



---

**Economic Commission for Europe****Inland Transport Committee****Working Party on the Transport of Dangerous Goods**

**Joint Meeting of Experts on the Regulations annexed to the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN) (ADN Safety Committee)**

**Thirty-sixth session**

Geneva, 27–31 January 2020

Item 6 of the provisional agenda

**Report of informal working groups****Report of the informal working group on membrane tanks**

**Transmitted by the governments of Belgium, France and the Netherlands<sup>\*, \*\*</sup>**

*Summary*

**Executive summary:** The document contains the report of the fifth meeting of the informal working group on Membrane tanks. During the meeting the amendments to the Regulations annexed to ADN had been developed to facilitate the use of membrane tanks on Type G vessels carrying dangerous goods, in particular deeply refrigerated gases.

**Action to be taken:** The Safety Committee is invited to discuss the report and to adopt the amendments which can be found in Annex I.

---

\* Distributed in German by the Central Commission for the Navigation of the Rhine under the symbol CCNR/ZKR/ADN/WP.15/AC.2/2020/11.

\*\* In accordance with the programme of work of the Inland Transport Committee for 2018–2019 (ECE/TRANS/2018/21/Add.1, cluster 9.3).

**Related documents:** Informal document INF.6 of the twenty-seventh session  
 ECE/TRANS/WP.15/AC.2/56 (Paragraphs 9–12)  
 ECE/ADN/33 (Paragraph 12 and Annex II)  
 Informal document INF.26 of the thirty-first session  
 ECE/TRANS/WP.15/AC.2/64 (Paragraph 62)  
 ECE/TRANS/WP.15/AC.2/2018/35  
 Informal document INF.25 of the thirty-third session  
 ECE/TRANS/WP.15/AC.2/68 (Paragraphs 68-70)  
 ECE/TRANS/WP.15/AC.2/2019/14  
 ECE/TRANS/WP.15/AC.2/70 (Paragraphs 72-74)  
 ECE/TRANS/WP.15/AC.2/2019/22  
 ECE/TRANS/WP.15/AC.2/72 (Paragraphs 62-65)

## Introduction

1. On 1 and 2 October 2019, the fifth meeting of the informal working group on Membrane tanks was held at the premises of the Flemish Government in Brussels, Belgium. The meeting was attended by delegates of Belgium, France and the Netherlands and by Bureau Veritas, EBU/ESO and industry representatives.
2. At the opening of the meeting, the Chair of the informal working group concluded, based on the report of the Safety Committee, that the Safety Committee supported the continuation of the work carried out so far by the informal working group. The informal working group took note of the valuable recommendations by the informal working group on Substances (Paragraphs 63 and 64 of ECE/TRANS/WP.15/AC.2/72) and processed these into the developed amendments. Regarding the definition of membrane tanks, the participants agreed with the informal working group on Substances that a membrane tank does not comply with the current definition of independent cargo tank in the Regulations annexed to ADN.
3. The participants of the informal working group look forward to the adoption of the proposed amendments to facilitate a societal need: the energy transition is expected to lead to a substantive growth of the demand of Liquefied Natural Gas (LNG) in Europe. Nevertheless, and although the use of membrane tanks has already for decades been a proven technique in maritime transport, the informal working group agreed on a conservative approach while drafting the amendments to the Regulations annexed to ADN, especially the amendments on the carriage conditions.
4. To operate as transparent as possible, a list of substances suitable for carriage of membrane tanks was established (see Annex 2). In comparison to the list of suitable substances published in ECE/TRANS/WP.15/AC.2/2019/14, two changes have been made:
  1. UN number 1005 was replaced by Identification number 9000, since this last number is the refrigerated entry of UN number 1005.
  2. UN number 2187 was removed based on the recommendation by the informal working group on Substances.

## I. Improvement of amendments

5. As stated in paragraph 3, the informal working group concluded that the membrane tank should not be considered as a (special type of a) independent cargo tank. Instead, since the membrane tank is supported by the inner steel hull of the vessel, the membrane could be considered as a special type of the integral cargo tank, but with such specific characteristics that justifies a separate definition and identification in ADN.

