

21 November 2019

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)

Addendum 109 – UN Regulation No. 110

Revision 5 – Amendment 3

04 series of amendments – Date of entry into force: 15 October 2019

CNG and LNG vehicles

This document is meant purely as documentation tool. The authentic and legal binding text is: ECE/TRANS/WP.29/2019/16 as amended by paragraph 105 in document ECE/TRANS/WP.29/1145.



UNITED NATIONS

* 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).

04 series of amendments to UN Regulation No. 110 (CNG and LNG vehicles)

Figure 1-2, amend to read (inserting a new row as reference to Annex 5Q):

"Figure 1-2

Tests applicable to specific classes of components (excluding CNG cylinders and LNG tank)

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
.....								
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

Note: X = Applicable
O = Not applicable
A = As applicable "

Insert new paragraphs 4.77. and 4.78. (Definitions), to read:

"4.77. "CNG compressor" means a device to establish the supply of CNG to the engine by increasing the pressure of the vapour.

4.78. "CNG accumulator" means a device which is used to store CNG downstream of the LNG vaporizer and/or CNG storage system (cylinder(s))."

Paragraph 8.2., amend to read:

"8.2. Provisions on CNG containers and CNG accumulators."

Insert a new paragraph 8.2.3., to read:

"8.2.3. Provisions on the CNG accumulators

The CNG accumulator shall be type approved pursuant to the provisions laid down in Annex 3A to this Regulation, taking into consideration:

- (a) The CNG accumulator with a volume ≤ 0.75 liter shall be tested as Class 6;
- (b) The CNG accumulator with a volume > 0.75 liter is considered as a CNG container(cylinder) with a maximum pressure of 26 MPa;
- (c) The CNG accumulator shall be equipped with at least the following safety components:
 - (i) Automatic cylinder valve according to paragraph 18.5.1.;
 - (ii) TPRD according to paragraph 18.5.2.;
 - (iii) Excess flow limiting according to paragraph 18.5.3.;
 - (iv) Manual valve according to paragraph 18.5.4.;
 - (v) Gas tight housing according to paragraph 18.5.5.;
 - (vi) PRD (pressure triggered) according to paragraph 18.5.6."

Paragraph 8.7., amend to read:

"

<i>Paragraph</i>	<i>Component</i>	<i>Annex</i>
8.7.	CNG Pressure regulator CNG Compressor	4D

"

Paragraphs 18.1.7.1. and 18.1.7.2., amend to read:

"18.1.7.1. Notwithstanding the provisions of paragraph 18.1.7., vehicles may be fitted with an extra engine for use on the vehicle (e.g. for cooling, heating etc.) which is connected to the CNG and/or LNG system.

18.1.7.2. The secondary engine referred to in paragraph 18.1.7.1. shall be permitted if, in the view of the Technical Services responsible for conducting type approval, secondary engine is adequately protected and the required operation of the normal CNG and/or LNG system is not affected."

Insert a new paragraph 18.3.2.9., to read:

"18.3.2.9. CNG Compressor"

Paragraph 18.5.1.1., amend to read:

"18.5.1.1. An automatic cylinder valve shall be installed directly on each CNG container and to each CNG accumulator."

Paragraph 18.5.1.3., amend to read:

"18.5.1.3. Notwithstanding the provisions of paragraph 18.5.1.2.

(a) The automatic cylinder valve may stay in an open position during commanded stop phases; and

(b) In the case where a fire alarm system is installed in the autonomous CNG and/or LNG heater compartment, the automatic valve(s) may be opened by a CNG/LNG electronic control unit to permit the warming of the engine. Any defect or failure of the system shall cause the automatic valve of the cylinder supplying the heating system to close; and

(c) In the case where a fire alarm system is installed in the refrigeration system compartment of the cargo compartment, the automatic valve(s) may be opened by a CNG/LNG electronic control unit to permit the cooling of the cargo compartment. Any defect or failure of the system shall cause the automatic valve of the cylinder supplying the refrigeration system to close; and

(d) In the case where a fire alarm system is installed in the secondary engine compartment, the automatic valve(s) may be opened by an electronic control unit to permit the provision of electrical power. Any defect or failure of the system shall cause the automatic valve of the cylinder supplying the refrigeration system to close."

