AMMONIUM NITRATE FIRE RISK ON BOARD SHIPS

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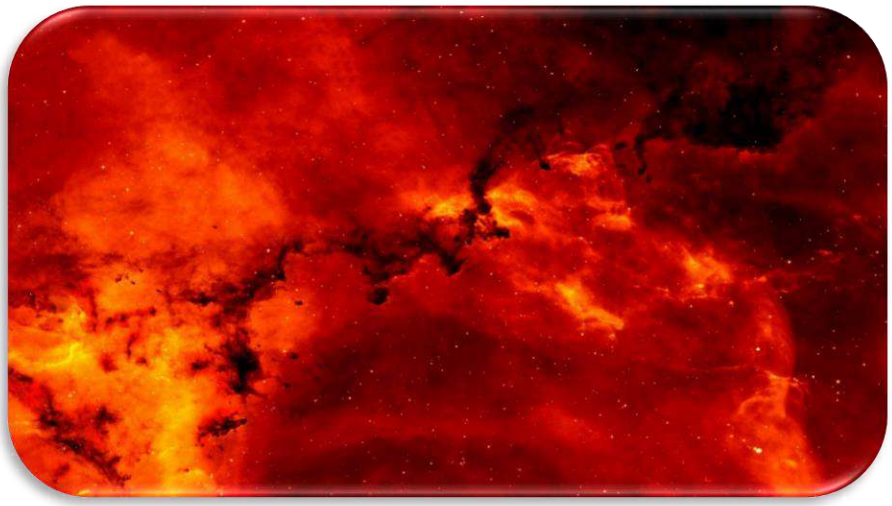

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Warning

This document provides an introduction to Ammonium Nitrate fire risk on board ships. For detailed advice it is necessary to read this in conjunction with relevant national and international legislation and guidance.

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	AMMONIUM NITRATE FIRE RISK ON BOARD SHIPS
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1. | Executive Summary

While the IMDG and other Codes & Regulations have detailed requirements and recommendations on the carriage of Ammonium Nitrate (AN), the prevention and mitigation controls of a disastrous fire on board a vessel loaded with Ammonium Nitrate may not always be fully explained and/or understood. The same applies for Ammonium Nitrate in Port areas.

This practical guide primarily focuses on the carriage of bagged Ammonium Nitrate on board ships and the associated Fire Risks both on board a ship as well as in Port Areas handling (loading & discharging) this cargo. Other aspects of safety such as stowage and compliance are not included in the scope of this guide. The objective of this guide is to outline the practice with respect to fire risks, on the requirements for vessels chartered to ship Ammonium Nitrate in break bulk through ports around the world. Key aspects of the International Maritime Dangerous Goods (IMDG) Code[1], as well as national regulatory frameworks such as those enforced by the Australian Maritime Safety Authority[2] (AMSA) and South African Maritime Safety Authority[3], (SAMSA) as well as industry good practices have been considered. However, the document should not in any way be considered exhaustive or all-inclusive and it is recommended that due diligence is applied to seek detailed knowledge of the various Codes and Regulations governing the carriage of Ammonium Nitrate in FIBC's.

Note: in this document, the term 'shall' is used with reference to mandatory duties under a recognised regulation or code such as the IMDG Code. The term 'should' is used where it is normally considered industry good practice.

2. | Chemistry & Properties of Ammonium Nitrate

While Ammonium Nitrate is an innocuous chemical under normal conditions, it is important to understand its chemistry. When subjected to certain conditions it can become a highly dangerous substance as shown in recent and past catastrophic events involving this chemical.

(Fig 1) Ammonium Nitrate Hazard Warning Labels

Broadly, Ammonium Nitrate that is used in the manufacture of explosives is referred to as Technical Grade Ammonium Nitrate (TGAN) which meets the definition of UN1942 and in

[1] https://www.imo.org/en/OurWork/Safety/Pages/DangerousGoods-default.aspx
[2] https://www.amsa.gov.au/
[3] https://www.samsa.org.za/Pages/default.aspx

some cases UN2067. It is normally in the shape of porous prills or granules. TGAN is also referred to as LDAN (Low Density Ammonium Nitrate) and HDAN (High Density AN). Based on its properties TGAN is classified as a Dangerous Good under the United Nations Recommendations on the Transport of Dangerous Goods – Model Regulations[4] (often called the Orange Book) and the International Maritime Dangerous Goods Code (IMDG).

Ammonium Nitrate (NH_4NO_3) is a white to grey odourless chemical with a melting Point of 169 degrees C which decomposes at 210 degrees C. While it does not burn by itself, it will accelerate burning of combustible material, producing toxic oxides of nitrogen and ammonia. The resulting nitrogen oxides will support combustion, even in the absence of oxygen. The resulting heat and pressure from the decomposition of ammonium nitrate may build up if the reaction takes place in a confined space and the heat and gases created are not able to dissipate. As the temperature rises, the rate of decomposition increases. In a confined space, the pressure can reach dangerous levels and cause an explosion that could include the detonation of the ammonium nitrate. When dealing with a large quantity of ammonium nitrate, localised areas of high temperature may be sufficiently confined by the mass of the material, to initiate an explosion. The explosion of a small quantity of ammonium nitrate in a confined space may act as a booster charge and initiate the explosion of larger quantities.

Ammonium Nitrate when heated: $NH_4NO_3 \rightarrow 2H_2O + N_2O$

Ammonium Nitrate when rapidly heated: $2NH_4NO_3 \rightarrow 2N_2 + O_2 + 4H_2O$

The properties of Ammonium Nitrate are described in the IMDG as follows:

UN 1942 *Crystals, granules or prills. Soluble in water. Supporter of combustion. A major fire aboard a ship carrying this substance 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 the risk of explosion. If heated strongly, decomposes, giving off toxic gases and gases which support combustion. Transport of AMMONIUM NITRATE liable to self-heating sufficient to initiate decomposition is prohibited.*

UN 2067 *Crystals, granules or prills. Wholly or partly soluble in water. Supporters of combustion. A major fire aboard a ship carrying this substance 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 the risk of explosion. If heated strongly, decomposes, giving off toxic gases and gases which support combustion. Transport of AMMONIUM NITRATE liable to self-heating sufficient to initiate decomposition is prohibited.*

[4] https://unece.org/transport/dangerous-goods/un-model-regulations-rev-22

In summary, Ammonium Nitrate has three main hazards when transported on a ship; *(Source: Safex TGAN Storage Good Practice Guide)*

a. Fire due to its oxidising nature

b. Decomposition with formation of toxic gases

c. Explosion

2.1. Fire

Ammonium Nitrate itself is not combustible and does not burn, but being an oxidising agent, it can facilitate the initiation of fire and will assist the combustion of other materials, even if air is excluded. Under confinement and exposed to heat from external fire, TGAN can thermally decompose. This reaction can, in turn, accelerate to an explosion.

Ammonium Nitrate products contaminated with oil or combustible materials can initiate a fire when hot. Similarly, combustible materials impregnated with Ammonium Nitrate have been known to start burning spontaneously when left on or near hot surfaces.

Hot Ammonium Nitrate melts or solutions can initiate fires when it comes into contact with combustible materials such as rags, wooden articles, or clothing. Hot Ammonium Nitrate solutions present the additional hazard of causing burns if in contact with the skin.

2.2. Decomposition

If Ammonium Nitrate is heated it will decompose to give off toxic gases. In an open and unconfined situation, it will decompose completely to give gaseous products of ammonia (NH_3) and nitric acid (HNO_3) in a steady controlled way with white fumes and vapours.

If heated sufficiently (such as in a fire) combined with contamination, confinement, or both (such as in drains or enclosed parts of equipment), other gases including brown vapours of toxic nitrogen dioxide (NO_2) will be given off **and the explosive sensitivity of ammonium nitrate increases**. Through self-accelerating reactions the temperature will keep on rising and a detonation is likely to occur. Fires involving Ammonium Nitrate have caused explosions.

2.3. Chemical Reaction

In the presence of moisture, ammonium nitrate can undergo an electrochemical reaction with copper to form copper tetramine nitrate $[Cu(NH_3)_4](NO_3)_2$, which is of the same order of brisance and sensitivity to impact as lead azide (a primary explosive). For this reason, brass or bronze should not be used for equipment or tools that come into contact with TGAN.

2.4. Explosion

Ammonium Nitrate is ideally set up as an explosive precursor substance since it carries the oxidising nitrate ion in intimate contact with the fuel element, the ammonium ion. All that is required are small amounts of contaminants to act as a catalyst which explains the **unpredictability of Ammonium Nitrate under fire conditions**. As a result of the

decomposition reactions of Ammonium Nitrate, the risk of an explosion is increased by heating Ammonium Nitrate in combination with contamination, confinement, or both.

In a fire situation, pools of molten Ammonium Nitrate may be formed. If the molten mass becomes confined, such as in drains, pipes, plant, or machinery, or combines with contaminants, it could explode.

