# DFG / TFG 540 - 550

11.09 -

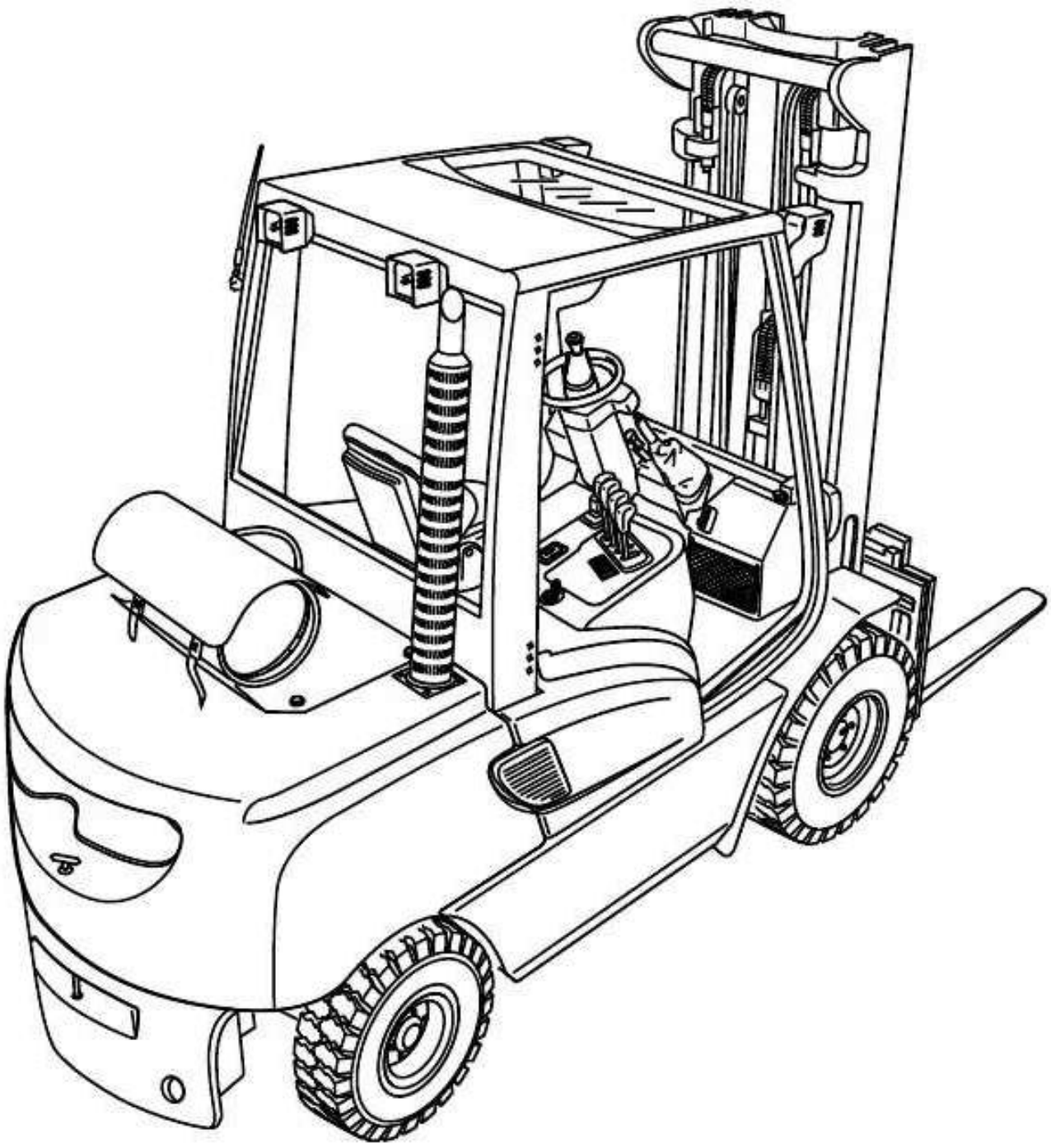
Operating instructions

GB

51167690

08.12

DFG 540
DFG 545
DFG 550
TFG 540
TFG 545
TFG 550



JUNGHEINRICH
Machines. Ideas. Solutions.

# Declaration of Conformity

CE

Jungheinrich AG, Am Stadtrand 35, D-22047 Hamburg
Manufacturer or agent acting in the European Union

| Type | Option | Serial no. | Year of manufacture |
|---|---|---|---|
| DFG 540<br>DFG 545<br>DFG 550<br>TFG 540<br>TFG 545<br>TFG 550 | | | |

**Additional information**

**On behalf of**

**Date**

(GB) **EU Conformity Declaration**

The undersigned hereby declare that the powered industrial truck described below in detail complies with the European Directives 2006/42/EC (Machinery Directive) and 2004/108/EEC (Electromagnetic Compatibility - EMC) including amendments as well as the legislative decree to incorporate the directives in national law. The signatories are in each case individually authorized to compile the technical documents.

# Foreword

**Notes on the operating instructions**

The present ORIGINAL OPERATING INSTRUCTIONS are designed to provide sufficient instruction for the safe operation of the industrial truck. The information is provided clearly and concisely. The chapters are arranged by letter and the pages are numbered continuously.

The operator manual details different industrial truck models. When operating and servicing the industrial truck, make sure that the particular section applies to your truck model.

Our trucks are subject to ongoing development. Jungheinrich reserves the right to alter the design, equipment and technical features of the system. No guarantee of particular features of the truck should therefore be assumed from the present operating instructions.

**Safety notices and text mark-ups**

Safety instructions and important explanations are indicated by the following graphics:

**⚠ DANGER!**

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

---

**⚠ WARNING!**

Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

---

**⚠ CAUTION!**

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

---

***NOTE***

Indicates a material hazard. Failure to comply with this instruction may result in material damage.

---

➔ Used before notices and explanations.

- ● Indicates standard equipment
- ○ Indicates optional equipment

**Copyright**

**Jungheinrich Aktiengesellschaft**

Am Stadtrand 35
22047 Hamburg - Germany

Tel: +49 (0) 40/6948-0

www.jungheinrich.com

08.12 EN

# Contents

# A Correct Use and Application

## 1 General

The industrial truck described in the present operating instructions is designed for lifting, lowering and transporting load units.
It must be used, operated and serviced in accordance with the present instructions.
Any other type of use is beyond the scope of application and can result in damage to personnel, the industrial truck or property.

## 2 Correct application

***NOTE***

The maximum load and load distance are indicated on the load chart and must not be exceeded.
The load must rest on the load handler or be lifted by an attachment approved by the manufacturer.
The load must rest on the back of the fork carriage and centrally between the forks.

---

– Lifting and lowering loads.

– Transporting lowered loads over short distances.
– Do not travel with a raised load (>30 cm).
– Do not carry or lift passengers.
– Do push or pull load units.
– Occasional towing of trailer loads.
– When towing trailer loads the load must be secured on the trailer.
– The permissible trailer load must not be exceeded.

# 3 Approved application conditions

**DANGER!**

Do not exceed the permissible surface and spot load limits on the travel routes.
At blind spots get a second person to assist.
The driver must ensure that the loading dock / ramp cannot move or come loose during loading / unloading.

---

– Operation in industrial and commercial environments.
– Permissible temperature range -20 to 40 °C.
– Operation only on secure, level surfaces with sufficient capacity.
– Operation only on routes that are visible and approved by the proprietor.
– Negotiating inclines up to a maximum of 15 %.
– Do not negotiate inclines crosswise or at an angle. Transporting loads downhill.
– Operation in partially public traffic.

**WARNING!**

**Extreme conditions**

▶ Special equipment and authorisation are required if the truck is to be constantly used in extreme conditions, especially in dusty or corrosive atmospheres.

▶ The truck is not authorised for use in areas at risk of explosion.
▶ In adverse weather conditions (thunder, lightning) the industrial truck must not be operated outside or in endangered areas.

---

# 4 Proprietor responsibilities

For the purposes of the present operating instructions the “proprietor” is defined as any natural or legal person who either uses the industrial truck himself, or on whose behalf it is used. In special cases (e.g. leasing or renting) the proprietor is considered the person who, in accordance with existing contractual agreements between the owner and user of the industrial truck, is charged with operational duties.
The proprietor must ensure that the industrial truck is used only for the purpose for which it is intended and that there is no danger to life and limb of the user and third parties. Furthermore, accident prevention regulations, safety regulations and operating, servicing and repair guidelines must be followed. The proprietor must ensure that all users have read and understood these operating instructions.

***NOTE***

Failure to comply with the operating instructions shall invalidate the warranty. The same applies if improper work is carried out on the truck by the customer or third parties without the permission of the manufacturer.

# 5 Adding attachments and/or accessories

### Adding accessories

The mounting or installation of additional equipment which affects or enhances the performance of the forklift truck requires the written permission of the manufacturer. Local authority approval may also need to be obtained.
Local authority approval does not however constitute the manufacturer’s approval.

# B Truck Description

## 1 Application

The DFG / TFG 540 - 550 is a four-wheel IC motor sit-down forklift truck. The DFG series are diesel engine trucks, while the TFG series are fitted with a petrol engine for LPG operation.

The DFG / TFG 540 - 550 is a cantilever counterbalanced truck which can lift, transport and deposit loads using the load handler attached in front.

Closed bottom pallets can also be lifted.

The DFG / TFG 540 - 550 is equipped with a hydrodynamic drive. The left pedal is a combination of crawl speed and brake pedal, and activates the rapid lift function during slow travel. The middle pedal is a standard brake as well as emergency brake pedal.

### 1.1 Truck models and rated capacity

The rated capacity depends on the model. The rated capacity can be derived from the model description.

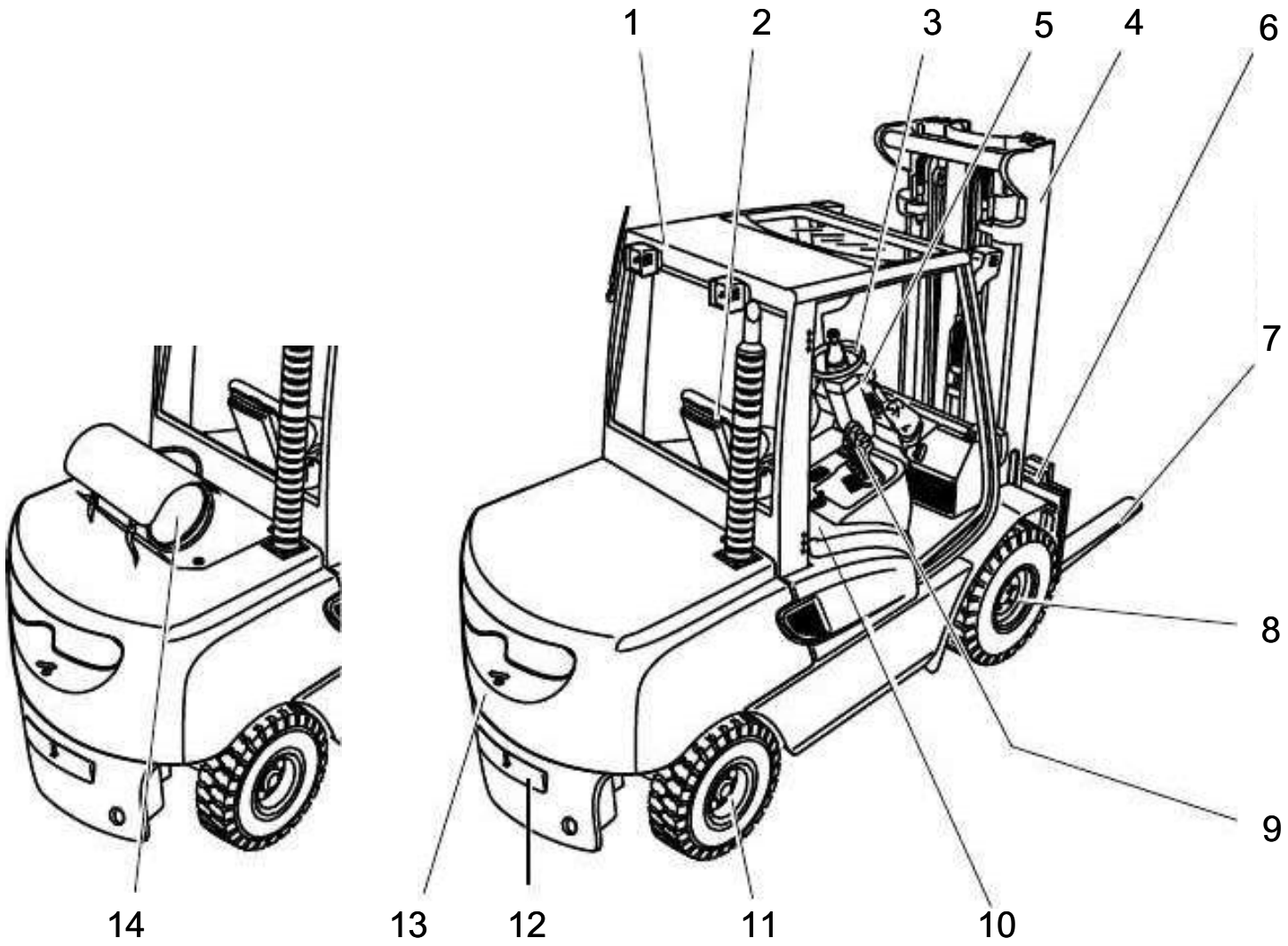
**DFG540**

| | |
|---|---|
| DFG | Model name |
| 5 | Series |
| 40 | Rated capacity x 100 kg |

The rated capacity does not generally match the permissible capacity. The capacity can be found on the load chart attached to the rack.

# 2 Assemblies and Functional Description

## 2.1 Assembly Overview




| Item | | Description | Item | | Description |
|---|---|---|---|---|---|
| 1 | ● | Overhead guard | 8 | ● | Drive |
| 2 | ● | Driver's seat | 9 | ● | Lifting device control |
| 3 | ● | Steering wheel | 10 | ● | Engine cover |
| 4 | ● | Mast | 11 | ● | Steer axle |
| 5 | ● | Control / display unit | 12 | ● | Trailer coupling |
| 6 | ● | Fork carriage | 13 | ● | Counterweight |
| 7 | ● | Fork tines | 14 | ● | LPG bottle (TFG only) |
| | | | | | |
| | ● = Standard equipment | | | ○ = Optional equipment | |

## 2.2 Functional Description

### Chassis

The chassis, in conjunction with the counterweight, forms the supporting base structure of the truck. It is used to support the main components.

The hydraulic oil reservoir is integrated on the right-hand side and the fuel tank for the DFG series is on the left side in the chassis.

### Operator position and overhead guard

The overhead guard (1) comes in a range of models and protects the driver from falling objects and other external influences.

All the controls are ergonomically arranged. The steering column and driver's seat can be adjusted individually.

The controls and warnings on the display unit (5) enable the system to be monitored during operation, thereby ensuring a very high level of safety.

### Steering

The steer cylinder of the hydrostatic steering is integrated in the steer axle (11) and is controlled by the power steering. The steer axle is fully floating in the chassis to ensure excellent grip even on non-level surfaces.

### Wheels

All wheels are located within the truck geometry. A choice of pneumatic or superelastic tyres are available.

### Engine

High performance, water-cooled diesel and LPG engines with long useful lives and low consumption and emission levels.

### Electrical system

12 volt system with threephase alternator. A start block prevents malfunctions when the truck is powered up. For diesel engines, a rapid pre-heat system is installed; LPG motors have an electronic ignition system for rapid and trouble-free engine starting. The key switch is used to stop the engine.

## Drive system

A power shift transmission with radiator and torque converter transfers the force to the drive axle (8).
The travel direction switch on the engine cover controls forward/reverse travel and the neutral position. This switch is used to select between the two travel stages for forward and reverse travel.

## Brakes

The brake pedal actuates two drum brakes which are applied to the drive wheels. An additional slow travel / brake pedal facilitates creep speed applications. The pedal should not be used for normal braking purposes. Worn drum brakes are automatically adjusted. The parking brake operates through mechanical actuation of the parking brake lever on the drum brake via Bowden cables.

## Hydraulic system

A multi-pilot valve allows for sensitive operation of the functions via the controls. The flow rate of the gear pump is regulated by the engine speed.

## Mast

Two or three-stage masts, optionally with free lift function; narrow mast sections ensure excellent visibility of the forks and attachments. Fork carriage and mast run on permanently lubricated and hence maintenance-free support rollers.

## Attachments

The trucks can be optionally fitted with mechanical and hydraulic attachments.

# 3 Technical Specifications

All technical details refer to standard trucks.
Values indicated with *) may vary, depending on the types of equipment used (e.g. mast, cabin, tyres etc.).

➔ Technical data specified in accordance with VDI 2198.
Technical modifications and additions reserved.

## 3.1 Performance data

**DFG 540/545/550**

| | Description | DFG 540 | DFG 545 | DFG 550 | |
|---|---|---|---|---|---|
| Q | Capacity (where C = 500 mm)[1)] | 4000 | 4500 | 5000 | kg |
| C | Load centre distance | 500 | 500 | 600 | mm |
| | Travel speed* with / without load | 24/24.5 | 23/23.5 | 22/22.5 | km/h |
| | Lift speed, with / without load | 0.49/0.53 | 0.49/0.53 | 0.48/0.53 | m/s |
| | Lowering speed with / without load | 0.51/0.49 | 0.51/0.49 | 0.51/0.49 | m/s |
| | Gradeability [2)]* with / without load | 25/26 | 24/26 | 23/26 | % |
| | Acceleration* with / without load to 15 m | 5/4.5 | 5/4.5 | 5.1/4.5 | s |
| | Available working pressure for attachments | 160 | 160 | 160 | bar |
| | Oil flow for attachments | 30 | 30 | 30 | l/min |

[1)] for vertical mast.

[2)] The values shown represent the maximum gradeability to overcome short differences in height and surface unevenness (surface edges). The truck must not operate on inclines of more than 15%.

**TFG 540/545/550**

| | Description | TFG 540 | TFG 545 | TFG 550 |
|---|---|---|---|---|
| Q | Capacity (where C = 500 mm)[1)] | 4000 | 4500 | 5000 |
| C | Load centre distance | 500 | 500 | 600 |
| | Travel speed* with / without load | 24.4/25.8 | 23.8/25.8 | 22.3/25.8 |
| | Lift speed, with / without load | 0.49/0.53 | 0.48/0.53 | 0.48/0.53 |
| | Lowering speed with / without load | 0.51/0.49 | 0.51/0.49 | 0.51/0.49 |
| | Gradeability [2)]* with / without load | 25/26 | 24/26 | 23/26 |
| | Acceleration* with / without load to 15 m | 4.8/4.2 | 5/4.5 | 5.5/4.5 |
| | Available working pressure for attachments | 160 | 160 | 160 |
| | Oil flow for attachments | 30 | 30 | 30 |

1) for vertical mast.

2) The values shown represent the maximum gradeability to overcome short differences in height and surface unevenness (surface edges). The truck must not operate on inclines of more than 15%.

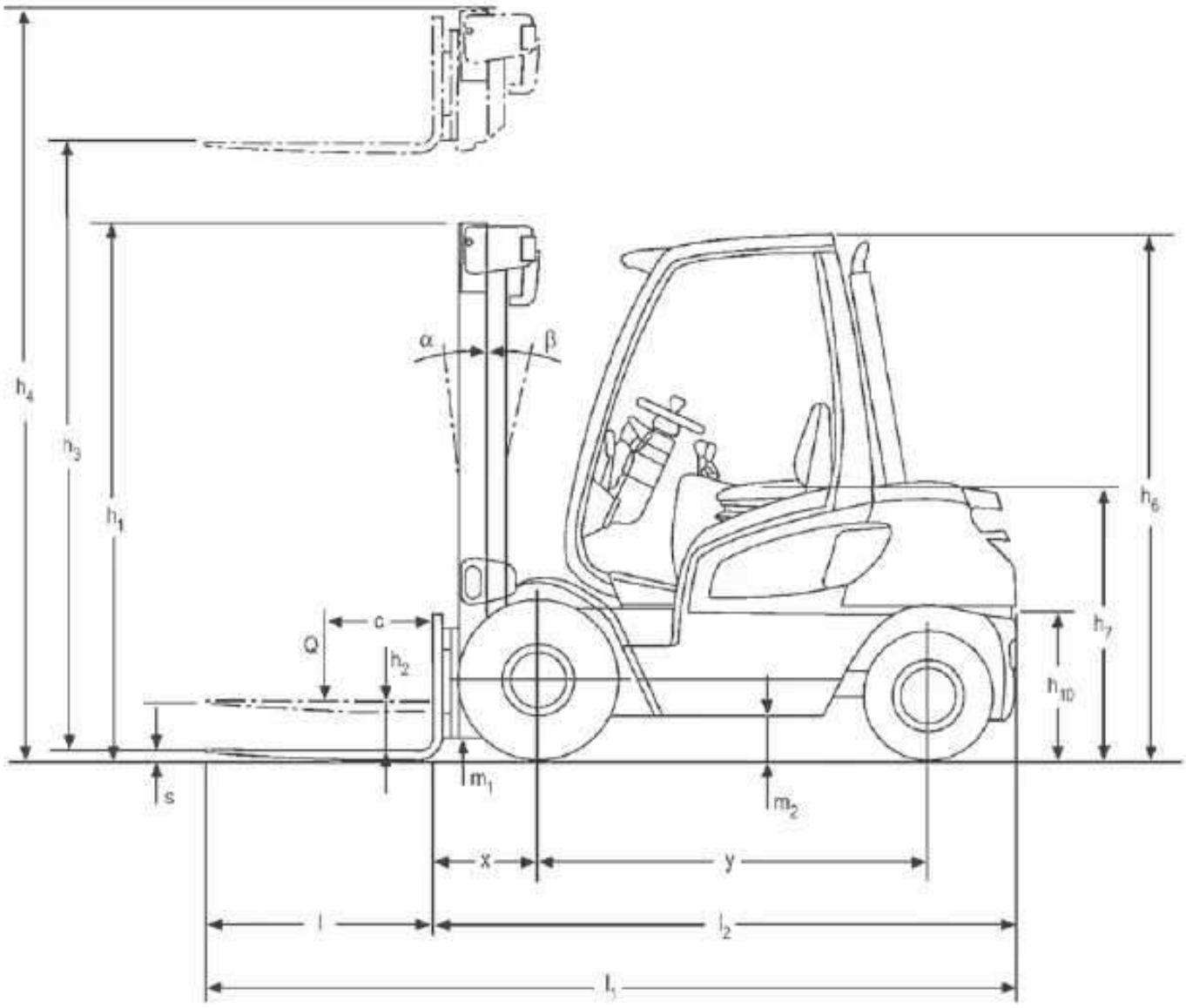
## 3.2 Dimensions

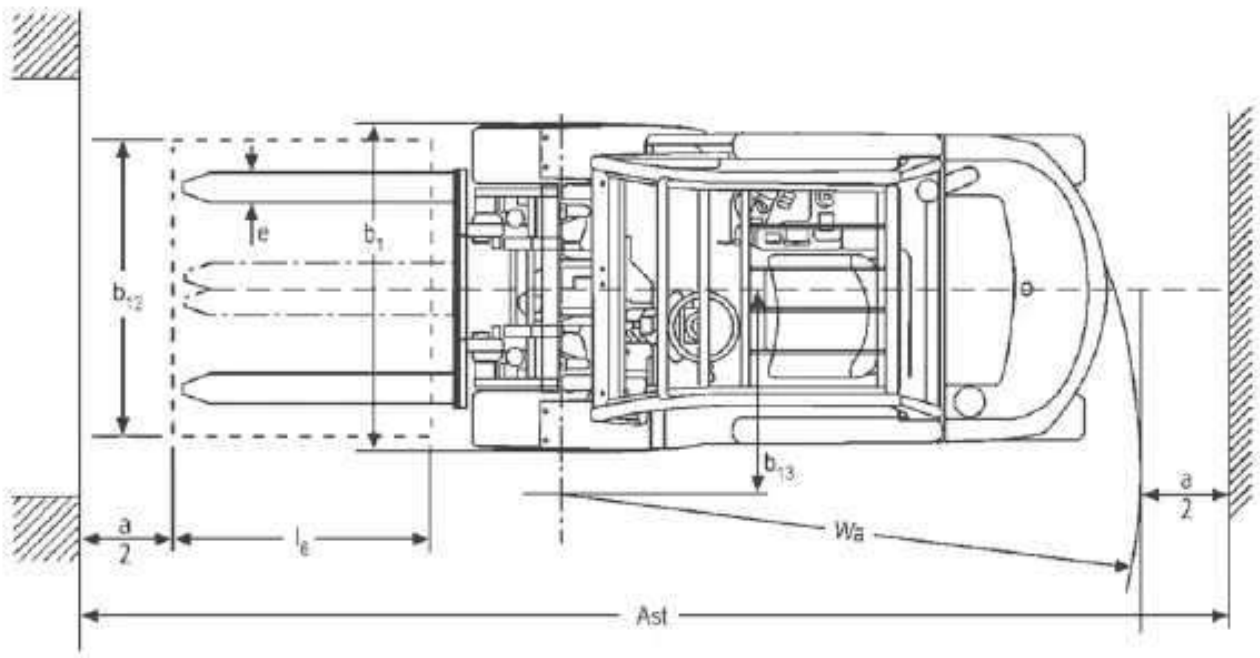
**DFG/TFG 540/545/550**

| | Description | DFG / TFG | | | |
|---|---|---|---|---|---|
| | | **540** | **545** | **550** | |
| a/2 | Safety distance | 100 | 100 | 100 | mm |
| $h_1$ | Mast height retracted* | 2540 | 2540 | 2540 | mm |
| $h_2$ | Free lift* | 150 | 150 | 150 | mm |
| $h_3$ | Lift* | 3500 | 3500 | 3500 | mm |
| $h_4$ | Mast height extended* | 4215 | 4215 | 4363 | mm |
| $h_6$ | Overhead guard height (cabin)* | 2375 | 2375 | 2375 | mm |
| $h_7$ | Seat height* | 1255 | 1255 | 1255 | mm |
| $h_{10}$ | Coupling height | 535/700 | 535/700 | 535/700 | mm |
| α | Mast tilt, fwd.* | 7 | 7 | 7 | ° |
| ß | Mast tilt, back* | 6 | 6 | 6 | ° |
| $l_1$ | Overall length * | 4145 | 4145 | 4260 | mm |
| $l_2$ | Headlength* | 2995 | 2995 | 3110 | mm |
| $b_1$ | Overall width* | 1400/- | 1450/- | 1450/- | mm |
| s/e/l | Fork dimensions* | 50x125 x1150 | 50x150 x1150 | 60x150 x1150 | mm |
| $m_1$ | Ground clearance with load below mast* | 190 | 190 | 190 | mm |
| $m_2$ | Ground clearance centre wheelbase* | 230 | 230 | 230 | mm |
| | Fork carriage ISO 2328 class / type A, B | 3 A | 3 A | 4 A | |
| $b_3$ | Fork carriage width* | 1260 | 1260 | 1260 | mm |
| Ast | Working aisle width for pallets 800 x 1200 longit. | 4619 | 4619 | 4769 | mm |
| Ast | Working aisle width for pallets 1000 x 1200 traverse | 4419 | 4419 | 4569 | mm |
| Wa | Turning radius | 2655 | 2655 | 2790 | mm |
| $b_{13}$ | Smallest turning radius | 900 | 900 | 900 | mm |
| x | Load distance* | 564[1)] | 564[1)] | 579[1)] | mm |
| c | Load centre of gravity | 500 | 500 | 600 | mm |
| y | Wheelbase | 1985 | 1985 | 1985 | mm |

*) The data listed in the table corresponds to the standard version.

[1)] 573 mm with DZ mast; with integrated SS: x=596 mm (605 mm with DZ mast); with SS attachment: x=636 mm (645 mm with DZ mast)



## 3.3 Weights

➔ All dimensions in kg.

**DFG/TFG 540/545/550**

| | DFG/TFG 540 | DFG/TFG 545 | DFG/TFG 550 |
|---|---|---|---|
| Tare weight* | 6279 | 6669 | 7434 |
| Axle load, w.o. load front/ rear* | 2810/3469 | 2937/3732 | 2795/4639 |
| Axle load, w. load front/ rear* | 8954/1325 | 9869/1300 | 10762/1673 |

*) The data listed in the table corresponds to the standard version.

## 3.4 Mast versions

All dimensions in mm

**DFG/TFG 540/545**

| Mast table | | | | | |
|---|---|---|---|---|---|
| **VDI3596 Description** | **Lift $h_3$** | **Free lift $h_2$** | **Retracted height $h_1$** | **Extended height $h_4$** | **Mast weight (kg)** |
| ZT | 2750 | 150 | 2165 | 3465 | 1135 |
| | 3000 | 150 | 2290 | 3715 | 1170 |
| | 3500 | 150 | 2540 | 4215 | 1240 |
| | 4000 | 150 | 2790 | 4715 | 1310 |
| | 4500 | 150 | 3040 | 5215 | 1430 |
| | 5000 | 150 | 3290 | 5715 | 1500 |
| | 5500 | 150 | 3540 | 6215 | 1570 |
| | 6000 | 150 | 3790 | 6715 | 1690 |
| | 6500 | 150 | 4040 | 7215 | 1760 |
| ZZ | 2775 | 1375 | 2140 | 3540 | 1070 |
| | 3025 | 1500 | 2265 | 3790 | 1110 |
| | 3525 | 1750 | 2515 | 4290 | 1180 |
| | 4025 | 2000 | 2765 | 4790 | 1250 |
| | 4525 | 2250 | 3015 | 5290 | 1320 |
| | 5025 | 2500 | 3265 | 5790 | 1440 |
| | 5525 | 2750 | 3515 | 6290 | 1510 |
| DZ | 4150 | 1375 | 2140 | 4915 | 1500 |
| | 4525 | 1500 | 2265 | 5290 | 1560 |
| | 5275 | 1750 | 2515 | 6040 | 1660 |
| | 5650 | 1875 | 2640 | 6415 | 1720 |
| | 6025 | 2000 | 2765 | 6790 | 1770 |
| | 6775 | 2250 | 3015 | 7540 | 1920 |

Special trucks are not included in this overview.

## DFG/TFG 550

| Mast table | | | | | |
|---|---|---|---|---|---|
| VDI3596 Description | Lift $h_3$ | Free lift $h_2$ | Retracted height $h_1$ | Extended height $h_4$ | Mast weight (kg) |
| ZT | 2750 | 150 | 2165 | 3613 | 1200 |
| | 3000 | 150 | 2290 | 3863 | 1240 |
| | 3500 | 150 | 2540 | 4363 | 1310 |
| | 4000 | 150 | 2790 | 4863 | 1380 |
| | 4500 | 150 | 3040 | 5363 | 1500 |
| | 5000 | 150 | 3290 | 5863 | 1570 |
| | 5500 | 150 | 3540 | 6363 | 1640 |
| | 6000 | 150 | 3790 | 6863 | 1760 |
| | 6500 | 150 | 4040 | 7363 | 1820 |
| ZZ | 2725 | 1225 | 2140 | 3640 | 1140 |
| | 2975 | 1350 | 2265 | 3890 | 1170 |
| | 3475 | 1600 | 2515 | 4390 | 1240 |
| | 3975 | 1850 | 2765 | 4890 | 1310 |
| | 4475 | 2100 | 3015 | 5390 | 1385 |
| | 4975 | 2350 | 3265 | 5890 | 1500 |
| | 5475 | 2600 | 3515 | 6390 | 1580 |
| DZ | 4050 | 1225 | 2140 | 4965 | 1570 |
| | 4425 | 1350 | 2265 | 5340 | 1620 |
| | 5175 | 1600 | 2515 | 6090 | 1730 |
| | 5550 | 1725 | 2640 | 6465 | 1780 |
| | 5925 | 1850 | 2765 | 6840 | 1835 |
| | 6675 | 2100 | 3015 | 7590 | 1990 |

Special trucks are not included in this overview.

## 3.5 Tyre type

**NOTE**

When replacing tyres/rims fitted at the factory, always use original spare parts or tyres approved by the manufacturer. Otherwise the manufacturer's specification cannot be guaranteed.
If you have any queries please contact the manufacturer's customer service department.

| Description | | DFG/TFG | |
|---|---|---|---|
| | | 540/545 | 550 |
| Front tyres | SE* | 8.25x15 | 300x15 |
| | Pneumatic* | 8.25x15 16PR | 300x15 18PR |
| | Tyre pressure bar | 8.5 | 8.5 |
| | Torque Nm | 580-620 | 580-620 |
| Rear tyres | SE* | 28x9-15 | 28x9-15 |
| | Pneumatic* | 28x9-15 | 28x9-15 |
| | Tyre pressure bar | 8.5 | 8.5 |
| | Torque Nm | 500-520 | 500-520 |

*) The models listed in the table correspond to the standard version. Other tyres can be used depending on the truck's equipment.

## 3.6 Engine Data

### DFG 540/545/550

| Description | DFG 540 | DFG 545 | DFG 550 | |
|---|---|---|---|---|
| Cylinder/cubic capacity | 4/4400 | 4/4400 | 4/4400 | $cm^3$ |
| Rated speed (without load) | 2200 | 2200 | 2200 | rpm |
| Engine output | 56 | 56 | 56 | kW |
| Fuel consumption<br>60 VDI duty cycles/h | 4.7 | 5.2 | 5.7 | l/h [kg/h] |

### TFG 540/545/550

| Description | TFG 540 | TFG 545 | TFG 550 | |
|---|---|---|---|---|
| Cylinder/cubic capacity | 6/4294 | 6/4294 | 6/4294 | $cm^3$ |
| Rated speed (without load) | 2200 | 2200 | 2200 | rpm |
| Engine output | 67 | 67 | 67 | kW |
| Fuel consumption<br>60 VDI duty cycles/h | 6.24 | 6.5 | 6.8 | l/h [kg/h] |

## 3.7 EN norms

**Noise emission level**

– DFG 540/545/550: 78 dB (A)*
– TFG 540/545/550: 78 dB(A)*

*+/- 3 dB(A) depending on the truck's equipment

in accordance with EN 12053 as harmonised with ISO 4871.

➔ The noise emission level is calculated in accordance with standard procedures and takes into account the noise level when travelling, lifting and when idle. The noise level is measured at the level of the driver's ear.

**Vibration**

– DFG 540/545/550: 0,60 m/s²
– TFG 540/545/550: 0,60 m/s²

in accordance with EN 13059.

➔ The vibration acceleration acting on the body in the operating position is, in accordance with standard procedures, the linearly integrated, weighted acceleration in the vertical direction. It is calculated when travelling over thresholds at constant speed (standard truck version). These recordings were taken on a single occasion and must not be confused with the human vibrations of the "2002/44/EC/Vibrations" operator directive. The manufacturer offers a special service to measure these human vibrations, (see "Human vibration measurement" on page 165).

**Electromagnetic compatibility (EMC)**

The manufacturer confirms that the truck adheres to the limits for electromagnetic emissions and resistance as well as the static electricity discharge test in accordance with EN 12895 as well as the standardised instructions contained therein.

➔ No changes to electric or electronic components or their arrangement may be made without the written agreement of the manufacturer.

⚠ **WARNING!**

**Medical equipment can be damaged by non-ionised radiation**

Electrical equipment on the truck emitting non-ionised radiation (e.g. wireless data transmission) can affect operators' medical equipment (pacemakers, hearing aids etc.) and result in malfunctions. Consult with a doctor or the medical equipment manufacturer to clarify whether it can be used near the industrial truck.

## 3.8 Conditions of use

**Ambient temperature**

– operating at -20 to 40°C

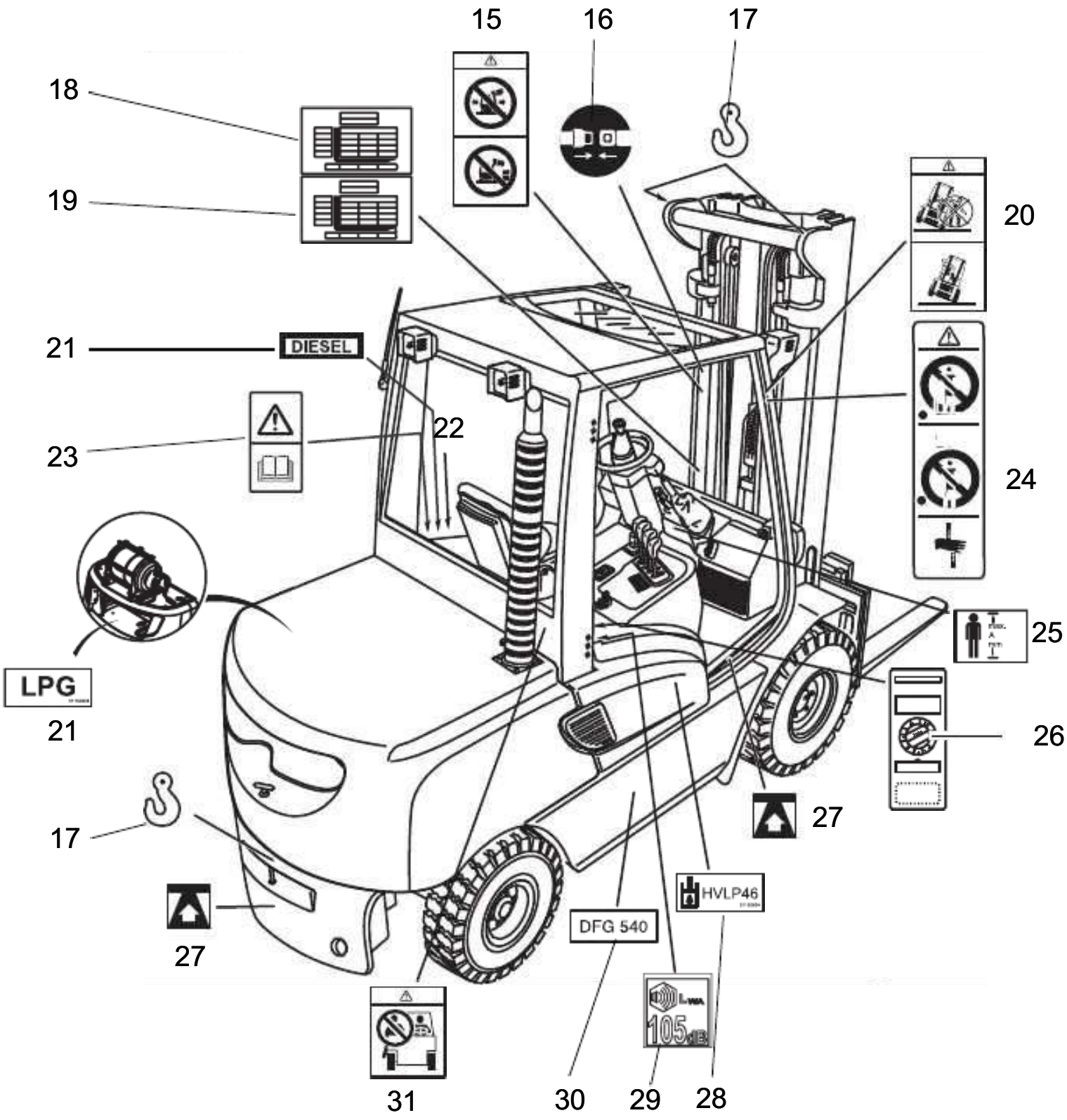
➔ Special equipment and authorisation are required if the truck is to be constantly used in conditions of extreme temperature or air humidity fluctuations.

## 3.9 Electrical requirements

The manufacturer certifies compliance with the requirements for the design and manufacture of electrical equipment, according to EN 1175 "Industrial Truck Safety - Electrical Requirements", provided the truck is used according to its purpose.

