

PARKING SYSTEMS PLANNING GUIDE

RESPACE®

Parking system planning made easy

- Reduction of the building volume by up to 65% compared to traditional underground garages
- More efficient use of space by eliminating ramps and driving lanes
- Simple integration of building supports
- Higher yield from a larger number of parking spaces or savings of space
- More parking comfort for users
- All of the parking spaces can be equipped with e-charging stations.

LODIGE
INDUSTRIES

CONTENTS

Product finder	1
Planning assistance - at your side from day one	2
RESPACE® - highest comfort for parking on minimum space	3
Planning of a RESPACE® layouts	4
The lifter	10
Turntable	12
Planning of the transfer cabin	14
Planning of the system energy supply	17
Planning of the complete system	19
Planning of driving accesses	20
Notes	21

COPYRIGHT & DISCLAIMER

All contents of this planning guide, in particular texts and graphics are protected by copyrights. Unless marked otherwise, the copyright is owned by Lödige Industries GmbH. The contents of this document

must not be published without the explicit agreement of Lödige Industries GmbH. We reserve making technical changes to the RESPACE® planning guide.

PRODUCT FINDER

	RESPACE®	CUBILE®	CAR LIFT*
Maximum parking space density			
Parking performance			
Building supports on the parking level			
Up to 30 parking spaces			
Up to 60 parking spaces	 **		
More than 60 parking spaces			 **
E-charging stations			
Maximum car size			
Public building			
Residential building			
Office building			
Parking garage/neighbourhood parking garage			 ***
Existing building			

 = suitable
  = well suitable
  = very well suitable

* Different models available

** Depending on the model, up to 60 parking spaces can be implemented and with multiple lifts/cabins, a corresponding number of parking spaces can be added.

*** Implementation according to EN 81-20/50 possible with the Traffico model car lift.

PLANNING ASSISTANCE – AT YOUR SIDE FROM DAY ONE

We assist you in your planning beginning right from the start. By viewing our global references on our website, you can get a first glance of the different solutions that offer efficient parking spaces even in complex conditions. Our practical product finder helps you select the right solution for your project.

If you have decided on the RESPACE® parking system, this planning guide provides important technical details as well as precise background information for your planning. Our experienced staff will be happy to assist with any ad-

ditional questions you might have. In addition, REVIT files are available to you online on our website that allow you to build accurate models and drawings. Our team of experts will help you with the layout of turning curves, the planning of loading and unloading zones, and achieving the desired capacity numbers. We are also at your side as a reliable and experienced partner during the subsequent phases. Find out more about our additional services below.

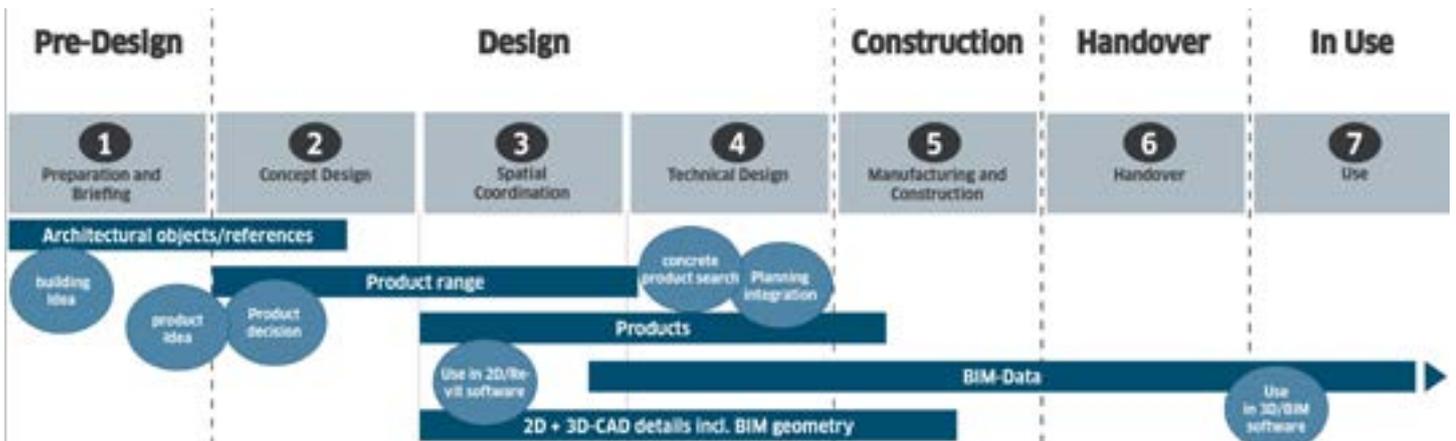


Fig. 1: Our support offers during the performance phases.

RESPACE® - HIGHEST PARKING COMFORT IN THE SMALLEST SPACE

RESPACE® is the new fully automated parking system of Lödige Industries, which is able to park more, larger and heavier cars than any other system on a minimum of space. It combines our knowledge and experience of more than 30 years in construction and installation of automated parking systems.

Our smart automated parking technology uses a parking pallet system similar to a children's slide puzzle. The pallets can be placed with a level of flexibility, thereby adjusting to existing building supports, load-bearing walls, and even the most complex floor plans. Each pallet is controlled individually by the system, but moves together with the surrounding pallets to achieve higher capacity and shorter waiting times. The RESPACE® system offers the possibility of charging electrical vehicles on up to 100% of the parking spaces and it is particularly suitable for residential and commercial buildings with a shortage of parking spaces.

Particularly suitable for:

- Residential and office buildings
- Facilities of 2-60 parking spaces (expandable)
- Easy retrofitting in existing properties

Declaration of conformity:

Automated parking systems by Lödige comply with the Machine Directive 2006/42/EC, Annex 1, and the type C standard DIN EN 14010. Local and national regulations have to be considered

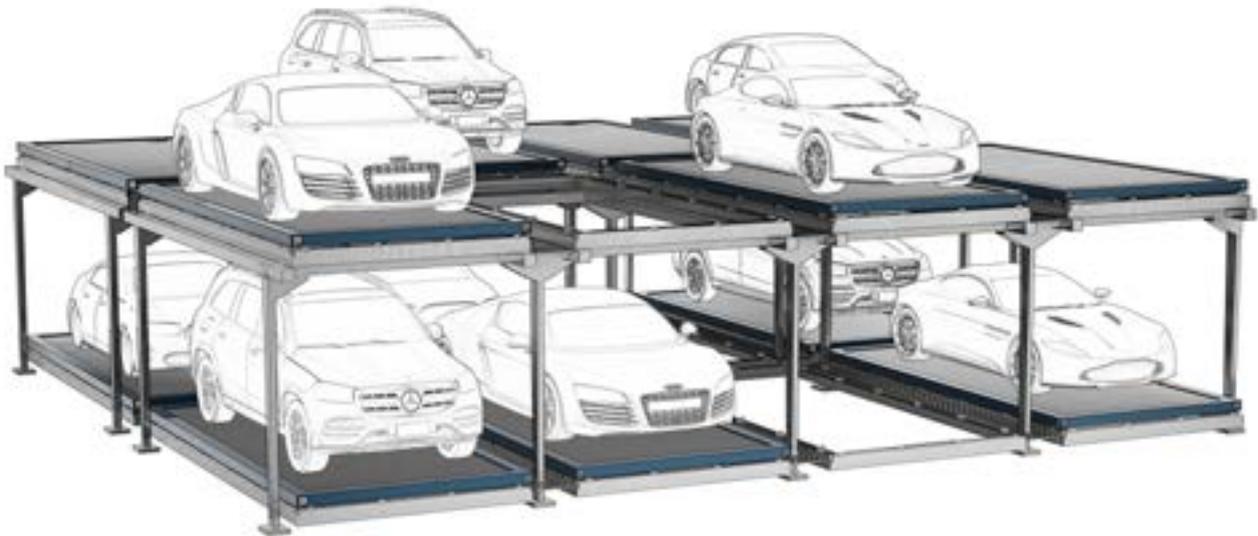
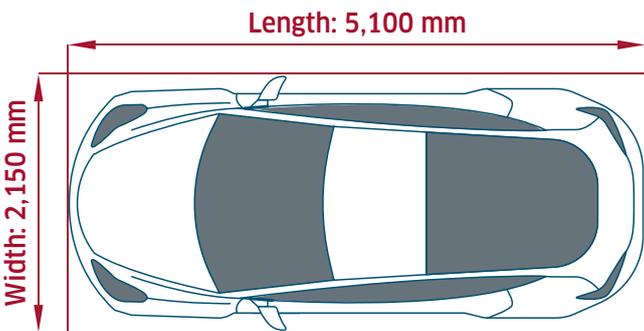


Fig. 2: 3D illustration of the RESPACE® parking system with 12 parking spaces as steel structure.

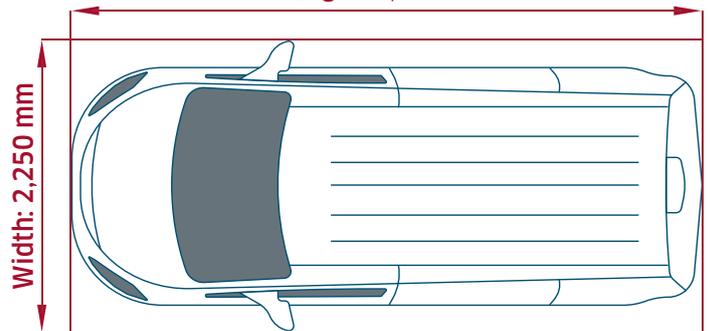
The RESPACE® parking system is suitable for vehicles with the following specifications:

Standard passenger cars:



Max. 3,000 kg

XL passenger cars: Length: 5,300 mm



Max. 3,000 kg

Fig. 3: Vehicle dimensions for the RESPACE® parking system.

