

27 November 2023

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## Agreement

### **Concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations\***

(Revision 3, including the amendments which entered into force on 14 September 2017)

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#### **Addendum 109 – UN Regulation No. 110**

#### **Revision 6 — Amendment 5**

06 series of amendments – Date of entry into force: 24 September 2023

#### **Uniform provisions concerning the approval of:**

- I. Specific components of motor vehicles using compressed natural gas (CNG) and/or liquefied natural gas (LNG) in their propulsion system**
- II. Vehicles with regard to the installation of specific components of an approved type for the use of compressed natural gas (CNG) and/or liquefied natural gas (LNG) in their propulsion system**

This document is meant purely as documentation tool. The authentic and legal binding texts is: ECE/TRANS/WP.29/2023/24.



**UNITED NATIONS**

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\* Former titles of the Agreement:

Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958 (original version); Agreement concerning the Adoption of Uniform Technical Prescriptions for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these Prescriptions, done at Geneva on 5 October 1995 (Revision 2).



Paragraph 3., Table 1-2, add reference to Annex 5R to read:

"Table 1-2

**Test Applicable to Specific Classes of Components (Excluding CNG Cylinders and LNG Tanks)**

<i>Test</i>	<i>Class 0</i>	<i>Class 1</i>	<i>Class 2</i>	<i>Class 3</i>	<i>Class 4</i>	<i>Class 5</i>	<i>Class 6</i>	<i>Annex</i>
Overpressure or strength	X	X	X	X	O	X	X	5A
External leakage	X	X	X	X	O	X	X	5B
Internal leakage	A	A	A	A	O	A	A	5C
Durability tests	A	A	A	A	O	A	A	5L
CNG/LNG compatibility	A	A	A	A	A	A	A	5D
Corrosion resistance	X	X	X	X	X	A	X	5E
Resistance to dry heat	A	A	A	A	A	A	A	5F
Ozone ageing	A	A	A	A	A	A	A	5G
Burst/destructive tests	X	O	O	O	O	A	X	5M
Temperature cycle	A	A	A	A	O	A	A	5H
Pressure cycle	X	O	O	O	O	A	X	5I
Vibration resistance	A	A	A	A	O	A	A	5N
Operating temperatures	X	X	X	X	X	X	X	5O
LNG low temperature	O	O	O	O	O	X	O	5P
Compatibility with heat exchange fluids of non-metallic parts	A	A	A	A	A	A	A	5Q
Test Procedure for Pressure Relief Device (temperature triggered)	A	O	O	O	O	O	A	5R
X = Applicable O = Not applicable A = As applicable								

Paragraphs 8.4. to 8.11., amend to read:

"8.4.-8.11. Provisions on other CNG components

The components shown shall be type approved pursuant to the provisions laid down in the annexes which can be determined from the table below:

<i>Paragraph</i>	<i>Component</i>	<i>Annex</i>
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"Insert new paragraph 18.6.3.1., to read: "18.6.3.1.	8.4.	Automatic valve Check valve or non-return valve Pressure relief valve Pressure relief device (temperature triggered) Manual valve Excess flow valve Pressure relief device (pressure triggered)	4A
	8.5.	Flexible fuel line-hose	4B
	8.6.	CNG filter	4C
	8.7.	CNG Pressure regulator CNG Compressor	4D
	8.8.	Pressure and temperature sensors	4E
	8.9.	Filling unit or receptacle	4F
	8.10.	Gas flow adjuster and gas/air mixer, injector or fuel rail	4G
	8.11.	Electronic control unit	4H

The primary relief valve shall have a minimum opening set pressure of 1.5MPa. This value shall take into account all applicable tolerances declared by the manufacturer."

Insert new paragraphs 24.31 to 24.34 (transitional provisions), to read:

- "24.31. As from the official date of entry into force of the 06 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approval under this Regulation as amended by the 06 series of amendments.
- 24.32. As from 1 September 2024, Contracting Parties applying this Regulation shall not be obliged to accept type approvals issued according to the preceding series of amendments, first issued after 1 September 2024.
- 24.33. Contracting Parties applying this Regulation shall continue to accept type approvals to the preceding series of amendments to this Regulation, first issued before 1 September 2024.
- 24.34. Notwithstanding paragraph 24.32, Contracting Parties applying this Regulation shall continue to accept type approvals of the equipment or parts issued according to the preceding series of amendments to this Regulation which are not affected (all but the primary Liquid Natural Gas relief valves, the temperature-triggered Pressure Relief Devices, the non-return valves and the manual valves) by the 06 series of amendments."

