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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

23 November 2017

### Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals

#### Thirty-fourth session

Geneva, 6-8 December 2017

Item 2 (h) of the provisional agenda

#### Classification criteria and related hazard communication: other issues

### **Proposal for a new classification of chemicals under pressure within chapter 2.3**

#### **Submitted by the European Chemical Industry Council (CEFIC) and the European Industrial Gases Association (EIGA)**

1. Some years ago the Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-committee) implemented new UN numbers for chemicals under pressure (UN3500 - UN3505). These products function similarly to aerosol dispensers (UN 1950), but are packed in pressure receptacles (refillable and non-refillable) up to 450 litres. These UN-numbers are also used by the EIGA members to transport liquids that are packed under a head of pressure for inerting the product or to facilitate its transfer in the process lines (e.g., benzene under hydrogen pressure). With the implementation of GHS in more and more countries, the question came up how these products need to be classified and labelled according to the GHS.
2. Current GHS chapters do not appropriately cover the hazards associated with this product type, leading to confusion and possibly resulting in over- or under-classification of products.
3. Chemicals under pressure used for spray applications present hazards that are similar to those requiring the use of aerosol dispensers that could be considered as one of the packaging possibilities for chemicals under pressure. Due to the similarities in hazards, aerosols and chemicals under pressure could be combined in the same chapter (2.3) of GHS using similar classification criteria. This approach has been taken in the draft proposal outlined in INF.12 presented at, and endorsed with comments by the sub-committee GHS at their 33<sup>rd</sup> session.
4. The attached informal document renames chapter 2.3 as “Aerosols and Chemicals Under Pressure” and clearly distinguishes the requirements for aerosols and for chemicals under pressure in separate sub-chapters. In this new structure, the present text from chapter 2.3 (Aerosols) is edited and renumbered as section 2.3.1, and the new text for chemicals under pressure is added after it in section 2.3.2. There is a common introduction added at the very beginning in 2.3.0 as well as common guidance in 2.3.3.
5. The attached proposal for chemicals under pressure presents three hazard categories for this new hazard class - two are designated for extremely flammable and flammable chemicals under pressure and one for non-flammable chemicals under pressure. The presentation of the classification criteria for chemicals under pressure follows that for the aerosols hazard class.

6. New labelling requirements are also proposed for chemicals under pressure, including new hazard statements. Two pictograms are proposed for categories 1 and 2 and one for category 3. This is in line with the way gases under pressure are addressed in the GHS. Regarding the hazard statements for chemicals under pressure, the two statements used for categories 1 and 2 have been merged into one hazard statement, and “may burst if heated” has been added at the end of the hazard statement for all three categories.

7. In order to differentiate “chemicals under pressure” from “gas mixtures” that may also contain liquid components, and to differentiate “liquids” under a low gas pressure head for inerting from “chemicals under pressure”, it is necessary to introduce some cut-off values.

- (a) The components of “chemicals under pressure” are “predominantly liquids or solids”, while the components of gas mixtures are “predominantly gaseous”. 50% of liquids or solids is proposed as a cut-off value to differentiate chemical under pressure from gas mixtures.
- (b) 200 kPa (gauge) is the minimum pressure used in chapter 2.5, *Gases under pressure* and is proposed as the cut-off value to differentiate chemicals under pressure from liquids packed under a low pressure head of gas.

8. The consequential amendments are set out after the proposed text of the new sub-chapter.

9. The Subcommittees are invited to consider the proposal in Annex 1 to this paper, and indicate whether they are content with the approach and the detail in both Annexes 3 and 4.

Subject to the Subcommittees’ views, CEFIC and EIGA will prepare a working document for the next sessions in June/July 2018.

## “Chapter 2.3

### Aerosols and chemicals under pressure

#### 2.3.0 Introduction

This chapter contains the definitions, classification criteria, hazard communication elements, decision logics and guidance for aerosols and chemicals under pressure. Although they present similar hazards, aerosols and chemicals under pressure are separate hazard classes and are covered in separate sections. While the hazards are similar and the classification is based on flammable properties and heat of combustion, they are presented in two different subchapters due to allowable pressure, capacity and construction of the two kinds of receptacles. A substance or mixture is classified as either an aerosol in accordance with 2.3.1 or a chemical under pressure in accordance with 2.3.2.

