Subject :

Work on Bulk Carrier Safety
in IMO and IACS

NKTECHNICAL INFORMATION

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The work on the Safety of Bulk Carrier with regard to the technical aspects is nearly completed in both IMO and IACS. In addition to the information circulated by our Technical Information No. 189 (dated 10 July 1996), the latest development made at the 35th session of the IACS Council and the IMO's sixty-eighth session of the Maritime Safety Committee is given hereunder:

1 IACS's Unified Requirements (URs) adopted at 35th session of its council, from 12 to 13 May 1997 and thereafter.

(a) URs for new ships

UR S17 "LONGITUDINAL STRENGTH OF HULL GIRDER IN FLOODED CONDITION FOR SINGLE SIDE SKIN BULK CARRIERS"

The UR is concerned with the longitudinal strength of hull girders in the flooded condition, and applies to all new single side skin bulk carriers of 150m in length or above contracted for construction on or after 1 July 1998, intending to carry solid bulk cargoes having cargo density of 1.0t/m^3 or above.

The UR has been developed with the aim of ensuring that longitudinal strength is to be sufficient enough to sustain the continued voyage in cases where any one cargo hold is flooded to the maximum equilibrium condition. The longitudinal bending moment and shearing force emanating from the wave load are assumed as 80% of the value set out in UR S11 (the value equal to the manifested ratio of 10^{-8}, and is proportional to the most probable maximum lifetime wave load) and are required to conform with the requirement of UR S11.

UR S18 "EVALUATION OF SCANTLINGS OF CORRUGATED TRANSVERSE WATERTIGHT BULKHEADS FOR SINGLE SIDE SKIN BULK CARRIERS CONSIDERING HOLD FLOODING"

The UR is concerned with strength of corrugated transverse watertight bulkhead in the flooded condition, and applies to all new single side skin bulk carriers of 150m in length or above contracted for construction on or after 1 July 1998, intending to carry solid bulk cargoes having cargo density of 1.0t/m^3 or above.

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The UR has been developed with the aim of ensuring that vertically corrugated transverse watertight bulkheads are to be sufficient enough to sustain the water pressure caused by flooding of any one cargo hold.

The draft UR presumes the water head which is to be considered at the time of flooding corresponds to the size of the ship and location of the watertight bulkheads, in order to evaluate the strength of watertight bulkheads without performing separate flooding calculations. Strength criteria consist of the total bending, shear and local bending of the corrugation of the bulkhead.

The necessary total bending capacity of corrugation is determined by first assuming one pitch of the corrugation as being a beam fixed at its lower end and supported at its upper end, and then assuming that when a plastic hinge occurs on the lower end and middle portion of the corrugation, the corrugation has collapsed.

The concept of net scantlings has been incorporated in each of these strength standards, i.e., required thickness consists of net scantling and corrosion margin. Criteria for the replacement after corrosion are provided depending on the corrosion allowance to the net thickness.

UR S20 Evaluation of Allowable Hold Loading for Single Side Skin Bulk Carriers Considering Hold Flooding (Strength of double bottoms during bulk carrier flooding)

This Unified Requirement also sets forth requirements for strength during flooding of any cargo hold of new bulk carriers in the same manner as UR S17 and UR S18. The applicability of this UR is limited to the same types of ships as those covered by UR S17, i.e., single side skin bulk carriers of 150m in length or above carrying solid bulk cargo having density of 1.0t/m3 or above..

The purpose of this draft UR is to ensure that there is sufficient strength in the double bottom structure under a given flooded cargo hold such that it will not buckle or collapse in cases when any one cargo hold is flooded due to cracking of the hull. It is one of the survival requirements for ships from the perspective of assuring hull strength during hold flooding.

Strength evaluation of the double bottom consists of calculating the shear strength of each floor of the double bottom adjacent to each bilge hopper and summing it with the shear strength of each girder end of the double bottom adjacent to the lower stool. It is assumed that the double bottom will collapse if the difference between the inner and outer loads acting on the double bottom during flooding of the cargo hold reaches the above calculated value. Thus, the requirement stipulates the required

section area of each floor and girder with regard to the maximum allowable cargo capacity of each hold. Further, the concept of net scantlings has been incorporated in calculations of the shear strength of each floor and girder.

