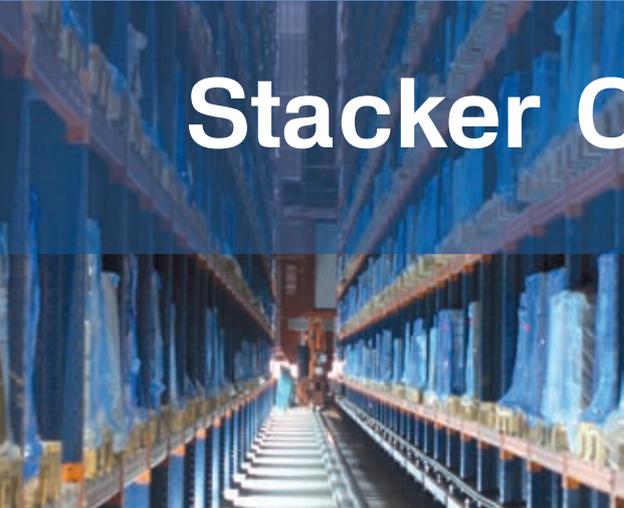




# Stacker Cranes for Pallets





Stacker cranes are machines designed for the automated storage of materials. They travel along the aisles of the warehouse, where they enter, position and extract materials.





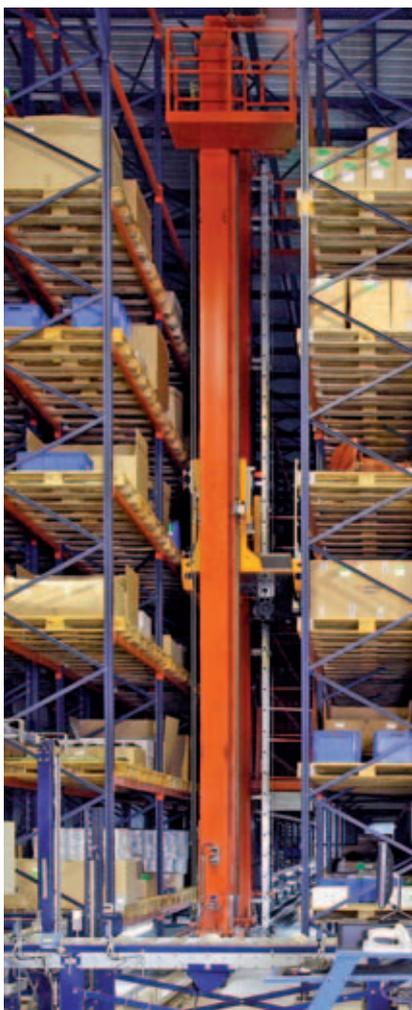
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Mecalux's stacker cranes have demonstrated their efficiency in sectors as diverse as the food industry, the car industry, pharmaceuticals, spare parts, metallurgy, chemicals and public administration.

## → STACKER CRANES FOR PALLETS



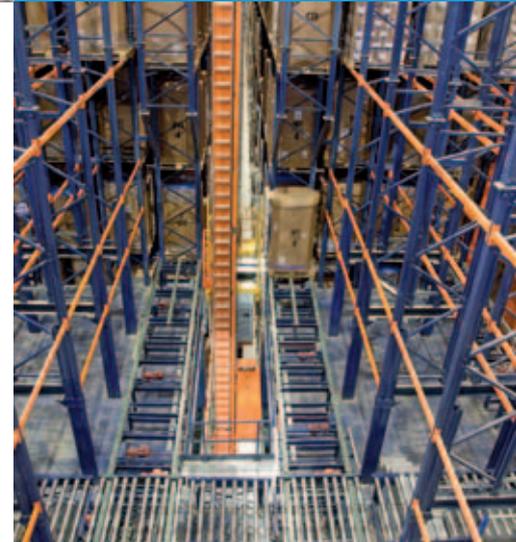
Stacker cranes are machines designed for the automated storage of materials by means of automated mechanical movements. Materials are entered and extracted in the same movement (this is known as a combined cycle). This increases the productivity of the installation at the same time as reducing the resources required for it to function.

In order to move the loads in the warehouse, the stacker cranes can carry out three types of movements:

- **Longitudinal:** on a rail along an aisle.
- **Vertical:** up the column of the stacker crane.
- **Transversal:** or in depth, performed by the extraction systems fitted to the cradle of the machine in order to extract or position a pallet.

The principal types of stacker cranes are:

- **Single-mast** (for pallet load weight up to 1,500 kg).
- **Twin-mast** (for pallet load weight up to 1,000 kg).



The Mecalux stacker cranes are state-of-the-art machines with commands operated by vector-controlled frequency variators with positioning control by means of laser telemeters and intelligent control by PC or PLC.

The range of stacker cranes adapts easily to the needs of each warehouse in terms of load capacity, dimensions, building height and cycle times, and so is able to cover a huge range of applications.

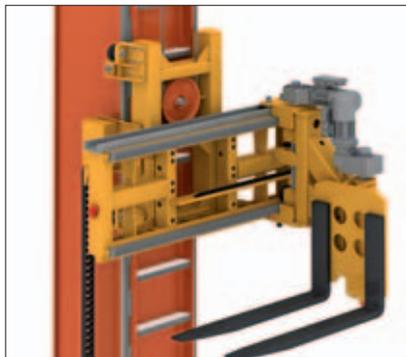
All of these systems can be adapted to special working conditions such as freezing temperatures (-30 °C), extreme humidity or special features including the possibility of increasing standard working speeds.

What is more, it has electronic energy recovery devices, which account for considerable savings in monthly energy consumption.

### Single-mast pallet stacker cranes (MTO)

Designed to handle non-operator automated systems in free-standing warehouses using conventional shelving without the need for upper guide rails. Its main advantages are:

- **Load picking on three sides** with bottom dimensions under 100 mm on the sides and 0 mm for front picking.
- **Does not require upper guide rail**, meaning it can be used in existing warehouses without having to reinforce the shelving units.
- **Eight-wheel running gear**, making aisle changes over the transfer bridge easy, without requiring a pit.
- **Completely automatic** operation that connects to EasyWMS®.