#### 2.3.1 Aerosols

##### 2.3.1.1 Definition

*Aerosols, this means aerosol dispensers, are any non-refillable receptacles made of metal, glass or plastics and containing a gas compressed, liquefied or dissolved under pressure, with or without a liquid, paste or powder, and fitted with a release device allowing the contents to be ejected as solid or liquid particles in suspension in a gas, as a foam, paste or powder or in a liquid state or in a gaseous state.*

**NOTE:** *Requirements for the design, manufacture and testing of aerosol dispensers are set out in the Recommendations on the Transport of Dangerous Goods, Model Regulations. In practice, the maximum capacity of aerosol dispensers is generally limited to 1000 ml.*

##### 2.3.1.2 Classification criteria

2.3.1.2.1 Aerosols are classified in one of three categories, depending on their flammable properties and their heat of combustion.

2.3.1.2.2 They should be considered for classification in Category 1 or 2 if they contain more than 1% components (by mass) which are classified as flammable according to the GHS criteria, i.e.:

- Flammable gases (see Chapter 2.2);
- Flammable liquids (see Chapter 2.6);
- Flammable solids (see Chapter 2.7);

or if their heat of combustion is at least 20 kJ/g.

**NOTE:** *Flammable components do not include pyrophoric, self-heating or water-reactive substances and mixtures because such components are not allowed in aerosol dispensers according to the Recommendations on the Transport of Dangerous Goods.*

2.3.1.2.3 An aerosol is classified in one of the three categories for this Class on the basis of its components, of its chemical heat of combustion and, if applicable, of the results of the foam test (for foam aerosols) and of the ignition distance test and enclosed space test (for spray aerosols). See decision logic in 2.3.1.4.1. Aerosols which do not meet the criteria for inclusion in Category 1 or Category 2 (extremely flammable or flammable aerosols) should be classified in Category 3 (non-flammable aerosols).

**NOTE 1:** *Aerosols containing more than 1% flammable components or with a heat of combustion of at least 20 kJ/g, which are not submitted to the flammability classification procedures in this chapter should be classified as aerosols, Category 1.*

**NOTE 2:** *Aerosols do not fall additionally within the scope of chapters 2.2 (flammable gases), 2.3.2 (chemicals under pressure), 2.5 (gases under pressure), 2.6 (flammable liquids) and 2.7 (flammable solids). Depending on their contents, aerosols may however fall within the scope of other hazard classes.*

### 2.3.1.3 Hazard communication

General and specific considerations concerning labelling requirements are provided in *Hazard communication: Labelling* (Chapter 1.4). Annex 1 contains summary tables about classification and labelling. Annex 3 contains examples of precautionary statements and pictograms which can be used where allowed by the competent authority.

Table 2.3.1.1: Label elements for aerosols

	Category 1	Category 2	Category 3
<b>Symbol</b>	Flame	Flame	No symbol
<b>Signal word</b>	Danger	Warning	Warning
<b>Hazard statement</b>	Extremely flammable aerosol Pressurized container: May burst if heated	Flammable aerosol Pressurized container: May burst if heated	Pressurized container: May burst if heated

