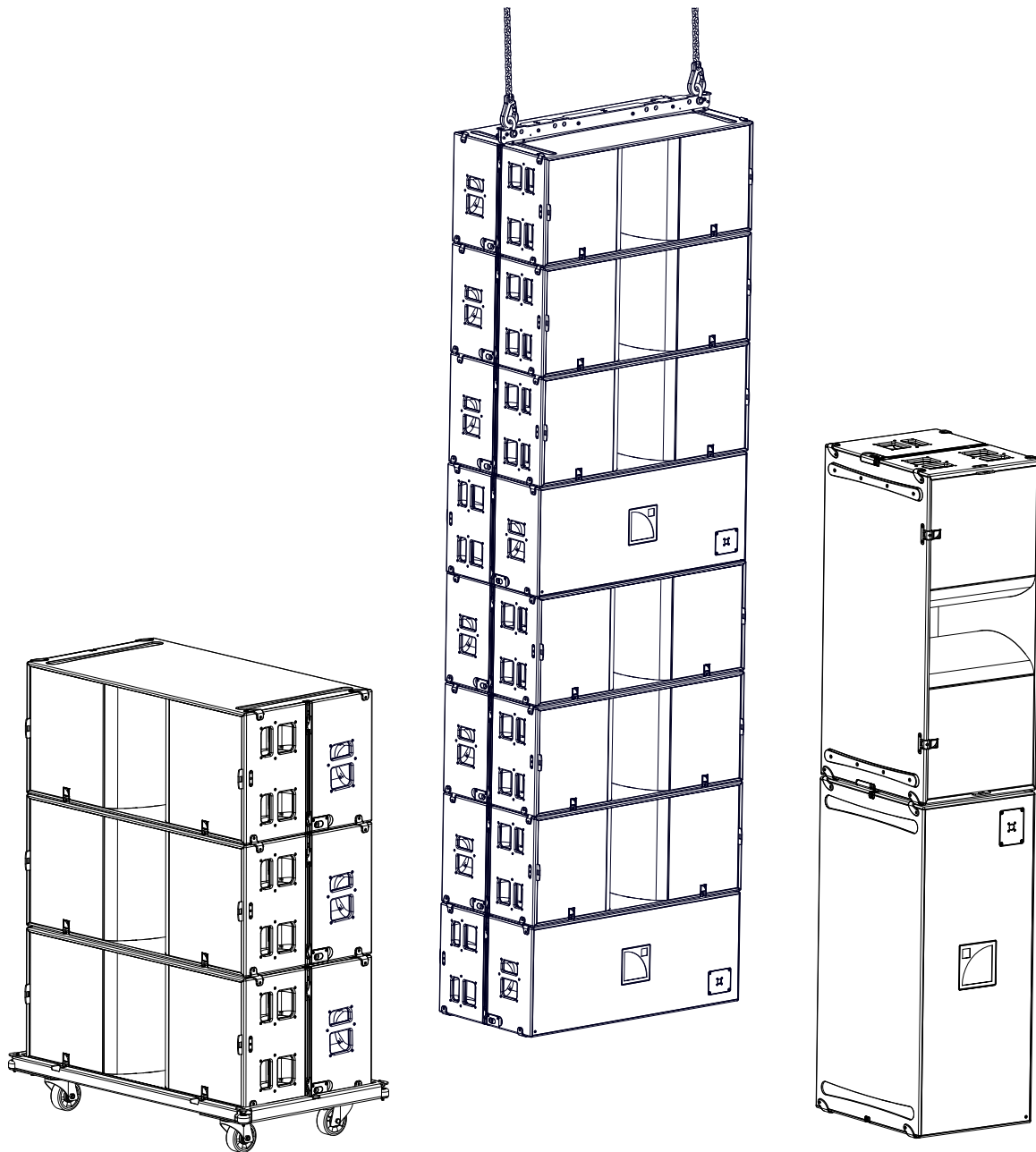


# KS28



## rigging manual (EN)



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# Safety

## Instructions

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- 
**Inspect the product before operation.**  
 If any sign of defect or damage is detected, immediately withdraw the product from use for maintenance.
- 
**Never incorporate equipment or accessories not approved by L-Acoustics.**
- 
**Read all the related PRODUCT INFORMATION documents shipped with the products before exploiting the system.**
- 
**Do not store the product on an unstable cart, stand, tripod, bracket, or table.**
- 
**Work with qualified personnel for rigging the system**  
 Installation should only be carried out by qualified personnel that are familiar with the rigging techniques and safety recommendations outlined in this manual.
- Ensure personnel health and safety**  
 During installation and set-up personnel must wear protective headgear and footwear at all times. Under no circumstances is personnel allowed to climb on a loudspeaker assembly.
- Respect the Working Load Limit (WLL) of third party equipment.**  
 L-Acoustics is not responsible for any rigging equipment and accessories provided by third party manufacturers. Verify that the Working Load Limit (WLL) of the suspension points, chain hoists and all additional hardware rigging accessories is respected.
- Respect the maximum configurations and the recommended safety precautions.**  
 For safety issue, respect the maximum configurations outlined in this manual. To check the conformity of any configuration in regards with the safety precautions recommended by L-Acoustics, model the system in Soundvision and refer to the warnings in Mechanical Data section.
- Be cautious when flying a loudspeaker configuration.**  
 Always verify that no one is standing underneath the loudspeaker array when it is being raised. As the array is being raised, check each individual element to make sure that it is securely fastened to the adjacent element. Never leave the array unattended during the installation process.  
 As a general rule, L-Acoustics recommends the use of safety slings at all times.
- Be cautious when ground-stacking a loudspeaker array.**  
 Do not stack the loudspeaker array on unstable ground or surface. If the array is stacked on a structure, platform, or stage, always check that the latter can support the total weight of the array.  
 As a general rule, L-Acoustics recommends the use of safety straps at all times.
- Risk of falling objects**  
 Verify that no unattached items remain on the array.
- Risk of tipping**  
 Remove all rigging accessories before transporting an array.
- Take into account the wind effects on dynamic load.**  
 When a loudspeaker assembly is deployed in an open air environment, wind can produce dynamic stress to the rigging components and suspension points.  
 If the wind force exceeds 6 bft (Beaufort scale), lower down and/or secure the loudspeaker array.
- 
**This system is intended for professional use.**
- 
**Read the USER MANUAL before operating the system.**  
 Use the loudspeaker system components described in the user manual and follow the operating instructions.

**Do not expose the product to extreme conditions.**

Do not expose the product to rain or sea spray.

Do not expose the product to moisture (mist, steam, humidity, condensation...) or excessive heat (direct sun, radiator...) for a long period of time.

**Contact L-Acoustics for advanced maintenance.**

Any unauthorized maintenance operation will void the product warranty.

## Symbols

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The following symbols are used in this document:



This symbol indicates a potential risk of harm to an individual or damage to the product.

It can also notify the user about instructions that must be strictly followed to ensure safe installation or operation of the product.



This symbol notifies the user about instructions that must be strictly followed to ensure proper installation or operation of the product.



This symbol notifies the user about complementary information or optional instructions.

## Welcome

Thank you for purchasing the L-Acoustics KS28.

This document contains essential information on rigging the system properly.

**As part of a continuous evolution of techniques and standards, L-Acoustics reserves the right to change the specifications of its products and the content of its document without prior notice.** Please check [www.l-acoustics.com](http://www.l-acoustics.com) on a regular basis to download the latest document and software updates.

# System components

## Loudspeaker enclosures

KS28 Flyable subwoofer 2 x 18"

## Rigging elements

KS28-BUMP Lifting beam for flying up to 16 x KS28  
 LA-SLING2T 1m chain sling with two-leg bridles rated 2 tons  
 KS28-PLA Removable front dolly on wheels for 1 x KS28  
 KS28-COV Protective cover for 1 x KS28  
 KS28-CHARIOT Chariot for up to 4 x KS28  
 KS28-CHARIOTCOV Protective cover for 3 or 4 x KS28 on KS28-CHARIOT

## Software applications

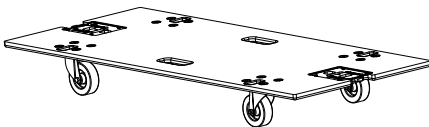
Soundvision 3D acoustical and mechanical modeling software

**i** Refer to the **Soundvision** help.

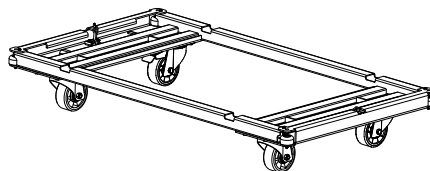
**i** **Other KS28 system components**  
 Other components of the system are presented in the KS28 user manual along with the enclosure configurations and connection schemes.

## Rigging elements

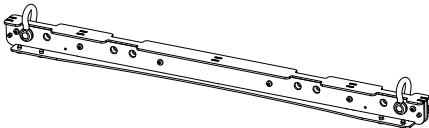
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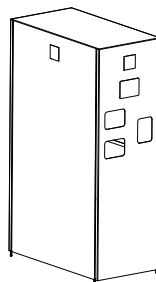
KS28-PLA



KS28-CHARIOT



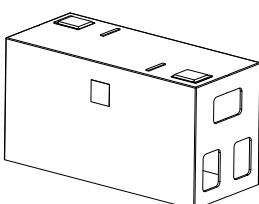
KS28-BUMP



KS28-CHARIOTCOV



LA-SLING2T



KS28-COV

# Mechanical safety

## Flown configurations

The KS28 rigging system complies with 2006/42/EC: Machinery Directive. It has been designed following the guidelines of BGV-C1.

2006/42/EC: Machinery Directive specifies a safety factor of 4 against the rupture. The flown deployments described in this manual achieve a safety factor of **5 or higher**.

