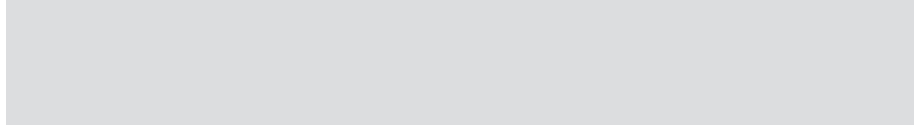


REACHSTACKERS 45 TONNES

TECHNICAL INFORMATION CONTAINER HANDLER, DRS





Dedicated for Container Handling

A workhorse dedicated for laden containers.

A reachstacker is one of the most flexible handling solutions weather to operate a smaller one-unit terminal or a medium sized port. The DRS reachstacker can handle loaded containers quickly and efficiently in narrow spaces, while still ensuring that the driver has optimum visibility. The machine comes in one wheel base optimised for lifting capacity in relation to manoeuvrability.

The extensive freedom allowed by the lifting equipment means that the machine's position in relation to the container and its drop-off is of little significance. The rotational and side-shift function means that the machine does not usually need to be placed at right angles to the container during loading and unloading. The distance between the container and the machine can also be varied, as the boom can be extended and withdrawn.

Compared to a conventional forklift, a larger proportion of the lifting manoeuvre can be performed while the truck is stationary.

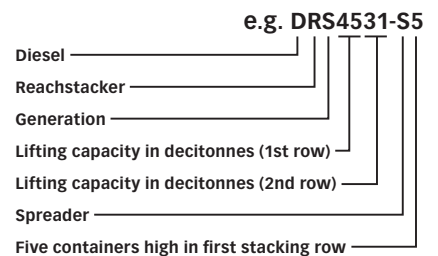
Containers can also be lifted and transported lengthwise, making it possible to pass through narrow gaps such as gates. The low overall height of the machine, with a lowered lifting boom, means high accessibility in low spaces.

Any driver with the ability to take advantage of the machine's capacity and technical benefits will find this reachstacker a powerful, flexible tool for handling containers and this to lowest possible cost.



More detailed information about the DRS models will be found in the technical data sheets.

Clarification of model designation





Capacity and dimensions

Adapted for toplift handling

The chassis and lifting equipment have gone through major improvements to ensure the best possible performance, strength and user-friendliness. The nature of the working cycle and capacity requirements in second and third row determine which of the two basic models that is the most suitable.

Lifting boom

The lifting boom bears the weight. The container-handling device consists of a telescopic boom to which a spreader has been attached. The booms durable and robust design is welded on the neutral axle for maximum strength. The boom consists of two sections, one section moving within the other. Rollers are fitted in the rear part of the inner-boom, which together with

the floating wear pads in front of the outer boom facilitate the sliding motion. The boom's fixture in the frame and the lifting cylinders are fitted with spherical plane thrust bearings.

Lifting boom hydraulics

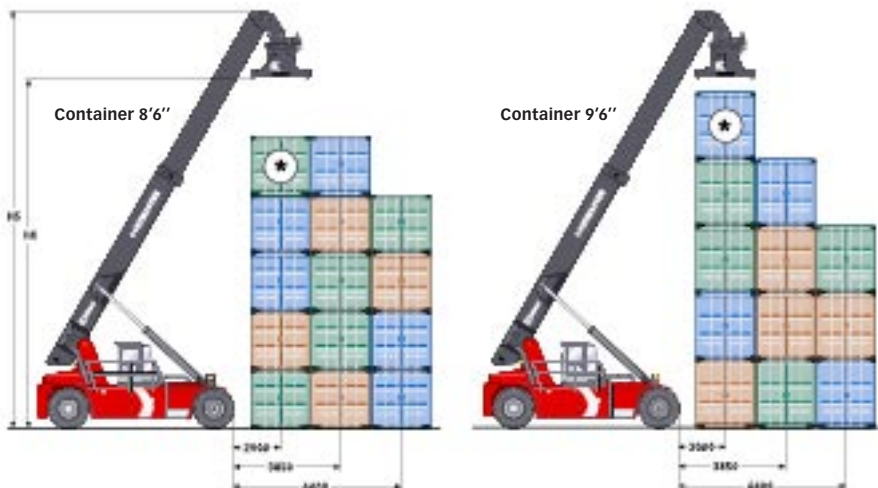
Hydraulic cylinders carry out the lifting and extension functions of the boom. Load sensing pumps feed the lifting cylinders via main valves. The pump pressure is determined by drive pressure (load).

