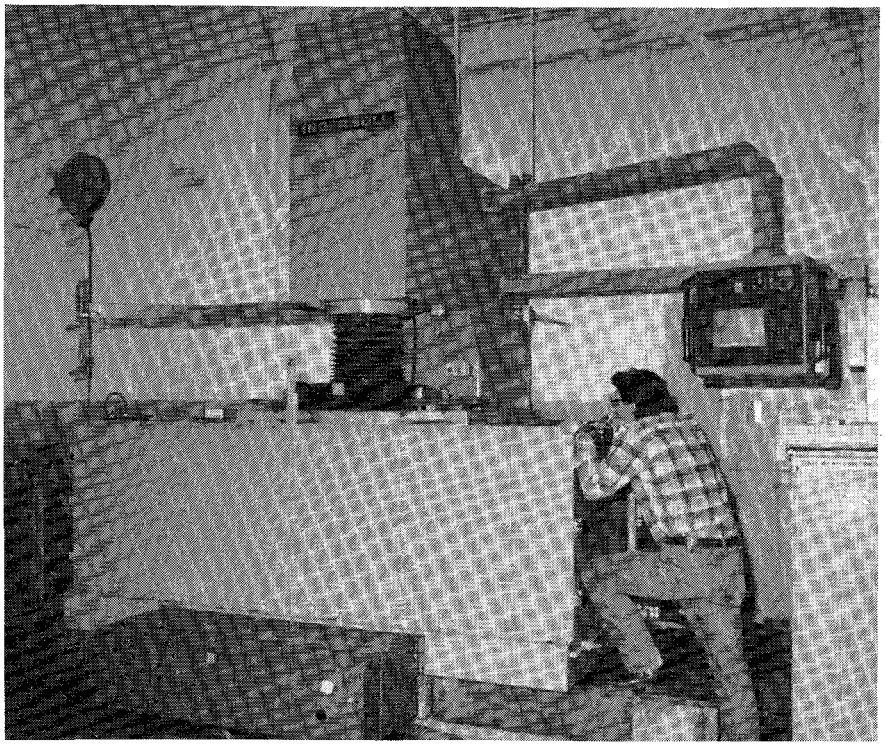
Soft-Tool Spotting by EDM



Shop employee at *Auto Metal Craft checks progress of EDM unit* as *it automatically spark-erodes* a *prototype stamping die* to *produce* a *100 percent spot.*

Michigan stamper of prototype parts now uses EDM to achieve fast, 100 percent spotting of zinc-alloy short run dies

The use of electrical-discharge machining (EDM) to ensure thorough spotting of so-called soft tooling has sparked a profitable new era for Auto Metal Craft, .Inc., an Oak Park, MI, producer of prototype stampings.

Widely used for contouring hard tooling in many industries, the EDM process now yields substantial time-saving and accuracy benefits for the company. The owners dared to be different, adopting the process for the precise spotting of upper and lower mating surfaces of dies made of zinc alloy-not steel.

They don't use electrodes in the conventional EDM sense. Instead, one of the two die sections is picked as the "electrode".

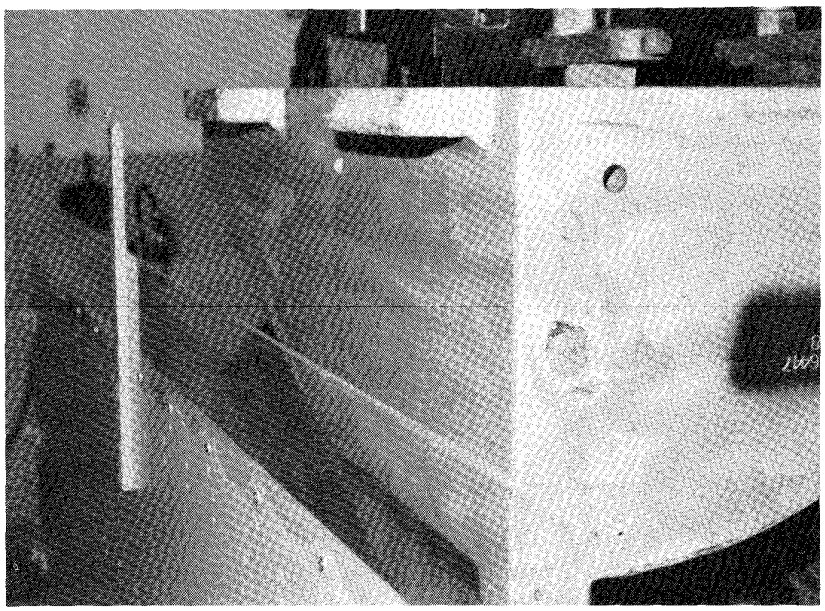
More specifically, one section of a cast die, typically the upper one, is mounted on the EDM unit's ram. When the electric power is turned on, the mating contour is spark-eroded-or, as some say, "burned" -into the cast die section that's resting on the bottom of the unit's work tank.

