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International Regulation News Update

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(+ “ships” are all self propelled vessels)



This 81st Session of the Maritime Safety Committee was the first session chaired by Mr. I. Ponomarev of the Russian Federation, former Chairman of IACS when he was employed by the Russian Maritime Register of Shipping

COATING PERFORMANCE STANDARDS, CPS

Mandatory Compliance

MSC 81 approved revisions to SOLAS II-1 which, upon adoption by MSC 82 in Dec 2006, will require dedicated seawater ballast tanks on all new ships ≥ 500 gt and all new double-side skin spaces on bulk carriers ≥ 150 m to be coated in accordance with the approved Coating Performance Standard which is also set to be adopted at MSC 82. New ship is defined as a ship for which:

- the building contract is placed on or after 1 July 2008, or
- in the absence of a building contract, the keels of which are laid or which are at a similar stage of construction on or after 1 January 2009, or
- the delivery of which is on or after 1 July 2012

The effectiveness of the protective coating system shall be verified during the life of a ship by the Administration based on the guidelines to be developed by the Organization. The MSC also approved MSC.1/Circ.1198 which recommends application of the Coating Performance Standard to bulk carriers ≥ 150 m in length that are constructed on/after 1 July 2006.

Technical Standards

After significant debate occurring over the 1-1/2 week meeting, standards for the surface preparation and paint application were agreed as summarized below:

- The soluble salt limit ≤ 50 mg/m² of sodium chloride
- The steel surface should be prepared so that the coating selected can achieve an even distribution at the required nominal dry film thickness (NDFT) and have an adequate adhesion by removing sharp edges, grinding weld beads and removing weld spatter and any other surface contaminant in accordance with ISO 8501-3 grade P2.
- 90% of all thickness measurements shall be greater than or equal to NDFT and none of the remaining 10% measurements shall be below 0.9 (NDFT).

- The surface is to be treated so as to achieve Sa 2½ on damaged shop primer and welds and Sa 2 removing at least 70% of intact shop primer, which has not passed a pre-qualification that is certified by the required test procedures as per the Standard
- The surface after erection is to achieve St 3 or better or Sa 2½ where practicable for butts. Small damages of up to 2% of total area are to achieve St 3. Contiguous damages over 25 m² or over 2% of the total area of the tank are to achieve Sa 2½.
- A dust quantity rating of “1” is required for dust size class “3”, “4” or “5”. Lower dust size classes are to be removed if the dust is visible, without magnification, on the surface to be coated.
- A minimum of two stripe coats and two spray coats are required. The second stripe coat, in way of welded seams only, may be reduced in scope where it is proven that the NDFT can be met by the coats applied in order to avoid unnecessary over thickness. Any reduction in the scope of the second stripe coat shall be fully detailed in Coating Technical File.
- Coatings are to be applied in accordance with the manufacturer’s specifications and are not to be applied if the relative humidity is above 85% or if the surface temperature is less than 3°C above the dew point.

Approval and Verification

Based on the results from prequalification tests (this may include 5 years of field experience in order to accept the current epoxy coatings that are known to perform at acceptable levels) of the coating system, which must be documented, a Statement of Compliance or Type Approval certificate is to be issued by a third party, independent of the coating manufacturer.

To ensure compliance with the CPS, a precise set of inspections are to be carried out by the qualified coating inspectors certified by NACE Level II, FROSIO level Red, or equivalent, as verified by the Administration. These inspectors must inspect surface preparation and coating application throughout the coating process to ensure compliance with this standard. Emphasis is placed on initiation of each stage of surface preparation and coatings application as improper work is extremely difficult to correct later in the coating progress. Representative structural members shall be non-destructively examined for coating thickness.



Prior to approving the Coating Technical File the Administration is to:

- check that the *Technical Data Sheet* complies with the coating performance standard;
- check that the coating identification on representative containers is consistent with the coating identified in the *Technical Data Sheet*;
- check that the inspector is qualified in accordance with the qualification standard included in the coating performance standard; check that the inspector's reports of the coating's application, as well as surface preparation, indicate compliance with the manufacturer's the *Technical Data Sheet*;
- monitor implementation of the Coating Inspection Requirements

are allowed to receive LRIT information irrespective of the ship's position from Port and Coastal States, which are entitled to receive LRIT information from ships up to 1000 nautical miles off their coast/port. The LRIT on board is to be capable to automatically transmit, without human intervention LRIT information at intervals not exceeding six hours.

