Institute of
Ship Design and Ship Safety

Exercise

Ship Design

Introduction Container Ships

Prof. Dr.-Ing. Stefan Krüger

Dipl.-Ing. Philip Augener
M.Sc. Maximilian Liebert
Exercise 1

Introduction Container Ships

1. What are the main design drivers of container ships?

2. Which are the two standard sizes for containers? How do these types differ in size? What are other parameters to classify different types of containers?

3. How is the position of a container aboard a container ship defined?

4. Explain the meaning of the nominal container capacity of a container ship. What other characteristic figures concerning the container capacity are of major interest?

5. Name two typical propulsion concepts for container ships and explain, when and why each concept is used!

6. State the intact stability criteria that are applicable for container ships? What kind of regulation does define them?

7. What specialty of container ships do you have to take into account regarding the weather criterion?

8. Which damage stability regulation is valid nowadays for new-buildings of container ships? What is the relevant IMO publication defining this?

9. Which two limiting stability curves result from the above mentioned stability criteria? What quantity does connect these two curves?

10. Which are the minimum standard loading conditions, that have to be evaluated for stability reasons? What kind of regulation does define this?

11. You have received a short version of the technical specification of a container vessel as well as a diagram with the limiting stability curves of the ship. What loading condition is represented by each dot in the diagram?

12. Which is the limiting criterion regarding the stack height of containers in the holds? Which additional criterion has to be considered regarding the stack height for containers on deck and what regulation does define this?
### Container dimensions

<table>
<thead>
<tr>
<th>Designation</th>
<th>ISO 668 (1995)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>45'</td>
</tr>
<tr>
<td>ft</td>
<td>8'6</td>
</tr>
<tr>
<td>mm</td>
<td>2531</td>
</tr>
<tr>
<td></td>
<td>8'6''</td>
</tr>
<tr>
<td>mm</td>
<td>2531</td>
</tr>
<tr>
<td></td>
<td>&lt;8'</td>
</tr>
<tr>
<td>ft</td>
<td>8'</td>
</tr>
<tr>
<td>mm</td>
<td>2531</td>
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<tr>
<td></td>
<td>8'6''</td>
</tr>
<tr>
<td>mm</td>
<td>2531</td>
</tr>
<tr>
<td></td>
<td>&lt;8'</td>
</tr>
</tbody>
</table>

### Height

- **H** mm
  - 2531 < 8'6"
  - 2856 < 9'6"
  - 2433 < 8'6"

### Length

- **L** mm
  - 13716 g±10
  - 12192 g±10
  - 9125 g±10
  - 6058 g±8

### Width

- **W** mm
  - 2259 g±5

### Difference

- **D1-D2** mm
  - ≤ 19mm
  - ≤ 19mm
  - ≤ 16mm
  - ≤ 13mm

### Max. grossmass kg

- 30480
- 30480
- 25400
- 24000

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In accordance with ISO 668 (1995)

**"GEEST" CONTAINER**
Definition:

**A**
- Position of a stack
- Example 20’ stack

**B**
- Position of a container
- Example 40’ container

BAY No.  ROW No.

- BAY No.: 34  -  01  -  82
- ROW No.: 05  -  02

In accordance with ISO 9711-1 (1990)
2.2 Criteria regarding righting lever curve properties

2.2.1 The area under the righting lever curve (GZ curve) shall not be less than 0.055 metre-radians up to $\varphi = 30^\circ$ angle of heel and not less than 0.09 metre-radians up to $\varphi = 40^\circ$ or the angle of down-flooding $\varphi_r$, if this angle is less than $40^\circ$. Additionally, the area under the righting lever curve (GZ curve) between the angles of heel of $30^\circ$ and $40^\circ$ or between $30^\circ$ and $\varphi_r$, if this angle is less than $40^\circ$, shall not be less than 0.03 metre-radians.

