ADVANCED COLD STORAGE

Interlake MECALUX

The refrigerated logistics sector is increasingly looking for ways to implement and optimize industrial freezer storage units that require temperatures below 32 degrees Fahrenheit.

The optimal solution for these storage units would be to fully automate them, requiring no human personnel. Due to the chamber size of many of these units, full automation is not always affordable or possible.

In addition to traditional storage solutions, as outlined on pages 49-50, other advanced solutions applied to cold storage units are:

- **Maximize room capacity,** optimizing the freezer space to achieve efficient energy use and profit growth.

- An easy **accessibility to goods** depending on product rotation.

- **Removing human personnel from storage spaces** or reducing the number to just the essential.

- **Proper control of the stored product,** which ensures an accurate inventory, despite an increased rotation and demand on traceability.

To help facilitate operations in industrial freezer units, the following improvements can be made:

- Robot may relocate freezer pallets to a warmer space that is more inhabitable for employees.

- Maintain and organize a high rotation of goods using an automated rack capable of preparing single or multiple box storage in low-temperature environments unsuitable for employees.

- Use Voice-order preparation equipment (pick to voice) that allow for the hands-free handling of goods.

It is essential to remain agile and minimize handling time when loading orders into transport trucks. The ability to move products waiting to be loaded instead of having trucks load in a different location is important. Having preloading areas where orders are held and moved according to the period in which they are to be delivered is also important.

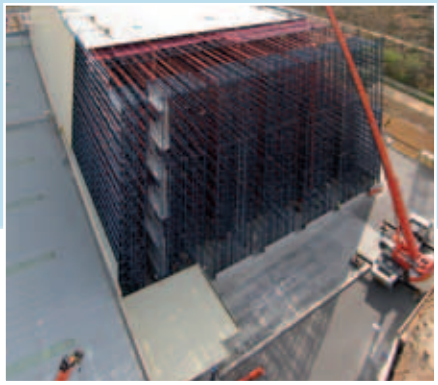
To do this, rollers or chain conveyors best facilitate moving goods in or out of the industrial freezer units.

When designing a freezer space, the management software used to monitor and organize the unit is just as important as the shelves themselves. EasyWMS® is a powerful tool Interlake Mecalux offers to customers working with both simple storage and picking solutions to the most complex warehouse automation.

The solutions presented in this catalog are taken from actual facilities and should be used only as examples. With individual cases, a number of optimization factors are taken into consideration when designing the freezer space.

Interlake Mecalux's technical team feature extensive logistical and cold storage experience and have been dedicated for over 40 years to creating the perfect solution to your freezer space.

Index of logistics solutions

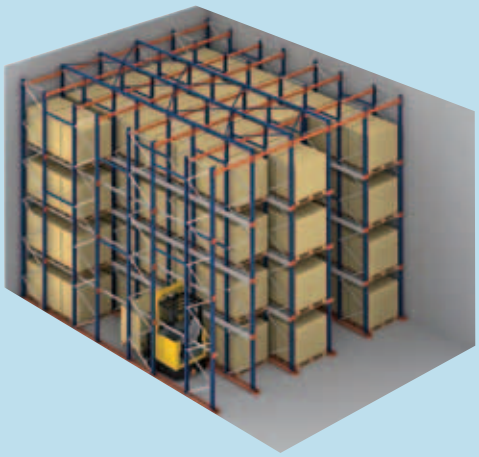


Compact Radio-Shuttle

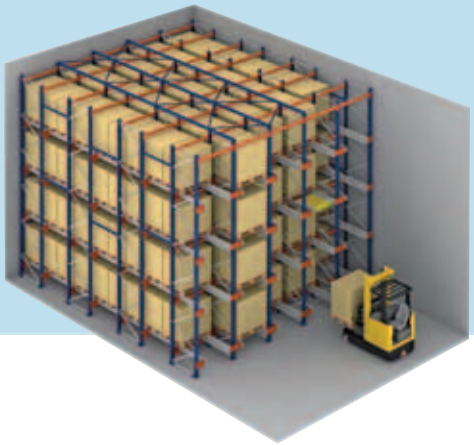
This is a semi-automated storage system pallet that uses a small radio shuttle to move between shelves independently and load pallets in storage aisles without the use of a forklift.

Its structure and operation make this system ideal for use in refrigerator or freezer units or storage spaces with low ceilings. Its characteristics are:

- Increased **maximum capacity** within a compact storage system.
- **Reduced time** to load pallets. The Radio-Shuttle retrieves pallets, thereby reducing the truck's necessity to go into the aisle.
- **Increased number of references stored.** Allows different references stored for each module (each corresponds to a reference level).
- **Reduced risk** of accidents.



Traditional compact structure.



Shuttle radio compact structure

- **Decreased shelf damage.** By not having to enter trucks, shelf damage such as scratches, dents or general metal damage, is greatly decreased.

- **Future growth.** Input and output flow increases rapidly with each car added.

- **Increased productivity.** While Radio-Shuttle runs a command, the operator searches for another pallet, creating a smooth and continuous process.

- **Compatible with various sizes of pallets.** Optimize the compact space in the different size pallet aisles, but always with the same width.

Automated operating systems combined with Radio-Shuttles enable fast and accurate loading and unloading of storage. The truck leaves the load on the rails and the Radio-Shuttle moves over them, independently, depositing it in your location.

The operator directs the movement and extraction of cargo through a remote control.

Security and Control

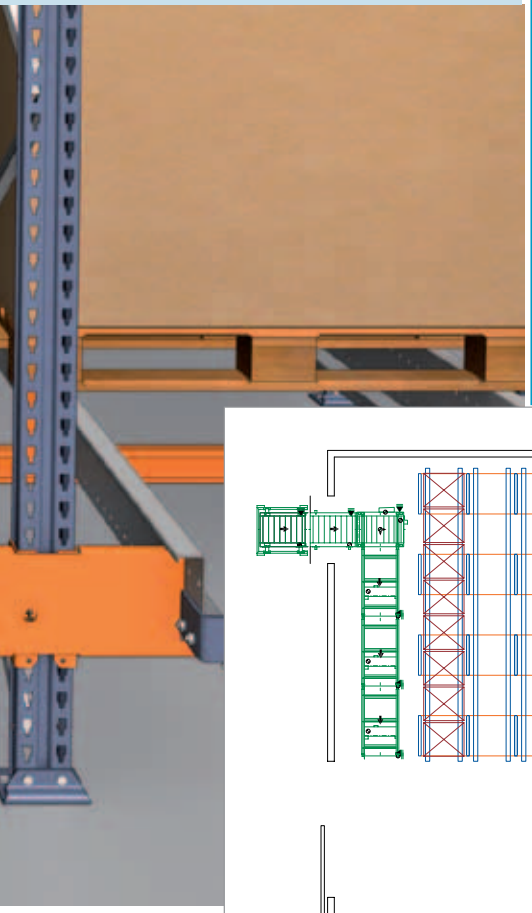
Radio-Shuttles feature various regulated security systems.

Certain electronic components (PLC, batteries, antenna, etc.) can function autonomously from the shuttle.

The remote transmits orders by radio to the programmable logic controller (PLC) located on each shuttle.

Remote Control Command

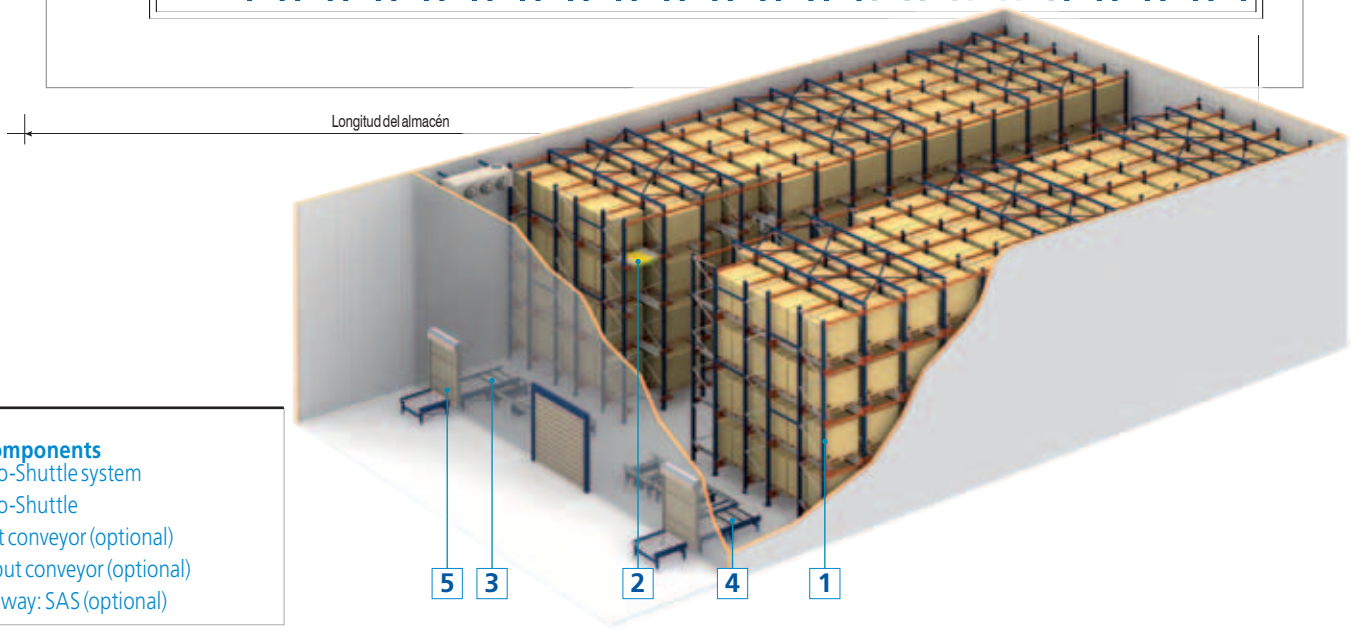
This semi-automatic compact system is controlled remotely. The operator intuitively selects the Radio-Shuttle mode without the need for training or complicated explanations.



