

altix
Arbeiten in der Höhe

Forklift Truck Course R1



R1 Counterbalanced Forklift Truck Supplementary Module

The Most Popular Forklift R1 Counterbalanced Forklift



R1 Counterbalanced Forklift

How NOT to do it!!



R1 Supplementary Module

- **Versatility:**

The counterbalanced forklift can be used both **indoors and outdoors** and is suitable for many sectors (logistics, construction, manufacturing).

- **Ease of use:**

Thanks to its design (load at the front, counterweight at the rear), **no additional support mechanism** is required → easy to operate.

- **High load capacity:**

Ideal for **heavy loads** and pallets, particularly in warehouse operations.

- **Versatility in use:**

Can **be driven right up to shelves or lorries**, as there are no support legs in the way.

- **Sturdy & reliable:**

Tried-and-tested technology → **durable and low-maintenance**.

- **Good availability:**

Widely used in Switzerland → **spare parts, service and training** readily available.



Models



Counterbalanced forklift trucks

- Cantilever
- Suitable for use on uneven floors
- Electric for indoor use
- Internal combustion for outdoor use
- 3 or 4 wheels
- Lifting height up to approx. 6m



Heavy-duty forklift

- Extended rear / counterweight



Models



1
tonne



100 tonnes



Operating ranges



Models

Video: Ride-on forklift



How much does a forklift cost?



50,000 – 75,000 CHF



40,000 – 60,000 CHF



Be aware of the costs

- Forklift costs range from 20,000 to 1,000,000.
- Battery costs: 2-20,000
- Cost of cargo (value of pallet: CHF 15,000-200,000)
- Who is liable if the forklift driver hits a pedestrian? The employer
- What about cases of negligence? Is the driver personally liable?



Learning objectives

- **1. Identify components and functions**

Using a real or a model counterbalanced forklift truck, participants can name the main components (e.g. lift mast, counterweight, chassis, load fork) and explain their basic functions, with at least 80 per cent of their answers being correct.

- **2. Explain stability**

Participants can use a sketch of the stability triangle to explain the difference in stability between a car and a counterbalanced forklift, as well as the change in the Center of gravity when the forklift is loaded and unloaded, without making any technical errors.

- **3. Assess factors affecting stability**

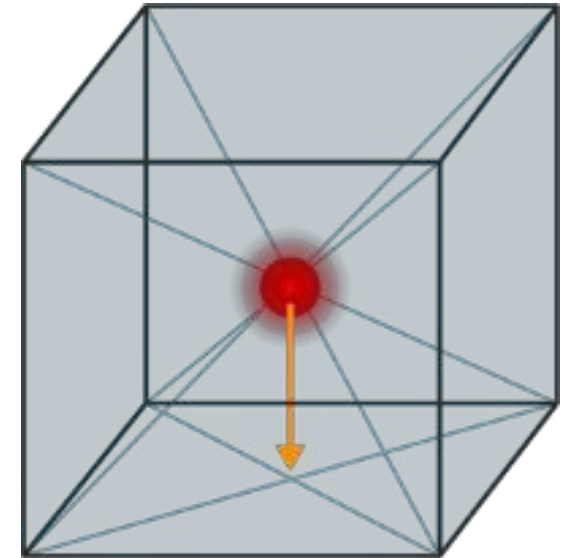
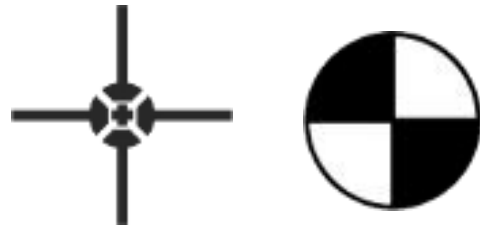
Participants can describe the effects of inclination, ground conditions and dynamic forces on stability in specified driving situations (e.g. cornering, gradients, uneven ground) and name at least three appropriate measures to prevent the Risk of tipping.



Center of gravity

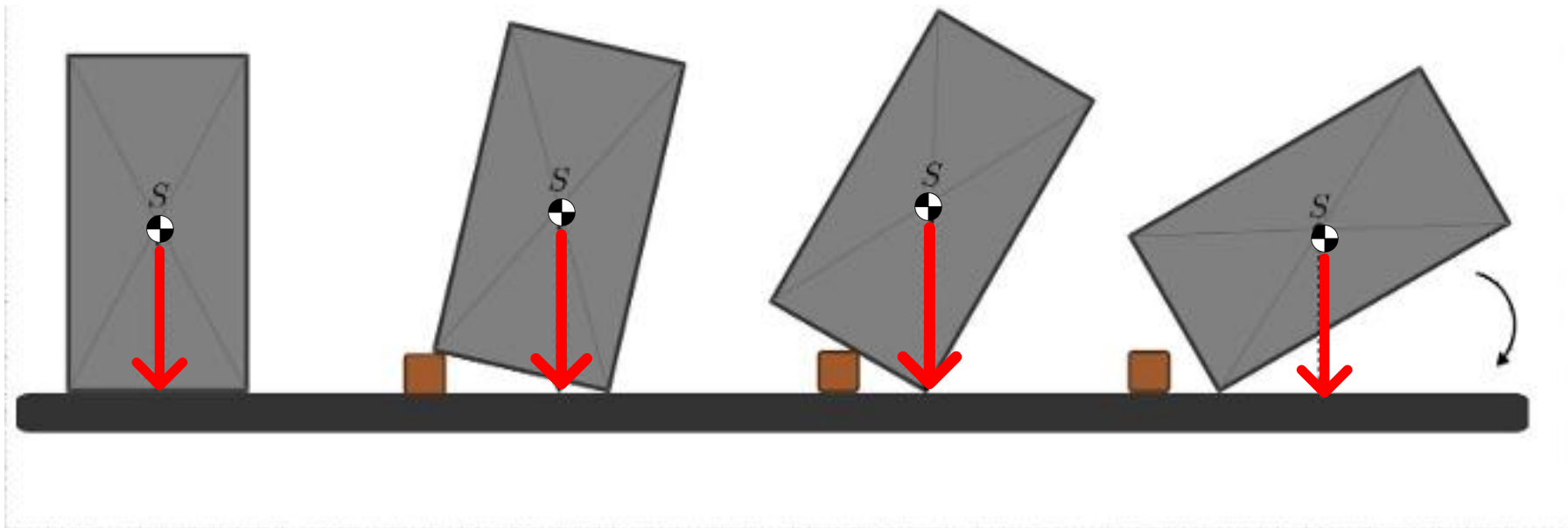
- Centre of mass
- The total mass of a body is concentrated at

- Center of gravity symbols



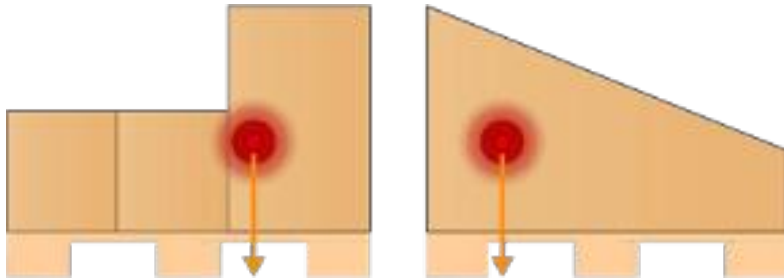
The stability of objects

- The lower the Center of gravity, the more stable the object
- The body tips over as soon as the Center of gravity lies outside the **line of gravity (base of support)**.

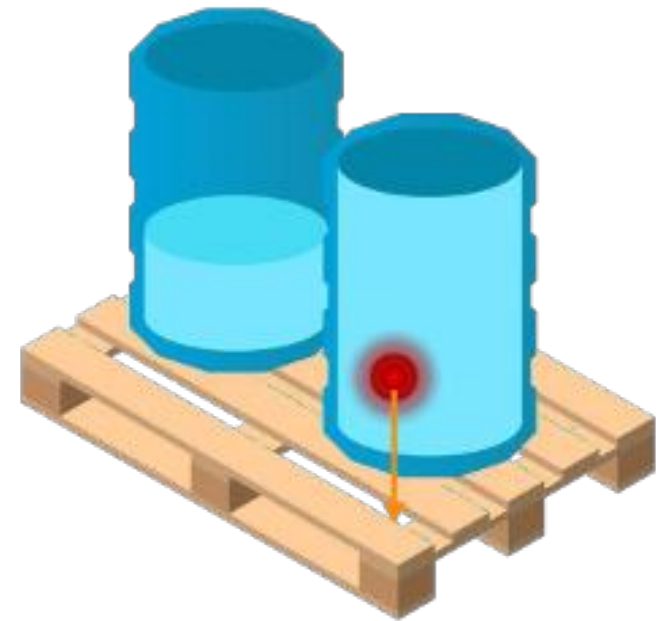


Center of gravity of bodies

The Center of gravity shifts towards the heavier parts of the load



Center of gravity towards the full end of the barrel



Center of gravity of

bodies
What's wrong? What could be improved?

Center of gravity as close as possible to the fork back



Center of gravity of bodies

The shifting center of gravity

- Shift in the Center of gravity caused by transport movement
- Liquids

Measures:

- Accelerate and brake carefully
- Drive with foresight



The Stability of Solids

- Sports cars have a fairly low Center of gravity
- The **lower** the Center of gravity, the sportier and more dynamic the **handling**
- Even at high speeds, the vehicle cannot tip over



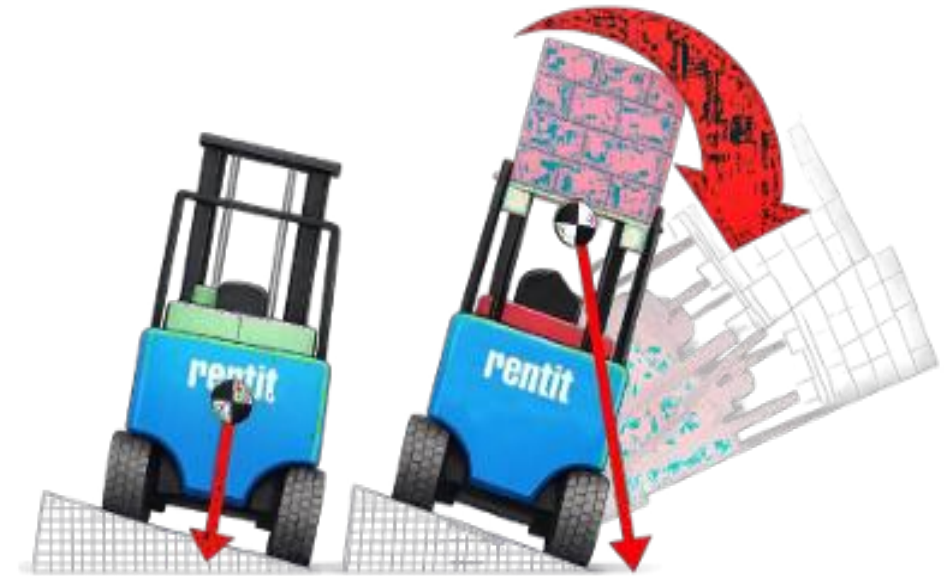
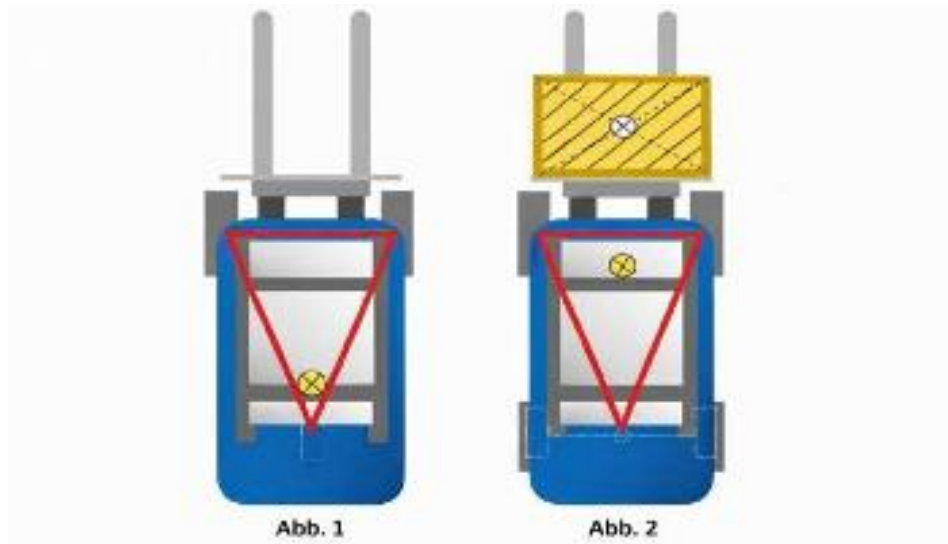
The Stability of Solids

- Industrial trucks are not sports cars
- Due to their design, their **Center of gravity** is **relatively high**

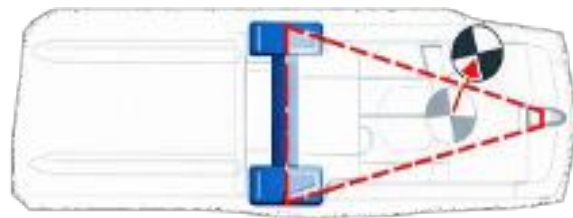


Stability

- Most counterbalanced forklift trucks have three contact points.
- If the Center of gravity lies outside the contact patch, the vehicle will tip over.
- **A car has 4 contact points**



Stability



Arbeitssicherheit

Falls Ihr Stapler umstürzen sollte, sind Sie im Innern und angeschnallt auf dem Fahrersitz am sichersten!