The maximum vehicle height is dependent on the height of the parking levels or depth of the cellar available.

PLANNING A RESPACE® LAYOUT

When a vehicle is parked in the transfer cabin, it is moved by hoist to the parking level and then transported on the shortest route to its allocated parking space. Empty spaces in the system allow the pallets to be circulated continuously in so-called cycles, moving the vehicle to be parked and later retrieved to the hoist and back into the transfer cabin.

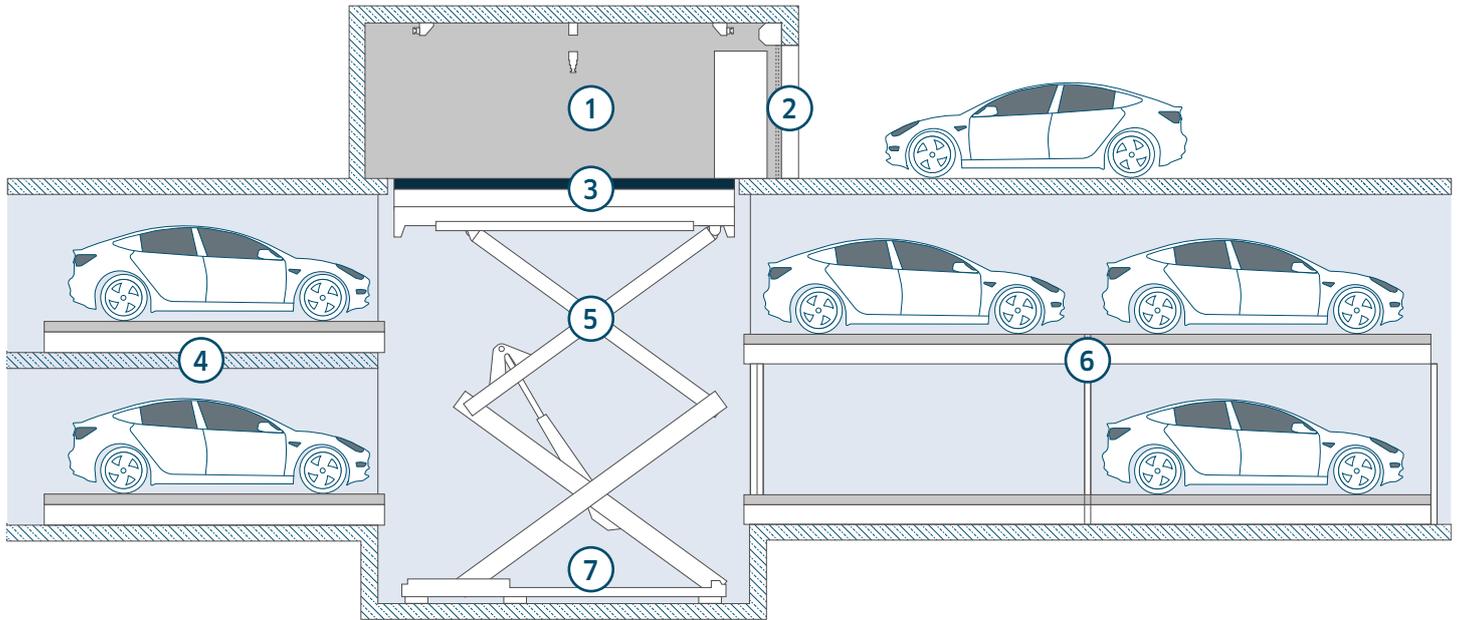


Fig. 4: The RESPACE® parking system.

LEGEND EXPLAINING THE RESPACE® SYSTEM

- | | |
|--|-------------------------------------|
| 1. Transfer cabin | 5. Scissor lift |
| 2. Cabin door | 6. Parking level as steel structure |
| 3. Ceiling opening | 7. Hoist shaft pit |
| 4. Parking level as concrete structure | |

PLANNING A RESPACE® LAYOUT

PALLET SIZE

The parking pallets for the RESPACE® parking system are available in two standard sizes. Other sizes are available on request. Only one pallet size can be used per system.

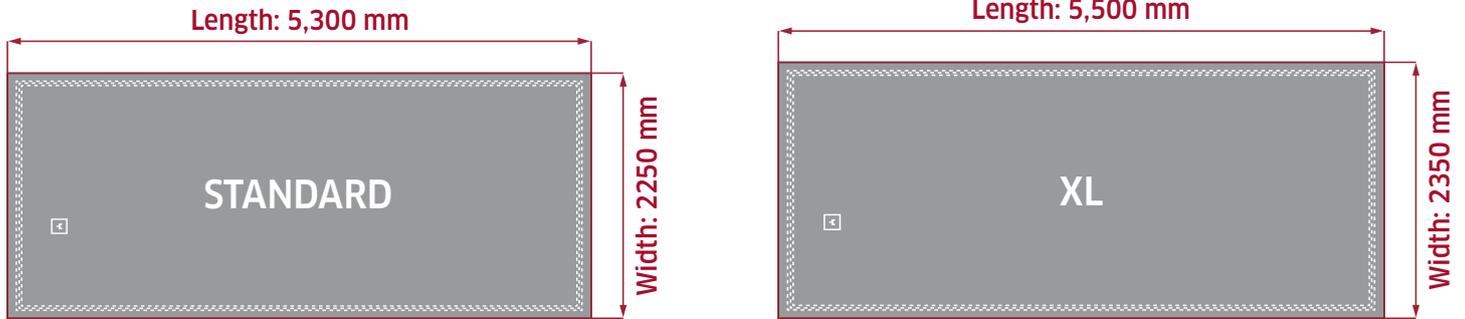


Fig. 5: Pallet sizes in the RESPACE® system.

The RESPACE® parking system can be planned for one or several parking levels. Floor plans across parking levels do not have to match. The number of parking spaces can be adjusted individually to the space available on each parking level.

The parking system consists of a modular combination of parking pallets. These are to be aligned flush to each other across the full area. The parking pallets are moved out of the parking cabin by a hoist and into the parking level to be transported further from there by the horizontal conveyors.

Depending on the arrangement, individual conveyors transport the pallets lengthwise, sideways or bidirectionally. For each cycle, one or more empty spaces are needed depending on size.

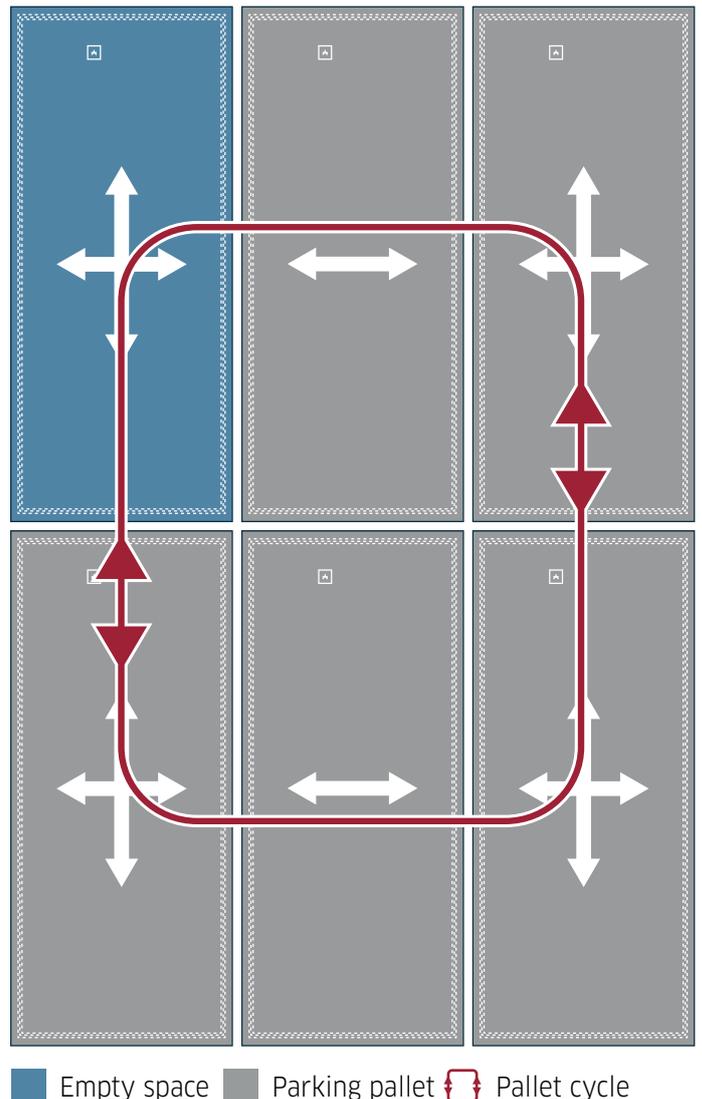


Fig. 6: Simple RESPACE® parking system with four parking spaces and integrated hoist.