For maximum lifting- and extension speeds hydraulics works in three steps depending on the weight of the load. Movement speed in lifting and telescope are adjusted after start up phase by changing the pumps output angle and by altering the engine running speed.

In the first step, up to 12 tonnes load, all load-sensing pumps feed the cylinders of the boom. One of the load sensing pumps priorities the steering function. If steering- and the spreader functions not are in use at the same time as lifting three variable pumps and the fixed pump serving the spreader functions will feed to the boom functions.

In second step the function of the new hydraulic- and control system optimises the function of the load sensing pumps to pump a maximum oil volume at a required oil pressure. This increases lifting speed with 15% for loads between 12 and 33 tonnes, most containers weigh somewhere within this span. In third step, above 33 tonnes load, the system will not use the variable pump that priorities the steering function.

The boom's extension function is damped in the end positions for reduced wear and greater comfort.



Capacity (tonnes)

Model	Container 8'6"			Container 9'6"			Lifting height toplift attachment	
	1:st row	2:nd row	3:rd row	1:st row	2:nd row	3:rd row	H4 (mm)	H5 (mm)
DRS4527-S5	42*/45	27	13	40*/45	27	13	14900	17900
DRS4531-S5	42*/45	31	15	40*/45	31	15	14900	17900



Rotator

The rotator is fixed in the inner boom and enables the container to be rotated. The rotator consists of an upper and a lower yoke joined with a powerful bearing. Rotation is enabled by two hydraulic motors, which drive a gear-ring. Two cylinders help prevent the container from swinging lengthways and can also be utilised to tilt the load.

The attachment

On the attachment, four twistlocks firmly locks the container to it by rotating thereby securely gripping the container's corner fittings. The mechanical levelling ensures that the twistlocks reach the corners, even if the container is leaning.

The attachment can easily be adapted to different container standards by two hydraulic cylinders pushing the T-beams back and forth within the mainframe of the spreader.

The container can also be moved sideways to facilitate loading and unloading or to compensate unbalanced containers. Two hydraulic cylinders perform the side-shift movement.

Attachment and rotator hydraulics

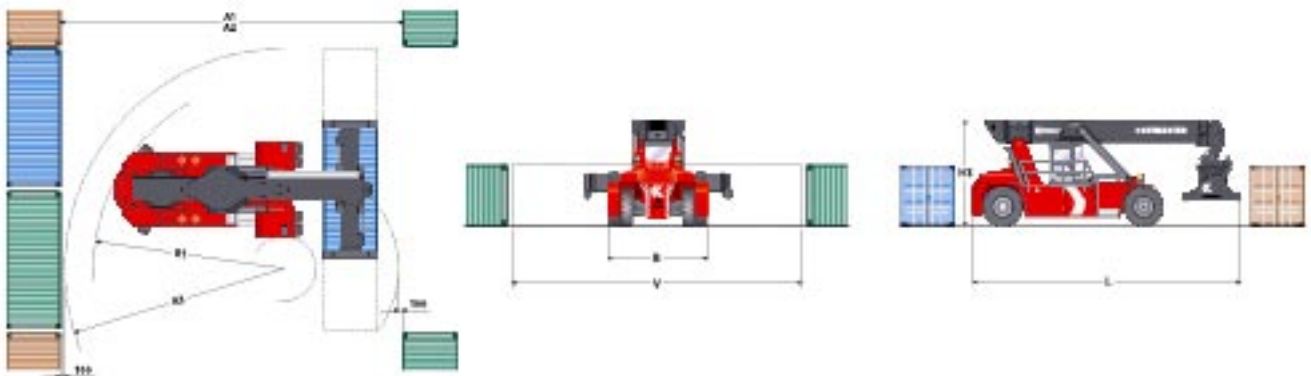
A fixed vane pump feed the spreader functions. The spreader functions are prioritised but when handling light loaded container the lifting- and extension functions pick oil fed from this pump to enhance lifting speed. When no load handling functions are used the pump will lead the oil through the cleaning and cooling system of the hydraulics.

