

Kalmar DCF280-520

Lift trucks 60,500 – 115,000 lbs



Technical information, Tier III

Welcome to a new world of heavy-duty handling

The Kalmar F generation heavy-duty lift trucks are based on long experience and smart utilisation of the latest technology. A machine loaded with customer value.

The heavy-duty lift trucks have been developed for a broad spectrum of heavy handling applications. Very strong emphasis has been put on providing our customers not only a machine, but productivity and cost efficiency.

This is a machine generation which reflects the overall increased demands and requirements among our customers all over the world.



The Two basic elements in heavy-duty handling

Based on our experience from more than 10,000 predecessors operating worldwide, the F-generation has gone through an aggressive product development, where we have scrutinised and improved every detail, component and system.

We have learned that demanding customers have two main priorities when it comes to machine choice and decision – productivity and cost efficiency. All other aspects are there to fulfil these priorities and add even more customer value.

When simple technical solutions were appropriate we applied them, and when the need was for more sophisticated systems we installed them to increase your productivity and cost efficiency.

And there is of course, exciting new leveraging technology under the skin in order to provide the best everyday performance and availability.

Finally, the technical optimization of the Kalmar F-generation means that you will get the best technology available but still have a reliable, simple, safe and hard working machine.

This is what it's all about. But of course you have to add “at the lowest operational cost possible”.

Made for top performance

To obtain the maximum out of your investment, you can never underestimate the importance of the driver's working environment. High productivity requires full driver concentration and efficiency to keep up handling speed, but also to avoid accidents causing injuries and costly damages.

This is what ergonomics are all about. Being comfortable and aware.

The driver environment on Kalmar Heavy Lift Trucks is the efficient Spirit Delta high visibility cabin; appreciated by professional drivers, proven on thousands of Kalmar machines all over the world.

We focus on four important ergonomic areas:

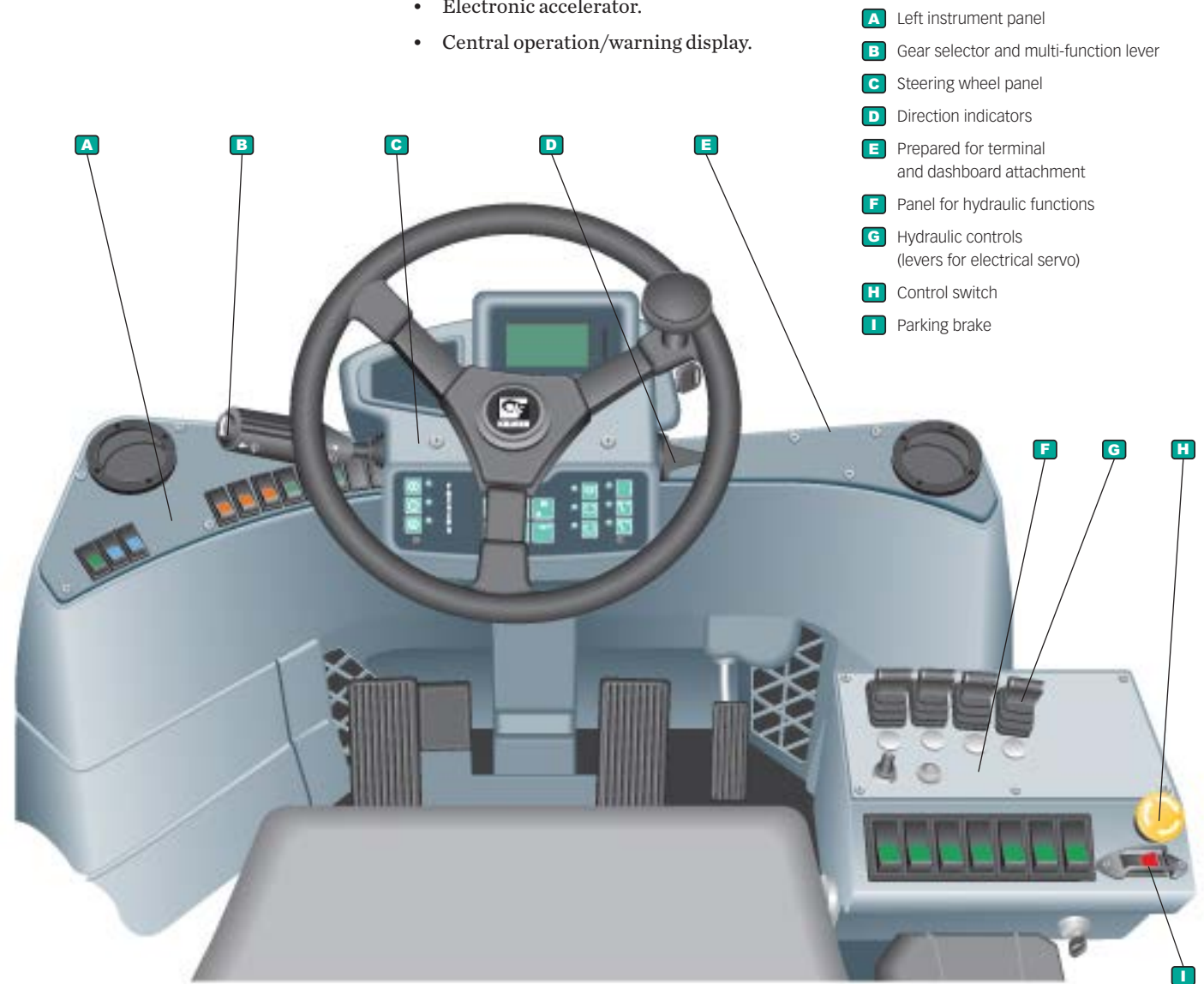
- Operation
- Visibility
- Sound and vibrations
- Climate

The result is a cabin where everything is optimized to improve driver performance.

Consider this:

- Individually adjustable controls, steering wheel and seat.
- Intuitively positioned instruments.
- Switches and buttons with lights.
- Comfort pedals.
- Electronic accelerator.
- Central operation/warning display.

- Separately suspended and isolated cabin.
- Shock absorption to minimize vibrations.
- Maximum sound level inside is 70 dB (A).
- Generous interior dimensions and floor space.
- Optimized visibility – 360° all around.
- Electronically controlled heating/ventilation.
- Filters for fresh air and recirculation.
- High performance air conditioning system, optional.
- Pollen filter, optional.



Match your specific handling requirements

When we designed the Kalmar series we already knew the detailed status of all the main alternatives on the market. Hence, we designed a machine which meets or exceeds the specifications of the others – on the spec sheet and in reality.