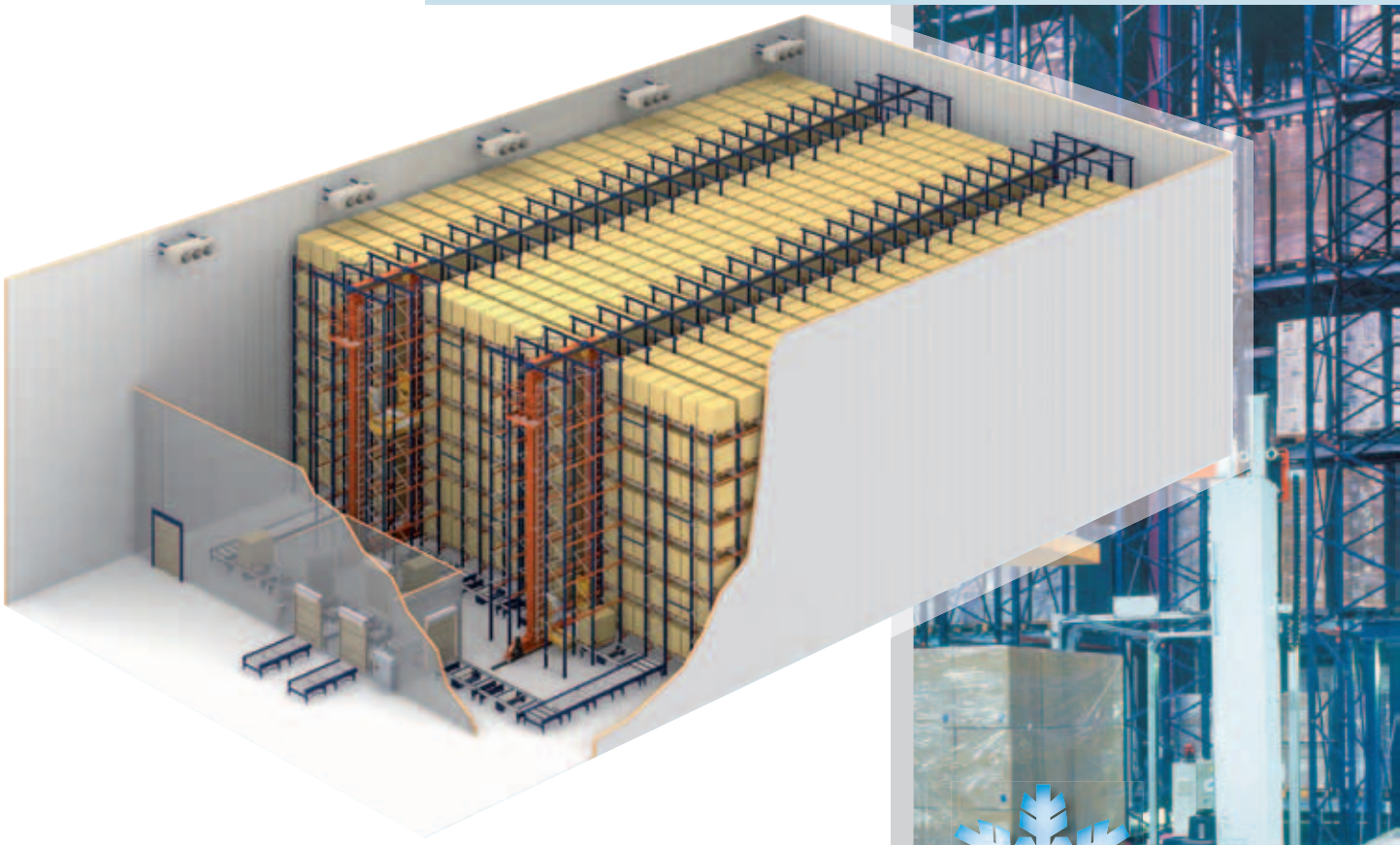
Application Example
A storage area with two Radio-Shuttle conveyors, one input and one output.

This will optimize operator execution times.

Length of storage



Basic components
1) Radio-Shuttle system
2) Radio-Shuttle
3) Input conveyor (optional)
4) Output conveyor (optional)
5) Gateway: SAS (optional)



Automatic compacting satellite truck

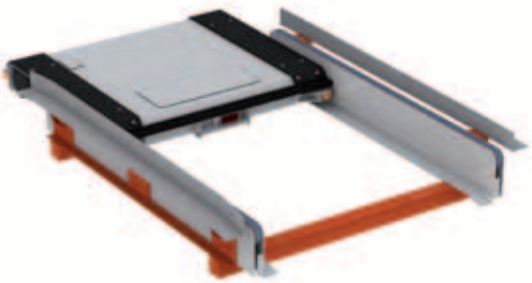
This is a compact automated satellite-truck used for organizing pallets in storage aisles.

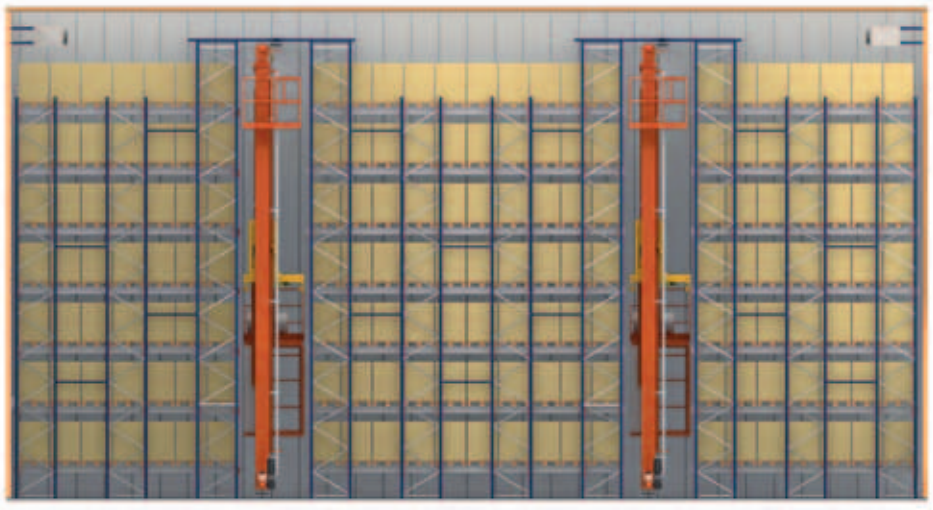
This mobile cart is equipped with a lifting system that moves under the loads inside the shelf on runners, allowing loading and unloading pallets at locations up to 40 ft. deep.

The system is ideal for high storage spaces or storage spaces with a high volume of pallets per SKU.

System advantages:

- **Minimizes** unused storage space.
- **No staff** inside of the storage space.
- The satellite truck transport **supports special pallets** of different widths.
- The **direct power** prevents battery recharge.
- **High productivity.**
- An **appropriate system** for recording large numbers of pallets.
- Automated movement increases **maximum safety.**
- **Build up** to 130 ft. high.

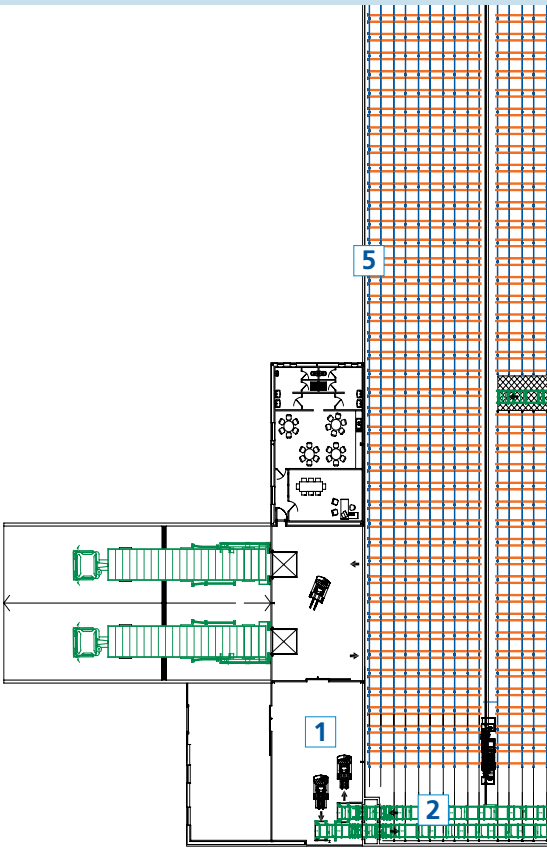


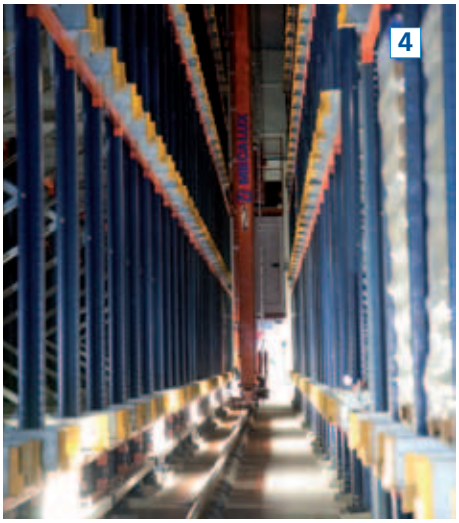


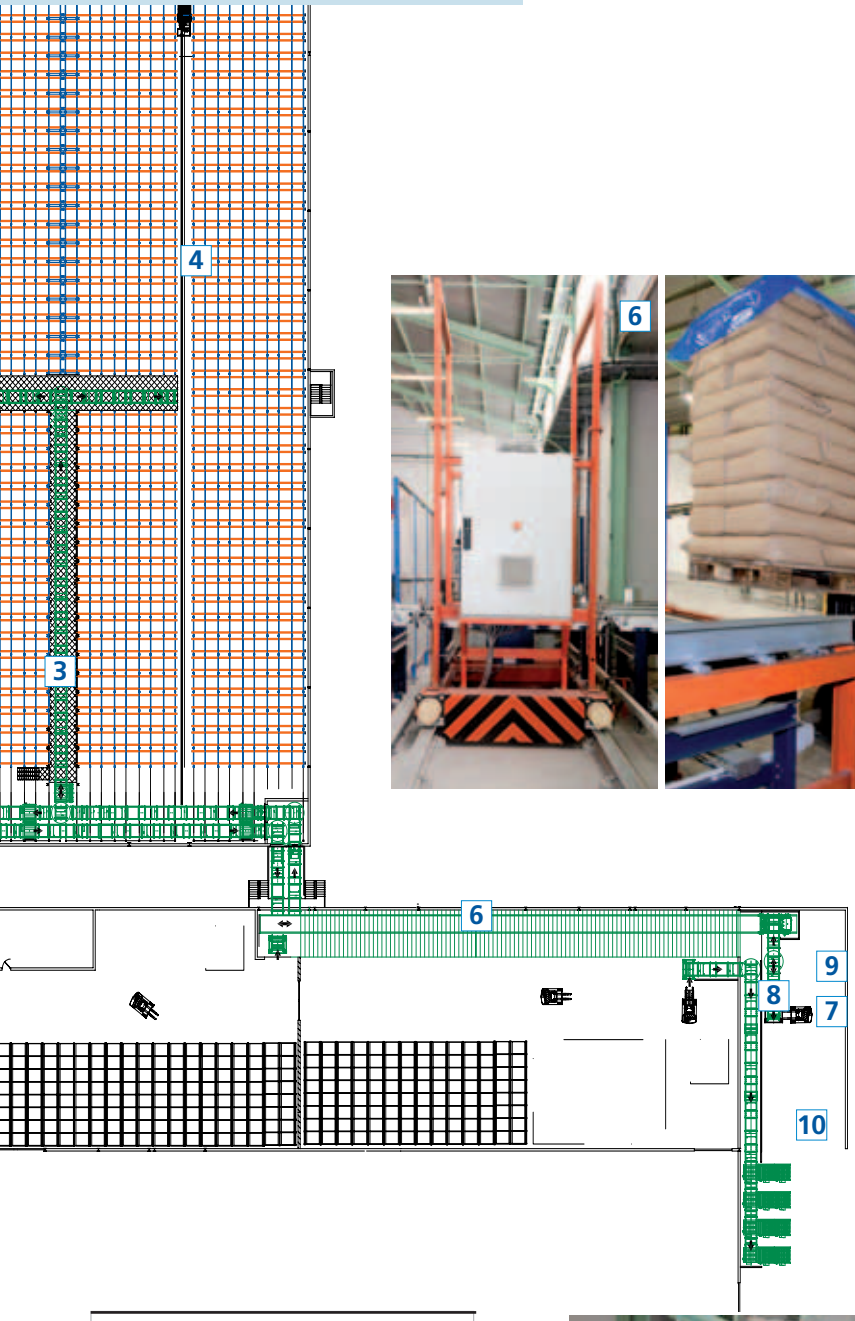
This system facilitates a dense storage block of pallets, containers or cages of various widths.

