PROGRAMMABLE LUBRICATION BEATS THE HEAT

A programmable lubrication station (left) installed on a press at Toledo Tool & Die directs lubricant flow to a roller (top left) and to several nozzles located in the die. Lube procedures can be set, tweaked and optimized, then saved with each die. Menu-driven software eases programming, and an access code protects the setups.

A pair of metalformers tell how an upgrade in lubrication strategies and equipment pay off big with improved speed and part quality, and reduced lubricant consumption and the costs associated with lube delivery, application and cleanup.

BY BRAD F. KUVIN, EDITOR

Faster, faster, faster—that's what every metalforming-plant manager wants from his pressroom. Fine-tune the part transfer system; program the servo feed to accurately keep up. Put the press line in overdrive, basically.

One problem: How do you get the heat out of the die, in order to not only protect precious die components but also to prevent part distortion? In too many cases, the solution is adding more lube—regardless of consequences such as waste and cleanup.

The trick is to apply just enough lubrication, precisely where it's needed to do the job—preventing heat buildup on die components and ensuring that stamped parts don't distort nor display tool marks. You want a process that runs cool, where good-quality parts fly out of the press faster, faster and faster.

We talked to two metalformers, each with a unique take on how upgrading its lubrication system has improved productivity, quality and safety. Toledo Tool & Die tackled a specific application where heat buildup in a progressive die limited press speed; it gained flexibility by being able to customize a lubrication system for each new die run on its new large-bed 600-ton press. And, a Johnson Controls stamping facility completely revamped its procedure for delivering lube to the plant, moving the lube to its 16 presses and making sure lube winds up on the steel and not on the floor. Its new bulk lubricant tank, mixer and plumbing system out to the presses saves the plant more than $200,000 per year.

Out with the Old...

Lubrication control is precisely what prompted Toledo Tool & Die (TT&D), Toledo, OH, to systematically upgrade the lubrication techniques used on its 30 presses. Primarily a progressive-die automotive stamper of small to mid-size parts (brake splash guards, fuel doors, side-glass window assemblies and such), TT&D has progressively added more tonnage to its shop to tackle larger heavier-gauge work.

"Until seven years ago, our biggest press was a 150-ton model," says president Tony Kujawa III. "Now we're running several presses in the 300- to 600-ton range with dies to 140 in. long. Our older paint-roller and spray-mist lubrication systems weren't doing a very good job of providing consistent and long-lasting lube on these high-tonnage presses."

For example, a couple of years ago the firm won a contract to stamp engine-valve sleeves, a drawn ring (2-in. draw) of 0.078-in.-thick plate, with an inside ring diameter of 6.009 in., ± 0.003 in. "That's a pretty tough dimensional tolerance on the ID," says Ron Shields, TT&D project engineer. "We have to draw the rings without scoring the sidewalls, and keep the parts cool to the touch to prevent distortion and meet the ID tolerances."