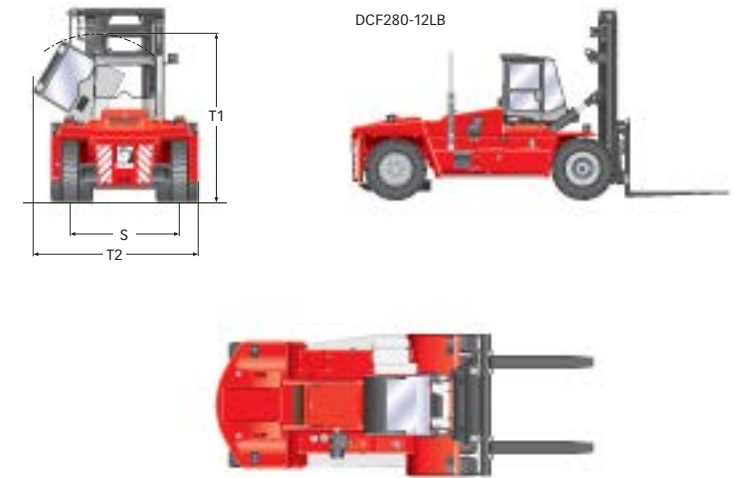
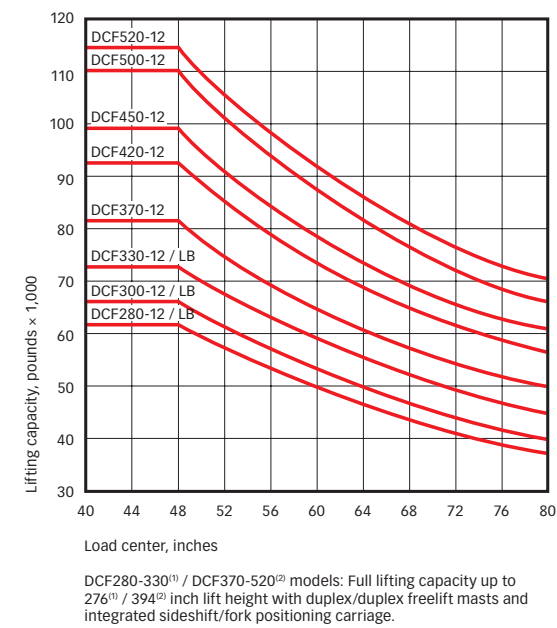
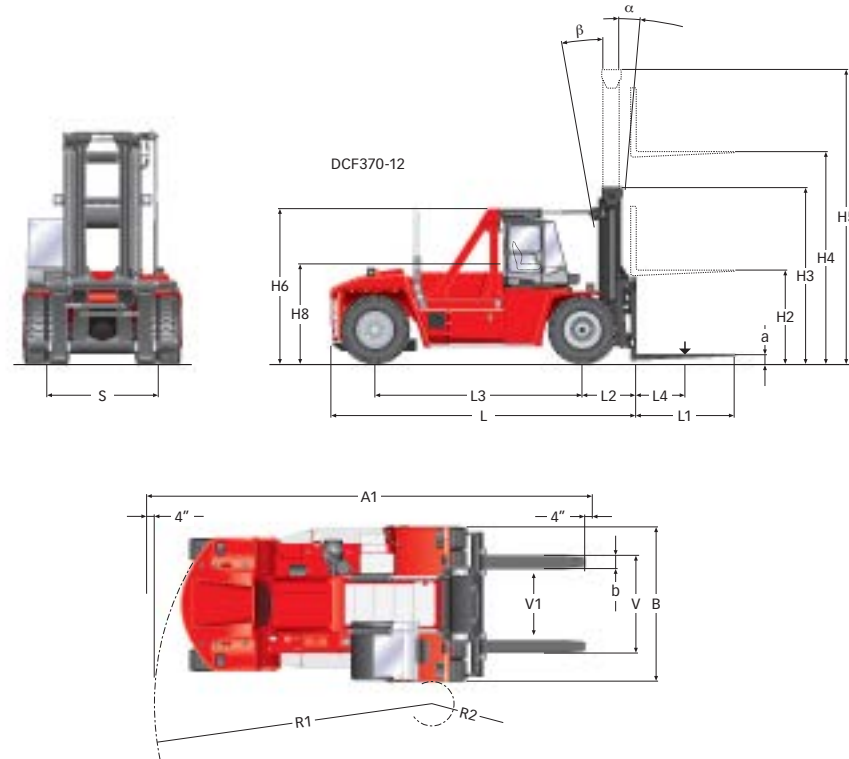
You can choose between several basic models, each optimized according to lifting capacity – stability – overall dimensions – weight – and driving performance.

Eleven models covering loads between 60,500 – 115,000 pounds, specified for a comprehensive range of lifting heights at 48 inch load center, including the side-shift/fork positioning carriage. This means that you may easily find the right machine or combination of machines to suit your operational requirements.

The design of the chassis, mast and carriage has resulted in machines with very good dimensional-, stability- and operational characteristics.

In spite of its size and capacity the machines have short turning radius. Together with the optimised visibility and good manoeuvrability, it saves site space and makes the machine a smooth operator in confined spaces. The counterweight and lifting height requirements have been matched with a modern chassis to keep down the overall weight but with no sacrifice in stability.

Additionally, we have ensured that every single detail, component and system have been selected and manufactured to provide the highest possible reliability.