Compact storage systems with satellite trucks are typical of systems which require very high yields, a high turnover of products and where it is essential that space is maximized.

Here is an example of a cold storage space dedicated to frozen foods.

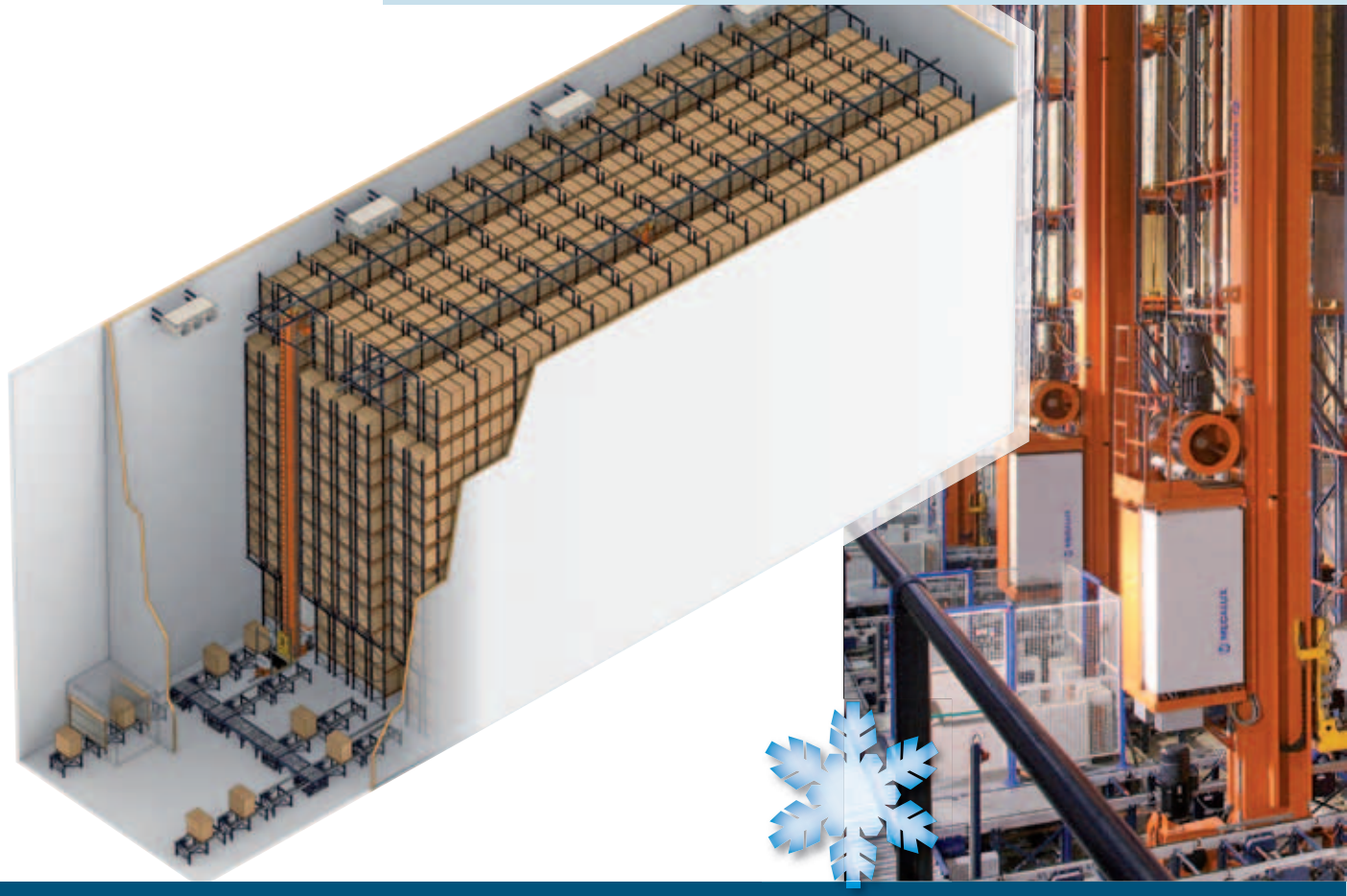






Satellite Truck Components

1) Inputs / outputs from the docks
2) Carriers within the storage space
3) Transporters that make up the communication tunnel (two levels)
4) Satellite truck shelves
5) Self-supporting warehouse
6) Shuttle transport
7) Input from production
8) Baler
9) Control Checkpoint
10) Communication Carriers



Single-mast and double-mast automatic stacker cranes

The automated cranes are created to run inputs and outputs in a single movement (combined cycle).

The need for maximum utilization of the available space has led to the development of cranes; machines that can exceed 130 ft and are designed to work in warehouses with narrow aisles.

The speed of movement, both horizontally and vertically, and automation multiplies the capacity of handling and removal of pallets.

These storages can be double- or single-mast. The dual tracks allow storage two levels deep, for every location on the shelf, maximizing storage capacity.

The implementation of this system in cold storage with the option of single-mast is appropriate when you need to increase the height of your storage capacity and direct access to any pallet.

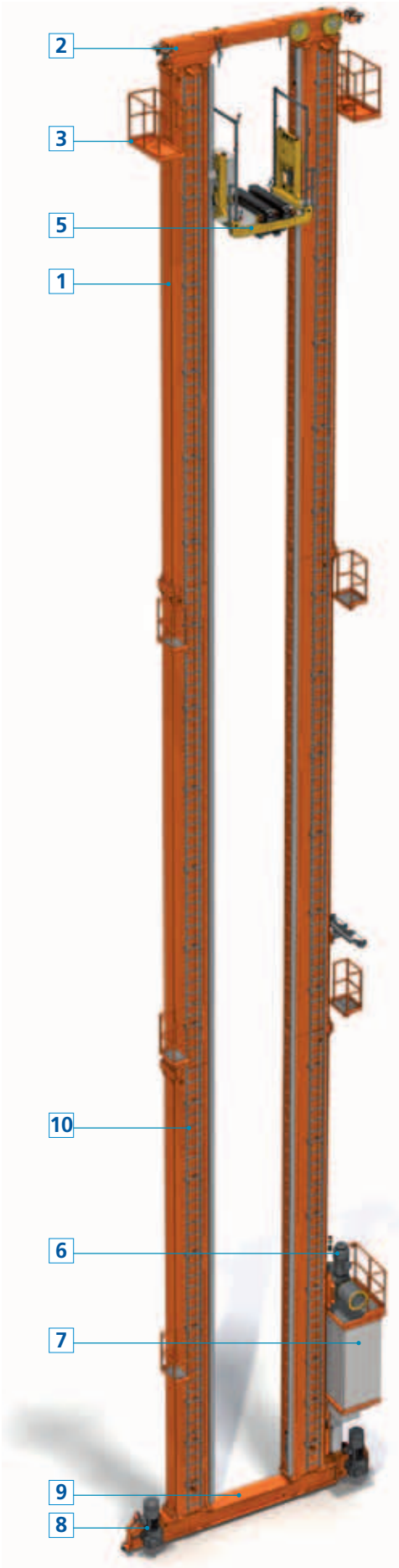
Double-mast units yield a 60 percent higher capacity than the single-mast. This is a preferable option in freezers that generally have several identical pallets. In addition to software management and location criteria A, B and C, it automatically selects the appropriate storage position, with the possibility of relocating the pallets if necessary.

Among the most relevant issues surrounding the design of this type of refrigeration system is the storage

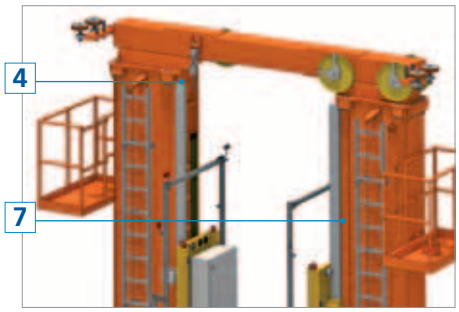
temperature, the type of goods to be stored, the weight that will go on the shelves, the input or output flows, and automated equipment available in the warehouse space.

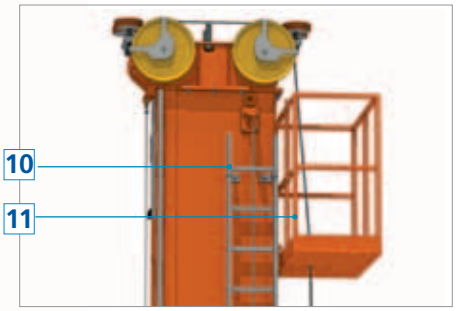
The use of automated solutions allows for reductions in heat and subsequently, savings on energy costs. It also reduces the need for workers to work in low temperature environments, and whose work would be restricted to maintenance only.

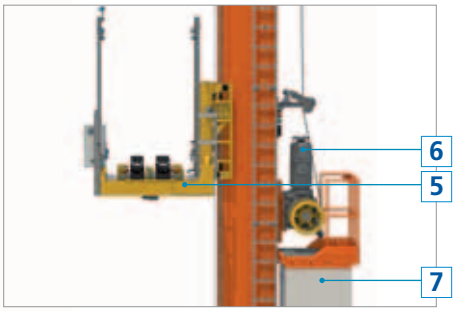
The entry of the goods from the docks or from production is done by automatic conveyor rollers or chains.

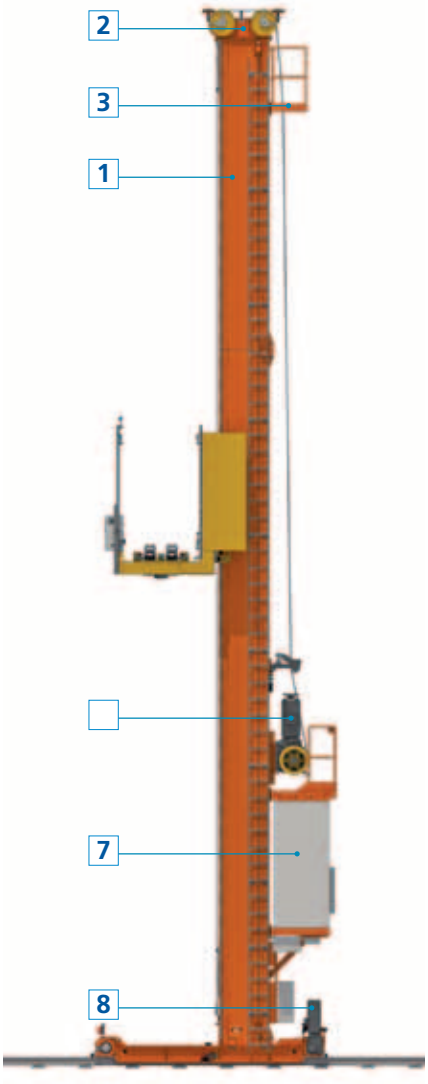


The stacker cranes are created for use in conjunction with the automatic pallet's automated movements. They move through the aisles of the warehouse according to the location of the goods they've been programmed to locate and pick.