Refer to Soundvision for the safety factor of a specific deployment.

The **safe limit** gives the maximum number of elements for which the safety factor is always compliant with the 2006/42/EC: Machinery Directive, regardless of the other deployment parameters (site angles, inter-enclosure angles, etc.)

The **maximum limit** gives the maximum number of elements for which the safety factor can be compliant with the 2006/42/EC: Machinery Directive, when the other deployment parameters provide the best mechanical conditions.

Configuration	Rigging accessory	Maximum / Safe limit
Flown	KS28-BUMP	16

## Other configurations

For other configurations, respect the recommended maximum limit for optimal stability.

Configuration	Rigging accessory	Maximum limit
Ground-stacked	No rigging accessory	4
Stacked upright	No rigging accessory	2
Stacked on chariot	KS28-CHARIOT	4



### Mechanical safety of the rigging system

Before any installation, always model the system in Soundvision and check the **Mechanical Data** section for any stress warning or stability warning.



## Assessing mechanical safety

In order to assess the actual safety of any array configuration before implementation, refer to the following warnings:



### **Rated working load limit (WLL) is not enough**

The rated WLL is an indication of the element resistance to tensile stress. For complex mechanical systems such as loudspeaker arrays, WLLs cannot be used per se to determine the maximum number of enclosures within an array or to assess the safety of a specific array configuration.

### **Maximum pullback angle**

If a pullback accessory is available, the pullback angle must not exceed a 90° negative site angle.

### **Mechanical modeling with Soundvision**

The working load applied to each linking point, along with the corresponding safety factor, will depend on numerous variables linked to the composition of the array (type and number of enclosures, splay angles) and the implementation of the flying or stacking structure (number and location of flying points, site angle). This cannot be determined without the complex mechanical modeling and calculation offered by Soundvision.

### **Assessing the safety with Soundvision**

The overall safety factor of a specific mechanical configuration always corresponds to the lowest safety factor among all the linking points. Always model the system configuration with the Soundvision software and check the **Mechanical Data** section to identify the weakest link and its corresponding working load. By default, a stress warning will appear when the mechanical safety goes beyond the recommended safety level.

### **Safety of ground-stacked arrays in Soundvision**

For ground-stacked arrays, a distinct stability warning is implemented in Soundvision. It indicates a tipping hazard when the array is not secured to the ground, stage or platform. It is the user's responsibility to secure the array and to ignore the warning.

### **Additional safety for flown arrays**

When flying an array, use available holes to implement a secondary safety.

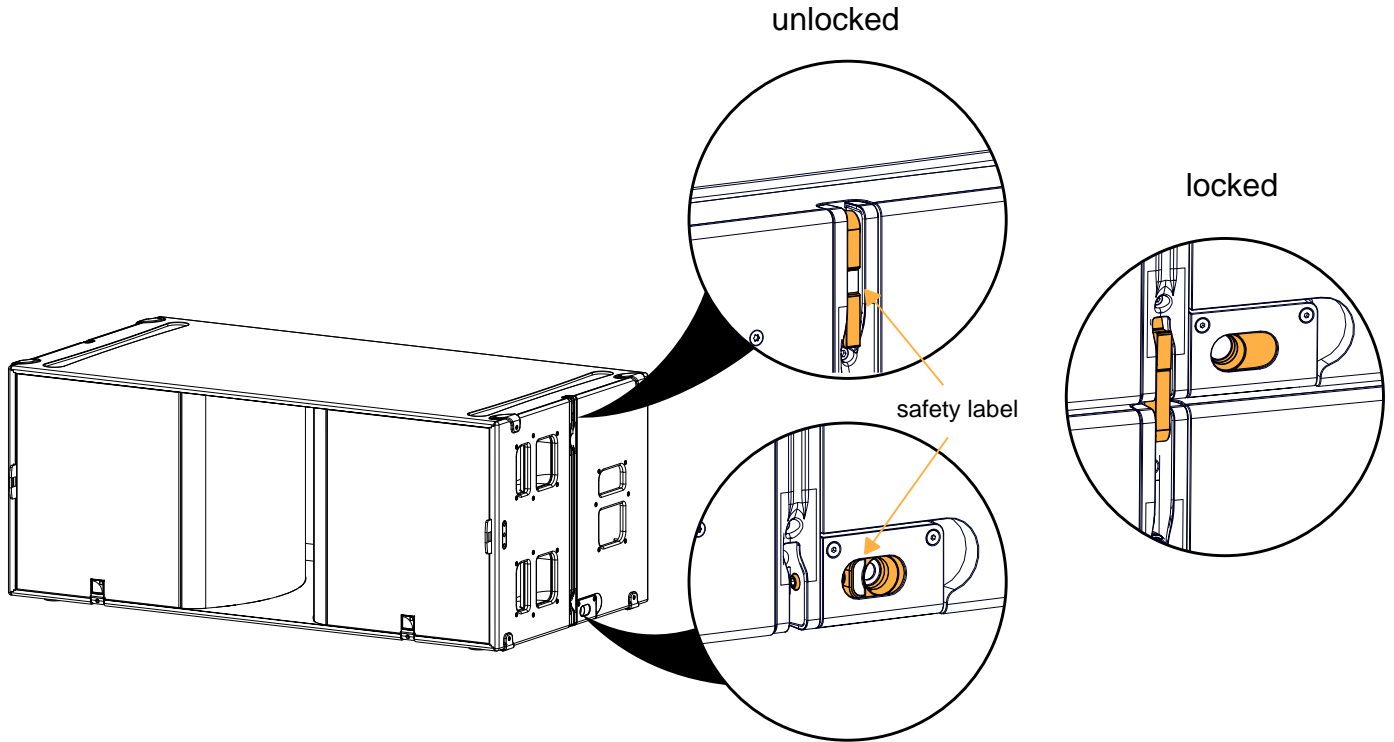
### **Considerations must be given to unusual conditions**

Soundvision calculations are based on usual environmental conditions. A higher safety factor is recommended with factors such as extreme high or low temperatures, strong wind, prolonged exposition to salt water, etc. Always consult a rigging specialist to adopt safety practices adapted to such a situation.

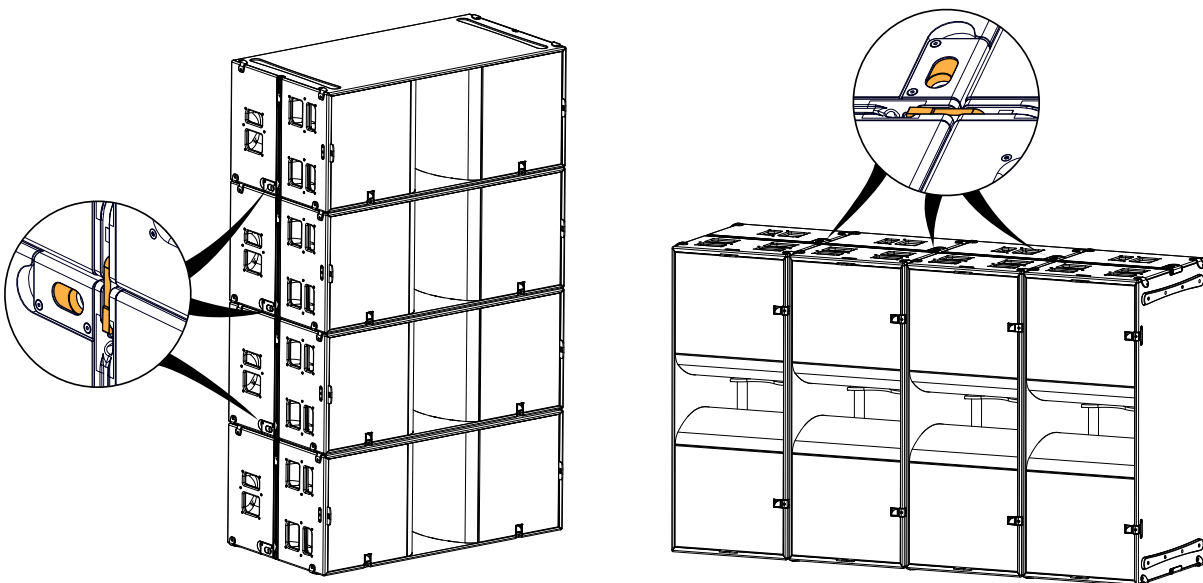
## Rigging system description

### KS28

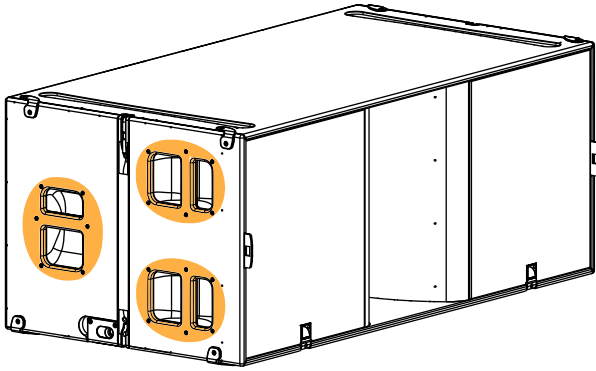
KS28 features flush-fitting rigging integrated in the cabinet. The rigging system consists of two rotating rigging arms and two spring-loaded pins to connect to other KS28, to KS28-BUMP or KS28-CHARIOT. The rigging arms and spring-loaded pins are fitted with yellow labels that allow to spot if a rigging point is not secured.