2.2.2 The righting lever (GZ) shall be at least 0.2 m at an angle of heel equal to or greater than $30^\circ$.

2.2.3 The maximum righting lever shall occur at an angle of heel not less than $25^\circ$. If this is not practicable, alternative criteria, based on an equivalent level of safety, may be applied subject to the approval of the Administration.

2.2.4 The initial metacentric height $GM_0$ shall not be less than 0.15 m.

2.3 Severe wind and rolling criterion (weather criterion)

2.3.1 The ability of a ship to withstand the combined effects of beam wind and rolling shall be demonstrated, with reference to figure 2.3.1, as follows:

1. the ship is subjected to a steady wind pressure acting perpendicular to the ship's centreline which results in a steady wind heeling lever ($L_{w1}$);

2. from the resultant angle of equilibrium ($\varphi_0$), the ship is assumed to roll owing to wave action to an angle of roll ($\varphi_1$) to windward. The angle of heel under action of steady wind ($\varphi_0$) should not exceed $16^\circ$ or $80\%$ of the angle of deck edge immersion, whichever is less;

3. the ship is then subjected to a gust wind pressure which results in a gust wind heeling lever ($L_{w2}$); and

4. under these circumstances, area $b$ shall be equal to or greater than area $a$, as indicated in figure 2.3.1 below:

$\varphi_0 = \text{angle of heel under action of steady wind}$

$\varphi_1 = \text{angle of roll to windward due to wave action (see 2.3.1.2, 2.3.4 and second footnote on page 20)}$

$\varphi_r = \text{angle of down-flooding (\varphi) or 50$^\circ$ or \varphi_c, whichever is least, where:}$

$\varphi_c = \text{angle of second intercept between wind heeling lever } L_{w2} \text{ and } GZ \text{ curves.}$

* $\varphi_r$ is an angle of heel at which openings in the hull, superstructures or deckhouses which cannot be closed weathertight immerse. In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

* Refer to the Explanatory Notes to the International Code on Intact Stability, 2008 (MSC.1/Circ.1281) (see page 119 of this publication).
where:

\[ M_{fs} \] free surface moment (mt)
\[ \Delta_{min} \] is the minimum ship displacement calculated at \( d_{min} \) (t)
\[ d_{min} \] is the minimum mean service draught of the ship without cargo, with 10% stores and minimum water ballast, if required (m).

3.1.13 The usual remainder of liquids in empty tanks need not be taken into account in calculating the corrections, provided that the total of such residual liquids does not constitute a significant free surface effect.

3.2 Permanent ballast

If used, permanent ballast should be located in accordance with a plan approved by the Administration and in a manner that prevents shifting of position. Permanent ballast should not be removed from the ship or re-located within the ship without the approval of the Administration. Permanent ballast particulars should be noted in the ship's stability booklet.

3.3 Assessment of compliance with stability criteria*

3.3.1 Except as otherwise required by this Code, for the purpose of assessing in general whether the stability criteria are met, stability curves using the assumptions given in this Code should be drawn for the loading conditions intended by the owner in respect of the ship's operations.

3.3.2 If the owner of the ship does not supply sufficiently detailed information regarding such loading conditions, calculations should be made for the standard loading conditions.

3.4 Standard conditions of loading to be examined

3.4.1 Loading conditions

The standard loading conditions referred to in the text of the present Code are as follows.

* Care should be taken in the assessment of compliance with stability criteria, especially conditions in which liquid transfer operations might be expected or anticipated, to ensure that the stability criteria is met at all stages of the voyage.