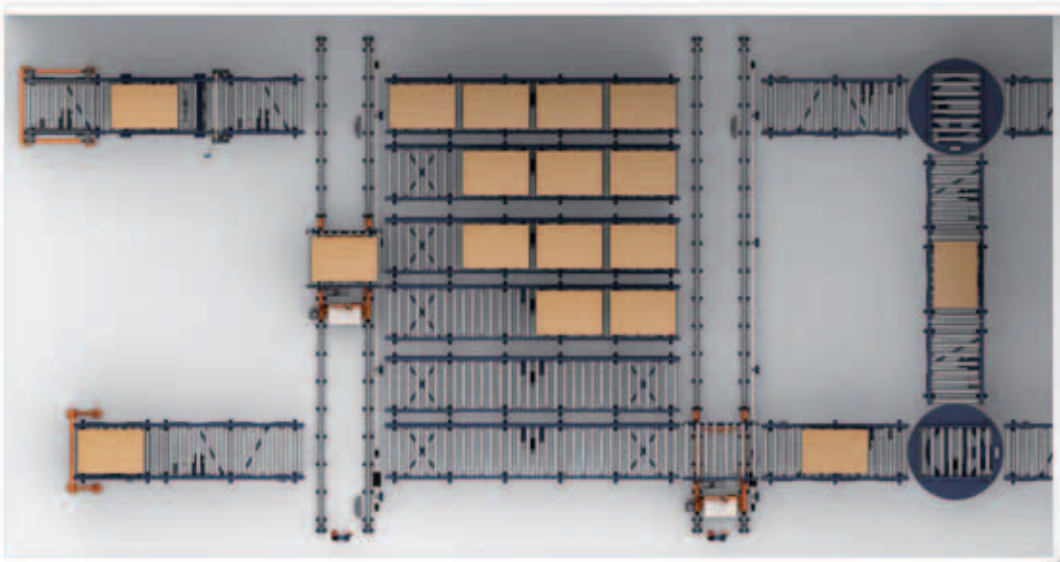




Basic components

1) Column
2) Upper connecting beam
3) Maintenance platform
4) Onboard cab
5) Lifting Cradle
6) Lift motor
7) Electrical cabinet
8) Motor Travel
9) Lower connecting beam
10) Ladder
11) Safety railing

Stacker cranes bring pallets in from the docks or production areas, and then move those pallets to the warehouse aisle the software has designated those pallets to be placed.

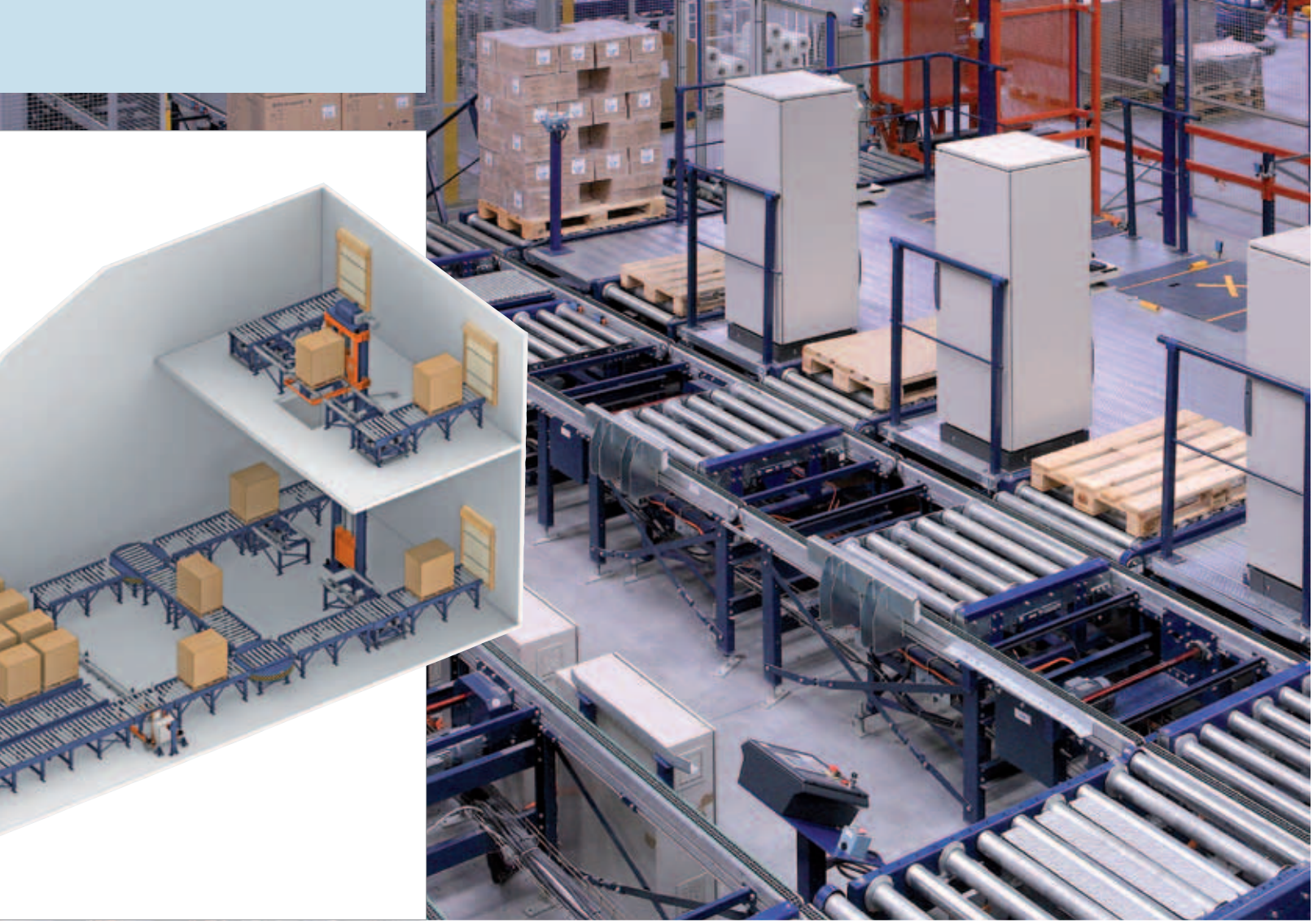


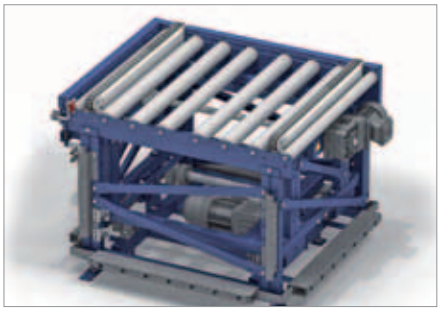
Automatic internal transport

This transport system represents an ideal combination of storage efficiency and input processing, shipping and handling of cargo units. This is a set of elements designed to transfer, accumulate and/or distribute goods to the specific positions requiring operational logistics. The various elements combine to form a transport circuit. All are adaptable to temperatures between -20 °F and 100 °F.

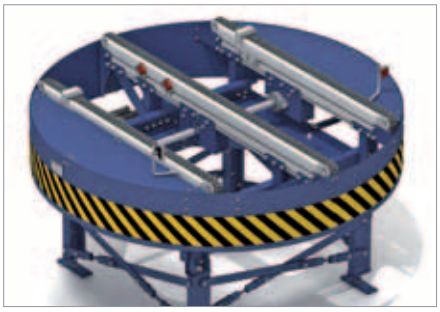
Roller conveyor (TR). Allows long distance pallet transfer in the longitudinal direction of the runners.

Conveyor chains (TC). For transverse movements on the runners. This roller conveyor allows 90 ° or 180 ° turns, facilitating the creation of recirculated and transportation routes.





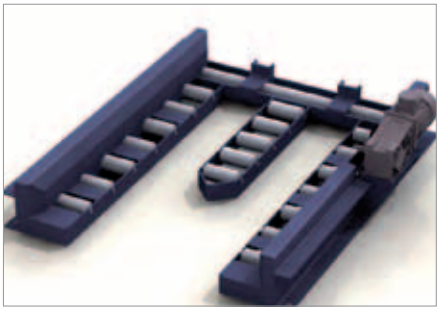
Transfer rollers and chains (TM). Has the capability to change functionality by 90° to be compatible with entry and exit loader units. To carry out this operation, a roller conveyor combines a fixed base and a chain conveyor on a lifting frame.



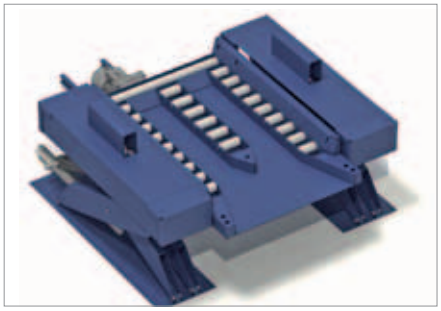
Transporter (rollers or chains) control (TG). Roller or chain conveyor with a rotation capacity, allowing units to transfer cargo between non-aligned carriers.

The roller or chain conveyor rotary makes it possible to route products from any angle to the direction of entry.

Inspection post (PIE). Control equipment transport system designed to ensure the dimensions of loading units in the entries meet the specifications of the installation. The first control of the transport unit scans barcode labels for product identification and subsequent registration in the SGA.



Roller conveyor (TRX). Located in both entry and exit positions of the conveyor, loads slide underneath the conveyor's truck, which starting at level 0, elevates about three inches to match the level of the rest of the transport system.



Roller conveyor (TRES). Combines the roles of transporters and TRT TRX-T in low or average-flow facilities.

Transfer car or shuttle. This non-moving, continuous load conveyor is convenient to use when the requirements are low and no lifting is necessary. These units always incorporate a second element, such as rollers or chains.

Client needs will determine if a single or double shuttle is optimal.

The electric overheads are a good alternative transport for vehicles with individual controls that move along a track in the form of "I ". The rail is suspended from the ceiling or fixed to the ground by gantry structures. It is very useful when connecting distant points; requires rapid transport flows.

Pallet lift. This is an essential machine when dealing with transport circuits on different levels, as it links the different floors of a facility. The lifting platform can be installed on a roller or chain conveyor.

Push / pop pallet. A picking system created by a retractable lifting device used in picking stations, car lifts and production areas that need empty pallets to be dispensed.

