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4 ALBERT EMBANKMENT  
LONDON SE1 7SR  
Telephone: +44 (0)20 7735 7611 Fax: +44 (0)20 7587 3210

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**EARLY IMPLEMENTATION OF DRAFT AMENDMENTS TO THE IMSBC CODE  
RELATED TO THE CARRIAGE AND TESTING OF IRON ORE FINES**

1 The Maritime Safety Committee, at its ninety-first session (26 to 30 November 2012), noted that the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC), at its seventeenth session (17 to 21 September 2011), had decided not to finalize a draft schedule for iron ore fines in order to await the outcome of related research, with a view to finalizing the draft schedule(s) and appropriate test methods at DSC 18; and had issued DSC.1/Circ.66/Rev.1 on Carriage of iron ore fines that may liquefy so that it would continue to be applied until the finalization of the schedule(s).

2 In this regard, the Maritime Safety Committee, at its ninety-first session, authorized DSC 18 to issue a DSC circular on early implementation of the draft schedule(s) for iron ore fines, after the Sub-Committee finalizes the draft schedule(s).

3 As instructed, DSC 18 (16 to 20 September 2013) prepared a draft individual schedule for IRON ORE FINES, a draft amendment to the individual schedule for IRON ORE and a draft amendment to appendix 2 to the IMSBC Code for the inclusion of "Modified Proctor/Fagerberg test procedure for iron ore fines", which are expected to be adopted as part of amendment 03-15 to the IMSBC Code by the Maritime Safety Committee, at its ninety-fifth session, in 2015. Therefore, taking into account that the mandatory entry into force date of these amendments would be 1 January 2017, DSC 18 agreed to invite SOLAS Contracting Governments to voluntarily implement the aforementioned draft schedules and test procedure as soon as possible.

4 The draft individual schedule for IRON ORE FINES and the draft revised individual schedule for IRON ORE are set out in annexes 1 and 2 to this circular. The draft new test procedure for determining TML of iron ore fines is set out in annex 3 to this circular.

5 Member Governments are invited to bring this circular to the attention of all concerned.

6 This circular supersedes DSC.1/Circ.66/Rev.1.

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## ANNEX 1

### DRAFT INDIVIDUAL SCHEDULE FOR IRON ORE FINES

#### IRON ORE FINES

The provisions of this schedule shall apply to iron ore cargoes containing both:

- .1 10% or more of fine particles less than 1 mm ( $D_{10} \leq 1$  mm); and
- .2 50% or more of particles less than 10 mm ( $D_{50} \leq 10$  mm).

Notwithstanding the above provision, iron ore fines where the total goethite content is 35% or more by mass may be carried in accordance with the individual schedule for "IRON ORE", provided the master receives from the shipper a declaration of the goethite content of the cargo which has been determined according to internationally or nationally accepted standard procedures.

#### Description

Iron ore fines vary in colour from dark grey, rusty red to yellow and contain hematite, goethite and magnetite with varying iron content.

IRON CONCENTRATE is a different cargo (See individual schedule for "Mineral Concentrates")

#### Characteristics

Angle of repose	Bulk density (kg/m <sup>3</sup> )	Stowage factor (m <sup>3</sup> /t)
Not applicable	1,500 to 3,500	0.29 to 0.67
Size	Class	Group
10% or more of fine particles less than 1 mm and 50% or more of particles less than 10 mm	Not applicable	A

#### Hazard

This cargo may liquefy if shipped at moisture content in excess of its transportable moisture limit (TML). See section 7 of this Code.

This cargo may affect magnetic compasses.

This cargo is non-combustible or has a low fire risk.

#### Stowage and segregation

No special requirements

#### Hold cleanliness

No special requirements

#### Weather precautions

When a cargo is carried in a ship other than a specially constructed or fitted cargo ship complying with the requirements in subsection 7.3.2 of this Code, during loading and unloading operations, the following provisions shall be complied with:

- .1 the moisture content of the cargo shall be kept less than its TML during loading operations and the voyage;
- .2 unless expressly provided otherwise in this individual schedule, the cargo shall not be handled during precipitation;
- .3 unless expressly provided otherwise in this individual schedule, during handling of the cargo, all non-working hatches of the cargo spaces into which the cargo is loaded or to be loaded shall be closed;
- .4 the cargo may be handled during precipitation under the conditions stated in the procedures required in subsection 4.3.3 of this Code; and
- .5 the cargo in a cargo space may be discharged during precipitation provided that the total amount of the cargo in the cargo space is to be discharged in the port.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of the Code. As the density of the cargo is high, due consideration shall be given to ensure that tanktop is not overstressed during voyage and during loading by a pile of the cargo.

