DFG/TFG 660-690

12.12 -

Operating instructions

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DFG 660
DFG 670
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Declaration of Conformity

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

Type	Option	Serial no.	Year of manufacture
DFG 660 DFG 670 DFG 680 DFG 690 DFG S80 DFG S90 TFG 660 TFG 670 TFG 680 TFG 690 TFG S80 TFG S90			

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

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Contents

A Correct Use and Application

1 General

The truck must be used, operated and serviced in accordance with the present instructions. All other types of use are beyond its scope of application and may result in damage to personnel, the industrial truck or property.

2 Correct application

NOTE

The maximum load and load distance are indicated on the capacity plate 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 be fully raised,see "Lifting, transporting and depositing loads" on page 113.

The following operations are in accordance with regulations and are permitted:

– Lifting and lowering loads.
– Transporting lowered loads over short distances.
– Occasional towing of trailer loads.
– When towing trailers the load must be secured on the trailer.
– The permissible trailer load must not be exceeded.

The following operations are prohibited:

– Travelling with a raised load (>30 cm).
– Carrying and lifting passengers.
– Pushing or pulling loads.
– Transporting hanging loads. If the truck is to be operated with hanging loads, proof of sufficient safety distance under local operating conditions must be obtained from a specialist assessor.

3 Approved application conditions

⚠ DANGER!

Do not exceed the permissible surface and point loading on the travel lanes.
At blind spots get a second person to assist.
The driver must ensure that the loading dock /dock leveller cannot be removed 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.
– Do not exceed the permissible surface and spot load limits on the travel routes.
– Operation only on routes that are visible and approved by the operating company.
– Negotiating inclines up to a maximum of 15 %.
– Do not travel across or at an angle on inclines. Travel with the load facing uphill.
– Operation in partially public traffic.
– Do not operate LPG trucks under ground level areas.
– The truck may only be operated in areas that are clean and free of oil and similar substances.

⚠ WARNING!

Operating an LPG truck under ground level areas could result in explosions.
LPG is heavier than air. An explosive LPG/air mixture could therefore form under ground level areas without sufficient ventilation.
▶ Do not use LPG trucks under ground level areas.

⚠ WARNING!

Use under extreme conditions
Using the truck under extreme conditions can result in malfunctions and accidents.
▶ 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 cannot be used in areas at risk of explosion.
▶ In adverse weather conditions (thunder, lightning) the industrial truck must not be operated outside or in endangered areas.

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4 Proprietor responsibilities

For the purposes of the present operating instructions the “operating company” 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 it is intended for and that danger to life and limb of the user and third parties are excluded. Furthermore, accident prevention regulations, safety regulations and operating, servicing and repair guidelines must be followed. The operating company must ensure that all users have read and understood these operating instructions.

NOTE

Failure to comply with the operating instructions invalidates 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 optional equipment

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

B Truck Description

1 Application

The DFG/TFG 660-690 is a four-wheel IC engine 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 660-690 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 660-690 is equipped with a hydrodynamic drive.

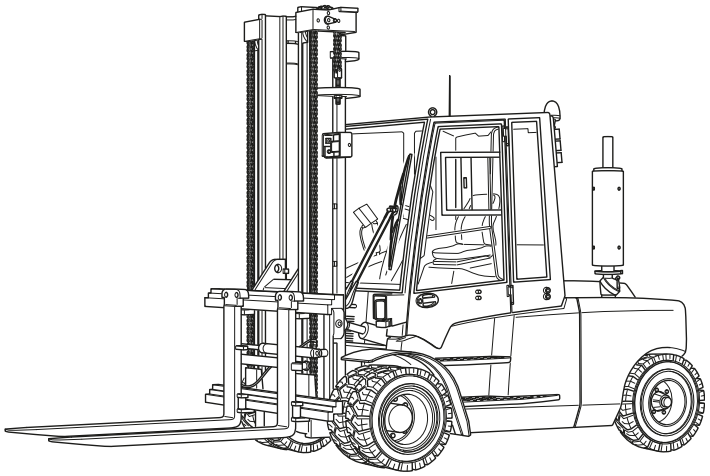
1.1 Truck models and rated capacity

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

DFG660

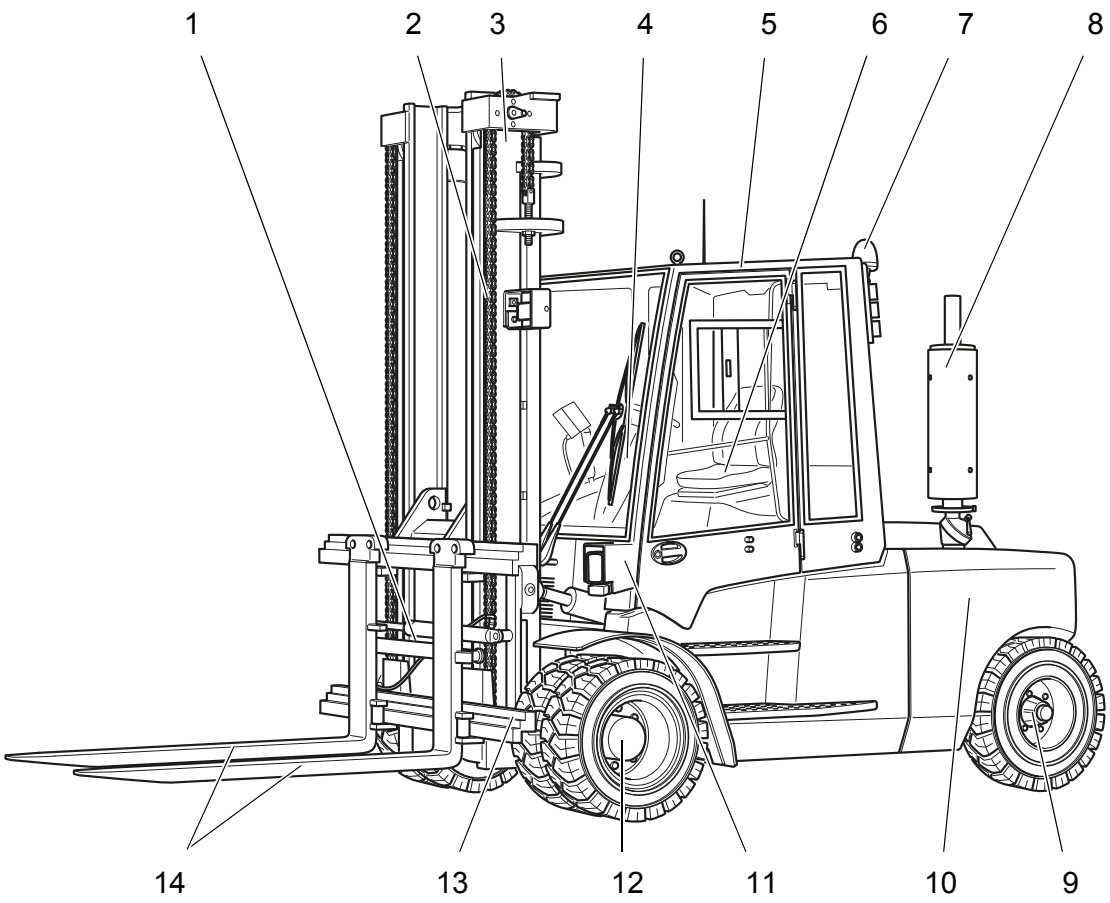
DFG	Model name
6	Series
60	Rated capacity x 100 kg

The rated capacity is not generally the same as the permissible capacity. The capacity can be found on the capacity plate attached to the truck.



2 Assemblies and Functional Description

2.1 Assembly Overview



Item		Description	Item		Description
1	○	Fork adjustment	8	●	Exhaust pipe
2	●	Load chains	9	●	Steer axle
3	●	Mast	10	●	Counterweight
4	●	Steering column	11	●	Illumination
5	●	Cab	12	●	Drive
6	●	Driver's seat	13	●	Fork carriage
7	○	Beacon	14	●	Fork tines
	● = Standard equipment			○ = Optional equipment	

2.2 Functional Description

Chassis and superstructure

A rigid chassis which protects the units and controls, provides the truck with maximum static safety. A wide opening cab (5) facilitates service and maintenance work. The hydraulic oil reservoir is integrated on the right-hand side and the fuel tank on the opposite side of the chassis. The vertical, free standing front exhaust pipe (8) is positioned much higher than is common. It prevents vibrations and sound saves from being transferred and exhaust gases from penetrating into the operator position.

Operator position

The operator position is articulating, which cushions vibrations and noise. Non-slip steps and a handle on the cab post ensure easy entry and exit. The driver is protected by the cab (5). To adapt the seat position, the driver can adjust the seat and steering head both vertically and horizontally. The accelerator pedal and brake pedal are of "automotive" design.

Steering

The steer cylinder of the hydrostatic steering is integrated in the steer axle (9) 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.

Diesel engine

Quiet-running, water-cooled diesel engines featuring high performance and low consumption with very clean fuel combustion under all operating conditions ensure soot values are below the limit of visibility. An additional particle filter (○) ensures very low exhaust levels.

LPG engine

Quiet running, water-cooled four-stroke engines featuring high performance and low consumption. Petrol engines with very low residual exhaust levels are used. A 3-way catalytic converter ensures very low exhaust levels.

Electrical System

12-volt system with 3-phase alternator. A repeat 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 start and stop the engine.

Drive System

A power shift gear with radiator and torque converter is flanged directly to the engine. This transfers the force to the drive axle (12).
The travel direction lever, either on the steering column or optionally on the multi-task handle, controls forward/reverse travel and the neutral position.

Brakes

The brake pedal activates the laminated brakes hydraulically. The parking brake is switched on and off by pressing the parking brake button in the multifunction display. It acts mechanically on the brake disc of the cardan shaft.

Hydraulic System

All operations can be performed sensitively, proportionally and simultaneously. Hydraulic functions are controlled by a servo hydraulic controller. Control is possible via single lever (SOLO-PILOT) or multi-task lever (MULTI-PILOT).

Mast

Two or three-stage masts, optionally with free lift function; narrow mast sections ensure excellent visibility of the fork tines and attachments. Fork carriages and lift frames run on lubricating 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.).

➔ The technical specifications comply with the German "Industrial Truck Data Sheet" Guidelines.
Technical modifications and additions reserved.

3.1 Performance data

DFG 660-690

	Component	**660**	**670**	**680**	**690**	
Q	Capacity [1]	6000	7000	8000	9000	kg
C	Load centre distance	600	600	600	600	mm
	Travel speed * with / without load	22.4/22.5	22.4/22.6	22.4/22.5	22.4/22.6	km/h
	Lift speed with / without load	0.50/0.60	0.40/0.60	0.40/0.60	0.40/0.60	m/s
	Lowering speed with / without load	0.60/0.36	0.60/0.36	0.60/0.36	0.60/0.36	m/s
	Gradeability [2] with / without load	30.3/32.0	28.7/31.0	27.1/31.0	24.6/28.0	%
	Tow force with/without load	49.5/49.5	49.5/49.5	49.5/49.5	49.5/49.5	kN
	Acceleration* with / without load to 15 m	6.0/5.0	6.0/5.0	6.0/5.0	7.0/6.0	sec
	Available working pressure for attachments	160	160	160	160	bar
	Oil flow for attachments	80	80	80	80	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%.

	Component	S80	S90	
Q	Capacity [1)]	8000	9000	kg
C	Load centre distance	900	900	mm
	Travel speed * with / without load	22.3/22.6	22.3/22.6	km/h
	Lift speed with / without load	0.40/0.60	0.40/0.60	m/s
	Lowering speed with / without load	0.60/0.36	0.60/0.36	m/s
	Gradeability [2] with / without load	21.5/25.0	20.9/24.0	%
	Tow force with / without load	49.5/49.5	52.9/52.9	kN
	Acceleration time * with / without load to 15 m	7.0/6.0	7.0/6.0	sec
	Available working pressure for attachments	160	160	bar
	Oil flow for attachments	80	80	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%.

	Component	660	670	680	690	
Q	Capacity (1	6000	7000	8000	9000	kg
C	Load centre distance	600	600	600	600	mm
	Travel speed * with / without load	22.4/22.6	22.4/22.6	22.4/22.6	22.4/22.6	km/h
	Lift speed with / without load	0.40/0.48	0.40/0.48	0.40/0.48	0.40/0.48	m/s
	Lowering speed w / w.o. load	0.60/0.48	0.60/0.36	0.60/0.36	0.60/0.36	m/s
	Gradeability (2 with / without load	27.5/30.0	27.5/30.0	26.5/30.0	23.0/27.0	%
	Tow force with / without load	45.6/45.6	45.6/45.6	45.6/45.6	45.6/45.6	kN
	Acceleration * with / without load to 15 m	6.0/5.0	6.0/5.0	6.0/5.0	7.0/6.0	sec
	Available working pressure for attachments	160	160	160	160	bar
	Oil flow for attachments	80	80	80	80	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%.

	Component	S80	S90	
Q	Capacity	8000	9000	kg
C	Load centre distance	900	900	mm
	Travel speed * with / without load	22.4/22.6	22.4/22.6	km/h
	Lift speed with / without load	0.40/0.48	0.40/0.48	m/s
	Lowering speed with / without load	0.60/0.36	0.60/0.36	m/s
	Gradeability* with / without load	20.2/23.0	17.6/20.0	%
	Tow force with / without load	45.6/45.6	45.6/45.6	kN
	Acceleration time * with / without load to 15 m	7.0/6.0	7.0/6.0	sec
	Available working pressure for attachments	160	160	bar
	Oil flow for attachments	80	80	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%.

3.2 Dimensions

DFG 660-690

	Model	**660**	**670**	**680**	**690**	
a/2	Safety distance	100	100	100	100	mm
h_1	Collapsed height*	2710	2710	3010	3160	mm
h_3	Lift*	3600	3600	3600	3600	mm
h_4	Extended height*	4510	4510	4810	4960	mm
h_6	Overhead guard height*	2705	2705	2705	2705	mm
h_7	Seat height*	1600	1600	1600	1600	mm
h_{10}	Coupling height	500	500	500	500	mm
α	Mast tilt, fwd.*	6	6	6	6	°
β	Mast tilt, back*	9	9	9	9	°
l_1	Length, including forks*	4760	4770	4880	5035	mm
l_2	Length, including fork shank*	3560	3570	3680	3835	mm
b_1	Overall width*	1820	2002	2002	2100	mm
s/e/l	Fork dimensions*	60/150/ 1200	60/150/ 1200	70/150/ 1200	70/150/ 1200	mm
m_1	Ground clearance, laden, below mast*	230	230	230	230	mm
m_2	Ground clearance centre wheelbase*	250	250	250	250	mm
	Fork carriage ISO 2328 class / type A, B	4 A	4 A	4 A	4 A	mm
b_3	Fork carriage width	1800	1800	2000	2100	mm
Ast	Working aisle width for pallets 800 x 1200 lengthways	5320	5330	5440	5745	mm
Ast	Working aisle width for pallets 1000 x 1200 traverse	5120	5130	5240	5545	mm
Wa	Turning radius	3250	3250	3350	3650	mm
b_{13}	Smallest turning radius	1270	1270	1320	1390	mm
x	Load distance*	680	680	700	700	mm
c	Load centre of gravity	600	600	600	600	mm
y	Wheelbase	2295	2295	2395	2545	mm

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

DFG S80-S90

	Model	S80	S90	
a/2	Safety distance	100	100	mm
h_1	Collapsed height*	3160	3310	mm
h_3	Lift*	3600	3600	mm
h_4	Extended height*	4960	5110	mm
h_6	Overhead guard height*	2705	2705	mm
h_7	Seat height*	1600	1600	mm
h_{10}	Coupling height	500	500	mm
α	Mast tilt, fwd.*	6	6	°
β	Mast tilt, back*	9	9	°
l_1	Length, including forks*	5640	5840	mm
l_2	Length, including fork shank*	3840	4040	mm
b_1	Overall width*	2150	2150	mm
s/e/l	Fork dimensions*	70/180/ 1800	70/180/ 1800	mm
m_1	Ground clearance, laden, below mast*	230	230	mm
m_2	Ground clearance centre wheelbase*	250	250	mm
	Fork carriage ISO 2328 class / type A, B	4 A	4 A	mm
b_3	Fork carriage width	2100	2100	mm
Ast	Working aisle width for pallets 800 x 1200 lengthways	5745	5995	mm
Ast	Working aisle width for pallets 1000 x 1200 traverse	5545	5795	mm
Wa	Turning radius	3900	3900	mm
b_{13}	Smallest turning radius	1490	1490	mm
x	Load distance*	700	700	mm
c	Load centre of gravity	900	900	mm
y	Wheelbase	2545	2745	mm

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

TFG 660-690

	Type	660	670	680	690	
a/2	Safety distance	100	100	100	100	mm

	Type	660	670	680	690	
h_1	Collapsed height*	2710	2710	3010	3160	mm
h_3	Lift*	3600	3600	3600	3600	mm
h_4	Extended height*	4510	4510	4810	4960	mm
h_6	Overhead guard height*	2705	2705	2705	2705	mm
h_7	Seat height*	1600	1600	1600	1600	mm
h_{10}	Coupling height	500	500	500	500	mm
α	Mast tilt, fwd.*	6	6	6	6	°
β	Mast tilt, back*	9	9	9	9	°
l_1	Length, including forks*	4860	4870	4980	5135	mm
l_2	Length, including fork shank*	3660	3670	3780	3935	mm
b_1	Overall width*	1820	2002	2002	2150	mm
s/e/l	Fork dimensions*	60/150/ 1200	60/150/ 1200	70/150/ 1200	70/150/ 1200	mm
m_1	Ground clearance, laden, below mast*	230	230	230	230	mm
m_2	Ground clearance centre wheelbase*	235	250	250	250	mm
	Fork carriage ISO 2328 class / type A, B	4 A	4 A	4 A	4 A	mm
b_3	Fork carriage width	1800	1800	2000	2100	mm
Ast	Working aisle width for pallets 800 x 1200 lengthways	5420	5430	5640	5895	mm
Ast	Working aisle width for pallets 1000 x 1200 traverse	5220	5230	5440	5695	mm
Wa	Turning radius	3350	3350	3550	3800	mm
b_{13}	Smallest turning radius	1320	1320	1370	1440	mm
x	Load distance*	680	680	700	700	mm
c	Load centre of gravity	600	600	600	600	mm
y	Wheelbase	2395	2395	2495	2645	mm

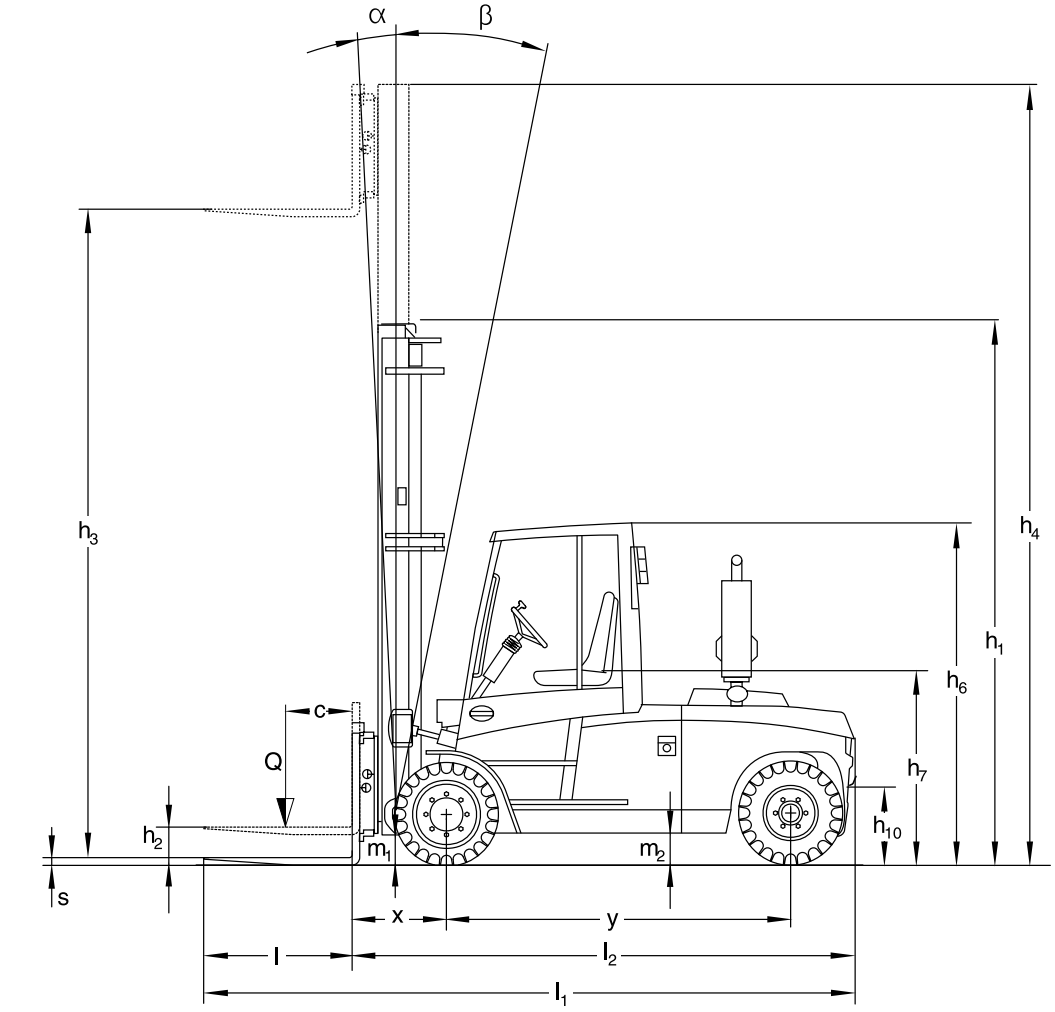
*) The data listed in the table corresponds to the standard version.

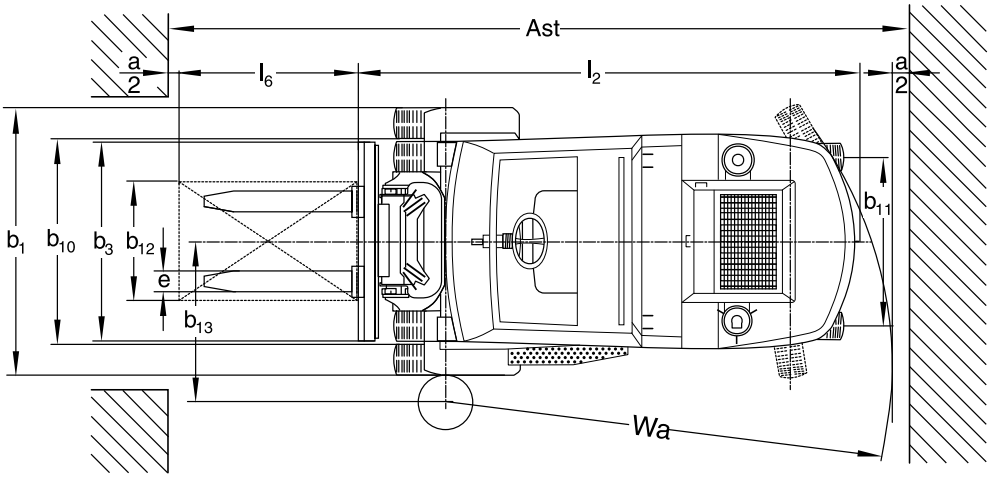
TFG S80-S90

	Component	S80	S90	
a/2	Safety distance	100	100	mm
h_1	Mast height retracted*	3160	3310	mm
h_3	Lift*	3600	3600	mm
h_4	Mast height extended*	4960	5110	mm

	Component	S80	S90	
h_6	Overhead guard height*	2705	2720	mm
h_7	Seat height*	1600	1600	mm
h_{10}	Coupling height	500	500	mm
α	Mast tilt, fwd.*	6	6	°
β	Mast tilt, back*	9	9	°
l_1	Length, including forks*	5740	5740	mm
l_2	Length, including fork shank*	3940	3940	mm
b_1	Overall width*	2150	2150	mm
s/e/l	Fork dimensions*	70/180/ 1800	70/180/ 1800	mm
m_1	Ground clearance, laden, below mast*	240	240	mm
m_2	Ground clearance centre wheelbase*	240	240	mm
	Fork carriage ISO 2328 class / type A, B	4 A	4 A	mm
b_3	Fork carriage width	2100	2100	mm
Ast	Aisle width for pallets 800 x 1200 lengthways	5895	5895	mm
Ast	Working aisle width for pallets 1000 x 1200 traverse	5695	5695	mm
Wa	Turning radius	3800	3800	mm
b_{13}	Smallest turning radius	1440	1440	mm
x	Load distance*	700	700	mm
c	Load centre of gravity	900	900	mm
y	Wheelbase	2645	2645	mm

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





11.14 EN

3.3 Weights

➔ All dimensions in kg.

DFG 660-690

	660	670	680	690
Net weight*	10500	11400	12400	14000
Axle loading, unladen load front / rear*	5000/5500	5500/5900	6000/6400	6800/7200
Axle loading, laden front / rear*	14900/1600	16400/2000	18100/2300	20500/2500

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

DFG S80-S90

	S80	S90
Net weight*	14400	15500
Axle loading, unladen load front / rear*	7200/7200	7800/7700
Axle loading, laden front / rear*	20400/2000	22500/2000

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

TFG 660-690

	660	670	680	690
Net weight*	10970	11570	12700	14200
Axle loading, unladen load front / rear*	5360/5610	5660/5910	5800/6100	6900/7300
Axle loading, laden front / rear*	14810/2160	16670/1900	18600/2100	20700/2500

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

TFG S80-S90

	S80	S90
Net weight*	14600	15200
Axle loading, unladen load front / rear*	7300/7300	7500/7700
Axle loading, laden front / rear*	20100/2500	22100/2100

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

3.4 Mast versions

➔ All dimensions in mm.

Mast chart					
VDI3596 Description	**Lift h_3**	**Free lift h_2**	**Retracted height h_1**	**Extended height h_4**	**Weight (kg)**
			660/670	**660/670**	
ZT	3600	0	2710	4510	2080
	4000	0	2910	4910	2140
	4500	0	3160	5410	2240
	5000	0	3410	5910	2335
	5500	0	3660	6410	2460
	6000	0	3910	6910	2585
	6500	0	4160	7410	2735
ZZ	3600	1800	2875	4675	2278
	4000	2000	3075	5075	2350
	4500	2250	3325	5675	2422
	5000	2500	3575	6075	2542
	5500	2750	3825	6575	2652
	6000	3000	4075	7075	2772
	6500	3300	4325	7575	2892
DZ	4500	1500	2585	5585	2671
	5000	1667	2752	6086	2754
	5500	1833	2918	6586	2837
	6000	2000	3085	7086	2920
	6500	2167	3252	7586	3045
	7000	2333	3418	8086	3191
	7500	2500	3585	8586	3295
	8000	2667	3752	9086	3397

Mast chart					
VDI3596 Description	**Lift h_3**	**Free lift h_2**	**Retracted height h_1**	**Extended height h_4**	**Weight (kg)**
			680	**680**	
ZT	3600	0	3010	4810	2180
	4000	0	3210	5210	2261
	4500	0	3460	5710	2360
	5000	0	3710	6210	2485
	5500	0	3960	6710	2610
	6000	0	4210	7210	2757
	6500	0	4460	7710	2910
ZZ	3600	1800	3025	4825	2326
	4000	2000	3225	5225	2350
	4500	2250	3475	5725	2422
	5000	2500	3725	6225	2604
	5500	2750	3975	6725	2724
	6000	3000	4225	7225	2847
	6500	3300	4475	7725	2964
DZ	4500	1500	2735	5736	2733
	5000	1667	2902	6236	2816
	5500	1833	3068	6736	2900
	6000	2000	3235	7236	3024
	6500	2167	3402	7736	3170
	7000	2333	3568	8236	3274
	7500	2500	3735	8736	3377
	8000	2667	3902	9236	3459

Special trucks are not included in this overview.

Mast chart					
VDI3596 Description	**Lift h_3**	**Free lift h_2**	**Collapsed height h_1**	**Extended height h_4**	**Weight (kg)**
			690/S80	**690/S80**	
ZT	3600	0	3160	4960	2240
	4000	0	3360	5360	2310
	4500	0	3610	5860	2435
	5000	0	3860	6360	2560
	5500	0	4110	6860	2710
	6000	0	4360	7360	2860
	6500	0	4610	7860	2985
ZZ	3600	1800	3175	4975	2374
	4000	2000	3375	5375	2446
	4500	2250	3625	5875	2556
	5000	2500	3875	6375	2676
	5500	2750	4125	6875	2796
	6000	3000	4375	7375	2916
	6500	3300	4625	7875	3036
DZ	4500	1500	2885	5886	2796
	5000	1667	3052	6386	2879
	5500	1833	3218	6886	3004
	6000	2000	3385	7386	3149
	6500	2167	3552	7886	3253
	7000	2333	3718	8386	3357
	7500	2500	3885	8886	3439
	8000	2667	4052	9386	3522

Mast chart					
VDI3596 Description	**Lift h_3**	**Free lift h_2**	**Collapsed height h_1**	**Extended height h_4**	**Weight (kg)**
			S90	**S90**	
ZT	3600	0	3310	5110	2285
	4000	0	3510	5510	2385
	4500	0	3760	6010	2510
	5000	0	4010	6510	2635
	5500	0	4260	7010	2810
	6000	0	4510	7510	2935
	6500	0	4760	8010	3060

Mast chart					
VDI3596 Description	**Lift h_3**	**Free lift h_2**	**Collapsed height h_1**	**Extended height h_4**	**Weight (kg)**
			S90	**S90**	
ZZ	3600	1800	3325	5125	2422
	4000	2000	3525	5525	2518
	4500	2250	3775	6025	2628
	5000	2500	4025	6525	2748
	5500	2750	4275	7025	2868
	6000	3000	4525	7525	2988
	6500	3300	4775	8025	3108
DZ	4500	1500	3035	6036	2858
	5000	1667	3202	6536	2983
	5500	1833	3368	7036	3128
	6000	2000	3535	7536	3232
	6500	2167	3702	8036	3336
	7000	2333	3868	8536	3418
	7500	2500	4035	9036	3501
	8000	2667	4202	9536	3574

Special trucks are not included in this overview.

3.5 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. If you have any queries contact the manufacturer's customer service department.

DFG/TFG 660-690

Model		DFG/TFG			
		660	**670**	**680**	**690**
Front tyres	SE*	355/65 - 15	8.25 - 15	8.25 - 15	300 - 15
	Pneumatic*	355/65 - 15 18 PR	8.25 - 15 18 PR	8.25 - 15 18 PR	300 - 15 18 PR
	Tyre pressure bar	10	10	10	10
	Torque Nm	650	650	650	650
Rear tyres	SE*	8.25 - 15	8.25 - 15	8.25 - 15	300 - 15
	Pneumatic*	8.25 - 15 18 PR	8.25 - 15 18 PR	8.25 - 15 18 PR	300 - 15 18 PR
	Tyre pressure bar	10	10	10	10
	Torque Nm	450	450	450	450

DFG/TFG S80-S90

Model		DFG/TFG	
		S80	**S90**
Front tyres	SE*	300 - 15	300 - 15
	Pneumatic*	300 - 15 18 PR	300 - 15 18 PR
	Tyre pressure bar	10	10
	Torque Nm	650	650
Rear tyres	SE*	300 - 15	300 - 15
	Pneumatic*	300 - 15 18 PR	300 - 15 18 PR
	Tyre pressure bar	10	10
	Torque Nm	450	450

*) 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 660-680

Model	DFG 660	DFG 670	DFG 680	
Cylinders/cubic capacity	4/4400	4/4400	4/4400	cm³
Rated speed (without load)	2200	2200	2200	rpm
Idle speed	850	850	850	rpm
Engine output	91	91	91	kW
Fuel consumption 60 VDI duty cycles/h	7.7	8.1	8.5	l/h [kg/h]

DFG 690-S90

Model	DFG 690	DFG S80	DFG S90	
Cylinders/cubic capacity	4/4400	4/4400	6/6600	cm³
Rated speed (without load)	2200	2200	2200	rpm
Idle speed	850	850	850	rpm
Engine output	91	91	90	kW
Fuel consumption 60 VDI duty cycles/h	8.8	8.8	10.3	l/h [kg/h]

TFG 660-680

Model	TFG 660	TFG 670	TFG 680	
Cylinders/cubic capacity	8/5700	8/5700	8/5700	cm³
Rated speed (without load)	2200	2200	2200	rpm
Idle speed	850	850	850	rpm
Engine output	85	85	85	kW
Fuel consumption 60 VDI duty cycles/h	8	8.5	8.9	l/h [kg/h]

TFG 690-S90

Model	TFG 690	TFG S80	TFG S90	
Cylinders/cubic capacity	8/5700	8/5700	8/5700	cm³
Rated speed (without load)	2200	2200	2200	rpm
Idle speed	850	850	850	rpm
Engine output	85	85	85	kW
Fuel consumption 60 VDI duty cycles/h	10.2	10.2	10.7	l/h [kg/h]

3.7 EN norms

Noise emission level

– DFG 660-690, S80: 73 dB (A)*
– DFG S90: 70 dB (A)*
– TFG: 71 dB(A)*

*+/- 4 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

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 198.

Whole-body vibration		
Motor type	**Vibration**	**Uncertainty**
TFG	1.0 m/s^2	0.2 m/s^2
DFG S90	0.9 m/s^2	0.2 m/s^2
DFG 660-690, S80	1.3 m/s^2	0.2 m/s^2

Hand/arm vibration	
Vibration	<2.5 m/s^2

The vibration that is characteristic for vibrations of the body cannot be used to determine the actual load caused by vibrations during operation. That depends on the operating conditions (condition of the travel routes, method of operation, etc.) and should therefore be determined on site at a suitable location. Hand/arm vibration must always be determined without exception, even if the values do not indicate any hazard at all, as in this case.