Vane traced. Combined with stacking and de-stacking pallets, these allow placer paddles to be set on sturdy pallets to avoid incidents in the transport and storage.

Self-supporting

The warehouse has such a great number of self-supporting shelves that they serve as the building's structural integrity in addition to the support structure for that warehouse's goods.

The height of these freestanding spaces is limited by local regulations or by the height of lift trucks or cranes. Generally, these structures cannot surpass 130 feet.

They are designed to work both at room and cold temperatures (refrigerating or freezing).

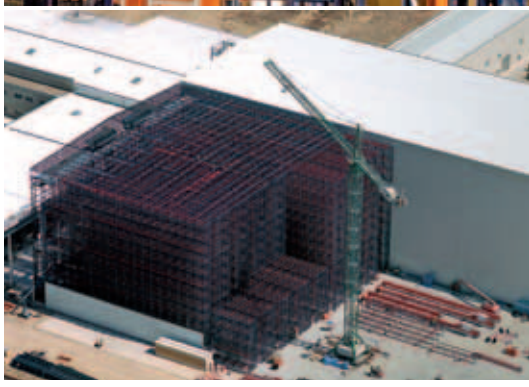
Often, because of the range available in the construction of a self-supporting structure, there is a wider range of good storage compatibility (pallets, containers, large packages, etc.)

Advantages

- Less run time.
- Increased building height.
- Better use of volume (no pillars or shelf replacement).
- Lower cost.

Freestanding shelving units support the evaporators, cooling equipment, maintenance walkways, access stairways, fire systems, stacker cranes, conveyors gateways and other similar items. All these aspects constitute an integral structure formed by shelves on which the pallets are stored and are calculated to support the structural integrity of the building.

Self-supporting high-capacity



The construction is very simple. Each shelf is anchored to a concrete foundation and given the proper amount of insulation. The structure is shaped by pre-assembled structures of variable height and strength that are then constructed together to eventually make the larger completed structure.

It is the ideal system for warehouses in high altitude spaces.

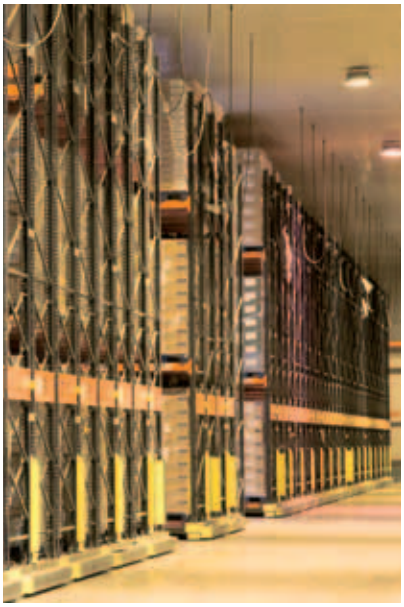
Picking operations

Picking operations at negative temperature require specific treatment, because the operator has to work comfortably and efficiently in adverse conditions.

Picking operations can be carried out through manual or automatic handling of the product, or a combination of both.

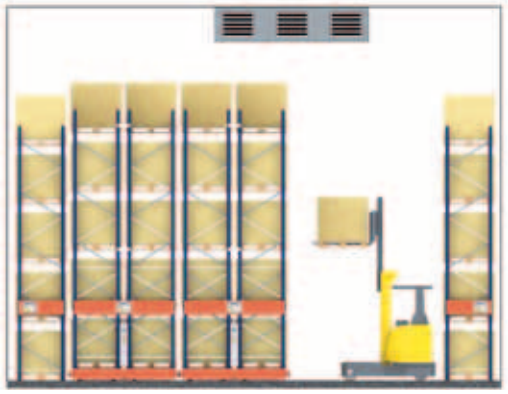
In this section you can view different picking solutions, all valid, but each case will need special treatment.

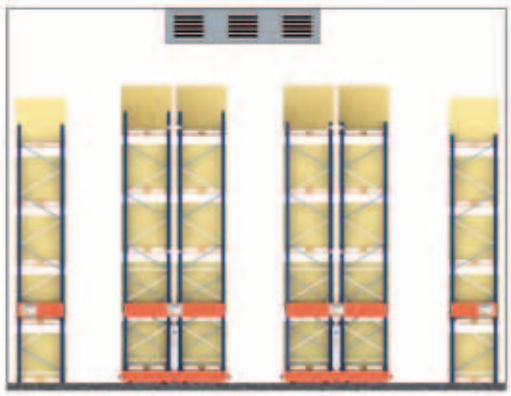
In the case of manual picking, the operator extracts the stored goods from the pallets.



By contrast, ground level picking on standard rack requires operators to travel the aisles using a pallet truck and order picker machines to pick up entire pallets instead of single items.

Pickers can grab goods that are 30 feet off the ground





Picking operations at the front of an automated warehouse.

Picking operations on standard rack.

If the warehouse goods are able to be relocated automatically into areas that are not freezing, it isn't necessary to make picking operators brave the inclimate conditions.

Computer Aids
Although the employees have their own equipment to help them handle the merchandise, streamlining picking operations requires a good warehouse management system like EasyWMS®.

The most useful aids are:

- **Radio frequency (RF).**
  Computer terminals with barcode readers that direct operators without using paper.

- **Equipment for voice picking.**
  Computer terminals with voice synthesizers to issue instructions and confirmations of accepted orders.

  The use of voice picking at negative temperatures is an efficient option as it leaves your hands free to handle goods, which facilitates and increases operator performance.

When the number of pallets to be handled is too high, picking can be done automatically by using WMS. Guide well ordered layers or box-to-box using this type of software.

Picking robot automatic depalletizer

The depalletizer robot picks up the merchandise from a pallet or point of origin and deposits in another destination. The pallets are powered by roller conveyors, chain or shuttles.

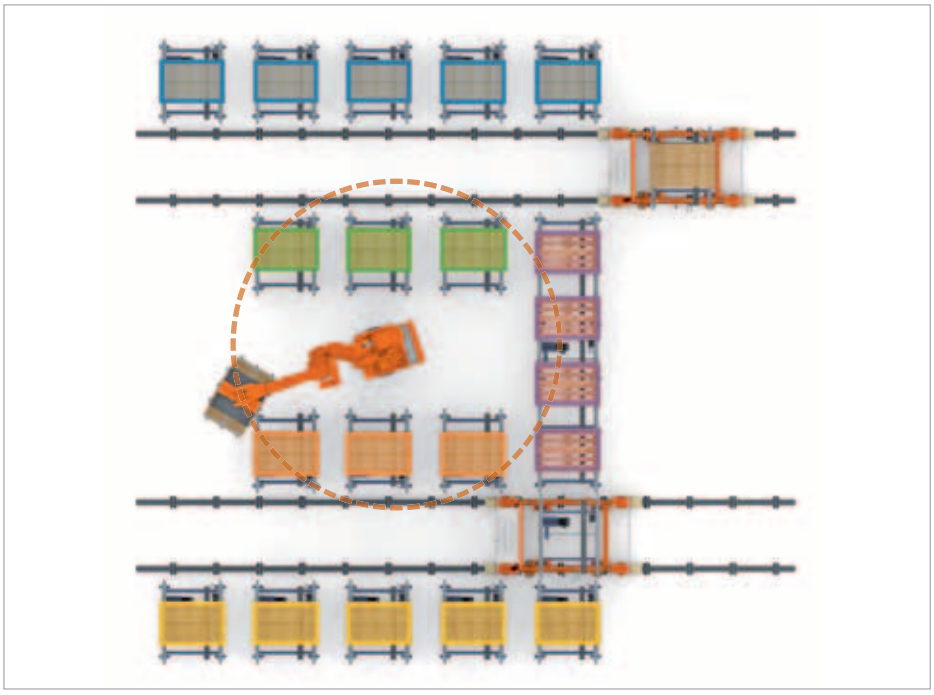
There are three robot picking systems:

- Anthropomorphic
- Two-axis gantry
- Three-axis gantry

The use of one or the other depends mainly on the cycles that are needed and the combined orders.

Anthropomorphic robot rotates 360º and has an articulated arm that combines different movements allowing access to the boxes or layers of any item in range. The operation order is similar to the ones shown on the opposite page.

Automatic picking system depalletizer robot operation outline.

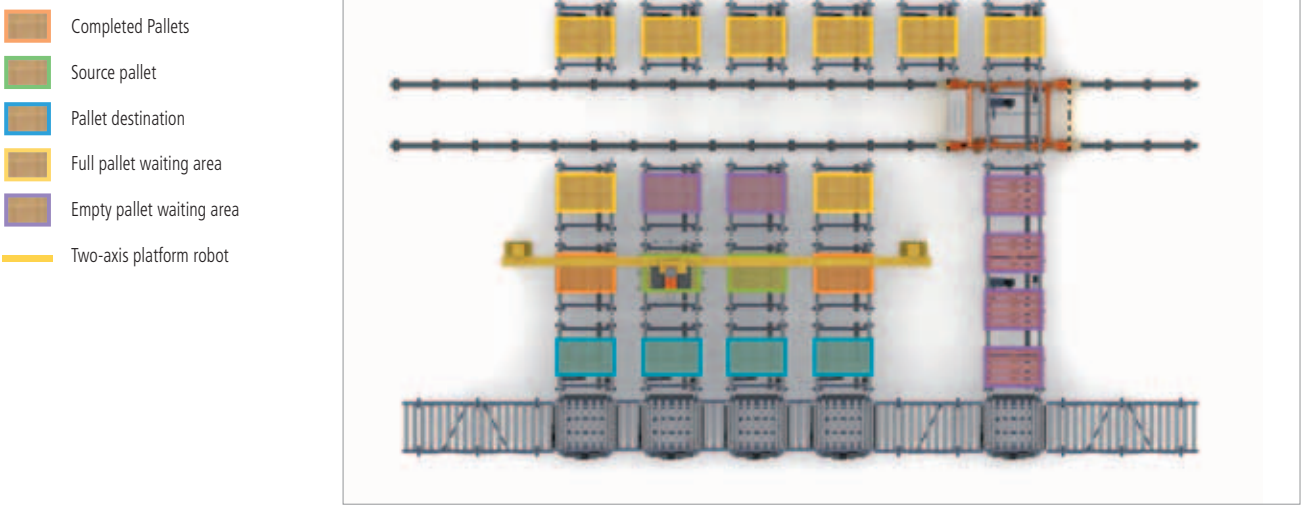


- Incomplete pallet orders
- Pallet starting point
- Pallet final destination
- Pallet waiting area
- Empty pallets
- Anthropomorphic robot

Two-axis platform robot

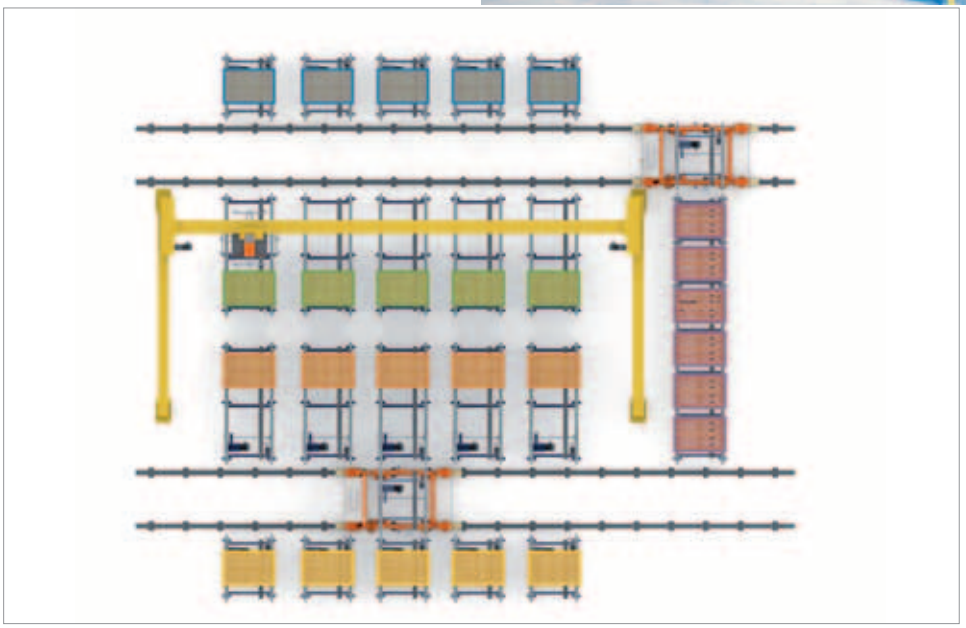
The manipulator arm is rigid and only moves vertically. The cart moves horizontally on the gate, having access to any point that is in the same alignment. You can access various pallets, usually placed in 4 or 5 positions, two home and rest stations.