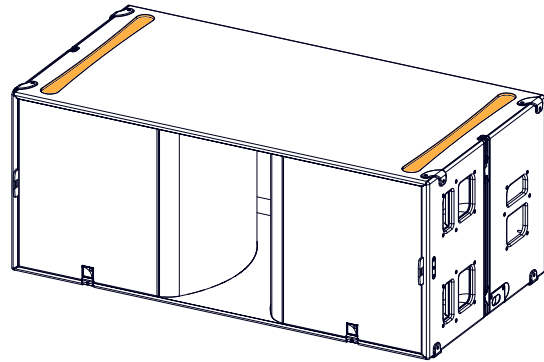
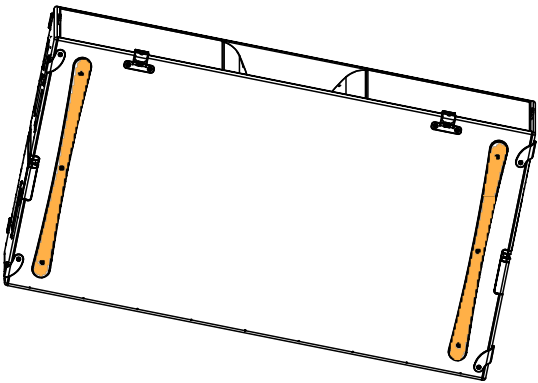
The rigging system allows securing enclosure arrays in stacked or on-end configuration.



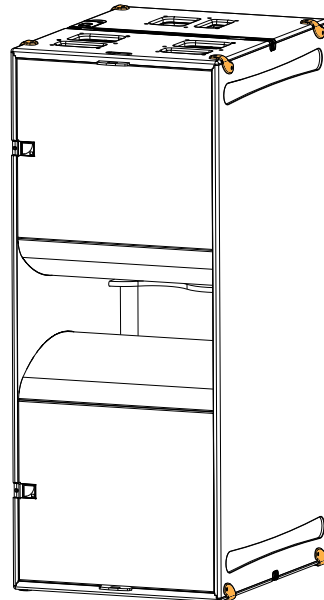
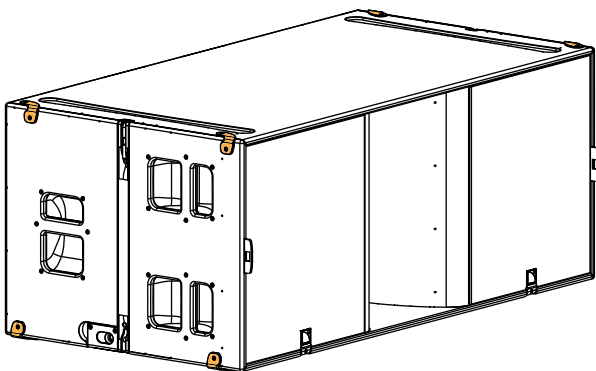
KS28 features six ergonomic handles.



KS28 features two ground runners for enclosure protection. Two tracks on the top of the enclosure fit the ground runners in stacking deployment.



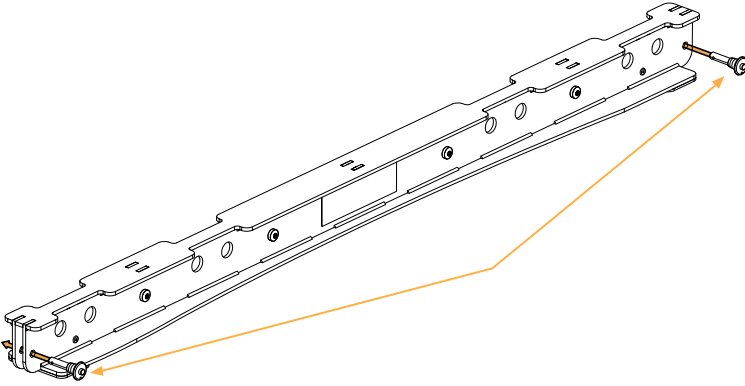
KS28 features eight L-shaped side runners for side protection and upright stacking.



## Elements for flying

### KS28-BUMP

KS28-BUMP features two ball-lock pins to secure the KS28 rigging arms.

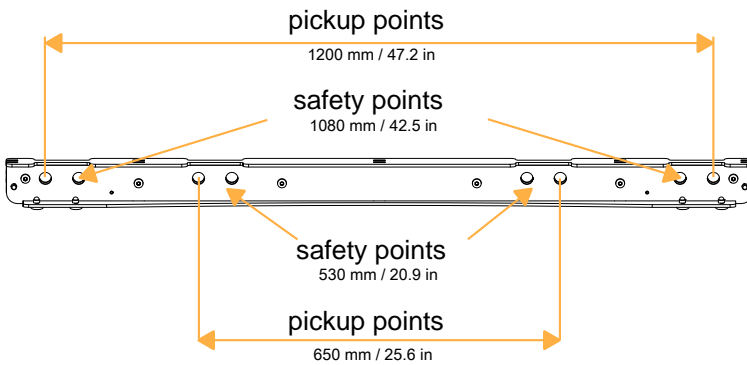


KS28-BUMP provides two sets of pickup points to choose from depending on the position of the lifting points. In addition, two sets of holes are available to implement a secondary safety.

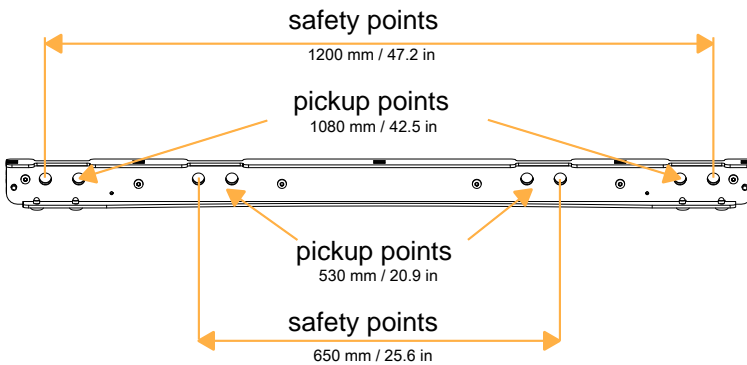


Always use the holes next to the pickup points to implement a safety.

#### Lifting with two motors (two chains)



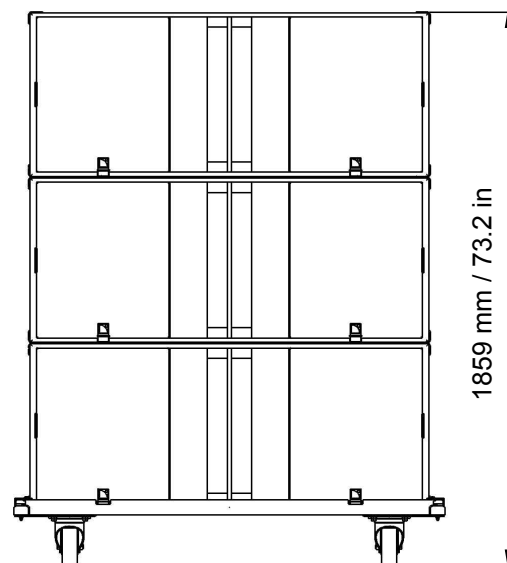
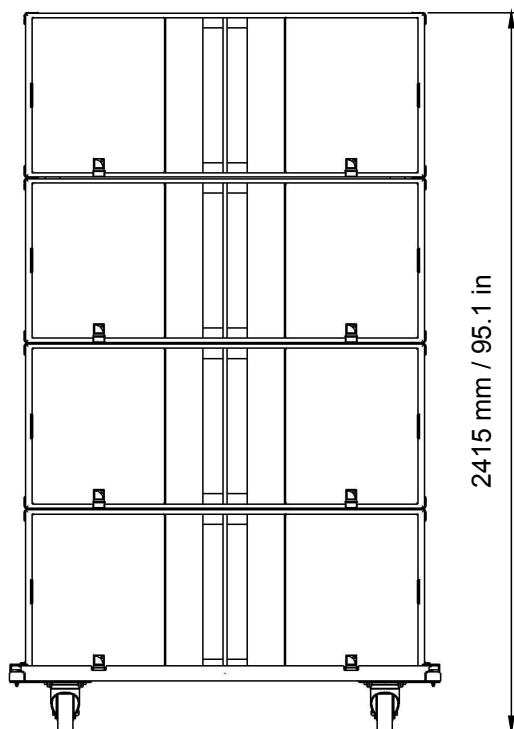
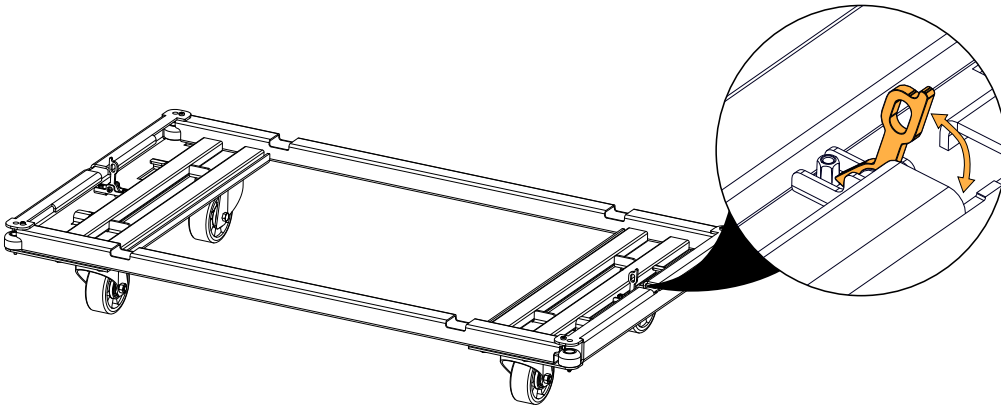
#### Lifting with one motor (one LA-SLING2T or an adapted bridle)



