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SOLID BULK CARGOES[1]

1. INTRODUCTION

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.

The main legislation governing safe carriage of solid bulk cargoes is the International Maritime Solid Bulk Cargoes (IMSBC) Code, compliance of which is mandatory under the SOLAS Convention.

The carriage of solid bulk cargoes other than grain shall be in compliance with the relevant provisions of the IMSBC Code. (SOLAS-VI/Reg.1-2)

Carrying solid bulk cargoes involves serious risks, which must be managed carefully to safeguard the crew and the ship. These risks include reduced ship stability, and even capsizing, due to cargo liquefaction; fire or explosion due to chemical hazards; and damage to ship structures due to poor loading procedures.

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.

The officers shall familiarize with the cargo i.e., hazard, stowage and segregation, hold cleanliness, weather precautions, ventilation, carriage, discharge and other requirements before loading the cargo.

1.1. Information Required from the Shipper prior loading any Bulk Cargo

As per section 4 of IMSBC Code, the shipper is required to provide the master with adequate information about the cargo in advance of loading to enable the precautions necessary for proper stowage and safe carriage of the cargo to be put into effect. Shipper must also declare that the cargo information is correct. The cargo information is in a form called **Shipper's Declaration**.

The shipper must provide the Master with valid, up-to-date information about the cargo's physical and chemical properties. The exact information and documentation they must provide is listed in the IMSBC Code under 'Assessment of acceptability of consignments for safe shipment; Provision of Information' and includes the correct Bulk Cargo Shipping Name (cargo's official name used in the Code) and a declaration that the cargo information is correct.

[1] W 23 / 2022 (Entire Chapter Updated)

2. GENERAL REQUIREMENTS FOR CARRYING SOLID BULK CARGOES

Where a solid bulk cargo is specifically listed in appendix 1 of IMSBC 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 the 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.

The IMSBC Code categorizes cargoes into three groups:

- **Group A** consists of cargoes which may liquefy if shipped at a moisture content exceeding their Transportable Moisture Limit (TML).
- **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 possess chemical hazards (Group B). Cargoes in this group can still be hazardous.

Cargoes can be in Group A, B or C, or Group A and B.

2.1. Group A Cargoes

These are the cargoes which may liquefy.

Liquefaction means that a cargo becomes fluid (liquefies). On ships, this happens when the cargo is compacted by the ship's motion. Cargoes which are prone to liquefaction contain a certain quantity of moisture and small particles, although they may look relatively dry and granular when loaded. Liquefaction can lead to cargo shift and even to the capsize and total loss of the ship and can occur even when cargoes are cohesive and trimmed level.

Examples of Group A cargoes:

- **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.
- **Mineral concentrates** are refined ores in which valuable components have been enriched by eliminating most waste materials. They include copper concentrate, iron concentrate, lead concentrate, nickel concentrate and zinc concentrate.
- **Nickel ore** There are several types of nickel ore which vary in colour, particle size and moisture content.
- **Coal (bituminous and anthracite)** is a natural, solid, combustible material consisting of amorphous carbon and hydrocarbons. It is best known as a Group B cargo due to its flammable and self-heating properties, but it can also be classed as Group A because it can liquefy if predominantly fine (i.e., if 75% is made up of particles less than 5mm in size). In these cases, it is classed as both Group A and B.

- **Bauxite** is a brownish-yellow, claylike, earthy material primarily consisting of aluminium oxides compounds, silica, iron oxides and titanium dioxides. Bauxite Fines containing more than 30% of fine particles less than 1 mm and more than 40% of particles less than 2.5 mm classed as Group A cargo. Bauxite also classed as Group C cargo depending upon the size of the particles.

2.1.1. Typical requirements for accepting and loading Group A cargoes:

To control the risks of liquefaction, Group A cargoes are tested to determine their Transportable Moisture Limit (TML) and their actual moisture content before they can be shipped. The TML is the maximum moisture content considered safe for carriage. The actual moisture content of the cargo
must be below the TML.

The information supplied by the shipper to the Master must include a signed certificate stating the TML, and a signed certificate or declaration of the cargo's actual moisture content.

For more information refer 'chapter 29.0 Cargoes which may liquefy'.

2.2. Group B Cargoes

These cargoes are associated with chemical hazards. Group B cargoes are those that meet either the IMDG Code's dangerous goods hazard criteria or the IMSBC Code's 'materials hazardous only in bulk' (MHB) criteria. MHB cargoes are materials that involve chemical hazards when transported in bulk, but that do not meet the criteria for inclusion in the IMDG classes. However, they present significant risks to health and safety when carried in bulk and require special precautions.

