

Kalmar LMV

Technical Handbook DC 9-16

This Handbook deals with the design and maintenance of Kalmar LMV forklift trucks.

In addition, it gives details of troubleshooting and the most common corrective maintenance.

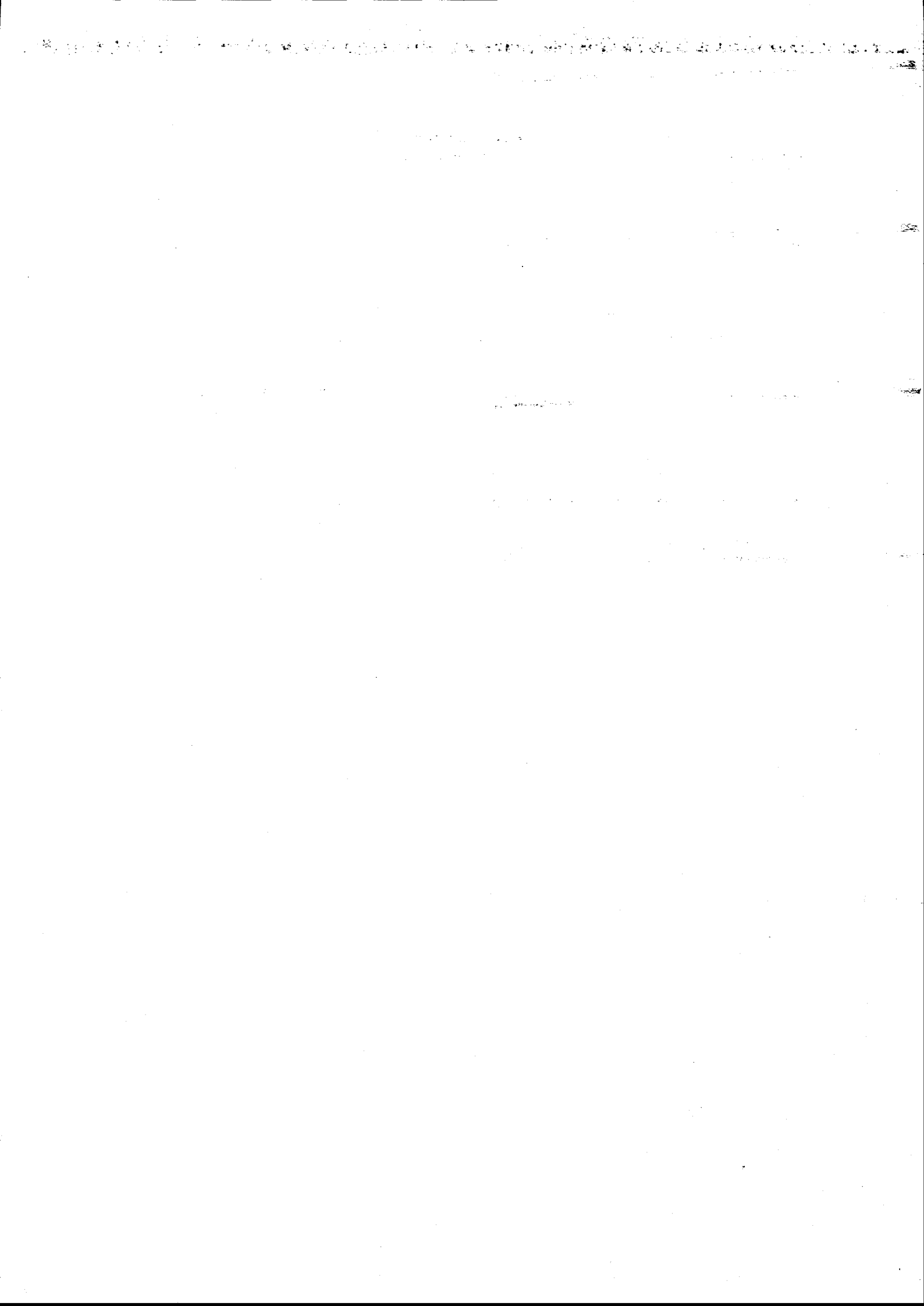
Operation and other matters that are primarily of interest to the operator are included in the Operator's Manual.

Kalmar LMV

We reserve the right to modify our design and material specifications without prior notice.

