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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

#### Sixtieth session

Geneva, 27 June-6 July 2022

Item 3 of the provisional agenda

#### Listing, classification and packing

## Proposal to create a UN Number for disilane

### Submitted by the Compressed Gases Association (CGA) and European Industrial Gases Association (EIGA)\*

#### Background

1. CGA and EIGA submitted ST/SG/AC.10/C.3/2017/43 at the fifty-second session (December 2017) of the Sub-Committee of Experts on the Transport of Dangerous Goods. This was a proposal to create a UN Number for disilane and UN Numbers for pyrophoric gases as well as to add criteria for pyrophoric gases into Division 2.1. There was general support for the proposal, and it was agreed that an amended proposal would be submitted to the Sub-Committee.
2. CGA and EIGA submitted document ST/SG/AC.10/C.3/2021/31 for consideration by the Sub-Committee at its June 2021 session with technical and editorial amendments that were decided at the 2017 meeting.
3. Since the submission of that document comments have been received from both industry and others identifying several areas that could need further consideration and clarification. The comments were related to potential consequences of the new definitions of pyrophoric gases on their storage. Therefore, CGA and EIGA decided to withdraw document ST/SG/AC.10/C.3/2021/31 (informal document INF.7 (58th session)) and to submit a revised document at a future session.
4. CGA and EIGA now propose a revised document focussing only on disilane.
5. Disilane (CAS RN 1590-87-0) is a pyrophoric liquefied gas under pressure. At atmospheric pressure, it boils at -14.3 °C and its vapour pressure at 20 °C is 2.3 bar. Furthermore, it is spontaneously flammable in air. As the gas has a critical temperature > 65 °C it is further classified as being a low pressure liquefied gas as defined in 2.2.1.2 (b)(ii).
6. A generic number is used for the transport of disilane (UN 3161). The proper shipping name is Liquefied Gas, Flammable, N.O.S. (Disilane) as there is no specific UN number for disilane. This generic UN number only partially reflects its flammability properties. As with

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\* A/75/6 (Sect.20), para. 20.51

silane (UN 2203), disilane is pyrophoric, and silane is forbidden for transport by air freight, both in cargo and passenger aircraft. All other pyrophoric materials in the UN Model Regulations are forbidden for transport by air freight, in cargo and passenger aircraft.

7. CGA and EIGA wish to see the hazard identification of disilane clarified so that there is no possibility of this product being transported by air.

8. There are two proposals:

- (a) Add into the Dangerous Goods List a new entry for disilane;
- (b) Add into the packing instruction P200 a new entry for disilane.

### Proposal 1

9. In 3.2.2 Dangerous Goods List create a new entry to identify disilane, as follows:

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provisions	Limited and excepted quantities		Packagings and IBCs		Portable tanks and bulk containers	
						(7a)	(7b)	Packing instruction	Special packing provisions	Instructions	Special provisions
(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)
-	3.1.2	2.0	2.0	2.0.1.3	3.3	3.4	3.5	4.1.4	4.1.4	4.2.5 / 4.3.2	4.2.5
xxxx	DISILANE	2.1				0	E0	P200			

### Proposal 2

10. In 4.1.4.1 list of packing instructions add under P200, the following new entry:

P200		PACKING INSTRUCTION ( <i>cont'd</i> )										P200	
Table 2: LIQUEFIED GASES AND DISSOLVED GASES													
UN No.	Name and description	Class or Division	Subsidiary hazard	LC <sub>50</sub> (ml/m <sup>3</sup> )	Cylinders	Tubes	Pressure drums	Bundles of cylinders	MEGCs	Test period (years)	Test pressure (bar)	Filling ratio	Special packing provisions
xxxx	DISILANE	2.1			X	X	X	X		10	225	0.39	q

11. Annex 1 includes a datasheet for disilane.

12. As there is no published data for the filling ratio, this has been developed from P200 3 (c), see Annex 2.

### Safety implications

13. No safety implications are foreseen, and CGA and EIGA are of the opinion that safety in the transport of the above pyrophoric gas will be enhanced.

## Annex I

### Data sheet to be submitted to the United Nations for new or amended classification or substances

Submitted by CGA and EIGA

Date: 30 March 2022

Supply all relevant information including sources of basic classification data. Data should relate to the production the form to be transported. State test methods. Answer all questions - if necessary, state "not known" or "not applicable" - If data is not available in the form requested, provide what is available with details. Delete inappropriate words.

#### Section 1. SUBSTANCE IDENTITY

1.1 Chemical name: **DISILANE**

1.2 Chemical formula: **Si<sub>2</sub>H<sub>6</sub>**

1.3 Molecular weight: **62.22**

1.4 Other names/synonyms: **Disilicon hydride**

1.5.1 UN number: **3161 Liquefied Gas, Flammable, N.O.S. (Disilane). Current number used for transport)**

1.5.2 CAS number: **1590-87-0**

1.6 Proposed classification for the Recommendations

1.6.1 proper shipping name: **DISILANE**

1.6.2 class/division: **2.1** subsidiary risk(s): **pyrophoric** Packing group: **not applicable**

1.6.3 proposed special provisions, if any: **none**

1.6.4 proposed packing instruction(s): **P200**

#### Section 2. PHYSICAL PROPERTIES

2.1 Melting point or range: **-133°C**

2.2 Boiling point or range: **-14.3°C**

2.3 Relative density at:

2.3.1 15°C: **0.675 (no data available on temperature)**

2.3.2 20°C: **no data available**

2.3.3 50°C: **no data available**

2.4 Vapour pressure at:

2.4.1 50°C: **7.4 bar(a) or 740 kPa**

2.4.2 65°C: **no data available**

2.5 Viscosity at 20°C: **not applicable**

2.6 Solubility in water at 20°C: **completely soluble**

2.7 Physical state at 20°C: **gas, furthermore the gas is a low pressure liquified gas as defined in 2.2.1.2 (b) (i) as the gas has a critical temperature > 65 °C.**

2.8 Appearance at normal transport temperatures, including colour and odour: **colourless, mouldy odour**

2.9 Other relevant physical properties:

Critical temperature: 158.85 °C (ref. Matheson Gas Data Book), so this qualifies the material as a low pressure liquified gas and the equation used to calculate fill density is P200 3 (c) as is used in Annex 2).