This information is provided in the "characteristics" section of the cargo's schedule in the IMSBC Code. Cargoes classified as dangerous goods in solid form in bulk will also have a 'UN' number in the Bulk Cargoes Shipping Name.

- Dangerous goods in solid form in bulk
- In the IMSBC Code these cargoes are classed as follows:
- Class 4.1: Flammable solids
- Class 4.2: Substances liable to spontaneous combustion
- Class 4.3: Substances which, in contact with water, emit flammable gases
- Class 5.1: Oxidizing substances
- Class 6.1: Toxic substances
- Class 7: Radioactive materials
- Class 8: Corrosive substances
- Class 9: Miscellaneous dangerous substances and articles.

2.2.1. Materials hazardous only in bulk (MHB)

MHB cargoes are materials which possess chemical hazards when transported in bulk that do not meet the criteria for inclusion in the IMDG classes above. They present significant risks when carried in bulk and require special precautions. They are described as follows:

- Combustible solids: materials which are readily combustible or easily ignitable
- Self-heating solids: materials that self-heat
- Solids that evolve into flammable gas when wet: materials that emit flammable gases when in contact with water
- Solids that evolve toxic gas when wet: materials that emit toxic gases when in contact with water
- Toxic solids: materials that are acutely toxic to humans if inhaled or brought into contact with skin
- Corrosive solids: materials that are corrosive to skin, eyes, metals or respiratory sensitisers.

2.2.2. Examples of Group B cargoes and the risks they present

The major risks associated with Group B cargoes are fire and explosion, release of toxic gas and corrosion.

- **Coal**
  Coal may create flammable atmospheres, heat spontaneously, deplete oxygen concentration and corrode metal structures. Some types of coal can produce carbon monoxide or methane.
- **Direct reduced iron (DRI)**
  DRI may react with water and air to produce hydrogen and heat. The heat produced may cause ignition. Oxygen in enclosed spaces may also be depleted.
- **Metal sulphide concentrates**
  Some sulphide concentrates are prone to oxidation and may have a tendency to self-heat, leading to oxygen depletion and emission of toxic fumes. Some metal sulphide concentrates may present corrosion problems.
- **Organic materials**
- **Ammonium nitrate-based fertilisers**
  Ammonium nitrate-based fertilisers support combustion. If heated, contaminated or closely confined, they can explode or decompose to release toxic fumes and gases.

- **Wood products transported in bulk**
  Wood products transported in bulk are listed in a new schedule to the Code: Wood Products – General. They include logs, pulpwood, roundwood, saw logs and timber. These cargoes may cause oxygen depletion and increase carbon dioxide in the cargo space and adjacent spaces.

2.2.3. Typical requirements for accepting and loading Group B cargoes

- **Information required on board ship for dangerous goods in solid form in bulk**
  To carry dangerous goods in solid form in bulk, ship must have a Document of Compliance for the Carriage of Dangerous Goods, supplied by the ship's flag or classification society. The Master must have a special list, manifest or stowage plan identifying the cargo's location, and there must be instructions on board for emergency response.
- **Segregation**
  Because of their potential hazards, many Group B cargoes are incompatible and must be segregated. When segregating cargoes, any secondary risks they present should be taken into account.
- **Specific risk mitigation measures**
  The cargo's schedule and the information provided by the shipper will detail the precautions to be taken when carrying Group B cargoes. The following are some of the common risk mitigation measures to employ.
- **Fire and explosion**
  Depending on the cargo, precautions against fire and explosion may include ventilating or inerting the cargo holds and the enclosed spaces adjacent to the holds: in some cases, the ventilators will need to be explosion proof. The atmosphere in the cargo holds and the enclosed spaces adjacent to the holds may also need to be monitored with an appropriate gas detector.
- **Toxic gas**
  Toxic gas risks will be mitigated using natural or forced mechanical ventilation.

  The choice of ventilation will depend on the type of cargo and the properties of the gas (i.e., whether it creates an explosive atmosphere). The Ship staff may need to monitor the cargo hold atmosphere.
- **Corrosion**
  Corrosion can be caused by some Group B cargoes and their residues. A coating or barrier may need to be applied to the cargo space structures before loading. Before loading and unloading corrosive cargoes, make sure that the cargo space is clean and dry.

2.3. Group C Cargoes

These are the cargoes which are neither liable to liquefy nor possess chemical hazards.

Although Group C cargoes do not present the dangers associated with Group A and B cargoes, they can still carry risks.

