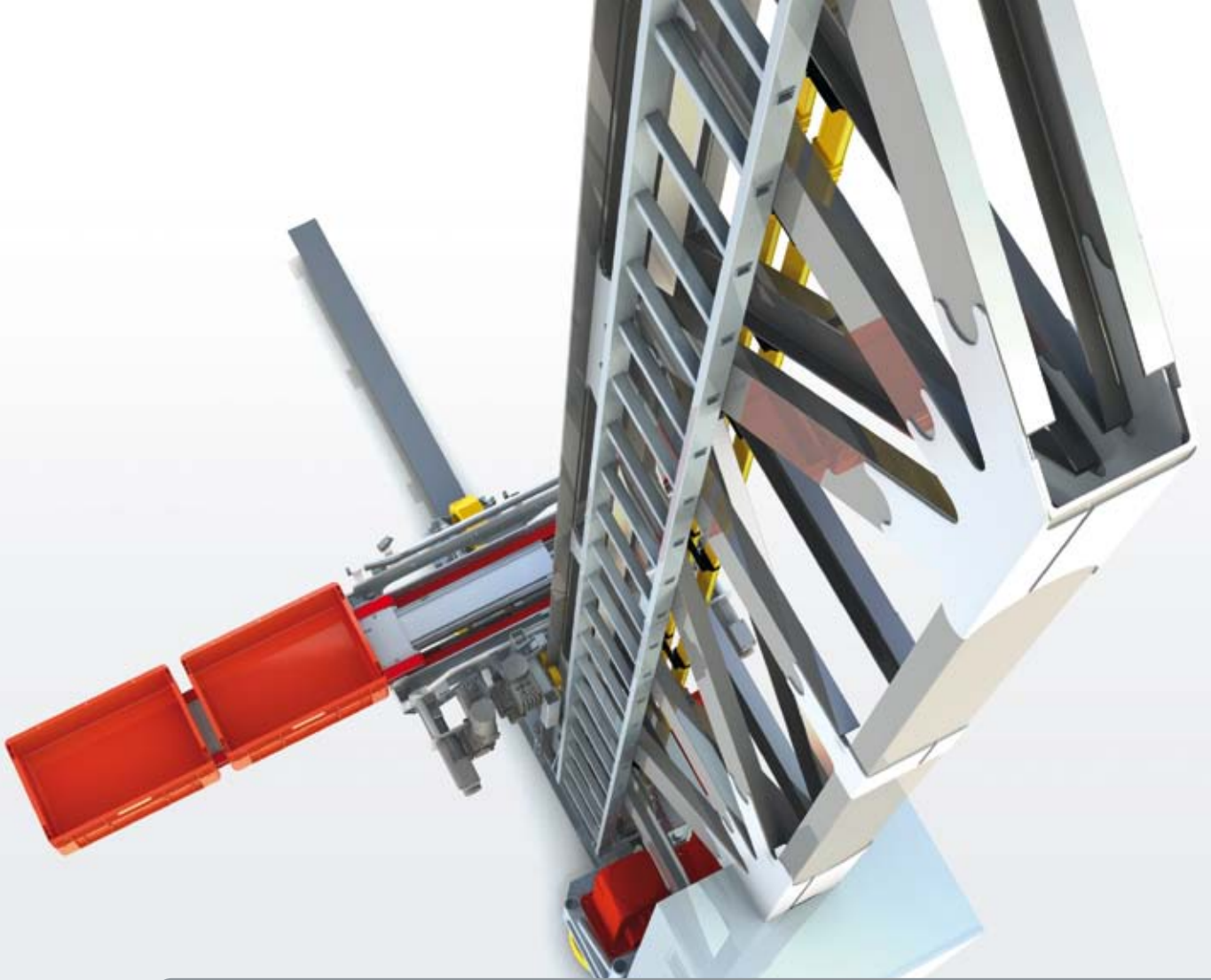




Energy-efficient and high-performance

Warehouse automation – Made by GEBHARDT





Changing storage technology

In times of globalisation, the use of low energy transport and the efficient storage of goods are of increasing importance. It is essential that the intralogistics industry therefore assumes the responsibility of sustainability and energy-efficiency. The demand for high-performance, as well as flexible systems, is no less important. Changing business models in the 21st century are driving factors for this development, specifically because of the progress in information technology.

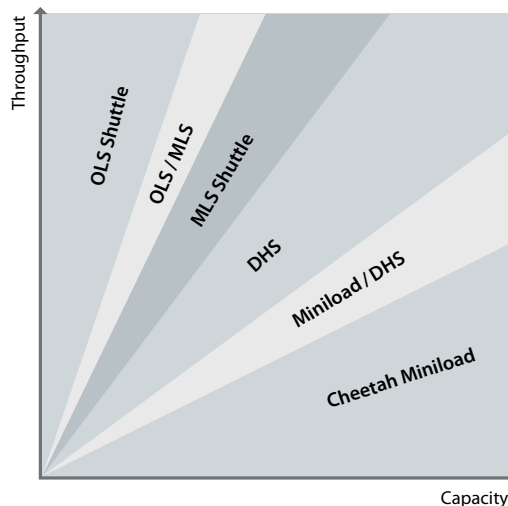
In the area of distribution logistics, customers are increasing their order frequency whilst the volume of each individual order reduces. Intralogistics systems must meet these requirements with increasing dynamics and automation. Staff must not be neglected in this development, since no logistics centre today works without the contribution of its employees. Therefore the improvement of operator ergonomics is also a main focus. The production logistics must be designed with in-

State-of-the-art conveyor and storage technology turn warehouses into efficient distribution centres. Investments in the form of modern technology, hardware and software, when completely integrated into the company's intralogistics, ensure that the required transport as well as transparency are achieved. This brochure explains the major components of GEBHARDT's automated warehouse technology.

GEBHARDT has strongly expanded its offering in warehouse technology. GEBHARDT provides the Cheetah in addition to classic storage and retrieval machines and lifting beams. This new ASRS Miniload machine constructed from composite material sets the standards in efficiency, throughput and low energy consumption. The StoreBiter One Level Shuttle (OLS) and Multi Level Shuttle systems (MLS) offer flexible responses to customer requirements in the high throughput areas.

GEBHARDT calls the interface between the shuttle and ASRS, "the Dynamic Handover System" (DHS). It has set a new benchmark in the design and development of the classic ASRS solutions. The StoreBiter 500, in contrast, is used for multiple-depth storage of pallets and trays. Other technologies for storage of pallets and heavy goods are, powered dynamic flow rack live storage, pallet storage and retrieval machines and curve-going pallet ASRS. The GEBHARDT load handling devices are fitted to many of the different machines in the GEBHARDT portfolio. Matching software to state-of-the-art, energy-savings technologies are also a focus at GEBHARDT. This comprehensive range of warehouse technology can be tailored to suit individual customer's requirements.

GEBHARDT conveyor and warehouse technology is produced in Germany. The name GEBHARDT stands for, "Quality Made in Germany". As a main contractor or equipment supplier, GEBHARDT offers customised solutions from idea to implementation. Integrated concepts from mechanics to electronic control and software are essential for high-performance logistics systems. GEBHARDT systems are used in many different industries, such as automotive, chemical, consumer electronics, retail, beverages, foods, pharmaceuticals and publishing. Tradition, quality, experience and reliability are components of the overall competence of GEBHARDT in the internal material flow from receiving goods to despatch. The GEBHARDT automated warehouse technology demonstrates this core competence.



creasing flexibility and cost effectiveness to ensure international competitiveness. The objective is staying competitive even in high cost countries. State-of-the-art storage systems provide a new level of efficiency that were unthinkable just a few years ago.

Parts and products must be available where and when they are needed. Production must have direct access to the required parts at the assembly point. In retail, a company must have its products readily available. GEBHARDT warehouse technology delivers just-in-time readiness for delivery.



CHEETAH, benchmark in lightweight energy saving Miniload design

Technical Features

- High energy efficiency from new lightweight construction
- High throughput with up to 18m storage height
- Low operating costs from adjustable precision dynamics
- Eco and Speed version

The Cheetah storage and retrieval machine (ASRS) with its innovative construction approach represents dynamics and efficiency in automatic small-parts storage. The Cheetah ASRS is constructed of various materials, integrating cutting edge fibre-composites. The bonded framework structure has been comprehensively tested for the stress and service life of a small parts ASRS crane. The rigid framework structure allows for shorter stabilisation times during operation.



This "Eco" version is a development in the scope of the "Blue Competence Initiative" of VDMA.

The Cheetah Speed is designed to achieve the maximum possible throughput. Acceleration of 6.5 m/s^2 and a top speed of 6.5 m/s , coupled with optimised load handling equipment, produce a clear increase of possible throughput—even at heights of 12 meters—with the Speed version.

Benefits

The Cheetah ASRS is offered in two versions. Cheetah Eco is designed to reduce energy consumption with its lite weight. The smart energy-savings technologies result in a clear efficiency gains as compared to conventional storage and retrieval machines. Integrating advanced controls ensures recovery of brake energy and/or optimising the lifting and traveling movements.

