OPPOSING FORCES

An unbiased comparison of hydraulic & servo-electric presses

A Whitepaper by Beckwood Press Company
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Introduction

In a hydraulic press, hydraulic fluid is pumped and pressurized to create the desired force, speed, and motion of the ram and any ancillary equipment (shuttles, knockout cylinders, booking rams, etc.). Conversely, a servo-electric press uses individual electro-mechanical (roller screw or ball screw style) actuators and servo motors / drives to perform each desired operation within the cycle.

While much has been written about the benefits of servo-electric presses, they are not always the best solution. Both forms of actuation have strengths and weaknesses, and choosing the right one for your application depends on numerous factors. This whitepaper explores the primary differences between the two technologies and offers recommendations for successful implementation based on the factors most important to you.

Position & Force Control

Both hydraulic and servo-electric presses have fully adjustable stroke profiles and can achieve maximum pressing force at any point throughout the stroke. This allows you to program the machine to adapt to different tool shut heights and perform "short cycle" strokes when desired (in a coil-fed punching application, for example), while also maintaining the flexibility to be used in deep drawing or powder compacting applications.

Programmable electro-mechanical actuators ensure accuracy and positional repeatability to within +/- 0.0005" and force control to within +/- 0.5% or better. They also offer instant feedback for diagnostics and maintenance, as well as built-in data acquisition to record and measure torque, force, position, speed, and time at a rate of 1 sample / ms.

While the accuracy of hydraulic systems has improved (both from a position and pressure control standpoint) due to the increased use of proportional/ servo valves and high-speed motion controllers, applications requiring high precision and force control are still better suited for a servo-electric press.

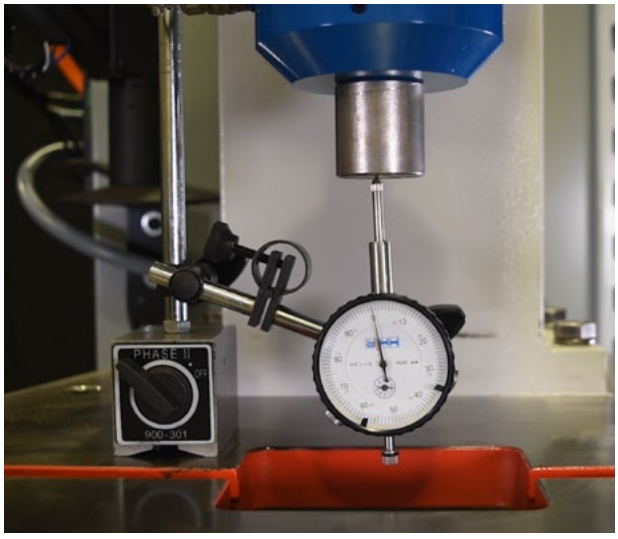

Figure 1: Servo-electric presses offer the highest level of precision available today.

Tonnage Requirements

Currently, most electro-mechanical actuators are limited to approximately 50 tons of force each. Although they can be arranged in series to accommodate higher-tonnage applications, groupings are typically limited to four because the increased component cost as well as the increased space required within the press' footprint to accommodate multiple actuators often aren't realistic for most manufacturers. For this reason, applications which require force beyond 200 tons are typically better suited for a hydraulic press.

Due to the inherent flexibility of a fluid power system, hydraulic presses can be easily scaled to accommodate both low and high-tonnage applications without greatly impacting the overall footprint.

Figure 2: 3,500-ton hydraulic press with hydraulic bed shuttle used to bulge-form stainless steel tankheads.

Forming Flexibility

Some applications require more flexibility in their forming equipment than others. For example, are you developing a new, cutting-edge manufacturing process or forming a new material? Are you working in a lab or clean room environment or a high-end manufacturing facility? If so, you do not want to be limited by traditional hydraulic equipment. Servo-electric presses are the most flexible, highest performing, and cleanest machines available today.

Carbon Footprint

While the cost of electricity in many locations has doubled or tripled over the last decade, so has the number of companies implementing green initiatives to reduce energy consumption, emissions, and other forms of pollution.

A large amount of electricity is required to power a hydraulic system, even when the press is idle. Some energy-efficient technologies like variable frequency drives (VFDs), pneumatic dwell systems, and soft starters are available for hydraulic presses, but even with these features, hydraulic presses still consume significantly more energy than their electro-mechanical counterparts. Servo-electric presses, however, only use energy on-demand, yielding a 20-50% energy savings depending on usage and duty cycle.

Because servo-electric presses run entirely on electricity, oil is not required. Not only does this reduce the number of components needed to run the system, it eliminates costly leaks and disposal fees and ensures that cleanliness requirements are maintained for meticulous environments like labs, clean rooms, and food processing plants.