PLANNING A RESPACE® LAYOUT

INCLUDING SPACING IN THE PLANNING

The following spacing needs to be planned in:

Minimum spacing between the system and the building wall	150 mm
Minimum spacing between the system and the hoist	150 mm
Minimum spacing between the pallets	100 mm
Minimum spacing around building supports	100 mm

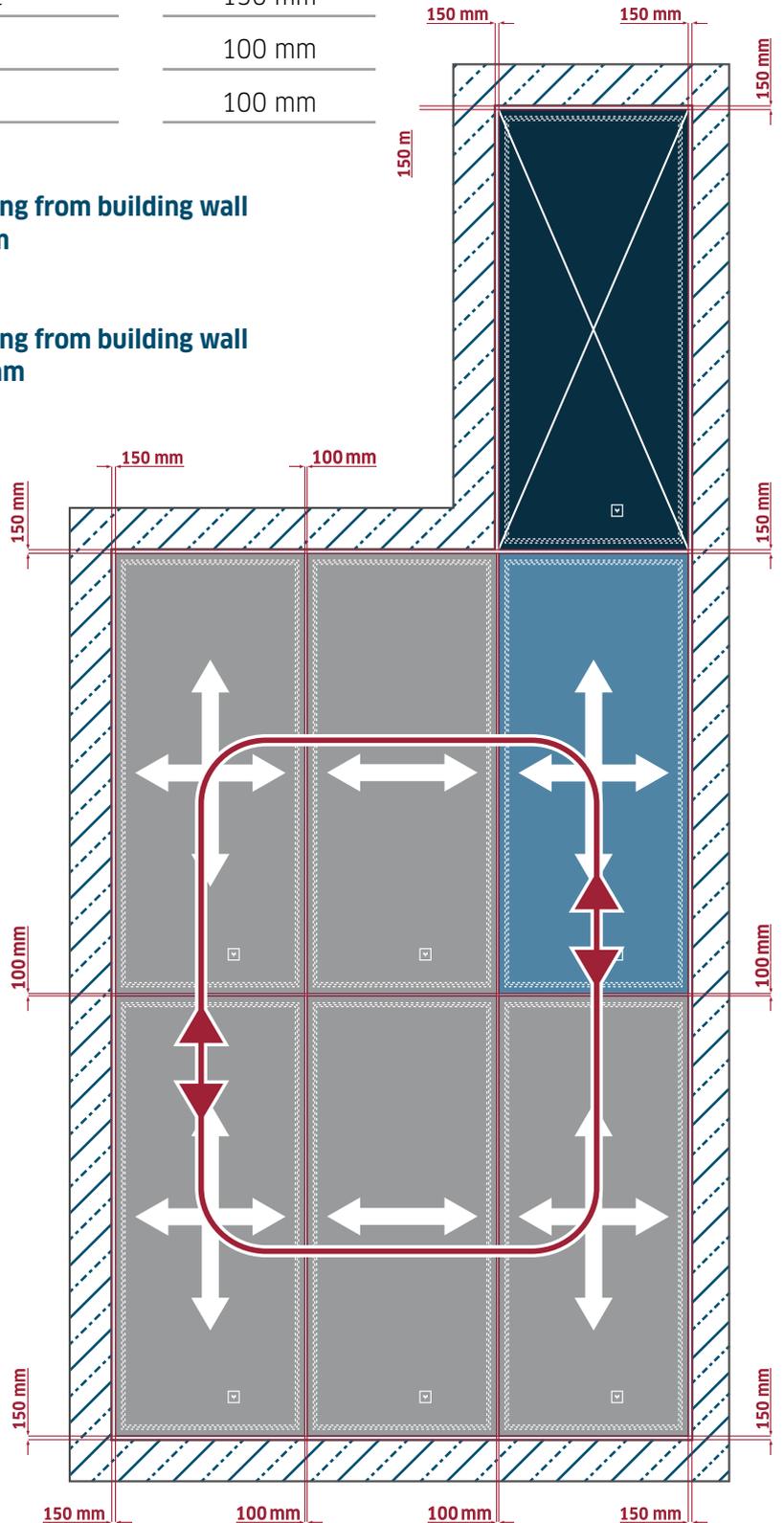
Example calculation of the width:

2 x pallet + 2 x spacing between pallets + 2 x spacing from building wall
2 x 2250mm + 2 x 100mm + 2 x 150mm = 5000mm

Example calculation of the length:

2 x pallet + 2 x spacing between pallets + 2 x spacing from building wall
2 x 5300mm + 1 x 100mm + 2 x 150mm = 11000mm

Note:



Hoist
 Empty space
 Parking pallet
 Parking pallets cycle

Fig. 7: Parking system with five parking spaces (standard pallets) without building supports.

PLANNING A RESPACE® LAYOUT

If building supports must be incorporated in the planning, it is always advisable to ask our experts. The general rule, however, is that the spacing between the pallet and building supports must be at least 100 mm. It is important that the entire row of pallets are in line. Our experts will gladly help you with the planning of your building supports for the most efficient parking system possible.

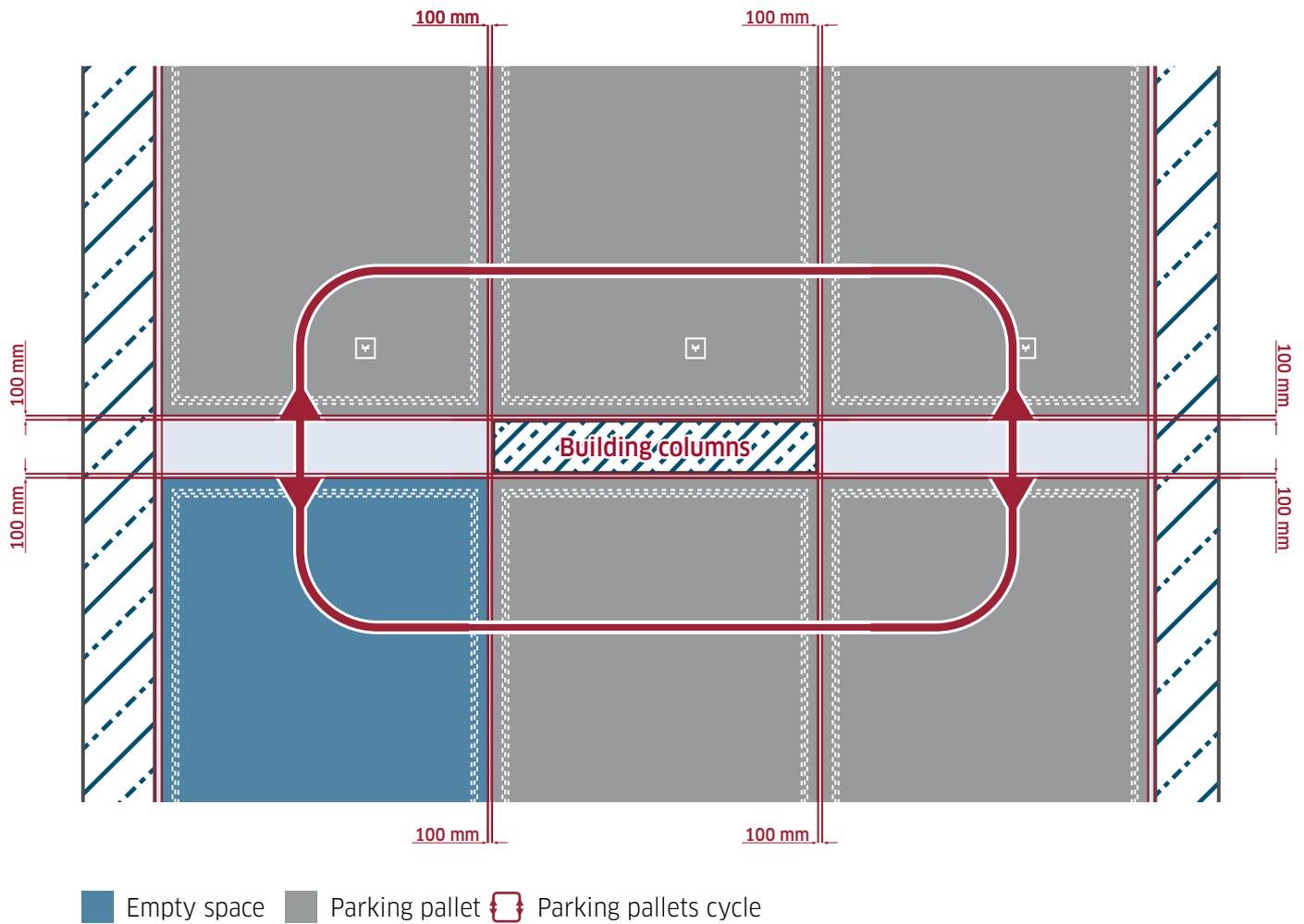


Fig. 8: Parking system with five parking spaces (standard pallets) and integrated building support.

PLANNING A RESPACE® LAYOUT

FLOOR HEIGHT OF THE PARKING LEVELS

The required clear floor height is dependent on the vehicle height that is intended.

CLEAR FLOOR HEIGHT ON THE FLOOR CEILINGS

The required clear height for installation of the automatic parking system on load-bearing floors is calculated as follows:

Height of RESPACE® conveyor incl. pallet: $h_R = 47 \text{ cm}$

Vehicle height plus reserve: $h_{\text{car}} = F_{\text{height}} \text{ cm} + 5 \text{ cm}$

Required height for technical building equipment (TBE): $h_{\text{TBE}} = T \text{ cm}$ (e.g. 15 cm for light and sprinklers)

**Required clear height per parking level =
Height of RESPACE® conveyor with pallet + vehicle height plus reserve + technical building equipment (TBE) height**

CLEAR FLOOR HEIGHT ON STEEL STRUCTURE PARKING LEVELS

Two or more parking levels can be arranged in a steel structure to reduce the clear height and accommodate cars of different heights in the parking system. The required clear floor height is calculated as follows:

Height of RESPACE® conveyor incl. pallet: $h_R = 47 \text{ cm}$

Vehicle height plus reserve: $h_{\text{car}} = F_{\text{height}} \text{ cm} + 5 \text{ cm}$

Space required for TBE: $h_{\text{TBE}} = T \text{ cm}$ (e.g. 15 cm for light and sprinklers)}

Additional height of the steel structure: $h_{\text{ST}} = 5 \text{ cm}$

**Required clear height for two parking levels =
2 x height of RESPACE® conveyor incl. pallet + 2 x vehicle height plus reserve + 1 x height of the steel structure + Space required for TBE**

Note: The space requirement slightly increases if a steel structure is planned. Depending on the project, the required height of the parking system will reduce, however. An expert planner of Lödige will be available to you for the execution planning.