Dimensions			DCF280-12		DCF300-12		DCF300-12		DCF370-12		DCF420-12		DCF450-12		DCF500-12		DCF520-12			
			LB		LB		LB													
Lifting capacity	Rated (lb)		60,500		65,000		72,000		80,000		90,000		100,000		110,000		115,000			
	Load center (in)	L4	48		48		48		48		48		48		48		48			
Truck	Truck length (in)	L	262.8		262.8		272.6		289.2		308.9		313.0		336.6		336.6			
	Truck width (in)	B	134.3		134.3		134.3		163.4		163.4		163.4		163.4		163.4			
	Height, basic machine, Spirit Delta (in)	H6	143.7	134.4	143.7	134.4	143.7	134.4	146.7	146.7	150.6	150.6	150.6	150.6	150.6	150.6	150.6			
	Seat height, Spirit Delta (in)	H8	90.6		90.6		90.6		92.5		92.5		96.5		96.5		96.5			
	Distance between center of front axle – front face of fork arm (in)	L2	44.3		44.3		44.3		51.0		51.0		55.1		56.7		56.7			
	Wheelbase (in)	L3	177.2		177.2		187.0		196.8		216.5		216.5		236.2		236.2			
	Track (c-c) front – rear (in)	S	100.0 – 90.1		100.0 – 90.1		100.0 – 90.1		119.3 – 103.3		119.3 – 103.3		119.3 – 110.8		119.3 – 110.8		119.3 – 110.8			
	Turning radius, outer – inner (in)	R1 – R2	253.8 – 37.4		253.8 – 37.4		261.8 – 37.4		271.7 – 39.4		291.3 – 43.3		320.9 – 43.3		340.6 – 47.2		340.6 – 47.2			
	Ground clearance, min. (in)		11.8		11.8		11.8		11.8		11.8		11.8		11.8		11.8			
	Height when tilting cab, max. Spirit Delta (in)	T1	–	149.6	–	149.6	–	149.6	–	–	–	–	–	–	–	–	–			
	Width when tilting cab, max. Spirit Delta (in)	T2	–	151.6	–	151.6	–	151.6	–	–	–	–	–	–	–	–	–			
	Min. aisle width for 90° stacking with forks (in)	A1	400.6		400.6		408.5		425.0		444.7		476.4		496.1		496.1			
Standard duplex mast	Lifting height (in)	H4	196.8		196.8		196.8		196.8		196.8		196.8		196.8		196.8			
	Mast height, min. (in)	H3	118.0		118.0		118.0		198.8		198.8		198.8		198.8		198.8			
	Mast height, max (in)	H5	276.4		276.4		276.4		297.2		297.2		297.2		318.9		318.9			
	Mast tilting, forward – backward* (°)	α – β	5 – 10		5 – 10		5 – 10		5 – 10		5 – 10		5 – 10		5 – 10		5 – 10			
	Ground clearance, min. (in)		–		–		–		–		–		–		–		–			
Forks	Width (in)	b	11.8		11.8		11.8		11.8		11.8		11.8		11.8		11.8			
	Thickness (in)	a	4.3		4.3		4.3		5.3		5.3		5.3		5.7		5.7			
	Length of fork arm (in)	l	96.0		96.0		96.0		94.5		94.5		94.5		94.5		94.5			
	Width across fork arms, max. – min. (in)	V	108.3 – 61.0		108.3 – 61.0		108.3 – 61.0		108.3 – 76.8		108.3 – 76.8		108.3 – 76.8		106.3 – 76.8		106.3 – 76.8			
	Sideshift ± at width across fork arms (in)	V1 – V	11.8 – 84.6		11.8 – 84.6		11.8 – 84.6		7.9 – 92.5		7.9 – 92.5		7.9 – 92.5		7.9 – 90.6		7.9 – 90.6			
Weight	Service weight (lb)		84,400		87,300		89,500		110,500		114,400		123,500		135,600		138,900			
	Axle load front, unloaded (lb)		43,200		43,200		43,200		58,200		60,400		63,500		72,800		75,000			
	Axle load front, at rated load (lb)		136,000		143,100		151,700		180,300		194,900		209,700		232,100		239,900			
	Axle load back, unloaded (lb)		41,200		44,100		46,300		52,250		54,000		60,000		62,800		63,900			
	Axle load back, at rated load (lb)		10,100		10,400		10,600		11,700		12,100		13,000		13,700		13,700			
Wheels / tires	Type, front – rear								Pneumatic – Pneumatic											
	Dimensions, front – rear (in)		16.00×25 – 16.00×25						18.00×25 – 18.00×25						18.00×33 – 18.00×33					
	Number of wheels, front – rear (*driven)		4* – 2		4* – 2		4* – 2		4* – 2		4* – 2		4* – 2		4* – 2		4* – 2			
	Pressure (Psi)		145		145		145		145		145		145		145		145			
Steering system	Type – maneuvering		Hydraulic servo – Steering wheel																	
Service brake system	Type – affected wheels		Oil cooled disc brakes (Wet disc brakes) – drive wheels																	
Parking brake system	Type – affected wheels		Dry, spring activated disc brake – drive wheels																	
Hydraulic pressure	Max. (Psi)		2466		2466		2466		2176		2466		2611		2901		2901			
Hydraulic fluid volume	(gal)		158.5		158.5		158.5		158.5		158.5		158.5		158.5		158.5			
Fuel volume	(gal)		105.7		105.7		105.7		105.7		105.7		105.7		105.7		105.7			

Versatility provides productivity

The standard lifting equipment for Kalmar is an integrated assembly consisting of a free visibility duplex mast, side-shift/fork positioning carriage and forks, hydraulics and control system. This is to ensure you get a reliable and good running machine with high availability even after long shifts and high load stresses in general cargo handling.

A major objective in the development process has been to combine optimum functionality for the driver together with high performance in lifting and load handling.

The mast and carriage are computer designed and optimized (FEM and Catia V5) which allowed for a decrease in the front axle weight. Together with Kalmar’s integrated high capacity carriage it allows you to fully utilize the capabilities of mast tilt, side-shift at full lifting height and full capacity. No compromises.



Full visual contact with the load and attachment, is provided by the Spirit Delta cabin and the open design of the mast and carriage.

Due to the wide range of optional equipment the machines can be fitted with a lifting system adapted to almost every application.

Duplex standard, clear view

Lift height, H4	DCF280-330 / LB			DCF370-450			DCF500			DCF520		
	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2
157.5	158.3	237.0	–	179.1	257.9	–	200.8	279.5	–	200.8	279.5	–
177.2	168.1	256.7	–	189.0	277.6	–	210.6	299.2	–	210.6	299.2	–
196.9	178.0	276.4	–	198.8	297.2	–	220.5	318.9	–	220.5	318.9	–
216.5	187.8	296.1	–	208.7	316.9	–	–	–	–	–	–	–
236.2	197.6	315.7	–	218.5	336.6	–	240.2	358.3	–	–	–	–
255.9	207.5	335.4	–	228.3	356.3	–	–	–	–	–	–	–
275.6	217.3	355.1	–	–	–	–	259.8	397.6	–	–	–	–
295.3	–	–	–	248.0	395.7	–	269.7	417.3	–	–	–	–
393.7	–	–	–	297.2	494.1	–	–	–	–	–	–	–

Duplex free-lift, clear view*

Lift height, H4	DCF280-330 / LB			DCF370-450			DCF500			DCF520		
	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2
157.5	158.3	237.0	78.7	179.1	257.9	78.7	–	–	–	–	–	–
177.2	168.1	256.7	88.6	189.0	277.6	88.6	–	–	–	–	–	–
196.9	178.0	276.4	98.4	198.8	297.2	98.4	198.1	297.2	297.2	198.1	297.2	297.2
216.5	187.8	296.1	108.3	208.7	316.9	108.3	–	–	–	–	–	–
236.2	197.6	315.7	118.1	218.5	336.6	118.1	–	–	–	–	–	–

* Duplex freelif and triplex mast requires el-hydr. servo incl minilevers.