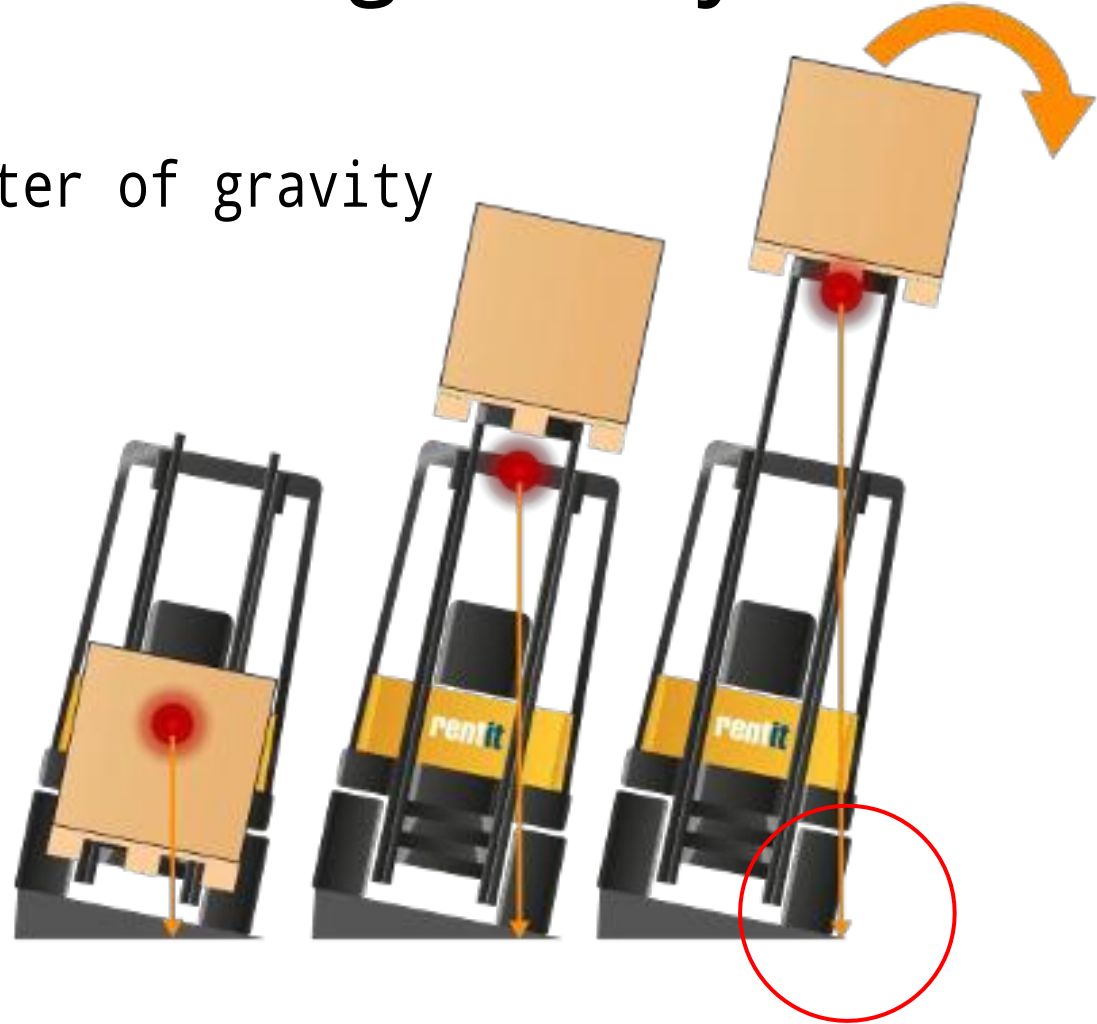
Tipping resistance of industrial trucks

- The stability of the industrial truck must comply with specified standards
- Tested on tilt platforms
- **Do not perform any driving manoeuvres for**
Life-threatening



Shift in the Center of gravity

- Lifting loads shifts the Center of gravity
- Stability decreases
- Risk of tipping:
- Wind, lateral forces, uneven ground, gradients



Centrifugal force

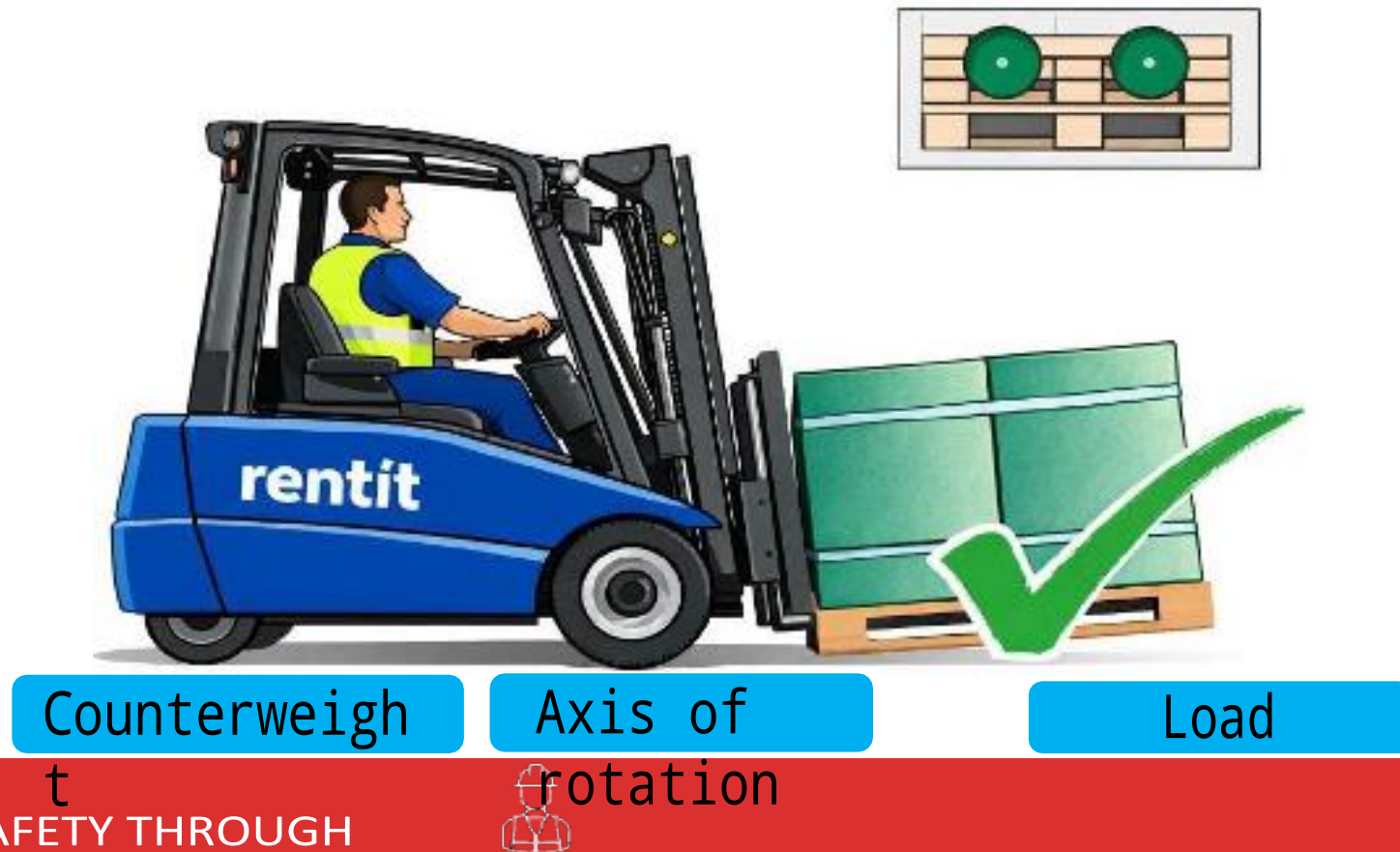
KAPITEL 1: Der Unfall



Structure and operation

What happens if the load is heavier than the counterweight?

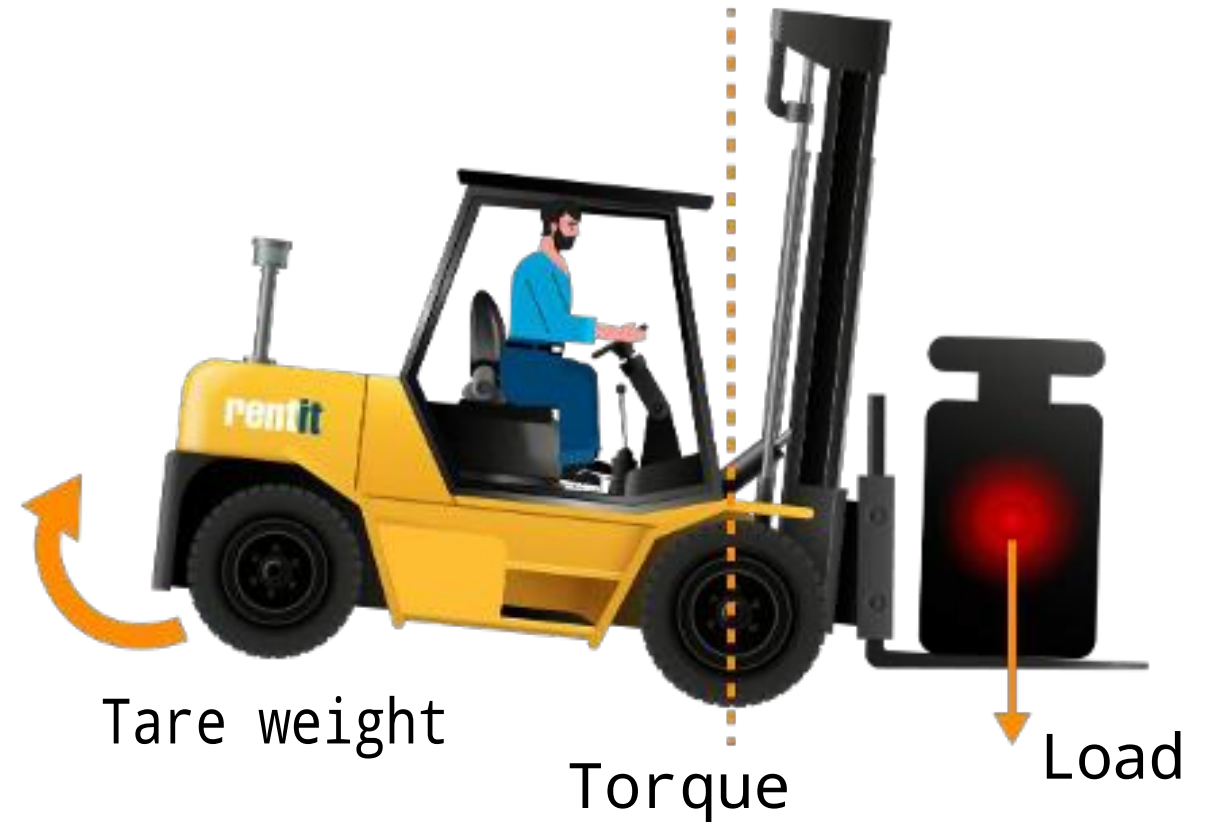
The forklift tips forwards!



Law of leverage

When is the forklift overloaded?

When the load on the forklift is heavier than the forklift's own weight.



Law of leverage

When is the forklift truck also overloaded?

