Regional Marine Forum OCIMF 2018

Tanker Damage Stability Regulations Guidelines and Interpretations

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Herbert Engineering Corp.

➢ Naval Architects and Marine Engineers since 1963

➢ Design and engineering consulting to shipping and offshore industries worldwide

➢ Expertise in conceptual, preliminary, and contract design of commercial vessels and offshore floating assets

➢ Offices in California, Texas, Maryland, Scotland, China and Singapore

Herbert Engineering Corp.

➢ Herbert-ABS Software Solutions LLC

➢ Marine software house joint venture with ABS

➢ CargoMax/LMP - Loading software for all commercial vessels and offshore floating platforms, widely used by all type of tankers

➢ HECSALV/HECSDS - Salvage and ship design software

Herbert Engineering Corp.

➢ Involved in the development of SOLAS and MARPOL stability regulations through collaboration with SNAME and USCG

➢ "A Study into Crane Loads Associated with Hose Handling at Offshore Terminals"

Regulations (1)

➢ MARPOL, IBC/BCH Code and IGC/GC Code

➢ Annex to MEPC 66/21 Annex 9-11 – April 2014 (introducing MARPOL Annex I Chapter 4 Part A Regulation 28.6, as well BCH Code Chapter 2.2.1 and IBC Code Chapter 2.2.6)

➢ MSC 93-3-5 Annex 3 – May 2014 (with similar revisions for the IGC Code Chapter 2.2.6)

Regulations (2)

➢ MSC.1/Circ.1461 Annex – July 2013: Guidelines for Verification of Damage Stability Requirements for Tankers

➢ MSC.1/Circ.1229 Annex – January 2007: Guidelines for the Approval of Stability Instruments

➢ IACS UR-L5 – May 2004: On-board Computers for Stability Calculations (latest Rev.3 June 2017)

Objectives

➢ Highlight some of the issues arising from the application of the current regulatory regime, as experienced during the preparation of hundreds of Loading Instruments (**LI**) and Stability Information Books (**SIB**) for all types of tankers

➢ Suggest additions and corrections to the guidelines to obviate to these issues

Issues

➢ When SIB and LI do not agree

- The predominance of SIB over LI

- Non-univocal guidelines

- Damage definition and intermediate phases

➢ Practical use of the LI on board

- Runtime

- Crew guidance

- Waivers and alternative verification

When SIB and LI do not agree

➢ "The stability instrument is not a substitute for the approved stability documentation, but used as a supplement to facilitate stability calculations" – MSC.1/Circ.1461 Annex

➢ "The input/output information should be easily comparable with approved stability information so as to avoid confusion and possible misinterpretation by the operator relative to the approved stability information" – UR L5

When SIB and LI do not agree

➢ Different damage treatment between SIB and LI

➢ Outflow and the GZ curve "The new floating position **can** be determined by assuming that the damaged displacement is equal to the intact displacement (constant displacement) minus the weight of liquids which were contained in the damaged compartments" - MSC.1/Circ.1461

➢ Different treatment for FS correction – how do you reconcile LI and SIB?
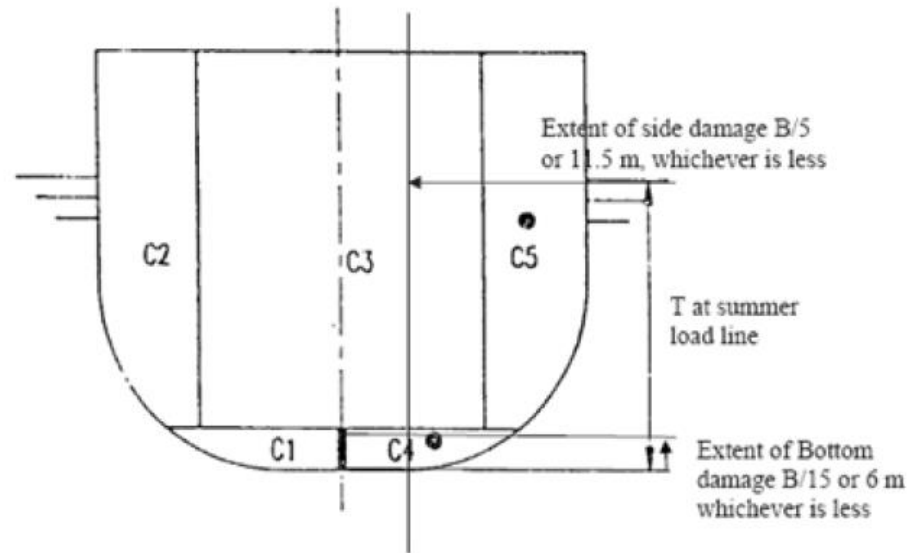
When SIB and LI do not agree