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

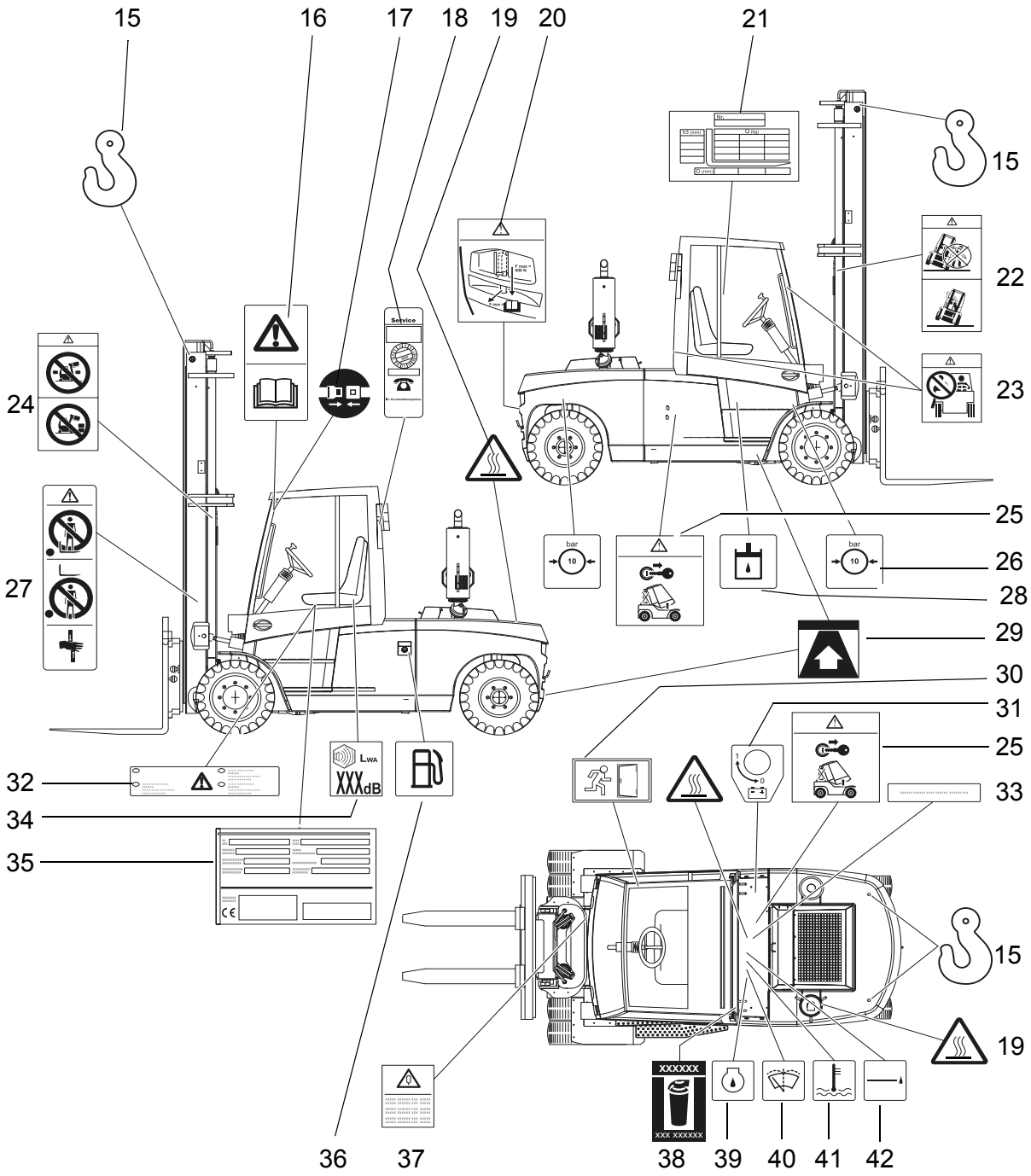
➔ Special equipment and authorisation are required if the truck is to be used continually in conditions of extreme temperature or condensing air humidity fluctuations.

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.

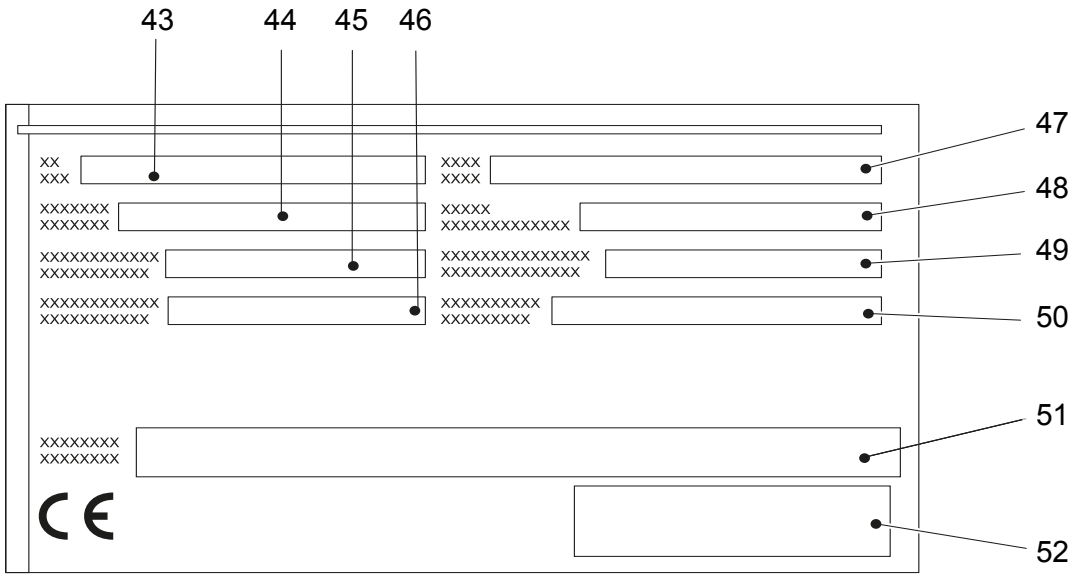
4 Identification points and data plates

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



Item	Component
15	Attachment points for loading by crane (○)
16	Read operating instructions
17	Wear seat belt
18	Test plaque (○)
19	Hot surface warning
20	Trailer coupling
21	Capacity plate
22	Tipover hazard
23	No passengers
24	Do not drive or tilt the mast forward with a load raised
25	Turn the exhaust pipe back before tilting the cab
26	Air pressure
27	Do not stand on load handler / Do not stand under load handler / Risk of trapping when mast extended
28	Hydraulic oil
29	Jack contact points
30	Emergency exit
31	Battery main switch
32	Warning
33	Coolant notice
34	Noise level
35	Truck data plate
36	Fuel
37	Lift load cushioning (○)
38	Fire extinguisher (○)
39	Add engine oil
40	Windscreen fluid
41	Coolant
42	Check engine oil

4.1 Data plate



Item	Component	Item	Component
43	Type	48	Year of manufacture
44	Serial number	49	Load centre distance (mm)
45	Rated capacity (kg)	50	Net weight in kg
46	Output	51	Manufacturer
47	Option	52	Manufacturer's logo

For queries regarding the truck or ordering spare parts always quote the truck serial number (44).

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.

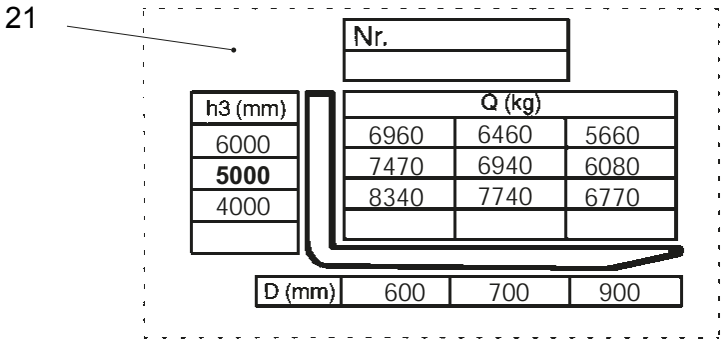
- ▶ When replacing the forks you must attach an additional capacity plate to the truck.
- ▶ Trucks supplied without forks are given a capacity plate for standard forks (length: 1150 mm).

The capacity plate (21) 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 (21) of the truck indicates the truck's capacity with the forks as originally supplied.

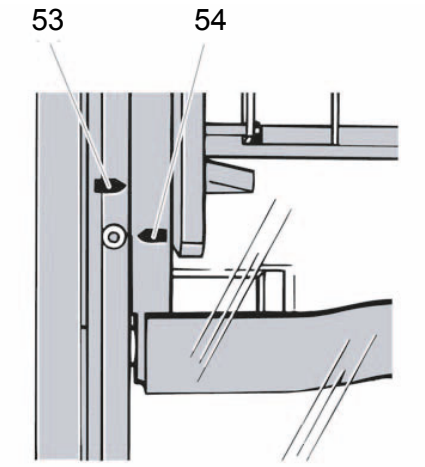
Example of how to calculate the maximum capacity:

With a load centre distance D of 700 mm and a maximum lift height h_3 of 5000 mm. the max. capacity Q is 6940 kg.



Lift height restriction

The arrow shaped markings (53 and 54) on the inner and outer masts show the operator 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.

4.4 Jack attachment point

The "Jack contact point" decal (29) indicates where the truck may be lifted and jacked up.

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!

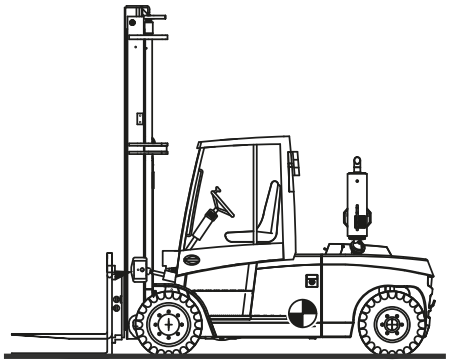
An altered centre of gravity can result in tipovers when cornering.

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

For trucks without a mast the centre of gravity will move significantly in the direction of the counterweight.

▶Drive carefully and with modified speed to avoid tipping over.

The picture shows the approximate centre of gravity location.



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.
- ▶ The truck should only be handled by people who are trained in using lifting slings and tools.
- ▶ Wear safety shoes when lifting the truck by crane.
- ▶ Do not walk into or stand in a hazardous area.
- ▶ Always attach the crane lifting gear to the prescribed strap points and prevent them from slipping.

➔ Truck net weight: see "Data plate" on page 40.

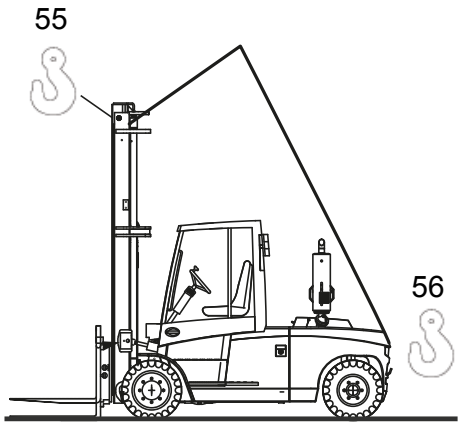
Lifting the truck by crane

Requirements

– Park the truck securely, see "Parking the truck securely" on page 103.

Procedure

- Secure the crane slings to the attachment points (55) and (56.
- Raise and load the truck.
- Lower and deposit the truck carefully (see "Parking the truck securely" on page 103).
- Secure the truck with wedges to prevent it from rolling away.



This concludes the loading by crane.

2.3 Loading with another industrial truck

⚠ DANGER!

Slipping can cause accidents

▶Do not use another Industrial truck to load the truck!

3 Securing the truck during transport

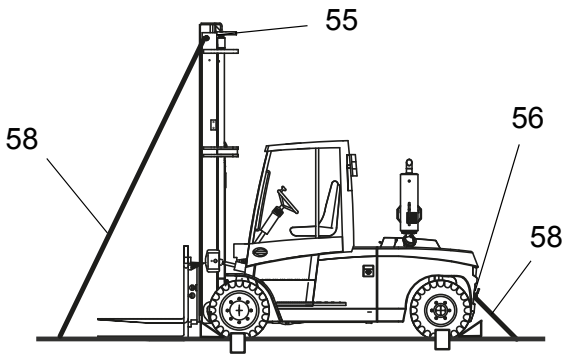
⚠ WARNING!

Accidental movement during transport

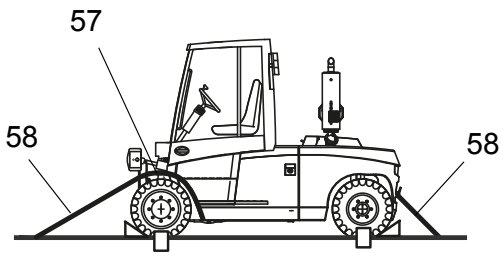
Improper fastening of the truck and mast during transport can result in serious accidents.

- ▶ 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 103.

Tools and Material Required

– 2 fastening belts with a tensioner
– Retaining wedges

Procedure

- Secure the truck with the fastening belt (58) at the top cross member of the mast (55) and the trailer coupling (56) or over the front axle cross member (57) and the trailer coupling (56).
- Tighten the fastening belts (58) with the tensioner.

The truck is now secured for transport.

4 Using the Truck for the First Time

Safety Instructions for Assembly and Commissioning

⚠ WARNING!

Incorrect assembly can result in accidents

The assembly of the truck at the application site, commissioning and operator 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.
- Check the brake fluid level.
- 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 86.

D Fuelling the Truck

1 General

1.1 Safety regulations for handling diesel fuel and LPG

⚠ WARNING!

An unsecured industrial truck can cause accidents

The truck can suddenly start to move.

▶ Switch off the truck securely before filling up or replacing the LPG bottle, see "Parking the truck securely" on page 103.

⚠ WARNING!

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.

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.

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.

⚠ CAUTION!

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.

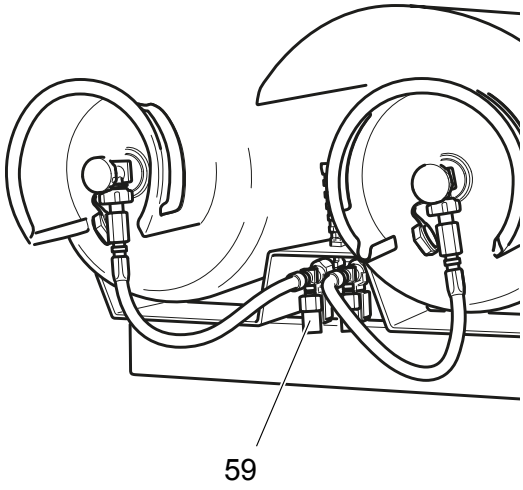
NOTE

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 operator 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.

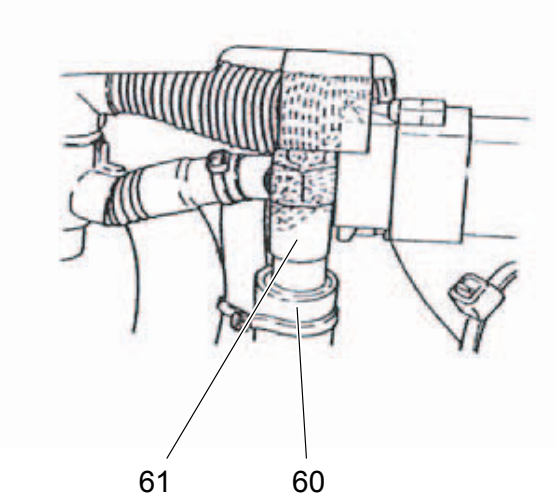
1.2 LPG system relief valve

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 (59).
- When the valve is activated the plastic cover comes off, thereby clearly indicating a fault in the gas system.
- In this case the truck must not be operated.
- The gas system must be check by suitably qualified and trained personnel.
- The operator must check that the plastic cover is in place each time he uses the truck.

- Models with a liquid gas tank have the relief valve (61) in the drive compartment. The relief valve is fitted with a hose (60) that diverts the LPG if the relief valve is opened.
- 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.



⚠ DANGER!

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

⚠ CAUTION!

Air in the fuel system will result in malfunctions.

▶ Never allow the fuel tank to run dry.

2.1 Fuelling

⚠ 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.

NOTE

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

NOTE

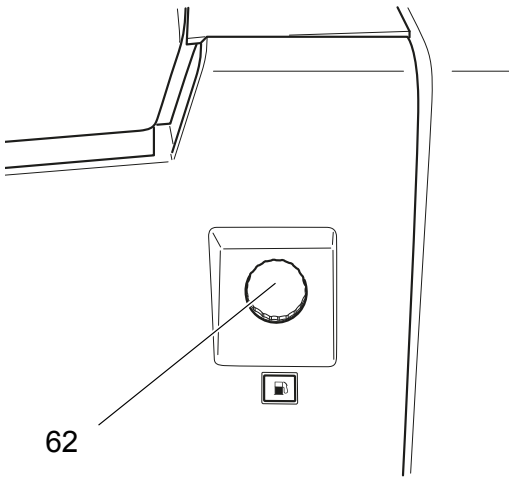
▶ Capacity: DFG 660-690 = 125 l.

▶ Use only diesel in accordance with DIN 590 or DIN 51628 with a cetane rating above 51.

2.1.1 Fuelling the tank system

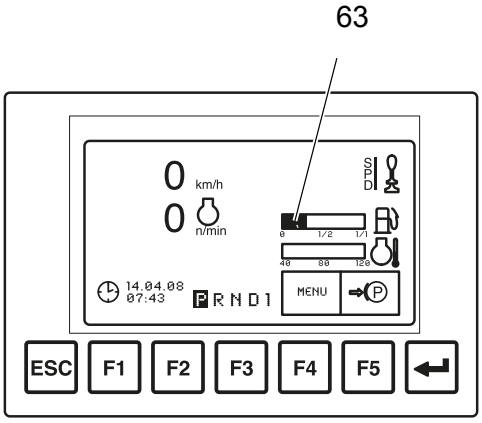
Procedure

- Park the truck securely before fuelling, see "Parking the truck securely" on page 103.
- Unscrew the tank cap (62).
- Insert the pump nozzle into the open tank filler neck.
- Add the fuel.
- Do not overfill the tank.
- Tighten the cap (62) back on after fuelling.



Fuelling is now complete.

The fuel gauge (63) indicates the fuel level.



NOTE

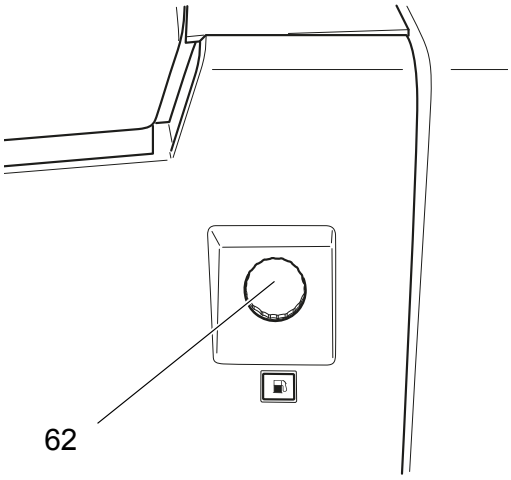
▶ Never allow the fuel tank to run dry. Air in the fuel system will result in malfunctions.

2.2 Fuelling with fuel containers

Procedure

- Unscrew the filler cap (62) and open the fuel container.
- Fit the spout onto the fuel container.
- Insert the spout into the open tank filler neck.
- Make sure the fuel container and spout are connected tightly to each other.
- Raise the fuel container carefully and slowly add the diesel.
- Do not overfill the tank.
- Screw the cap (62) back on tightly 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

⚠ DANGER!

Risk of explosion

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

⚠ CAUTION!

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.

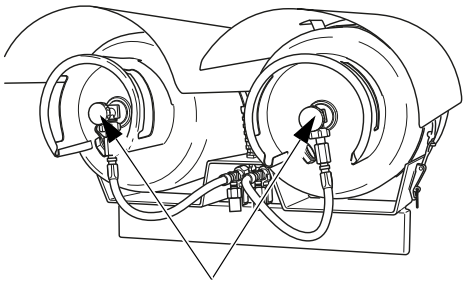
▶ Note the indications and markings on the LPG bottle.

3.1.1 Using an LPG bottle

Replace the LPG bottle

Procedure

- Park the truck securely before replacing the LPG bottle, see "Parking the truck securely" on page 103
- Close the shut-off valves (64) securely.
- Start the motor and allow the LPG system to run empty in neutral.



64

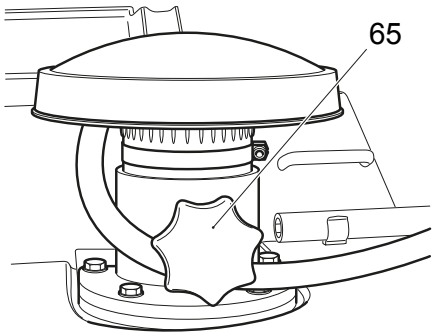
Remove the LPG bottle

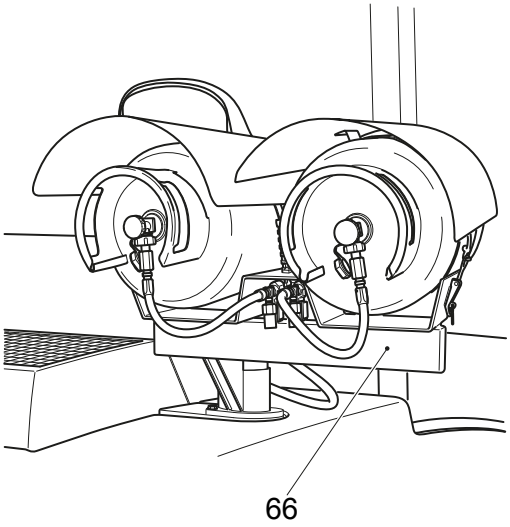
⚠ CAUTION!

The connection has a left thread

Procedure

- The LPG bottle console is released with the finger screw (65).
- Unfold the console (66) as far as the stop.
- Unscrew the union nut (68).
- Remove the hose (60) and immediately screw the valve cap onto the empty LPG bottle.
- Loosen the toggle-type fastener with the handle (67).
- Carefully remove the LPG bottle from the bracket and place it down securely.



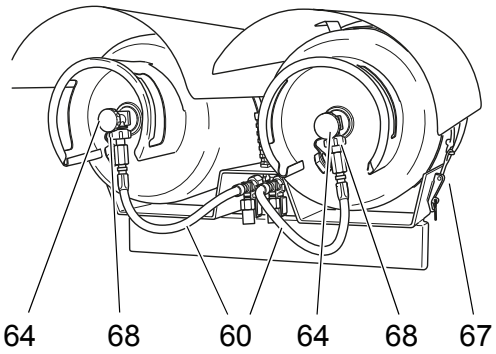


Inserting a new LPG bottle

Procedure

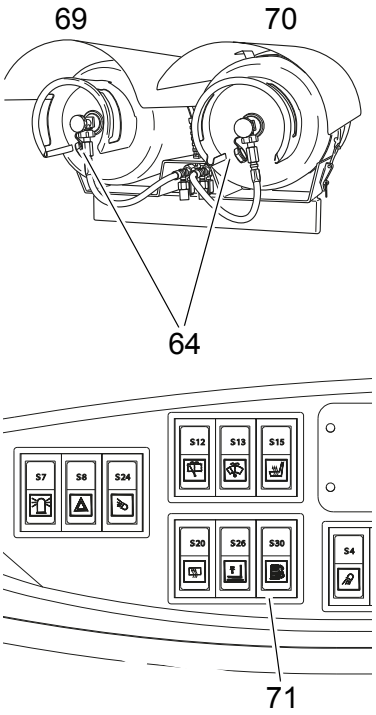
- Insert the LPG bottle into the bracket
- Align the hose connection downwards.
- Clamp the toggle-type fastener with the handle (67).
- Unscrew the valve cap.
- Fit the hose (60) in accordance with instructions.
- Carefully open the shut-off valve (64).
- Check the hose connection for leaks using a foam-forming agent.

The replacement is now complete.



3.1.2 Operating the Twin Bottle System and Liquid Gas Tank

Changing the LPG Supply



Procedure

The (71) switch controls the release of the LPG bottle or tank.

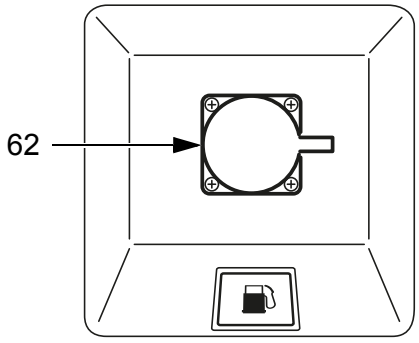
- Open the shut-off valves (64) of both LPG bottles by turning anticlockwise.
- Apply the (71) switch.
  - The left LPG bottle (69) is activated by the middle switch position.
  - The right LPG bottle (70) is activated by the lower switch position.
  - Close the LPG bottles and open the LPG tank by applying the top switch position.

LPG supply changed.

3.2 Liquid gas tank

The filling valve (72) is located on the left side of the truck.

Filling refillable liquid gas tanks



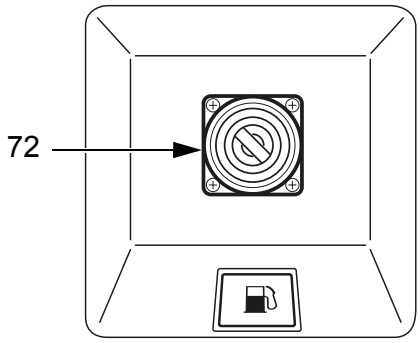
⚠ DANGER!

Risk of explosion

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

Requirements

– Park the truck securely (see "Parking the truck securely" on page 103).
– Note all guidelines and regulations concerning the filling of LPG bottles on the LPG pump.



Procedure

- Unscrew the tank cap (62).
- Lock the filling adapter of the tank system in place on the filling valve (72).
- Enabling filling on the tank system

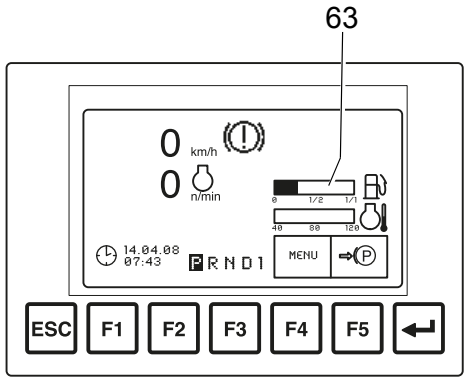
  The integrated filling stop valve prevents the tank from overfilling.
- When the filling process is complete, release the filling adapter of the filling system from the filling valve (72).
- Screw on the tank cap (62).

  The level of the tank is shown by the fuel indicator.

4 Fuel level indicator

4.1 Display unit

The level indicator (63) shows the capacity of the tank.



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.

Operator's rights, responsibilities and rules of conduct

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. Safety shoes must be worn on pedestrian-operated trucks.

Unauthorised use of truck

The operator is responsible for the truck during the time it is in use. The operator 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 informed immediately 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 operator must not carry out any repairs or alterations to the truck without authorisation and the necessary training to do so. The operator must never disable or adjust safety mechanisms or switches.

Hazardous area

⚠ WARNING!

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

A hazardous area is defined as the area in which people are at risk due to travel or lifting operations of the truck, its load handler or the load. This also includes the area within reach of falling loads or lowering/falling operating equipment.

- ▶ Instruct unauthorised persons to leave the hazardous area.
- ▶ In case of danger to third parties, give a warning signal in good time.
- ▶ If unauthorised persons are still within the hazardous area, stop the truck immediately.

⚠ WARNING!

Falling objects can cause accidents

Falling objects can injure the operator while the truck is being operated.

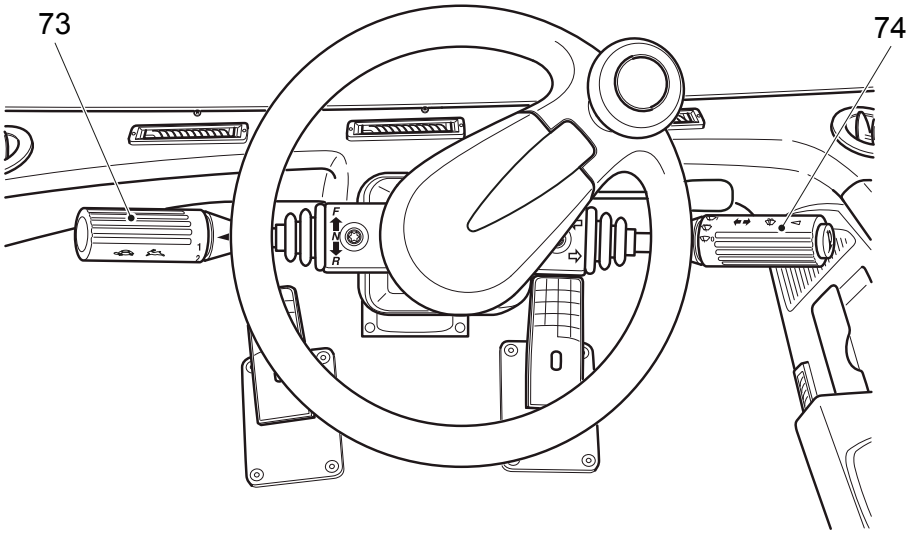
- ▶ The operator must remain within the protected area of the overhead guard while the truck is being operated.

Safety devices, warning signs and warning instructions

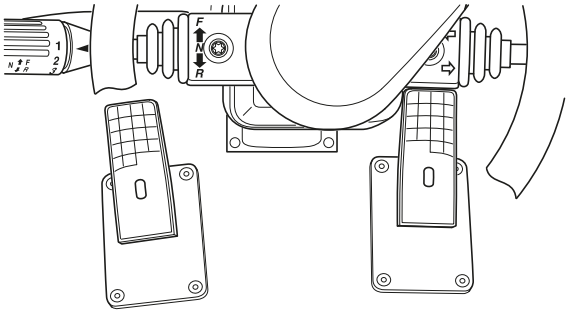
Safety devices, warning signs (see "Identification points and data plates" on page 38) and warning instructions in the present operating instructions must be strictly observed.

2 Displays and Controls

2.1 Multi-task switch



Einzelpedalsteuerung

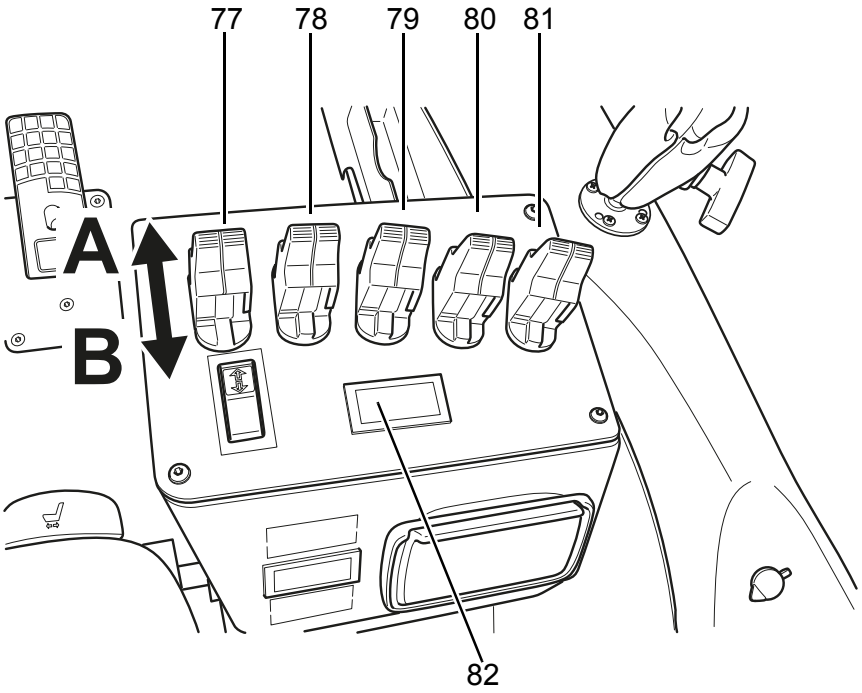


76 75

Item	Control / Display		Function
73	Multi-task switch – Travel function switch – Travel direction switch	●	 – Sets automatic gear shifting – Selects travel direction / neutral position
● = Standard equipment		○ = Optional equipment	

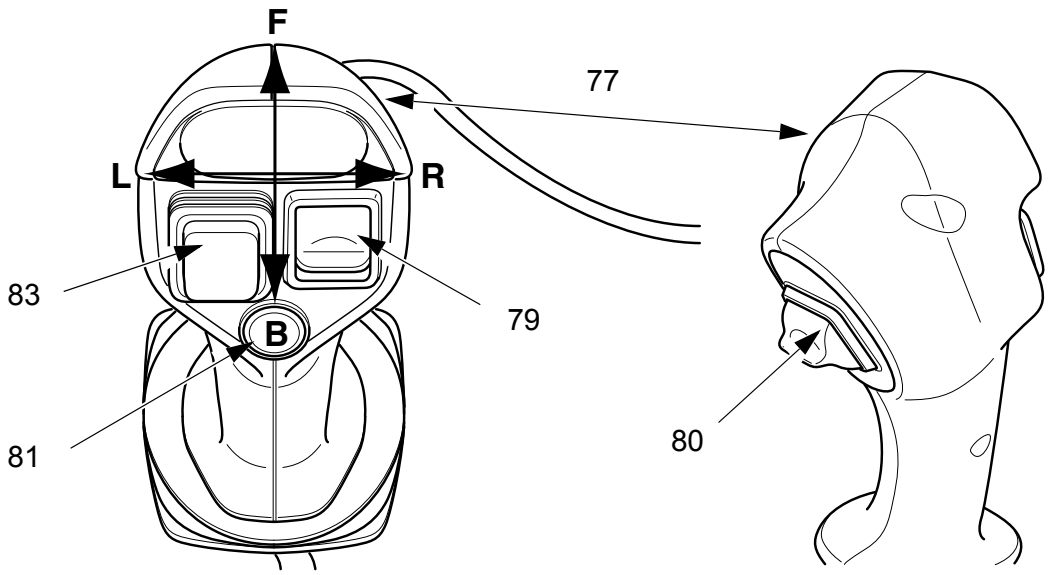
Item	Control / Display		Function
74	Multi-task switch – Travel direction indicator – Dipped lights/main beam – Windscreen wiper – Windscreen washing system – Horn	●	 – Switches the travel direction indicator on and off – Switch spot lights from dipped lights to main beam – Switches the windscreen wiper on and off – Switches interval speed on and off – Switches windscreen washing system on and off – Activates an audible warning
76	Brake pedal	●	When activated, causes the truck to brake to a halt immediately.
75	Accelerator pedal	●	Infinite travel speed control.
● = Standard equipment		**○ = Optional equipment**	

2.2 SOLO-PILOT



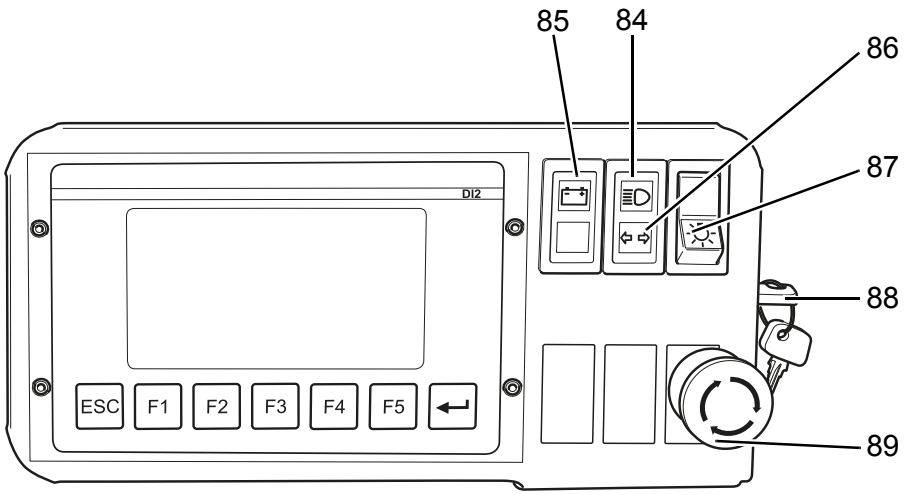
Item	Control / Display		Function
77	Lever	●	Load handler raise / lower
78	Lever	●	Mast forward / reverse tilt
79	Auxiliary hydraulics lever 1	○	1. Activate 1st attachment
80	Auxiliary hydraulics lever 2	○	2. Activate 2nd attachment
81	Auxiliary hydraulics lever 3	○	3. Activate 3rd attachment
82	Auxiliary hydraulics acknowledgement key	○	
● = Standard equipment		○ = Optional equipment	

2.3 MULTI-PILOT



Item	Control / Display		Function
77	MULTI-PILOT (F+B) MULTI-PILOT (L+R)	●	Load handler raise / lower Mast forward / reverse tilt
83	Travel direction switch	○	Selects travel direction / neutral position
79	Auxiliary hydraulics 1 switch	○	1. Activate attachment
80	Auxiliary hydraulics 2 switch	○	2. Activate attachment
81	ZH2 / ZH3 acknowledgement key switch	○	3. Activate attachment / acknowledgement key for ZH2
● = Standard equipment		○ = Optional equipment	

2.4 Controls

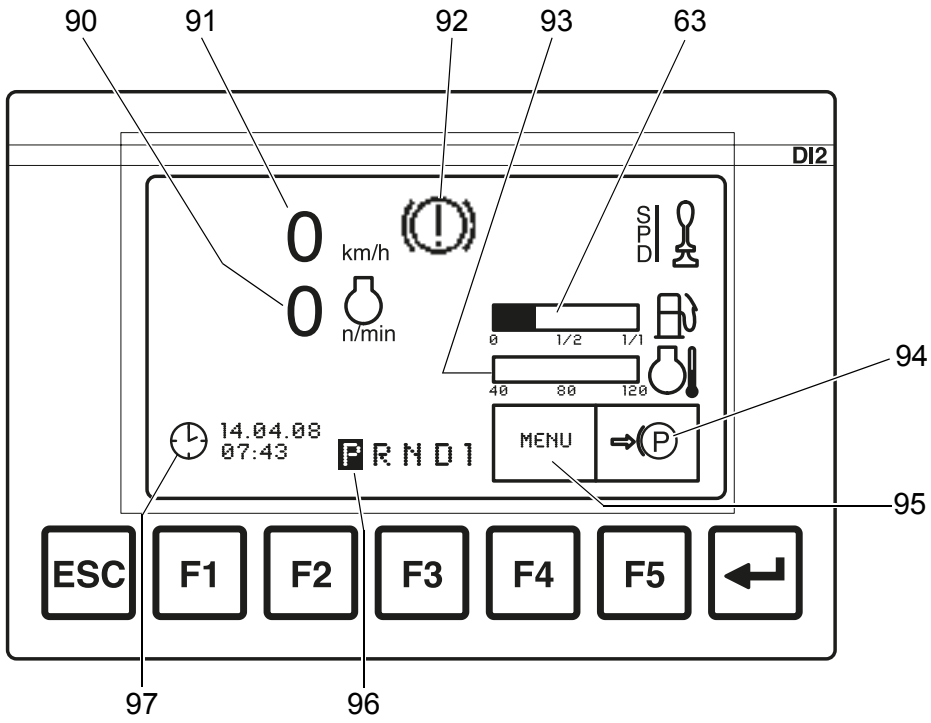


Item	Control / Display		Function
85	Battery indicator lamp	●	Lights up to indicate errors in the power supply
84	Main beam indicator lamp	●	Lit when the main beam is switched on
86	Hazard warning lights indicator lamp	●	Flashes when the hazard warning lights are activated
87	Dipped lights	●	Switches dipped lights on and off
88	Key switch	●	Switches the power supply on and off Starts and stops the engine
89	Emergency Disconnect switch	●	Switches control current on and off in emergencies.
● = Standard equipment		○ = Optional equipment	

2.4.1 Switch variants

Symbol	Switch/display		Function
	Switch Rear work lights	●	Switches the rear work lights on and off
	Switch Front work lights	●	Switches the front work lights on and off.
	Switch Rear window wiper	●	Switches the rear window wiper on and off
	Air conditioning system switch	○	Switches the air conditioning system on and off
	Fan 1 switch	●	Switches the cab fan on and off
	Switch Beacon	○	Switches the beacon on and off
	Switch Warning indicator	●	Switches warning indicator lights on and off
● = Standard equipment		○ = Optional equipment	

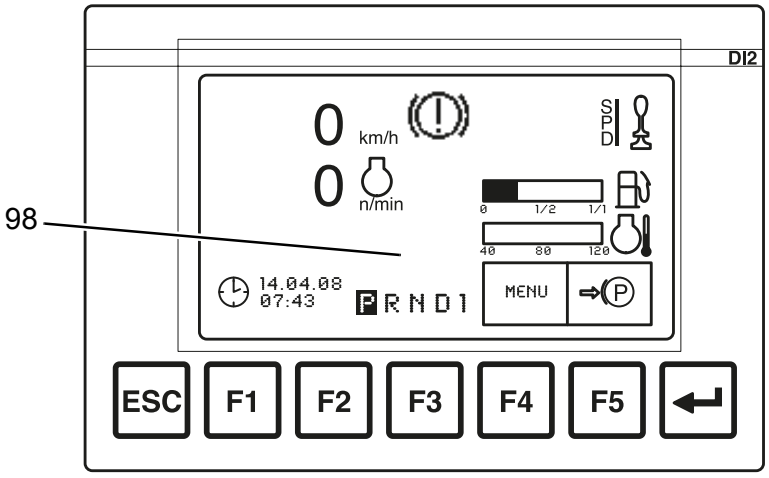
2.5 Multifunction display



Item	Control / Display		Function
63	Level indicator	●	Remaining fuel quantity
90	Engine speed	●	Current speed of the engine
91	Speed	●	Current speed
92	Warning indicator	●	Current warnings (variable)
93	Temperature display	●	Current engine temperature
94	Parking brake display	●	Position of the parking brake
95	Menu	●	Access to the configuration menu
96	Gear lever display	●	Current travel stage
97	Clock	●	Shows the time and date
● = Standard equipment		○ = Optional equipment	

2.5.1 Warnings

This field (98) shows information related to operation.



