In 1997, an automotive manufacturer approached metal stamper Kapco Inc., Grafton, WI, with a job requiring seven different operations and a production rate of 37,300 parts per week, each measuring 17.5 in. long by 4 in. wide and 0.95 in. thick. To handle the new business, Kapco added six presses tended by seven material-handling robots, and built a new facility to house the operation. The one-of-a-kind production line, up and running in late 1998, has catapulted Kapco into a new arena of growth, capability and profit-generating capacity, according to company officials.

The Tier-Two/Tier-Three supplier manufactures component pieces for the automotive, lawn-and-garden, electric-motor, health-and-fitness, construction-equipment and heavy-truck markets. Its one-stop shopping solution covers everything from stampage to drilling, tapping, fabricating, welding, painting and decorative coating.

Kapco’s partnership with Aida Dayton Technologies Corp., Dayton, OH, for the presses and Motoman Inc., West Carrollton, OH, for the robots was key to eliminating the obstacles this job presented, according to Kapco’s Tom Kacmarcik Jr., president of manufacturing. And those obstacles were many.

“Our company has never turned down a job, no matter how big the challenge,” he says. “Our first step was to find the most economical way to make the line productive. To do that, we needed six presses and we initially considered adding extra presses to run the line. But we soon found that even if we added 14 operators and ran two shifts a day, we were still 3000 parts short of what the customer needed. We also realized we didn’t have the floor space to house the job.” Kapco turned its obstacles into an opportunity and broke ground for a new state-of-the-art 83,000-sq.-ft. manufacturing facility (see sidebar).

The next step was to find a press manufacturer that could provide six presses for the new facility. To do that, we installed some finished-goods boxes and added conveyors with dividers. When one container is filled with material, a conveyor diverter shifts the pieces off to another container. The press can keep going, giving the operator plenty of time to take the full container out and bring an empty one in. We just swap the containers in and out. For a job-shop stamper, that is a great problem to have.”

New Equipment Receives New Home

The 83,000-sq.-ft. facility that Kapco built in Grafton, WI, to house its new automated press line was the latest in many efforts by the company to increase space. Over the years, Kapco outgrew its original 62,000-sq.-ft. facility, also in Grafton. The company could not find additional space in that area, so it housed three presses at a new location in Slinger, WI, about 30 minutes west of Grafton. But as equipment was added, the company found it still needed space. In Jackson, WI, midway between Grafton and Slinger, the company opened a warehouse to store the product. When Kapco was awarded an automotive job that necessitated the automated press line, the company set out to build a new plant.

“Neither one of the current facilities could take on this job as no floor space was available,” explains Tom Kacmarcik Jr., Kapco president of manufacturing. “So when this new, 83,000-sq.-ft. facility opened, we closed the Grafton and Slinger locations and the company set out to build a new plant.”

Automated Line Pays Dividends

The addition of six presses and seven robots allows Kapco Inc. to tackle a 37,300-part/week automotive job requiring seven separate forming operations.

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speeds required by Kapco also were a consideration.

With presses on order and a new facility near completion, Kapco was putting the pieces in place. But the company still had a manufacturing problem. The line ... 30 percent more time near the bottom of the stroke, holding pressure on the workplace longer, according to Aida officials. This minimizes springback by giving additional time for the workplace to set dimensionally.

Motoman officials determined that seven robots would be required to run the line and worked closely with Aida to ensure the robots would mesh with the operation of the presses. "A key issue was the capability to place the dies in exactly the same spot in the press each time they were used," Kacmarcik Jr. explains. "We were working with about 20 different dies so we determined that location holes for each of the dies would need to be drilled into the bolster of the presses. I didn't have the capability to do that in-house."

Aida provided a solution. The presses were crated and ready for shipment from Aida's Dayton, OH, location, but Aida offered to uncrate the presses, take the bolsters off and machine holes to Kapco specifications.

"Aida sent me bolster diagrams," says Kacmarcik Jr. "I marked them and Aida did the work. When the presses arrived at my plant, they were ready to be placed on the line. The accuracy they gave me was more than adequate. The type of bushing arrangements I chose allowed for us—when we actually modified the tooling—to make mistakes and still allow the tooling to work.

Based upon drawings supplied by Kapco, Aida installed bushings into the bolsters. Kapco then could use drop pins to place the dies onto the press bed in their correct locations. This reduced changeover time—a must for this job, according to Kacmarcik Jr.

