High-Speed Needs for Stamping Electrical Components

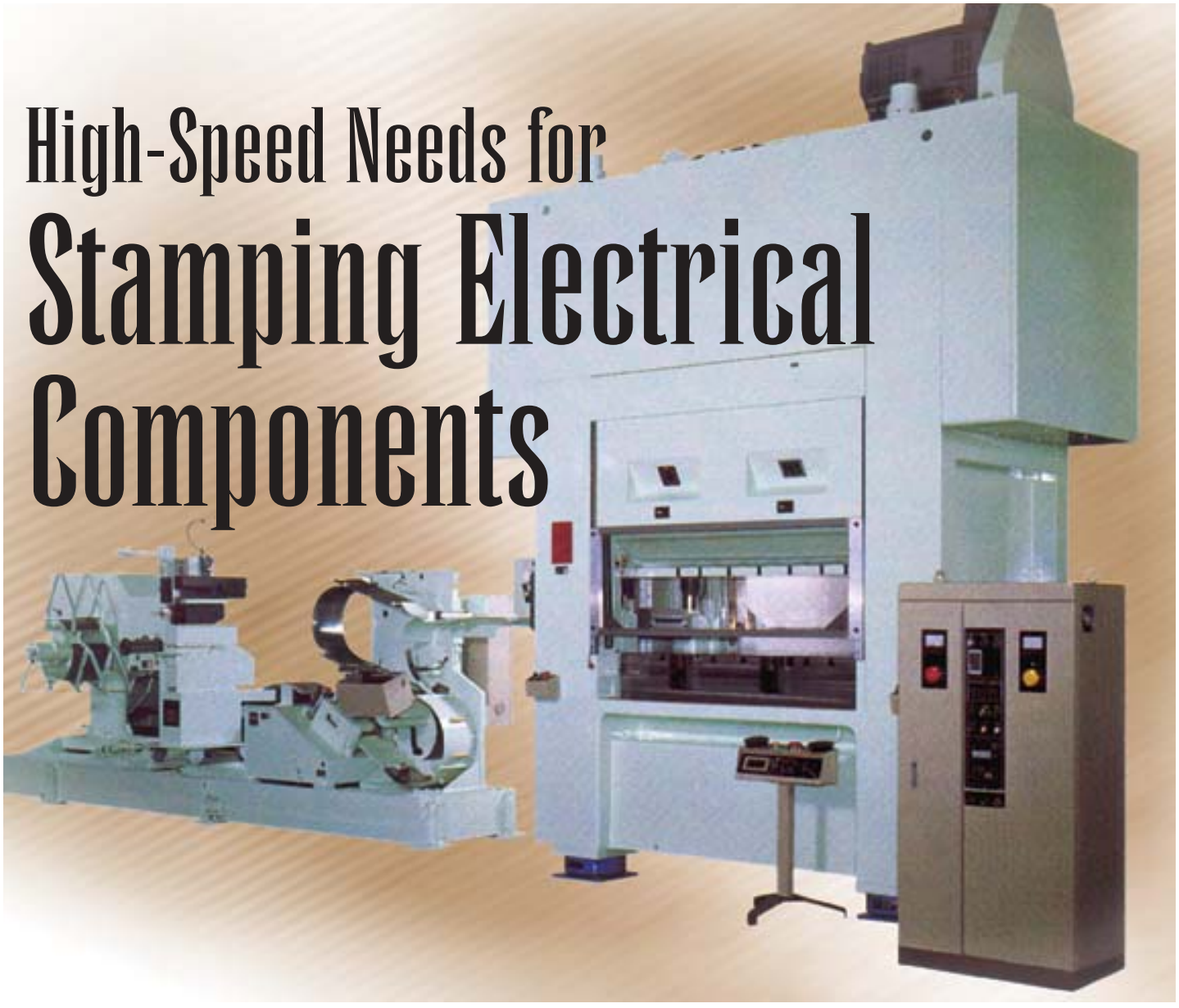

Photo courtesy of Aida-America

To meet demands for exacting tolerances when processing thin and exotic-alloy sheetmetal, stampers need a high-speed press designed to overcome thermal expansion and off-center loading, and optimize bottom-dead-center repeatability.

BY DENNIS BOERGER

To produce parts for the electrical and electronics industries, stampers must process thin, exotic materials and measure production tolerances in microns. Extremely tight punch-to-die clearance in the tool also is required. Without the proper high-speed press, these exacting conditions can prove challenging.

To help stampers achieve successful parts production in this arena, the single most important goal of the press builder is to design and implement high-speed press characteristics that maintain the best possible relationship between the punch and die. A high-speed press must provide the optimum environment for the tool, and the stamper must have a basic understanding of these high-speed press characteristics.

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Dynamic Accuracy Critical

Dynamic accuracy is the key requirement of a precision or high-speed press and the essential element that creates the optimum environment required for high-quality part production and long die life. The seven key characteristics of dynamic accuracy are:

- Elapsed-time die-height variation
- SPM die-height variation
- Start-up die-height variation
- Slide lateral displacement
- Slide tipping
- Component deflection
- Vibration.