Symbol	Display
	Engine cuts out automatically
	Engine cuts out automatically
	Engine is preheated
	Switch all travel direction switches to neutral position immediately
	No driver in the truck
	Service interval expired Contact Customer Services.
	Flashes to indicate an error in the brake system. Park the truck securely. Contact Customer Services.
	Information from transmission controller: Faulty travel pattern recorded
LIMP HOME	Emergency mode activated, see "Automatic Emergency Brake" on page 143
	Swivel seat (○)

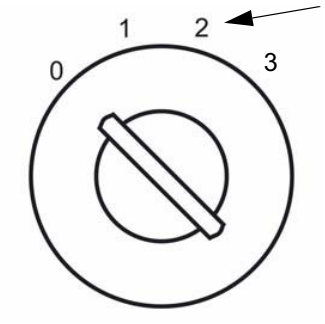
2.5.2 Warning indicators

Symbol	Display		Function
	Hydraulic oil	○	Hydraulic oil level too low.
	Transmission flashing	●	Transmission oil temperature too low Stop the truck immediately.
	Engine oil flashing with "Stop"	●	Engine oil pressure too low Engine cuts out.
	Exhaust gas pressure	●	Exhaust pressure too high Clean particle filter
	Brake pressure	●	No brake pressure present
	Air filter	●	Clean air filter
	Main control unit	●	Error in the main control unit (CVC)
	Transmission	●	Error in the transmission controller
	Hydraulic oil flashing	○	Hydraulic oil temperature too low (below +5° C) Hydraulic oil temperature too high (above +85° C) Stop the truck immediately
	Engine	●	Engine error
	Pilot valve	●	Pilot valve error
	Preheat display	●	Engine preheated
	“Stop“	●	Engine is switched off automatically
	Intake temperature flashing	●	Air filter must be cleaned immediately Park the truck immediately
	Multi-Pilot	●	Multi-Pilot has an error
	Engine temperature flashing with "Stop"	●	Engine temperature too high Engine cuts out.
● = Standard equipment		○ = Optional equipment	

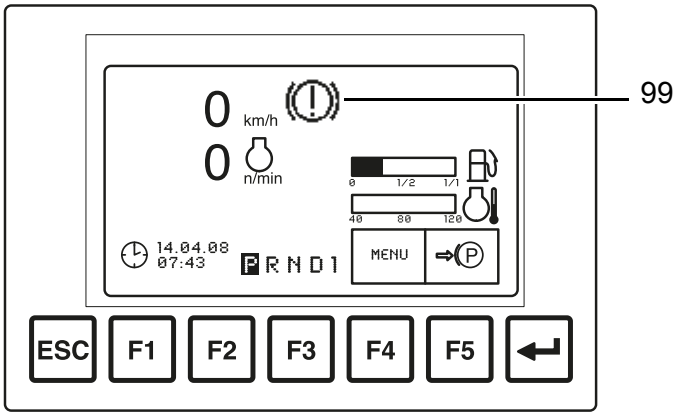
2.6 Operation of the multifunction display

Procedure

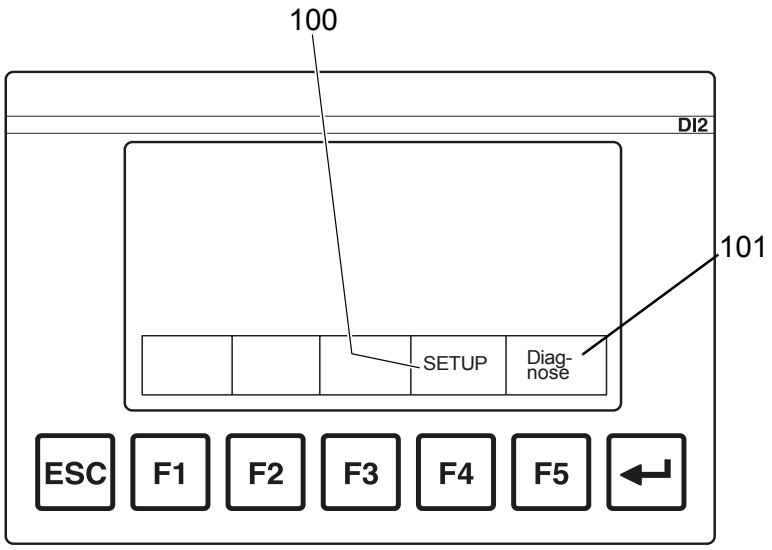
- Turn the key switch to stage "2" with the key.



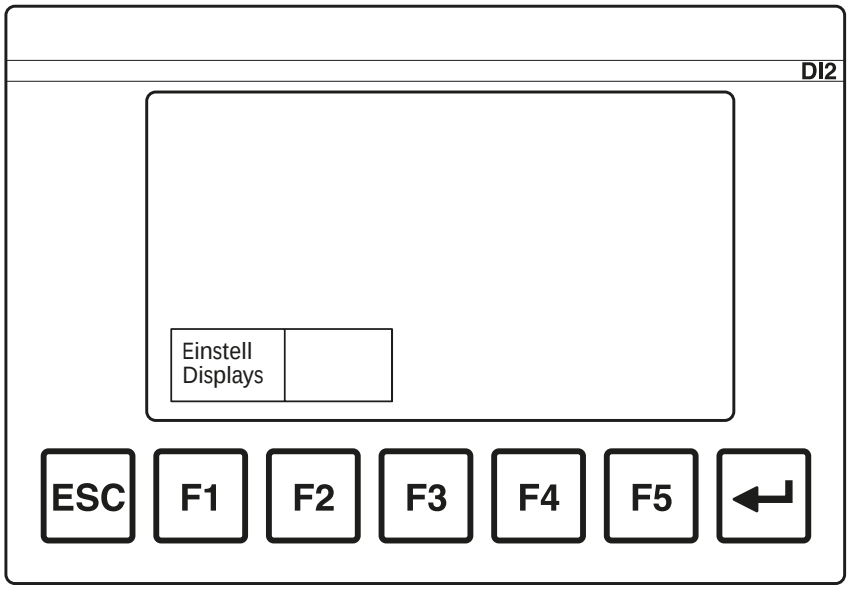
Operating data as well as Errors and information are shown in the multifunction display. Pictograms in the top section of the display act as warning indicators (99). The function keys (lower row) are lit. Areas inside borders in the display are directly assigned to these via function keys. Press the "ESC" key to exit the current menu item. Press the "Enter" key to go one step back.



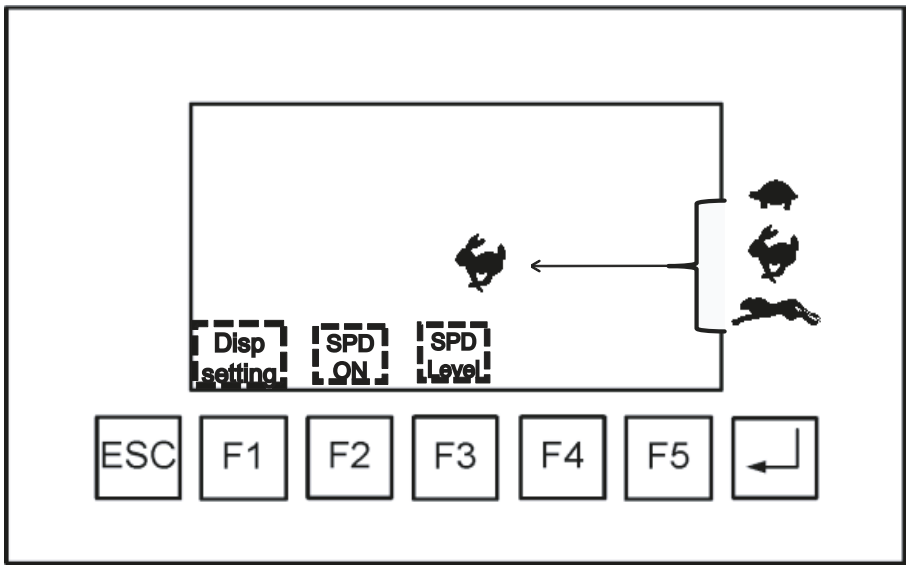
Press the "F4" key to go to the "SETUP" (100) and "Diagnostics" (101) areas.



Press the "F4" key (SETUP) to open the adjustment range for the display.



Optionally, the travel stages can also be adjusted here (single pedal drive)



Press the "F1" key to open the adjustment range for the standard values of the truck.

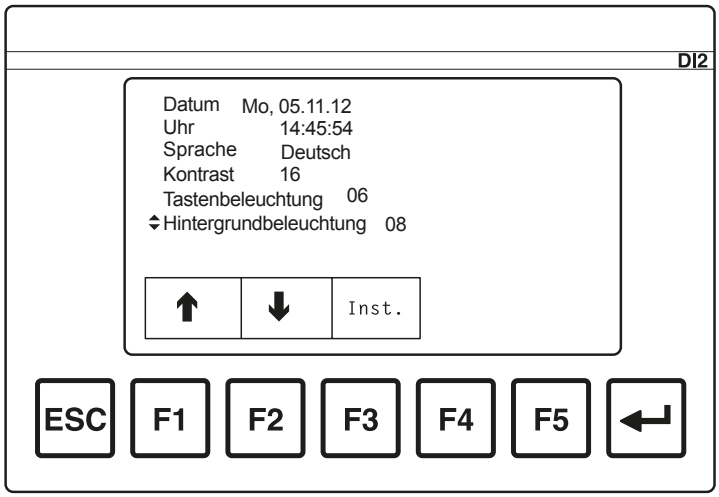
2.6.1 Setting Default Values

After the adjustment range is opened, you can set default values by pressing the "F1" and "F2" keys plus the "Enter" key.

Example 1:

Procedure

- Select a range with the "F1" or "F2" key.
- Confirm the selected range with the "Enter" key.
- Make the settings.
- Press the "ESC" button to exit the current menu range.
- Press the "F3" button to open further setting options (example 2).



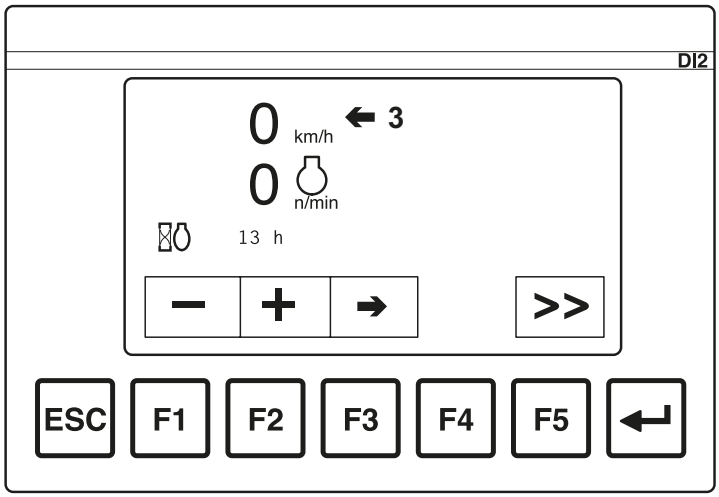
Example 2:

The display can be adapted to individual needs in this adjustment range.

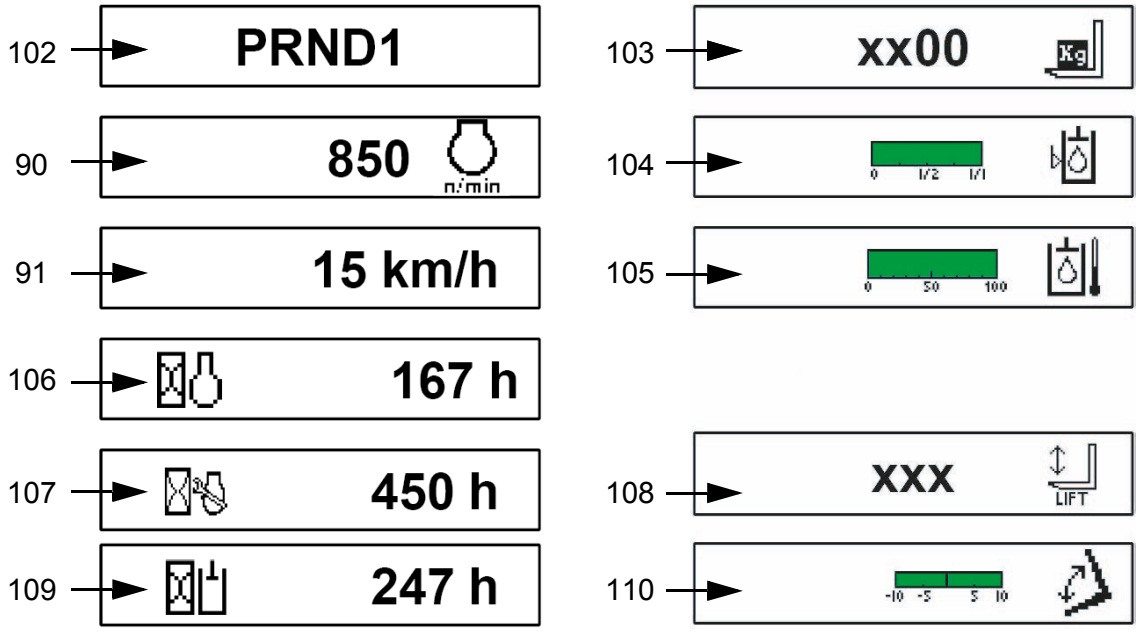
The arrow (3) designates the range in the display to be changed.

Procedure

- Make the settings with the "F1" and "F2" keys.
- Press the "F3" button to change to another range.
- Press the "F5" button to change to the next adjustment range.
- Press the "ESC" button to exit the current menu range.



Adjustment options

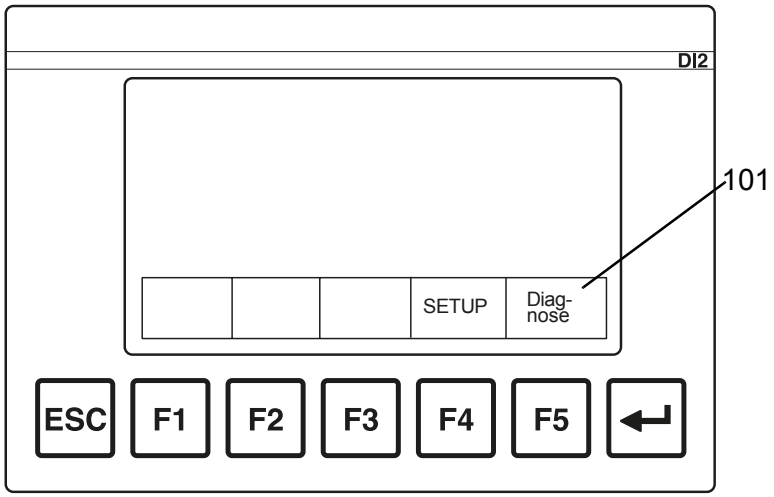


90	Engine speed (●)
91	Speed display (●)
102	Transmission status (●)
103	Weigher system (○)
104	Hydraulic oil reservoir capacity (○)
105	Hydraulic oil temperature (measurement in the tank) (○)
106	Engine operating hours (●)
107	Time until next service (●)
108	Lift height (○)
109	Hydraulic system operating hours (●)
110	Tilt angle (○)

● = Standard equipment	○ = Optional equipment

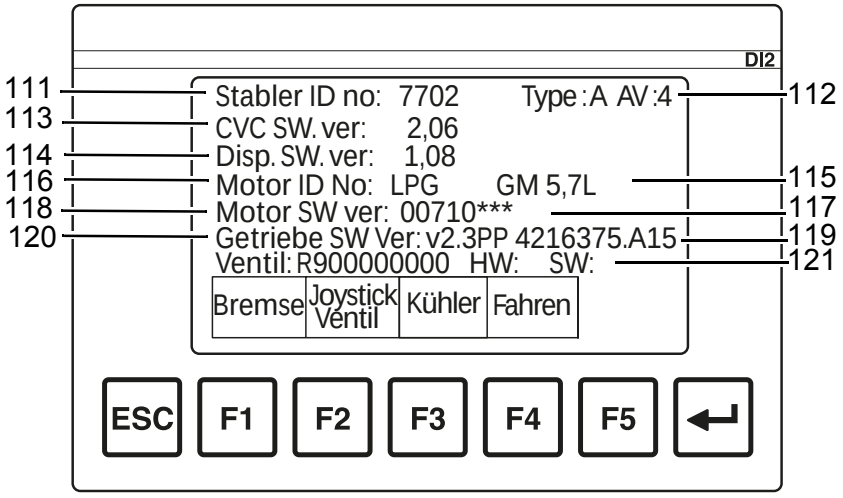
2.6.2 Diagnostics

Press the "F5" button to open the diagnostics area (101).



All default values of the truck can be seen here.

111	Serial number	117	Date of the engine software version
112	Truck type (A or C)	118	Engine software version
113	CVC firmware version	119	Transmission parameter no.
114	Engine variant	120	Transmission software version
116	Display firmware version	121	Information area for optional components
115	Engine type list number		

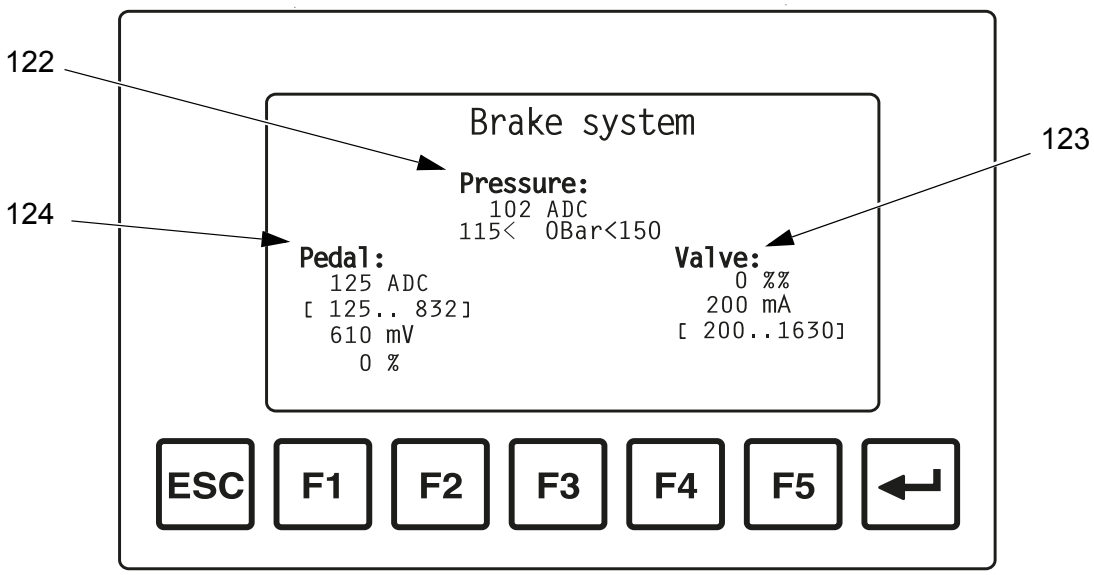


Reading Current Values

The "F1" to "F4" buttons open the lower level menu ranges.

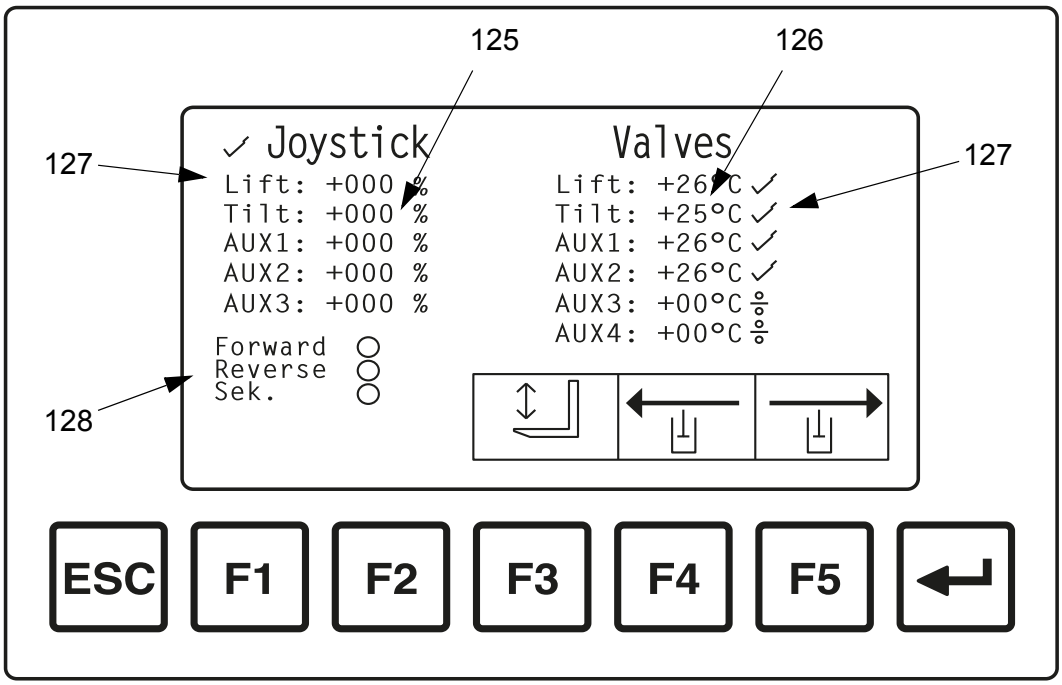
"F1" button - brake system:

The current values for the brake pressure (122), pedal position (124) and the valve (123) can be seen here.



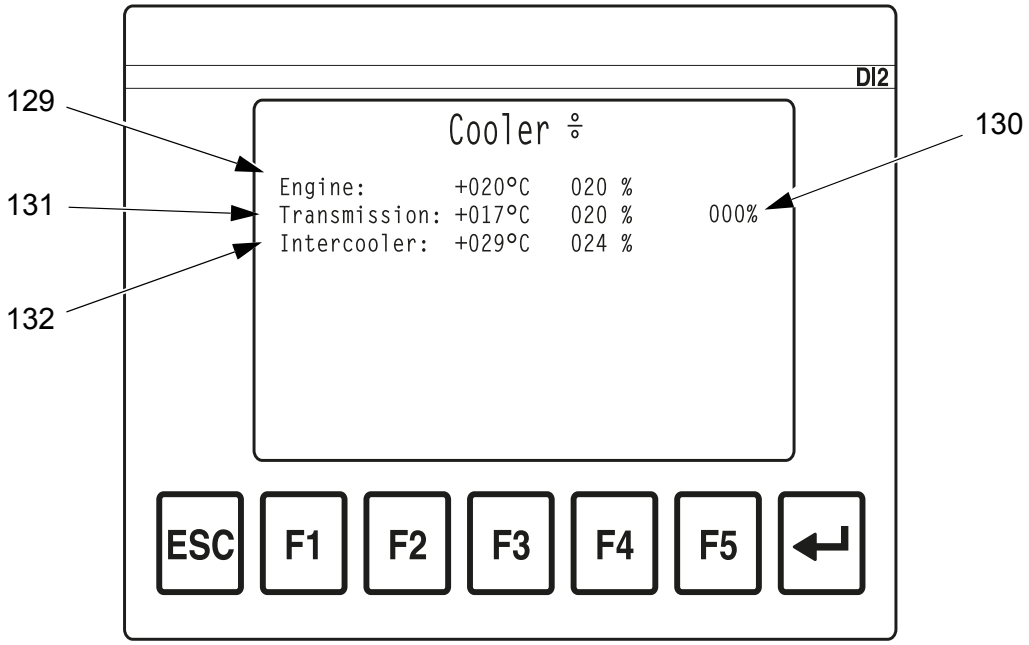
"F2" key - hydraulic controller.

– Activated ranges are identified by a checkmark (127).
– Range (125) indicates the position of the control lever(s):
  • Minus = forward
  • Plus = back
– Range (126) indicates the current temperature of the control module:
– Range (128) indicates the current setting of the travel direction:
  • (●) activated
  • (○) not activated
– Press the "F3" button to switch to another hydraulic range.
– The "F4" and "F5" buttons activate the selected hydraulic range



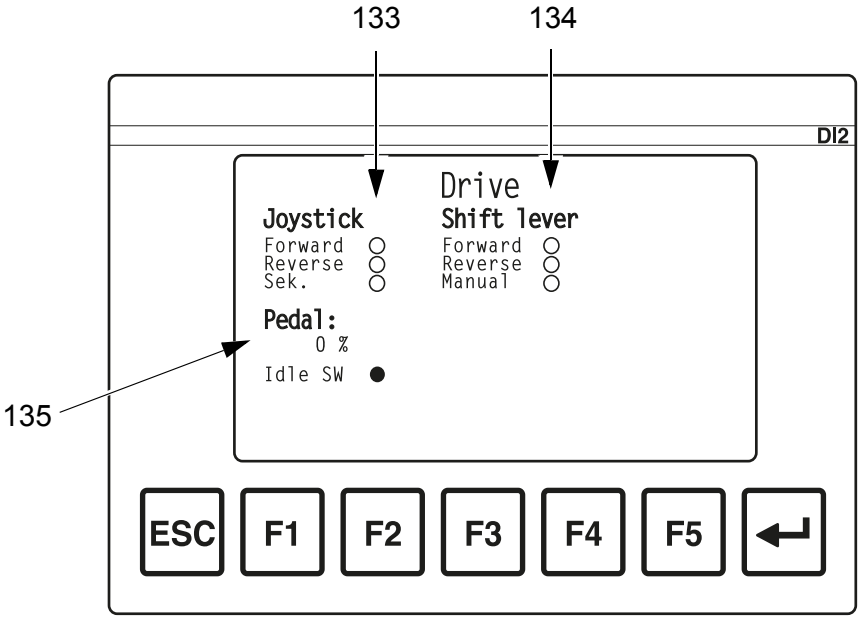
"F3" button - cooling

– Pressing this button provides information about the coolant temperature in "°C" and the air speed as a "%" for the engine (129), transmission (131) and charge air cooler (132) an.
– The speed of the cooler fan (130) is shown as a "%".



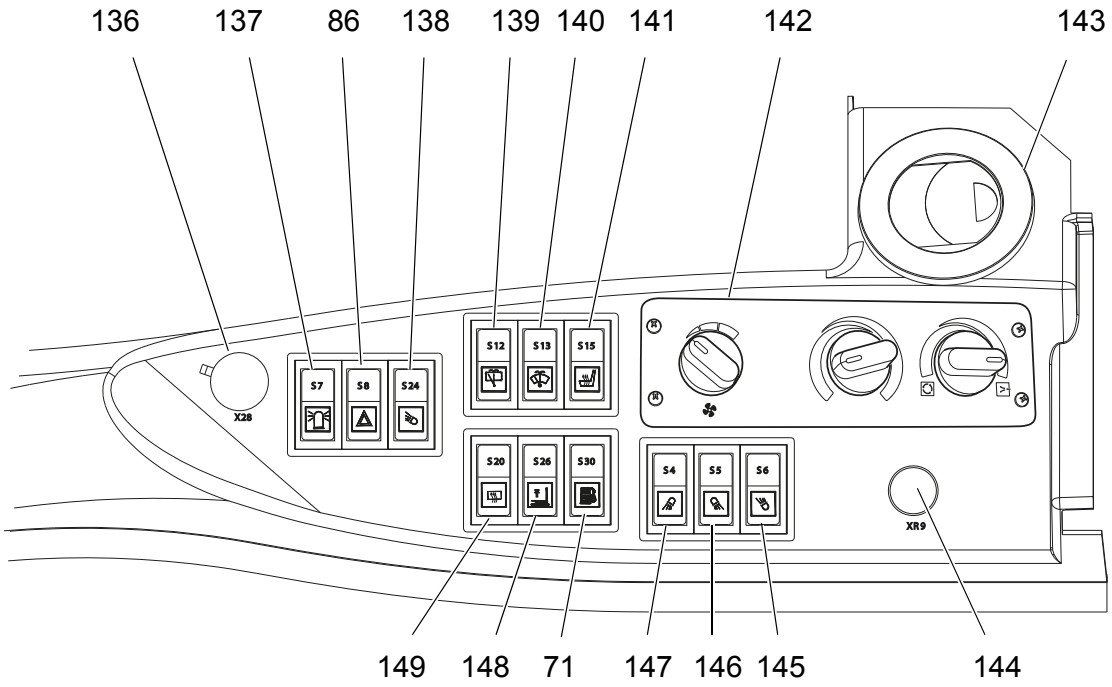
"F4" button - travel switch

– Indicates the current state of the travel direction (133), control lever(s) (134) and accelerator pedal (135).
  • (●) activated
  • (○) not activated

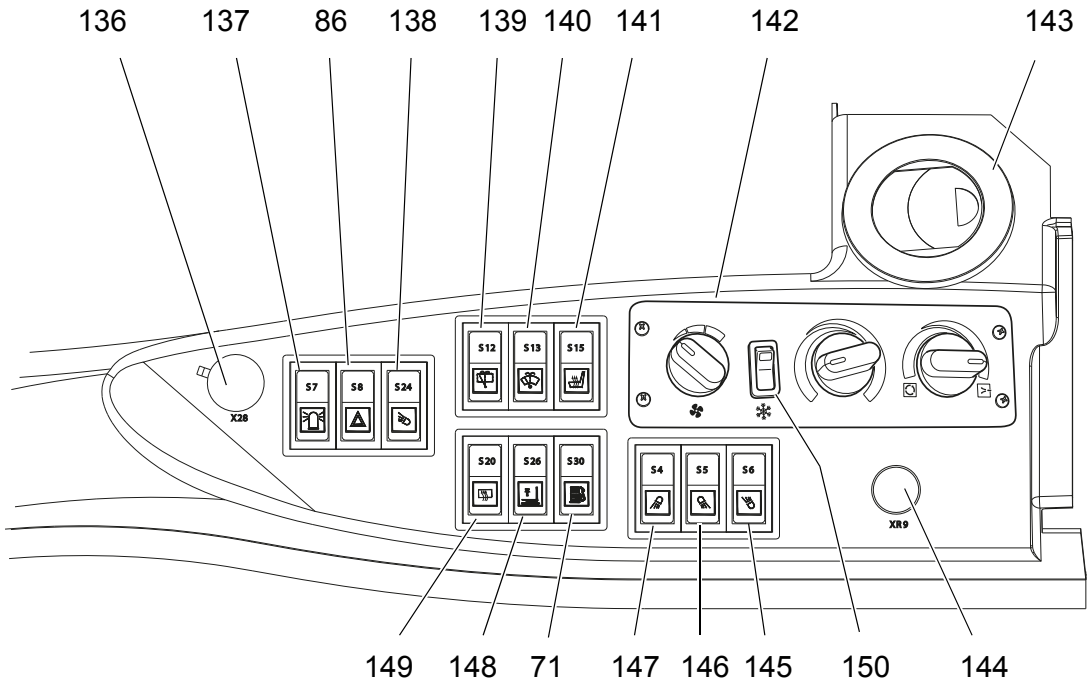


3 Dashboard

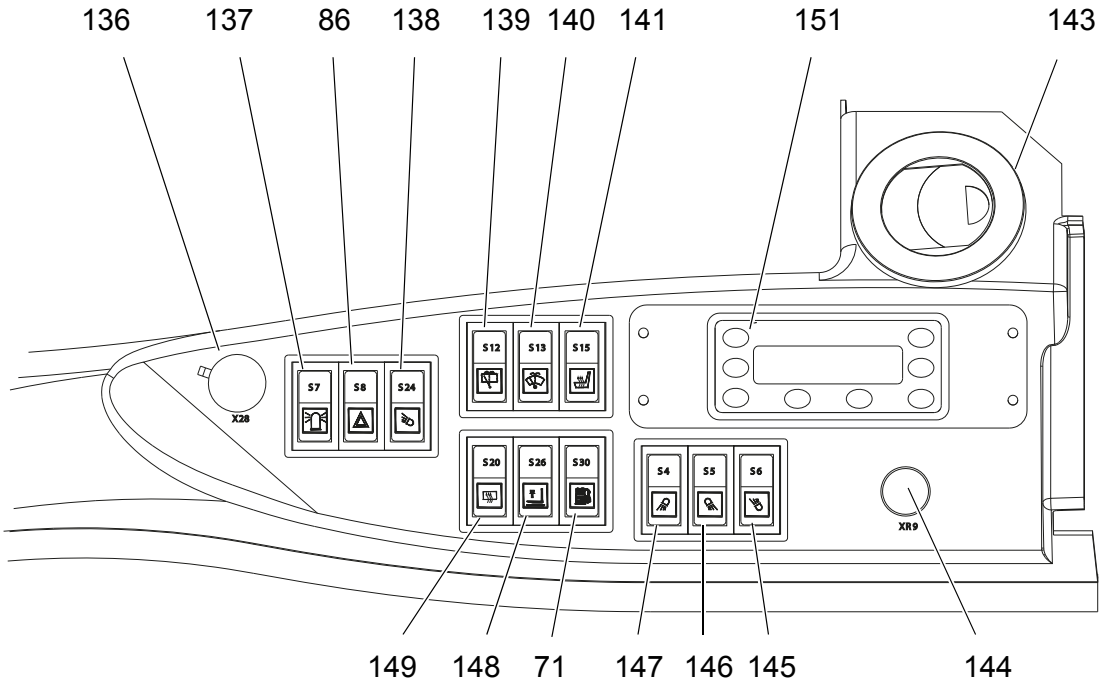
3.1 Without air conditioning system



3.2 With air conditioning system



3.3 With automatic air conditioning



Item	Component
71	LPG bottle switch (LPG only)
86	Hazard warning lights switch
136	Socket
137	Beacon
138	Work lights
139	Windscreen wiper / windscreen washing system (rear windscreen)
140	Windscreen wiper / windscreen washing system (roof window) (○)
141	Seat heating (○)
142	Heater + air conditioning controller (○) (manual)
143	Nozzle (heater)
144	Cigarette lighter
145	Spot lights
146	Spot lights (rear)
147	Spot lights (front)
148	Load damping
149	Rear window heating
150	Air conditioning system switch
151	Heater + air conditioning controller (○) (automatic)

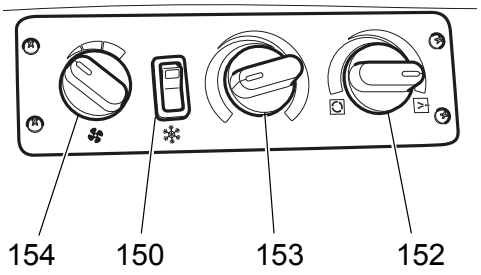
4 Heater, fan, air conditioning system

4.1 Heater

Cab heating is controlled by the temperature selector (153).

