

Subject

Pros and Cons Table of Double Side Skin Construction (DSS) vs. Single Side Skin Construction (SSS) for Bulk Carrier"

ClassNK

Technical Information

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To whom it may concern

While there was a controversial discussion about a double side skin construction of bulk carriers within IMO, etc. as one means of bulk carrier safety measure, please be informed that IACS (International Association of Classification Societies), on 16 July 2002, posted a Pros and Cons Table of Double Side Skin Construction (DSS) vs. Single Side Skin Construction (SSS) for New Construction under SOLAS Chapter XII on IACS' web site, after a comprehensive assessment from a technical view point and that IACS welcomes comment from all interested parties on this information.

You can access the Table from www.iacs.org.uk, "Other Technical", "Double Hull for Bulk Carrier?" then "Table".

The Table is attached to this Technical Information for your ready reference.

For any questions about the above, please contact:

NIPPON KAIJI KYOKAI (ClassNK)
External Affairs Division, Administration Center, Head Office
Address: 4-7 Kioi-cho, Chiyoda-ku, Tokyo 102-8567, Japan
Tel.: +81-3-5226-2038
Fax: +81-3-5226-2039
E-mail: xad@classnk.or.jp

Attachment:

1. Pros and Cons of Double Side Skin Construction (DSS) vs. Single Side Skin Construction (SSS) for New Construction under SOLAS Chapter XII (With comments made by JWG/ BCS)

NOTES:

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Pros and Cons of Double Side Skin Construction (DSS) vs. Single Side Skin Construction (SSS) for New Construction under SOLAS Chapter XII
(With comments made by JWG/BCS)

July 2002

Aspect	Double Side Skin (DSS)		Single Side Skin (SSS)	
	Pros	Cons	Pros	Cons
General				
Perception	Safer in structure and flexible in operation.	Loss of grain capacity in bulk carriers engaged more in such trade.	Higher grain capacity	Loss ratio of bulk carriers is perceived to be too high, despite the increase of bulk carrier in number and the relatively low casualty rate due to structural failure and the general decreasing trend of loss of lives on board of pre-SOLAS Chapter XII bulk carriers since 1993. Effect of SOLAS Chapter XII for new buildings is yet to be fully evaluated.
Steel Weight	The weight differences between DSS and SSS new bulk carriers complying with SOLAS Chapter XII remains small as long as DSS bulk carriers are exempted from hold flooding requirements.	Heavier than the same size of SSS Bulk Carriers.(e.g. 2 –5%up) Such effect may become larger when size of BC become smaller	Lighter than the same size of DSS Bulk Carriers.	
Ballast and Cargo Capacity and Cargo Handling				
Ballast Capacity	Double Side Spaces could be used for Ballast Tanks. (see Aspect "Corrosion")			
Ballasting/Deballasting Pumping		Due to higher discharge rates, larger pumping		

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		capacity would be necessary.		
Cargo Hold Cleaning	Easy for cargo hold cleaning and turn around time in unloading ports may be reduced.			Cargo hold cleaning may need special tools, in particular for certain bulk cargoes that would be stuck between hold frames.
Cargo Hold Volume		Some cargo hold volume loss is envisioned, unless compensated by diminution of ballast volume.	Beneficial for achieving maximum grain capacity.	
Deadweight		Slightly smaller than the same size of bulk carrier of single side skin construction due to steel weight increase.	Slightly larger than the same size of bulk carrier of double side skin construction.	
Mechanical Damage	Side shell structure is protected from possible mechanical damages by grab or bulldozer. Inner shell plating of hold is plain and smooth and facilitates unloading of cargoes, being thus less susceptible to mechanical damages.	Repair works of the double side structure will require longer time due to a need of access from both side of the inner hull for hot work, if mechanical damage happens. In cases where the inner skin is of lighter plate construction than would be used on a SSS bulk carrier, the inner skin may be more vulnerable to damage.		Hold frames are vulnerable to mechanical damage by bulldozers or pneumatic hammers during unloading operation.
Unloading	Higher cargo discharge rates and reduced unloading time as all internal surfaces are			Coal and ore cargoes subject to being hung up or lodged between frames,

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	smooth. Accommodates the increasing moves from port/terminal authorities to restrict, for health and safety reasons, the entry into hold spaces of shore workers to facilitate the removal of residual cargo.			requiring mechanical means to dislodge and greater discharge times.
Survivability of Vessel in association with Hatch Covers and Side Structure Integrity				
Corrosion	Highly corrosion resistant if the spaces of double side skin are used for void spaces, subject to quality of the initial coating.	Corrosive environment is envisioned if the space double side skin is used for ballast tanks. Maintenance of coating is difficult in the double side skin space	Blasting and re-coating of the hold side structure are easy.	Hold frames and side shell are exposed to cargoes, which causes high corrosion rate and grooving corrosion due to presence of corrosive cargoes such as coal, once the effect of protective coatings has been lost.
Fatigue		Limited experience for this new structural configuration. Fatigue cracks in longitudinal stiffeners on outer shell may be found in new design.	Integral hold frames are widely used, which eliminate discontinuities in the joints of hold frames with the end brackets. UR S12 (Rev.1 and later revisions), Side structure of Single Side Skin Construction, contains enhanced scantling requirements for hold frames, is applicable to bulk carriers, which are contracted for construction on or after 1st July 1998.	Fatigue cracks were found at welding of end brackets, connection of hold frames with the end brackets in case of build-up (overlap) types, which are to be detected and repaired after certain age of the vessel.
Flooding resulting from	Improved resistance against	See Cons of DSS under	Cargo hold structure and hull	Larger free surface effects

