

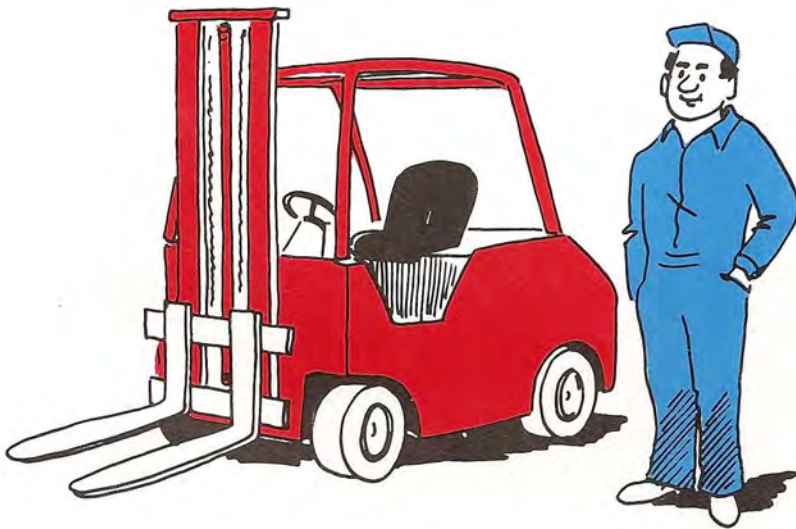
Introduction

INTRODUCTION

This book addresses itself to those of you who are going to become forklift truck operators and it deals with those subjects which you as an operator should know about. The aim of the manual is to help you to become a safe and efficient truck operator.

Perhaps you already have some relevant experience and feel that you know all there is to know about forklift trucks. However, it is our contention that everybody, irrespective of their experience, has something to learn from this book.

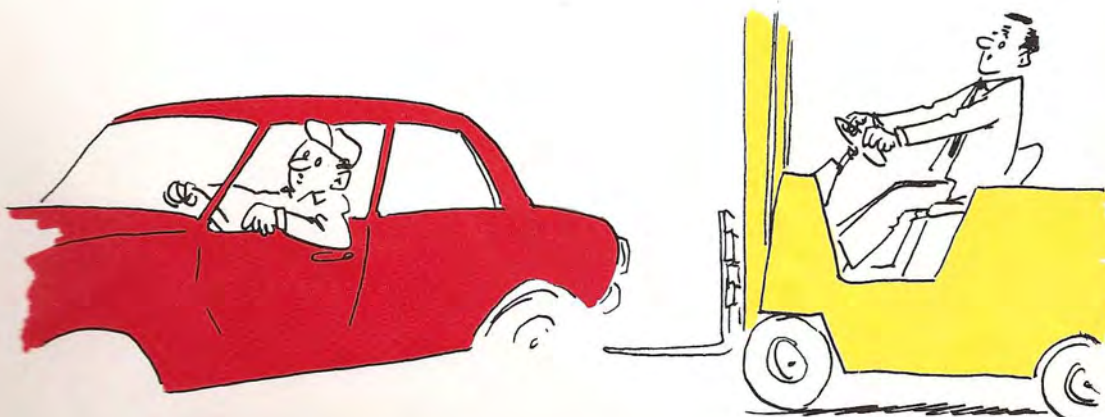
A good truck operator must be thoroughly familiar with the rules for safe truck operation.



INCREASING NUMBERS OF ACCIDENTS

The number of accidents in which forklift trucks are involved is far too high. Lack of training, or lack of proper training, has been identified as the major cause of these accidents. In the past, far too many people have been allowed to use these powerful machines with little or no training and the result has been far too many accidents to people, product and premises. Most accidents involving lift trucks are serious, often fatal.

Accidents must not occur due to lack of knowledge of how the truck works or of current legislation, or safe working rules!



Types of Trucks and Attachments

The development of the forklift truck



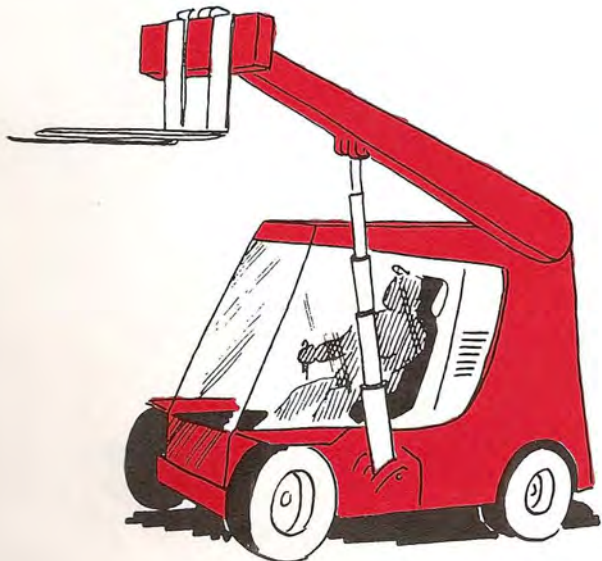
TRUCKS OF THE PAST

The first forklift trucks, which appeared in the early 30's, did not have much in common with the trucks of today. They had iron wheels, a mechanical lifting system using wire and there was a complete lack of operator protection.

TRUCKS OF TODAY

Over the years the forklift truck has been equipped with rubber tyres, hydraulics and other modern accessories. Operator comfort has also greatly improved.

The forklift is the piece of equipment most widely used in the materials handling industry today. Its popularity is due to its flexibility and wide range of applications.



TRUCKS OF TOMORROW

This is how the truck of the future may look. At present, the operator is faced with a number of daily problems, due to truck design, e.g. limited vision and exhaust fumes. The truck of the future may have a wide wheel base and a low chassis fitted with a telescopic arm.

Type of Forklift Truck

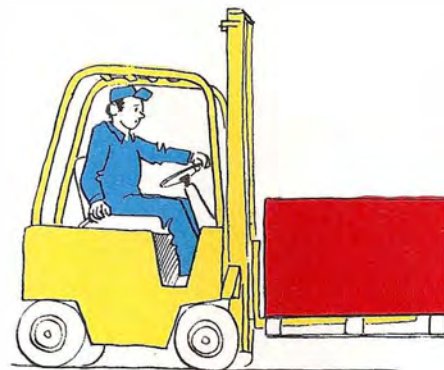
COUNTERBALANCED TRUCKS

The counterbalanced truck is the most common type of fork truck. It carries its load in front of the front wheels and has a counterweight at the rear to maintain balance.

The smaller counterbalanced trucks have electric motors or internal combustion engines. Electric drive trucks are often used indoors, in warehouses and factories. Trucks with internal combustion engines are used outside or where long distance travel is involved.

The larger counterbalanced trucks normally have diesel engines and are best suited for outdoor use, for example, handling of goods in ports, goods terminals, paper mills and timber yards.

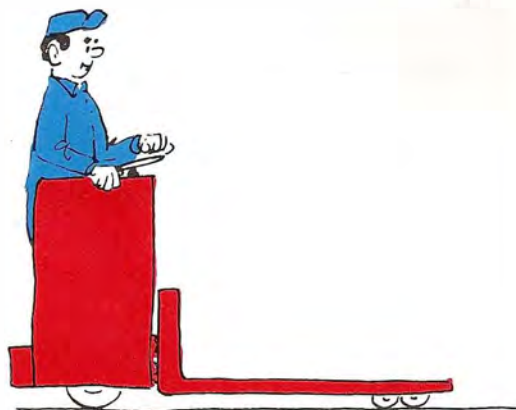
The counterbalanced truck can be fitted with different types of wheels and tyres depending on how and where it is going to be used.



PALLET TRUCKS AND STACKER TRUCKS

The support arms are characteristic of these types of trucks. They carry their loads between the wheel axles and, therefore, do not require a counterweight in the same way as a counterbalanced truck does.

The distance between the arms is such that they can roll under a pallet from the short side. Since a pallet is relatively low, the support arm wheels must be of small diameter. This means that the truck requires an even, flat surface with bearing capacity and without unduly steep gradients.



The **low-lift pallet truck** lacks a mast and is used for moving goods at floor level. It can be pedestrian or rider operated. The operator's area can be designed for either sitting or standing.

With an operator seat this truck is well suited to longer journeys. It is mostly used for moving pallets inside warehouses and production halls, but can even be used for loading and unloading lorries and railway wagons.

High lift stacker trucks are equipped with masts and are used mainly in warehouses and stores for transport and stacking. These too can be rider or pedestrian operated.



REACH TRUCK

The reach truck has, as the name implies, a mast which can be moved forward in the longitudinal direction of the truck. With the mast in the reached out position, it picks up, or puts down a load - just like a counter-balanced truck. With the mast in the retracted position, during transportation, it carries its load within its wheel base.

The reach truck is something between a counterbalanced truck and a pallet truck and is ideally suited for stacking and destacking in narrow aisles.

The reach truck is equipped with solid tyres.



The **four-way truck** is a special type of reach truck which can move laterally, due to the fact that the direction of the reach leg wheels can be changed. It is ideal for handling long loads.

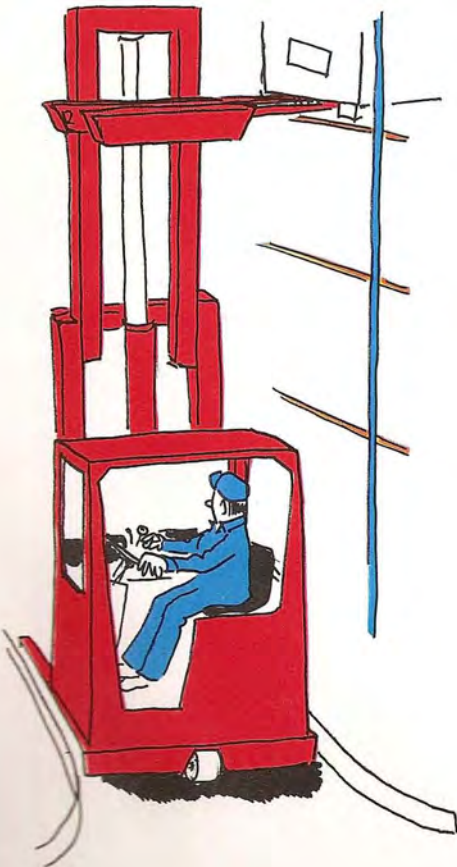
It is natural that the reach truck - which has been developed to save space - is mostly used indoors and normally for the handling of goods in warehouses and stores.



NARROW-AISLE TRUCKS

The narrow-aisle truck is a high-lift truck and can place good upon shelving on either side of an aisle, without the truck turning in the aisle.

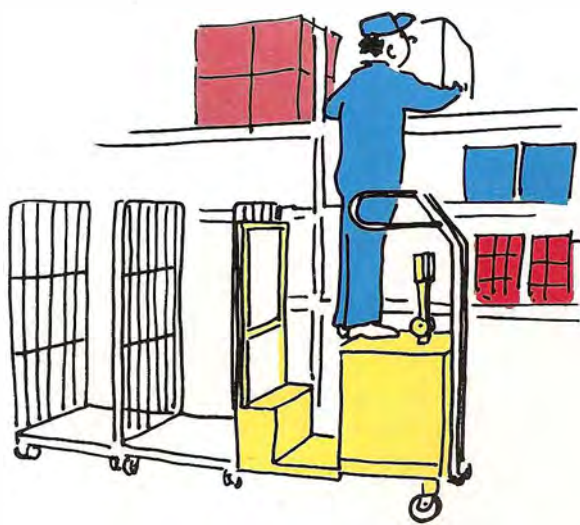
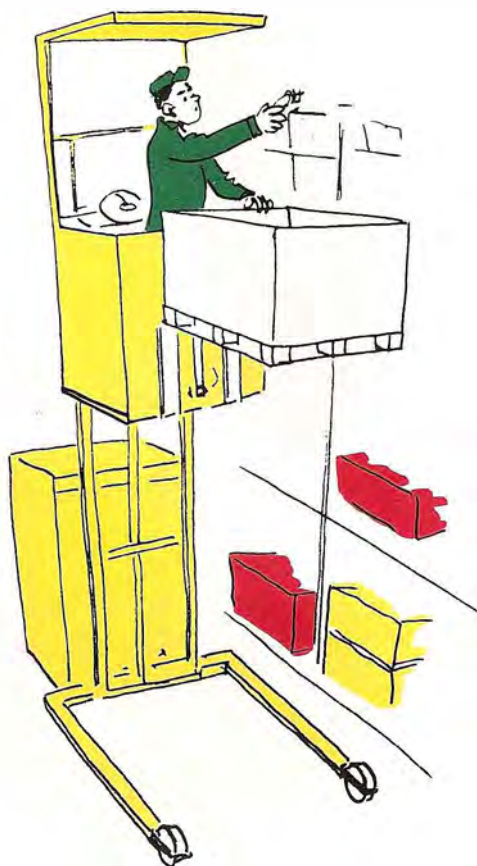
This truck works in warehouse aisles of about 1.5 m in width. This, together with the face that these trucks can be built to reach as high as 12 metres means that warehouse space can be exploited very effectively. The truck is steered in the aisle either on guide rails along the sides of the aisle, or electronically, with the aid of a power wire under the floor, (called a guided wire system). Since the truck cannot turn in the aisle, the goods must be stacked side ways. Therefore, the truck is equipped with either a special fork carriage that can rotate through 180° and reach out on either side to stack, or telescopic forks that are extendable.