The GEBHARDT Cheetah's dynamics are refined during the project planning phase to achieve optimum efficiency. This process reduces operating costs by avoiding oversizing. Subsequent upgrades are possible, as the structure of the Cheetah ASRS is designed for highest dynamics. The dramatically reduced operating costs lead to a faster return on investment. The long-term total cost of ownership is lower than those of conventional ASRS.

Automatic small-parts storage

GEBHARDT storage and retrieval machines have proven their value a hundredfold and are used around the world. They ensure the automatic storage of inventory into and removal from high bay warehouses. The reliable operation and sheer size of the storage capacity are key elements for efficiency and throughput.



Technical Features

- Rigid single-mast construction design for high dynamic resilience
- 2-wheel drive for high acceleration and traveling dynamics
- Low-wear bearing with vulkolan and polyamide guide rollers: extremely smooth running
- All critical service elements are accessible without ladder/platform, including the control cabinet
- Service and setting up can be carried out in narrow running aisles
- High safety standards



Depending on a Storage & Retrieval Machines (ASRS) type, they move loads from just a few grams up to 500 kg in heights of up to 22 m. The ASRS's are equipped according to requirements with different load handling devices. The ASRS types 714 to 718 are modularly designed with chassis of a precision welded, low-torsion steel profile construction. With the dynamics being engineered in house. Vulkolan-coated drive and guide rollers guarantee smooth, low-wear running. The mast is a profile steel construction. The low friction metal guide rails are precision welded to ensure exact guidance of the lifting frame with the Load Handling Device (LHD).

A high-performance steel reinforced toothed belt (minimal stretch and high resilience) is used in an enclosed lifting drive. The shear-resistant nylon-

fabric coating ensures a long service life and high load capacity. Automatic belt tensioners are fitted as standard.

Energy efficiency

The GEBHARDT automatic small-parts storage and retrieval machines are equipped with advanced energy saving technology on request. This comprises an active coordination of the running axis to achieve energy-optimised traveling profiles. In other words, the energy recovery system feeds back excess brake energy into the supply grid instead of emitting it as heat through the brake resistors. In addition to the design of the ASRS, the overall system would be optimised to establish an energy efficient automatic small-parts storage in order to fulfill the request.

SRM-Data

	Cheetah Eco 701.01	Cheetah Speed 701.02	714	716	717	718
Max. carrying capacity	120 kg	120 kg	50 kg	300 kg	300 kg	500 kg
Max. height	18 m	12 m	7.5 m	12 m	16 m	22 m
Max. v (x)	5 m/s	6.5 m/s	5 m/s	5 m/s	4.5 m/s	4 m/s
Max. a (x)	5 m/s ²	6.5 m/s ²	3 m/s ²	3 m/s ²	2 m/s ²	1.5 m/s ²
Max. v (y)	3.5 m/s	3.5 m/s	3 m/s	3 m/s	3 m/s	3 m/s
Max. a (y)	3.5 m/s ²	3.5 m/s ²	3 m/s ²	3 m/s ²	2 m/s ²	1.5 m/s ²
Conveyed goods	B, T, K	B, T, K	B, T, K	B, T, K, P	B, T, K, P	B, T, K, P

v = velocity, a = acceleration, x = running axis, y = lifting axis, B = container, T = tray, P = pallet, K = box

2

Multi-aisle ASRS P&D Stations with direct storage

3

Storage and retrieval machine type 718

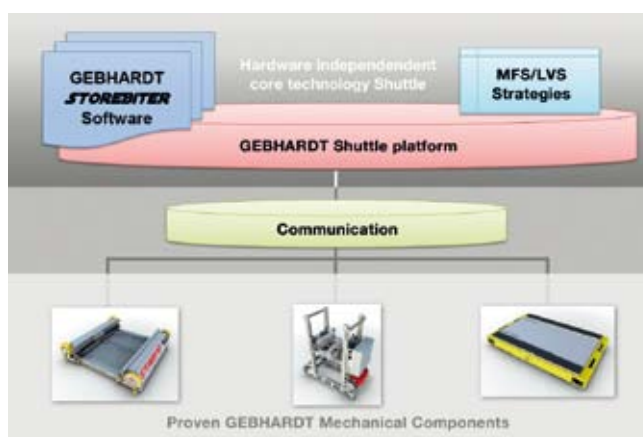


Shuttle platform technology – Fast, flexible and cost effective

The GEBHARDT Shuttle Platform (GSP) provides the core technology for Gebhardt's range of different shuttle types. The basis of the GEBHARDT Shuttle Platform is a comprehensive integrated shuttle, control and software concept that can be modularly adjusted for the different

System Benefits

- Hardware-independence
- High throughput
- System Scaled to suit the desired throughput
- FEM light-weight construction
- High energy efficiency
- Extensive layout flexibility



These shuttle types provide a highly dynamic as well as flexible system. The GEBHARDT shuttles can be moved between different shelf levels if the required throughput does not demand full deployment of a shuttle at each level. The level change is performed by vertical conveyors individually adjusted to the customer's requirements. If there is a shuttle on each shelf level, the vertical conveyors are used to deliver and retrieve goods from the shuttle. The GEBHARDT warehouse shuttle StoreBiter 500, has been developed for the handling of pallets, stillages and containers. The StoreBiter 500 can be combined with a storage and retrieval machine or a transfer car and can store as well as remove goods in multiple depths.

The shuttle warehouse systems, StoreBiter 300 MLS and OLS, are designed for handling totes, cartons and trays of up to 50 kg. In a multitude of applications, these shuttle systems offer effective access to incoming and outgoing goods according to the "goods to man" principle. The StoreBiter MLS can serve several levels via the integrated lifting function. The StoreBiter OLS, works without the lifting function serving one level.

GEBHARDT shuttle energy-efficiency is relative to required throughput. Leading edge drive technology is selected for each individual customer's application. The energy is supplied via bus bars or ultracaps battery storage.

StoreBiter 300 MLS

Technical Features

- Shuttle with lifting function
- High-performance 400V drives
- Various drive concepts
- Several levels of storage

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StoreBiter 300 MLS Type 750.02 with belt drive

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Detail of contact-free linear drive

3

StoreBiter 300 MLS Type 750.01 with linear drive

4

Typical StoreBiter 300 MLS system installation

The StoreBiter 300 MLS (Multi-Level-Shuttle) is a highly dynamic shuttle system to serve several storage levels. In a multitude of applications, this shuttle system offers effective access to incoming and outgoing goods according to the "goods to man" principle.

The various load handling devices allow the StoreBiter 300 MLS to handle totes, cartons and trays of up to 50 kg in single or multiple depths and of varying sizes.

The system is based on the rail-mounted StoreBiter 300 MLS Shuttle, a racking system with lifts, running rails and controls. The shuttle system offers increased storage and retrieval speeds as compared to classic ASRS solutions. The modular construction of the individual aisles provides for flexible expansion of the storage system as required. The storage system may be a multi-aisle warehouse where each aisle may be separated into several modules, dependent on the warehouse height. As required, each StoreBiter 300 MLS can access several warehouse levels. The GEBHARDT StoreBiter 300 is suitable for cost-effective storage of many different types of products. The StoreBiter 300 MLS is produced in three basic versions. Type 750.01 has a contact-free linear

drive. Energy transmission is possible contact-free by inductive current transfer or via power rails. This type has the benefit of having a drive that works nearly maintenance-free and allows relocation of the shuttle.

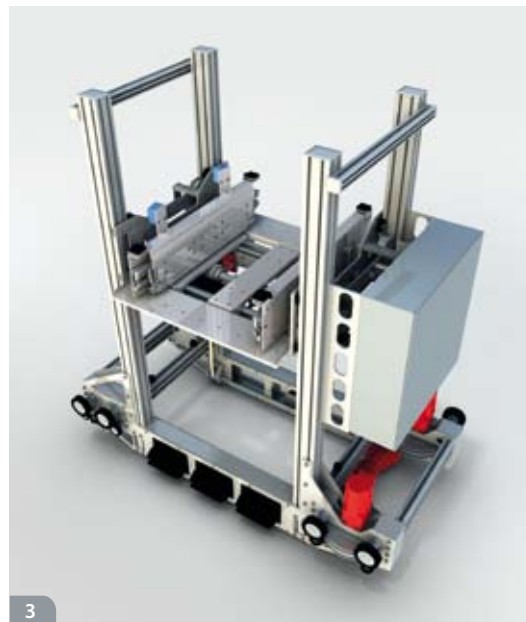
Type 750.02 is driven via an omega configured toothed belt drive where a toothed belt is fixed in the aisle and the drive on the shuttle moves along the aisle. This type is particularly suitable for short storage aisles and highly dynamic applications. Type 750.03 has an all-wheel drive and is used in long storage aisles. This drive concept allows the moving and storing of even heavy warehouse goods in multiple depths. The power transfer in types 750.02 and .03 is performed via power rails.



