INTERNATIONAL MARITIME ORGANIZATION

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Agenda item 9

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GUIDELINES FOR VERIFICATION OF DAMAGE STABILITY REQUIREMENTS FOR TANKERS AND BULK CARRIERS

A proposal for existing tankers and bulk carriers

Submitted by the Republic of Korea

SUMMARY

Executive summary:	This document provides the practical concerns on introducing the guidelines for verifying the damage stability prior to departure for existing tankers and bulk carriers
Strategic direction:	2
High-level action:	2.1.1
Planned output:	2.1.1.2
Action to be taken:	Paragraph 17
Related documents:	SLF 51/13/1, SLF 51/13/2, SLF 51/13/3 and SLF 51/17

Introduction

1 The Sub-Committee, at its fifty-first session, acknowledging the importance of complying with relevant damage stability requirements for operational loading conditions, invited Member Governments and international organizations to submit more information on the alleged non-compliance (e.g., type, size, age and the number of vessels involved).

2 In order to verify the practicability and effectiveness of introducing the guideline for verifying the damage stability prior to departure of existing tankers and bulk carriers, the Republic of Korea deems it necessary to investigate the following:

.1 the restrictions in the approved stability information and margins of damage stability for existing tankers and bulk carriers; and

.2 the deviation of calculation results of respective stability calculation programs for existing tankers and bulk carriers. It is noted that each country and shipyard are using different calculation programs. The makers of stability instrument are also using their own programs, which may cause a deviation of calculation result.

Restrictions and margin of damage stability

3 The Republic of Korea investigated restrictions and margins of damage stability for various ship types. The results of this investigation are provided in the subsequent paragraphs for respective ship types. For easy reference, the standard of assumed damage for each type of ship for damage stability calculation according to SOLAS and MARPOL is summarized as follows:

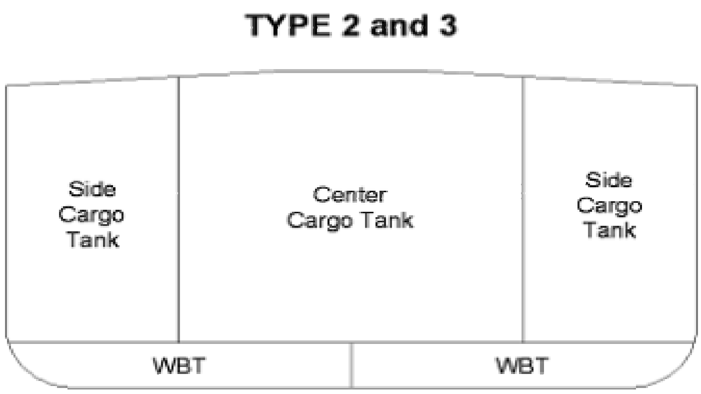
Ship	Ship Type	Standard of Damage
Bulk Carrier	150 metres in length and upwards	1 Compartment
Chemical Tanker	Type 1, 2 and 3	2 Compartments
Gas Carrier	2G	2 Compartments
	2PG	1 Compartment
Oil Tanker	150 metres in length and upwards	2 Compartments
	Less than 150 metres in length	1 Compartment

4 Bulk carriers

With regard to the damage stability requirements of bulk carriers, SOLAS regulation XII/4 is applicable. Bulk carriers of 150 m in length and upwards of single-side skin construction, designed to carry solid bulk cargoes having a density of 1,000 kg/m^3 and above shall, when loaded to the summer load line, be able to withstand flooding of any one cargo hold in all loading conditions and remain afloat in a satisfactory condition of equilibrium. It means that the current damage stability requirements for bulk carriers already reflect the worst possible conditions of cargo loading. Therefore, it is difficult to find the need to introduce the guidelines for verifying the damage stability prior to departure for bulk carriers.