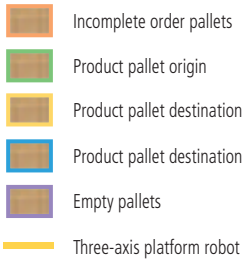
The production typically is as follows:



Three-axis platform robot
The three-axis platform robot is similar to the two-axis, but also moves laterally on the other axis. In this way, you can access two different pallet alignments, assigning each to original positions or destinations. This allows a greater diversification of orders and, in turn, a greater number of orders.

The production operation typically is as follows:





Combination of different systems. Frozen products factory

The automatic transport of goods between different production areas or from production areas to storage spaces helps maintain low staff and resource costs, and eliminates risk of accidents, while also maintaining great agility.

Below is a frozen vegetable company with fully automated internal transport, which communicates throughout seven production areas combined in two warehouse spaces. The production spaces combines transport roller and chain lifting machines with an electric overhead transport. The electrified track communicates quickly and allows distant connection points and high flows.

Only truck loading and unloading is done conventionally.

Input from loading docks

Conveyor system inside the warehouse

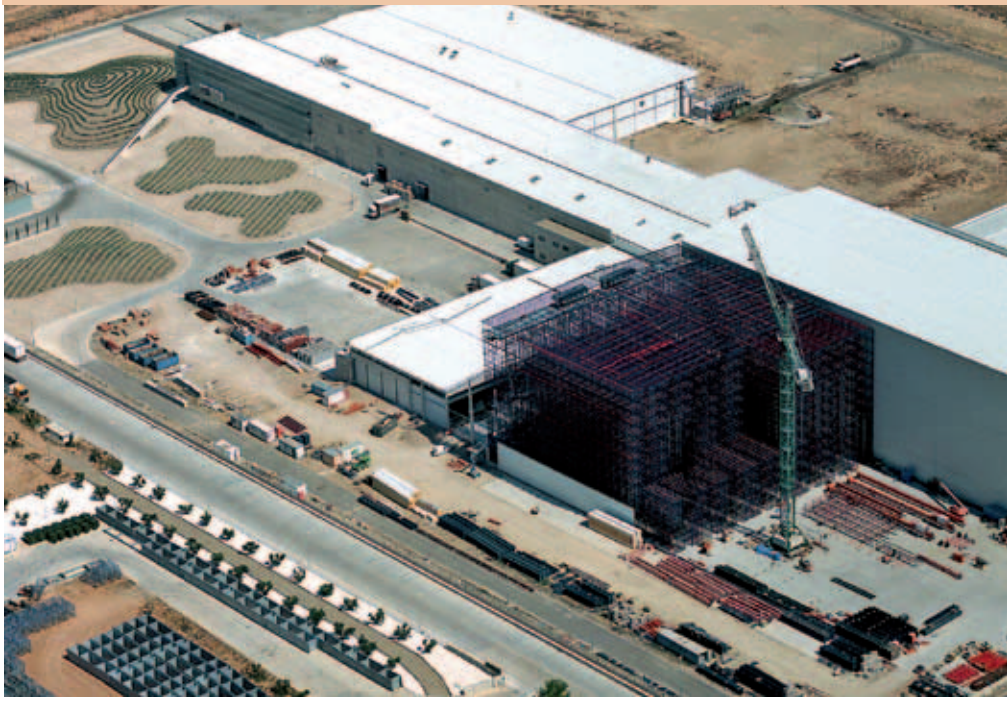
Hall with storage stacker

Conveyor Zone preload

Conveyor Zone preload

Salidas a muelles.

All operations were automated, performed at negative temperatures and the entire logistics center operation was directed by EasyWMS®.



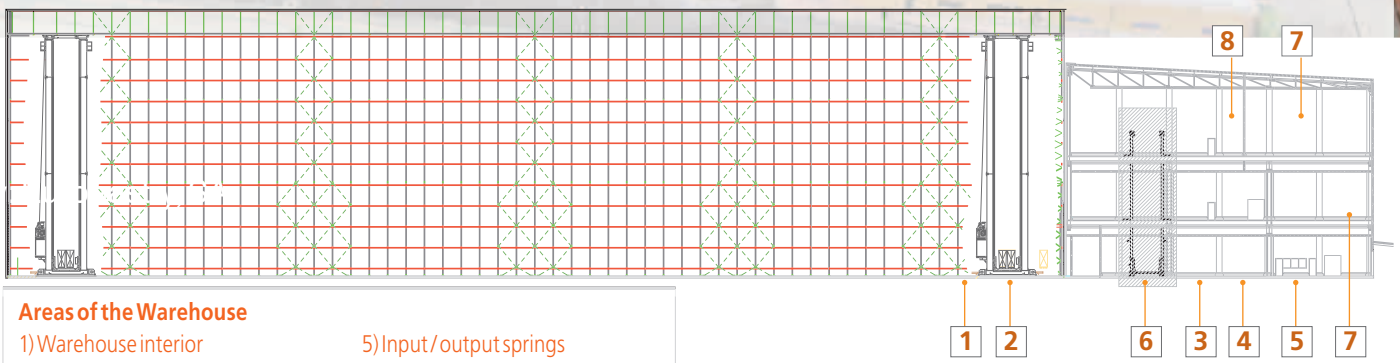
Production areas

1) Calibrated freezer exit
2) Conveyor and elevator to the upper floor
3) Area of wrapping and control
4) Electric overhead communication, entrance to the mixing and packaging area
5) Warehouse space input/output
6) Area of preparing packaging
7) Entry and exit of the packaging area
8) Conveyor bins for packaging and mixing
9) Out of the mixing area
10) Control panels
11) Warehouse miscellaneous

Combining different systems
Freezing solutions for a bread factory's dough supply

Example of a highly automated frozen bread storage and distribution logistics center.

The variety and capacity of orders has necessitated the introduction of automatic and manual picking using voice picking technology.



Areas of the Warehouse

1) Warehouse interior
2) Area Pallet recirculated
3) Area of preload
4) Control input
5) Input / output springs
6) Area lifting
7) Picking manual (voice picking)
8) Automatic Picking layers

All operations were automated, performed at negative temperatures and the entire logistics center operation was directed by EasyWMS®.

The trucks that handle the goods between conveyors and the loading docks hold three pallets simultaneously.

Both elevators communicate to the main building and are capable of lifting two pallets simultaneously.

The automatic picking robot is able to manipulate and access 10 complex layers of picking positions, five at the beginning and five at the end.

The lower power picking is done manually by using voice picking devices.

The checkpoint automatically verifies the 160 pallet per hour entered and verified in the system. In the future, this capacity is likely to increase through an entrance on an upper floor.

The eight storage cranes are capable of

1) Warehouse interior
2) SAS
3) Recirculated pallet area
4) Preload area

The warehouse's construction system is self-supporting, i.e., the shelves inside the warehouse space also support the building.

handling two pallets at once, providing a very high flow.

The SAS' door-opening device is controlled elsewhere in the warehouse.

The preload can be prepared with full or partial pallets for up to five different routes in order to be issued quickly and reduce truck loading times.

Combining different systems. Cold logistics center

This facility, possibly one of the coldest logistics centers in Europe, combines the following systems of storage and order preparation:

- Automatic stacker cranes
- Mobile Bases
- Buffer picking
- Preparation of orders by automated robot
- Standard picking
- Automatic transport mass

This combination makes it a highly flexible storage option.

More products can be stored in the automatic conveyor rotation.

Half rotation orders or pallets of different sizes are stored on mobile bases.

Freezer racking can store goods and single products for a long time.

The automatic buffer allows prepared orders waiting to be sent on shipments to remain undisturbed. A pallet stacker handles the temporarily stored pallets in this area.

1) Automated warehouse
2) Mobile bases facility
3) Compact Warehouse
4) Buffer output
5) Robot automatic picking
6) Interior Conveyors warehouse
7) Automated input / output docks
8) Compactors and elevators
9) Warehouse communication

The automatic picking robot can prepare high turnover products in small multiples instead of larger lump groupings. The pallets are fed by the stacker cranes and automated warehouse containers.

Goods are handled automatically in the receiving and shipment areas.

Warehouse movement of goods through the SAS is governed by the management and control of Interlake Mecalux (EasyWMS® and Galileo).

The roller or chain conveyors, automatic control station, compactor, elevators and security features all ensure an automatic, secure and high-capacity transport control.

1) Entry Pallet
2) Self overview
3) Superior recirculated
4) Stacker crane
5) Lift
6) Automated picking
7) Lower recirculated
8) Manual picking area

Automated warehouse interior
The storage area consists of five aisles of single and double depth with two levels of pallet entrances and exits.

The five stacker cranes offer large cycle capacity due to its ability to maintain a continuous and timely flow of operation.

Additionally, it coordinates with different picking zones in the main warehouse space.