An Ammonium Nitrate Fire is a Risk that needs to be managed while handling, stowing and carrying this chemical on board ships. So, what are some of the key Prevention and Mitigating Controls that our considered best practice and compliant to the Regulations or Codes applicable to bagged Ammonium Nitrate?

3. | Fire Prevention Controls

3.1. Packaging

Being classified as a Dangerous Good, there are clear guidelines to the Type and UN Test Criteria required for the transport of Ammonium Nitrate on-board ships. These standards shall be adhered to in order to ensure adequate containment of the product during its transport cycle from manufacture to use.

3.2. Combustible Material

Being an oxidising agent and a strong supporter of combustion, the IMDG and local regulations require that all combustible material be separated and segregated as far as practicable. Where combustible material is required as part of the transportation chain (such as wooden pallets), the amount of the combustible material should be kept to a minimum.

3.3. Vessel Selection

The Type and Size of vessel is one of many key considerations for transport of Ammonium Nitrate. Some of the key features to be considered are:

- Box hold to allow drop-stow of bags without any forklifting and with no projections on vessel's sides. Restricted to 2-3 holds maximum.
- Fitted with cranes with SWL of minimum 25mt at 26m outreach. Derricks not recommended. Heavy Lift Cranes greater than 150mt SWL should be reviewed from an operational safety and efficiency point of view – consider 25% slower load and discharge rates on Laytime
- Hydraulic hatch covers. Watertight tested. Pontoon Hatch Covers should be avoided.
- Steel floored tank tops with container shoes flush without any projections. Any lashing D Rings etc on hold sides should be covered with adequate protection from bags.
- Fitted with steel tween decks adjustable to two heights
- Have minimal combustible material e.g.: wooden hold floor, wooden dunnage etc in contact with or vicinity of the cargo – should be stowed away from the bags with a minimum 12m segregation

- Vessel Engine Room bulkhead rated as A60. If not A60, proper separation from the ER Bulkhead as per the IMDG shall be adhered to
- Should be less than 15 years old and fully vetted to the requirements of this Code of Practice
- Always consider the Port of Discharge rules (Draft, LOA, etc.) when assessing vessel specifications to avoid operational hiccups that can lead to operational delays.

3.4. Vessel Bunkers

Bunkering a vessel while loading Ammonium Nitrate is a hazard and should be avoided. Ideally a vessel should be fully bunkered for its intended voyage before commencing loading and discharge operations. If for some unforeseen operational reasons, a vessel laden with Ammonium Nitrate needs to be bunkered, it is industry good practice that this should only be authorised after the loading operation is complete and the hatches are fully closed and sealed. It is also good practice that bunkering occurs under the supervision of a competent Ship's Officer.

Ammonium Nitrate Bags shall (reference 7.1.2 of IMDG Code) be protected from sources of heat by at least a distance of 2.4m. These include any heated ship structures such as steam pipes, heating coils, top or side walls of heated fuel or cargo tanks where the surface temperature is liable to exceed 55 degrees C. The Master should be able to demonstrate any heated fuel tanks in direct contact with Ammonium Nitrate Bags will not attain a temperature higher than 50 degrees centigrade during the course of the voyage. See Appendix 1 Page 4 of 7 for an example of national requirements of such.

3.5. Port Conditions

Standards and procedures outlined in IMO Recommendations on the Safe Transport of Dangerous Cargoes and related activities in Port Areas (MSC.1/Circ.1216.2007) is a good starting point. The IMO Maritime Safety Committee Recommendations make a distinction between keeping and storage. Dangerous cargoes temporarily in the port area as part of the transport chain are not considered as being stored as their presence is solely concerned with awaiting loading onto and further onward movement by another mode of transport. Because this is an operation covered by the Recommendations, the term "keeping" is included in the overall definition of handling. Storage, which involves the holding of substances for an indeterminate period not directly involved with the transportation process, is considered to be outside the scope of these Recommendations and has been excluded from the definitions. Regulatory authorities may wish to regulate the storage of such substances but that would be achieved by other regulations unconnected with the transportation process.

Notices shall be displayed prominently in the area of handling operations bearing the words:

"Danger – No Smoking – No Naked Lights"

No greater quantity of ammonium nitrate shall be placed within the berth handling area than can be handled in one hour with the means of transport available for this purpose.

The Berth shall be declared to be a "Restricted Area" for the duration of the Ammonium Nitrate handling and all vehicles not directly involved shall not be permitted closer than 24m to the berth handling area.

3.6. Forklift & Trucks

All equipment used to lift and handle Ammonium Nitrate should be suitable and fit for purpose. It should be:

- mechanically sound
- fitted with appropriate fire extinguishers suitable for fighting electrical and vehicle fires
- free of any leaks of fuel, lubricating oil or hydraulic oil
- fitted with appropriate measures to prevent initiation of fire e.g. spark arrestors as identified by a competent risk assessment

Internal combustion diesel power or electrically operated trucks are the preferred means of moving Ammonium Nitrate to and from the vessel. Use of forklifts in ship's holds is not normally recommended because of the risk of heating or generation of sparks.

4. | Fire Mitigation Controls

4.1. Fire Watch

Ammonium Nitrate Fires can escalate rapidly and hence one of the key mitigating controls is preparedness, to ensure the no time is wasted in responding to a fire. The vessel should appoint a 24/7 fire watch during the entire loading and discharge operation. It is recommended this practice is also deployed during the voyage.

4.2. Vessel Readiness

It is industry good practice that, where practicable, the vessel should face toward sea passage for a quick exit to sea in case of an emergency. The vessel's main engines and auxiliary gear should be available for the immediate movement of the vessel if required. The vessel's fire fighting facilities should be kept in readiness throughout the handling operations with hoses run out and connected.

4.3. Tugs & Steel Hawsers

Where deemed necessary, suitable and sufficient Tugs as directed by the port authority should be on standby in case of a fire emergency that may require the ship to towed out to sea or a safe anchorage. Steel Wire Hawsers (suitably tested) should be available for an emergency tow in case of a fire emergency. They should be placed in a suitable position, typically over the fore and aft ends of the vessel, to avoid delay if the emergency towing plan is put into operation. The hawsers should so remain while the vessel is alongside the berth and should be tended and adjusted to meet the changes in the draft of the vessel.

4.4. Hatch Covers Openable

Ammonium Nitrate Fires can escalate out of control very rapidly. To mitigate consequential loss of life and damage, the provisions laid out in IMDG shall be complied with at all times. These clauses resonate with the International Convention for the Safety of Life at Sea[5] (SOLAS) as well as MSC recommendations on Dangerous Goods in Port Areas:

a. Ammonium Nitrate shall be stowed **ON DECK ONLY** as per **Category C** – see clause 7.1.3.2
b. Protected from **sources of heat** as per **SW1 –** see clause 7.1.2 & 7.1.5
c. Separated from combustible material as per **SG48 –** see clause 7.2.8 and 7.6.3.2
d. Stowage UNDER DECK as per Category A is only permitted subject to **SW14** which require full compliance to clause **7.6.2.8.4**

> 7.6.2.8.4 UN 1942 AMMONIUM NITRATE and UN 2067 AMMONIUM NITRATE BASED FERTILISER may be stowed under deck in a clean cargo space capable of being opened in an emergency. 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 flooding of the cargo space shall be considered before loading.

see appendix 2 for more detail for *(a), (b) and (c) above.*

While all the above IMDG Clauses are pertinent to Ammonium Nitrate fire risk, a clause that all Ships and Cargo operators must be particularly cognisant of is **Clause 7.6.2.8.4.** This clause addresses the ability to respond effectively if an Ammonium Nitrate fire on board a ship is out of control and the risk of an explosion is imminent. Containment of an Ammonium Nitrate Fire can lead to an explosion causing disastrous consequences to both life and property. This clause requires that ALL Hatches (including tween decks) shall be openable in case of an Ammonium Nitrate Fire. Several jurisdictions, that are shippers of this product in significant quantities, have taken heed of this risk and the related IMDG requirements. At the time of publishing, three countries that have specific arrangements are Australia, South Africa and Chile. See Appendix 1 for their respective guidance on compliance with this clause. The standard related to Tween Decks and Pontoon Hatch Covers (which should be carefully examined before loading a ship with Ammonium Nitrate) is of particular importance (e.g. pp1-4 of the Australia Government Ammonium Nitrate Information Sheet).

A vessel with a valid Document of Compliance (DOC) for the Carriage of Dangerous Goods does not guarantee that clause 7.6.2.8.4 has been complied with. All DOCs put the onus on the ship, its master and operator to comply to this clause in stating on the document: *"That the ship is suitable for the carriage of those classes of dangerous goods specified in the*

[5] https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx

appendix hereto, subject to the any provisions of the IMDG Code and IMSBC[6] Code for individual substance, materials or articles also being complied with." See Appendix 3

The majority of Ammonium Nitrate is shipped in dry multipurpose box hold vessels which comply with IMDG Clause 7.6.2.8.4 (see appendix 4). However, a volume of Ammonium Nitrate is also shipped on conventional Reefer Vessels which have multiple (~ 18-20) compartments. On such vessels, over-stowing of bags on the decks above, risks non-compliance with clause 7.6.2.8.4 and consequential significant risk to the vessel, crew and the ports it operates through (see Appendix 5). Reefer Vessels shall be loaded in compliance with IMDG Clause 7.6.2.8.4. A detailed technical paper on non-compliance with this Clause on Reefer Vessels is available on request.