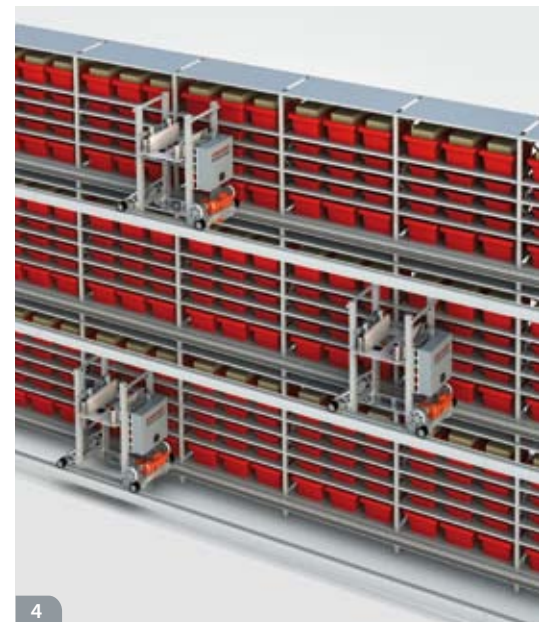
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Lifting the shuttle vehicle

Types 750.01 and 750.03 have no aisle-bound installation and thus may be elevated to several levels within the racks. This is particularly beneficial where throughput does not demand a dedicated shuttle in each level of the system.

Data transmission

Data transmission is performed via a data photo-cell or a shielded WLAN network depending on requirements. The shielded WLAN has a slotted hollow conductor encapsulated by an aluminium profile. This design reduces interference from and to the WLAN from other radio networks and increases functional safety.

StoreBiter® 300 OLS – The sprinter

Technical Features

- Maximum throughput by moving in both linear and vertical axis simultaneously
- Single- and multiple-depth storage
- Higher flexibility for customised solutions
- Higher energy-efficiency regarding the amount of moved containers



1

System example

2

Front and side view
StoreBiter 300 OLS

3

StoreBiter 300 OLS with gripper
technology LHD

The GEBHARDT StoreBiter 300 OLS is a shuttle system for higher throughput requirements. Different load handling devices make the StoreBiter 300 OLS highly flexible for the storage of totes, cartons and trays of different sizes in single or multiple depths. The shuttle system is perfect for the implementation of the "goods to man" principle.

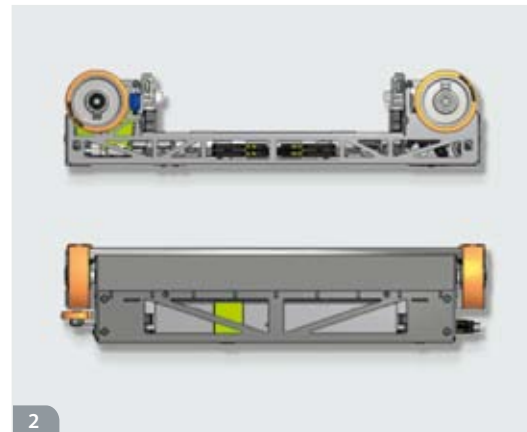
Effectiveness

The storage system may comprise of one or more aisles with the option of using several shuttles of the type StoreBiter 300 OLS. Each aisle is divided into several levels, depending on the warehouse height. For a high throughput requirement, each level is equipped with a shuttle or for lower throughputs the number of shuttles is reduced accordingly. Lifting devices are installed at the end of each aisle to either feed or remove the load from the shuttle or to transfer the shuttles from level to level.

The modular design of the individual system components allows the development of customised solutions to suit precisely the customer's individual requirements.

Power supply and data transmission

The StoreBiter 300 OLS type 751.01 is supplied with power via a power rail. The power rails are placed on each warehouse level. Type 751.02 is equipped with an ultracap battery unit. The shuttle may process several double cycles with this energy supply, even across several levels,



2

before having to be supplied with power again. The correct positioning of the charging station allows for an interruption-free operation. Data transmission takes place via WLAN or Bluetooth.

Energy efficiency

Low weight and nevertheless high payload are special characteristics of the GEBHARDT StoreBiter 300 OLS. The speed factor is no less important. The StoreBiter OLS offers outstanding dynamics values. The StoreBiter 300 OLS not only moves quickly in the aisle, but the conveyed goods are also stored and removed from the shelves at high speed. Additionally, the load handling equipment supplied with this device type is designed for short handover times. With regard to the number of containers stored and retrieved, a shuttle system based on the StoreBiter OLS is extremely energy-efficient. The StoreBiter OLS is operated with either 24 or 48V technology depending on requirements.

Availability

A StoreBiter 300 OLS warehouse is designed for high availability. The number of elevators is decisive here. The inclusion of several elevators makes it possible to achieve a redundancy that clearly increases the availability of a shuttle warehouse as compared to conventional ASRS. The storage placement/removal function is system-relatedly redundant if more than one shuttle per shelf aisle is deployed.



3

StoreBiter® 500 – The powerhouse

The GEBHARDT shuttle warehouse StoreBiter 500 is designed for the storage of pallets, stillages and containers. The load handling device is the shuttle vehicle itself – a flat lifting carriage that transports and places the conveyed goods in simple, fixed warehouse channels. The StoreBiter 500 acts perfectly autonomously in the warehouse aisle.



The warehouse process

The warehouse process comprises of 5 main steps that are automatically sequenced by the system.

- Step 1:** The carrier vehicle (SRM) with the StoreBiter 500 is placed in front of the channel in which the desired pallet is stored and docked.
- Step 2:** The StoreBiter 500 runs below the required pallet between the channel rails. The pallet is lifted.
- Step 3:** The StoreBiter 500 with lifted pallet returns to the carrier vehicle.
- Step 4:** Docks with the carrier vehicle.
- Step 5:** The carrier vehicle is automatically undocked and moves to the P&D Station.

Technical Features

- The wireless shuttle vehicle achieves high throughput
- Optimum storage capacity and space utilisation by multiple-depth storage
- The design of the warehouse without electrical installation in the storage aisles allows fast shelf assembly and commissioning of the system
- Simple adjustment to suit revised requirements as the modular construction approach – allows additional shuttles to be added, e.g., if the throughput requirements increase

The StoreBiter 500 can be combined with a storage and retrieval machine, a transfer car or a vertical conveyor. The shuttle is controlled by a PLC and wirelessly supplied with power via conductor lines or by batteries. This allows warehouse aisles of any length without the need of special cables or rope connections.

From an economic point of view, the system offers low initial investment and operating costs in relation to the high warehouse capacity. The passive storage channels and the simple and robust construction of the shuttle result in a low main-

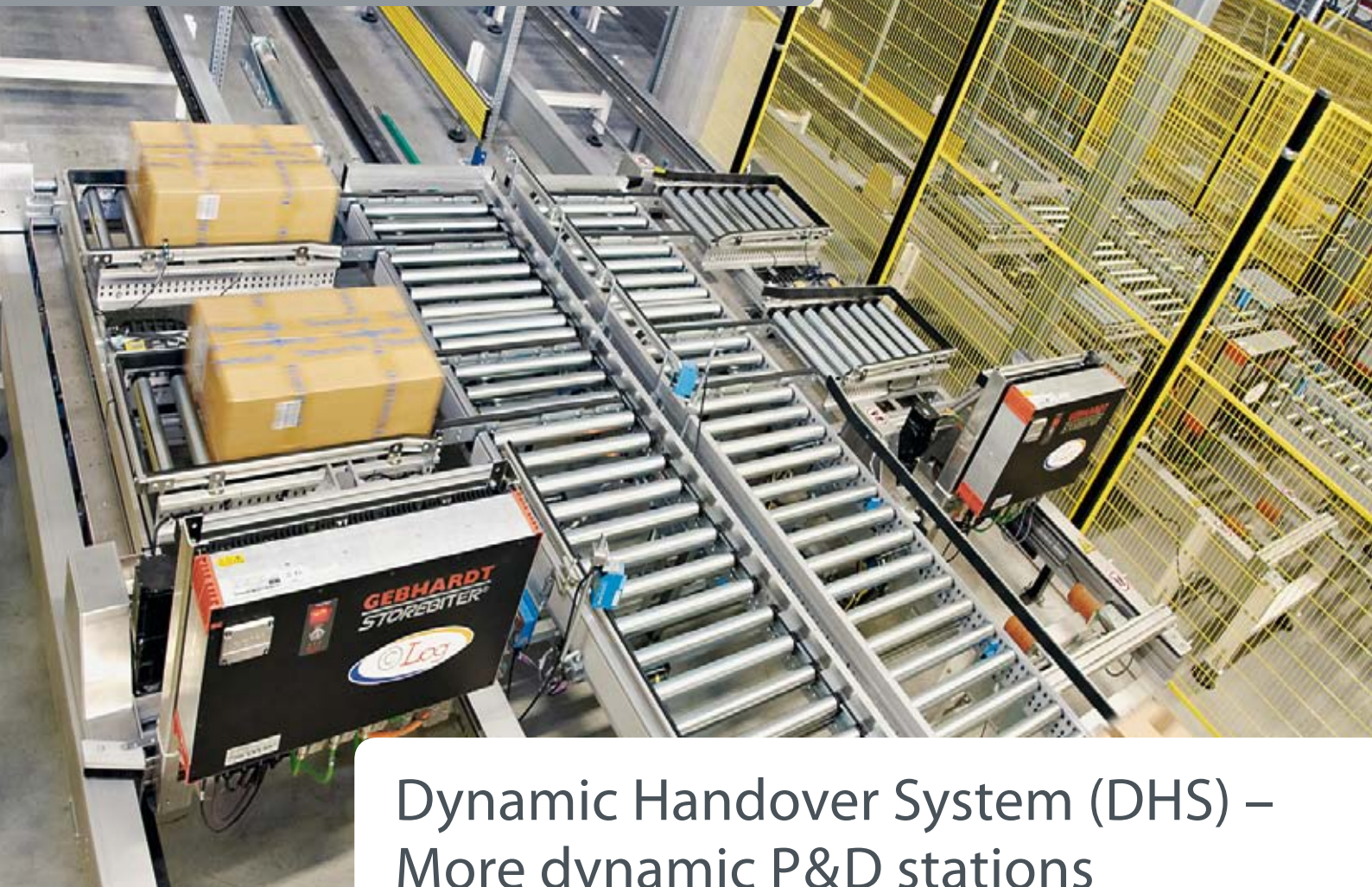
tenance and servicing requirements. The system design allows for easy interface for demand led IT-organisation and inventory monitoring.