Paragraph 18.5.2.1., amend to read:

"18.5.2.1. The pressure relief device (temperature triggered) shall be fitted to the CNG fuel container(s) and to each CNG accumulator in such a manner that can discharge into the gas-tight housing if that gas-tight housing fulfils the requirements of paragraph 18.5.5. below. However,"

Paragraph 18.5.3.1., amend to read:

"18.5.3.1. The excess flow limiting device shall be fitted in the CNG fuel container(s) and on each CNG accumulator on the automatic cylinder valve."

Insert a new paragraph 18.5.4.2., to read:

"18.5.4.2. For accumulators a manual shut-off valve or a mechanism to empty the accumulator prior to maintenance works shall be added."

Paragraph 18.5.5.1., amend to read:

"18.5.5.1. A gas-tight housing over the CNG container(s)/CNG accumulator fittings, which fulfils the requirements of paragraphs 18.5.5.2. to 18.5.5.5. shall be fitted to the CNG fuel container/CNG accumulator, unless the CNG container(s)/CNG accumulator is installed outside the vehicle, outside enclosed spaces such as passenger compartment or cargo area or engine compartment."

Paragraph 18.5.6.2., amend to read:

"18.5.6.2. The PRD (pressure triggered) shall be fitted to the fuel container(s) and to the CNG accumulator in such a manner that it can discharge into the gas-tight housing if that gas-tight housing fulfils the requirements of paragraph 18.5.5. above.

However, in case of vehicles of category M and N where the container(s) and/or CNG accumulator is (are) fitted outside the vehicle and on the roof or on the top of the bodywork of the vehicle, the pressure relief device (pressure triggered) shall be fitted to the fuel container(s) and/or to the CNG accumulator in such a manner that it can discharge the CNG only in a vertical upward direction."

Insert a new paragraph 18.5.6.3., to read:

"18.5.6.3. CNG accumulators shall not be mounted inside the engine compartment or be mounted in the crash zone of the vehicle, only inside the frame of the vehicle."

Insert new paragraphs 24.22. to 24.25. (Transitional provisions), to read:

"24.22. As from the official date of entry into force of the 04 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals under this Regulation as amended by the 04 series of amendments.

24.23. As from 1 September 2022, Contracting Parties applying this Regulation shall not be obliged to accept type approvals to the preceding series of amendments, first issued after 1 September 2022.

24.24. Until 1 September 2024, Contracting Parties applying this Regulation shall accept type approvals to the preceding series of amendments, first issued before 1 September 2022.

24.25. As from 1 September 2024, Contracting Parties applying this Regulation shall not be obliged to accept type approvals issued to the preceding series of amendments to this Regulation."

Annex 1A,

Paragraph 1.2.4.5.2., amend to read:

"1.2.4.5.2. CNG Pressure regulator(s): yes/no¹

CNG Compressor: yes/no¹ "

Paragraph 1.2.4.5.7., amend to read:

"1.2.4.5.7. CNG container(s) or cylinder(s): yes/no¹

LNG tank(s) or vessel(s): yes/no¹

CNG accumulator(s): yes/no¹ "

Items 1.2.4.5.15. to 1.2.4.5.15.3., amend to read (footnote ¹ remains unchanged):

"1.2.4.5.15. Connection to CNG/LNG system for secondary engine system: yes/no¹

1.2.4.5.15.1. Make(s) of the secondary engine system:

1.2.4.5.15.2. Type(s) of the secondary engine system:

1.2.4.5.15.3. Description and drawings of installation of the secondary engine system:"

"Items 1.2.4.5.15.4. to 1.2.4.5.15.6., shall be deleted."

Annex 1B,

Paragraph 1.2.4.5.2., amend to read:

"1.2.4.5.2. CNG Pressure regulator(s):

CNG Compressor:"

Paragraph 1.2.4.5.7., amend to read:

"1.2.4.5.7. CNG container(s) or cylinder(s): yes/no¹

LNG tank(s) or vessel(s): yes/no¹

CNG accumulator(s): yes/no¹ "

Items 1.2.4.5.15. to 1.2.4.5.15.3., amend to read (footnote ² remains unchanged):

"1.2.4.5.15. Connection to CNG/LNG system for the secondary engine system: yes/no²

1.2.4.5.15.1. Make(s):

1.2.4.5.15.2. Type(s):

1.2.4.5.15.3. Description and drawings of installation:"

Items 1.2.4.5.15.4. to 1.2.4.5.15.6., shall be deleted.