➢ Progressive flooding through DFP's: "The flooding of compartment(s) due to progressive flooding occurring in a predictable and sequential manner through a down-flooding point which is submerged (….) may be permitted" – MSC.1/Circ.1461 Annex

➢ Different intermediate phase treatment between SIB and LI: "Alternative methods may be accepted" – MSC.1/Circ.1461 Annex

Damage definition

➤ What are viable minor damages?

a. L-shaped

b. Checkerboard?

c. U-shaped?

d. Inverse L-shaped?

e. Internal???

f. Minor raking????

Extent of side damage B/5 or 11.5 m, whichever is less

C2   C3   C5

T at summer load line

C1   C4

Extent of Bottom damage B/15 or 6 m whichever is less

1. SIDE DAMAGE
1.1 Damaged compartments for maximum extent:

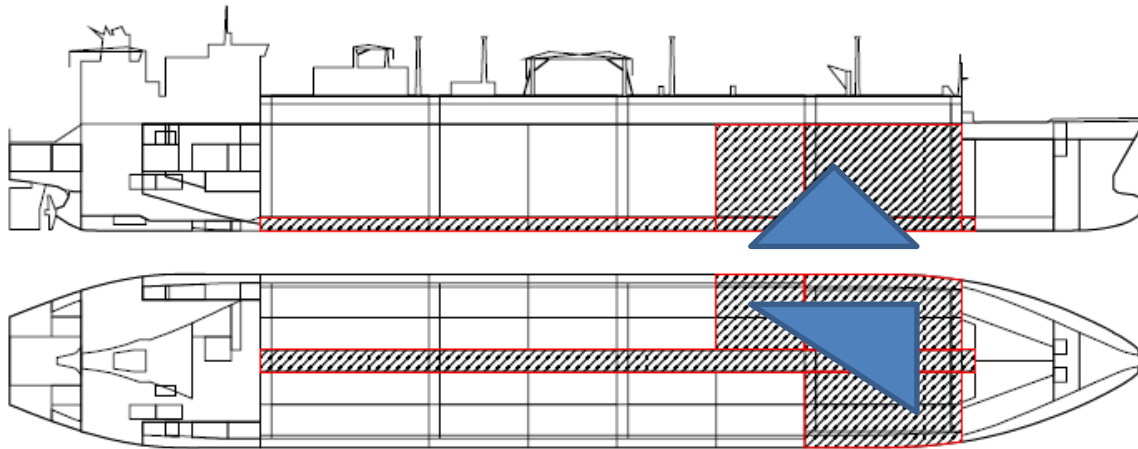1.1.1 C5, C3, C4

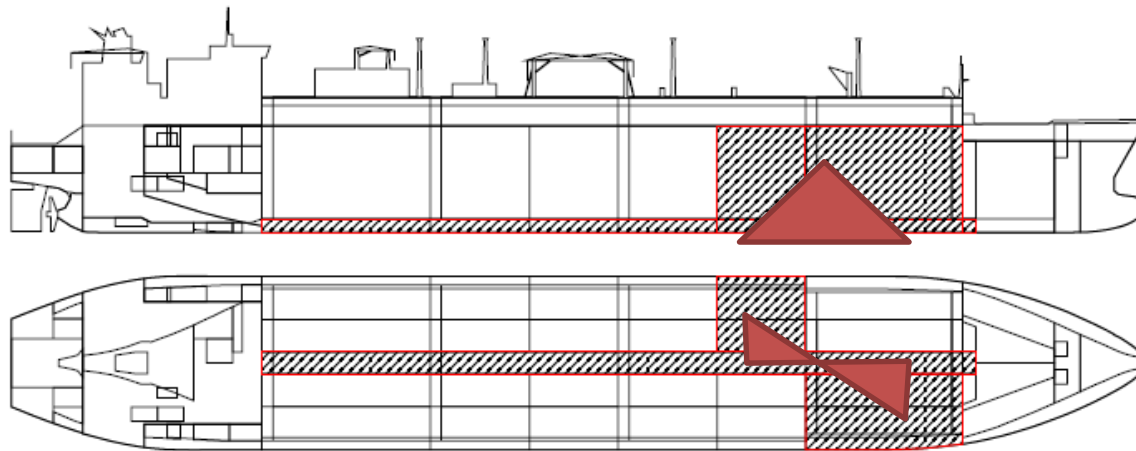1.2 Damaged compartments for lesser extent:
1.2.1 C5
1.2.2 C5, C4
1.2.3 C3, C5