### **Precautions**

Loading rates of this cargo are normally very high. Due consideration shall be given to the ballasting operation in developing the loading plan required by SOLAS regulation VI/7.3. Bilge wells shall be clean, dry and protected as appropriate to prevent ingress of the cargo.

### **Ventilation**

No special requirements

### **Carriage**

Cargo hold bilges shall be sounded at regular intervals and pumped out, as necessary. The appearance of the surface of this cargo shall be checked regularly during voyage, as far as practicable. If free water above the cargo or fluid state of the cargo is observed during voyage, the master shall take appropriate actions to prevent cargo shifting and potential capsize of the ship, and give consideration to seeking emergency entry into a place of refuge.

### **Discharge**

No special requirements

### **Clean-up**

No special requirements

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## ANNEX 2

### DRAFT REVISED INDIVIDUAL SCHEDULE FOR IRON ORE

#### IRON ORE

The provisions of this schedule shall apply to iron ore cargoes:

- .1 containing either:
  - .1 less than 10% of fine particles less than 1 mm ( $D_{10} > 1$  mm); or
  - .2 less than 50% of particles less than 10 mm ( $D_{50} > 10$  mm); or
  - .3 both; or
- .2 iron ore fines where the total goethite content is 35% or more by mass, provided the master receives from the shipper a declaration of the goethite content of the cargo which has been determined according to internationally or nationally accepted standard procedures.

#### Description

Iron ore varies in colour from dark grey to rusty red. It varies in iron content from haematite, (high grade ore) to ironstone of the lower commercial ranges. Mineral Concentrates are different cargoes (see IRON CONCENTRATE).

#### Characteristics

Angle of repose	Bulk density (kg/m <sup>3</sup> )	Stowage factor (m <sup>3</sup> /t)
Not applicable	1,250 to 3,500	0.29 to 0.80
Size	Class	Group
Up to 250 mm	Not applicable	C

#### Hazard

No special hazards.

This cargo is non-combustible or has a low fire risk.

Iron ore cargoes may affect magnetic compasses.

#### Stowage and segregation

No special requirements.

#### Hold cleanliness

No special requirements.

#### Weather precautions

No special requirement.

#### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of the Code. As the density of the cargo is extremely high, the tanktop may be overstressed unless the cargo is evenly spread across the tanktop to equalize the weight distribution. Due consideration shall be paid to ensure that tanktop is not overstressed during voyage and during loading by a pile of the cargo.

**Precautions**

Loading rates of this cargo are normally very high. Due consideration shall be given to the ballasting operation to develop the loading plan required by SOLAS regulation VI/7.3. Bilge wells shall be clean, dry and protected as appropriate to prevent ingress of the cargo.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

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## ANNEX 3

### DRAFT NEW TEST PROCEDURE FOR DETERMINING TML OF IRON ORE FINES

#### Appendix 2

*Laboratory test procedures,  
associated apparatus and standards*

## 1 Test procedures for materials which may liquefy and associated apparatus

### 1.4 Modified Proctor/Fagerberg test procedure for Iron Ore Fines

#### 1.4.1 Scope

- .1 The test procedure specified in this section (this test) should only be used for determining transportable moisture limit (TML) of Iron Ore Fines. See individual schedule for Iron Ore Fines.
- .2 Iron Ore Fines is iron ore containing both:
  - .1 10% or more of fine particles less than 1 mm, and
  - .2 50% or more of particles less than 10 mm.
  - .3 The TML of Iron Ore Fines is taken as equal to the critical moisture content at 80% degree of saturation according to the modified Proctor/Fagerberg method test.
  - .4 The test procedure is applicable when the degree of saturation corresponding to Optimum Moisture Content (OMC) is 90% or higher.

#### 1.4.2 Modified Proctor/Fagerberg test equipment

- .1 The Proctor apparatus (see figure 1.4.1) consists of a cylindrical iron mould with a removable extension piece (the compaction cylinder) and a compaction tool guided by a pipe open at its lower end (the compaction hammer).
- .2 Scales and weights (see 3.2) and suitable sample containers.
- .3 A drying oven with a controlled temperature interval from 100°C to maximum 105°C.
- .4 A container for hand mixing. Care should be taken to ensure that the mixing process does not reduce the particle size by breakage or increase the particle size by agglomeration or consistency of the test material.
- .5 A gas or water pycnometry equipment to determine the density of the solid material as per a recognized standard (e.g. ASTM D5550, AS1289, etc.)