#### CHARACTERISTICS

|                                     |                             |
|-------------------------------------|-----------------------------|
| Maximum height - single deep        | 15,000 mm                   |
| Upper guide rail rail               | No                          |
| Maximum weight over entire height   | 1,000 kg                    |
| Max. load dimensions                | 1,300 x 1,100 x 2,300 mm    |
| Type of extractor                   | Trilateral electric forks   |
| Max. drive speed ( $V_x$ )          | 100 m/min                   |
| Max. drive acceleration ( $a_x$ )   | 0.3 m/s <sup>2</sup>        |
| Max. lifting speed ( $V_y$ )        | 38 m/min                    |
| Max. lifting acceleration ( $a_y$ ) | 0.3 m/s <sup>2</sup>        |
| Aisle changing system               | Transfer bridge without pit |
| Europallets of 800 mm and 1,000 mm  | Yes                         |
| GMA or closed CHEP pallets          | Yes                         |

### Single-mast MT stacker cranes for pallets

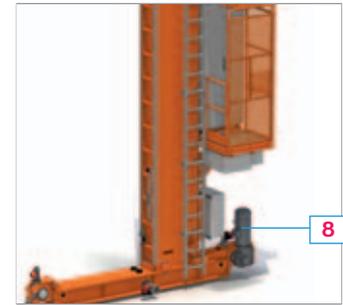
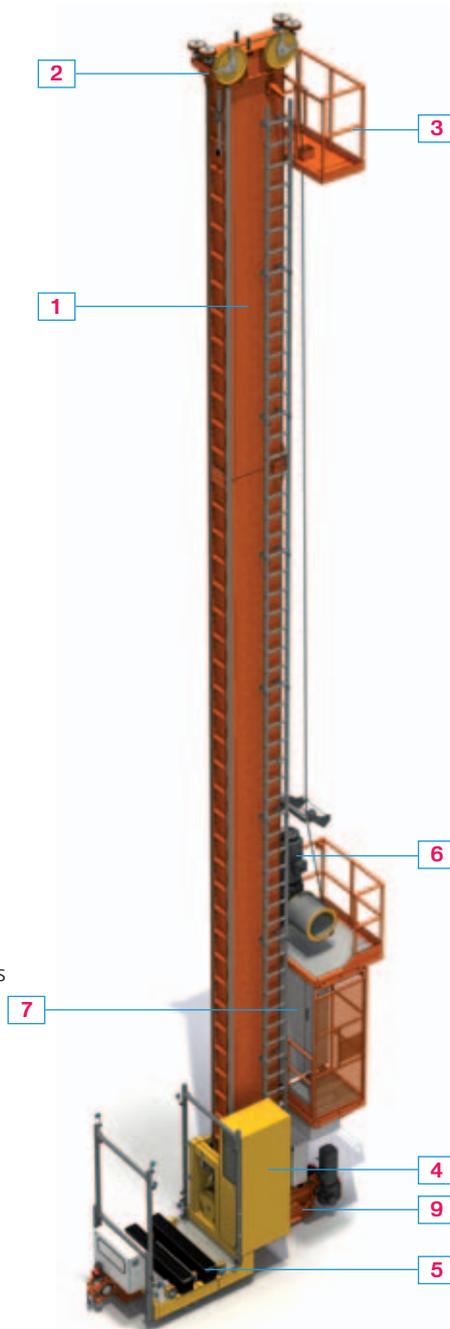
The new MT line is lighter, faster, and more energy efficient.

Designed to offer the greatest possible levels of functionality and efficiency, their wide range enables the user to select in each case the most suitable stacker crane in terms of available space and goods to be handled.

The existence of a type of machine for each warehouse height allows the cost of the installation to be trimmed to the maximum.

With stackers ranging from the MT-1 model, ideal for simpler installations, up to the MT-6 which can reach a storage height of 45 m, all commonplace needs are covered.

The table below details the technical limits of the range of Mecalux's single-mast stacker cranes.



#### Basic components

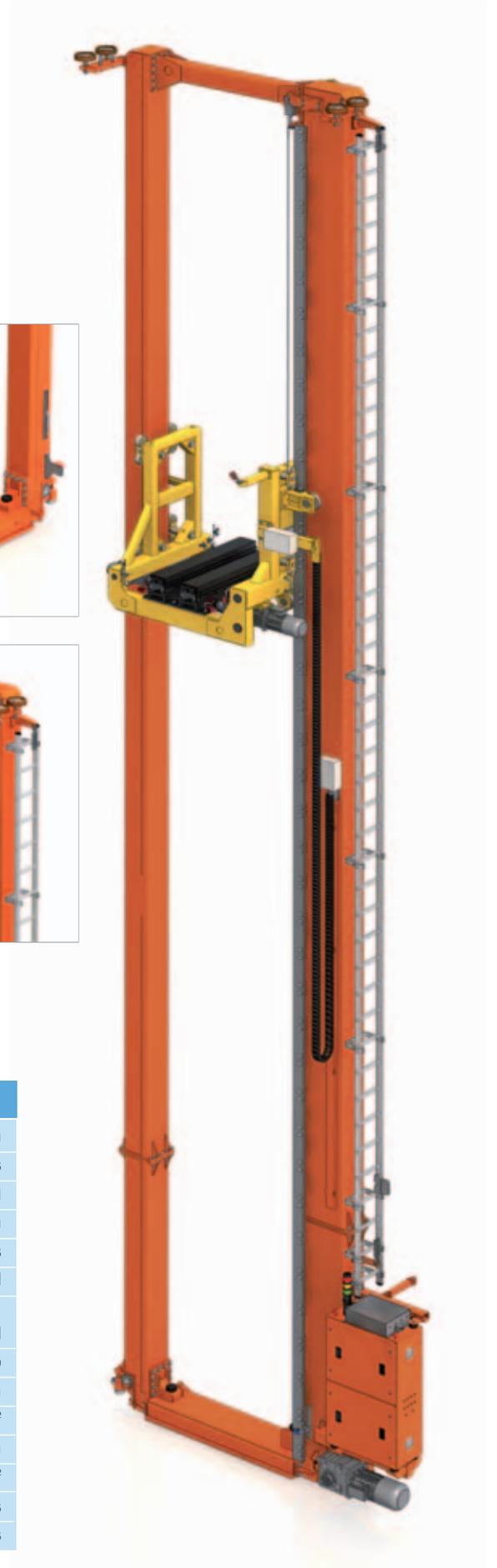
- 1 Column
- 2 Top guide base
- 3 Maintenance platform
- 4 Operator cabin
- 5 Lifting cradle
- 6 Gearmotor for lifting
- 7 On-board control panel
- 8 Gearmotor for traveling
- 9 Bottom guide base

| CHARACTERISTICS                      | MT-1  | MT-2      | MT-3      | MT-4      | MT-5      | MT-6      |
|--------------------------------------|---|-----------|-----------|-----------|-----------|-----------|
| Maximum height - single deep         | 18,000 mm   | 24,000 mm | 33,000 mm | 36,000 mm | 40,000 mm | 45,000 mm |
| Maximum height - double deep         | 15,500 mm   | 22,000 mm | 27,000 mm | 33,000 mm | 40,000 mm | 45,000 mm |
| Telescopic fork - single deep        | Yes   |           |           |           |           |           |
| Telescopic fork - double/triple deep | Optional  |           |           |           |           |           |
| Max. load admitted                   | 1,000 kg  |           |           |           |           |           |
| Max. drive speed (Vx)                | 220 m/min   |           |           |           |           |           |
| Max. drive acceleration (ax)         | 0.45 m/s <sup>2</sup>                                 |           |           |           |           |           |
| Max. lifting speed (Vy)              | 66 m/min  |           |           |           |           |           |
| Max. lifting acceleration (ay)       | 0.5 m/s <sup>2</sup>                                  |           |           |           |           |           |
| Shuttle car                          | Optional  |           |           |           |           |           |
| Side mounted cabin                   | Optional  |           |           |           |           |           |
| Working temperature range            | From -30 °C to +40 °C                                 |           |           |           |           |           |
| Max. load dimensions                 | 1,100 x 1,300 x 2,400 mm                              |           |           |           |           |           |
| Pallet type                          | Europallet of 800 mm and 1,000 mm in width (EN 13382) |           |           |           |           |           |
| Energy recovery system               | Optional  |           |           |           |           |           |

