
The Merchant Shipping (Additional Safety Measures for Bulk Carriers) Regulations 1999 (SI 1999/1644)

Notice to Surveyors, Shipowners, Masters, Bulk Cargo Shippers and Terminal operators

Summary

This MGN draws attention to the Merchant Shipping (Additional Safety Measures for Bulk Carriers) Regulations 1999 which came into force on 1st July 1999.

Key Points:

- These Regulations implement SOLAS Chapter XII to enhance the structural safety and resistance to flooding of bulk carriers.
- This Marine Guidance Note gives advice for the guidance of surveyors on the interpretation and application of these regulations.

INTRODUCTION

1. These regulations enact SOLAS Chapter XII adopted during the 1997 SOLAS Conference with effect from 1st July 1999. They relate to bulk carriers of 150m in length and upwards, carrying high density dry bulk cargoes, and introduce standards for damage stability and flotation, structure of bulkheads and double bottoms, overall longitudinal strength in the flooded state, hold loading, cargo density declarations, and provision of a loading instrument. The regulations also define how compliance with the requirements should be documented.
2. For new ships, the regulations require the checking of the structure and stability of the vessel with any hold flooded in all load conditions. The requirements are applicable to new ships carrying high density cargoes of over 1000 kg/m³. Structural standards for bulkheads, double bottoms and longitudinal strength are defined by IACS Unified Requirements and are referenced in an IMO Conference Resolution.
3. The requirements are also retrospectively applied to existing vessels. Research has shown that the majority of bulk carrier incidents affect those over 15 years old, carrying high density cargoes with alternate hold loading, and 40–50% involve the forward hold. There is a long phase-in period for existing vessels, whereby those over 15 years of age are checked and modified if required first, and the youngest vessels have until they are 17 years old to comply. The requirements apply to existing ships carrying cargoes with density of 1780 kg/m³ or over, as this was considered the point at which alternate hold loading becomes viable. Structural standards are specified in detail in a separate IMO Conference Resolution which incorporates in full the relevant IACS Unified Requirements. These only apply in the case of flooding of the forward hold, and because of this there is no special additional requirement for overall longitudinal strength in the flooded condition.

4. For ease of interpretation and correlation with international regulations, this Marine Guidance Note is drafted in terms of the SOLAS Regulations and applicable IACS standards. In this respect it should be noted that the IACS Unified Requirements are incorporated into the classification rules of each IACS member society.

5. The following table relates these to the UK regulations numbers :

SOLAS Chapter XII Regulation	Topic	UK Bulk Carriers Regulation	IACS Standard
1	Definitions	2	
2	Application	3	
-	Enhanced surveys of bulk carriers	4	URZ10.2 refers
3	Implementation Schedule	5	(URS23 refers)
4.1	Damage stability - new ships	6(1)	
4.2	Damage stability - existing ships	6(2)	
5	Structural strength - new ships	7	URS17, 18, 20
6	Structural strength - existing ships	8	URS19, 22
6.3	Loading restrictions as alternative to structural modifications - existing ships	8(3)	
7	Completion of enhanced periodical survey - existing ships over 10 years old	9	
8	Information on compliance	10	
9	Relaxation of stability and structural requirements - existing ships with insufficient watertight bulkheads	14	(URS24 refers)
10	Cargo density declaration	11	
11	Loading instrument	12	Rec. No. 48

Regulation XII/2 - Application

6. The Regulations apply only to those bulk carriers as defined in Conference Resolution 6 of the 1997 SOLAS Conference, which is also in line with the interpretation adopted for ISM Code compliance. They apply to -
- a. bulk carriers with the traditional structural configuration of single deck, upper wing tanks and lower hopper tanks in cargo areas;
 - b. ore carriers with two longitudinal bulkheads and double bottom in cargo areas, carrying ore cargoes in the centre holds only;
 - c. combination carriers, ie tankers also able to carry dry cargo in bulk.
7. Other ship configurations are excluded from the Regulations, even if the ship is carrying solid bulk cargoes. Most of the individual regulations apply only to bulk carriers, as defined, of single side skin construction and of 150m in length and upwards. Ore carriers are double side skin by definition and are therefore exempt from most regulations.