In addition, seawater load which is to be considered during flooding is calculated in conformity with UR S18.

UR S12 Side Structures in Single Side Skin Bulk Carriers

The aim of this draft revision is to eliminate the possibility of flooding of the cargo hold due to cracking of the single side skin structure (side shell plating) and to further strengthen the safety of the first barrier against flooding. Consequently, this draft UR applies to all new single side skin bulk carriers.

These requirements stipulate the provisions listed below which are considered to be necessary for improving the strength of side structures (side shell plating) in addition to existing provisions relating to minimum thickness of hold frame webs as well as upper and lower brackets.

① additional provisions regarding minimum thickness of hold frame webs and upper and lower brackets in way of the foremost cargo hold;

② provisions regarding minimum thickness of the throat of fillet welds of hold frame webs and their upper and lower brackets with side shell plates, hopper plates of bilge hopper tank and sloping plates of topside tank;

③ Provisions regarding standard scantlings, etc. of hold frame brackets;

④ Provisions regarding the section forms, etc. of hold frames;

⑤ Provisions regarding the scantlings of the inner brackets of the bilge hopper tank directly below the hold frame;

⑥ Provisions regarding the prevention of tripping of the hold frames in way of the foremost cargo hold; and

⑦ Provisions regarding the minimum thickness of side shell plating of the cargo hold.

UR S21 Evaluation of Scantlings of Hatch Covers of Bulk Carrier Cargo Holds

These draft requirements aim at preventing the flooding of cargo holds due to the entry of seawater into the holds via the hatch cover openings on exposed upper decks and are applicable to all new bulk carriers.

These draft requirements set forth strength and load criteria which should be considered when determining the net minimum scantlings of hatch covers located forward of 0.25L from the fore perpendicular in addition to the provisions of the International Convention on Load Lines, 1966 (66LL). The concept of net scantlings

has been incorporated in each of these strength standards, and provisions for corrosion margin and replacement criteria have been set accordingly. In addition, values for the load acting on the ship when the bow becomes awash with (immersed in) seawater during assumed conditions of navigation in stormy weather are stipulated as parameters for positions along the length of the ship.

This value is greatest for the foremost hatch cover and is about three to four times the value stipulated in 66LL. However, the probability of a given load occurring is incorporated in the strength criteria, and a value which is about twice as high as the value stipulated in the above convention is employed for allowable stress. Consequently, if both of these values for allowable stress (safety ratio) are kept the same and only load is compared, then the value for load employed in the UR is about 1.5 to 2 times greater than the largest load stipulated in the above convention.

UR S1A Additional Requirements for Loading Conditions, Loading Manuals and Loading Instruments for Bulk Carriers, Ore Carriers and Combination Carriers

This draft UR sets forth requirements in addition to those stipulated in UR S1 and apply to new built bulk carriers, Ore Carriers and Combination Carriers having a length of 150 m or more. The main additional requirements supplementing UR S1 are outlined briefly below.

① A description is given of the still water longitudinal bending moment and shear forces during flooding for ships subject to UR S17 (includes verification by loading instruments);

② A description is given of the maximum allowable and minimum required mass of the cargo and double bottom contents of each cargo hold as a function of the draught at the mid-hold position (includes verification by loading instruments);

③ A description is given of the maximum allowable and minimum required mass of cargo and double bottom contents of any two adjacent holds as a function of the mean draught in way of these holds (includes verification by loading instruments);

④ A description is given of the maximum allowable load on deck and hatch covers;

⑤ A description is given of loading condition at multiple port loading/unloading;

⑥ A description is given of maximum rate of ballast water change;

⑦ Conditions are set for prohibition against partial filling of peak tanks (requirement for approval of cargo loading manual)

⑧ Requirements are set to ensure acceptable levels of strength when the hold ballast tank is full and then the adjacent top side tanks, bilge hopper tanks and double bottom tanks are empty (requirement for approval of cargo loading manual);

⑨ A description is given of typical loading sequences; and

⑩ A description is given of typical sequences for the changing of ballast at sea.