The storage system works according to the first-in first-out principle. This ensures that the goods stored first are also removed from the warehouse first. The StoreBiter 500 is the optimum solution for space-saving storage of a multitude of pallets. The system fully utilises its benefits when the warehouse channels can be filled with separated types.

Data

	StoreBiter MLS	StoreBiter OLS	StoreBiter 500
Max. payload	2 x 50 kg	2 x 50 kg	1500 kg
Max. height	2 m	–	–
Max. v (x)	4 m/s	3 m/s	1.5 m/s
Max. a (x)	2 m/s ²	2.5 m/s ²	1 m/s ²
Max. v (y)	1.5 m/s	–	0.2 m/s
Max. a (y)	1.5 m/s ²	–	0.1 m/s ²
Conveyed goods	B, T, K	B, T, K	B, T, P
Power supply	Inductive; conductor line	Conductor line; Ultracaps	Conductor line; Ultracaps

v = velocity, a = acceleration, x = running axis, y = lifting axis, B = container, T = tray, P = pallet, K = box



Dynamic Handover System (DHS) – More dynamic P&D stations

System Benefits

- More dynamic P&D stations
- Combines ASRS- and shuttle technology
- Power increase while reducing energy consumption

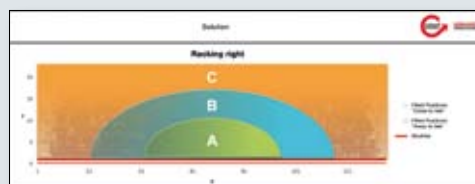
DHS is the development setting the new benchmark of automatic small-parts storage by making the P&D stations dynamic. This is done by use of shuttle vehicles moved within the racks and interacting with storage and retrieval machines.

The handover stations can be made more dynamic to increase output in automatic small-parts storage (ASRS). The system shows not only higher throughputs but also saves resources. The novel drive and communications technologies guarantee low-maintenance and a high availability operation.

Function

The DHS system connects the storage and retrieval machines with the shuttle technology. The shuttles move within the rack, e.g. below the first shelf level, while the ASRS acts in the aisle as usual.

This allows the P&D Station to move closer to the ASRS machine as required by the warehouse operation. The shuttles serve the goods to be stored and removed to the storage and retrieval machines. This considerably reduces the average running distances of the cranes and increases system throughput while lowering energy consumption. This solution includes the standard components from the GEBHARDT product portfolio. In addition to the conventional storage and retrieval machines or the GEBHARDT Cheetah, StoreBiter 300 OLS shuttle vehicles are used.



ABC-distribution



Stock level and filling

System Benefits

- Complexity reduction of the overall cycle
- Considerable performance increase
- Large energy savings from lower moved mass
- Removal of the classic P&D stations I/O points
- Dynamically changing P&D stations
- Dynamic adjustment to the requirements of the storage operation
- Reduction of the average ASRS running distances
- Very good accessibility
- Use of maintenance-friendly technology

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Operating modes

2-5

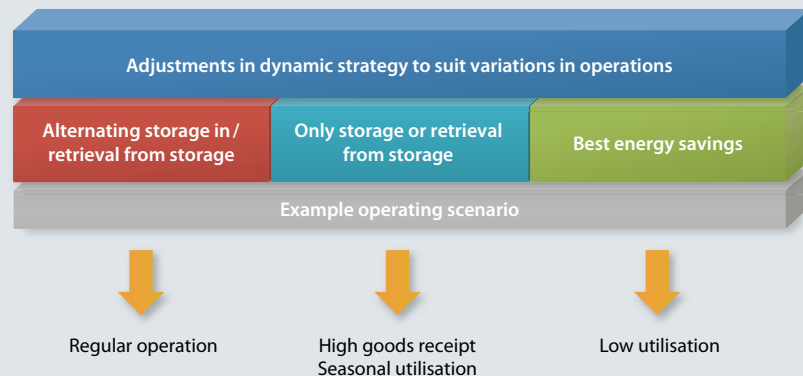
DHS system

6

Benefits



Throughput optimisation by dynamic strategy adjustment



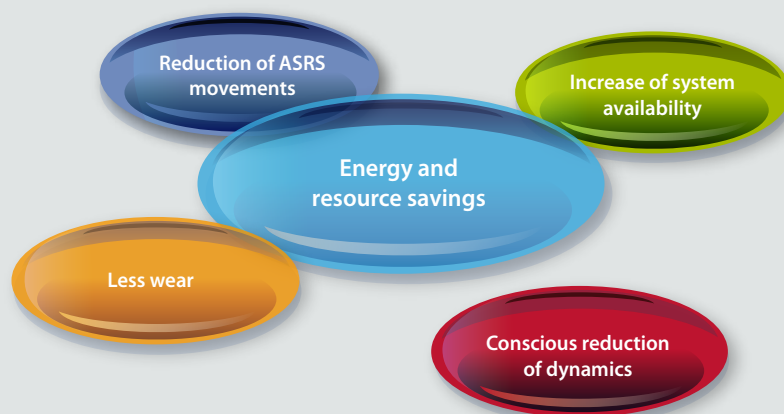
The DHS offers a wide spectrum of benefits. First, the complexity of the overall system is reduced. Higher throughputs are possible with fewer aisles. This throughput may be further increased dependant on the warehouse geometry design. Use of the shuttle vehicles clearly reduces the moved mass in the overall system, which leads to clear energy savings. Whilst the ratio of load weight to total weight at the ASRS is approx. 1 to 40 it is as low as 1 to 1.5 for the shuttle. DHS also does not require a classic P&D stations with typical I/O-points. DHS uses a simplified P&D Layout. In addition to reduction of the moved mass, the average running distances of the storage and retrieval machines can be clearly reduced as well. This reduces energy consumption as well as wear on the ASRS machine. The system is easily accessible for maintenance and servicing. The installed mechanics and the drive components used are constructed for low maintenance requirements. Extension of the required maintenance intervals may increase system availability.

Optimisation

The output increase can be adjusted to different operating strategies by more dynamic handover stations. For example, both shuttles can store or retrieve, or one shuttle stores and one retrieves. Processes like goods receipt, picking and goods output can therefore be considerably and specifically accelerated.

Costs

As compared to the classic ASRS solution, DHS can often save additional ASRS aisles required to reach the necessary capacity. The DHS can also increase output per area utilised and thus save warehouse space. The measures for energy and resource saving result in lower operating costs. The energy costs are lower in addition to lower maintenance and servicing costs. All of these aspects lead to shorter return on investment for the DHS systems.





Lifting beam Type 720 – Highly dynamic compact storage

Technical Features

- Storage and retrieval technology with particularly compact self-enclosed design
- For single- and multiple-depth ASRS-storage
- Compatible with all GEBHARDT load-handling devices

Technical Specifications

- Payload: max. 120 kg
- Max. v (x): 3m/s
- Max. a (x): 2m/s²
- Max. v (y): 2m/s
- Max. a (y): 2m/s²
- Open width: max. 10 m
- Height: max. 24 m

The GEBHARDT lifting beam warehouse Type 720 is based on a storage and retrieval machine technology with lifting beam and moving carriage. Efficient load handling equipment, e.g. a telescopic platten with belt conveyor, ensures fast access to totes, cartons and trays in automatic small-parts storage.

