New applications for servo-driven presses

Part I: Stamping of automotive components

BY ADAM GROSECLOSE

Editor's Note: This article is Part I of a two-part series that reviews applications for large servo-driven presses used to form automotive parts. Part II, which will appear in the July issue, discusses new technologies for servo-driven presses and die cushions.

During the last two years, presses with 2,500 to 3,000 tons' capacity have been developed to form large panels for automotive applications. Toyota and Honda have installed such large presses for automotive stamping in Japan. In Germany, BMW is installing a large servo press line in its Dresden plant.

Servo Press Capabilities

Figure 1 shows the difference between the motion of mechanical and servo presses. In addition to the flexibility of controlling the slide motion, servo-driven presses also offer considerable energy savings, especially in large-capacity presses. In these machines, the installed motor power is larger than in comparable-capacity mechanical presses. However, during a stamping operation (deep drawing, blanking, coining), the servomotor power is used only while the press is moving, since there is no continuously rotating flywheel and clutch/brake mechanism as there is in a conventional mechanical press.

In addition, the braking energy is transferred back into the power system during the dynamic braking operation of the servomotors. It also is possible to install an external energy storage capability to compensate for energy peaks and reduce the nominal power drawn from the local power supply system, if it is economically justified.

One example of this energy storage is shown in **Figure 2.** The energy of deceleration is stored in an external device and used when the press motion requires more than 235 HP for each motor (two motors = 470 HP). The stored energy—maximum 470 HP—is used during peak power requirements, so the facility power load remains nearly constant at about 70 HP.[1]

Production Comparisons

The best way to illustrate the cost-effective application of modern servo-driven presses is to make

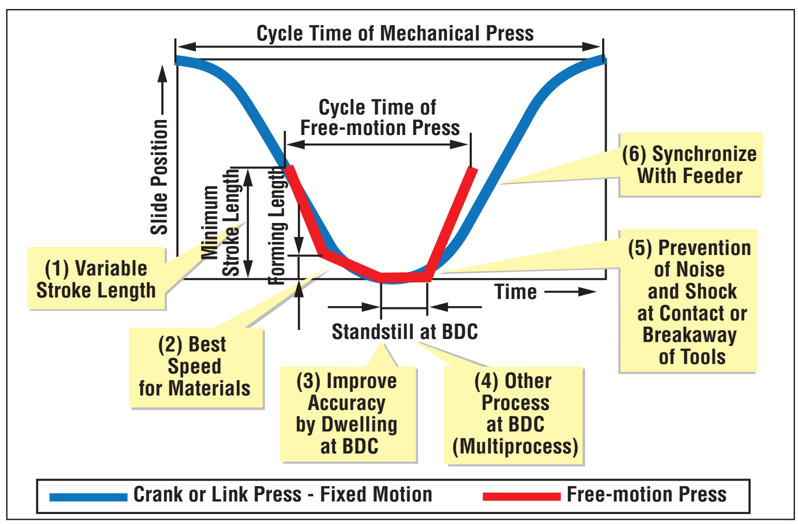

Figure 1

Servo-driven presses offer the flexibility of slide motion.[3]

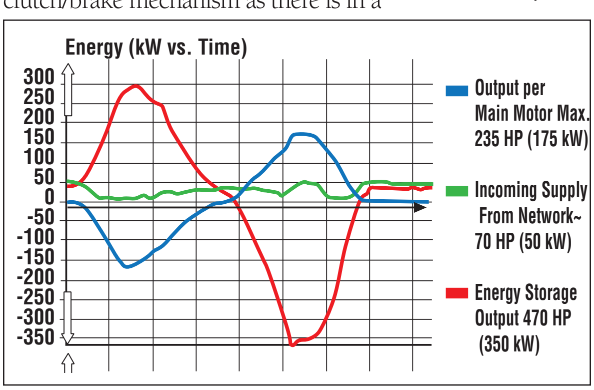

Figure 2

The main motor output can be supplied almost entirely by energy storage.[4]

