

Increasing die life and improving part quality

Factors that affect a stamping press's productivity

By James Landowski

The ultimate goal of any stamping operation is to provide the highest-quality part with the highest productivity and minimum possible cost. The design and construction of the bed, crown, and frame contribute to overall performance, but other factors such as slide motion and tooling impact also are important when trying to improve part quality and increase die life.

Basic Construction

Bed and frame rigidity and proper press foundation isolation play a part in dispersing the forces encountered in stamping operations. Using high-dampening-level press-mounting isolators also enhances the tool life compared to bolting the press directly to the floor. Using press mounts helps to keep the press properly leveled, which affects press and die life.

The overall press construction should use full-length tie-rods to "join" the key press member of the crown, uprights, and bed. Newer press designs offer taller, thicker beds and uprights, as these members deflect much less than older designs with low-profile beds and shallower frames. (For example, 2 by 4 rafters in a house are placed with the taller 4-inch-high side bearing the weight of the roof because the 4-inch height is stronger than the 2-inch thickness.)

Slide Motion

Another key to longer die life and better part quality is minimizing the lateral movement of the moving part of the tooling (punch) in relation to the fixed part of the mating tooling (die). Fundamentally, a press should be designed to manage or control the punch's movement by controlling the slide's movement.

Most press designs dedicate the job of guiding or controlling the slide vertical motion to the slide gibs only. These gibs must control not only the normal eccentric movement of the drive but also load forces generat-



ed by the tooling. Gibs usually must be replaced regularly. However, by using an additional component called a plunger guide in this guide train, both tool and gib life can be increased.

A plunger-guided slide design absorbs the normal side thrust of the eccentric drive and directs these forces away from the slide. With the thrust redirected, the gibs' job then is to guide the slide against the forces generated by the tooling. Full-length gibs must be used so that the slide remains completely guided throughout the entire stroke. This combination of plunger guide and full-length gibs provides more than twice the slide-guiding area compared to designs with only gibbing for slide guidance (see **Figure 1**).

With this design and by using oil lubricants rather than grease, gib clearances can be set closer (0.0015 inch nominally) than nonplunger-guided designs (typically, 0.008 to 0.015 inch). Using a close-tolerance, precision system to guide the slide controls the punch's movement. While this system costs more initially than nonplunger-guided systems, it can increase die life by 30 percent.

Link Motion

Another factor that affects die life is the effect of reverse loads, or snapthrough, during blanking or severe punching operations. The energy released after the breakthrough in the material, which occurs after the punch has penetrated 20 to 30 percent of the material thickness, propels the slide downward at a high velocity.

This sudden increase in velocity near the bottom of the stroke causes severe shock to both the press and the

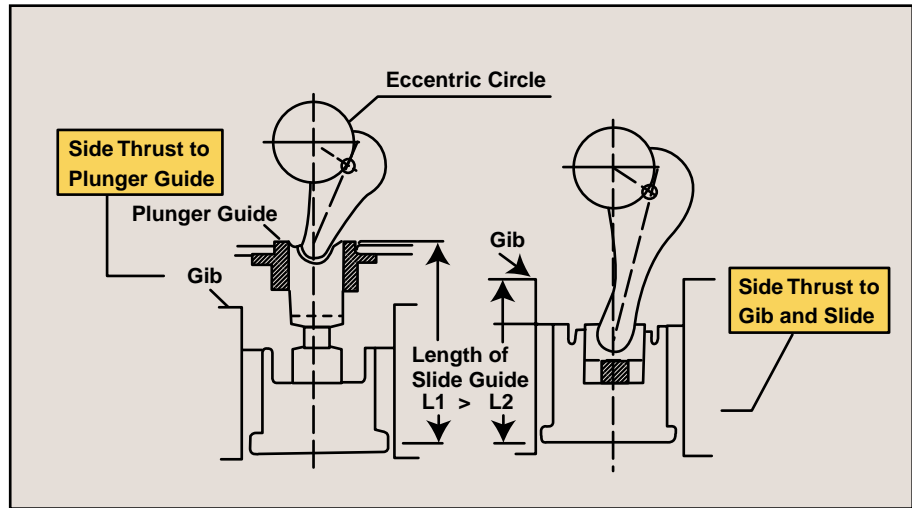


Figure 1

When a plunger is combined with gibbing, more slide-guiding area is provided.