(b) URs for existing ships

UR S19 "EVALUATION OF SCANTLINGS OF THE TRANSVERSE WATERTIGHT CORRUGATED BULKHEAD BETWEEN CARGO HOLDS NO. 1 AND 2, WITH CARGO HOLD NO. 1, FOR EXISTING SINGLE SIDE SKIN BULK CARRIERS"

UR S22 "EVALUATION OF ALLOWABLE HOLD LOADING OF CARGO HOLD NO. 1 WITH CARGO HOLD NO.1 FLOODED, FOR EXISTING SINGLE SIDE SKIN BULK CARRIERS"

The requirements given in the above URs are similar to the UR S18 and UR S22 respectively. However, only No. 1 cargo hold is the subject to the above URs, i.e., watertight bulkhead in-between No. 1 and No. 2 cargo hold and double bottom in way of No. 1 cargo hold. Requirements on safety factor and corrosion margins are relaxed compared to the requirements for new ships.

The phase in implementation scheme is subject to further consideration by IACS member, however, at present, the following scheme is suggested:

① For ships which will be 20 years of age or more on 1 July 1998, by the first intermediate or special survey to be held after 1 July 1998, whichever comes first;

② For ships which will be 10 years of age or more but less than 20 years of age on 1 July 1998, by the due date of the third special survey, or above, to be held during the period 1 July 1998 to 1 July 2003 at the latest.

③ For ships which will be less than 10 years of age on 1 July 1998, by the due date of the third special survey.

④ Early completion of a special survey coming due after 1 July 1998 to postpone compliance is not permitted.

In addition, with regard to UR S1A, the requirement ⑨ is applicable to existing ships.

2 IMO, Maritime Safety Committee (MSC) 68th session (From 28 May to 6 July 1997)

(a) Summary

The IMO adopted measures to enhance survey programme (ESP) as one of the

means of addressing the alarming increase in the sinking or loss of bulk carriers from the end of the 1980s on. In spite of these efforts, however, the same type of casualties still continued to occur. As a result, discussions came to be held from MSC65 on concerning the need to adopt residual stability and structural requirements in the SOLAS convention with regard to the flooding of cargo holds.

Discussions from then on sought to make these requirements retroactive with regard to existing ships in particular. Two contrasting views came to the fore. One view held that it was enough to carry out enhanced surveys based on a strict application of the rules, while the other view maintained that it was necessary for additional structural requirements to be implemented. Moreover, there was also opposition to the IACS Unified Requirements - which, in fact, will be the technical standards in implementing the SOLAS requirements -, because explanations of their technical background by IACS did not adequately address concerns that a considerable number of ships would not be able to satisfy the standards if they were applied. In addition, various other issues such as the length and age limitation of the applicable ships, the applicable structures, applicable cargo density on board, and other particulars to which the standards would apply could not be resolved. Therefore, the IMO had to deferred its decision on those issue.

In MSC68, consideration was given to the results of deliberations up to this point including the items which had been pending until now. As a result of these discussions, broad agreement was reached as outlined below.

a. The safety of bulk carriers can not be ensured through only the enforcement of stability requirements or structural requirements alone. Basically, requirements for both must be satisfied at the same time.
b. A majority of states did not support acceptance of the damage stability requirements given in the provisions of Part B-1 of SOLAS II-1 as equivalent requirements. As a result, this item was deleted.
c. It was decided that requirements to assure structural strength after flooding of a cargo hold of a new ship (transverse watertight bulkheads, double bottoms) would apply to ships of double side skin construction, not just ships of single side skin construction.
d. Separate draft Resolutions are to be prepared regarding recommended structural strength requirements for new ships and mandatory strength criteria for existing ships. Reference is to be made to IACS URs regarding technical details of these requirements.

The draft amendments to the SOLAS convention presented below were

approved based on the above agreement and are expected to be adopted during SOLAS Conference intended for this coming November.

