



by Roger Kern

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



The primary reason a shop buys a CNC EDM is not to make sparks, but to make money. In order to justify the purchase of a machine, evaluate the financial performance of a machine, or to help set an hourly quoting rate, it is important to accurately calculate the cost of owning and operating a CNC EDM. In this issue, we'll explore the key factors in CNC EDM costing, and present a model for calculating the hourly cost.

As with most any machine tool, the hourly cost of operation is made up of two components: Fixed Costs and Variable Costs.

## Fixed Costs

*Fixed Costs are those expenses that are more or less independent of the level of activity of the machine. Some of the more common fixed costs are listed below:*

### **Cost of Ownership:**

**Financed Machines:** Most machines are financed over a five year period with a fixed monthly payment. This is the most significant of the fixed costs, as those payments are due whether or not you run the machine. The cost of ownership for a financed machine is merely twelve times the monthly payment. Most shops that finance their machines will use this as their cost of ownership, in order to fully recover the cash outlays for the monthly payments.

**Machines purchased for cash:** If the machine is purchased outright, many companies will use the depreciation calculated by the company accountant for the ownership cost. This may have to be adjusted since machines are often aggressively depreciated to minimize taxes. In some cases, it might be better to estimate the economic life of the machine and divide the cost of the machine by this figure. Since most EDMs have little residual value at the end of their economic life, this factor can often be omitted. It could also be argued that an opportunity cost (the money invested in the machine could have earned interest in a CD) should be added to the depreciation figure.

In either case, remember to include the cost of tooling, accessories, freight, rigging, plumbing, and electrical installation in the total outlay for the machine for the purposes of this calculation.

**Property Taxes:** Many local jurisdictions tax machinery and equipment on a mil rate basis. Consult with your local assessor for the formula they will utilize when calculating the tax bill for your machine.

**Insurance:** Consult with your insurance carrier to determine the rate per thousand that will apply to cover the addition of the CNC EDM.

**Machine Repairs:** In the first year or two of ownership, the machine will most likely be covered by a manufacturer's warranty, unless it is a used machine. In all other cases, either include the cost of any maintenance contract purchased for the machine, or estimate the annual amount you anticipate spending on boards, pumps, encoders, etc. including service call labor and travel, if you don't do this work yourself.

**Routine Maintenance:** Even though routine maintenance will vary somewhat with the level of machine activity, for most installations it is relatively constant. The costs of routine maintenance will include some or all of the following:

#### For Wire Machines:

- Wire Guides
- Power Feed Contacts
- Nozzles, Flush Cups, Belts, etc
- Resin
- Dielectric Filters
- Cleaning: Seal Plate, auto-threader, water tanks, etc
- Labor cost to perform above maintenance items

#### For Sinker Machines:

- Dielectric Filters
- Disposal of Filters
- Dielectric Oil
- Disposal of Dielectric Oil
- Cleaning
- Labor cost to perform above maintenance items

Please note, it is very important not to underestimate the labor cost (including overhead) to perform the routine maintenance tasks, as this can easily exceed \$2,000 per year on wire machines. Some companies use their standard shop rate for costing the maintenance labor.

**Electricity Costs:** In theory, electricity costs might be considered variable costs. However, since most machines are powered up 24/7, and since the cost of operating the control, chiller, and pumps usually exceeds the energy required to run the generator, electricity costs are often considered fixed costs equal to the average machine KW consumption, times the hours in a year, times the electric rate. With the soaring cost of electricity, this is not an inconsequential number.

**Space Costs:** Since a machine sitting on the floor takes up space, the proportionate cost of that space needs to be calculated. This number may not be easy to get to, so a reasonable alternative is to use the average lease rate per foot for heated and air conditioned industrial space in your area, times the square footage occupied by the machine, accessory equipment, and workbench.

## Calculating The Fixed Cost Per Hour



Once the fixed costs have been determined, you now have to make one very big assumption: How many hours per year will the machine be producing revenue? Since this assumption will dramatically affect the fixed cost per hour, it is crucial that a thoughtful estimate be made. Many shops make the mistake of being optimistic in the projection of revenue hours in order to keep the fixed cost per hour low. However, if you do this, you are only kidding yourself. The hourly fixed cost is calculated by dividing the total fixed cost by the annual estimated revenue hours.

## Variable Costs

**Wire EDM:** For a Wire EDM there are only two significant variable costs:  
- Wire, Labor

• **Sinker EDM:** For a Sinker EDM there is only one significant variable cost:  
- Labor

Please note that for a Sinker EDM, the cost of making the electrode is normally not considered a part of the burning operation, but as a separate cost of making the tool.

The key difference between a CNC EDM and other shop equipment is that a CNC EDM is designed to run with varying amounts of operator intervention. Therefore, it is important to establish distinct variable labor costs depending on the amount of operator attention.

There are three common situations that define the amount of operator attention for most shops:

**1. Full attention:** There are certain jobs that require the operator to stand there and either monitor the machine, pick off slugs, or change parts. I classify this as requiring 100% attention.

