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**COMMITTEE OF EXPERTS ON THE TRANSPORT OF
DANGEROUS GOODS AND ON THE GLOBALLY
HARMONIZED SYSTEM OF CLASSIFICATION
AND LABELLING OF CHEMICALS**

Sub-Committee of Experts on the
Transport of Dangerous Goods

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Item 10 of the provisional agenda

GUIDING PRINCIPLES FOR THE MODEL REGULATIONS

Guiding principles for the assignment of portable tank requirements

Transmitted by the expert from the United States of America

Introduction

1. This paper consolidates the proposals in informal documents INF. 23 and INF.34 that were submitted to the twenty-seventh session of the Sub-Committee and takes into account comments received.

Proposal

2. Add the following guidance concerning the assignment of portable tank requirements to the Guiding Principles

Annex

GUIDELINES FOR ASSIGNING PORTABLE TANK REQUIREMENTS TO SUBSTANCES ~~IN CLASSES 3 TO 9~~ LISTED IN THE DANGEROUS GOODS LIST

1. These guidelines ~~for assigning portable tank requirements to substances in Classes 3 to 9~~ are provided as a reference to be used for assigning portable tank requirements to specific substances listed in the dangerous goods list. The guidelines were developed taking into consideration the hazards of dangerous goods and their physical and chemical characteristics.

~~2. The guidelines provide guidance for assigning specific requirements including minimum test pressures, minimum shell thicknesses, pressure relief device arrangements and bottom opening closure requirements for portable tanks used to transport substances in Classes 3 to 9.~~

3. For certain substances, the tank requirements recommended by these guidelines may not be appropriate owing to unique characteristics of the substance not addressed in these guidelines. In these instances expert judgement should be applied in assigning appropriate requirements. For example bottom openings may not be appropriate for substances corrosive to ship structures.

4. The guidelines are provided in two parts. Part I provides general guidance. Part II provides specific guidance for groups of substances organized on the basis of the Class or Division, Packing Group and subsidiary risk. Part III provides guidance on the assignment of TP notes.

Part I

General guidelines

In assigning tank requirements to a substance the following should be taken into account:

Prohibited substances: Some substances should be prohibited from transport in portable tanks. These substances are considered too dangerous for transport typically because of their instability or because they pose an unacceptably high level of risk when transported in bulk quantities under normal conditions of transport. The following substances are prohibited from transport in portable tanks:

- Substances of Class 1 (other than UN0331 or UN0332 - Explosive, blasting, type B or E (Agent, blasting, type B or E));
- Desensitised explosives in Division 4.1;
- Self-reactive substances (other than type F);
- Organic peroxides of Division 5.2 other than type F;
- Radioactive materials other than Low Specific Activity (LSA) non-fissile or fissile excepted materials.

Additional prohibited substances are specifically identified in the Model Regulations on the Transport of Dangerous Goods. Furthermore, some substances may only be transported on the basis of an approval by the competent authority.

Minimum shell thicknesses: The minimum shell thicknesses prescribed are provided in thicknesses relevant to reference steel with a guaranteed minimum tensile strength of 370 N/mm² and a guaranteed minimum elongation of 27%. When other materials are used equivalent thickness calculations should be performed. Minimum thicknesses range from 5 mm to 10 mm. Part II of the guidelines provide guidance for assigning minimum thicknesses. Granular or powdered solid substances of packing groups II or III may be transported in tanks with minimum shell thicknesses of 5 mm in the reference steel regardless of

the tank diameter when [6-6.2.4.26.7.2.4.2](#) of the Model Regulations on the Transport of Dangerous Goods is specified relevant to a given substance. Regardless of the minimum thickness specified in Part II, if the thickness determined in accordance with the provisions of sections [6-66.7.2.4](#) is greater, the greater thickness shall be applied.

Corrosive effects of substances on materials of construction: The minimum thicknesses prescribed do not take a substance's corrosive effects into account. The consignor must ensure that the tank materials of construction are compatible with the lading.

Minimum test pressures: Irrespective of the pressure assigned in these guidelines, the minimum test pressure assigned to an individual substance should be the greater of the pressure determined on the basis of the definitions in [6-66.7.2.1](#) of the Model Regulations and the pressure assigned in these guidelines.

Pressure-relief devices requirements: Two pressure relief device requirements are possible,

- (1) Normal (N) (where the provisions of paragraph [6-66.7.2.8.1](#) apply); or
- (2) [6-66.7.2.8.3](#).

When paragraph [6-66.7.2.8.3](#) is referenced, a frangible disk must be provided in series preceding the pressure relief device. Paragraph [6-66.7.2.8.3](#) should be assigned to substances that have the potential to polymerize or to produce solid or highly viscous substances capable of preventing proper operation of the relief valve.