8. A number of bulk carriers are constructed of mixed construction, with double side skins throughout most of the cargo area (for ease of cargo handling) but single side skin construction in the forward hold (for ease of construction). These come under the SOLAS definition of "bulk carrier of single side skin construction" as there is "a hold bounded by the side shell" and therefore Chapter XII, if interpreted literally, would require the double skinned cargo holds of new ships to meet the structural requirements intended by SOLAS Regulations XII/4 and 6 for single skin holds.
9. The term "bulk carrier of single side skin construction" was therefore clarified by IMO in Annex 1 to Resolution MSC89/71, which is attached to this Marine Guidance Note at Appendix B and which should be used as an interpretation of this term.
10. Evidence was submitted to IMO's Maritime Safety Committee's 71st session in May 1999 indicating that ships carrying heavy break bulk cargoes, such as steel components, rail tracks, etc may be faced with similar problems as bulk carriers, because of the very high permeability of the cargo spaces when fully loaded. However the Committee agreed to await the results of further research on the matter before deciding whether SOLAS Chapter XII should also apply to ships carrying these cargoes.

Surveys of Bulk Carriers

11. The IMO Enhanced Survey Programme was made mandatory from 1st January 1996 for bulk carriers and oil tankers by SOLAS Chapter XI, and bulk carriers are not permitted by SOLAS Chapter XII to carry dense cargoes unless they have been surveyed in accordance with the IMO Guidelines (Resolution A.744(18), as updated by Resolution 2 of the 1997 SOLAS Conference).
12. 95% of bulk carriers are classed with IACS member societies which have already enacted these requirements within their own rules. However, there remains a need in the UK Regulations to stipulate this requirement at regulation 5, primarily to ensure compliance by the remaining 5%.

Regulations XII/3 and XII/7 - Implementation Schedule

13. The regulations apply, in full, to all new ships, ie those whose keels are laid on or after 1st July 1999. Most bulk carriers are classed with IACS member classification societies which have implemented the relevant structural and stability requirements for their own ships since 1st July 1998.
14. For an existing ship over 15 years of age, regulations XII/4 and 6 (dealing with structure and damage stability) are effective at the date of the first periodical survey after 1st July 1999; for ships over 20 years of age this would apply from the date of the first intermediate or periodical survey, but in either case it should be completed by 1 July 2002. If a vessel underwent a survey immediately prior to 1st July 1999 then implementation of the regulations might be delayed by up to three years. This is not the intention of the regulations and on IACS' ships early completion of an intermediate or special survey due after 1st July 1998 to postpone compliance is not allowed by IACS Unified Requirement S23 para. 1(b). For non-IACS ships the effective date would be 1st July 1999.
15. No bulk carrier over ten years old may carry a high density bulk cargo unless she has undergone either a periodical survey or a survey of her cargo holds to an equivalent extent, as required by regulation XII/7.
16. Regulation XII/9 permits exemptions to certain ships that cannot comply with regulation XII/4.2 on condition that they are subject to additional surveys, fitted with bilge alarms and furnished with additional information. Although regulation XII/9 mentions no specific implementation date it is not expected that such ships should comply with these alternative provisions before the date on which they would have had to comply with regulation 4.2.
17. Enhanced surveys were required for bulk carriers from 1st January 1996, and additional requirements for these surveys were introduced by Resolution 2 of the 1997 SOLAS Conference. However many ships started these surveys before that date, and Resolution 7 accepts such surveys

for the purposes of compliance with these regulations, provided the surveys were undertaken before 1st January 1996.

18. An aide-memoir in the form of a table indicating, for age of ship, the regulations with which she has to comply, is attached at Appendix A for information of Port State Control Officers (PSCOs).