The Committee also adopted resolution MSC.210(81) on Performance standards and functional requirement for the long-range identification and tracking of ships and resolution MSC.211(81) on Arrangements for the timely establishment of the long-range identification and tracking system.

MARITIME SECURITY

SOLAS Revision for LRIT

The Committee adopted resolution MSC.202(81) which amends SOLAS Chapter V to require cargo ships (and high-speed craft) ≥ 300 GT, passenger ships (and high-speed passenger craft) and self-propelled mobile offshore drilling units to have the means to transmit by a Long-Range Identification and Tracking System (LRIT) the ship's identity and position with date and time of each transmitted position.

The secure information transmitted by the LRIT will be available only to recipients who are entitled to receive such information. Therefore, the LRIT is independent of the Automated Identification System (AIS), which is a broadcast system.

Ships built on/after 31 December 2008 need to comply on delivery. Ships built before 31 December 2008 and operating in Sea Areas A1 and A2 or in A1, A2 or A3 (as defined by SOLAS IV and summarized below in Figure 1) need to comply not later than the first radio survey after 31 December 2008.

Sea Area	Availability of Coverage			
	VHF	DSC	MF	IMS
A1	✓	✓		
A2	✓	✓	✓	
A3	✓	✓	✓	✓

Figure 1 – SOLAS Sea Area Summary

Ships fitted with approved Automatic Identification Systems and operating exclusively within sea area A1 are not required to comply with the provisions of this regulation. Flag States

Ship Security Officer Qualifications

The Committee adopted resolution MSC.203(81) which provides the mandatory minimum requirements for the issuance of certificates of proficiency for ship security officers.

Every candidate for a certificate of proficiency as ship security officer must have approved seagoing service of not less than 12 months or appropriate seagoing service and knowledge of ship operations and meet the standard of competence for certification of proficiency as ship security officer, set out in the new section A-VI/5 (items 1 to 4) of the STCW Code which was adopted by resolution MSC.209(81).

Although these amendments enter into force on 1 January 2008, a Party may continue to recognize personnel who hold, or can document, qualifications as ship security officers until 1 July 2009.

LIFE SAVING APPLIANCES

Guidelines for Lifeboat Systems

MSC.1/Circ.1205 was issued, providing, "Guidelines for developing operation and maintenance manuals for lifeboat systems." The guidelines recommend development of user-friendly manuals for the operation and maintenance of lifeboat systems including their launching appliances. Detailed instructions on the operation of the lifeboat, including preparing the boat to be lowered, lowering the boat, and using the on-load release gear in a safe manner are given. Also included in the guidelines are checklist lists for the weekly and monthly maintenance of the lifeboat (including release gear), lifeboat engine, its electric parts (battery, inside lamp, canopy lamp, search light), lifeboat equipment, davit and winch.

Measure to prevent Lifeboat Accidents

Several already issued MSC Circulars have been combined into one comprehensible circular to help prevent accidents on lifeboats. MSC.1/Circ.1206 supersedes MSC/Circ.1049, MSC/Circ.1093, MSC/Circ.1136 and MSC/Circ.1137, and provides guidelines for the periodic servicing and maintenance of lifeboats, launching appliances and on-load release gear, on safety during abandon ship drills using lifeboats, and for simulated launching of free-fall lifeboats.

Draft Amendments to Chapter III

MSC 81 approved draft amendments to address inconsistencies in SOLAS Chapter III, the LSA Code and the revised recommendation on testing of life-saving appliances. Some of the items addressed by the draft amendments include:

- a new definition for "Unfavorable conditions of trim and list", which allows, as an alternative, the use of the worst combination of maximum trim and list angles from a ship's intact and, if applicable, damaged stability condition;
- requirements periodic inspection and maintenance of davit-launched liferaft automatic release hooks; and
- revision to the standards for rescue and fast rescue boats and their launching appliances, and their testing requirements.

Also regulation III/19.3.3.4 has been revised to allow for simulated free-fall launching during abandon ship drills. It will require the crew to board the lifeboat, properly secure themselves in their seats, and commence the simulating launch procedure up to but not including the actual release of the lifeboat. The lifeboat will then either be free-fall launched with only the required operating crew on board, or lowered into the water by means of the secondary means of launching without the operating crew onboard, and then maneuvered in the water.