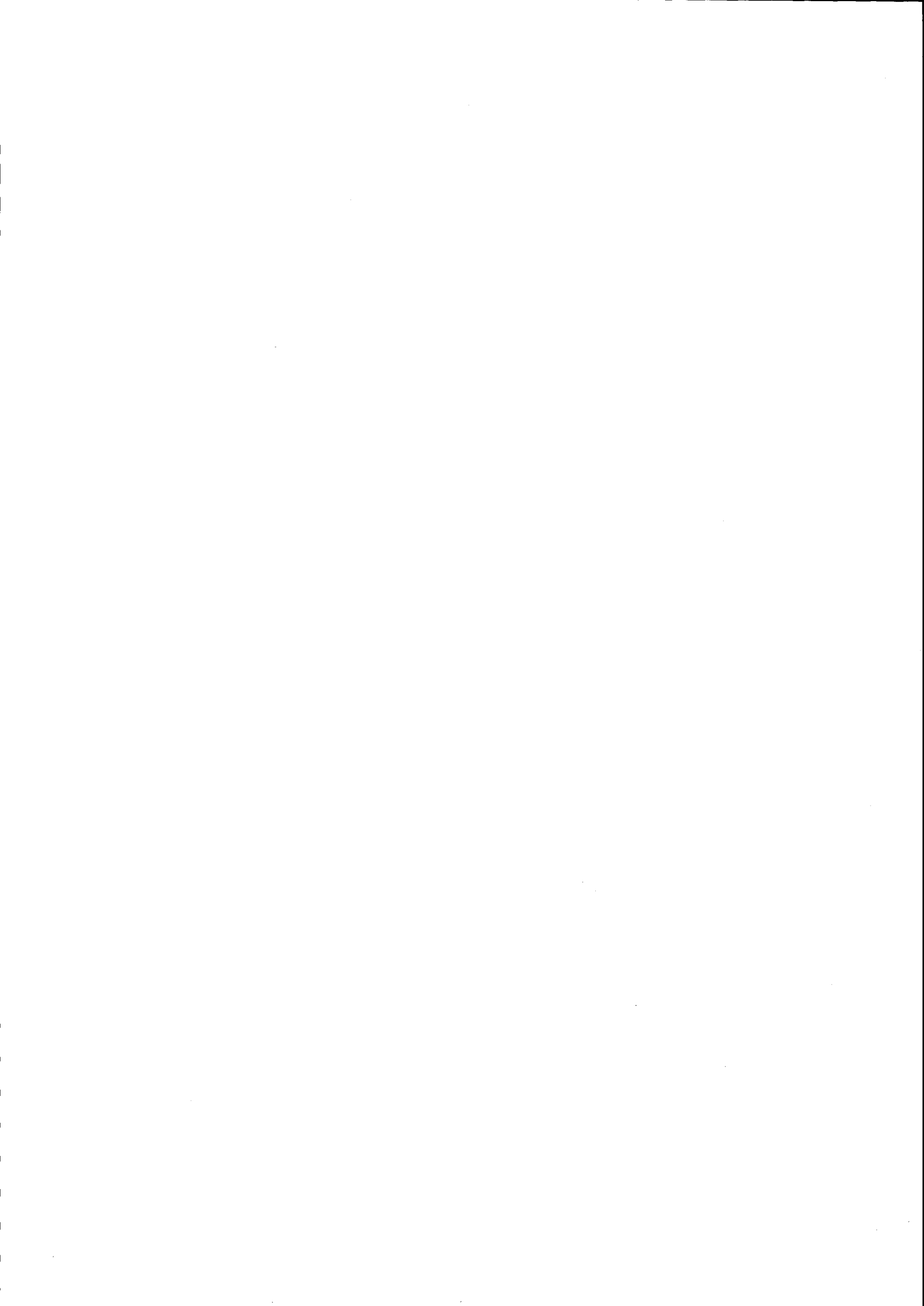
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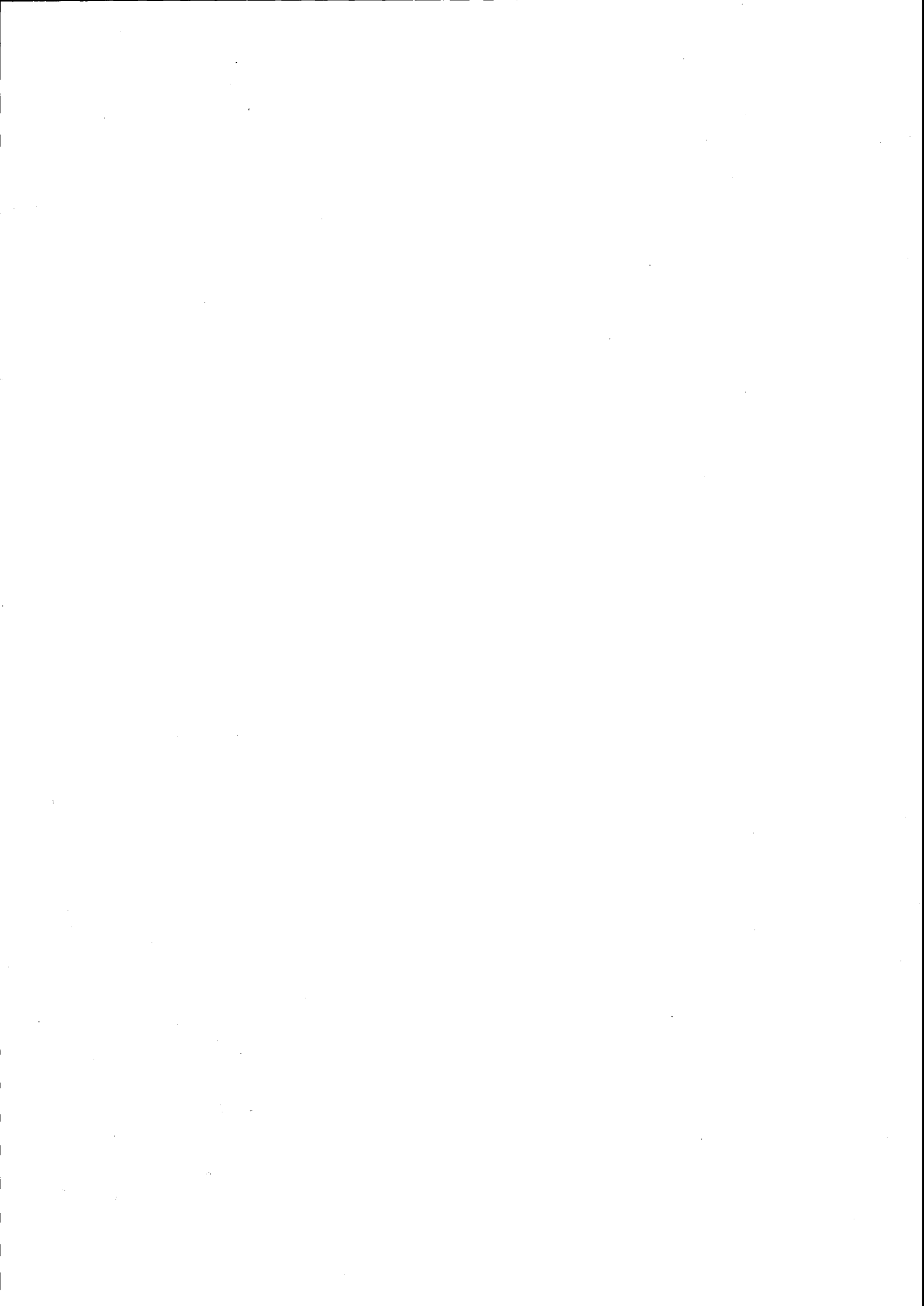
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Safety Instructions for working with tyres