Triplex free-lift, clear view*

Lift height, H4	DCF280-330 / LB			DCF370-450			DCF500			DCF520		
	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2	Mast height H3 min.	H5 max.	Free lift, H2
232.3	166.1	320.9	81.9	–	–	–	–	–	–	–	–	–
236.2	–	–	–	169.7	323.2	78,7	–	–	–	–	–	–

* Duplex freelif and triplex mast requires el-hydr. servo incl minilevers.

1 Duplex standard mast

The Duplex mast is a well proven design which minimizes the concealed angles for the driver.



2 Duplex free-lift mast

The Duplex mast is also available in a Free-lift version for certain lifting heights and models, providing full free-lift as well as exceptional visibility.



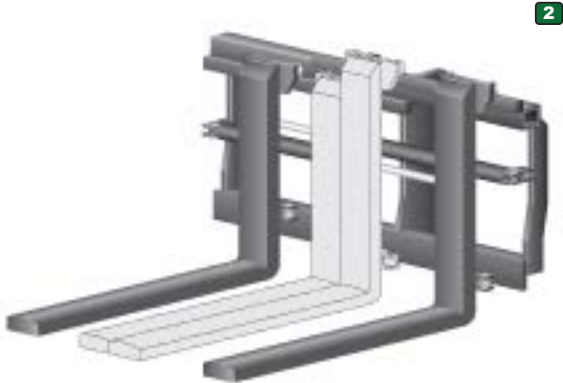
1 Standard carriage

Sideshift/fork positioning carriage hydraulic operated of free visibility type. The functions includes sideshift and fork positioning.



2 Carriage for steel application

This carriage of free visibility type includes sideshift and fork positioning. The forks could be positioned against each other to become a sort of flexible coil ram.



1 Fork shaft system

A smooth way to improve handling flexibility is to use the fork shaft system. The system enables the driver to quickly and easily change between different carriers or attachments like extra long forks, coil ram, inverted forks etc. The carriage is equipped with a separate shaft holder.



2 Coil ram

The coil ram is made for intensive handling of heavy coils, is mounted directly on the carriage and supported with a side-shift function.

3 Container handling attachments

Three versions of container handling attachments are available: fixed 20’ container frame, fixed 40’ container frame and 20/40’ expandable spreader. All three attachments can be mounted on standard or inverted forks depending on lifting height requirements.



4 Inverted forks

The inverted forks are easily mounted on the fork shaft system. They are used as a carrier for the top lift attachments. The inversion also means that the basic lifting height is maintained.

The basic set up

A key factor for heavy duty handling productivity is the basic machine set up. Heavy loads and high lifting speed, for example, put critical demands on the engine and hydraulic power support. Fast positioning during the handling cycle requires precise control with tight turning radius, effective and reliable brakes and high engine torque. Fast handling requires good stability, reliable brakes and smooth transmission.

Of course, all the working components and systems have to cope with the most demanding stresses during long shifts and heavy operations everyday.

We have put highest priority on overall technical reliability by looking at the choice of each component, long running cycle times and how it all comes together. We have incorporated into the Heavy Lift Trucks several major components and systems from our extremely reliable DRF reachstacker. Almost 3,000 of these machines have been delivered in the past years and have proven the durability of the components and systems, and its low running costs.

1 Chassis

The frame forms the basis of the machine's lifting and maneuvering characteristics and was designed exclusively for heavy duty operation. The beam construction, along with its width, makes the Heavy Lift Trucks stable, torsion resistant and service-friendly.

The frame is 3D modulated (Catia V5) and designed (FEM) in order to eliminate critical tensions under various kinds of strain. The mechanically welded chassis has been optimized according to strength, weight and stability.



2 Engine

The engine provides power for driving and the working hydraulics. The engines are low-emission turbo diesels with fuel injectors and intercoolers. The design of the combustion chambers, along with the precise fuel injection control, ensures more efficient combustion to provide lower emissions with increased torque and power. The engines meet the latest environmental requirements, and the sound and vibration standards.

The radiator is a 3 chamber design with a single fan to provide cooling for the engine and transmission. The engine cooler's separate expansion chambers are fitted with a level sensor that indicates low coolant level.