5 Chemical tankers

Chemical tankers investigated normally have high margins of damage stability due to their high degree of subdivision, except for types 2 and 3 chemical tankers. Types 2 and 3 chemical tankers normally have the following mid-ship section. Centre cargo tanks are loaded with type 2 chemical cargoes or heavy liquid cargoes, while side cargo tanks are loaded with light liquid cargoes or empty. When side cargo tanks are loaded, these ships normally have high margins of damage stability. However, when side cargo tanks are empty, it is difficult for many of these tankers to comply with the damage stability requirements. To comply with the damage stability requirement, some of these vessels have restrictions such as loading of all side cargo tanks in all cases or loading of some ballast tanks.



6 Gas carriers

Type 2G gas carriers are relatively large ships as they are more than 200 metres in length. Due to their high degree of subdivision, type 2G gas carriers normally have high margins of damage stability. Type 2PG gas carriers are relatively small as they are less than 100 metres in length. Although type 2PG gas carriers are subject to only one compartment standard damage, they have small margins of damage stability due to their size of cargo tank. As shown in table 1 of the annex to this document, 70% of type 2PG gas carriers need water ballast to comply with the damage stability requirements.

7 Oil tanker

Oil tankers investigated normally have high margins of damage stability due to their high degree of subdivision. Small oil tankers less than 150 metres in length are subject to the application of one compartment standard damage.

Calculation programs (software)

8 It should be noted that each country and shipyard are using different calculation programs. The makers of stability instrument are also using their own program, which may cause deviation in the calculation results. In the case of a new ship, damage stability booklet and stability instrument use similar programs, the outcome of which is that calculation results are not quite different from each other. However, in the case of existing ships, there may be deviation in the calculation results between damage stability booklets and stability instruments.

9 In this regard, sample calculations were carried out for the following vessels to investigate the deviations of results of each calculation program.

Ship Type	Deadweight (ton)	L_{BP} x B x D x draught (m)
Oil Tanker	19,990	137.0 x 23.7 x 13.35 x 9.6
Bulk Carrier	22,000	149.8 x 23.8 x 13.00 x 9.2

10 The above vessels were built from different countries and the approved damage stability booklets were also calculated by different programs. The calculation for verification was carried out by a stability instrument which is used in the Republic of Korea. The results of heeling angle and maximum righting lever (GZ) of the final stage of flooding are summarized as tables 2, 3, 4 and 5 of the annex to this document.

11 In the case of 22,000 DWT bulk carriers, the deviation is relatively small and considered to be as within the acceptable limits. However, in the case of 19,990 DWT oil tankers, the deviation in heeling angle exceeded 1.5 degrees and the deviation of maximum righting lever (GZ) was about 0.20 metre. Considering the minimum required righting lever is 0.1 metre, the deviation of 0.2 metre is not acceptable as a stability instrument. It is also noted that the calculation result with stability instrument may not comply with damage stability requirements even though the damage stability booklet complies with the damage stability requirements.

Conclusion

12 The damage stability issue for bulk carriers is regarded to be dealt with adequately at the design stage due to the current damage stability requirements applying the worst possible conditions of cargo loading. Therefore, it is hard to find a compelling need to verify the damage stability for the operational loading conditions of bulk carriers prior to departure.

13 Tankers normally have sufficient margins of damage stability due to their high degree of subdivision. However, type 2PG gas carriers and types 2 and 3 chemical tankers have small margins of damage stability due to their size of cargo tank. Some of type 2PG gas carriers and types 2 and 3 chemical tankers need water ballast in order to comply with the damage stability requirements and they normally have a regular or fixed loading pattern.

14 Therefore, for existing tankers and bulk carriers, the damage stability can be maintained by verifying whether the actual loading condition is within the range of loading conditions listed in the stability booklet.

15 The respective countries and shipyards are using the different calculation programs. The deviations of calculation results of respective programs can exceed the permissible limits for existing ships. If the vessels have small margins of damage stability, the result of calculation with stability instrument may not comply with the damage stability requirements. In the case of new ships, the problem can be minimized since the damage stability booklet and stability instrument use similar programs, the outcome of which is that calculation results are not quite different from each other.

