

## Chapter 7.3

---

### *Consigning operations concerning the packing and use of cargo transport units (CTUs) and related provisions*

#### 7.3.1 Introduction

This chapter contains the provisions appropriate to those responsible for the consignment operations in the dangerous goods transport supply chain, including provisions relating to packing of dangerous goods into cargo transport units.

#### 7.3.2 General provisions for cargo transport units

7.3.2.1 Packages containing dangerous goods shall only be loaded in cargo transport units that are strong enough to withstand the shocks and loadings normally encountered during transport, having regard to the conditions to be expected during the anticipated journey. The cargo transport unit shall be constructed in such a way as to prevent the loss of contents. Where appropriate, the cargo transport unit shall be fitted with devices to facilitate securing and handling of the dangerous goods. The cargo transport units shall be adequately maintained.

△ 7.3.2.2 Unless otherwise specified, the applicable provisions of the *International Convention for Safe Containers, 1972* (CSC Convention), as amended, shall be followed for the use of any cargo transport unit which meets the definition of a “container” within the terms of that Convention.

7.3.2.3 The *International Convention for Safe Containers, 1972* (CSC Convention) does not apply to offshore containers that are handled in open seas. The design and testing of offshore containers shall take into account the dynamic lifting and impact forces that may occur when a container is handled in open seas in adverse weather and sea conditions. The requirements for such containers shall be determined by the approving competent authority. Such provisions should be based on the *Guidelines for the approval of offshore containers handled in open seas* (MSC/Circ.860). Such containers shall be clearly marked with the words “OFFSHORE CONTAINER” on the safety approval plate.

#### 7.3.3 Packing of cargo transport units\*

7.3.3.1 Prior to the use of a cargo transport unit it shall be checked to ensure that it is apparently fit for its intended purpose.†

7.3.3.2 The interior and exterior of a cargo transport unit shall be inspected prior to loading to ensure that there is no damage that could affect its integrity or that of the packages to be loaded in it.

7.3.3.3 Packages shall be examined and any found to be damaged, leaking or sifting shall not be packed into a cargo transport unit. Care shall be taken to see that excessive water, snow, ice or foreign matter adhering to packages is removed before packing into a cargo transport unit. Whenever the handling provision “keep as dry as reasonably practicable” (H1) is assigned in column 16a of the Dangerous Goods List, the cargo transport unit including any contained goods, securing or packing materials shall be kept as dry as reasonably practicable.

7.3.3.4 Drums containing dangerous goods shall always be stowed in an upright position unless otherwise authorized by the competent authority.

7.3.3.5 Cargo transport units shall be loaded in accordance with 7.3.4, so that incompatible dangerous or other goods are segregated. Specific loading instructions such as orientation arrows, not to be double stacked, keep dry or temperature control requirements shall be met. Liquid dangerous goods shall be loaded below dry dangerous goods whenever possible.

\* See CTU Code.

† For safety approval plates and maintenance and examination of containers see the *International Convention for Safe Containers, 1972* (CSC Convention), as amended, annex I, regulations 1 and 2 (see 1.1.2.3).