* Refer to chapter VI of the 1974 SOLAS Convention.
### Preliminary Outline of Shipowner's Requirements for Concept Design

<table>
<thead>
<tr>
<th>Type</th>
<th>Container Vessel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Route 1</td>
<td>Northern Europe, Asia</td>
</tr>
<tr>
<td>Range</td>
<td>19.000nm at service speed</td>
</tr>
<tr>
<td></td>
<td>Specifies bunker capacity</td>
</tr>
<tr>
<td></td>
<td>Oil fuel tank protection acc. to MARPOL 73/78 Annex I New Regulation 12A</td>
</tr>
<tr>
<td>Stability Standard</td>
<td>intact: IMO 749, leak: acc. to SOLAS</td>
</tr>
<tr>
<td></td>
<td>keel laying Jan. 2009</td>
</tr>
<tr>
<td>Speed Service</td>
<td>24.2 kn</td>
</tr>
<tr>
<td></td>
<td>Service Speed at design condition, BF3, 85%MCR</td>
</tr>
</tbody>
</table>

#### Indicative Main Dimensions

- Main dimensions to be optimized with respect to economy (building and operational cost) for given capacity and operational requirements, including the requested stability standards
- LoA: 350.0m max
- Lpp - to be optimized
- B: 42.8m max
- T (design): 13.0m
- T (full scantling): 15.0m
- Deadweight: 112,000t at full scantling draft

#### Capacities - Payload-

- Container: 9,450 TEU geometric spaces
- 6,950 min. 14t homogeneous load (VCG at 45% of cont. height)
- Reefer: 700 10kW/reefer, utilisation factor: 0.8

#### Capacities - Bunker & Stores-

- specified by range

#### Capacities - Water Ballast-

- As needed to comply with effectual rules and criteria
- Overall capacity to be minimized

#### Load Case 1 (Design Condition)

- Design Condition, Departure
- max. number of TEU (12t homog. load, VCG at 45% of height)
- 100% bunker & stores
- design draft (even keel, no heel)
- ballast water as needed according to effectual stability criteria (required amount to be minimized)
### Load Case 2 (Arrival)

**Design Condition Arrival**
- 100% Payload (see above)
- 10% bunker holding tanks
- 100% service tanks
- preferably even keel and no heel
- ballast water as needed according to effectual stability criteria (see above)

### Load Case 3

**Ballast Condition**
- 0% payload
- 10% bunker holding tanks
- 100% service and settling tanks
- ballast water as needed (least trim possible) according to effectual stability criteria (see above)

### Interior Design

<table>
<thead>
<tr>
<th>Crew Cabins</th>
<th>25</th>
<th>fixed, additional rooms as required (storage spaces, mess, suez &amp; repair crew, pilot's cabin, owner's cabin etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Cabins</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Crew Number</td>
<td>25+6 Suez Crew</td>
<td></td>
</tr>
<tr>
<td>Public Spaces</td>
<td>separated day rooms for officers and crew, officer's laundry rm, etc.</td>
<td></td>
</tr>
</tbody>
</table>

### Additional Equipments

none

### Manoeuvring Devices

**Bowthruster**
- 1 x 2600kW

### Vessels of Comparison

<table>
<thead>
<tr>
<th>Lines</th>
<th>8200TEU</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA-Plan</td>
<td>9100TEU</td>
</tr>
<tr>
<td>Lightshipweight</td>
<td>9100TEU</td>
</tr>
</tbody>
</table>
3 Administrations may exempt cargo ships from the application of the requirements of subparagraphs .1 and .2 when such ships will be taken permanently out of service within two years after the implementation date specified in subparagraphs .1 and .2 above.

3 Administrations may exempt ships, other than ro-ro passenger ships, constructed before 1 July 2002 from being fitted with a VDR where it can be demonstrated that interfacing a VDR with the existing equipment on the ship is unreasonable and impracticable.

Regulation 21

International Code of Signals and IAMSAR Manual

1 All ships which, in accordance with the present Convention, are required to carry a radio installation shall carry the International Code of Signals as may be amended by the Organization. The Code shall also be carried by any other ship which, in the opinion of the Administration, has a need to use it.

