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# Guidance to Masters of Vessels Loading Concentrates in Bulk

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### 1 INTRODUCTION

Safely loading, stowing, and securing cargo is one of the most important factors in preparing a ship for safe voyage. Cargoes like mineral concentrates in bulk present high risks because of their physical and chemical properties.

The risks of marine transportation of concentrates are further elevated due to the fact that these cargoes account for a significant part of Canadian export in terms of quantity. To minimize these risks, a mandatory inspection program was established for ships loading concentrates in Canadian ports.

This guidance was published to help ship Masters prepare for inspections in order to save as much time and effort as possible, while also successfully completing the inspection process.

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

In Canada, safe loading, stowing, and securing of cargo is regulated by the *Cargo, Fumigation and Tackle Regulations* (CFTR) created under the *Canada Shipping Act, 2001*.

The master of a ship loading concentrates in bulk must make sure that their ship meets the requirements of the *International Maritime Solid Bulk Cargoes Code* (IMSBC Code) and any relevant parts of the SOLAS Convention (CFTR s. 108).

Section 119 of CFTR requires that ships loading concentrates in bulk be inspected.

## **2 RISKS ASSOCIATED WITH MARINE CARRIAGE OF CONCENTRATES**

### **2.1 Moisture migration and liquefaction**

Concentrates can become liquefied if shipped with a moisture content higher than their transportable moisture limit.

Liquefaction is a phenomenon in which a soil-like material suddenly transforms from a solid dry state to an almost fluid state.

Cargo liquefaction occurs when dry bulk cargoes with high moisture content start to behave like liquids when the ship is moving. These cargoes may shift rapidly in the holds of a ship, which makes the ship unstable and could lead to a capsizing.

The vibrations that occur during transportation cause the moisture in concentrates to move and form layers in the stow.

At a certain water content, known as the “flow moisture point”, this layer becomes liquid-like and may result in sudden shift of the cargo. It may cause damage to the ships structure or a loss of stability and capsizing.

As such, it is essential that a ship is structurally sound and that the moisture content of the concentrate being shipped does not exceed its transportable moisture limit.

## **2.2 Excessive stresses and strains due to poor loading and distribution of cargo when the ship sails**

Most concentrates have a mineral content of 15 - 20% of the metal. They are heavy and have a low stowage factor. Loading rates can be high and it is relatively easy to induce excessive stresses and strains in a ship during loading.

Such stresses and strains can be made worse during a voyage by poor cargo distribution and the motion of the ship during transit. To avoid excessive stresses and strains, you must follow the loading conditions approved by the ship's Flag State Administration.

## **2.3 General problems of corrosion and damage during loading**

Corrosion can occur in any part of a ship structure and is of particular concern in the way of watertight bulkheads, freshwater ballast and fuel tanks, side plates, or the ships' frames. This is mainly due to the possibility of structural failure and the ingress of liquids into the cargo holds and the cargo.

The heavy machinery used to discharge concentrates may cause damage to the cargo holds' structure. Structures badly weakened by corrosion are very prone to damage by heavy cargo grabs. Such damage might indicate wastage of the parts involved. However, damage can also occur in good metal by careless operation of heavy machinery.

## **2.4 Chemical hazards**

Some concentrates may have chemical hazards and belong to IMSBC Code Group B as either dangerous goods or materials hazardous when carried in bulk (MHB) or both.

According to the respective IMSBC Code schedules, depending on a specific material, concentrates may have the following chemical hazards:

- METAL SULPHIDE CONCENTRATES (MHB SH and / or TX and / or CR)
- METAL SULPHIDE CONCENTRATES, CORROSIVE UN 1759 (Class 8 and MHB SH and / or WT)
- METAL SULPHIDE CONCENTRATES, SELF-HEATING UN 3190 (Class 4.2 and MHB WT and / or TX and / or CR)

CR - Corrosive solids

SH - Self-heating solids

TX - Toxic solids

WT - Solids that evolve toxic gas when wet

It is important to clean cargo holds to avoid contaminants from previous cargo residues, wood dunnage, etc.

### 3 WHAT TO EXPECT DURING INSPECTION

The information in this section provides a general overview of the inspection process followed by a detailed description of specific inspection stages and the items that need to be verified to successfully obtain a Certificate of Readiness to Load and Fitness to Proceed Certificate.