- 7.3.3.6 Packages containing dangerous goods and unpackaged dangerous articles shall be secured by suitable means capable of restraining the goods (such as fastening straps, sliding slatboards, adjustable brackets) in the cargo transport unit in a manner that will prevent any movement during transport which would change the orientation of the packages or cause them to be damaged. When dangerous goods are transported with other goods (e.g. heavy machinery or crates), all goods shall be securely fixed or packed in the cargo transport units so as to prevent the release of dangerous goods. Movement of packages may also be prevented by filling any voids by the use of dunnage or by blocking and bracing. Where restraints such as banding or straps are used, these shall not be over-tightened to cause damage or deformation of the package or the securing points (such as D-rings) within the cargo transport unit. The packages shall be packed in such a way that there will be a minimum likelihood of damage to fittings during transport. Such fittings on packages shall be adequately protected. Where restraints such as banding or straps with integral container fittings are used, care should be taken to ensure that the Maximum Securing Load (*MSL*) of the fittings is not exceeded.
- 7.3.3.7 Packages shall not be stacked unless designed for that purpose. Where packages of different stacking designs are to be loaded together, consideration shall be given to their compatibility for stacking with each other. Where necessary, stacked packages shall be prevented from damaging the package below by the use of load bearing devices.
- 7.3.3.8 Cargo shall be entirely contained within the cargo transport unit without overhang or projections. Oversized machinery (such as tractors and vehicles) may overhang or project outside of the cargo transport unit provided that the dangerous goods integral to the machinery cannot leak or spill outside of the cargo transport unit.
- 7.3.3.9 During loading and unloading, packages containing dangerous goods shall be protected from being damaged. Particular attention shall be paid to the handling of packages during their preparation for transport, the type of cargo transport unit to be used for their carriage and to the method of loading or unloading, so that accidental damage is not caused through dragging or mishandling. Packages that appear to be leaking or damaged so that the contents may escape shall not be accepted for transport. If a package is found to be damaged so that the contents leak, the damaged package shall not be transported but moved to a safe place in accordance with instructions given by a competent authority or a designated responsible person who is familiar with the dangerous goods, the risks involved and the measures that should be taken in an emergency.
- Note 1:** Additional operational requirements for the transport of packagings and IBCs are provided in the special packing provisions for packagings and IBCs (see chapter 4.1).
- 7.3.3.10 When a dangerous goods consignment forms only part of the load of a cargo transport unit, it should, whenever possible, be packed adjacent to the doors with marks and labels visible, so as to be accessible in the event of an emergency or to facilitate inspection.
- 7.3.3.11 If the doors of a cargo transport unit are locked, the means of locking shall be such that, in cases of emergency, the doors can be opened without delay.
- 7.3.3.12 When venting is required, venting devices shall be kept clear and operable.
- 7.3.3.13 Cargo transport units containing dangerous goods shall be marked and placarded according to chapter 5.3. Irrelevant marks, labels, placards, orange panels, signs and marine pollutant marks shall be removed, masked or otherwise obliterated before packing a cargo transport unit.
- 7.3.3.14 Cargo transport units shall be packed so that the cargo is uniformly distributed consistent with the CTU Code.
- 7.3.3.15 If goods of class 1 are packed, the cargo transport unit shall comply with the definition in 7.1.2 for closed cargo transport unit for class 1.
- 7.3.3.16 If goods of class 7 are packed, the transport index and, if applicable, the criticality safety index, shall be limited according to 7.1.4.5.3.
- 7.3.3.17 Those responsible for the packing of dangerous goods into a cargo transport unit shall provide a “container/vehicle packing certificate” (see 5.4.2). This document is not required for tanks.
- 7.3.3.18 Flexible bulk containers are not allowed to be transported in cargo transport units (see 4.3.4).

## 7.3.4 Segregation provisions within cargo transport units

- 7.3.4.1 Dangerous goods which have to be segregated from each other according to the provisions in chapter 7.2 shall not be transported in the same cargo transport unit with the exception of dangerous goods which shall be segregated “away from” each other which may be transported in the same cargo transport unit with the approval of the competent authority. In such cases an equivalent standard of safety shall be maintained.

#### 7.3.4.2 Segregation in relation to foodstuffs

7.3.4.2.1 Dangerous goods having a primary or subsidiary hazard of classes 2.3, 6.1, 6.2, 7 (with the exception of UN 2908, 2909, 2910 and 2911), 8 and dangerous goods for which it is referred to in segregation code SG29 or SG50 in column 16b of the Dangerous Goods List shall not be transported together with foodstuffs (see 1.2.1) in the same cargo transport unit.

