TECH APPLICATION

# Electrical Discharge Machining

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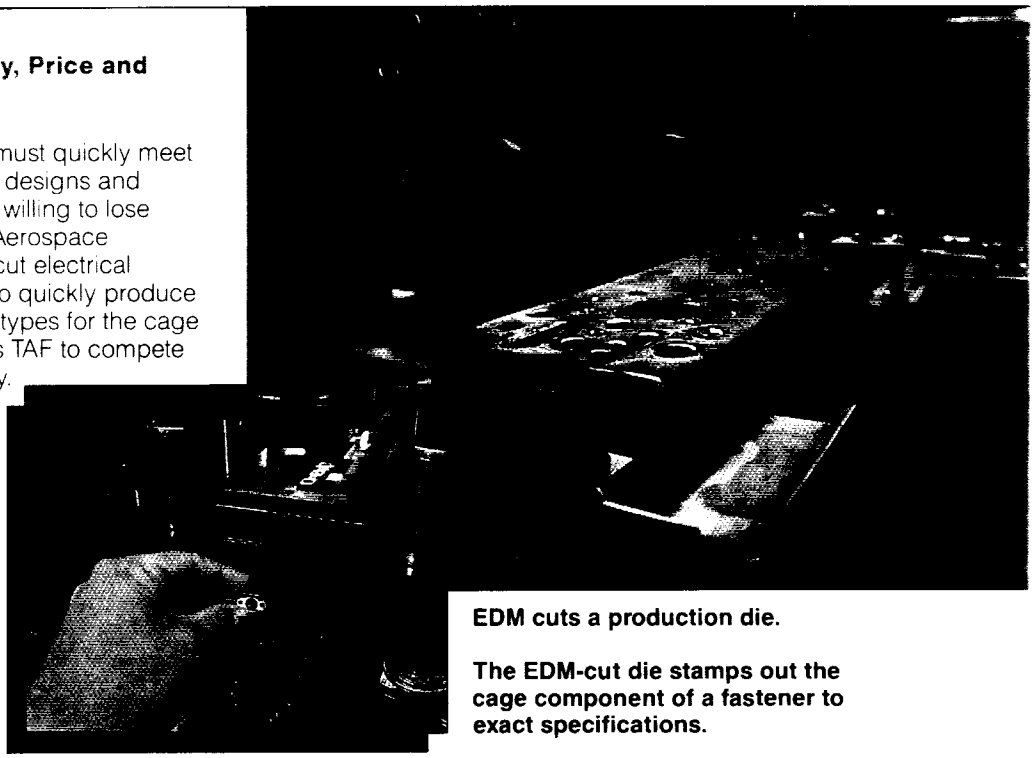
## The Challenge: Winning on Delivery, Price and Quality

Aerospace fastener manufacturers must quickly meet their customers' demands for new designs and stringent delivery schedules or be willing to lose contracts to competitors. In 1984, Tridair Aerospace Fasteners Division (TAF) invested in wire-cut electrical discharge machining (EDM) to enable it to quickly produce inexpensive but reliable tooling and prototypes for the cage components of its fasteners. EDM permits TAF to compete aggressively on delivery, price and quality.



**EDM cuts a production die.**

**The EDM-cut die stamps out the cage component of a fastener to exact specifications.**

### The Old Way

When a customer submitted a fastener request, TAF's research and development department would design the fastener and submit the design to the tool and die department. Working from a blueprint, a die maker would scribe the pattern onto steel, band saw it, and bend it up, a process that took a total of about 40 hours to make 12 to 15 prototypes. If the customer approved the sample, a die maker was assigned the task of making a production-quality die set. That same die maker was subsequently responsible for changing the tooling to meet reorder specifications, repairing worn dies, and supervising the production press.

Handmade die sets are slow to produce, expensive, inexact and unreliable, and a backlog had developed for the department. Because both are handmade, a production-quality die set might not meet specifications even though the prototype did. And reorders had similar problems. Therefore, when a handmade die was cutting parts to specifications, TAF would keep it running, building up inventory so that TAF could be assured of meeting shipping schedules. This inventory was an unproductive drain on TAF and a risk since the order might be cancelled or cut back.

### The New Way

To streamline operations, TAF purchased a wire-cut EDM machine. Now, when TAF receives a part for bid, it immediately prepares a computer numerical control (CNC) program for its EDM machine to cut 12 to 15 prototypes. If TAF wins the contract, it uses information from the CNC program to quickly produce short-run production tooling. For large orders, more durable tooling can be made while the short-term tooling is meeting initial delivery schedules. And because of the repeatability of EDM, all prototypes and parts produced by the short-term and long-term tooling will meet specifications.

