

ANNEX

**AMENDMENTS TO THE INTERNATIONAL MARITIME SOLID BULK CARGOES (IMSBC)  
CODE  
AMENDMENT 05-19**

**(Consolidated version of the IMSBC Code)**

The complete text of the IMSBC Code is replaced by the following:

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## General provisions

### 1.1 Introductory note

It should be noted that other international and national regulations exist and that those regulations may recognize all or part of the provisions of this Code. In addition, port authorities and other bodies and organizations should recognize the Code and may use it as a basis for their storage and handling by-laws within loading and discharge areas.

### 1.2 Cargoes listed in this Code

1.2.1 Typical cargoes currently shipped in bulk, together with advice on their properties and methods of handling, are given in the schedules for individual cargoes. However, these schedules are not exhaustive and the properties attributed to the cargoes are given only for guidance. Consequently, before loading, it is essential to obtain current valid information from the shipper on the physical and chemical properties of the cargoes presented for shipment. The shipper shall provide appropriate information about the cargo to be shipped (see 4.2).

1.2.2 Where a solid bulk cargo is specifically listed in appendix 1 to this Code (individual schedules for solid bulk cargoes), it shall be transported in accordance with the provisions in its schedule in addition to the provisions in sections 1 to 10 and 11.1.1 of this Code. The master shall consider whether to consult the authorities at the ports of loading and discharge, as necessary, concerning the requirements which may be in force and applicable for the carriage.

### 1.3 Cargoes not listed in this Code

1.3.1 If a solid cargo which is not listed in appendix 1 to this Code is proposed for carriage in bulk, the shipper shall, prior to loading, provide the competent authority of the port of loading with the characteristics and properties of the cargo in accordance with section 4 of this Code. Based on the information received, the competent authority will assess the acceptability of the cargo for safe shipment.

1.3.1.1 When it is assessed that the solid bulk cargo proposed for carriage may present hazards as those defined by group A or B of this Code as defined in 1.7, advice is to be sought from the competent authorities of the port of unloading and of the flag State. The three competent authorities will set the preliminary suitable conditions for the carriage of this cargo.

1.3.1.2 When it is assessed that the solid bulk cargo proposed for carriage presents no specific hazards for transportation, the carriage of this cargo shall be authorized. The competent authorities of the port of unloading and of the flag State shall be advised of that authorization.

1.3.2 The competent authority of the port of loading shall provide to the master a certificate stating the characteristics of the cargo and the required conditions for carriage and handling of this shipment. The competent authority of the port of loading shall also submit an application to the Organization, within one year from the issue of the certificate, to incorporate this solid bulk cargo into appendix 1 of this Code. The format of this application shall be as outlined in 1.3.3.

#### 1.3.3 Format for the properties of cargoes not listed in this Code and conditions of the carriage

**Tentative bulk cargo shipping name** (in capital letters)

**Description** (Describe the cargo)

**Characteristics** (Fill the following table)

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
|                              |                             |  |   |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
|                              |                             |  |   |

**Hazard** (Clarify the hazard of carriage of the cargo)

(Determine the following types of requirements. If no requirement is necessary, write "No special requirements")

**Stowage and segregation**

**Hold cleanliness**

**Weather precautions**

**Loading**

**Precautions**

**Ventilation**

**Carriage**

**Discharge**

**Clean-up**

(Specify the emergency procedures for the cargo, if necessary)

**Emergency procedures**

|   |
|---|
| <b>Special emergency equipment to be carried</b>  |
| <b>Emergency procedures</b><br><b>Emergency action in the event of fire</b><br><b>Medical first aid</b> |

**1.4 Application and implementation of this Code**

1.4.1 The provisions contained in this Code apply to all ships to which the SOLAS Convention, as amended, applies and that are carrying solid bulk cargoes as defined in regulation 1-1 of part A of chapter VI of the Convention.

1.4.2 Although this Code is legally treated as a mandatory instrument under the SOLAS Convention, the following provisions of this Code remain recommendatory or informative:

Section 11 Security provisions (except 11.1.1);

Section 12 Stowage factor conversion tables;

Section 13 References to related information and recommendations;

Appendices other than appendix 1 (Individual schedules of solid bulk cargoes) and appendix 5 (Bulk Cargo Shipping Names in three languages (English, French and Spanish)); and

The texts in the sections for "Description", "Characteristics (other than Hazard classification)", "Hazard" and "Emergency procedures" of individual schedules of solid bulk cargoes in appendix 1.

1.4.3 In certain parts of this Code, a particular action is prescribed, but the responsibility for carrying out the action has not been specifically assigned to any particular person. Such responsibility may vary according to the laws and customs of different countries and the international conventions into which these countries have entered. For the purpose of this Code, it is not necessary to make this assignment, but only to identify the action itself. It remains the prerogative of each Government to assign this responsibility.

## **1.5 Exemptions and equivalent measures**

1.5.1 Where this Code requires that a particular provision for the transport of solid bulk cargoes shall be complied with, a competent authority or competent authorities (port State of departure, port State of arrival or flag State) may authorize any other provision by exemption if satisfied that such provision is at least as effective and safe as that required by this Code. Acceptance of an exemption authorized under this section by a competent authority not party to it is subject to the discretion of that competent authority. Accordingly, prior to any shipment covered by the exemption, the recipient of the exemption shall notify other competent authorities concerned.

1.5.2 A competent authority or competent authorities which have taken the initiative with respect to the exemption:

.1 shall send a copy of such exemption to the Organization, which shall bring it to the attention of the Contracting Parties to SOLAS; and

.2 shall take action to amend this Code to include the provisions covered by the exemption, as appropriate.

1.5.3 The period of validity of the exemption shall be not more than five years from the date of authorization. An exemption that is not covered under 1.5.2.2 may be renewed in accordance with the provisions of this section.

1.5.4 A copy of the exemption or an electronic copy thereof shall be maintained on board each ship transporting solid bulk cargoes in accordance with the exemption, as appropriate.

1.5.5 Contact information for the main designated national competent authorities concerned is given in the separate document issued by the Organization.

## **1.6 Conventions**

Parts A and B of chapter VI and part A-1 of chapter VII of the SOLAS Convention, as amended, deal with the carriage of solid bulk cargoes and the carriage of dangerous goods in solid form in bulk, respectively, and only the relevant parts are reproduced below. This extract incorporates amendments that entered into force on 1 January 2011.

### **"Chapter VI**

#### **Carriage of cargoes and oil fuels**

##### **Part A**

##### *General provisions*

#### **Regulation 1**

##### *Application*

1 Unless expressly provided otherwise, this chapter applies to the carriage of cargoes (except liquids in bulk, gases in bulk and those aspects of carriage covered by other chapters) which, owing to their particular hazards to ships or persons on board, may require special precautions in all ships to which the present regulations apply and in cargo ships of less than 500 gross tonnage. However, for cargo ships of less than 500 gross tonnage, the Administration, if it considers that the sheltered nature and conditions of voyage are such as to render the application of any specific requirements of part A or B of this chapter unreasonable or unnecessary, may take other effective measures to ensure the required safety for these ships.

2 To supplement the provisions of parts A and B of this chapter, each Contracting Government shall ensure that appropriate information on cargo and its stowage and securing is provided, specifying, in particular, precautions necessary for the safe carriage of such cargoes.

#### **Regulation 1-1**

##### *Definitions*

For the purpose of this chapter, unless expressly provided otherwise, the following definitions shall apply:

1 *IMSBC Code* means the International Maritime Solid Bulk Cargoes (IMSBC) Code adopted by the Maritime Safety Committee of the Organization by resolution MSC.268(85), as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the annex other than chapter I.

2 *Solid bulk cargo* means any cargo, other than liquid or gas, consisting of a combination of particles, granules or any larger pieces of material generally uniform in composition, which is loaded directly into the cargo spaces of a ship without any intermediate form of containment.

#### **Regulation 1-2**

##### *Requirements for the carriage of solid bulk cargoes other than grain*

The carriage of solid bulk cargoes other than grain shall be in compliance with the relevant provisions of the IMSBC Code.

## **Regulation 2**

### *Cargo information*

1 The shipper shall provide the master or his representative with appropriate information on the cargo sufficiently in advance of loading to enable the precautions which may be necessary for proper stowage and safe carriage of the cargo to be put into effect. Such information shall be confirmed in writing and by appropriate shipping documents prior to loading the cargo on the ship.

2 The cargo information shall include:

- .1 in the case of general cargo, and of cargo carried in cargo units, a general description of the cargo, the gross mass of the cargo or of the cargo units, and any relevant special properties of the cargo. For the purpose of this regulation the cargo information required in sub-chapter 1.9 of the Code of Safe Practice for Cargo Stowage and Securing, adopted by the Organization by resolution A.714(17), as may be amended, shall be provided. Any such amendment to sub-chapter 1.9 shall be adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the annex other than chapter I;
- .2 in the case of solid bulk cargo, information as required by section 4 of the IMSBC Code.

3 Prior to loading cargo units on board ships, the shipper shall ensure that the gross mass of such units is in accordance with the gross mass declared on the shipping documents.

## **Regulation 3**

### *Oxygen analysis and gas detection equipment*

1 When transporting a solid bulk cargo which is liable to emit a toxic or flammable gas, or cause oxygen depletion in the cargo space, an appropriate instrument for measuring the concentration of gas or oxygen in the air shall be provided together with detailed instructions for its use. Such an instrument shall be to the satisfaction of the Administration.

2 The Administration shall take steps to ensure that crews of ships are trained in the use of such instruments.

## **Regulation 4**

### *The use of pesticides in ships*

Appropriate precautions shall be taken in the use of pesticides in ships, in particular for the purposes of fumigation.

## **Regulation 5**

### *Stowage and securing*

1 Cargo, cargo units and cargo transport units carried on or under deck shall be so loaded, stowed and secured as to prevent as far as is practicable, throughout the voyage, damage or hazard to the ship and the persons on board, and loss of cargo overboard.

2 Cargo, cargo units and cargo transport units shall be so packed and secured within the unit as to prevent, throughout the voyage, damage or hazard to the ship and the persons on board.

3 Appropriate precautions shall be taken during loading and transport of heavy cargoes or cargoes with abnormal physical dimensions to ensure that no structural damage to the ship occurs and to maintain adequate stability throughout the voyage.

4 Appropriate precautions shall be taken during loading and transport of cargo units and cargo transport units on board ro-ro ships, especially with regard to the securing arrangements on board such ships and on the cargo units and cargo transport units and with regard to the strength of the securing points and lashings.

5 Freight containers shall not be loaded to more than the maximum gross weight indicated on the Safety Approval Plate under the International Convention for Safe Containers (CSC), as amended.

6 All cargoes, other than solid and liquid bulk cargoes, cargo units and cargo transport units, shall be loaded, stowed and secured throughout the voyage in accordance with the Cargo Securing Manual approved by the Administration. In ships with ro-ro spaces, as defined in regulation II-2/3.41, all securing of such cargoes, cargo units, and cargo transport units, in accordance with the Cargo Securing Manual, shall be completed before the ship leaves the berth. The Cargo Securing Manual shall be drawn up to a standard at least equivalent to relevant guidelines developed by the Organization.

## **Part B**

### *Special provisions for solid bulk cargoes*

#### **Regulation 6**

##### *Acceptability for shipment*

1 Prior to loading a solid bulk cargo, the master shall be in possession of comprehensive information on the ship's stability and on the distribution of cargo for the standard loading conditions. The method of providing such information shall be to the satisfaction of the Administration.

#### **Regulation 7**

##### *Loading, unloading and stowage of solid bulk cargoes*

1 For the purpose of this regulation, *terminal representative* means a person appointed by the terminal or other facility, where the ship is loading or unloading, who has responsibility for operations conducted by that terminal or facility with regard to the particular ship.

2 To enable the master to prevent excessive stresses in the ship's structure, the ship shall be provided with a booklet, which shall be written in a language with which the ship's officers responsible for cargo operations are familiar. If this language is not English, the ship shall be provided with a booklet written also in the English language. The booklet shall, as a minimum, include:

- .1 stability data, as required by regulation II-1/5-1;
- .2 ballasting and deballasting rates and capacities;
- .3 maximum allowable load per unit surface area of the tank top plating;
- .4 maximum allowable load per hold;

- .5 general loading and unloading instructions with regard to the strength of the ship's structure including any limitations on the most adverse operating conditions during loading, unloading, ballasting operations and the voyage;
- .6 any special restrictions such as limitations on the most adverse operating conditions imposed by the Administration or organization recognized by it, if applicable; and
- .7 where strength calculations are required, maximum permissible forces and moments on the ship's hull during loading, unloading and the voyage.

3 Before a solid bulk cargo is loaded or unloaded, the master and the terminal representative shall agree on a plan which shall ensure that the permissible forces and moments on the ship are not exceeded during loading or unloading, and shall include the sequence, quantity and rate of loading or unloading, taking into consideration the speed of loading or unloading, the number of pours and the deballasting or ballasting capability of the ship. The plan and any subsequent amendments thereto shall be lodged with the appropriate authority of the port State.

4 The master and terminal representative shall ensure that loading and unloading operations are conducted in accordance with the agreed plan.

5 If during loading or unloading any of the limits of the ship referred to in paragraph 2 are exceeded or are likely to become so if the loading or unloading continues, the master has the right to suspend operation and the obligation to notify accordingly the appropriate authority of the port State with which the plan has been lodged. The master and the terminal representative shall ensure that corrective action is taken. When unloading cargo, the master and terminal representative shall ensure that the unloading method does not damage the ship's structure.

6 The master shall ensure that the ship's personnel continuously monitor cargo operations. Where possible, the ship's draught shall be checked regularly during loading or unloading to confirm the tonnage figures supplied. Each draught and tonnage observation shall be recorded in a cargo logbook. If significant deviations from the agreed plan are detected, cargo or ballast operations or both shall be adjusted to ensure that the deviations are corrected.

## **Chapter VII**

### **Carriage of dangerous goods**

#### **Part A-1**

#### *Carriage of dangerous goods in solid form in bulk*

#### **Regulation 7**

##### *Definitions*

*Dangerous goods in solid form in bulk* means any material, other than liquid or gas, consisting of a combination of particles, granules or any larger pieces of material, generally uniform in composition, which is covered by the IMDG Code and is loaded directly into the cargo spaces

of a ship without any intermediate form of containment, and includes such materials loaded in a barge on a barge-carrying ship.



### **Regulation 7-1**

#### *Application*

1 Unless expressly provided otherwise, this part applies to the carriage of dangerous goods in solid form in bulk in all ships to which the present regulations apply and in cargo ships of less than 500 gross tonnage.

2 The carriage of dangerous goods in solid form in bulk is prohibited except in accordance with the provisions of this part.

3 To supplement the provisions of this part, each Contracting Government shall issue, or cause to be issued, instructions on emergency response and medical first aid relevant to incidents involving dangerous goods in solid form in bulk, taking into account the guidelines developed by the Organization.

### **Regulation 7-2**

#### *Documents*

1 In all documents relating to the carriage of dangerous goods in solid form in bulk by sea, the bulk cargo shipping name of the goods shall be used (trade names alone shall not be used).

2 Each ship carrying dangerous goods in solid form in bulk shall have a special list or manifest setting forth the dangerous goods on board and the location thereof. A detailed stowage plan, which identifies by class and sets out the location of all dangerous goods on board, may be used in place of such a special list or manifest. A copy of one of these documents shall be made available before departure to the person or organization designated by the port State authority.

### **Regulation 7-3**

#### *Stowage and segregation requirements*

1 Dangerous goods in solid form in bulk shall be loaded and stowed safely and appropriately in accordance with the nature of the goods. Incompatible goods shall be segregated from one another.

2 Dangerous goods in solid form in bulk, which are liable to spontaneous heating or combustion, shall not be carried unless adequate precautions have been taken to minimize the likelihood of the outbreak of fire.

3 Dangerous goods in solid form in bulk, which give off dangerous vapours, shall be stowed in a well-ventilated cargo space.

### **Regulation 7-4**

#### *Reporting of incidents involving dangerous goods*

1 When an incident takes place involving the loss or likely loss overboard of dangerous goods in solid form in bulk into the sea, the master, or other person having charge of the ship, shall report the particulars of such an incident without delay and to the fullest extent possible to the nearest coastal State. The report shall be drawn up based on general principles and guidelines developed by the Organization.

2 In the event of the ship referred to in paragraph 1 being abandoned, or in the event of a report from such a ship being incomplete or unobtainable, the company, as defined in

regulation IX/1.2, shall, to the fullest extent possible, assume the obligations placed upon the master by this regulation.

### **Regulation 7-5**

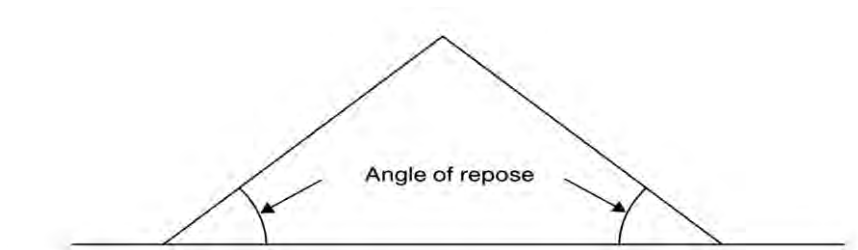
#### *Requirements for the carriage of dangerous goods in solid form in bulk*

The carriage of dangerous goods in solid form in bulk shall be in compliance with the relevant provisions of the IMSBC Code, as defined in regulation VI/1-1.1."

### **1.7 Definitions**

For the purpose of this Code, unless expressly provided otherwise, the following definitions shall apply:

*Angle of repose* means the maximum slope angle of non-cohesive (i.e. free-flowing) granular material. It is measured as the angle between a horizontal plane and the cone slope of such material.



*Bulk Cargo Shipping Name (BCSN)* identifies a bulk cargo during transport by sea. When a cargo is listed in this Code, the Bulk Cargo Shipping Name of the cargo is identified by capital letters in the individual schedules or in the index. When a cargo is dangerous goods as defined in the IMDG Code, as defined in regulation VII/1.1 of the SOLAS Convention, refer to 4.1.1.

*Bulk density* means the weight of solids, air and water per unit volume. Bulk density is expressed in kilograms per cubic metre ( $\text{kg/m}^3$ ), in general. The void spaces in the cargo may be filled with air and water.

*Cargo space* means any space in a ship designated for carriage of cargoes.

*Cargoes which may liquefy* means cargoes which contain a certain proportion of fine particles and a certain amount of moisture. They may liquefy if shipped with a moisture content in excess of their transportable moisture limit.

*Cohesive material* means materials other than non-cohesive materials.

*Competent authority* means any national regulatory body or authority designated or otherwise recognized as such for any purpose in connection with this Code. The competent authority shall operate independently from the shipper.

*Concentrates* means materials obtained from a natural ore by a process of enrichment or beneficiation by physical or chemical separation and removal of unwanted constituents.

*Consignment* means a solid bulk cargo presented by a shipper for transport.

*Flow moisture point* means the percentage moisture content (wet mass basis) at which a flow state develops under the prescribed method of test in a representative sample of the material (see paragraph 1 of appendix 2).

*Flow state* means a state occurring when a mass of granular material is saturated with liquid to an extent that, under the influence of prevailing external forces such as vibration, impact or ship's motion, it loses its internal shear strength and behaves as a liquid.

*GHS* means the seventh revised edition of the Globally Harmonized System of Classification and Labelling of Chemicals, published by the United Nations as document ST/SG/AC.10/30/Rev.7.

*Group A* consists of cargoes which may liquefy if shipped at a moisture content in excess of their transportable moisture limit.

*Group B* consists of cargoes which possess a chemical hazard which could give rise to a dangerous situation on a ship.

*Group C* consists of cargoes which are neither liable to liquefy (group A) nor to possess chemical hazards (group B).

*High-density solid bulk cargo* means a solid bulk cargo with a stowage factor of 0.56 m<sup>3</sup>/t or less.

*IMDG Code* means the International Maritime Dangerous Goods (IMDG) Code adopted by the Maritime Safety Committee of the Organization by resolution MSC.122(75), as may be amended by the Organization.

*Incompatible materials* means materials that may react dangerously when mixed. They are subject to the segregation requirements of 9.3 and the schedules for individual cargoes classified in group B.

*International Ship and Port Facility Security (ISPS) Code* means the International Code for the Security of Ships and of Port Facilities, consisting of Part A (the provisions of which shall be treated as mandatory) and Part B (the provisions of which shall be treated as recommendatory), as adopted, on 12 December 2002, by resolution 2 of the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974, as may be amended by the Organization.

*Manual of Tests and Criteria* means the sixth revised edition of the United Nations publication entitled "Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria" (ST/SG/AC.10/11/ Rev.6/Amendment 1).

*Materials hazardous only in bulk (MHB)* means materials which may possess chemical hazards when carried in bulk other than materials classified as dangerous goods in the IMDG Code.

*Moisture content* means that portion of a representative sample consisting of water, ice or other liquid expressed as a percentage of the total wet mass of that sample.

*Moisture migration* means the movement of moisture contained in a cargo by settling and consolidation of the cargo due to vibration and ship's motion. Water is progressively displaced, which may result in some portions or all of the cargo developing a flow state.

*Non-cohesive material* means dry materials that readily shift due to sliding during transport, as listed in appendix 3, paragraph 1, "Properties of dry bulk cargoes".

*Potential sources of ignition* means, but is not limited to, open fires, machinery exhausts, galley uptakes, electrical outlets and electrical equipment unless they are of certified safe type.

*Representative test sample* means a sample of sufficient quantity for the purpose of testing the physical and chemical properties of the consignment to meet specified requirements.

*Shipper* means any person by whom or in whose name, or on whose behalf, a contract of carriage of goods by sea has been concluded with a carrier, or any person by whom or in whose name, or on whose behalf, the goods are actually delivered to the carrier in relation to the contract of carriage by sea.

*Solid bulk cargo* means any cargo, other than a liquid or a gas, consisting of a combination of particles, granules or any larger pieces of material generally uniform in composition which is loaded directly into the cargo spaces of a ship without any intermediate form of containment.

*Sources of heat* means heated ship structures, where the surface temperature is liable to exceed 55°C. Examples of such heated structures are steam pipes, heating coils, top or side walls of heated fuel and cargo tanks, and bulkheads of machinery spaces.

*Stowage factor* means the figure which expresses the number of cubic metres which one tonne of cargo will occupy.

*Transportable moisture limit (TML)* of a cargo which may liquefy means the maximum moisture content of the cargo which is considered safe for carriage in ships not complying with the special provisions of 7.3.2. It is determined by the test procedures, approved by a competent authority, such as those specified in paragraph 1 of appendix 2.

*Trimming* means any levelling of a cargo within a cargo space, either partial or total.

*Ventilation* means exchange of air from outside to inside a cargo space.

- .1 *Continuous ventilation* means ventilation that is operating at all times.
- .2 *Mechanical ventilation* means power-generated ventilation.
- .3 *Natural ventilation* means ventilation that is not power-generated.
- .4 *Surface ventilation* means ventilation of the space above the cargo.

## Section 2

### General loading, carriage and unloading precautions

#### 2.1 Cargo distribution

##### 2.1.1 General

A number of accidents have occurred as a result of improper loading and unloading of solid bulk cargoes. It shall be noted that solid bulk cargoes have to be properly distributed throughout the ship to provide adequate stability and to ensure that the ship's structure is never overstressed. Furthermore, the shipper shall provide the master with adequate information about the cargo, as specified in section 4, to ensure that the ship is properly loaded.

##### 2.1.2 To prevent the structure being overstressed

A general cargo ship is normally constructed to carry cargoes in the range of 1.39 to 1.67 cubic metres per tonne when loaded to full bale and deadweight capacities. When loading a high-density solid bulk cargo, particular attention shall be given to the distribution of weights to avoid excessive stresses, taking into account that the loading conditions may be different from those found normally and that improper distribution of such cargo may be capable of stressing either the structure under the load or the entire hull. To set out exact rules for the distribution of loading is not practicable for all ships because the structural arrangements of each vessel may vary greatly. The information on proper distribution of cargo may be provided in the ship's stability information booklet or may be obtained by the use of loading calculators, if available.

##### 2.1.3 To aid stability

2.1.3.1 Having regard to SOLAS regulation II-1/5-1, a stability information booklet shall be provided aboard all ships subject to the Convention. The master shall be able to calculate the stability for the anticipated worst conditions during the voyage, as well as that on departure, and demonstrate that the stability is adequate.

2.1.3.2 Shifting divisions and bins, of adequate strength, shall be erected whenever solid bulk cargoes, which are suspected of readily shifting, are carried in 'tween-deck cargo spaces or in only partially filled cargo spaces.

2.1.3.3 As far as practicable, high-density cargoes shall be loaded in the lower hold cargo spaces in preference to 'tween-deck cargo spaces.

2.1.3.4 When it is necessary to carry high-density cargoes in 'tween-decks or higher cargo spaces, due consideration shall be given to ensure that the deck area is not overstressed and that the ship's stability is not reduced below the minimum acceptable level specified in the ship's stability data.

## **2.2 Loading and unloading**

2.2.1 Cargo spaces shall be inspected and prepared for the particular cargo which is to be loaded.

2.2.2 Due consideration shall be given to bilge wells and strainer plates, for which special preparation is necessary, to facilitate drainage and to prevent entry of the cargoes into the bilge system.

2.2.3 Bilge lines, sounding pipes and other service lines within the cargo space shall be in good order.

2.2.4 Because of the velocity at which some high-density solid bulk cargoes are loaded, special care may be necessary to protect cargo space fittings from damage. To sound bilges after the completion of loading may be effective to detect damage on cargo space fittings.

2.2.5 As far as practicable, ventilation systems shall be shut down or screened and air conditioning systems placed on recirculation during loading or discharge, to minimize dust ingress into the living quarters or other interior spaces.

2.2.6 Due consideration shall be given to minimize the extent to which dust may come into contact with moving parts of deck machinery and external navigational aids.

## Section 3

### Safety of personnel and ship

#### 3.1 General requirements

3.1.1 Prior to and during loading, carriage and discharge of a solid bulk cargo, all necessary safety precautions shall be observed.

3.1.2 Routine onboard operational fire safety risk assessments shall be carried out by the ship's crew for cargo handling areas on self-unloading bulk carriers featuring internally installed conveyor systems within the ship's structure. Due consideration shall be given to fire prevention and the effective operation of fire detection systems, containment and suppression under all anticipated operating conditions and cargoes. The fire safety risk assessments shall be detailed in the ship's Safety Management System (SMS) together with a recommended timing to provide regular assessments.

3.1.3 A copy of the instructions on emergency response and medical first aid relevant to incidents involving dangerous goods in solid form in bulk shall be on board.

#### 3.2 Poisoning, corrosive and asphyxiation hazards

3.2.1 Some solid bulk cargoes are susceptible to oxidation, which may result in oxygen depletion, emission of toxic gases or fumes and self-heating. Some cargoes are not liable to oxidize but may emit toxic fumes, particularly when wet. There are also cargoes which, when wetted, are corrosive to skin, eyes and mucous membranes or to the ship's structure. When these cargoes are carried, particular attention shall be given to protection of personnel and the need for special precautions to be taken prior to loading and after unloading.

3.2.2 Appropriate attention shall be given that cargo spaces and adjacent spaces may be depleted in oxygen or may contain toxic or asphyxiating gases, and that an empty cargo space or tank which has remained closed for some time may have insufficient oxygen to support life.

3.2.3 Many solid bulk cargoes are liable to cause oxygen depletion in a cargo space or tank. These include, but are not limited to, most vegetable products and forest products, ferrous metals, metal sulphide concentrates and coal cargoes.

3.2.4 Prior to entry into an enclosed space aboard a ship, appropriate procedures shall be followed taking into account the recommendations developed by the Organization. It is to be noted that, after a cargo space or tank has been tested and generally found to be safe for entry, small areas may exist where oxygen is deficient or toxic fumes are still present.

3.2.5 When carrying a solid bulk cargo that is liable to emit a toxic or flammable gas, and/or cause oxygen depletion in the cargo space, the appropriate instrument(s) for measuring the concentration of gas and oxygen in the cargo space shall be provided.

3.2.6 Emergency entry into a cargo space shall be undertaken only by trained personnel wearing self-contained breathing apparatus and protective clothing and always under the supervision of a responsible officer.

#### 3.3 Health hazards due to dust

To minimize the chronic and acute risks associated with exposure to the dust of some solid bulk cargoes, the need for a high standard of personal hygiene of those exposed to the dust cannot be overemphasized. Precautions, including the use of appropriate breathing protection,

protective clothing, protective skin creams, adequate personal washing and laundering of outer clothing, shall be taken as necessary.

### **3.4 Flammable atmosphere**

3.4.1 Dust of some solid bulk cargoes may constitute an explosion hazard, especially while loading, unloading and cleaning. This risk can be minimized by ventilating to prevent the formation of a dust-laden atmosphere and by hosing down rather than sweeping.

3.4.2 Some cargoes may emit flammable gases in sufficient quantities to constitute a fire or explosion hazard. Where this is indicated in the cargo schedule in this Code or by the cargo information provided by the shipper, the cargo spaces shall be effectively ventilated as necessary. The atmosphere in the cargo spaces shall be monitored by means of an appropriate gas detector. Due consideration shall be given to the ventilation and monitoring of the atmosphere in the enclosed spaces adjacent to the cargo spaces.

### **3.5 Ventilation**

3.5.1 Unless expressly provided otherwise, when cargoes which may emit toxic gases are carried, the cargo spaces shall be provided with mechanical or natural ventilation; and, when cargoes which may emit flammable gases are carried, the cargo spaces shall be provided with mechanical ventilation.

3.5.2 If maintaining ventilation would endanger the ship or the cargo, it may be interrupted unless this would produce a risk of explosion.

3.5.3 When continuous ventilation is required by the schedule for the cargo in this Code or by the cargo information provided by the shipper, ventilation shall be maintained while the cargo is on board, unless a situation develops where ventilation would endanger the ship.

3.5.4 Ventilation openings shall be provided in holds intended for the carriage of cargoes that require continuous ventilation. Such openings shall comply with the requirements of the Load Line Convention, as amended, for openings not fitted with means of closure.

3.5.5 Ventilation shall be such that any escaping hazardous gases, vapours or dust cannot enter the accommodation or other interior spaces in hazardous concentrations. Due consideration shall be given to prevent escaping hazardous gases, vapours or dust from reaching enclosed work areas. Adequate precautions shall be taken to protect the personnel in these work areas.

3.5.6 When a cargo may heat spontaneously, ventilation other than surface ventilation shall not be applied. On no account shall air be directed into the body of the cargo.

### **3.6 Cargo under in-transit fumigation**

3.6.1 Fumigation shall be performed based on the recommendations developed by the Organization.

3.6.2 When a fumigant is used, such as phosphine gas, for fumigation-in-transit, due consideration shall be given to the severe toxicity of fumigants, taking into account that fumigants may enter into occupied spaces despite many precautions taken. In particular, in the case that fumigant leaks from a cargo hold under fumigation, the possibility should be kept in mind that it may enter the engine-room via pipe tunnels, ducts, and piping of any kind, including wiring ducts on or below deck, or dehumidifier systems that may be connected to parts of the cargo hold or compartments of the engine-room. Attention shall be given to



potential problem areas such as bilge and cargo line systems and valves. In all cases, ventilation procedures on board the ship during the voyage should be scrutinized with regard to the possibility of drawing in the fumigant gas such as by incorrect ventilation procedures and settings, vacuum creation due to incorrect closing devices or flap settings, air conditioning and closed loop ventilation of the accommodation. Prior to commencement of fumigation procedures, it should be verified that ventilation flaps and closing devices are set correctly and that means of closing and sealing of all the bulkhead openings (such as doors and manholes) leading from the engine-room to piping tunnels/duct keels and other spaces that in case of leaks could become unsafe to enter during the fumigation are effective, confirmed closed and have warning signs posted.

3.6.3. Gas concentration safety checks shall also be continued throughout the voyage at least at eight-hour intervals or more frequently if so advised by the fumigator-in-charge at all appropriate locations, which shall at least include: accommodation; engine-rooms; areas designated for use in navigation of the ship; and frequently visited working areas and stores, such as the forecastle head spaces, adjacent to cargo holds being subject to fumigation in transit. Special attention shall also be given to potential problem areas such as bilge and cargo line systems. These readings shall be recorded in the ship's logbook.

## Section 4

### Assessment of acceptability of consignments for safe shipment

#### 4.1 Identification and classification

##### 4.1.1 Bulk Cargo Shipping Name

4.1.1.1 Each solid bulk cargo in this Code has been assigned a Bulk Cargo Shipping Name (BCSN). When a solid bulk cargo is carried by sea it shall be identified in the transport documentation by the BCSN.

4.1.1.2 Where the cargo is dangerous goods and not identified with a generic Proper Shipping Name, or not otherwise specified (N.O.S) in the IMDG Code, the BCSN shall consist of the Proper Shipping Name followed by the UN number.

4.1.1.3 Except for RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile-excepted UN 2912, RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I), non-fissile or fissile-excepted UN 2913 and ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. UN 3077, where the cargo is dangerous goods identified with a generic Proper Shipping Name and/or not otherwise specified (N.O.S) in the IMDG Code, the BCSN shall consist of, in the following order:

- .1 a chemical or technical name of the material;
- .2 a specific description to identify the properties of the material; and
- .3 the UN number.

4.1.2 If waste cargoes are being transported for disposal, or for processing for disposal, the name of the cargoes shall be preceded by the word "WASTE".

4.1.3 Correct identification of a solid bulk cargo facilitates identification of the conditions necessary to safely carry the cargo and the emergency procedures, if applicable.

4.1.4 Solid bulk cargoes shall be classified, where appropriate, in accordance with the UN Manual of Tests and Criteria, part III. The various properties of a solid bulk cargo required by this Code shall be determined, as appropriate to that cargo, in accordance with the test procedures approved by a competent authority in the country of origin, when such test procedures exist. In the absence of such test procedures, those properties of a solid bulk cargo shall be determined, as appropriate to that cargo, in accordance with the test procedures prescribed in appendix 2 to this Code.

#### 4.2 Provision of information

4.2.1 The shipper shall provide the master or his representative with appropriate information on the cargo sufficiently in advance of loading to enable the precautions which may be necessary for proper stowage and safe carriage of the cargo to be put into effect.

4.2.2 Cargo information shall be confirmed in writing and by appropriate shipping documents prior to loading. The cargo information shall include:

- .1 the BCSN when the cargo is listed in this Code. Secondary names may be used in addition to the BCSN;
- .2 the cargo group (A and B, A, B or C);

- .3 the IMO class of the cargo, if applicable;
- .4 the UN number preceded by letters "UN" for the cargo, if applicable;
- .5 the total quantity of the cargo offered;
- .6 the stowage factor;
- .7 the need for trimming and the trimming procedures, as necessary;
- .8 the likelihood of shifting, including angle of repose, if applicable;
- .9 additional information in the form of a certificate on the moisture content of the cargo and its transportable moisture limit in the case of a concentrate or other cargo which may liquefy;
- .10 likelihood of formation of a wet base (see 7.2.3 of this Code);
- .11 toxic or flammable gases which may be generated by cargo, if applicable;
- .12 flammability, toxicity, corrosiveness and propensity to oxygen depletion of the cargo, if applicable;
- .13 self-heating properties of the cargo, and the need for trimming, if applicable;
- .14 properties on emission of flammable gases in contact with water, if applicable;
- .15 radioactive properties, if applicable;
- .16 whether or not the cargo is classified as harmful to the marine environment in accordance with appendix I of Annex V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto, as amended; and
- .17 any other information required by national authorities.

4.2.3 Information provided by the shipper shall be accompanied by a declaration. An example of a cargo declaration form is set out on the next page. Another form may be used for cargo declaration. As an aid to paper documentation, Electronic Data Processing (EDP) or Electronic Data Interchange (EDI) techniques may be used.

**FORM FOR CARGO INFORMATION  
for Solid Bulk Cargoes**

|   |  |
|---|--|
| BCSN  |  |
| Shipper   | Transport document number  |
| Consignee   | Carrier  |
| Name/means of transport<br>Port/place of departure  | Instructions or other matters  |
| Port/place of destination   |  |
| General description of the cargo<br>(Type of material/particle size)  | Gross mass (kg/tonnes)   |
| Specifications of bulk cargo, if applicable:<br>Stowage factor:<br>Angle of repose, if applicable:<br>Trimming procedures:<br>Chemical properties if potential hazard*:<br>* e.g. class & UN No. and/or MHB hazard(s)   |  |
| Group of the cargo<br><input type="checkbox"/> Group A and B*<br><input type="checkbox"/> Group A*<br><input type="checkbox"/> Group B<br><input type="checkbox"/> Group C<br>* For cargoes which may liquefy<br>(group A and group A and B cargoes)                                  | Transportable moisture limit<br><br>Moisture content at shipment   |
| Classification relating to MARPOL<br>Annex V<br><br><input type="checkbox"/> harmful to the marine environment<br><input type="checkbox"/> not harmful to the marine environment  | Additional certificate(s)*<br><input type="checkbox"/> Certificate of moisture content and<br>transportable moisture limit<br><input type="checkbox"/> Weathering certificate<br><input type="checkbox"/> Exemption certificate<br><input type="checkbox"/> Other (specify)<br>* If required |
| Relevant special properties of the cargo<br>(e.g., highly soluble in water)   |  |
| DECLARATION<br>I hereby declare that the consignment is<br>fully and accurately described and that the<br>given test results and other specifications<br>are correct to the best of my knowledge and<br>belief and can be considered as<br>representative for the cargo to be loaded. | Name/status, company/organization of<br>signatory<br><br>Place and date<br><br>Signature on behalf of shipper  |

### **4.3 Certificates of test**

4.3.1 To obtain the information required in 4.2.1, the shipper shall arrange for the cargo to be properly sampled and tested. The shipper shall provide the ship's master or his representative with the appropriate certificates of test, if required in this Code.

4.3.2 When a concentrate or other cargo which may liquefy is carried, the shipper shall provide the ship's master or his representative with a signed certificate of the TML, and a signed certificate or declaration of the moisture content, each issued by an entity recognized by the competent authority of the port of loading. The certificate of TML shall contain, or be accompanied by, the result of the test for determining the TML. The declaration of moisture content shall contain, or be accompanied by, a statement by the shipper that the moisture content is, to the best of his knowledge and belief, the average moisture content of the cargo at the time the declaration is presented to the master.

4.3.3 When a concentrate or other cargo which may liquefy is carried, procedures for sampling, testing and controlling moisture content to ensure the moisture content is less than the TML when it is on board the ship shall be established by the shipper, taking account of the provisions of this Code. Such procedures shall be approved and their implementation checked by the competent authority of the port of loading. The document issued by the competent authority stating that the procedures have been approved shall be provided to the master or his representative.

4.3.4 If the cargo is loaded on to the ship from barges, in developing the procedures under 4.3.3, the shipper shall include procedures to protect the cargo on the barges from any precipitation and water ingress.

4.3.5 When a concentrate or other cargo which may liquefy is to be loaded into more than one cargo space of a ship, the certificate or the declaration of moisture content shall certify the moisture content of each type of finely grained material loaded into each cargo space. Notwithstanding this requirement, if sampling according to internationally or nationally accepted standard procedures indicates that the moisture content is uniform throughout the consignment, then one certificate or declaration of average moisture content for all cargo spaces is acceptable.

4.3.6 Where certification is required by the individual schedules for cargoes possessing chemical hazards, the certificate shall contain, or be accompanied by, a statement from the shipper that the chemical characteristics of the cargo are, to the best of his knowledge, those present at the time of the ship's loading. However, it is important to ensure that the samples taken are representative of the whole depth of the stockpile.

### **4.4 Sampling procedures**

4.4.1 Physical property tests on the consignment are meaningless unless they are conducted prior to loading on truly representative test samples.

4.4.2 Sampling shall be conducted only by persons who have been suitably trained in sampling procedures and who are under the supervision of someone who is fully aware of the properties of the consignment and also the applicable principles and practices of sampling.

4.4.3 For a concentrate or other cargo which may liquefy, the shipper shall facilitate access to stockpiles for the purpose of inspection, sampling and subsequent testing by the ship's nominated representative.

4.4.4 Prior to taking samples, and within the limits of practicability, a visual inspection of the consignment which is to form the ship's cargo shall be carried out. Any substantial portions of material which appear to be contaminated or significantly different in characteristics or moisture content from the bulk of the consignment shall be sampled and analysed separately.

Depending upon the results obtained in these tests, it may be necessary to reject those particular portions as unfit for shipment.

4.4.5 Representative samples shall be obtained by employing techniques which take the following factors into account:

- .1 the type of material;
- .2 the particle size distribution;
- .3 composition of the material and its variability;
- .4 the manner in which the material is stored, in stockpiles, rail wagons or other containers, and transferred or loaded by material-handling systems such as conveyors, loading chutes, crane grabs, etc.;
- .5 the chemical hazards (toxicity, corrosivity, etc.);
- .6 the characteristics which have to be determined: moisture content, TML, bulk density/stowage factor, angle of repose, etc.;
- .7 variations in moisture distribution throughout the consignment which may occur due to weather conditions, natural drainage, e.g. to lower levels of stockpiles or containers, or other forms of moisture migration; and
- .8 variations which may occur following freezing of the material.

4.4.6 Throughout the sampling procedures, utmost care shall be taken to prevent changes in quality and characteristics. Samples for moisture testing shall be immediately placed in suitable airtight, non-absorbent containers with a minimum of free air space to minimize any change in moisture content, such containers being properly marked.

4.4.7 Unless expressly provided otherwise, sampling for the test required by this Code shall follow an internationally or nationally accepted standard procedure.

4.4.8 For unprocessed mineral ores the sampling of stationary stockpiles shall be carried out only when access to the full depth of the stockpile is available and samples from the full depth of the stockpile can be extracted.

#### **4.5 Interval between sampling/testing and loading for TML and moisture content determination**

4.5.1 The shipper shall be responsible for ensuring that a test to determine the TML of a solid bulk cargo is conducted within six months to the date of loading the cargo. Notwithstanding this provision, where the composition or characteristics of the cargo are variable for any reason, the shipper shall be responsible for ensuring that a test to determine the TML is conducted again after it is reasonably assumed that such variation has taken place.

4.5.2 The shipper shall be responsible for ensuring that sampling and testing for moisture content is conducted as near as practicable to the date of commencement of loading. The interval between sampling/testing and the date of commencement of loading shall never be more than seven days. If the cargo has been exposed to significant rain or snow between the time of testing and the date of completion of loading, the shipper shall be responsible for ensuring that the moisture content of the cargo is still less than its TML, and evidence of this is provided to the master as soon as practicable.

4.5.3 Samples of frozen cargo shall be tested for the TML or the moisture content after the free moisture has completely thawed.

#### **4.6 Sampling procedures for concentrate stockpiles**

4.6.1 It is not practicable to specify a single method of sampling for all consignments since the character of the material and the form in which it is available will affect the selection of the procedure to be used. In the absence of internationally or nationally accepted standard sampling procedures, the following sampling procedures for concentrate stockpiles may be used to determine the moisture content and the TML of mineral concentrates. These procedures are not intended to replace sampling procedures, such as the use of automatic sampling, that achieve equal or superior accuracy of either moisture content or TML.

4.6.2 Subsamples are taken in a reasonably uniform pattern, where possible from a levelled stockpile.

4.6.3 A plan of the stockpile is drawn and divided into areas, each of which contains approximately 125 t, 250 t or 500 t, depending on the amount of concentrate to be shipped. Such a plan will indicate the number of subsamples required and where each is to be taken. Each subsample taken is drawn from approximately 50 cm below the surface of the designated area.

4.6.4 The number of sub-samples and sample size are given by the competent authority or determined in accordance with the following scale:

Consignments of not more than 15,000 t:  
One 200 g subsample is taken for each 125 t to be shipped.

Consignments of more than 15,000 but not more than 60,000 t:  
One 200 g subsample is taken for each 250 t to be shipped.

Consignments of more than 60,000 t:  
One 200 g subsample is taken for each 500 t to be shipped.

4.6.5 Subsamples for moisture content determination are placed in sealed containers (such as plastic bags, cans or small metallic drums) immediately on withdrawal for conveyance to the testing laboratory, where they are thoroughly mixed in order to obtain a fully representative sample. Where testing facilities are not available at the testing site, such mixing is done under controlled conditions at the stockpile and the representative sample placed in a sealed container and shipped to the test laboratory.

4.6.6 Basic procedural steps include:

- .1 identification of consignment to be sampled;
- .2 determination of the number of individual subsamples and representative samples, as described in 4.6.4, which are required;
- .3 determination of the positions from which to obtain subsamples and the method of combining such subsamples to arrive at a representative sample;
- .4 gathering of individual subsamples and placing them in sealed containers;
- .5 thorough mixing of subsamples to obtain the representative sample; and
- .6 placing the representative sample in a sealed container if it has to be shipped to a test laboratory.

**4.7 Examples of standardized sampling procedures, for information**

ISO 3082:2017 – *Iron ores – Sampling and sample preparation procedures*

(Note: Under this Standard the in situ sampling of ships and stockpiles is not permitted)

IS1405:2010 – *Iron Ores – Sampling & Sample Preparation – Manual Method*

(Note: This Indian Standard covers the in situ sampling of stockpiles up to a height of 3 m)

ISO 1988: 1975 – *Hard coal – Sampling*

ASTM D2234/D2234M –17– Standard Practice for Collection of a Gross Sample of Coal

Australian Standards

AS 4264.1 – *Coal and Coke-Sampling: Part 1: Coal – Sampling Procedures*

AS 1141 – Series – *Methods of sampling and testing aggregates*

BS 1017-1:1989 – *Sampling of coal and coke. Methods for sampling of coal*

BS 1017-2:1994 – *Sampling of coal and coke. Methods for sampling of coke*

Canadian Standard Sampling Procedure for Concentrate Stockpiles

European Communities Method of Sampling for the Control of Fertilizers

JIS M 8100 – Japanese General Rules for Methods of Sampling Bulk Materials

JIS M 8100:1992 – Particulate cargoes – General Rules for Methods of Sampling

Polish Standard Sampling Procedure for:

Iron and Manganese Ores – Ref. No. PN-67/H-04000

Non-ferrous Metals – Ref. No. PN-70/H-04900

Russian Federation Standard Sampling Procedure for the Determination of Moisture Content in Ore Concentrates.



#### **4.8 Documentation required on board the ship carrying dangerous goods**

4.8.1 Each ship carrying dangerous goods in solid form in bulk shall have a special list or manifest setting forth the dangerous goods on board and the location thereof, in accordance with SOLAS regulation VII/7-2.2. A detailed stowage plan, which identifies by class and sets out the location of all dangerous goods on board, may be used in place of such a special list or manifest.

4.8.2 When dangerous goods in solid form in bulk are carried, appropriate instructions on emergency response to incidents involving the cargoes shall be on board.

4.8.3 Cargo ships of 500 gross tonnage and over constructed on or after 1 September 1984 and cargo ships of less than 500 gross tonnage constructed on or after 1 February 1992, subject to SOLAS regulation II-2/19.4, shall have a Document of compliance when carrying dangerous goods in solid form in bulk, except class 6.2 and class 7.

## Section 5

### Trimming procedures

#### 5.1 General provisions for trimming

5.1.1 Trimming a cargo reduces the likelihood of the cargo shifting and minimizes the air entering the cargo. Air entering the cargo could lead to spontaneous heating. To minimize these risks, cargoes shall be trimmed reasonably level, as necessary.

5.1.2 Cargo spaces shall be as full as practicable without resulting in excessive loading on the bottom structure or 'tween deck to prevent sliding of a solid bulk cargo. Due consideration shall be given to the amount of a solid bulk cargo in each cargo space, taking into account the possibility of shifting and longitudinal moments and forces of the ship. Cargo shall be spread as widely as practicable to the boundary of the cargo space. Alternate hold loading restrictions, as required by SOLAS chapter XII, may also need to be taken into account.

5.1.3 The master has the right to require that the cargo be trimmed level, where there is any concern regarding stability based upon the information available, taking into account the characteristics of the ship and the intended voyage.

#### 5.2 Special provisions for multi-deck ships

5.2.1 When a solid bulk cargo is loaded only in lower cargo spaces, it shall be trimmed sufficiently to equalize the mass distribution on the bottom structure.

5.2.2 When solid bulk cargoes are carried in 'tween decks, the hatchways of such 'tween decks shall be closed in those cases where the loading information indicates an unacceptable level of stress of the bottom structure if the hatchways are left open. The cargo shall be trimmed reasonably level and shall either extend from side to side or be secured by additional longitudinal divisions of sufficient strength. The safe load-carrying capacity of the 'tween decks shall be observed to ensure that the deck structure is not overloaded.

5.2.3 If coal cargoes are carried in 'tween decks, the hatchways of such 'tween decks shall be tightly sealed to prevent air moving up through the body of the cargo in the 'tween decks.

#### 5.3 Special provisions for cohesive bulk cargoes

5.3.1 All damp cargoes and some dry ones possess cohesion. For cohesive cargoes, the general provisions in 5.1 shall apply.

5.3.2 The angle of repose is not an indicator of the stability of a cohesive bulk cargo and it is not included in the individual schedules for cohesive cargoes.

#### 5.4 Special provisions for non-cohesive bulk cargoes

5.4.1 Non-cohesive bulk cargoes are those listed in paragraph 1 in appendix 3 and any other cargo not listed in the appendix, exhibiting the properties of a non-cohesive material.

5.4.2 For trimming purposes, solid bulk cargoes can be categorized as cohesive or non-cohesive. The angle of repose is a characteristic of non-cohesive bulk cargoes which is indicative of cargo stability and has been included in the individual schedules for non-cohesive cargoes. The angle of repose of the cargoes shall establish which provisions of this section apply. Methods for determining the angle of repose are given in section 6.

#### **5.4.3 Non-cohesive bulk cargoes having an angle of repose less than or equal to 30°**

These cargoes, which flow freely like grain, shall be carried according to the provisions applicable to the stowage of grain cargoes. The bulk density of the cargo shall be taken into account when determining:

- .1 the scantlings and securing arrangements of divisions and bin bulkheads; and
- .2 the stability effect of free cargo surfaces.

#### **5.4.4 Non-cohesive bulk cargoes having an angle of repose greater than 30° to 35° inclusive**

These cargoes shall be trimmed according to the following criteria:

- .1 the unevenness of the cargo surface measured as the vertical distance ( $\Delta h$ ) between the highest and lowest levels of the cargo surface shall not exceed  $B/10$ , where  $B$  is the beam of the ship in metres, with a maximum allowable  $\Delta h = 1.5$  m; or
- .2 loading is carried out using trimming equipment approved by the competent authority.

#### **5.4.5 Non-cohesive bulk cargoes having an angle of repose greater than 35°**

These cargoes shall be trimmed according to the following criteria:

- .1 the unevenness of the cargo surface measured as the vertical distance ( $\Delta h$ ) between the highest and lowest levels of the cargo surface shall not exceed  $B/10$ , where  $B$  is the beam of the ship in metres, with a maximum allowable  $\Delta h = 2$  m; or
- .2 loading is carried out using trimming equipment approved by the competent authority.

## Section 6

### Methods of determining the angle of repose

#### 6.1 General

An angle of repose of a non-cohesive solid bulk material shall be measured by a method approved by the appropriate authority as required by 4.1.4 of this Code.

#### 6.2 Recommended test methods

There are various methods in use to determine the angle of repose for non-cohesive solid bulk materials. The recommended test methods are listed below:

##### 6.2.1 Tilting box method

This laboratory test method is suitable for non-cohesive granular materials with a grain size not greater than 10 mm. A full description of the equipment and procedure is given in 2.1 of appendix 2.

##### 6.2.2 Shipboard test method

In the absence of a tilting box apparatus, an alternative procedure for determining the approximate angle of repose is given in 2.2 of appendix 2.

## Section 7

### Cargoes which may liquefy

#### 7.1 Introduction

7.1.1 The purpose of this section is to bring to the attention of masters and others with responsibilities for the loading and carriage of bulk cargoes, the risks associated with liquefaction and the precautions to minimize the risk. Such cargoes may appear to be in a relatively dry granular state when loaded, and yet may contain sufficient moisture to become fluid under the stimulus of compaction and the vibration which occurs during a voyage.

7.1.2 A ship's motion may cause a cargo to shift sufficiently to capsize the vessel. Cargo shift can be divided into two types, namely, sliding failure or liquefaction consequence. Trimming the cargo in accordance with section 5 can prevent sliding failure.

7.1.3 Some cargoes which may liquefy may also heat spontaneously.

#### 7.2 Conditions for hazards

7.2.1 Group A cargoes contain a certain proportion of small particles and a certain amount of moisture. Group A cargoes may liquefy during a voyage even when they are cohesive and trimmed level. Liquefaction can result in cargo shift. This phenomenon may be described as follows:

- .1 the volume of the spaces between the particles reduces as the cargo is compacted owing to the ship's motion, etc.;
- .2 the reduction in space between cargo particles causes an increase in water pressure in the space; and
- .3 the increase in water pressure reduces the friction between cargo particles, resulting in a reduction in the shear strength of the cargo.

7.2.2 Liquefaction does not occur when the cargo consists of large particles or lumps and water passes through the spaces between the particles and there is no increase in the water pressure.

7.2.3 A cargo shift caused by liquefaction may occur when the moisture content exceeds the TML. Some cargoes are susceptible to moisture migration and may develop a dangerous wet base even if the average moisture content is less than the TML. Although the cargo surface may appear dry, undetected liquefaction may take place, resulting in shifting of the cargo. Cargoes with high moisture content are prone to sliding, particularly when the cargo is shallow and subject to large heel angles.

7.2.4 In the resulting viscous fluid state cargo may flow to one side of the ship with a roll but not completely return with a roll the other way. Consequently, the ship may progressively reach a dangerous heel and capsize quite suddenly.

#### 7.3 Provisions for cargoes which may liquefy

##### 7.3.1 General

7.3.1.1 Concentrates or other cargoes which may liquefy shall only be accepted for loading when the actual moisture content of the cargo is less than its TML. Notwithstanding this

provision, cargoes having moisture content in excess of the TML may be carried on a specially constructed or fitted cargo ship for confining cargo shift specified in 7.3.2.

7.3.1.2 Notwithstanding the provisions in 1.4 of this Code, the requirements in 4.2.2.9, 4.2.2.10, 4.3.2 to 4.3.5, 4.5, 4.6 and 8 of this Code need not apply to a cargo which may liquefy provided that the cargo is carried on a specially constructed or fitted cargo ship for confining cargo shift specified in 7.3.2 or on a specially constructed ship for dry powdery cargoes specified in 7.3.3.

7.3.1.3 Cargoes which contain liquids other than packaged canned goods or the like shall not be stowed in the same cargo space above or adjacent to these solid bulk cargoes.

7.3.1.4 Adequate measures shall be taken to prevent liquids entering the cargo space in which these solid bulk cargoes are stowed during the voyage.

7.3.1.5 Masters shall be cautioned about the possible danger of using water to cool these cargoes while the ship is at sea. Introducing water may bring the moisture content of these cargoes to a flow state. When necessary, due consideration shall be given to apply water in the form of spray.

### **7.3.2 Specially constructed or fitted cargo ships for confining cargo shift**

7.3.2.1 Specially constructed cargo ships for confining cargo shift shall have permanent structural boundaries, so arranged as to confine any shift of cargo to an acceptable limit. The ship concerned shall carry evidence of approval by the Administration.

7.3.2.2 Specially fitted cargo ships for confining cargo shift shall be fitted with specially designed portable divisions to confine any shift of cargo to an acceptable limit. Specially fitted cargo ships shall be in compliance with the following requirements:

- .1 The design and positioning of such special arrangements shall adequately provide not only the restraint of the immense forces generated by the flow movement of high-density bulk cargoes, but also for the need to reduce to an acceptable safe level the potential heeling movements arising out of a transverse cargo flow across the cargo space. Divisions provided to meet these requirements shall not be constructed of wood.
- .2 The elements of the ship's structure bounding such cargo shall be strengthened, as necessary.
- .3 The plan of special arrangements and details of the stability conditions on which the design has been based shall have been approved by the Administration. The ship concerned shall carry evidence of approval by the Administration.

7.3.2.3 A submission made to an Administration for approval of such a ship shall include:

- .1 relevant structural drawings, including scaled longitudinal and transverse sections;
- .2 stability calculations, taking into account loading arrangements and possible cargo shift, showing the distribution of cargo and liquids in tanks, and of cargo which may become fluid; and

- .3 any other information which may assist the Administration in the assessment of the submission.

### **7.3.3 Specially constructed cargo ships for dry powdery cargoes**

7.3.3.1 Specially constructed cargo ships for dry powdery cargoes shall be designed and constructed to:

- .1 carry solely dry powdery cargoes; and
- .2 handle cargoes by means of closed type systems using pneumatic equipment which prevent the cargo from the exposure to weather.

7.3.3.2 The ship concerned shall carry evidence of approval by the Administration.

## Section 8

### Test procedures for cargoes which may liquefy

#### 8.1 General

For a group A cargo, the actual moisture content and transportable moisture limit shall be determined in accordance with a procedure determined by the appropriate authority as required by 4.1.4 of this Code.

#### 8.2 Test procedures for measurement of moisture content

There are recognized international and national methods for determining moisture content for various materials. Reference is made to 1.1.4.4 of appendix 2.

#### 8.3 Methods for determining transportable moisture limit

The recommended methods for determining transportable moisture limit are given in appendix 2.

#### 8.4 Complementary test procedure for determining the possibility of liquefaction

8.4.1 A ship's master may carry out a check test for approximately determining the possibility of flow on board ship or at the dockside by the following auxiliary method:

Half fill a cylindrical can or similar container (0.5 to 1 L capacity) with a sample of the material. Take the can in one hand and bring it down sharply to strike a hard surface such as a solid table from a height of about 0.2 m. Repeat the procedure 25 times at one- or two-second intervals. Examine the surface for free moisture or fluid conditions. If free moisture or a fluid condition appears, arrangements should be made to have additional laboratory tests conducted on the material before it is accepted for loading.

8.4.2 If samples remain dry following a can test, the moisture content of the material may still exceed the transportable moisture limit (TML).



## Section 9

### Materials possessing chemical hazards

#### 9.1 General

Solid bulk cargoes which may possess chemical hazards during transport, because of their chemical nature or properties, are in group B. These materials can be classified as follows:

- .1 dangerous goods (see 9.2.2), not possessing additional chemical hazards specified in 9.2.3;
- .2 MHB (see 9.2.3); or
- .3 dangerous goods also possessing additional chemical hazards specified in 9.2.3.

It is essential to obtain current, valid information about the physical and chemical properties of the cargoes to be shipped in bulk, prior to loading.

#### 9.2 Hazard classification

9.2.1 The classification of materials possessing chemical hazards and intended to be shipped in bulk under the requirements of this Code shall be in accordance with 9.2.2 and 9.2.3.

##### 9.2.2 Classification of dangerous goods

SOLAS regulation VII/7 defines dangerous goods in solid form in bulk. For the purpose of this Code, dangerous goods shall be classified in accordance with part 2 of the IMDG Code.

##### 9.2.2.1 Class 4.1: Flammable solids

The materials in this class are readily combustible solids and solids which may cause fire through friction.

##### 9.2.2.2 Class 4.2: Substances liable to spontaneous combustion

The materials in this class are materials, other than pyrophoric materials, which, in contact with air without energy supply, are liable to self-heating.

##### 9.2.2.3 Class 4.3: Substances which, in contact with water, emit flammable gases

The materials in this class are solids which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

##### 9.2.2.4 Class 5.1: Oxidizing substances

The materials in this class are materials that, while in themselves not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material.

##### 9.2.2.5 Class 6.1: Toxic substances

The materials in this class are materials liable either to cause death or serious injury or to harm human health if swallowed or inhaled, or by skin contact.

### 9.2.2.6 Class 7: Radioactive material

The materials in this class are any materials containing radionuclides where both the activity concentration and the total activity in the consignment exceed the values specified in 2.7.2.2.1 to 2.7.2.2.6 of the IMDG Code.

### 9.2.2.7 Class 8: Corrosive substances

The materials in this class are materials which, by chemical action, will cause severe damage when in contact with living tissue or will materially damage, or even destroy, other goods or the means of transport.

### 9.2.2.8 Class 9: Miscellaneous dangerous substances and articles

The materials in this class are materials and articles which, during transport, present a danger not covered by other classes.

## 9.2.3 Materials hazardous only in bulk (MHB)

### 9.2.3.1 General

9.2.3.1.1 These are materials which, when carried in bulk, possess chemical hazards other than the hazards covered by the classification system of the IMDG Code. These materials present a significant risk when carried in bulk and require special precautions.

9.2.3.1.2 A material shall be classified as MHB if the material possesses one or more of the chemical hazards (excluding those hazards which are covered by the classification system of the IMDG Code) as defined below. When a test method is prescribed, representative samples of the cargo to be carried shall be used for testing. Samples shall be taken 200 to 360 mm inward from the surface at 3 m intervals over the length of a stockpile.

9.2.3.1.3 A material may also be classified as MHB by analogy with similar cargoes with known hazardous properties or by records of accidents.

9.2.3.1.4 Although the chemical hazards are intended to be closely defined in order to establish a uniform approach to MHB classification, where human experience or other factors indicate the need to consider other chemical hazards, these shall always be taken into account. Where deviations from the chemical hazards described in 9.2.3.2 to 9.2.3.7 have been recognized (Other hazards (OH)), they shall be properly recorded with justifications. Other hazards are to be included in the section for "Hazard" in the individual schedule.

9.2.3.1.5 A notational reference shall be provided in the "MHB" cell of the Characteristics table for each individual schedule for cargoes classified as MHB. When a material possesses one or more of the chemical hazards as defined below, the notational reference for each hazard shall be included in the "MHB" cell. A summary of the notational references is presented in the table below:

| Chemical hazard                           | Notational reference |
|---|----------------------|
| Combustible solids                        | CB                   |
| Self-heating solids                       | SH                   |
| Solids that evolve flammable gas when wet | WF                   |
| Solids that evolve toxic gas when wet     | WT                   |
| Toxic solids                              | TX                   |
| Corrosive solids                          | CR                   |
| Other hazards                             | OH                   |

### 9.2.3.2 Combustible solids: MHB (CB)

9.2.3.2.1 These are materials which are readily combustible or easily ignitable when transported in bulk and do not meet the established criteria for inclusion in class 4.1 (see 9.2.2.1 of this Code).

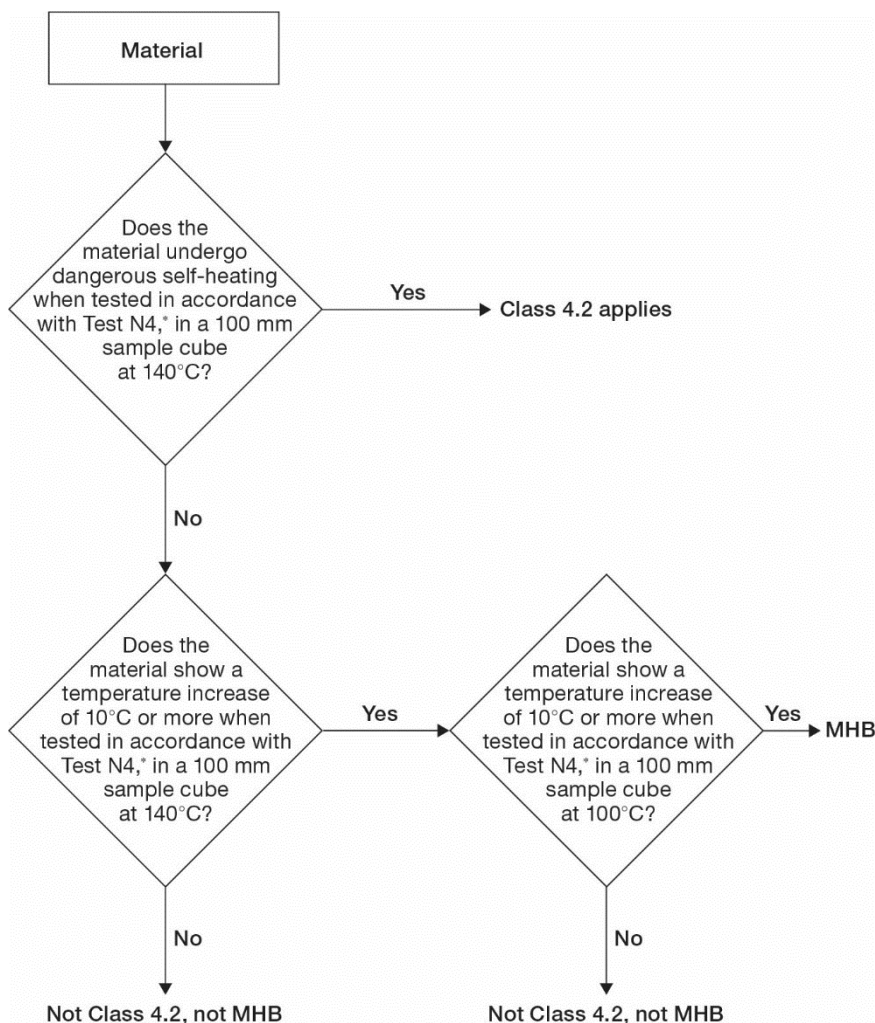
9.2.3.2.2 Powdered, granular or pasty materials shall be classified as MHB when the time of burning of one or more of the test runs, performed in accordance with the preliminary screening test method described in the *United Nations Manual of Tests and Criteria*, part III, 33.2.1.4.3.1, is less than 2 min. Powders of metals or metal alloys shall be classified as MHB when they can be ignited and the reaction spreads over the whole length of the sample in 20 min or less. The test sample in the preliminary screening test is 200 mm in length. A summary of this approach is presented in the table below:

| <b>Solid cargo</b> | <b>Hazard class 4.1, PG III<br/>burn time, burn distance</b> | <b>MHB<br/>burn time, burn distance</b> |
|--------------------|--|---|
| Powdered metal     | more than 5 min but not more than 10 min, 250 mm             | ≤ 20 min, 200 mm                        |
| Solid material     | < 45 s, 100 mm   | ≤ 2 min, 200 mm                         |

### 9.2.3.3 Self-heating solids: MHB (SH)

9.2.3.3.1 These are materials that self-heat when transported in bulk and do not meet the established criteria for inclusion in class 4.2 (see 9.2.2.2).

9.2.3.3.2 A material shall be classified as MHB if, in the tests performed in accordance with the test method given in the *United Nations Manual of Tests and Criteria*, part III, 33.3.1.6, the temperature of the test sample rises by more than 10°C when using a 100 mm cube sample at 140°C and at 100°C. The following flow chart illustrates the test procedure.



\* See United Nations Manual of Tests and Criteria, part III, 33.3.1.6.

9.2.3.3.3 In addition, a material shall be classified as MHB if a temperature rise of 10°C or more over ambient temperature is observed during any portion of the test performed in accordance with the test method described in *United Nations Manual of Tests and Criteria*, part III, 33.4.1.4.3.5. When performing this test, the temperature of the sample should be measured continuously over 48 hours. If, at the end of the 48-hour period the temperature is increasing, the test period shall be extended in accordance with the test method.

#### 9.2.3.4 Solids that evolve flammable gas when wet: MHB (WF)

9.2.3.4.1 These are materials that evolve flammable gases when in contact with water when transported in bulk and do not meet established criteria for inclusion in class 4.3 (see 9.2.2.3).

9.2.3.4.2 A material shall be classified as MHB if, in tests performed in accordance with the test method given in the *United Nations Manual of Tests and Criteria*, part III, 33.4.1, the flammable gas evolution rate is greater than zero. When performing this test, the rate of evolution of gas shall be calculated over 48 hours at one-hour intervals. If at the end of the 48-hour period the rate of evolution is increasing, the test period shall be extended in accordance with the test method.

### **9.2.3.5 Solids that evolve toxic gas when wet: MHB (WT)**

9.2.3.5.1 These are materials that evolve toxic gases when in contact with water when transported in bulk.

9.2.3.5.2 A material shall be classified as MHB if, in tests performed in accordance with the test method given in the *United Nations Manual of Tests and Criteria*, part III, 33.4.1, the toxic gas evolution rate is greater than zero. Toxic gas evolution shall be measured using the same test procedure for flammable gas evolution as prescribed in the test method. When performing this test, the rate of evolution of gas shall be calculated over 48 hours at 1-hour intervals. If at the end of the 48-hour period the rate of evolution is increasing, the test period shall be extended in accordance with the test method.

9.2.3.5.3 The gas shall be collected over the test period prescribed above. The gas shall be chemically analysed and tested for toxicity if the gas is unknown and no acute inhalation toxicity data is available. If the gas is known, inhalation toxicity shall be assessed based on all information available, using testing as a last resort option for concluding this hazard. Toxic gases in this respect are gases showing acute inhalation toxicity (LC<sub>50</sub>) of or below 20,000 ppmV or 20 mg/L by 4 hours' testing (GHS Acute Toxicity Gases/Vapours Category 4).

### **9.2.3.6 Toxic solids: MHB (TX)**

9.2.3.6.1 These are materials that have toxic hazards to humans if inhaled or with contact with skin when loaded, unloaded, or transported in bulk and do not meet the established criteria for inclusion in class 6.1 (see 9.2.2.5).

9.2.3.6.2 A material shall be classified as MHB in accordance with the criteria laid down within part 3 of the GHS:

- .1 cargoes developing cargo dust with an acute inhalation toxicity (LC<sub>50</sub>) of 1-5 mg/L by 4 hours' testing (GHS Acute Toxicity Dusts Category 4);
- .2 cargoes developing cargo dust exhibiting an inhalation toxicity of equal to or less than 1 mg/L/4 h (GHS Specific Target Organ Toxicity Single Exposure Inhalation Dust Category 1) or below 0.02 mg/L/6 h/d (GHS Specific Target Organ Toxicity Repeated Dose Inhalation Dust Category 1);
- .3 cargoes exhibiting an acute dermal toxicity (LD<sub>50</sub>) of 1,000-2,000 mg/kg (GHS Acute Toxicity Dermal Category 4);
- .4 cargoes exhibiting a dermal toxicity of or below 1,000 mg (GHS Specific Target Organ Toxicity Single Exposure Dermal Category 1) or below 20 mg/kg bw/d by 90 days' testing (GHS Specific Target Organ Toxicity Repeated Dose Dermal Category 1);
- .5 cargoes exhibiting carcinogenicity (GHS Category 1A and 1B), mutagenicity (GHS Category 1A and 1B) or reprotoxicity (GHS Category 1A and 1B).

### **9.2.3.7 Corrosive solids: MHB (CR)**

9.2.3.7.1 These are materials that are corrosive to skin, eye or to metal or are respiratory sensitizers and do not meet the established criteria for inclusion in class 8 (see 9.2.2.7).

9.2.3.7.2 A material shall be classified as MHB in accordance with the criteria laid down within part 3 of the GHS:

- .1 cargoes which are known to be a respiratory sensitizer (GHS Respiratory Sensitization Category 1);
- .2 cargoes exhibiting skin irritation with a mean value of or higher than 2.3 for erythema/eschar or oedema (GHS Skin Corrosion/Irritation Category 2);
- .3 cargoes exhibiting eye irritation with a mean value of or higher than 1 for corneal opacity/irititis or 2 for conjunctival redness/oedema (GHS Serious Eye Damage Category 1 or Eye Irritation Category 2A).

9.2.3.7.3 A material shall be classified as MHB when the corrosion rate on either steel or aluminium surfaces is between 4 mm and 6.25 mm a year at a test temperature of 55°C when tested on both materials. For the purposes of testing steel, type S235JR+CR (1.0037 resp. St 37-2), S275J2G3+CR (1.0144 resp. St 44-3), ISO 3574:1999, Unified Numbering System (UNS) G10200 or SAE 1020, and for testing aluminium, non-clad, types 7075-T6 or AZ5GU T6 shall be used. An acceptable test is prescribed in the *United Nations Manual of Tests and Criteria*, part III, section 37. When this test is performed the sample shall contain at least 10% moisture by mass. If the representative sample of the cargo to be shipped does not contain more than 10% moisture by mass, water shall be added to the sample.

## **9.3 Stowage and segregation requirements**

### **9.3.1 General requirements**

9.3.1.1 The potential hazards of the cargoes in group B and falling within the classification of 9.2.2 and 9.2.3 entail the need for segregation of incompatible cargoes. Segregation shall also take account of any identified subsidiary hazard.

9.3.1.2 In addition to general segregation as between whole classes of materials, there may be a need to segregate a particular material from others. In the case of segregation from combustible materials, this shall be understood not to include packaging material, ceiling or dunnage; the latter shall, in these circumstances, be kept to a minimum.

9.3.1.3 For the purpose of segregating incompatible materials, the words "hold" and "compartment" are deemed to mean a cargo space enclosed by steel bulkheads or shell plating and by steel decks. The boundaries of such a space shall be resistant to fire and liquid.

9.3.1.4 When two or more different solid bulk cargoes of group B are to be carried, the segregation between them shall be in accordance with 9.3.4.

9.3.1.5 Where different grades of a solid bulk cargo are carried in the same cargo space, the most stringent segregation provisions applicable to any of the different grades shall apply to all of them.

9.3.1.6 When solid bulk cargoes of group B and dangerous goods in packaged form are to be carried, the segregation between them shall be in accordance with 9.3.3.

9.3.1.7 Incompatible materials shall not be handled simultaneously. Upon completion of loading one cargo, the hatch covers of every cargo space shall be closed and the decks cleaned of residue before the loading of other material is commenced. When discharging, the same procedures shall be followed.

9.3.1.8 To avoid contamination, all foodstuffs shall be stowed:

- .1 "separated from" a material which is indicated as toxic;
- .2 "separated by a complete compartment or hold from" all infectious materials;
- .3 "separated from" radioactive materials; and
- .4 "away from" corrosive materials.

The terms are defined in 9.3.3 and 9.3.4, as appropriate.

9.3.1.9 Materials which may evolve toxic gases in sufficient quantities to affect health shall not be stowed in those spaces from where such gases may penetrate into living quarters or ventilation systems connecting to living quarters.

9.3.1.10 Materials which present corrosive hazards of such intensity as to affect either human tissue or the ship's structure shall only be loaded after adequate precautions and protective measures have been taken.

9.3.1.11 After discharge of toxic or oxidizing cargoes, the spaces used for their carriage shall be inspected for contamination before being used for other cargoes. A space which has been contaminated shall be properly cleaned and examined before being used for other cargoes.

9.3.1.12 After discharge of cargoes, a close inspection shall be made for any residue, which shall be removed before the ship is presented for other cargoes.

9.3.1.13 For cargoes for which in case of an emergency the hatches shall be opened, these hatches shall be kept free to be capable of being opened up.

## **9.3.2 Special requirements**

### **9.3.2.1 Materials of classes 4.1, 4.2 and 4.3**

9.3.2.1.1 Materials of these classes shall be kept as cool and dry as reasonably practicable and, unless expressly provided otherwise in this Code, shall be stowed "away from" all sources of heat or ignition.

9.3.2.1.2 Electrical fittings and cables shall be in good condition and properly safeguarded against short circuits and sparking. Where a bulkhead is required to be suitable for segregation purposes, cable and conduit penetrations of the decks and bulkheads shall be sealed against the passage of gas and vapour.

9.3.2.1.3 Cargoes liable to give off vapours or gases which can form an explosive mixture with air shall be stowed in a mechanically ventilated space.

9.3.2.1.4 Prohibition of smoking in dangerous areas shall be enforced, and clearly legible "NO SMOKING" signs shall be displayed.

### **9.3.2.2 Materials of class 5.1**

9.3.2.2.1 Cargoes of this class shall be kept as cool and dry as reasonably practicable and, unless expressly provided otherwise in this Code, shall be stowed "away from" all sources of heat or ignition. They shall also be stowed "separated from" other combustible materials.

9.3.2.2.2 Before loading cargoes of this class, particular attention shall be given to the cleaning of the cargo spaces into which they will be loaded. As far as reasonably practicable, non-combustible securing and protecting materials shall be used and only a minimum of dry wooden dunnage shall be used.

9.3.2.2.3 Precautions shall be taken to avoid the penetration of oxidizing materials into other cargo spaces, bilges and other spaces which may contain a combustible material.

### **9.3.2.3 Materials of class 7**

9.3.2.3.1 Cargo spaces used for the transport of Low Specific Activity Materials (LSA-I) and Surface Contaminated Objects (SCO-I) shall not be used for other cargoes until decontaminated by a qualified person so that the non-fixed contamination on any surface when averaged over an area of 300 cm<sup>2</sup> does not exceed the following levels:

4 Bq/cm<sup>2</sup> (10<sup>-4</sup> µCi/cm<sup>2</sup>) for beta and gamma emitters and the low-toxicity alpha emitters; natural uranium; natural thorium; uranium-235 or uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores, physical or chemical concentrates; radionuclides with a half-life of less than 10 days; and

0.4 Bq/cm<sup>2</sup> (10<sup>-5</sup> µCi/cm<sup>2</sup>) for all other alpha emitters.

### **9.3.2.4 Materials of class 8 or materials having similar properties**

9.3.2.4.1 These cargoes shall be kept as dry as reasonably practicable.

9.3.2.4.2 Prior to loading these cargoes attention shall be given to the cleaning of the cargo spaces into which they will be loaded, particularly to ensure that these spaces are dry.

9.3.2.4.3 Penetration of these materials into other cargo spaces, bilges, wells and between the ceiling boards shall be prevented.

