



Cutting near-net shaped part blanks on OMAX waterjet machines helps reduce part costs at Milco because there's less raw material involved.

Waterjet Helps Specialty Shop Cut Out the Competition

As a combined specialty shop, Milco Wire EDM Inc./dba Milco Waterjet must turn jobs around within a week or it risks losing work to its competitors. That's because many of the shop's customers tend to place higher value on shorter delivery times as opposed to job cost. And while Milco started as an EDM shop in Huntington Beach, California, its founder and president Steven Miller realized early on the potential of abrasive waterjet cutting technology.

Abrasive waterjet cutting capability not only helps the shop meet tight delivery schedules, but also lowers part costs to stay well ahead of the competition in terms of customer value. Waterjet cutting saves material, speeds up production and provides processing versatility.

Miller acquired his first waterjet cutting machine in 1994, and according to him, Milco was the only shop in the Huntington Beach area with such capability for quite some time. The machine ran nonstop, which spurred the purchase of a second waterjet and a third to increase capacity. Since then, the shop has upgraded each of those original machines as they aged, but always maintained three waterjets within its part processing operations.

The niche combination of EDM (sinker and wire) and waterjet continued to grow new business for Milco. And in 2000, the shop moved to its larger current location – still in Huntington Beach – with over 15,000 square-feet of floor-

space. This was also the time when Miller consolidated the two companies into one.

From its start, Milco has always used abrasive waterjet machines from OMAX® Corporation and currently has three OMAX 55100 JetMachining® Centers. The newest was purchased in 2014, the others in 2000 and 1999.

The cantilever-style machines provide Milco ample table sizes of 10' 6" x 5' 5" and X-Y cutting travels of 8' 4" x 4' 7". The newest 55100 is equipped with an OMAX-engineered 50-hp, high-efficiency, direct-drive EnduroMAX® Pump and the company's Tilt-A-Jet® cutting head that virtually eliminates taper for Milco's straight cuts. The shop runs waterjet nozzle sizes of 0.015", 0.020", 0.030" and 0.042" among the three machines.

"OMAX's EnduroMAX pump allows us to low-pressure pierce materials without damaging or delaminating them," commented Miller. "This capability, along with the ability to use miniature nozzles with the pump, has opened up several new areas of opportunity for us. The pump has proved itself long enduring as far as maintenance and is much more energy efficient."

According to Chase Miller, Steven's son and Milco's waterjet supervisor and programmer, the shop maximizes its waterjet cutting output using a specific three-machine strategy.

One of the two older machines is equipped with the 0.042"-diameter nozzle that provides the fastest cutting speeds for the shop's thicker materials. The other seasoned machine has dual heads/nozzles that mirror each other and cut two parts simultaneously to double output for higher volume jobs. And for jobs requiring tighter tolerances, Milco runs those on its newest OMAX with the Tilt-A-Jet head that allows the shop to easily hold part sizes well within +/- 0.005".

Milco's key markets include the aerospace, medical, tool and die, defense and architectural industries. The shop processes parts from mostly stainless steel, aluminum and cold-rolled steel but also works with Inconel, titanium and niobium, as well as honeycombed materials produced on 3D printers.

Part sizes can range from a gear measuring 0.040" in diameter to 4' x 8' steel sheets 3"-thick and weighing up to 4,000 lbs. Thicknesses cut on the waterjet machines are between 0.002" to 6". We have cut 12" thick before and we never want to do that again because we had to modify the machine.

"In terms of part production, we quote about 50 jobs per week and typically win 65 percent of them. We ship eight or more finished jobs per day, five days a week," said Brianna McGowan, estimating assistant at Milco. "We operate two shifts per day/five days per week and employ 20 people, with 75 percent of them working out on the shop floor."

Job lot sizes range from one or two prototype quantities to those with over 2,000 pieces. Many jobs used to repeat within the course of one, two or three-year time periods, but just-in-time (JIT) manufacturing on the customer side has basically stopped all that for Milco. Now, the shop will quote



Milco speeds part production using "stack ups" – raw pieces of material cut on its OMAX waterjets, stacked together, tack welded in place, then wire EDMed from start holes also cut with on waterjet machines

a job for 500 pieces, then get a purchase order for only 20 or less at a time.

In these instances, Milco will purchase and stock the material, make and keep finished parts shelved. While this is often impossible for most job shops, Miller said that waterjet cutting helps reduce part costs to the point where the strategy is economically feasible. So instead of producing a dozen or so parts sporadically, the shop will set up and run hundreds at a time because doing so is much more cost effective.

Usually, half of all the jobs that come through the door at Milco are EDM (sinker and wire) work while the other half is waterjet. And of those being wire EDMed, over 35 percent can, when possible, also benefit from being processed using both wire EDM and waterjet together. In fact, Miller said that over the past year or so, the shop's abrasive waterjet machines have been getting a bit more of the incoming work than the EDM machines.

The majority of tandem wire-and-water work done at Milco involves waterjet cutting near-net-shape part blanks and what the shop calls "stackups." The shop also removes excess material on parts wherever possible prior to EDMing and other downstream operations as well as waterjet cuts part features for which wire EDMing would be overkill.

No matter what they cut, the OMAX abrasive waterjets at Milco do it faster and much more cost effectively as compared with EDM, pointed out Miller. Plus, the waterjets cut cool to eliminate any issues with heat-affected zones on workpiece surfaces.

"And while waterjet machine consumables can be bit more costly than those of a wire EDM," said Miller, "waterjets cut over 20 times faster than do the EDMs. For us, that fact justifies the higher consumables cost. Plus, our waterjets help open up wire EDM capacity so that we can take on additional higher-profit EDM jobs."