Setup

The moving carriage handles the horizontal placement of the load handling device at the desired shelf bay, whilst the lifting beam handles the vertical placement of the carriages at the corresponding shelf level. Both ensure that the load handling device takes the required container(s) from the shelf by placing the load handling device in the correct position. A steel frame, comprising of 2 lifting columns and connection profiles ensures that the entire system is self-enclosed and self supporting.

The compact construction also has great benefits in narrow aisles. The GEBHARDT lifting beam has a high degree of volume utilisation. At low heights, the shelf structure can be integrated into the structure of the machine. This further improves the volume utilisation.

Use

A lifting beam has higher throughput and a more dynamic system operation than a storage and retrieval machine. The system can also be used separately or together with other intralogistics devices. A lifting beam is suitable for economic storage of a limited number of warehouse goods. This equipment is also used as a buffer in shipping, for sequencing or for storing empty containers.

Another application is in the support of picking processes. The lower shelf levels can be designed as drive through channels to implement zone picking, which allows direct access to the warehouse goods for the pickers. Several lifting beam units may be placed next to each other and connected by conveyors.

GEBHARDT lifting beam units are produced with an open width of max. 10m and a height of up to max. 24 m.



GEBHARDT flow rack system 525.20 – Dynamic pallet storage

Technical Features

- Horizontal flow rack channels – each carrier roller is driven by a gear chain drive
- Drive of several channels by a common motor – Drive parts like chains and gears are protected in the frame profile
- Secure, smooth pallet transport – conveyor speed 0.2 m/s – each flow rack channel is designed as an accumulation roller conveyor
- Lowest power demand, only approx. 5 Watt per pallet – no group transport – leads to high energy efficiency

1

Connection to high-performance pallet conveyor technology

2

Supply T-Car
e.g. with pallet lifter

3

Sorting and supply with ASRS

4

Supply of channels with T-Car

GEBHARDT produces powered flow rack warehouses for pallets, unit loads and trays up to 1500 kg. The flow rack warehouse of type 525.20 is based on the renowned GEBHARDT pallet accumulation conveyor type 525.20 – which has been synonymous with robust handling and energy efficiency technology for decades.

Benefits

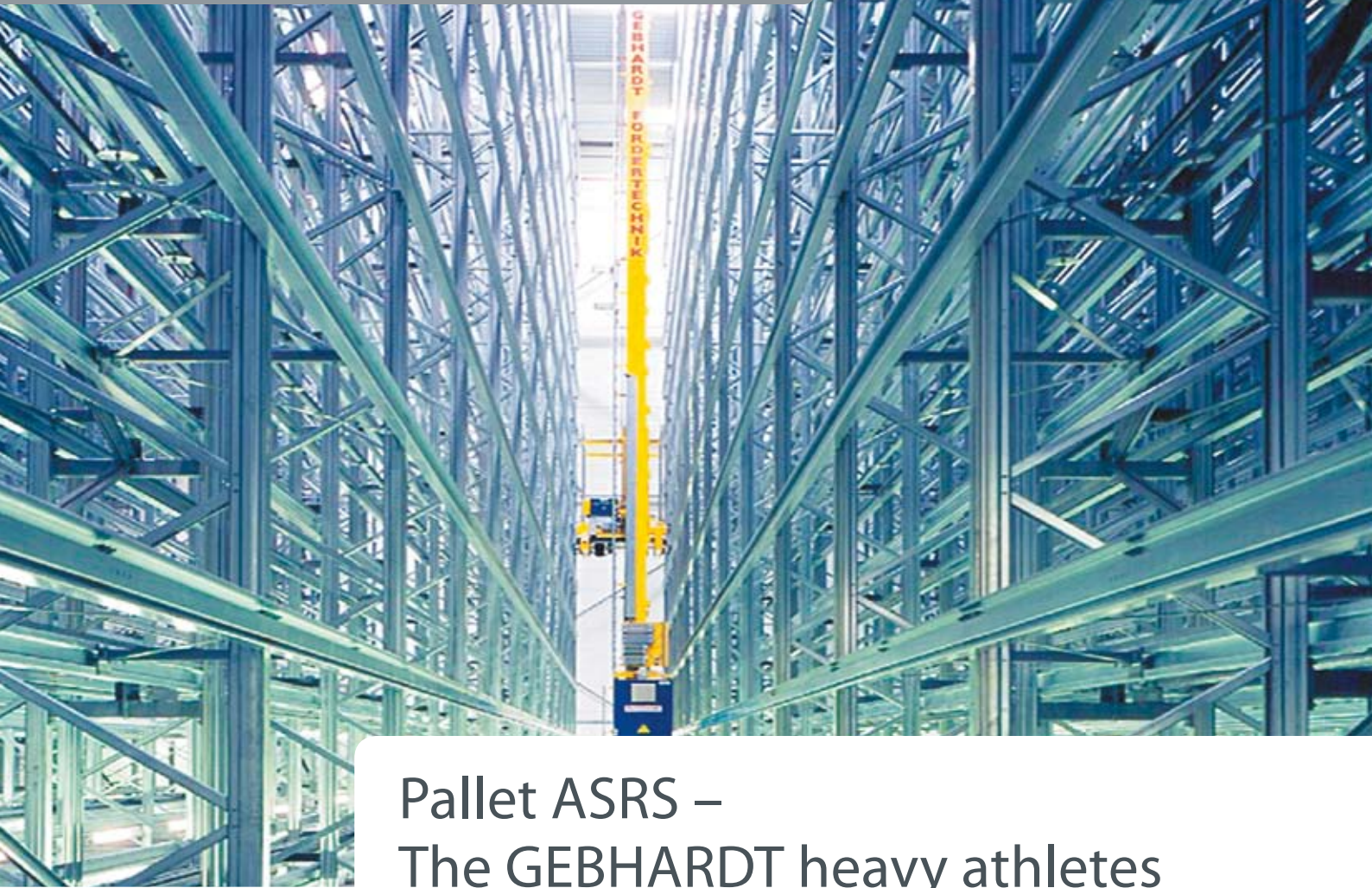
This system has many benefits. Space is used optimally since the lanes do not need to decline. There is also a low profile construction. The warehouse works according to the first-in first-out principle. This ensures that the goods stored first are also removed from the warehouse first. As compared to the gravity systems, the GEBHARDT flow rack warehouse offers a much higher amount of safety for both the goods and the staff.

The system works without a decline; brakes cannot fail; it works without line pressure and guarantees safe removal of the pallets even with damaged running rails. The warehouse has a load side and removal side. This leads to short travel and efficient work. The warehouse also can be expanded virtually without limitation. The flow rack channels can be 10 m or 100 m long. – No decline needs to be considered.

Safety

The flow rack warehouse 525.20 offers safety that is only possible with a powered horizontally placed flow rack system of accumulation roller conveyors. This means comprehensive safety for pallets with heavy and light conveyed goods and for the people who operate the warehouse. GEBHARDT accumulation roller conveyors guarantee safe continuous operation as every single roller is powered.

The pallets are transported on powered rollers and accumulate automatically with zero line pressure. No "braking" – therefore also no danger that pallets break free and hit the floor with destructive force.



Pallet ASRS – The GEBHARDT heavy athletes

Technical Features

- Payload up to 2500 kg
- Max. height up to 24 m
- 2-mast structure
- Optional camera system

GEBHARDT pallet storage and retrieval machines are used to store unit loads or pallets in high bay warehouses at a height of up to 24 m. This device type is also used for automatic loading and unloading of flow rack systems.

Construction

The ASRS machine Type 748 has a payload of up to 2500 kg and is produced in the proven two-mast technology. The result is a stiff and reliable structure that meets even the highest requirements. Telescopic forks are used as load handling device (LHD). The GEBHARDT StoreBiter 500 is used as LHD for multiple-depth storage as usual in channel warehouses.

Energy efficiency

The GEBHARDT pallet storage and retrieval machines can be equipped with state-of-the-art energy saving technology on request. This comprises an active coordination of the running axis to achieve energy-optimised running profiles. In addition an optional energy recovery system is available, e.g. to recover excess brake energy and feed into the supply grid instead of emitting it as heat through the brake resistors. Energy-efficient high-bay warehouses also require optimisation of the overall system.

Process safety

Type 748 ASRS may also be equipped with state-of-the-art camera systems for efficient trouble-shooting and increase of the operating comfort. This way, access to the ASRS machine for fault finding may often be avoided.



Technical Features

- High payload
- Low curve radius
- For pallet transport across several aisles in high-bay warehouses
- Efficient in low throughput requirements

Curve-going ASRS

The curve-going GEBHARDT storage and retrieval crane can be best utilised where pallets of up to 2000 kg are to be stored in a high-bay warehouse with several aisles.