9.3.2.4.4 Particular attention shall be given to the cleaning of the cargo spaces after unloading, as residues of these cargoes may be highly corrosive to the ship's structure. Hosing down of the cargo spaces followed by careful drying shall be considered.

### **9.3.3 Segregation between bulk materials possessing chemical hazards and dangerous goods in packaged form**

9.3.3.1 Unless otherwise required in this section or in the individual schedules, segregation between solid bulk cargoes of group B and dangerous goods in packaged form shall be in accordance with the following table.



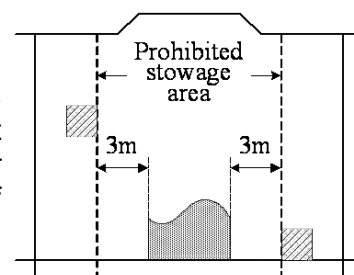
9.3.3.2 The Dangerous Goods List of the IMDG Code shall be consulted for additional requirements with regard to stowage and segregation of packaged dangerous goods.

| Bulk cargo (classified as dangerous goods)                    | Dangerous goods in packaged form |                   |     |     |     |            |   |     |     |     |     |     |     |     |   |   |   |
|---|----------------------------------|-------------------|-----|-----|-----|------------|---|-----|-----|-----|-----|-----|-----|-----|---|---|---|
|   | Class/<br>Division               | 1.1<br>1.2<br>1.5 | 1.3 | 1.4 | 2.1 | 2.2<br>2.3 | 3 | 4.1 | 4.2 | 4.3 | 5.1 | 5.2 | 6.1 | 6.2 | 7 | 8 | 9 |
| Flammable solids  | 4.1                              | 4                 | 3   | 2   | 2   | 2          | 2 | X   | 1   | X   | 1   | 2   | X   | 3   | 2 | 1 | X |
| Substances liable to spontaneous combustion                   | 4.2                              | 4                 | 3   | 2   | 2   | 2          | 2 | 1   | X   | 1   | 2   | 2   | 1   | 3   | 2 | 1 | X |
| Substances which, in contact with water, emit flammable gases | 4.3                              | 4                 | 4   | 2   | 2   | X          | 2 | X   | 1   | X   | 2   | 2   | X   | 2   | 2 | 1 | X |
| Oxidizing substances (agents)                                 | 5.1                              | 4                 | 4   | 2   | 2   | X          | 2 | 1   | 2   | 2   | X   | 2   | 1   | 3   | 1 | 2 | X |
| Toxic substances  | 6.1                              | 2                 | 2   | X   | X   | X          | X | X   | 1   | X   | 1   | 1   | X   | 1   | X | X | X |
| Radioactive materials   | 7                                | 2                 | 2   | 2   | 2   | 2          | 2 | 2   | 2   | 2   | 1   | 2   | X   | 3   | X | 2 | X |
| Corrosive substances  | 8                                | 4                 | 2   | 2   | 1   | X          | 1 | 1   | 1   | 1   | 2   | 2   | X   | 3   | 2 | X | X |
| Miscellaneous dangerous substances and articles               | 9                                | X                 | X   | X   | X   | X          | X | X   | X   | X   | X   | X   | X   | X   | X | X | X |
| Materials hazardous only in bulk (MHB)                        | MHB                              | X                 | X   | X   | X   | X          | X | X   | X   | X   | X   | X   | X   | 3   | X | X | X |

Numbers relate to the following segregation terms:

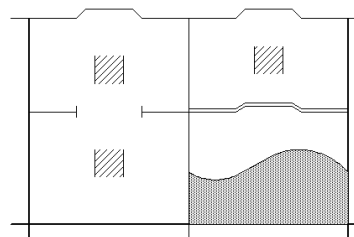
1 "Away from":

Effectively segregated so that incompatible materials cannot interact dangerously in the event of an accident but may be carried in the same hold or compartment or on deck provided a minimum horizontal separation of 3 metres, projected vertically, is provided.



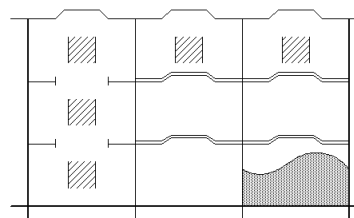
2 "Separated from":

In different holds when stowed under deck. Provided an intervening deck is resistant to fire and liquid, a vertical separation, i.e. in different compartments, may be accepted as equivalent to this segregation.



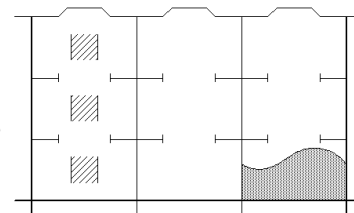
3 "Separated by a complete compartment or hold from":

Means either a vertical or a horizontal separation. If the decks are not resistant to fire and liquid, then only a longitudinal separation, i.e. by an intervening complete compartment, is acceptable.



4 "Separated longitudinally by an intervening complete compartment or hold from":

Vertical separation alone does not meet this requirement.



X Segregation, if any, is shown in the Dangerous Goods List of the IMDG Code or in the individual schedules in this Code.

**Legend**

Reference bulk material



Packages containing incompatible goods



Deck resistant to liquid and fire



**Note:** Vertical lines represent transverse watertight bulkheads between cargo spaces.

### 9.3.4 Segregation between solid bulk cargoes possessing chemical hazards

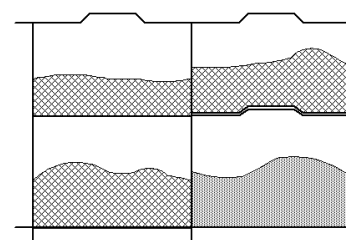
Unless otherwise required in this section or in the individual schedules for cargoes of group B, segregation between solid bulk cargoes possessing chemical hazards shall be according to the following table:

| Solid bulk materials  |                    |     |     |     |     |     |   |   |   |     |
|---|--------------------|-----|-----|-----|-----|-----|---|---|---|-----|
|   | Class/<br>Division | 4.1 | 4.2 | 4.3 | 5.1 | 6.1 | 7 | 8 | 9 | MHB |
| Flammable solids  | 4.1                | X   |     |     |     |     |   |   |   |     |
| Substances liable to spontaneous combustion                   | 4.2                | 2   | X   |     |     |     |   |   |   |     |
| Substances which, in contact with water, emit flammable gases | 4.3                | 3   | 3   | X   |     |     |   |   |   |     |
| Oxidizing substances  | 5.1                | 3   | 3   | 3   | X   |     |   |   |   |     |
| Toxic substances  | 6.1                | X   | X   | X   | 2   | X   |   |   |   |     |
| Radioactive materials   | 7                  | 2   | 2   | 2   | 2   | 2   | X |   |   |     |
| Corrosive substances  | 8                  | 2   | 2   | 2   | 2   | X   | 2 | X |   |     |
| Miscellaneous dangerous substances and articles               | 9                  | X   | X   | X   | X   | X   | 2 | X | X |     |
| Materials hazardous only in bulk (MHB)                        | MHB                | X   | X   | X   | X   | X   | 2 | X | X | X   |

Numbers relate to the following segregation terms:

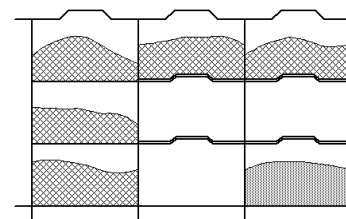
2 "Separated from":

In different holds when stowed under deck. Provided an intervening deck is resistant to fire and liquid, a vertical separation, i.e. in different compartments, may be accepted as equivalent to this segregation.



3 "Separated by a complete compartment or hold from":

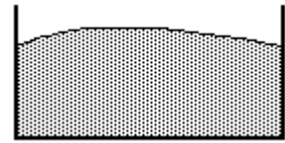
Either a vertical or a horizontal separation. If the decks are not resistant to fire and liquid, then only a longitudinal separation, i.e. by an intervening complete compartment, is acceptable.



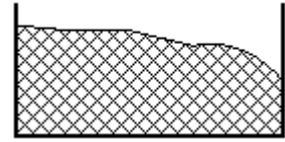
X Segregation, if any, is shown in the individual schedules in this Code.

**Legend**

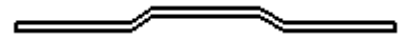
Reference bulk material



Incompatible bulk material



Deck resistant to liquid and fire



**Note:** Vertical lines represent transverse watertight bulkheads between cargo spaces.

## Section 10

### Carriage of solid wastes in bulk

#### 10.1 Preamble

10.1.1 The transboundary movement of wastes represents a threat to human health and to the environment.

10.1.2 Wastes shall be carried in accordance with the relevant international recommendations and conventions and, in particular, where it concerns transport in bulk by sea, with the provisions of this Code.

#### 10.2 Definitions

10.2.1 *Wastes*, for the purpose of this section, means solid bulk cargoes containing or contaminated with one or more constituents which are subject to the provisions of this Code applicable to cargoes of classes 4.1, 4.2, 4.3, 5.1, 6.1, 8 or 9 for which no direct use is envisaged but which are carried for dumping, incineration or other methods of disposal.

10.2.2 *Transboundary movement of waste* means any shipment of wastes from an area under the national jurisdiction of one country to or through an area under the national jurisdiction of another country, or to or through an area not under the national jurisdiction of any country provided at least two countries are involved in the movement.

#### 10.3 Applicability

10.3.1 The provisions of this section are applicable to the transport of wastes in bulk by ships and shall be considered in conjunction with all other provisions of this Code.

10.3.2 Solid cargoes containing or contaminated with radioactive materials shall be subject to the provisions applicable to the transport of radioactive materials and shall not be considered as wastes for the purposes of this section.

#### 10.4 Transboundary movements under the Basel Convention

Transboundary movement of wastes shall be permitted to commence only when:

- .1 notification has been sent by the competent authority of the country of origin, or by the generator or exporter through the channel of the competent authority of the country of origin, to the country of final destination; and
- .2 the competent authority of the country of origin, having received the written consent of the country of final destination stating that the wastes will be safely incinerated or treated by other methods of disposal, has given authorization for the movement.

#### 10.5 Documentation

In addition to the required documentation for the transport of solid bulk cargoes, all transboundary movements of wastes shall be accompanied by a waste movement document from the point at which a transboundary movement commences to the point of disposal. This document shall be available at all times to the competent authorities and to all persons involved in the management of waste transport operations.

## **10.6 Classification of wastes**

10.6.1 A waste containing only one constituent which is a cargo subject to the provisions of this Code applicable to cargoes of classes 4.1, 4.2, 4.3, 5.1, 6.1, 8 or 9 shall be regarded as being that particular cargo. If the concentration of the constituent is such that the waste continues to present a hazard inherent in the constituent itself, it shall be classified as the class applicable to that constituent.

10.6.2 A waste containing two or more constituents which are cargoes subject to the provisions of this Code applicable to cargoes of classes 4.1, 4.2, 4.3, 5.1, 6.1, 8 or 9 shall be classified under the applicable class in accordance with their dangerous characteristics and properties as described in 10.6.3 and 10.6.4.

10.6.3 The classification according to dangerous characteristics and properties shall be carried out as follows:

- .1 determination of the physical and chemical characteristics and physiological properties by measurement or calculation followed by classification according to the criteria applicable to the constituents; or
- .2 if the determination is not practicable, the waste shall be classified according to the constituent presenting the predominant hazard.

10.6.4 In determining the predominant hazard, the following criteria shall be taken into account:

- .1 if one or more constituents fall within a certain class and the waste presents a hazard inherent in these constituents, the waste shall be included in that class; or
- .2 if there are constituents falling under two or more classes, the classification of the waste shall take into account the order of precedence applicable to cargoes with multiple hazards set out in the IMDG Code.

## **10.7 Stowage and handling of wastes**

Wastes shall be stowed and handled in accordance with the provisions of sections 1 to 9 of this Code and with any additional provisions included in the individual schedules for cargoes in group B applicable to the constituents presenting the hazards.

## **10.8 Segregation**

Wastes shall be segregated in accordance with the provisions of 9.3.3 and 9.3.4, as appropriate.

## **10.9 Accident procedures**

In the event that, during transport, a waste will constitute a danger for the carrying ship or the environment, the master shall immediately inform the competent authorities of the countries of origin and destination and receive advice on the action to be taken.

## Section 11

### Security provisions

#### Introductory note

The provisions of this section address the security of bulk cargoes in transport by sea. It should be borne in mind that some substances shipped as bulk cargo may, through their intrinsic nature, or when shipped in combination with other substances, be used as constituents for, or enhance the effect of, weapons used in the commission of unlawful acts. (It should also be borne in mind that ships used to carry bulk cargoes may also be used as a means to transport unauthorized weapons, incendiary devices or explosives, irrespective of the nature of the cargo carried.) National competent authorities may apply additional security provisions, which should be considered when offering or transporting bulk cargoes. The provisions of this section remain recommendatory except 11.1.1.

#### 11.1 General provisions for companies, ships and port facilities

11.1.1 The relevant provisions of chapter XI-2 of SOLAS 74, as amended, and of part A of the ISPS Code shall apply to companies, ships and port facilities both engaged in the handling and transport of solid bulk cargoes and to which chapter XI-2 of SOLAS 74, as amended, applies, taking into account the guidance given in part B of the ISPS Code.

11.1.2 Due consideration should be given to the security-related provisions of the ILO/IMO Code of practice on security in ports and the IMDG Code, as appropriate.

11.1.3 Any shore-based company personnel, ship-based personnel and port facility personnel engaged in the handling and transport of bulk cargoes should be aware of any security requirements for such cargoes, in addition to those specified in the ISPS Code, and commensurate with their responsibilities.

11.1.4 The training of the company security officer, shore-based company personnel having specific security duties, port facility security officer and port facility personnel having specific duties, engaged in the handling and transport of bulk cargoes, should also include elements of security awareness related to the nature of those cargoes, for example where such cargoes are materials hazardous only in bulk.

11.1.5 All shipboard personnel and port facility personnel who are not mentioned in 11.1.4 and are engaged in the transport of bulk cargoes should be familiar with the provisions of the relevant security plans related to those cargoes, commensurate with their responsibilities.

#### 11.2 General provisions for shore-side personnel

11.2.1 For the purpose of this subsection, shore-side personnel covers individuals such as those who:

- prepare transport documents for bulk cargoes;
- offer bulk cargoes for transport;
- accept bulk cargoes for transport;
- handle bulk cargoes;
- prepare bulk cargoes' loading/stowage plans;

- load/unload bulk cargoes into/from ships; and
- enforce or survey or inspect for compliance with applicable rules and regulations; or
- are otherwise involved in the handling and transport of bulk cargoes as determined by the competent authority.

However, the provisions of 11.2 do not apply to:

- the company security officer and appropriate shore-based personnel mentioned in section A/13.1 of the ISPS Code;
- the ship security officer and the shipboard personnel mentioned in sections A/13.2 and A/13.3 of the ISPS Code; and
- the port facility security officer, the appropriate port facility security personnel and the port facility personnel having specific security duties mentioned in sections A/18.1 and A/18.2 of the ISPS Code.

For the training of those officers and personnel, refer to the ISPS Code.

11.2.2 Shore-side personnel engaged in transport by sea of bulk cargoes should consider security provisions for the transport of bulk cargoes commensurate with their responsibilities.

### **11.2.3 Security training**

11.2.3.1 The training of shore-side personnel should also include elements of security awareness, the need to control access to cargoes and ships, and general guidance on the types of bulk cargoes of security significance.

11.2.3.2 Security awareness training should address the nature of security risks, recognizing security risks, methods to address and reduce risks and actions to be taken in the event of a security breach. It should include awareness of security plans (if appropriate, refer to 11.3), commensurate with the responsibilities of individuals and their part in implementing security plans.

11.2.3.3 Such training should be provided or verified upon employment in a position involving transport of bulk cargoes by sea and should be periodically supplemented with retraining.

11.2.3.4 Records of all security training undertaken should be kept by the employer and made available to the employee if requested.

### **11.3 Provisions for high-consequence solid bulk cargoes**

11.3.1 For the purposes of this subsection, high-consequence solid bulk cargoes with high potential security implications are those which have the potential for misuse in an unlawful act and which may, as a result, produce serious consequences such as mass casualties or mass destruction, for example, class 5.1 ammonium nitrate UN 1942 and ammonium nitrate based fertilizers UN 2067.

11.3.2 The provisions of this subsection do not apply to ships and to port facilities (see the ISPS Code for ship security plan and for port security plan).



11.3.3 Consignors and others engaged in the transport of solid bulk cargoes with high potential security implications should adopt, implement and comply with a security plan that addresses at least the elements specified in 11.3.4.

11.3.4 The security plan should comprise at least the following elements:

- .1 specific allocation of responsibilities for security to competent and qualified persons with appropriate authority to carry out their responsibilities;
- .2 records of bulk cargoes with high potential security implications or types of bulk cargoes with high potential security implications transported;
- .3 review of current operations and assessment of vulnerabilities, including intermodal transfer, temporary transit storage, handling and distribution, as appropriate;
- .4 clear statements of measures, including training, policies (including response to higher threat conditions, new employee/employment verification, etc.), operating practices (e.g. choice/use of routes, where known, control of access to ships, bulk cargo storage and loading areas, proximity to vulnerable infrastructure, etc.), equipment and resources that are to be used to reduce security risks;
- .5 effective and up-to-date procedures for reporting and dealing with security threats, breaches of security or security-related incidents;
- .6 procedures for the evaluation and testing of security plans and procedures for periodic review and update of the plans;
- .7 measures to ensure the security of transport information contained in the plan; and
- .8 measures to ensure that the distribution of transport information is limited as far as possible.

**Section 12**

**Stowage factor conversion tables**

12.1 Cubic metres per metric tonne to cubic feet per long ton (2,240 lb, 1,016 kg)

*Factor: 1 m<sup>3</sup>/t = 35.87 ft<sup>3</sup>/ton (rounded to the nearest hundredth of a ft<sup>3</sup>/ton)*

|                   |       |       |       |       |       |       |       |       |       |       |
|-------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| m <sup>3</sup> /t | 0.00  | 0.01  | 0.02  | 0.03  | 0.04  | 0.05  | 0.06  | 0.07  | 0.08  | 0.09  |
| 0.0               | -     | 0.36  | 0.72  | 1.08  | 1.43  | 1.79  | 2.15  | 2.51  | 2.87  | 3.23  |
| 0.1               | 3.59  | 3.95  | 4.30  | 4.66  | 5.02  | 5.38  | 5.74  | 6.10  | 6.46  | 6.82  |
| 0.2               | 7.17  | 7.53  | 7.89  | 8.25  | 8.61  | 8.97  | 9.33  | 9.68  | 10.04 | 10.40 |
| 0.3               | 10.76 | 11.12 | 11.48 | 11.84 | 12.20 | 12.55 | 12.91 | 13.27 | 13.63 | 13.99 |
| 0.4               | 14.35 | 14.71 | 15.07 | 15.42 | 15.78 | 16.14 | 16.50 | 16.86 | 17.22 | 17.58 |
| 0.5               | 17.94 | 18.29 | 18.65 | 19.01 | 19.37 | 19.73 | 20.09 | 20.45 | 20.80 | 21.16 |
| 0.6               | 21.52 | 21.88 | 22.24 | 22.60 | 22.96 | 23.32 | 23.67 | 24.03 | 24.39 | 24.75 |
| 0.7               | 25.11 | 25.47 | 25.83 | 26.19 | 26.54 | 26.90 | 27.26 | 27.62 | 27.98 | 28.34 |
| 0.8               | 28.70 | 29.05 | 29.41 | 29.77 | 30.13 | 30.49 | 30.85 | 31.21 | 31.57 | 31.92 |
| 0.9               | 32.28 | 32.64 | 33.00 | 33.36 | 33.72 | 34.08 | 34.44 | 34.79 | 35.15 | 35.51 |
| 1.0               | 35.87 | 36.23 | 36.59 | 36.95 | 37.31 | 37.66 | 38.02 | 38.38 | 38.74 | 39.10 |
| 1.1               | 39.46 | 39.82 | 40.17 | 40.53 | 40.89 | 41.25 | 41.61 | 41.97 | 42.33 | 42.69 |
| 1.2               | 43.04 | 43.40 | 43.76 | 44.12 | 44.48 | 44.84 | 45.20 | 45.56 | 45.91 | 46.27 |
| 1.3               | 46.63 | 46.99 | 47.35 | 47.71 | 48.07 | 48.43 | 48.78 | 49.14 | 49.50 | 49.86 |
| 1.4               | 50.22 | 50.58 | 50.94 | 51.29 | 51.65 | 52.01 | 52.37 | 52.73 | 53.09 | 53.45 |
| 1.5               | 53.81 | 54.16 | 54.52 | 54.88 | 55.24 | 55.60 | 55.96 | 56.32 | 56.67 | 57.03 |
| 1.6               | 57.39 | 57.75 | 58.11 | 58.47 | 58.83 | 59.19 | 59.54 | 59.90 | 60.26 | 60.62 |

ft<sup>3</sup>/ton

12.2 Cubic feet per long ton (ft<sup>3</sup>/ton) (2,240 lb, 1,016 kg) to cubic metres per metric tonne (m<sup>3</sup>/t) (2,204 lb, 1,000 kg)

*Factor: 1 ft<sup>3</sup>/ton = 0.02788 m<sup>3</sup>/t (rounded to the nearest ten thousandth of a m<sup>3</sup>/t)*

|                      |        |        |        |        |        |        |        |        |        |        |
|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| ft <sup>3</sup> /ton | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      |
| 0                    | -      | 0.0279 | 0.0558 | 0.0836 | 0.1115 | 0.1394 | 0.1676 | 0.1952 | 0.2230 | 0.2509 |
| 10                   | 0.2788 | 0.3067 | 0.3346 | 0.3624 | 0.3903 | 0.4182 | 0.4461 | 0.4740 | 0.5018 | 0.5297 |
| 20                   | 0.5576 | 0.5855 | 0.6134 | 0.6412 | 0.6691 | 0.6970 | 0.7249 | 0.7528 | 0.7806 | 0.8085 |
| 30                   | 0.8364 | 0.8643 | 0.8922 | 0.9200 | 0.9479 | 0.9758 | 1.0037 | 1.0316 | 1.0594 | 1.0873 |
| 40                   | 1.1152 | 1.1431 | 1.1710 | 1.1988 | 1.2267 | 1.2546 | 1.2825 | 1.3104 | 1.3382 | 1.3661 |
| 50                   | 1.3940 | 1.4219 | 1.4498 | 1.4776 | 1.5055 | 1.5334 | 1.5613 | 1.5892 | 1.6170 | 1.6449 |
| 60                   | 1.6728 | 1.7007 | 1.7286 | 1.7564 | 1.7843 | 1.8122 | 1.8401 | 1.8680 | 1.8958 | 1.9237 |
| 70                   | 1.9516 | 1.9795 | 2.0074 | 2.0352 | 2.0631 | 2.0910 | 2.1189 | 2.1468 | 2.1746 | 2.2025 |
| 80                   | 2.2304 | 2.2583 | 2.2862 | 2.3140 | 2.3419 | 2.3698 | 2.3977 | 2.4256 | 2.4534 | 2.4818 |
| 90                   | 2.5092 | 2.5371 | 2.5650 | 2.5928 | 2.6207 | 2.6486 | 2.6765 | 2.7044 | 2.7322 | 2.7601 |
| 100                  | 2.7880 | 2.8159 | 2.8438 | 2.8716 | 2.8995 | 2.9274 | 2.9553 | 2.9832 | 3.0110 | 3.0389 |

m<sup>3</sup>/t

## Section 13

### References to related information and recommendations

#### 13.1 General

This section lists the references to the IMO instruments and other international standards (such as ISO, IEC) relevant to the requirements in this Code. It should be noted that this listing is not exhaustive.

#### 13.2 Reference list

The references to the subsections in this Code, references to the relevant IMO instruments or standard and subjects are in the following tables. Column 1 contains the references to the subsection numbers in this Code. Column 2 contains the references to the relevant IMO instruments or reference standard. Column 3 identifies the relevant subjects.

| Reference to subsections in this Code (1) | Reference to the relevant IMO instruments or standard (2) | Subject (3) |
|---|---|-------------|
|---|---|-------------|

##### 13.2.1 Dangerous goods and classification

|     |  |                                   |
|-----|--|-----------------------------------|
| 9.2 | IMDG Code (SOLAS VII/1.1)<br>SOLAS VII/1.2 | Classification of dangerous goods |
|-----|--|-----------------------------------|

##### 13.2.2 Stability

|       |                |                                      |
|-------|----------------|--------------------------------------|
| 2.1.3 | SOLAS II-1/5-1 | Stability information                |
| 2.1.3 | SOLAS VI/6.1   | Stability information                |
| 2.1.3 | SOLAS VI/7.2.1 | Stability information                |
| 2.1.3 | SOLAS VI/7.4   | Loading and trimming of bulk cargoes |
| 2.1.3 | SOLAS XII/8    | Stability information                |

##### 13.2.3 Fire-extinguishing arrangements

|                  |                       |  |
|------------------|-----------------------|--|
| General Group B  | SOLAS II-2/10.7       | Fire-extinguishing arrangements in cargo spaces  |
| General Group B  | FSS Code, chapter 5   | Fixed Gas Fire-Extinguishing Systems   |
| General          | FSS Code, chapter 9   | Fixed fire detection and fire alarm systems  |
| General          | FSS Code, chapter 10  | Sample extraction smoke detection systems  |
| Group B          | SOLAS II-2/19         | Special requirements for ships carrying dangerous goods  |
| Group A, B and C | MSC.1/Circ.1395/Rev.4 | List of solid bulk cargoes for which a fixed gas fire-extinguishing system may be exempted or for which a fixed gas fire-extinguishing system is ineffective |

### 13.2.4 Ventilation

|                 |   |  |
|-----------------|---|--|
| General Group B | International Convention on Load Lines 1966, Annex I, regulation 19 | Ventilation openings   |
| General Group B | SOLAS II-2/9.7  | Ventilation systems  |
| General Group B | SOLAS II-2/19.3.4   | Ventilation for ships carrying dangerous goods                             |
| General Group B | MSC.1/Circ.1434   | Unified Interpretation of SOLAS II-2/19.3.4                                |
| General Group B | MSC.1/Circ.1120   | Unified Interpretation of SOLAS including II-2/19.3.2, 19.3.4 and 19.3.4.2 |
| General Group B | IEC 60092-506   | Electrical standards for equipment safe for use in an explosive atmosphere |

### 13.2.5 Personnel protection

|                 |  |                                    |
|-----------------|--|------------------------------------|
| General Group B | IMO/WHO/ILO <i>Medical First Aid Guide for Use in Accidents Involving Dangerous Goods</i> (MFAG) | First aid measures                 |
| General Group B | SOLAS II-2/10.10 and FSS Code, chapter 3   | Fire-fighters' outfits             |
| General Group B | SOLAS II-2/19.3.6.1 and FSS Code, chapter 3  | Protective clothing                |
| General Group B | SOLAS II-2/19.3.6.2 and FSS Code, chapter 3  | Self-contained breathing apparatus |

### 13.2.6 Gas detection

|         |   |  |
|---------|---|--|
| General | SOLAS VI/3  | Oxygen analysis and gas detection equipment                                |
| General | Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds (MSC.1/Circ.1264), as amended by MSC.1/Circ.1396 | Gas detection equipment for fumigation                                     |
| General | IEC 60092-506   | Electrical standards for equipment safe for use in an explosive atmosphere |

### 13.2.7 Minimum information/documentation

|       |                                |   |
|-------|--------------------------------|---|
| 4.8.3 | SOLAS II-2/19.4                | Document of compliance for carriage of dangerous goods              |
| 4.2   | SOLAS VII/2                    | Cargo information   |
| 4.2   | SOLAS XII/8<br>SOLAS XII/10    | Cargo restrictions and other information<br>Density of bulk cargoes |
| 4.2   | SOLAS VI/7.2                   | Stability and other information on ships                            |
| 4.2   | SOLAS VII/7-2                  | Documentation for solid bulk dangerous goods                        |
| 4.2   | MARPOL Annex V, regulation 4.3 | Discharge of garbage outside special areas                          |

|     |                                    |   |
|-----|------------------------------------|---|
| 4.2 | MARPOL Annex V, regulation 6.1.2.2 | Discharge of garbage within special areas |
| 4.2 | MARPOL Annex V, appendix 1         | Cargo information                         |

### 13.2.8 Insulation of machinery space boundaries

|         |                           |   |
|---------|---------------------------|---|
| Group B | SOLAS II-2/3.2, 3.4, 3.10 | Definitions of "A", "B" and "C" class divisions |
| Group B | SOLAS II-2/9.2            | Fire integrity of bulkheads and decks           |
| Group B | SOLAS II-2/19.3.8         | Insulation requirement ("A-60")                 |

### 13.2.9 Fumigation

|     |   |  |
|-----|---|--|
| 3.6 | Recommendations on the safe use of pesticides in ships applicable to the fumigation of cargo holds (MSC.1/Circ.1264), as amended by MSC.1/Circ.1396), section 3 | Fumigation, application of fumigation, fumigants, safety precautions |
| 3.6 | SOLAS VI/4  | Use of pesticides in ships   |

### 13.2.10 Segregation

|         |               |   |
|---------|---------------|---|
| 9.3     | SOLAS VII/7-3 | Stowage and segregation requirement                       |
| Group B | IEC 60092-352 | Standards for electrical cable penetrations in boundaries |

### 13.2.11 Transport of solid wastes in bulk

|      |  |  |
|------|--|--|
| 10.4 | Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989) | Permitted transboundary movement of wastes |
| 10.6 | IMDG Code, subsection 2.0.5.4  | Classification of wastes                   |

### 13.2.12 Entering enclosed spaces

|       |   |   |
|-------|---|---|
| 3.2.4 | Resolution A.1050(27), 30 November 2011 | Revised recommendations for entering enclosed spaces aboard ships |
|-------|---|---|

### 13.2.13 Avoidance of excessive stresses

|       |                                  |  |
|-------|----------------------------------|--|
| 2.1.2 | SOLAS XII/5 and 6                | Structural strength of bulk carriers and structural and other requirements for bulk carriers |
| 2.1.2 | SOLAS XII/11                     | Loading instrument   |
| 2.1.2 | Resolution A.862(20), as amended | Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code)              |
| 2.1.2 | MSC.1/Circ.1357                  | Additional considerations for the safe loading of bulk carriers                              |



**APPENDIX 1**

**INDIVIDUAL SCHEDULES OF SOLID BULK CARGOES**

## ALFALFA

### Description

Material derived from dried alfalfa grass. Shipped in the form of meal, pellets, etc.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine Powder           | Not applicable       | 508 to 719                        | 1.39 to 1.97                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. Prior to loading of this cargo, a certificate shall be provided by a competent authority or shipper stating that the material as shipped does not meet the requirements for seed cake. Shipments which do meet the oil and moisture criteria for SEED CAKE shall comply with the requirements for SEED CAKE (a) UN 1386, SEED CAKE (b) UN 1386 or SEED CAKE UN 2217.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## ALUMINA

### Description

Alumina is a fine, white odourless powder with little or no moisture. Insoluble in organic liquids. Moisture content: 0% to 5%. If wet, alumina is unpumpable. This cargo is insoluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine powder           | Not applicable       | 781 to 1,087                      | 0.92 to 1.28                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Alumina dust is very abrasive and penetrating. Irritating to eyes and mucous membranes. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

The water used for the cleaning of the cargo spaces, after discharge of this cargo, shall not be pumped by the fixed bilge pumps. A portable pump shall be used, as necessary, to clear the cargo spaces of the water.

## ALUMINA, CALCINED

### Description

Light to dark grey in colour. No moisture content. This cargo is insoluble in water.

### Characteristics

| Physical properties       |                      |                                   |                                    |
|---------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Small particles and lumps | Not applicable       | 1,639                             | 0.61                               |
| Hazard classification     |                      |                                   |                                    |
| Class                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable            | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

The water used for the cleaning of the cargo spaces, after discharge of this cargo, shall not be pumped by the fixed bilge pumps. A portable pump shall be used, as necessary, to clear the cargo spaces of the water.

## ALUMINA HYDRATE

### Description

Alumina hydrate is a fine, moist, white (light coloured), odourless powder. Insoluble in water and organic liquids.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine powder           | Not applicable       | 500 to 1,500                      | 0.67 to 2.00                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CR                                | A and B                            |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. Alumina Hydrate dust is very abrasive and penetrating. Irritating to eyes, skin and mucous membranes.

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

### Stowage and segregation

"Separated from" oxidizing materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

The water used for the cleaning of the cargo spaces, after discharge of this cargo, shall not be pumped by the fixed bilge pumps. A portable pump shall be used, as necessary, to clear the cargo spaces of the water.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Nil (non-combustible).</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## ALUMINA SILICA

### Description

White, consists of alumina and silica crystals. Low moisture content (1% to 5%).

Lumps 60%.

Coarse grained powder – 40%. This cargo is insoluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 1,429                             | 0.70                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

The water used for the cleaning of the cargo spaces, after discharge of this cargo, shall not be pumped by the fixed bilge pumps. A portable pump shall be used, as necessary, to clear the cargo spaces of the water.

## ALUMINA SILICA, pellets

### Description

White to off-white. No moisture content.

### Characteristics

| Physical properties                              |                      |                                   |                                    |
|--|----------------------|-----------------------------------|------------------------------------|
| Size   | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Length:<br>6.4 mm to 25.4 mm<br>Diameter: 6.4 mm | Not applicable       | 1,190 to 1,282                    | 0.78 to 0.84                       |
| Hazard classification                            |                      |                                   |                                    |
| Class  | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable                                   | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## ALUMINIUM FERROSILICON POWDER UN 1395

### Description

Fine powder or briquettes.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.3                   | 6.1                  |                                   | B                                  |

### Hazard

In contact with water may evolve hydrogen, a flammable gas which may form an explosive mixture in air. Impurities may, under similar conditions, produce phosphine and arsine, which are highly toxic gases.

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

### Stowage and segregation

"Separated from" foodstuffs and all class 8 liquids.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Prior to loading this cargo, a certificate shall be provided by the manufacturer or shipper stating that the material was stored under cover, but exposed to the weather in the particle size to be shipped, for not less than 3 days prior to shipment. The bulkheads between the cargo spaces and the engine-room shall be gastight and shall be inspected and approved by the Administration. During handling of this cargo, "NO SMOKING" signs shall be posted on decks and in areas adjacent to cargo spaces and no naked lights shall be permitted in these areas. At least two sets of self-contained breathing apparatus, in addition to those required by SOLAS regulation II-2/10.10, shall be provided on board.

### Ventilation

Continuous mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. If maintaining ventilation endangers the ship or the cargo, it may be interrupted unless there is a risk of explosion or other danger due to interruption of the ventilation. In any case, mechanical ventilation shall be maintained for a reasonable period prior to discharge.

### Carriage

For quantitative measurements of hydrogen, phosphine and arsine and silane, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be of certified safe type for use in explosive atmosphere.

The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

**Discharge**

No special requirements.

**Clean-up**

After discharge of this cargo, the cargo spaces shall be swept clean twice. Water shall not be used for cleaning of the cargo space which has contained this cargo, because of danger of gas.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down and use CO<sub>2</sub>, if available. <b>Do not use water.</b></p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |



## ALUMINIUM FLUORIDE

### Description

Aluminium fluoride is a fine, white powder, odourless which presents itself dry. The cargo is not cohesive. The moisture content is less than 1%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine powder           | 32° to 35°           | 1,527                             | 0.65                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

The cargo may be slightly irritating to eyes and mucous membranes. In contact with acids, it develops toxic vapours of hydrogen fluoride. If involved in a fire, it may develop toxic fumes of hydrogen fluoride.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

**Precautions**

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

Maintain accommodation and equipment protected from dust.

**Clean-up**

Make sure that decks and holds are shovelled and swept clean before using water.

## ALUMINIUM NITRATE UN 1438

### Description

Colourless or white crystals. Soluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | Not applicable       |                                   | B                                  |

### Hazard

If involved in a fire will greatly intensify the burning of combustible materials and yield toxic nitrous fumes. Although non-combustible, mixtures with combustible material are easily ignited and may burn fiercely.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Due consideration shall be given to prevent contact of the cargo and combustible materials. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## Emergency procedures

### **Special emergency equipment to be carried**

Protective clothing (gloves, overalls and headgear).

Self-contained breathing apparatus.

Spray nozzles.

### **Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

### **Emergency action in the event of fire**

Use copious quantities of water, which is best applied in the form of a spray to avoid disturbing the surface of the material. The material may fuse or melt; in which condition application of water may result in extensive scattering of the molten materials. Exclusion of air or the use of CO<sub>2</sub> will not control the fire. Due consideration should be given to the effect on the stability of the ship due to accumulated water.

### **Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

**ALUMINIUM SILICON POWDER, UNCOATED UN 1398**

**Description**

Powder

**Characteristics**

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.3                   | Not applicable       |                                   | B                                  |

**Hazard**

In contact with water may evolve hydrogen, a flammable gas which may form explosive mixtures with air. Impurities may, under similar circumstances, produce phosphine and arsine, which are highly toxic gases. May also evolve silanes, which are toxic and may ignite spontaneously.

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

**Stowage and segregation**

"Separated from" foodstuffs and all class 8 liquids.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Prior to loading this cargo, a certificate shall be provided by the manufacturer or shipper stating that the material was stored under cover, but exposed to the weather in the particle size to be shipped, for not less than 3 days prior to shipment. The bulkheads between the cargo spaces and the engine-room shall be gastight and shall be inspected and approved by the Administration. During handling of this cargo, "NO SMOKING" signs shall be posted on decks and in areas adjacent to cargo spaces and no naked lights shall be permitted in these areas. This cargo shall be loaded in cargo spaces fitted with mechanical ventilation having at least two separate fans. The total ventilation shall be at least six air changes per hour, based on the empty space. At least two sets of self-contained breathing apparatus, in addition to those required by SOLAS regulation II-2/10.10, shall be provided on board.

**Ventilation**

Continuous mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. If maintaining ventilation endangers the ship or the cargo, it may be interrupted unless there is a risk of explosion or other danger due to interruption of the ventilation. In any case mechanical ventilation shall be maintained for a reasonable period prior to discharge. Ventilation shall be arranged such that any escaping gases are minimized from reaching living quarters on or under the deck.

**Carriage**

For quantitative measurements of hydrogen, phosphine, arsine, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

**Discharge**

No special requirements.

**Clean-up**

After discharge of this cargo, the cargo spaces shall be swept clean twice. Water shall not be used for cleaning of the cargo space which has contained this cargo, because of danger of gas.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down and use CO<sub>2</sub>, if available. <b>Do not use water.</b></p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## **ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS UN 3170**

### **Description**

Aluminium smelting by-products are wastes from the aluminium manufacturing process. Grey or black powder or lumps with some metallic inclusions. The term encompasses various different waste materials, which include but are not limited to:

|                      |                |
|----------------------|----------------|
| Aluminium dross      | Spent cathodes |
| Aluminium salt slags | Spent potliner |
| Aluminium skimmings  |                |

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Not applicable               | Not applicable              | 1,220                                      | 0.82  |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| 4.3                          | Not applicable              |  | B   |

### **Hazard**

Contact with water may cause heating with possible evolution of flammable and toxic gases such as hydrogen, ammonia and acetylene.

Fire is unlikely but may follow an explosion of flammable gas and will be difficult to extinguish. In port, flooding may be considered, but due consideration should be given to stability.

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

### **Stowage and segregation**

"Separated from" foodstuffs and all class 8 liquids.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### **Precautions**

Prior to loading this cargo, a certificate shall be provided by the manufacturer or shipper stating that, after manufacture, the material was stored under cover, but exposed to the weather in the particle size to be shipped, for not less than 3 days prior to shipment. Whilst the ship is alongside and the hatches of the cargo spaces containing this cargo are closed, the mechanical ventilation shall be operated continuously as weather permits. During handling of this cargo, "NO SMOKING" signs shall be posted on decks and in areas adjacent to cargo spaces and no naked lights shall be permitted in these areas. At least two self-contained breathing apparatus, in addition to those required by SOLAS regulation II-2/10.10, shall be provided on board. Bulkheads between the cargo spaces and the engine-room shall be gastight. Inadvertent pumping through machinery spaces shall be avoided.

**Ventilation**

Continuous mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. If maintaining ventilation endangers the ship or the cargo, it may be interrupted unless there is a risk of explosion or other danger due to interruption of the ventilation. In any case mechanical ventilation shall be maintained for a reasonable period prior to discharge. Ventilation shall be arranged such that any escaping gases are minimized from reaching living quarters on or under the deck.

**Carriage**

For quantitative measurements of hydrogen, ammonia and acetylene, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

**Discharge**

No special requirements.

**Clean-up**

Water shall not be used for cleaning of the cargo space which has contained this cargo, because of danger of gas.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down and use CO<sub>2</sub>, if available. <b>Do not use water.</b> If this proves ineffective, endeavour to stop fire from spreading and head for the nearest suitable port.</p> |
| <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p>  |



## ALUMINIUM SMELTING/REMelTING BY-PRODUCTS, PROCESSED

The provisions of this schedule shall not apply to ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS UN 3170.

### Description

Product obtained by treating the by-products of merging/recasting of aluminium with water and/or alkalis solutions to render the material less reactive with water. A damp powder with a slight smell of ammonia.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Less than 1 mm        | Not applicable       | 1,080 to 1,750                    | 0.57 to 0.93                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | WF and/or WT and/or CR            | A and B                            |

### Hazard

This cargo may develop small amount of hydrogen, a flammable gas which may form explosive mixtures with air, and of ammonia, which is a highly toxic gas.

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. Corrosive to eyes.

### Stowage and segregation

"Separated from" foodstuffs and all class 8 liquids. Segregation as for class 4.3 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable and the moisture content shall be kept less than its TML during loading operations and the voyage. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Persons who may be exposed to the cargo shall wear personal protective equipment, including goggles and/or skin protection as necessary. Prior to loading this cargo, a weathering certificate shall be provided by the manufacturer or shipper stating that, after manufacture, the material was stored under cover, but exposed to the weather in the particle size to be shipped, for not less than four weeks prior to shipment. Whilst the ship is alongside and the hatches of the cargo spaces containing this cargo are closed, the mechanical ventilation shall be operated continuously as weather permits. During handling of this cargo, "NO SMOKING" signs shall be posted on decks and in areas adjacent to cargo spaces and no naked lights shall be permitted in these areas. Bulkheads between the cargo spaces and the engine-room shall be gastight. Inadvertent pumping through machinery spaces shall be avoided. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

**Ventilation**

Continuous mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. If maintaining ventilation endangers the ship or the cargo, it may be interrupted unless there is a risk of explosion or other danger due to interruption of the ventilation. In any case, mechanical ventilation shall be maintained for a reasonable period prior to discharge. Ventilation shall be arranged such that any escaping gases are minimized from reaching living quarters on or under the deck.

**Carriage**

For quantitative measurements of hydrogen, ammonia and acetylene, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board. The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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. Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**Discharge**

No special requirements.

**Clean-up**

Persons who may be exposed to the cargo shall wear personal protective equipment including goggles and/or skin protection as necessary. After discharge of this cargo, the bilge wells and scuppers of the cargo spaces shall be checked and any blockage shall be removed. Prior to using water for hold cleaning, holds shall be swept to remove as much cargo residues as practicable.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down and use CO<sub>2</sub>, if fitted.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

**AMMONIUM NITRATE UN 1942**

**with not more than 0.2% total combustible material, including any organic substance, calculated as carbon to the exclusion of any other added substance**

**Description**

White crystals, prills or granules. Wholly or partly soluble in water.

**Note:** This schedule should only be used for substances that do not exhibit properties of class 1 when tested in accordance with Test Series 1 and 2 of class 1 (see *UN Manual of Tests and Criteria*).

**Characteristics**

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 1 mm to 4 mm          | 27° to 42°           | 1,000                             | 1.00                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | Not applicable       |                                   | B                                  |

**Hazard**

Oxidizer, supports combustion. A major fire aboard a ship carrying this cargo may involve a risk of explosion in the event of contamination (e.g. by fuel oil) or strong confinement. An adjacent detonation may also involve a risk of explosion. If heated strongly, this cargo decomposes, giving off toxic gases and gases which support combustion. Ammonium nitrate dust might be irritating to skin and mucous membranes. This cargo is hygroscopic and will cake if wet.

**Stowage and segregation**

"Separated from" sources of heat or ignition (see also **Loading**).  
 "Separated by a complete compartment or hold from" combustible materials (particularly liquids), chlorates, chlorides, chlorites, hypochlorites, nitrites, permanganates and fibrous materials (e.g. cotton, jute, sisal, etc.).  
 "Separated from" all other goods.  
 If the bulkhead between the cargo space and the engine-room is not insulated to class "A-60" standard, this cargo shall be stowed "away from" the bulkhead.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

This cargo shall not be loaded in cargo spaces adjacent to fuel oil tank(s), unless heating arrangements for the tank(s) are disconnected and remain disconnected during the entire voyage.  
 Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

***Prior to loading, the following provisions shall be complied with:***

- .1 This cargo shall not be accepted for loading when the temperature of the cargo is above 40°C.
- .2 Prior to loading, the shipper shall provide the master with a certificate signed by the shipper stating that all the relevant conditions of the cargo required by this Code, including this individual schedule, have been met.
- .3 The fuel tanks situated under the cargo spaces to be used for the transport of this cargo shall be pressure tested to ensure that there is no leakage of manholes and piping systems leading to the tanks.
- .4 All electrical equipment, other than those of approved intrinsically safe type, in the cargo spaces to be used for this cargo shall be electrically disconnected from the power source, by appropriate means other than a fuse, at a point external to the space. This situation shall be maintained while the cargo is on board.
- .5 Due consideration shall be given to the possible need to open hatches in case of fire to provide maximum ventilation and to apply water in an emergency and the consequent risk to the stability of the ship through fluidization of the cargo.

***During loading, the following provisions shall be complied with:***

- .6 Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed.
- .7 As far as reasonably practicable, combustible securing and protecting materials shall not be used. When wooden dunnage is necessary, only a minimum shall be used.

**Precautions**

This cargo shall only be accepted for loading when the competent authority is satisfied with regard to the resistance to detonation of this material based on the test. Prior to loading, the shipper shall provide the master with a certificate stating that the resistance to detonation of this material is in compliance with this requirement. The master and officers are to note that the ship's fixed gas fire-extinguishing installation will be ineffective on the fire involving this cargo and that applying copious amounts of water may be necessary. Pressure on the fire mains shall be maintained for fire-fighting and fire hoses shall be laid out or be in position and ready for immediate use during loading and discharging of this cargo. No welding, burning, cutting or other operations involving the use of fire, open flame, spark- or arc-producing equipment shall be carried out in the vicinity of the cargo spaces containing this cargo except in an emergency. Precautions shall be taken to avoid the penetration of this cargo into other cargo spaces, bilges and other enclosed spaces. Smoking shall not be allowed on deck and in the cargo spaces and "NO SMOKING" signs shall be displayed on deck whenever this cargo is on board. The hatches of the cargo spaces, whenever this material is on board, shall be kept free to be capable of being opened in case of an emergency.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water. The temperature of this cargo shall be monitored and recorded daily during the voyage to detect decomposition, which may result in heating and oxygen depletion.

### **Discharge**

If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary. Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed.

### **Clean-up**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

### **Emergency procedures**

#### **Special emergency equipment to be carried**

Protective clothing (boots, gloves, coveralls and headgear).  
Self-contained breathing apparatus.

#### **Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

#### **Emergency action in the event of fire**

***Fire in a cargo space containing this material:*** Open hatches to provide maximum ventilation. Ship's fixed gas fire-extinguishing installation will be inadequate. Use copious amounts of water and isolate the source of heat, if any. Flooding of the cargo space may be considered but due consideration should be given to stability.

***Fire in an adjacent cargo space:*** Open hatches to provide maximum ventilation. Heat transferred from fire in an adjacent space can cause the material to decompose with consequent evolution of toxic fumes. Dividing bulkheads should be cooled.

#### **Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## AMMONIUM NITRATE BASED FERTILIZER UN 2067

Ammonium nitrate-based fertilizers classified as UN 2067 are uniform mixtures containing ammonium nitrate as the main ingredient within the following composition limits:

- .1 not less than 90% ammonium nitrate with not more than 0.2% total combustible/organic material calculated as carbon and with added matter, if any, which is inorganic and inert towards ammonium nitrate; or
- .2 less than 90% but more than 70% ammonium nitrate with other inorganic materials or more than 80% but less than 90% ammonium nitrate mixed with calcium carbonate and/or dolomite and/or mineral calcium sulphate and not more than 0.4% total combustible/organic material calculated as carbon; or
- .3 ammonium nitrate-based fertilizers containing mixtures of ammonium nitrate and ammonium sulphate with more than 45% but less than 70% ammonium nitrate and not more than 0.4% total combustible organic material calculated as carbon such that the sum of the percentage compositions of ammonium nitrate and ammonium sulphate exceeds 70%.

### Description

Crystals, granules or prills. Wholly or partly soluble in water. Hygroscopic.

### Notes:

1. All nitrate ions for which there is present in the mixture a molecular equivalent of ammonium ions should be calculated as ammonium nitrate.
2. The transport of ammonium nitrate materials which are liable to self-heating sufficient to initiate decomposition is prohibited.
3. This entry may only be used for substances that do not exhibit properties of class 1 when tested in accordance with Test Series 1 and 2 of the *UN Manual of Tests and Criteria*.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 1 mm to 5 mm          | 27° to 42°           | 900 to 1,200                      | 0.83 to 1.11                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | Not applicable       |                                   | B                                  |

### Hazard

Supports combustion. A major fire aboard a ship carrying these substances may involve a risk of explosion in the event of contamination (e.g. by fuel oil) or strong confinement. An adjacent detonation may involve a risk of explosion.

If heated strongly decomposes, risk of toxic fumes and gases which support combustion, in the cargo space and on deck.

Fertilizer dust might be irritating to skin and mucous membranes.

This cargo is hygroscopic and will cake if wet.

### **Stowage and segregation**

"Separated by a complete compartment or hold from" combustible materials (particularly liquid), bromates, chlorates, chlorites, hypochlorites, nitrites, perchlorates, permanganates, powdered metals and vegetable fibres (e.g. cotton, jute, sisal, etc.).

"Separated from" all other goods.

"Separated from" sources of heat or ignition (*see also Loading*).

Not to be stowed immediately adjacent to any tank, double bottom or pipe containing heated fuel oil unless there are means to monitor and control the temperature so that it does not exceed 50°C.

If the bulkhead between the cargo space and the engine-room is not insulated to class A-60 standard, this cargo shall be stowed "away from" the bulkhead.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

#### ***Prior to loading, the following provisions shall be complied with:***

- .1 This cargo shall not be accepted for loading when the temperature of the cargo is above 40°C.
- .2 Prior to loading, the shipper shall provide the master with a certificate signed by the shipper stating that all the relevant conditions of the cargo required by this Code, including this individual schedule, have been met.
- .3 The fuel tanks situated under the cargo spaces to be used for the transport of this cargo shall be pressure tested to ensure that there is no leakage of manholes and piping systems leading to the tanks.
- .4 All electrical equipment, other than those of approved intrinsically safe type, in the cargo spaces to be used for this cargo shall be electrically disconnected from the power source, by appropriate means other than a fuse, at a point external to the space. This situation shall be maintained while the cargo is on board.
- .5 Due consideration shall be given to the possible need to open hatches in case of fire to provide maximum ventilation and to apply water in an emergency and the consequent risk to the stability of the ship through fluidization of the cargo.

#### ***During loading, the following provisions shall be complied with:***

- .6 Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed.
- .7 As far as reasonably practicable, combustible securing and protecting materials shall not be used. When wooden dunnage is necessary, only a minimum shall be used.

### **Precautions**

This cargo shall only be accepted for loading when the competent authority is satisfied with regard to the resistance to detonation of this material based on the test. The master and officers are to note that the ship's fixed gas fire-extinguishing installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary. Prior to loading, the shipper shall provide the master with a certificate stating that the resistance to detonation of this material is in compliance with this requirement. Pressure on the fire mains shall be maintained for fire-fighting and fire hoses shall be laid out or be in position and ready for immediate use during loading and discharging of this cargo. No welding, burning, cutting or other operations involving the use of fire, open flame, spark- or arc-producing equipment shall be carried out in the vicinity of the cargo spaces containing this cargo except in an emergency. Smoking shall not be allowed on deck and in the cargo spaces and "NO SMOKING" signs shall be displayed on deck whenever this cargo is on board. Precautions shall be taken to avoid the penetration of this cargo into other cargo spaces, bilges and other enclosed spaces. The hatches of the cargo spaces, whenever this material is on board, shall be kept free to be capable of being opened in case of an emergency.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water. The temperature of this cargo shall be monitored and recorded daily during the voyage to detect decomposition which may result in heating and oxygen depletion.

### **Discharge**

Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed. Ammonium nitrate based fertilizers are hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### **Clean-up**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.



## Emergency procedures

### **Special emergency equipment to be carried**

Protective clothing (boots, gloves, coveralls and headgear).  
Self-contained breathing apparatus.

### **Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

### **Emergency action in the event of fire**

*Fire in a cargo space containing this material:* Open hatches to provide maximum ventilation. Ship's fixed gas fire-extinguishing installation will be inadequate. Use copious quantities of water and isolate the source of heat, if any. Flooding of the cargo space may be considered but due consideration should be given to stability.

*Fire in an adjacent cargo space:* Open hatches to provide maximum ventilation. Heat transferred from fire in an adjacent space can cause the material to decompose with consequent evolution of toxic fumes. Dividing bulkheads should be cooled.

### **Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## AMMONIUM NITRATE BASED FERTILIZER UN 2071

Ammonium nitrate based fertilizers classified as UN 2071 are uniform ammonium nitrate based fertilizer mixtures of nitrogen, phosphate or potash, containing not more than 70% ammonium nitrate and not more than 0.4% total combustible organic material calculated as carbon or with not more than 45% ammonium nitrate and unrestricted combustible material. Fertilizers within these composition limits are not subject to the provisions of this schedule when shown by a trough test (see *UN Manual of Tests and Criteria*, part III, section 39) that they are not liable to self-sustaining decomposition.

### Description

Usually granules. Wholly or partly soluble in water. Hygroscopic.

### Notes:

1. All nitrate ions for which there is present in the mixture a molecular equivalent of ammonium ions should be calculated as ammonium nitrate.
2. The transport of ammonium nitrate materials which are liable to self-heating sufficient to initiate a decomposition is prohibited.
3. The NPK proportions for a fertilizer should not be used as a guide to its ability to undergo self-sustaining decomposition as this depends on the chemical species present.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 1 mm to 5 mm          | 27° to 42°           | 900 to 1,200                      | 0.83 to 1.11                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 9                     | Not applicable       |                                   | B                                  |

### Hazard

This cargo may be subject to self-sustaining decomposition if heated. The temperature in such a reaction can reach 500°C. Decomposition, once initiated, may spread throughout the remainder, producing gases which are toxic. None of these cargoes are subject to an explosion hazard.

Fertilizer dust might be irritating to skin and mucous membranes.

This cargo is hygroscopic and will cake if wet.

### Stowage and segregation

"Separated by a complete compartment or hold from" combustible materials (particularly liquid), bromates, chlorates, chlorites, hypochlorites, nitrites, perchlorates, permanganates, powdered metals and vegetable fibres (e.g. cotton, jute, sisal, etc.).

"Separated from" all other goods.

"Separated from" sources of heat or ignition (see also **Loading**).

Not to be stowed immediately adjacent to any tank, double bottom or pipe containing heated fuel oil unless there are means to monitor and control the temperature so that it does not exceed 50°C.

If the bulkhead between the cargo space and the engine-room is not insulated to class "A-60" standard, this cargo shall be stowed "away from" the bulkhead.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

#### ***Prior to loading, the following provisions shall be complied with:***

- .1 All electrical equipment, other than that of approved intrinsically safe type, in the cargo spaces to be used for this cargo shall be electrically disconnected from the power source, by appropriate means other than fuse, at a point external to the space. This situation shall be maintained while the cargo is on board.
- .2 Due consideration shall be given to the possible need to open hatches in case of fire to provide maximum ventilation and to apply water in an emergency and the consequent risk to the stability of the ship through fluidization of the cargo.
- .3 In addition, if decomposition occurs, the residue left after decomposition may have only half the mass of the original cargo. Due consideration shall be given to the effect of the loss of mass on the stability of the ship.

#### ***During loading, the following provisions shall be complied with:***

- .4 Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed.
- .5 As far as reasonably practicable, combustible securing and protecting materials shall not be used. When wooden dunnage is necessary, only a minimum amount shall be used.

### **Precautions**

This cargo shall only be accepted for loading when, as a result of testing in the trough test, its liability to self-sustaining decomposition shows decomposition rate not greater than 0.25 m/h. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary. Pressure on the fire mains shall be maintained for fire-fighting and fire hoses shall be laid out or be in position and ready for immediate use during loading and discharging of this cargo. No welding, burning, cutting or other operations involving the use of fire, open flame, spark- or arc-producing equipment shall be carried out in the vicinity of the cargo spaces containing this cargo except in an emergency. Smoking shall not be allowed on deck and in the cargo spaces and "NO SMOKING" signs shall be displayed on deck whenever this cargo is on board. Precautions shall be taken to avoid the penetration of this cargo into other cargo spaces, bilges and other enclosed spaces. The hatches of the cargo spaces, whenever this material is on board, shall be kept free to be capable of being opened in case of an emergency.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

The temperature of this cargo shall be monitored and recorded daily during the voyage to detect decomposition resulting in spontaneous heating and oxygen depletion.

### **Discharge**

Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed. Ammonium nitrate based fertilizers are hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### **Clean-up**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

### **Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (boots, gloves, coveralls and headgear).<br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b></p> <p><b><i>Fire in a cargo space containing this material:</i></b> Open hatches to provide maximum ventilation. Ship's fixed gas fire-extinguishing installation will be inadequate. Use copious quantities of water. Flooding of the cargo space may be considered but due consideration should be given to stability.</p> <p><b><i>Fire in an adjacent cargo space:</i></b> Open hatches to provide maximum ventilation. Heat transferred from fire in an adjacent space can cause the material to decompose with consequent evolution of toxic fumes. Dividing bulkheads should be cooled.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## AMMONIUM NITRATE BASED FERTILIZER (non-hazardous)

Ammonium nitrate based fertilizers transported in conditions mentioned in this schedule are uniform mixtures containing ammonium nitrate as the main ingredient within the following composition limits:

- .1 not more than 70% ammonium nitrate with other inorganic materials;
- .2 not more than 80% ammonium nitrate mixed with calcium carbonate and/or dolomite and/or mineral calcium sulphate and not more than 0.4% total combustible organic material calculated as carbon;
- .3 nitrogen type ammonium nitrate based fertilizers containing mixtures of ammonium nitrate and ammonium sulphate with not more than 45% ammonium nitrate and not more than 0.4% total combustible organic material calculated as carbon; and
- .4 uniform ammonium nitrate based fertilizer mixtures of nitrogen, phosphate or potash, containing not more than 70% ammonium nitrate and not more than 0.4% total combustible organic material calculated as carbon or with not more than 45% ammonium nitrate and unrestricted combustible material. Fertilizers within these composition limits are not subject to the provisions of this schedule when shown by a trough test (see *UN Manual of Tests and Criteria*, part III, section 39) that they are liable to self-sustaining decomposition or if they contain an excess of nitrate greater than 10% by mass.

### Description

Crystals, granules or prills non-cohesive when dry. Wholly or partly soluble in water.

### Notes:

1. All nitrate ions for which there is present in the mixture a molecular equivalent of ammonium ions should be calculated as ammonium nitrate.
2. The transport of ammonium nitrate materials which are liable to self-heating sufficient to initiate decomposition is prohibited.
3. The NPK proportions for a fertilizer should not be used as a guide to its ability to undergo self-sustaining decomposition as this depends on the chemical species present.
4. This schedule may only be used for substances that do not exhibit explosive properties of class 1 when tested in accordance with Test Series 1 and 2 of class 1 (see *UN Manual of Tests and Criteria*).
5. This schedule may only be used if the chemical or physical properties of an ammonium nitrate based fertilizer are such that, when tested, it does not meet the established defining criteria of any class.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 1 mm to 4 mm          | 27° to 42°           | 1,000 to 1,200                    | 0.83 to 1.00                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### **Hazard**

Even though this cargo is classified as non-hazardous, some of the properties of the ammonium nitrate based fertilizer classified in class 9 under UN 2071 are exhibited when heated strongly. When this cargo is heated strongly, it will decompose and give off toxic gases with the risk of toxic fumes in the cargo space, adjacent spaces and on deck. Monitoring of the cargo temperature may give an early indication of decomposition. Fertilizer dust might be irritating to skin and mucous membranes. It is hygroscopic cargo and will cake if wet.

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

### **Stowage and segregation**

The compatibility of non-hazardous ammonium nitrate based fertilizers with other materials which may be stowed in the same cargo space shall be considered before loading.

"Separated from" sources of heat or ignition (see also **Loading**).

Not to be stowed immediately adjacent to any tank, double bottom or pipe containing heated fuel oil unless there are means to monitor and control the temperature so that it does not exceed 50°C.

Fertilizers of this type shall be stowed out of direct contact with a metal engine-room boundary. This may be done, for example, by using flame-retardant bags containing inert materials or by any equivalent arrangement approved by the competent authority. This requirement need not apply if the bulkhead is class "A-60" or to short international voyages.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

#### ***Prior to loading, the following provisions shall be complied with:***

- .1 All electrical equipment, other than that of approved intrinsically safe type, in the cargo spaces to be used for this cargo shall be electrically disconnected from the power source, by appropriate means other than a fuse, at a point external to the space. This situation shall be maintained while the cargo is on board.
- .2 Due consideration shall be given to the possible need to open hatches in case of fire to provide maximum ventilation and to apply water in an emergency and the consequent risk to the stability of the ship through fluidization of the cargo.
- .3 In addition, if decomposition occurs, the residue left after decomposition may have only half the mass of the original cargo. Due consideration shall be given to the effect of the loss of mass on the stability of the ship.

#### ***During loading, the following provisions shall be complied with:***

- .4 Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed.

### **Precautions**

No welding, burning, cutting or other operations involving the use of fire, open flame, spark- or arc-producing equipment shall be carried out in the vicinity of the cargo spaces containing this cargo except in an emergency. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary. Smoking shall not be allowed on deck and in the cargo spaces and "NO SMOKING" signs shall be displayed on deck whenever this cargo is on board. The hatches of the cargo spaces, whenever this material is on board, shall be kept free to be capable of being opened in case of an emergency.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

### **Discharge**

Bunkering of fuel oil shall not be allowed. Pumping of fuel oil in spaces adjacent to the cargo spaces for this cargo, other than the engine-room, shall not be allowed. Ammonium nitrate based fertilizers are hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### **Clean-up**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

## Emergency procedures

### **Special emergency equipment to be carried**

Protective clothing (boots, gloves, coveralls and headgear).  
Self-contained breathing apparatus.

### **Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

### **Emergency action in the event of fire**

***Fire in a cargo space containing this material:*** Open hatches to provide maximum ventilation. Ship's fixed gas fire-extinguishing installation will be inadequate. Use copious quantities of water and isolate the source of heat, if any. Flooding of the cargo space may be considered but due consideration should be given to stability.

***Fire in an adjacent cargo space:*** Open hatches to provide maximum ventilation. Heat transferred from fire in an adjacent space can cause the material to decompose with consequent evolution of toxic fumes. Dividing bulkheads should be cooled.

### **Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.



## AMMONIUM SULPHATE

### Description

Brownish-grey to white crystals. Soluble in water. Free-flowing. Absorbs moisture. Moisture content 0.04% to 0.5%. Ammonia odour. Subject to natural loss in weight.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 2 mm to 4 mm          | 28° to 35°           | 943 to 1,052                      | 0.95 to 1.06                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Dust may cause skin and eye irritation. Harmful if swallowed. Even though this cargo is classified as non-hazardous, it may cause heavy corrosion of framing, side shell, bulkhead, etc., if sweating of cargo space occurs.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

During loading, due consideration shall be given to minimize dust generation. Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

**Discharge**

Ammonium sulphate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

**Clean-up**

After discharge of this cargo, the cargo spaces shall be thoroughly cleaned and washed out to remove all traces of the cargo and dried, except in the case that the cargo to be loaded subsequent to discharge is AMMONIUM SULPHATE.

## AMORPHOUS SODIUM SILICATE LUMPS

This schedule shall apply only to amorphous sodium silicate lumps with molar ratio of silicon dioxide to sodium oxide ( $\text{SiO}_2/\text{Na}_2\text{O}$ ) greater than 3.2.

### Description

Lumps. Colourless to green glassy solid.

### Characteristics

| Physical properties   |                      |                                  |  |
|-----------------------|----------------------|----------------------------------|--|
| Size                  | Angle of repose      | Bulk density ( $\text{kg/m}^3$ ) | Stowage factor ( $\text{m}^3/\text{t}$ ) |
| Up to 100 mm          | Not applicable       | 1,100 to 1,500                   | 0.67 to 0.91                             |
| Hazard classification |                      |                                  |  |
| Class                 | Subsidiary hazard(s) | MHB                              | Group                                    |
| Not applicable        | Not applicable       | CR                               | B  |

### Hazard

Dust may cause skin and eye irritation.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

During loading, due consideration shall be given to minimize dust generation. Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean and dry and covered as appropriate to prevent ingress of the cargo.

Persons who may be exposed to the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

During discharge, due consideration shall be given to minimize dust generation. This cargo is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

**Clean-up**

No special requirements.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Nil</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## ANTIMONY ORE AND RESIDUE

### Description

Lead-grey mineral, subject to black tarnish.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 2,381 to 2,941                    | 0.34 to 0.42                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

If involved in a fire, dangerous fumes of antimony and sulphur oxides can evolve. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## BARIUM NITRATE UN 1446

### Description

Glossy white crystals or powder. Soluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine powder           | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | 6.1                  |                                   | B                                  |

### Hazard

Toxic if swallowed or by dust inhalation. If involved in a fire mixture with combustible materials is readily ignited and may burn fiercely.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### Ventilation

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

### Carriage

No special requirements.

### Discharge

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (boots, gloves, overalls and headgear). Self-contained breathing apparatus.  
Spray nozzles.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Use copious amounts of water, which is best applied in the form of a spray to avoid disturbing the surface of the material. The material may fuse or melt, in which condition application of water may result in excessive scattering of molten materials. Exclusion of air or the use of CO<sub>2</sub> will not control the fire. Due consideration should be given to the stability of the ship due to the effect of accumulated water.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAAG), as amended.

## BARYTES

### Description

Crystalline ore mineral. A sulphate of barium. Moisture 1% to 6%.

### Characteristics

| Physical properties  |                      |                                   |                                    |
|--|----------------------|-----------------------------------|------------------------------------|
| Size   | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 80% lumps:<br>6.4 mm to 101.6 mm<br>20% fines:<br>less than 6.4 mm | Not applicable       | 2,941                             | 0.34                               |
| Hazard classification  |                      |                                   |                                    |
| Class  | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable   | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## BAUXITE

The provisions of this schedule shall apply to bauxite cargoes:

- .1 containing either:
  - .1 30% or less of fine particles less than 1 mm ( $D_{30} \geq 1$  mm); or
  - .2 40% or less of particles less than 2.5 mm ( $D_{40} \geq 2.5$  mm); or
  - .3 both;
- or
- .2 where the shipper provides the master with a certificate, in accordance with the result of the test approved by the competent authority of the port of loading, stating that the moisture of the cargo freely drains from the cargo so that the degree of saturation is not liable to reach 70%.

### Description

A reddish-brown to brownish-yellow clay-like and earthy mineral. Insoluble in water.

### Characteristics

| Physical properties    |                      |                                   |                                    |
|------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                   | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Typically up to 500 mm | Not applicable       | 1,100 to 2,000                    | 0.50 to 0.91                       |
| Hazard classification  |                      |                                   |                                    |
| Class                  | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable         | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

## BAUXITE FINES

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

- .1 more than 30% of fine particles less than 1 mm ( $D_{30} < 1 \text{ mm}$ ); and
- .2 more than 40% of particles less than 2.5 mm ( $D_{40} < 2.5 \text{ mm}$ ).

Notwithstanding the above provision, Bauxite cargo meeting the above criterion may be carried as a group C cargo in accordance with the provisions of the individual schedule for BAUXITE where the shipper provides the master with a certificate, in accordance with the result of the test approved by the competent authority of the port of loading, stating that the moisture of the cargo freely drains from the cargo so that the degree of saturation is not liable to reach 70%.

### Description

A reddish-brown to brownish-yellow clay-like and earthy mineral. Insoluble in water.

### Characteristics

| Physical properties  |                      |                                   |                                    |
|--|----------------------|-----------------------------------|------------------------------------|
| Size   | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| More than 30% of fine particles less than 1 mm and more than 40% of particles less than 2.5 mm | Not applicable       | 1,100 to 2,000                    | 0.50 to 0.91                       |
| Hazard classification  |                      |                                   |                                    |
| Class  | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable   | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

This cargo may suffer instability due to moisture content resulting in dynamic separation and formation of a liquid slurry (water and fine solids) above the solid material, resulting in a free surface effect which may significantly affect the ship's stability. This cargo is not liable to undergo dynamic separation when the cargo is shipped below its TML.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working.

### **Ventilation**

No special requirements.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly, including at least daily visual inspections where condition permits, during the voyage. If free water or a liquid slurry above the cargo or fluid state of the cargo is observed, including the flattening of the cargo, during voyage, the master shall take appropriate actions to prevent cargo shifting, loss of stability due to free surface effect and potential capsize of the ship, and give consideration to seeking emergency entry into a place of refuge. Cargo hold bilges shall be sounded at regular intervals and pumped out, as necessary.

An atypical motion of the ship (wobbling) may also be indicative of cargo instability and the master shall consider appropriate action.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

## BIOSLUDGE

### Description

Heat-dried activated sludge. Very fine granular product. Moisture: 3% to 5%. Black speckled colour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 654                               | 1.53                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## BORAX (PENTAHYDRATE CRUDE)

### Description

A chemical compound of boracic acid and soda. Free-flowing powder or granules. Grey colour. Dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 2.36 mm         | Not applicable       | 1,087                             | 0.92                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

Borax (pentahydrate crude) is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.

**BORAX, ANHYDROUS  
(crude or refined)**

**Description**

Crude is normally of yellow-white appearance. When highly refined, becomes white crystalline. Dusty and hygroscopic.

**Characteristics**

| Physical properties       |                      |                                   |                                    |
|---------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Granules less than 1.4 mm | 35°                  | 1,282                             | 0.78                               |
| Hazard classification     |                      |                                   |                                    |
| Class                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable            | Not applicable       | Not applicable                    | C                                  |

**Hazard**

Dust is very abrasive and irritating, but not toxic, if inhaled.

This cargo is hygroscopic and will cake if wet.

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

**Stowage and segregation**

No special requirements.

**Hold cleanliness**

No special requirements.

**Weather precautions**

No special requirements.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

Borax anhydrous (crude or refined) is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

**Clean-up**

No special requirements.

## BORIC ACID

### Description

A white free-flowing crystalline powder. Odourless and dry with not more than 1.0% moisture. Water soluble.

### Characteristics

| Physical properties          |                      |                                   |                                    |
|------------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                         | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine crystalline powder, dry | Not applicable       | 544 to 862                        | 1.16 to 1.84                       |
| Hazard classification        |                      |                                   |                                    |
| Class                        | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable               | Not applicable       | TX and/or CR                      | B                                  |

### Hazard

Mild irritation effects to nose and throat may occur from inhalation. May cause irritation to skin. May cause long-term health effects.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

"Separated from" metal hydrides and alkali metals.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No discharge operations during precipitation.

Boric acid is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

Thorough dry cleaning to be carried out prior to washing all cargo spaces.



**Emergency procedures**

**Special emergency equipment to be carried**

Nil

**Emergency procedures**

Nil

**Emergency action in the event of fire**

Nil

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## **BROWN COAL BRIQUETTES**

*(see appendix to this schedule)*

### **Description**

Brown coal (lignite) briquettes are manufactured by pressing dried brown coal particles into compressed blocks.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| Mainly up to 50 mm           | Not applicable              | 750                                    | 1.34                                    |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| Not applicable               | Not applicable              | CB and/or SH                           | B                                       |

### **Hazard**

This cargo is easily ignited, is liable to heat spontaneously, may ignite spontaneously and may deplete oxygen in the cargo space.

### **Stowage and segregation**

*Refer to the appendix to this schedule.*

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo. Previous cargo battens shall be removed from the cargo spaces.

### **Weather precautions**

No special requirements.

### **Loading**

Refer to the appendix to this schedule.

### **Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage. Refer to the appendix to this schedule.

### **Carriage**

Refer to the appendix to this schedule.

### **Discharge**

Refer to the appendix to this schedule.

### **Clean-up**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down. Exclusion of air may be sufficient to control fire. <b>Do not use water.</b> Seek expert advice and consider heading for the nearest suitable port.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

**Remarks**

The use of CO<sub>2</sub> or inert gas, if available, should be withheld until fire is apparent.

## APPENDIX

### BROWN COAL BRIQUETTES

#### Hazard

- 1 This cargo is easily ignited, liable to heat spontaneously and deplete oxygen in the cargo space.
- 2 This cargo is subject to oxidation, leading to depletion of oxygen and an increase in carbon dioxide in the cargo space (see also section 3).
- 3 This cargo is liable to heat spontaneously and may ignite spontaneously in the cargo space. When spontaneous heating occurs, flammable and toxic gases, including carbon monoxide, may be produced. Carbon monoxide is an odourless gas, slightly lighter than air, and has flammable limits in air of 12% to 75% by volume. It is toxic by inhalation, with an affinity for blood haemoglobin over 200 times that of oxygen. The recommended threshold limit value (TLV) for carbon monoxide exposure is 50 ppm.

#### Stowage and segregation

- 1 Boundaries of cargo spaces where these cargoes are carried shall be resistant to fire and liquids.
- 2 This cargo shall be "separated from" goods of classes 1 (division 1.4), 2, 3, 4 and 5 in packaged form (see IMDG Code) and "separated from" solid bulk material of classes 4 and 5.1.
- 3 Stowage of goods of class 5.1 in packaged form or solid bulk materials of class 5.1 above or below this cargo shall be prohibited.
- 4 This cargo shall be "separated longitudinally by an intervening complete compartment or hold from" goods of class 1 other than division 1.4.
- 5 This cargo shall not be stowed adjacent to hot areas.

Note: For interpretation of these terms, see section 9.

#### Loading

- 1 Prior to loading, the shipper, or their appointed agent, shall provide in writing to the master the characteristics of the cargo and the recommended safe handling procedures for loading and transport of the cargo. As a minimum, the cargo's contract specifications for moisture content, sulphur content and size shall be stated.
- 2 This cargo shall be stored for 7 days prior to loading. This substantially reduces the risk of spontaneous combustion in subsequent transport, storage and handling.
- 3 Before loading this cargo, the master shall ensure the following:
  - .1 weather deck enclosures to the cargo space have been inspected to ensure their integrity. Such closures are closed and sealed;

- .2 all electrical cables and components situated in cargo spaces and adjacent enclosed spaces are free from defects. Such cables and electrical components are safe to be used in a flammable and/or dusty atmosphere or positively isolated. The provisions of this clause need not apply to engine-rooms where the engine-room is separated from the cargo space by a gastight bulkhead with no direct access.
- 4 Smoking and the use of naked flames shall not be permitted in the cargo areas and adjacent spaces and appropriate warning notices shall be posted in conspicuous places. Burning, cutting, chipping, welding or other sources of ignition shall not be permitted in the vicinity of cargo spaces or in other adjacent spaces.
- 5 This cargo shall not be dropped more than one metre during loading to minimize the production of dust and fines.
- 6 Individual cargo spaces shall be loaded without interruption, where possible. Hot spots may develop in a cargo space that has been kept open for more than six days (or less in weather over 30°C).
- 7 Prior to departure, the master shall be satisfied that the surface of the material has been trimmed reasonably level to the boundaries of the cargo space to avoid the formation of gas pockets and to prevent air from permeating the body of the briquettes. Casing leading into the cargo space shall be adequately sealed. The shipper shall ensure that the master receives the necessary cooperation from the loading terminal.
- 8 Individual cargo spaces shall be closed and sealed as soon as practicable after the cargo has been loaded into each cargo space.

### **Precautions**

- 1 The ship shall be suitably fitted and carry on board appropriate instruments for measuring the following without requiring entry into the cargo space:
  - .1 concentration of methane in the atmosphere above the cargo;
  - .2 concentration of oxygen in the atmosphere above the cargo;
  - .3 concentration of carbon monoxide in the atmosphere above the cargo;
  - .4 pH value of cargo hold bilge samples.

These instruments shall be regularly serviced and calibrated. Ship personnel shall be trained in the use of such instruments. Details of gas measurement procedures are given at the end of this appendix.
2. It is recommended that means be provided for monitoring the temperature of the cargo in the range of 0°C to 100°C to enable the measurement of temperature of the cargo during the voyage without requiring entry into the cargo space.

### **Carriage**

- 1 As far as practicable, any gases which may be emitted from the cargo shall not be allowed to accumulate in adjacent enclosed spaces, such as store-rooms, carpenter's

shop, passageways, tunnels, etc. Such spaces shall be adequately ventilated and regularly monitored for methane, oxygen and carbon monoxide.