In addition, [6-66.7.2.8.3](#) is also specified for certain groups of substances as indicated in Part II and for individual substances as indicated in the Dangerous Goods List of chapter 3 of the Model Regulations based on the decisions of the Committee of Experts.

Bottom openings: Three possible bottom opening arrangements are proposed, [6-66.7.2.6.3](#) (which indicates three serially mounted means of closure), [6-66.7.2.6.2](#) (two serially mounted means of closure) or N.A. (Not Allowed). Bottom openings are not allowed for ~~P~~packing groups I and [certain packing group II](#) substances which are highly corrosive to steel [or aluminum](#).

Filling limits: Three different filling restrictions are possible. The filling limits are considered operational requirements. The filling limits do not have a direct relationship to the construction of the tank or the arrangement of the service equipment. On this basis, filling limits are not addressed in Part II of this Annex and will not be included in the tank type designations. The maximum filling limit for a substance should be consistent with the provisions under "Filling" in Chapter 4.2 of the Model Regulations. The consignor of the dangerous goods has the ultimate responsibility for assuring portable tanks are not filled in excess of the specified limits for each substance, solution or mixture transported.

Molten substances: Assignments for molten substances of all classes should be based on the requirements established for liquids of the same class, division, packing group and subsidiary risk of the [molten substance taking into account the hazards posed by the high temperature of the substance during loading, unloading and while in transport \(see 4.2.1.18\)](#). [Specific filling limits apply for molten and elevated temperature substances in 4.2.1.9.5.-](#)

Part II

Guidance for groups of substances based on Class or Division, Packing Group and subsidiary risk

Class or Division	PG	Sub-Risk	Tank Instruction	Notes
1			T1	Only UN0331 or UN0332 - Explosive, blasting, type B or E (Agent, blasting, type B or E) are authorized for transport in portable tanks.
2.1			T50/T75	T50 applies to non-refrigerated liquefied flammable gases. T75 applies to refrigerated liquefied flammable gases. These are evaluated on a case by case basis.
2.2			T50/T75	T50 applies to non-refrigerated liquefied gases. T75 applies to refrigerated liquefied gases. These are evaluated on a case by case basis.
2.3			T50	These are evaluated on a case by case basis.
3	I	Any other than 6.1/8	T11	
	II	Any other than 6.1/8	T4 or T7 ¹	
	III	Any other than 6.1/8	T2 or T4 ¹	
3	I	6.1 or 8	T14	
	II	6.1 or 8	T7 or T11 ¹	
	III	6.1 or 8	T2 or T4 ¹ or T7 ²	
4.1	I	Any		Desensitized explosives in Division 4.1 are not authorized for transport in portable tanks.
	II	Any	T3	Only Type F Self-reactive substances are authorized for transport in tanks. These substances are assigned T23.
	III	Any	T1	
4.2 Liquids	I	Any	T21	
	II	Any		Portable tank instructions are not currently assigned to any liquid self-heating substances
	III	Any		
4.2 Solids	I	Any	T21	
	II	Any	T3	
	III	Any	T1	
4.3 Liquids	I	Any	T9 or T10 ³	
	II	Any	T7	
	III	Any	T7	
4.3 Solids	I	Any	T9	
	II	Any	T3	
	III	Any	T1	
	I	Any	T10	

Class or Division	PG	Sub-Risk	Tank Instruction	Notes
	I	Any	T10	
5.1	III	Any	T4	
Liquids Solids	I	Any	N/A	
	II	Any	T3	
	III	Any	T1	
6.1 Liquids (TIH)	I	Any	T20	This instruction shall be assigned to substances with an inhalation toxicity less than or equal to 1000 ml/m ³ and saturated vapour concentration greater than or equal to 10 LC50.
			T22	This instruction shall be assigned to substances with an inhalation toxicity less than or equal to 200 ml/m ³ and a saturated vapour concentration greater than or equal to 500 LC50.
6.1 Liquids	I	Any	T14	
	II	Any	T7 or T8 ³ or T11 ¹	
	III	Any	T4 or T7 ¹	
6.1 Solids	I	Any	T6	
	II	Any	T3	
	III	Any	T1	
8 Liquids	I	Any	T10 or T14 ¹ or T20 ⁴	
	II	Any	T7 or T8 ³ or T11 ¹	
	III	Any	T4 or T7 ¹	
8 Solids	I	Any	T6	
	II	Any	T3	
	III	Any	T1	
9 Liquids	II	Any	T4	Special consideration may need to be given to Class 9 substances based on the substances' properties.
	III	Any	T4	
	II	Any	T1	
	III	Any	T3	

¹ This instruction shall be assigned to n.o.s. substances and may also be assigned based on the absolute vapour pressure of the substance.

² This instruction shall be assigned to n.o.s. substances with a Division 6.1 subsidiary risk.

