KALMAR CONTAINER HANDLING SYSTEMS
COMPLETE RANGE OF PRODUCTS AND KNOWHOW
Increasing Demands
To plan and to run a successful container terminal is a demanding task. There will be more and more pressure to cut operational costs in the future, but also to improve service level and operational efficiency of the container terminals.

The new, bigger vessels currently being built and even bigger ones coming are causing new challenges to terminal operators of how to further increase vessel loading and unloading efficiency. This not only calls for bigger and faster ship-to-shore cranes, but also for yard equipment that can keep up with the vessel operation. Operating the existing equipment more efficiently is important, also new handling methods are required in some cases to meet the new demands.

Terminal Development
Kalmar Terminal Development® is available to assist our customers when planning new terminals and when improving the efficiency of existing terminals. With it’s wide customerbase and product range Kalmar is in an ideal position to collect, analyze and use operational information, so that each application can be handled individually.

Layout drawings, equipment recommendations, estimates of number of equipment and overall cost calculations are available. Simulation including equipment utilization is available also. This service is useful for planning new terminals, but also for improving efficiency of existing terminals. Analysis of existing operations and proposals for improvements, including carrying out some of the improvements are available from Kalmar.

Several Criteria for Choice
Choice of operating system normally depends on several criteria, such as size of operation, required stacking density and land available, labor costs and availability both for operators and mechanics, required ship-to-shore crane productivity, required selectivity both in vessel and gate operations, shape of terminal and ground limitations.

Kalmar Terminal Development® can assist in analysing these factors. Kalmar does not compete, but works together with port consultants to give the best possible service to our customers.

Container Handling Systems / Selection Criteria:

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<th>RS+TT</th>
<th>SC</th>
<th>RTG+TT</th>
<th>RTG+SHC</th>
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<td>Vessel productivity</td>
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<td>Gate/road truck service</td>
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<td>Automation potential</td>
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Markings
Excellent  ***
Good        **
Modest      *

RS=Reach Stacker, SC=Straddle Carrier, RTG=Rubber Tired Gantry Crane, ASC=Automatic Stacking Crane, SHC=Shuttle Carrier, TT=Terminal Tractor, AGV=Automatically Guided Vehicle.

Note: For new, small terminals reach stackers are often the best alternative due to it’s flexibility and easy start up of operations.
Ship-to-Shore Cranes

Critical for Productivity
Kalmar Nelcon ship-to-shore cranes are specifically designed for efficient loading and unloading of containerships. Ship-to-shore crane performance is essential for efficient operations.

When unloading the ship, containers are placed either on terminal tractor trailers or directly on the ground, depending on the type of operation. Normally containers are placed under the ship-to-shore crane portal and hatch covers of the vessel placed under the backreach.

Increasing Size
Rail span i.e. distance between the rails can vary a lot, however 30.5 metres (100 ft) is the most common rail span. Wider rail span increases stability of the ship-to-shore crane without increasing wheel and corner loads drastically, therefore longer outreach will most likely result into growing rail span in the future.

Outreach of the crane depends on the width of vessels to be handled, the largest cranes today are designed for 22 rows of containers.

Faster Speeds
Hoist capacity of the crane also varies going up to 80 metric tons in twin lift (2x20 ft) and even higher in tandem lift (2x40 ft) operations. Many of the ship-to-shore cranes today are equipped with twin-lift spreaders.

Requirements for both hoisting and trolley speeds have increased. Today in most terminals yard equipment and it’s inability to keep up with the ship-to-shore cranes has become the bottleneck limiting productivity.

Second Trolley
There are additional features available for improved productivity, such as a second trolley system where in unloading the vessel the container is first placed on a platform on the crane.

A secondary trolley is used to move the container from the platform to the terminal tractor trailer or to the ground. This second trolley system can also be automated, whereas the main trolley is operated manually by the crane operator. Semi-automatic features can be added to help the operator in his work. Second trolley was first introduced by Kalmar.

Semi-Automatic Twistlocks
Today semi-automatic twistlocks are used more and more for locking the containers together on the deck of the vessel. The semi-automatic twist-locks need to be installed or removed from the container during loading/unloading. A second trolley system makes this work safer and faster as this work can be done at the platform without disturbing the main work cycle.