Procedure

- Turn to the right - higher temperature
- Turn to the left - lower temperature



Fan

➔ The fan speed is controlled with the (154) switch.

4.2 Air conditioning system (○)

➔ Keep doors and windows closed when the air conditioning system is on – this ensures the maximum cooling performance when the air circulation flap is fully opened. The air is continuously filtered both in heating and in air conditioning mode.

⚠ CAUTION!

Extreme temperature differences can affect your health.

- ▶When using the air conditioning system make sure the temperature is no higher than 6°C more than the outside air temperature.
- ▶Keep the doors and windows closed when the air conditioning system is switched on.
- ▶Do not direct discharge jets at other people.
- ▶There should be no draft effect.

4.2.1 Air Conditioning Mode

⚠ CAUTION!

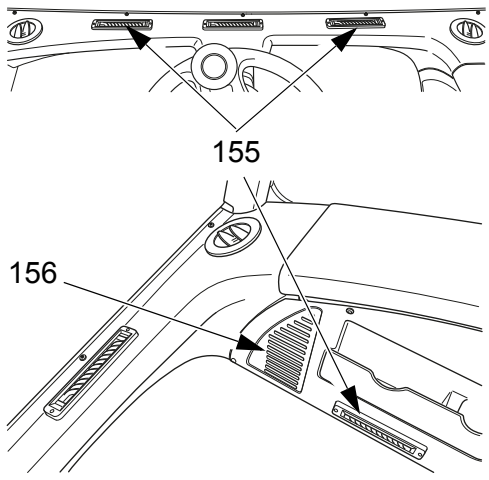
Never aim the nozzles directly at other people.

- ▶The discharge should always be directed to prevent any draft effect.

Starting the truck

Procedure

- The fan switch (154) and rocker switch (150) turn the air conditioning system on and off (green indicator lamp in the rocker switch (150) is lit during operation).



11.14 EN

- The air flow of the air conditioning system is controlled by discharge jets (155) and an intake nozzle (156) in the legroom (recirculated air) and by drawing in outside air.

⚠ CAUTION!

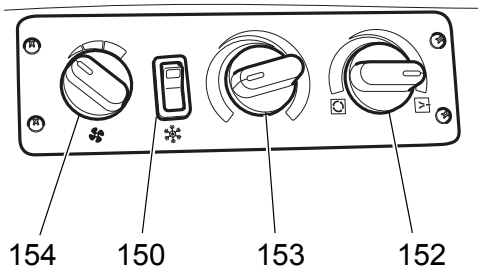
▶ The intake nozzle (156) must always be unobstructed

The air flow in the cab is set via the discharge jets.

4.2.2 Function of the controls

Procedure

- Switch (152) to the left: Recirculated air
- Switch (152) to the right: Outside air
- Centre position of the switch (152): Combination of recirculated air / outside air
- Switch (153) provides additional temperature control.
- The air flow is controlled by switch (154).



➔ Switch off the entire system before parking the truck. To switch off the entire system, turn the fan switch (154) all the way to the left and press the rocker switch (the green lamp goes out).

4.2.3 Air conditioning operation notes

➔ If there is a high level of air humidity in the truck, switch on the air conditioning system. To distribute air evenly to all the discharge jets, set the fan switch (154) to the highest level, set the temperature selector (153) as required and open the side sliding window a notch. When the humidity has been removed from the interior of the truck close the windows again and set the required air flow.

➔ To cool off the interior quickly, turn on the air conditioning system. To distribute air evenly, open all the discharge jets. Set the fan switch (154) to the highest level and open the side sliding window a notch. When the desired temperature has been reached, close the windows again and set the required air flow.

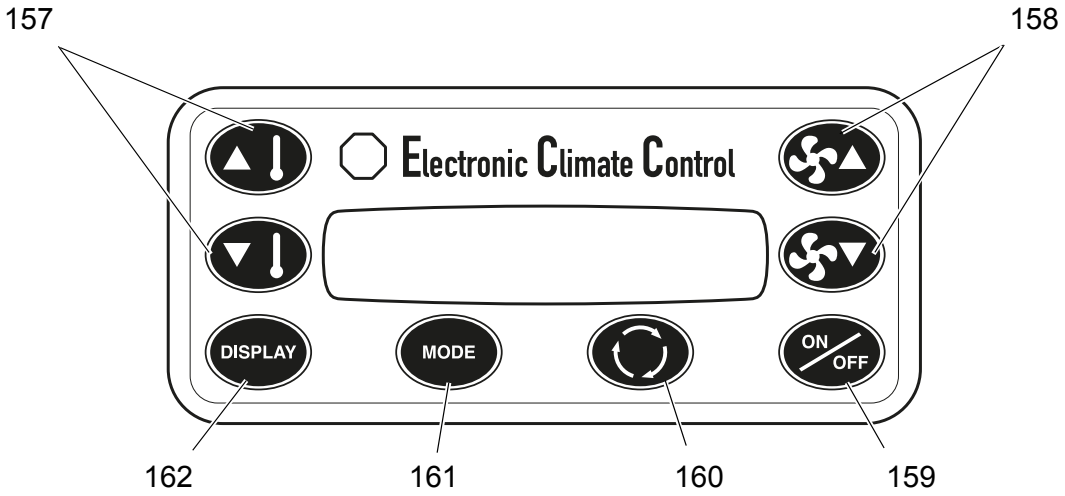
➔ To guarantee maximum operation of the air conditioning system it must be switched on in the cold season at least once a month for about 10 minutes (refrigerant needs to be recirculated).

➔ When the air conditioning system is operating, condensation water may be visible underneath the truck. This happens during the air dehumidification process, in particular at high external temperatures and high air humidity.

⚠ CAUTION!

Regular servicing of the air conditioning system is required to ensure it can work at a consistently high level, see "Servicing and Inspection" on page 199.

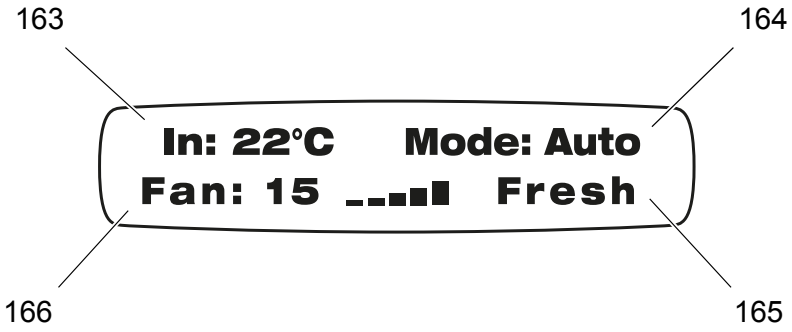
4.2.4 Automatic air conditioning



Item	Description	Description
157	Internal temperature setpoint	Setting for the desired internal temperature. The adjustment range is between 16°C (60°F) and 28°C (82°F). The setting should be no more than 5° - 6°C below the current outside temperature.
158	Fan	The fan speed can be adjusted up and down with the Up/Down buttons. The display is shown as a percentage.
159	ON / OFF	Turn the system on and off.
160	Air mix control	Setting of the outside and inside air. The setting can range from outside air to completely recirculated air.
161	Mode	Setting for the work mode of automatic air conditioning (automatic, heating, cooling, defrosting, fuel preheating (○)).
162	Display	Display of inside or outside temperature.

➔ When the setting for completely recirculated air is selected, the supply of outside air is shut off.

4.2.5 Displays



163	Display of inside or outside temperature
164	Current operating mode
165	Current air supply (Fresh = fresh air, Rec = recirculated air)
166	Current fan output

4.2.6 Notes on automatic air conditioning operation

– Automatic mode:
The set internal temperature is maintained automatically.
– Heater mode:
The cab is heated. The air conditioning compressor is switched off.
– Cooling mode:
The cab is cooled. The air conditioning compressor is switched on at an external temperature 10 °C and switched off at an external temperature of 8 °C. Fan output is controlled automatically.
– Defrosting mode:
The cab windows are defrosted. All air jets under the windows must be opened. The heater is activated. Fat output is at the highest stage.
– Fuel preheating (○)
All other functions are deactivated.

⚠ CAUTION!

Regular servicing of the air conditioning system is required to ensure it can work at a consistently high level, see "Servicing and Inspection" on page 199

5 Preparing the Truck for Operation

5.1 Checks and operations to be performed before starting daily operation

⚠ WARNING!

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

If damage or other truck or attachment (optional 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.

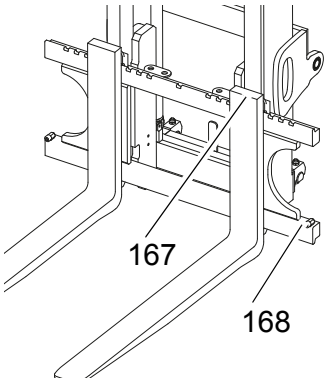
▶ Mark defective truck and take out of service.

▶ Do not return the industrial truck to service until 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.



Checks before daily operation

Procedure

- Visually inspect the entire truck (in particular the wheels, wheel bolts and load handler) for damage.
- Check the fork stop (167) and fork tine retainer (168).
- 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 jam 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 brake and parking brake: Start driving carefully and test the effectiveness of the brake pedal.
- Check the fuel supply.
- Check the fluid level of the window washer system (○), see "Adding Window Washer System Fluid" on page 182.

- Check the LPG system is working correctly, see "LPG containers" on page 54
- Attachment: Visually inspect bearing points, guides and stops for wear and damage and lubricate these components.
- Visually inspect battery and battery components.
- Check that the battery cable is positioned securely.
- Engine oil check.
- Checking the coolant level.
- Check hydraulic oil level and top up if necessary.
- Check wheels and tyres for damage.
- Test lighting.
- Check radiator and clean if necessary.

LPG only

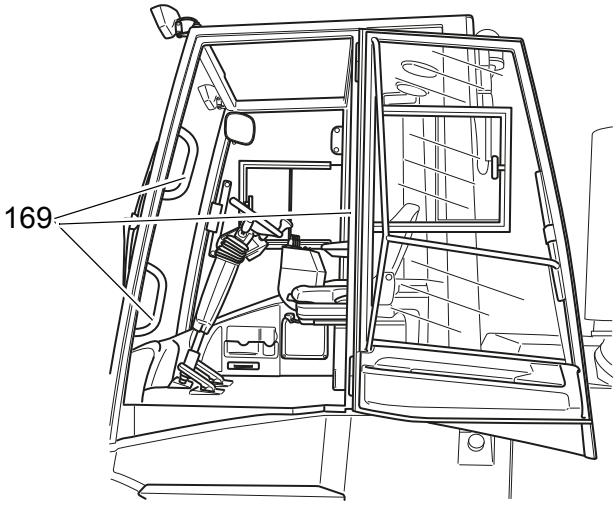
Procedure

- Check the gas system is working correctly, see "LPG containers" on page 54
- Leak test (smell of gas?).
- Leak test after bottle replacement.
- Check gas hoses for damage (visual inspection).
- Check that the gas line connection are secure.
- Test the entire gas system for leaks using a leakage spray.

5.2 Entry and exit

Procedure

- Open the cab door (○).
- To enter and exit the cab, hold onto the handle (169). Always face the truck when entering and exiting.



➔ Always use the entry aid (169) provided to climb onto the truck.

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

5.3 Setting up the operator position

⚠ WARNING!

Accidents can occur if the driver's seat, steering column and armrest are not engaged

The driver's seat, steering column and armrest can accidentally adjust during travel and therefore cannot be operated safely.

▶ Do not adjust the driver’s seat, steering column or armrest 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.

5.3.1 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.

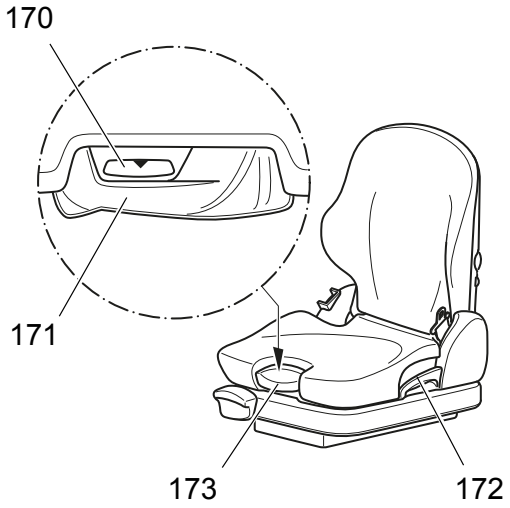
▶ Do not adjust the driver’s seat while travelling.

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

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

▶ Hold the weight setting lever 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 (171) as far as it will go in the arrow direction
- Move the weight adjustment lever (171) up and down to set the seat to a higher weight.
- Move the weight adjustment lever (171) 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 (170). 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 (171) back in full.

The driver's weight is now set.

Adjusting the backrest

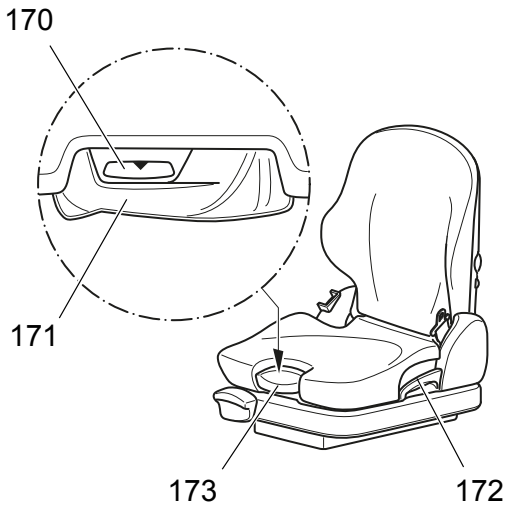
Procedure

- Sit on the driver's seat.
- Pull the lever (172) to adjust the backrest.
- Adjust the backrest tilt.
- Release the lever (172) again. The backrest is locked.

The backrest is now set.

➔ Hold the weight setting lever (171) only by the recess, never reach through underneath the lever.

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 lever173 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 (173) in position.

The seat position is now correctly set.

5.3.2 Adjusting the steering wheel / steering column

⚠ CAUTION!

Do not adjust the steering wheel while travelling

Individual steering wheel position

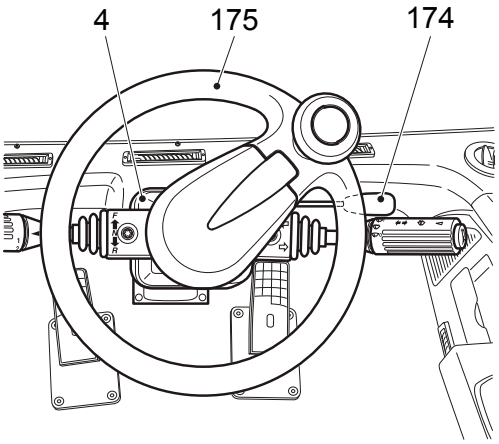
➔ The steering wheel can be height- and tilt-adjusted to suit the operator.

Adjusting the Tilt

Procedure

- Pull up on the adjusting lever (174).
- Tilt the steering wheel (175) forward or backward as required.
- Push the adjusting lever into the centre position.

The steering column tilt is adjusted.



Adjusting the Height

Procedure

- Push down on the adjusting lever (174).
- Adjust the steering column (4) to the required height.
- Pull the adjusting lever (174) into the centre position.

The steering column height is adjusted.

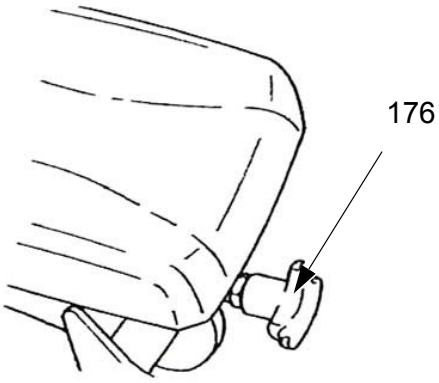
5.3.3 Adjusting the arm rest

The height and angle of the armrest can be adjusted with the screw (176).

Procedure

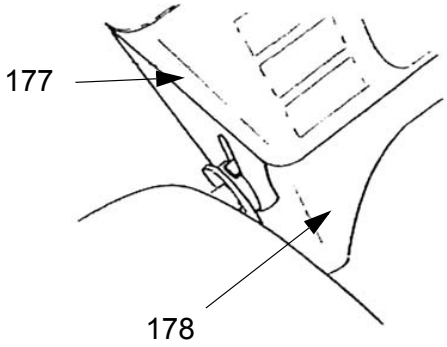
- Turn the screw clockwise - the armrest is raised.
- Turn the screw anti-clockwise - the armrest is lowered.

The armrest is adjusted.



5.3.4 Adjusting the Control Panel

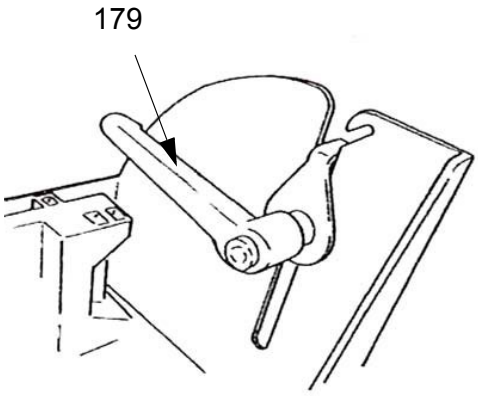
The height and tilt of the control panel (177) can be changed. This makes it possible to adjust the armrest (178) and control panel optimally to each other.



Procedure

- Release the lever (179).
- Move the control panel to the required position.
- Pull the lever tight again.

The control panel is adjusted.

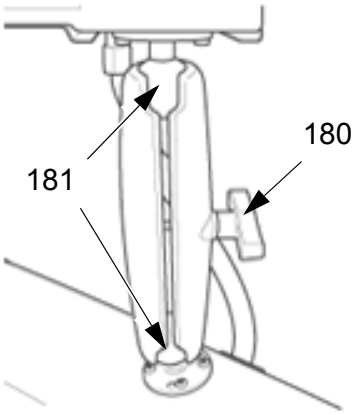


5.3.5 Adjusting the Multifunction Display

To ensure an optimum view of the multifunction display, it can be individually adjusted.

Procedure

- Sit on the driver's seat.
- Adjust the seat to its optimum position.
- Loosen the central wing screw (180) of the display holder just enough so that the two ball joints (181) can be moved freely in the holder.
- Move the display to the desired position and retighten the central wing screw (180).



5.4 Seat Belt

⚠ WARNING!

Travelling without a seat belt increases the risk of injury.

Accidents or personal injury can result if the seat belt is not worn or is modified.

- ▶ Always put the seat belt on 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.
- ▶ Report any defects immediately to your supervisor.
- ▶ Remove the truck from service until a functional seat belt has been fitted.

➔ 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.

Checking the seat belt

Procedure

- Check the attachment points for wear and damage.
- Check the cover for damage.
- Pull the belt out fully from the retractor and check for damage (loose seams, fraying and nicks).
- Test the belt buckle and make sure the belt returns correctly into the retractor.

Check the automatic locking system

Procedure

- Park the truck on a level surface.
- Jerk the seat belt out suddenly.

➔ The locking system should prevent the belt from coming out.

The seat belt has now been checked.

6 Industrial Truck Operation

6.1 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 point loading on the travel lanes.
At blind spots get a second person to assist.
The driver must ensure that the loading dock /dock leveller cannot be removed 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 operator 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 operator 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.

Do not use a mobile phone or walkie-talkie without a handsfree device while operating the truck.

Hazardous situations

If the truck is about to tip over, do not loosen the seat belt. The operator must not jump off the truck. The operator 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 operator must look in the direction of travel and must always have a clear view of the route ahead. If the truck is carrying loads that affect visibility, the truck must travel against the load direction. 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 operator. 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 and 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 facing uphill. The industrial truck must not be turned, operated at an angle or parked on inclines and 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, loading ramps and docks

Lifts may only be negotiated 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. Persons riding in the lift with the forklift truck must only enter the lift after the truck has come to a rest and must leave the lift before the truck. The driver must ensure that the loading ramp / dock 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 the manufacturer's customer service department.

For safety instructions on the nature of loads to be carried with attachments,see "Lifting, transporting and depositing loads" on page 113.

Towing trailers

The truck may only be used occasionally to tow trailers, see "Towing trailers" on page 128

⚠ 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 operator must comply with legal requirements, technical standards and health and safety regulations when operating an IC motor powered lift truck in closed rooms.

6.2 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.

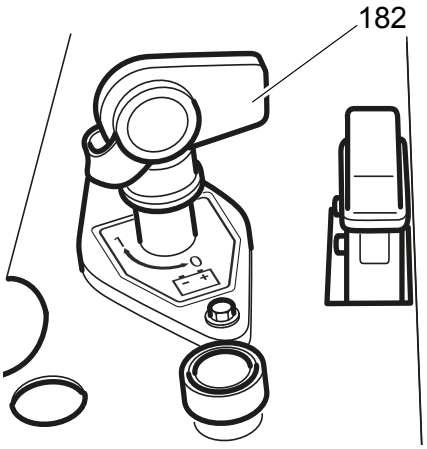
Requirements

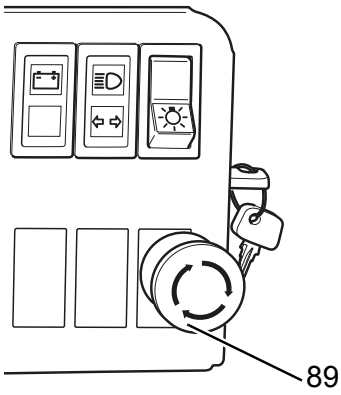
– Checks and operations to be performed before starting daily operation, see "Checks and operations to be performed before starting daily operation" on page 86.

Switching On the Truck

Procedure

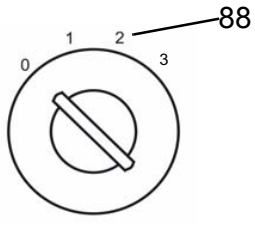
- Turn the battery isolator (182) to position "1".
- Unlock the Emergency Disconnect (89),
  - Turn the rotary button until the switch unlocks.
- Set the travel direction switch to neutral position N.
- Parking brake is activated.
- Carry out the appropriate starting procedure for the engine type; see 6.2.1 "Starting procedure for the DFG" or 6.2.2 "Starting procedure for the TFG".





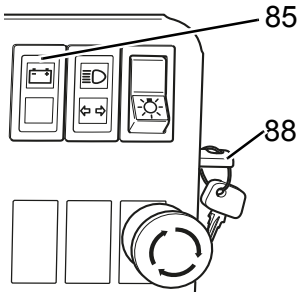
6.2.1 Starting procedure for the DFG

Procedure



- Insert the key in the key switch (88) and turn it to the “2” position.
- The pre-heat indicator lamp lights up and goes out automatically as soon as the required pre-heat time (approx. 4 seconds) has been reached.
- All the indicators light up briefly to test operation.

➔ All the indicators except for the engine oil pressure display, parking brake indicator, indicator lamp for neutral position and battery control light (85) should go out after a short while. If not, stop the start-up process and rectify the fault.



- Turn the key to position "3".

➔ Only apply the starter for a maximum of 15 seconds without interruption. The truck is equipped with an immobiliser which prevents it from starting again while the engine is running.

- Release the key as soon as the engine starts. The key automatically reverts to the "2" position.

➔ All indicators lights except for neutral position and parking brake should go out as soon as the engine starts. If not, stop the engine immediately and rectify the fault.

Truck is operational.

6.2.2 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 49)

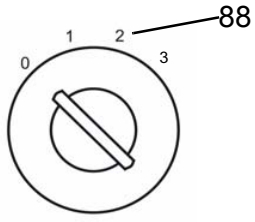
▶ Close the gas bottle shut-off valve.

▶ Set the key switch to "O"

▶ Notify your superior.

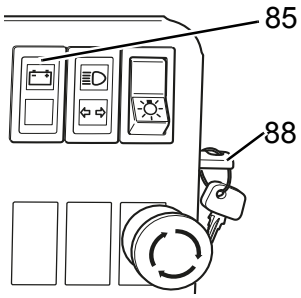
Procedure

- Slowly open the shut-off valve on the LPG bottles, see "LPG bottles" on page 54.
- Insert the key in the key switch (88) and turn it to the “2” position.



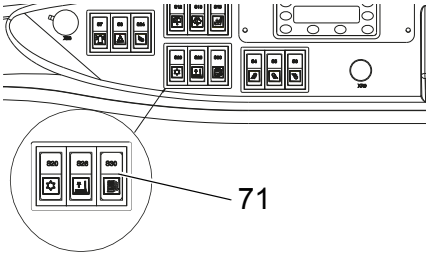
- All the indicators light up briefly to test operation.

➔ All the indicators except for the engine oil pressure display, parking brake indicator, indicator lamp for neutral position and battery control light (85) should go out after a short while. If not, abandon the starting procedure and rectify the fault.



- Select the LPG supply by pressing the (71) switch, see "Operating the Twin Bottle System and Liquid Gas Tank" on page 56.
- Turn the key to position "3".

➔ Apply the starter for no more than 15 seconds without interruption. The truck is equipped with an immobiliser which prevents it from starting again while the engine is running.



- Release the key as soon as the engine starts. The key automatically reverts to the "2" position.

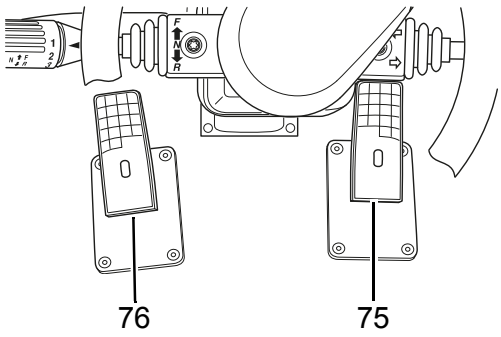
➔ All indicators lights except for neutral position and parking brake should go out as soon as the engine starts. If not, stop the engine immediately and rectify the fault.

Truck is operational.

6.3 Operational Checks

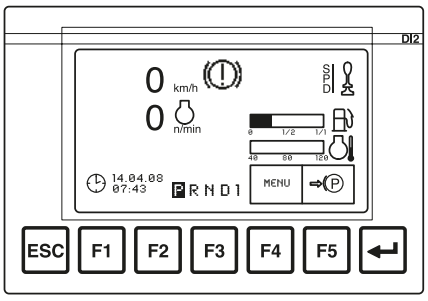
⚠ WARNING!

After starting the engine, perform the following operational checks:



Procedure

- Check whether the parking brake is locked in place.
- Turn the steering wheel as far as it will go in both directions and test the steering.
- Test the lift/lower, tilt and if applicable the attachment hydraulic control functions.
- Test the horn.
- Test the engine speed with the accelerator pedal (75) over a range of speeds while checking the freedom of movement of the pedal.
- Release the parking brake. Start driving carefully and press the parking brake (76) to test it.
- Press the "F5" button to lock the parking brake.



When all operational checks have been performed without problems, the truck is ready for operation.

6.4 Parking the truck securely

⚠ WARNING!

Switching off an LPG truck under ground level areas could result in explosions.

LPG is heavier than air. An explosive LPG/air mixture could therefore form under ground level areas without sufficient ventilation.

▶ LPG trucks may only be switched off in ground level rooms or higher and providing they are adequately ventilated. They must not be switched off 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.

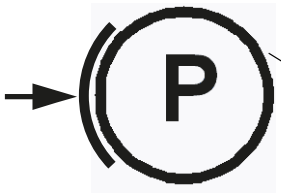
▶ Tilt the mast forward.

▶ Always apply the parking brake button before parking the truck.

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

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

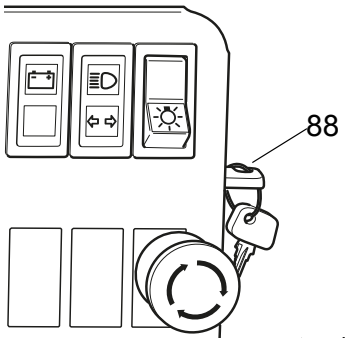
Parking the Truck Securely (DFG)



When you leave the truck it must be parked securely even if you only intend to leave it for a short time.

Procedure

- Turn the travel direction switch to idle (centre position).
- Press the "F5" button in the display: The brake shoe that appears in the "parking brake" icon (94) changes position to the right.
- Lower the load completely and position it horizontally.



NOTE

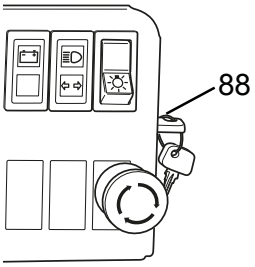
▶ Do not switch the engine off from full charge. Instead, let it run for a short while to allow the temperature to compensate.

- Turn the key in the key switch (88) to the "0" position and remove the key.

Parking the Truck Securely (TFG)

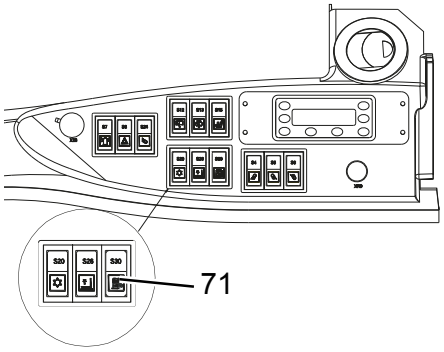
Procedure

- Turn the travel direction switch to idle (centre position).
- Press the "F5" button in the display. The brake shoe that appears in the "parking brake" icon (94) changes its position to the right.
- Lower the load completely and position it horizontally.



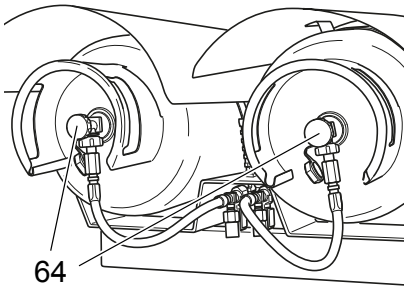
NOTE

▶ Do not switch the engine off from full charge. Instead, let it run for a short while to allow the temperature to compensate.



- Set the travel direction switch to neutral position.
- Turn the switch (71) to the upper position to close the electrical shut-off valves of the LPG bottles.
- Turn the key in the key switch (88) to the “0” position.
- Wait until the engine stops.
- Close the shut-off valves (64) of the LPG bottle securely.

After the motor is turned off, it continues running briefly for safety reasons. This uses up the remaining amount of LPG between the motor and the shut-off valve of the LPG system.



6.5 Emergency Disconnect

⚠ CAUTION!

Applying maximum braking can result in accidents

Applying the Emergency Disconnect switch during travel will cause the truck to decelerate to a halt at maximum force. This may cause the load to slide off the load handler. There is a higher risk of accidents and injury.

▶ Do not use the Emergency Disconnect switch as a service brake.

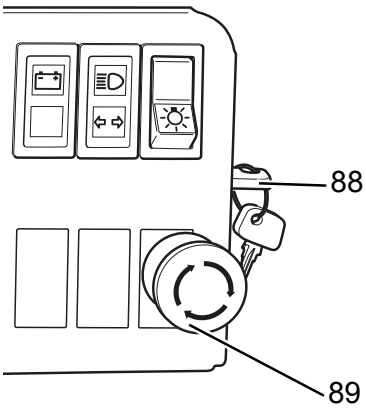
▶ Use the Emergency Disconnect switch during travel only in emergencies.

Applying the Emergency Disconnect

Procedure

- Press the Emergency Disconnect switch (89).

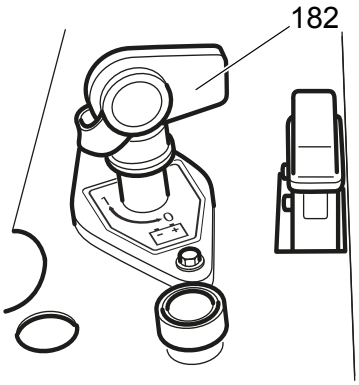
All electrical travel, steering and hydraulic functions are cut out. The truck brakes to a halt at maximum brake force.



6.5.1 Battery Isolator

Procedure

- Move the battery isolator (182) to position "1". All electrical functions are enabled.
- Move the battery isolator (182) to position "0" and remove it as necessary: All electrical functions are deactivated.