Guidelines for the simulated launching of free-fall lifeboats are included in the new MSC.1/Circ.1206.

Infant Lifejackets

In accordance with resolution MSC.201(81), not later than 1 July 2010 all passenger ships on voyages less than 24 hours are to be provided with a number of infant lifejackets equal to at

least 2.5% of the number of passengers on board.

Passenger ships on voyages of 24 hours or more are to be provided infant lifejackets for each infant on board. Also, if the adult lifejackets provided are not designed to fit persons weighing up to 140 kg and with a chest girth of up to 1,750 mm, a sufficient number of suitable accessories shall be available on board to allow them to be secured to such persons.

PASSENGER SHIP SAFETY INITIATIVE**General**

This initiative was originally proposed at the 72nd meeting of MSC in May 2000 and undertook to reassess safety and survivability of "large" passenger ships. During the assessment, it was recognized that none of the identified safety issues were uniquely associated with the size of ship or number of passengers and, as a result, the Committee agreed to expand this effort to all sizes of passenger ships.

At this session of the MSC, the Committee approved draft amendments to SOLAS, Chapters II-1, II-2 and III, along with the issuance of various MSC Circulars and other related instruments.

The amendments discussed below will, upon their adoption at MSC 82 in December 2006, apply to new passenger ships only, unless otherwise specified.

SOLAS II-1, Stability, Machinery & Electrical

New regulation 8-1 is added, requiring a passenger ship to be able to return to port, either under its own power or being towed, when subject the damage. Both options require compliance with specific damage stability criteria and a minimum subdivision index.

Also, passenger ships will be required to be fitted with water ingress and flood level monitoring systems for all watertight spaces below the bulkhead deck.

Amendments to regulation 41 require all cabins to be provided with auxiliary lighting to clearly indicate the exit, and new regulation 55 will allow alternative designs and arrangements for machinery and electrical installations, based on an engineering analysis which demonstrates that the performance of the alternative is at least equivalent to that afforded by the current prescriptive requirements.



SOLAS II-2, Fire Integrity

The following are new requirements in the approved draft amendments to Chapter II-2:

- all fire and smoke detectors and manual call points are to be *addressable* (individually identifiable);
- any smoke detectors fitted in cabins are to also sound an alarm within the cabin itself when activated;
- exhaust ducts from main laundries are to be fitted with (1) readily removable filters; (2) an automatic fire damper that is remotely operated and located in the lower end of the duct; (3) remote-control arrangements to shut off the exhaust and supply fans from within the laundry room and for operating the fire damper; and (4) suitably located hatches for inspection and cleaning.

New regulations have been approved, defining the "*casualty threshold*" (i.e., the ability for the passenger ship to safely return to port) and requiring a "*safe center*" (i.e., a centralized station to operate, control and monitor the various safety systems including fire detection/alarm, fixed fire-fighting, ventilation, general alarm, watertight doors, etc.) The safety center is to be, either, part of the navigating bridge or located in a separate space adjacent to and having direct access to the navigating bridge.

SOLAS III, Life Saving

Along the lines of the revision agreed for SOLAS II-1/41, a new regulation has been added that will allow alternative designs and arrangements for life-saving equipment, based on an engineering analysis performed in accordance with guidelines to be finalized by MSC 82.

Draft amendments to regulation III/17-1, requiring all ships to eventually be fitted with recovery systems (a system to retrieve persons from the sea, and/or survival and rescue craft), were not approved at this time. It was decided that the performance guidelines for such systems, along with relevant training standards, need to be developed first, and the matter was referred to two technical sub-committees for consideration.

New MSC Circulars

Several MSC Circulars issued have been issued as a result of the Passenger Ship Safety Initiative:

MSC.1/Circ.1181 - "*Amendments to the IAMSAR Manual*", outlines the additional, voluntary assistance and support that SAR Authorities may be able to provide or arrange from governments and emergency response resources, such as fire-fighting personnel and equipment, salvage personnel and equipment, emergency towing, damage control equipment, etc.

MSC.1/Circ.1182 - "*Guide to recovery techniques*". This guide discusses several underlying problems, as well as some of the solutions in recovering persons in distress at sea, whether it is a person overboard or in a survival or rescue craft. It suggests some practical recovery techniques, which have been used successfully to recover people in distress.