ORDER-PICKING TRUCKS

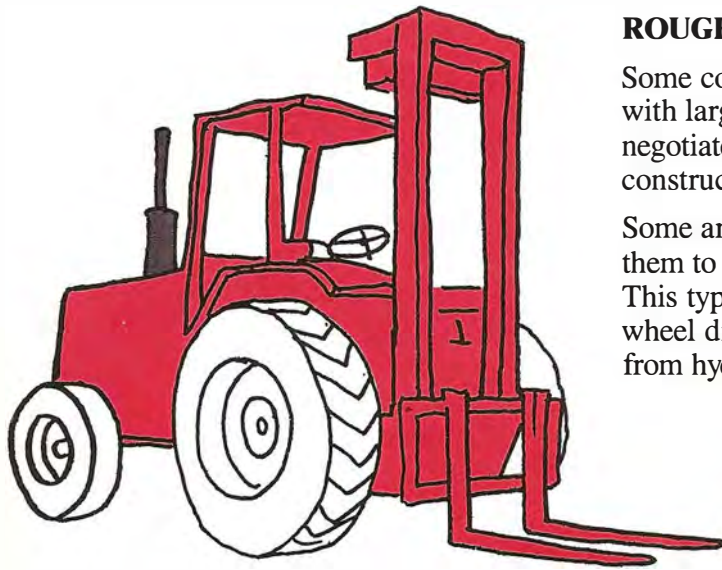
A truck which lifts the operator on a platform from which it can be manoeuvred is called a **high-lift order-picking truck**.

The operator can pick the goods by hand at different levels up to seven metres. The truck can either be driven freely in the aisles, or guided in the same way as narrow-aisle trucks on rails, or by using a guided wire system.



There is also a **low-lift order-picking truck**. In order to allow the operator to pick goods from higher racks there is a special slip-free platform at a higher level on top of the truck. From this platform the operator can reach to goods placed at a height of 2.5 m.

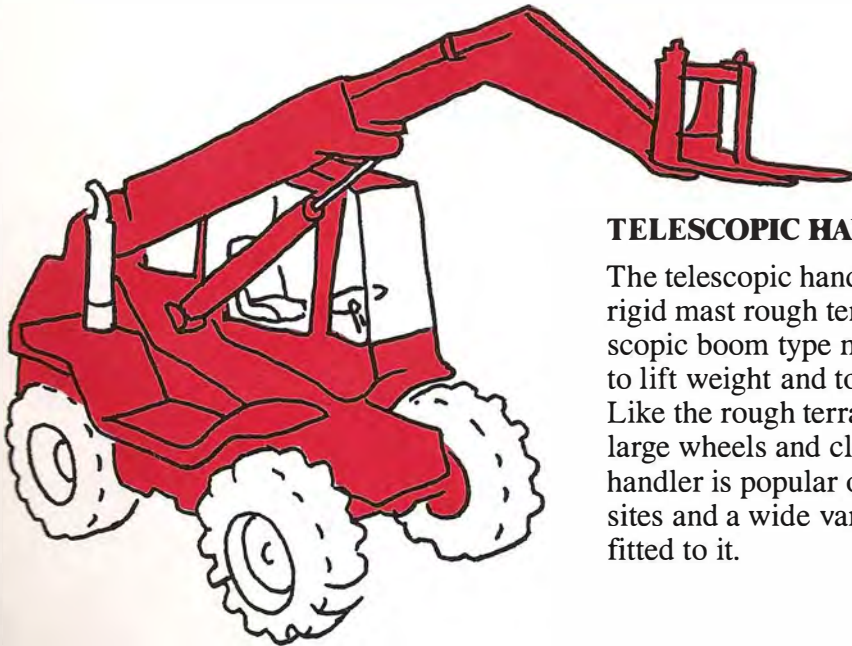
This truck is often used for order-picking by wholesalers and distributors.



ROUGH TERRAIN FORKLIFT TRUCKS

Some counterbalanced forklift trucks are fitted with large traction wheels, to enable them to negotiate the kind of terrain one might find on a construction site or farm.

Some are fitted with cleated tyres, to enable them to transport loads over undulating ground. This type of truck is available in two and four wheel drive, with various options of drive train from hydrostatic to diff-lock.



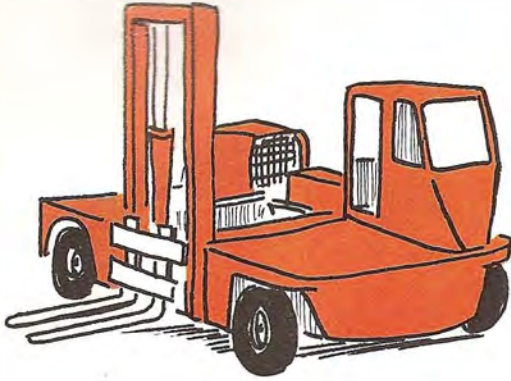
TELESCOPIC HANDLERS

The telescopic handler was developed from the rigid mast rough terrain forklift truck. The telescopic boom type mast gives it both the ability to lift weight and to reach out and pick up loads. Like the rough terrain truck it is fitted with large wheels and cleated tyres. The telescopic handler is popular on farms and construction sites and a wide variety of attachments can be fitted to it.

SIDE-LOADING TRUCKS

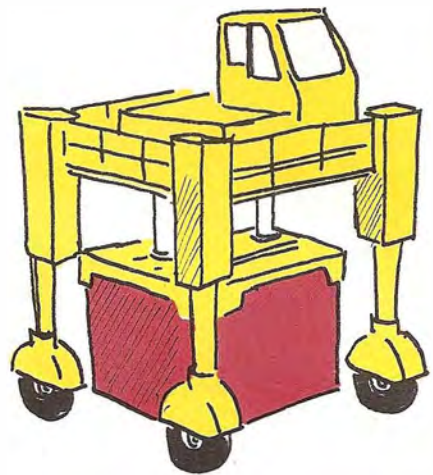
The side-loading truck has a mast at the side and this can be moved laterally. When lifting the mast in the outer position, the truck acts as a counter-balance. Most side-loading trucks are equipped with hydraulically folding stabilising legs.

There are some electrically propelled models, but the majority have engines. The truck is normally used for handling long loads, e.g. at steel works, timber yards and piping and metalware wholesalers. Side-loader trucks, specially built for handling containers, are also available on the market.



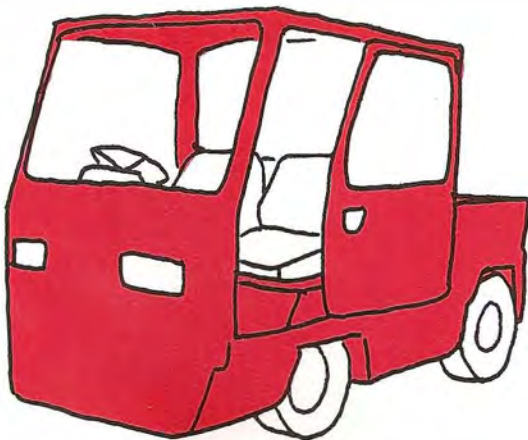
STRADDLE CARRIER TRUCKS

The straddle carrier truck lifts and handles loads which hang between the wheels from a lift frame. This type of truck is used for handling and transporting long loads, open-sided wagons, containers etc. in the steel industry, at pulp mills, on docks and at large terminals. A truck with high portal clearance can be used for stacking containers.



INDUSTRIAL TRACTOR

The industrial tractor is mostly used to pull trailers, but it can be used for other purposes, e.g. towing aircraft. Industrial tractors are available with either internal combustion engines or electric motors and there are 3-wheel and 4-wheel models available.



ATTACHMENTS

There are a number of attachments to facilitate the handling of different types of goods and load carriers. Some can be hydraulically manoeuvred from the operator's cab. A number of the most common attachments are described below.

Fork Extensions. Metal sleeves to slide onto the forks, and locked in-to place, to enable loads of different lengths to be handled. Normal extension should not be more than 50% longer than the basic forks and the load carried should not overhang the extension.



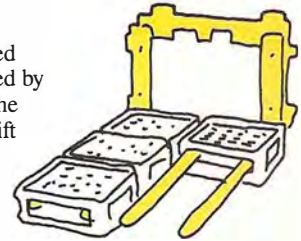
Crane Attachment. When fitted to the fork carriage in lieu of forks, this converts the truck into a mobile crane. The appropriate Lifting Regulations must then be complied with.



Sideshift. A fork carriage to provide limited lateral movement for accurate positioning of the load. Standard forks are used.



Milk Crate Tines. Unpalletised loads of crated milk are handled by special tines, spaced to enter the crates. Assembled on a sideshift for precise handling.

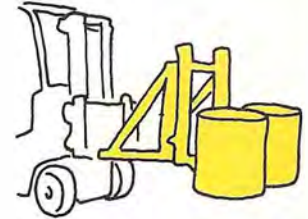


Boom (Ram) Attachment. Allows loads with a central hole (tyres, coils, etc.) to be handled without the need for any pallet or similar load carrier.



Carpet Boom. This is a special form of boom for handling rolls of carpet, the boom being inserted in the central core on which the carpet is rolled.

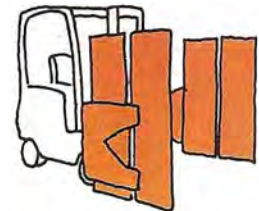
Drum Grip. A non-powered device, fitted either to the fork carriage or the forks. It automatically grips the top rim of the drum. Another type uses self-acting clamping arms. Both available for handling one or two drums, in the up-ended position.



Load Clamp. For handling bales, cases or other suitable loads by clamping action, without the use of pallets. Wide range of arms to suit the type of load: dual purpose arms available, e.g., pivoting forks for clamping bales or other loads, or for use as forks for palletised loads. Can have integral sideshift if needed.



Carton Clamp. Similar in action to a Load Clamp, with integral sideshift. Fitted with large contact pads on articulated arms for pallet-less handling of unit loads of cartoned goods.



Rotating Fork Unit. A rotating head (180 to 360 degrees), fitted with forks having a range of settings; for handling bins, etc., which need to be rotated so as to discharge the contents. The load unit requires suitable fork pockets.



Rotating Paper Roll Clamp.

Picks up paper rolls from floor or lorry level by clamping in articulated contact pads, and rotates them to vertical position for stacking on end. Split-roll units available for handling two or more rolls of the same size.



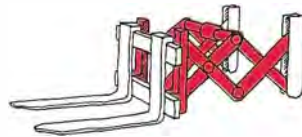
Load Push-pull. The load is carried on a slip-sheet instead of a pallet. The push-pull has two broad platens in lieu of forks; the load is pulled onto the platens by a gripper, and pushed off by a pusher plate. The attachment is also available with alternative functions, and sideshift if required.



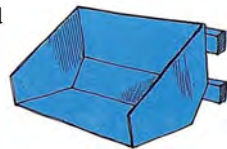
Load Stabiliser. For high loads which are not inherently stable. The load is carried on standard forks and the attachment mounted between the forks; it has a top pad, hydraulically powered, to exert pressure on top of the load to keep it stable.



Extendable attachment and extendable forks. By using an extendable attachment or hydraulically extendable forks you can raise or lower loads which are a longer distance from the truck. This is an advantage when loading lorries from the side, but can also be used for stacking two pallets far back, e.g. in a rack.

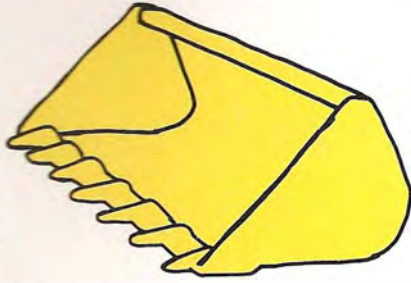


Shovel scoop. A truck equipped with a shovel scoop can handle bulk loads and scrap, or can be used for shovelling snow.

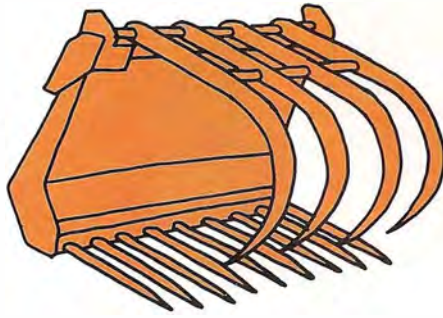


If your truck is fitted with an attachment you must know the characteristics of the attachment and the safety rules for its use.

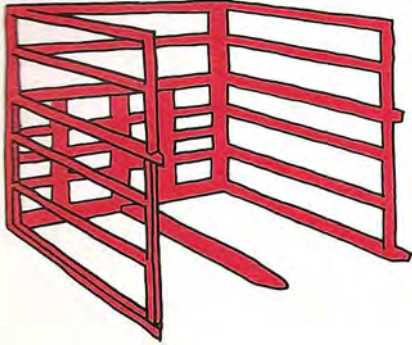
SPECIAL ATTACHMENTS FOR USE IN AGRICULTURE



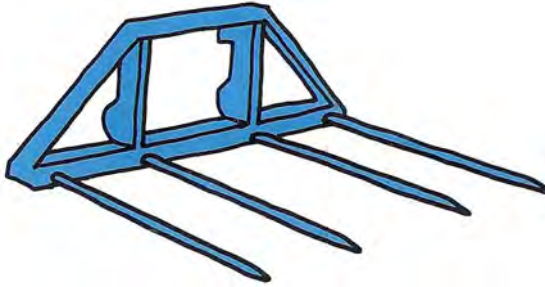
Heavy duty
digging bucket



Manure or silage
fork and top grab



Bale clamp



Bale fork

There are a wide range of attachments which can be fitted to rough terrain forklift trucks and telescopic handlers. These are purpose-designed to enable the truck to handle such materials as manure, bales of straw or hay, silage, bagged and loose fertilisers or cereals, etc. Dozer blades for dung clearance and snow ploughs are also available.

Forklift Truck Design

DESIGN REGULATIONS

Forklift trucks are designed and tested to internationally agreed standards which are frequently reviewed and up-dated.