6.6 Travel

⚠ WARNING!

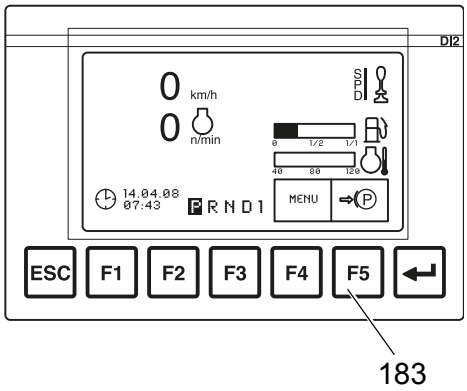
Improper travel can result in accidents

- ▶ 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.
- ▶ Do not lean out of the truck while travelling.
- ▶ Make sure that the travel area is clear.
- ▶ Adapt your travel speed to the route conditions in the work area and the load.
- ▶ Tilt the mast back and raise the fork carriage approx. 200 mm.
- ▶ Make sure you have sufficient visibility when reversing.

Travel

Requirements

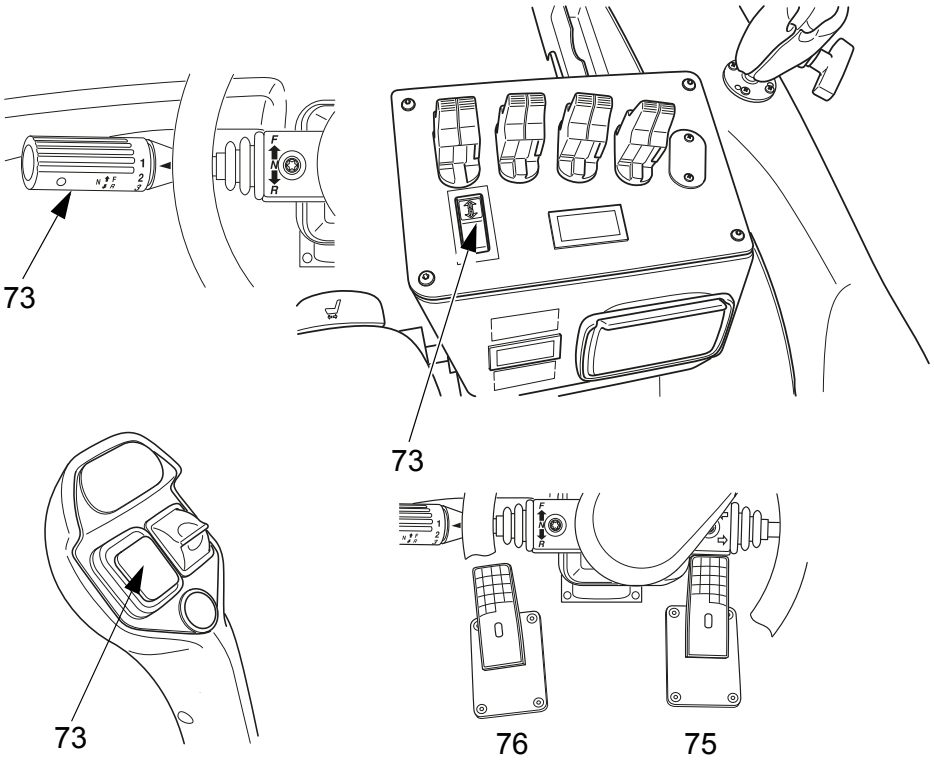
– Truck prepared for operation, see "Preparing the truck for operation" on page 99.



Procedure

- Release the parking brake, to do this press the "F5" button (183).
- Choose the travel direction with the travel direction switch (73).
- Raise the fork carriage approx. 200 mm.
- Tilt the mast back.
- Apply the accelerator pedal (75). The travel speed is governed by the accelerator (75).

The truck travels in the direction selected.



➔ Adjust the automatic gearshift with the rotary button on the lever (73).

– Stage "1": transmission does not switch into 2nd gear.
– Stage "2": the truck starts in 1st gear and automatically switches to 2nd gear as soon as the truck reaches a speed of 7-8 km/h.

➔ As soon as the speed is more than 3 - 4 km/h, the travel direction can no longer be changed. The reversing disable makes it impossible to change the travel direction from forward to reverse at high speed.
As soon as the speed is more than 8 km/h, it is not possible to switch from 2nd gear to first gear.

Changing Travel Direction

Press the pedal (76) to bring the truck to a standstill. Change the travel direction with the travel direction switch. Resume travel.

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.

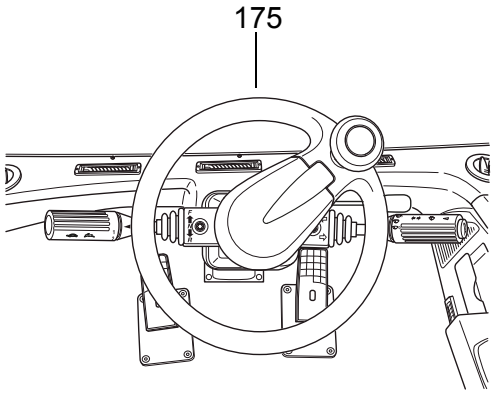
6.7 Steering

Steering

Procedure

- Very little steering effort is required; you should therefore turn the steering wheel (175) 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.



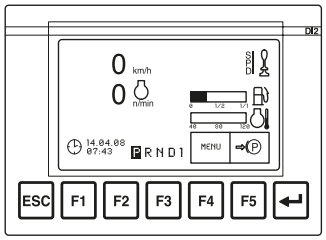
6.8 Brakes

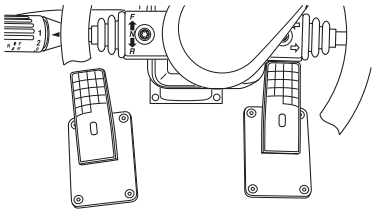
⚠ WARNING!

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.
- ▶ Use the service brake in emergencies.





76 75

There are two ways of braking:

– Service brake (76)

and for secure parking:

– Parking brake ("F5" button)

The truck has two brake systems that work independently of each other, a service brake and a parking brake.

6.8.1 Service brake

The drive coupling is deactivated in the first half of the pedal path. The tow force of the truck is reduced proportionately to how far the brake pedal is depressed (76).

The service brake is activated in the last half of the pedal path. If the pedal is depressed further, the truck is brought to a stop. The brake force is proportional to the pedal path.

To allow the truck to move slowly, first step on the brake pedal (76). The press the accelerator pedal (75). Carefully release the brake pedal (76). The truck begins to move slowly.

6.8.2 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 fork tines. There is an increased risk of accidents and injury!

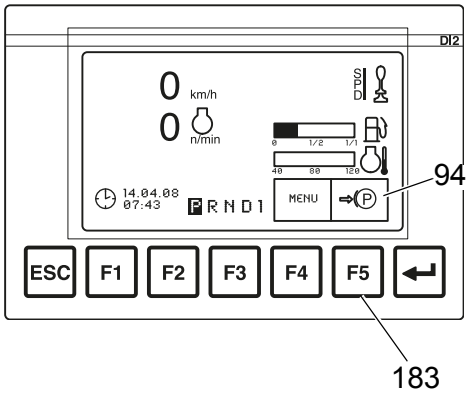
➔ The parking brake can be used as an emergency brake.

Procedure

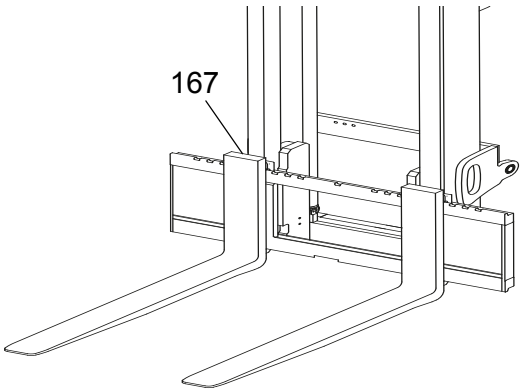
- To activate the parking brake, press the "F5" button (183). The arrow that appears in the "parking brake" icon (94) changes its position to the right.

⚠ CAUTION!

The parking brake is automatically activated when the driver's position is vacated.



6.9 Adjusting the forks



⚠ WARNING!

Trapping hazard

There is a trapping hazard when you perform this operation.

▶ Wear work gloves and safety shoes.

⚠ WARNING!

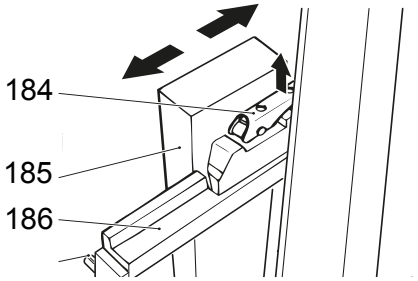
Unsecured and incorrectly adjusted fork tines can cause accidents

▶ Adjust the two fork tines so that they are equidistant from the outside edge of the fork carriage.

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

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

Adjusting the forks



Requirements

– Park the truck securely, see "Parking the truck securely" on page 103.

Procedure

- Lift up the locking lever (184).
- Push the forks (185) into the correct position on the fork carriage (186).

➔ To lift the load securely, the forks (185) 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 (185).

- Lift the locking lever down (184) and move the forks until the locking pin engages in a slot.

The forks are now adjusted.

6.10 Replacing the forks

⚠ WARNING!

Unsecured fork tines can cause injury

You can injure your legs when replacing the fork tines.

▶ Never pull the fork tines towards your body.

▶ Always push the fork tines away from your body.

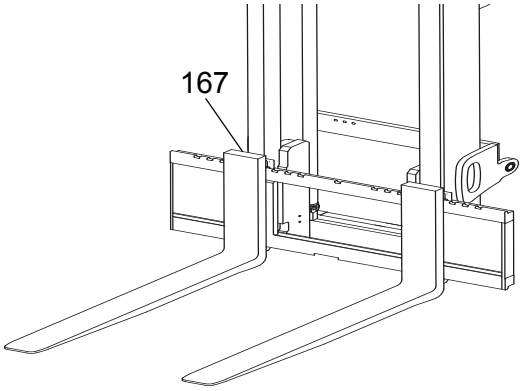
▶ Secure heavy fork tines with lifting slings and a crane before pushing them down from the fork carriage.

⚠ WARNING!

Trapping hazard

There is a trapping hazard when you perform this operation.

▶ Wear work gloves and safety shoes.



Replacing the fork tines

Requirements

– Load handler lowered and fork tines not touching the ground.

Procedure

- Loosen the fork stop (167).
- Carefully push the fork tines to the centre of the fork carriage and remove them.

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

6.11 Lifting, transporting and depositing loads

⚠ WARNING!

Unsecured and incorrectly positioned loads can cause accidents.

Before lifting a load the operator 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.
- ▶ Do not exceed the maximum loads specified on the capacity plate.
- ▶ Check the fork spread before lifting the load and adjust if necessary.
- ▶ Insert the forks as far as possible underneath the load.

Lifting loads

Requirements

– Load correctly palletised.
– Fork spread for the pallet checked and adjusted if necessary.
– Load 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 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 loads

Requirements

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

Procedure

- On slopes and inclines always carry the load facing uphill, never approach at an angle or turn.
- Accelerate and decelerate with care.
- 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.

Depositing loads

Requirements

– Storage location suitable for storing the load.

Procedure

- Set the mast vertical.
- Drive the truck 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 prevent damage to the load and the load handler.

- Lowers the load handler.
- Carefully remove the forks from the pallet.

The load is deposited.

6.12 Operating the lift mechanism and integrated attachments

⚠ WARNING!

Operating the lifting device and integrated attachments can be hazardous

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.
- ▶ If people do not leave the hazardous area despite the warning, prevent the truck from being used by unauthorised people.
- ▶ 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 exceed the maximum loads specified on the capacity plate.
- ▶ Do not 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 operator must be trained to handle the lift mechanism and the attachments.

6.12.1 Operating the Lifting Device with the Solo Pilot

Lifting and lowering

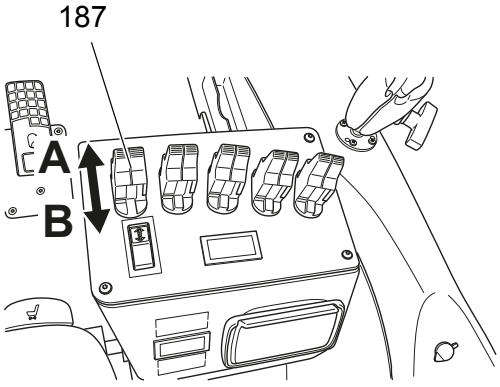
Requirements

– Truck prepared for operation, see "Preparing the truck for operation" on page 99.

Procedure

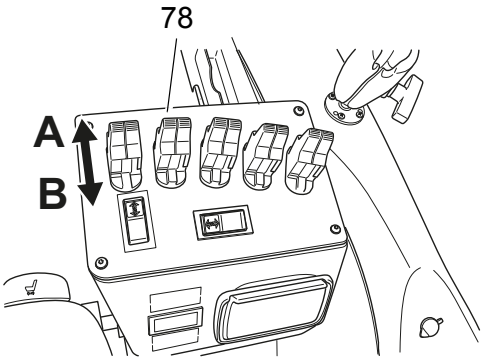
- Pull back on the lever (187). The load is raised.
- Press forward on the lever (187). The load is lowered.

The load is now raised or lowered.



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

Tilting the mast forward / backward



Requirements

– Truck prepared for operation, see "Preparing the truck for operation" on page 99.

Procedure

- Pull back on the lever (78). The mast tilts back.
- Push forward on the lever (78). The mast tilts forward.

The mast is now tilted back or forward.

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

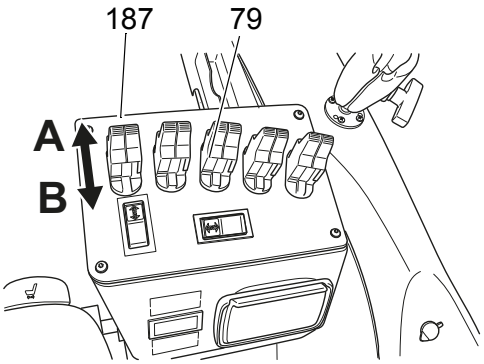
Depositing a load unit (SOLO-PILOT)

Procedure

- To place the load in a horizontal position: Press the lever (78) in direction (A).
- To position the load at the correct height: Press the lever (187) in direction (A or B).
- To lower the load: Press the lever (187) in direction (A).

➔ When you reach the limit position return the control lever to its home position.

Sideshifter (SOLO-PILOT)



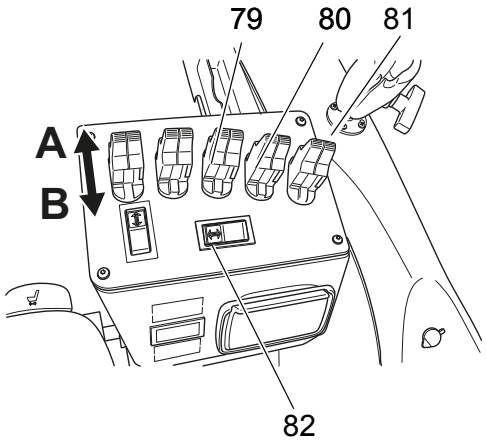
Procedure

- Push the lever (79) in direction (A). The fork tines are shifted to the right (as seen by the driver).
- Pull the lever (79) in direction (B). The fork tines are shifted to the left (as seen by the driver).

Fork Adjustment (SOLO-PILOT)

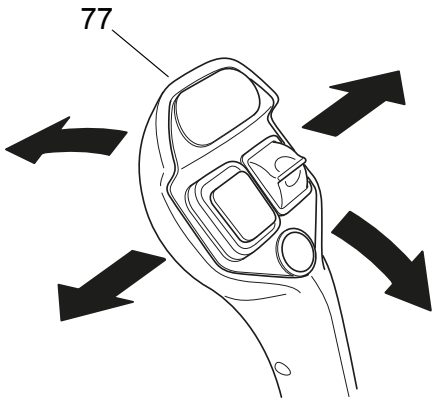
Procedure

- To adjust the fork to the width of the load:
  - Wider fork spread: Press the handle (80) in direction (A) while simultaneously pressing the acknowledgement key (82).
  - Narrower fork spread: Press the handle (80) in direction (B) while simultaneously pressing the acknowledgement key (82).
- To move both fork tines at the same time:
  - Right: Press the handle (80) in direction (A)
  - Left: Pull the handle (80) in direction (B).



6.12.2 Operating the lift mechanism with the Multi Pilot

Lifting and lowering



Requirements

– Truck prepared for operation, see "Preparing the truck for operation" on page 99.

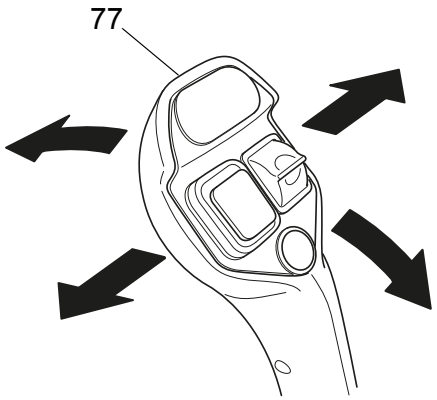
Procedure

- Pull back on MULTI-PILOT (77). The load is raised.
- Push MULTI-PILOT (77) forward. The load is lowered.

The load is now raised or lowered.

➔ When the end stop for the operation has been reached (there will be a noise from the pressure limitation valve) release MULTI-PILOT. MULTI-PILOT will revert automatically to the neutral position.

Tilting the mast forward / backward



Requirements

– Truck prepared for operation, see "Preparing the truck for operation" on page 99.

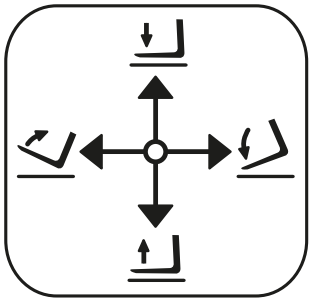
Procedure

- Push MULTI-PILOT (77) to the left. The mast tilts back.
- Push MULTI-PILOT (77) to the right. The mast tilts forward.

The mast is now tilted back or forward.

➔ When the end stop for the operation has been reached (there will be a noise from the pressure limitation valve) release MULTI-PILOT. MULTI-PILOT will revert automatically to the neutral position.

Twin operation



Requirements

– To prepare the truck for operation, see "Preparing the truck for operation" on page 99

Procedure

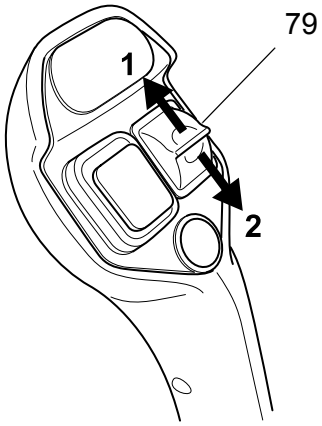
- To lower the load handler and tilt the mast forward at the same time, push the Multi Pilot forward and to the right.
- To lift the load handler and tilt the mast back at the same time, push the Multi Pilot back and to the left.
- To lower the load handler and tilt the mast back at the same time, push the Multi Pilot forward and to the left.

The mast is now tilted back / forward.

⚠ CAUTION!

▶To raise the load safely, set the fork tines as far apart from each other as possible and centrally to the truck. The load centre of gravity must lie centrally between the fork tines.

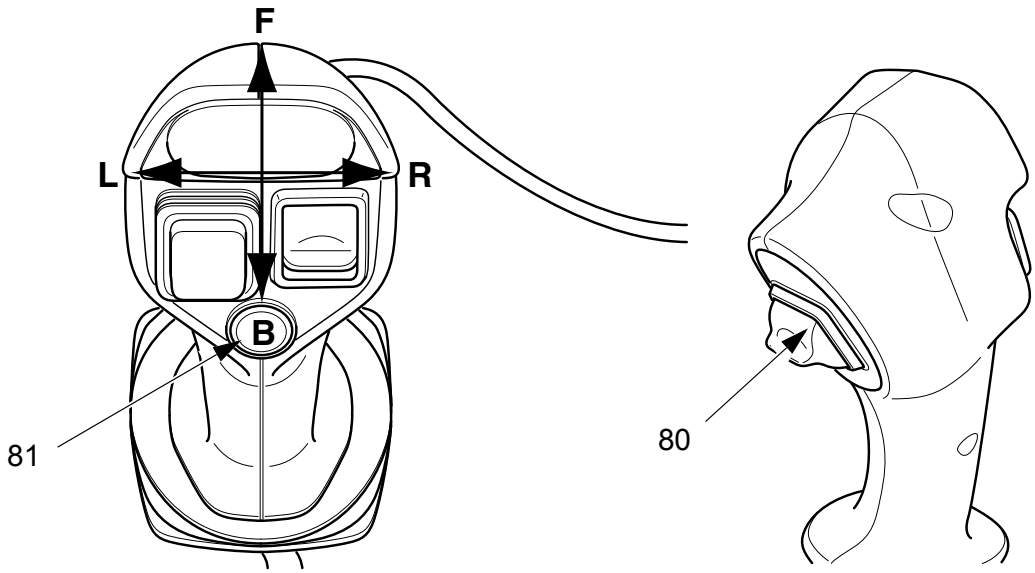
Sideshifter (MULTI-PILOT)



Procedure

➔ The references to left and right are based on load lifting as viewed from the operator's position.

- Sideshifter left: Press the control button (79) in direction (1).
- Sideshifter right: Press the control button (79) in direction (2).



Fork Adjustment (MULTI-PILOT)

Procedure

- Adjusting the fork makes it possible to set the fork to the width of the load.
  Wider fork spread: Press the control button (80) in direction (F) while simultaneously pressing the acknowledgement key (81).
  Narrower fork spread: Press the control button (80) in direction (B) while simultaneously pressing the acknowledgement key (81).

6.13 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 referenced ZH1, ZH2 and ZH3. Auxiliary hydraulic functions for exchangeable equipment are fitted with replacement couplings on the fork carriage.

⚠ 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 operating company must determine and apply suitable measures to ensure the safe operation of the truck. A lookout may have to be used or certain hazardous areas may have to be cordoned off. The truck can also be equipped with optional visual aids such as a camera system or mirrors. Travelling with visual aids requires plenty of practice at slow speed.

Safety instructions for sideshifter and fork positioner attachments

⚠ WARNING!

Restricted visibility and reduced tilt resistance can cause accidents

When using sideshifters and fork positioners, the change in centre of gravity can result in reduced lateral tilt resistance and accidents. Note that this affects visibility as well.

▶ Adapt the travel speeds to the visibility and load.

▶ Make sure you have sufficient 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 ZH2 or ZH3.

▶ 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 126.

Safety instructions for rotary attachments

⚠ WARNING!

A non-centred load 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 risk of tipover with extended telescopic attachments.

▶ Do not exceed the maximum loads specified on the capacity plate.

▶ Only use the telescopic function for stacking and retrieving.

▶ Retract the telescopic 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.

Transporting hanging loads can reduce the stability of the truck.

- ▶ 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.
- ▶ If the truck is to be operated with hanging loads, proof of sufficient safety distance under local operating conditions must be obtained from a specialist assessor.

Safety instructions for using loading buckets as attachments

⚠ WARNING!

Increased 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 86, check in particular check the fork carriage, mast rails and mast rollers for damage.

Fork extension safety instructions

⚠ WARNING!

Unsecured and oversized fork extensions can cause accidents.

- ▶ For fork extensions with an open cross sectional area, carry only loads that are resting along the entire length of the fork extension.
- ▶ Use only 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 86, check also 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 are free of dirt and foreign bodies near the entry opening point. Clean the fork extensions as required.

6.14 Operating additional attachments for the SOLO-PILOT

⚠ WARNING!

Incorrect symbols can cause accidents

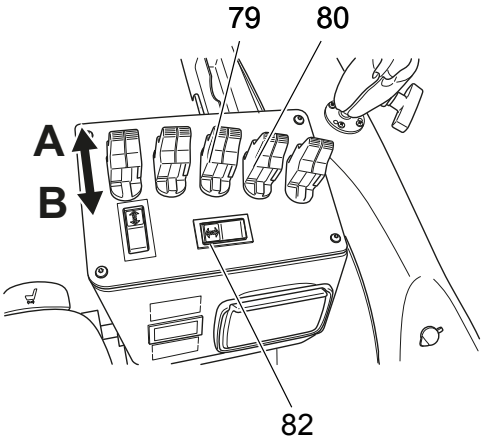
Symbols on controls that do not depict the function of the attachments can cause accidents.

▶ 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.

6.14.1 Solo Pilot with control of ZH1 and ZH2 hydraulic ports

Functions are assigned to the levers (79, 80) depending on the attachments used. Levers that are not required are void. For connections see "Fitting additional attachments" on page 126.



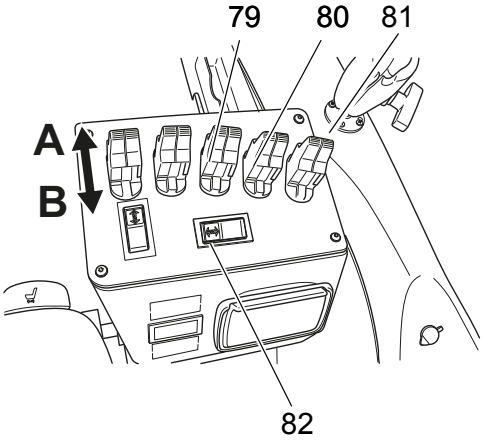
Procedure

- Operating hydraulic port ZH1:
  Move the lever (79) in direction A or B.
- Operating hydraulic port ZH2:
  Move the handle (80) in direction A or B while simultaneously pressing the (82) button.

The attachment performs its operation.

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

Functions are assigned to the levers (79, 80, 81) depending on the attachments used. Levers that are not required are void. For connections see "Fitting additional attachments" on page 126.



Procedure

- Operating hydraulic port ZH1:
  Move the handle (79) in direction A or B.
- Operating hydraulic port ZH2:
  Move the handle (80) in direction A or B while simultaneously pressing the acknowledgement key (82).
- Operating hydraulic port ZH3:
  Move the handle (81) in direction A or B while simultaneously pressing the acknowledgement key (82).

ZH3 does not have the acknowledgement function for ZH2.

The attachment performs its operation.

6.15 Operating additional attachments for the Multi Pilot

⚠ WARNING!

Incorrect symbols can cause accidents

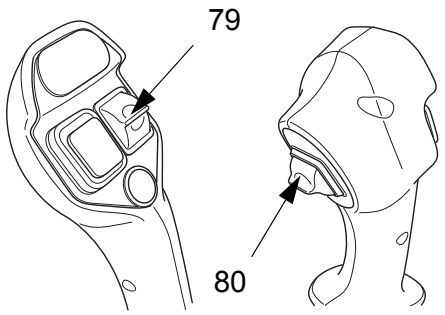
Symbols on controls that do not depict the function of the attachments can cause accidents.

▶ 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.

6.15.1 Multi Pilot with control of ZH1 and ZH2 hydraulic ports

Functions are assigned to the levers (79, 80) depending on the attachments used. Levers that are not required are void. For connections see "Fitting additional attachments" on page 126.



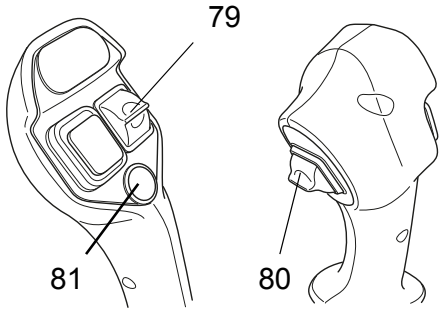
Procedure

- Operating hydraulic port ZH1:
  Press the button (79).
- Operating hydraulic port ZH2:
  Press the button (80).

The attachment performs its operation.

6.15.2 Multi Pilot with control of ZH1, ZH2 and ZH3 hydraulic ports

Functions are assigned to the levers (79, 80, 81) depending on the attachments used. Levers that are not required are void. For connections see "Fitting additional attachments" on page 126.



Procedure

- Operating hydraulic port ZH1:
  Press the button (79).
- Operating hydraulic port ZH2:
  Apply the (80) button and the acknowledgement key (81) simultaneously.
- Operating hydraulic port ZH3:
  Apply the (80) button and the acknowledgement key (81) simultaneously.

ZH3 does not have the acknowledgement function for ZH2.

The attachment performs its operation.

6.16 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.
- ▶ Observe the manufacturer's operating instructions.
- ▶ Before starting, check the fasteners are positioned correctly and securely and make sure they are complete.
- ▶ Before starting, make sure the attachment is working correctly.

⚠ 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.

Hydraulic ports

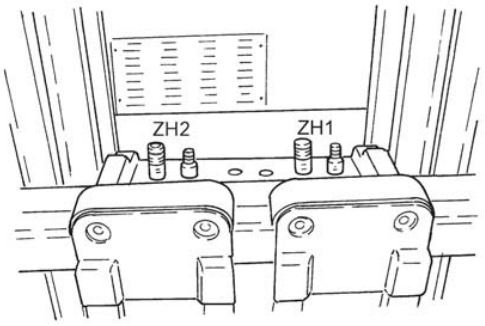
Requirements

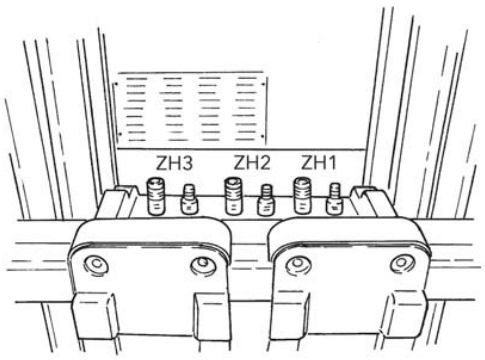
– Non-pressurised hydraulic hoses.
– Attachment directions of movement defined to match the controls' direction of movement.

Procedure

- Non-pressurised hydraulic hoses
- Switch off the truck and wait a few minutes.
- Attach the plug connector and engage it in position.
- Mark the controls with symbols that indicate the function of the attachment.

The attachment is hydraulically connected.





➔ 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.

7 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 38. If a load is also transported on the load handler, 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.

⚠ 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.

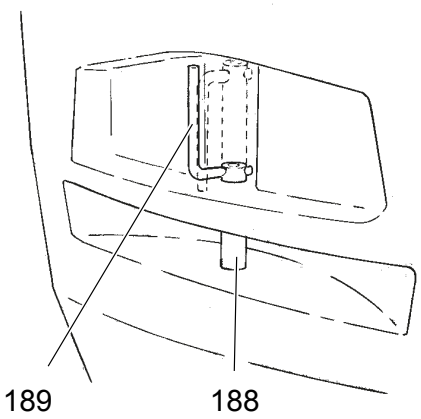
▶ The tiller must be horizontal, tilted down by no more than 10° and never facing up.

Attaching the trailer

Requirements

– Truck and trailer are on a level surface.

– Trailer prevented from rolling away.



Procedure

- The handle (189) is moved to a horizontal position and the bolt (188) is raised so that the coupling fork becomes free. Then position the handle (189) vertically so that the bolt (188) remains in place.
- Insert the trailer tiller into the opening.
- Move the handle (189) to a horizontal position let down the bolt (188), thereby locking the handle (189) in a vertical position.

The trailer is now attached to the truck.

8 Optional equipment

8.1 Rotating Driver's Seat

8.1.1 Functional Description

The driver's seat is turned via an electric motor. The electric motor is located under the cab. Travel is activated for the following seat positions:

– 0° seat position: Seat facing the load handler.
– 90° seat position (○): Seat facing the driver's door.
– 180° seat position: Seat facing the counterweight.

➔ Travel is inhibited while the driver's seat rotates.

➔ The travel direction switch must be set to neutral after the rotary movement is complete, and the travel direction can then be selected.

The truck is equipped with two sets of spot lights for forward and reverse travel. The spot lights can be activated to match the selected travel direction.

8.1.2 Emergency Disconnect

⚠ CAUTION!

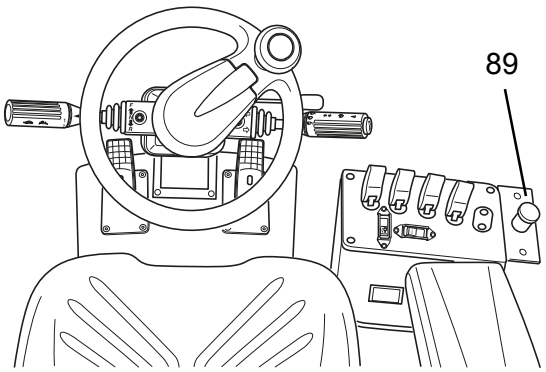
Applying maximum braking can result in accidents

Applying the Emergency Disconnect switch during travel will cause the truck to decelerate to a halt at maximum force. This may cause the load to slide off the load handler. There is a higher risk of accidents and injury.

▶Do not use the Emergency Disconnect switch as a service brake.

▶Use the Emergency Disconnect switch during travel only in emergencies.

An additional Emergency Disconnect switch (89) is included for the rotary seat option.



Applying the Emergency Disconnect

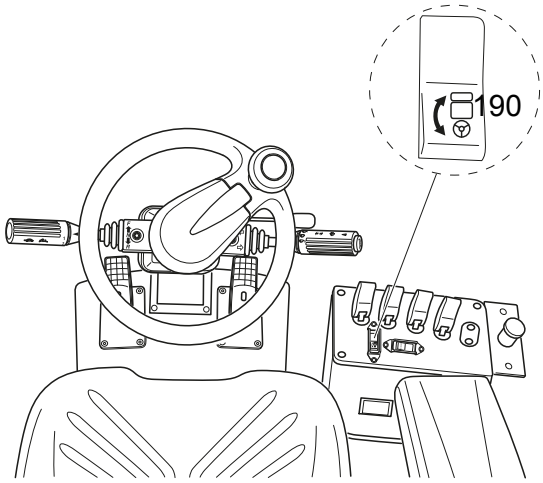
Procedure

- Press the Emergency Disconnect (89).

All electrical travel, steering and hydraulic functions are cut out. The truck brakes to a halt at maximum brake force.

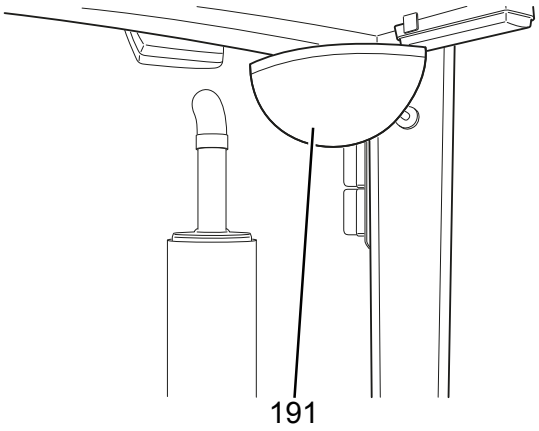
8.1.3 Rotary seat button

An additional rotary seat button (190) is included for the rotary seat option.



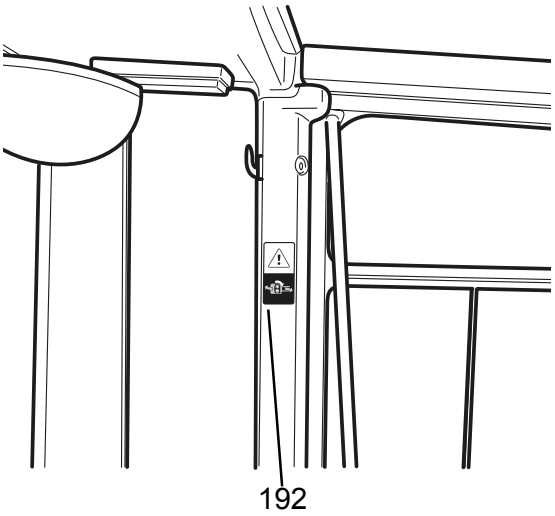
8.1.4 Panoramic mirror

➔ An additional panoramic mirror (191) is included for the rotary seat option.