In addition, while the series of amendments regarding bulk carrier safety are scheduled to be added to Chapter II-1 of SOLAS, it was also agreed during this meeting to include a new Chapter XII to the SOLAS convention.

(b) Results of deliberations concerning revisions to the SOLAS Convention (a new Chapter 12)

New bulk carrier is the ship which is constructed on or after [1 July 1999] and of 150m in length and upwards carrying solid bulk cargoes having a density of 1.0t/m3 and above.

Existing bulk carrier is the ship which is constructed before [1 July 1999], and of 150m in length and upwards of single side skin construction, carrying solid bulk cargoes having a density of 1.78t/m3 and above.

Regulation 1 Definitions

The terms "bulk carrier", "bulk carrier of single side skin construction", "length", solid bulk cargo", as well as "bulk carrier bulkhead and double bottom strength standards" are defined in this regulation. Although no definition is given here regarding "high density cargo", it is specified in each applicable regulation.

Regulation 2 Application

Bulk carriers shall comply with the requirements of this chapter in addition to the applicable requirements of other chapters.

Regulation 3 Implementation schedule

Existing bulk carriers to which regulations 4 or 6 apply shall comply with the provisions of such regulations according to the following schedule:

1. bulk carriers which will be 20 years of age or over on [1 July 1999], by the due date of the first intermediate survey or the first periodical survey after [1 July 1999], whichever comes first; and
2. bulk carriers which will be less than 20 years of age on [1 July 1999], by the due date of the first periodical survey after [1 July 1999] or by the date on which the ship reaches 15 years of age, whichever comes later.

Regulation 4 Damage stability requirements applicable to bulk carriers

1. This provision stipulates that new bulk carriers shall be able to withstand flooding of any one cargo hold in all loading conditions and remain afloat in a satisfactory

condition of equilibrium.

2. This provision stipulates that existing bulk carriers shall be able to withstand flooding of the foremost cargo hold in all loading conditions and remain afloat in a satisfactory condition.
3. This provision stipulates that the condition of equilibrium flooding shall satisfy the condition of equilibrium laid down in the annex to Assembly resolution A.320(IX), Regulation equivalent to regulation 27 of the international Convention on Load Lines, 1966, as amended by Resolution A.514(13). Further, it goes on to state that existing ships which have been assigned reduced freeboards B-60 or B-100, as appropriate, in compliance with regulation 27 of 66LL may be considered as satisfying the above requirements.

Regulation 5 Structural strength of new bulk carriers

This regulation stipulates that new bulk carriers (constructed on or after [1 July 1997]), regardless of its configuration, of 150m in length or above, carrying solid bulk cargoes having density of 1.0t/m3 or above, shall have sufficient strength to withstand flooding in any one cargo hold in all loading and ballast conditions with due regard for the recommendations recognized by the Organization (refer to IACS URs 17, 18 and 20 in the draft Conference Resolution).

Regulation 6 Structural and requirements for existing bulk carriers

This regulation stipulates that the foremost cargo hold of existing bulk carriers of 150m in length or above carrying solid bulk cargo having density of 1.78t/m3 or above, shall have sufficient strength to withstand flooding. The strength criteria for the transverse bulkhead and double bottom structure (prepared based on IACS URs S19 and S22; the content is the same) must be satisfied. In addition, consideration may also be given to any changes in the loading distribution and limits on the maximum loading capacity, in order to satisfy the requirements of these criteria.

Regulation 7 Survey of the cargo hold structure of bulk carriers

A bulk carrier of 150 m in length and upwards of single side skin construction, of 10 years of age and over, [constructed before 1 July 1999] shall not carry solid bulk cargoes having a density of 1.78 tons per cubic meter and above unless it has satisfactorily undergone either:

.1 a periodical survey in accordance with the enhanced survey programme of inspections required by regulation XI/2; or

.2 a survey of all cargo holds to the same extent as required for periodical surveys in the enhanced survey programme of inspections required by regulation XI/2.

