



by Roger Kern

Techtips is a collection of useful ideas, techniques, and procedures designed to further EDM knowledge.

Managing for CNC EDM Productivity

The “inconvenient truth” concerning EDM productivity is, that for most shops, the greatest potential for improving the throughput of the EDM Department has little to do with the cutting speeds of the EDM machines! Since CNC EDMs (both wire and sinker) are capable of

operating for extended periods without human intervention, managing these assets so that they spend the majority of time making sparks is the path to the promised land of improved EDM productivity and profitability.

There are 8,760 hours per year available for sparking. How many of those hours are your machines making sparks? Please note that I said sparking, not waiting for a program, being set-up, or waiting for the next job!

If you have a sophisticated job costing and reporting system that isolates cutting time from set-up time, you can readily determine the situation for your shop. However, an informal random survey can be almost as effective. Daily, take a walk through your EDM Department first thing in the morning, a few times randomly during the day, and just before going home at night. During each walk-through, note if each of your machines is sparking. At the end of two weeks, review your notes to determine the average percent-

age of machines sparking during the day, percentage of machines that started and ended the night sparking, and the percentage of machines that started and/or ended the weekend sparking. From your notes, you should be able to make a reasonable estimate of the sparking hours per year for each of your machines. During my numerous visits to shops large and small, I often observe the majority of the EDMs are not sparking at any given time. If your machines are “only” sparking 2,000 hours per year (and that is a lot for some shops), it is obvious that there is a huge potential for improvement.

While Peak Current, On-time, in²/hr, and in³/hr are the terms that excite the technician in most of us, it is the often overlooked and tedious management process that needs to be getting the lion’s share of our attention, if we want to maximize the profitability of the EDM Department.

The potential for productivity improvement by managing your EDM assets is enormous, especially when compared to the productivity improvement provided by technology. Let’s say that in one shop they increase cutting speed by 25% in an EDM Department that is sparking “only” 2,000 hours per year. That 25% increase in performance is equivalent to adding another 500 production hours. Compare this increase to another shop that, by

managing its assets, increases its sparking hours to 4,000 hours per year, doubling its capacity with little or no capital investment. And even at that, the second shop is only operating at less than 50% of theoretical capacity. Not only have they doubled their capacity, but they have also cut their fixed costs per hour by 50%. I know of a number of shops that purchase and operate a battery of 20 year old "obsolete" machines, yet successfully compete against shops with "state-of-the-art" equipment by running these older machines 120 hours per week.

In this issue, we'll attempt to uncover opportunities for improved productivity by repeatedly asking the question "why". This simple, but very powerful, method of process improvement theory will lead us to the root causes of machine idle time and toward suggested solutions.

Remember, a machine is either sparking or waiting, so let's begin by asking why a given machine isn't sparking?

- **Waiting for an operator**
- **Waiting for a job**
- **Waiting for the set-up to be completed**
- **Waiting for consumables**
- **Waiting for maintenance**
- **Waiting for repair**

Let's continue by examining each of these topics further by repeatedly asking why, and then suggesting possible solutions.

Why is the machine waiting for an operator?

• Job is finished *Why aren't there multiple jobs set up?*

CNC EDM's are quite capable of having a number of jobs set up on the table with matching electrodes in the tool changer. Some shops set the jobs up in the tool changer and mount the electrodes in a magazine on the table. Scheduling jobs and setups is crucial to the efficient operation of EDM machines. Night jobs need to be setup at the beginning of the day, so that, no matter what happens during the day, the job(s) will be ready when it's time to go home. Similarly, weekend burns need to be ready to go long before Friday at 5:00 PM. A number of highly successful shops devote much of the daytime weekday hours to assure that evening and weekend hours are devoted to unattended sparking.

• Slug removal *Why doesn't the program proceed to next opening?*

An inventive process plan can eliminate the need for off-hours coverage. For example, roughing all the openings in a block during the night, while leaving the slug cut-offs for the following day.

• Wire Break *Why did the wire break?*

- **Wrong wire selected**
- **Inappropriate technology selection**

Wire breakage can often be avoided by proper wire and technology selection (not running the

machine on the ragged edge). A machine sitting for just a short time waiting for an operator to rethread a broken wire, quickly gives up the advantage of that 5% extra speed obtained by pushing the envelope. Many machines now have re-threading capabilities, or can proceed to the next cut or job. Training of operators and programmers is the key here. Many shop owners decline the invitation for operators to attend factory training. Here is where that training would pay off.