8.1.5 Steering direction reversal notice sign

➔ An additional notice sign (192) is included for the steering direction reversal option.



8.1.6 Rotating the driver's seat

⚠ WARNING!

Rotary movement can result in trapping

When the driver's seat rotates parts of your body can be trapped between the cab and the driver's seat.

▶ The operator must remain seated on driver's seat during the rotary movement with both feet placed on the rotating panel.

▶ The door must remain closed.

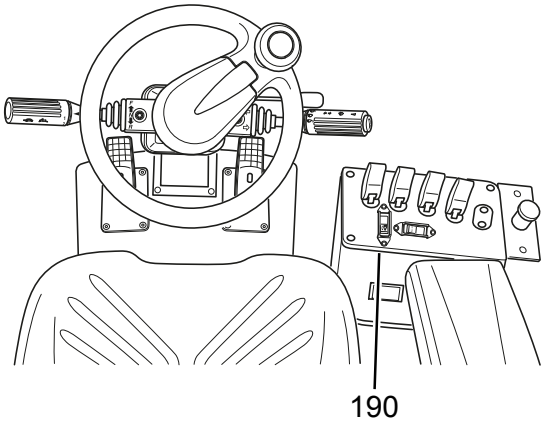
▶ No other persons are permitted in the cab.

Requirements

– Truck stationary.
– Operator on the driver's seat.
– Brake pedal activated.

Procedure

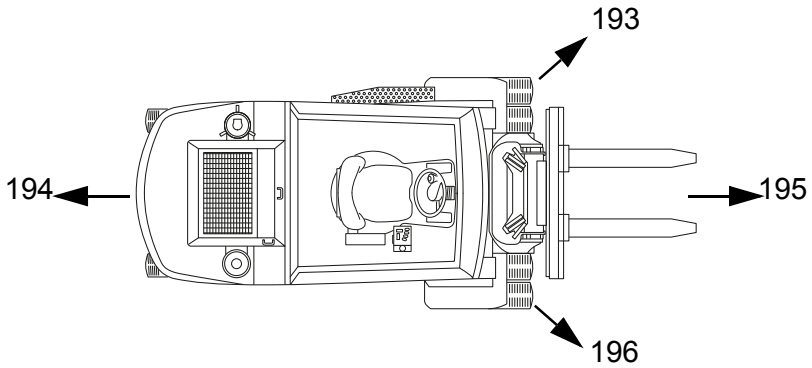
- To rotate the driver's seat:
  - Push the button (190) down and hold it down.
    The driver's seat rotates anti-clockwise.
  - Push the button (190) up and hold it in place.
    The driver's seat rotates clockwise.



→ Release the button (190) to stop the rotary movement of the driver's seat.

→ The rotary speed is reduced when the driver's seat has almost reached the 180° position. The rotary movement ends once the 180° position is reached. Release the button (190) to activate travelling.

8.1.7 Travelling in the 0° seat position



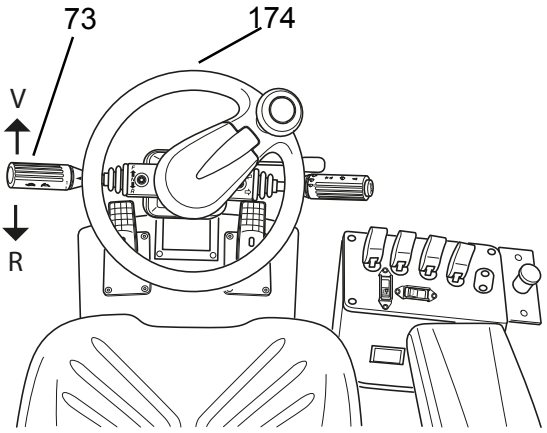
Item	Travel direction
193	Left
194	Reverse
195	Forward
196	Right

Selects the travel direction.

Procedure

- Set the travel direction switch (73) to direction V: The truck travels forward (195).
- Set the travel direction switch (73) to direction R: The truck reverses (194).

The truck travels in the direction selected.



Steers the truck

Procedure

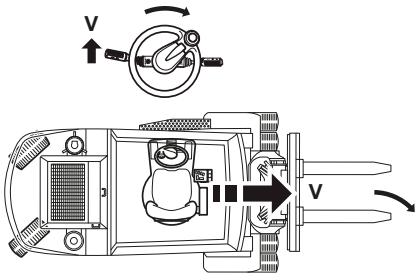
- To negotiate a right-hand bend (196): Turn the steering wheel (174) clockwise to match the desired steering radius.
- To negotiate a left-hand bend (193): Turn the steering wheel (174) anti-clockwise to match the desired steering radius.

The truck travels in the direction selected.

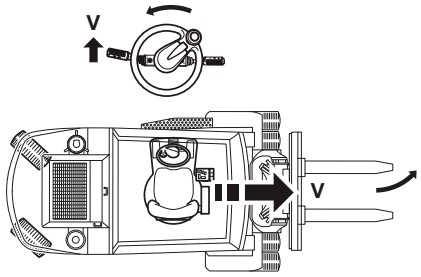
8.1.8 Travelling in the 90° seat position with steering direction reversal (○)

Forward travel direction

- To negotiate a right-hand bend:
  Travel direction switch in V, turn the steering wheel clockwise to match the desired steering radius.

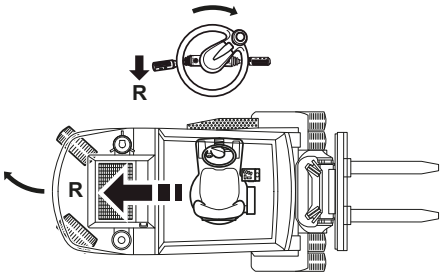


- To negotiate a left-hand bend:
  Travel direction switch in V, turn the steering wheel anti-clockwise to match the desired steering radius.

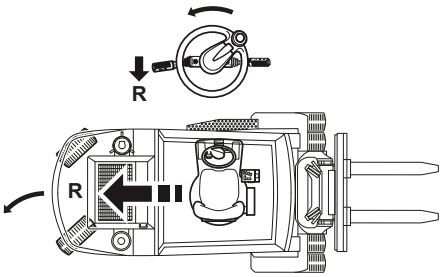


Reverse travel direction

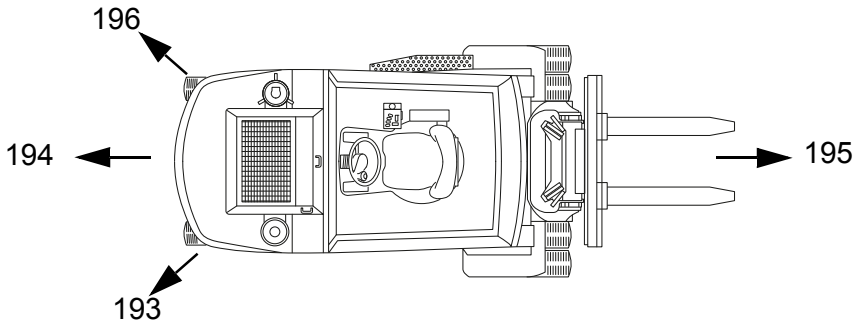
- To negotiate a right-hand bend:
  Travel direction switch in R, turn the steering wheel clockwise to match the desired steering radius.



- To negotiate a left-hand bend:
  Travel direction switch in R, turn the steering wheel anti-clockwise to match the desired steering radius.



8.1.9 Travelling in the 180° seat position



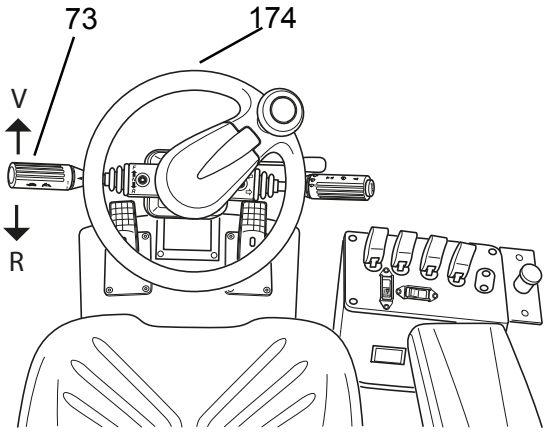
Item	Travel direction
193	Left
194	Forward
195	Reverse
196	Right

Selects the travel direction.

Procedure

- Travel direction switch (73) in direction V: The truck travels forward (194).
- Travel direction switch (73) in direction R: The truck reverses (195).

The truck travels in the direction selected.



Steers the truck

Procedure

- To negotiate a right-hand bend (196): Turn the steering wheel (174) clockwise to match the desired steering radius.
- To negotiate a left-hand bend (193): Turn the steering wheel (174) anti-clockwise to match the desired steering radius.

The truck travels in the direction selected.

8.1.10 Troubleshooting

Fault	Possible cause	Remedy
Truck operational, driver's seat does not rotate	– Travel speed too high – Operator not on the driver's seat – Faulty fuse	– Decelerate until the truck comes to rest – Operator on the driver's seat – Check fuse
Truck operational, driver's seat rotated, truck does not travel	– Driver's seat not in 0°, 90° (○) or 180° position	– Turn the driver's seat exactly to the 0°, 90° (○) or 180° position
Driver's seat rotated, truck switched off and on again, truck does not travel	– Driver's seat must be set to the 0° or 180° position after being switched off and on again.	– Rotate driver's seat exactly to the 0° or 180° position, switch truck off and on again

8.2 Sliding windows

⚠ CAUTION!

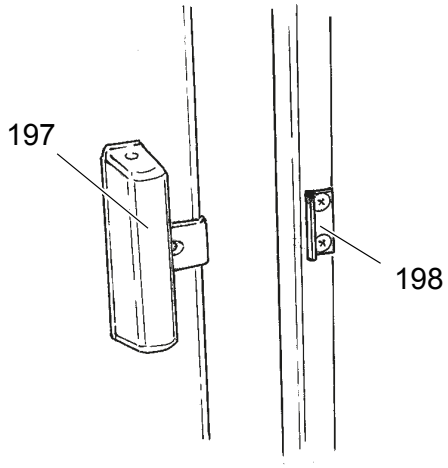
An unlocked sliding window can cause accidents

▶The sliding windows must be locked at all times.

Opening and closing the windows

Procedure

- Push the lock (197) up.
- Move the window forward or back.
- Insert the lock in the stop (198).



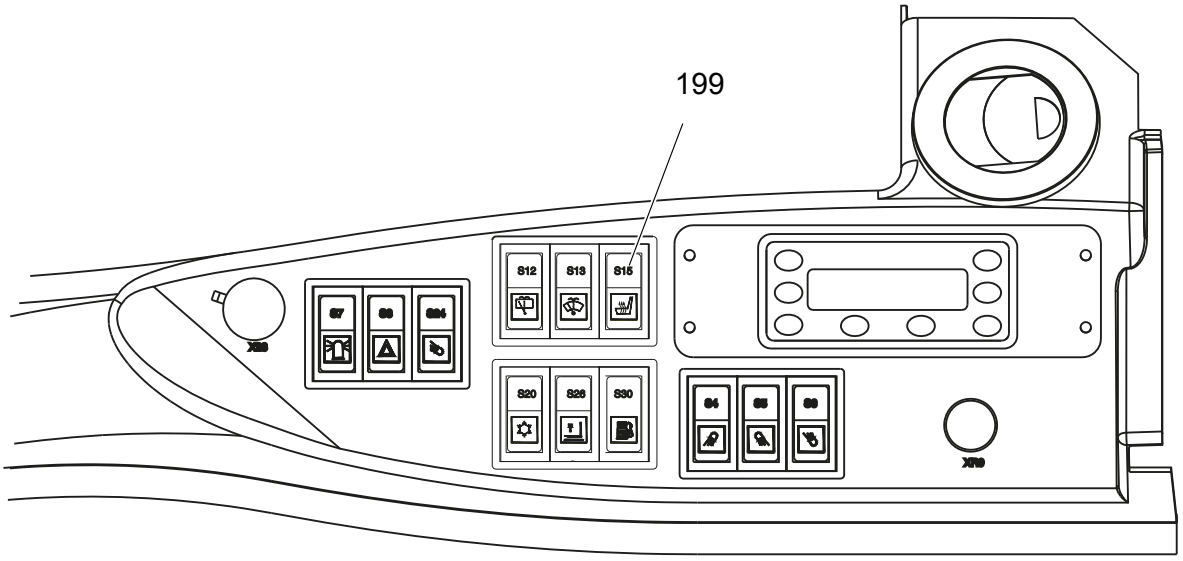
8.3 Emergency Exit

If a locking pin in the closing mechanism is removed, the right side window can be used as an emergency exit.

Procedure

- Open the window to its normal open position
- Use the upper ring to pull the locking pin out of the closing mechanism.
- Open the window all the way.

8.4 Driver'S Seat Heater



11.14 EN

Switching the seat heating on and off (optional equipment)

Procedure

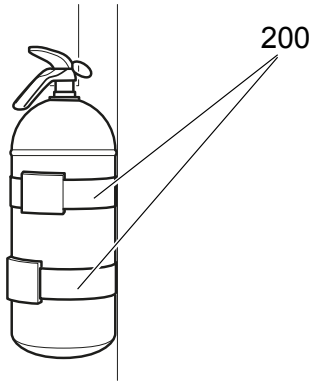
- Press the seat heating switch (199).
  Switch setting 1 = Seat heating on.
  Switch setting 0 = Seat heating off.

8.5 Fire Extinguisher

Procedure

- Open the fasteners (200)
- Pull the fire extinguish out of its bracket

To operate, refer to the illustrations on the fire extinguisher



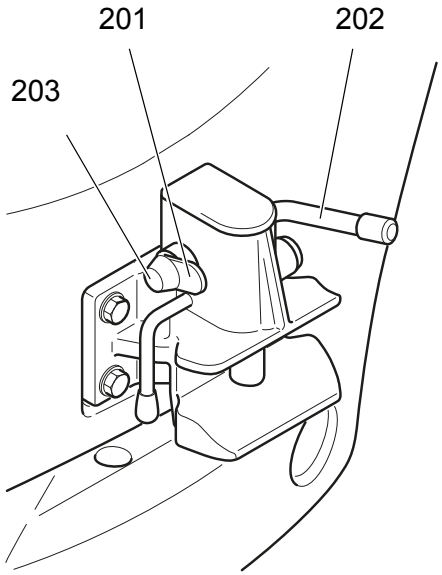
8.6 Rockinger Coupling with Hand Lever

Refer to the instructions for towing trailers, see "Towing trailers" on page 128.

⚠ CAUTION!

Incorrectly coupled trailers can cause accidents

- ▶Make sure the coupling is engaged securely before starting the truck.
- ▶The contro pin (203) must be flush with the control sleeve (201).



Rockinger Coupling Operation

Attaching a trailer

Procedure

- Prevent the trailer from rolling away.
- Adjust the trailer pull rod to the height of the coupling.
- Pull up on the hand lever (202).
- Slowly reverse the truck until the coupling engages.
- Press down on the hand lever (202).

Disconnecting a trailer

Procedure

- Prevent the trailer from rolling away.
- Pull up on the hand lever (202).

- Drive the truck forward.
- Press down on the hand lever (202).

9 Troubleshooting

9.1 Automatic Emergency Brake

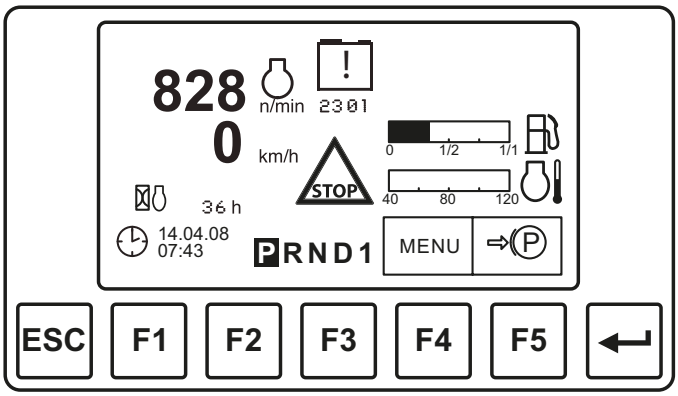
The automatic emergency brake is activated if an error occurs in one of the following components during operation:

– Brake pedal
– Pressure sensor in the brake system
– Magnetic coil in the service brake or parking brake

Emergency braking initiates the following sequence:

– The brakes are activated and the truck decelerates sharply
– STOP flashes on the multifunction display
– An error code appears in the multifunction display

If the emergency brake is activated, the truck can be moved to a safe location by activating emergency mode (see Activating Emergency Mode on page 124 and Travel in Emergency Mode on page 125). This does not apply, however, if the error is in the magnetic coil for the parking brake, in the earth connection for the brake pedal or in the pressure sensor. If one of these components is faulty, the truck cannot be driven and must be repaired by a qualified specialist as soon as possible.



Activation of Emergency Mode

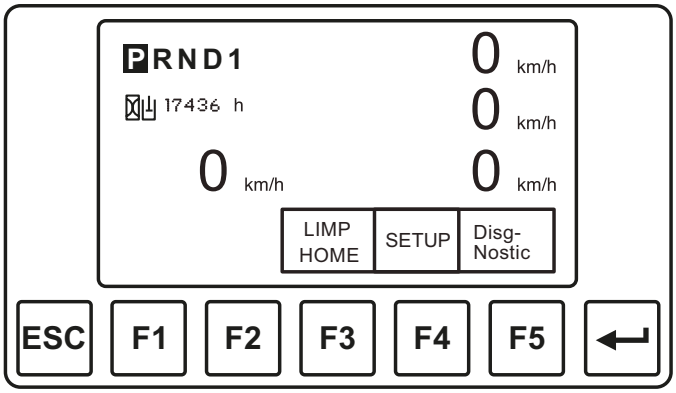
Requirements

– The automatic emergency brake is activated due to a serious error (see Automatic Emergency Brake on page 123).

Emergency mode cannot be activated for certain serious errors.

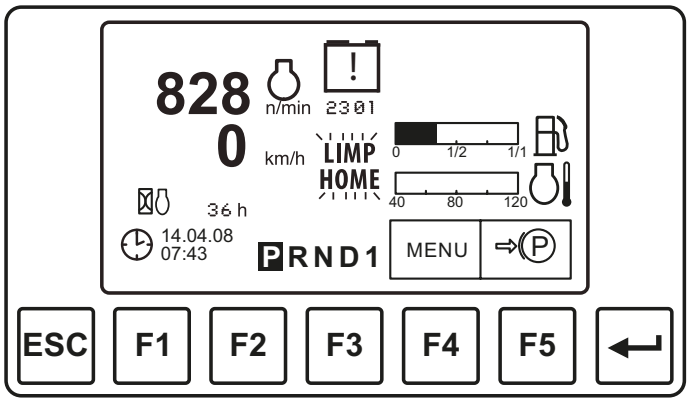
Procedure

- Press the "F4" button until the multifunction display shows LIMP HOME (emergency mode).
- Activate emergency mode with the "F3" button. When emergency mode is activated, the menu disappears over the row of function keys.



Procedure

- Press the "ESC" key to exit the current menu area and return to the travel mask. LIMP HOME flashes on the multifunction display.



Procedure

- Choose the travel direction with the travel direction switch.
  The parking brake can now be deactivated (see "Parking brake" on page 110). The truck can now travel at max. 1200 rpm. Error messages continue to appear in the display.

⚠ CAUTION!

The braking pattern deteriorates when driving in emergency mode. In some cases the brakes may not work. There is a higher risk of accidents and injury.

⚠ CAUTION!

Emergency mode must only be used to move the truck to a location where it can be securely parked. The truck must then be repaired as soon as possible by a qualified specialist. Never use emergency mode for normal truck operation.

9.2 Troubleshooting

This chapter enables the operator to localize and rectify basic faults or the results of incorrect operation himself. When trying to locate a fault, proceed in the order shown in the remedy 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.
Troubleshooting must only be performed by the manufacturer's customer service department. The manufacturer has a service department specially trained for these tasks.
In order for customer services to react quickly and specifically to the fault, the following information is essential:
- Truck serial number
- Event message from the display unit (if applicable)
- Error description
- Current location of truck.

Fault	Possible cause	Remedy
Starter motor is not working	Battery isolator is not switched on	Switch on the battery isolator
	Faulty fuse	Check fuses
	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
Motor does not start	Air filter contaminated	Clean / replace air filter
	Fuel filter clogged	Replace the fuel filter
Gear oil temperature indicator flashing	Gear oil too hot	Motor speed is automatically reduced
Motor running but truck does not travel	Travel direction lever in neutral position	Set travel direction lever to the required travel direction
	Parking brake applied	Release the parking brake
Lift speed too low	Hydraulic reservoir oil level too low	Check hydraulic oil, top up if necessary
	Hydraulic reservoir discharge system contaminated or clogged	Clean / replace hydraulic reservoir discharge system
Load cannot be raised to max. height	Hydraulic reservoir oil level too low	Check hydraulic oil, top up if necessary
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 stop to the other.

9.3 Operating the truck without its own drive system

9.3.1 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.

The brake system is designed so that the parking brake automatically applies when the truck comes to rest. It must therefore be released for towing as described below.

⚠ WARNING!

Uncontrolled truck movement

When the brakes are released the truck must be parked securely on a level surface, since the brakes are no longer effective.

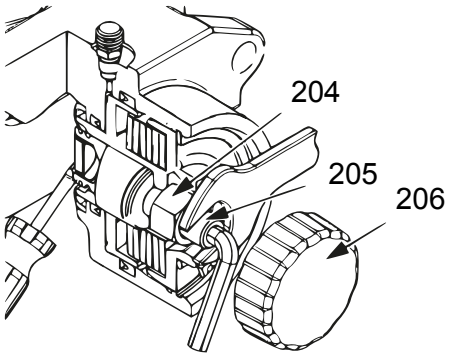
- ▶ Do not release the parking brake on slopes or inclines.
- ▶ Apply the parking brake again when you reach your destination.
- ▶ Do not park the truck with the parking brake released.

Emergency release of the parking brake

Procedure

- If the pressure supply fails, the parking brake can be released mechanically as follows:

  Park the truck on a level surface and prevent it from rolling away.
- Tilt the cab, see "Tilting the Cab" on page 167.
- Loosen and unscrew the screw cap (206).
- Loosen the retaining nut (204). Manually turn the adjusting screw (205) anti-clockwise with the Allen key until the brake disk is clear.



➔ A torque of at least 40 Nm (SW8) / 70 Nm (SW10) on the adjusting screw is required for emergency releasing.

- Counter-fix the retaining nut (204) manually. Fit the screw cap to protect against contamination and insert it by several threads.

⚠ DANGER!

▶The parking brake is non-operational in this condition. Use other methods to prevent the truck from rolling away.

▶Adjust the parking brake before starting up the truck again.

➔ The brake must be set to default after emergency release, repair work, fitting new brake lining support or brake disk, and if there is insufficient brake force.

⚠ DANGER!

▶The default setting must normally be set by the manufacturer's Customer Service.

Towing the Truck

Procedure

- Attach the tow bar to the trailer coupling of the recovery vehicle and the truck to be recovered.
- Remove the device to prevent the truck from rolling away.
- Tow the truck at max. 2 km/h.

⚠ DANGER!

▶One person must be seated in the towed truck to steer it.

➔ As the power steering does not work when the truck is being towed, it takes considerably more effort to steer it.

9.3.2 Emergency lowering

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

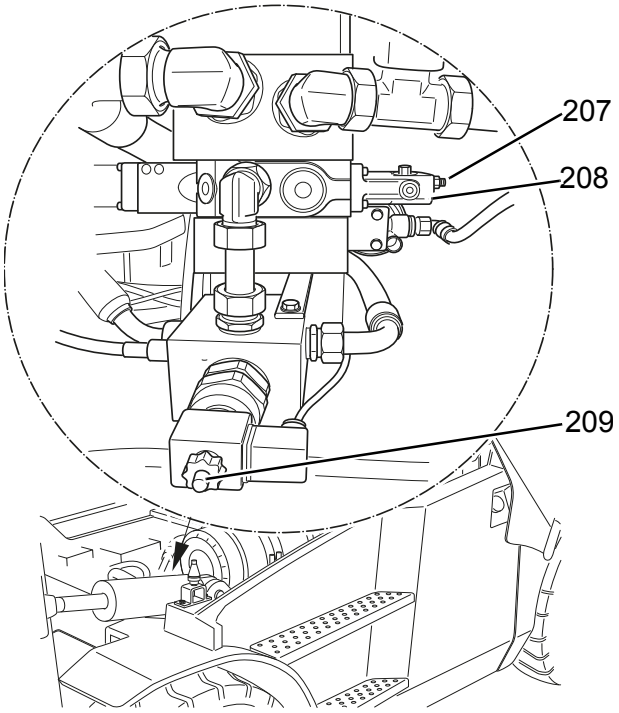
⚠ WARNING!

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

- Apply the Emergency Disconnect
- Turn key switch to "0".
- Tilt the cab, see "Tilting the Cab" on page 167.
- Loosen the red cap (209) on the solenoid valve on the valve block somewhat.
- Carefully loosen the nut (207) on the emergency lowering valve (208).
- The mast lowers slowly.
- Control the lowering speed with the nut (207).
- When the mast and the load handler have been lowered, torque the nut (207) to 2.5 - 3.0 Nm. Tighten the red cap (209) finger tight again.



⚠ WARNING!

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

9.3.3 Starting aid

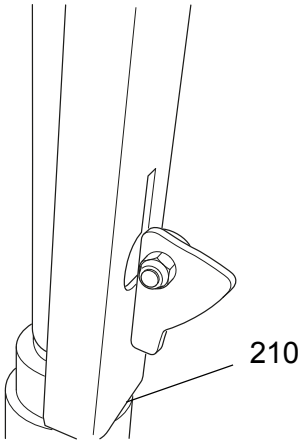
⚠ WARNING!

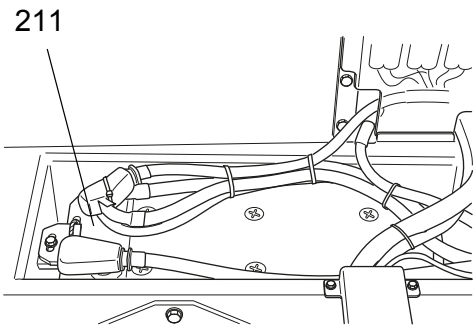
Danger from overheating

▶ Only use an ISO 6722 battery jump lead with fully insulated terminal pliers and a lead diameter of at least 50 mm².

Procedure

- Open the right side window completely.
- see "Tilting the Cab" on page 167Tilt the cab of the truck until the retaining device (210) is locked in position,
- First connect the positive terminal of the feeder battery to the positive terminal of the truck battery (211) with the red lead.
- Connect the negative terminal of the feeder battery and the earth point of the crane eye on the engine with the black lead.
- Use a ladder to change the truck height and reach through the open side window to start the truck engine with the ignition key with the cab fully tilted.
- 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 maintenance checklist service intervals.

⚠ 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 are subject to the manufacturer's quality control. To ensure safe and reliable operation, 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 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 "Maintenance and repairs" on page 162).

2 Maintenance Safety Regulations

Maintenance and repair personnel

➔ The manufacturer has a service department specially trained for these tasks. A maintenance contract with the manufacturer will ensure trouble-free operation.

Truck maintenance and repair work must only be carried out by specially trained personnel. The following operations are assigned to the following target groups.

Customer Services

Customer Services are specially trained in the use of the truck and are able to carry out maintenance and repairs independently. Customer Services are aware of the relevant standards, guidelines and safety regulations as well as potential risks.

Operating company

The maintenance personal of the operating company has the technical expertise and experience to perform the activities in the maintenance check list for the operating company. The maintenance and repair work to be performed by the operating company are also written down, see "Parking the truck securely" on page 103.

2.1 Working on the electrical system

⚠ CAUTION!

Accident risk from Working on the electrical system:

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

- ▶ Remove any rings or metal bracelets etc. before working on electrical components.
- ▶ Only trained personnel may work on the electrical system.
- ▶ Switch off the truck securely (see "Parking the truck securely" on page 103).
- ▶ Before working on the electrical system, all precautionary measures must be taken to avoid electrical accidents.
- ▶ Remove the starter battery connecting leads to de-energise the truck.

2.2 Consumables and used parts

⚠ CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable 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.

2.3 Wheels

⚠ 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. If you have any queries contact the manufacturer's customer service department.

2.4 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.
- ▶ Do not clean lift chains with high pressure jets 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.

2.5 Hydraulic system

⚠ WARNING!

Leaky hydraulic systems can result in accidents

Hydraulic oil can escape from leaky and faulty hydraulic systems.

- ▶ Report any defects immediately to your supervisor.
- ▶ Mark defective truck and take out of service.
- ▶ Do not return the industrial truck to service until you have identified and rectified the fault.
- ▶ Remove any spilled hydraulic immediately with an appropriate bonding agent.
- ▶ The bonding agent / consumable mixture must be disposed of in accordance with regulations.

⚠ WARNING!

Faulty hydraulic hoses can result in injury and infection

Pressurised hydraulic oil can escape from fine holes or hairline cracks in the hydraulic hoses. Brittle hydraulic hoses can burst during operation. People standing near the truck can be injured by the hydraulic oil.

- ▶ Call for a doctor immediately in the event of an injury.
- ▶ Do not touch pressurised hydraulic hoses.
- ▶ Report any defects immediately to your supervisor.
- ▶ Mark defective truck and take it out of service.
- ▶ Do not return the industrial truck to service until you have identified and rectified the fault.

NOTE

Testing and replacing hydraulic hoses

Hydraulic hoses can become brittle through age and must be checked at regular intervals. The application conditions of the industrial truck have a considerable impact on the ageing of the hydraulic hoses.

- ▶ Check the hydraulic hoses at least annually and replace if necessary.
- ▶ If the operating conditions become more arduous the inspection intervals must be reduced accordingly.
- ▶ In normal operating conditions a precautionary replacement of the hydraulic hoses is recommended after 6. The owner must carry out a risk assessment to ensure safe, prolonged use. The resulting protection measures must be observed and the inspection interval reduced accordingly.

2.6 Working in the vicinity of the engine

⚠ 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 Lubricants and Lubrication Schedule

3.1 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 consumables can cause slipping and endanger the environment

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

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

⚠ WARNING!

Improper handling of oils can be hazardous

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 oils must be removed immediately with an appropriate bonding agent.
- ▶ The mixture consisting of the bonding agent and oil 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 seek medical assistance 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 seek medical assistance immediately.
- ▶ Replace oil-soaked clothing and shoes immediately.

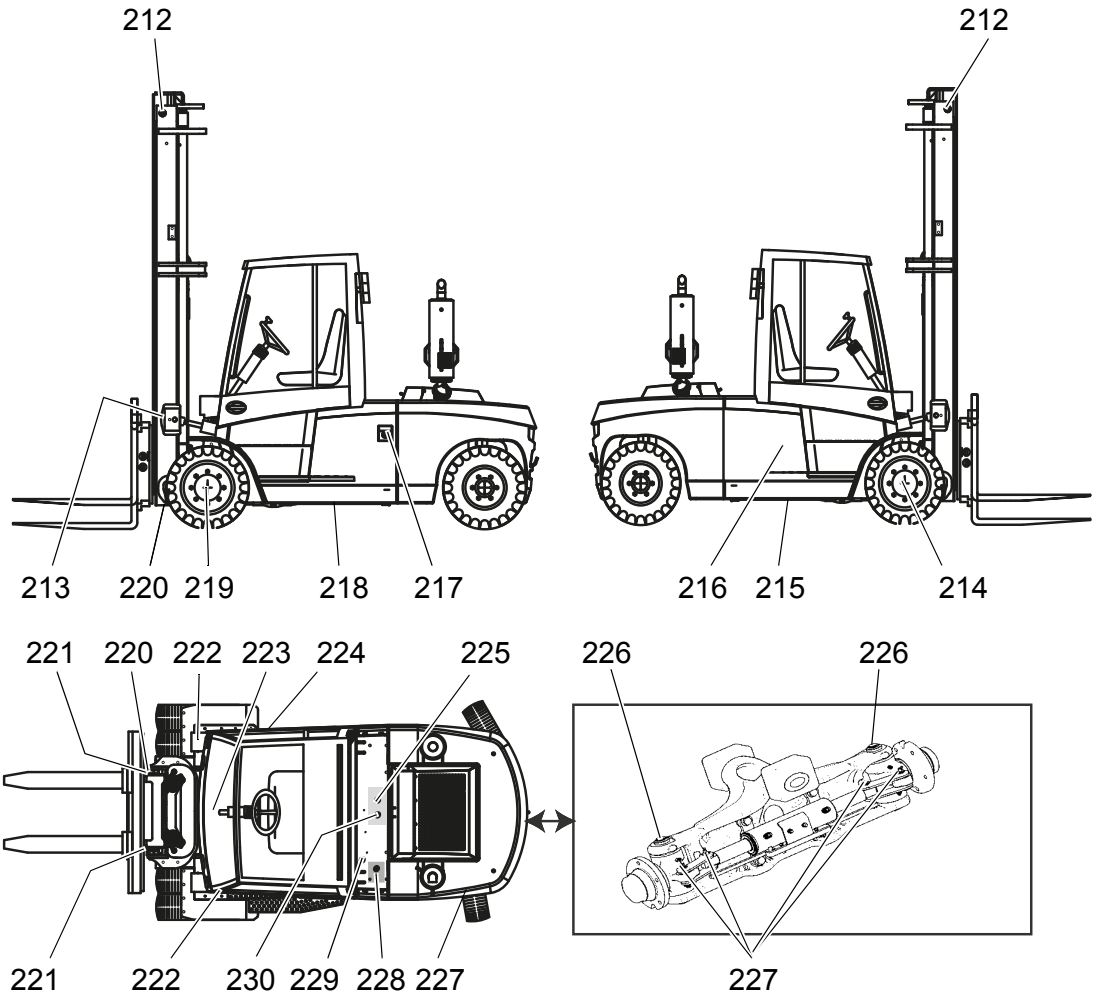
⚠ CAUTION!

Consumables and used parts are an environmental hazard

Used parts and consumables must be disposed of in accordance with the applicable 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.

3.2 Lubrication Schedule



Grease nipple

		Number
212	Chain sprocket	2/4
220	Mast, suspension	2
213	Tilt cylinder front bearing	2
221	Mast rollers	8/10/12
222	Tilt cylinder rear bearing	2
223	Cardan shaft	2
226	Stub axle pins	4
227	Track rod	4

Dipstick and filling points

215	Hydraulic oil filler plug (in the motor compartment)
217	Fuel filler neck
224	Battery (in the motor compartment)
225	Engine oil filler neck

Dipstick and filling points

228	Coolant tank
229	Engine oil dipstick
230	Filler neck for window washer system

Lowering points

214	Wheel hub, right
216	Hydraulic oil (right tank)
218	Fuel (left tank)
219	Wheel hub, left

3.3 Consumables

Item	Order no.	Quantity	Model	Used for
221	14038650		Lithium w. MOS NLGI 2	Grease lubrication
228	51332291	16 l	Fricofin V	Mix coolant with water 1:1
215	51132716	4 cylinders 150 l 6 cylinders 190 l 8 cylinders 170 l	Jungheinrich hydraulic oil	Hydraulics
225	52017727	4 cylinders 7 l 6 cylinders 15 l 8 cylinders 4.8 l	Titan UNIMAX PLUS MC SAE 10W40	Engine

Item	Order no.	Quantity	Type	Used for
	51267772	25 l	Agrifarm UTTO	Transmission
	52030273	2 x 0.9	Titan Supergear 80W-90	Reducing gear
	52030273	9 l	Titan Supergear 80W-90	Drive shaft Single
	52030273	12 l	Titan Supergear 80W-90	Drive shaft Wide/twin

* The coolant consists of a 1:1 mixture ratio of Fricofin V 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.