- Tyre changing can be dangerous and should only be carried out by specially trained personnel using proper tools and procedures. Failure to comply with these procedures may result in faulty positioning of the tyre and/or rim and cause the assembly to burst with explosive force sufficient to cause physical injury or death. Never fit or use damaged tyres or rims.
- Deflation and dismantling
 - Always check the tyre/rim assembly for proper component seating prior to removal from the truck.
 - Always deflate the tyre by removing the valve core prior to removing the complete assembly from the truck or dismantling any of the component. Before loosening mounting bolts, run a wire through the valve stem to ensure that it is not blocked. Ice or dirt can prevent all the air from escaping.
 - Never position body in front of the rim during deflation.
 - Always follow assembly and dismantling procedures outlined in the manufacturer's instruction manual, or other recognized industry instruction manuals. Use proper rubber lubricant.
 - Never use a steel hammer to assembling or dismantling rim components – use a lead, brass or plastic type mallets. The correct tools are available through rim/wheel distributors.
- Rim inspection
 - Always select the correct tyre size and construction matching the manufacturer's rim or wheel rating and size.
 - Do not use over-size tyres, too large for the rims, e.g. 14.5 inch tyres with 14 inch rims or 16.5 inch tyres with 16 inch rims.
 - Never use damaged, worn or corroded rims/wheels or fitting hardware. Always verify that the rim is in a serviceable conditioning.
 - Always clean and repaint lightly rusted rims.
 - Never use a rim/wheel component that can not be identified. Check rim parts against multi-piece rim/wheel matching charts.
- Assembly and inflation
 - Always double check to ensure that the rim assemblies have been correctly assembled and that securing studs and nuts are tightened to the correct torque setting.
- When adding air to a tyre on an industrial truck, use a clip-on chuck and stay out of the danger area. If the tyre has been run flat then the rim must be dismantled and all parts inspected for damage.
- Under-inflated tyres have a serious effect on the stability of the truck and reduces the safe load handling capacity. Always maintain tyres at the correct inflation pressures. Check inflation pressures daily.
- Inspect tyres regularly – every day if possible. Look for and remove broken glass, torn pieces of tread, embedded metal chips etc. Inspect for uneven or rapid tread wear, usually caused by mechanical irregularities, such as brakes out of adjustment or excessive toe-in and toe-out. If discovered, correct the irregularity immediately.
- When installing and tightening trail wheel bolts, observe the following:
 - Ensure that trail wheel or hub mounting surfaces and trail wheel fastener mounting surfaces are clean and free from paint and grease.
 - Tighten bolts to specified torque settings. Use staggered sequence; i.e. top bolt, bottom bolt etc.

