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Ref. T5/1.01
Ref: T3/1.02

MEPC/Circ.389
MSC/Circ.1021
21 March 2002

DESIGN SUGGESTIONS FOR BALLAST WATER AND SEDIMENT MANAGEMENT OPTIONS IN NEW SHIPS

1 Ballast water carried in ships to maintain safety and stability has been recognized as one of the major pathways for the transfer of harmful aquatic organisms and pathogens around the world. This threat to the aquatic environment has been acknowledged by the Convention on Biological Diversity, 1992, in Article 196 of the United Nations Convention on the Law of the Sea, 1982, and by other relevant international agreements.

2 A draft international convention for the control and management of ship's ballast water and sediments as well as associated guidelines for its implementation is being developed for consideration and adoption by a diplomatic conference in 2003. This is based on resolution A.868(20) concerning the Guidelines for the control and management of ship's ballast water to minimize the transfer of harmful aquatic organisms and pathogens.

3 The paramount importance of the safety of a ship is acknowledged when developing ballast water management measures to prevent, reduce and eliminate the transfer of harmful aquatic organisms and pathogens.

4 It was agreed that it is essential to continue the development of safer and more effective Ballast Water Management options that will result in continued reduction and eventual elimination of the transfer of harmful aquatic organisms and pathogens.

5 The Maritime Safety Committee at its seventy-fourth session (May 2001) and the Marine Environment Protection Committee at its forty-seventh session (March 2002) emphasized the need for ballast water and sediment management options to be taken into account when designing and building new ships, while noting that the future convention might require the development of ballast water management plans both for new and existing ships and approved the Guidance on "Design Suggestions for Ballast Water and Sediment Management Options in New Ships", as set out in the annex hereto.

6 Member Governments are invited to apply the annexed Guidance until the International Convention for the Control and Management of Ships' Ballast Water and Sediments is adopted and enters into force, to bring the Guidance to the attention of ship-builders, ship-owners, shipmasters and other parties concerned. Member Governments are also invited to inform the Organization on any experience gained in the implementation of this Guidance.

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ANNEX

DESIGN SUGGESTIONS FOR BALLAST WATER AND SEDIMENT MANAGEMENT OPTIONS IN NEW SHIPS

1 Introduction

1.1 Ballast water carried in ships to maintain safety and stability at sea has been recognized as one of the major pathways for the transfer of harmful aquatic organisms and pathogens around the world. Although ballast water has been carried around the world for many years, interest in ballast water as a global environmental problem has only attracted significant interest in recent years with the documented establishment of a number of aquatic pest species. The significance of the problem has been influenced greatly by the expansion in worldwide shipping and reduced voyage times with some 12 billion tonnes of ballast water now carried around the world annually. Scientific research indicates that several thousand species are transported in the ballast water of ships each day.

1.2 Therefore, the need is emphasized for ballast water and sediment management options to be taken into account when designing and building new ships and, in this regard the shipping industry should be contacted for design considerations. A range of suggested design considerations for new ships are given in the guidance.

2 Considerations at the design phase of new ships

Ballast water management equipment

2.1 Ballast water management and the processes chosen to achieve it should be considered as a basic component of the ship's design.

2.2 Design and installation of the ballast water pumping and piping system should ensure that the ease of operation and maintenance is maximized.

2.3 Ballast tank design should facilitate all aspects of ballast water management.

2.4 Installation of recording equipment should be considered for all ballast water operations and treatment actions. It should be possible for these records to be readily available to appropriate authorities that may request copies.

2.5 Remote data management should be considered.

2.6 Mechanisms should be designed into the equipment for ready analysis of system performance.

2.7 A Ballast Water Management Plan should be created for the ship as the methods used are established; in particular it should give guidance on safe and effective operation of the various ballast water management and treatment options that are considered appropriate for the ship.

2.8 The Ballast Water Management Plan should address training of the crew in the ballast water management processes described therein.