MSC.1/Circ.1183 - "*Guidelines on the provision of external support as an aid to incident containment for SAR Authorities and others concerned*", supplements the amendments to the IAMSAR Manual (MSC.1/Circ.1181) and provides details on how the other governments/emergency response resources may be utilized.

MSC.1/Circ.1184 - "*Enhanced contingency planning guidance for passenger ships operating in areas remote from SAR facilities*", outlines the extra steps that should be taken when passenger ships operate remote from SAR facilities. These steps include keeping the appropriate authorities informed of the ship's position and intentions while the ship is operating in the remote area, considering the carriage of enhanced life-saving appliances, the provision of additional life-saving resources, etc.

MSC.1/Circ.1185 - "*Guide for cold water Survival*", provides advice on how to prevent or minimize the hazards of exposure to cold water.

MSC.1/Circ.1186 - "*Guidelines on training of SAR service personnel*", provides aspect of search and rescue that should be considered by those planning and delivering major incident training for SAR personnel.

Fire Safety of Passenger Ship External Areas

While not part of the initial Passenger Ship Safety Initiative, following a submission by the United Kingdom (MSC 81/4/6) relating to the cabin balcony fire onboard the "Star Princess", the Committee approved MSC.1/Circ.1187, "Interim Operational Recommendations for Passenger Ships with Cabin Balconies", and amendments to Chapter II-2.

The approved circular recognizes the hazards posed by cabin balconies where there may be combustible materials and an effective fire detection system or fire suppression system is not installed. It recommends certain steps to take to counter the associated fire risk, that include, among others, increased fire patrols, informing crew and passengers of this particular risk along with a general re-emphasis of fire safety, etc.

The amendments to SOLAS Chapter II-2 will apply to passenger ships constructed on or after 1 July 2008, and to passenger ships constructed before 1 July 2008 at the time of the first survey after 1 July 2008. The amendments will require:

- 1) Cabin balcony primary deck coverings to be of an approved material that will not readily ignite.
- 2) Exposed surfaces of cabin balconies, except for natural hard wood decking systems, must be low flame-spread characteristics, and not be capable of producing excessive quantities of smoke and toxic products (as determined in accordance with the FTP Code).
- 3) Furniture and furnishings on cabin balconies must be of "restricted fire risk", unless such spaces are protected by an approved fixed pressure water-spraying system and an approved fixed fire detection and fire alarm system.
- 4) Partitions, not forming part of the ship's structure and separating cabin balconies, must be capable of being opened by the crew from each side for fire-fighting purposes.

The Fire Protection Subcommittee was tasked to develop performance standards for fixed pressure water-spraying system and fixed fire detection and fire alarm system for cabin balconies.

Common Structural Rules (CSR) should be verified under Tier III through a pilot project.

The **Tier II (Functional Requirements)** for new-build bulk carriers and oil tankers were also approved with the view that it will be contained in a Code that is referenced by SOLAS. These requirements address the performance of the structure in terms of minimum design life (25 yrs) using a *net-scantlings* approach and a fatigue life of not less than 25 years in Winter North Atlantic environmental conditions. It also addresses structural strength, including redundancy and residual strength, coating protection, extents of watertight and weathertight integrity and related construction, survey and in-service maintenance considerations.

Based on input from an intersessional IMO correspondence group, the **Tier III (Verification Procedure)**, for verifying that Tier IV and V standards meet the Tier I and II requirements, was further developed. With respect to Class Society Rules, Figure 2 illustrates the current view of the Committee. However, Tier III will be further developed for consideration at MSC 82 in December 2006.

MISCELLANEOUS

Status of Goal Based Standards

With the view to incorporate the **Tier I (Goals)** for new-build bulk carriers and tankers into SOLAS, the Committee approved the Tier I Goals. **Tier I** addresses basic safety and pollution prevention goals and will be applicable to all types of new ships from a future date to be agreed. The Committee also agreed that, prior to amending SOLAS to include the Tier I goals, the IACS