³ This instruction shall be assigned when the substance is highly corrosive to steel or aluminum.

⁴ T20 shall be assigned to substances with an inhalation toxicity less than or equal to 1000 ml/m³ and saturated vapour concentration greater than or equal to 10 LC50. T22 shall be assigned to substances with an inhalation toxicity less than or equal to 200 ml/m³ and a saturated vapour concentration greater than or equal to 500 LC50.

Part III

Guidelines for assigning portable tank special provisions (TP notes) to individual substances

Portable tank special provisions should be considered on an individual basis depending on the characteristics of the substances. The following guidance should be used:

TP1 The degree of filling prescribed in 4.2.1.9.2 shall not be exceeded.

$$\text{Degree of filling} = \frac{97}{1 + \alpha(t_r - t_f)}$$

(Note: TP1 applies to liquid substances with a vapour pressure of not more than 175 kPa (1.75 bar) at 65 °C.)

TP2 The degree of filling prescribed in 4.2.1.9.3 shall not be exceeded.

$$\text{Degree of filling} = \frac{95}{1 + \alpha(t_r - t_f)}$$

(Note: TP2 applies to liquid substances with a vapor pressure greater than 175 kPa (1.75 bar) at 65 °C and also to substances of Division 6.1 or Class 8 in PG I or II.)

TP3 The maximum degree of filling (in %) for solids transported above their melting points and for elevated temperature liquids shall be determined in accordance with 4.2.1.9.5.1.

$$\text{Degree of filling} = 95 \frac{d_r}{d_f}$$

(Note: TP3 applies to solids transported above their melting point and to elevated temperature liquids.)

TP4 The degree of filling shall not exceed 90% or, alternatively, any other value approved by the competent authority (see 4.2.1.15.2).

(Note: TP4 applies to low specific activity radioactive materials authorized for transport in portable tanks, and to sulphur trioxide, stabilized.)

TP5 The degree of filling prescribed in 4.2.3.6 shall be met.

(Note: TP5 applies to substances transported as refrigerated liquids.)

TP6 To prevent the tank bursting in any event, including fire engulfment, it shall be provided with pressure-relief devices which are adequate in relation to the capacity of the tank and to the nature of the substance transported. The device shall also be compatible with the substance.

(Note: TP6 applies to Hydrogen peroxides (UN 2014, 2015, 2984 and 3149) and Chloroprene, UN 1991.)

TP7 Air shall be eliminated from the vapour space by nitrogen or other means.

(Note: TP7 applies to pyrophoric, water reactive and other substances that are reactive with air, water or moisture.)

TP8 The test pressure for the portable tank may be reduced to 1.5 bar when the flash point of the substances transported is greater than 0 °C.

(Note: TP8 applies to certain flammable liquids with a flash point greater than 0 °C.)

TP9 A substance under this description shall only be transported in a portable tank under an approval granted by the competent authority.

(Note: TP9 is assigned to PGI n.o.s. entries.)

TP10 A lead lining, not less than 5 mm thick, which shall be tested annually, or another suitable lining material approved by the competent authority is required.

(Note: TP10 applies to bromine or bromine solutions.)

TP12 This substance is highly corrosive to steel.

(Note: TP12 applies to all substances which are highly corrosive to steel. The designation "highly corrosive to steel" is not defined or established by specific criteria and is based on expert judgement.)

TP13 Self-contained breathing apparatus shall be provided when this substance is transported.

(Note: TP13 applies to substances which are toxic by inhalation.)

TP16 The tank shall be fitted with a special device to prevent under-pressure and excess pressure during normal transport conditions. This device shall be approved by the competent authority. Pressure-relief requirements are as indicated in 6.7.2.8.3 to prevent crystallization of the product in the pressure-relief valve.

(Note: TP16 is applies to ammonium nitrate, liquid (hot concentrated solution).)

TP17 Only inorganic non-combustible materials shall be used for thermal insulation of the tank.

(Note: TP17 applies to blasting explosives and blasting agents of types B or E, ammonium nitrate, liquid (hot concentrated solution), and to ammonium nitrate emulsions, suspensions, or gels.)

TP18 Temperature shall be maintained between 18 °C and 40 °C. Portable tanks containing solidified methacrylic acid shall not be reheated during transport.

(Note: TP18 applies to stabilized methacrylic acid.)

TP19 The calculated shell thickness shall be increased by 3 mm. Shell thickness shall be verified ultrasonically at intervals midway between periodic hydraulic tests.

(Note: TP19 applies to sulphur dioxide and chlorine.)

TP20 This substance shall only be transported in insulated tanks under a nitrogen blanket.

(Note: TP20 applies to ethylene oxide, or ethylene oxide with nitrogen, up to a total pressure of 1 MPa (10 bar) at 50 EC.)