5. | Evacuation Emergency Procedures

A properly documented Emergency Procedure for Ammonium Nitrate should be signed off between the Port Authority and the Cargo Owner. This should be made available to the Ship's Master, Stevedore, Transport Operator, Fire Brigade and any other Authority concerned with the safety of the operation.

Notices should be prominently displayed on the ship and berth setting out the emergency arrangements in the event of fire, which may include but are not limited to:

- Arrangements for raising the alarm and evacuation
- Arrangements for respiratory protection
- Arrangements and means of fighting fires including the correct firefighting medium to use and identifying any medium that is unsafe to use
- Arrangements for ventilation and release of pressure, such as not battening down hatches

[6] International Maritime Solid Bulk Cargoes (IMSBC) Code: https://www.imo.org/en/OurWork/Safety/Pages/CargoesInBulk-default.aspx#:~:text=The%20primary%20aim%20of%20the,shipment%20of%20certain%20types%20of

APPENDIX 1: Sample National Transport of Ammonium Nitrate Arrangements

Australian Government Ammonium Nitrate Information Sheet

Carriage of Ammonium Nitrate of Class 5.1 (UN1942 & UN2067) and Class 9 (UN2071) to and from Australia

Note: This information sheet is for advice only and shippers and masters must consult the IMDG Code whenever shipping or carrying Ammonium Nitrate or any other class of dangerous good. IMDG Code references are to the 2014 edition of the Code that includes the 37-14 amendments. All persons involved in the transport of packaged dangerous goods intended to be transported by sea require mandatory training in accordance with 1.3 of the IMDG Code and Marine Order 41 (MO41). This information sheet is therefore not intended to be a guide in how to ship ammonium nitrate.

INTRODUCTION

The purpose of this Information Sheet is to remind all ship owners, ship operators and masters of the requirements for the safe carriage of Ammonium Nitrate on board ships with a particular emphasis on the carriage in Flexible Intermediate Bulk Containers (FIBC), whether these are loaded directly into the ship or are carried in containers, or where the Ammonium Nitrate is loaded loose in a bulk container.

The requirements for the carriage in packaged form of Ammonium Nitrate of all types are detailed in the IMDG Code[1] which in turn is mandated for the carriage of dangerous goods by sea by Regulation 3 of Chapter VII of SOLAS.

The mandatory application of the IMDG Code within Australia is implemented through delegated legislation adopted by the Australian Maritime Safety Authority (AMSA) under the *Navigation Act 2012*. This delegated legislation is known as *Marine Order 41 (Carriage of dangerous goods) 2009* (MO41) and by virtue of the scope of the application of the *Navigation Act 2012* this Marine Order applies to the loading of Regulated Australian Vessels (RAV) and foreign flagged vessels at an Australian port on all voyages. MO41 can be accessed from the AMSA website at: www.amsa.gov.au/shipping_safety/marine_orders/Marine_Orders_currently_in_force.asp

On the basis of both the adoption of the IMDG Code within SOLAS and within Australian legislation, the carriage of Ammonium Nitrate (and in fact all dangerous goods) in packaged form must be in compliance with the relevant provisions of the IMDG Code.

STOWAGE, HANDLING AND SEGREGATION

The primary source of information on the required stowage, handling and segregation for packaged dangerous goods can be found in the individual entries in the Dangerous Goods List (DGL) in Chapter 3.2 (in Volume 2) of the IMDG Code. Other additional requirements can then be applied as applicable to the material being shipped/loaded. These additional requirements can be found in other applicable Parts and Chapters of the Code – for stowage, handling and segregation requirements, Part 7 "*Provisions Concerning Transport Operations*" is of particular note.

Ammonium nitrate has three entries in the DGL:

UN1942 AMMONIUM NITRATE with not more than 0.2% total combustible material, including any organic substance, calculated as carbon to the exclusion of any other added substance, Class 5.1, PG III

UN2067 AMMONIUM NITRATE BASED FERTILIZER, Class 5.1, PG III

UN2071 AMMONIUM NITRATE BASED FERTILIZER, Class 9, PG III

UN1942 and UN2067 are Class 5.1 and have almost identical stowage, handling and segregation requirements. UN2017 is Class 9 and has slightly modified requirements that recognise the different risks of this material.

In the DGL column 16a uses alpha-numerical codes to provide the stowage and handling instructions, whilst column 16b also uses alpha-numerical codes but to provide the segregation requirements.

In column 16a - UN1942 and UN2067 are both Category C which, it should be noted, is stowage ON DECK ONLY on both cargo ships and passenger ships. This means that these two materials are prohibited from being stowed in a ship's hold.

[1]The IMDG Code as adopted by the Maritime Safety Committee of the Organization by resolution MSC.122(75) , as amended. The 2014 edition will come into mandatory effect from the 1st of January 2016 but may be used in lieu of the 2012 edition from 1 January 2015 until that time.

Australian Maritime Safety Authority, Canberra ACT Australia – April 2015 Page 1 of 7

The codes in the column then provide additional information. For both materials the codes are SW1 - protected from sources of heat, SW14 - Category A only if the special stowage provisions of 7.4.1.4 and 7.6.2.8.4 are complied with and SW23 – which requires compliance with 7.6.2.12 and 7.7.3.9 for carriage in BK3 flexible bulk containers (FBC) – not to be confused with flexible intermediate bulk containers (FIBC).

Category A is stowage ON or UNDER DECK on both cargo ships and passenger ships, so compliance with SW14 is the mechanism that permits UN1942 and UN2067 to be stowed in a ship's hold. SW14 is therefore critical to compliant and safe carriage of UN1942 and UN2067 in a ship's hold.

In column 16a – UN2071 is Category A which is stowage ON or UNDER DECK on both cargo ships and passenger ships. There is a single code in the column which is SW26 – for special stowage provisions see 7.4.1.4 and 7.6.2.11.1.1.

7.4.1.4 relates to stowage and segregation on container ships. It applies the relevant provisions of 7.6.2.8.4 and 7.6.2.11.1 for carriage of these materials in containers below deck on this type of vessel.

7.6.2.8.4 relates to stowage and segregation on general cargo ships. It relates to the carriage of UN1942 and UN2067 below deck on this type of vessel.

7.6.2.11.1 also relates to stowage and segregation on general cargo ships. It relates to the carriage of UN2071 below deck on this type of vessel.

WHAT ARE THE SPECIFIC REQUIREMENTS?

Where Ammonium Nitrate in packaged form is carried it must comply with all the specific and general requirements contained in the IMDG Code that relate to the material itself, the package in which it is shipped and the relevant stowage, segregation and consignment procedures. However there are a range of issues that shippers, carriers and masters should be particularly aware of.

1. The need to be able to open hatches

Section 7.6.2.8.4 of the IMDG Code states that AMMONIUM NITRATE, UN1942 and AMMONIUM NITRATE BASED FERTILIZERS, UN2067 *"may be stowed under deck in a clean cargo space* ***capable of being opened up in an emergency.***"

It must be remembered that "may be stowed" here is in the context that in accordance with the entries in the DGL, stowage under deck of UN1942 and UN2067 is not permitted unless this provision is complied with.

The section goes on to state that 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 flooding of cargo space, shall be considered before loading. This is simply a reminder and does not detract from the need to be able to open hatches. This requirement does not only apply while the ship is alongside and the ship should be capable of opening up hatches at sea in normal conditions.

Section 7.6.2.11.1.1 of the IMDG Code states that AMMONIUM NITRATE BASED FERTILIZER, UN2071 *"shall be stowed under deck in a clean cargo space* ***capable of being opened up in an emergency.*** *In the case of bagged fertilizer or fertilizer in containers or in bulk containers, it is sufficient if, in the case of an emergency, the cargo is accessible through free approaches (hatch entries), and mechanical ventilation enables the master to exhaust any gases or fumes resulting from decomposition."*

Where the specified cargo cannot be accessed through free approaches (such as stowage below hatch covers and/or tween decks where the cargo space has no access points) or where there is insufficient ventilation, hatches must be capable of being opened in an emergency. Where this is the case the section continues with the same requirements as for UN1942 and UN2071.

Can main hatches be opened?

Mechanically operated hatches (ram type or similar arrangements) are acceptable but the master should take care to ensure that the hatch will not dismount[2] and take into account the manufacturer's instructions for the covers.