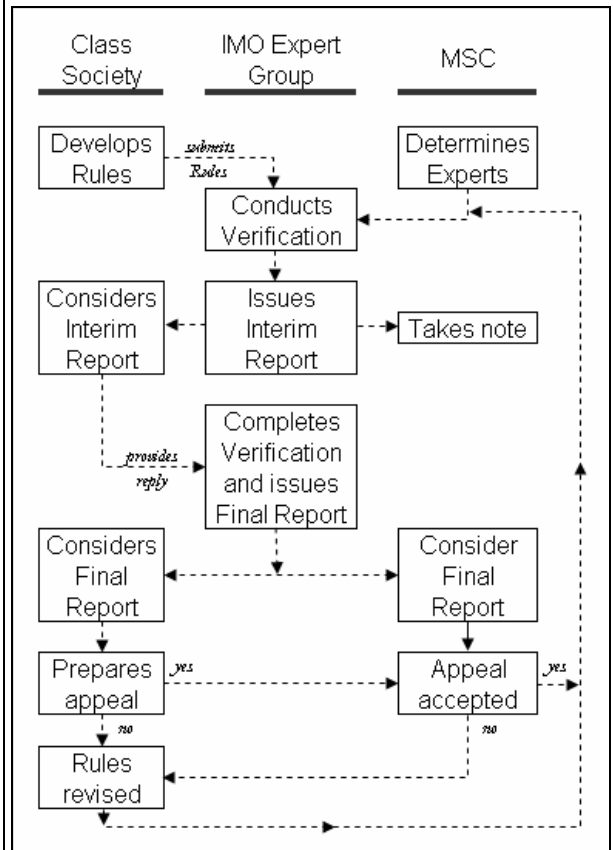


Figure 2 – Tier III Process for Class Rules

Revised Standards for VDRs and S-VDRs

MSC 81 adopted resolution MSC.214(81) which contains amendments to both the performance standards for VDRs (A.861(20)) and S-VDRs (MSC.163(78)), to include the ability to download and playback stored data and to define the standard method for downloading and read-out of data, to better enable the data to be used for accident investigation and ship management.

The revised standards also require that the VDRs provide an interface for downloading the stored data and playback the information to an external computer. The interface is to be compatible with an internationally recognized format, such as Ethernet, USB, FireWire, or equivalent.

The software for data downloading and playback should be compatible with an operating system available with commercial-off-the-shelf laptop computers and provided on a portable storage device such as a CD-ROM, DVD, USB-memory stick, etc.

The portable storage device containing the software, the instructions and any special (not commercial-off-the-shelf) parts necessary for the physical connection of the external computer, should be stored within the main unit of the VDR.

RO-RO Bow Door Requirements

The Committee approved MSC.1/Circ.1211 which contains a unified interpretation on the application of SOLAS II-1 to the arrangement of the collision bulkhead extension in the bow of RO-RO ships. Development of this interpretation was prompted after recognizing that SOLAS II-1 was being applied differently such that certain collision bulkhead extension arrangements would be damaged as a result of contact damage with the outer bow door/visor that was damaged or detached due to heavy weather which can lead to consequential flooding of the vehicle deck.

Referring to Figure 3, there are two new criteria that are being added (*see italicized text below*):

- the "collision bulkhead extension" includes *any part of a ramp attached to the extension*. Therefore the extension, including any attached ramp, is to be located within the 3m limit, as illustrated.
- The extension, including any attached ramp, is to be arranged to preclude the possibility of being damaged by the bow door or ramp (*detached or attached to the extension*) in the

event either the bow door or ramp are damaged or detached.

The above interpretation applies to passenger and cargo RO-RO vessels constructed on/after 1 July 2006. Further, it applies retroactively to existing passenger RO-RO vessels constructed on after 1 July 1997 where compliance is required by the first renewal survey carried out after 1 July 2006.

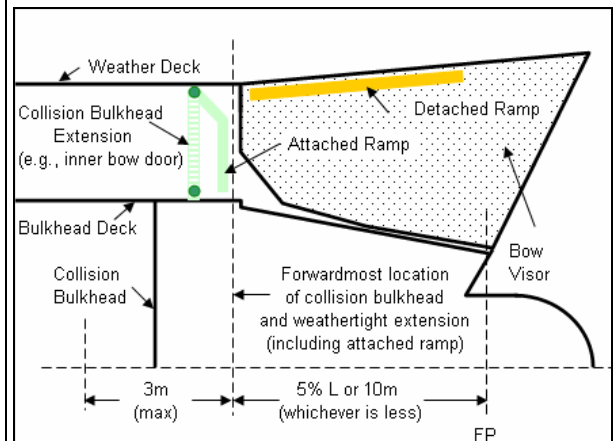


Figure 3 – Bow Door Arrangement

Frequency of Survey of the Ship's Bottom

The Committee adopted resolution MSC.204(81) which introduces the 5-year period of validity of the safety construction certificate as the basis for measuring the frequency of bottom inspections for all ships.