THE MAIN PARTS OF A FORKLIFT TRUCK

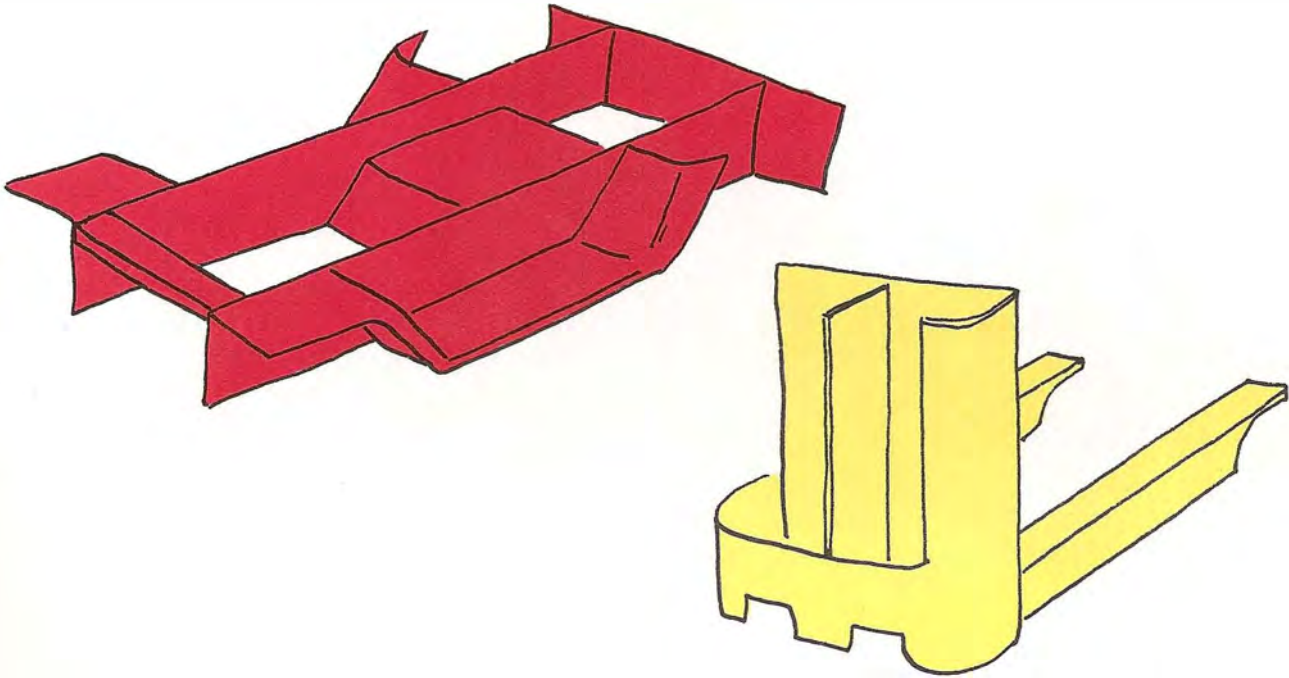
A truck comprises the following main parts.

- CHASSIS AND COUNTERWEIGHT
- WHEELS AND TYRES
- MOTOR AND POWER TRANSMISSION
- HYDRAULIC SYSTEM
- LIFTING SYSTEM
- STEERING AND BRAKE SYSTEMS

Chassis and Counterweight

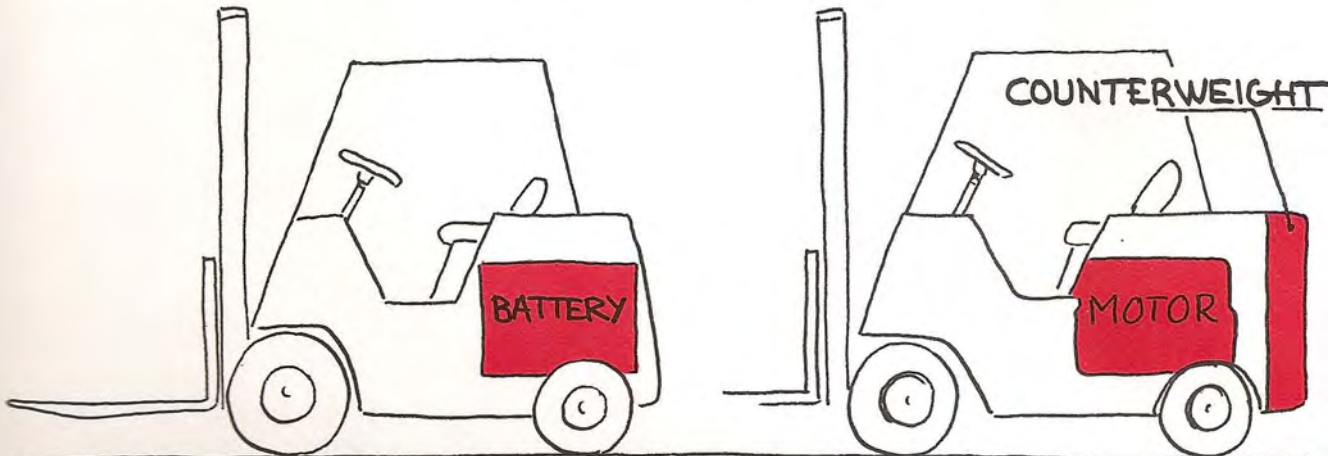
A truck is built on a load-bearing chassis. The greatest stresses for a counterbalanced truck occur where the front axle fits onto the chassis. These forces are greatest when the truck is fully loaded, because then the front wheels bear almost the entire weight of the truck and load.

The chassis of a pallet truck is characterized by the pallet legs. Since the load is carried between the wheel axles the weight is more evenly distributed between the front and rear axles than in the case of the counterbalanced truck.



COUNTERWEIGHT

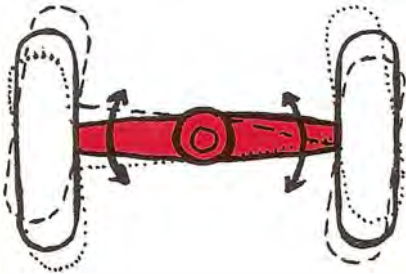
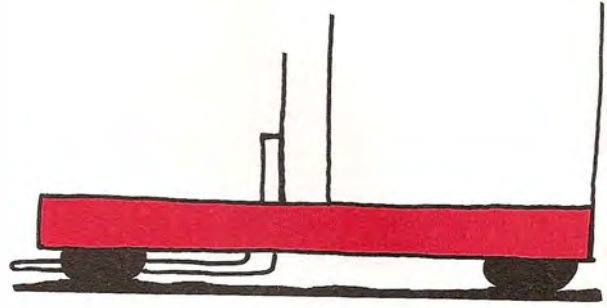
The rear of the counterbalanced truck must be heavy in order to meet the balance demands and to avoid tipping forward. The necessary counterweight is achieved by placing the motor and battery as far to the rear as possible and by adding an additional heavy weight.



Wheels and Tyres

WHEEL SUSPENSION

The truck has rigid suspension in order to have lateral stability when loading (especially necessary for high lifts).



The middle of the back axle of the four-wheeled counterbalanced truck is suspended from its centre. This means that all four wheels are in contact with the ground, even when the ground is uneven.

TYRES

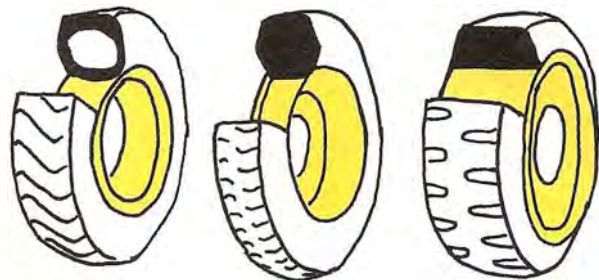
There are three different types of tyre available depending on where and how the truck is to be used:

- Pneumatic tyres
- Cushion tyres
- Solid tyres

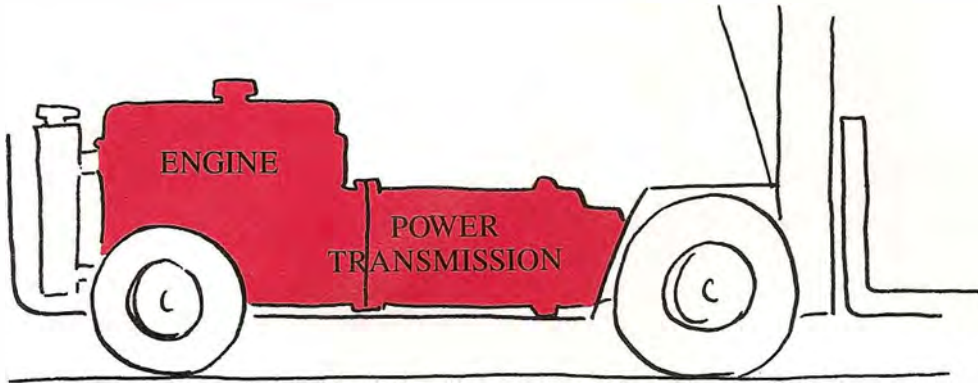
Counterbalanced trucks that work outdoors often use pneumatic tyres. They give a softer ride on uneven surfaces.

Cushion tyres are most suitable if you drive indoors. They have a lower roll resistance and eliminate the risk of getting a puncture. Furthermore, the truck is more stable, which is important for high lifts.

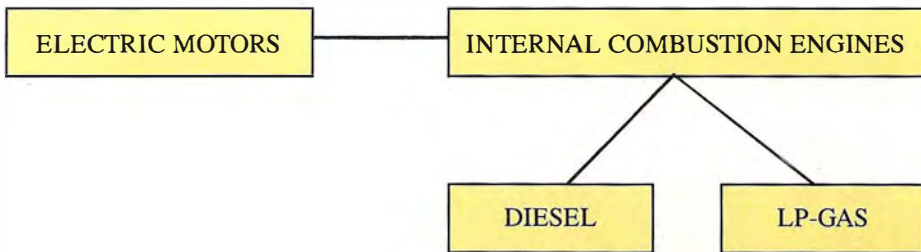
Reach trucks, pallet trucks and other high-lift trucks are normally fitted with solid tyres. The consistency of these tyres increases the lateral stability of the truck.



Motors and Engines



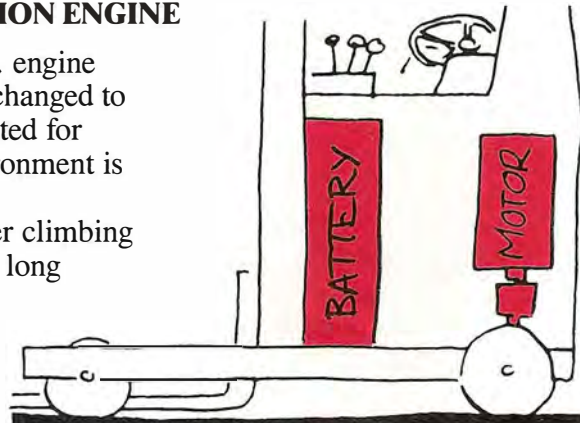
A truck can either be driven by an electric motor or an internal combustion engine. The most common IC engines in forklift trucks are the diesel engine and the LP-gas engine.



ELECTRIC MOTORS OR INTERNAL COMBUSTION ENGINE

Electric driven trucks are cleaner and quieter than I.C. engine drive trucks, but their batteries have to be charged or changed to cater for extended working hours. They are ideally suited for working indoors; particularly where a fume-free environment is essential.

I.C. engine driven trucks are much faster — have better climbing ability — and are better suited for outside work where long distance travel is involved.



DIESEL DRIVEN TRUCKS

The diesel engine is a very common type of power-plant used in counterbalanced trucks. It does not have spark plugs or a distributor.

The diesel engine is fitted with an injection pump which ensures that the fuel/air mixture is always injected into the "correct" cylinder. However, this type of engine gives off very unpleasant, noxious, fumes which include unburnt hydrocarbons and nitrous gases.

DIESEL

Advantages: — Better suited to outside work than battery-driven trucks.

Disadvantages: — Unpleasant fumes which include nitrous gases and unburnt hydrocarbons.
— Has only limited indoor use and should be fitted with an exhaust gas filter system if used indoors.
— High noise level.

LP-GAS DRIVEN TRUCKS

The LP-gas engine is of similar design to the petrol engine. The only difference is that the carburetter is equipped with an evaporator and regulator in which the gas is mixed with air. The LP-gas engine emits less unpleasant fumes than the diesel engine, but the virtually invisible exhaust gases contain more carbon monoxide.

LP-gas engines can be difficult to start in cold weather, due to LP-gas evaporation problems. To overcome this difficulty, pre-heat systems are fitted.

Advantages: — Unlimited no. of working hours/shift
— Clean engine = reduced engine wear
— Better climbing ability than battery driven trucks
— Better suited to outside work than battery driven trucks.

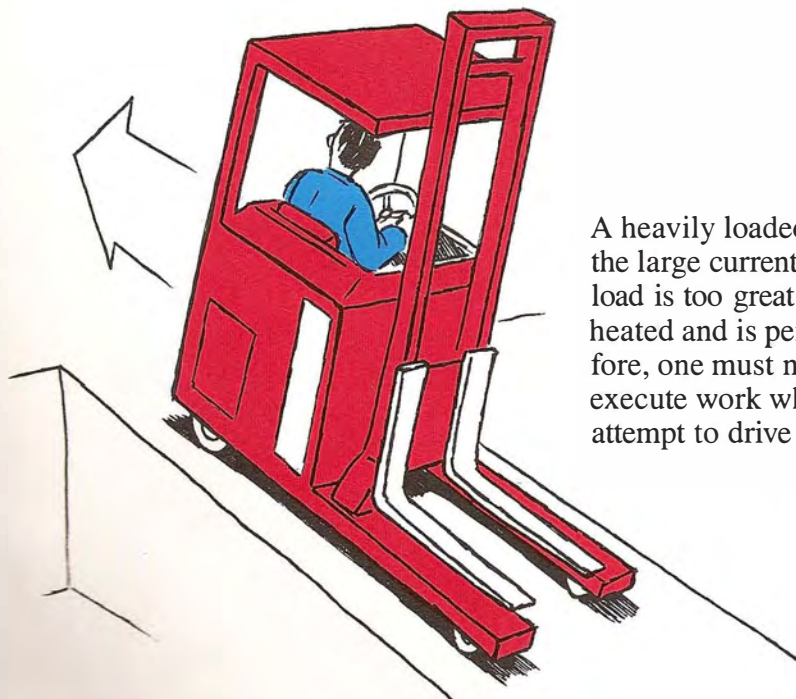
Disadvantages: — Invisible and virtually odourless fumes which normally contain more carbon monoxide than diesel exhaust fumes.
— Should be fitted with exhaust gas filter system for indoor use.
— Handling of LP-gas cylinders.