### 1.4.3 Temperature and humidity (see 1.1.3)

### 1.4.4 Procedure

#### .1 Establishment of a complete compaction curve

A representative sample according to a relevant standard (see section 4.7 of the IMSBC Code) of the test material is partially dried at a temperature of approximately 60°C or less to reduce the samples moisture to suitable starting moisture, if needed. The representative sample for this test should not be fully dried, except in case of moisture content measurement.

The total quantity of the test material should be at least three times as big as required for the complete test sequence. Compaction tests are executed for five to ten different moisture contents (five to ten separate tests). The samples are adjusted in order that partially dry to almost saturated samples are obtained. The required quantity per compaction test is about 2,000 cm<sup>3</sup>.

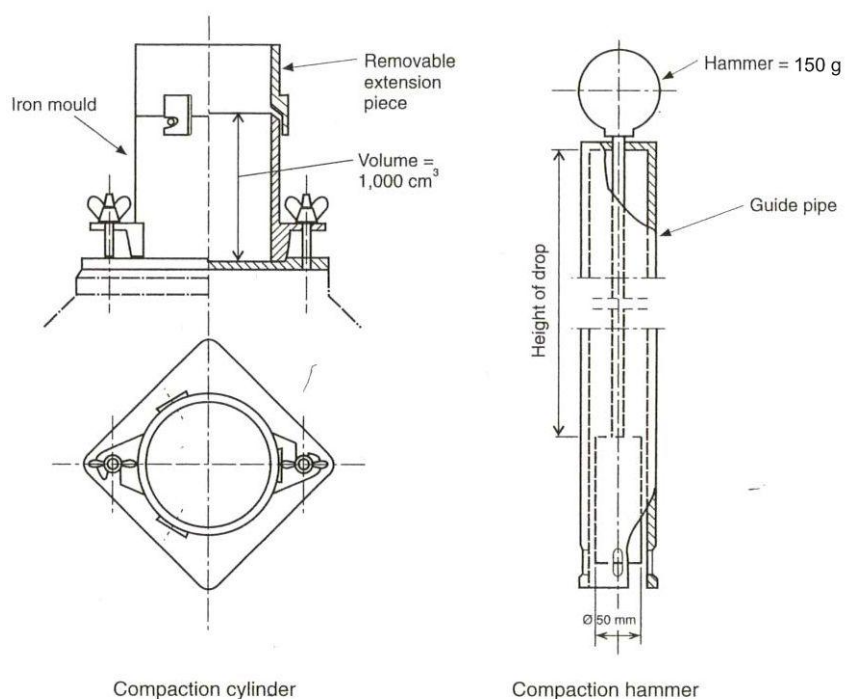


Figure 1.4.1

At each compaction test a suitable amount of water is added to the sample of the test material. The sample material is gently mixed before being allowed to rest and equilibrate. Approximately one fifth of the mixed sample is filled into the mould and levelled and then the increment is tamped uniformly over the surface of the increment. Tamping is executed by dropping a 150 g hammer 25 times through the guide pipe, 0.15 m each time. The performance is repeated for all five layers. When the last layer has been tamped, the extension piece is removed and the sample is levelled off along the brim of the mould with care, ensuring to



remove any large particles that may hinder levelling of the sample, replacing them with material contained in the extension piece and re-levelling.

When the weight of the cylinder with the tamped sample has been determined, the cylinder is emptied, the sample is dried at 105°C and the weight is determined. Reference is made to ISO 3087:2011 "Iron ores -- Determination of the moisture content of a lot". The test then is repeated for the other samples with different moisture contents.

Density of solid material should be measured using a gas or water pycnometry equipment according to internationally or nationally accepted standard, e.g. ASTM D5550 and AS 1289 (see subsection 1.4.2.5).