They are best suited where automation is sensible, but the low throughput allows for using one ASRS machine to serve several aisles. Curve-going SRM compete with conventional warehouses that can be served with stacker trucks. SRM have the benefit of requiring fewer staff and lower operating and maintenance costs. Multi-shift operation is also possible cost-effectively. Process safety can be increased as compared to stacker warehouses, throughput can be increased and operator errors can be minimised.

The curve-going SRM can serve several racking aisles by leaving the aisle and running to another

aisle via a rail and switch system. This system offers the benefits of an automatic warehouse, at lower investment costs than the aisle-specific SRM solution. Curve-going SRM also offer the benefit of flexibility. The warehouse can be supplemented by another SRM until each aisle has an SRM installed if the throughput requirements increase. Initial investment can thus be kept low. The small curve radius permits space-saving storing of racking aisles. This leads to optimised use of existing warehouse space.

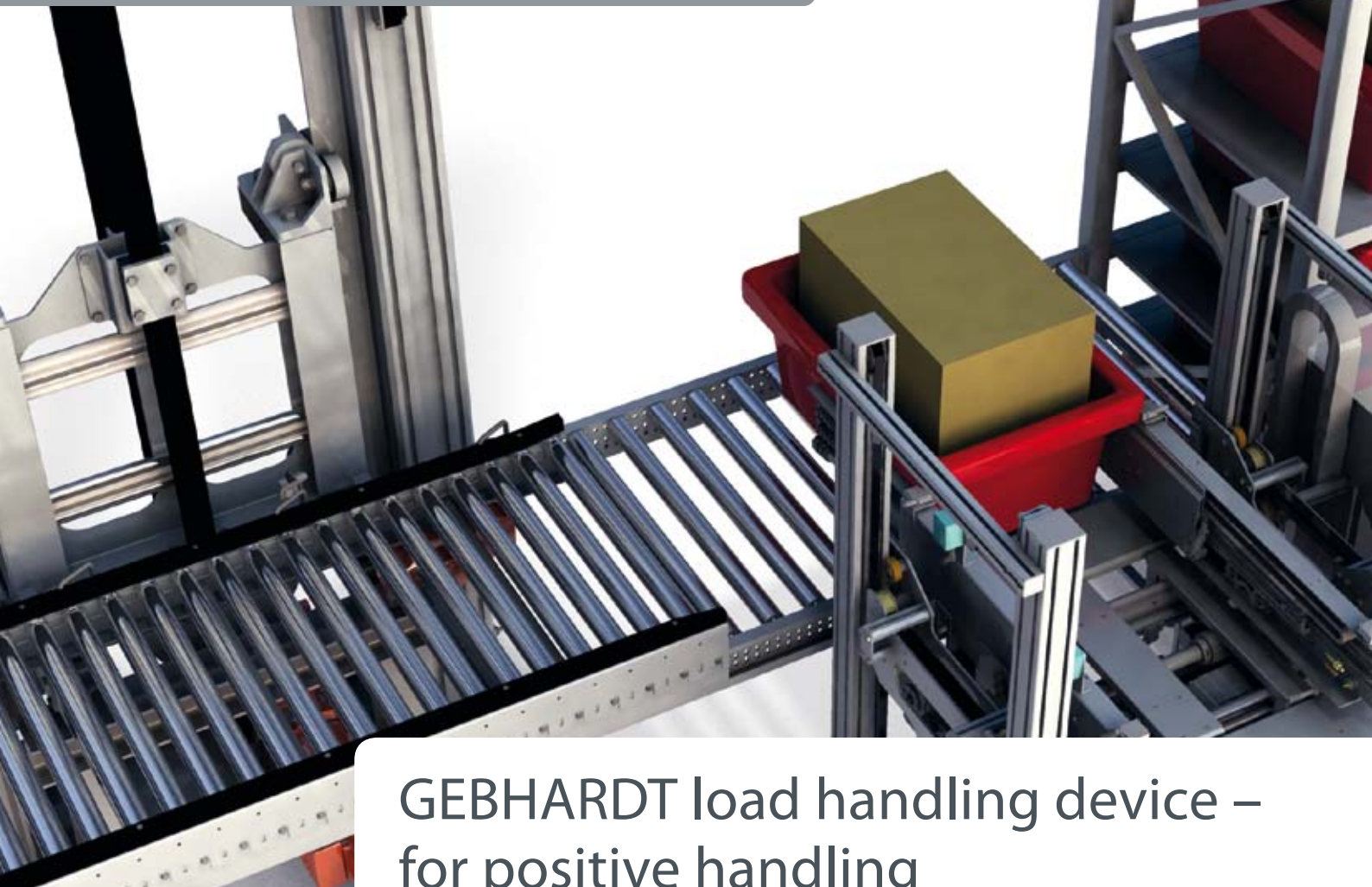


Data		
	Pallet SRM	Curve-running SRM
Max. payload	2500 kg	2000 kg
Max. height	24 m	20 m
Max. v (x)	3 m/s	3 m/s
Max. a (x)	1 m/s ²	0.5 m/s ²
Max. v (y)	0.5 m/s	0.5 m/s
Max. a (y)	0.5 m/s ²	0.5 m/s ²
Conveyed goods	T, P	T, P
Lower approach dimension	0.75 m	0.75 m
Min. upper approach dimension	0.4 m	0.4 m
Wheel base	2.33 m	2.33 m

v = velocity, a = acceleration, x = running axis, y = lifting axis, T = tray, P = pallet

1
GEBHARDT pallet SRM type 748

2
Curve-running SRM at aisle change



GEBHARDT load handling device – for positive handling

Technical Features

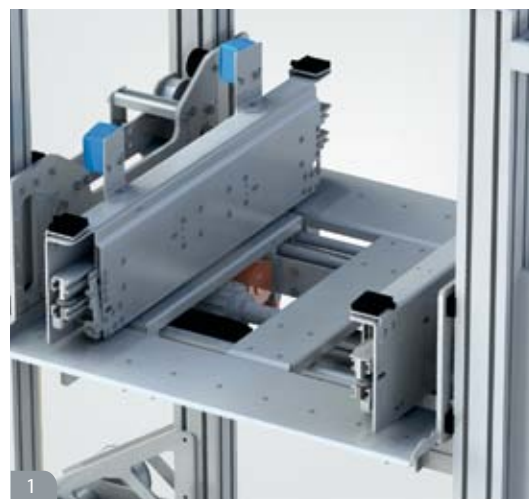
- High functional safety
- Flexible, adjustable & usable
- Low space requirements
- Fast handover times
- Decisive for high storage capacity

GEBHARDT warehouse technology is at the centre of action. Precision designed storage and retrieval machines, lifting beams and shuttles require equally well designed load handling devices (LHD). They form the interface with the conveyed goods. The conveyed goods have many different requirements and demand the highest performance from the load handling device.

The speed and acceleration of the ASRS machines is a fundamental requirement to achieve the high throughput of an automatic storage system. The functional safety and short handover times of the load handling device are at least as important. A simple robust construction is therefore required. The LHD are the partners of ASRS machines. They must guarantee quick and safe access to single or multiple-depth conveyed goods. GEBHARDT load handling device can store and retrieve many different types of warehouse goods including for example tote bins, cartons, trays, pallets or even engine blocks. Low space requirements and flexibility are also important benefits. The active multi-gripper in a typical recently completed project can move over 20 different load sizes in multiple depths.

SRM, lifting beam and shuttle can be equipped with one of ten different standard LHD's as required. The matching LHD is selected according to customer requirements and, if necessary, adjusted individually. Special load handling device for

motor blocks or special workpiece carriers are available. From classic telescopic solutions to gripper or tray technology, to complex LHD for sorting containers, GEBHARDT offers a comprehensive and diverse selection of high-tech load handling device.



Areas of use

- Shelf with support angle
 - Parallel gripper technology
 - Swivel gripper technology
 - Telescopic
 - Telescopic with belt
 - Speedloader
 - Extraction technology
- Shelf ASRS
 - Multifunction gripper active
 - Multifunction gripper passive
 - Parallel gripper technology
 - Swivel gripper technology
- Pallet racks
 - Telescopic fork
 - StoreBiter 500

GEBHARDT Load handling device



Parallel gripper technology

- Space-saving in y-direction
- No vertical lifting required → higher throughput
- Optimised for shuttle technology



Swivel-gripper technology

- High operational safety by form-locking
- No vertical lifting required → higher throughput
- Space saving with small clearance requirements



Telescopic

- High weights possible
- Multiple-depth storage
- Storage of various large containers possible



Telescopic with belt

- Multiple-depth storage with relocation
- Short storage and removal times
- Almost simultaneous load/off-load at the P&D position



Speedloader

- Extremely fast handover times
- No vertical lifting required
- Multiple-depth storage possible



Extraction technology

- High storage density for trays
- No vertical lifting of trays required
- Form-locking extraction of the tray



Active multifunction gripper

- Variable LHD-lengths/widths/heights are possible
- Multiple-depth shelf storage
- No additional equipment at the P&D position required



Passive multifunction gripper

- Different LHD-lengths/widths/heights are possible
- Multiple-depth shelf storage
- No additional equipment at the P&D position required



StoreBiter 500

- Multiple-depth channel storage
- Very high storage density
- Simple unpowered storage channels



Telescopic fork

- Storage/retrieval of pallets
- Multiple-depth storage
- Use with pallet storage and removal machines



GEBHARDT Controls & Software – A comprehensive control package

GEBHARDT Software

- Control / PLC
- Material Flow System
- Warehouse Management System
- Visualisation
- Active Maintenance Manager
- Hotline
- SAP solutions / ERP interface

GEBHARDT StoreWare provides all the software modules that are required for a successful, fully automated warehouse, from a single source. Use of progressive technologies optimises the material and information flow.