2 All ships shall carry an up-to-date copy of Volume III of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual.

Regulation 22

Navigation bridge visibility

1 Ships of not less than 55 m in length, as defined in regulation 2.4, constructed on or after 1 July 1998, shall meet the following requirements:

.1 The view of the sea surface from the conning position shall not be obscured by more than two ship lengths, or 500 m, whichever is less, forward of the bow to 10° on either side under all conditions of draught, trim and deck cargo;

.2 No blind sector, caused by cargo, cargo gear or other obstructions outside of the wheelhouse forward of the beam which obstructs the view of the sea surface as seen from the conning position, shall exceed 10°. The total arc of blind sectors shall not exceed 20°. The clear sectors between blind sectors shall be at least 5°. However, in the view described in .1, each individual blind sector shall not exceed 5°;

.3 The horizontal field of vision from the conning position shall extend over an arc of not less than 225°, that is from right ahead to not less than 22.5° abaft the beam on either side of the ship;

.4 From each bridge wing, the horizontal field of vision shall extend over an arc of at least 225°, that is from at least 45° on the opposite bow through right ahead and then from right ahead to right astern through 180° on the same side of the ship;

.5 From the main steering position, the horizontal field of vision shall extend over an arc from right ahead to at least 60° on each side of the ship;

.6 The ship’s side shall be visible from the bridge wing;

.7 The height of the lower edge of the navigation bridge front windows above the bridge deck shall be kept as low as possible. In no case shall the lower edge present an obstruction to the forward view as described in this regulation;

.8 The upper edge of the navigation bridge front windows shall allow a forward view of the horizon, for a person with a height of eye of 1,800 mm above the bridge deck at the conning position, when the ship is pitching in heavy seas. The Administration, if satisfied that a 1,800 mm height of eye is unreasonable and impractical, may allow reduction of the height of eye but not to less than 1,600 mm;

.9 Windows shall meet the following requirements:

.9.1 To help avoid reflections, the bridge front windows shall be inclined from the vertical plane top out, at an angle of not less than 10° and not more than 25°;

.9.2 Framing between navigation bridge windows shall be kept to a minimum and not be installed immediately forward of any work station;

.9.3 Polarized and tinted windows shall not be fitted;
### Permissible forces on containers

#### Racking Force (kN)

<table>
<thead>
<tr>
<th>Classification Society / ISO 1498-1 (1990)</th>
<th>LR</th>
<th>GL</th>
<th>DnV</th>
<th>ABS</th>
<th>BV</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>door and front wall frame 20'/40'</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>side walls, closed box containers</td>
<td>150</td>
<td>125</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>side walls 20'/40'</td>
<td>150</td>
<td>75</td>
<td>125</td>
<td>150</td>
<td>100</td>
<td>75</td>
</tr>
</tbody>
</table>

#### Forces in Vertical Direction (kN)

<table>
<thead>
<tr>
<th>Classification Society / ISO 1498-1 (1990)</th>
<th>LR</th>
<th>GL</th>
<th>DnV</th>
<th>ABS</th>
<th>BV</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>top 20'</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>118</td>
</tr>
<tr>
<td>tension 40'</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>150</td>
</tr>
<tr>
<td>bottom 20'</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>112</td>
</tr>
<tr>
<td>tension 40'</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>141</td>
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</tbody>
</table>

#### Compression at Bottom Corner 20'

<table>
<thead>
<tr>
<th>Classification Society / ISO 1498-1 (1990)</th>
<th>LR</th>
<th>GL</th>
<th>DnV</th>
<th>ABS</th>
<th>BV</th>
<th>ISO</th>
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<tbody>
<tr>
<td>954</td>
<td>-</td>
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<td>983</td>
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<td>1077</td>
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#### Horizontal Support Force (kN)