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Damage definition
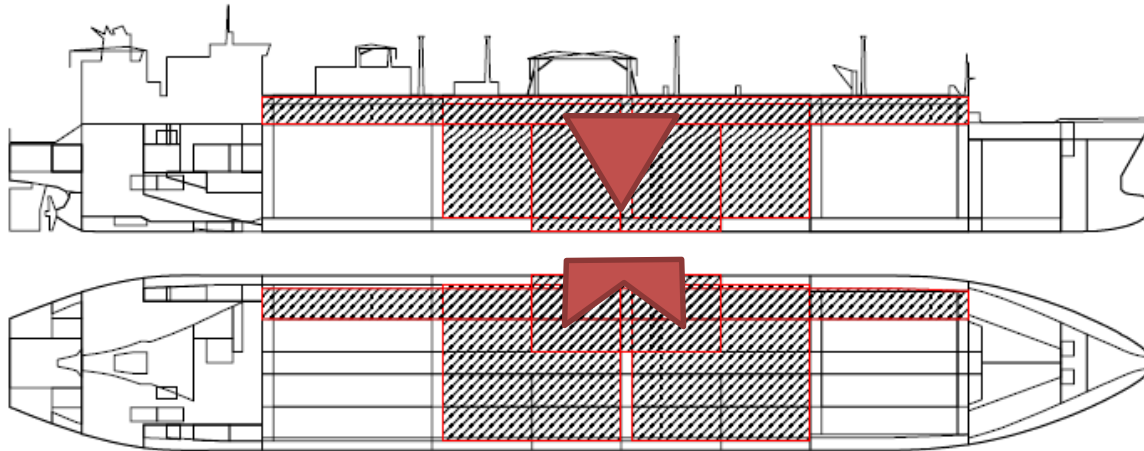
➢ L-shaped (SWB1P, SWB1S, SWB2P, Duct)

Damage definition
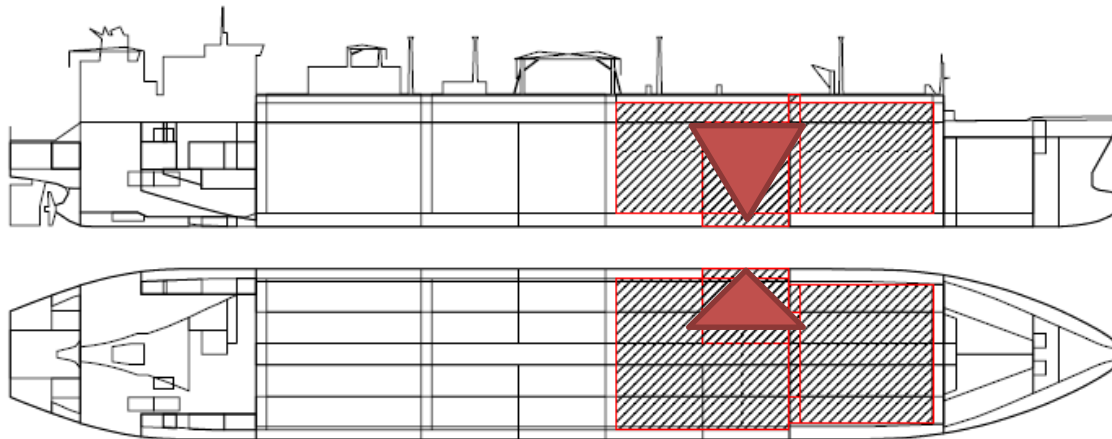
➢ Checkerboard (SWB1S, SWB2P, Duct)