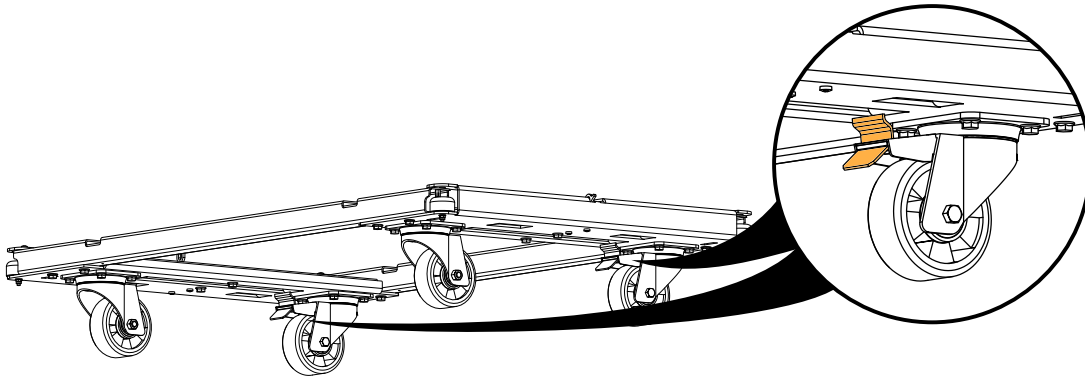
## Storage elements

### KS28-CHARIOT

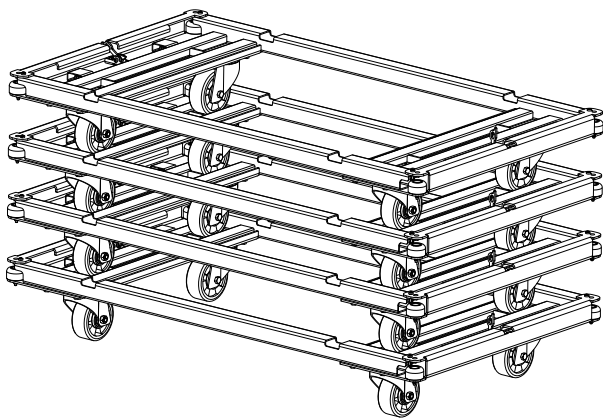
KS28-CHARIOT is designed to transport a stack of up to 4 KS28 and features two rigging arms to secure the lower KS28.



KS28-CHARIOT features two brakes for optimal stability.

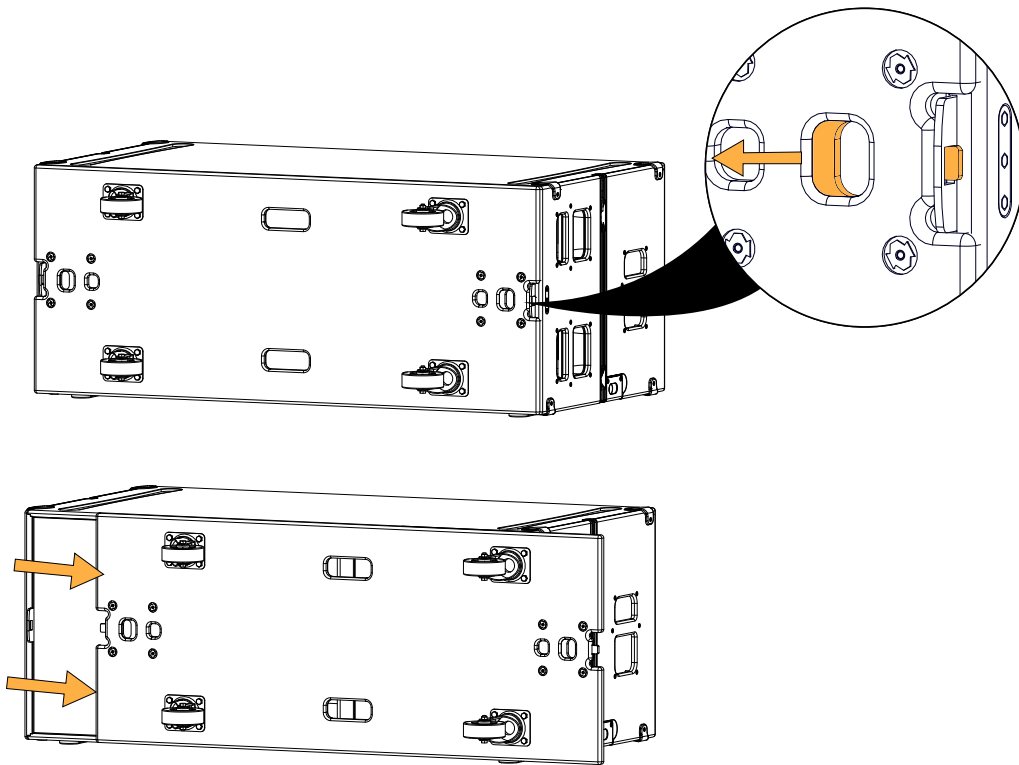


Multiple KS28-CHARIOT can be piled for easy storage.

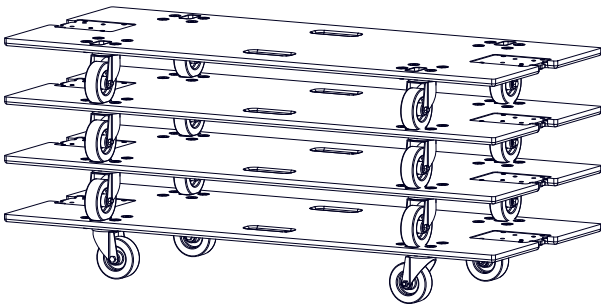


## KS28-PLA

KS28-PLA is a dolly board designed to be fitted to the front of a KS28 with two spring-loaded pins.

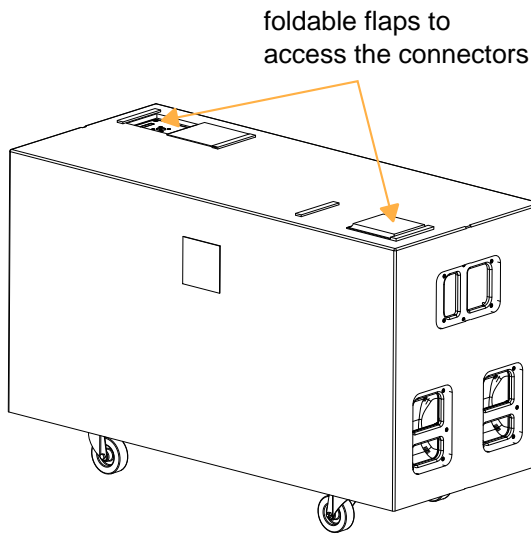


Multiple KS28-PLA can be piled for easy storage.



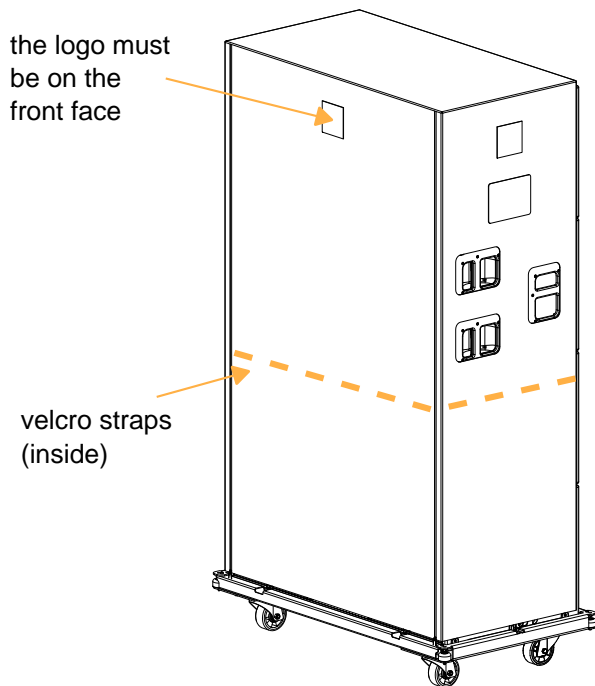
## KS28-COV and KS28-CHARIOTCOV

KS28-COV is an individual cover for KS28 on KS28-PLA.



KS28-CHARIOTCOV is a cover for a stack of three to four KS28 on KS28-CHARIOT.

To fit a stack of three KS28, KS28-CHARIOTCOV must be folded inwards and secured with the provided velcro straps.





# Rigging procedures

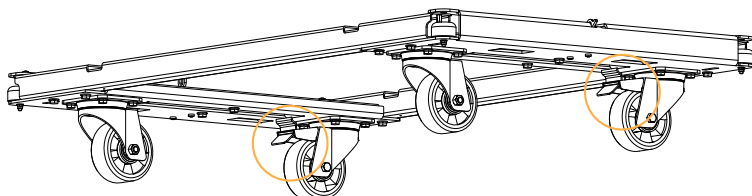
## Stacking KS28 vertically

type of deployment	stacked array
rigging accessories	KS28-PLA (optional)
	KS28-CHARIOT (optional)
min number of operators	2

