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# Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

Classification criteria for substances and mixtures  
Physical hazards

*(The contents of this presentation have been updated according to the fourth revised edition of the GHS, published in 2011)*

# Physical hazards

1. Explosives (Chap.2.1)
2. Flammable gases (including chemically unstable gases) (Chap.2.2)
3. Aerosols (Chap.2.3)
4. Oxidizing gases (Chap.2.4)
5. Gases under pressure (Chap.2.5)
6. Flammable liquids (Chap.2.6)
7. Flammable solids (Chap.2.7)
8. Self-reactive substances and mixtures (Chap.2.8)
9. Pyrophoric liquids (Chap.2.9)
10. Pyrophoric solids (Chap.2.10)
11. Self-heating substances and mixtures (Chap. 2.11)
12. Substances and mixtures which, in contact with water, emit flammable gases (Chap.2.12)
13. Oxidizing liquids (Chap.2.13)
14. Oxidizing solids (Chap.2.14)
15. Organic peroxides (Chap.2.15)
16. Corrosive to metals (Chap.2.16)

# Explosives (1)

The class of explosives comprises:

- **Explosive substances and mixtures**
- **Explosive articles** (except devices containing explosive substances or mixtures in such quantity or of such a character that their ignition or initiation shall not cause any effect external to the device); and
- **Substances, mixtures and articles not mentioned above** which are manufactured to produce a practical, explosive or pyrotechnic effect

# Explosives (2)

## Explosive substance or mixture:

Solid or liquid substance or mixture which, by chemical reaction, is in itself capable of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings

## Pyrotechnic substance/mixture:

Substance/mixture designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions

## Explosive article:

Article containing one or more explosive substances or mixtures

## Pyrotechnic article:

Article containing one or more pyrotechnic substances or mixtures

# Explosives (3)

**Explosives and articles** of this class, not classified as unstable explosives **are assigned to one of the 6 divisions below** according to the hazards they present:

<b>Division</b>	<b>Type of hazard</b>
<b>1.1</b>	Mass explosion hazard
<b>1.2</b>	Projection hazard
<b>1.3</b>	Fire hazard and minor blast and or projection hazard
<b>1.4</b>	No significant hazard in case of ignition/initiation
<b>1.5</b>	Insensitive substances/mixtures with mass explosion hazard
<b>1.6</b>	Extremely insensitive substances/mixtures with no mass explosion hazard

# Explosives (4)

Explosives and articles are classified and allocated to a division according to the results of Test Series 2 to 7 of Part I of the UN Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.5)

## Three step procedure:

1. Ascertain if the substance/mixture has explosive effects: Test Series 1
2. Acceptance procedure (as explosive): Test Series 2 to 4
3. Assignment to a hazard division: Test Series 5 to 7

# Explosives (5)

“Ammonium nitrate emulsions or suspensions or gels, intermediate for blasting explosives (ANE)” may be insensitive enough to be considered for classification as oxidizing liquids or solids.

Classification is made on the basis of the results of Test Series 8

# Explosives (6)

## Substance/mixture not classified as explosive if:

- a) There are no chemical groups with explosive properties (examples of such groups: see Annex 6, Table A6.1 of the *Manual of Tests and Criteria*);
- b) There are chemical groups with explosive properties which include oxygen and the calculated oxygen balance  $< -200$
- c) When the organic substance or a homogenous mixture of organic substances contain chemical groups associated with explosive properties but the exothermic decomposition energy is less than 500 J/g and the onset of exothermic decomposition is below 500°C.

# Explosives (7)

- d) For mixtures of inorganic oxidizing substances with organic material(s), the concentration of the inorganic oxidizing substance is:
  - i) less than 15 %, by mass, if the oxidizing substance is assigned to Category 1 or 2;
  - ii) less than 30 %, by mass, if the oxidizing substance is assigned to Category 3.

# Flammable gases (1)

A flammable gas is a gas having a flammable range with air at 20 °C and a standard pressure of 101.3 kPa

- **Category 1: Extremely flammable gas**

Gases ignitable when in mixture of  $\leq 13\%$  in air or having a flammable range with air of  $\geq 12\%$  (regardless of the lower flammable limit)

- **Category 2: Flammable gas**

Gases, other than those of Category 1, having a flammable range while mixed in air

To classify a flammable gas, data on its flammability are required. Classification is according to decision logic 2.2 (a)

# Flammable gases (2): Chemically unstable gases

A **chemically unstable gas** is a flammable gas that is able to react explosively even in the absence of air or oxygen.

A flammable gas that is also chemically unstable is additionally classified in one of the following two categories using the methods described in Part III of the Manual of Tests and Criteria according to the following criteria:

**Category A:** Flammable gases which are chemically unstable at 20°C and a standard pressure of 101.3 kPa

**Category B:** Flammable gases which are chemically unstable at a temperature greater than 20°C and/or a pressure greater than 101.3 kPa

To classify a flammable gas as **chemically unstable**, data on its chemical instability are required. Classification is according to decision logic 2.2 (b)

# Aerosols (1)

**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.

## Aerosols (2)

Aerosols are classified in one of the three categories for this Class on the basis of :

- their content in flammable components (liquid, solid or gases classified as flammable according to the GHS).
- their chemical heat of combustion\*
- the results of the tests:
  - Foam test\*\* (for foam aerosols),
  - Ignition distance test\*\* (for spray aerosols);
  - Enclosed space ignition test\* (for spray aerosols);

\* *mainly transport/storage*

\*\* *mainly worker/consumer*

# Aerosols (3)

**Category 1:** Extremely flammable aerosol

**Category 2:** Flammable aerosol

**Category 3:** Non-flammable aerosol

Aerosols which do not meet the criteria for inclusion in Category 1 or Category 2 should be classified in Category 3

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 chapter 2.3 of the GHS should be classified as aerosols, Category 1

## Aerosols (4)

To classify an aerosol as a flammable 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 logic 2.3 (a): for aerosols
- Decision logic 2.3 (b): for spray aerosols
- Decision logic 2.3 (c): for foam aerosols

# Oxidizing gases (1)

**An oxidizing gas is** any gas which may, generally by providing oxygen, cause or contribute to the combustion of other material more than air does.

“Gases which cause or contribute to the combustion of other material more than air does” means pure gases or gas mixtures with an oxidizing power greater than 23.5% as determined by a method specified in ISO 10156:2010.

**One single category for this class: Category 1**

## Oxidizing gases (2)

To classify an oxidizing gas, tests or calculation methods as described in ISO 10156:2010 "Gases and gas mixtures – Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets" should be performed.

Classification should be made according to decision logic 2.4

# Gases under pressure (1)

**Gases under pressure** are gases contained in a receptacle at a pressure of 200 kPa (gauge) or more, or which are liquefied or liquefied and refrigerated

*This definition covers four types of gases or gas mixtures to cope with effects of pressure or freezing which may lead to serious damage to people/surroundings or death of people independently from other hazards gases may possess*

# Gases under pressure (2)

According to their physical state when packaged they are classified as:

<b>Compressed gas</b>	A gas entirely gaseous at $-50\text{ }^{\circ}\text{C}$ ; (includes all gases with a critical temperature $\leq -50\text{ }^{\circ}\text{C}$ ).
<b>Liquefied gas</b>	Partially liquid at temperatures above $-50\text{ }^{\circ}\text{C}$ . (a) High pressure liquefied gas: critical temperature between $-50\text{ }^{\circ}\text{C}$ and $+65\text{ }^{\circ}\text{C}$ ; and (b) Low pressure liquefied gas: a gas with a critical temperature above $+65\text{ }^{\circ}\text{C}$ .
<b>Refrigerated liquefied gas</b>	Partially liquid because of its low temperature.
<b>Dissolved gas</b>	Dissolved in a liquid phase solvent.

Classification should be made according to decision logic 2.5

# Flammable liquids (1)

**Flammable liquids** are liquids having a flash point of not more than 93 °C. They are **classified** under one of the 4 categories of this class according to the following criteria:

**Category 1: Extremely flammable liquid and vapour**

- Flash point < 23 °C and initial boiling point ≤ 35 °C

**Category 2: Highly flammable liquid and vapour**

- Flash point < 23 °C and initial boiling point > 35 °C

**Category 3: Flammable liquid and vapour**

- Flash point ≥ 23 °C and ≤ 60 °C

**Category 4: Combustible liquid**

- Flash point > 60 °C and ≤ 93 °C

**Classification** should be made according to decision logic 2.6

## Flammable liquids (2)

**Gas oils, diesel and light heating oils** in the flash point range of 55 °C to 75 °C may be regarded as a special group for some regulatory purposes

**Liquids with a flash point of more than 35 °C and not more than 60 °C** may be regarded as non-flammable liquids for some regulatory purposes (e.g. transport) if negative results have been obtained in the sustained combustibility test L.2 of Part III, section 32 of the UN Manual of Tests and Criteria

**Viscous flammable liquids** such as paints, enamels, lacquers, varnishes, adhesives and polishes may be regarded as a special group for some regulatory purposes (e.g. transport). The classification or the decision to consider these liquids as non-flammable may be determined by the pertinent regulation or competent authority

**Aerosols** should not be classified as flammable liquids (see GHS, Chap. 2.3)

# Flammable solids (1)

**Flammable solids are** solids which are readily combustible, or may cause or contribute to fire through friction

**Readily combustible solids are** powdered, granular, or pasty substances which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly

**Flammable solids are** classified in one of the 2 categories for this class according to the results of the burning rate test (Test method N.1: see Part III, sub-section 33.2.1 of the *UN Manual of Tests and Criteria*)

# Flammable solids (2)

## Category 1:

- Burning rate test:
  - Substances or mixtures other than metal powders:
    - (a) wetted zone does not stop fire; and
    - (b) burning time  $< 45$  s or burning rate  $> 2.2$  mm/s
  - Metal powders: burning time  $\leq 5$  min

## Category 2:

- Burning rate test:
  - Substances or mixtures other than metal powders:
    - (a) wetted zone stops the fire for at least 4 min; and
    - (b) burning time  $< 45$  s or burning rate  $> 2.2$  mm/s
  - Metal powders: burning time  $> 5$  min and  $\leq 10$  min

**Classification** should be made according to decision logic 2.7

# Self-reactive substances and mixtures (1)

**Self-reactive substances and mixtures** are thermally unstable liquid or solid substances or mixtures liable to undergo a strongly exothermic decomposition even without participation of oxygen (air).

This definition **excludes substances and mixtures classified** under the GHS **as explosives** (Chapter 2.1), **organic peroxides** (Chapter 2.15) or as **oxidizing** (chapters 2.13 and 2.14).