3 Transmission

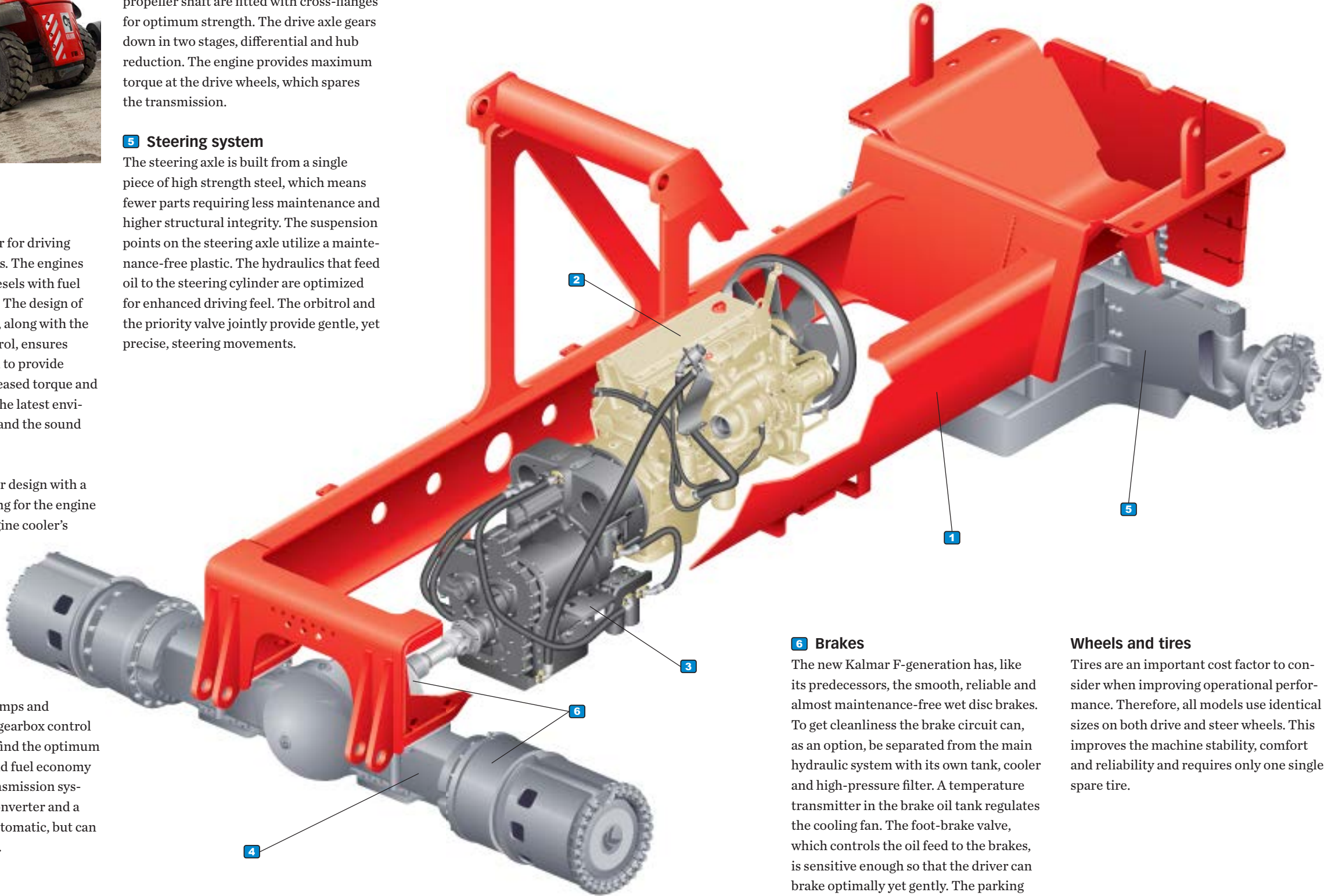
The transmission transfers power from the engine to the hydraulic pumps and driveline. The engine and gearbox control systems work together to find the optimum balance between power and fuel economy at any given time. The transmission system consists of a torque converter and a gearbox. The gearbox is automatic, but can partly be shifted manually.

4 Driveline

The propeller shaft and drive axle transfer the power from the transmission to the driving wheels. The mountings on the propeller shaft are fitted with cross-flanges for optimum strength. The drive axle gears down in two stages, differential and hub reduction. The engine provides maximum torque at the drive wheels, which spares the transmission.

5 Steering system

The steering axle is built from a single piece of high strength steel, which means fewer parts requiring less maintenance and higher structural integrity. The suspension points on the steering axle utilize a maintenance-free plastic. The hydraulics that feed oil to the steering cylinder are optimized for enhanced driving feel. The orbitrol and the priority valve jointly provide gentle, yet precise, steering movements.



6 Brakes

The new Kalmar F-generation has, like its predecessors, the smooth, reliable and almost maintenance-free wet disc brakes. To get cleanliness the brake circuit can, as an option, be separated from the main hydraulic system with its own tank, cooler and high-pressure filter. A temperature transmitter in the brake oil tank regulates the cooling fan. The foot-brake valve, which controls the oil feed to the brakes, is sensitive enough so that the driver can brake optimally yet gently. The parking brake is activated automatically when the ignition is turned off.

Wheels and tires

Tires are an important cost factor to consider when improving operational performance. Therefore, all models use identical sizes on both drive and steer wheels. This improves the machine stability, comfort and reliability and requires only one single spare tire.

The basic set up is a key factor for high productivity

Drivetrain – DCF280-330 / LB		Cummins QSB6.7	Volvo TAD760VE
Engine	Manufacturer, type designation	Cummins QSB6.7 (Turbo-Intercooler)	Volvo TAD760VE (Turbo-Intercooler)
	Fuel – type of engine	Diesel – 4-stroke	Diesel – 4-stroke
	Rating ISO 3046 – at revs (hp – rpm)	260 – 2200	241 – 2200
	Peak torque ISO 3046 – at revs (lb/ft – rpm)	730 – 1400	811 – 1500
	Number of cylinders – displacement (in³)	6 – 409	6 – 436
	Fuel consumption, normal driving (gal/h)	5.3	4.2
Gearbox	Manufacturer, type designation	Dana – TE17000	Dana – TE17000
	Clutch, type	Torque converter	Torque converter
	Gearbox, type	Powershift	Powershift
	Numbers of gears, forward – reverse	3 – 3	3 – 3
Alternator	Type – power (Amp)	AC – 80	AC – 80
Starting battery	Voltage – capacity (V – Ah)	2×12 – 140	2×12 – 140
Driving axle	Manufacturer – Type	AxleTech – Differential and hub reduction	AxleTech – Differential and hub reduction

Drivetrain – DCF370-520		Cummins QSM11	Volvo TAD1250VE
Engine	Manufacturer, type designation	Cummins QSM11 (Turbo-Intercooler)	Volvo TAD1250VE (Turbo-Intercooler)
	Fuel – type of engine	Diesel – 4-stroke	Diesel – 4-stroke
	Rating ISO 3046 – at revs (hp – rpm)	350 – 2000	349 – 1600
	Peak torque ISO 3046 – at revs (lb/ft – rpm)	1350 – 1100-1400	1298 – 1400
	Number of cylinders – displacement (in³)	6 – 659	6 – 740
	Fuel consumption, normal driving (gal/h)	5.3	5.3
Gearbox	Manufacturer, type designation	Dana – TE32000	Dana – TE32000
	Clutch, type	Torque converter	Torque converter
	Gearbox, type	Powershift	Powershift
	Numbers of gears, forward – reverse	4 – 4	4 – 4
Alternator	Type – power (Amp)	AC – 80	AC – 80
Starting battery	Voltage – capacity (V – Ah)	2×12 – 140	2×12 – 140
Driving axle	Manufacturer – Type	Differential and hub reduction*	Differential and hub reduction*

* DCF370-420 AxleTech, DCF450-520 Kessler

Performance – Cummins QSB6.7		DCF280-12 / LB	DCF300-12 / LB	DCF330-12 / LB
Lifting speed	Unloaded (ft/s)	1.1	1.1	1.1
	At rated load (ft/s)	0.6	0.6	0.6
Lowering speed	Unloaded (ft/s)	1.2	1.2	1.2
	At rated load (ft/s)	1.5	1.5	1.5
Traveling speed, F/R	Unloaded (mph)	17 – 17	17 – 17	17 – 17
	At rated load (mph)	16 – 16	16 – 16	16 – 16
Gradeability, max.	Unloaded (%)	52.5	52.5	52.5
	At rated load (%)	27.5	27.5	27.5
Gradeability, at 2 km/h	Unloaded (%)	36.5	36.5	36.5
	At rated load (%)	19.5	19.5	19.5
Drawbar pull	Max. (lbf)	46,990	46,990	46,990
Noise level, inside	LpAZ*, Spirit Delta (dB(A))	72	72	72
Noise level, outside	LWAZ** (dB(A))	–	–	–