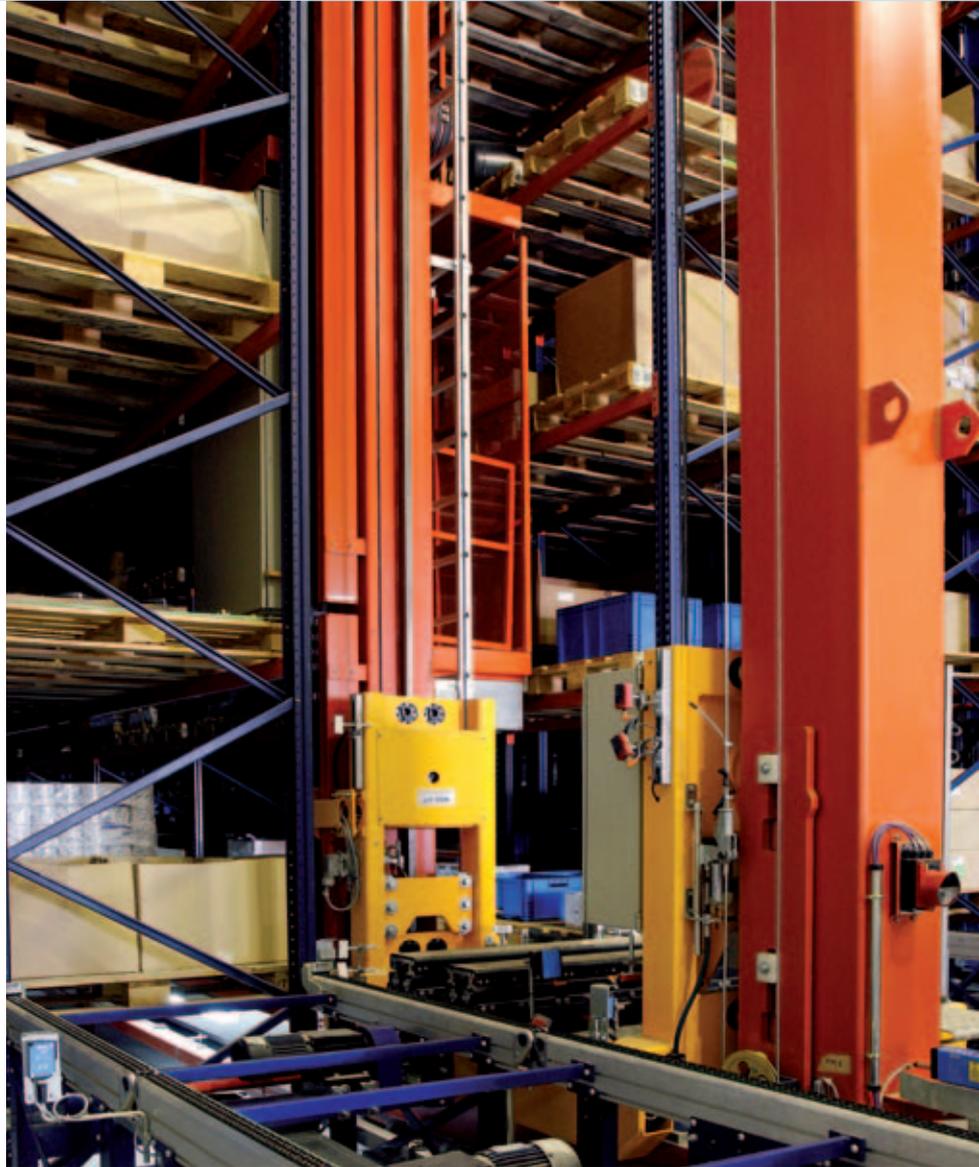
### Twin-mast stacker cranes (MTBO)

Created for simple storage systems, there are fewer features but it is just as safe, and has high capacity without the need for a great deal of space. Twin-mast cranes is affordable and energy efficient. Its main advantages are:

- **Minimum level of load pick-up** with a connection to automated conveyors.
- **Eight-wheel carriage**, making aisle changes easy over the transfer bridge without requiring a pit.
- **Total automation**, even for incoming and outgoing operations, if additional conveyors are placed at the header line.
- **Low energy consumption.**
- **Completely automatic** operation connecting to EasyWMS®.



| CHARACTERISTICS                                   |                               |
|---|-------------------------------|
| Maximum height                                    | 18,000 mm                     |
| Upper guide rail                                  | Yes                           |
| Maximum weight over entire height                 | 1,500 kg                      |
| Max. load dimensions                              | 1,300 x 1,100 x 2,400 mm      |
| Telescopic fork - single deep                     | Yes                           |
| Telescopic fork - double/triple deep              | Optional                      |
| Picking systems via radio shuttle/roller conveyor | Optional                      |
| Type of extractor                                 | Telescopic fork - double deep |
| Max. drive speed ( $V_x$ )                        | 120 m/min                     |
| Max. drive acceleration ( $a_x$ )                 | 0.3 m/s <sup>2</sup>          |
| Max. lifting speed ( $V_y$ )                      | 38 m/min                      |
| Max. lifting acceleration ( $a_y$ )               | 0.3 m/s <sup>2</sup>          |
| Europallets of 800 mm and 1,000mm                 | Yes                           |
| GMA pallets                                       | Yes                           |



### Twin-mast MTB stacker cranes for pallets

Twin-mast stacker cranes have been developed for circumstances requiring more demanding features. They offer enhanced improved performance in terms of storage height, load capacity and working speeds.