- Automated picking
- Manual picking – ground floor
- Manual picking – top floor

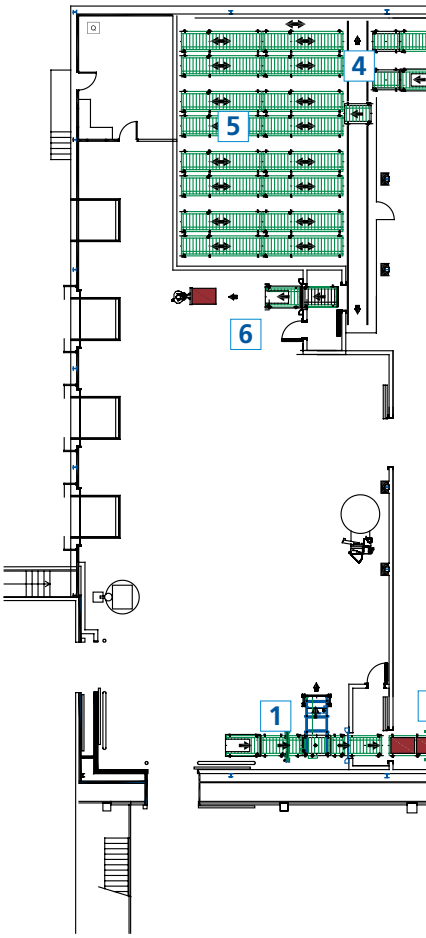
To achieve the required flow, the automated picking area provides a two-axis platform robot, shuttles and conveyor systems.

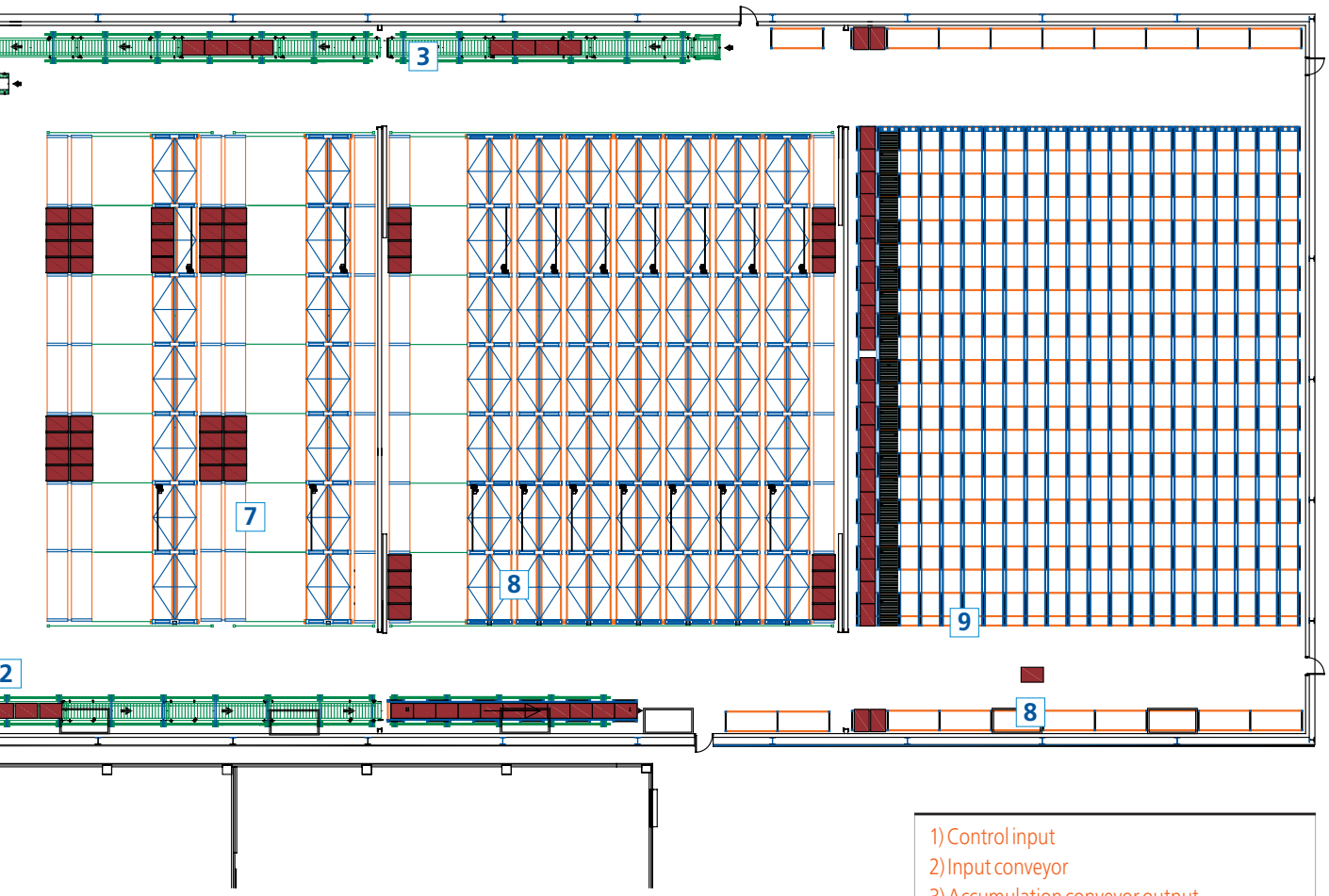
Lift Tables descend to lower level pallets at floor level to be handled along with pallet outside the automated operation.

Combination of different systems.
Solutions for a frozen food factory

Various conveyors can be combined with conventional storage systems and even help in the process of entry, shipping and handling of cargo units.

As an example of a conventional warehouse with diverse stacker crane systems, this industrial freezer composed of mobile bases and gravitationally dynamic shelves.





1) Control input
2) Input conveyor
3) Accumulation conveyor output
4) Shuttle
5) Preload
6) Output conveyors
7) Picking on mobile bases
8) Mobile Bases
9) Gravity dynamic shelving

Standard automated box or tray storage systems integrate the racking, machinery and warehouse management software.

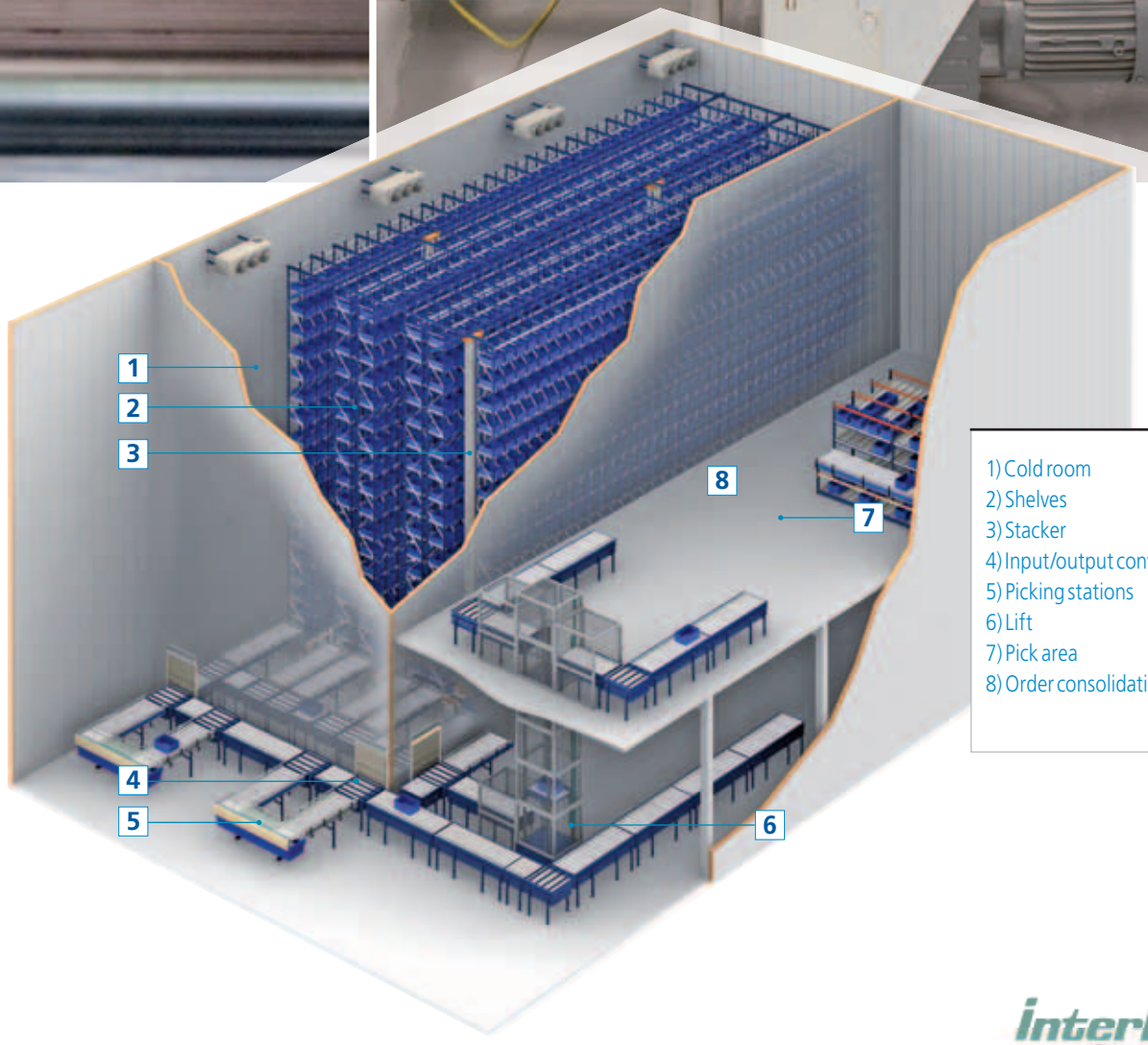
Its extraordinary adaptability makes it possible to integrate in any production or storage.

Automated warehouse boxes

Miniload automated warehouse boxes consist of aisles with shelving on both sides through which cranes circulate. The ends of these shelves host the picking and handling area, where the IN A BOX stacker crane deposits the load extracted from the shelf. Transporters approach the picking and handling area where they then take the goods and place them on the shelves.

Key features:

- Optimal use of space due to its high storage density.
- Excellent load accessibility.
- Permanent inventory through our state-of-the-art computer system.
- Increased productivity for conventional management.
- Total security for the processes of cargo handling, and do not need the presence of operators inside the storage area.
- Protection of cargo, cutting down on damaged goods and therefore profit loss.
- Reliability and ease of use.
- Low maintenance cost.
- Especially effective for companies with intensive picking process.
- Ideal for storing small or medium, temperature-controlled products such as perishables or pharmaceuticals.
- Reduced preparation and dispatch time for orders.
- Rapid return on investment.



1) Cold room
2) Shelves
3) Stacker
4) Input/output conveyors
5) Picking stations
6) Lift
7) Pick area
8) Order consolidation area

Standard Palletizing
The conventional pallet racking from Interlake Mecalux represents the best solution for warehouses needing to store wide varieties of palletized products while maintaining direct access to each pallet, or to optimize the space of the wider aisles.