Control / PLC

GEBHARDT controls are perfectly coordinated with the mechanical equipment. The programming is always based on the latest standards and is built in modules. Based upon individual customer requirements, GEBHARDT focuses on different bus systems for communication and control. High-quality components that are used as standard. The interface with high level IT systems is not a problem.

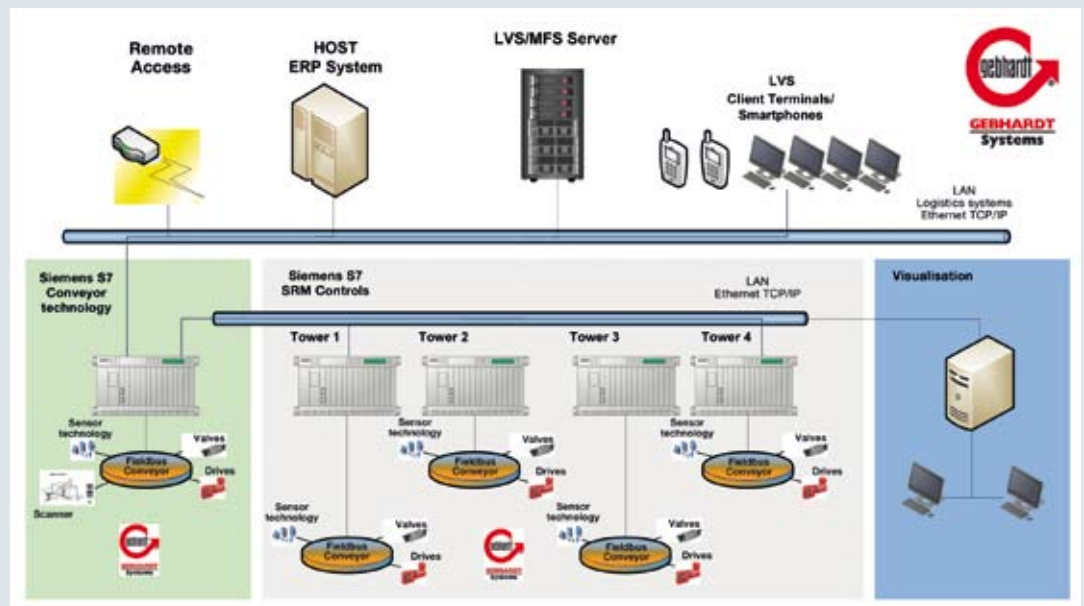
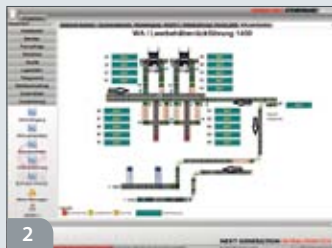
Material Flow System

The Material Flow System (MFS) guarantees an efficient material flow by coordinating the interaction of the different transport systems. With continuous real-time data collection, the material flow is controlled to ensure a smooth process without any delays. Additionally, the MFS offers its users the possibility of manually controlling or modifying the material flow. The MFS automatically performs adjustable throughput monitoring

and priority control for the best system optimisation possible. The MFS offers a comprehensive and flexible monitoring of the material flow.

Warehouse Management System

The Warehouse Management System (WMS) creates a seamless documentation and control of all the transport and warehouse processes. The material flow and order processing performance is augmented by permanent and current inventory information of the warehouse, continuous tracking of the shipping progress and real-time evaluations. The GEBHARDT StoreWare WMS is characterised by a modular architecture, diverse functions, simple integration into the existing IT infrastructure, efficient processes, energy efficiency functions and a comprehensive maintenance and service management.



The GEBHARDT StoreWare Software Suite combines all modules in a single interface. You no longer need to switch between different programmes. The screen design can be individually tailored to the customer requirements. The IT schematic shows integration into and interaction with the existing infrastructure, it also shows a typical structure of a GEBHARDT intralogistics control.

1

MFS – scanner statistics

2

VISU – overview

3

LVS – request containers

Visualisation

Visualisation (VISU) is the graphical interface between the operators and the system. The well-structured presentation of relevant system conditions is shown as simply as possible. The visualisation thus offers transparent insights into all processes. Among others, it contains error messages, error histories, drive and e-stop conditions, scanner statistics and product accumulation displays. Real time display of the actual material flow offers the option of recognising and countering any occurring bottlenecks in good time. Thus VISU is an important component for success.

Active Maintenance Manager

The GEBHARDT StoreWare Active Maintenance Manager (AMM) is a tool for supporting maintenance and servicing. The AMM provides a direct connection between the customer and GEBHARDT. The timely exchange of information on maintenance, error histories and parts wear increases system availability and reduces the operating costs. The AMM knows both the service life of the components used and the spare parts needed. They can be ordered right from the AMM.

Hotline

The GEBHARDT hotline offers full service around the clock on 356 days a year. The qualified hotline staff guarantees fast assistance. A remote service has been standard for many years. If help line cannot solve the problem, GEBHARDT offers a high-performance on-site service with short reaction times. GEBHARDT StoreWare is certified in the area of software development according to ISO 9001.

SAP solutions/ERP interface

The GEBHARDT software solutions can be connected to different host systems. In addition to an integration platform for data exchange with different systems, GEBHARDT offers standard interfaces with various ERP systems. Particular focus is on SAP solutions. The SAP interface to the SAP ERP Business Suite secures complete integration into the existing ERP system. It was developed by GEBHARDT conveyor technology as a SAP Certified Integration Partner. Additionally, the GEBHARDT COCKPIT was implemented as a programme for controlling the conveyor system in ABAP with the SAP developer environment in the SAP system. This is the basis of the continuous concept for electronic control and automation of a high-performance internal material flow system under inclusion of complex high bay warehouse concepts. The GEBHARDT Connector permits direct transport control of warehouse technology by the SAP system.





Blue Competence – Energy-efficient warehouse technology

Blue Competence

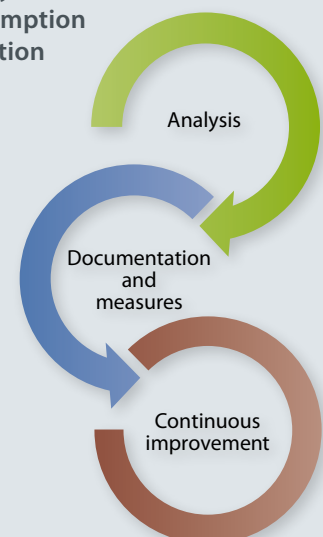
- Sustainability initiative of VDMA
- Reduction of energy consumptions
- Reduction of CO₂ emission
- Effective environmental protection
- Efficiency increase

In the scope of the Blue Competence sustainability initiative of VDMA, GEBHARDT takes on board complete responsibility for economy, ecology and society. The objective is minimisation of the energy and resource consumption by innovative technology.

Lowering costs, protecting the environment

The Blue Competence initiative of the VDMA helps to find sustainable products and companies who adopt sustainability. GEBHARDT decided early on to place its products and services under the Blue Competence flag of the VDMA. It has always been our objective to develop machines that keep the energy consumption as low as possible. This objective becomes more and more important particularly in times of increasing energy prices. GEBHARDT combines innovative software with advanced mechanics to achieve this objective. Optimisation that only includes individual components utilises only a small part of the optimisation potential. In intralogistics the overall system must be monitored. One example of this is the GEBHARDT dynamic handover system. The combination of shuttle and ASRS technology increases efficiency considerably. The reduction of energy consumption often goes hand in hand with the also welcome effect of wear reduction. Both together reduce the operating costs and make the logistics centre more efficient.