Centre of gravity too far

The permitted lift height
as per the load capacity
chart has been exceeded

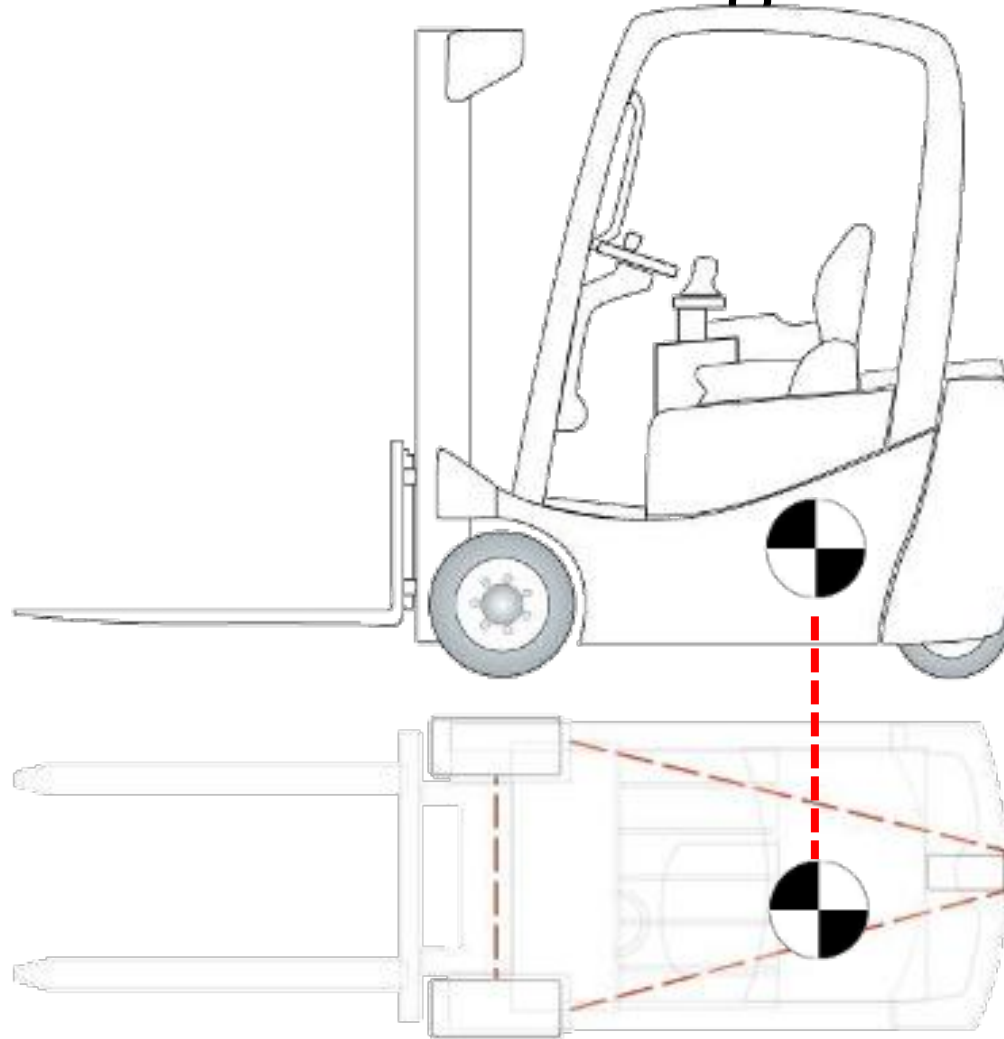


Lifts in progress

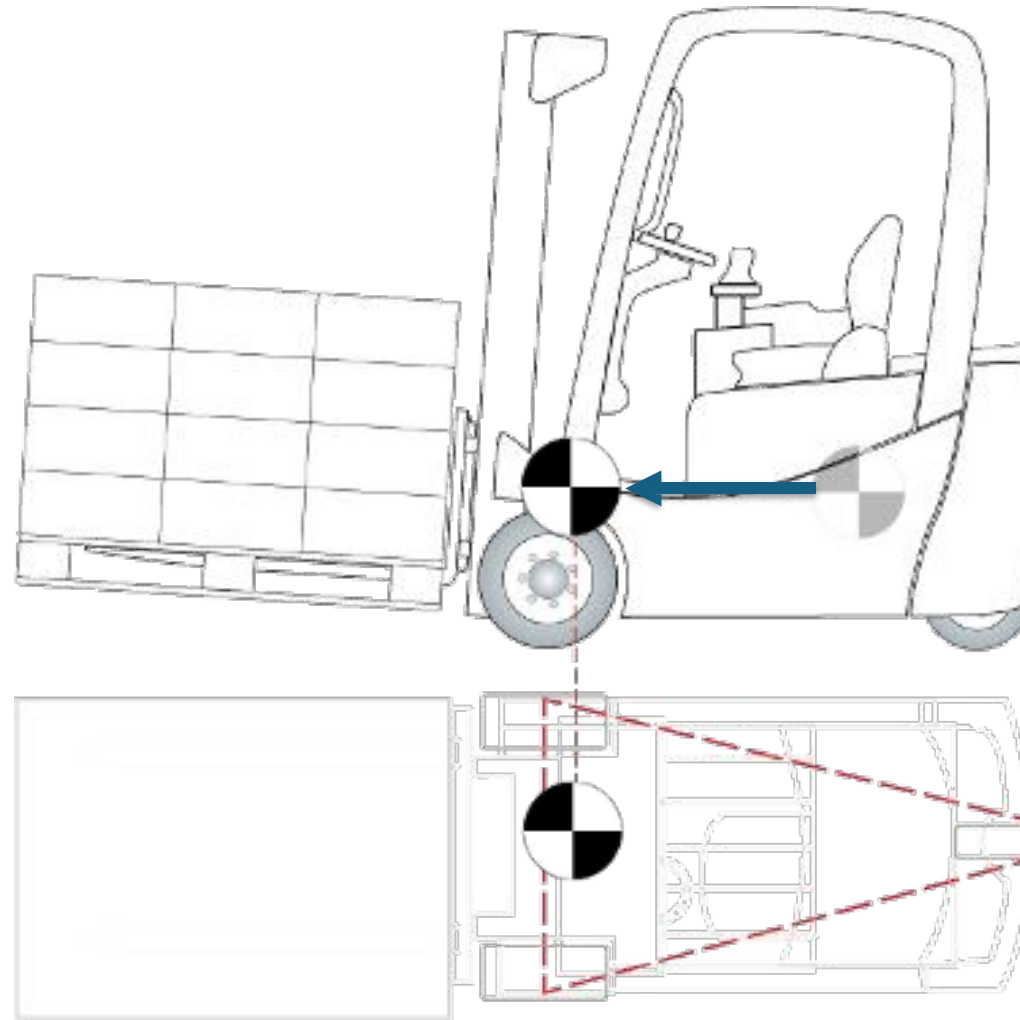
- Braking whilst lifting loads is **dangerous**
- Due to free-acting forces and a long mast a torque is generated, causing the vehicle **to tip** forward



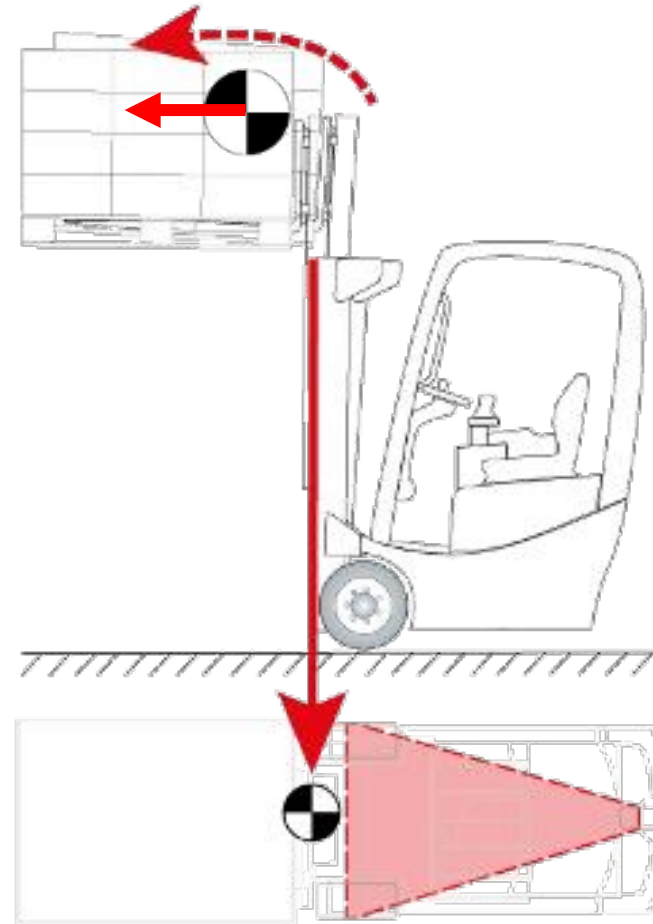
How does the Center of gravity behave?



How does the Center of gravity behave?



How does the Center of gravity behave?



Worksheet: Forklift Parts

Please complete the worksheet.



Forklift truck structure

1. Chassis
2. Counterweight
3. Operator's canopy
4. Tyres
5. Mast / Lift chain /
Lift cylinder
6. Fork carriage & loading forks
7. Load protection grille
8. Tilt cylinder



Tyre types

3 types of tyres

Solid rubber / Foam-filled

- + Puncture-proof
- + Higher load capacity
- + Low maintenance
- + Higher load capacity
- Expensive to replace / Ride comfort

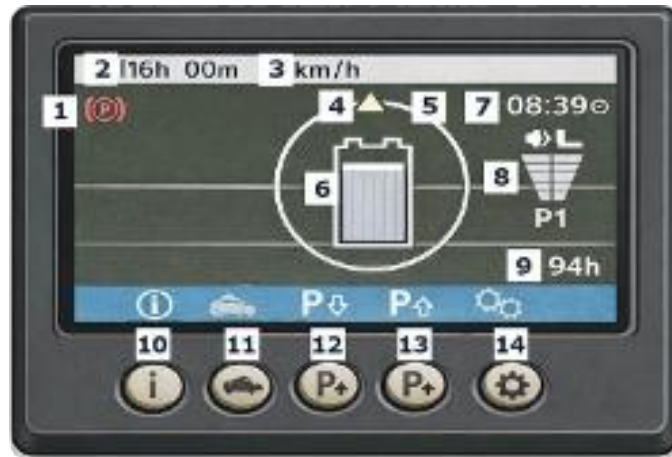


Pneumatic tyres

- + on uneven ground
- + Good suspension
- Prone to punctures
- Load capacity



Controls



1. Note: Parking brake engaged
2. Remaining range indicator
3. Travel speed
4. Drive wheel direction
5. Direction of travel
6. Battery charge level
7. Time display
8. Lifting speed
9. Operating hours display
10. Information button / Power off button
11. Button to reduce travel speed
12. Operating programme down
13. Operating programme up
14. Settings



Safety devices

Please stay in the vehicle!



Safety devices

Fasten your seatbelt



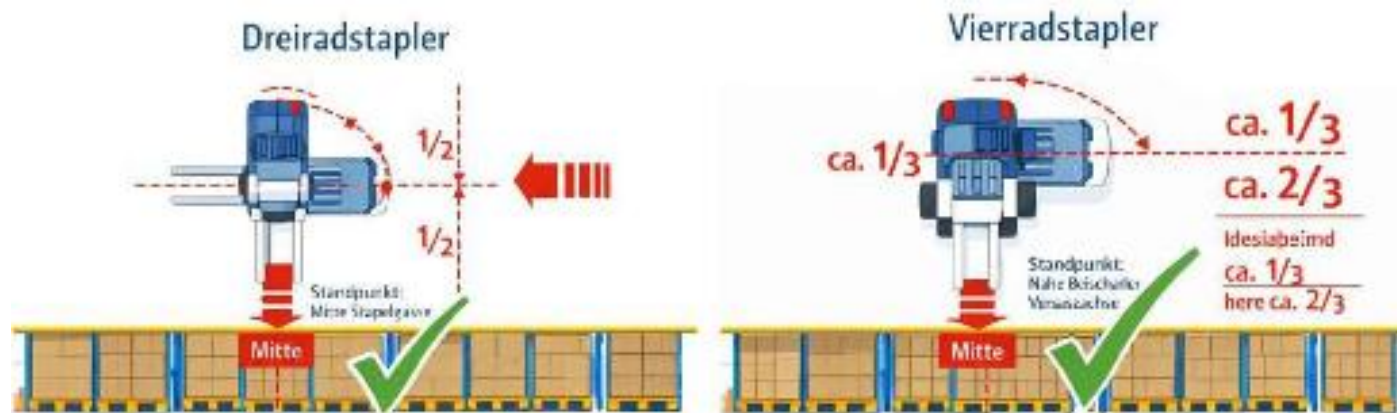
Safety device (Bluespot)



Working width

What is the working aisle width?

The aisle width refers to the clear space required for a forklift truck to operate safely between racks or stacks. The AST (technical aisle width) specified by the manufacturer describes the minimum technical aisle width under optimal conditions.



Working width

Is the AST the same for loading bays?

The width of a loading bay must be at least 10% greater than the technical aisle width (AST). If this additional width is not available, the bay must not be accessed by industrial trucks. The increased width improves driving stability and reduces the risk of falls.



Working width



Attachments (Legislation)



When changing attachments on counterbalanced forklift trucks, the provisions of the Accident Insurance Act (UVG), the Ordinance on Accident Prevention (VUV) and the Machinery Ordinance (MaschV) apply. In addition, the manufacturer's specifications and the SUVA guidelines must be strictly observed. **After attaching an attachment, the load capacity, stability and driver training must be checked and adjusted.**



Attachments

Which ones do you know? Fork

For picking up and transporting pallets and general cargo. They are available in various lengths and load-bearing capacities.



Attachments

Side shifters

Enables the load to be moved sideways without manoeuvring.
Increases precision and efficiency when stacking.



Attachments

Fork positioner

Allows the fork spacing to be adjusted hydraulically. Ideal for loads of varying widths.



Attachments



Fork positioner with side shift

Combines the fork positioner and side shift. Saves time and increases operational flexibility.

Application: For efficient working in confined warehouse areas.



Attachments

Drum clamp

For the safe handling of drums without pallets. Suitable for upright or horizontal drums.

Application: In chemical, beverage and industrial facilities.



Attachments

Push forks

Enable pallets to be pushed forwards and backwards without having to drive forward. The load remains on the forks throughout.

Application: For loading and unloading pallets onto and from deep-reach racking or side-loading and unloading of lorries



Attachments

Carpet spindle

For transporting rolled-up carpets or similar goods. The load is impaled onto the mandrel.

Application: In carpet warehouses or in exhibition stand construction



Attachments

Crane arm

Enables crane operations using a forklift truck. The load capacity is significantly reduced. **Application:** For occasional lifting work without a separate crane.



Attachments

Snow plough

For clearing snow from roads and operational areas. Fitted to the front of the forklift truck and can be fixed or adjustable.

Application: For winter maintenance on company premises, access roads and car parks.



Attachment

Bucket for rubble

For collecting and transporting loose materials such as sand, gravel, soil or granules. Replaces a loading shovel for light handling work.

Application: In maintenance depots, on building sites or in recycling plants.



Attachments

Container side spreader

Hydraulic attachment for moving containers or large-volume bins sideways without having to reposition the forklift. The load is lifted and moved sideways in a controlled manner.

Application: For the precise positioning of containers onto **lorries**, railway wagons or storage areas.



Learning objective assessment

1. Identifying components and functions

Using a real or a model counterbalanced forklift truck, participants can name the main components (e.g. lift mast, counterweight, chassis, load fork) and explain their basic functions, with at least 80 per cent of their answers being correct.

2. Explain stability

Participants can use a sketch of the stability triangle to explain the difference in stability between a car and a counterbalanced forklift, as well as the change in the Center of gravity when the forklift is loaded and unloaded, without making any technical errors.

3. Assess factors affecting stability

Participants can describe the effects of inclination, ground conditions and dynamic forces on stability in specified driving situations (e.g. cornering, gradients, uneven ground) and name at least three correct measures to prevent the Risk of tipping.



Learning objectives: Use of GG forklift trucks

- **1. Applying load capacity and centre of gravity**

Participants can **correctly determine and apply** the permissible load capacity and the centre of gravity **using a load capacity chart and specific load details**, completing **at least 80 per cent of the tasks correctly**.

- **2. Assess and apply safe driving practices**

Participants can explain and put into practice safe driving techniques in specified driving situations (empty run, loaded run, uphill/downhill), without errors or with a maximum of one non-safety-critical error.