6. Regarding the regulation of pressure in the cargo tank in relation to explosion protection, the informal working group noted that the requirements of 9.3.1.24 of the Regulations annexed to ADN apply to the carriage in membrane tanks. This ensures that the pressure in the tanks shall remain below the set pressure of the safety valves on board of the vessel. In line with the chosen conservative approach on the drafting of amendments, the informal working group agreed to prescribe both a refrigeration system and a water spray system on board of vessels equipped with membrane tanks.

7. On inerting facilities the informal working group held a lengthy discussion. Eventually it was decided to maintain the amendment for 9.3.1.18 of the Regulations annexed to ADN, ensuring that the inerting facilities are capable to maintain a pressure above atmospheric pressure in the spaces to be inerted.

8. In 9.3.1.21.1 it was made perfectly clear that this requirement applies to both Type G tank vessels with pressurized tanks and to Type G tank vessels with membrane tanks.

9. Since the carriage in membrane tanks does not imply another design of the vessels' hull, the carriage of new products or the carriage of products in a phase which is new to ADN (the Regulations annexed to ADN already contain prescriptions for carriage of refrigerated substances), the informal working group concluded that all these requirements simply apply to the carriage in membrane tanks. This implies for example that it is not necessary to draft specific requirements for membrane tanks on stability or on collision scenarios.

10. Regarding the improvement of the proposed amendments, the informal working group took note of the differences in the language versions in 8.6.1.3 and 8.6.1.4 (single, plural) and requests the Secretariat to take action as it deems appropriate.

## **II. Other issues, not specifically related to the carriage in membrane tanks**

11. During their discussions, the participants identified three items which are not specifically related to the carriage of substances in membrane tanks but which might require further discussion in the ADN Safety Committee.

12. Remark 42 applies to UN 1972 and UN 1038. Is this requirement still desirable and, if so, what is the rationale to apply this prescription only to UN 1972 and UN 1038?

13. 9.3.X.21.10 refers to a certain calculation according to 9.3.X.27. This subsection however prescribes no specific calculation. It can however be deduced that the last sentence of 9.3.X.27 of the Regulations annexed to ADN imply a calculation to determine whether the entire cargo remains for at least 52 hours in a condition not causing the safety valves to open. Is it desirable to make this calculation more explicit in this subsection to prevent any misunderstanding of the calculation to which 9.3.X.21.10 refers?

14. The informal working group noted that the carriage requirements of some refrigerated substances do not require a water spray system according to Column (9) of Table C (UN 1038, UN 1972 and UN 2187). Is it desirable that the informal working group on Substances reviews whether these carriage conditions are in line with the requirements of 9.3.1.21.11 of the Regulations annexed to ADN?

## **III. Conclusion**

15. The informal working group invites the Safety Committee to discuss the report of the informal working group, to adopt the proposed amendments and to take action as it deems appropriate.

## Annex I

### Provisional amendments to the ADN 2019

The cancelled text is striked through, **the additional text is bold and underlined**

#### 1.2.1 Definitions

“1.2.1 *Cargo tank type:*

(a) *Independent cargo tank* means a cargo tank which is permanently built in, but which is independent of the vessel’s structure;

(b) *Integral cargo tank* means a cargo tank which is constituted by the vessel’s structure itself and bounded by the outer hull or by walls separate from the outer hull;

(c) *Cargo tank with walls distinct from the outer hull* means an integral cargo tank of which the bottom and side walls do not form the outer hull of the vessel or an independent cargo tank;

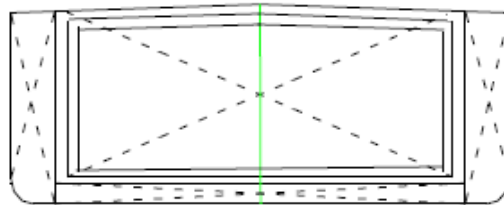
**(d) Membrane tank means an integral cargo tank which consists of a thin liquid-tight and gastight layer (membrane) and insulation supported by the adjacent inner hull and inner bottom structure of a double hull vessel.**

“1.2.1 **IGC Code means the International Code for the Construction and Equipment of Ships carrying Liquefied Gases in Bulk, published by the International Maritime Organization (IMO)**”

“1.2.1 *Type of vessel*

Type G: means a tank vessel intended for the carriage of **pressurized or refrigerated** gases. ~~Carriage may be under pressure or under refrigeration.~~

...