Regulation XII/4 - Damage Stability Requirements

19. The damage stability standards referred to in SOLAS Chapter XII are those of the "Regulation equivalent to regulation 27 of the International Convention of Load Lines, 1966" adopted by Resolution A.320(IX) on 12 November 1975, as amended by Resolution A.514(13) on 17 November 1983. The consolidated text of these resolutions is included in the UK Regulations at regulation 6(3) for completeness and is updated to remove ambiguity in the context of bulk carriers.
20. Bulk carriers with B-60 or B-100 freeboards are subject to an equivalent damage survivability check under the existing 1966 International Convention on Load Lines, and existing ships of such types are deemed to comply with the requirements. Foreign flag ships may, instead, have been assigned a reduced freeboard in compliance with either Resolution A.320(IX)/Resolution A.514(13) or Regulation 27(8) of Annex B of the 1988 Protocol to the International Convention of Load Lines, 1966. Either of these may also be accepted as complying with the required standards.
21. These are deterministic standards which seek to ensure that the ship can withstand a given level of damage within a statutory safety margin. SOLAS II-1/25-1 imposes a probabilistic standard of survivability, which requires the vessel to achieve an index of survival based on the probability of collision damage extent and load condition. This is not permitted as an equivalent to the deterministic damage requirements. Conversely, the deterministic standards above may be accepted as an alternative to the probabilistic requirements, as noted in the footnote to Regulation II-1/25-1.1.

Regulations XII/5 and 6 - Structural Requirements

22. The structure of new bulk carriers, designed to carry solid bulk cargoes having a density of 1000kg/m³ or greater, is required to comply with the IACS Unified Requirements S17, S18 and S20, as defined in Conference Resolution 3 of the 1997 SOLAS Conference. The Conference was aware of the difficulty of applying IACS' standards to IMO regulations, as these standards are "live" documents and could be amended by IACS without recourse to IMO. However it was considered that as the majority of bulk carriers would be IACS-classed anyway there would be few problems in using the IACS standards for these vessels.
23. The IACS standards UR S19 (Evaluation of Scantlings of the transverse watertight corrugated bulkhead between cargo holds Nos. 1 and 2, with cargo hold No. 1 flooded) and UR S22 (Evaluation of Allowable Hold Loading of Cargo Hold No. 1 with Cargo Hold No. 1 Flooded) apply retrospectively to existing single side skin bulk carriers. This time, in order to avoid the situation identified above, where a future IACS update would retrospectively affect existing ships without recourse to IMO, the technical content of these IACS URs is incorporated as Annexes 1 and 2 of Conference Resolution 4. This "freezes" the standard but still allows IMO to update it in future with a further IMO Resolution.
24. The retrospective standards only apply to existing bulk carriers carrying cargoes of density 1780kg/m³ or greater. High density cargoes are seen as being more hazardous than the same total weight of a lower density cargo because of the large empty volumes left in cargo holds. This permits a greater weight of sea-water to enter in the event of a breach of the hull envelope, leading to possible hull or bulkhead failure and/or loss of stability.
25. Many existing ships will require strengthening of their double bottom and/or transverse bulkhead structure in way of the forward hold in order to comply with these standards. Regulation XII/6.3 permits, as an alternative, that the ship accepts limitations on either the total deadweight loaded or

on cargo distribution restrictions such as avoiding alternate hold loading. These alternatives must be documented as at regulation XII/8. They are only applicable, though, when loading cargo with a density greater than 1780 kg/m³.

