TOPY Corporation and Kawasaki Robotics (USA), Inc. Palletizing Case Study

by John Weber and Jim Seebold

TOPY Corporation, located in Frankfort, Kentucky, manufacturers high quality steel and aluminum wheels for a variety of automotive manufacturers including General Motors, Ford, Honda, Isuzu, Nissan, Saturn, Subaru and Toyota.

In July of 2000, Kawasaki Robotics (USA), Inc. designed and installed a wheel palletizing system for TOPY's Paint Line #1 Wheel Palletizing operation.

In 2001, TOPY requested that Kawasaki supply a second robotic wheel palletizing system for their Paint Line #2 Wheel Palletizing operation. This system would replace 15 year old equipment and allow TOPY to keep up with their increased production capabilities. There was also concern about damage to the wheels due to manual handling and a desire to eliminate the possibility of worker injury that could occur due to the repetitive nature of the operation.

The existing wheel palletizing system required plant personnel to manually assemble pallets and transfer incoming 13–18 inch wheels, weighing up to 45 lbs., from conveyors to the pallets. Once the pallets were full, they were moved to a strapping station. The completed pallets were then moved out of the system for transport to the shipping area.

Kawasaki's goal was to design a fully automated robotic wheel palletizing system that increased productivity, decreased cost, decreased product damage, and eliminated the possibility of repetitive task injuries to personnel.

Kawasaki's project team TOPY lead engineer for the second system, John Weber, explains, "When designing the new system, we made enhancements to a number of components, based on the experience we gained from the Paint Line #1 system. We also redesigned all the wheel infeed equipment to handle wheels up to an 18 inch diameter."

Paint Line #2 system development started in April of 2001. System assembly on Kawasaki's shop floor started in May. Assembly and rough programming was completed for demonstration to the customer on June 25th and the system was disassembled and shipped to TOPY's Frankfurt, Kentucky facility June 30th.

Kawasaki installation support personnel arrived at the Frankfurt facility on July 1st to supervise the system installation. Installation and programming touch-ups were completed a week later and the system was ready for production at 8:00 AM on July 9th. Startup support continued through July. During that time, Kawasaki also provided system operation training to TOPY personnel. Customer support was needed to make minor programming changes—John Weber explains, "Since then, we've made a couple of minor customer requested programming changes that were easily handled over the phone or via e-mail."

At the heart of the Paint Line #2 Wheel Palletizing system are three high speed Kawasaki ZD130S palletizing robots. Robots #1 and #2 are wheel handling robots. Each is equipped with custom 3-jaw parallel pneumatic grippers that pick up the wheels—these grippers have interchangeable fingers or jaws. Robot #3 handles pallet trays and caps using a Kawasaki custom designed vacuum and pneumatic system. Collision sensors are used on all three robots. These collision sensors are installed between the robot's tool mounting flange and the end effector.

A custom pallet de-stacker is used in coordination with Omni Metalcraft conveyors and cross transfer units, with custom designed support framework throughout the system. Dunnage and wheel locating and feeding equipment are custom designed by Kawasaki. The cell control system is custom designed, using a Mitsubishi A2 series PLC with a color touch screen interface. All system pneumatic components are provided by SMC. The customer supplied band strapper is manufactured by ITW and integrated into the cell by Kawasaki. The robot risers and safety fencing are also custom designed by Kawasaki.

The pallet de-stacker feeds empty pallets onto an infeed conveyor. The conveyor system moves the empty pallets to the palletizing position. Tray stacks and cap stacks are also fed into the system by conveyors (trays on one conveyor and caps on another) to a position where they are destacked by robot #3.

Wheels are fed to the system via two conveyor systems, each with an escapement/kicker and centering station at the conveyor's entry position into the cell. The escapement/kicker ensures that only one wheel at a time is fed to the centering station. The centering station positions the wheel for pick up by robot #1 or #2.

When the pallet is in the palletizing position, robot #3 picks up a tray and places it on the empty pallet. When the wheels are in position at the centering stations, robot #1 picks up a wheel from one centering station and places it on the tray and robot #2 picks up a wheel from the other centering station and places it on the tray. When a layer is full, robot #3 picks up and places a tray on top of the first layer of wheels. This process is repeated until the specified number of layers is palletized. When the last layer of wheels has been palletized, robot #3 picks up and places a cap on top of the last layer of wheels.

The full pallet is moved out of the palletizing position via the conveyor system to the band strapping station. Two bands are strapped around the full pallet and the pallet moves out of the cell via an exit conveyor for pick up by a forklift and transport to a staging area or directly to trucks for shipment.

When asked how this system is unique, Project Manager Mark Niemiec responded, “There is no other system in the automotive wheel industry like this one!” The end effector on robot #3 is especially unique—it’s capable of handling trays and caps for six wheel sizes and empty pallets, without change over, using a combination of custom designed vacuum and pneumatic gripper tooling. System cycle time is only 3.4 seconds per wheel. The three robots are able to work in a small area with overlapping work zones, using zone clear signals. To accommodate the six wheel sizes, three sizes of wheel gripper fingers are used—changing them is simple and takes less than five minutes. The system also has a one-button system recovery function that automatically sends the robots to their home/start positions and resets the entire cell to restart from the beginning of the program. A restart can also be set to a particular layer and wheel number, so the system can restart from where it left off.■