# Self-reactive substances and mixtures (2)

7 categories for this class ("types A to G"). Classification to be made according to the results of Test Series A to H described in Part II of the *UN Manual of Tests and Criteria*:

- Test series A: determine if there is propagation of detonation
- Test series B: determine if there is detonation in the package
- Test series C: determine if there is propagation of deflagration
- Test series D: determine if there is rapid deflagration in the package
- Test series E: determine the effect of heating under confinement
- Test series F: determine the explosive power
- Test series G: determine if there is thermal explosion in the package
- Test series H: determine the self-accelerating decomposition temp.

Classification is according to decision logic 2.8

# Self-reactive substances and mixtures (3)

Classification procedures need not be applied if:

- a) There are no chemical groups with explosive properties or self-reactive properties (examples in Annex 6, Tables A6.1 and A6.2, of the *UN Manual of Tests and Criteria*);
- b) For a single organic substance or a homogeneous mixture of organic substances, the estimated SADT  $>75$  °C (related to a 50 kg package), or exothermic decomposition energy  $<300$  J/g.

# Pyrophoric liquids and solids

**Pyrophoric liquids/solids** are liquids/solids which, even in small quantities, are liable to ignite within five minutes after coming into contact with air

Pyrophoric liquids and solids are **classified under one unique category for each class** (Category 1) **on the basis of the results of** the following tests of the *Manual of Tests and Criteria*:

- **For liquids**: Test N.3 (Part III, sub-section 33.3.1.5); and
- **For solids**: Test N.4 (Part III, sub-section 33.3.1.6).

Classification of pyrophoric liquids is according to decision logic 2.9

Classification of pyrophoric solids is according to decision logic 2.10

# Self-heating substances and mixtures (1)

A self-heating substance or mixture is a solid or liquid substance or mixture, other than a pyrophoric liquid or solid, which, by reaction with air and without energy supply, is liable to self-heat. These substances or mixtures differ from a pyrophoric liquid or solid in that they will ignite only when in large amounts (kg) and after long periods of time (hours or days).

Classification to be made according to the results obtained in test method N.4 (Part III, sub-section 33.3.1.6 of the *UN Manual of Tests and Criteria*). Test method N.4 determine the ability of the substance or mixture to undergo oxidative self-heating by exposure of it to air at temperatures of 100 °C, 120 °C or 140 °C in a 25 mm or 100 mm wire mesh cube.

2 categories for this class

# Self-heating substances and mixtures (2)

## Category 1:

A positive result is obtained in a test using a 25 mm sample cube at 140 °C

## Category 2:

- (a) A positive result is obtained in a test using a 100 mm sample cube at 140 °C and a negative result is obtained in a test using a 25 mm cube sample at 140 °C and the substance or mixture is to be packed in packages with a volume of more than 3 m<sup>3</sup>; or
- (b) A positive result is obtained in a test using a 100 mm sample cube at 140 °C and a negative result is obtained in a test using a 25 mm cube sample at 140 °C, a positive result is obtained in a test using a 100 mm cube sample at 120 °C and the substance or mixture is to be packed in packages with a volume of more than 450 litres; or
- (c) A positive result is obtained in a test using a 100 mm sample cube at 140 °C and a negative result is obtained in a test using a 25 mm cube sample at 140 °C and a positive result is obtained in a test using a 100 mm cube sample at 100 °C.

# Self-heating substances and mixtures (3)

**Classification** is according to decision logic 2.11

**Classification procedure need not be applied** if the results of a screening test can be adequately correlated with the classification test and an appropriate safety margin is applied

**Examples of screening tests are:**

- (a) **The Bulk Powder Screening Test** with an onset temp. 60K above the reference temp. for a volume of 1 L
- (b) **The Grewer Oven test** with an onset temp. 80K above the reference temp. for a volume of 1 L

# Substances and mixtures which, in contact with water, emit flammable gases (1)

Substances and mixtures which, in contact with water, emit flammable gases are substances or mixtures which, in contact with water, emit flammable gases are solid or liquid substances or mixtures which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities

A substance or mixture shall be classified in one of the 3 categories of this class if:

- (a) Spontaneous ignition takes place in any step of the test procedure; or
- (b) There is an evolution of a flammable gas at a rate  $> 1$  litre/kg of substance per hour

according to test method N.5 (Part III, sub-section 33.4.1.4 of the *UN Manual of Tests and Criteria*)

# Substances and mixtures which, in contact with water, emit flammable gases (2)

## Category 1:

Any substance or mixture which reacts vigorously with water at ambient temperatures and demonstrates generally a tendency for the gas produced to ignite spontaneously, or which reacts readily with water at ambient temperatures such that the rate of evolution of flammable gas is equal to or greater than 10 litres per kilogram of substance over any one minute

## Category 2:

Any substance or mixture which reacts readily with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 20 litres per kilogram of substance per hour, and which does not meet the criteria for Category 1

## Category 3:

Any substance or mixture which reacts slowly with water at ambient temperatures such that the maximum rate of evolution of flammable gas is equal to or greater than 1 litre per kilogram of substance per hour, and which does not meet the criteria for Categories 1 and 2

## Substances and mixtures which, in contact with water, emit flammable gases (3)

**Classification** is in accordance with [decision logic 2.12](#)

**Classification procedure need not to be applied if:**

- a) The chemical structure does not contain metals or metalloids
- b) Experience in production or handling shows that it does not react with water (e.g. substance manufactured with water or washed with water); or
- c) The substance or mixture is known to be soluble in water to form a stable mixture

# Oxidizing liquids (1)

**An oxidizing liquid is** a liquid which, while in itself not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material

Liquids are **classified in one of the three categories of this class in accordance with test method O.2** (Part III, sub-section 34.4.2 of the *UN Manual of Tests and Criteria*)

**The test results are assessed on the basis of:**

- a) Whether the mixture substance/cellulose spontaneously ignites; and
- b) The comparison of the mean time taken for the pressure to rise from 690 kPa to 2070 kPa (gauge), with those of the reference substances

# Oxidizing liquids (2)

## Category 1:

Any substance or mixture which, in the 1:1 mixture, by mass, of substance (or mixture) and cellulose tested, spontaneously ignites; or the mean pressure rise time of a 1:1 mixture, by mass, of substance and cellulose is less than that of a 1:1 mixture, by mass, of 50% perchloric acid and cellulose

## Category 2:

Any substance or mixture which, in the 1:1 mixture, by mass, of substance (or mixture) and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 40% aqueous sodium chlorate solution and cellulose; and the criteria for Category 1 are not met

## Category 3:

Any substance or mixture which, in the 1:1 mixture, by mass, of substance (or mixture) and cellulose tested, exhibits a mean pressure rise time less than or equal to the mean pressure rise time of a 1:1 mixture, by mass, of 65% aqueous nitric acid and cellulose; and the criteria for Categories 1 and 2 are not met

**Classification** is in accordance with [decision logic 2.13](#)

# Oxidizing liquids (3)

Classification procedure for this class need not be applied:

– For organic substances/mixtures if:

- (i) They do not contain oxygen, fluorine or chlorine; or
- (ii) They contain oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen

– For inorganic substances/mixtures, if:

- They do not contain oxygen or halogen atoms

# Oxidizing solids (1)

**An oxidizing solid is** a solid which, while in itself is not necessarily combustible, may, generally by yielding oxygen, cause, or contribute to, the combustion of other material

Solids are **classified in one of the three categories of this class in accordance with test method O.1** (Part III, sub-section 34.4.1 of the *UN Manual of Tests and Criteria*)

**The test results are assessed on the basis of:**

- (a) Whether the mixture substance/cellulose ignites and burns; and
- (b) the comparison of the mean burning time with those of the reference mixtures

# Oxidizing solids (2)

## Category 1:

Any substance or mixture which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose.

## Category 2:

Any substance or mixture which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose and the criteria for Category 1 are not met.

## Category 3:

Any substance or mixture which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose and the criteria for Categories 1 and 2 are not met.

**Classification** is in accordance with decision logic 2.14

# Oxidizing solids (3)

Classification procedure for this class need not be applied:

- For organic substances/mixtures if:
  - They do not contain oxygen, fluorine or chlorine; or
  - They contain oxygen, fluorine or chlorine and these elements are chemically bonded only to carbon or hydrogen
- For inorganic substances/mixtures, if:
  - They do not contain oxygen or halogen atoms

# Organic peroxides (1)

**Organic peroxides** are liquid or solid organic substances which contain the bivalent -O-O- structure and may be considered derivatives of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals

The term **also includes organic peroxide formulations (mixtures)**

## Organic peroxides (2)

They are thermally unstable substances or mixtures which may:

- undergo exothermic self-accelerating decomposition
- be liable to explosive decomposition
- burn rapidly
- be sensitive to impact or friction
- react dangerously with other substances

will be regarded as possessing explosive properties when in laboratory testing the formulation is liable to detonate, to deflagrate rapidly or to show a violent effect when heated under confinement

# Organic peroxides (3)

7 categories for this class ("types A to G")

Classification to be made according to the results of Test Series A to H described in Part II of the *UN Manual of Tests and Criteria*:

- Test series A: determine if there is propagation of detonation
- Test series B: determine if there is detonation in the package
- Test series C: determine if there is propagation of deflagration
- Test series D: determine if there is rapid deflagration in the package
- Test series E: determine the effect of heating under confinement
- Test series F: determine the explosive power
- Test series G: determine if there is thermal explosion in the package
- Test series H: determine the self-accelerating decomposition temp.

Classification is in accordance with decision logic 2.15

# Corrosive to metals

Substance or a mixture which by chemical action will materially damage, or even destroy, metals.