Regulation XII/9 - Ships unable to comply with the hold flooding requirements

26. Regulation XII/9 anticipates that a number of existing bulk carriers of over 150m will be unable to comply with the flooding requirements of regulation 4.2. These might be four hold ships, where flooding of the forward hold represents an excessive loss of buoyancy, or ships such as self-discharging cement carriers with hoppers and discharge conveyors running through their bulkheads, rendering them non-watertight and again unable to comply.
27. Regulation XII/9 therefore permits exemption from the stability and structural standards subject to annual enhanced inspections for the forward hold, fitting of bilge well alarms in all cargo holds, and provision of additional information on emergency procedures. The exemption is not permitted for new ships. Regulation 9.2 calls for high level alarms to be fitted in bilge wells, but it is possible that this could be triggered by relatively small quantities of water and may not give indication of catastrophic flooding. Ship owners are therefore strongly recommended to comply with IACS' URS24 providing for "high high" level alarms in such ships.
28. Chapter XII of SOLAS refers to Administrations permitting "relaxations" rather than granting "exemptions". The term "exemption" has been used in regulation 14 of the UK regulations so as to ensure that UK flag ships will have the benefit of a formal document demonstrating compliance to exhibit to PSCOs when in foreign ports.
29. SOLAS Chapter XII defines no formal documentation to demonstrate that this relaxation has been permitted in respect of a ship. UK PSCOs may therefore find some difficulty in obtaining confirmation that such relaxation has been officially permitted.
30. IMO Resolution MSC79(70) expresses concern that owners might modify existing watertight bulkheads on a bulk carrier that would otherwise have to comply with regulations XII/4.2 and 6, so as to render the bulkheads non-watertight, and it is emphasised that this regulation is only applicable to ships originally constructed in this manner.
31. Clearly any bulk carrier modified in this way would not also be able to continue to benefit from a B-60 Freeboard, and it is therefore not clear that this method would be of value to many bulk carrier owners, but it may occur with certain ships of specialist design.

Regulation XII/8 - Documentation of Compliance

32. There is currently no formal certification in place to indicate compliance with these standards. IMO Resolution MSC79(70) urges Administrations to ensure that bulk carriers to which these regulations apply are clearly identified as such, either on the ISM Safety Management Certificate or in the Cargo Loading Manual. In the longer term the Cargo Ship Safety Construction, Safety Equipment and Safety Certificates will be amended to include "bulk carrier" as one of the recognised ship types but this can only take place after the 1988 SOLAS Protocol comes into effect on 3 February 2000.
33. The Cargo Loading Manual, required by SOLAS Regulation VI-7.2 from 1 July 1998 (as enacted in the UK by regulation 10(2) of the Merchant Shipping (Carriage of Cargoes) Regulations 1999, should be endorsed by the Certifying Authority to indicate which of the SOLAS regulations identified in the table at Appendix A are complied with.
34. Regulation XII/8.3 requires a triangle, of side 500mm in length, painted in a contrasting colour with its apex 300mm below the deck line, to be marked on the side shell of the ship when compliance with regulation XII/6.2 involves imposition of loading/operating restrictions as described in regulation XII/6.3. Recognising that a strict implementation of regulation XII/8.3 would result in every bulk carrier constructed before 1 July 1999 being so marked, and as this was not the intention

of the regulation, IMO has published interpretations to be followed when determining if triangle marks are required as Annex 2 to IMO Resolution MSC89(71) which is attached to this Marine Guidance Note at Appendix B.

Regulation XII/10 – Density declaration and verification

35. The shipper is required to declare the density of the cargo being carried, in addition to the other information required by SOLAS Regulation VI/2.2, as implemented in the UK by regulation 4(1) of the Merchant Shipping (Carriage of Cargoes) Regulations 1999. This is not strictly a safety requirement, as the safety of the vessel is more governed by the actual weight loaded into each hold, but it is important to verify compliance with the 1780 kg/m³ limit for existing ships. Therefore any cargo declared to have a density in the range of 1250 kg/m³ to 1780 kg/m³ must have its density verified by an accredited testing organisation.
36. This cargo density verification is clearly only of relevance to those existing ships not permitted to carry high density cargoes. IMO Resolution MSC79(70) clarifies that for bulk carriers of 150m in length and upwards of single side skin construction constructed before 1st July 1999, any cargo carried on or after the implementation date specified in regulation XII/3 and declared to have a density within the range of 1250 to 1780 kg/m³ shall have its density verified by an accredited testing organisation, unless such bulk carriers comply with all the relevant requirements of the Regulations applicable to the carriage of solid bulk cargoes having a density of 1780 kg/m³ and over.
37. In verifying the density of solid bulk cargoes reference may be made to MSC Circular 908 dated 9 June 1998 on a Uniform Method of the measurement of the bulk density of bulk cargoes. This Circular is also attached to this Marine Guidance Note at Appendix C. This Circular does not make clear, however, the means to ensure that a representative sample is taken for density measurement, and therefore reference should be made to IMO's Code of Safe Practice for Solid Bulk Cargoes (the BC Code), in particular Section 1 para. 1.10, Section 4.3 and Annex D.