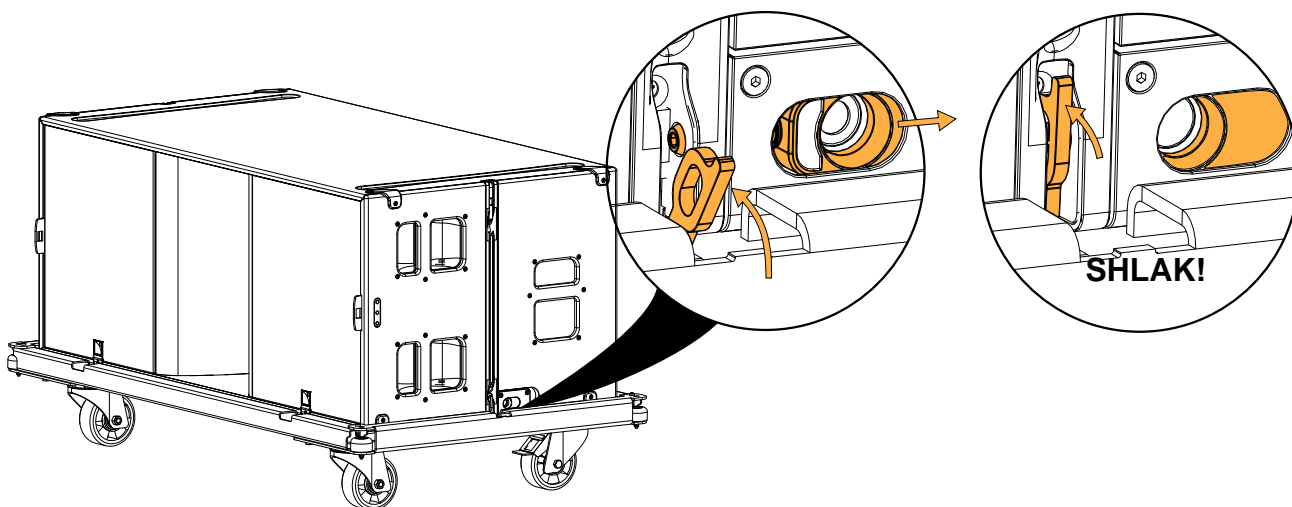
## Assembly

### Procedure

1. Engage both brakes on KS28-CHARIOT.

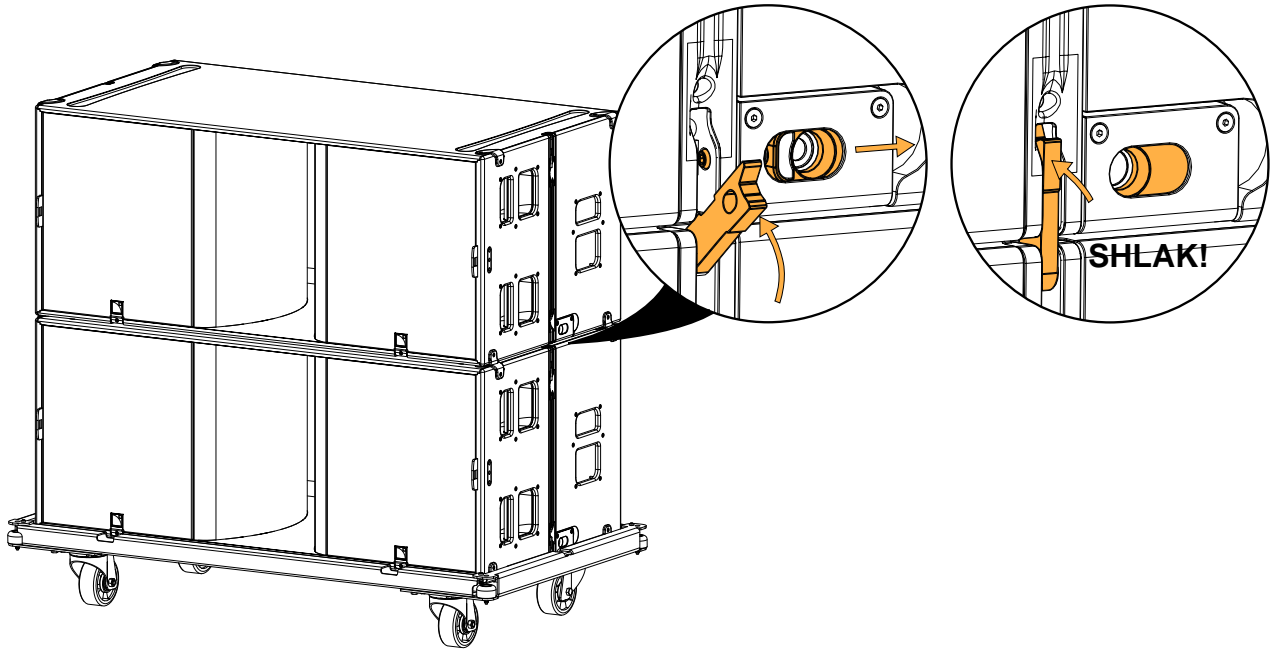


2. Place KS28 on KS28-CHARIOT and connect the two elements on both sides.



3. Place another KS28 on the assembly.  
Align the runners with the tracks.

4. Connect the two elements on both sides.

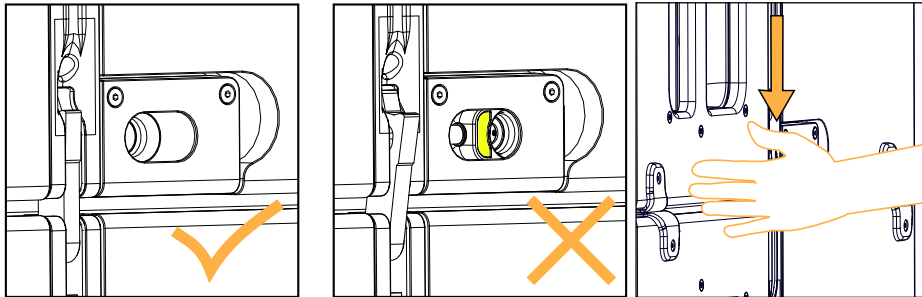


5. Repeat until the stack is complete.



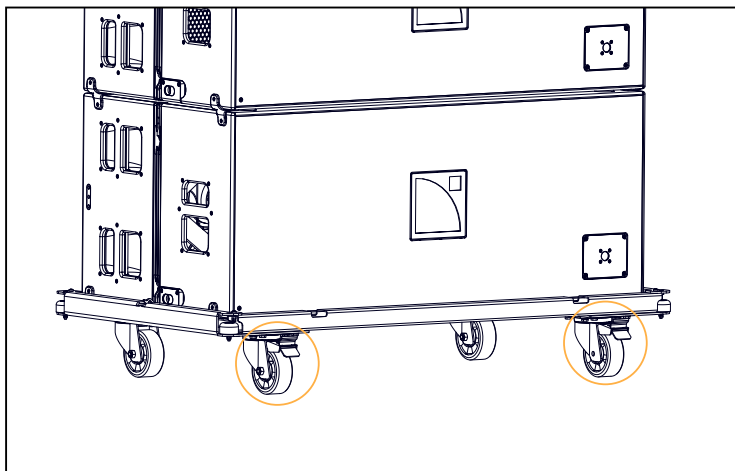
**Final check**

Visually check that no yellow labels are visible.  
Manually check that all linking points are secured.



6. Disengage the brakes and position the stack at its final position.

7. Block the stack using both brakes.



## Stacking KS28 upright

type of deployment	stacked array
rigging accessories	KS28-PLA (optional)
min number of operators	3

**! Secondary safety**  
Secure the assembly with a ratchet strap.

**! Risk of falling objects**  
Verify that no unattached items remain on the array.

## Assembly

### Procedure

1. Place one KS28 on its side.

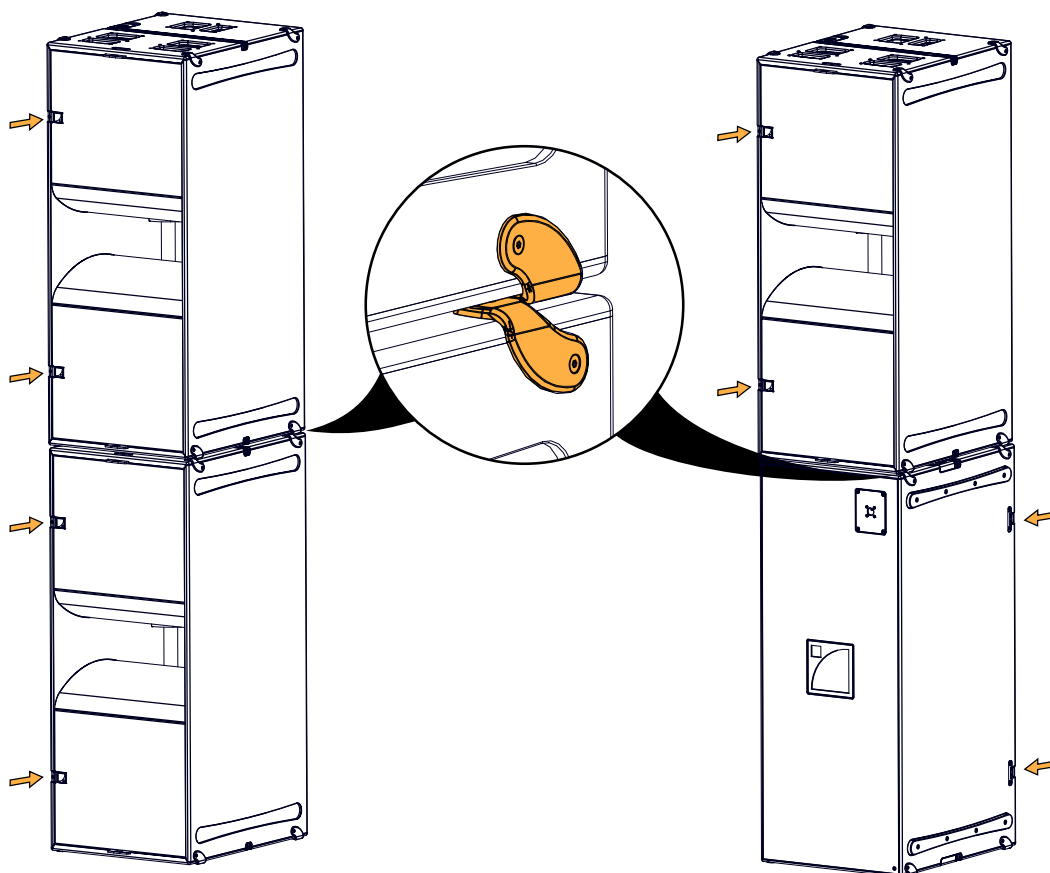


#### Enclosure position

In standard configuration, the logos on both enclosures must be on the same side.  
In cardioid configuration, the logos must be on opposite sides.

