors. Further advantages of the synchronous technology are greater dynamics and increased energy density. In addition to the compact components, the innovative cooling concept makes all coolant lines unnecessary. All of these functions

are combined in the new hydraulic power unit with minimal installation space in a compact control cabinet. This means the CytroBox can be flexibly integrated in existing production lines with minimum space requirements.

Cleverly networked to condition monitoring

With a view towards Industry 4.0, a data interface is essential for the future viability of the hydraulic power unit. Only with permanent condition monitoring can machine downtimes be prevented and availability increased. Already today, maintenance personnel routinely use apps to check the conditions of hydraulic power units, for example. By means of traffic light logic, they can see if everything is within acceptable limits or whether certain components need to be replaced. If that is the case, the maintenance technician can carry out the maintenance work efficiently and economically during a regularly scheduled downtime interval.

Equipped with a sensor package and open interfaces, the CytroBox is predestined for use in Industry 4.0. Integrated and wired sensors in the hydraulic power unit inform the press machine manufacturer about the current filter, oil, or drive condition. The collected data are then processed by the drive controller. Via a WiFi or 4G connection, the data can also be fed into a higher-level cloud and analyzed. A system such as the Online Diagnostic Network (ODiN) assists in data evaluation, for example.

Data analysis with ODIN

ODIN utilizes the interoperation of sensor technology, cloud-based applications, and machine-learning methods to monitor all operating states in a model-based manner, while also performing predictive maintenance. To do this, a machine-learning algorithm determines a normal, 'healthy' state of the machine in an initial learning phase, drawing on a multitude of sensor signals – such as pressure, flow rate, vibration, temperature and oil quality. After the initial learning phase, the online system continuously determines a health index of the monitored system using the data-based model. If the health index deteriorates because the data from multiple sensors change within the defined limits, the system signals a problem. The health index not only shows the condition of the unit actually monitored, but also gradual changes in the mechanical or hydraulic systems located upstream and downstream. If movements take longer or require more power over time, it is an indication of wear in the mechanical or hydraulic systems. The most current information – for example on sensor evaluation, maintenance work, or the machine health index – is visually presented to the operator via touch display directly on the CytroBox. The removable tablet is connected via WiFi with the cloud and the drive controller and therefore has mobile access to all of your important data.

Conclusion

The CytroBox hydraulic unit breaks new ground in terms of energy efficiency for the performance range of 7.5 kW to 30 kW and offers press manufacturers the advantages of efficient and space-saving hydraulic drives. Thanks to the switching cabinet construction design, the unit can also be easily and quickly installed in existing production lines, even if the space is limited. The integrated sensor system with a data interface and the data analysis by ODIN enable machine manufacturers to perform comprehensive condition monitoring, modernize their production, and increase the cost efficiency of their presses.