Substances/mixtures corrosive to metals are classified in a single category for this class, according to the test in Part III, sub-section 37.4 of the *Manual of Tests and Criteria*

Classification is in accordance with decision logic 2.16

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# Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

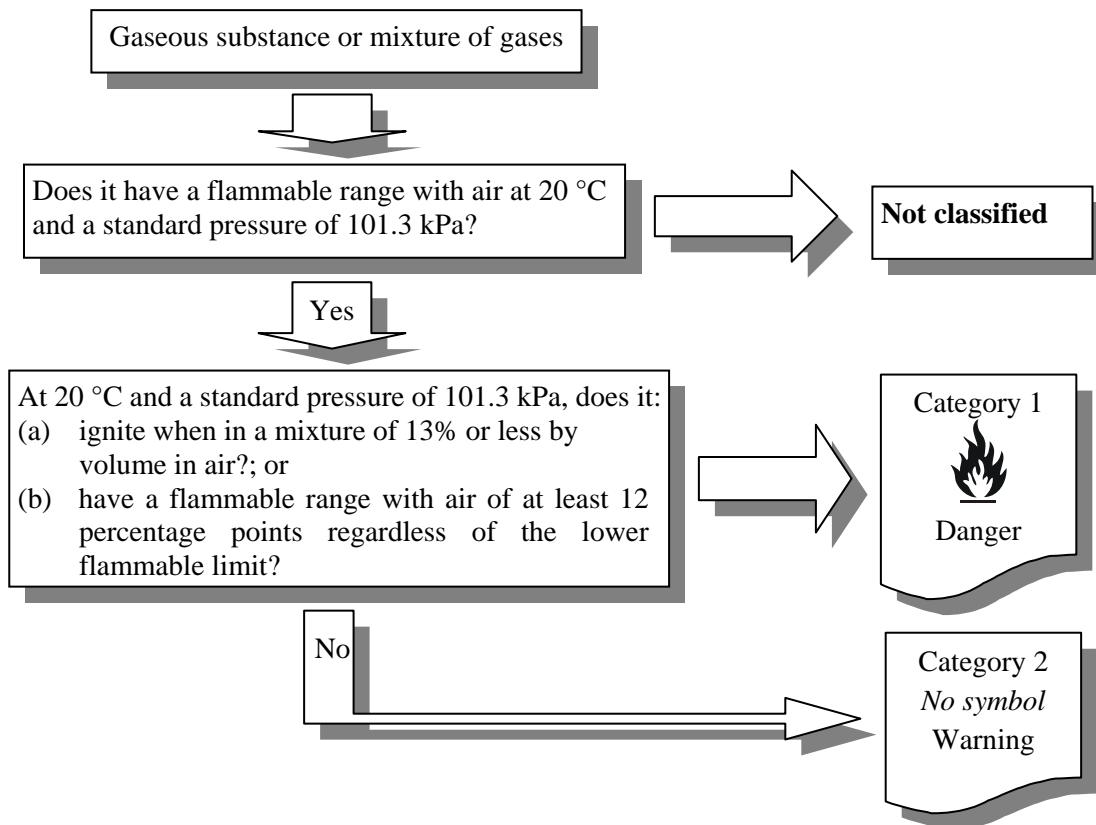
End of Classification criteria for substances and mixtures  
Physical hazards

*(The contents of this presentation have been updated according to the fourth revised edition of the GHS, published in 2011)*

### 2.2.4.1 Decision logic for flammable gases

To classify a flammable gas, data on its flammability are required. The classification is according to decision logic 2.2 (a).

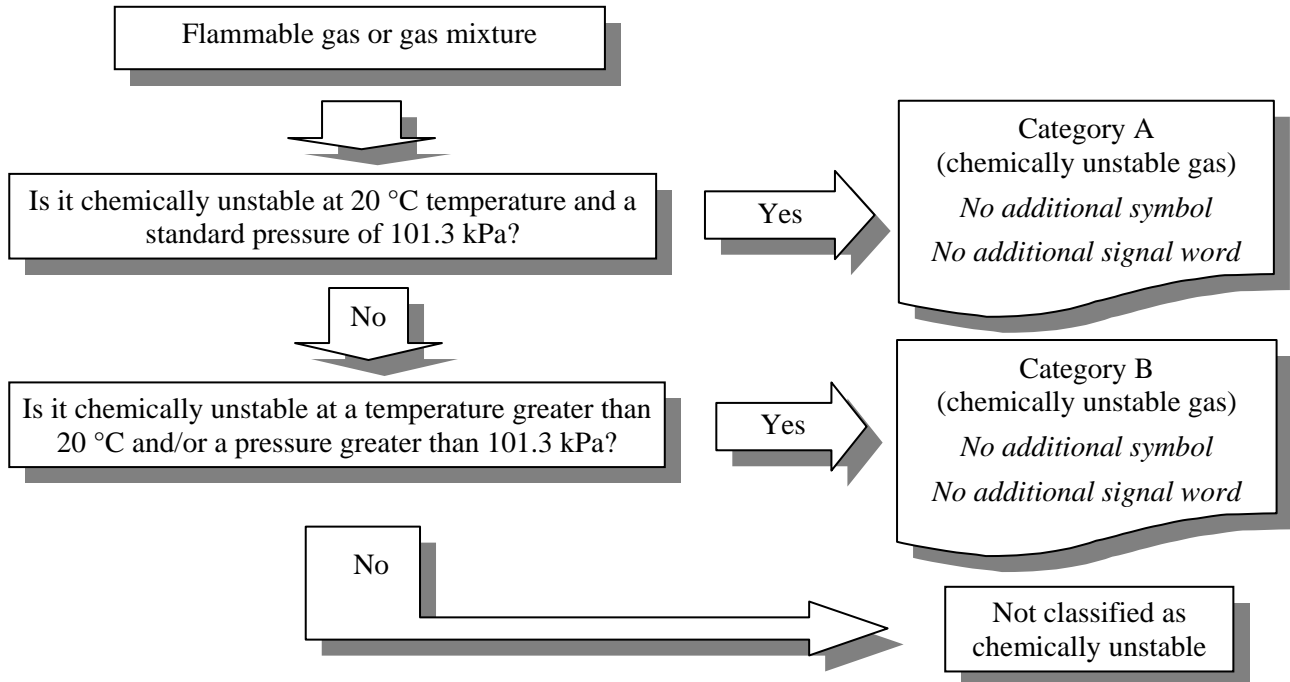
#### Decision logic 2.2 (a)



### 2.2.4.2 Decision logic for chemically unstable gases

To classify a flammable gas as chemically unstable, data on its chemical instability are required. The classification is according to decision logic 2.2 (b).

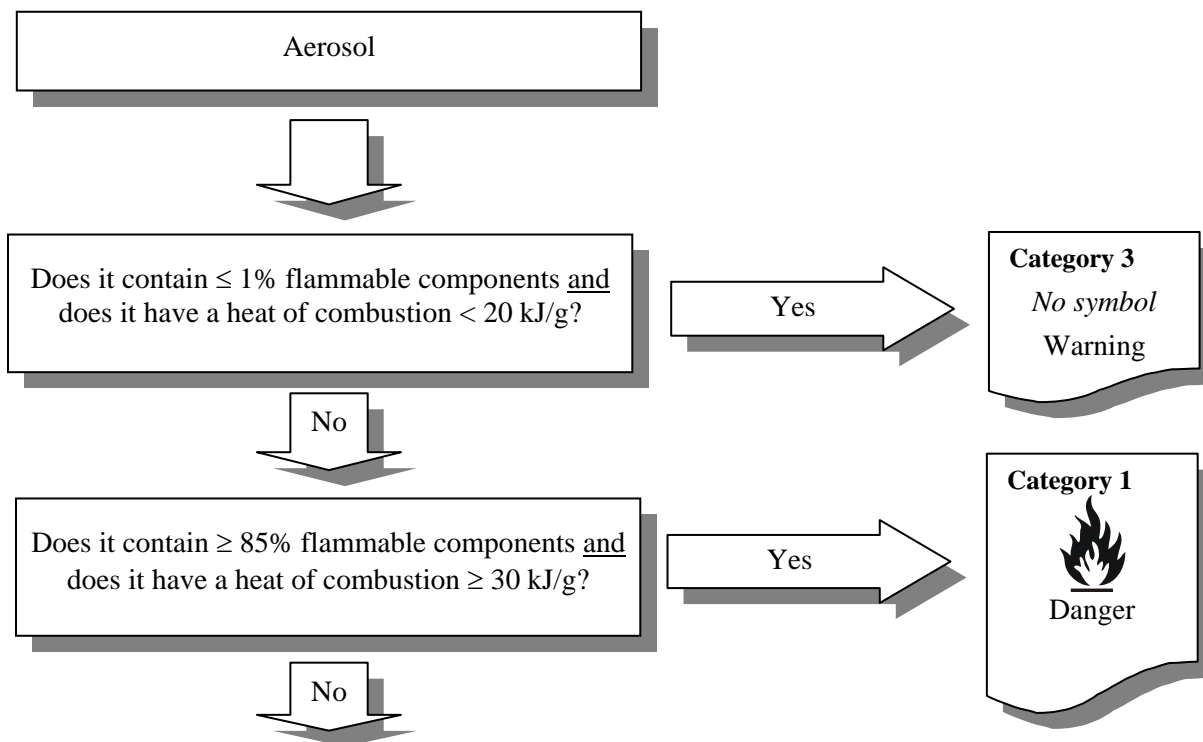
#### Decision logic 2.2 (b)



### 2.3.4.1 Decision logic

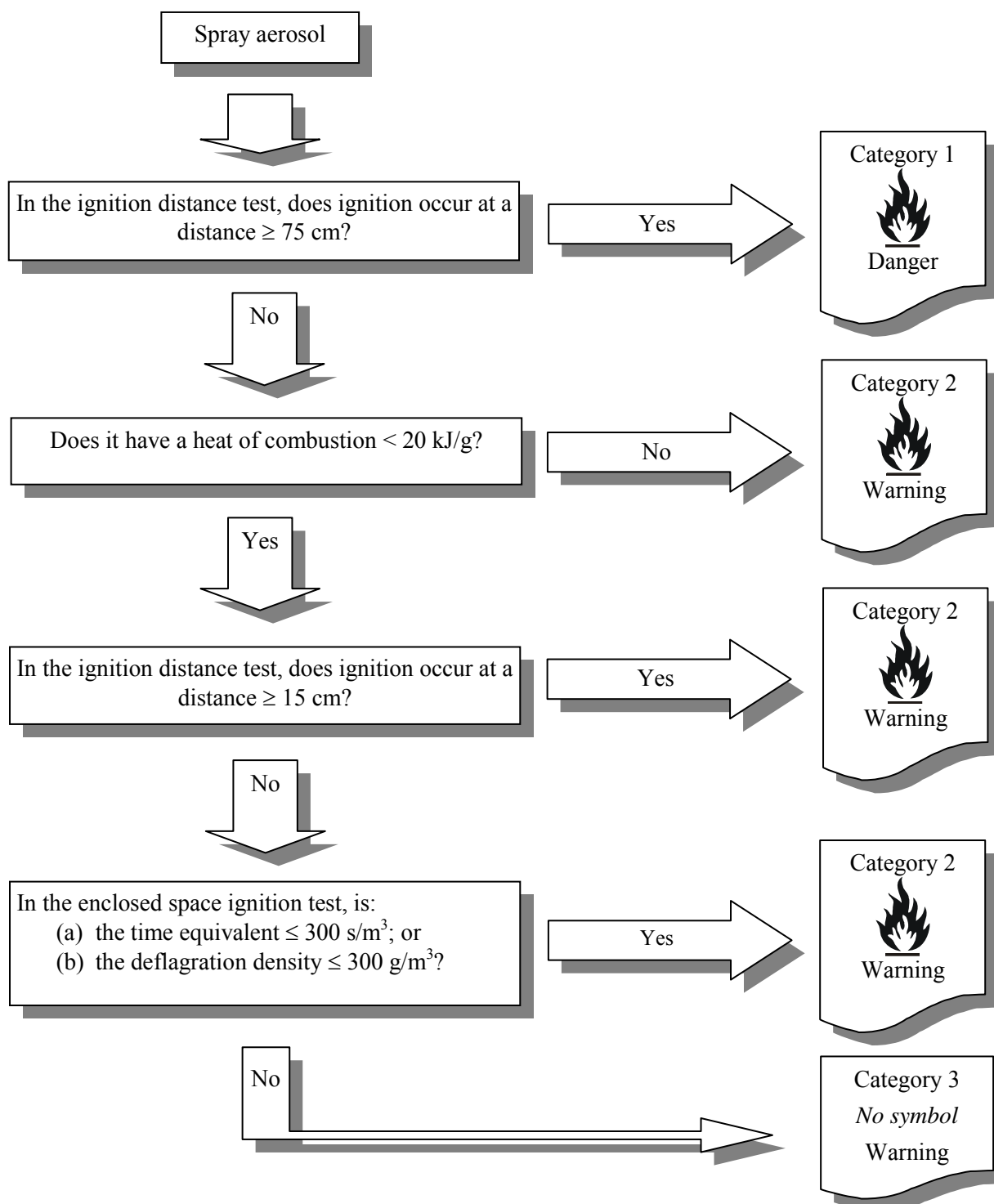
To classify an aerosol as a flammable aerosol, data on its flammable components, on its chemical heat of combustion and, if applicable, the results of the foam test (for foam aerosols) and of the ignition distance test and enclosed space test (for spray aerosols) are required. Classification should be made according to decision logics 2.3 (a) to 2.3 (c).