7.3.4.2.2 Notwithstanding the provisions in 7.3.4.2.1, the following dangerous goods may be transported with foodstuffs provided that they are not loaded within 3 m from foodstuffs:

- .1 dangerous goods of packing group III of classes 6.1 and 8;
- .2 dangerous goods of packing group II of class 8; and
- .3 any other dangerous goods of packing group III with a subsidiary hazard of classes 6.1 or 8; and
- .4 dangerous goods having a reference to 7.3.4.2.2 in column 16b of the Dangerous Goods List.

#### 7.3.5 Tracking and monitoring equipment

When security devices, beacons or other tracking or monitoring equipment are used, they shall be securely installed to the cargo transport unit and shall be of a certified safe type\* for the dangerous goods that will be carried within the cargo transport unit.

#### 7.3.6 Opening and unloading cargo transport units

7.3.6.1 Cargo transport units shall be approached with caution. Before opening the doors, the nature of the contents and the possibility that leakages may have caused an unsafe condition, concentration of toxic or flammable vapours, or an oxygen-enriched or oxygen-depleted atmosphere, shall be considered.

7.3.6.2 After a cargo transport unit carrying dangerous goods has been unpacked or unloaded, precautions shall be taken to ensure that there is no contamination likely to make the cargo transport unit dangerous.

7.3.6.3 After unpacking or unloading corrosive substances, particular attention shall be paid to cleaning, as residues may be highly corrosive to the metal structures.

7.3.6.4 When the cargo transport unit offers no further hazard, the dangerous goods placards and other marks related to dangerous goods shall be removed, masked or otherwise obliterated.

#### 7.3.7 Cargo transport units under temperature control

##### 7.3.7.1 Preamble

7.3.7.1.1 If the temperature of certain substances (such as organic peroxides and polymerizing or self-reactive substances) exceeds a value which is typical of the substance as packaged for transport, a self-accelerating decomposition or polymerization possibly of explosive violence, may result. To prevent such decomposition or polymerization, it is necessary to control the temperature of such substances during transport. Other substances not requiring temperature control for safety reasons may be transported under controlled temperature conditions for commercial reasons.

7.3.7.1.2 The provisions for the temperature control of certain specified substances are based on the assumption that the temperature in the immediate surroundings of the cargo does not exceed 55°C during transport and attains this value for a relatively short time only during each period of 24 h.

\* Refer to the Recommendations published by the International Electrotechnical Commission, in particular, to publication IEC 60079.

### 7.3.7.2 General provisions

7.3.7.2.1 Where a number of packages containing self-reactive substances, organic peroxides and polymerizing substances are loaded in a closed cargo transport unit, the total quantity of substance, the type and number of packages and the stacking arrangement shall not create an explosion hazard.

7.3.7.2.2 These provisions apply to certain self-reactive substances when required by 2.4.2.3.4, and certain organic peroxides when required by 2.5.3.4.1 and certain polymerizing substances when required by 2.4.2.5.2 or special provision 386 of chapter 3.3 which may only be transported under conditions where the temperature is controlled.

7.3.7.2.3 These provisions also apply to the transport of substances for which:

- .1 the proper shipping name as indicated in column 2 of the Dangerous Goods List of chapter 3.2 or according to 3.1.2.6 contains the word “STABILIZED”; and
- .2 the self-accelerating decomposition temperature (SADT) or the self-accelerating polymerization temperature (SAPT)\* determined for the substance (with or without chemical stabilization) as offered for transport is:
  - .1 50°C or less for single packagings and IBCs; or
  - .2 45°C or less for portable tanks.

When chemical inhibition is not used to stabilize a reactive substance which may generate dangerous amounts of heat and gas, or vapour, under normal transport conditions, these substances need to be transported under temperature control. These provisions do not apply to substances which are stabilized by the addition of chemical inhibitors such that the SADT or the SAPT is greater than that prescribed in paragraphs 7.3.7.2.3.2.1 or 7.3.7.2.3.2.2.