# 4 Identification points and data plates

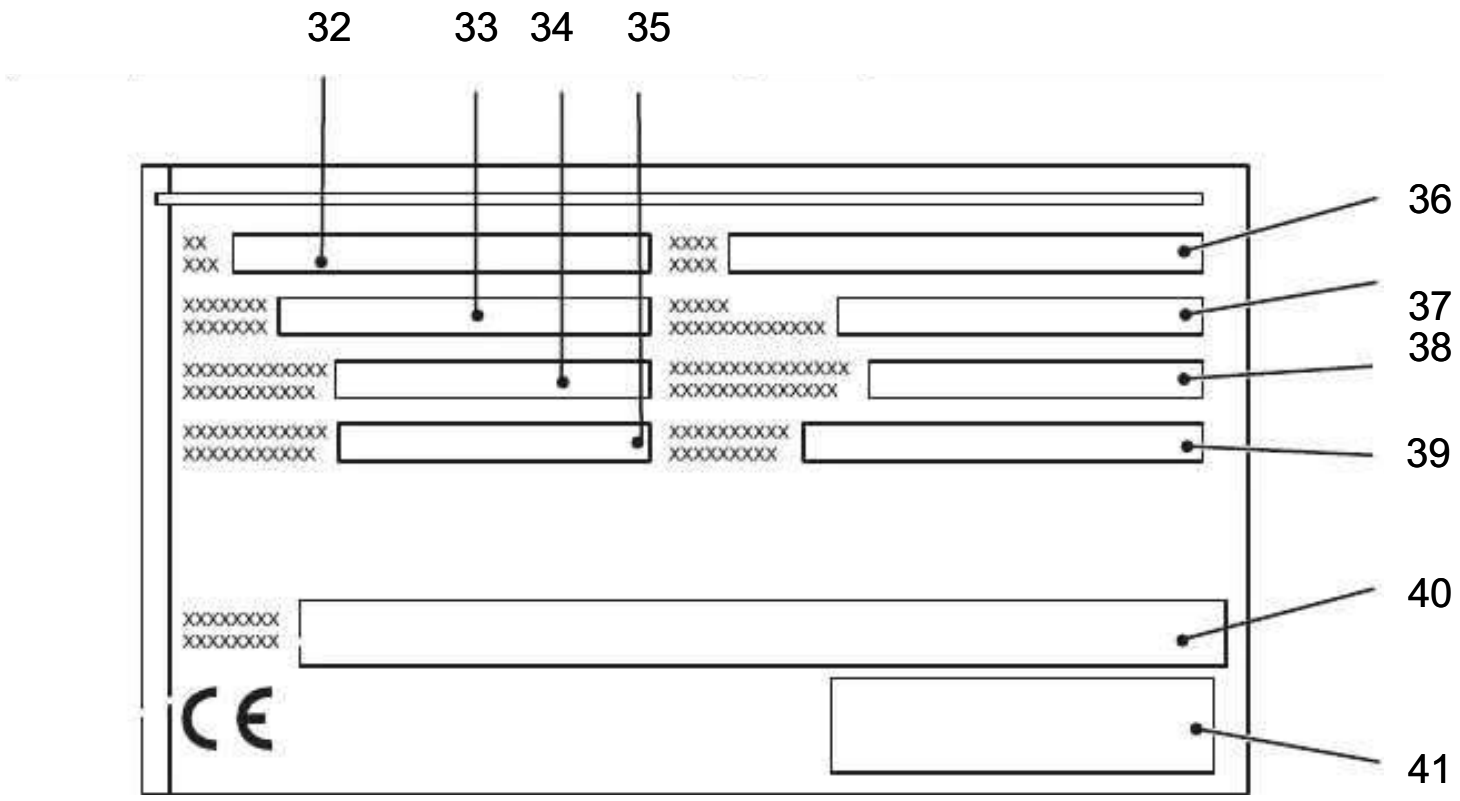
Warnings and notices such as capacity charts, strap points and data plates must be legible at all times. Replace if necessary.




| Item | Component |
|---|---|
| 15 | Do not travel with raised load or mast tilted forward with a raised load |

| Item | Component |
|---|---|
| 16 | Wear seat belt |
| 17 | Strap points for crane lifting |
| 18 | Capacity |
| 19 | Capacity with attachment |
| 20 | Tipover hazard |
| 21 | Fuel |
| 22 | Truck data plate under the engine cover (not shown) |
| 23 | Read operating instructions |
| 24 | Do not stand on load handler / Do not stand under load handler / Risk of trapping when mast extended |
| 25 | Max. body size (○) |
| 26 | Test plaque (○) |
| 27 | Jack contact points |
| 28 | Hydraulic oil specification |
| 29 | Noise level |
| 30 | Model description |
| 31 | Do not carry passengers warning |
|  | Serial number, engraved in chassis below the engine cover |

## 4.1 Data plate




| Item | Description | Item | Description |
|---|---|---|---|
| 32 | Type | 37 | Year of manufacture |
| 33 | Serial number | 38 | Load centre (mm) |
| 34 | Rated capacity in kg | 39 | Net weight in kg |
| 35 | Output in kW | 40 | Manufacturer |
| 36 | Option | 41 | Manufacturer's logo |

For queries regarding the truck or ordering spare parts always quote the truck serial number (33).

## 4.2 Truck capacity plate

**⚠ CAUTION!**

**Accident risk from fork replacement**

If you replace the forks with ones that differ from the originals, the capacity will change.

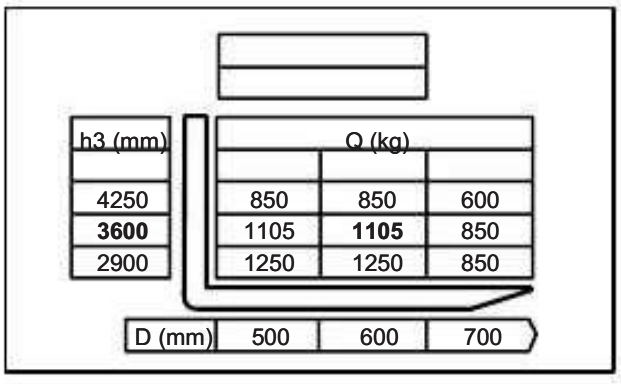
▶When replacing the forks you must attach an additional capacity plate to the truck.

▶Trucks supplied without forks are given a capacity plate for standard forks (length: 1150 mm).

The capacity plate (18) gives the capacity (Q in kg) of the truck for a vertical mast. The maximum capacity is shown as a table with a given load centre of gravity D (in mm) and the required lift height H (in mm).

The capacity plate (18) of the truck indicates the truck's capacity with the forks as originally supplied.

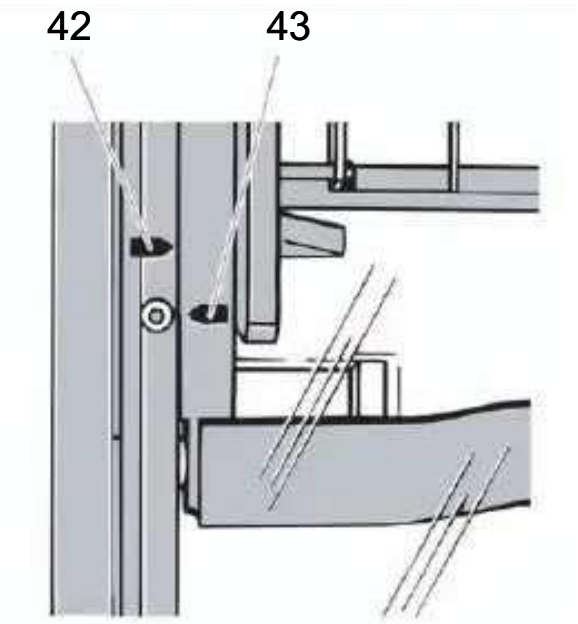
**Example of how to calculate the maximum capacity:**




For a load cente of gravity D of 600 mm and a maximum lift height $h_3$ of 3600 mm the maximum capacity is Q 1105 kg.

**Lift height restriction**

The arrow shape markings (42 and 43) on the inner and outer masts show the driver when the prescribed lift limits have been reached.



## 4.3 Attachment capacity plate

The attachment capacity plate is next to the truck's capacity plate and gives the truck's capacity Q (in kg) in conjunction with the respective attachment. The serial number for the attachment indicated on the capacity plate must match the data plate of the attachment.

➔ For loads with a centre of gravity greater than 500 mm, the capacities are reduced by the difference of the altered centre of gravity.

# 5 Stability

The truck's stability has been tested according to latest technological standards. These take into account the dynamic and static tipover forces that can occur if used correctly.

Stability can also be affected by the following factors:

– Tyre type
– Mast
– Attachment
– Transported load (size, weight and centre of gravity)

**⚠ WARNING!**

**Loss of stability can cause accidents**

Changing the components can alter the stability.

# C Transport and Commissioning

## 1 Transport

Transport can be carried out in two different ways, depending on the height of the mast and the local conditions.

– Vertically, with the mast assembled (for low heights)
– Vertically, with the mast dismantled (for large heights), all mechanical connections and hydraulic lines between the basic truck and the mast separated.

## 2 Truck laden

### 2.1 Centre of gravity of the truck

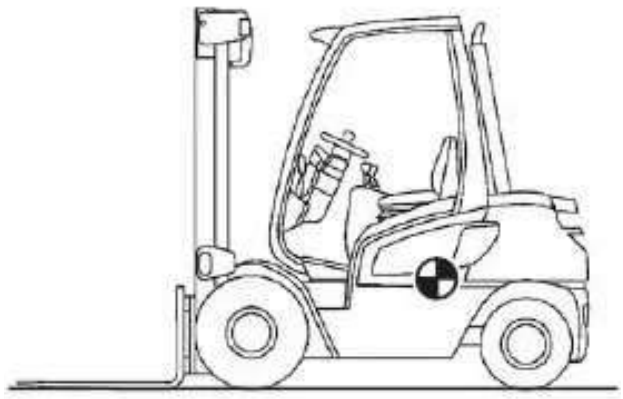
**WARNING!**

**Altering the centre of gravity can be hazardous**

The overall centre of gravity can vary depending on the truck's equipment (especially the mast version).

▶For masts with a low height the centre of gravity will move towards the counterweight.

▶For masts with a greater height the centre of gravity will move towards the centre of the truck.



## 2.2 Lifting the truck by crane

**CAUTION!**

**The mast can get damaged**

- ▶ Loading by crane is only intended for the initial transport before the truck is used for the first time.
- ▶ Loading must be carried out by specially trained staff in accordance with recommendations contained in Guidelines VDI 2700 and VDI 2703

**DANGER!**

**Crane slings can tear, resulting in accidents**

- ▶ Only use crane lifting gear with sufficient capacity.
- ▶ Loading weight = Net weight of truck (+ battery weight for electric trucks).
- ▶ The mast must be tilted back fully.
- ▶ The crane lifting gear on the mast must have a minimum clear length of 2 m.
- ▶ Crane slings should be fastened in such a way that they do not come into contact with any attachments or the overhead guard when lifting.
- ▶ Do not stand under a swaying load.

Truck net weight: (see "Weights" on page 23).

***Lifting the truck by crane***

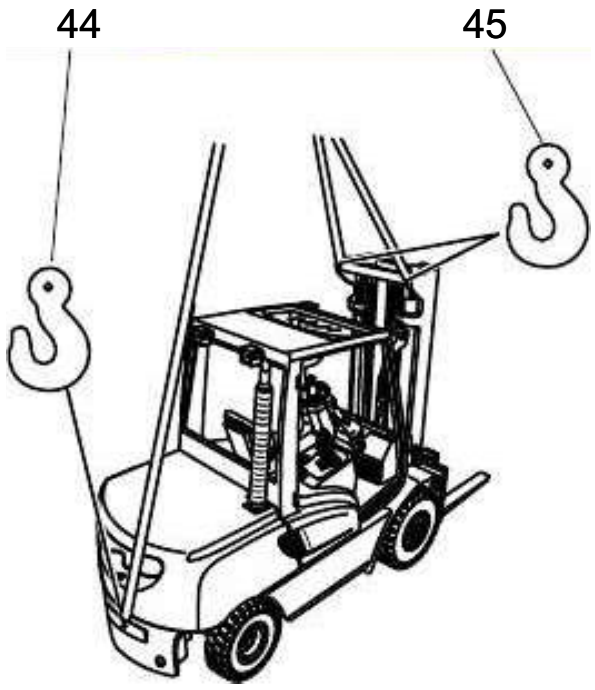
*Requirements*

– Park the truck securely, (see "Parking the truck securely" on page 71).

*Procedure*

- Fasten the crane slings securely to the attachment points (45) and (44).
- Raise and load the truck.
- Lower and deposit the truck carefully ((see "Parking the truck securely" on page 71)).
- Secure the truck with wedges to prevent it from rolling away.

*This concludes the loading by crane.*



## 2.3 Loading with another industrial truck

**⚠ WARNING!**

**The truck can be damaged**

The truck to be loaded can get damaged when loading with another industrial truck.

▶Only trained specialist personnel should load the truck.

▶Use only trucks with sufficient capacity for loading.

▶Only for loading and unloading.

▶The forks of the second industrial truck must be sufficiently long

▶Transporting over long distances prohibited.

---

***Loading the truck with a second industrial truck***

*Requirements*

– Park the truck securely, (see "Parking the truck securely" on page 71).

*Procedure*

- Raise the truck with the forks at the side between the axles.
- Raise the truck slightly and make sure it is securely positioned on the forks. If necessary adjust or secure the forks with stops.
- Carefully load/unload the truck, (see "Lifting, transporting and depositing loads" on page 79).
- Lower the truck slowly onto the ground and prevent it from rolling away.

*The truck is now loaded.*

# 3 Securing the truck during transport

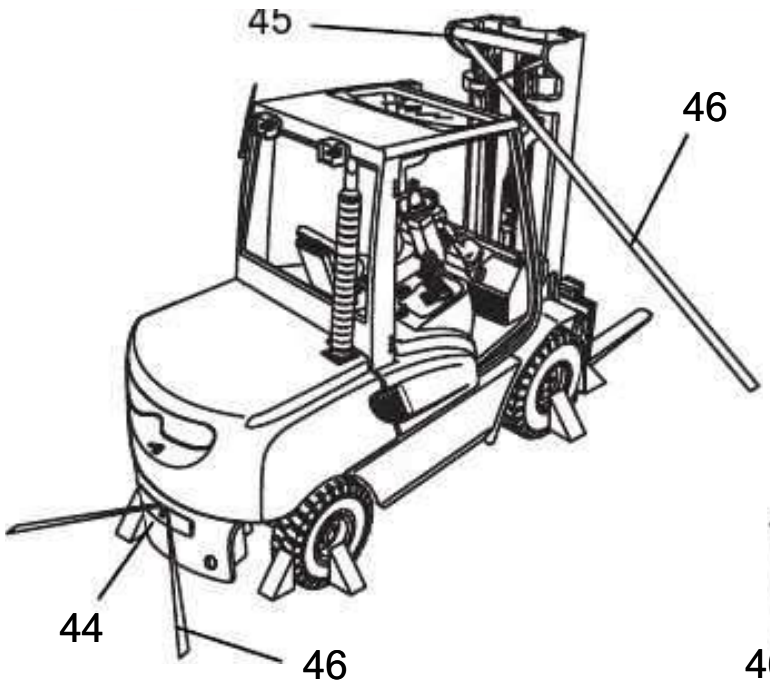
**WARNING!**

**Accidental movement during transport**

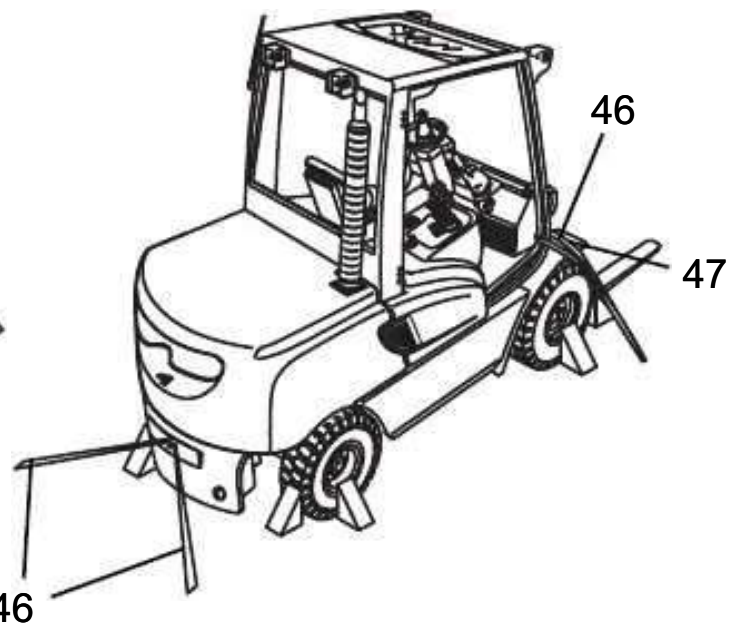
Improper fastening of the truck and mast during transport can result in serious accidents.

- ▶ Loading must be carried out by specially trained staff in accordance with recommendations contained in Guidelines VDI 2700 and VDI 2703 In each case correct measurements must be made and appropriate safety measures adopted.
- ▶ The truck must be securely fastened when transported on a lorry or a trailer.
- ▶ The loading area must have clamp rings and a wooden floor to secure the retaining wedges.
- ▶ Use wedges to prevent the truck from moving.
- ▶ Use only tensioning belts or tie-down straps or with sufficient strength.

Securing with a mast




Securing without a mast




***Securing the industrial truck for transport***

*Requirements*

– Position the industrial truck securely on a lorry or trailer, (see "Parking the truck securely" on page 71).

*Tools and Material Required*

– 2 tensioning belts with tensioning device
– Retaining wedges.

*Procedure*

- Secure the industrial truck with the tensioning belt (46) at the top cross member of the mast (45) and the trailer coupling (44) or over the front mud guards (47) and on the trailer coupling (44).
- Tighten the tensioning belts (46) with the tensioning device.

*The industrial truck is now secured for transport.*

# 4 Using the Truck for the First Time

## Safety Instructions for Assembly and Commissioning

**WARNING!**

**Accident risk from incorrect assembly**

The assembly of the truck at the application site, commissioning and driver training must only be performed by the manufacturer's customer service representatives who have been specially trained for these tasks.

- ▶ The hydraulic lines may only be connected to the basic truck / mast interface when the mast has been properly assembled.
- ▶ Only then can the truck be started.
- ▶ If several trucks have been delivered, make sure that the serial numbers of the load handlers, masts and basic trucks always match.

---

***Preparing the truck for operation after delivery or transport***

*Procedure*

- Check the equipment is complete.
- Check the engine oil level.
- Check the hydraulic oil level.
- Check the transmission oil level (only on trucks with hydrodynamic drives).
- Check the brake fluid level (only on trucks with hydrodynamic drives).
- Test the battery connections.
- Check the battery acid level (not for maintenance-free batteries).

*The truck can now be started, (see "Preparing the Truck for Operation" on page 59).*

# D Fuelling the Truck

## 1 General

### 1.1 Safety regulations for handling diesel fuel and LPG

**WARNUNG!**

**An unsecured truck can cause accidents**
The truck can suddenly start to move.

▶ Before filling up or replacing the LPG bottle, park the truck securely, Siehe “Parking the truck securely” auf Seite 71.

---

**WARNUNG!**

**Accident risk from ignition**

▶ Fuels and liquefied petroleum gas can ignite.

▶ Smoking, naked flames and other ignition sources are strictly prohibited in the immediate vicinity when handling fuels and LPG.

▶ Labels indicating the hazard are must be positioned where they are clearly visible.

▶ Do not store flammable materials in this area.

▶ Powder fire extinguisher must be provided within easy reach of the filling area.

▶ Use only category A, B or C type powder fire extinguishers to fight LPG fires.

▶ Bring any unsealed LPG bottles immediately outside, attach visible markings and notify the supplier.

---

**Storage and Transport**

The diesel and LPG storage and transport devices must comply with statutory requirements.

If there is no filling point available, the fuel must be stored and transported in clean, approved containers.

The contents must be clearly indicated on the container.

*HINWEIS*

**Fuel can cause environmental damage**

▶Bind any spilled diesel fuel with suitable methods.

▶Then dispose of the diesel and fuel filter in accordance with environmental regulations.

---

**Fuel filling and LPG bottle replacement personnel**

Personnel filling the trucks or replacing LPG bottles must have sufficient knowledge of the nature of fuels to ensure safe operation.

⚠ **VORSICHT!**

**Liquid gas can cause frostbite**

▶Liquid gas produces frostbite when it comes into contact with bare skin.

▶Avoid direct contact with the skin.

▶Wear gloves.

---

**Filling up LPG containers**

LPG containers remain attached to the truck and are filled up at LPG stations. Always follow the instructions of the tank system and LPG container manufacturer as well as statutory and local regulations when filling up.

*HINWEIS*

**Instructions for the safe operation of LPG systems**

▶All maintenance and repair work on LPG systems and containers should be carried out by qualified personnel who have been trained to work on LPG systems.

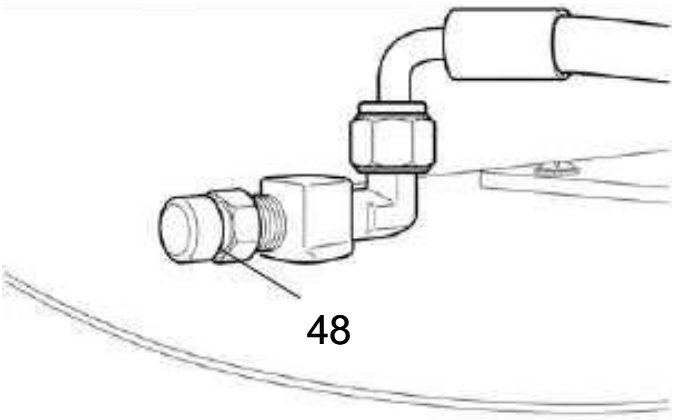
▶The owner must comply with all legal requirements, technical standards and health and safety regulations applicable to liquid gas.

▶Before starting work, the driver must check that all accessible components of the LPG system are in good working order, in accordance with the regulations of the country of use.

▶Do not operate the truck if there is any damage, corrosion, wear or degradation to individual components of the LPG system.

---

## 1.2 LPG system relief valve


48

LPG powered trucks are fitted with a relief valve. This is located on the rear cover next to the gas bottle.

– In the event of a fault the pressure in the gas system is restricted to a maximum level. The relief valve is fitted with a plastic cover (45).
– When the valve is activated the plastic cover comes off, thereby clearly indicating a fault in the gas system.
– In this event the truck must not be operated.
– The gas system must be check by suitably qualified and trained personnel.
– The user must check that the plastic cover is present each time he uses the truck.

**⚠ GEFAHR!**

**Danger from escaping liquid gas.**
Liquid gas can escape from faulty gas hoses.

▶Use only gas bottles with an integrated line break safety valve.
▶The gas bottle connection is also fitted with a line break safety valve which prevents the gas from escaping accidentally during operation.
▶When replacing, always use a gas bottle connection with an integrated line break safety valve.

# 2 Adding diesel

**⚠ VORSICHT!**

**Air in the fuel system will result in malfunctions.**

▶Never allow the fuel tank to run dry.

## 2.1 Fuelling

**⚠ WARNUNG!**

**Diesel fuel can be hazardous**

▶Diesel fuel can cause irritation if it comes into contact with the skin. Rinse any affected areas thoroughly.

▶If it comes into contact with the eyes rinse them immediately with flowing water and call for a doctor.

▶Wear safety gloves when handling diesel fuels.

***HINWEIS***

▶Fuelling must always be performed in designated areas by trained and authorised personnel.

***HINWEIS***

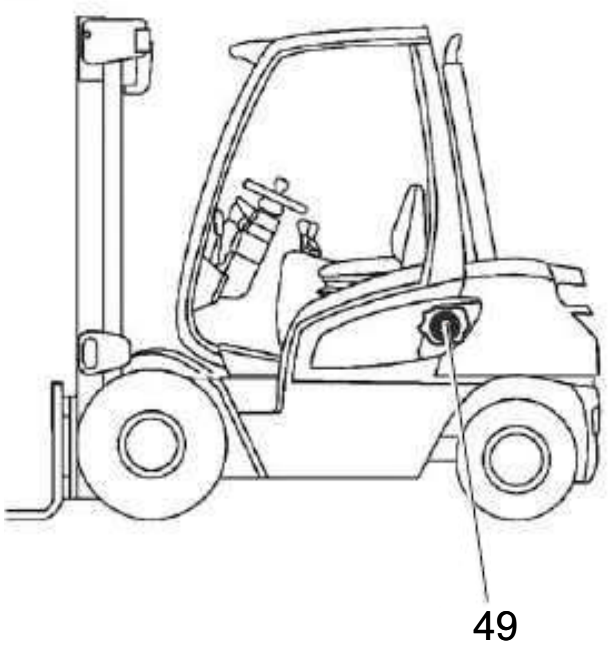
▶Capacity: DFG 540 - 550 = 70 l.

▶Use only DIN EN 590 diesel with a cetane rating above 51. Use of fuels that do not comply with this standard may cause increased ware and damage to the engine and exhaust gas system. Compliance with the required exhaust gas limits might no longer be provided. The company operating the truck is responsible in this case.

### 2.1.1 Fuelling the tank system

*Vorgehensweise*

- Park the truck securely before fuelling, (see "Parking the truck securely" on page 71).
- Unscrew the tank cap (49).
- Insert the pump nozzle into the open tank filler neck.
- Add the fuel.
- Do not overfill the tank.
- Tighten the cap (49) back on after fuelling.



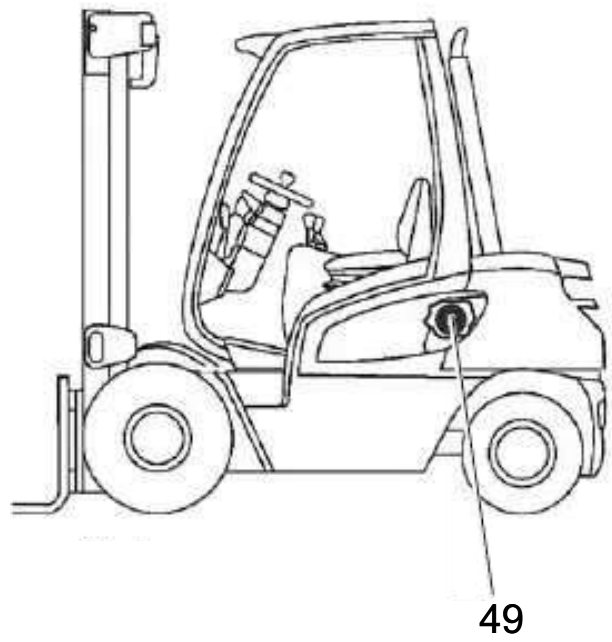

*Fuelling is now complete.*

## 2.2 Fuelling with fuel containers

*Vorgehensweise*

- Unscrew the tank cap (49) and open the fuel container.
- Fit the outlet pipe onto the fuel container.
- Insert the outlet pipe into the open tank filler neck.
- Make sure the fuel container and outlet pipe are connected tightly to each other.
- Raise the fuel container carefully and slowly add the diesel.
- Do not overfill the tank.
- Tighten the cap (49) back on after fuelling.

*Fuelling is now complete.*



# 3 LPG containers

Only use liquid gas that complies with DIN 51622 or comparable national regulations.

## 3.1 LPG bottles

**GEFAHR!**

**Risk of explosion**

▶The LPG bottle must only be replaced at designated areas by trained and authorised personnel.

**VORSICHT!**

**Using unsuitable LPG bottles can cause accidents.**

▶Use only approved LPG bottles.

▶The LPG bottle must always rest on an engaged bottle holder so that the hose connection of the shutoff valve is facing vertically down.

▶For bottle types of other countries note the national regulations.

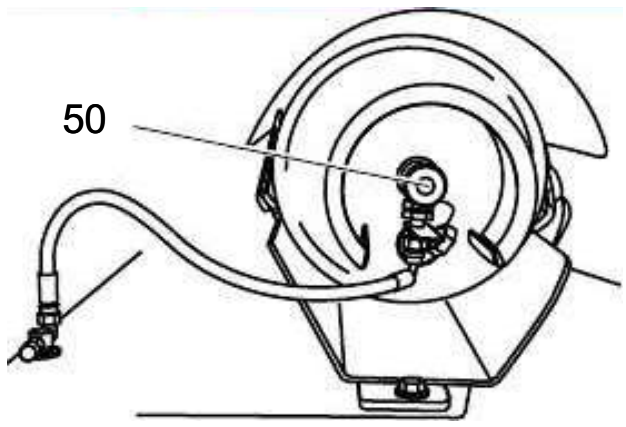
▶Note the indications and markings on the LPG bottle.

### 3.1.1 Using an LPG bottle

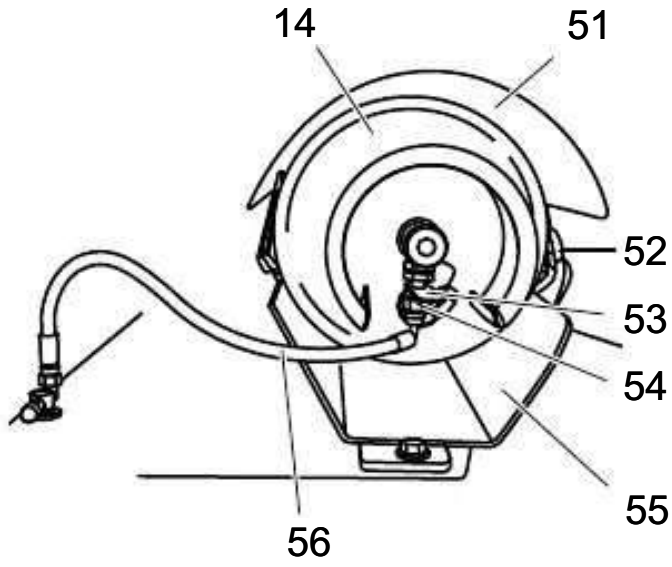
***Replace the LPG bottle***

*Vorgehensweise*

- Park the truck securely before replacing the LPG bottle, (see "Parking the truck securely" on page 71)
- Close the shut-off valves (50) securely.
- Start the motor and allow the LPG system to run empty in neutral.



### *Remove the LPG bottle*



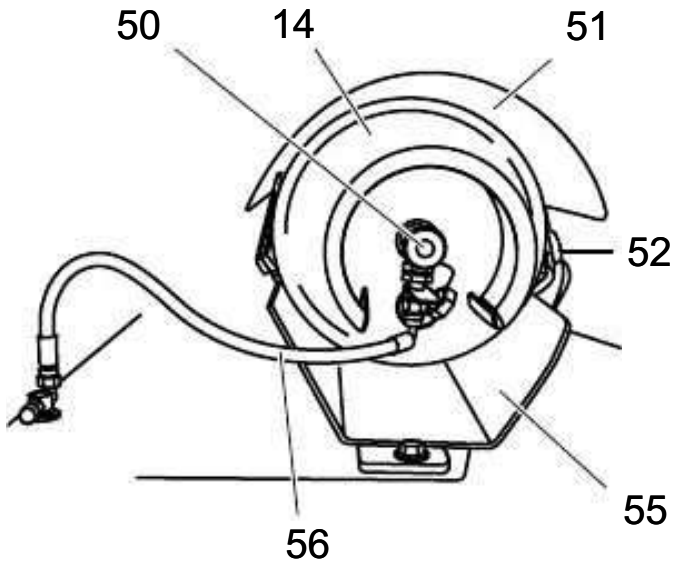

**⚠ VORSICHT!**

The connection has a left thread

*Vorgehensweise*

- Unscrew the union nut (54) while holding against the handle (53).
- Remove the hose (56) and immediately screw the valve cap onto the empty LPG bottle.
- Open the toggle-type fastener (52) and fold back the cover (51).
- Carefully remove the LPG bottle (14) from the bracket (55) and place it down securely.

### *Inserting a new LPG bottle*




*Vorgehensweise*

- Insert the LPG bottle (14) into the bracket (55)
- Align the hose connection downwards.
- Fold back the cover (51) and secure it with tensioning belts. Tighten the toggle-type fasteners (52).
- Unscrew the valve cap.
- Fit the hose (56) in accordance with instructions.
- Carefully open the shut-off valve (50).
- Check the hose connection for leaks using a foam-forming agent.

*The replacement is now complete.*

### 3.1.2 Operating with two LPG bottles

**⚠ WARNUNG!**

**Visibility is restricted when the truck reverses.**

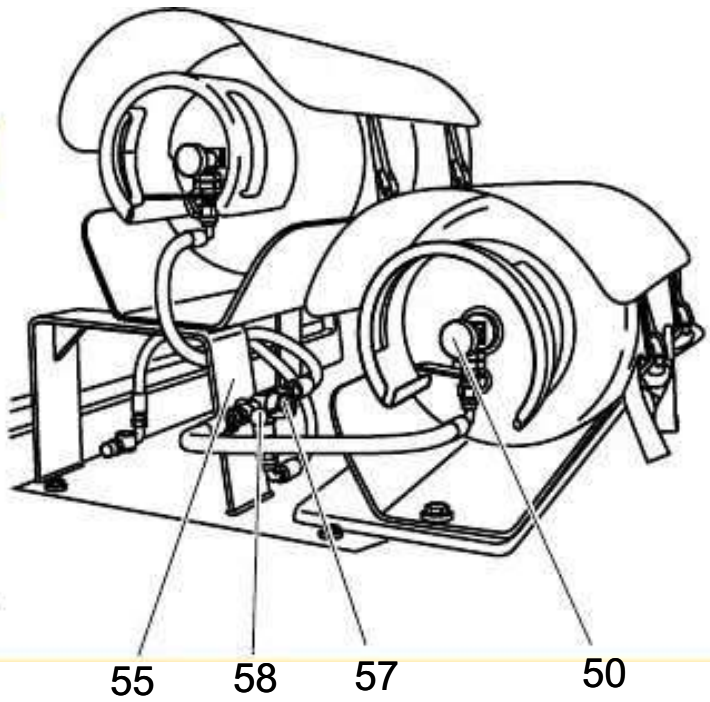
▶External mirrors must be fitted on either side of the industrial truck.

▶In addition, a panoramic mirror must be present above the LPG bottles.

***Operating the twin bottle system***

***HINWEIS***

**Use the additional valve (57) on the bracket (55) to change the gas supply. You can tell which bottle is supplying the gas by the gas hose connection on the shut-off valve (50) and the routing towards the LPG bottles (e.g. RH side of toggle valve = up, LH side of toggle valve = down).**




*Vorgehensweise*

- Use the lever (58) to change between the top and bottom LPG bottles.

***Replacing the LPG bottles***

*Vorgehensweise*

- (see "Using an LPG bottle" on page 46).

➔ Replace an empty LPG bottle at the earliest opportunity with a full one.

***Switching off the gas supply***

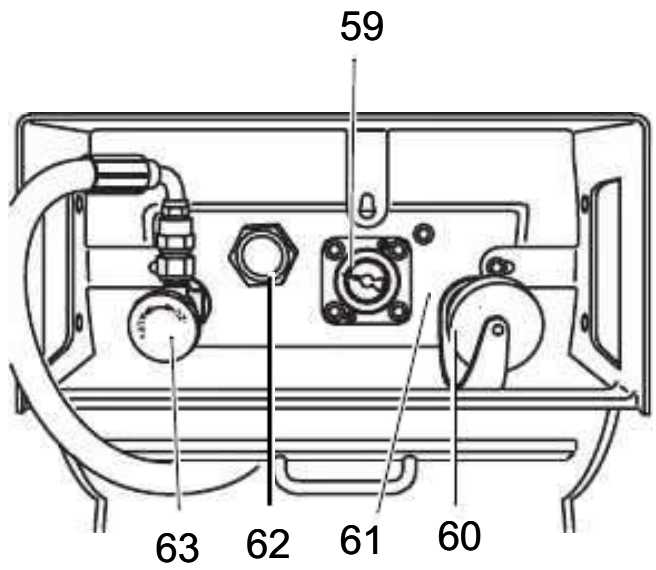
*Vorgehensweise*

- Close both shutoff valves (50) on the LPG bottles to interrupt the supply of LPG.

## 3.2 Liquid gas tank

Refillable liquid gas tanks contain a dispensing valve (63), a filling stop valve (61), a relief valve (62) and a display (59).

***Filling refillable liquid gas tanks (optional equipment).***




*Voraussetzungen*

– Note all guidelines and regulations concerning the filling of LPG bottles on the LPG pump.

*Vorgehensweise*

- Close the dispensing valve (63).
- Unscrew the cap (60) of the filling stop valve (61).
- Screw the filling connection of the liquid gas pump onto the filling stop valve (61).

➔ Fuelling automatically ends when the tank's capacity has been reached.

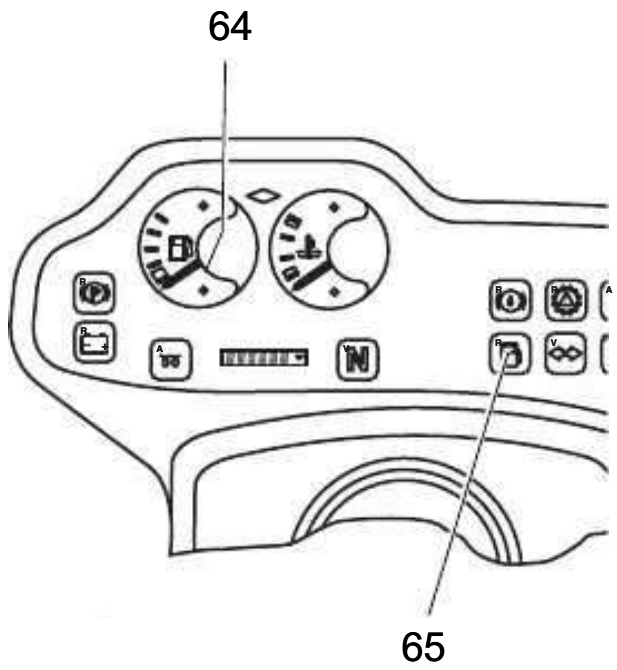
- After fuelling, unscrew the filling connection and screw the cap (60) of the filling stop valve (61) back on.

# 4 Fuel level indicator

## 4.1 Display unit

The level indicator (64) shows the capacity of the tank (only for DFG).

If the indicator (64) shows the reserve range, fill the tank. This is also displayed by the spare indicator (65).




## 4.2 Level indicator for LPG bottles (○)

When the level indicator for LPG bottles (○) is lit, this indicates that the LPG bottle is empty.

The remaining travel time will be 8 - 12 minutes, depending on the application and ambient conditions.

➔ Fluctuations in the liquid gas level caused by the travel mode can cause the level indicator to light up briefly. Only a permanently lit level indicator means that the LPG bottle is almost empty.

# E Operation

## 1 Safety Regulations for the Operation of the Forklift Truck

### Driver authorisation

The truck may only be used by suitably trained personnel, who have demonstrated to the proprietor or his representative that they can drive and handle loads and have been authorised to operate the truck by the proprietor or his representative.

### Driver's rights, obligations and responsibilities

The driver must be informed of his duties and responsibilities and be instructed in the operation of the truck and shall be familiar with the operating instructions. The driver shall be afforded all due rights. Safety shoes must be worn for pedestrian operated trucks.

### Unauthorised use of truck

The driver is responsible for the truck during the time it is in use. The driver must prevent unauthorised persons from driving or operating the truck. Do not carry passengers or lift other people.

### Damage and faults

The supervisor must be immediately informed of any damage or faults to the truck or attachment. Trucks which are unsafe for operation (e.g. wheel or brake problems) must not be used until they have been rectified.

### Repairs

The driver must not carry out any repairs or alterations to the truck without the necessary training and authorisation to do so. The driver must never disable or adjust safety mechanisms or switches.

## Hazardous area

**WARNING!**

**Risk of accidents / injury in the hazardous area of the truck**

The hazardous area is defined as the area in which a person is at risk due to truck movement, lifting operations, the load handler (e.g. forks or attachments) or the load itself. This also includes areas which can be reached by falling loads or lowering operating equipment.

- ▶ Instruct unauthorised people to leave the hazardous area.
- ▶ Give a warning signal with plenty of time for people to leave.
- ▶ If unauthorised personnel are still within the hazardous area stop the truck immediately.

---

**DANGER!**

**Accident risk**

- ▶ The driver must remain within the protected area of the overhead guard while the truck is being operated.

---

## Safety devices and warning labels

Safety devices, warning signs ((see "Identification points and data plates" on page 30)) and warning instructions in the present operating instructions must be strictly observed.