#### Decision logic 2.3 (a) for flammable aerosols

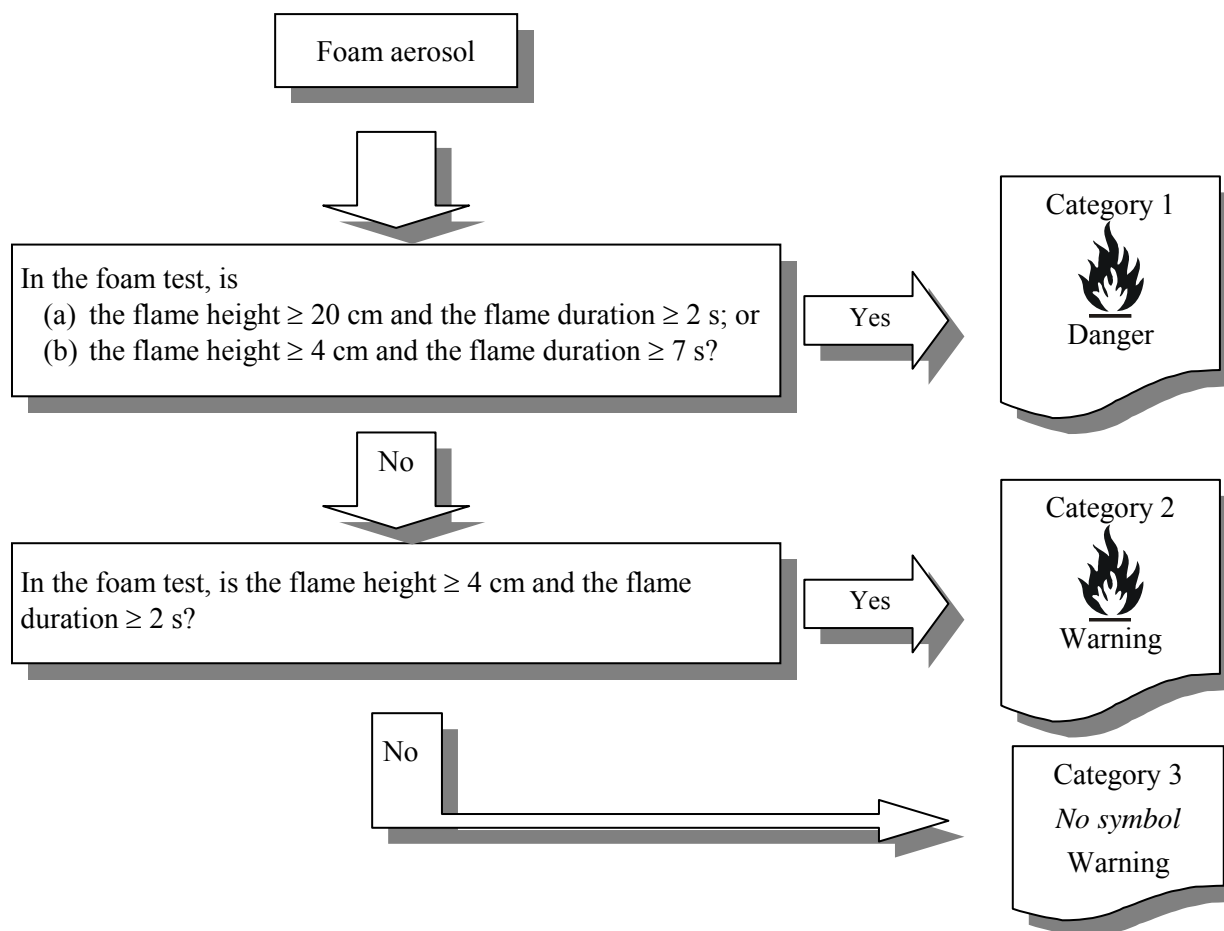


For spray aerosols, go to decision logic 2.3 (b);  
For foam aerosols, go to decision logic 2.3 (c);

*Decision logic 2.3 (b) for spray aerosols*



### Decision logic 2.3 (c) for foam aerosols



#### 2.3.4.2 Guidance

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

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

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

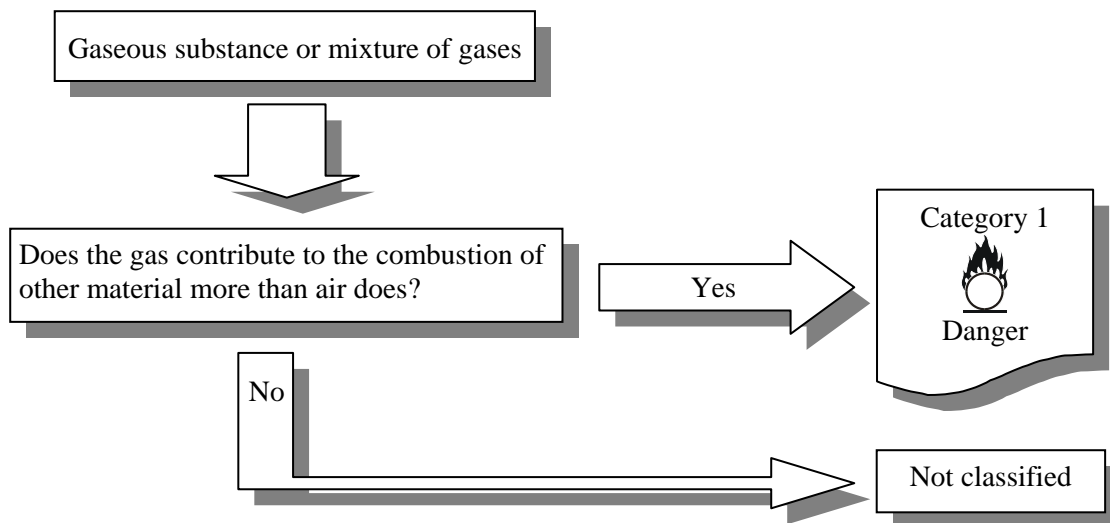
where:

- $\Delta H_c$  = chemical heat of combustion (kJ/g);
- $w_i\%$  = mass fraction of component  $i$  in the product;
- $\Delta H_c(i)$  = specific heat of combustion (kJ/g) of component  $i$  in the product;

The chemical heats of combustion can be found in literature, calculated or determined by tests (see ASTM D 240, ISO/FDIS 13943:1999 (E/F) 86.1 to 86.3 and NFPA 30B).

2.3.4.2.2 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.

*Decision logic 2.4 for oxidizing gases*



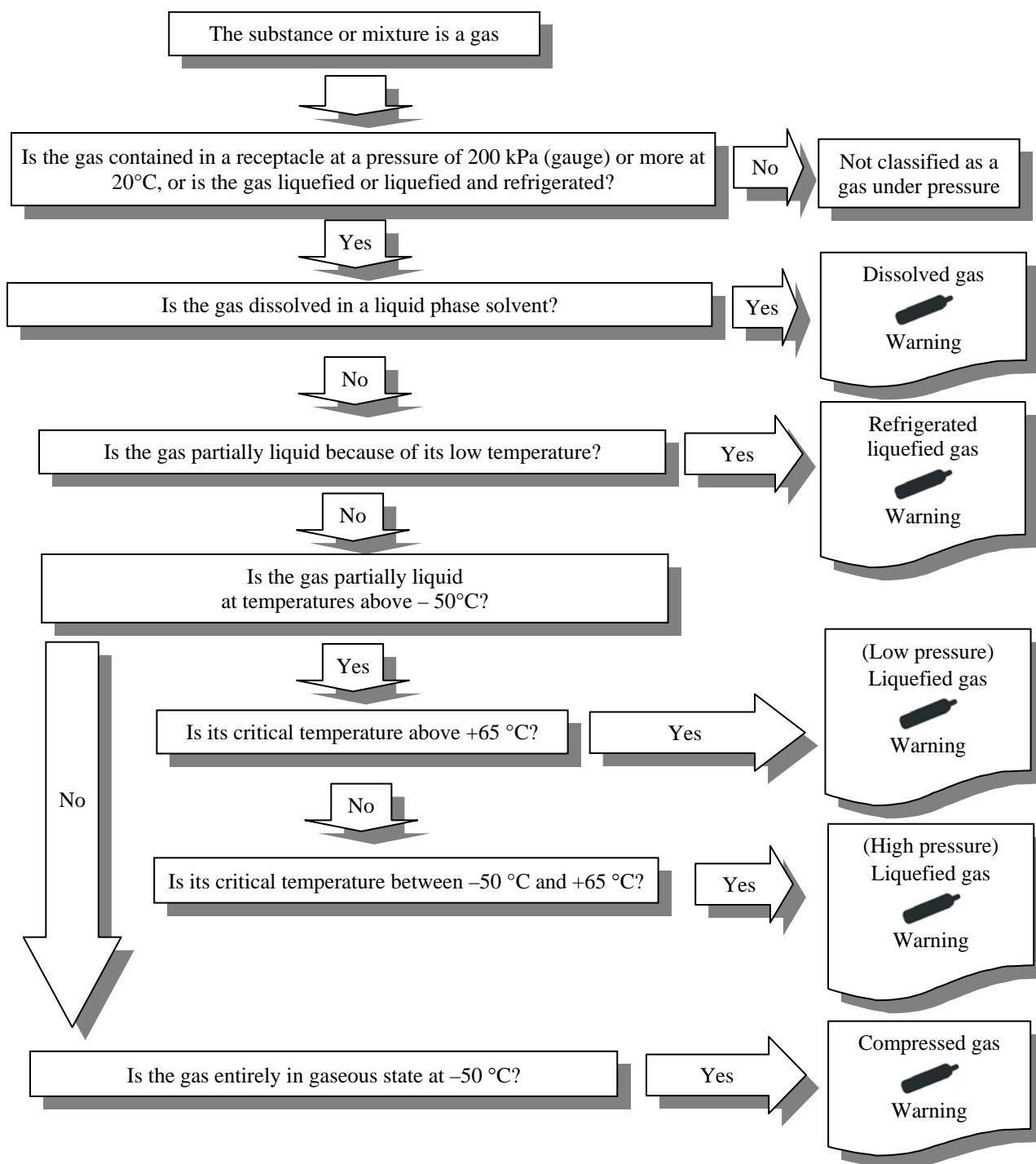
## 2.5.4 Decision logic and guidance

The decision logic and guidance, which follow, are not part of the harmonized classification system, but 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.