ON-SITE REQUIREMENTS FOR PARKING LEVELS

1. Statics requirements

The RESPACE®-system is anchored into the parking level floors. This requires a concrete quality of at least C25/30. The anchor depth is normally 10 cm. A floor coating resistant to salt water is to be provided to avoid inappropriate formation of dust.

Reinforced concrete ceilings on-site serve as the statics framework and must be load-bearing according to the structural analysis provided by the builder. You will receive the planning details and the load bearing plan for each parking level on consultation with us. For a rough calculation, it is sufficient to assume a surface load of 3.5 kN/m² (for a vehicle weight of up to 3000 kg).

2. Dimensions and tolerances

All indicated dimensions are minimum dimensions. Tolerances according to VOB [German Construction Contract Procedures] Part C are to be considered (e.g. DIN 18331 for concrete works, DIN 18330 for masonry works). The levelness of the underground on which RESPACE® is to be installed is defined in DIN EN 18202, Tolerances in building construction, Table 3, row 2B.

3. Drainage

Depending on the weather situation, it is possible that water collects on the parking levels. We recommend drainage by means of a pump sump on the lowest level. Pits for hoists have to be equipped with a pump sump and be sealed. It is recommended to paint the concrete of all surfaces.

4. Lighting

When in operation, lighting with an illumination value of 300 lux is sufficient on the parking levels; for maintenance work and to connect remote maintenance at least 500 lux is required in the area in front of switch cabinets. Sockets with 230 V connection are to be provided in the parking area for maintenance purposes. Please include an illumination value of 300 lux for the transfer cabin in your planning.

5. Ventilation and heating

Even though the system is free of combustion gases, we recommend installing a ventilation system to reduce humidity, prevent condensation, reduce moisture from vehicles and observe health and safety regulations. Temperatures below freezing point are to be avoided by means of heating. Relevant construction regulations must be observed.

5. Sound insulation on site

Sufficient sound insulation must be present on site for rooms requiring protection. Generally, applicable sound insulation regulations according to DIN 4109 must be taken into account. RESPACE®-systems are connected to the structure by insulation elements to reduce structure-borne noise. As a result, the noise development of the Respace parking system is below 85 dB(A) as the median value of the intrinsic curve measured at a distance of one metre.

6. Access to the parking levels

Lödige Industries assists in the planning of maintenance access and doors on the parking levels and the relevant safety equipment.

7. Fire protection on site

Fire protection measures, fire protection gates, optional sprinklers, fire alarm system, smoke extraction, etc. are to be planned by the builder and coordinated with Lödige Industries.

THE HOIST

The RESPACE® system offers three types of standard hoists. The right hoists depends on two factors: the lifting height and the possible pit depth. Electrical and hydraulic solutions are available.

THE LIFT SHAFT

All requirements resulting from the structural analysis, fire protection, sound insulation, and the building code should be included in the considerations regarding the layout of the shaft walls.

Compliance with the tolerances for building structures according to DIN 18202 must be taken into account for the design of the shaft. All surfaces must be plane and level, as well as right angled and perpendicular. If brick-work (e.g. existing walls) is to be used instead, this must be discussed and agreed with us beforehand because of the mounting options for the lift technology. Installations not relating to the lift must not be accommodated in the lift shaft.

The ceiling opening of the lift shaft in the drive-in cabin must comply at least with the following rules:

1. Drainage

It is possible that water collects in the shaft. Pits for hoists generally have to be equipped with a fixed-installed pump sump. It is recommended to paint the concrete and the pits must be sealed.

2. Ventilation/fire protection/sound insulation of the lift shaft

Ventilation, fire protection, and sound insulation in the lift shaft must be included in the planning in line with the requirements for the parking levels.

	 Scissor lift	 Double scissor lift	 4-column hoist
Maximum lifting height	3,200 mm	6,200 mm	17,000 mm
Minimum pit depth	900 mm	1,250 mm	750 mm

All standard hoists are devised so that models with longitudinal, traverse or bidirectional conveyors or models with rotary table function can be provided. Scissor and double scissor lifts will be delivered with a self-supporting steel structure. For a 4-column hoist, this same steel

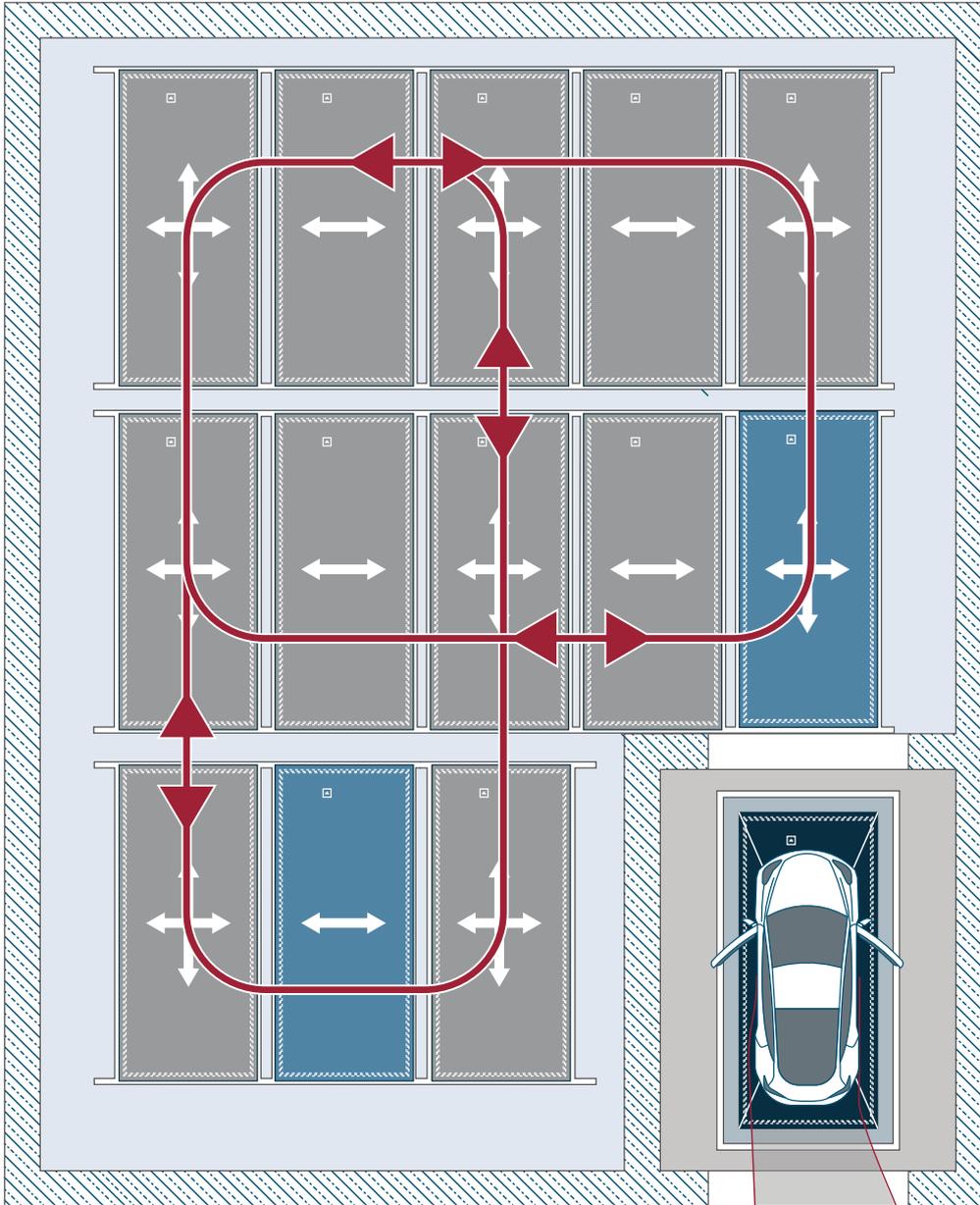
structure must also be attached to the shaft in some places. An opening for the pallet size plus 100mm circumferential space must be provided for the ceiling opening in the transfer cabinet in the area of the hoist.

THE HOIST

PLACEMENT OF THE HOIST

The hoist can be integrated in the parking cycle or be positioned separately. If the hoist is to be integrated in the parking cycle, this must be discussed beforehand with the expert planner. Our experts will also gladly provide advice to you for deciding which arrangement offers the optimal

solution. Scissor and double scissor lifts will be delivered including self-supporting steel structure. For a 4-column lifter, this structure must also be attached to the building in a few places.