Each function has it's own set of valves to ensure that each function gets the right oil volume and pressure.

Chassis

The frame forms the basis of the machine's lifting and manoeuvring characteristics. The frame's beam construction, along with its width, makes the reachstacker stable, torsion resistant and service-friendly. The basic principles of this chassis design have been tested for a long time in different locations in previous reachstacker models.

The chassis comes in one length optimised according to the relationship between capacity and manoeuvrability.



Dimensions

Model	Aisle width (mm)		Turning radius (mm)		Main dimesions (mm)						Service weight (kg)
	A1 - 20 ft	A2 - 40 ft	R1 - 20 ft	R3 - 40 ft	B	V	L	H3	Clearance	Wheels	
DRS4527-S5	11450	13600	8350	9400	4150	6050-12185	11700	4500	400	18.00x25/40	66000
DRS4531-S5	11450	13600	8350	9400	4150	6050-12185	11700	4500	400	18.00x25/40	69500



Driver environment

Drivers best friend

Kalmar's goal while developing the cab has been to assure the driver the best conceivable safety, ergonomics and visibility.

Sound and vibration

The cab is fitted with insulation material both inside and out. The maximum noise level inside the cab is 72 dB (A).

Ergonomics

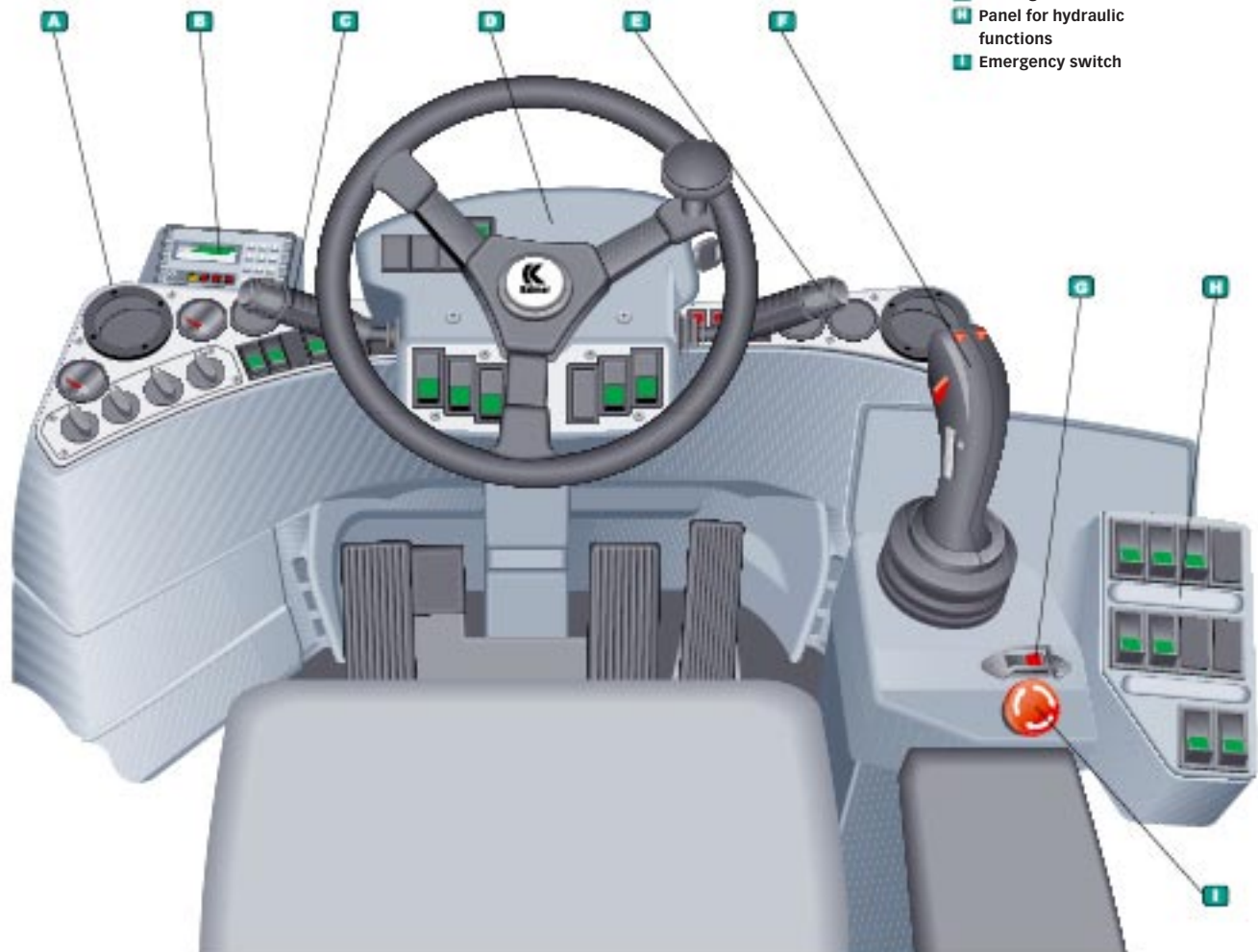
Entering the cabin is safe and easy by the newly developed angled instep. Well inside controls and instruments are well placed and have a precise feeling making them efficient to use.