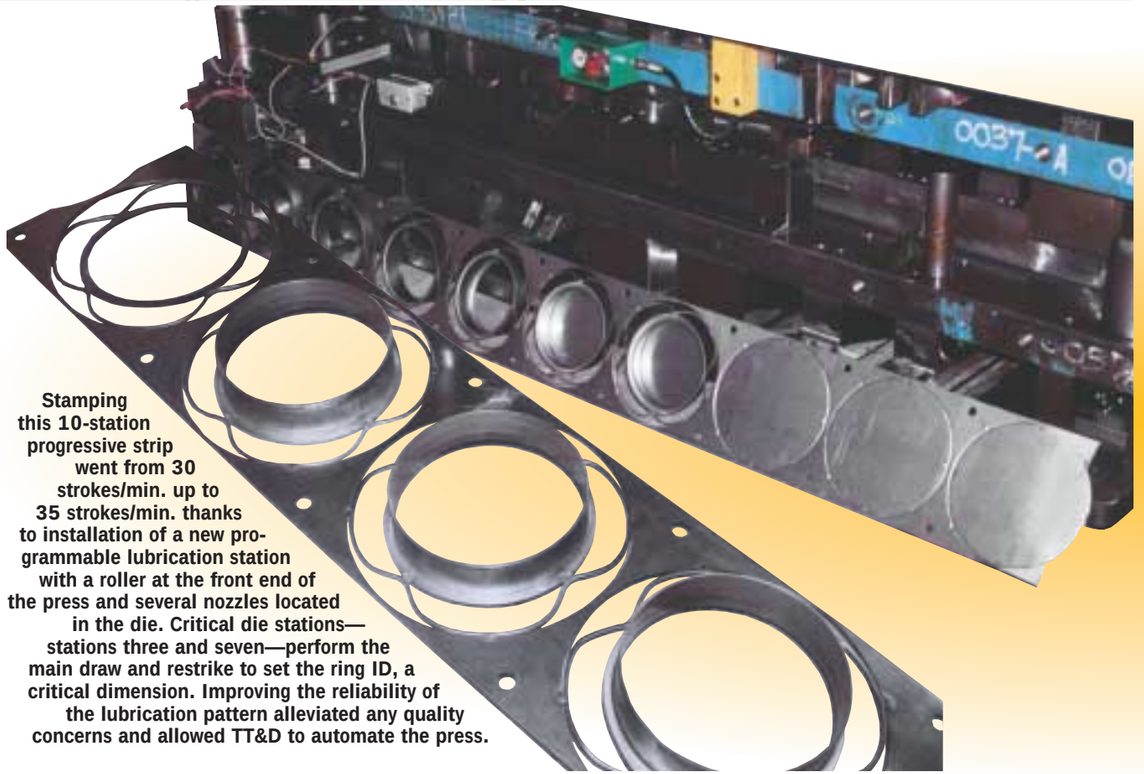
When it first brought the valve-sleeve job into the pressroom, TT&D found that it had to run the 10-station progressive-die job manually on a 400-ton press, at only 30 strokes/min., to ensure adequate lubrication throughout the process and prevent heat buildup in the die. It sprayed lubricant top and bottom at critical draw and redraw stations, but found that spraying the underside of the part was somewhat unpredictable.

...In with the New

In September 2001, TT&D ramped up valve-sleeve stamping to 35 strokes/min., automating production. The key enabler: installation of a programmable lubrication system from Unist, Inc., Grand Rapids, MI, that combines a uni-Roller roller lubricator at the entry end with downstream spray nozzles. The extra nozzles apply just the right amount of lubricant precisely where it's needed at critical areas on the strip. A Unist SPR-2000 programmable lubrication station controls nozzles and roller.

"The roller-coater gives the strip a nice, even layer, top and bottom," says Shields. "Then we position nozzles at the third station of the prog die, where we do the main form, and then again at the seventh station, where we final-size the ring diameter with a restrike and iron the draw. We position four nozzles there, to apply extra lube right where it's needed. Heat dissipation is critical at this station, to prevent distortion. In fact, we also changed tool material here, to control heat. We now use a bronze-alloy restrike tool instead of tool steel, to provide better lubricity and prevent galling. The switch to a bronze tool also allowed us to cut back on the amount of lube being sprayed."

How much to spray, when, where and for how long? How much lube to feed through the roller, and where to put it? It's all part of the process design,



Stamping this 10-station progressive strip went from 30 strokes/min. up to 35 strokes/min. thanks to installation of a new programmable lubrication station with a roller at the front end of the press and several nozzles located in the die. Critical die stations—stations three and seven—perform the main draw and restrike to set the ring ID, a critical dimension. Improving the reliability of the lubrication pattern alleviated any quality concerns and allowed TT&D to automate the press.

and thanks to a programmable system, the procedure can be set, tweaked and optimized, then saved with the die. The TT&D operator need only call up the appropriate program on the SPR-2000 for the die being run. The unit comes in three configurations, with as many as 22 inputs and outputs. Its menu-driven software eases programming, and an access code protects setups.

"System flexibility, being able to add nozzles where we want and control the volume of lube they apply, and also to vary the lubricant pattern applied by the rollers, has led us to standardize on the Unist equipment as we upgrade more of our presses," says Shields. For example, in January 2002 TT&D added a Unist system capable of controlling 14 nozzles as well as a roller coater to its newest press, a 600-ton Aida with 140-in. bed length, installed in late 2001.