Elapsed-time die-height variation refers to the thermal differences that occur in a press during operation. During production, press components heat up and become larger and longer, causing a change in die height and resulting in part dimensional variations. Since these components are highly susceptible to thermal growth, the press builder must incorporate technology that eliminates thermal expansion. The stamper should consider a high-speed press with a lubrication system that contains a high-performance oil heater/chiller.

The lubrication system is pretimed and should run heated oil through the press prior to operation to bring the equipment to an ambient operating temperature. Once the operator starts the press, oil shearing occurs and friction among press components generates heat that can cause significant thermal growth. To counter this effect, oil runs through the chiller, removing heat before being recirculated back over press components. This action keeps press components cooled. Such a setup provides a stable die space and prevents shut height from changing as the press warms. Without this type of system, stampers will experience significant changes in part quality, including inconsistencies in part dimensions.

Die-Height Variation Caused by SPM Change

The second characteristic, SPM die-height variation, defines a condition that occurs during press operation. As the press moves from slow to high speed, shut height shrinks. Inertia on reciprocating components increases and greater stress acts on the bearing system. Components stretch, resulting in shut-height changes. The result is poor part quality. For example, producing a part that requires five or six forms, the stamper can expect variations in form angles as press speed changes, leading to out-of-spec parts and rejection from the customer.

To address this condition, stampers may specify use of anti-friction bearings, but these carry the disadvantage of a shortened life span due to the pounding they take during stamping. As an alternative, use of oil-film bearings offer an infinite life but can create undesirable conditions. To distribute oil throughout the bearing, an oil-film bearing requires movement. When the press stops, oil cannot be distributed, causing the weight of the slide, upper die and suspension-point components to drag the shaft and connections to the bottom of their bearing clearances. When the operator starts the press, the shaft rotates, distributing an oil film that actually increases die height. As press speed increases, bearings become stressed and suspension components stretch. The oil film thins out due to the inertia force of the slide and descent of the upper die. This condition, along with elongation of suspension components, causes the shut height to close in.

For the stamper, the ideal choice is a high-speed press that combines the advantages of anti-friction and oil-film bearings. The anti-friction bearing holds the shaft and connecting rods on a constant centerline regardless of press speed. Upon press rotation, the oil-film bearing becomes stiffer than the anti-friction bearing, absorbing the shock of the stamping operation. The result: improved bottom-dead-center repeatability, which extends bearing life and produces high-quality parts.

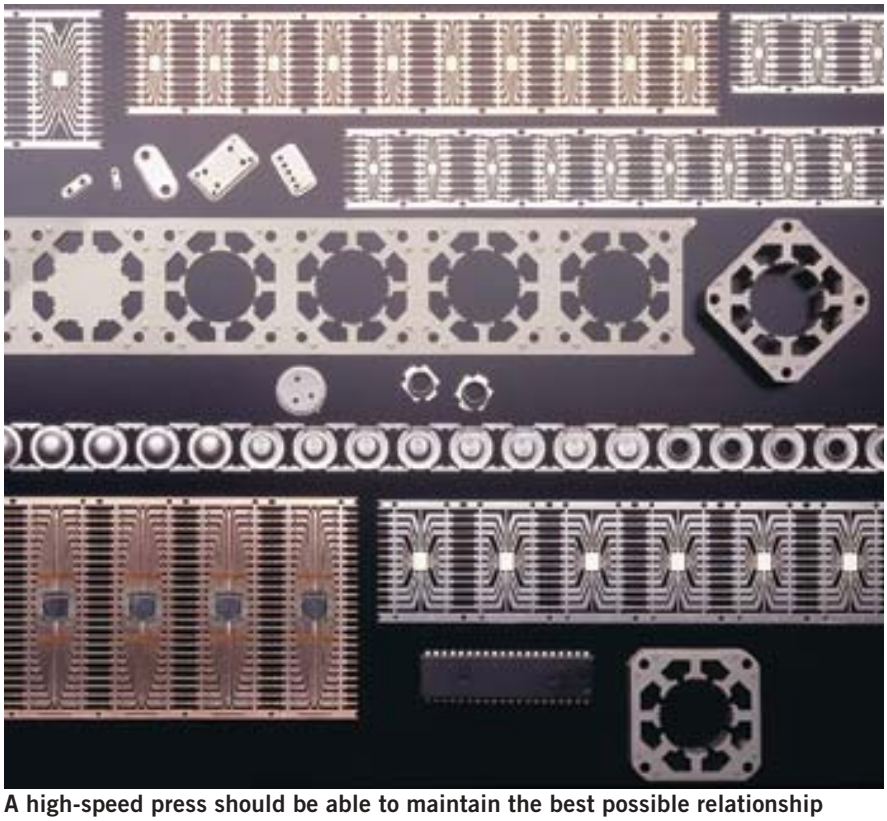
Start-Up Die-Height Variation

This variation occurs when an operator starts and stops the press. In the one to two strokes needed to stop and start a press, die height changes significantly, leading to production of as many as four bad parts and rejection of an entire part spool.