Motors and pumps that drive a hydraulic power unit can exceed 90 decibels. By eliminating the HPU and its components and only using power when the press is operating (on-demand), servo-electric presses maintain a very low ambient noise level, virtually eliminating noise pollution. On average, noise levels are typically 30% lower with servo-electric systems.[1]

Maintenance

The best way to prevent unplanned downtime with any piece of forming equipment is to follow its factory-recommended preventive maintenance schedule using either internal personnel or hiring the OEM under a service contract. For hydraulic presses, this includes performing oil changes, checking and replacing hydraulic lines and fittings, maintaining oil cleanliness, monitoring particulate counts, and reviewing press performance data to uncover inefficiencies. If your facility has in-house maintenance personnel familiar with the on-going needs of a fluid power system, these tasks can be relatively simple, inexpensive, and routine.

1. Curtiss-Wright Industrial Group. (2019). Benefits of Electric over Hydraulic Actuation. Exlar Corporation. 1-6. https://www.cw-actuation.com/Resources/Exlar-Resources/Why-Choose-Electric

However, if your maintenance team is less experienced with hydraulics or you don't have in-house maintenance capabilities, a servo-electric press is the better choice.

Servo-electric presses require very little maintenance over time. Without oil tanks, pumps, valves, and hoses, servo-electric presses require fewer components to achieve force. This makes them much easier to maintain and support compared to hydraulic or mechanical flywheel systems. Additionally, quick-connect cables on servo-electric presses install in a fraction of the time it takes to plumb a hydraulic system and are frequently used in "plug-and-play" environments.[2] Depending on the application and duty cycle, they can go 15 years or more without performing any factory recommended maintenance.[3]

Figure 3: Performing regular filter changes and maintaining oil cleanliess are vital on a fluid power system.

Cost of Acquisition vs. Cost of Ownership

Typically, hydraulic presses have a lower upfront cost of acquisition than servo-electric presses, so the savings from lower operating costs and improved part quality long-term are often overlooked on servo-electric machines. The amount of time it takes to achieve full ROI on an electro-mechanical system will vary depending on your application, usage requirements, and utility costs, but it is not uncommon to see payback in as little as one year.[4]

Due to their high accuracy and advanced data acquisition capabilities, servo-electric presses can also be used to perform "in-press" quality checks. The ability to verify part quality during the cycle often allows downstream quality checks to be eliminated and should be factored into ROI calculations for this technology.

In a fluid power system, one pump and reservoir can power multiple actuators. This results in additional upfront cost savings for applications which require ancillary operations like knockout cylinders, draw cushions, shuttles, clamps, etc.

If upfront cost is most important and/or you have multiple ancillary operations within your cycle, then a hydraulic press is the best choice. If long-term energy savings and improved part quality are your deciding factors, then a servo-electric press is the best choice.

Safety

Operating temperatures on a hydraulic press are much higher than servo-electric due to the nature of hydraulic fluid which heats up when it's being pumped throughout the system. If not cooled properly, this could cause premature component failure. When a high-pressure hose leaks or bursts on a fluid power system, it creates an unsafe work environment for the operator and maintenance staff.

When performing applications that require heated platens (hot forming, SPF, compression molding, etc.), servo-electric presses are the safer choice. Since

2. Curtiss-Wright Industrial Group. (2019). Benefits of Electric over Hydraulic Actuation. Exlar Corporation. 1-6. https://www.cw-actuation.com/Resources/Exlar-Resources/Why-Choose-Electric

3. Curtiss-Wright Industrial Group. Benefits of Exlar Electric Cylinders over Hydraulic Cylinders. Exlar Corporations. https://www.cw-actuation.com/Resources/Exlar-Resources/Benefits-of-Electric-Cylinders-over-Hydraulic-Cyli

4. Manufacturing.net. (2012, May 9). "Hydraulic vs. Electromechanical Actuators. Manufacturing.net. https://www.manufacturing.net/industry40/article/13240822/hydraulic-vs-electromechanical-actuators

oil is not required to generate force in an electro-mechanical system, it is much less of a fire hazard when working with increased temperatures.

Conclusion

Whether you're developing a new forming process or you simply want to improve an existing one, choosing the right equipment is paramount to your success.

Both hydraulic and servo-electric presses offer a variety of advantages and disadvantages that could be the deciding factor for your purchase. Before choosing any kind of press, it is important to understand your production goals, application requirements, safety objectives, maintenance capabilities, and efficiency standards and choose an OEM that can customize the machinery to meet your exact needs.

About Beckwood Press Company

Beckwood is a global manufacturer of hydraulic and servo-electric presses, automation systems, and turnkey aerospace forming equipment. Since 1976, Beckwood's commitment to manufacturing in the United States has resulted in machines that are safe, reliable, and easy to maintain and support. Headquartered in St. Louis, MO - USA, Beckwood's mission is to deliver better solutions that enable manufacturers to succeed.

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