Type G Cargo tanks design 2

Type of cargo tank 4”

“3.2.3.1 *Explanations concerning Table C:*

...

Column (8) “Cargo tank type”

Contains information concerning the cargo tank type.

1. Independent cargo tank
2. Integral cargo tank
3. Cargo tank with walls distinct from the outer hull
4. **Membrane tank**

...”

“3.2.3.2 Insert the following lines, identified by the informal working group on Substances, to Table C”

(1)	(2)	(3a)	(3b)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
UN No. or substance identification No.	Name and description	Class	Classification code	Packing group	Dangers	Type of tank vessel	Cargo tank design	Cargo tank type	Cargo tank equipment	Opening pressure of the pressure relief valve/high velocity vent	Maximum degree of filling in %	Relative density at 20 °C	Type of sampling device	Pump room below deck permitted	Temperature class	Explosion group	Anti-explosion protection required	Equipment required	Number of cones/blue lights	Additional requirements/Remarks
1010	1,2-BUTADIENE, STABILIZED, REFRIGERATED	2	3F		2.1+unst.	G	2	4	1; 3		95		1	no	T2 <sup>12)</sup>	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 3; 31
1010	1,3-BUTADIENE, STABILIZED, REFRIGERATED	2	3F		2.1+unst.+ CMR	G	2	4	1; 3		95		1	no	T2 <sup>12)</sup>	II B (II B2 <sup>4)</sup> )	yes	PP, EP, EX, TOX, A	1	2; 3; 31
1010	BUTADIENES STABILIZED or BUTADIENES AND HYDROCARBON MIXTURE, STABILIZED, REFRIGERATED, having a vapour pressure at 70 °C not exceeding 1.1 MPa (11 bar) and a density at 50 °C not lower than 0.525 kg/l (contains less than 0.1% 1.3-butadiene)	2	3F		2.1+unst.	G	2	4	1; 3		95		1	no	T2 <sup>12)</sup>	II B <sup>4)</sup> (II B2 <sup>4)</sup> )	yes	PP, EX, A	1	2; 3; 31

1010	BUTADIENES, STABILIZED or BUTADIENES AND HYDROCARBON MIXTURE, STABILIZED, REFRIGERATED, having a vapour pressure at 70° C not exceeding 1.1 MPa (11 bar) and a density at 50° C not lower than 0.525 kg/l, (with 0.1% or more 1.3-butadiene)	2	3F		2.1+unst.+ CMR	G	2	4	1; 3		95		1	no	T2 <sub>12)</sub>	II B <sup>4)</sup> (II B2 <sup>4)</sup> )	yes	PP, EP, EX, TOX, A	1	2; 3; 31
1011	BUTANE, REFRIGERATED, (contains less than 0.1% 1.3-butadiene)	2	3F		2.1	G	2	4	1; 3		95		1	no	T2 <sub>12)</sub>	II A	yes	PP, EX, A	1	2; 31
1011	BUTANE, REFRIGERATED, (with 0.1% or more 1.3-butadiene)	2	3F		2.1+CMR	G	2	4	1; 3		95		1	no	T2 <sub>12)</sub>	II A	yes	PP, EP, EX, TOX, A	1	2; 31
1012	1-BUTYLENE, REFRIGERATED	2	3F		2.1	G	2	4	1; 3		95		1	no	T2 <sub>12)</sub>	II A	yes	PP, EX, A	1	2; 31
1020	CHLOROPENTAFLUORO-ETHANE, REFRIGERATED, (REFRIGERANT GAS R 115)	2	3A		2.2	G	2	4	1; 3		95		1	no			no	PP	0	31
1030	1,1-DIFLUOROETHANE, REFRIGERATED, (REFRIGERANT GAS R 152a)	2	3F		2.1	G	2	4	1; 3		95		1	no	T1 <sub>12)</sub>	II A	yes	PP, EX, A	1	2; 31
1033	DIMETHYL ETHER, REFRIGERATED	2	3F		2.1	G	2	4	1; 3		95		1	no	T3	II B (II B2)	yes	PP, EX, A	1	2; 31
1038	ETHYLENE, REFRIGERATED LIQUID	2	3F		2.1	G	2	4	1; 3		95		1	no	T1 <sub>12)</sub>	II B (II B3)	yes	PP, EX, A	1	2; 31; 42
1055	ISOBUTYLENE, REFRIGERATED	2	3F		2.1	G	2	4	1; 3		95		1	no	T2 <sub>1), 12)</sub>	II A	yes	PP, EX, A	1	2; 31
1063	METHYL CHLORIDE, REFRIGERATED, (REFRIGERANT GAS R 40)	2	3F		2.1	G	2	4	1; 3		95		1	no	T1 <sub>12)</sub>	II A	yes	PP, EX, A	1	2; 31