11.14 EN

3.4 Coolant specification

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.

⚠ 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.

NOTE

Anti-freeze/water mixture ratio:

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

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.

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.

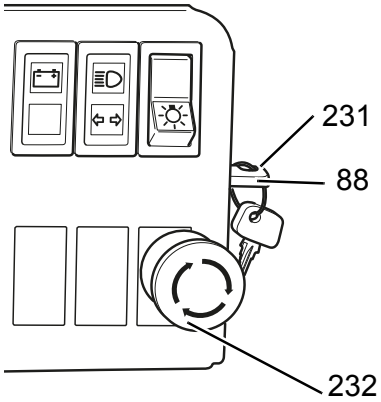
4 Maintenance and repairs

4.1 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 "Transport and Commissioning" on page 43.
- Fully lower the load handler.
- Remove the key (231) from the key switch (88) to prevent the truck from being switched on accidentally.
- Press the Emergency Disconnect switch (232) down.
- Turn the battery isolator (182) to position "B".

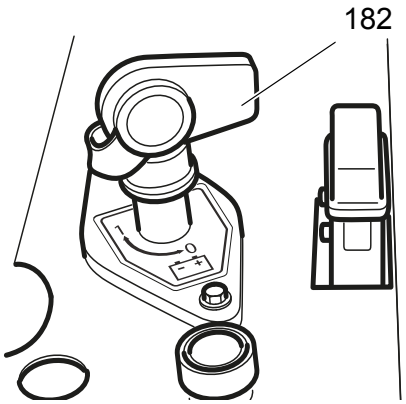


⚠ WARNING!

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 "Preparing the truck for maintenance and repairs" on page 162. When working on the parking brake, prevent the truck from accidentally rolling away (e.g. with wedges).



4.2 Lifting and jacking up the truck safely

⚠ WARNING!

A truck tipover can cause accidents

In order to raise the truck, use only suitable lifting gear at the points specially provided for this purpose.

▶ Note the weight of the truck on the data plate.

▶ Always use a jack with a minimum capacity of 10000 kg kg.

▶ Raise the unladen truck on a level surface.

▶ When raising the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

Raising and jacking up the truck securely

Requirements

– Prepare the truck for maintenance and repairs (see "Identification points and data plates" on page 38).

Tools and Material Required

– Jack

– Hard wooden blocks

Procedure

- Place the jack against the contact point.

  Jack contact point, see "Preparing the truck for maintenance and repairs" on page 162.
- Raise the truck.
- Support the truck with hard wooden blocks.
- Remove the jack.

The truck is now securely raised and jacked up.

4.3 Replacing wheels

⚠ WARNING!

A truck tipover can cause accidents

In order to raise the truck, use only suitable lifting gear at the points specially provided for this purpose.

▶ Note the weight of the truck on the data plate.

▶ Always use a jack with a minimum capacity of 10000 kg kg.

▶ Raise the unladen truck on a level surface.

▶ When raising the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

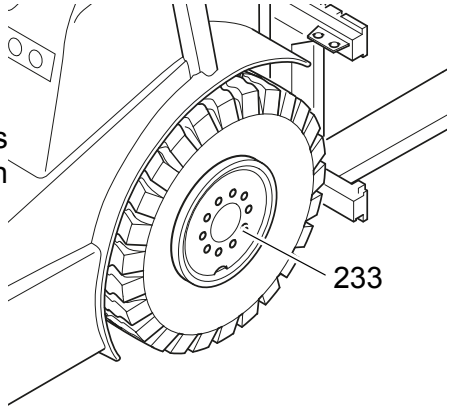
⚠ WARNING!

Falling wheels can cause injury

▶ The wheels of the truck are very heavy. A single wheel can weigh up to 250 kg.

▶ Always replace wheels with a suitable tool and protective equipment.

Dismantle the wheels



Requirements

– Prepare the truck for maintenance and repairs (see "Identification points and data plates" on page 38).

Tools and Material Required

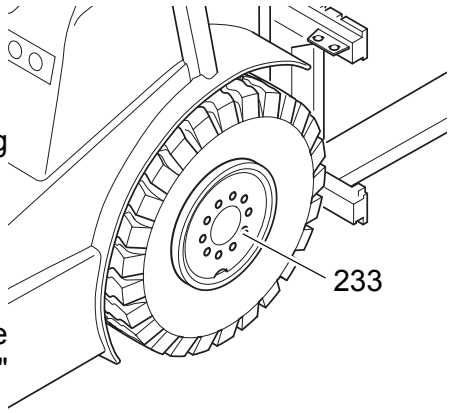
– Jack
– Hard wooden blocks
– Mounting lever
– Torque wrench

Procedure

- Place the jack against the contact point.
  Jack contact point, see "Tyre type" on page 33.
- Raise the truck.
- Support the truck with hard wooden blocks.
- Undo the wheel attachment (233).
- Disassemble the wheel, using a suitable mounting lever if necessary.

The wheel is now disassembled.

Fitting the wheels



Procedure

- Assemble the wheel, using a suitable mounting lever if necessary.
- Fit the wheel attachment.
- Remove the hard wooden blocks.
- Lower the truck.
- Torque the wheel attachment (233) crosswise with a torque wrench, for torques see "Tyre type" on page 33.

The wheel is now assembled.

➔ When using pneumatic tyres check the air pressure, for the air pressure see "Preparing the truck for maintenance and repairs" on page 162

4.4 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

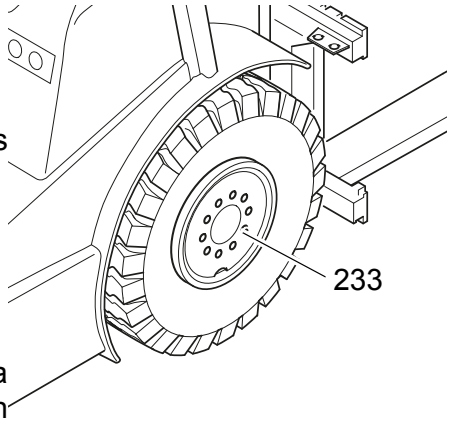
– Prepare the truck for maintenance and repairs (see "Tyre type" on page 33).

Tools and Material Required

– Torque wrench

Procedure

• Torque the wheel nuts (233) crosswise with a torque wrench, for torques see "Tyre type" on page 33.



The wheel attachment is now checked.

When using pneumatic tyres check the air pressure, for the air pressure see "Preparing the truck for maintenance and repairs" on page 162

4.5 Opening the Service Panel

There is a service panel between the cab and the cooler (234). The coolant level and engine oil can be checked here and coolant engine oil and cleaning agent for the window washer system can be added.

Opening the Service Panel

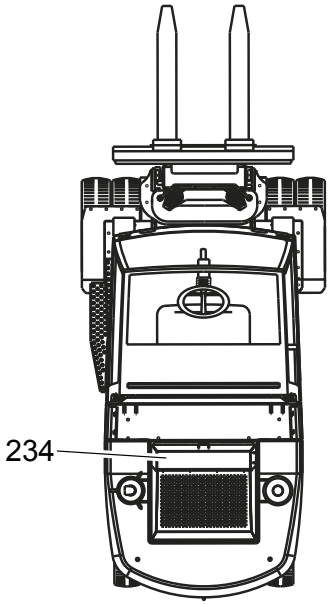
Requirements

– Prepare the truck for maintenance and repairs (see "Lowering the Cab" on page 169).

Procedure

• Raise the service panel (234).

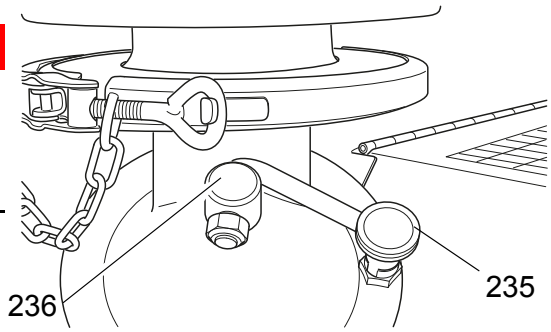
The service panel is now open.



4.6 Tilting the Cab

⚠ DANGER!

▶Before tilting the cab, allow the motor and muffler to cool off. Unlock the muffler and tilt it back.



Procedure

- To do this release the lever (236) and unlock the button (235). The muffler can be carefully turned back as far as the stop.
- After the cab is lowered, move the muffler back to its vertical position and lock it in place.

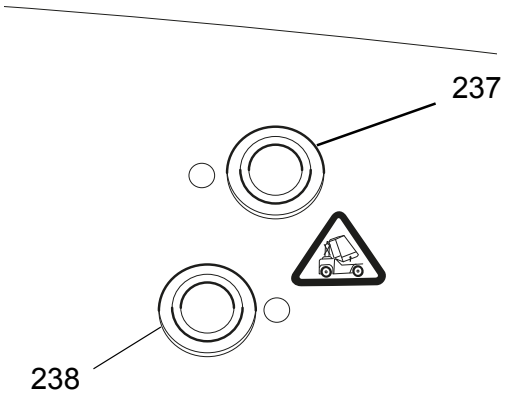
4.6.1 Raising the Cab Manually

Procedure

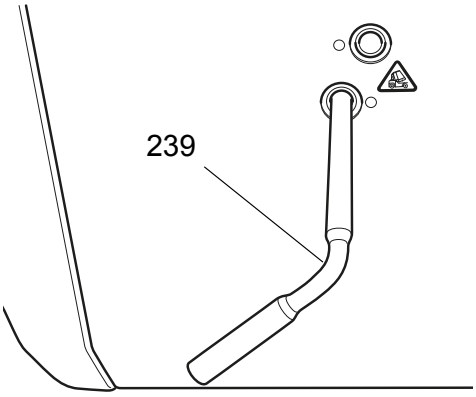
- Remove the pump rod (239) from the holder behind the driver's seat.
- The lift pump is fed into the cab through inlets in the chassis on the right side of the truck (237 = lift; 238 = lower)

⚠ CAUTION!

Before activating the lift pump always close the lowering valve.



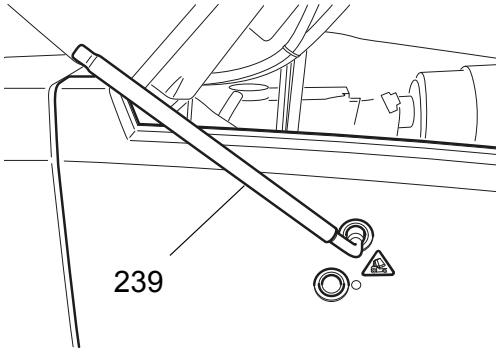
- To close, insert the long side of the pump rod through the infeed (238) onto the hex. bolt of the lowering valve and carefully turn clockwise.



Lifting

Procedure

- To lift the cab, insert the short side of the pump rod (239) through the infeed (237) onto the pump drive and activate. Tilt the cab back manually until the cab locking device engages in the engine compartment.
  Cab is now raised.

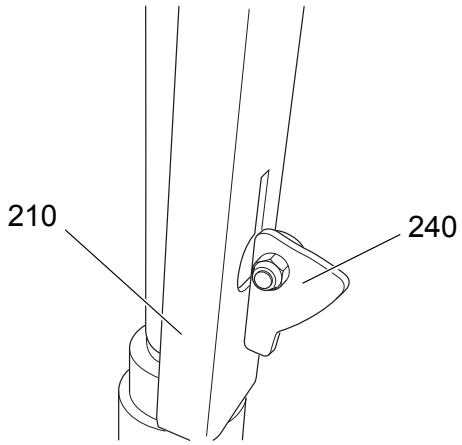


4.6.2 Lowering the Cab

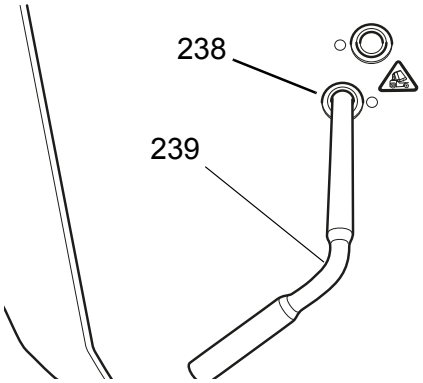
➔ The cab cannot be lowered electrically.

Procedure

- To lower the cab, use the lever (240) to release the locking device (210) and lower the cab.



- To lower the cab, insert the long side of the pump rod (239) through the infeed (238) onto the hexagon of the lowering valve and carefully turn the lowering valve anti-clockwise to open it.



⚠ DANGER!

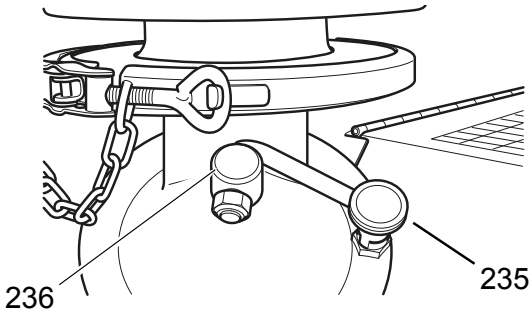
No persons are permitted in the area around the cab while it is being lowered.

➔ After the cab is lowered, return the muffler to the vertical position.

4.6.3 Raising the Cab Electrically (○)

⚠ DANGER!

▶Before tilting the cab, allow the motor and muffler to cool off. Unlock the muffler and tilt it back.



Procedure

- To do this release the lever (236) and unlock the button (235). The exhaust purifier can be carefully turned back as far as the stop.

⚠ CAUTION!

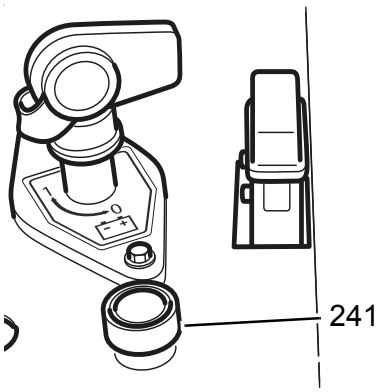
▶Before activating the lift pump always close the lowering valve.

- To close, insert the long side of the pump rod through the infeed (238) onto the hexagon of the lowering valve and turn clockwise as far as the stop.

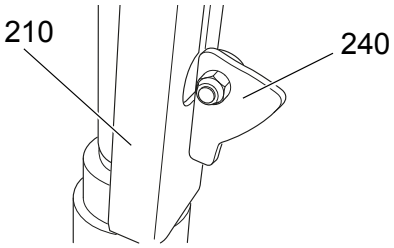
Lifting

Procedure

- Press switch (241) on the service panel. The cab is tilted back electrically until the cab locking device (210) engages.



- After the locking device (210) engages, it must also be secured in place with the lever (240).



4.6.4 Lowering the Cab

see section see "Preparing the truck for maintenance and repairs" on page 162.

⚠ DANGER!

No persons are permitted in the area around the cab while it is being lowered.

4.7 Replacing wheels

⚠ WARNING!

A truck tipover can cause accidents

In order to raise the truck, use only suitable lifting gear at the points specially provided for this purpose.

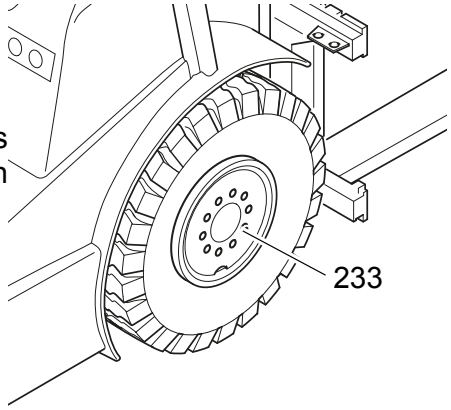
- ▶ Note the weight of the truck on the data plate.
- ▶ Always use a jack with a minimum capacity of 10000 kg kg.
- ▶ Raise the unladen truck on a level surface.
- ▶ When raising the truck, take appropriate measures to prevent it from slipping or tipping over (e.g. wedges, wooden blocks).

⚠ WARNING!

Falling wheels can cause injury

- ▶ The wheels of the truck are very heavy. A single wheel can weigh up to 250 kg.
- ▶ Always replace wheels with a suitable tool and protective equipment.

Dismantle the wheels



Requirements

– Prepare the truck for maintenance and repairs (see "Identification points and data plates" on page 38).

Tools and Material Required

– Jack
– Hard wooden blocks
– Mounting lever
– Torque wrench

Procedure

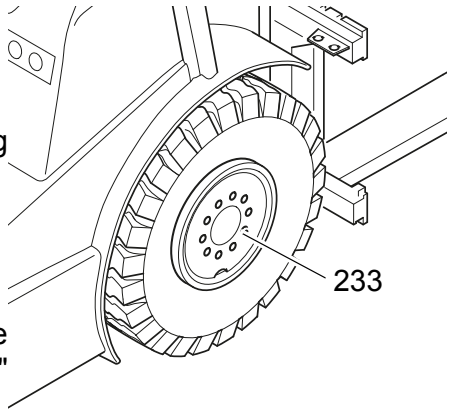
- Place the jack against the contact point.
  Jack contact point, see "Tyre type" on page 33.
- Raise the truck.
- Support the truck with hard wooden blocks.
- Undo the wheel attachment (233).
- Disassemble the wheel, using a suitable mounting lever if necessary.

The wheel is now disassembled.

Fitting the wheels

Procedure

- Assemble the wheel, using a suitable mounting lever if necessary.
- Fit the wheel attachment.
- Remove the hard wooden blocks.
- Lower the truck.
- Torque the wheel attachment (233) crosswise with a torque wrench, for torques see "Tyre type" on page 33.



The wheel is now assembled.

➔ When using pneumatic tyres check the air pressure, for the air pressure see "Preparing the truck for maintenance and repairs" on page 162

4.8 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

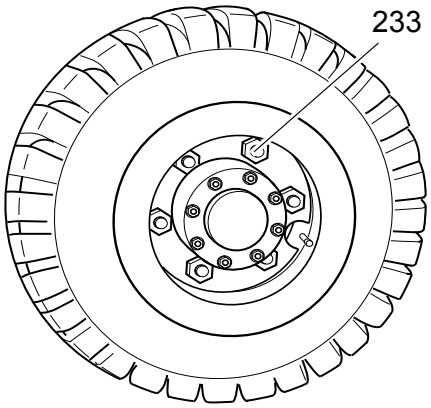
– Prepare the truck for maintenance and repairs (see "Tyre type" on page 33).

Tools and Material Required

– Torque wrench

Procedure

• Torque the wheel nuts (233) crosswise with a torque wrench, for torques see "Tyre type" on page 33.



The wheel attachment is now checked.

When using pneumatic tyres check the air pressure, for the air pressure see "Parking the truck securely" on page 103

4.9 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.
- ▶ Remove any spilled hydraulic 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 seek medical assistance 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 seek medical assistance immediately.
- ▶ Replace oil-soaked clothing and shoes immediately.

⚠ CAUTION!

Consumables and used parts are an environmental hazard

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

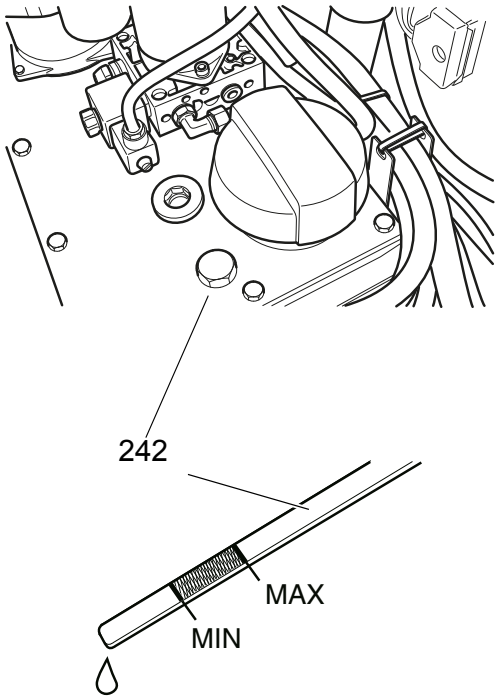
- ▶ Note the safety regulations when handling these materials.

4.9.1 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 (242) 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 markings.

For hot oil: the oil should lie just above the MAX marking.

- The difference between MIN and MAX is approximately 10 litres.
- Add hydraulic oil if necessary.
- Repeat the test.
- When the oil level is correct, fully insert the hydraulic oil dipstick (242) again.

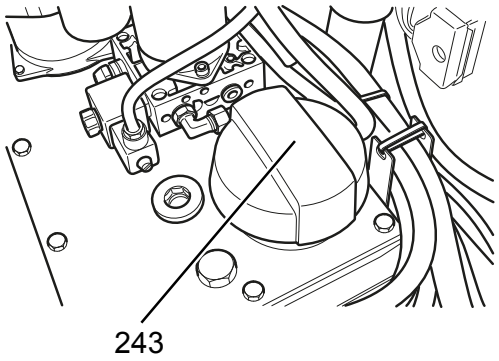
4.9.2 Adding hydraulic oil

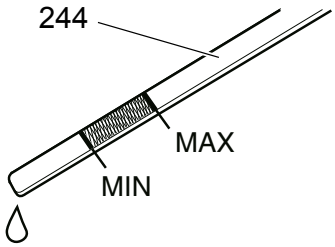
Procedure

- Unscrew the lid (243) of the hydraulic filter
- Add hydraulic oil to the MAX mark on the hydraulic oil dipstick (244).

➔ 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 fully.





4.10 Engine maintenance

⚠ WARNING!

Turning and hot components can cause trapping and burning hazards when the engine is running.

When the cover is open turning and hot components are freely accessible and can cause injury if touched.

- ▶ Before starting work make sure that the Emergency Disconnect switch can be reached to switch off the engine.
- ▶ Do not touch moving parts (e.g. fans, belt drives etc.) or hot surfaces.
- ▶ Truck maintenance and repair work must only be carried out by specially trained personnel who have been authorised by the owner.

4.10.1 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.

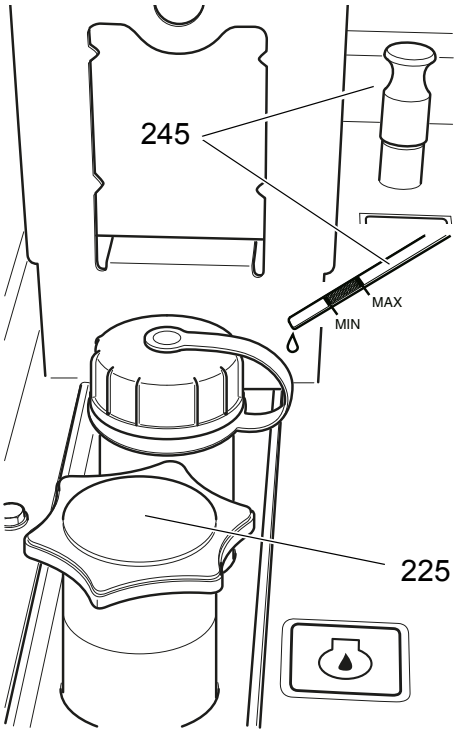
Checking the engine oil level

Requirements

– Park the truck on a level surface 9 "Servicing and Inspection"

Procedure

- Prepare the truck for maintenance and repairs.
- The engine oil dipstick (245) is located under the service panel behind the cab.
- Remove the oil dipstick.
- Check the oil level with the dipstick.
- Check the oil level while the motor is cold. If the motor is at operating temperature, it must stand for at least 2 minutes before the oil level can be read correctly.
- Add the correct grade of engine oil as required through the filler neck (225) when the oil level reaches the minimum range. The difference between minimum and maximum is about 0.75 litres.



The engine oil level has now been checked.

4.10.2 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

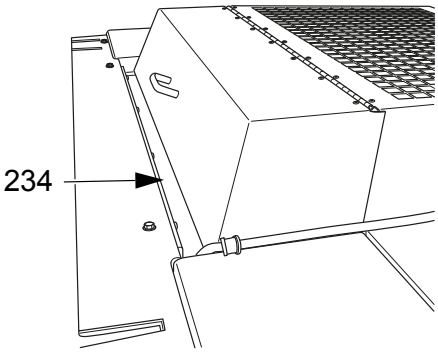
- ▶ If necessary, allow the engine to cool down sufficiently to prevent hot gases/liquids from escaping when the filler cap is opened.

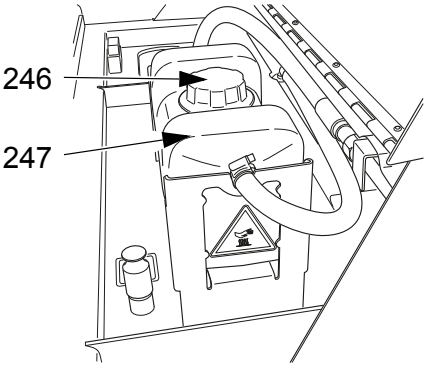
Checking the coolant level

Procedure

➔ The cooling system compensation tank is located on the left side of the truck in travel direction on the service panel.

- Park the truck securely on a level surface.
- Open the service panel cover (234).
- Check the coolant level on the expansion vessel (247).
- Close the service panel cover.





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 (246) from the expansion vessel (247).
- Check the anti-freeze content of the coolant with an anti-freeze tester.

NOTE

Incorrect coolant concentration can cause malfunctions

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

- Screw the filler cap back on.
- Fit the rear bonnet again and snap it back into position.

Check the cooler and fan and clean if necessary

Procedure

The cooling unit is located under the service panel (234).

- Open the service panel (234) completely.
- Clean the cooling unit carefully using compressed air without touching the cooling multi-plates.
- Close the service panel.

⚠ CAUTION!

A damaged cooler and fan can be dangerous

▶ Check the cooler and fan for damage. If the radiator or fan are damaged, do not operate the truck until the damage has been rectified.

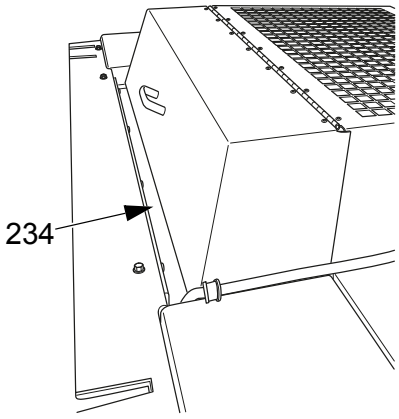
⚠ CAUTION!

A broken fan can be dangerous

▶ Using a suitable tool, check and make sure that the fan can move freely.

▶ The fan must not touch the deflector.

▶ Only start the motor when the cover is closed.



4.10.3 Cleaning and Replacing the Air Filter Cartridge

⚠ DANGER!

A running motor can be dangerous

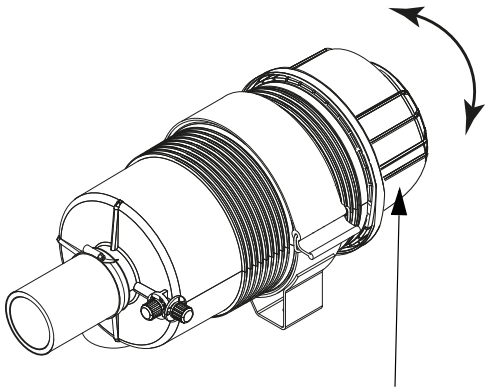
▶ Carry out all maintenance work with the motor switched off.

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

Replace air filter cartridge

Procedure

- Undo the end cap (248) and remove the dust collector pot.
- Carefully remove the air filter cartridge from the filter housing.



Cleaning the filter housing

Procedure

NOTE

A faulty motor 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.
- 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.

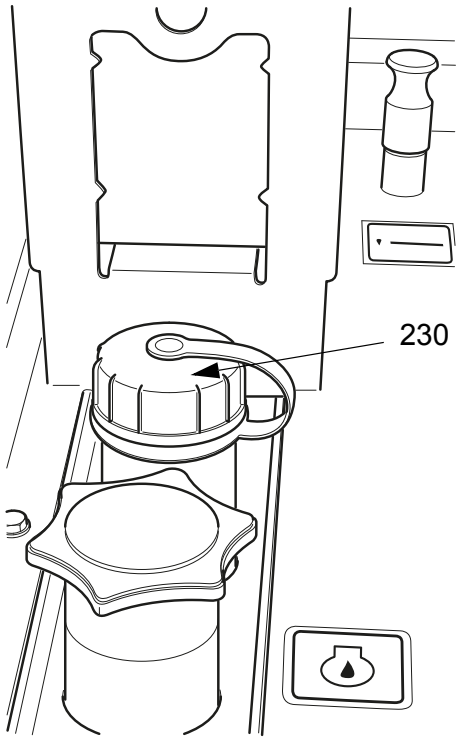
  ➔ Take care not to damage the air filter cartridges when assembling.
- Fit the dust extraction valve back into the dust collector pot.
- Insert the dust collector pot and fasten the end cap (248) in place.

4.10.4 Adding Window Washer System Fluid

Procedure

- Open the service panel.
- Unscrew the cover (230) and add window washing fluid.
- If necessary top up with anti-freeze.

The capacity of the tank is 5 litres.



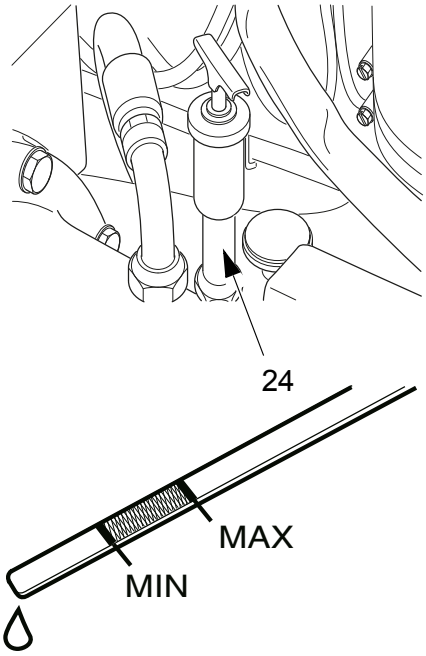
4.11 Check the transmission oil level

Procedure

- Prepare the truck for maintenance and repairs.
- Check the oil level with the dipstick (249). Slowly insert the dipstick into the transmission to prevent false measurements.

Check the oil level for the transmission while the motor is at idle. The oil must be at operating temperature.

- Add the correct grade of transmission oil through the filler neck as required.



4.12 Performing Other Maintenance Work

⚠ CAUTION!

▶Special knowledge and in some cases special tools are required to perform other maintenance work (especially changing oil and filters) according to the maintenance checklist (section see "Servicing and Inspection" on page 199). These tasks should therefore only be performed by the manufacturer's customer service department.

If service intervals are not observed as specified by the maintenance checklist see "Preparing the truck for maintenance and repairs" on page 162, the manufacturer's warranty will become void.

4.13 Closing the Motor Compartment

Procedure

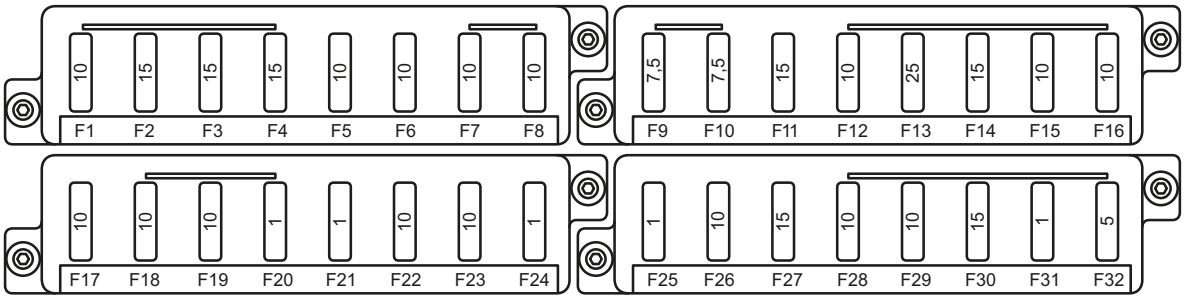
- Remove tools and other objects from the motor compartment.

⚠ DANGER!

No persons are permitted in the area around the cab while it is being lowered.

4.14 Checking electrical fuses

4.14.1 Standard Fuse Strip



Checking electrical fuses

Requirements

– Prepare the truck for maintenance and repairs (4.14.2).

Procedure

The main fuse box is located in the dashboard to the right of the driver's seat in the cab.

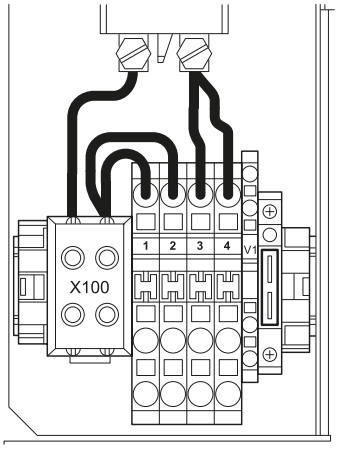
- Remove the electrical system cap.
- Check condition and rating of the fuses in accordance with the table.
- Replace any damaged fuses in accordance with the table.
- Close the electrical system cap.

The electrical fuses are now checked.

Type	Electric circuit		Rating (A)
F1	Parking light	●	10
F2	Dipped lights	●	15
F3	Main beam	●	15
F4	Rear work lights / tail light (roof panel)	○	15
F5	Indicator	●	10
F6	Warning indicator system	●	10
F7	Beacon	●	10
F8	Front windscreen wiper + horn	●	10
F9	Rear windscreen wiper	●	7.5
F10	Roof windscreen wiper	●	7.5
F11	Front / top work lights	●	15
F12	Terminal 15 switches	●	10
F13	Fan / air conditioning system	●	25
F14	Steering column switch, dipped lights	○	15
F15	Charge control light / swivel seat valve	●	10
F16	Compressor for air-sprung seat	○	10
F17	Seat heating	○	10
F18	12 volt socket terminal 30	○	10

Type	Electric circuit		Rating (A)
F19	Reading light	●	10
F20	Display	●	1
F21	Travel direction switch	●	1
F22	Radio	○	10
F23	+30 radio, cab lighting	○	10
F24	Ignition switch 15	●	1
F25	Ignition switch 50	●	1
F26	Swivel seat	○	10
F27	Front work lights	○	15
F28	Cigarette lighter	●	10
F29	Air conditioning system	●	10
F30	Load damping	○	15
F31	Brake pedal	○	1
F32	LPG supply (TFG only)	○	5

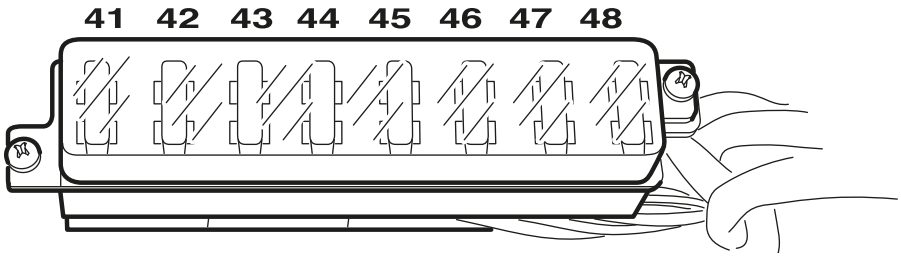
● = Standard equipment	○ = Optional equipment



Type	Electric circuit		Rating (A)
F1	Rear window heating	●	10
F2		●	15

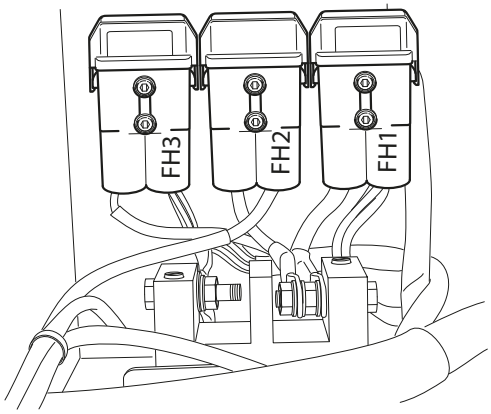
4.14.2 Fuse ratings in motor compartment for 4 + 6 cylinder diesel

All fuses (section 4.14.3 + see "Identification points and data plates" on page 38) are located on the right side of the motor compartment as seen in travel direction behind a Plexiglas window above the hydraulic reservoir.