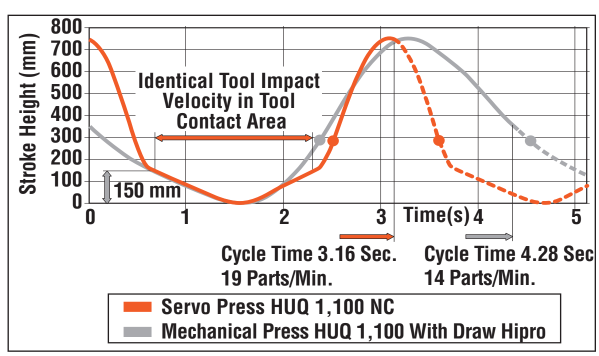

Figure 3

Compared here are the slide motions of a 1,100-ton mechanical and servo-driven press for identical slide velocity during forming. Courtesy of Schuler-Weingarten.

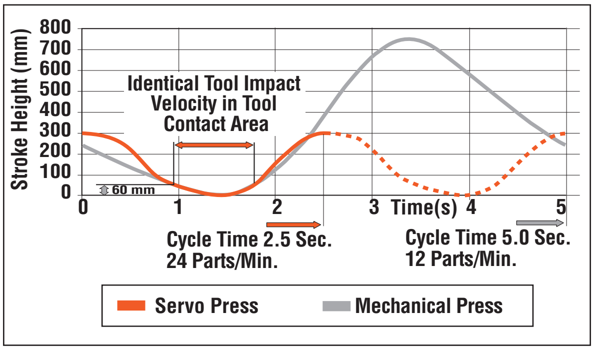

Figure 4

Cycle time is decreased by reducing the stroke length and operating the servo press in "pendulum" mode. Courtesy of Schuler-Weingarten.

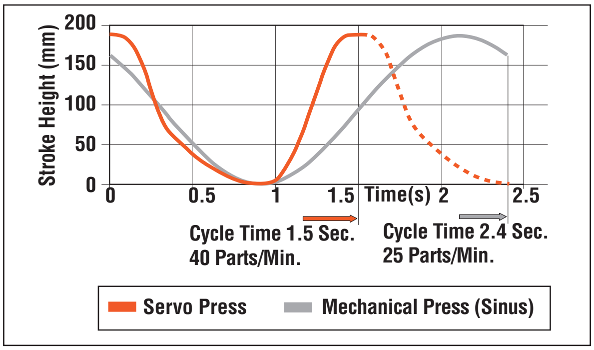

Figure 5

Cycle time and impact speed are reduced using a servo press. Courtesy of Schuler-Weingarten.

actual production comparisons. In one case, a 1,100-ton conventional crank press was compared with a 1,100 ton servo-driven press.[2] The reduction of cycle time and the increase of productivity, while maintaining the same slide velocity during the deformation process, are shown in **Figure 3**.

Figure 4 illustrates the cycle time reduction resulting from reducing the stroke length in the servo press, while maintaining the same slide velocity profile during deformation. In this case, the press drive is in "pendulum" mode—instead of making a total revolution in one direction, the drive shaft rotates back and forth. Tool life also can be improved by decreasing the tool impact speed while reducing the cycle time (see **Figure 5**).

Servo presses can save time and money through reduction of process time and longer tool life. They can save energy use through their more efficient power consumption (over mechanical presses') and the ability to store regenerative energy produced during motor decelerations.

Adam Groseclose is a graduate research associate with the Center for Precision Forming (CPF), The Ohio State University, 339 Baker Systems, 1971 Neil Ave., Columbus, OH 43210-1271, 614-292-9267, www.cpforming.org.

Notes

1. J. Osborn and P. Stephan, "Servo Press Technology – Drive Design and Performance," Metalforming, *August 2008, p. 18.*

2. T. Bloom, "Servo-Drive Presses for the Next Generation Press Shop," presentation prepared by Schuler-Weingarten A.G., p. 13.

3. K. Miyoshi, "Current Trends in Free Motion Presses," in proceedings from the 3rd Japan Society for Technology of Plasticity (JSTP), Intl. Seminar on Precision Forming, Nagoya, Japan, March 2004.

4. Bloom, "Servo-Drive Presses."