BATTERY DRIVEN TRUCKS

Battery driven trucks are ideal for operating indoors because there is a low noise level and no exhaust fumes. The speed of a battery driven truck is normally regulated by an accelerator which, in turn, is linked to a solid state electronic system, geared to controlling the power supplied to the motor from the battery. Modern trucks use stepless control systems that result in extremely smooth acceleration and deceleration.

BATTERY DRIVEN

- Advantages:
- No exhaust fumes.
 - Low noise level.
 - Very smooth control.
 - Low operational and maintenance costs.
- Disadvantages:
- Need spare batteries for extended shift working.
 - Expensive batteries and re-chargers.
 - Poor climbing ability.

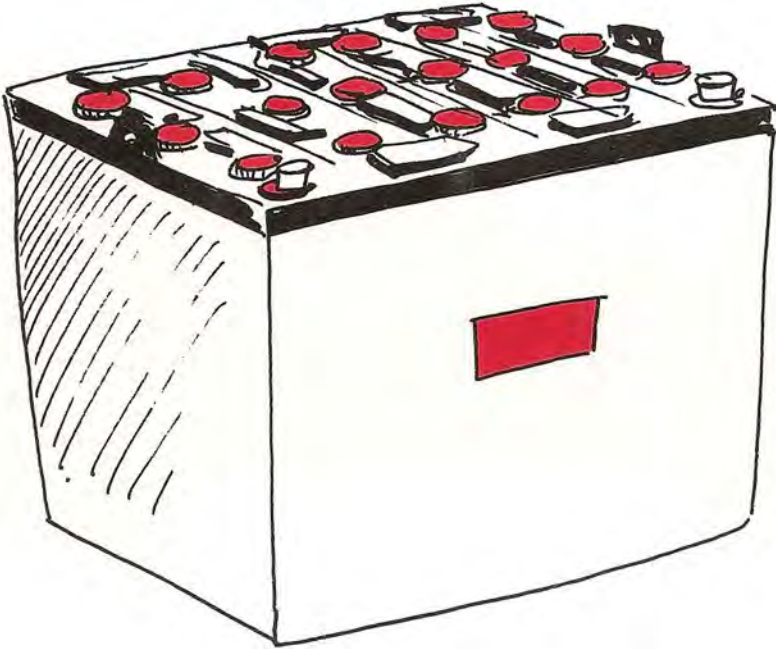


A heavily loaded battery driven motor gets hot due to the large current passing through the windings. If the load is too great or long-lasting the motor becomes overheated and is permanently damaged (burnt out). Therefore, one must never force a battery driven truck to execute work which is beyond its capacity, e.g. to attempt to drive up a too steep an incline.

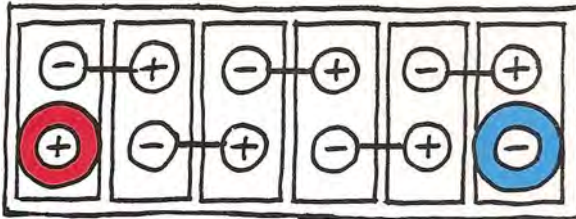
BATTERIES

The lead accumulator (the battery) provides the energy for battery driven trucks. This can store electric energy in the form of chemical energy.

Each battery cell consists of a positively and negatively charged plate in a bath of diluted sulphuric acid. There are separators between the plates to prevent short-circuiting in the cell.



The battery is made up of cells which are connected in series. Each cell has a voltage of approx 2 volt (v). 6 cells in series provide the battery with a voltage of 12 v, 12 cells in series provide 24 v etc.



Series connection
6 cells = 12 v

The voltage (v) of the battery is determined in the basic design of the truck. In general, most floor trucks operate at 24 volts, reach truck at 48 volts and four wheel counterbalanced trucks at 72 volts (or 80 volts in Germany).

The capacity of a battery is given in ampere hours (Ah), which shows the number of amperes (A) which the battery can provide during a certain number of hours (h). The capacity of a truck battery is usually given at 5 hours discharge (Ah/5h). However, from the point of view of indicating the energy available in a battery and, therefore, the amount of work it can do per charge, battery capacity must always be quoted in kilowatt hours (kW h).

$$\text{kW h} = \frac{v \times \text{Ah}}{1000}$$

On most trucks a choice of battery capacity is available.

One should never fit different sized batteries to a forklift truck without consulting the manufacturer of the truck because the battery forms an essential part of the truck's counter-weight.

Capacity:

$$400 \text{ Ah} = 80 \text{ A} \times 5 \text{ h}$$

$$\frac{v \times \text{Ah}}{1000} = \text{kWh}$$



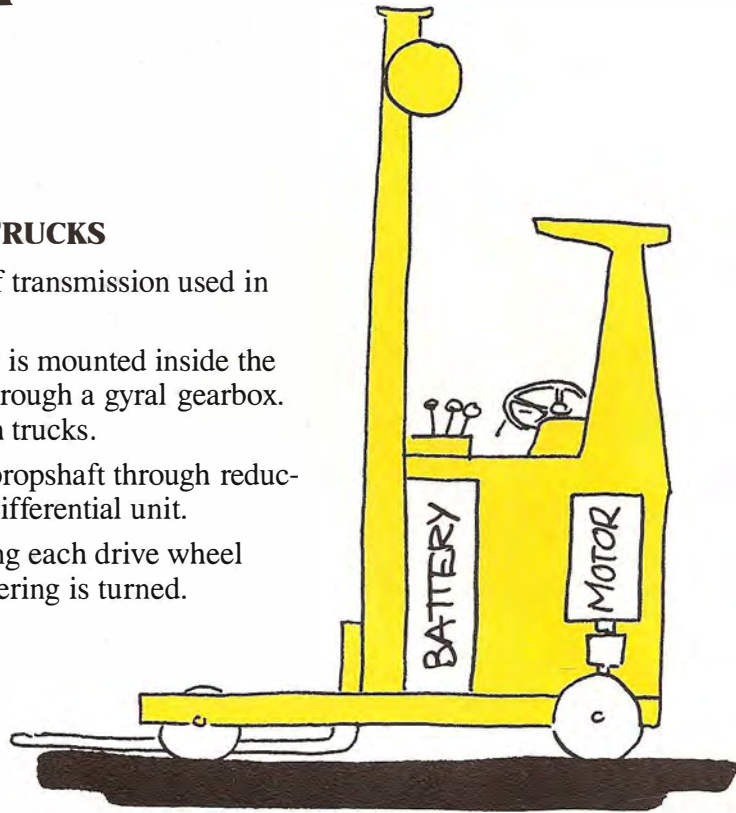
A battery eventually wears out, this means that its ability to be recharged decreases with time. A battery which is badly treated can quickly deteriorate. It is important to follow battery maintenance instructions since batteries are very expensive.

Power transmission

TRANSMISSION FOR ELECTRIC TRUCKS

In simple terms, there are three types of transmission used in electric driven trucks.

1. Motor in wheel. The electric motor is mounted inside the drive wheel and drives the wheel through a gyrax gearbox. This type is normally fitted to reach trucks.
2. Direct drive. One motor turning a propshaft through reduction gears to a standard drive axle differential unit.
3. Electric differential. A motor driving each drive wheel which switches on or off, as the steering is turned.



TRANSMISSION IN I/C DRIVEN TRUCKS

In simple terms, there are three types of transmission used in Internal Combustion engine driven trucks.

1. Conventional transmission. Driven via a clutch and manual gearbox, through a propshaft and differential; very similar to a motor car.
2. Automatic transmission. Driven via a torque converter to a propshaft and differential gears.
3. Hydrostatic transmission, i.e. the truck engine drives a hydraulic pump, which in turn drives one or more hydraulic motors connected to the wheels.

Hydraulic System

HYDRAULIC SYSTEM

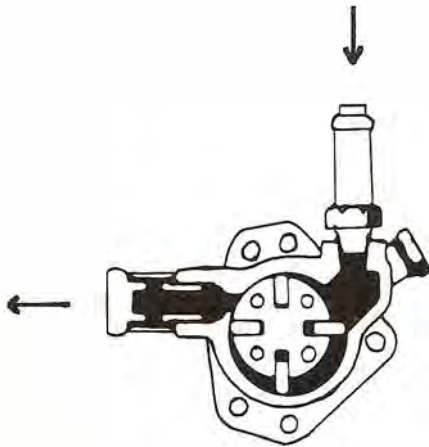
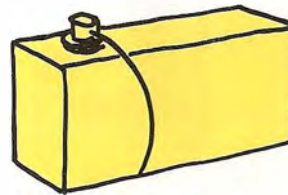
A hydraulic system is required in order for the truck to be able to lift the specified load, tilt (the forks) and perhaps slide the mast backwards and forwards, or operate attachments. The main components of the hydraulic system are:

- hydraulic pump
- hydraulic oil tank
- oil filters
- control valves
- pressure relief valve
- flow control valve
- jacks - lift, tilt, reach, etc.

HYDRAULIC OIL TANK

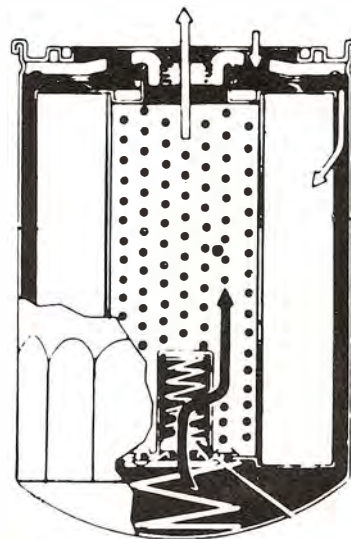
The hydraulic oil is kept in a tank. Both the outlet and inlet pipes are fitted to it.

Too little oil in the tank can result in not being able to raise the forks to their topmost position or, in the worst case, a breakdown in the steering system (if it is hydraulic).



HYDRAULIC PUMP

It is necessary that the oil can be fed into the cylinders under pressure if the hydraulic system is to fulfil the functions demanded of it. This pressure is obtained by means of a pump. The gear-driven pump and the piston pump are two common types of hydraulic pump.

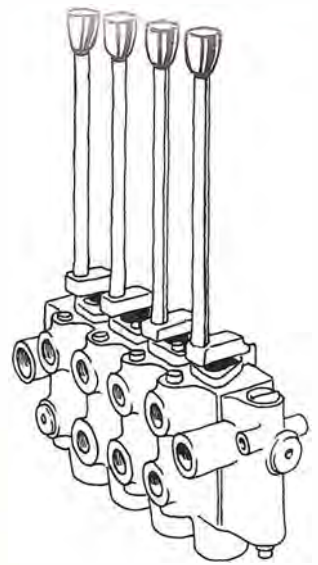
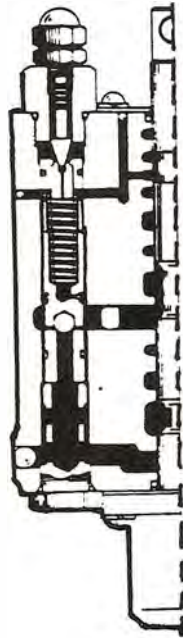


OIL FILTER

It is extremely important that hydraulic oil is kept meticulously clean. For this reason, two filters are fitted to the system. One of those is a coarse filter, similar to the type fitted to motor car engines, the other is a micro filter which, as the name implies, filters all extremely small foreign bodies and particles from the hydraulic oil during circulation through the system.

CONTROL VALVES

Control valves are the parts of the hydraulic system which you are in contact with. You regulate the control valves and thus the direction of the oil flow by means of the lift and tilt levers, etc.



RELIEF VALVE

A relief valve is built into the control valve system to avoid too high a pressure being built up.

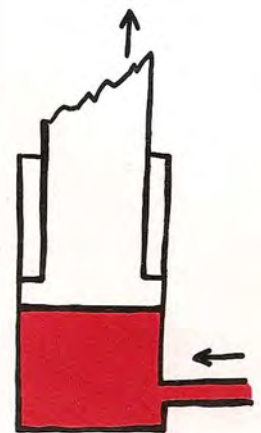
This valve allows excess oil to flow back to the tank when the maximum pressure is exceeded.

WORKING JACKS

There are two types of working jack (hydraulic cylinders):

- single-acting jack, e.g. the lift jack
- double acting jack, e.g. the tilt jack or reach jack.

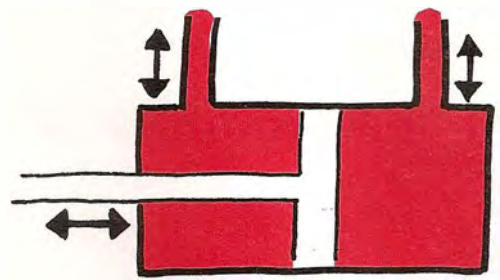
The hydraulic pressure in a single-acting jack can press the piston in one direction only (upwards in a lift jack), while a further force is required (force of gravity on the forks and load) to press back the piston. This means that a single-acting jack has oil on one side of the piston only. In order to lubricate the jack you must raise the forks to the top position at least once each working day.



SINGLE-ACTING

There is oil on both sides of the piston head in a double-acting jack. The piston can be made to carry out the desired movements by regulating the oil flow to the jack.