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collision damage to side structure	lower energy only collision resulting in holds flooding.	Aspect 'Survivability in accidental hold flooded condition' for the consequence of high energy collisions. Greater heeling due to non-symmetrical flooding as flooded tanks being to one side of the ship whilst single side skin ships will have symmetrical flooding with the hold being symmetrical	girder are strengthened against one hold flooding, resulting in higher probability of survival than DSS.	on flooded stability.
Hatch Covers	URS21 is applicable for new ships contracted for construction on or after 1 July 1998.		UR S21 is applicable for new ships contracted for construction on or after 1 July 1998.	
Hull Girder Strength	Increased shearing strength, resulting in reduced probability of side shell structural failure.	No hold flooding requirements for DSS may results in insufficient longitudinal hull girder strength in case of cargo hold flooding.	UR S17 "Longitudinal Strength of Hull girder in flooded condition for bulk carrier" requires sufficient strength in the flooded condition. Post SOLAS Chapter XII bulk carriers are in compliance with the requirement.	Single side skin is vulnerable to increased shearing force in hold flooding.
Inspection & Maintenance	Inspection will be facilitated by the means of permanent access using the hull structure.	Maintenance work would be difficult due to the double side skin space being very confined.	Inspection can be facilitated by use of a "cherry picker". Easy access to the site for hot work or re-coating of the hold side structure.	Inspection and maintenance will be difficult unless proper means of access is provided.
Means of Access	Access to the double side skin spaces is possible in loaded condition via topside tanks, weather condition	Access to the double side skin spaces is difficult in ballast condition via top side tanks, even if the spaces are	Access to hold structure is easy in ballast condition or after completion of unloading.	Special means of access is necessary to get closer to the upper part of side structure.

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	permitting.	used as void spaces.		Any permanent means of access is not feasible due to possible hampering of efficient unloading of cargo, as bulk cargoes easily remain between frames and such permanent means of access.
Small bulk carrier (less than 150m)	High corrosion resistance if the space is made void space.	Maintenance work of the double side skin spaces will become difficult as coating deteriorates.	Easy access to lower part of hold frames for inspection due to low height of bilge hopper tank.	Structural survivability is not required in SOLAS Chapter XII for this size of bulk carriers. Thus high probability of loss of the ship in case of breach of side shell water-tight integrity.
Survivability in accidental hold flooded condition		SOLAS Chapter XII does not require the structural strength of cargo holds and hull girder in accidental hold flooding through a failure of hatch covers or side structure. In case of hold flooding there is higher possibility of progressive flooding to adjacent cargo holds, which results in loss of the vessel. It should be noted that a probability of water ingress into a hold is not negligible.	Cargo hold bulkheads and bottom structures as well as hull girder are strengthened for structural survivability in accidental flooding in any one cargo hold by SOLAS Chapter XII and IACS URs S17, S18 and S20.	
Caution in FSA Study				
Fleet size providing statistical information		Very small.	Large for pre SOLAS Chapter XII bulk carriers.	Very small for post SOLAS Chapter XII bulk carriers.

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Hazard Identification		No comprehensive study on hazard of DSS.	A number of studies have been carried out, which identified known hazards.	
Historical Data		Very limited information. Past experience demonstrates that most bulk carrier casualties involve vessels in the latter half of their life cycle, i.e. we have to wait for a long time before obtaining relevant experience for post SOLAS Chapter XII bulk carriers.	Significant data for bulk carrier of pre SOLAS Chapter XII. No known casualty of bulk carriers complying with the requirements of UR S12 (Side Structure), UR S21 (Hatch Covers) and SOLAS Chapter XII.	Very limited period for substantiating historical data for problems of bulk carriers complying with recently implemented requirements such as SOLAS XII and IACS URs S12 and S21. Past experience demonstrate that most bulk carrier casualties involve vessels in the latter half of their life cycle, i.e. we have to wait for a long time before obtaining relevant experience for post SOLAS Chapter XII bulk carriers.
RCO	Unified basic standards for technical and structural specifications of "double side skin construction" and coating specifications can be developed for achieving fit for purpose design in reduced risks.		New RCOs to achieve stronger and durable side structure are possible, such as larger throat welding size in fillet welding or deep penetration welding for hold frames. Such measures may be developed by IACS	