* LpAZ according to EN12053 ** LWAZ according to 2000/14/EC

Performance – Cummins QSM11		DCF370-12	DCF420-12	DCF450-12	DCF500-12	DCF520-12
Lifting speed	Unloaded (ft/s)	1.1	1.1	1.1	1.1	1.1
	At rated load (ft/s)	0.9	0.9	0.9	0.9	0.9
Lowering speed	Unloaded (ft/s)	0.7	0.7	0.7	0.7	0.7
	At rated load (ft/s)	1.3	1.3	1.3	1.3	1.3
Traveling speed, F/R	Unloaded (mph)	15 – 15	15 – 15	17 – 17	16 – 16	16 – 16
	At rated load (mph)	12 – 12	12 – 12	14 – 14	13 – 13	13 – 13
Gradeability, max.	Unloaded (%)	35	35	35	35	35
	At rated load (%)	43	43	43	43	43
Gradeability, at 2 km/h	Unloaded (%)	35	35	35	35	35
	At rated load (%)	28	28	28	28	28
Drawbar pull	Max. (lbf)	85,200	85,200	85,200	85,200	85,200
Noise level, inside	LpAZ*, Spirit Delta (dB(A))	72	72	72	72	72
Noise level, outside	LWAZ** (dB(A))	–	–	–	–	–

* LpAZ according to EN12053 ** LWAZ according to 2000/14/EC

Performance – Volvo TAD760VE		DCF280-12 / LB	DCF300-12 / LB	DCF330-12 / LB
Lifting speed	Unloaded (ft/s)	1.1	1.1	1.1
	At rated load (ft/s)	0.6	0.6	0.6
Lowering speed	Unloaded (ft/s)	1.2	1.2	1.2
	At rated load (ft/s)	1.5	1.5	1.5
Traveling speed, F/R	Unloaded (mph)	17 – 17	17 – 17	17 – 17
	At rated load (mph)	16 – 16	16 – 16	16 – 16
Gradeability, max.	Unloaded (%)	30	30	30
	At rated load (%)	27.5	27.5	27.5
Gradeability, at 2 km/h	Unloaded (%)	30	30	30
	At rated load (%)	19.5	19.5	19.5
Drawbar pull	Max. (lbf)	46,990	46,990	46,990
Noise level, inside	LpAZ*, Spirit Delta (dB(A))	72	72	72
Noise level, outside	LWAZ** (dB(A))	–	–	–

* LpAZ according to EN12053 ** LWAZ according to 2000/14/EC

Performance – Volvo TAD1250VE		DCF370-12	DCF420-12	DCF450-12	DCF500-12	DCF520-12
Lifting speed	Unloaded (ft/s)	1.1	1.1	1.1	1.1	1.1
	At rated load (ft/s)	0.9	0.9	0.9	0.9	0.9
Lowering speed	Unloaded (ft/s)	0.7	0.7	0.7	0.7	0.7
	At rated load (ft/s)	1.3	1.3	1.3	1.3	1.3
Traveling speed, F/R	Unloaded (mph)	17 – 17	17 – 17	17 – 17	17 – 17	17 – 17
	At rated load (mph)	15 – 15	14 – 14	14 – 14	13 – 13	13 – 13
Gradeability, max.	Unloaded (%)	35	35	35	35	35
	At rated load (%)	34	32	31	29	29
Gradeability, at 2 km/h	Unloaded (%)	35	35	35	35	35
	At rated load (%)	31	31	29	28	26
Drawbar pull	Max. (lbf)	73,960	73,960	73,960	73,960	73,960
Noise level, inside	LpAZ*, Spirit Delta (dB(A))	72	72	72	72	72
Noise level, outside	LWAZ** (dB(A))	–	–	–	–	–

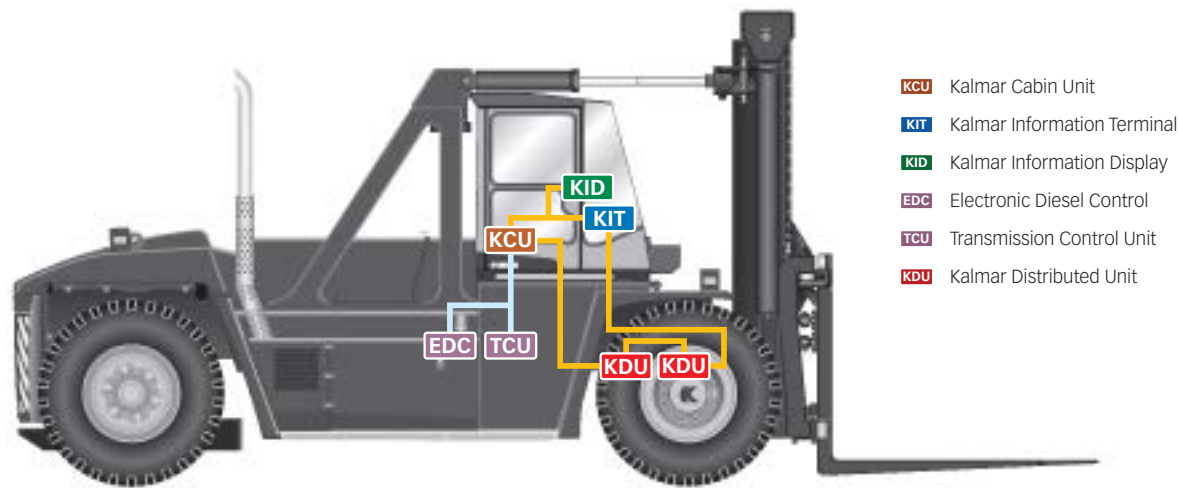
* LpAZ according to EN12053 ** LWAZ according to 2000/14/EC

The simple way to reach new levels of utilization

All vehicles today – cars, highway trucks, wheel-loaders, cranes etc – are constructed with more and more sophisticated components and systems. Each part interacts closely with the others and to reach the full potential requires computer assistance.