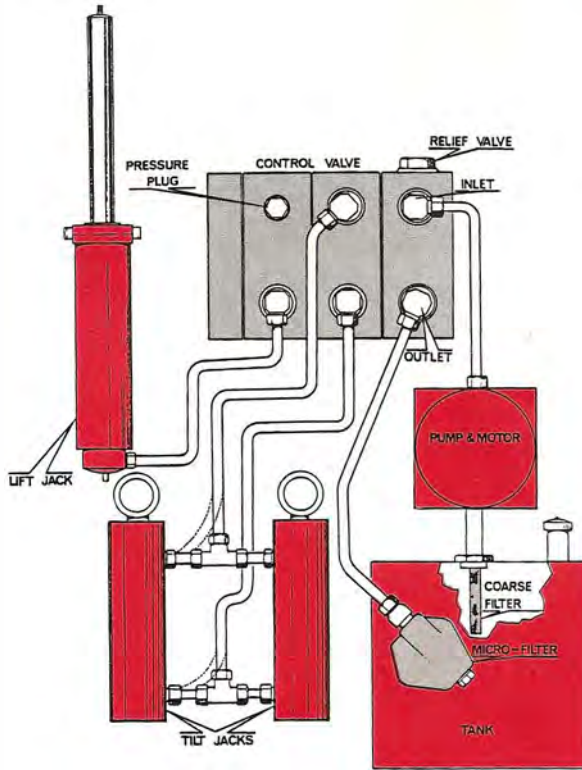
Piston rod surfaces must be as smooth as glass and coated with a thin layer of oil. Scratched surfaces shorten the life of a piston rod and the effectiveness of the packing.



DOUBLE—ACTING

A COMPLETE HYDRAULIC SYSTEM

We have now discussed the most important components of a hydraulic system. These are connected together as shown in the figure below to form the hydraulic system of the truck.



OVERHEATING

If the hydraulic oil becomes overheated, its viscosity decreases (it flows more easily) and its lubrication ability deteriorates. This can lead to the oil pump and control valves being damaged.

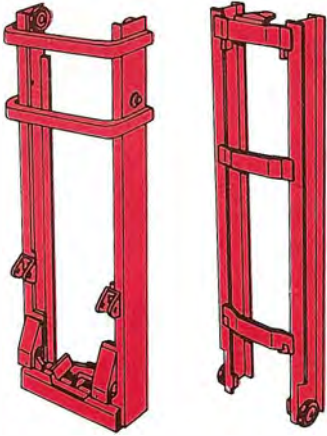
HIGH PRESSURE

The hydraulic system works under high oil pressure. A damaged hydraulic hose or damaged packing can easily burst and this will result in oil squirting out under high pressure. A serious accident can result if someone is hit by the oil as a result of a hydraulic failure.

Also, if the hydraulic system is subjected to shock forces, e.g. if you drive a loaded truck over uneven surfaces or if you use the controls on a loaded truck roughly, unusually high oil pressure results. Again, there is a great risk of hydraulic failure which could result in an accident.

LIFTING SYSTEM

The lifting system of a truck comprises a mast, lift jack, fork carriage and chains.

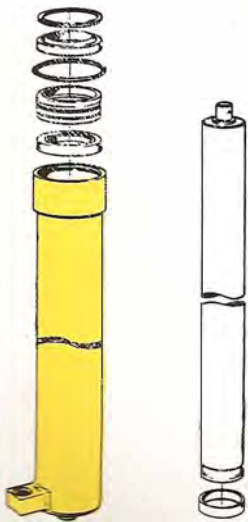
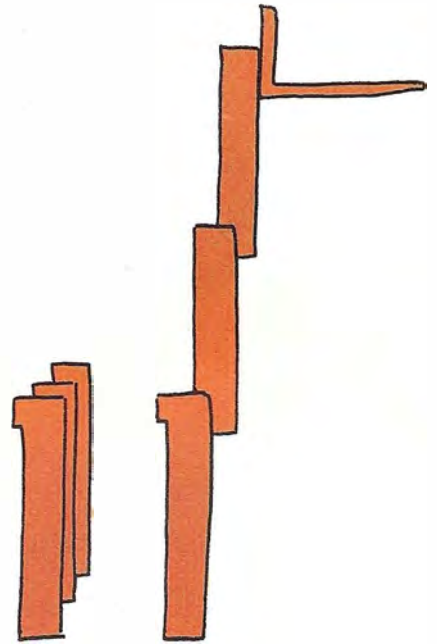


MAST

The mast consists of an outer and an inner mast. The outer mast is fixed to the truck chassis. The lift jack can move the inner mast which is mounted by means of rollers or slide bearings in the outer mast.

Many different types of masts are available, e.g. two-, three- or four-stage masts.

A three- or four stage mast is used to obtain as low a closed mast height truck as possible in relation to lift height. High-lift trucks have three- or four-stage masts.



Outer cylinder

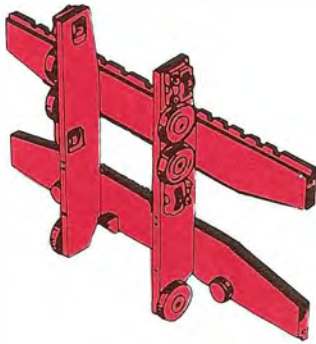
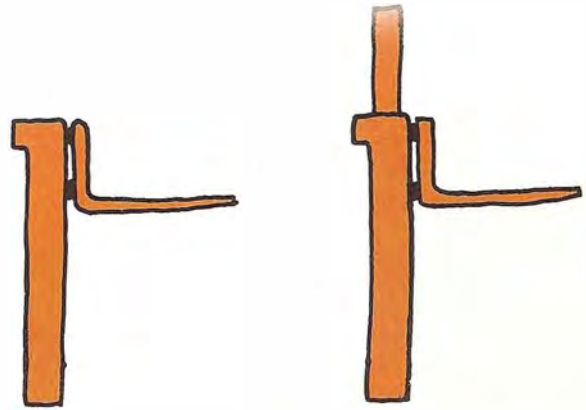
Piston

LIFT JACK

Consists of a piston enclosed within an outer cylinder. The lift jack is often positioned in the middle of the mast. Modern lift trucks have two lift jacks, each positioned in line with one of the mast beams, in order to improve forward vision.

FREE LIFT

Free lift is a term which is used to state how high the forks may be lifted without extending the mast. Full free lift means that the fork carriage can be lifted to the top of the outer mast before the inner mast starts to rise.

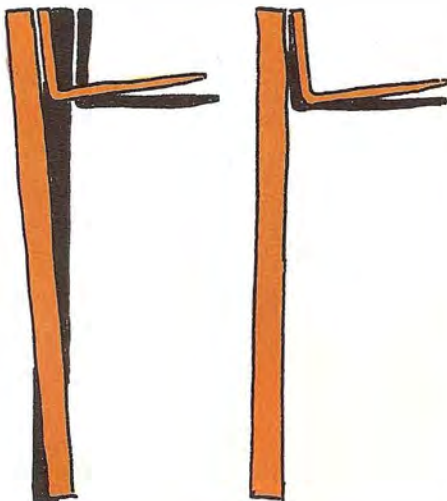
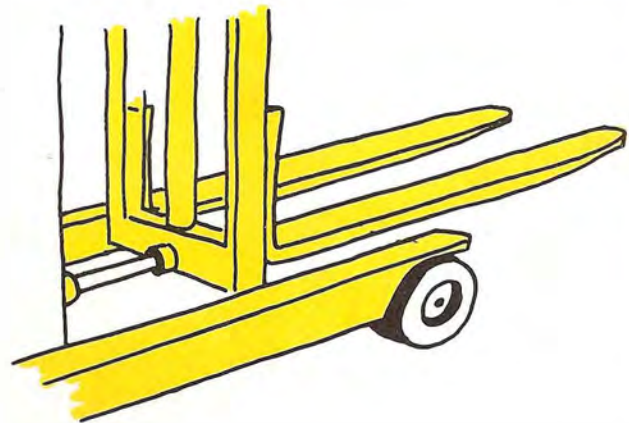


FORK CARRIAGE

The fork carriage is suspended on lifting chains and runs on rollers within the inner mast frame.

REACH TRUCK

The entire lifting system on a reach truck can be moved longitudinally. The lifting system is fixed to a mobile carriage that runs inside the reach legs at one end and is supported by an inner reach beam at the other end.



TILTING

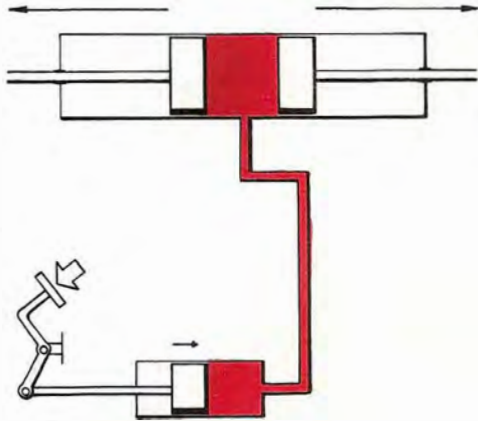
This means having the forks at an angle of tilt. This is achieved on most trucks by tilting the mast either forwards or backwards. On trucks with fixed masts, the hydraulic system is modified to provide a facility where only the forks, and not the mast, is tilted.

Brakes and Steering

BRAKING SYSTEMS

Brake actuation is of the greatest importance in ensuring secure handling.

The operator must never use a truck with defective brakes. Many electrically operated trucks are fitted with rheostatic, regenerative or opposite direction braking systems, in addition to mechanical brakes. These electric braking systems have the effect of slowing the truck down when the accelerator pedal is released.



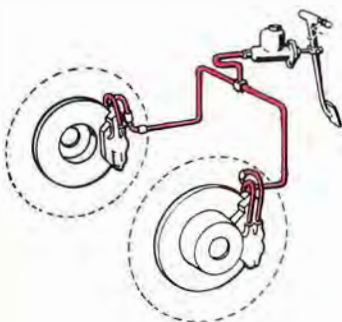
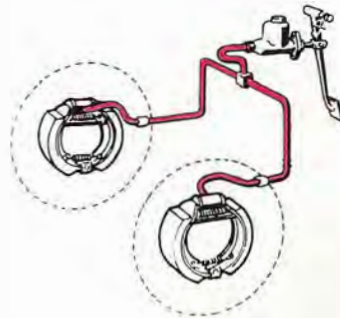
HYDRAULIC BRAKES

Braking power transmission is hydraulic. The brake pedal regulates the piston in the main brake cylinder.

When the brake pedal is pressed, hydraulic oil is forced from the main cylinder into the wheel cylinders where the pressure on the pistons activates the brake shoes or pads.

DRUM BRAKES

The fixed brake shoes are pressed against the rotating brake drums when the brakes are actuated on a truck fitted with drum brakes. Braking effect is achieved by means of the friction between the brake shoes and the brake drums.



DISC BRAKES

Two brake pads, one on each side, are pressed against the brake disc which rotates with the wheel. The advantages of disc brakes over drum brakes are the effective cooling of the disc brakes and the even braking effect.

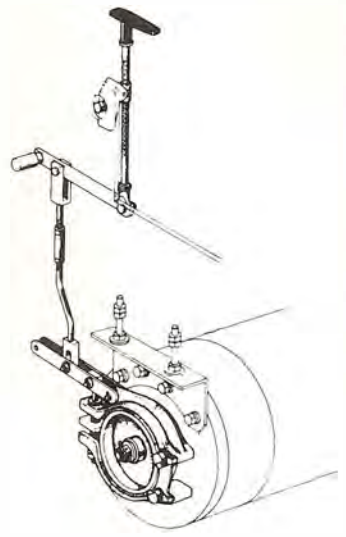
A disadvantage of disc brakes is that they get dirty easily.

PARKING BRAKES

A truck should either be equipped with a parking brake or with a brake that is automatically actuated when the operator leaves the cab, or with an audible alarm signal which goes off if the operator forgets to apply the mechanical brake.

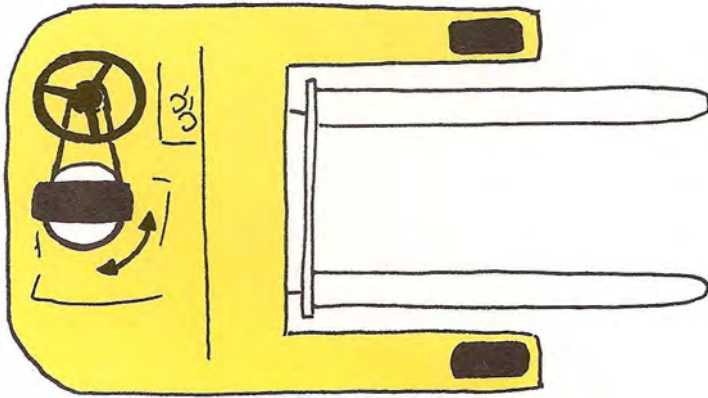
The parking brake can be a drum, disc or universal brake. The universal brake acts directly on the universal driving shaft before the gearbox.

Use the parking brake for parking and not for normal braking!



STEERING SYSTEM

There are many different steering systems available for trucks. The steering transmission for smaller trucks, three-wheeled counterbalanced trucks, is via a chain or toothed transmission gear. Others are fitted with recirculating ball steering assemblies. Large trucks usually employ some form of power-assisted steering system similar to that used in heavy lorries.