Damage definition

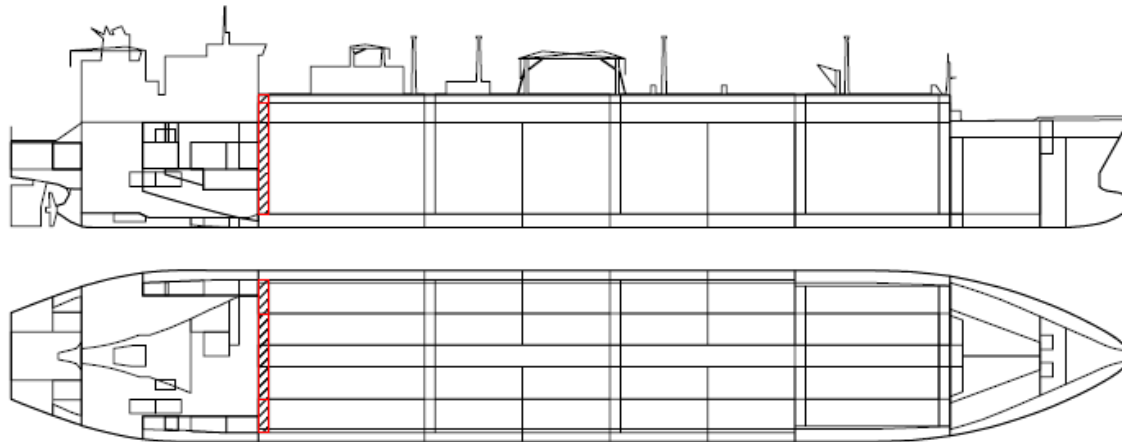➢ U-shaped (SWB3P, SWB4P, 2C, 3C, Trunk)

Damage definition
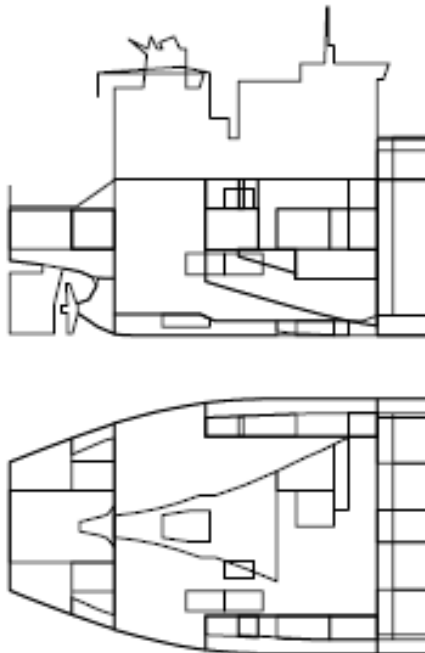
➢ Inverse L-shaped (SWB2P, 1C, 2C)
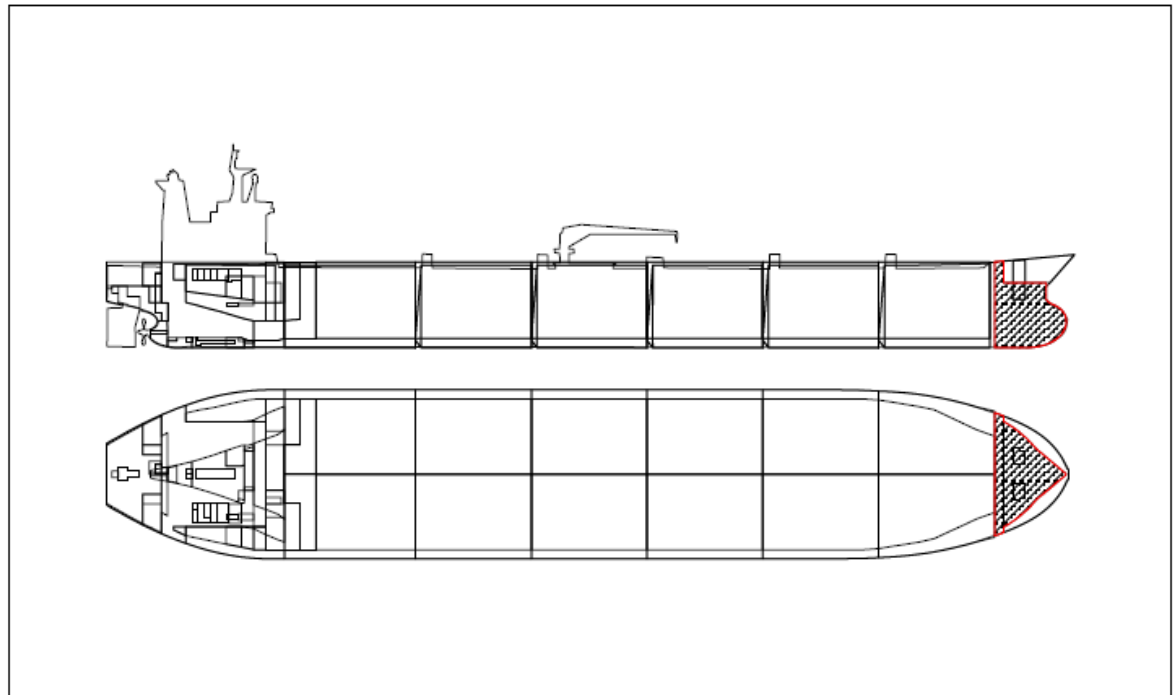
Damage definition

