

Worthington Steelpac Steps up to the Emerging Steel Pallet Market

Kegs, barrels, wooden crates, and boxes were used in the very early days of packaging and the transportation of goods. The use of wooden skids and pallets, along with an ongoing evolution of lift trucks, began to enter the picture in the 1940s. Although slow to evolve in their design and utilization, it is difficult to imagine how any type of manufacturing or distribution industry could function today without the use of pallets and their working partner, the forklift or lift truck.

This increasing dependence on pallets over the years has resulted in changes in the design, development, structure and production of pallets. Recently, steel pallets have entered the market, proving more durable than wooden pallets, resulting in more turns per pallet. In addition, steel pallets are 100 percent recyclable and lighter weight than rackable wood pallets. Steel pallets are also weather and fire resistant and are compliant with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service regulations.

Worthington Steelpac, a division of Worthington Industries based in Columbus, Ohio, toyed with the idea that steel distribution pallets may be a good product to add to their manufacturing lines. According to Don Pulver, Vice President/General Manager of Worthington Steelpac in York, PA, they conducted product design and developmental research on steel pallets for five years. "This was followed by 18 months of durability testing with Wal-Mart, Clorox® and SC Johnson," he reports. "We then felt confident to proceed with this new product line."

Consulting with Genesis Systems Group, a robotic systems integrator in Davenport, Iowa, the two firms explored the feasibility of automating the steel pallet production. Gathering production and manufacturing process information from Worthington, Genesis Systems considered a number of issues when designing this automated system.

As with almost all robotic manufacturing applications, part consistency is critical. Building these steel pallets was no exception. The system needed to be designed to weld three different-sized galvanized steel pallets (48" x 40", 48" x 48" and 36" x 36"), so the size of the holes in the parts had to be the same for all three-pallet sizes, to ensure consistent alignment.

According to Chuck Keibler, vice president of Genesis Systems Group, there was a considerable amount of time spent redesigning Worthington's parts. "Using Variable Simulation Analysis (VSA), a commercial software tool for dimensionally testing and redesigning components, we were able to establish the design and tolerances necessary for the parts."

Part consistency was only one of the challenges addressed in the initial phase of the system design. Genesis Systems Group also introduced the use of FANUC's QuadARM robot, which incorporates four robots into a single cell. These four robots are controlled by one controller as described in the OP-40 step below.

Put into production in March 2008 at Worthington's York, PA facility, the newly designed operation consists of five turnkey welding systems set up to weld the steel pallets in progression. The operation uses four FANUC arc welding robots, five FANUC spot welding robots, and two FANUC material handling robots, all governed by FANUC's software. The sequence to produce the three different-sized pallets includes a five-stage build process (OP-10 through OP-50 described below) where the pallet deck boards and risers are added into the appropriate station as needed. Throughout the process, the tooling can automatically change for different pallet sizes via the operator panel. Each operation includes various sensors and protection systems to ensure the safety of the operators and the surrounding work areas.

OP-10

The first operation utilizes a custom Genesis Versa 3M-Heavy three-station dual robot spot welding work cell with two FANUC R2000 165k robots.

The upper deck boards and bumpers are spot welded at three weld stations, forming the platform for the top of the pallet. The Genesis Versa 3M-Heavy three station pneumatic 120-degree continuously indexing turntable supports the tooling for the parts. One operator manually loads all parts at one of the stations. The tooling holds the parts in the upside down position. The welding is completed at each of the next two stations and the part is cycled to the operator station where it is automatically lifted from the tool. The operator then pushes the part onto the conveyor to advance to the next system (OP20) where the parts are reloaded.

OP-20

The next process includes a second Genesis Versa 3M-Heavy three-station dual robot spot welding work cell with two FANUC R2000 165kg robots.

The subassembly and three upper deck support boards are spot welded at the two weld stations. This completes the top of the pallet, which continues to be assembled upside down.

When this welding is complete, the part indexes to the load/unload station where it is automatically lifted from the tool and the operator pushes the part onto the conveyer to advance to the next station (OP40). The operator then reloads this station and the cycle continues.

OP-30

At this system, the Genesis Versa 3M-Heavy single robot spot welding work cell uses one FANUC R2000i 165kg spot welder to weld the two lower deck width boards and three lower deck length boards at two weld stations to complete the bottom of the pallet. Assembly is still done upside down using a 180-degree indexing turntable.

After the welding is complete, the part is automatically lifted from the tool and pushed onto the conveyer by the operator. It progresses to OP50 where the upside-down pallet assembly continues.

OP-40

This phase uses one FANUC ArcMate 100iB and one ArcMate 120iB arc welding robots, in addition to two FANUC M16iB material handling robots. These four robots make up the FANUC QuadARM, which is controlled by a single controller.

The operator loads a variation of the standard Genesis Versa RCTL Center Mount pneumatic 180-degree indexing turntable work cell with the top sub-assembly from OP20 to be ready for loading and arc welding of the nine risers to the top pallet subassembly.

At this point, the table indexes the top subassembly to the robots for welding. The two material handling robots grab and locate the risers for the arc welding robots. As each of the nine risers are loaded, one of the arc welding robots welds the four welds on each riser except for the center riser where the two robots both complete two welds. One material handling robot loads four risers and the second loads five risers.

When this welding application is complete, the pallet returns to the operator station where it is automatically lifted from the tool. The operator then uses a crane to lift the part from the fixture to the conveyer, pushing it to the next operation (OP50).

OP-50

This final phase marries the OP-30 and OP-40 subassemblies together. Another variation of the Genesis Versa RCTL work cell welds the riser OP30 bottom subassembly to the risers on OP40. One FANUC ArcMate 100iB and ArcMate 120iB are part of this final operation. The completed pallet is now automatically lifted from the tool and placed on the conveyor.

Genesis Systems' Project Manager, Dan Schrock, reports that the Worthington system is able to run 750 parts a day on three shifts, expandable to 1500 units per day. "The unique and challenging aspects of this system were the use of FANUC's QuadARM arc welding and material handling package and dual arm spot welding package on a three-position continuously rotating turntable. But, with Genesis' expertise and FANUC's input we were able to make it work successfully."

Mark Scherler, senior engineer for FANUC, comments about the system. "This is one of the initial QuadARM systems purchased from FANUC Robotics. Genesis did a good job of applying our MultiARM software in a way to take advantage of the additional capability provided by this technology."

Just as robotic technology advances, the steel pallet market will certainly emerge over the years. As our economy and the world look to green environmental solutions to reduce waste and deforestation, recyclable steel pallets will become a powerful player in the shipping industry. As this market grows, Worthington Steelpac is well positioned to step up as a major provider and player in this industry.

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