

Burnin' Large

Wire EDMing large and tall workpieces.

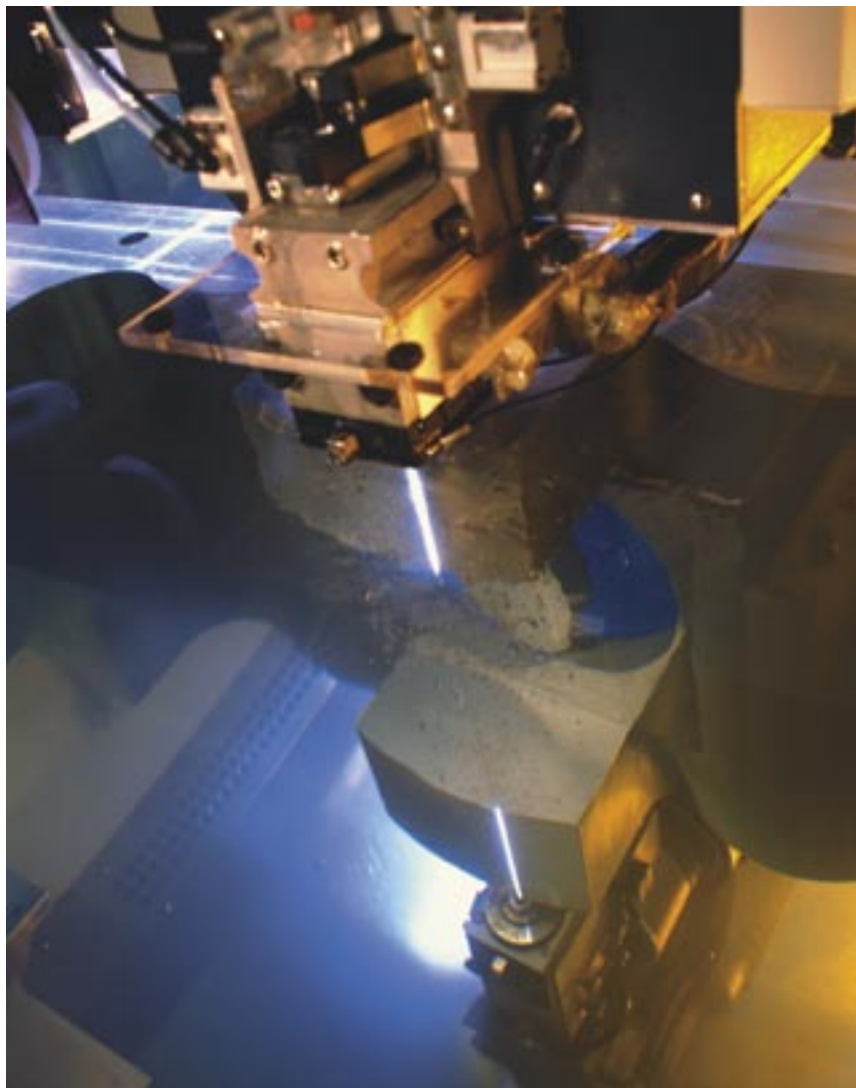
The wire EDMing of smaller and smaller parts is an area that's generating a great deal of interest, but the need for large parts hasn't disappeared. This article looks at WEDMing workpieces weighing several tons or more and measuring up to 42"×30"×20" or larger.

In addition to landing the job, the first requirement for a shop WEDMing large and tall workpieces is having a machine big enough to handle them. All major WEDM builders offer large-part machines. For example, the Model AQ750L from Sodick Inc. has X-, Y- and Z-axis travels of 30"×20"×16", respectively, to handle workpieces measuring up to 42"×30"×16" and weighing up to 3,300 lbs. In addition, the WEDM has 30"×2" U×V-axis travel.

"A large U×V travel lets you cut a large taper angle in a thick workpiece," said P.J. Naughton, marketing manager for Sodick, Schaumburg, Ill. "On the AQ750L machine, you cut a 30° taper at the full 16"."

