

Manufacturer Cuts Number of Setups from 4 to 1 using Mazak's Integrex Multi-Tasking System

Custom Machining Services, a manufacturer serving a variety of industries, realized it needed to increase production levels by expanding its milling and turning capabilities. Always on the lookout for technology to support the company's philosophy of machining parts with fewer labor-hours, this Valparaiso, IN company turned to a multi-tasking machining solution.

That solution was the Integrex 30Y and the Integrex 200Y from Mazak [Florence, KY]. This unique line of multi-tasking machines combines the advantages of a horizontal milling machine with a turning center. With the installation of the two systems, Custom Machining obtained its objective of fewer labor-hours through fewer setups and less work-in-progress. Additionally, the faster machining time and capabilities of the systems enabled Custom Machine to cut machining cycle times on some of its products by over 40 percent.

Unique Parts Manufacturer

Custom Machining Services is a manufacturer of unique products, including after-market automotive pump bodies, centrifuge replacement parts, magnetizing fixtures for soft-coupled drive shafts, and dairy centrifuges. The company also manufactures a line of crimping machines and specialty racing parts.

Its role as a manufacturer represents 85 percent of its operations. Only 15 percent of its total machining operations support job-shop activities.

The company maintains a philosophy of applying technology to its low-volume production operations to produce the same number of parts using fewer labor-hours. This approach has enabled Custom Machining to triple its product sales over the past 10 years without adding to its workforce.

Multiple Setups Too Slow

Many of the products machined at Custom Machining are multi-faceted, prismatic parts. Typically, each face on these parts requires a combination of turning, milling, drilling and tapping. Typically holes must be drilled and tapped at a variety of angles into the faces of these parts.

While the previous in-house machining systems were able to produce quality parts, they required extensive setups and handling to enable cutting tools to access all part sides. Company management decided it needed to produce these prismatic parts more efficiently through faster machining and by reducing the number of setups needed to machine each part. "We needed a new technology that could machine these parts, but with less labor-hours," explains Joe Intagliata, co-owner of Custom Machining. "We needed to find a machine that could perform more machining tasks per setup. By accomplishing this, we would be able to increase overall production volume on many of our parts."

After-market automotive pump bodies exemplify the multi-faceted parts machined at Custom Machining. "The original automotive pump bodies are made of aluminum, but those crack in service. We have redesigned the bodies using steel to provide a better after-market product," says Intagliata.

Custom would begin with a 4" high, 6" diameter slug of steel, which would first be turned on a lathe to reduce its diameter to a specified size. The part would then be transferred to a mill to receive pocket milling and the milling, drilling, and threading of four mounting holes and two ports.

The routine used to cut and thread the different holes were the same for each face. For the first hole, the procedure required the use of a center drill and a drill, followed by a threading tool. Using a special fixture, the milling machine operator would then reposition the part at the correct location and angle for the cutting tools to access the part and create the next hole.

Excluding the time it took to load the part into the fixture and perform the different setups, actual cutting times on the lathe and the mill totaled 90 minutes. When setting customer delivery dates, Custom had to take into account not only these times but also the periods when the part was considered work-in-progress and awaiting transfer from the lathe to the mill.

Mazak Solution and Why

Intagliata had considered installing an indexing head in one of his mills to increase its capabilities, and thus its productivity, but found that the results would still be unsatisfactory. While an indexer added to a current mill might simplify some setups, it still did not offer significant reductions in the number of setups or total machine-cutting times. "I had considered a mill with an integral indexing head, but none of the available milling machines come with an integrated indexer," he said.

Already experienced with the successful implementation of lathe technology from Mazak, Intagliata called Mazak to satisfy Custom Machining's latest need to increase capacity and capabilities.

Intrigued by the capabilities of that machine-tool supplier's line of multi-tasking systems, Custom Machining installed an Integrex 30Y. Just five months later, the success of that installation in decreasing setups and machining times resulted in the addition of another Integrex with a larger chuck and Y-axis travel. That later addition was the Integrex 200Y.

It only took a couple of days after the installation of these multi-tasking machines for Intagliata to discover he no longer needed to use a special fixture. According to Intagliata, "On this system, all we have to do is insert the rough piece of stock into the chuck. That's all - the machine performs all the machining tasks required to completely machine the pump body."

Now, with only one setup to complete the part, Intagliata has dramatically reduced the total machining time and overall production time for these steel pump bodies. "This part used to require two separate machines and four setups. Today, that same part is completed by one machine using just one setup and one operator."

The total cycle time for the pump body, including part positioning by the system control and all tool changes for face milling, hole drilling and threading, is now only 50 minutes. That represents an impressive 44 percent machining cycle-time reduction over the previous method of 90 minutes.

“The methods we applied before installing the multi-tasking system were capable with the equipment we had on hand, but this multi-tasking system is simply more efficient,” says Intagliata. “Also, the other machines aren’t as fast. Rapid travel on the Integrex is just that: rapid. That makes a big difference in cycle times.”