This procedure is a lot faster than the company's previous method. It has boosted spotting efficiency from the traditional 60-70 percent to the best: 100 percent.

For a stamper that specializes in prototype stampings for the automotive industry, these are significant and far-reaching advantages. Says President Patrick N. Woody: "Rapid delivery of orders is very important to us. When an engineer calls and says he needs prototype parts in a couple of weeks, we've got to comply. And that means the tooling must be built very quickly."

Spotting Drawbacks

Woody explains how his company shifted into the high-speed lane by using EDM: "We make our tooling from a proprietary zinc alloy. The method is relatively fast, compared to the machining of hard tooling, and this is a big advantage in the prototype work we do. "But there's an offsetting disadvantage. The basic castings, which are made from our molds by a nearby foundry, are often distorted. They shrink and warp as they cool. And so they're not as dimensionally accurate as a machined tool would be. "As a result," Woody continues, "extensive and time-consuming spotting work was necessary. We had to check the mating surfaces of the two die sections for high



Upper die for roof pillar, acting as *the electrode,* descends *into work tank, lowered by EDM unit's ram. It will spot the lower die, which rests* on *the bottom.*

and low spots, then grind the surfaces manually to obtain a more uniform spot, or gap, between the two surfaces. There was no practical way to get a perfect spot. Typically, the companies that buy prototype tooling settle for a 60-70 percent spot."

Determined to improve on these operations, Woody and his sons, who also work for the company, visited the tool-and-die shop of a major automobile maker. Watching one of the EDM units perform die-spotting duties for production stamping dies, they asked themselves a key question: "If EDM can ensure correct spotting on hard, production tooling, why shouldn't it do the same for our zinc-alloy dies?"

The Auto Maker's Reasons

The answer came quickly: "It should." But first, there were a few reflective pauses as the visitors reviewed their current situation. Woody's company deals with customers that buy prototype parts, and quantities are, of necessity, small.

However, building the dies to produce these parts is time-consuming and frequently difficult. Once the dies are in a press, stamping out the prototype parts is fast and simple.

The traditional method of spotting dies was particularly tedious, almost primitive. Blue ink was painted on the working surfaces of both the upper and lower dies. Then the dies would be brought into contact with each other. If the ink rubbed off in one or more places, an employee wielding a hand-held grinder would remove some die metal at these locations-carefully. The procedure would be repeated until the two surfaces meshed satisfactorily. Or, as Woody remembered, time would run out for building a set of dies, so prototype parts were stamped out with dies that were less than perfectly spotted.

Discussion with his hosts at the automotive tool-and-die shop further reinforced Woody's resolve to go the EDM route. As the automotive engineer explained, a set of press dies intended for actual production might take months to make if they were machined by the traditional methods. Even then, such tools aren't always 100 percent spotted. That's why automobile companies use EDM units for finishing their more costly production dies.

Soon after their visit, the Woodys contacted their local Ingersoll GmbH representative and inquired about the use of EDM for die spotting soft tooling.

"There was no data available," Woody shrugged. "It was unheard of. Evidently, no one could justify the cost of an EDM unit for that kind of work. And he surmised that many manufacturers that use stamped parts, including the auto makers, are accustomed to getting prototypes of less than optimal quality because they need them quickly, and there isn't time to spot the dies 100 percent.