Sampling

2.9 Ballast water system designs should take special account of the increased need for content sampling, with an aim to enhance the quality and ease of sampling of ballast water and sediments, without the need to enter potentially dangerous spaces or to partially fill ballast tanks. Examples of procedures and equipment are as follows:

.1 fitting of tanker hatches, wherever possible, as an alternative to manholes to allow more ready access to tanks;

.2 ensuring the area immediately below any tank opening is kept free (to the extent possible) of obstructions that may impede the lowering of sampling equipment;

.3 installation of sampling pipes within air/breather pipes as an alternative to accessing tanks by manholes or tanker hatches. Sampling pipes should be terminated at a convenient location on the top or side of the air pipe, so that a sampling pump may be easily fitted to the outlet;

.4 installation of stand alone sampling pipes that directly penetrate into the ballast tanks with the ends of sampling pipes located within tanks to ensure representative ballast water samples are taken;

.5 fitting of a quick release coupling on sampling pipes to permit the extraction of samples without removing the manhole cover or opening the tanker hatch;

.6 providing safe access to tanks (especially where access is not normally required);

.7 sounding pipe designs should also be enhanced to facilitate taking representative samples;

.8 provision for in-line sampling from either the ballast pump or some other point of the ballast pipework, to permit sampling either during ballasting or deballasting operations; and

.9 given the potential for variability of flow within the ballast water pipework attention should be given to ensuring uniform sampling, e.g., through use of a static mixer directly ahead of the sampling pipe.

Ballast water exchange at sea

2.10 Where Ballast Water Exchange at sea is the chosen method, the overall design strength and stability of the ship should be sufficient to permit its execution on all ballast voyages and in all except severe weather conditions. For the guidance of the master, the maximum sea state and swell conditions identified by the builder, if any, in which ballast water exchange can safely be carried out should be recorded in the Ballast Water Management Plan.

2.11 The design of the ship should make it easy to achieve exchange at sea, by reducing the demands upon other crew resources. In particular it should endeavour to minimize:

.1 the number of operational steps;

.2 the time taken, and

.3 the number of partially loaded tanks and the duration of their partial loading, needed to complete a ballast water exchange sequence.

2.12 The design of the ship should include consideration of the consequences of ballast water exchange at sea including: stability, hull girder strength, shear forces, resonance, sloshing, stemming, propeller immersion, limitations brought about by insufficient strength in various parts of the ship when the tanks are sequentially emptied and appropriate strengthening incorporated to allow this operation to be conducted safely.

2.13 Where the sequential method of exchange is to be used, particular attention should be given to the ballast tank layout, total ballast capacity, individual tank configuration and hull girder strength. If the Plan requires simultaneously emptying and refilling closely matched diagonal tanks then consequential torsional stresses should be considered. Still water bending moments, shear forces and stability should remain at or within safe limits.

2.14 Where the flow-through method of exchange is to be used adequate provision should be made to avoid the risk of over pressurization of ballast tanks or ballast piping. Enhancements in this regard may include the installation of additional air pipes, installation of tanker hatches (as an alternative to deck manholes), internal overflow pipes (to avoid water flowing over the deck) and interconnecting ballast trunks between tanks where applicable and possible.

2.15 Where the dilution method of exchange is to be used adequate provision should be made for appropriate piping arrangements to facilitate the loading of ballast water and, simultaneously, the unloading of the ballast water at the same flow rate. The hydrodynamic performance of the ballast tank is crucial to ensure full water exchange and sediment scouring.

Ballast Water Treatment Systems

2.16 Where a ballast water management system other than ballast water exchange is to be used, equipment chosen should provide for complete treatment of all ballast water including storm ballast water. A number of alternative treatment options are under development for managing ballast water. Due consideration should be given before selecting any system to the equipment and space requirements, effectiveness in inactivating or removing aquatic organisms and pathogens, environmental soundness, and to operational, maintenance and manpower requirements. Adequate provisions should also be made for additional power requirements.

2.17 Minimizing or removal of the risk to crewmembers whilst involving in the ballast water operation should also be considered. This should include, but not be limited to, exposure to machinery, entering enclosed spaces or working excessive hours and training.

2.18 Where a treatment method using heat is to be used, the design should analyse additional power demands and insulation requirements.

2.19 Where heat treatment of the ballast water using waste heat from the main engine is contemplated, appropriate piping and pump arrangements should be installed to facilitate the sequential flushing of the ballast water. If ballast water is intended to remain at an elevated temperature for several hours to inactivate harmful aquatic organisms and pathogens contained in sediments, attention should be given to the consequences.

2.20 Where chemical and biocide treatments are envisaged the safety and environmental aspects of stowage, storage and application of such substances should be considered, in particular:

.1 the allocation of appropriate storage areas (either on deck or adjacent to the ballast pump/pipework area in the engine room or in a designated room), preparation spaces and appropriate pipework fittings to allow the chemical/biocide to be added by an appropriate metering and mixing system to the ballast water line; and

.2 the Ballast Water Management Plan should contain advice to ships' personnel on the safe handling of toxic or corrosive chemicals carried on board for the purpose of dosing or otherwise treating ballast water, taking into account any instructions issued by the treatment system manufacturer.

