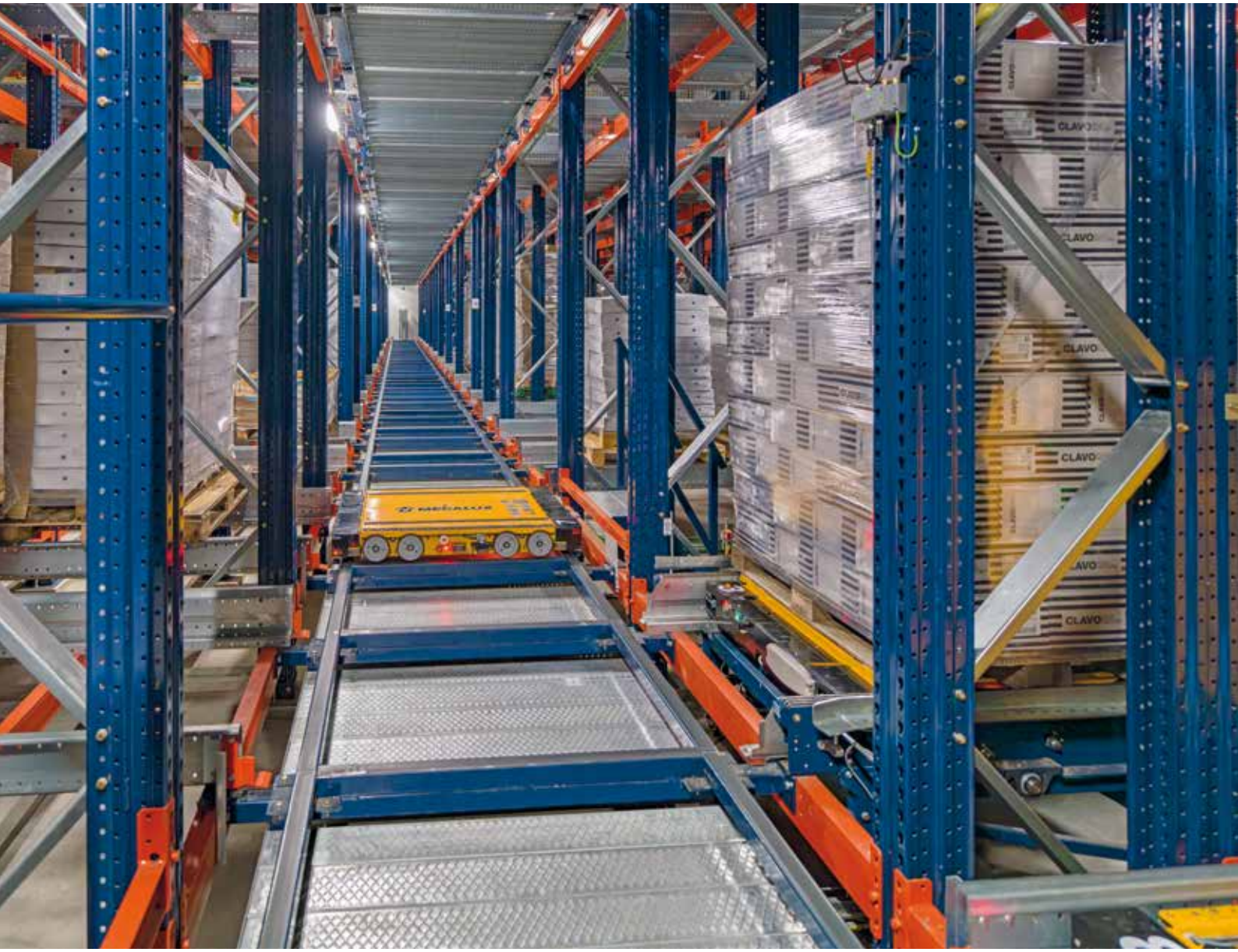
4-Way Pallet Shuttle

High-density pallet storage system employing autonomous, multi-directional shuttles to maximise warehouse capacity, productivity and flexibility



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The 4-Way Pallet Shuttle is a compact storage solution featuring an innovative multi-directional electric shuttle that stores and retrieves pallets from warehouse racking with unparalleled efficiency and precision.

These shuttle cars navigate the aisles and channels within the racking structure autonomously, eliminating the need for assistance from other material handling vehicles (e.g., stacker cranes or transfer cars). A series of vertical conveyors (pallet elevators) move unit loads between levels.

Advantages

High productivity
The operational versatility of the multi-directional shuttles significantly enhances warehouse performance.

Increased capacity
High-density storage maximises space utilisation.