- ☒ Hoist
- Empty space
- Parking pallet
- ☒ Parking pallets cycle

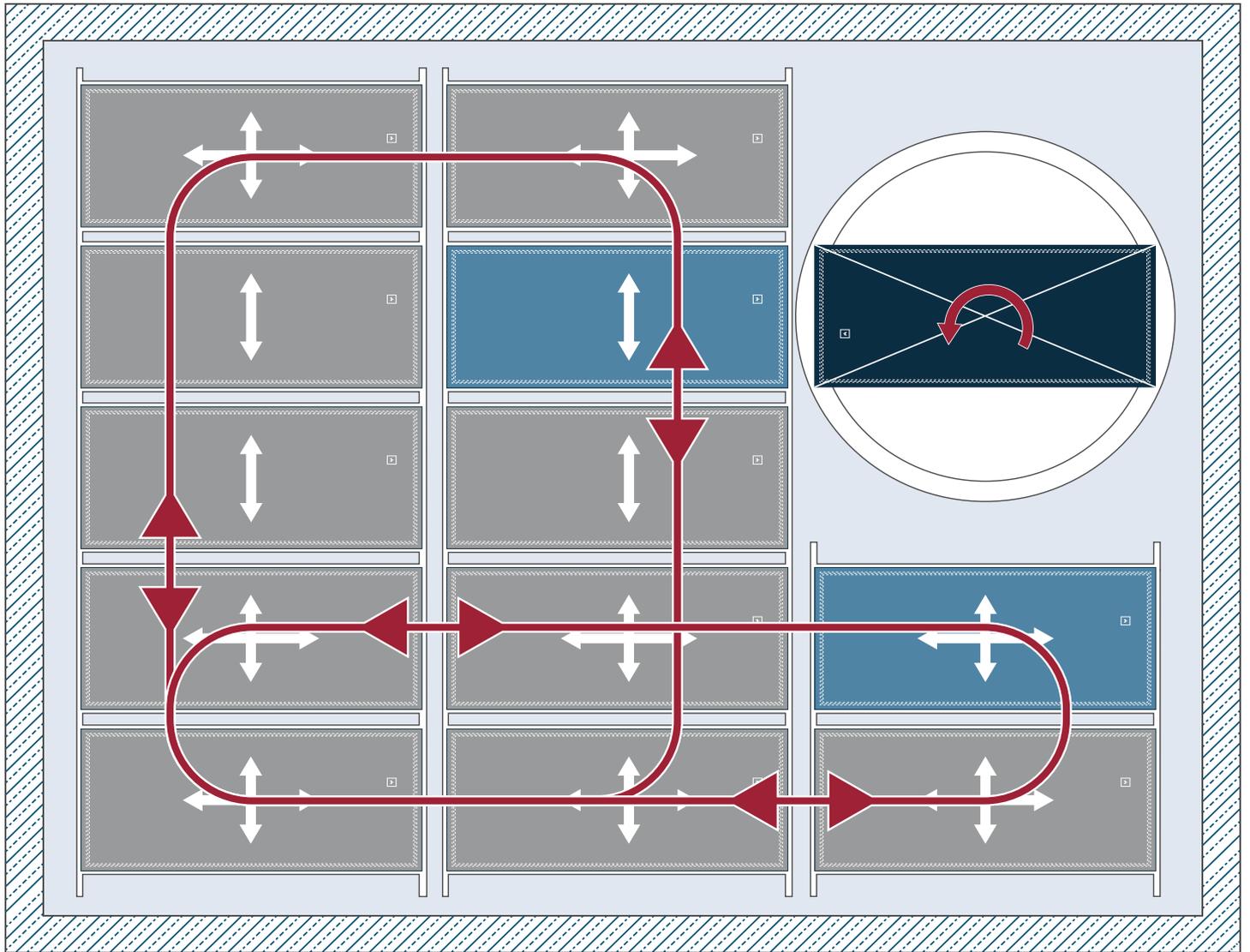
Fig. 9: Integrated hoist

TURNTABLE

TURNTABLE - FLEXIBILITY AND SAFETY

Installation of a turntable can offer additional flexibility to the planner. This way, the transfer cabin can be aligned independently from the parking spaces of the parking levels. The car can be prepared in the cabin in driving direction thanks to a turntable, even if the cabin is not designed as a drive-through. In order to use a turntable, space for

three pallets arranged next to each other is needed on the parking level. Ideally, a turntable can be installed in the transfer cabin or on the hoist. Rotation on a mezzanine floor is also feasible if the room height allows.



☒ Hoist ■ Empty space ■ Parking pallet ◻ Parking pallets cycle

Fig. 10: Turntable on the parking level

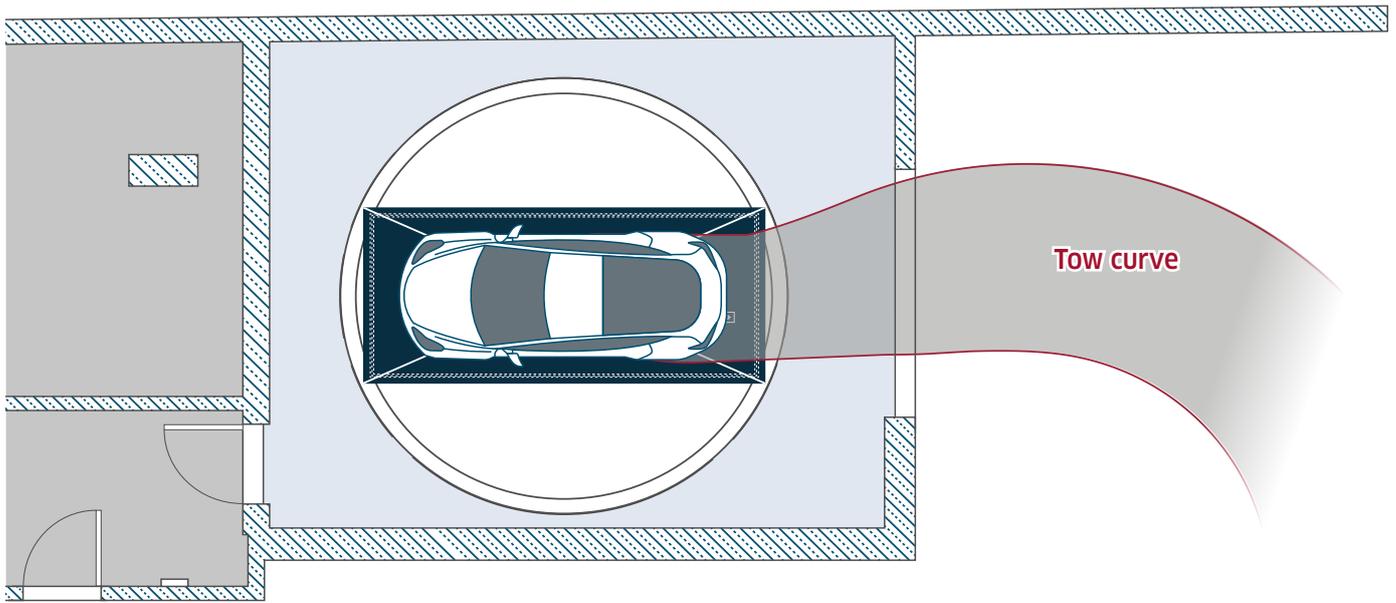


Fig. 11: Turntable in the cabin

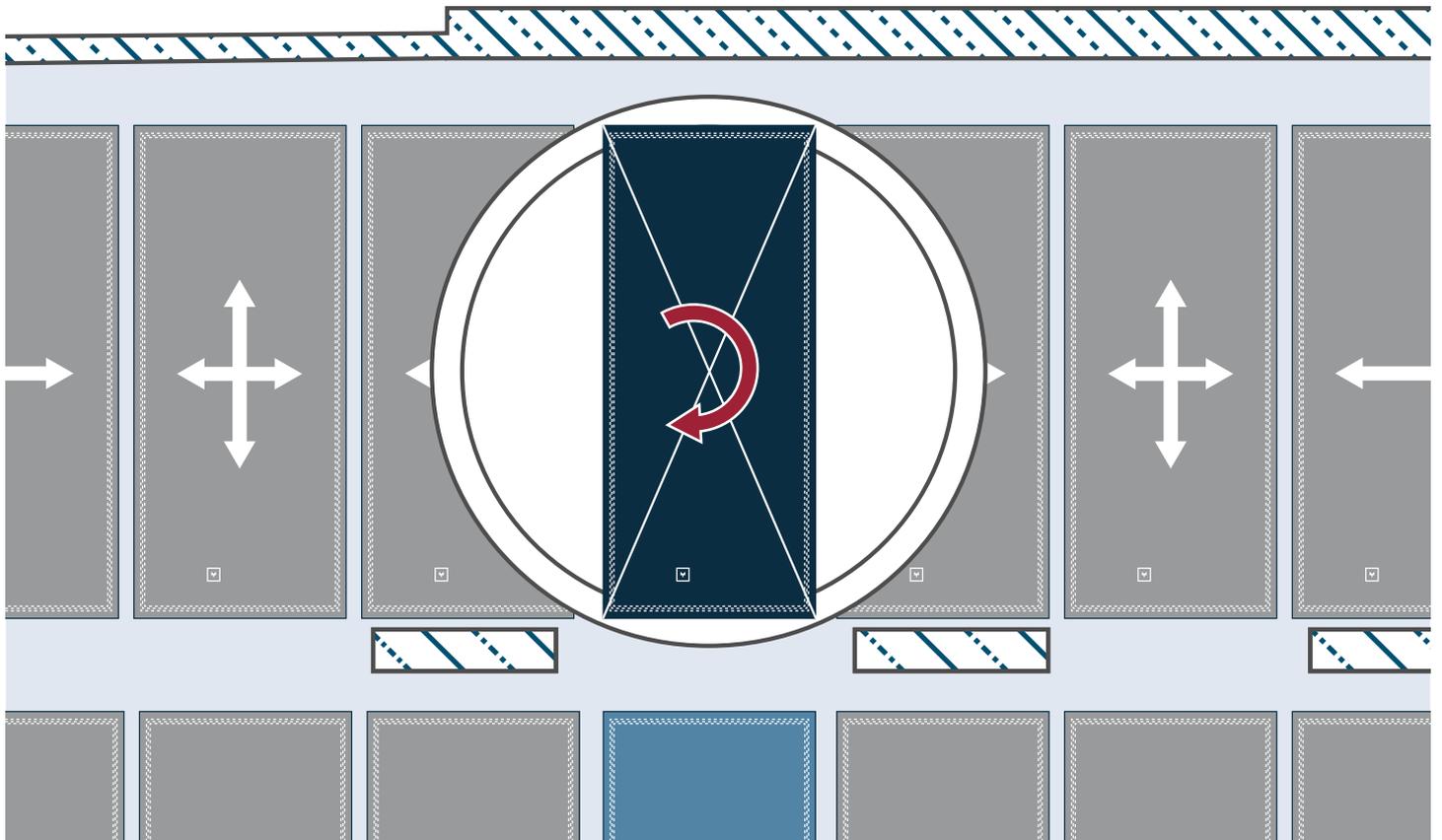


Fig. 12: Integrated turntable

PLANNING THE TRANSFER CABIN

The transfer cabin is the only point of contact of the parking system user with the fully automated parking process. It should therefore be large, easy to use, and designed in line with the builder's requirements. Dimensions and design of the transfer cabins can be adjusted flexibly to the overall architectural concept. Depending on the number of

planned parking spaces, it can be sensible to plan several transfer cabins. The transfer cabin will be designed by the architect and is part of the building. The following dimensions need to be taken into account in the planning:

	Recommended [*]	SP+turntable Recommended
Cabin width	3,800 mm	6,500 mm
Cabin length	6,500 mm	6,500 mm
Clear cabin height	2,700 mm [*]	2,500 mm ^{**}
Cabin door width	2,800 mm	2,800 mm
Clear cabin door height	2,100 mm [*]	2,100 mm ^{**}

^{*} For a standard pallet (SP) and a hoist without turntable. This dimension needs to be adjusted for a disabled access.

^{**} Depending on the planned vehicle height.

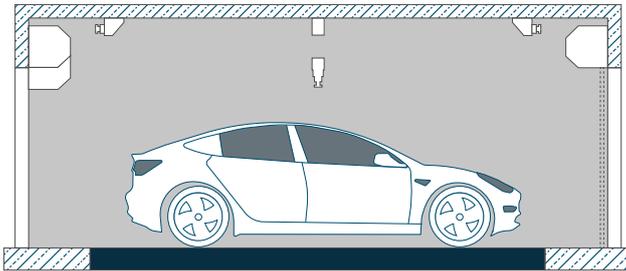


Fig. 13: Side view of the cabin

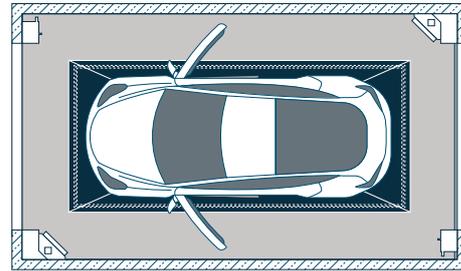


Fig. 14: Top view of the cabin

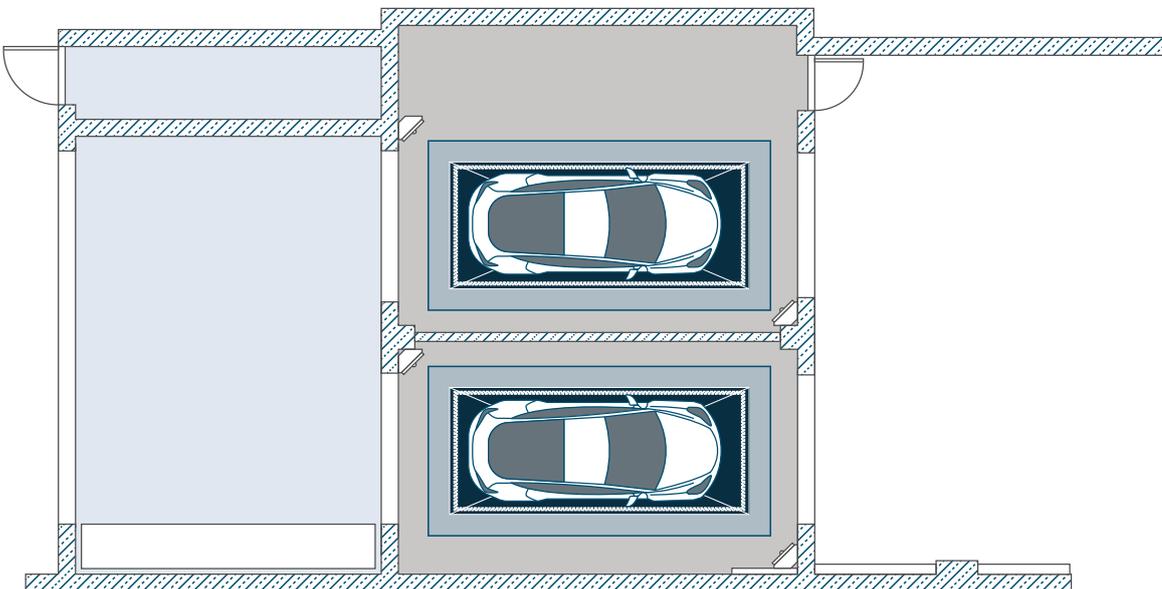


Fig. 15: Top view of a double cabin

PLANNING THE TRANSFER CABIN

To ensure easy driving access and operation of the transfer cabin, the platform and the cabin door should be aligned. We are happy to advise you further on the planning of the transfer cabin and the turning curve.

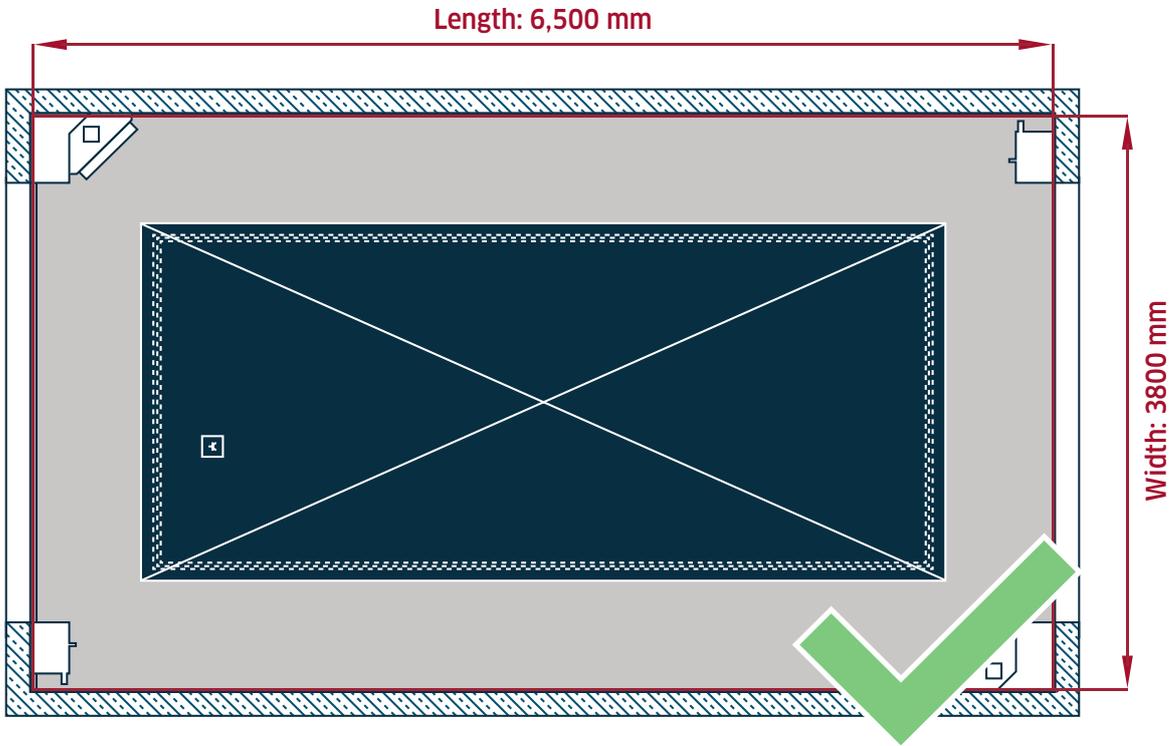


Fig. 16: Correct placement of the hoist in the cabin.

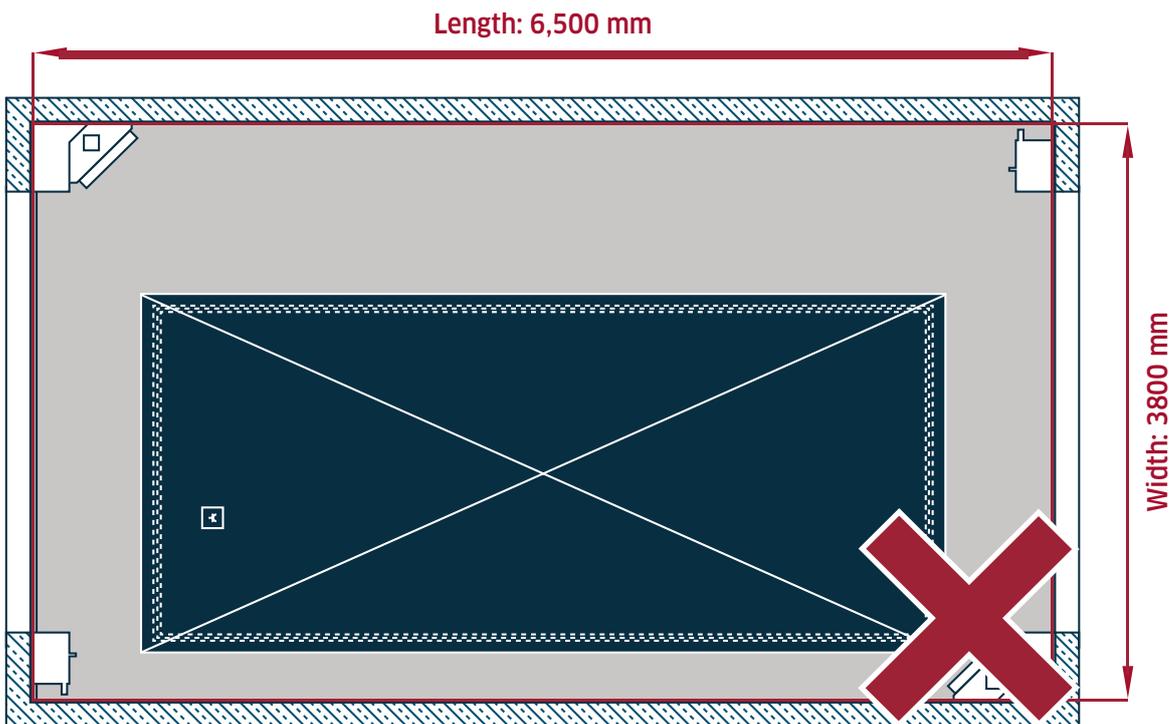


Fig. 17: Incorrect placement of the hoist in the cabin as the pallet is no longer aligned with the cabin gate.