When Milco cuts part blanks from plate material on its OMAX machines, it eliminates the added cost of individu-



Steven Miller, founder and president of Milco, poses with his team and holding a part cut on an OMAX waterjet machine to re-create a photo used in one of his shop's first magazine advertisements.

ally cut pieces/billets along with the additional time and manpower spent to machine them down to near net size. Cutting near-net shaped part blanks on the abrasive waterjet machines also help further reduce part costs because there's less raw material involved.

For one customer in particular, Milco waterjet cut gear blanks, then EDMed the teeth profiles. Instead of purchasing individual 1" x 2" x 3" pieces of raw material for each gear, the shop "nested" the whole job within a single 1"-thick sheet of material and waterjet cut the blanks about 0.100" apart from one another.

In efforts to further shorten job turnaround times, Milco, whenever possible, stacks several pieces of raw material to then simultaneously wire EDM multiple parts in one setup. The shop used to saw cut the raw material, stack the pieces together, tack weld them in place, hole pop any necessary start holes for the EDM and mount them on the machine for cutting. However, the shop now waterjet cuts the raw material as opposed to sawing them, which speeds up the process and eliminates having to deburr all the pieces. And the abrasive waterjet cuts any required holes in each piece as well, so there is no risk of chips making their way between the pieces when drilling them stacked together and causing a short circuit during the wire-EDM process.

Two other Milco jobs where waterjet cutting helped reduce part cost involved large, flat aerospace ring gaskets and plate splines, both with 4"-diameter I.D. sections. Prior to incorporating waterjet cutting, the shop saw cut the part profile – except for the I.D. – and sent the parts out to be double-disk ground. It then wire EDMed the parts to size after they returned from grinding.

Now, one of the shop's OMAX abrasive waterjet machines cuts the I.D. sections prior to the double-disk-grinding operation. As a result, there is a lot less part surface, which significantly reduces the cost of grinding them. And, there is less necessary EDMing, so that helps lower part cost as well.

On its wire-EDMs, Milco runs wire diameters ranging from 0.004" up to 0.012" and will often use one of its OMAX's instead of the shop's hole poppers to create start holes. According to Miller, the abrasive waterjet can pierce a hole within one second, where a hole popper would take 30 seconds. This difference in speed, he pointed out, can be significant, especially when one considers that some of Milco's parts will require over 100 start holes. And while not as accurate as a hole popper, the waterjet can pierce holes down to only 0.020" in diameter and do so very quickly, he added.

"At every turn, we continue to find new ways that water-



OMAX Waterjet machines not only save raw material and speed production, they provide Milco the processing versatility that differentiates it from the competition.

jet cutting contributes to our competitiveness,” commented Miller. “I’ve stuck with OMAX waterjets because they have always been a better machine, especially when it comes to software. We have yet to see a waterjet company remain as far ahead of the curve as OMAX does when it comes to software. The company constantly develops new, easy-to-use and highly functional software that we can simply download from the OMAX website.”

Both McGowan and Miller’s son Chase rely on OMAX’s Intelli-MAX® Software Suite that makes it easy to open a CAD file, manipulate it and identify a length of contour on a flat surface pattern. The shop does all its waterjet programming offline, and while Chase does the bulk of it, both he and McGowan are comfortable programming with the OMAX Intelli-CAM™ software that’s part of Intelli-MAX.

With its 3D to 2D conversion system, Intelli-CAM generates a machine-ready cutting geometry through a few simple computer mouse clicks. The software operates as a standalone application or in tandem with several of the popular third-party 3D CAD systems.

“We use Intelli-CAM in concert with Solidworks,” said Chase Miller. “I’ll open the job in Solidworks and evaluate and check the scaling of the design. Then, I can easily transport a 3D model into a 2D cut path for the waterjet machines.”

For Milco, EDM and abrasive waterjet cutting operations may be separate in the company name, but they couldn’t be any closer together when it comes to contributing to efficient part production. And while many shops are either an “EDM shop” or a “waterjet shop,” Milco reaps the benefits of having the processing power of both wire and water that keeps the shop ahead of the competition.

Clean, Cool Waterjet Cutting

Milco Wire EDM Inc./Milco Waterjet, LLC swears by its reverse osmosis (RO) system and chillers for its OMAX JetMachining® Centers. The systems keep the abrasive waterjet cutting machines operating at peak performance while also extending the life of gaskets, seals and other such consumable components involved with the process.

An RO system removes impurities and particles larger than .001 microns. But according to Milco founder and company president Steven Miller, shops should properly filter and/or soften source water – especially if extremely hard – before it enters the RO system and shortens the working life of its membrane.

Removing solids and minerals from hard water prolongs the life of the RO system and, in turn, those of the waterjet machine pump seals and gaskets. Plus, the shop’s EDMs benefit from the same RO-system-treated water to extend the life of deionization resins.

“In our RO system, we ran a set of membranes for five years,” said Miller. “Without softening, their working lives would have been cut in half, and in some instances, the cost of replacing membranes can be as high as a couple thousand dollars. However, there does need to be a certain parts-per-million balance of solids and minerals in the water used. So for that, we have a water company routinely test our source water and change the RO system filters accordingly. We also have digital readouts on the system where we can get a quick visual of the hardness levels.”

In addition to RO systems, Milco employs chillers that maintain cool water temperatures to further increase the lives of the shop’s abrasive waterjet machine pump seals. Instead of only 20 or 30 hours prior to the chiller, Milco now gets about 1,000 hours of run time from its pump seals.

“When we first got into waterjet cutting, we really worked the machines/pumps. They typically ran 12 hours at a time, in the cut and non-stop, so the water really heated up,” said Miller. “This shortened the life of the pump seals, and with that said, it was nothing out of the ordinary to have a pump down after 20 or so hours. After this scenario replayed a few times, we realized the key was cooling the water if we were going to run in such a fashion.”