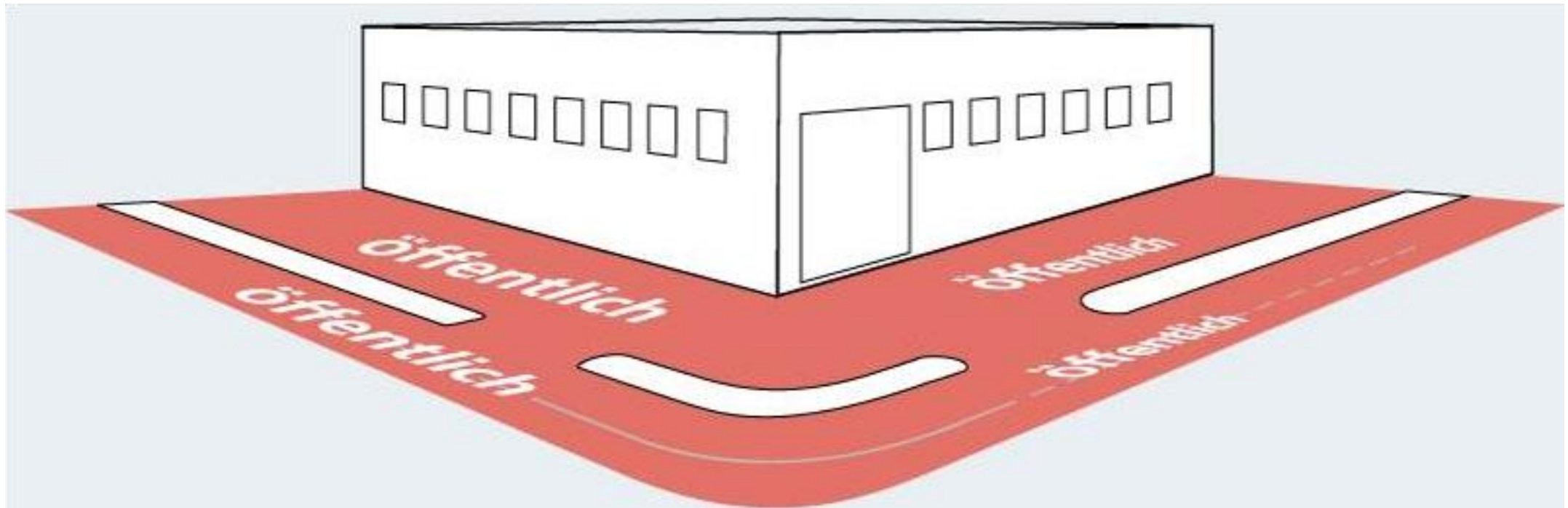
- **3. Checking operational readiness and safety**

Before starting work, participants can carry out a visual and functional inspection **using a checklist**, **identify any faults and respond to them correctly**, **comprehensively and in accordance with best practice**.

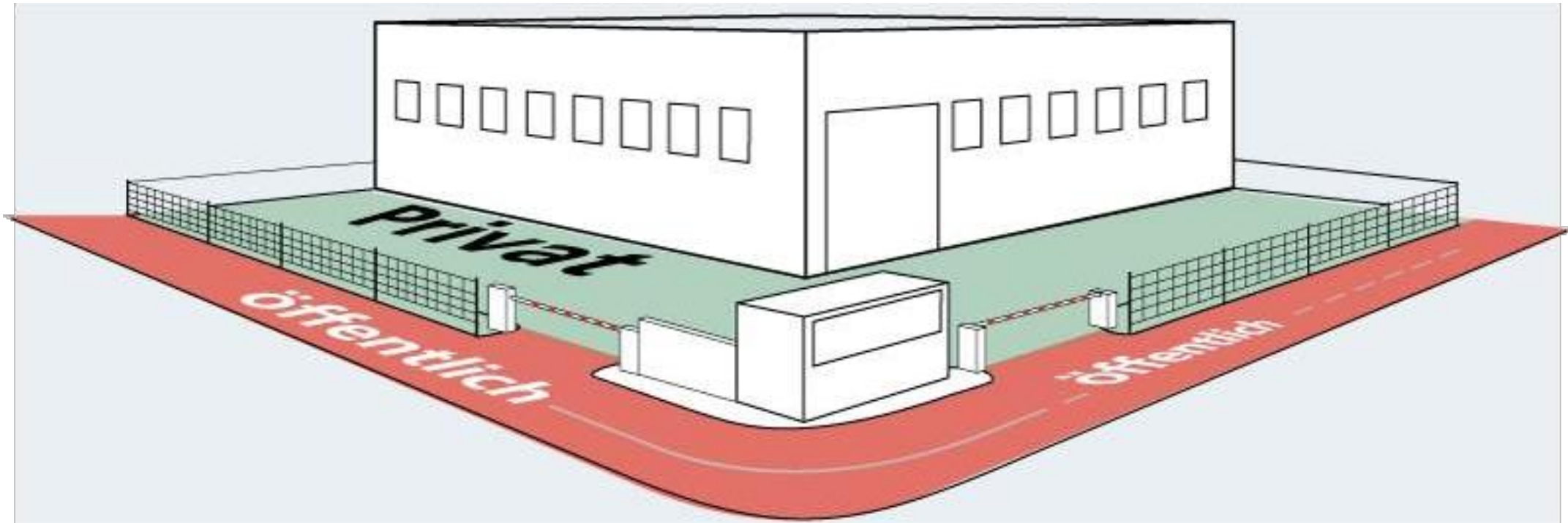


Public and Private Roads

Public?



Public and Private Roads



Load capacity charts

Why is it important to understand and apply load capacity charts correctly?



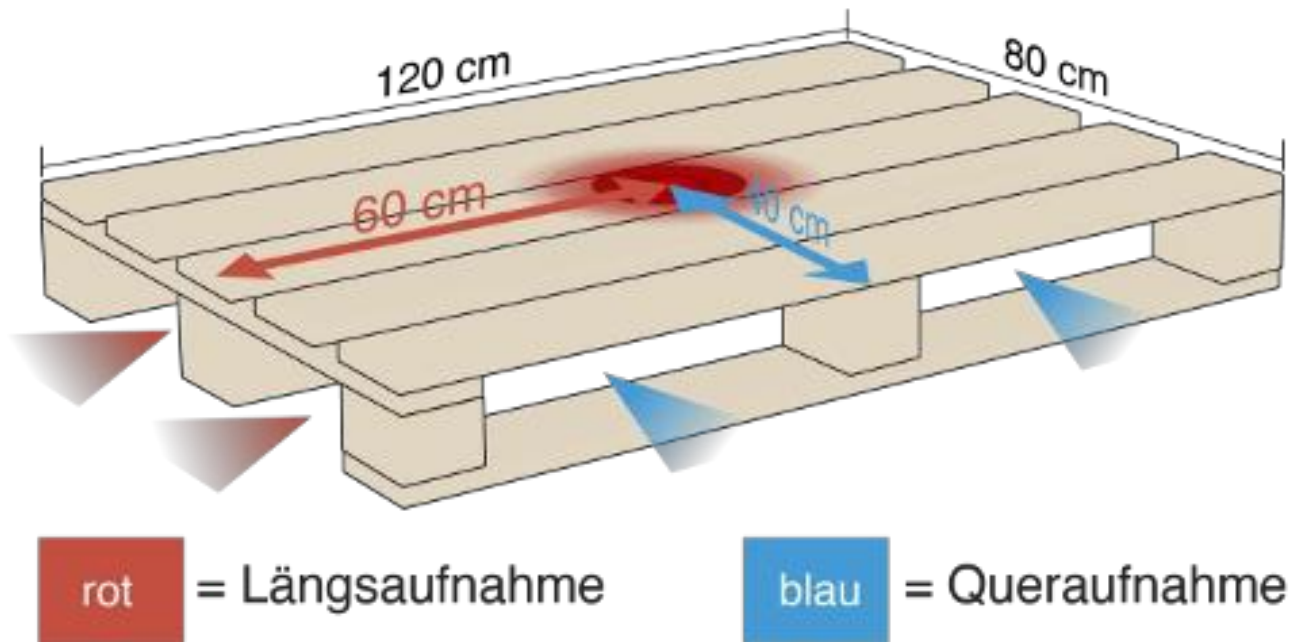
Load capacity

charte

Grafische Darstellung	Abkürzung	Bedeutung
	Q	Maximal zulässige Last (Angabe in Kilogramm oder Tonnen)
	C/D	Abstand vom Gabelrücken bis zum Schwerpunkt der Last (Lastschwerpunkt Abstand) in cm oder mm Je nach Hersteller mit Buchstaben C oder D gekennzeichnet
 max.	H	Hubhöhe (in m, cm oder mm) (Bezeichnung auch H)



Distance from the centre of gravity



Calculation of the distance from the load's centre of gravity

Euro pallet, Type 1, 80 x 120 cm, loaded crosswise

Special pallet, 100 x 100 cm (lengthways and crossways)

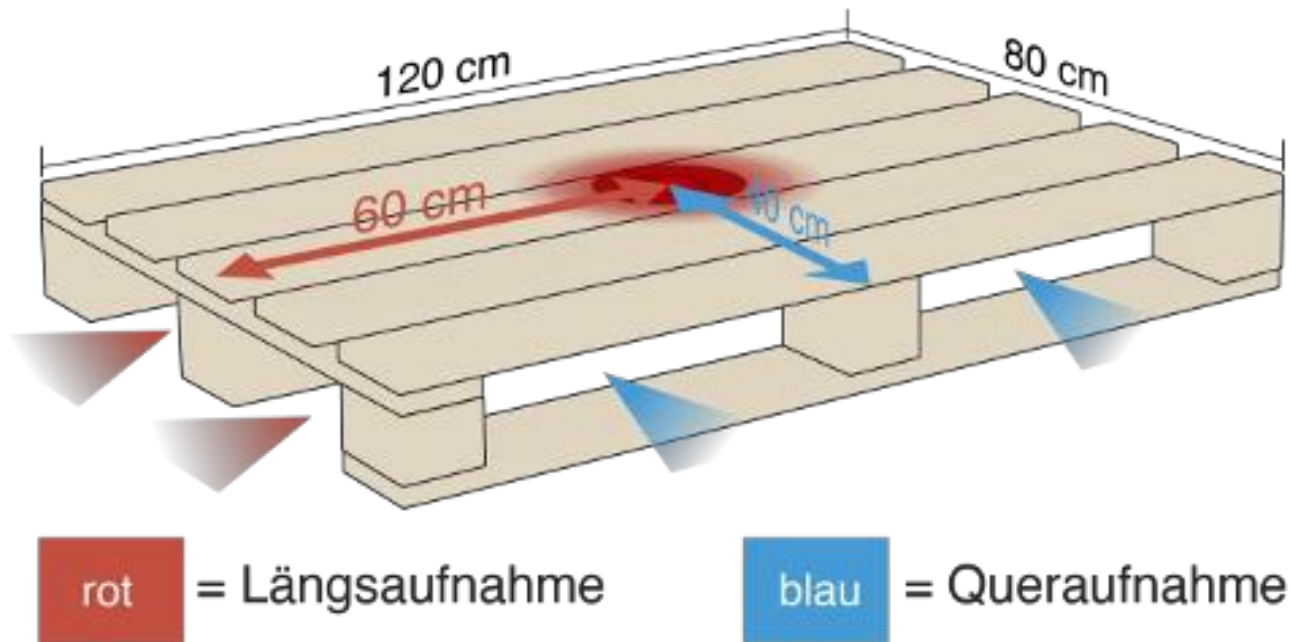
Euro pallet, Type 1, 80 x 120 cm, loaded lengthways

Distance from the centre of gravity

Special pallet, 160 x 160 cm



Distance from the centre of gravity



Calculation of the distance to the centre of gravity

40 cm Euro pallet, Type 1, 80 x 120 cm, loaded widthways

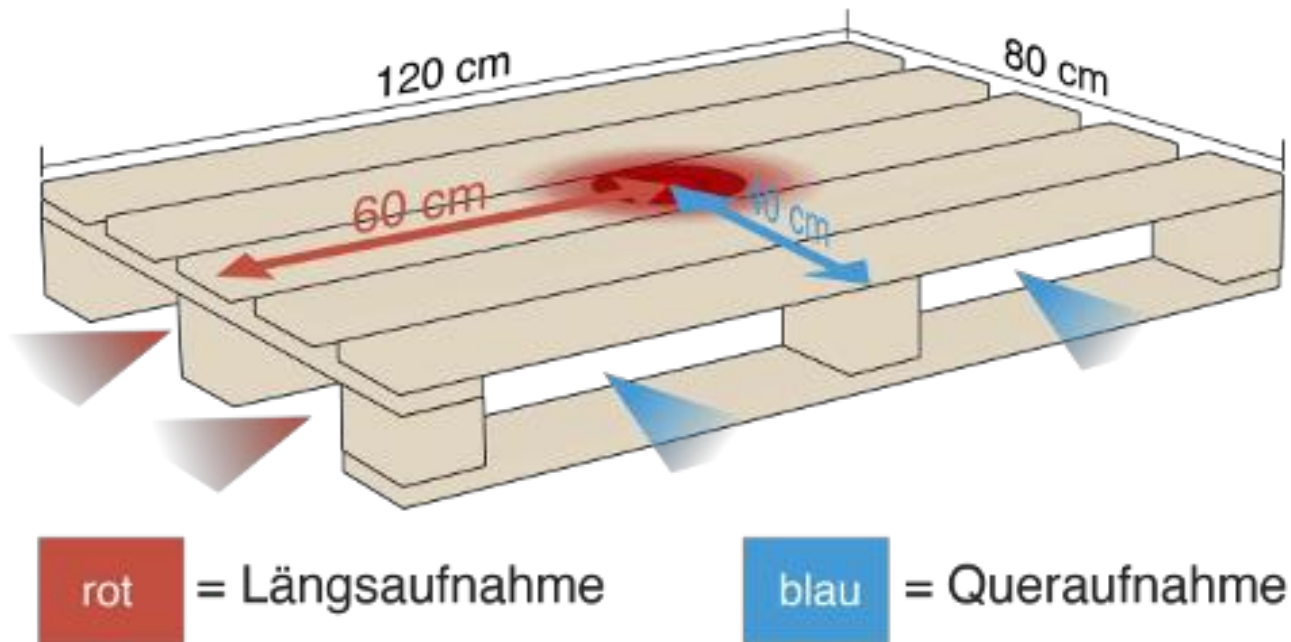
Special pallet, 100 x 100 cm (lengthwise and crosswise)