TP21 The shell thickness shall be not less than 8 mm. Tanks shall be hydraulically tested and internally inspected at intervals not exceeding 2.5 years.

(Note: TP21 applies to dinitrogen tetroxide and trifluoroacetyl chloride.)

TP22 Lubricant for joints or other devices shall be oxygen compatible.

(Note: TP22 applies to refrigerated liquids containing oxygen.)

TP23 Transport permitted under special conditions prescribed by the competent authorities.

(Note: TP23 applies to hydrogen, refrigerated liquid.)

TP24 The portable tank may be fitted with a device located under maximum filling conditions in the vapour space of the shell to prevent the build up of excess pressure due to the slow decomposition of the substance transported. This device shall also prevent an unacceptable amount of leakage of liquid in the case of overturning or entry of foreign matter into the tank. This device shall be approved by the competent authority or its authorized body.

(Note: TP24 applies to substances liable to build up excess pressure due to decomposition.)

TP25 Sulphur trioxide 99.95% pure and above may be transported in tanks without an inhibitor provided that it is maintained at a temperature equal to or above 32.5 °C.

(Note: TP25 applies to stabilized sulphur trioxide.)

TP26 When transported under heated conditions, the heating device shall be fitted outside the shell. For UN 3176 this requirement only applies when the substance reacts dangerously with water.

(Note: TP26 applies to substances transported in a molten state which react dangerously with water.)

TP27 A portable tank having a minimum test pressure of 4 bar may be used if it is shown that a test pressure of 4 bar or less is acceptable according to the test pressure definition in 6.7.2.1.

(TP27 applies when a higher test pressure has been assigned to a substance on the basis of its generic nomenclature, but it can be shown that a test pressure of 4 bar or less is acceptable according to the test pressure definition in 6.7.2.1 for the particular substance transported.)

TP28 A portable tank having a minimum test pressure of 2.65 bar may be used if it is shown that a test pressure of 2.65 bar or less is acceptable according to the test pressure definition in 6.7.2.1.

(Note: TP28 applies when a higher test pressure has been assigned to a substance on the basis of its generic nomenclature, but it can be shown that a test pressure of 2.65 bar or less is acceptable according to the test pressure definition in 6.7.2.1 for the particular substance transported.)

TP29 A portable tank having a minimum test pressure of 1.5 bar may be used if it is shown that a test pressure of 1.5 bar or less is acceptable according to the test pressure definition in 6.7.2.1.

(Note: TP29 applies when a higher test pressure has been assigned to a substance on the basis of its generic nomenclature, but it can be shown that a test pressure of 1.5 bar or less is acceptable according to the test pressure definition in 6.7.2.1 for the particular substance transported.)

TP30 This substance shall be transported in insulated tanks.

(Note: TP30 applies to stabilized methacrylic acid.)

TP31 This substance may only be transported in tanks in the solid state.

(Note: TP31 applies to certain substances whose proper shipping name authorizes a solid and a liquid state but whose portable tank instruction and special provisions only apply to the solid state.)

TP32 For UN Nos. 0331, 0332 and 3375, portable tanks may be used subject to the following conditions:

- (a) To avoid unnecessary confinement, each portable tank constructed of metal shall be fitted with a pressure-relief device that may be of the reclosing spring-loaded type, a frangible disc or a fusible element. The set to discharge or burst pressure, as applicable, shall not be greater than 2.65 bar for portable tanks with minimum test pressures greater than 4 bar;
- (b) The suitability for transport in tanks shall be demonstrated. One method to evaluate this suitability is test 8 (d) in Test Series 8 (see "*Manual of Tests and Criteria*", Part 1, subsection 18.7);
- (c) Substances shall not be allowed to remain in the portable tank for any period that could result in caking. Appropriate measures shall be taken to avoid accumulation and packing of substances in the tank (e.g. cleaning, etc).

(Note: TP32 applies to blasting explosives and blasting agents of types B or E, ammonium nitrate, liquid (hot concentrated solution), and to ammonium nitrate emulsions, suspensions, or gels.)

TP33 The portable tank instruction assigned for this substance applies for granular and powdered solids and for solids which are filled and discharged at temperatures above their melting point which are cooled and transported as a solid mass. For solids which are transported above their melting point see 4.2.1.18.

(Note: TP33 applies to certain granular and powdered solids and to certain solids which are filled and discharged at temperatures above their melting point which are cooled and transported as a solid mass.)

TP34 Portable tanks need not be subjected to the impact test in 6.7.4.14.1 if the portable tank is marked "NOT FOR RAIL TRANSPORT" on the plate specified in 6.7.4.15.1 and also in letters of at least 10 cm high on both sides of the outer jacket.

(Note: TP34 applies to hydrogen, refrigerated liquid and helium, refrigerated liquid.)
