Industrial Automation

# Maximizing Efficiency of Store-Friendly Pallets with Automated Mixed-Case Palletizing

System addresses the flexibility and specialized needs of the grocery, general merchandise, and food and beverage industries.

FEB 18

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Filed in: Feature, Robotics Features
Tagged: Distribution center, Mixed-case pallets, Amcap, Mixed-case palletizing

Dual robots building a pallet in AMCAP cell.

02.18.2010 — *Capable of building mixed-case pallets from an inventory of over 10,000 SKUs, the latest evolution in order assembly systems — Automated Mixed-Case Palletizing (AMCAP) — represents a paradigm shift in high SKU-count case palletizing.*

by Jim McMahon

Many high-throughput distribution centers face a growing logistics challenge – the need to prepare a wider variety of orders to ship and arrive on schedule and with a near zero tolerance of errors. Sometimes comprising thousands or tens-of-thousands of different stock-keeping unit (SKUs) and in an assortment of package styles, these items need to be stored, picked and stacked on pallets or roll cages ready for outbound transport with a very high level of efficiency to optimize labor usage and minimize operational costs. The product styles include boxes of all sizes, cans and jars in cardboard trays, open and closed cartons, beverages, bags and large, unstable tissue packages. The number of different SKUs with their varied packaging is growing continually, and is becoming increasingly difficult to handle with manual and conventional automated systems. Distribution centers are also experiencing a growing need to deliver these orders in more store-friendly formats to a diverse and expanding range of store configurations, yet within an environment of rising DC labor costs and stricter safety regulations.

One area of the DC supply chain that has recently experienced a quantum leap in efficiency is automated palletizing for handling a high volume of mixed-SKU cases. By utilizing sophisticated software and articulated, servo-driven robots that receive product in an automated sequence – when functioning as a sub-unit of a larger automated order assembly system – these automated palletizers are capable of rapidly building cube-optimized, virtually error-free, store-ready/aisle-ready pallets.

**Mixed-Case, High-SKU Automated Palletizing – an Evolution**

As early as the 1950's, conventional automated palletizers, which could process a single SKU continuously, came into use. By the late 1970's, robotics began to be employed to increase the flexibility of automated systems for singular SKU counts and different palletizing configurations. However, the cycle time was limited due to robot performance. With the introduction of servo-motors in the late 1980's, the speed and performance of single-SKU palletizing systems advanced considerably.

By the late 1990's, with the addition of improved software, mixed SKU palletizing systems – able to handle 350 to 400 SKU counts with limited package variety – began to appear in DCs. Equipped with articulated robots, these systems have proven valuable for DC operations, like beverage distributors, with a typical low-SKU-count product range.

The first versions of automated high-SKU, mixed-case palletizers become available to the logistics market about 2005. Equipped with four-, five- and six-axis robots and software with expanded capability, these highly-automated systems have begun a new evolution in volume-SKU, mixed-case palletizing.

Now, the latest generation of these systems currently being released provides greatly improved software and more versatile product gripping tools, capable of building a higher, more dense and more stable pallet than prior systems, with improvements in system speed, order accuracy and store-friendly flexibility. Extremely accurate, fast and reliable, the latest of these automated high-volume, mixed-case systems can access tens-of-thousands of SKUs and palletize more than 1,000 mixed cases per hour, averaging 130 different SKUs per pallet (1.2 cases of a particular SKU per pallet).

**New Paradigm in High-Rate, Mixed-Case Palletizing**

In order to process and palletize mixed cases at these high-speed rates with such high accuracy, product needs to be fed into the system in a sequenced format. This requires supporting an integrated-automation upstream solution consisting of delayering incoming single-SKU pallets, storage, picking and case buffering. The latest mixed-case palletizing units integrate with both high-speed, automated storage and retrieval systems (ASRS) and conventional pallet racking.

One of the most recent and technologically advanced high-SKU palletizing systems is Dematic's Automated Mixed-Case Palletizing (AMCAP). This system serves as an excellent example of state-of-the-art advancements within this rapidly evolving technology.

**Precisely Sequenced Pallet Builds**

The cycle starts with the DC's receipt of product, for example a trailer load of 22 pallets. Each pallet is entered into the DC's WMS which integrates with Dematic's WCS (warehouse control system), a control system for maximizing performance of order assembly systems. The WCS program has inherent functionality for running all aspects of the DC's order assembly, including delayering, storage, buffering and sequencing, picking, sortation and palletizing functions.

The in-coming pallets are typically stored in a high-bay warehouse storage system. Once stored, the DC's WMS releases the orders to Dematic's WCS. The WCS sorts the data based on store requirements (i.e. aisle position) and sends the pallet information to Dematic's PalletGenDirector software package. PalletGenDirector uses 16 different attributes of the product (length, width, height, weight, crushability, etc.) as well as the specific store requirements (i.e. aisle position) to determine the build sequence for each pallet.