Regulation 11 - Loading Instrument

38. This refers to Resolution 5 of the 1997 SOLAS Conference, which in turn refers to IACS Recommendation No. 48 for ships not yet fitted with a loading instrument.
39. Loading instruments previously fitted to bulk carriers should have been approved in accordance with the standards of a recognised organisation.

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APPENDIX A Merchant Shipping (Additional Safety Measures for Bulk Carriers) Regulations 1999

SOLAS Reg. No.	New Ships SSSC, >150m, >1000kg/m ³	Existing Ships (SSSC, >150m, >1780 kg/m ³)		
		Implementation Schedule		
3 (Implementation Schedule)	(constructed on or after 1 July 1999)	<15 years old (constructed 2 July 84 - 30 June 99)	15 - 20 years old (constructed 2 July 79 - 1 July 84)	20 years old and over (constructed on or before 1 July 79)
4 (Damage Stability)	Applies; Loading manual to be endorsed;	Applies at 1st periodical survey after age 15 years, but not later than age 17 years; Loading manual to be endorsed	Applies at 1st periodical survey after 1/7/99, but not later than 1/7/02; Loading manual to be endorsed	Applies at 1st intermediate or periodical survey after 1/7/99, but not later than 1/7/02; Loading manual to be endorsed
5 (Structural Strength)	Applies; Loading manual to be endorsed;	N/A		
6 (Structural Strength)	N/A	Applies at 1st periodical survey after age 15 years, but not later than age 17 years; Loading manual to be endorsed	Applies at 1st periodical survey after 1/7/99, but not later than 1/7/02; Loading manual to be endorsed	Applies at 1st intermediate or periodical survey after 1/7/99, but not later than 1/7/02; Loading manual to be endorsed
6.3 (Loading restrictions instead of structural mods)	N/A	Applies from date that Regulation 6 would have applied; Loading manual to be endorsed and triangle mark to be applied to ship's side; Loading manual to detail loading and operational restrictions, or restrictions on loading cargoes of density > 1780 kg/m ³ , to be stated.		
7 (Enhanced Surveys)	N/A	Applies to any ship over 10 years of age carrying a cargo of density > 1780 kg/m ³		
8 (Information on Compliance)	Applies	Applies at 1st periodical survey after age 15 years, but not later than age 17 years	Applies at 1st periodical survey after 1/7/99, but not later than 1/7/02	Applies at 1st intermediate or periodical survey after 1/7/99, but not later than 1/7/02
9 (Ships unable to comply with Reg. 4.2)	N/A	Applies from date that Regulation 4 would have applied; Loading manual to be endorsed.		
10.1 (Cargo Density Declaration)	Applies from 1 July 1999 to all bulk cargoes loaded on all bulk carriers.			
10.2 (Verification of Density)	N/A	Applies to cargoes 1250 kg/m ³ -1780kg/m ³ carried on ships not permitted (under 6.3) to carry cargoes over 1780kg/m ³ , from date that Regulation 6 would have applied.		
11 (Loading Instrument)	Applies to all bulk carriers >150m	Applies to all bulk carriers >150m at 1st intermediate or periodical survey after 1 July 1999		

ANNEX 6

**RESOLUTION MSC.89(71)
(adopted on -28 May 1999)****INTERPRETATION OF THE PROVISIONS OF SOLAS CHAPTER XII ON
ADDITIONAL SAFETY MEASURES FOR BULK CARRIERS**

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING that the 1997 SOLAS Conference adopted chapter XII of the International Convention for the Safety of Life at Sea (SOLAS), 1974 concerning additional safety measures for bulk carriers.

NOTING FURTHER that SOLAS chapter XII will enter into force on 1 July 1999.