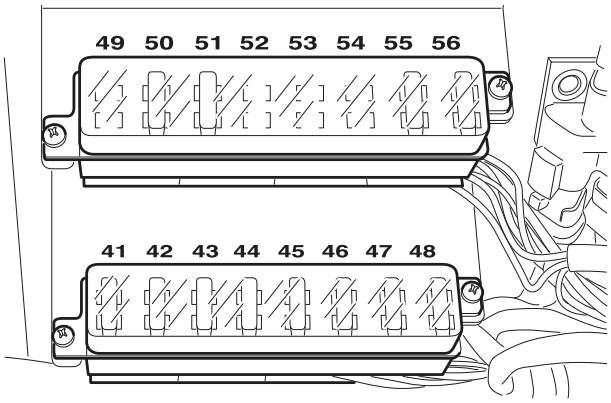
Component	Electric circuit		Rating (A)
F41	Front work lights on mast		15
F42	Transmission controller terminal 30		10
F43	Transmission controller terminal 30		15
F44	Option terminal 15 (X27:4)		10
F45	Particle filter alarm		5
F46	Valve block		10
F47	Engine controller terminal 30		5
F48	Transmission controller terminal 15		2

Main fuses in the motor compartment



Component	Electric circuit		Rating (A)
FH1	Cab		80
FH2	Pre-glow relay +30 (4 cylinder diesel)		50
FH2	Pre-glow relay +30 (6 cylinder diesel)		80
FH3	Engine controller +30		30

4.14.3 Fuse strip in motor compartment for LPG motor



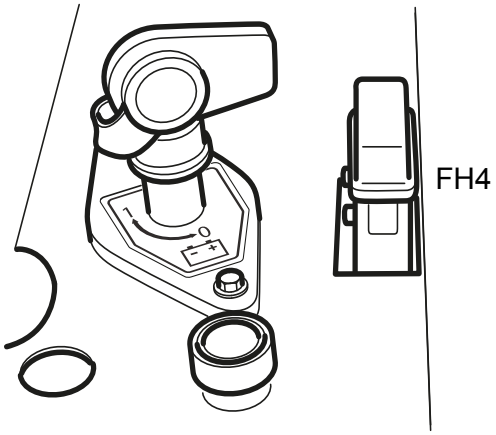
Type	Electric circuit		Rating (A)
F41	Front work lights on mast		15
F42	Transmission controller terminal 30		10
F43	Truck controller terminal 15		15
F44	Option terminal 15 (X27:4)		10
F45	Option terminal 15 (X27:1)		5
F46	Valve block		10
F47	Option terminal 15 (X26:7)		5
F48	Transmission controller terminal 15		2
F49	Option terminal 15		10
F50	Fan motor for LPG tank		15
F51	Engine controller terminal 15		7.5
F52	Option		
F53	Option		
F54	Option		
F55	Engine controller terminal 15		20
F56	Engine controller terminal 30		10

Main fuses in the motor compartment

Description	Power circuit		Rating (A)
FH1	Cab		80

➔ The fuses are located on the right side of the motor compartment as seen in travel direction behind a Plexiglas window.

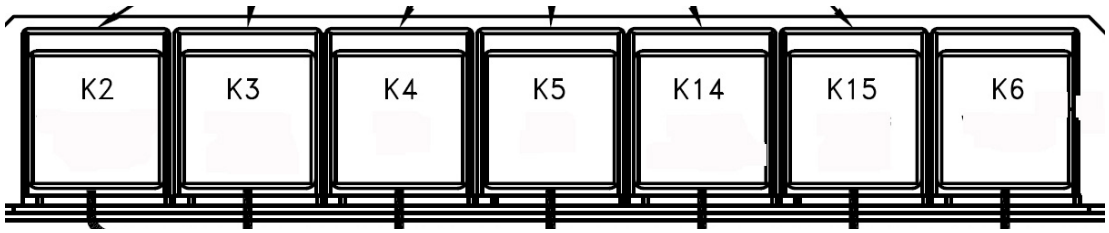
4.14.4 Cab lift fuse



Description	Power circuit		Rating (A)
FH4	Electric cab lift main fuse	○	80

4.14.5 Checking the Electric Relays (DFG)

The main fuse box with the relays is located in the dashboard to the right of the driver's seat in the cab.



K2	Work lights / rear
K3	Indicator relay
K4	Main beam
K5	Dipped lights
K14	Front / top work lights
K15	Front / bottom work lights
K6	Window wiper

⚠ WARNING!

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

4.15 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 component damage when cleaning the truck

Cleaning with a pressure washer can result in malfunctions due to humidity.

▶ Cover all electronic system assemblies (controllers, sensors, motors etc.) before cleaning the truck with a pressure washer.

▶ Do not hold the jet of the pressure washer by the marked points to avoid damaging them (see "Preparing the truck for maintenance and repairs" on page 162).

▶ Do not clean the truck with pressurised water.

Cleaning the truck

Requirements

– Prepare the truck for maintenance and repairs (see "Restoring the truck to service after decommissioning" on page 196).

Tools and Material Required

– Water-based solvents
– Sponge or cloth

Procedure

- Clean the surface of the truck with water-based solvents and water. Use a sponge or cloth to clean.
- In particular, clean the following areas:
  - Windows
  - All walk-on areas
  - Oil filler ports and their surroundings
  - Grease nipples (before lubrication)
- Dry the truck after cleaning, e.g. with compressed air or a dry cloth.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see "Preparing the truck for maintenance and repairs" on page 162).

The truck is now clean.

⚠ CAUTION!

Risk of electrical system damage

Cleaning the assemblies (controllers, sensors, motors etc.) of the electronic system with water can damage the electrical system.

▶ 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.

Cleaning the electrical system assemblies

Requirements

– Prepare the truck for maintenance and repairs (see "Opening the Service Panel" on page 166).

Tools and Material Required

– Compressor with water separator
– Non-conductive, antistatic brush

Procedure

- Expose the electrical system, see "Opening the Service Panel" on page 166.
- Clean the electrical system assemblies with weak suction or compressed air (use a compressor with a water trap) and not a conductive, anti-static brush.
- Fit the electrical system panel, see "Restoring the truck to service after decommissioning" on page 196.
- Carry out all the tasks in the section "Recommissioning the truck after cleaning or maintenance work" (see "Tilting the Cab" on page 167).

The electrical system assemblies are now clean.

4.16 Starter battery

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

➔ *not for maintenance-free batteries

⚠ WARNING!

Batteries can be hazardous

Batteries contain an acid solution which is poisonous and corrosive. Avoid contact with battery acid at all times.

- ▶ Dispose of used battery acid in accordance with regulations.
- ▶ Always wear protective clothing and goggles when working with batteries.
- ▶ Do not let battery acid come into contact with skin, clothing or eyes. If necessary, rinse with plenty of clean water.
- ▶ In the event of physical damage (e.g. skin or eye contact with battery acid) call for a doctor immediately.
- ▶ Spilled battery acid should be neutralised immediately with plenty of water.
- ▶ Only batteries with a sealed battery container may be used.
- ▶ Follow national guidelines and legislation.

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.

Checking the acid density

Procedure

- Clean the area around the inspection plugs.
- Unscrew the drain plug.

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

- If necessary, add distilled water to the top mark.
- Check the acid density with an acid siphon.

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

- Screw the inspection plugs back on.
- Recharge the battery as required.

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.

4.17 Exhaust system

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.

Check the exhaust system regularly for leaks.

Procedure

- Open the engine cover.
- Start the engine when the engine cover is open. To do this:
  - Open the right side window completely.
  - Tilt the cab of the truck until the retaining device (210) is locked in position, see "Cleaning" on page 189.
  - Use a ladder to change the truck height and reach through the open side window to start the engine with the ignition key with the cab fully tilted.
- 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.

4.18 Restoring the truck to service after maintenance and repairs

Procedure

- Thoroughly clean the truck, see "Lubrication Schedule" on page 158.
- Lubricate the truck according to the lubrication schedule, see "Preparing the Truck for Operation" on page 86.
- Clean the starter battery, grease the terminals and connect the starter battery.

⚠ 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 "Lifting and jacking up the truck safely" on page 163.

5 Decommissioning the industrial truck

If the truck is to be out of service for more than a month, 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.

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.

➔ Jack up the truck, see "Cleaning" on page 189.

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

5.1 Prior to decommissioning

Procedure

- Thoroughly clean the truck, see "Checking the hydraulic oil level" on page 175.
- Prevent the truck from rolling away.
- Check the hydraulic oil level and replenish if necessary, see "Lubrication Schedule" on page 158.
- 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 158.
- Disconnect the battery, clean it and grease the terminals.

In addition, follow the battery manufacturer's instructions.

5.2 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.

5.3 Restoring the truck to service after decommissioning

Procedure

- Thoroughly clean the truck.
- Lubricate the truck according to the lubrication schedule, see "Starter battery" on page 191.
- Clean the battery, grease the terminals and connect the battery.
- Charge the battery, see "Preparing the Truck for Operation" on page 86.
- 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, .

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.

6 Safety tests to be performed at intervals and after unusual incidents

➔ Perform a safety check in accordance with national regulations. The manufacturer recommends the truck be checked to FEM guideline 4.004. The manufacturer has a service department specially trained for these tasks.

The truck must be inspected at least annually (refer to national regulations) or after any unusual event by a qualified inspector. The inspector shall assess the condition of the system from purely a safety viewpoint, without regard to operational or economic circumstances. The inspector must 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 produced. The test results must be kept for at least the next 2 inspections.

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

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

7 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, consumables 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.

8 Human vibration measurement

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

9 Servicing and Inspection

⚠ WARNING!

Risk of accident due to neglected maintenance

Failure to perform regular servicing can lead to truck failure and poses a potential hazard to personnel and equipment.

▶ Thorough and expert servicing is one of the most important requirements for the safe operation of the industrial truck.

The application conditions of an industrial truck have a considerable impact on component wear. The following service intervals are based on single-shift operation under normal operating conditions. They must be reduced accordingly if the equipment is to be used in conditions of extreme dust, temperature fluctuations or multiple shifts.

NOTE

To prevent damage due to wear, the manufacturer recommends an on-site application analysis to agree on appropriate service intervals.

The following maintenance checklist lists the activities 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-interval activities should be performed by the operating company.

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

10 Maintenance checklist DFG

10.1 Operating Company

10.1.1 Standard Equipment

Brakes		W	A	B	C
1	Test brakes.	●			

Electrical System		W	A	B	C
1	Test warning and safety devices in accordance with operating instructions.	●			
2	Test displays and controls.	●			
3	Test Emergency Disconnect switch.	●			

Power Supply		W	A	B	C
1	Check battery cable connections are secure, grease terminals if necessary.	●			
2	Check battery and battery components.	●			

Travel		W	A	B	C
1	Check coolant level and top up if necessary.	●			
2	Check and clean radiator.	●			
3	Check tyre air pressure and top up if necessary.	●			
4	Check wheels for wear and damage.	●			
5	Check engine oil level, top up if necessary.	●			

Chassis and Superstructure		W	A	B	C
1	Check doors and/or covers.	●			
2	Check labels are legible and complete.	●			
3	Check engine compartment for contamination and clean if necessary.	●			
4	Check overhead guard and / or cab are secure and check for damage.	●			
5	Test driver's seat restraint system and check for damage.	●			

Hydraulic operations		W	A	B	C
1	Check load chain lubrication and lubricate if necessary.	●			
2	Test hydraulic system.	●			
3	Check hydraulic oil level and top up if necessary.	●			
4	Check forks or load handler for wear and damage.	●			

10.1.2 Optional Equipment

Work lights

Electrical System		W	A	B	C
1	Test lighting.	●			

Strobe light / beacon

Electrical System		W	A	B	C
1	Test strobe light / beacon and check for damage.	●			

Heating

Chassis and Superstructure		W	A	B	C
1	Test the heating.	●			

Clamping device

Hydraulic operations		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Sideshifter

Hydraulic operations		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Road traffic approval (StVZO)

Electrical System		W	A	B	C
1	Test lighting.	●			

Wiper/washer system

Chassis and Superstructure		W	A	B	C
1	Check wiper water container for leaks and check volume, top up if necessary.	●			

Fork positioner

Hydraulic operations		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Optional equipment

Chassis and Superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage compartments, grips, windscreen wipers and washing systems etc. are working correctly and check for damage.	●			

10.2 Customer Service

10.2.1 Standard Equipment

Brakes		W	A	B	C
1	Test brakes.			●	
2	Check the brake lining on the parking brake.			●	
3	Check connections and lines for leaks.			●	

Electrical System		W	A	B	C
1	Test warning and safety devices in accordance with operating instructions.			●	
2	Test displays and controls.			●	
3	Test the main switch / battery isolator.		●		
4	Test Emergency Disconnect switch.			●	
5	Check contactors and/or relays.			●	
6	Check fuse ratings.			●	
7	Check electrical wiring for damage (insulation damage, connections). Make sure wire connections are secure.			●	

Power supply		W	A	B	C
1	Check fuel system, tank and lines for leaks and damage.			●	
2	Check battery cable connections are secure, grease terminals if necessary.			●	
3	Check battery and battery components.			●	
4	Check battery voltage.			●	

Travel		W	A	B	C
1	Replace transmission oil filter.				●
2	Check transmission oil level or grease filling of the transmission and top up if necessary.			●	
3	Replace the axle return filter.			●	
4	Test exhaust system and check for leaks and damage.			●	
5	Test anti-freeze, top up if necessary.			●	
6	Replace radiator fluid and anti-freeze.				●
7	Check cooling system for leaks.			●	
8	Check coolant level and top up if necessary.			●	
9	Test hydraulic fans and check for leaks.			●	
10	Clean the engine oil cooler.			●	
11	Check and clean radiator.		●		
12	Check transmission for noise and leakage.			●	
13	Replace transmission oil.				●
14	Check tyre air pressure and top up if necessary.			●	

Travel		W	A	B	C
15	Check wheels for wear and damage.			●	
16	Check wheel suspension and attachment.			●	
17	Test starter and generator, check wires and attachment.			●	
18	Replace the engine discharge filter.		●		
19	Replace fuel filter.		●		
20	Replace the fuel pre-filter.			●	
21	Replace engine oil filter.		●		
22	Check V belt / multi-V belt is tensioned and check for damage. Replace if necessary.			●	
23	Replace air filter.			●	
24	Check air filter, replace if necessary.		●		
25	Check engine for noise and leakage.			●	
26	Replace engine oil.		●		
27	Check valve setting and adjust if necessary.			●	
28	Check engine suspension.			●	
29	Test water pump and the fans.			●	
30	Check glow plugs.			●	
31	Check fuel/water separator and discharge if necessary.		●		
32	Check drive axle for noise and leakage.			●	
33	Replace drive axle oil.				●
34	Clean or replace transmission oil suction filter if necessary.				●

Chassis and Superstructure		W	A	B	C
1	Check chassis and screw connections for damage.			●	
2	Check doors and/or covers.			●	
3	Check labels are legible and complete.			●	
4	Check attachment and setting function of the driver's seat.			●	
5	Check condition of the driver’s seat.			●	
6	Check engine compartment for contamination and clean if necessary.		●		
7	Check attachment of the counterweight.			●	
8	Check mast attachment / mounting.			●	
9	Check trailer coupling or tow mechanism stop.			●	
10	Check overhead guard and / or cab are secure and check for damage.			●	
11	Check operator mat and steps are non-slip and damage-free.			●	
12	Test driver's seat restraint system and check for damage.			●	

Hydraulic operations		W	A	B	C
1	Test "hydraulic" controls and make sure the labels are present, legible and complete.			●	
2	Test hydraulic controls and check they are assigned to the correct functions.			●	
3	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
4	Check running surfaces of the integral sideshifter and / or integral fork positioner for wear and damage, and lubricate if necessary.		●		
5	Check settings and wear levels of slide pieces and stops and adjust the slide pieces if necessary.			●	
6	Check load chain setting and tension if necessary.			●	
7	Check load chain lubrication and lubricate if necessary.		●		
8	Check lateral clearance of the mast connections and the fork carriage.			●	
9	Visually inspect the mast rollers and check contact surface wear level.			●	
10	Check running surfaces of the mast for wear and damage, and lubricate if necessary.		●		
11	Test hydraulic system.			●	
12	Replace hydraulic reservoir discharge paper filter.			●	
13	Replace hydraulic oil filter.			●	
14	Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage.			●	
15	Test emergency lowering system.			●	
16	Check hydraulic oil level and top up if necessary.			●	
17	Test relief valve and adjust if necessary.			●	
18	Replace hydraulic oil.				●
19	Check forks or load handler for wear and damage.			●	
20	Check piston rod screw depth and counter fixing / clamp. Where two tilt cylinders with the same stroke length are used, check the setting in respective of each other.			●	
21	Check tilt cylinders and mounting.			●	
22	Test lift and lowering speeds.			●	

Agreed services		W	A	B	C
1	Carry out a test run with rated load, if necessary with a customer-specific load.			●	
2	Lubricate truck according to the lubrication schedule.			●	
3	Demonstration after servicing.			●	

Steering		W	A	B	C
1	Test hydraulic steering and its components.			●	
2	Test the hydraulic steering for leaks.			●	
3	Check steering axle and steering knuckle for wear and damage.			●	
4	Check steering-knuckle bearing and adjust if necessary.			●	
5	Grease the steering axle.		●		
6	Check mechanical parts of steering column.			●	

10.2.2 Optional Equipment

Discharge strap

Electrical System		W	A	B	C
1	Check anti-static discharge strap is present and not damaged.			●	

Audible warning devices

Electrical System		W	A	B	C
1	Test the buzzer / warning alarm, check for damage and make sure it is secure.			●	

Trailer coupling

Chassis and Superstructure		W	A	B	C
1	Check trailer coupling or tow mechanism stop.			●	

Work platform

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Work lights

Electrical System		W	A	B	C
1	Test lighting.			●	

Strobe light / beacon

Electrical System		W	A	B	C
1	Test strobe light / beacon and check for damage.			●	

Data recorder

Electrical System		W	A	B	C
1	Check data recorder is secure and check for damage.			●	

90° / 180° rotary seat

Chassis and Superstructure		W	A	B	C
1	Check drive chain of rotary seat and adjust if necessary.		●		
2	Lubricate drive chain of rotary seat.		●		
3	Test rotary seat and check for damage.		●		
4	Check rotary drive motor attachment.		●		
5	Check rotary drive pinion for wear and damage.		●		

Electrical optional equipment

Electrical System		W	A	B	C
1	Test the electrical optional equipment and check for damage.			●	

Fire extinguisher

Agreed services		W	A	B	C
1	Check fire extinguisher is present, secure and check test interval.				●

Belt lock control

Chassis and Superstructure		W	A	B	C
1	Test the belt lock control and check for damage.			●	

Heating

Chassis and Superstructure		W	A	B	C
1	Test the heating.			●	
2	Replace heating breather.			●	
3	Check hoses for leaks and damage and make sure they are secure.			●	

Clamping device

Hydraulic operations		W	A	B	C
1	Test the acknowledgement key.			●	
2	Test the hose reel and check for leaks and damage.			●	
3	Check axial play of the front and rear rollers and adjust if necessary.			●	
4	Check attachment is properly secured to the truck and the supporting elements.			●	
5	Test attachment, check settings and check for damage.			●	
6	Check sliding blocks are complete.			●	
7	Check attachment bearing points, guides and stops for wear and damage, grease and clean these components.			●	
8	Check attachment lubrication; clean and lubricate if necessary.		●		
9	Check hydraulic ports and tighten if necessary.			●	
10	Check cylinder seals.			●	
11	Check cylinder piston rods and bushings.			●	

Air conditioning system

Chassis and Superstructure		W	A	B	C
1	Test air conditioning system and its settings and check its components for damage.			●	
2	Note: The air conditioning system must only be serviced every two years or 2000 service hours by specialist personnel.				
3	Visually inspect the filter and replace if necessary.			●	
4	Check temperature reading at the outlet of the ventilation nozzles against manufacturer's ratings.			●	

Crane hook

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Load backrest

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Particle filter

Travel		W	A	B	C
1	Note: Any work carried out on the particle filter system must only be performed by specialist personnel.				
2	Particle filter: Clean filter in accordance with the manufacturer's instructions.				
3	Test the particle filter system. Check its setting and check for contamination, clean if necessary.				
4	Measure the soot index according to the manufacturer's specifications or national regulations.			●	

Hose reel

Hydraulic operations		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	

Impact sensor

Electrical System		W	A	B	C
1	Check impact sensor is secure and check for damage.			●	

Sideshifter

Hydraulic operations		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	
2	Check axial play of the front and rear rollers and adjust if necessary.			●	
3	Check attachment is properly secured to the truck and the supporting elements.			●	
4	Test attachment, check settings and check for damage.			●	
5	Check sliding blocks are complete.			●	
6	Check attachment bearing points, guides and stops for wear and damage, grease and clean these components.			●	
7	Check attachment lubrication; clean and lubricate if necessary.		●		
8	Check hydraulic ports and tighten if necessary.			●	
9	Test the sideshifter, check settings and check for damage.			●	
10	Check cylinder seals.			●	
11	Check cylinder piston rods and bushings.			●	

Seat heating

Electrical System		W	A	B	C
1	Check electrical wiring for damage (insulation damage, connections). Make sure wire connections are secure.			●	

Road traffic approval (StVZO)

Electrical System		W	A	B	C
1	Test lighting.			●	

Boom

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Weigher sensors / switches

Electrical System		W	A	B	C
1	Test weigher system and check for damage.			●	

Wiper/washer system

Chassis and Superstructure		W	A	B	C
1	Check wiper water container for leaks and check volume, top up if necessary.			●	
2	Test windscreen wipers and check for damage, replace if necessary.			●	

Fork positioner

Hydraulic operations		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	
2	Check axial play of the front and rear rollers and adjust if necessary.			●	
3	Check attachment is properly secured to the truck and the supporting elements.			●	
4	Test attachment, check settings and check for damage.			●	
5	Check sliding blocks are complete.			●	
6	Check attachment bearing points, guides and stops for wear and damage, grease and clean these components.			●	
7	Check attachment lubrication; clean and lubricate if necessary.		●		
8	Check hydraulic ports and tighten if necessary.			●	
9	Test the fork positioner and check for damage.			●	
10	Check cylinder seals.			●	
11	Check cylinder piston rods and bushings.			●	

Access module

Electrical System		W	A	B	C
1	Test access module, check for damage and make sure it is secure.			●	

Optional equipment

Chassis and Superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage compartments, grips, windscreen wipers and washing systems etc. are working correctly and check for damage.			●	

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11 Maintenance checklist TFG

11.1 Operating Company

11.1.1 Standard Equipment

Brakes		W	A	B	C
1	Test brakes.	●			

Electrical System		W	A	B	C
1	Test warning and safety devices in accordance with operating instructions.	●			
2	Test displays and controls.	●			
3	Test Emergency Disconnect switch.	●			

Power Supply		W	A	B	C
1	Check battery cable connections are secure, grease terminals if necessary.	●			
2	Check battery and battery components.	●			

Travel		W	A	B	C
1	Check coolant level and top up if necessary.	●			
2	Check and clean radiator.	●			
3	Check tyre air pressure and top up if necessary.	●			
4	Check wheels for wear and damage.	●			
5	Check engine oil level, top up if necessary.	●			

Chassis and Superstructure		W	A	B	C
1	Check doors and/or covers.	●			
2	Check labels are legible and complete.	●			
3	Check engine compartment for contamination and clean if necessary.	●			
4	Check overhead guard and / or cab are secure and check for damage.	●			
5	Test driver's seat restraint system and check for damage.	●			

Hydraulic operations		W	A	B	C
1	Check load chain lubrication and lubricate if necessary.	●			
2	Test hydraulic system.	●			
3	Check hydraulic oil level and top up if necessary.	●			
4	Check forks or load handler for wear and damage.	●			

11.1.2 Optional Equipment

Work lights

Electrical System		W	A	B	C
1	Test lighting.	●			

Strobe light / beacon

Electrical System		W	A	B	C
1	Test strobe light / beacon and check for damage.	●			

Heating

Chassis and Superstructure		W	A	B	C
1	Test the heating.	●			

Clamping device

Hydraulic operations		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Sideshifter

Hydraulic operations		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Road traffic approval (StVZO)

Electrical System		W	A	B	C
1	Test lighting.	●			

Wiper/washer system

Chassis and Superstructure		W	A	B	C
1	Check wiper water container for leaks and check volume, top up if necessary.	●			

Fork positioner

Hydraulic operations		W	A	B	C
1	Check attachment lubrication; clean and lubricate if necessary.	●			

Optional equipment

Chassis and Superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage compartments, grips, windscreen wipers and washing systems etc. are working correctly and check for damage.	●			

11.2 Customer Service

11.2.1 Standard Equipment

Brakes		W	A	B	C
1	Test brakes.			●	
2	Check the brake lining on the parking brake.			●	
3	Check connections and lines for leaks.			●	

Electrical System		W	A	B	C
1	Test warning and safety devices in accordance with operating instructions.			●	
2	Test displays and controls.			●	
3	Test the main switch / battery isolator.		●		
4	Test Emergency Disconnect switch.			●	
5	Check contactors and/or relays.			●	
6	Check fuse ratings.			●	
7	Check electrical wiring for damage (insulation damage, connections). Make sure wire connections are secure.			●	

Power supply		W	A	B	C
1	Final adjustments to the LPG system.			●	
2	Check battery cable connections are secure, grease terminals if necessary.			●	
3	Check battery and battery components.			●	
4	Check battery voltage.			●	
5	Note: check the exhaust levels every six months and adjust if necessary. Observe other national guidelines and regulations.				
6	Note: The LPG system must only be inspected by LPG system experts.				
7	Test the LPG system and check for leaks and damage.			●	
8	Replace the LPG filter.			●	

Travel		W	A	B	C
1	Replace transmission oil filter.				●
2	Check transmission oil level or grease filling of the transmission and top up if necessary.			●	
3	Replace the axle return filter.			●	
4	Test exhaust system and check for leaks and damage.			●	
5	Test anti-freeze, top up if necessary.			●	
6	Replace radiator fluid and anti-freeze.				●
7	Check cooling system for leaks.			●	
8	Check coolant level and top up if necessary.			●	
9	Test hydraulic fans and check for leaks.			●	

Travel		W	A	B	C
10	Clean the engine oil cooler.			●	
11	Check and clean radiator.		●		
12	Check transmission for noise and leakage.			●	
13	Replace transmission oil.				●
14	Check tyre air pressure and top up if necessary.			●	
15	Check wheels for wear and damage.			●	
16	Check wheel suspension and attachment.			●	
17	Test starter and generator, Check wires and attachment.			●	
18	Replace engine oil filter.		●		
19	Note: replace multi-V belt every 3000 service hours.				
20	Check V belt / multi-V belt is tensioned and check for damage. Replace if necessary.			●	
21	Replace air filter.			●	
22	Check air filter, replace if necessary.		●		
23	Check engine for noise and leakage.			●	
24	Replace engine oil.		●		
25	Check engine suspension.			●	
26	Test water pump and the fans.			●	
27	Replace the spark plugs.			●	
28	Check drive axle for noise and leakage.			●	
29	Replace drive axle oil.				●
30	Clean or replace transmission oil suction filter if necessary.				●

Chassis and Superstructure		W	A	B	C
1	Check chassis and screw connections for damage.			●	
2	Check doors and/or covers.			●	
3	Check labels are legible and complete.			●	
4	Check attachment and setting function of the driver's seat.			●	
5	Check condition of the driver’s seat.			●	
6	Check engine compartment for contamination and clean if necessary.		●		
7	Check attachment of the counterweight.			●	
8	Check mast attachment / mounting.			●	
9	Check trailer coupling or tow mechanism stop.			●	
10	Check overhead guard and / or cab are secure and check for damage.			●	
11	Check operator mat and steps are non-slip and damage-free.			●	
12	Test driver's seat restraint system and check for damage.			●	

Hydraulic operations		W	A	B	C
1	Test "hydraulic" controls and make sure the labels are present, legible and complete.			●	
2	Test hydraulic controls and check they are assigned to the correct functions.			●	
3	Check cylinders and piston rods for damage and leaks, and make sure they are secure.			●	
4	Check running surfaces of the integral sideshifter and / or integral fork positioner for wear and damage, and lubricate if necessary.		●		
5	Check settings and wear levels of slide pieces and stops and adjust the slide pieces if necessary.			●	
6	Check load chain setting and tension if necessary.			●	
7	Check load chain lubrication and lubricate if necessary.		●		
8	Check lateral clearance of the mast connections and the fork carriage.			●	
9	Visually inspect the mast rollers and check contact surface wear level.			●	
10	Check running surfaces of the mast for wear and damage, and lubricate if necessary.		●		
11	Test hydraulic system.			●	
12	Replace hydraulic reservoir discharge paper filter.			●	
13	Replace hydraulic oil filter.			●	
14	Check that hydraulic ports, hose and pipe lines are secure, check for leaks and damage.			●	
15	Test emergency lowering system.			●	
16	Check hydraulic oil level and top up if necessary.			●	
17	Test relief valve and adjust if necessary.			●	
18	Replace hydraulic oil.				●
19	Check forks or load handler for wear and damage.			●	
20	Check piston rod screw depth and counter fixing / clamp. Where two tilt cylinders with the same stroke length are used, check the setting in respective of each other.			●	
21	Check tilt cylinders and mounting.			●	
22	Test lift and lowering speeds.			●	

Agreed services		W	A	B	C
1	Carry out a test run with rated load, if necessary with a customer-specific load.			●	
2	Lubricate truck according to the lubrication schedule.			●	
3	Demonstration after servicing.			●	

Steering		W	A	B	C
1	Test hydraulic steering and its components.			●	
2	Test the hydraulic steering for leaks.			●	
3	Check steering axle and steering knuckle for wear and damage.			●	
4	Check steering-knuckle bearing and adjust if necessary.			●	
5	Grease the steering axle.		●		
6	Check mechanical parts of steering column.			●	

11.2.2 Optional Equipment

Discharge strap

Electrical System		W	A	B	C
1	Check anti-static discharge strap is present and not damaged.			●	

Audible warning devices

Electrical System		W	A	B	C
1	Test the buzzer / warning alarm, check for damage and make sure it is secure.			●	

Trailer coupling

Chassis and Superstructure		W	A	B	C
1	Check trailer coupling or tow mechanism stop.			●	

Work platform

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Work lights

Electrical System		W	A	B	C
1	Test lighting.			●	

Strobe light / beacon

Electrical System		W	A	B	C
1	Test strobe light / beacon and check for damage.			●	

Data recorder

Electrical System		W	A	B	C
1	Check data recorder is secure and check for damage.			●	

90° / 180° rotary seat

Chassis and Superstructure		W	A	B	C
1	Check drive chain of rotary seat and adjust if necessary.		●		
2	Lubricate drive chain of rotary seat.		●		
3	Test rotary seat and check for damage.		●		
4	Check rotary drive motor attachment.		●		
5	Check rotary drive pinion for wear and damage.		●		

Electrical optional equipment

Electrical System		W	A	B	C
1	Test the electrical optional equipment and check for damage.			●	

Fire extinguisher

Agreed services		W	A	B	C
1	Check fire extinguisher is present, secure and check test interval.				●

Belt lock control

Chassis and Superstructure		W	A	B	C
1	Test the belt lock control and check for damage.			●	

Heating

Chassis and Superstructure		W	A	B	C
1	Test the heating.			●	
2	Replace heating breather.			●	
3	Check hoses for leaks and damage and make sure they are secure.			●	

Clamping device

Hydraulic operations		W	A	B	C
1	Test the acknowledgement key.			●	
2	Test the hose reel and check for leaks and damage.			●	
3	Check axial play of the front and rear rollers and adjust if necessary.			●	
4	Check attachment is properly secured to the truck and the supporting elements.			●	
5	Test attachment, check settings and check for damage.			●	
6	Check sliding blocks are complete.			●	
7	Check attachment bearing points, guides and stops for wear and damage, grease and clean these components.			●	
8	Check attachment lubrication; clean and lubricate if necessary.		●		
9	Check hydraulic ports and tighten if necessary.			●	
10	Check cylinder seals.			●	
11	Check cylinder piston rods and bushings.			●	

Air conditioning system

Chassis and Superstructure		W	A	B	C
1	Test air conditioning system and its settings and check its components for damage.			●	
2	Note: The air conditioning system must only be serviced every two years or 2000 service hours by specialist personnel.				
3	Visually inspect the filter and replace if necessary.			●	
4	Check temperature reading at the outlet of the ventilation nozzles against manufacturer's ratings.			●	

Crane hook

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Load backrest

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Hose reel

Hydraulic operations		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	

Impact sensor

Electrical System		W	A	B	C
1	Check impact sensor is secure and check for damage.			●	

Sideshifter

Hydraulic operations		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	
2	Check axial play of the front and rear rollers and adjust if necessary.			●	
3	Check attachment is properly secured to the truck and the supporting elements.			●	
4	Test attachment, check settings and check for damage.			●	
5	Check sliding blocks are complete.			●	
6	Check attachment bearing points, guides and stops for wear and damage, grease and clean these components.			●	
7	Check attachment lubrication; clean and lubricate if necessary.		●		
8	Check hydraulic ports and tighten if necessary.			●	
9	Test the sideshifter, check settings and check for damage.			●	
10	Check cylinder seals.			●	
11	Check cylinder piston rods and bushings.			●	

Seat heating

Electrical System		W	A	B	C
1	Check electrical wiring for damage (insulation damage, connections). Make sure wire connections are secure.			●	

Road traffic approval (StVZO)

Electrical System		W	A	B	C
1	Test lighting.			●	

Boom

Hydraulic operations		W	A	B	C
1	Check attachment is properly secured to the truck and the supporting elements.			●	

Weigher sensors / switches

Electrical System		W	A	B	C
1	Test weigher system and check for damage.			●	

Wiper/washer system

Chassis and Superstructure		W	A	B	C
1	Check wiper water container for leaks and check volume, top up if necessary.			●	
2	Test windscreen wipers and check for damage, replace if necessary.			●	

Fork positioner

Hydraulic operations		W	A	B	C
1	Test the hose reel and check for leaks and damage.			●	
2	Check axial play of the front and rear rollers and adjust if necessary.			●	
3	Check attachment is properly secured to the truck and the supporting elements.			●	
4	Test attachment, check settings and check for damage.			●	
5	Check sliding blocks are complete.			●	
6	Check attachment bearing points, guides and stops for wear and damage, grease and clean these components.			●	
7	Check attachment lubrication; clean and lubricate if necessary.		●		
8	Check hydraulic ports and tighten if necessary.			●	
9	Test the fork positioner and check for damage.			●	
10	Check cylinder seals.			●	
11	Check cylinder piston rods and bushings.			●	

Access module

Electrical System		W	A	B	C
1	Test access module, check for damage and make sure it is secure.			●	

Optional equipment

Chassis and Superstructure		W	A	B	C
1	Check that optional equipment such as mirrors, storage compartments, grips, windscreen wipers and washing systems etc. are working correctly and check for damage.			●	

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