- 2 Under no circumstances, except in emergency, shall the hatches be opened or the cargo space be ventilated or entered during the voyage.
- 3 The atmosphere in the space above the cargo in each cargo space shall be regularly monitored for the concentrations of methane, oxygen and carbon monoxide.
- 4 The frequency of the monitoring shall be determined based upon the information provided by the shipper and the information obtained through the analysis of the atmosphere in the cargo space. The monitoring shall be conducted at least daily and as close as practical to the same time of day. The results of monitoring shall be recorded. The shipper may request more frequent monitoring, particularly if there is evidence of significant self-heating during the voyage.
- 5 The following issues shall be taken into account:
  - .1 The oxygen level in the sealed cargo space will fall from an initial 21% over a period of days to stabilize at levels of the order of 6 to 15%. If the oxygen level does not fall below 20%, or rapidly increases after an initial fall, it is possible that the cargo space is inadequately sealed and is at risk of spontaneous combustion.
  - .2 Carbon monoxide levels will build up to concentrations which fluctuate in the 200 to 2,000 parts per million (ppm) range in a safe, well-sealed cargo space. A rapid increase of approximately 1,000 ppm in carbon monoxide levels in this cargo over a 24-hour period is a possible indicator of spontaneous combustion, particularly if accompanied by an increase in methane levels.
  - .3 The methane composition in briquette cargo is normally low, less than 5 ppm and does not constitute a hazard. However, a sudden and continuing rise in methane levels, to concentrations above 10 ppm, is an indicator of the occurrence of spontaneous combustion in the hold.
  - .4 The temperature in this cargo in a well-sealed cargo space normally remains at 5 to 10°C above seawater temperature, the increase being due to normal diurnal breathing of small quantities of air into the cargo space. Checking of the cargo space seals to minimize air leakage is essential. A rapid increase in temperature of approximately 20°C over 24 hours is evidence of spontaneous combustion.
- 6 Regular hold bilge testing shall be systematically carried out. If the pH monitoring indicates that a corrosion risk exists, the master shall ensure that all bilges are kept dry during the voyage in order to avoid possible accumulation of acids on tank tops and in the bilge system.
- 7 When the behaviour of the cargo during the voyage differs from that specified in the cargo information, the master shall report such differences to the shipper. Such reports will enable the shipper to maintain records on the behaviour of this cargo, so that the information being provided to the master can be reviewed in the light of the transport experience.

- 8 When the master is concerned that the cargo is showing any signs of self-heating or spontaneous combustion, such as an increase in the concentration of methane or carbon monoxide or an increase in temperature, as described above, the following actions shall be taken:
- .1 Consult with the ship's agent at the loading port. The company's designated person ashore shall be advised immediately.
  - .2 Check the seal of the cargo space and re-seal the cargo space, as necessary.
  - .3 Do not enter the cargo space and do not open the hatches, unless the master considers access is necessary for the safety of the ship or safety of life. When any ship's personnel have entered into a cargo space, re-seal the cargo space immediately after the personnel vacate the cargo space.
  - .4 Increase the frequency of monitoring the gas composition, and temperature when practicable, of the cargo.
  - .5 Send the following information, as soon as possible, to the ship's owner or agent at the loading port to obtain expert advice:
    - .1 the number of cargo spaces involved;
    - .2 monitoring results of the carbon monoxide, methane and oxygen concentrations;
    - .3 if available, temperature of the cargo, location and method used to obtain results;
    - .4 the time the gas analyses were taken (monitoring routine);
    - .5 the quantity of the cargo in the cargo space(s) involved;
    - .6 the description of the cargo as per the shipper's declaration, and any special precautions indicated on the declaration;
    - .7 the date of loading, and Estimated Time of Arrival (ETA) at the intended discharge port (which shall be specified); and
    - .8 any other comments or observations the master may consider relevant.

## **Discharge**

Prior to, and during, discharge:

- 1 The cargo space shall be kept closed until just before the commencement of discharge of that space. The cargo may be sprayed with a fine water spray to reduce dust.
2. Personnel shall not enter the cargo space without having tested the atmosphere above the cargo. The personnel entering into a cargo space in which the atmosphere contains oxygen levels below 21% shall wear self-contained breathing apparatus.

Carbon dioxide and carbon monoxide gas levels shall also be tested prior to entry into the cargo spaces. The recommended threshold limit value (TLV) for carbon monoxide is 50 ppm.

3. During discharge, attention shall be given to the cargo for signs of hot spots (i.e. steaming). If a hot spot is detected, the area shall be sprayed with fine water spray and the hot spot shall be removed immediately to prevent spreading. The hot spot cargo shall be spread out on the wharf away from the remainder of the cargo.
4. Prior to suspending the discharge of this cargo for more than eight hours, the hatch covers and all other ventilation for the cargo space shall be closed.

## **PROCEDURES FOR GAS MONITORING OF BROWN COAL BRIQUETTE CARGOES**

### **1 Observations**

1.1 Carbon monoxide monitoring, when conducted in accordance with the following procedures, will provide a reliable early indication of self-heating within this cargo. This allows preventive action to be considered without delay. A sudden rapid rise in carbon monoxide detected within a cargo space, particularly if accompanied by an increase in methane levels, is a conclusive indication that self-heating is taking place.

1.2 All vessels engaged in the carriage of this cargo shall carry on board an instrument for measuring methane, oxygen and carbon monoxide gas concentrations, to enable the monitoring of the atmosphere within the cargo space. This instrument shall be regularly serviced and calibrated in accordance with the manufacturer's instructions. Care shall be exercised in interpreting methane measurements carried out in the low oxygen concentrations often found in unventilated cargo holds. The catalytic sensors normally used for the detection of methane rely on the presence of sufficient oxygen for accurate measurement. This phenomenon does not affect the measurement of carbon monoxide, or measurement of methane by infrared sensor. Further guidance may be obtained from the instrument manufacturer.

### **2 Sampling and measurement procedure**

#### **2.1 Equipment**

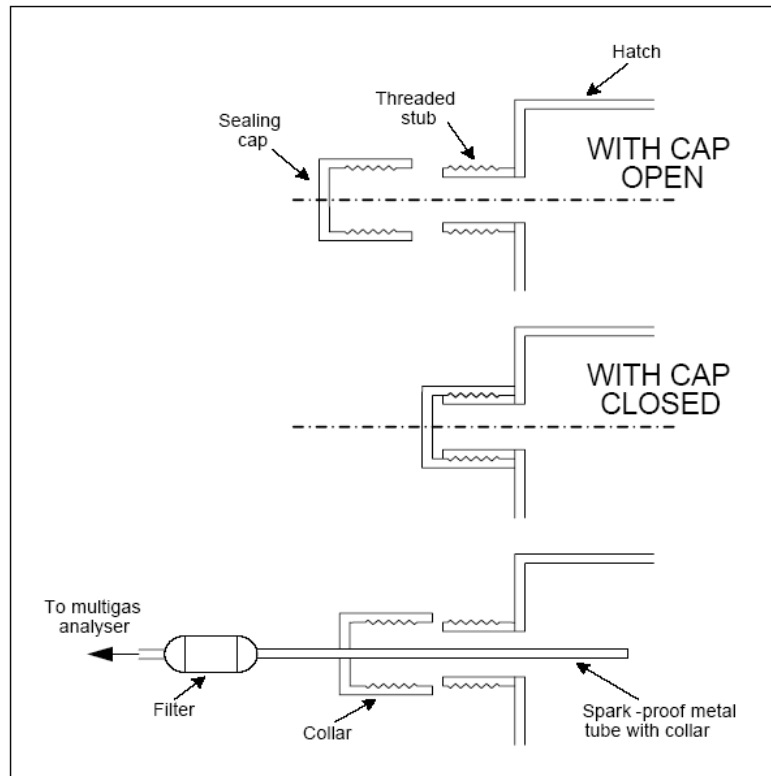
2.1.1 An instrument which is capable of measuring methane, oxygen and carbon monoxide concentrations shall be provided on board a ship carrying this cargo. The instrument shall be fitted with an aspirator, flexible connection and a length of spark-proof metal tubing to enable a representative sample to be obtained from within the square of the hatch.

2.1.2 When recommended by the manufacturer, a suitable filter shall be used to protect the instrument against the ingress of moisture. The presence of even a small amount of water will compromise the accuracy of the measurement.

#### **2.2 Siting of sampling points**

2.2.1 In order to obtain meaningful information about the behaviour of this cargo in a cargo space, gas measurements shall be made via one sample point per cargo space. To ensure flexibility of measurement in adverse weather, however, two sample points shall be provided per cargo space, one on the port side and one on the starboard side of the hatch cover or hatch coaming (refer to diagram of gas sampling point). Measurement from either of these locations is satisfactory.





*Diagram of gas sampling point*

2.2.2 Each sample point shall comprise a hole of diameter approximately 12 mm positioned as near to the top of the hatch coaming as possible. It shall be sealed with a sealing cap to prevent ingress of water and air. It is essential this cap be securely replaced after each measurement to maintain a tight seal.

2.2.3 The provision of any sample point shall not compromise the seaworthiness of the vessel.

### **2.3 Measurement**

The explanation on procedures for measurement is as follows:

- .1 remove the sealing cap, insert the rigid tube into the sampling point and tighten the integral cap to ensure an adequate seal;
- .2 connect the instrument to the sampling tube;
- .3 draw a sample of the atmosphere through the tube, using the aspirator, until steady readings are obtained;
- .4 log the results on a form which records cargo hold, date and time for each measurement; and
- .5 put back the sealing cap.

## BRUCITE

### Description

White to grey particles. The main component is magnesium hydroxide. The cargo is mined from a natural pit and then crushed into particles.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 5 mm to 40 mm         | Various              | 1,100 to 1,300                    | 0.77 to 0.91                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CALCIUM FLUORIDE, CALCIUM SULPHATE, CALCIUM CARBONATE MIXTURE

### Description

The cargo contains 35% to 55% calcium fluoride, 18% to 30% calcium sulphate and 10% to 20% calcium carbonate.

This cargo is a fine white-light grey powder aggregated in lumps, and is transported as filter cakes. This cargo is insoluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 50 mm           | Not applicable       | 1,100 to 2,500                    | 0.40 to 0.91                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage and segregation

"Separated from" foodstuffs and all class 8 acids.

### Hold cleanliness

No special requirements.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the voyage, the master shall take appropriate actions to prevent cargo shifting and potential capsizing of the ship, and give consideration to seeking emergency entry into a place of refuge.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

## **CALCIUM NITRATE UN 1454**

The provisions of this Code shall not apply to the commercial grades of calcium nitrate fertilizers consisting mainly of a double salt (calcium nitrate and ammonium nitrate) and containing not more than 10% ammonium nitrate and at least 12% water of crystallization.

### **Description**

White deliquescent solid, soluble in water.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| Not applicable               | Not applicable              | 893 to 1,099                           | 0.91 to 1.12                            |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| 5.1                          | Not applicable              |  | B                                       |

### **Hazard**

Non-combustible materials. If involved in a fire, will greatly intensify the burning of combustible materials. Although non-combustible, mixtures with combustible material are easily ignited and may burn fiercely.

This cargo is hygroscopic and will cake if wet.

This cargo is harmful if swallowed.

### **Stowage and segregation**

"Separated from" foodstuffs.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Appropriate measures shall be taken to prevent the cargo from contact with combustible materials.

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### **Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

No special requirements.

**Discharge**

Calcium nitrate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear). Self-contained breathing apparatus. Spray nozzles.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Use copious quantities of water, which is best applied in the form of a spray to avoid disturbing the surface of the material. The material may fuse or melt, in which condition application of water may result in extensive scattering of the molten materials. Exclusion of air or the use of CO<sub>2</sub> will not control the fire. Due consideration should be given to the stability of the ship due to the effect of accumulated water.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## CALCIUM NITRATE FERTILIZER

The provisions of this schedule shall apply only for cargoes containing not more than 15.5% total nitrogen and at least 12% water.

### Description

Granules mainly of a double salt (calcium nitrate and ammonium nitrate). Refer to the schedule for CALCIUM NITRATE UN 1454 where the total nitrogen content exceeds 15.5%, or where the water content is less than 12%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 1 mm to 4 mm          | 34°                  | 1,053 to 1,111                    | 0.90 to 0.95                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CARBORUNDUM

### Description

A hard black crystalline compound of carbon and silicon. Odourless. No moisture content.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 75% lumps:<br>under 203.2 mm<br>25% lumps:<br>under 12.7 mm | Not applicable       | 1,786                             | 0.56                               |
| Hazard classification                                       |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | Not applicable                    | C                                  |

### Hazard

Slightly toxic by inhalation.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

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

### Precautions

Protect machinery, accommodation and equipment from dust. Personnel involved in cargo handling shall wear protective clothing and dust filter masks.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



**CASTOR BEANS or  
CASTOR MEAL or  
CASTOR POMACE or  
CASTOR FLAKE UN 2969**

**Description**

The beans from which castor oil is obtained.

**Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Not applicable               | Not applicable              | -  | -   |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| 9                            | Not applicable              |  | B   |

**Hazard**

Contain a powerful allergen which, by inhalation of dust or by skin contact with crushed bean products, can give rise to severe irritation of the skin, eyes and mucous membranes in some persons. They are also toxic by ingestion.

**Stowage and segregation**

"Separated from" foodstuffs and oxidizing materials (goods in packages and solid bulk materials).

**Hold cleanliness**

No special requirements.

**Weather precautions**

No special requirements.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Due consideration shall be given to prevent dust entering living quarters and working areas. Castor meal, castor pomace and castor flakes shall not be carried in bulk.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

**Ventilation**

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

After discharge of this cargo, the cargo spaces shall be thoroughly cleaned and washed out to remove all traces of the cargo.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear). Self-contained breathing apparatus.  
Spray nozzles.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if available. Exclusion of air may be sufficient to control fire.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## CEMENT

### Description

Cement is a finely ground powder which becomes almost fluid in nature when aerated or significantly disturbed, thereby creating a very minimal angle of repose. After loading is completed, de-aeration occurs almost immediately and the product settles into a stable mass. Cement dust can be a major concern during loading and discharge if the vessel is not specially designed as a cement carrier or shore equipment is not fitted with special dust control equipment.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 0.1 mm          | Not applicable       | 1,000 to 1,493                    | 0.67 to 1.00                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

It may shift when aerated.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

The ship shall be kept upright during loading of this cargo. This cargo shall be so trimmed to the boundaries of the cargo space that the angle of the surface of the cargo with the horizontal plane does not exceed 25°. Both the specific gravity and the flow characteristics of this cargo are dependent on the volume of air in the cargo. The volume of air in this cargo may be up to 12%. This cargo shows fluid state prior to settlement. The ship carrying this cargo shall not depart until the cargo has settled. After the settlement, shifting of the cargo is not liable to occur unless the angle of the surface with the horizontal plane exceeds 30°.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

**Carriage**

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed, as necessary. All vents and access ways to the cargo spaces shall be shut during the voyage. Bilges in the cargo spaces carrying this cargo shall not be pumped unless special precautions are taken.

**Discharge**

No special requirements.

**Clean-up**

In the case that the residues of this cargo are to be washed out, the cargo spaces and the other structures and equipment which may have been in contact with this cargo or its dust shall be thoroughly swept prior to washing out. Particular attention shall be given to bilge wells and framework in the cargo spaces. The fixed bilge pumps shall not be used to pump the cargo spaces, because this cargo may make the bilge systems inoperative.

## CEMENT CLINKERS

### Description

Cement is formed by burning limestone with clay. This burning produces rough cinder lumps that are later crushed to a fine powder to produce cement. The rough cinder lumps are called clinkers and are shipped in this form to avoid the difficulties of carrying cement powder.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 40 mm           | Not applicable       | 1,190 to 1,639                    | 0.61 to 0.84                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed.

All vents and access ways to the cargo spaces shall be shut during the voyage. Bilges in the cargo spaces carrying this cargo shall not be pumped unless special precautions are taken.

### Discharge

No special requirements.

**Clean-up**

In the case that the residues of this cargo are to be washed out, the cargo spaces and the other structures and equipment which may have been in contact with this cargo or its dust shall be thoroughly swept prior to washing out.

## CHAMOTTE

### Description

Burned clay. Grey. Shipped in the form of fine crushed stone. Used by zinc smelters and in manufacture of firebrick (road metal). Dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 10 mm           | Not applicable       | 667                               | 1.50                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CHARCOAL

### Description

Wood burnt at a high temperature with as little exposure to air as possible. Very dusty, light cargo. Can absorb moisture to about 18 to 70% of its weight. Black powder or granules.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| -                     | Not applicable       | 199                               | 5.02                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CB and/or SH                      | B                                  |

### Hazard

May ignite spontaneously. Contact with water may cause self-heating. Liable to cause oxygen depletion in the cargo space.

### Stowage and segregation

Segregation as required for class 4.1 materials. "Separated from" oily materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. Hot charcoal screenings in excess of 55°C shall not be loaded.

### Precautions

Charcoal in class 4.2 shall not be carried in bulk. This cargo shall be exposed to the weather for not less than 13 days prior to shipment. Prior to loading, the manufacturer or shipper shall give the master a certificate stating that the cargo is not class 4.2 in accordance with the result of the test approved by the competent authority. The certificate shall also state that this cargo has been weathered for not less than 13 days. This cargo shall only be accepted for loading when the actual moisture content of the cargo is not more than 10%.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.



**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted. Exclusion of air may be sufficient to control fire.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## CHEMICAL GYPSUM

### Description

Calcium sulphate hydrate generated as a product or by-product in the process of smelter and refinery and polyaluminum chloride. White or brown powder without smell and insoluble.

In use for Gypsum-Board and Cement.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 40 µm to 1 mm         | Not applicable       | 570 to 1,170                      | 0.85 to 1.74                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

### Precautions

No special requirements.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

Prior to washing out the residues of this cargo, the decks and the cargo spaces shall be shovelled and swept clean, because washing out of this cargo is difficult.

## CHLORITE

### Description

Grey to green lumps. Chlorite is a group of phyllosilicate minerals and its main component is silicate.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 10 mm to 200 mm       | Various              | 1,500 to 2,700                    | 0.37 to 0.67                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is non-combustible or of low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CHOPPED RUBBER AND PLASTIC INSULATION

### Description

Plastic and rubber insulation material, clean and free from other materials, in granular form.

### Characteristics

| Physical properties      |                      |                                   |                                    |
|--------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                     | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Granular<br>1 mm to 4 mm | Not applicable       | 500 to 570                        | 1.76 to 1.97                       |
| Hazard classification    |                      |                                   |                                    |
| Class                    | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable           | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

During handling and carriage, no hot work, burning and smoking shall be permitted in the vicinity of the cargo spaces containing this cargo. Prior to shipment, a certificate shall be given to the master by the shipper stating that this cargo consists of clean plastic and rubber material only. When the planned interval between the commencement of loading and the completion of discharge of this cargo exceeds 5 days, the cargo shall not be accepted for loading unless the cargo is to be carried in cargo spaces fitted with a fixed gas fire-extinguishing system. The Administration may, if it considers that the planned voyage does not exceed 5 days from the commencement of loading to the completion of discharge, exempt from the requirements of a fitted fixed gas fire-extinguishing system in the cargo spaces for the carriage of this cargo.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CHROME PELLETS

### Description

Pellets. Moisture: up to 2% maximum.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 8 mm to 25 mm         | Not applicable       | 1,667                             | 0.60                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CHROMITE ORE

### Description

Concentrates or lumpy, dark grey in colour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 254 mm          | Not applicable       | 2,222 to 3,030                    | 0.33 to 0.45                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Toxic by dust inhalation.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CLAY

### Description

Clay is usually light to dark grey and comprises 10% soft lumps and 90% soft grains. The material is usually moist but not wet to the touch. Moisture is up to 25%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 150 mm          | Not applicable       | 746 to 1,515                      | 0.66 to 1.34                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

The moisture content of this cargo shall be kept as low as practicable to prevent the cargo becoming glutinous and handling of the cargo becoming extremely difficult.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

After discharge of this cargo, particular attention shall be given to the bilge wells of the cargo spaces.



## CLINKER ASH

### Description

Coal ash discharged from coal-fired power stations. Grey-coloured, possibly ranging from near-white to near-black, and odourless substance collected from the bottom of boilers, and resembles sand. Moisture content is about 15% to 23%. This cargo can be classified into wet type, which is discharged using water, and dry type, which is discharged out under dry condition.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 90 mm           | Not applicable       | 600 to 1,700                      | 0.59 to 1.67                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | TX                                | A and B                            |

### Hazard

The material may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. May cause long-term health effects.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and while on the voyage. When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 or a ship complying with the requirements in 7.3.3 of this Code, 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 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 this Code.

**Precautions**

Persons who may be exposed to the dust of the cargo shall wear gloves, goggles or other equivalent dust eye-protection and dust filter masks.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (goggles, dust filter masks, gloves and coveralls).</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Nil (non-combustible).</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## COAL

(see also the appendix to this schedule)

Coal shall be classified as group A and B unless classified as group B only by a test determined by the appropriate authority or where it has the following particle size distribution:

- .1 not more than 10% by weight of particles less than 1 mm ( $D_{10} > 1$  mm); and
- .2 not more than 50% by weight of particles less than 10 mm ( $D_{50} > 10$  mm).

Notwithstanding the above, a blend of two or more coals shall be classified as group A and B unless all original coals in the blend are group B only.

### Description

Coal (bituminous and anthracite) is a natural, solid, combustible material consisting of amorphous carbon and hydrocarbons.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 50 mm           | Not applicable       | 654 to 1,266                      | 0.79 to 1.53                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CB and/or SH and/or WF and/or CR  | B (and A)                          |

### Hazards

Coal may create flammable atmospheres, may heat spontaneously, may deplete the oxygen concentration, may corrode metal structures. This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

### Stowage and segregation

Refer to the appendix to this schedule.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When a cargo may liquefy during voyage in case that the moisture content of the cargo is in excess of its TML and the cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

Without reasonable trimming, vertical cracks into the body of the coal may form, permitting oxygen circulation and possible self-heating.

Due consideration shall be given to moisture migration and formation of dangerous wet base when blended coals are loaded.

### **Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Refer to the appendix to this schedule.

### **Ventilation**

*Refer to Special precautions in the appendix to this schedule.*

### **Carriage**

*Refer to the appendix to this schedule.*

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

### **Emergency procedures**

|   |
|---|
| <b>Special emergency equipment to be carried</b><br>Nil   |
| <b>Emergency procedures</b><br>Nil  |
| <b>Emergency action in the event of fire</b><br>Batten down. Exclusion of air may be sufficient to control the fire. <b>Do not use water.</b><br>Seek expert advice and consider heading to the nearest port. |
| <b>Medical first aid</b><br>Refer to the <i>Medical First Aid Guide (MFAG)</i> , as amended.  |

### **Remarks**

The use of CO<sub>2</sub> or inert gas, if available, should be withheld until fire is apparent.

## APPENDIX

### COAL

#### Properties and characteristics

1. Coals may emit methane, a flammable gas. A methane/air mixture containing between 5% and 16% methane constitutes an explosive atmosphere which can be ignited by sparks or naked flame, e.g. electrical or frictional sparks, a match or lighted cigarette. Methane is lighter than air and may, therefore, accumulate in the upper region of the cargo space or other enclosed spaces. If the cargo space boundaries are not tight, methane can seep through into spaces adjacent to the cargo space.
2. Coals may be subject to oxidation, leading to depletion of oxygen and an increase in carbon dioxide or carbon monoxide concentrations in the cargo space. Carbon monoxide is an odourless gas, slightly lighter than air and has flammable limits in air of 12% to 75% by volume. It is toxic by inhalation, with an affinity for blood haemoglobin over 200 times that of oxygen.
3. Some coals may heat spontaneously and the spontaneous heating may lead to spontaneous combustion in the cargo space. Flammable and toxic gases, including carbon monoxide, may be produced.
4. Some coals may be liable to react with water and produce acids which may cause corrosion. Flammable and toxic gases, including hydrogen, may be produced. Hydrogen is an odourless gas, much lighter than air and has flammable limits in air of 4% to 75% by volume.

#### Segregation and stowage requirements

1. Unless expressly provided otherwise, boundaries of cargo spaces where this cargo is carried shall be resistant to fire and liquids.
2. This cargo shall be "separated from" goods of classes 1 (division 1.4), 2, 3, 4 and 5 in packaged form (see IMDG Code) and "separated from" solid bulk materials of classes 4 and 5.1.
3. Stowage of goods of class 5.1 in packaged form or solid bulk materials of class 5.1 above or below this cargo shall be prohibited.
4. The master shall ensure that this cargo is not stowed adjacent to hot areas.
5. This cargo shall be "separated longitudinally by an intervening complete compartment or hold from" goods of class 1 other than division 1.4.

Note: For interpretation of these terms, see section 9.

#### General requirements for all types of these cargoes

1. Prior to loading, the shipper or his appointed agent shall provide in writing to the master the characteristics of the cargo and the recommended safe handling procedures for loading and transport of the cargo. As a minimum, the cargo's contract specifications for moisture content, sulphur content and size shall be stated, and especially whether the cargo may be liable to emit methane or self-heat.

- 2 Before loading, the master shall ensure the following:
  - .1 All cargo spaces and bilge wells are clean and dry. Any residue of waste material or previous cargo is removed, including removable cargo battens.
  - .2 All electrical cables and components situated in cargo spaces and adjacent enclosed spaces are free from defects. Such cables and electrical components are safe for use in an explosive atmosphere or positively isolated. The provisions of this clause need not apply to engine-rooms where the engine-room is separated from the cargo space by a gastight bulkhead with no direct access.
- 3 The ship shall be suitably fitted and carry on board appropriate instruments for measuring the following without requiring entry in the cargo space:
  - .1 concentration of methane in the atmosphere;
  - .2 concentration of oxygen in the atmosphere;
  - .3 concentration of carbon monoxide in the atmosphere; and
  - .4 pH value of cargo space bilge samples.
- 4 These instruments shall be regularly serviced and calibrated. Ship personnel shall be trained in the use of such instruments. Details of gas measurement procedures are given at the end of this appendix.
- 5 It is recommended that means be provided for measuring the temperature of the cargo in the range 0°C to 100°C to enable the measurement of temperature of the cargo while being loaded and during voyage without requiring entry into the cargo space.
- 6 Smoking and the use of naked flames shall not be permitted in the cargo areas and adjacent spaces and appropriate warning notices shall be posted in conspicuous places. Burning, cutting, chipping, welding or other sources of ignition shall not be permitted in the vicinity of cargo spaces or in other adjacent spaces, unless the space has been properly ventilated and the methane gas measurements indicate it is safe to do so.
- 7 Prior to departure, the master shall be satisfied that the surface of the material has been trimmed reasonably level to the boundaries of the cargo space to avoid the formation of gas pockets and to prevent air from permeating the body of the briquettes. Casings leading into the cargo space shall be adequately sealed. The shipper shall ensure that the master receives the necessary cooperation from the loading terminal.
- 8 The atmosphere in the space above the cargo in each space shall be regularly monitored for the concentration of methane, oxygen and carbon monoxide. Details of gas monitoring procedures are given at the end of this appendix. The results of monitoring shall be recorded. The frequency of the monitoring shall be determined based upon the information provided by the shipper and the information obtained through the analysis of the atmosphere in the cargo space.

- 9 Unless expressly provided otherwise, surface ventilation shall be conducted in all cargo spaces carrying this cargo for the first 24 hours after departure from the loading port. During this period, the atmosphere in the cargo spaces shall be monitored once from one sample point per cargo space and, for the purpose of the gas monitoring, the ventilation shall be stopped for an appropriate period prior to the gas monitoring.
- 10 When the methane concentrations monitored within 24 hours after departure are at an acceptably low level, the ventilation openings shall be closed and the atmosphere in the cargo spaces shall be monitored. When the methane concentrations monitored within 24 hours after departure are not at an acceptably low level, surface ventilation shall be maintained, except for an appropriate period for gas monitoring, and the atmosphere in the cargo spaces shall be monitored. This procedure shall be followed until the methane concentrations become acceptably low level. In any event, the atmosphere in the cargo spaces shall be monitored on a daily basis.
- 11 When significant concentrations of methane are subsequently observed in unventilated cargo spaces, the appropriate special precautions for coals emitting methane shall apply.
- 12 The master shall ensure, as far as practicable, that any gases which may be emitted from this cargo do not accumulate in adjacent enclosed spaces.
- 13 The master shall ensure that enclosed working spaces such as storerooms, carpenter's shop, passageways, tunnels, etc., are regularly monitored for the presence of methane, oxygen and carbon monoxide. Such spaces shall be adequately ventilated.
- 14 Regular hold bilge testing shall be systematically carried out during voyage carrying this cargo. If the pH monitoring indicates that a corrosion risk exists, bilges shall be frequently pumped out during the voyage in order to avoid possible accumulation of acids on tank tops and in the bilge system.
- 15 If the behaviour of the cargo during the voyage differs from that specified in the cargo declaration, the master shall report such differences to the shipper. Such reports will enable the shipper to maintain records on the behaviour of the coal cargoes, so that the information provided to the master can be reviewed in the light of transport experience.

## **Special precautions**

### **1 Coals emitting methane**

When the shipper has informed that the cargo is liable to emit methane or analysis of the atmosphere in the cargo space indicates the presence of methane in excess of 20% of the Lower Explosion Limit (LEL), the following additional precautions shall be taken:

- .1 Adequate surface ventilation shall be maintained, except for an appropriate period for the purpose of gas monitoring.
- .2 Care shall be taken to remove any accumulated gases prior to operation of the hatch covers or other openings for any reason, including discharging. Care shall be taken to operate hatch covers of the cargo spaces and other openings to avoid creating sparks. Smoking and the use of naked flame shall be prohibited.
- .3 Personnel shall not be permitted to enter the cargo space or enclosed adjacent spaces unless the space has been ventilated and the atmosphere tested and found to be gas-free and to have sufficient oxygen to support life.

Notwithstanding these provisions, emergency entry into the cargo space may be permitted without ventilation, testing the atmosphere or both, provided that the entry into the cargo space is undertaken only by trained personnel wearing self-contained breathing apparatus under the supervision of a responsible officer and special precautions are observed to ensure that no source of ignition is carried into the space.

- .4 The master shall ensure that enclosed working spaces such as storerooms, carpenter's shops, passageways, tunnels, etc., are regularly monitored for the presence of methane. Such spaces shall be adequately ventilated and, in the case of mechanical ventilation, only equipment safe for use in an explosive atmosphere shall be used.

## **2 Self-heating coals**

When the shipper informed that the cargo is likely to self-heat or analysis of the atmosphere in the cargo space indicates an increasing concentration of carbon monoxide, then the following additional precautions shall be taken:

- .1 The cargo spaces shall be closed immediately after completion of loading in each cargo space. The hatch covers may also be additionally sealed with a suitable sealing tape. Only natural surface ventilation shall be permitted and ventilation shall be limited to the absolute minimum time necessary to remove methane which may have accumulated.
- .2 Personnel shall not enter the cargo space during voyage, unless they are wearing self-contained breathing apparatus and access is critical to safety of life and the safety of the ship.
- .3 Prior to loading, temperature of this cargo shall be monitored. This cargo shall only be accepted for loading when the temperature of the cargo is not higher than 55°C.
- .4 When the carbon monoxide level is increasing steadily, a potential self-heating may be developing. In such a case, the cargo space shall be completely closed and all ventilation ceased, and the master shall seek expert advice immediately. Water shall not be used for cooling material or fighting coal cargo fires at sea, but may be used for cooling the boundaries of the cargo space.
- .5 When the carbon monoxide level in any cargo space reaches 50 ppm or exhibits a steady rise over three consecutive days, a self-heating condition may be developing and the master shall inform the shipper and the company of, at least, the following information if an accurate assessment of the situation is to be achieved:
  - .1 identity of the cargo spaces involved; monitoring results covering carbon monoxide, methane and oxygen concentrations;
  - .2 if available, temperature of the cargo, location and method used to obtain results;
  - .3 time gas sample taken (monitoring routine);
  - .4 time ventilators opened/closed;
  - .5 quantity of coal in hold(s) involved;



- .6 type of coal as per cargo information, and any special precautions indicated on information;
- .7 date loaded, and ETA at intended discharge port (which shall be specified); and
- .8 comments or observations from the ship's master.

### **3 Gravity-fed self-unloading bulk carrier**

3.1 A gravity-fed self-unloading bulk carrier means a vessel that has gravity-fed systems from the bottom of cargo holds, using gates that may be opened or closed to feed the cargo onto conveyor belts. Such belts run in fore and aft direction underneath the holds; from there the cargo is carried by means of conveyor systems to the deck and discharged onto shore with a self-unloading boom that can extend over the shore and has a conveyor belt. This is not applicable for the vessels with unloading systems such as cranes and grabs.

3.2 When this cargo is carried on a gravity-fed self-unloading bulk carrier, the following requirements of this appendix need not apply:

- paragraph 1 of "Segregation and stowage requirements"; and
- paragraph 9 of "General requirements for all types of these cargoes".

### **3.3 Loaded voyage procedures for atmospheric monitoring of cargoes**

#### **3.3.1 Bulk coal cargo safety procedures**

3.3.1.1 These requirements apply when these cargoes are to be carried on a gravity-fed self-unloading bulk carrier. It is recommended that a document, such as a flow chart, describing cargo operations and carriage procedures for these cargoes be provided to the ship by the vessel's operator.

### **3.4 Ventilation**

3.4.1 When ventilating, it shall be ensured that excess air does not ingress excessively into the body of the cargo of coal as this may eventually promote self-heating.

3.4.2 Due to the presence of non-airtight unloading gates at the bottom of the cargo hoppers just above the tunnels, the following methods of ventilation shall be used:

- if methane is detected in the tunnel, it shall be "positive-pressure" ventilated (more supply than exhaust in the tunnels, to remove methane gas); and
- if carbon monoxide is detected in the tunnel, it shall be "negative-pressure" ventilated (more exhaust than supply in the tunnels, to remove carbon monoxide). The release of carbon monoxide may be an indication of self-heating.

## **Procedures for gas monitoring of coal cargoes**

### **1 Observations**

1.1 Carbon monoxide monitoring, when conducted in accordance with the following procedures, will provide a reliable early indication of self-heating within this cargo. This allows preventive action to be considered without delay.

A steady rise in the level of carbon monoxide detected within a cargo space is a conclusive indication that self-heating is taking place.

1.2 All vessels engaged in the carriage of this cargo shall carry on board an instrument for measuring methane, oxygen and carbon monoxide gas concentrations, to enable the monitoring of the atmosphere within the cargo space. This instrument shall be regularly serviced and calibrated in accordance with the manufacturer's instructions. Care shall be exercised in interpreting methane measurements carried out in the low oxygen concentrations often found in unventilated cargo holds. The catalytic sensors normally used for the detection of methane rely on the presence of sufficient oxygen for accurate measurement. This phenomenon does not affect the measurement of carbon monoxide, or measurement of methane by infrared sensor. Further guidance may be obtained from the instrument manufacturer.

## 2 Sampling and measurement procedure

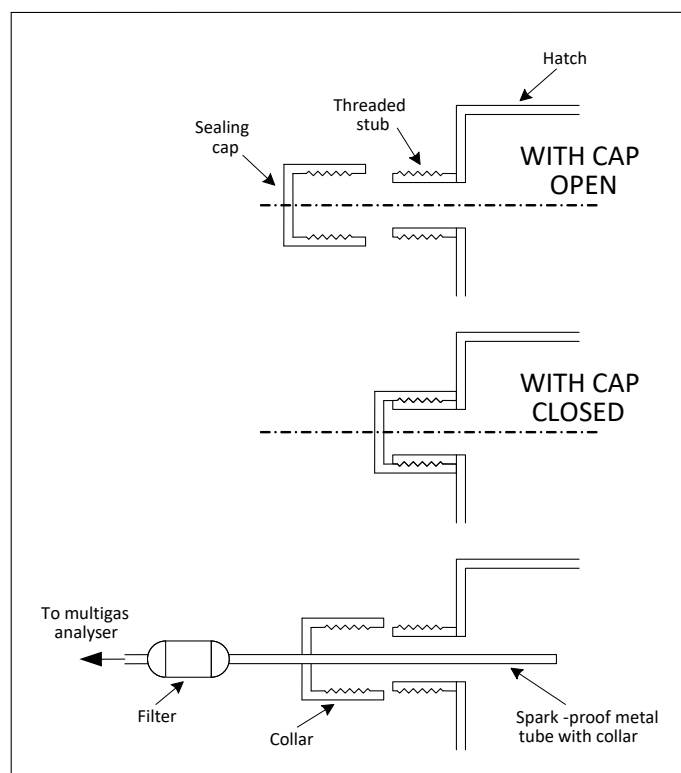
### 2.1 Equipment

2.1.1 An instrument which is capable of measuring methane, oxygen and carbon monoxide concentrations shall be provided on board a ship carrying this cargo. The instrument shall be fitted with an aspirator, flexible connection and a length of spark-proof metal tubing to enable a representative sample to be obtained from within the square of the hatch.

2.1.2 When recommended by the manufacturer, a suitable filter shall be used to protect the instrument against the ingress of moisture. The presence of even a small amount of moisture will compromise the accuracy of the measurement.

### 2.2 Siting of sampling points

2.2.1 In order to obtain meaningful information about the behaviour of this cargo in a cargo space, gas measurements shall be made via one sample point per cargo space. To ensure flexibility of measurement in adverse weather, two sample points shall be provided per cargo space, one on the port side and one on the starboard side of the hatch cover or hatch coaming. (Refer to the diagram of gas sampling point.) Measurement from either of these locations is satisfactory.



### ***Diagram of gas sampling point***

2.2.2 Each sample point shall comprise a hole of diameter approximately 12 mm positioned as near to the top of the hatch coaming as possible. It shall be sealed with a sealing cap to prevent ingress of water and air. It is essential that this cap is securely replaced after each measurement to maintain a tight seal.

2.2.3 The provisions of any sample point shall not compromise the seaworthiness of the vessel.

## **2.3 Measurement**

2.3.1 The explanation on procedures for measurement is as follows:

- .1 remove the sealing cap, insert the spark-proof metal tube into the sampling point and tighten the collar to ensure an adequate seal;
- .2 connect the instrument to the sampling tube;
- .3 draw a sample of the atmosphere through the tube, using the aspirator, until steady readings are obtained;
- .4 log the results on a form which records cargo space, date and time for each measurement; and
- .5 put back the sealing cap.

## **2.4 Measurement strategy**

The identification of incipient self-heating from measurement of gas concentrations is more readily achieved under unventilated conditions. This is not always desirable because of the possibility of the accumulation of methane to dangerous concentrations. This is primarily, but not exclusively, a problem in the early stages of a voyage. Therefore it is recommended that cargo spaces are initially ventilated until measured methane concentrations are at an acceptably low level.

## **2.5 Measurement in unventilated holds**

Under normal conditions, one measurement per day is sufficient as a precautionary measure. However, if carbon monoxide levels are higher than 30 ppm then the frequency shall be increased to at least twice a day at suitably spaced intervals. Any additional results shall be logged.

## **2.6 Measurement in ventilated holds**

2.6.1 If the presence of methane is such that the ventilators are required to remain open, then a different procedure shall be applied to enable the onset of any incipient self-heating to be detected.

2.6.2 To obtain meaningful data the ventilators shall be closed for a period before the measurements are taken. This period may be chosen to suit the operational requirements of the vessel, but it is recommended that it is not less than four hours. It is vital in the interests of data interpretation that the shutdown time is constant whichever time period is selected. These measurements shall be taken on a daily basis.

## **2.7 Measurement in cargo and self-unloading spaces of gravity-fed self-unloading bulk carrier**

### 2.7.1 Measurement in unventilated cargo and self-unloading spaces

2.7.1.1 When the shipper has declared that the coal cargo has or may have self-heating characteristics, the holds shall not be ventilated unless otherwise specified in this section.

2.7.1.2 Under normal conditions, one measurement per day is sufficient as a precautionary measure. If carbon monoxide levels are higher than 30 ppm then the frequency of measurements shall be increased to at least twice daily, at suitable intervals. Any additional results shall be logged.

2.7.1.3 If the carbon monoxide level in any hold indicates a steady rise or reaches 50 ppm, a self-heating condition may be developing and the owners of the vessel shall be notified as outlined in the procedures. Above this level, the vessel shall operate on "negative-pressure" ventilation, in order to reduce the amount of carbon monoxide. Regular monitoring of carbon monoxide levels shall continue.

2.7.1.4 Persons entering cargo or unloading spaces with carbon monoxide levels higher than 30 ppm shall not do so without self-contained breathing apparatus.

### 2.7.2 Measurement in ventilated cargo and self-unloading spaces

2.7.2.1 If the presence of methane is indicated by monitor, and such that ventilation is required, then a different procedure shall be applied to enable the onset of any possible self-heating to be detected. "Positive-pressure" or "through ventilation" shall be operated to remove the methane.

2.7.2.2 To obtain meaningful data, the ventilators and/or ventilation shall be closed for a period before measurements are taken. This period may be chosen to suit the operational requirements of the vessel, but it is recommended that it is not less than four hours. It is vital, in the interests of data interpretation, that the shutdown time is constant whichever time period is selected. These measurements shall be taken on a daily basis. If the carbon monoxide results exhibit a steady rise, or exceed 50 ppm on any day, the owner shall be notified.

2.7.2.3 In addition, the following points shall be considered:

- at no time shall ventilation be shut down when crew members are in the self-unloading spaces;
- special fire-fighting equipment and/or procedures may be necessary for the vessel; and
- establish specific crew training for gravity-fed self-unloading bulk carriers.

## COAL SLURRY

### Description

Coal slurry is a mixture of fine particles of coal and water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Under 1 mm            | Not applicable       | 870 to 1,020                      | 0.98 to 1.15                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. Spontaneous combustion is possible if the coal dries out but is unlikely under normal conditions.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

**Ventilation**

As this cargo, in general, may emit methane, the cargo spaces carrying this cargo shall be tested regularly, using a suitable gas detector, and natural surface ventilation shall be conducted, as necessary.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## COAL TAR PITCH

### Description

A coarse distilled residue of Coal Tar, a by-product of Cokes production. Mostly comprises many kinds of polycyclic aromatic hydrocarbon. A black solid at ambient temperature. It is insoluble in water. A raw material in use for electrodes and materials covering pitch bound on metallurgy coke. The moisture content is up to 6%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 100 mm<br>1 to 10% of fine particles:<br>less than 1 mm | Not applicable       | 600 to 1,100                      | 0.91 to 1.67                       |
| Hazard classification   |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | TX and/or CR                      | B                                  |

### Hazard

When heated, it melts and turns into inflammable liquid. It softens between 70°C and 120°C. Corrosive to eyes. May cause long-term health effects. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Persons who may be in contact with this cargo shall be supplied with protective gloves, dust masks, protective clothing and goggles.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## **Emergency procedures**

### **Special emergency equipment to be carried**

Protective clothing (goggles, dust filter masks, gloves and coveralls).

### **Emergency procedures**

Wear protective clothing, protective gloves, dust masks and goggles.

### **Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.  
Exclusion of air may be sufficient to control fire.

### **Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.



## COARSE CHOPPED TYRES

### Description

Chopped or shredded fragments of used tyres in coarse size.

### Characteristics

| Physical properties         |                      |                                   |                                    |
|-----------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                        | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 15 cm x 20 cm approximately | Not applicable       | 555                               | 1.80                               |
| Hazard classification       |                      |                                   |                                    |
| Class                       | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable              | Not applicable       | Not applicable                    | C                                  |

### Hazard

May self-heat slowly if contaminated by oily residue, if not properly aged before shipment and if offered to the shipment in smaller size than indicated in "Characteristics".

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

During handling and carriage no hot work, burning and smoking shall be permitted in the vicinity of the cargo spaces containing this cargo. Prior to shipment, a certificate shall be given to the master by the shipper stating that this cargo is free of oily products or oily residue and has been stored under cover but in the open air for not less than 15 days prior to shipment.

When the planned interval between the commencement of loading and the completion of discharge of this cargo exceeds 5 days, the cargo shall not be accepted for loading unless the cargo is to be carried in cargo spaces fitted with a fixed gas fire-extinguishing system. The Administration may, if it considers that the planned voyage does not exceed 5 days from the commencement of loading to the completion of discharge, grant exemption from the requirements of a fitted fixed gas fire-extinguishing system in the cargo spaces for the carriage of this cargo.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## COARSE IRON AND STEEL SLAG AND ITS MIXTURE

### Description

A coarse slag arising from iron and steel manufacture, and a coarse slag mixed with one of the following substances or a combination thereof: concrete debris, fly-ash, firebricks, dust collected from iron/steel-making processes, refractory material debris and fine raw materials of iron making.

This cargo includes shaped blocks made of iron and steel slag with one of the additives or a combination of additives: cement, ground granulated blast furnace slag and fly-ash, and its debris, and their mixture with iron and steel slag.

The colour is in the range from greyish-white to dark grey, and the appearance is in the range from granulated, pebble to block shaped.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 90 to 100% of lumps:<br>up to 300 mm<br>up to 10% fine particles:<br>less than 1 mm | Not applicable       | 1,200 to 3,000                    | 0.33 to 0.83                       |
| Hazard classification   |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special requirements.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

## COKE

### Description

Grey lumps may contain fines (Breeze).

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 200 mm          | Not applicable       | 341 to 800                        | 1.25 to 2.93                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

## COKE BREEZE

### Description

Greyish powder.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Less than 10 mm       | Not applicable       | 556                               | 1.80                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

## COLEMANITE

### Description

A natural hydrated calcium borate. Fine to lumps, light grey appearance similar to clay. Moisture approximately 7%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 300 mm          | Not applicable       | 1,639                             | 0.61                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## COPPER GRANULES

### Description

Sphere-shaped pebbles. 75% copper with lead, tin, zinc, traces of others. Moisture content 1.5% approximately. Light grey colour when dry, dark green when wet. Odourless.

### Characteristics

| Physical properties                       |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size                                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines up to 10 mm<br>Clinkers up to 50 mm | Not applicable       | 4,000 to 4,545                    | 0.22 to 0.25                       |
| Hazard classification                     |                      |                                   |                                    |
| Class                                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable                            | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## COPPER MATTE

### Description

Crude black copper ore. Composed of 75% copper and 25% impurities. Small metallic round stones or pellets. Odourless.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 3 mm to 25 mm         | Not applicable       | 2,857 to 4,000                    | 0.25 to 0.35                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## COPPER SLAG

### Description

Residue generated from copper smelting process. This cargo is highly permeable and pore water of this cargo drains quickly. It is black or red-brown in colour and either granular or lump.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 10 mm           | Not applicable       | 1,500 to 2,500                    | 0.40 to 0.67                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. This cargo is abrasive.

This cargo is non-combustible and 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 ship complying with the requirements in 7.3.2 of this Code, 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 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

This cargo shall be trimmed to ensure that the height difference between peaks and troughs does not exceed 5% of the ship's breadth and that the cargo slopes uniformly from the hatch boundaries to the bulkheads to avoid steep surfaces of cargo that could collapse during voyage.

When the stowage factor of this cargo is equal to or less than  $0.56 \text{ m}^3/\text{t}$ , the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Appropriate action shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo.

Due consideration shall be given to protect equipment from the dust of the cargo.

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### **Ventilation**

No special requirements.

### **Carriage**

Bilge water shall be removed regularly during the voyage. The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## COPRA (dry) UN 1363

### Description

Dried kernels of coconuts with a penetrating rancid odour which may taint other cargoes.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 500                               | 2.00                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.2                   | Not applicable       |                                   | B                                  |

### Hazard

Liable to heat and ignite spontaneously especially when in contact with water. Liable to cause oxygen depletion in the cargo space.

### Stowage and segregation

This cargo shall not be stowed on or adjacent to heated surfaces, including fuel oil tanks.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. This cargo shall not be accepted for loading when wet.

### Precautions

This cargo shall only be accepted for loading when the cargo has been weathered for at least one month before shipment or when the shipper provides the master with a certificate issued by a person recognized by the competent authority of the country of origin stating that the moisture content of the cargo is not more than 5%. Smoking and the use of naked lights in cargo spaces and adjacent areas shall be prohibited. Entry into the cargo space for this cargo shall not be permitted until the cargo space has been ventilated and the atmosphere tested for concentration of oxygen.

### Ventilation

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

### Carriage

The temperature of this cargo shall be measured and recorded regularly during voyage to monitor for possible self-heating.

### Discharge

No special requirements.

### Clean-up

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Nil

**Emergency procedures**

Nil

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted. Exclusion of air may be sufficient to control fire.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## CRUSHED CARBON ANODES

### Description

Crushed Carbon Anodes are spent carbon anodes that are crushed into smaller pieces to permit their shipment for recycling. Carbon anodes are used to introduce electricity into the aluminium smelter pots. This cargo is mainly composed of black crushed lumps and pieces principally containing carbon and other impurities. The material is odourless.

### Characteristics

| Physical properties                |                      |                                   |                                    |
|------------------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                               | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Mainly coarse pieces up to 60 cm + | Not applicable       | 800 to 1,000                      | 1.00 to 1.25                       |
| Hazard classification              |                      |                                   |                                    |
| Class                              | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable                     | Not applicable       | Not applicable                    | C                                  |

### Hazard

This cargo may generate dust.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection, dust filter masks and barrier creams as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## CRYOLITE

### Description

A fluoride of sodium and aluminium used in the production of aluminium and for ceramic glazes. Grey pellets.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 6.4 mm to 12.7 mm     | Not applicable       | 1,429                             | 0.70                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Prolonged contact may cause serious damage to the skin and nervous system. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## DIAMMONIUM PHOSPHATE (D.A.P.)

### Description

Odourless white crystals or powder. Depending on source it can be dusty. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Diameter: 2.54 mm     | 30° to 40°           | 833 to 999                        | 1.10 to 1.20                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is hygroscopic and may harden in the cargo space under humid conditions.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

Condensation in the cargo spaces carrying this cargo, sweating of this cargo and entering of water from hatch covers to the cargo spaces shall be checked regularly during the voyage.

Due attention shall be given to the sealing of hatches of the cargo spaces.

### Discharge

Diammonium phosphate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

After discharge of this cargo, particular attention shall be given to bilge wells of the cargo spaces.



**DIRECT REDUCED IRON (A)  
Briquettes, hot-moulded**

**Description**

**Direct reduced iron (DRI) (A)** is a metallic grey material, moulded in a briquette form, emanating from a densification process whereby the DRI feed material is moulded at a temperature greater than 650°C and has a density greater than 5,000 kg/m<sup>3</sup>. Fines and small particles (under 6.35 mm) shall not exceed 5% by weight.

**Characteristics**

| Physical properties   |                      |                                   |   |
|---|----------------------|-----------------------------------|---|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t)            |
| Approximate size:<br>Length<br>50 mm to 140 mm<br>Width<br>40 mm to 100 mm<br>Thickness<br>20 mm to 50 mm<br>Briquette weight<br>0.2 to 3.0 kg<br>Fines and small particles:<br>under 6.35 mm | Not applicable       | 2,500 to 3,300                    | 0.30 to 0.40<br>To be verified by the shipper |
| Hazard classification   |                      |                                   |   |
| Class   | Subsidiary hazard(s) | MHB                               | Group   |
| Not applicable  | Not applicable       | SH and/or WF                      | B   |

**Hazard**

Temporary increase in temperature of about 30°C due to self-heating may be expected after material handling in bulk. The material may slowly evolve hydrogen after contact with water (notably saline water). Hydrogen is a flammable gas that can form an explosive mixture when mixed with air in concentration above 4% by volume. It is liable to cause oxygen depletion in cargo spaces.

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

**Stowage and segregation**

"Separated from" goods of class 1 (division 1.4S), 2, 3, 4 and 5 and class 8 acids in packaged form (see IMDG Code).

"Separated from" solid bulk materials of classes 4 and 5.

"Separated longitudinally by an intervening complete compartment or hold from" goods of class 1 other than division 1.4S.

Boundaries of compartments where this cargo is carried shall be resistant to fire and passage of liquid.

**Hold cleanliness**

The cargo spaces shall be clean, dry and free from salt and residues of previous cargoes. Prior to loading, wooden fixtures such as battens, loose dunnage, debris and combustible materials shall be removed.

### **Weather precautions**

This cargo shall be kept as dry as practicable during loading and the voyage. Open storage is acceptable prior to loading. This cargo shall not be loaded onto ships or transferred between ships or barges during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be kept closed. Only when weather permits, may non-working hatch covers be left open for a minimum of 1 hour after completion of each pour to allow cooling after cargo handling in bulk.

### **Loading**

Prior to loading this cargo, the shipper shall provide the master with a certificate issued by a competent person recognized by the competent authority of the port of loading stating that the cargo, at the time of loading, is suitable for shipment and that it conforms with the requirements of this Code; that the quantity of fines and small particles (up to 6.35 mm in size) is no more than 5% by weight; the moisture content is less than 1.0% and the temperature does not exceed 65°C.

This cargo shall not be loaded when the temperature is in excess of 65°C, if its moisture content is in excess of 1.0% or if the quantity of fines and small particles (up to 6.35 mm in size) exceeds 5% by weight.

Appropriate precautions shall be taken during loading in order to have a cargo composed of essentially whole briquettes. The cargo shall be loaded in such a way so as to minimize breakage of briquettes and the additional generation of fines and small particles and concentration of fines in any area of the cargo. The addition of fines and particles less than 6.35 mm or dust in homogenous cargoes of briquettes shall be prohibited.

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. Due consideration shall be given to evenly spreading the cargo across the tank top to minimize the concentration of fines.

The cargo temperature shall be monitored during loading and recorded in a log detailing the temperature for each lot of cargo loaded, a copy of which shall be provided to the master. After loading, a certificate, confirming that throughout the whole consignment the fines and small particles (under 6.35 mm in size) are less than 5% by weight, shall be issued by a competent person recognized by the competent authority of the port of loading.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

The carrier's nominated technical persons or other representatives shall have reasonable access to stockpiles and loading installations for inspection.

Shippers shall provide comprehensive information on the cargo and safety procedures to be followed in the event of emergency. The shipper may also provide advice in amplification of this Code but the advice shall not be contrary thereto in respect of safety.

Where practicable, ballast tanks adjacent to the cargo spaces containing this cargo, other than double-bottom tanks, shall be kept empty. Weather deck closures and hatch covers shall be inspected and tested to ensure integrity and weathertightness which shall be maintained throughout the voyage.

Appropriate precautions shall be taken to protect machinery, equipment and accommodation spaces from the dust of the cargo. Radars and exposed radiocommunication equipment of the ship shall be protected from the dust of this cargo. Bilge wells of the cargo spaces shall be clean, dry and protected from ingress of the cargo, using non-combustible material. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

During handling of this cargo, "NO SMOKING" signs shall be posted on decks and in areas adjacent to cargo spaces, and no naked lights shall be permitted in these areas.

Cargo spaces containing this cargo and adjacent spaces may become oxygen-depleted. Flammable gas may also build up in these spaces. All precautions shall be taken upon entering the cargo and adjacent spaces.

### **Ventilation**

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo. On no account shall air be directed into the body of the cargo. When mechanical ventilation is used, the fans shall be certified as explosion-proof and shall prevent any spark generation, thereby avoiding the possibility of ignition of hydrogen-air mixture. Suitable wire mesh guards shall be fitted over inlet and outlet ventilation openings. Ventilation shall be such that escaping gases cannot enter living quarters in hazardous concentrations.

### **Carriage**

For quantitative measurements of hydrogen, a suitable detector shall be on board while this cargo is carried. The detector shall be suitable for use in an oxygen-depleted atmosphere and of a type certified safe for use in an explosive atmosphere. The concentrations of hydrogen in the cargo spaces carrying this cargo shall be measured regularly during the voyage, and the results of the measurements shall be recorded and kept on board for a minimum of two years. When the monitored hydrogen concentration is higher than 1% (> 25% lower explosive limit (LEL)) by volume, appropriate safety precautions shall be taken in accordance with those procedures provided by the shipper in case of emergency. If in doubt, expert advice shall be sought.

Bilge wells shall be checked regularly for the presence of water. If water is found, it shall be removed by pumping or draining the bilge wells.

The cargo temperature shall be taken regularly during the voyage and a record kept on board for a minimum of two years. If the temperature in the cargo space exceeds 65°C, appropriate safety precautions shall be taken in accordance with the procedures provided by the shipper in case of emergency. If in doubt, expert advice shall be sought.

### **Discharge**

The hydrogen concentration in the cargo space shall be measured immediately before any opening action of the hatch covers. If the hydrogen concentration is greater than 1% (> 25% lower explosive limit (LEL)) by volume, all appropriate safety precautions in conformity with the procedures provided by the shipper or the recommendations of the competent authority shall be taken. If in doubt, expert advice shall be sought.

During discharge, a fine spray of fresh water may be applied to this cargo, for dust control, only when the cargo will be stored in an open area. It is not recommended to apply a fine spray of fresh water to this cargo when it will be stored in an enclosed space or is to be transhipped.

### **Clean-up**

Accumulations of dust from this cargo on deck or in proximity to cargo spaces shall be removed as quickly as possible. Consideration shall be given to carefully cleaning exposed

radiocommunication equipment to which dust from the cargo might adhere, such as radar, radio aeriels, VHF installations, AIS and GPS. Hosing with seawater shall be avoided.

### **Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b></p>  |
| <p style="text-align: center;">Nil</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b></p>   |
| <p style="text-align: center;">Nil</p>   |
| <p style="text-align: center;"><b>Emergency action in the event of fire</b></p>  |
| <p style="text-align: center;"><b>Do not use water. Do not use steam. Do not use CO<sub>2</sub>.</b></p>   |
| <p style="text-align: center;">Batten down.</p>  |
| <p>The specific procedures in the event of emergency provided by the shipper should be consulted and followed, as appropriate. If in doubt, expert advice should be sought as quickly as possible.</p> |
| <p style="text-align: center;">Preparations should be made for grab discharge if serious heating occurs.</p>   |
| <p style="text-align: center;"><b>Medical first aid</b></p>  |
| <p style="text-align: center;">Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p>   |

**DIRECT REDUCED IRON (B)**  
**Lumps, pellets, cold-moulded briquettes**

**Description**

**Direct reduced iron (DRI) (B)** is a highly porous, black/grey metallic material formed by the reduction (removal of oxygen) of iron oxide at temperatures below the fusion point of iron. Cold-moulded briquettes are defined as those which have been moulded at a temperature less than 650°C or which have a density of less than 5,000 kg/m<sup>3</sup>. Fines and small particles under 6.35 mm in size shall not exceed 5% by weight.

**Characteristics**

| Physical properties  |                      |                                   |                                    |
|--|----------------------|-----------------------------------|------------------------------------|
| Size   | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Lumps and pellets:<br>Average particle size<br>6.35 mm to 25 mm.<br>Cold-moulded<br>briquettes:<br>Approximate maximum<br>dimensions<br>35 mm to 40 mm.<br>Fines and small<br>particles: Under<br>6.35 mm up to 5% by<br>weight. | Not applicable       | 1,750 to 2,000                    | 0.50 to 0.57                       |
| Hazard classification  |                      |                                   |                                    |
| Class  | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable   | Not applicable       | SH and/or WF                      | B                                  |

**Hazard**

Temporary increase in temperature of about 30°C due to self-heating may be expected after material handling in bulk.

There is a risk of overheating, fire and explosion during transport. This cargo reacts with air and with fresh water or seawater to produce heat and hydrogen. Hydrogen is a flammable gas that can form an explosive mixture when mixed with air in concentrations above 4% by volume. The reactivity of this cargo depends upon the origin of the ore, the process and temperature of reduction, and the subsequent ageing procedures. Cargo heating may generate very high temperatures that are sufficient to ignite the cargo. Build-up of fines may also lead to self-heating, auto-ignition and explosion. Oxygen in cargo spaces and enclosed spaces may be depleted.

**Stowage and segregation**

"Separated from" goods of classes 1 (division 1.4S), 2, 3, 4 and 5, and class 8 acids in packaged form (See IMDG Code).

"Separated from" solid bulk materials of classes 4 and 5.

Goods of class 1, other than division 1.4S, shall not be carried in the same ship.

Boundaries of compartments where this cargo is carried shall be resistant to fire and passage of liquid.

**Hold cleanliness**

The cargo spaces shall be clean, dry and free from salt and residues of previous cargoes. Prior to loading, wooden fixtures such as battens, loose dunnage, debris and combustible materials shall be removed.

**Weather precautions**

The cargo shall be kept dry at all times during storage, before and during loading, and during transportation. The cargo shall not be loaded onto ships, or transferred between ships or barges, during precipitation. During loading of this cargo, all non-working hatches of cargo spaces into which this cargo is loaded, or to be loaded, shall be kept closed.

**Loading**

Prior to loading, the terminal shall ensure that the conveyor belts used for loading this cargo contain no accumulation of water or other substances. Each time cargo operations are commenced or restarted, particularly after rain or washing down, any loading belt shall be operated empty and not over a ship's cargo space.

Prior to loading, an ultrasonic test or another equivalent method with a suitable instrument shall be conducted to ensure weathertightness of the hatch covers and closing arrangements and all readings shall confirm weathertightness.

Prior to loading this cargo, the shipper shall provide the master with a certificate issued by a competent person recognized by the competent authority of the port of loading stating that the cargo, at the time of loading, is suitable for shipment, and that it conforms with the requirements of this Code; that the quantity of fines and small particles is no more than 5% by weight; that the moisture content is less than 0.3%; and that the temperature does not exceed 65°C. This certificate shall state the date of manufacture for each lot of cargo to be loaded in order to meet the loading criteria with regard to ageing and material temperature.

The cargo shall not be accepted for loading when its temperature is in excess of 65°C or if its moisture content is in excess of 0.3% or if the quantity of fines and small particles exceeds 5% by weight. Any cargo that has been wetted, or is known to have been wetted, shall not be loaded into any cargo space.

Prior to loading, provision shall be made to introduce a dry, inert gas at tank top level so that the inert gas purges the air from the cargo and fills the free volume above. Nitrogen is preferred for this purpose. All vents, accesses and other openings, such as coaming drains, that could allow the inert atmosphere to be lost from cargo spaces carrying this cargo shall be closed and sealed.

The cargo shall be loaded in such a way as to minimize both the breakage of the cold-moulded briquettes, pellets, lumps and the additional generation of fines and the concentrating of fines in any area of the cargo. This cargo shall be homogenous, with no added waste. The addition of DRI particles, fines or dust in this cargo shall be prohibited.

Due consideration shall be given to evenly spreading the cargo across the tank top to minimize the concentration of fines. Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

The cargo temperature and moisture shall be monitored during loading and recorded in a log detailing the temperature and moisture for each lot of cargo loaded, a copy of which shall be provided to the master. After loading, a certificate shall be issued by a competent person recognized by the competent authority of the port of loading, confirming that, throughout the whole consignment, fines and small particles (under 6.35 mm size) are less than 5% by weight, that the moisture content has not exceeded 0.3% and the temperature does not exceed 65°C.

On completion of loading of a cargo space, it shall be immediately closed and sealed. Sufficient inert gas shall then be introduced to achieve an oxygen concentration less than 5% throughout the cargo space.

### **Precautions**

Due consideration shall be given to the possibility of moisture inside the cargo pile in order to avoid loading of wet cargo or a wet part of the cargo, recognizing that the bottom of the pile can be wet even though the surface of cargo pile looks dry. The carrier's nominated technical persons or other representatives shall have reasonable access to stockpiles and loading installations for inspection.

Prior to shipment, the cargo shall be aged for at least 3 days, or treated with an air-passivation technique, or another equivalent method, that reduces the reactivity to the same level as the aged product. Such ageing process shall be approved by the competent authority that shall also provide a certificate to that effect.

Shippers shall provide comprehensive information on the cargo and safety procedures to be followed in the event of emergency. This advice may be an amplification of this Code, but shall not be contrary thereto in respect of safety.

Where practicable, ballast tanks adjacent to the cargo spaces containing this cargo, other than double-bottom tanks, shall be kept empty. Weathertightness shall be maintained throughout the voyage. Bilge wells of the cargo spaces shall be clean, dry and protected from ingress of the cargo, using non-combustible material.

Due consideration shall be given to protecting equipment, machinery and accommodation spaces from the dust of the cargo. Radars and exposed radiocommunication equipment of ships which carry this cargo shall be protected from the dust of this cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

During any handling of this cargo, "NO SMOKING" signs shall be posted on decks and in areas adjacent to cargo spaces, and no naked lights shall be permitted in these areas. Smoking, burning, cutting, chipping, grinding or other sources of ignition shall not be allowed in the vicinity of cargo spaces containing this cargo at any time.

Cargo spaces containing this cargo and adjacent spaces may become oxygen-depleted. Flammable gas may also build up in these spaces. All precautions shall be taken when entering the cargo spaces.

The ship shall be provided with the means to ensure that the requirement of this Code to maintain the oxygen concentration below 5% can be achieved throughout the voyage. The ship's fixed CO<sub>2</sub> fire-fighting system shall not be used for this purpose. Consideration shall be given to providing the vessel with the means to top up the cargo spaces with additional supplies of inert gas, taking into account the duration of the voyage.

The ship shall be provided with the means for reliably measuring the temperatures at several points within the stow, and determining the concentrations of hydrogen and oxygen in the cargo space atmosphere on voyage whilst minimizing as far as practicable the loss of the inert atmosphere.

Any cargo that has already been loaded into a cargo space and which subsequently becomes wetted, or in which reactions have started, shall be discharged without delay.

The ship shall not sail until the master and a competent person recognized by the competent authority of the port of loading are satisfied:

- .1 that all loaded cargo spaces are correctly sealed and inerted;
- .2 that the temperature of the cargo has stabilized at all measuring points and that the temperature does not exceed 65°C; and
- .3 that, at the end of the inerting process, the concentration of hydrogen in the free space of the holds has stabilized and does not exceed 0.2% by volume.

### **Ventilation**

The cargo spaces carrying this cargo shall remain tightly sealed and the inert condition maintained during the voyage.

### **Carriage**

For quantitative measurements of hydrogen and oxygen, suitable detectors shall be on board while this cargo is carried. The detectors shall be suitable for use in an oxygen-depleted atmosphere and of a type certified safe for use in explosive atmospheres. The concentrations of hydrogen and oxygen in the cargo spaces carrying this cargo shall be measured at regular intervals during voyage, and the results of the measurements shall be recorded and kept on board for a minimum of two years.

The oxygen concentration in the cargo spaces carrying this cargo shall be maintained at less than 5% throughout the duration of the voyage. When the monitored hydrogen concentration is higher than 1% (> 25% lower explosive limit (LEL)) by volume, appropriate safety precautions shall be taken in accordance with those procedures provided by the shipper in the event of emergency. If in doubt, expert advice shall be sought.

Cargo temperatures shall be taken at regular intervals during voyage and the results of the measurements shall be recorded and kept on board for a minimum of two years. If the temperature in the cargo space exceeds 65°C, appropriate safety precautions shall be taken in accordance with the procedures provided by the shipper in the event of emergency. If in doubt, expert advice shall be sought.

Bilge wells shall be checked regularly for the presence of water. If water is found, it shall be removed by pumping or draining the bilge wells. Consideration shall be given to increasing the frequency of cargo monitoring following periods of bad weather. All measurements shall be taken so as to minimize as far as practicable the loss of inert gas from the cargo spaces.

### **Discharge**

The hydrogen concentration in the cargo space shall be measured immediately before any opening action of the hatch covers. If the hydrogen concentration is greater than 1% (> 25% lower explosive limit (LEL)) by volume, all appropriate safety precautions in conformity with the procedures provided by the shipper or the recommendations of the competent authority shall be taken. If in doubt, expert advice shall be sought.

During precipitation, all cargo operations shall be suspended and holds containing cargo shall be closed. Monitoring for hydrogen in those holds containing cargo shall be resumed.

### **Clean-up**

Accumulations of dust from this cargo on deck or in proximity to cargo spaces shall be removed as quickly as possible. Hosing with seawater shall be avoided. Consideration shall be given to



carefully cleaning exposed radiocommunication equipment to which dust from the cargo might adhere, such as radar, radio aerials, VHF installations, AIS and GPS.

### Emergency procedures

#### Special emergency equipment to be carried

Nil

#### Emergency procedures

Nil

#### Emergency action in the event of fire

In the event of emergency, the specific procedures provided by the shipper should be consulted and followed, as appropriate.

#### **Do not use CO<sub>2</sub>. Do not use water. Do not use steam.**

Batten down and reinstate the inert atmosphere using supplies or equipment if available on board. Increase the frequency of monitoring. If temperature and/or hydrogen concentration steadily rise, seek expert advice as quickly as possible.

If the temperature in the cargo space exceeds 120°C, the ship should make for the nearest appropriate port to discharge the cargo affected. Preparations should be made for grab discharge.

If additional nitrogen gas is available, the use of this gas will assist in keeping the oxygen concentration down and may contain the fire and prevent an explosive atmosphere if hydrogen is produced.

Flooding with water of the affected cargo hold should only be contemplated as a last resort, always taking the stability and strength of the ship into account.

#### **Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

**DIRECT REDUCED IRON (C)**  
**(By-product fines)**

**Description**

**Direct reduced iron (DRI) (C)** is a porous, black/grey metallic material generated as a by-product of the manufacturing and handling processes of DRI (A) and/or DRI (B). The density of DRI (C) is less than 5,000 kg/m<sup>3</sup>.

**Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|--|-----------------------------|--|---|
| <b>Size</b>  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| Fines and small particles with an average size less than 6.35 mm, no particles to exceed 12 mm | Not applicable              | 1,850 to 3,300                         | 0.30 to 0.54                            |
| <b>Hazard classification</b>   |                             |  |   |
| <b>Class</b>   | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| Not applicable   | Not applicable              | SH and/or WF                           | B                                       |

**Hazard**

Temporary increase in temperature of about 30°C due to self-heating may be expected after material handling in bulk.

There is a risk of overheating, fire and explosion during transport. This cargo reacts with air and with fresh water or seawater, to produce hydrogen and heat. Hydrogen is a flammable gas that can form an explosive mixture when mixed with air in concentrations above 4% by volume. Cargo heating may generate very high temperatures that are sufficient to lead to self-heating, auto-ignition and explosion.

Oxygen in cargo spaces and in enclosed adjacent spaces may be depleted. Flammable gas may also build up in these spaces. All precautions shall be taken when entering cargo and enclosed adjacent spaces.

The reactivity of this cargo is extremely difficult to assess due to the nature of the material that can be included in the category. A worst case scenario should therefore be assumed at all times.

**Stowage and segregation**

"Separated from" goods of classes 1 (division 1.4S), 2, 3, 4 and 5, and class 8 acids in packaged form (see IMDG Code).

"Separated from" solid bulk materials of classes 4 and 5.

Goods of class 1, other than division 1.4S, shall not be carried in the same ship. Boundaries of compartments where this cargo is carried shall be resistant to fire and passage of liquid.

**Hold cleanliness**

Cargo spaces shall be clean, dry and free of salt and residues of previous cargoes. Prior to loading, wooden fixtures such as battens, loose dunnage, debris and combustible materials shall be removed.

### **Weather precautions**

The cargo shall be kept within the permissible moisture content indicated in this schedule at all times during loading, and during transportation.

This cargo shall not be loaded onto ships, or transferred between ships or barges, during ANY precipitation. During loading of this cargo, all non-working hatches of cargo spaces into which this cargo is loaded, or to be loaded, shall be kept closed.

### **Loading**

Prior to loading, the terminal shall ensure that the conveyor belts and all other equipment used for loading this cargo contain no accumulation of water or other substances. Each time cargo operations are commenced or restarted, particularly after rain or washing down, any loading belt shall be operated empty and not over a ship's cargo space.

Prior to loading, an ultrasonic test or another equivalent method with a suitable instrument shall be conducted to ensure weathertightness of the hatch covers and closing arrangements and all readings shall confirm weathertightness.

Prior to loading this cargo, the shipper shall provide the master with a certificate issued by a competent person recognized by the competent authority of the port of loading stating that the cargo, at the time of loading, is suitable for shipment; that it conforms with the requirements of this Code; that the moisture content is less than 0.3%; and the temperature does not exceed 65°C. This certificate shall state that the cargo meets the loading criteria with regard to ageing and material temperature.

The cargo shall not be accepted for loading when its temperature is in excess of 65°C or if its moisture content is in excess of 0.3%. Any cargo that has been wetted, or is known to have been wetted, shall not be loaded into any cargo space.

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

The cargo temperature shall be monitored during loading and recorded in a log detailing the temperature for each lot of cargo loaded, a copy of which shall be provided to the master. After loading, a certificate shall be issued by a competent person recognized by the competent authority of the port of loading confirming that throughout the whole consignment of fines and small particles the moisture content has not exceeded 0.3% and the temperature does not exceed 65°C.

On completion of loading of a cargo space, it shall be immediately closed and sealed. Sufficient inert gas shall then be introduced to achieve an oxygen concentration less than 5% throughout the cargo space.

### **Precautions**

Due consideration shall be given to the possibility of moisture inside the cargo pile in order to avoid loading of wet cargo or a wet part of the cargo, recognizing that the bottom of the pile can be wet even though the surface of cargo pile looks dry. The carrier's nominated technical persons or other representatives shall have reasonable access to stockpiles and loading installations for inspection.

Prior to shipment, the cargo shall be aged for at least 30 days and a certificate confirming this shall be issued by a competent person recognized by the competent authority of the port of loading.

Shippers shall provide to the master, prior to loading, comprehensive information on the cargo and safety procedures to be followed in the event of emergency. This advice may be an amplification of this Code, but shall not be contrary thereto in respect of safety.

Where practicable, ballast tanks adjacent to the cargo spaces containing this cargo, other than double-bottom tanks, shall be kept empty. Weathertightness shall be maintained throughout the voyage. Bilge wells of the cargo spaces shall be clean, dry and protected from ingress of the cargo, using non-combustible material. The introduction of moisture and accumulation of condensation in the cargo spaces shall be avoided.

Appropriate precautions shall be taken to protect equipment, machinery and accommodation spaces from the dust of the cargo. Radars and exposed radiocommunication equipment of ships which carry this cargo shall be protected from the dust of this cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

During any handling of this cargo, "NO SMOKING" signs shall be posted on decks and in areas adjacent to cargo spaces, and no naked light shall be permitted in these areas. Smoking, burning, cutting, chipping, grinding or other sources of ignition shall not be allowed in the vicinity of cargo spaces containing this cargo at any time.

Cargo spaces containing this cargo and adjacent spaces may become oxygen-depleted. No person shall enter a loaded cargo space or an enclosed adjacent space unless the space has been ventilated and the atmosphere tested and found to be gas-free and have sufficient oxygen to support life. Notwithstanding, emergency entry may be permitted without ventilation, testing, or both provided that the entry into the space is undertaken only by trained personnel wearing self-contained breathing apparatus under the supervision of a responsible officer and no source of ignition is introduced into the space.

Prior to loading, provision shall be made to introduce a dry, inert gas at tank top level so that the inert gas purges the air from the cargo and fills the free volume above. Nitrogen is preferred for this purpose. All vents, accesses and other openings, such as coaming drains, that could allow the inert atmosphere to be lost from cargo spaces carrying this cargo shall be closed and sealed.

The ship shall be provided with the means to ensure that a requirement of this Code to maintain the oxygen concentration below 5% can be achieved and maintained throughout the voyage. The ship's fixed CO<sub>2</sub> fire-fighting system shall not be used for this purpose. Consideration shall be given to providing the vessel with the means to top up the cargo spaces with additional supplies of inert gas, taking into account the duration of the voyage.

The ship shall be provided with the means for reliably measuring the temperatures at several points within the stow and determining the concentrations of hydrogen and oxygen in the cargo space atmosphere on voyage. Appropriate precautions shall be taken to minimize, as far as practicable, the loss of the inert atmosphere.

Any cargo that has already been loaded into a cargo space and which subsequently is exposed to additional fresh water or seawater over its natural moisture content and becomes wetted, or in which reactions have started and its temperature has exceeded 120°C, shall be discharged without delay.

On completion of loading of a cargo space, it shall be immediately closed and sealed. Sufficient inert gas shall then be introduced to achieve an oxygen concentration less than 5% throughout the cargo space.

The ship shall not sail until the master and a competent person recognized by the competent authority of the port of loading are satisfied:

- .1 that all loaded cargo spaces are correctly sealed and inerted;
- .2 that the temperature of the cargo has stabilized at all measuring points and that the temperature does not exceed 65°C; and
- .3 that at the end of the inerting process, the concentration of hydrogen in the free space of the holds has stabilized and does not exceed 0.2% by volume.

### **Ventilation**

The cargo spaces carrying this cargo shall remain tightly sealed and the inert condition maintained during the voyage.

### **Carriage**

For quantitative measurements of hydrogen and oxygen, suitable detectors shall be on board while this cargo is carried. The detectors shall be suitable for use in an oxygen-depleted atmosphere and of a type certified safe for use in explosive atmospheres. The concentrations of hydrogen and oxygen in the cargo spaces carrying this cargo shall be measured at regular intervals during voyage, and the results of the measurements shall be recorded and kept on board for a minimum of two years.

The oxygen concentration in the cargo spaces carrying this cargo shall be maintained at less than 5% throughout the duration of the voyage by topping up with inert gas.

Cargo temperatures shall be taken at regular intervals during the voyage and the results of the measurements shall be recorded and kept on board for a minimum of two years. If the temperature in the cargo space exceeds 65°C or the monitored hydrogen concentration exceeds 1% (> 25% lower explosive limit (LEL)) by volume, appropriate safety precautions shall be taken in accordance with the procedures provided by the shipper in the event of emergency. If in doubt, expert advice shall be sought.