Euro pallet, Type 1, 80 x 120 cm, stored lengthways

Distance from the centre of gravity

Special pallet, 160 x 160 cm

Distance from the centre of gravity



Calculation of the distance to the centre of gravity

40 cm Euro pallet, Type 1, 80 x 120 cm, loaded widthways

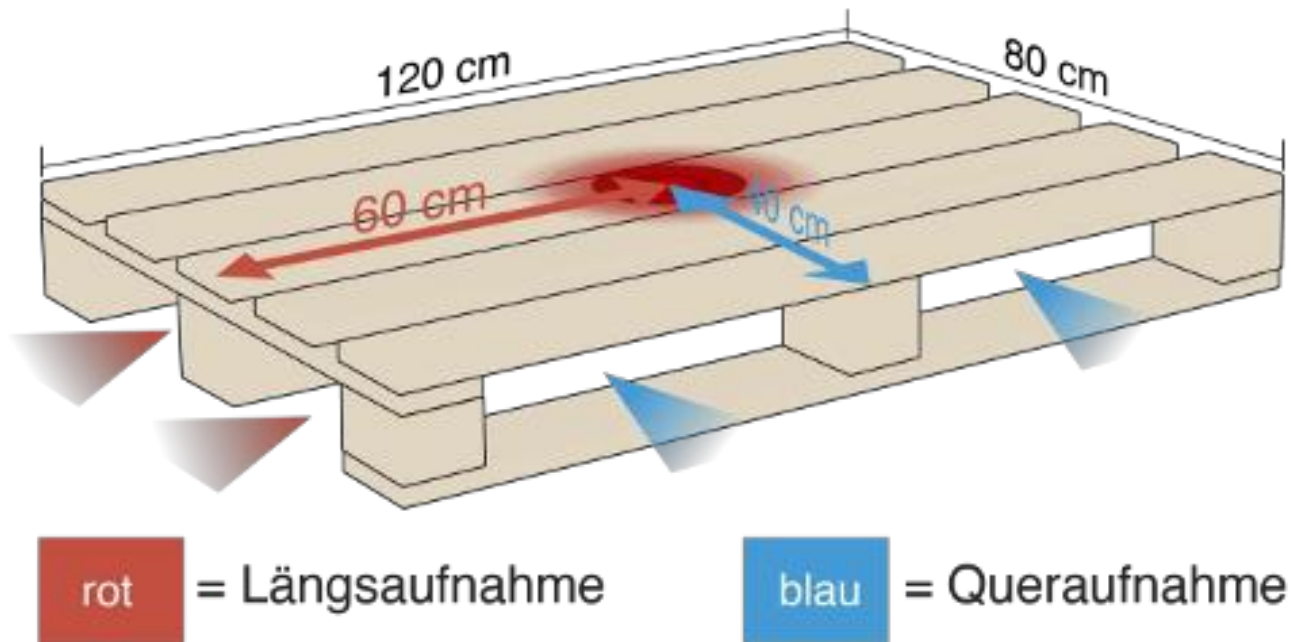
50 cm special pallet, 100 x 100 cm (lengthwise and crosswise)

Euro pallet, Type 1, 80 x 120 cm,
loaded lengthways

Distance from the centre of gravity

Special pallet, 160 x 160 cm

Distance from the centre of gravity



Calculation of the distance to the centre of gravity

40 cm Euro pallet, Type 1, 80 x 120 cm, loaded crosswise

50 cm special pallet, 100 x 100 cm (lengthwise and crosswise)

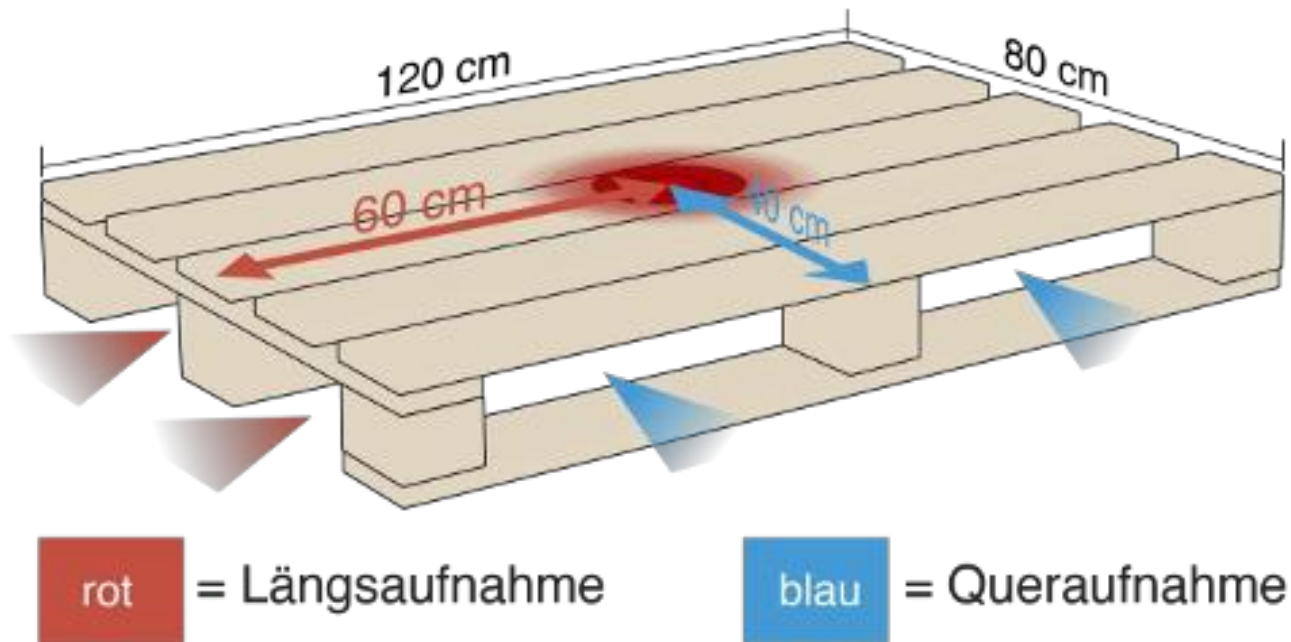
60 cm Euro pallet, Type 1 80 x 120 cm,
photographed lengthways

Distance from the centre of gravity

Special pallet, 160 x 160 cm



Distance from the centre of gravity



Calculation of the distance to the centre of gravity

40 cm Euro pallet, Type 1, 80 x 120 cm, photographed widthways

50 cm special pallet, 100 x 100 cm (lengthwise and crosswise)

60 cm Euro pallet, Type 1, 80 x 120 cm, loaded lengthways

Distance from the centre of gravity

80 cm special pallet, 160 x 160 cm

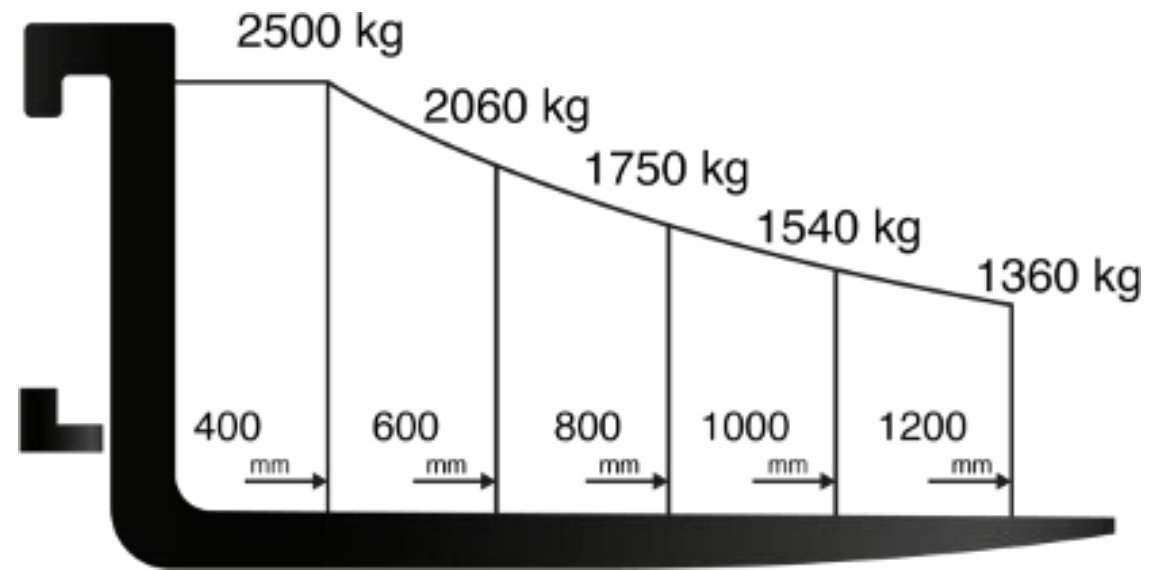


Tragraft diagrams

Maximum permissible load decreases

If the distance between the load's centre of gravity and the two values lies between them, take the safer value

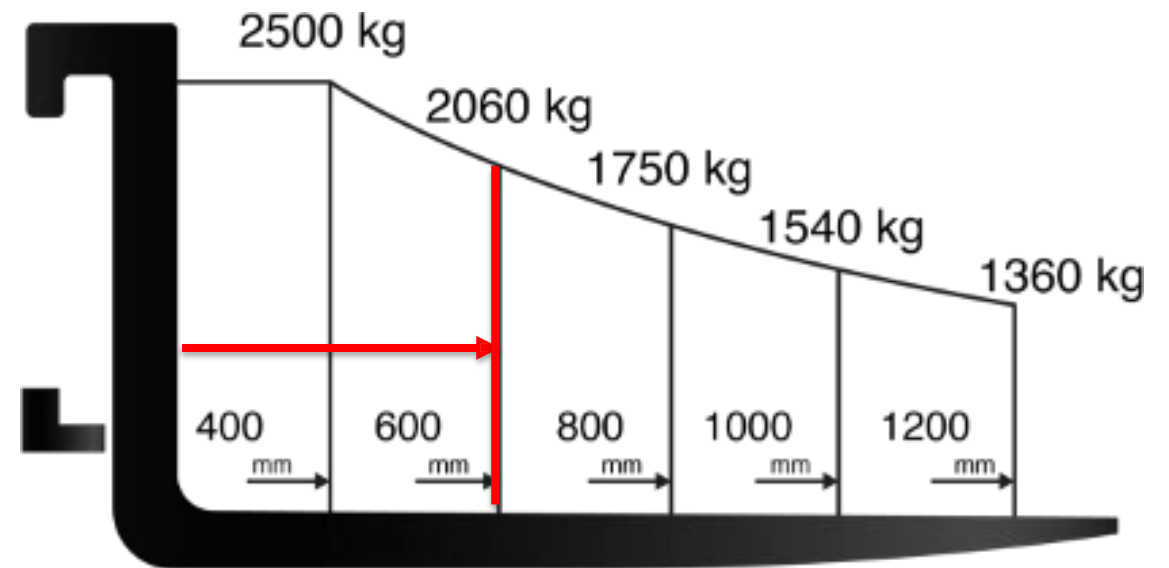
(e.g. 500 mm > 400 mm)



Tragraft diagrams

How much weight can be lifted
with a load centre distance of
600 mm?

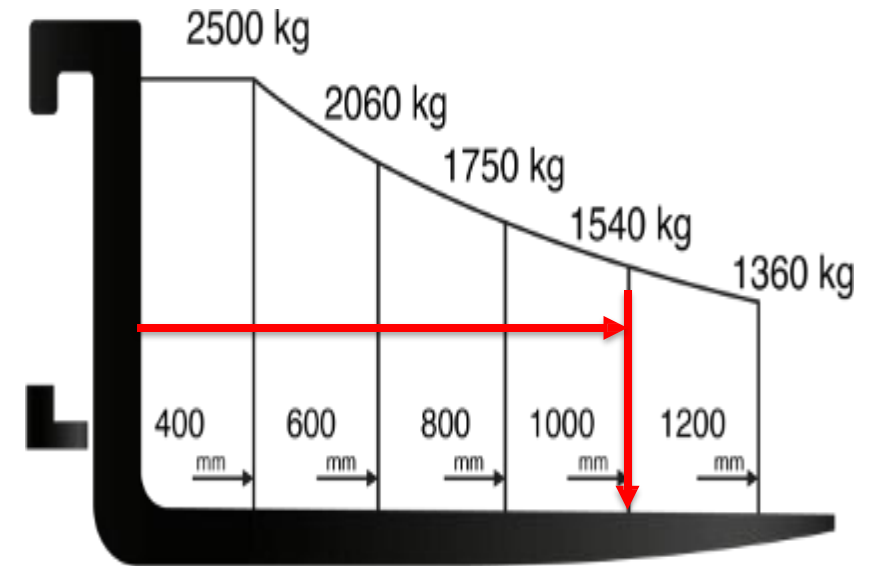
2060 kg.



Tragraft diagrams

What is the maximum permissible distance from the centre of gravity for a load weighing 1540 kg?