PLANNING THE TRANSFER CABIN

OPERATING TERMINAL

For the safety of users, a side entrance door or an escape mechanism of the cabin door must be provided. An operating terminal must be located outside of the cabin. Weather protection must be provided for outdoor use. Electricity connections must be provided for maintenance work.

CABIN ENTRANCE DOOR

The rolling cabin door, to be provided by the customer, must be equipped with a door interface control unit that is installed on site and provides potential-free contacts so that the RESPACE® parking system can control the door. When it opens and closes, the door must not encroach on the vehicle's parking dimensions in the cabin. To make sure of this, a rolling gate is required. A swinging door is not suitable.

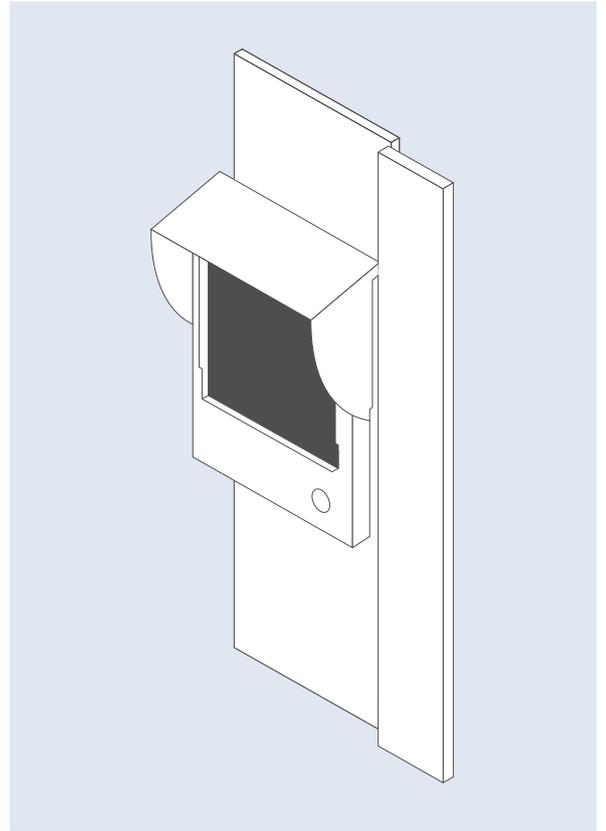


Fig. 18: Operating terminal outdoors with weather protection

Voltage	230V - 1-phase/neutral/earth maximum 16A 400V AC- 3-phase/neutral/earth maximum 16A
Speed	Minimum 0.17m/s
Security	Option 1: Under door sensor (light barrier) and security contact strip. Option 2: Light screen If one of the security sensors is triggered, the door should open completely.
Standard	Compliance with the EN standards for industrial gates including EN12453 and EN14010, with a minimum mechanical strength of 300N/5cm ²

The selection of a suitable industrial doors falls within the responsibility of the architect or building planner. Doors/access doors are to be selected in consideration of the following points:

- Type of materials, colour
- Length of the lifecycle
- Standard requirements for fire and smoke
- EMC requirements
- Wind load
- Insulation
- Sound insulation
- Waterproofing/air circulation
- CE certification
- Provisions for emergency opening - outside/inside

PLANNING THE SYSTEM ENERGY SUPPLY

ELECTRICITY SUPPLY FOR THE PARKING SYSTEM

An electricity supply for the automatic parking system must be planned. The electricity consumption depends on many factors, which can be calculated as soon as the layout has been drafted and agreed with the Lödige expert team.

ELECTRICITY SUPPLY FOR E-VEHICLES

A separate electricity supply for one or more electricity supply cabinets is required for electrical charging as well as the parking system's electricity supply. The wiring from the cabinets to the parking system equipment will be

undertaken by Lödige Industries. Charging capacities between 7kW-11kW and in special cases 22Kw are possible.

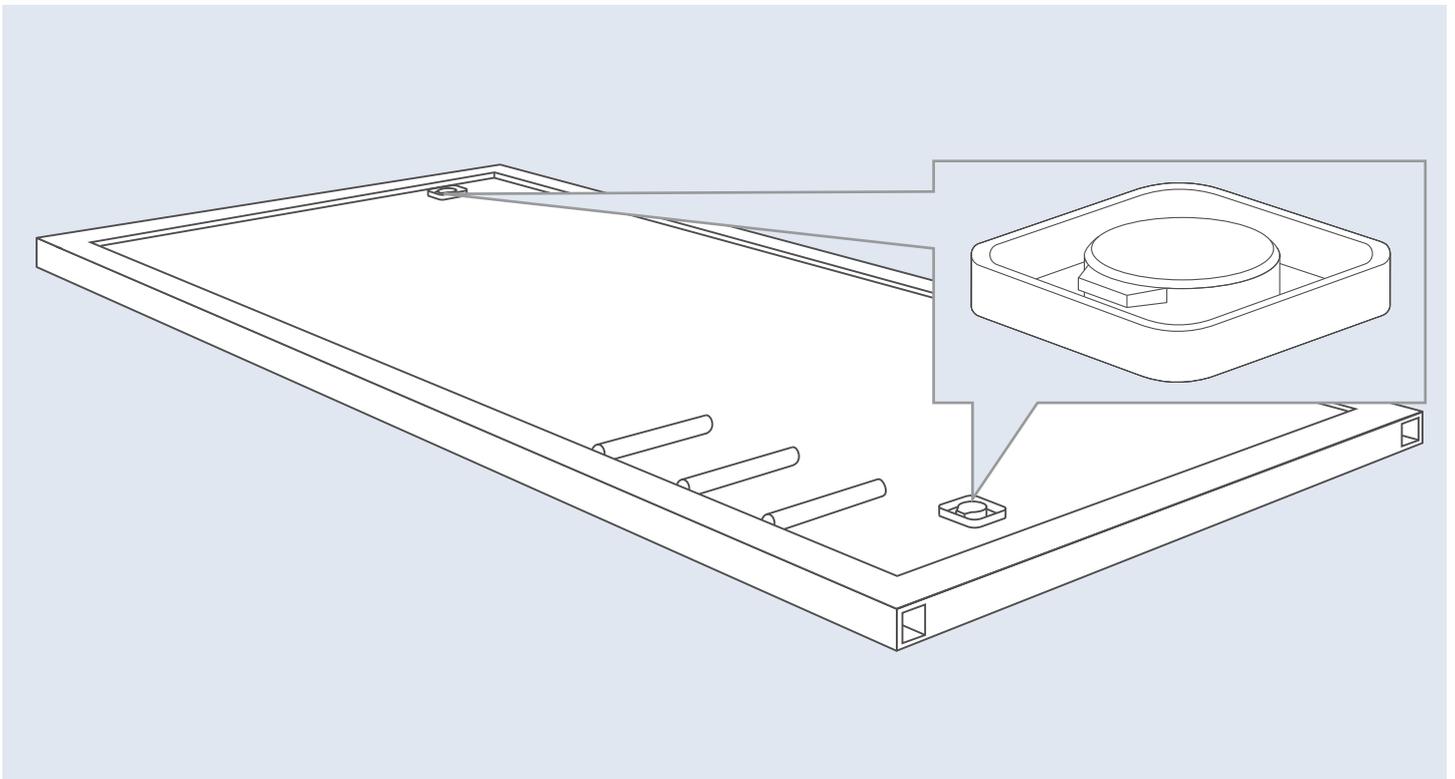


Fig. 19: RESPACE® pallet with EV-charging sockets.

PLANNING THE SYSTEM ENERGY SUPPLY

SWITCH CABINETS

The RESPACE® system needs space for switch cabinets. Inlets with the corresponding fuses and main switches, where possible should be placed in the direct vicinity of the parking system. The switch cabinet for the hoist must

be located near the machine. Escape routes mandated by law must be provided in front of the switch cabinets.