**2. Split attention:** For most jobs setup, slug removal, and teardown will require 100% attention, while during the burn the operator is off running one or more other machines. If one operator typically runs two machines this rate would be 50%. If one operator typically runs three machines this rate would be 33%. This all depends upon the type of work typically done in your shop.

**3. Unattended:** Once jobs have been set up for overnight or weekend burns, the process runs with essentially no labor input so the rate would normally be 0% for this category of labor. However, some shops add a small percentage to cover occasionally looking in on the machine during this period.

Please note that the term "labor" used here includes the overhead normally associated with an employee (fringes, taxes, supervision, etc) and not just the employee's hourly rate.

## Calculating The Total Cost

The total estimated cost is merely the sum of the fixed and variable costs. However, since there are three possible labor costs, there will be necessarily three distinct total machine costs.

The spreadsheet on page 12 illustrates this entire procedure for a typical Wire EDM. The numbers used are purely for purpose of the example, and may vary significantly for your shop.



## Time Recording and Costing

Needless-to-say, your shop's time recording and job costing systems need to be able to track the various cost levels associated with each labor category. In my shop, we used suffixes after the employee number on the time sheet, so that the operator could readily record and the timekeeper could readily input the various types of labor used on a given job:

<b>No suffix:</b>	<b>Full attention</b>
<b>-S</b>	<b>Split attention</b>
<b>-U</b>	<b>Unattended</b>

The job costing system was programmed with the overhead rate for each machine, and the three classes of labor defined above for each employee.

## What About Programming?

Normally, off line programming is considered a separate cost center with its own fixed and variable costs. These can be calculated with an analysis similar to that proposed for CNC EDM.

However, for those wire and sinker EDM installations in which programming is done by the operator on the machine (which is quite common for CNC sinkers), programming can be treated as follows:

- **Programming on the machine when it is stopped:**
  - Full attention
- **Programming on the machine while it is running another job:**
  - Split attention

## Summary

In today's extremely competitive business environment, accurately calculating your costs will allow you to quote with a greater degree of confidence and, when the job is completed, accurately determine whether or not the work was profitable.

*Any suggestions for future topics are welcome.*

*Tell us what you would like to read about.*

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## — Example —

<u>FIXED COSTS</u>	<u>NOTES</u>	
<b>Annual cost components</b>		
<b>Ownership</b> . . . . . \$36,068.00	<b>Lease payments</b>	
Machine cost . . . . . \$150,000.00		
Interest rate . . . . . 7.50%		
Term (months) . . . . . 60		
Monthly payment . . . . . \$3,005.69		
<b>Property taxes</b> . . . . . \$2,625.00		
Value . . . . . \$150,000.00		
Assessment % . . . . . 70%		
Mil rate . . . . . .25		
<b>Insurance</b> . . . . . \$122.00		
Value . . . . . \$150,000.00		
Cost per \$1,000 . . . . . \$0.81		
<b>Repairs</b> . . . . . \$2,500.00		
<b>Maintenance</b> . . . . . \$5,200.00		
Guides . . . . . \$750.00		<b>1 set per year</b>
Power feeds . . . . . \$300.00		
Nozzles, cups, etc . . . . . \$150.00		
Resin . . . . . \$500.00		<b>6 regens per year</b>
Filters . . . . . \$1,500.00		<b>Set of two every 250 hours</b>
Labor . . . . . \$2,000.00	<b>1 hour per week @\$40./hr.</b>	
<b>Electricity</b> . . . . . \$3,456.00		
kw/hr . . . . . 4		
\$/kw-hr . . . . . \$0.10		
<b>Space</b> . . . . . \$1050.00		
\$/sq ft . . . . . \$7.00		
Sq ft . . . . . 150		
<b>TOTAL FIXED COST</b> . . . \$51,021.00		
Production hrs/yr . . . . . 2,500		
<b>FIXED COST/HR</b> . . . . . \$20.41		
<b>VARIABLE COSTS</b>		
<b>Wire</b> . . . . . \$2.28 Per hour		
Wire type . . . . . Brass		
Wire dia . . . . . .01		
\$/lb . . . . . \$5.00	<b>This is equivalent to \$.0047 per meter</b>	
Wire speed, mm/sec . . . . . 135		
<b>Labor</b>		
<b>Full attention</b> . . . . . \$40.00		
Labor rate . . . . . \$40.00	<b>This includes overhead</b>	
% Attention . . . . . 100%		
<b>Split Attention</b> . . . . . \$20.00		
Labor rate . . . . . \$40.00	<b>This includes overhead</b>	
% Attention . . . . . 50%		
<b>Unattended</b> . . . . . \$ —		
Labor rate . . . . . \$40.00	<b>This includes overhead</b>	
% Attention . . . . . 0%		
<b>Variable Hourly Cost</b>		
<b>Full Attention</b> . . . . . \$42.28		
<b>Split Attention</b> . . . . . \$22.28		
<b>Unattended</b> . . . . . \$2.28		
<b>TOTAL MACHINE COSTS</b>		
<b>Full Attention</b> . . . . . \$62.69		
<b>Split Attention</b> . . . . . \$42.69		
<b>Unattended</b> . . . . . \$22.69		