## .2 Definitions and data for calculations (see figure 1.4.2)

- empty cylinder, mass in grams:  $A$
- cylinder with tamped sample, mass in grams:  $B$
- wet sample, mass in grams:  $C$

$$C = B - A$$

- dry sample, mass in grams:  $D$
- water, mass in grams (equivalent to volume in  $\text{cm}^3$ ):  $E$

$$E = C - D$$

Volume of cylinder:  $1000 \text{ cm}^3$

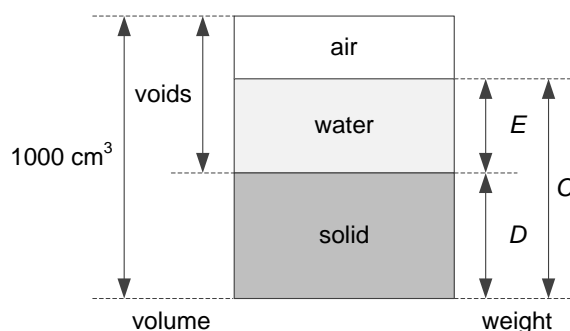


Figure 1.4.2

## .3 Calculation of main characteristics

- density of solid material,  $\text{g/cm}^3$  ( $\text{t/m}^3$ ):  $d$
- dry bulk density,  $\text{g/cm}^3$  ( $\text{t/m}^3$ ):  $\gamma$

$$\gamma = \frac{D}{1000}$$

- net water content, volume %:  $e_v$

$$e_v = \frac{E}{D} \times 100 \times d$$

- void ratio:  $e$  (volume of voids divided by volume of solids)

$$e = \frac{d}{\gamma} - 1$$

- degree of saturation, percentage by volume:  $S$

$$S = \frac{e_v}{e}$$

- gross water content, percentage by mass:  $W^1$

$$W^1 = \frac{E}{C} \times 100$$

- net water content, percentage by mass:  $W$

$$W = \frac{E}{D} \times 100$$

#### .4 Presentation of the compaction tests

For each compaction test the calculated void ratio ( $e$ ) value is plotted as the ordinate in a diagram with net water content ( $e_v$ ) and degree of saturation ( $S$ ) as the respective abscissa parameters.

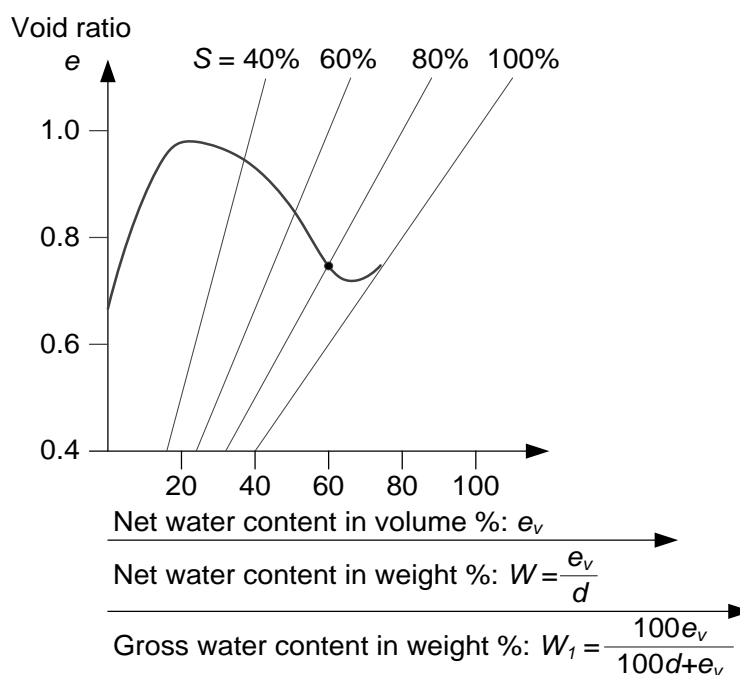


Figure 1.4.3

**.5      Compaction curve**

The test sequence results in a specific compaction curve (see figure 1.4.3).

The critical moisture content is indicated by the intersection of the compaction curve and the line  $S = 80\%$  degree of saturation. The transportable moisture limit (TML) is the critical moisture content.

Optimum Moisture Content (OMC) is the moisture content corresponding to the maximum compaction (maximum dry density) under the specified compaction condition. To check the applicability of this test, the relationship between moisture content and dry density should be evaluated, during this test. Then the OMC and the corresponding degree of saturation should be determined. This test procedure was developed based on the finding that the degree of saturation corresponding to OMC of iron ore fines was 90 to 95%, while such degree of saturation of mineral concentrates was 70 to 75%. In the case that the degree of saturation corresponding to OMC is less than 90%, the shipper should consult with an appropriate authority, for the reason that this test may not be applicable for the material and the TML determined by this test may be too high."

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