


Robots Tend to the Pressroom

A skilled workforce of 50 manages a pressroom staffed with 30 press-tending and resistance-welding robots to ensure that Inalfa Roof Systems, a stamping plant providing sunroof-preparation services, makes holes in roofs and not in its bottom line.

BY BRAD F. KUVIN, EDITOR

It's a unique relationship, that between an automotive OEM and a provider of sunroof systems. The stamper that receives OEM roof panels, and then cuts and forms the hole in the roof, acts as both customer and supplier, a very tricky location between rock and hard place. One such stamper is Inalfa Roof Systems LLC, Warren, MI, a specialist in sunroof-preparation metal-forming. The firm has invested millions of dollars in recent years, automating to stay competitive in what has become an increasingly competitive market as many OEMs look to bring roof-preparation stamping inhouse.

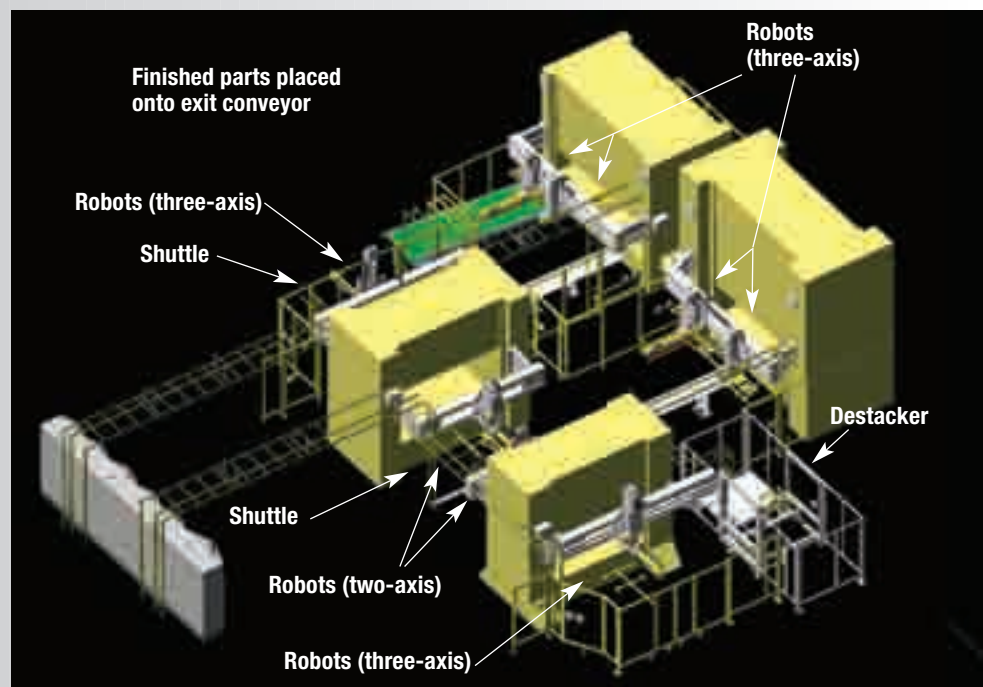
Inalfa's to-the-point strategy for

 *Editor's Note: To view a video of the robotic press-tending operations at Inalfa Roof Systems, as described in this article, please log on to www.metalforming-magazine.com and surf to our online Multimedia Center.*

A Pressroom Full of Robots



Cell 5



The main press bay at Inalfa Roof Systems (top) houses four robotic press cells—cells one, two and three process roof panels (as does cell four, located in an adjacent building), while cell five stamps roof reinforcements. Cell five (bottom), automated in mid-2005, houses four presses oriented in a zig-zag pattern that required a series of press-tending pick-and-place robots and between-press shuttles to move parts through a four-press four-die process.



Press-tending press-mounted robots (below) on the roof-reinforcement line move blanks in and out of presses as servo-actuated shuttles (left) convey stampings between presses.



staying in the game, as explained by Larry Wojciechowski, vice president of operations and general manager: Find ways to get better at what it does by building a smarter, more competitive workforce, slashing labor content and striving to minimize or eliminate rework.

“In our market,” Wojciechowski says, addressing the move to automate Inalfa’s press lines, “it’s not ‘Build it and they will come,’ it’s more like ‘If you don’t build it, they will go away.’”

The plant now boasts a trimmed-down workforce of 50 augmented by 30 press-tending and welding robots that work in five press cells totaling 15 mechanical stamping presses. Four of the cells work on roof panels, punching holes in the panels and preparing each opening to accept a reinforcement stamping that is formed in a fifth automated press cell.

