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Achieve More with Twin Wire EDM Technology

As wire costs continue to increase, twin wire will be recognized as a strong tool for fine tuning wire EDM performance and reducing cost.

Ken Baeszler

Most, if not all mold shops are under ever constant pressure to reduce operating costs and improve turnaround time to compete in the global market. This is no surprise; we have been fighting this war for some time now. One thing that may or may not be apparent to those on the front line is the effort that machine tool manufacturers take to help make their products more productive and economical. There are many different approaches EDM manufacturers now take to reduce operating costs. Some main areas of focus include:

- Improving electrical and EDM generator efficiency to reduce overall power consumption.
- Re-developing erosion technology with an emphasis on slower wire feedrates.
- Increasing precision in the roughing cuts to reduce trim passes.
- Increasing cutting speeds and precision of smaller diameter brass EDM wires to the point where they can replace larger diameter wires in many applications.

These enhancements are all valuable, but there are other opportunities to save cost.

For instance, what if we looked at a wire EDM like we look at a machining center? What if we could automatically change from a roughing wire to a finishing wire? Being able to change wire automatically has merit in more than a few applications.

The following applications represent four different scenarios that present additional cost savings opportunities:

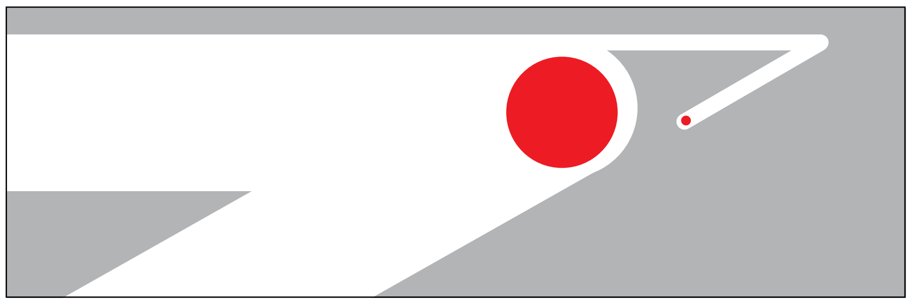
Application 1

Small Radii Requirements

The most common use for twin wire EDM systems is the ability to erode contours with small inside radii using a larger wire diameter first, then automatically change to a smaller diameter wire, perform the finish passes and complete the smaller radii **(see Figure 1)**.

In **Figure 2**, the cost benefits associated with using this strategy become apparent. Without the benefit of twin wire, this part would most often be cut completely with .004" diameter wire, since it would be too costly and

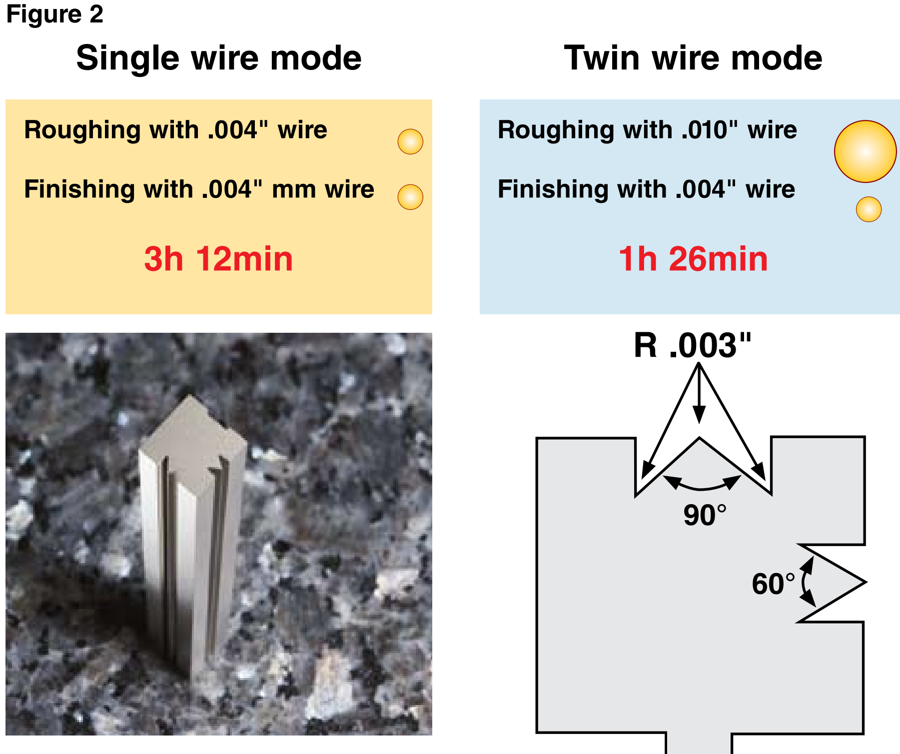
Figure 1



Figures courtesy of GF AgieCharmilles.

Larger diameter wires will not complete small radius requirements.

Figure 2



This example illustrates the time saving benefits of twin wire technology.

Figure 3

Illustrates how many components require that the inside shapes and the outside perimeter be machined with wire EDM. Many components can benefit from using a combination of different wire diameters.