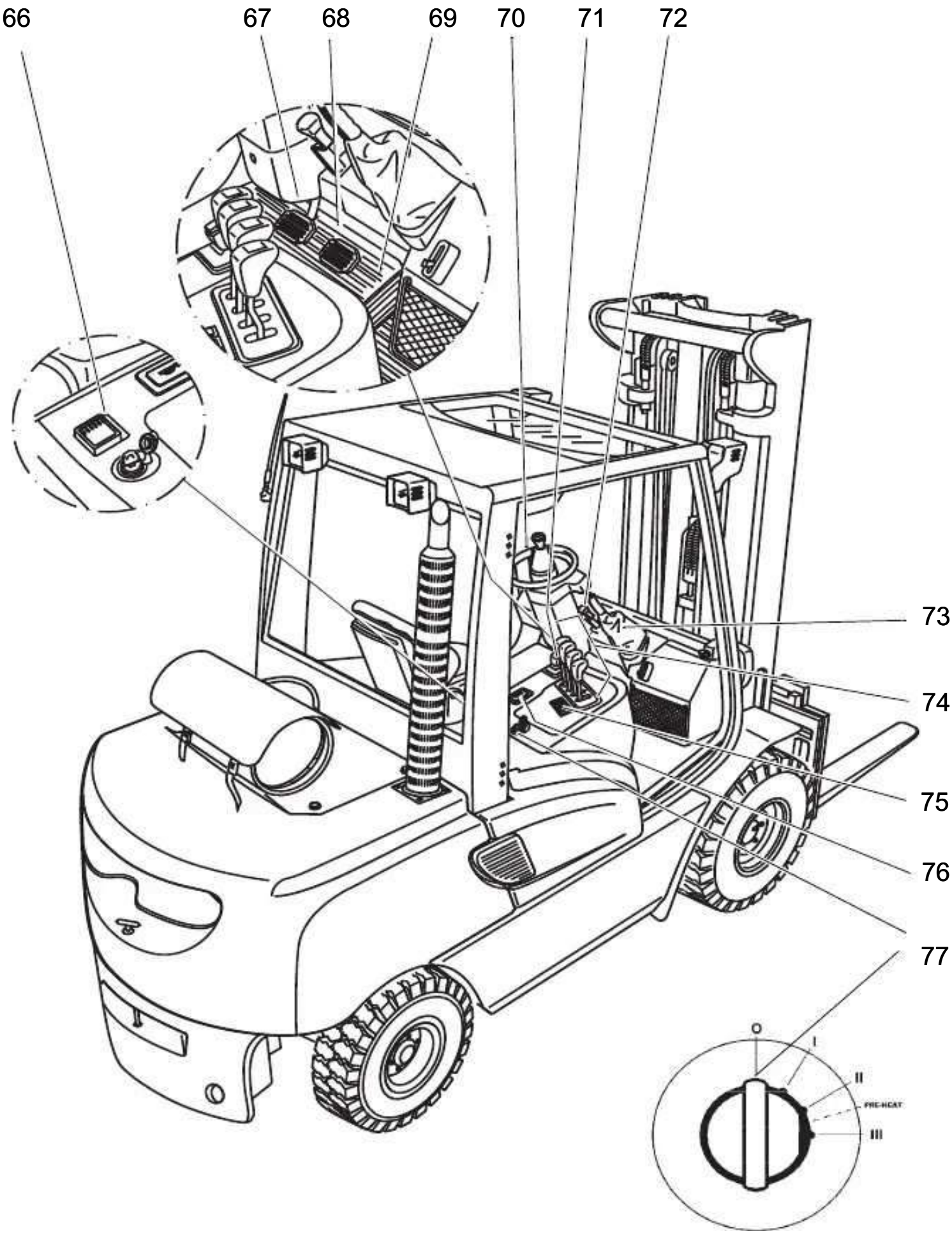
**CAUTION!**

**Reduced headroom can cause injuries**

- ▶ Trucks with reduced headroom are equipped with a warning label within the driver's line of sight. The max. recommended body size indicated on this sign must be observed.
- ▶ The headroom is also reduced when you wear a protective helmet.

---

# 2 Displays and Controls



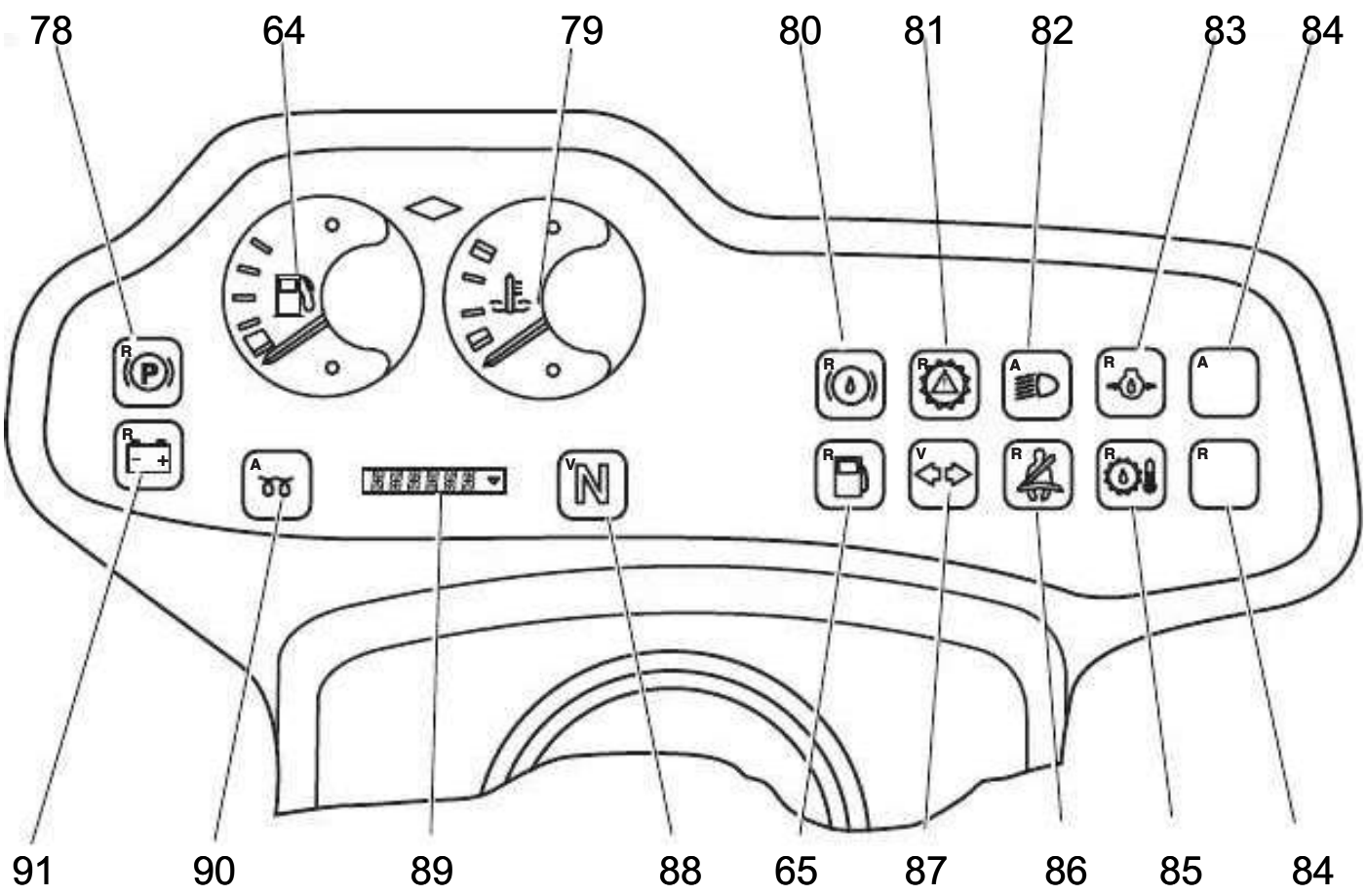
| Item | Control / Display | | Function |
|---|---|---|---|
| 66 | Emergency Disconnect switch | ● | Switches control current on and off in emergencies |
| 67 | Slow travel / brake pedal | ● | 1st zone: controls slow travel.<br>2nd zone: applies service brake. |
| 68 | Brake pedal | ● | Upon activation, the truck brakes to a halt immediately. |
| 69 | Accelerator pedal | ● | Controls the engine speed and / travel and lift speeds. |
| 70 | Steering wheel | ● | Steering the industrial truck. |
| 71 | Travel direction switch/ gear selector | ● | – Selects travel direction / neutral position<br>– Gear selection |
| 72 | Steering column adjusting lever | ● | Adjusts the steering column tilt. |
| 73 | Parking brake lever | ● | To apply / release the parking brake:<br>– Pull up lever to engage.<br>– Push lever forward to release. |
| 74 | SOLOPILOT | ● | Operates the following functions:<br>– Load lifting lift/lower<br>– Mast forward / reverse tilt<br>– Sideshifter left / right (○)<br>– Auxiliary hydraulics (○) |
| 75 | Options switch | ● | Options |
| 76 | Horn | ● | Activates an audible warning. |
| 77 | Key switch | ● | Switches power supply on and off.<br>Starts and stops the engine.<br>**O** - All main circuits are switched off and the key can be removed.<br>**I** - All consumers off<br>**II** -All consumers on<br>**pre-heat** - Pre-heat<br>**III** - Starting the motor (automatically returns to the II position). |

| | |
|---|---|
| ●= Series equipment | ○= Optional equipment |

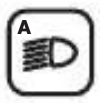
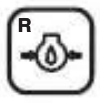
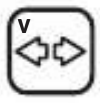
## 2.1 Display unit

The control panel display unit shows the operating data, the battery charge, the service hours and error details and information. Pictograms in the left top section of the control panel act as warning indicators.

### 2.1.1 Graphical displays

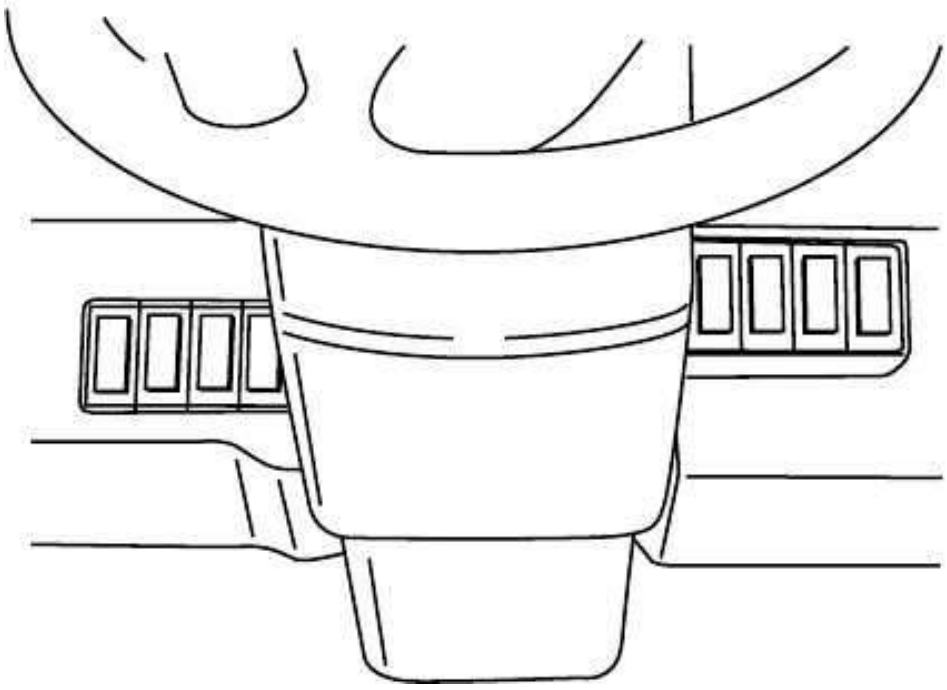



| Item | | Control / Display | | Function |
|---|---|---|---|---|
| 64 | | Fuel display (DFG) | ● | Graphic illustration of the fuel supply. |
| 65 | | Fuel supply indicator (DFG) | ● | When lit, indicates the fuel supply is too low. |
| 78 | | Parking brake warning indicator | ● | Parking brake activated<br>– Truck operational, parking brake active. |
| 79 | | Coolant temperature display | ● | Indicates the coolant temperature. |
| 80 | | Brake fluid indicator | ● | When lit, indicates the brake fluid level is too low. |

| Item | | Control / Display | | Function |
|---|---|---|---|---|
| 81 |  | Not used | ● | |
| 82 |  | Dipped lights | ● | Switches dipped lights on and off. |
| 83 |  | Engine oil pressure display | ● | When lit, indicates that the engine oil pressure is too low. |
| 84 | | Not used | ○ | |
| 85 |  | Converter temperature indicator | ● | When lit, indicates that the oil temperature in the power shift transmission is too high. |
| 86 |  | Seat belt indicator | ○ | When lit indicates that the seat belt has not been properly attached. |
| 87 |  | Flashing indicator | ○ | Right / left indicator lamps activated |
| 88 |  | Neutral position | ● | When lit, indicates that the travel direction switch is in neutral. |
| 89 |  | Time / service hours display | ● | Indicates the time or number of operating hours in service. |
| 90 |  | Pre-heat indicator lamp | ● | Engine is preheated (DFG only). |
| 91 |  | Charge current indicator | ● | Battery not charging. |

| | |
|---|---|
| ●= Series equipment | ○= Optional equipment |

## 2.2 Instrument panel switches (○)



| | Display | Function |
|---|---|---|
| | Rear windscreen wiper | Switches rear windscreen wiper on and off. |
| | Front windscreen washing system | Switches the front windscreen washing system on and off. |
| | Front windscreen wiper | Switches the window wiper on and off. |
| | Parking light | Switches parking light on and off. |
| | Rear work lights | Switches rear work lights on and off. |
| | Dipped lights | Switches dipped lights on and off. |
| | Front work lights | Switches front work lights on and off. |
| | Warning indicator | Switches the warning indicator on and off. |
| | Rear windscreen heating | Switches rear windscreen heating on and off. |

➔ The arrangement of switches and buttons on the dashboard and engine cover is customised to customer preference.

## 2.3 Travel direction switch/gear selector

### 2.3.1 Travel direction switch

**NOTE**

The engine will not start when the travel direction switch is in the forward or reverse position.

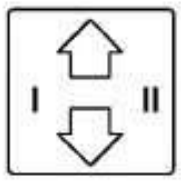
When the travel direction switch is in the middle position, the gear is in neutral.

*Procedure*

- To select the forward gear, push the travel direction switch forward.
- To select the reverse gear, push the travel direction switch back.

### 2.3.2 Gear selector

Gears are selected manually. When travelling on a slope, press ‘I’ to select a lower gear.



# 3 Preparing the Truck for Operation

## 3.1 Checks and operations to be performed before starting daily operation

**⚠ WARNING!**

**Damage and other truck or attachment (special equipment) defects can result in accidents.**

If damage or other truck or attachment (special equipment) defects are discovered during the following checks, the truck must be taken out of service until it has been repaired.

▶Report any defects immediately to your supervisor.

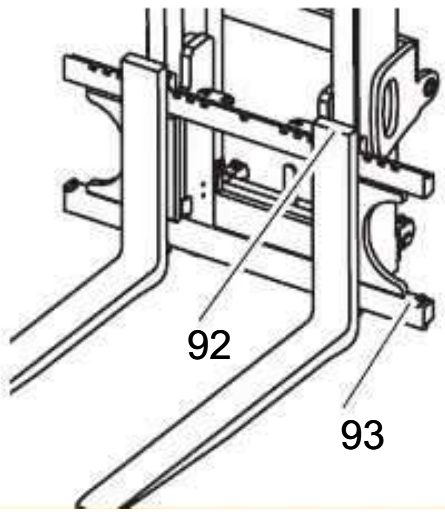
▶Tag out and decommission a faulty lift truck.

▶Only return the truck to service when you have identified and rectified the fault.

**⚠ CAUTION!**

**Checking the accelerator pedal**

▶The accelerator pedal should only be checked when the parking brake is applied and the engine is idle.




***Inspection before starting daily operation***

*Procedure*

- Visually inspect the entire truck (in particular wheels, wheel bolts and load handler) for damage.
- Check the fork stop (92) and fork tine retainer (93).
- Visually inspect the hydraulic system in the visible area for damage and leaks.
- Check the driver's seat has been adjusted to the correct position.
- Test the horn and reversing buzzer (○) where applicable.
- Check that the load chart and warning labels are legible.
- Test the controls and displays.
- Test the steering.
- Make sure the load chains are evenly tensioned.
- Test the seat belt. (The belt should block if extracted suddenly.)
- Test the seat switch. When the driver's seat is vacated it should not be possible to activate the working hydraulics.
- Test the restraint system (○),
- Test the lift/lower, tilt and if applicable the attachment hydraulic control functions.
- Check the accelerator pedal can move freely by pressing it several times.
- Test the service and parking brakes: Approach carefully and test the effectiveness of the brake pedal.
- Check the fuel supply.
- Check the fluid level of the windscreen washer system (○), (see "Adding window washer system fluid" on page 150).
- Check the gas system is working correctly, (see "LPG containers" on page 46)

## 3.2 Entry and exit

*Procedure*

- Open the cab door (○)
- To enter and exit the cab, hold onto the handle (94).


➔ An additional step is provided for the driver position extension (○)

## 3.3 Trucks with reduced headroom X (○)

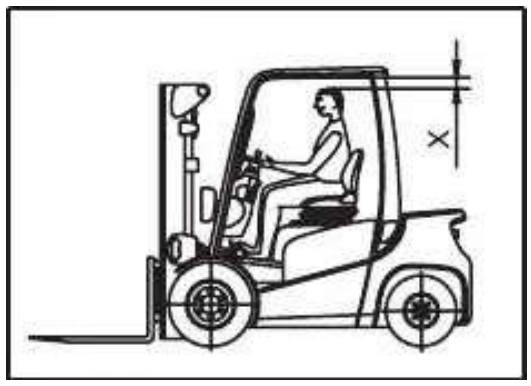
**WARNING!**

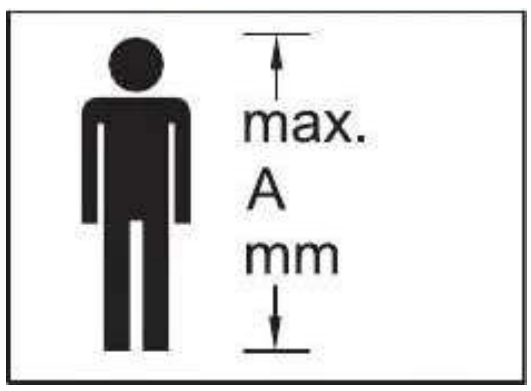
**An unsuitable workplace can damage your health**

Failure to observe the recommended body size can cause stress and endanger the driver and may lead to lasting ill health due to an unhealthy posture and excessive strain on the driver.

▶ The owner must ensure that truck operators do not exceed the maximum body size indicated.

▶ The owner must check that the drivers can sit in a normal and upright position without having to strain.



## 3.4 Setting up the operator position

**WARNING!**

**Accident risk**

▶Do not adjust the driver's seat while travelling.

---

*Procedure*

- Before starting to travel, adjust the driver's seat, steering column and armrest (if necessary) so that all the controls are within reach and can be applied without having to strain.
- Adjust the visibility aid equipment (mirrors, camera systems etc.) so that the working environment can be clearly seen.

### 3.4.1 Adjusting the driver's seat

**WARNING!**

**Risk of accidents and damage to health**

An incorrectly adjusted driver's seat can result in accidents and damage to health.

▶Do not adjust the driver's seat while travelling.

▶The driver's seat should lock in position after adjustment.

▶Check and adjust the individual driver's seat setting before starting to use the truck.

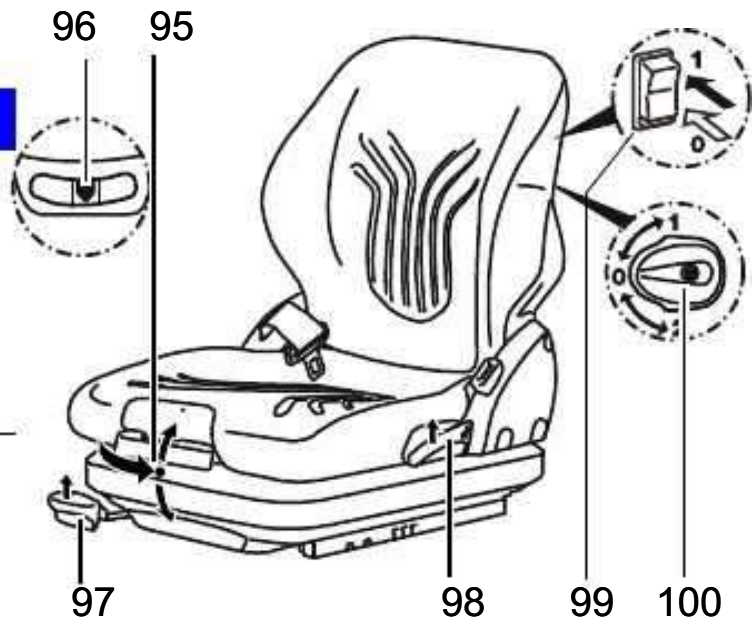
▶Hold the weight setting lever (95) only by the recess, do not reach through underneath the lever.

---

### *Adjusting the driver's weight*

**NOTE**

To achieve optimal seat cushioning the driver's seat must be set to the driver's weight.
Set the driver's weight when the seat is occupied.




*Procedure*

- Fold out the weight adjustment lever (95) as far as it will go in the arrow direction
- Move the weight adjustment lever (95) up and down to set the seat to a higher weight.
- Move the weight adjustment lever (95) up and down to set the seat to a lower weight.

➔ The driver's weight is correct when the arrow is in the middle of the display window (96). The minimum or maximum weight setting is reached when you can feel a return stroke on the lever.

- After setting the weight, move the lever (95) back in full.

*The driver's weight is now set.*

### *Adjusting the backrest*

*Procedure*

- Sit on the driver's seat.
- Pull the lever (98) to adjust the backrest.
- Adjust the backrest tilt.
- Release the lever (98) again. The backrest is locked.

*The backrest is now set.*

➔ Hold the weight setting lever (95) only by the recess, never reach through underneath the lever.

### *Driver's seat with pneumatic weight adjustment (MSG 75) (○)*

*Procedure*

- Pull the weight adjustment lever (95) up to set the seat to a higher weight.
- Push the weight adjustment lever (95) down to set the seat to a lower weight.

*The driver's weight is correct when the arrow is in the middle of the display window (96).*

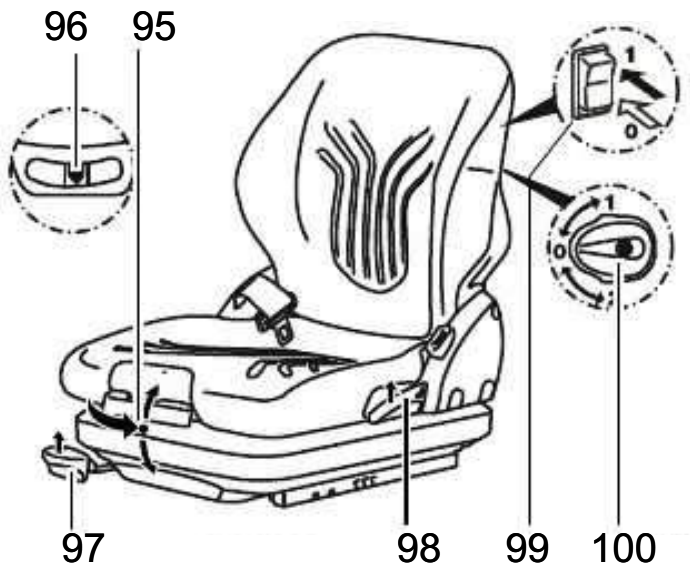
### *Adjusting the seat position*

**⚠ CAUTION!**

**An unsecured driver's seat can cause injury**

An unsecured driver's seat can slide out of its guide during travel, resulting in accidents.

- ▶ The driver's seat must be locked in position.
- ▶ Do not adjust the driver's seat while travelling.




*Procedure*

- Sit on the driver's seat.
- Pull up the driver's seat locking lever97 in the direction of the arrow.
- Push the driver's seat forwards or backwards to the desired position
- Engage the driver's seat locking lever (97) in position.

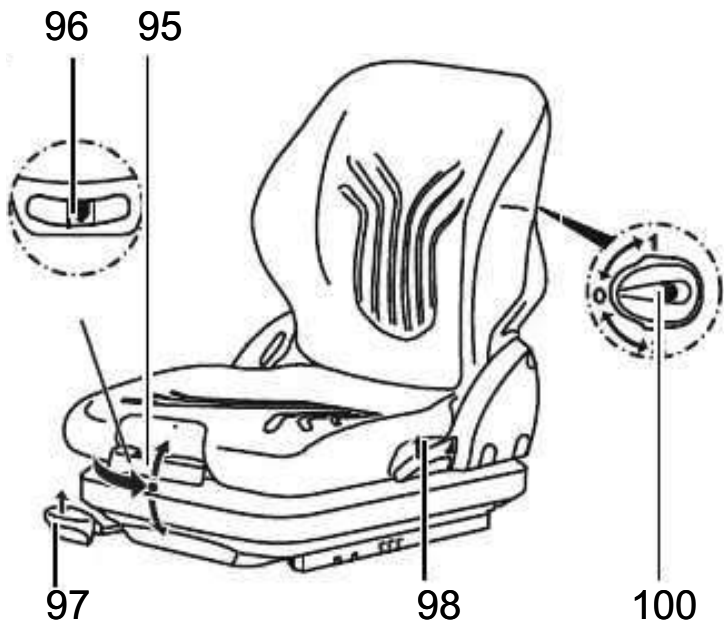
*The seat position is now correctly set.*

### *Adjusting the lumbar vertebrae support (○)*

*Procedure*

- Turn the hand wheel (100) to the required position.
  Position 0 = no warping in lumbar vertebrae area.
  Position 1 = increasing warping in upper lumbar vertebrae area.
  Position 2 = increasing warping in lower lumbar vertebrae area.

*The lumbar vertebrae support is now set.*



### 3.4.2 Adjusting the steering wheel / steering column

**⚠ CAUTION!**

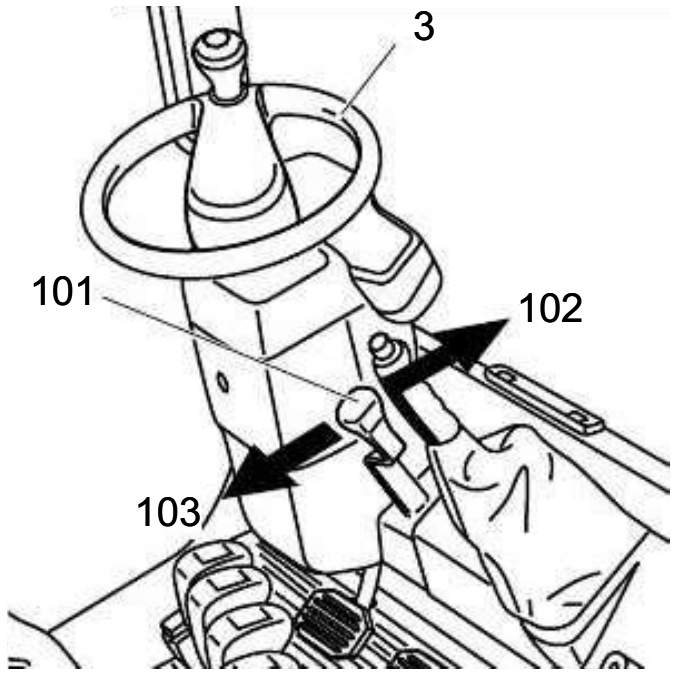
Do not adjust the steering wheel while travelling

**Individual steering wheel position**

The tilt of the steering wheel can adjusted to suit the operator.

*Procedure*

- Pull the steering wheel adjusting lever (101) in the direction of the arrow (103).
- Tilt the steering wheel (3) forward or backward as required.
- Push the steering wheel adjusting lever (102) in the direction of the arrow.

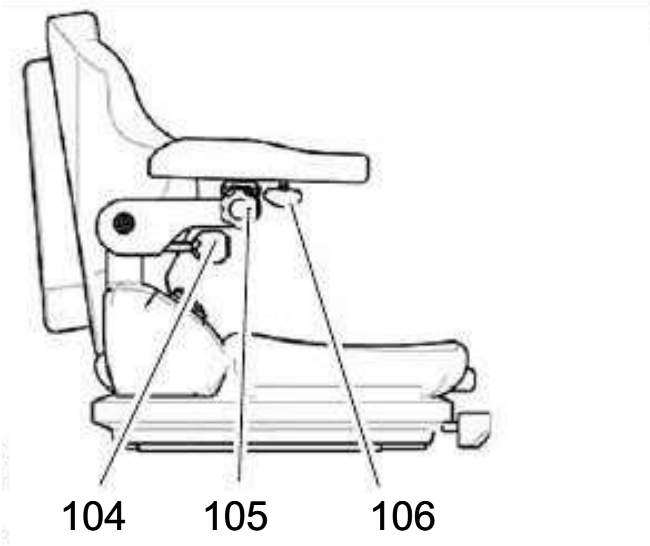



### 3.4.3 Adjusting the armrest (○)

*Procedure*

- Loosen the screw (104) and tilt the armrest up or down.
- Re-tighten the screw (104).
- Loosen the screw (105) and set the armrest vertical.
- Re-tighten the screw (105).
- Loosen the screw (106) and set the armrest horizontal.
- Re-tighten the screw (106).

*The armrest is now positioned.*



## 3.5 Seat Belt

**DANGER!**

**Travelling without a seat belt increases the risk of injury.**

If the seat belt is not worn or is modified, personal injury can result.

- ▶ Always put on the seat belt before starting the industrial truck.
- ▶ Do not modify the seat belt.
- ▶ Damaged or non-operational seat belts must be replaced by trained personnel.
- ▶ Seat belts must always be replaced after an accident.
- ▶ Only original spare parts must be used for retrofits or repairs.

➔ Protect the seat belt from contamination (e.g. cover it when the truck is idle) and clean it regularly. Frozen belt locks or pulleys must be thawed out and dried to prevent them from freezing up again.
The temperature of the warm air should not exceed +60 °C!

**Starting the industrial truck on steep slopes**

The automatic blocking system locks the belt in the retractor when the truck is positioned on a steep slope. This prevents the belt from being pulled out of the retractor.

➔ Carefully drive the truck off the slope and then put on the belt.

# 4 Industrial Truck Operation

## 4.1 Safety regulations for truck operation

### Travel routes and work areas

Only use lanes and routes specifically designated for truck traffic. Unauthorised third parties must stay away from work areas. Loads must only be stored in places specially designated for this purpose.
The truck must only be operated in work areas with sufficient lighting to avoid danger to personnel and materials. Additional equipment is necessary to operate the truck in areas of insufficient lighting.

**⚠ DANGER!**

Do not exceed the permissible surface and spot load limits on the travel routes.
At blind spots get a second person to assist.
The driver must ensure that the loading dock / ramp cannot move or come loose during loading / unloading.

---

***NOTE***

Loads must not be deposited on travel or escape routes, in front of safety mechanisms or operating equipment that must be accessible at all times.

---

### Travel conduct

The driver must adapt the travel speed to local conditions. The truck must be driven at slow speed when negotiating bends or narrow passageways, when passing through swing doors and at blind spots. The driver must always observe an adequate braking distance between the forklift truck and the vehicle in front and must be in control of the truck at all times. Abrupt stopping (except in emergencies), rapid U turns and overtaking at dangerous or blind spots are not permitted. Do not lean out or reach beyond the working and operating area.

### Hazardous situations

If the truck is about to tip over, do not loosen the seat belt. The driver must not jump off the truck. The driver must lean his upper body over the steering wheel and hold on with both hands. Tilt your body in the opposite direction of fall.

### Travel visibility

The driver must look in the direction of travel and must always have a clear view of the route ahead. Loads that affect visibility must be positioned at the rear of the truck. If this is not possible, a second person must walk alongside the truck as a lookout to observe the travel route while maintaining eye contact with the driver. Proceed only at walking pace and with particular care. Stop the truck as soon as you lose eye contact.

### Negotiating slopes and inclines

Negotiating slopes or inclines up to 15% is only permitted if they are specifically designed as travel routes, are clean and have a non-slip surface and providing they can be safely travelled along in accordance with the truck's technical specifications. The truck must always be driven with the load unit facing uphill. The industrial truck must not be turned, operated at an angle or parked on inclines or slopes. Inclines must only be negotiated at slow speed, with the driver ready to brake at any moment. Particular care is required when travelling near slopes and quay walls.

### Negotiating lifts and docks

Lifts may only be entered if they have sufficient capacity, are suitable for driving on and authorised for truck traffic by the owner. The driver must satisfy himself of the above before entering these areas. The truck must enter lifts with the load in front and must take up a position which does not allow it to come into contact with the walls of the lift shaft. People travelling in the lift with the forklift truck must only enter the lift after the truck has come to a halt and must exit the lift before the truck. The driver must ensure that the loading ramp / bridge cannot move or come loose during loading / unloading.

### Type of loads to be carried

The operator must make sure that the load is in a satisfactory condition. Loads must always be positioned safely and carefully. Use suitable precautions to prevent parts of the load from tipping or falling down. Prevent liquid loads from sloshing out.

Inflammable liquids (e.g. fused metal etc.) may only be transported with suitable auxiliary equipment. Contact your authorized Jungheinrich customer adviser.

For safety instructions on the nature of loads to be carried with attachments,(see "Lifting, transporting and depositing loads" on page 79).

### Towing trailers

The truck may only be used occasionally to tow trailers, (see "Towing trailers" on page 93)

**DANGER!**

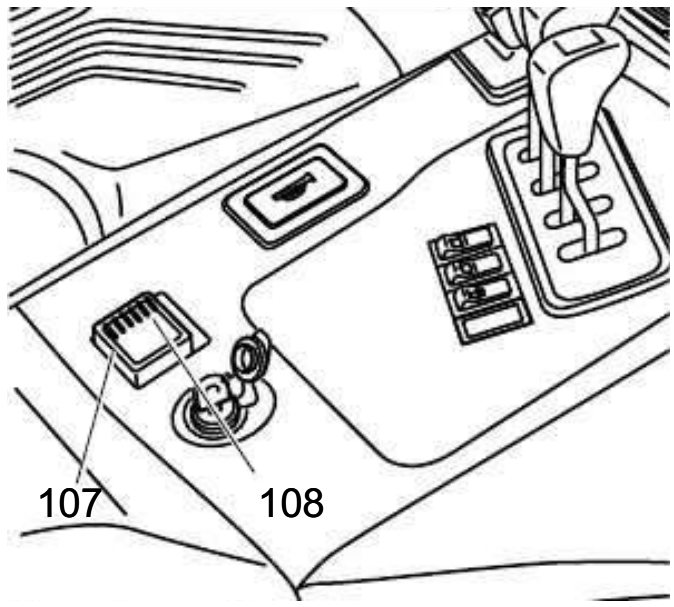
### Exhaust emissions can be fatal

- The truck must only be operated in well ventilated areas. If the truck is operated in enclosed areas, this can lead to a build-up of harmful exhaust emissions, resulting in dizziness, tiredness and even death.
- The user must comply with legal requirements, technical standards and health and safety regulations when operating an IC motor powered lift truck in closed rooms.

## 4.2 Preparing the truck for operation

### Before starting the truck

The truck should only be operated from the driver's seat. Do not run up the engine in idle. The engine soon reaches operating temperature at a moderate charge and when the speed alternates. Only fully charge the engine once it has reached operating temperature.



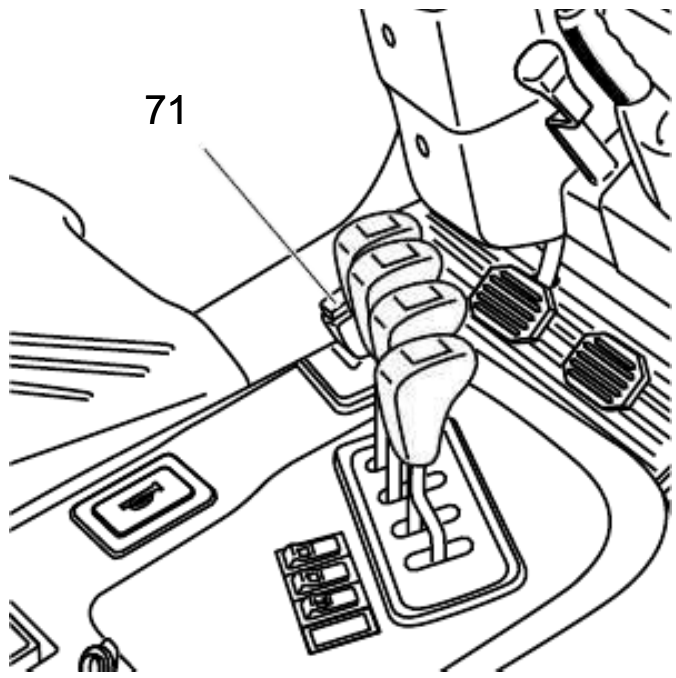

*Requirements*

– Checks and operations to be performed before starting daily operation, (see "Checks and operations to be performed before starting daily operation" on page 59).

### *Switching on the industrial truck*

*Procedure*

- Unlock the Emergency Disconnect switch (107). To do this, raise the flap (108) and pull up the Emergency Disconnect switch
- Apply the parking brake.
- Set the travel direction switch (71) to neutral N. Otherwise the motor cannot be started.
- Perform the appropriate starting procedure depending on the type of motor; see 4.2.1 "Starting procedure for the DFG" or 4.2.2 "Starting procedure for the TFG".



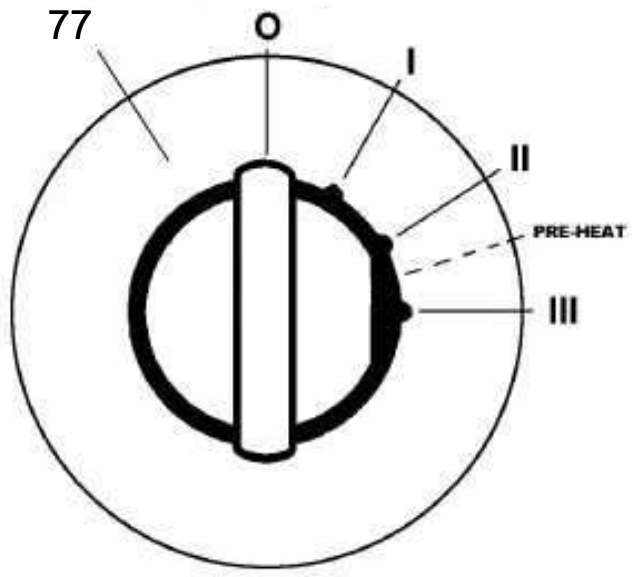
### 4.2.1 Starting procedure for the DFG

*Procedure*

- Insert the key in the key switch (77). Set key switch to “II”.
- All the indicators light up briefly to test operation.

➔ All the indicators except for the engine oil pressure display (83), parking brake indicator (78), indicator lamp for neutral (88) and charge current indicator (110) should go out after a short while. If not, stop the start-up process and rectify the fault.

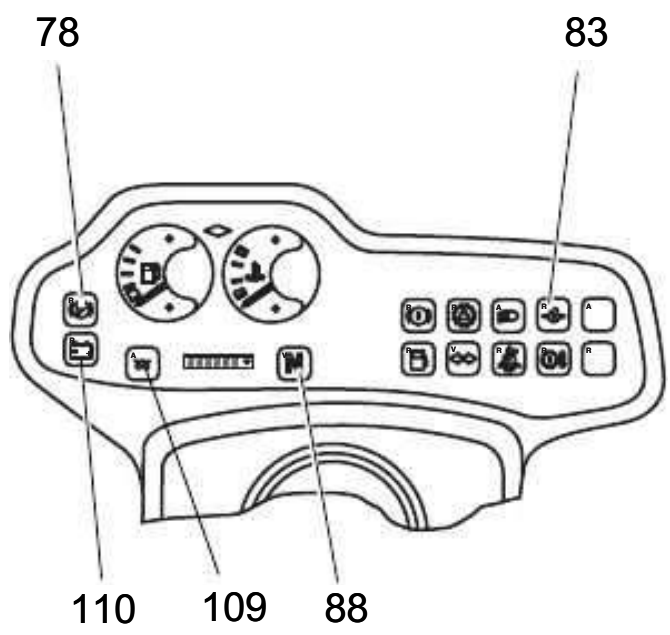
- Turn the ignition/starter switch further to the PRE-HEAT setting and hold it there for about 4 seconds.




- Now set the ignition / starter key to the "III" position.

➔ Only apply the starter for a maximum of 15 seconds without interruption. The truck contains a restart blocking mechanism which prevents it from starting again while the engine is running.

- Release the key as soon as the engine starts. It automatically reverts to the "II" setting.




➔ All indicators lights except for neutral setting (88) and parking brake (78), if activated, should go out as soon as the engine starts. If not, stop the engine immediately and rectify the fault.

*The truck is now ready for operation.*

### 4.2.2 Starting procedure for the TFG

**DANGER!**

**Risk of escaping liquid gas if the truck does not start**

▶Note the safety regulations governing the handling of liquid gas ((see "Safety regulations for handling diesel fuel and LPG" on page 41))

▶Close the gas bottle shut-off valve.

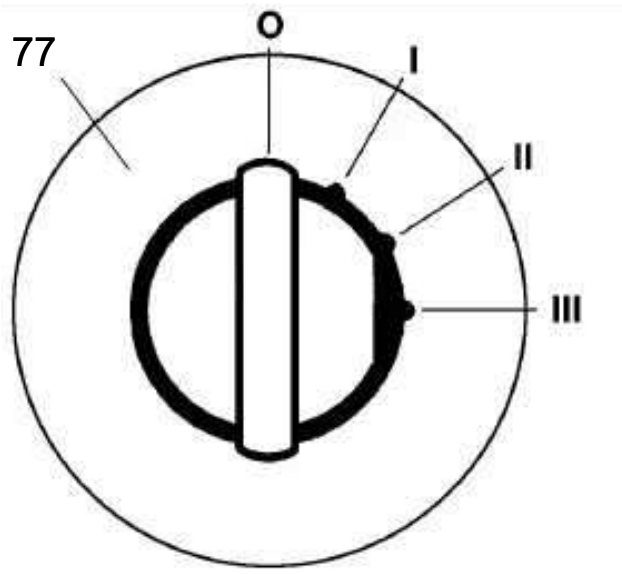
▶Set the key switch to "O"

▶Notify your superior.