1077	PROPYLENE, REFRIGERATED	2	3F		2.1	G	2	4	1; 3		95		1	no	T1 12)	II A	yes	PP, EX, A	1	2; 31
1086	VINYL CHLORIDE, STABILIZED, REFRIGERATED	2	3F		2.1+unst.	G	2	4	1; 3		95		1	no	T2 12)	II A	yes	PP, EX, A	1	2; 3; 13; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S.	2	3F		2.1 + CMR	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A, EP, TOX	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE A)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE A0)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE A01)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE A02)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE A1)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE B)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE B1)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 3)	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31

1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE B2)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 <sub>3)</sub>	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1965	HYDROCARBON GAS MIXTURE, REFRIGERATED, N.O.S., (MIXTURE C)	2	3F		2.1	G	2	4	1; 3		95		1	no	T4 <sub>3)</sub>	II B <sup>4)</sup>	yes	PP, EX, A	1	2; 31
1972	METHANE, REFRIGERATED or NATURAL GAS, REFRIGERATED, with high methane content	2	3F		2.1	G	2	4	1; 3		95		1	no	T1 <sub>12)</sub>	IIA	yes	PP, EX, A	1	2; 31; 42
1978	PROPANE, REFRIGERATED	2	3F		2.1	G	2	4	1; 3		95		1	no	T1 <sub>12)</sub>	II A	yes	PP, EX, A	1	2; 31
9000	AMMONIA, ANHYDROUS, DEEPLY REFRIGERATED	2	3TC		2.1+2.3+8+N1	G	2	4	1; 3		95		1	no	T1 <sub>12)</sub>	II A	yes	PP, EP, EX, TOX, A	2	1; 2; 31



“7.2.3.28 ~~Refrigeration system~~ **Instruction on maximum loading temperature**

For the carriage of refrigerated substances, an instruction shall be on board mentioning the permissible maximum loading temperature, in relation to the ~~capacity of the refrigeration system and the~~ insulation design of the cargo tanks **and, if on board, the capacity of the refrigeration system.**”

“8.6.1.3 *Model for a certificate of approval for tank vessels*

...

- 6. Types of cargo tanks:
  - 1. Independent cargo tanks
  - 2. Integral cargo tanks
  - 3. Cargo tank wall distinct from the hull
  - 4. Membrane tanks**

...

cargo tank wall distinct from the hull
<b><u>membrane tank</u></b>
opening pressure relief device/high velocity vent valve/safety valve in kPa

”

“8.6.1.4 *Model for a provisional certificate of approval for tank vessels*

...

- 6. Types of cargo tanks:
  - 1. Independent cargo tanks
  - 2. Integral cargo tanks
  - 3. Cargo tank wall distinct from the hull
  - 4. Membrane tanks**

...

cargo tank wall distinct from the hull
<b><u>membrane tank</u></b>
opening pressure relief device/high velocity vent valve/safety valve in kPa

”

“8.6.3 ...

<b><u>8.1</u></b>	Are suitable means of collecting leakages placed under the pipe connections which are in use and are they empty?	O	O
<b><u>8.2</u></b>	<b><u>Is a water film as mentioned in 9.3.1.21.11 activated?</u></b>	<b><u>O</u></b>	<b><u>O</u></b>

...

<b><u>20.</u></b>	<b><u>Is the loading temperature within the range of the maximum permissible temperature as prescribed in 7.2.3.28?</u></b>	<b><u>O**</u></b>	<b><u>O**</u></b>
-------------------	---	-------------------	-------------------

...”

“9.3.1.0.1 a) The vessel’s hull and ~~the cargo tanks~~ shall be constructed of shipbuilding steel or other at least equivalent metal.