1,000 mm



Tragraft diagrams

Solve the exercises



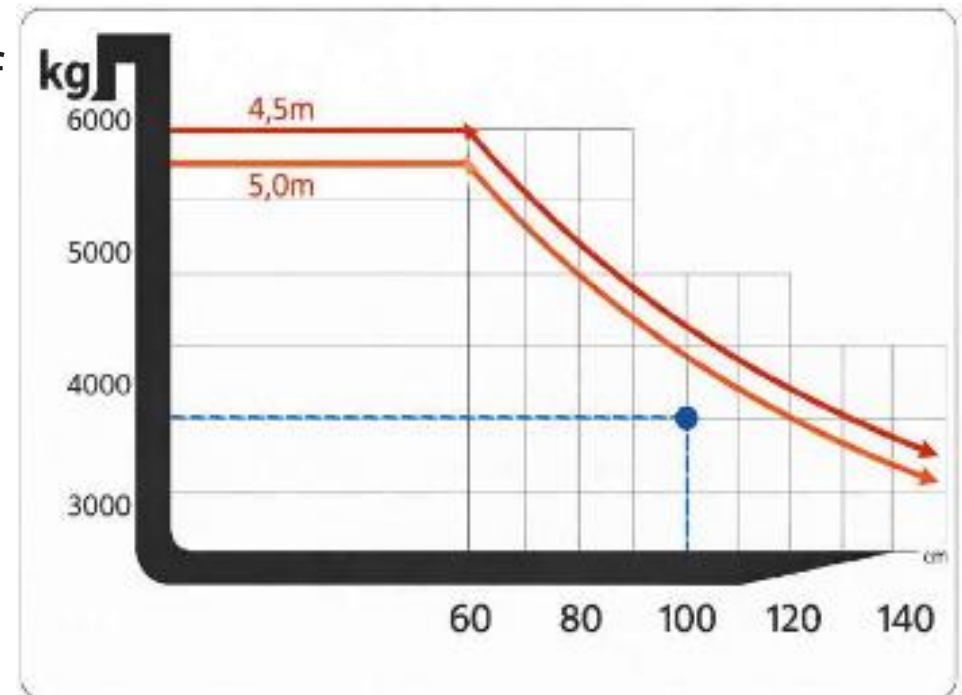
Tragraft diagrams

Question:

What is the maximum weight that can be lifted with a load centre distance of 100 cm and a lifting height of 5 m?

Answer:

The permissible load capacity is 4,000 kg, as this is the nearest specified value on the load capacity diagram.



Tragraft diagrams

Solve the exercises



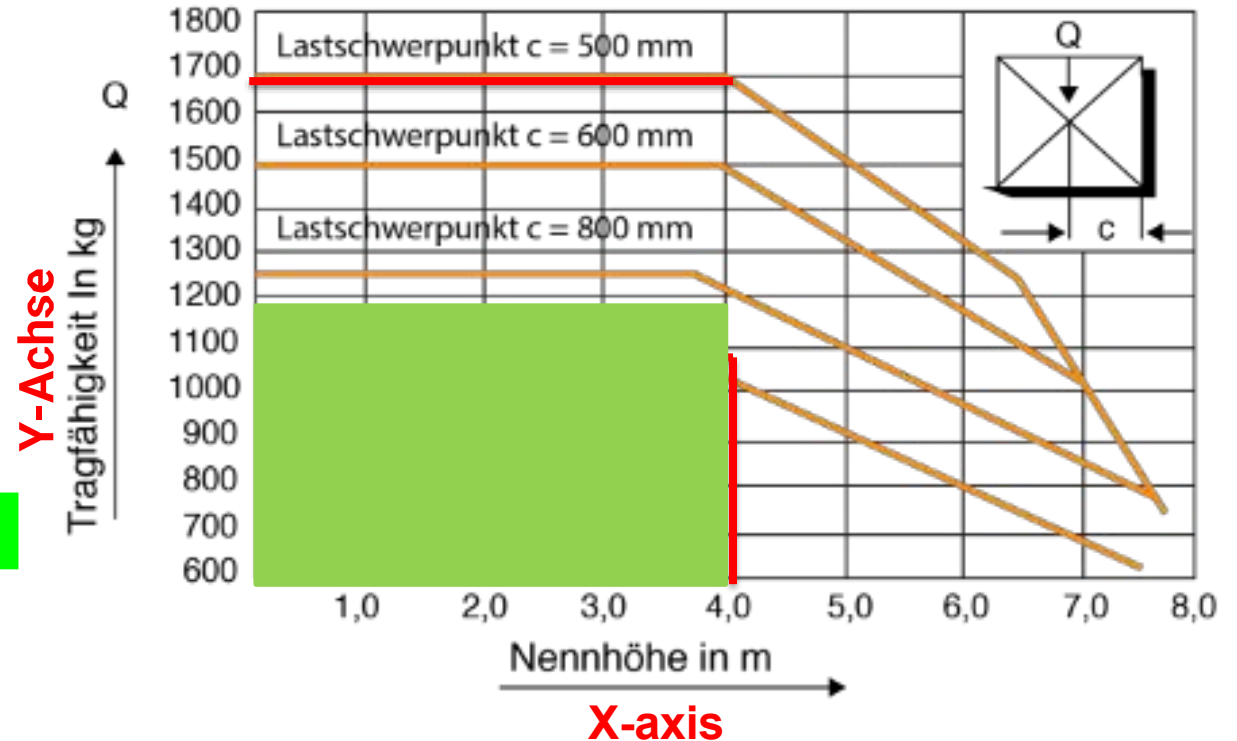
Load capacity charts

Can I lift 1,100 kg to a height of 4 m with a load centre distance of 800 mm?

YES

How should I lift a 1,700 kg pallet?

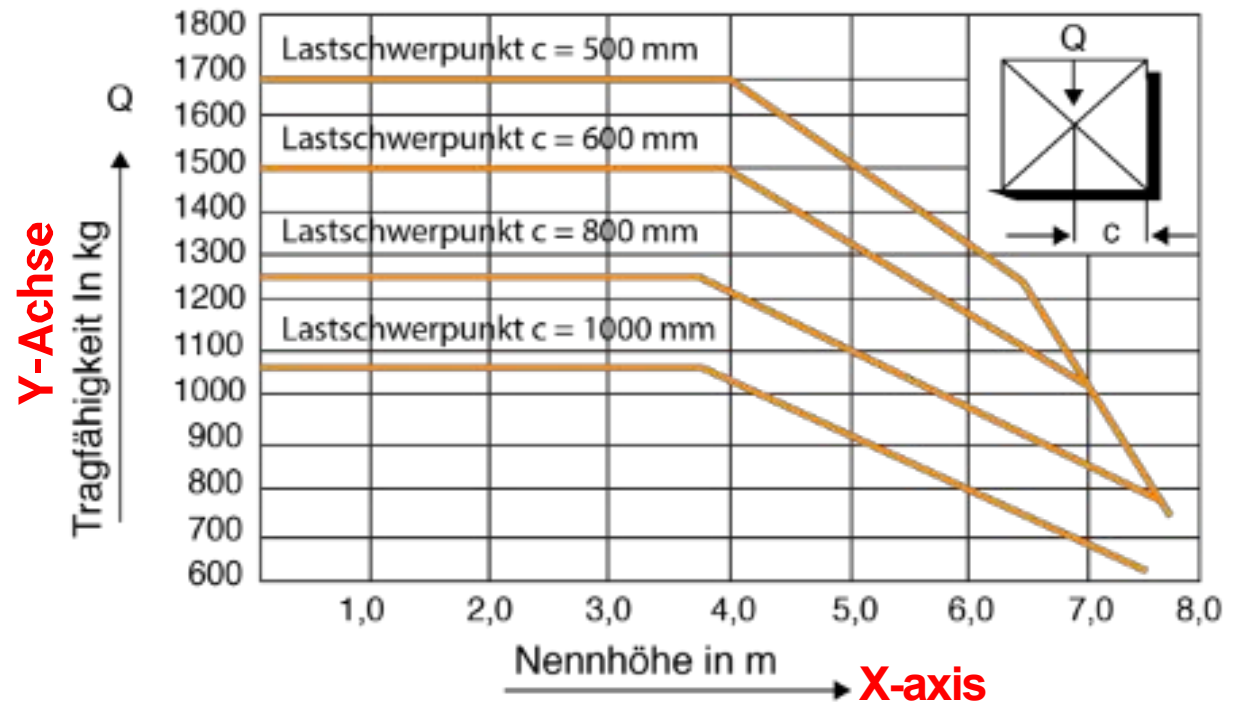
Across the pallet, with a load centre distance of 400 mm, as this is less than 500 mm and therefore optimal



Load capacity charts

The lower the load centre of gravity distance, the higher the load capacity!

The higher you lift, the less weight you can lift. (Law of the lever)



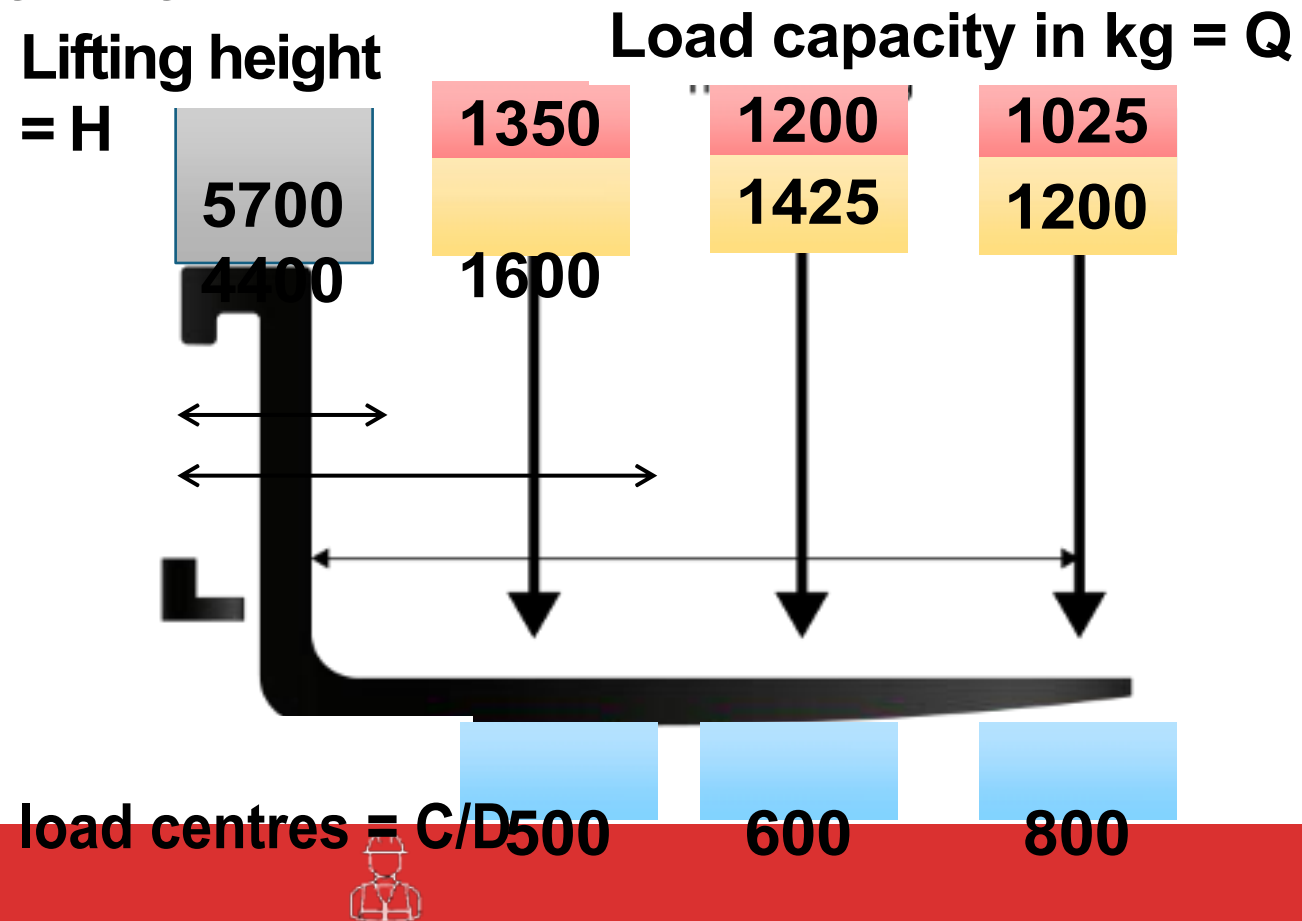
Lifting force diagrams

Solve the exercises



Load-capacity diagrams

2 different lifting heights

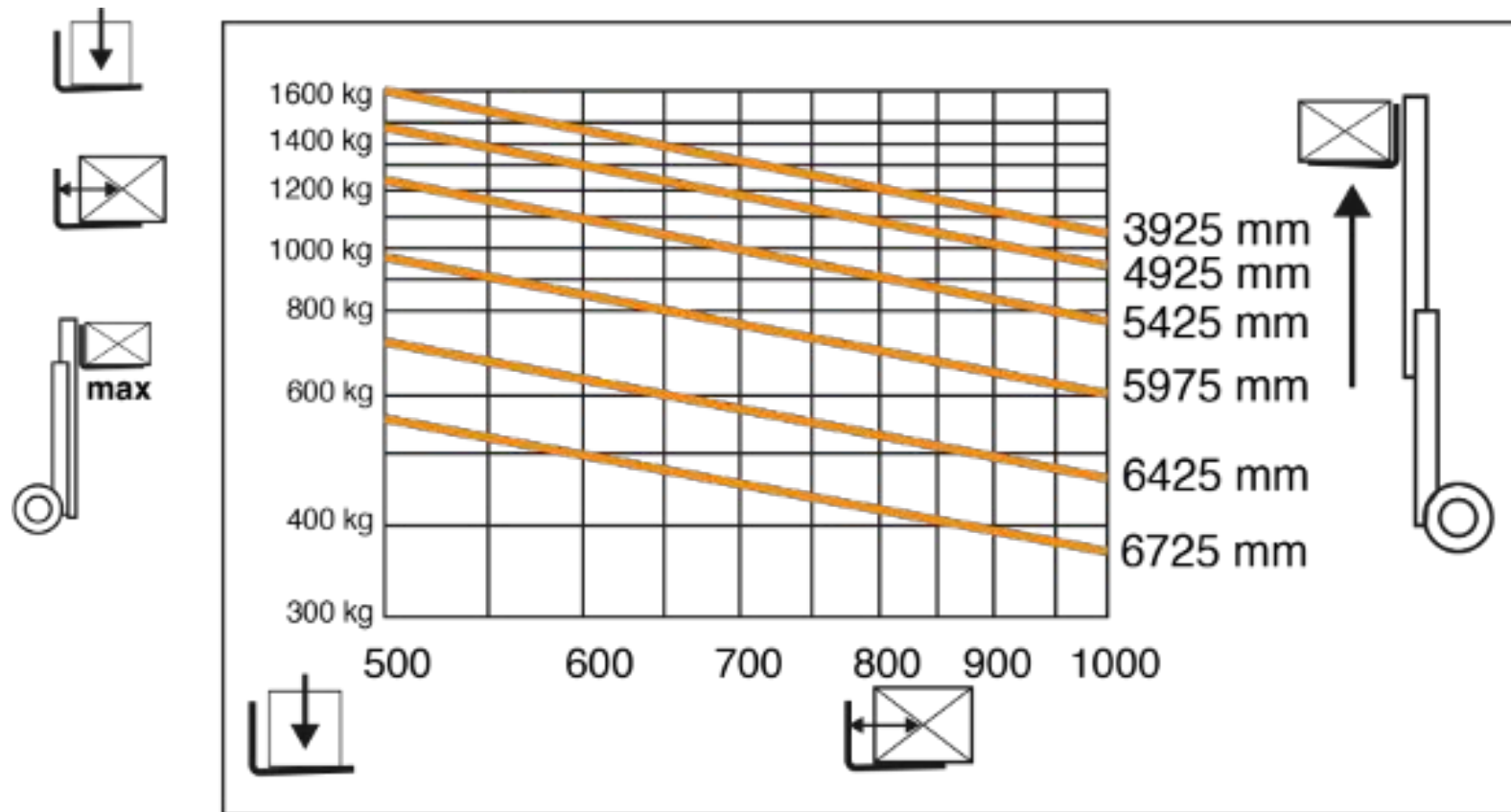


Tragraft diagrams

Complete the exercises



Tragraft diagrams



Tragraft diagrams

Solve the exercises



Tragraft diagrams

Fitting of additional equipment (clamp)

Change in load capacity diagram
Dead weight of the attachment

Suitable load capacity chart
provided by the supplier

This forklift truck can also
be fitted with a clamp
(attachment)



Load capacity charts

Question:

How many kg can I lift using the side shift and how many kg using the clamp at a lifting height of 4 m and a load centre distance of 60 cm?