The vertical grip type joystick has a precise feeling and all main hydraulic controls are placed on the lever as push buttons. On the side panel on right hand contains the rest of the hydraulic function buttons direct in reach of hand.

From the drivers position the visibility is high in all directions. To further increase the visibility the cabin can be hydraulically moved lengthwise. Tinted windows are standard equipment.

Climate

An efficient heating and ventilation system comes as standard. An air cooling system is available as an optional extra. The cooling system provides comfort, even in extremely high temperatures.



- A Left instrument panel
- B Control system, display and keyboard
- C Gear selector
- D Steering wheel panel
- E Multi function lever
- F Joystick
- G Parking brake
- H Panel for hydraulic functions
- I Emergency switch



Performance

The ultimate workhorse

Container handling is not just about lifting container fast and high. All functions must work smoothly together even under heavy-duty operations. An efficient machine is a machine that can handle all moments of the working cycle in a simple and precise way at lowest possible cost, just like the DRS reachstacker.

Over the years the DRS has shown a remarkable availability which is the basic for this further development. All performance boosts have been made with no compromise to the quality of the reachstacker, keeping and enhancing the virtual availability.



Transmission

The proven 4 by 4 transmission transfers power from the engine to the hydraulic pumps and drive line.

The transmission system consists of a torque converter and a gearbox. The same gearbox is used whichever engine is chosen. The gearbox is automatic, but can partly be shifted manually. The torque converter is a hydraulic coupling positioned between the engine and gearbox. The gearbox and torque converter work together via a joint hydraulic system. This gearbox is one of the most used in the heavy range of Kalmar due to its high reliability.