The company prepares nearly 400,000 roofs per year, primarily for mid- to low-volume models—20,000 to 100,000 units annually per vehicle platform. In time, Wojciechowski expects the firm to focus primarily on

smaller annual-volume jobs in the 20,000 to 60,000 range, and that’s where he’s steering his production capabilities.

Roof Handling— a Job Not Fit for Man

Inalfa Roof Systems is part of Inalfa USA, which manufactures sunroof modules. In the last 10 years or so, the 100,000-sq.-ft. Warren plant, which includes a tightly packed 16,000-sq.-ft. bay where most of its press cells reside, has evolved and automated to where it requires only two to three operators per cell. Roof-preparation cells employ robots, all from Nachi Robotic Systems, Novi, MI, to load and unload the bulky and flimsy roof panels in and out of stamping presses, as well as weld reinforcement panels to the roofs.

In each roof-prep cell, the first press operation cuts the hole in the roof panel; the second press flanges down all four sides of the hole; the third press forms an offset on the cam flanges and puts a return flange on the rear flange. Then a robot takes the stamping to a holding station where an operator fits a

stamped reinforcement onto the panel and locks it into place underneath the back of the roof panel using the return flange. A robot then carries the roof assembly to a robotic resistance-welding station, for welding the reinforcement to the roof.

“Because we can count on the robots to place the material in the same place every cycle, without any dropping, dragging or banging,” says Wojciechowski, “we’ve significantly reduced our rework and scrap rates.”

Other measures are notably improved thanks, in part, to automation. “Ford, GM and Chrysler look for PPMs in the 80 to 100 range,” says Wojciechowski, “and we’re consistently at the low end of that range. Also, our plant efficiency continues to improve, measured in part by equipment uptime, which consistently exceeds 90 percent.”

Key to optimizing uptime is a well-trained conscientious workforce dedicated to quickly diagnosing downtime issues and working to keep the equipment—robots and presses—running as much as possible. Two years ago the firm made a breakthrough with its workforce when they agreed to combine two worker classifications—robot technician and die setter.

“The new classification,” shares

Pressroom Robots

Wojciechowski, “creates what we refer to as automation technicians. These people have combined cross-functional skill sets that allow them to keep our automated press cells running. They know how a tool should react in production, and also can adjust robot tooling to ensure that parts are properly oriented in the dies. They also perform preventive-maintenance tasks on fixtures and end-of-arm tooling to prepare for die changes.”

How to Automate a Zig-Zag Configuration

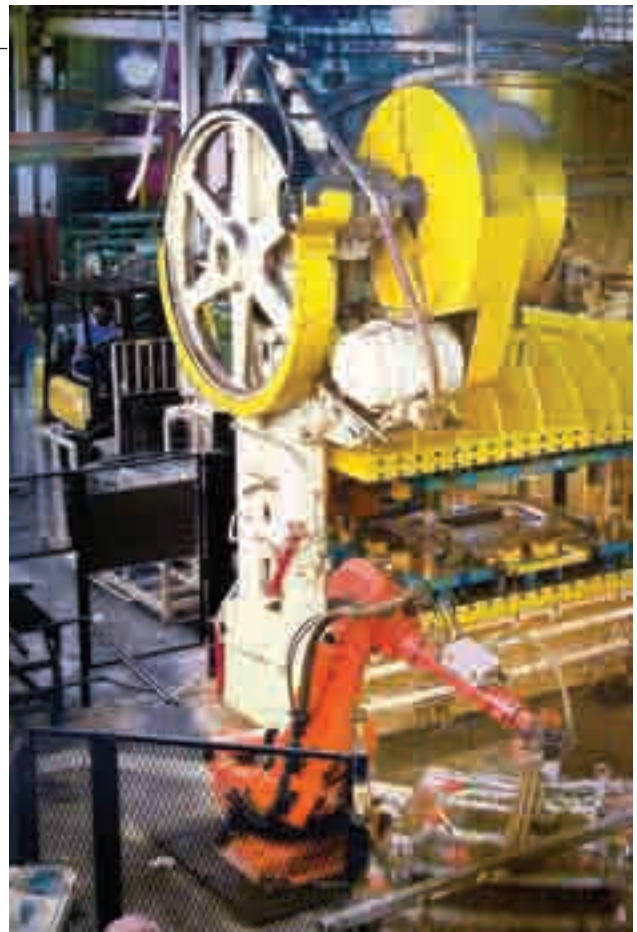
All four roof-preparation cells receive roof-reinforcement stampings from one four-press line that operates two shifts per day. In all, 11 different jobs run through the reinforcement line, automated just two years ago with impressive results.

