

Dana-Spicer's Multi-machine Palletech line replaces transfer line and allows flexibility for small and large lot sizes while maximizing spindle uptime

Manufacturing parts for unique off-road vehicles can pose unusual problems. For instance, the parts are low volume, complex and at times huge. These vehicles carry hundreds of tons of coal in mining operations; others tow 747 planes on tarmacs, while some carry golfers around courses. But they all have one thing in common, they all need drive train components manufactured in low volumes.

For Dana Spicer (Plymouth, MN) it's an opportunity. One they've been taking advantage of for years. They've made it an important niche in their business by supplying the broadest line of axles, transaxles and powershift transmissions in the industry. Dana has even dedicated an entire group of five divisions to meet the wide-ranging and special needs of off-highway vehicles. Beyond supplying components for these types of vehicles, Dana is also a Tier One supplier to the automotive industry.

To deliver short-run components on a Just-In-Time (JIT) basis to its various assembly plants requires flexibility. The challenges Dana faces to achieve this flexibility include: loading parts in machine tools for cutting when needed; moving parts around when others take priority; and to complete the entire cutting sequence with usually one setup and on one machine.

Dana Manufacturing Engineer Steve Little is faced with these challenges daily. At one time, Dana used transfer lines to solve them. Little said that transfer lines presented their own problems such as large capital expenditures, inflexibility when a new axle design was needed, and the inability to cost effectively do short-run production. "In fact we had 14 transfer lines to make one housing," he added.

"With transfer lines," Little said, "we couldn't do some of the components that we do today. The steps needed to setup the machine from a cost standpoint would have just been unbelievable, and wouldn't have been cost effective."

Flexible Manufacturing – Providing a solution

Little said that they solved the problem with a modular-designed flexible manufacturing system (FMS). The first CNC machine they purchased was a Mazak H-15 horizontal machining center with 15 pallets in 1985. Little added, "Seven years later we added on another machine and another 15 pallets and at the time we worried about the compatibility since so much time had gone by. But the integration of the two machines went smoothly. Then, 3 years after that, we added on another machine and

another 15 pallets with a load station. At that time we also updated the computer for controlling the load stations and the machines. A year after that we added on one more machine and another 15 pallets. We ended up with 4 machines and 60 pallets and it can still be expanded.”

The last machines bought for this FMS were Mazak Ultra 650 horizontal machining centers. Because of room constraints, this FMS uses pallets that are stored in a three-tier automated storage and retrieval system.

Then Dana added a Mazak Pallettech system using two H-1000 horizontal machining centers and 10 pallets with one load/unload station. These last two machining centers replaced 14 standard CNC machines. But because of their round-the-clock-spindle usage, precision, and flexibility in automatically moving parts in and out on pallets, Little said “in reality they could easily replace 20 or 30 machines.

“Now we have the flexibility to do one part, 10 parts or 100 parts. Our average run is between one and 100 parts cutting some steel but primarily ductile cast iron. However, it is basically whatever assembly requires. The schedule changes daily. You might run five parts one day and within a week you might run the same five parts again.”

When asked about the expense of fixture costs for the Pallettech system, Little said, “in any instance the fixturing has to be amortized over the length of the job. Even if the parts were being done on a manual machine tool, a fixture would still be required. So fixtures are just part of the job cost.”

For one customer they designed a sophisticated and unique fixture that could rotate an axle housing along its axis infinitely within 97 degrees of movement and machine it in one setup. Without this type of fixture, precision and quality could be compromised because it would have taken multiple setups to machine it.

The two Mazak H-1000s primarily machine axle housings because of their large table size (39.3” X 39.3”). Little added that they purchased these machines because of the success of the early Mazak FMS and they needed greater capacity. He commented that the H-1000 has a cycle time that is 30% faster than the machines they replaced.

Little remarked that with the Pallettech system, there is no machining interruption because part setup is done outside of the machine. For successive parts, they just mount the part in the fixture, input the program and tell the Pallettech where the part is located in the system. He added that “changeover from one customer’s part to another used to be a big endeavor, but not anymore, which really helps our scheduling. If they need one part, they can get one part. The Pallettech has relieved all our set up worries.”

He also said that quality has improved because of the Pallettech being able to do the entire cutting in one setup instead of several. Without the Pallettech system, these large heavy parts had to be sent to the quality control department for checking which has now been eliminated. “Just sending such a large part to quality control and having it checked could take over an hour,” Little added.

Programming for the parts are done on the machine's CNC controller. Little commented that the Mazak CNC controllers are very easy to program. Asked about the cost effectiveness of programming just one part, Little replied, "It is easier to program one part and get it right the first time than to do it manually and hope the machining is accurate. The nice thing about the Pallettech system is the fact that if the part comes up again the program is saved and ready to use."

Why Mazak

Little said, "Before we purchased a Pallettech system, we checked all the machine tool manufacturers and the difference was the productivity and value. Mazak was the logical choice."

And this has been confirmed for Dana through the years. Little added, "Most machines, on an average, should offer about 7 years of productive use. And 7 years is based on a 10-hour day. We were putting that kind of time on the Mazak machines in 3 years or less, because we worked seven days a week, 24-hours a day. Our first Mazak machine has 15 years on it. But that is really saying that we've used it a minimum of 25 years. And it has been great and is still going strong. We just schedule downtime for maintenance."

Little added that their H-1000 HMCs were modified to have their Y axis stretched to 78" that is comparable to Mazak's larger H-1250 model machines. They have a large pallet size of (49.2" X 49.2") that allows them to produce very large parts. The H-1000 is equipped with a 4000-RPM, 40 horsepower spindle and up to 120-tool storage capacity.

With the increased demand for off-road vehicles and Dana filling this niche with precision parts, Dana will expand the Mazak Pallettech Systems to meet manufacturing capacity when needed Little said.