Bilge wells shall be checked regularly for the presence of water. If water is found, it shall be removed by pumping or draining the bilge wells. Consideration shall be given to increasing the frequency of cargo monitoring following periods of bad weather. All measurements shall be taken so as to minimize, as far as practicable, the loss of inert gas from the cargo spaces.

### **Discharge**

The hydrogen concentration in the cargo space shall be measured immediately before any opening action of the hatch covers. If the hydrogen concentration is greater than 1% (> 25% lower explosive limit (LEL)) by volume, all appropriate safety precautions in conformity with the procedures provided by the shipper or the recommendations of the competent authority shall be taken. If in doubt, expert advice shall be sought.

During precipitation, all cargo operations shall be suspended and holds containing cargo shall be closed. Monitoring for hydrogen of those holds containing cargo shall be resumed.

### Clean-up

Accumulations of dust from this cargo on deck or in proximity to cargo spaces shall be removed as quickly as possible. Hosing with seawater shall be avoided. Consideration shall be given to carefully cleaning exposed radiocommunication equipment to which dust from the cargo might adhere, such as radar, radio aerials, VHF installations, AIS and GPS.

### Emergency procedures

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>In the event of emergency, the specific procedures provided by the shipper should be consulted and followed, as appropriate.</p> <p style="text-align: center;"><b>Do not use CO<sub>2</sub>. Do not use water. Do not use steam.</b></p> <p>Batten down and reinstate the inert atmosphere using supplies or equipment if available on board. Increase the frequency of monitoring. If temperature and/or hydrogen concentration steadily rise, seek expert advice as quickly as possible.</p> <p>If the temperature in the cargo space exceeds 120°C, the ship should make for the nearest appropriate port to discharge the cargo affected. Preparations should be made for grab discharge.</p> <p>If additional nitrogen gas is available, the use of this gas will assist in keeping the oxygen concentration down and may contain the fire and prevent an explosive atmosphere if hydrogen is produced.</p> <p>Flooding with water of the affected cargo hold should only be contemplated as a last resort, always taking the stability and strength of the ship into account.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## DISTILLERS DRIED GRAINS WITH SOLUBLES

### Description

A dried blend of coarse grains and condensed distillers solubles that remain after the fermentation of the starch fraction of corn with yeasts and enzymes to produce ethanol and carbon dioxide. Yellowish brown in colour with a cooked corn odour. Moisture content not more than 13% and oil content not more than 11%. This schedule is not applicable to wet distillers grain (WDG) and distillers dried grain (DDG), which are not transported in bulk.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 450 to 520                        | 1.92 to 2.22                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Load in open unconfined areas. Trim in accordance with the relevant provision required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

### Discharge

If this cargo has hardened, it shall be trimmed to avoid the formation of overhanging faces, as necessary.

### Clean-up

No special requirements.

## DOLOMITE

### Description

Dolomite is a light yellow/brown coloured mineral stone which is very hard and compact. Dolomite may sometimes, incorrectly, be used to describe a material consisting of the oxides of calcium and magnesium (dolomitic quicklime). In this case, see "LIME (UNSLAKED)".

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 32 mm           | Not applicable       | 1,429 to 1,667                    | 0.60 to 0.70                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## FELSPAR LUMP

### Description

Crystalline minerals consisting of silicates of aluminium with potassium sodium, calcium and barium. White or reddish in colour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 0.1 mm to 300 mm      | Not applicable       | 1,667                             | 0.60                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## FERROCHROME

### Description

Raw material of iron mixed with chrome. Extremely heavy cargo.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 300 mm          | Not applicable       | 3,571 to 5,556                    | 0.18 to 0.28                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## **FERROCHROME, exothermic**

### **Description**

An alloy of iron and chromium. Extremely heavy cargo.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Up to 300 mm                 | Not applicable              | 3,571 to 5,556                             | 0.18 to 0.28                                |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| Not applicable               | Not applicable              | Not applicable                             | C   |

### **Hazard**

No special hazards.

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

### **Stowage and segregation**

No special requirements.

### **Hold cleanliness**

No special requirements.

### **Weather precautions**

No special requirements.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

During loading, carriage and discharging, welding or other hot work shall not be carried out in the vicinity of the cargo spaces containing this cargo.

### **Ventilation**

No special requirements.

### **Carriage**

No special requirements.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

## FERROMANGANESE

### Description

Raw material or iron mixed with manganese.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 300 mm          | Not applicable       | 3,571 to 5,556                    | 0.18 to 0.28                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## FERRONICKEL

### Description

An alloy of iron and nickel.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 300 mm          | Not applicable       | 4,167                             | 0.24                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## FERRONICKEL SLAG (granulated)

### Description

The slag is a by-product from smelting and refining of iron ore and nickel ore in electric furnace. It is granulated by air or water cooling. This cargo is mainly composed of magnesium silicate, and the composition is similar to natural sand. The colour can be pale greenish, grey to brownish.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 5 mm            | 36° to 56°           | 1,100 to 1,730                    | 0.58 to 0.91                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazard.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, safety glasses or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## **FERROPHOSPHORUS (including briquettes)**

### **Description**

An alloy of iron and phosphorus used in the steel industry.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Diameter: 2.54 mm            | Not applicable              | 5,000                                      | (0.20 for briquettes)                       |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| Not applicable               | Not applicable              | WF and/or WT                               | B   |

### **Hazard**

May evolve flammable and toxic gases (e.g. phosphine) in contact with water.  
This cargo is non-combustible or has a low fire risk.

### **Stowage and segregation**

Segregation as for class 4.3 materials. "Separated from" foodstuffs and class 8 liquids.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

This cargo shall be kept as dry as reasonably practicable.

### **Ventilation**

Mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. Ventilation fans shall be of certified safe type for use in a flammable atmosphere. They shall normally be run continuously whenever this cargo is on board. Where this is impracticable, they shall be operated as weather permits and in any case for a reasonable period prior to discharge.

### **Carriage**

For quantitative measurement of flammable and toxic gases such as Phosphine, which may be evolved from this cargo in accordance with the cargo information, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

### **Discharge**

No special requirements.

**Clean-up**

After discharge of this cargo, the cargo spaces shall be swept clean. Water shall not be used for cleaning of the cargo space which has contained this cargo, because of danger of gas.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down and use CO<sub>2</sub>, if available. <b>Do not use water.</b></p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |



**FERROSILICON UN 1408**  
**with 30% or more but less than 90% silicon**  
**(including briquettes)** (see appendix to this schedule)

**Description**

Ferrosilicon is an extremely heavy cargo.

**Characteristics**

| Physical properties     |                      |   |   |
|-------------------------|----------------------|---|---|
| Size                    | Angle of repose      | Bulk density (kg/m <sup>3</sup> )                 | Stowage factor (m <sup>3</sup> /t)            |
| Up to 300 mm briquettes | Not applicable       | 1,389 to 2,083<br>(1,111 to 1,538 for briquettes) | 0.48 to 0.72<br>(0.65 to 0.90 for briquettes) |
| Hazard classification   |                      |   |   |
| Class                   | Subsidiary hazard(s) | MHB   | Group   |
| 4.3                     | 6.1                  |   | B   |

**Hazard**

In contact with moisture or water it may evolve hydrogen, a flammable gas which may form explosive mixtures with air and may, under similar circumstances, produce phosphine and arsine, which are highly toxic gases.

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

**Stowage and segregation**

"Separated from" foodstuffs and all class 8 liquids.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo. *Refer to the appendix to this schedule.*

**Precautions**

The manufacturer or the shipper shall provide the master with a certificate stating that, after manufacture, the cargo was stored under cover, but exposed to dry weather for not less than three days prior to shipment.

**Ventilation**

Continuous mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. If maintaining ventilation endangers the ship or the cargo, it may be interrupted unless there is a risk of explosion or other danger due to interruption of the ventilation. In any case, mechanical ventilation shall be maintained for a reasonable period prior to discharge. *Refer to the appendix to this schedule.*

**Carriage**

For quantitative measurements of hydrogen, phosphine and arsine, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

**Discharge**

*Refer to the appendix to this schedule.*

**Clean-up**

After discharge of this cargo, the cargo spaces shall be swept clean twice. Water shall not be used for cleaning of the cargo space which has contained this cargo, because of danger of gas.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down and use CO<sub>2</sub>, if available. <b>Do not use water.</b></p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## **APPENDIX**

### **GENERAL REQUIREMENTS FOR CARRIAGE OF FERROSILICON**

- 1 Chapter II-2 of SOLAS requires fire-fighter's outfits, full chemical protective suits and self-contained breathing apparatus to be readily available on board.
- 2 Gas concentrations shall be measured, during the voyage, at least once during every eight hours at each outlet ventilator and in any other accessible space adjacent to the cargo space carrying this cargo and the results shall be recorded in the log-book. Facilities shall be provided to make accurate determinations of the gas concentrations at each outlet ventilator without danger to the operator.
- 3 Ventilation fans shall be in operation at all times from commencement of loading until the cargo space is free of ferrosilicon.
- 4 The bilge wells shall be in a clean, dry condition before loading. The bilge timbers shall be in good condition and covered with double burlap.
- 5 The bilge wells shall be opened up and the cargo space cleaned up after discharging. A gas check shall be made before commencement of cleaning up.

### **DETAILED REQUIREMENTS**

Prior to loading, the bulkheads to the engine-room shall be inspected and approved by the Administration as gastight and the safety of the bilge pumping arrangements shall be approved by the Administration. Inadvertent pumping through machinery spaces shall be avoided.

- (i) Where the bilge suction valve of the cargo space is located in the machinery space, the valve shall be checked and the valve lid and seat lapped to a fine finish, as necessary. After re-assembly, the valve shall be locked shut and a notice shall be placed adjacent to the valve warning against opening without the master's permission.
- (ii) All pipes passing through the cargo space shall be in good order and condition. Hold atmosphere sampling units shall be effectively blanked off.
- (iii) Electrical circuits for equipment in cargo spaces which is unsuitable for use in an explosive atmosphere shall be isolated by removal of links in the system other than fuses.
- (iv) The cargo spaces shall be ventilated by at least two separate fans which shall be explosion-proof and arranged so that the escaping gas flow is separated from electrical cables and components. The total ventilation shall be at least 6 air changes per hour, based on an empty cargo space.
- (v) Ventilator trunkings shall be in sound condition and so arranged to preclude interconnection of the atmosphere in the cargo space with other cargo spaces, accommodation or work areas.

### **OPERATIONAL REQUIREMENTS**

- (i) Smoking and naked flame shall be prohibited on deck in the vicinity of the cargo space or in the cargo space itself during loading or discharging.
- (ii) Any portable lighting shall be safe for use in an explosive atmosphere.
- (iii) The cargo shall be kept dry and, during wet weather conditions, cargo handling shall be suspended and the cargo space shall be closed.

- (iv) Sets of self-contained breathing apparatus shall be located and stored for immediate use together with a lifeline and a gas detector.
- (v) Prior to commencement of discharging, the atmosphere in the cargo space shall be tested for the presence of toxic and flammable gases.
- (vi) Checks for contaminant gases shall be carried out at 30-min intervals while persons are in the cargo space.
- (vii) Entry into the cargo space shall be prohibited when gas concentrations exceed the Threshold Limit Values for phosphine (0.3 ppm) or for arsine (0.05 ppm) or where the oxygen level is below 18%.

## **GASES RELEASED FROM FERROSILICON IMPURITIES WHEN WATER IS ADDED**

### **(i) Arsine**

Arsine is a toxic, colourless gas with a garlic-like odour.

#### **Toxicity**

Arsine is a nerve and blood poison. There is generally a delay before the onset of symptoms (sometimes a day or so). These are at first indefinite.

#### **Symptoms**

1 Feeling of malaise, difficulty in breathing, severe headache, giddiness, fainting fits, nausea, vomiting and gastric disturbances.

2 In severe cases, vomiting may be pronounced, the mucous membranes may have a bluish discolouration and urine is dark and bloodstained. After a day or so there is severe anaemia and jaundice.

#### **Concentration**

A concentration of 500 ppm is lethal to humans after exposure of a few minutes, while concentrations of 250 ppm are dangerous to life after 30 min exposure. Concentrations of 6.25 to 15.5 ppm are dangerous after exposure of 30 to 60 min. A concentration of 0.05 ppm is the threshold long limit to which a person may be exposed.

### **(ii) Phosphine**

Phosphine is colourless, flammable and highly toxic and has the odour of rotting fish.

#### **Toxicity**

Phosphine acts on the central nervous system and the blood.

#### **Symptoms**

The symptoms exhibited by phosphine poisoning are an oppressed feeling in the chest, headache, vertigo, general debility, loss of appetite and great thirst. Concentrations of 2,000 ppm for a few minutes and 400 to 600 ppm are dangerous to life. 0.3 ppm is the maximum concentration tolerable for several hours without symptoms.

No long-term exposures to this gas shall be permitted.

**FERROSILICON**

with at least 25% but less than 30% silicon, or 90% or more silicon  
(see appendix to this schedule)

**Description**

Ferrosilicon is an extremely heavy cargo.

**Characteristics**

| Physical properties     |                      |   |   |
|-------------------------|----------------------|---|---|
| Size                    | Angle of repose      | Bulk density (kg/m <sup>3</sup> )                 | Stowage factor (m <sup>3</sup> /t)            |
| Up to 300 mm briquettes | Not applicable       | 1,389 to 2,083<br>(1,111 to 1,538 for briquettes) | 0.48 to 0.72<br>(0.65 to 0.90 for briquettes) |
| Hazard classification   |                      |   |   |
| Class                   | Subsidiary hazard(s) | MHB   | Group   |
| Not applicable          | Not applicable       | WF and/or WT                                      | B   |

**Hazard**

In contact with moisture or water it may evolve hydrogen, a flammable gas which may form explosive mixtures with air and may, under similar circumstances, produce phosphine and arsine, which are highly toxic gases.

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

**Stowage and segregation**

Segregation as required for class 4.3 materials. "Separated from" foodstuffs and all class 8 liquids.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo. Refer to the appendix to this schedule.

**Precautions**

The manufacturer or the shipper shall provide the master with a certificate stating that, after manufacture, the cargo was stored under cover, but exposed to open air for not less than three days prior to shipment.

**Ventilation**

Continuous mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. If maintaining ventilation endangers the ship or the cargo, it may be interrupted unless there is a risk of explosion or other danger due to interruption of the ventilation. In any case, mechanical ventilation shall be maintained for a reasonable period prior to discharge. *Refer to the appendix to this schedule.*

### Carriage

For quantitative measurements of hydrogen, phosphine and arsine, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

### Discharge

Refer to the appendix to this schedule.

### Clean-up

After discharge of this cargo, the cargo spaces shall be swept clean twice. Water shall not be used for cleaning of the cargo space which has contained this cargo, because of danger of gas.

### Emergency procedures

|  |
|--|
| <b>Special emergency equipment to be carried</b><br>Self-contained breathing apparatus.                                      |
| <b>Emergency procedures</b><br>Wear self-contained breathing apparatus.  |
| <b>Emergency action in the event of fire</b><br>Batten down and use CO <sub>2</sub> , if available. <b>Do not use water.</b> |
| <b>Medical first aid</b><br>Refer to the <i>Medical First Aid Guide (MFAG)</i> , as amended.                                 |

## APPENDIX

### GENERAL REQUIREMENTS FOR CARRIAGE OF FERROSILICON

- 1 Two sets of self-contained breathing apparatus shall be carried in the ship in addition to normal fire-fighter's outfit.
- 2 Gas concentrations shall be measured, during the voyage, at least once during every eight hours at each outlet ventilator and in any other accessible space adjacent to the cargo space carrying this cargo and the results shall be recorded in the log-book. Facilities shall be provided to make accurate determinations of the gas concentrations at each outlet ventilator without danger to the operator.
- 3 Ventilation fans shall be in operation at all times from commencement of loading until the cargo space is free of ferrosilicon.
- 4 The bilge wells shall be in a clean, dry condition before loading. The bilge timbers shall be in good condition and covered with double burlap.
- 5 The bilge wells shall be opened up and the cargo space cleaned up after discharging. A gas check shall be made before commencement of cleaning up.

### DETAILED REQUIREMENTS

Prior to loading, the bulkheads to the engine-room shall be inspected and approved by the Administration as gastight. Satisfaction with the safety of the bilge pumping arrangements shall

be approved by the Administration. Inadvertent pumping through machinery spaces shall be avoided.

- (i) Where the bilge suction valve of the cargo space is located in the machinery space, the valve shall be checked and the valve lid and seat lapped to a fine finish, as necessary. After re-assembly, the valve shall be locked shut and a notice shall be placed adjacent to the valve warning against opening without the master's permission.
- (ii) All pipes passing through the cargo space shall be in good order and condition. Hold atmosphere sampling units shall be effectively blanked off.
- (iii) Electrical circuits for equipment in cargo spaces which is unsuitable for use in an explosive atmosphere shall be isolated by removal of links in the system other than fuses.
- (iv) The cargo spaces shall be ventilated by at least two separate fans which shall be explosion-proof and arranged so that the escaping gas flow is separated from electrical cables and components. The total ventilation shall be at least 6 air changes per hour, based on an empty cargo space.
- (v) Ventilator trunkings shall be in sound condition and so arranged to preclude interconnection of the atmosphere in the cargo space with other cargo spaces, accommodation or work areas.

#### **OPERATIONAL REQUIREMENTS**

- (i) Smoking and naked flame shall be prohibited on deck in the vicinity of the cargo space or in the cargo space itself during loading or discharging.
- (ii) Any portable lighting shall be safe for use in an explosive atmosphere.
- (iii) The cargo shall be kept dry and during wet weather conditions, cargo handling shall be suspended and the cargo space shall be closed.
- (iv) Sets of self-contained breathing apparatus shall be located and stored for immediate use together with a lifeline and a gas detector.
- (v) Prior to commencement of discharging, the atmosphere in the cargo space shall be tested for the presence of toxic and flammable gases.
- (vi) Checks for contaminant gases shall be carried out at 30-min intervals while persons are in the cargo space.
- (vii) Entry into the cargo space shall be prohibited when gas concentrations exceed the Threshold Limit Values for phosphine (0.3 ppm) or for arsine (0.05 ppm) or where the oxygen level is below 18%.

#### **GASES RELEASED FROM FERROSILICON IMPURITIES WHEN WATER IS ADDED**

##### **(i) Arsine**

Arsine is a toxic, colourless gas with a garlic-like odour.

##### **Toxicity**

Arsine is a nerve and blood poison. There is generally a delay before the onset of symptoms (sometimes a day or so). These are at first indefinite.

### **Symptoms**

- 1 Feeling of malaise, difficulty in breathing, severe headache, giddiness, fainting fits, nausea, vomiting and gastric disturbances.
- 2 In severe cases, vomiting may be pronounced, the mucous membranes may have a bluish discolouration and urine is dark and bloodstained. After a day or so there is severe anaemia and jaundice.

### **Concentration**

A concentration of 500 ppm is lethal to humans after exposure of a few minutes, while concentrations of 250 ppm are dangerous to life after 30 min exposure. Concentrations of 6.25 to 15.5 ppm are dangerous after exposure of 30 to 60 min. A concentration of 0.05 ppm is the threshold long limit to which a person may be exposed.

### **(ii) Phosphine**

Phosphine is colourless, flammable and highly toxic and has the odour of rotting fish.

### **Toxicity**

Phosphine acts on the central nervous system and the blood.

### **Symptoms**

The symptoms exhibited by phosphine poisoning are an oppressed feeling in the chest, headache, vertigo, general debility, loss of appetite and great thirst. Concentrations of 2,000 ppm for a few minutes and 400 to 600 ppm are dangerous to life. 0.3 ppm is the maximum concentration tolerable for several hours without symptoms.

No long-term exposures to this gas shall be permitted.



## **FERROUS METAL BORINGS, SHAVINGS, TURNINGS or CUTTINGS UN 2793 in a form liable to self-heating**

This schedule shall *not* apply to consignments of materials which are accompanied by a declaration submitted prior to loading by the shipper and stating that they have no self-heating properties when transported in bulk.

### **Description**

Metal drillings usually wet or contaminated with such materials as unsaturated cutting oil, oily rags and other combustible material.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| Not applicable               | Not applicable              | Various                                | Various                                 |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| 4.2                          | Not applicable              |  | B                                       |

### **Hazard**

These materials are liable to self-heat and ignite spontaneously, particularly when in a finely divided form, wet or contaminated with such materials as unsaturated cutting oil, oily rags and other combustible matter.

Excessive amounts of cast iron borings or organic materials may encourage heating. Self-heating or inadequate ventilation may cause dangerous depletion of oxygen in cargo spaces.

### **Stowage and segregation**

"Separated from" foodstuffs.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

During loading, the material shall be compacted in the cargo space as frequently as practicable with a bulldozer or other means. The bilge of each cargo space in which the cargo is loaded shall be kept as dry as practicable. After loading, the cargo shall be trimmed to eliminate peaks and compacted. Wooden wet battens and dunnage shall be removed from the cargo space before the cargo is loaded.

### **Precautions**

The temperature of this cargo shall be measured prior to and during loading. The temperature of the cargo in the stockyard shall be measured at points between 200 mm and 350 mm from the surface of the cargo pile. This cargo shall only be accepted for loading when the temperature of the cargo prior to loading does not exceed 55°C. If the temperature of the cargo in any cargo space exceeds 90°C during loading, loading shall be suspended and shall not be recommenced until the temperature of the cargo in all cargo spaces has fallen below 85°C.

The ship shall not depart unless the temperature of the cargo in all cargo spaces is below 65°C and has shown a steady or downward trend in temperature for at least eight hours.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

The surface temperature of the cargo shall be monitored and recorded daily during the voyage. Temperature readings shall be taken in such a way as not to require entry into the cargo space or, alternatively, if entry is required for this purpose, at least two sets of self-contained breathing apparatus, additional to those required by SOLAS regulation II-2/10.10 shall be provided.

### Discharge

Entry into the cargo spaces containing this cargo shall only be permitted for trained personnel wearing self-contained breathing apparatus when the main hatches are open and after adequate ventilation is conducted or for personnel using appropriate breathing apparatus.

### Clean-up

Prior to washing out the residues of this cargo, any oil spillages shall be cleaned from the tank tops and the bilge wells of the cargo spaces for this cargo.

### Emergency procedures

|  |
|--|
| <b>Special emergency equipment to be carried</b><br>Self-contained breathing apparatus   |
| <b>Emergency procedures</b><br>Nil   |
| <b>Emergency action in the event of fire</b><br>Whilst at sea, any rise in surface temperature of the material indicates a self-heating reaction problem. If the temperature should rise to 80°C, a potential fire situation is developing and the ship should make for the nearest suitable port. Batten down.<br><b>Water should not be used at sea.</b><br>Early application of an inert gas to a smouldering situation may be effective. |
| <b>Medical first aid</b><br>Refer to the <i>Medical First Aid Guide (MFAG)</i> , as amended.   |

### Remarks

In port, copious quantities of water may be used, but due consideration should be given to factors affecting the stability of the ship.

## FERROUS SULPHATE HEPTAHYDRATE

### Description

Pale green crystals. Highly soluble in water. Product commonly referred to as "Copperas".

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Crystals              | Not applicable       | 750 to 1,250                      | 0.80 to 1.33                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Harmful if swallowed. Causes serious eye irritation. Causes skin irritation.

Tends to caking when damp.

This cargo is highly soluble and will be acidic when wet.

Excessive levels spilt into water systems may result in oxygen depletion from the water.

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

### Stowage and segregation

"Separated from" oxidizing substances.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. It shall not be handled during precipitation.

During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Avoid contact with eyes and skin. Persons who may be in contact with the product shall wear protective clothing, gloves and eye protection. Typically, this is a non-dusty product, however, in particularly dry conditions, if dust is generated, a filter mask shall also be worn. Bilge wells shall be clean, dry and covered, as appropriate, to prevent ingress of the cargo.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

Hatches of the cargo spaces shall be weathertight to prevent water ingress.

### Discharge

If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

After discharge of this cargo, the cargo spaces and the bilge wells shall be swept clean and then thoroughly washed out.

## FERTILIZERS WITHOUT NITRATES (non-hazardous)

### Description

Powder and granular. Greenish, brown or beige in colour. Odourless. Very low moisture content (0% to 1%). Hygroscopic.

### Characteristics

| Physical properties   |                      |                                      |                                       |
|-----------------------|----------------------|--------------------------------------|---------------------------------------|
| Size                  | Angle of repose      | Bulk density<br>(kg/m <sup>3</sup> ) | Stowage factor<br>(m <sup>3</sup> /t) |
| 1 mm to 3 mm          | Not applicable       | 714 to 1,111                         | 0.90 to 1.40                          |
| Hazard classification |                      |                                      |                                       |
| Class                 | Subsidiary hazard(s) | MHB                                  | Group                                 |
| Not applicable        | Not applicable       | Not applicable                       | C                                     |

### Hazard

No special hazards.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

Fertilizers without nitrates are hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.

## FISH (IN BULK)

### Description

Fish carried in bulk after freezing.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

Fish carried in bulk may liquefy.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Prior to the carriage of this cargo, due consideration shall be given to consult with the competent authority. The requirement in section 7 of this Code, requiring a determination of TML and moisture content declaration may be dispensed with for this cargo.

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

No special requirements.

### Carriage

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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

After completion of discharge, attention shall be given to residues of this cargo, which are liable to decompose, resulting in emission of toxic gases and depletion of oxygen.

## FISH MEAL (FISH SCRAP), STABILIZED UN 2216

### Anti-oxidant treated

*The provisions of this entry shall **not** apply to consignments of fishmeal, which are accompanied by a certificate issued by the competent authority of the country of shipment, stating that the material has no self-heating properties when transported in bulk.*

### Description

Brown to greenish-brown material obtained through heating and drying of oily fish. Moisture content: greater than 5% but not exceeding 12%, by mass. Strong odour may affect other cargo.

Fat content: not more than 15%, by mass.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 300 to 700                        | 1.43 to 3.33                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 9                     | Not applicable       |                                   | B                                  |

### Hazard

Liable to heat spontaneously unless has low fat content or effectively anti-oxidant treated.  
Liable to cause oxygen depletion in cargo space.

### Stowage and segregation

Segregation as required for class 4.2 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

The cargo shall not be accepted for loading when the temperature of the cargo exceeds 35°C or 5°C above the ambient temperature, whichever is higher. The cargo may be loaded without weathering/curing prior to loading.

### Precautions

1 This cargo shall only be accepted for loading when the stabilization of the cargo is achieved to prevent spontaneous combustion by effective application:

- .1 of between 400 and 1,000 mg/kg (ppm) ethoxyquin, or
- .2 of between 1,000 and 4,000 mg/kg (ppm) butylated hydroxytoluene,

at the time of production, within 12 months prior to shipment, and anti-oxidant remnant concentration shall be not less than 100 mg/kg (ppm) at the time of shipment.

2 The shipper shall provide the master with a certificate issued by a person recognized by the competent authority of the country of shipment specifying:

- .1 moisture content;
- .2 fat content;
- .3 details of anti-oxidant treatment for meals older than six months;
- .4 anti-oxidant concentrations at the time of shipment, which must exceed 100 mg/kg (ppm);
- .5 total weight of the consignment;
- .6 temperature of fishmeal at the time of dispatch from the factory; and
- .7 date of production.

A suitable equipment for quantitative measurement of the concentration of oxygen in the cargo space shall be provided on board the ship.

### **Ventilation**

Surface ventilation, either natural or mechanical, shall be conducted during the voyage, as necessary, for the cargo spaces carrying this cargo. If the temperature of the cargo exceeds 55°C and continues to increase, ventilation to the cargo space shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo spaces.

### **Carriage**

This cargo shall be kept as cool and dry as reasonably practicable. The temperature of this cargo shall be measured at eight-hour intervals during the voyage. The results of measurements shall be recorded and kept on board.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements

### **Emergency procedures**

|  |
|--|
| <b>Special emergency equipment to be carried</b><br>Self-contained breathing apparatus.                              |
| <b>Emergency procedures</b><br>Wear self-contained breathing apparatus.  |
| <b>Emergency action in the event of fire</b><br>Batten down; use ship's fixed fire-fighting installation, if fitted. |
| <b>Medical first aid</b><br>Refer to the <i>Medical First Aid Guide (MFAG)</i> , as amended.                         |

## FLUE DUST, CONTAINING LEAD AND ZINC

### Description

A yellow to grey granular material obtained as a by-product from refining and smelting of lead and/or zinc containing materials. This can include dusts from primary production (lead and/or zinc containing ores and concentrates), from secondary production (recycling of lead and/or zinc containing materials) and from further refining of lead and/or zinc containing materials (such as zinc or lead metal).

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines up to 1.2 mm    | 56°                  | 2,200 to 4,200                    | 0.24 to 0.45                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
|                       | Not applicable       | TX and/or CR                      | A and B                            |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

May cause long-term health effects. Corrosive to eyes and irritating to skin.

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

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 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 this Code.



As the density of this cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of this cargo.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

Persons who may be exposed to the dust of the cargo shall wear personal protective equipment including goggles or other equivalent dust eye-protection, respiratory protection and/or skin protection as necessary. Due consideration shall be given to prevent dust entering living quarters and enclosed working area. Eating and drinking shall be prohibited in the cargo work areas.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the voyage, the master shall take appropriate actions to prevent cargo shifting and potential capsizing of the ship, and give consideration to seeking emergency entry into a place of refuge.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (goggles, gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed firefighting installation, if fitted.<br/>Use water spray to control spread of dust, if necessary.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## FLUORSPAR

### Description

Yellow, green or purple crystals. Coarse dust.

### Characteristics

| Physical properties   |                      |  |  |
|-----------------------|----------------------|--|--|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> )          | Stowage factor (m <sup>3</sup> /t)     |
| Not applicable        | Not applicable       | Dry: 1,429 to 1,786<br>Wet: 1,786 to 2,128 | Dry: 0.56 to 0.70<br>Wet: 0.47 to 0.56 |
| Hazard classification |                      |  |  |
| Class                 | Subsidiary hazard(s) | MHB  | Group                                  |
| Not applicable        | Not applicable       | TX   | A and B                                |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. Harmful and irritating by dust inhalation. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

"Separated from" foodstuffs and all class 8 materials (goods in packaged form and solid bulk materials).

### Hold cleanliness

No special requirements.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

Protect machinery, accommodation and bilge wells from dust.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>                                     |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p>  |
| <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## FLY ASH, DRY

### Description

Fly ash, dry is the light, finely divided dusty fine powder residue from coal- and oil-fired power stations. Do not confuse with calcined pyrites.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 794                               | 1.26                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

May shift when aerated.

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

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

The ship carrying this cargo shall not depart until the cargo has settled.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed.

All vents and access ways to the cargo spaces shall be shut during the voyage. Bilges in the cargo spaces carrying this cargo shall not be pumped unless absolutely necessary.

### Discharge

No special requirements.

**Clean-up**

In the case that the residues of this cargo are to be washed out, the cargo spaces and the other structures and equipment which may have been in contact with this cargo or its dust shall be thoroughly swept prior to washing out. Particular attention shall be given to bilge wells and framework in the cargo spaces. After complying with the foregoing requirements, the cargo spaces shall be washed out and the water for washing out shall be pumped out in an appropriate manner, except in the case that the BCSN of the cargo to be loaded subsequent to discharge is FLY ASH, DRY.

## FLY ASH, WET

### Description

Greyish powder. This cargo is a mixture of the light, finely divided dusty fine powder residue from coal- and oil-fired power stations and water (not less than 10% of water). Ammonia odour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Under 1 mm            | Not applicable       | 900 to 1,300                      | 0.77 to 1.11                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

It is non-combustible or has a low fire risk.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

No special requirements.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

**Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

## FOAM GLASS GRAVEL

### Description

Foam glass gravel is a lightweight insulation product used in the construction/building industry. This cargo is odourless and of grey anthracite colour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Not applicable       | 130 to 250                        | 4.00 to 7.69                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Dust may cause skin and eye irritation.  
This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks as well as protective clothing, as necessary. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

Entry into the cargo spaces containing this cargo shall only be permitted for trained personnel wearing protective clothing and goggles or other equivalent dust eye-protection as well as dust filter masks.

### Clean-up

No special requirements.



## GLASS CULLET

### Description

Green, brown or uncoloured glass. May have a slight sweet smell. Used to make new glass, glass wool and foam glass. It may also be flint flat glass cullet which may have a grey or ochre appearance caused by adherent glass dust. May have a slight odour caused by organic impurities (plastics, foil). Used for glass production (bottle industry).

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 200 cm          | Not applicable       | 600 to 1,330                      | 0.75 to 1.67                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Potential inhalation hazard and skin and eye irritation from cullet dust during handling, placement and transportation.

Potential risk for cuts or punctures during handling and placement.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

To protect against possible cuts or penetration injuries as well as against exposure of glass dust to skin, ears and eyes, personnel working with glass cullet shall wear long sleeves, pants, gloves, work boots, hard hats, ear protection and eye protection. Shirt sleeves and pant legs can be taped for additional protection.

Personnel can also wear disposable nuisance dust masks to protect against dust inhalation.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

Avoid handling which creates dust. Wet suppression is an effective measure of dust control.

## GRAIN SCREENING PELLETS

The provisions of this schedule shall apply only to grain screening pellets material containing not more than 6.2% oil content and not more than 17.5% oil and moisture content combined.

### Description

Grain screening pellets are animal feed products, pelletized animal feed derived from dockage removed from grains. Screenings means dockage that has been removed from grain that does not qualify for any other grain grades. Depending upon their quality, screenings vary in level of parent and volunteer grain material, broken or shrunken kernels, hulls, weed seeds, chaff, dust and other plant material. The colour ranges from brown to yellow.

### Characteristics

| Physical properties                        |                      |                                   |                                    |
|--|----------------------|-----------------------------------|------------------------------------|
| Size                                       | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Length: 12 to 38 mm<br>Diameter: 4 to 7 mm | Less than 30°        | 478 to 719                        | 1.39 to 2.09                       |
| Hazard classification                      |                      |                                   |                                    |
| Class                                      | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable                             | Not applicable       | Not applicable                    | C                                  |

### Hazard

This cargo flows freely like grain.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which the cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

A certificate from a person recognized by the competent authority of the country of shipment shall be provided by the shipper to the master, prior to loading, confirming that the oil and the moisture contents as described in the schedule have been met.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear a dust filter masks, protective eyewear and protective clothing as necessary.

### Ventilation

No special requirements.

### Carriage

Hatches of the cargo spaces shall be weathertight to prevent water ingress.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## GRANULAR FERROUS SULPHATE

### Description

Grey to brown granules. Absorbs moisture and is highly soluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 15 mm           | 30° to 45°           | 1,100 to 1,600                    | 0.63 to 0.91                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Harmful if swallowed. Causes serious eye irritation. Causes skin irritation.

Tends to caking when damp.

It is highly soluble and will be acidic when wet.

Excessive levels spilt into water systems may result in oxygen depletion from the water.

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

### Stowage and segregation

"Separated from" oxidizing substances.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. It shall not be handled during precipitation.

During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Avoid contact with eyes and skin. Persons who may be in contact with the product shall wear protective clothing, gloves and eye-protection. Minimize dust generation when loading. If dust is generated a filter mask shall also be worn.

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

Hatches of the cargo spaces shall be weathertight to prevent water ingress.

### Discharge

If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

After discharge of this cargo, the cargo spaces and the bilge wells shall be swept clean and then thoroughly washed out.

## **GRANULATED NICKEL MATTE (less than 2% moisture content)**

### **Description**

Crude dark grey nickel product composed of about 55% nickel, 20% copper and 25% other mineral impurities. The material is odourless.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| Up to 3 mm                   | Not applicable              | 2,800 to 4,000                         | 0.25 to 0.36                            |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| Not applicable               | Not applicable              | TX and/or CR                           | B                                       |

### **Hazard**

Contact with the skin may give rise to irritation.

This cargo is moderately toxic by inhalation.

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

### **Stowage and segregation**

"Separated from" foodstuffs.

### **Hold cleanliness**

No special requirements.

### **Weather precautions**

No special requirements.

### **Loading**

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

### **Precautions**

Persons who may be exposed to the dust component of the cargo shall wear personal protective equipment including goggles or other equivalent dust eye-protection, respiratory protection and/or skin protection, as necessary. Due consideration shall be given to prevent dust entering living quarters and enclosed working area. Eating and drinking is prohibited in the cargo work areas. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo.

### **Ventilation**

No special requirements.

### **Carriage**

No special requirements.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (gloves, boots and coveralls).  
Self-contained breathing apparatus.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Nil (non-combustible).

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## GRANULATED SLAG

### Description

Residue from steelworks blast furnaces with a dirty grey, lumpy appearance. Iron: 0.5%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 5 mm            | Not applicable       | 1,111                             | 0.90                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards. Slag dust is fine and has abrasive characteristics.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

This cargo shall not be accepted for loading when the temperature of the cargo exceeds 50°C.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## GRANULATED TYRE RUBBER

### Description

Fragmented rubber tyre material cleaned and free from other materials.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Granular, up to 10 mm | Not applicable       | 555                               | 1.80                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

During handling and carriage, no hot work, burning and smoking shall be permitted in the vicinity of the cargo spaces containing this cargo. Prior to shipment, a certificate shall be given to the master by the shipper stating that this cargo consists of clean rubber material only. When the planned interval between the commencement of loading and the completion of discharge of this cargo exceeds 5 days, the cargo shall not be accepted for loading unless the cargo is to be carried in cargo spaces fitted with a fixed gas fire-extinguishing system. The Administration may, if it considers that the planned voyage does not exceed 5 days from the commencement of loading to the completion of discharge, exempt from the requirements of a fitted fixed gas fire-extinguishing system in the cargo spaces for the carriage of this cargo.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## GYPSUM

### Description

A natural hydrated calcium sulphate. Insoluble in water. It is loaded as a fine powder that aggregates into lumps. Gypsum is not water soluble. Average moisture content is 1% to 2%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 100 mm          | Not applicable       | 1,282 to 1,493                    | 0.67 to 0.78                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

Prior to washing out the residues of this cargo, the decks and the cargo spaces shall be shovelled and swept clean, because washing out of this cargo is difficult.



## GYPSUM GRANULATED

### Description

Gypsum granulated made from calcium sulphate hydrate which is produced artificially or industrial by-product. It is produced by granulating and processing such calcium sulphate hydrate until its grain size becomes 10 mm diameter or more. Insoluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Greater than 10 mm    | Not applicable       | 310 to 1,200                      | 0.83 to 3.23                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## ILMENITE CLAY

### Description

Very heavy black clay. Abrasive. May be dusty. Titanium, silicate and iron oxides are obtained from ilmenite clay. Moisture content: 10% to 20%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 0.15 mm         | Not applicable       | 2,000 to 2,500                    | 0.40 to 0.50                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## ILMENITE (ROCK)

### Description

Ilmenite (rock) is obtained from mine blasting followed by crushing. It has a black colour. It may be smelted in electric arc furnaces or can be used in blast furnaces.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 100 mm          | Not applicable       | 2,400 to 3,200                    | 0.31 to 0.42                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

This cargo has no special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

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

### Precautions

Avoid breathing dust. Persons who may be exposed to the dust of the cargo shall wear a dust filter masks, protective eyewear and clothing as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## ILMENITE SAND

### Description

Very heavy black sand. Abrasive. May be dusty. Titanium, monazite and zinc ore are obtained from ilmenite sand.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 0.15 mm         | Not applicable       | 2,380 to 3,225                    | 0.31 to 0.42                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## ILMENITE (UPGRADED)

### Description

Ilmenite (upgraded) is obtained from the smelting of rock or sand ilmenite into electric arc furnaces. Ilmenite (upgraded) has a granular form and its colour varies from black (normal grades) to brown-orange for its purified grade.

Ilmenite (upgraded) is also known as titanium slag, titanium ore concentrate, chloride slag, sulphate slag, high grade sulphate slag, slag fines, slag ilmenite electro thermal smelting or TiO<sub>2</sub> slag.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 12 mm           | Not applicable       | 1,860 to 2,400                    | 0.41 to 0.54                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This material may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and while on the voyage. When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. As the density of the cargo is extremely high, the tank top may be overstressed unless the

cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate to prevent ingress of the cargo. Avoid breathing dust. Persons who may be exposed to the dust component of the cargo shall wear personal protective equipment including goggles or other equivalent dust eye-protection and respiratory protection as necessary. Wash hands and face before eating, drinking or smoking.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.



## IRON AND STEEL SLAG AND ITS MIXTURE

This cargo may contain substances hazardous to human health such as cadmium, lead, hexavalent chromium, boron and fluorine. This individual schedule shall not apply to cargoes that meet the criteria specified in 9.2.2.5 and 9.2.3.6.

### Description

The main component of the cargo is a slag arising from iron and steel manufacture, and a slag mixed with one of the following additives or a combination thereof: cement, granulated blast furnace slag and concrete debris.

The cargo is mostly stabilized before transportation by ageing and slaking for the volume and/or chemical stability in practical usages, and physical properties such as the grain size, etc. are controlled for the performance requirement if necessary. The cargo is transported at room temperature.

This cargo does not include both slag residue and hot iron and steel slag discharged from iron and steelmaking processes.

The iron and steel slag is a vitrified or crystallized solid formed out of high temperature processes, and it is a mixture of several mineralogical phases.

This cargo may include shaped blocks made of iron and steel slag with a combination of cement and ground granulated blast furnace slag. The colour is in the range from greyish-white to dark grey, and the appearance is in the range from granulated, pebble to blocks. Examples of the application of this cargo are: road construction materials, concrete aggregate, soil improvement, civil engineering materials, raw materials of cement industry and raw materials for fertilizer.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 100 mm          | Not applicable       | 1,200 to 3,000                    | 0.33 to 0.83                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

This cargo is non-combustible and 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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### **Ventilation**

No special requirements.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the voyage, the master shall take appropriate actions to prevent cargo shifting and potential capsizing of the ship, and give consideration to seeking emergency entry into a place of refuge.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

## 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

| Physical properties   |                      |                                      |                                       |
|-----------------------|----------------------|--------------------------------------|---------------------------------------|
| Size                  | Angle of repose      | Bulk density<br>(kg/m <sup>3</sup> ) | Stowage factor<br>(m <sup>3</sup> /t) |
| Up to 250 mm          | Not applicable       | 1,250 to 3,500                       | 0.29 to 0.80                          |
| Hazard classification |                      |                                      |                                       |
| Class                 | Subsidiary hazard(s) | MHB                                  | Group                                 |
| Not applicable        | Not applicable       | Not applicable                       | C                                     |

### Hazard

No special hazards.

Iron ore cargoes 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

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the 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.

## 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

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 10% or more of fine particles less than 1 mm and 50% or more of particles less than 10 mm | Not applicable       | 1,500 to 3,000                    | 0.29 to 0.67                       |
| Hazard classification   |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the 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 the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## IRON ORE PELLETS

### Description

Pellets are approximately spherical lumps formed by crushing iron ore into a powder. This iron oxide is formed into pellets by using clay as a binder and then hardening by firing in kilns at 1,315°C. Moisture content: 0% to 2%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 20 mm           | Not applicable       | 1,900 to 2,400                    | 0.45 to 0.52                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Bilge wells shall be clean, dry and covered 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.

**IRON OXIDE, SPENT or  
IRON SPONGE, SPENT UN 1376  
obtained from coal gas purification**

**Description**

Powdery material, black, brown, red or yellow. Strong odour may taint other cargo.

**Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Up to 20 mm                  | Not applicable              | 2,222                                      | 0.45  |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| 4.2                          | Not applicable              |  | B   |

**Hazard**

Liable to heat and ignite spontaneously, especially if contaminated with oil or moisture. Toxic gases: hydrogen sulphide, sulphur dioxide and hydrogen cyanide may be produced. Dust may cause an explosion hazard. Liable to reduce the oxygen in the cargo space.

**Stowage and segregation**

"Separated from" foodstuffs.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Prior to loading, the shipper or the manufacturer shall provide the master with a certificate stating that the cargo has been cooled and then weathered for not less than 8 weeks prior to shipment.

**Ventilation**

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.



**Carriage**

For quantitative measurements of oxygen and hydrogen cyanide, suitable detectors for each gas or combination of gases shall be on board while this cargo is carried. The detectors shall be suitable for use in an atmosphere without oxygen and of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.<br/>Spray nozzles.</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if available.<br/>Exclusion of air may be sufficient to control fire.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## IRON OXIDE TECHNICAL

### Description

Iron oxide technical is generated as a product or by-product in the manufacture of di-iron trioxide (iron (III) oxide) for industrial and commercial use. The material is odourless and red in colour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine particles        | Not applicable       | 1,000                             | 1.00                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

Dust may cause skin and eye irritation. Iron cargoes may affect magnetic compasses. This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. 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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

After discharge of this cargo, the bilge wells and the scuppers of the cargo spaces shall be checked and any blockage in the bilge wells and the scuppers shall be removed.

## IRON SINTER

### Description

The thermally agglomerated substance formed by heating a variable mixture of finely divided coke, iron ore, blast furnace dust, steelmaking dust, mill scale, other miscellaneous iron-bearing materials, limestone and dolomite at 1,315°C to 1,482°C.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 200 mm          | Not applicable       | 1,800 to 2,100                    | 0.47 to 0.56                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Dust of this cargo is fine and may be irritating to eye and respiratory tract. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Bilge wells of the cargo space shall be protected from ingress of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

Bilge shall be sounded and pumped out as necessary during the voyage.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## IRON SMELTING BY-PRODUCTS

### Description

This cargo is a by-product from the smelting of iron ore, ilmenite and titanomagnetite. Grey or black, small to large size lumps (up to 45 tonnes), granulated iron included. Depending on the dominant size, Iron by-products from smelting of iron ore, ilmenite and titanomagnetite is called variously:

|                           |                            |
|---------------------------|----------------------------|
| <b>Iron pan edges</b>     | <b>K1-K3 bears</b>         |
| <b>Separation of iron</b> | <b>Steel bears</b>         |
| <b>Granulated iron</b>    | <b>Pig iron by-product</b> |
| <b>Plate iron</b>         | <b>Beach iron</b>          |
| <b>Pool iron</b>          | <b>Iron skulls</b>         |
| <b>Flat iron</b>          |                            |

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Not applicable       | Various                           | Various                            |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

The tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo. Large pieces shall not be dropped in the cargo hold and placement of very large lumps shall be such that the tank top is not overstressed by point loads. The weight distribution in the hold shall be considered during loading.

### Precautions

Bilge wells of the cargo spaces shall be protected from ingress of the cargo.

### Ventilation

No special requirements.

**Carriage**

No special requirements.

**Discharge**

When this cargo is discharged by magnet or spider grab:

- .1 the deck and deck machineries shall be protected from falling cargo; and
- .2 damages to the ship shall be checked, after the completion of discharge.

**Clean-up**

No special requirements.

## IRONSTONE

### Description

Ore. Moisture: 1% to 2%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 75 mm                 | Not applicable       | 2,564                             | 0.39                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with relevant provisions required under sections 4 and 5 of this Code. If doubt exists, trim reasonably level to the boundaries of the cargo space so as to minimize the risk of shifting and to ensure that adequate stability will be maintained during the voyage.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## LABRADORITE

### Description

A lime-soda rock form of felspar. May give off dust.

### Characteristics

| Physical properties       |                      |                                   |                                    |
|---------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Lumps:<br>50 mm to 300 mm | Not applicable       | 1,667                             | 0.60                               |
| Hazard classification     |                      |                                   |                                    |
| Class                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable            | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## LEAD NITRATE UN 1469

### Description

White crystals. Soluble in water. Derived from the action of nitrate acid on lead.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | 6.1                  |                                   | B                                  |

### Hazard

Toxic if swallowed or dust inhaled.

Not combustible by itself, but mixtures with combustible materials are easily ignited and burn fiercely.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### Ventilation

Natural surface ventilation shall be conducted during the voyage, as necessary, for the cargo spaces carrying this cargo.

### Carriage

No special requirements.

### Discharge

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (gloves, coveralls and headgear).

Self-contained breathing apparatus.

Spray nozzles.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Use copious quantities of water, which is best applied in the form of a spray to avoid disturbing the surface of the material. The material may fuse or melt, in which condition application of water may result in extensive scattering of the molten materials. Exclusion of air or the use of CO<sub>2</sub> will not control the fire. Due consideration should be given to the effect on the stability of the ship due to accumulated water.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## LEAD ORE

### Description

Heavy soft grey solid material.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powder                | Not applicable       | 1,493 to 4,167                    | 0.24 to 0.67                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Toxic, with acids evolves highly toxic vapour.  
This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

"Separated from" all class 8 liquids.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## LIME (UNSLAKED)

### Description

White or greyish-white in colour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Lump                  | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | SH and/or CR                      | B                                  |

### Hazard

Unslaked lime combines with water to form calcium hydroxide (hydrated lime) or magnesium hydroxide. This reaction develops a great deal of heat which may be sufficient to cause ignition of nearby combustible materials.

Corrosive to eyes and mucous membranes.

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

### Stowage and segregation

"Separated from" all packaged dangerous goods and solid bulk cargoes in group B.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

This cargo shall be kept as dry as practicable. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

Do not discharge during precipitation.

### Clean-up

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Nil

**Emergency procedures**

Nil

**Emergency action in the event of fire**

Nil (non-combustible).

**Do not use water.**

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## LIMESTONE

### Description

Limestone varies in colour from cream through white to medium dark grey (when freshly broken).

Moisture: up to 4%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines up to 90 mm     | Not applicable       | 1,190 to 1,493                    | 0.67 to 0.84                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered 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.

## **LINTED COTTON SEED**

**with not more than 9% moisture and not more than 20.5% oil**

### **Description**

Cotton seed with short cotton fibres adhering to the kernel after approximately 90%-98% of the cotton has been removed by machine.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| -                            | Not applicable              | 490  | 2.02  |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| Not applicable               | Not applicable              | SH   | B   |

### **Hazard**

May self-heat and deplete oxygen in cargo space.

### **Stowage and segregation**

No special requirements.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### **Precautions**

Entry into the cargo space for this cargo shall not be permitted until the cargo space has been ventilated and the atmosphere tested for concentration of oxygen.

### **Ventilation**

No special requirements.

### **Carriage**

Hatches shall be weathertight to prevent the ingress of water.

### **Discharge**

If this cargo has hardened, it shall be trimmed to avoid the formation of overhanging faces, as necessary.

### **Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Self-contained breathing apparatus.

**Emergency procedures**

Wear self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.



## MAGNESIA (DEADBURNED)

### Description

Manufactured in briquette form and is usually white, brown or grey. It is very similar in size, appearance and handling to gravel and is dry and dusty. Deadburned magnesia is natural magnesite calcined at very high temperatures, which results in a non-reactive magnesium oxide, which does not hydrate or produce spontaneous heat.

### Characteristics

| Physical properties       |                      |                                   |                                    |
|---------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines up to approx. 30 mm | Not applicable       | 2,000                             | 0.50                               |
| Hazard classification     |                      |                                   |                                    |
| Class                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable            | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Prior to loading, the shipper or the manufacturer shall provide the master with a declaration stating that the cargo has been sufficiently heat-treated and is ready for loading.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## MAGNESIA (UNSLAKED)

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines up to 90 mm     | Not applicable       | 1,250                             | 0.80                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | SH and/or CR                      | B                                  |

### Hazard

Combines with water to form magnesium hydroxide with an expansion in volume and a release of heat. May ignite materials with low ignition temperatures. Similar to LIME (UNSLAKED) but is less reactive. Corrosive to eyes and mucous membranes.

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

### Stowage and segregation

"Separated from" all packaged dangerous goods and solid bulk cargoes in group B.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

Do not discharge during precipitation.

### Clean-up

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Nil

**Emergency procedures**

Nil

**Emergency action in the event of fire**

Nil (non-combustible).

**Do not use water.**

**Medical first aid**

Refer to the *Medical First Aid Guide (MFAG)*, as amended.

## MAGNESITE, natural

### Description

Magnesite is white to yellow in colour.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 3 mm to 30 mm         | Not applicable       | 1,429                             | 0.70                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## MAGNESIUM NITRATE UN 1474

### Description

White crystals, soluble in water. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | Not applicable       |                                   | B                                  |

### Hazard

Although non-combustible by itself, mixtures with combustible material are easily ignited and may burn fiercely.

This cargo is hygroscopic and will cake if wet.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

Magnesium nitrate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.<br/>Spray nozzles.</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Use copious quantities of water, which is best applied in the form of a spray to avoid disturbing the surface of the material. The material may fuse or melt, in which condition application of water may result in extensive scattering of the molten materials. Exclusion of air or the use of CO<sub>2</sub> will not control the fire. Due consideration should be given to the effect on the stability of the ship due to the accumulated water.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

**Remarks**

Material is non-combustible unless contaminated.

## MAGNESIUM SULPHATE FERTILIZERS

### Description

Powdered fertilizers or fertilizer components containing magnesium sulphate.  
Grey to brown powder. Partially soluble in water and may be dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powder                | 30° to 35°           | 850 to 1,150                      | 0.87 to 1.18                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

May be harmful if swallowed. May cause skin or eye irritation.  
It is partially soluble.  
Dusty but may cake if wetted.  
This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. It shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Avoid contact with eyes and skin. Minimize dust generation when loading. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

Hatches of the cargo spaces shall be weathertight to prevent water ingress.

### Discharge

If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

After discharge of this cargo, the cargo spaces and the bilge wells shall be swept clean and then thoroughly washed out.

## MANGANESE COMPONENT FERROALLOY SLAG

### Description

By-product generated in process of manufacturing manganese component ferroalloy. Particles or lumps of green, brownish-red or greyish-black. Moisture: 1.2% to 5.6%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 200 mm          | Not applicable       | 1,480 to 1,935                    | 0.52 to 0.68                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## MANGANESE ORE

### Description

Manganese ore is black to brownish black in colour. It is a very heavy cargo.

Moisture content: up to 15%.

### Characteristics

| Physical properties    |                      |                                   |                                    |
|------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                   | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine dust up to 250 mm | Not applicable       | 1,429 to 3,125                    | Fines to 0.32<br>Lumps to 0.70     |
| Hazard classification  |                      |                                   |                                    |
| Class                  | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable         | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## MANGANESE ORE FINES

The provisions of this schedule shall apply to manganese 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 provisions, manganese ore cargoes which do not exhibit a flow moisture point (FMP) are not liable to liquefy and shall be shipped as a group C cargo under the provisions of the MANGANESE ORE individual schedule.

This schedule applies to manganese ore cargoes which may liquefy. For manganese ore cargoes not liable to liquefy see the MANGANESE ORE schedule.

### Description

Manganese ore fines is multicoloured and usually brown to black. Its colour and texture may vary due to variations of the manganese and gangue minerals present. It is a very heavy cargo with typical moisture content up to 15% by weight.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Typically up to 15 mm with more than 10% finer than 1 mm and more than 50% finer than 10 mm | Not applicable       | 1,450 to 3,200                    | 0.31 to 0.69                       |
| Hazard classification   |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

The dust of this cargo is irritating to the eyes and mucous membranes.

It is stable and non-reactive under normal conditions of use, storage and transport. However, this cargo may ignite in contact with incompatible materials such as acids, alkalis, oxidizing and reducing agents. It may decompose to form toxic manganese oxide particles when heated to decomposition.

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

### Stowage and segregation

Separated from acids, alkalis, oxidizing and reducing agents.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo.

### **Ventilation**

No special requirements.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the voyage, the master shall take appropriate actions to prevent cargo shifting and potential capsizing of the ship, and give consideration to seeking emergency entry into a place of refuge.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

## MARBLE CHIPS

### Description

Dry, dusty, white to grey lumps, particles and powder mixed with a small amount of gravel and pebbles.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 654                               | 1.53                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## MATTE CONTAINING COPPER AND LEAD

### Description

Brown to black material in the form of coarse lumps or chunks formed during the smelting of primary and secondary lead containing materials and composed mainly of sulphides of lead, copper and iron. The material is used in the production of copper and/or lead metal and precious metals.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 500 mm          | Not applicable       | 3,180 to 4,960                    | 0.20 to 0.31                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
|                       | Not applicable       | TX and/or CR                      | B                                  |

### Hazard

May have acute inhalation toxicity. May cause long-term health effects. Corrosive to eyes and irritating to skin.

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

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of this cargo.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear personal protective equipment including goggles or other equivalent dust eye-protection, respiratory protection and/or skin protection as necessary. Due consideration shall be given to prevent dust entering living quarters and enclosed working area. Eating and drinking shall be prohibited in the cargo work areas.

### Ventilation

No special requirements.

### Carriage

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (goggles, gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed firefighting installation, if fitted.  
Use water spray to control spread of dust, if necessary.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## METAL SULPHIDE CONCENTRATES

(see also Mineral concentrates schedule)

### Description

Mineral concentrates are refined ores in which the valuable components have been enriched by eliminating the bulk of waste materials. Generally the particle size is small although agglomerates sometimes exist in concentrates which have not been freshly produced.

The most common concentrates in this category are: zinc concentrates, lead concentrates, copper concentrates and low-grade middling concentrates.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Not applicable       | 1,790 to 3,230                    | 0.31 to 0.56                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | SH and/or TX and/or CR            | A and B                            |

### Hazard

Some metal sulphide concentrates may have acute and long term health effects.

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

Some sulphide concentrates are liable to oxidation and may have a tendency to self-heat, with associated oxygen depletion and emission of toxic fumes. Some materials may present corrosion problems.

### Stowage and segregation

Unless determined by the competent authority, segregation as required for class 4.2 materials. "Separated from" foodstuffs and all class 8 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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**

This cargo shall be trimmed to ensure that the height difference between peaks and troughs does not exceed 5% of the ship's breadth and that the cargo slopes uniformly from the hatch boundaries to the bulkheads to avoid steep surfaces of cargo that could collapse during voyage.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Entry into the cargo space for this cargo shall not be permitted until the cargo space has been ventilated and the atmosphere tested for concentration of oxygen. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

When a metal sulphide concentrate is considered as presenting a low fire risk, the carriage of such cargo on a ship not fitted with a fixed gas fire-extinguishing system shall be subject to the Administration's authorization as provided by SOLAS regulation II-2/10.7.1.4.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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. For quantitative measurements of oxygen and toxic fumes liable to be evolved by the cargo, suitable detectors for each gas and fume or combination of these shall be on board while this cargo is carried. The detectors shall be suitable for use in an atmosphere without oxygen. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.



**Emergency procedures**

**Special emergency equipment to be carried**

Self-contained breathing apparatus.

**Emergency procedures**

Wear self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation.  
Exclusion of air may be sufficient to control the fire. **Do not use water.**

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

**Remarks**

Fire may be indicated by the smell of sulphur dioxide.

## **METAL SULPHIDE CONCENTRATES, CORROSIVE UN 1759**

*(see also Mineral concentrates schedule)*

This schedule shall only apply to cargoes that would fall under Packing Group (PG) III as specified in the IMDG Code if they were carried in a packaged form.

### **Description**

Mineral concentrates are refined ores in which the valuable components have been enriched by eliminating the bulk of waste materials. Generally, the particle size is small, although agglomerates sometimes exist in concentrates which have not been freshly produced.

The most common concentrates in this category are: zinc concentrates, lead concentrates, copper concentrates and low grade middling concentrates.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| Various                      | Not applicable              | 1,700 to 3,230                         | 0.31 to 0.59                            |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| 8                            | Not applicable              | SH and/or WT                           | A and B                                 |

### **Hazard**

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

Some sulphide concentrates are liable to oxidation and may have a tendency to self-heat, with associated oxygen depletion and emission of toxic fumes. Moisture in the cargo will form sulphurous acid which is corrosive to steel. Some metal sulphide concentrates may have acute and long term health effects.

### **Stowage and segregation**

Unless determined by the competent authority, segregation as required for class 4.2 and class 8 materials.

"Separated from" foodstuffs.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo forming.

### **Precautions**

Entry into the cargo space for this cargo shall not be permitted until the space has been ventilated and the atmosphere tested for concentration of oxygen. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of this cargo. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working. Persons who may be exposed to the dust of the cargo shall wear gloves, goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

When a metal sulphide concentrate is considered as presenting a low fire risk, the carriage of such cargo on a ship not fitted with a fixed gas fire-extinguishing system shall be subject to the Administration's authorization as provided by SOLAS regulation II-2/10.7.1.4.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

For quantitative measurements of oxygen and toxic fumes liable to be evolved by the cargo, suitable detectors for each gas and fume or combination of these shall be on board while this cargo is carried. The detectors shall be suitable for use in an atmosphere without oxygen.

The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly during the voyage, and the results of the measurements shall be recorded and kept on board.

### **Discharge**

No special requirements.

### **Clean-up**

After discharge of this cargo, the cargo spaces shall be thoroughly washed out and dried. Wet dust or residues will form corrosive sulphurous acid, which is dangerous to personnel and will corrode steel.

## Emergency procedures

### Special emergency equipment to be carried

Protective clothing (gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.

### Emergency procedures

Wear protective clothing and self-contained breathing apparatus.

### Emergency action in the event of fire

Batten down; use ship's fixed fire-fighting installation, if fitted.  
Exclusion of air may be sufficient to control the fire. **Do not use water.**

### Medical first aid

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## Remarks

Fire may be indicated by the smell of sulphur dioxide.

## METAL SULPHIDE CONCENTRATES, SELF-HEATING UN 3190

(see also Mineral concentrates schedule)

This schedule shall only apply to cargoes that would fall under Packing Group (PG) III as specified in the IMDG Code if they were carried in a packaged form. This includes cargoes in PG III that may be exempted in packages of less than 450 L or 3 m<sup>3</sup>.

### Description

Mineral concentrates are refined ores in which the valuable components have been enriched by eliminating the bulk of waste materials. Generally, the particle size is small, although agglomerates sometimes exist in concentrates which have not been freshly produced.

The most common concentrates in this category are: zinc concentrates, lead concentrates, copper concentrates and low grade middling concentrates.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Not applicable       | 1,700 to 3,230                    | 0.31 to 0.59                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.2                   | Not applicable       | WT and/or TX and/or CR            | A and B                            |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

These sulphide concentrates are liable to oxidation and will self-heat, with associated oxygen depletion and emission of toxic fumes. Some materials may present corrosion problems.

Some metal sulphide concentrates may have acute and long term health effects.

### Stowage and segregation

"Separated from" foodstuffs and class 8 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When this cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo forming.

### **Precautions**

The temperature of this cargo shall be measured prior to and during loading. The temperature of the cargo in the stockyard shall be measured at points between 200 mm and 350 mm from the surface of the stockpile. The cargo shall only be accepted for loading when the temperature of the cargo prior to loading does not exceed 55°C.

Means shall be provided for measuring the temperature of the cargo in the range 0°C to 100°C to enable the measurement of temperature of the cargo while being loaded and during voyage without requiring entry into the cargo space.

Entry into the cargo space for this cargo shall not be permitted until the space has been ventilated and the atmosphere tested for concentration of oxygen. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of this cargo. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working. Persons who may be exposed to the dust of the cargo shall wear gloves, goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during the voyage.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

For quantitative measurements of oxygen and toxic fumes liable to be evolved by the cargo, suitable detectors for each gas and fume or combination of these shall be on board while this cargo is carried. The detectors shall be suitable for use in an atmosphere without oxygen.

The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly during voyage, and the results of the measurements shall be recorded and kept on board.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

### Emergency procedures

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.  
Exclusion of air may be sufficient to control the fire. **Do not use water.**

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

### Remarks

Fire may be indicated by the smell of sulphur dioxide.

**Mineral concentrates**

(see Bulk Cargo Shipping Names below)

|   |   |   |
|---|---|---|
| <b>CEMENT COPPER<br/>COPPER CONCENTRATE<br/>IRON CONCENTRATE<br/>IRON CONCENTRATE<br/>(pellet feed)<br/>IRON CONCENTRATE<br/>(sinter feed)<br/>LEAD AND ZINC CALCINES<br/>(mixed)<br/>LEAD AND ZINC MIDDINGS<br/>LEAD CONCENTRATE</b> | <b>LEAD ORE RESIDUE<br/>LEAD SILVER<br/>CONCENTRATE<br/>MANGANESE<br/>CONCENTRATE<br/>NEFELENE SYENITE<br/>(mineral)<br/>NICKEL CONCENTRATE<br/>PENTAHYDRATE CRUDE<br/>PYRITES<br/>PYRITIC ASHES (iron)</b> | <b>PYRITIC CINDERS<br/>SILVER LEAD<br/>CONCENTRATE<br/>SLIG (iron ore)<br/>ZINC AND LEAD<br/>CALCINES (mixed)<br/>ZINC AND LEAD<br/>MIDDINGS<br/>ZINC CONCENTRATE<br/>ZINC SINTER<br/>ZINC SLUDGE</b> |
|---|---|---|

See also the entries for metal sulphide concentrates.

**Description**

Mineral concentrates are refined ores in which valuable components have been enriched by eliminating the bulk of waste materials.

**Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Various                      | Not applicable              | 1,754 to 3,030                             | 0.33 to 0.57                                |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| Not applicable               | Not applicable              | Not applicable                             | A   |

**Hazard**

The above materials may liquefy if shipped at a moisture content in excess of their transportable moisture limit (TML). See sections 7 and 8 of this Code.

These cargoes will decompose burlap or canvas cloth covering bilge wells. Continuous carriage of these cargoes may have detrimental structural effects over a long period of time. These cargoes are non-combustible or have low fire risks.

**Stowage and segregation**

No special requirements.

**Hold cleanliness**

No special requirements.

**Weather precautions**

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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**

This cargo shall be trimmed to ensure that the height difference between peaks and troughs does not exceed 5% of the ship's breadth and that the cargo slopes uniformly from the hatch boundaries to the bulkheads to avoid steep surfaces of cargo that could collapse during voyage.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## MONOAMMONIUM PHOSPHATE (M.A.P.)

### Description

M.A.P. is odourless and comes in the form of brownish-grey granules. It can be very dusty. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | 35° to 40°           | 826 to 1,000                      | 1.00 to 1.21                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Bulk M.A.P. has a pH of 4.5 and in the presence of moisture content can be highly corrosive. This cargo is hygroscopic and will cake if wet.

This cargo will decompose burlap or canvas cloth covering bilge wells. Continuous carriage of this cargo may have detrimental structural effects over a long period of time.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

Condensation in the cargo spaces carrying this cargo, sweating of this cargo and entering of water from hatch covers to the cargo spaces shall be checked regularly during the voyage. Due attention shall be given to the sealing of hatches of the cargo spaces.

**Discharge**

Monoammonium phosphate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

**Clean-up**

After discharge of this cargo, particular attention shall be given to bilge wells of the cargo spaces.

## MONOAMMONIUM PHOSPHATE (M.A.P.), MINERAL ENRICHED COATING

### Description

This cargo is monoammonium phosphate (M.A.P.) with a mineral enriched coating. Odourless, brownish-grey granules. It is hygroscopic and can be very dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 4 mm            | 35° to 40°           | 826 to 1,000                      | 1.00 to 1.21                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CR                                | B                                  |

### Hazard

This cargo has a pH of 4.5 and in the presence of moisture can be highly corrosive to eyes and skin.

This cargo will cake if wet.

This cargo will decompose burlap or canvas cloth covering bilge wells. Continuous carriage of this cargo may have detrimental structural effects over a long period of time.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear gloves, goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

Condensation in the cargo spaces carrying this cargo, sweating of this cargo and entering of water from hatch covers to the cargo spaces shall be checked regularly during the voyage. Due attention shall be given to the sealing of hatches of the cargo spaces.

**Discharge**

This cargo is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

**Clean-up**

After discharge of this cargo, particular attention shall be given to bilge wells of the cargo spaces.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## MONOCALCIUMPHOSPHATE (MCP)

### Description

The product consists of monocalciumphosphate, monohydrate. Granulated. Light grey. Odourless.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 0.2 mm to 2 mm        | Approximately 32°    | 900 to 1,100                      | 0.91 to 1.11                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CR                                | A and B                            |

### Hazard

Potential inhalation hazard and eye irritation from monocalciumphosphate dust during handling, placement and transportation.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, gloves, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

Avoid handling which creates dust.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.<br/>Exclusion of air may be sufficient to control the fire.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## NICKEL ORE

### Description

Nickel ore varies in colour. There are several types of ore of variable particle size and moisture content. Some may contain clay-like ores. For concentrates, see NICKEL CONCENTRATE.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Not applicable       | 1,400 to 1,800                    | 0.55 to 0.71                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This material may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Cargo spaces must be clean and dry.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.



**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure that it is working.

**Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## OLIVINE GRANULAR AND GRAVEL AGGREGATE PRODUCTS

This schedule shall only apply to cargoes containing less than 5% of fine particles less than 0.5 mm.

### Description

Olivine granular and gravel aggregate products are naturally occurring minerals and the colour can be pale greenish-grey to brownish.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 100 mm          | 30° to 45°           | 1,600 to 1,900                    | 0.53 to 0.63                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage & segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## OLIVINE SAND

### Description

Olivine sand is a naturally occurring mineral and the colour can be pale greenish-grey to brownish.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 20 mm           | 30° to 45°           | 1,600 to 1,900                    | 0.53 to 0.63                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage & segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

No special requirements.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## PEANUTS (in shell)

### Description

An edible, tan-coloured nut. Variable moisture content. Extremely dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 304                               | 3.29                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

May heat spontaneously.

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

### Stowage and segregation

"Away from" sources of heat.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## PEAT MOSS

### Description

Surface mined from mires, bogs, fens, muskeg and swamps. Types include moss peat, sedge peat and grass peat. Physical properties depend on organic matter, water and air content, botanical decomposition and degree of decomposition.

May range from a highly fibrous cohesive mass of plant remains which, when squeezed in its natural state, exudes clear to slightly coloured water, to a well decomposed, largely amorphous material with little or no separation of liquid from solids when squeezed.

Typically air-dried peat has low density, high compressibility and high water content; in its natural state it can hold 90 percent or more of water by weight when saturated.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine powder           | Not applicable       | 80 to 500                         | 2.00 to 12.50                      |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CR                                | A and B                            |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

Oxygen depletion and an increase in carbon dioxide in cargo and adjacent spaces.

Risk of dust explosion when loading. Caution should be exercised when walking or landing heavy machinery on the surface of uncompressed peat moss.

Dust may cause eye, nose and respiratory irritation.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

Prior to loading, this cargo shall be stockpiled under cover to effect drainage for reduction of moisture content. This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

Peat moss having a moisture content of more than 80% by weight shall only be carried on a ship complying with the requirements in 7.3.2 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

All personnel of the ship carrying this cargo and all personnel involved in handling of this cargo shall be cautioned that washing hands before eating or smoking and prompt treatment of cuts

and scrapes are necessary in case of contact with this cargo or its dust. Entry of personnel into cargo spaces shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level.

**Ventilation**

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.<br/>Exclusion of air may be sufficient to control the fire.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## PEBBLES (sea)

### Description

Round pebbles. Rolls very easily.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 30 mm to 110 mm       | Not applicable       | 1,695                             | 0.59                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

This cargo shall be loaded carefully to prevent damage to the tank top.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## PELLETS (concentrates)

### Description

Concentrate ore which has been pelletized. Moisture up to 6%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 10 mm approximately   | Not applicable       | 2,128                             | 0.47                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## PERLITE ROCK

### Description

Clay-like and dusty. Light grey. Odourless. Moisture: 0.5% to 1%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 943 to 1,020                      | 0.98 to 1.06                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## PETROLEUM COKE (calcined or uncalcined)

### Description

Black, finely divided residue from petroleum refining in the form of powder and small pieces. The provisions of this schedule should not apply to materials having a temperature below 55°C when loaded.

### Characteristics

| Physical properties    |                      |                                   |                                    |
|------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                   | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powder to small pieces | Not applicable       | 599 to 800                        | 1.25 to 1.67                       |
| Hazard classification  |                      |                                   |                                    |
| Class                  | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable         | Not applicable       | SH                                | B                                  |

### Hazard

Uncalcined petroleum coke is liable to heat and ignite spontaneously when not loaded and transported under the provisions of this entry.

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

### Stowage and segregation

"Separated from" foodstuffs.

"Separated longitudinally by an intervening complete compartment or hold from" all goods of class 1, divisions 1.1 and 1.5.

"Separated by a complete compartment or hold from" all other hazardous materials and dangerous goods (goods in packaged form and solid bulk materials).

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

No special requirements.

### Loading

- 1 When the cargo is loaded in a cargo space over a tank containing fuel or other material having a flashpoint under 93°C, the cargo having a temperature of 55°C or higher shall not be loaded in the cargo space, unless part of the cargo having a temperature 44°C or lower is loaded in a layer of at least 0.6 m thickness throughout the cargo space prior to loading the cargo having a temperature of 55°C or higher.
- 2 When the cargo having a temperature of 55°C or higher is loaded in accordance with the above requirement and the thickness of the layer of the cargo to be loaded is bigger than 1.0 m, the cargo shall first be loaded within a layer, the thickness of which is between 0.6 m and 1.0 m.
- 3 After the completion of loading operation specified in the above paragraphs, the loading operation may proceed.

The cargo shall be trimmed in accordance with the cargo information required by section 4 of this Code.

**Precautions**

This cargo shall not be loaded when the temperature of this cargo exceeds 107°C. The master shall post warnings about the high temperature of this cargo near the cargo spaces.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.<br/>Spray nozzles.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use of ship's fixed fire-fighting installation, if available.<br/>Exclusion of air may be sufficient to control fire.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## PHOSPHATE (defluorinated)

### Description

Granular, similar to fine sand. Shipped dry. Dark grey. No moisture content.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 893                               | 1.12                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## PHOSPHATE ROCK (calcined)

### Description

Usually in the form of fine ground rock or prills. Extremely dusty. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 794 to 1,563                      | 0.64 to 1.26                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage.

This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

Phosphate rock (calcined) is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.

## PHOSPHATE ROCK (uncalcined)

### Description

Phosphate rock is an ore in which phosphorus and oxygen are chemically united. Depending on the source, it is tan to dark grey, dry and dusty. Moisture: 0% to 2%. Depending on its source this cargo may have flow characteristic, but once settled it is not liable to shift.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powder to lumps       | Not applicable       | 1,250 to 1,429                    | 0.70 to 0.80                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## PIG IRON

### Description

Foundry pig iron is cast in 28 grades into 20 kg pigs. In a random heap, pig iron occupies approximately 50% of the apparent volume.

### Characteristics

| Physical properties       |                      |                                   |                                    |
|---------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 550 mm x 90 mm<br>x 80 mm | Not applicable       | 3,333 to 3,571                    | 0.28 to 0.30                       |
| Hazard classification     |                      |                                   |                                    |
| Class                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable            | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

This cargo is usually loaded using tubs. In such case, tubs are usually lowered by a crane into the hold and the contents are spilled out. When this cargo is loaded using tubs, the first few tubs shall be lowered onto the tank top to avoid damage.

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

Prior to washing out the residues of this cargo, the bilge wells of the cargo spaces shall be cleaned.



## PITCH PRILL

(see appendix to this schedule)

### Description

Pitch prill is made from tar produced during the coking of coal. It is black with a distinctive odour. It is extruded into its characteristic pencil shape to make handling easier. Cargo softens between 40°C to 50°C. Melting point: 105°C to 107°C.

### Characteristics

| Physical properties               |                      |                                   |                                    |
|-----------------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                              | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 9 mm diameter and up to 7 mm long | Not applicable       | 500 to 800                        | 1.25 to 2.00                       |
| Hazard classification             |                      |                                   |                                    |
| Class                             | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable                    | Not applicable       | CB and/or CR                      | B                                  |

### Hazard

Melts when heated. Combustible, burns with a dense black smoke. Dust may cause skin and eye irritation. Normally this cargo has a low fire risk. However powder of the cargo is easy to ignite and may cause fire and explosion. Special care should be taken for preventing fire during loading or discharging.

### Stowage and segregation

Segregation as required for class 4.1 materials.

### Hold cleanliness

No special requirements.

### Weather precautions

Refer to the appendix to this schedule.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

This cargo shall not be stowed in a cargo space adjacent to heated tanks to avoid softening and melting of the cargo.

### Precautions

Refer to the appendix to this schedule.

### Ventilation

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

### Carriage

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed. Condensation in the cargo spaces carrying this cargo shall be checked regularly during voyage.

### Discharge

Adequate measures shall be taken to prevent dust generation.

### Clean-up

No special requirements.

## Emergency procedures

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, overalls and headgear).<br/>Self-contained breathing apparatus, spray nozzles.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if available.<br/>Exclusion of air may be sufficient to control fire.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## APPENDIX

### PITCH PRILL

#### General precautions

- 1 Personnel engaged in loading shall be supplied with gloves, dust masks, approved protective clothing and goggles.
- 2 Eyewashes and sunscreen creams shall be readily available.
- 3 Number of personnel in area of loading shall be kept to a minimum. Personnel in area of loading shall be aware of all the hazards involved.
- 4 Personnel engaged in the handling of this cargo shall wash well and keep out of the sun for a few days, after the cargo handling.
- 5 The hatch shall be closed after loading or discharge has ceased and the ship shall be washed out to remove all dust.
- 6 Due consideration shall be given to suspending cargo handling when wind is blowing dust.
- 7 After completion of discharging this cargo, the deck shall be cleaned up to remove all spillages.
- 8 Ventilation of the accommodation spaces shall be closed and the air conditioning systems for the accommodation spaces shall be on recycle mode when this cargo is being handled – either loading or discharging.
- 9 The cargo dust is easily ignited and may cause fire and explosion. Special care shall be taken to prevent fire during loading and discharging the cargo.