### 2.5.4.1 Decision logic

Classification can be made according to decision logic 2.5.

#### *Decision logic 2.5 for gases under pressure*



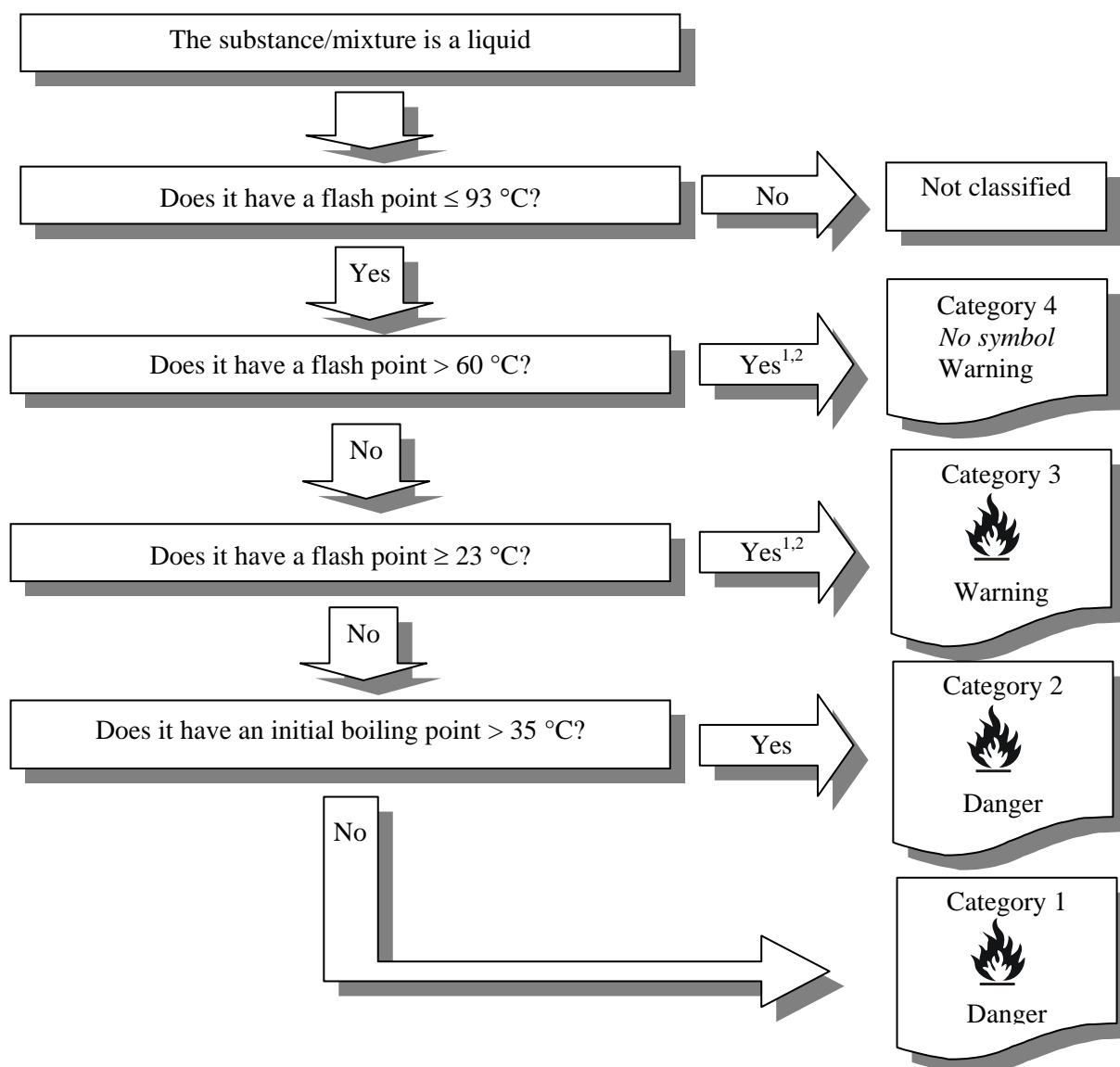
## 2.6.4 Decision logic and guidance

The decision logic and guidance, which follow, are not part of the harmonized classification system, but 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.

### 2.6.4.1 Decision logic

Once the flash point and the initial boiling point are known, the classification of the substance or mixture and the relevant harmonized label information can be obtained according to decision logic 2.6.

#### *Decision logic 2.6 for flammable liquids*



<sup>1</sup> Gas oils, diesel and light heating oils in the flash point range of 55 °C to 75 °C may be regarded as a special group for some regulatory purposes as these hydrocarbons mixtures have varying flash point in that range. Thus classification of these products in Category 3 or 4 may be determined by the pertinent regulation or competent authority.

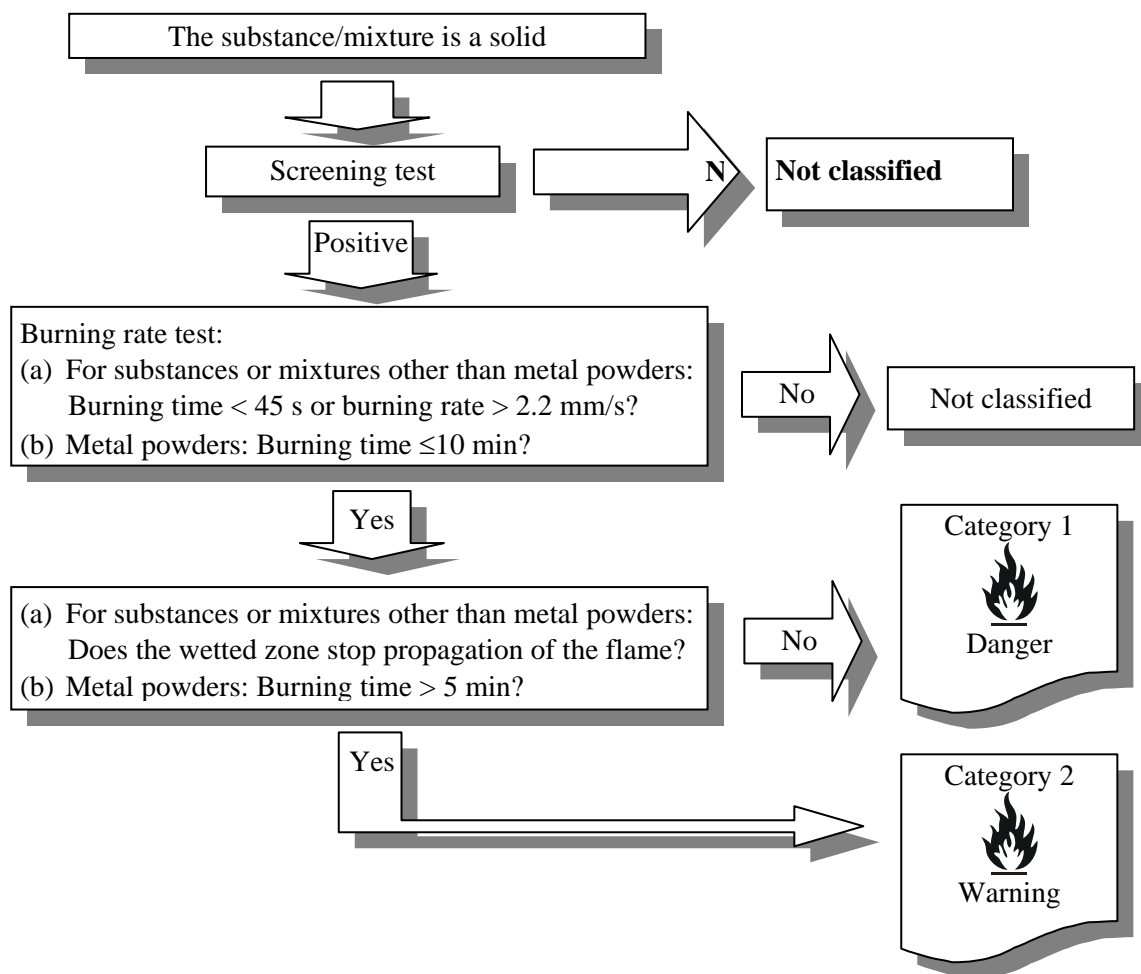
<sup>2</sup> Liquids with a flash point of more than 35 °C and not more than 60 °C may be regarded as non-flammable liquids for some regulatory purposes (e.g. transport) if negative results have been obtained in the sustained combustibility test L.2 of Part III, section 32 of the UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria.