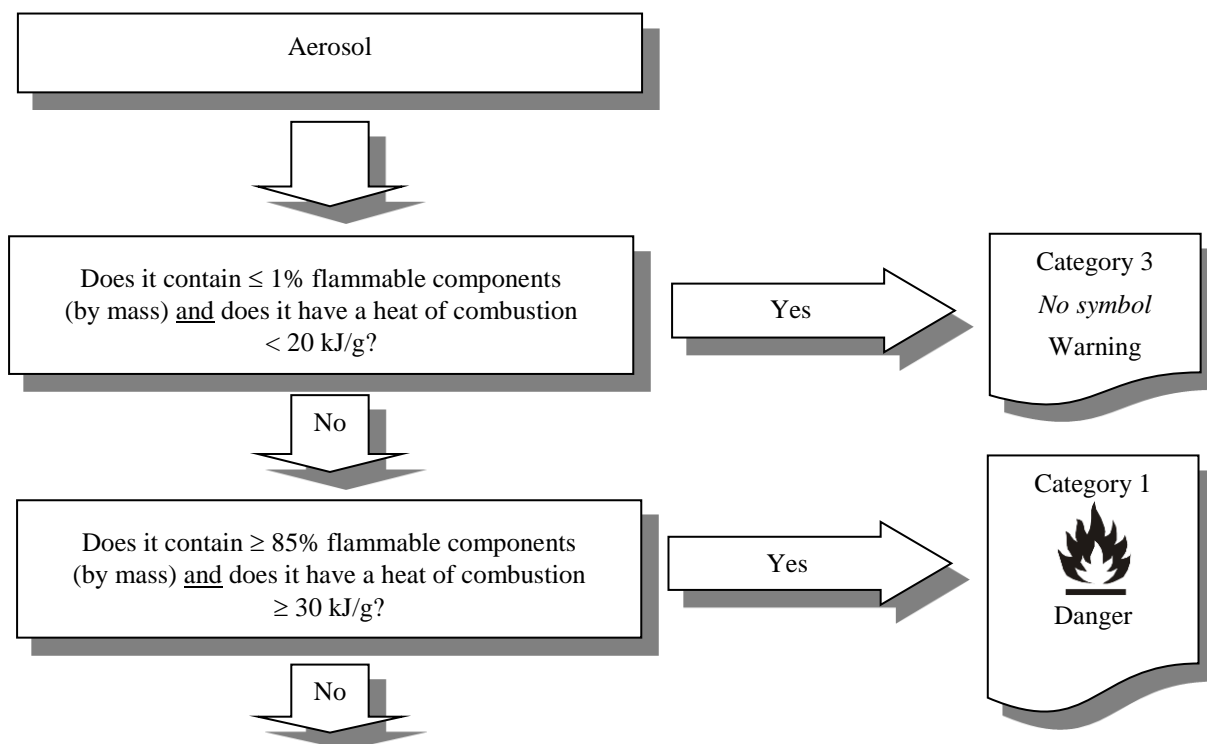
### 2.3.1.4 Decision logic and guidance

The decision logic and guidance, which follow, have been provided here as additional guidance. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