Regulation 8 Information on compliance with requirements for bulk carriers

1. This regulation stipulates that the booklet required by regulation 7.2 in Chapter VI (amendment to SOLAS effective from 1 July 1998) shall be endorsed by the Administration or by an organization recognized by it to indicate that regulations 4, 5, 6, and 7 of this chapter, as appropriate are complied with.
2. With regard to existing ships (those constructed before 1 July 1999), any restrictions that may be applied to comply with regulation 6 shall be so indicated in the above mentioned booklet. Further, such ships shall also be permanently marked on the side shell at amidships, port, and starboard with a solid equilateral triangle having sides of 500 mm.

Regulation 9 Requirements for existing bulk carriers not being capable of complying with regulation 4.2 due to design configuration of their cargo holds

This regulation stipulates that existing bulk carriers constructed with an insufficient number of transverse watertight bulkheads, and self-unloading bulk carrier of which transverse bulkhead is not watertight due to the presence of tunnels for self-unloader, may be exempted by the Administration from the application of regulations 4.2 and 6 on condition that they comply with the following requirements:

.1 Degree of annual surveys of the foremost cargo hold is to be up-graded to the extent required by the inspection prescribed in the enhanced survey programme, therein for intermediate surveys of cargo holds.

.2 Such bulk carriers are to be provided with bilge well high water level alarms in all cargo holds, or in cargo conveyor tunnels, as appropriate. These alarms are to give an audible and visual alarm on the navigation bridge, as approved by the Administration or an organization recognized by it.

.3 Detailed information is to be provided on specific cargo hold flooding scenarios. This information is to be accompanied by detailed instructions on evacuation preparedness based on the ISM Code, and is to be used as the basis for crew training and drills.

Regulation 10 Solid bulk cargo density declaration

This regulation states that prior to the loading of any bulk cargo, the shipper must declare the solid bulk cargo density. Any cargo which is declared to have a density within the range 1.25 to 1.78 tons per cubic meter is to have its density verified by an accredited testing organization.

Regulation 11 Loading instrument

This regulation states that all bulk carriers, including existing bulk carriers which are 150 meters in length or over are to be fitted with a loading instrument which satisfies the requirements of an organization recognized by the flag State Administration, or the Administration. The functional capabilities of the loading instrument are set forth in (draft) Conference resolution which refers to IACS Recommendation No. 48.

3 Others

There appears some differences between IMO and IACS, such as definition of New Bulk Carrier and Existing Bulk Carrier, phase in implementation scheme for existing bulk carriers and applicable configuration for new bulk carriers. These are on going discussion among IACS members to address those issues.

Please contact Development Department (Phone +81-3-5226-2025 / Facsimile +81-3-5226-2024) for further inquiry.

The Outcome of the MSC68

	regulations	application	applicable SOLAS regulations in new Chapter XII*2	conditions					technical standards	remarks
		New/Existing Ships*1		length	age	structural configuration	cargo density	applicable cargo hold		
1	Structural strength at flooding condition	New	Reg.5 (Chapter II-1 Reg. 23-5)	150 m and above	all	all	1.0 t/m^3 and above	all (taking into account the Loading Condition)	IACS UR17, UR18, UR20	UR is given recommendatory nature by the Condition
		Existing	Reg.6 (Chapter II-1 Reg. 23-6)	150 m and above	15 years and above	Single Side Skin	1.78 t/m^3 and above	Foremost Hold	IACS UR19, UR22*3	loading restriction*4 may be taken into account
2	Damage stability	New	Reg.4.1 (Chapter II-1 Reg. 23-4.1)	150 m and above	all	all	1.0 t/m^3 and above	all (taking into account the Loading Condition)	IMO Res. A.320(IX)	Ships given B-100 and B-60 freeboard may be considered as complying with this requirement
		Existing	Reg.4.2 (Chapter II-1 Reg. 23-4.2)	150 m and above	15 years and above	Single Side Skin	1.78 t/m^3 and above	Foremost Hold	IMO Res. A.320(IX)	Ships given B-100 and B-60 freeboard may be considered as complying with this requirement *5
3	Further enhancement of surveys	Existing	Reg.7 (Chapter II-1 Reg. 23-7)	150 m and above	10 years and above	Single Side Skin	1.78 t/m^3 and above	—	IMO Res. A.744	The IACS registered ships comply with this requirements
4	Information on compliance	New/Existing	Reg.8 (Chapter II-1 Reg. 23-8)	The compliance with reg.4, 5,6 and 7 (above) shall be indicated in the Booklet required by VI/7.2 and endorsed by the Administration or Organization recognized by it.						
5	Requirements for ships not capable of complying with damage stability requirements	Existing	Reg.9 (Chapter II-1 Reg. 23-9)	Bulk carriers being within the application limits of regulation 4.2, which have been constructed with an insufficient number of transverse watertight bulkheads to satisfy that regulation, may be exempted by the Administration from the application of regulations 4.2 and 6 on condition that they shall comply with the requirements given in this regulation						
6	Solid bulk cargo density declaration	New/Existing	Reg.10 (Chapter VI Reg. 2-1)	Prior to loading a bulk cargo, the shipper shall declare the density of the cargo in accordance with regulation [VI/2]. Any cargo that is declared to have a density within the range 1.25 to 1.78 tons per cubic meter shall have its density verified by an accredited testing organization						
7	Loading Instruments	New/Existing	Reg.11 (Chapter VI Reg. 5-1)	150 m and above	all	all	all	—	IACS Recom. 48	No additional requirements for instruments already approved by classification societies etc. (the recommendation is not mandatory)n