## 2.7.4 Decision logic

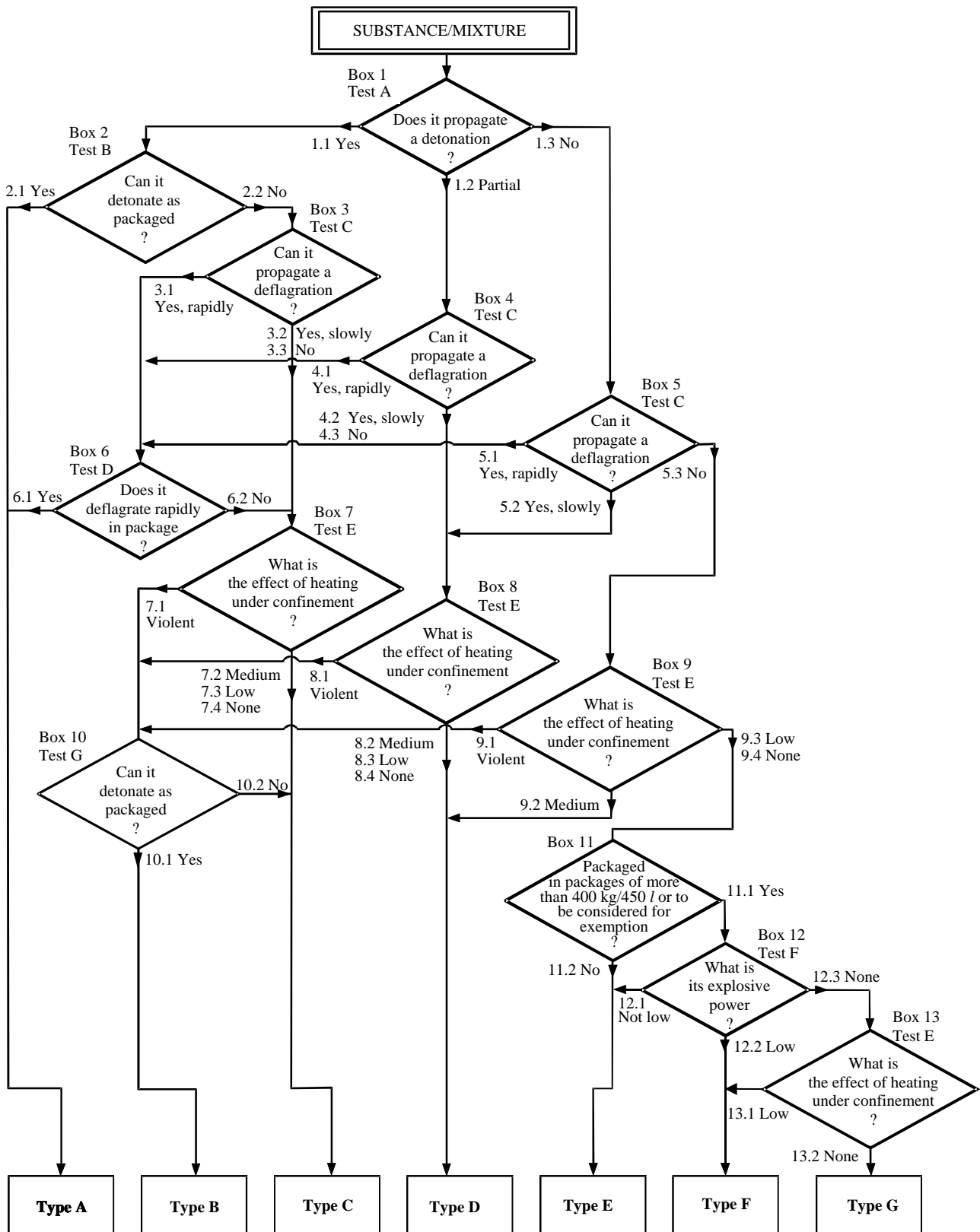
The decision logic which follows, is not part of the harmonized classification system, but has been provided here as additional guidance. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

To classify a flammable solid, the test method N.1 as described in Part III, sub-section 33.2.1 of the *UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria* should be performed. The procedure consists of two tests: a preliminary screening test and a burning rate test. Classification is according to decision logic 2.7.

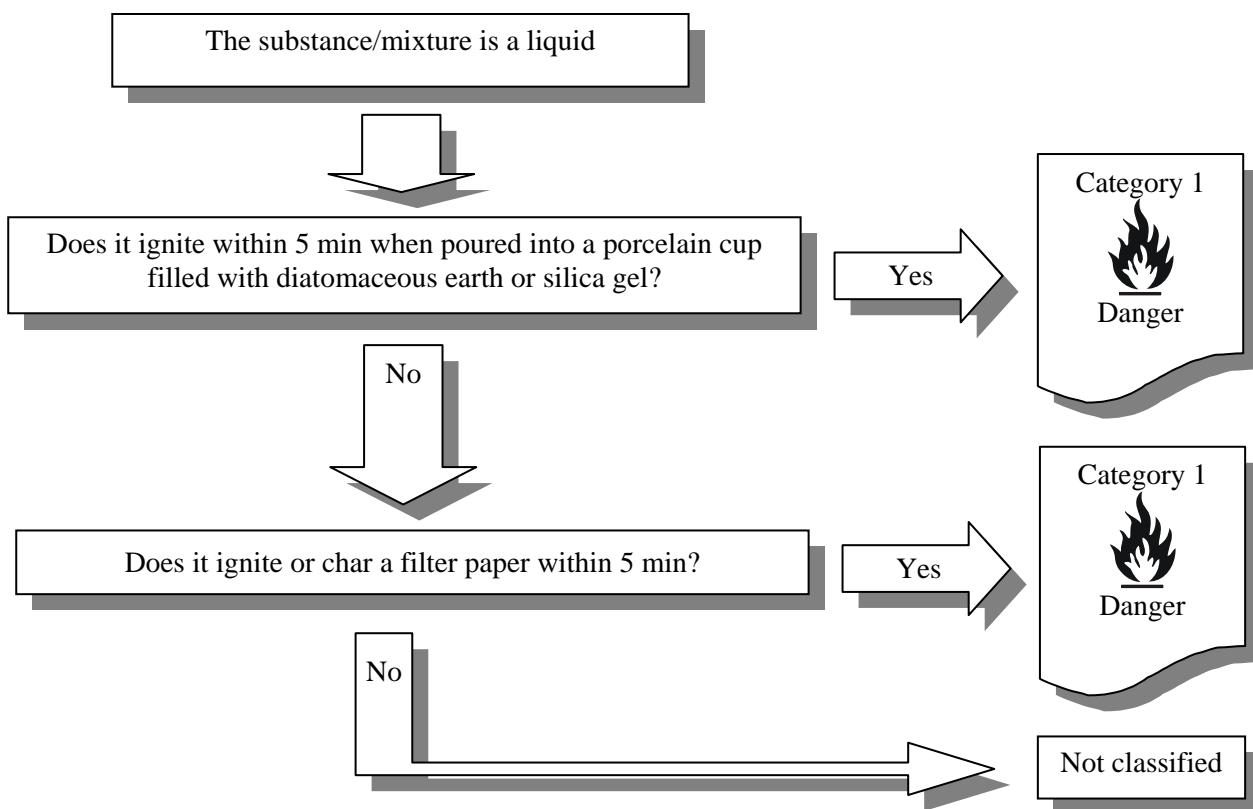
### *Decision logic 2.7 for flammable solids*



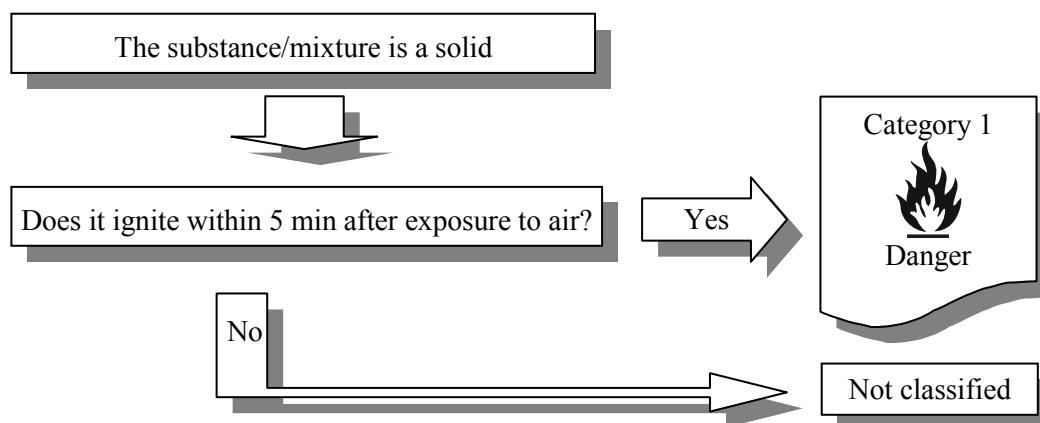
**Decision logic 2.8 for self-reactive substances and mixtures**