DESIRING to ensure that all Contracting Governments to the 1974 SOLAS Convention implement SOLAS chapter XII in a consistent and uniform manner,

RECOGNIZING, therefore, the need to establish, for that purpose, guidance on applications of, and the interpretation to, the relevant provisions of that chapter, further to that already adopted by, resolution MSC.79(70),

RESPONDING to the request of the 1997 SOLAS Conference, as recorded in Conference resolution 8 thereof, regarding the term "bulk carrier of single side skin construction",

REALIZING that SOLAS regulation XII/8.3, if applied literally, would require every bulk carrier of 150 m in length and upwards of single side skin construction, carrying solid bulk cargoes having a density of 1,780 kg/m³ and above constructed before 1 July 1999, to be permanently marked on the side shell with a solid triangle, and recognizing that this is clearly not the intention of the regulation.

1. URGES Governments concerned to:

- .1 interpret the term "bulk carrier of single side skin construction" defined in regulation XII/1.2 as indicated in Annex 1 to the present resolution; and
- .2 interpret the requirement for certain bulk carriers to be permanently marked on the side shell with a triangle, provided in SOLAS regulation XII/8.3, as indicated in Annex 2 to the present resolution; and

2. INVITES Governments concerned to bring the contents of this resolution to the attention of all parties concerned.

ANNEX 1

INTERPRETATION OF THE TERM "BULK CARRIER OF SINGLE SIDE SKIN CONSTRUCTION"

- 1 "Bulk carrier of single side skin construction" means a bulk carrier where one or more cargo holds are bound by the side shell only or by two watertight boundaries, one of which is the side shell, which are less than 760 mm apart in bulk carriers constructed before 1 January 2000 and less than 1,000 mm a part in bulk carriers constructed on or after 1 January 2000. The distance between the watertight boundaries is to be measured perpendicular to the side shell.
- 2 The above interpretation should be applied as follows:
 - .1 in bulk carriers with single side skin construction in the foremost cargo hold, constructed before 1 July 1999, regulations XII/4.2 and 6 should be applied in accordance with the implementation schedule required by regulation XII/3; and
 - .2 in bulk carriers constructed on or after 1 July 1999, the requirements for damage stability under regulation XII/4.1 and structural integrity under regulation X11/5 should be complied with in respect of cargo holds with single side skin construction.

ANNEX 2

INTERPRETATION OF THE REQUIREMENT FOR CERTAIN BULK CARRIERS TO BE PERMANENTLY MARKED ON THE SIDE SHELL WITH A TRIANGLE

SOLAS regulation XII/8.3 requires a triangle to be marked on the side shell of the ship when compliance with regulation XII/6.2 involves imposition of loading/operating restrictions as described in regulation XII/6.3. Such operating restrictions only need to be imposed for solid bulk cargoes having a density of 1,780 kg/m³ and above, and apply at all times when solid bulk cargoes having a density of 1,780 kg/m³ and above are carried. The following interpretations should be followed when determining if triangle marks are required:

- 1 When a ship's loading booklet restricts the ship to carry solid bulk cargoes having a density of less than 1,780 kg/m³, a triangle mark is not required, provided that all reference to carriage of solid bulk cargoes having a density of 1,780 kg/m³ and above are removed from the loading booklet. The loading booklet is to clearly specify that the ship is prohibited from carrying solid bulk cargoes having a density of 1,780 kg/m³ and above.
- 2 When a ship's deadweight is restricted, but the load line assignment permits deeper draughts, and operating restrictions in the form of draught or deadweight limits are imposed on the ship to obtain compliance with the requirements, the loading booklet is to clearly specify the operating restrictions and a triangle is to be permanently marked on the ship's sides. If the ship's load line and loading booklet are revised to limit the ship's draught at all times, operating restrictions and the triangle marks are not required.
- 3 Where restrictions, other than a general restriction to homogeneous loading, are imposed on the distribution of cargo in the two foremost cargo holds as a condition of compliance, then the loading booklet is to clearly specify the applicable operating restrictions and a triangle is to be permanently marked on the ship's sides.