The side shift can lift a maximum of 1,400 kg and the clamp a maximum of 1,100 kg.



Load capacity charts

Solve the exercises



Commissioning

What is involved in commissioning and decommissioning?

- Battery check
- Visual inspection
- Functional check

How often must these be carried out?

Once a month

Once a week

Once a year

Daily before use

Daily before use



Commissioning

R1 pages 25-26



Various batteries



Lithium-Ionen-Batterie



Traktionsbatterie (Blei-Säure)

 Hohe Energiedichte → längere Laufzeiten bei gleicher Größe  Geringes Gewicht → besser für mobile Geräte und Fahrzeuge  Sehr geringe Selbstentladung  Wartungsfrei	 Günstiger Anschaffungspreis  Robust und zuverlässig  Einfache Ladegeräte  Gut geeignet für hohe Stromstärken (z. B. Stapler)
 Hoher Anschaffungspreis  Empfindlich gegen Überladung, Tiefentladung und hohe Temperaturen  Spezielle Ladegeräte erforderlich  Brand- und Explosionsrisiko bei unsachgemäßer Handhabung  Höhere Selbstentladung	 Schwer und unhandlich  Regelmäßige Wartung erforderlich (Kontrolle des Säurestands)  Geringere Energiedichte → kürzere Laufzeiten  Enthält giftige und korrosive Säure  Höhere Selbstentladung



Battery check

- Switch off the charger, reposition the plug
- Personal protective equipment
- Measuring acid density
- Check the fluid level (top up with distilled water)
- Check that the battery surface is clean
- Remove gloves correctly and dispose of them
- Make an entry in the logbook



Measure the battery's state of charge

Acid density is measured in kg/dm^3

Fully charged: $1.24 - 1.30 \text{ kg/dm}^3$

Recharge if below 1.20 kg/dm^3

Deep discharge below 1.14 kg/dm^3 **damages the battery**

The float in the acid tester must not touch either the top or the bottom of the casing during the measurement process.



Battery monitoring

It is very important to wear the correct PPE when checking the battery

In the event of contact with battery acid

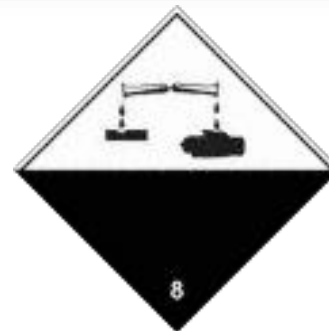
1. Rinse eyes immediately with an eye wash for approx. 15 minutes
2. In any case, seek medical attention

!! Possible

consequences?



Battery monitoring



Visual inspection

- Service of the hoist
- Lifting mast, lifting chain & lifting cylinder
- Hydraulic connections, hoses & cylinders
- Fork carriers & loading forks
- Wheels, tyres & wheel mounting
- Chassis and operator's canopy
- Lighting



Functional check

- Driver's seat & steering wheel adjustment
- Restraint system
- Unlocking the emergency switch & start-up procedure
- Lifting mechanism, mast tilt, side shift
- Foot brake, counter-current brake, parking brake and coasting brake
- Horn
- Fluid leaks (after driving off)



Commissioning

What should I do if, for example, oil is leaking from the vehicle?

Report / Take out of service / Mark

**TAKE OFF THE
ROAD MARK
REPORT**



Taking out of service

- Use designated parking spaces
- Position the wheels in a longitudinal direction
- Apply the parking brake
- Lift mast vertical, forks horizontal, side shift in neutral
- Taking out of service, emergency stop engaged
- Remove the key



! Important! When taking a gas-powered forklift out of service, always close the main valve on the gas cylinder.



Types of drive systems

What types of drive systems are there?

Internal combustion / Electric / Hybrid / Gas-powered



Refuelling internal combustion forklift trucks

Park the vehicle correctly and properly

Park the vehicle

Switch off the vehicle

Ensure adequate ventilation! (Caution: hazardous vapours)

Smoking and open flames are prohibited

Keep oil absorbent (or a suitable absorbent material) to hand so that you can respond appropriately in the event of a fuel spill.

(In the event of an incident, ensure the used absorbent is disposed of correctly)

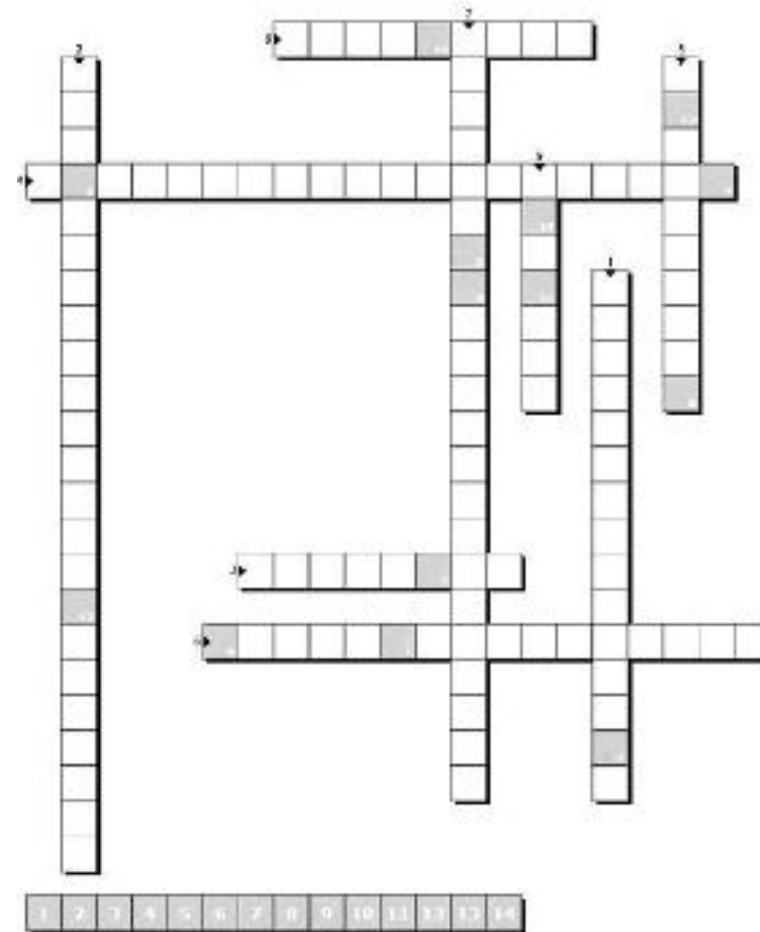


Gas-powered forklift trucks

- Propane gas cylinders must only be changed by trained personnel. Before starting, switch off the engine and close the main valve on the gas cylinder.
- The empty cylinder must be carefully removed and fitted with its protective cap. The full, approved and externally undamaged gas cylinder must then be positioned securely and connected correctly.
- Once the main valve has been opened, the connection point must be checked for leaks. Open flames and smoking are prohibited.
- Gas cylinders must be secured to prevent them from falling over and must only be stored in well-ventilated areas.



Crossword



Riding Technique

Empty run: fork 15 cm above the ground!

CAUTION: on uneven floors, adjust the fork height!



Riding Technique

- The forklift's pivot point is in the centre of the front axle.
- It is particularly important to make conscious use of the pivot point, especially when manoeuvring in confined spaces.



Here is the pivot point: centre of the front axle



Riding Technique

What is important to bear in mind when transporting tall loads?



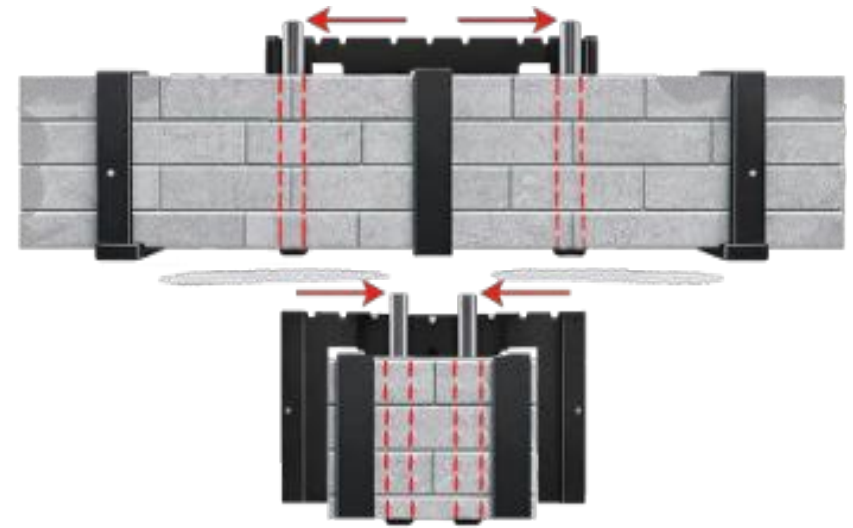
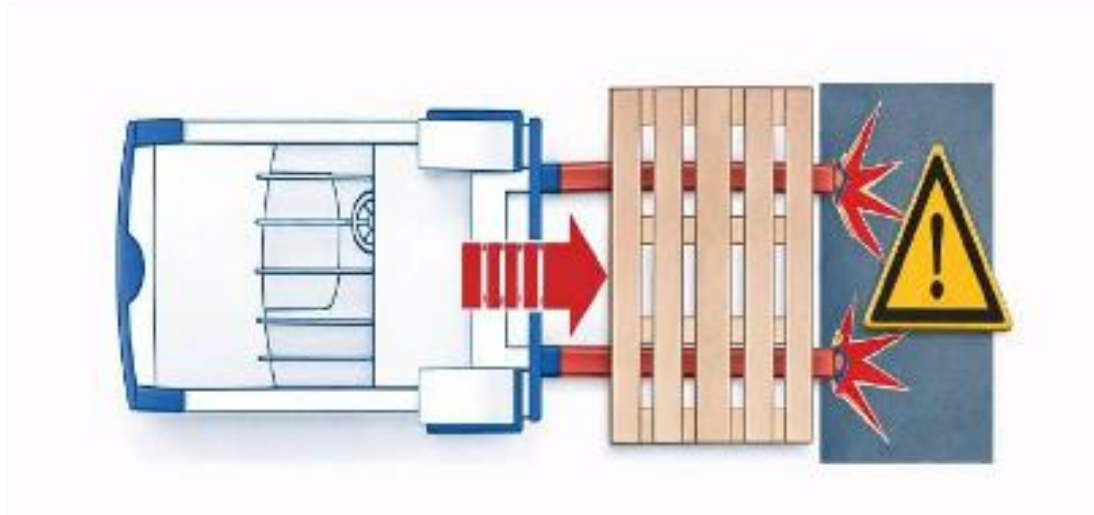
Riding Technique



Riding Technique

Adjust the fork width

Caution when lifting loads sideways



Riding Technique

When transporting uphill – always keep the load facing upwards. **Drive slowly and steadily** – avoid sudden manoeuvres.



Secure and centre the load – avoid overhangs. **Be aware of visibility and distance** – allow for a longer stopping distance. **Use only tested equipment** – check the brakes



Riding and steering. Technique



Stock-in and stock-out procedures

Rule of thumb for racks with a depth of 110 cm:

The pallet must protrude approximately 5 cm beyond the Spreader beam on each side.

This ensures that the pallet blocks at the front and rear rest fully on the spreader beams and that the load is distributed evenly.