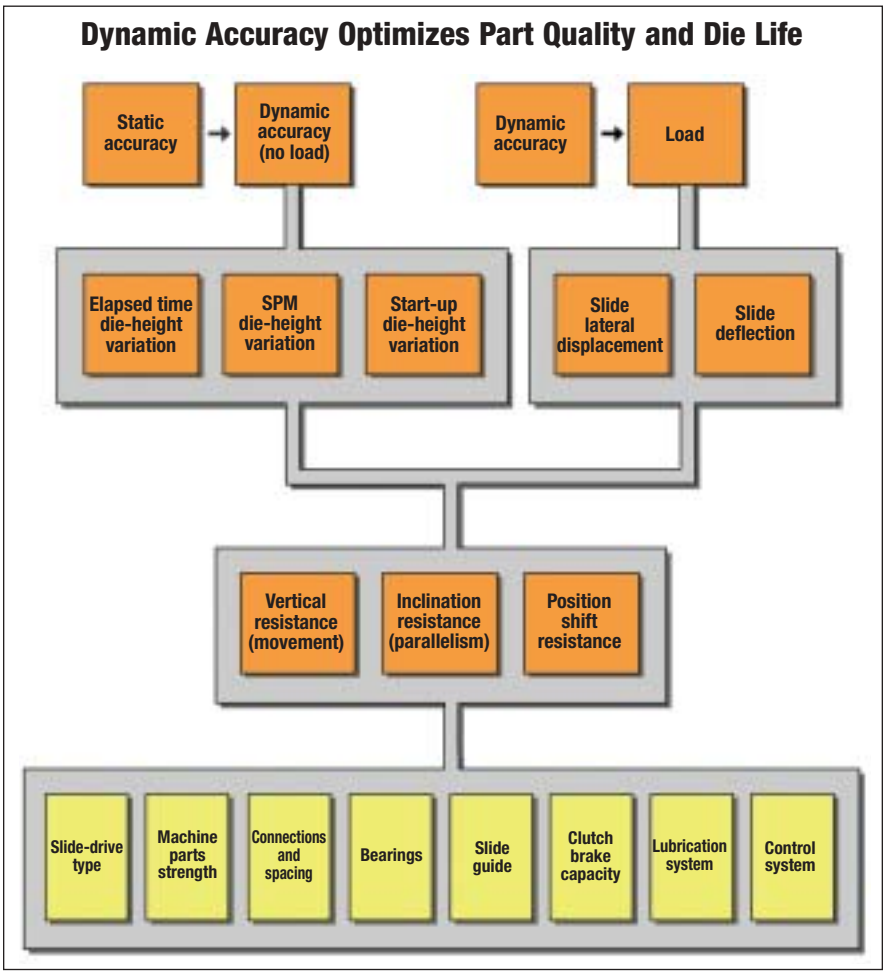
The solution: a high-speed press built to drop from full speed to a dead stop in less than one stroke, and in reverse, from a stop to operating speed in less than one stroke. In addition, a servo-driven feed system can be programmed to feed material only when the press reaches operating speed.

Lateral Displacement

Stampers using multiple-stage tooling typically deal with slide lateral displacement. Production of small electronic components can mean using a die with as many as 50 stations, negating the



A high-speed press should be able to maintain the best possible relationship between punch and die and provide an environment that allows the tool to produce a good part.



Dynamic accuracy is the essential requirement of precision presses and is key to precision metalforming.

possibility of a perfectly centered load in the press. Off-center loads cause the slide to move laterally toward the greatest load. Lateral displacement also changes the punch-to-die relationship, resulting in excessive die wear and in some cases chipping of die components.

To limit or prevent lateral displacement, a stamper should consider a high-speed press with a preloaded roller-bearing slide-guide system. In addition to improving die life and part quality, the preloaded roller-slide guide's lube-free system eliminates press oil in the die space.

Slide-Tipping Resistance

A high-speed press must resist slide tipping, allowing stampers to maintain part accuracy and improve die life. To accomplish this, builders use wide-spaced connecting rods and massive structure in the press columns. Wide-spaced connections on a high-speed press—at least 30 percent farther apart than on a conventional press—allow the machine to restrain and minimize the effects of off-center loads. Also, use of massive columns reduces elongation under load.

Similar to slide lateral displacement and slide tipping, component deflection occurs when the slide, bed and crown are under load. Stampers should look for a high-speed press with an extremely rigid bed, bolster plate, slide and frame. The added stiffness increases die life and improves part accuracy.

Finally, stampers should consider a press built to reduce vibration levels. This can be achieved through press design, where use of several different cast materials in the press structure will effectively dampen vibration. Less vibration means increased die life and improved part quality. **MF**