*Procedure*

- Slowly open the shut-off valve on the LPG bottle.
- Insert the key in the key switch (77). Set key switch to “II”.
- All the indicators light up briefly to test operation.

All the indicators except for the engine oil pressure display (83), parking brake indicator (78), indicator lamp for neutral (88) and charge current indicator (110) should go out after a short while. If not, stop the start-up process and rectify the fault.



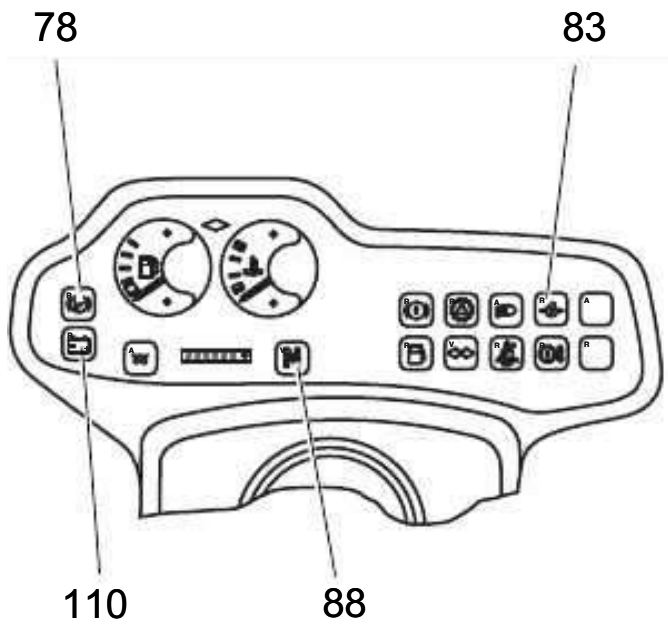

- Now set the ignition / starter key to the "III" position.

Only apply the starter for a maximum of 15 seconds without interruption. The truck contains a restart blocking mechanism which prevents it from starting again while the engine is running.

- Release the key as soon as the engine starts. It automatically reverts to the "II" setting.

All indicators lights except for neutral setting (88) and parking brake (78) should go out as soon as the engine starts. If not, stop the engine immediately and rectify the fault.

*The truck is now ready for operation.*



## 4.3 Parking the truck securely

**DANGER!**

**Risk of explosion**

▶ LPG trucks may only be parked in ground level rooms or higher and providing they are adequately ventilated. They must not be parked near to cellar doors and entry points, hollows, drains, drain inlets or other recesses below the parked truck.

**WARNING!**

**An unsecured truck can cause accidents**

Parking the truck on an incline, without the brakes applied or with a raised load / load handler is dangerous and is strictly prohibited.

▶ Always park the truck on a level surface. In special cases the truck may need to be secured with wedges.

▶ Always fully lower the mast and load handler.

▶ Tilt the mast forward.

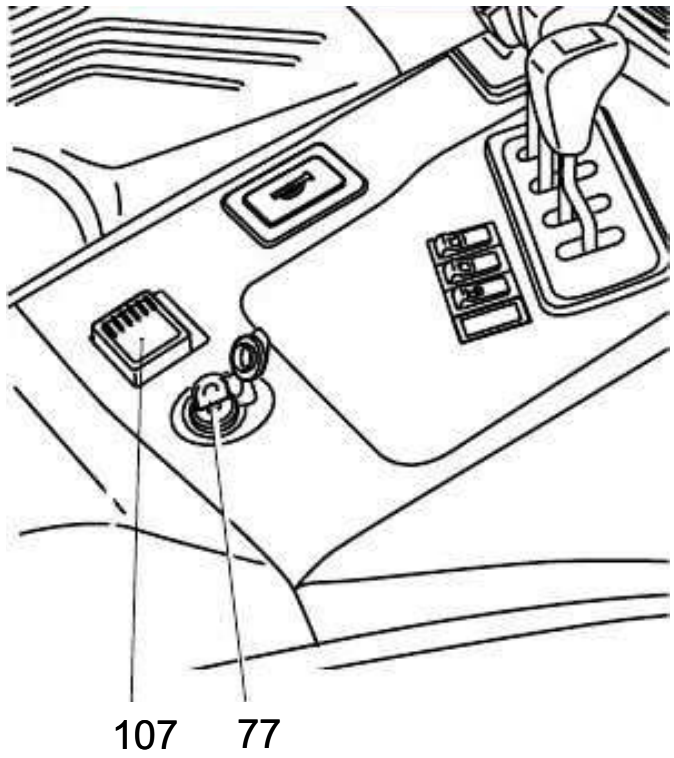
▶ Select a place to park where no other people are at risk of injury from lowering forks.

▶ Do not park and abandon the truck on an incline.

***Parking and leaving the truck***

*Procedure*

- Apply the parking brake, (see "Parking brake" on page 76).
- Lower the load handler.
- Turn the key in the key switch (77) to the “0” position.
- Remove the key from the key switch (77).
- Press the Emergency Disconnect switch (107) down.
- Close the gas bottle (TFG only).




**TFG only:** If the ignition key is set to “0” while the engine is running, the engine will continue to run for a short time. This ensures that the remaining gas in the lines between the engine and the automatic shutoff valve of the gas system is used up. If the engine has accidentally switched off, start up the engine and switch it off again in the correct manner at the end of the journey.

## 4.4 Emergency Disconnect

**⚠ CAUTION!**

**Accident risk**

The operation of the Emergency Disconnect switch must not be affected by any objects placed in its way.

---

### Applying the Emergency Disconnect

*Procedure*

- Press the Emergency Disconnect switch (107) down.

*All electrical functions are deactivated. The truck coasts.*

107

## 4.5 Travel

**⚠ WARNING!**

**Improper travel can result in accidents**

- ▶ Do not get up from the driver's seat during travel.
- ▶ Do not drive the truck unless your are wearing a seat belt and the panels and doors are properly locked.
- ▶ Make sure that the travel area is clear.
- ▶ Adapt the travel speed to the conditions of the route, the work area and the load.
- ▶ Tilt the mast back and raise the fork carriage approx. 200 mm.
- ▶ Make sure you have enough visibility when reversing.

***Travel***

*Requirements*

– Truck prepared for operation, (see "Preparing the truck for operation" on page 68).

*Procedure*

- Release the parking brake.
- Choose the travel direction with the travel direction switch (71).

**NOTE**

Only change direction when the truck has stopped.


- To select the forward gear, push the switch forward.
- To select the reverse gear, pull the switch back.
- Raise the fork carriage approx. 200 mm.
- Tilt the mast back.
- Apply the accelerator pedal (69). The travel speed is governed by the accelerator (69).

*The truck travels in the direction selected.*

**Neutral locking**

If the driver leaves the truck without taking it out of gear, the truck will automatically be set to neutral. To resume travel (sitting on the truck) all controls must be deactivated, the travel direction switch must be set to neutral "N" and then the required direction selected.

**Slow travel / brake pedal**

*Requirements*

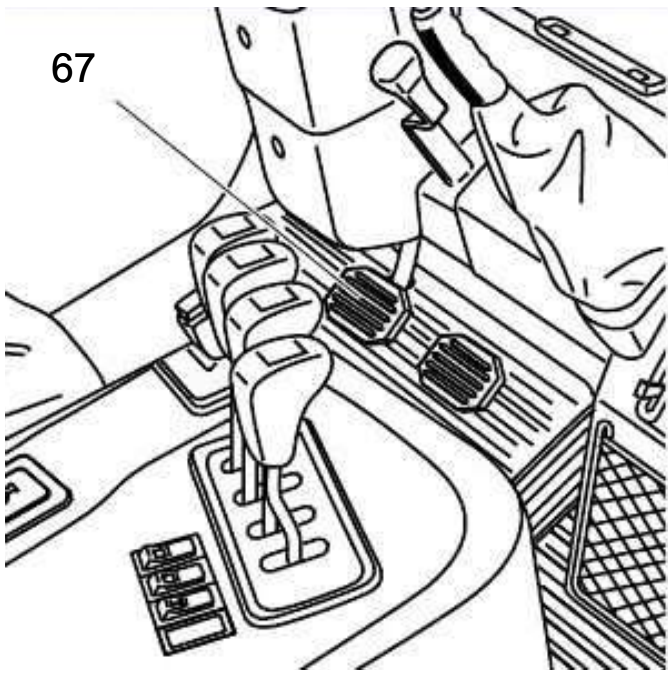
– Truck ready for operation, (see "Preparing the truck for operation" on page 68).

*Procedure*

• Apply the slow travel / brake pedal (67) sensitively.

*The Industrial truck moves slowly in the selected travel direction and allows for excellent shunting in confined areas. Rapid lifting is possible at a slow travel speed.*

67



**NOTE**

The slow travel / brake pedal can also actuate the drum brakes but this is only intended as a crawl speed aid. The pedal should not be used as a service brake. This operating mode can only be used for max. 5 seconds when the engine is running at high speed.

## 4.6 Steering

***Steering***

*Procedure*

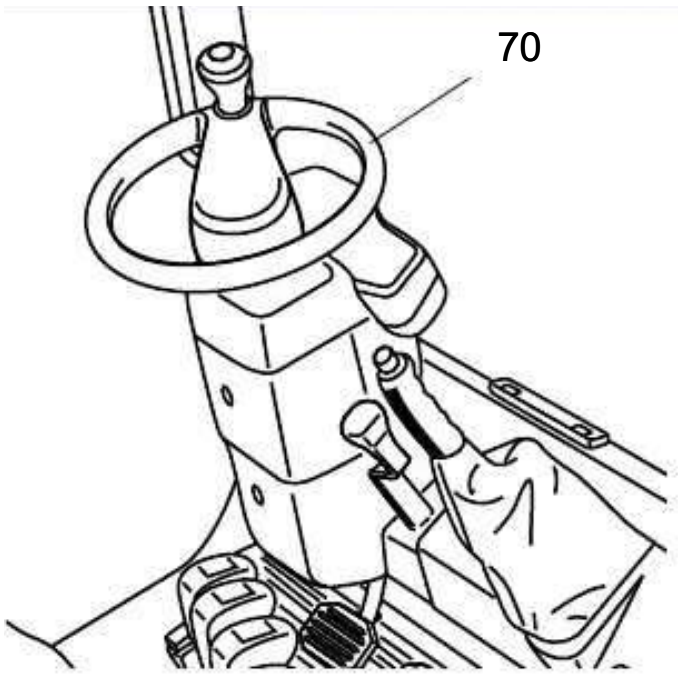
➔ Very little steering effort is required; you should therefore turn the steering wheel (70) sensitively.

• To negotiate a right-hand bend: Turn the steering wheel clockwise according to the required steering radius.

• To negotiate a left-hand bend: Turn the steering wheel anti-clockwise according to the required steering radius.

*The truck travels in the direction selected.*

70



## 4.7 Brakes

**⚠ WARNING!**

**Accident risk**

The brake pattern of the truck depends largely on the ground conditions.

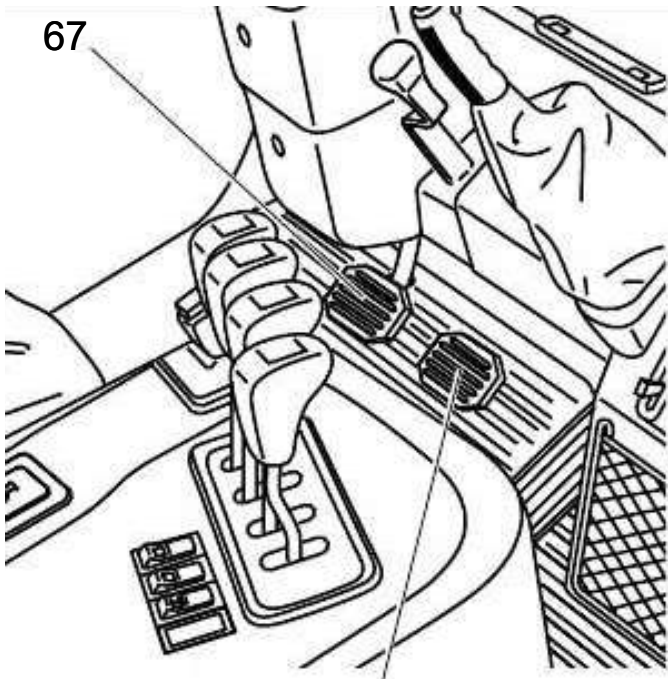
- ▶ The driver must be aware of travel route conditions and them into account when braking.
- ▶ Brake with care to prevent the load from slipping.
- ▶ Allow for increased braking distance when travelling with an attached load.

### 4.7.1 Service brake

The brake pedal hydraulically actuates the drum brakes of the front wheels.

When the brake pedal (68) is applied the drum brakes are applied without disengaging the transmission.

Applying the slow travel / brake pedal (67) controls the flow of power in the power shift gear. This pedal can also be used to brake gently during crawl speed operations.



### 4.7.2 Parking brake

**⚠ DANGER!**

**Accident risk**

- ▶ The parking brake will hold the truck with maximum load on a clean ground surface, on inclines of up to 15%.
- ▶ Do not park and abandon the truck on an incline.
- ▶ Applying the parking brake during travel will cause the truck to brake to a standstill.

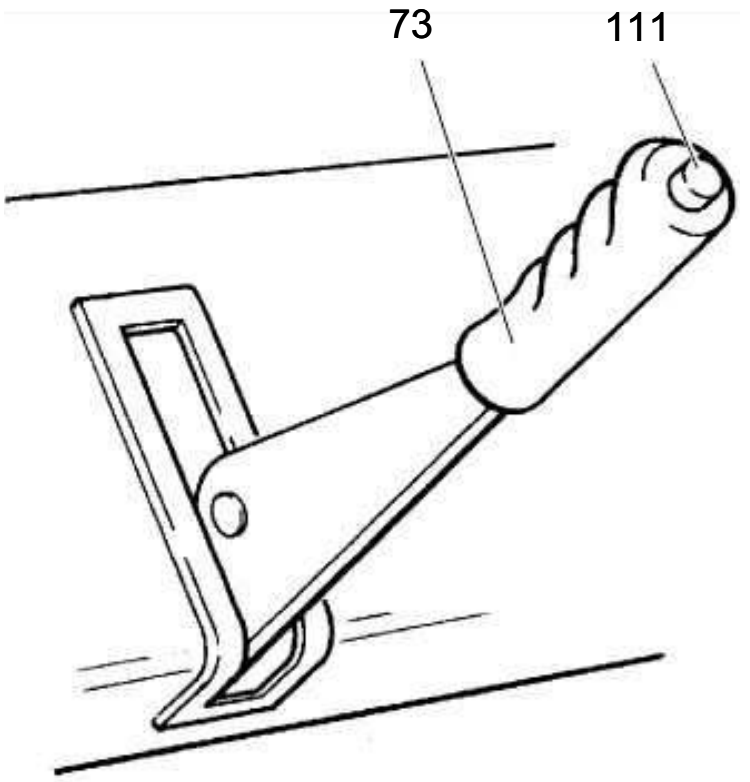
  This may cause the load to slide off the forks tines. There is a higher risk of accidents and injury!
- ▶ When leaving the industrial truck, always engage the parking brake. An audible warning will sound if the parking brake is not applied.

---

➔ The parking brake can be used as an emergency brake.

*Procedure*

- Pull back the parking brake lever (73) beyond the pressure point as far as the stop. The parking brake is engaged and the parking brake lever is locked in this position.
- Press the release knob (111) and push the parking brake lever forward to release the parking brake.



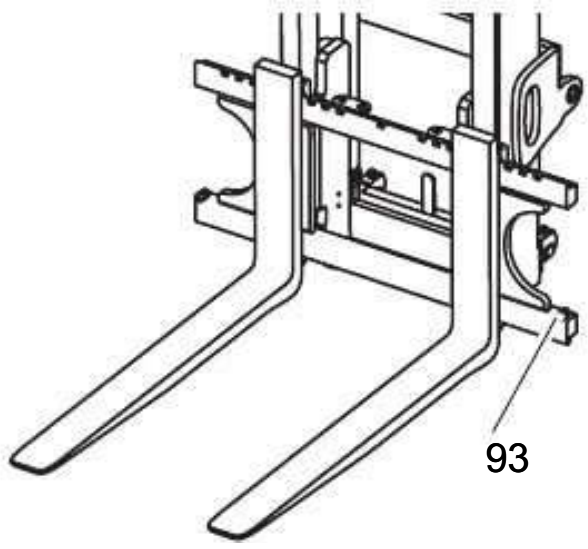
## 4.8 Adjusting the forks

**⚠ WARNING!**

**Trapping hazard**

There is a trapping hazard when you perform this operation.

▶ Wear work gloves and safety shoes.




**⚠ WARNING!**

**Unsecured and incorrectly adjusted forks can cause accidents**

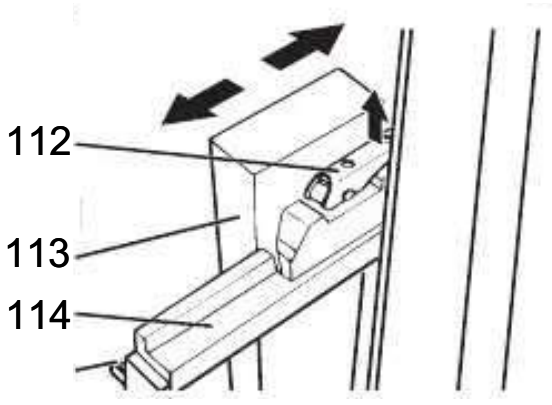
Before adjusting the forks make sure the retaining bolts (93) are fitted.

▶ Adjust the forks so that both forks are equidistant from the outside edge of the fork carriage.

▶ Engage the locking pin in a groove to prevent the forks from moving accidentally.

▶ The load centre of gravity must be located centrally between the forks.

***Adjusting the forks***




*Requirements*

– Park the truck securely, (see "Parking the truck securely" on page 71).

*Procedure*

- Lift up the locking lever (112).
- Push the forks (113) into the correct position on the fork carriage (114).

➔ To lift the load securely, the forks (113) must be spread as far apart as possible and positioned centrally with respect to the fork carriage. The load centre of gravity must be centrally aligned between the forks (113).

- Lift the locking lever down (112) and move the forks until the locking pin engages in a slot.

*The forks are now adjusted.*

## 4.9 Replacing the forks

**WARNING!**

**Unsecured forks can cause injury**

You can injure your legs when replacing the forks.

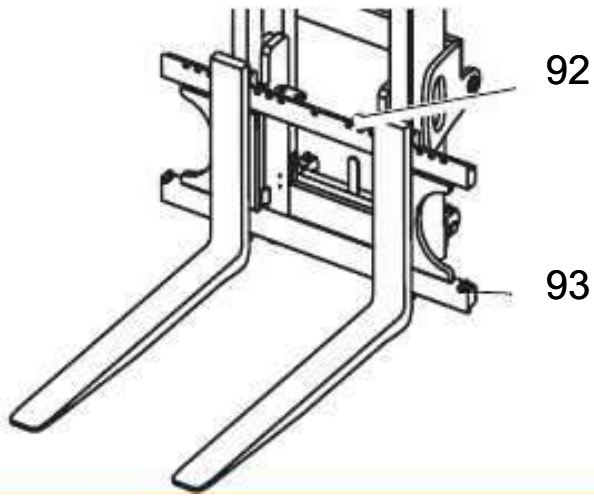
- ▶ Never pull the forks towards your body.
- ▶ Always push the forks away from your body.
- ▶ Secure heavy forks with lifting slings and a crane before pushing them down from the fork carriage.
- ▶ After replacing the forks fit the retaining bolts (93) and make sure the bolts are seated correctly. Retaining bolt torque: 85 Nm.

**WARNING!**

**Trapping hazard**

There is a trapping hazard when you perform this operation.

- ▶ Wear work gloves and safety shoes.




***Replacing the forks***

*Requirements*

– Load handler lowered and forks not touching the ground.

*Procedure*

- Disassemble the retaining bolts (93).
- Loosen the fork stop (92).
- Carefully push the forks off the fork carriage.

*The forks are now dismantled from the fork carriage and can be replaced.*

## 4.10 Lifting, transporting and depositing loads

**⚠ WARNING!**

**Unsecured and incorrectly positioned loads can cause accidents**

Before lifting a load unit the driver must make sure that it has been correctly palletised and does not exceed the truck's capacity.

- ▶ Instruct other people to move out of the hazardous area of the truck. Stop working with the truck if people do not leave the hazardous area.
- ▶ Only carry loads that have been correctly secured and positioned. Use suitable precautions to prevent parts of the load from tipping or falling down.
- ▶ Do not transport loads other than on the authorised load handler.
- ▶ Damaged loads must not be transported.
- ▶ If the stacked load obscures forward visibility, then you must reverse the truck.
- ▶ Make sure you have enough visibility when reversing.
- ▶ Never exceed the maximum loads specified in the capacity chart.
- ▶ Never stand underneath a raised load handler.
- ▶ Do not stand on the load handler.
- ▶ Do not lift other people on the load handler.
- ▶ Do not reach through the mast.
- ▶ Check the fork spread before lifting the load and adjust if necessary.
- ▶ Insert the forks as far as possible underneath the load.

---

***Lifting load units***

*Requirements*

– Load unit correctly palletised.
– Fork spread for the pallet checked and adjusted if necessary.
– Load unit weight matches the truck's capacity.
– Forks evenly loaded for heavy loads.

*Procedure*

- Drive the truck carefully up to the pallet.
- Set the mast vertical.
- Slowly insert the forks into the pallet until the fork shank touches the pallet.
- Raise the load handler.
- Reverse carefully and slowly until the load unit is outside the storage area. Make sure you have enough clear space to reverse into.

**NOTE**

Loads must not be deposited on travel or escape routes, in front of safety mechanisms or operating equipment that must be accessible at all times.

---

### *Transporting load units*

*Requirements*

– Load unit correctly lifted.
– Load handler lowered for transport (approx. 150 - 200 mm above the ground).
– Mast tilted back fully.

*Procedure*

- Accelerate and decelerate gradually.
- Adapt your travel speed to the conditions of the route and the load you are transporting.
- Watch out for other traffic at crossings and passageways.
- Always travel with a lookout at blind spots.
- On slopes and inclines always carry the load facing uphill, never approach at an angle or turn.

### *Depositing load units*

*Requirements*

– Warehouse location suitable for storing the load.

*Procedure*

- Set the mast vertical.
- Drive carefully up to the storage location.
- Carefully lower the load handler so that the forks are clear of the load.
  Avoid depositing the load to avoid damaging the load and the load handler.
- Lower the load handler.
- Carefully remove the forks from the pallet.

*The load unit is lowered.*

## 4.11 Operating the lift mechanism and integrated attachments

**⚠ WARNING!**

**Accident risk when operating the lifting device and integrated attachments**

Other people can be injured in the truck's hazardous area.
The hazardous area is defined as the area in which people are at risk from the truck movement, the load handler, attachments etc. This also includes areas which can be reached by falling loads or lowering operating equipment.

Apart from the operator (in the normal operating position) there should be no other people in the truck's hazardous area.

- ▶ Instruct other people to move out of the hazardous area of the truck. Stop working with the truck if people do not leave the hazardous area.
- ▶ The truck must be prevented from being used by unauthorised people if people do not leave the hazardous area despite the warning.
- ▶ Only carry loads that have been correctly secured and positioned. Use suitable protection measure to prevent parts of the load from tipping or falling down.
- ▶ Never exceed the maximum loads specified in the capacity chart.
- ▶ Never stand underneath a raised load handler.
- ▶ Do not stand on the load handler.
- ▶ Do not lift other people on the load handler.
- ▶ Do not reach through the mast.
- ▶ The controls should only be operated from the driver's seat, and never suddenly.
- ▶ The driver must be instructed in how to operate the lifting device and the attachments.

*NOTE*

**When the driver's seat is not occupied, the control lever is mechanically locked in centre position.**

If the driver leaves the industrial truck without moving the travel direction switch to the neutral, the control block will remain locked in the centre position at first when the driver returns to the driver's seat. The control lever is not released again until the driver has moved the travel direction switch to the neutral. This safety function also takes effect if the driver gets up off the seat for longer than 1.5 seconds without leaving the vehicle. In this case as well the transmission must be switched once to neutral. If the industrial truck is equipped with belt lock control (○) the belt must also be closed again to release the control lever.

➔ When the controls are released they automatically revert to neutral and the lifting mechanism remains in the position it has reached.

When the mechanical end stop has been reach for the relevant functions (there will be a noise from the pressure relief valve) immediately move the control lever back to its original position.

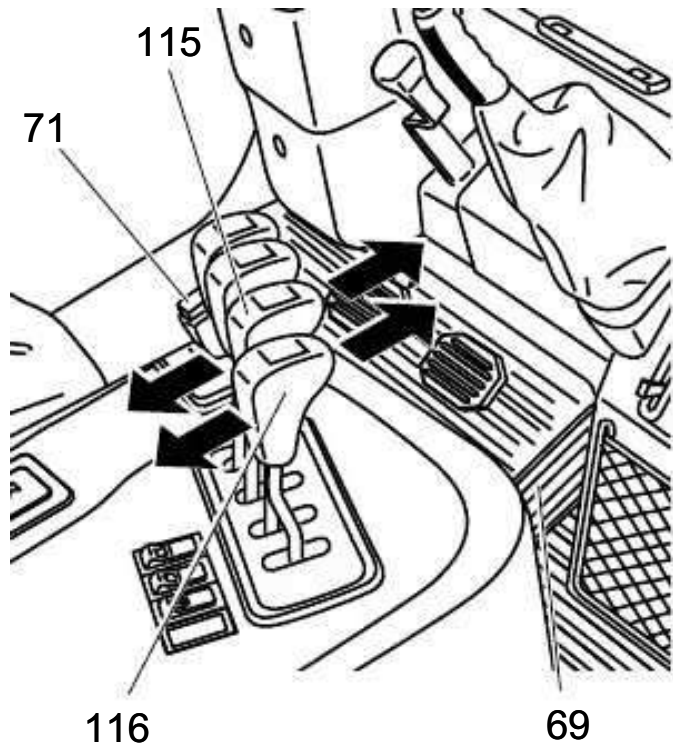
## Controlling the speed of the lifting device

Moving the lever and changing the engine speed governs the operating speed of the hydraulic cylinders. When the levers (116, 115) are released they automatically revert to neutral and the lifting device remains in the position it has reached.

*Procedure*

- Set the travel direction switch (71) to neutral.
- Increase the motor speed with the accelerator pedal (69) and
- Keep moving the lever back to increase the speed of the lifting device.

➔ The engine speed does not affect the lowering speed of the fork carriage.



### 4.11.1 Operating the lift mechanism with the SOLO PILOT

***Lifting and lowering***

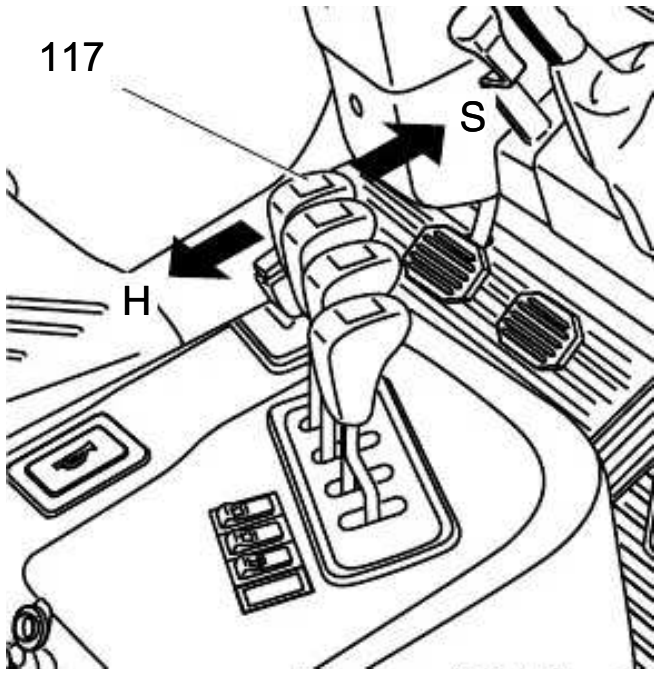
*Requirements*

– To prepare the truck for operation, (see "Preparing the truck for operation" on page 68)

*Procedure*

- Pull the Solo-Pilot lever (117) in direction H to raise the load.
- Push the Solo-Pilot lever (117)in direction S to lower the load.

*The load is now raised / lowered.*




When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

***Tilting the mast forward / backward***

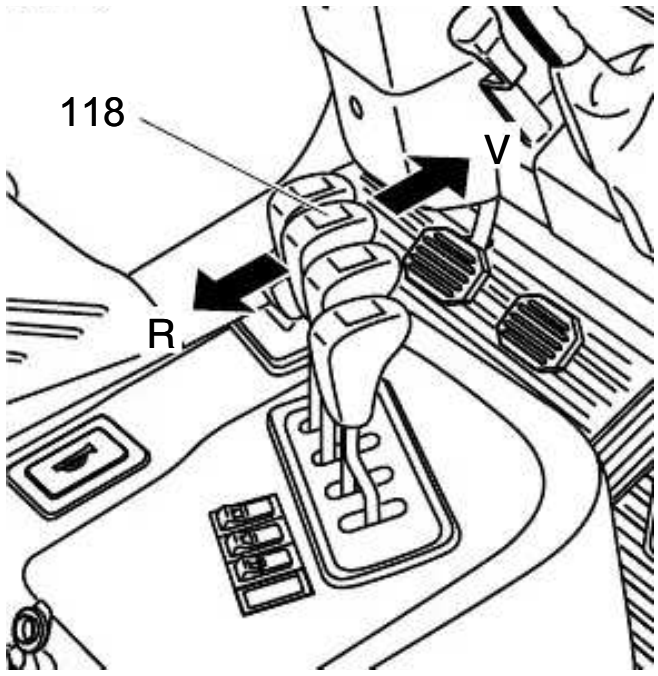
*Requirements*

– To prepare the truck for operation, (see "Preparing the truck for operation" on page 68)

*Procedure*

- Pull the Solo-Pilot lever (118) in direction R to tilt the mast back.
- Push the Solo-Pilot lever (118) in direction V to tilt the mast forward.

*The mast is now tilted back / forward.*




When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

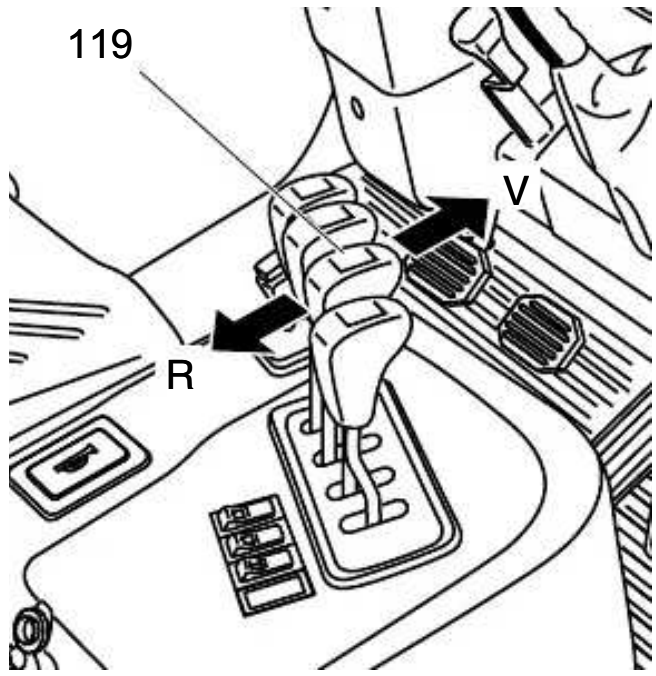
***Positioning the integrated sideshift (option)***

*Requirements*

– Truck prepared for operation, (see "Preparing the truck for operation" on page 68).

*Procedure*

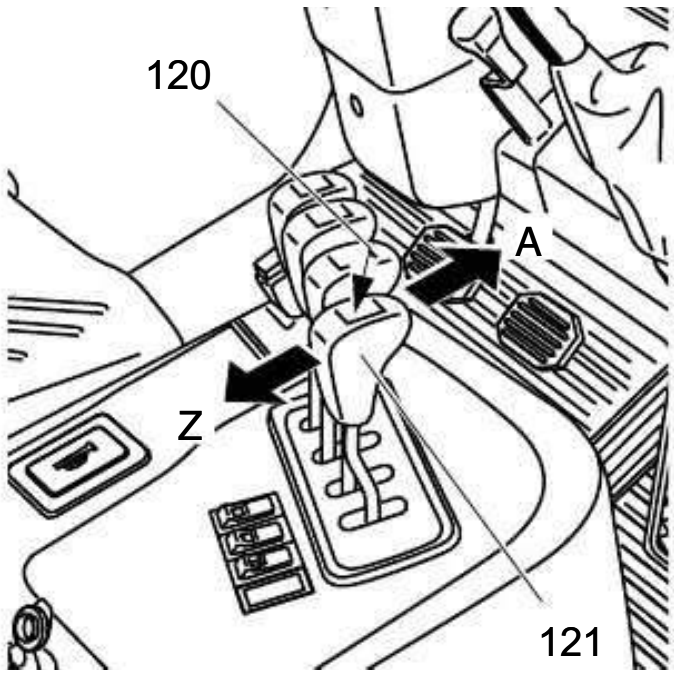
- Pull the SOLO-PILOT lever (119) in direction R to move the load handler to the right (from the driver's viewpoint).
- Push the SOLO-PILOT lever (119) in direction V to move the load handler to the left (from the driver's viewpoint).




*The sideshifter is now positioned.*

When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

***Positioning the forks with an integrated fork adjuster (option)***




**⚠ CAUTION!**

Do not use the fork adjuster to clamp loads.

---

*Requirements*

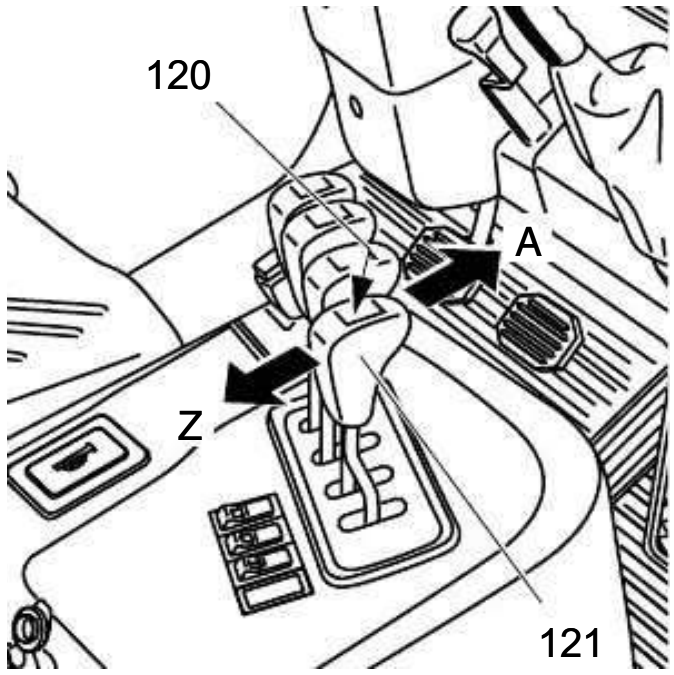
– Truck prepared for operation, (see "Preparing the truck for operation" on page 68).

*Procedure*

- Press the toggle switch (120) and at the same time pull the Solo Pilot (121) in direction Z: the forks will move towards each other.
- Press the toggle switch (120) and at the same time push the Solo Pilot (121) in direction A: the forks will spread apart.

*The forks are now positioned.*

***Synchronising the alignment of the fork tines with an integrated fork adjuster (optional equipment)***




*Requirements*

– Truck ready for operation, (see "Preparing the truck for operation" on page 68).
– The fork tines are no longer aligned.

*Procedure*

- Press the toggle switch (120) and at the same time push the SOLO-PILOT (121) in direction A and spread the fork tines apart as far as they will go.
- Press the toggle switch (120) and at the same time pull the SOLO-PILOT (121) in direction Z and bring the fork tines as close to each other as they will go.

*The fork tines are now synchronised.*

➔ When the limit position for the operation has been reached (there will be a noise from the pressure relief valve) release the lever. The lever will revert automatically to neutral.

## 4.12 Safety instructions for operating additional attachments

Optionally, trucks can be fitted with one or more auxiliary hydraulic functions to operate attachments. The auxiliary hydraulics are indicated with HF4 and HF5.
Auxiliary hydraulic functions for exchangeable equipment are fitted with replacement couplings on the fork carriage. To fit exchangeable equipment (see "Fitting additional attachments" on page 91).

**DANGER!**

**Attaching exchangeable equipment can result in accidents.**

Other people can be damaged by attaching exchangeable equipment. Use only exchangeable equipment which has been deemed safe after a risk analysis carried out by the owner.

- ▶ Only use attachments with a CE mark.
- ▶ Only use attachments that have been designed by the attachment manufacturer for use with the respective industrial truck.
- ▶ Only use attachments that have been fitted for the purpose by the owner.
- ▶ Make sure the operator has been instructed in the use of the attachment and that he uses it for its correct purpose.
- ▶ Re-assess the residual capacity of the truck and if it has been altered, attach an additional capacity plate to the truck.
- ▶ Note the attachment manufacturer's operating instructions.
- ▶ Only use attachments that do not restrict visibility in the travel direction.

If visibility in the travel direction is impaired, the owner must carry out a risk analysis to assess whether the truck needs to be fitted with auxiliary equipment such as a camera system or mirrors. If such equipment is used, spend sufficient time practicing travelling with them.

### Safety instructions for sideshifter and fork adjuster attachments

**⚠ WARNING!**

When using multi fork adjusters (multi pallet clamps), restricted visibility and reduced lateral tilt resistance can result in accidents.

▶Adapt the travel speeds to the visibility and load.

▶Make sure you have enough visibility when reversing.

---

### Safety instructions for clamping attachments (e.g. baling clamps, barrel clamps, grabs etc.)

**⚠ WARNING!**

**Falling loads can cause accidents**

This can result in malfunctions and the load can fall accidentally.

▶Clamping attachments may only be added to trucks which have a button to enable additional hydraulic functions.

▶Clamping attachments must only be operated on trucks will auxiliary hydraulics HF4 or HF5.

▶When connecting the attachment make sure that the hydraulic lines of the attachment are connected to the right ports, (see "Fitting additional attachments" on page 91).

---

### Safety instructions for rotary attachments

**⚠ WARNING!**

**A non-centred centre of gravity can result in accidents**

When using rotary devices and non-centred loads, the centre of gravity can be displaced from the centre with a high risk of accidents.

▶Adapt the travel speed to the load.

▶Lift the load from the centre.

---

### Safety instructions for telescopic attachments

**⚠ WARNING!**

**Accident risk from increased tipover hazard and reduced residual capacity**

There is a greater tipover risk with extended telescopic attachments (e.g. reach carriages, telescopic forks, telescopic crane booms).

▶Only use the telescopic function for stacking and retrieving.

▶Always retract the attachment fully during transport.

▶Adapt the travel speed to changed load centre of gravity.

---

**Safety instructions for attachments when transporting suspended loads**

**⚠ WARNING!**

**Swinging loads and a reduced residual capacity can result in accidents**

- ▶Adapt the travel speed to the load, less than walking pace.
- ▶Secure swinging loads for example with lifting slings.
- ▶Reduce the residual capacity and have it certified by a expert.

---

**Safety instructions for using loading buckets as attachments**

**⚠ WARNING!**

**Greater mast loading can cause accidents.**

- ▶When carrying out the daily checks and operations before starting, (see "Checks and operations to be performed before starting daily operation" on page 59), in particular attention check the fork carriage, mast rails and mast rollers for damage.

---

**Safety notices for fork extensions:**

**⚠ WARNING!**

**Unsecured and excessive fork extensions can cause accidents.**

- ▶For fork extensions with an open cross sectional area, only carry loads that are resting along the entire length of the fork extension.
- ▶Only use fork extensions with the same fork cross section and minimum fork length of the truck and which comply with the details on the fork extension data plate.
- ▶The basic fork length must be at least 60% of the length of the fork extension.
- ▶Lock the fork extensions onto the basic forks.
- ▶When carrying out the daily checks and operations before starting, (see "Checks and operations to be performed before starting daily operation" on page 59), also check the fork extension lock.
- ▶Mark any fork extensions with an incomplete or faulty lock and take them out of service.
- ▶Do not use trucks with an incomplete or faulty fork extension lock. Replace the fork extension.
- ▶Only restore the fork extension to service when the fault has been rectified.
- ▶Use only fork extensions which have no dirt or foreign bodies near the entry opening point. Clean the fork extensions as required.