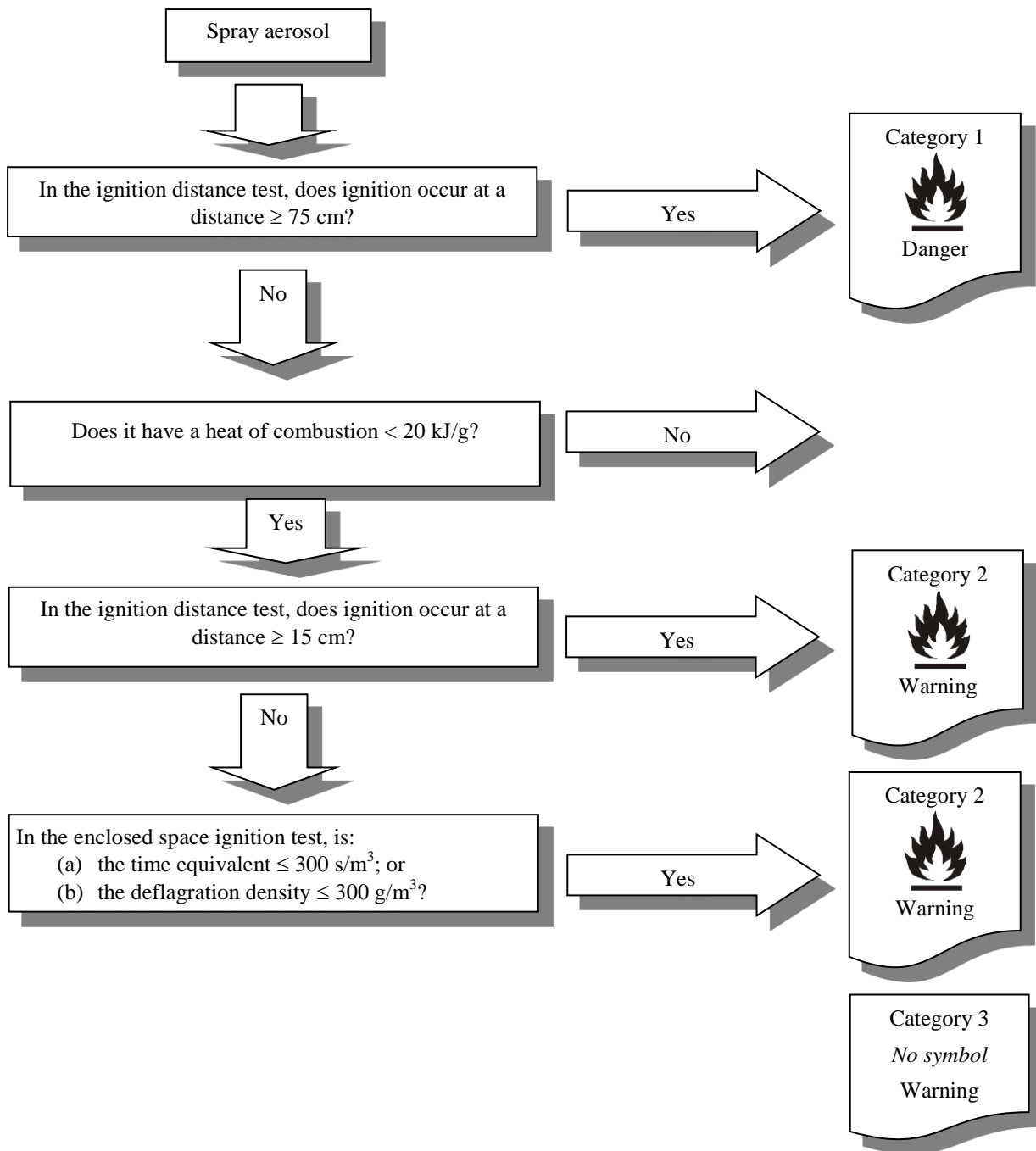
#### 2.3.1.4.1 Decision logic

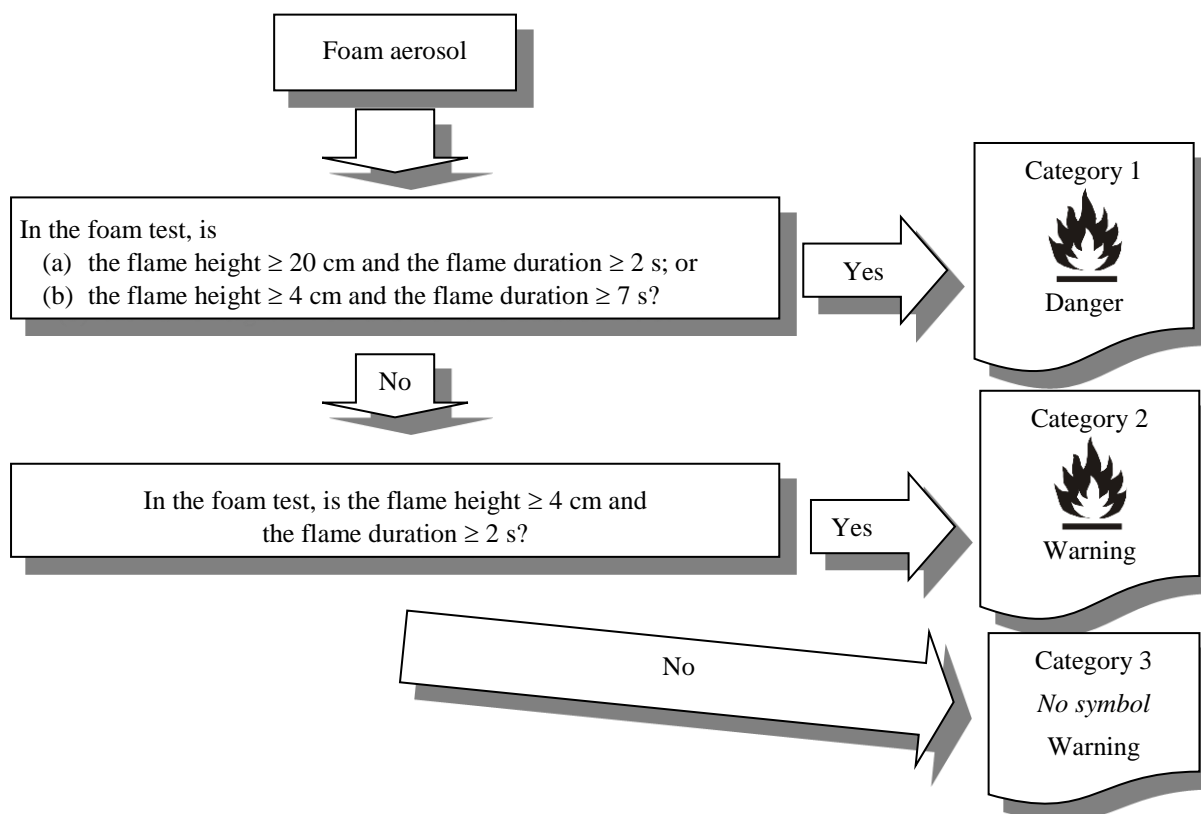
To classify an aerosol data on its flammable components, on its chemical heat of combustion and, if applicable, the results of the foam test (for foam aerosols) and of the ignition distance test and enclosed space test (for spray aerosols) are required. Classification should be made according to decision logics 2.3.1 (a) to 2.3.1 (c).