#### **Commercial considerations do not affect inspection**

Transport Canada will conduct inspections pursuant to the CFTR. Time pressures due to commercial considerations will not be regarded as an overriding factor for the process of assigning an Inspector, inspecting the ship, or issuing a Certificate of Readiness to Load, Fitness to Proceed, or written statement.

#### 3.1 Main steps

- The ship Master or agent notifies respective Transport Canada Center about the intended loading and applies for inspection for the purpose of receiving a Certificate of Readiness to Load
- Before the ship's arrival, in order to minimize inspection time, an Inspector contacts the ship and asks for electronic copies of the documents listed in the MASTER - INSPECTION CHECKLIST - CONCENTRATES.
- At the agreed time, the Inspector will carry out the inspection for issuing a Certificate of Readiness to Load
- Once an inspection has been successfully completed, the Inspector will issue a Certificate of Readiness to Load
- Loading starts
- Once loading is complete, the ship's Master or Agent will notify the respective Transport Canada Center and apply for an inspection for a Fitness to Proceed Certificate
- At an agreed time, the Inspector will carry out the inspection for issuing a Fitness to Proceed Certificate
- Once the inspection has been successfully completed, the Inspector will issue a Fitness to Proceed Certificate

#### 3.2 Notification and request for the readiness to load inspection

Before a ship begins loading concentrates in bulk in a Canadian port the CFTR requires the master or agent to notify the respective Transport Canada Center and apply for a Certificate of Readiness to Load a ship.

The ship's agent will call the respective Transport Canada Centre, ask for a readiness to load inspection, and provide accurate information about the date, time, ship's name and terminal.

Following the request an Inspector will contact the ship and ask for electronic copies of the documents listed in the MASTER - INSPECTION CHECKLIST - CONCENTRATES.

### **3.3 Start of inspection**

An Inspector will inspect the ship at the agreed time and determine whether the ship complies with all applicable requirements of the regulations and can safely load, stow, and carry the intended cargo.

### **3.4 Safety of inspectors on board the ships**

The ship Master must take all necessary steps to ensure safety of the Marine Safety Inspector while on board the ship, this includes providing safe access to the ship, any enclosed space, cargo holds, and decks. There must be proper lighting and ventilation, and sufficient and competent crew to accompany the Inspector.

To provide safe access to cargo holds, please refer to IMO Resolution A.1050(27) - REVISED RECOMMENDATIONS FOR ENTERING ENCLOSED SPACES ABOARD SHIPS. At all times, an empty cargo hold is considered by Transport Canada as an enclosed space.

### **3.5 Readiness to load inspection process**

The following paragraphs expand on what to expect during the inspection for a Certificate of Readiness to Load.

The Master must make sure that the load line marks are clearly readable and marked according to the ship's Load Line Certificate. The Inspector will verify the marks and visually check the condition of the external hull.

While inspecting the ship, the Inspector will ask the Master for copies of the ship's certificates and relevant documents approved by the ship's flag authority or a recognized organization (such as Classification Society) on behalf of the ship's flag authority.

Occasionally, a ship that has recently changed ownership and / or country of registration may arrive with approval documents issued by its former flag administration. The Inspector will not issue a Readiness to Load Certificate until the ship's present administration issues the required documents.

After examining the documents and certificates, the Inspector will carefully inspect all spaces in which cargo will be loaded.



When inspecting the cargo spaces, Inspector will carefully examine cargo hatches, decks, bulkheads, wing tanks, and topside tanks for any sign of damage or leaks. Rust stains or damp streaks generally indicate that cracks may exist. In this case, repairs may be necessary. The inspection would include the double bottom tank tops, sounding or filling pipes, and the ship's side plating for possible leaks. Any signs of grab damage (like indentations or distortion) may warrant further examination. Heavy corrosion in any area will be considered suspect. Bilge wells must be accessible for inspection, clear of obstruction and any foreign material and must be covered with burlap or other suitable material secured in place.

The Inspector may ask the Master to test the bilge pumping arrangement to ensure it works. Hatch coamings and seals on hatches will be examined for any signs of leakage. The cargo spaces must be clean and dry.

### **3.6 Issuance of the Certificate of Readiness to Load**

If the ship is found compliant with all applicable requirements, the Inspector will issue a Certificate of Readiness to Load.

If some requirements have not been met, the Inspector will give the Master a written statement detailing the deficiencies to be rectified before a Certificate of Readiness to Load can be issued.