Annex 2B, item 1, amend to read:

"1. CNG/LNG component considered:

Container(s) or cylinder(s)²

Tank(s) or vessel(s)²

CNG accumulator(s)²

Pressure indicator²

Pressure relief valve²

.....

Gas injectors²

CNG Compressor²
Gas flow adjuster²
....."

Annex 2B, Addendum

Insert new items 1.1.3. to 1.1.3.3., amend to read:

- "1.1.3. CNG accumulator
- 1.1.3.1. Dimensions:.....
- 1.1.3.2. Material:.....
- 1.1.3.3. Capacity:....."

Insert new items 1.32. to 1.32.2., to read:

- "1.32. CNG Compressor
- 1.32.1. Working pressure(s):¹ MPa
- 1.32.2. Material:....."

Annex 4D,

The title, amend to read:

"Provisions on the approval of the CNG pressure regulator and CNG compressor."

Paragraph 1., amend to read:

- "1. The purpose of this annex is to determine the provisions on the approval of the CNG pressure regulator and CNG compressor."

Paragraph 2.2., amend to read (inserting a new reference to Annex 5Q):

- "2.2. The materials constituting the regulator which are in contact with the heat exchange medium of the regulator when operating, shall be compatible with that fluid, the procedure in Annex 5Q shall be used."

Insert new paragraphs 4. to 5.3.2., to read:

- "4. CNG compressor
- 4.1. The material constituting the CNG compressor which is in contact with the compressed natural gas when operating shall be compatible with the test CNG. In order to verify this compatibility, the procedure in Annex 5D shall be used.
- 4.2. The materials constituting the CNG compressor which are in contact with the heat exchange medium of the CNG compressor when operating, shall be compatible with that fluid. In order to verify this compatibility, the procedure in Annex 5Q shall be used.
- 4.3. The component shall comply with the test procedures for the Class of components according to the scheme in Figure 1-1 of paragraph 3. of this Regulation.
- 4.4. The electrical system, if existing, shall be isolated from the body of the CNG Compressor. Isolation resistance shall be > 10 MΩ.
- 4.4.1. Means shall be provided to ensure a safe discharge of static electricity in the compressor.
- 4.5. The CNG compressor shall be provided with a pressure control device to

- maintain the pressure within the operating pressure range.
- 4.5.1. The limitation of the power supplied by the actuating mechanism can be accepted in lieu of a pressure control device.
- 4.5.2. An electronic control system can be accepted in lieu of a pressure control device.
- 4.5.3. The pressure control device may function by restricting or closing off the inlet to the compressor.
- 4.5.4. The pressure control device is not allowed to vent natural gas to the atmosphere during normal function.
- 4.6. The CNG Compressor shall be provided with a pressure relief valve to limit the pressure to the maximum safe working pressure of the compressor.
- 4.6.1. A fuel system pressure relief valve may be used instead of a pump pressure relief valve if, by relieving system pressure, it relieves the pump pressure.
- 4.7. The CNG compressor is allowed to function before the engine is started or during commanded stop phases to produce required pressure in the fuel system. This function shall be achieved without delivering fuel to the engine, if the engine is not running.
- 4.8. Durability test (continued operation) of the CNG compressor:
The CNG compressor shall be able to withstand 50,000 cycles without any failure when tested according to the following procedure:
- (a) Cycle the CNG compressor for 95 per cent of the total number of cycles at room temperature and at the service pressure. Each cycle shall consist of flow until a stable outlet pressure has been obtained, after which the gas flow shall be shut off by a downstream valve within 1 s, until the downstream lock-up pressure has stabilized. Stabilized outlet pressures are defined as set pressure ± 15 per cent for at least 5 s;
 - (b) Cycle the inlet pressure of the CNG compressor for 1 per cent of the total number of cycles at room temperature from 100 per cent to 50 per cent of the service pressure. The duration of each cycle shall be no less than 10 s;
 - (c) Repeat the cycling procedure of (a) at 85 °C, 105 °C or 120 °C, as applicable, at the service pressure for 1 per cent of the total number of cycles;
 - (d) Repeat the cycling procedure of (b) at 85 °C, 105 °C or 120 °C, as applicable, at the service pressure for 1 per cent of the total number of cycles;
 - (e) Repeat the cycling procedure of (a) at -40 °C or -20 °C, as applicable, and 50 per cent of service pressure for 1 per cent of the total number of cycles;
 - (f) Repeat the cycling procedure of (b) at -40 °C or -20 °C, as applicable, and 50 per cent of service pressure for 1 per cent of the total number of cycles;
 - (g) At the completion of all tests indicated in subparagraphs (a), (b), (c), (d), (e) and (f) above, the CNG compressor shall be leak proof (see Annex 5B) at the temperatures of -40 °C or -20 °C, as applicable, and at room temperature and at the temperature of 85 °C, 105 °C or 120 °C, as applicable.