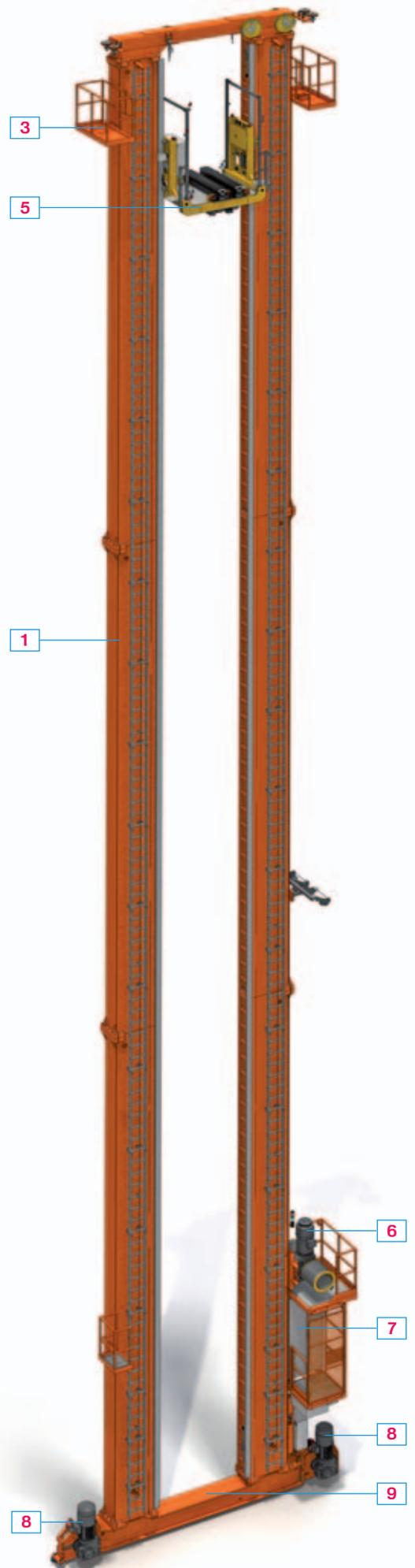
The lifting cradle operates between two columns allowing access to all levels, thus ensuring that the installation is sturdy and strong.

This class of stacker cranes also offers a wide range of machines enabling optimal adaptation to height and weight factors of the load. The range of twin-mast stacker cranes of Mecalux can be seen in the following table.

| CHARACTERISTICS                                    | MTB-1   | MTB-2     | MTB-3     | MTB-4     | MTB-5     | MTB-6     | MTB-7     |
|--|---|-----------|-----------|-----------|-----------|-----------|-----------|
| Maximum height - single deep                       | 12,000 mm   | 17,000 mm | 22,000 mm | 27,000 mm | 35,000 mm | 40,000 mm | 45,000 mm |
| Maximum height - double deep                       | -   | 12,000 mm | 20,000 mm | 27,000 mm | 35,000 mm | 40,000 mm | 45,000 mm |
| Telescopic fork - single deep                      | Yes   |           |           |           |           |           |           |
| Telescopic fork - double/triple deep               | Optional  |           |           |           |           |           |           |
| Picking systems via radio-shuttle/ roller conveyor | Optional  |           |           |           |           |           |           |
| Max. load admitted                                 | 1,500 kg  |           |           |           |           |           |           |
| Max. drive speed ( $V_x$ )                         | 180 m/min   |           |           |           |           |           |           |
| Max. drive acceleration ( $a_x$ )                  | 0.5 m/s <sup>2</sup>                                  |           |           |           |           |           |           |
| Max. lifting speed ( $V_y$ )                       | 66 m/min  |           |           |           |           |           |           |
| Max. lifting acceleration ( $a_y$ )                | 0.8 m/s <sup>2</sup>                                  |           |           |           |           |           |           |
| Optional shuttle car                               | Yes   |           |           |           |           |           |           |
| Optional maintenance elevator cabin                | Yes   |           |           |           |           |           |           |
| Working temperature range                          | From -30 °C to +40 °C                                 |           |           |           |           |           |           |
| Max. load dimensions                               | 1,300 x 1,100 x 2,400 mm                              |           |           |           |           |           |           |
| Pallet type  | Europallet of 800 mm and 1,000 mm in width (EN 13382) |           |           |           |           |           |           |
| Optional energy recovery system                    | Yes   |           |           |           |           |           |           |

**Basic components**

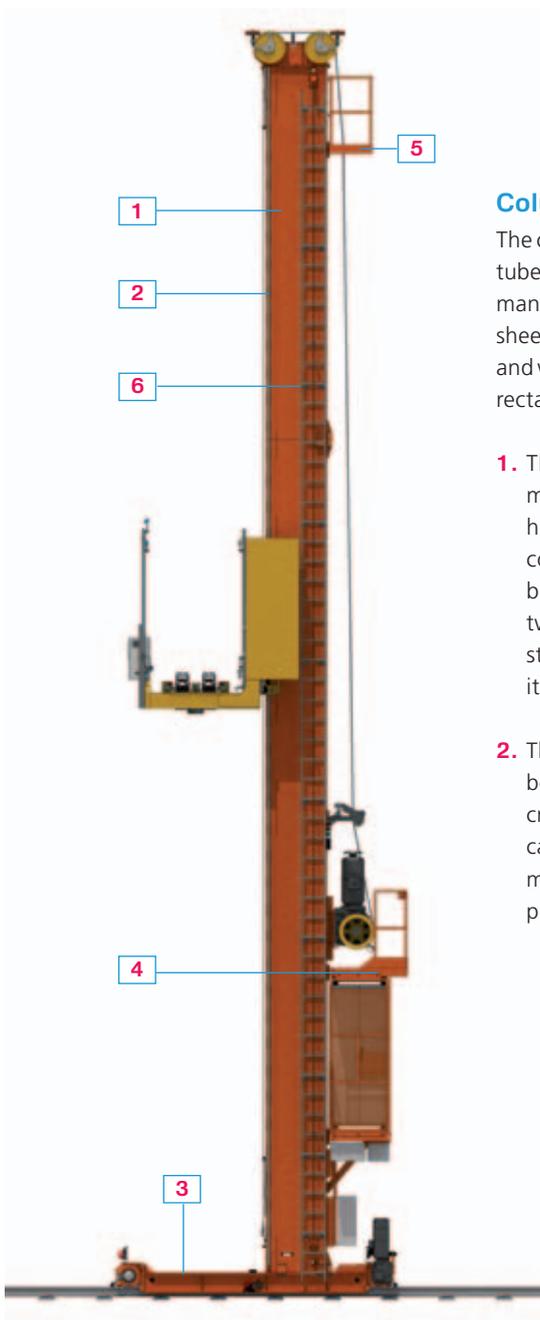
- 1 Columns
- 2 Top guide base
- 3 Maintenance platform
- 4 Operator cabin
- 5 Lifting cradle
- 6 Gearmotor for lifting
- 7 On-board control panel
- 8 Gearmotor for traveling
- 9 Bottom guide base





The design of the stacker cranes minimises the forces transmitted to the structure on which they are supported. In the long run this prevents the rack and warehouse structure from being damaged. Stacker cranes are made up of the following components: columns, guide base or bottom frame, top guide base, hoisting control and the mobile hoisting frame or cradle.