Unique Features

The multi-tasking capabilities of the Integrex line come from its design. Combining the advantages of a milling machine and a turning center, this line features high-velocity rapid travel, part rotation, tool rotation, automatic tool changing, tailstock support, synchronized tapping and Mazatrol or EIA/ISO programming. The same short-taper shank toolholder accommodates all the turning, milling, drilling and tapping tools to simplify tool handling requirements on the system. Integrex 200Y rapid traverse rates in the X, Y, Z and C axes are 1,181, 590, 1,299 and 400 ipm, respectively.

The multi-axis movements possible on the Integrex 200Y make it a great solution for the machining of prismatic parts and cylindrical surfaces. The spindle head holds the chuck for C-axis turning. The turret is mounted on a slide, which provides for X and Z-axis movement while synchronous turret movement provides 5.5" travel in the Y axis. The turret itself has a 225° B-axis movement.

The unique addition of the Y-axis turret travel provides for off-center drilling and tapping as well as cross-cut milling. The B-axes movement of the turret allows users to machine inclined surfaces and oblique holes and perform precision contouring and helical milling. Maximum rotation speed of the milling tools is 10,000 rpm with 10 hp.

Very Fine Accuracy

When the pump body leaves the Integrex, the only operation remaining is to remove the flange section that was in the chuck. A quick cut on the bandsaw and Custom Machining has a symmetrical part.

“The Integrex is a pretty rigid machine,” says Intagliata. That rigidity provides Custom with excellent accuracy for mating parts. “Our operator mills a flat surface on some of the bearing housings we manufacture. The location tolerances off the Integrex match those of our mills. It surprised us just how nice a job the Integrex does. We hold the pump bodies to 0.002” on location and a couple tenths on the diameter. This means the mating parts for the pump body slip right into each other. The Integrex is a great milling machine.”

88 percent Reduction in Production Time

One job that tested many of the Integrex’s capabilities is a fixture designed for use in magnetizing components for soft-coupled magnetic-drive systems. “This product would have been a nightmare to do on any other machine,” claims Intagliata.

Ray Lewis, first-shift Integrex operator, concurs. “Without the Integrex, this part would have required six setups on a mill using an indexing head before being transferred to a lathe for the necessary turning operations,” he says.

The magnetizing fixture has nine components. Each component requires turning, face milling and the drilling and threading of several off-center holes. The result is a lengthy machining program. The ability of the tool magazine to hold 40 tools on the Integrex 200Y and 30Y proved to be beneficial in creating a relatively short total production time for this part.

According to Lewis, “This part requires 37 different tools to machine every feature. So when this job comes in, I load all the necessary tools into the Integrex, which can take some time. But, while it takes 3.5 hours to set up the system with those tools, I can knock out each of the parts in just one hour. I’ve calculated that, compared to doing this on a lathe and a mill, this multi-tasking system saves me up to half of a week of production time per fixture.”

Rather than incurring Lewis's estimate of a 35- or 40-hour production schedule to produce the fixture using a lathe and a mill, the multi-tasking solution incurs a combined 15-hour setup and machining time. That translates into a total production time reduction of 60 percent.

Programming a Breeze

The functions available on the Integrex Mazatrol PC Fusion 640 CNC makes Lewis's job easier. "Once the cutting operations are programmed into the control, I can verify the programs using the solid model mode on the Mazatrol control."

"This allows the operator to check the cutting tool path and the metal removal characteristics," explains Intagliata. Potential interference points appear in red, allowing the operator to fine-tune the program to maximum machining efficiency and trouble-free cutting.

The Mazatrol control is easy to learn and use. The Mazatrol provides programming functions using conversational English and clear graphics to step the operator through programming and machine operation. Built-in diagnostics alert the operator to any errors or machine problems, then walk the operator through correction procedures.

Taking full advantage of the milling and turning functions of the Integrex were not difficult for Lewis. He claims it is easier to use than a mill. "I came over to this machine from a mill and this is a lot easier. Programming the Integrex is similar to a mill in many ways. What makes this machine great is that it performs like a mill with lathe capabilities."

Built-in milling and turning functions in the Mazatrol with interactive programming make the Integrex easy to program. This allows users to avoid lengthy programming when using G code to mill pockets and faces and drill and tap holes. The result is a very user-friendly programmable controller.

Lewis's milling background proved beneficial on the Integrex. The machining of an industrial centrifuge required the drilling and tapping of a number of differently sized holes into a round cylindrical part.

The centrifuge is machined from 7" diameter 316 stainless-steel round stock. A 2" high section of this stock weighs in at 15 lbs. After machining, the 2" high centrifuge tips the scale at 7 lb.