2. Place another KS28 on the first one.

Make sure the side runners fit together.



## Flying KS28

type of deployment	flown array
rigging accessories	KS28-BUMP
	LA-SLING2T (optional)
	KS28-CHARIOT (optional)
additional material	2 Ø19 mm shackles WLL 3.25 t
min number of operators	2



### Secondary safety on KS28-BUMP

Use the holes next to the pick-up points to implement a secondary safety. Refer to [KS28-BUMP](#) (p.12). Consider using LA-SLING2T.



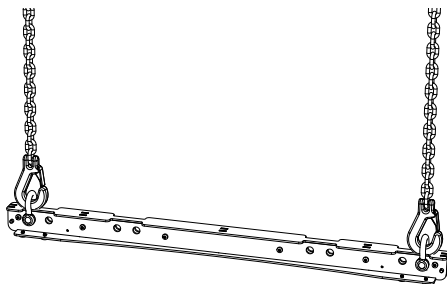
### Risk of falling objects

Verify that no unattached items remain on the array.

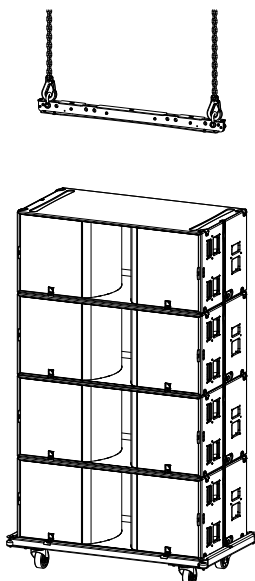
## Assembly

### Procedure

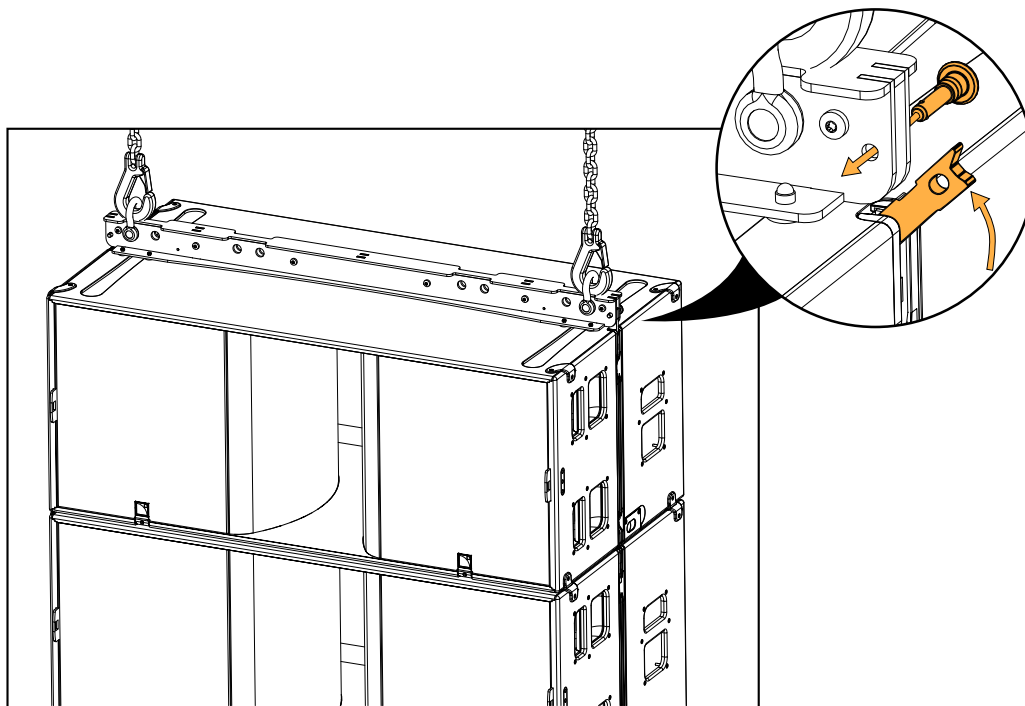
1. Secure two chains to the selected pick-up points on KS28-BUMP.



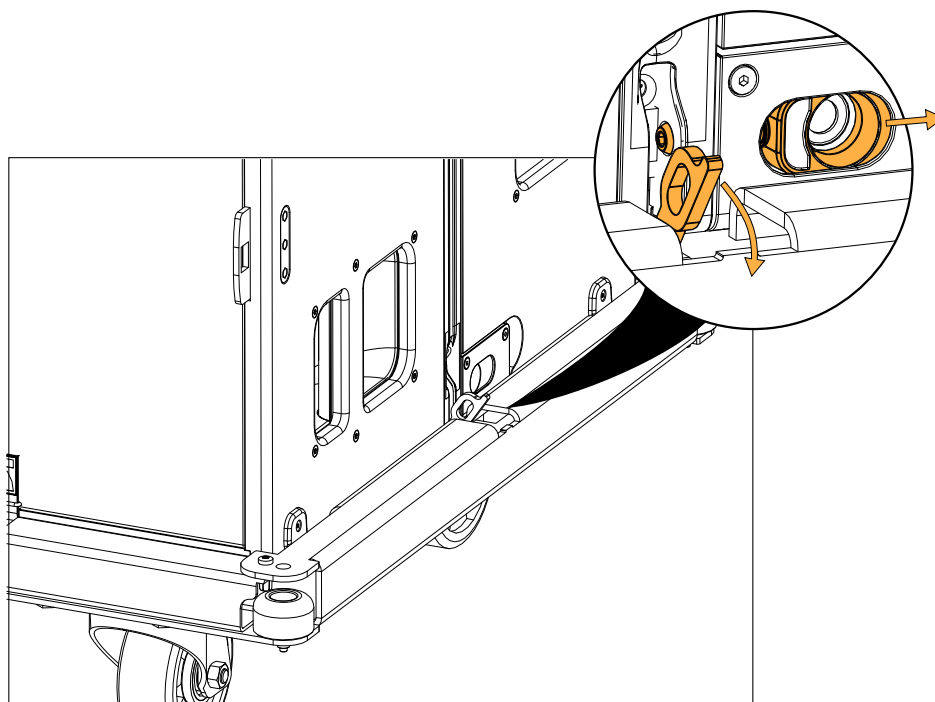
2. Lift the assembly.
3. Position a stack of KS28 under the pickup point.  
See [Stacking KS28 vertically](#) (p.17).



4. Lower the assembly and connect KS28-BUMP to the top enclosure on both sides.



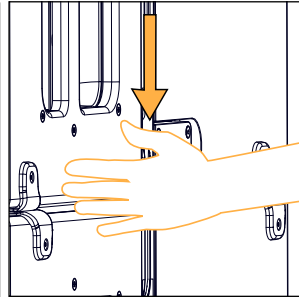
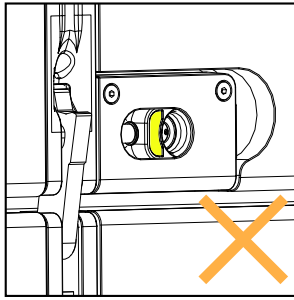
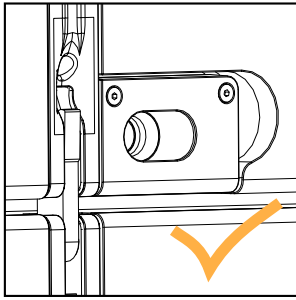
5. If KS28 is stacked on KS28-CHARIOT, remove the rigging arms from the chariot before lifting.





### Final check

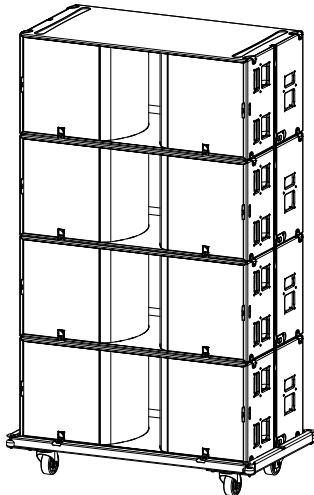
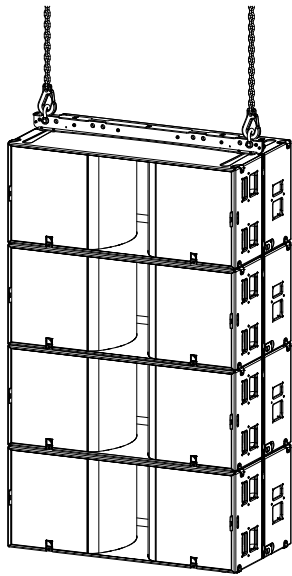
Visually check that no yellow labels are visible.  
Manually check that all linking points are secured.



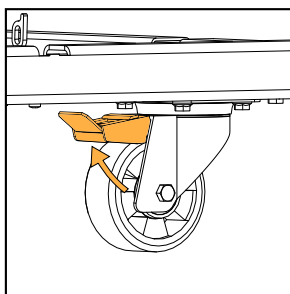
### Risk of collision

Do not stand close to the array when lifting the enclosures.