## POTASH

### Description

Brown, pink or white in colour, potash is produced in granular crystals. It is odourless and hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powder up to 4 mm     | 32° to 35°           | 971 to 1,299                      | 0.77 to 1.03                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage.

This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed to prevent water ingress, as necessary.

### Discharge

Potash is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

This cargo is mildly corrosive. After discharge of this cargo, the cargo spaces and the bilge wells shall be thoroughly swept clean and washed out to remove all traces of the cargo, except in the case that the cargo to be loaded subsequent to discharge is POTASH.

## POTASSIUM CHLORIDE

### Description

Brown, pink or white in colour, powder. Potassium chloride is produced in granular crystals. It is odourless and is soluble in water. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 4 mm            | 30° to 47°           | 893 to 1,235                      | 0.81 to 1.12                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Even though this cargo is classified as non-hazardous, it may cause heavy corrosion when wet.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed to prevent water ingress.

### Discharge

Potassium chloride is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

After discharge of this cargo, the cargo spaces and the bilge wells shall be swept clean and thoroughly washed out.

## POTASSIUM NITRATE UN 1486

### Description

Transparent, colourless or white crystalline powder or crystals. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Crystals or powder    | 30° to 31°           | 1,136                             | 0.88                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | Not applicable       |                                   | B                                  |

### Hazard

Oxidizes when wet. Mixtures with combustible materials are readily ignited and may burn fiercely.

This cargo is hygroscopic and will cake if wet.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Due consideration shall be given to prevent contact of the cargo and combustible materials. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

Potassium nitrate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.

### Emergency procedures

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.  
Spray nozzles.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Use copious quantities of water, which is best applied in the form of a spray to avoid disturbing the surface of the material.

The material may fuse or melt, in which condition application of water may result in extensive scattering of the molten materials.

Exclusion of air or the use of CO<sub>2</sub> will not control the fire.

Due consideration should be given to the effect on the stability of the ship due to accumulated water.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

**Remarks**

This material is non-combustible unless contaminated.

## POTASSIUM SULPHATE

### Description

Hard crystals or powder. Colourless or white.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | 31°                  | 1,111                             | 0.90                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## PUMICE

### Description

Highly porous rock of volcanic origin. Greyish-white.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powder to lumps       | Not applicable       | 308 to 526                        | 1.90 to 3.25                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



**PYRITE (containing copper and iron)**

This cargo can be categorized as group A or C. This cargo entry is for cargo in group C.

**Description**

Iron disulphide, containing copper and iron. Moisture 0% to 7%. Extremely dusty.

**Characteristics**

| Physical properties      |                      |                                   |                                    |
|--------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                     | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines to lumps of 300 mm | Not applicable       | 2,000 to 3,030                    | 0.33 to 0.50                       |
| Hazard classification    |                      |                                   |                                    |
| Class                    | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable           | Not applicable       | Not applicable                    | C                                  |

**Hazard**

No special hazards.

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

**Stowage and segregation**

No special requirements.

**Hold cleanliness**

No special requirements.

**Weather precautions**

No special requirements.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

## **PYRITES, CALCINED (calcined pyrites)**

### **Description**

Dust to fines, calcined pyrites is the residual product from the chemical industry where all types of metal sulphides are either used for the production of sulphuric acid or are processed to recover the elemental metals – copper, lead, zinc, etc. The acidity of the residue can be considerable, in particular, in the presence of water or moist air, where pH values between 1.3 and 2.1 are frequently noted.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Not applicable               | Not applicable              | 2,326                                      | 0.43  |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| Not applicable               | Not applicable              | TX and/or CR                               | A and B                                     |

### **Hazard**

Highly corrosive to steel when wet. Inhalation of dust is irritating and harmful. This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### **Stowage and segregation**

"Separated from" foodstuffs.

### **Hold cleanliness**

Due consideration shall be given to cleaning and drying of the cargo spaces.

### **Weather precautions**

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Ceiling boards shall be removed or sealed to prevent penetration by this cargo. The tank top on which this cargo is to be loaded shall be covered with protective coating such as lime-wash before loading to avoid any potential corrosive reaction between the cargo, water and steel. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

**Ventilation**

No special requirements.

**Carriage**

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed to prevent water ingress, as necessary.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Nil (non-combustible).</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## PYROPHYLLITE

### Description

A natural hydrous aluminium silicate. Chalk-white. May be dusty.  
Lumps: 75%, Rubble: 20%, Fines: 5%.

### Characteristics

| Physical properties   |                      |                                      |                                       |
|-----------------------|----------------------|--------------------------------------|---------------------------------------|
| Size                  | Angle of repose      | Bulk density<br>(kg/m <sup>3</sup> ) | Stowage factor<br>(m <sup>3</sup> /t) |
| Lumps to fines        | Not applicable       | 2,000                                | 0.50                                  |
| Hazard classification |                      |                                      |                                       |
| Class                 | Subsidiary hazard(s) | MHB                                  | Group                                 |
| Not applicable        | Not applicable       | Not applicable                       | C                                     |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## QUARTZ

### Description

Crystalline lumps.

### Characteristics

| Physical properties       |                      |                                   |                                    |
|---------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Lumps:<br>50 mm to 300 mm | Not applicable       | 1,667                             | 0.60                               |
| Hazard classification     |                      |                                   |                                    |
| Class                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable            | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## QUARTZITE

### Description

Quartzite is a compact, granular, metamorphosed sandstone containing quartz. It is white, red, brown or grey in colour and its size varies from large rocks to pebbles. It may also be shipped in semi-crushed and graded sizes.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 10 mm to 200 mm       | Not applicable       | 1,563                             | 0.64                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

Dust of this cargo is very abrasive.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Protect machinery and equipment from dust. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

**RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non-fissile or fissile-excepted UN 2912**

**Description**

This schedule includes ores containing naturally occurring radionuclides (e.g., uranium, thorium) and natural or depleted uranium and thorium concentrates of such ores, including metals, mixtures and compounds.

**Characteristics**

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 7                     | Not applicable       |                                   | B                                  |

**Hazard**

Low radiotoxicity. Some materials may possess chemical hazards. This cargo is non-combustible or has a low fire risk.

**Stowage and segregation**

"Separated from" foodstuffs.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Personnel shall not be unnecessarily exposed to dust of this cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks. There shall be no leakage outside the cargo space in which this cargo is stowed.

**Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

**Carriage**

All instructions provided by the shipper shall be followed for the carriage of this cargo.

**Discharge**

All instructions provided by the shipper shall be followed for the discharge of this cargo.

**Clean-up**

Cargo spaces used for this cargo shall not be used for other goods until decontaminated. Refer to 9.3.2.3 of this Code.

### Emergency procedures

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.  
Use water spray to control spread of dust, if necessary.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.  
Radio for medical advice.

### Remarks

Most materials are likely to be non-combustible. Speedily collect and isolate potentially contaminated equipment and cover. Seek expert advice.



**RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I), non-fissile or fissile-excepted UN 2913**

**Description**

The radioactivity of SCO-I is low. This schedule includes solid objects of non-radioactive material having a radioactive material distributed on its surfaces which:

- 1 the non-fixed contamination on the accessible surface, averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>), does not exceed 4 Bq/cm<sup>2</sup> for beta and gamma emitters and low-toxicity alpha emitters, or 0.4 Bq/cm<sup>2</sup> for all other alpha emitters;
- 2 the fixed contamination on the accessible surface, averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300 cm<sup>2</sup>), does not exceed 4 x 10<sup>4</sup> Bq/cm<sup>2</sup> for beta and gamma emitters and low-toxicity alpha emitters, or 4 x 10<sup>3</sup> Bq/cm<sup>2</sup> for all other alpha emitters; and
- 3 the non-fixed contamination plus the fixed contamination on the inaccessible surface, averaged over 300 cm<sup>2</sup> (or the area of the surface if less than 300cm<sup>2</sup>), does not exceed 4 x 10<sup>4</sup> Bq/cm<sup>2</sup> for beta and gamma emitters and low-toxicity alpha emitters, or 4 x 10<sup>3</sup> Bq/cm<sup>2</sup> for all other alpha emitters.

**Characteristics**

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 7                     | Not applicable       |                                   | B                                  |

**Hazard**

Low radioactivity.

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

**Stowage and segregation**

"Separated from" foodstuffs.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Personnel shall not be exposed to dust of this cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles and dust filter masks. There shall be no leakage outside the cargo space in which this cargo is stowed.

**Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

**Carriage**

All instructions provided by the shipper shall be followed for the carriage of this cargo.

**Discharge**

All instructions provided by the shipper shall be followed for the discharge of this cargo.

**Clean-up**

Cargo spaces used for this cargo shall not be used for other goods until decontaminated. Refer to 9.3.2.3 of this Code.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.<br/>Use water spray to control spread of dust, if necessary.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.<br/>Radio for medical advice.</p> |

**Remarks**

Most materials are likely to be non-combustible. Speedily collect and isolate potentially contaminated equipment and cover. Seek expert advice.

## RASORITE (ANHYDROUS)

### Description

A granular, yellow-white crystalline material with little or no dust. Abrasive. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Less than 2.36 mm     | Not applicable       | 1,282 to 1,493                    | 0.67 to 0.78                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

Rasorite (anhydrous) is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.

## RUTILE SAND

### Description

Fine-particled brown to black sand. Abrasive. Shipped dry. May be dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 0.15 mm or less       | Not applicable       | 2,500 to 2,700                    | 0.37 to 0.40                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## SALT

### Description

Fine white grains. Moisture variable to 5.5%. This cargo is highly soluble. In the case of ingress of water into the holds, there is a risk to the loss of the stability of the ship through dissolution of this cargo (formation of a wet base and shifting of cargo).

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Grains up to 12 mm    | Not applicable       | 893 to 1,235                      | 0.81 to 1.12                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

The parts of the cargo space in contact with the cargo such as tank tops, hoppers, side plating and bulkheads shall be lime-washed or coated with paint to prevent corrosion.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## SALT CAKE

### Description

Impure sodium sulphate. White in colour. Granular, shipped dry.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 10 mm to 200 mm       | Not applicable       | 1,052 to 1,124                    | 0.89 to 0.95                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## SALT ROCK

### Description

White. Moisture content 0.02%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Small granules        | Not applicable       | 943 to 1,020                      | 0.98 to 1.06                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## SAND

Sands included in this schedule are:

|                        |                   |
|------------------------|-------------------|
| Foundry sand           | Silica sand       |
| Potassium felspar sand | Soda felspar sand |
| Quartz sand            |                   |

### Description

Usually fine particles. Abrasive and dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 0.1 mm to 5 mm        | Not applicable       | 1,020 to 2,000                    | 0.50 to 0.98                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

Inhalation of silica dust can result in respiratory disease. Silica particulates are easily transported by air and inhaled.

Industrial sand may be coated with resin and will cake if exposed to heat (55°C to 60°C).

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

### Stowage and segregation

Industrial sand coated with resin shall be "separated from" sources of heat.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage.

This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.



**Ventilation**

No special requirements.

**Carriage**

The bilge wells of the cargo spaces carrying this cargo shall be kept dry.

**Discharge**

No special requirements.

**Clean-up**

After discharge of this cargo, particular attention shall be given to bilge wells of the cargo spaces.

## SAND, HEAVY MINERAL

### Description

The cargo is generally a blend of two or more heavy mineral sands. Such sands are characterized by their heavy bulk density and relatively fine grain size. Abrasive. May be dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 5 mm            | Not applicable       | 2,380 to 3,225                    | 0.31 to 0.42                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

**SAND, MINERAL CONCENTRATE, RADIOACTIVE MATERIAL,  
LOW SPECIFIC ACTIVITY (LSA-I) UN 2912**

**Description**

This cargo is generally a concentrate stream resulting from the processing of heavy mineral sands. Such mineral sand concentrates are characterized by their heavy bulk density and relatively fine grain size. This schedule includes concentrates of sands containing natural or depleted uranium and thorium, including metals, mixtures and compounds.

Abrasive. May be dusty. This cargo is cohesive if moisture content is above 1%.

**Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density<br/>(kg/m<sup>3</sup>)</b> | <b>Stowage factor<br/>(m<sup>3</sup>/t)</b> |
| Fine Particles<br>up to 2 mm | Approximately 35°           | 2,200 to 3,225                             | 0.31 to 0.45                                |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                                 | <b>Group</b>                                |
| 7                            | Not applicable              | TX and CR                                  | A and B                                     |

**Hazard**

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

Low radiotoxicity.

May cause long-term health effects and skin irritation.

Prolonged and repeated exposure to silica dust can result in respiratory disease.

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

**Stowage and segregation**

"Separated from" foodstuffs.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Personnel shall not be unnecessarily exposed to dust of this cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks. There shall be no leakage outside the cargo space in which this cargo is stowed.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

All instructions provided by the shipper shall be followed for the carriage of this cargo. The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

All instructions provided by the shipper shall be followed for the discharge of this cargo.

### **Clean-up**

Cargo spaces used for this cargo shall not be used for other goods until decontaminated. Refer to 9.3.2.3 of this Code.

### **Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and headgear).<br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.<br/>Use water spray to control spread of dust, if necessary.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

### **Remarks**

Most materials are likely to be non-combustible. Speedily collect and isolate potentially contaminated equipment and cover. Seek expert advice.

## SAWDUST

### Description

Fine particles of wood.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CB                                | B                                  |

### Hazard

Spontaneous combustion if not clean, dry and free from oil. Liable to cause oxygen depletion within the cargo space.

### Stowage and segregation

Segregation as required for class 4.1 materials.

"Separated from" all class 5.1 liquids and all class 8 liquids.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. Prior to loading this cargo, the shipper shall provide the master with a certificate stating that the cargo is clean, dry and free from oil.

### Ventilation

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Nil

**Emergency procedures**

Nil

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.  
Exclusion of air may be sufficient to control fire.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## SCALE GENERATED FROM THE IRON AND STEEL MAKING PROCESS

### Description

This cargo consists mainly of ferric oxide which is collected from various places of iron and steel making process. Mill scale, which is scale collected from water used in hot rolling process and from drainage pits with a small amount of oil which is used for rolling, is a main component of this cargo. This cargo is reused as a raw material for iron.

Shape varies from powder to lumps. Colour is grey, ash brown, ash black green, brown, burnt umber or black. Specific gravity of solids is 3 to 6.

This cargo consists mainly of moisture, oil (less than 1.2%), wustite (FeO), magnetite (Fe<sub>3</sub>O<sub>4</sub>), hematite (Fe<sub>2</sub>O<sub>3</sub>), metallic iron and fayalite (Fe<sub>2</sub>SiO<sub>4</sub>). The main chemical elements in this cargo except for moisture and oil are in the range of the followings: Fe > 70%, Ca < 0.8%, Si < 0.7%, Al < 0.3%, Cr < 1.5%, Ni < 0.5%, Mn < 1.0%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 150 mm          | Not applicable       | 1,300 to 3,300                    | 0.30 to 0.77                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

As this cargo may contain oil less than 1.2%, due consideration shall be given not to discharge bilge directly from the cargo holds.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

**SCRAP METAL**

*(see appendix to this schedule)*

**Description**

"Scrap" iron or steel covers an enormous range of ferrous metals, principally intended for recycling.

**Characteristics**

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Not applicable       | Various                           | Various                            |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

**Hazard**

No special hazards.

This cargo is non-combustible or has a low fire risk except when cargo contains swarf (fine metal turnings liable to spontaneous combustion) refer to the entry for FERROUS METAL BORINGS, SHAVINGS, TURNINGS or CUTTINGS UN 2793 in this Code.

**Stowage and segregation**

No special requirements.

**Hold cleanliness**

No special requirements.

**Weather precautions**

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

*Refer to the appendix to this schedule.*

**Precautions**

*Refer to the appendix to this schedule.*

**Ventilation**

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

**Carriage**

Bilges in the cargo spaces carrying this cargo shall not be pumped unless absolutely necessary. Bilgewater of this cargo may contain a certain amount of dirt and oil from old machinery. *Refer to the appendix to this individual schedule.*

**Discharge**

When this cargo is discharged by magnet or spider grab:

- .1 the deck and deck machineries shall be protected from falling cargo; and
- .2 damages to the ship shall be checked, after the completion of discharge.

**Clean-up**

Prior to cleaning up the cargo spaces for this cargo, the crew shall be informed of danger due to broken glass and sharp edges. Prior to washing out the residues of this cargo, any oil

spillages shall be cleaned from the tank tops and the bilge wells of the cargo spaces for this cargo.

## **APPENDIX**

### **SCRAP METAL**

Handling of this cargo varies from magnets to spider grabs, depending usually on the size of material. This cargo may include articles from the size of car bodies to fine metal turnings (swarf). The weight of individual pieces will also vary greatly, ranging from heavy machinery to tin cans.

#### **Loading**

Before loading, the cargo spaces shall be prepared as per general loading practice and any areas liable to be damaged by falling cargo shall be protected with dunnage. This includes decks and coamings in way of the material's path to the cargo spaces. Removing the ship's side rails may be advisable.

A layer of this cargo shall be carefully placed over the tank top in the square to cushion any fall out. Magnet and grab drivers shall be instructed not to release their loads too high above the pile.

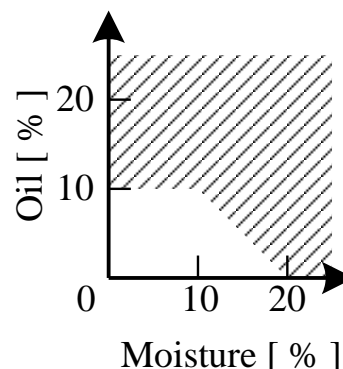
The usual method of loading is to form a pile along the ship's centre line and use the slope to roll material into the ends and sides. Every effort must be made to work the wings and ends to evenly distribute the weight. If this is not done, the light high-volume pieces will roll to the wings and the small heavy pieces will concentrate in the square.

When pumping the bilge wells, the master shall be aware that a certain amount of dirt and oil can be expected from old machinery. Broken glass and sharp jagged edges may be present and care shall be taken by personnel working near scrap.

Before hatches are closed, the cargo spaces shall be checked that no sharp projections could pierce the ship's side.

**SEED CAKE, containing vegetable oil UN 1386  
(a) mechanically expelled seeds, containing more than 10% of oil  
or more than 20% of oil and moisture combined**

The range of oil and moisture content is indicated in the figure.



To be carried in bulk only with special permission from the competent authority.

**Description**

Residue remaining after oil has been expelled mechanically from oil-bearing seeds. The cereals and cereal products included in this schedule are those derived from:

**Bakery materials**

- Barley malt pellets
- Beet
- Bran pellets
- Brewer's grain pellets
- Citrus pulp pellets
- Coconut
- Copra
- Corn gluten
- Cotton seed
- Expellers
- Gluten pellets
- Ground nuts, meal
- Hominy chop
- Linseed
- Maize
- Meal, oily

**Mill feed pellets**

- Niger seed, expellers
- Oil cake
- Palm kernel
- Peanuts
- Pellets, cereal
- Pollard pellets
- Rape seed
- Rice bran
- Rice broken
- Safflower seed
- Seed expellers, oily
- Soya bean
- Strussa pellets
- Sunflower seed
- Toasted meals

The above may be shipped in the form of pulp, meals, cake, pellets and expellers.

**Characteristics**

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 478 to 719                        | 1.39 to 2.09                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.2                   | Not applicable       |                                   | B                                  |

**Hazard**

May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may be produced.

**Stowage and segregation**

See 9.3 of this Code.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

This cargo shall only be accepted for loading when the temperature of the cargo is not higher than ambient temperature plus 10°C or 55°C, whichever is lower. Before shipment, this cargo shall be properly aged; the duration of ageing required varies with the oil content. The competent authority may permit seed cakes described in this schedule to be carried under conditions governing SEED CAKE (b), when satisfied, as a result of tests, that such relaxation is justified (see following schedule). Certificates from the competent authority giving such permission shall state the oil content and moisture content. The temperature of this cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. If the temperature of the cargo reaches 55°C and continues to increase, ventilation to the cargo shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo space. Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level.

**Ventilation**

The cargo spaces carrying this cargo shall not be mechanically ventilated during voyage to prevent self-heating of the cargo, except in case of emergency.

**Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Self-contained breathing apparatus.

**Emergency procedures**

Wear self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

**SEED CAKE, containing vegetable oil UN 1386  
(b) solvent extractions and expelled seeds, containing not more than 10%  
of oil and when the amount of moisture is higher than 10%,  
not more than 20% of oil and moisture combined**

The provisions of this schedule do not apply to the following materials, due to those materials not meeting the criteria for class 4.2 materials:

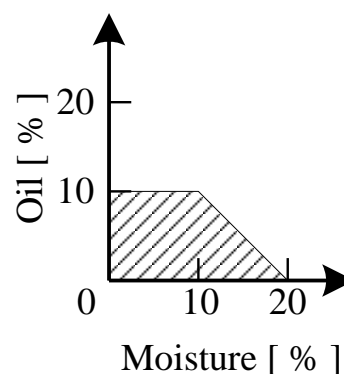
- .1 solvent-extracted rape seed meal, rape seed pellets, soya bean meal, cotton seed meal and sunflower seed meal, containing not more than 4% oil and 15% oil and moisture combined;
- .2 mechanically expelled citrus pulp pellets containing not more than 2.5% oil and 14% oil and moisture combined;
- .3 mechanically expelled corn gluten meal containing not more than 11% oil and 23.6% oil and moisture combined;
- .4 mechanically expelled corn gluten feed pellets containing not more than 5.2% oil and 17.8% oil and moisture combined; and
- .5 mechanically expelled beet pulp pellets containing not more than 2.8% oil and 15.0% oil and moisture combined.

A certificate from a person recognized by the competent authority of the country of shipment shall be provided by the shipper, prior to loading, stating that the oil and moisture content of the material is as specified above.

Note: This entry covers the following:

- .1 all solvent-extracted and expelled seed cakes containing not more than 10% oil, and not more than 10% moisture; and
- .2 all solvent-extracted and expelled seed cakes containing not more than 10% oil and moisture content higher than 10%, in which case the oil and moisture combined must not exceed 20%.

The range of oil and moisture content is indicated in the figure.



When, in solvent-extracted seed cake, the oil or oil and moisture content exceeds the percentages stated above, guidance shall be sought from the competent authorities.

### Description

Residue remaining after oil has been extracted by a solvent process or expelled mechanically from oil-bearing seeds. The cereals and cereal products included in this schedule are those derived from:

|                               |                              |
|-------------------------------|------------------------------|
| <b>Bakery materials</b>       | <b>Mill feed pellets</b>     |
| <b>Barley malt pellets</b>    | <b>Niger seed, expellers</b> |
| <b>Beet</b>                   | <b>Oil cake</b>              |
| <b>Bran pellets</b>           | <b>Palm kernel</b>           |
| <b>Brewer's grain pellets</b> | <b>Peanuts</b>               |
| <b>Citrus pulp pellets</b>    | <b>Pellets, cereal</b>       |
| <b>Coconut</b>                | <b>Pollard pellets</b>       |
| <b>Copra</b>                  | <b>Rape seed</b>             |
| <b>Corn gluten</b>            | <b>Rice bran</b>             |
| <b>Cotton seed</b>            | <b>Rice broken</b>           |
| <b>Expellers</b>              | <b>Safflower seed</b>        |
| <b>Gluten pellets</b>         | <b>Seed expellers, oily</b>  |
| <b>Ground nuts, meal</b>      | <b>Soya bean</b>             |
| <b>Hominy chop</b>            | <b>Strussa pellets</b>       |
| <b>Linseed</b>                | <b>Sunflower seed</b>        |
| <b>Maize</b>                  | <b>Toasted meals</b>         |
| <b>Meal, oily</b>             |                              |

The above may be shipped in the form of pulp, meals, cake, pellets and expellers.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 478 to 719                        | 1.39 to 2.09                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.2                   | Not applicable       |                                   | B                                  |

### Hazard

May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may also be produced.

### Stowage and segregation

See 9.3 of this Code.

If the bulkhead between the cargo space and the engine-room is not insulated to class "A-60" standard, solvent extraction seed shall be stowed "away from" the bulkhead.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

This cargo shall only be accepted for loading when the cargo is substantially free from flammable solvent and a certificate from a person recognized by the competent authority of the country of shipment specifying the oil content and moisture content is issued.

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.



### Precautions

Before shipment, this cargo shall be properly aged; the duration of ageing required varies with the oil content. The temperature of this cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. If the temperature of the cargo reaches 55°C and continues to increase, ventilation to the cargo shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo space. Notwithstanding the previous requirement, in the case of solvent-extracted seed cakes the use of carbon dioxide or inert gas shall be withheld until fire is apparent. Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level. When the planned interval between the commencement of loading and the completion of discharge of this cargo exceeds 5 days, the cargo shall not be accepted for loading unless the cargo is to be carried in a cargo space equipped with facilities for introducing carbon dioxide or inert gas into the space. Smoking and the use of naked lights shall be prohibited in the vicinity of the cargo space during loading and unloading and on entry into the cargo spaces at any other time. Electrical circuits for equipment in cargo spaces which is unsuitable for use in an explosive atmosphere shall be isolated by removal of links in the system other than fuses. Spark-arresting screens shall be fitted to ventilators to the cargo spaces containing this cargo.

### Ventilation

Surface ventilation, either natural or mechanical, shall be conducted, as necessary, for removing any residual solvent vapour. To prevent self-heating of the cargo, caution is required when using mechanical ventilation.

### Carriage

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

### Discharge

No special requirements.

### Clean-up

No special requirements.

### Emergency procedures

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

### Remarks

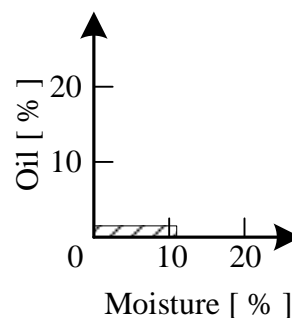
The use of CO<sub>2</sub> is limited to controlling the fire and further amounts may need to be injected from time to time during the sea passage to reduce the oxygen content in the hold. On arrival in port, the cargo will need to be dug out to reach the seat of the fire.

**SEED CAKE UN 2217**

**with not more than 1.5% oil and not more than 11% moisture**

The provisions of this schedule do not apply to the following materials, due to those materials not meeting the criteria for class 4.2 materials: solvent-extracted rape seed meal, rape seed pellets, soya bean meal, cotton seed meal and sunflower seed meal containing not more than 1.5% oil and not more than 11% moisture. A certificate from a person recognized by the competent authority of the country of shipment shall be provided by the shipper, prior to loading, stating that the oil and moisture content of the material is as specified above.

The range of oil and moisture content is indicated in the figure.



**Description**

Residue remaining after oil has been extracted by a solvent process from oil-bearing seeds. The cereals and cereal products included in this schedule are those derived from:

- |                               |                              |
|-------------------------------|------------------------------|
| <b>Bakery materials</b>       | <b>Meal, oily</b>            |
| <b>Barley malt pellets</b>    | <b>Mill feed pellets</b>     |
| <b>Beet</b>                   | <b>Niger seed, expellers</b> |
| <b>Bran pellets</b>           | <b>Oil cake</b>              |
| <b>Brewer's grain pellets</b> | <b>Palm kernel</b>           |
| <b>Citrus pulp pellets</b>    | <b>Peanuts</b>               |
| <b>Coconut</b>                | <b>Pellets, cereal</b>       |
| <b>Copra</b>                  | <b>Pollard pellets</b>       |
| <b>Corn gluten</b>            | <b>Rape seed</b>             |
| <b>Cotton seed</b>            | <b>Rice bran</b>             |
| <b>Expellers</b>              | <b>Rice broken</b>           |
| <b>Gluten pellets</b>         | <b>Safflower seed</b>        |
| <b>Ground nuts, meal</b>      | <b>Seed expellers, oily</b>  |
| <b>Hominy chop</b>            | <b>Soyabean</b>              |
| <b>Linseed</b>                | <b>Strussa pellets</b>       |
| <b>Maize</b>                  | <b>Sunflower seed</b>        |

The above may be shipped in the form of pulp, meals, cake, pellets, expellers.

**Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| 0.1 mm to 5 mm               | Not applicable              | 478 to 719                             | 1.39 to 2.09                            |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| 4.2                          | Not applicable              |  | B                                       |

**Hazard**

May self-heat slowly and, if wet or containing an excessive proportion of unoxidized oil, ignite spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may also be produced.

**Stowage and segregation**

See 9.3 of this Code.

If the bulkhead between the cargo space and the engine-room is not insulated to class "A-60" standard, this cargo shall be stowed "away from" the bulkhead.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded or to be loaded shall be closed.

**Loading**

This cargo shall only be accepted for loading when the cargo is substantially free from flammable solvent and a certificate from a person recognized by the competent authority of the country of shipment specifying the oil content and moisture content is issued.

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

The temperature of this cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. If the temperature of the cargo reaches 55°C and continues to increase, ventilation to the cargo shall be stopped. If self-heating continues, then carbon dioxide or inert gas shall be introduced to the cargo space. Notwithstanding the previous requirement, the use of carbon dioxide or inert gas shall be withheld until fire is apparent. Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level. When the planned interval between the commencement of loading and the completion of discharge of this cargo exceeds 5 days, the cargo shall not be accepted for loading unless the cargo is to be carried in a cargo space equipped with facilities for introducing carbon dioxide or inert gas into the space. Smoking and the use of naked lights shall be prohibited in the vicinity of the cargo space during loading and unloading and on entry into the cargo spaces at any other time. Electrical circuits for equipment in cargo spaces which is unsuitable for use in an explosive atmosphere, shall be isolated by removal of links in the system other than fuses. Spark-arresting screens shall be fitted to ventilators to the cargo spaces containing this cargo.

**Ventilation**

Surface ventilation, either natural or mechanical, shall be conducted, as necessary, for removing any residual solvent vapour. To prevent self-heating of the cargo, caution is required when using mechanical ventilation.

**Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

**Remarks**

The use of CO<sub>2</sub> is limited to controlling the fire, and further amounts may need to be injected from time to time during passage to reduce the oxygen content in the hold. On arrival in port, the cargo will need to be dug out to reach the seat of the fire.

## SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES

This schedule shall only apply to seed cakes and other residues of processed oily vegetables which are substantially free from flammable solvents or other flammable chemicals, meet the criterion for self-heating solids specified in 9.2.3.3 and do not meet any of the criteria for dangerous goods specified in 9.2.2.

### Description

Residues remaining after oil has been mechanically expelled or extracted by solvent or other chemical processes from oil-bearing seeds, grains, cereals, fruit or vegetables. This cargo may be shipped in the form of pulp, meals, cake, pellets and expellers.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Various*             | 478 to 719                        | 1.39 to 2.09                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | SH                                | B                                  |

\* Some cargoes in pelletized form may be non-cohesive. See 5.4 of this Code.

### Hazard

This cargo may heat spontaneously. Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may also be produced.

Loading of dry pellets using cargo blowers may present a risk of dust explosion.

### Stowage and segregation

Unless otherwise determined by the competent authority, segregation as required for class 4.2 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. Solvent-extracted cargo shall only be accepted for loading when the cargo is substantially free from flammable solvent. Before shipment, solvent-extracted cargoes shall be properly aged; the duration of ageing required varies with the oil content.

This cargo shall only be accepted for loading when the temperature of the cargo is not higher than the ambient temperature plus 10°C, or 55°C, whichever is lower. All sources of ignition shall be considered and avoided to prevent possible dust explosions. Blower equipment shall be earthed. Piping shall be electrically continuous or earthed.

### Precautions

Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level.

Persons who may be exposed to the dust of the cargo shall wear a dust filter masks, protective eyewear and protective clothing, as necessary.

The temperature of this cargo shall be measured regularly at a number of depths in the cargo spaces and recorded during the voyage. If the temperature of the cargo reaches 55°C and continues to increase, ventilation for the cargo shall be stopped.

If self-heating continues, then carbon dioxide or inert gas shall be introduced into the cargo space. Notwithstanding the previous requirement, in the case of solvent-extracted cargoes, the use of carbon dioxide or inert gas shall be withheld until fire is apparent.

Electrical circuits for equipment in cargo spaces which are unsuitable for use in an explosive atmosphere shall be isolated by removal of links in the system other than fuses.

Spark-arresting screens shall be fitted to ventilators to the cargo spaces containing this cargo.

### **Ventilation**

Surface ventilation either natural or mechanical shall be conducted, as necessary, for removing any residual solvent vapour. To prevent self-heating of the cargo, caution is required when using mechanical ventilation.

### **Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

### **Discharge**

No special requirements.

### **Clean-up**

No special requirements.

### **Emergency procedures**

|  |
|--|
| <b>Special emergency equipment to be carried</b><br>Self-contained breathing apparatus.  |
| <b>Emergency procedures</b><br>Wear self-contained breathing apparatus.  |
| <b>Emergency action in the event of fire</b><br>Batten down; use ship's fixed CO <sub>2</sub> fire-fighting installation, if fitted. |
| <b>Medical first aid</b><br>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.  |

### **Remarks**

The use of CO<sub>2</sub> or inert gas is limited to controlling the fire, and further amounts may need to be injected from time to time during passage to reduce the oxygen content in the hold. On arrival in port, the cargo will need to be removed in stages to reach the seat of the fire.

## SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES

This schedule shall only apply to seed cakes and other residues of processed oily vegetables which are substantially free from flammable solvents or other flammable chemicals and do not meet any of the criteria on dangerous goods or materials hazardous only in bulk specified in 9.2.2 or 9.2.3, respectively.

### Description

Residues remaining after oil has been mechanically expelled or extracted by solvent or other chemical processes from oil-bearing seeds, grains, cereals, fruit or vegetables. This cargo may be shipped in the form of pulp, meals, cake, pellets and expellers.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Various               | Various*             | 478 to 719                        | 1.39 to 2.09                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

\* Some cargoes in pelletized form may be non-cohesive. See 5.4 of this Code.

### Hazard

Liable to oxidize, causing subsequent reduction of oxygen in the cargo space. Loading of dry pellets using cargo blowers may present a risk of dust explosion. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

In the case of seed cakes, a certificate from a person recognized by the competent authority of the country of shipment shall be provided by the shipper, prior to loading, stating that the requirements for exclusion from either the schedule for SEED CAKE UN 1386 (b) or UN 2217, whichever is applicable, are met as set out in those schedules and that the material does not meet the MHB (SH) criteria specified in 9.2.3.3.

Solvent-extracted cargo shall only be accepted for loading when the cargo is substantially free from flammable solvent. Before shipment, solvent-extracted cargoes shall be properly aged; the duration of ageing required varies with the oil content.

### Precautions

Entry of personnel into cargo spaces for this cargo shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level.

Persons who may be exposed to the dust of the cargo shall wear a dust filter masks, protective eyewear and protective clothing, as necessary.

**Ventilation**

No special requirements.

**Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.



## SILICOMANGANESE (carbo-thermic)

### Description

This material is a result of a carbo-thermic reduction process. A ferroalloy comprising principally manganese and silicon, mainly used as a deoxidizer and alloying element in the steel-making process. Particles or lumps of metallic-silver to dark-grey colour metal.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines up to 80 mm     | Not applicable       | 3,100 to 4,000                    | 0.25 to 0.32                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

"Separated from" acids, alkalis, oxidizing and reducing agents and foodstuffs.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

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

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## SILICOMANGANESE (low carbon)

### Description

A ferroalloy comprising principally manganese and silicon, mainly used as a deoxidizer and alloying element in the steel-making process. Particle or lump of blackish brown, silver white metal.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 10 mm to 150 mm       | Not applicable       | 3,000 to 3,300                    | 0.30 to 0.33                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | WF and/or WT and/or TX            | B                                  |

### Hazard

This cargo is non-combustible and has a low fire risk. However, in contact with water, this cargo may evolve hydrogen, a flammable gas that may form explosive mixtures with air and may, under similar conditions, produce phosphine and arsine which are highly toxic gases. This cargo is liable to reduce oxygen content in a cargo space. May cause long-term health effects.

### Stowage and segregation

Segregation as required for class 4.3 materials.

"Separated from" foodstuffs and all class 8 liquids.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

The manufacturer or the shipper shall provide the master with a certificate stating that, after manufacture, the cargo was stored under cover, but exposed to open air for not less than three days prior to shipment.

Smoking shall not be allowed on deck and in the cargo spaces and "NO SMOKING" signs shall be displayed on deck whenever this cargo is on board. Electrical fittings and cables shall be in good condition and properly safeguarded against short circuits and sparking. Where a bulkhead is required to be suitable for segregation purposes, cable and conduit penetrations of the decks and bulkheads shall be sealed against the passage of gas and vapour. Whenever practicable, ventilation systems for the living quarters shall be shut down or screened and air condition systems shall be placed on recirculation during loading and discharge of this cargo,

in order to minimize the entry of dust into living quarters or other interior spaces of the ship. Precautions shall be taken to minimize the extent to which dust of this cargo may come in contact with moving parts of deck machinery and external navigation aids such as navigation lights.

Entry of personnel into enclosed spaces shall not be permitted until tests have been carried out and it has been established that the oxygen content has been restored to a normal level throughout the space and that no toxic gas is present, unless adequate ventilation and air circulation throughout the free space above the material has been effected.

**Ventilation**

Mechanical surface ventilation shall be conducted during the voyage, as necessary, for the cargo spaces carrying this cargo.

**Carriage**

For quantitative measurements of oxygen and flammable gases liable to be evolved by the cargo, a suitable detector for each gas or combination of gases shall be on board while this cargo is carried. The detector shall be suitable for use in an atmosphere without oxygen and of certified safe type for use in explosive atmosphere. The concentrations of these gases in the cargo spaces carrying this cargo shall be measured regularly, during voyage, and the results of the measurements shall be recorded and kept on board.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down and use CO<sub>2</sub>, if available. <b>Do not use water.</b></p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

**Remarks**

Material is virtually non-combustible when dry.

## SILICON SLAG

### Description

Silicon slag is an odourless greyish metallic material mainly in lump. It is composed of silicon and silicon dioxide in variable proportions.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 150 mm          | Not applicable       | 1,500 to 3,000                    | 0.33 to 0.67                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

The dust may cause irritation of eyes, skin and upper respiratory tract.  
This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

"Separated from" acids or base materials.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

**SODA ASH**  
**(dense and light)**

**Description**

Powdery; composed of white, odourless grains and dust. It is made by the combustion of salt and limestone. Soluble in water. Soda ash is ruined on contact with oil.

**Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| Powdery                      | Not applicable              | 599 to 1,053                           | 0.95 to 1.67                            |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| Not applicable               | Not applicable              | Not applicable                         | C                                       |

**Hazard**

No special hazards.

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

**Stowage and segregation**

No special requirements.

**Hold cleanliness**

No special requirements.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

**Ventilation**

No special requirements.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

After discharge of this cargo, the cargo spaces shall be swept clean except in cases where the cargo to be loaded subsequent to discharge is SODA ASH. The residues of this cargo may be pumped as slurry during washing out.

## SODIUM NITRATE UN 1498

### Description

Colourless, transparent, odourless crystals. Hygroscopic and soluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 508 to 719                        | 1.39 to 1.97                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | Not applicable       |                                   | B                                  |

### Hazard

Although non-combustible, mixtures with combustible material are readily ignited and may burn fiercely.

This cargo is hygroscopic and will cake if wet.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

Sodium nitrate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.  
Spray nozzles.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Use copious quantities of water, which is best applied in the form of a spray to avoid disturbing the surface of the material. The material may fuse or melt, in which condition application may result in extensive scattering of the molten material. Exclusion of air or the use of CO<sub>2</sub> will not control the fire. Due consideration should be given to the effect on the stability of the ship due to accumulated water.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

**Remarks**

This material is non-combustible unless contaminated.

## SODIUM NITRATE AND POTASSIUM NITRATE MIXTURE UN 1499

### Description

A hygroscopic mixture, soluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | 30°                  | 1,136                             | 0.88                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 5.1                   | Not applicable       |                                   | B                                  |

### Hazard

Although non-combustible, mixtures with combustible material may readily ignite and burn fiercely.

This cargo is hygroscopic and will cake if wet.

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Due consideration shall be given to prevent contact of the cargo and combustible materials. Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The master and officers are to note that the ship's fixed gas fire-fighting installation will be ineffective on fires involving this cargo and that applying copious amounts of water may be necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

Sodium nitrate and potassium nitrate mixture is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

No special requirements.



**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.  
Spray nozzles.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Use copious quantities of water, which is best applied in the form of a spray to avoid disturbing the surface of the material. The material may fuse or melt, in which condition application of water may result in extensive scattering of the molten materials. Exclusion of air or the use of CO<sub>2</sub> will not control the fire. Due consideration should be given to the effect on the stability of the ship due to the accumulated water.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

**Remarks**

Material is non-combustible unless contaminated.

## SOLIDIFIED FUELS RECYCLED FROM PAPER AND PLASTICS

This schedule shall not apply to material classified as dangerous goods (class 4.2).

### Description

Solidified fuels comprising papers and plastics by compressing or extruding in moulds. The main raw materials of this cargo are waste paper and plastic. Moisture content is 5% or less. Ash content is 10% or less. Total chlorine is 0.3% or less.

### Characteristics

| Physical properties                                       |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Length:<br>30 mm to 100 mm<br>Diameter:<br>15 mm to 30 mm | Not applicable       | 400 to 500                        | 2.00 to 2.50                       |
| Hazard classification                                     |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | SH                                | B                                  |

### Hazard

Spontaneous ignition is not liable to occur up to 200°C. When ignited, it burns violently. When melted, it generates flammable and toxic gases. Spontaneous-heating may take place and may deplete oxygen in the cargo spaces.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Prior to loading, the manufacturer or shipper shall give the master a certificate stating that the cargo is not class 4.2. Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

During handling and carriage, no hot work, burning and smoking shall be permitted in the vicinity of the cargo spaces containing this cargo. After discharging this cargo, entry into cargo spaces shall not be permitted unless they have been sufficiently ventilated.

### Ventilation

The hatches of the cargo spaces shall be closed and the spaces shall not be ventilated during voyage.

### Carriage

Entry into the cargo spaces shall not be permitted during voyage.

### Discharge

The hatches of the cargo spaces shall be opened and sufficiently ventilated prior to entry.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (protective glasses, heat-resistant gloves and coveralls).

**Emergency procedures**

Wear protective clothing.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.  
Extinguish fire with water, foam or dry chemicals.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## SPODUMENE (UPGRADED)

### Description

Spodumene (upgraded) is an odourless and tasteless off-white to beige sand containing a mixture of naturally occurring silicates and quartz. It is produced by processing naturally occurring spodumene.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 8 mm            | 30° to 40°           | 1,600 to 2,000                    | 0.50 to 0.63                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When this cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## STAINLESS STEEL GRINDING DUST

### Description

Brown lumps: Moisture content 1% to 3%. May give off dust.

### Characteristics

| Physical properties       |                      |                                   |                                    |
|---------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                      | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Lumps:<br>75 mm to 380 mm | Not applicable       | 2,381                             | 0.42                               |
| Hazard classification     |                      |                                   |                                    |
| Class                     | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable            | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## STONE CHIPPINGS

### Description

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fines up to 25 mm     | Not applicable       | 1,408                             | 0.71                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## SUGAR

### Description

Depending on type, sugar may be either brown or white granules, with a very low moisture content to the order of 0% to 0.05%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Granules up to 3 mm   | Not applicable       | 625 to 1,000                      | 1.00 to 1.60                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

As sugar dissolves in water, ingress of water may result in the creation of air pockets in the body of the cargo with the ship's motion. The hazards are then similar to the hazards presented by cargoes which may liquefy. In case of ingress of water into the holds, the risk to the stability of the ship through dissolution of sugar (formation of a liquid base and shifting of cargo), should be recognized. This cargo is highly soluble.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed to prevent water ingress, as necessary.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## SUGARCANE BIOMASS PELLETS

### Description

Sugarcane biomass pellets are light blonde to chocolate brown in colour; very hard and cannot be easily squashed. Sugarcane biomass pellets are made of bagasse, straw and leaves left over from industrial and agricultural activities. Normally there are no additives or binders blended into the pellet. This schedule is also applicable to sugarcane biomass pellets produced with the use of up to 2% of oxide-based mineral additives such as calcium, magnesium and aluminium oxides. The raw material is fragmented, dried and extruded into pellet form. The raw material is compressed to approximately one-third of its original volume and the finished sugarcane biomass pellets typically have a moisture content of 6 to 10%.

### Characteristics

| Physical properties   |                      |                                     |                                    |
|---|----------------------|-------------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> )   | Stowage factor (m <sup>3</sup> /t) |
| Cylindrical with<br>Diameter:<br>6 mm to 12 mm<br>Length: 10 to 50 mm | Approximately 30°    | 600 to 700                          | 1.43 to 1.67                       |
| Hazard classification   |                      |                                     |                                    |
| Class   | Subsidiary hazard(s) | MHB                                 | Group                              |
| Not applicable  | Not applicable       | CB and/or WF and/or<br>WT and/or OH | B                                  |

### Hazard

Shipments are subject to oxidation leading to depletion of oxygen and increase of carbon monoxide and carbon dioxide in cargo and communicating spaces (also see Weather precautions).

Swelling occurs if exposed to moisture. Sugarcane biomass pellets may ferment over time if moisture content is over 15% leading to generation of asphyxiating and flammable gases which may cause spontaneous combustion. Handling of sugarcane biomass pellets may cause dust to develop. Risk of explosion at high dust concentration.

### Stowage and segregation

Segregation as required for class 4.1 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed. There is a high risk of renewed oxygen depletion and carbon monoxide formation in previously ventilated adjacent spaces after closure of the hatch covers.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Entry of personnel into the cargo spaces containing this cargo or the connecting spaces shall not be permitted until tests have been carried out and it has been established that the oxygen content and carbon monoxide levels have been restored to the following levels: oxygen 21% and carbon monoxide < 100 ppm. Use of cargo hold lighting such as hot halogen lamps shall be avoided in the proximity of cargo spaces containing this cargo. Fuses to such lights shall be removed or secured while this cargo is present in the cargo space. Precautions shall be taken to prevent generation of high concentrations of dust during handling and cleaning of this cargo.

**Ventilation**

Cargo spaces carrying this cargo shall not be ventilated during voyage. Ventilation of enclosed spaces adjacent to a cargo hold before entry may be necessary even if these spaces are apparently sealed from the cargo hold.

**Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus and combined or individual oxygen and carbon monoxide meters should be available.</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p>   |
| <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted. Exclusion of air may be sufficient to control fire. Extinguish fire with carbon dioxide, foam or water.</p> |
| <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p>  |

## SULPHATE OF POTASH AND MAGNESIUM

### Description

Granular light brown material. Solution in water is almost neutral. May have a slight odour, depending on the process of manufacturer. Melting point: 72°C. Moisture: 0.02%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 1,000 to 1,124                    | 0.89 to 1.00                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is highly soluble.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

The cargo shall be trimmed in accordance with the cargo information required by section 4 of this Code. If doubt exists, trim reasonably level to the boundaries of the cargo space so as to minimize the risk of shifting and to ensure that adequate stability will be maintained during the voyage.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## SULPHUR (formed, solid)

This schedule shall not apply to crushed, lump and coarse-grained sulphur (see SULPHUR UN 1350), or to co-products from sour gas processing or oil refinery operations NOT subjected to the below-described forming process.

### Description

A co-product recovered from sour gas processing or oil refinery operations that has been subjected to a forming process that converts sulphur from a molten state into specific solid shapes (e.g. prills, granules, pellets, pastilles or flakes); bright yellow in colour; odourless.

### Characteristics

| Physical properties      |                      |                                   |                                    |
|--------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                     | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Approx.<br>1 mm to 10 mm | Not applicable       | 900 to 1,350                      | 0.74 to 1.11                       |
| Hazard classification    |                      |                                   |                                    |
| Class                    | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable           | Not applicable       | Not applicable                    | C                                  |

### Hazard

This cargo is non-combustible or has a low fire risk. If involved in a fire, cargo may generate harmful gases.

When handled and shipped in accordance with the provisions of the schedule, this cargo poses no corrosion or dust hazards for human tissue or vessel.

### Stowage and segregation

"Separated from" strong oxidizers, such as fluorine, chlorine, chlorates, nitrates (nitric acid), peroxides, liquid oxygen, permanganates, dichromates or the like.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo. Holds shall not be washed with seawater.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. Appropriate precautions shall be taken to minimize impact, abrasion and crushing when handling to prevent dust from forming. Standard application of surfactants inhibits airborne dust from forming.

### Precautions

Protect machinery, accommodations and equipment from small particles or any dust if formed. Persons involved in cargo handling shall wear protective clothing, goggles and dust filter masks. Holds including trimming plates and tank tops shall be treated with protective coating such as lime-wash to avoid any potential corrosive reaction between sulphur, water and steel. Upper sections shall have a sound coating of paint. Hatches shall be sealed tightly.

### Ventilation

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

**Carriage**

As a fine spray of fresh water or surfactant is added during loading, bilges shall be sounded and pumped out as necessary throughout the voyage.

**Discharge**

Appropriate safety precautions shall be taken when entering the cargo spaces, particularly in the area of the bottom layers of sulphur in ships hold, taking into account the recommendations developed by the Organization.

Appropriate precautions shall be taken to minimize impact, abrasion and crushing when handling to prevent dust from forming.

**Clean-up**

Persons involved in clean-up shall wear hard hats, protective goggles, long-sleeve shirts, long pants and impervious gloves. Use of approved respirators shall be considered. Holds shall be thoroughly washed using only fresh water following discharge.

Appropriate safety precautions shall be taken when entering the cargo spaces, taking into account the recommendations developed by the Organization.

**SULPHUR UN 1350**  
**(crushed lump and coarse grained)**

**Note:** Fine grained sulphur (flowers of sulphur) shall not be transported in bulk.

**Description**

A mineral substance found free in volcanic countries. Yellow in colour, brittle, insoluble in water, but readily fusible by heat. Sulphur is loaded in a damp or wet condition.

**Characteristics**

| Physical properties            |                      |                                   |                                    |
|--------------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                           | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Particles or lumps of any size | Not applicable       | 1,053 to 1,176                    | 0.85 to 0.95                       |
| Hazard classification          |                      |                                   |                                    |
| Class                          | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.1                            | Not applicable       |                                   | B                                  |

**Hazard**

Flammability and dust explosion especially during loading and unloading and after discharge and cleaning.

This cargo may ignite readily.

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

**Stowage and segregation**

"Separated from" foodstuffs.

**Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

Must be thoroughly clean and washed with fresh water.

**Weather precautions**

No special requirements.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

When this cargo is involved in a fire, a toxic, very irritating and suffocating gas is evolved. This cargo forms explosive and sensitive mixtures with most oxidizing material. This cargo has a liability to dust explosion, which may occur especially after discharge and during cleaning. The hold trimming plates and tank tops of the cargo spaces for this cargo shall be lime-washed or coated with paint to prevent corrosion. Upper sections shall have a sound coating of paint. Electrical circuits for the equipment in cargo spaces for this cargo which is unsuitable for use in an explosive atmosphere shall be isolated by removal of links in the system other than fuses. Due consideration shall be given to the isolation of electrical circuits for the equipment in the adjacent spaces of the cargo spaces which is unsuitable for use in an explosive atmosphere. Any ventilators of the cargo spaces for this cargo shall be fitted with spark-arresting screens. Fine grained sulphur (flowers of sulphur) shall not be transported in bulk.

**Ventilation**

Surface ventilation only, either natural or mechanical, shall be conducted, as necessary, during the voyage for this cargo.

**Carriage**

Bilges in the cargo spaces carrying this cargo shall be pumped regularly to prevent accumulation of water/acid solution.

**Discharge**

No special requirements.

**Clean-up**

The cargo spaces and other structures which may have been in contact with this cargo or the dust shall not be swept. After discharge of this cargo, the cargo spaces, and other structures as necessary, shall be washed out with fresh water to remove all residues of this cargo. Then the cargo spaces shall be thoroughly dried. Wet dust or residues may form highly corrosive sulphurous acid, which is extremely dangerous to personnel and corrosive to steel. Persons involved in cleaning up shall be provided with protective clothing, goggles and dust filter masks to wear.

**Emergency procedures**

|  |
|--|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if available. Exclusion of air may be sufficient to control the fire. <b>Do not use water.</b></p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## SUPERPHOSPHATE

### Description

Greyish-white. Moisture: 0% to 7%. Hygroscopic.

### Characteristics

| Physical properties                               |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Granular, fines and powder up to 0.15 mm diameter | 30° to 40°           | 1,000 to 1,190                    | 0.81 to 1.00                       |
| Hazard classification                             |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable                                    | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is hygroscopic and will cake if wet.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

The hold trimming plates and tank tops of the cargo spaces for this cargo shall be lime-washed or coated with paint to prevent corrosion.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

Moisture from condensation, cargo heating or leaking hatchcovers may cause formation of phosphoric or phosphorous acid which may cause corrosion to steelwork. After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed, as necessary. This cargo will decompose burlap or canvas cloth covering bilge wells.

### Discharge

Superphosphate is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

After discharge of this cargo, particular attention shall be given to bilge wells of the cargo spaces.



## **SUPERPHOSPHATE (triple, granular)**

### **Description**

Granular in form, dark grey colour and, depending on its source, can be dusty. Hygroscopic.

### **Characteristics**

| <b>Physical properties</b>   |                             |  |   |
|------------------------------|-----------------------------|--|---|
| <b>Size</b>                  | <b>Angle of repose</b>      | <b>Bulk density (kg/m<sup>3</sup>)</b> | <b>Stowage factor (m<sup>3</sup>/t)</b> |
| 2 mm to 4 mm                 | Not applicable              | 813 to 909                             | 1.10 to 1.23                            |
| <b>Hazard classification</b> |                             |  |   |
| <b>Class</b>                 | <b>Subsidiary hazard(s)</b> | <b>MHB</b>                             | <b>Group</b>                            |
| Not applicable               | Not applicable              | Not applicable                         | C                                       |

### **Hazard**

No special hazards.

This cargo is hygroscopic and will cake if wet.

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

### **Stowage and segregation**

No special requirements.

### **Hold cleanliness**

Clean and dry as relevant to the hazards of the cargo.

### **Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### **Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### **Precautions**

Hold trimming plates and tank tops shall be lime-washed to prevent corrosion.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

Moisture from condensation, cargo heating or leaking hatchcovers may cause formation of phosphoric or phosphorous acid, which may cause corrosion to steelwork. After the completion of loading of this cargo, the hatches of the cargo spaces shall be sealed, as necessary. This cargo will decompose burlap or canvas cloth covering bilge wells.

### **Discharge**

If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### **Clean-up**

After discharge of this cargo, particular attention shall be given to bilge wells of the cargo spaces.

## SYNTHETIC CALCIUM FLUORIDE

### Description

Odourless white-light brown material containing up to 70-80% calcium fluoride, 5-10% aluminium fluoride and 10-20% silicon dioxide.

The product consists of large particles and lumps which may break up during transport generating powder.

The product is insoluble in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 30 mm           | Not applicable       | 700 to 900                        | 1.11 to 1.43                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage and segregation

"Separated from" hydrofluoric acid, chlorine fluoride, manganese fluoride and oxygen difluoride.

### Hold cleanliness

No special requirements.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the voyage, the master shall take appropriate actions to prevent cargo shifting and potential capsizing of the ship, and give consideration to seeking emergency entry into a place of refuge.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

## SYNTHETIC SILICON DIOXIDE

### Description

Odourless white powder containing up to 85% silicon dioxide, about 7% aluminium fluoride and up to 8% crystal water in dry weight.

The product has very low solubility in water.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 0.1 mm          | Approximately 40°    | 300 to 500                        | 2.00 to 3.33                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage and segregation

"Separated from" hydrofluoric acid, chlorine fluoride, manganese fluoride and oxygen difluoride.

### Hold cleanliness

No special requirements.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code.

**Precautions**

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo.

Due consideration shall be given to protect equipment from the dust of the cargo.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## TACONITE PELLETS

### Description

Ore. Grey, round steel pellets. Moisture: 2%.

### Characteristics

| Physical properties          |                      |                                   |                                    |
|------------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                         | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Pellets up to 15 mm diameter | Not applicable       | 599 to 654                        | 1.53 to 1.67                       |
| Hazard classification        |                      |                                   |                                    |
| Class                        | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable               | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## TALC

### Description

Talc is an extremely soft, whitish, green or greyish natural hydrated magnesium silicate. It has a characteristic soapy or greasy feel.

### Characteristics

| Physical properties        |                      |                                   |                                    |
|----------------------------|----------------------|-----------------------------------|------------------------------------|
| Size                       | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powdery up to 100 mm lumps | Not applicable       | 1,370 to 1,563                    | 0.64 to 0.73                       |
| Hazard classification      |                      |                                   |                                    |
| Class                      | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable             | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## TANKAGE

### Description

The dried sweeping of animal matter from slaughterhouse floors. Very dusty.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | -                                 | -                                  |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | SH and/or OH                      | B                                  |

### Hazard

Subject to spontaneous heating and possible ignition. Possibly infectious.

### Stowage and segregation

Segregation as required for class 4.2 materials.

"Separated by a complete compartment or hold from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

Do not load if the temperature is above 38°C.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

The temperature of this cargo shall be measured daily during the voyage. The results of measurements shall be recorded to check possible self-heating.

### Discharge

No special requirements.

### Clean-up

No special requirements.



**Emergency procedures**

**Special emergency equipment to be carried**

Self-contained breathing apparatus.

**Emergency procedures**

Wear self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.

Use full protective clothing in case of fire situation.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## TAPIOCA

### Description

Dry, dusty mixture of powder and granules.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Powder and granules   | 32°                  | 735                               | 1.36                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

May heat spontaneously with oxygen depletion in the cargo space.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## TITANOMAGNETITE SAND

### Description

Titanomagnetite sand has a nominal iron content of 57%.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 0.4 mm          | Not applicable       | 2,740 to 2,820                    | 0.35 to 0.36                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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

Cargo shall be trimmed to avoid steep surfaces of cargo that could collapse during voyage. As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Bilge wells shall be clean, dry and covered to prevent ingress of the cargo. Bilge covers shall not significantly degrade the capacity or operation of the bilge system. Bilges shall be sounded and pumped out, as necessary, throughout the voyage.

**Ventilation**

No special requirements.

**Carriage**

Unless this cargo is carried in a ship complying with the requirements in 7.3.2 of this Code, the appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

After discharge of this cargo, the bilge wells shall be checked and any blockage shall be removed. If the ship is fitted with a de-watering system of the cargo spaces, after discharge of this cargo, the system shall be checked and any blockage in the systems shall be removed.

## UREA

### Description

White, granular and odourless. Moisture content is less than 1%. Hygroscopic.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 1 mm to 4 mm          | 28° to 45°           | 645 to 855                        | 1.17 to 1.56                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

This cargo is hygroscopic and will cake if wet.

Urea (either pure or impure) may, in the presence of moisture, damage paintwork or corrode steel.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### Carriage

No special requirements.

### Discharge

Urea is hygroscopic and may cake in overhangs, impairing safety during discharge. If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

### Clean-up

After discharge of this cargo, the cargo spaces shall be swept, washed out and dried.

## VANADIUM ORE

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 1,786                             | 0.56                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | TX                                | B                                  |

### Hazard

Dust may be toxic.

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

### Stowage and segregation

Segregation as required for class 6.1 materials.

"Separated from" foodstuffs.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Exposure of persons to dust shall be minimized.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Self-contained breathing apparatus.

**Emergency procedures**

Wear self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.

Exclusion of air may be sufficient to control fire.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## VERMICULITE

### Description

A mineral of the mica group. Grey. Average moisture: 6% to 10%. May give off dust.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 3 mm                  | Not applicable       | 730                               | 1.37                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

Prior to loading, a certificate based on test shall be provided by the manufacturer or shipper stating that the asbestos content is less than 1%.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.



## WHITE QUARTZ

### Description

99.6% silica content.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Lumps up to 150 mm    | Not applicable       | 1,639                             | 0.61                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

No special requirements.

### Ventilation

No special requirements.

### Carriage

No special requirements.

### Discharge

No special requirements.

### Clean-up

No special requirements.

## WOODCHIPS

### Description

Natural timber mechanically chipped into the approximate size of a business card.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| As above              | Not applicable       | 326                               | 3.07                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | CB                                | B                                  |

### Hazard

This material possesses a chemical hazard. Some shipments may be subject to oxidation leading to depletion of oxygen and increase of carbon dioxide in cargo and adjacent spaces. With moisture content of 15% or more this cargo has a low fire risk. As the moisture content decreases, the fire risk increases. When dry, woodchips can be easily ignited by external sources; are readily combustible and can ignite by friction. A condition with complete depletion of oxygen may be present in less than 48 hours.

### Stowage and segregation

Segregation as for class 4.1 materials.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Entry of personnel into cargo and adjacent confined spaces shall not be permitted until tests have been carried out and it has been established that the oxygen level is 20.7%. If this condition is not met, additional ventilation shall be applied to the cargo hold or adjacent enclosed spaces and re-measuring shall be conducted after a suitable interval.

An oxygen meter shall be worn and activated by all crew when entering cargo and adjacent enclosed spaces.

In dry weather, dust which settles on deck will dry out quickly and is easily ignited. Appropriate precautions shall be taken to prevent fire.

### Ventilation

Ventilation of enclosed spaces adjacent to a cargo hold before entry may be necessary even if these spaces are apparently sealed from the cargo hold.

### Carriage

No special requirements.

### Discharge

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Self-contained breathing apparatus and oxygen meters should be available.

**Emergency procedures**

Nil

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.  
Exclusion of air may be sufficient to control fire.

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## WOOD PELLETS CONTAINING ADDITIVES AND/OR BINDERS

### Description

The wood pellets covered by this schedule are those containing additives and/or binders. These wood pellets are light blond to dark brown in colour; very hard and cannot be easily squashed; have a typical specific density between 1,100 to 1,700 kg/m<sup>3</sup>. Wood pellets are made of sawdust, planer shavings and other wood waste such as bark coming out of the lumber manufacturing processes. The raw material is fragmented, dried and extruded into pellet form using appropriate additives and/or binders. The raw material is compressed to approximately one-third of its original volume. The finished wood pellets typically have a moisture content of 4% to 8%. Wood pellets are used as a fuel in district heating and electrical power generation as well as a fuel for small space heaters such as stoves and fireplaces.

Wood pellets are also used as animal bedding due to the absorption characteristics. Such wood pellets typically have a moisture content of 8% to 10%.

For wood pellets not containing any additives and/or binders see separate schedule.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Cylindrical with<br>Diameter:<br>3 mm to 12 mm<br>Length: 10 to 20 mm | Approximately 30°    | 600 to 750                        | 1.33 to 1.67                       |
| Hazard classification   |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | WF                                | B                                  |

### Hazard

Shipments are subject to oxidation leading to depletion of oxygen and increase of carbon monoxide and carbon dioxide in cargo and communicating spaces (also see Weather precautions).

Swelling if exposed to moisture. Wood pellets may ferment over time if moisture content is over 15%, leading to generation of asphyxiating and flammable gases which may cause spontaneous combustion.

Handling of wood pellets may cause dust to develop. Risk of explosion at high dust concentration.

### Stowage and segregation

Segregate as for class 4.1 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed. There is a high risk of renewed oxygen depletion and carbon monoxide formation in previously ventilated adjacent spaces after closure of the hatch covers.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Entry of personnel into cargo and adjacent confined spaces shall not be permitted until tests have been carried out and it has been established that the oxygen content and carbon monoxide levels have been restored to the following levels: oxygen 21% and carbon monoxide < 100 ppm. If these conditions are not met, additional ventilation shall be applied to the cargo hold or adjacent confined spaces and re-measuring shall be conducted after a suitable interval.

An oxygen and carbon monoxide meter shall be worn and activated by all crew when entering cargo and adjacent enclosed spaces.

**Ventilation**

Ventilation of enclosed spaces adjacent to a cargo hold before entry may be necessary even if these spaces are apparently sealed from the cargo hold.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus and combined or individual oxygen and carbon monoxide meters should be available.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.<br/>Exclusion of air may be sufficient to control fire.<br/>Extinguish fire with carbon dioxide, foam or water.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## WOOD PELLETS NOT CONTAINING ANY ADDITIVES AND/OR BINDERS

### Description

The wood pellets covered by this schedule are those not containing any additives and/or binders. These wood pellets are light blond to dark brown in colour; very hard and cannot be easily squashed; have a typical specific density between 1,100 to 1,700 kg/m<sup>3</sup>. The wood pellets are made of sawdust, planer shavings and other wood waste such as bark coming out of the lumber manufacturing processes. The raw material is fragmented, dried and extruded into pellet form. The raw material is compressed to approximately one-third of its original volume. The finished wood pellets typically have a moisture content of 4% to 8%. Wood pellets are used as a fuel in district heating and electrical power generation as well as a fuel for small space heaters such as stoves and fireplaces.

Wood pellets are also used as animal bedding due to the absorption characteristics. Such wood pellets typically have a moisture content of 8% to 10%.

For wood pellets containing additives and/or binders see separate schedule.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Cylindrical with<br>Diameter:<br>3 mm to 12 mm<br>Length:<br>10 mm to 20 mm | Approximately 30°    | 600 to 750                        | 1.33 to 1.67                       |
| Hazard classification   |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | OH                                | B                                  |

### Hazard

Shipments are subject to oxidation leading to depletion of oxygen and increase of carbon monoxide and carbon dioxide in cargo and communicating spaces (also see "Weather precautions").

Swelling if exposed to moisture. Wood pellets may ferment over time if moisture content is over 15%, leading to generation of asphyxiating and flammable gases but gas concentrations do not reach flammable levels. This cargo has a low fire risk.

Handling of wood pellets may cause dust to develop. Risk of explosion at high dust concentration.

### Stowage and segregation

Segregate as for class 4.1 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

**Weather precautions**

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed. There is a high risk of renewed oxygen depletion and carbon monoxide formation in previously ventilated adjacent spaces after closure of the hatch covers.

**Loading**

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

**Precautions**

Entry of personnel into cargo and adjacent confined spaces shall not be permitted until tests have been carried out and it has been established that the oxygen content and carbon monoxide levels have been restored to the following levels: oxygen 21% and carbon monoxide < 100 ppm. If these conditions are not met, additional ventilation shall be applied to the cargo hold or adjacent confined spaces and re-measuring shall be conducted after a suitable interval.

An oxygen and carbon monoxide meter shall be worn and activated by all crew when entering cargo and adjacent enclosed spaces.

**Ventilation**

Ventilation of enclosed spaces adjacent to a cargo hold before entry may be necessary even if these spaces are apparently sealed from the cargo hold.

**Carriage**

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|  |
|--|
| <p><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus and combined or individual oxygen and carbon monoxide meters should be available.</p>   |
| <p><b>Emergency procedures</b><br/>Nil</p>   |
| <p><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.<br/>Exclusion of air may be sufficient to control fire.<br/>Extinguish fire with carbon dioxide, foam or water.</p> |
| <p><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p>  |

## Wood Products – General

(see Bulk Cargo Shipping Names below)

**LOGS**            **PULP WOOD**  
**TIMBER**        **ROUNDWOOD**  
**SAW LOGS**

### Description

This schedule only applies to wood products transported in bulk, i.e. loaded and discharged by such means as elevator or grab and which are not specifically referred to in a separate schedule.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| -                     | Not applicable       | 250 to 500                        | 2.00 to 4.00                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       |                                   | B                                  |

### Hazard

These cargoes are liable to cause oxygen depletion and increase of carbon dioxide in the cargo space and adjacent spaces.

These cargoes are non-combustible or have a low fire risk.

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

No special requirements.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Entry of personnel into cargo and adjacent confined spaces shall not be permitted until tests have been carried out and it has been established that the oxygen level is 21%. If this condition is not met, additional ventilation shall be applied to the cargo hold or adjacent enclosed spaces and remeasuring shall be conducted after a suitable interval.

An oxygen meter shall be worn and activated by all crew when entering cargo and adjacent enclosed spaces.

### Ventilation

Ventilation of enclosed spaces adjacent to a cargo hold before entry may be necessary even if these spaces are apparently sealed from the cargo hold.

### Carriage

No special requirements.



**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

**Special emergency equipment to be carried**

Self-contained breathing apparatus and an oxygen meter should be available.

**Emergency procedures**

Nil

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if fitted.

Exclusion of air may be sufficient to control fire.

**Medical first aid**

Refer to the *Medical First Aid Guide (MFAG)*, as amended.

## WOOD TORREFIED

### Description

Wood torrefied is wood that has been partially burned or roasted and formed into pellets or briquettes. Chocolate brown or black in colour. May contain up to 3% binder.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|---|----------------------|-----------------------------------|------------------------------------|
| Size  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Pellets with a diameter of 6 mm to 12 mm. Briquettes with a thickness of 12 mm to 50 mm and a length and width up to 75 mm. | 35° or less          | 650 to 800                        | 1.25 to 1.54                       |
| Hazard classification   |                      |                                   |                                    |
| Class   | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable  | Not applicable       | CB and/or SH and/or CR            | B                                  |

### Hazard

Shipments may be subject to oxidation leading to depletion of oxygen and increase of carbon monoxide and carbon dioxide in cargo and adjacent spaces.

Wood torrefied is readily combustible and may self-heat and spontaneously combust.

Handling of wood torrefied may cause dust to develop with a subsequent risk of dust explosion when loading. Dust may cause eye, skin and respiratory irritation.

### Stowage and segregation

Segregation as for class 4.1 materials.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo, all non-working hatches of the cargo spaces into which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

### Precautions

Entry of personnel into cargo and adjacent confined spaces shall not be permitted until tests have been carried out and it has been established that the oxygen content and carbon monoxide levels have been restored to the following levels: oxygen 20.7% and carbon monoxide < 100 ppm. If these conditions are not met, additional ventilation shall be applied to the cargo hold or adjacent confined spaces and remeasuring shall be conducted after a suitable interval. An oxygen and carbon monoxide meter shall be worn and activated by all crew when entering cargo and adjacent enclosed spaces.

Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

**Ventilation**

Ventilation of enclosed spaces adjacent to a cargo hold before entry may be necessary even if these spaces are apparently sealed from the cargo hold.

**Carriage**

Hatches of the cargo spaces carrying this cargo shall be weathertight to prevent the ingress of water.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

**Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Self-contained breathing apparatus and combined or individual oxygen and carbon monoxide meters should be available.</p>  |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Nil</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Batten down; use ship's fixed fire-fighting installation, if fitted.<br/>Exclusion of air may be sufficient to control fire.<br/>Extinguish fire with carbon dioxide, foam or water.</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide</i> (MFAG), as amended.</p> |

## ZINC ASHES UN 1435

Shipments require the approval of the competent authority of the countries of shipment and the flag State of the ship.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Not applicable        | Not applicable       | 900                               | 1.11                               |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| 4.3                   | Not applicable       |                                   | B                                  |

### Hazard

In contact with moisture or water liable to give off hydrogen, a flammable gas, and toxic gases. This cargo is non-combustible or has a low fire risk.

### Stowage and segregation

"Separated from" foodstuffs and all class 8 liquids.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage. This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code. This cargo shall not be accepted for loading when the cargo is damp or known to have been wetted.

### Precautions

Reject any damp material or any material which is known to have been wetted. Possible ignition sources, including hot work, burning, smoking, electrical sparking, shall be eliminated in the vicinity of the cargo spaces containing this cargo during handling and carriage of this cargo.

### Ventilation

Continuous mechanical ventilation shall be conducted during the voyage for the cargo spaces carrying this cargo. If maintaining ventilation endangers the ship or the cargo, it may be interrupted unless there is a risk of explosion or other danger due to interruption of the ventilation. In any case, mechanical ventilation shall be maintained for a reasonable period prior to discharge.

### Carriage

For quantitative measurements of hydrogen, a suitable detector shall be on board while this cargo is carried. The detector shall be of certified safe type for use in explosive atmosphere. The concentration of hydrogen in the cargo spaces carrying this cargo shall be measured regularly, during the voyage, and the results of the measurements shall be recorded and kept on board.

### Discharge

No special requirements.

**Clean-up**

After discharge of this cargo, the cargo spaces shall be swept clean twice. Water shall not be used for cleaning of the cargo space which has contained this cargo, because of danger of gas.

**Emergency procedures**

**Special emergency equipment to be carried**

Protective clothing (gloves, boots, coveralls and headgear).  
Self-contained breathing apparatus.

**Emergency procedures**

Wear protective clothing and self-contained breathing apparatus.

**Emergency action in the event of fire**

Batten down; use ship's fixed fire-fighting installation, if available.  
**Do not use water.**

**Medical first aid**

Refer to the *Medical First Aid Guide* (MFAG), as amended.

## ZINC OXIDE ENRICHED FLUE DUST

### Description

This cargo, also named waelz oxide, is an odourless fine powder that aggregates into lumps. Its colour could be light brown or greyish yellow/greyish green. The main constituent is zinc oxide. Secondary constituents are lead oxides.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 10 mm           | Not applicable       | 2,150 to 2,400                    | 0.42 to 0.47                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | TX                                | A and B                            |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

The dust of the cargo is harmful and may cause long-term health effects.

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

### Stowage and segregation

"Separated from" foodstuffs.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When a cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution.

Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### **Precautions**

Exposure of persons to dust of the cargo shall be minimized. Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells shall be clean, dry and covered as appropriate to prevent ingress of the cargo. Persons who may be exposed to the dust of the cargo shall wear gloves, goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### **Ventilation**

The cargo spaces carrying this cargo shall not be ventilated during voyage.

### **Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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**

Prior to washing out the residues of this cargo, the decks and the cargo spaces shall be shovelled and swept clean, because washing out of this cargo is difficult.

### **Emergency procedures**

|   |
|---|
| <p style="text-align: center;"><b>Special emergency equipment to be carried</b><br/>Protective clothing (gloves, boots, coveralls and dust filter masks).<br/>Self-contained breathing apparatus.</p>   |
| <p style="text-align: center;"><b>Emergency procedures</b><br/>Wear protective clothing and self-contained breathing apparatus.</p> <p style="text-align: center;"><b>Emergency action in the event of fire</b><br/>Nil</p> <p style="text-align: center;"><b>Medical first aid</b><br/>Refer to the <i>Medical First Aid Guide (MFAG)</i>, as amended.</p> |

## ZINC SLAG

### Description

Residue generated from zinc smelting process. This cargo is highly permeable and pore water of this cargo drains quickly. It is black or red-brown in colour and either granular or lump.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Up to 10 mm           | Not applicable       | 1,500 to 2,500                    | 0.40 to 0.67                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code. This cargo is abrasive.

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 ship complying with the requirements in 7.3.2 of this Code, 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 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

This cargo shall be trimmed to ensure that the height difference between peaks and troughs does not exceed 5% of the ship's breadth and that the cargo slopes uniformly from the hatch boundaries to the bulkheads to avoid steep surfaces of cargo that could collapse during voyage.

When the stowage factor of this cargo is equal to or less than 0.56 m<sup>3</sup>/t, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight



distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Appropriate action shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear protective clothing, goggles or other equivalent dust eye-protection and dust filter masks, as necessary.

**Ventilation**

No special requirements.

**Carriage**

Bilge water shall be removed regularly during the voyage.

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## ZIRCON KYANITE CONCENTRATE

### Description

Zircon kyanite concentrate is an odourless and tasteless off-white to brown mixture of the heavy mineral sand processing waste stream (concentrate) and zircon sand. It is used for upgrading mineral sand products such as zircon and kyanite. It is a very heavy cargo.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| Fine particles        | Not applicable       | 2,400 to 3,000                    | 0.33 to 0.42                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | A                                  |

### Hazard

This cargo may liquefy if shipped at a moisture content in excess of its transportable moisture limit (TML). See sections 7 and 8 of this Code.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

Clean and dry as relevant to the hazards of the cargo.

### Weather precautions

When this cargo is carried in a ship other than a ship complying with the requirements in 7.3.2 of this Code, 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 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 this Code. As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

**Precautions**

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo. The bilge system of a cargo space to which this cargo is to be loaded shall be tested to ensure it is working.

**Ventilation**

No special requirements.

**Carriage**

The appearance of the surface of this cargo shall be checked regularly during the voyage. If free water above the cargo or fluid state of the cargo is observed during the 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.

## ZIRCONSAND

### Description

Usually fine white to yellow, very abrasive extracted from ilmenite sand. May be dusty. Shipped dry.

### Characteristics

| Physical properties   |                      |                                   |                                    |
|-----------------------|----------------------|-----------------------------------|------------------------------------|
| Size                  | Angle of repose      | Bulk density (kg/m <sup>3</sup> ) | Stowage factor (m <sup>3</sup> /t) |
| 0.15 mm or less       | Not applicable       | 2,600 to 3,000                    | 0.33 to 0.36                       |
| Hazard classification |                      |                                   |                                    |
| Class                 | Subsidiary hazard(s) | MHB                               | Group                              |
| Not applicable        | Not applicable       | Not applicable                    | C                                  |

### Hazard

No special hazards.

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

### Stowage and segregation

No special requirements.

### Hold cleanliness

No special requirements.

### Weather precautions

This cargo shall be kept as dry as practicable before loading, during loading and during voyage.

This cargo shall not be loaded during precipitation. During loading of this cargo, all non-working hatches of the cargo spaces to which this cargo is loaded, or to be loaded, shall be closed.