<table>
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<th>Classification Society / ISO 1498-1 (1990)</th>
<th>LR</th>
<th>GL</th>
<th>DnV</th>
<th>ABS</th>
<th>BV</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>top tension 20'</td>
<td>340</td>
<td>250</td>
<td>200</td>
<td>250</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>compression 40'</td>
<td>340</td>
<td>250</td>
<td>200</td>
<td>250</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td>intermediate tension 20'</td>
<td>840</td>
<td>650</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>300</td>
</tr>
<tr>
<td>compression 40'</td>
<td>840</td>
<td>650</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>250</td>
</tr>
<tr>
<td>bottom tension 20'</td>
<td>500</td>
<td>400</td>
<td>200</td>
<td>350</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>compression 40'</td>
<td>500</td>
<td>400</td>
<td>350</td>
<td>350</td>
<td>300</td>
<td>150</td>
</tr>
</tbody>
</table>

### Lashing loads at corner casting

Acting parallel to front and side face at top and bottom corner fitting.

In accordance with ISO 1161 (1984)
SSW Super 1000

MAIN PARTICULARS

- Length over all: appr. 151.72 m
- Length between perpendiculars: 142.00 m
- Breadth: 23.40 m
- Depth to Main Deck: 9.50 m
- Depth to Upper Deck: 11.75 m
- Draught, design: 7.60 m
- Draught, maximum: 8.00 m
- Deadweight (D = 8.00 m): appr. 13,000 t
- Speed (D = 7.45m/7.75m): appr. 19.0 kn
- Class: BV + 1 HULL + MACH

TANK CAPACITIES

- Heavy fuel oil: appr. 1.012 m³
- Marine diesel oil: appr. 117 m³
- Lubricating oil: appr. 37 m³
- Fresh water: appr. 153 m³
- Ballast/heeling water: appr. 5.870 m³
- Cruising range: appr. 10,000 nm

CONTAINER CAPACITIES

- Max. number of containers (IMO): 20’-cont.
- On deck: 714 TEU
- In cargo holds: 322 TEU
- Total: 1036 TEU

40’-reefer
- On deck: appr. 136 FEU
- In cargo hold: appr. 114 FEU
- Total: 250 FEU
- Rows max. in holds/on hatches: 8/9
- Tiers max. in holds/on hatches: 4/6
- Stability (14t/TEU homog. at 45%): draught = 8.0 m
- max. number of containers: 745 TEU

MAIN ENGINE

- MAK (opt. MAN, Wärtsilä): 9 M 43
- MCR: 9000 kW / 500 rpm
- Single gearbox vertical type with PTO for
  - Shaft alternator (1700 kW)
  - Variable-pitch propeller
  - Bow thruster: 800 kW

POWER SUPPLY

- Diesel Generators: 3 x 550 kW el.
- Shaft Generator (const. speed): 1 x 1700 kW el.
- Emergency Generator: 1 x 315 kW el.
- Reefer Container: 257 FEU
- Reefer Stowage: (114 Hold / 136 Deck)

INWATER SURVEY AUT-UMS
- Shaft alternator (1700 kW)
- Ice IA Container Ship
- Dangereous Cargo
- Bow thruster: 800 kW

RESTRICITED NAVIGATION

- Gross Tonnage: appr. 10,585 GT
- Net Tonnage: appr. 5,372 NT
- Complement: staff 16+2
- Pilot: 1

SSW Schichau Seebeck Shipyard GmbH
Riedemannstr.1 - D-27572 Bremerhaven
Tel: +49 471 39 20    Fax: +49 471 39 22 39
E-Mail: info@ssw-shipyard.com www.schichau-seebeck-shipyard.com

MainData_Super1000M-Ice.xls 10.07.2006
SSW SUPER 1000 eco

Main particulars:

- Length: 150.32 m
- Length BPP: 142.37 m
- Breadth: 23.48 m
- Moulded: 23.48 m
- Depth: 12.71 m
- T. Max: approx 6.80 m
- T. Rated: 1633 kts
- Engine output: 5000 kW
- Gross Tonnage: nrt
- Deadweight (max): dwt
- Containers 20 Ft boxes: 228 pcs.
- Containers 40 Ft boxes: 114 pcs.
- Containers 45 Ft boxes: 103 pcs.
- Max. containers in t. nom. 40x VIG: 745 pcs.
- Containers 40/20 Ft boxes: 156/15 pcs.
- Containers 40/20 Ft t. boxes: 240/10 pcs.
- Containers 40/20 Ft t. total: 492/25 pcs.