In June, Charmilles, Lincolnshire, Ill., will introduce a WEDM for larger workpieces to the North American market. According to Gisbert Ledvon, the company's marketing manager, with X- and Y-axis travels of 31.5"×21.7" and a programmable Z-axis travel from 0" to just under 20", the Robofil 640cc can cut workpieces measuring up to 51.2"×39.4"×19.7" and weighing more than 6,600 lbs. The machine's U×V-axis travel is 31.5"×21.7". "You can cut a 30° taper all the way to 20"," Ledvon said.

Comparable in size to the 640cc is Makino Inc.'s U86, with axis travels of 31.5" in X, 23.6" in Y and 19.7" in Z. "The maximum part size you could



Makino

fit inside the U86 would basically be its table size of 48"×35.8"," said Jeff Kiszonas, the Mason, Ohio-based machine builder's EDM product manager. He added that the recommended maximum workpiece thickness is 19.6" and the maximum weight is 6,600 lbs. "The machine itself weighs in excess of 21,000 lbs.," Kiszonas said. "It's got a massive casting system."

Pushing the size envelope is AccuteX EDM, Dayton, Ohio, a newly

formed importer of wire and sinker EDMs and drillers. Its AU-3000i WEDM has a standard Z-axis travel of 20" (30" is optional), a Y-axis travel of 29", an X-axis travel of 118" and a U×V-axis travel of ±6". "It is the largest wire machine built in the world today," boasted Charlie Quillen, company president.

Of course, the bigger the workpiece a WEDM is able to handle, the higher the cost. "The larger the travel,

the more expensive the machine is," Naughton said.

Get It Fixed

To effectively WEDM the big stuff, a machine with a fixed bed, or table, is essential. Like the name implies, the bed doesn't move. What's moving—in X and Y—is the lower arm.

"When talking about a heavy part, if you tried to put something like that on a compound table, you'd be kidding yourself. It's not going to happen," Quillen said. With a fixed table, "you're not trying to shift a massive weight and the amount of water that's in a tank all around, which occurs with a compound table."

Because the WEDMing of large and tall parts generates more debris compared to making small parts, it's also essential to have a properly sized system for filtering the water. "With a well-sized filtration system, your machine can run over the weekend," Ledvon said. "If your filtration system is only going to last 30, 40, 50 hours, you're going to be dead by Saturday night."

A fixed bed and properly sized filtration system are necessities, but a couple of options are available to assist large-part WEDMing. A larger wire spool is a common and important option, especially when running unattended. "Standard is an 11-lb. spool,



Charmilles

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which most everybody runs with," said Brian Pfluger, a WEDM application engineer at Makino. "You can put a 44-lb. wire spool on the machine, so you change the spool less frequently. When you run bigger work, you'll run at least a 22-lb. spool."

For the biggest parts, AccuteX EDM offers a 100-lb. spool unit that sits beside the machine. "That would definitely let you run over the weekend—or even for a week," Quillen said.

Kiszonas noted that Makino offers a power booster for doing big WEDM work, which is often used when vaporizing with a coated 0.012"-dia. wire. "That wire is specifically designed to take the added power," he said. "You can probably get a 20 to 30 percent reduction in cycle time, depending on the application."

Tall Tales

As workpiece thickness increases, so does the level of machining difficulty. "When you EDM tall parts, you have to have more tension on the wire," Quillen noted. "Maybe you're cutting a 15"-tall part and, say, 2,200 grams of tension might work fine. Now, when you take that part to 24", 2,200 grams is not going to do it."

Therefore, it's important that an EDM is capable of providing enough tension to avoid frequent wire break-

age and machining a "tremendous" bow, or belly, into the part. "Probably 2,500 to 2,800 grams is about as far as the majority of the machines go," he said, noting that the AU-3000i provides up to 2,800 grams of tension.

Having adequate flushing pressure to clear debris out of the gap is also necessary when EDMing tall parts. Quillen recommends a high-pressure pump, in the neighborhood of 350 psi, for a WEDM capable of cutting 24"- to 26"-tall parts.

Another challenge when WEDMing tall parts is threading the wire. "We have successfully threaded up to 20" tall using an automatic threading system," Quillen recounted. "I don't know if we're going to be able to automatically thread at 30" tall. There's a good chance for the real tall parts of having to do it manually."

