

OPTIMIZING EFFICIENCY IN DEEP STORAGE OF PALLETIZED LOADS



TABLE OF CONTENTS

Introduction2

Removing the Barriers to High-Density Storage in Brownfield Facilities.....3

PowerStore: The World's Leading Pallet Shuttle System.....3-4

PowerStore versus Crane-Based ASRS.....5-7

Cold-Storage Environments.....8

Ideal Solution.....8

INTRODUCTION

Shuttle storage and retrieval systems designed for deep-lane storage of high-volume palletized SKUs provide an attractive ROI for companies with small, medium and large storage needs. Fully-automated systems, such as PowerStore® from Swisslog, are highly configurable in size and shape, capable of integrating into existing brownfield or greenfield facilities with low ceiling heights to maximize density and efficiency within cold storage, beverage, packaged foods and consumer goods warehouses, and automotive production facilities.

Supply chain executives within the food and beverage, pharmaceutical and consumer products industries are faced with considerable challenges when balancing production runs, inventory volumes and delivery schedules. Warehouse managers are increasingly required to store more products in existing warehouses, to retrieve them faster for growing volumes of just-in-time orders to retail stores, make more efficient productive use of labor, reduce energy consumption and improve cost efficiencies. Inventory is costly. It requires facilities, labor, energy and equipment to manage it. If the manufacturer is warehousing items that require refrigeration or freezer storage – such as food, beverages or pharmaceuticals – costs can be amplified substantially.

"Food manufacturers are being saddled with having to maintain more inventory at the plant, as opposed to the retailer or the distribution center," said John Olakowski, Director Pallet Shuttle Sales, with Swisslog Warehouse and Distribution Solutions. "This has put considerable pressure on manufacturers to figure out ways to better utilize their warehouse space."

Warehouse managers are increasingly required to store more products in existing warehouses, to retrieve them faster for growing volumes of just-in-time orders to retail stores, make more efficient productive use of labor, reduce energy consumption and improve cost efficiencies.

Space utilization within production warehouses is at a premium, and they are consistently running out of space. Finished products are frequently stacked on floors and aisles, which contributes to increased fork truck accidents, spillage and damaged products, and lost and expired products – particularly troublesome in food and beverage, and pharmaceutical environments. The continuous increase in the cost of land, construction, labor and facilities has put a heightened demand on space utilization within these production warehouses. Consequently, manufacturers are more closely looking at their storage, and how they can more optimally balance their inventory against production and delivery.

REMOVING THE BARRIERS TO HIGH-DENSITY STORAGE IN BROWNFIELD FACILITIES

The majority of production warehouses operating in food and beverage, pharmaceutical and consumer products, however, have been limited in automated pallet-handling solutions because of their lower ceiling heights, in comparison to high-bay warehouses, which can accommodate crane-based automated storage and retrieval systems (AS/RS) to gain storage, throughput, labor and cost efficiencies.

These factors, along with increased volumes of product throughput, the inclination for longer production runs when feasible, and the addition of new product lines, is forcing an increasing number of manufacturers into utilizing 3PLs or renting outside space to store manufactured products. But this presents a new set of issues. Although most contemporary 3PLs run highly efficient operations, transporting pallets of product to off-site storage incurs rental costs, increased transportation costs, and loss of last-touch product control, which can increase product damage and returns.

But now, this scenario has taken a dramatic turnabout. A growing number of manufacturers are moving their high-volume, palletized SKUs away from single-deep and double-deep rack storage locations, away from floor staging, and to some degree away from remote warehousing sites. Instead, they are embracing recently-introduced, highly-automated, pallet deep-storage systems, which can provide sufficient density and flexibility to fit easily within existing low-ceiling-height brownfield facilities, and accommodate pallets from conventional racking, floor staging and much of their remote warehousing.

A growing number of manufacturers are moving their high-volume, palletized SKUs away from single-deep and double-deep rack storage locations, away from floor staging, and to some degree away from remote warehousing sites.

POWERSTORE: THE WORLD'S LEADING PALLET SHUTTLE SYSTEM



One such system is PowerStore®, from Swisslog Warehouse and Distribution Solutions. A robotic, carrier-based storage and retrieval system designed for deep storage of palletized loads, PowerStore adapts to any warehouse, regardless of size constraints, to retrofit existing space into a fully automated warehouse solution.

PowerStore enables warehouse operators to optimize for system flexibility, modularity and scalability. Existing warehouse space can accommodate the racking structure required, with no need for new construction.

The system delivers options in automated pallet storage that did not exist before. By providing a dynamic combination of high density and high throughput, it enables a high-performance, lean warehouse storage solution, designed to maximize capacity and throughput in any warehouse

POWERSTORE: THE WORLD'S LEADING PALLET SHUTTLE SYSTEM

condition. This is ideal for manufacturers and distributors, including those in the cold-storage food and beverage industries, whose operations demand flexible high-density storage for high-volume, limited-SKU counts.