Annexes 2A and 2C, amend the markings accordingly

Annex 3A – Appendix A, paragraph A.24, shall be deleted

Annex 3A – Appendix A, paragraphs A.25 to A.27, renumber as paragraphs A.24 to A.26

Annex 3B, paragraph 1., amend to read:

- "1. Scope
- ...
- Service conditions to which the tanks will be subjected are detailed in paragraph 2. below.
- ..."

Annex 4A, paragraph 3.2.3., amend to read:

"3.2.3. The non-return valve, being in the normal position of use specified by the manufacturer, is submitted to 20,000 operations; then it is deactivated. Following 20,000 cycles of operation, subject the check valve to 240 h of chatter flow at a flow rate that causes the most chatter. Failure in any sense during the procedure shall constitute a failure of the check valve. All parts shall remain in position and function properly after this test. The non-return valve shall remain leak-proof (external) at a pressure of 1.5 times the working pressure (MPa) (see Annex 5B)."

Annex 4A, paragraph 4.2.5., amend to read:

"4.2.5. The pressure relief device (temperature triggered) shall be so designed to open the fuse at a temperature of 110 °C ± 10 °C as specified in Annex 5R."

Annex 5, paragraph 2., Table 5.1, add reference to Annex 5R and amend to read:

"Table 5.1

Test	Class 0	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Annex
Overpressure or strength	X	X	X	X	O	X	X	5A
External leakage	X	X	X	X	O	X	X	5B
Internal leakage	A	A	A	A	O	A	A	5C
Durability tests	A	A	A	A	O	A	A	5L
CNG/LNG compatibility	A	A	A	A	A	A	A	5D
Corrosion resistance	X	X	X	X	X	A	X	5E
Resistance to dry heat	A	A	A	A	A	A	A	5F
Ozone ageing	A	A	A	A	A	A	A	5G
Burst/destructive tests	X	O	O	O	O	A	X	5M
Temperature cycle	A	A	A	A	O	A	A	5H
Pressure cycle	X	O	O	O	O	A	X	5I
Vibration resistance	A	A	A	A	O	A	A	5N
Operating temperatures	X	X	X	X	X	X	X	5O
LNG low temperature	O	O	O	O	O	X	O	5P
Compatibility with heat exchange fluids of non-metallic part	A	A	A	A	A	A	A	5Q
Test Procedure for Pressure Relief Device (temperature triggered)	A	O	O	O	O	O	A	5R
X = Applicable O = Not applicable A = As applicable								

Remarks:

- (a) Internal leakage: Applicable if the Class of the component consists of internal valve seats that are normally closed during engine "OFF" condition;

...

- (g) Pressure Relief Device (temperature triggered) shall be tested.

The material used ..."

*Annex 5L*, amend to read:

## "Annex 5L

### **Durability Test (Continued Operation)**

1. Test method for CNG components
  - 1.1. The component shall be connected to a source of pressurized dry air or nitrogen by means of a suitable fitting and subjected to the number of cycles specified for that specific component. A cycle shall consist of one opening and one closing of the component within a period of not less than  $10 \pm 2$  seconds.
    - (a) Room temperature cycling

The component shall be operated through 96 per cent of the total cycles at room temperature and at rated service pressure. During the off cycle the downstream pressure of the test fixture should be allowed to decay to 50 per cent of the test pressure. After that, the components shall comply with the leakage test of Annex 5B at room temperature. It is allowed to interrupt this part of the test at 20 per cent intervals for leakage testing.
    - (b) High temperature cycling

The component shall be operated through 2 per cent of the total cycles at the appropriate maximum temperature specified at rated service pressure. The component shall comply with the leakage test of Annex 5B at the appropriate maximum temperature at the completion of the high temperature cycles.
    - (c) Low temperature cycling

The component shall be operated through 2 per cent of the total cycles at the appropriate minimum temperature specified at rated service pressure. The component shall comply with the leakage test of Annex 5B at the appropriate minimum temperature specified at the completion of the low temperature cycles.

Following cycling and leakage re-test, the component shall be capable of completely opening and closing when a torque not greater than that specified in Table 5.3 below is applied to the component handle in a direction to open it completely and then in the reverse direction. For a lever operated valve, the appropriate maximum torque is to be determined by applying a pull force up to 150 N to the end of the handle operating mechanism.