Maximum flexibility
The shuttle cars move between levels and aisles, and several shuttles can operate in a single aisle simultaneously. This makes it possible to adjust the system's throughput to changing scenarios, such as executing priority tasks and managing demand peaks.

Greater diversification
Each channel can house multiple SKUs and pallet sizes.

Autonomous, intelligent operation
Shuttles move within the aisles and channels guided by fleet management software, which controls traffic and optimises routes.

Operational efficiency and agility
A series of sensors ensure safety and effectiveness in detecting, handling and positioning pallets.

Scalability
New shuttles can be added to boost throughput and tailor the solution to business growth.

Energy efficiency
The system reduces energy consumption in low-temperature warehouses through high-density storage.

Versatility
The shuttle is equipped with sensors that detect and handle pallets of different widths and dimensions, adapting to standard formats such as Euro, GMA (American) and perimeter-base CHEP pallets.

Applications

The 4-Way Pallet Shuttle is the automated storage and retrieval system (AS/RS) best suited to businesses with intensive loading and unloading cycles or high demand variability. Its compact design leverages available space, while its versatility makes it adaptable to the requirements of companies across multiple sectors.

Warehouses with high product turnover

This AS/RS is perfect for streamlining the management of facilities with large daily volumes of incoming and outgoing palletised loads.

Facilities with large-scale storage

It is the ideal solution for companies that house a small number of SKUs and large quantities of pallets per SKU. Its high-density storage expands warehouse capacity, while the shuttle's operational speed ensures maximum performance.

Cold-storage and freezer warehouses

The shuttles can operate in cold stores, where high-density solutions optimise the space to be cooled, reducing costs and minimising operators' exposure to low temperatures.

The shuttle's low-rise design saves space between levels, increasing storage capacity.

Components

Aisle guide wheels
Group of 4 wheels that guide the shuttle as it navigates the aisles, ensuring stable movement.

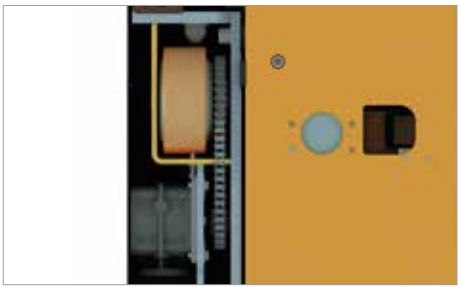
Lifting platform
Located on the top of the shuttle, it slightly raises the pallet for transport through the channels. There are two configurations. The first is compatible with pallets measuring 800 x 1,200 mm and 1,000 x 1,200 mm. The second accommodates pallets with dimensions of 1,200 x 1,200 mm in addition to the aforementioned sizes.

Channel running wheels
Set of 8 translation wheels (4 driving and 4 non-driving) that sit on the base of the storage channel rails to enable the shuttle to move inside it.

Channel guide wheels
Group of 6 wheels that reinforce the longitudinal guidance of the shuttle as it operates within the channels.

Battery
The shuttle cars use batteries that provide them with high autonomy. The batteries' operating parameters (charge status, temperature, etc.) are continuously monitored to ensure system uptime and manage the charging process.

Sensors
The shuttle car incorporates several sensors to enhance its operational effectiveness. They fulfil different functions, such as verifying the correct positioning of the pallet on the shuttle, detecting the last pallet deposited in the channel and calculating the distance to another shuttle in front of it.



Aisle running wheels
Set of 4 translation wheels that rest on the aisle rails, allowing the shuttle to move along them.

Antenna
Device through which the shuttle car receives instructions (via Wi-Fi) from the WMS and fleet management software.

Load characteristics	
Pallet requirements	Euro pallet, per UNE-EN 13382
Load dimensions	800/1,000 x 1,200 mm
Load capacity	1,500 kg
Shuttle characteristics:	
Z-channel wheels	8
X-aisle wheels	4
Lifting stroke	26 mm
Positioning accuracy	< 10 mm
Speed (X-aisle)	1.2 m/s (without load) - 1 m/s (with load)
Acceleration (X-aisle)	1.2 m/s² (without load) - 1 m/s² (with load)
Speed (Z-channel)	1.5 m/s (without load) - 1.2 m/s (with load)
Acceleration (Z-channel)	1 m/s² (without load) - 0.5 m/s² (with load)
Lifting/lowering time	2 s
Battery type	LiFePO4
Battery life	Over 10 hours (ambient temperature) 8 hours (cold storage)
Battery capacity	60 Ah
Temperature range	-30 °C to 45 °C, 70% humidity

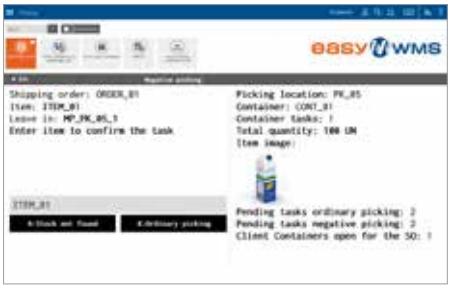
System components

Frames and beams
Vertical and horizontal profiles that, together with the rails, make up the racking framework. The shuttles travel through its aisles and storage channels to deposit and remove pallets.