PowerStore simultaneously uses automated storage and retrieval devices to transport pallets within the system's aisles and lanes, along with lifts and transfer stations to vertically move pallets between aisle levels. Palletized product is stored in highly dense rows – up to 20 pallets deep of the same SKUs.

The aisle carriers, traveling at speeds up to 10 feet per second (fps), transport row carriers, with or without a pallet loads on them, between the vertical conveyors and the designated rows. The aisle carriers establish their position along an aisle rail through a laser positioning system.

Row carriers, traveling at speeds exceeding 3 fps, retrieve pallets from and deliver to transfer stations at the vertical conveyors. The row carriers utilize a precision laser for positioning, and wireless Ethernet/IP or Bluetooth for communication with the aisle carriers. Row carriers are designed to handle various pallet types – such as CHEP, EURO, Blockpallet, Stringer and AS, with load requirements up to 3,400 pounds.

The vertical conveyors and transfer stations utilize a single-mast design, which accommodates fast and effective pallet movements between levels. The conveyors lift and lower pallets at a speed up to 6 fps.

Aisle and row carriers, working in combination with vertical conveyors and transfer stations, constitute a single module of the PowerStore system, with throughput capability of up to 200 pallets per hour, per module.

A typical PowerStore system consists of multiple modules working in coordination, led and monitored by flexible software components designed to solve complex distribution requirements, and seamlessly integrated with the company's ERP or host system.



The PowerStore system for the Americas and Asia Pacific regions.



PowerStore adapted for use in Europe.

POWERSTORE VERSUS CRANE-BASED ASRS

Although ideal for low-bay, brownfield applications, if SKU volumes and throughput requirements are compatible, PowerStore can present an extremely efficient solution for high-bay environments up to 100 feet high.

The criteria for storing and processing with PowerStore differ from crane-based AS/RS. Stacker cranes can go three pallets deep with a telescope fork, and then with a satellite remote unit can run a pallet as much as 12 pallets deep, and then return back to the stacker crane. They provide high-storage utilization of low-volume, mixed SKUs, with flexibility in the store-and-retrieve functions.

Crane-based AS/RS are best suited for:

PowerStore utilizes deep lane storage technology to maximize cube utilization. It is best suited for:

Mixed-case order fulfillment processing	Medium-to-high pallet throughput
Case-pick applications	Full pallet picking
Medium-to-low pallet throughput applications	Pallet storage, retrieval and staging for shipment
Storing low-count pallets of individual SKUs	Pallet deconstruction and layer-pick pallet builds
	Storing a high number of individual SKU pallets

Flexibility and Scalability

When assessing a system for pallet AS/RS, expanding SKUs, fluctuations in throughput volume and potential reduction of SKUs need to be factored. Seasonal influences, and the rise and fall of the popularity of items, necessitate the need for highly flexible and scalable requirements in an ASRS automated system.

The scalable design of PowerStore allows it to be easily installed and implemented in any existing or greenfield warehouse or distribution center. It is ideal for low-ceiling height applications and facilities with unusual configurations, allowing for any number of modules, levels, aisles, rows and pallet locations. But it can also be easily extended or contracted as SKU models and throughput volumes change.

For high-density storage in FIFO or LIFO configurations, multiple SKUs can be stored and accessed on any aisle and any level as needed. Deep-lane and shallow-lane storage can be easily accommodated within modules, without any additional equipment, and little or no modification to the system.

Crane-based AS/RS are most always installed in greenfield sites, and allow limited flexibility for expansion or contraction of the system.



POWERSTORE VERSUS CRANE-BASED ASRS

High Storage Density

Those pallet-storage systems that are highly efficient have achieved a high density of space utilization. This means they have a space configuration that allows for the maximum number of pallet positions to fit into the system, and utilize both the footprint and the facility height effectively.

Utilizing deep-lane storage, PowerStore can store 25 percent more pallets in the same footprint versus crane-based AS/RS systems. Crane-based AS/RS requires additional or longer aisles to achieve the same storage requirements as PowerStore, resulting in a larger system.

Additionally, PowerStore requires 3 inches of space around the perimeter of the load as it sits in the rack, compared to 6 inches with crane-based AS/RS. This translates into better pallet load density with PowerStore.



High Throughput

Crane-based AS/RS systems use one captive stacker crane servicing an aisle for the store-and-retrieve functions, or roaming cranes that can travel between aisles in low-throughput applications. The stacker crane must travel horizontally and vertically to the store or pick location, and must stop in position to fork the load and position the pallet on the carriage prior to traveling again. Depending on the load profile, weight and height of the system, a single stacker crane can perform between 26–36 pallet store-and-retrieve cycles per hour.

Having one aisle/row robotic shuttle per storage level in a PowerStore module, allows for throughput of up to 28 combined pallet moves per hour, per level. A typical PowerStore module with five aisles could move up to 140 pallets in or out, combined per hour. The result requires approximately four times the number of crane-based aisles to achieve similar results.

