rotate relative to the mast and it rotates together with the jib. The derricks described here often have no crane cabin. The crane is remote-controlled by a control panel that either lies somewhere or is strapped onto the shoulders of an operator. The cranes depicted here are all driven electrically.

The hook block is made so heavy that it slacks itself. This is necessary, but requires a large weight because the runner is a very thick and therefore tough steel cable that does not slack easily.

6.1 Hoisting diagram

The capacity of a crane depends on the range and the maximum load of all the parts of the crane, together as well as apart. The right side of the graph shows the important impact of the range. The hoisting angle is also clearly visible.

6.2 Stabilising pontoons

Stabilising pontoons are employed when the heeling tanks fail to reduce the list to an angle of less than 3°. The pontoons are necessary when the GM₀ may get smaller than 1 metre. They are rigidly attached to the sides of the ship at a distance of 0.5 metre in such a way that the ship and pontoon essentially become one.

A pontoon consists of four tanks that can be filled and emptied independently. The pontoon increases the GM₀ of the depicted ship by 0.4–0.8 metres. The pontoon can transfer both downward and upward forces. After use, the pontoons are emptied and brought back on board.

<table>
<thead>
<tr>
<th>jib angle</th>
<th>63°</th>
<th>49°</th>
<th>27°</th>
<th>13°</th>
<th>0°</th>
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<tr>
<td>lift capacity</td>
<td>275 t</td>
<td>275 t</td>
<td>203 t</td>
<td>166 t</td>
<td>162 t</td>
</tr>
<tr>
<td>range</td>
<td>5.0 m</td>
<td>16.8 m</td>
<td>25.0 m</td>
<td>27.0 m</td>
<td>27.5 m</td>
</tr>
</tbody>
</table>

7 Gantry cranes

Gantry cranes are deck cranes that can move, over the cargo, along the ship in longitudinal direction. Many different types of cranes can be attached to the gantry. Ships lacking

- Gantry cranes with a revolving crane on top
- Gantry cranes with a moveable cable trolley with jib.
- Gantry cranes with a double portal and cable trolley without a jib.

Gantry cranes are always sensitive to trim; 2° often is the maximum. Cranes that have a cable trolley are even more sensitive and in this case a list of 2° is the maximum. If there is a revolving crane on top this maximum may be a little bit higher, but it will never be more than 5°.

In general, the four-point suspension of the hoist gives the gantry crane an excellent load control. This ensures that the load stays in line so that it can be deposited at the right place.

A disadvantage of gantry cranes is their massive weight that shifts the centre of gravity to a higher point. This reduces the stability and the carrying capacity. An advantage is that the ship hardly needs any strengthening: only the guide rails on deck need a strong foundation.

A characteristic of gantry cranes is the large reel on the side for the feeder cable.
The portal uses train wheels to ride over the guide rails. The travelling part uses pinions to mesh into the toothed rack, which is attached to the deck. Clamps on the sets of wheels fit around the rails without actually touching them in order to prevent the gantry from tipping over.

### 7.1 Revolving gantry crane

The revolving gantry crane is mostly used for containers and timber. The revolving crane cannot be topped. On the end of the jib there is a rotating head that, when the crane is revolving, is automatically kept in longitudinal direction. The four runners suspend a fully automated spreader that can pick up, for instance, containers from stacks or timber.

The name parallel-swinger comes from both the swinging motion of the jib and from the automated parallel-mechanism that prevents the load from rotating. The depicted crane-type is driven electric-hydraulically.

### 7.2 Gantry crane with a trolley and a fixed jib

Some gantry cranes are equipped with folding side beams. Then the trolley can have a fixed jib. The trolley attached to the portal beams is a crane house that travels on rails; there are also wheels underneath the flanges of the rails to prevent tipping over.

The trolley has a fixed arm with four runners to which different spreaders can be attached. This type of gantry crane is used mainly for containers and timber. The propulsion is either electrical or electric-hydraulic. Similar to the traveling of the portal, with aid of pinions and toothed racks, the traveling of the trolley is also by pinions and toothed racks.