If a ship is fitted with pontoon type hatches or pontoon tween deck hatches, it is highly unlikely to be able to open up these hatches if relying on a slewing crane. This is due to operating restrictions on the crane and some very significant safety issues associated with handling unrestrained hatches at sea. Some ships are fitted with hatch gantry cranes which may mitigate some of the safety issues but many of these have significant operating restrictions that limit their use to smooth water.

[2]Partial opening and then resting on blocks being an option considered by some.

An option provided to ship owners by hatch manufactures, that AMSA been made is aware of, for pontoon hatches is a jacking system that lifts the pontoon hatch within the pontoon guides. This gives an opening of about 400mm or more without the need to use cranes (see image below).

Hatch cover jacking arrangement

Where options such as hatch gantries or jacking systems are to be relied upon the ship must have **evidence that the flag state or its recognized organization have accepted that the means of opening can be operated at sea**, in conditions where the ship is rolling and pitching. If this evidence cannot be provided then these options cannot be relied upon.

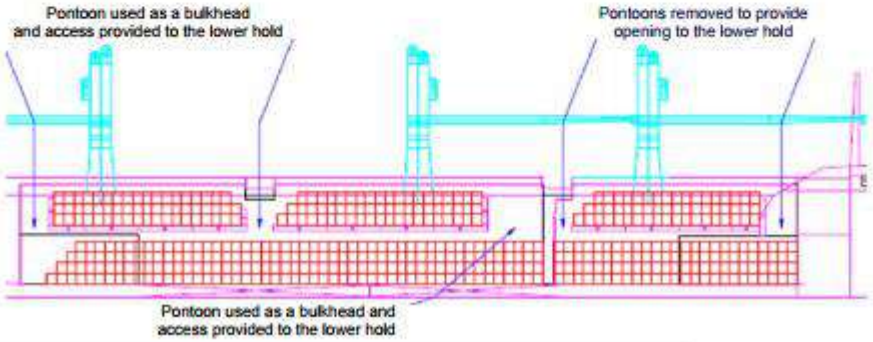
The ability of each ship to comply with this requirement will vary depending on the arrangement on each individual vessel, however, **it is not necessary that all hatch covers are able to be opened up**. The general expectation is that hatches accounting for no less than 30 per cent hatch opening area of a single cargo hold will need to be opened up in an emergency. The openings should be spaced so cargo below deck is accessible from the main deck by water jet for cargo cooling purposes. Where the space is adjacent to a machinery space or other high risk space it would normally be expected that the hatch in the way of the adjoining bulkhead be capable of being opened up for the purpose of boundary cooling[3].

Can tween deck hatches be opened?

Some vessels have mechanically operated tween deck hatches but many are fitted with pontoon type hatches. In these circumstances the hatches either need to be left opened (and not used to carry cargo) or partially opened up to the extent that section 7.6.2.8.4 (and 7.6.2.11.1.1 if applicable) can be complied with.

For tween decks arrangements where hatches cannot be opened up, an alternative is to have around 30 per cent of the tween deck pontoons removed to provide the necessary openings to fight fire (boundary cool) and to provide maximum ventilation in an emergency. These should not be removed from a single location but must be spaced along the length of the hold. For short holds it may only be possible to remove the fore and aft tween decks pontoons. An example is provided below.

Where pontoons are removed measures need to put in place to ensure the cargo is properly secured and protection is provided in respect of the risk of falls in the vicinity of the opening.



[3]Boundary cooling must be able to be applied from the main deck as AN produces toxic gases when heated. Entry into the cargo space is not practical nor safe given appropriate equipment, suitable for use in such an atmosphere, is not carried on most ships

Where tween deck pontoons are removed, what space is required between cargo and hatches (tween deck and main)?

It is necessary that sufficient space is provided between the top of the stow and the underside of hatches that cannot be opened (tween deck pontoons or over-stowed main deck hatches) to allow gases of decomposition to be ventilated.

Where AN is stowed below these hatches and the cargo is not containerised (i.e FIBC cargo), a minimum of 0.5m is to be provided between the top of the stow and underside (lowest protrusion that interferes with air flow) of the hatches.

For containerised cargo the design of the vessel should be such that sufficient space is provided around the containers, however where the cargo is a mixed stow of containerised cargo and break bulk and some of the cargo may obstruct ventilation flows, at least 0.5m of clear space between the top of the cargo and the underside (lowest protrusion that interferes with air flow) of the hatches should be provided.

Where tween deck hatch pontoons are removed cargo cannot be stowed in the resultant opening in a way that it may obstruct ventilation flow from the lower hold. A minimum of 0.5m (more is advisable) along the space between the edge of the hatch and the side of the stow must be provided and consideration be given with respect to the movement of cargo and the impact of lashing arrangements.

2. The need to stow UN1942 and UN2067 "protected from sources of heat"

In column 16a the individual entries in Chapter 3.2 of the IMDG Code for UN1942 and UN2067 include code SW1 – protected from sources of heat. This term is defined in section 7.1.2 of the IMDG Code:

Protected from sources of heat *means that packages and cargo transport units shall be stowed at least 2.4 m from heated ship structures, where the surface temperature is liable to exceed 55°C. Examples of heated structures are steam pipes, heating coils, top or side walls of heated fuel and cargo tanks, and bulkheads of machinery spaces. In addition, packages not loaded inside a cargo transport unit and stowed on deck shall be shaded from direct sunlight. The surface of a cargo transport unit can heat rapidly when in direct sunlight in nearly windless conditions and the cargo may also become heated. Depending on the nature of the goods in the cargo transport unit and the planned voyage precautions shall be taken to ensure that exposure to direct sunlight is reduced.*

Use of A60 insulation in lieu of the specified distance on surfaces that are likely to exceed 55°C should be at the discretion of the vessel's Flag Adminstration or RO. For example for machinery room bulkheads, when considering the temperature rise of the cargo hold side of the bulkhead in case of a fire in the machinery space.

What if fuel tanks are not heated?

All Heavy Oil fuel tanks have heating fitted; however, it will not always be necessary to heat these tanks during the course of a voyage. Where a vessel has planned its voyage in such a way that heat will not be applied to a particular tank, the master may consider such a tank not to be a heated fuel tank for the purposes of the definition of "*protected from sources of heat*" during that voyage.

What if fuel tanks are only heated to a certain temperature?

Where the master can demonstrate there are procedures in place to ensure heated fuel tanks adjacent to UN1942 or UN2067 in packaged form cannot (or are managed in a way that they will not) attain a temperature of more than 50°C, this is would be acceptable to AMSA.

3. UN2071 and the engine room bulkhead

Whilst the entry for UN2071 in the DGL does not have a requirement to protect from sources of heat, there is a special provision in 7.6.2.11.1.3 requiring the cargo is stowed out of direct contact from metal engine room bulkheads – for example by the use of wooden boards between the cargo and the bulkhead. It should be noted that "out of direct contact" includes the package which is not considered by itself to prevent direct contact.

4. Carriage of AN in FIBC

Ammonium Nitrate is commonly carried in Flexible Intermediate Bulk Containers (FIBC) either directly into the hold or within containers. Under these circumstance the FIBC are invariably stacked. For FIBC to be used for UN1942, UN2067 or UN2071 (or any other dangerous goods where FIBC are permitted) the requirements of Chapter 6.5 of the IMDG Code will apply.

In respect of stacking; sections 6.5.2.1 (marking) and 6.5.6.6 (stacking test) apply to FIBC and the maximum allowable stacking load of an FIBC must not to be exceeded.

What is the maximum allowable stacking load?

The maximum allowable stacking load is shown on the specifications markings applied to the FIBC in accordance with section 6.5.2.1 of the IMDG Code. As noted in section 6.5.2.1.1.7. **Where the figure zero (0) is included in the specification the FIBC cannot be stacked.** Where a figure is provided in the specification marking then this is the stacking test load applied to the FIBC – it is not the maximum stack load that can be applied in normal use.

As an example of IMDG Code markings with respect to stacking look at the following:

(un) 13H2/Z/06 01/S/AUS/AP5011/0/1200

In this case the number 0 indicates the FIBC cannot be stacked while the number 1200 indicates the maximum permissible mass.

(un) 13H2/Z/06 01/S/AUS/AP5033/6840/1200

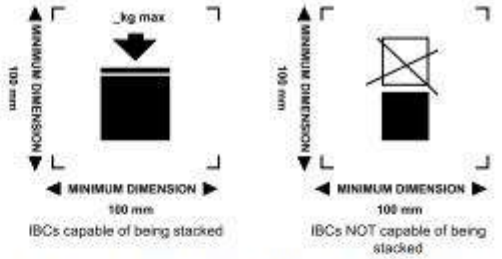
In this case the number 6840 indicates the applied stacking test load (meaning the FIBC can be stacked) and again the number 1200 indicates the maximum permissible mass.

Where an FIBC can be stacked the maximum allowable stack load can be arrived at by dividing the applied stacking test load by 1.8. For the example above:

Applied stacking test load = 6480 kg ÷ 1.8 = 3600 kg maximum allowable stack load

Therefore only three similar FIBC with a maximum permissible mass of 1200kg can be carried on top of this FIBC.

