



Guidelines for the Carriage of Divinylbenzene in Containers

These Guidelines are valid until 1 January 2020

A Joint Publication of CINS (the Cargo Incident Notification System), the International Group of P&I Clubs and the TT Club

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INTRODUCTION

Background

The practices set out in this document are intended to improve safety during the carriage of Divinylbenzene in containers.

Divinylbenzene shall be transported in compliance with the requirements set out in the International Maritime Dangerous Goods Code (IMDG Code).

The IMO's Maritime Safety Committee has approved changes to the way polymerizing substances such as Divinylbenzene are carried. These changes are contained in amendment 39-18 of the IMDG Code, which will be mandatory from 1 January 2020, but may be applied on a voluntary basis from 1 January 2019¹.

To ensure the safe carriage of Divinylbenzene in containers before 1 January 2020 when the amended IMDG Code requirements come into force mandatorily, the practices set out below include selected provisions from the IMDG Code plus additional precautions to enhance its safe carriage.

¹ The IMDG Code is mandatory and contains requirements for the safe carriage of packaged dangerous goods. It is published by the International Maritime Organization (IMO) and revised biennially. At the date of publishing these Guidelines, Amendment 38-16 to the Code is in force. Amendment 39-18 enters into force on 1 January 2020. Governments may apply Amendment 39-18 in whole or in part on a voluntary basis from 1 January 2019.

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CINS – Cargo Incident Notification System

The Cargo Incident Notification System (CINS) is a shipping line initiative, established in 2011, with the aim of increasing safety in the supply chain, reducing the number of cargo incidents on-board ships and highlighting the risks caused by certain cargoes and/or packing failures. Membership of CINS comprises over 80% of the world's container slot capacity. The International Group of P&I Clubs, TT Club and Exis Technologies are advisory members.

CINS provides analysis of operational information on cargo and container incidents which lead to injury or loss of life, loss or serious damage of assets, environmental concerns. Data relating to any cargo incident on-board a ship are uploaded to the CINS database. The data includes information on cargo type, nature, packaging, weight; journey (load and discharge ports); type of incident and root cause.

International Group of P&I Clubs

The thirteen principal underwriting associations which comprise the International Group, between them provide liability cover (protection and indemnity) for approximately 90% of the world's ocean-going tonnage. Each Group Club is an independent, non-profit making mutual insurance association, providing cover for its shipowner and charterer members against third party liabilities relating to the use and operation of ships. Each Club is controlled by its members through a board of directors, or committee, elected from the membership.

Clubs cover a wide range of liabilities, including loss of life and personal injury to crew, passengers and others on board, cargo loss and damage, pollution by oil and other hazardous substances, wreck removal, collision and damage to property.

TT Club

TT Club is the international transport and logistics industry's leading provider of insurance and related risk management services.

Established in 1968, the Club's membership comprises ship operators, ports and terminals, road, rail and airfreight operators, logistics companies and container lessors. As a mutual insurer, the Club exists to provide its policyholders with benefits, which include specialist underwriting expertise, a world-wide office network providing claims management services, and first class risk management and loss prevention advice.

TT Club is managed by Thomas Miller.

Guidelines for the Carriage of Divinylbenzene in Containers

1. CARGO ISSUES

1.1. Hazardous Properties of Divinylbenzene (DVB)

Divinylbenzene (DVB) is a liquid chemical that is prone to polymerization (a form of self-reaction). When shipped in bulk, DVB polymerization can cause a large amount of heat and flammable gas to be generated. The gas cloud can resemble smoke from a fire. If exposed to an ignition source and a specific amount of oxygen, the DVB gas may explode. Stowage of containers carrying DVB on board ships can therefore present a risk of explosion and fire.

Products with a polymerization risk generally use chemical inhibitors to prevent self-reaction taking place. With DVB, the chemical inhibitors that are most commonly used to prevent polymerization may be ineffective in preventing it under certain conditions, such as increased heat or low oxygen content. The inhibitor used with products such as DVB works for a limited period of time at a maximum temperature of about 27°C, assuming that a critical oxygen saturation is maintained.

DVB has been shipped for many years but rarely resulted in polymerization incidents. However, it is understood that, since about 2006, DVB with a higher percentage of active ingredients (increased from about 60% to 80%) has been carried in unrefrigerated tank containers, rather than in drums packed in refrigerated containers. There have since been a number of polymerization incidents, mostly ashore, particularly when DVB was shipped from warmer regions of the USA in the summer.

