

Cushioning the blow

Detroit-area toolmaker aims to draw a bead on new opportunities

By Dan Davis, Editor in Chief, *The FABRICATOR*®

November 8, 2005

Hercules Machine Tool & Die Co. has intalled a fully programmable hydraulic cushion onto a mechanical press in hopes that it can cut down on try-out time and attract more business involving specialty stamped parts

If anyone should know that there's strength in numbers, it's Hercules.

Hercules Machine Tool & Die Co. maintains 36 stamping presses, ranging in size from 500 tons to 4,000 tons, in its two facilities totaling 140,000 square feet in Warren, Mich. With these presses the company is able to manufacture a variety of prototype and finished production tooling,

But in today's economy there's also strength in flexibility, so Hercules is limbering up. The company has installed a fully programmable hydraulic cushion on a mechanical press in hopes that it can cut down on tryout time and attract more business involving specialty stamped parts. With the automotive industry's increasing use of high-strength steel, which simply doesn't flow like typical steel; pregalvanized material, which has a tendency to flake if not precisely hit; and tailor welded blanks, the opportunities are many using this type of technology.

Additionally, the supplier of the hydraulic cushion technology, Red Stag Engineering & Automation Inc., believes its hydraulic cushion technology has the potential to eliminate the use of draw beads in a stamped part design in some cases. If Red Stag can prove that this is possible on the Hercules press, it will put Hercules in a position of strength with its customers, which consist of the Big Three, transplnt Tier 1 automotive suppliers, and other transportation companies.

"We hope to prove this out and show them that we can do this," said Robert Crane, a senior engineer with Hercules.

Pressed to Evolve

Hercules is no stranger to using technology to keep ahead of competitors. The company uses CNC machining for 3-D die design requirements and the latest software to match customers' programming environments. Fifteen of the company's 36 presses can produce at least 1,000 tons or more of stamping force. The largest five are a Verson double-action, 2,000-ton press with a 180-inch by 100-in. bed size and 103-in. shut height; a 2,500-ton Danly with a 100-in. by 180-in. bed; a Hamilton straight-side, 2,600-ton press with a 206-in. by 80-in. bed size and a 66-in. shut height; a Danly double-action, 3,250-ton press with a 96-in. by 180-in. bed; and a 4,000-ton Danly with the hydraulic cushion, a 204-in. by 108-in. bed size, and a 66-in. shut height.

The company's commitment to technology and the knowledge of its tool and die experts have helped Hercules evolve into a respected supplier to the automotive industry over the last 60 years. The

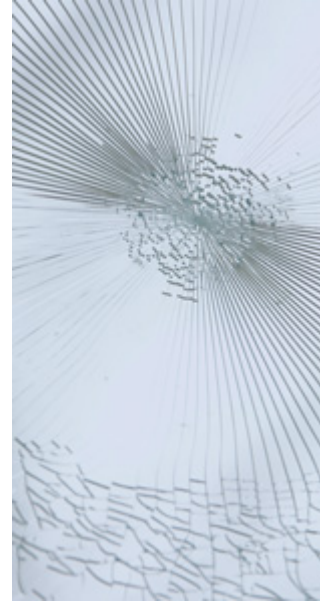


Figure 1

The 4,000-ton Danly press at Hercules Machine Tool & Die Co. can operate as a hydraulic press, a mechanical press with air cushions, or a press with nitrogen cylinders thanks to the installation of new hydraulic cushion technology.

company is proud of its ability to incorporate engineering changes during construction of blank, draw, trim and pierce, restrike, flange, transfer, and cam and aerial dies and during the production tooling design process. It also takes pride in its quick turnaround die repair and its delivery of Class A outer surface body panel dies, which produce metal stampings with no imperfections or surface distortions.

Crane admitted that Hercules' business has survived the most recent economic downturn through the staff's resourcefulness and by coming to grips with the realities of outsourcing. Hercules, which is owned by a Japanese company, has started outsourcing some die construction to overseas sources, and company management has tapped employees' ideas to keep costs in line with budgets.

The move to install Red Stag's hydraulic cushion technology was the next step in tackling the new demands of Hercules' automotive customers.

"We've been interested in it for a while," Crane said. "Now we are seeing the Big Three getting more and more into it."

Of course, before committing to it, Hercules wanted to see the press technology in action. Although the hydraulic cushions were not widely adopted at the time, Red Stag did have three installations with the technology in Midwest facilities.

In 1998 Red Stag installed two hydraulic cushion systems on two 1,200-ton mechanical presses with bed sizes of 180 in. by 102 in. at Autodie International in Grand Rapids, Mich. In 2000 Red Stag installed the third generation of the technology at Sekley Co. in Salem, Ohio. This time the technology was used not only for tryout purposes, but also for routine production. Second-generation technology was later installed at the Sekley facility on another mechanical press capable of producing 1,800 tons of stamping force and with a bed size of 180 in. by 100 in. This press has three cushion tables, each capable of 350 tons with a total of 1,050 tons.