## The Results: Fast Delivery and Streamlined Production

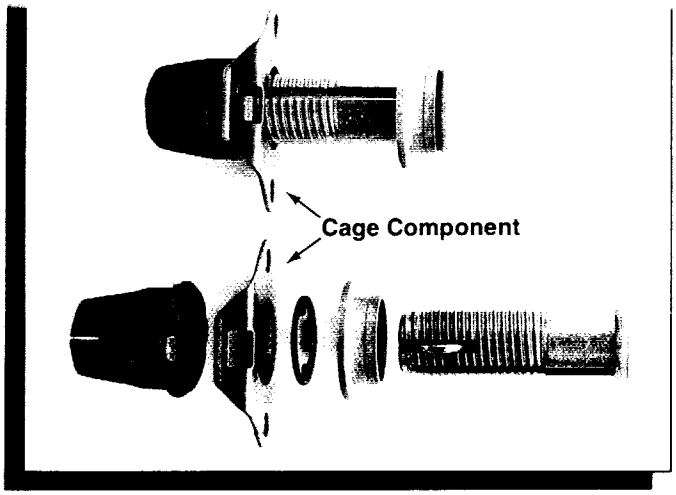
**Fast response.** The tool and die department has eliminated its backlog and responds quickly to changing customer requirements. The weak link in the production process has been eliminated. Time to produce a prototype has been reduced from 40 hours to 4 hours.

**Lower production costs.** Fewer hours are required to make production tooling, for much of the time the EDM machine can operate unattended. This translates into reduced production costs and lower costs per part.

**Faster tooling production.** It now takes an average of 125 hours to make a long-run production die set, instead of the 300–400 hours required with conventional machining which could mean an elapsed time of up to 6 months.

**More reliable die sets.** EDM'ed dies consistently manufacture to specification and run with fewer problems so that customers' delivery schedules can be met without significant inventories.

**Longer die life.** Since the EDM cutting rate is not affected by material hardness, dies can be made out of higher quality, tougher steel which lasts about 4 times longer and needs sharpening less frequently. EDM can produce more complex die components, reducing the number of die parts and further increasing die life, reliability and accuracy.




**Aerospace fasteners are specifically designed to withstand vibration and remain locked in place. They are corrosion resistant and can withstand an average of 250 cycles of reuse. By using these long-lasting fasteners, an aerospace company can decrease the number of spare parts needed to keep its planes flying.**

**More accurate tooling.** In an air-conditioned room, the wire-cut EDM machine cuts to an accuracy of 0.001 inch.

**Dependability.** The EDM machine runs 24 hours a day and after 7,000 operating hours in 3 years has never had a breakdown.

**Improved use of die makers' time.** Die makers no longer spend their time machining dies. They do only final assembly and fine tuning of the dies, so they have more time to spend on die design.

**Lower scrap rate.** Scrap rate for the dies is now 0.5% compared with 10–20% for conventional machining. For parts coming off the press, the scrap rate is now about 1%, compared with the old rate of 20–30%.

**Energy usage and savings.** Conventional machining uses a 2-horsepower motor for 6–8 hours per day for 6 days. The EDM machine runs 24 hours per day and is machining typically 12 hours per day, 7 days per week. It runs off 440 voltage. The significant reduction in scrap rates lowers the average energy usage per finished part. More modest energy savings result from producing dies more efficiently and reducing downtime for die repair.

**Design experimentation.** EDM allows the designer to go from ideas to physical parts in 3 or 4 hours. Now riskier designs can be tried without enormous expenses and developing a quality part is easier.

### What Did It All Cost?

TAF spent about $196,000 to install wire-cut EDM. This cost included $120,000 for the wire-cut EDM machine itself, $30,000–40,000 for a computer and software, and additional expenses for setting up a special air-conditioned room for increased cutting accuracy. The payback period was about 6 months.

### The Bottom Line: Fast Response Time and Improved Production Methods

Wire-cut EDM gives TAF the greater flexibility and faster turnaround time it needs. Now TAF can rapidly respond to changing customer demands and grow in a tough business environment.

### Other Applications of EDM

EDM can be used on any material that conducts electricity. Wire-cut EDM is used by mold and die makers when they need precision, when they are working with hardened materials, or when no other method will do the job. Vertical EDM uses the same principle as wire-cut EDM but can be used to machine blind shapes. It is frequently used for drilling microholes and creating small and/or deep slots. For more information on EDM see TechCommentary Vol. 3, No. 1.

### Company Profile

Tridair Aerospace Fasteners Division, Torrance, California.

Manufacturer of precision fasteners for the aerospace and defense markets.

Company philosophy:
We will make any fastener for any application.

**Paul Hafeli, Tool and Die Design Supervisor, says "Manufacturers who are not using EDM won't be in business very long because the advantages of EDM are so great."**

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