### Section 3. FLAMMABILITY

#### 3.1 Flammable vapour

3.1.1 Flash point (2.3.3'): **not applicable for gases and gas mixtures**

3.1.2 Is combustion sustained? (2.3.1.3'') **not applicable for gases and gas mixtures**

3.2 Autoignition temperature: **-50°C**

3.3 Flammability range (LEL/UEL): **(Pyrophoric)**

3.4 Is the substance a flammable solid? (2.4.2<sup>1</sup>): **no**

### Section 4. CHEMICAL PROPERTIES

4.1 Does the substance require inhibition/stabilization or other treatment such as nitrogen blanket to prevent hazardous reactivity? **no**

4.2 Is the substance an explosive according to paragraph 2.1.1.1? (2.1<sup>1</sup>): **no**

4.3 Is the substance a desensitized explosive? (2.4.2.4<sup>1</sup>): **no**

4.4 Is the substance a self-reactive substance? (2.4.1<sup>1</sup>): **no**

4.5 Is the substance pyrophoric? (2.4.3<sup>1</sup>): **yes**

4.5.1 If yes, give details: **this substance is not a liquid or solid. The substance ignites spontaneously in air as silane (UN 2203)**

4.6 Is the substance liable to self-heating? (2.4.3<sup>1</sup>): **no**

4.7 Is the substance an organic peroxide? (2.5.1<sup>1</sup>): **no**

4.8 Does the substance in contact with water emit flammable gases? (2.4.4<sup>1</sup>): **no**

4.9 Does the substance have oxidizing properties? (2.5.1<sup>1</sup>): **no**

4.10 Corrosivity (2.8<sup>1</sup>): **this substance is not known to be corrosive**

4.11 Other relevant chemical properties: **no data available**

### Section 5. HARMFUL BIOLOGICAL EFFECTS

5.1 LD50, oral (2.6.2.1.1<sup>1</sup>): **this substance is not known to be toxic by ingestion**

5.2 LD50, dermal (2.6.2.1.2<sup>1</sup>): **this substance is not known to be toxic by contact with the skin**

5.3 LC50, inhalation (2.6.2.1.3<sup>1</sup>): **this substance is not known to be toxic by inhalation**

5.4 Saturated vapour concentration at 20°C (2.6.2.2.4.3): **this substance is completely gaseous at 20°C**

5.5 Skin exposure (2.8<sup>1</sup>) results: **this substance is not known to be toxic by contact with the skin**

5.6 Other data: **no data available**

5.7 Human experience: **no data available**

### Section 6. SUPPLEMENTARY INFORMATION

#### 6.1 Recommended emergency action

6.1.1 Fire (include suitable and unsuitable extinguishing agents): **Shutting off the source of the gas is the preferred method of control. If this is not possible, do not extinguish; cool point of release with a water spray or fog being careful not to extinguish flame.**

6.1.2 Spillage: **Keep area evacuated and free from ignition sources until any spilled liquid has evaporated (ground free from frost). Dust deposited can be vacuum cleaned or the area hosed down with water.**

6.2 Is it proposed to transport the substance in:

6.2.1 Bulk Containers (6.8<sup>1</sup>): **no**

6.2.2 Intermediate Bulk Containers (6.5<sup>1</sup>): **no**

6.2.3 Portable tanks (6.7<sup>1</sup>): **no**

If yes, give details in Sections 7, 8 and/or 9.

**Section 7. BULK CONTAINERS (only complete if yes in 6.2.1)**

7.1 Proposed type(s): **Not applicable**

**Section 8. INTERMEDIATE BULK CONTAINERS (IBCs) (only complete if yes in 6.2.2)**

8.1 Proposed type(s): **Not applicable**

**Section 9. MULTIMODAL TANK TRANSPORT (only complete if yes in 6.2.3)**

9.1 Description of proposed tank (including IMO tank type if known): **Not applicable**

9.2 Minimum test pressure: **Not applicable**

9.3 Minimum shell thickness: **Not applicable**

9.4 Details of bottom openings, if any: **Not applicable**

9.5 Pressure relief arrangements: **Not applicable**

9.6 Degree of filling: **Not applicable**

9.7 Unsuitable construction materials: **Not applicable**

## Annex II

### Filling ratio of disilane

1. As there is no data available for the filling ratio of disilane it has been developed from P200 3 (c).

2. For low pressure liquefied gases and gas mixtures for which relevant data are not available, the maximum filling ratio shall be determined as follows:

$$FR = (0.0032 \times BP) - 0.24 \times d_1$$

Where: FR = maximum filling ratio  
BP = boiling point (in Kelvin)  
d<sub>1</sub> = density of the liquid at boiling point (in kg/l)

3. For disilane:

Boiling point (in Kelvin) = (273.15 + (-14.3)) = 258.85 K

Density (d<sub>1</sub>) = 0.675

$$FR = ((0.0032 \times 258.85) - 0.24) \times 0.675$$

4. This gives a filling ratio of 0.397, which has been rounded down to FR = 0.39.

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