### 7.3 U-gantry with a cable trolley without a fixed jib

The forces in a crane are distributed more equally in gantry cranes with two beams and a cable trolley without a jib than in a gantry crane with a fixed or rotating jib; there are more torsional forces in the latter. This allows the structure to be only slightly heavier than structures with only one beam. However, the crane cabin should be placed higher than in the other two types of gantry cranes because the load always remains some distance below it.

Similar to the other types of gantry cranes, this type can best be used for moving containers and parcels of timber, paper or other bundled cargo.
8 Side loaders

Side-load systems are used for the transhipment of small cargo units like pallets, rolls of paper and general cargo. The system comprises of one or more doors in the side of the ship, and one or more elevators situated behind these doors to transport the cargo from the ramp, at quay level, to the holds or vice versa.

The advantages of this loading system are:
- It has hardly any impact on the ship's stability because it adds almost no weight. Furthermore, the ramp lies low.
- A high transfer capacity. The cargo does not have to be transported over unnecessary distances. This minimises the waiting period.
- If the route over the quay to the ship is covered, loading and discharging can also be done when there is rain or snow.

The disadvantages are:
- The doors in the side of the ship reduce the longitudinal strength. This has to be compensated elsewhere by applying extra steel strengthening.
- The elevators reduce the available cargo volume
- It is unsuitable for heavy loads
- There is a maximum size for the cargo to fit the dimensions of the elevators.

Some characteristics of side-load systems:
- The maximum work load (of the elevator) is 8-20 tons
- The lifting speed of the elevator is 0.33-0.66 m/s (20-40 metres/minute)
- The locks of the side doors have to be checked before departure.
9 Ramps

RoRo-vessels are ships where the cargo is driven on board via ramps. Loading and discharging can take place quickly because all the cargo is driven on board. An advantage of this is that the ship is independent from the shore facilities.

In general, ramps have sufficient length to be used both in high and low tides. Opening and closing is done with a winch or hydraulic cylinders. There are many safety measures for locking and sealing the side doors and ramps.

The most important types of ramps are:
- Straight ramps, extending straight from the fore, the aft or from the side.
- Quarter ramps, having an angle of 45° relative to the centreline.
- Slew ing ramps, here the angle can be varied between +45° and -45° relative to the centreline.

Driving from the supply deck to the other decks also proceeds via ramps. These can be distinguished into:
- fixed ramps
- adjustable ramps
- car decks that also serve as ramps

9.1 Several types of ramps

- Straight ramps
The use of straight ramps on a ship means that the ship depends on the presence of an extending quay in the berthing place onto which the ramp can be placed. This requires a long quay and, if loading and discharging is done via the foreship and the aftship, the full length of the ship has to fit in the berthing place. However, this is not necessary if the straight ramps extend from the side of the ship.
- **Straight ramp in the fore ship**
  The bow visor door in the fore ship has a very complicated shape because it is part of the streamlined profile of the ship's bow. The inside of this door has a flat edge with a rubber seal to make the door watertight. This outer door or visor absorbs the forces of the waves. For this reason there are high demands for fatigue, strength, locks, seals and safety. The stem should have a compulsory second watertight door that is part of the collision bulkhead. This second door is flat. As this door is placed at the collision bulkhead usually it is not possible to use this door as a ramp.

- **Straight ramp in the aft ship**
  The aft ship can suffice with just one watertight door, which, if it is flat, is used as a ramp. In the picture on the right this is the case. The closed ramp protrudes above the aft ship. The pictures below show ramps that are not part of a door.

- **Straight ramp in the side**
  Straight ramps can also be located on the side and they are comparable to the straight ramps in the stern and to the side loaders discussed earlier. The ship designer tries to make the side ramp in such a manner that, when closed, it forms a seamless whole with the ship’s skin. There are also high demands for locking, sealing and safety measures for these types of ramps.
9.2 Quarter ramps

A quarter ramp makes an angle of approximately 45° with the ship’s centre line. This limits the orientations of the ship in berthing to the side where the ramp is located. Quarter ramps can do with less quay length than straight ramps.