Brakes

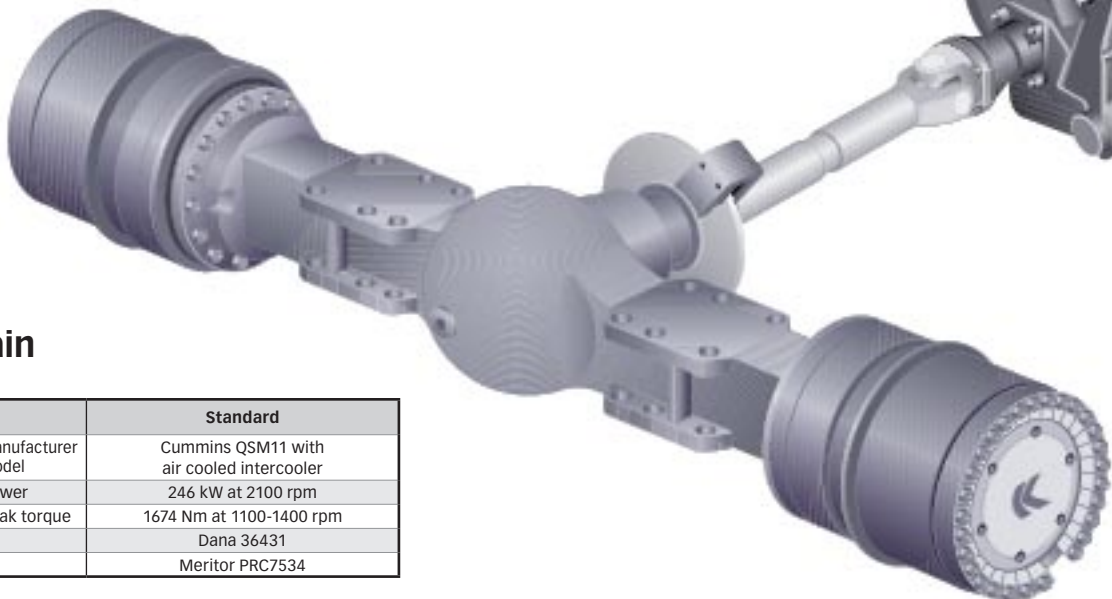
A fixed pump feed the brake circuit. It is separated from the hydraulic system and has its own tank, cooler and filter. The brakes are of wet disc brake type. When the accumulators are set at required value the priority valve lead oil through the wet brakes to cool them.

Pushing a button on the side panel activates the parking brake and the main brakes.

Drive line

The propeller-shaft and drive axle transfers the power from the transmission to the driving wheels. The drive axle shifts gear down in two stages, differential and hub reduction. The engine only achieves maximum torque at the drive wheels, which spares the transmission.

Standard drive train



Drive train

		Standard
Engine	Manufacturer Model	Cummins QSM11 with air cooled intercooler
	Power	246 kW at 2100 rpm
	Peak torque	1674 Nm at 1100-1400 rpm
Transmission		Dana 36431
Driving axle		Meritor PRC7534

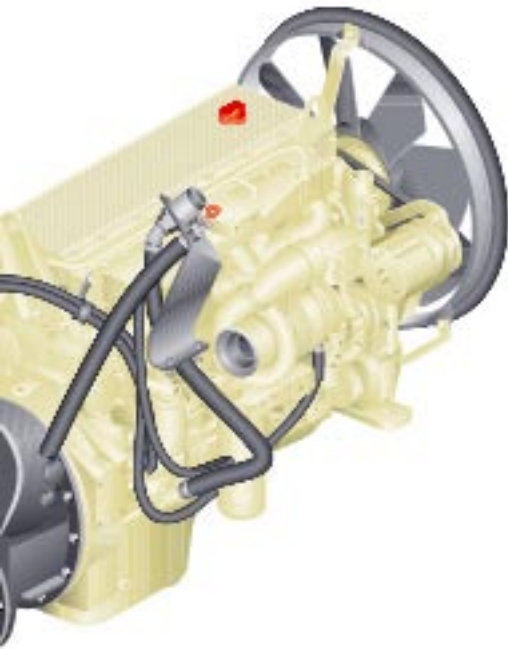
Engine

Cummins engine is standard. The engine provides power for driving and the working hydraulics. The engines are low-emission turbo diesels with unit injectors and intercoolers.

The design of the combustion vessels in these engines, along with the precise fuel

injection control, ensures more efficient combustion. Emissions decrease, while power and torque increase. The engines fulfil the requirements of 97/68*2004/26 EC stage 3, US EPA Tier 3. Scania is available as optional extra in the stage/Tier 2 version.

The engines are specially adapted for the working principle of a reachstacker machine type with high torque at low revs.



Steering system

A variable pump via a priority valve and the orbitrol feeds the double action steering cylinder. The priority valve secures that the steering cylinder gets oil whenever it needs it. The steering function operates smooth, fast and precise. Lifting speeds will be increased by leading oil from the steering function when it's not used.

The steering axle is of a heavy-duty sandwich-type. Mechanical stops limit the axle oscillation, which improves the lateral stability. The axle are mounted onto the frame with spherical plane bearings on the pivot points.