### Loading

Trim in accordance with the relevant provisions required under sections 4 and 5 of this Code.

As the density of the cargo is extremely high, the tank top may be overstressed unless the cargo is evenly spread across the tank top to equalize the weight distribution. Due consideration shall be given to ensure that the tank top is not overstressed during the voyage and during loading by a pile of the cargo.

### Precautions

Bilge wells shall be clean, dry and covered as appropriate, to prevent ingress of the cargo.

Appropriate precautions shall be taken to protect machinery and accommodation spaces from the dust of the cargo. Bilge wells of the cargo spaces shall be protected from ingress of the cargo. Due consideration shall be given to protect equipment from the dust of the cargo. Persons who may be exposed to the dust of the cargo shall wear goggles or other equivalent dust eye-protection and dust filter masks. Those persons shall wear protective clothing, as necessary.

### Ventilation

No special requirements.

### Carriage

No special requirements.

**Discharge**

No special requirements.

**Clean-up**

No special requirements.

## APPENDIX 2

### LABORATORY TEST PROCEDURES, ASSOCIATED APPARATUS AND STANDARDS

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

Six methods of testing for the transportable moisture limit are currently in general use:

- .1 flow table test;
- .2 penetration test; and
- .3 Proctor/Fagerberg test.

As each method has its advantages, the selection of the test method should be determined by local practices or by the appropriate authorities.

- .4 Modified Proctor/Fagerberg test procedure for iron ore fines;
- .5 Modified Proctor/Fagerberg test procedure for coal; and
- .6 Modified Proctor/Fagerberg test procedure for bauxite.

#### 1.1 Flow table test procedure

##### 1.1.1 *Scope*

The flow table is generally suitable for mineral concentrates or other fine material with a maximum grain size of 1 mm. It may also be applicable to materials with a maximum grain size up to 7 mm. It will not be suitable for materials coarser than this and may also not give satisfactory results for some materials with high clay content. If the flow table test is not suitable for the material in question, the procedures to be adopted should be those approved by the authority of the port State.

The test described below provides for determination of:

- .1 the moisture content of a sample of cargo, hereinafter referred to as the test material;
- .2 the flow moisture point (FMP) of the test material under impact or cyclic forces of the flow table apparatus; and
- .3 the transportable moisture limit of the test material.

##### 1.1.2 *Apparatus (see figure 1.1.2)*

- .1 Standard flow table and frame (ASTM Designation (C230-68) – see 3).
- .2 Flow table mounting (ASTM Designation (C230-68) – see 3).
- .3 Mould (ASTM Designation (C230-68) – see 3).

- .4 Tamper (see figure 1.1.2.4): the required tamping pressure may be achieved by using calibrated, spring-loaded tampers (examples are included in figure 1.1.2.4) or some other suitable design of tamper that allows a controlled pressure to be applied via a 30 mm diameter tamper head.
- .5 Scales and weights (ASTM Designation (C109-73) – see 3) and suitable sample containers.
- .6 Glass graduated measuring cylinder and burette having capacities of 100-200 ml and 10 ml, respectively.
- .7 A hemispherical mixing bowl approximately 30 cm diameter, rubber gloves and drying dishes or pans. Alternatively, an automatic mixer of similar capacity can be used for the mixing operations. In this case, care should be exercised to ensure that the use of such a mechanical mixer does not reduce the particle size or consistency of the test material.
- .8 A drying oven with controlled temperature up to approximately 110°C. This oven should be without air circulation.



Figure 1.1.2 – Flow table and accessory apparatus

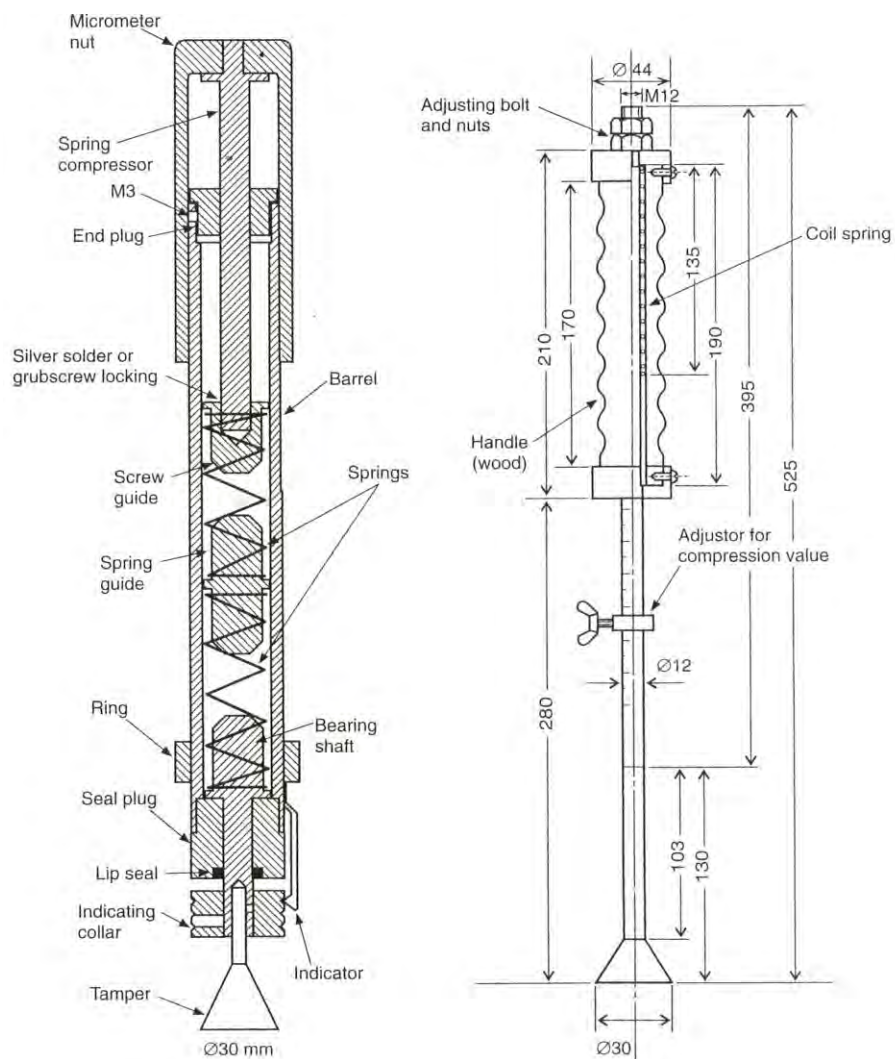


Figure 1.1.2.4 – Examples of spring-loaded tampers



### 1.1.3 *Temperature and humidity*

It is preferable to work in a room where the samples will be protected from excessive temperatures, air currents and humidity variations. All phases of the material preparation and testing procedure should be accomplished in a reasonable space of time to minimize moisture losses and, in any event, within the day of commencement. Where possible, sample containers should be covered with plastic film or other suitable cover.

### 1.1.4 *Procedure*

The quantity of material required for a flow moisture test will vary according to the specific gravity of the material to be tested. It will range from approximately 2 kg for coal to 3 kg for mineral concentrates. It should be collected as a representative sample of the cargo being shipped. Experience has shown that more accurate test results will be obtained by ensuring that the moisture content of the test sample is increased rather than decreased towards the FMP.

Consequently, it is recommended that a preliminary flow moisture test should be conducted, generally in accordance with the following, to indicate the condition of the test sample, i.e. the quantity of water and the rate at which it is to be added or whether the sample should be air-dried to reduce its moisture content before commencing the main flow moisture test.

#### 1.1.4.1 *Preparation of the test sample*

The representative sample of test material is placed in the mixing bowl and thoroughly mixed. Three subsamples (A), (B) and (C) are removed from the mixing bowl as follows: about one fifth of the sample (A) should be immediately weighed and placed in the drying oven to determine the moisture content of the sample "as-received". Two further subsamples, each of about two fifths of the gross weight, should then be taken, one (B) for the preliminary FMP test and the other (C) for the main FMP determination:

- .1 *Filling the mould.* The mould is placed on the centre of the flow table and filled in three stages with the material from the mixing bowl. The first charge, after tamping, should aim to fill the mould to approximately one third of its depth. The quantity of sample required to achieve this will vary from one material to another, but can readily be established after some experience has been gained of the packing characteristics of the material being tested.

The second charge, after tamping, should fill the mould to about two thirds of its depth and the third and final charge, after tamping, should reach to just below the top of the mould (see figure 1.1.4-2).

- .2 *Tamping procedure.* The aim of tamping is to attain a degree of compaction similar to that prevailing at the bottom of a shipboard cargo of the material being tested. The correct pressure to be applied is calculated from:

$$\text{Tamping pressure (Pa)} = \text{Bulk density of cargo (kg/m}^3\text{)} \\ \times \text{Maximum depth of cargo (m)} \\ \times \text{Gravity acceleration (m/s}^2\text{)}$$

Bulk density can be measured by a single test, using the Proctor C apparatus described in ASTM Standard D-698 or JIS-A-1210, on a sample of the cargo at the proposed moisture content of loading.

When calculating the tamping pressure, if no information concerning cargo

depth is available the maximum likely depth should be used.

Alternatively, the pressure may be estimated from table 1.1.4.1.

The number of tamping actions (applying the correct, steady pressure each time) should be about 35 for the bottom layer, 25 for the middle and 20 for the top layer, tamping successively over the area completely to the edges of the sample to achieve a uniformly flat surface for each layer.

- .3 *Removal of the mould.* The mould is tapped on its side until it becomes loose, leaving the sample in the shape of a truncated cone on the table.

**Table 1.1.4.1**

| Typical cargo        | Bulk density (kg/m <sup>3</sup> ) | Maximum cargo depth       |            |            |              |
|----------------------|-----------------------------------|---------------------------|------------|------------|--------------|
|                      |                                   | 2 m                       | 5 m        | 10 m       | 20 m         |
|                      |                                   | ← Tamper pressure (kPa) → |            |            |              |
| Coal                 | 1,000                             | 20 (1.4)                  | 50 (3.5)   | 100 (7.1)  | 200 (14.1)   |
|                      | 2,000                             | 40 (2.8)                  | 100 (7.1)  | 200 (14.1) | 400 (28.3)   |
| Metal ore            | 3,000                             | 60 (4.2)                  | 150 (10.6) | 300 (21.2) | 600 (42.4)   |
|                      | 4,000                             | 80 (5.7)                  | 200 (14.1) | 400 (28.3) | 800 (56.5)   |
| Lead ore concentrate | 5,000                             | 100 (7.1)                 | 250 (17.7) | 500 (35.3) | 1,000 (70.7) |

(values in parenthesis are equivalent kgf when applied via a 30 mm diameter tamper head)

1.1.4.2 *The preliminary flow moisture test*

- .1 Immediately after removing the mould, the flow table is raised and dropped up to 50 times through a height of 12.5 mm at a rate of 25 times per min. If the material is below the FMP, it usually crumbles and bumps off in fragments with successive drops of the table (see figure 1.1.4-3).
- .2 At this stage, the flow table is stopped and the material returned to the mixing bowl, where 5-10 ml of water, or possibly more, is sprinkled over the surface and thoroughly mixed into the material, either with rubber-gloved fingers or an automatic mixer.

The mould is again filled and the flow table is operated as described in 1.1.4.2.1 for up to 50 drops. If a flow state is not developed, the process is repeated with further additions of water until a flow state has been reached.

- .3 *Identification of a flow state.* The impacting action of the flow table causes the grains to rearrange themselves to produce compaction of the mass. As a result, the fixed volume of moisture contained in the material at any given level increases as a percentage of the total volume. A flow state is considered to have been reached when the moisture content and compaction

of the sample produce a level of saturation such that plastic deformation occurs. At this stage, the moulded sides of the sample may deform, giving a convex or concave profile (see figure 1.1.4-4).

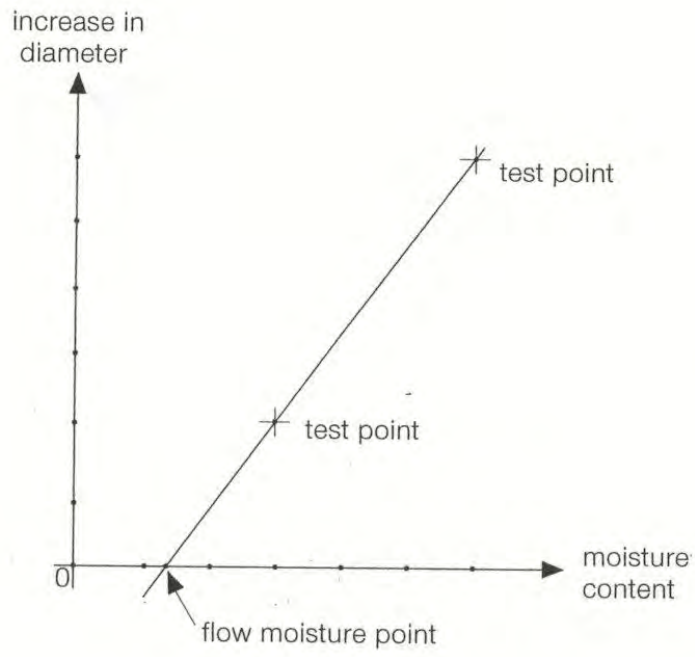
With repeated action of the flow table, the sample continues to slump and to flow outwards. In certain materials, cracks may also develop on the top surface. Cracking, with the appearance of free moisture, is not, however, an indication of development of a flow state. In most cases, measurement of the deformation is helpful in deciding whether or not plastic flow has occurred. A template which, for example, will indicate an increase in diameter of up to 3 mm in any part of the cone is a useful guide for this purpose. Some additional observations may be useful. For example: when the (increasing) moisture content is approaching the FMP, the sample cone begins to show a tendency to stick to the mould. Further, when the sample is pushed off the table, the sample may leave tracks (stripes) of moisture on the table. If such stripes are seen, the moisture content may be above the FMP: the absence of tracks (stripes) is not necessarily an indication of being below the FMP.

Measuring the diameter of the cone, at the base or at half height, will always be useful. By addition of water in increments of 0.4% to 0.5% and applying 25 drops of the flow table, the first diameter increase will generally be between 1 and 5 mm and after a further increment of water the base diameter will have expanded by between 5 and 10 mm.

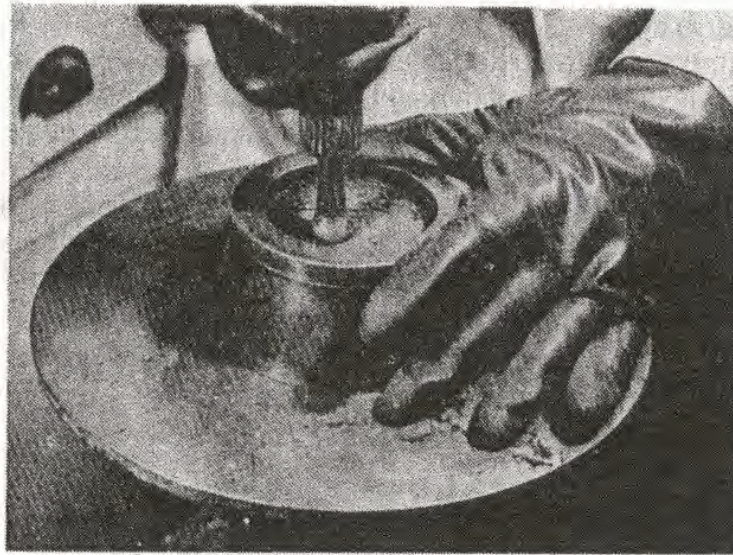
- .4 As an alternative to the procedure described above, for many concentrates a fast way of finding the approximate FMP is as follows:

When the moisture content is definitely beyond the FMP, measure the diameter after 25 drops, repeat the test after adding a further increment of water, measure the diameter and draw a diagram as illustrated in figure 1.1.4-1, showing increase in diameter plotted against moisture content. A straight line drawn through the two points will cross the moisture content axis close to the FMP.

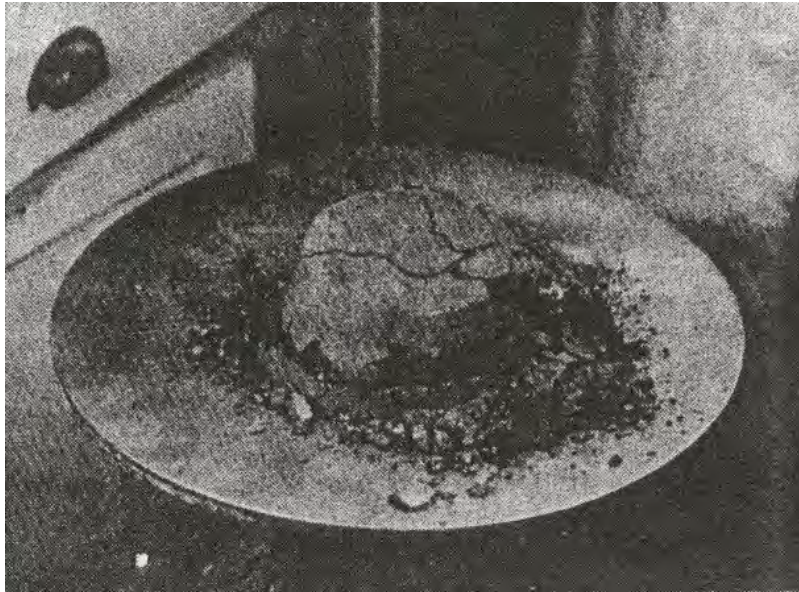
Having completed the preliminary FMP test, the sample for the main test is adjusted to the required level of moisture content (about 1% to 2%) below the flow point.



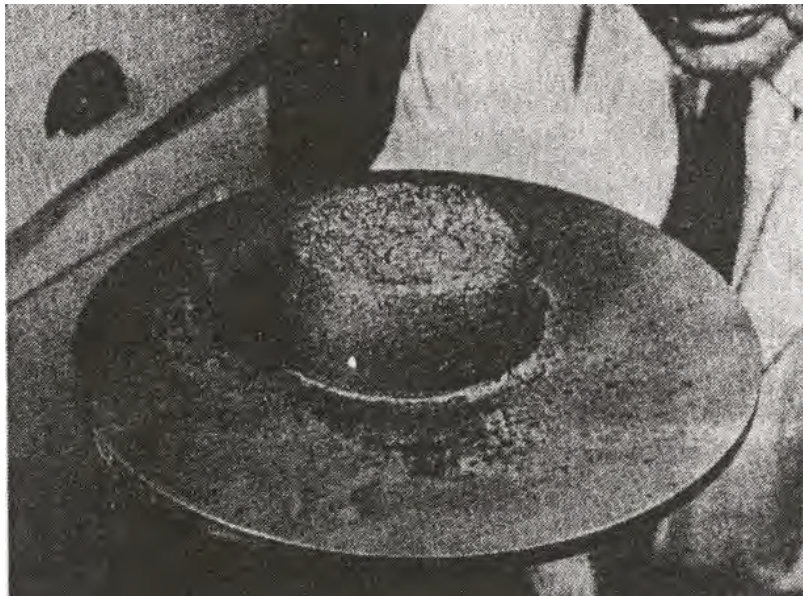
**Figure 1.1.4-1**



**Figure 1.1.4-2**



**Figure 1.1.4-3**



**Figure 1.1.4-4**

#### 1.1.4.3 *Main flow moisture test*

When a flow state has been reached in the preliminary test, the moisture content of subsample (C) is adjusted to about 1% to 2% less than the last value which did not cause flow in the preliminary test (this is suggested simply to avoid starting the main test too close to the FMP and then having to waste time air-drying it and starting again). The final test is then carried out on this adjusted sample in the same manner as for the preliminary test, but in this case with the addition of water in increments of no more than 0.5% of the mass of the test material (the lower the "preliminary" FMP, the smaller the increments should be). After each stage, the whole moulded sample should be placed in a container, weighed immediately and retained for moisture determination if required. This will be necessary if the sample flowed or if the next, slightly wetter, sample flows. If not required, it may be returned to the mixing bowl.

When a flow state has been reached, the moisture content should be determined on two samples, one with moisture content just above the FMP and the other with moisture content just below the FMP. The difference between the two values should then be 0.5% or less, and the FMP is taken as the mean of these two values.

#### 1.1.4.4 *Determination of moisture content*

##### *Introduction*

It should be noted that, for many materials, there are recognized international and national methods for determining moisture content. These methods, or ones that have been established to give equivalent results, should be followed.

##### *Concentrates and similar materials*

It is clearly important that the samples should be dried to a constant mass. In practice, this is ascertained after a suitable drying period at 105°C by weighing the sample successively with an interval of several hours elapsing. If the mass remains constant, drying has been completed, whereas if the mass is still decreasing, drying should be continued.

The length of the drying period depends upon many variables, such as the disposition of the material in the oven, the type of container used, the particle size, the rate of heat transfer, etc. It may be that a period of five hours is ample for one concentrate sample, whereas it is not sufficient for another. Sulphide concentrates tend to oxidize, and therefore the use of drying ovens with air circulation systems is not recommended for these materials, nor should the test sample be left in the drying oven for more than four hours.

##### *Coal*

The recommended methods for determination of the moisture content are those described in ISO 589-1974, "Hard Coal – Determination of Total Moisture". This method, or ones that have been established to give equivalent results, should be followed.

##### *Calculation of moisture content, FMP and transportable moisture limit:*

Taking  $m_1$  as the exact mass of the subsample "as-received" (see 1.1.4.1),

Taking  $m_2$  as the exact mass of the "as-received" subsample, after drying,

Taking  $m_3$  as the exact mass of the sample just above the flow state (see 1.1.4.3),

Taking  $m_4$  as the exact mass of the sample just above the flow state, after drying,

Taking  $m_5$  as the exact mass of the sample just below the flow state (see 1.1.4.3),

Taking  $m_6$  as the exact mass of the sample just below the flow state, after drying,

Then:

- .1 The moisture content of the concentrate "as-received" is:

$$\frac{(m_1 - m_2)}{m_1} \times 100, \text{ in per cent} \quad (1.1.4.4.1)$$

- .2 The FMP of the material is:

$$\frac{\frac{(m_3 - m_4)}{m_3} + \frac{m_5 - m_6}{m_5}}{2} \times 100, \text{ in per cent} \quad (1.1.4.4.2)$$

- .3 The transportable moisture limit of the material is 90% of the FMP.

### **Peat moss**

For all peat moss, determine the bulk density, using either the ASTM or CEN (20 L) method.

Peat should be above or below 90 kg/m<sup>3</sup> on a dry weight basis in order to obtain the correct TML.

As indicated in 1.1.1, the following should be determined:

- .1 the moisture content of a sample of cargo (MC);
- .2 the flow moisture point (FMP);
- .3 the transportable moisture limit (TML). The TML will be determined as follows:
  - .3.1 for peat with a bulk density of greater than 90 kg/ m<sup>3</sup> on a dry weight, the TML is 85% of the FMP; and
  - .3.2 for peat with a bulk density of 90 kg/ m<sup>3</sup> or less on a dry weight, the TML is 90% of the FMP.

## **1.2 Penetration test procedure**

The penetration test constitutes a procedure whereby a material in a cylindrical vessel is vibrated. The flow moisture point is determined on the basis of the penetration depth of an indicator.

### **1.2.1 Scope**

- .1 The penetration test is generally suitable for mineral concentrates, similar materials and coals up to a top size of 25 mm.
- .2 In this procedure, the sample, in a cylindrical vessel, is subjected to vertical vibration of 2 *g* rms  $\pm$  10% (*g* = gravity acceleration) for 6 min. When the penetration depth of a bit put on the surface exceeds 50 mm, it is judged that the sample contains a moisture content greater than the flow moisture point.
- .3 This procedure consists of a preliminary test to get an approximate value of the flow moisture point and a main test to determine the accurate flow moisture point. When the approximate value of the flow moisture point is known, the preliminary test can be omitted.
- .4 The room where the samples are tested should be prepared as mentioned in 1.1.3.

1.2.2 Apparatus (see figure 1.2.2)

- .1 The test apparatus consists of:
  - .1 a vibrating table;
  - .2 cylindrical vessels;
  - .3 indicators (penetration bits and a holder);
  - .4 a tamper (see 1.1.2.4); and
  - .5 ancillary equipment (see 1.1.2.5 to .8).
- .2 The vibrator (see figure 1.2.2.2), with a table on which a cylindrical vessel can be clamped, should be capable of exciting a mass of 30 kg at a frequency of either 50 Hz or 60 Hz with an acceleration of 3 g rms or more, and it can be controlled to adjust the acceleration level.
- .3 Dimensions of cylindrical vessels (see figures 1.2.2.3-1 and 1.2.2.3-2) are as follows:

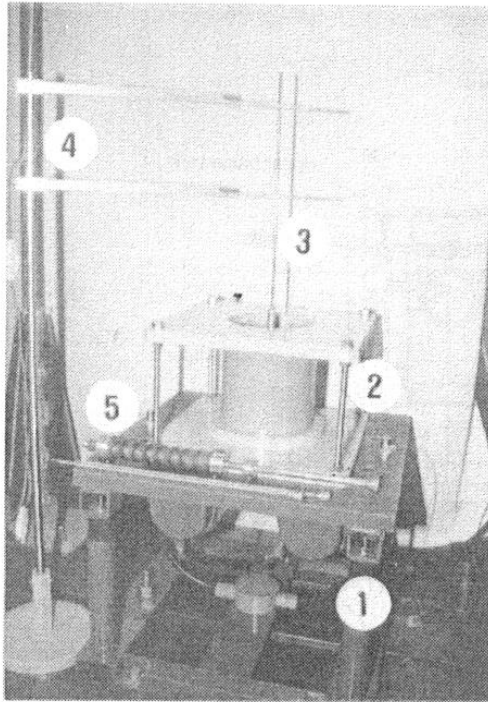
| Cylinder size | Inner diameter | Depth  | Wall thickness  |
|---------------|----------------|--------|-----------------|
| small         | 146 mm         | 202 mm | 9.6 mm or more  |
| large         | 194 mm         | 252 mm | 10.3 mm or more |

The vessels should be made of reasonably rigid, non-magnetic, impermeable and lightweight material such as acrylics or vinyl chloride.

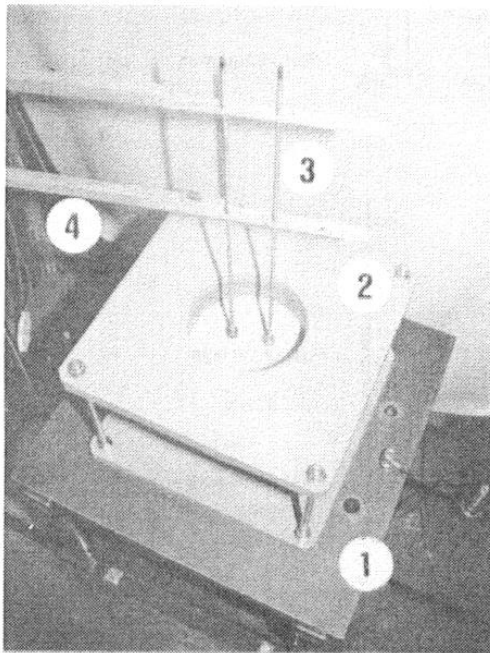
The small cylindrical vessel is selected for the materials having a maximum particle size of 10 mm or less. The large cylindrical vessel is for those having a maximum particle size of 25 mm or less.

- .4 Penetration bits (see figure 1.2.2.4) are made of brass. The mass of the bit for coal should be adjusted to 88 g (5 kPa), and that for concentrates to 177 g (10 kPa). When the sample contains coarse particles, it is recommended that two bits of the same pressure are put on the surface to avoid misjudgment.
- .5 A holder (see figure 1.2.2.5) should be made to guide the rod of a bit with minimum friction to the centre of a cylindrical vessel. When two bits are used, they should be positioned in accordance with figure 1.2.2.
- .6 A cylindrical vessel and penetration indicators should be selected in accordance with the nature and condition of the test sample, namely size of particles and bulk density.





- ① Vibration table
- ② Cylindrical vessel (150 mm diameter)
- ③ Penetration bit (10 kPa)
- ④ Bit holder
- ⑤ Tamper

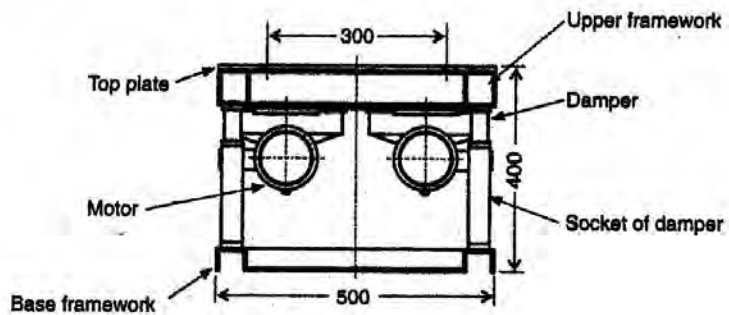


- ① Vibration table
- ② Cylindrical vessel (150 mm diameter)
- ③ Penetration bit (5 kPa)
- ④ Bit holder

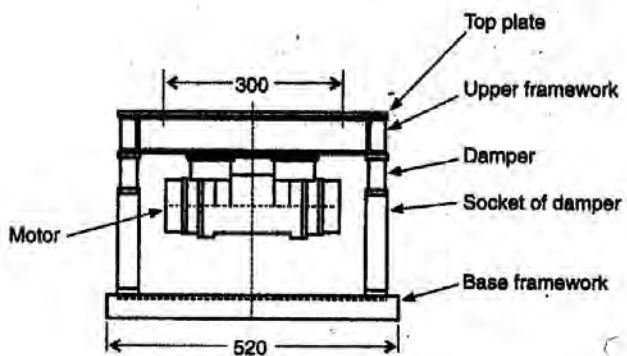
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**Figure 1.2.2 – Test apparatus**

FRONT VIEW



SIDE VIEW



VIEW FROM BASE

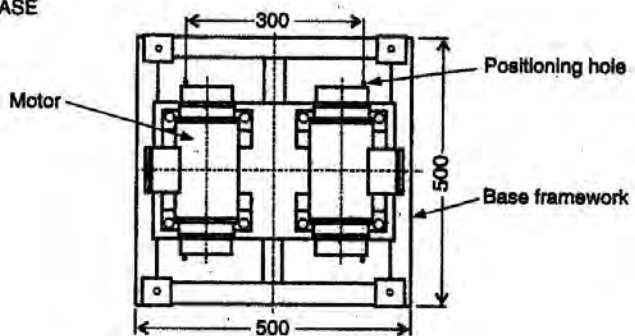


Figure 1.2.2.2 – *Vibration table*

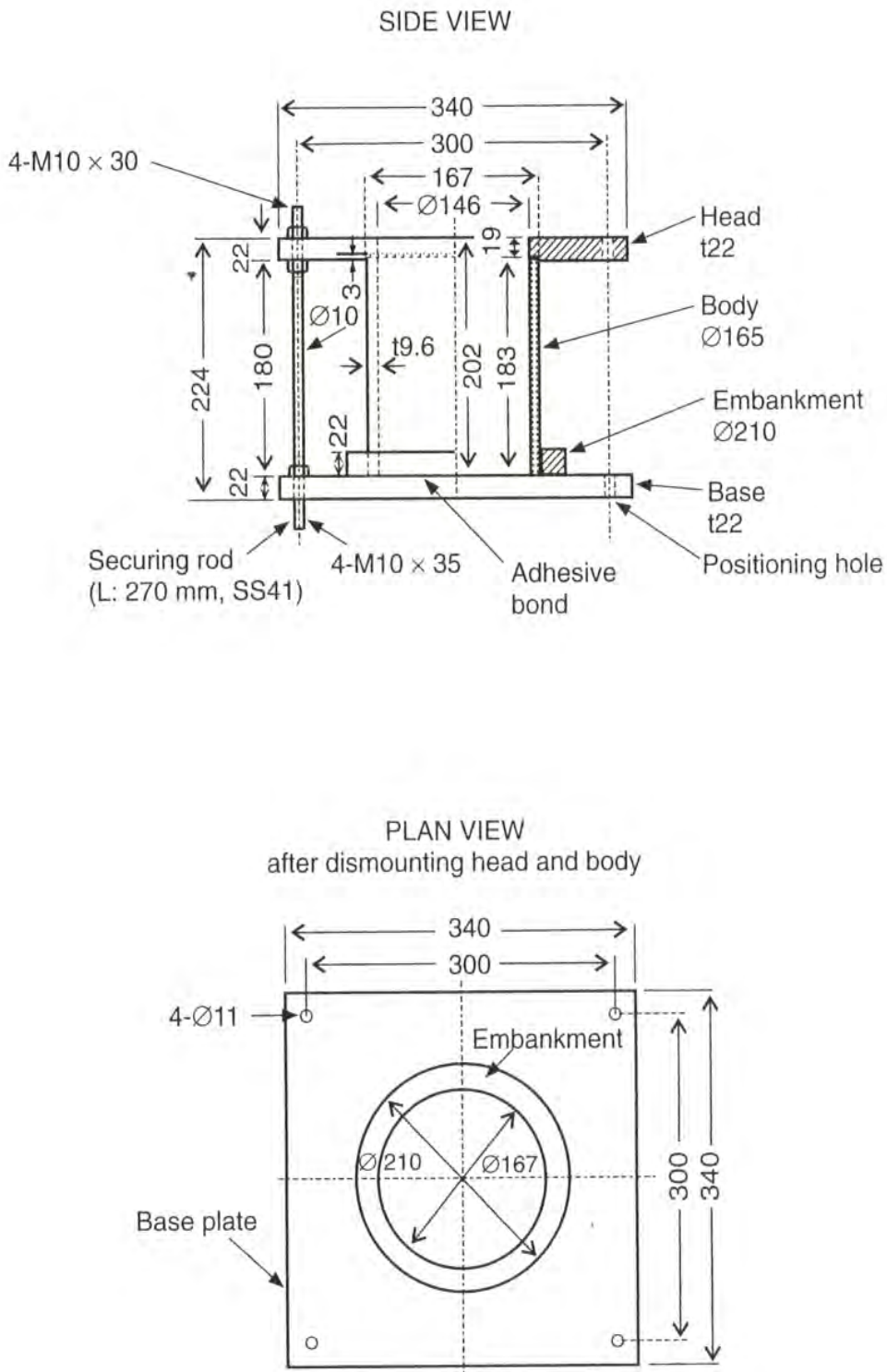
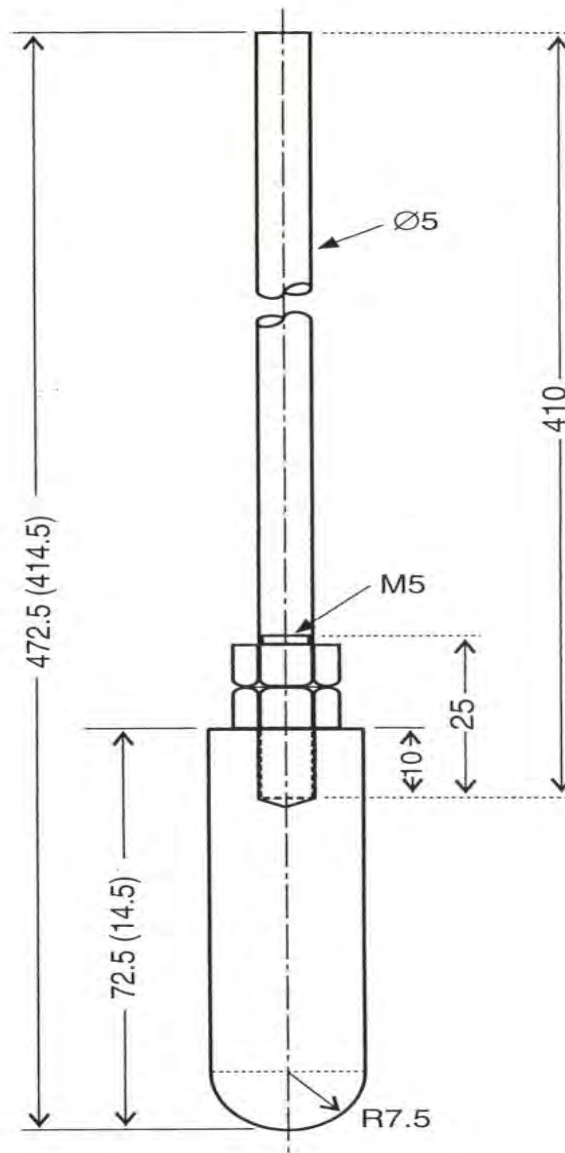


Figure 1.2.2.3-1 – Cylindrical vessel, 150 mm diameter





(Dimensions indicated in brackets are of the 5 kPa bit)  
(unit: mm)

**Figure 1.2.2.4 – Penetration bit**

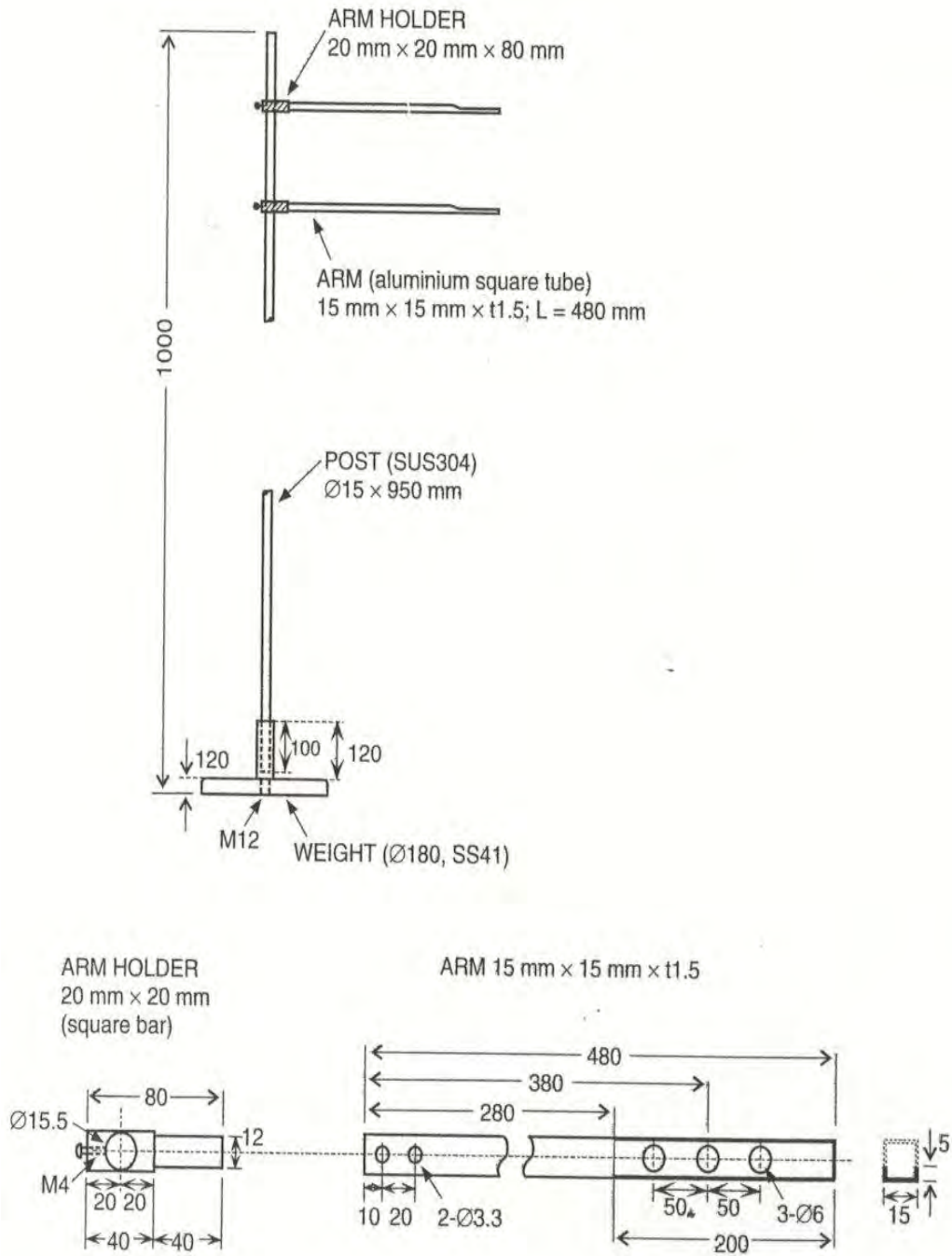


Figure 1.2.2.5 – Bit holder

### 1.2.3 Procedure

#### 1.2.3.1 Preparation of the test sample and the vibrating table

- .1 The quantity of the sample required is approximately six times or more the capacity of the selected cylindrical vessel. The amount of representative test sample with which each container is filled should be as follows: approximately 1,700 cm<sup>3</sup> for the small container, and 4,700 cm<sup>3</sup> for the large container.
- .2 Mix the sample well and divide into three approximately equal sub-samples, namely (A), (B) and (C). The sub-sample (A) should be immediately weighed and placed in the drying oven to determine the moisture content of the sample "as-received".

The sub-samples (B) and (C) are used for the preliminary test and the main test, respectively.
- .3 The vibration level of the vibrating table should be calibrated, using an acceleration meter, prior to carrying out testing. The acceleration of the table should be adjusted to 2 g rms  $\pm$  10% with a container filled with a sample mounted on the table.

#### 1.2.3.2 Preliminary flow moisture test

This test is intended to measure quickly the approximate flow moisture point, using sub-sample (B). Water is added in increments after every penetration test. When a flow state has been reached, the moisture content of the sample just above the flow state is measured. The moisture content of the sample just below the flow state can be calculated by deducting the increment of water last added from the gross mass of the sample.

- .1 Fill the appropriate cylindrical vessel with sub-sample (B) in four distinct stages and tamp after the addition of each layer using a specified tamper. Tamp to a pressure denoted in 1.1.4.1 for mineral concentrates or to 40 kPa for coals, and apply the pressure evenly over the whole surface area of the material until a uniformly flat surface is obtained.
- .2 Place the penetration bit on the surface of the material through the holder.
- .3 Operate the vibrator at a frequency of 50 Hz or 60 Hz with an acceleration of 2 g rms  $\pm$  10% for 6 min. If necessary, the acceleration level should be checked by referring to the output of the acceleration meter attached to the vibrating table.
- .4 After 6 min of vibration, read the depth of penetration.
- .5 When the depth of penetration is less than 50 mm, it is judged that liquefaction did not take place. Then:
  - .1 Remove the material from the cylindrical vessel and replace in the mixing bowl with the remainder of the sample.
  - .2 Mix well and weigh the contents of the mixing bowl.

- .3 Sprinkle an increment of water of not more than 1% of the mass of the material in the bowl and mix well.
- .4 Repeat the procedure described in 1.2.3.2.1 to 1.2.3.2.5.
- .6 When the depth of penetration is greater than 50 mm, it is judged that liquefaction took place. Then:
  - .1 Remove the material from the cylindrical vessel and replace in the mixing bowl.
  - .2 Measure the moisture content in accordance with the procedure described in 1.1.4.4.
  - .3 Calculate the moisture content of the sample just below the flow moisture point on the basis of the amount of water added.
- .7 If the penetration depth in the first attempt exceeds 50 mm, i.e. the sample as-received liquefied, mix subsamples (B) and (C) and dry at room temperature to reduce the moisture. Then, divide the material into two subsamples (B) and (C), and repeat the preliminary test.

#### 1.2.3.3 *The main flow moisture test*

- .1 On the basis of the preliminary test, the main test should be carried out to determine the flow moisture point more accurately.
- .2 Adjust the moisture content of the subsample (C) to the last value, which did not cause flow in the preliminary flow moisture test.
- .3 The first test of the main flow moisture test is carried out on this adjusted sample in the same manner as described in 1.2.3.2. In this case, however, the addition of water in increments should not be more than 0.5% of the mass of the test material.
- .4 When the approximate value of the flow moisture point is known in advance, the moisture content of the subsample (C) is adjusted to approximately 90% of this value.
- .5 When a flow state has been reached, the flow moisture point is determined as described in 1.1.4.3.



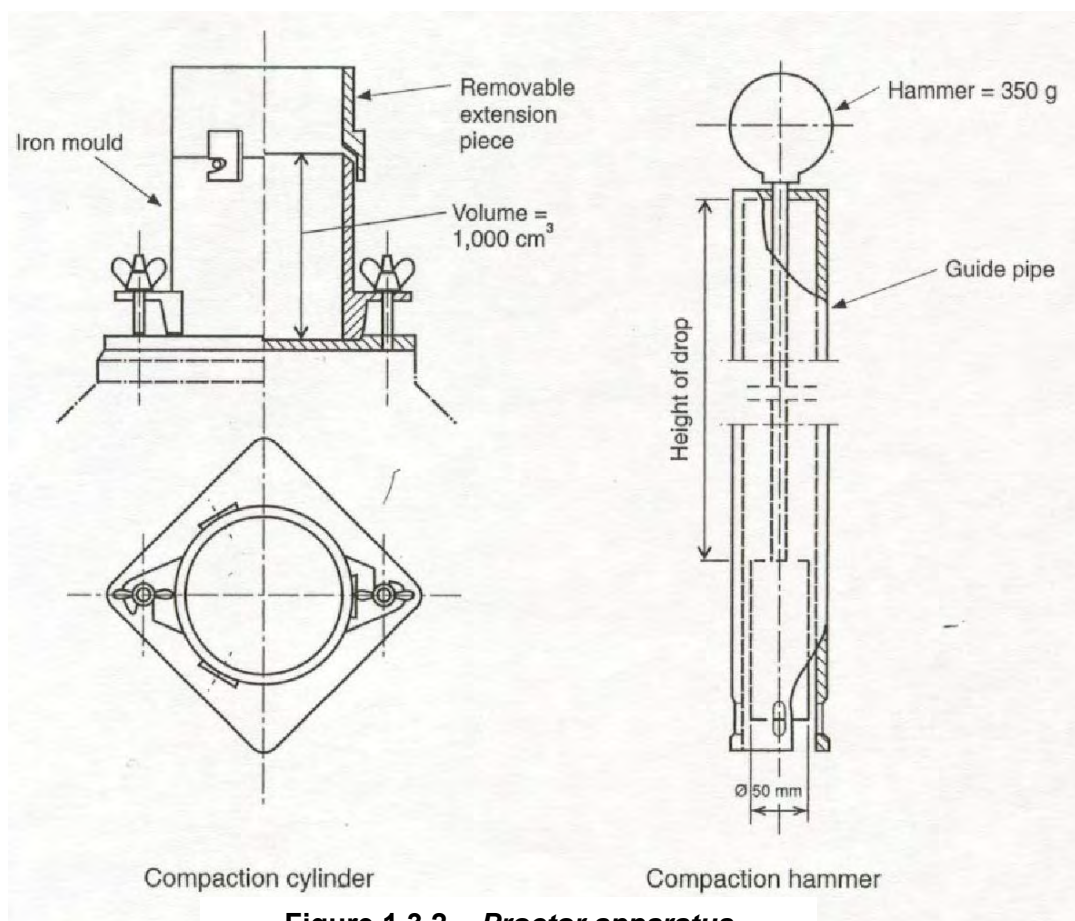
### **1.3 Proctor/Fagerberg test procedure**

#### **1.3.1 Scope**

- .1 Test method for both fine and relatively coarse-grained ore concentrates or similar materials up to a top size of 5 mm. This method should not be used for coal or other porous materials.
- .2 Before the Proctor/Fagerberg test is applied to coarser materials with a top size greater than 5 mm, an extensive investigation for adoption and improvement is required.
- .3 The transportable moisture limit (TML) of a cargo is taken as equal to the critical moisture content at 70% degree of saturation according to the Proctor/Fagerberg method test.

#### **1.3.2 Proctor/Fagerberg test equipment**

- .1 The Proctor apparatus (see figure 1.3.2) 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. This oven should be without air circulation.
- .4 A suitable mixer. Care should be taken to ensure that the use of the mixer does not reduce the particle size or consistency of the test material.
- .5 Equipment to determine the density of the solid material, for example a pycnometer.



**Figure 1.3.2 – Proctor apparatus**

1.3.3 *Temperature and humidity (see 1.1.3)*

1.3.4 *Procedure*

- .1 *Establishment of a complete compaction curve.* A representative sample according to a relevant standard (see 4.7 of this Code) of the test material is dried at a temperature of approximately 100°C. 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 5 to 10 different moisture contents (5 to 10 separate tests). The samples are adjusted in order that dry to almost saturated (plastic) samples are obtained. The required quantity per compaction test is about 2,000 cm<sup>3</sup>.

At each compaction test a suitable amount of water is added to the sample of the dried test material and mixed thoroughly for 5 min. 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 the hammer 25 times through the guide pipe, 0.2 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. When the weight of the cylinder with the tamped sample has been determined, the cylinder is emptied, the sample is dried and the weight is determined.

The test then is repeated for the other samples with different moisture contents.

.2 *Definitions and data for calculations (see figure 1.3.4.2)*

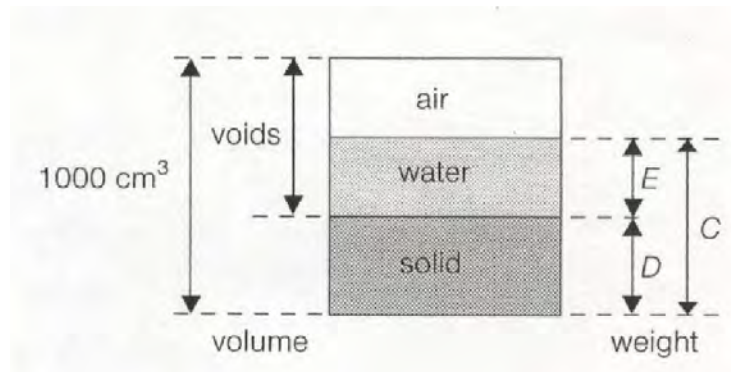
- empty cylinder, mass in grams:  $A$
- cylinder with tamped sample, mass in grams:  $B$
- wet sample, mass in grams:  $C$

$$C = B - A$$

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

$$E = C - D$$

Volume of cylinder:  $1,000 \text{ cm}^3$



**Figure 1.3.4.2**

.3 *Calculation of main characteristics*

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

$$\gamma = \frac{D}{1,000}$$

- 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)

$$e = \frac{1,000d - D}{D} = \frac{d}{\gamma} - 1$$

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

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

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

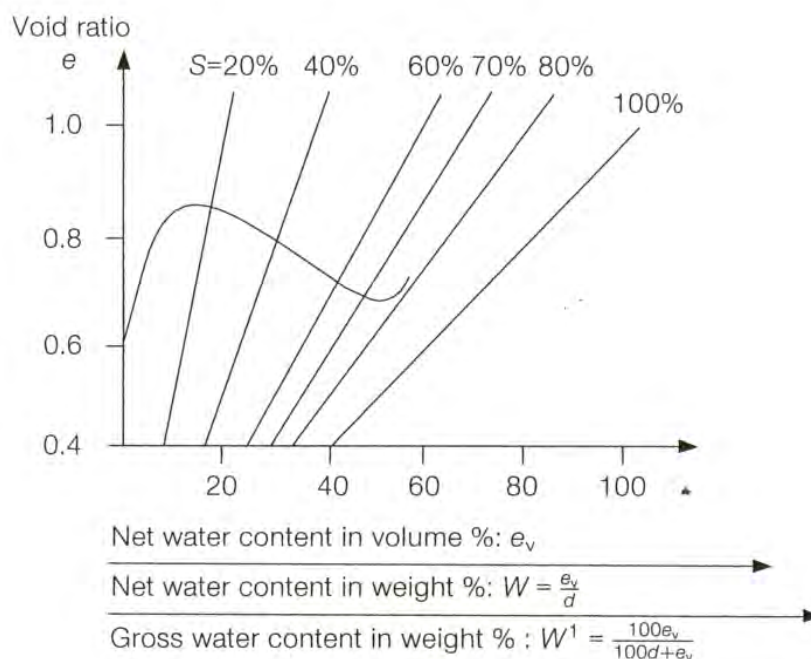
$$W^1 = \frac{E}{C} \times 100$$

- 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 1.3.4.5**

#### .5 Compaction curve

The test sequence results in a specific compaction curve (see figure 1.3.4.5).

The critical moisture content is indicated by the intersection of the compaction curve and the line  $S = 70\%$  degree of saturation. The transportable moisture limit (TML) is the critical moisture content.

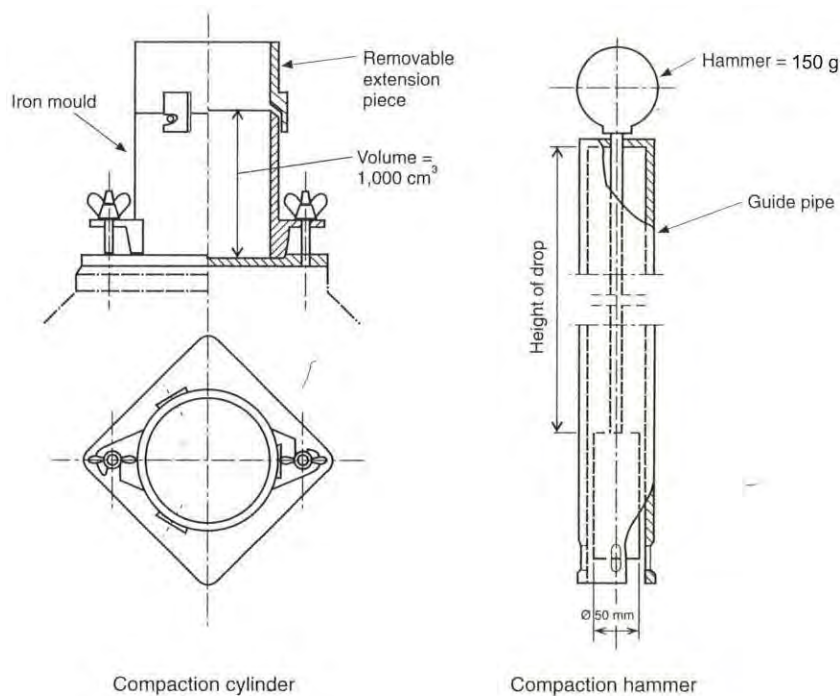
## **1.4 Modified Proctor/Fagerberg test procedure for iron ore fines**

### **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.)



**Figure 1.4.1**

**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 4.7 of this Code) of the test material is partially dried at a temperature of approximately 60°C or less to reduce the sample's 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 (5 to 10 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>.

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 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:  $1,000 \text{ cm}^3$

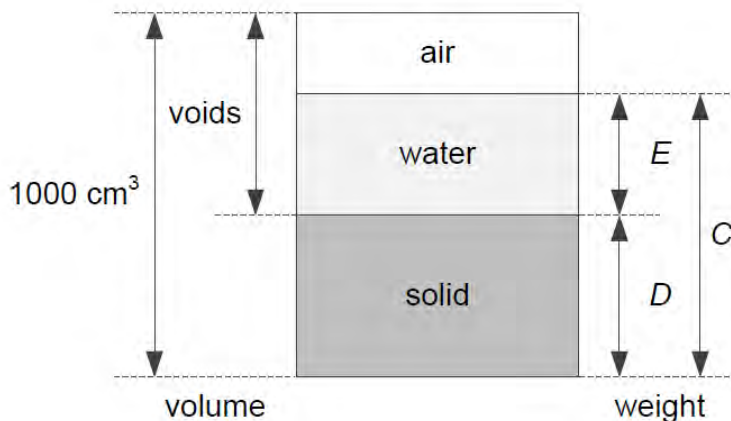


Figure 1.4.2

## .3 Calculation of main characteristics

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

$$\gamma = \frac{D}{1,000}$$

- 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:  $W'$

$$W' = \frac{E}{C} \times 100$$

- 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.

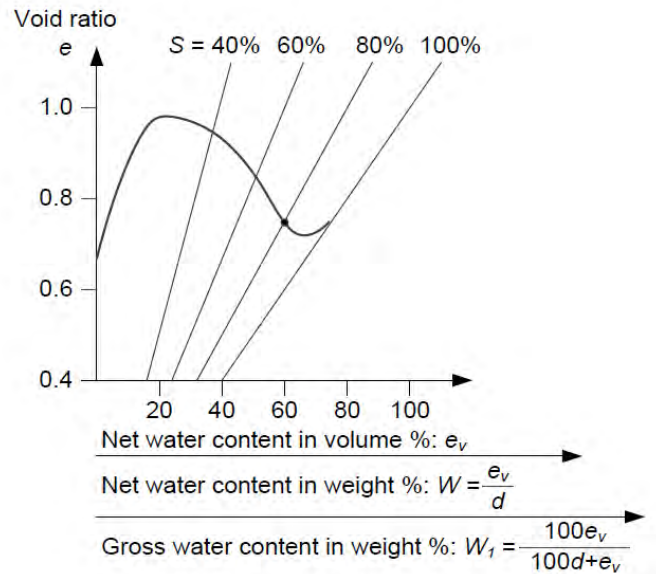
#### **.5 Compaction curve**

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.





**Figure 1.4.3**

## 1.5 Modified Proctor/Fagerberg test procedure for coal

### 1.5.1 Scope

This procedure details the laboratory determination of transportable moisture limit (TML) for coals up to a nominal top size of 50 mm. The procedure is based on a modification of the Proctor/Fagerberg test described in 1.3 of this appendix.

Key modifications to the original test procedure contained in 1.3 of this appendix are:

- .1 Sample preparation to facilitate the testing of 0 x 50 mm coal through reconstitution to -25 mm;
- .2 Use of a 150 mm diameter compaction cylinder; and
- .3 Sample compaction using a hammer equivalent to the Proctor/Fagerberg "D" energy hammer.

The transportable moisture limit is the moisture content corresponding to the intersection of the 70% degree saturation curve and the test sample compaction curve.

In the case of coals where moisture freely drains from the sample such that the test sample compaction curve does not extend to or beyond 70% saturation, the test is taken to indicate a cargo where water passes through the spaces between particles and there is no increase in pore water pressure. Therefore, the cargo is not liable to liquefy. (See 7.2.2 of this Code).

The procedure commences with a drum of coal containing a sample of not less than 170 kg delivered to the testing laboratory and terminates with the laboratory reporting the test result for the coal. Details of the sample collection process are excluded from this procedure. However, it is important that the sample accurately represents the size distribution of the cargo and reference should be made to the normative reference list below.

## **1.5.2 Normative references**

The following documents are referenced in this procedure. For dated references, only the cited edition applies.

- AS 1289.3.5.1:2006, Methods of testing soils for engineering purposes. Method 3.5.1: Soil classification tests – Determination of the soil particle density of a soil – Standard method;
- ISO 589:2008, Hard Coal – Determination of total moisture;
- ISO 3310-2:2013, Technical requirements and testing – Part 2: Test sieves of perforated metal plate; and
- ISO 13909-4:2001, Hard coal and coke – Mechanical sampling – Part 4 – Coal – Preparation of test samples.

## **1.5.3 Definitions**

### **1.5.3.1 Transportable moisture limit (TML)**

The transportable moisture limit (TML) of a cargo which may liquefy means the maximum moisture content of the cargo which is considered safe for carriage in a ship not complying with the requirements in 7.3.2 of this Code.

### **1.5.3.2 Test outcomes**

The transportable moisture limit determined by this procedure is the moisture content corresponding to the intersection of the 70% degree saturation curve and the test sample compaction curve. This is also referred to as the PFD70 value (Proctor/Fagerberg – D energy hammer – 70% saturation).

Where moisture freely drains from the sample or the cylindrical mould at moisture content such that the test sample compaction curve does not extend to or beyond 70% saturation (as described in 1.5.5.3.4), the test is taken to indicate a cargo where water passes through the spaces between particles and there is no increase in pore water pressure. Therefore, the cargo is not liable to liquefy. (See 7.2.2 of this Code).

### **1.5.3.3 Optimum moisture content (OMC)**

The optimum moisture content is the moisture content corresponding to the maximum compaction (maximum dry density) under the specified compaction condition.

### **1.5.3.4 Gross water content or total moisture ( $W^1$ )**

The moisture content of a sample is calculated as the mass of water divided by the total mass of solids plus water and is referred to as either the gross water content or the total moisture content. Gross water content is to be determined using the method for determining total moisture defined in the standard ISO 589:2008.

#### **1.5.4 Determination of the TML of blends of two or more coals**

In circumstances where a shipper intends to load a cargo consisting of a blend of two or more coals, the shipper may:

- .1 determine the TML of the blend by direct application of the test method described within this procedure to a representative sample of the blended product; or
- .2 declare the TML of the blend based on TML determinations on each of the component coals.
  - .1 Where all component coals in the blend are known to be group A and B coals:
    - .1.1 the blended cargo should be declared as group A and B, and
    - .1.2 the TML of the blended cargo should be determined as the lowest TML value of any of the component coals.
  - .2 Where a group A and B cargo component is blended with a coal which is designated as group B only:
    - .2.1 the blended cargo should be declared as group A and B, and
    - .2.2 the TML should be taken as the lowest TML of the group A and B component coals contained within the blend.
  - .3 Where all component coals are determined to be group B only coals, the blended cargo may be declared as a group B only cargo.

#### **1.5.5 Modified Proctor/Fagerberg test procedure for coal**

##### **1.5.5.1 Apparatus**

###### **1.5.5.1.1 Work area**

The work area should be located where the samples are protected from excessive temperatures, air currents and humidity variations. All samples should be stored in suitable sample containers, including plastic sample bags, and the containers should be sealed.

###### **1.5.5.1.2 Standard sieves**

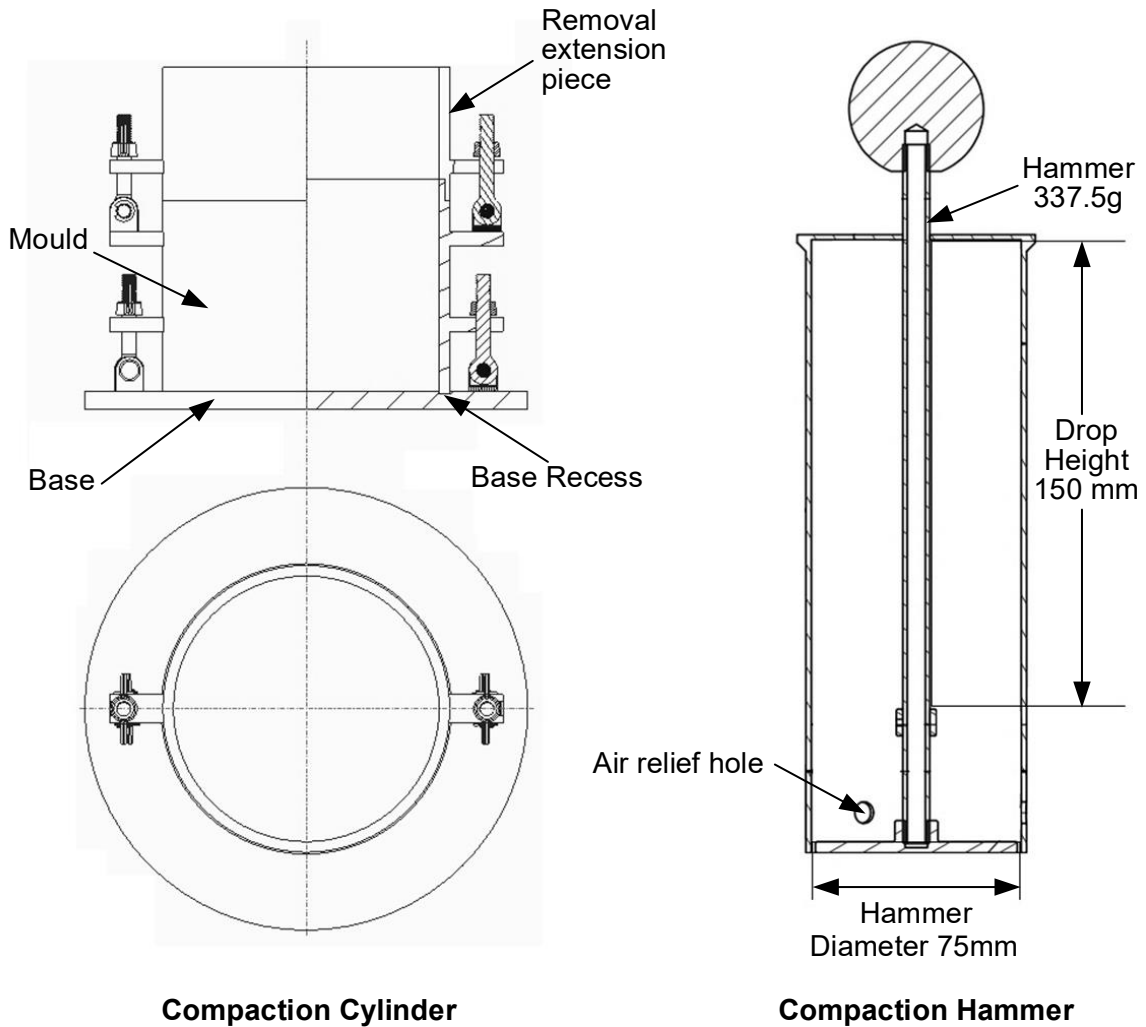
Square aperture laboratory sieves of 16 mm and 25 mm aperture as nominated in ISO 3310-2:2013 are required for reconstitution of the sample at 25 mm top size. A 2.36 mm sieve is required for generation of + 2.36 mm and - 2.36 mm fractions for particle density determination. Optionally a 2 mm sieve may be used for this purpose.

### 1.5.5.1.3 Proctor/Fagerberg apparatus

The Proctor/Fagerberg apparatus consists of a cylindrical stainless steel mould having 150 mm diameter and 120 mm height with a removable extension piece (the compaction cylinder) and a compaction tool guided by a pipe at its lower end (the compaction hammer), which are shown in figure 1.5.5.1.3.1. A schematic diagram of the Proctor/Fagerberg apparatus is shown in figure 1.5.5.1.3.2 with dimensions and tolerances indicated in table 1.5.6.2.



**Figure 1.5.5.1.3.1 – Example of Proctor/Fagerberg test apparatus, hammer and hammer guide**



**Figure 1.5.5.1.3.2 – Schematic of a Proctor/Fagerberg apparatus**

#### **1.5.5.1.4 Compaction hammer**

A "D" energy equivalent compaction hammer is used for this test. Dimensions are shown in figure 1.5.5.1.3.2 and table 1.5.6.2 (Note: the compaction hammer has been modified to match the mould used.)

#### **1.5.5.1.5 Drying oven**

The drying oven should be ventilated, with forced circulation of air or inert gas, typically with a stainless-steel interior and capable of maintaining a temperature within the range of  $105^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

#### **1.5.5.1.6 Weighing balance**

The weighing balance should be capable of weighing the sample and the container, as received, with an accuracy of better than  $\pm 5$  g.

#### **1.5.5.1.7 Pycnometer**

Water pycnometry equipment is used to determine the density of the full-sized coal (non-crushed) in accordance with AS 1289.3.5.1:2006. Specific equipment required is as follows:

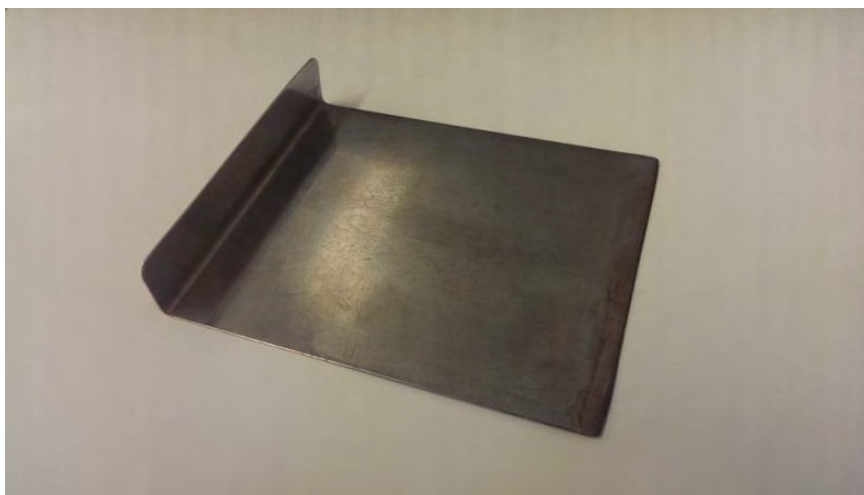
- a conical flask or density bottle of 250 mL capacity;
- a vacuum desiccator or other vacuum equipment;
- a drying oven set to 105°C to 110°C;
- balances: one with  $\pm 0.05$  g accuracy and the second with  $\pm 1$  g accuracy;
- a 0°C to 100°C thermometer;
- a 2.36 mm sieve (as noted in 1.5.5.1.2)
- a vacuum source;
- a water bath set at 60°C;
- distilled, demineralized or deionized water;
- a wash bottle containing water;
- a wire basket to hold the + 2.36 mm sample;
- a container filled with water to hold the wire basket without interference; and
- a scale to weigh the basket both suspended in water and drained.

#### **1.5.5.1.8 Containers for hand mixing and sample preparation**

Sufficient heavy-duty plastic buckets with lids of not less than 10 L capacity are required for storage and handling. Heavy-duty plastic bags (200 micron thick or greater) are required for storage and hand mixing of samples.

#### **1.5.5.1.9 Flat scraping device**

A thin steel scraper is required for separating the remnant sample formed in the extension piece lying above the top level of the mould. For ease of use, the scraper should have dimensions of 160 mm wide, 200 mm long and 3 mm to 5 mm thick, such as that shown in figure 1.5.5.1.9.



**Figure 1.5.5.1.9 – Typical scraping device**

#### **1.5.5.1.10 Drying trays**

Drying trays or pans should have a smooth surface, be free from contamination and heat resistant, for example stainless steel or enamel. Dimensions should be suitable to fit in the drying oven and ensure that the total sample can be contained at a loading of about 1 g/cm<sup>2</sup> of surface area.

#### **1.5.5.1.11 Spray bottle**

A suitable plastic bottle is required to add a mist spray of water to the sample.

#### **1.5.5.1.12 Gloves**

Heat resistant gloves are required for removal of hot trays and dishes.

#### **1.5.5.1.13 Sample divider**

A suitable sample divider as specified in ISO 13909-4:2001 is required for sub-sampling the primary sample and blending the reconstituted sample for testing.

### **1.5.5.2 Sampling and sample preparation**

#### **1.5.5.2.1 General**

This procedure commences with receipt of sample of not less than 170 kg, sealed in a heavy duty (200 micron thick) plastic bag and contained in a suitable drum (e.g. 220 L). This packaging ensures the sample does not dry prior to TML determination.

#### **1.5.5.2.2 Sample preparation**

Representative samples are required that have been obtained using ISO 13909-4:2001 and if required may be partially air dried or partially dried at a temperature of 40°C or less to reduce the water content to a starting point suitable for dry sieving the coal with minimal fines adhering to the oversize fraction. For this purpose, samples should not be dried below 6% total moisture. The representative subsamples for the test should not be fully dried, except in the case of gross water content determination.

### 1.5.5.2.2.1 Sample homogenization and division

Take the as-received sample and divide into individual subsamples using a sample dividing apparatus as specified in ISO 13909-4:2001. Place these subsamples into heavy-duty plastic bags.

### 1.5.5.2.2.2 Reconstituted sample preparation procedure

When the sample contains particles above 25 mm, the reconstitution process below should be applied.

In this process, particles above 25 mm are removed from the sample and replaced by an equivalent mass of particles in the range 16 mm to 25 mm. Through this process a final reconstituted sample of sufficient mass for TML testing is generated which contains a maximum particle size of 25 mm.

One of two methods may be selected to generate the reconstituted sample:

- .1 Split the entire as-received sample and then reconstitute; or
- .2 Scalping off particles above 25 mm and substituting particles between 16 mm and 25 mm from a separate subsample.

#### Method 1 Splitting the full as-received sample and reconstitution

- Step 1 Take the full as-received sample.
- Step 2 Screen at 25 mm, 16 mm and 2.36 mm. If a 2.36 mm screen is not available, a 2 mm screen may be used.
- Step 3 Weigh each of the four size fractions and calculate the percentage represented by each size fraction.
- Step 4 Sub-divide from each size fraction below 25 mm the required mass to create a 25 kg reconstituted sample using the sample size components specified in table 1.5.5.2.2.2.1.

**Table 1.5.5.2.2.2.1 Reconstitution size proportions (Method 1)**

| Size fraction              | Quantity  |
|----------------------------|---|
| -2.36 mm (or -2 mm)        | percentage of this fraction in the original sample              |
| 2.36 mm (or 2 mm) to 16 mm | percentage of this fraction                                     |
| 16 mm to 25 mm             | percentage of this fraction plus the percentage of + 25 mm coal |

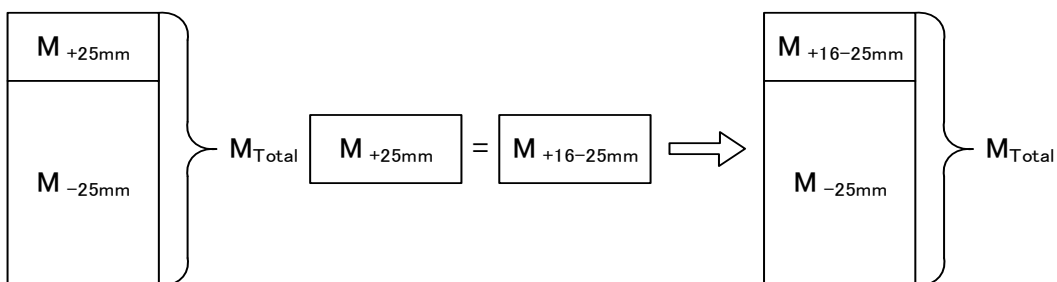
- Step 5 Combine each size fraction.
- Step 6 Fully mix the reconstituted sample.
- Step 7 Split the sample into approximately eight representative sub-samples and place each into a heavy duty plastic bag. These bags now contain the sample for Proctor/Fagerberg testing.
- Step 8 A sample of particles passing a 2.36 mm screen (or 2 mm if 2.36 mm is not available) is required for particle density pycnometry.



**Method 2 Scalping particles above 25 mm and replacement with 16 mm to 25 mm particles**

This method is described in figure 1.5.5.2.2.2 and table 1.5.5.2.2.2. The reconstitution process commences where the coal is initially sieved into particle sizes larger than 25 mm and smaller than 25 mm. Coal particles in the size range of 16 mm to 25 mm are extracted from separate subsamples and reconstituted back into the original - 25 mm screened coal based on a mass equivalent to the + 25 mm sized coal removed from the initial sample to provide a final reconstituted sample of sufficient mass for TML testing.

Coal Sample



**Figure 1.5.5.2.2.2 – Overview of sample reconstitution (Method 2)**

**Table 1.5.5.2.2.2 Sample reconstitution (Method 2)**

| Step  | Example  |
|---|--|
| 1 Generate a sample of approximately 25 kg which is sufficient to complete approximately eight Proctor/Fagerberg tests.   | Assumes each subsample bag contains 8 kg to 10 kg.   |
| 2 Screen this sample at 25 mm, ensuring minimal adhering fines on the + 25 mm fraction. Weigh the + 25 mm coal.   | For a coal containing 20% + 25 mm material, approximately 5 kg of initial sample is removed. |
| 3 Create sufficient 16 mm to 25 mm coal by screening one or more further subsample bags of coal at 16 mm and 25 mm.   | In the above example, 5 kg of 16 mm to 25 mm coal is required.                               |
| 4 Extract an amount of 16 mm to 25 mm coal of mass equal to the mass of + 25 mm removed in step 2 within $\pm 0.05$ kg using a rotary sample divider or similar device, recombining sector trays as required to obtain the required mass. | 5 kg in the above case.  |
| 5 Add the mass of 16 mm to 25 mm coal from step 4 to the - 25 mm coal from step 2. Blend and divide into approximately eight test portions using a rotary sample divider or similar device.   |  |
| 6 Place each reconstituted test portion in heavy duty plastic bags, label and seal. <b>These now become the test portions used for Proctor/Fagerberg testing.</b>   | Each bag should contain approximately 2.5 kg to 3 kg of reconstituted - 25 mm coal.          |
| 7 Discard the + 25 mm and - 16 mm coal.   |  |

### 1.5.5.2.3 Initial moisture

Initial moisture is to be determined on a test portion from table 1.5.5.2.2.2 step 5 using the method provided in ISO 589:2008. This moisture value provides a guide to the moisture steps required to develop the Proctor/Fagerberg compaction curve.

### 1.5.5.2.4 Particle density measurement

In accordance with water pycnometer standard AS 1289.3.5.1:2006, measure the density of solids on the full size range (non-crushed) coal. The density of solids is used for determining the void ratio for plotting compaction curves. The recommended methodology is described below:

- .1 Generate a full particle size sample of approximately 10 kg, weigh and then screen the entire contents at 2.36 mm. If a 2.36 mm screen is not available, a 2 mm screen may be substituted. Record the following:
  - .1 the total mass of the material;
  - .2 the mass of + 2.36 mm material; and
  - .3 the mass of - 2.36 mm material.
- .2 Calculate the percentage of - 2.36 mm coal in the sample.
- .3 Divide the + 2.36 mm coal into two test portions using sample dividing apparatus as specified in ISO 13909-4:2001 such as a rotary sample divider. Place each test portion in a heavy duty plastic bag and label.