- Fixed inboard ramp
  The figure on the next two pages depicts a ship with a fixed ramp that leads to the lower hold. This costs space because nothing can be stored underneath the ramp.

- Hoistable car decks
  A hoistable car deck is depicted in the figure to the right. These can be used as tween decks, allowing two layers of cars to be transported above each other.

When the tween deck is full, the ramp, complete with cars, is hoisted to the tween deck position. The lower deck can be loaded when the ramp has been hoisted.
Ro Ro vessel:

1. Straight stern ramp/door
2. Hoistable ramp
3. Shell door
4. Fixed ramp with cover
5. Door
6. Car-deck access ramp
7. Hydraulic Power Pack
8. Hoistable car decks
10 Registers and certificates

Lloyd's Register of Shipping

Register of Ship's Lifting Appliances and Cargo Handling Gear

Name of Ship: SWOGBRACHT
LR Number: 8197835
Official Number: P.C.M
Port of Registry: AMSTERDAM
Owner: C.W. SCHAFER MATHAUS GEBRECHER SWOGBRACHT
Date of Issue: 28 FEBRUARY 1970
Class Notation of Lifting Appliance if applicable:
Surveyor's Signature:
Lloyd's Register Office of Issue and Stamp

This Register is to be kept available at all times and to be examined by the authorized personnel recommended by the International Labour Office in accordance with SOLAS Convention 1960

Part 1 THOROUGH EXAMINATION OF LIFTING APPLIANCES

Note 1.
Except for initial examination, all the Lifting Appliances are thoroughly examined on the same date it will be sufficient to enter in column 1 "All Lifting Appliances". If not, or if an initial examination is conducted then the Lifting Appliances which have been thoroughly examined on the date stated must be clearly indicated.

Note 2.
The thorough examinations to be indicated in column 2 include:
Initial
12-monthly
Five-yearly
Repair/damage
Other thorough examinations

<table>
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<tr>
<th>Situation and description of Lifting Appliances with distinguishing numbers or marks, if any, which have been thoroughly examined (see note 1).</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tr>
<td></td>
<td>Certificate</td>
<td>Examinations performed (see note 2)</td>
<td>I certify that on the date to which I have appointed by signature, the Lifting Appliances shown in column 1 were thoroughly examined and no defects affecting their safe working condition were found other than those shown in column 5. Date, stamp and signature</td>
<td>Remarks (to be dated and signed)</td>
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<td>Deck Cranes</td>
<td>SMK 0642054/3</td>
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<tr>
<td>Nos. 1 through 3</td>
<td></td>
<td></td>
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</tbody>
</table>

Front page of the cargo handling gear register

A page of the cargo handling gear register
### Certificate of Test and Thorough Examination of Lifting Appliances

**Ship:**

**Certificate number:** D21K 9040004/1

**Certificate holder:**

**Certificate number:**

**Port:**

**Port number:**

**Cargo:**

**Cargo number:**

**Cargo port:**

**Cargo port number:**

**Cargo port number:**

**Port of registry:**

**Port of registry number:**

---

<table>
<thead>
<tr>
<th>Situation and description of lifting appliances (with distinguishing numbers or marks, if any) which have been tested and thoroughly examined</th>
<th>Angle to the horizontal or vertical at which test load applied</th>
<th>Test load (tonnes)</th>
<th>Safe working load (SWL) at angle or radius shown in column 3 (tonnes)</th>
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<tbody>
<tr>
<td>No. 1 Cargo Lift at Fr. 135 starboard</td>
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<td></td>
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<tr>
<td>No. 2 Cargo Lift at Fr. 139 starboard</td>
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<td>16.0</td>
<td></td>
</tr>
<tr>
<td>No. 3 Cargo Lift at Fr. 118 starboard</td>
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<td>16.0</td>
<td></td>
</tr>
<tr>
<td>No. 4 Cargo Lift at Fr. 102 starboard</td>
<td>20.0</td>
<td>16.0</td>
<td></td>
</tr>
<tr>
<td>No. 5 Cargo Lift at Fr. 87 starboard</td>
<td>20.0</td>
<td>16.0</td>
<td></td>
</tr>
</tbody>
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