## → MECHANICAL COMPONENTS

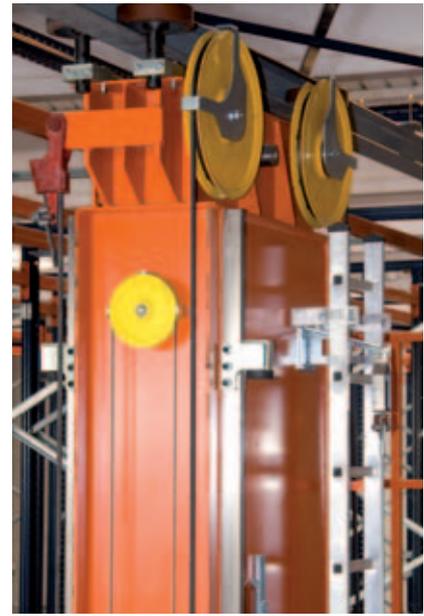


### Columns

The columns can be formed by structural tubes or by box-girders. They are manufactured from highly resistant steel sheets which have been specially shaped and welded together forming a rectangular-shaped box-girder.

1. The box girder is reinforced inside by means of lattice ribbing fitted horizontally and diagonally, giving the column greater resistance to torsion and bending. The structure formed by the two columns and the two frames strengthens the stacker crane, ensuring it is sturdy and stable when moving.
2. The columns come with **vertical tracks** bolted on both sides that guide a hoisting cradle. These tracks are ST 52 K-grade calibrated rectangular sections which are mechanized to obtain a high degree of precision.

3. A **plate of welded steel** is bolted at the base of the column to the bottom frame. These machine-cut steel plates are welded to both edges of the column, and then bolted to the top and bottom guide bases.
4. Under the hoisting group platform there is a completely enclosed and secure control cabin, along with an electrical control panel.
5. Maintenance tasks are accessed via the emergency ladder installed along the column's flank, which comes equipped with a safety cable. All the equipment complies with current safety regulations.
6. The **MTB line** of twin-mast cranes can be installed with an independent elevator cabin to carry out maintenance tasks.



### Bottom guide base or frame

This structure in the form of a box is made up of profiles and steel sheets welded together, which are resistant to bending and torsion thanks to the reinforcement ribbing welded inside at regular intervals.

The drive wheel and free wheel headers are fastened to both ends of the bottom chassis with bolted and welded plates. The free wheel header allows the column to be plumbed easily.

The drive wheel is fitted by heat on a shaft which is supported on a set of bearings located in these housings. The wheel is fitted or removed by dismantling the system of fixing clamps.

A conical gear reducer with hollow shafts is fitted on these shafts. It is secured by a torque arm which is connected to an AC drive equipped with an electro-brake and an incremental encoder for blocking the speed regulation loop. The free wheel is mounted in the same way with the difference that the shaft does not need to be prolonged for the gear reducer to be fitted.



With the aim of ensuring the safe and silent functioning of the stacker crane, both the drive wheel and the free wheel have been designed with a machine produced flat rim made of cast steel. The rolling contact surface has been specially treated.

The guidance system in a longitudinal direction is done using contrast wheels positioned at both sides of the rolling rail and close to both the drive wheel and the free wheel.

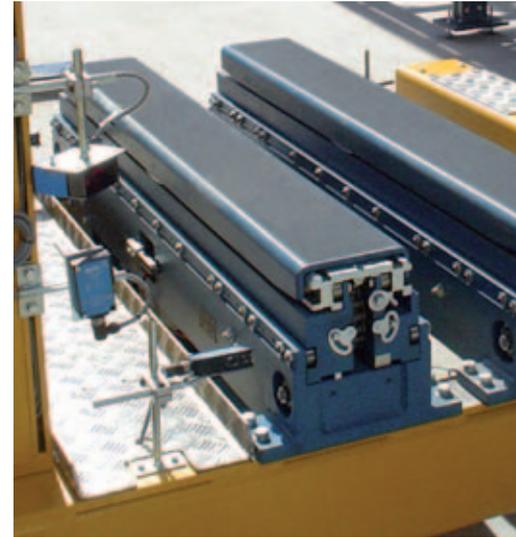
Claws are bolted to the ends of the bottom frame in order to keep the wheels in contact with the rolling rail, thus preventing the carts from derailing in the case of accidental collisions.

### Top guide base

The top guide base or frame is made up of welded plates, located at the top of the column, which are used to support the horizontal guide wheels on the top rail. These wheels are covered in a strip of VULKOLLAN® in order to cushion the noise that may be produced by operating the stacker crane at high speeds.

The top guide base is fitted with the guide pulleys for the lifting cable, which in turn are mounted on the shafts by means of cylindrical roller bearings.

The stacker crane is designed so that the impact forces on the buffers are transmitted directly to the floor slab. In this way, any forces resulting from the machine crashing into the buffers are not transmitted to either the structure or the warehouse roof.



### Hoisting operation

The function of the lifting mechanism is to raise the mobile frame vertically.

It consists of an alternating current motor designed to operate vector frequency converters and is equipped with an encoder to close the speed and braking control loop.

This is coupled to a helicoidal conical gear reducer. The side of the gears are specially treated and fitted with ground gear teeth. The conical units are also treated and lapped.

The drums are fitted on the shaft of the gear reducer. The lifting cables are wound around the drums, which are calculated according to the DIN 4130 standard. They are secured by means of a system of chocks which is easily adjusted and disassembled.

### Mobile hoisting frame or cradle

The purpose of the mobile lifting frame (cradle) is to move the load and the cabin up and down and to perform the pick-up and deposit cycles with the extendable forks fitted on the cradle.

An aluminium striate sheet floor is fitted in the spaces between the two bodies of the fork and the structure of the mobile frame. This is designed to support the weight of a person while carrying out maintenance work.

At the side of the frame next to the column, support rollers are fitted which can be adjusted by means of cams. This enables the mobile frame to be adjusted horizontally, vertically and along the longitudinal axis of the aisle.

The MT model has a built-in speed control mechanism situated in the hoisting cradle, as opposed to the MTB model, which has the same mechanism located on the side of the machine column, both of which activate the safety catch to immediately block the cradle.

A speed control mechanism, fitted on the side of the column of the machine, triggers the fall protection device. The engagement of the chocks does not damage the vertical guide profiles.

### Extraction systems

A determining element in the performance of the stacker cranes is the system for extracting the load unit. In function of the requirements of each installation, the load unit is parameterised in order to obtain the best results.

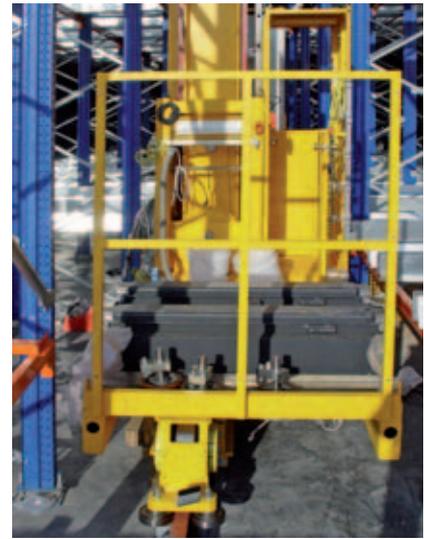
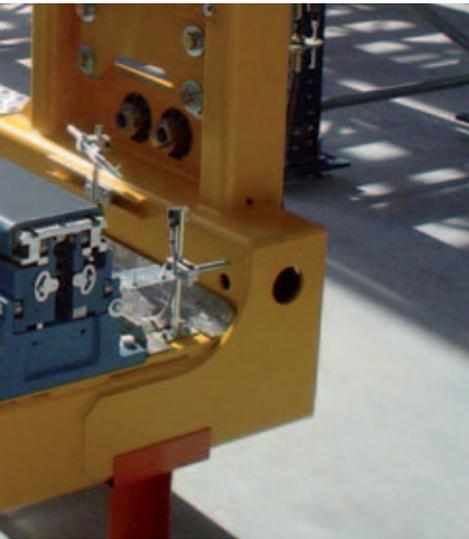
The fundamental parameter to take into account, in addition to the extraction speed, is the depth of the fork's extension. In function of the relationship between the static and dynamic capacity of each case, single, double and even triple depth systems are used.