---

## 4.13 Operating additional attachments for the SOLO-PILOT

**WARNING!**

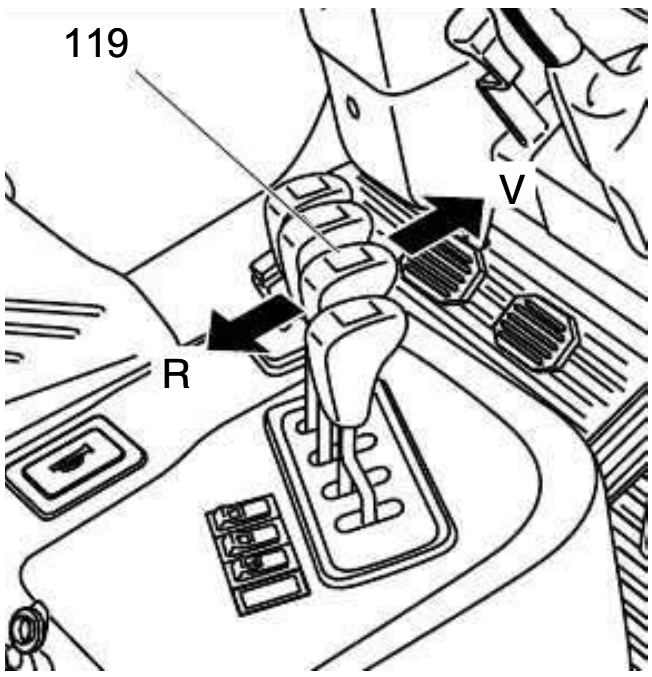
**Incorrect symbols can cause accidents**

Symbols on controls that do not depict the function of the attachments can cause accidents.

- ▶ Mark the controls with symbols that indicate their function.
- ▶ Specify the attachments' direction of movement in accordance with ISO 3691-1 so that they match the controls' direction of movement.

### 4.13.1 Solo Pilot with control of ZH1 hydraulic port

Depending on the attachments used the lever (119) is assigned the function of the attachment. Levers that are not required are void. For connections (see "Fitting additional attachments" on page 91).



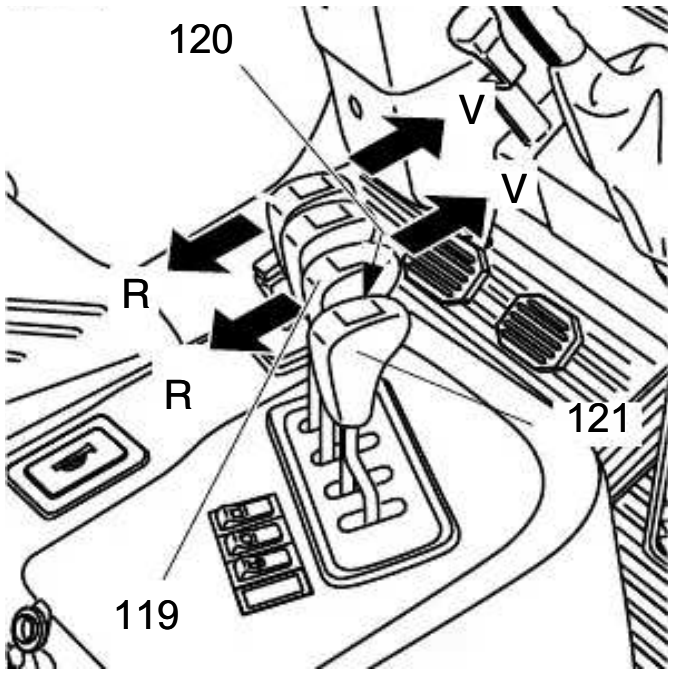

*Procedure*

- Operating the hydraulic port ZH1:

  Move the lever (119) in direction V or R.

*The attachment's function is performed.*

### 4.13.2 Solo Pilot with control of ZH1 and ZH2 hydraulic ports



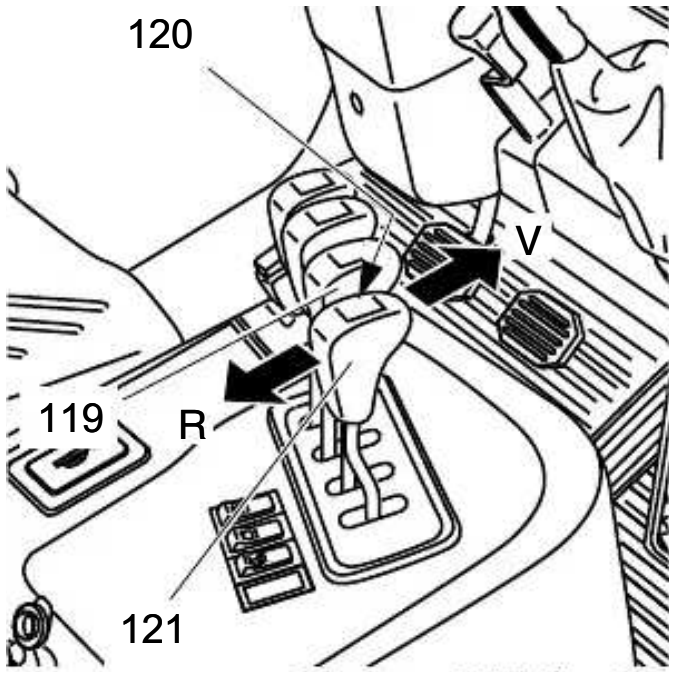

Depending on the attachments used the lever / button (119, 121, 120) is assigned the function of the attachment. Levers that are not required are void. For connections (see "Fitting additional attachments" on page 91).

*Procedure*

- Operating the hydraulic port ZH1:
  Move the lever (119) in direction V or R.
- Operating the hydraulic port ZH2:
  Press the toggle switch (120) and at the same time move the lever (121) in the V or R direction.

*The attachment's function is performed.*

### 4.13.3 Solo Pilot with control of ZH1, ZH2 and ZH3 hydraulic ports




Functions are assigned to the levers / buttons (119, 121, 120) depending on the attachments used. Levers that are not required are void. For connections (see "Fitting additional attachments" on page 91).

*Procedure*

- Operating the hydraulic port ZH1:
  Move the lever (119) in direction V or R.
- Operating the hydraulic port ZH2:
  Move the lever (121) in direction V or R.
- Operating the hydraulic port ZH3:
  Press the toggle switch (120) and at the same time move the lever (121) in the V or R direction.

*The attachment's function is performed.*

## 4.14 Fitting additional attachments

**⚠ WARNING!**

**Incorrectly connected attachments can cause accidents.**

Attachments with incorrectly connected hydraulic attachments can result in accidents.

- ▶ Attachments must only be assembled and commissioned by trained, specialist personnel.
- ▶ Note the attachment manufacturer's operating instructions.
- ▶ Before commissioning, check the fasteners are positioned correctly and securely and make sure they are complete.
- ▶ Before commissioning, make sure the attachment is working correctly.

---

***Hydraulic ports***

*Requirements*

– Non-pressurised hydraulic hoses.
– The exchange ports on the truck are marked ZH2 and ZH3.
– Attachment directions of movement defined to match the controls' direction of movement.

*Procedure*

- Lower the fork carriage to the ground.
- Turn off the ignition (set the ignition / starter switch 0).
- Turn the ignition on again (set the ignition / starter switch I), but do not start the motor.
- Move all levers as far as they will go in both directions several times. The driver's seat must be occupied to do this. Otherwise the control lever will remain in neutral
- Attach the plug connector and engage it in position.
- Mark the controls with symbols that indicate their function.

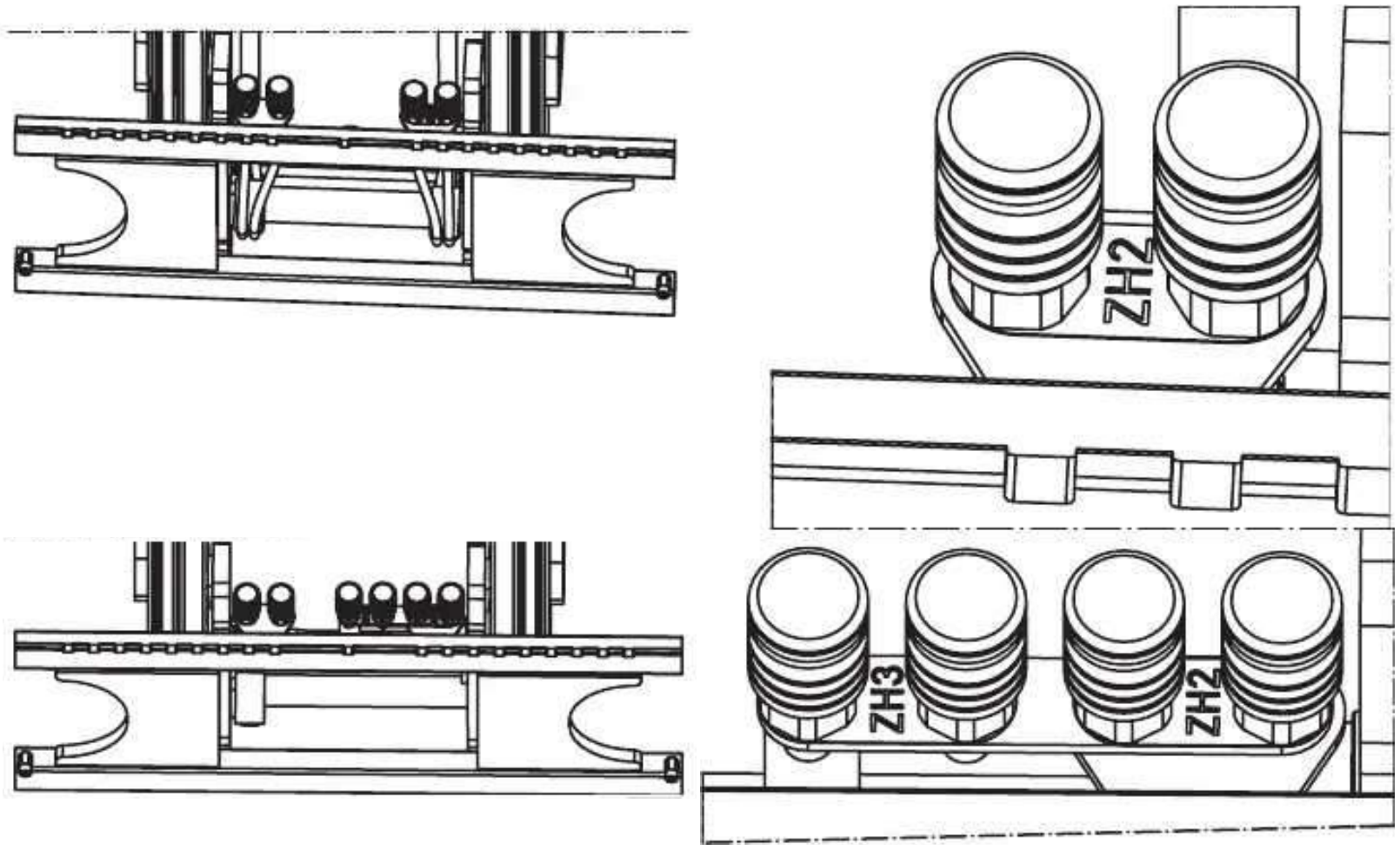
*The attachment is now hydraulically connected.*

**⚠ WARNING!**

**Hydraulic ports for clamping attachments**

- ▶ Clamping attachments may only be added to trucks which have a button to enable additional hydraulic functions.
- ▶ On trucks with auxiliary hydraulics ZH2 the clamping function should only be attached to the coupling pair marked ZH2.
- ▶ On trucks with auxiliary hydraulics ZH3 the clamping function should only be attached to the coupling pair marked ZH3.

---




➔ Spilled hydraulic oil must be set using a suitable agent and disposed of in accordance with environmental regulations.
If hydraulic oil comes into contact with the skin, wash it off immediately with soap and water. If it comes into contact with the eyes rinse them immediately with flowing water and call for a doctor.

# 5 Towing trailers

**DANGER!**

**Inappropriate speeds and excessive trailer loads can be dangerous**

If you do not adapt your speed and / or use an excessive trailer load, the truck can pull apart when cornering and braking.

- ▶ The truck should only be used occasionally to tow trailers.
- ▶ The overall weight of the trailer should not exceed the capacity indicated on the capacity plate, (see "Identification points and data plates" on page 30). If a load is also transported on the forks, the trailer load must be reduced by the same amount.
- ▶ Do not exceed the maximum speed of 5 km/h km/h.
- ▶ A truck must not be continually operated with trailers.
- ▶ Do not use supporting loads.
- ▶ Towing must only be performed on level, secure travel routes.
- ▶ The owner must test trailer operation with the permissible tow load by means of a trial run under the applicable operating conditions on site.

## Attaching the trailer

**⚠ CAUTION!**

**Trapping hazard**

There is a trapping risk when you attach a trailer.

▶ Follow the instructions of the coupling manufacturer if using special trailer couplings.

▶ Secure the trailer to prevent it from rolling away before coupling it.
▶ Do not get caught between the truck and the tiller when coupling the trailer.
▶ The tiller must be horizontal, tilted down by no more than 10° and never facing up.

### *Attaching the trailer*

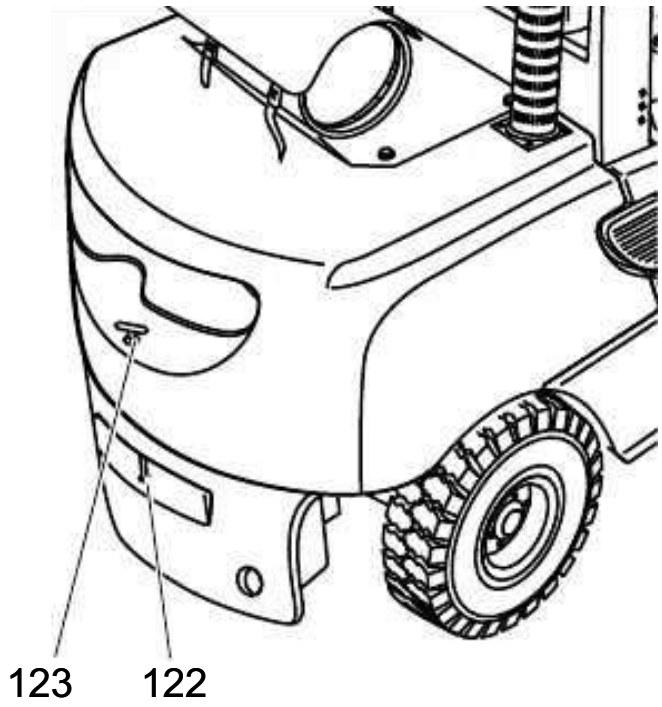
*Requirements*

– Truck and trailer are on a level surface.
– Trailer prevented from rolling away.

*Procedure*

- Push the tow pin (123) down and turn it 90°.
- Pull the tow pin up and insert the tiller of the trailer into the opening.
- Insert the tow pin, push it down, turn it 90 degrees and engage it.

*The trailer is now attached to the truck.*




To additionally ensure safe operation, the truck can be fitted with an electrical connection for trailers with lighting.

# 6 Optional equipment

## 6.1 Steel cab

For trucks fitted with a steel cabin, both doors can be closed.

**⚠ CAUTION!**

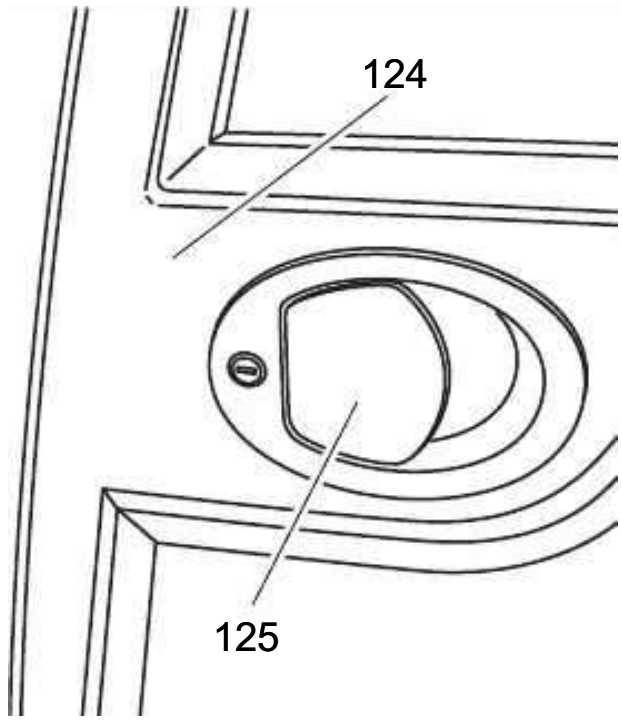
**An open door can cause accidents (124)**

- ▶Do not travel with an open door (124). When opening the door make sure there is nobody in the door's swing range.
- ▶Always close the door tightly and make sure it is locked.
- ▶Closing the door does not release the driver from his responsibility to wear a seat belt, (see "Seat Belt" on page 65).

***Opening and closing the door***

*Procedure*

- To unlock the cabin door turn the key anti-clockwise.
- To lock the cabin door turn the key clockwise.
- To open the cabin door, unlock the door and pull out the handle (125).




## 6.2 Sliding windows

**⚠ CAUTION!**

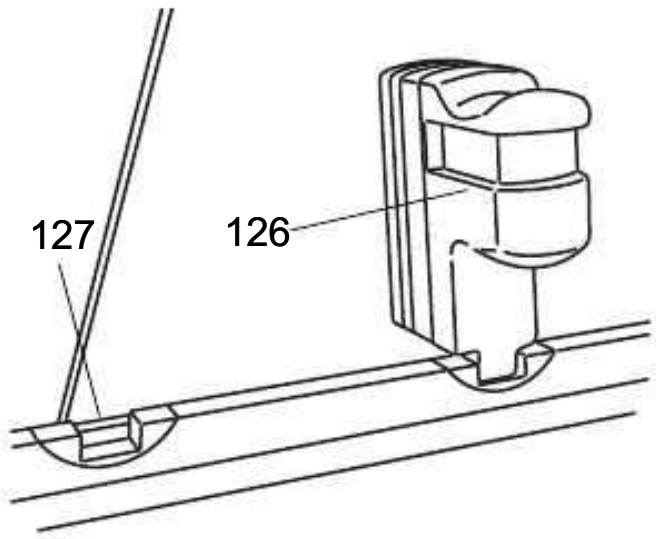
**An unlocked sliding window can cause accidents**

- ▶The sliding windows must be locked at all times.

***Opening and closing the windows***

*Procedure*

- Push the lock (126) up.
- Move the window forward or back.
- Insert the lock in the stop (127).



## 6.3 Panel door

**⚠ CAUTION!**

**An open door can cause accidents (124)**

▶Do not travel with an open door (124). When opening the door make sure there is nobody in the door's swing range.

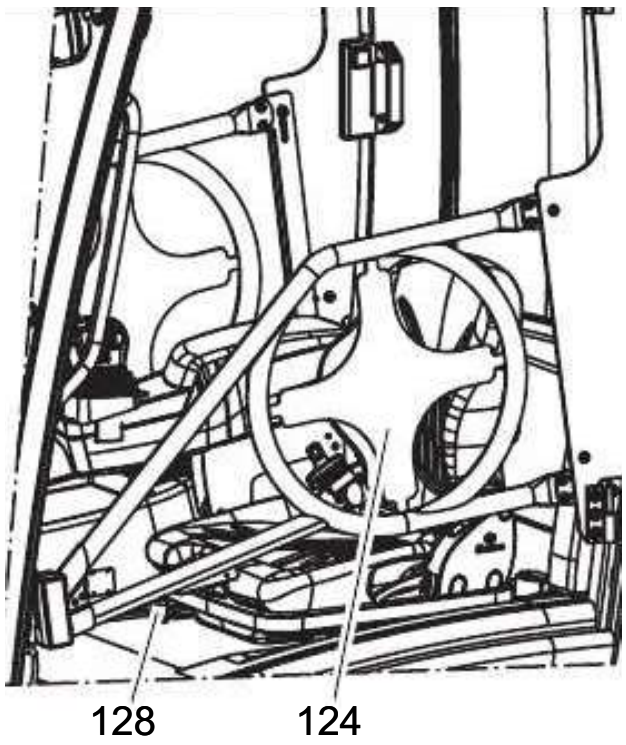
▶Always close the door tightly and make sure it is locked.

▶Closing the door does not release the driver from his responsibility to wear a seat belt, (see "Seat Belt" on page 65).

---

**Hazardous situations**

If the truck is about to tip over, do not loosen the seat belt. The driver must not jump off the truck. The driver must lean his upper body over the steering wheel and hold on with both hands. Tilt your body in the opposite direction of fall.




*Requirements*

– On trucks with a door monitoring sensor, travel is only enabled when the panel door is closed (○).

*Procedure*

- Pull the handle (128) towards the operator position, the door swings open.
- Pull the door (124) towards the driver; the door closes.

## 6.4 Backrest extension

**⚠ CAUTION!**

**Accident risk when adjusting the backrest during travel**

▶The backrest extension must not be changed during travel!

---

*Procedure*

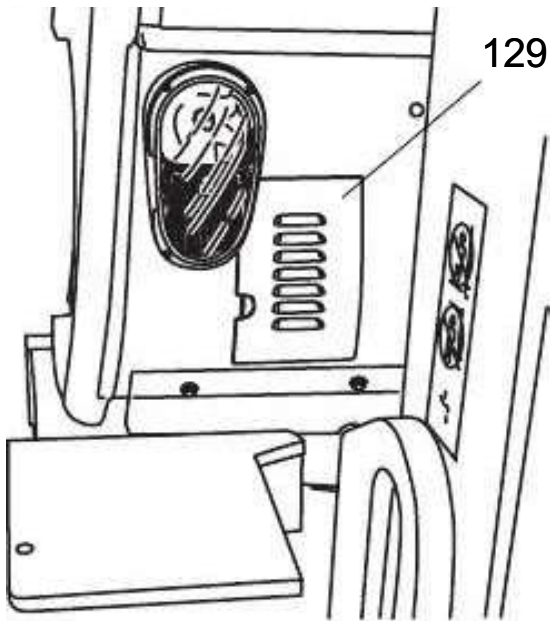
- The backrest extension height can be adjusted by changing the detent.
- To do this push the backrest up or down.

## 6.5 Heating

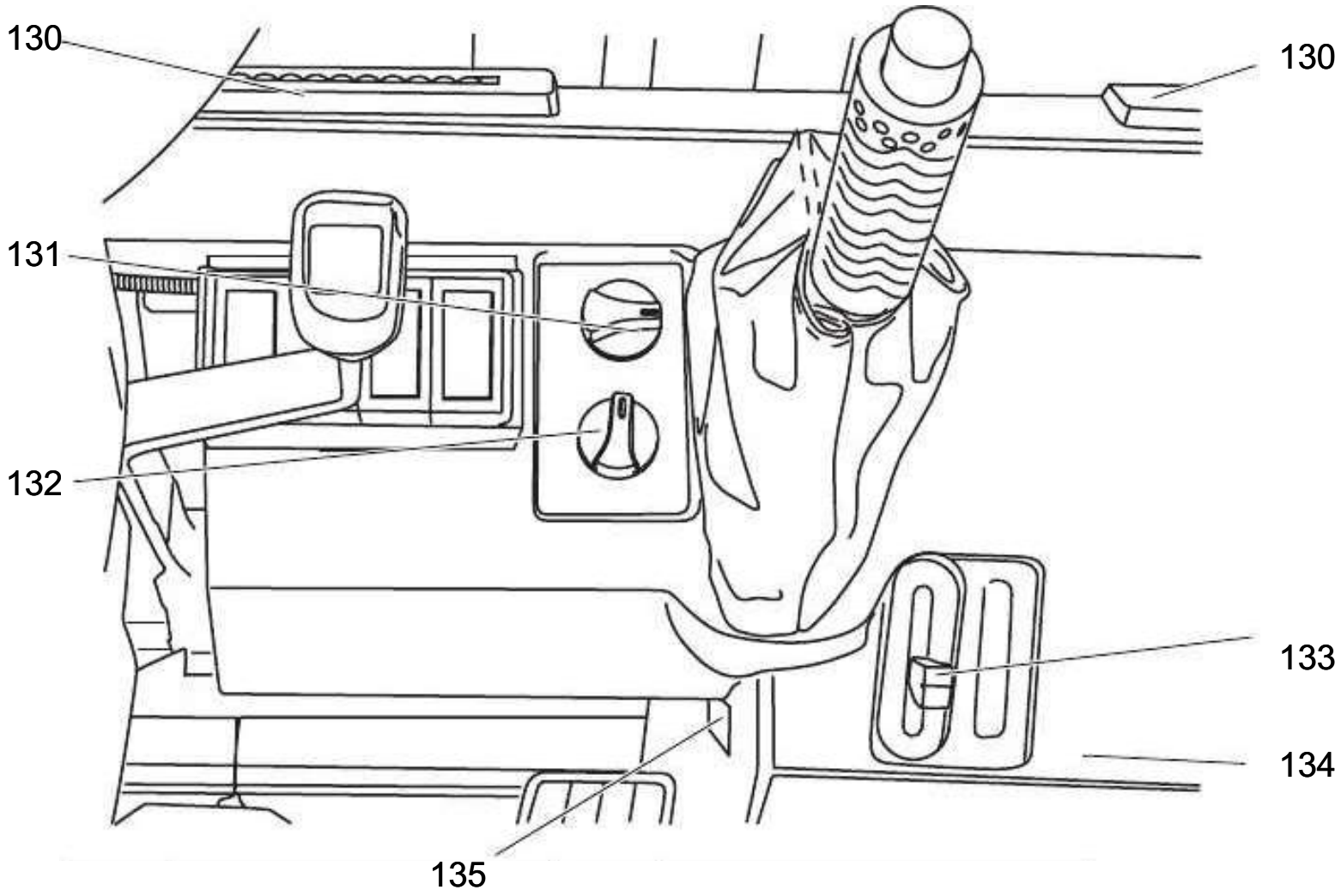
***Replacing the air conditioning filter***

*Procedure*

- Unscrew the cover (129).
- Clean the inside of the filter mat or replace it if necessary.




Check the filter after 500 operating hours and replace it at the latest after 1000 operating hours.




| Item | Name | Item | Name |
|---|---|---|---|
| 130 | Windscreen jets | 133 | Recirculating air flap: Recycling the air in the cab |
| 131 | Fan settings | 134 | Heating console |
| 132 | Temperature controller | 135 | Foot compartment jet |

***Heating operation***

*Procedure*

- Press the switch (131) to switch off the fan.
- Set the nozzles (135 and 130) to the required position.
- Turn the temperature controller (132) to the right to increase the cab temperature.
- Turn the temperature controller (132) to the left to decrease the cab temperature.
- The recirculating air flap (133) on the heating console (134) is used to make cab air settings and adjust fresh air.

## 6.6 Removable load backrest

**⚠ CAUTION!**

**Trapping hazard and heavy load backrest weight**

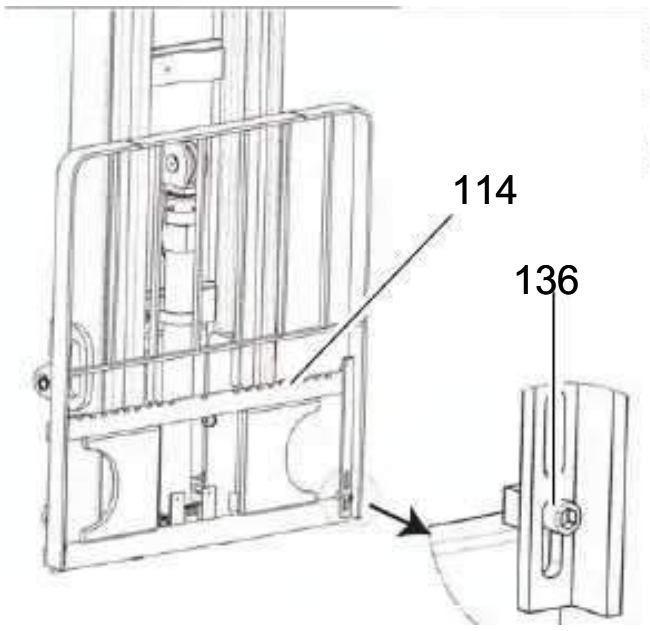
▶Wear safety gloves and safety shoes when carrying out this operation.

▶Two people are required to remove and attach the load backrest.

***Load backrest disassembly***

*Procedure*

- Loosen the screws (136)
- Remove the load backrest from the fork carriage and put it down securely.




***Load backrest assembly***

*Procedure*

- Attach the load backrest to the top rail of the fork carriage.
- Fit the bolts and tighten them with a torque wrench.

➔ Torque = 85 Nm

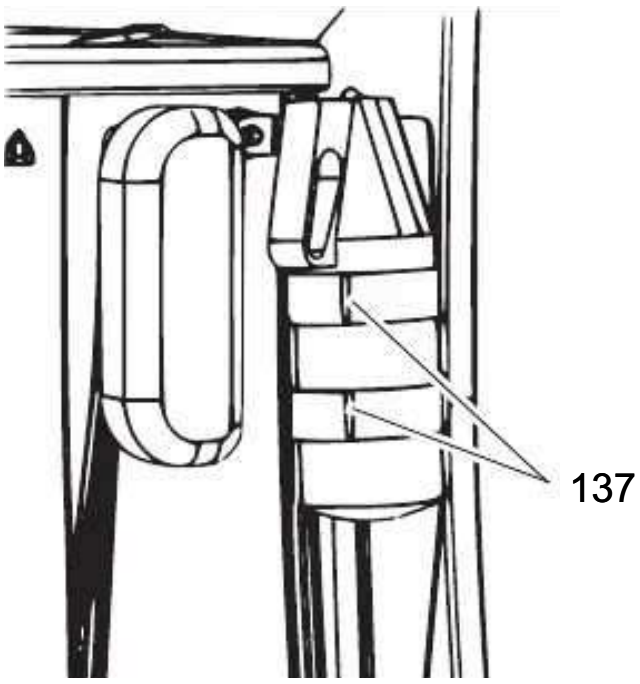
## 6.7 Fire extinguisher

*Procedure*

- Open the fasteners (137)

➔ • Pull the fire extinguish out of its bracket

➔ To operate, refer to the illustrations on the fire extinguisher



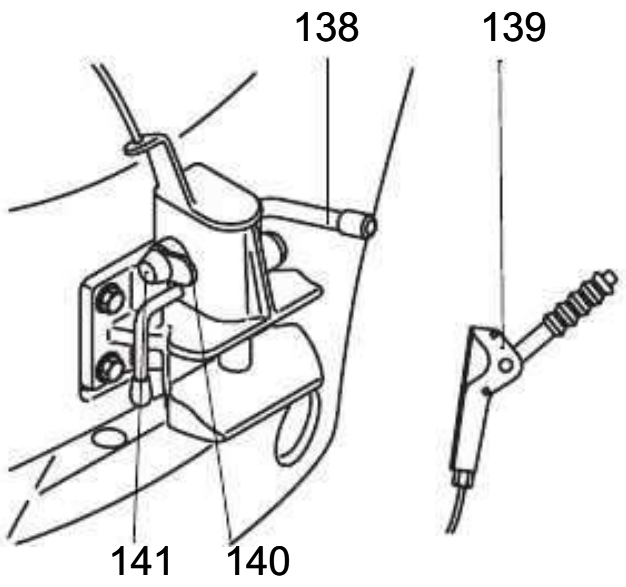
## 6.8 Rockinger coupling with hand lever or remote control

Refer to the instructions for towing trailers, (see "Towing trailers" on page 93).

**⚠ CAUTION!**

**Incorrectly coupled trailers can cause accidents**

- ▶Make sure the coupling is engaged securely before starting the truck.
- ▶The contro pin (141) must be flush with the control sleeve (140).




***Rockinger coupling operation (attaching trailers)***

*Procedure*

- Prevent the trailer from rolling away.
- Adjusting the trailer pull rod to the height of the coupling.
- Pull the hand lever (138) / remote control (139) (○) up.
  The remote control (139) (○) is located in the overhead guard, depending on the truck model.
- Slowly reverse the truck until the coupling engages.
- Push the hand lever (138) / remote control (139) (○) down.

***Rockinger coupling operation (disconnecting trailers)***

*Procedure*

- Prevent the trailer from rolling away.
- Pull the hand lever (138) / remote control (139) (○) up.
- Drive the truck forward.
- Push the hand lever (138) / remote control (139) (○) down.

## 6.9 Camera system

**⚠ CAUTION!**

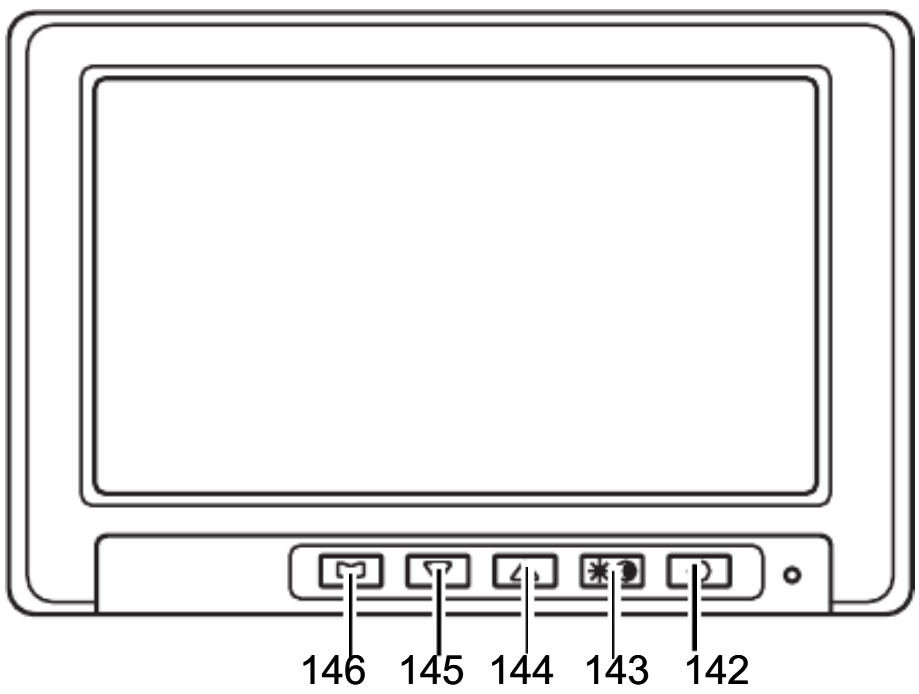
**Accident risk from hidden work areas**

▶The camera system acts as an aid to assist safe operation.

▶Practice travelling and working with the camera system.

▶Align the camera so that the hidden work area can be seen.

➔ When using the camera to reverse, the monitor automatically switches on when you engage reverse gear.




**Using the camera system**

– Press the button (142) on the monitor to switch the camera system on or off.
– Press the button (143) to lighten or darken the screen (day / night settings).
– Press the button (146) to open the menu.

➔ Pressing the button several times changes the menu item (contrast, brightness, colour saturation, language, video, light reflection) or quits the menu.

Adjusting the menu items

– Press the button (144) to go one step forward.
– Press the button (145) to go one step back.

➔ Clean a dirty screen or vent slots with a soft cloth or brush.

## 6.10 Optional equipment for working in areas with heavy accumulation of dust

When working in areas with high levels of dust (lint, splinters) the Industrial truck can be fitted with an optional lint filter on the cooler.

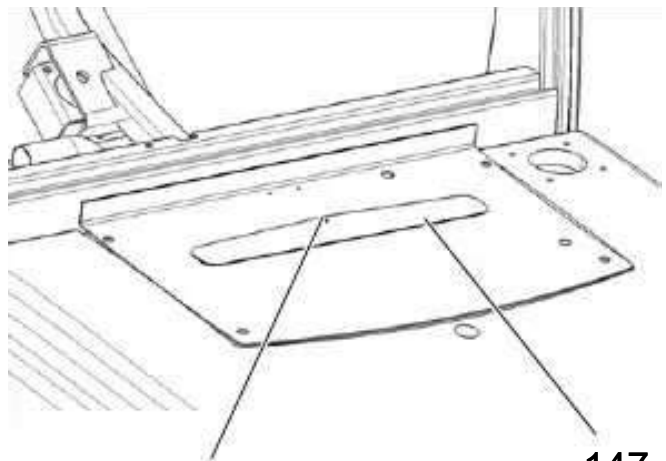
**⚠ CAUTION!**

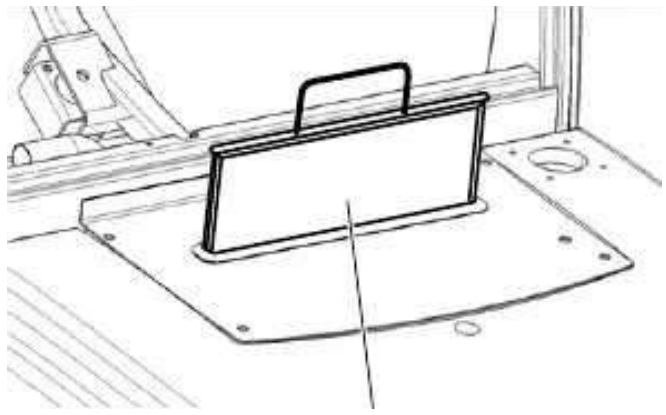
**Clogged lint filters can cause fires**

▶The lint filter must be cleaned regularly according to how much it is clogged.

*Procedure*

- Remove the cover (147) after the lock (148) is opened.
- Remove the (149) lint mesh and clean it.
- Fit the lint mesh back and set the cover in place.



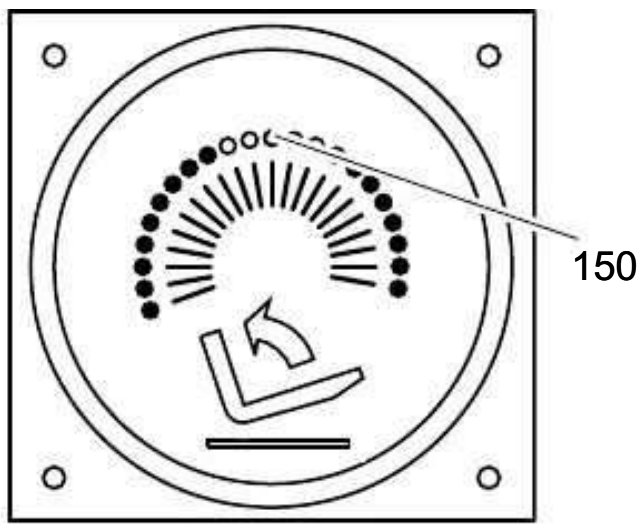




## 6.11 Tilt angle display

***NOTE***

The current tilt angle is shown in an additional display that is attached on the right of the dashboard.

– Green LEDs (150) indicate the vertical position to the ground.



## 6.12 Speed reduction

The maximal achievable speed is limited to a preset value. Full motor speed and power are available while stopped and accelerating. The speed of the motor is not ramped down until the set maximum speed is reached.

The maximum speed is factory set and can be adjusted by trained and authorised customer service personnel.

## 6.13 Transmission block

The gear block is an option which prevents the driver from starting the truck if it is in gear. The block also prevents the driver from changing the direction of travel when the truck is in second gear.

➔ Important: although the truck can travel when shifting gear in idle, braking is still enabled.

## 6.14 Reversing Block

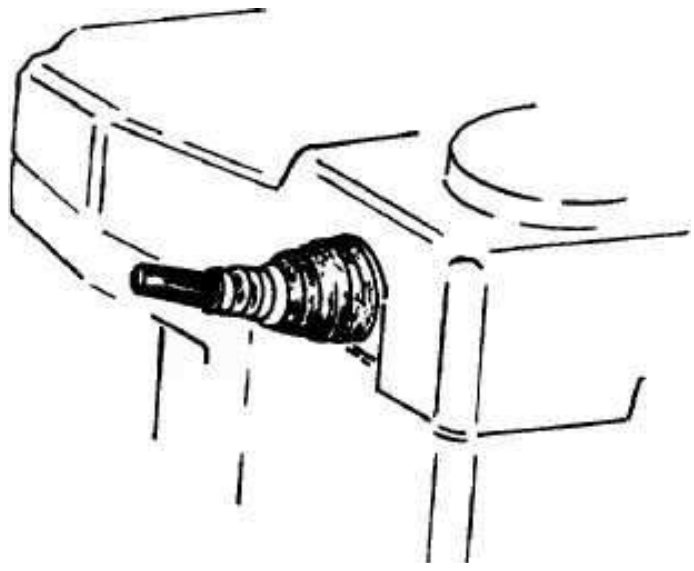
The travel direction can only be changed (reversing) if the industrial truck is travelling at less than 3 km/h. If the driver attempts to change direction without braking at a faster speed, the system automatically activates idle speed. The required travel level can only be applied when the speed is reduced accordingly.