7.3.7.2.4 In addition, if a self-reactive substance or organic peroxide or a substance the proper shipping name of which contains the word “STABILIZED” and which is not normally required to be transported under temperature control is transported under conditions where the temperature may exceed 55°C, it may require temperature control.

7.3.7.2.5 The “control temperature” is the maximum temperature at which the substance can be safely transported. In the event of loss of temperature control, it may be necessary to implement emergency procedures. The “emergency temperature” is the temperature at which such procedures shall be implemented.

#### 7.3.7.2.6 Derivation of control and emergency temperatures

Type of receptacle	SADT <sup>a</sup> /SAPT <sup>a</sup>	Control temperature	Emergency temperature
Single packagings and IBC	20°C or less over 20°C to 35°C over 35°C	20°C below SADT/SAPT 15°C below SADT/SAPT 10°C below SADT/SAPT	10°C below SADT/SAPT 10°C below SADT/SAPT 5°C below SADT/SAPT
Portable tanks	≤ 45°C	10°C below SADT/SAPT	5°C below SADT/SAPT

<sup>a</sup> i.e. the SADT/SAPT of the substance as packed for transport.

7.3.7.2.7 The control and emergency temperatures are derived using the table in 7.3.7.2.6 from the self-accelerating decomposition temperature (SADT) or from the self-accelerating polymerization temperature (SAPT) which are defined as the lowest temperatures at which self-accelerating decomposition or self-accelerating polymerization may occur with a substance in the packaging, IBC or portable tank as used in transport. An SADT or SAPT shall be determined in order to decide if a substance shall be subjected to temperature control during transport. Provisions for the determination of the SADT and SAPT are given in 2.4.2.3.4, 2.5.3.4.2 and 2.4.2.5.2 for self-reactive substances, organic peroxides and polymerizing substances and mixtures, respectively.

7.3.7.2.8 Control and emergency temperatures, where appropriate, are provided for currently assigned self-reactive substances in 2.4.2.3.2.3 and for currently assigned organic peroxide formulations in 2.5.3.2.4.

7.3.7.2.9 The actual transport temperature may be lower than the control temperature but shall be selected so as to avoid dangerous separation of phases.

### 7.3.7.3 Transport under temperature control

7.3.7.3.1 Prior to the use of cargo transport unit, the refrigeration system shall be subjected to a thorough inspection and a test to ensure that all parts are functioning properly.

\* The SAPT shall be determined in accordance with the test procedures established for the SADT for self-reactive substances in accordance with part II, section 28 of the *Manual of Tests and Criteria*.

**7.3.7.3.2** Refrigerant gas shall only be replaced in accordance with the manufacturer's operating instructions for the refrigeration system. Prior to filling replacement refrigerant gas, a certificate of analysis from the supplier shall be obtained and checked to confirm that the gas meets refrigeration system specifications. In addition, if concerns about the integrity of the supplier and/or the refrigerant gas supply chain give rise to suspicion of contamination of the gas, the replacement refrigerant gas shall be checked for possible contamination prior to use. If the refrigerant gas is found to be contaminated, it shall not be used, the cylinder shall be plainly marked "CONTAMINATED", the cylinder shall be sealed and sent for recycling or disposal, and notification shall be given to the refrigerant gas supplier and authorized distributor and competent authority(ies) of the countries in which the supplier and distributor reside, as appropriate. The date of last refrigerant replacement shall be included in the maintenance record of the refrigeration system.

**Note:** Contamination can be checked by using flame halide lamp tests, gas sniffer tube tests or gas chromatography. Replacement refrigerant gas cylinders may be marked with the test result and the date of testing.

**7.3.7.3.3** When a cargo transport unit is to be filled with packages containing substances having different control temperatures, all packages shall be pre-cooled to avoid exceeding the lowest control temperature.

**7.3.7.3.3.1** In the event that non-temperature-controlled substances are transported in the same cargo transport unit as temperature controlled substances, the package(s) containing substances that require refrigeration shall be stowed in such a way as to be readily accessible from the door(s) of the cargo transport unit.