5. Classification and test pressures
 - 5.1. The part of the CNG compressor which is in contact with the pressure of the container is considered as Class 0.
 - 5.1.1. The Class 0 part of the CNG compressor shall be leak-proof (see Annex 5B) at a pressure up to 1.5 times the working pressure (MPa) with the outlet(s) of that part closed off.
 - 5.1.2. The Class 0 part of the CNG compressor shall withstand a pressure of up to 1.5 times the working pressure (MPa).
 - 5.1.3. The Class 1 and Class 2 part of the CNG compressor shall be leak-proof (see Annex 5B) at a pressure of up to twice the working pressure.
 - 5.1.4. The Class 1 and Class 2 part of the CNG compressor shall withstand a pressure of up to twice the working pressure.
 - 5.1.5. The Class 3 part of the CNG compressor shall withstand a pressure of up to twice the relief pressure of the pressure relief valve, on which it is subject.
 - 5.2. The part of the CNG compressor which is in contact with a pressure higher than 26 MPa is considered as Class 6.
 - 5.2.1. The Class 6 part of the CNG compressor shall be leak-proof (see Annex 5B) at a pressure of up to 1.5 times the working pressure (MPa) declared by the manufacturer with the outlet(s) of that part closed off.
 - 5.2.2. The Class 6 part of the CNG compressor shall withstand a pressure of up to 1.5 times the working pressure (MPa) declared by the manufacturer.
 - 5.2.3. The part of the CNG compressor that is in contact with a pressure below 26 MPa is classified as per Part I, Section 3, of this Regulation.
- 5.3. The CNG compressor shall be so designed as to operate at the temperatures as specified in Annex 5O.
 - 5.3.1. Where the CNG compressor is cooled by inclusion in the engine coolant circuit it shall be considered as an engine mounted in Annex 5O
 - 5.3.2. Where the CNG compressor is using heat exchange fluids, the non-metallic parts in contact with the fluid shall comply with Annex 5Q."

Annex 4I, paragraph 2.2., amend to read (as reference to Annex 5Q):

"2.2. The material constituting the LNG heat exchanger - vaporizer which is in contact with the CNG when operating shall be compatible with the test CNG. In order to verify this compatibility, the procedure in Annex 5D shall be used.

The materials constituting the LNG heat exchanger - vaporizer which are in contact with the heat exchange medium of the regulator when operating, shall be compatible with that fluid. The procedure in Annex 5Q shall be used."

Annex 5, Table 5.1, amend to read (insert a new row as reference to Annex 5Q):

"Table 5.1

<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

<i>Test</i>	<i>Class</i> <i>0</i>	<i>Class</i> <i>1</i>	<i>Class</i> <i>2</i>	<i>Class</i> <i>3</i>	<i>Class</i> <i>4</i>	<i>Class</i> <i>5</i>	<i>Class</i> <i>6</i>	<i>Annex</i>
.....								
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

X = Applicable

O = Not applicable

A = As applicable

Remarks:

(a) Internal leakage:

.....

(e) Vibration resistance test: Applicable if the Class of the component consists of integral parts that will move repeatedly during engine operation;

(f) Compatibility with heat exchange fluids of non-metallic parts: Applicable, if the Class of the components consists out of material in contact with the heat exchange fluid.

The materials"