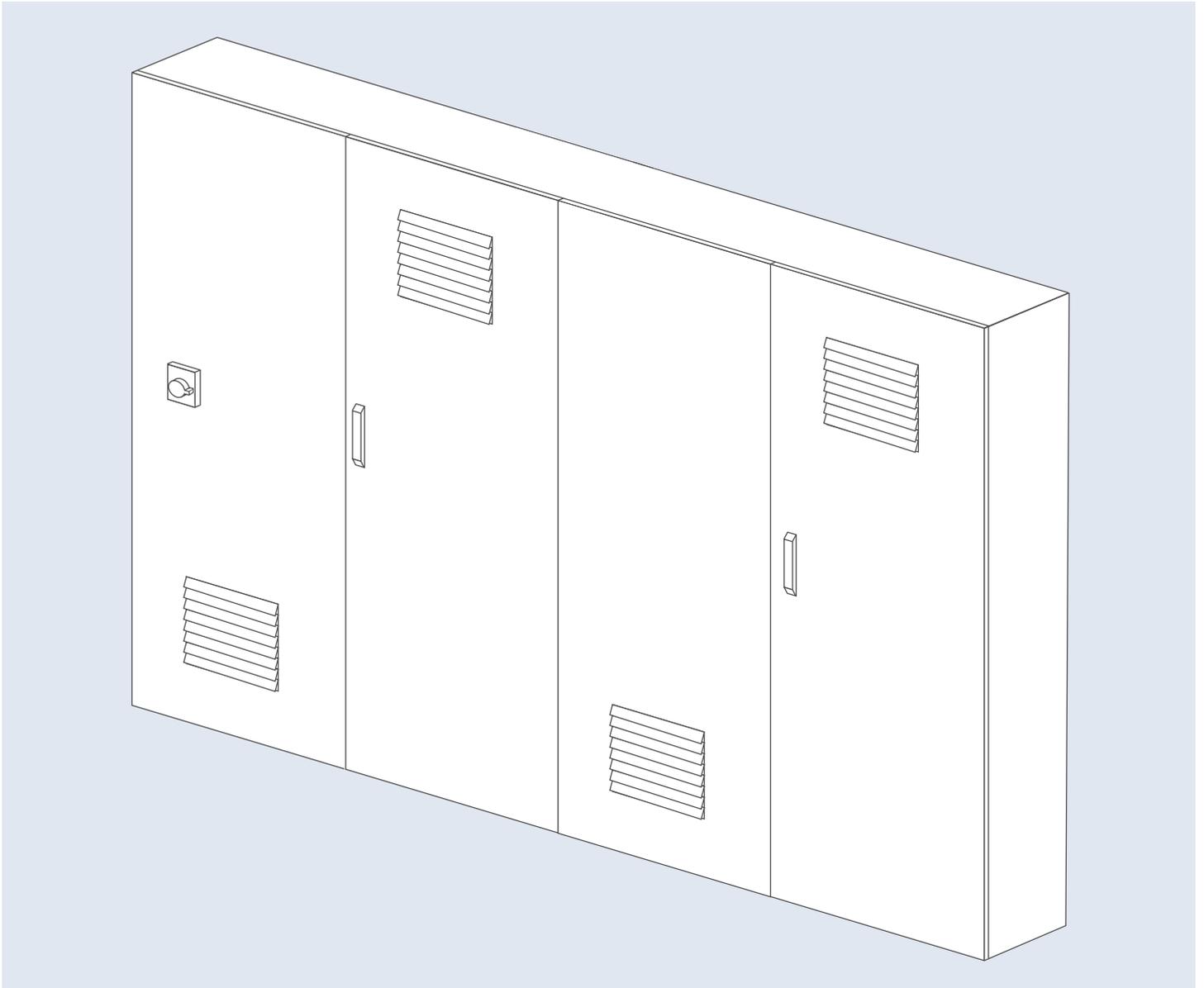


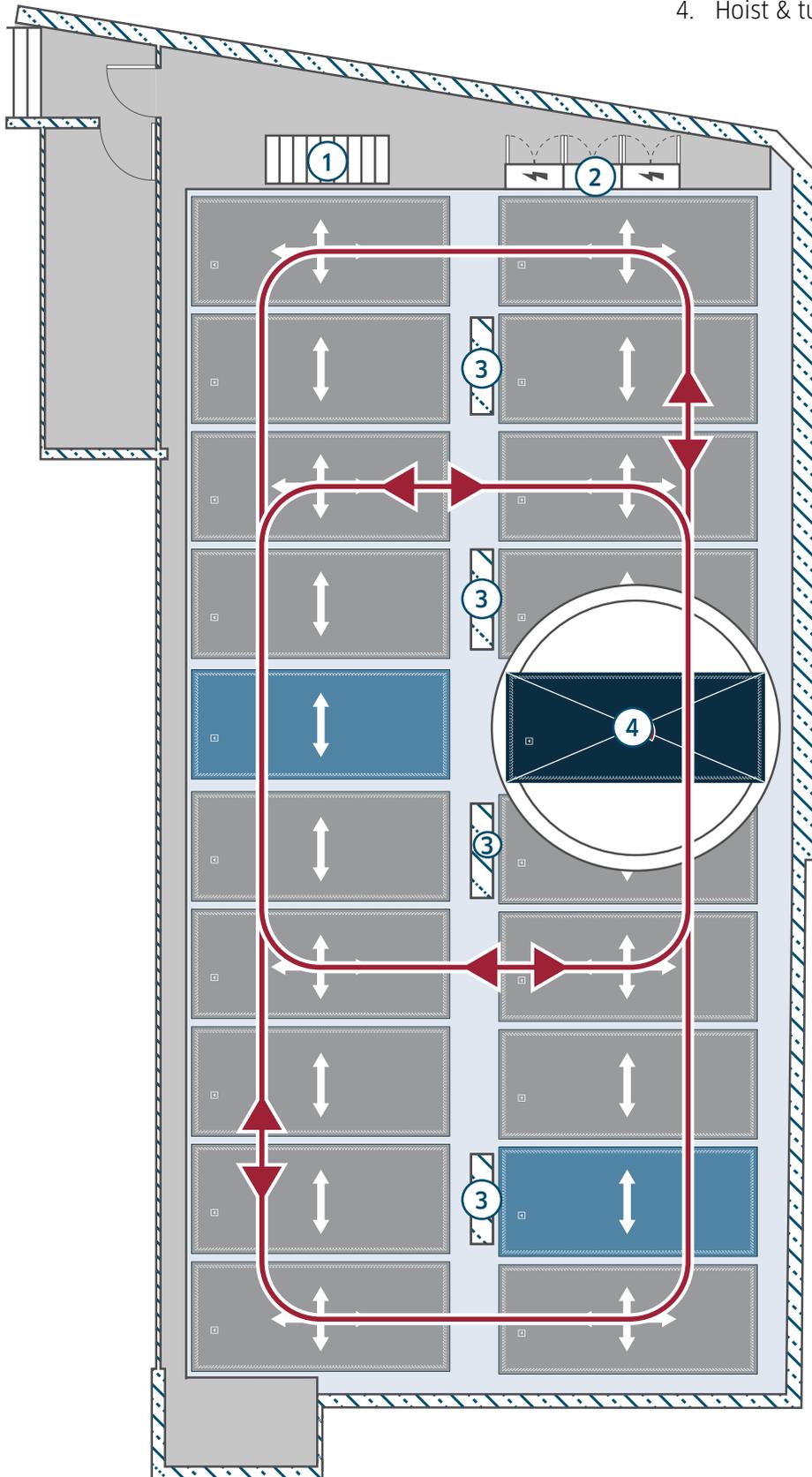
Fig. 20: Switch cabinets are to be placed close to the parking system.

Note on humidity (EN60204-1):

In line with EN 60204-1, Chapter 4.4.3, the electrical equipment is laid out to work problem-free in the intended ambient air temperature between +5°C and 40°C (outside of encasings (switch cabinets or housings)). The electrical equipment can work problem-free according to EN 60204-1, Chapter 4.4.4, if the relative humidity does not exceed 50% at a maximum temperature of 40°C. Higher relative humidities are permissible in low temperatures (e.g. 90% at 20°C). Harmful effects from occasional thawing must be avoided. Suitable ventilation should be provided.

LEGEND

- 1. Stairs
- 2. Switch cabinets
- 3. Building supports
- 4. Hoist & turntable



⊠ Hoist ■ Empty space ■ Parking pallet ◻ Parking pallets cycle

Fig. 21: Complete overview of the RESPACE® system with accesses, switch cabinets, and maintenance openings.

PLANNING ACCESS

Versatile access options

Our experts will gladly explore with you which of our various access options is the right one for your project. Depending on the selection made, additional elements will be needed. The Lödige Booking Portal can be used by the parking system manager to create and administer users or user groups. Alternative, Lödige employees can create the users for smaller systems with less user fluctuation.

The following four access control options offer users easy, comfortable access:

Remote control/key fob

A remote control, for example, in the form of a key fob with integrated RFID token can be used to call the cabin on arrival at the parking system and to start the parking process at the terminal.

The Lödige ParkGO! App

ParkGO! is the accompanying access app for the automatic parking systems of Lödige Industries. Users can track the status of the system and request their vehicle remotely. Confirmation of the retrieval process at the cabin sets the parking process in motion. 24/7 help is available.

Automatic license plate recognition

State-of-the-art technology ensures a reliable and convenient user access control. It is used for systems that have a defined user group as well as for systems with a booking portal linked to independent reservation systems via an interface. This also enables temporary booking of parking spaces. The automatic license plate recognition is always used in combination with a further identification by QR code. It is used to check the user's identity at the terminal before the parking process is started.

QR code

A QR code is assigned to a parking ticket in the Lödige Booking Portal and sent to the user by email. On arrival, the user identifies him or herself at the terminal by means of the QR code.



Fig. 22: The Lödige ParkGO! App.

NOTES

A series of horizontal dotted lines for writing notes.

Lödige Industries GmbH.
Balhorne Feld 28
33106 Paderborn
Germany

Tel. +49 5251 6830-0
info@lodige.com

www.lodige.com