"While most of our work requires only the roller coater at the front end, since we find the lube remains adequately on the sheet through our 10- to 15-station prog dies," says Shields, "we want the flexibility down the road to be able to handle larger dies. That's why we purchased the larger press. With that press tonnage and bed size, the sky is the limit, and we don't want to limit the type of job we can bring in here based on our lubrication system."

Off the Floor and onto the Steel

Optimizing a pressroom-lubrication process revolves around three key steps, according to Steve Page, an engineer at the Johnson Controls stamping facility in Athens, TN. The three steps: transporting the lube to the plant, moving the lube to the presses, and applying the lube to the steel.

"When we looked closely at our methods of lube delivery for each of these steps," says Page, we saw tremendous opportunities at every step to remove serious inefficiencies and save the plant a lot of money."

Save money is exactly what the plant did when it revamped its lubrication process in August 2001. The old system had the plant shipping as much as 1800 gal./month of premixed lube (1200 gal./month average), half of which Page estimates wound up on the plant floor due to existing spray apparatus.

"Overspray and dump-off onto the floor was particularly problematic when trying to spray the bottom of the sheet," says project leader Jeff McDonald. "Each of our press operators spent 45 min. per shift cleaning oil off the floor around the presses. They also had to periodically carry 5-gal. buckets of lube across the plant to refill the reservoirs, time that the presses weren't running. Also consider that that we were spending a lot of money to transport water to the plant."

After completing a nine-month six-sigma project aimed at reducing costs for die lubrication, the plant decided to bring in concentrated lube and do its own mixing; plumb the mixed lubrication right to the presses; and apply lubricant using rollers.

TT&D likes the flexibility offered by its programmable lubrication stations, so that its ability to lubricate dies doesn't limit the type of job in can run. It won this job—upper-suspension control-arm brackets—in March 2002. Running the 12-station progressive die, lubrication is provided by a roller at the entry end complemented by four nozzles in the die—two at the form station and two more at the cam-pierce station.

"The increased productivity (a 30-percent increase in press uptime), reduction in oil consumption (due to the rollers) and reduction in freight costs saves us $225,000 per year," says McDonald. "This doesn't even account for some other significant benefits that we haven't attached dollar values to, such as improved die life and an improvement in air quality."

Programmable Delivery at Every Press

Lubricant flows from the firm's 2500-gal. bulk tank to a mixing station, and then out to the presses. Consumption has been reduced to 500 gal./month. At each press, a Unist SPR-2000 programmable lubrication station controls lube supply to uni-Roller roller coaters, and to spray nozzles when needed. The Johnson Controls plant typically runs transfer dies 12 to 15 ft. long, with six to eight die stations.

"We often only have to apply lubricant at the entry end, so we need a good long-lasting layer of lube that will hold up downstream, where we typically do our forming," says Page. "We also do a lot of deep drawing, and use nozzles to spray into radii that need good coverage in order to prevent splitting. Since we've installed the new lube systems, we've not had any splits. And, we've seen dramatic improvements in our die life so that we've not had any burrs on our parts—burrs complicate our downstream welding operations by causing poor weld-joint fitup. This is another benefit to the new lubrication system that's not accounted for in our payback analysis."

To place the lube onto the steel, the firm programs the SPR-2000 unit uniquely for every die. Some dies need more oil, some need less.

"We vary the release of the lube to the roller based on specific need," says McDonald, "making sure we keep the roller pad wet. Generally, we release the lube into the roller in 0.25-sec. pulses, at every 5th to 10th stroke of the press on top of the sheet and every 10th to 20th stroke on the bottom.

"We also can set up the roller," McDonald continues, "to adjust for sheet width. This way, if we switch from a 50-in. coil to 10 in., we only wet the 10 in. of the roller that we need to, reducing consumption."

Six-Month Payback

Not many capital projects pay for themselves in six months, but this project at Johnson Controls did, quickly returning the $140,000 invested in the bulk tank, mixing station, plumbing and Unist equipment.

"While it took awhile to work through the six-sigma process," sums up Page, "to define the problem and gather the data necessary to win the confidence of management, the results have been well worth the time spent. And the dollars invested." **MF**