Depth is understood as the number of pallets which can be placed in the rack at each side of the aisle; hence, the term single depth is used when a single pallet is placed at each side; and double depth is used when two pallets can be placed at each side of the aisle.

In the systems with a single depth, priority is given to the speed and flexibility of the system over the total storage capacity, while in double depth systems, an excellent balance is achieved between storage capacity and handling speed.

Different extraction systems are available:

- Single deep
- Double deep
- Triple deep
- Shuttle car
- Roller conveyor



#### Single-deep telescopic fork

This horizontal handling mechanism enables load units to be deposited in or extracted from single-depth racking.

The telescopic fork is made up of two arms joined together by a drive shaft, in order to prevent tension. The great resistance against torsion of the coupling guarantees the uniform movement of the arms. The profiles of the hooked connector are inserted together by means of curved rollers and sliding guides, which gives the telescopic arm great strength.

#### Double-deep telescopic fork

This consists of a horizontal handling mechanism which helps to deposit or extract load units in double-depth racking by means of telescopic forks.

The telescopic fork is made up of two arms joined together by chain gearing or an articulated shaft in order to prevent tension. The great resistance against torsion of the coupling guarantees the uniform movement of the arms.

The profile of telescoping parts and selected manufacturing materials not only allows load picking and deliveries at a second depth level, but also at a 150 mm height difference above the first depth level. Such a difference greatly lowers the overall height of double-deep automatic warehouses, with the subsequent saving in building space.

#### Triple-depth telescopic fork

Enables the placement of three pallets across each side of the aisle on shelves which have top-hats.

These forks are specially indicated for applications which favour increased storage density. The transport systems using headers varies slightly, due to the fact that pallets are warehoused and transported in the opposite direction than normal.

| CHARACTERISTICS                             | SINGLE DEEP                                 | DOUBLE DEEP                               | TRIPLE DEEP                                 |
|---|---|---|---|
| Fork sizes for loads of 1,000 kg            | 1,300 mm                                    | 1,300 mm                                  | 1,900 mm                                    |
| Fork sizes for loads of 1,500 kg            | 1,350 mm                                    | 1,350 mm                                  | -   |
| Fork stroke                                 | 1,425 + 50 mm                               | 2,800 + 50 mm                             | 1,435 + 50 mm                               |
| Height x width of the fork                  | 65 x 170 mm                                 | 70 x 180 mm                               | 75 x 175 mm                                 |
| Maximum deployment speed with load          | 40 m/min                                    | 42 m/min                                  | 40 m/min                                    |
| Maximum deployment speed without load       | 80 m/min                                    | 90 m/min                                  | 80 m/min                                    |
| Acceleration with/without load              | 0.8 m/s <sup>2</sup> / 1.5 m/s <sup>2</sup> | 0.8 m/s <sup>2</sup> / 2 m/s <sup>2</sup> | 0.8 m/s <sup>2</sup> / 1.2 m/s <sup>2</sup> |
| Height difference between 1st and 2nd depth | -   | 150 mm                                    | 0 mm  |
| Crossbeam in the shelf location (top-hat)   | -   | -   | 270 mm                                      |



## → ELECTRICAL COMPONENTS



### Shuttle car

This is a mobile cart which is fitted with a lifting system. It moves below the loads along the inside of the rack on guides, enabling pallets to be loaded and unloaded in storage spaces of up to 20 m in depth.

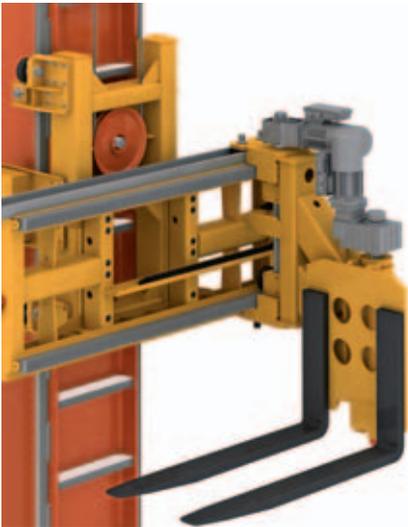
The system makes dense storage possible in blocks of pallets with different widths, containers or cages.

When applicable, a storage system of this type offers the following benefits:

- **Compact storage** minimizing dead space.
- Allows for the transport of **special pallets of different widths**.
- The shuttle car permits the **transport of special pallets of different widths**.
- The direct electrical supply facilitates the **repair of breakdowns** in manual mode operation from the control panel.
- The use of **proven mechanical elements**, especially standard gearboxes, ensure the **great reliability of the installation**.
- The power line runs along the bottom of the shelf by appropriate support elements.
- VULKOLLAN® wheels **eliminate noise** when running.
- **Positioning by absolute encoder** does not require cams in the rack.
- On-board sensors permit the maximum approximation between pallets, thus obtaining a high degree of compactness.

### On-board conveyors

Ideal for feeding live channels with roller tracks that stack by gravity. Totally automates the filling of gravity-fed channels.



### Trilateral forks

A special application used in the MT0 machines, it can provide solutions to conventional warehouses without the need for overhead guides.

Offers the option of delivering loads frontally and storing them laterally.



### Electric box

The electric box on board the stacker crane is fitted in the back part of the front column. The controls are laid out so that the stacker crane can be operated as an individual unit.

The electrical connection to the cradle and the lift is made through sliding brushes fitted loosely to the cradle. The electrical power to the stacker crane can be cut thanks to a switch placed alongside the electrical closet and safety switches installed outside the aisle.

### Module to feed energy back into the network

Optionally, an electronic module for feeding energy back into the network may be offered. This permits a saving on electricity consumption of around 15%. The device is assembled on the stacker crane and connects the power supply voltage from the intermediate circuit of the convertors. When the engines work as generators, most of their energy is therefore returned to the client's supply network for absorption by any other consumption element that may be connected to it.



### Data transmission

In order to establish communication between the decentralised periphery terminals and the fixed PC or PLC, along with the adjustable-speed drives, infrared optical communication systems (photocells) are used, with reaches of up to 240 m and a transmission speed of 1.5 Mbps, for working temperatures of up to -30°C, if necessary.