Current SOLAS I/10 requires two inspections of the ship's bottom during any 5 year period. Upon receiving explicit acceptance by 2/3rd of the SOLAS Contracting Parties, the amendment contained in MSC.204(81) will enter into force and thereby replace "any five year period" with the 5-year "period of validity of the safety construction certificate" tankers and bulk carriers subject to the enhanced survey program under resolution A.744(18). The 36 month period between any two consecutive surveys of the ship's bottom remains unaffected.

Bridge Visibility during BW Exchange

Chapter V of SOLAS was amended by resolution MSC.201(81) which, when it enters into force on 1 July 2010, will allow deviation from the bridge visibility requirements during ballast water exchange carried out in accordance with an approved BW Management Plan. However, the master must first determine that it is safe to do so and ensure that a proper lookout is maintained. The duration of the deviation is recorded in the ship's record of navigational activities.



Fire Integrity of Accommodation Windows

Based on a submission by IACS, the Committee agreed with the inconsistency in SOLAS II-2 in that the A-60 class windows are required to be installed in A-0 class exterior boundaries for certain portions of the deckhouse (refer to the shaded Area A in Figure 4, below).

Accordingly, MSC.1/Circ.1204 was approved and recommends the early application of an amendment to SOLAS regulation II-2/4.5.2.3 which was approved and, upon adoption at MSC 82 (Dec 2006) will remove the inconsistency raised by IACS.

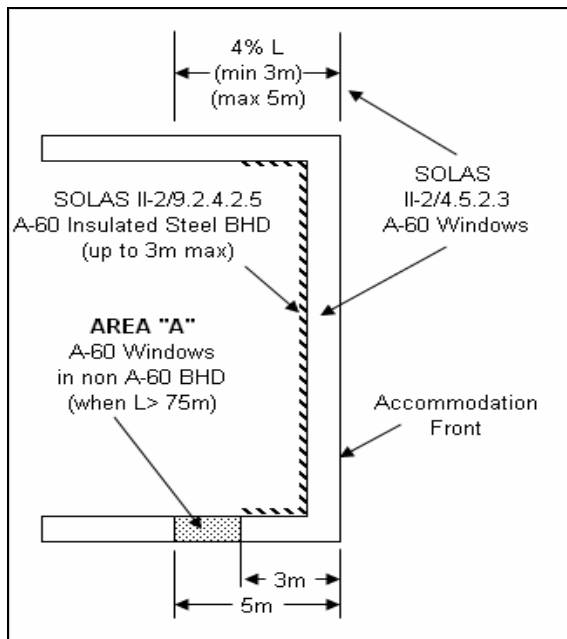


Figure 4 – SOLAS II-2

High Speed Craft – Inner Bow Doors

The HSC Code, 2000, requires the fitting of an internal weathertight bow door on ro-ro high-speed craft fitted arranged with a bow loading door opening.

One of the alternative options for fitting this inner door that is allowed for by the HSC Code is to demonstrate that a craft complies with certain residual stability criteria with water on the vehicle deck that has accumulated as a result of failure of the bow shell door while the craft is proceeding at the maximum attainable speed in long crested seas of the greatest significant wave height corresponding to the worst intended operating conditions.

Model testing is identified in the Code as one of the options for determining the quantity of water that the craft in question may accumulate.

The Committee approved MSC.1/Circ.1195 which contains guidelines for carrying out such model test. Parameters, such as model scale, environmental loads, and instrumentation, as well as a test procedure, are included in MSC.1/Circ.1195.

Alternative Assessment of Intact Stability

The Committee approved MSC.1/Circ.1200 which contains Interim Guidelines for carrying out model tests to determine the wind heeling lever and/or the angle of roll for assessing compliance with the severe wind and rolling criterion (weather criterion), as contained in Code on Intact Stability for All Types of Ships as per resolution A.749(18).

The Circular provides two options to determine the wind heeling lever, lw_1 , as indicated in Figure 5, below, which is a result of the wind force acting on the exposed area of the ship above the waterline and the equal, but opposite, drift force acting on the submerged area of the ship:

- a simplified procedure where the wind moment is obtained for the upright condition only and applied as a constant value for all angles of roll; and
- a complete test procedure where the wind moment is determined for a suitable number of heel angles.