The four presses comprising the line are arranged in a zig-zag pattern that once required operators to manually walk components from press to press. “Before automation,” says Wojciechowski, “operators had to bend over and reach into dies. They’d routinely request that we take them off of that line.”

Automating the reinforcement line proved particularly challenging because

floor-space limitations prevented the firm from rearranging the presses in a straight line, which would have made it relatively simple for a set of robots to move stampings from press to press. Instead, the firm searched for an automation solution that could pick and place stampings in and out of the presses and quickly cycle them through a series of 90-deg. turns among the presses. “Part orientation posed a huge challenge,” adds Wojciechowski.

To automate the reinforcement line, Inalfa turned, in 2005, to AP&T North America, Monroe, NC, which supplied several of its SpeedFeeder two- and three-axis press robots; its Shuttle SH units that move parts around the cell, from press to press; and a blank destacker. The line takes in blanks of 1-mm-thick cold-rolled steel ranging in size from 7 by 44 in. to 45 by 52 in. Four presses, each with SpeedFeeder units at the front and back to load and unload, run blanks through four separate operations—form, trim, restrike and then, in the fourth press, either a simple hole-piercing operation or in-die pierce-nut installation. Also, a stand at press three allows



One of four roof-preparation stamping lines at Inalfa. Each cell houses six robots: Three robots handle the roofs; one robot applies a sealant where the roof marries to the reinforcement; and two robots resistance-weld the assembly together.

some parts to be flipped as required, for pin insertion or to properly feed the press to favorably locate burrs on the sheetmetal.

AP&T’s SpeedFeeder robots mount to the presses to minimize floor-space requirements, and employ telescopic slides. Inalfa uses two-axis models with an x-axis range of 71 in. (in and out of the press) and vertical z-axis range of 15.7 in.; three-axis models have an added y-axis linear range of 181 in. Load capacity is 87.6 lb. The blank destacker, specifically designed for feeding blanks to fully automatic press lines, can handle blanks to 52-in. square, 0.02 to 0.08 in. thick, and in stacks to 15.7-in. weighing as much as 55 lb.

To tool-up the SpeedFeeder robots, Inalfa opted primarily for dedicated grippers for each set of stamping tools, a more costly option than flexible grippers but one that speeds die changes—it takes less time to install new grippers



These stamped roof-reinforcement assemblies resistance-weld to prepared roof panels.

than it does to manipulate adjustable grippers. It does, however, employ a few sets of swivel-mounted suction cups at the first press. After forming, robots wield magnetic end-of-arm tools. In all, eight sets of robotic tooling handle the 11 jobs running through the line. In contrast, robots in the four roof-preparation cells employ only the swivel-mounted suction cups, to optimize flexibility.

Press Upgrades Contribute to Productivity Push

Along with the new automation installed in 2005 came new press controls—Brake Sentry models from Rexcon Controls and Automation, Harrison Township, MI—and new tonnage monitors for each press—Loadguard Series 4 units from Helm Instrument Co., Maumee, OH. The cell upgrade also included new state-of-the-art safety

equipment, including fencing and interlocked access doors.

Sensors in the robotic tooling and in the shuttle fixtures keep the cell controller updated on the location of every part in the cell, as parts move around on shuttles at high speeds. The line produces 11 styles or sizes of reinforcements using eight different tool sets.

“We can change the line over in about 2 hours,” says Wojciechowski, “the big challenge being part orientation in the shuttle fixtures and in the presses. That’s probably 40 percent of our setup time, and affords us notable opportunities to improve our die-change times.”

Inalfa has the reinforcement line operating at a cycle time considerably quicker than the initial cycle time of a year ago, and is quickly closing in on its goal. “To get there, we’re looking at a few upgrades to help us shave tenths of a second here and there,” Wojciechowski says. For example, he’s looking at upgrading the shuttle gearboxes to increase speed by another 500 mm/sec. and acceleration by 20 percent. “But, we can only move so quickly,” he says, “and still ensure that we maintain a secure grip on the parts.”

Added Capacity Yields Growth Opportunities

Automating the reinforcement line, by nearly doubling throughput, freed up capacity for the cell, which has Wojciechowski busy looking for opportunities to fill that capacity. In particular, he’s after the stampings that the parent company outsources that go into its sunroof modules—glass rings, support beams and the like.

“Since the middle of last year, we’ve been bringing in new work that our parent company had been sourcing out,” he says, “and over last Christmas we launched a new die for them that will make 100,000 hits/yr. This new work for the parent company comprises some 10 percent of our work now, and it’s growing quickly. Eventually we hope to capture all of their sourced stampings, thanks to the press time we freed up by automating the reinforcement line.” **MF**