#### Decision logic 2.3.1 (a) for aerosols



For spray aerosols, go to decision logic 2.3.1 (b);  
For foam aerosols, go to decision logic 2.3.1 (c);

*Decision logic 2.3.1 (b) for spray aerosols*

**Decision logic 2.3.1 (c) for foam aerosols**

[Guidance common to both subchapters and has been moved to 2.3.3]

**2.3.1.4.2** See sub-sections 31.4, 31.5 and 31.6 of the *UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, for Ignition distance test, Enclosed space ignition test, and Aerosol foam flammability test.

## NEW SUB-CHAPTER

**2.3.2 Chemicals under pressure****2.3.2.1 Definition**

*Chemicals under pressure* are mixtures containing 50% or more by mass of liquids or solids [e.g., pastes or powders] and a propellant, in pressure receptacles other than aerosol dispensers, at a pressure of 200 kPa (gauge) or more at 20 °C. The propellant (gas) can be a compressed, liquefied or dissolved gas under pressure.

**NOTE:** *Mixtures, containing less than 50% by mass of liquids or solids, [e.g., pastes or powders], should be considered for classification as gases under pressure (see chapter 2.5) or, if not meeting the criteria for classification as gases under pressure, should be considered for other physical hazard classes appropriate for liquids or solids (see decision logic 2.3.2.).*

**2.3.2.2 Classification criteria**

2.3.2.2.1 Chemicals under pressure are classified in one of three categories, depending on their flammable properties and their heat of combustion (see 2.3.2.4.1).

2.3.2.2.2. Chemicals under pressure should be classified in **Category 1** if

- they contain **at least** 85% components (by mass) which are classified as flammable according to the GHS criteria, i.e.:
  - Flammable gases (see Chapter 2.2);

- Flammable liquids (see Chapter 2.6);
- Flammable solids (see Chapter 2.7);

- **and** their heat of combustion is at least 20 kJ/g.

2.3.2.2.3 Chemicals under pressure are classified in Category 3 if

- they contain **1% or less** components (by mass) that are classified as flammable according to the above GHS criteria, **and**;
- the heat of combustion is **less than 20 kJ/g**.

2.3.2.2.4 Chemicals under pressure are classified in **Category 2** if they do not meet the criteria for Category 1 or 3.

*NOTE:* The flammable components in a chemical under pressure do not include pyrophoric, self-heating or water-reactive substances and mixtures because such components are not allowed in chemicals under pressure according to the Recommendations on the Transport of Dangerous Goods, Model Regulations.

*NOTE:* Chemicals under pressure do not fall additionally within the scope of section 2.3.1 (aerosols), chapters 2.2 (flammable gases), 2.5 (gases under pressure), 2.6 (flammable liquids) and 2.7 (flammable solids). Depending on their contents, chemicals under pressure may however fall within the scope of other hazard classes, including their labelling elements.

### 2.3.2.3 Hazard communication

General and specific considerations concerning labelling requirements are provided in *Hazard communication: Labelling* (Chapter 1.4). Annex 1 contains summary tables about classification and labelling. Annex 3 contains examples of precautionary statements and pictograms which can be used where allowed by the competent authority.