Redundancy

Central to the performance capability of any AS/RS is its ability to access 100 percent of SKUs. If one section of the system were to be disabled for repairs, for example, ideally the system should be able to access as close to 100 percent of inventory as possible, because of built-in redundancy.

With crane-based AS/RS, when one crane goes down, access to the inventory on the whole aisle is off line. PowerStore provides redundancy in a mechanical failure by having a shuttle and a vertical lift on each level. If a shuttle goes down, only the individual aisle, and the one above, will need to go off line for maintenance. The rest of the system continues in operation. So only a small percentage of inventory in those aisles is off line.

"With PowerStore, if more than one module is built into the system, you would not put all of your SKUs into one module," said Randy Jennings, Director Food and Beverage Sales, with Swisslog. "You would give yourself the flexibility and spread out your SKUs across the modules to make sure you had access to them. And even spread them out across different levels within a module, which is an added layer of redundancy that crane-based AS/RS cannot provide."

POWERSTORE VERSUS CRANE-BASED ASRS

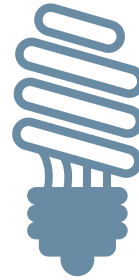
Energy Use/Sustainability

PowerStore system energy efficiency is not determined by energy recuperation or sharing, as is common with crane-based AS/RS, but rather by the inherent low-energy requirements of its robotic, automated pallet-retrieval-and-delivery shuttle vehicles, which are powered by 5 HP motors, compared to 50 HP motors on ASRS cranes. When compared to energy use of ASRS cranes, factoring in energy recuperation and energy sharing, high-bay robotic pallet shuttle systems consume 70 percent less energy – making them highly energy-efficient systems for high-bay pallet storage and retrieval.

Because crane-based AS/RS require additional or longer aisles to achieve the same storage requirements compared to PowerStore, this results in higher power consumption for AS/RS, and 100 percent higher CO₂ emissions.

Additionally, the PowerStore robotic shuttles run on DC power, which opportunity-charges off the aisle when nested. The batteries on board are Lithium-ion, which has high energy

density and a slow discharge process, allowing the vehicles to run long periods between charges. This system allows the shuttles roaming flexibility between charging, providing higher throughput.



"Energy consumption rates are a top-level consideration in high-bay warehouses," said Mohan Ramankutty, Senior Director of Design & Development, with Swisslog's PowerStore systems. "AS/RS cranes have been the longstanding workhorse for high-throughput automated pallet movement in these facilities, as well as the biggest users of power."

"PowerStore presents an alternative option for high-bay distribution that greatly reduces energy requirements," added Ramankutty. "While maintaining pallet throughput levels higher than that of AS/RS cranes, the cost per pallet move is 33 percent less, because of the reduced energy use. Less than 1 cent per pallet move."



COLD-STORAGE ENVIRONMENTS

An increasing number of supply chain manufacturers, including food processors, bottlers and distributors require 24-hour operations, at maximum throughput. Without AS/RS, warehouses depend upon the accelerated use of fork lifts maneuvering pallets into low-bay racking and staging for shipping, which is both highly labor intensive and space consuming.

Manual pallet handling in cold-storage warehouses can be particularly difficult. Compared to ambient-temperature facilities, many manually operated cold-storage warehouses are plagued with a higher incidence of wrong item fulfillment and poor product rotation, which increases returns, shipping costs and labor.



Cold-storage warehouses also have heightened facility, equipment and product damage, primarily caused by manually-operated forklifts impacting racks, doors, walls and product cases – significantly higher than that found in warehouses with ambient temperatures.

Personnel turnover in cold-storage warehouses is also higher than in ambient-temperature facilities. The extreme temperatures create difficult working conditions for personnel, heightened safety issues, and staff recruitment and retention problems.

Like crane-based AS/RS, PowerStore can perform in various temperature zones including deep-freeze environments. The system has a temperature range from -22 degrees F – 113 degrees F.

IDEAL SOLUTION

"The ability to put this system into a brownfield low-ceiling height facility is a critical factor for many end users," continued Ramankutty. "This is what the system was originally designed to support."

PowerStore is most frequently utilized when throughput is high, SKU-mix is medium-to-low, and ceiling height restrictions are 40-feet or lower. Its technology is based upon providing two fundamental conditions: a) maximum pallet storage density, with total control of SKUs; and b) throughput balance, so as to store and retrieve pallets without creating bottlenecks in production or shipping.

To this end, PowerStore presents an ideal solution, providing an attractive ROI for companies in the food and beverage, pharmaceutical and consumer products industries with small, medium and large storage requirements.

"What I have been observing over the past year or so is a very welcoming acceptance of the PowerStore solution in the distribution, automotive and pharmaceutical industries," said Rupesh Narkar, Sales Project Manager, with Swisslog. "The industry is moving more towards modular solutions with a good aspect of scalability. And PowerStore offers that."



Swisslog
www.swisslog.com

swisslog
Member of the KUKA Group