➢ Internal (Cofferdam)

Damage definition

➢ Can smaller tanks be included in the ER? How small is small enough?
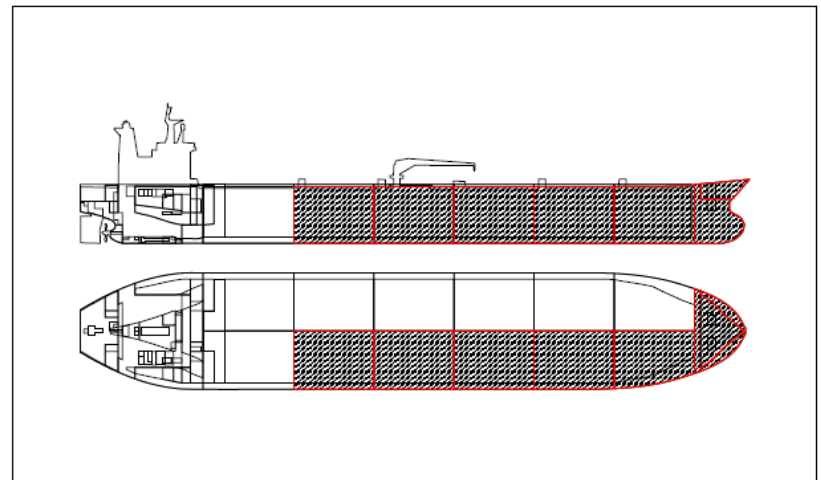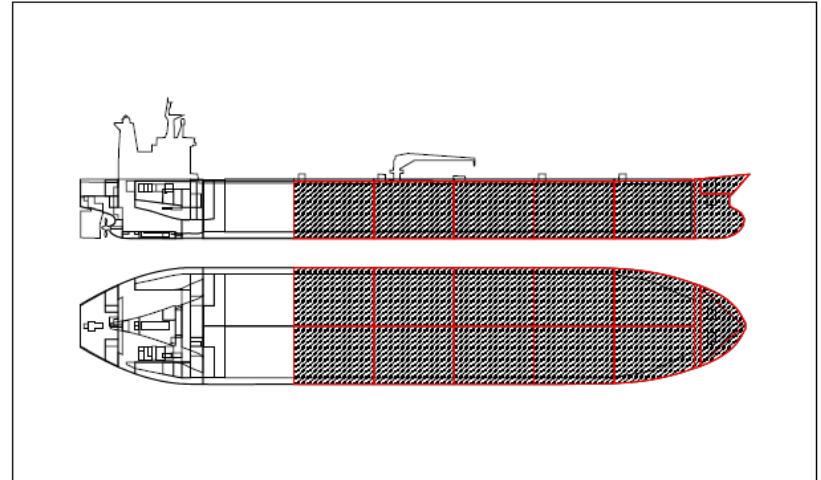
Damage definition