- 4 Where restrictions are imposed on the maximum mass of packaged cargoes to be carried in the foremost cargo hold as a condition of compliance with the Standards for the evaluation of allowable hold loading of the foremost cargo hold, as contained in annex 2 to 1997 SOLAS Conference resolution 4, the loading booklet is to clearly state these limits, but the triangle marks are not required.
- 5 Where a homogeneous distribution of cargo in the two foremost cargo holds is required as a condition of compliance, then the loading booklet is to clearly specify the applicable operating restrictions and a triangle is to be permanently marked on the ship's sides.

**UNIFORM METHOD OF MEASUREMENT OF THE DENSITY
OF BULK CARGOES**

- 1 SOLAS regulation XII/10 (Solid bulk cargo density declaration), as adopted by the 1997 SOLAS Conference on Bulk Carrier Safety and interpreted by operative paragraph 4 of resolution MSC 79 (70), requires the shipper, prior to loading bulk cargo on a bulk carrier, to declare the density of the cargo which shall be verified by an accredited testing organization.
- 2 The Maritime Safety Committee, at its seventy - first session (19 to 28 May 1999), recognizing the need for a uniform method of density measurement of the bulk cargoes, adopted the performance specification for the measurement of the density of such cargoes set out at annex.
- 3 Member Governments are invited to bring this circular to the attention of all parties concerned.

ANNEX

**PERFORMANCE SPECIFICATION FOR THE MEASUREMENT
OF THE DENSITY OF BULK CARGOES***

1 Scope

- 1.1 This specification may be used to determine the bulk density of bulk cargoes.
- 1.2 Bulk density is the weight of solids, air and water per unit volume. It includes the moisture content of the cargo and the voids whether filled with air or water.
- 1.3 The density should be expressed in kilograms per cubic metre (kg/m³).

2 Apparatus

- 2.1 This specification provides for the use of a container of known volume and tare weight.
- 2.2 The container should be sufficiently rigid to prevent deformation or volume changes occurring during the test. Where the material contains lumps, or will not readily flow into corners, the container should be of cylindrical shape and/or of large size in comparison to the size of lumps. Its capacity must be large enough to contain a representative sample of the cargo for which the density is to be determined.
- 2.3 The internal surfaces of the container should be smooth with any attachments such as handles being fitted to the exterior.
- 2.4 Weighing should be done using a weighing instrument certified by an accredited testing organization.

3 Procedure

- 3.1 A sample that is representative of the particle size, compaction and moisture of the material to be loaded on the ship should be selected.
- 3.2 The container should be filled with a sample of the material so that it is trimmed level with the top of the container. The material should not be tamped.
- 3.3 The weight of the filled container should be measured and the tare weight subtracted to obtain the weight of the sample.
- 3.4 The density of the sample should be calculated by dividing the weight of the bulk material to be loaded by the volume of the container.

4 Recording results

- 4.1 The density of the sample should be recorded using the recommended form given in the appendix and made available when requested.
 - 4.2 The result of the density measurement should be signed by a representative of the accredited testing organization.
- * Reference is made to paragraph 1.10 - "Representative test sample" and Appendix D - "Laboratory test procedures, associated apparatus and standards" of the Code of Safe Practice for Solid Bulk Cargoes (BC Code).

Appendix

RECORD OF DENSITY MEASUREMENT

The density of the cargo has been measured in accordance with the uniform method of density measurement of bulk cargoes described in the annex to MSC/Circ.908 which refers to SOLAS regulation XII/10.

Cargo: (name and relevant reference in the BC Code):

Shipper (name, address, telephone, etc.)

Sample origin (stock pile, ship's hold, etc.)

Date (sampling and density measurement)

Gross weight (GW) (container plus sample)		kg
Tare weight (TW) (container)		kg
Net weight (NW) (sample)	(NW=GW-TW):	kg
Volume (V) (container)		m ³
Calculated density (d) of the cargo	(d= NW/V)	kg/m ³

Measurement conducted by the accredited testing organization
(Signature, stamp)

Done on at