* Denotes Reefer Position.
8,200 TEU CONTAINER SHIP

MAIN DIMENSIONS
Length over all abt. 334 m
Length between perp. 319 m
Breadth moulded 42.8 m
Depth to main deck 24.5 m
Draught design (T_d) 13 m
Draught scantling (T_s) 14.5 m

DEADWEIGHT
Deadweight on T_d 83.000 MT
Deadweight on T_s 100.800 MT

CLASSIFICATION
Class GL-[100A5, CONTAINER SHIP, +MC, SOLAS II-2 Reg. 19, AUT, IW, NAV-O, ERS

CONTAINER CAPACITIES
With max. number of Containers (IMO Visibility)
On deck (6/7 tiers) 3,927 4,369 TEU
In hold 3,835 3,835 TEU
Total 7,762 8,204 TEU
Rows in holds / on hatches 15 / 17 Row
Tiers in holds / on hatches / dk 9 / 6/7 Tier
One(1) high cube (9’6”) container to be stowed on top tier in hold
EL. Plugs (for reefer Container)
On deck 40’ 500 Plugs
In hold 40’ 200 Plugs
Total No. of loaded container at Ts abt. 6,300 TEU
(Based on 14T/TEU, Full bunkers, 8’6”, 45% VCG)

TANK CAPACITIES
Heavy fuel oil abt. 10.400 m³
Marine diesel oil abt. 500 m³
Fresh water abt. 500 m³
Ballast water abt. 27.000 m³

COMPLEMENT
30 + 6 p

FUEL OIL CONSUMPTION OF MAIN ENGINE
D.F.O.C at NCR abt. 248.8 t/d

CRUISING RANGE
23.000 NM
Bow thruster 2.500 kw

CARGO HATCH COVER
Type Steel pontoon, non-sequential
Stack weight 90 tons for 20ft, 120 tons for 40 ft
Max. Panel weight 40 tons incl. container loose fittings

POWER SUPPLY
Diesel Generators 2,800 kw x 4 sets
Emergency Generator 300 kw x 1 set

MAIN ENGINE
HYUNDAI-B&W 12K98MC
MCR 68,640 KW X 94 RPM
NCR 61,780 KW X 90.8 RPM

SERVICE SPEED
Service Speed at Td abt. 25.6 kts
Sea margin 15 %

NAVIGATION EQUIPMENT
3 - Radar (ARPA, S-band : 1, X-band : 2)
2 - Gyro compass & 1-Auto pilot
1 - Dual axis speed log with docking mode
2 - DGPS Navigators
1 - Electronic chart system

HULL NO. 1632-4, 1680-1
Date. Oct. 24, 2003
Solution 1

1 Introduction Container Ships

1. What are the main design drivers of container ships?

The main design drivers for container ships are the deadweight (in combination with the fuel oil consumption on design draught) and the longitudinal strength.

2. Which are the two standard sizes for containers? How do these types differ in size? What are other parameters to classify different types of containers?

Containers can be classified by the cargo into dry, liquid and reefer containers. Additionally the length (TEU, FEU, 45', 10') and the height (high cubes) are important. The dimensions of containers are shown in the figure attached.

Note:

\[ l_{FEU} = 2 \cdot l_{TEU} + 76 \text{ mm} \] (1)

3. How is the position of a container aboard a container ship defined?

The position of a container on a container vessel is explicitly given by the bay (x-coordinate), the row (y-coordinate) and the tire (z-coordinate). The code for the positions of container is explained in the figure on hand.