*Decision logic 2.9 for pyrophoric liquids*



**Decision logic 2.10 for pyrophoric solids**



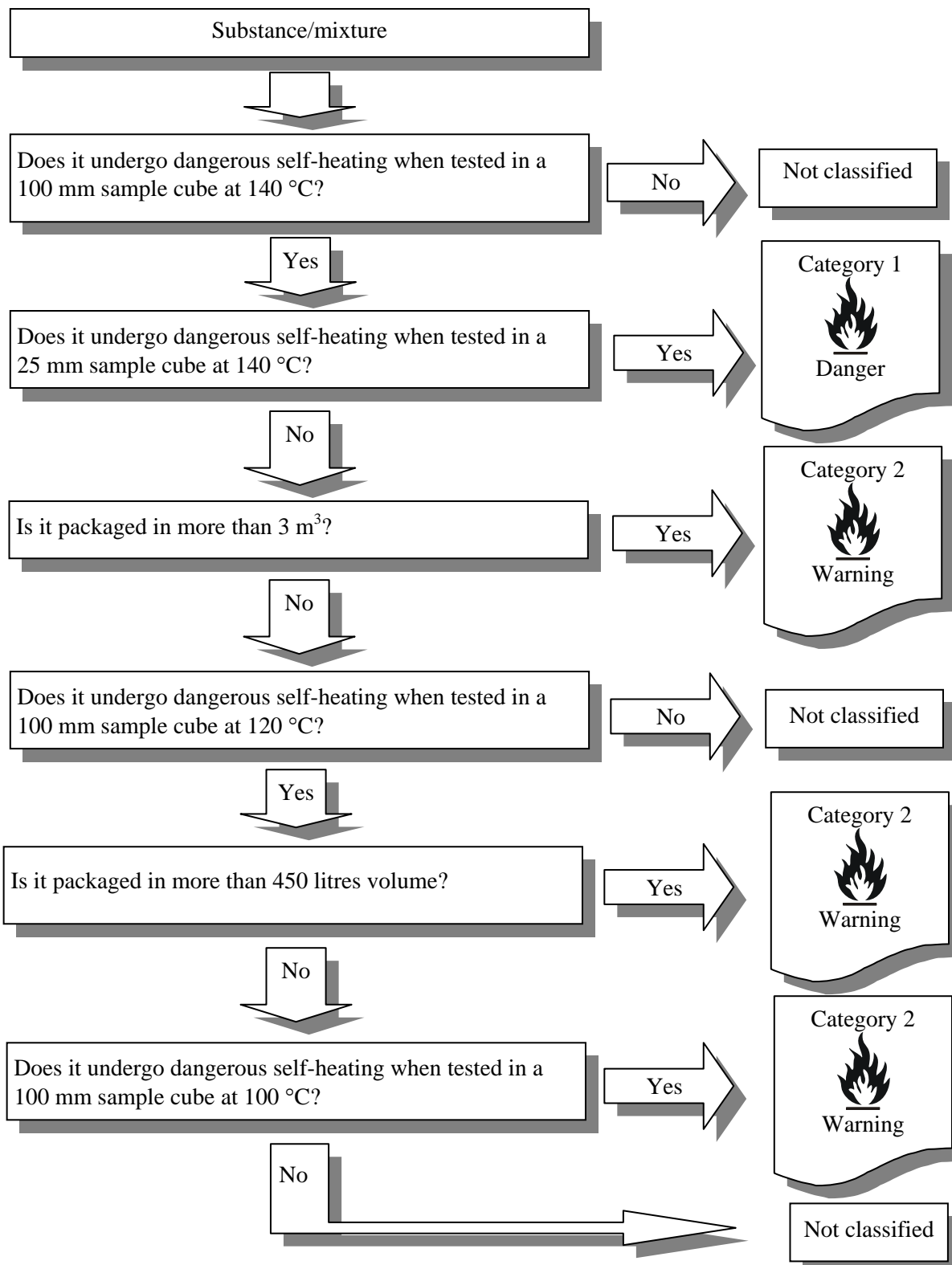
**2.10.4.2 Guidance**

The classification procedure for pyrophoric solids need not be applied when experience in production or handling shows that the substance or mixture does not ignite spontaneously on coming into contact with air at normal temperatures (i.e. the substance or mixture is known to be stable at room temperature for prolonged periods of time (days)).

### 2.11.4.1 Decision logic

To classify a self-heating substance or mixture, test method N.4, as described in Part III, sub-section 33.3.1.6 of the *UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, should be performed. Classification is according to decision logic 2.11.

#### Decision logic 2.11 for self-heating substances and mixtures



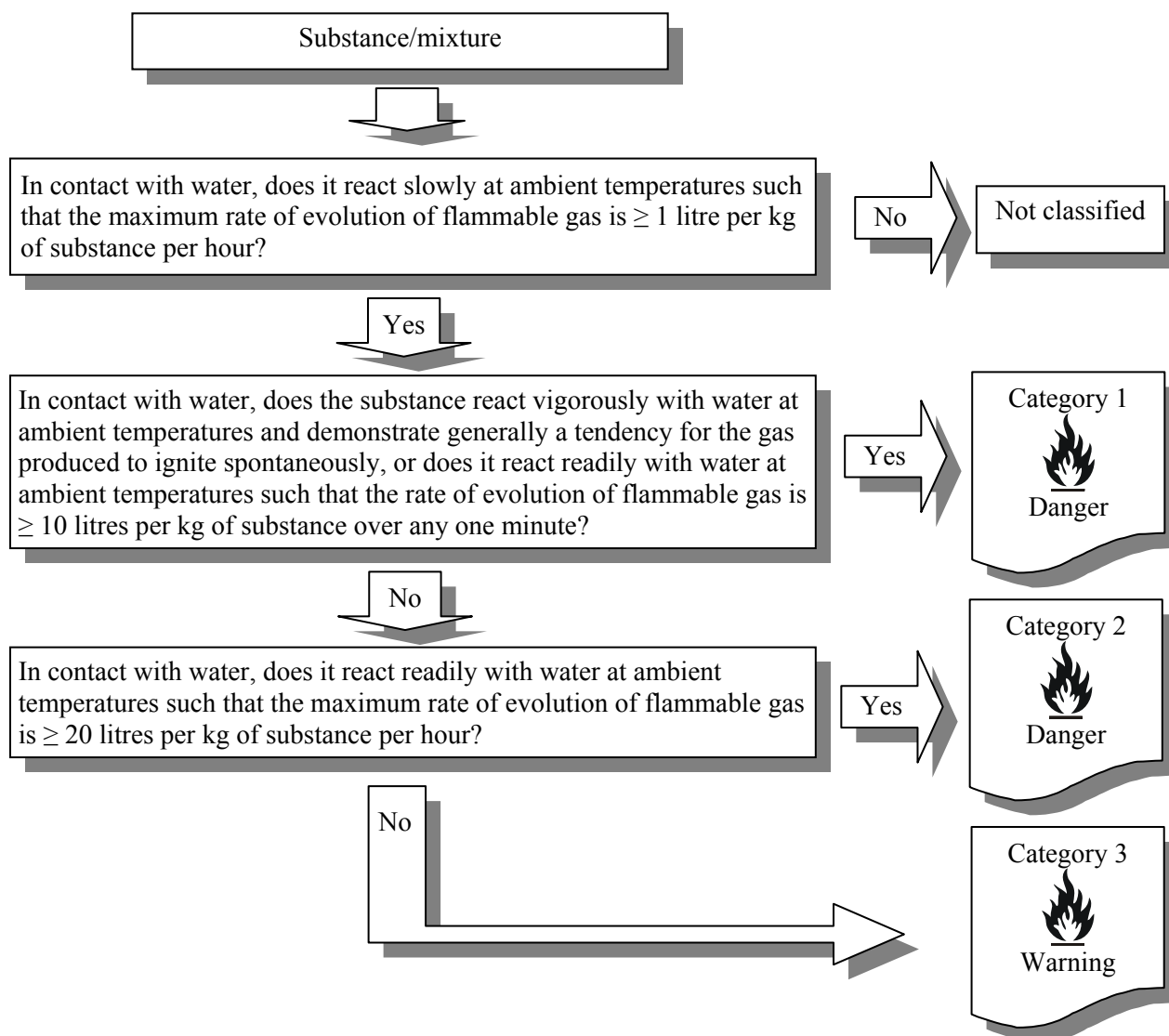
## 2.12.4 Decision logic and guidance

The decision logic and guidance which follow, are not part of the harmonized classification system, but 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.

### 2.12.4.1 Decision logic

To classify a substance or mixture which, in contact with water emits flammable gases, test N.5 as described in Part III, sub-section 33.4.1.4 of the *UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, should be performed. Classification is according to decision logic 2.12.

#### *Decision logic 2.12 for substances and mixtures which, in contact with water, emit flammable gases*



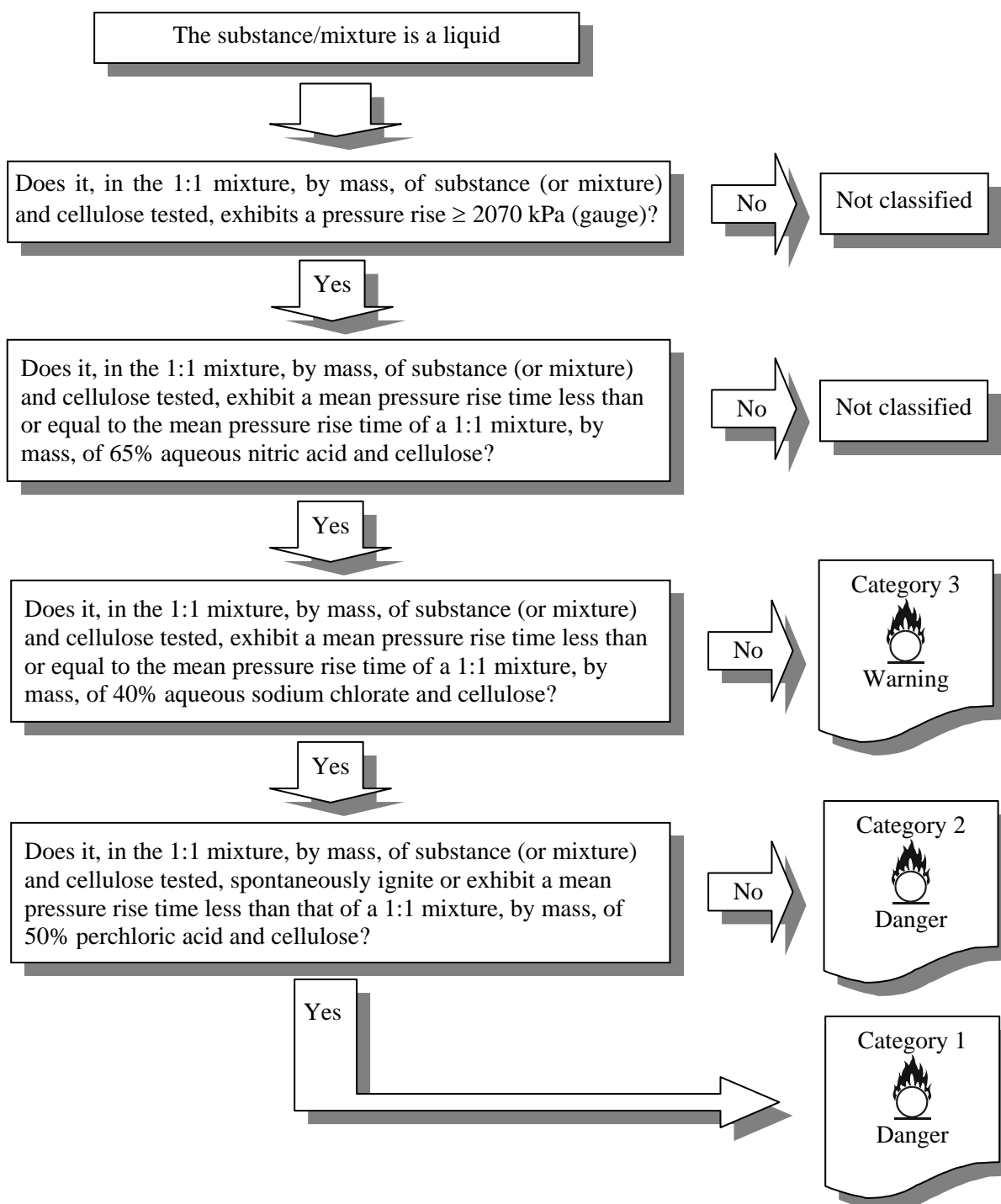
## 2.13.4 Decision logic and guidance

The decision logic and guidance which follow, are not part of the harmonized classification system, but 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.

### 2.13.4.1 Decision logic

To classify an oxidizing liquid test method O.2 as described in Part III, sub-section 34.4.2 of the *UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria* should be performed. Classification is according to decision logic 2.13.