- .4 Divide the - 2.36 mm coal into two test portions, place each test portion in a heavy duty plastic bag and label.
- .5 Determine the density of solids of the + 2.36 mm fraction following the method described in Section 5.2 of AS 1289.3.5.1:2006. As noted in the standard, duplicate determinations are required.
- .6 Determine the density of solids of the - 2.36 mm fraction using the method described in Section 5.1 of the above standard with the following clarifications:
  - .1 Use of 250 mm conical or pycnometry flasks is recommended.
  - .2 From the sample bag pour 1 L of coal into a beaker of known tare weight.
  - .3 Weigh the 1 L sample and calculate the approximate bulk density of the material.
  - .4 Remove a portion of the sample (nominally a mass in kilograms of 0.18 x bulk density) and place into the flask, and complete the pycnometry analysis.
  - .5 A water bath temperature of 60°C is recommended.
- .7 Calculate the density of solids using the method in Section 6 of AS 1289.3.5.1:2006.

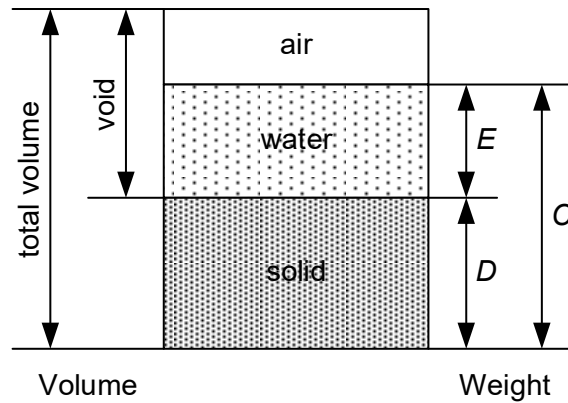
### 1.5.5.3 Test procedure

#### 1.5.5.3.1 Variables and definitions

The variables and definitions used in the determination of TML are summarized in table 1.5.5.3.1 with some key variables as illustrated in figure 1.5.5.3.1.

**Table 1.5.5.3.1 – Summary of variables and definitions**

| Variable  | Unit              | Symbol/value used in calculations |
|---|-------------------|-----------------------------------|
| Mass of empty cylinder and base                 | g                 | A                                 |
| Mass of cylinder, base and tamped test portion  | g                 | B                                 |
| Wet mass of test portion in the mould           | g                 | $C = B - A$                       |
| Wet mass of test portion removed from the mould | g                 | $C_1$                             |
| Dry mass of test portion removed from the mould | g                 | $D_1$                             |
| Gross water content                             | %                 | $W^1$                             |
| Dry mass of test portion in the mould           | g                 | D                                 |
| Mass of water in the mould                      | g                 | E                                 |
| Volume of cylinder                              | cm <sup>3</sup>   | V                                 |
| Density of solids                               | g/cm <sup>3</sup> | d                                 |
| Density of water                                | g/cm <sup>3</sup> | $\rho_w$                          |



**Figure 1.5.5.3.1 – Illustration of key variables**

### 1.5.5.3.2 Establishment of the initial compaction point

The initial compaction point is obtained using the first test portion of the reconstituted material at the initial moisture content. For each compaction point determination, all steps in the procedure from packing the mould to weighing the mould and sample are to be completed at the same time without breaks. In any case, coal should not be left in the mould for longer than 30 min prior to weighing.

The test procedure is as follows:

- Step 1 Clean the mould, collar and base plate. Inspect and clean the hammer and ensure that it moves freely in the guide tube.
- Step 2 Determine the mass, *A*, of the empty cylinder, comprising the mould plus base plate.
- Step 3 Assemble the mould, collar and base plate and place the assembly on a stable bench.
- Step 4 Place approximately 0.5 L (one fifth of the full 2.5 L) of the test portion into the mould, level, and then tamp uniformly over the surface by dropping the hammer 25 times vertically through the full height of the guide pipe, moving the guide pipe to a new position after each drop. The required pattern for even compaction of each layer in the mould is shown in figure 1.5.5.3.2.
- Step 5 Repeat step 4 four more times so that there are 5 layers of material in the mould. Ensure that the compacted test portion with the final layer is above the top of the compaction mould whilst the extension piece is still attached.
- Step 6 When the last layer has been tamped, remove the extension piece taking care not to disturb the compacted test portion inside. Level the compacted test portion to the top of the mould using the flat scraping device, ensuring that any large particles that may hinder levelling of the test portion are removed and replaced with material contained in the extension piece and re-level. If any holes in the surface are still observed after levelling, they should be manually filled with finer material contained in the extension piece. Care should be taken to avoid any further compaction of the test portion.
- Step 7 Determine the mass, *B*, of the mould and compacted coal and then calculate the mass, *C*, of the wet test portion using the equation:

$$C = B - A \tag{1}$$

Step 8 When the weight of the cylinder with the tamped test portion has been determined, remove the test portion from the mould, determine the mass of the wet test portion,  $C_1$ , and dry the entire test portion in an oven at  $105^\circ\text{C}$  until constant mass is achieved. After drying, determine the weight,  $D_1$ , of the dried test portion and then calculate the percentage gross water content,  $W^1$ , as follows:

$$W^1 = (C_1 - D_1)/C_1 \times 100\% \tag{2}$$

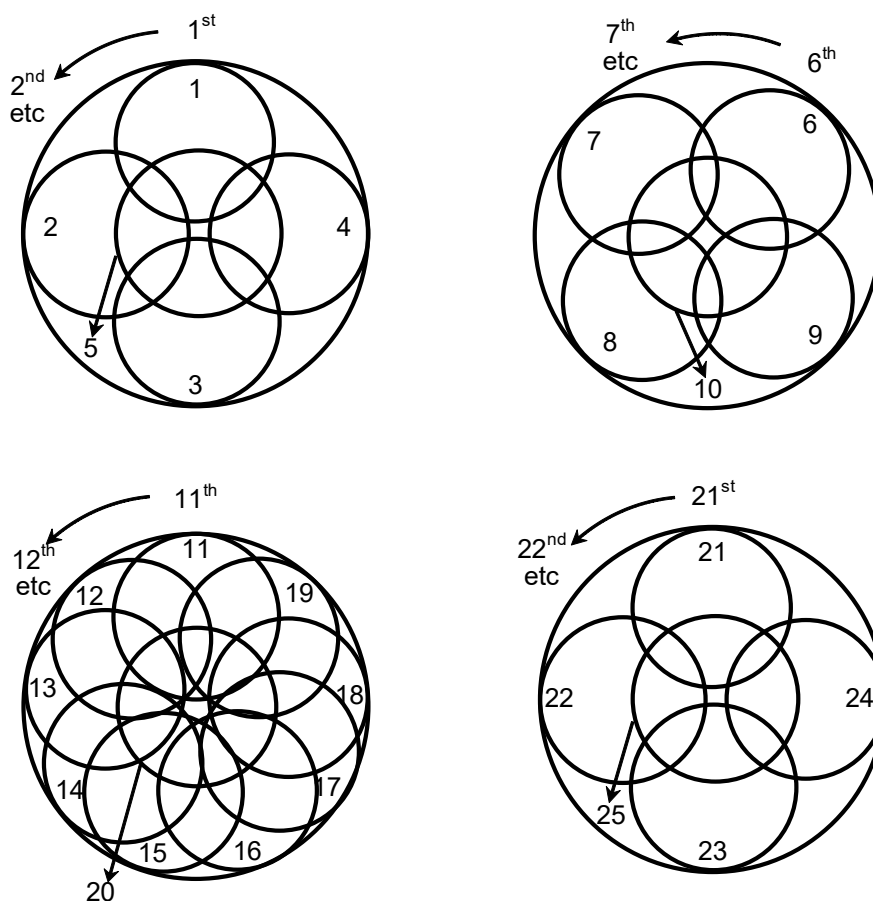
Step 9 Using the calculated gross water content, calculate the mass of the dry test portion in the mould,  $D$ , using the equation:

$$D = C - C \times W^1/100 \tag{3}$$

Step 10 Calculate the mass,  $E$ , of water in the mould using the equation:

$$E = C - D \tag{4}$$

Step 11 Discard the used coal sample. Coal from a previously compacted test portion should not be reused.



**Figure 1.5.5.3.2 – Recommended compaction patterns**

### 1.5.5.3.3 Establishment of complete compaction curve

The range of water contents should be adjusted so that partially dry to almost saturated test portions are obtained. Care should be taken to follow the precaution in 1.5.5.3.2 above regarding prompt completion of each point in the compaction curve.

The test procedure is as follows:

- Step 1 For each compaction test, a predetermined amount of water is added to the test portion (approximately 2.5 kg) in a heavy duty plastic bag. The water quantity added is that required to increase the moisture content to the target value for the next test. The water should be added as a mist spray to the surface of the individual test portions. The water at this point should be added slowly and in small quantities, as the introduction of large amounts of water may induce localized compaction behaviour.
- Step 2 After the calculated water addition, the test portion should then be mixed thoroughly in the plastic bag by sealing the bag and turning it over repeatedly for 5 min.
- Step 3 The test portion should then be allowed to equilibrate for a minimum of 12 hours prior to compaction testing.
- Step 4 Repeat steps 1 to 11 from 1.5.5.3.2.
- Step 5 Repeat the test between four and seven times using the other prepared test portions with different water contents to obtain at least five points on the compaction curve. The water contents should be chosen so that:
  - .1 at least one point corresponds to moisture content higher than the optimum moisture content (OMC) or than the value corresponding to 70% of degree of saturation ( $S$ ), in order to satisfactorily define the compaction curve; and
  - .2 at least one point corresponds to the degree of saturation ( $S$ ) between 70% and 80%, in order to effectively assess the PFD70 value.

A point close to a degree of saturation ( $S$ ) of 80% will also assist accurate assessment if the OMC is greater than 70%.

### 1.5.5.3.4 Visual appearance of coal in the cylindrical mould

In order for the test to obtain a PFD70 value, all tests conducted at or below the PFD70 moisture value should have an even moisture distribution throughout the cylindrical mould.

Two examples of tests using samples of the same coal at different moisture contents are shown in figure 1.5.5.3.4.1. The left hand photograph shows a coal specimen at a relatively low degree of saturation. Note that the coal remains in place following removal of the collar. The right hand photograph shows a specimen near or possibly above 70% degree of saturation. Once again the coal remains in place following removal of the collar. Both tests provided valid points on the compaction curve.



**Figure 1.5.5.3.4.1 – Photographs showing valid tests for a partially saturated test portion (left) and a near fully saturated test portion (right)**

Coals where water passes through the spaces between particles exhibit moisture migration within the Proctor/Fagerberg cylindrical mould. Moisture migration may take place when the degree of saturation of the specimen is less than 70%.

Evidence of moisture migration is from visual observation at the completion of each test as follows:

- .1 moisture leakage from the base of the mould is evident as shown in figure 1.5.5.3.4.2; and
- .2 the portion above the top of the cylindrical mould appears unsaturated and the test portion maintains its structure without deformation or movement.

In this case, moisture migration has occurred and hence for this coal water passes through the spaces between particles.



**Figure 1.5.5.3.4.2 – Test showing water leakage from the base of the cylindrical mould indicating moisture migration**

### 1.5.5.3.5 Calculation of key parameters for determination of compaction curve

Carry out the following calculations for each compaction test:

$$d = \text{density of solids, g/cm}^3 \text{ (t/m}^3\text{) by pycnometry (see 1.5.5.2.4)}$$

$$\begin{aligned} \gamma &= \text{dry bulk density, g/cm}^3 \text{ (t/m}^3\text{)} \\ &= D/V \end{aligned}$$

$$\begin{aligned} e_v &= \text{net water content (percentage by volume)} \\ &= (E/D) \times 100 \times d/\rho_w \end{aligned}$$

$$\text{where } \rho_w = \text{density of water, g/cm}^3 \text{ (t/m}^3\text{)}$$

$$\begin{aligned} e &= \text{void ratio (volume of voids divided by volume of solids)} \\ &= (d/\gamma) - 1 \end{aligned}$$

$$\begin{aligned} S &= \text{degree of saturation (percentage by volume)} \\ &= e_v/e \end{aligned}$$

$$W^1 = \text{gross (total) water content (percentage by mass) (see 1.5.5.3.2, Step 8).}$$

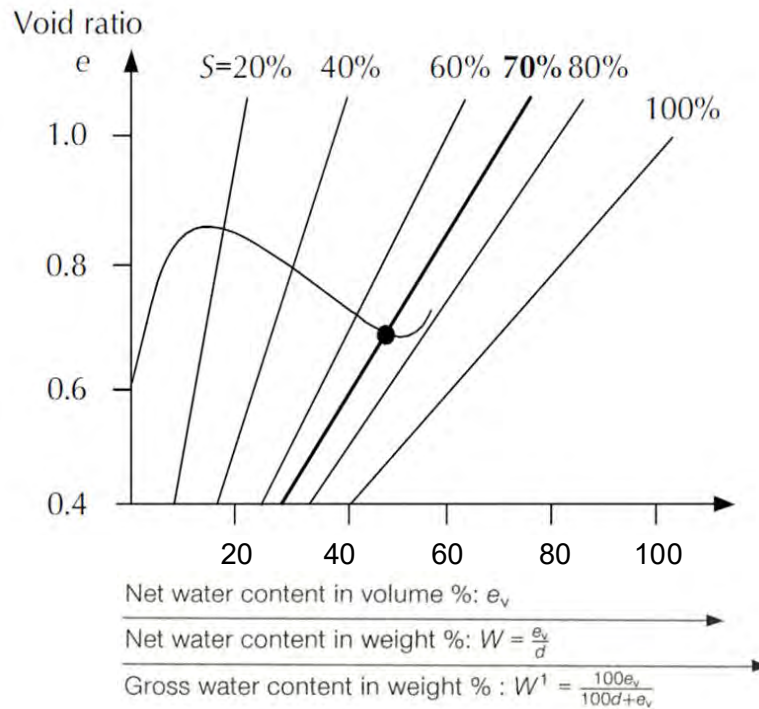
### 1.5.5.3.6 Presentation of compaction results

Record all the compaction test results in a suitable spreadsheet (such as that shown in table 1.5.6.1) and from this spreadsheet create a compaction curve as shown in figure 1.5.5.3.6 by plotting the calculated void ratio ( $e$ ) for each compaction test on the ordinate against either the net or gross water content plotted on the abscissa.

The lines in figure 1.5.5.3.6 correspond to plots of void ratio ( $e$ ) versus net water content ( $e_v$ ) at 20%, 40%, 60%, 70%, 80% and 100% degree of saturation ( $S$ ). These lines are calculated



at five values of void ratio using the formulae in 1.5.5.3.7. (Note: These lines corresponding to degree of saturation will be curved in the case of plotting gross water content on the abscissa.)



**Figure 1.5.5.3.6 – Typical compaction curve**

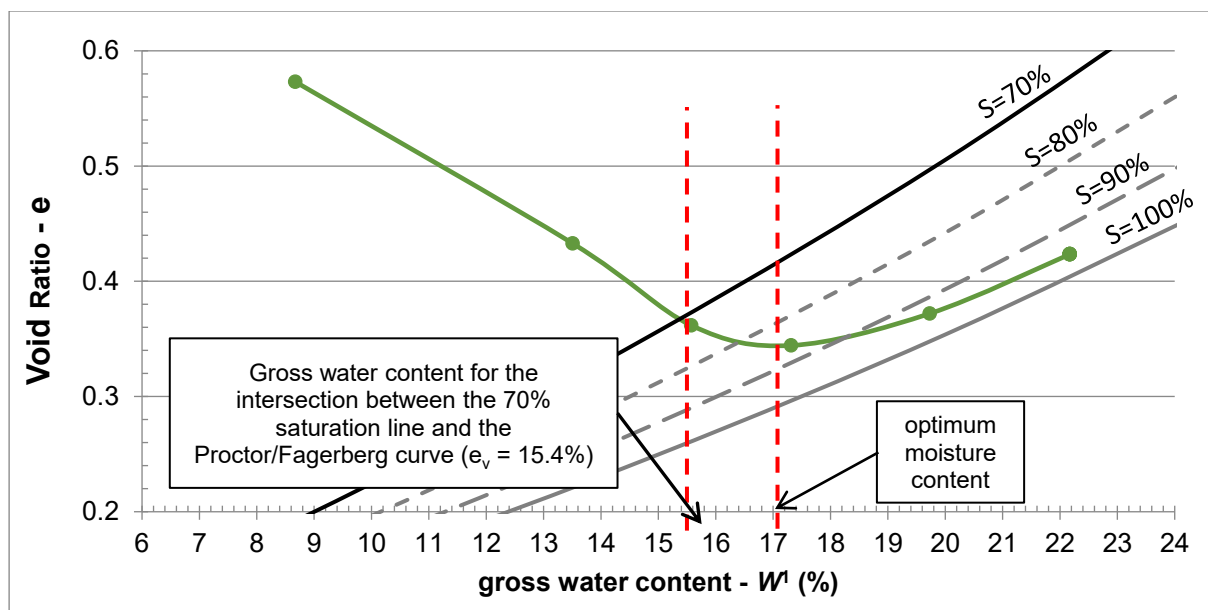
**1.5.5.3.7 Sample compaction curve**

An example of the results obtained when applying the modified Proctor/Fagerberg test to a coal sample is provided in table 1.5.6.1, with the corresponding compaction curve and the 70% degree of saturation line plotted as described below.

The preferred approach to presenting the results is to plot the void ratio (*e*) against the gross water content (*W*<sup>1</sup>) allowing moisture for any saturation level to be read directly from the plot as gross water content. This approach is shown in figure 1.5.5.3.7. The saturation lines are plotted according to the equation:

$$e = W^1 / (100 - W^1) \times 100 \times d / S$$

The intercept of the compaction curve with the 70% degree of saturation line in figure 1.5.5.3.7 occurs at a gross water content of 15.4%, which is the transportable moisture limit (TML). For this example, the optimum moisture content (OMC) occurs at a degree of saturation of about 85%.



**Figure 1.5.5.3.7 – Example of a measured compaction curve for void ratio versus gross water content with the 70%, 80%, 90% and 100% degree of saturation lines plotted**

### 1.5.5.3.8 Determination of transportable moisture limit

#### 1.5.5.3.8.1 Determination of PFD70 moisture content

The PFD70 value is determined as the gross (total) water content corresponding to the intersection of the compaction curve and the line  $S = 70\%$  saturation. The optimum moisture content (OMC) is the gross (total) moisture content corresponding to the maximum compaction (maximum dry density and minimum void ratio) under the specified compaction condition.

The test procedure is applicable for determination of coal TML where the degree of saturation corresponding to the OMC of the coal is at or greater than 70%. Where the OMC lies below 70% degree of saturation, this test is not applicable for the specific coal and the PFD70 may overstate the TML. In such cases, the certificate of analysis should state that the OMC is below 70% saturation and the shipper should consult with an appropriate authority.

#### 1.5.5.3.8.2 Cases where the highest determinable point on the compaction curve lies below 70% saturation

In coals where there is visual evidence that water passes through the spaces between particles and the compaction curve does not extend to or beyond the 70% degree of saturation line, the coal is deemed to be free-draining and a TML value is not applicable. By reference to 7.2.2 of this Code, such coals are cargoes which are not liable to liquefy, and hence are classified as group B only.

### 1.5.6 Test report

The test report from application of the modified Proctor/Fagerberg test procedure should include the following information:

- .1 identification of the sample;
- .2 a unique reference to this test procedure;



Note: The example above uses two drying trays for each test.

**Table 1.5.6.2 – Specifications and tolerances for Proctor/Fagerberg cylindrical mould and hammer**

| Parameter                             | Units           | Dimension | Tolerance    |
|---------------------------------------|-----------------|-----------|--------------|
| Hammer mass                           | g               | 337.5     | ± 2          |
| Hammer diameter                       | mm              | 75        | ± 0.2        |
| Drop height                           | mm              | 150       | ± 2          |
| Tube ID                               | mm              | 78        | ± 0.2        |
| Tube OD                               | mm              | 82        | ± 0.2        |
| Tube wall thickness                   | mm              | 2         | ± 0.2        |
| Tube clearance                        | mm              | 1.5       | ± 0.2        |
| Mould inner diameter                  | mm              | 150       | ± 0.5        |
| Mould inner height                    | mm              | 120       | ± 1          |
| Mould inner volume                    | cm <sup>3</sup> | 2,121     | ± 18         |
| Removable extension piece height      | mm              | 75        | ± 1          |
| Depth of recess into base to seat     | mm              | 1         | ± 0.2        |
| Gap between mould and base            | mm              | ≤ 0.1     |              |
| Gap between mould and extension piece | mm              |           | (0 to + 0.1) |
| Clearance between mould and hammer    | mm              | ≤ 6       |              |

## 1.6 Modified Proctor/Fagerberg test procedure for bauxite

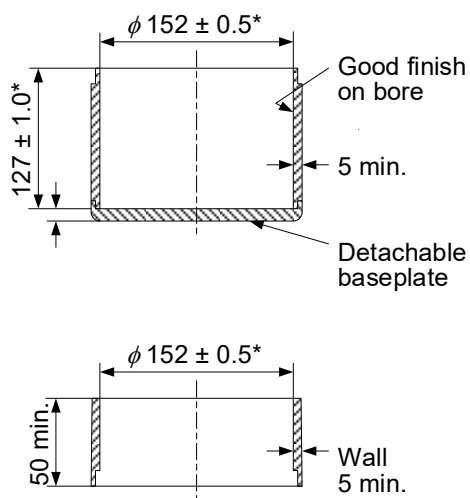
### 1.6.1 Scope

- .1 The test procedure specified in this section (this test) should only be used for determining transportable moisture limit (TML) of bauxite cargoes containing both:
  - .1 more than 30% of fine particles less than 1 mm ( $D_{30} < 1$  mm); and
  - .2 more than 40% of particles less than 2.5 mm ( $D_{40} < 2.5$  mm).
- .2 The TML of a cargo is taken as equal to the critical moisture content at 80% degree of saturation according to the modified Proctor/Fagerberg test procedure for bauxite where the optimum moisture content (OMC) of the bauxite tested occurs at saturation levels greater than or equal to 90%.
- .3 The TML of a cargo is taken as equal to the critical moisture content at 70% degree of saturation according to the modified Proctor/Fagerberg test procedure for bauxite where the OMC of the bauxite occurs at saturation levels less than 90%.
- .4 Where moisture freely drains from the sample such that the test sample compaction curve cannot extend to or beyond 70% saturation, the test is taken to indicate a cargo where water passes easily through the spaces between particles. Therefore, the cargo is not liable to liquefy.

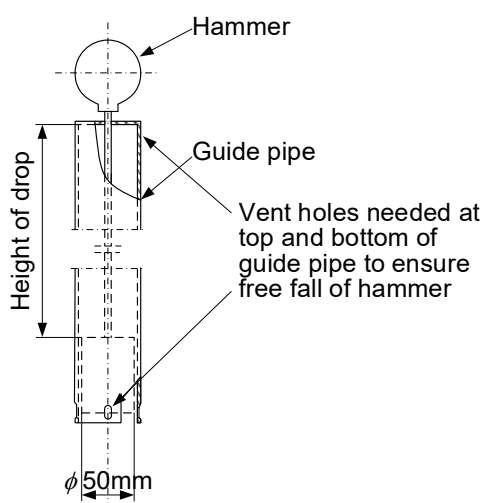
### 1.6.2 Test equipment

- .1 The Proctor apparatus (see figure 1.6.2) consists of a cylindrical iron mould (the CBR mould) with a removable extension piece that is screwed onto the top and a compaction tool guided by a pipe open at its lower end (the compaction hammer).

- .2 A weighing balance (see 3.2) capable of weighing the sample and the container, as received, with an accuracy of better than  $\pm 1$  g, and suitable sample containers.
- .3 A drying oven with a controlled temperature interval from  $100^{\circ}\text{C}$  to maximum  $105^{\circ}\text{C}$ .
- .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.
- .5 A gas or water pycnometry equipment to determine the density of the solid material as per a recognized standard (e.g. ASTM D5550, AS 1289, BS 1377 Part 2).



CBR Mould compaction cylinder and screw-on extension piece (from BS 1377 Part 4. all dimensions in mm)



Compaction hammer

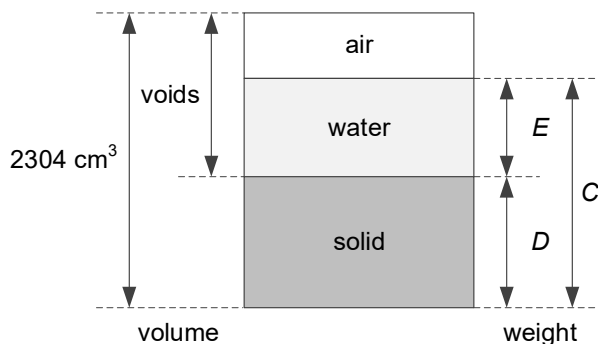


Figure 1.6.2 – Equipment and definitions

### 1.6.3 Temperature and humidity (see 1.1.3 of this appendix)

### 1.6.4 Procedure

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

A representative sample according to a relevant standard (see 4.7 of this Code) of the test material is utilized.

#### .2 Sample homogenization and division

Divide the as-received sample into individual sub-samples using a sample dividing apparatus as specified in ISO 6140:1991 "Aluminium ores – Preparation of samples". Place these subsamples into heavy-duty plastic buckets that can be sealed to preserve water content.

#### .3 Reconstituted sample preparation procedure

Reconstitution is required for bauxites if the amount of material in the representative sample that is coarser than 25 mm is greater than 10% of the total mass (by dry weight). In this case the reconstitution process below should be applied (see also figure 1.6.4.3). In this process, particles above 25 mm are removed from the sample and replaced by an equivalent mass of particles in the range 6.3 mm to 25 mm. Note that 6.3 mm is a standard sieve size. If it is not available, a 6 mm sieve may be used instead. Through reconstitution, a final reconstituted sample of sufficient mass for TML testing is generated which contains a maximum particle size of 25 mm, but which better reproduces the compaction characteristics of the full as-received particle size distribution with particles greater than 25 mm.

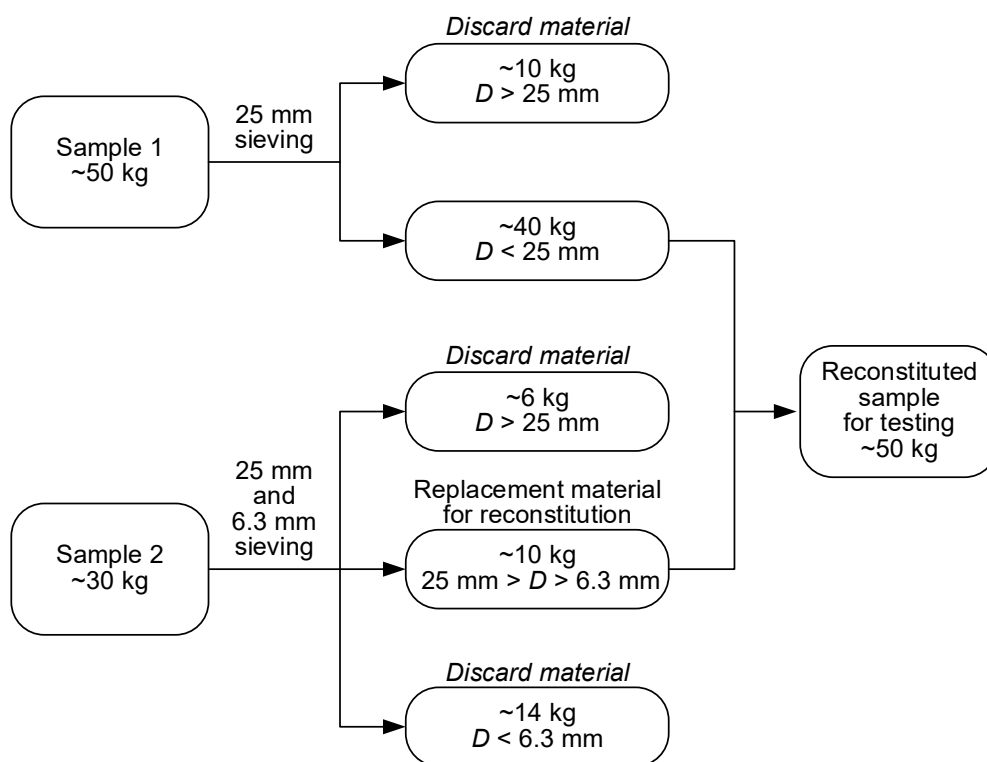


Figure 1.6.4.3 – Schematic diagram of reconstitution sample procedure

Step 1: The first step in sample preparation is to sieve the sample at 25 mm to determine the amount of dry weight that is larger than 25 mm. All material retained on the 25 mm sieve is to be discarded, while material passing 25 mm is to be tested (see figure 1.6.4.3). Screen about 40 kg of bauxite for one Proctor/Fagerberg compaction curve if reconstitution is required. If the amount (by dry weight) that is larger than 25 mm is 10% or less, then no reconstitution is required. A total of about 50 kg of 25 mm screened bauxite is needed for one Proctor/Fagerberg compaction curve. Obtain this and proceed to Step 4 if no reconstitution is required.

Step 2: If reconstitution is required, then from a separate representative sub-sample of the same ore screen at 25 mm and 6.3 mm and retain the portion between these two sieve sizes. Produce about 15 kg of screened bauxite between these two sizes for one Proctor/Fagerberg compaction curve (see figure 1.6.4.3).

Step 3: Add the 6.3 to 25 mm fraction from Step 2 to the <25 mm fraction from Step 1. The amount of 6.3 mm to 25 mm fraction added must be equal to the mass of > 25 mm bauxite removed and discarded in Step 1.

Step 4: Fully mix the reconstituted or scalped sample.

#### **.4      **Compaction****

Compaction tests are executed for 5 to 10 (but typically 7) different moisture contents in separate tests. The number of tests should fully define the compaction curve, including accurately determining the optimum moisture content and conditions near to or at full saturation. A total of about 40 kg to 100 kg of unscreened bauxite is typically needed for one series of tests, depending on whether reconstitution is required or not.

Divide the screened bauxite into 5 to 10 subsamples and place each in a sealed plastic bucket. The water content of the subsamples is adjusted by adding a suitable amount of water into each bucket in order to obtain water contents ranging from the as-received water content to almost saturated sub-samples.

Typically, one test is carried out at the as-received water content. Four to eight tests are carried out at higher water contents. Depending on the as-received water content, one or two tests are carried out at lower water contents than the as-received water content. These lower water content tests are obtained by partially drying the bauxite sub-sample at room temperature. Note that full drying of the bauxite samples is not to be carried out. Note that some bauxites are not sensitive to pre-drying, but unless this is comprehensively demonstrated for the bauxite being tested, pre-drying is not permitted.

The subsamples are mixed at the target water contents before being allowed to rest and equilibrate overnight in the sealed plastic buckets. The plastic bucket contents are remixed immediately before compaction to ensure that a homogeneous sample is tested.

The required quantity of prepared bauxite per compaction test is about 5 kg, so this is the target amount for each subsample. The subsamples will be compacted at the prepared water contents to define a full compaction curve.

Approximately one fifth of the subsample in a plastic bucket is filled into the mould with the extension piece attached (figure 1.6.2) and levelled to form the first layer increment. Bauxites that display plasticity may tend to stick together into clumps at the wetter water contents. It is important to gently disaggregate the clumps by hand into small particles when loading the mould.

The bauxite is then tamped uniformly over the surface of the layer. Tamping is executed as per the Proctor/Fagerberg method *D*, by dropping a 150 g hammer 58 times through the guide pipe, 0.15 m each time. The guide tube is held by hand and positioned so that it is just touching with the surface of the ore, but is not resting on it. This allows the hammer to fall the full specified height and compact the bauxite, while avoiding additional (and excessive) compaction arising from the weight of the guide tube, itself, which should not be compressing the bauxite.

The performance is repeated for all five layers so that the last layer only just overfills the mould-extension piece junction. The aim is to fill the mould by compacting in five nearly equal layers in order to produce a uniformly compacted sample in which the specified energy has been put into bauxite that occupies the mould volume.

Bauxite should not extend more than 1 cm in height above the mould into the extension piece. If a height of more than 1 cm of bauxite is found, the sample has been under compacted and the test should be redone.

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.

The levelling process should be a horizontal cutting action, not a pushing action as that would compress more material into the mould volume than had been compacted by the specified energy input.

After the weight of the cylinder with the tamped sample has been determined, the cylinder is emptied, the full sample is dried at 105°C as per ISO moisture determination standard for bauxite (ISO 9033:1989 "Aluminium ores – Determination of the moisture content of bulk material") and the weight is determined. The test is then repeated for the other samples with different moisture contents.

#### **.5 Definitions and data for calculations (see figure 1.6.2)**

- 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:  $2,304.5 \text{ cm}^3$

## .6 Calculation of main characteristics

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

$$\gamma = \frac{D}{2,304}$$

- 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:  $W^1$

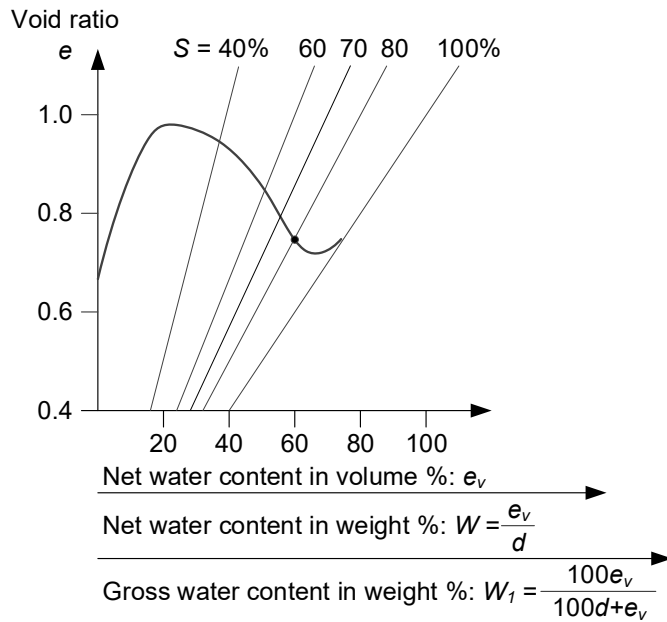
$$W^1 = \frac{E}{C} \times 100$$

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

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

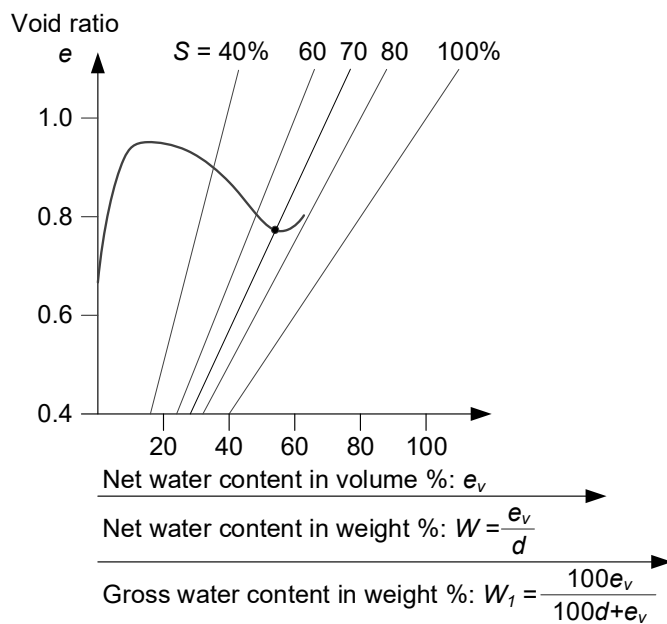
## .7 Presentation of the compaction tests

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 1.6.4.7.1**

Form of bauxite compaction curve when the optimum moisture occurs at a saturation greater than 90%. TML is determined as the critical water content at 80% saturation.



**Figure 1.6.4.7.2**

Form of bauxite compaction curve when the optimum moisture occurs at a saturation less than 90%. TML is determined as the critical water content at 70% saturation.

**.8 Compaction curve**

The test sequence results in a specific compaction curve (see figures 1.6.4.7.1 and 1.6.4.7.2).

Should the optimum moisture content (OMC) of bauxite occur at or above 90% saturation, the critical moisture content is indicated by the intersection of the compaction curve and the line  $S = 80\%$  degree of saturation (see figure 1.6.4.7.1). The TML is the critical moisture content.

Should the optimum moisture content (OMC) of bauxite occur below 90% saturation, the critical moisture content is indicated by the intersection of the compaction curve and the line  $S = 70\%$  degree of saturation (see figure 1.6.4.7.2). The TML is the critical moisture content.

Where the OMC is not clearly defined by carrying out a sufficient number of tests at water contents close to and on either side of the OMC, then a TML based on  $S = 80\%$  cannot be adopted. The TML shall be based on  $S = 70\%$ . This is to guard against the erroneous adoption of a high OMC due to insufficient definition of the compaction curve.

Where moisture very freely drains from the sample at moisture content such that the test sample compaction curve does not extend to or beyond 70% saturation, the test is taken to indicate a cargo where water passes freely through the spaces between particles.

## **2 Test procedures to determine the angle of repose and associated apparatus**

### **2.1 *Determination of angle of repose of fine-grained materials (size less than 10 mm): "tilting box test". For use in laboratory or port of loading***

#### **2.1.1 *Scope***

The test provides for the determination of the angle of repose of fine-grained non-cohesive materials (size less than 10 mm). The results so obtained may be used when interpreting sections 5 and 6 of this Code for the materials in question.

#### **2.1.2 *Definition***

The angle of repose obtained by this test is the angle formed between the horizontal and the top of the testbox when the material in the box just begins to slide in bulk.

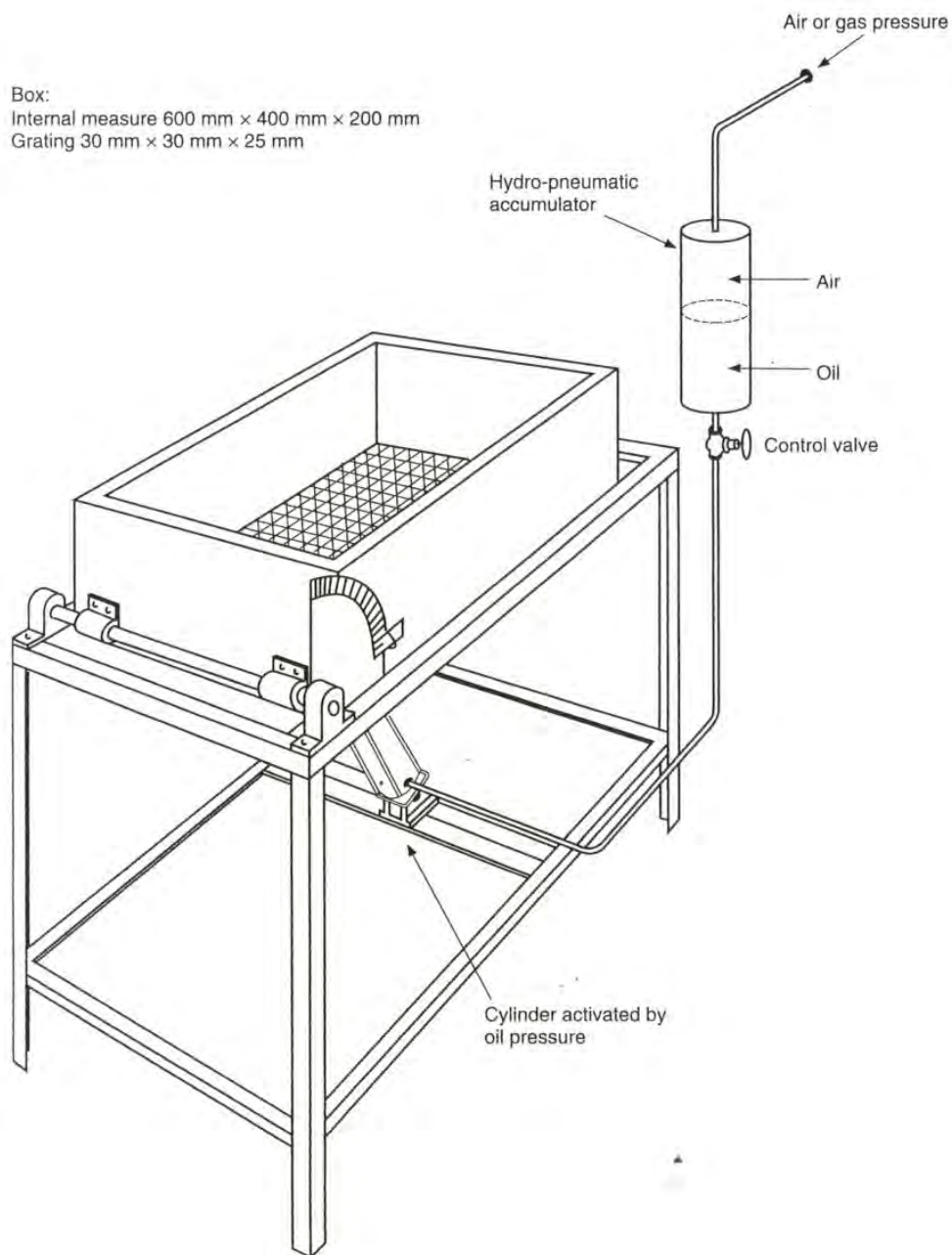
#### **2.1.3 *Principle of test***

When measuring the angle of repose by this method, the material surface should initially be level and parallel to the testbox base. The box is tilted without vibration and tilting is stopped when the product just begins to slide in bulk.

#### **2.1.4 *Apparatus (see figure 2.1.4)***

Apparatus is as follows:

- .1 A framework, on top of which is attached an open box. Attachment of the box to the frame is by means of a shaft passing through bearings affixed to both the frame and the end of the box, enabling the box to be subjected to a controlled tilt.
- .2 The dimensions of the box are 600 mm long, 400 mm wide and 200 mm high.
- .3 To prevent sliding of the material along the bottom of the box during tilting, a tightly fitting grating (openings 30 mm x 30 mm x 25 mm) is placed on the bottom of the box before filling.
- .4 Tilting of the box is effected by a hydraulic cylinder fitted between the frame and the bottom of the box. Other means may be used to obtain the required tilting but in all cases vibration must be eliminated.
- .5 To pressurize the hydraulic cylinder, a hydropneumatic accumulator may be used, pressurized by air or gas at a pressure of about 5 kp/cm<sup>2</sup>.
- .6 The rate of tilting should be approximately 0.3°/s.
- .7 Range of tilt should be at least 50°.



**Figure 2.1.4 – Basic sketch of tilting box**

- .8 A protractor is fitted to the end of the shaft. One lever of the protractor is fitted so that it may be screw-adjusted to the horizontal.
- .9 The protractor should measure the angle of the top of the box to the horizontal to within an accuracy of  $0.5^\circ$ .
- .10 A spirit level or some other levelling device should be available to zero the protractor.

### 2.1.5 Procedure

The box is filled with the material to be tested by pouring it slowly and carefully from the lowest practical height into the box in order to obtain uniformity of loading.

The excess material is scraped off with the aid of a straight edge, inclined at about 45° towards the direction of scraping.

The tilting system is then activated and stopped when the material just begins to slide in bulk.

The angle of the top of the box to the horizontal is measured by the protractor and recorded.

### 2.1.6 Evaluation

The angle of repose is calculated as the mean of three measurements and is reported to within half a degree.

**Notes:** Preferably the test should be carried out with three independent samples.

Care should be taken to ensure that the shaft is adjusted to be horizontal before testing.

## 2.2 **Alternative or shipboard test method to be used for the determination of the angle of repose when the tilting box is not available**

### 2.2.1 Definition

According to this method the angle of repose is the angle between the cone slope and the horizontal measured at half height.

### 2.2.2 Principle of test

To determine the angle of repose, a quantity of the material to be tested is poured very carefully out of a flask onto a sheet of rough-textured paper, in such a way that a symmetrical cone is formed.

### 2.2.3 Equipment

The necessary equipment to carry out this test is as follows:

- a horizontal table free from vibrations;
- a sheet of rough-textured paper onto which the material should be poured;
- a protractor; and
- a 3-L conical flask.

#### 2.2.4 Procedure

Put the sheet of paper on the table. Split 10 L of the material to be tested into three subsamples and test each in the following way:

Pour two thirds of the subsample (i.e. 2 L) onto the sheet, producing a starting cone. The remainder of this subsample is then poured very carefully from a height of a few millimetres on top of the cone. Care should be taken that the cone will be built up symmetrically. This may be achieved by revolving the flask slowly close around the top of the cone when pouring.

When measuring, care should be taken that the protractor does not touch the cone; otherwise this may result in sliding of the material and spoil the test.

The angle has to be measured at four places around the cone, about 90° apart.

This test should be repeated on the other two subsamples.

#### 2.2.5 Calculations

The angle of repose is taken as the mean of the 12 measurements and is reported to half a degree. This figure can be converted to the tilting box value as follows:

$$a_t = a_s + 3^\circ \quad (2.2.5)$$

Where  $a_t$  = angle of repose according to the tilting box test

$a_s$  = angle of repose according to the survey test

### 3 Standards used in test procedures

#### 3.1 Standard flow table and frame

##### 3.1.1 Flow table and frame

3.1.1.1 The flow table apparatus shall be constructed in accordance with figure 3. The apparatus shall consist of an integrally cast rigid iron frame and a circular rigid table top, 10 inches  $\pm$  0.1 inch (254 mm  $\pm$  2.5 mm) in diameter, with a shaft attached perpendicular to the table top by means of a screw thread. The table top, to which the shaft with its integral contact shoulder is attached, shall be mounted on a frame in such a manner that it can be raised and dropped vertically through the specified height, with a tolerance in height of  $\pm$  0.005 inches (0.13 mm) for new tables and  $\pm$  0.015 inches (0.39 mm) for tables in use, by means of a rotated cam. The table top shall have a fine-machined plane surface, free of blowholes and surface defects, and shall be scribed as shown in figure 3. The table top shall be of cast brass or bronze having a Rockwell hardness number not less than HRB 25 with an edge thickness of 0.3 inches (8 mm), and shall have six integral radial stiffening ribs. The table top and attached shaft shall weigh 9 lb  $\pm$  0.1 lb (4 kg  $\pm$  0.05 kg) and the weight shall be symmetrical around the centre of the shaft.

3.1.1.2 The cam and vertical shaft shall be of medium-carbon machinery steel, hardened where indicated in figure 3. The shaft shall be straight and the difference between the diameter of the shaft and the diameter of the bore of the frame shall be not less than 0.002 inches (0.05 mm) and not more than 0.003 inches (0.08 mm) for new tables and shall be maintained at from 0.002 inches to 0.010 inches (0.26 mm) for tables in use. The end of the shaft shall not fall upon the cam at the end of the drop, but shall make contact with the cam not less than 120° from the point of drop. The face of the cam shall be a smooth spiralled curve of uniformly increasing radius from ½ inch to 1¼ inches (13 mm to 32 mm) in 360° and there shall be no appreciable jar as the shaft comes into contact with the cam. The cam shall be so located and the contact faces of the cam and shaft shall be such that the table does not rotate more than one revolution in 25 drops. The surfaces of the frame and of the table which come into contact at the end of the drop shall be maintained smooth, plane, and horizontal and parallel with the upper surface of the table and shall make continuous contact over a full 360°.

3.1.1.3 The supporting frame of the flow table shall be integrally cast of fine-grained, high-grade cast iron. The frame casting shall have three integral stiffening ribs extending the full height of the frame and located 120° apart. The top of the frame shall be chilled to a depth of approximately ¼ inch (6.4 mm) and the face shall be ground and lapped square with the bore to give 360° contact with the shaft shoulder. The underside of the base of the frame shall be ground to secure a complete contact with the steel plate beneath.

3.1.1.4 The flow table may be driven by a motor, connected to the camshaft through an enclosed worm gear speed reducer and flexible coupling. The speed of the camshaft shall be approximately 100 rpm. The motor drive mechanism shall not be fastened or mounted on the table base plate or frame.

The performance of a flow table shall be considered satisfactory if, in calibration tests, the table gives a flow value that does not differ by more than 5 percentage points from flow values obtained with a suitable calibration material.

### 3.1.2 *Flow table mounting*

3.1.2.1 The flow table frame shall be tightly bolted to a cast iron or steel plate at least 1 inch (25 mm) thick and 10 inches (250 mm) square. The top surface of this plate shall be machined to a smooth plane surface. The plate shall be anchored to the top of a concrete pedestal by four ½ inches (13 mm) bolts that pass through the plate and are embedded at least 6 inches (150 mm) in the pedestal. The pedestal shall be cast inverted on the base plate. A positive contact between the base plate and the pedestal shall be obtained at all points. No nuts or other such levelling devices shall be used between the plate and the pedestal. Levelling shall be effected by suitable means under the base of the pedestal.



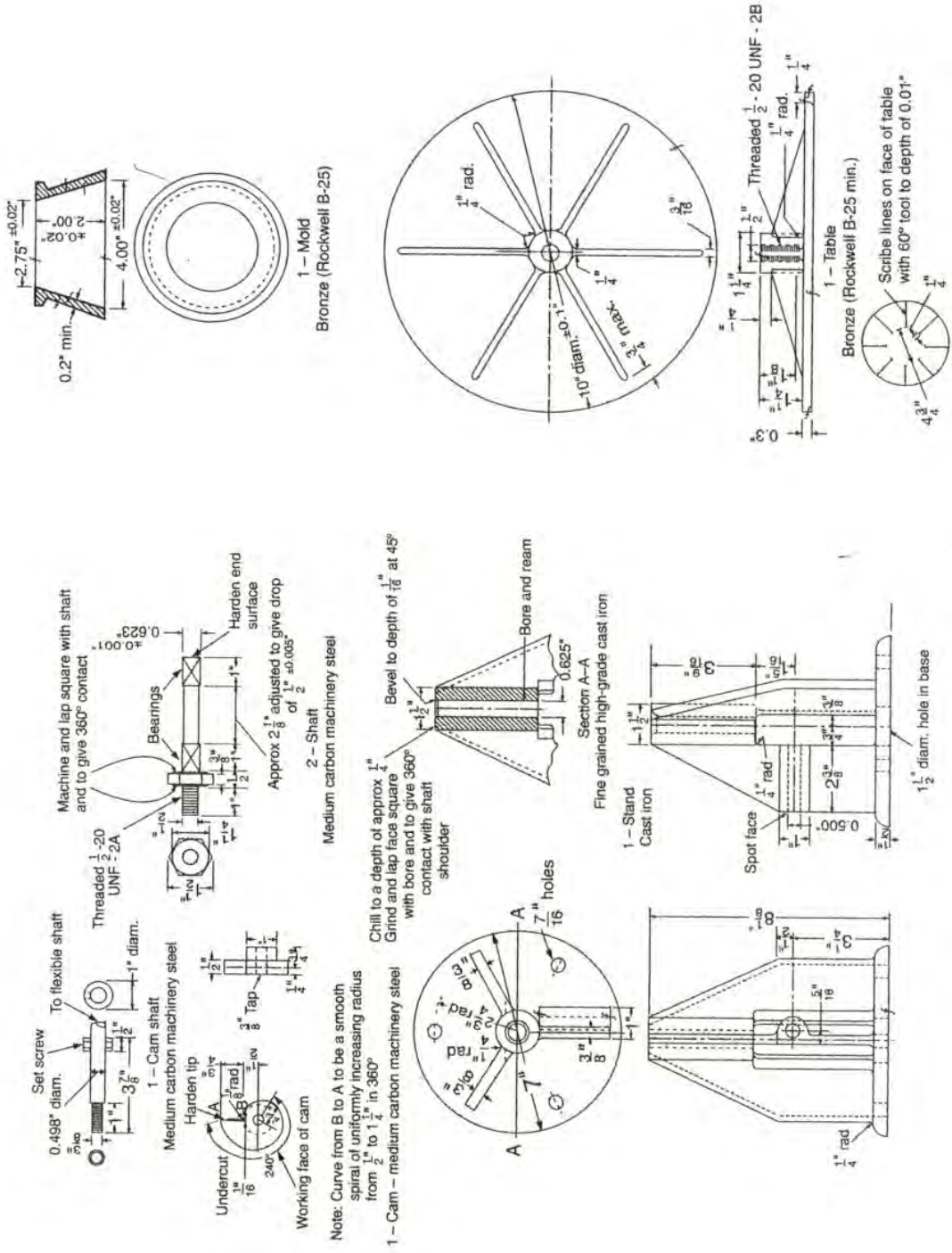


Figure 3

3.1.2.2 The pedestal shall be 10 inches to 11 inches (250 mm to 275 mm) square at the top, and 15 inches to 16 inches (375 mm to 400 mm) square at the bottom, 25 inches to 30 inches (625 mm to 750 mm) in height, and shall be of monolithic construction, cast from concrete weighing at least 140 lb/ft<sup>3</sup> (2,240 kg/m<sup>3</sup>). A stable gasket cork pad, ½ inch (13 mm) thick and approximately 4 inches (102 mm) square, shall be inserted under each corner of the pedestal. The flow table shall be checked frequently for levelness of the table top, stability of the pedestal, and tightness of the bolts and nuts in the table base and the pedestal plate. (A torque of 20 lb/ft (27 Nm) is recommended when tightening those fastenings.)

3.1.2.3 The table top, after the frame has been mounted on the pedestal, shall be level along two diameters at right angles to each other, in both the raised and lowered positions.

### 3.1.3 *Flow table lubrication*

3.1.3.1 The vertical shaft of the table shall be kept clean and shall be lightly lubricated with a light oil (SAE-10). Oil shall not be present between the contact faces of the table top and the supporting frame. Oil on the cam face will lessen wear and promote smoothness of operation. The table should be raised and permitted to drop a dozen or more times just prior to use if it has not been operated for some time.

### 3.1.4 *Mould*

3.1.4.1 The mould for casting the flow specimen shall be of cast bronze or brass, constructed as shown in figure 3. The Rockwell hardness number of the metal shall be not less than HRB 25. The diameter of the top opening shall be 2.75 inches  $\pm$  0.02 inches (69.8 mm  $\pm$  0.5 mm) for new moulds and 2.75 inches + 0.05 inches (+ 1.3 mm) and – 0.02 inches for moulds in use. The surfaces of the base and top shall be parallel and at right angles to the vertical axis of the cone. The mould shall have a minimum wall thickness of 0.2 inches (5 mm). The outside of the top edge of the mould shall be shaped so as to provide an integral collar for convenient lifting of the mould. All surfaces shall be machined to a smooth finish. A circular shield approximately 10 inches (254 mm) in diameter, with a centre opening approximately 4 inches (102 mm) in diameter, made of non-absorbing material not attacked by the cement, shall be used with the flow mould to prevent mortar from spilling on the table top.

## 3.2 ***Scales and weights***

### 3.2.1 *Scales*

3.2.1.1 The scales used shall conform to the following requirements. On scales in use, the permissible variation at a load of 2,000 g shall be  $\pm$  2.0 g. The permissible variation on new scales shall be one half of this value. The sensibility reciprocal shall be not greater than twice the permissible variation.

### 3.2.2 *Weights*

3.2.2.1 The permissible variations on weights shall be as prescribed in the table below. The permissible variations on new weights shall be one half of the values in the table below.

#### PERMISSIBLE VARIATIONS ON WEIGHTS

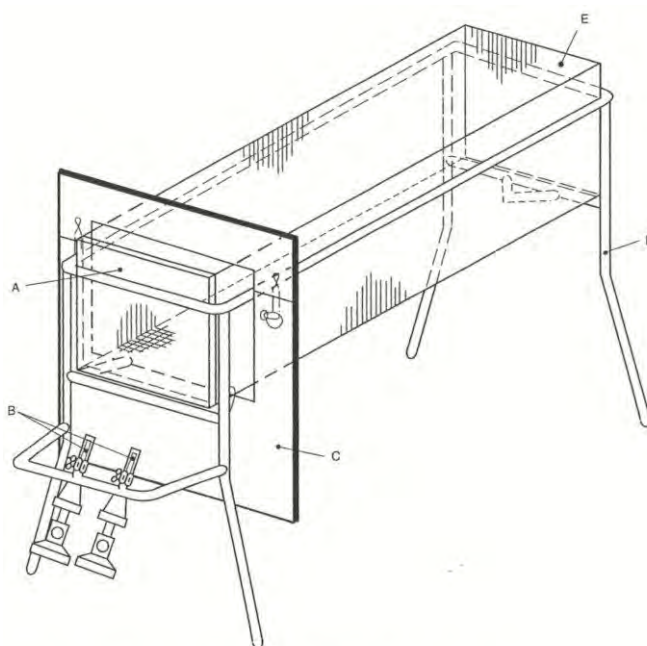
| Weight (g) | Permissible variations<br>on weights in use,<br>plus or minus (g) |
|------------|---|
|------------|---|

|       |       |      |
|-------|-------|------|
| 1,000 | ..... | 0.50 |
| 900   | ..... | 0.45 |
| 750   | ..... | 0.40 |
| 500   | ..... | 0.35 |
| 300   | ..... | 0.30 |
| 250   | ..... | 0.25 |
| 200   | ..... | 0.20 |
| 100   | ..... | 0.15 |
| 50    | ..... | 0.10 |
| 20    | ..... | 0.05 |
| 10    | ..... | 0.04 |
| 5     | ..... | 0.03 |
| 2     | ..... | 0.02 |
| 1     | ..... | 0.01 |

## 4 Trough test for determination of the self-sustaining exothermic decomposition of fertilizers containing nitrates

### 4.1 Definition

A fertilizer capable of self-sustaining decomposition is defined as one in which decomposition initiated in a localized area will spread throughout the mass. The tendency of a fertilizer offered for transport to undergo this type of decomposition can be determined by means of the trough test. In this test localized decomposition is initiated in a bed of the fertilizer to be contained in a horizontally mounted trough. The amount of propagation, after removal of the initiating heat source, of decomposition through the mass is measured.



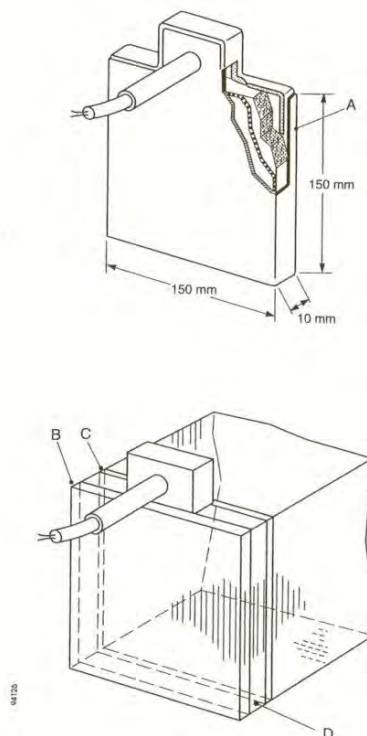
- A Steel plate (150 x 150 mm and 1 to 3 mm thick)
- B Gas burners (e.g. Teclu or Bunsen)
- C Heat shield (2 mm thick)
- D Stand (e.g. made from 15 mm wide, 2 mm thick steel bar)
- E Gauze trough (150 x 150 x 500 mm)

**Figure 4-1 – Gauze trough with support and burners**

### 4.2 Apparatus and materials

The apparatus (figure 4-1) consists of a trough of internal dimensions 150 mm x 150 mm x 500 mm, open at the top. The trough is constructed of square-meshed gauze (preferably stainless steel) with a mesh width of about 1.5 mm and a wire thickness of 1.0 mm supported on a frame made from, for example, 15 mm wide, 2 mm thick steel bars. The gauze at each end of the trough may be replaced by 1.5 mm thick, 150 mm x 150 mm stainless steel plates. The trough should be rested on a suitable support. Fertilizers with a particle size distribution such that a significant amount falls through the mesh of the trough should be tested in a trough of smaller mesh gauze, or alternatively in a trough lined with gauze of a smaller mesh. During initiation sufficient heat should be provided and maintained to

establish a uniform decomposition front. Two alternative heating methods are recommended, namely:



- A Aluminium or stainless steel sheathing (thickness 3 mm)
- B Insulating plate (thickness 5 mm)
- C Aluminium foil or stainless steel plate (thickness 3 mm)
- D Position of heating device in trough

**Figure 4-2 – Electrical heating device (capacity 250 W)**

#### 4.2.1 Electrical heating

An electrical heating element (capacity 250 W) enclosed in a stainless steel box is placed inside and at one end of the trough (figure 4-2). The dimensions of the stainless steel box are 145 mm x 145 mm x 10 mm, and the wall thickness is 3 mm. The side of the box which is not in contact with the fertilizer should be protected with a heat shield (insulation plate 5 mm thick). The heating side of the box may be protected with aluminium foil or a stainless steel plate.

#### 4.2.2 Gas burners

A steel plate (thickness 1 mm to 3 mm) is placed inside one end of the trough and in contact with the wire gauze (figure 4-1). The plate is heated by means of two burners which are fixed to the trough support and are capable of maintaining the plate at temperatures between 400°C and 600°C, i.e. dull red heat.

4.2.3 To prevent heat transport along the outside of the trough, a heat shield consisting of a steel plate (2 mm thick) should be installed at about 50 mm from the end of the trough where the heating takes place.

4.2.4 The life of the apparatus may be prolonged if it is constructed of stainless steel throughout. This is particularly important in the case of the gauze trough.

4.2.5 Propagation may be measured using thermocouples in the substance and recording the time at which a sudden temperature rise occurs as the reaction front reaches the thermocouple.

### **4.3 Procedure**

4.3.1 The apparatus should be set up under a fume hood to remove toxic decomposition gases or in an open area where the fumes can be readily dispersed. Although there is no explosion risk, when performing the test it is advisable to have a protective shield, e.g. of suitable transparent plastics, between the observer and the apparatus.

4.3.2 The trough is filled with the fertilizer in the form to be offered for shipment, and decomposition is initiated at one end, either electrically or by means of gas burners as described above. Heating should be continued until decomposition of the fertilizer is well established and propagation of the front (over approximately 30 mm to 50 mm) has been observed. In the case of products with high thermal stability, it may be necessary to continue heating for two hours. If fertilizers show a tendency to melt, the heating should be done with care, i.e. using a small flame.

4.3.3 About 20 min after the heating has been discontinued, the position of the decomposition front is noted. The position of the reaction front can be determined by difference in colour, e.g. brown (undecomposed fertilizer) to white (decomposed fertilizer), or by the temperature indicated by adjacent pairs of thermocouples which bracket the reaction front. The rate of propagation may be determined by observation and timing or from thermocouple records. It should be noted whether there is no propagation after heating is discontinued or whether propagation occurs throughout the substance.

### **4.4 Test criteria and method of assessing results**

4.4.1 If propagation of the decomposition continues throughout the substance, the fertilizer is considered capable of showing self-sustaining decomposition.

4.4.2 If propagation does not continue throughout the substance, the fertilizer is considered to be free from the hazard of self-sustaining decomposition.

## **5 Description of the test of resistance to detonation**

### **5.1 Principle**

5.1.1 The test sample is confined in a steel tube and subjected to detonation shock from an explosive booster charge. Propagation of the detonation is determined from the degree of compression of lead cylinders on which the tube rests horizontally during the test.

## 5.2 **Sample preparation**

5.2.1 The test must be carried out on a representative sample of cargo. Before being tested for resistance to detonation, the whole mass of the sample is to be thermally cycled five times between 25°C and 50°C ( $\pm 1^\circ\text{C}$ ) in sealed tubes. The sample shall be maintained at the extreme temperatures, measured at the centre of the sample, for at least 1 hour during each thermal cycle and at 20°C ( $\pm 3^\circ\text{C}$ ) after complete cycling until tested.

## 5.3 **Materials**

Seamless steel tube to ISO 65-1981-Heavy or equivalent

|                           |             |
|---------------------------|-------------|
| Tube length               | 1,000 mm    |
| Nominal external diameter | 114 mm      |
| Nominal wall thickness    | 5 to 6.5 mm |

Bottom plate (160 x 160 mm) of good weldable quality, thickness 5 to 6 mm to be butt-welded to one end of the tube around the entire circumference.

Initiation system and booster

Electrical blasting cap or detonating cord with non-metallic sleeve (10 to 13 g/m).

Compressed pellet of secondary explosive, such as hexogen/wax 95/5 or tetryl, with a central recess to take the detonator.

500  $\pm$  1 gramme plastic explosive containing 83 to 86% penthrite, formed into a cylinder in a cardboard or plastic tube. Detonation velocity 7,300 to 7,700 m/s.

Six witness cylinders of refined, cast lead for detecting detonation.

50 mm diameter x 100 mm high, refined lead of at least 99.5% purity.

## 5.4 **Procedure**

Test temperature: 15 to 20°C. Figures 1 and 2 show the test arrangement.

Fill the tube about one-third of its height with the test sample and drop it 10 cm vertically five times on the floor. Improve the compression by striking the side wall with a hammer between drops. A further addition shall be made such that, after compaction or by raising and dropping the tube 20 times and a total of 20 intermittent hammer blows, the charge fills the tube to a distance of 70 mm from its orifice.

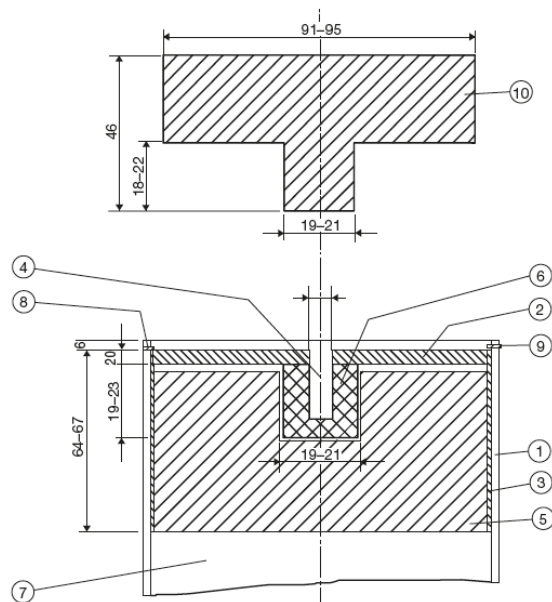
Insert the plastic explosive into the tube and press it down with a wooden die. Place the compressed pellet centrally in the recess within the plastic explosive. Close it with a wooden disc so that it remains in contact with the test sample. Lay the test tube horizontally on the 6 lead cylinders placed at 150 mm intervals (centric), with the centre of the last cylinder 75 mm from the bottom plate, on a firm, level, solid surface that is resistant to deformation or displacement. Insert the electrical blasting cap or the detonating cord.

Ensure that all necessary safety precautions are taken, connect and detonate the explosive.

Record, for each of the lead cylinders, the degree of compression expressed as a percentage of the original height of 100 mm. For oblique compression, the deformation is taken as the average of the maximum and minimum deformation.

**5.5 Results**

The test is to be carried out twice. If in each test one or more of the supporting lead cylinders are crushed by less than 5%, the sample is deemed to satisfy the resistance to detonation requirements.



Dimensions in mm

- |   |                               |   |   |
|---|-------------------------------|---|---|
| ① | Steel tube                    | ⑥ | Compressed pellet                                   |
| ② | Wooden disc                   | ⑦ | Test sample   |
| ③ | Plastic or cardboard cylinder | ⑧ | 4 mm diameter hole drilled to receive split pin (9) |
| ④ | Wooden rod                    | ⑨ | Split pin   |
| ⑤ | Plastic explosive             | ⑩ | Wooden die for (5) diameter as for detonator        |

**Figure 1 – Booster charge**



- ① Steel tube
- ② Lead cylinders
- ③ Steel block
- ④ Bottom plate
- ⑤ Booster charge
- 1 to 6 numbers of lead cylinders

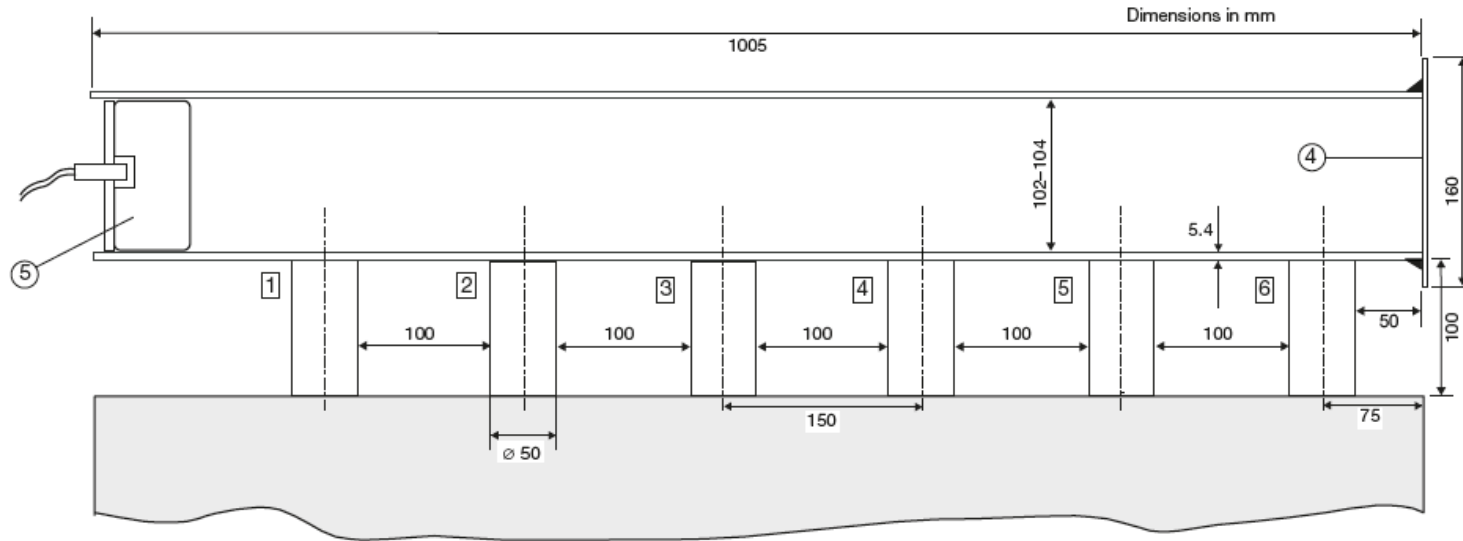
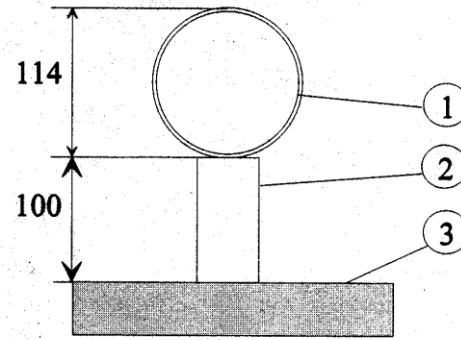


Figure 2 – Positioning of the steel tube on the firing site

## **6 Self-heating test for charcoal**

### **6.1 Apparatus**

6.1.1 *Oven.* A laboratory oven fitted with internal air circulation and capable of being controlled at  $140^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

6.1.2 *Wire mesh cube.* Construct an open-top cube, 100 mm side, from phosphor bronze gauze 18,000 mesh per square centimetre (350 x 350 mesh). Insert it inside a slightly larger, well-fitting cube, made of phosphor bronze gauze 11 mesh per square centimetre (8 x 8 mesh). Fit the outer cube with a handle or hooks so that it can be suspended from above.

6.1.3 *Temperature measurement.* A suitable system to measure and record the temperature of the oven and in the centre of the cube. "Chromel-alumel" thermocouples, made from 0.27 mm diameter wire, are suitable for measuring the temperature range expected.

### **6.2 Procedure**

6.2.1 Fill the cube with carbon and tap down gently, adding carbon until the cube is full. Suspend the sample in the centre of the oven which has been preheated to  $140^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Insert one of the thermocouples in the centre of the sample and the other between the cube and the oven wall. Maintain the temperature of the oven at  $140^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for 12 hours and record the oven temperature and the sample temperature.

### **6.3 Results**

6.3.1 Non-activated carbon, non-activated charcoal, carbon black and lamp black fail the test if the temperature at any time during the 12 hours exceeded  $200^{\circ}\text{C}$ .

6.3.2 Activated carbon and activated charcoal fail the test if the temperature at any time during the 12 hours exceeded  $400^{\circ}\text{C}$ .

### APPENDIX 3

#### PROPERTIES OF SOLID BULK CARGOES

#### 1 Non-cohesive cargoes

1.1 The following cargoes are non-cohesive when dry:

ALUMINIUM FLUORIDE  
AMMONIUM NITRATE  
AMMONIUM NITRATE BASED FERTILIZERS (TYPE A, TYPE B and  
NON-HAZARDOUS)  
AMMONIUM SULPHATE  
BORAX, ANHYDROUS  
BRUCITE  
CALCIUM NITRATE FERTILIZER  
CHLORITE  
DIAMMONIUM PHOSPHATE  
FERRONICKEL SLAG (granulated)  
FLUE DUST, CONTAINING LEAD AND ZINC  
GRAIN SCREENING PELLETS  
GRANULAR FERROUS SULPHATE  
MAGNESIUM SULPHATE FERTILIZERS  
MONOAMMONIUM PHOSPHATE  
MONOAMMONIUM PHOSPHATE (M.A.P.), MINERAL ENRICHED COATING  
MONOCALCIUMPHOSPHATE (MCP)  
OLIVINE GRANULAR AND GRAVEL AGGREGATE PRODUCTS  
OLIVINE SAND  
POTASH  
POTASSIUM CHLORIDE  
POTASSIUM NITRATE  
POTASSIUM SULPHATE  
SAND, MINERAL CONCENTRATE, RADIOACTIVE MATERIAL, LOW SPECIFIC  
ACTIVITY (LSA-I) UN 2912  
SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES  
(group B)  
SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES  
(group C)  
SODIUM NITRATE AND POTASSIUM NITRATE MIXTURE  
SPODUMENE (UPGRADED)  
SUGARCANE BIOMASS PELLETS  
SUPERPHOSPHATE  
SYNTHETIC SILICON DIOXIDE  
TAPIOCA  
UREA  
WOOD PELLETS CONTAINING ADDITIVES AND/OR BINDERS  
WOOD PELLETS NOT CONTAINING ANY ADDITIVES AND/OR BINDERS  
WOOD TORREFIED

1.2 Prior to completion of loading, the angle of repose of the materials to be loaded should be determined (see section 6) so as to determine which provisions of this Code relating to trimming apply (see section 5).

1.3 All cargoes, other than those listed in this appendix, are cohesive and the use of the angle of repose is, therefore, not appropriate. Cargoes not listed should be treated as cohesive until otherwise shown.

## **2 Cargoes which may liquefy**

2.1 Many fine-particled cargoes, if possessing a sufficiently high moisture content, are liable to flow. Thus any damp or wet cargo containing a proportion of fine particles should be tested for flow characteristics prior to loading.

## **3 Precautions for the cargoes which may possess a chemical hazard**

3.1 In circumstances where consultation with the competent authority is required prior to shipment of dry bulk cargoes, it is equally important to consult authorities at the port of loading and discharge concerning requirements which may be in force.

