

Press release

Comparative study proves energy efficiency and cost savings with electromechanical joining systems

Results showcase Kistler's commitment to sustainable production

Winterthur, November 2024

As part of a commissioned study by Kistler, researchers at Ostfalia University of Applied Sciences investigated the energy efficiency of three joining processes with different drive technologies – electromechanical joining systems as well as hydraulic and pneumatic ones. The results show that the electromechanical variant is the most efficient in terms of joining work alone, i.e. the joining stroke. Joining processes with electromechanical systems are up to 5.9 times more energy-efficient than their hydraulic variant. The pneumatic joining system has the highest energy consumption: depending on the efficiency of the compressed air system, it consumes between 8.4 and 20.6 times more energy than the electromechanical alternative.

The researchers examined the NCFE electromechanical joining module, designed for simple, cost-sensitive joining processes from Kistler, and comparable joining systems with hydraulic and pneumatic drives respectively, for the comparative study. All systems performed with force of 15 kN. The test setup for the study represents a typical pressing process that takes place every day in a wide range of industries and sectors, including the automotive and aerospace, 3C and medical industries, as well as in white-goods and power-tools manufacturing.

The electromechanical system from Kistler operated at a speed of 180 millimeters per second. As the hydraulic and pneumatic systems cannot reach these speeds due to their pump capacities and pipe diameters, they ran at their respective maximum speeds: the pneumatic system achieves approx. 50 millimeters per second, while the hydraulic version reaches 65 millimeters per second.

Energy loss in pneumatic systems

“The conversion of electrical energy into compressed air energy inevitably results in losses,” says Prof. Dr.-Ing. Udo Triltsch, Professor for Mechanical Engineering at Ostfalia University of Applied Sciences. “The more inefficient the compressed air system, the higher the losses: these different energy losses must be taken into account when calculating the energy cost of pneumatic joining processes. To that end, we differentiate between various compressed air generation systems in this study: very efficient compressed air generation systems with efficient pneumatics which require 100-

watt hours to generate one cubic meter of compressed air, systems with average or normal pneumatics which use 175-watt hours for the same amount of compressed air, and finally systems with inefficient pneumatics which use 250-watt hours. This allows us to represent realistic industrial conditions.”

Higher energy efficiency of electromechanical joining modules

Taking these assumptions into account, the researchers calculated the required joining stroke energy consumption of the different joining systems. The results show that the electromechanical joining system (servo press) from Kistler consumes significantly less energy than the other systems during the test (see Fig. 2). “The results clearly demonstrate the efficiency benefits of the electromechanical system,” says Nanno Peters, Dipl.-Ing. (FH) at the chair.

Based on the energy consumption (Figure 1), the university also calculated the annual energy costs for each of the joining systems. They assumed a total of 260 working days per year and a daily operating time of eight hours, the equivalent of 6,000 operating hours, as well as the average price of industrial electricity costs (in 2022) per kilowatt hour. Here too, the results clearly show that the highest cost savings can be achieved with the electromechanical joining systems from Kistler.

Providing future-proof solutions for a sustainable production and savings on operating costs

Alexander Müller, Head of Business Center NC Joining Systems at Kistler, draws a positive conclusion: “We are of course very pleased with the results of the study. They prove that we offer future-proof and sustainable solutions. The ecological footprint is a crucial parameter in production. Therefore, we offer our customers joining modules and solutions that combine cost-effectiveness, sustainability and efficiency. When users switch from a pneumatic system to an electromechanical solution, for example, they can reduce their energy consumption by up to 93%. They also benefit from lower overall operating costs – after all, they also save on procurement and operating costs if their joining system is configured according to the application. In that case, both maintenance costs and CO₂ consumption are proven to be lower in the long term.”

Image material (please name the Kistler Group as picture source)

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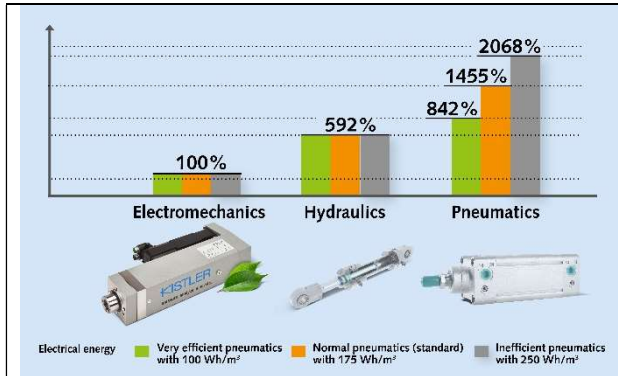


Figure 1: Comparison of the annual energy consumption of different joining systems (electromechanical, hydraulic and pneumatic) calculated on the basis of the study results.

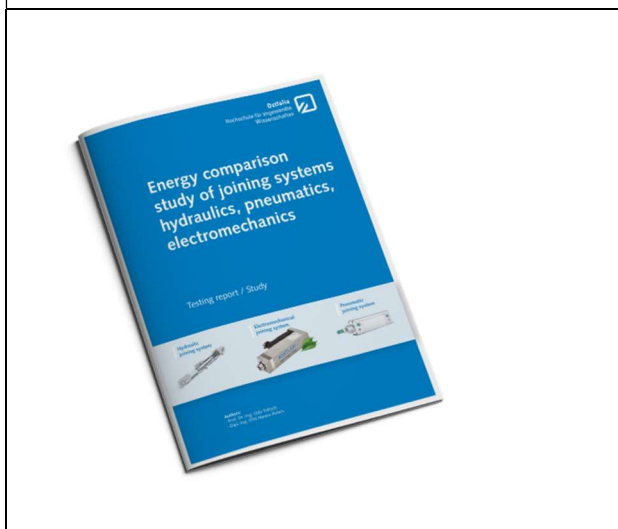
**ENERGY COMPARISON STUDY OF JOINING SYSTEMS
HYDRAULIC, PNEUMATIC AND ELECTROMECHANICAL**

Electromechanical joining system

- Reduction of Total Costs of Ownership (TCO)
- Reduction of the number of NOK parts
- Energy savings 93 %
- Reduction of CO₂ emissions 2,6 t

Electromechanical NC joining systems offer significant advantages over conventional technologies such as hydraulics or pneumatics.

Figure 2: The results of the comparative study from Ostfalia University of Applied Sciences clearly demonstrate the higher energy efficiency of Kistler's electromechanical system compared to joining systems with hydraulic and pneumatic drives.



The test report of the comparative study on the energy efficiency of the various joining technologies by the Ostfalia University of Applied Sciences can be viewed on the Kistler website.

(Test report can be viewed with registration)



Servo presses from Kistler are highly flexible and deliver significant cost savings compared to hydraulic and pneumatic systems.



Discussion of the comparative study of Ostfalia University, with the Kistler colleagues responsible for electromechanical joining systems.

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