• No operator available *Why is the operator not available?*

- **Working on other machine(s)**
- **Operator is on break (bathroom, coffee, lunch)**
- **Operator is out (shift over, weekend, sick, holiday, vacation)**

It has been my experience that most EDM Departments are understaffed. Since EDMs are capable of long periods of unattended operation, many shops underestimate the manpower required to keep the machines running for extended periods. While increased staffing is often considered heresy in today's world of cost cutting, in fact, just such increased staffing can dramatically improve the productivity of an EDM operation. I know of a production EDM operation with more than twenty machines with just two operators. Since they can't keep up with the loading and unloading of parts, yet are required to keep as many machines sparking as possible, they turn down the feedrate override on all the machines! One more operator

would increase the throughput of the department by a phenomenal 40%, yet that solution was not open for consideration in order to “keep costs down.” Additional staffing, whether it is accomplished by more staff, cross-training, or flexible scheduling designed around the process, can substantially improve the bottom line.

Why is the machine waiting for a job?

- **Blanks not ready**
- **Program not ready**

Scheduling the flow of jobs through the shop is a topic in itself. However, by utilizing a computerized shop scheduling system that “backward schedules” from the delivery date, based upon the operations that need to be performed and the estimated time to complete these operations, management can plan when a part will need to be in the EDM so that programs, parts, electrodes, and fixtures are completed by that time. The EDM Department staff needs to be apprised of that schedule in advance, so that they can properly allocate those jobs to the day, night, and weekend schedule. This type of management activity is tedious, but not rocket science. Someone needs to be responsible for seeing to it that the parts, electrodes, programs, fixtures, and drawings arrive at the EDM Department not only on time, but as a completed package.

Why is the set-up taking so long?

- **Blanks or electrodes not properly prepared**

Why weren't the blanks prepared?

A missing start hole or improperly ground reference edges can spoil the best laid process plan.

- **Program has errors**
Why wasn't the program tested in advance?

Complicated programs should be tested in advance, either with off-line screen simulation, or when the machine is not being used.

- **The operator has to study the job**

If the operator doesn't have a clue as to the orientation of the parts or electrodes or the process sequence, a fifteen minute setup can take hours. Communication can be as elaborate as a process sheet and layout drawing, or as simple as markings on a print, but there must be effective communication between all parties. In addition, if the EDM staff is apprised of the schedule for the machines in advance, much of the preparation can be completed in advance.

- **The tooling is inadequate**

A high quality tooling package with enough components to allow multiple jobs to be pre-set off the machine, is essential to minimize set-up times. Certainly

good EDM tooling is expensive, but a properly tooled machine can often do the work of two machines, even without a robot.

Why is the machine waiting for consumables?

A machine being down solely because the shop is out of wire or filters is inexcusable! “Just in time” may be the catch phrase of the day, but the security of having an extra box of wire, box of filters, belt, flush cup, or dielectric fluid is worth far more than the cost of a small inventory of these essential items. A weekend of burning lost, due to lack of consumables, could easily mean \$2,400 in lost revenue, in addition to the havoc it will wreak on the EDM Department schedule and the schedule of subsequent operations.

Why is the machine down due to lack of preventative maintenance?

There is nothing more frustrating than having a hot job ready to go into the machine at 5:00 PM on a Friday evening, only to find that suddenly the wire won't thread because the threader needs cleaning. Most maintenance items are predictable, and scheduling regular preventative maintenance, so that it doesn't interfere with production, can significantly contribute to improved productivity.

Why is the machine still waiting for repairs?

Unexpected breakdowns, while rare, are an unpleasant fact of life. How we respond to them can make the difference between a day of downtime and a week of downtime. Immediate and persistent contact with the OEM service and parts departments, combined with timely parts orders and utilization of premium transportation, can minimize non-sparking time due to breakdowns. It also helps immeasurably if someone on staff has a basic knowledge of electricity and electronics to communicate problems to the factory and carry out the suggested diagnostics.

What about robots?

You may have noted that I haven't advocated the use of robots in this exercise. While, at some point, a robot is an essential ingredient to utilizing the majority of the 8,760 hours available for production each year, it takes a highly sophisticated management system to actually achieve the potential productivity a robot can provide. Unless and until your company can implement management practices that get you to the 4,000 hour production level, your management system will most likely be inadequate to even consider integrating a robot into your EDM production system.

Summary

The marginal cost of each additional unattended sparking hour for an EDM machine is minimal compared to the additional revenue generated. The combination of cutting performance improvement, and the application of sound management practices to substantially increase unattended hours will pay substantial dividends to those shops willing to take on the challenge.

Any suggestions for future topics are welcome.

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rjk@gedms.com

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