This built-in intelligence is designed to support and leverage your handling operations, not confuse it.

The Kalmar F-generation possesses a well proven, thoroughly tested and optimized control system, which supports your driver, mechanics and financial controller. And it is simple to use.



The communication network layout.

The reliable distributed control system

Two things are needed for a command initiated by the driver to result in a particular function, or for several functions to work together: power supply and communication.

The power-feed supplies the machine's electrical or electro-hydraulic functions with voltage. The communication system controls and checks that the functions have been activated, waits in standby mode or indicates faults.

Communication

The distributed power-feed and communication network consists of electrical components and a microcomputer-based system for controlling and monitoring the functions.

The most important components in the network are the control units (nodes). They distribute control of the machine's functions. Each node has its own processor. The nodes integrate with each other and all communication; control signals and signal information are sent via data buses.

The nodes transmit their signals in messages on the network. Each message contains several signals and has its own address. Any units that need to know the status of a signal listen for the address of the signal's message. All the nodes in the network listen to each other.

CAN-bus is a two-wire transfer of data and a definition of a bus type. CAN-bus technology has been chosen because it provides a reliable, robust transfer of data and is difficult to disrupt. CAN-bus loops have been used in Kalmar machines since 1995.

The greatest benefit of using CAN-bus technology is that the amount of cabling can be reduced. All that is needed to establish communication are two data-bearing leads and two leads for feeding the nodes' processors. The network loop for both the CAN-bus and the nodes' processor feed are redundant.

The Kalmar Cabin Unit (KCU) is the control node for the entire network. There are several nodes, called KDUs (Kalmar

Distribution Units), in the network. Each node is positioned near the functions it is designed to deal with.

The Transmission Control Unit (TCU), which is the gearbox node, deals with the gearbox. The unit is connected in a separate CAN-bus loop with the EDC engine node (Engine Diesel Control) and KCU. The engine node controls the fuel injection and receives its control signals from its own transmitters on the engine.

Power supply

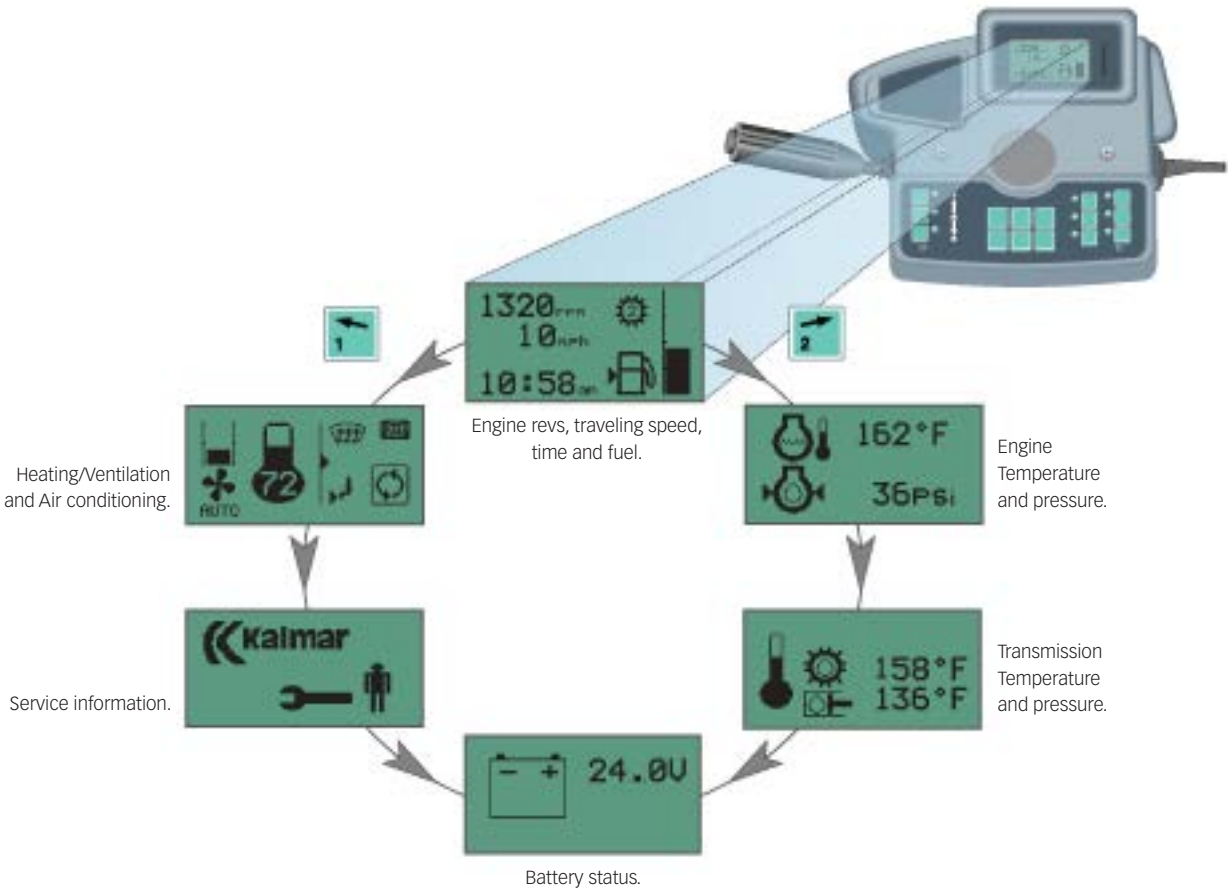
Power-feed for the functions differ from the feed required for communication and feeding of the nodes' processors. Each distribution unit (node) in the distributed network is fed voltage from one of the power distribution boxes. The distribution boxes are located inside the cabin and on one side of the frame. The distribution units (nodes) guide power from the distribution box to the required functions based on the instructions in the messages from the communication network.

Control functions – support the driver

The driver and machine communicate very simply via the Kalmar Information Terminal (KIT) and the Information Display located right in front of the driver in the cabin. The two-way communication – from the driver to the machine and opposite – is handled by the KCU (Kalmar Cabin Unit) which is the control node for the entire network.

Information to the driver comprises alarm warnings, operating details and action-guided information. Messages, status, fault indications etc are presented on the Information Display (KID), while warnings and other monitoring indications are presented to the left.

Messages are only presented when they are relevant to the driver and the operation. The driver can focus on the job instead of checking meters and indicators.



We have made sure your investment becomes profitable

To understand the full potential of your investment requires being aware of the details, features and technical matters in a machine like the new Kalmar.

But when it comes to availability it is critical that it operates constantly and is kept in good condition with an absolute minimum of maintenance and repairs.