Rails
Horizontal profiles that guide the movement of the trolleys. Rails are installed within each storage channel and serve as the pallets' support surface.

Vertical conveyors (pallet elevators)
High-performance load-lifting devices used to connect different levels. A minimum of two vertical conveyors are installed; however, the number can be increased to boost the AS/RS's operational capacity.

Fleet management software
Program that coordinates all shuttle movements.



Easy WMS warehouse management system
Software that organises goods-related operations (entries, exits, repositioning, etc.) and supervises inventory in real time.

Operation

The flexible and multi-directional movement of the shuttles significantly streamlines pallet loading and unloading.

1

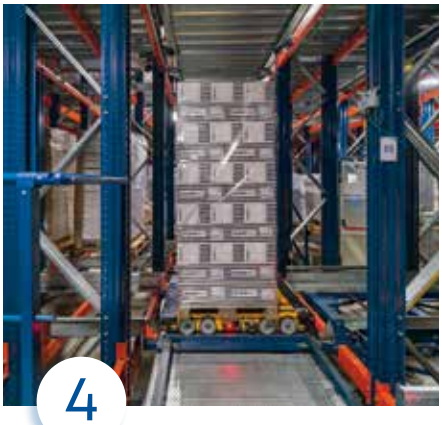
The conveyor, located at the entrance to the AS/RS, moves the pallet to be stored to the racking input point. Along its path, the pallet passes through an inspection station to check its dimensions (for clearance) and deckboards.

2

The **WMS assigns the pallet the optimal position**. Meanwhile, the fleet manager selects the ideal shuttle and determines the most appropriate route to reach that location.

3

With the help of the vertical conveyor, the shuttle moves to the designated storage level. Alternatively, the shuttle can load the pallet onto an elevator for another shuttle to pick it up at the destination level.



4

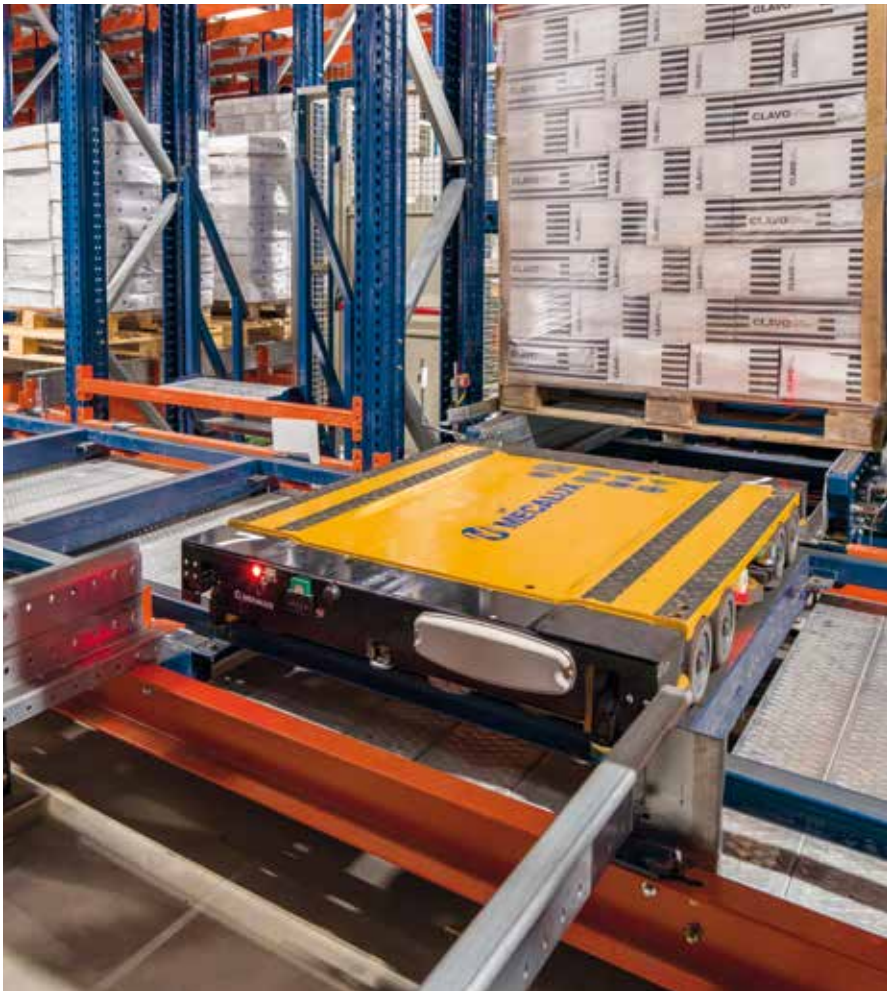
Once at the corresponding level, **the shuttle moves along the aisle, following the direction of movement established by the fleet manager**, which coordinates traffic.