Stock-in and stock-out procedures

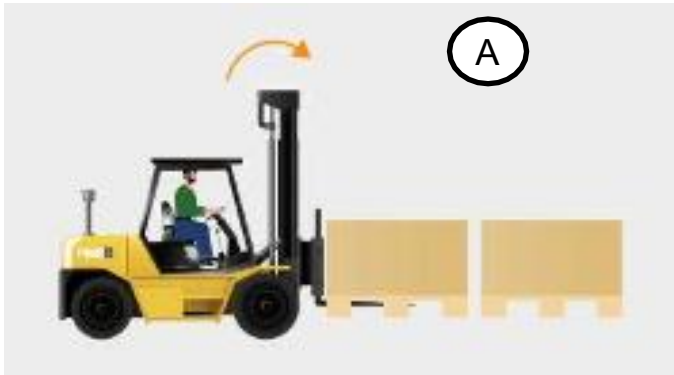
Please read R1 pages 44-48



Exercise: Block storage (stacking)

A/F/E/C/D

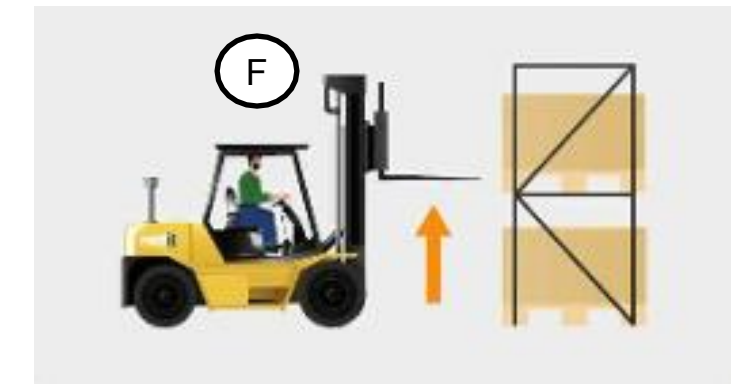
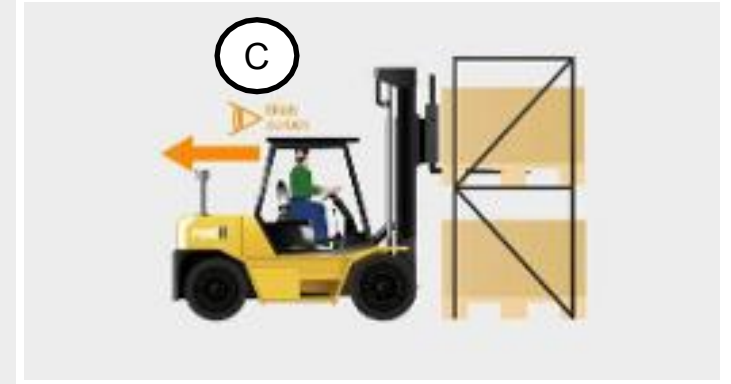
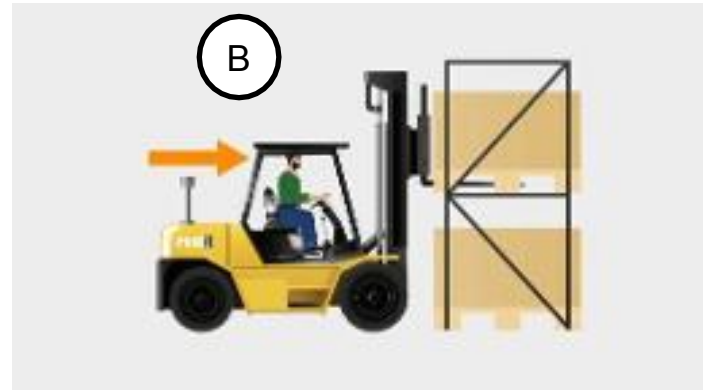
Write down the correct sequence



Exercise: Shelf Stock Removal

Write down the correct order:

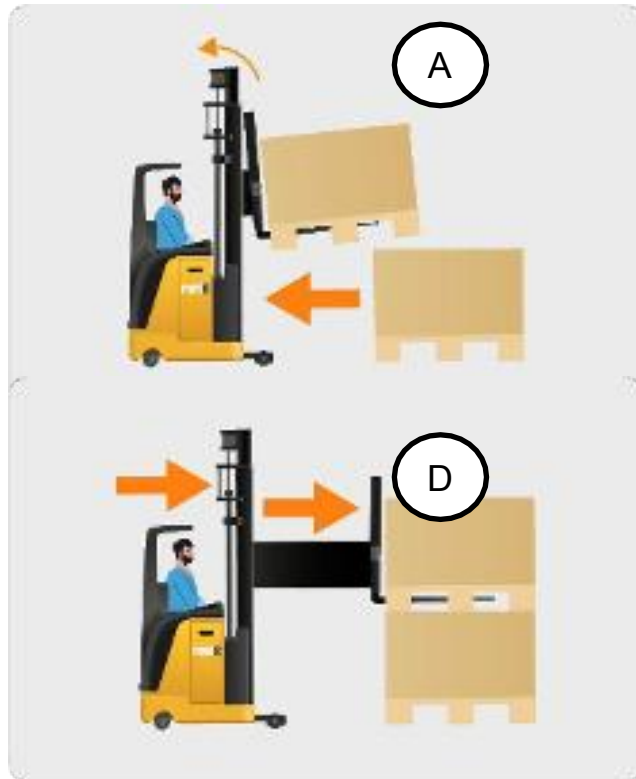
F/B/C/D/A/E



Exercise: Dismantling a block camp

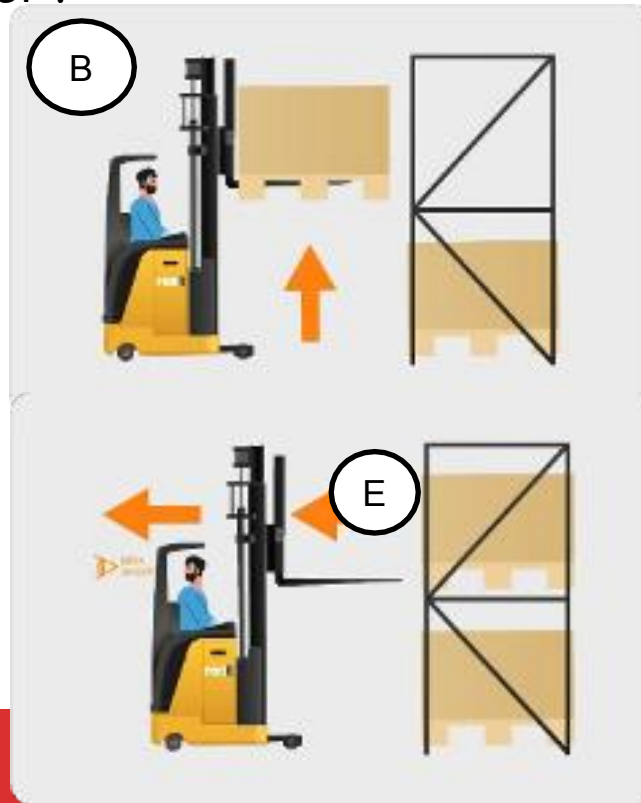
Write down the correct sequence:

E/D/C/A/B/F

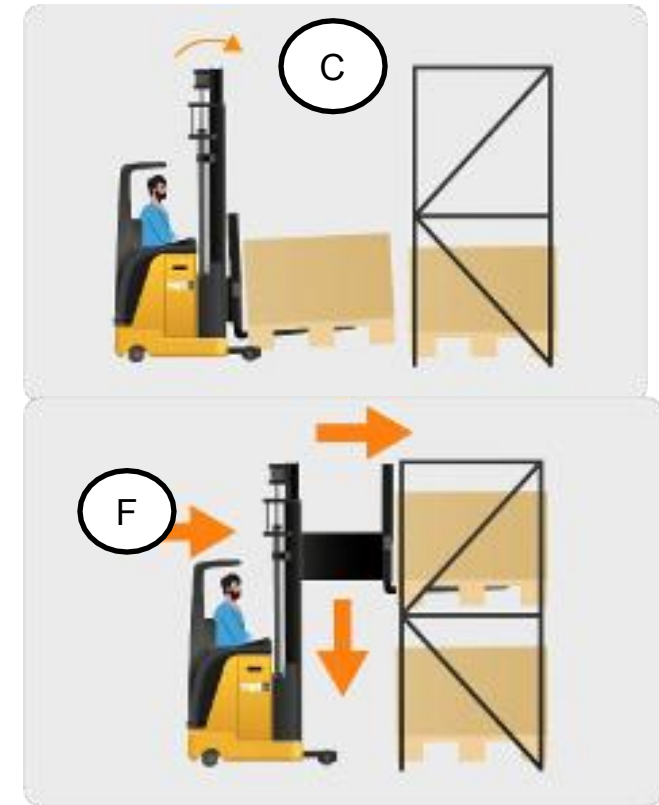


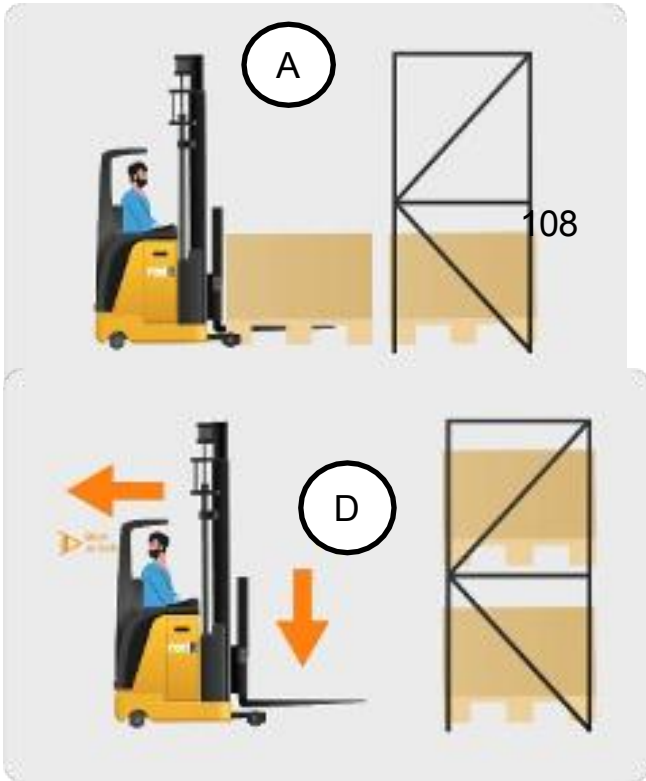
Exercise: Storing items on a shelf

Write down the correct order:



C/A/B/F/E/D





Load securing

Only stack stable loads; secure unstable loads beforehand.
Stabilise sacks with stretch film.

Take special care to secure drums containing liquids (shifting).
Center of gravity, Risk of tipping). Never transport free-standing drums without securing them.



Special operations

Special operations are relatively rare, so they must always **be carefully planned**. Potential hazards and the agreed procedure must be documented in writing within the company.

The employer must check that safety rules are being followed.

A written record must be kept of which employees are assigned to and instructed in such work.



Special operations

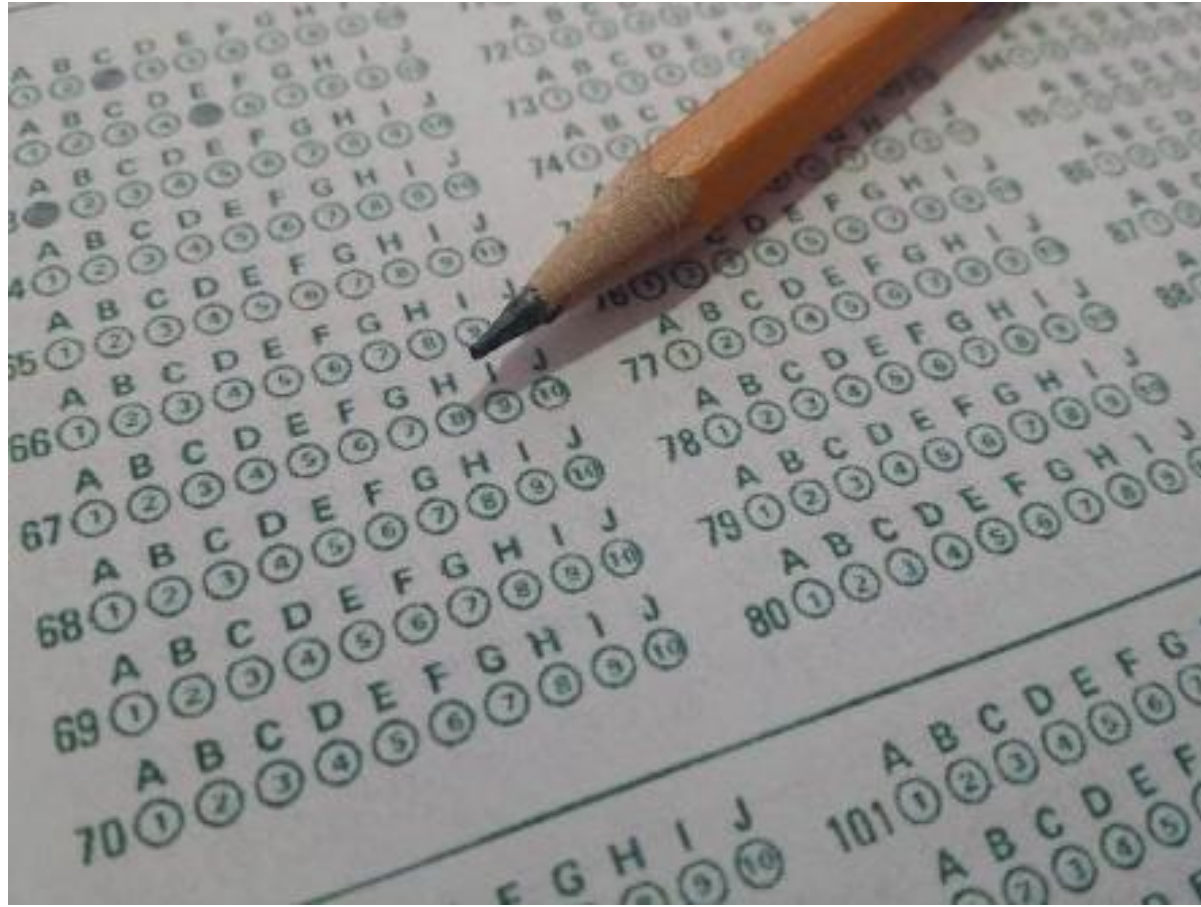
When transporting bulky loads with a forklift, no persons must be used as 'load holders' walking alongside the forklift. There is a risk that they could become trapped or end up in the load's fall zone.



Any questions?



Exam



Course evaluation



CONTACT

Altix Academy AG

Klosterstrasse 40a
CH- 8406 Winterthur

Tel.: 052 511 13 93

Email: schulung@altix.ch

altix
Arbeiten in der Höhe

THANK
YOU
VERY
MUCH!