Less stops for planned maintenance

The service intervals have been extended to 500 hours, which means that you don't have to take the machine out of work more than 6 times a year (3,000 hours utilization).

The DCF is designed for fast daily inspection and preventive maintenance. All checkpoints are easily accessible and concentrated to specific locations. Lubrication free components or central lubrication points have been utilized. The wet disc brake system is practically maintenance free.

The indicator and monitoring support built into our control system make sure that the machine won't be misused or maintained incorrectly. The driver and mechanics will always get indications and guidance in time to avoid unnecessary and costly wear and tear or technical breakdowns. No unwanted stops.

A safe communication network

The control and monitoring system is the new Kalmar control system, but already successfully applied in almost 3,000 Kalmar machines worldwide.

This new redundant CAN-bus system is proven to be excellent in functionality and reliability. The network of control nodes allows for less wiring and connectors which reduces the number of sources of error. The power-feed for each node and the transfer of control signals are independent of the other nodes, which means the risk of disruption becomes minimal. The redundant design means that there are always two paths to choose to maintain communication, which results in extra safety and reliability.

Reliability starts already at the concept stage

One of the guiding principles in designing the DCF was to minimize the number of potential sources of error. Therefore the machines consist of as few components and moving parts as possible. The functionality and operational reliability is assured by extensive testing.



To increase workplace safety the machine can be fitted with alcohol interlock.

The hydraulic system is critical

No other part of the machine is working so hard under continuous pressure. To secure the reliability we have minimized the number of hydraulic components and couplings.

To ensure optimum oil pressure and security regardless of the handling operation the hydraulic system is based on three fixed displacement vane pumps – one for the brake system, cooling and filtering, one for working hydraulics and one supporting both steering and working hydraulics.

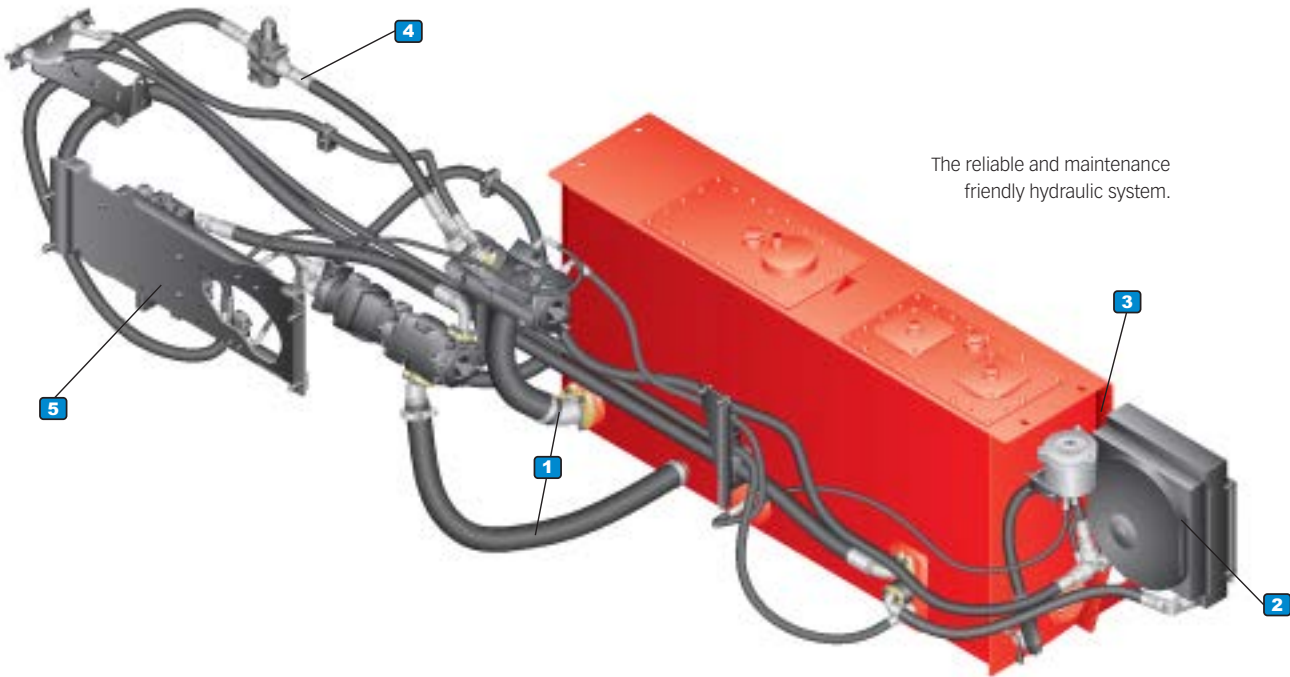
The distribution of pressure between working hydraulics and steering is done by the priority valve which ensures that the steering always receives enough pressure. The hydraulic oil pump for load handling is disconnected during forward driving, to use the engine power most efficiently.

All three pumps interact together, using the same oil tank and filters, which are located inside the tank. The system is equipped with one oil cooler and a separate fan to secure the right oil temperature, to match the hydraulic brake heat generation

as well as feeding the overall system during tough handling cycles.

Oil supply and temperature control is handled through Kalmar's distributed control system. All indications are presented when appropriate on the Kalmar Information Display (KID) in the cabin.

Separated brake oil and main hydraulic system oil tanks are available as an option.



The reliable and maintenance friendly hydraulic system.

Other improving features:

- 1 Large dimensions of hydraulic hoses improves the hose's lifetime (slower flow, less friction and less heating).
- 2 Thermostatic cooling of both the main system and the brake system improves the oil lifetime (temperature control, optimized working temperature).

- 3 High density filter improves the oil lifetime (clean oil).
- 4 ORFS – leak proof couplings all around improves reliability (minimizes leakage).

- 5 All main hydraulic components at ground level are gathered on a separate plate, bolted to the chassis and therefore simple to remove.

Global presence and local service bring
our products and solutions closer to our customer.



Cargotec improves the efficiency of cargo flows on land and at sea - wherever cargo is on the move. Cargotec's daughter brands, Hiab, Kalmar and MacGregor are recognised leaders in cargo and load handling solutions around the world. Cargotec's global network is positioned close to customers and offers extensive services that ensure the continuous, reliable and sustainable performance of equipment. Cargotec's sales totalled EUR 2.6 billion in 2010 and it employs approximately 11,000 people. Cargotec's class B shares are quoted on NASDAQ OMX Helsinki under symbol CGCBV. www.cargotec.com



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