Proposal

16 The investigation results outlined above show the practical concerns of introducing the guidelines for the verification of damage stability using a stability instrument for existing tankers and bulk carriers. The Republic of Korea therefore proposes that existing tankers and bulk carriers should not be subject to the newly introduced guidelines for verifying the damage stability prior to departure.

Action requested of the Sub-Committee

17 The Sub-Committee is invited to take into account the foregoing information and proposal and take action as appropriate.

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ANNEX

Table 1 – Description of sample ships (2PG gas carriers)

Dimensions L_{BP} x B x D (m)	Water ballast (ton)	Restrictions on stability information
55.00 X 10.50 X 4.80	72.8	No.2 W.B.T(P&S) and No.5 W.B.T(P&S) should be full.
56.10 X 10.50 X 4.80	84.3	No.2 W.B.T(P&S) and No.5 W.B.T(P&S) should be full.
72.00 X 12.50 X 6.00	-	Not necessary
82.00 X 14.00 X 6.80	195.0	No.1 W.B.T.(C) and No.3 W.B.T.(C) should be full.
84.00 X 13.50 X 6.30	-	Not necessary
67.00 X 12.20 X 5.60		Not Necessary
55.00 X 10.50 X 4.30	195.0	No.1 W.B.T(P&S) and No.3 W.B.T(P&S) should be full.
91.73 X 14.00 X 7.20	72.5	No.1 W.B.T(P&S), No.2 W.B.T(P&S), No.3 W.B.T(P&S) and No.4 W.B.T(P&S) should be full.
93.44 X 14.40 X 6.50	118.9	For VCM cargo No.2 W.B.T(C) and No.4 W.B.T(P&S) should be full.
	96.9	Other cargoes No.2 W.B.T(P&S) and No.2 W.B.T(C) should be full.
87.00 X 14.40 X 6.50	148.0	For VCM cargo No.2 W.B.T(C) and No.4 W.B.T(P&S) should be full.
	97.0	Other cargoes No.2 W.B.T(P&S) and No.2 W.B.T(C) should be full.

Table 2 – Deviation of heeling angle according to the different calculation programs (19,990 DWT oil tanker)

Damage cases	Heeling angle (°) (Approved booklet)	Heeling angle (°) (Verified results)	Deviations (°)
Case 1	4.03	5.01	0.98
Case 2	4.91	6.16	1.25
Case 3	7.83	9.36	1.53
Case 4	5.62	6.91	1.29
Case 5	3.49	4.37	0.88
Case 6	8.45	9.96	1.51
Case 7	9.23	10.68	1.45

Table 3 – Deviation of maximum righting arm according to the different calculation programs (19,990 DWT oil tankers)

Damage cases	Max. GZ (m) (Approved booklet)	Max. GZ (m) (Verified results)	Deviations (m)
Case 1	0.739	0.58	0.159
Case 2	0.709	0.52	0.189
Case 3	0.658	0.52	0.138
Case 4	0.729	0.60	0.129
Case 5	0.744	0.59	0.154
Case 6	0.688	0.58	0.108
Case 7	0.695	0.59	0.105

Table 4 – Deviation of heeling angle according to the different calculation programs (22,000 DWT bulk carriers)

Damage cases	Heeling angle (°) (Approved booklet)	Heeling angle (°) (Verified results)	Deviations (°)
Case 1	9.6	9.7	0.10
Case 2	12.7	13.1	0.40
Case 3	14.5	14.6	0.10
Case 4	9.7	9.1	0.60

Table 5 – Deviation of maximum righting arm according to the different calculation programs (22,000 DWT bulk carriers)

Damage cases	Max. GZ (m) (Approved booklet)	Max. GZ (m) (Verified results)	Deviations (m)
Case 1	0.386	0.383	0.003
Case 2	0.292	0.315	0.023
Case 3	0.181	0.177	0.004
Case 4	0.336	0.326	0.006

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