When the deficiencies are rectified and the ship is ready, the master or agent must notify Transport Canada and apply for a Certificate of Readiness to Load a ship again.

### **3.7 Changes to the approved loading plan**

If, before the start or in the course of loading, the previously approved loading plan changes, the Master must notify the respective Transport Canada Center, prepare a new stability calculation and submit it to the Inspector before completing loading and with enough time for the Inspector to check the calculation and issue a new Certificate of Readiness to Load.

### **3.8 Notification and request for the Fitness to Proceed inspection**

At the completion of loading concentrates in bulk the CFTR require the master or agent to notify the respective Transport Canada Center and apply for a Fitness to Proceed Certificate to the ship.

The ship's agent will contact the respective Transport Canada Centre, ask for a Fitness to Proceed inspection, and provide accurate information about the date, time, ship's name and terminal.

### **3.9 Fitness to Proceed inspection process**

An Inspector will inspect the ship at the agreed time and determine whether the cargo stowage complies with all applicable requirements of the regulations and the ship is fit to proceed to sea for the intended voyage.

The Inspector will verify if the loading was done according to the approved loading plan and check proper trimming and levelling of the cargo.

### **3.10 Issuance of the Fitness to Proceed Certificate**

Based on the positive results of the inspection the Inspector will issue a Fitness to Proceed Certificate.

### **3.11 Deviations from the previously approved loading plan**

If for any reason the ship is found to be overloaded or deviating from the conditions in the approved loading plan, the Inspector will not issue a Fitness to Proceed Certificate.

The Inspector will inform the master of the outstanding requirements to be complied with before a Fitness to Proceed Certificate can be issued.

## **4 SPECIFIC REQUIREMENTS**

### **4.1 Liquefaction**

Concentrates belong to Group A (cargoes that may liquefy) and can only be loaded if the actual moisture content of the cargo is below its transportable moisture limit (TML). Sampling, testing, and controlling the moisture content of concentrates must be done according to the shipper's procedures that have been approved by Transport Canada.

A valid letter of approval must be provided to the Master by the shipper. See also the Ship Safety Bulletin 07 / 2014 - [APPROVAL OF PROCEDURES FOR SAMPLING, TESTING, AND CONTROLLING THE MOISTURE CONTENT FOR SOLID BULK CARGOES THAT MAY LIQUEFY.](#)

### **4.2 Bilges**

Bilge wells and strainer plates in the cargo spaces must be in good order. Bilge wells must be dry, free from extraneous material and covered by burlap or by other appropriate material to allow water outside the bilges to drain to the bilge sections while preventing the cargo from entering the bilges.

Bilge lines, sounding pipes and other service lines within the cargo spaces must be in good order. Cargo space fittings must be protected from damage. Sounding the bilges

after loading is complete may be used to detect the absence of damage on cargo space fittings.

### 4.3 Structural strength and limitations

Ships are designed with certain limitations deliberately imposed on their operations to make sure that their structural integrity is maintained. These limitations are only observed if a ship is loaded according to the loading conditions in the ship's approved loading manual.

The use of cargo loading methods, quantities, and hold sequences not shown in the ship's approved loading manual may cause structural failure due to excessive stresses. In particular, overstressing local structural members can occur even when the ship's loading instrument calculations indicate that the hull girder still water shear forces (SWSF) and still water bending moments (SWBM) are within their permissible limits.

Exceeding the permissible limits specified in the ships' approved loading manual may lead to overstressing of the ship's structure and may result in catastrophic failure of the hull structure. Thus, when deviating from the cargo load conditions contained in the ship's approved loading manual, you must make sure not to exceed both the overall (SWSF and SWBM) and local structural limits.

Overstressing the local structural members may occur in case of non-homogeneous hold loading such as alternate hold loading and block loading (see Figure 1). Alternate hold loading refers to loading in odd-numbered holds with even-numbered holds remaining empty (or vice versa). Block loading refers to stowing cargo in a block of 2 or more adjoining holds with holds adjacent to such blocks remaining empty.

To prevent overstressing hull structures, prepare proposed loading plans and sequences according to the loading conditions in the ship's approved loading manual.