2.3.1. Examples of Group C cargoes, their risks and mitigation measures

- **Iron ore and high-density cargoes**
  These cargoes can be extremely dense and can overstress the tank top. Make sure that their weight is evenly distributed during loading and during the voyage so that the tank top is not overstressed, and also consider trimming the cargo. Loading rates of iron ore are normally very high and ship staff should also consider the ship's ballasting operations and loading sequences.
- **Sand and fine particle materials**
  Fine particle materials can be abrasive. Silica dust is easily inhaled and can result in respiratory disease.
- **Cement**
  Cement may shift when aerated during loading. Dust can also be produced from this cargo.
- **Cement Clinkers**
  The rough cinder lumps are called clinkers and are shipped in this form to avoid the difficulties of carrying cement powder.

3. SOLID BULK CARGO NOT LISTED IN THE IMSBC CODE

If a solid cargo which is not listed in appendix 1 of the IMSBC Code is proposed for carriage in bulk, master shall inform the Ship Manager. The Master will load such cargo only after proper documentation from the relevant authorities is available on board and confirmation from the office.

Following procedure is followed for loading such solid bulk cargo:

- 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 the IMSBC Code. Based on the information received, the competent authority shall assess the acceptability of the cargo for safe shipment.
- When it is assessed that the solid bulk cargo proposed for carriage may present hazards, such as those defined by group A or B of the IMSBC Code as defined in 1.7 of the code, 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.

- 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 authorised. The competent authorities of the port of unloading and of the Flag State shall be advised of that authorisation.
- 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.

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

3.1. Exemptions

Under section 1.5 of the Code, a competent authority (or authorities) can grant an exemption which allows ships to carry a cargo outside the requirements specified in its schedule, provided that equivalent provisions have been put in place.

Agreement of all three competent authorities (port State of departure, port State of arrival or flag State) is required to ship a cargo under an exemption. Acceptance of an exemption by authorities not party to it is discretionary: i.e., if the loading port authority issues an exemption, the unloading port and flag state authorities can choose to accept it or reject it.

An exemption can be valid for up to five years and does not necessarily lead to the creation of a new or revised schedule.

4. CHECKS AND FLOWCHART FOR ACCEPTING AND LOADING SOLID BULK CARGOES

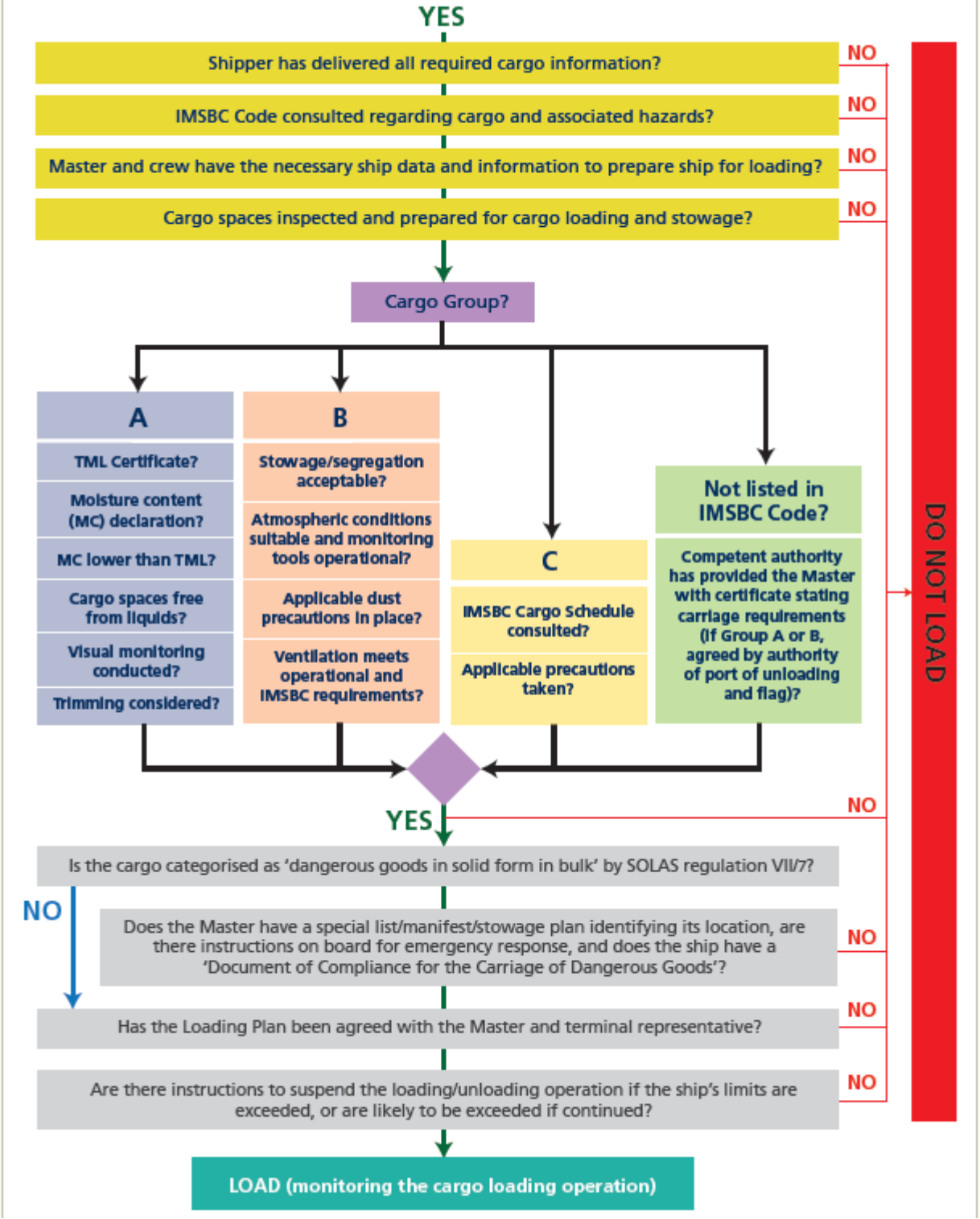
All the key procedures must be followed when accepting and loading any solid bulk cargo for shipment. Always consult the IMSBC Code to ensure that all mandatory measures and specific advice have been implemented.