Innovator in the industry
Kalmar Nelcon has introduced many unique features improving crane productivity and safety, such as second trolley and semi-automatic chassis loading system. Kalmar Nelcon are well known in the ports for their high quality ship-to-shore cranes with high performance and reliability combined with minimum maintenance requirements.
Reach Stackers and Heavy Lift Trucks

Popular Choice
Reach stackers have in most markets gained ground in container handling, because of their flexibility and higher stacking and storage capacity when compared to lift trucks. Using reach stackers container blocks can be kept 4-deep due to the second row access. Aisles between container blocks can also be kept narrower than with lift trucks, thus improving space utilization. Operator’s visibility is enhanced improving safety.

Easy to Start
In small and medium size terminals and in multi-purpose terminals reach stackers are often the best choice due to their versatility in operation. Reach stackers are easy to transport between terminals and therefore reduce the risks involved, especially when starting a new terminal.

Two Choices
Kalmar offers two reach stacker alternatives to choose from: ContChamp with a wide variety of options to suit all container handling and intermodal applications and ContMaster as a simple, reliable workhorse for port operations. Kalmar is the leading manufacturer of reach stackers in the world.

Lift Trucks
Traditionally lift trucks with gantry spreaders have been the prevailing handling equipment in the ports. Heavy lift trucks are often the best choice when a combination of containers and general cargo is handled with the same machinery. Kalmar has a wide range of models to choose from for different types of loads.

• Reach stackers used for stacking and for loading and unloading of road trucks and terminal tractors
• Reach stackers can also be used for short distance transportation if needed
• Terminal tractors used for transporting of containers between vessel and container yard
• Estimate 3-4 reach stackers and 4-5 terminal tractors required per ship-to-shore crane, including landside operation
• Storage capacity approx. 500 TEU per hectare 3-high (max. 5-high)
• Low capital costs
• Optimum solution for new terminals, multi-purpose terminals, small to medium size operations and when frequent changes in fleet size and location
Straddle Carriers

- Straddle carriers used for all functions: stacking, transportation and loading and unloading of road trucks
- Estimate 4-5 straddle carriers required in total per ship-to-shore crane, including landside operation
- Storage capacity approx. 500-750 TEU per hectare 2-3-high (max. 4-high)
- Low labor usage
- Optimum solution for medium to large size operations, when high flexibility and selectivity are required and when labor costs need to be minimized

High Crane Productivity
Straddle carriers are often used in medium-size and large terminals. Straddle carrier system is labor efficient and enables high crane productivity, because an effective buffer zone is created under the ship-to-shore crane. This makes it possible for the ship-to-shore cranes to operate at maximum efficiency thus maximizing vessel productivity.

Straddle carrier system gives high selectivity because of a relatively low stacking height. Because of this straddle carriers are ideal for terminals with import/export cargo or transhipment terminals with lot of smaller feeders making high stacking impractical.

Flexibility
Straddle carrier system is flexible to changes: straddle carriers can be easily moved within the terminal based on operational requirements and layouts are easy to change since no runways are needed. Straddle carriers are most economical, when travelling distances are reasonable. Separate workshop facilities for straddle carriers are normally needed.

Two Choices
Kalmar has two alternatives to choose from, based on customer preferences: Electrical model with low maintenance requirements and environmentally advanced design and a more conventional, simpler design with mechanical powertrain and hydraulic hoist system. All are available for 3- or 4-high stacking and with single or twin-lift spreaders.

Smartpath® system for automatic container positioning is available as an option, resulting into virtually no misplaced containers and optimal routing when connected to the yard management system. Kalmar is the leading manufacturer of straddle carriers in the world.
Rubber Tired Gantry Cranes

- RTG Cranes used for stacking and for loading and unloading of road trucks and terminal tractors
- Terminal tractors used for transporting of containers between vessel and container yard
- Estimate 2-3 RTG cranes and 4-5 terminal tractors required in total per ship-to-shore crane, including landside operation.
- Storage capacity approx. 1.000 TEU per hectare 4-high (max. 8-high)
- Low operating and maintenance costs
- Optimum solution for large and very large terminals with long travelling distances and when high storage capacity and efficient block stacking is required.

High Storage Capacity
Rubber tired gantry (RTG) cranes are often used in large and very large terminals. RTG crane system gives very high stacking density because of high stacking capability and block stacking. This makes RTG cranes ideal for terminals where high stacking is possible, for example transhipment terminals or terminals with good planning and control of incoming road trucks.