These pallet builds can be assigned over multiple AMCAP units, and can be preplanned for a short lead-time before the build takes place. The pallets to be built can also be visualized in 3D before each build cycle.

Entire pallets are then automatically or manually delayered and conveyed to Dematic's high-speed MiniLoad and MultiShuttle buffering and sequencing systems where they are stored until needed at the palletizing cells.

**Optimized Efficiency in the Work Cell**

Each AMCAP cell (built on a mezzanine) is fed by two conveyors providing the sequenced cases, which are then aligned and oriented, and presented to two six-axis, servo-driven articulated arm robots for pick up. The two robots build each pallet cooperatively at a rate of greater than 1,000 mixed-SKU cases per hour.

One of the unique aspects of AMCAP is the multi-axis, end-of-arm-tool (EOAT) attached at the end of the robots' articulated arms. This universal tool can handle all standard types of packaging including boxes of various sizes, cardboard trays, open or closed cartons, bags and large unstable containers without stopping or changing tools. There is no use of pneumatic suction technology, enabling it to grip any type of packaging. The main emphasis of the gripper is on a fast, reliable grab, which will not damage packed items.

The products are conveyed into a stop location. The robot then approaches the product and precisely picks it up. The package is held in a stable, known position on the tool, so it can be moved rapidly to the proper position on the pallet. The combined dual-robotic cycle of feeding, grabbing and placing the cartons establishes the system's high throughputs.

Once stacking is complete, the pallet is lowered through the mezzanine floor with a lift, and as it is being lowered it is stretch wrapped for stability. The completely lowered pallet, now fully stretch wrapped, has a label applied to it as it comes out on the outbound conveyor. The system then directs the completed order pallet to an output spur for the assigned active trailer to be loaded.

Palletizing, however, continues even while the built pallet is being removed from the active build area, only a few seconds are lost in the transition. After the pallet continues down through the mezzanine, slider plates close to form a solid surface. The robots immediately begin stacking cases for the next layer on the next pallet that is being built on these slider plates. A new pallet is then raised by a lift up to the mezzanine level, the slider plates open and the cases are dropped onto the new pallet, and the robots continue. The transition from the slider plates to the pallet is done without slowing the robot's performance. This streamlined performance has been facilitated by the coordination between AMCAP's discrete functions – robots, conveyors, lift and slider plates.

**Cube- and Volume-Optimized Dispatch Units**

The computer-aided determination of the palletizing sequence also increases the pallet density. It builds cube- and volume-optimized pallets with a 90 percent-plus density, compared to the typical 70 to 80 percent density of manually-produced pallets. The software calculates the packaging contact surfaces and determines the layering of the individual packages, these are critical to producing a stable palletizing pattern.

Within the AMCAP system, stacking criteria is modified by a number of factors including case size and shape, crushability, stability factors, volume of cases per layer, number of layers, the layer pattern, and family group rules unique to stores, departments, aisles and aisle sections.

What starts out as 22 pallets when received into the DC, ends up being 20 pallets when exiting the AMCAP cells, partially because of the increased density, but also because the pallets are built to a seven-foot height which they are able to easily sustain because if the pallet's increased stability. This greater cube utilization reduces transportation volumes, improving cost efficiencies.

**A New Benchmark in Automated Palletizing**

With the emergence of high-rate, mixed-case palletizing, a new level of flexibility and efficiency above and beyond the capabilities of conventional automated and manual palletizing systems has been realized. Improved productivity at both the DC and the store, ability to deliver to multiple store formats, increased accuracy, reduced labor hours and minimized transport costs, are but some of the key benefits of this new breed of automated mixed-case palletizing.

It has enabled a truly system-wide order assembly capability which has now become a standardized option f high-throughput retail DCs that handle a high volume of SKUs. There is no question that this technology has set a new benchmark for improving the efficiency of DC operations.

**About Dematic Corporation**

Dematic provides logistics solutions that optimize material and information flow from receiving to shipping within the four walls of the factory, warehouse, or distribution center. These solutions, built around automated material handling technologies, process improvements, and software, are engineered to improve overall supply chain and business performance.

Dematic's integrated systems are supported by a seamless, one-source implementation capability that reduces time, cost, and risk. This is accomplished by owning and controlling data driven design services, real-time WMCS software, proven material flow technologies, and best in class engineering, project management, and life cycle support services. Dematic is dedicated to customer satisfaction and guarantees successful system performance.

For more information on Dematic's DC solutions, contact Lizbeth Tommy, Strategic Marketing, at Dematic Corporation; 507 Plymouth Ave., N.E., Grand Rapids, MI 49505; 616-913-6662; email lizbeth.tommy@dematic.com; http://www.dematic.us.

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