➢ Non-onerous damages

Damage Definition
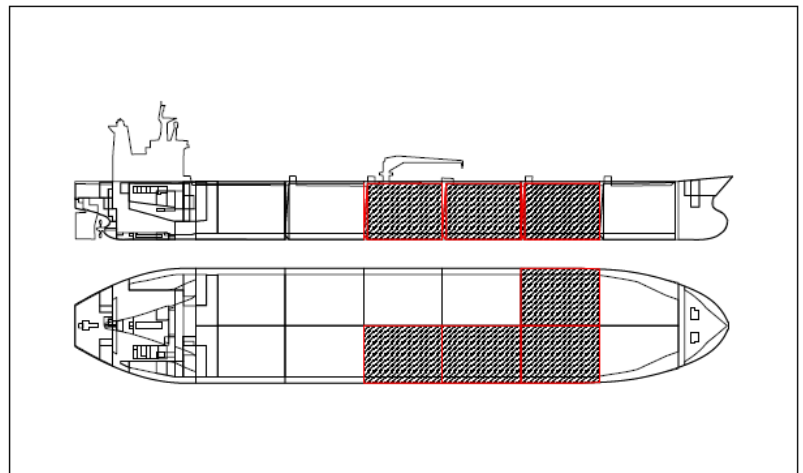
➢ Standard raking

Damage Definition

➢ Invalid "minor" raking damage

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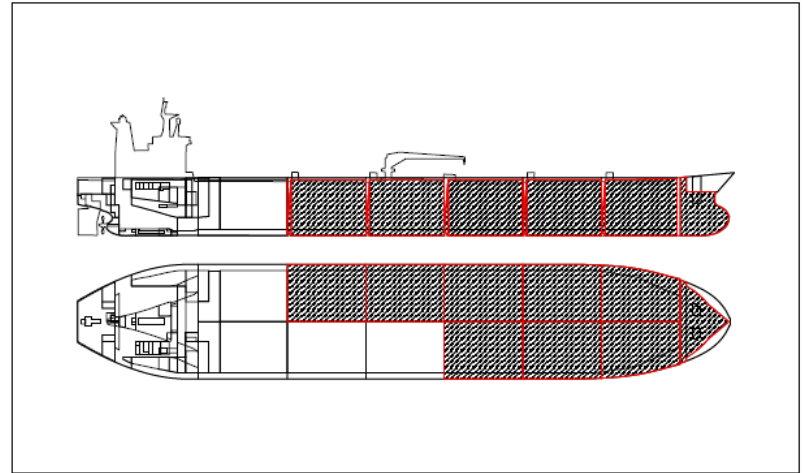
Practical use of the LI on board

➢ Runtime limitations: how long is it reasonable a wait to complete a direct damage stability calculation?

➢ The concept of GM Margin: should there be an additional "Freeboard Margin"?

➢ Crew training: do tanker crews understand damage stability sufficiently to appreciate the role of outflow?