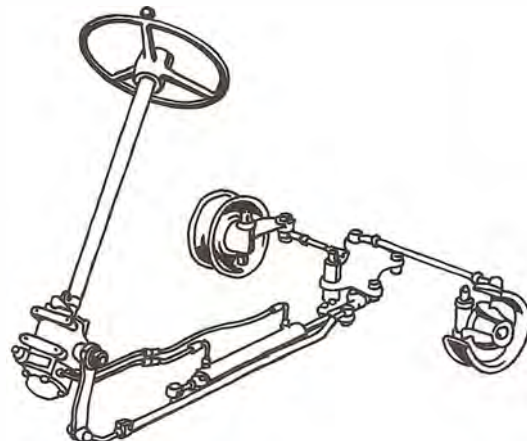


The counterweight on a counterbalanced truck keeps the steered wheel on the ground. Therefore, the steering is heavy when the truck is not loaded. When the truck is loaded the force acting on the steered wheels is lessened and steering becomes easier.

If your truck is equipped with power or hydrostatic steering you cannot feel the force required to turn the wheels.

Turning the steering wheel while the truck is at a stand-still can damage the steering equipment and scrub the tyres.

Avoid turning the wheels of a truck which is standing still.



FROM THE GROUND

Loading and unloading can either take place at ground level or from a loading bay. If you are working from the ground, you will need adequate access to both sides of the vehicle and firm ground (free of pot holes or man-holes covers).

Remember that the truck tilts forward when taking up heavy loads at the same time as the lorry platform springs upwards. Be careful not to damage the truck or vehicle.

Place loads tight up to each other to prevent movement in transit. If your truck is not fitted with a side-shift attachment, use the "gating" method.



UNLOADING LORRIES AND TRAILERS

If unloading from the ground, take loads off from alternate sides of the vehicle, otherwise, the trailer bed will lean to such an angle that it will be impossible to insert the forks into a pallet, or under the loads. In extreme cases, the vehicle will capsize.

Use the "gating" method or side-shift when removing loads, to ensure that adjacent loads are not damaged.

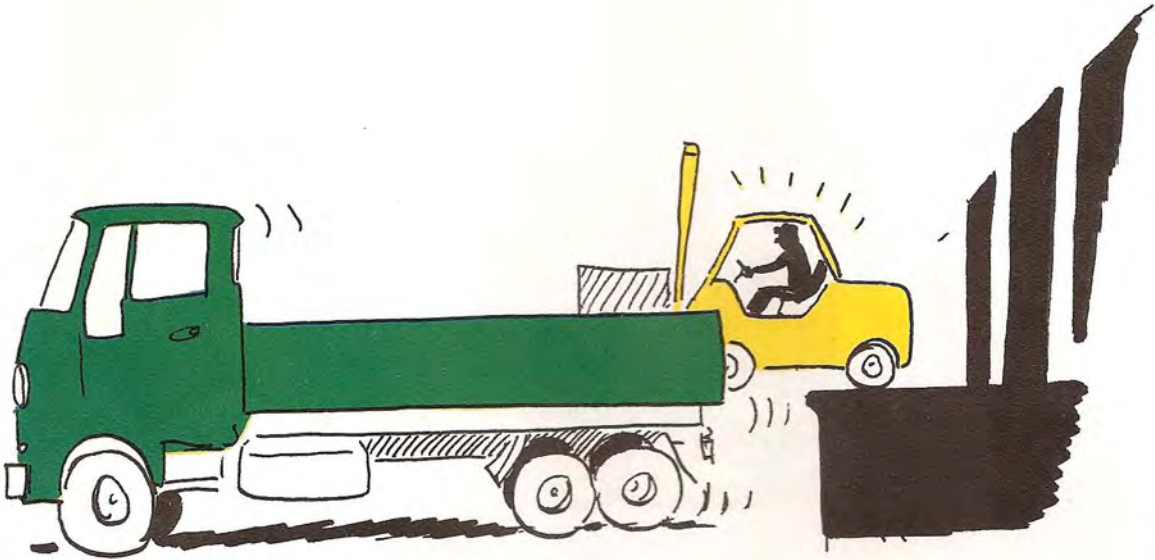
Endeavour to unload from the rear, working towards the headboard of the vehicle.

As each load is removed, take it well away from the vehicle so as not to impede future progress by cluttering-up your work area.

FROM A LOADING BAY OR PLATFORM

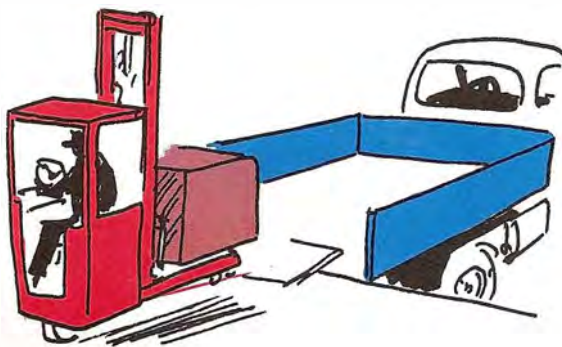
Double check that the brakes are applied on the vehicle or railway wagon you are loading or unloading. The parking brake must always be on or chocks must be placed under the wheels.

A truck which drives onto a lorry platform or a railway wagon has such a large live force that it can easily set an unbraked vehicle or wagon in motion.



Before you drive onto a lorry platform or a railway wagon, you must check that it has a sufficient bearing capacity. Keep in mind that a loaded truck can have a very high point loading. The bridge plate or dock leveller must be adequately wide and strong. It must also be placed so that it will not move as the truck drives over it.

When stacking in covered loading spaces with limited roof height, your truck must have a free lift mast of low design. A sideshift attachment is useful, because of the limited space. The loading space is often dark and the walls and roof thin, all of which calls for careful handling.



Towing trailers

Many companies use towing vehicles with trailers for transporting goods over longer distances.

Tractors or special towing trucks, and also forklift trucks, are used for towing. The fork lift trucks have the advantage of being able to load and unload their own trailers. However, rear wheel steered forklift trucks are not ideal tow vehicles and trailers may not be towed by rear wheel steered vehicles on public roads, unless specific permission has been obtained from the police and local authority.

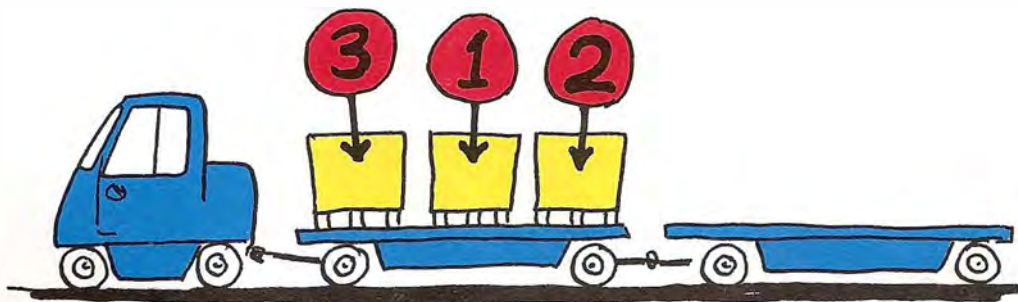


TRAILERS

Trailers come in many different shapes and sizes, depending on how they are to be used. They can have 2 or 4 wheel steering, be fitted with brakes, have sides and/or roof etc. They can be used as a single trailer or be coupled into a trailer train.

When you are loading a trailer train, you should start by placing the heaviest loads onto the trailer, closest to the towing vehicle.

The first load should be placed in the centre of the trailer to ensure that the trailer does not overturn. Suitable loading order is shown in the figure below. Trailers must be unloaded in reverse order. There are often local rules which you must follow.



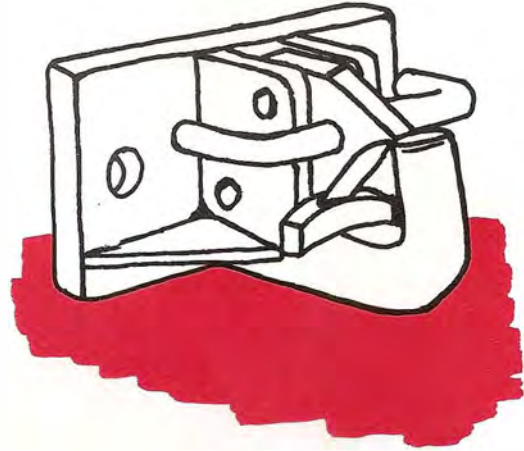
RESPONSIBILITY

As the driver of a vehicle train, you are responsible for the truck, trailers and load. The load must be secure and if necessary, anchored. If another truck operator loads the trailers that you are going to tow, this operator must follow your instructions. Before you couple already loaded trailers, you must check that the loads are secure.



TRAILER COUPLING

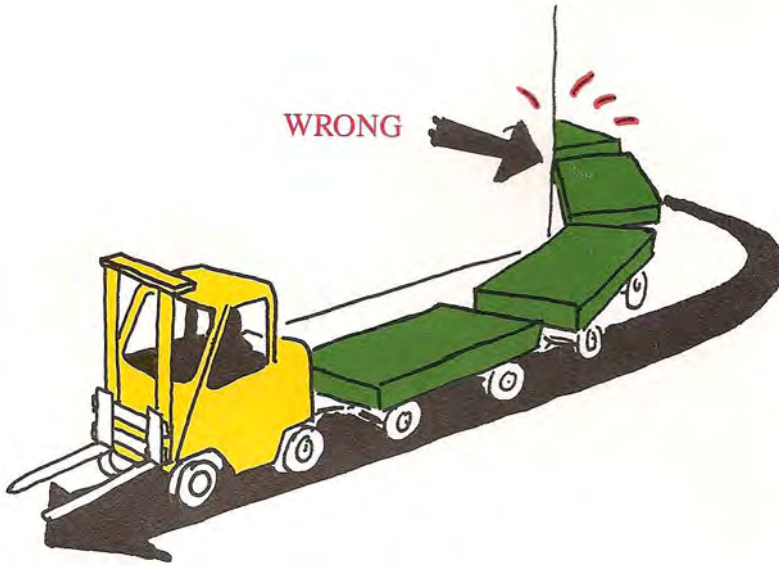
This is how you should couple a trailer: reverse the towing vehicle toward the trailer so that the couplings are aligned with one another and couple the trailer carefully. Check that all trailers are correctly coupled before you drive. Always start slowly, so that the couplings are not torn apart. If a lighting system is incorporated you must ensure that the cables are coupled correctly.



DRIVING WITH TRAILERS

When turning corners you must take into consideration the steering system of the trailers, since two wheel steered trailers cut inwards in corners whereas four wheel steered trailers follow the line of the towing vehicle.

High speeds, especially combined with corners or driving downhill, can give rise to powerful lateral movement. This risk is especially great when driving with empty or lightly loaded trailers. Careful driving and braking is a necessity when manoeuvring a vehicle train. When driving on public roads the vehicle train must be equipped in accordance with the regulations in force.



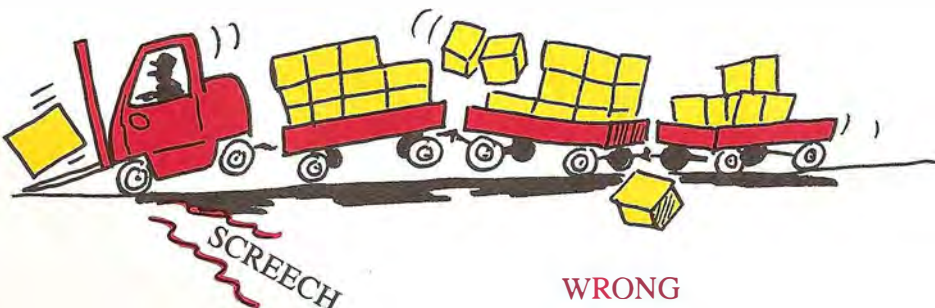
BRAKING AND PARKING

The crucial safety factor for a vehicle train is its capacity to stop, not the towing vehicle's capacity to tow.

Always start braking in good time, so that you can gently pull up at the required point. Remember that a vehicle train cannot be reversed into the right position. Sudden braking can cause the load to slide on the trailers and it is possible that the trailers can run into one another or overturn. Most emergency braking can be avoided if you drive carefully and at a steady speed, and take into consideration both the load and road surface conditions.

If possible, trailers should be parked on even ground. When left, the parking brakes of the trailers must be applied or chocks placed under the wheels. Brakes must be applied before the towing vehicle is uncoupled.

If the trailers have mechanical brakes, you must check that these are released before you move off with the trailer in tow.



Safe Truck Operation

TRAFFIC ENVIRONMENT

The word environment is used in many different connections within industry. Perhaps it is most often used in relation to noise, ventilation, lighting etc. It is seldom that we hear of traffic environment. However, despite this, it is of great importance and affects almost every employee.

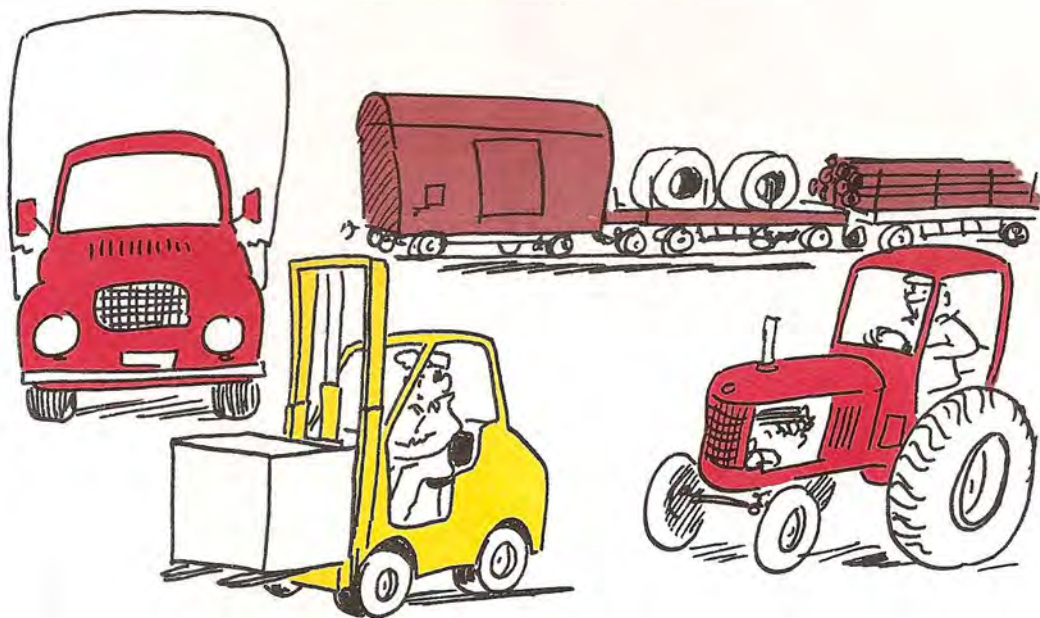
What constitutes a good traffic environment? In short, it can be defined as: different categories of road users being able to carry out their work without exposing others to health or accident risks.