It should be noted that in accordance with section 6.5.2.2.2 of the IMDG Code, from 1 January 2011 all manufactured, repaired or remanufactured IBCs are required to bear the new pictogram shown below in addition to the markings noted above. This pictogram clearly indicates the allowable stack mass limits and it is recommended this practice be adopted as soon as practical to limit confusion in this regard.



Stacking pictogram to be applied to IBC in accordance with section 6.5.2.2.2 of the 2014 edition of the IMDG Code

How are FIBC to be secured?

Regulation 5 of Chapter VI requires that 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 (CSM) approved by the Administration.

For dangerous goods this is reinforced by Regulation 5 of Chapter VII of SOLAS.

The CSM is to be drawn up to a standard at least equivalent to relevant guidelines developed by the Organization[4] and is to include information on how to secure the cargo being carried. It has been noted that many vessels which carry FIBC directly in the hold of a ship (not in containers) do not comply with this as the CSM contains no instruction for the safe stowage of FIBC[5]. If the CSM does not include such guidance, then FIBCs cannot be carried without the specific approval of the ship's flag state or an organisation recognised by the flag state[6,7].

Where a vessel carries cargo that is not addressed, or adequately addressed, by the Cargo Securing Manual then port State Control action may be taken.

What about FIBC in Containers?

Where FIBC are carried in a container, the stacking limitations still apply. An FIBC which is marked to indicate it cannot be stacked, cannot be stacked in a container. In addition, as indicated in section 1, the need to be able to open hatches in an emergency still needs to be complied with.

[4] Refer to the Guidelines on the preparation of the Cargo Securing Manual, approved by the Maritime Safety Committee of the Organization and promulgated by circular MSC/Circ.745

[5] Refer to Annex 10 of the Code of Safe Practice for Cargo Stowage and Securing adopted by IMO Res A.714(17) as amended

[6] Normally the ships classification society.

[7] This assumes the vessel is permitted to carry Dangerous Goods by virtue of SOLAS II-2/19.

5. Carriage of AN in Bulk Containers (BK2 Packages)

The individual entries in Chapter 3.2 of the IMDG Code for UN1942, UN2067 and UN2071 allow Ammonium Nitrate to be carried in Bulk Containers as a "BK2" package, as described in Chapter 6.9 of the IMDG Code. In addition for UN1942, a BK2 may only be employed if use of the package is specifically approved by the competent authority by virtue of Special Provision 952. A copy of this approval is to be available to the master of the vessel by virtue of subsections 9.1.3 and 9.1.4 of MO41.

AN cannot be shipped in a BK2 unless the package complies with the relevant provisions of Chapter 4.3 and 6.9 of the IMDG Code. If a package does not fully comply with these chapters, the package can only be used if an exemption/approval is issue by AMSA (or the country of origin for cargoes not originating from Australia). Regardless, such exemptions need not be accepted by other authorities (or by AMSA if the shipment originates from another country) as noted in Chapter 7.9 of the IMDG Code.

Is a Freight Container suitable for use as a BK2?

A Freight container may be used as a BK2 package provided it complies with section 6.9.3 of the IMDG Code. Generally speaking, most freight containers are general purpose (GP) containers designed and tested in accordance with ISO 1496-1:1990 "*Series 1 Freight containers- Specification and testing - Part 1: General cargo containers for general purposes*". These containers will not be designed with end wall strength that would pass the tests specified in ISO 1496-4:1991 "*Series 1 Freight containers- Specification and testing - Part 4: Non pressurized containers for dry bulk*". This requires that the end wall be tested to 0.6P in lieu of 0.4P as applied to GP containers. For the test "P" is the container payload8.

BK2 packages must be able to pass this test standard, be sift proof (with a liner of sufficient strength where one is used) and be able to withstand the full load (1.0P) on the door end if they are to be discharged by tilting – this requirement is not mitigated by procedures that are intended to prevent the possibility of the tilting occurring with one or both doors still closed.

This does not mean a GP container cannot be used, however, it does mean that a CA approval will be required and the container will be limited to a payload that is equivalent to a test load of 0.6P for the cargo actually carried in the container. This will be calculated using the following formula:

$$\text{Maximum Allowable Payload} = \frac{((\text{Maximum Gross Weight} - \text{Tare}) \times 0.4)}{0.6}$$

In addition, a GP container will need to be fitted with service equipment to make it sift proof (a liner) and allow for safe discharge (take the load off the doors). Such equipment must also comply with Chapter 4.3 of the IMDG Code and it should be noted that section 4.3.2.3 requires that the arrangement be so constructed that the cargo cannot come into contact with wood or other incompatible cargo. As such timber should not be used for the service equipment such as barriers.

An example of the type of arrangement that may be accepted by AMSA is provided in the image below.

Are there serviceability requirements for BK2 packages?

Yes, chapters 5.4 and 6.9 require that all BK2 packages should be inspected before they carry dangerous goods and container based systems must have a valid CSC plate. This is reinforced for BK2 packages by section 4.3.1.15 which requires that a bulk container be visually inspected prior to being filled to ensure it is structurally serviceable[9], its interior walls, ceiling and floors are free from protrusions or damage and that any inner liners or substance retaining equipment are free from rips, tears or any damage that would compromise its cargo retention capabilities.

[8]The payload "P" is the Maximum Gross Mass less the Tare Weight of the container.

[9] Section 4.3.1.15 indicates some of the issues that would result in a container not being structurally serviceable when inspected.

6. Carriage of AN in Flexible Bulk Containers (FBC or BK3 Packages)

Flexible bulk containers (FBC or BK3 packages) are not to be confused with Flexible Intermediate Bulk Containers (FIBC) nor with Bulk Containers (BK2 packages).

For UN1942 and UN2067 carriage is permitted in BK3 packages as indicated in column 13 of the DGL. For UN2071 carriage in BK3 packages is NOT permitted.

A BK3 package must be designed, constructed, inspected and tested in accordance with section 6.9.5 of the IMDG Code. The section also includes the marking requirements in 6.9.5.5 that practically mean an FBC is marked in terms of the maximum stacking load in the same way as an FIBC - but excluding the new pictogram.

The use of a BK3 has restrictions in the Code that include that they may only be carried in the hold of a ship and can only be stacked three high (maximum permitted and only where the stacking test load marked permits it). Any BK3 specific restrictions are in addition to other applicable provisions such as those required to be complied with by the codes in columns 16a and 16b of the DGL and all other applicable general requirements for the cargo. This means that the need to open hatches and other requirements noted above in points 1 and 2 above still apply when BK3 packages are used.

WHAT IS THE RISK WITH AMMONIUM NITRATE

When heated, all Ammonium Nitrate (AN) will start to decompose into gases including oxygen and nitrogen oxides, but the nature of gases produced by decomposition depends on temperature and conditions under which heating occurs. It can be induced to decompose explosively by detonation when large quantities are heated to the point it decomposes, or the product is involved in a fire, and the gases are contained.

Ammonium Nitrate is a salt of Ammonia and Nitric Acid and when heated at lower temperatures (80°C. to 93°C) the decomposition, simultaneous vaporization and dissociation of ammonium nitrate into ammonia and nitric acid, is an endothermic vaporization reaction which tends to offset or balance the heat-producing reaction effectively cooling the cargo. Under these conditions when the external heat source is removed from the AN, the temperature of the material drops rapidly as a result of the endothermic nature of the volatilization into ammonia and nitric acid[10].

$$NH_4NO_3 \longrightarrow NH_3 + HNO_3$$

However, the effectiveness of this self-limiting effect during heat decomposition will be removed where the material is tightly confined such as when carried in the hold of a ship. This is the reason that hatches need to be able to opened up as specified in section 7.1.11.5 and 7.1.16 of the IMDG Code. Under these circumstances the energy from the exothermic decomposition into nitrous oxide and water overpowers the moderating effect of the vaporization reaction, thereby resulting in a rapid escalation of temperature and reaction rate which can accelerate to detonation state conditions.

$$NH_4NO_3 \longrightarrow N_2O + 2H_2O$$

At approximately 166°C to 212°C, ammonium nitrate begins to melt and decomposes exothermically into nitrous oxide and water vapour[11] as described in the formula above. The nitrous oxide is a supporter of combustion, even in confined spaces where there is a lack of oxygen. As the temperature rises the rate of decomposition increases and more toxic oxides are liberated. This increases the risk of detonation. This is compounded by the fact that molten ammonium nitrate is more shock sensitive and requires much less pressure under heat conditions to offset the self-limiting effect and trigger a deflagration or detonation. Under these circumstances an explosion may be caused by compression or some sort of impact on the molten material. When the temperature of the material exceeds 250°C, or if the material is subject to a strong shock then violent decomposition occurs:

$$NH_4NO_3 \longrightarrow N_2 + 2H_2O + \tfrac{1}{2}O_2$$

[10] This reaction requires energy to break the bonds (heat in this case) as such the reaction absorbs heat. The enthalpy of the reaction expressed as ΔH is about 171kJ/mol (+41kcal/mol), where: ΔH = energy used in breaking the bonds – energy released in the bond making process. Where "bond making" is the process of the formulation of the resultant molecules from the reaction.