Process for energy consumption reduction



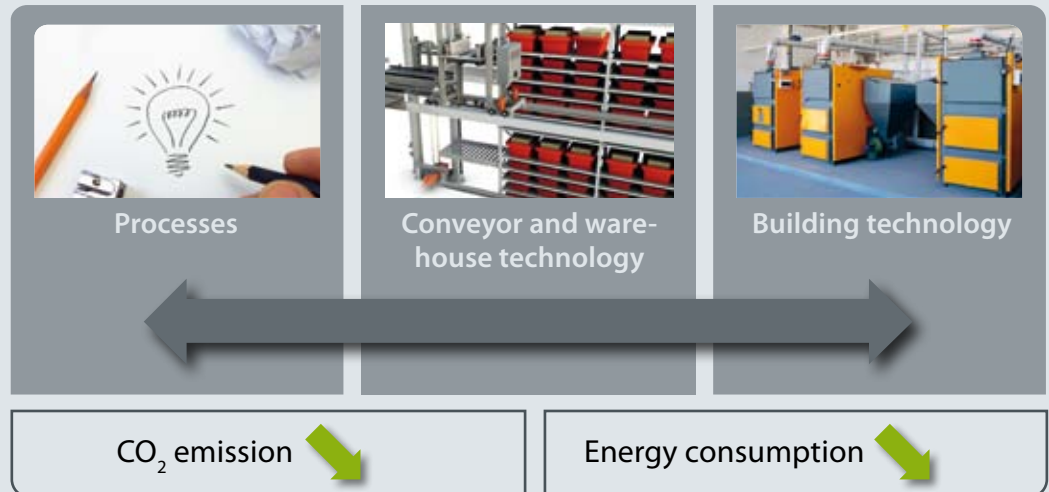
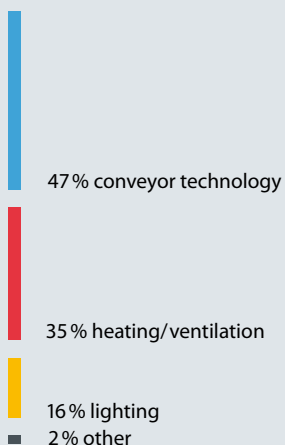
Options for optimising energy consumptions



1

ASRS type 718
with energy savings functions

Partial energy consumption in automatic warehouses



The energy consumption in automated warehouses depends not only on the automatic conveyor and warehouse technology. The larger part of the energy consumption refers to heating/ventilation, lighting and other building services. Therefore, an integrated approach is needed if energy consumption in the warehouse should be reduced. The building technology is important in addition to the conveyor and warehouse technology. The processes and procedures in the warehouse operation also have a major influence.

Light-weight construction

The GEBHARDT products for warehouse technology are developed with the declared objective of implementing light-weight construction. GEBHARDT engineers can use comprehensive simulation tools like FEM for this. Use of innovative materials and fabricating procedures are a matter of course. The composite material of the SRM Cheetah is the living proof of our aims.

Dynamics adjustment

The energy usage in logistics centres and thus also in automatic small-parts storage can fluctuate considerably during the course of the day. There is a great savings potential here. Smart dynamics adjustment allows for energy saving particularly in the traveling axis. Smart algorithms analyse the order loading and automatically adjust the dynamic values of the warehouse technology.

Energy recovery

The energy generated in the movement and positioning energy released in the system is connected via the mains feedback device and the interim circuit of the frequency inverters. Generated energy that cannot be used in another axis can be fed back into the mains. This technology permits ASRS to save up to 50 % energy. Amortisation with pallet handling ASRS is at approx. 2 years.

Software

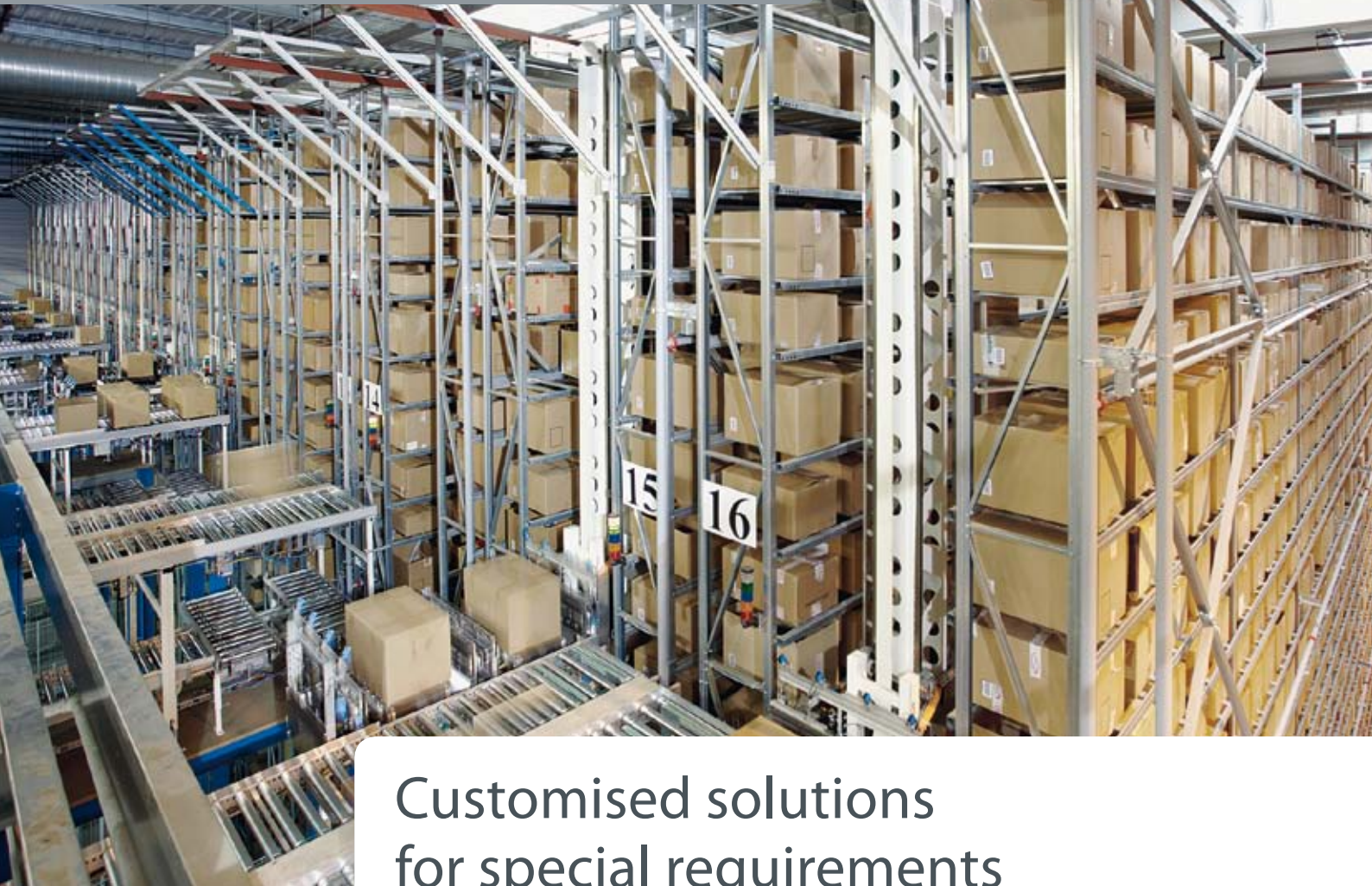
Smart software for saving energy comprise various functions. In addition to the dynamics adjustment, the path to be travelled must be minimised, e.g. by ABC analysis. The work load management can ensure that auxiliary processes like relocations are performed in times of low work load, e.g. at night. The storage and relocation strategies must be optimised for each individual application.

Interim circuit coupling

The interim circuit coupling represents smart control of the traveling and lifting axis. The objective is to achieve the minimum traveling and lifting time for a maximum number of double cycles with the minimum energy consumption. The energy that is released, e.g. when the traveling axis is braked, is diverted to the lifting axis to supply the required movement of the lifting axis. This solution pays off immediately and reduces energy consumption by up to 20%.

Continuous improvement

Energy consumption of a logistics centre can be continually improved. The improvement process must be continually revised and updated. The starting point is the evaluation of consumption data, followed by a search for potential improvements. Efficiency is increased once potential savings are identified. The results must be measured, visualised and monitored before the process is instigated.



Customised solutions for special requirements

Performance Features

- Precise system adjustment to specific customer requirements
- Customer-specific hard- and software solutions
- Flexible answer to variable processes and warehouse strategies

GEBHARDT stands for high flexibility with top quality. Adjustment of existing devices or completely re-constructed machines is no problem for GEBHARDT owing to experienced and very well-trained employees.

Customer-specific solutions

Individual processes are a matter of course in intralogistics. GEBHARDT reacts to this with a great expertise for individual solutions. GEBHARDT employees are experienced in coordinating customer-specific solutions from sales through design to production. This is particularly true for special load handling device for warehouse technology. GEBHARDT engineers have found solutions for many different load carriers, special sorting tasks or the transport of freshly cast motor blocks. Storage and retrieval machines, as well as shuttles, can be adjusted in geometry, often also outside of the specifications laid down. Customer-specific solutions do not, however, cover mechanics alone. Control and software can easily be adjusted for individual customers. This provides a flexible response to customers ever changing processes and warehouse strategies.

1

Load handling device for container sorting

2

ASRS in special heights of 22 m



1



2



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