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Purpose

As you review this newsletter, I hope you can appreciate the time and effort it took to put this together.

Having been in this business for over 30 years, I find that over the last several there has been a huge increase in bad, incorrect information and half-truths provided to EDM users.

My salespeople and I experience this every day with clients that have been completely misinformed. My family has and is in manufacturing here in the USA. I believe you become competitive by having solid, documented information to make solid business and manufacturing decisions.

Whether you buy from my company or not, I hope you can use this information to grow your business and bring some manufacturing back to the USA.

Fred A. Wisen

President

North American EDM
Supplies Inc.



Wire Facts

Everybody wants to talk about the price of wire. They feel that the lower they can go in price the more profitable they are and the better their business decisions. **WRONG**

This concept is based on bad information, incorrect understanding of cost and ignorance. It is true "that you don't know what you don't know". So, let's make sure everyone knows.

In our previous issue, we discussed what makes a good wire and the factors that should be looked at to make that determination. These factors have to do with the manufacture of the wire. Things that are not talked about but extremely important in the edm process. Things like the surface finish of the wire itself, is it free from scratches and gouges. Lower quality wires are manufactured where the draw guide is used just a bit past its usable life. To make lower cost wire something has to be sacrificed. The tooling is used beyond

its usable life, raw material is not as pure as it should be, the annealing process is not checked as often. All these factors affect your machines performance, accuracies and life.

The first concept we need to understand is not all wires are made the same. The second is the country of manufacture does have an impact on the quality of an edm wire. The third and most important, EDM machine tool builders do not make EDM Wire. The same as US car makers don't make tires, brakes, steering wheels, nuts, bolts, belts, carburetors; you get the idea.

Many of the name brand wires have gone to factories in China over the past several years; with the tariffs, they have moved to manufactures in Vietnam.

It is surprising how many clients are mistaken about the country of manufacture for their name brand edm wires. The name on the spool no longer represents the manufacturing location.

Sent to you by:

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Terminology:

Dielectric Strength:

The minimum applied electric field (applied voltage divided by the electrode separation distance) that results in breakdown. IE: a spark

DC Arc: A short circuit between the electrode and workpiece creating a pit. Caused by poor oil quality or "pressing" the gap. (Can be a fire starter in the machine)

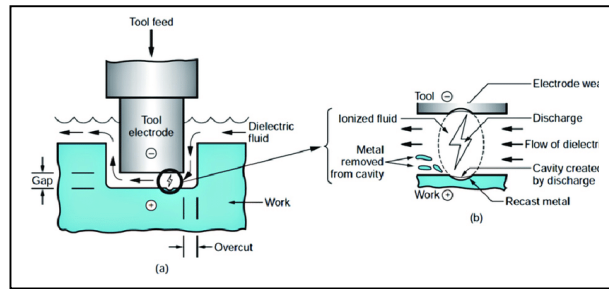
Duty Factor: The percentage of ratio between the pulse duration and the total cycle time.

Viscosity: A measure of a fluid's resistance to flow. (Low viscosity oils have better flow and flushing characteristics)

VOC: Volatile Organic Compounds.

Compounds with high pressure at room temperature and cause a large number of molecules to evaporate into the air at slight rises in temperature.

Dermatitis: (In relation to EDM) The defatting of the skin upon exposure to edm petroleum products, especially those contaminated with debris from the edm process.



While it is still unknown exactly what happens during the edming process, several theories have advanced with support evidence. One, which we will cover, is the Thermoelectric Model.

Thermoelectric, is as the name states, the combination of heat and electricity working in concert. We will cover what happens during one edm cycle which occurs in the range of 300,000 times per second.

The electrode, which is charged either positively or negatively depending on the application, is brought to the workpiece. Between them is the dielectric fluid. Oil in the case of a sinker machine but the concept is also true of the WEDM. Both the oil and water are the insulators in this equation.

Debris, metal and / or graphite particles in the dielectric can contribute to or be determinantal to the edm process. Too much and we generate a "cool" spark and our cutting rates become very slow.

As the electrode nears the workpiece an electrical field starts to be generated. This will result in a voltage increase and an amperage decrease. As we get closer to the workpiece, the number of ionic particles increase. Ionic particles refer to charged particles in the dielectric. The insulating properties of the fluid begin to diminish with electrical field increasing.

The voltage has reached the peak, but the amperage is still low. At this point a current is established between the workpiece and electrode. The fluid has reached its breakdown point. As the fluid begins to breakdown the voltage will drop and amperage will begin to increase. We will see a rapid increase in heat as the amperage continues to climb and the voltage to drop. This heat will vaporize some of the electrode, workpiece and dielectric fluid. As this occurs a discharge path begins to develop between the electrode and workpiece.

The Thermoelectric Model of the EDM Process

At the peak of on-time a vapor bubble forms between the electrode and workpiece. This bubble tries to expand outward but is contained by the rapid rush of ions to the discharge channel. These ions are attracted by the high electromagnetic field created at discharge. The amperage continues to rise, and the voltage maintains its downward trend.