[11] This reaction releases energy as the energy used to break the bonds if the AN is much less that that released but the formulation of Nitrous Oxide and water vapour. As a result the ΔH is about -23kJ/mol (-5.5kcal/mol).

South African Maritime Safety Authority – Stowage of Ammonium Nitrate

South African
Maritime Safety Authority

Ref: SM6/5/2/1

Date: 18 March 2002

MARINE NOTICE No. 4 OF 2002

TO ALL PRINCIPAL OFFICERS, MASTERS, SHIP'S AGENTS AND CARGO SURVEYORS

STOWAGE OF AMMONIUM NITRATE - UN No. 1942

1. This Marine Notice applies to the stowage of Ammonium Nitrate (UN No.1942) shipped through South African ports in IBCs (bulk bags).

2. Ammonium Nitrate (UN No. 1942) stowed in IBCs (bulk bags) is considered to be **packaged dangerous goods** and the relevant provisions of the IMDG Code are therefore applicable. Regulation 7.1.11.5 of the IMDG Code is applicable and states: *"Ammonium Nitrate (UN No. 1942) should be stowed in a clean [mechanically ventilated] cargo space capable of being opened up in an emergency"*. In order to ensure compliance with this requirement, SAMSA requires that at least 30% of the weather deck hatch cover or tween deck hatch cover (as applicable) must be capable of being opened to gain access to the cargo spaces in which the Ammonium Nitrate is stowed, and that these hatch covers or relevant part thereof are not over-stowed with cargo.

3. Furthermore, Ammonium Nitrate (UN No.1942) must be stowed *"away from sources of heat"*. This means that Ammonium Nitrate must be stowed at least 3 metres horizontally away from engine-room bulkheads, and away from any other source of heat (> 40° C), such as heated bunker fuel tanks.

4. Attention is also drawn to the requirements of SOLAS Regulation II-2/54 [Special requirements for ships carrying dangerous goods] concerning the carriage of additional safety equipment, such as breathing apparatus and protective clothing.

MR C NISSEN
ACTING CHIEF EXECUTIVE OFFICER

Safe Ships - Clean Seas
PO Box 13186, HATFIELD, 0028
Tel: +27 12 342 3049 Fax: +27 12 342 3160

Chilean General Directorate of Maritime Territory and Merchant Marine

ORDINARIO / PERMANENTE
CIRCULAR O-32/013

ARMADA DE CHILE
DIRECCIÓN GENERAL DEL TERRITORIO
MARÍTIMO Y DE MARINA MERCANTE

D.G.T.M. Y M.M. ORDINARIO N° 12.600/143 VRS.

APRUEBA CIRCULAR DE LA DIRECCIÓN GENERAL DEL TERRITORIO MARÍTIMO Y DE MARINA MERCANTE, ORDINARIA N° O-32/013.

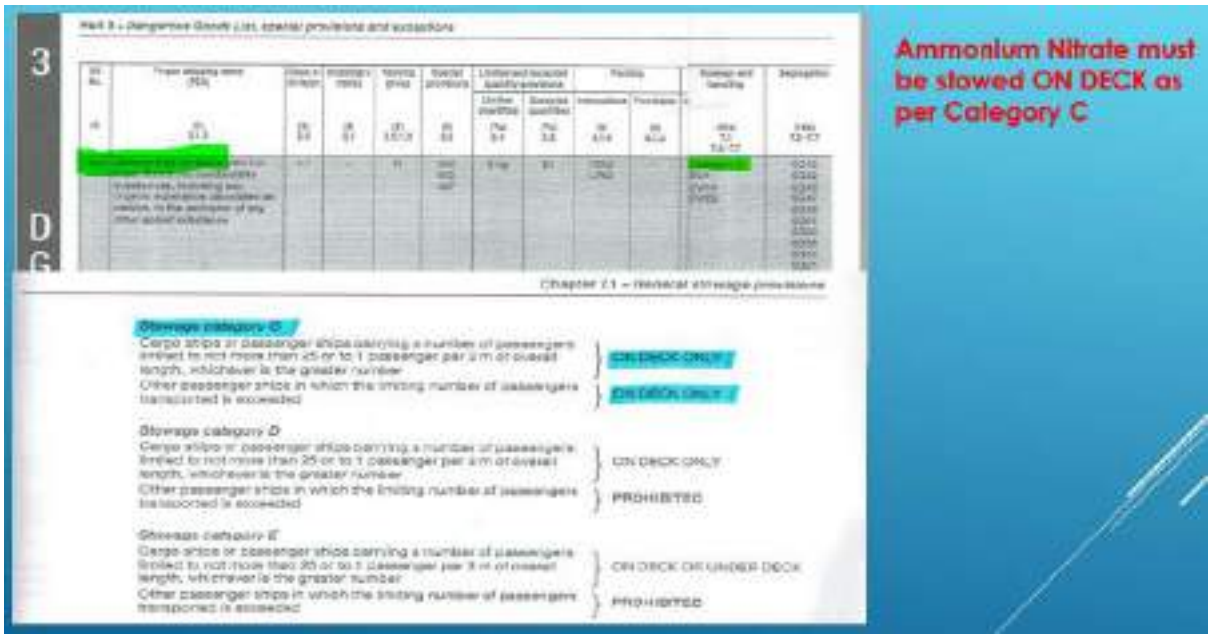
VALPARAÍSO, 05 de abril de 2019.

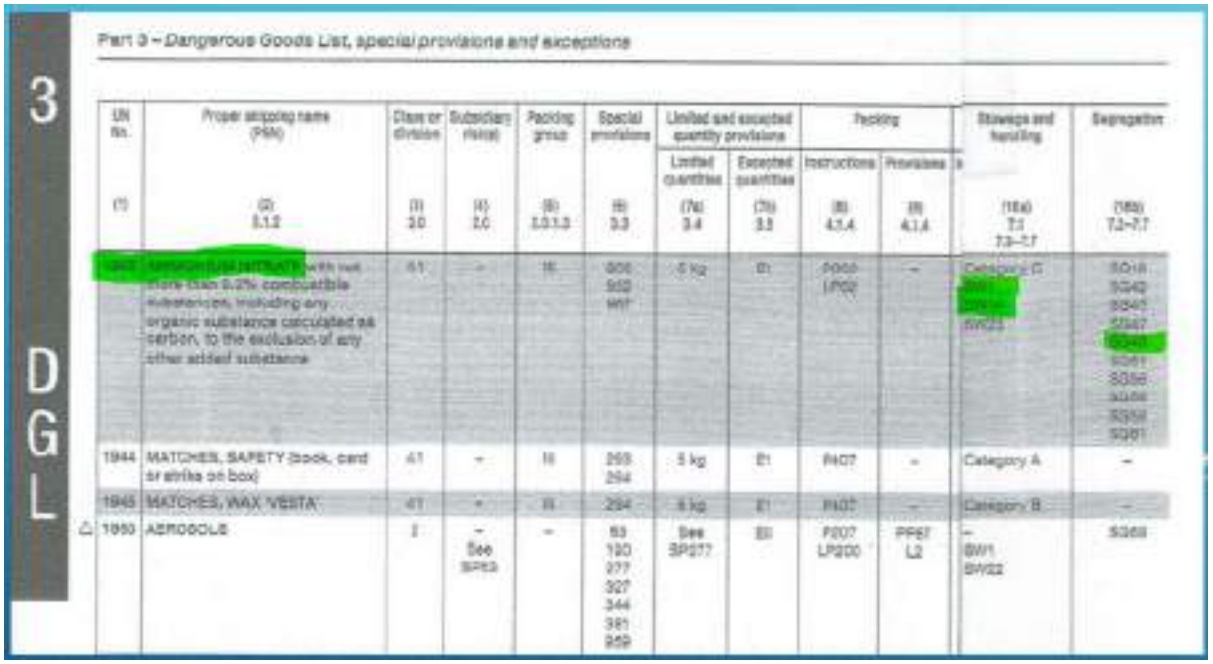
VISTO: el D.L. N° 2.222, de 1978 que sustituye Ley de Navegación; el D.F.L. N° 292, de 1953, que aprueba Ley Orgánica de la Dirección General del Territorio Marítimo y de Marina Mercante; el D.S. (M) N° 1.340 bis, de 1941, que aprueba el Reglamento General de Orden Seguridad y Disciplina en las Naves y Litoral de la República; el D.S. (M) N° 618, de 1970, que aprueba el Reglamento de Seguridad para la Manipulación de Explosivos y otras Mercaderías Peligrosas en los Recintos Portuarios; el D.S. N° 6, de 1967, que aprueba el Reglamento para Almacenamiento y Manipulación de Nitrato de Amonio y Preparación y Empleo de Explosivos por Mezcla de Nitrato con Petróleo; el D.S. N° 298, de 1995, que Reglamenta el Transporte de Cargas Peligrosas por Calles y Caminos; el D.S. N° 400, de 1978, que fija Texto Refundido, Coordinado y Sistematizado de la Ley N° 17.798, sobre Control de Armas; el D.S. N° 83, de 2008, que aprueba el Reglamento Complementario de La Ley N° 17.798, Sobre Control de Armas y Elementos Similares; el D.S. N° 777, de 1978, que aprueba como Reglamento de la República el Código Marítimo Internacional de Mercaderías Peligrosas y sus Anexos y deroga parte que Indica del Reglamento General de Transportes para la Marina Mercante; el D.S. N° 72, de 2014, que promulga el Código Marítimo Internacional de Cargas Sólidas a Granel (Código IMSBC); la Resolución N° 96, de 1997, que Actualiza y Modifica el Reglamento de Manipulación y Almacenamiento de Cargas Peligrosas en Recintos Portuarios; la Resolución N° 98 Exenta, de 2017, que Establece Disposiciones y Listados, para la Actualización Permanente de Productos Explosivos y Sustancias Químicas Sometidas a Control de La Ley N° 17.798 sobre "Control de Armas" y su Reglamento Complementario; la Resolución exenta, D.G.M.N. Nº 4268, de 2017, Listado de Productos Explosivos y Sustancias Químicas Controladas; la Circular D.G.T.M. y M.M. N° O-32/011, de 2000, que Establece Procedimiento de Control de Mercancías Peligrosas en los Recintos Portuarios; la Circular D.G.T.M. y M.M. N° O-31/004, de 1995, sobre Disposiciones de Seguridad para la Operación de Vehículos y Equipos de Transferencia Mecanizados en los Recintos Portuarios y a bordo de los Buques; la Circular MSC.1/Circ.1216, de 2007, que adopta recomendaciones revisadas sobre el Transporte sin Riesgos de Cargas Peligrosas y Actividades Conexas en Zonas Portuarias; el Código ESC, Código de Prácticas de Seguridad para la Estiba y Sujeción de la Carga; el Código de Comercio, Chile, 1965, y teniendo presente las facultades que me confiere la reglamentación vigente.