Safety rules

- Follow the local safety regulations.
- Before starting, check that nobody is in the way of the truck and its accessories.
- The truck should be driven only by specially trained operators who are authorised to do so by the work supervisor.
- The truck must not be used if its brakes, steering or lifting equipment is faulty. Neither must it be used if it has been repaired, modified or adjusted without the approval of the work supervisor.
- A passenger may not be carried on the truck.
- Do not exceed the lifting capacity of the truck (see the Load diagram in the cab).
- It is not permissible to use the truck for lifting personnel, unless it is equipped with an approved personnel cage.
- Do not drive the truck with a heavy load raised high above the ground, since the truck may overturn.
- During transport with container attachment – drive carefully and always with the attachment lowered, even if the attachment is empty.
- Always apply the parking brake before leaving the cab. Always remove the key if the truck is left unattended.
- The parking brake may also be used as EMERGENCY BRAKE (see Brake system).
- Under no circumstances may compressed air be used to remove a hydraulic piston from its cylinder.
- Always attend to damage and wear that may be of significance to the performance and useful life of the truck or to the safety of the personnel.
- Follow the safety rules whenever carrying out service work on the air conditioner. The refrigerant is injurious to the skin and eyes.
- The brake system is equipped with accumulators charged to a pressure of up to 210 bar. To prevent accidents when working on the brake system, never disconnect any component without previously relieving the accumulator pressure by means of the accumulator discharge valve.
- Never carry out any service work on the lifting mast when the engine is running.

Design - General survey

Kalmar LMV DC 9-16 tonne diesel trucks are of sturdy design for heavy duty. They are built around a chassis which has high strength and torsional stiffness and an extremely low centre of gravity.

The operator's cab is provided with vibration isolation and sound insulation and offers excellent all-round visibility. It satisfies with a comfortable margin the demands for a safety cab specified by various standards and regulations.

The operator is provided with many facilities for adjusting his seating attitude. The seat, backrest and springing of the operator's seat can be adjusted in a wide variety of ways.

The cab is tiltable and offers excellent accessibility to the transmission and hydraulic pumps. The engine is easily accessible through a casing, divided in two halves.

The Volvo six-cylinder turbocharged TD 61 AW or TD 71 AW engine, combined with a three-speed gearbox with torque converter, provides smooth power whenever needed.

The drive axle with hub reductions, the oil-cooled hydraulic brake system and the pendulum-mounted steered axle with double-acting steering cylinder satisfy very strict demands on strength and mobility when travelling on irregular surfaces.