Table 5.3

<i>Component inlet size [mm]</i>	<i>Maximum torque [Nm]</i>
6	1.7
8 or 10	2.3
12	2.8

- 1.2. This test shall be conducted at the appropriate maximum temperature specified, and shall be repeated at a temperature of -40 °C.
- 1.3. Durability test for LNG products are mentioned in their specific Annex 4I up to Annex 4O, where applicable."

Add new Annex 5R, to read:

## "Annex 5R

### Test Procedure for Pressure Relief Device (temperature triggered)

1. Benchtop activation - pressure relief device (PRD)(temperature triggered).
  - 1.1. The purpose of the test is to demonstrate that a PRD (temperature triggered) will consistently activate throughout its designed life.
  - 1.2. Test set-up

The test set-up shall consist of an oven, or chimney (test chamber) capable of maintaining a temperature of 600 °C ± 10 °C surrounding the test article. The PRD (temperature triggered) shall not be exposed to direct flame impingement.
  - 1.3. Test samples
    - 1.3.1. Two virgin PRDs shall be tested, and the averaged activation time shall establish a baseline activation time.
    - 1.3.2. One sample PRD (temperature triggered) that has been subjected to and passed the following design qualification tests: Annex 5E, Annex 5H, Annex 5L, and Annex 5N.
  - 1.4. Test Procedure
    - 1.4.1. The test chamber temperature shall be 600 °C ± 10 °C for a minimum of two minutes prior to running the test.
    - 1.4.2. Place sample PRD (temperature triggered) that has been pressurized to 25 per cent of service pressure in the test chamber; record time to activation.
  - 1.5. Acceptable results

PRDs (temperature triggered) that have been tested according to the tests outlined in paragraph 3.1.2., shall activate within two minutes of the recorded base line activation time of the samples listed in paragraph 3.1.
  - 1.6. Batch testing

The PRD (temperature triggered) manufacturer shall institute a production batch inspection and acceptance testing programme that ensures consistent safety performance of the product.

2. Pressure relief device (temperature triggered) requirements

The pressure relief device specified by the manufacturer shall be shown to be compatible with the service conditions listed in paragraph 4. of Annex 3A and through the following qualification tests:

- (a) One specimen shall be held at a controlled temperature of not less than 95 °C and a pressure not less than test pressure (30 MPa) for 24 hours. At the end of this test there shall be no leakage or visible sign of extrusion of any fusible metal used in the design.
- (b) One specimen shall be fatigue tested at a pressure cycling rate not to exceed 4 cycles per minute as follows:
  - (i) Held at 82 °C while pressured for 10,000 cycles between 2 MPa and 26 MPa;
  - (ii) Held at -40 °C while pressure for 10,000 cycles between 2 MPa and 20 MPa.

At the end of this test there shall be no leakage, or any visible sign of extrusion of any fusible metal used in the design.

- (c) Exposed brass pressure retaining components of pressure relief devices shall withstand, without stress corrosion cracking, immersion in ammonia. Following the immersion, the pressure relief device shall be leak tested by applying an aerostatic pressure of 26 MPa for one minute during which time the component shall be checked for external leakage. Any leakage shall not exceed 200 cm<sup>3</sup>/h.
  - (i) Subject each test sample to the physical stresses normally imposed on, or within, a part as a result of its assembly with other components. Apply these stresses to the sample prior to testing and maintain them throughout the test. Samples with thread, intended to be used for installing the product in the field, shall have the threads engaged and tightened to the torque specified in the instruction manual of the sample or specified by the manufacturer. Polytetrafluorethylene (PTFE) tape or pipe compounds shall not be used on the threads;
  - (ii) Degrease three samples and expose them continuously for 10 days at a set position to a moist ammonia–air mixture, maintained in a glass chamber of approximately 30 l in capacity with a glass cover. Aqueous ammonia having a specific gravity of 0.94 shall be maintained at the bottom of the glass chamber, below the samples, at a concentration of 21.2 ml/l of chamber volume. Position the samples 40 mm above the aqueous ammonia solution, supported by an inert tray. Maintain the moist ammonia–air mixture in the chamber at atmospheric pressure and at a temperature of 34 °C ± 2 °C.
- (d) Exposed stainless steel pressure retaining components of pressure relief devices shall be made of an alloy type resistant to chloride induced stress corrosion cracking."