**7.3.7.3.3.2** If substances with different control temperatures are loaded in the cargo transport unit, the substances with the lowest control temperature shall be stowed in the most readily accessible position from the doors of the cargo transport unit.

**7.3.7.3.3.3** The door(s) shall be capable of being opened readily in case of emergency so that the package(s) can be removed. The carrier shall be informed about the location of the different substances within the unit. The cargo shall be secured to prevent packages from falling when the door(s) is (are) opened. The packages shall be securely stowed so as to allow for adequate air circulation throughout the cargo.

**7.3.7.3.4** The master shall be provided with operating instructions for the refrigeration system, procedures to be followed in the event of loss of control and instructions for regular monitoring of operating temperatures. Spare parts shall be carried for the systems described in 7.3.7.4.2.3, 7.3.7.4.2.4 and 7.3.7.4.2.5 so that they are available for emergency use should the refrigeration system malfunction during transport.

**7.3.7.3.5** In cases where it may not be possible to carry specific substances according to the general provisions, full details of the proposed method of shipment shall be submitted to the competent authority concerned for approval.

#### **7.3.7.4 Methods of temperature control**

**7.3.7.4.1** The suitability of a particular means of temperature control for transport depends on a number of factors. Among those to be considered are:

- .1 the control temperature(s) of the substance(s) to be transported;
- .2 the difference between the control temperature and the anticipated ambient temperature conditions;
- .3 the effectiveness of the thermal insulation of the cargo transport unit. The overall heat transfer coefficient shall not be more than 0.4 W/(m<sup>2</sup>·K) for cargo transport units and 0.6 W/(m<sup>2</sup>·K) for tanks; and
- .4 the duration of the voyage.

**7.3.7.4.2** Suitable methods for preventing the control temperature being exceeded are, in order of increasing capability:

- .1 thermal insulation, provided that the initial temperature of the substance is sufficiently below the control temperature;
- .2 thermal insulation with a cooling method, provided that:
  - an adequate quantity of non-flammable coolant (such as liquid nitrogen or solid carbon dioxide), allowing a reasonable margin for delay, is carried;
  - liquid oxygen or air is not used as a coolant;
  - there is a uniform cooling effect even when most of the coolant has been consumed; and
  - the need to ventilate the cargo transport unit before entering is clearly indicated by a warning on the door(s) (see 5.5.3);
- .3 single mechanical refrigeration, provided that the unit is thermally insulated and, for substances with a flashpoint lower than the sum of the emergency temperature plus 5°C, explosion proof electrical fittings are used within the cooling compartment to prevent ignition of flammable vapours from the substances;

- .4 combined mechanical refrigeration system and cooling method, provided that:
  - the two systems are independent of one another; and
  - the provisions of 7.3.7.4.2.2 and 7.3.7.4.2.3 are met;
- .5 dual mechanical refrigeration system, provided that:
  - apart from the integral power supply unit, the two systems are independent of one another;
  - each system alone is capable of maintaining adequate temperature control; and
  - for substances with a flashpoint lower than the sum of the emergency temperature plus 5°C, explosion proof electrical fittings are used within the coolant compartment to prevent ignition of flammable vapours from the substances.

7.3.7.4.3 The refrigeration equipment and its controls shall be readily and safely accessible and all electrical connections weatherproof. Inside the cargo transport unit, the temperature shall be measured continuously. The measurement shall be taken in the air space of the unit, using two measuring devices independent of each other. The type and place of the measuring devices shall be selected so that their results are representative of the actual temperature in the cargo. At least one of the two measurements shall be recorded in such a manner that temperature changes are easily detectable. The temperature shall be checked every four to six hours and logged.

7.3.7.4.4 If substances are transported with a control temperature less than +25°C, the cargo transport unit shall be equipped with a visible and audible alarm effectively set at no higher than the control temperature. The alarms shall work independently from the power supply of the refrigeration system.