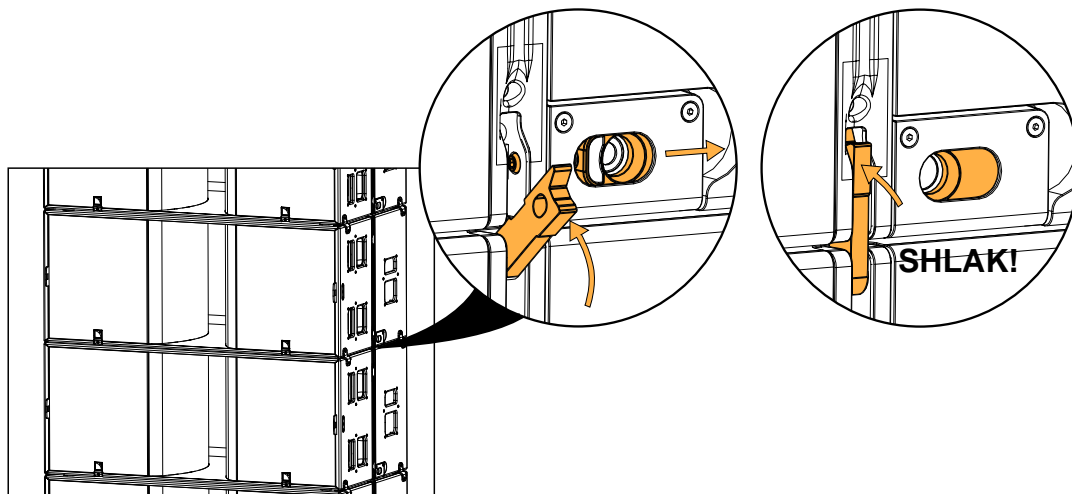
6. Lift the assembly and remove the chariot.
7. Position another KS28 or KS28 stack under the pickup point.



- ! If KS28 is stacked on KS28-CHARIOT, make sure the KS28-CHARIOT brakes are not engaged.



- 8. Lower the assembly on the stack and connect the stack to the assembly on both sides. Align the runners and the tracks.

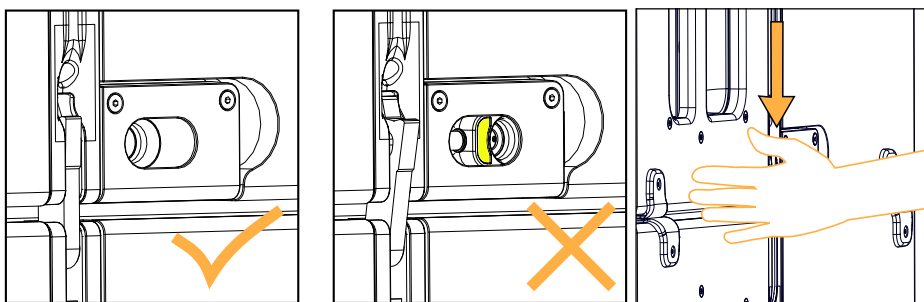


- 9. Repeat steps 5 (p.21) to 8 (p.23) until the array is complete.



**Final check**

Visually check that no yellow labels are visible.  
Manually check that all linking points are secured.



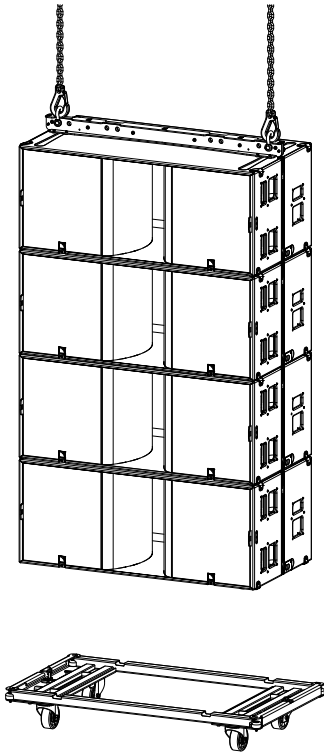
**Risk of collision**

Do not stand close to the array when lifting the enclosures.

- 10. Lift the array to its final position.

## Disassembly

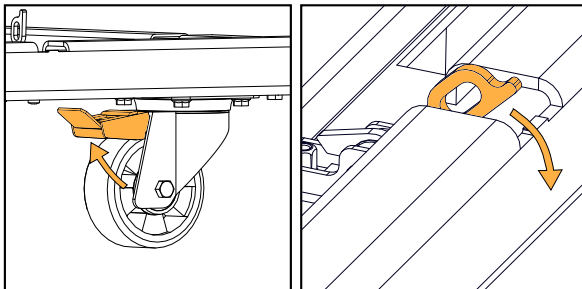
1. Position a KS28-CHARIOT under the array.



### Prepare KS28-CHARIOT

Make sure the KS28-CHARIOT brakes are not engaged.

Make sure the KS28-CHARIOT rigging arms are in the open position.

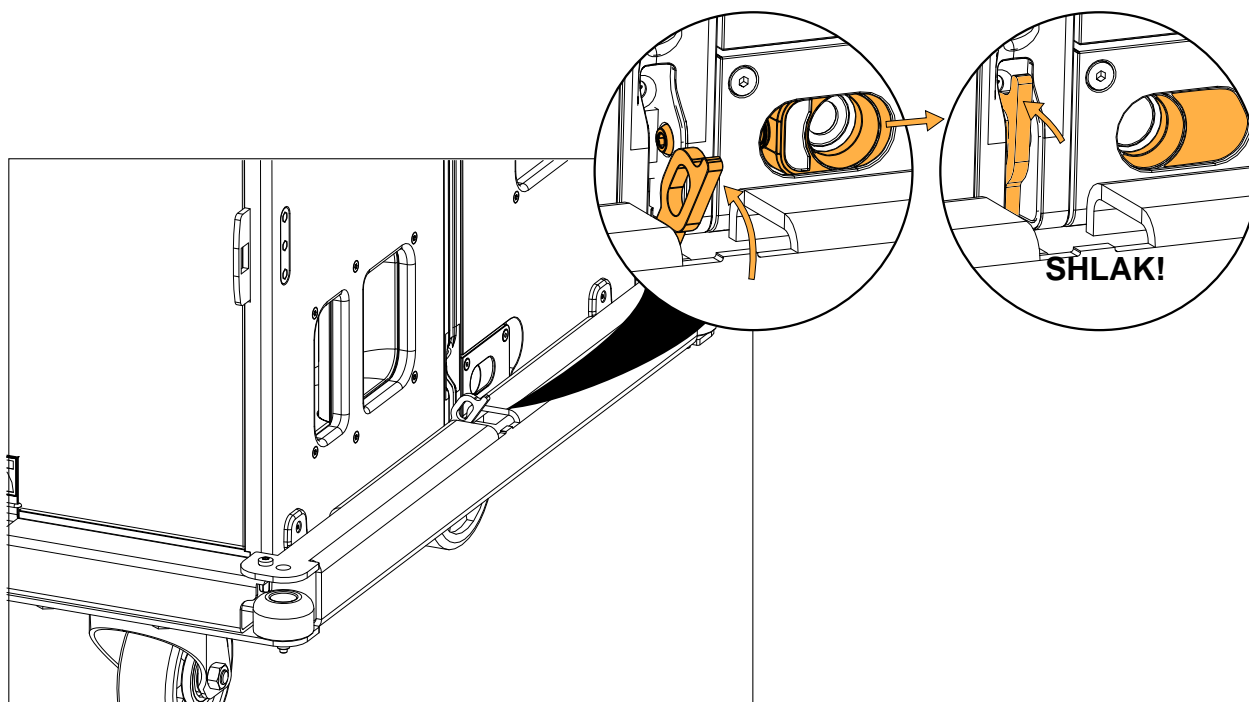


Proceed slowly when lowering the array.

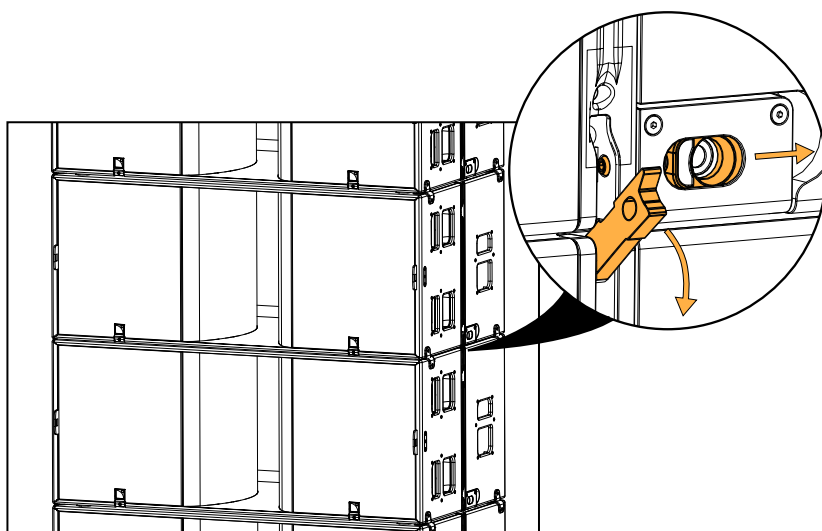
2. Lower the array until it rests on KS28-CHARIOT.



3. Secure the bottom enclosure to KS28-CHARIOT.



4. Disconnect a stack from the array on both sides.



Make sure both linking points are disconnected before lifting the array.