3.2 Where required, the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) should be consulted prior to loading.

APPENDIX 4

INDEX

| MATERIAL  | Group   | REFERENCES  |
|---|---------|---|
| ALFALFA   | C       |   |
| ALUMINA   | C       |   |
| ALUMINA, CALCINED                                   | C       |   |
| ALUMINA HYDRATE                                     | A and B |   |
| ALUMINA SILICA                                      | C       |   |
| ALUMINA SILICA, pellets                             | C       |   |
| Aluminium dross                                     | B       | see ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS UN 3170 |
| ALUMINIUM FERROSILICON POWDER UN 1395               | B       |   |
| ALUMINIUM FLUORIDE                                  | A       |   |
| Aluminium hydroxide                                 | A and B | see ALUMINA HYDRATE   |
| ALUMINIUM NITRATE UN 1438                           | B       |   |
| ALUMINIUM REMELTING BY-PRODUCTS UN 3170             | B       |   |
| Aluminium salt slags                                | B       | see ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS UN 3170 |
| ALUMINIUM SILICON POWDER, UNCOATED UN 1398          | B       |   |
| Aluminium skimmings                                 | B       | see ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS UN 3170 |
| ALUMINIUM SMELTING BY-PRODUCTS UN 3170              | B       |   |
| ALUMINIUM SMELTING/REMELTING BY-PRODUCTS, PROCESSED | A and B |   |
| AMMONIUM NITRATE UN 1942                            | B       |   |
| AMMONIUM NITRATE BASED FERTILIZER UN 2067           | B       |   |
| AMMONIUM NITRATE BASED FERTILIZER UN 2071           | B       |   |
| AMMONIUM NITRATE BASED FERTILIZER (non-hazardous)   | C       |   |
| AMMONIUM SULPHATE                                   | C       |   |
| AMORPHOUS SODIUM SILICATE LUMPS                     | B       |   |
| ANTIMONY ORE AND RESIDUE                            | C       |   |
| Antimony ore residue                                | C       | see ANTIMONY ORE AND RESIDUE  |
| Bakery materials                                    | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES   |
| BARIUM NITRATE UN 1446                              | B       |   |

| MATERIAL  | Group   | REFERENCES  |
|---|---------|---|
| Barley malt pellets   | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| BARYTES   | C       |   |
| BAUXITE   | C       |   |
| BAUXITE FINES   | A       |   |
| Beach iron  | C       | see IRON SMELTING BY-PRODUCTS   |
| Beet, expelled  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Beet, extracted   | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| BIOSLUDGE   | C       |   |
| Blende (zinc sulphide)  | A       | see ZINC CONCENTRATE  |
| BORAX (PENTAHYDRATE CRUDE)                                    | C       |   |
| BORAX, ANHYDROUS, crude                                       | C       |   |
| BORAX, ANHYDROUS, refined                                     | C       |   |
| BORIC ACID  | B       |   |
| Bottom ash  | A and B | see CLINKER ASH   |
| Bran pellets  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Brewer's grain pellets  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| BROWN COAL BRIQUETTES   | B       |   |
| BRUCITE   | C       |   |
| Calcined clay   | C       | see ALUMINA, CALCINED   |
| Calcined pyrites  | A and B | see PYRITES, CALCINED   |
| Calcium fluoride  | A and B | see FLUORSPAR   |
| CALCIUM FLUORIDE, CALCIUM SULPHATE, CALCIUM CARBONATE MIXTURE | A       |   |
| CALCIUM NITRATE UN 1454                                       | B       |   |
| CALCIUM NITRATE FERTILIZER                                    | C       |   |
| Calcium oxide   | B       | see LIME (UNSLAKED)   |
| Canola pellets  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| CARBORUNDUM   | C       |   |
| CASTOR BEANS UN 2969  | B       |   |
| CASTOR FLAKE UN 2969  | B       |   |
| CASTOR MEAL UN 2969   | B       |   |
| CASTOR POMACE UN 2969   | B       |   |

| MATERIAL                                   | Group     | REFERENCES  |
|--|-----------|---|
| CEMENT                                     | C         |   |
| CEMENT CLINKERS                            | C         |   |
| CEMENT COPPER                              | A         | see Mineral Concentrates schedule   |
| Chalcopyrite                               | A         | see COPPER CONCENTRATE  |
| CHAMOTTE                                   | C         |   |
| CHARCOAL                                   | B         |   |
| CHEMICAL GYPSUM                            | A         |   |
| CHLORITE                                   | C         |   |
| CHOPPED RUBBER AND PLASTIC INSULATION      | C         |   |
| Chile saltpetre                            | B         | see SODIUM NITRATE  |
| Chilean natural nitrate                    | B         | see SODIUM NITRATE  |
| Chilean natural potassic nitrate           | B         | see SODIUM NITRATE AND POTASSIUM NITRATE MIXTURE                            |
| Chrome ore                                 | C         | see CHROMITE ORE  |
| CHROME PELLETS                             | C         |   |
| CHROMITE ORE                               | C         |   |
| Chromium ore                               | C         | see CHROMITE ORE  |
| Citrus pulp pellets                        | B or C    | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| CLAY                                       | C         |   |
| CLINKER ASH                                | A and B   |   |
| COAL                                       | B (and A) |   |
| COAL SLURRY                                | A         |   |
| COAL TAR PITCH                             | B         |   |
| COARSE CHOPPED TYRES                       | C         |   |
| COARSE IRON AND STEEL SLAG AND ITS MIXTURE | C         |   |
| Coconut                                    | B or C    | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| COKE                                       | C         |   |
| COKE BREEZE                                | A         |   |
| COLEMANITE                                 | C         |   |
| COPPER CONCENTRATE                         | A         | see Mineral Concentrates schedule   |
| COPPER GRANULES                            | C         |   |
| COPPER MATTE                               | C         |   |
| Copper nickel                              | A         | see NICKEL CONCENTRATE  |
| Copper ore concentrate                     | A         | see COPPER CONCENTRATE  |
| Copper precipitate                         | A         | see CEMENT COPPER   |
| COPPER SLAG                                | A         |   |
| COPRA (dry) UN 1363                        | B         |   |
| Copra, expelled                            | B or C    | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |

| MATERIAL   | Group  | REFERENCES  |
|--|--------|---|
| Copra, extracted   | B or C | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Corn gluten  | B or C | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Cotton seed  | B or C | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| CRUSHED CARBON ANODES  | C      |   |
| CRYOLITE   | C      |   |
| Deadburned magnesite   | C      | see MAGNESIA (DEADBURNED)   |
| DIAMMONIUM PHOSPHATE   | C      |   |
| DIRECT REDUCED IRON (A)<br>Briquettes, hot-moulded                 | B      |   |
| DIRECT REDUCED IRON (B)<br>Lumps, pellets, cold-moulded briquettes | B      |   |
| DIRECT REDUCED IRON (C)<br>By-product fines                        | B      |   |
| DISTILLERS DRIED GRAINS WITH SOLUBLES                              | C      |   |
| DOLOMITE   | C      |   |
| Dolomitic quicklime  | B      | see LIME (UNSLAKED)   |
| D.R.I.   | B      | see DIRECT REDUCED IRON (A) or (B) or (C)                                   |
| Expellers  | B or C | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| FELSPAR LUMP   | C      |   |
| FERROCHROME  | C      |   |
| FERROCHROME, exothermic  | C      |   |
| FERROMANGANESE   | C      |   |
| Ferromanganese, exothermic   | C      | see FERROMANGANESE  |
| FERRONICKEL  | C      |   |
| FERRONICKEL SLAG (granulated)                                      | C      |   |
| FERROPHOSPHORUS  | B      |   |
| Ferrophosphorus briquettes   | B      | see FERROPHOSPHORUS   |
| FERROSILICON UN 1408   | B      |   |
| FERROSILICON   | B      |   |
| FERROUS METAL BORINGS UN 2793                                      | B      |   |
| FERROUS METAL CUTTINGS UN 2793                                     | B      |   |
| FERROUS METAL SHAVINGS UN 2793                                     | B      |   |
| FERROUS METAL TURNINGS UN 2793                                     | B      |   |
| FERROUS SULPHATE HEPTAHYDRATE                                      | C      |   |
| FERTILIZERS WITHOUT NITRATES                                       | C      |   |
| FISH (IN BULK)   | A      |   |



| MATERIAL  | Group   | REFERENCES  |
|---|---------|---|
| FISHMEAL, STABILIZED UN 2216                            | B       |   |
| FISHSCRAP, STABILIZED UN 2216                           | B       |   |
| Flat iron   | C       | see IRON SMELTING BY-PRODUCTS   |
| Flint flat glass cullet                                 | C       | see GLASS CULLET  |
| FLUE DUST, CONTAINING LEAD AND ZINC                     | A and B |   |
| FLUORSPAR   | A and B |   |
| FLY ASH, DRY  | C       |   |
| FLY ASH, WET  | A       |   |
| FOAM GLASS GRAVEL                                       | C       |   |
| Foundry sand  | C       | See SAND  |
| Galena (lead sulphide)                                  | A       | see LEAD CONCENTRATE  |
| Garbage tankage   | B       | see TANKAGE   |
| GLASS CULLET  | C       |   |
| Gluten pellets  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| GRAIN SCREENING PELLETS                                 | C       |   |
| GRANULAR FERROUS SULPHATE                               | C       |   |
| Granulated iron   | C       | see IRON SMELTING BY-PRODUCTS   |
| GRANULATED NICKEL MATTE (LESS THAN 2% MOISTURE CONTENT) | B       |   |
| GRANULATED SLAG   | C       |   |
| GRANULATED TYRE RUBBER                                  | C       |   |
| Ground nuts, meal                                       | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| GYPSUM  | C       |   |
| GYPSUM GRANULATED                                       | C       |   |
| Hominy chop   | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| ILMENITE CLAY   | A       |   |
| ILMENITE (ROCK)   | C       |   |
| ILMENITE SAND   | A       |   |
| ILMENITE (UPGRADED)                                     | A       |   |
| IRON AND STEEL SLAG AND ITS MIXTURE                     | A       |   |
| IRON CONCENTRATE  | A       | see Mineral Concentrates schedule   |
| IRON CONCENTRATE (pellet feed)                          | A       | see Mineral Concentrates schedule   |
| IRON CONCENTRATE (sinter feed)                          | A       | see Mineral Concentrates schedule   |
| Iron disulphide   | C       | see PYRITE  |
| IRON ORE  | C       |   |
| Iron ore (concentrate, pellet feed, sinter feed)        | A       | see IRON CONCENTRATE (pellet feed or sinter feed)                           |
| IRON ORE FINES  | A       |   |
| IRON ORE PELLETS  | C       |   |

| <b>MATERIAL</b>                | <b>Group</b> | <b>REFERENCES</b>   |
|--------------------------------|--------------|---|
| IRON OXIDE, SPENT UN 1376      | B            |   |
| IRON OXIDE TECHNICAL           | A            |   |
| Iron pan edges                 | C            | see IRON SMELTING BY-PRODUCTS   |
| Iron silicate granulated       | A            | See COPPER SLAG   |
| IRON SINTER                    | C            |   |
| Iron skulls                    | C            | see IRON SMELTING BY-PRODUCTS   |
| IRON SMELTING BY-PRODUCTS      | C            |   |
| IRON SPONGE, SPENT UN 1376     | B            |   |
| Iron swarf                     | B            | see FERROUS METAL BORINGS, SHAVINGS, TURNINGS OR CUTTINGS UN 2793           |
| IRONSTONE                      | C            |   |
| K1-K3 bears                    | C            | see IRON SMELTING BY-PRODUCTS   |
| LABRADORITE                    | C            |   |
| LEAD AND ZINC CALCINES (mixed) | A            | see Mineral Concentrates schedule   |
| LEAD AND ZINC MIDDINGS         | A            | see Mineral Concentrates schedule   |
| LEAD CONCENTRATE               | A            | see Mineral Concentrates schedule   |
| LEAD NITRATE UN 1469           | B            |   |
| LEAD ORE                       | C            |   |
| Lead ore concentrate           | A            | see LEAD CONCENTRATE  |
| LEAD ORE RESIDUE               | A            | see Mineral Concentrates schedule   |
| LEAD SILVER CONCENTRATE        | A            | see Mineral Concentrates schedule   |
| Lead silver ore                | A            | see LEAD SILVER CONCENTRATE   |
| Lead sulphide                  | A            | see LEAD CONCENTRATE  |
| Lead sulphide (galena)         | A            | see LEAD CONCENTRATE  |
| Lignite                        | B            | see BROWN COAL BRIQUETTES   |
| LIME (UNSLAKED)                | B            |   |
| LIMESTONE                      | C            |   |
| LINTED COTTON SEED             | B            |   |
| Linseed, expelled              | B or C       | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Linseed, extracted             | B or C       | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| LOGS                           | B            | see Wood Products – General schedule  |
| MAGNESIA (DEADBURNED)          | C            |   |
| MAGNESIA (UNSLAKED)            | B            |   |
| Magnesia, clinker              | C            | see MAGNESIA (DEADBURNED)   |
| Magnesia, electro-fused        | C            | see MAGNESIA (DEADBURNED)   |
| Magnesia lightburned           | B            | see MAGNESIA (UNSLAKED)   |
| Magnesia calcined              | B            | see MAGNESIA (UNSLAKED)   |
| Magnesia caustic calcined      | B            | see MAGNESIA (UNSLAKED)   |
| Magnesite clinker              | C            | see MAGNESIA (DEADBURNED)   |
| MAGNESITE, natural             | C            |   |

| <b>MATERIAL</b>  | <b>Group</b> | <b>REFERENCES</b>  |
|--|--------------|--|
| Magnesium carbonate  | C            | see MAGNESITE, natural   |
| MAGNESIUM NITRATE UN 1474                                    | B            |  |
| MAGNESIUM SULPHATE FERTILIZERS                               | C            |  |
| Maize, expelled  | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES |
| Maize, extracted   | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES |
| MANGANESE COMPONENT FERROALLOY<br>SLAG                       | C            |  |
| MANGANESE CONCENTRATE  | A            | see Mineral Concentrates schedule  |
| MANGANESE ORE  | C            |  |
| MANGANESE ORE FINES  | A            |  |
| M.A.P.   | C            | see MONOAMMONIUM<br>PHOSPHATE  |
| MARBLE CHIPS   | C            |  |
| MATTE CONTAINING COPPER AND LEAD                             | B            |  |
| Meal, oily   | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES |
| METAL SULPHIDE CONCENTRATES                                  | A and B      |  |
| METAL SULPHIDE CONCENTRATES,<br>CORROSIVE UN 1759            | A and B      |  |
| METAL SULPHIDE CONCENTRATES,<br>SELF-HEATING UN 3190         | A and B      |  |
| Mill feed pellets  | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES |
| Milorganite  | C            | see BIOSLUDGE  |
| Mineral Concentrates   | A            |  |
| MONOAMMONIUM PHOSPHATE                                       | C            |  |
| MONOAMMONIUM PHOSPHATE (M.A.P.),<br>MINERAL ENRICHED COATING | B            |  |
| MONOCALCIUMPHOSPHATE (MCP)                                   | A and B      |  |
| Muriate of potash  | C            | see POTASSIUM CHLORIDE   |
| NEFELINE SYENITE (mineral)                                   | A            | see Mineral Concentrates schedule  |
| NICKEL CONCENTRATE   | A            | see Mineral Concentrates schedule  |
| NICKEL ORE   | A            |  |
| Nickel ore concentrate                                       | A            | see NICKEL CONCENTRATE   |
| Niger seed, expelled   | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES |
| Niger seed, extracted  | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES |

| MATERIAL                                       | Group   | REFERENCES  |
|--|---------|---|
| Oil cake                                       | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| OLIVINE GRANULAR AND GRAVEL AGGREGATE PRODUCTS | C       |   |
| OLIVINE SAND                                   | A       |   |
| Palm kernel, expelled                          | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Palm kernel, extracted                         | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Peanuts, expelled                              | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Peanuts, extracted                             | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| PEANUTS (in shell)                             | C       |   |
| PEAT MOSS                                      | A and B |   |
| PEBBLES (sea)                                  | C       |   |
| PELLETS (concentrates)                         | C       |   |
| Pellets, cereal                                | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Pencil pitch                                   | B       | see PITCH PRILL   |
| PENTAHYDRATE CRUDE                             | A       | see Mineral Concentrates schedule   |
| PERLITE ROCK                                   | C       |   |
| PETROLEUM COKE (calcined)                      | B       |   |
| PETROLEUM COKE (uncalcined)                    | B       |   |
| PHOSPHATE ROCK (calcined)                      | C       |   |
| PHOSPHATE ROCK (uncalcined)                    | C       |   |
| PHOSPHATE (defluorinated)                      | C       |   |
| PIG IRON                                       | C       |   |
| Pig iron by-product                            | C       | see IRON SMELTING BY-PRODUCTS   |
| PITCH PRILL                                    | B       |   |
| Plate iron                                     | C       | see IRON SMELTING BY-PRODUCTS   |
| Pollard pellets                                | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Pool iron                                      | C       | see IRON SMELTING BY-PRODUCTS   |
| POTASH   | C       |   |

| MATERIAL   | Group   | REFERENCES  |
|--|---------|---|
| Potash muriate   | C       | see POTASSIUM CHLORIDE  |
| POTASSIUM CHLORIDE   | C       |   |
| Potassium felspar sand   | C       | see SAND  |
| POTASSIUM NITRATE UN 1486  | B       |   |
| Potassium nitrate/sodium nitrate (mixture)                         | B       | see SODIUM NITRATE AND POTASSIUM NITRATE MIXTURE UN 1499                    |
| POTASSIUM SULPHATE   | C       |   |
| Prilled coal tar   | B       | see PITCH PRILL   |
| PULP WOOD  | B       | see Wood Products – General schedule  |
| PUMICE   | C       |   |
| PYRITE (containing copper and iron)                                | C       |   |
| PYRITES, CALCINED  | A and B |   |
| PYRITES  | A       | see Mineral Concentrates schedule   |
| Pyrites (cupreous, fine, flotation or sulphur)                     | A       | see PYRITES   |
| Pyritic ash  | A and B | see PYRITES, CALCINED   |
| PYRITIC ASHES (iron)   | A       | see Mineral Concentrates schedule   |
| PYRITIC CINDERS  | A       | see Mineral Concentrates schedule   |
| PYROPHYLLITE   | C       |   |
| QUARTZ   | C       |   |
| Quartz sand  | C       | see SAND  |
| QUARTZITE  | C       |   |
| Quicklime  | B       | see LIME (UNSLAKED)   |
| RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I) UN 2912        | B       |   |
| RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I) UN 2913 | B       |   |
| Rape seed, expelled  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Rape seed, extracted   | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| RASORITE (ANHYDROUS)   | C       |   |
| Rice bran  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Rice broken  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Rough ammonia tankage  | B       | see TANKAGE   |
| ROUNDWOOD  | B       | see Wood Products – General schedule  |
| RUTILE SAND  | C       |   |

| MATERIAL  | Group   | REFERENCES  |
|---|---------|---|
| Safflower seed, expelled  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Safflower seed, extracted   | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| SALT  | C       |   |
| SALT CAKE   | C       |   |
| SALT ROCK   | C       |   |
| Saltpetre   | B       | see POTASSIUM NITRATE   |
| SAND  | C       |   |
| SAND, HEAVY MINERAL   | A       |   |
| Sand, ilmenite  | C       | see ILMENITE SAND   |
| SAND, MINERAL CONCENTRATE, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I) UN 2912  | A and B |   |
| Sand, zircon  | C       | see ZIRCON SAND   |
| SAWDUST   | B       |   |
| SAW LOGS  | B       | see Wood Products – General schedule  |
| SCALE GENERATED FROM THE IRON AND STEEL MAKING PROCESS  | A       |   |
| SCRAP METAL   | C       |   |
| SEED CAKE, containing vegetable oil UN 1386 (a) mechanically expelled seeds, containing more than 10% of oil or more than 20% of oil and moisture combined  | B       |   |
| SEED CAKE, containing vegetable oil UN 1386 (b) solvent extraction and expelled seeds, containing not more than 10% of oil and when the amount of moisture is higher than 10%, not more than 20% of oil and moisture combined | B       |   |
| SEED CAKE UN 2217   | B       |   |
| SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES  | B       |   |
| SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES  | C       |   |
| Seed expellers, oily  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Separation of iron  | C       | see IRON SMELTING BY-PRODUCTS   |
| Silica sand   | C       | see SAND  |
| SILICOMANGANESE (carbo-thermic)   | C       |   |
| SILICOMANGANESE (low carbon)  | B       |   |
| Silicon dross   | C       | see SILICON SLAG  |
| SILICON SLAG  | C       |   |

| <b>MATERIAL</b>   | <b>Group</b> | <b>REFERENCES</b>  |
|---|--------------|--|
| SILVER LEAD CONCENTRATE                                 | A            | see Mineral Concentrates schedule  |
| Silver lead ore concentrate                             | A            | see SILVER LEAD CONCENTRATE  |
| Sinter  | A            | see ZINC AND LEAD CALCINES<br>(mixed)  |
| Slag, granulated  | C            | see GRANULATED SLAG  |
| SLIG (iron ore)   | A            | see Mineral Concentrates schedule  |
| SODA ASH  | C            |  |
| Soda feldspar sand                                      | C            | see SAND   |
| SODIUM NITRATE UN 1498                                  | B            |  |
| SODIUM NITRATE AND POTASSIUM<br>NITRATE MIXTURE UN 1499 | B            |  |
| SOLIDIFIED FUELS RECYCLED FROM<br>PAPER AND PLASTICS    | B            |  |
| Soyabean, expelled                                      | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES   |
| Soyabean, extracted                                     | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES   |
| Spent cathodes  | B            | see ALUMINIUM SMELTING<br>BY-PRODUCTS or ALUMINIUM<br>REMELTING BY-PRODUCTS<br>UN 3170 |
| Spent potliner  | B            | see ALUMINIUM SMELTING<br>BY-PRODUCTS or ALUMINIUM<br>REMELTING BY-PRODUCTS<br>UN 3170 |
| Spodumene   | C            | see SAND   |
| SPODUMENE (UPGRADED)                                    | A            |  |
| STAINLESS STEEL GRINDING DUST                           | C            |  |
| Steel bears   | C            | see IRON SMELTING BY-<br>PRODUCTS  |
| Steel swarf   | B            | see FERROUS METAL BORINGS,<br>SHAVINGS, TURNINGS OR<br>CUTTINGS UN 2793                |
| Stibnite  | C            | see ANTIMONY ORE AND<br>RESIDUE  |
| STONE CHIPPINGS   | C            |  |
| Strussa pellets   | B or C       | see SEED CAKE or<br>SEED CAKES AND OTHER<br>RESIDUES OF PROCESSED OILY<br>VEGETABLES   |
| SUGAR   | C            |  |
| SUGARCANE BIOMASS PELLETS                               | B            |  |
| SULPHATE OF POTASH AND MAGNESIUM                        | C            |  |
| Sulphide concentrates                                   | B            | see METAL SULPHIDE<br>CONCENTRATES   |
| SULPHUR UN 1350 (crushed lump and<br>coarse grained)    | B            |  |

| MATERIAL   | Group   | REFERENCES  |
|--|---------|---|
| SULPHUR (formed, solid)                                  | C       |   |
| Sunflower seed, expelled                                 | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Sunflower seed, extracted                                | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| SUPERPHOSPHATE   | C       |   |
| SUPERPHOSPHATE (triple, granular)                        | C       |   |
| Swarf  | B       | see FERROUS METAL BORINGS, SHAVINGS, TURNINGS OR CUTTINGS UN 2793           |
| SYNTHETIC CALCIUM FLUORIDE                               | A       |   |
| SYNTHETIC SILICON DIOXIDE                                | A       |   |
| TACONITE PELLETS   | C       |   |
| TALC   | C       |   |
| TANKAGE  | B       |   |
| Tankage fertilizer                                       | B       | see TANKAGE   |
| TAPIOCA  | C       |   |
| TIMBER   | B       | see Wood Products – General schedule  |
| TITANOMAGNETITE SAND                                     | A       |   |
| Toasted meals  | B or C  | see SEED CAKE or SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES |
| Triple superphosphate                                    | C       | see SUPERPHOSPHATE (triple, granular)                                       |
| UREA   | C       |   |
| VANADIUM ORE   | B       |   |
| VERMICULITE  | C       |   |
| WHITE QUARTZ   | C       |   |
| WOODCHIPS  | B       |   |
| WOOD PELLETS CONTAINING ADDITIVES AND/OR BINDERS         | B       |   |
| WOOD PELLETS NOT CONTAINING ANY ADDITIVES AND/OR BINDERS | B       |   |
| Wood Products – General                                  | B       |   |
| WOOD TORREFIED   | B       |   |
| ZINC AND LEAD CALCINES (mixed)                           | A       | see Mineral Concentrates schedule   |
| ZINC AND LEAD MIDLINGS                                   | A       | see Mineral Concentrates schedule   |
| ZINC ASHES UN 1435                                       | B       |   |
| ZINC CONCENTRATE   | A       | see Mineral Concentrates schedule   |
| Zinc, dross, residue or skimmings                        | B       | see ZINC ASHES UN 1435  |
| Zinc ore, burnt  | A       | see ZINC CONCENTRATE  |
| Zinc ore, calamine                                       | A       | see ZINC CONCENTRATE  |
| Zinc ore, concentrates                                   | A       | see ZINC CONCENTRATE  |
| Zinc ore, crude  | A       | see ZINC CONCENTRATE  |
| ZINC OXIDE ENRICHED FLUE DUST                            | A and B |   |



| <b>MATERIAL</b>            | <b>Group</b> | <b>REFERENCES</b>                 |
|----------------------------|--------------|-----------------------------------|
| ZINC SINTER                | A            | see Mineral Concentrates schedule |
| ZINC SLAG                  | A            |                                   |
| ZINC SLUDGE                | A            | see Mineral Concentrates schedule |
| Zinc sulphide              | A            | see ZINC CONCENTRATE              |
| Zinc sulphide (blende)     | A            | see ZINC CONCENTRATE              |
| ZIRCON KYANITE CONCENTRATE | A            |                                   |
| ZIRCONSAND                 | C            |                                   |

**APPENDIX 5**

**Bulk Cargo Shipping Names in three languages  
(English, Spanish and French)**

| <b>ENGLISH</b>                                      | <b>FRENCH</b>  | <b>SPANISH</b>  |
|---|--|---|
| ALFALFA   | LUZERNE  | ALFALFA   |
| ALUMINA   | ALUMINE  | ALÚMINA   |
| ALUMINA, CALCINED                                   | ALUMINE CALCINÉE   | ALÚMINA CALCINADA   |
| ALUMINA HYDRATE                                     | HYDRATE D'ALUMINE  | HIDRATO DE ALÚMINA  |
| ALUMINIUM FLUORIDE                                  | FLUORURE D'ALUMINIUM   | FLUORURO DE ALUMINIO  |
| Aluminium hydroxide                                 | Hydroxyde d'aluminium  | Hidróxido de aluminio   |
| ALUMINA SILICA                                      | ALUMINE SILICEUSE  | ALÚMINA SÍLICE  |
| ALUMINA SILICA, pellets                             | ALUMINE SILICEUSE en granules                                    | ALÚMINA SÍLICE, pellets de  |
| Aluminium dross                                     | Laitier d'aluminium  | Residuos de aluminio  |
| ALUMINIUM FERROSILICON POWDER UN 1395               | ALUMINO-FERROSILICIUM EN POUDRE UN 1395                          | ALUMINIO-FERROSILICIO EN POLVO, UN 1395   |
| ALUMINIUM NITRATE UN 1438                           | NITRATE D'ALUMINIUM UN 1438                                      | NITRATO DE ALUMINIO, UN 1438  |
| ALUMINIUM REMELTING BY-PRODUCTS UN 3170             | SOUS-PRODUITS DE LA REFUSION DE L'ALUMINIUM UN 3170              | PRODUCTOS DERIVADOS DE LA REFUNDICIÓN DEL ALUMINIO, UN 3170   |
| Aluminium salt slags                                | Scories salines d'aluminium                                      | Escoria de sales de aluminio  |
| ALUMINIUM SMELTING/REMELTING BY-PRODUCTS, PROCESSED | SOUS-PRODUITS DE LA FABRICATION/REFUSION DE L'ALUMINIUM, TRAITÉS | PRODUCTOS DERIVADOS DE LA FUNDICIÓN DEL ALUMINIO o PRODUCTOS DERIVADOS DE LA REFUNDICIÓN DEL ALUMINIO, TRATADOS |
| ALUMINIUM SILICON POWDER, UNCOATED UN 1398          | SILICO-ALUMINIUM EN POUDRE NON ENROBÉ UN 1398                    | ALUMINIO-SILICIO EN POLVO, NO RECUBIERTO, UN 1398   |
| Aluminium skimmings                                 | Crasse d'aluminium   | Espuma de aluminio  |
| ALUMINIUM SMELTING BY-PRODUCTS UN 3170              | SOUS-PRODUITS DE LA FABRICATION DE L'ALUMINIUM UN 3170           | PRODUCTOS DERIVADOS DE LA FUNDICIÓN DEL ALUMINIO, UN 3170   |
| AMMONIUM NITRATE UN 1942                            | NITRATE D'AMMONIUM UN 1942                                       | NITRATO AMÓNICO, UN 1942  |

| ENGLISH  | FRENCH   | SPANISH  |
|--|--|--|
| AMMONIUM NITRATE BASED FERTILIZER UN 2067          | ENGRAIS AU NITRATE D'AMMONIUM UN 2067                | ABONOS A BASE DE NITRATO AMÓNICO, UN 2067              |
| AMMONIUM NITRATE BASED FERTILIZER UN 2071          | ENGRAIS AU NITRATE D'AMMONIUM UN 2071                | ABONOS A BASE DE NITRATO AMÓNICO, UN 2071              |
| AMMONIUM NITRATE, BASED FERTILIZER (non-hazardous) | ENGRAIS AU NITRATE D'AMMONIUM (non dangereux)        | ABONOS A BASE DE NITRATO AMÓNICO (no entrañan peligro) |
| AMMONIUM SULPHATE                                  | SULFATE D'AMMONIUM                                   | SULFATO AMÓNICO  |
| AMORPHOUS SODIUM SILICATE LUMPS                    | MORCEAUX DE SILICATE DE SODIUM AMORPHE               | TERRONES DE SILICATO SÓDICO AMORFO                     |
| ANTIMONY ORE AND RESIDUE                           | MINERAI D'ANTIMOINE ET RÉSIDU DE MINERAI D'ANTIMOINE | ANTIMONIO, MINERAL Y RESIDUOS DE                       |
| Bakery materials                                   | Produits de boulangerie                              | Materias de panadería                                  |
| BARIUM NITRATE UN 1446                             | NITRATE DE BARYUM UN 1446                            | NITRATO DE BARIO, UN 1446                              |
| Barley malt pellets                                | Malte d'orge en boulettes                            | Malta de cebada, pellets de                            |
| BARYTES  | BARYTINE   | BARITAS  |
| BAUXITE  | BAUXITE  | BAUXITA  |
| BAUXITE FINES                                      | FINES DE BAUXITE                                     | FINOS DE BAUXITA                                       |
| Beach iron   | Fer de type grès dit "beach iron"                    | Hierro de tipo arenisco conocido como "beach iron"     |
| Beet, expelled                                     | Betterave, triturée                                  | Remolacha, prensada                                    |
| Beet, extracted                                    | Betterave, sous-produits de l'extraction             | Remolacha, en extracto                                 |
| BIOSLUDGE  | BOUE ACTIVÉE   | FANGOS BIOLÓGICOS                                      |
| Blende (zinc sulphide)                             | Blende (sulfure de zinc)                             | Blenda (sulfuro de cinc)                               |
| BORAX (PENTAHYDRATE CRUDE)                         | BORAX (BRUT PENTAHYDRATÉ)                            | BÓRAX (CRUDO PENTAHIDRATADO)                           |
| BORAX, ANHYDROUS, crude                            | BORAX ANHYDRE brut                                   | BÓRAX ANHIDRO, crudo                                   |
| BORAX, ANHYDROUS, refined                          | BORAX ANHYDRE raffiné                                | BÓRAX ANHIDRO, refinado                                |
| BORIC ACID   | ACIDE BORIQUE  | ÁCIDO BÓRICO   |
| Bottom ash   | Cendres résiduelles                                  | Cenizas de fondo                                       |
| Bran pellets                                       | Son en boulettes                                     | Salvado, pellets de                                    |
| Brewer's grain pellets                             | Drêches de brasserie en boulettes                    | Orujo de cerveza, pellets de                           |
| BROWN COAL BRIQUETTES                              | CHARBON BRUN EN BRIQUETTES                           | BRIQUETAS DE LIGNITO                                   |
| BRUCITE  | BRUCITE  | BRUCITA  |
| Calcined clay                                      | Argile calcinée                                      | Arcilla calcinada                                      |

| <b>ENGLISH</b>   | <b>FRENCH</b>  | <b>SPANISH</b>   |
|--|--|--|
| Calcined pyrites   | Pyrites calcinées  | Piritas calcinadas   |
| Calcium fluoride   | Fluorure de calcium  | Fluoruro de calcio   |
| CALCIUM FLUORIDE,<br>CALCIUM SULPHATE,<br>CALCIUM CARBONATE<br>MIXTURE | MÉLANGE DE FLUORURE<br>DE CALCIUM, DE<br>SULFATE DE CALCIUM ET<br>DE CARBONATE DE<br>CALCIUM | FLUORURO DE CALCIO,<br>SULFATO DE CALCIO Y<br>CARBONATO DE<br>CALCIO EN MEZCLA |
| CALCIUM NITRATE<br>UN 1454   | NITRATE DE CALCIUM UN<br>1454  | NITRATO CÁLCICO,<br>UN 1454  |
| CALCIUM NITRATE<br>FERTILIZER  | ENGRAIS AU NITRATE DE<br>CALCIUM   | ABONOS A BASE DE<br>NITRATO CÁLCICO  |
| Calcium oxide  | Oxyde de calcium   | Óxido de calcio  |
| Canola pellets   | Canola en boulettes  | Píldoras de canola   |
| CARBORUNDUM  | CARBORUNDUM  | CARBORUNDO   |
| CASTOR BEANS UN 2969   | GRAINES DE RICIN<br>UN 2969  | SEMILLAS DE RICINO,<br>UN 2969   |
| CASTOR FLAKE UN 2969   | GRAINES DE RICIN EN<br>FLOCONS UN 2969   | ESCAMAS DE RICINO,<br>UN 2969  |
| CASTOR MEAL UN 2969  | FARINES DE RICIN<br>UN 2969  | HARINA DE RICINO,<br>UN 2969   |
| CASTOR POMACE<br>UN 2969   | TOURTEAUX DE RICIN UN<br>2969  | PULPA DE RICINO,<br>UN 2969  |
| CEMENT   | CIMENT   | CEMENTO  |
| CEMENT CLINKERS  | CIMENT, CLINKERS DE  | CEMENTO, CLINKERS<br>DE  |
| CEMENT COPPER  | CUIVRE CÉMENT  | COBRE DE<br>CEMENTACIÓN  |
| Chalcopyrite   | Chalcopyrite   | Calcopirita  |
| CHAMOTTE   | CHAMOTTE   | CHAMOTA  |
| CHARCOAL   | CHARBON DE BOIS  | CARBÓN VEGETAL   |
| CHEMICAL GYPSUM  | GYPSE DE SYNTHÈSE  | YESO QUÍMICO   |
| CHLORITE   | CHLORITE   | CLORITA  |
| Chile saltpetre  | Salpêtre du Chili  | Salitre de Chile   |
| Chilean natural nitrate  | Nitrate naturel du Chili   | Nitrato natural de Chile   |
| Chilean natural potassic<br>nitrate                                    | Nitrate de potassium naturel<br>du Chili   | Nitrato potásico natural<br>de Chile   |
| CHOPPED RUBBER AND<br>PLASTIC INSULATION                               | FRAGMENTS D'ISOLANT<br>EN PLASTIQUE ET EN<br>CAOUTCHOUC                                      | FRAGMENTOS DE<br>REVESTIMIENTOS<br>AISLANTES DE GOMA Y<br>PLÁSTICO             |
| Chrome ore   | Minerai de chrome  | Cromo, mineral de  |
| CHROME PELLETS   | CHROME EN PELLETS  | CROMO, PELLETS DE  |
| CHROMITE ORE   | MINERAI DE CHROMITE  | CROMITA, MINERAL DE  |
| Chromium ore   | Minerai de chromium  | Cromio, mineral de   |
| Citrus pulp pellets  | Pulpe d'agrumes en<br>boulettes  | Cítricos, pellets de pulpa<br>de   |

| ENGLISH   | FRENCH  | SPANISH   |
|---|---|---|
| CLAY  | ARGILE  | ARCILLA   |
| CLINKER ASH                                     | CENDRES DE MÂCHEFER   | CENIZAS DE CLÍNKER  |
| COAL  | CHARBON   | CARBÓN  |
| COAL SLURRY                                     | BOUES DE CHARBON  | FANGOS DE CARBÓN  |
| COAL TAR PITCH                                  | BRAI DE GOUDRON DE HOUILLE                                      | BREA DE ALQUITRÁN DE HULLA  |
| COARSE CHOPPED TYRES                            | FRAGMENTS DE PNEUS DE GRANDES DIMENSIONS                        | FRAGMENTOS DE NEUMÁTICOS TRITURADOS                                       |
| COARSE IRON AND STEEL SLAG AND ITS MIXTURE      | SCORIES DE FER ET D'ACIER À GROS GRAINS ET LEUR MÉLANGE         | ESCORIA GRUESA DE HIERRO Y ACERO Y SU MEZCLA                              |
| Coconut   | Noix de coco  | Coco  |
| COKE  | COKE  | COQUE   |
| COKE BREEZE                                     | POUSSIER DE COKE  | CISCO DE COQUE  |
| COLEMANITE                                      | COLÉMANITE  | COLEMANITA  |
| COPPER CONCENTRATE                              | CONCENTRÉ DE CUIVRE   | COBRE, CONCENTRADO DE   |
| COPPER GRANULES                                 | CUIVRE EN GRANULES  | COBRE, GRÁNULOS DE  |
| COPPER MATTE                                    | MATTE DE CUIVRE   | COBRE, MATA DE  |
| Copper nickel                                   | Nickel-cuivre   | Cuproníquel   |
| COPPER SLAG                                     | SCORIES DE CUIVRE   | ESCORIA DE COBRE  |
| Copper ore concentrate                          | Concentré de minerai de cuivre                                  | Cobre, concentrado mineral de   |
| Copper precipitate                              | Précipités de cuivre  | Cobre, precipitado de   |
| COPRA (dry) UN 1363                             | COPRAH (sec) UN 1363  | COPRA (seca), UN 1363   |
| Copra, expelled                                 | Coprah, trituré   | Copra, prensada   |
| Copra, extracted                                | Coprah, sous-produit d'extraction                               | Copra, en extracto  |
| Corn gluten                                     | Gluten de maïs  | Maíz, gluten de   |
| Cotton seed                                     | Graines de cotonnier  | Semillas de algodón   |
| CRUSHED CARBON ANODES                           | ANODES EN CARBONE CONCASSÉES                                    | ÁNODOS DE CARBÓN TRITURADOS   |
| CRYOLITE  | CRYOLITHE   | CRIOLITA  |
| Deadburned magnesite                            | Magnésite calcinée  | Magnesita calcinada a muerte  |
| DIAMMONIUM PHOSPHATE                            | HYDROGÉNOPHOSPHATE DE DIAMMONIUM                                | FOSFATO DIAMÓNICO   |
| DIRECT REDUCED IRON (A) Briquettes, hot-moulded | FER OBTENU PAR RÉDUCTION DIRECTE (A) Briquettes moulées à chaud | HIERRO OBTENIDO POR REDUCCIÓN DIRECTA (A) Briquetas moldeadas en caliente |

| ENGLISH   | FRENCH  | SPANISH   |
|---|---|---|
| DIRECT REDUCED IRON<br>(B) Lumps, pellets,<br>cold-moulded briquettes | FER OBTENU PAR<br>RÉDUCTION<br>DIRECTE (B) Morceaux,<br>pellets, briquettes moulées à<br>froid et tournures de fer<br>indiennes | HIERRO OBTENIDO<br>POR REDUCCIÓN<br>DIRECTA (B) Terrones,<br>pellets y briquetas<br>moldeadas en frío |
| DIRECT REDUCED IRON<br>(C) By-product fines                           | FER OBTENU PAR<br>RÉDUCTION<br>DIRECTE (C) Fines en tant<br>que sous-produit  | HIERRO OBTENIDO<br>POR REDUCCIÓN<br>DIRECTA (C) Finos<br>obtenidos como<br>productos derivados        |
| DISTILLERS DRIED<br>GRAINS WITH SOLUBLES                              | DISTILLATS SÉCHÉS DE<br>GRAINS AVEC RÉSIDUS<br>SOLUBLES   | GRANOS SECOS DE<br>DESTILERÍA CON<br>SOLUBLES   |
| DOLOMITE  | DOLOMITE  | DOLOMITA  |
| Dolomitic quicklime   | Chaux vive dolomitique  | Cal dolomítica  |
| D.R.I.  | not applicable in French  | HRD   |
| Expellers   | Expellers   | Tortas de presión   |
| FELSPAR LUMP  | FELDSPATH EN<br>MORCEAUX  | FELDESPATO EN<br>TERRONES   |
| FERROCHROME   | FERROCHROME   | FERROCROMO  |
| FERROCHROME,<br>exothermic  | FERROCHROME,<br>exothermique  | FERROCROMO<br>exotérmico  |
| FERROMANGANESE  | FERROMANGANÈSE  | FERROMANGANESO  |
| Ferromanganese,<br>exothermic   | Ferromanganèse<br>exothermique  | Ferromanganeso<br>exotérmico  |
| FERRONICKEL   | FERRONICKEL   | FERRONÍQUEL   |
| FERRONICKEL SLAG<br>(granulated)                                      | SCORIES DE<br>FERRONICKEL<br>(en granules)  | ESCORIA DE<br>FERRONÍQUEL<br>(granulada)  |
| FERROPHOSPHORUS   | FERROPHOSPHORE  | FERROFÓSFORO  |
| Ferrophosphorus briquettes  | Ferrophosphore en<br>briquettes   | Ferrofósforo, briquetas de  |
| FERROSILICON UN 1408  | FERROSILICIUM UN 1408   | FERROSILICIO, UN 1408   |
| FERROSILICON  | FERROSILICIUM   | FERROSILICIO  |
| FERROUS METAL<br>BORINGS UN 2793                                      | ROGNURES DE MÉTAUX<br>FERREUX UN 2793   | VIRUTAS DE<br>TALADRADO DE<br>METALES FERROSOS,<br>UN 2793  |
| FERROUS METAL<br>CUTTINGS UN 2793                                     | EBARBURES DE METAUX<br>FERREUX<br>UN 2793   | RECORTES DE<br>METALES FERROSOS,<br>UN 2793   |
| FERROUS METAL<br>SHAVINGS UN 2793                                     | COPEAUX DE MÉTAUX<br>FERREUX UN 2793  | RASPADURAS DE<br>METALES FERROSOS,<br>UN 2793   |
| FERROUS METAL<br>TURNINGS UN 2793                                     | TOURNURES DE MÉTAUX<br>FERREUX<br>UN 2793   | VIRUTAS DE<br>TORNEADO DE<br>METALES FERROSOS,<br>UN 2793   |

| <b>ENGLISH</b>   | <b>FRENCH</b>   | <b>SPANISH</b>  |
|--|---|---|
| FERROUS SULPHATE<br>HEPTAHYDRATE                                 | SULFATE FERREUX<br>HEPTAHYDRATÉ   | SULFATO FERROSO<br>HEPTAHIDRATADO   |
| FERTILIZERS WITHOUT<br>NITRATES (non-hazardous)                  | ENGRAIS SANS NITRATES<br>(non dangereux)                                  | ABONOS SIN NITRATOS<br>(no entrañan peligro)                              |
| FISH (IN BULK)   | POISSON (EN VRAC)   | PESCADO (A GRANEL)  |
| FISHMEAL, STABILIZED<br>UN 2216                                  | FARINE DE POISSON<br>STABILISÉE UN 2216                                   | HARINA DE PESCADO<br>ESTABILIZADA, UN 2216                                |
| FISHSCRAP, STABILIZED<br>UN 2216                                 | DÉCHETS DE POISSON<br>STABILISÉS UN 2216                                  | DESECHOS DE<br>PESCADO<br>ESTABILIZADOS,<br>UN 2216                       |
| Flat iron  | Fer plat  | Hierro plano  |
| Flint flat glass cullet  | Calcin de verre de silex plat   | Desperdicios gruesos de<br>vidrio flint                                   |
| FLUE DUST, CONTAINING<br>LEAD AND ZINC                           | CENDRES VOLANTES<br>CONTENANT DU PLOMB<br>ET DU ZINC                      | POLVO DE LOS<br>CONDUCTOS DE<br>HUMOS QUE CONTIENE<br>PLOMO Y CINC        |
| FLUORSPAR  | SPATH FLUOR   | ESPATOFLÚOR   |
| FLY ASH, DRY   | CENDRES VOLANTES<br>SÈCHES  | CENIZAS VOLANTES<br>SECAS   |
| FLY ASH, WET   | CENDRES VOLANTES<br>HUMIDES   | CENIZAS VOLANTES<br>HÚMEDAS   |
| FOAM GLASS GRAVEL  | GRANULAT DE VERRE<br>CELLULAIRE   | GRAVA DE VIDRIO<br>CELULAR  |
| Foundry sand   | Sable de fonderie   | Arena de fundición  |
| Galena (lead sulphide)   | Galène (sulfure de plomb)   | Galena (sulfuro de plomo)   |
| Garbage tankage  | Détritus organiques   | Detritos orgánicos  |
| GLASS CULLET   | CALCIN DE VERRE   | DESPERDICIOS DE<br>VIDRIO   |
| Gluten pellets   | Gluten en boulettes   | Gluten, pellets de  |
| GRAIN SCREENING<br>PELLETS                                       | CRIBLURES DE GRAIN EN<br>PELLETS  | PELLETS DE GRANZA<br>DE GRANO   |
| GRANULAR FERROUS<br>SULPHATE                                     | SULFATE FERREUX EN<br>GRANULES  | SULFATO FERROSO<br>GRANULAR   |
| Granulated iron  | Granulats ferreux   | Hierro granulado  |
| GRANULATED NICKEL<br>MATTE<br>(LESS THAN 2%<br>MOISTURE CONTENT) | MATTE DE NICKEL EN<br>GRANULES<br>(TENEUR EN HUMIDITÉ<br>INFÉRIEURE À 2%) | MATA DE NIQUEL<br>GRANULADA<br>(CONTENIDO DE<br>HUMEDAD INFERIOR A<br>2%) |
| GRANULATED SLAG  | SCORIES EN GRAINS   | ESCORIA GRANULADA   |
| GRANULATED TYRE<br>RUBBER  | CAOUTCHOUC DE PNEUS<br>EN GRANULES  | NEUMÁTICO<br>GRANULADO  |
| Ground nuts, meal  | Farine d'arachide   | Maní (cacañuetes),<br>harina de   |
| GYPSUM   | GYPSE   | YESO  |

| ENGLISH   | FRENCH  | SPANISH   |
|---|---|---|
| Hominy chop   | Hominy chop   | Sémola de maíz triturada                                      |
| GYPSUM GRANULATED                                   | GYPSE EN GRAINS   | YESO GRANULADO  |
| ILMENITE CLAY                                       | ARGILE D'ILMÉNITE   | ILMENITA, ARCILLA DE  |
| ILMENITE (ROCK)                                     | ILMÉNITE (ROCHE)  | ILMENITA (ROCA)   |
| ILMENITE SAND                                       | SABLE D'ILMÉNITE  | ILMENITA, ARENA DE  |
| ILMENITE (UPGRADED)                                 | ILMÉNITE VALORISÉE  | ILMENITA<br>(ENRIQUECIDA)                                     |
| IRON AND STEEL SLAG<br>AND ITS MIXTURE              | SCORIES DE FER ET<br>D'ACIER ET LEUR<br>MÉLANGE                 | ESCORIA DE HIERRO Y<br>ACERO Y SU MEZCLA                      |
| IRON CONCENTRATE                                    | CONCENTRÉ DE FER  | HIERRO,<br>CONCENTRADO DE                                     |
| IRON CONCENTRATE<br>(pellet feed)                   | CONCENTRÉ DE FER<br>(pour pellets)                              | HIERRO,<br>CONCENTRADO DE<br>(para pellets)                   |
| IRON CONCENTRATE<br>(sinter feed)                   | CONCENTRÉ DE FER<br>(pour agglomérés)                           | HIERRO,<br>CONCENTRADO DE<br>(para aglomerados)               |
| Iron disulphide                                     | Disulfure de fer  | Disulfuro de hierro   |
| IRON ORE  | MINERAI DE FER  | HIERRO, MINERAL DE  |
| Iron ore (concentrate, pellet<br>feed, sinter feed) | Minerai de fer (concentré,<br>pour pellets, pour<br>agglomérés) | Hierro, mineral de<br>(concentrado,<br>aglomerados o pellets) |
| IRON ORE FINES                                      | FINES DE MINERAI DE<br>FER                                      | FINOS DE MINERAL DE<br>HIERRO                                 |
| IRON ORE PELLETS                                    | MINERAI DE FER EN<br>PELLETS                                    | HIERRO, PELLETS DE<br>MINERAL DE                              |
| IRON OXIDE, SPENT<br>UN 1376                        | OXYDE DE FER<br>RÉSIDUAIRE<br>UN 1376                           | ÓXIDO DE HIERRO<br>AGOTADO, UN 1376                           |
| IRON OXIDE TECHNICAL                                | OXYDE DE FER DE<br>QUALITÉ TECHNIQUE                            | OXIDO DE HIERRO<br>(GRADO TÉCNICO)                            |
| Iron pan edges                                      | Fer en forme de poêles dit<br>«iron pan edges»                  | Bordes de bandejas de<br>hierro                               |
| Iron silicate granulated                            | Silicate de fer en grains                                       | Silicato de hierro<br>granulado                               |
| IRON SINTER   | AGGLOMÉRÉS DE FER   | HIERRO SINTERIZADO  |
| Iron skulls   | Fer en forme de crânes dit<br>«iron skulls»                     | Hierro en forma de<br>cráneos conocido como<br>«iron skulls»  |
| IRON SMELTING<br>BY-PRODUCTS                        | SOUS-PRODUITS DE LA<br>FUSION DU FER                            | PRODUCTOS<br>DERIVADOS DE LA<br>FUNDICIÓN DEL<br>HIERRO       |
| Iron swarf  | Copeaux de fer  | Hierro, virutas de  |
| IRON SPONGE, SPENT<br>UN 1376                       | TOURNURE DE FER<br>RÉSIDUAIRE UN 1376                           | ESPONJA DE HIERRO<br>AGOTADA, UN 1376                         |
| IRONSTONE   | ROCHE FERRUGINEUSE  | ROCA FERRUGINOSA  |
| K1-K3 bears   | Pièces en forme d'ours des<br>groupes K1-K3 dites "bears"       | Cuescos K1 – K3   |
| LABRADORITE   | LABRADOR  | LABRADORITA   |



| ENGLISH                           | FRENCH   | SPANISH   |
|-----------------------------------|--|---|
| LEAD AND ZINC CALCINES<br>(mixed) | PLOMB ET ZINC<br>CALCINÉS<br>(en mélange)        | PLOMO Y CINCO,<br>CALCINADOS<br>DE (en mezclas) |
| LEAD AND ZINC<br>MIDDLEINGS       | MIXTES DE PLOMB ET DE<br>ZINC                    | PLOMO Y CINCO,<br>MIXTOS DE                     |
| LEAD CONCENTRATE                  | CONCENTRÉ DE PLOMB                               | PLOMO,<br>CONCENTRADO DE                        |
| LEAD NITRATE UN 1469              | NITRATE DE PLOMB<br>UN 1469                      | NITRATO DE PLOMO,<br>UN 1469                    |
| LEAD ORE                          | MINERAI DE PLOMB                                 | PLOMO, MINERAL DE                               |
| Lead ore concentrate              | Concentré de minerai de<br>plomb                 | Plomo, concentrado de<br>mineral de             |
| LEAD ORE RESIDUE                  | RÉSIDU DE MINERAI DE<br>PLOMB                    | PLOMO, RESIDUOS DE<br>MINERAL DE                |
| LEAD SILVER<br>CONCENTRATE        | CONCENTRÉ DE PLOMB<br>ARGENTIFÈRE                | PLOMO Y PLATA,<br>CONCENTRADO DE                |
| Lead silver ore                   | Minerai de plomb argentifère                     | Plomo y plata, mineral de                       |
| Lead sulphide                     | Sulfure de plomb                                 | Sulfuro de plomo                                |
| Lead sulphide (galena)            | Sulfure de plomb (galène)                        | Sulfuro de plomo (galena)                       |
| Lignite                           | Lignite  | Lignita   |
| LIME (UNSLAKED)                   | CHAUX (VIVE)                                     | CAL (VIVA)                                      |
| LIMESTONE                         | CALCAIRE   | PIEDRA CALIZA                                   |
| LINTED COTTON SEED                | GRAINES DE COTONNIER<br>AVEC LINTER              | SEMILLAS DE<br>ALGODÓN<br>DESPEPITADO           |
| Linseed, expelled                 | Graines de lin, triturées                        | Linaza, prensada                                |
| Linseed, extracted                | Graines de lin, sous-produits<br>de l'extraction | Linaza, en extracto                             |
| LOGS                              | GRUMES   | TRONCOS   |
| MAGNESIA<br>(DEADBURNED)          | MAGNÉSIE (CALCINÉE)                              | MAGNESIA (CALCINADA<br>A MUERTE)                |
| MAGNESIA (UNSLAKED)               | MAGNÉSIE (VIVE)                                  | MAGNESIA (VIVA)                                 |
| Magnesia, clinker                 | Magnésie en clinkers                             | Magnesia, clinker de                            |
| Magnesia, electro-fused           | Magnésie électrofondue                           | Magnesia electrofundida                         |
| Magnesia, lightburned             | Magnésie calcinée légère                         | Magnesia quemada<br>ligeramente                 |
| Magnesia, calcined                | Magnésie calcinée                                | Magnesia calcinada                              |
| Magnesia, caustic calcined        | Magnésie calcinée<br>caustique                   | Magnesia cáustica<br>calcinada                  |
| Magnesite, clinker                | Magnésite, clinkers de                           | Magnesita, clinker de                           |
| MAGNESITE, natural                | MAGNÉSITE, naturelle                             | MAGNESITA natural                               |
| Magnesium carbonate               | Carbonate de magnésium                           | Carbonato de magnesio                           |
| MAGNESIUM NITRATE<br>UN 1474      | NITRATE DE MAGNÉSIUM<br>UN 1474                  | NITRATO DE<br>MAGNESIO, UN 1474                 |
| MAGNESIUM SULPHATE<br>FERTILIZERS | ENGRAIS AU SULFATE DE<br>MAGNÉSIUM               | ABONOS DE SULFATO<br>DE MAGNESIO                |
| Maize, expelled                   | Maïs, trituré                                    | Maíz, prensado                                  |

| ENGLISH   | FRENCH  | SPANISH   |
|---|---|---|
| Maize, extracted  | Maïs, sous-produit de l'extraction                          | Maíz, en extracto   |
| MANGANESE COMPONENT FERROALLOY SLAG                       | SCORIES DE FERRO-ALLIAGES DE MANGANÈSE                      | ESCORIA DE ALEACIÓN DE HIERRO CON MANGANESO   |
| MANGANESE CONCENTRATE                                     | CONCENTRÉ DE MANGANÈSE                                      | MANGANESO, CONCENTRADO DE   |
| MANGANESE ORE   | MINERAI DE MANGANÈSE  | MANGANESO, MINERAL DE   |
| MANGANESE ORE FINES                                       | FINES DE MINERAI DE MANGANÈSE                               | FINOS DE MINERAL DE MANGANESO   |
| M.A.P.  | [not applicable in French]                                  | FMA   |
| MARBLE CHIPS  | ÉCLATS DE MARBRE  | MÁRMOL, ASTILLAS DE   |
| MATTE CONTAINING COPPER AND LEAD                          | MATTE CONTENANT DU CUIVRE ET DU PLOMB                       | MATA QUE CONTIENE COBRE Y PLOMO   |
| Meal, oily  | Farines oléagineuses  | Harina oleosa   |
| METAL SULPHIDE CONCENTRATES                               | CONCENTRÉS DE SULFURES MÉTALLIQUES                          | SULFUROS METÁLICOS, CONCENTRADOS DE   |
| METAL SULPHIDE CONCENTRATES, CORROSIVE UN 1759            | CONCENTRÉS DE SULFURES MÉTALLIQUES, CORROSIFS, UN 1759      | CONCENTRADOS DE SULFUROS METÁLICOS, CORROSIVOS, UN 1759                               |
| METAL SULPHIDE CONCENTRATES, SELF-HEATING UN 3190         | CONCENTRÉS DE SULFURES MÉTALLIQUES, AUTOÉCHAUFFANTS UN 3190 | CONCENTRADOS DE SULFUROS METÁLICOS QUE EXPERIMENTAN CALENTAMIENTO ESPONTÁNEO, UN 3190 |
| Mill feed pellets   | Sous-produits de meunerie en boulettes                      | Piensos, pellets de   |
| Milorganite   | Milorganite   | Milorganita   |
| Mineral Concentrates                                      | Concentrés de minerais                                      | Concentrados de minerales   |
| MONOAMMONIUM PHOSPHATE                                    | MONOPHOSPHATE D'AMMONIUM                                    | FOSFATO MONOAMÓNICO   |
| MONOAMMONIUM PHOSPHATE (M.A.P.), MINERAL ENRICHED COATING | MONOPHOSPHATE D'AMMONIUM, REVÊTEMENT ENRICHÉ EN MINÉRAUX    | FOSFATO MONOAMÓNICO, REVESTIMIENTO ENRIQUECIDO CON MINERALES                          |
| MONOCALCIUMPHOSPHATE (MCP)                                | PHOSPHATE MONOCALCIQUE                                      | FOSFATO MONOCÁLCICO   |
| Muriate of potash   | Muriate de potasse  | Muriato de potasa   |
| NEFELINE SYENITE (mineral)                                | SYÉNITE NÉPHÉLINIQUE (minerai)                              | SIENITA NEFELÍNICA (mineral)  |
| NICKEL ORE  | MINERAI DE NICKEL   | MINERAL DE NÍQUEL   |

| ENGLISH  | FRENCH   | SPANISH  |
|--|--|--|
| NICKEL CONCENTRATE                             | CONCENTRÉ DE NICKEL                              | NÍQUEL,<br>CONCENTRADO DE                            |
| Nickel ore concentrate                         | Concentré de minerai de nickel                   | Níquel, concentrado de mineral de                    |
| Niger seed, expelled                           | Graines de niger, triturées                      | Níger, semillas de, prensadas                        |
| Niger seed, extracted                          | Graines de niger, sous-produits de l'extraction  | Níger, semillas de, en extracto                      |
| Oil cake                                       | Tourteaux oléagineux                             | Torta oleaginosa                                     |
| OLIVINE GRANULAR AND GRAVEL AGGREGATE PRODUCTS | AGRÉGATS DE GRAINS ET DE GRAVIERS D'OLIVINE      | PRODUCTOS AGREGADOS GRANULARES Y DE GRAVA DE OLIVINO |
| OLIVINE SAND                                   | SABLE D'OLIVINE                                  | ARENA DE OLIVINO                                     |
| Palm kernel, expelled                          | Amande de palmiste, triturée                     | Nuez de palma, prensada                              |
| Palm kernel, extracted                         | Amande de palmiste, sous-produit de l'extraction | Nuez de palma, en extracto                           |
| Peanuts, expelled                              | Cacahuètes, triturées                            | Cacahuetes (maní), prensados                         |
| Peanuts, extracted                             | Cacahuètes, sous-produits de l'extraction        | Cacahuetes (maní), en extracto                       |
| PEANUTS (in shell)                             | CACAHUÈTES (en coques)                           | CACAHUETES (con vaina)                               |
| PEAT MOSS                                      | TOURBE HORTICOLE                                 | TURBA FIBROSA  |
| PEBBLES (sea)                                  | GALETS (de mer)                                  | CANTOS RODADOS (de mar)                              |
| PELLETS (concentrates)                         | PELLETS (concentrés)                             | PELLETS (concentrados)                               |
| Pellets (cereal)                               | Céréales en boulettes                            | Cereales, pellets de                                 |
| Pencil pitch                                   | Brai en crayons                                  | Brea en lápices                                      |
| PENTAHYDRATE CRUDE                             | PENTAHYDRATE BRUT                                | PENTAHIDRATO EN BRUTO                                |
| PERLITE ROCK                                   | ROCHE PERLITE                                    | PERLITA, ROCA DE                                     |
| PETROLEUM COKE (calcined)                      | COKE DE PÉTROLE (calciné)                        | COQUE DE PETRÓLEO (calcinado)                        |
| PETROLEUM COKE (uncalcined)                    | COKE DE PÉTROLE (non calciné)                    | COQUE DE PETROLEO (no calcinado)                     |
| PHOSPHATE ROCK (calcined)                      | ROCHE PHOSPHATÉE (calcinée)                      | FOSFATO EN ROCA (calcinado)                          |
| PHOSPHATE ROCK (uncalcined)                    | ROCHE PHOSPHATÉE (non calcinée)                  | FOSFATO EN ROCA (no calcinado)                       |
| PHOSPHATE (defluorinated)                      | PHOSPHATE (défluoré)                             | FOSFATO (desfluorado)                                |
| PIG IRON                                       | FONTE EN GUEUSES                                 | HIERRO EN LINGOTES                                   |
| Pig iron by-product                            | Sous-produits de la fonte brute                  | Productos derivados del hierro en lingotes           |
| PITCH PRILL                                    | BRAI EN GRAINS                                   | BREA EN BOLITAS                                      |

| ENGLISH   | FRENCH  | SPANISH  |
|---|---|--|
| Plate iron  | Plaques de fer  | Placas de hierro   |
| Pollard pellets   | Recoupette en boulettes   | Moyuelo, pellets de  |
| Pool iron   | Résidus de hauts fourneaux  | Residuos de altos hornos   |
| POTASH  | POTASSE   | POTASA   |
| Potash muriate  | Muriate de potasse  | Muriato de potasa  |
| POTASSIUM CHLORIDE  | CHLORURE DE POTASSIUM   | CLORURO POTÁSICO   |
| Potassium felspar sand                                      | Sable de feldspath potassique                                       | Arena de feldespato potásico   |
| POTASSIUM NITRATE UN 1486                                   | NITRATE DE POTASSIUM UN 1486  | NITRATO POTÁSICO, UN 1486  |
| Potassium nitrate/sodium nitrate (mixture)                  | Nitrate de potassium/nitrate de sodium (en mélange)                 | Nitrato potásico y nitrato sódico, mezclas de                        |
| POTASSIUM NITRATE MIXTURE                                   | NITRATE DE POTASSIUM EN MÉLANGE                                     | NITRATO POTÁSICO EN MEZCLA   |
| POTASSIUM SULPHATE  | SULFATE DE POTASSIUM  | SULFATO DE POTASIO   |
| Prilled coal tar  | Goudron de houille en grains  | Alquitrán de hulla en bolitas  |
| PULP WOOD   | BOIS À PÂTE   | MADERA PARA PASTA PAPELERA   |
| PUMICE  | PONCE   | PIEDRA PÓMEZ   |
| PYRITE (containing copper and iron)                         | PYRITE (contenant du cuivre et du fer)                              | PIRITA (contiene cobre y hierro)                                     |
| PYRITES, CALCINED   | PYRITES CALCINÉES   | PIRITAS CALCINADAS   |
| PYRITES   | PYRITES   | PIRITAS  |
| Pyrites (cupreous, fine, flotation, or sulphur)             | Pyrites (cuivreuses, fines, flottation, soufre)                     | Piritas (cuprosas, disgregadas, flotación o azufre)                  |
| Pyritic ash   | Cendres pyriteuses  | Cenizas piríticas  |
| PYRITIC ASHES (iron)  | CENDRES PYRITEUSES (fer)  | CENIZAS PIRITOSAS (hierro)   |
| PYRITIC CINDERS   | CENDRES PYRITEUSES  | ESCORIAS PIRITOSAS   |
| PYROPHYLLITE  | PYROPHYLLITE  | PIROFILITA   |
| QUARTZ  | QUARTZ  | CUARZO   |
| Quartz sand   | Sable quartzeux   | Arena de cuarzo  |
| QUARTZITE   | QUARTZITE   | CUARCITA   |
| Quicklime   | Chaux vive  | Cal viva   |
| RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I) UN 2912 | MATIÈRES RADIOACTIVES DE FAIBLE ACTIVITÉ SPÉCIFIQUE (LSA-I) UN 2912 | MATERIALES RADIATIVOS, DE BAJA ACTIVIDAD ESPECÍFICA (BAE-I), UN 2912 |

| ENGLISH  | FRENCH  | SPANISH   |
|--|---|---|
| RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I) UN 2913                     | MATIÈRES RADIOACTIVES, OBJETS CONTAMINÉS SUPERFICIELLEMENT (SCO-I) UN 2913                          | MATERIALES RADIATIVOS, OBJETOS CONTAMINADOS EN LA SUPERFICIE (OCS-I), UN 2913                         |
| Rape seed, expelled  | Graines de colza, triturées   | Semillas de colza, prensadas  |
| Rape seed, extracted   | Graines de colza, sous-produits de l'extraction   | Semillas de colza, en extracto  |
| RASORITE (ANHYDROUS)   | RASORITE (ANHYDRE)  | RASORITA (ANHIDRA)  |
| Rice bran  | Son de riz  | Arroz, salvado de   |
| Rice broken  | Brisures de riz   | Arroz partido   |
| Rough ammonia tankage  | Déchets organiques ammoniacaux  | Amonio en bruto, desechos orgánicos de  |
| ROUNDWOOD  | RONDINS   | ROLLIZOS  |
| RUTILE SAND  | SABLE DE RUTILE   | RUTILO, ARENA DE  |
| Safflower seed, expelled   | Graines de carthame, triturées  | Cártamo, semillas de, prensadas   |
| Safflower seed, extracted  | Graines de carthame, sous-produits de l'extraction  | Cártamo, semillas de, en extracto   |
| SALT   | SEL   | SAL   |
| SALT CAKE  | PAIN DE SEL   | SAL, TORTA DE   |
| SALT ROCK  | ROCHE SALINE  | SAL GEMA  |
| Saltpetre  | Salpêtre  | Salitre   |
| SAND   | SABLE   | ARENA   |
| SAND, HEAVY MINERAL  | SABLES MINÉRAUX LOURDS  | ARENAS DE MINERALES PESADOS   |
| Sand, ilmenite   | Sable, ilménite   | Arena de ilmenita   |
| SAND, MINERAL CONCENTRATE, RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I) UN 2912 | MATIÈRES RADIOACTIVES DE FAIBLE ACTIVITÉ SPÉCIFIQUE (LSA-I), SABLES, CONCENTRÉS DE MINÉRAUX UN 2912 | ARENAS DE CONCENTRADOS DE MINERALES, MATERIAL RADIATIVO DE BAJA ACTIVIDAD ESPECÍFICA (BAE-I), UN 2912 |
| Sand, zircon   | Sable, zircon   | Arena de circonio   |
| SAWDUST  | SCIURE DE BOIS  | SERRÍN  |
| SAW LOGS   | BOIS DÉBITÉ   | TRONCOS PARA ASERRAR  |
| SCALE GENERATED FROM THE IRON AND STEEL MAKING PROCESS                                 | DÉPÔTS PROVENANT DE LA FABRICATION DU FER ET DE L'ACIER   | CASCARILLA GENERADA DE LOS PROCESOS SIDERÚRGICOS  |
| SCRAP METAL  | FERRAILLE   | CHATARRA  |

| ENGLISH   | FRENCH   | SPANISH   |
|---|--|---|
| SEED CAKE, containing vegetable oil UN 1386 (a) mechanically expelled seeds, containing more than 10% of oil or more than 20% of oil and moisture combined  | TOURTEAUX contenant de l'huile végétale UN 1386 a) Graines triturées par procédé mécanique contenant plus de 10 % d'huile ou plus de 20 % d'huile et d'humidité combinées  | TORTA DE SEMILLAS, con una proporción de aceite vegetal, UN 1386 a) residuos de semillas prensadas por medios mecánicos, con un contenido de más del 10% de aceite o más del 20% de aceite y humedad combinados   |
| SEED CAKE, containing vegetable oil UN 1386 (b) solvent extraction and expelled seeds, containing not more than 10% of oil and when the amount of moisture is higher than 10%, not more than 20% of oil and moisture combined | TOURTEAUX contenant de l'huile végétale UN 1386 b) Sous-produits de l'extraction au solvant ou graines triturées contenant au maximum 10 % d'huile et, si la teneur en humidité est supérieure à 10%, pas plus de 20 % d'huile et d'humidité combinées | TORTA DE SEMILLAS, con una proporción de aceite vegetal, UN 1386 b) residuos de la extracción del aceite de las semillas con disolventes o por prensado, con un contenido de no más del 10% de aceite o, si el contenido de humedad es superior al 10%, no más del 20% de aceite y humedad combinados |
| SEED CAKE UN 2217   | TOURTEAUX UN 2217  | TORTA DE SEMILLAS, UN 2217  |
| SEED CAKES AND OTHER RESIDUES OF PROCESSED OILY VEGETABLES  | TOURTEAUX ET AUTRES RÉSIDUS DE VÉGÉTAUX HUILEUX TRAITÉS  | TORTAS DE SEMILLAS Y OTROS RESIDUOS DE PLANTAS OLEAGINOSAS PROCESADAS   |
| Seed expellers, oily  | Expellers oléagineux   | Semillas oleosas, torta de presión de   |
| Separation of iron  | Résidus du processus de séparation   | Hierro de separación  |
| Silica sand   | Sable siliceux   | Arena de sílice   |
| SILICOMANGANESE (carbo-thermic)   | SILICOMANGANÈSE (carbothermique)   | SILICOMANGANESO (carbotérmico)  |
| SILICOMANGANESE (low carbon)  | SILICOMANGANÈSE (à faible teneur en carbone)   | SILICOMANGANESO (bajo contenido de carbono)   |
| Silicon dross   | Crasses de silicium  | Espuma de silicio   |
| SILICON SLAG  | SCORIES DE SILICIUM  | ESCORIA DE SILICIO  |
| SILVER LEAD CONCENTRATE   | CONCENTRÉ DE PLOMB ARGENTIFÈRE   | PLATA Y PLOMO, CONCENTRADO DE   |
| Silver lead ore concentrate   | Concentré de minerai de plomb argentifère  | Plata y plomo, concentrado de mineral de  |
| Sinter  | Agglomérés   | Sinterizado   |

| <b>ENGLISH</b>                                       | <b>FRENCH</b>   | <b>SPANISH</b>  |
|--|---|---|
| Slag, granulated                                     | Scories, en grains  | Escoria granulada   |
| SLIG, iron ore                                       | SLIG (minerai de fer)   | SLIG (mineral de hierro)  |
| SODA ASH   | SOUDE DU COMMERCE   | SOSA, CENIZA DE   |
| Soda felspar sand                                    | Sable de feldspath sodique  | Arena de feldespató sódico  |
| SODIUM NITRATE UN 1498                               | NITRATE DE SODIUM UN 1498   | NITRATO SÓDICO, UN 1498   |
| SODIUM NITRATE AND POTASSIUM NITRATE MIXTURE UN 1499 | NITRATE DE SODIUM ET NITRATE DE POTASSIUM EN MÉLANGE UN 1499        | NITRATO SÓDICO Y NITRATO POTÁSICO, EN MEZCLA, UN 1499               |
| SOLIDIFIED FUELS RECYCLED FROM PAPER AND PLASTICS    | COMBUSTIBLES SOLIDIFIÉS RECYCLÉS À PARTIR DE PAPIER ET DE PLASTIQUE | COMBUSTIBLES SOLIDIFICADOS RECICLADOS DE PAPELES Y PLÁSTICOS        |
| Soyabean, expelled                                   | Graines de soja, triturées  | Soja, prensada  |
| Soyabean, extracted                                  | Graines de soja, sous-produits de l'extraction                      | Soja, en extracto   |
| Spent cathodes                                       | Cathodes usées  | Cátodos agotados  |
| Spent potliner                                       | Revêtement usé des cuves  | Cubas electrolíticas agotadas                                       |
| Spodumene  | Spodumène   | Espodumeno  |
| SPODUMENE (UPGRADED)                                 | SPODUMÈNE (ENRICHÍ)   | ESPODUMENO (ENRIQUECIDO)  |
| STAINLESS STEEL GRINDING DUST                        | ACIER INOXYDABLE, POUSSIÈRE DE MEÛLAGE                              | ACERO INOXIDABLE, POLVO DEL RECTIFICADO DE                          |
| Steel bears  | Pièces d'acier en forme d'ours dites "steel bears"                  | Cuescos de acero  |
| Steel swarf  | Rognures d'acier  | Acero, virutas de   |
| Stibnite   | Stibnite  | Estibina  |
| STONE CHIPPINGS                                      | PIERRES CONCASSÉES  | GRAVILLA  |
| Strussa pellets                                      | Strussa en boulettes  | Strussa, pellets de   |
| SUGAR  | SUCRE   | AZÚCAR  |
| SUGARCANE BIOMASS PELLETS                            | BIOMASSE DE LA CANNE A SUCRE EN PELLETS                             | PELLETS DE BIOMASA DE CAÑA DE AZÚCAR                                |
| SULPHATE OF POTASH AND MAGNESIUM                     | SULFATE DE POTASSIUM ET DE MAGNÉSIUM                                | SULFATO DE POTASA Y MAGNESIO  |
| Sulphide concentrates                                | Concentrés sulfurés   | Sulfuros, concentrados de   |
| SULPHUR UN 1350 (crushed lump and coarse grained)    | SOUFRE UN 1350 (concassé en morceaux et en poudre à gros grains)    | AZUFRE, UN 1350 (en terrones triturados o en polvo de grano grueso) |
| SULPHUR (formed, solid)                              | SOUFRE (solide, moulé)  | AZUFRE (sólido con forma)   |
| Sunflower seed, expelled                             | Graines de tournesol, triturées                                     | Girasol, semillas de, prensadas                                     |

| ENGLISH  | FRENCH   | SPANISH   |
|--|--|---|
| Sunflower seed, extracted                                | Graines de tournesol, sous-produits de l'extraction            | Girasol, semillas de, en extracto                           |
| SUPERPHOSPHATE   | SUPERPHOSPHATE   | SUPERFOSFATO  |
| SUPERPHOSPHATE (triple, granular)                        | SUPERPHOSPHATE (triple, granuleux)                             | SUPERFOSFATO (triple granular)                              |
| Swarf  | Rognures   | Virutas   |
| SYNTHETIC CALCIUM FLUORIDE                               | FLUORURE DE CALCIUM DE SYNTHÈSE                                | FLUORURO DE CALCIO SINTÉTICO                                |
| SYNTHETIC SILICON DIOXIDE                                | DIOXYDE DE SILICONE DE SYNTHÈSE                                | DIÓXIDO DE SILICIO SINTÉTICO                                |
| TACONITE PELLETS   | TACONITE EN PELLETS  | TACONITA, PELLETS DE  |
| TALC   | TALC   | TALCO   |
| TANKAGE  | DÉCHETS ORGANIQUES   | DESECHOS ORGÁNICOS  |
| Tankage fertilizer                                       | Engrais à base de déchets organiques                           | Fertilizante orgánico                                       |
| TAPIOCA  | TAPIOCA  | TAPIOCA   |
| TIMBER   | BILLES DE BOIS   | MADERAJE  |
| TITANOMAGNETITE SAND                                     | SABLE TITANOMAGNÉTITE  | ARENA DE TITANOMAGNETITA                                    |
| Toasted meals  | Farines grillées   | Harinas tostadas  |
| Triple superphosphate                                    | Superphosphate triple  | Superfosfato triple   |
| UREA   | URÉE   | UREA  |
| VANADIUM ORE   | MINERAI DE VANADIUM  | VANADIO, MINERAL DE   |
| VERMICULITE  | VERMICULITE  | VERMICULITA   |
| WHITE QUARTZ   | QUARTZ BLANC   | CUARZO BLANCO   |
| WOODCHIPS  | COPEAUX DE BOIS  | MADERA, ASTILLAS DE   |
| WOOD PELLETS CONTAINING ADDITIVES AND/OR BINDERS         | GRANULÉS (PELLETS) DE BOIS CONTENANT DES ADDITIFS ET/OU LIANTS | PELLETS DE MADERA QUE CONTIENEN ADITIVOS Y/O AGLUTINANTES   |
| WOOD PELLETS NOT CONTAINING ANY ADDITIVES AND/OR BINDERS | GRANULÉS (PELLETS) DE BOIS NE CONTENANT AUCUN ADDITIF OU LIANT | PELLETS DE MADERA QUE NO CONTIENEN ADITIVOS NI AGLUTINANTES |
| Wood Products – General                                  | Produits du bois – Généralités                                 | Productos generales de madera                               |
| WOOD TORREFIED   | BOIS TORRÉFIÉ  | MADERA TORRADA  |
| ZINC AND LEAD CALCINES (mixed)                           | ZINC ET PLOMB CALCINÉS (en mélange)                            | CINC Y PLOMO, CALCINADOS DE (en mezclas)                    |
| ZINC AND LEAD MIDDINGS                                   | MIXTES DE ZINC ET DE PLOMB                                     | CINC Y PLOMO, MIXTOS DE                                     |
| ZINC ASHES UN 1435                                       | CENDRES DE ZINC UN 1435  | CINC, CENIZAS DE, UN 1435                                   |



| <b>ENGLISH</b>                   | <b>FRENCH</b>                                 | <b>SPANISH</b>  |
|----------------------------------|---|---|
| ZINC CONCENTRATE                 | CONCENTRÉ DE ZINC                             | CINC, CONCENTRADO DE  |
| Zinc dross, residue or skimmings | Zinc, crasses, résidus, laitier               | Cinc (desechos de, residuos de o espuma de)                   |
| Zinc ore, burnt                  | Minerai de zinc, brûlé                        | Cinc, mineral quemado de                                      |
| Zinc ore, calamine               | Minerai de zinc, calamine                     | Cinc, mineral de, calamina                                    |
| Zinc ore, concentrates           | Minerai de zinc, concentrés                   | Cinc, mineral de, concentrados                                |
| Zinc ore, crude                  | Minerai de zinc, brut                         | Cinc, mineral de, bruto                                       |
| ZINC OXIDE ENRICHED FLUE DUST    | CENDRES VOLANTES ENRICHIES AUX OXYDES DE ZINC | POLVO DE LOS CONDUCTOS DE HUMOS ENRIQUECIDO CON OXIDO DE CINC |
| ZINC SINTER                      | AGGLOMÉRÉS DE ZINC                            | CINC SINTERIZADO  |
| ZINC SLAG                        | SCORIES DE ZINC                               | CINC, ESCORIA DE  |
| ZINC SLUDGE                      | BOUES DE ZINC                                 | CINC, FANGOS DE   |
| Zinc sulphide                    | Sulfure de zinc                               | Sulfuro de cinc   |
| Zinc sulphide (blende)           | Sulfure de zinc (blende)                      | Sulfuro de cinc (blenda)                                      |
| ZIRCON KYANITE CONCENTRATE       | CONCENTRÉ DE KYANITE ET DE ZIRCON             | CONCENTRADO DE CIANITA DE CIRCONIO                            |
| ZIRCONSAND                       | SABLE DE ZIRCON                               | CIRCONIO, ARENA DE  |