Efficient Block Stacking
RTG cranes are an efficient way of handling high block stacks as work cycle times are short when moving containers. RTG cranes are more flexible to changes than rail mounted equipment. Long travelling distances in the terminal are not problematic, as terminal tractors are transporting containers. Maintenance requirements are low and special workshops for RTG cranes are normally not needed.

Wide Range of Choices
Kalmar RTG crane is available for up to 1 over 7-high stacking with either single or twin-lift spreader. It has some unique features as standard such as AC drive system and electric antisway system. Also a zero emission model with no diesel engine is available. Optional Smartail® automatic steering and container positioning verification both increases productivity and helps to avoid misplaced containers.

RTG Cranes with Shuttle Carriers®
In new terminals with high productivity requirements and in high labor cost markets, Shuttle Carriers® are the ideal solution. When utilizing Shuttle Carriers®, an effective buffer zone is created under the ship-to-shore cranes and under the yard cranes. This makes it possible for both ship-to-shore cranes and yard cranes to operate at maximum efficiency, thus minimizing ship turnaround time. This is an ideal solution for transhipment terminals.
Automatic stacking cranes (ASC) used for stacking and inside stack transportation
Automatic stacking cranes can also be used for loading and unloading of road trucks via remote control
Shuttle Carriers used for transporting of containers between vessel and front end of container yard
Shuttle Carriers can also be used for loading and unloading of road trucks
Estimate 3 ASCs and 2 Shuttle Carriers required on vessel side in total per ship-to-shore crane
Estimate 3 ASCs and 3-4 Shuttle Carriers required, if Shuttle Carriers also used for landside operation
Storage capacity approx. 1,100 TEU per hectare 4-high
Low labor, operating and maintenance costs
Optimum solution for large and very large terminals when high storage capacity is required and labor usage needs to be minimized

Three Types Available
Rail Mounted Gantry (RMG) Cranes can be divided into three types based on design and application: rail mounted cranes, rail mounted cranes with cantilevers and automatic stacking cranes (ASC).
RMG cranes can be built wider than RTG cranes to cover several rail tracks and road truck lanes simultaneously. RMG cranes move containers lengthwise to the correct position in the container stack. RMG stacks can have end or side feeding by transport equipment depending on the layout.

Cantilevered
Rail mounted cranes with cantilevers allow operation also under the cantilevers on both sides of the rails. Road truck traffic can be easily separated from the rail operations.

Easy Automation
Automatic stacking cranes are gaining popularity as they offer high stacking density with very low labor usage. Movements are controlled by a computer system receiving input from the yard management system of the terminal.

Railspan of an automatic stacking crane is typically narrower than with manually operated RMG cranes and containers are fed from the end of the stack. Road trucks can be loaded/unloaded by remote control, one operator controlling several automatic stacking cranes, or by using Shuttle Carriers®.

Environmentally Friendly
RMG cranes have high capital costs, also due to ground works needed for installing the rails. However, they are ideal for automated operation and are environmentally friendly, because shore power is normally used. Kalmar is the leading manufacturer of automatic stacking cranes in the world.
RoRo Operation
In Roll on-Roll off operation loads stay on trailers, which are transported in special RoRo vessels, equipped with ramps. RoRo tractors are used to move trailers in and out of the ship via these ramps. There are several types of trailers and cassettes used depending on the loads.

For RoRo vessels with steep ramps and especially in climates with harsh winter conditions, 4-wheel drive tractors are required in order to achieve sufficient traction. Small turning radius and capability of driving in both directions is required for RoRo operations in order to get maximum vessel fill ratio. Trailers are normally parked in the container yard in a fishbone pattern.

Terminal Operation
In terminal operations terminal tractors are commonly used for moving containers on trailers between the ship-to-shore cranes and container stacking area. Trailers are specially built for inside terminal usage only and with corner guides, which makes it easier to place containers on them. Normally the trailer is permanently attached to the terminal tractor.

Multi trailer systems (MTS) with 2-5 trailers in combination are becoming more popular, especially if containers are moved long distances. With multi trailer systems normally a towing coupling and a heavy counterweight are used. 2-wheel drive tractors with fixed forward facing driving position are normally used.

Chassis Operation
Chassis operation is commonly used in North America. In chassis operation containers are not stacked on the yard but stored on regular road chassis. Terminal tractors move containers on chassis between the ship-to-shore cranes and the container yard. In the container yard chassis are parked with their rear ends facing each other as in a parking area.