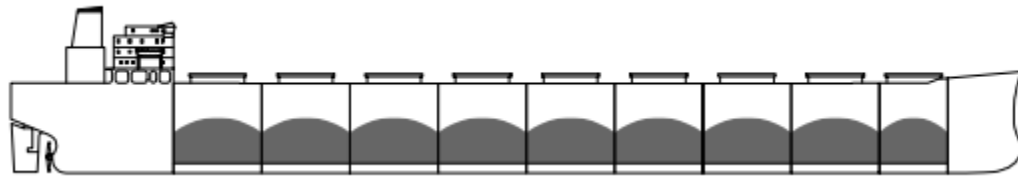
Ships loading bulk cargoes must not load or carry cargo in load configurations that are not specifically authorized in the approved loading manual, which must be used in conjunction with the approved loading instrument.

To avoid potential delays during inspections the approved loading manual should be updated to include additional approved loading conditions. Otherwise, a special approval from an organization recognized by the Flag Administration (Classification Society) should be provided for a particular loading condition before the Marine Safety Inspector issues a Certificate of Readiness to Load. Unauthorized loading condition is a deviation from the approved stability manual, even though the ship's loading instrument calculation indicates that the ships' SWSF / SWBM are within the permissible limits.

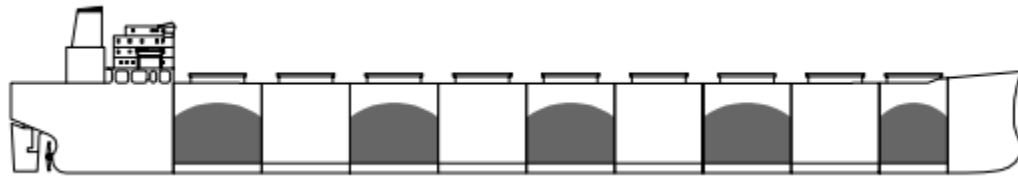
Alternatively, the ship can be provided with a set of approved local loading criteria which define the maximum cargo weight as a function of the ship's mean draft for each cargo hold and block of cargo holds. In this case, you must make sure that the amount of

cargo carried in each hold satisfies the cargo weight and draught limits specified by the local loading criteria and the hull girder SWSF and SWBM values are within their permissible limits.

**Figure 1. Loading conditions**



1. Homogeneous hold loading - cargo is evenly distributed in all holds.



2. Alternate hold loading in odd cargo holds (fully loaded condition) – approximately double the cargo weight per hold is loaded in the odd numbered holds.



3. Block loading – cargo is loaded in blocks of two or more adjoining holds with adjacent holds remaining empty.

#### **4.4 Trimming and levelling concentrates**

In addition to complying with the trimming and levelling requirements of IMSBC Code, section 118 of the CFTR requires concentrates to be trimmed and levelled so that:

- they reach all boundaries of the hold
- they slope uniformly from the hatch boundaries to the bulkheads
- no shearing faces remain to collapse during the voyage
- in the case of iron ore concentrates, the height differences between the peaks and troughs in the square of the hatch of the hold do not exceed 5% of the ship's breadth, and
- in the case of sulphide concentrates, the height differences between the peaks and troughs do not exceed 5% of the ship's breadth in the athwartship direction for the full width of the hold

#### **4.5 Structural integrity**

All decks, hatch covers, hatch coamings and cargo holds shall have no cracks and deformation and shall be in a satisfactory condition.

Cargo hold inspection includes but is not limited to the following items inside and in a way of the cargo hold:

- safe means of access to cargo holds (to be in good order)
- structural members to show no sign of cracks, leaks, excessive corrosion, deformation or damage
- bilge wells (to be clean and dry)
- integrity of bilge wells' covers
- protection of bilge wells (burlap)
- pumping arrangement (to be operational)
- water ingress alarms (to be operational)
- sounding pipes (to be in good order)
- ventilation systems (to be operational)
- hatch coamings and seals (to be in good order)
- hatch cover locking devices (to provide for secure and weathertight closing of hatch covers)

#### **4.6 Miscellaneous**

Operational oxygen analysis and gas detection instruments must be available on board together with the certificate of approval and the detailed instructions for their use (CFTR s.123(1), SOLAS VI / 3.1)

Cargo hold water level indicators / detectors must be operational (SOLAS XII / 12).

Loading instruments must be approved by the Flag Administration / Recognized Organization (Classification Society) on behalf of the Flag Administration, and operational (CFTR s.126 (2), SOLAS XII / 11).