Following such incidents, IMDG Code amendment 38-16, which entered into mandatory force on 1 January 2018, included a new subdivision of Class 4.1 for polymerizing substances with new UN numbers. The IMO's Maritime Safety Committee has, in amendment 39-18 of the IMDG Code, approved further changes to the way polymerizing substances such as DVB are carried, which will be mandatory from 1 January 2020.

DVB shall be transported in compliance with the requirements set out in the IMDG Code. To ensure the safe carriage of DVB in containers in advance of the mandatory application of IMDG Code amendment 39-18, the additional precautions set out below to enhance its safe carriage are strongly recommended.

1.2. Other Trade Names for DVB

Divinylbenzene (DVB) may be improperly declared when presented for shipment. Examples of other trade names encountered have included:

Diethenylbenzene
Diethylbenzene
Vinylstyrene

2. CARRIAGE OF DIVINYLBENZENE IN CONTAINERS

2.1. Divinylbenzene Categories

DVB is not specifically listed in the IMDG Code but is classified under UN number 3532 and UN number 3534. These associated entries in the IMDG Code are shown below.

IMDG Class	UN Number	Description
Class 4.1	UN 3532	POLYMERIZING SUBSTANCE, LIQUID, STABILISED, N.O.S.
Class 4.1	UN 3534	POLYMERIZING SUBSTANCE, LIQUID, TEMPERATURE CONTROLLED, N.O.S.

The IMDG Code requires that any polymerizing substances shipped in bulk in tank containers be sufficiently stabilized to prevent polymerization from occurring at bulk mean temperatures of 45°C, with temperature control required if this cannot be accomplished using a chemical inhibitor alone.

2.2. DVB Carried in Containers – Temperature Controlled

Polymerizing substances carried under UN 3534, using drums packed in a refrigerated container or a refrigerated tank container, generally use chemical inhibitors and temperature control to ensure they remain sufficiently stabilised.

2.3. DVB Carried in Containers – Not Temperature Controlled

Polymerizing substances carried under UN 3532 without any temperature control, use chemical inhibitors alone to prevent polymerization taking place.

In order to identify whether DVB can be safely transported without any temperature control, Special Provision 386 of the IMDG Code, chapter 3.3, requires that a risk assessment is carried out to determine if the level of stabilization is sufficient to prevent the substance from dangerous polymerization.

The factors to be taken into consideration by the **shipper or person offering the goods for transport** include, but are not limited to, the following:

- The capacity and geometry of the packaging, IBC or tank and the effect of any insulation present.
- The temperature of the substance when offered for transport.
- The anticipated duration of the journey (taking reasonable account of potential delays).
- The ambient temperature conditions typically encountered throughout the journey (considering the season of year and expected routing).
- The effectiveness and other properties of the stabilizer employed.
- Applicable operational controls imposed by regulation (for example, requirements to protect from sources of heat, including other cargo transported at a temperature above ambient).
- Any other relevant factors.

Transport of DVB without any temperature control therefore generally relies on the DVB being at a low enough temperature when shipped, and the total journey time to the receiver being short enough, for the chemical inhibitor to remain effective throughout the entire journey at the prevailing time of the year.

The chemical inhibitors most commonly used to prevent DVB polymerization require oxygen in order to work, and also break down and become ineffective if the DVB is exposed to temperatures above about 27° C.

The time it takes to deplete the chemical inhibitor and oxygen below a safe threshold level, allowing auto-polymerization to commence, depends on the temperature of the DVB liquid, which dictates the consumption rate of the chemical inhibitor and oxygen.

In order to transport DVB without temperature control, some DVB shippers chill the DVB before loading it into a tank container and then endeavour to arrange the land and sea transport so that the total journey time is short enough for the DVB to remain sufficiently cool to avoid polymerization.

However, if the DVB is shipped during a period of higher ambient temperatures, or if the transit time or voyage are longer than envisaged, there is a risk of polymerization occurring.

Under the changes contained in amendment 39-18 of the IMDG Code, chapter 7.3.7, the only method of temperature controlled permitted for shipments of polymerizing substances, apart from shipments on short international voyages, is the use of refrigerated equipment, regardless of the type of container used.

In advance of the mandatory application of IMDG Code amendment 39-18 on 1 January 2020, it is strongly recommended under these guidelines that DVB is only carried in drums in a refrigerated container or in a refrigerated tank container.

The shipper or person offering the DVB for transport shall ensure that the carrier is presented with full and complete disclosure of information relating to all aspects of the cargo, including its preparation for transport, material parameters and assumptions that have been made, in order for the carrier to make appropriate provision for all aspects of the service to be delivered, including stowage on board the ship.

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