#### Decision logic 2.13 for oxidizing liquids



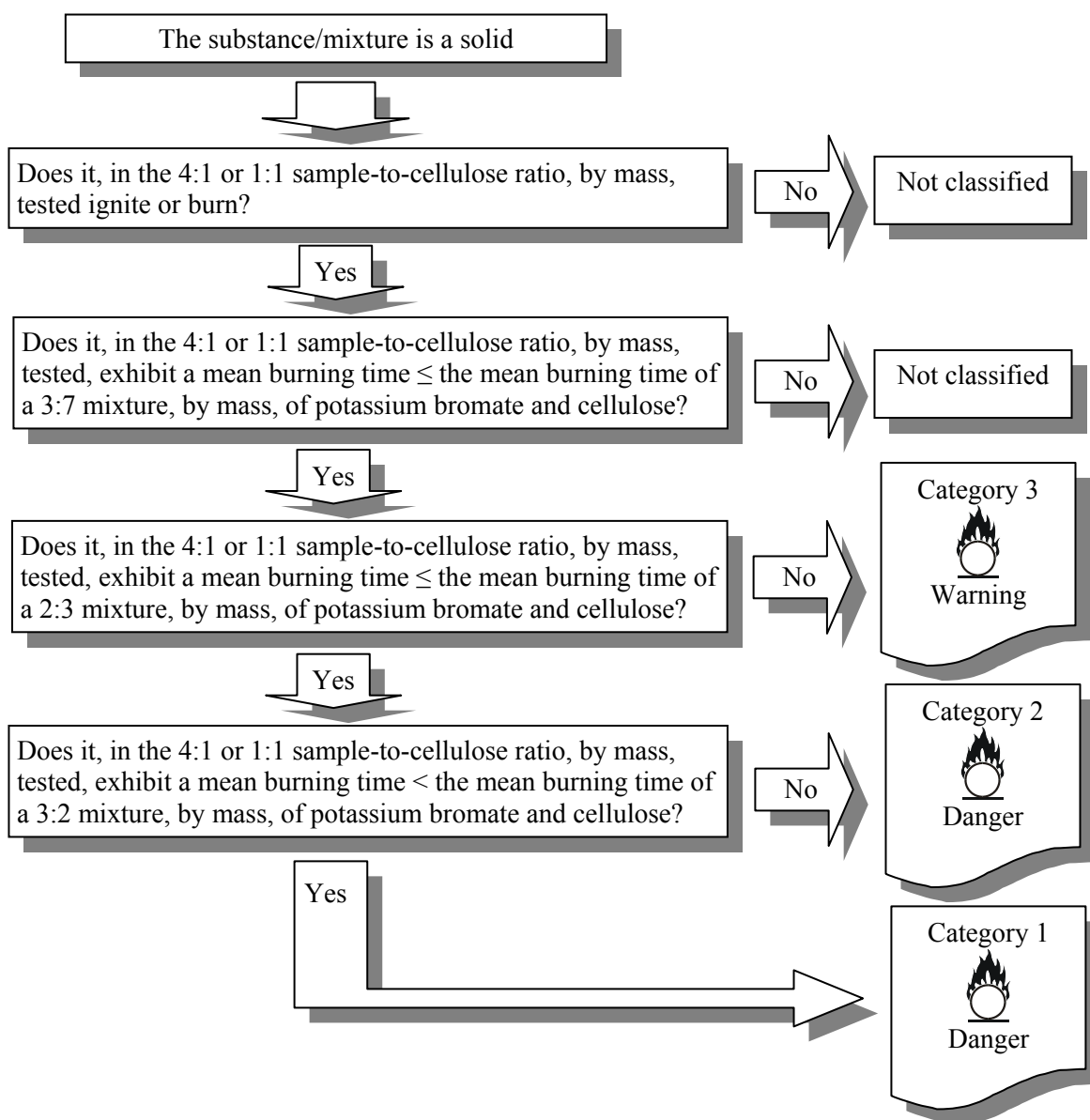
## 2.14.4 Decision logic and guidance

The decision logic and guidance which follow, are not part of the harmonized classification system, but 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.

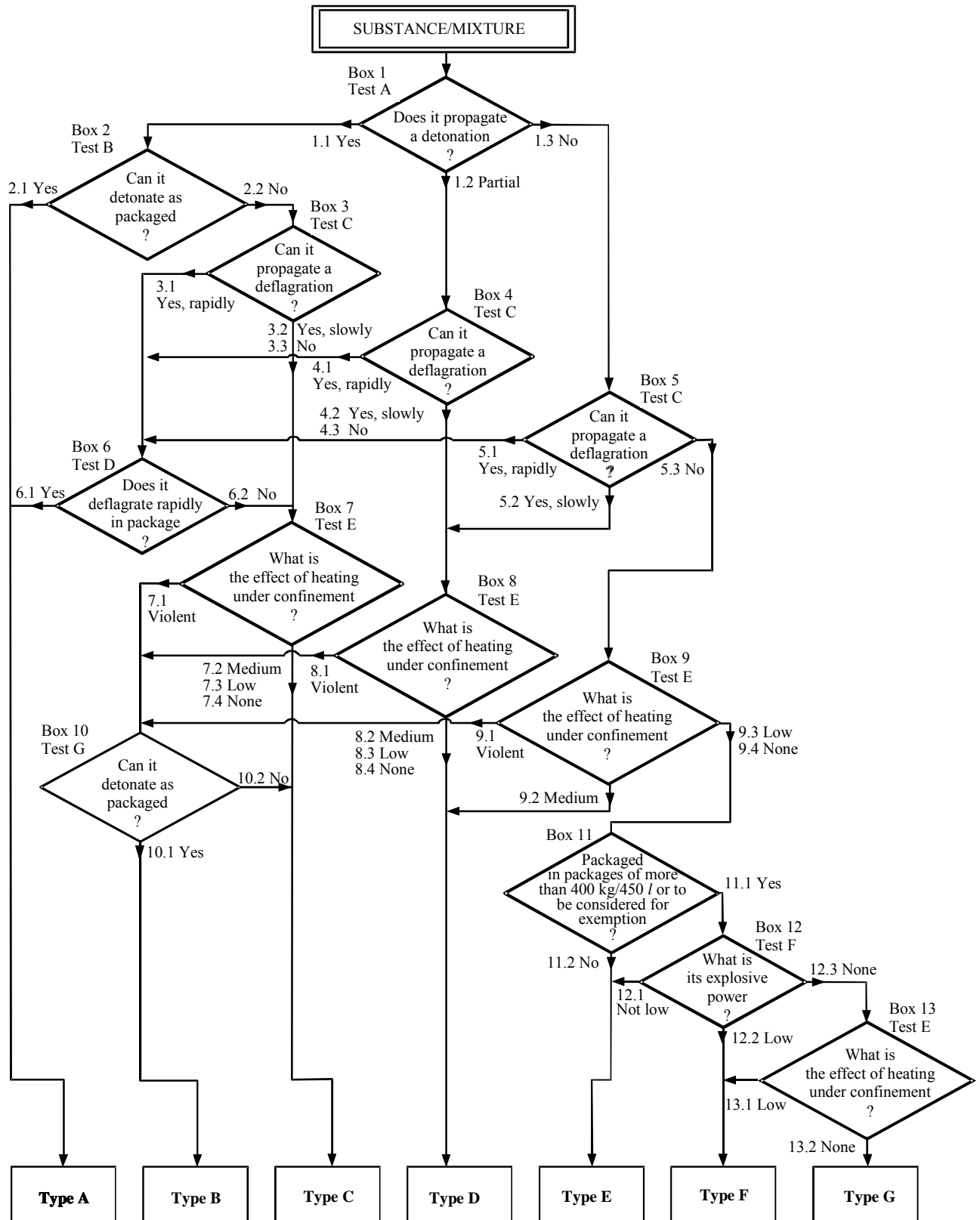
### 2.14.4.1 Decision logic

To classify an oxidizing solid test method O.1 as described in Part III, sub-section 34.4.1 of *the UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*, should be performed. Classification is according to decision logic 2.14.

#### Decision logic 2.14 for oxidizing solids

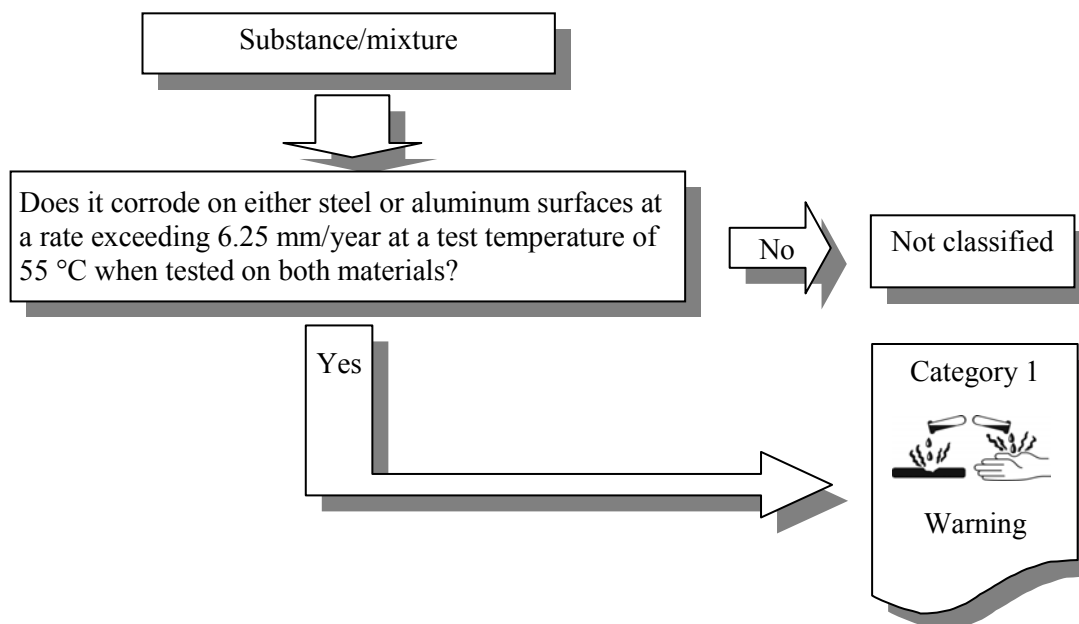


*Decision logic 2.15 for organic peroxides*



#### 2.16.4.1 *Decision logic*

##### *Decision logic 2.16 for substances and mixtures corrosive to metals*



#### 2.16.4.2 *Guidance*

The corrosion rate can be measured according to the test method of Part III, sub-section 37.4 of the *UN Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*. The specimen to be used for the test should be made of the following materials:

- (a) For the purposes of testing steel, steel types S235JR+CR (1.0037 resp.St 37-2), S275J2G3+CR (1.0144 resp.St 44-3), ISO 3574, Unified Numbering System (UNS) G 10200, or SAE 1020;
- (b) For the purposes of testing aluminium: non-clad types 7075-T6 or AZ5GU-T6.