The drive cannot be set from neutral to travel if the engine is more than 300 rpm above idle speed. Travel is only activated when the speed falls below this limit.

## 6.15 Direction switch mounted to the steering column

The travel direction switch is attached to the steering column on the left

When the travel direction switch is in the centre position, the drive is in idle / neutral



*Procedure*

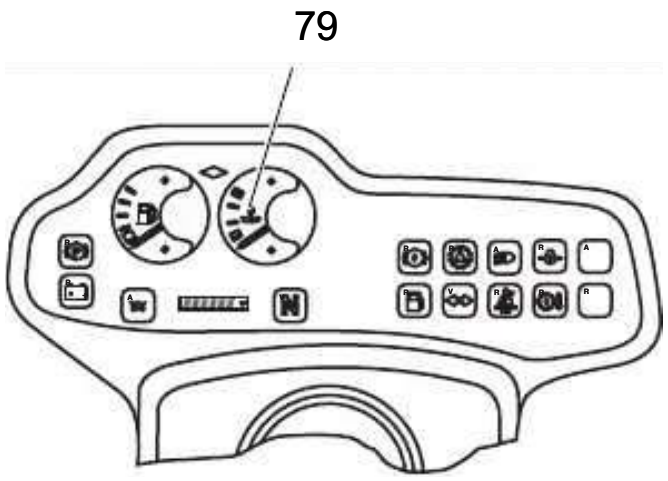
- To select forward gear, push the lever forward.
- To select reverse gear, push the lever back.

Travel is released in the same way as for the standard version ((see "Travel" in chapter 4.5)).

## 6.16 Temperature control system

**WARNING!**

In each case the cause of the overheating must be established and rectified by a trained and authorised customer service engineer.




The warning indicator (79) goes on and an audible warning is sounded when the permissible coolant temperature is exceeded. The truck will only travel for another 30 seconds, after which the drive is automatically switched to neutral.

As soon as the permissible coolant temperature is exceeded, proceed as follows:

*Procedure*

- Remove the truck from the hazardous area if necessary,
- Lower the fork carriage and load securely.
- Switch the drive to neutral and apply the parking brake.
- Run the motor at a slightly higher speed (to improve the cooling effect of the fan) until the temperature drops back to the normal level.

➔ If the temperature does not drop, park the truck securely, switch the motor off and have the truck examined.

➔ In acutely hazardous situations, after the 30 second residual travel period, the truck can be operated again for a further 30 seconds by switching off the ignition and starting the engine again.

## 6.17 Control layout with Cardan function

**⚠ WARNING!**

**Ensure there are no other people standing underneath the raised load and driver's cab.**

▶Do not stand on the load handler.

▶Do not lift other people on the load handler.

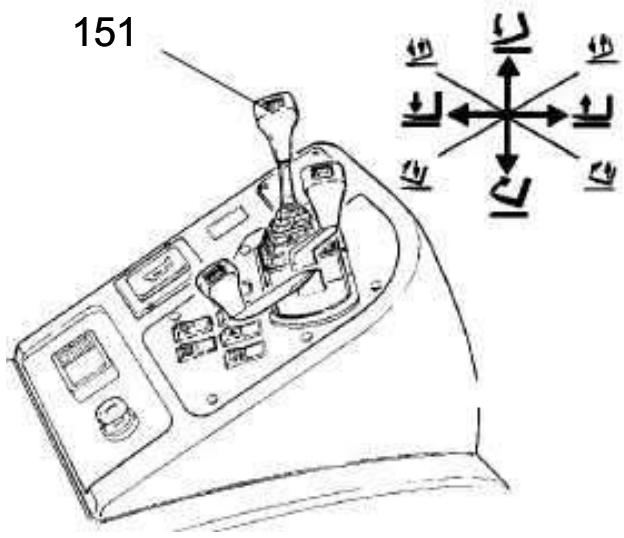
▶Instruct other people to move out of the hazardous area of the industrial truck.

▶Never stand underneath a raised and unsecured load handler / driver's cab.

*Procedure*

- Push the main control lever (151) forward to tilt the mast forward.
- Push the main control lever to the right and forward to tilt the mast forward and raise the load.
- Push the main control lever to the right to raise the load.
- Push the main control lever to the right and pull back to tilt the mast back and raise the load.
- Pull the main control lever back to tilt the mast back.
- Pull the main control lever back and push to the left to tilt the mast back and lower the load.
- Push the main control lever to the left to lower the load.
- Push the main control lever to the left and forward to tilt the mast forward and lower the load.

151



# 7 Troubleshooting

## 7.1 Troubleshooting

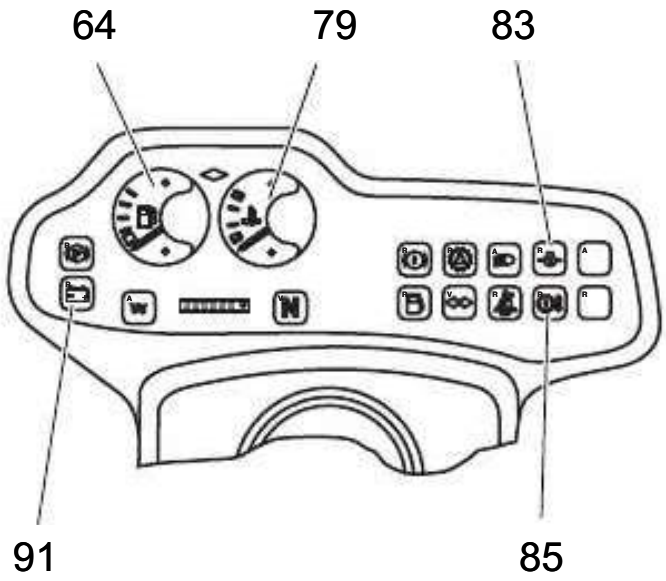
This chapter enables the user to identify and rectify basic faults and the effects of incorrect operation. When trying to locate a fault, proceed in the order shown in the table.

➔ If, after carrying out the following remedial action, the truck cannot be restored to operation or if a fault in the electronics system is displayed with a corresponding error code, contact the manufacturer's service department.
Additional troubleshooting must only be performed by the manufacturer's specialist service engineers. The manufacturer's customer service department is specially trained to carry out these operations.
In order for customer services to react quickly and specifically to the fault, the following information is essential:
- Truck serial number
- Error number on the display unit (if applicable)
- Error description
- Current location of truck

**Operational fault displays**

Faults during operation are indicated by indicators being lit:

– Engine oil pressure (83)
– Charge current (91)
– Coolant temperature (79)
– Transformer temperature (85)




**⚠ WARNING!**

**Risk from engine damage**

▶ The engine must be switched off immediately, and if possible the industrial truck should be parked securely.
▶ Contact the manufacturer's service department.
▶ The engine should only be started again once the fault has been removed.

➔ Check the fuel display (64) during operation (with TFG option).

| Fault | Possible Cause | Action |
|---|---|---|
| Starter does not turn | Travel direction switch not in neutral | Set the travel direction switch to neutral. |
| | Battery charge too low | Check battery charge, charge battery if necessary |
| | Battery terminal cable loose or terminals oxidized. | Clean and grease terminals, tighten battery terminal cable |
| | Starter cable loose or broken | Check the starter motor cable |
| Engine does not start | Air filter contaminated | Clean / replace air filter |
| | **Additional for LPG** | |
| | LPG bottle shutoff valve closed | Shutoff valve open |
| | LPG bottle empty | Replace the LPG bottle |
| | Ignition distributor cap damp | Ignition distributor cap dry, if necessary apply contact spray |
| | Spark plugs damp, oily or loose | Dry, clean and tighten spark plugs |
| | Spark plugs faulty | Replacing spark plugs |
| | **Additional for diesel** | |
| | Fuel tank empty, injection system has drawn in air | Fill up with diesel and bleed the injection system |
| | Water in fuel system | Discharge the fuel system<br>Fill up the truck<br>Bleeding the fuel system |
| | Fuel filter contaminated | Check the flow of fuel, if necessary replace the fuel filter |
| | Paraffin separation from the diesel (flakes forming) | Park the truck in a warm room and wait until the separation has returned to its original state.<br>If necessary replace the fuel filter<br>Filling with winter diesel |
| Engine oil indicator lit during operation | Engine oil level too low | Check engine oil level, top up if necessary |

| Fault | Possible Cause | Action |
|---|---|---|
| Engine temperature display in red zone | Engine oil level too low | Check engine oil level, top up if necessary |
| | Radiator contaminated | Clean radiator |
| | Coolant level too low | Check engine radiator system for leaks, add coolant if necessary |
| | Fan V belt slipping | Check V belt tension, tighten or replace as required |
| Transmission oil indicator lit during operation | Transmission oil level too low | Check transmission oil level, top up if necessary |
| | Radiator contaminated | Clean radiator |
| Engine running but truck does not travel | Travel direction switch in neutral | Set travel direction switch to required direction |
| | Parking brake applied | Releasing the parking brake |
| Truck does not reach max. speed | Transmission oil level too low | Check transmission oil level, top up if necessary |
| Lift speed too low | Hydraulic reservoir oil level too low | Check hydraulic oil, top up if necessary |
| | Hydraulic reservoir discharge system contaminated or blocked | Clean / replace hydraulic reservoir discharge system |
| Excessive steering play | Air in steering system | Check hydraulic oil level and top up if necessary, then turn the steering wheel several times from one end to the other. |
| Malfunction in the electrical system | Faulty fuse | Test fuses (see chapter F) |

## 7.2 Operating the truck without its own drive system

### 7.2.1 Towing the truck

**⚠ WARNING!**

**Accident risk**

Other people can be injured if the truck is towed incorrectly.

- ▶ Only use vehicles to tow the truck which have sufficient tow and brake forces for the trailer load without its own braking system.
- ▶ Always use a pull rod to tow.
- ▶ Always tow the truck at walking pace.
- ▶ Do not park the truck with the parking brake released.
- ▶ One person must be seated in the recovery truck to steer it and one person must be seated on the towed truck.

***Towing the truck***

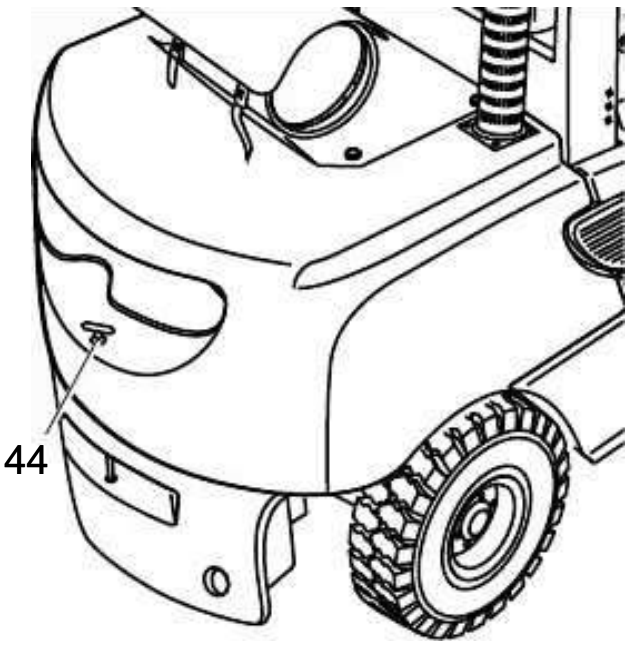
*Requirements*

– Park the truck securely.

*Procedure*

- Connect the pull rod to the trailer coupling (44) of the towing truck and attach it to the truck to be towed.
- Release the parking brake, (see "Parking brake" on page 76).
- Tow the truck to its destination.
- Apply the parking brake, (see "Parking brake" on page 76).
- Undo the tow connection.

*The truck has now reached its destination.*



### 7.2.2 Emergency lowering

The mast can be lowered manually if a fault occurs in the hydraulic system.

**WARNING!**

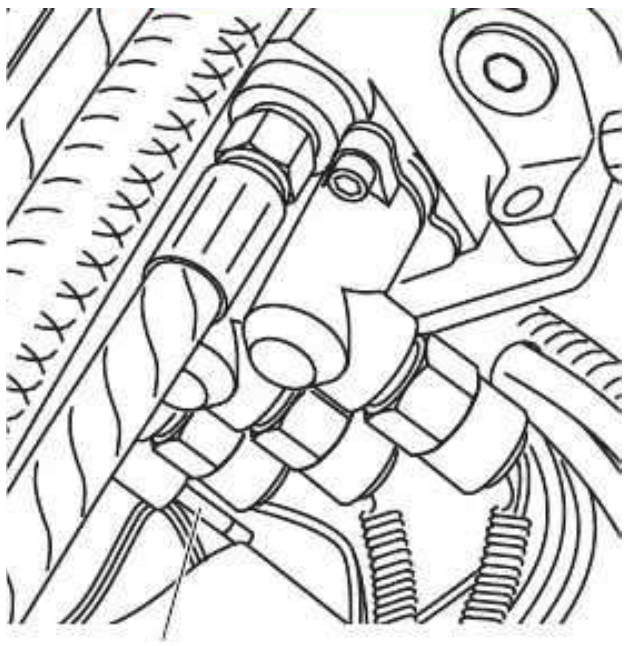
**Lowering the mast can result in injuries**

- ▶ Instruct other people to move out of the hazardous area of the truck during emergency lowering.
- ▶ Never stand underneath a raised load handler.
- ▶ Only operate the emergency lowering valve when standing next to the truck.
- ▶ Emergency lowering of the mast cannot be applied when the load handler is in the rack.
- ▶ Report any defects immediately to your supervisor.
- ▶ Tag out and decommission a faulty lift truck.
- ▶ Only return the truck to service when you have identified and rectified the fault.

*Procedure*

- Press the Emergency Disconnect switch.
- Turn key switch to "0".
- Apply the parking brake.
- Open the engine cover.
- Pull the protective cover off the left valve.
- Push the locking pin (152) on the valve block forward, thereby releasing the control lever.
- Lower the mast with the lever.

*The mast is now lowered.*

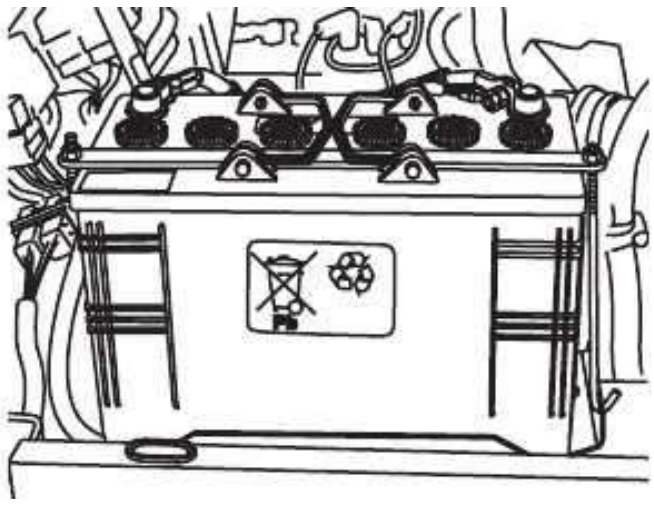


152

**WARNING!**

Only return the truck to service when you have identified and rectified the fault.

### 7.2.3 Starting aid



**⚠ WARNING!**

**Danger from overheating**

▶ Only use an ISO 6722 battery jump lead with fully insulated terminal pliers and a lead diameter of at least 25 $mm^2$.

*Procedure*

- First connect the positive terminal of the feeder battery to the positive terminal with the red lead.
- Connect the negative terminal of the feeder battery to the negative terminal with the black lead.
- To start the truck switch on the ignition with the engine cover open.
- Start the engine as normal.
- When the engine has started first remove the negative lead followed by the positive lead

If the starter motor does not switch on the engine after connecting the battery terminals, check that the battery terminal clips are positioned correctly.

# F Industrial Truck Maintenance

## 1 Operational Safety and Environmental Protection

The checks and servicing operations contained in this chapter must be performed in accordance with the intervals as indicated in the servicing checklists.

**WARNING!**
**Risk of accidents and damage to components**
Any modification to the truck, in particular the safety mechanisms, is prohibited. Do not alter the truck's operating speeds under any circumstances.
Do not bond the front window with adhesive.

**Exception:** Owners should only make changes or have changes made to powered industrial trucks if the truck manufacturer is no longer operating in the field and there is no successor to the business; owners must however:

– Ensure that the changes to be made are planned, tested and performed by a specialist engineer in industrial trucks taking safety into account.
– keep permanent graphic records of the plans, tests and completion of the changes
– carry out and have authorised the respective changes to the capacity data plates, decals and stickers as well as the operator and service manuals.
– attach permanent and clearly visible marking to the truck indicating the types of changes made, the date of the changes and the name and address of the organisation responsible for the work.

***NOTE***

Only original spare parts have been certified by our quality assurance department. To ensure safe and reliable operation of the truck, use only the manufacturer's spare parts.

For safety reasons, only components which have been specially agreed by the manufacturer for this truck may be installed near the computer, controllers and wire guidance sensors (antennae). These components (computers, controllers, wire guidance sensors (antennae)) must therefore not be replaced either by similar components from other trucks of the same series.

On completion of inspection and service work, carry out the operations listed in the “Recommissioning the truck after cleaning or maintenance work” section ((see "Restoring the truck to service after maintenance and repairs" on page 160)).

# 2 Maintenance Safety Regulations

### Maintenance and repair personnel

Truck maintenance and repair work must only be carried out by specially trained personnel. A maintenance contract with the manufacturer will ensure trouble-free operation. The manufacturer's service department has customer service technicians specially trained for these tasks.

### Lifting and jacking up

**⚠ WARNING!**

**Lifting and jacking up the truck safely**

In order to raise the truck, the lifting gear must only be secured to the points specially provided for this purpose.

You may only work under a raised load handler / raised cab if they have been secured with a sufficiently strong chain or the fastening bolt.

In order to raise and jack up the truck safely, proceed as follows:

- ▶ Jack up the truck only on a level surface and prevent it from moving accidentally.
- ▶ Always use a jack with sufficient capacity. When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).
- ▶ In order to raise the truck, the lifting gear must only be secured to the points specially provided for this purpose, (see "Identification points and data plates" on page 30).
- ▶ When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

## Cleaning

**⚠ CAUTION!**

**Fire hazard**

The truck must not be cleaned with flammable fluids.
If flammable materials are not removed from the engine compartment, they can come into contact with hot components and cause a fire.

- ▶ Carry out all necessary safety measures to prevent sparking before cleaning (e.g. by short-circuiting).
- ▶ Remove all deposits / accumulations of flammable materials from the engine compartment.

---

**⚠ CAUTION!**

**Risk of electrical system damage**

The electrical system can be damaged if it is cleaning with water. It is prohibited to clean the electrical system with water.

- ▶ Do not clean the electrical system with water.
- ▶ Clean the electrical system with weak suction or compressed air (use a compressor with a water trap) and not a conductive, anti-static brush.

---

**⚠ CAUTION!**

**Risk of component damage when cleaning the truck**

If the truck is to be cleaned with a water jet or a high-pressure cleaner, all electrical and electronic components must be carefully covered beforehand as moisture can cause malfunctions. Do not clean with pressurised water.

➔ After cleaning, carry out the operations detailed in “Recommissioning the truck after cleaning or maintenance work” ((see "Restoring the truck to service after maintenance and repairs" on page 160)).

## Electrical system

**CAUTION!**

**Accident risk from Electrical system:**

▶Only trained personnel may work on the electrical system.

▶Before working on the electrical system, all precautionary measures must be taken to avoid electrical accidents.

▶The connecting leads on the starter battery must be disassembled to disable it.

**WARNING!**

**Electric currents can cause accidents**

Make sure the electrical system is voltage-free before starting work on it. Before starting maintenance on the electrical system:

▶Park the truck securely ((see "Parking the truck securely" on page 71)).

▶Press the Emergency Disconnect.

▶ Disconnect the battery.

▶Remove any rings or metal bracelets etc. before working on electrical components.

## Consumables and used parts

**CAUTION!**

**Consumables and used parts are an environmental hazard**

Used parts, oils and fuels must be disposed of in accordance with the relevant environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

▶Note the safety regulations when handling these materials.

## Welding

Remove electrical and electronic components from the truck before performing welding operations, to avoid damage.

## Settings

When repairing or replacing hydraulic, electric or electronic components or assemblies, always note the truck-specific settings.

### Tyre type

**WARNING!**

**The use of tyres that do not match the manufacturer's specifications can result in accidents.**

The quality of tyres affects the stability and performance of the truck.

Uneven wear affects the truck's stability and increases the stopping distance.

- ▶When replacing tyres make sure the truck is not skewed.
- ▶Always replace tyres in pairs, i.e. left and right at the same time.

When replacing rims and tyres fitted at the factory, only use the manufacturer’s original spare parts. Otherwise the manufacturer’s specifications cannot be ensured.

### Lift chains

**WARNING!**

**Non-lubricated and incorrectly cleaned lift chains can cause accidents**

Lift chains are safety-critical parts. They must not contain any serious contamination.

Lift chains and pivot pins must always be clean and well lubricated.

- ▶Lift chains should only be cleaned with paraffin derivatives e.g. petroleum or diesel fuels.
- ▶Never clean lifting chains with steam jet high pressure cleaners or chemical cleaning agents.
- ▶Immediately after cleaning, dry the lift chain with compressed air and apply a chain spray.
- ▶Always lubricate a chain when it is discharged.
- ▶Lubricate a lift chain with particular care around the pulleys.

**WARNING!**

**Diesel fuel can be hazardous**

- ▶Diesel fuel can cause irritation if it comes into contact with the skin. Rinse any affected areas thoroughly.
- ▶If it comes into contact with the eyes rinse them immediately with flowing water and call for a doctor.
- ▶Wear safety gloves when handling diesel fuels.

## Hydraulic hoses

**WARNING!**

**Brittle hydraulic hose lines can cause accidents**

The hoses must be replaced every six years. The manufacturer's customer service department is specially trained to carry out these operations.

---

**WARNING!**

**Hydraulic line leaks can cause accidents**

Hydraulic oil can escape from leaky and faulty hydraulic lines.

- ▶ Report any defects immediately to your supervisor.
- ▶ Tag out and decommission a faulty lift truck.
- ▶ Only return the truck to service when you have identified and rectified the fault.
- ▶ Spilled fluids must be removed immediately with an appropriate bonding agent. The bonding agent / consumable mixture must be disposed of in accordance with regulations.

---

**WARNING!**

**Hairline cracks in the hydraulic lines can cause injury and infection**

Pressurised hydraulic oil can penetrate the skin through fine holes or hairline cracks in the hydraulic lines, causing severe injury.

- ▶ Call for a doctor immediately if you are injured.
- ▶ Do not touch pressurised hydraulic lines.
- ▶ Report any defects immediately to your supervisor.
- ▶ Tag out and decommission a faulty lift truck.
- ▶ Only return the truck to service when you have identified and rectified the fault.
- ▶ Spilled fluids must be removed immediately with an appropriate bonding agent. The bonding agent / consumable mixture must be disposed of in accordance with regulations.

---

**WARNING!**

**Danger from hot fluids and components!**

- ▶ Consumables (hydraulic oil, engine oil, coolant) and power train components (engine, manifold, exhaust system, turbo charger etc.) get very hot during operation.
- ▶ When carrying out maintenance and repairs wear suitable protective clothing (gloves etc.) to avoid getting burned.

---

# 3 Servicing and Inspection

Thorough and expert servicing is one of the most important requirements for the safe operation of the industrial truck. Failure to perform regular servicing can lead to truck failure and poses a potential hazard to personnel and equipment.

**⚠ WARNING!**

The application conditions of an industrial truck have a considerable impact on the wear of the service components.
We recommend that a Jungheinrich customer service adviser carries out an application analysis on site to work out specific service intervals to prevent damage due to wear.
The service intervals stated are based on single shift operation under normal operating conditions. They must be reduced accordingly if the truck is to be used in conditions of extreme dust, temperature fluctuations or multiple shifts.

---

The following servicing checklist indicates the operations to be performed and the respective intervals to be observed. Maintenance intervals are defined as:

| | | |
|---|---|---|
| W | = | Every 50 service hours, at least weekly |
| A | = | Every 500 service hours |
| B | = | Every 1000 service hours, or at least annually |
| C | = | Every 2000 service hours, or at least annually |
| ● | = | Standard maintenance interval |
| ✳ | = | Cold store maintenance interval (in addition to standard maintenance interval) |

➔ W maintenance intervals must be performed by the owner.

During the run-in period – after approx. 100 service hours – the owner must check the wheel nuts / bolts and re-tighten if necessary.

# 4 Maintenance checklist

## DFG / TFG

| | | Maintenance intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Chassis / Superstructure** | | | | | | |
| 1.1 | Check all load bearing components for damage. | | | ● | | |
| 1.2 | Check screw connection. | | | ● | | |
| 1.3 | Check overhead guard for damage and make sure it is secure. | | | ● | | |
| 1.4 | Check trailer hitch. | | | ● | | |
| 1.5 | Check the engine compartment for contamination and clean if necessary. | | ● | | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Drive** | | | | | | |
| 2.1 | Combustion engine, see separate checklist | | | | | |
| 2.2 | Check the transmission for noise and leakage | | | ● | | |
| 2.3 | Check pedal mechanism, adjust and lubricate if necessary | | | ● | | |
| 2.4 | Check the gear oil level | | | ● | | |
| 2.5 | Change the gear oil | | | | | ● |
| 2.6 | Clean gear oil suction filter and discharge | | | | ● | |
| 2.7 | Changing the gear oil filter | | | | | ● |
| 2.8 | Check drive axle for noise and leakage | | | ● | | |
| 2.9 | Check drive axle oil level (hydrokinetic only) | | | ● | | |
| 2.10 | Replace drive axle oil (hydrokinetic only) | | | | | ● |
| 2.11 | Check switching mechanism on control lever for wear and lubricate the contact surfaces (hydrokinetic only) | | | | ● | |
| 2.12 | Lubricate drive axle / mast swivel axle (hydrokinetic only) | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Brake system** | | | | | | |
| 3.1 | Test operation and settings | | | ● | | |
| 3.2 | Check brake lining wear (hydrokinetic only) | | | ● | | |
| 3.3 | Check brake mechanism, adjust and lubricate if necessary (hydrokinetic only) | | | ● | | |
| 3.4 | Check brake lines, connections and brake fluid level (hydrokinetic only) | | | ● | | |
| 3.5 | Change brake fluid (hydrokinetic only) | | | | | ● |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Wheels** | | | | | | |
| 4.1 | Check wheels for wear and damage | | | ● | | |
| 4.2 | Check suspension and fastening | | | ● | | |
| 4.3 | Check air pressure | | ● | | | |

| | | Maintenance intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Steering** | | | | | | |
| 5.1 | Check the steering play. | | | ● | | |
| 5.2 | Check the mechanical parts of the steering column; grease if necessary. | | | ● | | |
| 5.3 | Check the steer axle, stub axle, stops for wear and deformation. | | | | | ● |
| 5.4 | Test the operation of the hydraulic components and check for leaks. | | | ● | | |
| 5.5 | Grease the steering axle. | | | ● | | |

| | | Maintenance intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Mast** | | | | | | |
| 6.1 | Check mast attachment. | | | ● | | |
| 6.2 | Check and lubricate the mast suspension. | | | ● | | |
| 6.3 | Check operation, wear and setting. | | | ● | | |
| 6.4 | Visually inspect rollers, slide pieces and stops. | | | ● | | |
| 6.5 | Check lift chains and guides for wear, adjust and lubricate. | | | ● | | |
| 6.6 | Check lateral slack and ensure mast sections are parallel. | | | ● | | |
| 6.7 | Check fork tines and fork carriage for wear and damage. | | | ● | | |
| 6.8 | Check protective mechanisms for damage and make sure they are secure | | | ● | | |
| 6.9 | Check the tilt cylinder suspension and fastening. | | | ● | | |
| 6.10 | Check the mast tilt angle. | | | ● | | |
| 6.11 | Check the running surfaces of the mast for wear and damage, and lubricate if necessary. | | ● | | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Hydraulic system** | | | | | | |
| 7.1 | Test operation | | | ● | | |
| 7.2 | Check connections and ports for leaks and damage | | | ● | | |
| 7.3 | Check hydraulic cylinder for leaks and damage and make sure it is secure | | | ● | | |
| 7.4 | Check oil level | | | ● | | |
| 7.5 | Replace hydraulic oil | | | | | ● |
| 7.6 | Replace filter cartridge | | | | ● | |
| 7.7 | Clean hydraulic oil suction filter and discharge | | | | ● | |
| 7.8 | Test operation of pressure limitation valves | | | | | ● |
| 7.9 | Test hose guide and check for damage | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Electrical system** | | | | | | |
| 8.1 | Test operation | | | ● | | |
| 8.2 | Make sure wire connections are secure and check for damage | | | ● | | |
| 8.3 | Test all warning devices and safety switches. | | | ● | | |
| 8.4 | Test operation of instruments and displays | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Battery** | | | | | | |
| 9.1 | Check acid density, acid level and battery voltage | | | ● | | |
| 9.2 | Check terminals are securely attached, and apply terminal screw grease | | | ● | | |
| 9.3 | Check battery cables for damage, replace if necessary. | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Attachment** | | | | | | |
| 10.1 | Test operation | | | ● | | |
| 10.2 | Check attachment on truck and load bearing components | | | ● | | |
| 10.3 | Check position of bearings, guides and stops for wear and damage, grease these components. | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Lubrication** | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 11.1 | Lubricate truck in accordance with Lubrication Schedule. | | ● | | |





| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **General measurements** | | | | | | |
| 12.1 | Test travel speed and braking distance | | | | | ● |
| 12.2 | Test lift and lowering speeds | | | | | ● |
| 12.3 | Test safety devices and cutouts | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Demonstration** | | | | | | |
| 13.1 | Test run with rated load | | | ● | | |
| 13.2 | After carrying out maintenance, present the truck to the supervisor. | | | ● | | |

## DFG maintenance

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Engine** | | | | | | |
| 1.1 | Check engine for noise and leaks | | | ● | | |
| 1.2 | Check injection pump flow start, adjust if necessary | | | | | ● |
| 1.3 | Check injector pressure, adjust if necessary | | | ● | | |
| 1.4 | Tighten cheese head screws | | | | | ● |
| 1.5 | Check valve play, adjust if necessary | | | ● | | |
| 1.6 | Check engine oil level, top up if necessary | | ● | | | |
| 1.7 | Replace the engine oil. | | | ● | | |
| 1.8 | Replace the engine oil filter | | | ● | | |
| 1.9 | Check V belt for tension and damage | | | ● | | |
| 1.10 | Check maximum speed (without load), adjust if necessary | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Coolant** | | | | | | |
| 2.1 | Check the coolant level and top up if required (change coolant annually) | | ● | | | |
| 2.2 | Check anti-freeze content, top up if necessary | | | | | ● |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Exhaust** | | | | | | |
| 3.1 | Check exhaust system for leaks and damage | | | | | ● |
| 3.2 | Check exhaust levels, adjust if necessary | | | | | ● |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Air filter** | | | | | | |
| 4.1 | Clean air filter cartridge | | | ● | | |
| 4.2 | Replace air filter cartridge | | | | ● | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Hydraulics** | | | | | | |
| 5.1 | Check and lubricate the hydraulic pump drive | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Fuel system** | | | | | | |
| 6.1 | Replacing the fuel filter | | | ● | | |
| 6.2 | Check fuel/water separator, and discharge if necessary | | | ● | | |
| 6.3 | Check fuel tank and lines for leaks and damage | | | ● | | |

## TFG maintenance

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Engine** | | | | | | |
| 1.1 | Check engine for noise and leaks | | | ● | | |
| 1.2 | Check spark plugs, replace if necessary | | | ● | | |
| 1.3 | Check ignition time, adjust if necessary | | | ● | | |
| 1.4 | Check ignition distributor, adjust if necessary | | | ● | | |
| 1.5 | Check valve clearance, adjust if necessary | | | ● | | |
| 1.6 | Check engine oil level, top up if necessary | | ● | | | |
| 1.7 | Replace the engine oil | | | ● | | |
| 1.8 | Replace the engine oil filter | | | ● | | |
| 1.9 | Check V belt for tension and damage | | | ● | | |
| 1.10 | Check maximum speed (without load), adjust if necessary | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Coolant** | | | | | | |
| 2.1 | Check the coolant level and top up if required (change coolant annually) | | ● | | | |
| 2.2 | Check anti-freeze content, top up if necessary | | | | | ● |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Exhaust** | | | | | | |
| 3.1 | Check exhaust system for leaks and damage | | | | | ● |
| 3.2 | Check exhaust levels, adjust if necessary | | | | | ● |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Air filter** | | | | | | |
| 4.1 | Clean air filter cartridge | | | ● | | |
| 4.2 | Replace air filter cartridge | | | | ● | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **Hydraulics** | | | | | | |
| 5.1 | Check and lubricate the hydraulic pump drive | | | ● | | |

| | | Service intervals | | | |
|---|---|---|---|---|---|
| | | Standard = ● | W | A | B | C |
| **LPG system** | | | | | | |
| 6.1 | Check LPG system for leaks and damage | | | ● | | |
| 6.2 | Have LPG filter replaced by specialist | | | ● | | |
| 6.3 | Have LPG system examined by specialist | | | | | ● |
| 6.4 | Have the exhaust pollutant levels checked by a specialist and adjust to the lowest level achievable. | | | | ● | |
| 6.5 | Check and service Impco units | | | | | ● |

# 5 Lubricants and Lubrication Schedule

## 5.1 Handling consumables safely

### Handling consumables

Consumables must always be handled correctly. Follow the manufacturer's instructions.

**WARNING!**

**Improper handling is hazardous to health, life and the environment**

Consumables can be flammable.

- ▶ Keep consumables away from hot components and naked flames.
- ▶ Always keep consumables in prescribed containers.
- ▶ Always fill consumables in clean containers.
- ▶ Do not mix up different grades of consumable. The only exception to this is when mixing is expressly stipulated in the operating instructions.

---

**CAUTION!**

**Spilled liquids can cause slipping and endanger the environment**

Risk of slipping from spilled liquids. The risk is greater when combined with water.

- ▶ Do not spill fluids.
- ▶ Spilled fluids must be removed immediately with an appropriate bonding agent.
- ▶ The bonding agent / consumable mixture must be disposed of in accordance with regulations.

---

**WARNING!**

Oils (chain spray / hydraulic oil) are flammable and poisonous.

- ▶ Dispose of used oils in accordance with regulations. Store used oil safely until it can be disposed of in accordance with regulations.
- ▶ Do not spill oil.
- ▶ Spilled fluids must be removed immediately with an appropriate bonding agent.
- ▶ The bonding agent / consumable mixture must be disposed of in accordance with regulations.
- ▶ Observe national regulations when handling oils.
- ▶ Wear safety gloves when handling oils.
- ▶ Prevent oil from coming into contact with hot motor parts.
- ▶ Do not smoke when handling oil.
- ▶ Avoid contact and digestion. If you swallow oil do not induce vomiting but call for a doctor immediately.
- ▶ Seek fresh air after breathing in oil fumes or vapours.
- ▶ If oil has come into contact with your skin, rinse your skin with water.
- ▶ If oil has come into contact with your eyes, rinse them with water and call for a doctor immediately.
- ▶ Replace oil-soaked clothing and shoes immediately.

## Consumables and used parts

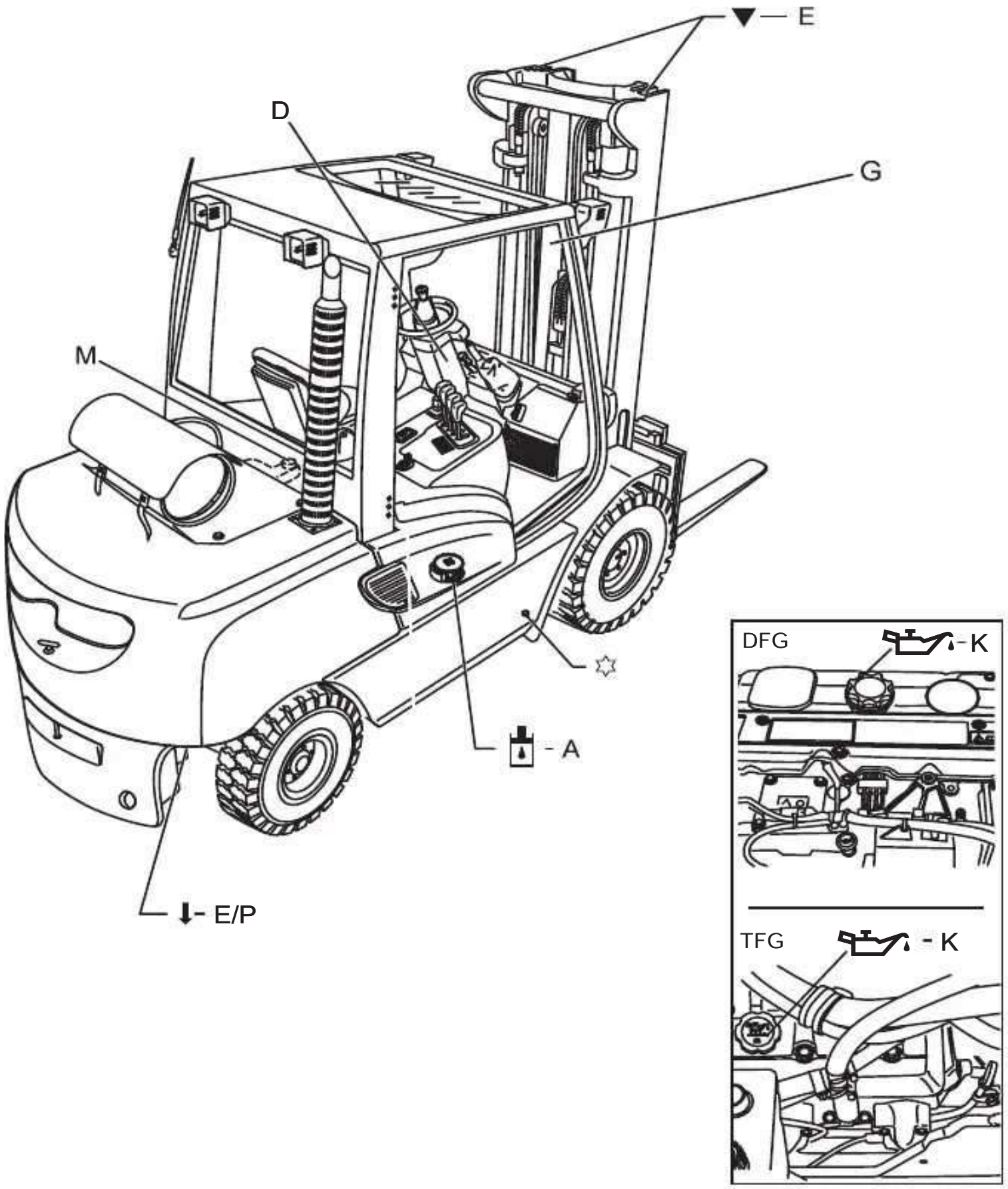
**⚠ CAUTION!**

**Consumables and used parts are an environmental hazard**

Used parts, oils and fuels must be disposed of in accordance with the relevant environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

▶Note the safety regulations when handling these materials.

## 5.2 Lubrication Schedule




▼ Contact surfaces
⬇ Grease nipple
Hydraulic oil filler neck
✡ Hydraulic oil drain plug
M Coolant expansion vessel
E Steer axle lubrication
K Engine oil filler neck

## 5.3 Consumables

**DFG/TFG 540-550**

| Code | Order no. | Package quantity | Capacity | Description | Used for |
|---|---|---|---|---|---|
| A | 51132827 | 5 l | 80 l | Juncheinrich hydraulic oil | Hydraulic system |
| D | 00002832 | | 0.3 l | Brake fluid SAE J 1703 | Brake System |
| E | 50055726 | | | K-P-2K grease | |
| G | 29201280 | 400 ml | | Chain spray | Mast chains |
| N | 05099205 | | 7.3 l | ATF Dexron II D | Transmission |
| P | 51050011 | 20 l | 4.5 l | Titan Supergear 80W-90 | Axle |
| K | 51094056 | 5 l | 6.9 l (DFG)<br>4.7 l (TFG) | Titan UNIC PLUS SAE 10W-40 | Engine oil |
| M | 51115303 | 1 l | 16 l | Fricofin S | Coolant* |

* The coolant consists of a 1:1 mixture ratio of Fricofin S and water

➔ The volumes indicated are approximate.