2.21 Where filtration systems are envisaged adequate provision should be made for their installation, maintenance and repair, including provision of adequate replacement filters. Filtration systems should be sized so that they can be operated at a reasonable capacity for ballast water use. Provision should be made for the environmentally sound disposal of filter backwash.

2.22 Where cyclone type systems are envisaged adequate provision should be made for their installation, maintenance and repair. Cyclone type systems should be sized so that they can be operated at a reasonable capacity for ballast water use. Provision should be made for disposal of cyclone concentrates as for filtration systems.

2.23 Installation of ultra-violet irradiation systems should pay due attention to the need for some form of pre-filtration of the ballast water prior to treatment.

2.24 Other potential treatment systems, e.g., ozonization, oxygen deprivation, electro-ionization, will have specific installation, operation, maintenance and repair parameters that will need to be addressed.

2.25 Any ballast water treatment system should incorporate adequate monitoring systems to ensure its effective operation.

Alternative water supplies

2.26 Where use of alternative water supplies other than seawater is considered then appropriate deck and associated pipework to permit the loading of such water to the ballast tanks should be taken into account.

Shore based or mobile treatment facilities

2.27 Where consideration is given to ballast water loading or discharge using shore based or mobile treatment facilities, installation of appropriate infrastructure, such as booster pumps and associated pipe work on deck should be taken into account with a view to practical and safe operations.

3 Design considerations to enhance management, control and operational strategies

Sea chests

3.1 Taking into account the need for the design of sea chests to minimize skin friction of the ship's hull, generating laminar flow of water over the hull form and facilitating good flow of water into the ship's seawater suction pipes:

.1 consideration should be given to the design of the sea chest grate openings as a primary filter of larger marine organisms;

.2 securing arrangements should minimize the potential for the sea grate to fall off during service, e.g., by hinging the grate on the forward side;

.3 installation of systems to allow for the cleaning and treatment of the sea chest following ballasting, e.g., by installing a steam and air connection or piping from Butterworth tank washing systems (used for cargo tank washing); and

.4 shutting of isolation sea suction valves to prevent the fouling or contamination of the ballast water piping and systems.

Ballast water suction piping

3.2 The design of the ship's ballast water suction piping should allow for it to be maintained in a clean condition between ballasting operations, e.g., by water circulation from one tank or from sea without taking up or discharging water, or by hypochlorination.

Sea suction strainers

3.3 Taking into account the role of sea suction strainers as a secondary filter in the ship's ballast water pumping and piping system the design should minimize the mesh size of the strainers (without restricting the water flow to the ballast pumps). Consideration should be given to manufacture the strainers from stainless steel (preferably SUS 316L) to minimize the potential for corrosion of the strainers during service, and consequential loss of effectiveness as a secondary filter.

3.4 Systems and procedures should be developed for the cleaning of strainers prior to any ballasting operation.

Ballast pumps

3.5 The design of a ship's ballast pumps should be matched not only to the primary function of the ship's ballast water system, but also to any additional requirements to accommodate treatment systems.

Ballast tanks

3.6 The design of ballast tanks should facilitate the enhanced removal of ballast water and sediments by:

.1 internal girders, longitudinals, stiffeners, intercostals and floors, where fitted should incorporate extra drain holes which will allow water to flow with minimal restriction during discharge and stripping operations;

.2 where inner members butt against bulkheads, their installation should be such as to prevent the formation of stagnant pools or sediment traps;

.3 where internal longitudinals are fitted with face bar stiffeners, consideration should be given to fit the face bar stiffeners below the horizontal surfaces to aid drain off from the stiffeners;

.4 flow calculations (CFD) should be undertaken to determine the size of drain holes to confirm there is sufficient flow of water to the suction heads to match the capacity of the discharge of ballast water;

.5 installation of suction wells in ballast tanks that do not form part of the bottom of the ship;

.6 consideration of the installation of tank cleaning systems to assist with the removal of sediments during ballast discharge. Also, consideration of the use of such systems during the loaded passage to assist in the minimization of sediment in a tank; and

.7 installation of ballast water stripping systems using eductors.