As we approached the end of our off-time, the voltage and current have stabilized. Pressure within the vapor bubble has reached critical and we are removing some material. The material at the discharge point is now in a molten state, the discharge path is now filled with superhot plasma. (Vaporized material, dielectric fluid and carbon all with a very high current passing between the electrode and workpiece)

As we begin our off-time, the voltage and amperage drops to zero. The temperature decreases rapidly as dielectric fluid floods the collapsing vapor bubble and cools the workpiece. This action forces the debris from the cut or slot. It also creates recast. (Recast is the mixture of electrode and molten material that has solidified back on the workpiece.) The cut material floats off to the filters and the vapor rises to the surface.

If we do not provide enough off-time the debris will stay in the discharge path, this could result in "cool" sparks as the electrode discharges before the gap has been established. It can also cause a DC arc situation damaging the electrode and work pieces. (DC Arc = Welding).

Clean oil and of a sufficient dielectric strength are required for proper and efficient edming. EDM Oil should never be looked at as a commodity item or as an afterthought. It is an integral part of the edm process and a high determining factor in surface finish, cutting speed, electrode wear and safety.



EYE ON IT

As machines become faster, accuracies more important, metals much more advanced; the role of the edm is changing.

It is imperative that you stay competitive.

Unfortunately, many companies feel that buying a cheaper product is the way to save money and be competitive. Nothing could be further from the truth.

An edm is balancing act of theories. It must remain in balance. For every action there really is an opposite and equal reaction somewhere in the machine.

Cheap products have a high but hidden cost.

Give me some Real World facts!

Do you **REALLY** know the cost associated with the operation of your WEDM????

Lets do some real world cost factors?

Assumptions:

0.010" Diameter brass EDM wire on a P5R (11 pound) spool.

Wire speed of 98 mm/sec. * 3600 seconds = 353 M/Hr.

5kg (P5R) Spool of 0.010" wire at 11,700 M per spool

Current wire price you are paying: \$ 4.50 / pound (\$49.50 / spool)

\$49.50 spool cost / 11,700M wire length = \$ 0.0042 per Meter

353 M/Hr. * \$ 0.0042 = \$ 1.48 / hour wire cost

Machine Cost: \$60.00 / Hr.: electricity, wire, water, wear parts, labor, filters, maintenance, overhead and, of course, financing.

Wire is 2.5% of your hourly cost.

If we increase your wire cost to a much better wire at \$ 6.50 / pound and run the same calculations.

Wire cost is 3.5% of your hourly cost. You ONLY need to see a 1% increase to break even. Anything above that is pure profit.

If you see no increase but reduce your wire breaks by just 2 over the 33 hours to run the spool, the \$6.50 wire is a winner.

If we were to take a ProSource EDM Consumables "SONIC" wire and run these calculations, let see what we get.

Using the same wire size and spool size. Wire buy price would be \$ \$5.98 / pound.

$((($5.98 * 11\#) / 11,700M) * 353) / 60 = 3.3\%$ of machine run cost per hour.

3.3% - 2.5% = 0.8% increase needed.

"SONIC" runs 10 - 15% faster than brass.

Reduced wire breaks, only 1 less is needed per spool to win without any speed increase.

Cost that are incurred on poor wire: poor part finish, recast, loss of filter life, increased wear on guides, power feeds (carbides) and rollers, increased secondary operation times.

The savings from a reduction in these items are not included in the calculations.

Let's Get Technical

The structure of the recast layer in sinker edm work that is formed on steels consists mainly of iron carbides in acicular or globular form, distributed within an austenite matrix, which are independent of the composition of the base material and of the type of the electrode (Copper or Graphite). The increase in carbon content in the recast layer is intrinsically related to the pyrolysis products that follows the cracking of the dielectric and is very confined to the melted and resolidified work piece material forming the iron carbides. Due to the very high cooling gradient from the surface into the matrix material, the iron carbides are normally oriented perpendicularly to the surface.

The existence of cracks which start on the white layer and progress in the HAZ. The fundamental cause of cracking lies in the existence of the internal stresses which are created at the time of the machining operation. The surface crack density and the depth of these cracks are directly related to the machining conditions; the more we increase the discharge energy, the more the appearance frequency of these cracks increases. These types of cracking are due to very high temperature, and the phenomena of segregation to solidification, which is due to the enrichment in certain elements, as solidification progresses, and the internal stresses grow. The elements which have a harmful effect on steel and which increase its tendency to cracking are silicon, nickel, sulphur, phosphorus, and carbon. These are influenced by on time, off time and peak current. Lowering these will assist in crack reduction.

CONCLUSION:

The "W*" philosophy of always buy the lower price is costing you money.

Over 35 years, I have watched a number of companies "save" themselves right out of business.

We have a client that purchased another machine to handle their increased workload. They also buy the cheapest wire they can find. Had they just put a better wire on the existing machines, \$ 175,000 would still be in their pockets and they would have achieved the needed result.

Many feel their current wire is running OK. "You don't know what you don't know" really comes into play here. They put up with wire breaks, poor finishes and slow machines believing it is part of the edm process. It is not.

It's kind of like, I thought my bicycle was the greatest mode of transportation – until I got a car. You may think your wire is working well – but is it or have you just accepted the poor performance?? There is a big difference between value and price.

Call me, I will not sell you anything but let's talk about where your wire is coming from and what issues you don't need to deal with. It's about helping everyone to be competitive.

If you have any question, comments or suggestion; please let me know.

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