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Implementation of the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN): interpretation of the Regulations annexed to ADN

The transport of Carbon Dioxide (CO_2) and required refrigerating system

Transmitted by European Barge Union (EBU) and European Skippers Organisation (ESO)*,**

Introduction

1. With this document, European Barge Union (EBU) and European Skippers Organisation (ESO) would like to draw attention to the provisions of the transport of CO_2. Transport conditions of CO_2, Ethylene and Liquified Natural Gas (LNG) are compared with each other as they seem to deviate from each other in an unlogic way. In the end of this document, EBU/ESO would like to ask the ADN Safety Committee their point of view to consider a minor adaption to harmonize the transport conditions.

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I. Transport provisions of carbon dioxide, refrigerated liquid — UN 2187 ("CO_2")

2. CO_2 makes for 0.04 % part of the air which is breathed out by humans. The identified risks of deep cooled carbon dioxide under pressure, are limited to the cryogen effects and the ability to locally expel oxygen, if released in large amounts.

3. In line with the ADN, CO_2 can be transported; the product is classified as gas and the following position in Table C of Chapter 3.2 has been allocated :

2187	CARBON DIOXIDE, REFRIGERATED LIQUID	2	3A		2.2	G	1	1	1	95		1	yes			no	PP	0	31,39

4. This entry can be found since the introduction of Carbon Dioxide in Table C of Chapter 3.2 in the 2011 version of the ADN.

5. The transport may be performed by tank barges of the type G,1,1 with refrigerating system (number "1" in column 9). The remarks 31 and 39 in column 20 provide the following transport provisions:

"31. When these substances are carried, the vessel shall be equipped with a quick closing valve placed directly on the shore connection.

39. (a) The joints, outlets, closing devices and other technical equipment shall be of such a sort that there cannot be any leakage of carbon dioxide during normal transport operations (cold, fracturing of materials, freezing of mixtures, run-off outlets, etc.)

(b) The loading temperature (at the loading station) shall be mentioned in the transport document

(c) An oxygen meter shell be kept on board, together with instructions on its use which can be read by everyone on board. The oxygen meter shall be used as a testing device when entering holds, pump rooms, areas situated at depth when work is being carried out on board.

(d) At the entry of accommodation and in other places where the crew may spend time there shall be a measuring device which lets off an alarm when the oxygen level is too low or when the CO_2 level is too high.

(e) The loading temperature (established after loading) and the maximum duration of the journey shall be mentioned in the transport document."

II. Analyse of G-1-1-vessels with refrigeration system required

6. After analysing Table C of Chapter 3.2; the following substances have been identified, for which also a barge type G,1,1 with refrigeration system is required:

1038	ETHYLENE, REFRIGIRATED LIQUID	2	3F		2.1	G	1	1	1		95		1	no	T1[12)]	IIB (IIB3)	yes	PP, EX, A	1	2; 31; 42
1972	METHANE, REFRIGERATED LIQUID or NATURAL GAS, REFRIGIRATED LIQUID with high methane content	2	3F		2.1	G	1	1	1		95		1	no	T1[12)]	IIA	yes	PP, EX, A	1	2; 31; 42

2187	CARBON DIOXIDE, REFRIGIRATED LIQUID	2	3A		2.2	G	1	1	1		95		1	yes			no	PP	0	31,39
9000	AMMONIA, ANHYDROUS REFRIGIRATED	2	3TC		2.1+ 2.3+ 8+ N1	G	1	1	1; 3		95		1	no	T1[12)]	IIA	yes	PP, EP, EX, TOX, A	2	1; 2; 31

III. Transport provisions of Ethylene, refrigerated liquid — UN 1038 and Methane, refrigerated liquid — UN 1972

7. The transport condition of these two flammable gases have been placed in the Table C of Chapter 3.2 more or less similar to CO_2, however for these two substances remark "42" has been added to column 20.

8. On the very same moment, UN 1972, Methane refrigerated liquid (LNG) was introduced in Table C of Chapter 3.2. The remark "42" and the concept of holding time, according to 7.2.4.16.17 of ADN have been introduced in the 2015 version of ADN.