**⚠ WARNING!**

**Using incorrect hydraulic oil can be dangerous**

▶ Do not use hydraulic oils with a different specification or viscosity and do not mix with additives.

**Grease guidelines**

| Code | Saponification | Dew point °C | Worked penetr. at 25 °C | NLG1 class | Application temperature °C |
|---|---|---|---|---|---|
| E | Lithium | 185 | 265-295 | 2 | -35/+120 |

**Coolant specification**

The quality of the coolant used can have a major impact on the efficiency and service life of the cooling circuit. The recommendations listed below are useful for servicing a good cooling circuit with anti-freeze and/or anti-corrosion.

➔ Always use clean, soft water. Do not use distilled water.

**⚠ DANGER!**

**Anti-freeze is poisonous**

- ▶Anti-freeze contains ethylene glycol and other components which can result in poisoning if ingested.
- ▶Ingression into the human body can also result if poisonous quantities come into contact with the skin for long or repeated periods.
- ▶Note the manufacturer's safety instructions.

---

The quality of the anti-freeze must be checked at least annually, e.g. at the start of the cold season.

If the correct procedures are not applied, the manufacturer cannot be held liable for frost or corrosion damage.

***NOTE***

**Corrosion damage**

- ▶Even if the coolant cannot freeze up due to the application conditions, you must still use anti-freeze. The anti-freeze provides protection against corrosion and raises the boiling point of the coolant.

---

***NOTE***

**Anti-freeze/water mixture ratio:**

- ▶1: 1 (anti-freeze to -35°C)
- ▶Never mix different types of anti-freeze.

---

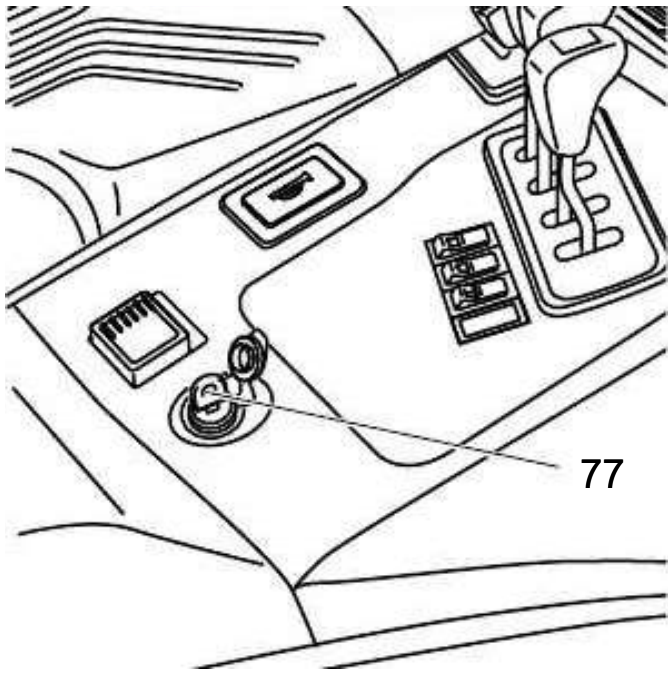
# 6 Maintenance and repairs

## 6.1 Preparing the truck for maintenance and repairs

All necessary safety measures must be taken to avoid accidents when carrying out maintenance and repairs. The following preparations must be made:

*Procedure*

- Park the truck securely, (see "Parking the truck securely" on page 71).
- Fully lower the load handler.
- Remove the key from the key switch (77) to prevent the truck from being switched on accidentally.




**WARNING!**

**Risk of accidents when working under the load handler, driver's cab and lift truck**

▶When working under a raised load handler, driver's cab or a raised truck, secure them to prevent the truck from from lowering, tipping or sliding away.

▶When raising the truck, follow the instructions, (see "Lifting the truck by crane" on page 36). When working on the parking brake, prevent the truck from accidentally rolling away (e.g. with wedges).

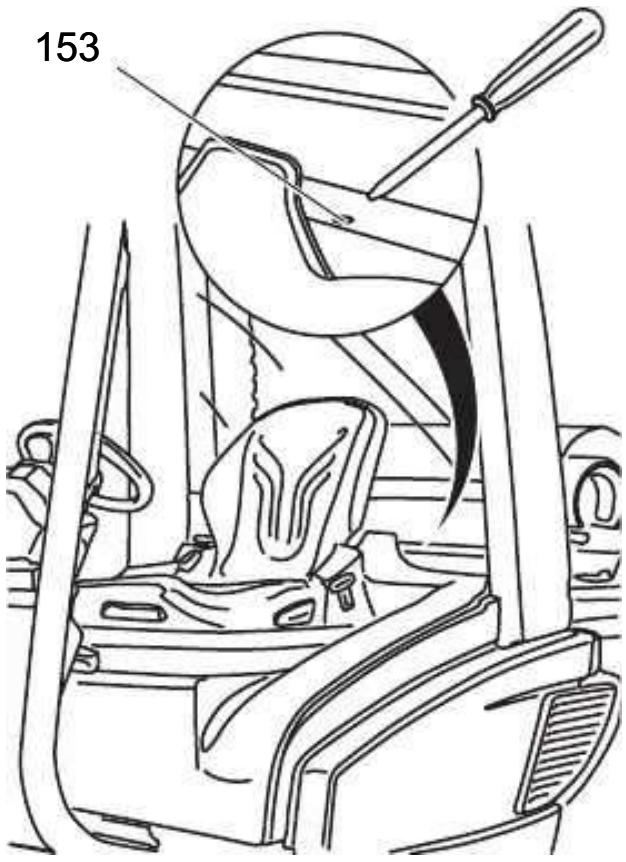
## 6.2 Opening the engine cover

*Requirements*

– For trucks with a closed cab open both cabin doors before lifting the engine cover (○).

*Procedure*

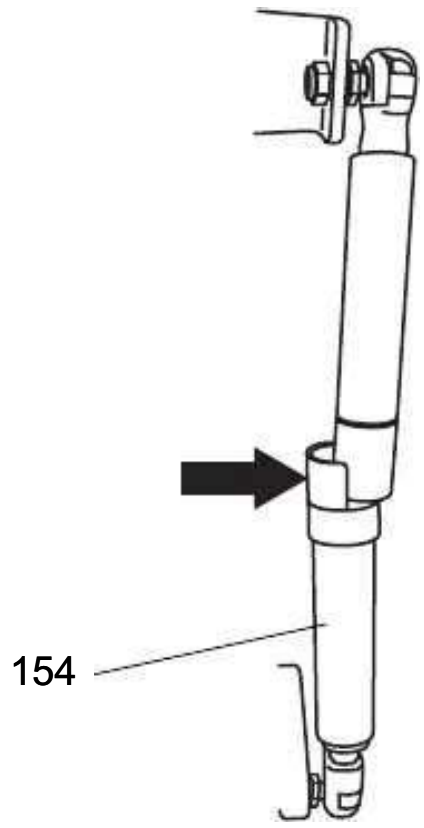
- Before opening the engine compartment push the steering column as far forward as it will go and push the seat fully back along its guide rails.
- To open the engine compartment fit a suitable instrument (e.g. screwdriver) through the access hole and push it onto the locking device (153) of the engine cover.
- Lift up the engine cover fully. A gas pressure damper keeps the engine cover in the raised position.
- Make sure the engine cover has engaged correctly before operating the truck again.




***Closing the engine cover***

*Procedure*

- Raise the engine cover slightly and push the bottom section (154) of the gas pressure damper in the direction of the arrow as far as it will go against the top part of the gas pressure damper.
- Push the engine cover down and allow it to lock in place. Push the driver`s seat back and lock it in place.
- To adjust the seating position and steering wheel position to your requirements, (see "Adjusting the driver's seat" on page 61).



## 6.3 Checking the wheel attachments.

**⚠ WARNING!**

**Using different tyres can cause accidents**

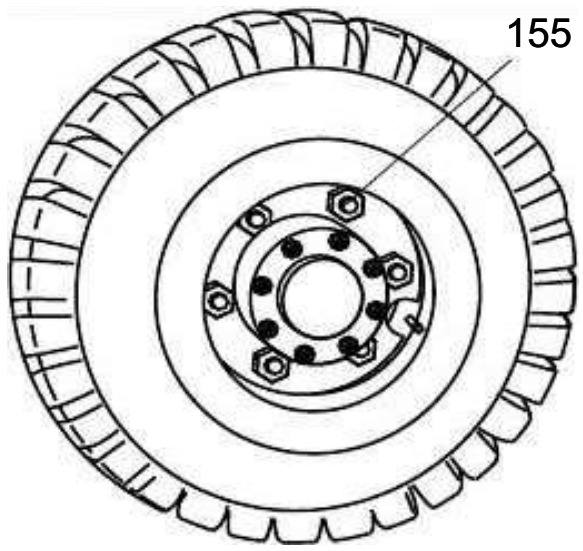
The quality of tyres affects the stability and performance of the truck.

▶The diameter of the wheels must differ by no more than 15 mm.

▶Always replace tyres in pairs. After replacing the tyres check the wheel nuts are secure after 10 service hours.

▶Always use tyres of the same make, model and profile.

***Checking the wheel attachment***




*Requirements*

– Prepare the truck for maintenance and repairs ((see "Preparing the truck for maintenance and repairs" on page 133)).

*Tools and Material Required*

– Torque wrench

*Procedure*

• Torque the wheel nuts (155) crosswise with a torque wrench, for torques (see "Tyre type" on page 26).

*The wheel attachment is now checked.*

➔ When using pneumatic tyres check the air pressure, for the air pressure (see "Tyre type" on page 26)

## 6.4 Hydraulic system

**⚠ CAUTION!**

The hydraulic oil is pressurised during operation and is a hazard to health and to the environment.

- ▶ Do not touch pressurised hydraulic lines.
- ▶ Dispose of used oil in accordance with regulations. Store used oil safely until it can be disposed of in accordance with regulations.
- ▶ Do not spill hydraulic oil.
- ▶ Spilled fluids must be removed immediately with an appropriate bonding agent.
- ▶ The bonding agent / consumable mixture must be disposed of in accordance with regulations.
- ▶ Observe national regulations when handling hydraulic oil.
- ▶ Wear safety gloves when handling hydraulic oil.
- ▶ Prevent hydraulic oil from coming into contact with hot motor parts.
- ▶ Do not smoke when handling hydraulic oil.
- ▶ Avoid contact and digestion. If you swallow oil do not induce vomiting but call for a doctor immediately.
- ▶ Seek fresh air after breathing in oil fumes or vapours.
- ▶ If oil has come into contact with your skin, rinse your skin with water.
- ▶ If oil has come into contact with your eyes, rinse them with water and call for a doctor immediately.
- ▶ Replace oil-soaked clothing and shoes immediately.

---

**⚠ CAUTION!**

**Consumables and used parts are an environmental hazard**

Used parts, oils and fuels must be disposed of in accordance with the relevant environmental protection regulations. To change the oil contact the manufacturer's customer service department, who have been specially trained for this task.

- ▶ Note the safety regulations when handling these materials.

---

### 6.4.1 Checking the hydraulic oil level

*Requirements*

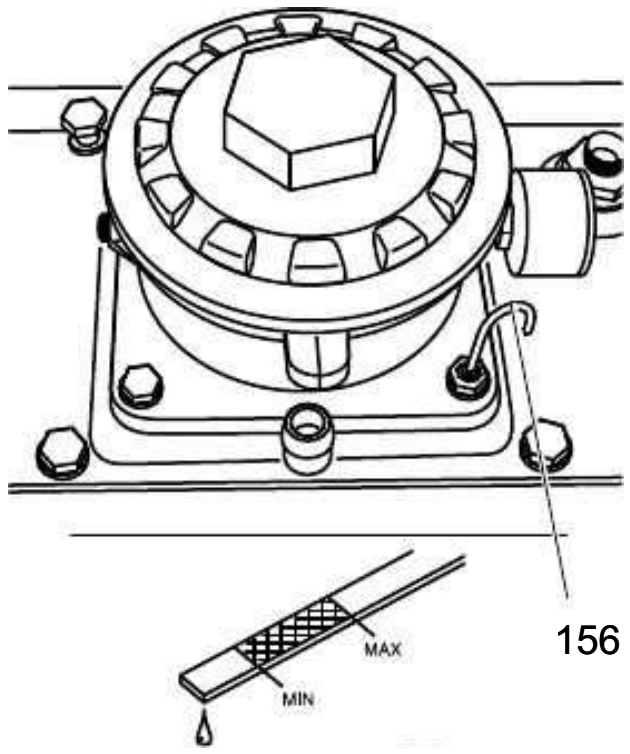
– Park the truck on a level surface.
– Start the engine and fully raise and lower the mast once.
– Switch off the engine.

*Procedure*

- Remove the hydraulic oil dipstick (156) from the hole wipe it with a clean cloth and insert it fully again.
- Remove the hydraulic oil dipstick and check the level of the hydraulic oil.

  For cold oil: The oil level should lie between the “Min.” and “Max.” levels.

  For hot oil: The hydraulic oil should lie just above the MAX marking.
- Add hydraulic oil if necessary.
- Repeat the test.
- When the oil level is correct, fully insert the hydraulic oil dipstick (156) again.



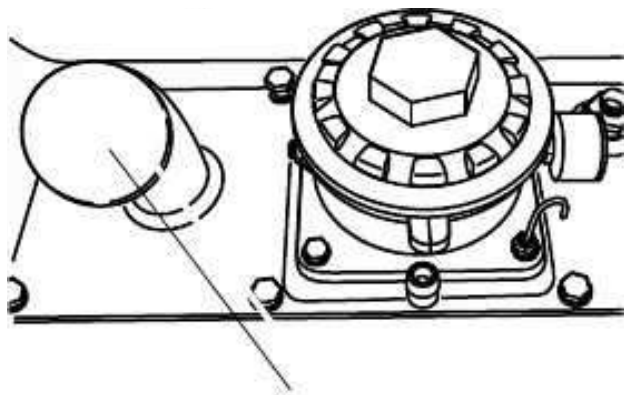
156

### 6.4.2 Adding hydraulic oil

*Procedure*

- Unscrew the lid (157) of the hydraulic oil filler neck.
- Add hydraulic oil to the MAX mark on the hydraulic oil dipstick.

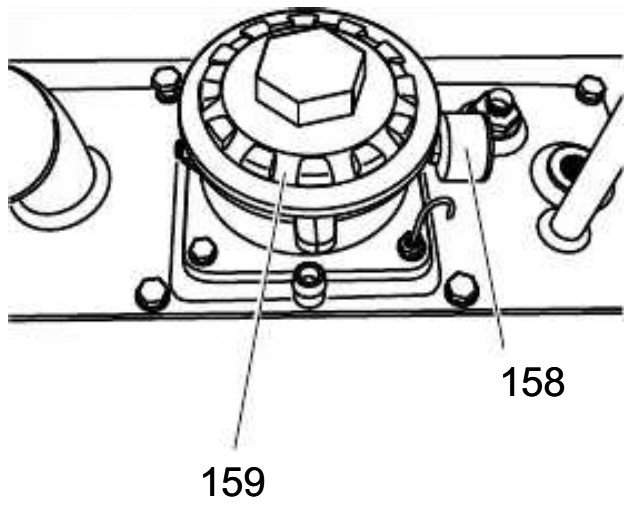
  Use only approved hydraulic oil (see consumables table).
- Check the hydraulic oil level with the dipstick and top up as required.
- Screw the lid back on.
- Insert the dipstick back in full.


157

### 6.4.3 Replacing the hydraulic oil filter

**⚠ CAUTION!**

**If the pressure indicator (158) on the hydraulic oil filter is in the red zone, the filter must be replaced immediately.**

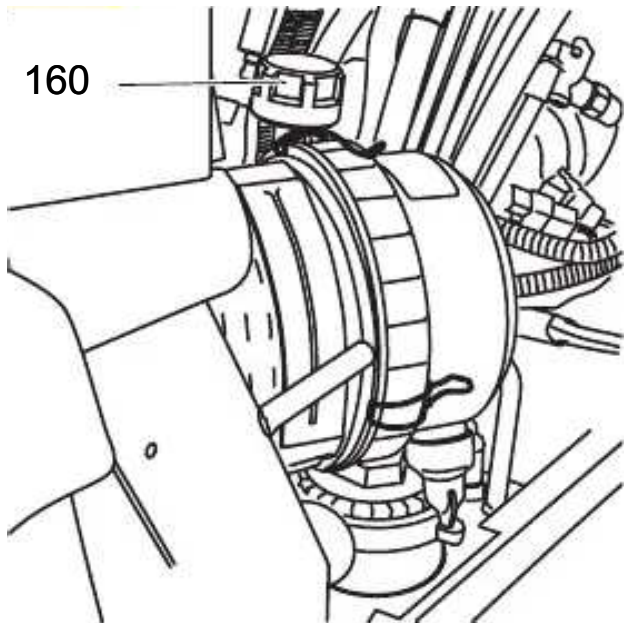



*Procedure*

- Loosen the quick release on the strap retainer of the air filter and push the air filter housing to the side.
- Unscrew the lid (159).
- Remove the hydraulic oil filter in the lid.
- Insert a new hydraulic oil filter and screw the lid back on.
- Fasten the air filter in place again.

➔ Collect any spilled hydraulic oil. Dispose of the hydraulic oil and hydraulic oil filter and fuel in accordance with environmental regulations.

### 6.4.4 Replacing the ventilation/discharge filter




*Procedure*

- Unscrew the ventilation/discharge filter (160).
- Visually inspect the filter.
- If contaminated insert a new filter.
- Screw the ventilation/discharge filter back on.

➔ Collect any spilled hydraulic oil. Dispose of the hydraulic oil and hydraulic oil filter and fuel in accordance with environmental regulations.

## 6.5 Engine maintenance

**⚠ DANGER!**

**A running engine can be dangerous.**

▶There is a high risk of injury when the cover is open and the engine running.

▶Do not reach into moving parts (e.g. fan, belt drive).

▶Truck maintenance and repair work must only be carried out by specially trained personnel who have been authorised by the owner.

▶There must be nobody present in the danger zone.

### 6.5.1 DFG engine maintenance

***NOTE***

**Used oil contaminates the environment**

▶Dispose of used oil and used engine oil filters in accordance with environmental regulations.

**⚠ CAUTION!**

**Risk of scalding through hot oil.**

▶Wear appropriate safety gloves when replacing the oil and oil filter.

***NOTE***

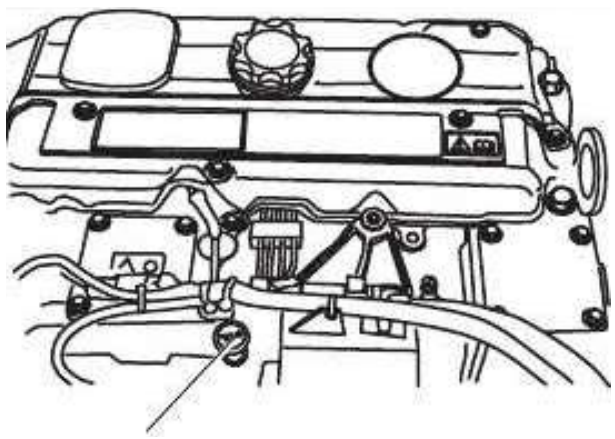
**When the engine is cold the engine oil can be viscous.**

▶Only change the engine oil when the engine is at operating temperature and the industrial truck is horizontal. Always replace the engine oil and engine oil filter together.

***Checking the engine oil level***

*Requirements*

– Park the truck on a level surface (see "Parking the truck securely" on page 71)




*Procedure*

- Remove the dipstick (161).
- Wipe the dipstick with a lint-free cloth and put in back fully into the port.
- Remove the dipstick again and check that the oil level is between the MIN and MAX markings.
- If the engine oil level is below the bottom MIN marking, add engine oil as per the consumables list ((see "Consumables" on page 131)).



*The engine oil has now been checked.*

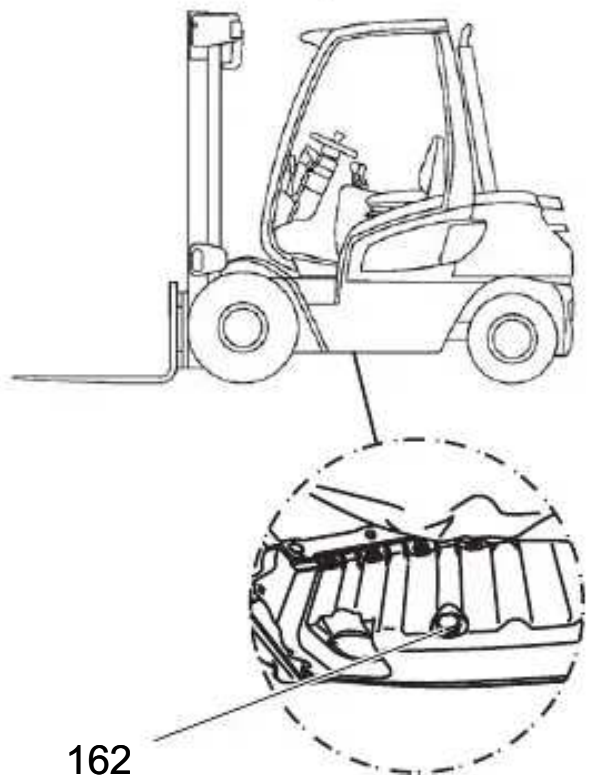
*The engine oil has now been checked.*



### *Draining the engine oil*

*Procedure*

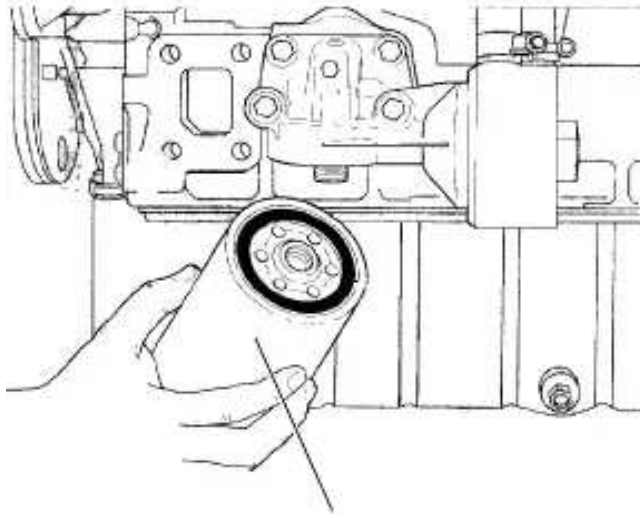
- Unscrew the filler cap.
- Thoroughly clean the oil drain plug (162) and around the drain hole.
- Unscrew the oil drain plug.
- Collect any oil that emerges.
- Screw in the oil drain plug with a new seal.




### *Replace the engine oil filter*

*Procedure*

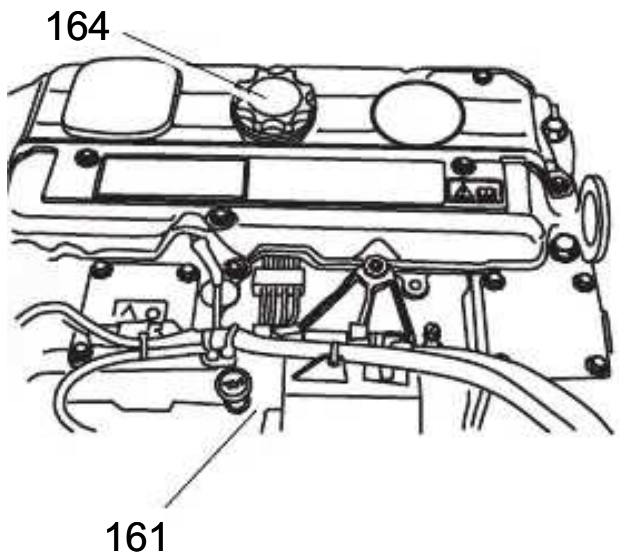
- Undo the oil filter (163) with a filter wrench and manually unscrew it.
- Thoroughly clean the sealing faces of the oil filter flange.
- Apply a thin layer of engine oil to the seal of the new oil filter.
- Hand-tighten the oil filter.




### *Adding engine oil*

*Procedure*

- Add fresh engine oil through the filler port (164) in accordance with the consumables table.
- Check the engine oil level with the dipstick (161) and top up if necessary, (see "Consumables" on page 131).
- Screw the filler cap back on.

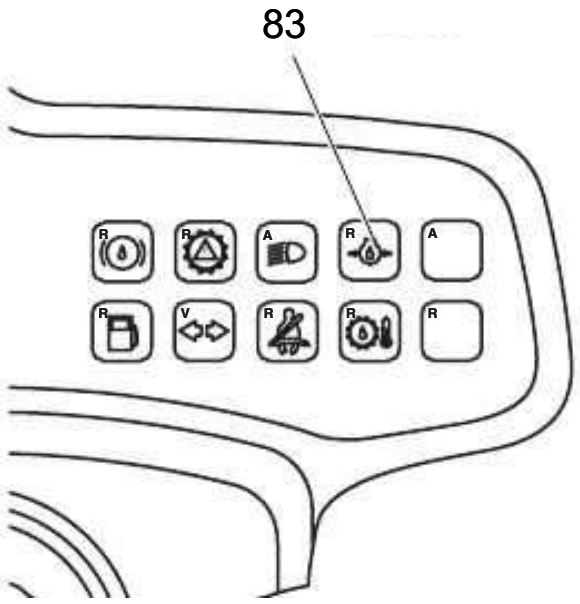


**NOTE**

**The incorrect amount of oil will damage the engine.**

▶After replacing the oil and oil filter carry out a test run and check the oil pressure display (83).

▶Check that the oil drain plug and oil filter housing are tight.



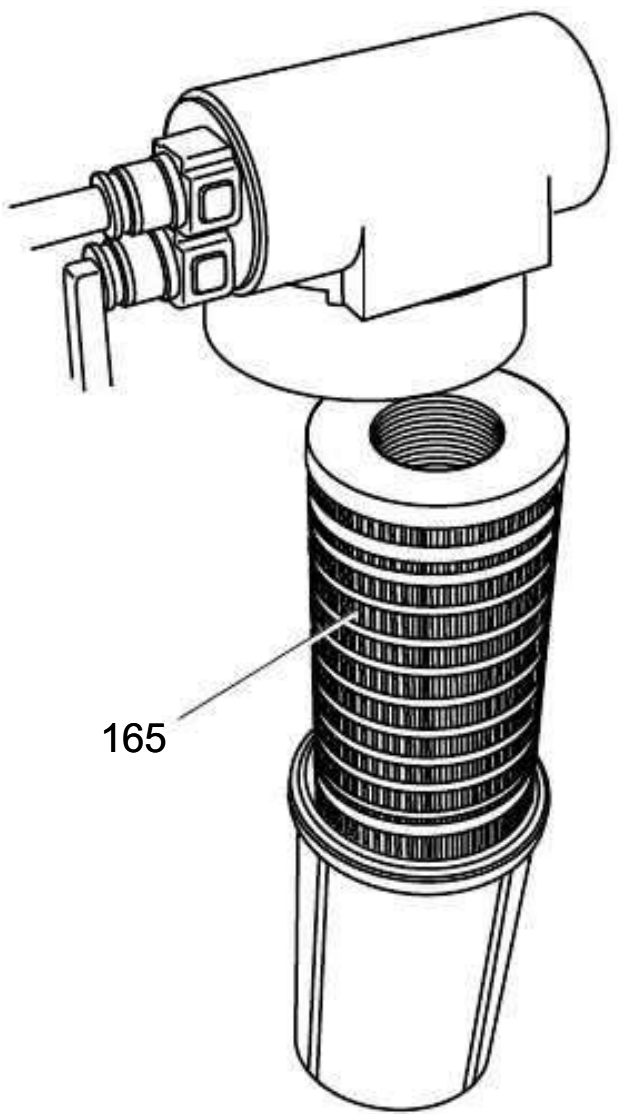

## 6.5.2 Replacing the fuel filter

**NOTE**

**Fuel can cause environmental damage**

▶Bind any spilled diesel fuel with suitable methods.

▶Then dispose of the diesel and fuel filter in accordance with environmental regulations.




*Procedure*

- Drain the fuel from the filter into a suitable container.
- Undo the filter housing with a filter wrench and manually unscrew it.
- Turn the filter insert anticlockwise to loosen and remove it.
- Install a new filter insert and lock it in place.
- Thoroughly clean the sealing faces of the filter flange.
- Apply a thin layer of diesel to the seal of the new fuel filter (165).
- Prefill the filter housing with clean diesel.
- Screw on the filter housing and hand-tighten.
- The fuel filter bleeds itself automatically after the ignition is turned on.

➔ While running the engine check the fuel filter and the union nuts of the injectors for leaks.

### 6.5.3 Check V-belt for damage

*Procedure*

- Check the V-belt for cracks, deformation and wear.

**NOTE**

**A damaged V-belt will result in malfunctions.**

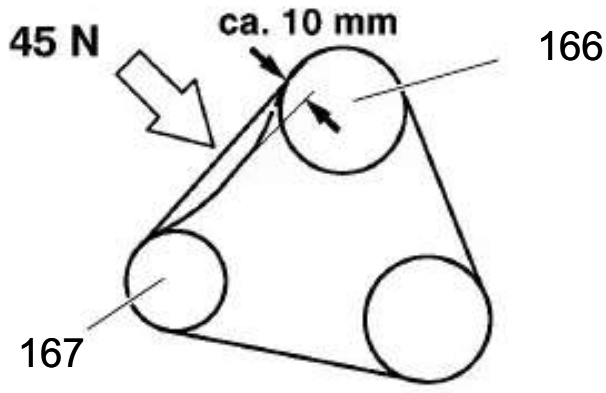
▶ If the V-belt is not in a suitable condition, you must only start to use the truck when the damage has been rectified.

### 6.5.4 Checking the V belt tension

*Procedure*

- Insert the V belt between the fan V belt pulley (166) and the generator V belt pulley (167) using a force of 45 N.

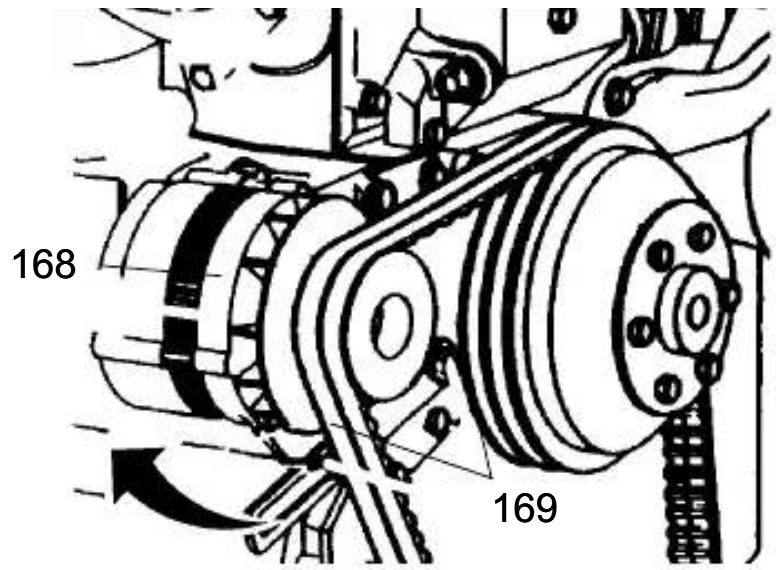
*It should be possible to insert the V belt approx. 10 mm.*




### 6.5.5 Adjusting the V belt tension

*Procedure*

- Undo the screws (169) and pull the three-phase alternator (168) until you reach the prescribed V belt tension.
- Re-tighten the screws.
- Check the V belt tension again and repeat the adjustment if necessary.



### 6.5.6 TFG engine maintenance

**NOTE**

**Used oil contaminates the environment**

▶Dispose of used oil and used engine oil filters in accordance with environmental regulations.

**⚠ CAUTION!**

**Risk of scalding through hot oil.**

▶Wear appropriate safety gloves when replacing the oil and oil filter.

**NOTE**

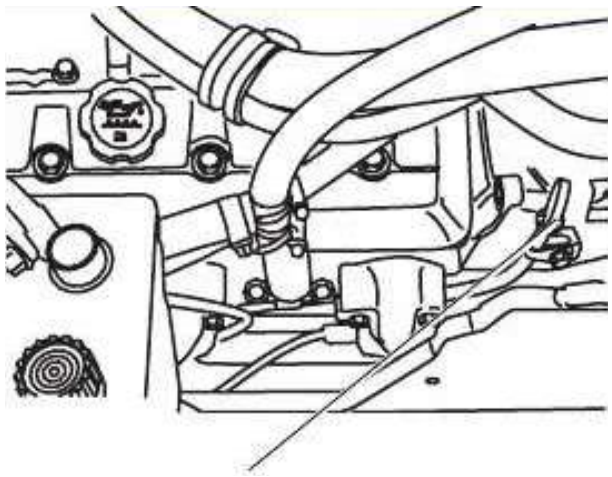
**When the engine is cold the engine oil can be viscous.**

▶Only change the engine oil when the engine is at operating temperature and the industrial truck is horizontal. Always replace the engine oil and engine oil filter together.

***Checking the engine oil level***

*Requirements*

– Park the truck on a level surface (see "Parking the truck securely" on page 71)



161

*Procedure*

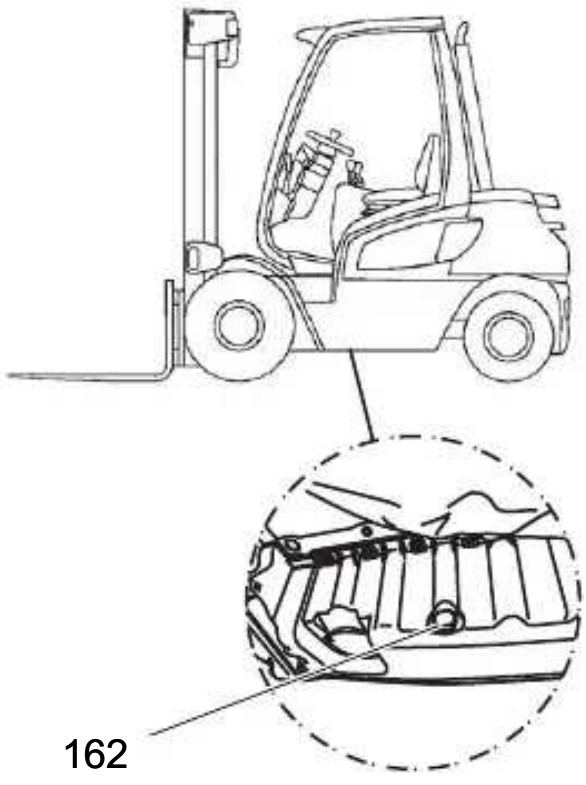
- Remove the dipstick (161).
- Wipe the dipstick with a lint-free cloth and put in back fully into the port.
- Remove the dipstick again and check that the oil level is between the MIN and MAX markings.
- If the engine oil level is below the bottom MIN marking, add engine oil as per the consumables list ((see "Consumables" on page 131)).

*The engine oil has now been checked.*

### *Draining the engine oil*

*Procedure*

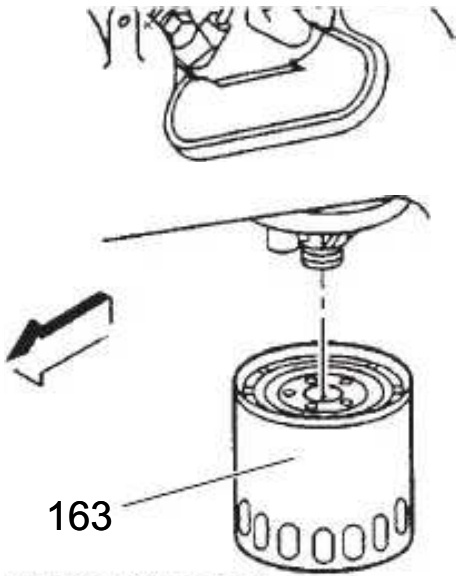
- Unscrew the filler cap (164).
- Thoroughly clean the oil drain plug (162) and around the drain hole.
- Unscrew the oil drain plug.
- Collect any oil that emerges.
- Screw in the oil drain plug with a new seal.




### *Replace the engine oil filter*

*Procedure*

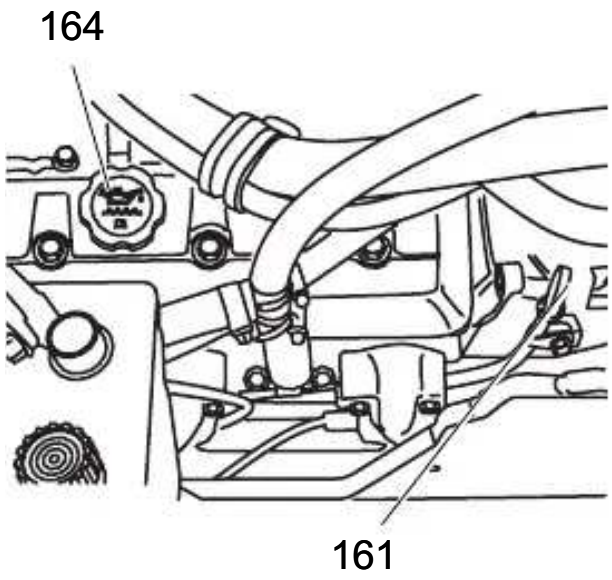
- Undo the oil filter (163) with a filter wrench and manually unscrew it.
- Thoroughly clean the sealing faces of the oil filter flange.
- Apply a thin layer of engine oil to the seal of the new oil filter.
- Hand-tighten the oil filter.




### *Adding engine oil*

*Procedure*

- Add fresh engine oil through the filler port (164) in accordance with the consumables table.
- Check the engine oil level with the dipstick (161) and top up if necessary, (see "Consumables" on page 131).
- Screw the filler cap back on.

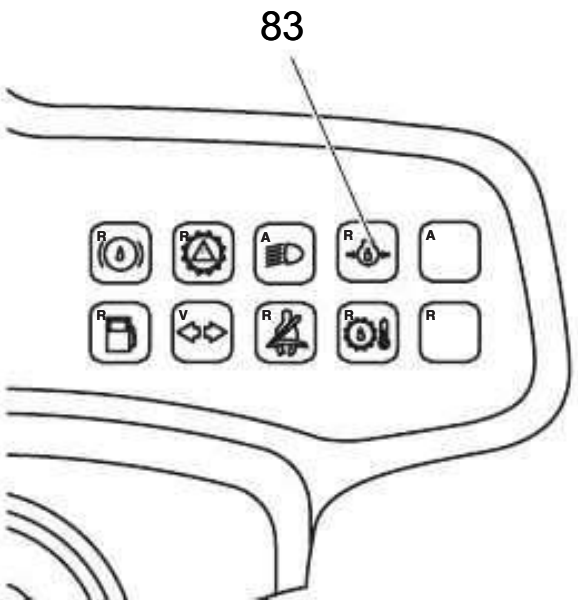


**NOTE**

**The incorrect amount of oil will damage the engine.**

▶ After replacing the oil and oil filter carry out a test run and check the oil pressure display (83).

▶ Check that the oil drain plug and oil filter housing are tight.



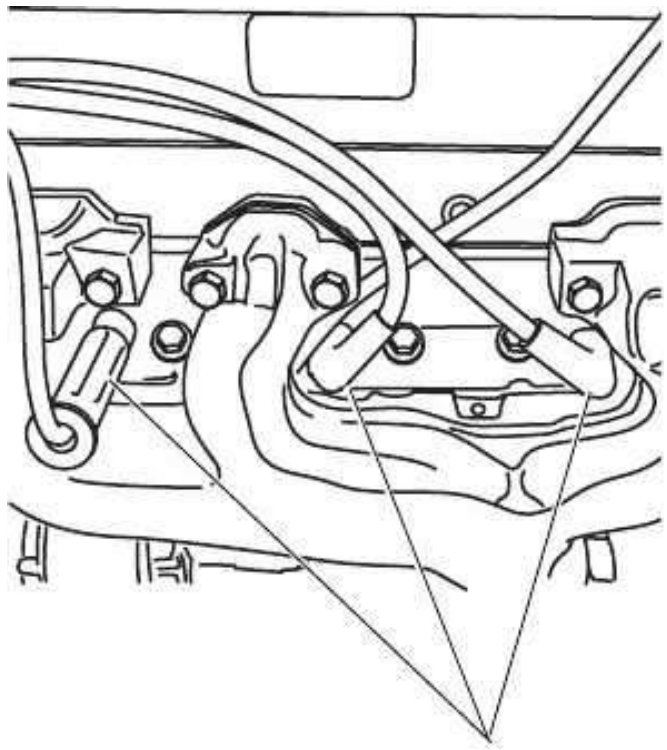

83

## 6.5.7 Replacing spark plugs

*Procedure*

- Remove spark plug connector (170).
- Thoroughly clean around the spark plugs on the cylinder head.
- Unscrew the spark plugs.
- Check the electrode distance of the new spark plugs with a feeler gauge.