Following should be complied with:

- Shipper has delivered the cargo information and documentation listed in the Code under ‘Assessment of acceptability of consignments for safe shipment; Provision of Information’, including the correct Bulk Cargo Shipping Name (BCSN), and provided a declaration that the cargo information is correct
- Consult the relevant IMSBC Code schedule to find out the cargo’s general and specific hazards
- If the cargo is listed as Group A, follow all procedures relating to the safe carriage of cargoes which may liquefy.
- Certificates of transportable moisture limit (TML) has been obtained. The interval between sample or testing and loading not exceeding six months.

- Certificate of the moisture content of the cargo has been obtained. The interval between sampling/testing and the date of commencement of loading shall never be more than seven days.
- The actual moisture content should not exceed TML of the cargo
- Cargo is not exposed to rain
- If the schedule indicates the cargo is Group B, shipper to provide a statement that the chemical characteristics of the cargo are, to the best of his knowledge, those present at the time of loading:
- If the cargo is classified as ‘dangerous goods in solid form in bulk’ the Master shall have a special list, manifest or stowage plan identifying its location, instructions on board for emergency response, and a Document of Compliance for the Carriage of Dangerous Goods. Please refer chapter 31.0 Carriage of Dangerous Cargo in Solid Form for more information.
- Whatever the cargo Group, take the recommended precautions to remove or minimise the cargo’s hazard, including:
- preparing recommended safety equipment and procedures
- activating any cargo monitoring equipment ready for loading
- Before sailing on the loaded passage, consider other factors for the safe carriage of the cargo, such as the ingress of water, which could affect the cargo during the passage.

Loading flowchart – follow the steps to see if it is safe to load your cargo



5. PRECAUTIONERY MEASURES DURING CARGO HANDLING

Precautionary measures as provided for the cargo in IMSBC Code are to be observed. Some cargoes produce dust during cargo load/discharge operation if dust is inhaled and it can result in respiratory disease. Depending upon the characteristic of the cargo, the Code may require avoid breathing dust. The crew who may be exposed to the dust component of the cargo must wear personal protective equipment including goggles or other equivalent dust eye-protection, and respiratory protection e.g. dust filter masks as necessary. The crew shall wash hands and face before eating and drinking.

Fine particle materials of some cargoes can be abrasive. Appropriate precautions are required to protect machinery and accommodation spaces from the dust of sand and fine particle of cargoes, and to prevent the cargo from getting into the bilge wells. The hydraulic piston of hatch covers shall be kept covered with canvass to protect from the abrasive particles.

During handling of some Group B cargoes, "NO SMOKING" signs on deck and “NO NAKED LIGHTS” is permitted in the cargo area shall be posted and the crew may require protective clothing and self-contained breathing apparatus.

All officers are required to familiarize themselves with the precautions as specified for the cargo in IMSBC Code and master to ensure compliance with the precautionary measures on board.