The hydraulic system is reliable and has high performance charged by three hydraulic pumps. For further details, see group 70.

Component units

- Sound-insulated and safety-tested operator's cab with excellent all-round visibility. The non-slip, substantial steps provide convenient access to the cab. All models in the series can be equipped with a rotatable operator's seat.
- Clearly arranged, console-mounted instrument panel.
- Engine – Volvo TD 61 AW or TD 71 AW six-cylinder, four-stroke, turbocharged diesel engine with direct injection and thermostatically controlled water cooling.

The engine is equipped with:

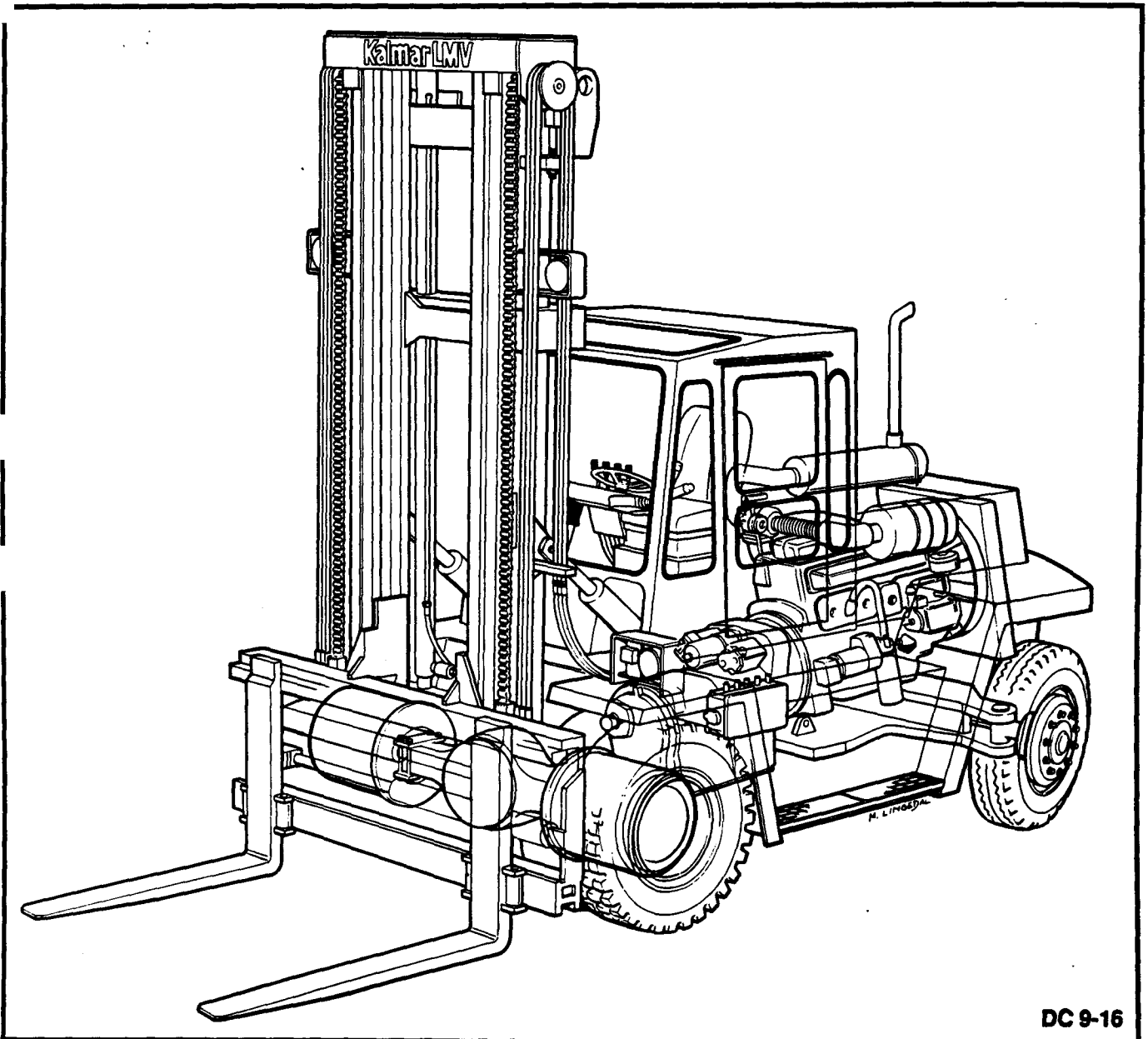
- Injection pump with centrifugal governor that compensates for load variations.
- Alternator.
- Perkins 6-cylinder engine 1006-6 is available as an option.