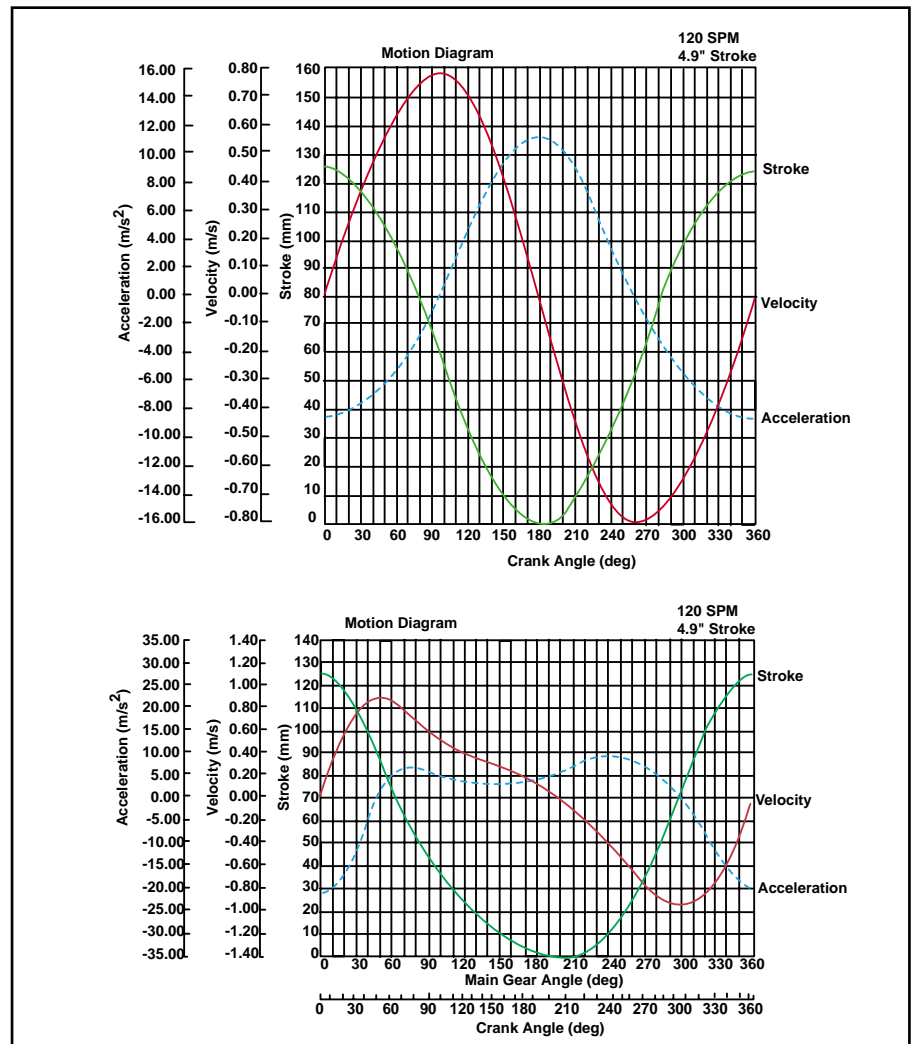


Figure 2

These charts show the difference in slide motion between an eccentric drive press (Figure 2a) and a link motion press (Figure 2b).

tooling. The slide's velocity at the point of this breakthrough is linked directly to the amount of reverse load generated.

To combat this effect, a link motion drive can be used to reduce the slide velocity (touch speed) near the bottom of the stroke to about 40 percent that of a crank motion press at the same stroke-per-minute (SPM) rate. The touch speed of the slide to the dies and the impact force on the dies are about 60 percent that of a crank motion press. This reduced velocity means reduced impact between the upper and lower dies, which can increase die life.

Because the slide velocity remains reduced until after the bottom of the stroke, parts remain in the working cycle of the stroke longer. A longer pressing time can be beneficial, especially in coining and forming appli-

cations in which slower speeds are preferable to provide higher accuracy and associated part quality.

The charts in **Figure 2** show the difference in slide motion between an eccentric drive press and a link motion press. The chart of the link motion press shows both a reduction of the slide velocity near the bottom and the reversal of link motion beyond 180 degrees.

While link motion drive reduces snapthrough, it offers a smaller feed angle, or window, for feeding material in a continuous mode of operation than an eccentric drive has. The higher acceleration of the slide after bottom position limits the feed length or pitch that can be achieved during the feed cycle. The initial cost of the drive also is higher than that of an eccentric drive.

Conclusion

To stay competitive in a demanding global market, higher output and quality are essential. Don't rely only on your tooling to make a good part. Instead, consider the press as an integral part of the overall production system. ■

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