＊1 : The draft amendments to the SOLAS convention will be formally adopted at the SOLAS Conference, and expected to enter into force on 1 July 1999. New ships will be the ship constructed on or after 1 July 1997, and existing ships will be ships constructed prior to that date.
A phase in scheme for the application of Reg 4.2 and 6 to existing ships are given in Regulation 3, with the following categories depending on the age of the ship.
(1) bulk carriers which will be 20 years of age and over on [1 July 1999], by the due date of the first intermediate survey or the first periodical survey after [1 July 1999], whichever comes first; and
(2) bulk carriers which will be less than 20 years of age on [1 July 1999], by the due date of the first periodical survey after [1 July 1999] or by the date on which the ship reaches 15 years of age, whichever comes later

＊2 : The whole safety measures been discussed will be incorporated as new chapter XII of the SOLAS.

＊3 : Detailed technical standards will be given in the SOLAS Conference resolution, instead of making reference to IACS UR19 and UR22. (The contents are the same)

＊4 : The following restrictions may be taken into account in order to meet the requirements given in Reg 6.2.
(1) restrictions on the distribution of the total cargo weight between the cargo holds; (i.e., homogeneous loading)
(2) restrictions on the maximum deadweight.

＊5 : Requirements given in the SOLAS part B-1 were not accepted as equivalent. Therefore, even ships build on or after 1 February 1997 which are meeting the requirements shall be re-calculated in accordance with this regulation. Those are the ships given B-0 freeboard, which are inter alia relatively small "handy size" bulk carriers.

＊6: Ships to which the restriction given in *4 above applies, there shall be indication on the restriction in the booklet required by the SOLAS regulation VI/7.2. In addition, ▲ shall be marked on each side of the hull. The booklet required by the SOLAS regulation VI/7.2 is a book newly introduced by the SOLAS 1996 amendments entry into force on 1 July 1998 containing information necessary for loading/unloading operations.

＊7 : The conditions for the exemption are given as follows:
(1) for the foremost cargo hold the inspections prescribed for the annual survey in the enhanced programme of inspections required by regulation XI/2 shall be replaced by the inspections prescribed therein for the intermediate survey of cargo holds;
(2) be provided with bilge well high water level alarms in all cargo holds, or in cargo conveyor tunnels, as appropriate, giving an audible and visual alarm on the navigation bridge, as approved by the Administration or an organization recognized by it in accordance with the provisions of regulation XI/1; and
(3) be provided with detailed information on specific cargo hold flooding scenarios. This information shall be accompanied by detailed instructions on evacuation preparedness under the provisions of Section 8 of the International Safety Management (ISM) Code and be used as the basis for crew training and drills.