5. Lift the assembly and put the stack aside.  
6. Repeat the procedure.

# Specifications

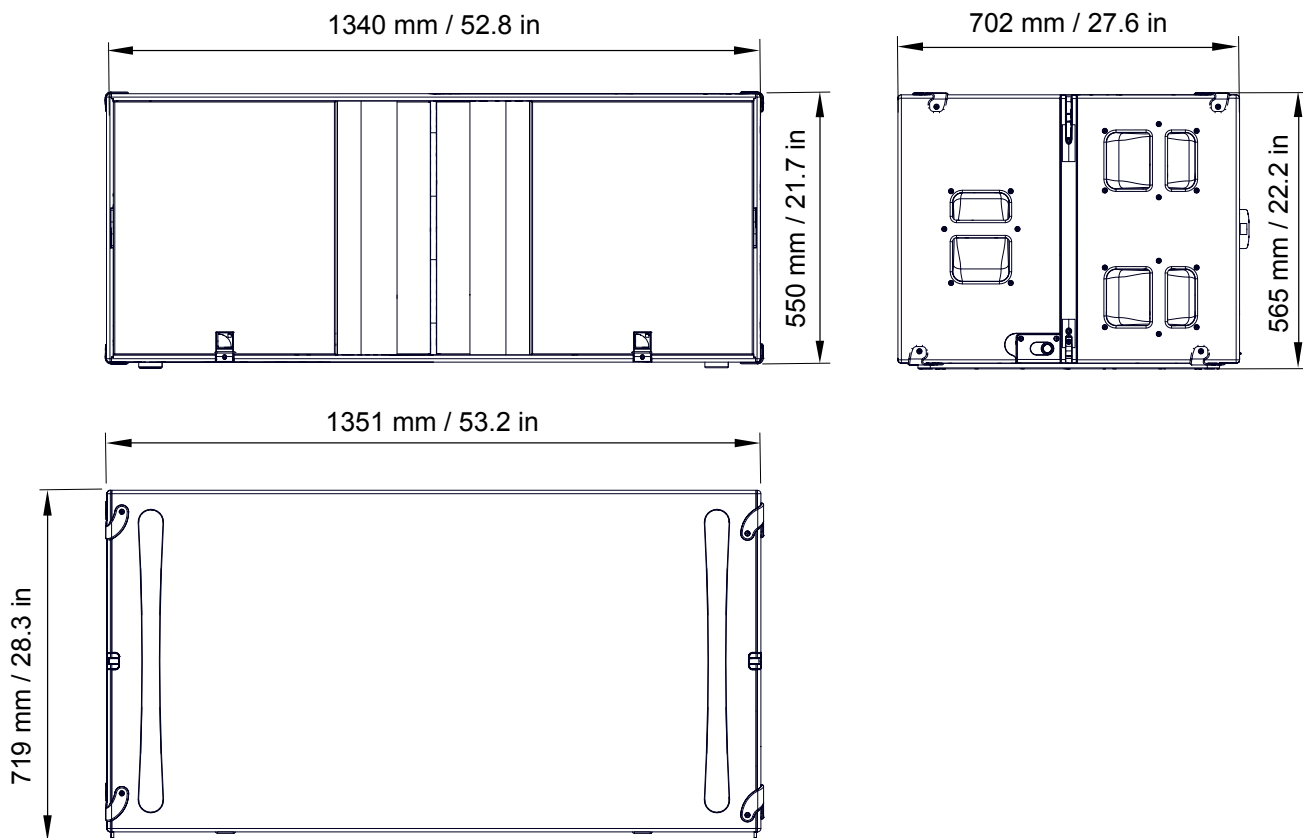
## KS28 specifications

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<b>Description</b>	flyable subwoofer 2 x 18", amplified by LA12X
<b>Low frequency limit (-10 dB)</b>	25 Hz ([KS28_100])
<b>Maximum SPL<sup>1</sup></b>	143 dB ([KS28_100])
<b>Directivity</b>	standard or cardioid
<b>Transducers</b>	2 x 18" neodymium, aluminium die cast basket
<b>Acoustical load</b>	bass-reflex, L-Vents
<b>Nominal impedance</b>	4 $\Omega$
<b>Connectors</b>	4-point speakON
<b>Rigging and handling</b>	flush-fitting 2-point rigging system 6 ergonomic handles 2 ground runners 8 side runners
<b>Weight (net)</b>	79 kg / 174 lb
<b>Cabinet</b>	first grade Baltic beech and birch plywood
<b>Front</b>	steel grill with anti-corrosion coating acoustically neutral 3D fabric
<b>Rigging components</b>	high grade steel
<b>Finish</b>	dark grey brown Pantone 426C

<sup>1</sup> Peak level at 1 m under half space conditions using pink noise with crest factor 4 (preset specified in brackets).

### KS28 dimensions

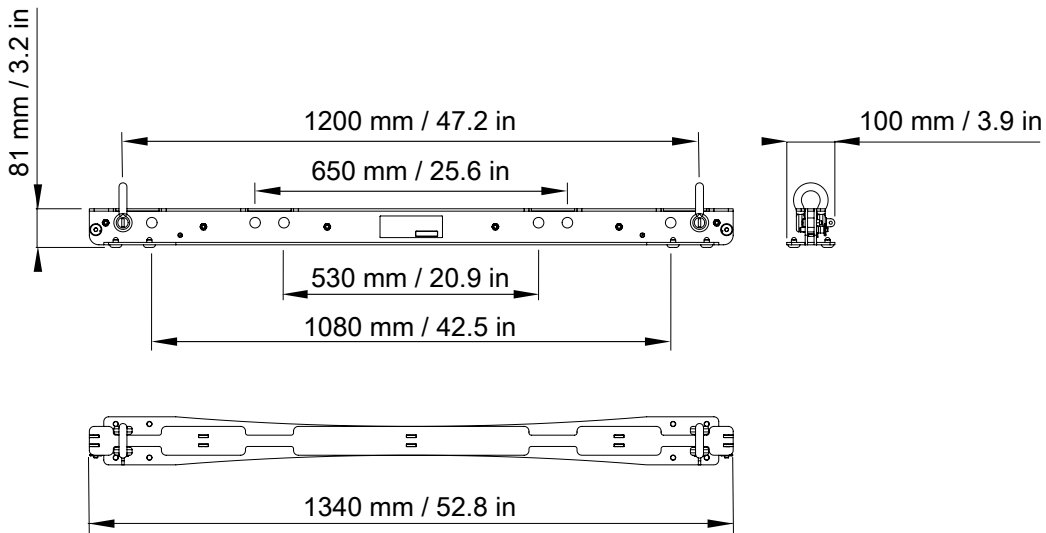


## KS28-BUMP specifications

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<b>Description</b>	lifting beam for flying up to 16 × KS28 2 × Ø19 mm shackles WLL 3.25 t
<b>Weight (net)</b>	15.5 kg / 34.2 lb
<b>Material</b>	high grade steel

## KS28-BUMP dimensions



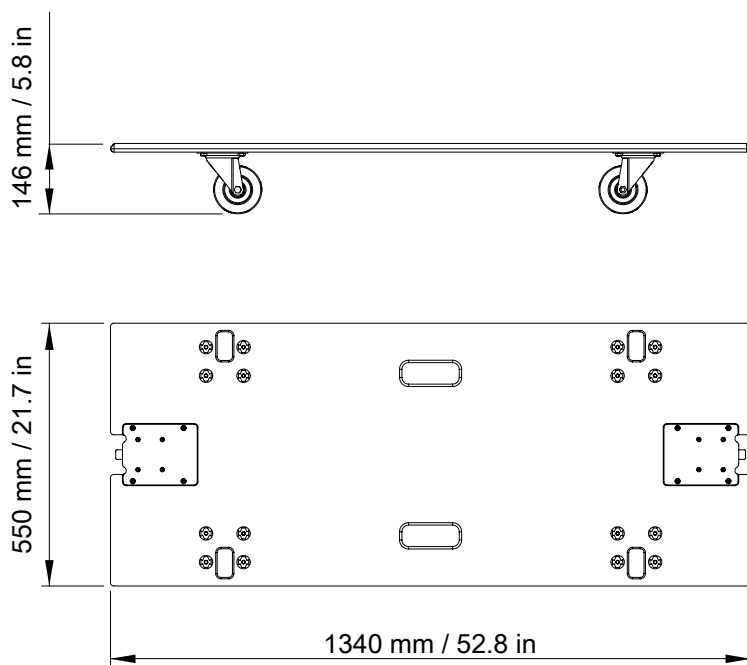
## KS28-PLA specifications

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**Description** removable front dolly on wheels for 1 × KS28

**Weight (net)** 14 kg / 30.8 lb

## KS28-PLA dimensions



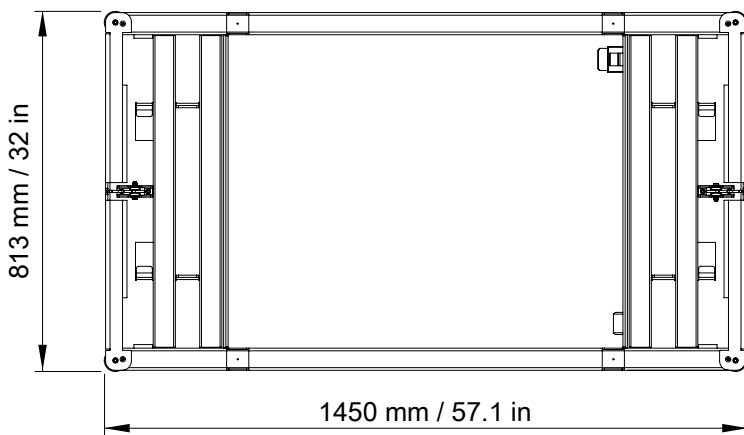
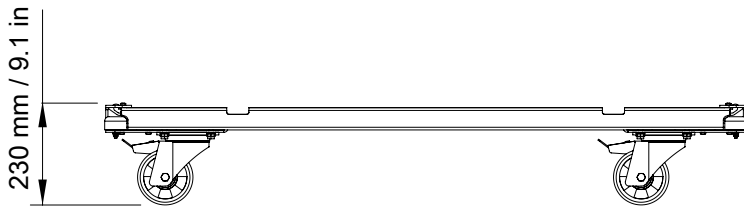
## KS28-CHARIOT specifications

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**Description**                   chariot for up to 4 × KS28

**Weight (net)**                   53.5 kg / 118 lb

## KS28-CHARIOT dimensions





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