**Table 2.3.2.1: Label elements for chemicals under pressure**

	<b>Category 1</b>	<b>Category 2</b>	<b>Category 3</b>
<b>Symbol</b>	Flame Gas cylinder	Flame Gas cylinder	Gas cylinder
<b>Signal word</b>	Danger	Warning	Warning
<b>Hazard statement</b>	Extremely flammable chemicals under pressure: May burst if heated	Flammable chemicals under pressure: May burst if heated	Chemicals under pressure: May burst if heated

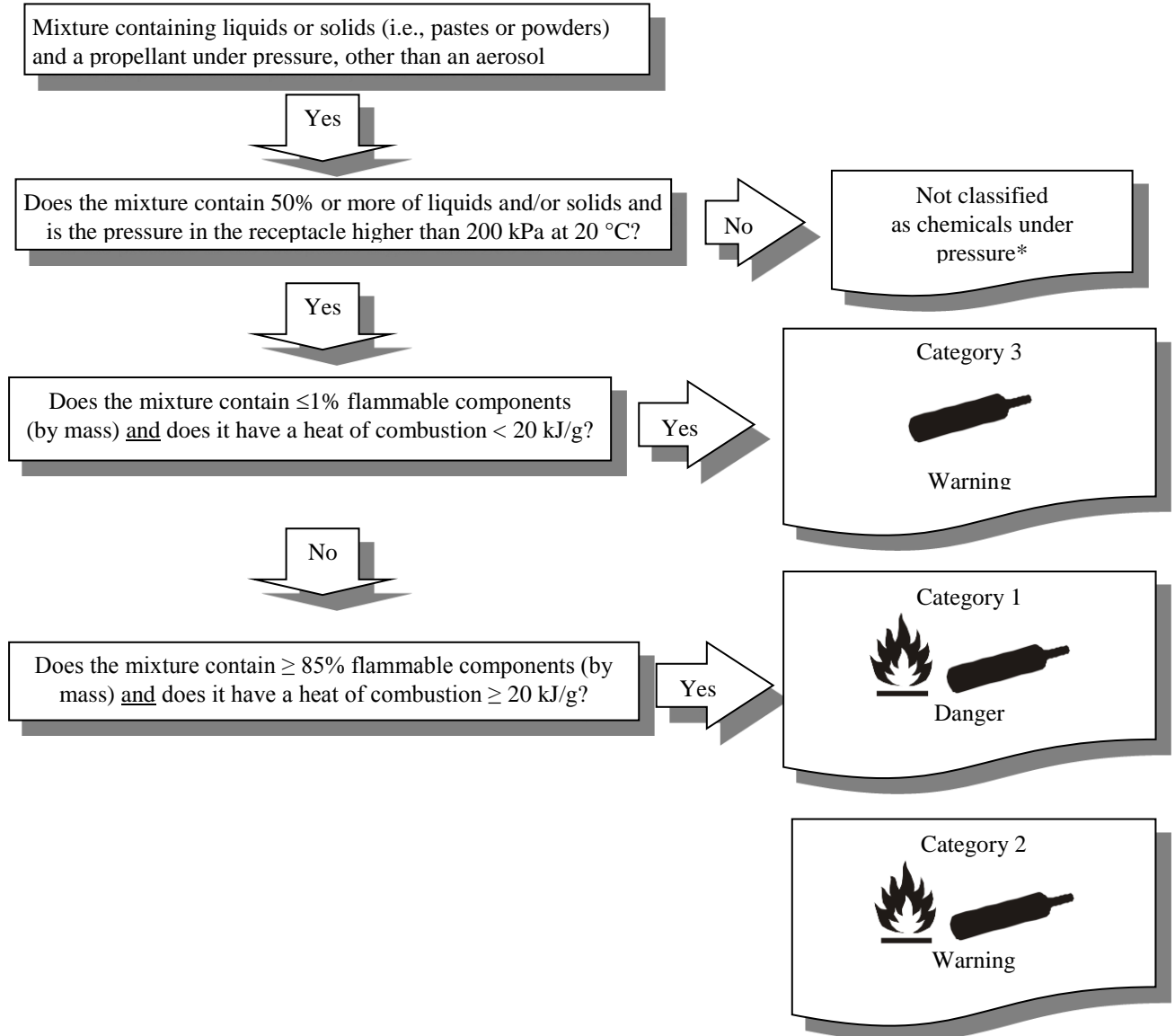
### 2.3.2.4 Decision logic and guidance

Decision logic 2.3.2 and the guidance on chemical heat of combustion in 2.3.3 which follow are not part of the harmonised classification system but have been provided as additional guidance. Mixtures of liquids or solids (i.e., pastes or powders) under pressure may be classified as chemicals under pressure, gases under pressure or in other physical hazard classes appropriate for liquids or solids. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

#### 2.3.2.4.1 Decision logic

To classify a mixture as chemicals under pressure, data on its pressure, its flammable components, and on its chemical heat of combustion are required. Classification should be made according to the decision logic 2.3.2.