~~The independent cargo tanks~~ **and membrane tanks<sup>1</sup>** may also be constructed of other materials, provided these have at least equivalent mechanical **strength** properties and resistance against the effects of temperature and fire.”

“9.3.1.18 Inerting facilities

9.3.1.18.1 In cases in which inerting or blanketing of the cargo is prescribed, the vessel shall be equipped with an inerting system.

The system shall be capable of maintaining a permanent pressure of 7 kPa (0.07 bar) in the spaces to be inerted. In addition, the inerting system shall not increase the pressure in the cargo tank to a pressure greater than that at which the pressure valve is regulated. The set pressure of the vacuum-relief valve shall be 3.5 kPa (0.035 bar).

A sufficient quantity of inert gas for loading or unloading shall be carried or produced on board if it is not possible to obtain it on shore. In addition, a sufficient quantity of inert gas to offset normal losses occurring during carriage shall be on board.

The premises to be inerted shall be equipped with connections for introducing the inert gas and monitoring systems so as to ensure the correct atmosphere on a permanent basis.

When the pressure or the concentration of inert gas in the gaseous phase falls below a given value, the monitoring system shall activate an audible and visible alarm in the wheelhouse. When the wheelhouse is unoccupied, the alarm shall also be perceptible in a location occupied by a crew member.

**9.3.1.18.2 Vessels equipped with membrane tanks shall have an inerting system capable of inerting all insulation spaces of the tanks.**

**The system shall be capable of maintaining a permanent pressure above atmospheric pressure in the spaces to be inerted.**

**The inert gas shall be produced on board or carried in a quantity that is sufficient for the entire holding time as determined in accordance with 7.2.4.16.16 and 7.2.4.16.17. The circulation of inert gas throughout the spaces to be inerted shall be sufficient to allow for effective means of gas detection.**

**The spaces to be inerted shall be equipped with connections for introducing the inert gas and monitoring systems so as to ensure the required atmosphere on a permanent basis.**

**When the pressure, the temperature or the concentration of the inert gas in the gaseous phase falls below a given value, this monitoring system shall activate an audible and visible alarm in the wheelhouse. When the wheelhouse is unoccupied, the alarm shall also be perceptible in a location occupied by a crew member.”**

“9.3.1.23.1 Cargo tanks and piping for loading and unloading shall comply with the provisions concerning ~~pressure~~ vessels **equipped with pressurized tanks or provisions concerning vessels equipped with membrane tanks**, which have been established by the competent authority or a recognized classification society for the substances carried.”

<sup>1</sup> **For membrane tanks the equivalence for resistance against the effect of temperature and fire is deemed to be proven where the materials of the membrane tanks fulfil the following requirements:**

1. **They withstand the range between the maximum temperature in service and 5 °C below the minimum design temperature, but not lower than -196 °C; and**
2. **They are fire-resistant or protected by a suitable system such as a permanent inert gas environment or provided with a fire-retardant barrier.**

## Annex II

### List of UN numbers and identification numbers of substances suitable for carriage in membrane tanks

- UN 1010 BUTADIENES (four entries)
  - UN 1011 BUTANE (two entries)
  - UN 1012 1-BUTYLENE
  - UN 1020 CHLOROPENTAFLUOROETHANE  
(REFRIGERANT GAS R 115)
  - UN 1030 1,1-DIFLUOROETHANE  
(REFRIGERANT GAS R 152a)
  - UN 1033 DIMETHYL ETHER
  - UN 1038 ETHYLENE, REFRIGERATED LIQUID
  - UN 1055 ISOBUTYLENE
  - UN 1063 METHYL CHLORIDE (REFRIGERANT GAS R-40)
  - UN 1077 PROPYLENE
  - UN 1086 VINYL CHLORIDE, STABILIZED
  - UN 1965 HYDROCARBONS GAS MIXTURE,  
LIQUEFIED, N.O.S. (ten entries)
  - UN 1972 METHANE, REFRIGERATED LIQUID or NATURAL  
GAS, REFRIGERATED LIQUID, with high methane  
content
  - UN 1978 PROPANE
  - Identification No. 9000 AMMONIA, ANHYDROUS, DEEPLY  
REFRIGERATED
-