Applications

The Kalmar LMV DC 9-16 tonne range of trucks is based on an entirely new approach to the design and production of medium-heavy, diesel-powered forklift trucks. The trucks are durable and safe, and their accessibility for service and maintenance is unexcelled.

Due to their versatility, the trucks can be used in a number of applications, such as:

- Steelworks and heavy engineering industry, where the trucks handle individual tasks in the handling of medium-heavy goods.
- The forest industry for handling logs by means of a log grapple attachment, sorting of logs at sawmills and handling of sawn timber in units loads.
- Ports and container terminals for handling medium-heavy goods and handling empty containers.
- Factories producing houses - lifting of house sections.



- Gearbox with torque converter
 - Constant-mesh gearbox with hydraulically actuated clutches for the different gears. The clutches are electrically operated.
 - Torque converter, which is a hydraulic coupling that amplifies the output torque on an increase in load. Torque conversion takes place smoothly and steplessly throughout the engine speed range.
 - Oil cooler connected to the engine cooling system for cooling the oil in the gearbox and torque converter.
 - Oil pump which supplies oil under pressure to the gearbox and torque converter.
 - Full-flow oil filter for effective cleaning of the gearbox oil.
- Drive axle with two-stage reduction - in the differential and the hub reductions.
 - Oil cooled hydraulic brakes for the foot brake, e.g. Wet disc brakes.
 - Disc type parking brake applied by a sturdy spring and released by hydraulic oil pressure.
- Hydraulic system with
 - Gear type hydraulic pumps connected to take-offs on the torque converter. One pump for lifting/tilting and one for the other functions in the main hydraulics and also a separate pump for accumulator charging, which in turn serves the brake circuits.
 - Main valve for controlling the main hydraulics. The valve is controlled mechanically from the cab by means of cables. An hydraulic servo system is available as an option.
 - A high pressure filter after each pump for effective cleaning of the hydraulic fluid before it is fed to the system.
 - Steering valve (Orbitrol) - flow-control valve which supplies hydraulic fluid to the steering cylinder.
- Steered axle with pendulum mounting and double-acting steering cylinder.
- Sturdy clear-vision mast. Of duplex or triplex design, with or without free lift.
 - Outer mast with hydraulically controlled 5° forward and 10° backward tilting.
 - Tilting cylinders with back-pressure valves to prevent the load from tilting the mast forward.
 - Inner mast with support rollers that carry the forces on the mast. Yoke with guide rollers for the hydraulic hoses and guide sprockets for the lifting chains.
 - Lifting cylinders - two cylinders mounted on the outer mast.
- Fork carriage designed for optimum visibility and equipped hydraulic with fork positioning and sideshifting.

Tightening torques

(According to Kalmar LMV K Standard 20060.0001)

The tightening torques are applicable to steel bolts and nuts tightened with a torque wrench under the following conditions:

Condition	Surface treatment		Lubrication
	Bolt	Nut	
1	untreated	untreated	oiled
2	bright galvanised bright galvanised bright galvanised	untreated bright galvanised hot-dip galvanised	dry or oiled
3	hot-dip galvanised	untreated	dry or oiled

The values specified in Table 1 are applicable to nut-and-bolt joints, but can also be used for bolts fitted into tapped holes. However, in the latter case, the preloading force will be somewhat lower, depending on its depth of engagement.

When tightening by machine, the torque specified in Table 1 should be reduced by approx. 5 %, due to the increased scatter and to prevent the bolt from being tightened beyond its yield point.