A unique mechanical design with exclusive twin wire digital control of the spark.[1]

Photos courtesy of GF AgieCharmilles.

cumbersome to switch wire diameters on conventional wire EDM machines.

Application 2

Multiple Contours with Varying Requirements

Many components require that the inside shapes and the outside perimeter be machined with wire EDM. **Figure 3** represents an application where the inside details have smaller radii requirements that the outside detail. On conventional EDM machines, there are at least two ways of approaching this job:

1. Complete the outer contour and the inner contours with the smaller diameter wire.

2. Cut the inner contours with the smaller diameter wire, manually change wire to a larger diameter, and complete the outer contour. This process may achieve a faster cutting time, but that time savings may be lost due to costs associated with the wire changeover. On most EDM machines, this changeover can be a timely process requiring the actual changing and re-alignment of the wire guides.

On a twin wire EDM machine, the job can be approached in an entirely different manner:

1. If small enough, the inner contours can be no-core cut with the larger diameter wire first. Otherwise there would have to be an intervention for slug removal.

2. The twin wire system will then automatically change over to the smaller diameter wire and perform the finish cut on the inner contours.

3. The twin wire system will then automatically switch back to the larger diameter wire and complete the outside perimeter of the component.

It should be noted that in a situation where high accuracy details are going to be finished with two different diameter wires, the operator may want to verify the position of each wire prior to erosion. This is mainly due to the slight manufacturing variations in the wire itself.

It also should be noted that in larger components, it may be necessary to rough out the outer perimeter prior to completing the inner profile. This strategy would be used if there is a concern about part movement during erosion.

Table 1

Comparison Chart for Twin Wire Technology

.010 Wire Example	Erosion time mins.	Wire usage in meters	Total Wire Cost
Stratified wire only			
Main Cut	46.51	605	$6.62
Trim 1	33.33	333	$3.65
Trim 2	31.75	317	$3.47
Trim 3	16.67	167	$1.82
Trim 4	24.10	241	$2.64
Total Time	**152.35**	**1663**	**$18.20**
Hard brass only			
Main cut	63.29	759	$4.76
Trim 1	37.04	370	$2.32
Trim 2	28.57	286	$1.79
Trim 3	16.67	167	$1.04
Trim 4	23.53	235	$1.47
Total Time	**169.10**	**1818**	**$11.39**
Rough w/stratified - finish w/brass			
Main Cut- Stratified	46.51	605	$6.62
Trim 1 - Brass	37.04	370	$2.32
Trim 2 - Brass	28.57	286	$1.79
Trim 3 - Brass	16.67	167	$1.04
Trim 4 - Brass	23.53	235	$1.47
Total Time	**152.32**	**1663**	**$13.25**

Material:
Tool Steel
Height:
60mm
Surface Finish:
.3Ra

Table courtesy of GF AgieCharmilles.

Comparison of three different strategies for cutting the same piece of 60mm tool steel with high accuracy and surface finish requirements.

Application 3

Using the Best Wire for the Task

As the cost of wire continues to increase, this strategy becomes more relevant. With twin wire EDM systems, it becomes an easy matter to use high-performance stratified wires for the roughing pass, and then automatically change over to economical brass wire for the finishing passes. This combination

Twin wire configuration.[2]

allows the user to take full advantage of the high-speed capability of stratified wire in the rough cut without wasting the high priced wire on the successive finish cuts.

Table 1 compares three different strategies for cutting the same piece of 60mm tool steel with high accuracy and surface finish requirements. The cost savings of using two different types of .010" diameter wire for this application is apparent.

Application 4

Superfine Surface Finish Requirements

Some twin wire EDM systems are capable of achieving surface finishes as low as .05 Ra µm. In order to obtain such finishes, a high quality zinc coated wire should be used. This high quality .008" zinc-coated wire can be up to 60

Figure 4

Surface finishes down to .05 Ra µm are now obtainable.

Picture of three types of wires: high performance, economical and small diameter. Each wire has its strong points.

percent more expensive than brass, and does not provide a real advantage in cutting speed. With this scenario, it may pay to actually rough with brass wire, and finish with the zinc-coated wire.

This is an unusual reversal in the world of wire EDM. The emphasis on technology development for economical brass wire has opened up a new world of possibilities that will allow brass wire to operate at much the same speeds as a zinc-coated wire in many applications **(see Figure 4)**.

Summary

The automatic wire changing capabilities of twin wire EDM systems are

ED wire-cutting machine with two wire spools for different wire types.[2]

ED wire-cutting machine in operation using two different types of wires.[2]

well suited for any multi-diameter wire application. As wire costs continue to increase, they also will be recognized as a strong tool for fine tuning wire EDM performance and reducing cost.

Although twin wire technology has been well embraced by the precision die-making community, it is only in its infancy in precision moldmaking applications. As the pressure continues to use more cost-effective EDM techniques, the more likely we are to use it in the future.

References

[1]*FI 2050TW.*
[2]*AC Vertex 1.*

MMT

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