5

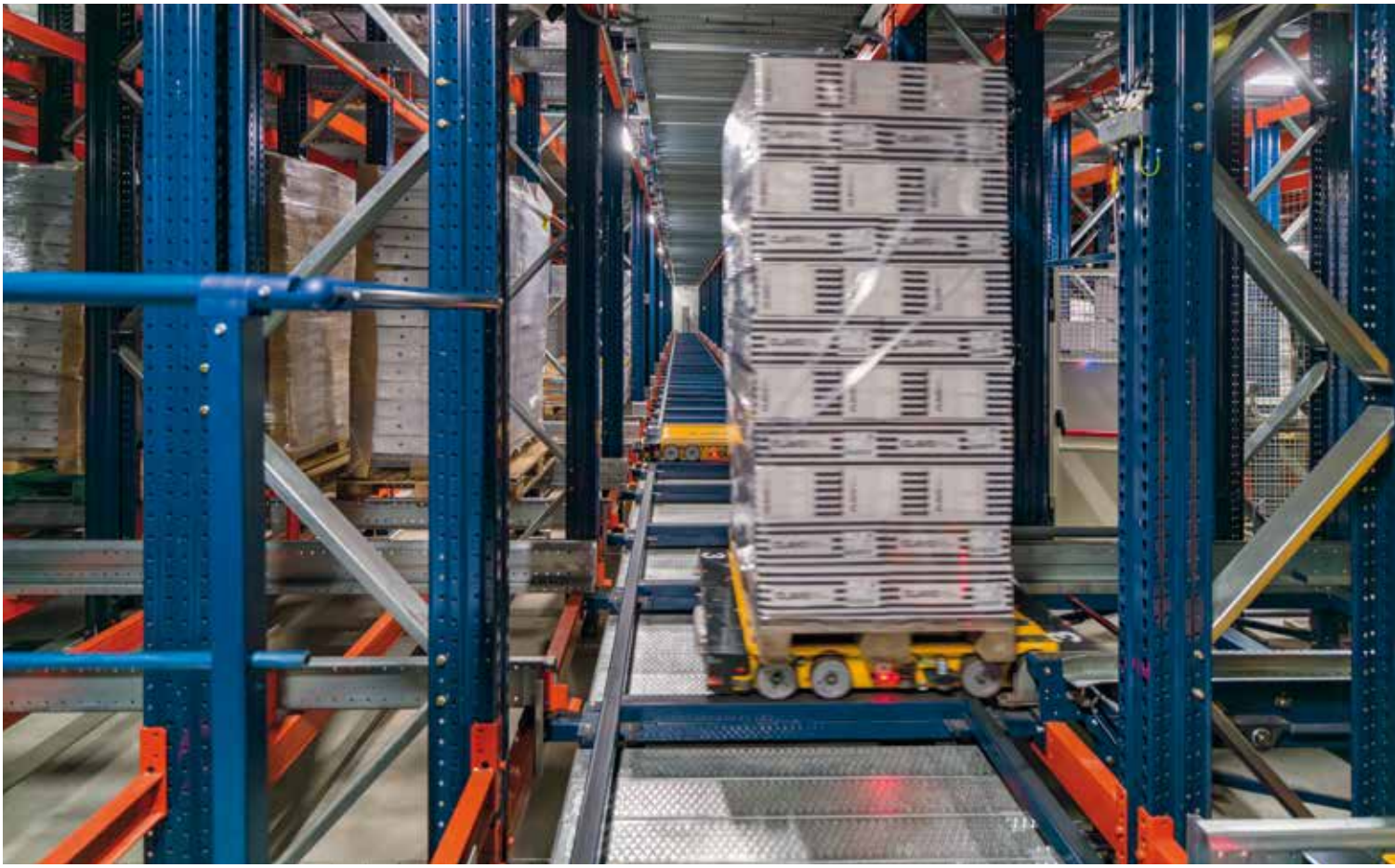
When the shuttle reaches the destination storage channel, it raises the pallet slightly and enters the channel, depositing the load in the deepest available location. The shuttle car stores the goods as compactly as possible, irrespective of the size of the pallets in the channel.