1 ORIGINAL

- The document shown above can be found at: https://www.directemar.cl/directemar/site/docs/20190503/20190503124045/o_32_013_050419.pdf
- Chilean Maritime Circulars - Regulatory Framework can be found at: https://www.directemar.cl/directemar/site/tax/port/fid_adjunto/taxport_27_62__2.html

APPENDIX 2: Ammonium Nitrate Stowage on Deck





7.1.5 Stowage codes

The stowage codes given in column 16a of the Dangerous Goods List are as specified below:

Stowage code	Description
SW1	Protected from sources of heat.
SW2	Clear of living quarters.
SW3	Shall be transported under temperature control.
SW4	Surface ventilation is required to assist in removing any residual solvent vapour.
SW5	If under deck, stow in a mechanically ventilated space

Protected from sources of heat means that packages and cargo transport units shall be stowed at least 2.4 m from heated ship structures, where the surface temperature is likely to exceed 55°C. Examples of heated structures are steam pipes, heating coils, top or side walls of heated fuel and cargo tanks, and bulkheads of machinery spaces. In addition, packages not loaded inside a cargo transport unit and stowed on deck shall be shaded from direct sunlight. The surface of a cargo transport unit can heat rapidly when in direct sunlight in nearly windless conditions and the cargo may also become heated. Depending on the nature of the goods in the cargo transport unit and the planned voyage precautions shall be taken to ensure that exposure to direct sunlight is reduced.

Stowage means the proper placement of dangerous goods on board a ship in order to ensure safety and environmental protection during transport.

Stowage on deck means stowage on the weather deck. For open ro-ro cargo spaces see 7.3.2.2.

Stowage under deck means any stowage that is not on the weather deck. For hatchless containerships see 7.4.4.1.

Structurally serviceable for class 1 means the cargo transport unit shall not have major defects in its structural components, e.g. top and bottom rails, top and bottom end rails, door sill and header, floor cross-members, corner posts, and corner fittings in a freight container. Major defects are dents or bends in the structural

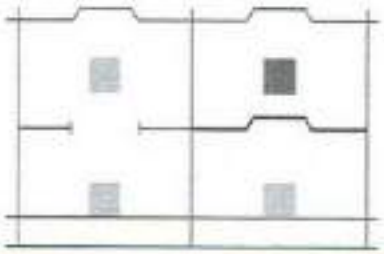
* For cargo spaces, refer to SOLAS II-2/19.3.2 and for refrigerated or heated cargo transport units refer to Recommendations published by the International Electrotechnical Commission, in particular IEC 60092.

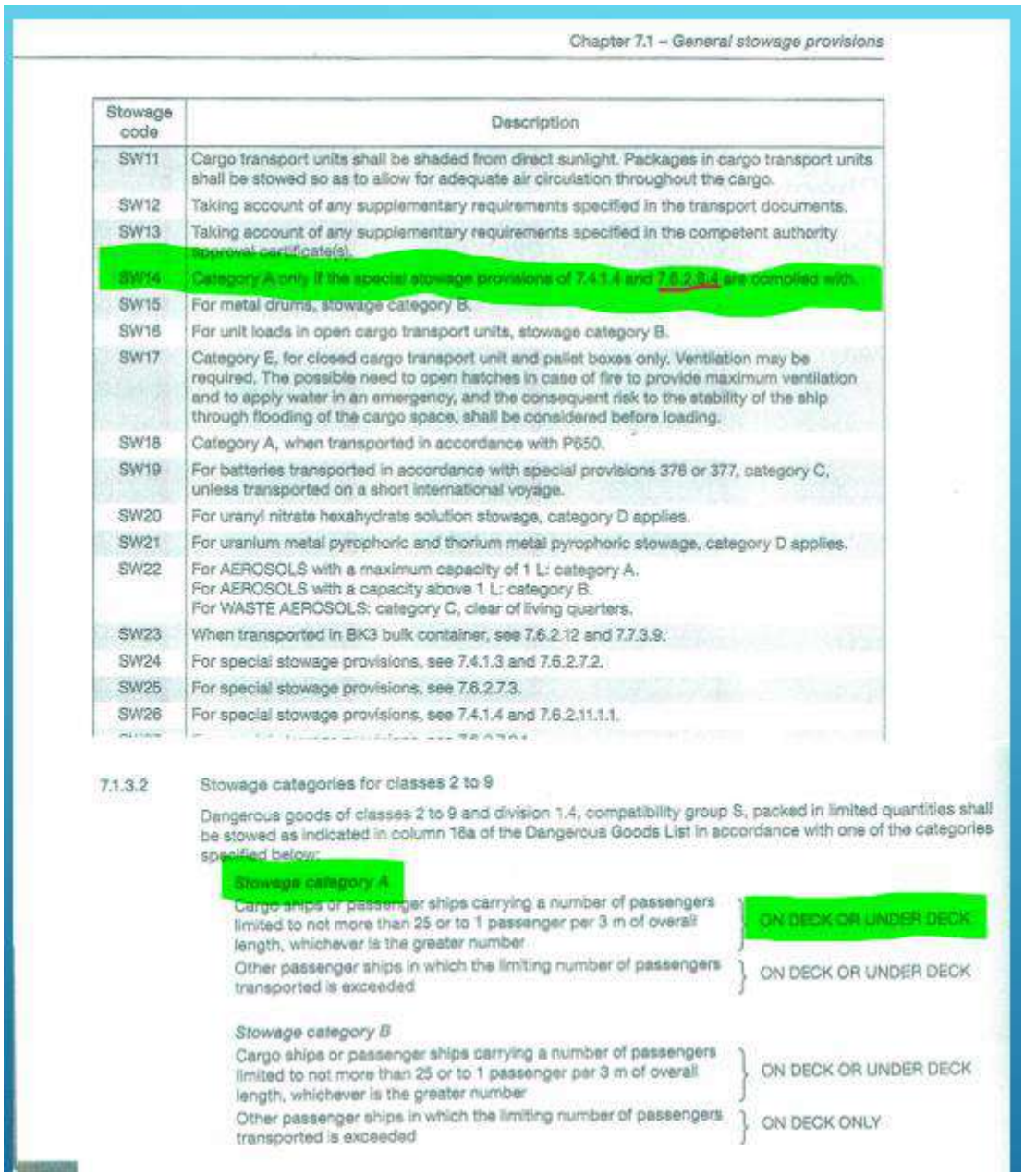
7

SG48 Stow "separated from" combustible material (particularly liquids). Combustible material does not include packing materials or dunnage.

Separated from:

In different compartments or holds when stowed *under deck*. Provided the intervening deck is resistant to fire and liquid, a vertical separation, i.e. in different compartments, may be accepted as equivalent to this segregation. For *on deck* stowage, this segregation means a separation by a distance of at least 6 m horizontally.