Your employer has a responsibility to ensure, in so far as is practicable, a safe system of work.

DIFFERENT CATEGORIES OF ROAD USERS MUST CO-OPERATE WITH EACH OTHER

There are many different types of road users in any industrial area. Proper roads around factories are often lacking. Driving areas and storage areas can overlap and it can be difficult to know which is which. Truck operators can easily become irritated when it is difficult to get through with their vehicles.

Rules and the co-operation of all employees are necessary in order to have a good traffic environment. This applies to both drivers of vehicles and pedestrians.



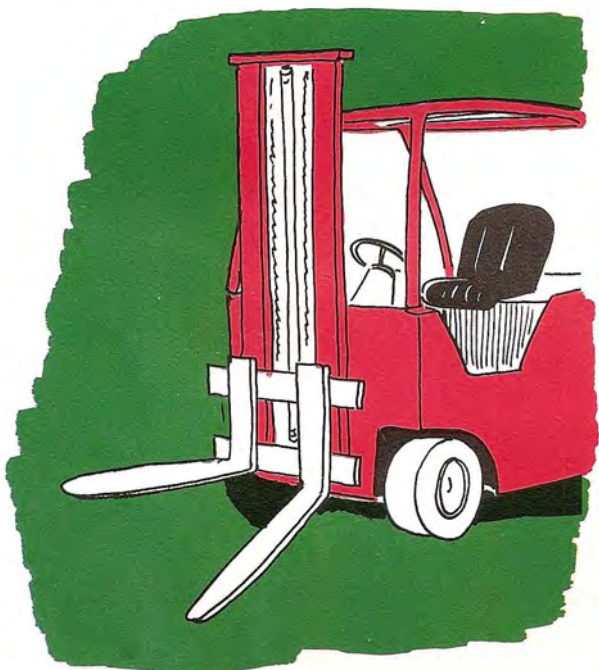
TRUCKS AND PEDESTRIANS

Ideally, truck traffic and pedestrians should be separated from one another as much as possible, e.g. by means of marked pedestrian paths, separate doors and guard rails at doors to protect pedestrians. In certain cases it may be necessary to have special areas fenced off for truck traffic only. Pedestrians and cycle traffic must be completely prohibited in these special areas.

INFLUENCE TRAFFIC ENVIRONMENT

As a truck operator you can through your supervisor and safety officer influence the traffic environment by pointing out risks and suggesting improvements. This can apply to both your vehicle and other areas of traffic environment.

Suggestions regarding road markings, signs and different driving procedures can be of value and can help to increase traffic safety at your place of work.



WHEN NOT TO DRIVE YOUR TRUCK

A truck must not be used if it constitutes a safety risk. Brakes, steering and lifting device defects clearly mean that the truck must not be used and the responsibility lies with you, the operator. Therefore, refuse to operate a defective truck!

Furthermore, a truck must not be operated if repairs, alterations or adjustments have been executed without the approval of a supervisor.

A load must not be handled if it constitutes a safety risk. You must not handle the load if, for example, it is too heavy or badly loaded, or if the pallet is broken. Instead, report to your supervisor, so that the fault can be corrected!

NO PASSENGERS

Passengers must not be carried on forklift trucks unless a proper seat, approved by the manufacturer, has been fitted.



A TRUCK IS NOT A LIFT FOR PERSONNEL

It is highly dangerous to lift persons who stand on forks or pallets. Remember that you, as the truck operator, are always responsible. The fact that your supervisor or someone else states that they will accept responsibility is of no consequence.

A truck can only be used to lift persons if it is fitted with an approved working platform.

Your employer should seek assurance from the truck's manufacturer that the truck is suitable for use with a working platform.



- The platform should be equipped with:
 - means to secure the platform to the forks;
 - guard rails at least 1 m above the platform;
 - toe boards with a maximum height of 100 mm;
 - a gate which must open inwards and be spring-loaded;
 - a slip-resistant floor;
 - screens to prevent any person touching moving parts of the truck;
i.e. mast or chains
- The total weight of the platform plus persons and equipment must not exceed 50 % of the truck's rated lifting capacity
- Warning cones should be used to cordon off the area when a truck platform is being used. Working from a platform must only be attempted with the truck positioned on a firm, level surface.
- The driver should be specially trained in the use of the platform and stay at the controls when the platform is being elevated.
- The person on the platform must be able to communicate with the driver.
- The truck should not be driven whilst the platform is elevated.
- Ideally, there should be controls on the platform to stop the truck being moved when the platform is raised.

DRIVING ON PUBLIC ROADS

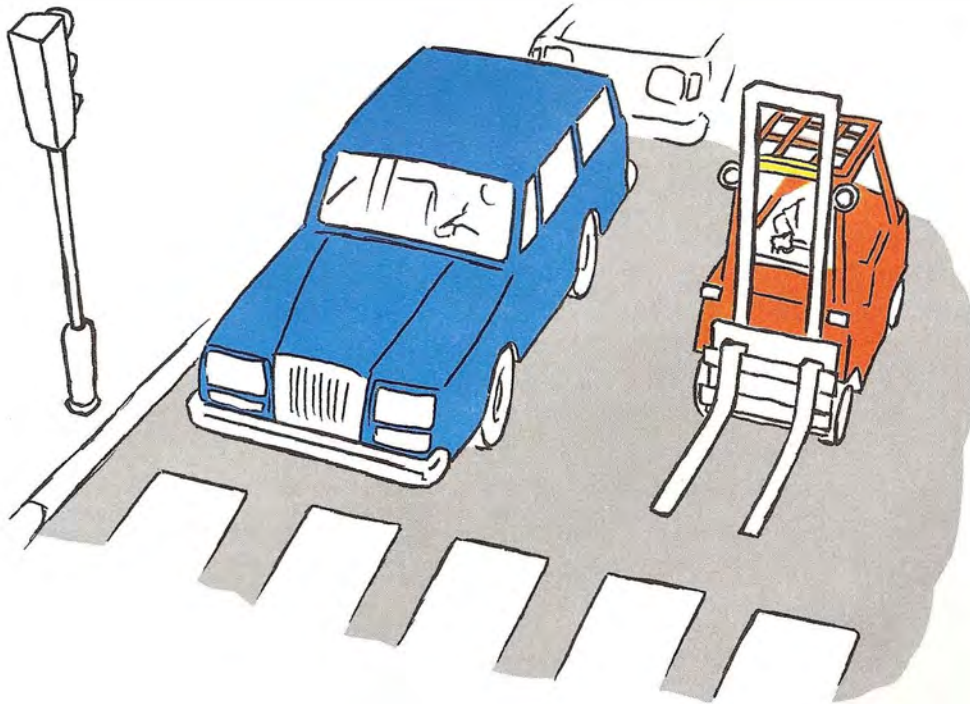
Your employer must obtain permission to use a forklift truck on public roads and it may have to have a current road fund licence and it must have adequate insurance, cover.

A truck which is driven on a public road may have to be equipped as required in law, e.g. with regard to conforming to lighting, indicators and reflector requirements.

The driver must hold the correct driving licence.

The law regarding the securing of loads must be followed when driving with a load on public roads. Remember that your visibility must not be restricted.

The rules regarding the use of a forklift truck can vary from one local authority to another – so it is important that the operator is thoroughly familiar with the rules that apply to him.



SLOW VEHICLE SIGN

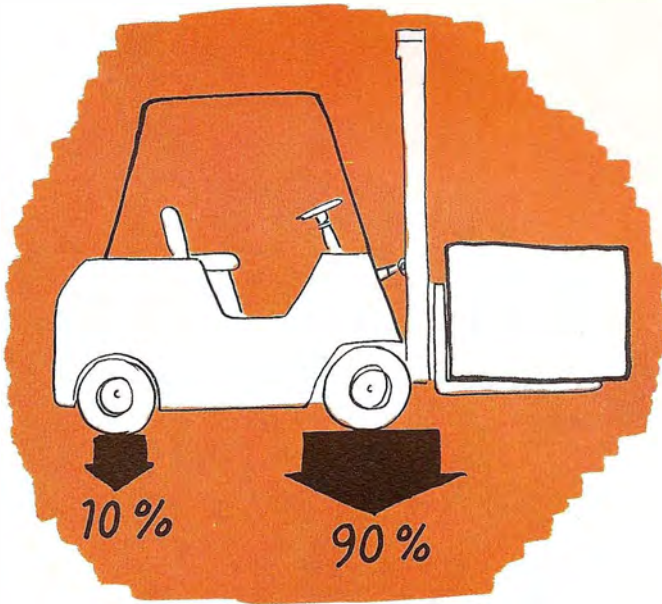
Ideally, the truck should carry a prominent SLOW VEHICLE sign to warn other road users that it is a slow moving vehicle.



TRUCKS IN LIFTS

A truck may be driven into a lift only if permission to do so has been obtained. Note that all not lifts are not suitable for the transportation of trucks. There must be nobody in the lift when a truck is driven in or out. A truck must always be driven into a lift so that the load enters first. The capacity of the lift must never be exceeded.

Switch off the motor and apply the parking brake before the lift starts to move.



FLOOR LOAD

Upper floors and mezzanines should have a sign stating the maximum SWL of the floor. Remember that a fully loaded counterbalanced truck carries 90% of the total weight (truck + load) on the front axle. The wheels are what bear the axle and these have a very small contact surface with the floor. This means that forces on the bearing surface under the truck can be very great.

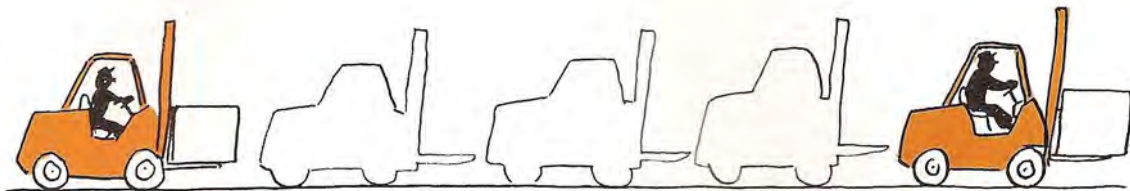
CLEARANCE

Watch for overhead clearance. Always check that you have sufficient clearance between the truck mast and door frames, cables, piping, overhead crane beams, racking, tie bars, or bridges etc.



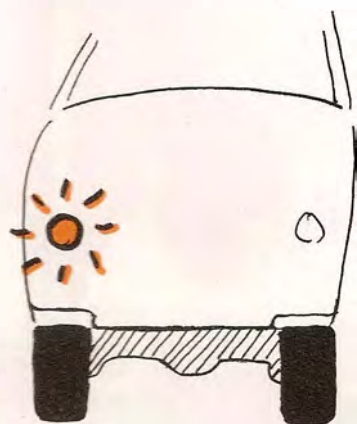
DISTANCE BETWEEN VEHICLES

When you drive behind another vehicle you must always keep in mind that the vehicle in front can suddenly brake. Therefore, always keep at least three truck lengths between you and the vehicle in front.



SIGNALLING

If your truck is fitted with indicators, use them – or give hand signals – to indicate when you are turning, in order that other vehicles and persons in the vicinity can see where you are going. If necessary, you should use the horn to attract the attention of others.



POOR OR RESTRICTED VISIBILITY

Drive slowly when visibility is poor or restricted, and use the horn to let others know you are coming. It is better to sound the horn once too often rather than too little.

If the load obstructs your view, you must reverse in order to be able to see where you are going. If you are driving up an incline where the load must lead, get a colleague to walk ahead and give you signals.

LOADED TRUCKS SHOULD HAVE PRIORITY

A loaded truck should be given right of way over an unloaded truck at crossings and in narrow passages. In other cases, the rules which apply in normal traffic are to be followed.

APPROPRIATE SPEEDS

You must always be prepared for the unexpected. Your speed should be suited to the existing road conditions, visibility and load. Keep in mind that the friction between the load and the forks can vary. Water, ice and oil etc. always result in reduced friction.

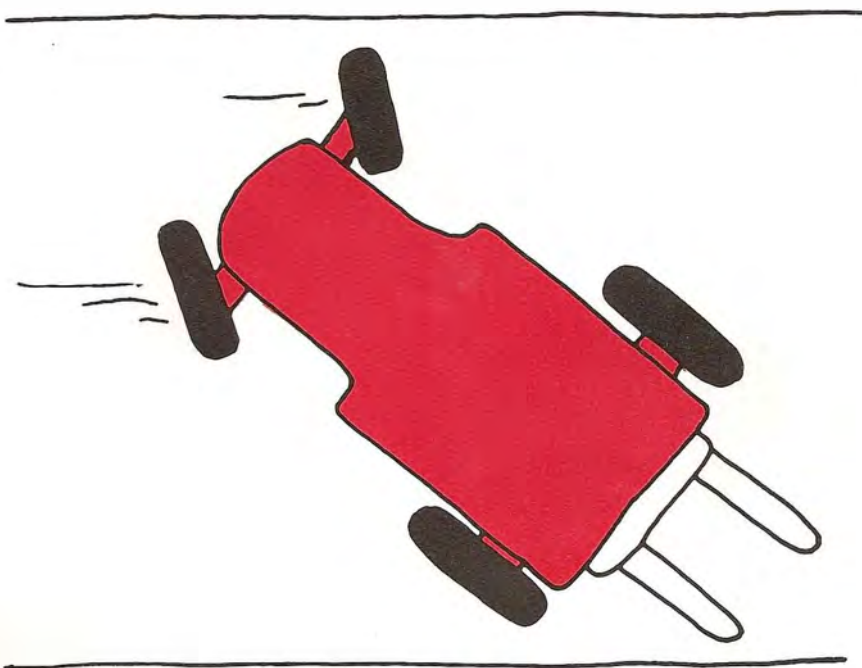
Avoid quick acceleration and sudden braking. Do not drive too fast around corners since the truck may overturn or the load may fall off. Special care must be taken on wet or slippery surfaces.