*Decision logic 2.3.2*



\*should be considered for classification in other physical hazard classes as appropriate



### 2.3.3 *Guidance on chemical heat of combustion*

The specific heat of combustion ( $\Delta hc$ ), in kilojoules per gram (kJ/g) is the product of the theoretical heat of combustion ( $\Delta h_{\text{comb}}$ ) and the combustion efficiency, usually less than 1.0 (a typical efficiency is 0.95 or 95%).

For a composite formulation, the specific heat of combustion is the summation of the weighted heats of combustion for the individual components, as follows:

$$\Delta hc(\text{product}) = \sum_i^n [w_i\% \times \Delta hc_i]$$

Where:

$\Delta hc$  = specific heat of combustion (kJ/g);

$w_i\%$  = mass fraction of component  $i$  in the product;

$\Delta hc_i$  = specific heat of combustion (kJ/g) of component  $i$  in the product;

The specific heat of combustion can be found in the literature (e.g. Perry's Chemical Engineer's Handbook), calculated or determined by tests (see ASTM D 240, ISO/FDIS 13943:2017 (E/F) 86.1 to 86.3 and NFPA 30B.)"

## Consequential amendments














### Chapter 2.5

Amend the note under 2.5.2.1

**NOTE:** *Aerosols and chemicals under pressure should not be classified as gases under pressure. See Chapter 2.3.*

## Annex 1

## A1.3 Aerosols and Chemicals under pressure (see Chapter 2.3 for classification criteria)

Classification		Labelling			Hazard statement codes	
Hazard class	Hazard category	Pictogram		Signal word		Hazard statement
		GHS	UN Model Regulations <sup>a</sup>			
Aerosols	1			<b>Danger</b>	Extremely flammable aerosol. Pressurized container: May burst if heated	H222 H229
	2			<b>Warning</b>	Flammable aerosol. Pressurized container: May burst if heated	H223 H229
	3	No pictogram		<b>Warning</b>	Pressurized container: May burst if heated	H229
Chemicals under pressure	1	 		<b>Danger</b>	Extremely flammable chemicals under pressure: May burst if heated	Hxxx
	2	 		<b>Warning</b>	Flammable chemicals under pressure: May burst if heated	Hyyy
	3			<b>Warning</b>	Chemicals under pressure: May burst if heated	Hzzz

<sup>a</sup> Under the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, the symbol, number and border line may be shown in black or white. The background colour is red for categories 1 and 2 and green for category 3.

## Annex 3

### Section 1, Table A3.1.1 – Hazard statement codes for physical hazards

Insert new rows for chemicals under pressure to read as follows:

Code (1)	Physical hazard statements (2)	Hazard class (GHS chapter) (3)	Hazard category (4)
<b>Hxxx</b>	Extremely flammable chemicals under pressure: May burst if heated	Chemicals under pressure (chapter 2.3)	<b>1</b>
<b>Hyyy</b>	Flammable chemicals under pressure: May burst if heated	Chemicals under pressure (chapter 2.3)	<b>2</b>
<b>Hzzz</b>	Chemicals under pressure: May burst if heated	Chemicals under pressure (chapter 2.3)	<b>3</b>

### Section 2, Table A3.2.2 – Codification of prevention precautionary statements

Insert new rows for chemicals under pressure to read as follows:

Code (1)	Prevention precautionary statement (2)	Hazard Class (3)	Hazard Category (4)	Conditions for use (5)
P210	Keep away from heat, hot surfaces, sparks open flames and other ignition sources. No smoking	Chemicals under pressure (chapter 2.3)	1, 2, 3	
P211	Do not spray on an open flame or other ignition source	Chemicals under pressure (chapter 2.3)	1, 2	