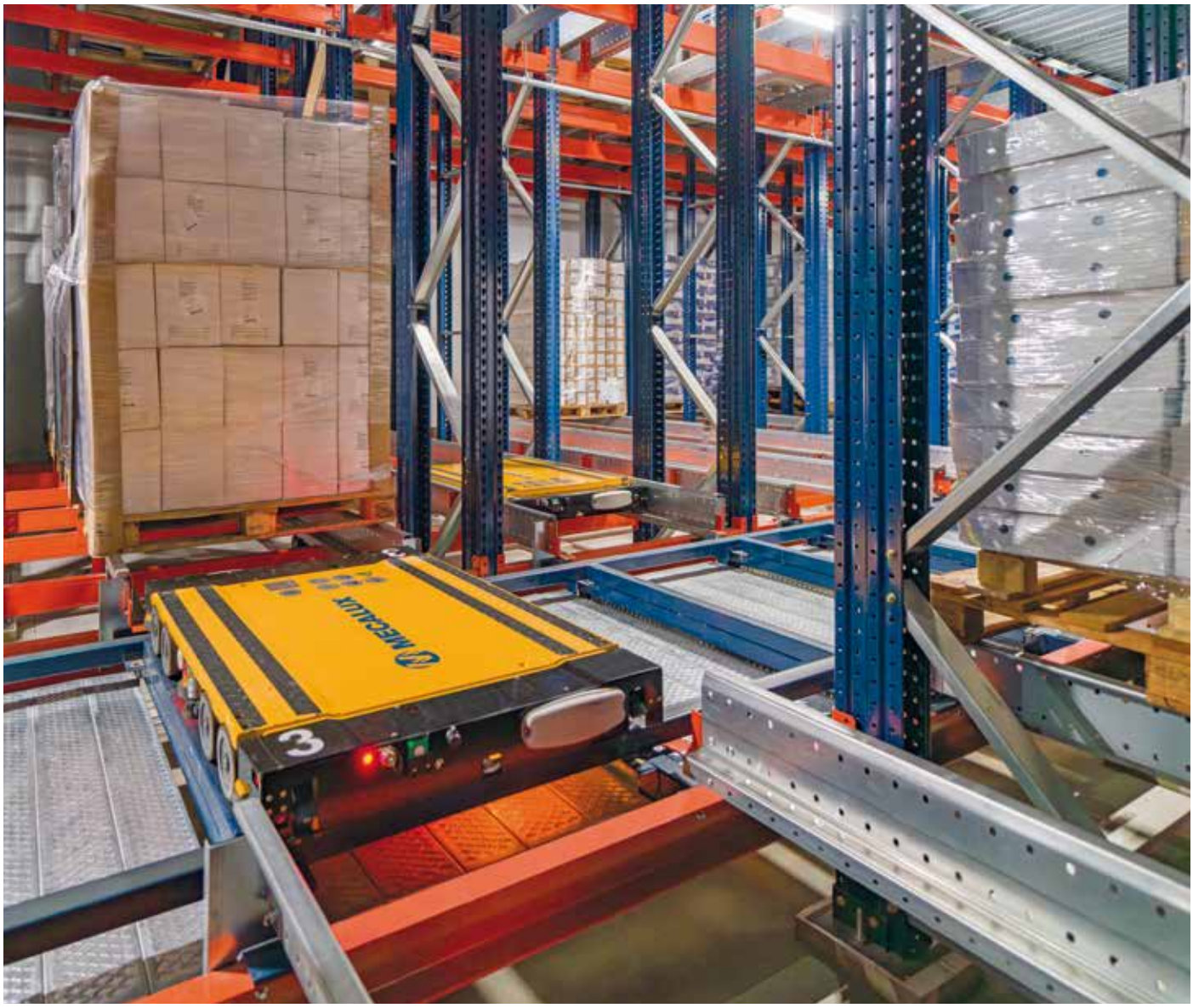
6

After depositing the pallet, the shuttle remains in standby position in the storage channel, adjacent to the aisle. In this position, the shuttle waits for the next work order without blocking the aisle or disrupting the flow of other shuttles.



The 4-Way Pallet Shuttle enables flexible and versatile goods management by allowing more than one product reference and different pallet sizes to be stored in the same storage channel.





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