Performance

Model	Lifting speed (m/s)		Lowering speed (m/s)		Driving speed (km/h)		Grade ability (%)		Draw pull (kN)
	unloaded	at 70% of rated load	unloaded	at rated load	unloaded (F/R)	at rated load (F/R)	at 2 km/h, unloaded, max	at 2 km/h, loaded, max	max
DRS4527-S5	0,37	0,29	0,40	0,30	25/25	22/22	50	29	330
DRS4531-S5	0,37	0,29	0,40	0,30	25/25	22/22	50	29	330



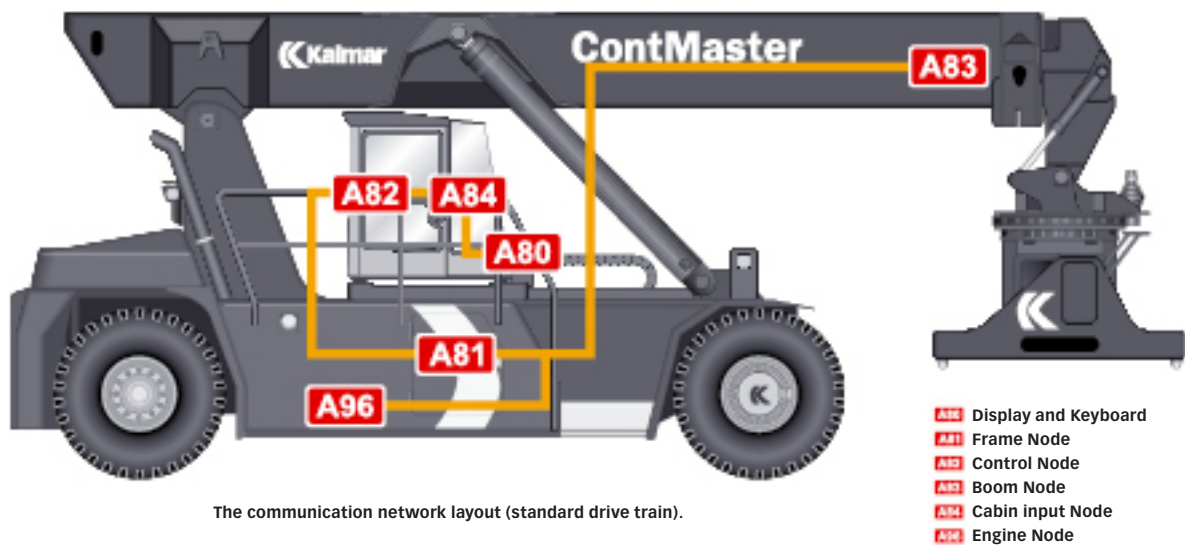
Electrical- and control system

A system designed for maximum reliability and performance.

The system is a mix of a traditional electrical system and an advanced CAN-bus system. Basic functions in the cabin and

on the chassis are operated without any involvement of the CAN-bus system. Functions that require a more advanced control system are CAN-bus driven. For example the boom functions, the spreader move-

ments, engine management or monitoring functions. In other words CAN-bus technology is only used when it is necessary to achieve high performance with retained reliability.



CAN-bus communication

The system consists of electrical components and a microcomputer based system for controlling and monitoring the reachstacker's functions.

The most important components of the control system are the nodes. 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. CAN-bus is a two-wire transfer of data and a defined of a bus type. CAN-bus provides reliable and robust transfer of data and is difficult to disrupt.

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

The CAN-bus system consists of five nodes (control units) and one display mounted on the top of the dashboard. Each node has its own field of responsibility and is connected to the other nodes in the system.

The control system consists of six nodes linked together. Two nodes, A82 and A84, and the display A80 are found in the cabin. The control system display A80 is logically located on the left side of the dashboard. A84 is the only module not containing any program and is purely an input node for the cabin switches. A82 monitors critical values of the engine, stability, execute cabin transfer and spreader indication lights.

A96 deals with the management of the engine and is located on the right hand side locker together with the frame node (A81). A81 control boom functions. Node A83 is positioned on the boom and controls the spreader functions.

