Servos Well-Serve Progressive Dies

The ability to ease vibration and limit snapthrough shock, while optimizing stroke lengths and speeds, means longer tool life and greater throughput.

BY LOUIS A. KREN, SENIOR EDITOR

Watching a servo-driven press optimized for particular tool applications is like watching a great athlete in action. Some athletes, say basketball players at the top of their game, achieve greatness seemingly without effort. The best athletes appear to operate in slow-motion, hardly breaking a sweat while piling up stats and wins.

The same is true in the pressroom. Rarely does a servo-mechanical press appear to reach the highest speeds or strain to produce, yet high-quality part after high-quality part exit the machine without pause, at surprisingly high rates. But productivity improvements aren't limited to a job run. Productivity progresses from job to job and application to application, due to significantly increased die life and a decreased need for press repair and long-term maintenance.

These advantages stretch across the tooling spectrum, particularly in relation to complex progressive tools. To find out why, and to back up the testimony from more than one metalformer, *MetalForming* magazine explored the topic with Bob Southwell, vice president of sales and marketing for Aida-America, an experienced player in the servo-mechanical-press market.

Better Stroke Control the Key

"Complex-progressive-die applications often feature a lot of intricate, tight-tolerance tooling," says Southwell.

In many cases, tool wear in these scenarios result from vibration in the tooling and in the press.

"Vibration comes about from, firstly, the contact velocity of tooling with the material, and, secondly, through snapthrough, the reverse loads encountered as a tool blanks through material at some point in the stroke."

How does a servo-mechanical press bring advantages here?

"Typically, for use with progressive dies, metalformers purchase presses with longer stroke lengths to handle the worst-case dies," Southwell explains. "But many progressive dies require much shorter working strokes. Metalformers may employ presses with 12- or 16-in. stroke lengths, but their tooling only requires 6- to 8-in. stroke lengths. When using traditional presses with longer stroke lengths, contact velocity can be very high."

In these cases, using servo-mechanical presses brings benefits in three ways.

"First, a metalformer can run a shorter stroke length using pendulum-crank motion, which reduces stroke velocity," says Southwell.

Here, the press is programmed to use only a portion of the bottom of the press stroke, as the crankshaft or eccentric gears swing back and forth. In general, pendulum motion enables a switch from long-stroke heavy-forming operations to short-stroke light forming in the same press, yet delivers optimal forming speed for any stamping operation, according to Southwell.

"Secondly, momentary slowdowns

can be programmed for when the tool contacts the part material–'kissing' the material instead of slamming into it," he says. "This reduces the shock load at impact. Thirdly, especially when punching and forming higher-strength steels and special aluminum alloys, metalformers can program a silent-blanking type of profile at the critical point in the stroke where the actual blanking occurs."

A silent blanking-motion profile, which refers to decreased noise levels as the tooling blanks part material, further reduces shock and vibration. Besides decreased shock and vibration, lowering punch velocity at key points in the press stroke significantly reduces heat generation, which also helps improve die life.

"Over the past 15 years, we have worked with many metalformers that use complex progressive dies," explains Southwell, "Some of them, running the same tools on a repetitive basis, were well aware of tool life and time between sharpening. Through these metalformers we have seen tool-life increases of 200, 400 and even 800 percent between sharpening when carrying over dies to properly programmed servo-mechanical presses. Some metalformers have been able to justify the purchases of servo presses on tool-life improvement alone."

Snapthrough Addressed

As with other types of tooling, complex progressive dies can be negatively impacted by snapthrough forces. As hinted at above, servo-mechanical presses bring much to the table in combating these forces and their detrimental effects.

"When a tool engages part material, snapthrough directly relates to the speed at which the tooling cuts through the materials," Southwell says. "If, in programming a servo-mechanical press, you can reduce velocity just for that very short impact distance, say from 100 to 20 percent, you typically can reduce the shock load by about the same percentage. So, shock load decreases by 80 to 90 percent.

"This decrease not only lessens the noise of impact," he continues, "but also reduces vibration as the punch and die come together."

Interference between the punch and die via vibration causes tools to chip and wear, and can, long-term, harm press components. Thus, eliminating vibration pays dividends.

"In the short term, tool life and part quality improve," says Southwell. "Longer term, metalformers experience significant improvement related to press wear and maintenance."

Proper Programming Needed

As Southwell explains, manipulating stroke length and speed along the stroke length pays big dividends. The key is to properly program a servo-mechanical press to optimize these settings.

"Even though metalformers want to minimize shock and vibration at the point of contact, they don't want to slow down the entire process," says Southwell.

Here is where productivity gains are accomplished, and where press and control providers can greatly assist metalformers.

"For example, we work with our customers to apply programming to their particular applications," Southwell says. "Our servo-application engineers work with metalformers to optimize their tooling. Typically, we'll take a die and determine the needed working stroke, and work through snapthrough challenges based on tool complexity, punching and forming requirements, and the material to be worked."

From there, engineers program the stroke length to best achieve good part quality and ideal tool life. Then, speed and force intervals are tackled to improve productivity. In the case of many progressive-die applications, according to Southwell, that means shortening the stroke length. The result?

"While the press might only be running, in old-school terms, at 40 strokes/min. in a full revolution, in actual parts produced/min. it now runs at 90 or 100," he explains. "Though tooling seems to be running at a low velocity, the metalformer is obtaining a massive improvement in throughput."

Thus Southwell has pinpointed where a servo-mechanical press, properly tuned to the tooling and the application, in a sense becomes the elite athlete, performing seemingly effortlessly, yet quite effectively.

"Servo presses require a larger initial investment, due to the motors and controls," summarizes Southwell. "But metalformers have realized rapid ROIs due to improved productivity and tool life." **MF**