Quality	8,8			10,9	12,9
	Tightening torque, Nm				
Thread M fin	Condition				
	1	2	3	1	1
M 8x1	27	24	30	39	46
M10x1,25	54	48	61	76	91
M12x1,25	96	85	108	135	162
M16x1,5	230	205	260	323	388
M18x1,5	330	294	373	466	559
M20x1,5	460	409	520	647	777
M24x2	786	700	888	1100	1330
M30x2	1560	1388	1763	2200	2640
M36x3	2660	2367	3005	3730	4480

Main components

Alternate power lines	9-600	10-600	12-600	13.6-600	13.6 EC3	13.6 EC4	12-1200	15-1200	16-600	16-900	16-1200
Engine											
Volvo TD 61 AW	●	●	●	●	●	●	●	●	●	●	●
Volvo TD 71 AW		○	○	○	○	○	○	○	○	○	○
Perkins 1006-6	○	○	○	○	○	○					
Gearbox											
Clark 28000 (All Volvo)	●	●	●	●	●	●	●	●	●	●	●
Clark 18000 (Perkins)	○	○	○	○	○	○					
Drive axle											
Kessler D81 PL478-NL8	●	●	●	●	●	●	●	●	●	●	●

● Standard ○ Option

Supplementary books

In addition to the Instruction Manual and the Technical Handbook for the DC 9-16, the following books are delivered with every truck.

Spare parts catalogue
 Instruction Manual for the Volvo TD 61 AW/71 AW/Perkins 1006-6
 Workshop Manual for the Perkins 1006-6
 Workshop Manual for the Clark transmission.

Replacement system - Spare parts

Kalmär LMV operates a system of replacement parts, repair kits and seal kits covering most of the vital components of the truck. For the contents of these kits, see the Spare parts catalogue.

Tools

Kalmär LMV offers a wide range of tools for maintenance work on forklift trucks.

For further information, please get in touch with the Parts Department of Kalmär LMV.

Thread UNF	Tightening torque, Nm Condition				
	1	2	3	1	1
1/4	13	11	14	19	22
5/16	26	23	29	37	44
3/8	47	42	53	67	79
7/16	75	66	85	107	126
1/2	114	101	128	162	191
9/16	164	145	185	231	273
5/8	227	202	256	321	379
3/4	396	352	447	559	661
7/8	629	560	710	889	1050
1	937	834	1058	1320	1560
1 1/8	1350	1200	1525	1900	2250
1 1/4	1860	1655	2100	2630	3110
1 3/8	2500	2225	2825	3530	4170
1 1/2	3260	2900	3680	4610	5450

System of units

The SI system of units is employed in this handbook.
 The conversion factors are as follows:

Pressure

megapascal MPa	bar	Kilogram-force per square centimetre, kgf/cm ² Atmosphere, at	Pound-force per square inch, psi
1	10	10.2	145
0.1	1	1.02	14.5
0.098	0,98	1	14.2

Torque

newton- metre Nm	Kilogram force- metre kgf m	Pound-force foot lbf ft
1	0.102	0.74
9.81	1	7.23

Power

Kilowatt kW	Horsepower (metric) hp	Horsepower hp
1	1.36	1.34
0.735	1	0.986

To reduce the risk of settlement of the material and the associated reduction in the preloading force if the hardness of the surface supporting the bolt head or nut is lower than 200 HB, a washer should be fitted under the bolt head and nut. This is not applicable if flanged bolts or flanged nuts are used.

When tightening is carried out, the specified torque should be applied without pause, to ensure that the torque wrench will not be tripped by the static friction before the joint has been tightened to the specified torque.

Quality	8,8			10,9	12,9
	Tightening torque, Nm Condition				
Thread M	1	2	3	1	1
4	3,2	2,9	3,6	4,6	5,5
5	6,4	5,7	7,2	9,1	11
6	11	9,8	12,5	16	19
8	26	24	30	38	45
10	52	47	59	74	89
12	91	81	103	128	154
16	220	198	250	313	375
20	430	386	490	610	732
24	750	668	848	1050	1270
30	1480	1317	1672	2080	2500

Thread UNC	Tightening torque, Nm Condition				
	1	2	3	1	1
1/4	12,5	11,1	14,1	17,6	20
5/16	25	22,3	28,3	35	42
3/8	44	39	50	62	73
7/16	70	62	79	100	118
1/2	107	95	121	151	178
9/16	153	136	173	216	255
5/8	210	187	237	298	353
3/4	370	390	418	524	619
7/8	594	528	671	839	990
1	889	791	1005	1260	1480
1 1/8	1260	1120	1424	1780	2100
1 1/4	1760	1565	1990	2490	2940
1 3/8	2320	2065	2620	3280	3870
1 1/2	3060	2720	3455	4320	5100



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