Practical use of the LI on board

➢ Protecting ER damages with ballast in aft-most tanks
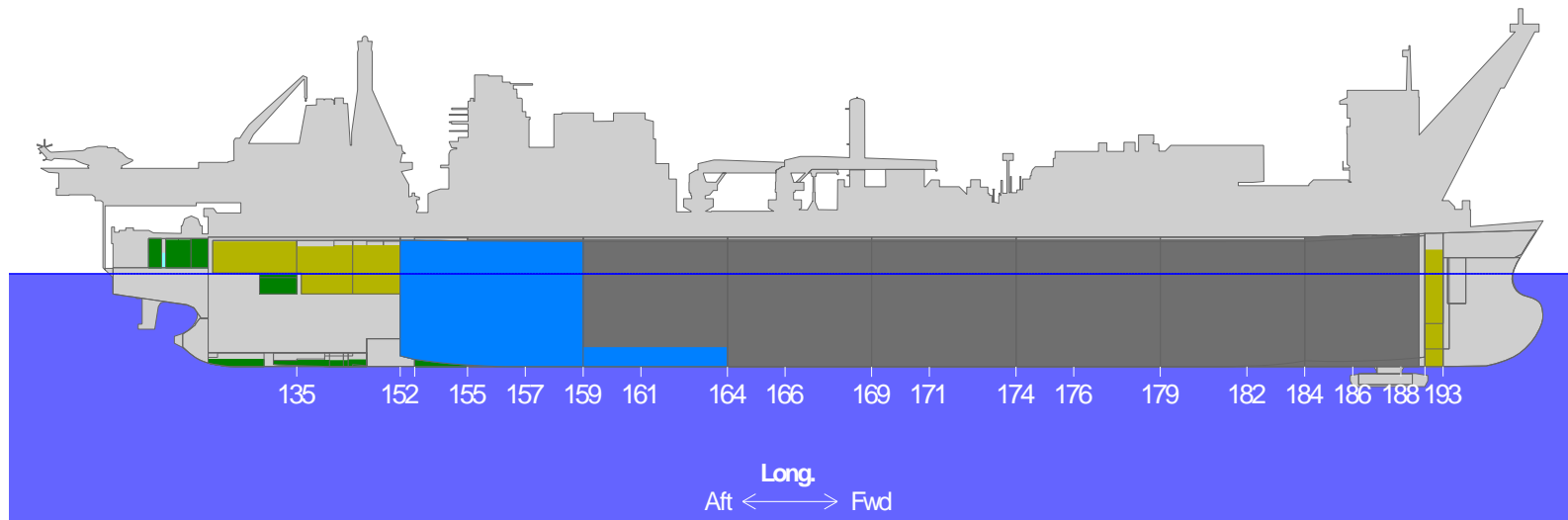
Practical use of the LI on board

➢ MSC.1/Circ.1461 LI Types:

- **Type 1**: Software calculating intact stability only (for vessels not required to meet a damage stability criterion)

- **Type 2**: Software calculating intact stability and checking damage stability on basis of a limit curve or previously approved loading conditions

- **Type 3**: Software calculating intact stability and damage stability by direct application of pre-programmed damage cases for each loading condition

➢ Type 2: When is a loading condition close enough?

Conclusions

➢ If the LI shows that there are shortcomings with the approved ship documentation, the guidelines should impose that the ship documentation is corrected and re-issued.

➢ The guidelines should be imposed on all ships, regardless of their age in a manner compatible with the amendments concerning the LI.

➢ It is **NOT ACCEPTABLE** to retain a SIB in open conflict with the approved LI.

Conclusions

➢ The guidelines should provide **UNIVOCAL** interpretations of the regulations. For instance, MSC.1/Circ.1461 Annex should say: "The new floating position MUST be determined by assuming that the damaged displacement is equal to the intact displacement (constant displacement) minus the weight of liquids which were contained in the damaged compartments."

Conclusions

➢ There should be a guideline explicitly specifying that the only valid damage cases are those that can be created by a convex body penetrating the vessel from the outside

➢ Although our preference would be to define such shape as a simple box as assumed by other regulations such SOLAS and MODU Code, it is conceivable that this could be extended to tetrahedrons and pyramids the base of which is on the vessel outer skin, and that are fully contained in the maximum extent box

➢ The guidelines should have extensive examples of valid and invalid damage cases in 3D

Conclusions

➢ There should be a guideline explicitly specifying the requirement to include all of the damage conditions that are considered valid (including lesser cases) within in the damage calculation booklet submitted by the shipyard to the Administration/RO/Owner at the original design stage.

➢ The full list of all minor damage cases (including side, bottom and raking) should be specified by the yard in the SIB so that exactly the same list is used in the LI

Conclusions

➢ There should be a guideline explicitly specifying that all tanks and other watertight spaces smaller than 5 m³ or 0.2% of the displacement volume at Summer load line draft (whichever the larger) should either not be modelled or should be included as damaged in all damage cases that involve the compartment that contains them

Conclusions

➢ Crews should be trained on the practical use of the software, including sufficient understanding of the tankers damage stability regulations so that operational non-compliances can be readily obviated

➢ Type 2 software should not be allowed to include alternative compliance by way of comparison with the SIB loading conditions. This should only be allowed by waivers issued by Flag on the basis of a strict definition of when two loading conditions can be considered similar enough

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