4. Explain the meaning of the nominal container capacity of a container ship. What other characteristic figures concerning the container capacity are of major interest?

Some of the classes container ships are divided into are: Feeder (up to approx. 3,000 TEU), Panamax \((B_{max} = 32.3 m)\) (up to approx. 5,500 TEU), Post-Panmax, New-Panmax, New-Post-Panmax,... Additionally there are Open-Top container ships, which do not have hatch covers in order to increase the handling speed of the cargo.

Furthermore the notation for large container vessel are Ultra Large Container Ships (ULCS), Ultra Large Container Vessels (ULCV) as well as Megaboxer. If container ships are equipped with cranes they are called geared, if not ungeared. Only rather small container ships are equipped with cranes.

5. Name two typical propulsion concepts for container ships and explain, when and why each concept is used!

Small Feeder are mostly equipped with four stroke medium speed diesel engines, gearbox and a controllable pitch propeller (CPP). Sometimes in addition with a power take of. Why? Because there is not enough space for a large two stroke engine and feeders have more harbor contacts.

Larger container ships are usually equipped with a two stroke low speed diesel engine and with a fixed pitch propeller. Reason: These engines are the most economic diesel engines. The electrical power is produced with gen-sets (generators + auxiliary engines). Depending on the capacity for
reefer-containers the installed auxiliary engine power can be very high. The installed main engine power of older container ships is very high, because these vessels were sailing with very high speeds before the economic crisis of 2008. Newer container ships are designed for slower speeds, leading to smaller main engines. The largest container ships (e.g. MAERSK Triple-E) can be equipped with two low speed two stroke diesel engines and two fixed pitch propellers. The whole engine plant is located in a twin-skag aftbody. There are also designs for such big vessels (e.g. OOCL G-Class) which are equipped with only one two stroke engine and one fixed pitch propeller.

6. State the intact stability criteria that are applicable for container ships? What kind of regulation does define them?

The criteria regarding righting lever curve properties (RAHOLA) and the severe wind and rolling criterion (weather criterion), which can be found in the International Code on Intact Stability (IS-Code 2008).

7. What specialty of container ships do you have to take into account regarding the weather criterion?

Resulting from the loading conditions the side lateral area of container ships varies, which has to be considered when applying the weather criterion.

8. Which damage stability regulation is valid for new-buildings of container ships in the moment? In which code do you find it?


9. Which two limiting stability curves result from the above mentioned stability criteria? What quantity does connect these two curves?

\[
KG_{\text{max}}(\text{loadcase}) + GM_{\text{req}}(\text{loadcase}) = KM(\text{loadcase})
\]

Following from this \(KG_{\text{max}}\) and \(GM_{\text{req}}\) curves for each loading condition are linked over the \(KM\). There is a limiting curve for each stability criterion covering the whole range of draughts of the vessel. The envelope of all these curves is the resulting valid limiting curve of stability for the vessel.

10. Which are the minimum standard loading conditions, that have to be evaluated for stability reasons? What kind of regulation does define this?

Fully loaded departure condition, fully loaded arrival condition, ballast departure condition, ballast arrival condition. These can be found in the IS-Code 2008.

11. You have received a short version of the technical specification of a container vessel as well as a diagram with the limiting stability curves of the ship.

12. You have received a short version of the technical specification of a container vessel as well as a diagram with the limiting stability curves of the ship. What loading condition is represented by each dot in the diagram?

Loadcases are Full Scantling Draft, Design Departure, Design Arrival and Ballast Arrival.

13.
14. Which is the limiting criterion regarding the stack height of containers in the holds? Which additional criterion has to be considered regarding the stack height for containers on deck and what regulation does define this?

The weight of the container stack can only be so high, that the undermost container can carry it (including dynamic parts). For the containers on deck of the vessel the navigation bridge visibility according to SOLAS.