Power supply

The power supply starts from the distribution boxes that are connected to the batteries charged by the alternator. One of the boxes is located in the locker on right hand side, the other one will be found in the cabin together with two of the nodes.

Most of the reachstacker functions are dependent of the electrical- or the CAN-bus system. In a traditional system a function is fed directly from one of the distribution boxes via a switch or lever. Power feed of a CAN-bus driven function is always transferred via one or several nodes of the nodes in the CAN-bus network.

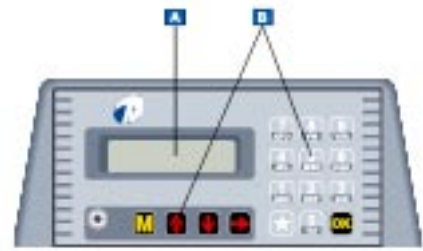
All nodes are fed with power from one of the two distribution boxes. In this case the electrical power dedicated to a specific function is transferred though the node. The node transmits the power according to the message received on the CAN-bus system, initiated of the operator, and the function is executed.



Control functions

Functions are displayed in the multi-function display A80. During normal operation the display shows a basic menu that provides the driver with basic data. The display also shows alarms reporting errors on the engine, communication buses and sensors.

In addition to the drivers interface there is also interfaces for maintenance and calibration. These menus are accessible by turning the service key in the electrical box locker on the right frame side. The node also has a plug-in contact for a PC used for calibrations or error detecting.



■ A80 display
■ A80 keyboard

Reliability

The machine structure

The chassis and boom are of a heavy-duty design. Well-known mechanical components have been chosen and are carefully tested together under heavy conditions in various climates. The DRS reachstacker is the sum of long experience of operating reachstackers.

Hydraulics

The load sensing pumps feeding the main hydraulics generates less heat than fixed pumps and provide higher efficiency. There are extremely reliable, well sealed ORFS-couplings (O-ring face seals) in all hydraulic connections. Well known hydraulic components put together in a balanced system. The temperature and cleanliness are kept under control in two separate systems, main hydraulic circuit and brake circuit. The brake circuit has a separate tank with its one cleaning system. A filter clogging warning indicator on the right hand dashboard tells the operator when to replace the return filters of the hydraulic system to maintain a high cleanliness.

Electrical- and control system

The system combines electric and CAN-bus functions in a reliable way. The amount of wiring needed is reduced by this solution



and along with that the potential sources of errors. The display A80 continuously gives the driver information about the machines performance. It also provides the driver with alarms and error messages if any of the controlled functions suffers from malfunctions. This increases the reliability because expected breakdowns can be

prevented in an early stage. The machine is also equipped with a forced motion switch, a portable control positioned on the back of the cabin rear wall, making it possible to move the machine without using the accelerator, ignition key and gear lever in case of emergency.



Standard equipment

Chassis

- Angled entrance
- Lifting eyes front/rear
- Towing pin

Body

- Steps with anti slip protection
- Rear view mirrors on each side

Steeringaxle

- Rear axle: Kalmar
- Double acting steering cylinder

Drive train

- Engine: Cummins QSM11 (Tier III)
- Transmission: Spicer off Highways 15.5HR36431
- Engine protection system
- Transmission protection system
- Front axle: Meritor
- Filter/Water separator

Cabin

- Heating
- Instep handle
- Fixed drivers seat BEGE
- Armrest right hand side
- Wipers/washers on front, rear and roof pane
- Interval wipers on front pane
- Sliding window on left side
- Emergency exit
- Lockable doors (key)
- Inside rear view mirror
- Joystick for boom and attachment functions incl. tilt
- Control panel in cabin for top lift (std incl. 3 buttons)
- Steering wheel knob
- Horn
- Electric accelerator pedal
- 24 V outlet
- Brake pedal incl. transmission disconnection (declutch)
- Button for electronic hand brake
- Warning buzzer for not activated hand brake, leaving seat
- Hydraulically movable cabin (horizontal)