The fixed photocells are placed at the end of the aisle and the onboard ones are mounted on the bottom guide base. For the version of data communication between the mounted box and the lifting cradle, a set of photocells are fitted facing the cradle and the above mentioned bottom guide base.

## → AISLE EQUIPMENT

The aisle equipment is made up of a bottom rail, a top guide rail, safety equipment, electrical supply, data transmission and systems for measuring position.

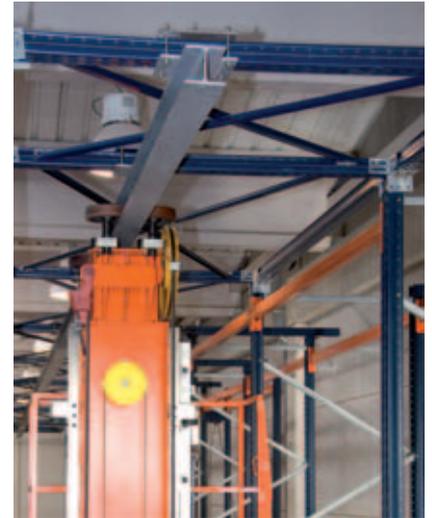


### The bottom guide rail

A RN-45 type track or equivalent is fastened to the concrete slab with support plates having anti-vibration plastic insulators placed at a distance that is suited to the total mass, in order to properly distribute loads.

This fastening system is quickly and easily levelled, tolerating live loads and the effects due to thermal variations.

A special welding method is used between different sections to bear the aforementioned circumstances.



### The top guide rail

The top guide rail can be formed by a HEA 120. It is fixed to the top profiles used to join the rack structures by means of welded adjustment plates.

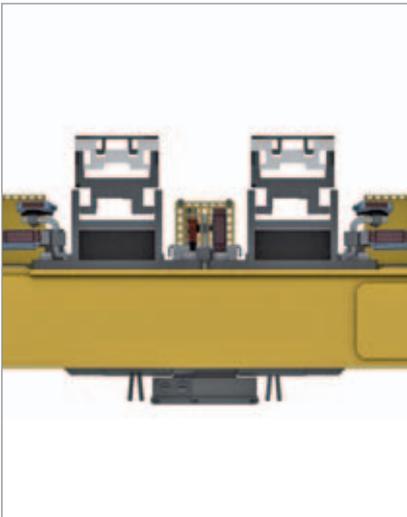
Contrast wheels apply lateral force to the top guide track.



### Position measurement systems

When measuring the exact position of each axis, the most suitable system is selected:

- Crossbeam detection
- Pallet push/pull control
- Laser range finder by default
- Absolute encoder



#### Crossbeam detection

The optical detection of crossbeams has been improved, considering the unit's arrow that sharpens the precision in load pick-up/deposits on the shelves.



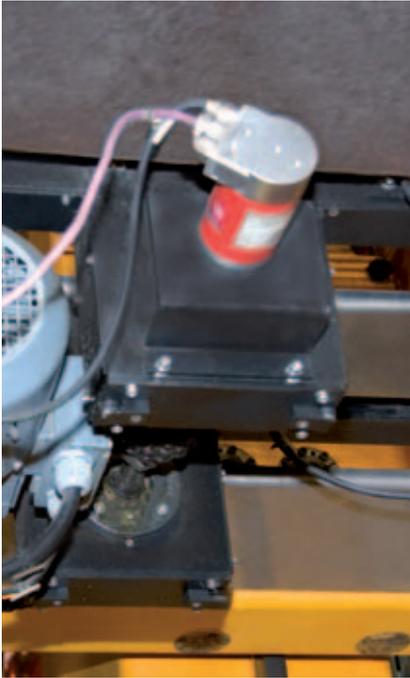
#### Pallet push/pull control

Features analogue laser measurers to control the position of the pallets, thus keeping them from falling when being pushed or pulled.



#### Laser telemeters

Optical equipment which measures the distance at a high precision at a resolution of 0.1 mm by reflecting the laser beam on the reflecting panel at the opposite end. These systems are used for controlling the drive and lifting position. As they do not depend on any mechanical system which would suffer from wear or a wheel which could slide out, measurements are direct and extremely reliable.

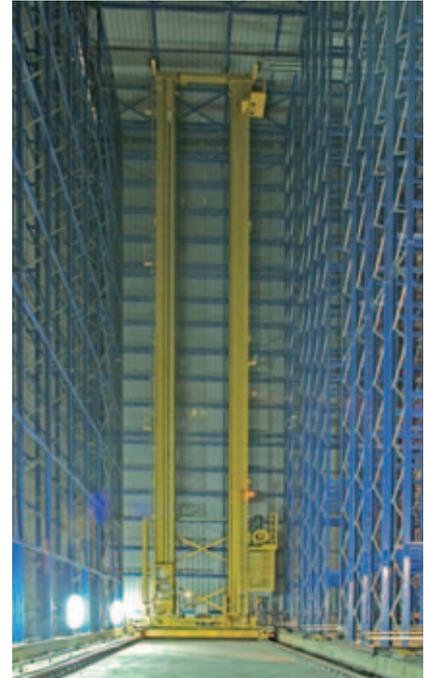


#### Absolute encoders

Rotary devices with a codified value which is neither repetitive nor incremental. They produce an absolute and unique value for each angle of the shaft. They keep the measured value even when the machine has been disconnected. They are commonly installed in telescopic forks and shuttle cars, and are fitted with coupling devices without excessive sliding or wear and, in most cases, cover short routes.

Electrical safety devices are engaged when stopping the stacker crane in order to access the aisles.





### Systems for aisle changing stacker crane

When the required throughput of stored goods is relatively low, but the storage capacity must be high, it will be a cost saving solution to use stacker cranes to serve multiple aisles. Mecalux can offer the following two systems for aisle changing.

- Curved track switches
- Transfer shuttle bridge

#### Curved track switches

In this system, it is the stacker crane which carries out the manoeuvre of changing from one aisle to another by means of a railway-type switch. A simple mechanical operation by switching points enables the destination aisle to be selected.

The main difference of these stacker cranes to normal ones is the inclusion of rotating wheels with side guide rollers, which are fitted in a special console.

The curved track switches system allows the stacker cranes to move at high speeds around these bends.

The top guide fitted around bends and switches, consists of a rail designed so that the top contrast wheels of the stacker crane never leave the profile as they travel along.

They do not require any additional maintenance as the components for changing aisles are simply operated by means compressed air systems with a low level of wear.

#### Transfer shuttle bridge

The transfer shuttle bridge is the machine in charge of moving the stacker cranes from one aisle to another. The stacker crane is located on the bridge where it is anchored and moves sideways to the destination aisle where the transfer is to take place.

This system enables work to be done at a higher speed inside the aisles, although it is less flexible in terms of changing aisles than the bend turning system.

The installation of one system or another entails an exhaustive study of the factors involved in each case.



## → OPERATIONAL MODES

The stacker cranes of Mecalux can operate in automated, semi-automated or manual modes in function of needs.