  ➔ It should be 0.8 mm ± 0.1 mm.
- Screw in the spark plugs by hand and then torque them to 20 Nm.



170

### 6.5.8 Check V-belt for damage

**NOTE**

**A damaged V-belt will result in malfunctions.**

▶If the V-belt is not in a suitable condition, you must only start to use the truck when the damage has been rectified.

*Procedure*

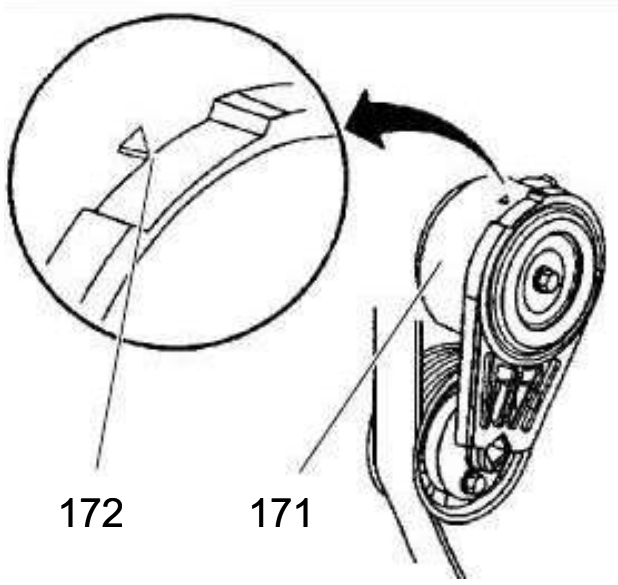
- Check the V-belt for cracks, deformation and wear.

### 6.5.9 Checking the V belt tension

The V-belt tension is maintained by an automatic belt tensioner (171). No manual adjustment is required.

*Procedure*

- If the attachment indicator (172) is outside the index marking, this means a new belt must be fitted.




**CAUTION!**

**It is essential to route the V-belt correctly.**

▶Belts must be replaced by qualified and authorised personnel.

## 6.5.10 Cooling system

**NOTE**

**Lack of coolant can cause malfunctions**

- ▶ The coolant level should be between the “MIN” and “MAX” markings on the expansion vessel.
- ▶ If the coolant is below the MIN marking, this indicates possible leakage in the radiator system.
- ▶ Do not continue using the truck.
- ▶ The truck may only be started again once the cause has been removed.

**⚠ CAUTION!**

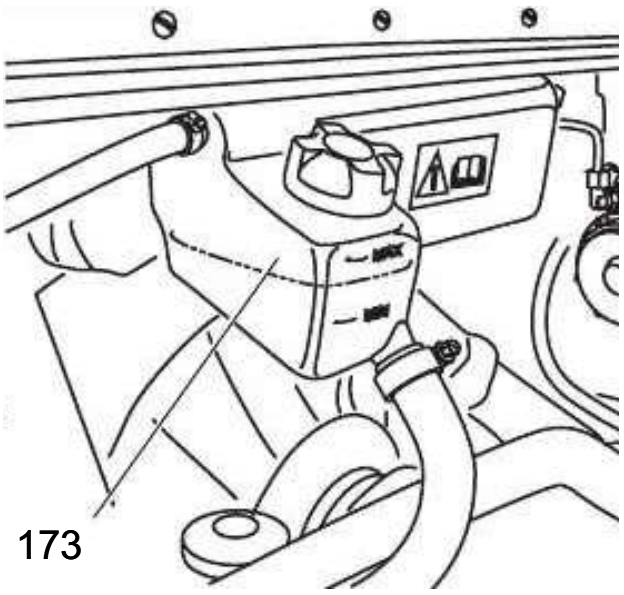
**Hot coolant can cause injury**

- ▶ Allow the engine to cool down sufficiently to prevent hot gases/liquids from escaping when the filler cap is opened.

***Checking the coolant level***

*Procedure*

- Park the truck securely on a level surface.
- Open the engine cover.
- Check the coolant level on the expansion vessel (173).




173

**NOTE**

**The incorrect coolant can cause malfunctions**

- ▶ To prevent the build up of lime as well as front and corrosion damage in the radiator system, and to raise the boiling point temperature of the coolant, the cooling circuit must be filled each year with a mixture of water and anti-freeze with anti-corrosion additives.
- ▶ Coolant can only be checked and added by experts.

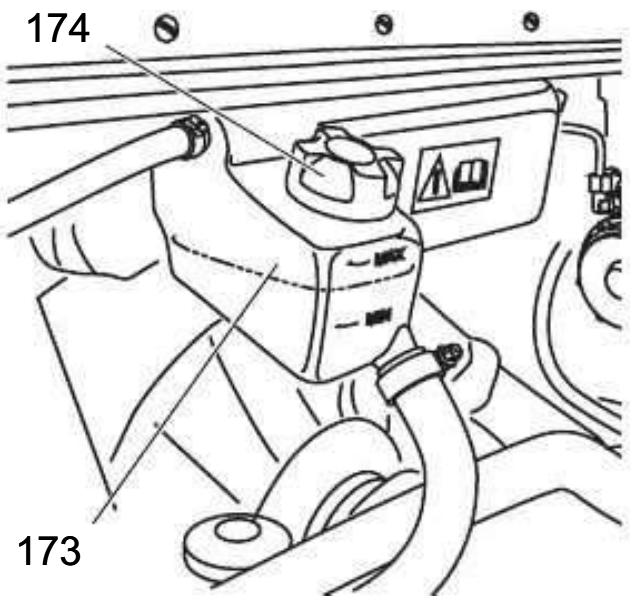
***Check the coolant concentrate***

*Tools and Material Required*

– Anti-freeze tester for coolants

*Procedure*

- Slowly unscrew the filler cap (174) from the expansion vessel (173).
- Check the anti-freeze content of the coolant with an anti-freeze tester.




***NOTE***

**The incorrect coolant concentration can cause malfunctions**

▶ If there is insufficient anti-freeze content arrange for trained personnel to restore the correct mixture ratio.

---

- Screw the filler cap back on.
- Close the engine cover.

➔ **Check the cooler and fan and clean if necessary**
Request customer service for this job.

## 6.5.11 Replace air filter cartridge

**DANGER!**

**A running engine can be dangerous**

▶Carry out all maintenance work with the engine switched off.

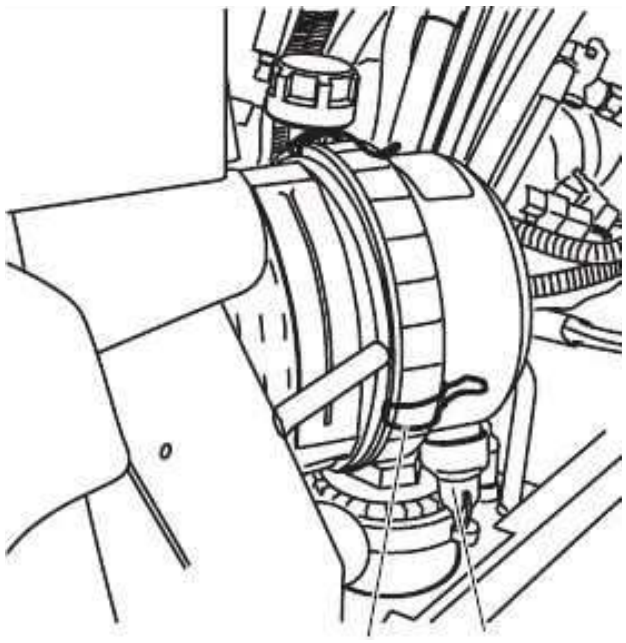
▶Do not start the engine if the air filter cartridge is removed.

---

***Replace air filter cartridge***

*Procedure*

- Undo the 2 mounting clamps (176) and remove the dust collector pot.
- Carefully remove the air filter cartridge from the filter housing.



176 175

***Cleaning the filter housing***

*Procedure*

**NOTE**

**A faulty engine can cause malfunctions**

▶Do not clean the air filter housing with compressed air.

▶Always use a clean cloth to clean the air filter housing.

---

- Remove the air filter cartridge.
- Thoroughly clean the dust collector pot. To do this remove the dust extraction valve (175).
- Carefully clean the air filter housing with a clean cloth.
  There must be no residue from the cloth in the air filter housing.
- Insert the air filter cartridges back in the filter housing.
  Take care not to damage the air filter cartridges when assembling.
- Fit the rubber element back into the dust collector pot.
- Insert the dust collector pot and secure it with the 2 mounting clamps (176).

### 6.5.12 Adding window washer system fluid

*Procedure*

- Open the engine cover.
- Make sure there is sufficient windscreen fluid in the container.
- If necessary top up with anti-freeze.

➔ Fill with weather-dependent additives.

## 6.6 Checking electrical fuses

***Checking electrical fuses***

*Requirements*

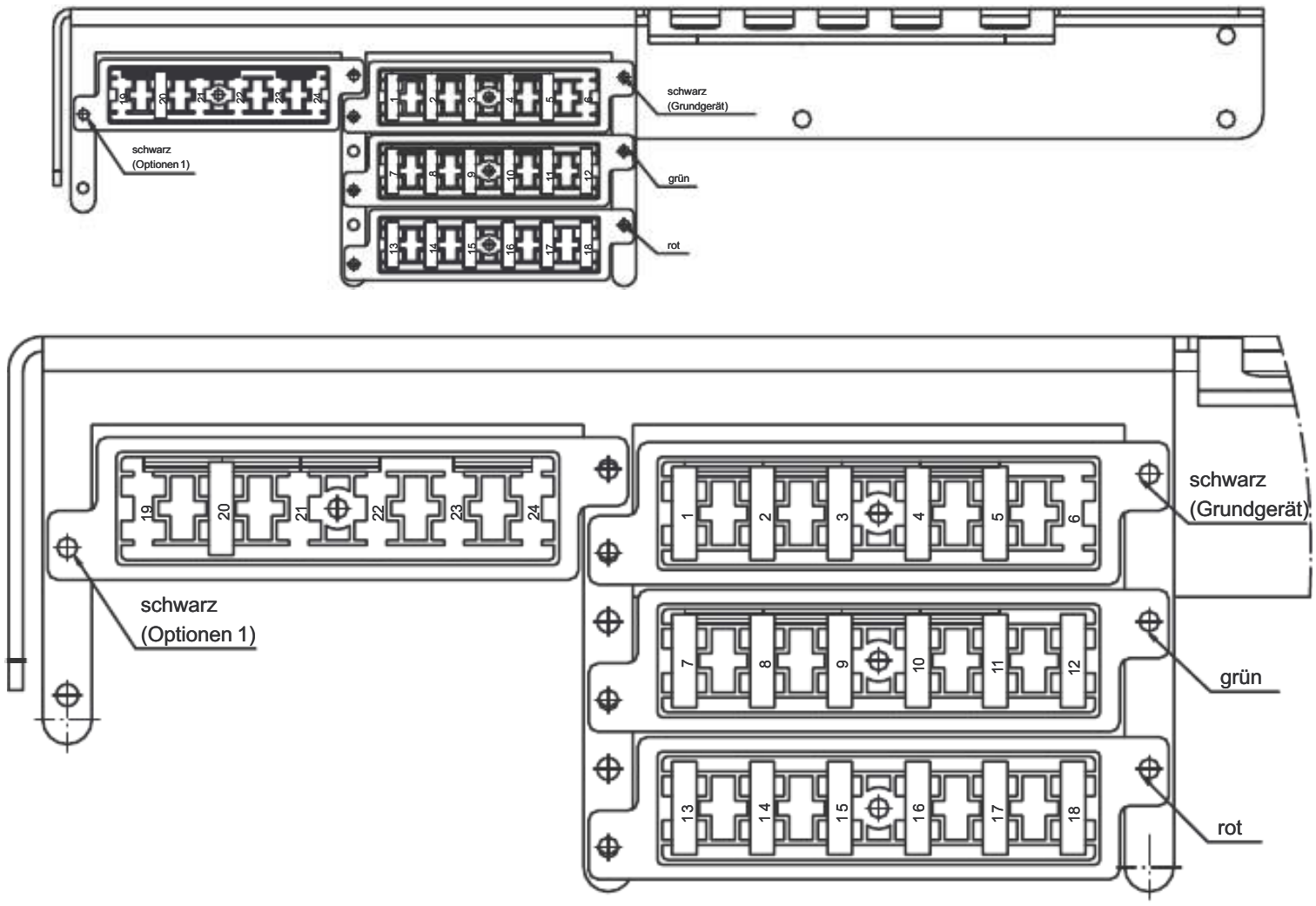
– Prepare the truck for maintenance and repairs ((see "Preparing the truck for maintenance and repairs" on page 133)).

*Procedure*

- Open the engine cover.
- Check condition and rating of the fuses in accordance with the table.
- Replace any damaged fuses in accordance with the table.
- Close the engine cover.

*The electrical fuses are now checked.*

## 6.6.1 Fuse ratings




**Fuse layout for the basic truck (black fuse box)**

| Item | | Electric circuit | Rating (A) |
|---|---|---|---|
| 1 | ● | Work lights | 20 |
| 2 | ● | Travel direction / reversing light / reversing buzzer | 7.5 |
| 3 | ● | Illumination kit A / brake light | 20 |
| 4 | ● | Neutral relay / display lighting | 7.5 |
| 5 | ● | Horn / beacon | 10 |
| 6 | ● | Spare | |

**Fuse layout for cab only (green fuse box)**

| Item | | Electric circuit | Rating (A) |
|---|---|---|---|
| 7 | ○ | Heating | 15 |
| 8 | ○ | Front window wiper | 10 |
| 9 | ○ | Windscreen washer pump | 10 |
| 10 | ○ | Rear window heating | 15 |
| 11 | ○ | Rear window wiper | 10 |
| 12 | ○ | Radio | 10 |

| ●= Series equipment | ○= Optional equipment |
|---|---|



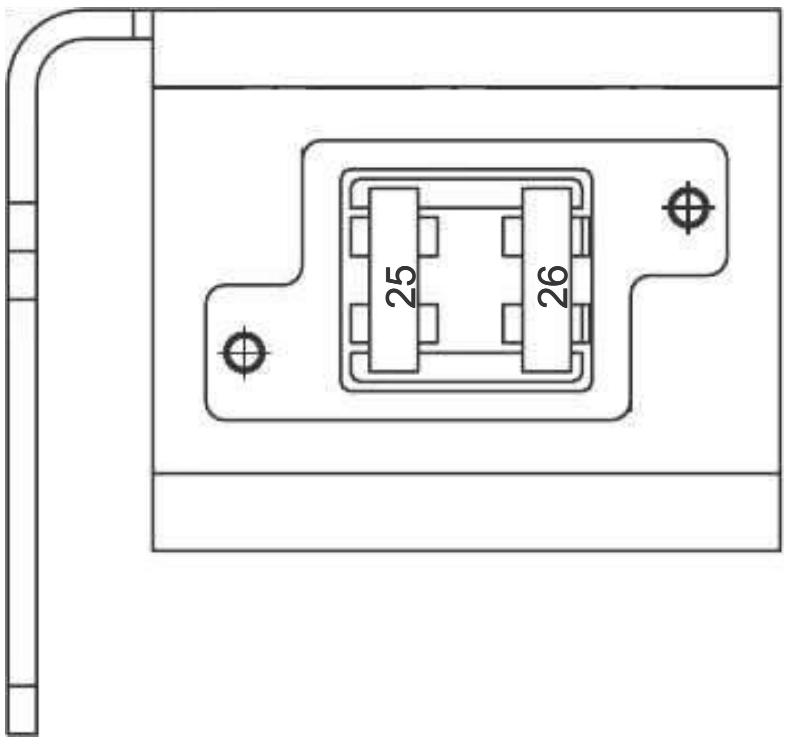


**Fuse box for StVZO illumination only (red fuse box)**

| Item | | Electric circuit | Rating (A) |
|---|---|---|---|
| 13 | ○ | Dipped lights | 15 |
| 14 | ○ | Flasher / parking light | 20 |
| 15 | ○ | Indicator | 15 |
| 16 | ○ | Parking light / right tail light | 7.5 |
| 17 | ○ | Parking light / left tail light | 7.5 |
| 18 | ○ | Brake light | 7.5 |

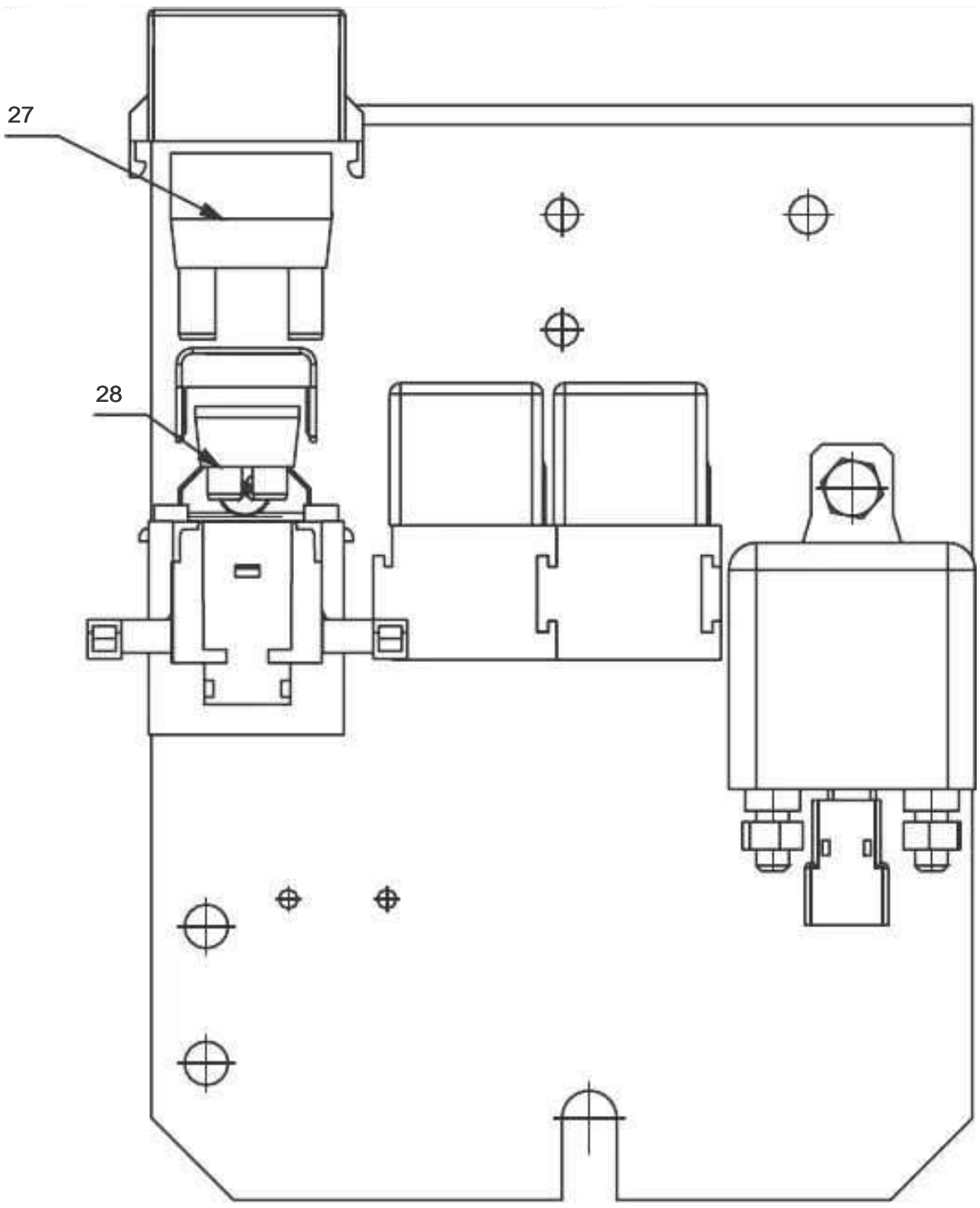
**Fuse box options 1 (black fuse box)**

| Item | | Electric circuit | Rating (A) |
|---|---|---|---|
| 19 | ● | Spare | |
| 20 | ● | Seat heating | 10 |
| 21 | ● | Spare | |
| 22 | ● | Spare | |
| 23 | ● | Spare | |
| 24 | ● | Spare | |




**TFG fuse box**

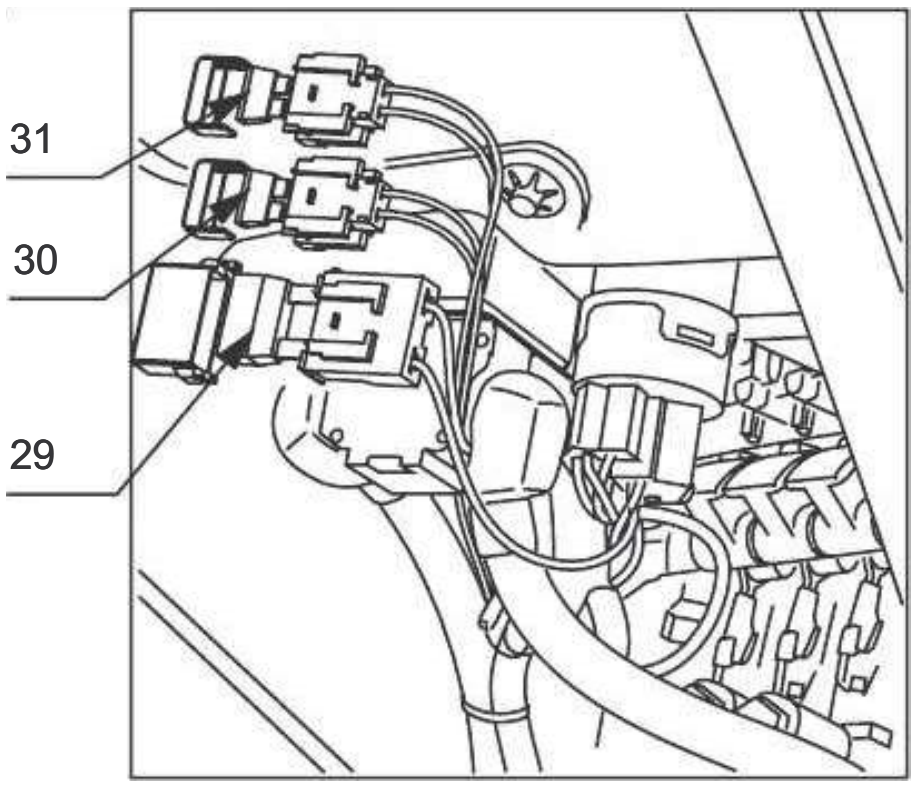
| Item | | Electric circuit | Rating (A) |
|---|---|---|---|
| 25 | ● | Gas shutoff valve | 5 |
| 26 | ● | Gas shutoff valve | 5 |




**DFG fuse box**

| Item | | Electric circuit | Rating (A) |
|---|---|---|---|
| 27 | ● | Pre-heat | 100 |
| 28 | ● | Fuel pump | 15 |

| | |
|---|---|
| ●= Series equipment | ○= Optional equipment |




**Emergency Disconnect fuse box**

| Item | | Electric circuit | Rating (A) |
|---|---|---|---|
| 29 | ● | Entire truck | 50 |
| 30 | ● | Seat monitoring | 7.5 |
| 31 | ○ | Road traffic regulations lighting | 30 |

| | |
|---|---|
| ●= Series equipment | ○= Optional equipment |

**WARNING!**

**To avoid damaging the electrical system, only use fuses with the correct ratings.**

## 6.7 Starter battery

### Checking the battery condition, acid level* and acid density*

➔ *not for maintenance-free batteries

**⚠ CAUTION!**

**Battery acid can be dangerous**

- ▶ Battery acid is highly corrosive. Therefore it is essential to avoid contact with battery acid.
- ▶ If clothing, skin or eyes have nevertheless come into contact with battery acid, immediately rinse the affected parts with water.
- ▶ If the eyes have been affected, immediately seek medical attention.
- ▶ Neutralise spilled battery acid immediately.

---

***Check battery***

*Procedure*

- Check the battery housing for cracks and any spilled acid. Remove any oxidisation remains from the battery terminals. Lubricate the battery terminals with an acid-free grease. Check the acid level.

➔ The acid should lie between the top and bottom markings.

***Checking the acid density***

*Procedure*

- Clean the area around the inspection plugs. If necessary, add distilled water to the top mark. Check the acid density.

➔ If the battery is charged sufficiently, the acid density should be 1.24 to 1.28 kg/l.

- Recharge the battery if necessary. Fit the drain plug back on.

**Battery disposal**

Batteries may only be disposed of in accordance with national environmental protection regulations or disposal laws. The manufacturer's disposal instructions must be followed.

## 6.8 Exhaust system

***Check the exhaust system regularly for leaks.***

*Procedure*

- Open the engine cover.
- Start the engine when the engine cover is open.
- Check for any rising smell of exhaust and altered engine noise level.
- If you detect a rising smell of exhaust and altered engine noise level arrange for the exhaust system to be inspected by specialist personnel.

*The exhaust system has now been checked for leaks.*

***NOTE***

**Check emissions at regular intervals**

▶ Check the combustion engine exhaust emissions at regular intervals in accordance with national regulations.

▶ Black or blue exhaust smoke is an indicator of high emission levels resulting from combustion engine damage or wear.

▶ In this case the truck must be examined by specialist personnel.

## 6.9 Seat belt maintenance

***Check the safety restraint belt***

*Procedure*

- Pull out the belt completely and check for fraying
- Test the belt buckle and make sure the belt returns correctly into the retractor.
- Check the cover for damage.

***Testing the automatic blocking system***

*Procedure*

- Park the truck on a level surface.
- Pull out the seat belt with a jerk

➔ The interlock must prevent the belt from coming out.

*The seat belt service is now complete.*

**DANGER!**

**A faulty seat belt can cause injury**

Using a faulty seat belt can result in injury.

▶Only operate the truck with the seat belt intact. A faulty seat belt should be replaced immediately.

▶The truck must remain decommissioned until a functional seat belt has been fitted.

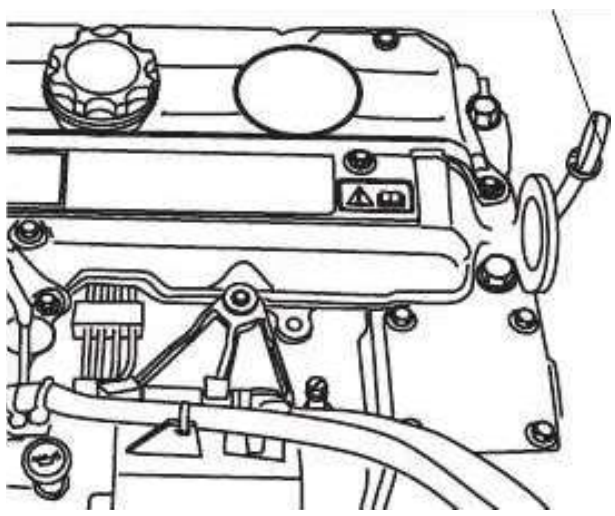
## 6.10 Transmission

***Check oil level***

*Procedure*

- Open the engine cover.
- Remove the transmission oil dipstick (177) and wipe it off.
- Reinsert the transmission oil dipstick and pull it out. The oil level must be between the marks.
- Reinsert the transmission oil dipstick. Make sure it is closed correctly.

177



## 6.11 Brake

### 6.11.1 Checking the parking brake

The parking brake must be able to hold the truck plus the maximum load on an incline of 15%. If it cannot, the parking brake must be adjusted. Please contact Jungheinrich customer service in this case.

### 6.11.2 Checking the brake fluid level

*Procedure*

- Undo the screws of the left-hand panel.
- Remove the panel.
- Check the brake fluid level on the brake fluid reservoir.
- The brake fluid level should lie between the MIN and MAX markings.
- If necessary, add brake fluid.
  Capacity: 0.25 l
- After adding brake fluid, refit the panel.

## 6.12 Restoring the truck to service after maintenance and repairs

*Procedure*

- Thoroughly clean the truck.
- Lubricate the truck according to the lubrication schedule, (see "Lubrication Schedule" on page 130).
- Clean the battery, grease the terminals and connect the battery.
- Check the transmission oil for condensation water and replace if necessary (hydrostatic trucks only).
- Check the hydraulic oil for condensation water and replace if necessary.

➔ The manufacturer's customer service department is specially trained to carry out these operations.

**⚠ WARNING!**

**Faulty brakes can cause accidents**

As soon as the truck has been started, test the brakes several times.

▶ Report any defects immediately to your supervisor.

▶ Tag out and decommission the faulty industrial truck.

▶ Only return the truck to service when you have identified and rectified the fault.

---

- Start up the truck, (see "Preparing the Truck for Operation" on page 59).

➔ If there are switching problems in the electrical system, apply contact spray to the exposed contacts and remove any oxide layers on the contacts of the controls by applying them repeatedly.

# 7 Decommissioning the industrial truck

If the truck is to be out of service for more than a month, e.g. for commercial reasons, it must be stored in a frost-free and dry room. All necessary measures must be taken before, during and after decommissioning as described hereafter.

**WARNING!**

**Lifting and jacking up the truck safely**

In order to raise the truck, the lifting gear must only be secured to the points specially provided for this purpose.

You may only work under a raised load handler / raised cab if they have been secured with a sufficiently strong chain or the fastening bolt.

In order to raise and jack up the truck safely, proceed as follows:

- ▶ Jack up the truck only on a level surface and prevent it from moving accidentally.
- ▶ Always use a jack with sufficient capacity. When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).
- ▶ In order to raise the truck, the lifting gear must only be secured to the points specially provided for this purpose, (see "Transport" on page 35).
- ▶ When jacking up the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

---

When the truck is out of service it must be jacked up so that all the wheels are clear of the ground. This is the only way of ensuring that the wheels and wheel bearings are not damaged.

If the truck is to be out of service for more than 6 months, agree further measures with the manufacturer's customer service department.

## 7.1 Prior to decommissioning

*Procedure*

- Thoroughly clean the truck.
- Test the brakes.
- Check the hydraulic oil level and replenish if necessary,
  (see "Checking the hydraulic oil level" on page 137).
- Apply a thin layer of oil or grease to any non-painted mechanical components.
- Lubricate the truck according to the lubrication schedule, (see "Lubrication Schedule" on page 130).
- Disconnect the battery, clean it and grease the terminals.
  In addition, follow the battery manufacturer's instructions.
- Spray all exposed electrical contacts with a suitable contact spray.

## 7.2 During decommissioning

**NOTE**

**Full discharge can damage the battery**

Self-discharge can cause the battery to fully discharge. Full discharge shortens the useful life of the battery.

▶Charge the battery at least every 2 months.

## 7.3 Restoring the truck to service after decommissioning

*Procedure*

- Thoroughly clean the truck.
- Lubricate the truck according to the lubrication schedule, (see "Lubrication Schedule" on page 130).
- Clean the battery, grease the terminals and connect the battery.
- Charge the battery, (see "Starter battery" on page 156).
- Check the transmission oil for condensation water and replace if necessary (hydrostatic trucks only).
- Check the engine oil for condensation water and replace if necessary.
- Check the hydraulic oil for condensation water and replace if necessary.

➔ The manufacturer's customer service department is specially trained to carry out these operations.

**⚠ WARNING!**

**Faulty brakes can cause accidents**

As soon as the truck has been started, test the brakes several times.

▶Report any defects immediately to your supervisor.

▶Tag out and decommission the faulty industrial truck.

▶Only return the truck to service when you have identified and rectified the fault.

---

- Start up the truck, (see "Preparing the Truck for Operation" on page 59).

➔ If there are switching problems in the electrical system, apply contact spray to the exposed contacts and remove any oxide layers on the contacts of the controls by applying them repeatedly.

# 8 Safety tests to be performed at intervals and after unusual incidents

➔ Perform a safety check in accordance with national regulations. Jungheinrich recommends the truck be checked to FEM guideline 4.004. The Jungheinrich safety department has trained personnel who are able to carry out inspections.

The truck must be inspected at least annually or after any unusual event by a qualified inspector (be sure to comply with national regulations). The inspector shall assess the condition of the truck from purely a safety viewpoint, without regard to operational or economic circumstances. The inspector shall be sufficiently instructed and experienced to be able to assess the condition of the truck and the effectiveness of the safety mechanisms based on the technical regulations and principles governing the inspection of forklift trucks.

A thorough test of the truck must be undertaken with regard to its technical condition from a safety aspect. The truck must also be examined for damage caused by possible improper use. A test report shall be provided. The test results must be kept for at least the next 2 inspections.

The owner is responsible for ensuring that faults are rectified immediately.

➔ A test plate is attached to the truck as proof that it has passed the safety inspection. This plate indicates the due date for the next inspection.

# 9 Final de-commissioning, disposal

Final de-commissioning or disposal of the truck in must be performed in accordance with the regulations of the country of use. In particular, regulations governing the disposal of batteries, fuels and electronic and electrical systems must be observed.

The truck must only be disassembled by trained personnel in accordance with the procedures as specified by the manufacturer. Note the manufacturer's safety instructions as specified in the service documentation.

# 10 Human vibration measurement

Vibrations that affect the driver during operation over the course of the day are known as human vibrations. Excessive human vibrations will cause the driver long term health problems. The European "2002/44/EC/Vibration" operator directive has therefore been established to protect drivers.
To help operators to assess the application situation, the manufacturer offers a service of measuring these human vibrations.

# 11 HUSS FS - MK Series Diesel Particle Filter Operating Instructions (○)

## 11.1 Important General Instructions

Read the operating instructions carefully before using the soot particle filter.

The general accident prevention and other health and safety regulations must be observed.
The use of additive-based fuels can have a negative effect on the exhaust and thus the useful life of the diesel particle filter. Therefore use only DIN EN 590 diesel with a Cetane rating above 50.

➔ The HUSS diesel particle filter complies with TRGS 554, TA Air and VERT (Switzerland).

Application range of TRGS 554 (Technical Regulations for Hazardous Materials), TA Air and VERT:

– These Technical Regulations apply to work environments where diesel engine emissions may be contained in the air in the workplace.
– In Switzerland, VERT specifies in particular the requirements for tunnel building projects and major construction sites.

## 11.2 Important safety instructions

**⚠ CAUTION!**

**The safe and proper use of the diesel particle filter requires careful operation and maintenance.**

---

**⚠ CAUTION!**

**Operation and regeneration:**

- ▶ The diesel particle filter may only be operated and regenerated by persons who have been trained in filter regeneration and are aware of the potential hazards.
- ▶ Only trained and authorized personnel may work on the diesel particle filter.
- ▶ Remove the diesel particle filter from service immediately if it is clearly damaged or not working properly. Avoid any build up of flammable materials near the filter.

---

**⚠ DANGER!**

**Risk of burning!**
**During regeneration the entire diesel particle filter system heats up and hot exhaust emerges from the exhaust pipe.**

---

***Starting the truck in a hazardous situation (with starter interlock active):***

*Procedure*

- Depress and hold down both the “M” and “F” buttons on the HUSS control and at the same time start the industrial truck.



## 11.3 Functional Description

As the engine runs the diesel engine exhaust flows through the filter element which retains virtually all the harmful soot particles.

The longer the diesel engine runs, the more the diesel particle filter fills up and the greater the backpressure on the exhaust.

The level of the diesel particle filter is shown on the HUSS Control display, enabling

regeneration to be made at the right time.
When a defined maximum backpressure or maximum charge time is reached, the HUSS Control activates the “Filter Full” alarm.

To burn off the soot particles in the filter element, the HUSS Control system starts regeneration when the engine is switched off.

A starter interlock and engine forced cutout are incorporated in the control system to protect the engine and diesel particle filter.

## 11.4 HUSS Control Operation

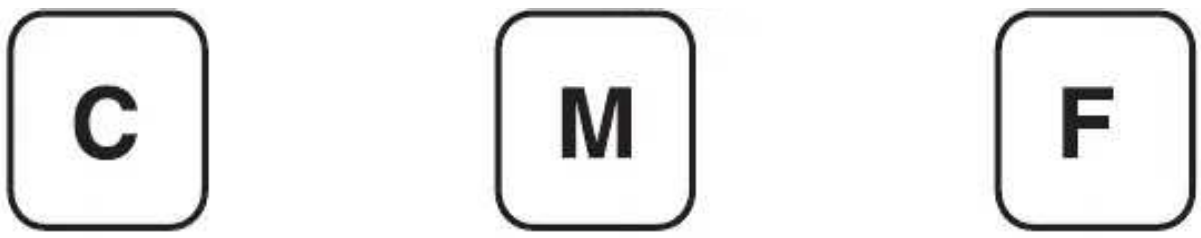
The diesel particle filter is operated by the HUSS Control unit. The control unit is mounted within the operator's field of vision.

➔ The HUSS control system only works with the ignition is switched on.


**Display**

The top line shows the functional stages; in the bottom line a bar indicates the condition of the filter (backpressure / regeneration time)

**Keys**




**C**ontrol (Steuertaste) **M**ode (Modustaste) **F**unction (Funktionstaste)

## 11.5 HUSS Control Operating Instructions

| Normal operation | Display | Function LED |
|---|---|---|
| Switch on the ignition. The buzzer sounds for min. 1 second and both LEDs light up at the same time. | Self test | Green and red LEDs lit |
| If a message is stored it will be displayed, in conjunction with the flashing red LED. | e.g. alarm / filter full HHHHHHHHHHH | Red LED flashing |
| Stored message: Before the last cutout the exhaust backpressure exceeded the upper limit for at least 20 seconds or regeneration was interrupted. The buzzer sounds continuously. | | |
| Note to this message: The industrial truck cannot be started, regeneration must be performed. | ATTENTION: in a hazardous situation the industrial truck can be started by continually pressing on the “M” and “F” buttons. | |
| If no message is stored the engine can be started. | Engine ready | |

**Messages in normal operation that indicate the status of the diesel particle filter:**

| | | |
|---|---|---|
| with this message>>> Normal operation possible | Filter condition HHHHHHHH | Green LED flashing |
| with this message>>> Regeneration required | Regenerate HHHHHHHH | Red LED flashing |
| 10 regenerations had to be made within the maximum charge time. Call the JH service department | Call service department / White ash | |
| Diesel particle filter maintenance required, the JH service department must be called. | | Maintenance |

## 11.6 Regeneration

➔ Regenerate daily even if the filter is not full

**⚠ DANGER!**

**Risk of fire and explosion**

▶ Pay attention when handling fuel.

▶ Avoid naked flames when handling fuel.

▶ Do not smoke. This applies even in areas where the fuel can only be smelled.

**⚠ DANGER!**

**Risk of fire and poisoning**

High temperatures and exhaust with poisonous content result every time combustion takes place.

The entire exhaust system becomes very hot during and immediately after operation.

| Regeneration | Display<br><br>Function LED |
|---|---|
| Park the truck on a level surface<br>Switch off the engine.<br>Ignition ON: HUSS Control is energised.<br>Press the “M” button and hold it down for 5 seconds. Regeneration starts after 5 seconds. | Start regeneration in 5 sec.<br>>>>>>>>>Green LED |
| Other displays after the 5 seconds<br>The fan is set to pre-cooling. | Pre-cooling glow plug |
| The glow plug is switched on. | Regeneration<br>Start glow plug |
| The fuel-air mixture is ignited. | Regeneration<br>Start ignition |
| The diesel particle filter is regenerated. The display shows the remaining regeneration time. | Regeneration on |
| Regeneration is complete.<br>This display appears for 3 minutes. | Regeneration completed |

| Interrupting Regeneration | |
|---|---|
| Regeneration can be interrupted by switching off the ignition with the ignition key or by pressing the “F” button on the control system. The display counts down from 5 seconds until the regeneration process is switched off. The buzzer sounds continuously. | “Filter full” alarm >>red LED flashes |
| IMPORTANT: If you press the “M” and “F” buttons | |

| | |
|---|---|
| simultaneously the engine of the industrial truck can be started in hazardous situations even with “Alarm/Filter full”. | |





| Interrupting Regeneration | |
|---|---|
| **Faults** | |
| All the hardware and software functions are tested during regeneration.<br>Any faults will cause the regeneration to be cancelled. Faults are displayed on the HUSS control. The battery voltage is also checked. If the minimum level is not reached, regeneration is cancelled. If one of the faults indicated here is displayed, call the JH service department to rectify the fault. | Glow plug fault<br>Fuel pump fault<br>Solenoid fault<br>Fan fault<br>Temperature gauge fault<br>Regeneration fault<br>Regeneration interrupted Low voltage |

## 11.7 Maintenance

The HUSS control displays the scheduled maintenance times.

Call the JH service department to carry out maintenance.

The Huss control system is factory-set for the industrial truck. Only trained JH service engineers are authorised to make changes to these settings.