### Section 2, Table A3.2.3 - Codification of response precautionary statements

Insert new rows for chemicals under pressure to read as follows:

Code (1)	Prevention precautionary statement (2)	Hazard Class (3)	Hazard Category (4)	Conditions for use (5)
P381	In case of leakage, eliminate all ignition sources.	Chemicals under pressure (chapter 2.3)	1,2	
P376	Stop leak if safe to do so.	Chemicals under pressure (chapter 2.3)	1, 2, 3	
P370 + P378	In case of fire, use .... to extinguish.	Chemicals under pressure (chapter 2.3)	1, 2	Manufacturer/supplier or the competent authority to specify appropriate media.

## Section 2, Table A3.2.4 - Codification of storage precautionary statements

Insert new rows for chemicals under pressure to read as follows:

Code (1)	Prevention precautionary statement (2)	Hazard Class (3)	Hazard Category (4)	Conditions for use (5)
P403	Store in a well-ventilated place.	Chemicals under pressure (chapter 2.3)	1, 2, 3	
P410	Protect from sunlight.	Chemical under pressure (chapter 2.3.2)	1, 2, 3	<i>May be omitted for chemicals under pressure filled in transportable cylinders in accordance with packing instruction P200 of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, unless those chemicals under pressure are subject to (slow) decomposition or polymerisation, or the competent authority provides otherwise.</i>
P410 + P403	Protect from sunlight. Store in a well-ventilated place.	Chemicals under pressure (chapter 2.3)	1, 2, 3	

## Annex 3

## Section 3 - Use of Precautionary Statements

## Aerosols and Chemicals Under Pressure (Chapter 2.3)

Hazard Category	Symbol	Signal Word	Hazard Statement
1	Flame and gas cylinder 	Danger	Hxxx - Extremely flammable chemicals under pressure: May burst if heated
2	Flame and gas cylinder 	Warning	Hyyy - Flammable chemicals under pressure: May burst if heated

Precautionary Statements			
Prevention	Response	Storage	Disposal
P210 Keep away from heat, hot surfaces, sparks open flames and other ignition sources. No smoking. P211 Do not spray on an open flame or other ignition source.	P381 In case of leakage, eliminate all ignition sources. P376 Stop leak if safe to do so. P370 + P378 In case of fire, use .... to extinguish.	P410 + P403 Protect from sunlight. Store in a well-ventilated place.  <i>P410 may be omitted for chemicals under pressure filled in transportable cylinders in accordance with packing instruction P200 of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, unless those chemicals under pressure are subject to (slow) decomposition or polymerisation, or the competent authority provides otherwise.</i>	

Hazard Category	Symbol	Signal Word	Hazard Statement
3	Gas cylinder 	Warning	Hzzz - Chemicals under pressure: May burst if heated

Precautionary Statements			
Prevention	Response	Storage	Disposal
P210 Keep away from heat, hot surfaces, sparks open flames and other ignition sources. No smoking.	P376 Stop leak if safe to do so.	P410 + P403 Protect from sunlight. Store in a well-ventilated place.  <i>P410 may be omitted for chemicals under pressure filled in transportable cylinders in accordance with packing instruction P200 of the UN Recommendations on the Transport of Dangerous Goods, Model Regulations, unless those chemicals under pressure are subject to (slow) decomposition or polymerisation, or the competent authority provides otherwise.</i>	

In Annex 4, Section 9 – Guidance on the preparation of Safety Data Sheets (SDS), physical and chemical properties and safety characteristics, Table A4.3.9.2, Data relevant with regard to physical hazard classes (supplemental), update the row for aerosols and add a new line for chemicals under pressure as follows:

Chapter	Hazard Class	Property/Safety characteristic/ Test result and Remarks/Guidance
2.3; section 2.3.1	Aerosols	– indicate the total percentage (by mass) of flammable components unless the Aerosol is classified as Aerosol cat. 1 because it contains more than 1 % flammable components or has a heat of combustion of at least 20 kJ/g and is not submitted to the flammability classification procedures (see the Note 1 in Chapter 2.3, paragraph 2.3.1.2)
2.3; section 2.3.2	Chemicals under pressure	– indicate the total percentage (by mass) of flammable components – indicate the heat of combustion (generally in kJ/g)