Having determined lw_1 and setting lw_2 (wind lever due to wind gusts) equal to $1.5lw_1$, the area b should not be less than area a.

The Guidelines also recommend that the angle of roll to windward due to irregular wave action (ϕ_1) be set equal to 70% of the resonant roll amplitude in beam regular waves.

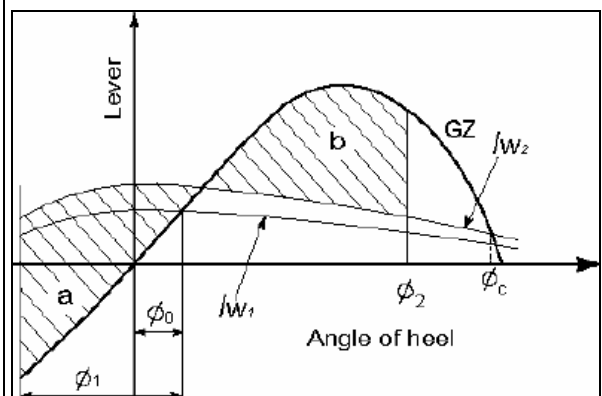


Figure 5 – Intact Stability Weather Criteria



Fire System Safety (FSS) Code Revisions

The Committee adopted resolution MSC.206(81) which, upon entering into force on 1 July 2010, will completely revise Chapter 5 of the Code on “Fixed gas fire-extinguishing systems”, of the FSS Code. The revision includes:

- specific reference to ISO standards for gas cylinders;
- that audible alarms are unique for the event and can be heard throughout the protected space;
- installation and testing requirements for low-pressure CO2 systems.

Expert Group Reports

ISM Code Assessment

A report by a group of independent experts was presented and briefly discussed. Due to very limited availability of raw data, the group collected and relied on the expert judgment from various levels of the shipping industry and from questionnaires completed by shipboard personnel, shore-based personnel, shipping companies and Administrations) in conducting their assessment of the impact and effectiveness of implementation of the ISM Code. Although the replies to the questionnaire were not considered to be a representative sample of the entire industry, they were considered to represent the collective experience from those that support the Code.

Based on the data and opinions, the report concluded that although tangible positive benefits were evident when the ISM Code is fully implemented, compliance could be made more efficient by reducing administrative processes (such as use of information technology and integration of all documentation requirements) and by improving compliance monitoring.

The Joint MSC/MEPC Working Group on Human Element has been tasked to evaluate the report's recommendations which include the need to examine the cause and effect between ISM implementation and safety records, relationship between PSC and ISM compliance and possible revision to both the Code (to further improve the safety culture) and its associated Guidelines (to assist companies to implement the Code).

Explosions in Chemical and Product Tankers

The Committee considered a report on incidents of explosions on chemical and product tankers which was carried out by an Inter-Industry Working Group over the last two years. The Group set out to identify the root causes of a database of incidents that have occurred over the past 25 years the Group identified 35 occurrences that involved fires and explosions in cargo areas of chemical and product tankers. Any common factors amongst these incidents were identified with the objective of identifying corrective actions that would prevent any further similar incidents.

The analysis revealed that the accidents occurred:

- For ships < 20,000 deadweight;
- For a majority of the cases, during tank cleaning, venting or gas freeing;
- For a significant number of cases, when established procedures were not observed;
- In ships carrying MARPOL Annex II cargoes.

The most significant contribution to the incidents, which in most cases involved ignition within a tank, was a failure to follow operational procedures. Technical or operational factors and manning levels were not considered to be a factor. Because none of the incidents occurred when inert gas was applied, the Group recommended that formal safety assessment and cost/benefit analysis be carried out before decisions are made concerning the mandatory provision of inert gas systems to product tankers under 20,000 deadweight.

Having reviewed the Report, the Committee tasked its technical Sub-Committees to consider several recommendations including:

- The need to evaluate a number of safety, operational and environmental issues identified in the Report with respect to the provision of inert gas systems;
- The need to carry out a formal safety assessment and cost/benefit analysis before deciding on the provision of inert gas systems;
- Considering means to reduce the source of ignition by, for example, introducing measures to mitigate in-tank pump failures and increasing the awareness of industry with respect to the consequences of static electricity which can develop from chemical spraying or steaming.



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