Chapter 7.1 – General stowage provisions

Stowage code	Description
SW11	Cargo transport units shall be shaded from direct sunlight. Packages in cargo transport units shall be stowed so as to allow for adequate air circulation throughout the cargo.
SW12	Taking account of any supplementary requirements specified in the transport documents.
SW13	Taking account of any supplementary requirements specified in the competent authority approval certificate(s).
SW14	Category A only if the special stowage provisions of 7.4.1.4 and 7.6.2.8.4 are complied with.
SW15	For metal drums, stowage category B.
SW16	For unit loads in open cargo transport units, stowage category B.
SW17	Category E, for closed cargo transport unit and pallet boxes only. Ventilation may be required. 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 flooding of the cargo space, shall be considered before loading.
SW18	Category A, when transported in accordance with P650.
SW19	For batteries transported in accordance with special provisions 376 or 377, category C, unless transported on a short international voyage.
SW20	For uranyl nitrate hexahydrate solution stowage, category D applies.
SW21	For uranium metal pyrophoric and thorium metal pyrophoric stowage, category D applies.
SW22	For AEROSOLS with a maximum capacity of 1 L: category A. For AEROSOLS with a capacity above 1 L: category B. For WASTE AEROSOLS: category C, clear of living quarters.
SW23	When transported in BK3 bulk container, see 7.6.2.12 and 7.7.3.9.
SW24	For special stowage provisions, see 7.4.1.3 and 7.6.2.7.2.
SW25	For special stowage provisions, see 7.6.2.7.3.
SW26	For special stowage provisions, see 7.4.1.4 and 7.6.2.11.1.1.

7.1.3.2 Stowage categories for classes 2 to 9

Dangerous goods of classes 2 to 9 and division 1.4, compatibility group S, packed in limited quantities shall be stowed as indicated in column 16a of the Dangerous Goods List in accordance with one of the categories specified below:

Stowage category A

Cargo ships or passenger ships carrying a number of passengers limited to not more than 25 or to 1 passenger per 3 m of overall length, whichever is the greater number — ON DECK OR UNDER DECK

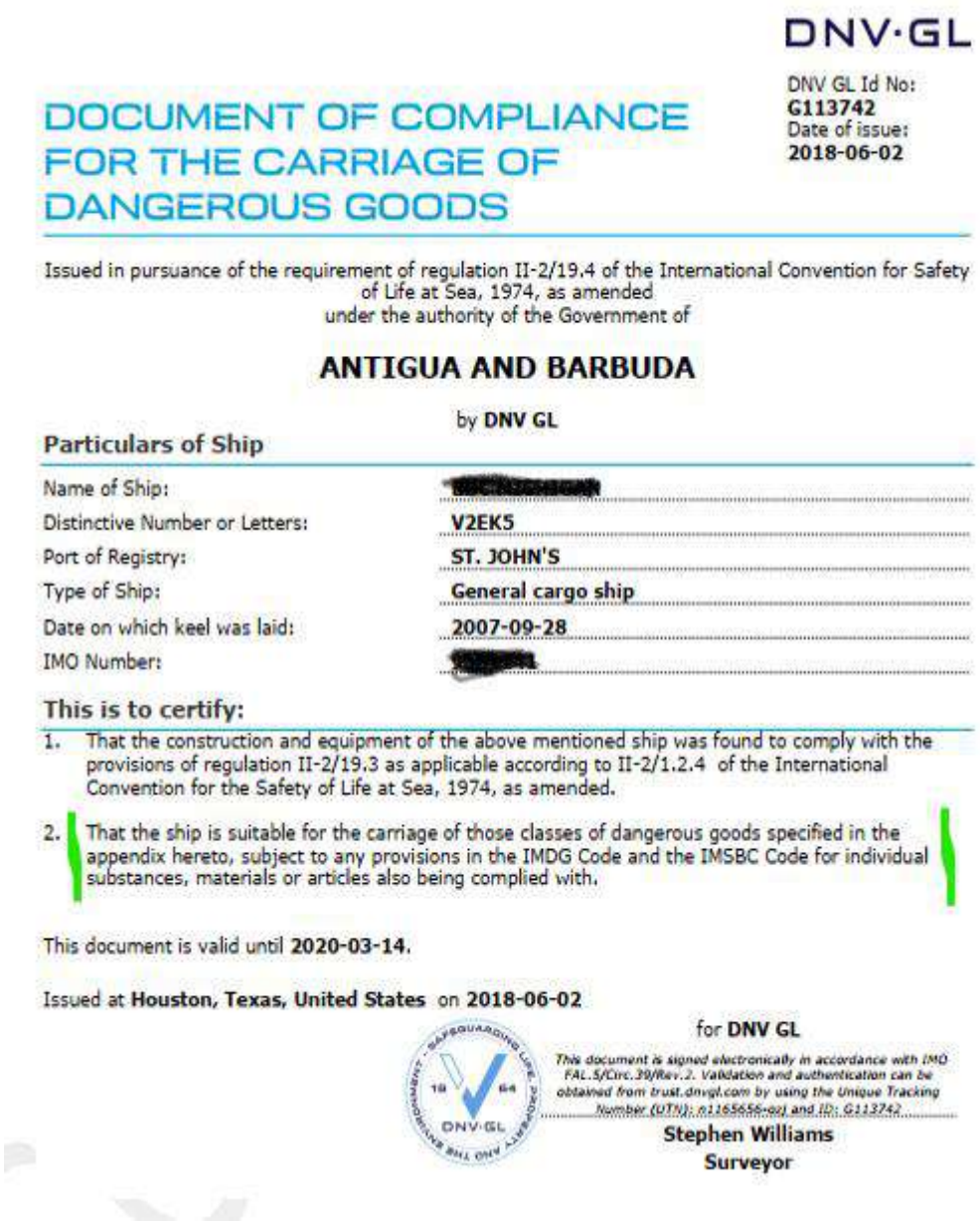
Other passenger ships in which the limiting number of passengers transported is exceeded — ON DECK OR UNDER DECK

Stowage category B

Cargo ships or passenger ships carrying a number of passengers limited to not more than 25 or to 1 passenger per 3 m of overall length, whichever is the greater number — ON DECK OR UNDER DECK

Other passenger ships in which the limiting number of passengers transported is exceeded — ON DECK ONLY

APPENDIX 3: Sample Document of Compliance



DNV·GL

DNV GL Id No:
G113742
Date of issue:
2018-06-02

DOCUMENT OF COMPLIANCE FOR THE CARRIAGE OF DANGEROUS GOODS

Issued in pursuance of the requirement of regulation II-2/19.4 of the International Convention for Safety of Life at Sea, 1974, as amended
under the authority of the Government of

ANTIGUA AND BARBUDA

by **DNV GL**

Particulars of Ship

Name of Ship:	[redacted]
Distinctive Number or Letters:	**V2EK5**
Port of Registry:	**ST. JOHN'S**
Type of Ship:	**General cargo ship**
Date on which keel was laid:	**2007-09-28**
IMO Number:	[redacted]

This is to certify:

1. That the construction and equipment of the above mentioned ship was found to comply with the provisions of regulation II-2/19.3 as applicable according to II-2/1.2.4 of the International Convention for the Safety of Life at Sea, 1974, as amended.

2. That the ship is suitable for the carriage of those classes of dangerous goods specified in the appendix hereto, subject to any provisions in the IMDG Code and the IMSBC Code for individual substances, materials or articles also being complied with.

This document is valid until **2020-03-14**.

Issued at **Houston, Texas, United States** on **2018-06-02**

for **DNV GL**

This document is signed electronically in accordance with IMO FAL.5/Circ.39/Rev.2. Validation and authentication can be obtained from trust.dnvgl.com by using the Unique Tracking Number (UTN): n1165656-en and ID: G113742

Stephen Williams
Surveyor

APPENDIX 4: Dry Multi-Purpose Vessel Stow ☑

APPENDIX 5: Reefer Vessel Stow

About The Author

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Brian is a senior global logistics professional with proven experience in highly sensitive dangerous goods (including Explosives & Ammonium Nitrate) in the chemical industry involving large global manufacturing organisations with multibillion-dollar turnovers. His 30 plus years of broad management experience, specialising in the commercial field with a background in operations, spans across all modes of transport & logistics – sea, air, rail and trucking including warehousing and storage. He is a member of the Safex (Switzerland) Panel of Experts, a member of the Nautical Institute (London) Technical Panel and a member of the ICHCA (London) Technical Panel. He is also an Advisory Council Member of GLG (New York), Advisor to Guidepoint Expert Network (New York) and Senior Member of ITIC (London).

Brian runs an independent consultancy Dev Global Logistics Services (DGLS Australia) assisting corporations in the Explosives and Ammonium Nitrate industry globally. He is also Founder and CEO of the Explosives & Ammonium Nitrate Digital Shipping Portal ShipEcharter.

International Cargo Handling Coordination Association

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