△ 7.3.7.4.5 If an electrical supply is necessary for the cargo transport unit to operate the refrigeration or heating equipment, it shall be ensured that the correct connecting plugs are fitted. For under deck stowage, plugs shall, as a minimum, be of an IP 55 enclosure in accordance with IEC Publication 60529, with the specification for electrical equipment of temperature class T4 and explosion group IIB. However, when stowed on deck, these plugs shall be of an IP 56 enclosure in accordance with IEC Publication 60529.

### 7.3.7.5 Special provisions for self-reactive substances, organic peroxides and polymerizing substances

7.3.7.5.1 For self-reactive substances (class 4.1) identified by UN Nos. 3231 and 3232 and organic peroxides (class 5.2) identified by UN Nos. 3111 and 3112, one of the following methods of temperature control described in 7.3.7.4.2 shall be used:

- .1 the methods referred to under 7.3.7.4.2.4 or 7.3.7.4.2.5; or
- .2 the method referred to under 7.3.7.4.2.3 when the maximum ambient temperature to be expected during transport is at least 10°C below the control temperature.

7.3.7.5.2 For self-reactive substances (class 4.1) identified by UN Nos. 3233 to 3240, organic peroxides (class 5.2) identified by UN Nos. 3113 to 3120 and polymerizing substances identified by UN Nos. 3533 and 3534 or for those substances where the words “TEMPERATURE CONTROLLED” are added as part of the proper shipping name in accordance with 3.1.2.6.2, one of the following methods shall be used:

- .1 the methods referred to under 7.3.7.4.2.4 or 7.3.7.4.2.5;
- .2 the method referred to under 7.3.7.4.2.3 when the maximum ambient temperature to be expected during transport does not exceed the control temperature by more than 10°C; or
- .3 for short international voyages only (see 1.2.1), the methods referred to under 7.3.7.4.2.1 and 7.3.7.4.2.2 when the maximum ambient temperature to be expected during transport is at least 10°C below the control temperature.

### 7.3.7.6 Special provisions for flammable gases or liquids having a flashpoint less than 23°C c.c. transported under temperature control

7.3.7.6.1 When flammable gases or liquids having a flashpoint less than 23°C c.c. are packed or loaded in a cargo transport unit equipped with a refrigerating or heating system, the cooling or heating equipment shall comply with 7.3.7.4.

7.3.7.6.2 When flammable liquids having a flashpoint less than 23°C c.c. and not requiring temperature control for safety reasons are transported under temperature control conditions for commercial reasons, explosion proof electrical fittings are required except when the substances are pre-cooled to and transported at a control temperature of at least 10°C below the flashpoint. In case of failure of a non-explosion proof refrigerating system, the system shall be disconnected from the power supply. It shall not be reconnected if the temperature has risen to a temperature less than 10°C below the flashpoint.

7.3.7.6.3 When flammable gases not requiring temperature control for safety reasons are transported under temperature control conditions for commercial reasons, explosion proof electrical fittings are required.

**7.3.7.7 Special provisions for vehicles transported on ships**

Insulated, refrigerated and mechanically refrigerated vehicles shall conform to the provisions of 7.3.7.4 and 7.3.7.5 as appropriate. In addition, the refrigerating appliance of a mechanically refrigerated vehicle shall be capable of operating independently of the engine used to propel the vehicle.

**7.3.7.8 Approval**

The competent authority may approve that less stringent means of temperature control may be used or that artificial refrigeration may be dispensed with under conditions of transport such as short international voyages or low ambient temperatures.

**7.3.8 Loading of cargo transport units on board ships**

Before loading, cargo transport units used for the transport of dangerous goods shall be examined for external signs of damage, leakage or sifting of contents. Any cargo transport unit found to be damaged, leaking or sifting shall not be loaded on to a ship until repairs have been effected or damaged packages have been removed.