Impressed With Press Technology

Hercules now owns the fourth generation of Red Stag's hydraulic cushion technology, which is a very big deal on Hercules' very big stamping press—which weighs 760 tons. The system comprises three hydraulic cushion tables that have five cylinders per cushion table, and each table has its own 150-HP motor that runs the hydraulics. The entire system, including software and control technology, took nearly two months to install during the summer of 2004.

The Danly press, with its ability to produce 4,000 tons of stamping force, was the only press that made sense for the technology upgrade, Crane said.

"That gives us plenty of tonnage to work these cushions and do what the dies are designed for," he said.

For example, if Hercules wanted to set each of the cushion tables to 500 tons, the press would need more than 1,500 tons of ram pressure to overcome the tonnage at the bottom of the stroke. So even if Hercules is pushing its hydraulic cushion technology to the maximum allowable limits, it still has 2,500 tons of ram force to stamp the most difficult of metals.

But the hydraulic cushion doesn't have to be pushed to the limits to be effective. Pressure sensors and position sensors allow for complete control over the press and table positions, even while the table is performing in a production mode, according to Paul Pfundtner, Red Stag's president. The cushions are controlled by Ikon/Pentium-based computer technology.

To further illustrate his point about flexibility, Pfundtner described the programming that would take place to form a tailor welded blank. The press operator calls up the programming screen and views four graphs: one representing the cumulative force delivered by all of the tables and three separate graphs for each of the individual hydraulic cushion tables. In this particular mode, the operator programs the first 2 in. of the stroke to deliver 400 tons of total cushion pressure, 300 tons for the next 2 in., and 200 tons for the last 4 in. of the



Figure 2

Absolute control of the stamping process is needed to ensure that Hercules is able to protect the Class A surface finish on the automotive body panels it supplies to customers.

stroke. In total, the operator can make as many as eight pressure changes during the stroke as the part is being formed.

If a tryout run reveals that the center cushion isn't generating enough pressure to produce a quality stamping of the tailor welded blank, the operator can increase the tonnage of cylinders on the center cushion during, perhaps, the second stage. The computer is set up to redistribute the tonnage evenly over the other cylinders on the table.

Such control over the stamping process allows the Danly press to be operated in many capacities:

- A trial mode using a variety of combinations of cushion table tonnages to duplicate a full hydraulic press
- A high-volume stamping mode like that of a mechanical press using air cushions
- A mechanical press production mode using air-over-hydraulic cushions
- A stamping press production mode using nitrogen cylinders

Crane said that Hercules primarily has used the Danly press in a mechanical press mode to keep up with new work that emerged in the early part of 2005. The hope was to investigate the press's full functionality when time allowed.

Hope to Impress Others

The goal was to get the automakers to take note of this hydraulic cushion technology. Pfundtner and his team are going to schedule a meeting with representatives of the Auto/Steel Partnership at Hercules' shop. The Auto/Steel Partnership has a draw die with removable draw beads, and Red Stag wants to demonstrate how the cushion technology, using the partnership's tooling, could produce a finished drawn part without using the draw beads. Pfundtner said Red Stag engineers already have developed tooling for deep-drawn stainless steel sinks and high-strength aluminum without the use of draw beads.

Crane said Hercules is anxious to make draw panels without draw beads a reality.

"We hope to prove it out and show [the automakers] that we can do this," he said.

The elimination of draw beads would lead to tremendous savings in material for the automotive industry because a smaller blank could be used.

Crane pointed out that eliminating draw beads also would save time. Now engineers adjust draw beads in the tryout press. In a trial-and-error process, they add and remove draw beads to control material flow in the tooling. With the ability to control the additional tonnage pressure exerted by the hydraulic cushions, engineers can adjust stamping parameters more quickly and more precisely.

The hydraulic cushion technology also should extend the life of a press, according to Crane, because the cushions preaccelerate the binder going down as the ram comes down so that the binder has started to move down when the ram meets it. The well-synchronized motion of the tooling maximizes the force of the ram, but minimizes the collision impact as the ram makes contact with the binder.

Meanwhile the world anxiously awaits the results.

Hercules Machine Tool & Die Co., 13920 E. Ten Mile Road, Warren, MI 48089, 586-778-4120, fax 586-778-0070, www.hmtd.com

Red Stag Engineering & Automation Inc., E3356 Mountain View Lane, Waupaca, WI 54981, 715-258-5074, fax 715-258-5242, redstag@waupacaonline.net, www.redstag.com

Pin down the answer

The intelligent hydraulic cushion setup at Hercules Machine Tool & Die Co. involves the implementation of a sub-bolster and a moving bolster on the Danly press. Such an arrangement simplifies relocating cushion pins to different hole patterns as needed. With the sub-bolster in place, a press operator doesn't have to remove the pins before rolling out the bolster. The operator can retract the pins below the bolster and move the bolster out with the pins still installed in the press. The operator then can raise the pins and remove the pins that are not needed or relocate the pins to the location where they are needed.