Instrumentation

- Gauges
 - Hour
 - Fuel
 - Transmission oil temperature
- Warning/Indication lamps
 - charging
 - direction
 - high beam
 - parking brake
 - failure indicator
 - low brake pressure
 - low transmission oil pressure
 - high transmission oil temperature
 - indication locked twistlock
 - Indication alignment
 - indication opened twistlock
 - warning hydraulic oil return filter
 - warning brake hydraulic oil filter
- Display
 - stability control bar (%)
 - actual gear and driving direction
 - travelling speed (km/h)
 - transmission slip ratio (%)
 - engine rpm
 - gear rpm
 - engine coolant temperature
 - engine oil pressure
 - operating hours/effective operating hours
 - automatic gripping on/off
 - alternative languages

Wheels

- Tyres : 18.00 × 25/40 ply

Lifting boom

- Lifting boom std 5 high

Hydraulics

- Return filters hydr. oil (10 micron)
- Pressure filter brakes (10 micron)
- Load sensing pumps (3 pcs)
- Fixed pumps (2 pcs)
- Visual level glass hydraulic tank/brake tank

Electrics

- Electrical system 24 V
- Main power switch electrical
- 2 working lights on attachment
- 4 working lights on boom
- 2 working lights on front edge cabin
- 2 rear lights on fenders activated in reverse
- 2 head lights on front fenders
- 2 position lights on each side
- Lights high/low beam front
- Tail lights, brake lights
- Directional indicators front and rear
- Rotating beacon

Attachment

- Top lift 20'-40' (cap. 45 ton)
 - Sideshift ± 800 mm
 - Slewing mechanical $\pm 5^\circ$
 - Oscillation $+200^\circ/-100^\circ$
 - Controlled tilt $\pm 2^\circ$
 - Hooks on corners (4 pcs) for sling

Signs and documentation

- Load chart diagram in cabin
- Machine data plate chassi incl. load chart
- Warning stickers
- Information stickers
- Fuse diagram
- Instruction manual
- Maintenance manual
- Spare parts catalogue
- Instruction manual engine
- Instruction/service manual transmission



Service friendly

Service

This is a machine built to run. Therefore Kalmar has tried to minimise the time for stoppages by extending the service intervals, reducing the service points and making maintenance work as easy as possible to perform.

Service accessibility

Hatches on the side of the machine together with a small inspection hatch on the engine hood gives easy access for daily inspections. The top covers don't need to be removed. With this solution most of the daily inspection work can be done from ground level. The transmission filters are located outside the frame on the backside of the right fender.

On the right hand side behind the service hatch the batteries are located on a roll out device providing excellent access during inspections or service. Behind the same hatch the main battery relay, contactors and fuses are located together the frame node of the control system. The cabin transfer unit will also be found here. All components are in easy reach and have great accessibility.

Fault identification

The maintenance displays of control unit A80 are only intended for professional maintenance personnel, so they can correct error situations and make necessary calibrations.

The service switch of the control system is located behind the seat on the back wall of the cabin. By turning this switch and thereby pushing the M-button on the display keyboard gives access to the maintenance displays. In this mode all nodes and related functions can be gone through in order to locate the error.



Easy accessible air intake mounted on left fender.

The air intake is located on the left fender by the instep. On the same side, behind the service hatch, you will find the hydraulic filters, cooler for the main hydraulics and the pressure accumulators. Measuring points of the hydraulic system is also located here.

When the top covers of the frame above the engine compartment are removed engine, transmission and main hydraulic components are easy accessible. The cabin can be moved back and forth which also increases the accessibility.



Service hatch on right hand side. The batteries can be rolled out.



Service hatch for hydraulic on left hand side.



Easy access for inspections- and maintainance work when top covers are removed.

Contact information:

Kalmar global partner

Local presence

Kalmar is a global supplier of heavy materials handling equipment and services for ports, terminals, industry and intermodal handling.

Local presence means that we can support our customers throughout the product's life cycle, wherever they are located.

There are 17 Kalmar sales companies that support dealers and agents in 140 countries around the world.



Other reachstacker models



Intermodal Handler



Empty Container Handler

Kalmar Industries

Product line – Reachstackers

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