Although special machines and retrofits are typically not found in a WEDM builder's lexicon, builders, and sometimes end users, are able to modify the machine by adding a Z-axis extension and burn thicker workpieces than the standard allows. "There was a customer in California who did a 40"- or 48"-high extension on his own for a unique application," Ledvon said. "Obviously, the more modular the machine tool, the more flexibility the end user has to modify it himself."

The following companies contributed to this report:

AccuteX EDM

(937) 463-7645
www.accutexedm.com

Charmilles

(847) 913-5300
www.charmillesus.com

Makino Inc.

(513) 573-7200
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Sodick Inc.

(847) 310-9000
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Turn and burn

When wire EDMing, some consider “turn and burn” to be cutting a shape in the workpiece and then indexing it before cutting another shape. However, “the way I understand turn and burn is turning the part while EDMing,” said Gisbert Ledvon, marketing manager for Charmilles Corp.

To perform the latter, the WEDM combines a servo-controlled B-axis with a wire cutting in the X and Y axes. This enables the EDMing of complex contours even in difficult-to-machine materials that might not be possible to do with conventional machining.

“You really can’t do a full 3-D part with a standard wire EDM,” Ledvon said. “An EDM can only do, let’s call it, a 2½-D part. But if this turn while burning is applied, you can create complex shapes.”

He gave as a simple example the production of a titanium screw for the medical industry. “While turning the round rod, the wire follows and creates that shape of the screw,” Ledvon said. —A. Richter

making the biggest parts and having the biggest equipment.”

Sometimes, though, the needed equipment isn’t readily available. “I’ve been to a couple shops in Canada where they’ve actually built their own EDMs, because they didn’t find, on the open market, machines that would fit their specific needs,” said Kiszonas. “There’re not many like that, but there’s a couple.” △

Of course, requests from customers can add customization to an EDM builder’s vocabulary. Ledvon noted that Agie Charmilles has a product department in Europe that builds special doors and tanks, integrates B axes into controls (see sidebar, page 69) and adds robots and other automation equipment. “We have the capability,” he said, “specifically if we have a turnkey request. Lately, that seems to be something that is becoming more and more common. People want to find a complete solution.”

Nonsubmerged Flushing

Not all WEDMing of large and tall parts is performed in a submerged environment. Sometimes workpieces are too long, for example, to fit into the tank and have to extend out the opening in an enclosed, adaptive flushing machine. With such a system, one end of the workpiece is machined, then it is turned around and the other end is machined.

Ledvon explained that the enclosed work zone enables the work area to be temperature-controlled even though the workpiece isn’t submerged, because chilled water is continually splashed on it. The adaptive flushing control measures the contamination in the spark gap and determines the power requirements to achieve a good spark. Based on that information, the control regulates the flushing pressure.

“If you lose your flushing pressure, you don’t flush away the debris fast enough, so there’s a risk of contamination in the cutting zone, which would force the wire to break,” Ledvon said.

In addition, a good seal between

the upper and lower flushing nozzles and workpiece ensures optimal flushing pressure and cutting conditions. The nozzles contain a small rubber insert. During machining, the flushing pressure forces physical contact between the inserts and the workpiece, explained Pfluger. “Typically, those nozzles will be within 0.015” to 0.020” of the workpiece and the workpiece will be flat, top and bottom,” he said.

When the workpiece isn’t flat and the top or bottom nozzle doesn’t seal properly, the adaptive flushing control takes over, recognizing a flawed flushing condition and helping to speed the burn without sacrificing accuracy.

“Once you tell the machine what the part thickness is, what kind of flushing condition you have, what kind of wire you’re using—a handful of variables like that—the adaptive control reads all that information, picks the proper energy setting and applies that to the wire to get the best available cut for the conditions,” said Kiszonas.

Whether the final part is a large mold or die, an aerospace prototype or other huge part, once the appropriate equipment is in place and the right cutting conditions are established, an end user is set to begin. Granted, the universe of large-part WEDMing is limited, but it is a niche machine builders are wise not to ignore. “Even though it’s not a large market, it’s an important market,” said Naughton.

“You’ve got a small number of users in this country that are looking at huge machines in the wire EDM industry,” said Quillen. “Somebody looking for a machine that size probably has always made huge parts. He specializes in