### Automated mode (without man on board)

Here the orders are executed after being sent through a communication photocell from the transport management computer. In this mode, the following operations are executed:

- Location.
- Extraction.
- Change of location.
- Correction of errors in the warehouse.
- Self-learning of the storage locations in the warehouse.



### Semi-automated mode

This is used for carrying out support functions, including:

- Automated access to a location, positioning the stacker crane automatically in the location ordered by the operator.
- Automated cycle of forks: automatically extracts or deposits a load unit in the location indicated by the operator.
- Relocating goods.



### Manual mode (with man on board)

Enables all the parts of the stacker crane to be accessed with restrictions in order to carry out maintenance and repair work.

This operation mode requires visual control: it is always executed using manual controls and at low speeds.



## → SAFETY EQUIPMENT



### Safety equipment on board

- **Ladders** with landings.
- **Safety cable** (life line) on which to anchor the harness of the maintenance operator when using the ladder to prevent a possible fall. Each machine is supplied with a safety harness for taking breaks while working at great heights.
- **Safety railings** fitted in all maintenance platforms to safeguard against possible accidents.
- **Maintenance platforms** fitted in the positions of the stacker crane when it is not possible to gain access from the ground floor. They are accessible from the ladder or the cabin.
- **Lift for maintenance personnel** (optional), independent of the load lifting system.
- **Control cabin** fitted flush with the load frame.
- An **optional heated cabin**, in an elevator or on the lifting chassis, is mounted on stacker cranes operating in extreme temperature conditions.
- Certified **electronic control** with safety brake, preventing contact with the aisle end buffer.
- **Closed cabin** with manual controls for maintenance operations.
- **Mechanical over-speed detaining system** for the cradle lift in case the lifting cable breaks.
- **Magnetohermic protection** in the electric boxes against over-currents and over-voltage.
- **Heat protection** in the electric motors through temperature probes against over-currents. Current limiters in the electrical supply of motors.
- **End stops** for lifting and monitoring of the vertical speeds and extraction of forks.
- **Touch-sensitive photocell** installed in the cradle to confirm empty storage spaces and to safeguard against pallets falling.
- **System for checking** that the forks and the load are centred before performing drive and lifting movements.
- **Built-in load calculation in cradle lift**, which blocks operation on overweight loads or ones with prospective defects.

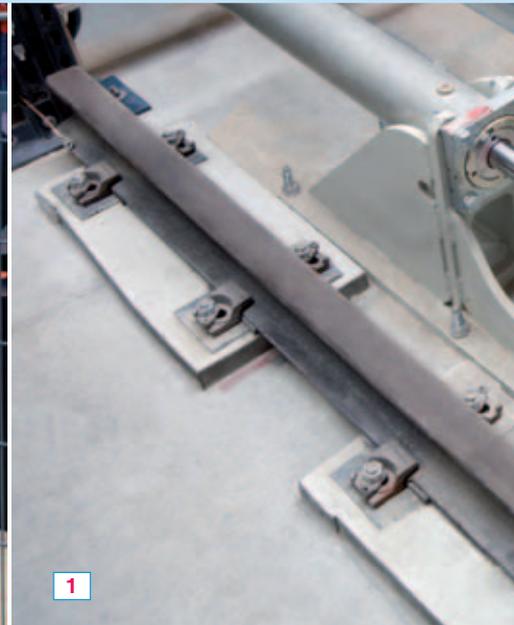
Mecalux, aware of the importance of ensuring optimal and safe working conditions in work stations, has equipped its stacker cranes with the ergonomic and safety equipment needed to perform work and maintenance operations as simply as possible.



Safety rail.



Hand ladder and top maintenance platform.



- 1 Hydraulic buffer
- 2 Touch control screen
- 3 Safety barrier
- 4 Safety cladding
- 5 Door detector closed and opened with a single access key

### Aisle safety equipment

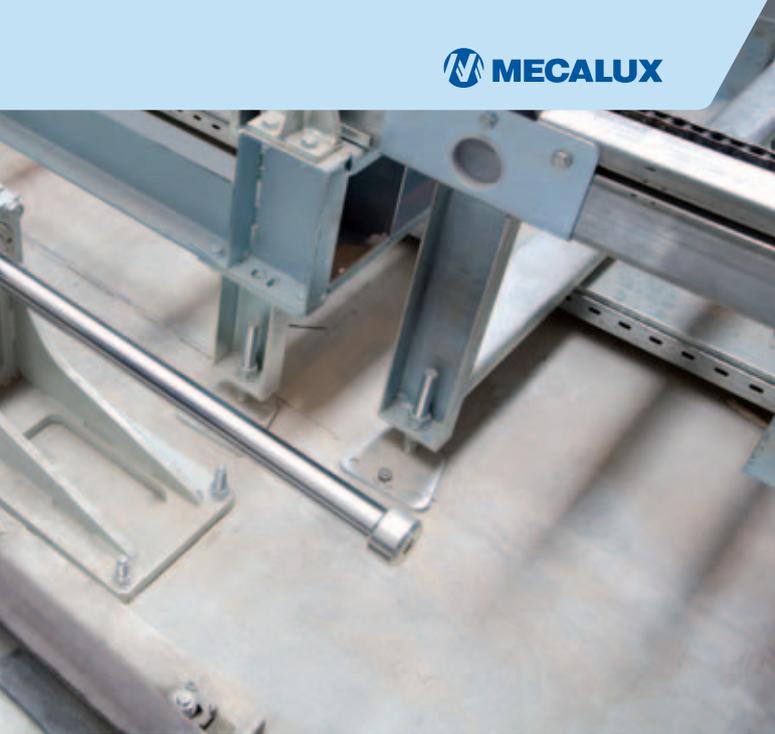
- **Emergency stop systems of the stacker crane engaged by means of regulated buttons located** in the manual control positions and in specific areas of the installation.
- **Emergency stop systems of the stacker crane engaged by a taut cable** fitted along the aisle at 20 cm above the floor, which acts on a regulated safety device.
- **Mechanical safety device** fitted at the ends of the aisle, consisting of hydraulic buffers fitted rigidly at the aisle ends. The buffers are calculated to absorb 100% of the impact produced by the stacker crane when travelling at a nominal speed with the cradle carrying a load.
- **End stops** in the aisle for controlling the drive movements.
- **Emergency stop areas** at the ends of the aisle to prevent mechanical impact against the hydraulic buffers.
- **Fencing, signposting and emergency circuits** well positioned to allow safe access to the aisles when doing maintenance work .
- **Touch screen** with button pad. The aisle access procedure is done according to UNE-EN528 regulations.

### Wireless transmission systems for safety signals

An alternative transmission system to one using horizontal electrical line signals, this one uses radiofrequency safety signals which activate prospective emergency stoppages in the facility.

It consists of an emitter located at one end of the aisle and a receiver mounted on board the crane.

This system presents category 3 safety according to EN954-1 and one IP = d, according to ISO13849-1.





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