1038	ETHYLENE, REFRIGIRATED LIQUID	2	3F		2.1	G	1	1	1		95		1	no	T1[12)]	IIB (IIB3)	yes	PP, EX, A	1	2; 31; 42
1972	METHANE, REFRIGERATED LIQUID or NATURAL GAS, REFRIGIRATED LIQUID with high methane content	2	3F		2.1	G	1	1	1		95		1	no	T1[12)]	IIA	yes	PP, EX, A	1	2; 31; 42

9. Remark "42" means that for those substances no refrigerating system is required, as long as the holding time in relation to temperature elevation and blow off is sufficient and guaranteed.

Classification:

10. Ethylene (UN 1038) and Methane (UN 1972) are categorised as 2.1 3F gases meaning deep cooled flammable gases. Carbon Dioxide (UN 2187) is categorised as a 2.2 3A gas meaning deep cooled asphyxiating gas. According to classification hierarchy of 2.2.2.1.3 groups designated by letter F take precedence of the groups designated by letter A or O.

11. Based on the classification group CO_2 is of a lower hierarchy as Ethylene and Methane. And although CO_2 and Ethylene were both already present in Table C of Chapter 3.2 in 2015, remark 42 was added only for Ethylene. Resulting in the fact that the entry for CO_2 was not amended accordingly. Seen the identified risks and classification for these three deep cooled substances it could possibly be CO_2 was overlooked when remark 42 was introduced.

12. Meaning that in the case of transport of CO_2 under UN 2187 in the same type of barges, a refrigeration system is required and for Methane and Ethylene the alternative of remark 42 is available. This in contradiction to the classification criteria and systematic.

Remark "42" in column 20 stipulates the following:

> "42. Loading of refrigerated liquified gases shall be carried out in such a manner to ensure that unsatisfactory gradients do not occur in any cargo tank, piping or other ancillary equipment. When determining the holding time (as described in ADN 7.2.4.16.17) it shall be assured that the degree of filling does not exceed 98 % in order to prevent the safety valves from opening when the tank is in liquid full condition.

When refrigerated liquified gases are carried using a system according to 9.3.1.24.1 (b) of 9.3.1.24.1 (c), a refrigeration system is not required."

"9.3.1.24 Regulation of cargo pressure and temperature

9.3.1.24.1 Unless the entire cargo system is designed to resist the full effective vapour pressure of the cargo at the upper limits of the ambient design temperature, the pressure of the tanks shall be kept below the permissible maximum set pressure of the safety valves, by one or more of the following means:

(a) A system for the regulation of cargo tank pressure using mechanical refrigeration;

(b) A system ensuring safety in the event of the heating increase in pressure of the cargo. The insulation or the design pressure of the cargo tank, or the combination of these two elements shall be such as to leave an adequate margin for the operating period and the temperatures expected; in each case the system shall be deemed acceptable by a recognized classification society and shall ensure safety for a minimum time of three times the operation period;

(c) For UN 1972 only, a system for the regulation of cargo tank pressure whereby the boil-off vapours are utilized as fuel;

(d) Other systems deemed acceptable by a recognized classification society."

13. In the case of transport of CO_2 under UN 2187 the same type of barges (G11 with a refrigeration system is required). A refrigeration system is not applicable/available on the existing fleet of type G.1.1 barges.

IV. Summary and question to the ADN Safety Committee

14. EBU/ESO notices that upon introduction of remark "42" it has been added in column 20 for Ethylene and Methane. Meaning, taking into account the comparable thermal conductivity and the requirements regarding the holding time, these substances may be transported without a refrigeration system. However, this is not applied to CO_2. The barges do comply to the same requirements in respect to design and intrinsic insulation systems, in relation to the holding time.

15. If no refrigeration system is available, under the provisions of ADN 7.2.4.16.17 (determination of the holding time, taking into account the expected duration of the journey), the transport of Carbon Dioxide can take place safely under the same requirements as for Methane and Ethylene.

16. EBU/ESO would ask the ADN Safety Committee to consider adding remark "42" also to the entry of CO_2 (UN 2187), to harmonize the transport conditions.