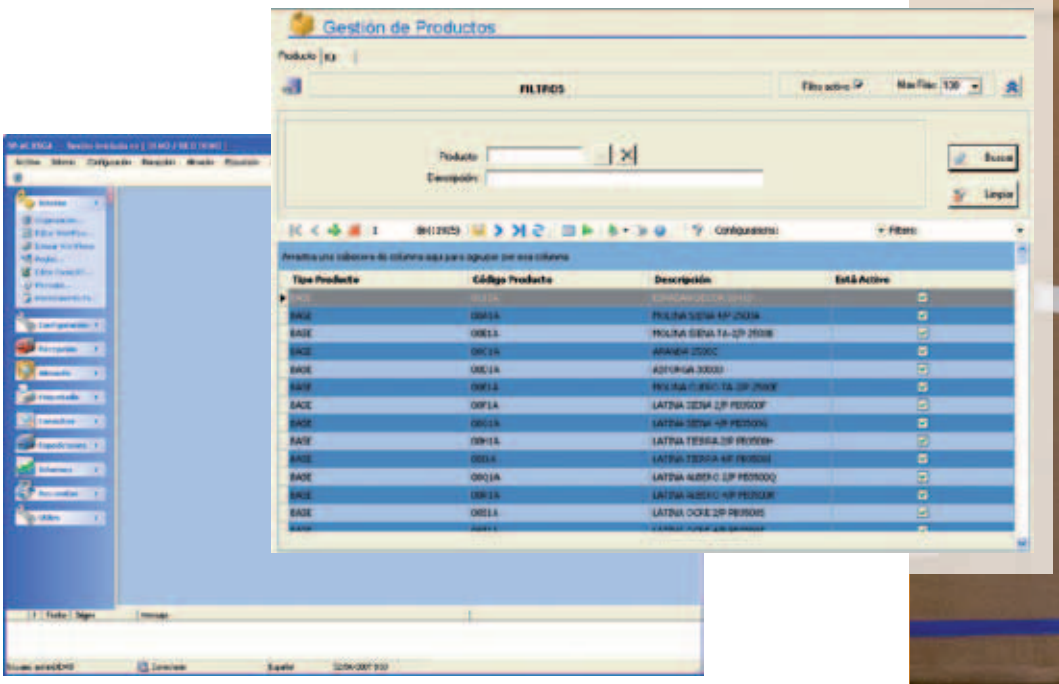
Pallet racking
This storage system is widely used in both refrigerator and freezer spaces, which often requires efficient use of space. This is the optimal solution for small or moderately sized warehouses with low or medium heights serviced by conventional forklifts.

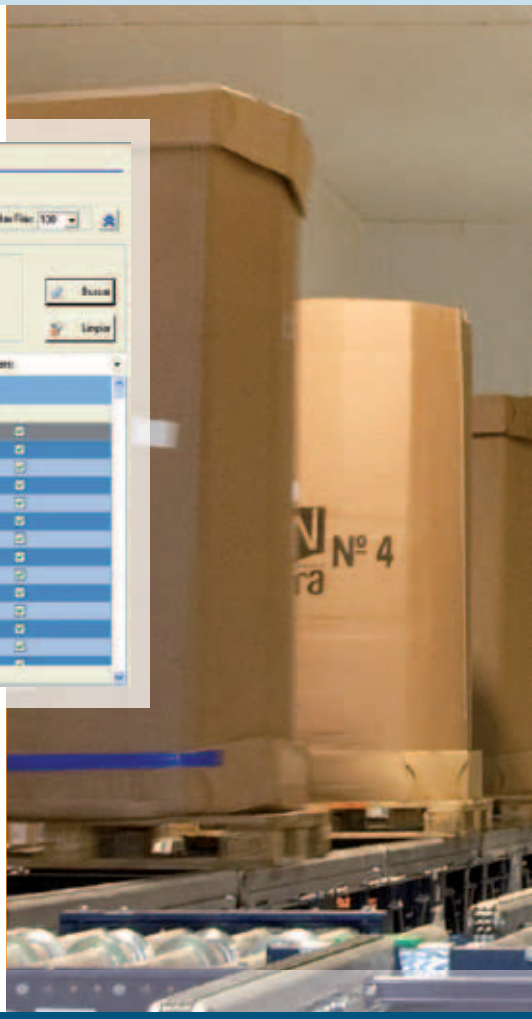
Traditional systems

Dynamic Gravity
This compact "first-in, first-out" structure incorporates carton or pallet flow and is set with a slight slope.

It's suitable for cold climates with a large number of pallets where accumulation and turnover are important.

Push-Back
This system allows users to store up to four pallets deep per level. In addition, this system utilizes the most height and considerably increases warehouse storage capacity, while maintaining the normal turnover rate, of two or more pallets per SKU. With this system, each level can correspond to a single pallet.





easyWMS

Warehouse Management Software

This software has been designed with the latest technology standards, using robust databases and internationally renowned programming languages.

Interlake Mecalux, aware of the high level of industry demand for computer applications responsible for programming, maintaining and updating their warehouses, has created a software development center called EasyWMS®.

Software Features

EasyWMS ® has been designed under the premise of facilitating its use in all warehouse types, including cold warehouses, which have special and unique characteristics.

One of the software's main features - the graphical interface display screens that report to and interact with the operator - is necessary for efficient and operational productivity.

EasyWMS® can easily undertake the following tasks:

- Ticket management . EasyWMS® greatly simplifies the receiving process for the user, allowing single or multiple container reference management. Logistics data for product tracking, such as lot, serial number, expiration date, temperature, weight, quality, etc, are all part of this management system.

- Storage Management. The placement process begins once the product has been received. Using the powerful rules management tool in EasyWMS®, users are able to define management details and warehouse location, taking into account the physical and logistical warehouse and merchandise.-

Output Management. To manage outgoing materials, EasyWMS® works with a practical system of picking, using output orders or output routes either set by the user or programmed automatically.
Executing the process efficiently, the software also categorizes multiple picking operation types, then automatically produce the Bill of Laiding to process fewer picking operations in a single run or from a single workstation.

- Inventory Management. EasyWMS® provides real time inventories of stored stock and maintains the inventory's current location and in-stock adjustments without fail.

EasyWMS® offers you absolute control to monitor what you have in your inventory and to make additions, deletions or changes to the main stored data, as well as logistical considerations surrounding receiving, storage and dispatch management.

- Querying and reporting tools. Users may access their warehouse status queries as well as queries into warehouse machinery (cranes, conveyors, workstations, terminals and radiofrequencies) at any time. Examples of these queries include those relating to entries, outputs, the machine's history or troubleshooting solutions. While users can always display information about the status of the warehouse, bins and stored goods, the most common requests are those pertaining to the percentage of the warehouse that is occupied, gaps or lists of products with their relevant data.

-Integration. A refrigerated warehouse can operate independently of other warehouse management software, or integrate with other systems in more complex warehouse operations in which the warehouse is not solely used for freezer storage.

EasyWMS® offers solutions to both situations without changing the software or technology platform. The only necessary alteration is to select the precise level of complexity within the broad range of capabilities available with EasyWMS®.

Special thanks:

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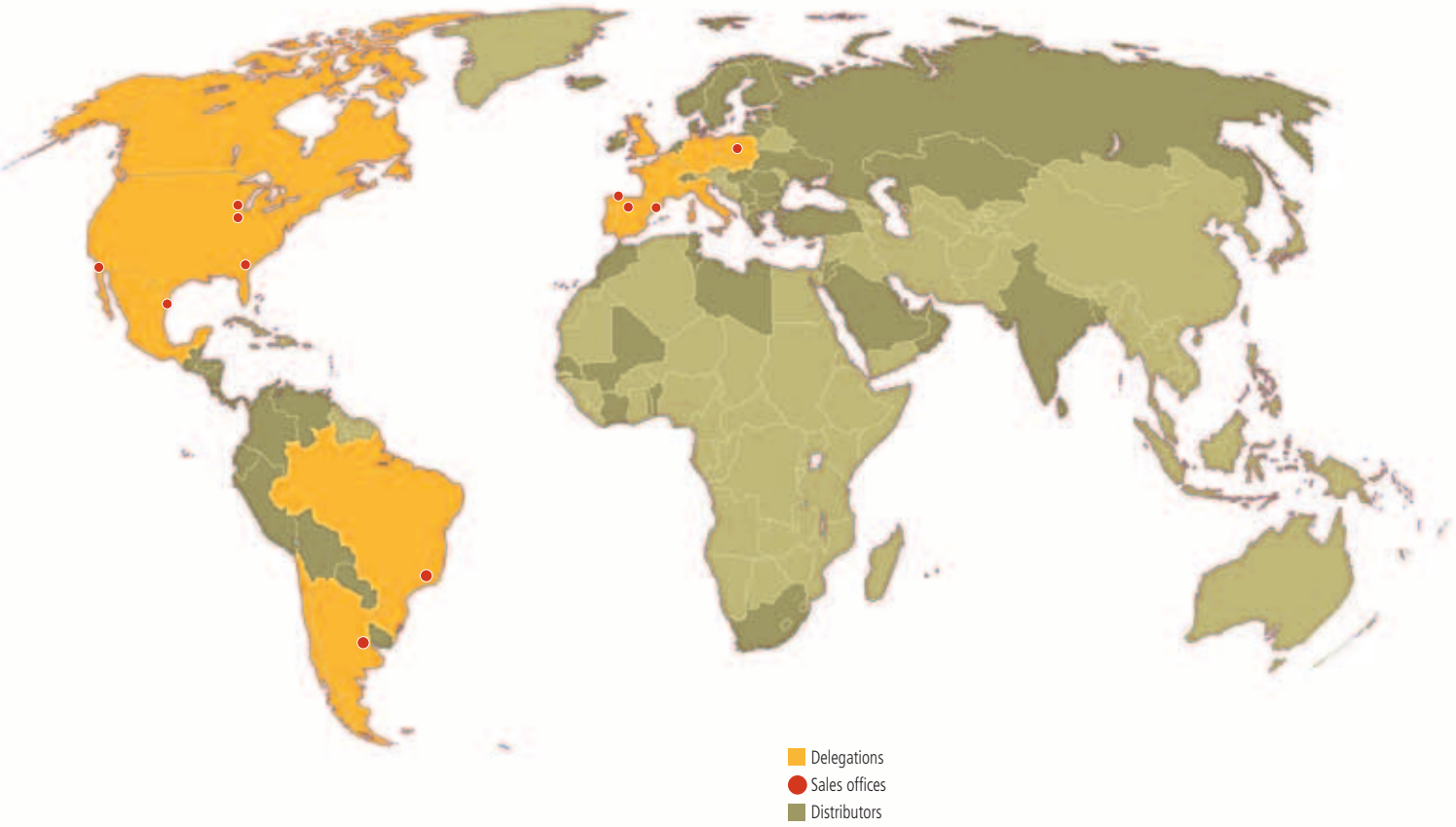
Delegations
Sales offices
Distributors

Tel. 1-877-632-2589 - info@interlakemecalux.com - interlakemecalux.com

SALES OFFICES

CHICAGO
1600 North 25th Ave.
Melrose Park, IL 60160

DALLAS
3333 West University Drive
BLDG 2 unit 2105,
Denton TX 76207

SAN DIEGO
8607 Ave. De La Fuente
San Diego, CA 92154

PRODUCTION PLANTS

CHICAGO
1600 North 25th Avenue
Melrose Park, IL 60160

MATAMOROS
Las Rusias 2700,
Industrial del Norte
Matamoros Tamaulipas,
C.P. 87316

PONTIAC
701 Interlake Drive
Pontiac, IL 61764

TIJUANA
Blvd. Bellas Artes, 9001
Ciudad Industrial Nueva Tijuana
Tijuana, B.C. - C.P. 22444

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