Road trucks are directed from the gate to the correct slot, where they either leave or pick-up the chassis. 2-wheel drive tractors with fixed seat position can be used.

Terminal tractors can be used in various applications, also other than the three main applications described above. Kalmar is the leading manufacturer of terminal tractors in the world with Kalmar and Ottawa brand names.
Intermodal Handling

Reach Stackers
Handling of containers on railcars is a common task in most ports today. Reach stackers are widely used in intermodal operations due to their flexibility and speed. One or two rail tracks can be accessed from the side. Also lift trucks with extended gantry spreaders can be used for accessing the first rail.

If second rail access is required, a longer wheelbase reach stacker is needed. With a combihandler spreader, trailers can also be handled easily. Reach stackers or lift trucks can be moved easily within the railyard or between the rail and yard operations.

RTG Cranes
RTG cranes can be effectively used also for handling of containers or trailers on railcars. Up to four rail tracks can be covered simultaneously and containers can be stored also at the side of the rail tracks. RTG cranes are most effective when high numbers of railcars are handled systematically. RTG cranes can be allocated into yard operations within the same terminal, if necessary.

RMG Cranes
RMG cranes are commonly used in large rail operations as several tracks can be covered simultaneously. With cantilevered RMG cranes road truck traffic can be easily separated from the rail operations. RMG cranes are normally dedicated to a specific area, as they can not be moved long distances, for example between rail and yard operations.

Straddle Carriers
Straddle carriers can also be used in handling of containers on railcars. This requires an on-dock railyard with a short distance to the main container yard, in order to be economical.

The straddle carriers need to be sized properly to get sufficient operating clearance between the straddle carrier side frame and the railcars. When using straddle carriers, the train needs to be split in sections in order to reduce running distances over the railcars and there needs to be sufficient space between each rail track for the straddle carriers.
Empty Container Handling and General Cargo

Dedicated Area
Empty containers are normally handled in separate areas, sometimes in dedicated empty container depots far away from the vessel operations. This releases valuable space for loaded containers.

Specialized Equipment
Most common way of handling empty containers is to use empty container lift trucks or empty container reach stackers. These machines are specifically designed for empty container handling with lower hoist capacity, but with excellent stability and visibility when stacking high. This improves productivity and minimizes operating costs, but also allows high density block stacking up to 8-high.

Selectivity Not Critical
Empty containers can be block stacked high, as selectivity requirements for empty containers are normally not critical. Double handling of empty container is possible with empty container lift trucks. Empty container reach stackers further increase flexibility by allowing second row access.

Different Types
Kalmar offers both empty container lift trucks and reach stackers based on customer preference. For occasional empty container handling with lower stacking height, also normal fork lift trucks can be used.

General Cargo
For general cargo and special loads there is always need for regular fork lift trucks. Kalmar has a complete range of fork lift trucks for all kinds of applications and loads starting from 6 metric tons up to 90 metric tons. When talking about heavy materials handling, Kalmar has the correct products and knowhow to meet your specific needs.
Optimal Solution for Every Development Stage

Note: actual storage capacity depends on operational aspects such as required selectivity etc.

Kalmar has the equipment and knowhow available at every development stage of your terminal. Kalmar can assist in developing your operations and help you to focus on your core business by switching from ownership to equipment availability. Our services include spare parts, field service, service packages, refurbishing, upgrades, financial solutions and total fleet management.
Kalmar Industries

The Kalmar Mission
Kalmar’s overriding mission is to provide solutions to make container and materials handling faster and more efficient. This commitment has driven Kalmar to become the leading global supplier of heavy-duty material handling equipment and services in the container, trailer and heavy industrial sectors.

To meet new and challenging market requirements, Kalmar will decisively expand its range of value-added services to further develop its position as being more than just a supplier of machines.

Being supported by the best global network in the industry is a basic prerequisite for a successful expansion into the service market for Kalmar.

By remaining at the forefront of both product technology and value adding services, Kalmar will sustain its position as the leading global solutions provider.

Global Operation
Kalmar machines are in operation in environments ranging from sub-zero arctic climates to tropical humidity and heat. Our global experience and understanding of local conditions enable us to serve customers in all corners of the world.

The company has over 100 years of experience in lifting and moving heavy objects with our machines in over 140 countries around the globe. Kalmar’s highly efficient distribution network, organized in three time zones, is the only global network of its kind in the industry.