REAR WHEEL SKIDS

When an ordinary car with front wheel steering skids, the driver checks the skid by turning the front wheels in the direction of the skid. However, it does not help to turn the steering wheel when a rear wheel steered vehicle skids: either the wheels are turned into a more transverse position or else the vehicles swings around and overturns.

Badly worn or incorrectly inflated tyres can contribute to sudden and uncontrollable skids at high speeds.



DRIVING SPACE

A forklift truck can make very sharp turns due to the fact that it is rear wheel steered. Remember that the rear end of the truck has a greater turning radius than the front end, so watch out for rear end swing.

You must drive slowly in narrow passages and check that there is sufficient room for both the truck and the load.

All types of doorways not intended for two-way traffic must be crossed in the middle of the gangway.



DRIVE WITH LOWERED FORKS

Always drive with the forks as low as possible (10-15 cm above the ground) when loaded or unloaded. Raised forks are extremely dangerous in the event of an accident!

Lateral stability is poor and the risk of overturning high, if you drive with raised forks.

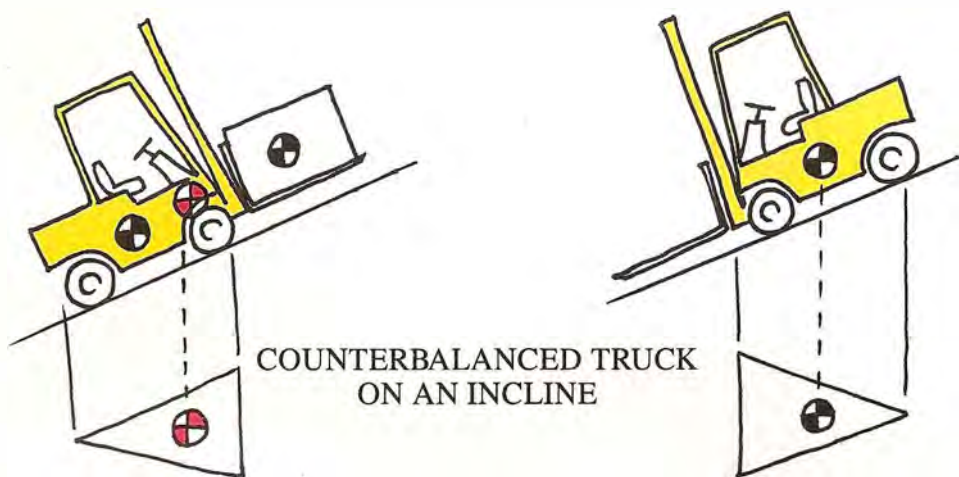
The same rules apply even if your truck is fitted with other handling attachments.

- The load must be raised when stacking, but **never turn with the load in a raised position** unless it is absolutely essential, and then perform the manoeuvre very carefully



DRIVING ON INCLINES

Driving on inclines always requires good judgement and great care. You must drive slowly and brake gently especially when going downhill. Never drive with the forks in a higher position than that which is necessary to clear the ground. Never turn on or drive laterally on a steep incline as there is a great risk of overturning. The direction in which you drive on an incline is of great importance. Empty trucks are driven in a different way to a loaded truck. Driving in the wrong manner can cause the truck to topple over, e.g. when braking.



Ideally, when driving an **unloaded counterbalanced truck** you must always have **the forks pointing downwards**. When **loaded**, you must have the load pointing towards the crown of the incline – **forks uphill**. Where this is not possible, (for example, when loading lorries using a portable ramp) descend the ramp with greater care.

DANGEROUS AREAS

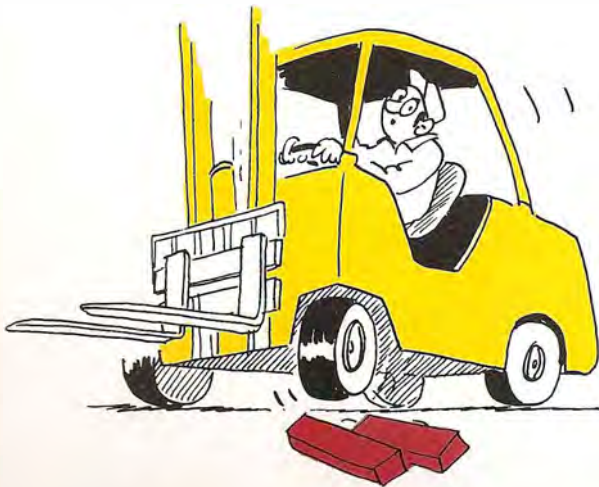
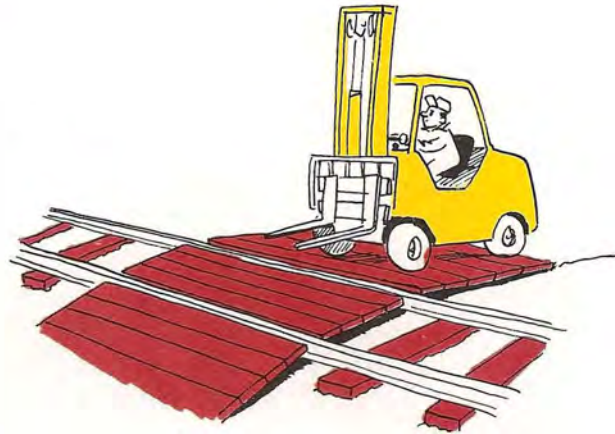
You must always take the greatest care when you drive on loading docks etc. For example, if a wheel is driven over an edge, the truck can fall over and a serious accident can result.

If you have an accident where your truck starts to overturn, remain in the driving seat and brace yourself and maintain a firm grip of the steering wheel. Never attempt to jump off the truck as it may then fall on you.



RAILWAY CROSSING OR KERBS

A truck is well and truly shaken even when driven slowly over a railway crossing or kerb. The crossing is less violent if you drive over the obstruction slowly at an angle, one wheel at a time.



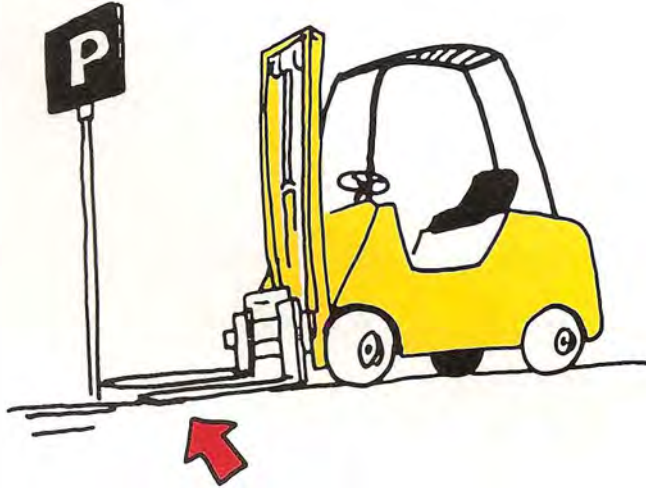
AVOID DRIVING OVER OBJECTS LYING IN YOUR PATH

The truck can easily overturn if you drive over objects lying in your path. Sharp objects, e.g. bits of steel plate, can damage the tyres. Therefore, remove potentially dangerous objects.

PARKING

A truck must never be left unguarded other than in its allotted parking space. There are often local parking regulations, but the following general rules should always be kept in mind:

- Do not park where the truck will create an obstruction
- Apply the parking brake
- Tilt the mast forward and lower the forks so that they rest evenly on the ground. This reduces the likelihood of anyone tripping over them. If the truck is laden level the load and lower it to the floor
- Engage neutral
- Turn off the motor and remove the key



MAXIMUM LOAD

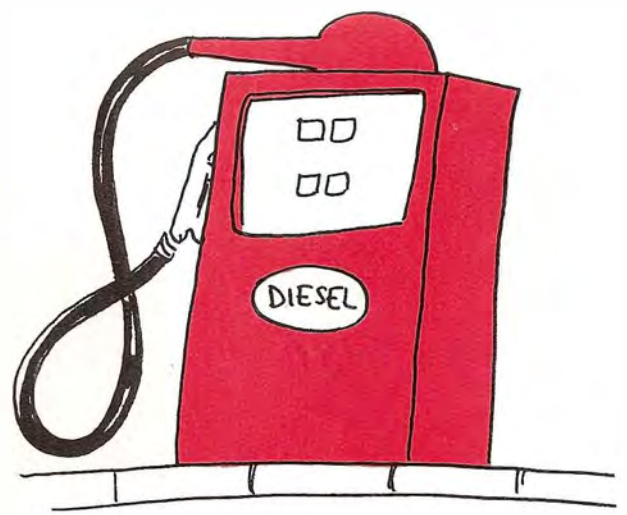
Never exceed the maximum lifting capacity of the truck. If this is exceeded, truck parts and material can be damaged. Overloading a truck can be fatally dangerous for both you and your workmates.

If your truck is fitted with an attachment, you must remember that the truck lifting capacity is reduced due to the weight of the attachment and the displacement of the load centre.

Fire prevention

You must always be aware of the fire risk in a truck. Motor fuel and hydraulic oil are explosively flammable. Therefore, be careful when filling up with fuel. Naked flames and smoking are prohibited during this operation.

Hydrogen gas, which is highly explosive, is formed in batteries. A spark caused by a tool falling on the battery is enough to ignite this gas.



EXTINGUISHING FIRES

If you have no fire extinguisher on your truck, you must know where one is kept at your working place.

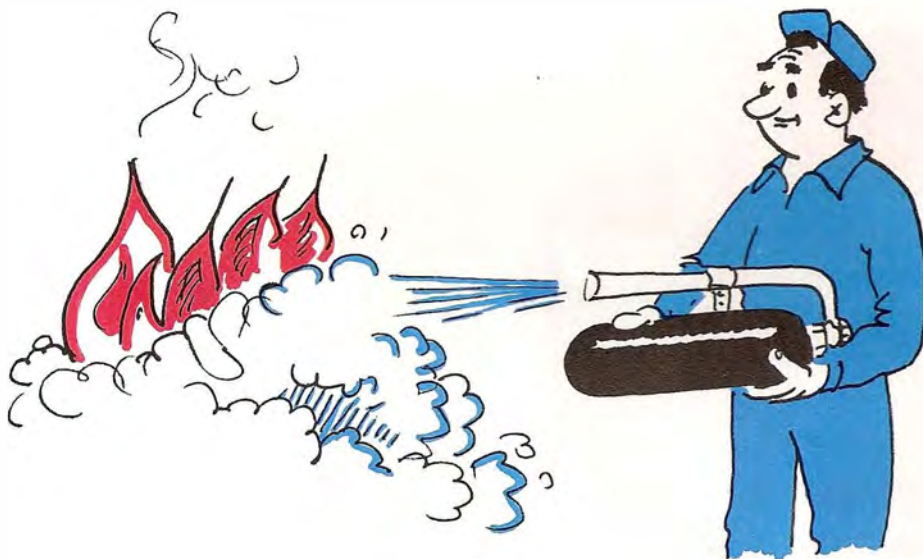
Never block access to fire fighting equipment by parking your truck in front of it.

Fires in trucks are usually electrical, oil or petrol fires and the correct type of extinguishers must be used, e.g. carbon dioxide or dry powder extinguishers. Both of these cut off oxygen to the fire, so that the fire is smothered. The fire extinguisher jet should be aimed at the base of the flames.

Carbon dioxide extinguishers are suitable for fires in motors or electrical equipment, but are less effective for other parts of the truck.

Dry powder extinguishers are suitable for most types of fires. However, the powder can make it more difficult to carry out repairs on the truck afterwards.

Never attempt to extinguish an oil fire by putting water on it. Water is, on the other hand, suitable for extinguishing fires involving fibrous materials such as paper, wood and cloth.



Always use standard approved fire extinguishers

You must be aware of the explosion risk in the event of fire in a truck that carries an LP-gas bottle. Take the following action:

If possible close accessible valves. It is a good idea to carry a fireproof glove in the truck at all times. Notify the fire brigade and your supervisor. After taking the above mentioned steps, try to extinguish the fire. If this cannot be done, the LP Gas bottle must be kept cool by pouring water on it until the fire brigade arrives on the scene. Inform the fire brigade that LP Gas bottles are involved.

Remember that an LP Gas bottle that has been exposed to heat must be removed by fire-control personnel.



Rules to reduce the risk of fire:

- **No smoking when refueling**
- **Turn off the motor when filling up with fuel!**
- **Wipe off any fuel that might have been spilt, before starting the motor!**
- **Naked flames and smoking are strictly prohibited when charging batteries or filling fuel!**
- **Trucks must be kept clean!**



We have now gone through quite a number of safety regulations which you as a lift truck operator must know. Your company may have many more.

It is impossible to draw up rules and regulations to cover all conceivable situations that you might find yourself in. Therefore, you must have good judgement and must keep an eye out for every situation that could constitute a safety risk. By doing this, you should be able to avoid dangerous situations.

When you are driving your truck, safety depends on you!