To create the holes in this part took some milling expertise. According to Lewis, "Someone with a turning background might have used a 0.812" end mill and plunge the hole. A milling guy would consider using a ½" end mill and walking it around, then adjust the size of the walk all day long to create the right-sized hole. On a mill, I would have had to use both G and M coding to do this operation. On the Integrex, it is a simple end-milling operation."

Intagliata estimates that to have performed this job without the Integrex would have required two different machines, four setups and five operations. The total machining cycle times would have been 120 minutes. On the Integrex, the total cycle time is only 75 minutes and one setup.

Less Scrap, Increased Competitiveness

By eliminating the need for several setups to complete its prismatic parts, Custom Machining has obtained more than faster cycle times and fewer setups. "The fewer setups we have to do to complete a part means we have less scrap due to setup errors," says Intagliata.

The simple operation of the machines and their capabilities means a single operator can run both machines simultaneously. "Once a program is created, the Integrex systems are mistake-proof," says Intagliata. "It doesn't matter who is running the machine. As long as they make sure the tooling stays in shape they can't help but make good parts on the Integrex."

In the hands of skilled machinists, this system allows the machine programmers to experiment with many fixturing ideas to suit the company's machining requirements. "The Integrex allows me to be creative," says Lewis.

He points to a machined zinc-chromate treated cast iron part that will become the body of a crimping actuator that will be used to crimp airline fittings. "The 9.5" casting diameter means I run close to the chuck size of 10". To hold this awkward part in the chuck took some doing. We

designed and built a fixture that could handle the part's large size and its awkward center of gravity.”

“Being creative and doing this on the Integrex were key to making this job competitive for us,” adds Intagliata.

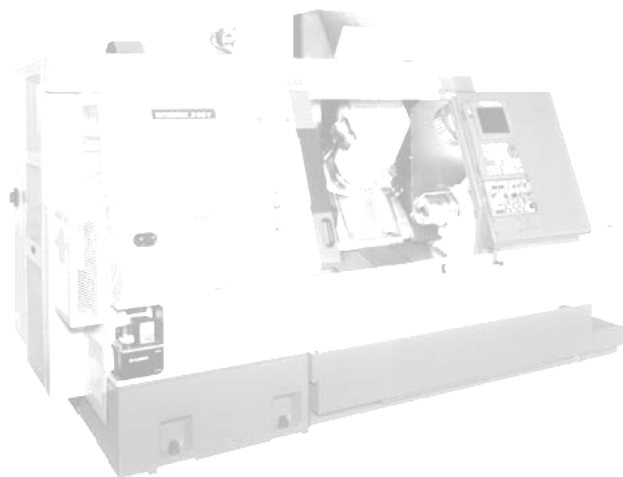
Another creative experiment may soon include the use of tombstone-type fixtures on the Integrex. According to Intagliata, “A tombstone-type fixture would allow us to simply rotate the tombstone using the chuck. The Integrex would then be able to machine a number of parts on each side of the fixture. By rotating the fixture a few degrees, we would be able to cut angled holes into the sides of the parts.”

According to Intagliata, the sky is the limit for Custom Machining since installing the Integrex machines. “We run as many jobs as we can on them. We wish we had more Integrexes. The more you do on these systems, the more things you think of to do on them. Some day, you will walk in here and see nothing but Integrex machines.”

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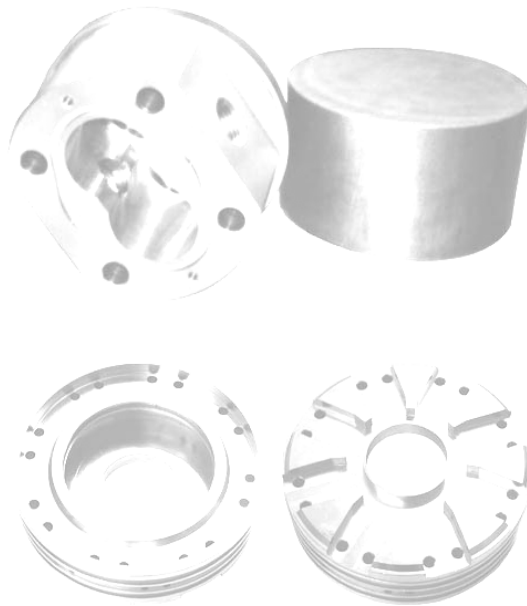
PhotoCaption 1:

Multi-Tasking Integrex 200 with multiple positioning B-axis for efficient milling and turning.



PhotoCaption 2a (top image):

The Integrex 200Y from Mazak turns, face mills, bores and thread mills the complex, multi-faceted features of this steel pump body in almost half the total time it would have taken on a lathe and a mill.



PhotoCaption 2b (bottom image):

Built-in milling and turning functions in the Mazatrol MT control made programming easy by eliminating the need to use G and M codes to turn and mill this industrial centrifuge. Machining time was 60% of that required to machine this 316 stainless steel part on a lathe and milling machine.