If we completely change over the line, we have to change out all six dies and change the robot tooling," he says. "That now takes one operator only six hours to complete—changing out five presses and changing tooling on seven robots."

Working closely with Motoman, Aida modified its press controls to operate in concert with the robots. Also, flexibility to handle other jobs was designed into the robots.

We were responsible for the layout of the cell and positioning the equipment in the proper orientation as well as creating the programming that would allow the robots to inter-

**Automated Line**

Fig. 1—The slide motion of an Aida PMX link-motion drive as compared to a conventional mechanical crank press. With link motion, the press spends almost as much as 30 percent more time near the bottom of the stroke, holding pressure on the workplace longer, according to Aida officials. This minimizes springback by giving additional time for the workplace to set dimensionally.

Fig. 2—Hydraulic overload protection is said to protect die and press components beyond the level provided by conventional presses.
Automated Line

face with the control systems of the presses,” says Lyle Weaver, Motoman project manager. “Communication with Aida was a critical element in carry ing out these responsibilities,” Weaver adds. “They provided us with the footprint for each press as well as the mechanical and electrical specifications so that we could determine press clearances to properly lay out the cell. We also had to coordinate our delivery schedules to ensure that the robotic work cell arrived at about the same time as the presses.”

Flexibility is Key

“This line is not job-specific, like a transfer system might be,” stresses Kacmarcik Jr. “We can run each robot at each press as its own separate work center—they don’t have to be run in sequence. For example, we have one job where we run two totally different parts, and each part is presented on each of the presses and robot line. Their final operations actually occur in the middle of the line, then we convey the finished parts out the back of the two middle presses. Half the line runs one part, and half the line runs a second part. Then we can shut one side down for changeovers while the other side runs.”

One Allen-Bradley Slick 500 controller runs the whole line and each robot has its own controller for its unique tasks. The main Allen-Bradley controller monitors each of those controllers, making sure each robot has completed its program and checking sensors—installed in each robot’s grippers—to make sure each robot is handling a part correctly.

Kapco does not have an operator assigned to watch the control panel at all times. Instead, each morning an operator manually turns on all of the presses and robot controllers. Then the control panel takes over, allowing the operator to load and inspect parts, and move finished containers. If a problem occurs, the main controller houses troubleshooting logic, developed by Motoman, to help operators determine the cause.

Motoman also was required to design and build tools for the ends of the robotic arms. End-of-arm tooling on the robots include vacuum cups for flat blanks presented to the line, gripper fingers and mandrels specially designed by Motoman that allow pick-up through holes in the parts.

As Kapco worked to put the final pieces in place in late 1998 for the new press line, the line’s versatility surfaced.

“I discovered that by combining the speed of the presses with automation, I only would have to run the line three days a week to meet the parts requirement for the automotive job,” says Kacmarcik Jr. “I had to decide how to use the other two days of the work week. We added four additional parts to bring the robotic line to capacity.”

Die Maintenance

Cut by 70 Percent

“Two of the dies used for the automotive job are 120 in. long, 40 in. wide and weigh 17,000 lb each,” Kacmarcik stated.

Equipped with Aida’s Hydraulic Overload Protection system, the PMX’s slide connection is configured to operate as a high-speed valve, eliminating pressure relief valves and large hydraulic-flow systems found on older presses with wrist pin and saddle bushing connections (Fig. 2). As a result, die and press components are protected beyond the level provided by conventional presses.

“With every job we have used the PMX for, we’ve experienced at least a 100 percent increase in production and at least a 70 percent decrease in die maintenance,” Kacmarcik Jr. says. “Combining the presses with robots has improved our part quality by 200 percent.”

The Results

At Kapco, blanks enter the 600-ton progressive-die press, which makes two parts on each stroke, and does some partial shaping. A robot then picks up these parts from a tray, thus beginning the part’s journey through the robotic line, which consists of six operations on five presses—tended by seven robots—to create forms, holes and extrusions. From beginning to end, each part spends about 56 sec. in the line.

This marriage of presses and robots has given Kapco the capability and flexibility it needs to remain a major player in the automotive-stamping universe.

Information for this article was supplied by Aida-Dayton Technologies Corp., 7660 Center Point Blvd., Dayton, OH 45424-6380. Tel. 937/237-2382. Details also were supplied by Kapco Inc., 1000 Badger Circle, P.O. Box 227, Grafton, WI 53024-0227. Tel. 262/377-6500.