Gamble Paid Off

For Auto Metal Craft, however, the EDM approach seemed to be a low-risk gamble that could payoff in more business for the company. And the Woodys were right.

"We got together with the Ingersoll representatives to tryout

the idea," Woody said. "They used one of their application-research units to spot one of our tools. We couldn't believe how well it worked."

More research was done, all of it successful, and then the purchase order was signed. By August 1988, Auto Metal Craft was die spotting its zinc-alloy tooling with an EDM unit.

Currently the next-to-the -largest EDM unit in the manufacturer's line, the C462 has a work tank measuring about 49 x 102 in. in plan, and a height of about 33 in. above the table that supports it. Recommended weight limit for an electrode (or, for the upper die Woody chooses to mount in its place) is 5,500 lb. The workpiece (the lower die) shouldn't exceed 17,600 lb. Such limits should pose no problems for Woody-or for many other stampers who might wish to emulate him.

To power the new EDM unit, Woody uses the supply in his plant; he didn't have to buy one of Ingersoll's standard generators. The zinc alloy requires less energy to contour than does tool steel. Moreover, the unit's tank is now filled with a special type of dielectric fluid that's got a higher conductivity than conventional oil for electrical discharge machining.

Not long after the EDM unit was put into full operation, its owners were shipping prototype parts, stamped from 100 percent spotted dies, in about two days, not in the two weeks or so that the jobs used to require.

Rewarding Features

Several features of the EDM unit contribute to this increase in efficiency. Its operation can be entirely automatic, so untended die spotting is possible during the plant's second and third shifts, resulting in higher output. Two other characteristics increase the unit's effectiveness in generating precise part sizes, thus eliminating the need for the company to perform secondary operations and spend a lot of time at it.

Programmed planetary, or orbiting, motion is one of the features. Its effect is minimal electrode wear, improved accuracy, and enhanced control of form geometry. This is especially critical for spotting operations, in which the upper-die section acts as the electrode.

The other rewarding characteristic is the programming capabilities of the machine's CNC. Unlike most other EDM control systems, the one in Woody's shop permits adaptive programming and the setting of off-time schedules. In effect, it permits the non-sparking cycle time to be lengthened, allowing the machine ample opportunity to completely flush the sludge that might otherwise inhibit efficient metal removal.

Such programming flexibility is particularly important during

those two shifts of untended operation. At Auto Metal Craft, that's the case about 85 percent of the time. "We're a small shop," Woody explains. "We don't run more than one shift for regular stamping operations. But that EDM unit of ours sparks away almost continuously."

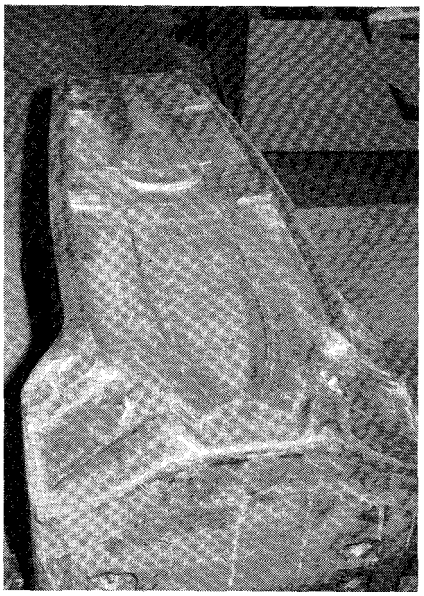
Eroding the Competition

Improved-shorter-lead time is just one of the benefits delivered by the EDM unit. Overall, Woody contends, it has helped in the bidding for jobs with the auto makers.

The word has gotten around even to his competitors. They're now bringing die-spotting work to him.

"Because customers can get a 100 percent spot from us, they're increasingly unwilling to accept the quality of spotting they get from other prototype shops," he says.

Where will it stop? Exclaims Woody: "As a result of this EDM acquisition, a new era of business is opening for us--service to other die shops." For that reason, he's seriously considering the purchase of a running mate to his first EDM unit.



Zinc-alloy lower die, EDM'd for use, along with its mating upper die, in the stamping of prototype parts, is nearly 100 percent spotted, thus ensuring precise forming.

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